Unified Communications:

Convergence of Platforms and Strategies of Two Software Vendors

By

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ABSTRACT

Unified communication (UC) is the convergence of various modes of communication - voice telephony, email, instant messaging (IM), video conferencing and so on - used by enterprise workers. Academic literature exists that discusses digital convergence in various domains. Although UC has received considerable attention in the business press, we are not aware of any academic study within the domain of UC that explains the convergence of platforms and its links to the technology strategy of UC firms. This thesis presents an academic analysis of some platforms underlying UC and the emerging strategies of two software firms within the UC market. The theory of network effects originally developed by Rohlfs is central to the analysis in this thesis. The analysis of platform strategies of the UC firms is informed by the theoretical work on platform leadership (Gawer & Cusumano), convergence (Greenstein et al.), platform envelopment (Eisenmann et al.), and two-sided platforms (Tirole et al.).

The thesis first describes four platform applications underlying UC viz. voice telephony, email, IM, and video communication. The analysis of email, IM and video communication in this thesis is unique as it takes a long term view to explain the current market situation within these domains. In particular, the thesis describes technological factors, network effects, standard battles, and competition that have led to the current market state. The thesis also links insights from these platforms to repercussions for UC supplier firms.

The thesis then describes the strategies of two software vendors - Microsoft and IBM - using elements from Gawer & Cusumano's work on platform leadership. Microsoft has defined a broad scope of innovation for its converged UC platform requiring it to enter the voice telephony market. The thesis posits that Microsoft's strategy for success is platform envelopment i.e. Microsoft is using shared components and installed user base from its email and IM platforms to create a multi-platform bundle and compete with entrenched platforms in the voice market. The thesis argues that IBM's choice for a narrower platform scope stems from its inferior market position in the email and IM markets as well as scope differences (vis-à-vis Microsoft). Convergence has created system integration opportunities that IBM's services unit has targeted. The thesis describes the implications of IBM's decisions on its ecosystem.

Thesis Advisor: Professor Erik Brynjolfsson
Title: Schussel Professor of Management

To my parents, Mrs. Razia Hydari and Mr. Imam Hydari

To my wife, Hajar and sons, Omar and Sohaib

To my sister Asma Abdullah

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I have also benefited from my discussions with people in the industry. Farooq Muzaffar (Sloan 2002) and Bilal Wahid (MIT 2008) at Verizon Communications helped shape my initial thoughts through vigorous debate about Unified Communication and the competitive strategies of firms in this market space. Managers from Microsoft and Nortel as well as other companies spoke with me to provide their perspective about Unified Communications.

My thanks to David Verrill, Executive Director of MIT Center for Digital Business (CDB), and his assistant Carlene Doucette for providing me work space and support at the CDB during my thesis work.

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The System Design and Management (SDM) program provided the opportunity to pursue graduate education at MIT while working full time. The SDM staff has facilitated my years at MIT and I want to thank Mr. Patrick Hale, Mr. Jeff Shao, Mr. William Foley, and the rest of SDM staff members for their support.

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(Author's Signature)

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1 Introduction

1.1 Research Objectives

The domain I have chosen for my thesis – Unified Communication & Collaboration (UC)[1] – is surrounded by hype as the addressable market appears to be big[2], leading enterprise technology suppliers to make huge investments[3] and strategic bets around UC. The analysis of UC is complicated because of the rapid co-evolution of technology and demand. The analysis is further complicated by the fact that UC is driven by technological convergence of network platforms that has led to changes in the boundaries of existing firms and hitherto distinct industries. The current market situation is fluid as the firms grapple with the following question:

- What should be UC's value proposition that appeals to large market segments
- What should be the scope of activities and products of a firm
- Given that dominant players exist in constituent products, should a firm develop a complete offering by itself or with partners? If it is the latter, what criteria should firms use to choose partners
- How should firms respond to changes associated with convergence, such as changes in the identity of their competition or changes in user's expectations about product functionality and price[4]

Scholars have proposed and developed theories about issues around technology, market and firm strategy that underlie the questions faced by firms in the UC market space. The study of convergence is intellectually challenging as convergence patterns display immense variety and it is

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[1] Unified Communications & Collaboration is the convergence of computing and communication in the workplace. Some abbreviate Unified Communication & Collaboration as UCC. However, UCC has long been used as an acronym for Uniform Commercial Code. To avoid confusion, we will use UC as an acronym. Please refer to chapter 3 for details about Unified Communications & Collaboration.

[2] IDC estimates that unified communications ecosystem will grow to $20 billion by 2012. (Please see) **Freedman, Nora. 2008.** IBM Commits $1B to Unified Communications. *IDC Link.* [Online] March 12, 2008. [Cited: March 14, 2008.] http://www.idc.com/getdoc.jsp?containerId=lcUS21137708.

[3] For example, IBM has committed to invest $1 billion in support of its UC strategy. Please see the reference cited in footnote 2.

[4] **Greenstein, Shane M. 2000.** *Technological Convergence.* [Compact Disc] [ed.] Richard C. Dorf. s.l. : CRC Press LLC, Chapman & Hall/CRCnetBASE, 2000. Technology Management Handbook.

difficult to construct general analytical frameworks that can adequately explain every example of convergence[4].

The research objectives for this thesis were:

1. To study select platforms – voice telephony, email, instant messaging, video communication - that underlie UC pre-convergence and draw insights about the effects of technology, compatibility standards, and network effects on these platforms and use these insights to explain the market situation and implications for UC

2. To describe the emerging platform strategies of two large software vendors, viz. IBM and Microsoft, within the domain of UC

1.2 Thesis Outline

Chapter 2 summarizes the academic frameworks that are useful in describing the UC market. Most of these frameworks will be familiar to a student of technology strategy but the chapter provides a refresher. It also establishes the meaning of technical terms that I use in later chapters. For those who are not familiar with any of these frameworks, I have included references that can provide more detailed explanations.

Chapter 3 defines Unified Communication and Collaboration (UC) for the purpose of this thesis. As UC is a nascent market, point-of-views about UC differ. Chapter 3 also describes the evolution of platforms underlying UC - email, instant messaging, voice telephony, and video communication - to draw insights about the effects of technology, compatibility standards, and networks effects on these platforms

Chapter 4 describes Microsoft's UC strategy. It provides a brief overview of the company and then describes Microsoft's platform strategy within the UC space. Chapter 4 posits that Microsoft has been utilizing platform envelopment to succeed in the UC space.

Chapter 5 describes IBM's UC strategy. It provides a brief overview of the company and then describes IBM's high level vision and platform strategy within the UC space.

Chapter 6 provides a summary of the thesis and conclusions that can be drawn from the study.

2 Relevant Analytical Frameworks

The following sections summarize the work of some scholars that I felt would be relevant to the study of UC market. I intend to use portions of these theories to describe the UC market and the strategies of two software vendors. The following sections also serve to define and explain technical terms that I will use in later chapters.

2.1 Bandwagon Effects

Jeffrey Rohlfs performed seminal work on bandwagon effects (also known as network effects) within telecommunication and high technology industries[5,6,7,8]. Rohlfs' recent book[9] summarizes the economic theory behind bandwagon effects and provides business case studies that illustrate bandwagon effects. The examples presented in his book range from facsimile to the internet.

The Oxford dictionary defines 'bandwagon' as 'an activity or cause that has suddenly become fashionable or popular' ascribing the origin of the word to the 'former use of a wagon to carry a band in a parade'[10]. Rohlfs defines **bandwagon effects** as: 'a benefit that a person enjoys as a result of others doing the same thing that he or she does'.

Thus, bandwagon effects are demand side increasing returns that result from users adopting a particular product[11]. The mere fact that others have adopted a product increases the utility or value of the product for the existing user base.

These positive feedback effects present in bandwagon products can strongly affect outcomes in a competitive situation. For example, two videocassette standards viz. VHS and Betamax competed in the market place. Betamax was reputed to have better picture quality whereas VHS had longer recording and running time. Video rental stores became the primary *direct* customers for

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[5] *A Theory of Interdependent Demand for a Communications Service.* **Rohlfs, Jeffrey. 1974.** 1, s.l. : The Rand Corporation, 1974, The Bell Journal of Economics and Management Science, Vol. 5, pp. 16-37.
[6] **Greenstein, Shane. 2003.** Jumping on Bandwagons. *IEEE Micro.* September-October 2003, pp. 75-77.
[7] *Book Review: Bandwagon Effects in High-Technology Industries.* **Shapiro, Carl. 2003.** Number 3, s.l. : Springer Wien, November 2003, Journal of Economics, Vol. 80. ISSN 09318658.
[8] **Varian, Hal R. 2001.** Economic Scene: Videoconferencing May at Last Get The Critical Mass It Needs. *New York Times.* October 4, 2001.
[9] **Rohlfs, Jeffrey H. 2001.** *Bandwagon Effects in High-Technology Industries.* s.l. : The MIT Press, 2001.
[10] [Online] [Cited: February 13, 2008.] http://www.askoxford.com/concise_oed/bandwagon?view=uk.
[11] We will use 'product' to refer to both product and/or service.

videocassettes. Rental stores carried both VHS and Betamax for a while but ultimately rental stores *standardized* on VHS tapes as more and more customers bought VHS recorder and players for recording television programs. So the end users could only get the *fashionable* VHS tapes even if they found Betamax to be of superior picture quality. VHS won the battle not because of an absolute technical superiority but because of indirect bandwagon effects emanating from consumers' adoption of VHS recorder for television recording.

Types of Bandwagon Effects

Bandwagon effects can be of two types:

Network Externalities	These are direct effects that increase the value of the service to all users as the user base of the product increases. Network externalities are generally evident in communication product. For example, facsimile users benefited as more and more businesses and individuals adopted facsimile simply because the original facsimile users could communicate with more people.
Complementary Bandwagon Effects	These are indirect effects that increase value for the users of a *main* good caused by the increased provision of complementary goods and services. For example, widespread adoption of the IBM Personal Computer (*main* good) resulted in the widespread provision of application software (complementary good).

Table 1: Types of bandwagon effects

Bandwagon Effects – Critical Mass and the Bootstrap Problem

Products that are subject to bandwagon effects need to attain **critical mass** before the value delivered is large enough to entice users. This poses a particular bootstrap problem – how to build an initial user set that can propel the product to success. Thus firms dealing with bandwagon products need to consciously solve the bootstrap problem. Some of the steps that firms have taken to solve the bootstrap problem include:

- Costly customer acquisition strategies such as penetration pricing or subsidies for marquee users for exclusive access[12]
- Management of the provision of complementary products
- Agreement between rival firms for compatibility standard

Bandwagon Effects and Interlinking

Consumers of products within a product category such as instant messaging may enjoy bandwagon effects with (1) all consumers using the product as supplied by the same vendor, or (2) all consumers using any product within the category and supplied by any vendor.

For bandwagon benefits to accrue to all users irrespective of their supplier, the products must be **interlinked**. In case of communication products like instant messaging, subject to direct network effects, this is achieved by interlinking. Usually the suppliers of the communication service work together to enable the interlinking:

Microsoft agreed to interlink its enterprise instant messaging (EIM) product with consumer instant messaging products provided by AOL, MSN, and Yahoo!. This interlinking enabled users of Microsoft's enterprise instant messaging product access to approximately 400 million users within the AOL, MSN and Yahoo! Consumer IM networks (circa July 2004)[13]. The EIM product did not complete directly with the consumer IM products.

However, Yahoo and Microsoft also agreed to interlink their respective consumer instant messaging service, creating a combined user community of 350 million users worldwide (circa July 2006)[14]. This interlinking of competing networks immensely benefited the users of both IM networks by increasing their reach from a single user interface.

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[12] **Eisenmann, Thomas R. 2007.** *Managing Proprietary and Shared Platforms: A Life-Cycle View.* s.l. : SSRN, 2007. Working Paper. 07-105.

[13] Microsoft, America Online, MSN and Yahoo! Announce Industry-First Connectivity to Enterprise Instant Messaging Users. [Online] [Cited: February 17, 2008.] http://www.microsoft.com/presspass/press/2004/jul04/07-15enterpriseimconnectivitypr.mspx.

[14] Yahoo! And Microsoft Bridge Global Instant Messaging Communities. [Online] [Cited: February 17, 2008.] http://www.microsoft.com/presspass/press/2006/jul06/07-12IMInteropPR.mspx.

Interlinking also benefits where there are complementary bandwagon effects. This is usually achieved through **compatibility standards** that competing products agree to honor thereby allowing complementary products to work with all base products. For example, the Peripheral Component Interconnect (PCI) standard although developed initially by Intel, was eventually adopted by Sun and Macintosh. All computer platforms (Macintosh, Sun, Wintel and so on) were then able to benefit from peripheral components produced for the standard PCI; and peripheral suppliers found it advantageous to develop using PCI because it ensured wider reach for them.

Dynamics of Complementary Bandwagon Effects

An important difference between network externalities and complementary bandwagon effects is that the latter usually has a longer lag time before users experience increase in returns. An instant messaging user who joins an IM network immediately benefits from the existing user base and vice versa. But consider the complementary bandwagon effects associated with videocassette recorder and the *VHS vs. Betamax* competition as an example. There will be some time lag between increased demand for a particular product and the production of complementary products. So the users' decision to buy a particular product is complex – they may buy one particular product but demand may not grow enough for the product to foster the production of complementary goods. In such cases, other benefits of the products or even perception about who will win can produce bandwagon effects for one good. In case of *VHS vs. Betamax*, VHS was able to build initial installed base because users could use VHS' longer recording time to record television program. This in turn made it more profitable for rental video shops to carry VHS tapes.

Recent Case Study – Bandwagon Effects Decide Blu-Ray vs. HD DVD Battle

In a more recent battle between two rival high definition digital video disc (DVD) - *Blu-ray vs. HD DVD* (backed by Sony and Toshiba respectively) – Blu-ray was able to win the battle because Sony was able to win exclusive contracts with major DVD manufacturers such as Philips, Pioneer, Panasonic and so on. This contributed to convincing media companies such as Warner Brothers, retailers like Wal-Mart and video rental stores such as Netflix and Blockbuster to back the Blu-ray format. Sony was also able to build an initial installed base by bundling Blu-ray into its Playstation 3 video game console. The research firm IDC reported that the cheapest Blu-ray player on the market

was actually the Playstation 3[15]. Sony used bundling i.e. Blu-ray players along with Playstation 3 to create an installed base for its Blu-ray technology.

2.2 Competitive Strategy as Ecology

James Moore introduced an ecological perspective to competitive analysis especially within the domain of high technology[16]. Marco Iansiti et al further developed the ecological paradigm into a strategic framework for analysis[17,18].

The Oxford Dictionary defines 'ecosystem' as 'a biological community of interacting organisms and their physical environment'[19]. The Encyclopedia Britannica summarizes ecosystems as 'the complex of living organisms, their physical environment, and all their interrelationships in a particular unit of space'[20]. The emphases that one must note are:

- A holistic view of the organisms and their environment in a particular unit of space
- The interrelationships and the interactions amongst organisms and between organisms and environment

Participants in a biological ecosystem not only depend on each other but also share fate. If the overall health of the ecosystem deteriorates, all ecosystem participants suffer.

Business Ecosystems

Business ecosystems are a 'loose network of suppliers, distributors, outsourcing firms, makers of related products or services, technology services and a host of other organizations'[21] that together bring a product or service to market. The 'other organizations' may include customers, competitors,

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[15] Toshiba climbs on 'HD DVD' exit. *BBC News.* [Online] [Cited: February 26, 2008.] http://news.bbc.co.uk/go/pr/fr/-/2/hi/business/7250068.stm.
[16] **Moore, James F. 1993.** Predators and Prey: A New Ecology of Competition. *Harvard Business Review.* May-June 1993, pp. 75-86.
[17] **Iansiti, Marco and Levien, Roy. 2004.** *The Keystone Advantage - What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability.* s.l. : Harvard Business School Press, 2004. ISBN 1591393078.
[18] **Iansiti, Marco and Levien, Roy. 2004.** Strategy as Ecology. *Harvard Business Review.* March 2004.
[19] [Online] [Cited: February 27, 2008.] http://www.askoxford.com/concise_oed/ecosystem?view=uk.
[20] [Online] [Cited: February 27, 2008.] http://www.britannica.com/eb/article-9031944/ecosystem.
[21] **Iansiti, Marco and Levien, Roy. 2004.** Strategy as Ecology. *Harvard Business Review.* March 2004.

capital providers, the government and so on if any of their actions have an effect on how you develop and market a particular product.

A broad definition such as the one given above can over complicate analysis by introducing too many players and very complex set of relationships. Analysis can be made tractable by focusing on the firms that have the strongest dependencies and thus the strongest effects on your business. It may also be helpful to partition the ecosystem into **business domains** – groups of firms that compete in the same product category.

For a firm to be successful, each critical domain within its ecosystem should be healthy. Thus Microsoft cannot be successful unless the critical domains of system integrators and independent software vendors who participate in its ecosystem are healthy. One can sense a two-way causal relation between the success of Microsoft and the success of its business ecosystem — so Microsoft (and other firms in general) needs to think about and manage not only their own business but also the network or ecosystem around them.

Taking a broader ecosystem view is more important today than perhaps the early part of the twentieth century because business structure has transformed from vertically integrated companies (such as IBM, Ford and DuPont in the early 20th century) to networks of companies banding together to provide a product or service (e.g. Dell, Intel and Microsoft).

Insights from an Ecological Perspective of Strategy and Competition

The key insights derived by using ecology to understand firm strategy are:

- Businesses should not be merely concerned about narrowly defined industry segments in which they operate but about the whole range of complex relationships ranging from capital providers, suppliers of intermediate goods, technology providers, complementary goods producers (complementors), customers, competitors and so on. Businesses may organize themselves into different communities or ecosystems and the competitive battle may largely take place between competing ecosystems rather than *merely* firms.

- Businesses especially high technology businesses go through co-evolution so that changes introduced in the system by one party causes other interdependent parties to evolve. For

example, the introduction of a technological innovation within a product space by one firm may cause:

  - Demand evolution such that consumers not only wholeheartedly adopt the innovation for the originally intended application but also for unintended applications which further spurs innovation
  - Evolution of competitive technologies as a response which in turn requires a counter-response
  - Evolution within complementary products which then feeds into the evolution of the original product

- Like natural ecosystems, businesses ecosystems can be profoundly affected by the changes in environment. Too radical a change in the environment may cause business ecosystems to collapse as in natural ecosystems. Technological change can be the root cause for such radical change is some cases but often it is the poor handling of firm interrelationship or exploitation by dominant firms in the ecosystem that may lead to the collapse of the ecosystem.
- Successful firms may not necessarily have the best R&D in their area but they are able to leverage and contribute to their business ecosystem, integrate well across firm boundaries, and integrate innovations well into their existing assets.
- In the face of changes in environment, successful firms are able to sift out legacy assets that are likely to survive and combine these assets with the innovations to deal with the change.
- Incumbents can evolve rather than be disrupted if they build capabilities around systematic consideration of ecosystem, defining the right architecture and integrating innovations into their legacy assets, capabilities and processes.

2.2.1 Evolutionary Stages of Business Ecosystems

Business ecosystems may form as a result of technological innovation. Firms participating in these business ecosystems need to match their strategies and actions with the evolutionary stage of the ecosystem. Figure 1 summarizes one evolutionary path that a business ecosystem may take:

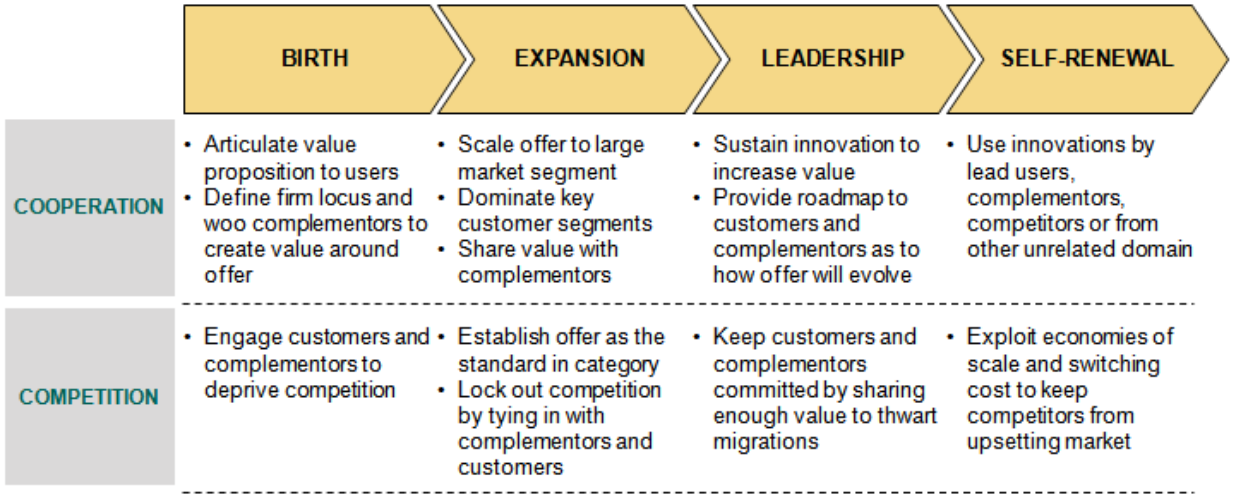

Figure 1: Evolutionary stages of business ecosystems[22]

Firms need to recognize what evolutionary stage of the business ecosystem they find themselves in, and act accordingly. Moreover, firms need to think about cooperation and competition with respect to all organizations that affect their business ecosystems rather than narrowly focusing on immediate customers, suppliers and competitors.

It must be emphasized that this is *one possible* evolutionary path *not the only* path. Mature ecosystems may be threatened by other ecosystems or innovations. They may also face changes in environment such as regulatory changes[23], macroeconomic changes or customer behavior changes. Missteps can lead to the death of the business ecosystem as happened with New England's ice harvesting ecosystem of the nineteenth century[24].

2.2.2 Measures of Ecosystem Health

Measures of ecosystem health can be useful for comparative purposes – comparison between measures of rival ecosystems or changes in the measures over time. Like natural ecosystems,

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[22] (Adapted from) **Moore, James F. 1993.** Predators and Prey: A New Ecology of Competition. *Harvard Business Review.* May-June 1993, pp. 75-86.

[23] For example, the Telecommunications Act of 1996 with the stated goal as claimed by Federal Communications Commission: 'to let anyone enter any communications business - to let any communications business compete in any market against any other'. Telecommunications Act of 1996. *fcc.gov.* [Online] 1996. [Cited: February 29, 2008.] http://www.fcc.gov/telecom.html.

[24] (page 146-157) **Utterback, James M. 1994.** *Mastering The Dynamics of Innovation.* s.l. : Harvard Business School Press, 1994.

healthier business ecosystems are able to efficiently convert input to output (**productivity**), to withstand perturbations in the environment (**robustness**) and foster variety within the ecosystem (**niche creation**).

Productivity

This is the ability of the ecosystem to effectively convert innovation into lowered costs and new products for the ecosystem. The following could be used as measures:

- Return on Invested Capital (ROIC)
- Change in ROIC over time
- Time to adoption of innovation

For example, Figure 2 compares the relative productivity of three business ecosystems:

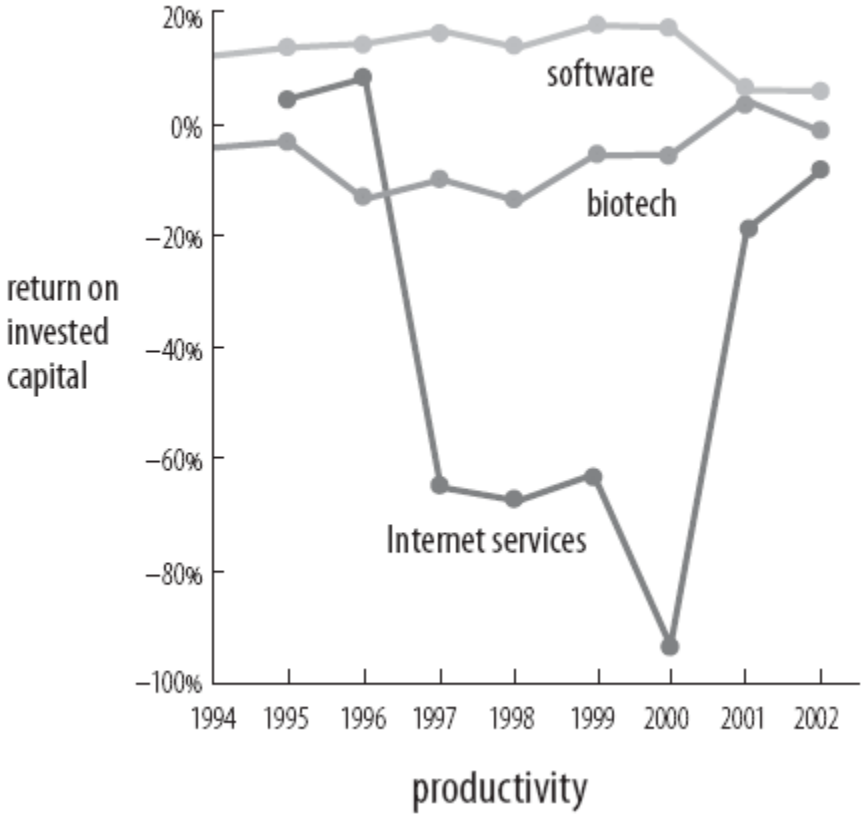

Figure 2: Relative productivity of three business ecosystems

[Source: (Iansiti, et al., 2004)]

Robustness

This is the ability of the ecosystem to survive perturbation in the environment such as regulatory, technological or macroeconomic shocks. The following could be used as measures:

- Survival rates of firms
- Persistence of structure i.e. how stable are the inter-relationship between various firms within the ecosystem over time

Figure 3 compares the robustness of three business ecosystems:

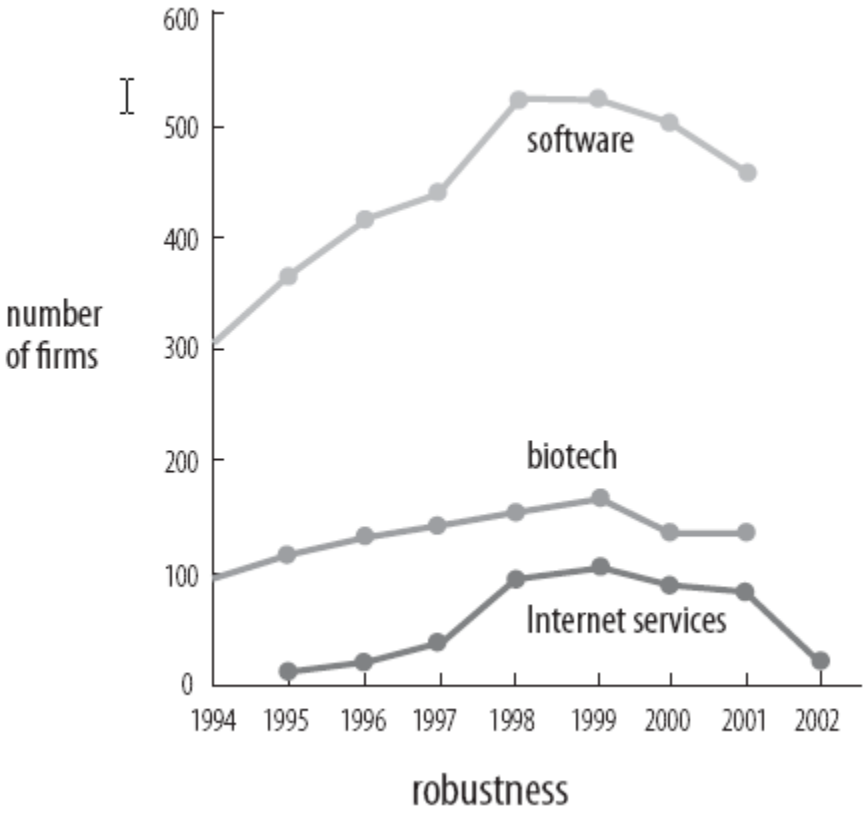

Figure 3: Relative robustness of three business ecosystems

[Source: (Iansiti, et al., 2004)]

Niche Creation

This is the ability to foster the growth of functions or applications within the ecosystem. This could be measured by:

- Growth of new firms
- Growth in product or technical variety

2.2.3 Ecosystem Strategies

Firms can choose operating strategies based on the resources and capabilities they possess. However, firms also need to align their strategies to those of the firms around them in the ecosystem and the environment. The following are some operating strategies that firms can adopt:

Keystones

These are firms that occupy a 'hub' in the network of firms by possessing a unique capability or asset that is needed by many other firms in the ecosystem. Instead of exploiting this advantage narrowly, keystones share the value broadly to improve the overall health of the ecosystem. This feeds back into the success of the keystones, who are usually able to capture superior value compared to other ecosystem firms.

The sharing of value is thus not altruistic but leads to self enriching consequence. It must be noted that keystones may have to regulate ecosystem even to the point of predatory behavior to improve the overall health of the ecosystem. Boudreau[25] argues that platform suppliers (equivalent to keystones is some cases) may have to regulate or even thwart complementor entry to improve the overall health of the ecosystem.

Physical Dominators

These are firms that have unique assets or capabilities and use these advantages to take over most functions in the ecosystem through vertical and horizontal integration. Integrated firms of early twentieth century are good examples for physical dominators.

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[25] **Boudreau, Kevin.** Too Many Complementors? Evidence on Software Firms. *Submitted to Management Science.* [Manuscript].

Value Dominators (or Hub Landlords)

These firms use a unique advantage to capture more value than they create themselves. This is an inherently unstable strategy and leads to the ultimate destruction of the ecosystem.

Niche Players

These firms provide specialized functions such that the value they create and the number of relations they have are a small percentage of the overall ecosystem. However as a group, niche players constitute bulk of the ecosystem.

Niche players leverage keystone contributions to provide a highly differentiated function. Niche players not only face threats from direct competitors but also from keystones – if the functions that niche players provide are at the periphery of keystone functions, they may get absorbed into the keystone. To sustain themselves, niche players need to remain ahead through innovation, specialize further or move to different function.

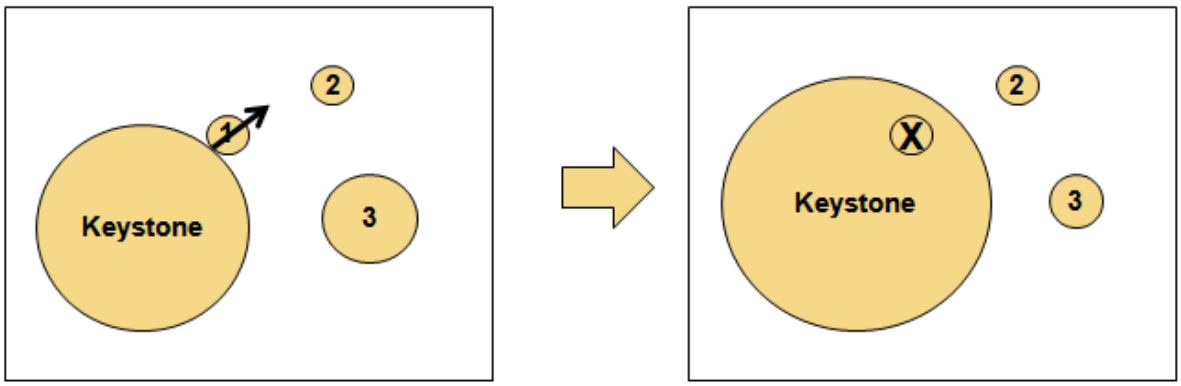

Figure 4: Sustaining a niche strategy

2.2.4 Foundations – Architecture, Integration and Market Management

The operating strategies of firms are undergirded by architecture of the firm, its integration capability and its management of the market. These are the foundation over which the operating strategies are built.

Architecture

Architecture defines how the firm draws its boundaries with regards to technologies, products and organizations. This determines what innovation will be carried out within the firm and what will be leveraged from the ecosystem. Architecture also defines how and with whom the firm will interact to fulfill its mission.

Keystone firms owe their 'hub' position to the ability to uniquely solve a common problem. The sharing of this solution is usually accomplished through a platform to which other ecosystem firms can connect. Well designed platforms usually hide the way they have *implemented* the solution but make the *interface* widely known. The hiding of implementation is not merely to protect a trade secret but to allow keystone to change the implementation without affecting the interfaces and the interfacing firms.

Platforms have the tendency to prey on niche firm innovation that has become a common solution to its client firms. This may appear as harmful domination that reduces surplus although speciously at times.

Iansiti et al[26] have provided guidance for managing platforms as well as managing products that use platforms. The following table summarizes the guidance provided by Iansiti et al:

MANANGING PLATFORMS	*MANAGING PRODUCTS*
1. Provide solutions to general problems 2. Balance implementation and interface design 3. Selectively open the platform to balance distributed innovation with control needs 4. Shape your ecosystem	1. Leverage platform but manage switching costs 2. Invest in understanding the architecture and dynamics of the platforms that you use 3. Beware of the platform frontier

Table 2: Guidance for managing platform vs. product

[Adapted from (Iansiti, et al., 2004)]

[26] **Iansiti, Marco and Levien, Roy. 2004.** *The Keystone Advantage - What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability.* s.l. : Harvard Business School Publishing, 2004.

Integration

Integration defines how organizations collaborate – both inter-firm and intra-firm collaboration. Integration entails organizations sharing data, capabilities, technological components, or intellectual property.

Integration could be a combination of capabilities across organizational boundaries (internal/external divide) or a combination of old capabilities with new (legacy/innovation divide). Cisco was able to able to enter the Cable Modem Termination System (CMTS)[27] market by leveraging its existing router and combining it with radio technology from Broadcom and ESP. Cisco was then able to capture a major market share from the then strong incumbent Motorola.

Market Management

Traditional markets are simpler than the markets that manage transactions between domains within a business ecosystem. Ecosystem marketplaces often connect multiple domains and may subsidize particular domains to increase the overall health of the ecosystem. For example, Microsoft Windows group links together consumers and the thousands of the application developers for the Windows operating system. Microsoft's success depends on the provision of large number of high quality applications for its operating system. Thus it provides access to Application Programming Interface (APIs) and development tools at very low costs to developers[28].

[27] CMTS are devices installed by cable operators on their premises. The cable modems within consumer's home communicates with CMTS.

[28] **Eisenmann, Thomas, Parker, Geoffrey and Van Alstyne, Marshall W. 2006.** Strategies for Two-Sided Markets. *Harvard Business Review.* October 2006, pp. 92-101.

2.3 Platform Strategies and Platform Leaders

Greenstein defines platforms as a 'cluster of technically standardized components that buyers use together with components to make applications'[29]. Platforms provide solutions to common problems in a particular domain. Platforms also make it easy for others to interface with and re-use these solutions. Products that use established platforms are usually easier to develop as they can leverage the solutions that platforms have provided. These products may also reap scale economies as the platform development costs are amortized over several different products[30].

In the automotive industry, platforms are a group of components primarily the floor and inner body structure that can then be used with a range of engines and transmissions to create different vehicles. Automotive platforms thus help increase variety by cutting cost and reducing development time[31].

A computing **platform** such as Microsoft Windows allows innovation because it abstracts the computing hardware and also facilitates applications development through its vast library of Application Programming Interfaces (APIs). In the computing and communication industries, a platform is usually developed by one firm or very few firms while complements for that platform are developed by many firms.

A firm that provides at least one core solution that is valuable, rare and easy to interface with can aspire to become a **platform leader**. Platform leaders use their *core solution* to drive industry wide innovation by managing and fostering the provision of complements.

2.3.1 The Four Levers of Platform Leadership

Scope

Scope is the locus of innovation that a platform leader has ascribed to itself, leaving the rest of the innovation to complementor firms. Scope determines what complements will be developed in-house by the platform leader versus letting the complementors develop them outside.

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[29] **Greenstein, Shane. 1998.** Industrial Economics and Strategy: Computing Platforms. *IEEE Micro.* May-June 1998, pp. 43-53.

[30] **Ulrich, Karl T. and Eppinger, Steven D. 2004.** *Product Design and Development.* Third Edition. s.l. : McGraw Hill Irwin, 2004. ISBN 0072471468.

[31] **Gold, Aaron.** Platform? What's the Heck's a Platform. *About.com.* [Online] [Cited: March 5, 2008.] http://cars.about.com/cs/automakers/a/Kappa_platform.htm.

Scope Determinants: Scope decisions are driven not only by the resources and capabilities of the firm (financial, technical, and organizational) but also by the dynamics of the complementary bandwagon effects. If the platform is highly dependent on a particular complement to solve the startup problem, the platform leader may need to develop the complement in-house.

Signaling Scope to Market: Platform leaders can signal to the market if they intend to leave a complementary product space to other firms. Intel chooses a complementor with good potential and openly helps the complementor to succeed in the space. Intel calls this scope signaling mechanism 'rabbit strategy'[32].

Product Technology

Platform leader's decision about scope leads to a high level architecture for the platform – what solutions will be available within the platform, what will be the structure of the components, how will intellectual property get shared with external firms and how will complementors interface with the platform.

Modular vs. Integrated: An important distinction is whether the architecture is modular vs. integrated. Modular architectures are achieved by partitioning the platform into sub-systems and connecting the pieces together using well define interfaces. This allows for independent technological evolution of components while keeping the architecture intact as long as the interface definitions are adhered.

Information & Access to Interfaces: Platform leaders need to control the amount of information they reveal through interfaces and also who has access to these interfaces. Revealing too much information can open the platform leader to substitution attacks. Providing open access to all interfaces may create too much competition in the complementary goods space, dissuading complementors from innovating in adjacent markets[33].

Proprietary vs. Standard Interface: Platform leaders also need to decide if they will use proprietary interfaces or adhere to industry standard interfaces. Proprietary interfaces may allow dominant platform leaders to capture superior returns as the switching costs for complementors will be high.

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[32] **Cusumano, Michael A. and Gawer, Annabelle. 2002.** The Elements of Platform Leadership. *MITSloan Management Review.* Spring 2002, Vol. 43, 3, pp. 51-58.
[33] **Boudreau, Kevin.** Too Many Complementors? Evidence on Software Firms. *Submitted to Management Science.* [Manuscript].

However, adhering to industry standard interface can help solve the startup problem with installed base as well as encourage innovation within complementary products. Competing platform will have to share the value albeit the value created might be larger.

Relationship with External Complementors

Platform leaders need to manage both collaboration and competition with complementors. Platform leaders need to work with complementors in trying to establish interfaces to ensure that the platform and complements work together smoothly – today and as the product and platform evolves. Platform leaders need to exercise *ecological control* – that is they need to lead and control the process by which interfaces are defined and allowed to evolve.

Conflicts with Complementors: Platform leaders also need to handle two sources of conflict with complementors. First, complementors will prefer standard interfaces instead of proprietary interfaces to lower their switching costs from one platform to the other. Second, complementors at the periphery of platform scope may get subsumed into the platform in later evolutions. This converts platform leader's relationship with such complementors from collaborators in one era to direct competitors in the next era.

Impact of Platform Expansion: The expansion of platform into complementor's territory can have detrimental reputational impact in the long term on the platform leader. Complementors may not want to associate with the platform leader that intrudes and captures complementor space instead aligning themselves with rival platforms. However, there are times when such an expansion is necessary - for example, when the complementor's service also solves a widely faced core problem or when the complementor poses a threat to the platform leader of eventual substitution.

Internal Organization

Platform leaders are often confronted with co-opetition i.e. i.e. having 'to compete and cooperate at the same time'[34] with other firms. This requires that platform leader organize internally to facilitate interactions with complementors.

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[34] **Bradnenburger, Adam M and Nalebuff, Barry J. 1996.** *Co-opetition.* s.l. : Currency Doubleday, 1996. ISBN 0385479506.

Organization Structure: Platform leaders may organize groups with similar goals under one executive. However, groups may need to be organized into separate departments if they have conflicting goals or outside constituencies to serve. To generate trust amongst complementors, platform leaders might visibly erect Chinese wall amongst departments - where one department collaborates and the other competes with these complementors.

Organization Culture and Processes: Platform leaders may also need to establish formal processes such as arbitration by senior management when conflicts arise between departments. Decision making process that includes debate on maximizing long term value for the firm rather than letting powerful groups have their way is also beneficial.

2.3.2 Establishing Platform Leadership

Platform-Leader Wannabes - Choosing Product vs. Platform

As mentioned earlier, platforms provide solutions to one or more core problems facing business ecosystem. The platform should be easy to connect to and build upon so that complementors can innovate in the complement product space.

A firm that can solve a core problem also needs to think about other issues before embarking on a platform strategy. There issues include:

- Capability to evolve the platform along with technology
- Capability to come up with the right architecture and the interfaces that can be used by complementors
- Capability to organize internally so that conflicts between internal firm groups and external complementors are adequately handled
- Capability to entice complementors to become users of firm's platform

Coring – Creating a Platform De Novo

A firm could solve a fundamental problem facing a business ecosystem but to be successful in *coring* i.e. creating a new platform, the firm's innovation should have strong appropriability[35,36] and inimitability[37]. This may initially come from technology superiority but may sustain itself through strong network effects or high switching costs. Otherwise, the firm will not be able to protect its share of the value in the business ecosystem.

The *coring* firm must also facilitate complementors by at least providing easy to use interfaces to the platform. Large firms may even be able to share their complementary assets[36] – manufacturing, distribution, service, marketing, finance, and complementary technologies – to strengthen the complementors in their business ecosystem.

The *coring* firm should also create tight coupling with complementors. This coupling could be achieved by using proprietary interfaces to the platform so that platform migration is difficult. Coupling can also be created by other means such as making the complementor dependent on *coring* firm's complementary assets.

Tipping – Winning the Platform Battle

Tipping is the activity by which platform-leader wannabes tilt the market in the favor of their platform. On the demand side, platform-leader wannabes should focus on user base and complementors. Firms could capture a large installed base perhaps by absorbing initial losses from costly customer acquisition tactics. Firms could also facilitate complementors to use their platform by providing easy to use interfaces. Complementors could also be enticed by sharing more value with them compared to rival platform. On the supply side, platform-leader wannabe could signal through their assemblage of superior complementary assets when compared to rival platforms. For example, Matsushita touted its mass-production facilities to convince videotape developers to commit to VHS.

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[35] *Capturing Value from Innovation.* **Teece, David J. 1991.** 1, s.l. : Licensing Executives Society International, March 1991, les Nouvelles (Journal of Licensing Executives Society International), Vol. XXVI, pp. 21-26.

