Technology Landscape

Connectivity Era

Embedded Connectivity
(smart, dynamic)

Logical Connectivity
(wireless/service oriented, semantic, event-based)

Physical Connectivity
(networked, group productivity information overload)

Personal Computing
(individual productivity tools)

Computing Era

Mainframe Computing
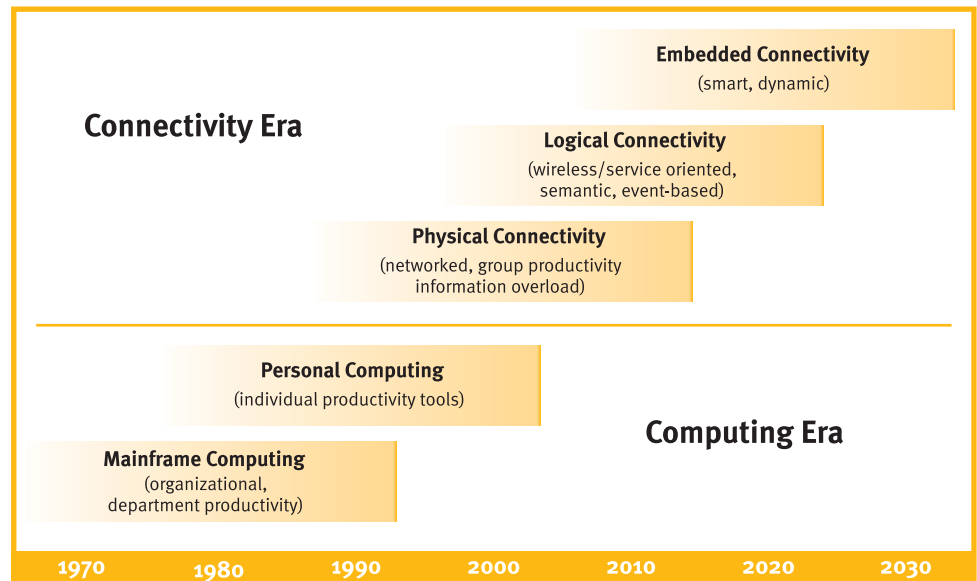(organizational, department productivity)

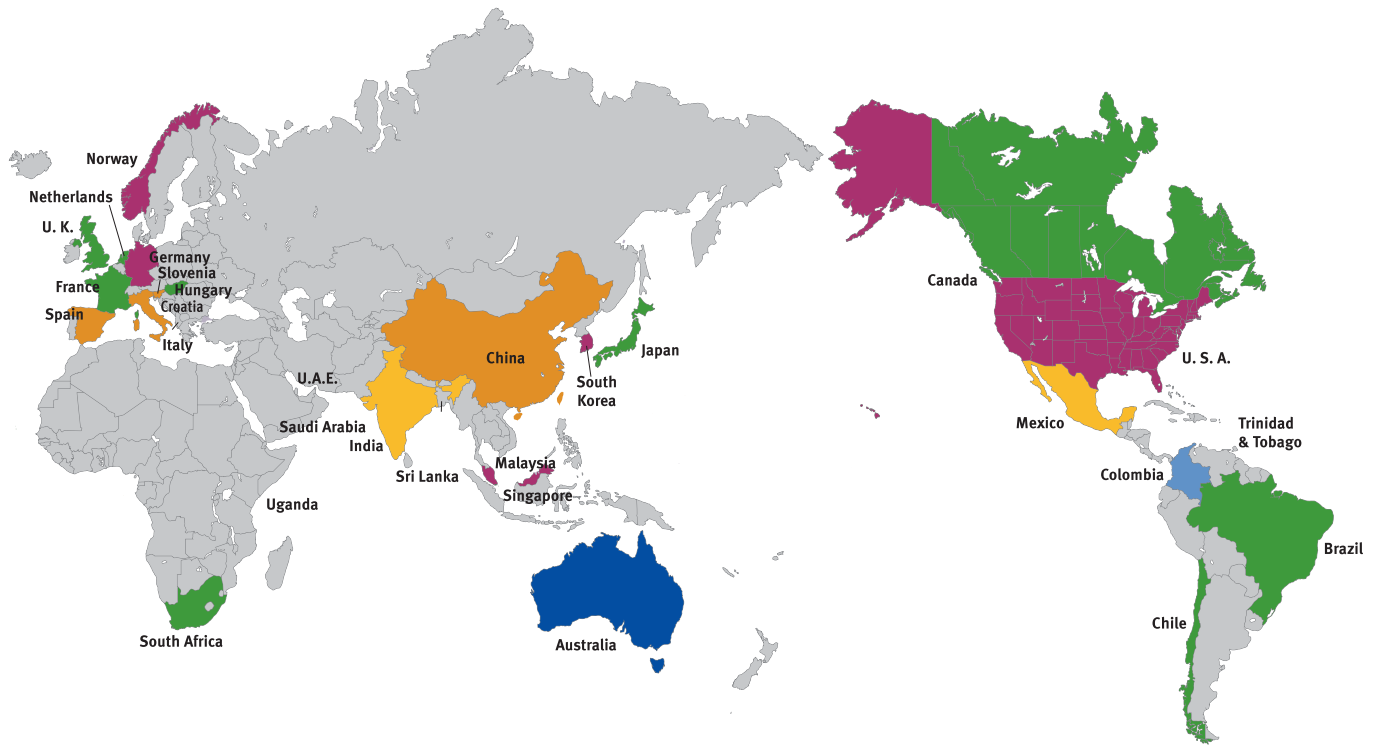1970   1980   1990   2000   2010   2020   2030

Gartner, Inc. research[1]

Major trends

- **Bringing structure to unstructured data**
- **Distributed, component-based software**
- **A move to open-source software**
- **Security, authentication and Digital Rights Management**

The patterns[2] surfacing in the technology and information architecture landscape suggest we are headed into a period of technology change that may be as significant as the shift from mainframe architectures to client/server architectures in the 1980s. Whereas PCs and client/server software made it possible to distribute both applications and data closer to their users in the 1980s, the next-generation technology architecture will distribute even smaller units of software over the Internet directly to distant users as well as directly to devices and objects such as equipment on the factory floor, packages on store shelves or servers and hardware devices in a partner organization. Using sophisticated messaging, open-source solutions

1. J. Fenn and others, *CIO Update: Key Technology Predictions, 2003 to 2012,* IGG-01082003-02 (Stamford, CT: Gartner, Inc., January 8, 2003).
2. Larry Downes, "Unleashing Killer Architecture: The Shape of Things to Come," *CIO Magazine* (June 15, 2003): n.p., www.cio.com/archive/061503/architecture.html.

