

ARMY RESEARCH LABORATORY



# ARL Intranet Analysis and Development Study

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## **Abstract**

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We analyze the concept and practice of **Intranets** used in midsize and large enterprises, focusing on their use and impact within research and development (R&D) organizations. We examine the shift from the old concept of business computing to the modern concept of enterprise computing, and consider **Intranets**—a class of enterprise computing—relative to enterprise computing trends. By analyzing in detail some case studies selected from the literature, on-site visits, and workshop discussions, we then offer three tools to frame the critical issues and provide structure for systematically constructing strategic Intranets specific to a given organization's mission and culture. Arguing that creation of an Intranet that projects an image of a world-class organization demands no less than a world-class enterprise that is strategically enabled through information technology, we then analyze the current U.S. Army Research Laboratory (ARL) Intranet and present a three-step action plan to expedite ARL's movement toward creation of such an Intranet.

# Table of Contents

		<u>Page</u>
1.	<b>Introduction</b> .....	1
2.	<b>R&amp;D Enterprise Computing</b> .....	3
3.	<b>Case Studies From the Literature</b> .....	7
3.1	Oak Ridge National Laboratory and Lockheed Martin Energy Systems.. .....	7
3.2	The Naval Undersea Warfare Center .....	8
4.	<b>Case Studies From Site Visits</b> .....	9
4.1	PricewaterhouseCoopers .....	9
4.2	EDS .....	13
5.	<b>Key Learnings</b> .....	15
6.	<b>A Process for Developing Strategic Intranets</b> .....	16
7.	<b>Classes of Intranets</b> .....	18
8.	<b>ARL Intranet Analysis</b> .....	20
8.1	Background .....	20
8.2	Current State.....	22
8.3	Strengths and Weaknesses .....	22
9.	<b>Intranet Development Plan for ARL</b> .....	23
10.	<b>Conclusions</b> .....	27
11.	<b>References</b> .....	31
	<b>Distribution List</b> .....	33
	<b>Report Documentation Page</b> .....	35

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# 1. Introduction

Intranets are emerging rapidly. Intranet technology is the fastest-growing computer technology within the past 2 years, and leading organizations worldwide are rushing to use Intranets as tools for business improvement and as agents of organizational change, with varying degrees of success. Intranet objectives and implementations run the gamut from simple, low-cost tactical Web pages to ambitious, strategic corporate systems. One no longer needs to be a visionary to recognize that Web technology can be a powerful enabler of internal enterprise management. Yet, according to Dave Whitten, Vice President of the Gartner Group, the biggest mistake in creating Intranets is in failing to align them with clear business objectives (Whitten 1997). While the task of aligning an Intranet with clear business objectives appears straightforward, quite the opposite is true.

In the first place, business objectives are typically framed in terms of external results that impact the organization. A typical business objective might be to be the number one producer of XY widgets worldwide, as measured by number of sales. Since an Intranet is a closed environment for use internal to an enterprise, alignment of externally oriented business objectives to an Intranet is complex and uncharted. Expected internal results are typically defined in secondary terms such as metrics, policies, and procedures. How these secondary terms line up with an enterprise's stated business objectives is frequently poorly understood by the workforce.

A second major factor concerns the culture and "Corporate image" that management typically would like an Intranet to reinforce or change. While Corporate culture is frequently discussed, it is rarely explicitly defined by the internal enterprise. The Corporate image is typically defined as part of an overarching marketing strategy directed at selling products to customers. The application of Web technology to external marketing issues is currently a hotbed of Internet research and development (R&D). R&D for applying Web technology to internal marketing and culture change issues to create Intranets has received much less attention.

A recurring theme among visionary researchers is that the impact of information technology in the knowledge age is revolutionary and pervasive. Its effect extends to every aspect of business, research and development. Fernando Flores (1997), asked by the Association of Computing Machinery to speak about the future of the next 50 years of business and computing, states that “business is all about communication.” The top business consultant and workflow software pioneer continues to say that cyberspace is

... not a technological revolution. It is a change in the way human beings relate. We human beings are essentially relationships. Changing these relationships, we are going to also change the way we work, and the way we do business. Then we need to investigate how social relations are changing in business, and how technology is affecting this, and vice-versa. But this change extends further than business. We are also changing the way that we relate with ourselves.

Intranets are the very embodiment of the cyberspace revolution that Flores talks about. It should be no surprise that wide variation of Intranets exists, with little agreement regarding purpose, scope, or content even within a single enterprise sector. A successful Intranet project is one whose implementation matches expectations. In the R&D sector, expectations range from enablers of sweeping, strategic change to limited, tactical tools. The same is true in all enterprise sectors today. Leaders in the strategic use of Intranets to achieve critical enterprise goals are emerging in various sectors.

The goal of the Harvard Business School (HBS) Intranet is to enrich the learning environment by putting course material online and making assignments, schedules, and research tools readily accessible to students. Reporting about its progress in *CIO Magazine* (Santosus 1998), HBS Dean Kim Clark clearly considers the school’s efforts to be successful. The Naval Undersea Warfare Center (NUWC), Newport Division, also uses its Intranet to enhance classroom learning, but the primary role of the NUWC Intranet, according to Division Commander Captain Stephen Logue (Kalin 1998), is “to do more with less.” Driven by severe budget reductions, NUWC uses its Intranet to streamline its purchasing process and to enable a culture shift toward more information sharing. As a result, the NUWC Intranet had many hurdles to overcome that the HBS Intranet never faced.