[36] *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy.* **Teece, David J. 1986.** 6, s.l. : North-Holland, 1986, Vol. 15, pp. 285-305.

[37] **Collis, David J. and Montgomery, Cynthia A. 1994.** Competing on Resources: Strategy in the 1990s. *Harvard Business Review.* July-August 1994, pp. 118-128.

Platform envelopment is another way by which platform-leader wannabes can tip the market in their favor. Envelopment essentially uses the firms existing platform leadership in one business domain to envelop another adjacent domain. Platform envelopment is the discussed in more detail in the next section.

2.4 Convergence, Bundling, and Platform Envelopment

2.4.1 Convergence

Convergence signifies coming together of two different entities. Convergence may be in space as the coming together of Allegheny River and Monongahela River at the center of Pittsburgh to form the Ohio River[38]. Convergence may also result from changes over time – for example, the technological changes that enabled the coming together of wireless phone and music player into a single device such as Apple's iPhone.

For students of management, to study convergence is to study the evolution of boundaries between two or more industries. The most visible convergence today (circa 2008) and most apt to this thesis is the convergence taking place between communications and computers.

Types of Convergence

Convergence can be of at least three types as discussed below.

Convergence of Substitutes: Convergence can happen when two distinct products may gradually become substitutes.

- **Given** set of users may find the two products substitutable for **growing** set of tasks
- **Growing** set of users may find the two products substitutable for **given** set of tasks

Over time, one or both of these products may start offering the same benefit to the consumer by acquiring similar feature set. For example, consider the early period of personal computer (circa 1980) and the electric typewriter. The important use cases of personal computers then did not include word processing. However, personal computers shared certain features with the electric

[38] **Greenstein, Shane and Khanna, Tarun. 1997.** What Does Industry Convergence Mean? [ed.] David B. Yoffie. *Competing in the Age of Digital Convergence*. s.l. : Harvard Business School Press, 1997, Chapter 5.

typewriter from the very beginning such as the keyboard. With the introduction of good word processing software and quality pc-compatible printers, personal computers *converged* with the electric typewriter.

Convergence of Complements: Convergence of complements can happen if:

- Two products used together are more valuable to users than used separately.
- Two products evolve such that they are more valuable today than they were previously.

Convergence in complements can then manifest itself as firms may then be able to bundle the two products together to form a larger system. For example, *complements* - sensors and signal processors - are brought together in modern medical imaging products such as Computerized Topographic (CT) scanner to provide more benefits and value to users[39].

Convergence of Functionally Unrelated Entities: Convergence can also take place between two functionally unrelated entities i.e. products or services that provide unrelated benefits to users. This may happen when the entities differ in the benefits they offer yet share the same components and user relationships. For example, a music player and mobile phone have been converged although they are functionally unrelated and were once available only as separate products[40].

Convergence Type Depends on Level of Analysis: Type depends on the level at which we view the convergence. For example, the Java Virtual Machine (JVM) deployed on a Wintel personal computer (PC) may be considered convergence in complements. But JVM may also be deployed on Apple's Macintosh computer (Mac) or Sun Microsystems' workstation (Sun). Thus the following combinations may all be viewed as convergence in substitutes: 'JVM + PC', 'JVM + Mac', 'JVM + Sun'.

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[39] **Greenstein, Shane M. 2000.** *Technological Convergence.* [Compact Disc] [ed.] Richard C. Dorf. s.l. : CRC Press LLC, Chapman & Hall/CRCnetBASE, 2000. Technology Management Handbook.

[40] This is inspired by the discussion in (Eisenmann, et al., 2007).

Economic Effects of Convergence

Although both types of convergence may seem to occur simultaneously if viewed from different levels (component vs. system), clearly understanding the type at a given level helps understand the effects on market structure.

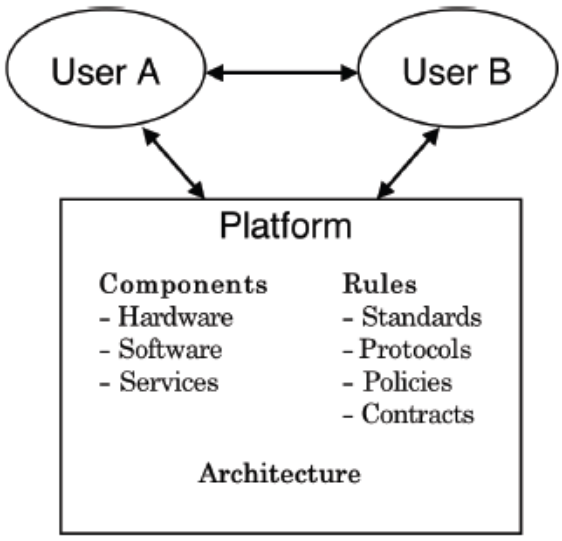
Convergence in substitute usually increases competition and decreases market concentration. For example, the public telephone network and the cable network have converged as substitutes so users have more options for getting their telephone and cable TV subscriptions. Firms facing convergence in substitute may move to control scarce resources or vertically integrate into distribution if a competitor firm controls distribution channel.

Convergence in complements may increase competition at the component level if the complements can interface with core product through an open technical standard. Greenstein et al have discussed the effect of convergence in complement on market structure in more detail[41].

[41] **Greenstein, Shane and Khanna, Tarun. 1997.** What Does Industry Convergence Mean? [ed.] David B. Yoffie. *Competing in the Age of Digital Convergence.* s.l. : Harvard Business School Press, 1997, Chapter 5.

2.4.2 Platform-Mediated Networks and Envelopment

Eisenmann et al[42] view of platform is slightly more expansive than taken by some other scholars such as Greenstein or Cusumano. Einsenmann views platforms as:



> ***Platform*** *encompasses the set of components and rules employed in common in most interactions between network users.* ***Components*** *include hardware, software, and service modules, along with an architecture that specifies how they fit together.* ***Rules*** *encompass information visible to network participants that is used to coordinate their activities. In particular, rules include* ***standards*** *that ensure compatibility between different components;* ***protocols*** *that govern information exchange; policies that constrain network user behavior; and* ***contracts*** *that specify terms of trade and the rights and responsibilities of network participants.*

Figure 5: Eisenmann's view of platforms

Entrenched platforms enjoy a huge incumbency advantage because of network effects, switching costs, and endogenous sunk costs. One way for an attacker to succeed in an entrenched platform markets is to create a truly superior platform through discontinuous innovation to replace an incumbent's platform. Another way is what Eisenmann et al call 'platform envelopment'[42].

[42] **Eisenmann, Thomas, Geoffrey, Parker and Van Alstyne, Marshall. 2007.** *Platform Envelopment.* 2007. Working Paper. 07-104.

Platform Envelopment

Platform envelopment is an attack by one platform provider into another platform market. The attacker creates a multi-platform bundle by leveraging common technological components and shared user base. Platform envelopment by an attacker makes the incumbents in the target market vulnerable despite any network effects and switching costs and even without the attacker creating a platform that is vastly superior.

Relationships between Platforms

The following table summarizes some of the relationships between independent platforms arbitrarily named 'A' and 'B':

RELATION	*DESCRIPTION*	*EXAMPLE*
Functionally Unrelated	Serve different purposes but may have common components and shared users	Mobile phones and music players.
Substitutes	Close substitutes are already converged so envelopment is irrelevant. Weak substitute may offer similar benefits to users but with some differentiation. Weak substitutes are candidate for envelopment	Wire-line voice and wireless voice. Wire-line voice offers higher voice quality and close to zero call drops. Wireless voice offers mobility and reachability.
Nested Network Users	One platform is a nested user of another platform. Both platforms appear complements to users	eBay is a nested user of the public internet.
Nested Components	One platform complements another platform when users try to accomplish a task. Each platform fulfills part of the task.	eBay for auction along with credit cards or PayPal for payments.

Table 3: Relationships between platforms

The platforms may complement each other *reciprocally* or *unilaterally*. Reciprocally specific platforms are those that are mostly deployed together. The use of one of the platform independent of the other is rare. For example:

- Microsoft Windows operating system with Microsoft Office suite
- eBay and PayPal – 78% of eBay buyers user PayPal and 70% of PayPal transactions are completed on eBay

Reciprocally specific complements exhibit strong negative cross price elasticity.

Unilaterally specific complement platforms are those that have a unilateral relationship i.e. one platform is always deployed with the other but not vice versa. For example:

- Quicken is mostly used on a Windows PC but most Windows users do not own Quicken
- Most eBay users use FedEx or UPS for shipping but most FedEx users are not eBay users

Cross price elasticity is one-sided in the case of unilaterally specific platforms – increase in the price of Windows will have a negative effect on the demand for Quicken but not the other way around.

2.4.3 Potential Advantages of Platform Envelopment

Price Discrimination Gains

If the consumer valuation of individual platforms is negatively correlated or weakly correlated, bundling reduces the variance in the aggregate valuation for the set of platforms. In cases where firms cannot offer different prices for individual platforms based on customer willingness-to-pay, bundling allows price discrimination. Eisenmann et al extend the analysis by Bakos and Brynjolfsson[43] to suggest that bundling will be beneficial when the marginal cost of the two platforms is low compared to the value of the two platforms.

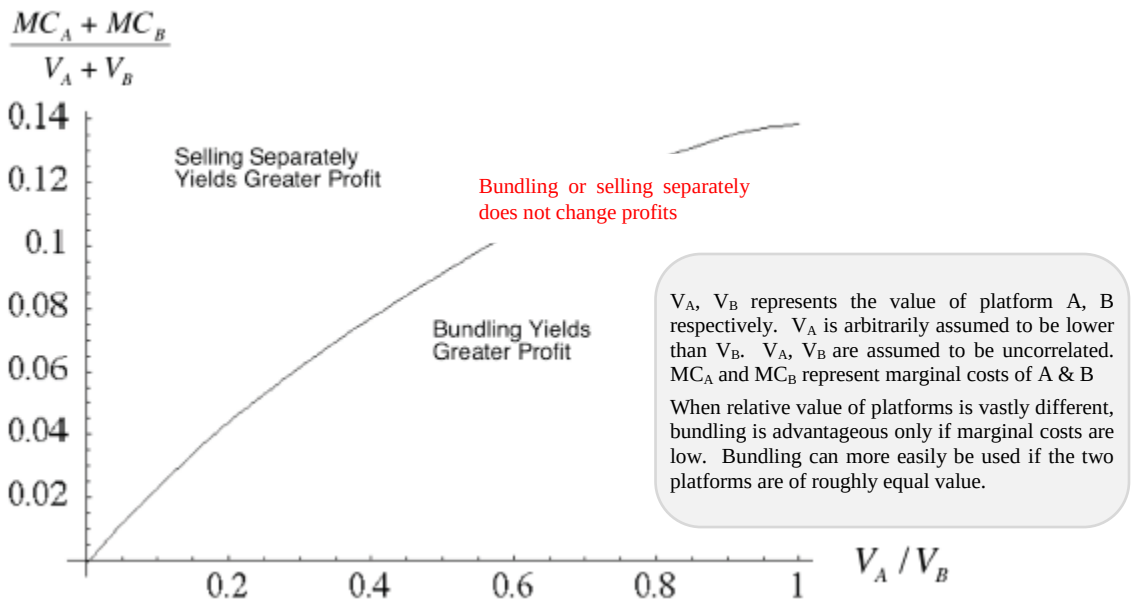


Figure 6: Bundling decision based on value and marginal costs of platforms

(Adapted from Platform Envelopment by Eisenmann et al)

Profit gains through price discrimination are likely to accrue on envelopment if (1) platforms are functionally independent and their use is not strongly correlated (2) platforms are complements but not reciprocally specific complements (3) platforms are weak substitutes but marginal costs are very low (as V_A, V_B will be low for weak substitutes).

[43] *Bundling Information Goods.* **Bakos, Yannis and Brynjolfsson, Erik. 1999.** Number 12, 1999, Management Science, Vol. 45, pp. 1613-1630.

Efficiency Improvements

Bundling of platforms can provide economies of scope in marketing, production, operations. Bundling can also improve quality; or increase demand and overall profit by removing high double margins.

Economies of Scope in Marketing: Bundling may reduce search costs for customers as well as reduce customer acquisition costs for the producers. These benefits can accrue irrespective of the relationship between platforms.

Economies of Scope in Production and Ongoing Operations: Bundling may decrease production costs because of shared components. These economies are more likely to occur when platform relationship is 'weak substitutes' rather than 'functionally unrelated' or 'complements'.

Quality Advantages: Bundling may result in quality improvements in the case of weak substitutes or reciprocally specific complements.

Avoidance of High Double Margins: Bundling may remove double marginalization if two firms with market power provide reciprocally specific complements.

Strategic Advantages

Through envelopment, platform providers can gain strategic advantages when attacking another platform or foreclosing an attacker.

Extending Market Power: Envelopment may help increase profits when target platform is reciprocally specific complement or unilaterally specific complement to firm's platform. This could choke the complement producer by cutting off demand for complement producer who may find it difficult to cover fixed costs.

Foreclosure of Attacker's Market: Envelopment may foreclose attacker's own market by taking over control of a complement that may be necessary for any rival platform to succeed. Sony was able to gain advantage by enveloping Blu-ray with Playstation 3.

Table 4 links the possible advantages of envelopment with the platform relationships that should be present in the enveloped platforms.

ADVANTAGE	*PLATFORM RELATIONSHIP*	*REMARKS*
Price Discrimination	• Functionally independent with low usage correlation • Complements but not reciprocally specific	
Scope Economies in Marketing	• Functionally independent • Weak substitutes • Complements	
Scope Economies in Production and Operations	• Functionally independent • Weak Substitutes	Scope economies may or may not realize with functionally independent platforms.
Quality	• Weak substitutes • Reciprocally specific complements	
Removal of Double Margins	• Reciprocally specific complements	Separate providers have market power
Extending Market Power	• Reciprocally specific complements • Unilaterally specific complements	
Foreclosure of Market	• Reciprocally specific complements	

Table 4: Platform relationships and envelopment benefits

2.4.4 Types of Envelopment Attacks

Platform providers can launch **conglomeration** attack if the platforms are functionally unrelated, **intermodal** attack if the platforms are weak substitute or **foreclosure** attack if the platforms are complements. The table below summarizes the various attack types:

	PLATFORM RELATIONSHIP	**POTENTIAL ADVANTAGES**		
		PRICE DISCRIMINATION GAINS	EFFICIENCY IMPROVEMENTS	STRATEGIC ADVANTAGES
Conglomeration	Functionally unrelated	• Strong gains if user valuations negatively correlated • Moderate gains if weakly correlated • No gains if perfectly correlated	• Scope economies in marketing • Scope economies in production for some platform pairs	• Limited
Intermodal	Weak substitutes	• Limited because of strong correlation of user valuations	• Scope economies due to shared components • Quality improvements through improved knowledge of customer preferences	• Opportunity to neutralize an emerging threat
Foreclosure	Complements	• Limited gains with reciprocally specific complements because of strong correlation • Moderate gains with unilaterally specific	• Quality improvements due to tighter integration • Avoidance of double marginalization	• Attack complement market and extend market power • Protect core market by foreclosing rival access to important complement

Table 5: Summary of envelopment attacks

[Adapted from (Eisenmann, et al., 2007) page 15]

3 Unified Communications & Collaboration – Technologies, Products and Convergence

Telecommunication services and computing are essential to modern business. In United States alone, businesses allocate billions for capital and operational expenditure on communication and computing, expecting a return on their investments through gains in productivity. Communication and computing tools not only allow individual workers to do their jobs more efficiently but also improve business processes through better coordination.

A knowledge worker today uses multiple modes of communication during the course of his or her work day. These may include real-time communication modes such as telephone and instant messaging as well as asynchronous modes such as email and voice mail. However, the various computing, communication, and collaboration applications have hitherto existed largely in separate silos. Knowledge workers spend time juggling through various communication modes and devices that are available to them. There is value to be gained by the integration of these communication and computing applications to create a unified user experience. The industry jargon term for this unification is Unified Communications & Collaboration (UC).

UC can also help speed up business processes by removing human latency – the time that is wasted in reaching the right person for decision making within an organization or in making the actual decision and communicating it to all stakeholders. Although reducing 'human latency' may ultimately be the 'largest single value'[44] of UC, achieving this will require time and effort on the part of businesses. Firms will have to examine their business processes carefully and incorporate UC tools to achieve reduction in human latency. A research study by Brynjolfsson et al suggests that gains in productivity from IT investments depend on complementary organizational investments[45].

3.1 What is Unified Communication & Collaboration

Broadly speaking, UC is the convergence of the computing and communication tools that knowledge workers use in the course of a workday. The question is: what constitutes UC?

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[44] **Elliott, Bern. 20 August 2007.** *Magic Quadrant for Unified Communications, 2007.* s.l. : Gartner, 20 August 2007. Research. G00150273.

[45] **Brynjolfsson, Erik. May 2005.** VII Pillars of IT Productivity. *Optimize.* May 2005.

Technology research firm IDC asserts that enterprises are still not sure as to what constitutes UC[46,47]. This can partly be attributed to the newness of the market – 'birth' stage of Moore's ecosystem model. Vendors are trying to define benefits that enterprises can gain from UC adoption but also doing it in a way that plays to their strengths or allows them to re-brand their existing product suite as UC product. This has resulted in divergent views and customer confusion.

Given that some technologies underlying UC are mature and widely deployed across enterprises, businesses are confused as to whose definition they should buy into. For example, networking vendor Cisco places more emphasis on the network, IP PBXs and IP phones within the context of UC. Traditional enterprise telecommunication vendors such as Avaya and Nortel emphasize IP PBX and communication systems integration capabilities. Microsoft and IBM on the other hand place more emphasis on desktop applications such as email, instant messaging and enterprise collaboration tools.

UC Definitions

Instead of focusing on vendor definitions, we could instead start by looking at how some of the well known technology research firms are defining the term. The perspective of these firms is formed not only by looking at a broad range of vendors but also by talking to customers and users.

> *IDC defines unified communications as solution or platform, accessible through desktop and mobile devices, that combines: unified messaging (email, fax, and voice messages in the same mailbox); advanced IP telephony calling and management; web, audio- and videoconferencing; Instant messaging; and pervasive presence management. In addition, UC applications enable integration with horizontal and vertical industry business processes and applications*[48].

Frost & Sullivan argues for a narrow definition of Unified Communications rather than a broad definition that incorporates all vendors' point of views. Frost & Sullivan deems a tighter definition necessary for the term to remain relevant. Otherwise, the term Unified Communication becomes 'everything and nothing'.

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[46] **Freedman, Nora and Germanow, Abner. September 2007.** *Key Trends in Enterprise VoIP 2007: Customer Perspectives on Unified Communications.* Framingham, MA : IDC, September 2007. Survey. IDC #208643.
[47] **Frost & Sullivan. 2007.** *World Unified Communications Markets.* Palo Alto, CA : Frost & Sullivan, 2007. N180-64.
[48] (Quote from) **Freedman, Nora. 2008.** IBM Commits $1B to Unified Communications. *IDC Link.* [Online] March 12, 2008. [Cited: March 14, 2008.] http://www.idc.com/getdoc.jsp?containerId=lcUS21137708.

Frost & Sullivan defines a unified communications application as an integrated set of voice, data and video communications, all of which leverage PC- and telephony-based presence information.

Further, Frost & Sullivan also lists what it views as mandatory and optional components in any UC offering:

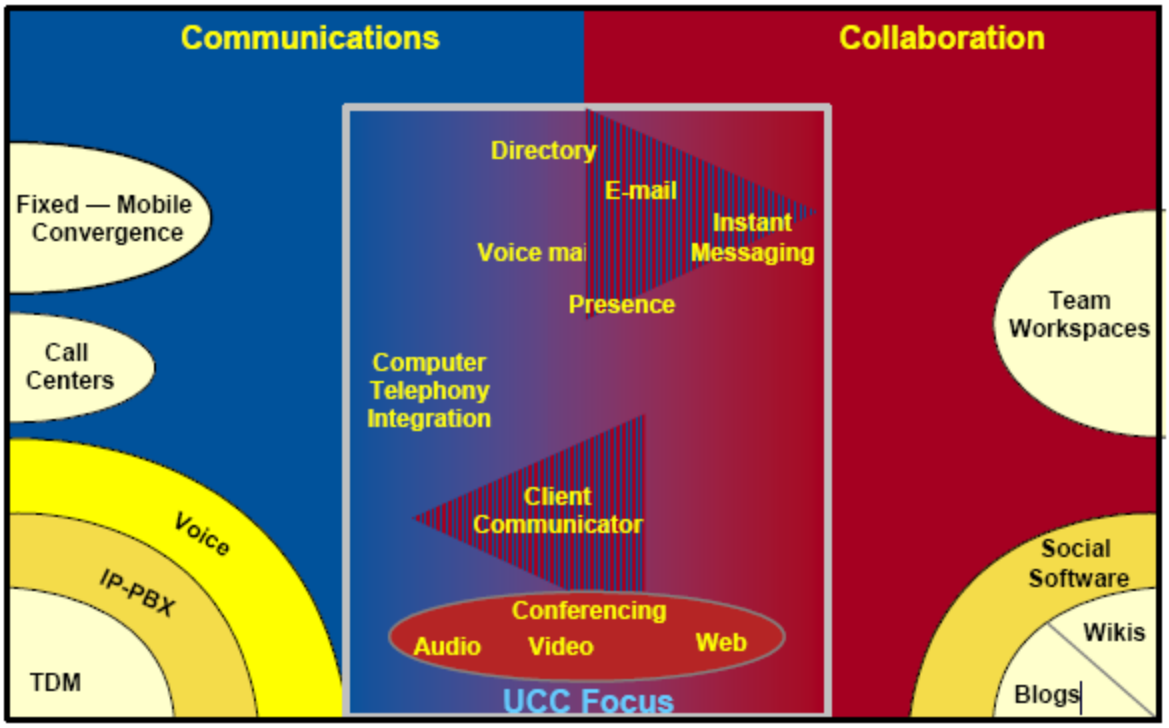
FROST & SULLIVAN'S PERSPECTIVE ON UNIFIED COMMUNICATIONS	
MANDATORY COMPONENTS	*OPTIONAL COMPONENTS*
• PC based presence (online or offline) • Telephony presence (on the phone or available for call) • Point-to-point voice calling • Chat (i.e. instant messaging) • Audio conferencing • Web collaboration (application, file and desktop sharing) • PC-based video • Find-me/Follow-me capabilities (for call routing)	• Unified messaging • Social networking capabilities • Wikis/blogs • Mobile client • APIs for easy integration with other applications

Table 6: Unified Communication and Collaboration components

Gartner has a more abstract definition of Unified Communication although Gartner clarifies what constitutes UC at other places.

Gartner defines UC products (equipment, software and services) as those that enhance individual, workgroup and organizational productivity by enabling and facilitating the control, management, integration and use of multiple enterprise communication methods. UC products achieve this through the convergence and integration of communication channels (that is, media), networks, systems and business applications, as well as through the consolidation of the controls over them. UC products may be made up of a stand-alone product suite or may be a portfolio of integrated applications and platforms[49].

[49] (Quote from) **Elliott, Bern. 20 August 2007.** *Magic Quadrant for Unified Communications, 2007.* s.l. : Gartner, 20 August 2007. Research. G00150273.



IP PBX = Internet Protocol private branch exchange, TDM = time division multiplexing, UCC = unified communications and collaboration

Source: Gartner (November 2007)

Figure 7: Gartner's view of UC

The earlier generations of UC products will bring together the following five product areas along with **presence** into a converged offering:

Voice: IP based telephony used with Softphones[50] as well as IP-based desktop phones. Telephony is integrated into company directory and calendars.

Messaging: Integration of voice mail with email and facsimile

Email: Further evolution of email towards contact management and collaboration tool.

Instant Messaging: Use of IM not just as a quick text based method for real-time communication but also as a launch pad for other communications such as voice and video.

[50] "In computing, a softphone is a software program for making telephone calls over the Internet using a general purpose computer, rather than using dedicated hardware. Often a softphone is designed to behave like a traditional telephone, sometimes appearing as an image of a phone, with a display panel and buttons with which the user can interact. A softphone is usually used with a headset connected to the sound card of the PC, or with a USB phone". (From) Soft phone. *Wikipedia.* [Online] [Cited: March 15, 2008.] http://en.wikipedia.org/wiki/Softphone.

Conferencing: Integration of audio, video, and web conferencing.

Presence

A frequently used term within UC is **presence** which is information about user's availability and the best communication mode to contact the user. Most users who have used instant messaging will be familiar with the concept – IM users can set their status as 'available', 'busy', 'away' etc. that allows other IM users interested in communicating to know if it is appropriate to contact the original user on IM or not. With **rich presence**, users will also be able to share information about their availability on multiple systems as UC systems will aggregate availability information from multiple sources such as phone (both IP and mobile), IM, email and calendar. The availability of presence information will make communication more valuable. For example, the following blog posting titled "Voice 2.0: A Manifesto for the future" notes the advantage of presence to voice communication:

> *Presence will drive a fundamental change in the way that communications networks are used today. Today, callers have no way of knowing whether the party being called is available, or busy, or would consider the call an intrusion. With presence, the availability of a called party is known by the calling party before making the call. This seemingly simple idea will increase the immediacy and value of calls in all kinds of applications. It will do away with calls that begin with "Is this a good time", and reduce the volume of voice mail created when parties can't connect. The range of new applications for presence is huge also. For instance, imagine an ad-hoc collaboration application where you are able to know, before initiating the call, whether all parties can attend the call, right now*[51].

Achieving a comprehensive **presence** view of any knowledge worker is tough today. Presence information is distributed across many different applications. These applications are supplied by different vendors and service providers, and operate using different protocols. A knowledge worker might be using a SIP based IP phone service from Cisco, XMPP based IM system from Jabber and CDMA based mobile phone from Verizon, along with Simple Mail Transfer Protocol (SMTP) based email system and iCalendar-compatible[52] calendar from Microsoft. A presence service needs to

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[51] **Saunders, Alec. 2005.** Voice 2.0. *Saunderslog.com.* [Online] October 21, 2005. [Cited: March 17, 2008.] http://saunderslog.com/voice-20/.

[52] "iCalendar — ICal outlines a common format for the exchange of calendaring and scheduling information across the Internet. A product of the Internet Engineering Task Force, iCal was published as a standards track document in 1998. The IETF also published two companion protocols in 1998: iTIP, which specifies how calendaring systems use iCal objects to interoperate with other calendaring systems; and iMIP, which specifies a binding between iTIP

aggregate information from all these multi-vendor multi-protocol applications and provide interfaces to client application to gain access to the aggregated presence information. Internet Engineering Task Force (IETF) Informational RFC 2778 defines two distinct sets of clients of a presence service: "one set of clients, called *presentitites*, provides *presence information* to be stored and distributed. The other set of clients, called *watchers*, receives *presence information* from the service"[53].

Vendors such as Avaya, Cisco, IBM, Microsoft etc. have noticed the importance of controlling presence service and have each argued that they are best able to provide presence aggregation. For example, Avaya announced its Intelligent Presence Server on March 17, 2008 claiming to be able to aggregate presence from Avaya voice products as well as IBM and Microsoft products using multiple protocols such as SIP/SIMPLE and XMPP[54].

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and Internet e-mail transports. The iCal protocols offer basic calendaring interoperability such as sending, receiving and responding to meeting invites among users of different calendaring software. ICal has gained support across the messaging industry since it became available in Outlook 2002". (From) **Marsan, Carolyn Duffy. 2002.** Calendaring Standards Gain Popularity. *Network World.* [Online] October 10, 2002. [Cited: March 17, 2008.] http://www.networkworld.com/cgi-bin/mailto/x.cgi?pagetosend=/export/home/httpd/htdocs/news/2002/1028calendar.html.

[53] **Day, M., Rosenberg, J. and Sugano, H. 2000.** A Model for Presence and Instant Messaging. *Internet Engineering Task Force.* [Online] February 2000. [Cited: March 17, 2008.] http://tools.ietf.org/html/rfc2778. RFC 2778.

[54] **Greenfield, Dave. 2008.** Avaya Changes the UC Game. *ZD Net.* [Online] March 17, 2008. [Cited: March 17, 2008.] http://blogs.zdnet.com/Greenfield/?p=210.

UC Applies to the Convergence in the Business Market

The term UC is generally applied to business market products although consumer market products are increasingly providing integrations amongst various communication modes. For example, Skype which is a consumer product provides computer-to-computer voice communication as well as voice telephony, instant messaging, video communication, (limited) audio conferencing, voice mail and (limited) presence.

Although UC in its developed form will comprise of a whole range of applications from plain old telephony (POTS) to newer Enterprise 2.0 collaboration tools[55] (Web 2.0 within enterprise) such as Wikis, blogs, and so on - we posit that enterprises' UC adoption decisions will be driven by their existing investments in voice, email and instant messaging (please see Appendix E for some evidence from an actual decision). We list some reasons below to support our assertion:

- Enterprises have invested large sums such as for on-premise private branch exchanges (PBX) which are not ready for replacement. Enterprises have used five to seven years depreciation cycles for the traditional Time Division Multiplexing (TDM) PBXs but these PBXs last even longer[56,57]. Gartner claims that the product life cycle of TDM PBX systems is at least eight years[58]. Similarly, buying firms will not rip-and-replace their investments in IP PBX systems. UC products should be able to leverage these voice telephony investments by integrating with them rather than requiring a replacement.

- Although Email and Instant Messaging are not subject to long depreciation cycles as they are purchased on an annual per user license basis, they too are sticky because of migration costs and the risk of business disruption. Austin et al[59] assert that 'migration costs are significant and it is difficult to build a business case for changing e-mail platforms based solely on return on investment'. Moreover, email and instant messaging have become

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[55] **McAfee, Andrew P. Spring 2006.** Enterprise 2.0: The Dawn of Emergent Collaboration. *MITSloan Management Review.* 3, Spring 2006, Vol. 47, pp. 21-28.
[56] **McCourt, Tavis C. and O'Donnell, Christoph. 3 August 2006.** *Avaya, Inc.* s.l. : Morgan Keegan & Company, Inc., 3 August 2006. Equity Research.
[57] **Frost & Sullivan. 2006.** *North American Enterprise E-mail and Instant Messaging Solution Markets.* Palo Alto, CA : Frost & Sullivan, 2006. F852-62.
[58] **Lassman, Jay and O'Connell, Daniel. 24 July 2007.** *IPT vs. TDM Life Cycle Purchase and Operations Costs.* s.l. : Gartner, 24 July 2007. Research. G00150236.
[59] **Austin, Tom and Cearley, David W. 19 January 2007.** *Dissatisfaction with IBM and Microsoft E-Mail and Calendaring is Real.* s.l. : Gartner, 19 January 2007. Research. G00145489.

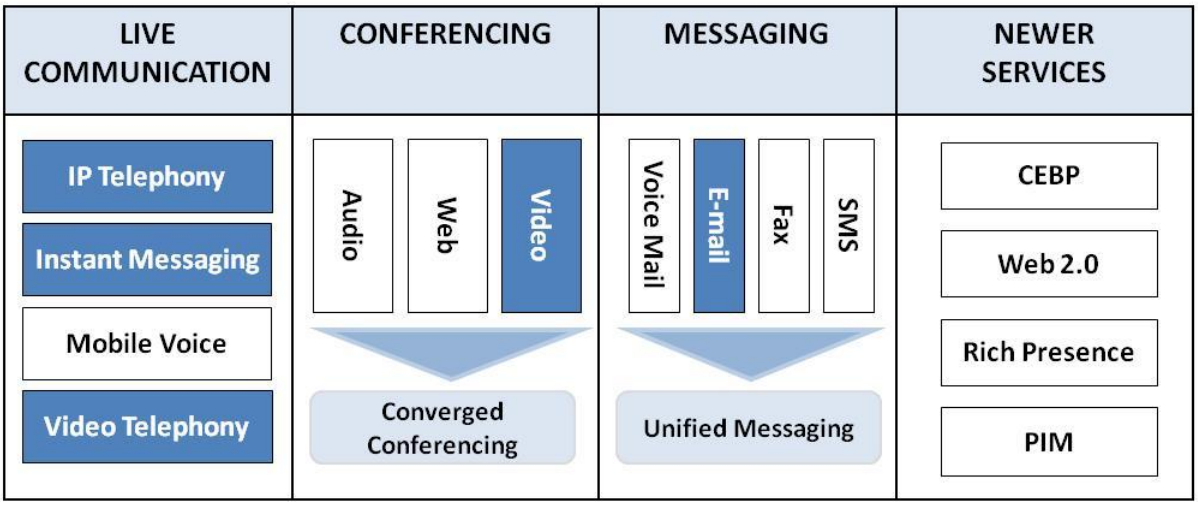
essential business tools and businesses will not risk any migration related disruptions unless they can prove large returns through productivity increases or cost savings.

- As voice, email and instant messaging are currently installed and widely used applications within enterprises, they have created customer groove-in[60] with particular vendors i.e. users have invested time and effort in training for the operation, maintenance and trouble shooting of the particular vendor platform that they are using. Changing a platform that has achieved groove-in is difficult because of organizational resistance as well as the cost of retraining etc.

[60] **Arthur, W. Brian. 1996.** Increasing Returns and the New World of Business. *Harvard Business Review*. July-August 1996, pp. 100-109.

3.2 Products and Technologies Underlying UC

Figure 8 summarizes our perspective on UC. As noted in the previous section, we feel that UC decisions within enterprises will be driven by their existing investments in telephony, instant messaging and email - the figure highlights this fact and we discuss these three components in greater detail later on. Video communication is also worth greater discussion not only for its perceived value in communication but also for the vendor infatuation with video communication. Moreover, many strategic failures within video communications market in previous episodes provide important lessons.



Abbreviations: PIM is Personal Information Manager. CEBP is Communication Enabled Business Processes.

Figure 8: Communication and collaboration applications currently used by knowledge workers.

Drivers of Convergence between UC Components

The integration of these communication applications is enabled by evolution in a number of high technology areas.

- **Hardware Performance and Costs**: Availability of low priced and high performance general purpose hardware. The performance improvements that have happened in the following areas have affected UC most: processing power (microprocessors), volatile memory (RAM), storage (disks, tapes), input/output devices (microphones, video devices).

- **Software Advances**: Advances in software such that software running on general purpose hardware can support applications such as voice which were previously implemented on special hardware.

- **Broadband Availability & Digital Transmission**: Ubiquity of the public broadband internet and the move towards encoding all information and media types into digital formats. With digital encoding, all information types can now be exchanged over the packet-based internet.

- **Coding Technology**: Media encoding has also benefitted from advances in compression technology. Exchange of information and media on the open and public internet has benefitted from advances in cryptography and protocol design.

- **Standard Protocols**: The adoption of packet based Internet Protocol (IP) for transport and the Session Initiation Protocol (SIP) for the control of communication sessions at the application layer. Although IP has been around for a while, SIP is a recent protocol that has been in a furious standards battle against a competing protocol called H.323[61]. SIP may ultimately win the battle because of the backing of major technology powerhouses such as Cisco and Microsoft. An extension of SIP for messaging called SIMPLE (Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions) has been competing with the open-source, XML-based XMPP (eXtensible Messaging and Presence Protocol)[62].

3.2.1 Voice Telephony

Enterprise voice market is big as enterprises spend large amounts on voice telephony hardware and software every year. Synergy Research estimated that enterprises in North America spent roughly $10 billion in 2006 on voice hardware and software[63]. These expenditures do not include the service

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[61] H.323 is a telecommunication standard developed by ITU (http://www.itu.int/ITU-T/). The focus of H.323 has been to handle voice and multimedia calls over IP. H.323 is also designed to work well with legacy Public Switched Telephone Network (PSTN). (Please see) **Glasmann, Josef, Kellerer, Wolfgang and Müller, Harald. 2003.** Service Architectures in H.323 and SIP: A Comparison. *IEEE Communications Surveys & Tutorials.* [Online] 2003. [Cited: March 17, 2008.] http://www.comsoc.org/livepubs/surveys/public/2003/oct/glasmann.html.

[62] **Moore, Cathleen. 2003.** XMPP vs SIMPLE: The Race for Messaging Standards. *InfoWorld.* [Online] May 23, 2003. [Cited: March 16, 2008.] http://www.infoworld.com/article/03/05/23/21FExmpp_1.html.

[63] (page 3) **Jensen, Troy D. 21 May 2007.** *Avaya, Inc.* s.l. : Piper Jaffray & Company, 21 May 2007. Equity Research.

fees paid to telecom carriers to carry off-premise voice traffic. The telecom service fees when added up to the hardware and software expenditures could lead to substantially larger total telecom spend. Businesses spend these large amounts as voice telephony today is considered an essential business tool and is provided to nearly every office worker in North America.

Enterprise Telephony is PBX Based: Enterprise voice telephony is different from consumer telephony as most large businesses have on-premise telephone exchanges known as Private Branch Exchange (PBX)[64]. These PBX systems allow workers in a corporation to speak to each other without requiring their calls to leave the company locations' phone network. A big advantage of this approach is the telecom fees saving that ensue from avoiding the phone company network. Some disadvantages are the capital expenditures required for PBX equipment and the need to maintain telecom staff to run the PBX system. PBXs are thus efficient for larger enterprises but not very suitable for small businesses.

The PBX systems were traditionally supplied by vertically integrated telecommunication firms such as Avaya (AV) and Nortel (NT). Traditional PBX systems were packaged as special purpose hardware with proprietary software and utilized Time Division Multiplexing (TDM) for call switching. Although there is a large existing installed base of TDM PBXes, the newer installations in 2007 were largely IP-based software driven PBXes running on general purpose hardware. Incumbent vendors also offer hybrid TDM/IP PBX that can support the incumbent's legacy TDM installed base while providing a smoother transition to IP-based voice communication.

The traditional PBX systems were linked to the Public Switched Telephone Network (PSTN) using trunk lines but the newer IP-based PBXes could not be directly linked to the PSTN. Special VoIP gateways served as intermediary between IP PBXes and the PSTN.

Figure 9 breaks down enterprise telephony into components to facilitate understanding.

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[64] To be complete, we want to point out that very small businesses (e.g. doctor's office with staff of five) may buy phone service directly from telecommunication companies much like residential users. Businesses may also have smaller private telephone systems known as Key Telephone System or KTS that can support up to 130 lines [http://www.voip-news.com/dictionary/kts/ accessed on Apr 30, 2008]. Finally, enterprises may buy Centrex from telecommunication companies. Centrex provides benefits similar to PBX such as shortened dialing to colleagues (similar to 5-digit dialing within MIT in 2008) but frees the business from initial capital expenditure and ongoing operational costs of a PBX.

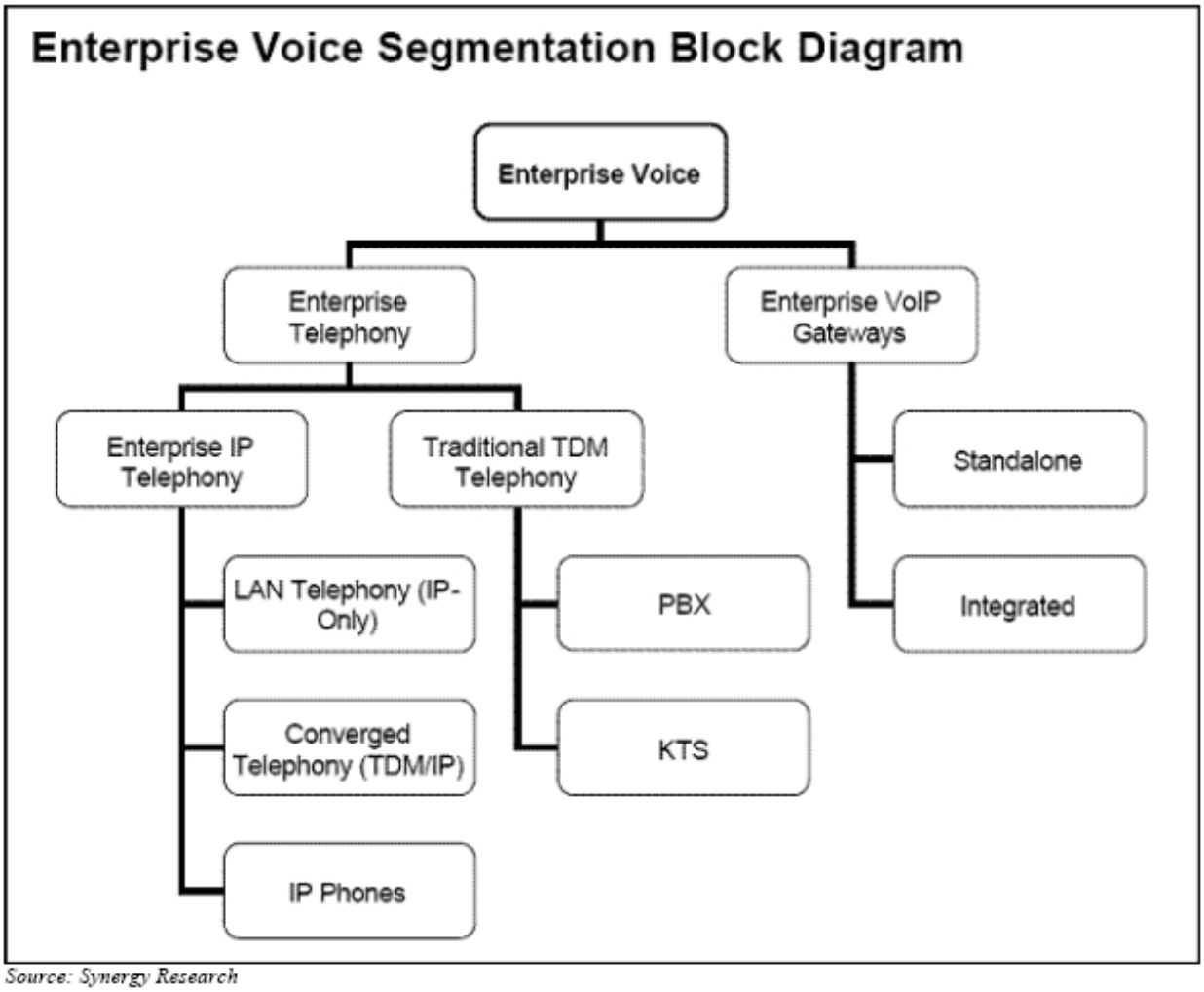

Figure 9: Enterprise voice components

VoIP is the future of Enterprise Telephony: Although voice transmission over packet network was demonstrated in 1974, it was not until the late 1990s that voice transmission over packet networks started to become more widespread. ARPANET researchers implemented the Network Voice Protocol (NVP) in December 1973 and successfully tested the protocol by transmitting voice in real-time at 16 Kbps between USC's Information Sciences Institute and MIT's Lincoln Laboratory. However, the quality of sound was poor. Real-time packet voice influenced internet's design as developers of NVP advocated for a separation of transport from other features such as guaranteed

delivery. Vint Cerf and Jon Postel explicitly separated Transmission Control Protocol (TCP) from Internet Protocol (IP) to allow for real-time applications.[65]

The following factors fostered the adoption of packet based VoIP in enterprises by the early 2000s:

- Deployment of broadband internet
- Advances in hardware and software
- Advances in coding, protocols and algorithms for real-time media
- Evangelism by respected enterprise networking vendor, Cisco

It must be noted that although VoIP started gaining momentum with consumers as an economical ersatz for regular long distance and international calling, it entered enterprise telephony as a 'disruptive technology'[66] which clearly offered much lower call quality in the beginning but provided other benefits that were attractive to some enterprises. These other benefits (discussed below) were related to convergence of voice, data and video that was enabled by IP. Gradually, the products and technologies around VoIP evolved so that the quality of a VoIP call is now satisfactory even to more discerning users.[67]

VoIP Benefits: With VoIP, enterprises are able to combine their separate voice and data networks into a single packet based network. This results in savings for enterprises by building and maintaining one rather than two separate networks. However, corporate networks had to be enhanced in order to support a critical application such as voice where business users expect high reliability and availability. Moreover, the Public Safety Answering Point (PSAP) agency in the USA and its counterparts elsewhere, have depended on the availability, reliability and location specificity of the traditional phone systems. The corporate networks had to be enhanced to be able to provide same features to VoIP – for example, networks were enhanced to continue to power the phones even in the case of electric power failure. The traditional phone system was able to power its

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[65] **Gray, Robert M. July 2005.** The 1974 Origin of VoIP. *IEEE Signal Processing Magazine.* July 2005.
[66] **Christensen, Clayton M.** *The Innovator's Dilemma.* s.l. : ColinsBusiness Essentials. ISBN: 0060521996.
[67] For further discussion on the disruptive nature of VoIP, please see "**Christensen, Clayton M., Anthony, Scott D. and Roth, Erik A. October 2001.** *Innovation in the Telecommunictions Industry: Separating Hype From Reality.* October 2001. Working Paper."

equipment separately from the main electric power system and thus wasn't affected in case of main electric power failures.

