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Web 2.0: Conceptual Framework and Research Directions

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ABSTRACT

The article examines the emerging shift in businesses towards Web 2.0 principles, concepts and technologies. The principles, concepts and technologies of Web 2.0 are gaining momentum and a number of businesses are adopting them. There are varying and diffused understanding of Web 2.0 parameters and characteristics leading to multitude of interpretations. Therefore a framework for understanding Web 2.0 businesses is an important step in analyzing them. Here we propose a framework for understanding Web 2.0 based businesses and identify areas for future research.

Keywords

Web 2.0, Rich user interfaces, Social networks, Peer-to-peer, Network effect, Collective Intelligence, Folksonomies, Collaboration, Modularity

INTRODUCTION

We define Web 2.0 as the adoption of open technologies and architectural frameworks to facilitate participative computing. Web 2.0 is about collaborative and participative computing wherein users communicate and collaborate while at the same time contribute and participate. Web 2.0 is shaping the way users work and interact with information on the web by shifting the focus to the user of the information. Web 2.0 relies heavily on creating and leveraging network effect by attracting a large number of participants and enabling interactions between them. Web 2.0 is about harnessing the potential of Internet in a more collaborative and peer-to-peer manner through mechanisms to create enhanced customer experience, collaboration and co-creation of value. Mechanisms such as Wikis, RSS, Web services, blogs, podcasts, instant messaging etc. are enablers for this. Web 2.0 has more to do with the mindset change to facilitate collaborative participation and leveraging the collective intelligence of peers. Web 2.0 is about adopting and leveraging the Web to play a critical role in facilitating peer-to-peer linkages. The challenge for Web 1.0 (as we would like to call the earlier wave of Internet) has been to involve the end users in a collaborative seamless peer-to-peer fashion in an economical and reliable manner and at the same time ensuring rich user experiences. Rich user experience is a critical aspect of Web 2.0 and plays an important role in encouraging collaborative information exchange.

Customer and partner facing processes using Web 2.0 has the potential to not only transform peer-to-peer collaboration, but also inter-entity collaborations and commerce by enabling various types and combinations of business-to-consumer (B2B), business-to-business (B2B), consumer-to-consumer (C2C), business-to-enterprise (B2E) business-to-government (B2G) etc. collaboration and commerce. Web 2.0 has the potential to not only enable rich peer-to-peer interactions but also enable collaborative value creation across business partners. There are opportunities such as providing rich information on all the convergent services subscribed to by a consumer (including third party services) leveraging Web 2.0 standards which could be achieved through the use of Mashups based on content from multiple sources (exposed using APIS, RSS Feeds, Web Services etc.) to create new services.

However the literature is scarce in the case of Web 2.0 concepts and principles. The existing literature on Web 2.0 has examined issues such as the structure and influence of blogs (Gill, 2004; Kumar, Novak, Raghavan and

Tomkins, 2004), online and social networking communities and their influence (Korica, Maurer and Schinagl, 2006; O'Marchu, Breslin and Decker, 2004, Kolbitsch and Hermann, 2006), benefits of social networks (Cross and Nohria, 2002; Garton and Haythornthwaite, 1997; Kautz and Selman, 1997), collaboration (McAfee, 2006). A framework to understand the Web 2.0 principles in their entirety to the best of our knowledge has not been investigated and reported in academic literature. This paper attempts to create a framework for understanding Web 2.0 based businesses and identifies future research directions. In the next section, we describe the drivers and enablers of Web 2.0. In the succeeding section, we present the principles of Web 2.0 followed by the research methodology employed in our study. Next, we propose the conceptual framework emerging out of the analysis of the Web site survey. Finally, we present the implications of our findings.

DRIVERS AND ENABLERS OF WEB 2.0

The Web 2.0 way of thinking and collaborating is driven by factors such as technology, infrastructure and social. Infrastructural factors include the availability of low cost bandwidth and increasing computing power. Increasing computing power is enabling service providers to create new and powerful web applications which are closer to desktops in terms of look and feel as well as functionalities. Widespread availability of broadband has triggered the adoption of computing and collaboration via rich interfaces. Social computing mechanisms such as Wikis, Blogs etc. is attracting large scale end user adoption resulting in increased collaboration across users. This is complemented by technology drivers such as the availability of Internet browsers which support RIA) and open technologies such as Web services, data feeds, Ajax etc. which reduce the cost of computing involved in Web 2.0.

