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Technology Management: Lowering Total Cost of Ownership (TCO) Through Thin Client Technology

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Paper Abstract

IS professionals face the daunting challenge of keeping up with the pace of technology while controlling the Total Cost of Ownership. Using the TCO model developed by the Gartner Group and the TCA model by the Tolley Group, many IS professionals have confirmed the overall cost of deploying applications within an enterprise. One possible alternative to controlling the TCO of an organization is thin client technology. A key feature in the recently release Windows 2000 Server is Microsoft's Terminal Services which is an enhancement to Windows NT Server v4.0 Terminal Server Edition which was the server platform for launching thin client technologies.

Introduction

Corporate management and their Information System ("IS") professionals continue to fight the battle of keeping up with the accelerating pace of technology advancement. Keeping up with technology has its costs. Industry experts, who previously subscribe to Moore's Law, now believe that the executive's industry generalization is conservative in light of the growth of the industry. For this paper, we will assume that Moore's Law is generally accurate.

"...the pace of technology change is such that the amount of data storage that a microchip can hold doubles every 18 months."

Gordon Moore
Founder and CEO Intel Corporation

"A very small addendum to Moore's Law is Rock's Law which says that the cost of capital equipment to build semiconductors will double every four years."

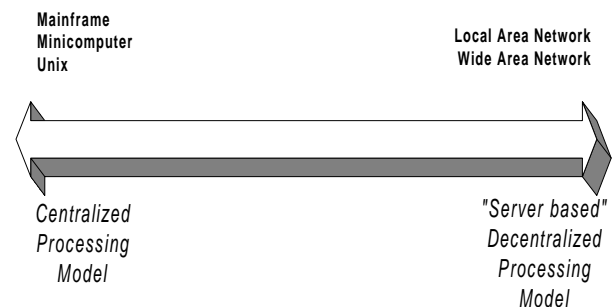
Arthur Rock
Venture Capitalist, assisted with founding of Intel Corporation in 1968

The Technology Pendulum

Since the dawn of the computing era, IS professionals attempt to take advantage of technology to deliver

information to the end user. While there are a number of documented achievements and disasters, the intention of the IS professional is to take advantage of the existing IS infrastructure to provide effective applications to solve the organization's IS requirements.

Early computing platforms required that the processing infrastructure be designed around a centralized processing environment. This environment, primitive in comparison to today's platforms, provide computing abilities where the end user interfaced with the "system" via "dumb" devices and the processing was share amongst all of the users. In some cases, a small group of users could monopolize the performance of the CPU at the detriment of the rest of the user group.



Intel's development of the 8088/8086 Microprocessor in 1978, led to the introduction of the IBM PC in 1981 and the computing revolution that continues today. As the industry closed out the 1990's, the "Year of the LAN" came to fruition and the frustrations of the IS professional increased as application software in the overall business environment required server based computing with increasing demands for throughput and functionality.

In an effort to address the performance demands of many organizations, proponents of the "server-based" decentralized processing model followed Moore's Law in answering the call of faster and more robust processing platforms. Their answer to the problem was to implement faster and more powerful CPU based systems. Advances in microprocessor development have been able to squeeze over 28 million transistors (Intel Pentium III 600 – 733MHz) onto a CPU plane. Generally, the centralized processing model of the past was generally looked at as old technology with little relevance to future solutions.

According to The Tolley Group, “[an organization’s] success is dependent upon the speed at which an organization can empower its employees and reach customers.” The use of technology plays a strategic role in the success or failure of an organization that is competing in an e-commerce based, worldwide economy.

Total Cost of Ownership

“Even though the prices of hardware and some computing technologies are falling, the convoluted nature of today’s enterprise environments is causing the overall cost of IT services – and specifically the cost of deploying applications – to skyrocket.” The Gartner Group’s Total Cost of Ownership model and The Tolley Group’s Total Cost of Application Ownership White Paper suggest that the initial and recurring costs of providing applications can well exceed \$10,000 per user. Hardware costs (client and server) constitute less than 15 percent of the total. The remaining costs are categorized as:

- Network and communications infrastructure
- Personnel costs related to application development and acquisition.
- Personnel costs related to application maintenance and update
- Costs related to providing application technical support
- Hidden costs related to lost productivity incurred when users are unable to access important applications with the appropriate level of performance.

