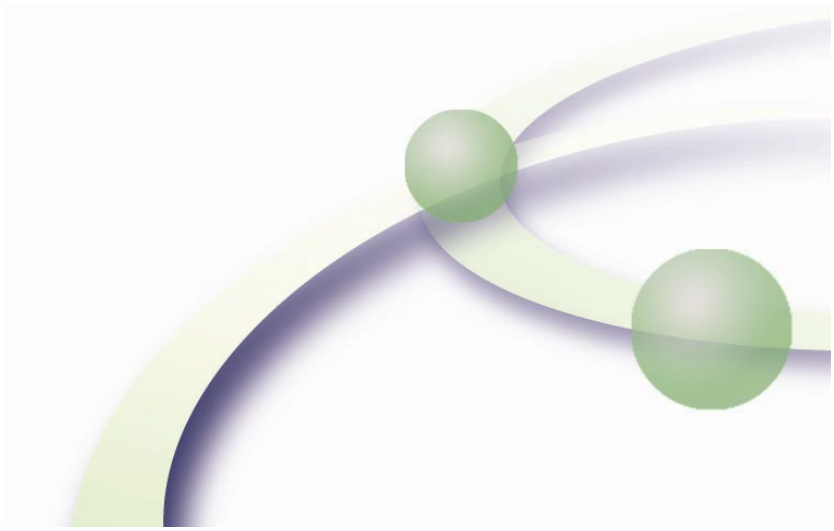


Communication, Collaboration & Technology:

Back to the Future

Ray Ozzie

Founder, Chairman & CEO, Groove Networks

Peter O'Kelly

Industry Analyst

Table of Contents

Executive Summary

Computing and networking technology has incredible potential to advance communication and collaboration, and, in doing so, to help improve personal, organizational, and inter-personal/organizational effectiveness and efficiency.

Unfortunately, the software industry, generally speaking, hasn't been particularly effective at capitalizing on the opportunities. Software tools for document-oriented collaboration, email, and instant messaging have certainly been useful in many respects. The mainstream state-of-the-art in communication/collaboration software, however, is discouraging when you factor in the increasing communication and information intensity of life in the 21st century.

It's time for a back-to-basics assessment of the goals, challenges, and opportunities in the application of technology to communication and collaboration…

We must advance business objectives and reduce costs by making collaboration more effective through the application of information technology. Instead most organizations have accumulated a hodgepodge of incompatible point solutions for communication and collaboration, most with dubious ROI. Most organizations also face severe challenges both in integrating collaborative applications and in addressing new requirements such as mobile/wireless devices, increasingly stringent government requirements for privacy and security (Sarbanes-Oxley, for example), the need for business continuity when outbreaks such as SARS can have immediate bottom-line implications, and our always-on work and lifestyles.

Today's collaboration challenges are primarily the result of rapidly changing technologies, business requirements, and global economic realities. Communication and collaboration patterns and dynamics have changed dramatically during the last 20 years, but nearly all of the software products designed to facilitate communication and collaboration haven't kept pace.

It's time for a back-to-basics assessment of the goals, challenges, and opportunities in the application of technology to communication and collaboration, and that's what this document is about. What follows is a new framework for assessing software products and their utility for communication and collaboration, along with some recommendations for information technology strategists.

As a preview, I believe that a new approach is required, one that:

- Is fundamentally designed around **workspace-centered collaboration**, complementing existing tools that are focused more on documents, messaging, and interaction.
- Exploits the **channels and items model** that ranges from email and instant messaging to more recent developments such as weblogs and RSS feeds.
- Provides a robust, high-performance set of **collaboration-conducive middleware** services that together enable complacency-immune privacy and security control, seamless mobility with local/off-

line execution, integral presence management and awareness, universal subscriptions with customizable notifications, and more.

- Incorporates a broad and flexible set of **templates and tools**, designed to complement and integrate with popular productivity applications as well as enterprise and Internet applications and services; these enable both immediate "out-of-the-box" business utility and strong synergy with existing tools and applications.
- Fully embraces the wide **spectrum of today's e-work and collaboration patterns and dynamics,** including mobile, occasionally connected, and multi-device usage patterns.
- Comprehensively supports the fluid mix of **personal and organizational work styles and controls** required for flexible personalization as well as robust systems management, integration, security and privacy.

What is a collaborative workspace?

A 'workspace' is a place where people are brought together, along with relevant information and tools, in order to get things done and solve business problems.

A preview of the recommendations:

- Focus first on fundamentals – real-world collaboration patterns and dynamics; too often, organizations have started with what was technically and economically feasible with then-available tools rather than what was the best form-follows-function fit for real-world business requirements.
- Next assess how connection technologies can support and augment collaboration.
- Inventory and evaluate your current communication and collaboration tools; most organizations have inadvertently collected several selectively redundant and incompatible tools, at great expense and complexity, which collectively fail to satisfy beyond-the-basics requirements. You can almost certainly do more with less in this context.
- Explore new opportunities and new tools that were designed with a more fundamental focus on collaboration requirements, avoid the now irrelevant historical constraints that plagued many earlier tools, and offer strong synergy with other tools and applications.

For the rest of this document, the path to the framework and recommendations includes:

1. A review of communication and collaboration concepts. The IT industry has inconsistently used and abused so many collaboration-related words and phrases that it's important to revisit the basics to ensure we're working with a shared context.
2. A review of computing and networking advances and some of the reasons why they have great potential for advancing communication and collaboration.
3. A summary of the current state-of-the-art, highlighting today's key challenges.
4. A new framework, building on all of the above, which I hope will help to build consensus on what needs to happen next if connection technologies are to become more broadly useful for communication and collaboration and reasons why the potential has not yet been realized.
5. An optimistic summary of the potential we can realize, if we're successful, and some recommendations for how we can get there from here.