The U.S. Army Research Laboratory (ARL), like NUWC, is looking to its Intranet to help do more with less. At the same time, ARL sees the potential to utilize its Intranet as a knowledge enabler and a business reinvention enabler. Along these lines, some simple, but tough, questions come to mind. How do you create an Intranet that projects an immediate sense of a world-class R&D organization? How do you utilize an Intranet strategically and still motivate scientists and engineers to use it?

To answer these questions, we must decide what it means to be “world-class” in this context. Some basic assumptions about a world-class R&D organization are that it is recognized internationally, is technically competent, is internally well run, and applies state-of-the-art technology and best practices to perform an excellent job for its customers. In the context of an Intranet, the focus is on applying state-of-the-art information technology and best practices to create and implement an Intranet that strategically and effectively furthers the internal goals of the enterprise. Thus, to answer these questions, we must also answer a third question: How do you create a world-class Intranet?

The literature makes it apparent that these three questions raise a number of issues, some of which this report seeks to address. Specific goals of the study are to (1) clarify the distinctions among business computing, enterprise computing, and Intranets and identify latest trends; (2) investigate case studies **from** the literature and on-site visits; (3) against those findings, identify key learnings, define a process model for developing strategic Intranets, and formulate some trial Intranet classes to distinguish key characteristics and issues; and (4) with sharper definitions in place, identify what ARL has in place and suggest ways it might move forward to meet **ARL's** objectives.

## **2. R&D Enterprise Computing**

Intranets are part of the class of computing called enterprise computing. This general area was formerly called business computing, as distinguished from scientific computing.

Historically, business computing referred to administrative financial and human resource applications used to automate line-of-business processes. These typically were justified by displacing people from business administration functions and were run on centralized mainframes accessible only to the Corporate information technology (IT) function and the administrative specialists. In most organizations, and especially in R&D organizations, business computing was viewed as a necessary but not very exciting housekeeping activity, with little direct relevance to most people's primary mission.

Today, management and IT researchers view enterprise computing much more broadly. The well-known management visionary, Peter Drucker (1998), describes two new paradigms that significantly impact enterprise computing: (1) The distinction between business and nonbusiness organizations and their processes is quite artificial; and (2) In the current knowledge age, the new basic resource common to all enterprises is information. He states that "whether you are managing a software company, a hospital, a bank or a Boy Scout organization, the differences apply to only about 10% of your work. This 10% is determined by the organization's specific mission, its specific culture, its specific history, and its specific vocabulary. The rest is pretty much interchangeable." Thus, any process required to achieve the enterprise mission is a business process, and enterprise computing includes business computing in this sense. Moreover, Drucker points out that "information does not pertain to any specific industry or business. Information also does not have any one end-use nor does any one end-use require a particular kind of information." This is radically different from the traditional assumption "that a unique technology pertains to every industry and that every end-use is supplied by a specific and unique product or service." The new enterprise computing and the concept of information as a basic resource are tightly bound. Both are mission-critical in new, uncharted, and far-reaching ways.

Enterprise computing has increasingly focused on delivering knowledge applications, such as communication and collaboration, to the organization through Intranets. New research is underway to better understand the impact of Intranets on organizational knowledge creation, organizational memory, and organizational decision-making (Scott 1998; Sridhar 1998).

Peter Senge (1994) extends the concept of knowledge applications by suggesting that enterprise computing include “microworlds” on a personal computer that provide information from diverse sources and the capability to experimentally “integrate learning about complex team interactions with learning about complex business interactions. These new microworlds allow groups to reflect on, expose, test, and improve the mental models upon which they rely in facing difficult problems.” From a technology perspective, Senge is describing an integration of data warehousing technology, decision support technology, and Intranet technology.

Another major area of enterprise computing is global enterprise resource planning (ERP) systems. Complex and expensive ERP systems, available from vendors such as Baan, Oracle, PeopleSoft, and SAP, include business applications such as procurement, payroll, accounting, and human resource management. Most of these are not yet Web-accessible. According to Ameet Patel (1998), the survival of these products depends on whether or not they will be able to extend these applications into the emerging areas of Intranets and commercial Web-based processes. Organizations deploy ERP systems to standardize industry business practices across the enterprise and in so doing more effectively manage the enterprise as a whole. Another motivation is to reduce costs by eliminating inefficient and redundant systems. Although many companies claim that they cannot compete without ERP systems (Kay 1998), the problems and costs of implementing and deploying these systems are great. Anil Gupta, Baan vice president, notes that “ERP is not a technological implementation. It’s change management, which is about people, processes, procedures, and new ways of doing things, which are always more taxing.”

Retallick (1998) discusses the central role of data in business knowledge sharing and identifies four requirements for enterprise knowledge sharing. Enterprise computing data are of two types: (1) structured and (2) unstructured. Usually, data used for business process applications such as procurement are structured and stored in a database or application-specific store that is organizationally managed. Unstructured data, such as text documents, are more common to knowledge applications and are often dispersed and managed by individual users who see themselves as the “owners” of the data. To share not only product or process

knowledge, but also knowledge about what is going on in an enterprise, four requirements must be met:

- (1) An integrated suite of business applications that are “married” with knowledge applications so that they trigger actions and know about other areas of business.
- (2) A consistent user interface for common applications, such as calendars and business applications, that is accessible to everyone in the enterprise.
- (3) Formal and informal workflow applications for use by everyone in the enterprise.
- (4) A system to manage the workload of information suppliers, such as “help-desk” workers.

