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An Architecture and Business Process Framework for Global Team Collaboration

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An Architecture and Business Process Framework for Global Team Collaboration

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ABSTRACT

Tools for remote team collaboration within businesses have been available since the mid-1980s. Two opposing trends cause complete collaboration solutions to remain elusive. On the one hand, core tool capabilities are developed as point solutions, and then extra functions are added. These added functions may not integrate well with or be as fully developed as the core functionality. On the other hand, enterprises are rapidly globalizing and becoming more dependent on comprehensive collaboration applications to coordinate distributed teams. This means that overall productivity is affected by how well tools, processes, and capabilities are integrated; the tools should not be just a collection of separate features/functions.

An audit of collaboration tools used at Intel showed both overlaps and gaps between remote tools and day-to-day activities of workers. When an employee has so many tools to choose from and furthermore, works on multiple teams, the choices become overwhelming and confusing. The underlying architecture of a realistic solution to these overlaps and gaps must provide integration interfaces within the team collaboration environment, and to other business applications, information technology services, and infrastructure. In this paper, we describe a multi-level approach to integration, and we discuss unique findings about Intel's remote teams that justify our model. An essential element of progress towards the goal of an integrated solution will be the deployment of enabling platforms and the likelihood that these practical, indeed necessary, innovations in collaboration will also provide market pull for Intel's core products. By identifying and addressing our own needs, we can also provide solutions for a significant percentage of the Fortune 500 market that engages global workforces for knowledge work.

INTRODUCTION

Global expansion, outsourcing, competitive pressure to do complex projects more efficiently, and increased focus on work-life balance drive the need for employees to collaborate more effectively.

Globally expanding companies face challenges in melding multiple cultures with diverse values, histories, and perspectives. This can make it hard for individual employees to understand their colleagues even when they share a corporate culture–especially when a company is functionally distributed.

Today, we use information systems to improve the productivity of individuals or to automate tasks. However, these mainstream information systems do little to improve the ability of groups of people to work together on collective tasks such as collaborative problem analysis, idea synthesis, decision making, design, conflict resolution, and planning. Team productivity and performance has the potential to yield exponential results due to synergistic factors, knowledge creation and construction, diverse perspectives, and coping with complexity.

Almost every business process or project involves some form of collaboration and coordination between participants. Globally dispersed teams incorporate talents from different locations, and key team members can be chosen for their proximity to important customers and other stakeholders [1]. With the right collaboration tools, companies can become more agile and reduce product time to market [2].

Teams that effectively collaborate avoid or significantly reduce the following cost factors:

- *Time to market*: Cost of not meeting market window, loss of competitive advantage.
- *Time to information*: Project delays due to lack of information or incorrect information.

- *Cost of duplicate projects*: Unintended duplication of effort.
- *Cost of poor coordination*: Increased risk of severe product flaws and recalls.
- *Travel and relocation*: Remote coordination instead of face-to-face meetings and co-location.
- *Opportunity cost of intellectual capital*: Knowledge worker hours can produce more variation in value than manual worker hours; teamwork hours can produce exponentially more value than individual worker hours.

Remote collaboration software and related research have been under development since the mid-80s [3]. In most cases, the market has offered clusters of point solutions that represent their own core capabilities. Not only do these point solutions fail to encompass complete sets of collaboration needs, they also tend to embody outdated models of how corporations work that no longer apply in the global enterprise.

Moreover, team collaboration products on the market do not support enterprise-scale multiteaming; lack interoperability of needed applications; do not support business process and application integration; nor do they promote fluid switching between asynchronous and synchronous collaboration modes within a single environment. End users must learn different tools for different collaborative activities and move information across multiple environments. At the scale of an 80,000 person enterprise with two-thirds of the employees engaged in multiple teams, these constant shifts in applications and environments are counter-productive. Most collaboration tools lack rich, expressive, user-friendly interaction models, the kind that are needed for groups that rely on distance collaboration full-time and that include members who may never have met face-to-face. For this reason, they may fail to attract pervasive recurring usage.

To address these challenges, Intel's IT Virtual Collaboration Research Team [VCRT] decided to do the following:

- Survey Intel's "virtuality" on five dimensions: time, space, business unit, media, and culture.
- Create a baseline of related external research and current collaboration tool use at Intel.
- Identify the "desired user experience."
- Design user-oriented solution concepts for Intel and similar organizations.
- Define a service-oriented architecture for team collaboration.
- Specify enabling IT infrastructure dependencies.

The baseline and survey work validated the first-hand observations of team members and led to a definition of the desired user experience. By starting with the desired user experience as a goal, the team avoided the trap of thinking in terms of predefined capabilities. Instead we worked from the experience to identify supporting capabilities.

New capabilities offered in the collaboration environment map to the unmet needs identified in the virtuality survey and baseline work. For example, 64% of our employees belong to upwards of three or more teams; yet, multi-teaming is not addressed by existing commercial tools.