Communication and Collaboration

Context

There's currently a great deal of chaos and confusion at the intersection of technology, communication, and collaboration. Entire market segments have appeared (and some subsequently disappeared) for groupware, teamware, contextual collaboration, workflow, knowledge management, and other areas. There doesn't seem to be much communication and collaboration among the purveyors of products in these areas, however; terminology and architectural approaches are often inconsistent and incompatible.

As such, the first step in understanding how computing and networking technology can be productively applied for communication and collaboration is to get back to basics – to focus on how people communicate and collaborate – without complicating the analysis by including technology dimensions.

Organizations that communicate and collaborate effectively are more responsive, productive, and flexible; people and resources are well leveraged and the organization is robustly connected with its environment…

Basics

In a business/organizational context, people communicate and collaborate in order to jointly accomplish purposeful work. From such a perspective, communication and collaboration are critically important for effectiveness and efficiency. Organizations that communicate and collaborate effectively are more responsive, productive, and flexible; people and resources are well leveraged and the organization is robustly connected with its environment (customers, competitors, partners, regulators, and so on).

Efficiency is also a fundamental goal for communication and collaboration, especially in today's increasingly decentralized world. People working in specialized roles must efficiently interact with others and with information resources in order to minimize coordination costs while maximizing organizational effectiveness.

The basis for understanding the quantifiable value of collaboration technology is rooted in Transaction Cost Economics (these concepts were explored as early as 1937 by Ronald Coase in The Nature of the Firm); that is, for any business process involving multiple people or groups, the returns for collaboration improvements can be approximated by:

$$ROC \approx \sum_{i=1}^{N} \Delta O_i + (\Delta I_i \times \Delta C_i)$$

ROC is the return on collaborative process change, and

N is the number of entities involved in a given work process

O is the overhead cost incurred in setting up collaboration between entities

I is the number of interactions back-and-forth to complete a work process

C is the real cost of each interaction, generally in terms of time or quality

I don't mean to imply that I think you should apply this formula in all contexts, of course, but I do think it's important to understand that there is a formal model that facilitates quantitative (effectiveness/efficiency) analysis of transaction costs, especially in today's ROI-focused business environment.

Patterns

There are several popular communication and collaboration patterns. One common pattern involves a focus on documents, processes, and projects.

- Document-focused collaboration endeavors include activities such as the creation of quarterly financial reports, employee performance evaluations, and customer interaction reports. The documents are used to communicate news, status updates, proposals, and other initiatives, and they become part of the "organizational memory" (often with very precise filing, retention, and auditing policies). Generally speaking, people collaborate to produce documents that communicate information to other people.
- Process-focused collaboration is more about actions and transactions than document production. Examples include activities such as performing an audit, reviewing a product design to assess manufacturability, preparing a sales proposal, resolving a customer support issue, making a product pricing or packaging decision, establishing employee objectives, and evaluating candidate employees or suppliers.
- Project-focused collaboration is typically more loosely structured and often more elaborate than process-focused collaboration. A project might focus on improving profitability or customer satisfaction, coordinating a deal, creating new product offerings, or developing an innovative marketing campaign. On a personal level, a project might be focused on building a home or determining the itinerary for the next family vacation.

Another popular communication and collaboration pattern involves a flow among subscription, notification, assembly, action, and publication activities.

- Subscription involves registering or otherwise making your interests known. If I work in the marketing group, for instance, I'm probably interested in competitors, advertising techniques, and business analytics.
- Notification entails communication to advise you when something has transpired in one of your subscription domains, for example, when a competitor launches a new product or an advertising agency promotes a new campaign model. (Note that subscription and notification are conducive to collaboration but are not inherently collaborative on their own.)
- Assembly means coordinating with others who have a shared context such as common interests or responsibilities, e.g., inviting team members to meet in a shared workspace to start brainstorming about potential responses to an event notification.
- Action is what people do in a joint workspace after assembling because they've been notified about something that transpired in one of their common subscription/interest domains. The action will almost certainly involve documents, processes, and/or projects.
- Publication follows action; when the collaborative activity has produced results or otherwise taken actions, a record of the joint work is produced and communicated. The cycle often then begins again, as others are notified of the publication of new information in one of their subscription/interest domains.

These patterns are prevalent in all types of organizations and across all cultures; they are how we collectively get things done.

Dynamics

Of course, the communication and collaboration patterns are rarely undertaken in isolation, and they often result in changes in the environmental conditions that led to their creation. Some examples:

- Documents often result in the creation of new projects or processes. A document describing a new competitive threat could result in the chartering of a new project focused on developing a competitive product response. A document addressing the challenges and opportunities in the application of technology to communication and collaboration endeavors might, if successful, lead a group of people to engage in a multi-organization project to advance interoperability and related standards.
- Processes and projects generate documents, both deliverables (i.e., one goal of the process or project is to produce a document) and artifacts (records of activities undertaken as part of the process or project, often required for auditing or other policies).
- An instance of subscription/notification/assembly/ action/publication (hereafter "SNAAP") cycle often spawns several more instances and can easily lead to changes in the environmental context in which it transpired.

High-performance teams often design their physical work environments to facilitate SNAAP activities, with closely-knit team members working in adjacent offices and a common group

workspace. Any team member can easily grab other team members and assemble in the group workspace to take action upon notification of important events.