Brown and Duguid (1998) of Xerox Palo Alto Research Center make the point that the production of knowledge—a subject of particular interest to people in R&D—is a social process, and somehow that social process must be brought together with the technological knowledge processes, not replaced by them. Many of the emerging knowledge technologies are proving most effective when used in an inclusive, rather than exclusive, way with other human-oriented processes.

R&D enterprise computing can encompass most of the enterprise functions automated by other, less research-oriented, organizations. The major differences between R&D enterprise computing and that of other organizations are the omission of certain sector-specific functions, such as industry manufacturing practices, and the primary focus on R&D. Since the principal product of R&D is knowledge, the current trend in enterprise computing toward knowledge applications and knowledge sharing is especially propitious.

### 3. Case Studies From the Literature

**The** case studies in this section and the next come from two sources: (1) the literature and (2) personal site visits. By definition, R&D Intranets are closed systems. For that reason, the degree of detail available in the literature about another organization's Intranet implementation and its impact is limited. Fortunately, site visits to IBM/Lotus, Cognitive Communications, EDS, and **PricewaterhouseCoopers** have provided rich benchmarks for this project.

3.1 Oak Ridge National Laboratory **and Lockheed Martin Energy Systems.** Oak Ridge National Laboratory (ORNL) and Lockheed Martin Energy Systems (LMES) are part of a public/private cooperative venture located on three campuses in eastern Tennessee. ORNL, established during the Manhattan Project in 1942, comes from a culture of secrecy, high security, and compounds surrounded by barbed wire and guarded gates. The introduction of an Intranet and its attendant Web-based culture of openness has presented ORNL/LMES with more cultural challenges than technology challenges (Slater 1996). It started as a grass roots effort by scientists and engineers who recognized that they could use the technology to accelerate their research through faster communication and shared access to large data sets. Applications of all sorts, most aimed at achieving collaboration with other researchers, have appeared. Examples include a system that lets employees maintain information about property assigned to them, a locator system that lets employees update their personal contact information, and Web access to data in some of **ORNL/LMES's** legacy research databases. Researchers have been particularly interested in examples using the Intranet to participate remotely in **experiments** that involve manipulation of visual images. Although the ORNL Director, Alvin Trivelpiece, and the central IT department gave the group working on the project a lot of encouragement, they provided no organizational resources or funding for the effort. Departmental and divisional management have been resistant, viewing the work as nonessential. In addition, many managers and employees continue to view information as job security and, in a time of downsizing, see an Intranet as a threat. To overcome this resistance, Intranet supporters launched a sequence of educational activities that culminated in June 1998 in Web Week, an internal symposium to

highlight recent developments in the ORNL/LMES's Intranet and Internet. The results were mixed-enthusiasts found it very useful, but it received little management support.

**3.2 The Naval Undersea Warfare Center. The NUWC** Intranet, mentioned earlier in this report, was launched as a Corporate cost saving measure with strong commitment and direction from Division Commander CPT Stephen Logue (Kahn 1998). Since 1994, the NUWC budget has shrunk from \$1.2 billion to \$750 million, and since 1992, overall headcount has shrunk by nearly one third. At the same time, it has had to absorb staff from three other bases. Newport had a major technological advantage, however, since more than 90% of their 3,000 employees have networked computers on their desktops and about two thirds of the employees are engineers and scientists that take quickly to new technology.

A major Intranet success at NUWC is the "IntraMart," an application that provides a direct link to Office Depot's private Web site and lets NUWC users do just-in-time purchasing with direct delivery. The head of NUWC's commercial acquisitions department, using ideas he saw at the Massachusetts Institute of Technology (MIT) and the National Aeronautics and Space Administration (NASA), introduced a government **bankcard** process and established the necessary customer-supplier relationship that enabled the center to successfully implement the purchasing function as a Web application for end-users. The initial project has recently been expanded to automatically check available funding and provide records of the purchases.

NUWC also uses its Intranet to provide access to various Corporate legacy databases, such as an equipment database and an employee phone list, and to post the weekly reports that CPT Logue sends to supervision. The open access to information has created the main hurdle, in a culture where information has always heretofore been a source of power. Although the purchasing system also faced resistance from the purchasing and finance functionals, the enthusiasm of the end-users and management assurances that the new system increased accountability helped to overcome this barrier.

## 4. Case Studies From Site Visits

**4.1 PricewaterhouseCoopers.** PricewaterhouseCoopers LLP (PwC) was formed in July 1998 by the merger of Coopers & Lybrand and Price Waterhouse and is now the largest professional services firm in the world with over **150,00** employees in over 100 countries. Its Intranet, called **KnowledgeCurve**, is the central ‘communications and knowledge-sharing tool for PricewaterhouseCoopers and is the “home” for all of its internal Web-based initiatives.