Overall, analysts and IT professionals have agreed that the Total Cost of Ownership (TCO) model looks at the costs of owning and maintaining various forms of computing hardware. This hardware centric view of costs must be modified to include the extension of application software to a growing population of mobile and geographically dispersed users, both inside and outside of the company’s “brick and mortar” structure. Applications must be accessible across a wide variety of connectivity options including,

- Dial-up connections
- Wireless and wired LAN and WAN connections
- Internet, intranet, and extranet connections
- Diverse computing platforms including
 - Legacy hardware
 - Personal computers (PC) systems
 - Network terminals
 - Macintosh systems
 - UNIX workstations
 - Net PCs
 - Palm and Windows CE devices
 - Other emerging information appliances

The Tolley Group identified four critical factors that determine the cost of application deployment.

1. **Physical location of the application:** The choice of where an application is stored (on the server or on the client) is a determining factor in the cost and complexity of deployment and management of applications over time. IT related costs, including in-house labor and outside consultants, as well as the time required to distribute, install and configure and applications, and the cost of managing updates on all of an enterprises’ computing devices must be considered.
2. **Execution location of the application:** The choice of where the application actually runs (server based, client, or client/server relationship) determines the hardware, network and connectivity required to access the application. To ensure adequate end-user productivity, the system infrastructure must ensure adequate network bandwidth and hardware processing capabilities. In some cases, this may require extensive hardware and network configuration and updates.
3. **Physical location of the data:** The location of stored data can also determine the speed at which information is available, as well as the cost associated with protecting and backing up valuable enterprise data.
4. **Location of user and means of connectivity:** An end user’s location and network connectivity can impact the cost and complexity of deploying an application. Deployment of an application over a LAN, WAN, or the Internet will influence cost factors such as support personnel, network infrastructure, and network bandwidth. In some cases, the cost of deployment and ongoing support could make the deployment cost prohibitive.

Computing Models and TCO

The three computing models that most IT professionals consider and look to optimize are:

1. **Traditional Desktop Model:** In order to allow end-users access to the latest and most sophisticated applications, the traditional desktop model requires a full function, fully configured PC. The costs to support this model include a sizable support staff to deploy and maintain applications. Since applications are loaded on each PC, hardware and software failures on

individual desktops can cause lost productivity. In general, the traditional desktop model usually leads to the highest cost of ownership.

2. **Client/Server or Network Computing Model:** The client/server based computing model typically stores applications and data on the server and downloads the information to the client during execution. This model has the possibility of generating excessive network traffic and leads to higher network costs. Lack of network bandwidth can also result in loss of productivity due to poor application response. Mobile and remote users could experience significant bandwidth problems in this model.

3. **Thin Client Model:** Applications reside and execute on the server in this model. Since the applications is installed, configured, and deployed on the server associated costs are greatly reduced. And since only the user interface of the application is distributed to the client, virtually any device can access event the most sophisticated application. In fact, if the thin client model includes a “client-independent approach,” the distributed applications can be run on any client device in any location and deliver LAN-like performance. It doesn’t matter if users are working on high-end PCs, legacy PCs, Unix workstations, Macintosh systems or network and Windows-based (“dumb”) terminals. The key to the thin client model is the shared capabilities of the server and functionality provided by the operating system (OS). According to the Gartner Group, a thin client based solution can cut desktop technical support costs by 25 percent, desktop administration costs by nearly 60 percent, and a predicted reduction of end user IT costs of approximately 33 percent.

Windows 2000 Server	Windows 2000 Advanced Server	Windows 2000 Datacenter Server
Active Directory	All Windows 2000 Server features	All Windows 2000 Advanced Server features
Windows Management Tools	Network load balancing	Up to 16-way SMP
Kerberos and PKI Security	Enhanced Application fail-over clustering	Advanced clustering
Windows Terminal Services	Component load balancing	
COM+ component services	High performance sort	
Enhanced Internet and Web Services	Up to 64GB main memory	
Up to 2-way Symmetrical Multi-Processing (SMP)	Up to 4-way SMP	

Windows 2000 Terminal Services is the multi-user feature found in Windows NT 4.0 Terminal Server Edition, a special version of the networking software that supports thin client functionality. The Terminal Services feature is based on the Citrix MultiWin technology, which Microsoft licensed from Citrix as part of the 1997 joint development and marketing agreement. When Terminal Services is installed on a Windows 2000 Server, all client application execution, data processing and data storage occurs on the server.

Terminal Services is now a configurable service and is integrated with the Windows 2000 Server kernel. This means all versions of Microsoft Windows 2000 Server have thin client support. Microsoft estimates that organizations that utilize Terminal Services in their enterprise using either Independent Computing Architecture (ICA) or Remote Desktop Protocol (RDP) will lower their TCO by 35 to 37 percent.