Another important communication and collaboration dynamic is the fact that there is no one "right" approach in the use of workspaces and communication channels. Some people are "interrupt-driven" and prefer to work by subscribing to multiple channels; others are more work-and workspace-focused and strive to minimize interruptions and distractions. Most people use a mix of workspaces and channels.

Again, there are no major headlines in this analysis; people have been communicating and collaborating with these patterns for eons. Indeed, perhaps you noticed that this section has thus far been largely devoid of technology concepts. The communication and collaboration basics, patterns, and dynamics described thus far apply equally well to ancient Egyptians building pyramids and modern-day e-lancers swarming via Web conferencing to jointly brainstorm on a project proposal to a multinational corporation.

In all cases, communication and collaboration are most effective and efficient when people are working within a shared context – in a shared, secure workspace containing documents, artifacts, and tools – and are guided by a common sense of goals, patterns, and dynamics. The importance of context and precision cannot be overstated; people attempting to collaborate without a deep shared context are always less effective and efficient because of high coordination costs and increased potential for misunderstanding or miscommunication.

…each time there has been an improvement in "connection technology" … it has had an impact on the pace and nature of personal interaction as well as the pace and structure of business interaction.

But as timeless and technology-transcendent as these patterns have been, a number of technology-induced changes have occurred during recent years that have irrevocably altered the ways in which people work and interact:

- The boundaries between work and non-work (and vocation/avocation) have become very blurry, in part because of organizational "reengineering" (the need to do more with less) and in part because tools such as email and mobile/wireless devices have made it relatively simple and inexpensive for people to be accessible all of the time.
- Similarly, the information and communication intensity of life outside the workplace has steadily increased. Whether it's a car-pooling "soccer parent" or a hobbyist who has incorporated blogs into their ongoing research, tools that were once used primarily in enterprises are now commonly used in all facets of communication and collaboration. One corollary is the high desirability of having tools that seamlessly combine both activity domains; people don't want distinct sets of communication and collaboration tools for different activity domains any more than they want to carry multiple phones for different facets of their lives. In other words, the needs to minimize coordination costs and to maximize communication and collaboration effectiveness are now universal challenges.

A final note on dynamics: each time there has been an improvement in "connection technology" e.g. the technologies that bring us together (from roads to the telegraph to the Internet), it has had an impact on the pace and nature of personal interaction as well as the pace and structure of business interaction. The next section includes a review of key

computing and networking connection technologies and the patterns and dynamics embodied in many of today's popular collaboration-oriented products.

Connection Technologies

Context

Computing and networking technology has great potential to increase communication and collaboration efficiency and effectiveness, but progress toward realizing the potential has, to date, been very uneven. This section includes an overview of technology-related dimensions, and the next section highlights challenges most organizations face today at the intersection of technology, communication, and collaboration.

Basics

Modern computing and networking technology can do amazing things for communication and collaboration. Some specifics:

- Data can be communicated in a broad variety of ways, from wireline to wireless. A modern commodity notebook computer has built-in network connectors representing five orders of magnitude difference in bandwidth, from dial-up modem to USB to 10Mb, 100Mb and 1Gb Ethernet connections.
- Inexpensive personal computers have immense computational capacity that can be devoted to intensive tasks such as graphical rendering and data encryption.
- Massive amounts of data can be stored, searched, and retrieved at very high speed, even on commodity personal computers.
- Personal computing devices have tremendous mobility, enabling communication and collaboration in a way that matches human lifestyles.

… technology has great potential to increase communication and collaboration efficiency and effectiveness, but progress toward realizing the potential has, to date, been very uneven.

- Digitized objects (documents and multimedia) and artifacts can be shared easily.
- Processes (actions and transactions) can be automated and managed, e.g., overcoming constraints of place and time to globally do business on the Internet.
- Messages can be exchanged in multimedia (text, voice, audio, etc.), both synchronously (real-time) and asynchronously (stored and forwarded).
- Tools can be used to add value to data through analysis, filtering and other techniques, e.g., to maintain visibility into a project schedule or as Amazon does with its recommendations service.

At a fundamental level, computing and networking technology can help to overcome many historical constraints in communication and collaboration. Conceptually, I can give you something and still have it (a difficult trick with non-digitized objects and artifacts), and place, time, and distance constraints can be greatly alleviated.

Patterns

Three architectural patterns are prevalent among currently popular products designed to facilitate communication and collaboration:

- Document-centric products focus on content, documents, pages, or sites (webs of documents/pages). Vendors such as Documentum, FileNet, and OpenText compete in this market segment.
- Message-centric products focus purely on message transmission, storage and management, and commonly include tools for calendaring/scheduling. Outlook Express and Eudora are examples of popular message-centric client products.
- Interaction-centric products focus on maintaining interactive conversational sessions among a number of individuals. It's important to note that there are three primary architectures of interaction-centric products: real-time, server-based, and purely client-based, satisfying a range of interaction needs from short-lived to long-lived sessions, from the synchronous/ephemeral to the asynchronous/persistent, and from simple textual interaction (e.g. AIM) to joint co-editing of CAD images (e.g. PTC Pro/E).

In addition, two "integration" patterns are prevalent – treating document-centric, message-centric and interaction-centric tools as services or components integrated into higher-level designs:

- Aggregation-oriented products represent attempts to combine communication and collaboration services into unified user interface frameworks for personal convenience and customization. Portal products represent an attempt to aggregate such services in the context of websites, while "integrated collaboration environment" products such as IBM Lotus Notes and Microsoft Outlook represent attempts to aggregate such services in the context of rich clients.
- Solution-oriented products represent attempts to "contextually" integrate communication and collaboration services into enterprise applications such as SAP, Siebel, and PeopleSoft for operational, sales, and human resources actions and transactions.