**KnowledgeCurve** was begun in the United States in December 1995 to support the Corporate-wide deployment of a Web browser to employee’s desktops. It was developed by the Knowledge Strategies Group in cooperation with the Strategic Technology Group and the Marketing and Communications Group in Coopers & Lybrand. By April 1997, it was fully operational in the U.S. firm and was named among *InformationWeek’s* 25 most Innovative Intranets in 1996 and 1997. Global expansion was chartered in June 1997. Today, **KnowledgeCurve** is viewed as a tool to support the efforts of the Chairman’s office, and as a major supporter of the merger process. According to Tracy Beverly, **PricewaterhouseCooper’s** Global Director of Intranet Services (1998), one major objective for **KnowledgeCurve** is to support rapid integration of the two organizations by:

- Contributing toward communication of **PricewaterhouseCooper** values, culture and standards.
- Stimulating innovation and growth by leveraging both **firms’** investments in knowledge management and technology.
- Connecting people and build communities across lines of service, industries, and geographies.
- Integrating a firm-wide body of content in a single place, regardless of underlying technology.

. Providing a timely and efficient delivery vehicle for information and communication.

Other KnowledgeCurve objectives are also described in terms of what they will do for the business, not in technology or functional terms. Current objectives include:

- Create value through a knowledge management Intranet.
- Support quick access to resources of the global firm.
- Keep up-to-date in a rapidly changing environment.
- Work smartly.
- Support dynamic internal communications globally.
- Facilitate virtual communities.
- Link a network of experts.
- Stimulate continuous learning.
- Save time and money via the virtual office.
- Unify a variety of technology and content.

Each objective is achieved through a variety of technology and content solutions, some of which overlap. Applications such as travel and subscription management are viewed as part of the virtual office. These applications are just being introduced in the upcoming version and only provide forms that can be **downloaded**—no **workflow** applications are integrated with the **Intranet**.

The **PricewaterhouseCooper** Intranet is based on Lotus Notes/Domino. The foundation for an Intranet began in Coopers in the 1980s, when **email** and discussion groups became widespread. This planted the seeds of a sharing culture. In the late '80s, Notes was used as the technology base for these functions. When the Intranet was launched in 1995, it was very basic, providing simple functions such as news, user information, and a guide to Corporate resources. The first major change occurred in 1997, following extensive usability testing and redesign. A lot of content was added at that time, and the Intranet was moved to a Notes/Domino server. In September of this year, another major usability testing initiative was launched. Focus groups were set up and interviews were conducted, yielding increased awareness among end-users and the input necessary for the 1998 redesign now in progress.

A number of initiatives have been put in place to motivate employees to use **KnowledgeCurve**. The most successful of these is giving cash bonuses as a reward for participating. Plans include putting Intranet participation into people's job descriptions and developing new role models. Management wants to replace the current "cowboy" role model (the worker who stays all night and successfully solves a tough technical problem on his own) with a new role model that rewards the worker who goes home to family and community at night and uses the Intranet to collaboratively work out problems during work hours. A Champions Program was launched a year ago to motivate Intranet participants. They currently have 200 champions in this program. "Fun" things are also included in the Intranet, such as information on favorite vacation sites, to draw users.

Creation of the Intranet has involved a lot of R&D. Coopers, along with Hewlett-Packard, was one of the earliest companies trying to develop an enterprise-wide Intranet and continues to be a recognized industry leader in this area. About 50 people **globally** in Corporate IT, including library services people, are assigned to this project. They do not have responsibility for the Intranet infrastructure. Most of the content is third-party content, paid for on a charge-back basis. Internal content is coordinated by IT but produced and owned by the people who need it to do their jobs. **KnowledgeCurve** also provides many pertinent external links, saving professionals the time and effort needed to find and evaluate such links.

**KnowledgeCurve** is content-rich, with a large quantity of third-party content. The most used area of **KnowledgeCurve** is its “Research Center,” which receives 35%–40% of the hits. The Research Center provides third-party content and evaluated external links that are highly relevant to employees jobs. Examples of **KnowledgeCurve** content include:

- Who’s Who, leadership profiles.
- News and events.
- Top business news, press releases, and client news.
- Employee benefit information.
- Web development tools.
- Service and industry descriptions.
- Client and competitor information, including projects done for clients and personalized folders.
- Stock presentations for clients, recruits, and suppliers.
- People directories.
- Policies and procedures.
- Discussion groups and feedback.

KnowledgeCurve also provides a content architecture whose design structure is based on content use. Personal profiles of individuals are kept for purposes of targeting KnowledgeCurve content.

4.2 **EDS.** Despite heavy involvement in helping other organizations build knowledge management systems, including the U.S. Army, EDS is just beginning its own Intranet creation. A small, local grassroots FY98 knowledge management start-up, funded by \$130k of Corporate seed money, has resulted in FY99 funding of \$3.2 million to extend the work and provide training to the entire workforce. Although Corporate IT has developed a limited Intranet, the knowledge management start-up is a local project with no linkage to the Corporate Intranet. Similar stand-alone initiatives within specific EDS business units is common. For example, the EDS technical community of about 35,000 people maintains **TechLore** Page, with no linkage to the Corporate Intranet. Apparently, EDS is only now starting to consider a consistent enterprise strategy for the Corporate Intranet. Currently, Strategic Business Units decide for themselves whether or not to use Web technology to help them run their internal business and are under no mandate to align such efforts with a strategic Corporate effort.

The knowledge management start-up project is focused on creating collaborative communities within EDS. Anyone interested in participating in an ad hoc knowledge management team is given funding to travel to a team meeting, then is expected to help develop a team Web page. Current knowledge management content includes reports of team activities, contact information, Web tools, and some “fun” items such as the Kiersey Temperament Sorter. The goal of the project was to demonstrate the concept and “sell” the idea of a knowledge-based organization to management. The next phase will be to develop some formal processes for individual Web pages, extend participation and concept education, and link this initiative to other Corporate initiatives. This project appears to be aimed more at team building and collaborative work processes than at building an enterprise-wide Intranet.