Another benefit of VoIP was the ability to plug in your phone anywhere on the corporate network and still carry your telephone number. This simplified move/add/change (MAC) operations immensely as in the traditional TDM PBX systems, MAC had to be performed by telecommunication administrators. The downside to this flexibility was the loss of location specificity that PSAP systems depended on to provide relief in case of any emergencies. Some VoIP implementations solve this problem by requiring users to update their addresses whenever they change locations although this mechanism is not fool-proof.

But more importantly perhaps, VoIP offers the ability to unify various modes of communications used by an office worker. As voice communication migrated to IP and software based technologies with VoIP, it became possible to converge it with other communication, collaboration and business applications such as email, IM, word processors, CRM tools and calendars. Thus voice communication forms a major component of any Unified Communication offer.

Voice Telephony and Network Effects: Being a communication application, voice is subject to direct network effects. However, voice being a century-old application is already heavily penetrated (at least in industrialized countries). Moreover, interlinking means that the network effects are enjoyed by all users but there are no proprietary network effects that give any particular firm market power.

Traditional voice telephony was dominated by large vertically integrated firms such as Avaya and Nortel, who also developed most of the complements. With VoIP came the shift to software platforms which opened more possibilities for complementor firms to emerge. Thus voice telephony platforms will be subject to indirect network effects. Because of the universal interconnectivity requirements, voice platforms either use standard protocols natively or through gateway systems. However, the level of development support provided by voice platform vendors may differ and this could be the decision criteria that complementors use to join a particular ecosystem.

Enterprise Voice Market

The North American enterprise voice market in 2007 was dominated by Cisco, Avaya and Nortel. Although Avaya and Nortel were the incumbent leaders in the market at the turn of the 21st century,

Cisco successfully exploited the technology shift from TDM to VoIP to enter the market in early 2000 and establish itself as the dominant player by 2007. Table 7 depicts the changes in business model as voice networks converged with data networks.

ENTERPRISE COMM BUSINESS MODELS		
	Voice Model	**Data Model**
System Life Cycle	7-8 years	3-4 years
Handsets life Cycle	life of system or longer	Less than System
Softw are Life Cycle	3 years	under 2 years
Installation	Built into price	Per Diem
Maintenance	On-site end to end	Helpline centric
Softw are Licensing	Hardw are Centric	Per seat

Source: Infotech

Table 7: Enterprise Communication business models

As mentioned earlier, VoIP also resulted in a shift from special purpose hardware with proprietary software to general purpose hardware running voice software. For example, Cisco's Unified Communication System (release 5 of Cisco's IP PBX) runs on Intel processor based fault tolerant servers from IBM and HP with Linux or Microsoft Windows as the operating system[68].

Cisco in Enterprise Voice: Cisco entered the enterprise voice market by the announcing the acquisition of Selsius Systems in October 1998. Selsius Systems was described as a 'leading supplier of network PBX systems for high-quality telephony over IP networks'[69]. By 2002, Cisco's VoIP platform incorporated technologies from many more acquisitions including ActiveVoice, Amteva, Sentient Networks, GeoTel Communications, TransMedia Communications, and Calista[70]. However in 2002, CIBC's equity research analysts did not think that Cisco's VoIP products and services were ready just yet to provide the strong growth that Cisco was seeking from the enterprise voice market – the analysts quote various conversations with distributors and customers where Cisco products were found lacking in features, reliability or service levels[70]. It seemed that Cisco did

[68] **Costello, Rich. 7 June 2006.** *Cisco Unified Communications System.* s.l. : Gartner, 7 June 2006. Research. G00139819.
[69] **Cisco Systems. 1998.** Cisco Systems to Acquire Selsius Systems, Inc. for $145 Million. *Cisco Systems.* [Online] October 14, 1998. [Cited: April 30, 2008.] http://newsroom.cisco.com/dlls/fspnisapi6d14.html.
[70] **Kamman, Steve and Wang, Andrew. 10 October 2002.** *Enterprise VoIP: VoIP Is For Real in SMB Mkt, Smaller Players Leading.* s.l. : CIBC, 10 October 2002. Equity Research.

not understand the enterprise voice market requirements well enough e.g. it lost potential customers as it had not implemented 'music on hold' in its VoIP system.

The CIBC analysts did not however doubt Cisco's execution ability and averred that Cisco would solve any issues and become a major enterprise voice player as Cisco eventually did. The CIBC analysts also credited Cisco for evangelizing VoIP to corporate customers. Avaya and Nortel, the incumbent players in 2002 lost share to Cisco in the transition from TDM to IP based PBX systems. These incumbents were held back by their legacy installed base as well as financial issues that affected traditional telecom players after the telecom bust[70]. Figure 10 shows the market share of these three players based on revenue from first quarter of 2007[71].

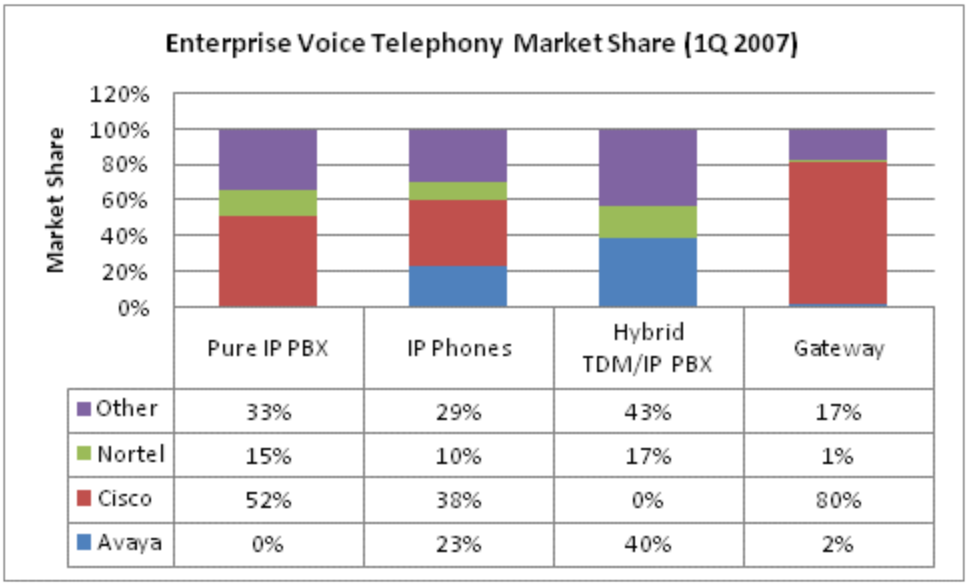

Figure 10: Enterprise voice telephony market share (1Q 2007)

Microsoft's Entrance into Enterprise Voice: In June 2006, Microsoft unveiled a plan to deliver an enterprise communication solution that unifies voice, conferencing, IM, email and collaboration[72]. With the widespread acceptance of IP based software powered voice systems, Microsoft now considered enterprise voice communication to be part of its scope. Microsoft felt that it could add

[71] Data compiled from "**Jensen, Troy D. 21 May 2007.** *Avaya, Inc.* s.l. : Piper Jaffray & Company, 21 May 2007. Equity Research".

[72] **Microsoft. 2006.** Microsoft Unveils Unified Communications Product Road Map and Partner Ecosystem. *Microsoft.* [Online] June 25, 2006. [Cited: Apr 30, 2008.] http://www.microsoft.com/presspass/press/2006/jun06/06-25UCGRoadmapPR.mspx.

value by integrating voice to other communication, collaboration and business productivity applications where Microsoft has traditionally enjoyed market leadership.

> *We really punctuate the fact that voice is absolutely a part of Microsoft unified communications*
>
> ***[Microsoft CEO Steve Ballmer]***[73]

Although Microsoft is a software giant and has technical capabilities in voice and speech processing, it is a relative newbie in enterprise voice telephony. Microsoft has attempted to mitigate this shortcoming through its alliance with traditional voice and networking incumbent Nortel Networks. Microsoft CEO Steve Ballmer described the Microsoft and Nortel alliance branded as Innovative Communication Alliance (ICA) as follows:

> *First is R&D. Nortel and Microsoft are cross-licensing intellectual property, we're forming joint teams to collaborate on product development. It expands really from the enterprise to the mobile space to wireline carrier solutions. Those solutions will include contact center software, advanced mobility solutions, mission-critical telephony functions, and importantly data-networking infrastructure.*
>
> *Secondly, we're working together on the sales and marketing front. We want to work very closely together and invest significant resources to really market and sell our joint solutions. This will include developing a series of solutions for small and medium businesses all the way up to the largest public and private sector organizations around the globe. We were brainstorming backstage on some of the ways we can get out and really make vivid for people that this isn't just about what goes on in the data centers, or in the network operations centers for our customers, but really the experience that every end user in every organization around the globe will experience.*
>
> *The third area of cooperation is in systems integration. Nortel is forming a dedicated systems integration division focused on these Microsoft-Nortel Unified Communications Solutions that will include a focus on the deployment of applications and infrastructure. It will provide our customers, we think, with an excellent transition path from the traditional phone systems, corporate PBXs of today to the world of unified communications based around software that spans phones and PCs and servers and businesses around the world.*
>
> ***[Microsoft CEO Steve Ballmer]***[73]

ICA provides Microsoft with intellectual property, engineering talent, and voice-related brand recognition of Nortel Networks. ICA is also clearly tilted towards Microsoft when it comes to voice

[73] **Ballmer, Steve, et al. 2006.** Transcript: Microsoft/Nortel News Conference. *Microsoft.* [Online] July 18, 2006. [Cited: April 30, 2008.] http://www.microsoft.com/presspass/exec/steve/2006/07-18Nortel.mspx.

products – that is, if Microsoft offers a product to fulfill a customer need, it will form part of the joint ICA offering even if Nortel has a more mature product. Nortel products will only be used to fill in gaps in Microsoft product offering. In lieu of all this, Nortel receives a 'bellwether' system integrator status for Microsoft's Unified Communication initiative. Nortel executives estimated that the ICA was worth $1 billion in incremental revenue to Nortel Networks[73].

Microsoft and Enterprise Voice Grade Reliability: Microsoft is still fighting to gain mind share within the enterprise VoIP market. Microsoft has a general perception among users of low reliability – in the voice market with very high expectation of reliability and availability, this is hurting Microsoft. A study done by Infonetics Research found that buyers rated Cisco high on reliability but low on pricing, and rated Microsoft high on financial stability but low on reliability[74]. The author believes that Microsoft will be able to overcome shortcomings in features, reliability and so on just as Cisco was able to overcome its early predicament in the enterprise voice market. It is worth noting that the earlier versions of Cisco Call Manager (IP PBX) systems ran over Microsoft Windows servers. Thus, Microsoft was able to provide a reliable operating system platform for the Cisco's Call Manager with enterprise voice grade reliability. Microsoft is often rightly criticized for product flaws but in this case, perception about Microsoft product reliability may be worst than reality.

Microsoft will also attempt to win share by competing on price – its executives have publicly stated that the price of enterprise solutions will fall substantially in three years.

> *I want to share an exciting vision of business communications. Within three years, more than 100 million people will be able to make phone calls from Microsoft Outlook, SharePoint, and other Microsoft Office Systems applications; and customers will be able to gain this value with VoIP solutions that are half the cost of what they are today.*
>
> ***[Microsoft Business Division President, Jeff Raikes][75]***

Even with aforementioned points that make the case for Microsoft, it would have been hard for Microsoft to compete within the voice telephony market because of entrenched competition. But

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[74] **2008.** Infonetics Research: Cisco, Microsoft locked in battle for unified communications market. *Marketwire.* [Online] April 24, 2008. [Cited: April 30, 2008.] http://www.marketwire.com/mw/release.do?id=848297.

[75] **2007.** Webcast on Office Communications Server 2007 and VoIP: Transcript of comments by Jeff Raikes, President, Microsoft Business Division. [Online] March 7, 2007. [Cited: April 30, 2008.] http://www.microsoft.com/presspass/exec/jeff/03-07OfficeCommunications.mspx.

through platform envelopment as discussed in Section 4.5 below, Microsoft will be able to gain a share within the enterprise voice telephony market.

3.2.2 Email

Email allows asynchronous communication between two computer users – one user can compose a message and send it to another user electronically who can view the message later. The message is stored at a mail server for the other user to retrieve it when convenient. Although email originally allowed exchange of plain text, it has evolved so as to allow message exchange in many document formats. Email also allows exchange of files in (nearly) any format as an attachment. Emails can be exchanged on one multi-user computer system, on intranets or on the public internet – with the last form of email dominant today with the widespread adoption of the internet.

History of Email

Email has a long history going back to 1961, when the multi-user Compatible Time-Sharing System (CTSS) developed at MIT's Computation Center allowed users to pass messages by creating files such as **TO TOM** and placing them in common file storage space. The intended recipient could then look at the message whenever they logged in to CTSS. Tom Van Vleck reports that he and Noel Morris wrote MAIL in summer of 1965 for Multics although other systems such as SDC's Q32 operating system and BBN may have implemented email before that[76]. Lawrence G. Roberts reports the following noteworthy events around internet email[77]:

[76] **Van Vleck, Tom. 2004.** The History of Electronic Mail. *Multics.* [Online] September 10, 2004. [Cited: March 17, 2008.] http://www.multicians.org/thvv/mail-history.html. Author's claim has not been independently corroborated.
[77] **Roberts, Lawrence G. 1999.** Internet Chronology. [Online] October 24, 1999. [Cited: March 19, 2008.] http://www.ziplink.net/~lroberts/InternetChronology.html.

DATE	*EVENT*
March 1972	First basic email programs, SNGMSG and READMAIL written by Ray Tomlinson at BBN.
July 1972	First email management program, RD written by Larry Roberts at ARPA to list incoming messages and support forwarding, filing, and responding to them.
November 1977	Complete email specification (RFC 733) released by two email pioneers, Dave Crocker and John Vittal.
November 1983	Domain Name System (DNS) designed by Jon Postel, Paul Mockapetris, and Craig Partridge to support the Email addressing space, creating .edu, .gov, .com, .mil, .org, .net, & .int.
1989	Internet opened to commercial mail through MCI Mail

Table 8: Important historical events around email

[Adapted from (Roberts, 1999)[77]]

Email has continued to grow after NSF opened internet to commercial use in 1991. On the consumer side, email was offered by Internet Service Providers (ISPs) to their subscribers. Users were provided with a mail box at the ISP to store their emails and an application program that ran on the user's computer to access their emails. Webmail such as *hotmail* first introduced around 1996 allowed users to access their emails through any computer with a web browser and connected to the internet.

Although it took decades for email to open to commercial use, the early design of email by Larry Roberts has been the **dominant design**[78] with most email programs even today having a basic structure similar to Larry's original program.

Email is one of the most widely used internet applications today. According to Pew Internet & American Life Project survey conducted in December 2007, 92% of internet users reported sending or reading emails[79,80]. Figure 11 estimates that roughly 6.5% of the US internet visits came from just three webmail providers (Yahoo Mail, Hotmail and Gmail). Yahoo cited comScore to claim that 'the worldwide Web mail market counts approximately 543 million people, with Yahoo! Mail alone

[78] *Dominant Designs and the Survival of Firms.* **Suárez, Fernando F. and Utterback, James M. 1995.** Number 6, September 1995, Strategic Management Journal, Vol. 16, pp. 415-430.

[79] **Pew Internet & American Life Project. 2007.** Internet Activity. [Online] December 2007. [Cited: March 19, 2008.] http://www.pewinternet.org/trends/Internet_Activities_2.15.08.htm.

[80] **Brownlow, Mark. 2008.** Email and webmail statistics. *Email Marketing Reports.* [Online] February 2008. [Cited: March 19, 2008.] http://www.email-marketing-reports.com/metrics/email-statistics.htm.

representing 255 million"[81]. Microsoft claimed in May 2007 that it had more than 280 million accounts[82]. These claimed numbers may not add up exactly but they do suggest an order of magnitude for the number of email users.

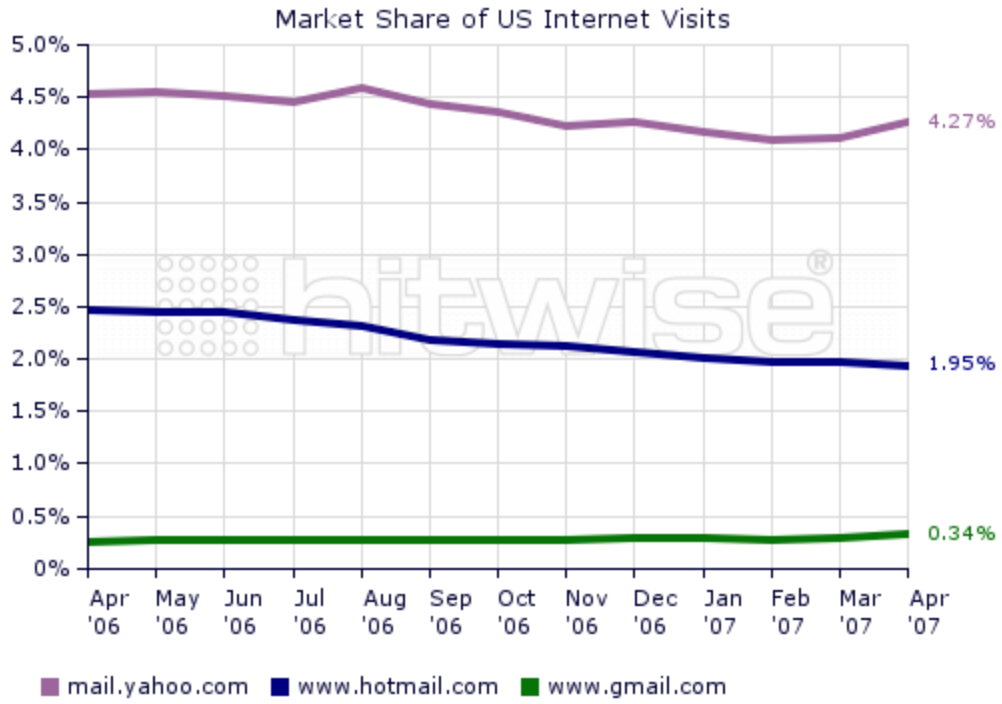

Figure 11: Share of internet visits for top three webmail providers

[Source: (Prescott, 2007)]

The main drivers for email's popularity have been lower costs, good reliability and almost instantaneous delivery (some of the alternate means of communications were phone and postal mail).

Business Models for Consumer Email: There are three different business models for consumer email:

- Advertisement supported webmail (free to users). This is a classic example of a two-sided market[83,84].

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[81] **Kremer, John (Vice President, Yahoo! Mail). 2007.** Happy 10th Birthday, Yahoo! Mail. *Yodel Anecdotal.* [Online] October 8, 2007. [Cited: March 19, 2008.] http://ycorpblog.com/2007/10/08/happy-10th-birthday-yahoo-mail/.

[82] **Microsoft. 2007.** Windows Live Hotmail Fact Sheet. *Microsoft PressPass - Information for Journalists.* [Online] May 2007. [Cited: March 18, 2008.] http://www.microsoft.com/presspass/newsroom/msn/factsheet/hotmail.mspx.

- Fee based webmail which comes with premium features such as extra storage compared to free webmail

- Bundled email provided by ISP, who bundle email with internet access and other services and charge for the whole bundle

Email Standards Battle – X.400 vs. SMTP

As email is a store-and-forward application, the high level tasks that an email system must perform are:

- Email transmission

- Email storage

- Email retrieval

Two standard protocols for email transmission were proposed viz. Simple Mail Transfer Protocol (SMTP) and X.400 by IETF and ITU-T respectively. These protocols battled for dominance in the 1980s and early 1990s. However, SMTP has become the de facto standard for email with X.400 now used in specialized applications where some of its features such as security and guaranteed delivery are valuable.

SMTP Protocol: SMTP evolved from earlier work on email within Arpanet during the 1970s. RFC 821[85] written in 1982 by Jonathan Postel documents the protocol. The quote below from RFC 821 introduces the SMTP protocol and Figure 12 provides a high level depiction of mail exchange using SMTP.

> *The objective of Simple Mail Transfer Protocol (SMTP) is to transfer mail reliably and efficiently.*

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[83] *Platform Competition in Two-sided Markets.* **Rochet, Jean-Charles and Tirole, Jean. June 2003.** 4, s.l. : MIT Press, June 2003, Journal of the European Economic Association, Vol. 1, pp. 990-1029.

[84] **Eisenmann, Thomas, Parker, Geoffrey and Van Alstyne, Marshall W. 2006.** Strategies for Two-Sided Markets. *Harvard Business Review.* October 2006, pp. 92-101.

[85] **Postel, Jonathan B. 1982.** Simple Mail Transfer Protocol. *Internet Engineering Task Force.* [Online] August 1982. [Cited: March 19, 2008.] http://www.ietf.org/rfc/rfc0821.txt. RFC 821.

SMTP is independent of the particular transmission subsystem and requires only a reliable ordered data stream channel.

…

The SMTP provides mechanisms for the transmission of mail; directly from the sending user's host to the receiving user's host when the two host are connected to the same transport service, or via one or more relay SMTP-servers when the source and destination hosts are not connected to the same transport service[85].

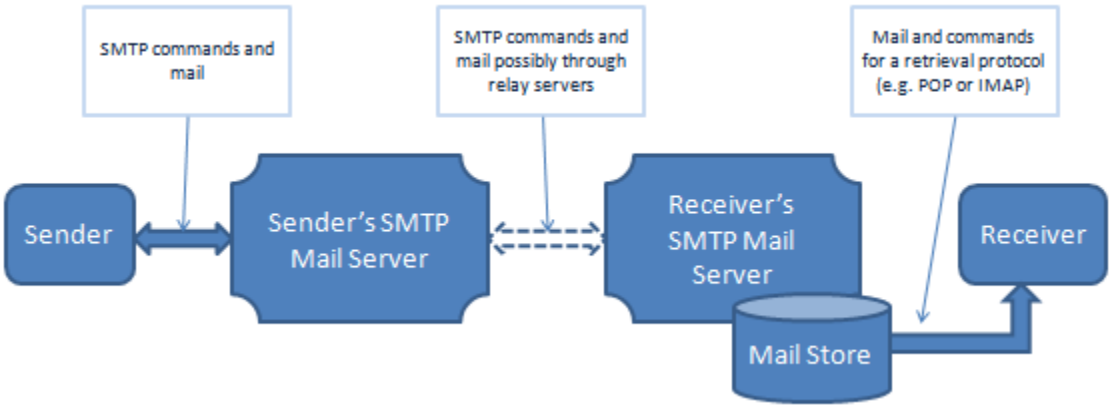

Figure 12: Mail exchange using SMTP protocol (simplified)

The SMTP protocol required the recipients to retrieve messages from the file system of the SMTP server. This meant that remote users could not access email unless they used the remote File Transfer Protocol (FTP) to access the server. Separate mail retrieval protocols such as Post Office Protocol (POP) or Internet Message Access Protocol (IMAP) were developed to allow remote access to SMTP email[86].

SMTP Shortcomings: SMTP did not guarantee delivery of email message instead putting the onus of delivery on a 'reliable ordered data stream channel'. In practice, this has meant that the email will bounce back to the sender if it is undelivered for any reason.

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[86] *A Comparative Study of Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP) and X.400 Electronic Mail Protocols.* **Tzerefos, Polychronis, et al. 1997.** Washington, DC : IEEE Computer Society , 1997. Proceedings of the 22nd Annual IEEE Conference on Local Computer Networks . pp. 545-554. ISBN: 0-8186-8141-1 .

SMTP was originally developed to carry only American Standard Code for Information Interchange (ASCII) text messages and could not carry other media[87]. Multipurpose Internet Mail Extensions (MIME) was developed to enhance SMTP's ability to carry media such as images, audio and video files, and computer programs. MIME allowed text in character sets other than ASCII as well as non-text attachments.

SMTP did not provide email security but Secure/Multipurpose Internet Mail Extensions (S/MIME) protocol was developed to enable encryption and digital signing of SMTP/MIME email messages[88]. A big flaw with SMTP was the relative ease with which email could be spoofed[89] as SMTP lacked a strong user authentication procedure. The author is aware of instances in the mid-1990s when undergraduate colleagues received spurious emails offering graduate admissions to top computer science programs that were really pranks by fellow students. Figure 13 shows how easily anyone with access to UNIX **telnet** could send an email as user watcher@Arizona.EDU[90] (or any other user @Arizona.EDU). Many servers have now fixed this simple hack but it was possible to spoof email using this hack till the late 1990s.

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[87] **Crocker, David H. 1982.** Standard for the Format of ARPA Internet Messages. *Internet Engineering Task Force.* [Online] August 13, 1982. [Cited: March 26, 2008.] http://tools.ietf.org/html/rfc822. RFC 822.

[88] Smime Status Pages - S/MIME Mail Security (Active WG) . *IETF Tools.* [Online] [Cited: March 26, 2008.] http://tools.ietf.org/wg/smime/.

[89] 'Email spoofing is a term used to describe fraudulent email activity in which the sender address and other parts of the email header are altered to appear as though the email originated from a different source'. (Please see) E-mail spoofing. *Wikipedia.* [Online] [Cited: March 26, 2008.] http://en.wikipedia.org/wiki/E-mail_spoofing.

[90] **Trumbo, Jan. 1997.** How to Forge Email. *Email Protocols : SMTP, MIME, POP & IMAP.* [Online] November 13, 1997. [Cited: March 26, 2008.] http://www.opus1.com/www/presentations/EMAILPROTO/sld012.htm.

```
$ telnet/port=25 arizona.edu
Trying... Connected to ARIZONA.EDU.

220 Arizona.EDU -- Server ESMTP (PMDF V4.3-10 #2381)
helo big.brother
250 Arizona.EDU OK, Tennis.Opus1.COM.
mail from:<watcher@Arizona.EDU>
250 Address Ok.
rcpt to:<trumbo@Arizona.EDU>
250 trumbo OK.
data
354 Enter mail, end with a single ".".
Do you know where your kids are at 10 pm??
.
250 Ok.
quit
221 Bye received. Goodbye.
Connection closed by Foreign Host
```

Figure 13: How to forge an email[90]

The SMTP protocol made it easy to setup email service (cf. X.400) and thus became widely adopted. One of the major downside of this openness is the current email spam problem that has reduced the effectiveness of email as a communication medium. The spam problem stems from the lack of user authentication within SMTP. Paul Festa discusses the relationship between SMTP and Spam in more detail[91] - the following is a passage from the Festa's article quoting internet email pioneer Suzanne Sluizer:

> *"You have to remember the era in which this protocol was designed," said Sluizer, the self-described "grandmother" of SMTP.*
>
> *"Back in the time we were doing this work, we were talking about hundreds or maybe thousands of sites on what was then called the ARPAnet. We were looking at connecting with a few in Europe and some smaller networks in the U.S. "It was a trusted situation, and the protocols were developed on the basis of that trust. So it's very surprising to me that we are using the same protocols coming up on 25 years later, because you need different things in a commercial environment than you need in a research environment."*

X.400 Protocol: The inadequacy of SMTP for commercial and security critical applications led to the development of X.400 by ITU-T in 1982. X.400 was built from the grounds up unlike SMTP. Although X.400 is more secure and robust than SMTP, it is also more complex.

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[91] **Festa, Paul. 2003.** End of the road for SMTP? *ZDNet News.* [Online] August 1, 2003. [Cited: March 18, 2008.] http://news.zdnet.com/2100-1009_22-5058610.html.

X.400 guarantees delivery by requiring acknowledgement during each phase of transmission. If an acknowledgement is not received, the message is resent. X.400 also allows multiple email bodies that enabled the delivery of multimedia content.

The addressing scheme of X.400 was also more complex than internet email e.g. the author's internet email hydari@mit.edu could appear as 'G=Zia;S=Hydari;O=MIT;P=EDU;A=;C=US' for X.400 based email system. Such addresses were very difficult for users to memorize.

Reasons for SMTP's success over X.400: SMTP has become the de facto email standard despite the support X.400 had from ITU-T and other industry bodies such as Electronic Mail Association (EMA)[92]. Moreover, SMTP prevailed even though X.400 provided good solutions from the onset to some of the SMTP shortcomings mentioned above. Some of the reasons for SMTP's success in the standards battle are:

- SMTP email being a nested platform within the public internet benefitted immensely from bandwagon effects of internet adoption in the 1990s (see Figure 14). Although interlinking between email systems was possible, users avoided the extra costs of setting up interlinking. SMTP's openness also facilitated adoption

- SMTP evolved from earlier systems so it benefited from legacy support

- X.400 was highly complex. Its addressing scheme was also considered difficult for users and may have contributed to lack of adoption

[92] **Redmond, Tony. 2000.** Sending Messages - Routing and Transport. *Windows IT Library.* [Online] October 2000. [Cited: March 19, 2008.] http://www.windowsitlibrary.com/Content/519/06/1.html.

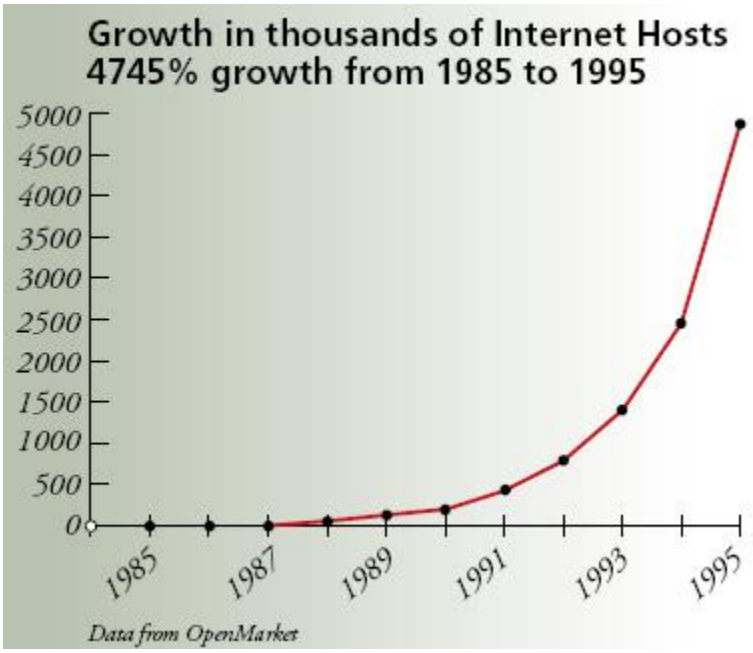

Figure 14: Growth in internet hosts from 1985 to 1995

[Source: (Frenkel, 1995)[93]]

Interlinking within Email Systems

Email being a communication tool has very strong direct network effects. Internet Email benefitted from the widespread adoption of the internet. Although interlinking was possible, internet email has largely replaced other email systems in North America. X.400 has persisted in specialized applications such as military and intelligence where X.400's early advantage in security and guaranteed delivery fostered adoption.

Other Email Systems: The other email systems included corporate or organizational email systems that allowed exchange of emails amongst employees or members. These email systems were closed to users outside the particular organization and generally used proprietary protocols such as cc:Mail. There were other cross-organizational systems such as BITNET email. BITNET was a university network founded in 1981 that gradually gave way to internet after NSF opened the internet in 1991. It was possible for BITNET users to communicate with internet users through BITNET gateways.

In theory, interlinking removed the advantage of proprietary network effects that internet email enjoyed (over other email system). But the primary reason for the success of internet email has been

[93] **Frenkel, Karen A. 1995.** An interview with Gordon Bell. *Interactions.* October 1995, Vol. 2, 4, pp. 66-79.

the success of internet itself – e.g. the Corporation for Research and Educational Networking (CREN) recommended 'that its members terminate their dependence on BITNET-NJE by December 31, 1996'[94].

Enterprise Email

Email is a highly used communication tool within enterprises although the author has not found any estimates on total worldwide enterprise email users. Gartner estimates that there were 234 million users in October 2006 in U.S., the U.K., Germany, Italy and France in enterprises with more than 500 email users[95]. Many enterprises provide internet email to their employees as email allows enterprise workers to communicate not only with their colleagues within the firm but also to people outside the firm cost effectively. Moreover, email is similar to the PSTN in its wide spread reach.

Hosted Email[96] vs. On-premise Email: Unlike consumer email, enterprise email overwhelmingly uses on-premise mail servers for storage and forwarding of email. Recall that consumer email is either hosted by ISP or by webmail providers. Enterprises view email communications to be critical data and thus want to control the servers where email is stored. This has required enterprises to build email infrastructure by running mail servers in-house.

Enterprise Email market: Many vendors provide email infrastructure software (mail servers etc.) but the two dominant players in the market are Microsoft and IBM, with their products Exchange/Outlook and Lotus Notes respectively. Microsoft is the overall market leader but its dominance is more pronounced in smaller enterprises than in larger enterprises[97]. Google has tried to build a hosted email offering for businesses but the hosting model for business email is nascent and adoption is low at this time. Gartner estimates that hosted email comprised 1% of enterprise seats but hosted email is projected to grow to 20% of enterprise seats by 2012.[98]

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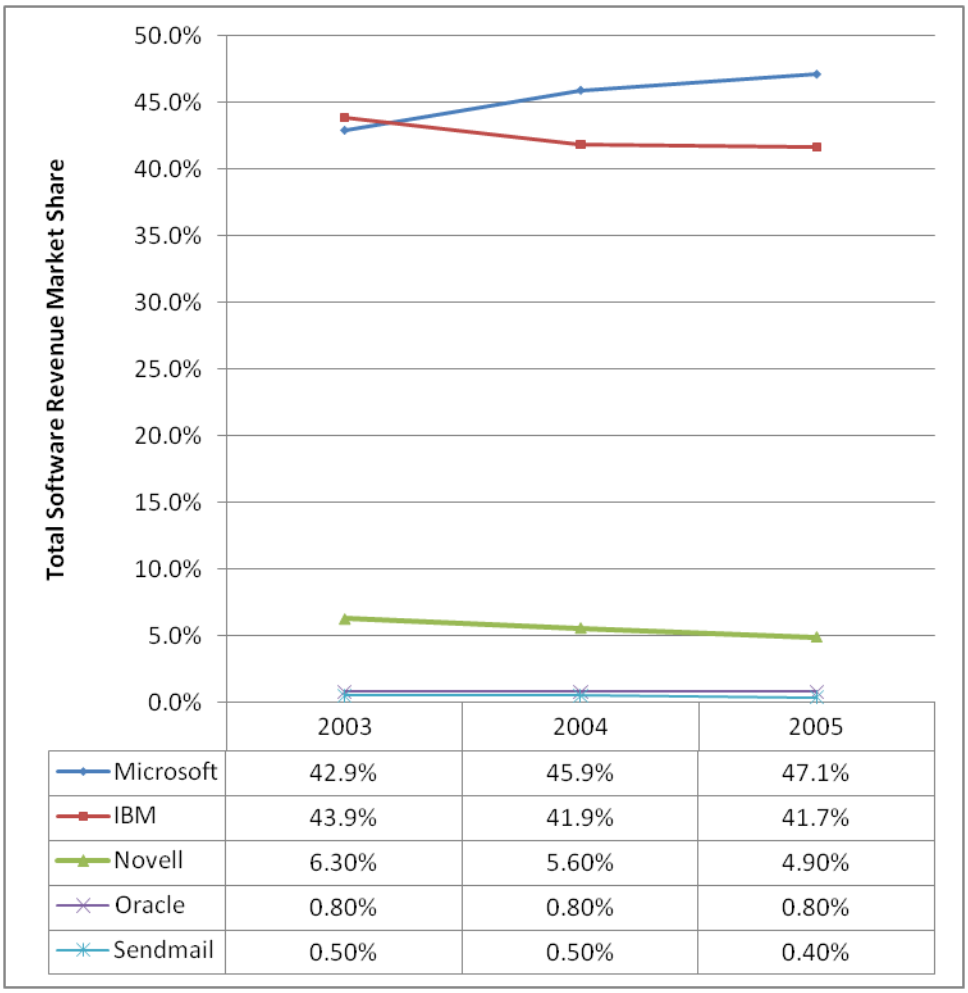
[94] Winding Down BITNET-NJE. *Corporation for Research and Educational Networking.* [Online] [Cited: March 26, 2008.] http://www.cren.net/cren/bitnet1/winding-down.html.
[95] (page 14) **Austin, Tom and Cearley, David W. 19 January 2007.** *Dissatisfaction with IBM and Microsoft E-Mail and Calendaring is Real.* s.l. : Gartner, 19 January 2007. Research. G00145489.
[96] Also referred to as Software as a Service (SaaS) email.
[97] (page 7) **Austin, Tom and Cearley, David W. 19 January 2007.** *Dissatisfaction with IBM and Microsoft E-Mail and Calendaring is Real.* s.l. : Gartner, 19 January 2007. Research. G00145489.
[98] **Cain, Matthew W. 22 February 2008.** *E-Mail Hosting: Poised for Explosive Growth.* s.l. : Gartner, 22 February 2008. Research. G00154840.

IBM was once the clear market leader but lost its place to Microsoft. For a period, IBM did not invest enough in Lotus Notes to evolve it. Lotus Notes was also more expensive as Microsoft aggressively priced Exchange/Outlook to win market share. Anecdotally, Lotus Notes had an unintuitive and unfriendly user interface that caused user resentment against Lotus Notes. Figure 15 shows the enterprise email and calendaring worldwide market share for the period 2003-2005. The Herfindahl index calculated using the market share for Microsoft, IBM, Novell, Oracle and Sendmail is at least 0.38 for the period, suggesting a very concentrated market.



	2003	2004	2005
Microsoft	42.9%	45.9%	47.1%
IBM	43.9%	41.9%	41.7%
Novell	6.30%	5.60%	4.90%
Oracle	0.80%	0.80%	0.80%
Sendmail	0.50%	0.50%	0.40%

Figure 15: Enterprise email and calendaring worldwide market share[99]

Figure 16 shows the forecasted enterprise email seat share in 2009 based on a Gartner study[100]. This predicts a further increase in Microsoft's market power by 2009 in the enterprise email space.

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[99] (page 3) **Austin, Tom, Cearley, David W. and Cain, Matthew W. 25 September 2006.** *Microsoft E-Mail Momentum Growing at IBM's Expense.* s.l. : Gartner, 25 September 2006. Research. G00139277.

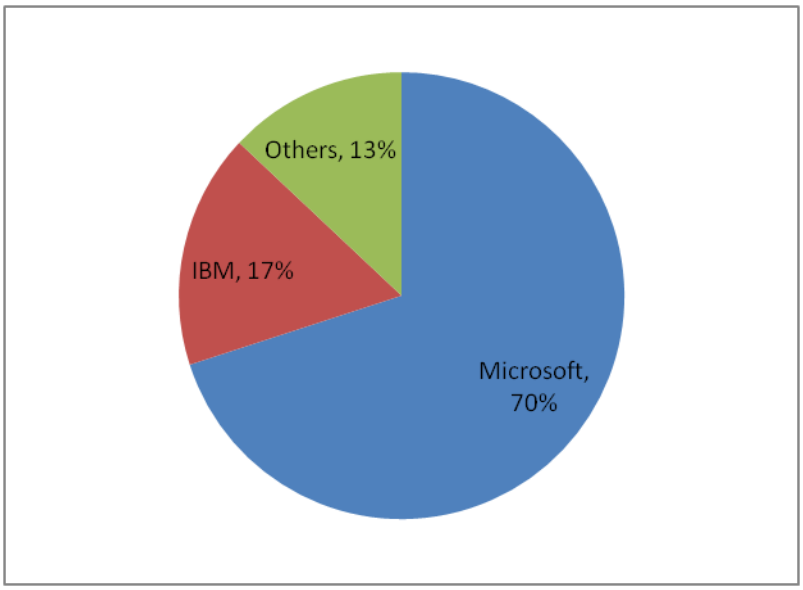

Figure 16: Forecasted enterprise email seat share, 2009

Network Effects and Enterprise Email Market: As with voice telephony, email is universally linked either through standard SMTP protocol or through gateways. Email as an application does exhibit direct network effects but these network effects are not proprietary to particular firms. Although enterprise email market is highly concentrated, the reason for Microsoft's share isn't proprietary direct network effects. Microsoft's leadership position in the enterprise market is due to superior feature set built through product evolution, easier user interface, competitive pricing, and bundle pricing. Enterprise email platforms do exhibit indirect network effects as we will discuss in Chapters 4 and 5.