Percentage of GDP spent on technology

- 12%+
- 10.0 – 11.9%
- 8.0 – 9.9%
- 6.0 – 7.9%
- 4.0 – 5.9%
- < 4%

Country spending on information and communications technology

Country	% GDP	Country	% GDP	Country	% GDP
Colombia	12.0%	Brazil	8.3%	Slovenia	4.7%
Australia	10.7%	Chile	8.1%	India	3.9%
Singapore	9.9%	United States	7.9%	Mexico	3.2%
United Kingdom	9.7%	Germany	7.9%	Croatia	N/A
Japan	9.6%	South Korea	7.4%	Sri Lanka	N/A
Netherlands	9.3%	Norway	7.2%	Trinidad & Tobago	N/A
South Africa	9.2%	Malaysia	6.6%	U.A.E.	N/A
France	9.1%	Italy	5.7%	Uganda	N/A
Hungary	8.9%	China	5.7%	Saudi Arabia	N/A
Canada	8.7%	Spain	5.1%		

and new security protocols, data processing and information exchange will become tightly connected to business processes, facilitating new kinds of collaboration, partnering and outsourcing relationships.

The individual movements that are fueling this next-generation architecture scenario have been percolating for some time. The unprecedented spread of data exchange standards like TCP/IP, XML and MP3, and broad access to nonproprietary networking and data communications infrastructure (the Internet) have supported rising technology waves and strong development undercurrents. Many experts say that the combination of new standards, distributed software and a worldwide Internet infrastructure will create a profoundly new technology architecture landscape within the next five years.

We identified the rapid adoption of collaboration technologies earlier in this document. In this section we will explore four additional aspects of this technology landscape that will likely impact information creation, dissemination and management. We will conclude by providing a framework for analyzing some of the specific applications, technologies and standards that will be the building components of this new environment.

Bringing structure to unstructured data

A scan of the technology landscape identifies increased investments in technologies and standards that allow organizations to bring structure to unstructured data.

In the interviews OCLC staff did with 100 professionals actively engaged in the creation, management and dissemination of information, there was a clearly expressed interest in technologies and methods that will allow information professionals (and end users) to bring structure to the vast amount of unstructured data that is available in today's Information Mall. Increased user interest in unstructured or uncataloged information such as historical photograph collections, audio clips, research notes, genealogy materials and other riches hidden in library special collections has ignited conversations of how best to create metadata and methods to ensure dynamic and meaningful links to and among these currently unstructured information objects.

This drive to bring structure to unstructured data is being spurred by not only the library and information community, but by the business and government communities worldwide. It is estimated that 85 percent of the content in an enterprise is unstructured content[3] and as enterprises look for new forms of competitive advantages, they are working to harness the power of this unstructured data.

Two dominant technical and structural approaches have emerged: a reliance on search technologies and a trend towards automated data categorization.

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3.   Interview with Outsell, Inc., Analyst Marc Strohlein (July 2003).

Search technologies

With the Web at 6 billion pages and growing, and organizational information page counts dwarfing that figure, finding what you what when you want it can be a daunting task. This problem has dominated the technology landscape in the last several years. The "killer app" solution is "search."

Searching has become an international pastime. Over 625 million searches are conducted on the top eight search engines each day.[4] Yet, even after five years of rapid growth, search engine technology is considered by many analysts to be in its early stages. The search engine arena is highly competitive, with nearly a hundred solutions on the market from companies ranging from upstarts like Endeca to the leaders Google, Yahoo! and Microsoft.

The following chart provides a brief overview of the top search technologies and sample vendors.

A survey of search technologies

Search technologies[5]	Definition	Sample vendors
Boolean (extended Boolean)	Retrieves documents based on the number of times the keywords appear in the text.	Virtually all search engines
Clustering	Dynamically creates "clusters" of documents grouped by similarity, usually based on a statistical analysis.	Autonomy, GammaSite, Vivisimo
Linguistic analysis (stemming, morphology, synonym-handling, spell-checking)	Dissects words using grammatical rules and statistics. Finds roots, alternate tenses, equivalent terms and likely misspellings.	Virtually all search engines
Natural language processing (named entity extraction, semantic analysis)	Uses grammatical rules to find and understand words in a particular category. More advanced approaches classify words by parts of speech to interpret their meaning.	Albert, Inxight Software, InQuira
Ontology (knowledge representation)	Formally describes the terms, concepts and interrelationships in a particular subject area.	Endeca, InQuira, iPhrase, Verity
Probabilistic (belief networks, inference networks, Naive Bayes)	Calculates the likelihood that the terms in a document refer to the same concept as the the query.	Autonomy, Recommind, Microsoft
Taxonomy (categorization)	Establishes the hierarchical relationships between concepts and terms in a particular search area.	GammaSite, H5 Technologies, YellowBrix
Vector-based (vector support machine)	Represents documents and queries as arrows on a multidimensional graph—and determines relevance based on their physical proximity in that space.	Convera, Google, Verity

Source: Forrester Research, Inc.

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4.   Danny Sullivan, *Searches Per Day,* searchenginewatch.com (February 25, 2003).
5.   Chart Source: "You Are Here," by David Howard, *New Architect* (January 2003). Copyright© 2003 by CMP Media LLC, 600 Community Drive, Manhasset, NY 11030, USA. Reprinted from *NEW ARCHITECT MAGAZINE* with permission.

One 2002 estimate suggests that Google search engines handle more questions in a day and a half than all the libraries in the U.S. provide in a year.[6]

There is little doubt that the rapid adoption of search technology has dramatically increased the power and productivity of the World Wide Web. Savvy Web users have become experts at maximizing search techniques to achieve the desired output but are also beginning to demand more sophisticated (or more structured) search methodologies. A group of high school students interviewed for this scan discussed how they have learned search techniques to find the information they need for school projects.

"[Search success] depends on how to do some of your searches. Because a lot of people say when they use search engines, they don't find what they want but if you learn how to put your words in, you end up getting the results you want."[7]

Marsadie, 16-year old girl

"Yeah, with Google, you can search within your results. Like, you can type in like a general word that like, say your report is about like the Cold War. You can type in 'Cold War' and it will come up with a bunch of stuff, then you can narrow it down like you just go search within results and then type in 'Berlin Wall,' or 'Soviet Union,' or something like that...'Arms Race'...and then it will narrow it down and you can usually get better results that way."[7]

Catherine, 16-year old girl

"... I actually tried doing research on a few different things but they came up invalid or just really not good. I found better information in just a regular book."[7]

James, 17-year old boy

As users become more experienced and more discriminating, the shortcomings of current search solutions are surfacing. While many students had become very skilled at finding what they wanted, all focus group participants felt that easier search methods are needed. The experts agree. Finding known objects in huge search spaces, assembling top-down overviews that summarize the important points of a topic, and helping searchers decide what they really want when their initial search ideas are confused, misguided or ambiguous are casting doubts on the long-term viability of today's search techniques.[8]

6. Barbara Quint, "Some Advice for Google Answers," *Information Today* 19, no.6, (June 2002): 8.
7. OCLC Focus Groups, Columbus, Ohio (November 12, 2003).
8. Fred Hapgood, "Sleuthing Out Data," *CIO Magazine* (May 1, 2003), www.cio.com/archive/050103/et_article.html.