PRINCIPLES OF WEB 2.0

The fundamental principles of Web 2.0 are Rich User Experiences, Peer-to-peer, Network effect, Collective intelligence, Web as the platform, Collaboration, Modularity:

1. Rich User Experiences

The fundamental tenet of this principle is the provision of *intuitive user experiences*. Rich user experiences enable easy social interactions as well as ease of sharing, accessing and consuming information and knowledge. An interesting development of richer user experiences is the emergence of browser based applications which behavioral characteristics which are similar to desktop applications. These include drag and drop, online edit etc. Examples include Ajax (Asynchronous Javascript and XML) based RIA.

2. Peer-to peer

Peer-to peer principle of Web 2.0 espouses *sharing as the norm* through the network wherein collaboration and sharing are important activities. There is a shift towards collaborative markets (end-user managed collaboration) from collaborative hierarchies (centrally managed collaboration). The collaboration is self managed and emergent rather than central and imposed. The rules of collaboration and participation are decided as the network grows and not decided upfront. There are also very low barriers for new user participation. Examples include Wikis, blogs, video sharing etc.

3. Network effect

Network externalities or network effects is a key principle behind Web 2.0, wherein *massively parallel distributed participation* is targeted. The value of information which is shared by participants in the network increases directly proportional to the number of participants in the network. Web 2.0 models depend on network effects to create value where the whole is larger than the individual parts.

4. Collective Intelligence

The principle of *collective intelligence* lays emphasis on the large scale distributed intelligence of the participants in the network over central intelligence. Collective intelligence is realized by user created, modified, updated content which are tagged using key words thereby facilitating semantic computing.

5. Web as the platform

Web as the platform refers to the shifting of centralized computing to distributed computing with the Internet browser acting as the de facto platform. This includes RIA based applications which are accessed, modified and shared using the Internet browser. Users can run applications without downloading programs, and save files directly onto the web.

6. Collaboration

Collaboration in Web 2.0 could be B2B, B2C, B2E, B2G etc. There is a high degree of ease for new user participation and users can share data across the web using a variety of applications such as Blogs, Wikis, Podcasts, Reviews etc. There is a shift towards end-user managed collaboration from centrally managed collaboration. The collaboration is self managed and emergent rather than central and imposed. The rules of collaboration and participation are decided as the network grows and not decided upfront. There are also very low barriers for new user participation. The value of information which is shared by participants in the network increases exponentially proportional to the number of participants in the network.