3.2.3 Instant Messaging

Instant messaging programs (IM) allow two or more computer users to communicate in real-time primarily using short text messages over the internet. IM users maintain a list of their contacts within a 'buddy list' that is displayed in a graphical user interface. The buddy list also shows the availability or 'presence' of the buddies. To communicate using IM, users need to login securely to the IM system – thus login provides a rudimentary level of user authentication. Text communication can also be encrypted allowing users to communicate in secrecy over the public

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[100] **Austin, Tom and Cearley, David W. 19 January 2007.** *Dissatisfaction with IBM and Microsoft E-Mail and Calendaring is Real.* s.l. : Gartner, 19 January 2007. Research. G00145489.

internet. IM serves as a substitute for phone and email although there are differences in the benefits that users derive from the use of each communication mode.

IM has evolved so that they are no longer limited to text exchanges. Users can initiate voice and video calls, initiate audio or web conference, send and receive files, browse websites together, share applications, and send voice mail messages from the IM client.

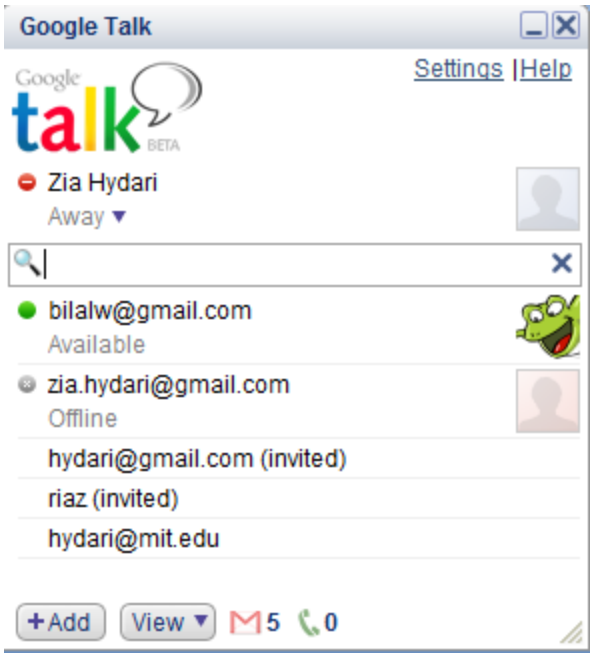

Figure 17: Screen shot of an instant messaging program

History of Consumer Instant Messaging

Instant messaging has been available for several decades – Tom Van Vleck, a systems programmer at MIT, reports that he and Noel Morris wrote the first instant messaging program for Compatible Time-Sharing System (CTSS) in 1965[101]. Robert Frankston, a MIT student, wrote commands for Multics in 1970 that allowed instant messaging on the system. The UNIX system had an instant messaging program called **talk** that was quite popular up to the 1990s, and is still used by some in

[101] **Van Vleck, Tom. 2004.** The History of Electronic Mail. *Multics.* [Online] September 10, 2004. [Cited: March 17, 2008.] http://www.multicians.org/thvv/mail-history.html. Author's claim has not been independently corroborated.

2008. DEC's PDP-11 computer system also had an instant messaging program called **talk** in the 1970s[102]. Figure 18 shows a UNIX talk session.

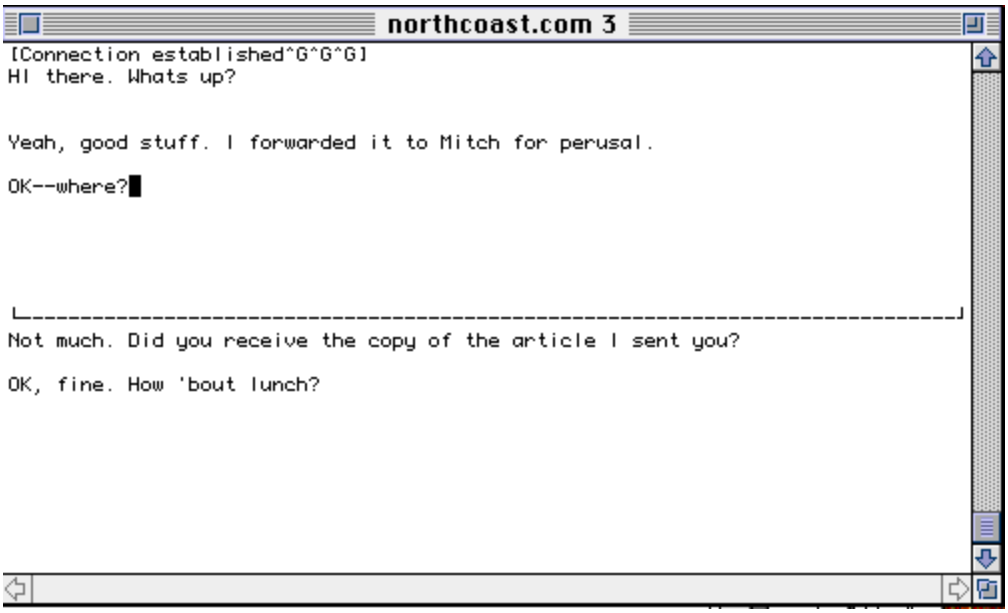

Figure 18: UNIX talk session

(Source: http://www.savetz.com/mbone/ch2_1.html accessed on March 16, 2008)

The earliest instant messaging systems allowed users logged on the same multi-user computer system to communicate with each other. Gradually, the system evolved to allow communication between users logged onto different machines. UNIX **talk** and other UNIX tools provided many of the benefits that modern IM systems provide. Although UNIX **talk** did not show a buddy list with presence information, users could **finger** to find out if another user was online. The user could then launch a **talk** session. Multiple **talk** sessions could be run simultaneously in multiple terminal windows allowing a user to communicate with several other users simultaneously as with modern IM systems.

[102] Instant Messaging & Messengers. *Wikipedia.* [Online] [Cited: March 17, 2008.] http://en.wikipedia.org/wiki/Instant_messaging.

Various bulletin board systems (BBS) in 1980s provided personal computer users instant messaging facilities. America Online (AOL) provided an instant messaging facility as early as 1989[103]. AOL's original Instant Messenger required users to have AOL as their Internet Service Provider (ISP).

Early Internet Based Instant Messaging Systems: The first free internet based instant messaging service called ICQ ('I Seek You') was introduced by (company) Mirabilis Limited in 1996. AOL quickly offered its own internet based IM using a proprietary protocol called OSCAR (Open System for Communication in Real Time). Despite the nomenclature, AOL's IM protocol or system was hardly an open system – it used a proprietary protocol and did not interlink to other systems. AOL later purchased Mirabilis and ICQ for $287 million in June 1998[104]. At the time of purchase by AOL, Mirabilis did not have any revenue and was not planning to charge a fee. However, it had a user base of 12 million that spent about an hour on internet chat. AOL viewed instant messaging as a **two-sided market[105]** – its IM business model was to sell advertisement to produce and services firms that would reach its large IM user base when these users were logged into AOL IM system. AOL also viewed IM as a driver for its ISP business[106].

Later Entrants to Instant Messaging: Other vendors quickly entered the instant messaging market, most notably Yahoo! with Yahoo Messenger in 1998 and Microsoft with its MSN Messenger service in 1999. Yahoo considered IM to be a driver of its portal business whereas Microsoft saw IM as driving its core operating system and applications businesses[106]. Microsoft bundled Messenger into Windows XP and integrated its functionality into Internet Explorer (browser), MSN Hotmail (web-based email) and Outlook Express (email client)[107].

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[103] **Laing, Gordon. 2003.** AOL Instant Messenger 5.2. *vnunet.com.* [Online] November 21, 2003. [Cited: March 17, 2008.] http://www.vnunet.com/vnunet/downloads/2128603/aol-instant-messenger.

[104] **Hansell, Saul. 1998.** America Online to Buy Internet Chat Service for $287 Million. *The New York Times.* [Online] June 9, 1998. [Cited: March 17, 2008.] http://query.nytimes.com/gst/fullpage.html?res=9F0DE5D9143AF93AA35755C0A96E958260&sec=&spon=&pagewanted=print.

[105] **Eisenmann, Thomas, Parker, Geoffrey and Van Alstyne, Marshall W. 2006.** Strategies for Two-Sided Markets. *Harvard Business Review.* October 2006, pp. 92-101.

[106] **Fan, Steven and Viard, Brian V. 28 February 2005.** *The Long Battle For An Instant Messaging Standard.* Stanford Graduate School of Business. Stanford, CA : Stanford Graduate School of Business, 28 February 2005. Case. SM-138.

[107] **Yoffie, David B. 17 March 2005.** *Instant Messaging.* Harvard Business School. Boston, MA : Harvard Business School Publishing, 17 March 2005. Case. 9-704-502.

Consumer IM Market in 2006: Although AOL was an early leader in the consumer IM space, it has since lost its number one position to other players. Figure 19 shows the estimated worldwide user base for IM in 2006. The estimate is based on actual login to the service during the month of May – those who are subscribed to a service but did not login were not counted. The estimate does not include the amount of time that each user spent logged in to a service or if any users are multi-homing i.e. using more than one IM service on a regular basis.

Instant Messengers: Worldwide
May 2006 vs. May 2005
Source: comScore Media Metrix

comScore Media Metrix

Audience: All Persons at Worldwide Home/Work/College-University Locations

	Unique Visitors (000)		
	May-05	May-06	% Change
Instant Messengers	**310,194**	**339,044**	**9**
MSN Messenger Service	180,777	203,902	13
Yahoo! Messenger	79,115	77,865	-2
Yahoo! Insider	69,642	63,513	-9
AIM.COM/AIM App	34,800	33,952	-2
ICQ	30,751	33,890	10
AOL Instant Message	29,312	20,412	-30
MSN Messenger Service Canada	11,447	13,784	20
E-MESSENGER.NET	3,663	3,905	7
PalTalk	2,084	3,580	72
Google Talk (App)	N/A	3,389	N/A
Rediff Bol Instant Messenger (App)	N/A	2,647	N/A
XFire	551	1,509	174
MEEBO.COM	N/A	1,313	N/A
Trillian (App)	1,247	1,298	4
IMVU.COM	N/A	1,028	N/A

Figure 19: Worldwide unique visitors of instant messaging services

(Source: http://www.siliconvalleysleuth.com/2006/07/google_talk_fai.html accessed March 16, 2008)

Multi-homing and Federation in Instant Messaging

Federation is the ability of distinct IM systems to interoperate with each other at the server level, so that users can exchange messages and share presence information while subscribing to different systems. Since IM has not been a winner-take-all market as yet, the absence of federation has forced

users to multi-homing i.e. subscribing to multiple systems to be able to communicate with users on each system.

Figure 19 estimates approximately 340 million unique visitors in May 2006 to various instant messaging services with a year-on-year growth rate of 9%. It does not provide any estimate of multi-homing users. Anecdotally, many users maintain IM accounts on various services and use them on a regular basis. For example, the author and many of the author's friends use MSN Messenger, Google Talk, Skype, and AIM on a regular basis. Users are forced to maintain multiple accounts because many IM services are not or were not interoperable.

AOL Blocks Free Interlinking to AIM: The early market leader AOL actively blocked attempts to create an interoperability standard. AOL was probably trying to protect its proprietary network externality that came with its larger user base built as the first-mover in the market. Even after the acquisition of Mirabilis which made AOL nearly an IM monopoly, AOL resisted the calls to adopt open standards for IM. AOL spokeswoman Tricia Primrose told the New York Times in June 1998 that there were no standards for instant messages now, but that "historically AOL supports open standards that gain critical mass and acceptance by consumers"[108]. Microsoft introduced its Messenger product on July 22, 1999 with the capability to access AOL's IM user base. Microsoft was acutely aware of the network externalities affecting IM and reverse engineered AOL IM service for interlinking. AOL IM promptly disabled access to its network by MSN Messenger users leading Microsoft to release another version of its IM with a workaround to access the AOL network[109]. AOL was willing to negotiate with other vendors to allow them access to its network for a fee but was not willing to interlink for free. AOL suggested that: "We want interoperable systems, but that's going to happen by AOL and Microsoft sitting down together, not by Microsoft hacking into our systems".[110]

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[108] **Hansell, Saul. 1998.** America Online to Buy Internet Chat Service for $287 Million. *The New York Times.* [Online] June 9, 1998. [Cited: March 17, 2008.] http://query.nytimes.com/gst/fullpage.html?res=9F0DE5D9143AF93AA35755C0A96E958260&sec=&spon=&pagewanted=print.

[109] **Chandrasekaran, Rajiv. 1999.** Clash of the Titans Erupts Over AOL's Instant Messaging. *The Washington Post.* July, 1999, Vol. 24, p. A01.

[110] **Clark, Don. 1999.** Internet Rivals Attempt to Open Up AOL's Instant Message System. *Wall Street Journal.* July 26, 1999, p. 2; Section B; Column 3.

Ad-hoc Interlinking is the Current State: Interlinking or federation between IM services has largely been through vendor negotiations as there were no commonly agreed upon interconnection standard because of the intransigence of the market leaders, well aware of the competitive advantage of large user bases in a network market. Thus, unlike voice telephony on the Public Switched Telephone Network (PSTN) or email on the internet, IM have not been connected universally. Vendors have created ad hoc interlinking through negotiations e.g. Yahoo! Messenger and MSN Messenger were connected by the two vendors (circa July 2006) creating an interlinked user base of 350 million users[111]. AOL which signed deals to interconnect with Enterprise IM such as Sametime for a fee, finally connected to consumer application Gmail (but not to Google's IM 'talk') in December 2007[112,113,114].

3.2.3.1 Enterprise Instant Messaging

While IM started in the consumer space for use with 'buddies', it has been widely adopted within enterprises and continues to show robust growth. Unlike email which was largely provided by employers in North America and Europe, the majority of business users have utilized consumer IM at work. However, businesses are quickly deploying Enterprise IM (EIM) solutions for instant messaging amongst employees and amongst employees and external partners (customers and suppliers). Frost & Sullivan noted in 2006 that 'even though an 80 percent of enterprise IM (EIM) users still use consumer IM clients, their numbers are fast decreasing'[115]. Gartner predicts that 'by 2010, 90% of users with business e-mail accounts will have IT-controlled IM accounts'[116] and further predicts that 'by 2013, 95% of workers in global 100 organizations will use the IM client as their primary interface for real-time communications'[117].

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[111] Yahoo! And Microsoft Bridge Global Instant Messaging Communities. [Online] [Cited: February 17, 2008.] http://www.microsoft.com/presspass/press/2006/jul06/07-12IMInteropPR.mspx.
[112] **Smith, David Mario. 11 December 2007.** *Google and AOL Integrate E-mail and Instant Messaging.* Stamford, CT : Gartner, 11 December 2007. Research. G00154171.
[113] **Hall, Michael. 2007.** Google Adds AIM to Chat for Gmail. *Instant Messaging Planet.* [Online] December 4, 2007. [Cited: March 7, 2008.] http://www.instantmessagingplanet.com/public/article.php/3714641.
[114] **Davidson, Michael. 2007.** Gmail + Chat + AIM = Crazy Delicious. *The Official GMail Blog.* [Online] December 4, 2007. [Cited: March 17, 2008.] http://gmailblog.blogspot.com/2007/12/gmail-chat-aim-crazy-delicious.html.
[115] **Frost & Sullivan. 2006.** *North American Enterprise E-mail and Instant Messaging Solution Markets.* Palo Alto, CA : Frost & Sullivan, 2006. F852-62.
[116] **Eid, Tom. 27 November 2006.** *Businesses Increase Their Use of Instant Messaging.* Stamford, CT : Gartner, 27 November 2006. Research. G00244778.
[117] **Smith, David Mario and Lundy, James. 30 April 2007.** *MarketScope for Instant Messaging, 2007.* Stamford, CT : Gartner, 30 April 2007. G00147732.

Although consumer IM use was widespread within businesses, there were concerns because consumer IM services were unsecure, un-auditable and unregulated. Early on, consumer IM conversations would traverse the public internet unencrypted making them vulnerable to eavesdropping. The conversations could not be centrally recorded by the business as the central server was not in control of the business but rather in control of the service provider such as AOL, Microsoft or Yahoo!. The ability to maintain record for audit purposes was necessary in certain industries such as financial services – e.g. 'Securities and Exchange Commission Rule 17a-4 requires that firms retain all business communications, including instant messages, for three years'[118]. With consumer IMs, enterprises could not control who their employees were communicating with during business hours. This led an industry analyst to proclaim that "Adopt Enterprise IM or Go to Jail"[118].

Major consumer IM vendors – Microsoft, AOL and Yahoo! – offered versions of their IM geared towards enterprise users[119]. Other notable players in this space were (1) IBM which offered an enterprise IM product known as Sametime and (2) Jabber Incorporated which offered an open source IM system. These versions overcame some of the problems mentioned in the last paragraph – security, audit capability and central administration and regulation. AOL and Yahoo! quit the enterprise market in 2004 although they continued to federate with EIM. By 2005, the EIM market was concentrating around IBM and Microsoft, who together shipped 77% of the IM seats[120].

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[118] **Root, Nate L., Orlov, Laurie M. and Hudson, Ryan. 14 October 2003.** *Adopt Enterprise IM or Go To Jail.* s.l. : Forrester, 14 October 2003. Brief. 32907.

[119] Microsoft offers EIM through Live Communication Server (LCS) and Office Communication Server (OCS). We will refer to Microsoft's offering as Microsoft EIM.

[120] **Frost & Sullivan. 2006.** *North American Enterprise E-mail and Instant Messaging Solution Markets.* Palo Alto, CA : Frost & Sullivan, 2006. F852-62.

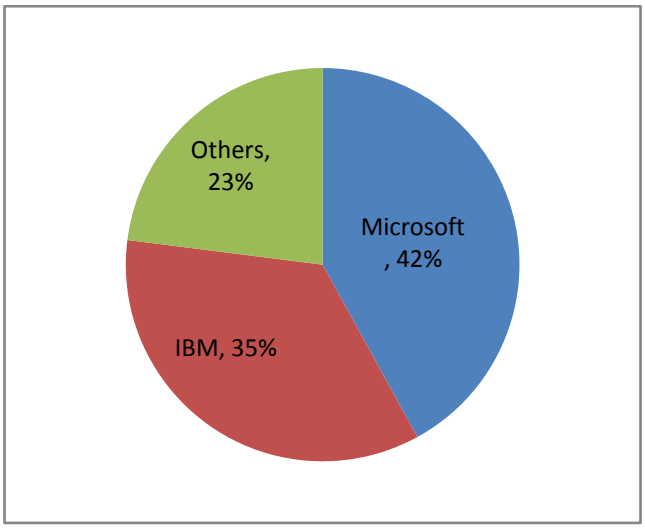

Figure 20: Enterprise IM seats shipped share in 2005
(Based on Frost & Sullivan data[120])

Enterprise IM Advantages

Multitasking: IM allows users to communicate with several other users simultaneously – in separate session or in a single chat session. Audio conference provides an alternative to multi-user chat but there is no phone equivalent for communicating with several users simultaneously in separate sessions. IM also allows communication with others while in a phone conversation, web or video conference, or a meeting[121]. However, multi-tasking has its downside – e.g. many meetings are run unproductively because meeting participants are busy chatting with others rather than paying attention to the issue being discussed.

Increased Collaboration amongst Employees: EIM is more convenient for short communication than phone because the connection procedure is easier (click on the buddy list) and the connection could be left 'live' for the duration of the work day. Getting a response on IM can be more likely as (1) IM provides 'presence' information so you know *a priori* if someone is available and (2) IM recipient can communicate quickly even when he is on the phone or busy with another task

Increased Collaboration with Partners: EIM provides another mode for businesses to communicate with their partners (customers, suppliers, complementors) in addition to phone. The ability to exchange files, browse websites and share applications during an IM session is an added benefit of IM over phone. This collaboration could be done on a one-to-one basis e.g. connecting an account

[121] **McFarland, Jennifer. 2001.** Instant Messaging. *Harvard Management Communication Letter.* August 1, 2001.

manager connecting directly with the purchase manager at client firm. It can also be done in a 'call center' type setting where customers can connect to an IM chat session to get support.

Enterprise IM Standards

There are two competing standards for Enterprise IM viz. SIMPLE and XMPP. Both standards are being managed by the internet standards body Internet Engineering Task Force (IETF) and are in various stages of the standards process.

The two leading EIM vendors – IBM and Microsoft – have backed SIMPLE because of it is capable of unifying with other media (voice, video). SIMPLE is based on SIP which is now widely adopted by voice (and IP PBX) vendors. SIMPLE protocol design also relieve load on central servers as the IM traffic does not pass through the central server once the session has been established. The drawback to this approach is that it is harder to archive messages in a central place. It must be noted though that IBM uses a proprietary protocol Virtual Places for its EIM. IBM has committed to change the protocol to SIP in the next few years and currently uses a SIP gateway for interconnectivity.

XMPP is an open source standard based on the extensible markup language (XML). It has considerable support from the developer community for both of these reasons (1) open source allows developers to customize it to match their application (2) XML allows developers to integrate more easily with business applications. Jabber Incorporated did pioneering work on the XMPP standard but other companies most notably HP, Sony and Google have adopted XMPP. A major criticism on XMPP i.e. lack of media support was somewhat mitigated with the development of a media extension named Jingle by Google.

Federation and Interlinking within Enterprise Instant Messaging Systems

EIM vendors offer company-to-company federation so that *Company A* using IBM's Sametime can link to *Company B* using IBM's Sametime if both these companies choose to interconnect. Cross vendor interlinking has been very weak – IBM's Sametime system does not connect natively to Microsoft's EIM system. However, Microsoft has promised to open its EIM system so that third party developers can integrate Microsoft's EIM systems with other vendors. Smaller players Jabber and Antepo are able to federate with IBM's EIM and Microsoft's EIM[122].

EIM federation with consumer IMs: Although enterprises are wary of consumer IMs because of the aforementioned problems (security, audit, regulation), enterprise sometimes need to connect to consumer IMs as employees may need to communicate with partners who are only available on consumer IMs. Most EIM have federated with consumer IMs e.g. IBM has federated with AOL, Yahoo and Google. Microsoft EIM can federate with AOL, Yahoo and MSN[122].

EIM federation through Hub: As mentioned earlier, native connectivity between EIM systems is very weak. In addition to overcoming this hurdle, companies need to deal with each partner separately when trying to setup EIM federation. AOL has proposed a hub-based approach through its AIM Business Network. The idea is for AIM Business Network to act as a trusted clearing house for all inter-company instant messaging since AOL has already built interfaces with nearly all of EIM for consumer IM federation. As a next step, it can also connect *Company A* using IBM's Sametime to *Company B* using Microsoft's EIM. Although this is technically feasible, the business model for AIM Business Network is not clear at this moment[123]. A facility such as AIM Business Network if widely adopted can result in IM finally achieving interlinking similar to PSTN and email.

Enterprise IM and Network Effects: Because of the lack of universal interlinking, IM does exhibit proprietary network effects within the consumer IM domain giving specific firms market power. For example, AOL charges other IM networks to connect to the AOL IM network.

Within businesses, EIM decisions are made centrally so usually[124] all users within one enterprise either have one particular EIM or they have none. But the network effects within consumer IM spill over to enterprise IM as, (1) many EIM networks are not interconnected (2) many businesses still do not have EIM so the employees in such businesses use consumer IM. So, EIM systems federate with consumer IM systems to increase the number of users reachable. Thus Microsoft's large user base and its federation relationships in the consumer IM market, give it an advantage in the EIM market.

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[122] **Smith, David Mario. 30 October 2006.** *Federation Is Your Only Option for IM Interoperability.* Stamford, CT : Gartner Research, 30 October 2006. G00152584.

[123] **Rubens, Paul. 2007.** The AOL Business Network: What's the Angle? *Instant Messaging Planet.* [Online] May 4, 2007. [Cited: March 17, 2008.] http://www.instantmessagingplanet.com/enterprise/article.php/3675981.

[124] There may be more than one EIM systems because of M&A activity. For example, Verizon standardized on IBM's Sametime in early 2000s but then had to support two EIM systems because of the MCI acquisition. MCI used Microsoft EIM.

3.2.4 Video Communication

> *If, as it is said to be not unlikely in the near future, the principle of sight is applied to the telephone as well as that of sound, earth will be in truth a paradise, and distance will lose its enchantment by being abolished altogether*[125]*. [Arthur Mee, 1898]*

The Problem with Video Communication as 'Being There'

The yearning for establishing two-way video communication is more than a century old as enunciated in the quote above. Face-to-face communication provides a level of efficacy that is unmatched by other modes of communications. The telecommunications endeavor has been to achieve the level of efficacy offered by face-to-face communication 'by creating a sense of *being there*, by establishing some form of audio and video connections between two distant locations'[126].

Measuring Communication Efficacy: Social psychologists have proposed ways to measure the fidelity with which telecommunication methods capture the essence of face-to-face communication. One such metric is *social presence*[127], which is the communicator's sense of awareness of the interaction partner[128]. Hollan & Stornetta[126] assert that there is a generally agreed ranking of the efficacy of communication modes as depicted by Figure 21. Another metric, proposed by Daft and Lengel, is *information richness*[129], which is judged by the following criteria: (1) instantaneous feedback (2) capacity to transmit multiple cues such body language, intonation, inflection, and emotion (3) natural language, and (4) personal focus on the recipient. The ranking suggested by using *information richness* as a metric is similar – with face-to-face communication the richest followed by telephone, email, addressed documents (letter, note, memo), and unaddressed documents (special reports, fliers

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[125] **Mee, Arthur. 1898.** The Plesaure Phone. *The Strand Magazine.* September 1898, pp. 339-345. [Online] [Cited: 26 March 2008.] http://earlyradiohistory.us/1898pls.htm.

[126] *Beyond Being There.* **Hollan, Jim and Stornetta, Scott. 1992.** Monterey, California, United States : ACM, 1992. Proceedings of the SIGCHI conference on Human factors in computing systems . pp. 119 - 125 . ISBN:0-89791-513-5.

[127] **Short, John, Williams, Ederyn and Christie, Bruce. 1 January 1976.** *The Social Psychology of Telecommunications.* s.l. : John Wiley and Sons Ltd, 1 January 1976. ISBN: 0471015814.

[128] Social Presence Theory. *Theory Clusters.* [Online] [Cited: March 26, 2008.] http://www.tcw.utwente.nl/theorieenoverzicht/Theory%20clusters/Communication%20and%20Information%20Technology/Social_Presence_Theory.doc/.

[129] **Daft, Richard L. and Lengel, Robert H. 1984.** Information Richness: A New Approach to Managerial Behavior and Organizational Design. *Research in Organizational Behavior.* 1984, Vol. 6, pp. 191-233 .

and bulletins)[130]. Studies have often shown that audio-video communication is closer to audio-only communication than to face-to-face communication[126].

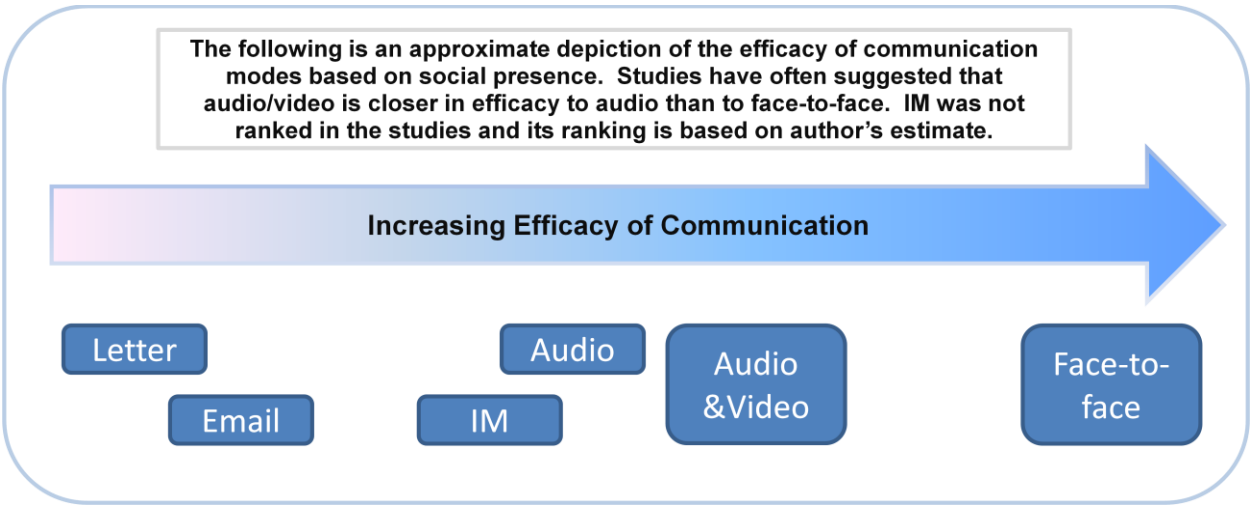

Figure 21: Ranking of the efficacy of communication modes based on '*social presence*'

The *Beyond Being There* project at Bell Communication Research (circa 1992) concluded that converged computing and communication especially video communication could not substitute face-to-face communication so the goal of telecommunication research should shift to using electronic communication to fulfill needs that cannot be fulfilled by face-to-face communications. Some of the unique benefits of electronic communications that the study listed were asynchronous communication, automatic archiving, and anonymous communication[131,132]. The study also listed constructing and providing access to user profiles – *computing personals* – as a mean to improving communication. The reader in 2008 can readily recognize the last benefit because of the prevalence of sites such as LinkedIn and Facebook[133].

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[130] Media Richness Theory. *Theory Clusters.* [Online] [Cited: March 27, 2008.] http://www.tcw.utwente.nl/theorieenoverzicht/Theory%20clusters/Mass%20Media/Media_Richness_Theory.doc/.

[131] **Klemmer, Scott.** Scott's Thoughts on: Beyond Being There. [Online] [Cited: March 26, 2008.] Page archived at http://www.archive.org/index.php. http://www2.sims.berkeley.edu/courses/is290-1/s01/Embodiment/hollan-klemmer.html.

[132] **Nielsen, Jakob. 1995.** Beyond Being There. *Useit.* [Online] August 1995. [Cited: March 25, 2008.] http://www.useit.com/alertbox/beyondproject.html.

[133] www.linkedin.com; www.facebook.com

Technology and Complementary Products for Video Communications

Video communication is a demanding application and it has led to the expansion of the technology envelope in several areas. For most of its history, video communication was most affected by the availability and cost of bandwidth. Listed below are some of the areas that have either affected or co-evolved with video communication:

Bandwidth: The bandwidth requirements have increased from the very early AT&T Picturephone service that used three voice circuits[134] (3 x 64 kbps) to the high-end Cisco TelePresence system 3000 in 2006 that needed 9 Mbps to 12 Mbps[135]. Bandwidth is a very strong unilaterally specific complement of video communication - the absence of reasonably priced bandwidth has often contributed heavily to the failure of video communication products.

Processing Power: Video requires high processing power for encoding, compressing and manipulating the massive amounts of data that are generated for each video frame. Intel entered into the videoconferencing systems market with the intent of nurturing a market that could use Intel's advances in microprocessors. For example, a high definition video screen with a resolution of 1080 x 1920 represents approximately 2 million data points. Assuming 1 byte for color coding, this implies approximately 2 MB uncompressed data for each screen. Assuming 30 frames per second, a one second video clip is represented by approximately 60 MB of uncompressed data (because of high redundancy, compressed video can be represented more efficiently).

Camera and Tracking Technology: To increase presence, video communication system should be able to track the face of communicating parties. The image should be crisp and a high fidelity reproduction. The camera mechanism should also focus on the person that is speaking in a group conferencing session.

Audio Technology: Microphones have evolved to high quality noise cancelling devices that can catch an audio signal from a few feet as is the case in group conferencing. The audio and video

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[134] **Lipartito, Kenneth. 2003.** Picturephone and the Information Age: The Social Meaning of Failure. *Technology and Culture.* January 2003, Vol. 44, 1, pp. 50-81.

[135] The Cisco TelePresence system had three 65-inch Plasma Screens and delivered video at a resolution of 1,080 lines. **Lemon, Sumner. 2006.** First impressions of Cisco's TelePresence. [Online] October 26, 2006. [Cited: March 29, 2008.] http://www.infoworld.com/article/06/10/26/HNciscotelepresence_1.html.

should be synchronized as they may be transported on separate channels. This is necessary for the conversation to looks real.

Compression Algorithms: Compression is one area that has co-evolved with video communication as some of the pure play firms in the 1980s tried to use the ubiquitous low bandwidth phone lines for video communication. These pure play firms succeeded in using the ordinary phone lines for video transmission by developing compression algorithms.

Communication Protocols: Standard audio-visual communication protocols such as H.323 benefited the industry as products from different vendors could interoperate using standards.

Display Technology: The earlier system used bulky cathode ray tubes. Advances in display technologies such as Liquid Crystal Display (LCD) and Plasma displays have been adopted for video communications.

Figure 22: Picturephone's inaugural call made by First Lady Mrs. Lyndon B. Johnson in 1964. [Source: (Lipartito, 2003)[134]]

Strategic Failure with Video Communications

The world was introduced to the term 'network effects' through the failure of **Picturephone**, a video telephony service introduced by American Telephone & Telegraph (AT&T) commercially in the early 1970s. AT&T had demonstrated two-way video telephone as early as 1964 (Figure 22) at the New York World's Fair and a one-way phone back in 1927[136].

The goal of creating a mass market for two-way video communication has remained elusive although not solely because of technological shortcomings. Technical shortcomings did play a role in the failures but sometimes more important causes were incomplete economic analysis, misunderstanding of customer needs, and poor managerial decision making. We provide a brief description of strategic failures in video communication to convey these points.

> *Picturephone was a loser – it never achieved critical mass and market success. No one seems to care why a loser lost – they only care why a winner wins* [137]. ***[Hal Varian]***

The First Picturephone Fiasco: On July 1, 1970 AT&T first offered Picturephone as a limited service in Pittsburgh, Pennsylvania[138]. On July 3, 1971 the New York Times reported that the Picturephone has been failing to find market and since 25 such phones were installed in Pittsburgh initially, 16 new ones have been installed and 8 have been disconnected[139].

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[136] **CNN. 2000.** Video phones: Why is no one calling? *CNN*. [Online] September 5, 2000. [Cited: March 26, 2008.] http://archives.cnn.com/2000/TECH/computing/09/05/picture.phones.ap/index.html.

[137] (Foreword to) **Rohlfs, Jeffrey H. 2001.** *Bandwagon Effects in High-Technology Industries.* s.l. : The MIT Press, 2001. ISBN 0262182173.

[138] **New York Times. 1970.** First Picturephone Service Begins. *New York Times.* July 1, 1970, p. 1. Column 2 (LexisNexis Academic).

[139] **New York Times. 1971.** Bell System's Picturephone. *New York Times.* July 3, 1971, p. 26. Column 1 (LexisNexis Academic).

Rohlfs[137] analyzes AT&T's introduction of Picturephone in Chicago on a trial basis in the early 1970s. The service was offered for $86.50 per month – roughly equivalent to $450 per month in 2008[140]. The monthly subscription fees included thirty minutes of free calling but few users exceeded that time. Demand peaked at 200 subscribers and AT&T had to withdraw the service. Here are some of the points that Rohlfs makes in analyzing the Picturephone fiasco:

- Picturephone had technological shortcomings but they were overcome adequately. Technology did not seem to be the prime cause of failure

- Picturephone was considered in between audio and face-to-face communication but closer to audio

- Picturephone was priced with the expectation that people will change the way they communicate for business. Potential users were more reluctant to risk their business on an unproven concept.

- **AT&T did not solve the bootstrap problem for a network product**. This was the crux of the problem – only two hundred users subscribed to Picturephone and some of them hardly knew anyone else with a Picturephone. This meant that Picturephone subscribers used the service sparingly if at all.

AT&T did consider building a self sufficient user set to solve the bootstrap problem but was dissuaded because its returns would have been capped if Picturephone was successful. AT&T was a regulated monopoly back then and tariffs had to be approved by the government. Picturephone was thus a poor risk as government would have curtailed AT&T's returns through price controls if Picturephone became successful.

The Return of Picturephone as a Group Conferencing Service: On July 8, 1982 AT&T inaugurated the Picturephone Meeting Service (PMS)[141]. While the earlier Picturephone offering was a desktop product for individual use, PMS was for group communication that could be utilized from

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[140] Inflation Calculator. *U.S. Department of Labor, Bureau of Labor Statistics.* [Online] [Cited: March 29, 2008.] http://data.bls.gov/cgi-bin/cpicalc.pl.

[141] **New York Times. 1982.** Picturephone Service Begins. *New York Times.* July 9, 1982, p. 8. Section D; Column 6.

specialized rooms. These rooms were equipped with cameras, color monitors, microphones and connected to high bandwidth lines to carry the audio/video traffic.

> *Picturephone meetings evolved from years of experience with regular picturephone service which is basically a person to person medium of communication. Utilizing the latest in advanced telecommunication equipment and technique, we have expanded so that a group of people in one city can have face to face business meetings in another city without having to be there in person. You can show slides, charts, view graphs and videotapes; work on an erasable board. At the touch of a button, on master control, the hard copy machine will deliver a paper copy of any picture on the incoming monitor within seconds.*[142] ***[Picturephone Meeting Service Plan Guide, Bell Telephone]***

Table 9 shows the two different usage models for PMS and their associated costs.

PMS MODELS	*COSTS*
Public Rooms	• Hourly leasing charges e.g. o $1340/hour for leasing rooms in New York and Washington[141] (roughly equivalent to $3000/hour in 2008[143]). o $2380 for leasing rooms in New York and Los Angeles[141] (roughly equivalent to $5200/hour in 2008[143]).
On-premise Rooms	• Upfront capital expenditure from few hundred thousand dollars to millions[144,145,146] • Hourly usage charges based on locations e.g. o $600/hour for New York and Washington meeting[141] (roughly equivalent to $1300/hour in 2008[143]). o $1640/hour for New York and Los Angeles meeting[141] (roughly equivalent to $3600/hour in 2008[143]).

Table 9: AT&T's Picturephone Meeting Service usage models

AT&T planned to have the service available in 16 cities in 1982 and a total of 42 cities by year-end 1983[141]. AT&T was able to generate interest even before the public announcement in July 1982 as it convinced buyers to install 230 private rooms across the US. AT&T pitched PMS as a substitute for

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[142] **Tambellini, Aldo.** MIT Fellow at CAVS. [Online] [Cited: March 26, 2008.] http://www.aldotambellini.com/mit.html.

[143] Inflation Calculator. *U.S. Department of Labor, Bureau of Labor Statistics.* [Online] [Cited: March 29, 2008.] http://data.bls.gov/cgi-bin/cpicalc.pl.

[144] **Newsweek. 1982.** Reach Out - And See Someone. *Newsweek.* United States, July 19, 1982, p. 51. Business.

[145] **Berg, Eric N. 1985.** Picturephones: A New Effort. *New York Times.* July 11, 1985, p. 2. Section D; Column 1; Financial Desk.

[146] **Frenkel, Karen A. 1995.** An interview with Gordon Bell. *Interactions.* October 1995, Vol. 2, 4, pp. 66-79.

business travel and they did get buy in from some early adopters. Gordon Bell, a computer pioneer and Digital Equipment Corporation (DEC) executive, reported that he completed the Ethernet deal with Intel and Xerox after meeting for a few hours on the Picturephone[146].

AT&T's PMS public rooms were a spectacular failure. An industry analyst Elliot M. Gold estimated that AT&T could tally only 400 meeting in 1983 and 1984. Gold further estimated that AT&T's revenue from the service was roughly $200 thousand in 1983 with expenses totaling $4.5 million. By January 1985, AT&T closed its meeting rooms in Los Angeles with plans to close the remaining 5 out of 10 meeting rooms shortly thereafter.

Gold surmised that few executives want to leave their offices to videoconference from a public room[147]. The costs were exorbitant (see Table 9) and could only be justified in the rarest of circumstances. As with the earlier Picturephone fiasco, AT&T failed to solve the startup problem for on-premise PMS, which was subject to direct network effects. Gordon Bell has asserted that AT&T's failures with Picturephone were related to their focus on selling bandwidth:

> *They worry about selling bandwidth or offering a service to sell bandwidth, not necessarily making the right choice for the right thing to happen or being creative with a new venture* [146]. ***[Gordon Bell]***

The Era of Pure Play Firms – PictureTel, Compression Labs, and Widcom: Although AT&T again failed with Picturephone, it did spawn the on-premise videoconferencing industry that was then dominated by pure play firm for some time. These companies tried to bring down capital and operating costs to foster adoption. Although personal video communication failed again during this era as partly evident from Widcom's fate, but the group video communications model has persisted in the business market.

The pure play firms of this era utilized compression to reduce the bandwidth requirement of video communication so that it may be transmitted on standard phone lines. The use of standard phone lines had two advantages (1) high availability of standard phone lines meant that adoption will not be impeded by lack of a necessary complement (i.e. network transport) (2) lower operating costs could encourage usage as standard phone charges were lower than special high bandwidth circuit charges.

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[147] **1985.** AT&T's Video Meeting Rooms Just Can't Draw a Crowd. *Business Week.* January 14, 1985, p. 126. Section: Information Processing.

Widcom: Bob Widergren, a Silicon Valley Entrepreneur started Widcom in 1979 and took it public in 1983. By 1985, the company had sold 80 systems including one to US President Ronald Reagan. Widcom's product required a digital phone line and was affected by the delay by AT&T in rolling out digital phone lines. Widcom product Personal Videoconferencing Stations (PVS) required $56,000 coder and $35,000 for two video phones to form a two way system. The usage rate paid to AT&T was 33 cents/minute. Despite the media attention, Widcom failed to turn a profit and filed for bankruptcy protection in June 1986. A year later, Widcom was liquidated[148,149,150,151].

Compression Labs Inc.: (CLI) focused on room systems and shipped 660 systems in the period 1984-1986, with a rate of 100 systems per quarter at the end of 1986[152,149]. In 1986, these room systems ranged from $100,000 - $300,000 with bandwidth costs of $100-$800 per hour. Despite predictions by CLI president John Tyson that videoconferencing will be 'most dramatic change in telecommunications in the last 100 years', CLI continued to rake up losses. CLI was finally acquired by rival firm VTEL in 1997 with VTEL claiming a good fit as both firms had focused on the education and government vertical[153].