Citrix Corporation has established its Citrix Metaframe product to enhance the functionality of Microsoft’s Terminal Services using Citrix’s Independent

Microsoft and Citrix Solutions

Microsoft Corporation recently released its Microsoft Windows 2000 Server product that upgraded Microsoft NT Server v4.0. The product is a complete set of infrastructure services based on Microsoft’s new Active Directory directory service. The mainstream business server (Windows 2000 Server) includes the capabilities required for workgroups and departmental deployments of file and print servers, application servers, web servers, and communication servers. The more powerful mid-range server (Windows 2000 Advanced Server) provides the advanced functionality required for enterprise and larger departmental solutions. The following is a summary of the significant features:

Computing Architecture (ICA). The key areas of enhancement are:

1. **Heterogeneous Computing Environments:** Metaframe delivers Windows-based application access to virtually all types of client hardware, OS platform, network connections and LAN protocols.
2. **Enterprise Scale Management:** Organizations building enterprise computing solutions including increased system scalability and simplified application deployment will find Citrix's management tools significantly better than the basic Terminal Server offering. Citrix promotes "push" access to application deployment.
3. **Seamless Desktop Integration:** Metaframe offers increased functionality over Terminal Services including access to all local system resources such as audio, local drives, COM ports and local printers. Although applications run remotely from the server, they look, feel and perform as though they are running locally.

Components of the Thin Client Solution

A thin client solution may come in a variety of configurations. However, the primary focus is on the following network components:

- **Network OS:** Most thin client solutions require Microsoft's Terminal Services as part of its OS layer. Therefore, while the enterprise's primary server may be a different network OS (i.e. Novell, Unix, Macintosh, etc.), the application server that runs the Terminal Services must include Microsoft Windows 2000 Server.
- **Application Server Hardware:** The application server that runs Terminal Services must be a robust platform. Since Microsoft and Citrix rely on Terminal Services for thin client to function, end user session performance will be dependent on the performance capabilities of the server. As mentioned above, Windows 2000 Server has the capability to take advantage of SMP sessions, server and applications load balancing, and large amounts of main memory.
- **Client Hardware:** The client in a thin client environment will vary depending on whether you are taking advantage of Windows 2000 Server only or Citrix Metaframe. While Windows 2000 Server accepts a variety of thin clients, it may not work with many cross platform devices or legacy PCs. Citrix Metaframe's ICA client accepts most platform OS for the client interface

including legacy PCs such as 286, 386, and 486 PCs.

- **Connections:** Most LAN and WAN protocols are accepted in a thin client environment including TCP/IP, IPX/SPX, and NETBUI. Further, Microsoft and Citrix will communicate of Internet, Intranet, and Extranet communications.

The Technology Pendulum Returns

With the use of thin client technology such as Windows 2000 Server's Terminal Services and Citrix Metaframe v1.8 as a means to control TCO in an enterprise, the Technology Pendulum swings back to a centralized processing model...almost. Both OS options provide IT professionals the option to use various client platforms while controlling the point of application execution. Either option suggests TCO savings of 33 – 37 percent while improving support, deployment, and application performance.

Application software vendors are continuing to provide compatibility scripts so that their software can be used in shared environments. In some cases, where the vendor has been slow to deliver their compatibility scripts, Citrix technical support has worked with end users to develop the scripts. One vendor, Corel has not brought WP9's scripts to market even though they have a significant user base. It should be noted that WP9 would load and run. But any Citrix user who changes his or her printer destination, templates, macros, default directories or fonts will change the settings for all other users. Other vendors are making their software natively thin client aware.

Conclusion

As IT professionals continue to walk the "budget tightrope," managing the TCO within the IT budget becomes an ever increasing dilemma. While stretching TCO may appear to be a virtual shell game where you need to guess whose budget gets affected by the increasing costs of technology, thin client technology may be one solution that almost any enterprise can embrace.

The thin client architecture can bring the best of different computing models and architectures together. You can instantly provide access to virtually any business critical application, including 16 and 32 bit Windows applications, across any type of network connection to any type of client. You get single-point deploying, managing, and supporting applications.

The use of thin client technology empowers the IT professional with tools that will assist in the development, implementation, deployment, and support of applications of the enterprise. While its up-front costs may appear prohibitive, TCO analysis show that IT professionals should not count the technology out of there is toolbox.

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