The **TechLore** Home Page is one of the most popular local Intranets within EDS. The technical community formed a team that established the following content categories:

- Cooperative Work Technologies.
- Certifications.
- Emerging Technology.
- Desktop Applications.
- Information Management.
- Software Development.
- Capability Management.
- Infrastructure.
- Contributions/Discussions.

The Capability Management section contains rich project information that takes a user to varied materials associated with a given project, such as documents, processes, and experts. That section also allows individuals to self-select areas of interest and their level of expertise in those areas. Each category has a “gatekeeper” assigned to decide if the individual has self-selected correctly. One of the major problems has been the amount of “junk” contributed to this Intranet, since everyone is free to contribute anything. The technical community decided to self-police by having each subcategory post an expiration date and a user “owner,” responsible for controlling content. Corporate IT checks activity on these pages, and if it is low, Corporate IT goes to the “owner” for permission to delete those pages.

## 5. Key Learnings

A number of key findings emerge from case studies in the literature, the on-site visits, and the “Developing an Effective Knowledge Management Intranet Workshop” that the author participated in on 4-5 November 1998 in New York, NY. Other workshop participants included managers from BellSouth Corp., Compaq Computer Corp., Prudential, Volkswagen of America, Caterpillar, Dofasco Steel, Mitretek Systems, and U.S. the Army Edgewood Research Development and Engineering Center (ERDEC).

Central to many learnings is the observation that an **Intranet** is both an exceptional enabler and an unrivaled magnifier of realities in the enterprise. It is not the technology to use if people want to hide behind political curtains. If the value of information determines power in an organization, then the information architecture is not a technical document-it is a political map. The Intranet that implements that architecture therefore becomes a political instrument.

Eight key learnings should be seriously contemplated when planning for a strategic Intranet:

- (1) Clear business objectives and how the Intranet will help achieve them should be articulated prior to creating an Intranet.
- (2) Top management commitment, resource allocation, and communication to motivate the workforce is essential.
- (3) Policies and procedures that reinforce desired workplace behavior and information ownership should be in place before the Intranet project begins; otherwise, the decisions leading to these policies and procedures will appear to be very political.
- (4) Each stage of an Intranet project should be very focused, resulting in short-term, visible success.

- (5) Clear measures of success should be established prior to starting an Intranet project and communicated to those responsible for meeting these metrics.
- (6) Metrics should evolve with the Intranet and be formally updated and communicated.
- (7) An ample supply of job-relevant content should be provided from internal, external, and third-party sources and should be organized to enable rapid, focused subject-matter research.
- (8) All other Intranet features and issues, including visual and technical design and content, are secondary to and dependent on the first six items.

These learnings appeared in all sectors and seemed to apply to all organizations with 50 or more people.

## **6. A Process for Developing Strategic Intranets**

This section defines a process model for developing strategic Intranets that is based on the project-proven process used by Cognitive Communications, an industry leader in Intranet strategy. Cognitive Communications has used various steps in its process to develop successful Intranets for leading Global 200 companies such as Xerox **Parc**, General Motors, Mastercard International, and Andersen Consulting (Weiner 1998).

The process model is designed to ensure that the enterprise Intranet supports and embodies the Corporate vision for that enterprise. This can happen only if Corporate business objectives are clearly articulated and translated into focused projects whose impact can be measured.

The Strategic Intranet Process Model includes 14 steps:

- (1) Assess, or confirm, the business need for an Intranet and commitment **from** top management.
- (2) Articulate clear business objectives to meet the business need.
- (3) Identify process changes and behavioral changes that must happen to attain the business objectives.
- (4) Identify content and processes the Intranet needs to include to meet the business objectives.
- (5) Determine who currently “owns” the processes and content and if any ownership change is needed.
- (6) **Put in** place Intranet policies, procedures, metrics, and incentives needed to effect desired changes. Communicate these to the workforce.
- (7) Identify focused, short-term Intranet projects with a high potential for success.
- (8) Prioritize Intranet projects.
- (9) Develop a tactical **roadmap** for the top Intranet project:
  - Create a content architecture.
  - Develop metrics.
  - Develop incentives for workforce to use it.
  - Develop a deployment plan.

- (10) Attain the required level of funding and personnel to ensure project success.
- (11) Design and develop the Intranet application.
- (12) Deploy.
- (13) Provide ongoing support and help.
- (14) Evaluate results, **refine** steps 1-8 as required, and repeat steps 9-14.

Development of the Intranet is treated as a project. The first steps in the process are aimed at putting in place the groundwork required to align the project with business goals and provide the business infrastructure needed to enable cultural change. The actual building of the technology solution does not occur until step 11 of this process. Without clear articulation of goals, policies, and process ownership, it is impossible to create an Intranet design to embody the Corporate vision. As an example of this, if content and process ownership follows the formal organizational structure, then so must the Intranet information structure. A different, perhaps more user-oriented, information structure would in this case lead to power struggles and other political ownership issues.

## **7. Classes of Intranets**

Teasing the varied meanings of Intranet apart and differentiating the key attributes are not easy tasks. The only agreed-upon meaning is that an Intranet is a Web-based system for use internal to an organization. “Intranet” is a word that takes on a different context and meaning in the eyes of every beholder.