Product vendors in these categories historically have attempted to contrast their offerings more on the basis of "enterprise abilities" (scalability, manageability, and so on) than on their potential to advance communication and collaboration effectiveness and efficiency as previously described in this document.

Dynamics

Computing and networking technology evolve at an astounding rate, advancing through several "generations" since the broad deployment of information systems began less than 50 years ago. Some of the dynamics that are important to consider in this context include the move to "smart", mobile devices and a very rapidly changing distribution of effort among utility, application, and solution layers.

A smart device has considerable built-in computing and communication capabilities, facilitating local execution of tools and applications and occasionally-connected networking models. Laptop and tablet computers are examples of mobile smart devices, as are, increasingly, personal digital assistants (Palm, Pocket PC, and Symbian devices) and late-generation, multi-function phones (typically running on a proprietary, Symbian, or Microsoft SmartPhone platform). People working with such devices can benefit from using communication and collaboration patterns that wouldn't have been practical for tethered (network-connected via a wire), desktop-oriented computing, so the adoption of the new device types and networking modes is a very important dynamic.

The significance of the rate of change in this context is difficult to overestimate, and it has fundamentally altered the economic models (price/performance, etc.) in connection technologies. The list of capabilities in the Basics section above, for example, while often taken for granted today, would have seemed like woefully optimistic science fiction to most people only ten years ago – when, incidentally, many of today's communication and collaboration software products were already on the market.

The distribution of effort among utilities, applications, and solutions is another key dynamic. For this context:

- A utility is a capability or service that is effectively ubiquitous, and is often guided by industry consortia or standards organizations. Examples include TCP/IP and recent XML Web services developments.
- An application is a purpose-built tool for a specific domain, such as a word processor or a customer relationship management client.
- A solution generally involves custom development work, either for unique business requirements that aren't practically addressed by applications or to integrate otherwise disparate applications and utilities.

The distribution of effort among these layers has been very fluid during recent years, largely due to consolidation in the software vendor market and the commercialization, standardization, and broad deployment of Internet-related formats and protocols. Some examples:

- Official and de facto standards have in many domains expanded to subsume previously proprietary products and services. TCP/IP and XML, for example, now dominate networking protocols, and XML is rapidly growing to dominate data storage formats as well.

- Broadly useful applications tend to disintegrate into utilities. Many would argue that Microsoft Word and Adobe Acrobat have evolved and have been sufficiently widely deployed to become more of a set of utilities (for content rendering and editing) than their application roots. Messaging tools (both email and instant messaging) are also examples of applications evolving into utilities. As another example, the Windows SharePoint Services technologies included with Windows Server 2003 are more utility than application, a leading indicator of the portal application market segment evolving into sets of utilities.
- Broadly applicable solutions often evolve into applications. Market segments such as enterprise resource planning, human resources management, sales force automation, and customer relationship management are examples. Fifteen years ago, most organizations built their own solutions in these areas; now almost all enterprises buy and customize applications from vendors such as Microsoft, Oracle, PeopleSoft, SAP, and Siebel.

This is a great time to be a customer in the information technology business. The devices, tools, and services available today, both for organizations and for individual consumers, offer capabilities and price/performance metrics that would have delightfully surprised even the most optimistic technologists of previous generations, and in many ways we're just getting started. The evolution of hardware and network services has been much swifter than the development of communication and collaboration software, however, and the ramifications are now being painfully felt by both organizations and individuals.

Challenges

In practice, the technology products and patterns most widely used today are not a great form-follows-function fit for communication and collaboration patterns and dynamics, and this misfit produces many challenges. The software industry has done reasonably well with basic communication-oriented utilities and applications, but progress in beyond-the-basics collaboration-focused software has been relatively discouraging. This section outlines many of the resulting challenges.

Security and Privacy

There has been a lot of discussion about security and privacy in computing and networking contexts during recent years, but the stark reality today is that most communication and collaboration products are sorely deficient in their support for even the most basic security and privacy requirements from either the perspective of an individual or an organization. Digital rights management and role-based authentication are inconsistently applied, for example, and inter-organization (or inter-personal, extra-organizational boundaries) communication and collaboration are commonly done with tools and services that offer little or no provisions for security and privacy.

In some cases the attendant lack of risk management stems from inadvertent complacency, i.e., people who don't realize the tools they're using are insufficient for security and privacy. In other cases the inadequate responsibility for security and privacy results from a lack of reasonable alternatives. If someone needs to communicate and collaborate with people outside their enterprise in order to get work done and their choices are 1) a multi-month wait for their enterprise's IT group to register outside participants in an enterprise directory;

2) resorting to phone, fax, and/or overnight delivery services; 3) sending file attachments in email over the Internet, it's certainly not uncommon for the third choice to become the default, even when people vaguely understand that it's not a secure or private choice.

Security and privacy policies also often lead decentralized workgroups to make locally sensible but globally unfortunate compromises, such as using point solutions that result in redundant administrative work and the creation of objects and artifacts that are invisible or inaccessible to others within the organization. Coordination is either precluded or supported only with exceptionally inefficient work-around techniques that typically defeat the security and privacy requirements that initially led to the deployment of the point solution.

The rapid evolution and broad deployment of mobile devices and wireless networking models has also resulted in some significant and mostly under-appreciated security and privacy challenges. Consider the increasingly common use of wireless Internet access at hotels, Starbucks outlets, conferences, and other domains. Most of the people who take advantage of these wireless networking services are blissfully ignorant of the ease with which others can use "sniffer" tools to capture data, messages, and interactions.