7. Modularity

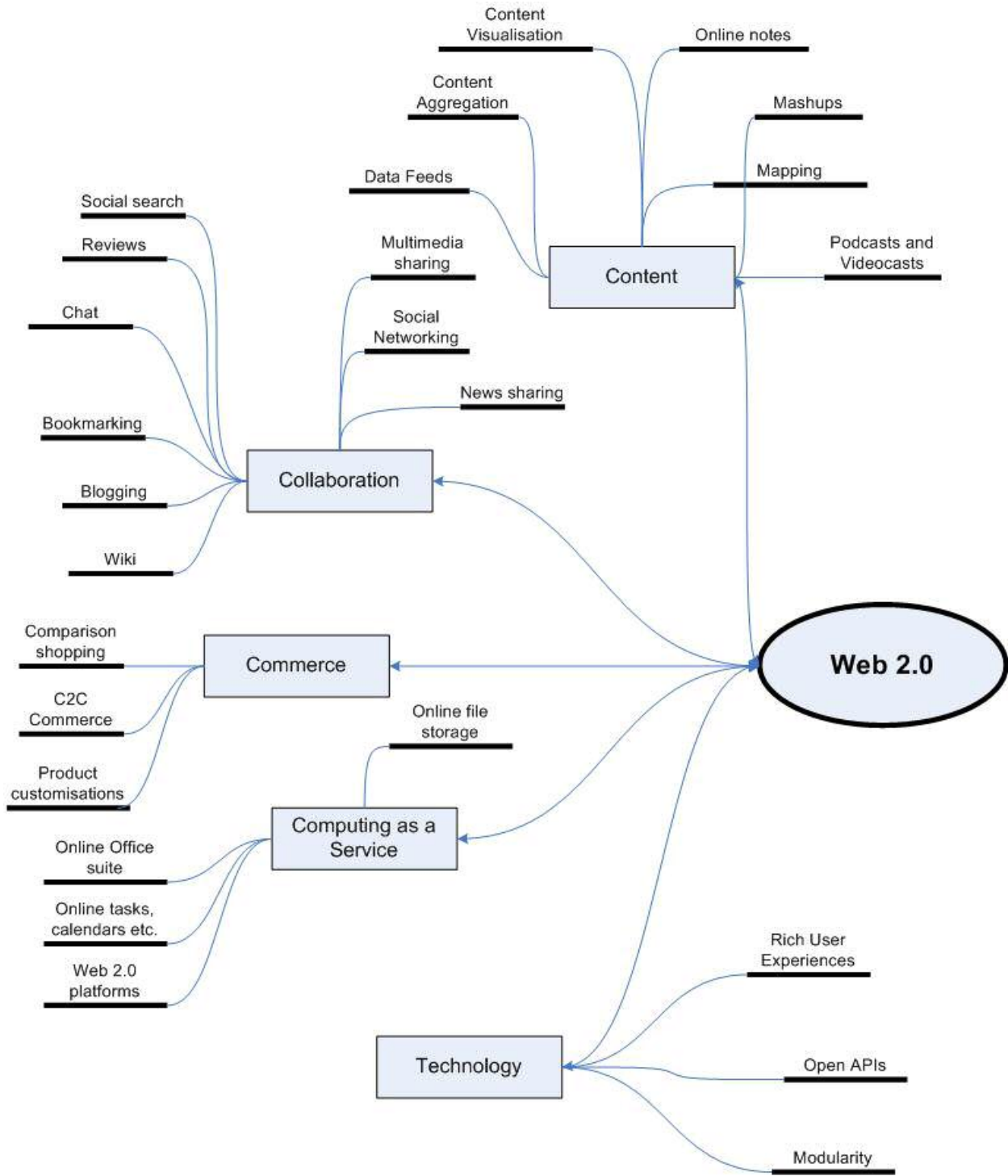
The principle of *modularity* stresses on the usage of small modular constituents which make the whole larger than the parts. There are distributed information packets which users can pull in and modify in new and innovative ways. The content sources could be exposed using APIS, Web Feeds, Web Services etc. There are no tight interconnections and there is facility for extension mechanisms enabling network participants to contribute and consume.

METHODOLOGY

We adopted a case survey methodology to understand the underlying parameters and attributes of Web 2.0 businesses and arrive at a framework for understanding the same. We adopted a Website survey methodology. We created the Website survey methodology as an extension of the case survey methodology. The case survey methodology is used when the aim is generalizability of the study results. We are interested in both generalisability of results as well as empirical evaluation of the different Web 2.0 businesses. Case surveys bridge the gap between surveys and case studies to combine their respective benefits of generalizable, cross-sectional analysis and in-depth, processual analysis (Larsson, 1993; Lucas, 1974; Yin and Herald, 1975; Yin and Yates, 1974; Larsson, 1993). For the website survey, we compiled a list of 200 Web 2.0 firms from across the world. We assembled this extensive list of Web 2.0 firms through search of sites as well as by Internet search. In addition, we used sources such as newspapers, and research from firms such as Forrester Research and Gartner. Each website was examined and we finalised a sample of 200 Web 2.0 firms across US, Europe and Asia Pacific regions.