PictureTel: MIT graduate students Jeffery G. Bernstein and Brian L. Hinman started PicTel (later renamed PictureTel) in 1984. By January 1986, they had an approved prototype and planned to go to full production by October 1986. PictureTel's system worked on regular phone lines by utilizing compression technology developed by the firm. A five-phone office system cost around $130,000[154]. By 1989, PictureTel had sales of $5.9 million at a $5 million loss and the price of a PictureTel system had dropped to $34,000 per site. The system included a color monitor, a two-way

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[148] **Goldstein, Mark L. 1985.** Bob Widergren's Picture Phone. *Industry Week.* July 22, 1985, p. 54. Section: Executives on the Spot.
[149] **Kuzela, Lad. 1986.** Call Me on the TV: Videoconferencing Spreads to Smaller Firms. *Industry Week.* February 17, 1986, p. 66. Section: Information Management.
[150] **Surtees, Lawrence. 1986.** Phone Transmits Stills. *The Globe and Mail (Canada).* May 1, 1986, p. B20.
[151] **Wallace, Beatson. 1988.** Q & A. *The Boston Globe.* November 3, 1988. Section: Economy.
[152] **Kuzela, Lad. 1986.** Call Me on the TV: Videoconferencing Spreads to Smaller Firms. *Industry Week.* February 17, 1986, p. 66. Section: Information Management.
[153] **VTEL.** VTEL Company Information. *VTEL.* [Online] [Cited: March 29, 2008.] http://www.vtel.com/CompanyInformation.html.
[154] **Gilpin, Kenneth N. and Schmitt, Eric. 1986.** 13 Engineers at Pictel Meet Phone Deadline. *New York Times.* January 16, 1986, p. 2. Section D; Column 5.

audio system and a video codec and used a common phone line. PictureTel reduced system prices substantially in May 1988 and these price reductions were matched by Compression Labs Inc[155].

After doubling sales every year for six years, PictureTel lowered Wall Street's expectations twice in 1992 blaming customer confusion as well as other external factors for sluggish sales. By then, PictureTel was a major player in group videoconferencing system with a 40% share of the approximate $225 million market. PictureTel claimed that customer confusion was caused by industry product announcements that did not live up to customer expectations. Analysts blamed PictureTel to be part of the problem as the firm's product road map wasn't clear to the customers. PictureTel had publicly committed to using Intel's video processing chips which was cancelled by Intel in August 1992[156].

PictureTel continued to lower prices on its group conferencing systems reaching a starting price of $15,000 in 1993. The firm also announced a desktop videoconferencing system that interfaced with a personal computer and had a starting price of $6,000[157].

The entry of Intel into videoconferencing damaged the industry as described later. PictureTel was acquired by competitor Polycom in August 2001.

Other Players: Japanese consortiums such as Sony, Mitsubishi and Panasonic largely failed within the video communication market – Panasonic dropped out of the market in 1990 and Mitsubishi and Sony had weak sales[158].

Intel and the ProShare Debacle: There is a popular maxim that generals tend to 'fight the last war'. They use the lessons learnt from previous wars to prosecute the next war sometimes oblivious of the changed circumstances in the new war – new players with different strategies, different technologies, different relative strengths and weaknesses of players, and new rules of engagement.

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[155] **Duffy, Bob. 1989.** Picturetel is Opening Quite a Few Eyes. *Business Week.* April 10, 1989, p. 82. Section: Information Processing.
[156] **Hyatt, Josh. 1992.** What's in a PictureTel. *The Boston Globe.* August 26, 1992. Section: Economy.
[157] **Hyatt, Josh. 1993.** PictureTel focuses on Desk: Videoconferencing Products to Debut. July 16, 1993. Section: Economy.
[158] **The Toronto Star. 1990.** Picturephone Not the Expected Hot Seller. *The Toronto Star.* March 15, 1990, p. F7. Section: Life.

Although Intel entered videoconferencing for the first time in the early 1990s, the firm apparently tried to guard against the mistakes made by earlier players. Two leading business academics Adam M. Brandenburger and Barry J. Nalebuff gave a positive review to Intel's ProShare strategy in their 1996 book 'Co-opetition'[159]. Yet by the admission of Intel's own executives later on, ProShare was a 'miserable failure' and Intel's actions may have contributed to 'undermine the whole market segment and not end up fostering innovation'[160]. Intel learnt lessons from 'last wars' in video conferencing failures but failed to handle the changed circumstances.

Intel had felt that Microsoft and the software industry weren't moving fast enough to take advantage of the advances in Intel's microprocessors. As video processing is very demanding, Intel viewed video communication as a means to make use of their powerful microprocessors. This view was shared at the very top of the company and Andy Grove was a visible backer of the ProShare initiative. But instead of entering the market as a component provider, Intel decided to compete as a system supplier to 'help create the market'. Intel's ProShare was a desktop videoconferencing system introduced in January 1994 and designed to work with Integrated Services Digital Network (ISDN) lines[161].

ProShare was one of the largest non-microprocessor investment from Intel – the company spent hundreds of million dollars on development and marketing[160,161]. The marketing budget for ProShare was second only to the Intel Inside branding program. The development staff included 700 technical people and was lead by Pat Gelsinger, who had led Intel's P6 and 486 microprocessor development projects. Grove commented[161]:

> *We can't expect to succeed if we aren't willing to put our best people on the project.* ***[Intel CEO Andy Grove]***

Intel worked with phone companies and personal computer vendor Compaq to solve three problems:

- Startup problem

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[159] **Bradnenburger, Adam M and Nalebuff, Barry J. 1996.** *Co-opetition.* s.l. : Currency Doubleday, 1996. ISBN 0385479506.

[160] **Gawer, Annabelle and Cusumano, Michael. 2002.** *Platfrom Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation.* s.l. : Harvard Business School Press, 2002. ISBN 1578515149.

[161] **Burgelman, Robert A., Carter, Dennis L. and Bamford, Raymond S. 22 July 1999.** *Intel Corporation: The Evolution of an Adaptive Organization.* s.l. : Stanford University, 22 July 1999. Case. SM-65.

- Bandwidth problem

- Distribution problem

The ProShare system had a list price of $1,999 but phone companies subsidized and offered ProShare for $999 for their customers. This was a win-win for both Intel and phone companies as it sold ProShare and ISDN – both of which were a tough sell individually (reciprocally specific complements). Intel also partnered with Compaq to bundle ProShare with Compaq's business computers to further bring down the price of ProShare to $700-$800[159].

But in its quest to lower the cost of the ProShare system, Intel chose to ignore the de jure standard for videoconferencing – H.323 – and implemented its own protocol instead. Although two videoconferencing vendors were open to Intel's initiative, the market leader PictureTel launched a major public relations campaign against Intel for going against an established standard and for destroying the market through low prices. Ultimately, Intel was able to support H.323 which ensured interoperability with other videoconferencing systems.

PictureTel was substantially weakened because of the price pressure created first by Intel and then by other internet based video communication systems (see Table 10). Intel had to invest in PictureTel to shore up the company's finances. Intel also passed on the marketing of its ProShare product line to PictureTel as it scaled back its ProShare intiative after 5 years and approximately $750 million in investments.

COMPANY AND SYSTEM	*REMARKS*	*PRICE*
PictureTel Concorde 4500	High quality desktop system	$38,500 (roughly $50,000 in 2008)[162]
Intel ProShare Conferencing Video System	Mid-range system compatible with LAN and ISDN transport. Bundles with desktop collaboration tools	$1,499 (roughly $2,000 in 2008)[162]
Enhanced CU-SeeMe	Low-end internet video communication system	$99 (roughly $130 in 2008)[162]

Table 10: Price differences between high, medium and low end video communication systems, 1997 [Source: (1997)[163]]

David B. Johnson, Intel's Director for Media and Interconnect Technology Lab averred:

> *We wanted to deliver an affordable product that would make videoconferencing a desktop PC add-on. We were so intent on videoconferencing as a method for selling CPUs that our own products drove prices down to where the channel wasn't making money, we weren't making money, competitors couldn't make money – and therefore, we didn't help the overall marketplace.*
>
> *Major players are still there, but they are weak. A number of the more peripheral players have left. Being a catalyst is very hard because, if you don't do enough, you don't really change the balance. You don't accelerate things. Likewise, you need to be careful not to come in so hard that you don't undermine the conditions in the market you enter.*
>
> *In some ways, what we did with ProShare was enter the market segment with a product and expect the market to respond. But then you have to be careful because you can undermine the whole market segment and not end up fostering innovation. Some people claim we did just that* [160].

Gordon Bell's Lost Bet on Video Communication: Gordon Bell joined Microsoft Research in 1995 and put forth a vision to make video communication and telepresence a reality in a few years. In June 1996, Bell also entered a bet with Jim Gray[164] that:

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[162] Inflation Calculator. *U.S. Department of Labor, Bureau of Labor Statistics.* [Online] [Cited: March 29, 2008.] http://data.bls.gov/cgi-bin/cpicalc.pl.

[163] **1997.** Videoconference System: Intel ProShare Conferencing Video System 200. *Network Computing*. May 1, 1997.

By April 1, 2001, 50% of the PCs that run a Microsoft OS will ship with:

1. Videophone (1-10 frames per second)

2. Telephone Quality voice

3. At least 20% of these video-enabled PCs will be used to teleconference at least once every day or at least five times a day[165].

Bell defined telepresence as 'being there without having to' or 'being there while being here'[166]. Bell also explained that to make telepresence a reality in business, work will have to be done along three different dimensions:

Mechanism: How is telepresence achieved? This is a technology question.

Application: What will telepresence be used for? Will it be used to run technical meeting and problem solving sessions and/or to nurture sales relationships? This is a social question.

The Group Structure: Who will use telepresence? How accessible is telepresence to knowledge workers? Is it used for off-site communication?

Figure 23 depicts these dimensions in greater detail.

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[164] Jim Gray is a preeminent computer scientist currently working at Microsoft Research. He is a fellow of ACM, NAE, NAS, AAAS and was awarded an ACM Turing Award.

[165] **Bell, Gordon. 9 May 2002.** *The Lack of PC-based Video Telephony: How I Lost a Technology Bet.* Microsoft Research. San Francisco, CA : s.n., 9 May 2002. Technical Report. [http://research.microsoft.com/~gbell/TR_2002_49_Why_I_Lost_A%20Bet_on_Video_Telephony.doc]. MSR-TR-2002-49.

[166] **Frenkel, Karen A. 1995.** An interview with Gordon Bell. *Interactions.* October 1995, Vol. 2, 4, pp. 66-79.

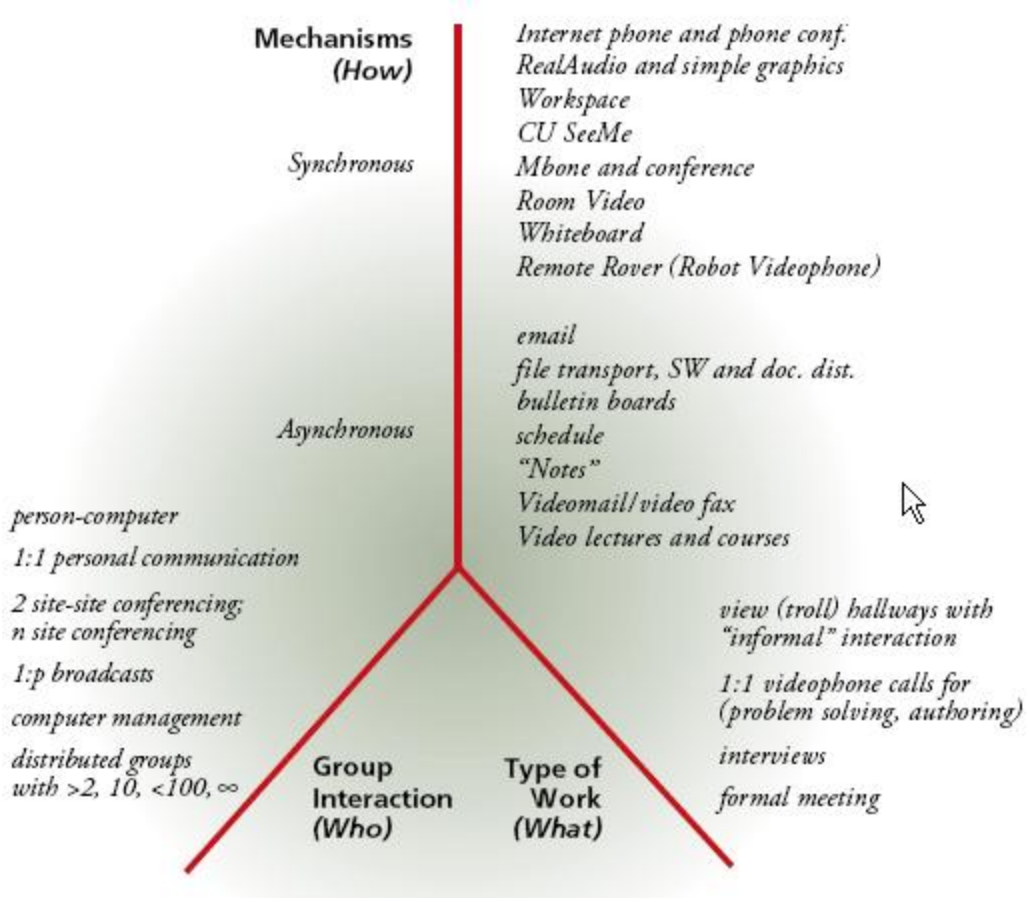

Figure 23: Telepresence - mechanisms, type of work and group interactions

[Source: (Frenkel, 1995)[166]]

Despite market advances and Bell's own work, Bell announced in May 2002 that he has lost the bet to Jim Gray. Bell analyzed his 'lost bet' and posited four heuristics that guarantee failure in video communication[165]:

1. **Voice quality must be at least competitive with telephony.** The audio from video communication should have low latency, negligible jitter and echo cancellation.

2. **Video technology should increase not decrease presence.** Video should move away from small, jerky, low fidelity images. The camera should also track the face of the participants.

3. **Setting up video conference should be as easy as making a POTS telephone call.** Video communication takes more effort than making a simple phone call. In case of a

complex room based video conferencing system, this may be several minutes and may require the help of technicians.

4. **Video conferencing must be as ubiquitous as telephones**. This is a classic direct network effects heuristic.

The Road Ahead for Video Communication

On October 4, 2001, Hal Varian wrote[167]:

> *Will the current reluctance to travel simulate widespread use of videoconferencing? The stock market seems to think so. Shares of companies that specialize in videoconferencing have shot up 30 percent or more in the last two weeks.*

Varian was more cautious about videoconferencing than stock market investors as he recapped the history of video communication with its dependence on network effects and on the availability of bandwidth. In 2008, it seems that Varian caution was well founded – while videoconferencing has made progress, it is still far from reaching the adoption level of telephone, email or instant messaging.

VIDEOCONFERENCING 2007			
SEGMENT	*REVENUE*	*GROWTH*	*TOP VENDORS*
Infrastructure	$138 million	18%	Tandberg, Radvision, Polycom
Endpoints	$451 million	32%	Tandberg, Polycom, Sony
Services	$117 million	14%	Wire One, AT&T, Verizon

Table 11: Videoconferencing segments, revenue, growth (year-on-year) and top vendors, 2007
[Data compiled from Frost & Sullivan Reports[168,169,170]]

The acceleration of market growth in 2007 (Table 11) has been attributed to

(1) Wider deployment of high speed IP networks

(2) Cost reductions and availability of high-definition video

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[167] **Varian, Hal R. 2001.** Economic Scene: Videoconferencing May at Last Get The Critical Mass It Needs. *New York Times.* October 4, 2001.
[168] **Frost & Sullivan. January 2008.** *North American Enterprise Videoconferencing Endpoints Market.* January 2008. Market Engineering Research. N32D-64.
[169] **Frost & Sullivan. 15 February 2008.** *North American Videoconferencing Services Markets.* 15 February 2008. Market Engineering Research. N075-01.
[170] **Frost & Sullivan. February 2008.** *Videoconferencing Infrastructure Systems Market (Americas).* February 2008. Market Engineering Research. N196-64.

(3) Vendor marketing push (especially Cisco and Microsoft)

(4) Push for 'green' technologies where videoconference is seen as a replacement for physical travel

Although all the listed factors may be contributing to the growth in video communication, but it is also possible that for a fleeting episode, market is benefitting from the entrance of major players such as Cisco and Microsoft as well as push from traditional players as has happened in the past.

Recent Evolution of Video Conferencing Products: In 2005, video conferencing products moved towards Liquid Crystal Display (LCD) and plasma screens which allowed smaller footprints and more elegant design for video conferencing systems. In 2006, vendors introduced videoconferencing and telepresence systems that used high-definition video and audio to provide a more 'realistic' video conferencing experience albeit at a higher operational cost. Table 12 shows the bandwidth requirement for standard definition versus high definition video per video stream using two different encoding methods:

	MPEG-2	*MPEG-4/H264*
Standard Definition	3-4 Mbps	2 Mbps
High Definition	15 Mbps	8 Mbps

Table 12: Bandwidth requirements for standard definition and high definition video[171]

Many new videoconferencing and telepresence offerings were made available in 2006. Table 13 shows the top 10 videoconferencing systems of the year 2006 as ranked by a trade publication Videoconferencing Insight[174]:

[171] **Shao, Jiong, et al. 22 June 2006.** *Investor's Guide to IPTV.* s.l. : Lehman Brothers, 22 June 2006. Global Equity Research.

VIDEO SYSTEM	*DESCRIPTION*
Cisco TelePresence System	1080p[172] HD video and HD audio with room and furniture design. Proprietary non-standard technology. Expensive.
HP Halo Collaboration Studio TelePresence System	High quality video and audio. Proprietary technology. Collaborating with Tandberg to link to standard based systems.
Polycom HD Telepresence Solution	Polycom RPX HD with 720p HD video on large cinematic walls and its own Siren HD audio. Eye-level HD cameras. Standards-based technology. Multipoint with Polycom MGC HD MCU.
Teliris VirtuaLive Telepresence Suites	1080p video at 60fps and HD audio. Flexible designs for rooms. Multipoint available. Supports SD video conferences
The Aethra Vega X7 HD visual communication systems	720p[173] HD video, stereo HD audio, a nine-site MCU and a third-party HD camera. Optimized for 768 Kbps.
LifeSize Room HD videoconferencing system	720p HD video and LifeSize own proprietary HD audio system. Multipoint for four sites. Meeting scheduling from Microsoft Outlook.
Polycom HDX 9004 HD visual communication system	720p HD video, Polycom HD audio, Polycom HD camera and more.
Sony PCS-HG90 HD visual communication system	720p HD video format at 60 fps and a video transfer rate up to 8 Mbps over an IP network. Multipoint for 4 sites.
The TANDBERG 95 MXP, 85 MXP and 75 MXP HD visual communication systems	720p HD video, stereo HD audio, and a TANDBERG HD camera
TANDBERG Centric 1700 MXP HD visual communication system	720p HD video on the desktop, stereo HD audio, and a TANDBERG HD camera.

Table 13: Top 10 videoconferencing and telepresence systems, 2006[174]

Readers should note the presence of 'newer' vendors in Table 13 such as Cisco, HP, Teliris, Aethra and LifeSize in addition to the leaders Polycom, Sony and Tandberg as listed in Table 11.

Cisco and Microsoft's Approach to Video Communication: Although both Cisco and Microsoft have lower end solutions, Cisco has focused on the very high end telepresence 'room' systems that

[172] 1080p means an image resolution of 1080 vertical lines drawn using progressive scanning. In progressive scanning, each vertical line is drawn in sequence. This gives a better picture quality than interlaced scanning where odd and even lines are drawn alternately.
[173] 720p means an image resolution of 720 vertical lines drawn using progressive scanning.
[174] The 10 Best Video Conferencing Solutions for 2006. *Asterisk VoIP News.* [Online] [Cited: May 2, 2008.] http://www.asteriskvoipnews.com/blogsphere_news/the_10_best_video_conferencing_solutions_for_2006.html.

project life size images in high-definition video. The cost of building a two location system using Cisco Telepresence 3000 could be $299,000[175]. Cisco's demonstrations of telepresence are very impressive but it is the author's belief that if Cisco intends to build a mass market for video communication, Cisco has not learned from the past failures in video communication and isn't even fighting the 'last war'.

Figure 24: Cisco CEO John Chambers demonstrates telepresence
[Source: You Tube Video[176]]

Figure 24 shows Cisco's annual industry analyst conference, C-Scape, where Cisco CEO John Chambers is using Telepresence system to meet with three other remote participants: Filippo Passerini, Chief Information Officer and President of Global Business Services, Procter & Gamble (Cincinnati, OH); Erik Huggers, Group Controller, Future Media, BBC (London, UK); Erik Brynjolfsson, Director, MIT Center for Digital Business and Professor of Information Technology and Strategy, MIT (Boston, MA)..

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[175] **Lemon, Sumner. 2006.** First impressions of Cisco's TelePresence. [Online] October 26, 2006. [Cited: March 29, 2008.] http://www.infoworld.com/article/06/10/26/HNciscotelepresence_1.html.
[176] **2007.** Cisco C-Scape: TelePresence Session. *You Tube.* [Online] December 11, 2007. [Cited: April 30, 2008.] http://www.youtube.com/watch?v=CJmCQa9hRl4.

Besides the high capital cost associated with the Cisco Telepresence system which may impede the building of critical mass as in the case of AT&T Picturephones, the bandwidth requirement is also high – about 12 Mbps[175]. This may sound low to some in the era of Gigabit networks but the edge networks will have to be scaled up to handle high usage if Cisco style video communication is to be successful. Similar to the failed strategies of AT&T and Intel, Cisco's strategy is driven not by solving the right telecommunication problem but by increasing sales of its networking gear.

Figure 25: Microsoft RoundTable - group video communication device
[Source: Microsoft website[177]]

Microsoft on the other hand is making video communication a part of its Unified Communications platform in ways that facilitate collaboration. It has developed a high quality 360-degree camera RoundTable that is portable and low priced (around $3000[178]). More importantly, Microsoft has worked to integrate RoundTable with business collaboration applications that may help RoundTable adoption.

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[177] Microsoft RoundTable. *Microsoft Unified Communications.* [Online] [Cited: March 30, 2008.] http://www.microsoft.com/uc/products/roundtable.mspx.

[178] **O'Reilly, Dennis. 2007.** Microsoft RoundTable. *PCWorld.* [Online] August 16, 2007. [Cited: March 30, 2008.] http://www.pcworld.com/businesscenter/article/135913/microsoft_roundtable.html.

Figure 26: Business meeting using Microsoft Roundtable

[Source: Microsoft website[177]]

The author feels that Microsoft's approach will gain better mass market traction because of the following reasons:

1. Microsoft seems to be aiming RoundTable to substitute audio conferencing rather than face-to-face communications. As numerous studies have shown, audio-video communication is closer to audio-only communication rather than 'face-to-face' communication. In large distributed audio conferences, it is sometimes hard to know who is speaking at a particular moment. Adding video from RoundTable with its 360 degree camera which tracks the speaker can help to alleviate this problem. Of course, good quality video can also improve *social presence* and *information richness* in group communication.

2. Microsoft is integrating RoundTable into its suite of business productivity and collaboration applications. This will provide may use cases to a wide segment of the knowledge workers in today's businesses.

3. RoundTable's price range is reasonable enough for workgroups at many US corporations to afford it. It is still not in the range that each individual worker can be provided with RoundTable. However, increasingly laptops are shipping with built-in camera that can be used by individual workers who are unable to move to RoundTable equipped meeting rooms.

4. Microsoft is using platform envelopment which we will discuss in Section 4.5.

Lessons from the PDA market may apply to Video Communication: Personal digital assistants (PDA) were introduced by Apple in 1992 under the Newton brand. Palm closely followed Apple by introducing the 'Zoomer' in 1993[179]. The early PDA products were a failure with a total industry investment of $1 billion with nothing to show in return by the end of 1994[180]. Undeterred by this early failure unlike some of its competitors[181], Palm surveyed Zoomer buyers and found the following:

> *What these people said opened the company's eyes. More than 90% of Zoomer owners also owned a PC. More than half of them bought Zoomer because of software (offered as an add-on) that transferred data to and from a PC. These were business users, not retail consumers.* ***And they didn't want to replace their PCs - they wanted to complement them****. People weren't asking for a PDA that was smart enough to compete with a computer. They wanted a PDA that was simple enough to compete with paper.*

Palm redesigned the Zoomer by creating several guiding principles based on the customer feedback: software should be simple and quick; device should fit into shirt pocket; price should be low; hand writing recognition should work for most people without making the software too complex and slow. The redesigned Palm was a hit and sold approximately four hundred thousand units by the end of 1996[179].

Palm also pursued a multi-sided platform strategy by courting developers early on. In early 1996, Palm introduced a software development kit (SDK) with source code for all applications that developers could use under a royalty-free license. It even created Palm Ventures with $50 million to support businesses developing Palm OS applications. Palm thus heavily subsidized the developer side of the market instead charging only end-users. This strategy has resulted in a large number of applications for Palm which in turn has contributed to Palm's success.

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[179] **Evans, David S., Hagiu, Andrei and Schmalensee, Richard. 2006.** *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries.* Cambridge, MA : The MIT Press, 2006. ISBN: 0262050854.

[180] **Dillon, Pat. 1998.** The Next Small Thing. [Online] May 15, 1998. [Cited: May 1, 2008.] http://www.fastcompany.com/magazine/15/smallthing.html.

[181] For example, PDA contender 'Go' liquidated in 1994 and Apple eventually discontinued Newton in 1998. Please see (pages 156 & 160 in) "**Evans, David S., Hagiu, Andrei and Schmalensee, Richard. 2006.** *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries.* Cambridge, MA : The MIT Press, 2006. ISBN: 0262050854".

Perhaps video communications vendors also need to pay attention to end-user surveys which have often shown that video communication is a substitute for audio communication rather than face-to-face meetings. Video communications systems need to be simple, quick, and affordable. These systems should allow development of complementary applications through application programming interfaces. The author believes that Microsoft's strategy is better than other vendors if the strategic goal is to make video communication a high usage collaboration tool in workplaces.

3.3 Summary

Insights and conclusions are summarized in Chapter 6.

4 Microsoft's UC Strategy

4.1 Introduction

Founded in 1975 and incorporated in 1981, Microsoft is the largest software producer with revenue of $51 billion in 2007 and expected revenue of approximately $60 billion in 2008[182,183]. From its beginning as a provider of BASIC programming language interpreter and later as a provider of single user operating system MS-DOS for IBM personal computers, Microsoft has grown into 'one of the greatest franchises in history'[182] with products and services ranging from digital games to enterprise software to Internet Protocol Television (IPTV) infrastructure software. Figure 27 shows the organizational structure of Microsoft, with Unified Communications Group highlighted for emphasis.

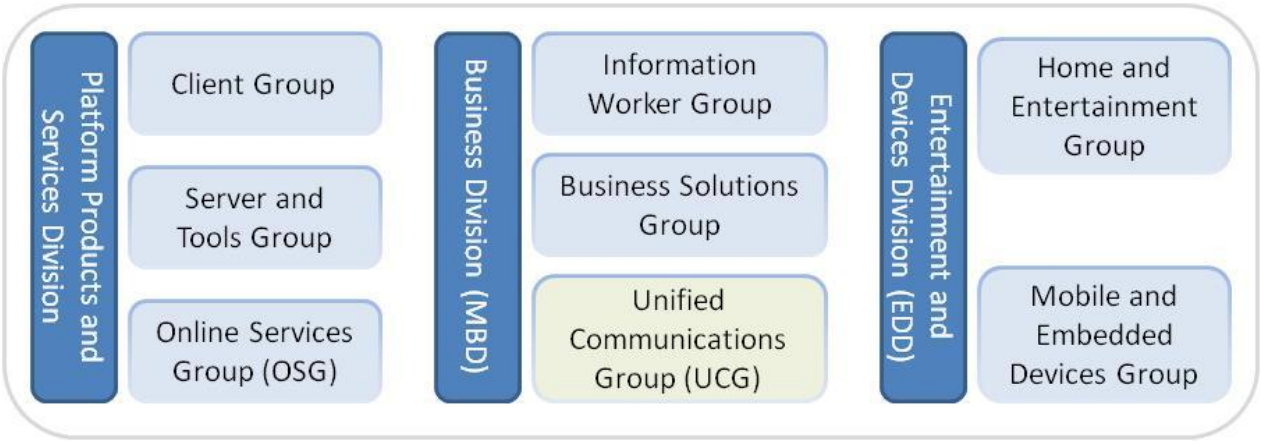

Figure 27: Microsoft business organization - divisions and groups[184]

[182] **Egbert, Katherine and Bukovinsky, Eric. 5 March 2008.** *Microsoft (NASDAQ: MSFT) - Microsoft Sticks Its Head in the Clouds - Initiating with a Buy.* s.l. : Jefferies & Company, Inc., 5 March 2008. Equity Research.

[183] Microsoft Corp MSFT.O (NASDAQ) - Full Description. *Thomson Reuters.* [Online] [Cited: May 3, 2008.] http://stocks.us.reuters.com/stocks/fullDescription.asp?rpc=66&symbol=MSFT.O.

[184] Please see "Our Commitment to Our Customers - Microsoft's Business. *Microsoft.* [Online] [Cited: May 2, 2008.] http://www.microsoft.com/about/companyinformation/ourbusinesses/business.mspx".

Microsoft is well known for creating positive spillovers among its various business divisions. In some cases, Microsoft has also been subject to anti-trust litigation[185] for abusing its market power in one product market to destroy competition in new markets through platform envelopment.

Appendix A shows some of Microsoft's recent M&A and launch activities. Many of these recent acquisitions indirectly strengthen Microsoft's UC position but the acquisition of Parlano, developer of a group chat product, directly strengthens Microsoft's UC offer. Table 14 provides details about the products and competitors of Microsoft's business units.

Microsoft's Orchestration[186] of UC Market: Cusumano and Selby have listed five principles that Microsoft uses to '*pioneer and orchestrate evolving mass markets*'[187]. We list these principles below as they are relevant to Microsoft's foray into UC:

> 1. *Enter evolving mass markets early or stimulate new markets with 'good' products that set industry standards*
> 2. *Incrementally improve new products and periodically make old products obsolete*
> 3. *Push volume sales and exclusive contracts to ensure that company products become and remain industry standard*
> 4. *Take advantage of being the standard provider with new products and product linkages*
> 5. *Integrate, extend and simplify products to reach new mass markets*
>
> ***[Cusumano & Selby]***[187]

UC is a result of convergence of network platforms. Although some of the underlying platforms are mature or nearing maturity, UC itself is an early stage mass market. As mentioned in Section 3.2.1, Microsoft entered the voice market in 2007 although its voice platform lacks advanced features provided by some of its competitors. Microsoft claims that it has implemented '20% of the features

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[185] United States v. Microsoft. *Antitrust Case Filings - Antitrust Division, US Department of Justice.* [Online] [Cited: May 2, 2008.] http://www.usdoj.gov/atr/cases/ms_index.htm.

[186] Orchestration is the arrangement, coordination, and management of complex computer systems, middleware, and services. (Please see) Orchestration. *Wikipedia.* [Online] [Cited: May 9, 2008.] http://en.wikipedia.org/wiki/Orchestration.

[187] **Cusumano, Michael A. and Selby, Richard W. 1995.** *Microsoft Secrets: How the World's Most Powerful Software Company Creates Technology, Shapes Markets, and Manages People.* s.l. : Touchstone, 1995. ISBN: 0028740483.

that have 80% usage'[188] and will incrementally build the product to parity with other competitor products. It is noteworthy that Microsoft did not delay entry until its voice product compared on a feature to feature basis with competitor products. Microsoft has also introduced innovations in voice telephony that have the potential to become industry standard as discussed in Section 4.2 below. Finally, it is integrating voice and video within its existing email and IM platform to succeed in this new mass market.

[188] Microsoft sales director made the claim at a presentation at Verizon Business in June 2007 in Ashburn, VA.

UNIT	*SHORT DESCRIPTION*	*PRODUCTS*	*COMPETITION*
Client Group	Primarily responsible for Windows product family for client systems	Windows Vista, including Home, Home Premium, Ultimate, Business, and Enterprise Starter Edition; Windows XP Professional and Home; Media Center Edition; Tablet PC Edition; and other standard Windows operating systems[189]	(Unix) Apple, HP, IBM, Sun. Linux available to OEM for free under General Public License. (Media) Apple, Real Networks.
Server & Tools Group	Server operating system, database, middleware, and development tools	Windows Server operating system; Microsoft SQL Server; Microsoft Enterprise Services; product support services; Visual Studio; System Center products; Forefront Security products; Biz Talk Server; MSDN; and TechNet, among others[189]	(Unix) HP, IBM, Sun, SCO. (Linux) Novell, Red Hat. (Middleware) Sun, Oracle, IBM. (Systems) BEA, CA. (Development tools) Borland, Oracle, Sun, IBM and others.
Online Services Group (OSG)	Webmail, IM, search, online portals and channels, premium web, internet access. (Business model) subscription, advertising, transaction fees	MSN Search; MapPoint; MSN Internet Access; MSN Premium Web Services (consisting of MSN Internet Software Subscription, MSN Hotmail Plus, MSN Bill Pay, and MSN Radio Plus); Windows Live; and MSN Mobile Services[189]	AOL, Google, Yahoo!, and other portals and online services
Business Division (MBD) [Includes Unified Communications Group (UCG)]	Personal, team and organizational productivity, communication and collaboration applications. Business applications primarily for SMB. 90% of MBD revenue from Microsoft office. 75/25 revenue split between businesses and consumers[189]	Microsoft Office; Microsoft Project; Microsoft Visio; Microsoft Office SharePoint Server; Microsoft Exchange Server; Microsoft Exchange Hosted Services; Microsoft Office Live Meeting; Microsoft Office Communication Server; Microsoft Office Communicator; Microsoft Tellme Service, Microsoft Dynamics AX; Microsoft Dynamics CRM; Microsoft Dynamics GP; Microsoft Dynamics NAV; Microsoft Dynamics SL; Microsoft Dynamics Retail Management System; Microsoft Partner Program; and Microsoft Office Accounting[189]	(Productivity applications) Apple, Corel, Google, IBM, Novell, Oracle, Red Hat, Sun Microsystems. (Business applications) Intuit, Sage, Oracle, SAP. **(Unified Communications) Cisco, IBM, Nortel, Avaya, Alcatel-Lucent, Siemens and others.**
Entertainment and Devices Division (EDD)	Xbox video game systems, games (Xbox, PC, online). Music device. IPTV software. Mobile devices and software.	Xbox 360 console and games; Xbox Live; Zune; Mediaroom; numerous consumer software and hardware products (such as mice and keyboards); Windows Mobile software platform; Windows Embedded device operating system; and Windows Automotive[189]	(Games) Nintendo, Sony. (Music) Apple. (Mobile) Nokia, Openwave Systems, Palm, QUALCOMM, Wind River, Research In Motion, and Symbian. (IPTV) SeaChange

Table 14: Microsoft business units, products, and competition

[189] **Microsoft.** *Microsoft Corporation Annual Report 2007.*

4.2 Microsoft's UC Scope

> *As more and more of our communications and entertainment is transmitted over the Internet thanks to email, instant messaging, video conferencing, and the emergence of Voice over Internet Protocol (VoIP), Internet Protocol Television (IPTV), and other protocols, a new wave of software-driven innovations will eliminate the boundaries between the various modes of communications we use throughout the day.*
>
> *Soon, you'll have a single identity that spans all of the ways people can reach you, and you'll be able to move a conversation seamlessly between voice, text, and video and from one device to another as your location and information sharing needs change. You'll also have more control over how you can be reached and by whom: when you are busy, the software on the device at hand will know whether you can be interrupted, based on what you are doing and who is trying to reach you.*
>
> ***[Microsoft Chairman Bill Gates]***[190]

The above quote is taken from one of only two mass emails that Microsoft Chairman sent in 2007[190]. The email reiterates Microsoft's position that software-driven innovations will be instrumental in unifying the various modes of communications used by office workers. The email also implies that Microsoft will play a central role in this transformation of how enterprise workers communicate and collaborate.

Before we describe Microsoft's UC scope, it will be helpful to revisit our view of UC as depicted in the Figure 8 as reference for further discussion (we have reproduced a copy of Figure 8 below).

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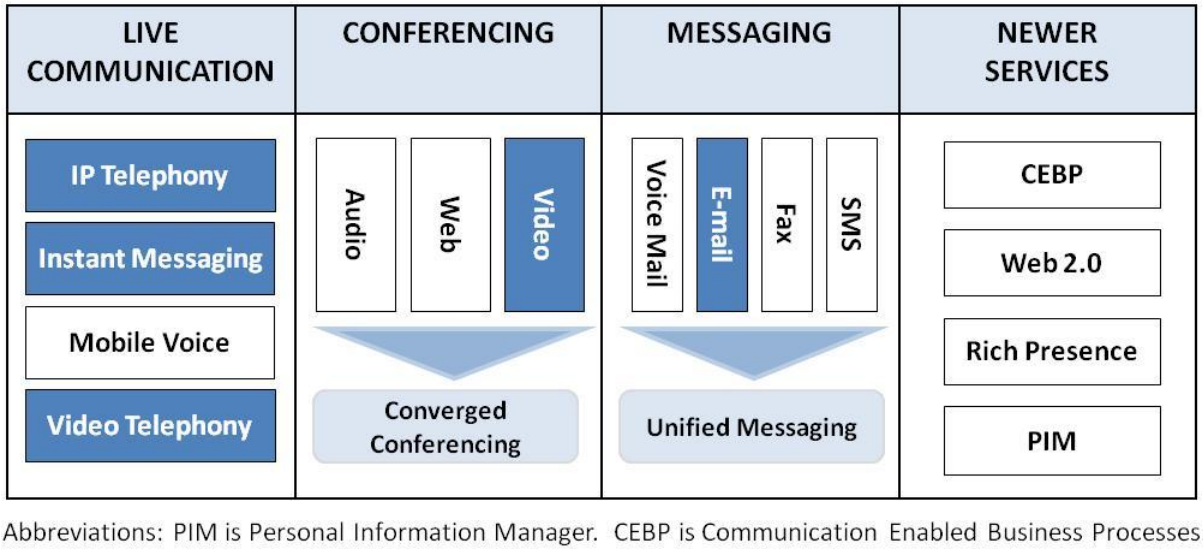
[190] **2007.** Bill Gates on the Age of Software-Powered Communications. *Microsoft.* [Online] October 16, 2007. [Cited: May 4, 2008.] http://www.microsoft.com/mscorp/execmail/2007/10-16unifiedcommunications.mspx.



Copy of Figure 8: Communication and collaboration applications currently used by knowledge workers.

Microsoft's scope spans the entire gamut of software platforms and applications that constitute Unified Communications. Although Microsoft is primarily focused on competing as a software vendor in the UC space, it has also created hardware products when complementary products that could fit into Microsoft's vision were unavailable. A good example of Microsoft created hardware is RoundTable, a conferencing phone with a 360 degree camera that tracks the active speaker in a meeting. Microsoft UC strategy is an extension of its long running strategy to compete in all broad-based 'horizontal' software platform and product markets. As a Director of Product Management within Microsoft's UC Group put it to the author in response to a question about Microsoft's scope of innovation, 'the boundary is communication'. Given Microsoft's wide scope in this market and its relationship with complementors, Microsoft's ecosystem strategy resembles that of '**physical dominators**'.

Microsoft's Corporate Vice President for Real-Time Collaboration business unit had the following comments about the formation of Unified Communication Group early 2006:

> *Our vision for Unified Communications (UC) stems from two primary drivers.*
>
> *First, customers have told us about the pain and loss of productivity they experience everyday due to multitude of silo'ed communications tools – e-mail/calendaring, IM, voice-telephony, audio/video/Web conferencing, etc. – across multiple devices. It is not unusual to see people first calling "office#," leaving voice mail, then calling "cell#," (saying, "I left message on*

office#"), then sending the person e-mail, when it should have been clear from calendar information that the person is unreachable at an offsite.

Second, UC is driven by the technological convergence that is driving all communications technologies – IM, VoIP-telephony, SMS, audio-video-Web conferencing) to be IP-based. For example, the move from TDM (time-division multiplexing) voice to VoIP itself is driving a major industry transformation as evidenced by news stories everyday.

Unified Communications is about breaking down today's silo'ed communications experiences and instead providing rich communication capabilities that allow people, teams, organizations to communicate simply and effectively while integrating seamlessly with business applications and processes. It will enable the millions of information workers using our products to communicate seamlessly across different communication modes and devices, while at the same time reducing the cost and complexity of our customers' communications infrastructure, providing compelling business value to our customers. The formation of the UCG further represents Microsoft's commitment to rapidly deliver on this vision for our business customers and for our partner ecosystem.

[Microsoft Corporate Vice President Anoop Gupta][191]

As is evident from the quote above and from other Microsoft pronouncements and actions, Microsoft considers email/calendaring, IM, voice telephony, voice mail, fax, SMS, audio/video/web conferencing to be within its scope of innovation. Table 15 provides the product road map as enunciated by Microsoft in 2006. Table 15 also details of products that Microsoft considers outside its own scope and within that of its partner ecosystem (the partner portion is highlighted for emphasis).

[191] **2006.** Q&A: Microsoft Forms Unified Communications Group to Deliver Innovative Communications Solutions. *Microsoft.* [Online] January 30, 2006. [Cited: May 2, 2008.] http://www.microsoft.com/presspass/features/2006/jan06/01-30UnifiedComms.mspx.