Most of the people who take advantage of these wireless networking services are blissfully ignorant of the ease with which others can use "sniffer" tools to capture data, messages, and interactions.

Flexibility

While individual products designed for communication involving documents, messaging, interaction, and aggregation may suffice for their designated purposes, they aren't sufficiently flexible for broader communication and collaboration needs. Email, for example, is useful for basic messaging but is not an effective context for collaboration, and the misapplication of email is one of the key reasons why so many people spend a disproportionate amount of (generally unpleasant) time toiling in their email inboxes every day.

The inability to easily leverage objects and artifacts across contexts is another ramification of inadequate robustness. It's not uncommon for communication in one context to lead to collaboration in another context, but most of today's tools aren't sufficiently robust to seamlessly support such dynamics.

Mobility

Most of the communication and collaboration tools in use today have very limited support for mobile workers, devices, and workspaces. Indeed, the Web client wave has in many ways reversed earlier progress in personal computing tools and applications, with most Web applications being unusable when network-disconnected.

Limited support for mobility is challenging in several respects:

- It constrains people to primarily working on a single device, often a desktop or laptop computer, and leaves synchronization across devices as an exercise for the user (e.g., the user is responsible for ensuring the document on which they're collaborating at work is somehow securely copied to their home PC if they need to work on it at home).

- It turns devices into underachievers, by failing to exploit the power of mobile devices with local application, storage, and networking capabilities. A laptop user constrained to Web-centric collaborative applications, for instance, basically has an expensive "dumb terminal" – it may be used to communicate and collaborate only as long as it's network-connected (for intranet applications, this almost always entails a VPN connection for networking outside of the organizational domain).
- Workspace-oriented tools, objects, and artifacts are not easily shared. It's once again an exercise for the user to ensure that colleagues are updated with the most recent document versions, for example.

Mobility constraints will become even more problematic as tablet form-factor PCs grow in popularity over the next few years.

Multiple Devices

In most cases, the use of laptops, PDAs, smartphones, and tablets is additive; we're using more devices instead of replacing existing devices, and it's getting much easier and cheaper to connect other devices, such as webcams, security systems, and in-board systems in cars and other vehicle types. Most people are rapidly moving into multi-device work and lifestyles, but today's means of synchronizing digital stuff (data and personal preferences/profiles) among the devices are often manual and incomplete. We need to move toward a world of robust remote device access and secure, federated, self-synchronizing groups of devices, so that people won't have to worry about object location and versioning issues.

We need to move toward a world of robust remote device access and secure, federated, self-synchronizing groups of devices, so that people won't have to worry about object location and versioning issues.

Scalability

While the enterprise "abilities" have been successfully addressed by some software vendors, different types of communication and collaboration scalability boundaries can present challenges. Moving a collaborative project beyond enterprise boundaries, for example, is often either impossible or impractical, since many enterprise-oriented collaboration tools are designed for exclusively behind-the-firewall intranet contexts and do not scale to accommodate participants who are not included in the organization's directory.

Another type of scalability involves the shift from personal to group collaborative contexts (or vice versa). Today's communication and collaboration tools are often limited in their support for personal work, so moving from personal to group contexts often means switching applications, another exercise for the user.

Inconsistency, Isolation, and Incompatibility

People often have to work with a combination of tools for a given communication and collaboration context, and in most cases the tools are inconsistent, isolated, and incompatible. A multi-site presentation review (such as a sales briefing for a new product launch) typically entails the use of a conference call, videoconferencing, application sharing tools, and perhaps sub-discussions using instant messaging, with several different and inconsistent product vendors and service providers involved. On-line services such as

WebEx offer some simplification, but they are intended (and priced) primarily for enterprise customers and either operate in an ephemeral mode or produce artifacts that aren't easy to manage within an organization.

Isolation of objects and artifacts is also challenging; many of today's applications are like "data roach motels" – data goes in but rarely comes out, and can't be readily leveraged in other contexts. Some "knowledge management" vendors have attempted to provide solutions to address the challenge, but they are often brute-force (e.g., index everything and hope somebody finds a useful way to apply it), counter to organizational norms, or of very limited utility because of security and privacy requirements. Of course, such tools, when used in environments with weak security and privacy policies, only serve to amplify the problems and risks.

Incompatibility is a huge problem for communication and collaboration dynamics. It's not uncommon, for example, to have an instant message exchange expand to become the basis for a meeting or project, but it's often difficult or impossible to evolve the instant message exchange (the transcript artifact) into a document within a process- or project-focused workspace. Most people start over when faced with such context-shifts, wasting time and attention.

Shallow Shared Context

The number of and incompatibility among tools makes it exceptionally difficult to build and sustain shared context. In most cases it's challenging to coordinate around file versions, let alone sharing tools, artifacts, and processes. Email is especially problematic for shared context. As a result, the reality today is that most organizations use computing and networking for communication but not for collaboration; they can transmit and share documents and messages, but they can't readily leverage technology-enhanced collaboration because they don't routinely use workspace-centric tools for collaboration.

Limited Autonomy and Personalization

As previously noted, individuals who wish to collaborate with others often face a decision between waiting for support from their organization's IT group or (complacently or inadvertently) relying on tools that are deficient for security and privacy requirements. In a surprisingly large number of contexts, however, people don't even consider technology's potential for collaboration – their needs go quietly unmet or at best under-served because of a lack of autonomy and personalization.

Organizations that aren't large enough to warrant an IT group or to be targeted by collaboration software vendors face similar choices – going with an insufficiently secure solution or reverting to phone, fax, and other previous-generation communication-oriented alternatives that are even less useful for collaboration.