What are some attributes that would clarify important distinctions needed to compare and contrast Intranets? Is the Intranet **from** one case study so different **from** that of another case

study as to make a comparison meaningless? Are the differences and similarities mainly due to the enterprise sector or mainly due to other factors?

Telleen (1998) uses level and scope of expectations to define an Intranet and best determine a planning approach. He separates expectations into existential visions and referential visions. Existential visions are those that expect an enterprise to change the way it does business or even the business itself. Referential visions are those that expect an enterprise to make existing processes faster or more efficient. Existential visions generally focus on the development of people and organizations and **define** a set of referential goals in support of that development that the visions want the Intranet to support. Expectations based on referential visions generally are more technically focused, looking for the Intranet to Web-enable existing applications and processes to make them less expensive and more user **friendly**.

The media frequently use the concept of generation to categorize Intranets. First-generation Intranets typically refer to a single networked system that provides internal **email** throughout an enterprise. Second and third generations loosely refer to extensions of the first generation that evolve from applications addressing a single narrow business process or a single site to multiple, but limited, applications. The term “fourth generation” is now used to describe Intranets that support broad operational applications or advanced knowledge management.

Case studies of ambitious, fourth-generation Intranets show that as Intranets evolve, expectations become hybrids of Telleen’s existential and referential visions. Interestingly, the case studies also make plain the fact that similarities are greater than differences across enterprise sectors. The major factors that differentiate one Intranet from another are functionality, scope, and complexity. Similar expectations are sometimes translated into very different functionalities, resulting in Intranets that face very different organizational, political, and technical issues.

Herein, we distinguish seven Intranet classes to differentiate Intranets in terms of function:

- (1) Information storage and distribution.
- (2) Information access and analysis.
- (3) Collaborative Workgroup functions.
- (4) Self-service workflow functions.
- (5) A one-stop enterprise computing interface.
- (6) Education administration and distribution.
- (7) Knowledge sharing.

These provide the classification structure needed to systematically plan and architect a strategic Intranet. They will be particularly useful applied to some of the process steps defined in section 4, especially steps 4 and 8.

## **8. ARL Intranet Analysis**

**8.1 Background.** Some parts of the ARL enterprise have had a network infrastructure in place since the 1980s, and have used that infrastructure to make **email** and electronic documents part of the everyday work environment since that time. Other parts of the enterprise were slower to use network technologies such as **FTP** and **TCP** but had **email** capabilities in place by the end of that decade. By the late '80s, many ARL researchers felt at home with some aspects of transferring files, using **email** to distribute notices, and obtaining information **from** electronic public directories. In the early '90s, when distributed Army R&D laboratories were brought together organizationally to form ARL, the various cultures ranged from users who were computer-shy to local experts developing IT tools to automate special group or site processes and using multiple languages and platforms. The multiplicity of electronic processes and

applications was a barrier to moving the diverse cultures toward a common vision. ARL-wide communication was dysfunctional, and the Office of the Director had no way to harness IT to help manage the enterprise. By the mid-'90s, the situation worsened as Defense resources were severely cut and the operational staff that had provided many of the day-to-day services manually were severely reduced.

At the end of 1996, the Corporate Information and Computing Center (CICC) was formed as part of a major ARL business realignment. Two major responsibilities assigned to this center were:

- (1) Use IT to streamline ARL business processes.
- (2) Enable internal business operations to be conducted over an ARL Intranet.

Work on an enterprise information architecture began early in 1997, and the first ARL Intranet was launched in April 1997. The first Intranet was very different from the one in place today. It was very basic, including a news section, brief announcements of the forthcoming automated purchasing and travel systems, access to a local "locator" phone database at headquarters, and some user information and support.

Enterprise Systems Division (**ESD**), the part of CICC responsible for creating the Intranet, was established as an eight-person division. Only five of these were technical staff. The high-priority tasks for the division in 1997 were (1) to create an enterprise IT architecture and (2) to develop an automated **workflow** system to be used ARL-wide for small purchases.

The ARL Intranet, named **ARLinside**, was designed primarily to give Web-access to ARL **workflow** systems. The complete vision for the Intranet was grand-it would be the single entry point for all enterprise computing throughout ARL. However, with low priority and virtually no available technical resources or funding, the first version was built as a prototype to demonstrate the concept and its potential. As part of the launching of the Intranet project, ESD published the

Intranet Standards and Guidelines document detailing standard procedures and processes required for process owners to post content information on the Intranet (David, to be published).

**8.2 Current State.** ARLinside Version 5 is a major change from the first version. It has moved to a new production server, tests new features on a dedicated development server, and has added a considerable amount of internally generated content. It dynamically displays a “What’s Hot” section and a “What’s New” section, to let users be up-to-the-minute with ARL Dispatches, the ARL Calendar, and major new application releases. It gives the workforce Web access to a newly developed Corporate “phonebook,” new applications for purchasing and personnel job description formulation, plus access to two Technical Library site pages and many Chief of Staff (COS) content pages. From both a technical and content point of view, it is a maturing Intranet.

Although usage continues to increase, participation and usage by researchers is far less than desired.

**8.3 Strengths and Weaknesses.** ARLinside is strongest in areas aligned with its initial and primary objective: to provide Web-access to traditional “business” computing. In ARL, this had meant access to procedures and processes typically performed by the COS organization as services to support research.