Several technology analysts surveyed for this scan said that using today's search technologies was simply "using brute force to solve the data discovery problem." Search (or search alone) is not the long-term answer for superior information discovery.

Automatic data categorization—enabling the smarter "find"

Several data organization and description technologies and methodologies are gaining popularity as ways to address the void. Data organization techniques that library science has utilized for decades are becoming popular and important outside the information management community.

"The demand, outside the library community, for information about data organization and metadata is exploding,"[9] say Gartner, Inc. technology analysts. In 2003 Gartner issued several research notes on metadata including, *Enterprises Need a Metadata Integration Strategy*[10] and *Taxonomy Creation: Bringing Order to Complexity*.[11]

Many data categorization techniques are being applied across the landscape including: taxonomies, semantics, natural-language recognition, auto-categorization, "what's related" functionality, data visualization, personalization and more. All techniques aim to help searchers find what they really want.

Data categorization is not new. "At one time, researchers speculated that solving such search problems might require artificial intelligence: systems that simulated human thought and could behave like skilled reference librarians. [...] Until recently, however, IT applications required paid humans to think up the category names, define their relationships and write the rules that channeled data into the proper boxes. As a result, the technique was limited to fields with big budgets, such as financial analysis or defense. During the past few years, however, technology development has made it much easier to automate or at least semiautomate categorization."[12] Data categorization techniques are moving from manual activities, done by librarians and other information professionals, to automated processes executed on behalf of users.

"More and more information travels with a lengthening entourage of data about itself. Autocategorization software recognizes and leverages that data."[13] Information professionals have an opportunity to leverage these new technologies to bring information management methods to a large portion of today's born-digital content.

9.   Interview with Gartner, Inc., Analysts Rita Knox, Research Director and Vice President, and Debra Logan, Research Director.
10. M. Blechar, *How to Manage Your Metadata*, AV-20-5975 (Stamford, CT: Gartner, Inc., August 18, 2003).
11. M. Blechar, *Enterprises Need a Metadata Integration Strategy*, DF-20-5020 (Stamford, CT: Gartner, Inc., July 24, 2003); K. Harris and others, *Taxonomy Creation: Bringing Order to Complexity,* QA-20-8719 (Stamford, CT: Gartner, Inc., July 24, 2003).
12. Hapgood, "Sleuthing Out Data."
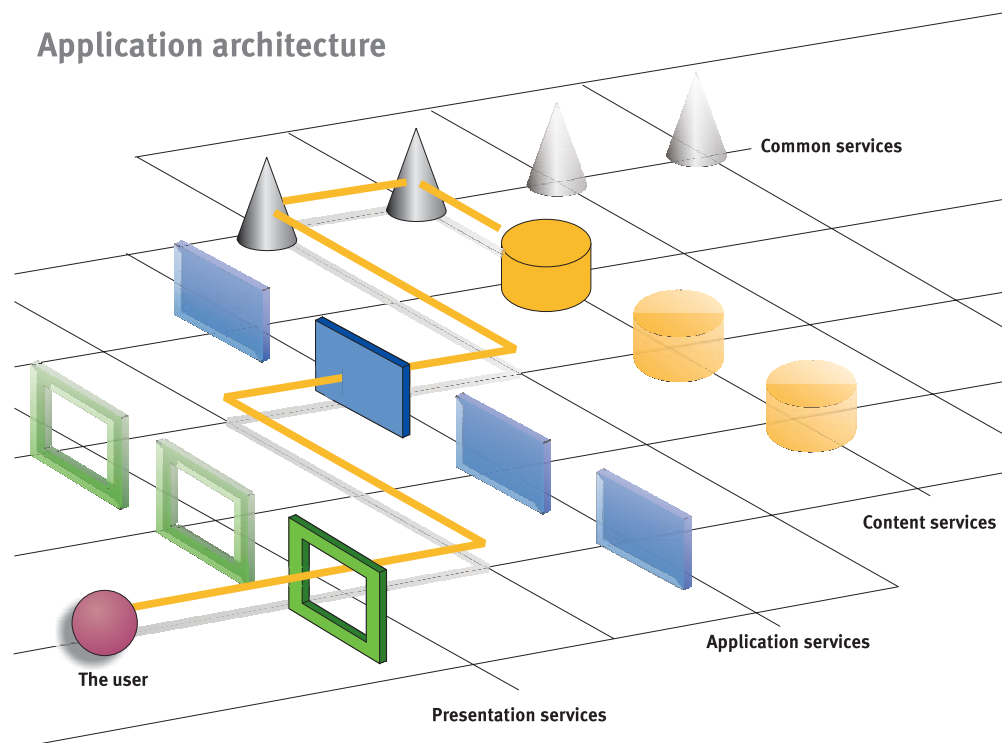13. Ibid.

Distributed, component-based software

A second dominant technology architecture trend is the apparent move away from the monolithic, hard-to-maintain masses of application software code we've known in the past toward smaller components that communicate with each other to complete particular tasks.

In the future, developers and end users will license software in pieces— some from traditional application and systems software vendors and others from companies specializing in particular business functions. Open-source applications will become part of the mix. Companies will also write their own modules for activities in which they already enjoy a distinct advantage and combine them with the increasing number of standard, easily available components. These changes will help to eliminate the painful and unsatisfying make-or-buy dichotomy of today's technology environment.

In a component-based environment, information technology professionals will have the ability to manage components independently, making modifications far simpler, faster and potentially cheaper. Patrons and customers will benefit by access to information and services on more devices and at multiple, distributed points of service.

Application architecture

The user

Presentation services

Application services

Content services

Common services

Many technologies and standards are fueling this shift from monolithic, bound-together technology solutions to distributed, component-based software. One of the dominant enabling technologies in this arena is Web services.

Web services

Web services are commonly used business processes delivered over the Web, based on industry-wide-standards. Using Web services, small software modules located anywhere on the Web are able to interact with each other using standard protocols, making it possible to quickly link together computer systems across organizations worldwide.

Web services are receiving significant attention and funding due to the potential they hold for both users and IT departments.[14]

The chief benefits driving the interest in and adoption of Web services include:

- Web services let organizations bridge communications gaps—between software written in different programming languages, developed by different vendors, running on different operating systems.

- Web services run over the Internet, over intranets or other Internet protocol-based networks, which are common inside companies. The infrastructure required to use Web services is stable, reliable and inexpensive.

- Major technology vendors, including Hewlett-Packard, IBM, Microsoft, Oracle and Sun, have agreed to support a set of standard Web services software technologies that spell out how different computer systems should interact with each other—offering an uncommon level of cross-industry cooperation.