Each Web 2.0 firm was analyzed using the Web 2.0 conceptual framework comprising of parameters such as Content, Collaboration, Commerce, Computing as a service and Technology (see Figure 1). Based on the parameters in the conceptual framework, a Website Survey of Web 2.0 firms was conducted. The websites were evaluated and ranked according to the questionnaire given in Appendix 1. Experts evaluated each website using the 20 question survey. The questions were classified into five parameters which form part of the Web 2.0 analysis framework such as Content, Collaboration, Commerce, Computing as a service and Technology.

Figure 1: Web 2.0 Conceptual Framework



CONCEPTUAL FRAMEWORK

The conceptual framework is an attempt to categorise and classify the various Web 2.0 characteristics into clearly understandable parameters. The Web 2.0 framework parameters, characteristics and examples are given in Table 1. The following are the parameters of the framework:

Content Parameter

The content parameter captures all the Web 2.0 functionalities, which are content related. This includes Data Feeds such as RSS/Atom feeds, Online notes, Podcasts and videocasts, Mapping, Mashups, Content aggregation, Content visualization etc. The content could be exposed as RSS feeds or information services which are exposed via open APIs(Application Programming Interfaces) . The content could be audio and video files shared by end users. The shared content is tagged by the content contributors as well as peers so that the bottom up folksonomy based benefits are leveraged. Users can choose multiple tags that will help him to find the content easily in future. Mashups use content from multiple source (exposed using APIs, Web Feeds, Web Services etc) to create new services. Content could be third party via a public interface or Data feeds such as RSS or Atom. Google, Ebay, Amazon have been publishing APIs that give access to their service. Availability of simple and lightweight API's have made mashups relatively easy to design.

For example, services such as Feedburner and Newsgator offer RSS feed aggregation functionalities; Youtube, Meebo, ClipShack etc. offer audio and video storing, sharing, tagging and streaming functionalities; Stikipad offers online notes; Google Maps, Wayfaring etc. offer Map based functionalities; Housingmaps, Mappr etc. offers a Mashup of content and functionalities from multiple sources; Netvibes, Pageflakes etc. offer RIA (Rich Internet Applications) based functionalities which offer near desktop like features; Google aggregator carries out news aggregation and Marumushi offers content visualization. The content could come from the end users in the form of blogs; news media sources such as BBC, or firm/product/service details from firms.

This opens up a number of possible research areas such as: How can business intelligence be abstracted out of unstructured content created by users? How can RSS usages be tracked? What are the optimal interactions mechanisms between Web services and Web 2.0? How can folksonomies be leveraged within the enterprise and across business partners to create enterprise and inter-enterprise folksonomies? How can data feed mechanisms such as RSS be effectively adopted to communicate with the customers at real time about important announcements? How can I create rich user experiences for my online customers? How can enterprises preserve time criticality of information while communicating with customers? What is the impact of RIA based technologies such as AJAX on online customer behavior?

Table 1: Parameters, Characteristics and Examples

Parameters	Characteristics	Examples
Content	Data Feed: RSS/Atom feed creation, aggregation etc. Online notes Podcasts and videocasts: Storing, tagging, sharing, audio and video Mapping services Mashups Personalised, customizable start pages Content aggregation Content visualization	Feedburner, Newsgator, ReminderFeed Stikipad Youtube, Meebo, ClipShack, Loomia, Odeo, Podomatic Google Maps, Wayfaring, Frappr Housingmaps, Mappr Netvibes, Pageflakes Google aggregator Marumushi
Collaboration	Blogging: Including audio and video blogging Bookmarking: Saving, sharing, tagging, searching bookmarks Reviews: Ranking, reviews of music, movies, books, products etc Wiki: Group information creation, editing, consuming Social networking News sharing, aggregation Instant Messaging Multimedia sharing: Saving, sharing, searching, tagging photos, videos, music Social Search: User ranked search, Blog/Podcast/video search, individual search etc.	Blogger, Blogniscient, del.icio.us, Blummy, Furl Mouthshut Wikipedia, Socialtext, eBayWiki, Wetpaint, Jotspot MySpace, Last.fm, az Places, Tagworld, Xanga, Facebook Shoutwire, Newsvine, Bloglines, Digg, Gabbr Campfire, Meebo Flickr, Shozu, Tabblog, Photobucket, Shutterfly, Buzznet, DailyMotion, Metacafe Technorati, Podzinger, Aftervote, Rollyo, Truveo
Commerce	End user product customizations Comparison shopping (across enterprises) Customer to Customer (C2C) commerce	Etzy, Zazzle Amazon Zazzle
Computing as a service	Office suite applications Online file storage and sharing Online Web 2.0 platforms Online task lists, to do lists, online calendars, reminders Project Management	Google Docs and Spreadsheets, iRows, gOffice Pando, Dropsend, Amazon Yahoo Pipes, QED Wiki Zimbra, Eventful, Spongecell, Skobee, Voo2do, Kiko 37Signals, Airset
Technology	Rich User Experiences Open APIs Modularity	Panic.com/goods, Google Maps Amazon, Google Maps, Craigslist, Flickr Netvibes