It is weakest in areas aligned directly with the laboratory’s research mission. There is very little job-related, subject-matter content to attract researchers to use the site routinely. The few third-party content links that are available on ARLinside are not easily found because content is primarily organized not by subject but by internal offices that “own” the content. No process is in place to identify objectives or to motivate use of the Intranet by researchers. The primary participants are the service organizations, largely because the inclusion of many COS content pages is mandatory.

ARLinside has been forced to start with a fourth-generation approach of providing enterprise-level access to workflow automation. These applications, among the most difficult

and costly to achieve, have little appeal to most of the workforce. Unfortunately, multiple processes at various sites were not standardized or reengineered before the automation was delivered. As a result, the software is too often seen as part of a problem instead of as a solution. Tim Woisin, Director of Information Management at Compaq Computer Corporation, states that “All of our IT enterprise failures have been because we have been unable to get global agreement on a single process” (Woisin 1998). ARLinside, by design, is intimately associated with these high-risk workflow projects.

Another major problem is that the ARL Intranet continues to be severely underfunded and understaffed relative to expectations for its performance. Only 5% of the ESD budget is designated for the Intranet project directly, and this is used primarily for Intranet technical support and maintenance. No funding has been provided for strategic planning and motivation of the workforce.

Despite these problems, the case studies reveal that ARLinside is a leading-edge Intranet. Only a few enterprises have developed the fourth-generation concept of a Web-accessible, single user-interface to enterprise computing. In most enterprises today, business computing and group collaboration applications are still separated by technological and organizational structures. Data warehouse initiatives and Intranets are rarely discussed in the same breath. This is changing rapidly, however, as Intranet leaders continue to grow and publicize their feats. The challenge for ARL is to retain its Intranet vision while championing its early accomplishments and sharpening the development focus to match resource realities.

## **9. Intranet Development Plan for ARL**

The ARL Intranet was created to provide Web access to a planned suite of operational application software intended for use by all ARL sites. Since automation would mandate a new, single process at all ARL sites that would be different from any currently in use, a major objective of the Intranet was to market the new processes. This strategic, cost-saving objective was expected to have resistance.

ARLinside has evolved from a limited, fuzzy concept to a viable, technically mature business information infrastructure. In addition to the operational applications, it includes much operational content and other applications. Some of these have potential for wide appeal. Most have strategic goals in the “do-more-for-less” category.

The challenge for ARLinside to embody the vision of ARL as a world-class R&D enterprise articulates a new expectation for ARL’s Intranet. The business objectives associated with this expectation are undoubtedly different from the original set. The target audience is the research community, not operational functionals.

This section recommends a plan to help ARL reap the benefits of the first Intranet project and to develop a roadmap for the next-generation ARL Intranet. This plan draws upon the key learnings of section 5, the process model defined in section 6, and the classes distinguished in section 7 to address ways for ARLinside to project the image of a world-class R&D organization.

As noted earlier, in the context of an Intranet, to create the image of a world-class R&D organization is to demonstrate a world-class Intranet. This takes direction, commitment, and resources from the top as well as enthusiastic participation from the ranks.

The plan focuses on three primary actions:

Action #1. Broadly champion the existing ARL Intranet, build awareness of its strengths in the ARL research community, and make highly visible additional, job-related, third-party content.

Action #2. Apply the Strategic Intranet Process Model to systematically evaluate, refine, grow, and migrate the current version of ARLinside to the desired next-generation Intranet.

**Action #3.** Translate the business objectives articulated by action 2 into a focused Intranet project that is expected to have an immediate, positive impact on the research community and that can be successfully implemented in no more than 4 months.

Action #1 builds on work already accomplished but not broadly recognized or utilized. A world-class Intranet needs enthusiastic, participating users. ARL suffers from a common predicament, well described by Lew McCreary, Editor-in-Chief of *WebMaster Magazine* (McCreary 1997): “With Intranets, market laws still apply-notwithstanding the captive user base. Just because you build it doesn’t necessarily mean they will come.” User training is the first step. In most of the case studies reviewed for this report, the IT organization had responsibility for IT (and, therefore, **Intranet**) training. When this function crosses organizational lines, the complexities and barriers that arise need special attention. Training alone, however, neither creates champions nor regular users. Some solutions to this problem include giving users something they desperately need or want (i.e., “low-hanging fruit”), internal marketing, and formal incentives.

To the research community, nothing is more important than job-related content. The ARL Technical Library is the historical provider of such information. Currently, all commercially provided content is found on the site technical library pages. The Intranet offers an opportunity to add value to accessing, searching, and presenting this information to researchers. In particular, good Intranet design can present the information in a way that reinforces business objectives and makes it easier for the researcher to locate. This author recommends that ARL adopt the U.K. Defense Evaluation and Research Agency knowledge management concept of “Deep Storage.” Commercial and reference publications, archived customer and technical reports, and published journals reside in electronic form in a Deep Storage repository rather than being linked directly to “library” Web pages. The Deep Storage repository is accessible to the Corporate Data Warehouse, which is in turn accessible to the Intranet. This architecture permits the flexibility of design necessary to align the **Intranet** and its content to business objectives.