- Web services technologies let organizations leverage prior investments in technology. Web services are not used to build new systems from scratch but rather as tools to dynamically integrate existing computer systems to create efficiencies or deliver new capabilities.

Web services are enabling the rapid connection of information that was simply structurally impossible just a few years ago. Standards acceptance will be a critical determinant of Web services successes. The most important of these standards, XML or extensible markup language, has gained industry-wide support and acceptance.

The initial use of Web services technologies has been inside organizations. But as organizations gain experience and standards are adopted, Web services and other component-based software tools will become mainstream in the technology landscape in the next two to five years.

Leading search information provider Google is extending the reach and increasing the connectivity of its search application using Web services. It launched the Google Web APIs developer's kit in the spring of 2002. The kit,

"Originally designed to reduce costs and smoothen application integration, Web services have also become a new platform for information providers."

Elangovan Balusamy[15]

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14. Sari Kalin, "The Essential Guide to Web Services," *Darwin: Business Evolving in the Information Age,* (January 2002): n.p., www.darwinmag.com.
15. Elangovan Balusamy, "Web Services Development Made Easy," Oracle Corporation (2003), http://otn.oracle.com/oramag/webcolumns/2003/techarticles/balusamy.html.

which can be downloaded over the Web, includes programming examples and a Web Services Description Language File (WSDL) for writing programs on any platform that supports Web services.

Hardware advances are also likely to reinforce Web services adoption. "Web services enable the linking of intelligence to each individual item in commerce. The Auto-ID Center at MIT estimates that about a trillion new Internet-friendly devices will be added to the network in the next 10 years. Integrating technology devices like chips and radio transmitters will simply become part of a product's basic packaging."[16]

As these technologies reach mainstream adoption, librarians and information providers must think about how to deploy Web services for their users. Many current commercial applications of Web services, from providing real-time stock quotes to information about local traffic patterns,[17] have direct corollaries to library information services.

We need to sustain the open connectivity—the linking among people, organizations, data and ideas—that drives the growth and diversity of the Web.

Industry Pundit

A move to open-source software

A move to lower cost, open-source software will enable organizations to bring solutions and services to market faster and cheaper.

When Linus Torvalds sat down in 1991 to write a version of Unix that would run on Intel chips (later to become Linux), he probably didn't think too much about creating a whole new way to develop and maintain software. Yet the

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Top 20 projects*

freshmeat maintains the Web's largest index of Unix and cross-platform software, themes and Palm OS software. Thousands of applications, which are preferably released under an open-source license, are meticulously cataloged in the freshmeat database, and links to new applications are added daily. www.freshmeat.net

1. **Mplayer** A movie player for Linux
2. **Linux** The Linux Kernel
3. **cdrtools** A tool to create disk-at-once and track-at-once CDs
4. **Gaim** A CTK2-based instant messaging client
5. **xine** A Unix video player
6. **MySQL Database Server** A fast SQL database server
7. **gcc** The GNU Compiler Collection
8. **TightVNC** An enhanced VNC distribution
9. **Apache** A high-performance, Unix-based HTTP server
10. **PHP** A high-level scripting language
11. **Nmap** A network exploration tool and security/port scanner
12. **phpMyAdmin** Handles the basic administration of MySQL over the WWW
13. **libcomprex GNUpdate** A compression/decompression library
14. **Webmin** A Web-based interface for Unix system administration
15. **Mozilla** A Web browser for X11
16. **GkrellM** System monitor package
17. **OpenSSL** The open-source toolkit for Secure Sockets Layer and Transport Layer Security
18. **Samba** Tools to access a server's filespace and printers via SMB
19. **libjpeg** Library of JPEG support functions
20. **LILO** Linux boot loader

* Based on number of subscriptions, URL hits and record hits as of November 29, 2003.

Source: freshmeat.net, accessed November 29, 2003.

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16. Downes, "Unleashing Killer Architecture."
17. Balusamy, "Web Services Development."

act of opening the code to anyone interested and willing to make a contribution has had a revolutionary impact.

Fast-forward to 2001: Linux is factored into the core strategy of most major vendors (including Hewlett-Packard, IBM, Intel, Oracle and Sun Microsystems) and is increasingly the platform of choice for many server applications. Open-source development products (JBoss, FreeSQL, Tomcat) are widely available and in some cases (such as Apache) widely used. There are at least 30 Linux distributions available.

Many experts feel that although open-source applications have not yet fully matured, they believe the applications are mature enough to include as key parts of their future IT strategies.

A recent study conducted by *CIO Magazine*[18] found there is evidence the IT community is growing more comfortable with the open-source development model, reporting that open-source software will dominate as the Web server application platform and server operating system within five years. The majority (64 percent) of companies surveyed are using open source today, most frequently as a server operating system and for Web development.

CIOs surveyed say the greatest benefits from using open source are lower total cost of ownership, lower capital investment and greater reliability and uptime compared to their existing systems. IT executives report that open source provides greater flexibility and control, and faster, cheaper application development. All things being equal, the majority of IT executives surveyed said they would choose open source for a new implementation over a proprietary vendor solution.

Adoption of open-source development methods as acceptable practice is also starting to take root. The open-source development process, where volunteer developers contribute code over the Internet, does not appear to be a concern for the majority of IT executives in the *CIO Magazine* survey. When asked how comfortable their organization was with the open-source development process compared to the traditional proprietary development process (full-time, paid developers, code managed and organized centrally),

SourceFORGE.net is the largest repository of open-source code on the Internet. As of November 23, 2003, SourceForge reported hosting 71,580 projects and over 740,000 registered users. Over 1,800 open-source education projects are hosted on the site.

SourceFORGE.net

SourceFORGE: November 2003 project of the month

Creator: Tim Kosse

Age: 22

Education: Currently studying Computer Science (Dipl.) at the RWTH Aachen

Location: Aachen, Germany

Profile

Project Name: FileZilla

Founded/Started: February 2001

FileZilla, a secure FTP client for Windows, is an open-source success story. The program was started two years ago in Germany by a computer science student named Tim Kosse. While working on his degree, Tim began to write a simple FTP program for a class assignment. After the class was completed, Tim continued to improve upon the code base. Eventually he chose to host it on SourceFORGE.net. With feedback and support from the SourceFORGE.net community, Tim's code and FileZilla's feature set continued to improve. Today, the program has a thriving user base and a large community of devotees around the world. As of November 2003, the project is ranked in the top 15 projects (out of 70,000) on the site and has more than 4,000 downloads daily.*

* SourceFORGE.net, November 29, 2003.

18. Lorraine Cosgrove Ware, "Confidence in Open Source Growing," *CIO Research Reports* (January 7, 2003).

27 percent said they were more comfortable with open source and 36 percent said they had the same level of comfort as with the proprietary process.