Other unique capabilities in our concept vision (see section entitled Visionary Concept) include individual and team workspaces for coordinating among multiple teams, asynchronous workspaces for tracking collaboration across time zones, and expressivity for social bonding when employees don't meet face-to-face. The design also addresses ease of use and navigation via an object-oriented 3D graphic desktop.

These new capabilities are as important as existing ones such as document storage and shared visual communication. However, there was a new focus on integrating all user needs into an interoperable collaboration environment.

The VCRT has made significant progress towards understanding and measuring virtuality, and in developing the overall concept design. Because of the interdependencies among the user interface, business process, applications, architecture, and enabling infrastructure layers, the team continues to explore these layers and their interconnections. Future research will evolve the asynchronous and mobility capabilities, prototype an interactive environment, validate user acceptance, and increase understanding of enabling technologies, architecture requirements, and feasibility.

INTEL VIRTUALITY DATA

A 2003 survey conducted at Intel Corporation [4] with 1260 respondents created an index to measure Intel's degree of team "virtuality." The purpose was to identify the potential payback of a radically new collaboration solution. Virtuality was defined by an initial set of five "discontinuities": time, space, organization, culture, and media [5]. Two new discontinuities added to the construct of virtuality were multiple teaming and differences in tools and practices. Three factors emerged in analysis: team distribution, variety of practices, and workplace mobility. Team distribution measures the degree to which people work with others distributed over different geographies and time zones. Variety of practices measures the degree to which employees experience cultural and

work process diversity on their teams. Workplace mobility is the degree to which employees work in environments other than regular offices, including different Intel sites, home, travel routes, and places outside the company.

On the one hand, we found that being geographically distributed in and of itself had no impact on team performance as measured by conformance to Intel values of discipline, quality, customer-orientation, risk-taking, results orientation, and great place to work. On the other hand, lack of shared work practices and structure, and workplace mobility negatively impacted performance. Cultural differences also posed a challenge to perceived performance. 71% of employees work on teams with people of a different culture or with people who speak different native languages or dialects of English. Thus, cultural differences are a key factor in any collaboration tool strategy.

In interviews with employees about team processes a consistent complaint was that the variety of processes, particularly the variety of tools used in a process, was a main source of frustration. (Variety of tools means employees need to use different tools and processes for different projects, or they have to resort to different tools to accomplish a single task.) The data also pointed out that two-thirds of Intel employees belong to three to ten teams simultaneously. This situation compounds the problem of different tools and processes, as employees must often switch tools for the same activity when going from one team to another. For instance, documents may be stored in a collaboration portal, on a Web site, on a shared drive, sent as e-mail attachments, or simply shared on the desktop in real time. Multiple teams times multiple methods compounds the negative impact of diverse practices.

The survey was conducted to answer questions that came up during the discussion of collaboration tool design to test whether our observations could be generalized across the full spectrum of Intel job types, ranks, business units, and geographies. We were surprised to find that virtuality experienced on the factory floor was similar to that of non-factory knowledge workers. The data provide strong support for our envisioned collaboration solution, which provides a platform for the integration of different processes and tools.

In 2004, we repeated the virtuality index survey and our results revealed that the five key metrics and associated indicators used for the virtuality index all increased. Some of these increases were marginal, while others were statistically significant.

Figure 1 shows indicators with significant per-employee trending from 2003-2004.

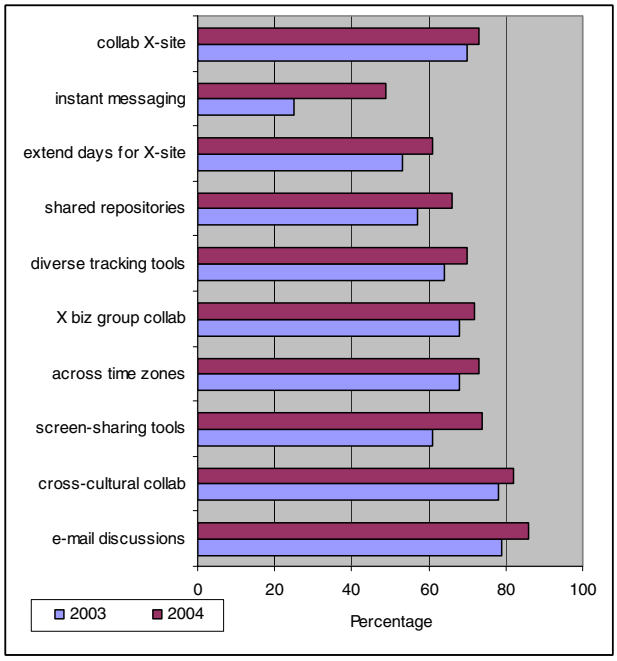

Figure 1: Virtuality trending: 2003-2004

These changes have differing impacts on productivity. Our earlier study found that distance and crossing organizational boundaries alone had no effect on perceived performance, whereas using diverse tracking tools had a negative effect on performance. The latter has increased by 6%, indicating that the need for a common collaboration platform with shared business process tools is increasing. The growth in various available tools also denotes more cross-site work and uptake of existing technologies. Instant messaging in particular had just been introduced at the time of the last study and is showing nonlinear growth with respect to other indicators. This reinforces the VCRT's identification of presence awareness and sociability tools as a key need of the global workforce.