AI&inside has in place a small, but interested, group of participants that are the points of contact for user content pages and work informally with the **ARLinside** Webmaster on technical issues. This group might form the core for a champions program similar to one described by Tracy Beverly, Global Director of Intranet Services for **PricewaterhouseCooper** (Beverly 1998). They launched a highly visible Champions Program a year ago. They sent **email** and brochures to 200 users of their Intranet announcing the start of the program and asked each to participate 1 hour per month as early testers of the planned new version. Each participant included this participation as an objective on his/her performance evaluation, was permitted to put up a personal **homepage** on the Intranet, and was given access to a special Intranet discussion group just for "champions." The champions represented all areas and all levels in the **firm**. The program was highly successful in marketing the new Intranet.

This author recommends that Action #2 be included as part of the CICC strategic planning effort. This action should also build from successes of the past 2 years. One way to undertake this action is to do formal usability testing in parallel with a Strategic Intranet Process Model workshop.

Formal usability testing would provide an evaluation of the current Intranet and, at the same time, build awareness. Small, narrow focus groups could be set up to evaluate and comment on specific Intranet components and suggest improvements for next versions. Interviews with individuals could serve the same purpose and, at the same time, provide an opportunity to introduce new users to the system and to mentor new Intranet champions.

A Strategic Intranet Process Model workshop made up of a few key people could be used to develop a plan for:

- Reviewing current state of steps 1-7 of the Strategic Intranet Process Model.
- As appropriate, revising objectives and redirecting tactics related to steps 1-7 of the Strategic Intranet Process Model.

- . Defining a path forward for implementing steps 8 and 9 of the model for the next-generation Intranet.

Action #3 cannot be successfully implemented until Actions #1 and #2 are complete. When that happens, there are a number of Web design methodologies that the project should consider. As part of the new ARL Science and Technology Academic Recognition System (S.T.A.R.S.) program, Tyrone Williams presented a Web development methodology this summer that extends the methodology used for designing the current Intranet (Williams 1998). The methodology presented adapts elements of classical software engineering methodology to Web-related programming languages and technologies. Other useful references are modeling tools described by Arocena and Mendelzon (1998) and Takahashi (1998) and lessons learned from the University of Georgia Intranet project (Dennis 1998).

## 10. Conclusions

Intranets are rapidly becoming the centerpiece of the new R&D enterprise computing phenomenon. The present analysis of government and leading industry Intranets reveals that the Intranet of any modern enterprise serves as a relentless internal mirror of the organization and its vision. It is as much political instrument as technological tool.

A second critical point of this analysis is that information and the processes that convert that information into **knowledge** are **common** to **all** enterprises, regardless of the organization's specific mission. What is special about the R&D organization is the fact that its principal product is knowledge. This has two important implications for an R&D organization: (1) It can draw upon "best of breed" Intranet experiences **from** any type of organization in any sector; and (2) An Intranet that provides knowledge management should be viewed as a "core" R&D function.

The case studies presented show that some industry leaders are successfully using an Intranet as a leadership tool to transform their enterprise into a knowledge-based organization. In each

case, this has happened through an evolutionary, planned process with strong financial, as well as personal, commitment from the top of the organization. Bottom-up approaches work well to awaken sleepy top management to the potential of an Intranet but appear to lead inevitably to a costly, uncontrolled excess of information not focused on business needs. As a result, as an Intranet matures and begins to tackle the thorny problems associated with the dynamic changes needed to compete in today's business climate, motivation of end-users becomes a major challenge.

From the case studies and trends analyses, we have derived three tools to **frame** and clarify the key issues and provide guidelines for their solution. Seven key **learnings** that are business-sector independent and appear to be critical to the success of strategic Intranets designed for midsize and large organizations have been identified. We have defined a **14-step** Strategic Intranet Process Model to provide a systematic method for applying these learnings to a specific organization. This model ensures that the Intranet solution supports and embodies the Corporate vision for that organization. We also have defined an Intranet classification structure to be used in conjunction with the process model for planning and architecting a strategic Intranet. Used together, these tools can help bring the focus an organization needs to build a strong relationship between its business goals, its information technology goals, and its culture.

We began by asking how you create an Intranet that projects an immediate sense of a **world-class** R&D organization. A pivotal finding of this analysis is that an Intranet is a magnifier of organizational realities. You create an Intranet that projects a world-class image when you create a world-class enterprise that is strategically enabled through information technology.

Another finding that is critically relevant to answering this question is that it is essential for an organization to clearly articulate its goals, policies, and ownership of processes in order to create an Intranet design that embodies the Corporate vision. Unless that is done, political factors and status quo organizational structures determine Intranet architecture and design. Any attempt to design the Intranet in ways that change process and information ownership results in power struggles.

Applying these findings specifically to the ARL Intranet shows that ARLinside is just one step behind the Intranet leaders. The initial conceptual vision of ARLinside as an enabler of “business computing” was particularly ambitious, resulting in an advanced, fourth-generation Intranet concept but omitting alignment with other critical enterprise objectives. With its current experience and technology base, the state-of-the-art perspective and tools presented here, and the recent rapid expansion of available third-party content, ARLinside is well equipped to move forward and become a leading R&D Intranet. We recommend a three-step action plan for accelerating the migration of ARLinside from where it is today to where it wants to be. Action #1 will harvest the current Intranet. Action #2 will apply this study’s key learnings, Strategic Intranet Process Model, and Intranet classification structure to develop a **roadmap** for the next generation ARLinside. Action #3 will start the journey by identifying a focused, quickly achievable Intranet project expected to have immediate and positive impact on the ARL research community.

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