Users are beginning to view many software applications as commodity products with little differentiation among vendor offerings. Open source provides organizations with another compelling choice that offers the flexibility, quality and reliability necessary to implement many functional applications to run a business. Faced with budget constraints and increased spending on security infrastructure, the open-source movement will allow organizations that cannot wait for funding to get started on IT initiatives. This will likely mean an even faster rate of new technology introductions in the future landscape.

"Amazon.com embraced open source in 2002, converting from Sun's proprietary operating system to Linux. The switch is simplifying the process by which freelance retailers known as Amazon associates can build links to Amazon applications into their Web sites, using Amazon's payment, fulfillment and customer service without actually installing the software."[19]

It is not a coincidence that many of the developers participating in the open-source arena are the same young people for whom a collaborative gaming environment is part of their social landscape.

"They care passionately that the results of their cooperative creative efforts not be appropriated, or inappropriately co-opted. That which has been achieved by sharing should, in turn, be shared with the rest of the community."[20]

Security, authentication and Digital Rights Management (DRM)

The traditional book as a thematic collection is changing. Books are being decomposed to their fundamental constituent elements.

Director, Museum Library

Moving that intellectual property around in virtual forms and formats is creating enormous challenges for authors, publishers and information providers. We don't have to look any farther than the music industry to see the dramatic changes that new access models can have on distribution of intellectual property. Sales of music via online music sites are expected to account for $1.4 billion or 11 percent of music industry sales within the next three years. By 2008, 33 percent of music industry sales will come from downloads.[21]

Three primary technology issues surfaced in our review: security, authentication and digital rights management technologies. The more we researched these topics, the more it became clear that these are not three distinct issues, but are increasingly becoming part of one highly interrelated discussion. Due to the complexity of the issues and the brevity required in

19. Downes, "Unleashing Killer Architecture."
20. Mark Federman, "Enterprise Awareness McLuhan Thinking," Keynote speech at the Information Highways Conference, Toronto, Canada (March 25, 2003): 10.
21. Forrester Research, quoted in "Online Stores Launch Flashy Campaigns to Sell That Tune," *The Wall Street Journal* (Monday, November 10, 2003).

this scan, our discussion concentrates on providing an overview of what we will define as the "secure rights management" landscape. How each individual component of secure rights management, security, authentication and Digital Rights Management (DRM) will develop independently is still very unclear. There are hundreds of players, fragmented vertical markets and fuzzy standards. What is clear is that all key players in the information supply chain—content owners, software developers, hardware vendors, wireless and network providers—and the e-commerce infrastructure and payments companies are making substantial investments in both the technology and standards of secure rights management.

At the heart of the digital rights discussion is the desire for owners of content (intellectual property) and users of content to have a reliable mechanism(s) to create, distribute and redistribute intellectual property to any authorized user, anytime, anywhere and on any device and, after distribution, to ensure that content is used as authorized over time.

Although the user requirements and the supplier requirements are not at odds, the current business models and technologies infrastructures available to deliver these needs are incompatible. The struggle to develop new models has created significant confusion and disruption for all parties in the information supply chain—which should perhaps be renamed the information supply grid to reflect the interconnected and nonlinear process publishing has become.

"One of the greatest impediments to realizing the potential of universal access to digital collections, [is] our current system of protecting intellectual property rights. The system works reasonably well—albeit not perfectly—in the traditional analog environment. Transferring the concepts of copyright to the digital arena, however, raises numerous thorny problems."[22]

The notions of what constitutes an author, a publication, a text, for example, do not transfer well from a print world to a digital one. "When theorists talk about the power of the new media to make everyone an author...or to provide everyone with universal access to potential audiences of millions of readers, they invoke a notion of authorship and a model of access that are more appropriate to traditional print media than to electronic communication. What is an author, after all, if the new media no longer support the legal status or institutional privileges that have traditionally defined that role?"[23]

Two models help to visualize the complexity, and most importantly, the tight integration of the many elements of a secure rights management environment.
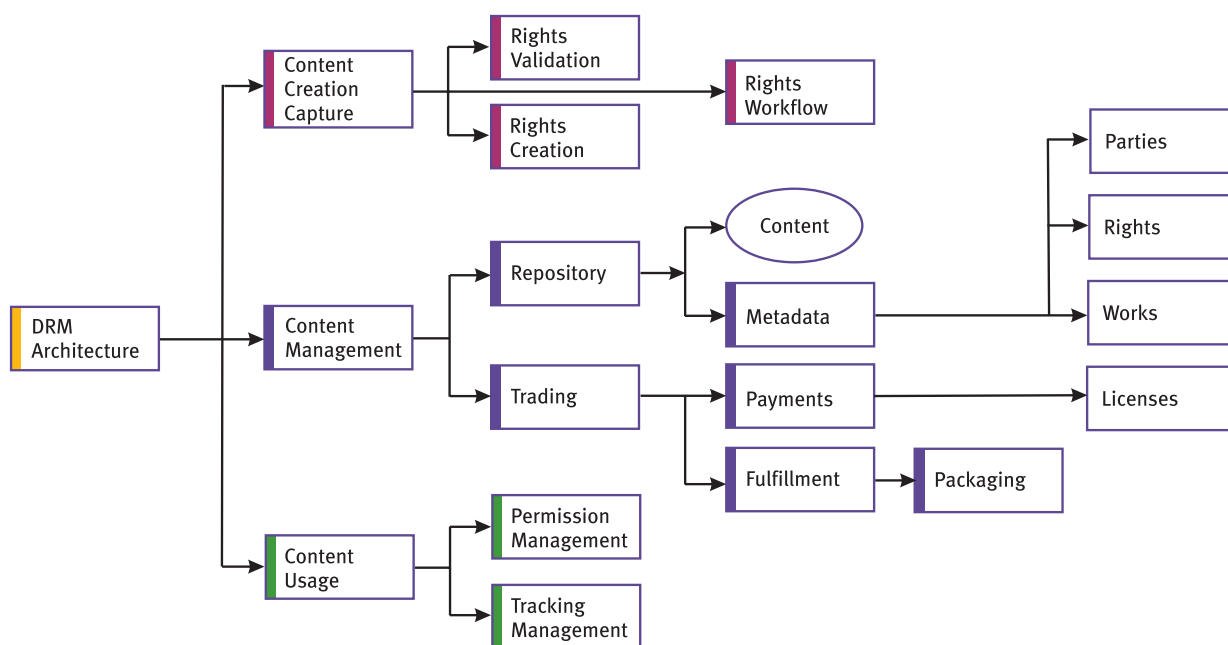
As the diagram illustrates, the DRM architecture requires a framework that can manage content creation, management and usage. The DRM architecture must ensure security and authentication at each step of the information supply chain.

Digital Rights Management is a nightmare—too confusing.