PRODUCT	*PROVIDER*	*DESCRIPTION*
Office Communications Server 2007	Microsoft	Session Initiation Protocol (SIP) standards-based real-time communication platform that enables presence-based VoIP call management; audio-, video- and webconferencing; and instant messaging communication within and across existing software applications, services and devices.
Exchange Server 2007 unified messaging	Microsoft	Goes beyond e-mail and today's stand-alone voice-mail systems to deliver a unified inbox experience that includes e-mail, voice mail and faxing functionality, as well as new capabilities such as speech-based auto attendant allowing users to access their communications from any phone
Office Communicator 2007	Microsoft	Unified communications client that works in tandem with Office Communications Server 2007 to deliver a presence-based, enterprise VoIP "softphone"; secure, enterprise-grade instant messaging that allows for intercompany federation and connectivity to public instant messaging networks such as MSN®, AOL and Yahoo!; one-to-one and multiparty video- and audioconferencing; and webconferencing. As with the previous versions, Office Communicator 2007 will be available in desktop, browser-based and Windows Mobile®-based versions.
Office Live Meeting	Microsoft	Rich conferencing service designed to help users more effectively collaborate, conduct training and deliver presentations using just a PC and an Internet connection. Improvements to Office Live Meeting include support for e-learning, enhanced audio and video capabilities including VoIP, a streamlined user interface, seamless integration with the Microsoft Office system and simpler deployment
Office RoundTable	Microsoft	Audio-video collaboration device with a unique 360-degree camera. When combined with Office Communications Server 2007, RoundTable delivers an immersive conferencing experience that extends the meeting environment across multiple locations. Meeting participants on site and in remote locations gain a panoramic view of everyone in the conference room as well as close-up views of individual participants as they take turns speaking.
Office Communicator phone experience	Microsoft & Ecosystem Partners	Communicator-based software designed to run an innovative set of new voice and video devices — including business-enabled IP desktop phones — from Polycom Inc., LG-Nortel Co. Ltd. and Thomson Telecom. This is a new ecosystem designed to run on dedicated communications devices in tandem with Office Communications Server 2007 to extend and enhance the Microsoft unified communications experience
PC peripheral devices	Microsoft & Ecosystem Partner	USB handsets, wireless USB headsets, USB webcams and PC monitors with built-in audio and video components. Devices from industry partners GN Netcom Inc., Logitech, Motorola, Plantronics Inc., Samsung and Tatung Co. will work with Microsoft Office Communicator 2007 to deliver a compelling communication experience on the PC.

Table 15: Microsoft's UC product road map, 2006[192]

[192] **2006.** Microsoft Unveils Unified Communications Product Road Map and Partner Ecosystem. *Microsoft.* [Online] June 25, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/press/2006/jun06/06-25UCGRoadMapPR.mspx.

The data in Sections 3.2.2 & 3.2.3 show that Microsoft is the market leader in email and instant messaging. Section 3.1 includes reasons as to why an enterprise's current email and instant messaging system investments are among the most important determinants of UC system buying decisions (please see Appendix E for buying decision criteria as described by a large UC customer). Microsoft is also a leading provider of web conferencing[193] and PIM[194]. Microsoft is strengthening its position in mobile and video communication both through acquisitions and internal product development. Microsoft is using its market power in business email, EIM, PIM, web conferencing and so on to envelop other areas in the UC market space as discussed in Section 4.5 below.

Microsoft and Enterprise Voice Telephony: Microsoft drew a skeptical response from the market when it declared in 2006 that 'voice is absolutely a part of Microsoft unified communications'[73]. This skepticism stemmed from several reasons:

1. Traditional voice telephony was dominated by large players such as Avaya and Nortel with brand names and customer relationships constructed over decades. These players also had huge installed bases in a heavily penetrated market as voice is a century-old application.

2. Users expect very high reliability from voice telephony. Microsoft's perception in the market was hardly linked to reliable products (even though the reality might be different in certain cases).

3. There wasn't a technological shift happening in the industry that could open the way for Microsoft's entry. A big technological shift did happen at the turn of the 21st century from TDM systems to software-based VoIP systems. However, Cisco was able to benefit from the shift to establish itself as a major enterprise voice (VoIP) player by building a huge installed base and market share. As in some other markets such as internet browsers, Microsoft was entering late into the market.

Nonetheless, Microsoft entered into enterprise voice market with a lot of fanfare, releasing its first voice product in the autumn of 2007 as part of Office Communication Server (OCS). Microsoft's

[193] Microsoft Office Live Meeting which has evolved from Microsoft's acquisition of PlaceWare in 2003.
[194] PIM is provided through the address book & calendaring modules within Microsoft's email & directory products.

OCS introduced voice innovations that have the potential to increase the quality of VoIP beyond what is available from competing vendors. For example:

- **Wide-band Audio**: Microsoft is perhaps the first major vendor to introduce the use of 16 KHz sampling rather than 8 KHz sampling that is traditionally used for voice telephony[195]. The higher sampling rate results in superior sound quality as 16 KHz samples capture a wider band of frequencies in human voice than 8 KHz. Microsoft claims that 'wideband not only improves the intelligibility and naturalness of speech, but also adds a feeling of transparent communication and eases speaker recognition'[196].

- **Intelligent Adaptive End-Points**: Microsoft also argues that building QoS into corporate networks is often not enough to mitigate all quality issues as the scope of QoS is limited to the managed network only. Further, it is hard to predict the traffic patterns even in a managed network, so problems can occur unless the network is over provisioned [further discussion can be found in (Microsoft)[196]]. Microsoft has instead adopted the famous 'end-to-end argument' to build intelligent end-points (which Microsoft lists as 'PC, Windows CE devices with phone form factors, Windows Mobile device, or other devices running partner platforms with similar capabilities'[196]). These intelligent end-points will monitor network situation to adapt the traffic accordingly. For example, the end-points gracefully degrade to use a lower bit rate stream, admittedly with lower voice quality, when the network appears to be congested or when the network is low bandwidth and lossy such as a wireless connection on an airport.

The audio and video codec technology developed by Microsoft has pushed the technology envelope such that more specialized technology firms such as Polycom, LG Nortel, Intel, Texas Instruments, AudioCodes, Dialogic, and Tandberg are licensing Microsoft's codec technology[197,198].

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[195] Voice generates analog (continuous) signal which is digitized by taking discrete samples. The Nyquist-Shannon Sampling Theorem states that it is possible to reconstruct an analog signal if sampling is done at double the rate of highest frequency in the signal. Sampling at 8 KHz means that frequencies in human voice above 4 KHz will not be captured.

[196] **Microsoft.** *Quality of Experience: A Strategic Competitive Advantage of Microsoft Unified Communications.*

[197] **2007.** Gary Hermansen Leaves Global IP Sound. *TMCNET*. [Online] September 11, 2007. [Cited: May 5, 2008.] http://blog.tmcnet.com/blog/tom-keating/voip/gary-hermansen-leaves-global-ip-sound.asp.

[198] **2008.** TANDBERG to Deliver First High-Definition Webcam for Microsoft. *Tandberg.* [Online] March 20, 2008. [Cited: May 5, 2008.] http://www.tandberg.com/press_room/viewPressRelease.do?id=375.

These innovations by Microsoft also provide a contrast to Cisco's approach which has built intelligence into the network and argued that Cisco's Unified Communication platform takes advantage of the network services such as power or quality of service[199].

Signaling Scope to the Market: Microsoft has been very explicit in signaling its UC scope to market – through investments in existing products, new product announcements, high-profile alliances, and through its construction of partner ecosystem. Existing products and products announcement informed the market of what Microsoft clearly considered as within its scope of innovation. Some of the alliances and partnerships and the way they were structured served to signal what Microsoft clearly considered to be outside its scope.

In July 2006, Microsoft and Nortel announced the Innovative Communication Alliance (ICA) as a strategic partnership in the emerging Unified Communications space[200]. The alliance spanned R&D, sales and marketing, and systems integration. Given Nortel's long legacy with enterprise telephony, Microsoft was able to acquire intellectual property from Nortel that could be used in Microsoft's enterprise VoIP offering. Nortel also agreed to send its development resources to join Microsoft's UC team in Redmond to collaborate on research and product development. In return, Nortel could provide complementary products such as contact center applications, advanced telephony functions, advanced mobility solutions and data-networking infrastructure as part of the ICA offer. Nortel was also anointed as the 'bellwether system integrator' for Microsoft UC offering for which Nortel agreed to create a special service organization dedicated to providing system integration for the ICA offerings. Although Nortel will be the leading system integrator, Microsoft is also creating a certified system integration partner network that will help customers implement Microsoft's UC offering to interoperate with legacy investments[201,202].

It is clear from the public discussion about ICA from the very start such as the joint press conference by Microsoft CEO Steve Ballmer and Nortel CEO Mike Zafirovski (with other

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[199] **Cisco. January 2007.** *Benefits of Deploying Cisco Unified Communications within a Cisco Network.* January 2007. White Paper. C11-337455-01.

[200] **2006.** Microsoft and Nortel Announce Innovative Communications Alliance (ICA). *Microsoft.* [Online] July 18, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/features/2006/jul06/07-18UCGNortel.mspx.

[201] **Goldman, Jeff. 2007.** Partnering with Microsoft on OCS 2007. *Enterprise VoIP Planet.* [Online] August 23, 2007. [Cited: May 3, 2008.] http://www.voipplanet.com/trends/article.php/3695941.

[202] Microsoft Unified Communications Partners. *Microsoft.* [Online] [Cited: May 3, 2008.] http://www.microsoft.com/uc/partners.mspx.

executives from both companies) that Microsoft was going to own the voice portion within ICA[203]. Nortel products were to be used as stop-gap as Microsoft built its voice product from the grounds up with help from Nortel developers and intellectual property. It is also clear that Microsoft considers data networking, gateways that connect to PSTN, systems integration, and custom communication solutions development for enterprises to be outside its scope. Nortel on the other hand saw an opportunity within ICA for 'substantial new revenue through service offerings such as convergence planning, integration, optimization, monitoring and managed services'[204]. Nortel's moves were an admission of the possibility of Microsoft triumphing in the voice market – a market that was traditionally Nortel's turf.

Appendix C includes some of Microsoft's complementors in the device space.

Support for Developing Complementary Applications: As has been Microsoft's practice in the past, it is providing subsidized support to developers of applications based on its Unified Communication solution. Its OCS Speech Server is an Interactive Voice Response (IVR) platform that allows the development of speech-enabled applications. Microsoft does not charge a premium for deploying these applications and has provided development tools and support[205]. Microsoft also provides extensive subsidized support to developers for the Exchange platform[212].

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[203] **Ballmer, Steve, et al. 2006.** Transcript: Microsoft/Nortel News Conference. *Microsoft.* [Online] July 18, 2006. [Cited: April 30, 2008.] http://www.microsoft.com/presspass/exec/steve/2006/07-18Nortel.mspx.

[204] **2006.** Nortel and Microsoft Form Strategic Alliance to Accelerate Transformation of Business Communications. *Microsoft.* [Online] July 18, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/press/2006/jul06/07-18UCGNortelPR.mspx.

[205] Microsoft Office Communications Server 2007 Speech Server. [Online] [Cited: May 5, 2008.] http://www.microsoft.com/uc/products/speechserver.mspx.

4.3 Microsoft's UC Product Technology

The architecture of Microsoft's UC platforms and products is highly modular when viewed at the level of constituent applications such as voice, IM, conferencing, email, video and presence. This is partly due to the fact that Microsoft's UC offering is a convergence of its separately existing platforms with newly developed platforms. The existing platforms were available to complementors for interfacing and Microsoft continues to provide them unbundled to users and complementors. Referring back to Table 15, the combination of several platforms constitutes a complete Microsoft UC solution. However, buyers can pick parts of Microsoft UC offer and use it with products from other complementors. In fact, buyers could even choose to use select components from one of the server platforms that bundle several components as discussed below.

Office Communication Server (OCS) & Unbundled Components: OCS is an evolution of Microsoft's earlier instant messaging platform - Live Communication Server (LCS) - that has been enhanced to include VoIP, call management, and multi-party on-premise web conferencing. However, Microsoft has offered OCS in two Client Access License (CAL) editions so that buyers do not have to use Microsoft's complete offering.

FEATURES	*STANDARD CAL*	*STANDARD CAL AND ENTERPRISE CAL*
Enterprise Instant Messaging	●	●
Enhanced presence	●	●
Peer-to-peer voice and video	●	●
File transfer	●	●
Multi-party Web conferencing		●
Application sharing		●
Software-powered VoIP		●
Call management		●

Table 16: Microsoft Office Communication Server editions and feature comparison[206]

[206] Microsoft Office Communications Server 2007 edition comparison. *Microsoft.* [Online] [Cited: May 6, 2008.] http://office.microsoft.com/en-us/communicationsserver/FX102405721033.aspx.

Enterprises can continue to leverage their existing investments in legacy telephone systems while interoperating with OCS. For example, Indiana University, which has 35,000 phone lines and 34,000 email users, is nearing completion on a Unified Communication project that will utilize OCS along with Nortel's PBX[207].

Microsoft's OCS has used Session Initiation Protocol (SIP), an IETF standard for real-time communications that has facilitated interoperability with complementary products and services. Microsoft has also provided development server and tools that allow the development of speech-enabled applications.

Exchange Server for Unified Messaging & Unbundled Components: From its beginning as an email server, Exchange has evolved into a unified messaging system that not only receives and stores email, faxes, and voice mail but also allows access to voice mail through telephone rather than an email client. This makes it a substitute for traditional voice mail systems and a competitor to (earlier complements) voice mail systems that used Exchange for storage. For example, Cisco and Avaya integrated their voice mail systems with Microsoft Exchange to provide a single inbox to users[208,209].

However, the platform is modular and Microsoft offers Exchange in two CAL editions allowing buyers to use it in conjunction with products from other complementors. Table 17 shows how buyers can choose the features that they want from Microsoft Exchange and use it in conjunction with other complementors.

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[207] **Lucas, J. Michael and Horn, Jennifer Van. 2008.** IU UniCom Project OCS/CS2100 Integration. [Online] February 10, 2008. [Cited: May 5, 2008.] www.educause.edu/ir/library/powerpoint/NMD08030E.pptx.

[208] **2006.** Avaya Modular Messaging 3.0 . *Gartner*. [Online] May 26, 2006. [Cited: May 5, 2008.] http://www.gartner.com/DisplayDocument?ref=g_search&id=492505.

[209] Cisco Unity. [Online] [Cited: May 5, 2008.] http://www.cisco.com/en/US/products/sw/voicesw/ps2237/.

FEATURE	STANDARD CAL	STANDARD CAL + ENTERPRISE CAL
E-mail, shared calendaring, contacts, tasks, management	●	●
Outlook Web Access	●	●
Exchange ActiveSync	●	●
Advanced Exchange ActiveSync Policies ***		●
Unified Messaging		●
Per-User/Per-Distribution List Journaling		●

Table 17: Microsoft Exchange Server editions and (incomplete) feature comparison[210]

Although Exchange supports standard protocols such as SMTP, Microsoft has also used proprietary protocols and has extended industry standard protocols. However, Microsoft has provided technical specification to Exchange developers for Microsoft's proprietary protocols and extensions to standard protocols[211]. Microsoft also provides Software Development Kit (SDK), documentation, samples, development support and community portal without charge to Exchange developers[212]. Exchange is clearly a **two-sided platform** where Microsoft subsidizes the developer community but charges the end-users.

4.4 Microsoft's Relationship with UC Complementors

Appendix C lists Microsoft's more than 100 official partners circa April 2008. Most of these are systems integration, communication and IT services and support firms that will facilitate the deployment of Microsoft's UC offering and provide operational support. Microsoft has actively courted these firms as it considers system integration, services and support to be outside its UC scope. Conflict with these firms is less likely as Microsoft's scope expansion will not affect this group.

Microsoft's Conflict with Voice Vendors: Microsoft also sought relationship with traditional voice vendors such as Avaya and Nortel. The Innovative Communications Alliance (ICA) with Nortel

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[210] **2007.** Exchange Server 2007 Editions and Client Access Licenses. *Microsoft.* [Online] October 15, 2007. [Cited: May 5, 2008.] http://www.microsoft.com/exchange/evaluation/editions.mspx.

[211] **2008.** Exchange Server Protocols. *Microsoft.* [Online] April 24, 2008. [Cited: May 5, 2008.] http://msdn.microsoft.com/en-us/library/cc307725(EXCHG.80).aspx.

[212] Exchange Server Developer Center. *MSDN.* [Online] [Cited: May 5, 2008.] http://msdn.microsoft.com/en-us/exchange/default.aspx.

was a result of this effort. At present, Nortel's voice products especially with advanced capabilities are being used within ICA offerings. However, Microsoft products will eventually replace most of Nortel's voice products but Nortel is resigned to this conflict. Nortel may not be too sanguine about its prospects as an enterprise voice company as the market has shifted to software-based VoIP where Cisco has a commanding market leadership. Avaya executives have claimed however that they were approached by Microsoft ahead of Nortel but they turned down the offer to license its voice technology to Microsoft[213]. Avaya executives claimed that they would have relinquished call control to Microsoft only for 'a very big price'. Despite the conflict, Avaya has continued to integrate with Microsoft's messaging, conferencing, desktop applications, and directory services because of Microsoft's huge installed base in these areas.

Microsoft's Conflict with Device Complementors: Microsoft has actively partnered with firms producing IP phones, headsets, speakerphones, webcams, video systems and monitors to create complements to its UC offer. However, these relationships are not free from conflicts. For example, phone/speakerphone makers are in direct conflict with Microsoft's aim to make the soft phone as the primary user interface while making the hardware phone obsolete. Microsoft and Tandberg recently announced an initiative where Tandberg would develop a high-definition webcam for Microsoft Unified Communications[214]. This is despite the fact that Microsoft has an existing webcam product line[215] for Unified Communication and can move to higher quality webcams later on.

Why then are these device makers innovating in the complementary market space when they may be target of Microsoft's platform expansion? First, these devices use standard interfaces such as USB or Bluetooth so they can operate with most other platforms that use standard interfaces too. These devices do not face very high switching costs as would be the case with proprietary interfaces. The only cost to these firms would be the investments they had done to complement Microsoft's innovations in enterprise voice technology. Second, these complementors may get enough return in

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[213] **Turner, Rik. 2007.** Avaya "Turned Down Microsoft" Before MS-Nortel Deal. *DataMonitor Computer Wire.* [Online] February 28, 2007. [Cited: May 1, 2008.] http://www.computerwire.com/industries/research/?pid=C5509F00-E9E0-44DA-8C95-4E64DD0232C4.

[214] **2008.** TANDBERG to Deliver First High-Definition Webcam for Microsoft. *Tandberg.* [Online] March 20, 2008. [Cited: May 5, 2008.] http://www.tandberg.com/press_room/viewPressRelease.do?id=375.

[215] Microsoft Unified Communications: Phones and Devices Optimized for Microsoft Office Communicator. *Microsoft TechNet.* [Online] [Cited: May 3, 2008.] http://technet.microsoft.com/en-us/bb970310.aspx.

products sales, brand enhancement, and technology improvements that they are willing to develop complementary product knowing full well the conflicts with Microsoft that exist.

4.5 Platform Envelopment – Microsoft's Strategy for Success

We alluded to the fact that Microsoft is using platform envelopment[216] as a strategy for success in UC market. Microsoft has a market leading position (#1 or #2) in three platform markets that underlie UC viz. email, IM and web-conferencing. Although these platforms may not have strong proprietary network externalities because of universal interlinking (e.g. email), they do exhibit complementary bandwagon effects because of the proprietary applications that users and complementors may have created using a particular platform (e.g. FedEx QuickShip application is a complement to Microsoft's email application and allows shipping from within the email program[217]). Microsoft is thus able to leverage its software development expertise, common components, and shared user relationships from its existing email and IM platforms to move into the enterprise voice market using an envelopment strategy. In fact, Microsoft has an even deeper base for its envelopment strategy – Indiana University, a major pilot customer cited experience with Windows Server operating system as one reason for choosing Microsoft's platform[218]. The Indiana University Unified Communication project team also confirmed that they received heavy discounts on their enterprise Client Access Licenses (CAL) implying that pricing was done on a much larger bundle of software programs than just UC software.

Difficulty in Classification – 'Convergence in Substitute' or 'Convergence in Complements': In trying to think through the envelopment strategies with UC, one is confronted with the problem of classifying various platforms as substitutes, complements or functionally unrelated. We do not use a rigorous cross price elasticity based approach in deciding whether two platforms within UC are

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[216] **Eisenmann, Thomas, Geoffrey, Parker and Van Alstyne, Marshall. 2007.** *Platform Envelopment.* 2007. Working Paper. 07-104.

[217] **2008.** FedEx Enables Shipping Inside Microsoft Office Outlook . *FedEx.* [Online] February 11, 2008. [Cited: May 5, 2008.] http://news.van.fedex.com/node/7647/print.

[218] **Lucas, J. Michael and Horn, Jennifer Van. 2008.** IU UniCom Project OCS/CS2100 Integration. [Online] February 10, 2008. [Cited: May 5, 2008.] www.educause.edu/ir/library/powerpoint/NMD08030E.pptx.

substitutes or complements. Even our intuitive functionality based approach[219] is wrought with difficulties as each platform has multi-uses which in the converged multi-platform bundle form complex set of relationships. For example, should we consider convergence between Microsoft's OCS and Exchange platforms, a convergence between weak substitutes or complements? Email can and (anecdotally does) substitute for voice or IM conversation within enterprises. But the email platform Exchange also serves as a store for voice mail and IM transcripts so in that sense the Exchange platform provides a complementary service to the voice platform.

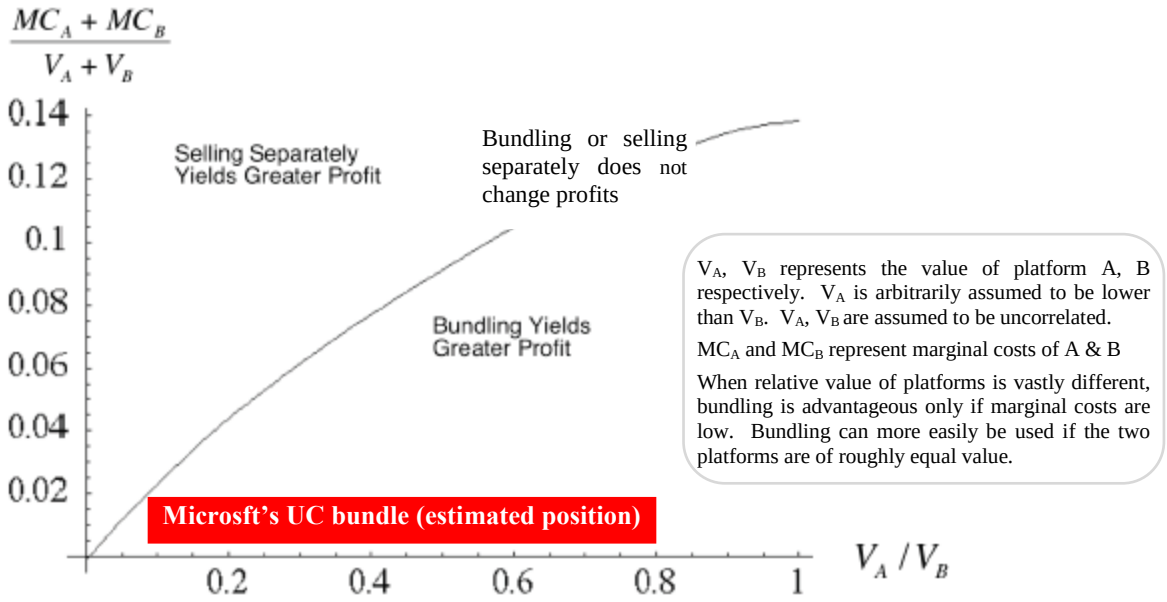
4.5.1 Potential Envelopment Gains to Microsoft

At a very broad level, all underlying UC components provide communication and collaboration services to enterprise workers so they are functionally related. Instead of laying out the complex set of usage relationships (substitute vs. complements) between the converging platforms, we instead delve directly into discussing the potential envelopment gains that could accrue to Microsoft.

Price Discrimination Gains

In discussing the potential price discrimination gains, it will be helpful to revisit Figure 6, which is reproduced below for ease of reference. We have also marked Microsoft estimated position on this graph.

[219] (Motivated by:) "**Greenstein, Shane and Khanna, Tarun. 1997.** What Does Industry Convergence Mean? [ed.] David B. Yoffie. *Competing in the Age of Digital Convergence.* s.l. : Harvard Business School Press, 1997, Chapter 5".



Copy of Figure 28: Bundling decision based on value and marginal costs of platforms

(Adapted from Platform Envelopment by Eisenmann et al)

Given that software platforms have marginal costs approaching zero, it will be beneficial for Microsoft to bundle voice with email and IM platforms even if the relative value of the two platforms is very low for buyers. Thus Microsoft can see price discrimination gains for platforms that provide functions that are weak substitutes or complements of each other.

Bundle pricing is one factor that allows Microsoft to either force the competitors to bring down their prices or risk losing market share. Microsoft has stated that average cost of enterprise VoIP will drop to half in three years[220].

Indirect Network Effects – Benefits to Complementors:

Platform bundling may also have advantages for complementors who may have access to newer functionality of additional platforms through APIs. For example, a developer of complementary applications for Microsoft's email platform can more easily incorporate rich presence – including information from calendar, IM and voice - that has been aggregated by Microsoft's bundled UC platform.

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[220] **2007.** Microsoft Set to Deliver Enhanced VoIP Solutions, Lead Unified Communications Shift to Software. *Microsoft.* [Online] March 7, 2007. [Cited: May 5, 2008.] http://www.microsoft.com/presspass/press/2007/mar07/03-06VoiceCon07PR.mspx.

Efficiency Improvements:

Economies of Scope in Marketing: Bundling has the potential of reducing customer acquisition cost for Microsoft as well as search and transaction costs for buyers. On the buyer side though, there might be two different sets of decision makers for computing services (OS, desktop, email, IM, Web 2.0) and telecommunication services (voice, voice mail, fax). Scope economies will be highest in cases where decision making at the buyer firm has been organizationally unified.

Quality Advantages: Enterprise voice is generally regarded as a very high reliability application. To be successful within the enterprise voice market, Microsoft will have to attain the expected level of reliability. These quality improvements will also spillover to other components of the multi-platform bundle. Another example of quality spillovers would be the wide-band audio innovation (Section 4.2) that Microsoft has applied to its voice and IM components.

4.6 Summary

Insights and conclusions are summarized in Chapter 6.

5 IBM's UC Strategy

5.1 Background

Founded in 1911, IBM is one of the largest global information technology companies generating approximately $99 billion in 2007 revenue[221]. IBM has pioneered many technology innovations in the past and continues to be among the top innovator firms, generating the highest number of patents in each of the last 15 years[221,222]. IBM operates three major lines of businesses:

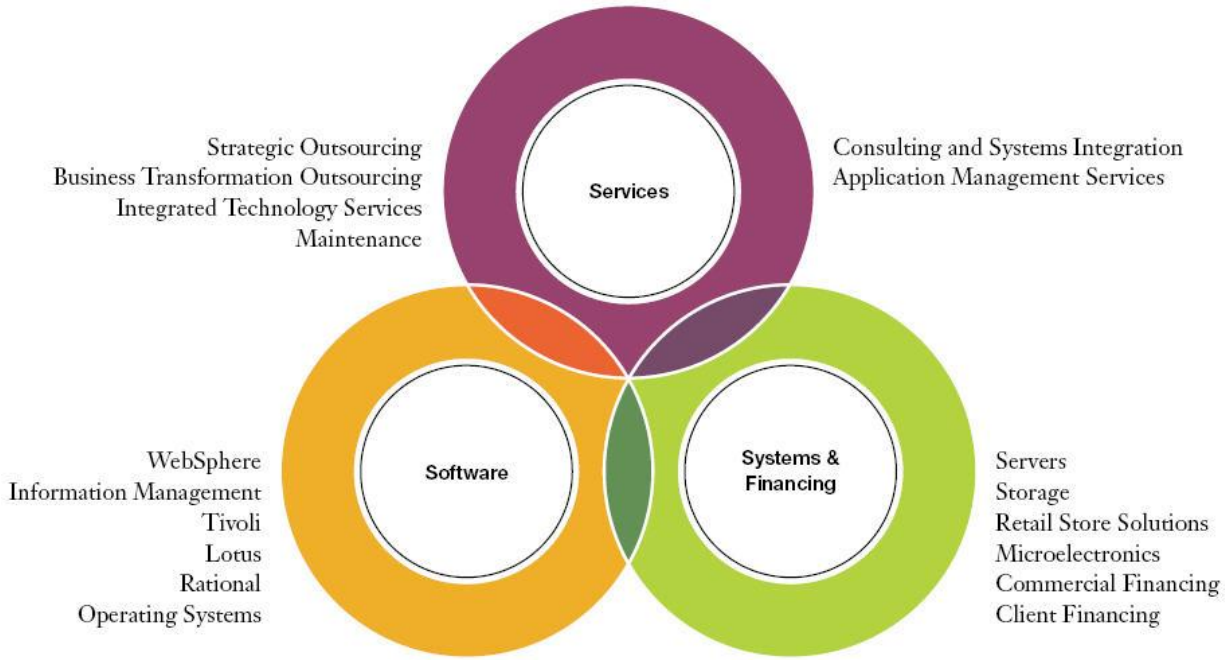

Figure 29: IBM business units, products and services[221]

Global Services: which provides technology and business consulting services and represented 55.3% of revenue and 37.1% of pre-tax income in 2007[221]

Systems and Technology/Financing: which provides hardware products as well as financing to clients & channel partners and represented 24.3% of revenue and 23.3% of pre-tax income in 2007[221]

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[221] **IBM.** *IBM 2007 Annual Report.*

[222] **2008.** IFI Patent Intelligence Announces 2007's Top U.S. Patent Assignees. *Wolters Kluwer Health.* [Online] January 14, 2008. [Cited: May 5, 2008.] http://www.ificlaims.com/IFI%20Patent%20Release%201-9-08.htm.

Software: which primarily provides middleware and operating system software and represented 20.4% of revenue and 39.6% of pre-tax income in 2007[221]

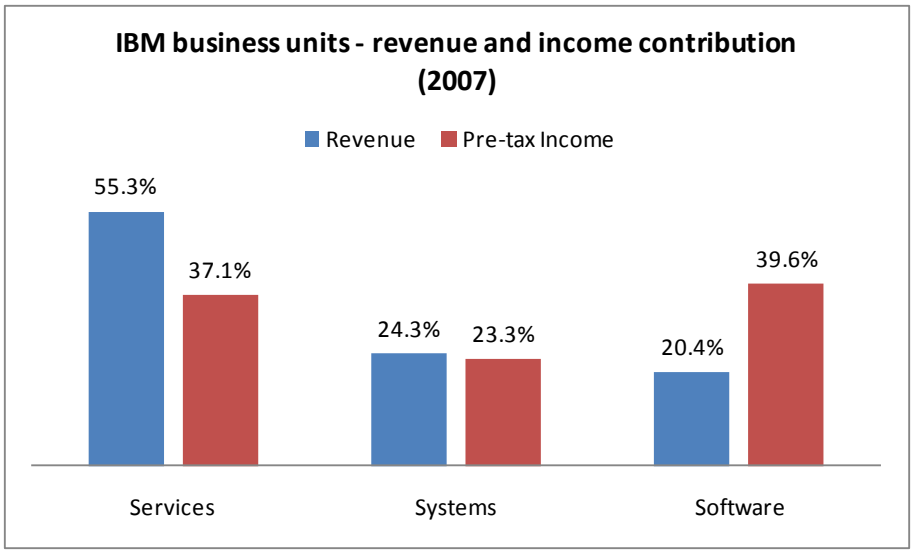

Figure 30: IBM business units - revenue and pre-tax income contribution, 2007

Although the services unit provided the bulk of IBM revenue in 2007, it is a lower margin business unit with the software unit providing the largest share of pre-tax income in 2007. Both these units, i.e. the services and software units, are important for IBM's unified communications strategy as the software unit provides IBM's UC platform whereas the services unit provide system integration services to fulfill demand created by convergence. IBM's UC platform is part of the Lotus suite. Table 18 provides brief descriptions of IBM's software suites.

Appendix D shows IBM's recent M&A activities with the WebDialogs acquisition in August 2007 relevant to UC.

SOFTWARE PRODUCT	*DESCRIPTION*
Websphere	Advanced database, content management and information integration software that helps companies integrate, manage and gain value from their business information
Information Management	Advanced database, content management and information integration software that helps companies integrate, manage and gain value from their business information
Tivoli	Software for infrastructure management, including security and storage management that will help organizations better manage their IT infrastructure to more effectively deliver IT services
Lotus	Collaboration, messaging and social networking software that enables businesses to communicate, collaborate and increase productivity
Rational Software	Software tools that help clients manage their software development processes and capabilities
Operating Systems	Software engines that manage the fundamental processes that make computers run

Table 18: IBM software suites

IBM's Overall Vision & Strategy

On the corporate level, IBM has enunciated the following strategic guiding principles for its business[221]:

Focus on open technologies and high value solutions: IBM seeks to continually shift upscale from segments that are commoditizing, in search of higher returns

Deliver integration and innovation to clients: IBM seeks to be the global integrator of choice for large enterprises

Become the premier globally integrated enterprise: IBM has made changes to its own organization to operate as a globally integrated enterprise by transforming core processes and functions that were once managed regionally

Figure 31 shows how IBM views its position with relation to some other firms in the IT industry.

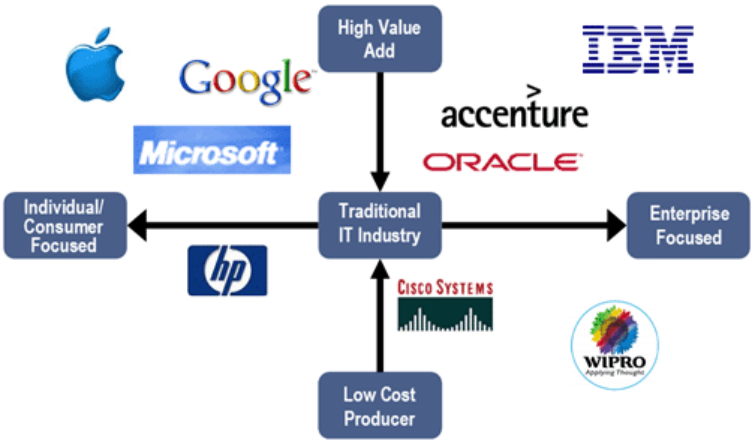

Figure 31: IBM view of its position within the IT industry[223]

Of course IBM's claims about its strategy and IBM's view of its position in the IT industry can be vigorously contested, especially whether it is the producer of the highest value-added goods in the IT industry. However, the purpose here is to show IBM's self image and link it to its actions. On a broad level, IBM is focused on being the IT infrastructure provider for the large enterprise market, with only a small presence in the Small and Medium Business (SMB) segments (with its exit from the personal computer market in December 2004[224], it is nearly absent from the consumer market). IBM is also focused on remaining the system integrator and IT service provider of choice for large enterprises.

Repercussions on UC Strategy: In the email and IM segments, IBM's top competitor Microsoft has a strong presence in the consumer segment unlike IBM. This has likely led to lower average costs for Microsoft as components may be shared across the business and consumer versions[225]. It also encourages complementors to develop for Microsoft's platforms as the complementors will have a larger addressable market. Although IBM has federated with consumer IM networks, it incurs extra costs to do so. Microsoft has a more favorable position as its joint consumer IM network with Yahoo! has hundreds of millions of active subscribers.

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[223] **Murphy, Patricia. 2007.** IBM Business Perspective 2007 - Presentation by IBM VP Investor Relations to European Investors. *IBM*. [Online] September 2007. [Cited: May 3, 2008.] http://www.ibm.com/investor/events/pmurphy0907/#.

[224] **Dunn, Darrell. 2005.** IBM Tries To Allay Concerns Regarding Sale Of PC Business . *Information Week*. [Online] January 19, 2005. [Cited: May 5, 2008.] http://www.informationweek.com/news/hardware/showArticle.jhtml?articleID=57702211.

[225] The consumer version is a two-sided platform where advertisers subsidize most users

With its focus on being the system integrator and IT services provider for large enterprises, IBM has also sought integration opportunities emanating from the convergence that has led to Unified Communications.

IBM's View of Communication Trends and Its High-Level UC Plans

In a keynote speech at a trade conference in March 2008, General Manager of IBM Lotus Software Mike Rhodin predicted that five trends will drive demand for unified communication as quoted below:

> 1. *The virtual workplace will become the rule. Desk phones and desktop computers will gradually disappear, replaced by mobile devices, including laptops. Social networking tools and virtual world meeting experiences will simulate the feeling on being there in-person.*
>
> 2. *Instant messaging and other real-time collaboration tools will become the norm, bypassing e-mail.*
>
> 3. *Companies will go beyond the initial uses of instant messaging and will integrate IM with business processes and line-of-business applications.*
>
> 4. *Interoperability and open standards will tear down proprietary walls within business and public domains. Corporate demand for interoperability and maturing industry standards will force unified communications providers to embrace interoperability.*
>
> 5. *Meetings will become increasingly ad hoc and instantaneous based on context and need. 3-D virtual world and gaming technologies will have a significant impact on online corporate meeting.*
>
> ***[Mike Rhodin, General Manager of IBM Lotus Software]***

Given that these predictions came from a for-profit corporation, we need to decipher what IBM gains by enunciating these trends.

Establishing IBM's instant messaging client as the main user interface to control the user experience: For real-time communication, IM becoming the norm is a description of the past and not prediction of the future. IBM's email business has been losing market share for a long time so putting it down makes sense even when there exist use cases when asynchronous modes may be the best mode of communication. Even within the newer Web 2.0 platforms that are the primary

collaboration mode of the next generation of workers, there is provision for asynchronous communication which is similar to email in essence such as the 'Send Message' feature in Facebook.

Signaling IBM's focus on IM, interoperability and leveraging existing voice investments to encourage complementors to join IBM's ecosystem: IBM focus on IM, its stated position to remain out of enterprise voice, its calls for interoperability and interconnection, and its public exhortation to enterprises to leverage their existing TDM voice investments - signal to voice vendors that joining IBM's ecosystem is less risky than partnering with Microsoft. It also helps IBM's services unit gain business as enterprises need specialized help to utilize their legacy voice systems to take advantage of the innovations happening in the IP-based Unified Communication space.

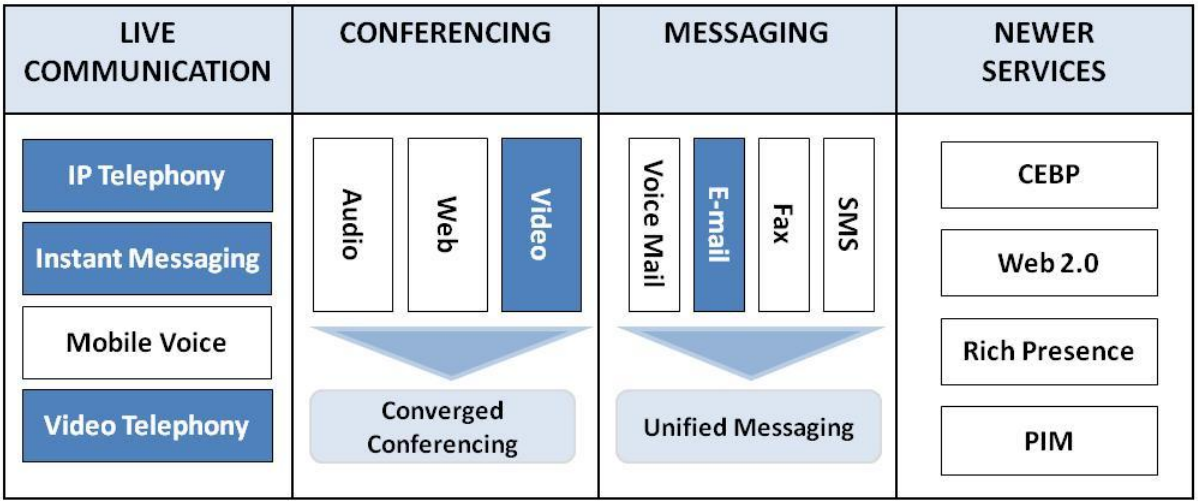
IBM has committed to investing $1 billion to evolve its existing UC applications as well as develop newer applications to realize the vision it laid out in March 2008. It has laid out four elements that will help attain its vision[226]:

> ***Software platform**: creating an open, easy to use unified user experience*
>
> ***Integration services**: enabling enterprises to better plan, deploy and manage their solutions, reducing risk and increasing time to business value*
>
> ***Business partners**: leveraging partners to form a broad ecosystem, giving customer choice and the ability to leverage existing investments*
>
> ***Industry expertise**: relying on vast experience in business process optimization, being responsive and agile to customer needs and market demands, offering customers a competitive advantage*

[226] **Galitzine, Greg. 2008.** IBM To Invest $1Billion in Unified Communications Initiatives. *TMCnet.* [Online] March 11, 2008. [Cited: May 5, 2008.] http://hdvoice.tmcnet.com/topics/unified-communications/articles/22633-ibm-invest-1billion-unified-communications-initiatives.htm.

5.2 IBM UC Scope

While discussing IBM's UC scope, it will be useful to refresh our view of UC by referring to Figure 8 as reproduced below.



Copy of Figure 8: Communication and collaboration applications currently used by knowledge workers.

Strong Email and IM base: IBM has a strong existing installed base in the email and IM markets as detailed in Section 3.2.2 above. Although an early market leader in both enterprise email and EIM, IBM lost its leadership to Microsoft in recent years. In retaining part of its user base, IBM has been helped by the fact that its email platform (Lotus Notes) encouraged and facilitated the development of complementary applications. These users have been more loyal to IBM's email platform because of the higher cost of migration.

Conferencing & Web 2.0: IBM provided net conferencing through its on-premise IM. It lacked a on-demand web-conferencing platform like WebEx until August 2007 when it acquired WebDialogs. IBM has also invested in creating a Web 2.0 platform – its Lotus Quickr team collaboration software allows enterprise knowledge sharing and collaboration. The platform also provides interfaces that allow the creation of applications that access Quickr[227].

[227] Lotus Quickr. *IBM.* [Online] [Cited: May 5, 2008.] http://www.ibm.com/developerworks/lotus/products/quickr/

Voice Telephony Products Out of IBM's Scope: IBM has decided to stay out of the enterprise voice telephony product market although it has the technical capabilities as well as the financial and marketing resources to enter the market. Instead IBM has sought to create a large ecosystem of voice vendors around its IM platform Sametime while creating system integration opportunities for its services business.

Scope Determinants: Although IBM has the technical, financial and marketing resources to create a broad platform offer like Microsoft's UC platform, it has focused on strengthening the market position of its existing email and (especially) IM platforms by drawing a broad set of complementors. Since IBM's position has declined to number two in both business email and EIM markets entering other UC areas such as voice telephony could have weakened its email & IM position even further, as (1) incumbent voice vendors would have felt antagonized and retaliated by competing in the instant messaging market, or (2) incumbent voice vendors would have partnered with Microsoft, that had a larger installed base in email and IM. IBM's quest for complementors is especially true in voice telephony but also to some extent in video communication. Although IBM's IM platform Sametime offers basic video chatting, IBM has defined a much narrower video communication scope compared to Microsoft instead focusing on drawing in partners into its ecosystem.