Collaboration Parameter

The collaboration parameters include Blogging (including audio and video blogging), Bookmark sharing, Reviews, Wiki, Photo and Video sharing, Social search (User ranked search, Blog Search, Podcast search), Social networking, News sharing, Chat etc. Collaboration based Web 2.0 business models strive to generate network effects through the creation of peer-to-peer networks wherein collaboration and sharing are important activities. Self managed collaboration is the norm as opposed to a central node-managed collaboration. This could be in the form of Wikis, blogs, video sharing etc. The content which is shared is tagged (assigned keywords) to enable easier search and discovery. Collaborative categorization of content using tags allows users to retrieve content through user created tags.

Services such as Blogger and Blogniscient offer blogging functionality; del.icio.us, Blummy, Furl etc. offers bookmarking functionalities, Mouthshut offers user review platform, Wikipaedia, eBayWiki etc. offer Wiki services which enable group information creation and editing, Flickr, Shutterfly, Metacafe etc. offer multimedia sharing services, Technorati, Podzinger, Aftervote etc. offers services such as user ranked search, Blog/Podcast/video search, individual search etc., Myspace, facebook etc. offers social networking services, Newsvine, Digg etc. offers news sharing and aggregation related services, Campfire offers online chat services.

Possible areas for future research include: How can enterprises leverage the tacit knowledge of internal and external stakeholders? How can enterprises encourage community participation of their online customers? How can enterprises leverage the collective intelligence of the community? How can enterprises facilitate enhanced social interactions, collaboration and knowledge sharing? How does self managed collaboration impact collaboration effectiveness over centrally managed collaboration? What are the information quality issues in collaborative information creation mechanisms such as Wikis? How can Web 2.0 based mechanisms enhance interorganizational business processes? How can enterprises benefit from Mashups based interorganisational collaborative services.

Commerce Parameter

Commerce parameter captures all the Web 2.0 functionalities, which are commerce related. Enterprises can leverage the user inputs as well as customer purchase behavior of goods, and in the form of information services, as well. Community participation, customer reviews etc. can be effectively leveraged to offer customized products and services. Commerce parameters include End user product customizations, Comparison shopping (across enterprises), Customer to Customer (C2C) commerce etc. Services such as Etzy and Zazzle offer end use product customization functionality, Amazon offers comparison shopping across enterprises, Zazzle offers customer to customer commerce. Possible areas for future research include: How can enterprises gather real time market research data? How can enterprises involve customers in product go to market decisions? How can enterprises involve their customer base in developing new products/services?

Computing as a service

Computing as a service parameter includes Office suite applications, Online file storage and sharing, Online Web 2.0 platforms, Online task lists, calendars, to do lists, calendar sharing, reminders, planners etc. The applications could be exposed as APIs. For example services such as Google Docs and Spreadsheets, iRows etc. offer Office suite applications, Pando, Dropsend etc. offer online file storage and sharing, Yahoo Pipes, IBMs QED Wiki offer online Web 2.0 platforms, Zimbra, Eventful offer Online task lists, calendars, to do lists, calendar sharing, reminders, planners etc. 37Signals, Airset etc. offers project management functionalities. Possible research areas include: What are the effective pricing mechanisms for computing as a service based offerings? How can enterprises ensure quality of service? How can micropayment mechanisms enhance computing as a service based offerings? How can performance be guaranteed in applications/infrastructure offered as computing as a service?