Corporate Librarian

22. Robert S. Martin, "Reaching Across Library Boundaries," In: *Emerging Visions for Access in the 21st Century Library,* Council on Library and Information Resources and the California Digital Library, Washington DC: CLIR (August 2003): 5.
23. Geoffrey Nunberg, "Farewell to the Information Age," In *The Future of the Book,* ed. Geoffrey Nunberg (Berkeley, CA: University of California Press, 1996): 105.
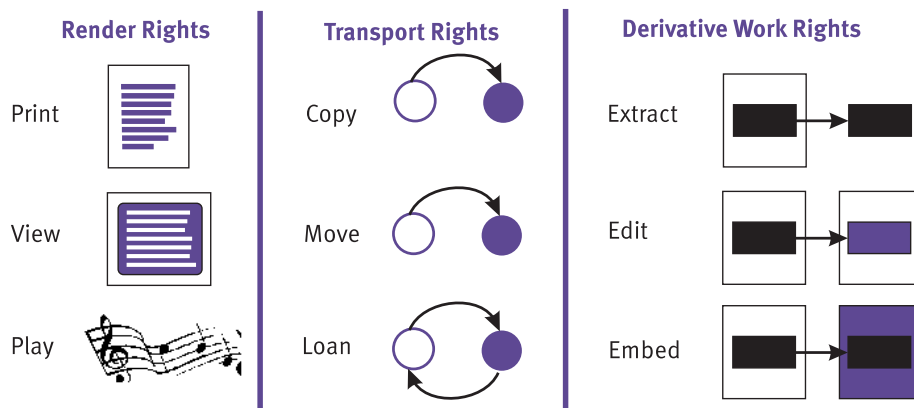
DRM Functional Architecture diagram[24]

A second model, developed by Dr. Mark Stefik, Manager of the Information Sciences and Technologies Laboratory at Palo Alto Research Center (PARC) has been included below to help illustrate the concepts of granting digital rights over the life of an asset.[25]

An effective DRM architecture will not only require secure rights management at the initial content use, but must remain persistent with the content as it is edited or embedded, in the future. Since next-generation applications will reach much deeper into day-to-day activities of consumers, businesses and governments, they will require built-in safeguards far beyond passwords and physical security. That security must "travel" with the asset as it is consumed, reused and repurposed. That security must also support both the user and the owner.

Render Rights

Print

View

Play

Transport Rights

Copy

Move

Loan

Derivative Work Rights

Extract

Edit

Embed

24. Created by Renato Iannella, Chief Scientist at IPR Systems and published in "Digital Rights Management (DRM) Architectures," *D-Lib Magazine* 7, no.6 (June 2001).
25. Published in "DRM Concepts/Standards," *GiantSteps.com,* copyright 2000, GiantSteps Media Technology Strategies, all rights reserved, www.giantstepsmts.com/.

Owner-centric	User-flexible	26
Digital Dog Kennel or Leash (maintain control at all times and all costs)	Digital Dog Chip (digital object identifier links to a database)	
	Digital Dog Tag (metadata and watermarks) but sometimes it also involves Kennel (firewalls, encryption) or a Leash (temporary unlocking key) Free range	
The revenue is made at time of each license	Flexible revenue timing—pay for usage, pay for time, some usage is free	
Financial risk/reward balance is locked at this time	Risk/reward balance can adapt to fit circumstances	
Fixed usages as specified by owner	Flexible, permissible usage travel with objects either directly or via link back to a database (equivalent to a dog's microchip)	
Fixed consumer-oriented licenses	Standard "Nano contracts"	
Owner-centric	User-flexible	

More and more, there is a move from technologies that provide "copyright protection" (owner-centric) to technology frameworks that enable "rights management" (user-flexible). As outlined in the "Digital Dog" chart above, rights management technologies must meld with other trends. Technology analysts are not sure how this melding of technology and user adoption will occur. Many predict that the technical DRM solutions will not mature as separate solutions, but rather will become embedded features within larger enterprise applications and hardware solutions. Intel, Microsoft, Sun and others have plans to implement DRM features in future releases. It is likely that hardware devices, including cell phones and many entertainment appliances, will also embed DRM features and options. The DRM architectures we discussed in this section will be supported by these technical advances but how quickly, and how effectively, remains to be seen. DRM solution adoption will likely be driven more by economics than technologies. It is still early in the "melding process." But as one senior information professional reminds us, "Until a workable approach in addressing intellectual property rights is developed, we cannot realize the potential of digital libraries."[27]

26. Iannella, "Digital Rights Management (DRM) Architectures."
27. Martin, "Reaching Across Library Boundaries."

To do in 2004:
- ✉ Wi-Fi
- 😊 Personalization
- 🔔 Alerts
- 💬 Smart Cards

Which technologies have captured the attention of the information consumer? Four technologies should be on your to-do list for 2004.

Wi-Fi, short for wireless fidelity, is a technology that has captured the heart of the information consumer and is filling tables at coffee shops across the world. Public wireless Internet access via "hotspots" is a customer service technology worth reviewing this year. Many libraries are already experimenting with or implementing Wi-Fi in their institutions. There are security concerns and the relatively short range reach of hotspots and ability to figure out the right financial model are still hurdles to clear. Jupiter Research reports that 6 percent of U.S. consumers have used Wi-Fi services in a public place[1]. Why not make the library the first public place for the next 50 percent?

The high school students interviewed for the scan told us that the technology tool they wanted most was a PDA device that "contained all the information they needed to do their work."[2] Vendors are responding. Several vendors now offer PDAs under $100, making it possible for the information consumer to get a PDA for about the price of two video games. **Personalization, alert technology** and other PDA-friendly information services have brought a world of convenience to the business user. The information consumer is ready for libraries to bring "all the information they need to do their work" to their PDAs.

Smart Cards, the "intelligent" credit card originally launched in the 1980s may finally have its year in 2004. As infrastructure elements come into place and security costs skyrocket, these access authentication mechanisms and data stores are gaining in popularity with both the information consumer and institutions. Universities, banks and governments worldwide are adopting these plastic computers. It is worth exploring how collaborative programs with other local or campus agencies could deliver new and innovative customer services.

1. Matt Villano, "Wi-Fi is Hot but Users Still Warming to It," www.wi-fiplanet.com/news/article.php/3111721 (December 4, 2003).
2. OCLC Focus Groups, Columbus, Ohio (November 12, 2003).

"How close are we to the Semantic Web that [Tim] Berners-Lee describes? Yes, and my American garage door talks to my Belgian toaster, and they agree I am hungry. Great idea. I think it will take a long time to realize, and that we will go through several generations of enabling technologies before we find ones that are suitable to actually get the job done."[28]

Herbert Van de Sompel

Hype or hope?

Our review of the technology landscape identified four major trends. The first, a rush to find ways to bring structure to unstructured data—giving rise to powerful search engines and the emergence of automatic data categorization techniques. Second, we highlighted the move away from highly integrated technology architectures to more distributed, component-based software solutions and the associated rise in Web services. The third major trend identified is the maturing of open-source solutions as legitimate components to an IT department's technical strategy. Finally, we provided a review of some of potential DRM architectures that may help support the growth of digital libraries.