Personalization is also generally limited, especially in terms of integrating multiple facets of an individual's work and personal life. This makes the use of leading communication and collaboration technologies a distinctly mixed blessing; the tools are often useful for specific needs but collectively result in disintegrated user experiences, each with its own interface, formats, and dependencies (e.g., on external service providers), often resulting in people

opting for the least common denominator, email, whether or not it's appropriate and sufficiently secure.

Poor ROI, Rapid Obsolescence, and High Risk Exposure

Moving beyond user and IT challenges to business metrics, today's communication and collaboration state-of-the-art also generally results in:

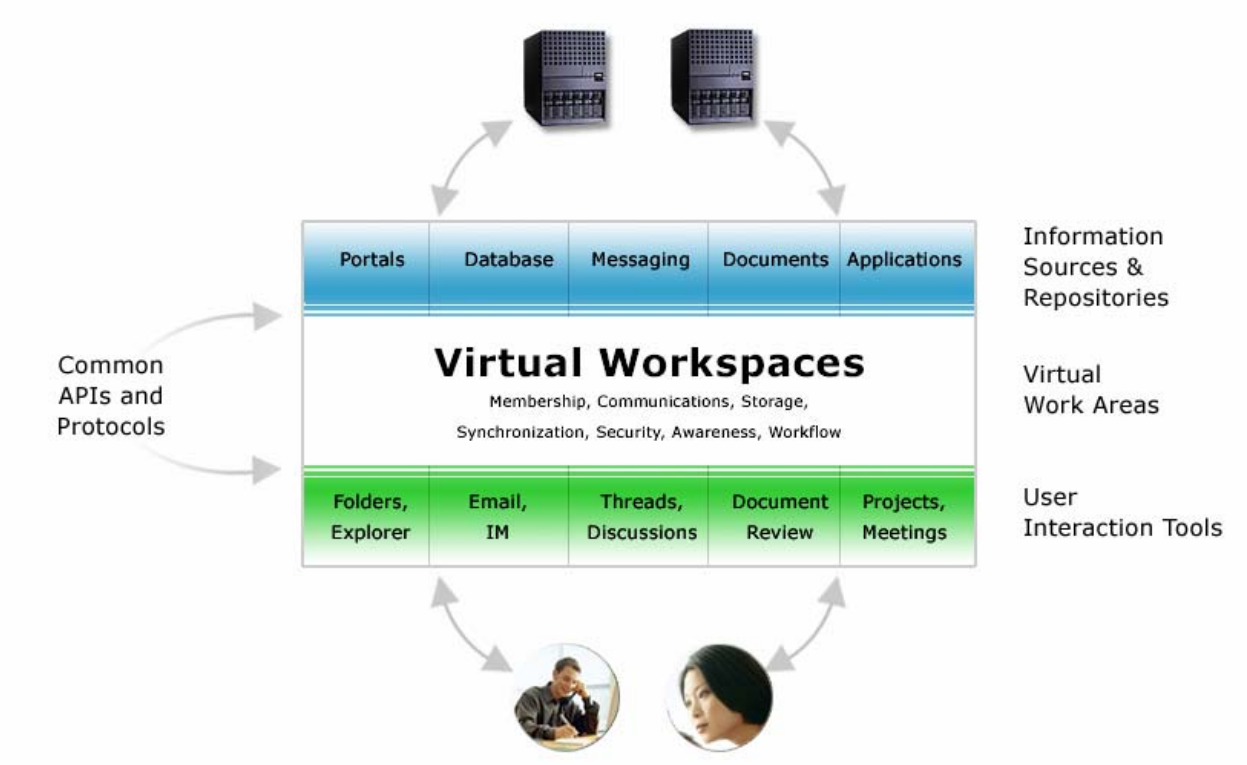
- Questionable return on investment: the products are typically expensive to purchase, deploy, and manage, and business results are elusive and/or practically impossible to quantify.
- Rapid obsolescence: communication and collaboration products that have been in the market for several years tend to be too monolithic and fragile to embrace utility/application/solution dynamics, leading to accelerated depreciation and even complete investment write-offs.
- Unacceptable risk exposure, both in terms of security and privacy exposure and in basics such as auditing requirements. An organization using a disparate collection of point-solution products and services for communication and collaboration is often, from an auditing perspective, simply out of control. The instability among many service providers in this context can also present significant business risks.
- Pain and expense at the user level. The need for multiple tools to meet a range of collaboration functionality forces users to learn multiple tools and to spend time integrating data/activities across tools. It also drives users to continue to search for new tools that then must be evaluated and supported by IT.

Back to the Future: A New Approach

Context

We clearly need a better form-follows-function fit among communication, collaboration, and connection technologies. Most existing products were designed and developed with deliberate compromises (in scope, interoperability, flexibility, and other areas) due to computing and networking constraints that are now mostly irrelevant, and many also failed to transcend the relentless utility/application/solution dynamics.

To build better products for communication and collaboration, we need to get back to basics – to revisit the ways in which people actually communicate and collaborate in the real world, to factor in the opportunities presented by computing and networking technology, and to then design products that embody the best of both worlds. It's fundamentally important for software products to directly support the communication and collaboration patterns and dynamics people naturally use, rather than just dealing with subsets of the problem space and leaving integration up to unsuspecting and overwhelmed individuals and organizations. We need to go back to the future, to recapture the early enthusiasm for how communication and collaboration technologies can augment interpersonal interaction while avoiding the limitations that have constrained earlier collaborative software products.



The new approach includes:

1. An application model centered on shared workspaces and channels.
2. A collaboration-conducive middleware layer with comprehensive services for security, synchronization, and other requirements.
3. A fundamental commitment to maximize personalization and autonomy while also optionally optimizing organizational integration.