Technology

Technology parameter includes Rich User Experiences, Open APIs, Modularity etc. Services such as Panic.com/goods, Google Maps etc. offer rich user experiences leveraging technologies such as Ajax. Amazon, Google Maps, Craigslist, Flickr etc. have open APIs which are Web services APIs. These interfaces can be leveraged by external entities to provide enhanced services, Mashups etc. Netvibes is an example of modularity as it aggregates content from a multitude of sources and lets users mix and match the look and feel of the content presented.

CONCLUSION

In this article, we develop a framework with which we assessed the Web 2.0 services and offer insights for further research on Web 2.0. The framework highlights multiple analysis parameters segregated across Content, Collaboration, Commerce, Computing as a service and Technology. The framework is a useful tool for analyzing Web 2.0 based businesses. The framework was validated through a Web site survey of Web 2.0 businesses. The concepts and guiding principles behind Web 2.0 are at an early stage of evolution. Therefore the research to populate the framework is ongoing. Going forward, different business models and different industry segments will have to be examined in detail to identify industry segment specific parameters. The degree of importance of the parameters may vary depending on the nature and complexity of business domains. For example, business domains such as the Media industry would include Citizen journalism as an important characteristic, similarly the retail industry would need to include user generated content, comments and reviews as a key characteristic. This research is a first step towards developing an overarching framework to understand Web 2.0 based businesses. Towards that we believe this paper makes important contributions for both practitioners and researchers. Practitioners can have a better understanding of the parameters and characteristics which form part of Web 2.0 based businesses and plan their efforts accordingly. This paper contributes to the ongoing research in Web 2.0 by suggesting areas for future research. Researchers could use these parameters to design variables in their studies pertaining to Web 2.0. The results presented here are preliminary in nature and the research is in progress. Going further, we intend to examine the degree of impact of the determinants of the parameters on specific business domains and segments.

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Appendix 1: Questionnaire used for Web site survey

Content

- | | | | |
|---|----------------------|---|--|
| 1) User created, modified, updated content | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 2) Data Feeds (RSS/ATOM/XML/JS) | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 3) Podcasts | <i>Not Available</i> | <i>Limited Podcast library</i> | <i>Extensive Podcast library</i> |
| 4) Videocasts | <i>Not Available</i> | <i>Limited Videocast library</i> | <i>Extensive Videocast library</i> |
| 5) Search and information retrieval powered by Tags | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 6) Aggregation Mechanisms such as Mashups | <i>Not Available</i> | <i>Mashups of internal data sources</i> | <i>Mashups of internal and external data sources</i> |

Collaboration

- | | | | |
|--|----------------------|--------------------------------------|--------------------------------------|
| 7) End user self managed collaboration | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 8) Customer peer-to-peer network such as Blogs | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 9) Customer peer-to-peer network such as Wikis | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 10) Customer peer-to-peer network such as Discussion Forums | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 11) Collective intelligence mechanisms such as user reviews | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 12) Presence of Folksonomies creation mechanisms such as tagging | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 13) Collaborative product customization functionality | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |

Commerce

- | | | | |
|--|----------------------|--------------------------------------|--------------------------------------|
| 14) End user product customization functionality | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 15) Comparison shopping linked to end user recommendations | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |

Computing as a service

- | | | | |
|--|----------------------|--------------------------------------|--------------------------------------|
| 16) Browser based office suite applications | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 17) Online file storage and sharing | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |
| 18) Online task lists, calendars, calendar sharing, reminders, planners etc. | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |

Technology

- | | | | |
|---|----------------------|--------------------------------------|--|
| 19) Extent of adoption of Rich Internet Applications (RIA) such as AJAX, Flex etc.? | <i>Not used</i> | <i>RIA enabled widgets in use</i> | <i>Sophisticated RIA frameworks in use</i> |
| 20) Rich Internet Applications based desktop like functionalities in browser such as drag & drop, edit etc. | <i>Not Available</i> | <i>Exists at a rudimentary level</i> | <i>Advanced functionality exists</i> |