These four trends may be among the more significant developments shaping the technology landscape, but they represent only a fraction of the technological advancements that information professionals must access and evaluate. While it would be impractical to list the hundreds of emerging technologies and standards uncovered during our research, we want to provide an overview of a few more technologies that we feel may have an impact on the future shape of the information landscape.

We feel it is important not only to identify these technology trends, but to present them in frameworks that information professionals could use to separate "the hype from the hope" of these new and emerging technologies and tools. What tools are being adopted today? Which technologies are not yet ready for prime time, but may shape the landscape in the next 5–10 years? Which of today's hot technologies may not survive?

28. Tom Storey, "An Interview with Herbert Van de Sompel: Developing New Protocols to Support and Connect Digital Libraries," *OCLC Newsletter* No.261 (July 2003): 12.

We conclude our review of the technology landscape by taking a broad look at several of the specific technologies shaping the future of knowledge management. To provide that overview, we use an adoption framework called "hype cycles" that was developed by Gartner, Inc., the world's leading technology research and advisory organization.[30] Widely used today to help technology professionals assess the maturity of emerging technologies, the hype cycles can provide an interesting view of many of the technologies impacting areas of interest. Gartner provides over 100 hype cycles to its clients. They have granted OCLC permission to use two of those hype cycles for review in this report: the Hype Cycle for Knowledge Management and the Hype Cycle for Web Services.

The Hype Cycle for Knowledge Management, 2003 identifies 23 technologies or solutions that Gartner feels will influence the future development of knowledge management. To understand a technology or technical solution's placement on the curve is a helpful management device. Gartner has added the element of "human attitude" or "market hype" to the traditional production adoption curve to allow information managers the opportunity to factor in the impact of hype, both positive and negative, on strategic investment decisions. Four of the solutions on the Hype Cycle for Knowledge Management—packaged methodologies, document management, best-practices programs and Web content management—have reached the "plateau of productivity" phase on the curve, indicating that they have been adopted by at least 30 percent of the market and are being deployed today as knowledge management enablers. Gartner plots the remaining 19 of these technologies at various points on the curve and indicates their estimated "time to plateau." Certain technologies, such as personal knowledge networks and corporate blogging, are very early in the cycle according to Gartner. Others have passed through the "peak of inflated expectations" and are perhaps currently no longer making press headlines, sitting in the "trough of disillusionment." Automated text categorization, discussed earlier in this section, is located in the trough. Gartner suggests that these technologies should not necessarily be discounted simply because they have fallen from the headlines as they may provide interesting potential that could be realized in a more quiet phase of the adoption cycle. According to its placement on this chart, Gartner estimates that automated text categorization will reach the plateau of productivity with the next two to five years.

Several of the top trends and technologies identified in this scan—e-learning, taxonomies and collaboration techniques—are plotted on the Knowledge Management Hype Cycle.

In the Hype Cycle for Web Services, 18 technical solutions are plotted to provide a guide to the ever-growing number of Web services solutions that are available today or will be available in the next decade. Web services tailored for specific industries and applications as well as Web services for infrastructure, security, networking and portals, all appear to be on the horizon.

Since 1995, Gartner has used hype cycles to characterize the over-enthusiasm or "hype" and subsequent disappointment that typically happen with the introduction of new technologies. Hype cycles show how and when technologies move beyond the hype to offer practical benefits and become widely accepted. Gartner currently offers over 100 hype cycles to their clients covering a vast array of technologies including: Web services, XML technologies, open-source technologies, advanced analytics, application development, mobile and wireless networking, personal computers and more.[29]

For more information see: www.gartner.com

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29.   Definitions of the different phases of a Gartner Hype Cycle are included in the Glossary, pp. 113–23.
30.   A. Linden and J. Fenn, "Understanding Gartner's Hype Cycles," *Strategic Analysis Report,* R-20-1971 (Stamford, CT: Gartner, Inc., May 30, 2003): 6.

Hype Cycle for Knowledge Management, 2003[31]

Key: Time to Plateau

○ Less than two years

● Two to five years

● Five to 10 years

△ More than 10 years

Real-Time Collaboration

Expertise Location and Management
Taxonomy

Records Management
Competitive Intelligence

Smart Enterprise Suites
Personal Knowledge Management
Semantic Web

Virtual Community

Information Retrieval/Search
Virtual Teams

Team Collaboration Support

Packaged Methodologies

Web Content Management

Best-Practices Programs

Document Management

Information Extraction
Idea Management
Information Quality

E-learning

Automated Text Categorization

Corporate Blogging
Personal Knowledge Networks

As of June 2003

Visibility

Maturity

Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity

Terminology definitions

Personal Knowledge Networks
Virtual networks centered on individual knowledge workers

Corporate Blogging
The application of "Web log" styles to corporate objectives

Information Quality
A characteristic that makes information suitable to support knowledge work

Idea Management
A process for developing, identifying and using valuable insights

Information Extraction
Culling concepts from unstructured data

Virtual Community
A self-selecting, peer-to-peer group that connects people by interest, skills and practices

Semantic Web
Extends the Web through semantic markup languages that describe entities and their relationships

Personal Knowledge Management
Powerful KM systems on the desktop

Smart Enterprise Suites
The convergence of portals, content management and collaboration functionality into a single product

Taxonomy
A classification of information components and the relationships among them

Expertise Location and Management
A tacit knowledge capture and sharing process

Real-Time Collaboration
Interaction between participants in real time using a meeting or presentation format

Records Management
The management of knowledge content through its complete life cycle

Competitive Intelligence
The analysis of an enterprise's business environment

Automated Text Categorization
Use of statistical models or hand-coded rules to rate a document's relevancy to specific subject categories

E-learning
The use of electronic technologies to deliver cognitive information and training

Team Collaboration Support
Tools that bring together real-time communications and asynchronous collaboration for teams

Information Retrieval/Search
The retrieval of documents based on a metric applied to a user's query

Virtual Teams
A project-oriented group of knowledge workers who do not physically work together