Basics

Workspace-centricity: everything starts with a workspace-centered approach. People collaborate in workspaces filled with shared tools, objects, and artifacts, so software-facilitated collaboration products must follow the same approach. Some specifics, as suggested in the diagram above:

- Workspaces contain tools, objects, and artifacts. Tools may be combined into templates for common collaborative domains (such as documents, processes, and projects). A wide variety of object types are supported (documents, attachments, discussions, diagrams, and so on) and artifacts (e.g., chat transcripts, previous versions of objects) may be easily captured and managed.
- From a user's perspective, workspaces are easy to use in conjunction with popular desktop utilities and applications. Users may opt to use Microsoft Word as their primary document editor within the

workspace, for instance, or to use Microsoft PowerPoint for group presentations and discussions within the workspace. The objects and artifacts created within the workspace must also be readily usable in other utilities and tools, e.g., copying and pasting diagrams or document outlines into PowerPoint and Word.

- From an enterprise perspective, the workspaces must be simple to use in conjunction with enterprise and Internet utilities and applications, including those focused on documents, messages, and interaction. To maximize utility and minimize redundancy, for example, it must be easy to integrate workspace tools with enterprise messaging utilities and applications such as SAP and PeopleSoft. It must also be straightforward for the workspace-based tools to both consume and produce XML Web services.
- From a developer's perspective, workspaces, tools, objects, and artifacts must be simple to incorporate into business solutions. Developers may extend tools and create new tools using leading integrated development environments (IDEs, such as Microsoft Visual Studio.NET).

Channels and items: workspaces are ideal for document, process, and project-centered collaboration. Channels complement workspaces by providing a means of monitoring other information flows such as RSS (Rich Site Summary, increasingly used to publish weblog content) and NNTP (Network News Transfer Protocol) feeds. The distinction between workspaces and channels is often a personal or contextual choice, e.g., I may elect to be sent daily summaries of all new activity within your workspace, in which case your workspace is more of a channel than a workspace, as far as I'm concerned.

The use of XML-based, technology-independent standards such as RSS is a key enabler for channels, as it permits a great deal of flexibility and personalization.

The use of XML-based, technology-independent standards such as RSS is a key enabler for channels, as it permits a great deal of flexibility and personalization. When managed in an RSS-centric level of abstraction, in which information flows are expressed as channels and items, individuals can use the tools (along with services for filtering, searching, and organizing) they find most productive for a variety of channel-oriented information resources. Options range from stand-alone reader/browser clients such as NetNewsWire (http://ranchero.com/netnewswire/) to offerings such as NewsGator (http://www.newsgator.com) which extend Microsoft Outlook with more channel-oriented capabilities.

Collaboration-conducive middleware: while the overall workspaces and channels application model is simple and intuitive, the underlying service layer required to make it all work – securely, flexibly, and reliably – is expansive and intricate. Some of the most important services that must be provided in a manner that doesn't unduly complicate the user conceptual model include:

- Security and privacy: all workspaces and channels must be fully secure and private by default – complacency immune. This requires a comprehensive and map-able approach for identity, authentication, workspace roles, and other related services. From a user's perspective, security is pervasive and always-on; it's not a manual option that can be easily overlooked. From an organizational perspective, workspace services for security and privacy must also seamlessly accommodate enterprise security and system management products.

- Mobility and local operation: while complementary to Internet-centric standards and services, the workspace and channel environments must also fully exploit the power and mobility of emerging device types. From a user's perspective, the environment must look and operate the same whether or not a network connection is present, and synchronization (tools, objects, and artifacts) must be automatic and unobtrusive. From an organizational perspective, all of the above must be provided in a model that is robust, in order to minimize support costs, and secure, since devices are occasionally lost or stolen.

- Universal role-based membership: people have different roles in different collaboration contexts, and the workspace and channels environment must support role definitions. For many workspace needs, roles such as manager, participant, and guest will suffice; for more advanced needs, solution developers must be able to create additional role types. Roles are assigned privileges within workspaces, e.g., a participant may be able to add and change objects but not change or delete others' objects, or change the overall workspace environment.

- Integral presence management and awareness: users must be able to manage and communicate their personal status (available, busy, and so on – as with instant messaging utilities) and easily stay aware of others' presence status. Presence awareness must be available at multiple levels of abstraction: system-wide, within specific workspaces, and at the tool level.

- Flexible subscriptions and notifications: users must be able to subscribe to workspaces and channels of personal interest, with a variety of notification options (scope, frequency, and communication medium). For example, one user might elect to see unread indicators within a workspace visited periodically and instant message-style notifications for workspaces used to facilitate time-sensitive projects, while another user may elect to have all workspace and channel-related notifications appear as unread indicators within a newsreader client.

Personal autonomy with organizational integration: in order to accommodate our increasingly connected work styles and personal lifestyles, the new model must also effectively balance the need for personalization and autonomy with organizational practices, policies, and services. Some specifics:

- The workspace and channels environment must be fully usable without IT support (while also being IT-friendly). Groups of people with no IT support should be able to install and use the product without any technical support and without requiring a hosted application server somewhere on the Internet.

- Individuals must be able to establish trust levels for others they communicate and collaborate with in a manner that is complementary to and compatible with organizational policies. This hybrid "web of trust" model is directly analogous to how people work in the real world, but very few products embody the approach today. The trust model should also extend to information or classes of information, allowing a mapping between the user trust level and content.