Signaling Scope to Market: IBM has aggressively pushed its IM system Sametime as the cornerstone of its UC strategy. It has also signaled its scope through actual product offering and/or product road maps in the areas where IBM wishes to compete. It has publicly stated that it has no plans to compete with the PBX vendors[228]. It has also sought partnership with voice vendors which have gone beyond mere integration of products to cross licensing of technology:

1. IBM has licensed software technology from Siemens to create middleware that will enable Sametime to integrate with legacy PBX system

2. IBM has licensed to Cisco its Lotus Expeditor platform for Cisco's UC offer. Lotus Expeditor forms the bedrock for IBM's Sametime platform (please see Section 5.3 below)

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[228] **Gonsalves, Antone. 2007.** IBM vs. Microsoft In Telephony Integration Middleware Race. *Information Week.* [Online] August 23, 2007. [Cited: May 5, 2008.] http://www.informationweek.com/news/internet/showArticle.jhtml?articleID=201801861.

However, it has repeatedly proffered the system integration capabilities of its services unit to enterprise customers to create a UC solution out of legacy voice investments.

5.3 IBM's UC Product Technology

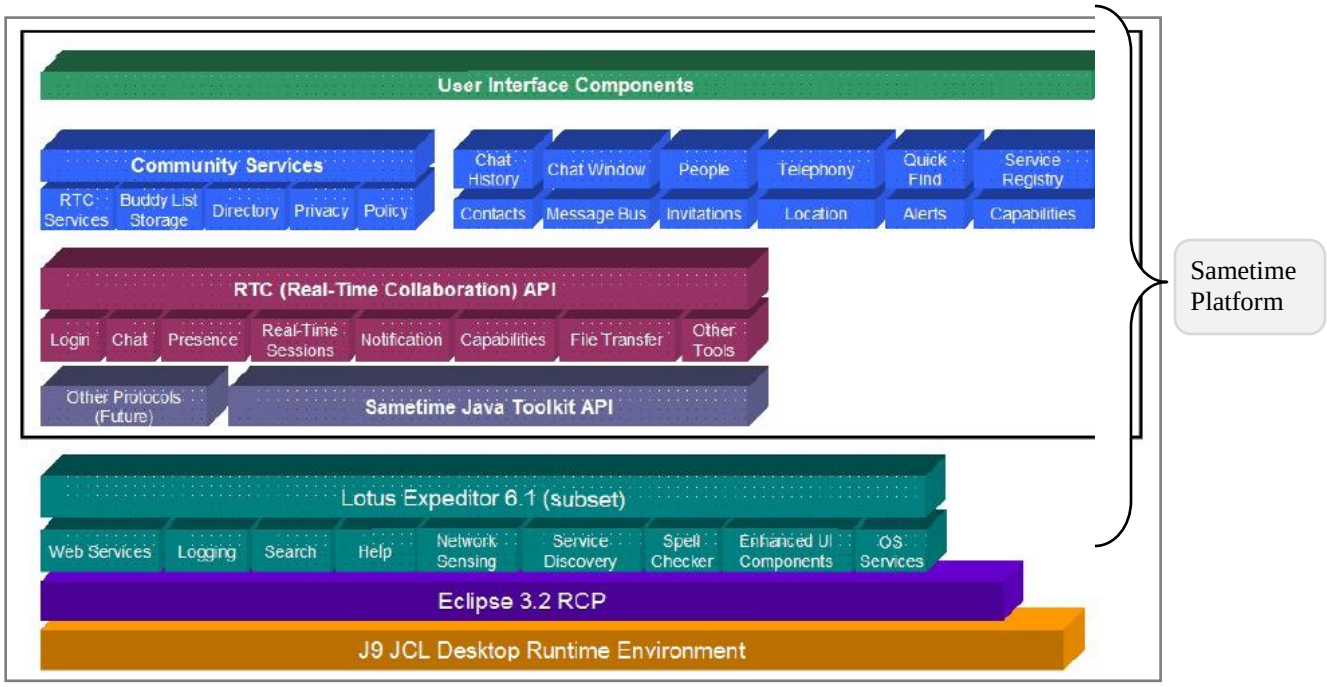

Figure 32: IBM instant messaging client architecture[229]

The core of IBM's UC offering is its instant messaging platform Sametime. The architecture for Sametime is layered and modular. Figure 32 shows the architecture diagram for the client software Sametime Connect. The Sametime platform is built over the Java Runtime Environment, which allows Sametime to run across multiple operating system platforms. The public open-source software Eclipse forms the bedrock layer for Sametime. IBM created the Eclipse project in 2001 with support from multiple software vendors but the project is now managed by an independent not-for-profit foundation[230]. Eclipse is noted for its architecture that allows users to extend Eclipse using plug-ins developed in multiple programming languages.

Extending Sametime: Sametime facilitates the creation of plug-ins that can extend the native functionality of Sametime; Eclipse is known for its extensibility through plug-ins and Sametime shares this architectural feature with Eclipse. IBM has provided tools and published documentation with public interfaces and programming examples that allow people to write extensions. The plug-

[229] Lotus Sametime, Version 8.0.1 Integration Guide. *IBM*. [Online] [Cited: May 8, 2008.] http://www.ibm.com/developerworks/lotus/documentation/sametime/

[230] About the Eclipse Foundation. [Online] [Cited: May 5, 2008.] http://www.eclipse.org/org/.

ins that adhere to the public interfaces can not only extend Sametime, but they can also plug into any client developed using Lotus Expeditor[229] (please see Figure 32). IBM has also created forums that facilitate developers to exchange their extensions with others[231].

Licensing and Interfacing with Complementors: IBM has licensed its Lotus Expeditor technology to Cisco to build Cisco's UC client. It has also partnered extensively with voice vendors such as Avaya, Nortel, Shoretel, NEC, Siemens and so on to integrate its Sametime client with voice product from these vendors.

Non-standard Protocol: Although the modularity and openness of IBM's instant messaging architecture is admirable, it has been criticized for the use of a proprietary protocol 'Virtual Places' for communication. Although it has built support for the standard Session Initiation Protocol (SIP) and XMPP through gateways, this adds to the complexity of the system. IBM has so far not supported SIP natively within Sametime although it has stated its intention to do so in future.

The Unified Telephony Middleware: IBM has also announced that it is creating middleware based on technology licensed from Siemens that will allow Sametime to integrate with legacy and newer PBX systems from multiple vendors. This is also part of IBM's strategy to create opportunities for its services unit for system integration within the UC space.

5.4 IBM's Relationship with External Complementors

IBM has been successful in attracting top tier voice vendors into its ecosystem to the disadvantage of Microsoft. Although most of the voice vendors have interfaced with Microsoft products because of the ubiquity of the Microsoft products, these voice vendors have built stronger relationship with IBM (except Nortel which has an alliance with Microsoft). This is partly due to the open, extensible architecture of IBM's UC system as well as its technology licensing policy. But it is also because "the enemy of my enemy is my friend". Because of Microsoft's entry into the enterprise voice market, the voice vendors are now in competition with Microsoft in the voice market. IBM on the other competes with Microsoft in email, IM and other areas.

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[231] Lotus Sametime Code Exchange. *IBM*. [Online] [Cited: May 5, 2008.] http://www.ibm.com/developerworks/exchange/dw_categoryView.jspa?categoryID=7.

Conflicts with Complementors: IBM does have conflicts with some of its complementors. For example, IBM competes with Cisco in web conferencing albeit Cisco is a market leader in web conferencing while IBM has a miniscule market share.

A source of conflict with pure IP PBX vendors is IBM's system integration strategy that extends the life of legacy PBX systems by building UC services on top of these investments. The goal of IP PBX vendors such as Cisco and Shoretel has been to push enterprise customers to retire their legacy PBX systems. For pure IP PBX vendors, UC was another reason in their arsenal to convince customers to retire legacy PBX systems as UC.

IBM's system integration work through its services business unit also conflicts with the services units of Avaya, Nortel and so on. It may also have second order affect on Cisco's services partner ecosystem causing them to exit if they see IBM building an advantage in the space because of the Cisco-IBM product relationships.

Finally, second tier voice vendors worry that it is only a matter of time before IBM enters into the voice market despite its proclamations to the contrary. This scenario is plausible as IBM has the technological capabilities as well as financial and marketing resources to enter the voice market. These second tier voice vendors worry that once IBM has strengthened its position in the IM market, it will envelop the voice market.

5.5 IBM's Management of Multi-Sided Platform

Multi-sided platforms have a unique characteristic that demand on one side of the market is heavily dependent on the demand on the other side of the market – demand vanishes on both sides if there is no demand on the other side, irrespective of price[232]. For IBM to get voice vendors interested in utilizing IBM's IM platform for UC, it must have and must be able to sustain a large enough user base on its own. It has tried to strengthen its base by subsidizing complementor firms in return for deploying IBM's IM solution.

IBM has also subsidized the developer community at large by providing development tools, documentation and example program for free.

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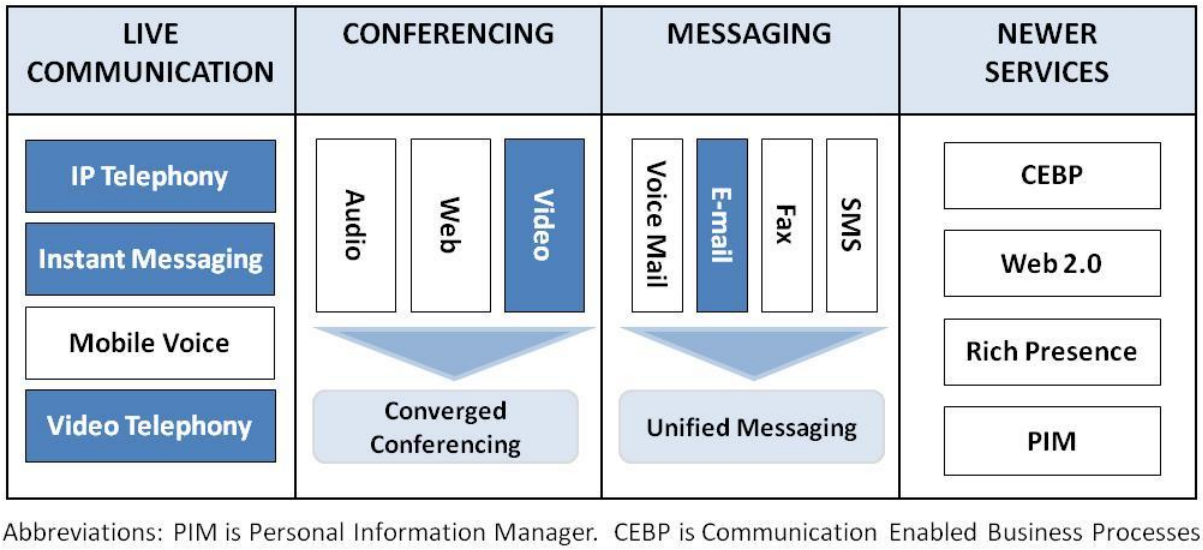
[232] (Page 64) **Evans, David S., Hagiu, Andrei and Schmalensee, Richard. 2006.** *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries.* Cambridge, MA : The MIT Press, 2006. ISBN: 0262050854.

5.6 Summary

Insights and conclusions are summarized in Chapter 6.

6 Conclusion

Unified Communication (UC) is the convergence of various modes of communication and collaboration used by enterprise workers in the course of their workday. UC has been enabled by (1) the convergence of transport networks as communication services move to IP based networks, and (2) the use of software platforms (for communication applications) which can be complemented, extended and integrated in way not possible before. Figure 8 provides our point-of-view as to what constitutes UC; a copy of Figure 8 is reproduced below for reference:



Copy of Figure 8: Communication and collaboration applications currently used by knowledge workers.

To reiterate, the research objectives for this thesis were:

1. To study select platforms – voice telephony, email, instant messaging, video communication - that underlie UC pre-convergence and draw insights about the effects of technology, compatibility standards, and network effects on these platforms and use these insights to explain the market situation and implications for UC

2. To describe the emerging platform strategies of two large software vendors, viz. IBM and Microsoft, within the domain of UC

6.1 Insights about Platforms Underlying UC

UC buying decision criterion: Enterprises are attracted to UC for its potential business value, but UC buying decisions are driven by an enterprise's investments in voice telephony, enterprise instant messaging, and enterprise email. This buying decision criterion for UC favors incumbent firms in the business email, enterprise instant messaging and enterprise voice telephony markets.

Email and network effects: Email is a heavily penetrated enterprise communication tool with direct network effects. However, due to interlinking these network effects are not proprietary to any single vendor.

Enterprise email market: Microsoft and IBM are the top two vendors in the enterprise email market, which is highly concentrated. Email platforms from both these vendors foster development of complementary applications. In the two-sided market (of email users and email complement developers), both firms subsidize developers by providing free tools. Microsoft's dominance in enterprise email is not due to demand side network effects; rather, Microsoft's dominance stems from superior feature set built through product evolution, ease of use, competitive pricing, and bundle pricing. Both Microsoft and IBM leverage their email installed base for UC but Microsoft's strengthening market position in business email more strongly supports its UC position.

Consumer instant messaging (IM) and network effects: IM is highly penetrated in North American consumer market. Consumer IM exhibit proprietary network effects as interlinking is through ad hoc federation. Consumer IM is a two-sided platform that subsidizes IM users but charges advertisers. Microsoft is among the largest consumer IM network and thus has favorable federation position (compared with IBM which does not compete in the consumer IM market).

Enterprise instant messaging (EIM) market: Microsoft and IBM are the top two vendors in the enterprise IM market, which is highly concentrated. Within businesses, EIM decisions are made centrally so usually all users within one enterprise either have one particular EIM or they have none. But the network effects within consumer IM spill over to enterprise IM as, (1) many EIM networks are restricted within firm boundaries and are not interconnected (2) many businesses still do not have EIM so the employees in such businesses use consumer IM. So, EIM systems federate with consumer IM systems to increase the number of users reachable. Thus Microsoft's large user base and its federation relationships in the consumer IM market, gives it an advantage in the EIM market.

Microsoft's leadership in EIM: Although Microsoft has a reachability advantage in EIM market over IBM due to Microsoft's large consumer IM user base, it surpassed early leader IBM not through demand side network effects but through product evolution, ease of use, and pricing.

Microsoft's EIM installed base critical within UC: Microsoft's EIM installed base is critical to its UC strategy. First, it has bundled its voice telephony platform within the IM server so Microsoft's EIM installed base also gets the voice platform as these users upgrade to newer versions. Second, IBM has made its EIM Sametime the centerpiece of its UC strategy so it is critical for Microsoft to maintain or enhance its share within EIM to thwart IBM's UC strategy.

Enterprise voice telephony and network effects: Voice telephony exhibits direct network effects but because of nearly universal interlinking over standard protocols, these effects are not proprietary to particular vendors.

Enterprise voice telephony market: The enterprise telephony was traditionally dominated by Avaya and Nortel in North America but Cisco was able to become a strong player because of the technological shift to IP-based software powered systems. Microsoft has entered the voice market with entrenched platform vendors.

Video communication and strategic failures: Video communication provides many examples of strategic failures spread over many episodes that can be valuable to a student of technology strategy. The stated goal of many video vendors during each episode has been to replace face-to-face communication although many studies have shown that users find audio-video communication to be closer to audio-only communication rather than face-to-face communication. Video communication exhibits both direct and indirect network effects. In fact, the failure of AT&T's Picturephone in 1970s led Jeffrey Rohlfs to do his seminal work on network effects. AT&T failed to solve the startup problem for Picturephone as the regulatory regime made it impossible to use penetration pricing or other costly acquisition strategies. Intel also failed miserably with its video strategy for ProShare as Intel ignored the existing standard and created an offer based on Intel's proprietary standard. Intel's goal in entering the video communication market was to foster the market for a complement that could utilize its innovations in processor technology. Intel partnered with telecommunication firms and computer manufacturers to bring down the price of ProShare.

However, its lack of coordination with existing video communication vendors, its use of proprietary protocol, and its low pricing ended up harming the video communication ecosystem.

Cisco and Microsoft within video communication: At the present time, Cisco and Microsoft are two UC vendors whose video strategies should be of interest. Cisco has adopted a strategy that is similar in details to AT&T's Picturephone strategy. Cisco has created a video communication platform Cisco Telepresence system that is very high priced and requires high network bandwidth to operate. Cisco's goal with Telepresence is to substitute face-to-face meetings. Microsoft in its video strategy seems to be focused on substituting audio-only meetings. Microsoft has created a video camera RoundTable that is priced so that departments within US enterprises can afford to purchase RoundTable. Moreover, Microsoft has integrated video communication in its productivity suites to provide ready use-cases for its video communication platform. Microsoft's video communication strategy is most promising in our view and will strengthen Microsoft's UC position.

6.2 Insights about Microsoft's UC Strategy

Microsoft's scope: Microsoft has defined a broad scope for its UC strategy including almost all applications in Figure 8 above. Importantly, it has decided to enter the voice market by building a voice platform largely on its own to compete with entrenched platforms. Through the Innovative Communication Alliance (ICA), Microsoft has partnered with legacy voice provider Nortel to purchase Nortel's voice intellectual property and get development support from Nortel engineers.

Microsoft's platform architecture: Microsoft's platform is modular with public interfaces and development tools to extend the core platform. Microsoft subsidizes developers by providing tools and documentation for free. This fosters the creation of complementary applications for Microsoft's platform.

Microsoft's complementors: Microsoft has most actively sought complementors in the systems integration and services space. As part of ICA, Microsoft has rewarded Nortel by making it the 'bellwether systems integrator' for Microsoft's UC platform. Microsoft has also sought complementors to develop hardware that can use Microsoft's innovations in the UC space (e.g. innovations related to Microsoft's voice product).

Microsoft's conflict with complementors: Microsoft's scope conflicts with many of its complementors' scope. Some conflicted complementors have decided to cede their turf to Microsoft in return for something else (e.g. Nortel got system integration within ICA for giving up voice telephony). Other firms have complemented Microsoft's platforms because the use of standard interfaces allows these complementors to migrate to other platforms without incurring huge switching costs.

Platform envelopment for UC success: Microsoft has accentuated that voice is absolutely a part of Microsoft's unified communication platform. To succeed as an entrant in the voice market with entrenched platforms, Microsoft is leveraging common components and installed base of its business email and enterprise IM platforms to enter into the voice market with a multiplatform bundle. As the marginal cost of software is low, bundling allows Microsoft to realize price discrimination gains. Microsoft also gains economies of scope in development and marketing through platform bundling. Finally, platform bundling can result in quality spillovers across platforms.

6.3 Insights about IBM's UC Strategy

IBM's scope: IBM has a strong presence in business email and enterprise IM markets although its position has weakened (cf. Microsoft) in recent years. Given a diminishing position in email and IM, IBM has decided not to enter the voice telephony market with a software based VoIP platform. Instead it has focused its UC strategy on the IM platform Sametime and system integration services.

IBM UC platform architecture: IBM UC platform architecture is modular and extensible. The platform architecture facilitates the building of extensions. IBM has utilized the extension architecture of an open source tool Eclipse, which has a large developer base. IBM provides free documentation and tools to further attract developers. IBM UC superior platform architecture could create very strong complementary network effects for its UC platform.

IBM's relationship with complementors: IBM has sought to create a broad ecosystem of voice vendors who can utilize Sametime as a complement to their voice platforms. IBM has also licensed technology from Siemens to create middleware software that can interconnect disparate legacy PBX and IP PBX systems within an enterprise into a single UC system. IBM's largest business unit is the services unit and IBM's strategic goal is to create business for its system integration and services

business within the UC market. IBM's strategy also results in conflicts with voice vendors – (1) the IP PBX vendors want enterprise customers to retire legacy PBX and IBM's middleware solution can elongate their life (2) traditional PBX vendors have system integration and services units of their own who will face competition from IBM.

IBM's strategy for success: Microsoft's expansive UC scope has made it a competitor to many firms with products in the UC space (e.g. Cisco in the voice space). IBM has skillfully allied with firms most affected by Microsoft's expansive UC scope. IBM has also surmounted feature set and usability shortcomings in its email and IM platforms. IBM's Sametime platform architecture, that facilitates complement development, can create strong complementary network effects. Finally, its middleware software can help Sametime gain share by integrating with existing voice hardware while generating business for IBM's services unit.

6.4 Ideas for Future Research

UC provides a rich business domain for the study of technology strategy. We briefly describe some research issues that can be pursued further.

UC strategies of voice vendors: One of the largest revenue components of UC is voice. Prominent voice vendors such as Avaya, Cisco and Nortel have all stated their strategic commitment to UC. Building on this thesis, future research could focus on the UC strategies of the voice vendors.

Adoption of UC and its business value: UC is in the early stages of adoption cycle. This thesis presented UC from the supplier's perspective. Future research could focus on the demand side and study the drivers and inhibitors of UC adoption. Future research could also measure the business value gained by the early adopters of UC.

7 Bibliography

A Comparative Study of Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP) and X.400 Electronic Mail Protocols. **Tzerefos, Polychronis, et al. 1997.** Washington, DC : IEEE Computer Society , 1997. Proceedings of the 22nd Annual IEEE Conference on Local Computer Networks . pp. 545-554. ISBN: 0-8186-8141-1 .

A Theory of Interdependent Demand for a Communications Service. **Rohlfs, Jeffrey. 1974.** 1, s.l. : The Rand Corporation, 1974, The Bell Journal of Economics and Management Science, Vol. 5, pp. 16-37.

About Danger. *Danger*. [Online] [Cited: May 2, 2008.] http://www.danger.com/about/.

About the Eclipse Foundation. [Online] [Cited: May 5, 2008.] http://www.eclipse.org/org/.

Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. **Henderson, Rebecca M. and Clark, Kim B. 1990.** 1990, Administrative Science Quarterly, Vol. 35, pp. 9-30.

Arthur, W. Brian. 1996. Increasing Returns and the New World of Business. *Harvard Business Review*. July-August 1996, pp. 100-109.

1985. AT&T's Video Meeting Rooms Just Can't Draw a Crowd. *Business Week.* January 14, 1985, p. 126. Section: Information Processing.

Austin, Tom and Cearley, David W. 19 January 2007. *Dissatisfaction with IBM and Microsoft E-Mail and Calendaring is Real.* s.l. : Gartner, 19 January 2007. Research. G00145489.

Austin, Tom, Cearley, David W. and Cain, Matthew W. 25 September 2006. *Microsoft E-Mail Momentum Growing at IBM's Expense.* s.l. : Gartner, 25 September 2006. Research. G00139277.

2006. Avaya Modular Messaging 3.0 . *Gartner.* [Online] May 26, 2006. [Cited: May 5, 2008.] http://www.gartner.com/DisplayDocument?ref=g_search&id=492505.

Bakos, Yannis and Brynjolfsson, Erik. 2000. Aggregation and Disaggregation of Information Goods: Implications for Bundling, Site Licensing and Micropayment Systems. [ed.] Brian Kahin and Hal R Varian. *Internet Publishing and Beyond: The Economics of Digital Information and Intellectual Property.* s.l. : MIT Press, 2000.

Ballmer, Steve, et al. 2006. Transcript: Microsoft/Nortel News Conference. *Microsoft.* [Online] July 18, 2006. [Cited: April 30, 2008.] http://www.microsoft.com/presspass/exec/steve/2006/07-18Nortel.mspx.

Begonha, Duarte, et al. Fixed-Mobile Convergence – A Technology Perspective. *McKinsey & Company Telecommunications Extranet.* [Online] [Cited: March 5, 2008.] https://telecoms.mckinsey.com/html/knowledge/article/FMC_TechP.asp.

Bell, Gordon. 9 May 2002. *The Lack of PC-based Video Telephony: How I Lost a Technology Bet.* Microsoft Research. San Francisco, CA : s.n., 9 May 2002. Technical Report. [http://research.microsoft.com/~gbell/TR_2002_49_Why_I_Lost_A%20Bet_on_Video_ Telephony.doc]. MSR-TR-2002-49.

Berg, Eric N. 1985. Picturephones: A New Effort. *New York Times.* July 11, 1985, p. 2. Section D; Column 1; Financial Desk.

Beyond "Beyond Being There": Towards Multiscale Communication Systems. **Roussel, Nicolas and Gueddana, Sofiane. 2007.** Augsburg, Germany : ACM, 2007. Proceedings of the 15th international conference on Multimedia . pp. 238 - 246. ISBN: 978-1-59593-702-5.

Beyond Being There. **Hollan, Jim and Stornetta, Scott. 1992.** Monterey, California, United States : ACM, 1992. Proceedings of the SIGCHI conference on Human factors in computing systems . pp. 119 - 125 . ISBN:0-89791-513-5.

2007. Bill Gates on the Age of Software-Powered Communications. *Microsoft.* [Online] October 16, 2007. [Cited: May 4, 2008.] http://www.microsoft.com/mscorp/execmail/2007/10-16unifiedcommunications.mspx.

Blakely, Rhys. 2007. Microsoft swoop hands Multimap founder $25m. *TimesOnline.* [Online] December 12, 2007. [Cited: May 2, 2008.] http://business.timesonline.co.uk/tol/business/industry_sectors/media/article3040853.ece.

Blood, Steve and O'Connell, Daniel. 13 November 2007. *Although It's Promising, Microsoft's Software-Powered VoIP Is Not a Reason to Stop Deploying IP Telephony.* Stamford, CT : Gartner, 13 November 2007. Research. G00152584.

Book Review: Bandwagon Effects in High-Technology Industries. **Shapiro, Carl. 2003.** Number 3, s.l. : Springer Wien, November 2003, Journal of Economics, Vol. 80. ISSN 09318658.

Boudreau, Kevin. Too Many Complementors? Evidence on Software Firms. *Submitted to Management Science.* [Manuscript].

Bradnenburger, Adam M and Nalebuff, Barry J. 1996. *Co-opetition.* s.l. : Currency Doubleday, 1996. ISBN 0385479506.

Brownlow, Mark. 2008. Email and webmail statistics. *Email Marketing Reports.* [Online] February 2008. [Cited: March 19, 2008.] http://www.email-marketing-reports.com/metrics/email-statistics.htm.

Brynjolfsson, Erik and Kahin, Brian, [ed.]. 2000. *Understanding the Digital Economy: Data, Tools, and Research.* s.l. : MIT Press, 2000. ISBN 0262523302.

Brynjolfsson, Erik and Urban, Glen L., [ed.]. 2001. *Strategies for E-Business Success.* s.l. : Jossey-Bass, 2001. ISBN 0787958484.

Brynjolfsson, Erik. May 2005. VII Pillars of IT Productivity. *Optimize.* May 2005.

Bundling Information Goods. **Bakos, Yannis and Brynjolfsson, Erik. 1999.** Number 12, 1999, Management Science, Vol. 45, pp. 1613-1630.

Burgelman, Robert A., Carter, Dennis L. and Bamford, Raymond S. 22 July 1999. *Intel Corporation: The Evolution of an Adaptive Organization.* s.l. : Stanford University, 22 July 1999. Case. SM-65.

Cain, Mathew W. 2 May 2007. *MarketScope for E-Mail Systems, 2007.* s.l. : Gartner, 2 May 2007. Research. G00148025.

Cain, Matthew W. 22 February 2008. *E-Mail Hosting: Poised for Explosive Growth.* s.l. : Gartner, 22 February 2008. Research. G00154840.

Capturing Value from Innovation. **Teece, David J. 1991.** 1, s.l. : Licensing Executives Society International, March 1991, les Nouvelles (Journal of Licensing Executives Society International), Vol. XXVI, pp. 21-26.

Chandrasekaran, Rajiv. 1999. Clash of the Titans Erupts Over AOL's Instant Messaging. *The Washington Post.* July, 1999, Vol. 24, p. A01.

Christensen, Clayton M. *The Innovator's Dilemma.* s.l. : ColinsBusiness Essentials. ISBN: 0060521996.

Christensen, Clayton M., Anthony, Scott D. and Roth, Erik A. October 2001. *Innovation in the Telecommunictions Industry: Separating Hype From Reality.* October 2001. Working Paper.

CIO. 2003. Q&A with Harvard's Marco Iansiti: Integration Strategy. *CIO.com.* [Online] May 15, 2003. [Cited: March 17, 2008.] http://www.cio.com/article/print/31905.

Cisco. January 2007. *Benefits of Deploying Cisco Unified Communications within a Cisco Network.* January 2007. White Paper. C11-337455-01.

2007. Cisco C-Scape: TelePresence Session. *You Tube.* [Online] December 11, 2007. [Cited: April 30, 2008.] http://www.youtube.com/watch?v=CJmCQa9hRl4.

Cisco Systems. 1998. Cisco Systems to Acquire Selsius Systems, Inc. for $145 Million. *Cisco Systems.* [Online] October 14, 1998. [Cited: April 30, 2008.] http://newsroom.cisco.com/dlls/fspnisapi6d14.html.

Cisco Unity. [Online] [Cited: May 5, 2008.] http://www.cisco.com/en/US/products/sw/voicesw/ps2237/.

Clark, Don. 1999. Internet Rivals Attempt to Open Up AOL's Instant Message System. *Wall Street Journal.* July 26, 1999, p. 2; Section B; Column 3.

CNN. 2000. Video phones: Why is no one calling? *CNN.* [Online] September 5, 2000. [Cited: March 26, 2008.] http://archives.cnn.com/2000/TECH/computing/09/05/picture.phones.ap/index.html.

Collis, David J. and Montgomery, Cynthia A. 1994. Competing on Resources: Strategy in the 1990s. *Harvard Business Review.* July-August 1994, pp. 118-128.

Costello, Rich. 7 June 2006. *Cisco Unified Communications System.* s.l. : Gartner, 7 June 2006. Research. G00139819.

Crocker, David H. 1982. Standard for the Format of ARPA Internet Messages. *Internet Engineering Task Force.* [Online] August 13, 1982. [Cited: March 26, 2008.] http://tools.ietf.org/html/rfc822. RFC 822.

Cusumano, Michael A. and Gawer, Annabelle. 2002. The Elements of Platform Leadership. *MITSloan Management Review.* Spring 2002, Vol. 43, 3, pp. 51-58.

Cusumano, Michael A. and Selby, Richard W. 1995. *Microsoft Secrets: How the World's Most Powerful Software Company Creates Technology, Shapes Markets, and Manages People.* s.l. : Touchstone, 1995. ISBN: 0028740483.

Cusumano, Michael A., Mylonadis, Yiorgos and Rosenbloom, Richard S. 1992. Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta. *Business History Review.* Spring 1992, Vol. 66, pp. 51-94.

Daft, Richard L. and Lengel, Robert H. 1984. Information Richness: A New Approach to Managerial Behavior and Organizational Design. *Research in Organizational Behavior.* 1984, Vol. 6, pp. 191-233 .

Davidson, Michael. 2007. Gmail + Chat + AIM = Crazy Delicious. *The Official GMail Blog.* [Online] December 4, 2007. [Cited: March 17, 2008.] http://gmailblog.blogspot.com/2007/12/gmail-chat-aim-crazy-delicious.html.

Day, M., Rosenberg, J. and Sugano, H. 2000. A Model for Presence and Instant Messaging. *Internet Engineering Task Force.* [Online] February 2000. [Cited: March 17, 2008.] http://tools.ietf.org/html/rfc2778. RFC 2778.

Delaney, Kevin J., Karnitschnig, Matthew and Guth, Robert A. 2008. Microsoft Withdraws Yahoo Offer After Attempt to Bridge Gap in Price. *Wall Street Journal.* [Online] May 4, 2008. [Cited: May 5, 2008.] http://online.wsj.com/article/SB120986002095265343.html.

Dillon, Pat. 1998. The Next Small Thing. [Online] May 15, 1998. [Cited: May 1, 2008.] http://www.fastcompany.com/magazine/15/smallthing.html.

Dominant Designs and the Survival of Firms. **Suárez, Fernando F. and Utterback, James M. 1995.** Number 6, September 1995, Strategic Management Journal, Vol. 16, pp. 415-430.

Duffy, Bob. 1989. Picturetel is Opening Quite a Few Eyes. *Business Week.* April 10, 1989, p. 82. Section: Information Processing.

Duffy, Jim. 1997. Nokia Catches a Falling Ipsilon. *Network World Fusion.* [Online] December 9, 1997. [Cited: March 31, 2008.] http://www.networkworld.com/news/1997/1209ipsilon.html.

—. 1996. Start-Up Takes New IP Route. *Network World.* [Online] March 4, 1996. [Cited: March 30, 2008.] http://www.networkworld.com/news/1997/1209ipsilon2.html.

Dunn, Darrell. 2005. IBM Tries To Allay Concerns Regarding Sale Of PC Business . *Information Week.* [Online] January 19, 2005. [Cited: May 5, 2008.] http://www.informationweek.com/news/hardware/showArticle.jhtml?articleID=57702211.

Egbert, Katherine and Bukovinsky, Eric. 5 March 2008. *Microsoft (NASDAQ: MSFT) - Microsoft Sticks Its Head in the Clouds - Initiating with a Buy.* s.l. : Jefferies & Company, Inc., 5 March 2008. Equity Research.

Eid, Tom. 27 November 2006. *Businesses Increase Their Use of Instant Messaging.* Stamford, CT : Gartner, 27 November 2006. Research. G00244778.

Eisenmann, Thomas R. 2007. *Managing Proprietary and Shared Platforms: A Life-Cycle View.* s.l. : SSRN, 2007. Working Paper. 07-105.

—. 2 October 2007. *Platform-Mediated Networks: Definitions and Core Concepts.* Boston, MA : Harvard Business School Publishing, 2 October 2007. Module Note. 9-807-049.

Eisenmann, Thomas, Geoffrey, Parker and Van Alstyne, Marshall. 2007. *Platform Envelopment.* 2007. Working Paper. 07-104.

Eisenmann, Thomas, Parker, Geoffrey and Van Alstyne, Marshall W. 2006. Strategies for Two-Sided Markets. *Harvard Business Review.* October 2006, pp. 92-101.

Elliot, Bern and Lock, Christopher. 3 January 2007. *A Framework for Unified Communications.* s.l. : Gartner, 3 January 2007. Research. G00145337.

Elliot, Bern. 27 November 2007. *Finding on Unified Communications: A Hard Justification Is Good to Find.* s.l. : Gartner, 27 November 2007. Research. G00153309.

—. 28 November 2007. *Findings: Early Adoption Trends for Unified Communications Based on Job Role.* s.l. : Gartner, 28 November 2007. Research. G00153303.

—. 13 June 2007. *Three 'Killer' Business Communication Applications.* s.l. : Gartner, 13 June 2007. Research. G00149038.

—. 23 August 2007. *Unified Communications Product Overview, 2007.* s.l. : Gartner, 23 August 2007. Research. G00150437.

Elliott, Bern. 20 August 2007. *Magic Quadrant for Unified Communications, 2007.* s.l. : Gartner, 20 August 2007. Research. G00150273.

E-mail spoofing. *Wikipedia.* [Online] [Cited: March 26, 2008.] http://en.wikipedia.org/wiki/E-mail_spoofing.

Evans, David S., Hagiu, Andrei and Schmalensee, Richard. 2006. *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries.* Cambridge, MA : The MIT Press, 2006. ISBN: 0262050854.

2007. Exchange Server 2007 Editions and Client Access Licenses. *Microsoft.* [Online] October 15, 2007. [Cited: May 5, 2008.] http://www.microsoft.com/exchange/evaluation/editions.mspx.

Exchange Server Developer Center. *MSDN.* [Online] [Cited: May 5, 2008.] http://msdn.microsoft.com/en-us/exchange/default.aspx.

2008. Exchange Server Protocols. *Microsoft.* [Online] April 24, 2008. [Cited: May 5, 2008.] http://msdn.microsoft.com/en-us/library/cc307725(EXCHG.80).aspx.

Fan, Steven and Viard, Brian V. 28 February 2005. *The Long Battle For An Instant Messaging Standard.* Stanford Graduate School of Business. Stanford, CA : Stanford Graduate School of Business, 28 February 2005. Case. SM-138.

2008. FedEx Enables Shipping Inside Microsoft Office Outlook . *FedEx.* [Online] February 11, 2008. [Cited: May 5, 2008.] http://news.van.fedex.com/node/7647/print.

Festa, Paul. 2003. End of the road for SMTP? *ZDNet News.* [Online] August 1, 2003. [Cited: March 18, 2008.] http://news.zdnet.com/2100-1009_22-5058610.html.

Foster, Richard N. 1986. *Innovation: The Attacker's Advantage.* s.l. : Summit Books, 1986. ISBN 0671622501.

Freedman, Nora and Germanow, Abner. September 2007. *Key Trends in Enterprise VoIP 2007: Customer Perspectives on Unified Communications.* Framingham, MA : IDC, September 2007. Survey. IDC #208643.

Freedman, Nora. 2008. IBM Commits $1B to Unified Communications. *IDC Link.* [Online] March 12, 2008. [Cited: March 14, 2008.] http://www.idc.com/getdoc.jsp?containerId=lcUS21137708.

Frenkel, Karen A. 1995. An interview with Gordon Bell. *Interactions.* October 1995, Vol. 2, 4, pp. 66-79.

Frost & Sullivan. 2006. *North American Enterprise E-mail and Instant Messaging Solution Markets.* Palo Alto, CA : Frost & Sullivan, 2006. F852-62.

—. 2007. *North American Enterprise Telephony System Markets.* Palo Alto, CA : Frost & Sullivan, 2007. N11A-62.

—. January 2008. *North American Enterprise Videoconferencing Endpoints Market.* January 2008. Market Engineering Research. N32D-64.

—. 2006. *North American Hosted IP Telephony and VoIP Access Services Market.* Palo Alto, CA : Frost & Sullivan, 2006. N01F-63.

—. 15 February 2008. *North American Videoconferencing Services Markets.* 15 February 2008. Market Engineering Research. N075-01.

—. February 2008. *Videoconferencing Infrastructure Systems Market (Americas).* February 2008. Market Engineering Research. N196-64.

—. 2007. *World Unified Communications Markets.* Palo Alto, CA : Frost & Sullivan, 2007. N180-64.

Galitzine, Greg. 2008. IBM To Invest $1Billion in Unified Communications Initiatives. *TMCnet.* [Online] March 11, 2008. [Cited: May 5, 2008.] http://hdvoice.tmcnet.com/topics/unified-communications/articles/22633-ibm-invest-1billion-unified-communications-initiatives.htm.

Gallagher, Leigh. 2001. Videoconferencing - A Costly, Glitch-ridden Dream. *The Business Times Singapore.* August 13, 2001.

2007. Gary Hermansen Leaves Global IP Sound. *TMCNET.* [Online] September 11, 2007. [Cited: May 5, 2008.] http://blog.tmcnet.com/blog/tom-keating/voip/gary-hermansen-leaves-global-ip-sound.asp.

Gawer, Annabelle and Cusumano, Michael A. 2008. How Companies Become Platform Leaders. *MITSloan Management Review.* Winter 2008, Vol. 49, 2, pp. 28-35.

—. 2002. *Platfrom Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation.* s.l. : Harvard Business School Press, 2002. ISBN 1578515149.

Gilpin, Kenneth N. and Schmitt, Eric. 1986. 13 Engineers at Pictel Meet Phone Deadline. *New York Times.* January 16, 1986, p. 2. Section D; Column 5.

Glasmann, Josef, Kellerer, Wolfgang and Müller, Harald. 2003. Service Architectures in H.323 and SIP: A Comparison. *IEEE Communications Surveys & Tutorials.* [Online] 2003. [Cited: March 17, 2008.] http://www.comsoc.org/livepubs/surveys/public/2003/oct/glasmann.html.

Gold, Aaron. Platform? What's the Heck's a Platform. *About.com.* [Online] [Cited: March 5, 2008.] http://cars.about.com/cs/automakers/a/Kappa_platform.htm.

Goldman, Jeff. 2007. Partnering with Microsoft on OCS 2007. *Enterprise VoIP Planet.* [Online] August 23, 2007. [Cited: May 3, 2008.] http://www.voipplanet.com/trends/article.php/3695941.

Goldstein, Mark L. 1985. Bob Widergren's Picture Phone. *Industry Week.* July 22, 1985, p. 54. Section: Executives on the Spot.

Gonsalves, Antone. 2007. IBM vs. Microsoft In Telephony Integration Middleware Race. *Information Week.* [Online] August 23, 2007. [Cited: May 5, 2008.] http://www.informationweek.com/news/internet/showArticle.jhtml?articleID=201801861 .

Gray, Robert M. July 2005. The 1974 Origin of VoIP. *IEEE Signal Processing Magazine.* July 2005.

Greenfield, Dave. 2008. Avaya Changes the UC Game. *ZD Net.* [Online] March 17, 2008. [Cited: March 17, 2008.] http://blogs.zdnet.com/Greenfield/?p=210.

Greenstein, Shane and Khanna, Tarun. 1997. What Does Industry Convergence Mean? [ed.] David B. Yoffie. *Competing in the Age of Digital Convergence.* s.l. : Harvard Business School Press, 1997, Chapter 5.

Greenstein, Shane. 1998. Industrial Economics and Strategy: Computing Platforms. *IEEE Micro.* May-June 1998, pp. 43-53.

—. 2003. Jumping on Bandwagons. *IEEE Micro.* September-October 2003, pp. 75-77.

Greenstein, Shane M. 2000. *Technological Convergence.* [Compact Disc] [ed.] Richard C. Dorf. s.l. : CRC Press LLC, Chapman & Hall/CRCnetBASE, 2000. Technology Management Handbook.

Hall, Michael and Roling, John. 2006. Sametime Cuts Federation Deal with Yahoo, AIM and Google. *Instant Messaging Planet.* [Online] December 6, 2006. [Cited: March 17, 2008.] http://www.instantmessagingplanet.com/enterprise/article.php/3647601.

Hall, Michael. 2007. Google Adds AIM to Chat for Gmail. *Instant Messaging Planet.* [Online] December 4, 2007. [Cited: March 7, 2008.] http://www.instantmessagingplanet.com/public/article.php/3714641.

Hamel, Gary and Breen, Bill. 2007. Aiming for an Evolutionary Advantage. *The Future of Management.* Boston, MA : Harvard Business School Press, 2007.

Hansell, Saul. 1998. America Online to Buy Internet Chat Service for $287 Million. *The New York Times.* [Online] June 9, 1998. [Cited: March 17, 2008.] http://query.nytimes.com/gst/fullpage.html?res=9F0DE5D9143AF93AA35755C0A96E958260&sec=&spon=&pagewanted=print.

Hyatt, Josh. 1993. PictureTel focuses on Desk: Videoconferencing Products to Debut. July 16, 1993. Section: Economy.

—. 1992. What's in a PictureTel. *The Boston Globe.* August 26, 1992. Section: Economy.