Web Content Management
Controlling Web site content with specific tools

Best-Practices Programs
A process of capturing and sharing process-oriented knowledge
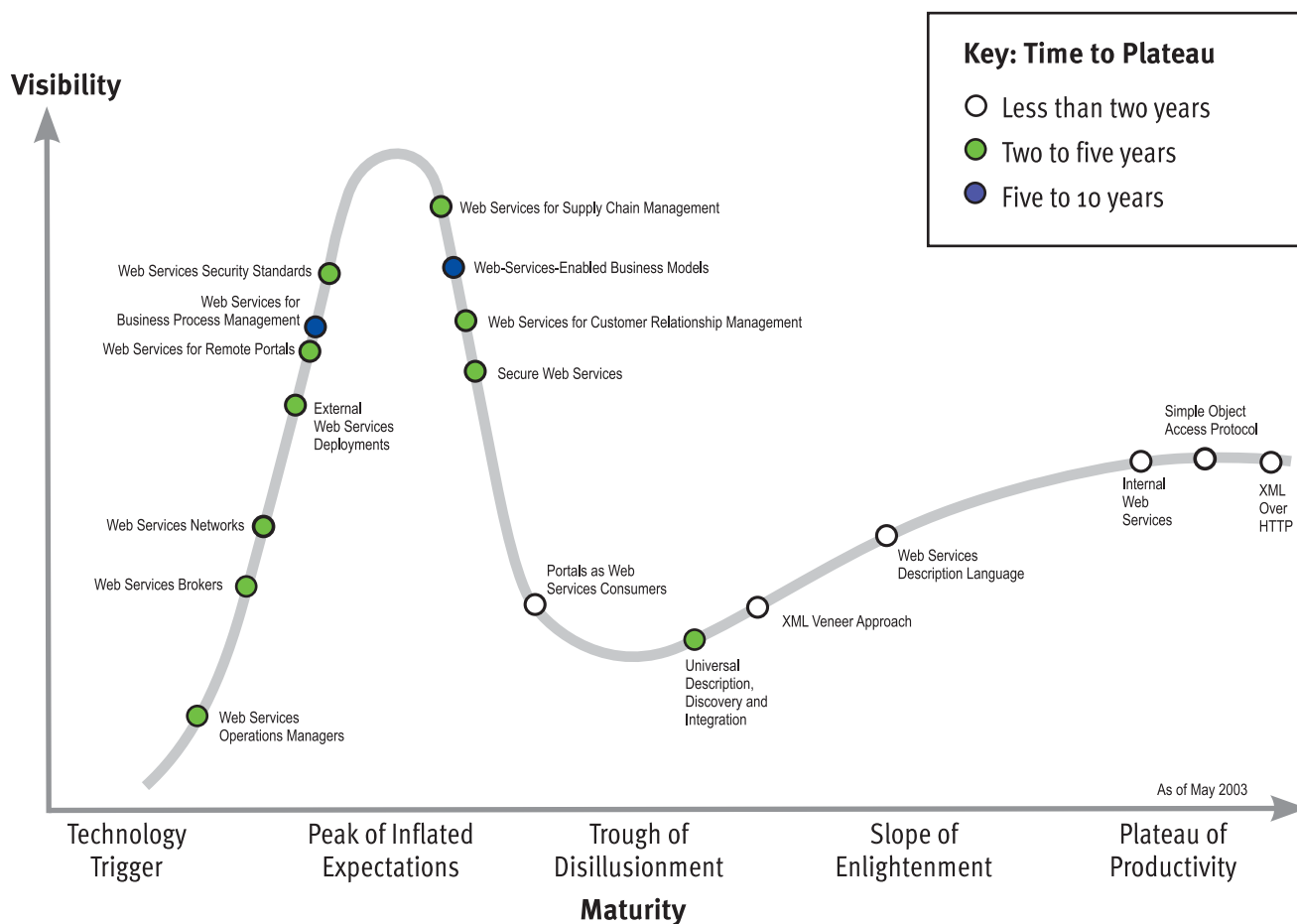
Document Management
A server-based repository that offers library services

Packaged Methodologies
Capturing and using process-oriented knowledge

31.   F. Caldwell and others, "Hype Cycle for Knowledge Management, 2003," *Strategic Analysis Report,* R-20-0010 (Stamford, CT: Gartner, Inc., June 6, 2003).

Hype Cycle for Web Services, 2003 [32]

Visibility

Web Services for Supply Chain Management

Web Services Security Standards

Web-Services-Enabled Business Models

Web Services for Business Process Management

Web Services for Remote Portals

Web Services for Customer Relationship Management

Secure Web Services

External Web Services Deployments

Simple Object Access Protocol

Web Services Networks

Internal Web Services

XML Over HTTP

Web Services Brokers

Portals as Web Services Consumers

Web Services Description Language

XML Veneer Approach

Universal Description, Discovery and Integration

Web Services Operations Managers

As of May 2003

Key: Time to Plateau
○ Less than two years
● Two to five years
● Five to 10 years

Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity

Maturity

Terminology definitions

Web Services Operations Managers
Address out-of-band management of Web services

Web Services Brokers
Provide security and deliver intelligence for internal Web services

Web Services Networks
A brokering service that supports digital collaboration between applications

External Web Services Deployments
Web services that provide data interchange and application integration

Web Services for Remote Portals
A common means for portals to obtain and display information

Web Services for Business Process Management
Web services used to circumscribe and initiate business processes

Web Services Security Standards
Standards that establish methods through which Web services can be connected securely

Web Services for Supply Chain Management
The use of Web services technologies to improve connections for buying and selling

Web Services-Enabled Business Models
Approaches for doing business impossible without the benefits of Web services

Web Services for Customer Relationship Management
CRM applications serving as producers or consumers of Web services

Secure Web Services
Implementations of Web services that resist computer attack

Portals as Web Services Consumers
The use of an enterprise portal through which the results of Web services are displayed

Universal Description Discovery and Integration
A type of service to publish, search for and use Web services

XML Veneer Approach
Uses XML to transport data without using Web services

Web Services Description Language
A formal XML vocabulary and grammar that describe, discover and use Web services

Internal Web Services
The use of Web services to accomplish noninvasive integration

Simple Object Access Protocol
Allows one application to invoke a remote procedure call on another application

XML Over HTTP
Uses XML and XML standards, but not Web services standards

32.   Whit Andrews and others, "Hype Cycle for Web Services, 2003," *Strategic Analysis Report* (Stamford, CT: Gartner, Inc., May 30, 2003).

Implications

- The emergence of Web services and the movement away from stovepipe, monolithic applications will likely make distributed applications more achievable than older distributed application models, such as OSI or CORBA. *How do libraries take advantage of these new technologies and new architectures to deliver new or additional services?*

- The increased importance of open-source software and changes in the way organizations create, distribute, acquire and exploit software are providing new opportunities for industry. *What new opportunities exist for libraries to work together to build more open-source solutions?*

- Building flexibility and responsiveness into processes, products and organizational structure will be required to take advantage of many of the emerging technologies—going "permanently beta" may be the trend. *What organization or staffing changes will be required for libraries to operate in these new, less formal structures?*

- The change in the nature of ownership of intellectual property has driven many technology companies as well as content companies to invest in digital rights management solutions. *What DRM solutions will be required to meet the unique needs of libraries and which technologies will simply become part of the "general information exchange infrastructure"?*

- There will be increased autonomy and independence for regions and countries as the dependency on expensive, monolithic technical systems declines. *What challenges, and what opportunities, does this create for increased collaboration of libraries around the world?*