- Standards-based, self-describing, and loosely coupled: tools and artifacts created within workspaces must be completely self-describing in a standards-based, technology-independent model, using XML and XML Schema. Support for de facto standards such as Microsoft file formats and inter-application communication protocols is also required. Loose coupling means the product is designed to flexibly embrace changes in the utility/application/solution mix. It must be possible for the workspace environment to accommodate new presence awareness services, for example, without breaking existing applications or making major changes to the user experience.

Patterns

The new model must support all of the communication and collaboration patterns people routinely use without unnecessarily complicating the workspace environment with technology-related concepts. In practice, this entails:

- Templates and tools designed to address document, process, and project-oriented collaboration, including a combination of 'out-of-the-box" templates and tools and a software developer kit for developers who wish to create custom tools and templates.
- Full support for the subscription/notification/assembly/action/publication work cycle, with an intuitive conceptual model for the technology-related enablers that make it possible for teams to SNAAP together in a manner similar to physically co-located teams even when they're working in different places and time zones, and with no shared IT infrastructure.

On the technology side, the document, message, and interaction architectural patterns must be supported in a way that does not constrain user experience or overall flexibility. All three primary modes of interaction (real-time, server-based, and client-based) must be seamlessly supported, i.e., the tools must naturally augment the work context without distracting users from the task at hand. In addition, the workspace and channel environment must be compatible with aggregation- and solution-oriented integration patterns.

Dynamics

Goals here include:

- Flexibly and seamlessly supporting transitions among document, process, and project patterns.
- Supporting role- and work state-based individual preferences for workspaces and channels.
- Providing a consistent, no-compromises user experience whether network-connected or disconnected, using a desktop PC, a Tablet PC, or other device type. Synchronization among different devices and work modes must be unobtrusive and automatic.
- Transcending changes in the utility/application/solution layers in a way that doesn't disrupt user experience. In practice, this entails an architecture built on components, XML Web services, XML Schema, and support for official and de facto standards.

In summary, there's a bit of a paradox in the "basics" for the new model; in order to help people use connection technologies to communicate and collaborate more effectively, it's necessary to build on an expansive, intricate, and flexible service layer without complicating the user experience for people who want to stay focused on workspaces and channels.

Conclusions and Recommendations

Surrounded by New Opportunities

There have been several false starts and dashed hopes in products and services focused at the intersection of communication, collaboration, and connection technologies. At a personal level, many of us are overwhelmed. We're chained to email and the Web, drowning in an information and notification flood that leaves us feeling more and more like human message-processing machines.

At an organizational level, experience with communication and collaboration products and services has been expensive and cumbersome, with business results that are usually difficult to measure and disappointing. The IT people responsible for selecting and managing the tools are also often painfully aware of the attendant security- and privacy-related risks; those who remain blissfully unaware of today's security and privacy requirements will have some very nasty realizations in the near future.

It's inevitable that the IT industry will overcome the challenges and better avail itself of the opportunities simply because the opportunities are so great and the implications of not more effectively dealing with the challenges are completely unacceptable at both personal and organizational levels.

There has been a tendency during recent years to accentuate the negative – to focus attention more on what hasn't worked than on the compelling potential of what has yet to be realized. This isn't surprising, given the recent turbulent economic times, the post "Internet bubble" IT market realities, and the often indefensible business results produced by earlier communication- and collaboration-oriented products and services.

Accentuating the positive, it's now clear that the IT industry is poised to deliver breakthrough effectiveness and efficiency through the use of connection technologies for communication and collaboration. It's both desirable and mandatory, in that people and enterprises that avail themselves of the opportunities will be much more responsive, productive, and competitive than those which pessimistically extrapolate from earlier experiences and conclude a better way is not forthcoming.

…the IT industry will overcome the challenges… simply because the opportunities are so great and the implications of not more effectively dealing with the challenges are completely unacceptable at both personal and organizational levels.

Recommendations

The path forward need be neither disruptive nor expensive. You can make a series of tactical moves that will leave you and your organization better prepared to capitalize on the strategic opportunities.

1. **Focus on fundamentals:** the first step toward more efficient and effective leverage of connection technologies is to understand and appreciate the inherent complexity in how people communicate and

collaborate. The overview in this document is a good start, but you must also be mindful of influences such as organizational culture, incentive systems, and policies. No technology will facilitate improved collaboration among people who are implicitly or explicitly discouraged from collaborating.

2. **Think form-follows-function**: add the attributes outlined in the "Back to the Future" section to your product/service evaluation criteria. You don't need to "rip and replace" current tools, but your future architecture should be workspace- and channel-centered, personally and organizationally friendly, deeply secure and private, open and standards-based, and designed to fully exploit smart, mobile devices.

3. **Reduce dependencies on point solutions and consolidate around fewer products and services.** Most organizations have large collections of mostly incompatible and highly redundant communication and collaboration tools; taking a comprehensive perspective and focusing efforts around workspace-centered tools can often lead to immediate expense reductions as well as improved effectiveness and efficiency. Inventory and evaluate your current investments; your organization is probably using more communication and collaboration products than you suspect.

4. **Take it personally:** autonomy and personalization are critically important considerations. Enterprise integration and adherence to organizational policies are basic requirements, but a high degree of enterprise-compatible autonomy and personalization are also fundamentally important for today's increasingly integrated work and personal lifestyles.

5. **Be proactive and collaborate with your partners and suppliers:** your product and service suppliers need to fully appreciate your requirements in this context, as they may otherwise continue to set priorities similar to the ones that produced today's deeply challenged communication and collaboration environment.

6. **Explore new opportunities and new tools that were designed with a more fundamental focus on collaboration requirements,** avoiding the now irrelevant historical constraints that plagued many earlier tools, and that offer strong synergy with other tools and applications.