Iansiti, Marco and Levien, Roy. 2004. Strategy as Ecology. *Harvard Business Review.* March 2004.

—. 2004. *The Keystone Advantage - What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability.* s.l. : Harvard Business School Publishing, 2004.

Iansiti, Marco and West, Jonathan. 1997. Technology Integration: Turning Great Research into Great Products. *Harvard Business Review.* May-June 1997, pp. 69-79.

Iansiti, Marco. 2005. Managing the Ecosystem. *InformationWeek.* [Online] Feb 4, 2005. [Cited: March 17, 2008.] http://www.informationweek.com/news/showArticle.jhtml?articleID=59300381.

Iansiti, Marco, McFarlan, F. Warren and Westerman, George. 2003. Leveraging the Incumbent's Advantage. *MITSloan Management Review.* Summer 2003, pp. 58-64.

IBM. *IBM 2007 Annual Report.*

2008. IFI Patent Intelligence Announces 2007's Top U.S. Patent Assignees. *Wolters Kluwer Health.* [Online] January 14, 2008. [Cited: May 5, 2008.] http://www.ificlaims.com/IFI%20Patent%20Release%201-9-08.htm.

Inflation Calculator. *U.S. Department of Labor, Bureau of Labor Statistics.* [Online] [Cited: March 29, 2008.] http://data.bls.gov/cgi-bin/cpicalc.pl.

2008. Infonetics Research: Cisco, Microsoft locked in battle for unified communications market. *Marketwire.* [Online] April 24, 2008. [Cited: April 30, 2008.] http://www.marketwire.com/mw/release.do?id=848297.

Instant Messaging & Messengers. *Wikipedia.* [Online] [Cited: March 17, 2008.] http://en.wikipedia.org/wiki/Instant_messaging.

1996. Intel's New ProShare Videoconferencing System. *Newsbytes.* April 30, 1996.

Jensen, Troy D. 21 May 2007. *Avaya, Inc.* s.l. : Piper Jaffray & Company, 21 May 2007. Equity Research.

Kamman, Steve and Wang, Andrew. 10 October 2002. *Enterprise VoIP: VoIP Is For Real in SMB Mkt, Smaller Players Leading.* s.l. : CIBC, 10 October 2002. Equity Research.

Kardos, Donna. 2008. Microsoft to Acquire Danger, Maker of Sidekick Technology. *Wall Street Journal.* [Online] February 11, 2008. [Cited: May 1, 2008.] http://online.wsj.com/article/SB120274323781658967.html.

Kauffman, Stuart A. 1995. Escaping the Red Queen Effect. *The McKinsey Quarterly.* 1995, Number 1.

Klemmer, Scott. Scott's Thoughts on: Beyond Being There. [Online] [Cited: March 26, 2008.] Page archived at http://www.archive.org/index.php. http://www2.sims.berkeley.edu/courses/is290-1/s01/Embodiment/hollan-klemmer.html.

Kremer, John (Vice President, Yahoo! Mail). 2007. Happy 10th Birthday, Yahoo! Mail. *Yodel Anecdotal.* [Online] October 8, 2007. [Cited: March 19, 2008.] http://ycorpblog.com/2007/10/08/happy-10th-birthday-yahoo-mail/.

Kuzela, Lad. 1986. A Videoconference at Your Desk? Studio-size Systems May Take a Back Seat to Enhance One-on-One. *Industry Week.* November 24, 1986.

—. 1986. Call Me on the TV: Videoconferencing Spreads to Smaller Firms. *Industry Week.* February 17, 1986, p. 66. Section: Information Management.

Laing, Gordon. 2003. AOL Instant Messenger 5.2. *vnunet.com.* [Online] November 21, 2003. [Cited: March 17, 2008.] http://www.vnunet.com/vnunet/downloads/2128603/aol-instant-messenger.

Lassman, Jay and O'Connell, Daniel. 24 July 2007. *IPT vs. TDM Life Cycle Purchase and Operations Costs.* s.l. : Gartner, 24 July 2007. Research. G00150236.

Lemon, Sumner. 2006. First impressions of Cisco's TelePresence. [Online] October 26, 2006. [Cited: March 29, 2008.] http://www.infoworld.com/article/06/10/26/HNciscotelepresence_1.html.

Lipartito, Kenneth. 2003. Picturephone and the Information Age: The Social Meaning of Failure. *Technology and Culture.* January 2003, Vol. 44, 1, pp. 50-81.

Lotus Quickr. *IBM.* [Online] [Cited: May 5, 2008.] http://www.ibm.com/developerworks/lotus/products/quickr/.

Lotus Sametime Code Exchange. *IBM.* [Online] [Cited: May 5, 2008.] http://www.ibm.com/developerworks/exchange/dw_categoryView.jspa?categoryID=7.

Lotus Sametime, Version 8.0.1 Integration Guide. *IBM.* [Online] [Cited: May 8, 2008.] http://www.ibm.com/developerworks/lotus/documentation/sametime/.

Lucas, J. Michael and Horn, Jennifer Van. 2008. IU UniCom Project OCS/CS2100 Integration. [Online] February 10, 2008. [Cited: May 5, 2008.] www.educause.edu/ir/library/powerpoint/NMD08030E.pptx.

Lundy, James and Smith, David Mario. 14 May 2007. *The Top Five Uses for Instant Messaging.* Stamford, CT : Gartner, 14 May 2007. Research. G00148048.

Mann, Jeffrey and Elliot, Bern. 23 November 2007. *The New Market for Unified Communications and Collaboration.* s.l. : Gartner, 23 November 2007. Research. G00153236.

Marsan, Carolyn Duffy. 2002. Calendaring Standards Gain Popularity. *Network World.* [Online] October 10, 2002. [Cited: March 17, 2008.] http://www.networkworld.com/cgi-bin/mailto/x.cgi?pagetosend=/export/home/httpd/htdocs/news/2002/1028calendar.html&pagename=/news/2002/1028calendar.html.

Maynard, Jason and McGrath, Bryan. 24 January 2008. *Microsoft Corp. (MSFT) - Two in a Row.* s.l. : CreditSuisse, 24 January 2008. Equity Research.

McAfee, Andrew P. Spring 2006. Enterprise 2.0: The Dawn of Emergent Collaboration. *MITSloan Management Review.* 3, Spring 2006, Vol. 47, pp. 21-28.

McCourt, Tavis C. and O'Donnell, Christoph. 3 August 2006. *Avaya, Inc.* s.l. : Morgan Keegan & Company, Inc., 3 August 2006. Equity Research.

McFarland, Jennifer. 2001. Instant Messaging. *Harvard Management Communication Letter.* August 1, 2001.

Media Richness Theory. *Theory Clusters.* [Online] [Cited: March 27, 2008.] http://www.tcw.utwente.nl/theorieenoverzicht/Theory%20clusters/Mass%20Media/Media_Richness_Theory.doc/.

Mee, Arthur. 1898. The Plesaure Phone. *The Strand Magazine.* September 1898, pp. 339-345. [Online] [Cited: 26 March 2008.] http://earlyradiohistory.us/1898pls.htm.

2006. Microsoft and Nortel Announce Innovative Communications Alliance (ICA). *Microsoft.* [Online] July 18, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/features/2006/jul06/07-18UCGNortel.mspx.

2008. Microsoft completes Fast Search tender offer . *CNNMoney.com.* [Online] April 25, 2008. [Cited: May 2, 2008.] http://money.cnn.com/news/newsfeeds/articles/apwire/8c12ddcf80ee195cadeaf1227710b902.htm.

Microsoft Corp MSFT.O (NASDAQ) - Full Description. *Thomson Reuters.* [Online] [Cited: May 3, 2008.] http://stocks.us.reuters.com/stocks/fullDescription.asp?rpc=66&symbol=MSFT.O.

Microsoft. *Microsoft Corporation Annual Report 2007.*

—. 2006. Microsoft Unveils Unified Communications Product Road Map and Partner Ecosystem. *Microsoft.* [Online] June 25, 2006. [Cited: Apr 30, 2008.] http://www.microsoft.com/presspass/press/2006/jun06/06-25UCGRoadmapPR.mspx.

Microsoft Office Communications Server 2007 edition comparison. *Microsoft.* [Online] [Cited: May 6, 2008.] http://office.microsoft.com/en-us/communicationsserver/FX102405721033.aspx.

Microsoft Office Communications Server 2007 Speech Server. [Online] [Cited: May 5, 2008.] http://www.microsoft.com/uc/products/speechserver.mspx.

Microsoft. *Quality of Experience: A Strategic Competitive Advantage of Microsoft Unified Communications.*

Microsoft RoundTable. *Microsoft Unified Communications.* [Online] [Cited: March 30, 2008.] http://www.microsoft.com/uc/products/roundtable.mspx.

2007. Microsoft Set to Deliver Enhanced VoIP Solutions, Lead Unified Communications Shift to Software. *Microsoft.* [Online] March 7, 2007. [Cited: May 5, 2008.] http://www.microsoft.com/presspass/press/2007/mar07/03-06VoiceCon07PR.mspx.

2008. Microsoft to Buy Ad-Software Firm. *Wall Street Journal.* [Online] March 17, 2008. [Cited: May 2, 2008.] http://online.wsj.com/article/SB120572479731440975.html.

Microsoft Unified Communications Partners. *Microsoft.* [Online] [Cited: May 3, 2008.] http://www.microsoft.com/uc/partners.mspx.

Microsoft Unified Communications: Phones and Devices Optimized for Microsoft Office Communicator. *Microsoft TechNet.* [Online] [Cited: May 3, 2008.] http://technet.microsoft.com/en-us/bb970310.aspx.

2006. Microsoft Unveils Unified Communications Product Road Map and Partner Ecosystem. *Microsoft.* [Online] June 25, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/press/2006/jun06/06-25UCGRoadMapPR.mspx.

Microsoft. 2007. Windows Live Hotmail Fact Sheet. *Microsoft PressPass - Information for Journalists.* [Online] May 2007. [Cited: March 18, 2008.] http://www.microsoft.com/presspass/newsroom/msn/factsheet/hotmail.mspx.

Microsoft, America Online, MSN and Yahoo! Announce Industry-First Connectivity to Enterprise Instant Messaging Users. [Online] [Cited: February 17, 2008.] http://www.microsoft.com/presspass/press/2004/jul04/07-15enterpriseimconnectivitypr.mspx.

Moore, Cathleen. 2003. XMPP vs SIMPLE: The Race for Messaging Standards. *InfoWorld.* [Online] May 23, 2003. [Cited: March 16, 2008.] http://www.infoworld.com/article/03/05/23/21FExmpp_1.html.

Moore, James F. 1993. Predators and Prey: A New Ecology of Competition. *Harvard Business Review.* May-June 1993, pp. 75-86.

Murphy, Patricia. 2007. IBM Business Perspective 2007 - Presentation by IBM VP Investor Relations to European Investors. *IBM.* [Online] September 2007. [Cited: May 3, 2008.] http://www.ibm.com/investor/events/pmurphy0907/#.

New York Times. 1971. Bell System's Picturephone. *New York Times.* July 3, 1971, p. 26. Column 1 (LexisNexis Academic).

—. 1970. First Picturephone Service Begins. *New York Times.* July 1, 1970, p. 1. Column 2 (LexisNexis Academic).

—. 1982. Picturephone Service Begins. *New York Times.* July 9, 1982, p. 8. Section D; Column 6.

Newsweek. 1982. Reach Out - And See Someone. *Newsweek.* United States, July 19, 1982, p. 51. Business.

Nielsen, Jakob. 1995. Beyond Being There. *Useit.* [Online] August 1995. [Cited: March 25, 2008.] http://www.useit.com/alertbox/beyondproject.html.

2006. Nortel and Microsoft Form Strategic Alliance to Accelerate Transformation of Business Communications. *Microsoft.* [Online] July 18, 2006. [Cited: May 3, 2008.] http://www.microsoft.com/presspass/press/2006/jul06/07-18UCGNortelPR.mspx.

Optimize. 2004. Ecosystems: A Different Kind of Biotechnology. *InformationWeek.* [Online] July 1, 2004. [Cited: March 17, 2008.] http://www.informationweek.com/news/showArticle.jhtml?articleID=22103585.

Orchestration. *Wikipedia.* [Online] [Cited: May 9, 2008.] http://en.wikipedia.org/wiki/Orchestration.

O'Reilly, Dennis. 2007. Microsoft RoundTable. *PCWorld.* [Online] August 16, 2007. [Cited: March 30, 2008.] http://www.pcworld.com/businesscenter/article/135913/microsoft_roundtable.html.

Our Commitment to Our Customers - Microsoft's Business. *Microsoft.* [Online] [Cited: May 2, 2008.] http://www.microsoft.com/about/companyinformation/ourbusinesses/business.mspx.

Pew Internet & American Life Project. 2007. Internet Activity. [Online] December 2007. [Cited: March 19, 2008.] http://www.pewinternet.org/trends/Internet_Activities_2.15.08.htm.

Platform Competition in Two-sided Markets. **Rochet, Jean-Charles and Tirole, Jean. June 2003.** 4, s.l. : MIT Press, June 2003, Journal of the European Economic Association, Vol. 1, pp. 990-1029.

Postel, Jonathan B. 1982. Simple Mail Transfer Protocol. *Internet Engineering Task Force.* [Online] August 1982. [Cited: March 19, 2008.] http://www.ietf.org/rfc/rfc0821.txt. RFC 821.

Prescott, LeeAnn. 2007. Gmail Traffic Up 17% Since Opening Up, Still Early Adopter Appeal. *Hitwise Intelligence.* [Online] May 10, 2007. [Cited: March 19, 2008.] http://weblogs.hitwise.com/leeann-prescott/2007/05/gmail_traffic_up_17_since_open.html.

Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. **Teece, David J. 1986.** 6, s.l. : North-Holland, 1986, Vol. 15, pp. 285-305.

2006. Q&A: Microsoft Forms Unified Communications Group to Deliver Innovative Communications Solutions. *Microsoft.* [Online] January 30, 2006. [Cited: May 2, 2008.] http://www.microsoft.com/presspass/features/2006/jan06/01-30UnifiedComms.mspx.

Redmond, Tony. 2000. Sending Messages - Routing and Transport. *Windows IT Library.* [Online] October 2000. [Cited: March 19, 2008.] http://www.windowsitlibrary.com/Content/519/06/1.html.

Robert F. Mason, Ted Chamberlin. 15 October 2007. *MPLS Can Carry Your Next Videoconference, but Should It?* Stamford, CT : Gartner, 15 October 2007. Research. G00151757.

Roberts, Lawrence G. 1999. Internet Chronology. [Online] October 24, 1999. [Cited: March 19, 2008.] http://www.ziplink.net/~lroberts/InternetChronology.html.

—. 2007. Routing Economics Threaten the Internet. *Internet Evolution.* [Online] October 25, 2007. [Cited: March 30, 2008.] http://www.internetevolution.com/author.asp?section_id=499&doc_id=136705.

Rohlfs, Jeffrey H. 2001. *Bandwagon Effects in High-Technology Industries.* s.l. : The MIT Press, 2001. ISBN 0262182173.

Root, Nate L., Orlov, Laurie M. and Hudson, Ryan. 14 October 2003. *Adopt Enterprise IM or Go To Jail.* s.l. : Forrester, 14 October 2003. Brief. 32907.

Rubens, Paul. 2007. The AOL Business Network: What's the Angle? *Instant Messaging Planet.* [Online] May 4, 2007. [Cited: March 17, 2008.] http://www.instantmessagingplanet.com/enterprise/article.php/3675981.

Saunders, Alec. 2005. Voice 2.0. *Saunderslog.com.* [Online] October 21, 2005. [Cited: March 17, 2008.] http://saunderslog.com/voice-20/.

Shao, Jiong, et al. 22 June 2006. *Investor's Guide to IPTV.* s.l. : Lehman Brothers, 22 June 2006. Global Equity Research.

Shapiro, Carl and Varian, Hal R. 1999. *Information Rules: A Strategic Guide to the Network Economy.* s.l. : Harvard Business School Press, 1999. ISBN 087584863X.

Short, John, Williams, Ederyn and Christie, Bruce. 1 January 1976. *The Social Psychology of Telecommunications.* s.l. : John Wiley and Sons Ltd, 1 January 1976. ISBN: 0471015814.

Silk, Alvin J. (Editor). 2006. *What is Marketing.* s.l. : Harvard Business School Publishing, 2006. ISBN 9781422104606.

Smime Status Pages - S/MIME Mail Security (Active WG) . *IETF Tools.* [Online] [Cited: March 26, 2008.] http://tools.ietf.org/wg/smime/.

Smith, David Mario and Lundy, James. 30 April 2007. *MarketScope for Instant Messaging, 2007.* Stamford, CT : Gartner, 30 April 2007. G00147732.

Smith, David Mario. 27 September 2007. *Battle Unde Way Among IM Presence Protocols.* Stamford, CT : Gartner, 27 September 2007. Research. G00152130.

—. 30 October 2006. *Federation Is Your Only Option for IM Interoperability.* Stamford, CT : Gartner, 30 October 2006. Research. G00152584.

—. 11 December 2007. *Google and AOL Integrate E-mail and Instant Messaging.* Stamford, CT : Gartner, 11 December 2007. Research. G00154171.

—. 2 January 2008. *Instant Messaging, Presence and Web Conferencing Perform an Ever Tighter 'Dance of Integration'.* Stamford, CT : Garter, 2 January 2008. Research. G00154175.

Smith, Michael D., Bailey, Joseph and Brynjolfsson, Erik. 2000. Understanding Digital Markets: Review and Assessment. [ed.] Erik Brynjolfsson and Brian Kahin. *Understanding the Digital Economy: Data, Tools, and Research.* s.l. : MIT Press, 2000.

Social Presence Theory. *Theory Clusters.* [Online] [Cited: March 26, 2008.] http://www.tcw.utwente.nl/theorieenoverzicht/Theory%20clusters/Communication%20and%20Information%20Technology/Social_Presence_Theory.doc/.

Soft phone. *Wikipedia.* [Online] [Cited: March 15, 2008.] http://en.wikipedia.org/wiki/Softphone.

Story, Louise. 2007. Microsoft Takes Aim at Google's Ad Supremacy. *The New York Times.* [Online] September 26, 2007. [Cited: May 2, 2008.] http://www.nytimes.com/2007/09/26/technology/26adco.html?_r=1&scp=4&sq=microsoft%20acquires%20aquantive&st=cse&oref=slogin.

Strauss, Stephen. 1995. Mind & Matter: How Our Videophone Future Didn't Happen - But Still Could. *The Globe and Mail (Canada).* January 21, 1995.

Surtees, Lawrence. 1986. Phone Transmits Stills. *The Globe and Mail (Canada).* May 1, 1986, p. B20.

Tambellini, Aldo. MIT Fellow at CAVS. [Online] [Cited: March 26, 2008.] http://www.aldotambellini.com/mit.html.

2008. TANDBERG to Deliver First High-Definition Webcam for Microsoft. *Tandberg.* [Online] March 20, 2008. [Cited: May 5, 2008.] http://www.tandberg.com/press_room/viewPressRelease.do?id=375.

1996. Telecommunications Act of 1996. *fcc.gov.* [Online] 1996. [Cited: February 29, 2008.] http://www.fcc.gov/telecom.html.

The 10 Best Video Conferencing Solutions for 2006. *Asterisk VoIP News.* [Online] [Cited: May 2, 2008.] http://www.asteriskvoipnews.com/blogsphere_news/the_10_best_video_conferencing_solutions_for_2006.html.

The Toronto Star. 1990. Picturephone Not the Expected Hot Seller. *The Toronto Star.* March 15, 1990, p. F7. Section: Life.

Toshiba climbs on 'HD DVD' exit. *BBC News.* [Online] [Cited: February 26, 2008.] http://news.bbc.co.uk/go/pr/fr/-/2/hi/business/7250068.stm.

Trumbo, Jan. 1997. How to Forge Email. *Email Protocols : SMTP, MIME, POP & IMAP.* [Online] November 13, 1997. [Cited: March 26, 2008.] http://www.opus1.com/www/presentations/EMAILPROTO/sld012.htm.

Turner, Rik. 2007. Avaya "Turned Down Microsoft" Before MS-Nortel Deal. *DataMonitor Computer Wire.* [Online] February 28, 2007. [Cited: May 1, 2008.] http://www.computerwire.com/industries/research/?pid=C5509F00-E9E0-44DA-8C95-4E64DD0232C4.

Ulrich, Karl T. and Eppinger, Steven D. 2004. *Product Design and Development.* Third Edition. s.l. : McGraw Hill Irwin, 2004. ISBN 0072471468.

United States v. Microsoft. *Antitrust Case Filings - Antitrust Division, US Department of Justice.* [Online] [Cited: May 2, 2008.] http://www.usdoj.gov/atr/cases/ms_index.htm.

Utterback, James M. 1994. *Mastering The Dynamics of Innovation.* s.l. : Harvard Business School Press, 1994. ISBN 0875843425.

Van Vleck, Tom. 2004. The History of Electronic Mail. *Multics.* [Online] September 10, 2004. [Cited: March 17, 2008.] http://www.multicians.org/thvv/mail-history.html.

Varian, Hal R. 2001. Economic Scene: Videoconferencing May at Last Get The Critical Mass It Needs. *New York Times.* October 4, 2001.

1997. Videoconference System: Intel ProShare Conferencing Video System 200. *Network Computing.* May 1, 1997.

1984. Videoconferencing: Nearly There. *The Economist.* US, November 3, 1984, p. 100.

VTEL. VTEL Company Information. *VTEL*. [Online] [Cited: March 29, 2008.] http://www.vtel.com/CompanyInformation.html.

Wallace, Beatson. 1988. Q & A. *The Boston Globe*. November 3, 1988. Section: Economy.

2007. Webcast on Office Communications Server 2007 and VoIP: Transcript of comments by Jeff Raikes, President, Microsoft Business Division. [Online] March 7, 2007. [Cited: April 30, 2008.] http://www.microsoft.com/presspass/exec/jeff/03-07OfficeCommunications.mspx.

Winding Down BITNET-NJE. *Corporation for Research and Educational Networking.* [Online] [Cited: March 26, 2008.] http://www.cren.net/cren/bitnet1/winding-down.html.

Yahoo! And Microsoft Bridge Global Instant Messaging Communities. [Online] [Cited: February 17, 2008.] http://www.microsoft.com/presspass/press/2006/jul06/07-12IMInteropPR.mspx.

Yoffie, David B. 17 March 2005. *Instant Messaging.* Harvard Business School. Boston, MA : Harvard Business School Publishing, 17 March 2005. Case. 9-704-502.

Appendix A. Microsoft's Recent M&A Activities

ACTION	*DATE*	*SHORT DESCRIPTION*
Withdraws Yahoo! bid	May 2008	Microsoft withdraws bid as Yahoo! insists on a $37 per share price. Microsoft originally offered to buy Yahoo! on Jan 31, 2008 at a premium price of $31 per share when Yahoo! was trading around $19 per share[233].
Acquires Danger, Inc.	Apr 2008	Mobile software platform that power's T-Mobile's Sidekick phone
Acquires Fast	Apr 2008	Enterprise search with capability to search files and databases[234].
Acquires Rapt Inc.	Mar 2008	Advertising yield management system that helps media companies price, predict and provision advertising assets.[235]
Acquires Multimap	Dec 2007	UK based online mapping service popular in Europe.
Acquires Parlano	Aug 2007	Enterprise group chat which becomes part of Microsoft's UC offer
Acquires aQuantive Inc.	Aug 2007	Internet advertising specialist.
Acquires Tellme Networks Inc.	May 2007	Voice services, including nationwide directory assistance, enterprise customer service and voice-enabled mobile search
Acquires Colloquis Inc	Oct 2006	Provider of conversational online business solutions that feature natural language processing

[233] **Delaney, Kevin J., Karnitschnig, Matthew and Guth, Robert A. 2008.** Microsoft Withdraws Yahoo Offer After Attempt to Bridge Gap in Price. *Wall Street Journal.* [Online] May 4, 2008. [Cited: May 5, 2008.] http://online.wsj.com/article/SB120986002095265343.html.

[234] **2008.** Microsoft completes Fast Search tender offer . *CNNMoney.com.* [Online] April 25, 2008. [Cited: May 2, 2008.] http://money.cnn.com/news/newsfeeds/articles/apwire/8c12ddcf80ee195cadeaf1227710b902.htm.

[235] **2008.** Microsoft to Buy Ad-Software Firm. *Wall Street Journal.* [Online] March 17, 2008. [Cited: May 2, 2008.] http://online.wsj.com/article/SB120572479731440975.html.

Appendix B. Microsoft's UC Complementary Device Providers

PHONES[236]

Vendor	Type	Name	Description	
LG-Nortel	IP Phone	IP8540	Intelligent & secure standalone IP phone with 5.7" color touch-screen display, embedded Office Communicator 2007 client, and headset and speakerphone modes. Contacts are dialed by name with presence icons signaling their availability status.	
Polycom	IP Phone	CX700	High quality standalone IP phone with high definition audio experience, 5.7" color touch-screen display, embedded Office Communicator 2007 client, and handset, full-duplex speakerphone or headset modes. Click to call with name-based calling with presence icons signaling their availability status.	
LG-Nortel	USB Phone	IP8501	Full connectivity USB handset with familiar design form, headset and speakerphone modes, and presence and voicemail indicators.	
Polycom	USB Phone	CX200	USB handset with familiar design form, headset and speakerphone modes, and presence and voicemail indicators.	

[236] Source: http://technet.microsoft.com/en-us/bb970310.aspx

HEADSETS[237]

Vendor	Type	Name	Description	
GN	USB Headset	GN9330	Wireless headset with 200-foot range and noise cancellation technology. Connects to PCs.	
GN	USB Headset	GN2000	Corded headset with foam ear cushions and in-line on/off-hook button.	
GN	USB Headset	GN2000 Duo NC	Wideband headset provides true "Plug & Play" integration and wideband audio performance. The in-line hook switch control answers/ends calls and adjusts volume. Features noise-cancelling microphone for crystal clear communication by effectively reducing unwanted background noise.	
LG-Nortel	Bluetooth Headset	IP 8502	Solution for mobile workforce USB Bluetooth headset with presence indicator and 33-foot range. Capable of dual-homing to both mobile phone and PC.	
Plantronics	USB Headset	SupraPlus Wideband	Wideband headset with full wideband Wideband audio, improved noise cancelling microphone, reduced echo, and tight integration of Office Communicator 2007 call control features.	

[237] Source: http://technet.microsoft.com/en-us/bb970310.aspx

SPEAKERPHONES[238]

Vendor	Type	Name	Description	
Polycom	Speakerphone	CX100	Portable, full-duplex speakerphone with 7-foot pickup range. Carrying case included.	

MONITORS[238]

Vendor	Type	Name	Description	
Samsung	LCD Monitor	SyncMaster 225UW	22” widescreen LCD monitor with integrated 2.0-megapixel webcam, microphone and speakers, and 1680 x 1050 resolution.	

[238] http://technet.microsoft.com/en-us/bb970310.aspx

Appendix C. Microsoft's UC Partners

2e2 | www.2e2.com
2S | www.2s.com.br
4Patient Care | www.4PatientCare.com
Accenture | www.accenture.com
Avanade | www.avanade.com
Aculab | www.applianx.com
Adtech Global Solutions | www.adtechglobal.com
Akonix | www.akonix.com/uclaunch
ALSY | www.alsy.fr
Arvato | www.arvato-systems.com
ASUS | www.asus.com
AT&T | www.corp.att.com
AudioCodes | www.audiocodes.com
Avanu / CAI Network | www.cainetworks.com
Avtex | www.avtex.com
Axians | www.axians.com/application/
Belgacom-Telindus | www.telindus.com
Berbee | www.berbee.com
BT Conferencing | www.bt.com/collaboration
BT Global Services | www.bt.com/collaboration
Citrix | www.Citrix.com
Commlogik | www.commlogik.com
Compugen | pathways.compugen.com
Computacenter (UK) | www.computacenter/services
Core BTS | www.corebts.com
Dassault Systemes | www.3ds.com
Dell | www.dell.com
DescaLimited | www.desca.com
Dialogic | www.dialogic.com/microsoftuc
Dimension Data | www.dimensiondata.com/microsoftsolutions
DynTek | www.dyntek.com
Elisa | www.elisa.fi
EMC | www.emc.com/microsoft
Ementor | www.ementor.com
Enabling Technologies | www.enablingtechcorp.com
Ericsson | www.ericsson.com/enterprise
F5 Networks | www.f5.com/microsoft
FaceTime | www.facetime.com
Foundry Networks | www.foundrynet.com
Fujitsu Ltd. | www.fujitsu.com/global
Geomant | www.geomant.com
Global Crossing | www.globalcrossing.com
Glück & Kanja | www.Glueckkanja.com/uc
GN | www.jabra.com/usbheadsets
Gold Systems | www.goldsys.com
GTSI | www.gtsi.com
Hanaro Telecom | www.hanaro.com
Heartland Technologies | www.heartlandtechnologies.com
HP | www.hp.com
implement.com | www.implement.com
Inacom | www.inacom.com
infoWAN | www.infowan.de
Intech | www.intechpr.com
Intellinet | www.intellinet.com/uc
InterCall | www.intercall.com
Juniper Networks | www.juniper.net
Kapsch BusinessCom | www.kapsch.net
KPN | www.KPN.com
LegendCorp - CA | www.legendcorp.com
LG-Nortel | www.LG-NORTEL.com

Logista (Office Management Systems) | www.logistasolutions.com
Longview Systems | www.longviewsystems.com/dept.aspx?dept_id=1
Micromenders | www.micromenders.com
MTS Allstream | www.mtsallstream.com
Namescape | www.namescape.com/OCS
NEC | www.nec.com
Netconnect | www.meet24.com
Network Services Plus Inc. (NSPI) | www.nspi.com
NextiraOne | www.nextiraone-eu.com
Nortel | www.nortel.com
NWN | www.nwnit.com
OnX | www.onx.com
Palm | www.palm.com/Treo
PEI | www.pei.com
Plantronics | www.plantronics.com/north_america/en_US/uc/products/index.jhtml
Polycom | www.polycom.com
Post CTI | www.postcti.com
Premiere Global Services | www.premiereglobal.com
Project Leadership Associates | www.projectleadership.net
Quest Software | www.quest.com/microsoft
Quintec | www.quintec.cl
Resolute | www.resolutecorp.com
Samsung DM | www.samsung.com
Samsung TN | www.samsungnetwork.com
SAP | www.duet.com
SCE Group | www.scegroup.com.mx
Siemens | www.siemens.com/it-solutions
SKT Business Communication Solutions | www.sktbcs.com
SpieCom | www.spiecom.com
Stauffer | www.ksac.com
Swisscom | www.swisscom.com/solutions/index/product/unified_communication.htm
Tandberg | www.tandberg.com
TDC | www.tdc.dk
Telstra | www.telstra.com
Telus | www.telus.com/unified
The Via Group | www.theviagroup.com
T-Systems | www.t-systems.com
Unis Lumin | www.unislumin.com
Unisys | www.unisys.com/services/communication_a_collaboration
Vail | www.vailsys.com
Versay | www.versay.com
Verizon Business | www.verizonbusiness.com
Webcall | www.webcall.ch
Wipro | www.wipro.com

Source: http://www.microsoft.com/uc/partners_all.mspx [accessed on May 6, 2008]

Appendix D. IBM's Recent M&A Activities

ACTION	*DATE*	*SHORT DESCRIPTION*
Acquires Telelogic	Apr 2008	Enterprise software and development tools
Acquires Diligent	Apr 2008	End-to-end disk based data protection
Acquires FilesX	Apr 2008	Data protection and recovery solutions
Acquires Infodyne	Apr 2008	Software for trading firms
Acquires Encentuate	Mar 2008	Identity and access management software
Acquires Arsenal	Feb 2008	On-demand data protection
Acquires Net Integration	Feb 2008	Networking infrastructure for small business
Acquires Cognos	Jan 2008	Business intelligence
Acquires XIV	Jan 2008	Enterprise storage
Acquires DataMirror	Sep 2007	Data integration
Acquires WebDialogs	Aug 2007	Web conferencing and communications services (Unified Communications related)

Appendix E. Interview with Indiana University Unified Communications (IU UniCom) Project Team

BACKGROUND:

Indiana University (IU) is a major Midwestern public university spread over 8 campuses. In February 2008, IU had approximately 99,000 enrolled students and approximately 33,000 faculty and staff members. IU has been cited by Microsoft as a major reference customer for the ICA offering[239]. The IU UniCom project included the deployment of Nortel Communication Server 2100 (CS2100) with the beta version of Microsoft Office Communications Server (OCS).

The interview was conducted on May 13, 2008. The interviewee included (among others):

- J Michael Lucas, Vice President of Information Technology, Indiana University-Purdue University, Indianapolis, IN.

- Jennifer L Van Horn, Vice President of Information Technology, Indiana University, Bloomington, IN.

INTERVIEW NOTES:

Organization: IU merged the telephony organization across two campuses in the late 1990s. It also merged voice, data, video and messaging under a single director in 2003. The merging of separate organizations under a single director facilitated the UC project.

Decision: For the UC project, IU interviewed all major vendors. IU also tested open source solutions and it has Cisco CallManager in production (running over Microsoft Windows). Michael thinks that an enterprise's UC decision depends on their starting point. He said that IU had 35,000 phone lines running on Nortel systems and 34,000 exchange mail boxes. IU has a single (Microsoft's) Active Directory tree. Naturally, IU's IT services organization has had deep relationships with the two vendors.

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[239] http://www.microsoft.com/presspass/press/2007/jul07/07-16MSNortelICAPR.mspx [cited on May 13, 2008]

Decision: Michael was approached by Nortel two years ago to upgrade to their enterprise grade PBX, CS2100. Michael had told them that he would upgrade if Nortel could integrate with Microsoft's desktop applications. With the ICA offer, this requirement was satisfied.

Decision: CS2100 with OCS allowed IU to migrate users in batches. Not everyone wants to use a soft phone or even an IP phone. Using CS2100 with OCS allowed a phased migration.

Decision: IU benefitted from OCS because they have a single Active Directory. Other universities do not have single directory or Exchange instance so it is harder for them to benefit.

Scope of firms: Call control for most users is still through the CS2100. OCS connects to CS2100 through SIP gateway. OCS does not connect to PSTN and routes calls to PSTN through CS2100. There are users within IU who have completely migrated to soft-phones (with USB headsets) connecting to OCS. Their dialed calls go through OCS to CS2100 to PSTN. Jennifer and Michael said that they would be happy to move to OCS if Microsoft achieves feature parity with competitive voice products. They did not express concerns about the reliability of Microsoft products.

Scope of firms: IU has purchased one RoundTable video system but it is only being used for demonstration. IU users could not comment on its performance under actual use.

Product Quality: Two users on the call were using OCS soft-phones. There was no discernible difference in the voice quality of the soft phone users. Anecdotally, the voice quality has been very good. Jennifer uses soft-phone only and she seemed very satisfied with her experience. The soft-phone users on the call could not vouch for any superior experience from OCS-OCS calls because of Microsoft's voice innovations (16 KHz sampling etc.).

Competitive Products: IU has considered buying two Cisco Telepresence systems for two campuses but still hasn't. (*What he described was a classic network effects problem - author*) Michael said that you have to have enough Telepresence systems to take advantage of them. Also, they do not work with the other video conferencing systems that IU has deployed.

Bundle Pricing: Microsoft rolled everything into the enterprise Client Access License so presumably they were pricing on a bundle even beyond the complete OCS package. Microsoft offered IU very good discounts both for staff and students. Michael said that it was partly due to the fact that IU agreed to be one of the earliest pilot customers for the ICA offer.

Microsoft-Nortel Alliance: Michael opined that Microsoft and Nortel invested a lot of effort and resources to ICA in the beginning but the relationship ebbs and rises at times. He has been pushing Nortel to certify their CS2100 and OCS deployment but Nortel has been slow in certifying.

Microsoft-Nortel Alliance: Initially the Microsoft sales team did not seem well aware of the alliance. The Nortel sales team was better prepared when it came to the joint offer.

Microsoft-Nortel Alliance: Jennifer and Michael agreed that Nortel has marketed itself as the system integrator for the alliance. They also agreed that Microsoft and Nortel developers are working together closely in developing products as they saw developers from the two firms working together during a visit to Rayleigh, NC. IU UniCom needs were met with out-of-the-box integration between CS2100 and OCS. As there was no need for customer integration, IU did not hire Nortel for any system integration or custom service development.

INSIGHTS:

UC buying decisions are driven by the existing investments in voice and email. We have argued that they are additionally dependent on existing instant messaging investment in an enterprise but this was not the case at IU

Cisco's Telepresence system faces issues similar to what AT&T faced with its Picturephone offer in the 1970s.

Microsoft can succeed in getting a share of the enterprise voice market if it can evolve its product to a richer feature set. Given that Microsoft announced its intention to develop a voice product in 2006, they are still early in their product cycle. Microsoft will eventually evolve OCS, as it has done with other products, so that it satisfies the need of a growing set of enterprise users.

Microsoft provides bundle prices that are heavily discounted. This will help Microsoft in platform envelopment.

Appendix F. Interview with Microsoft's Director of Product Management

BACKGROUND:

Moz Hussain is a Director of Product Management within Microsoft's Unified Communications Group. He also writes a blog: "Moz@Work"[240]. The interview was conducted on the phone in February 2008. The interview notes are not verbatim.

INTERVIEW NOTES:

- The current voice vendors are vertically integrated companies (like Ford with Model T) and Microsoft wants to vertically disintegrate the voice industry to the GM model

- Microsoft wants communication tools to enable the use of information. Thus Microsoft's scope of activities is 'communication'. All horizontal software-based communication applications will fall within Microsoft's scope

- Microsoft wants user interfaces to evolve to take advantage of touch, vision and speech

- Microsoft views Unified Communication as a collection of communication tools. Some UC Requests For Proposal (RFP) list 1000 PBX features because Cisco pushed UC as PBX features.

- Microsoft views UC's objective to (1) increase user productivity (2) streamline communication (3) improve business processes. It wants to make an impact with people to people communication (for example, a person sending an invoice to another person and waiting for a decision), machine to people (e.g. enhanced reminders based on presence) and people to machine (e.g. interactive voice response systems).

- Microsoft is agnostic to network & hardware. Cisco's approach is to take advantage of their networks QoS. Microsoft on the other hands has built smart codecs that adopt bit rate according to network conditions.

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[240] http://mozatwork.spaces.live.com/default.aspx?mkt=en-US&partner=Live.Spaces [accessed on May 13, 2008]

Appendix G. Interview with Nortel's Director of Strategic Enterprise Technologies

BACKGROUND:

Tony Rybczynski is a Director of Strategic Enterprise Technologies at Nortel Network. He also writes as blog: "The Hyperconnected Enterprise"[241]. The interview was conducted on the phone on February 19, 2007. The interview notes are not verbatim.

INTERVIEW NOTES:

- Tony views unified communications as voice, instant messaging, and presence

- The value to enterprises is speeding human processes or electronic processes.

- Tony cited the example of a Florida hospital where patient discharge time was 6 pm. The hospital could save $2 million per year if the discharge time could be advanced to 5 pm. The problem was reaching the doctor who could sign-off on the discharge. Nortel helped build a solution that integrated discharge order into the Clinical Order Entry System. The doctor could then authorize discharge electronically. Nortel then integrated communication into the electronic process so that doctors could be reached during their rounds and could authorize discharge from where ever they were.

- Tony admitted that he does not see a future for vertically integrated telecommunication equipment firms of the past. He says that Nortel recognizes that and hence the alliance with Microsoft.

- Nortel's IP is accelerating the evolution of Microsoft's voice technologies and products. Nortel's IP PBX is in a unique position to be part of the ICA offer. The alliance is investing more in OCS. Nortel's multimedia server MCS6100 is now being converted into services that others can utlize

[241] http://blog.tmcnet.com/the-hyperconnected-enterprise/ [accessed on May 13, 2008]

- Nortel is enhancing its data position through ICA. Cisco represents 73% of the market and Gartner says that they are using their market power to charge more. Nortel can provide some competition and take away share from Cisco.

- Tony found that some Microsoft Exchange users want to go with IBM's instant messaging platform Sametime. He opined that IBM is a softer negotiator than Microsoft. (If you go to IBM meeting with 10 people, you get to sit where you want; in a Microsoft meeting, your name is bolted down)

- Nortel has integrated IBM's speech technology into its products

Appendix H. Interview with a Product Manager at a Second Tier Enterprise Voice Vendor[242]

BACKGROUND:

The enterprise voice vendor is based in Massachusetts. It also provides networking solutions and earned revenue in access of $1 billion in 2007. The interview was conducted on the phone on February 22, 2008.

INTERVIEW NOTES:

- Product Manager (PM) views UC as the seamless integration of communication to business processes

- When I pressed him if he could provide classes of use-cases beyond notification and expertise based routing, he could not provide any additional classes

- Vendor considers find-me-follow-me and single contact number as 'tablestake' feature for an IP-PBX

- Avaya and Nortel have been affected by the fundamental shift in their business i.e. modular software based product over commodity hardware

- Cisco's approach to IP PBX is similar to network. They use their existing relationships from network products and push a lot of IP PBX volume. Cisco also bundles network and IP PBX

- Nortel is still investing in voice. It has developed a pure SIP software based IP PBX for small businesses viz. Small Business Communication Server 500. The software runs over x86 based Dell hardware.

- IBM is investing in telephony with Siemens.

[242] The product manager who was interviewed requested that he should not be identified.

- Cisco is using its strengths in the data center to move onto desktop. Microsoft is moving from desktop to data center. IBM is trying to strengthen its presence on both desktop and data center.

- Microsoft has 700 engineers working on Office Communication Server together with 100 Nortel engineers.

- Microsoft has developed state of the art codec that has been licensed by Texas Instruments and others.

    - Superb voice quality

    - Adaptive coding i.e. codecs adapts to network conditions

- For end devices that can complement Microsoft's voice innovations, Microsoft has a reference design that has been implemented by LG/Nortel and Uniden

- Customers are confused as all the vendors are pitching UC according to their strengths. Uptake is from early adopters only

- Adoption will be driven by building connectors to business applications such as Siebel and Salesforce.com

- There is also room for vertical solution development such as a the solution the vendor developed for the education vertical which automates the call back to prospective students during the admissions process

- The enterprise level benefits are notification and expertise based routing. Personal productivity benefits are communication mode escalations (e.g. IM to voice to video conference from the desktop) and rich presence