Overall metrics of team performance to Intel values (as perceived by the individual) have either stayed steady or improved (e.g., "work fairly distributed" has increased 10%, from 44-54%). However, one disconcerting finding is that project timeliness has declined from a 52% rating to a 48% rating. There may be many explanations for this change, but a likely one is that coordination is suffering from the increases in the other virtuality factors. If so, this is a problem that needs an immediate solution.

These data confirm our initial hypothesis in tracking virtuality: it is increasing rather than static. An additional hypothesis is that there can be a critical mass threshold that would create nonlinear changes in the organization's performance. Supposing this to be the case, then the increasing dependence on remote teams makes the need

for effective collaboration support a core infrastructure requirement. This hypothesis could also explain why integrated tool sets have not reached the market already: the conditions that impact a company's bottom line have not been fully present up until now. There is no indication that virtuality will decrease.

Valuable research from the academic community is also being incorporated into our ongoing plans. In particular, the work of Carmel and Espinosa [6] has informed the team's sense of urgency and research about time zone differences and the growing need for asynchronous teaming tools to meet the demand for a better coordination capability. Majchrzak and Malhotra [7,8] describe a range of team needs for both cognitive and social integration, as well as task execution, tying these needs to how IT departments can respond. Hinds et al. [9] have compiled recent case studies on global collaboration, and the VCRT expects further engagement with these researchers. As well, the user interface needs of asynchronous team tools, and their ability to maintain user engagement across very large time separations will lead the research into new areas of engagement involving theories of "flow" [10] and experiments with multi-user video games that show what visualizations and activities keep users engaged and bring them back to the online encounter. Some of these findings can be applied to the problem of working environments where analogous activities may occur [11, 12].

VISIONARY CONCEPT

Intel Information Technology (IT)'s Collaboration Vision was developed by our cross-functional VCRT. The team had worked for two years on analyzing the current state, defining the new requirements and then combining them into an integrated vision. Whenever the team tried to communicate the vision, people immediately tried to map it to the tools they were most familiar with. This mapping created a false impression because it did not include key attributes such as integration, interoperability, multi-teaming, or expressive user interface. A well-constructed presentation provided the first step for people to begin to recognize differences between our vision and the existing tools they already used. The deciding step for gaining user buy-in occurred when IT Research funded a "Concept Car" [13] to build a dynamic, visual mock-up of our vision. This dramatically improved our ability to communicate key concepts to managers and employees.

Our vision was featured at the 2003 IT Strategic Long Range Planning and IT Product Line Business Plan internal planning forums where it inspired a multi-year program in IT to drive towards the vision.

Unique characteristics of our vision include the ability to see all "my" multi-team activities in one place, work without time and location boundaries, interact expressively with remote team members, and move effortlessly among business applications and team spaces.

Usage scenarios include meeting in real time across space and knowing who is participating, location of participants and their time of day; working asynchronously on a shared document or project tasks while tracking progress; coordinating responsibilities across projects and meetings, and managing diverse tasks.

Figure 2: Virtual collaboration vision concept

The envisioned solution in Figure 2 supports the VCRT's and individual's natural work flow by coordinating participation in multiple networked teams and providing an immersive interactive experience that engages the user.

Comparison to Other Tools

A comparison of twenty-one different collaboration tools in the market and how they scored against differentiating attributes showed that no one vendor met all of the attributes key to our concept vision [14]. The differentiating attributes that we examined included the following:

- Integration and interoperability.
- Aggregated views for multi-teaming.
- Singular, expressive Electronic Person.
- Combined project and activity timeline integrated with personal calendar.
- Intuitive search scoping and cross repository search.

Scoring was based on third-party reviews and vendor data. If a product met 40% of a differentiating attribute, then it received credit for that attribute. Fifteen of the products exhibited at least one attribute, and six of them at least two. No one product provided all of the above capabilities and none of the products offer cross workspace aggregation to support multi-teaming.

To summarize, gaps between the concept vision and current tools include the following:

- *Too Many Tools and Not Interoperable:* Multiple separate tools required to fulfill all needs; limited interoperability between these tools.
- *Siloed Workspaces:* Hard to share and view content between team workspaces in current tools; need a user-centric view that gives greater flexibility for managing cross-team activities.
- *Interface Not Engaging or Coordinated:* Too many windows to flip through; cannot see what is important in one view; cannot easily get to other applications or transfer data between applications. Lack of graphics and too much reliance on text and hierarchies.
- *Limited Expressivity:* Hard to send and perceive subtle, but important, cues and feedback during virtual meetings (e.g., audio, visual, body language, side-bar interactions). Reliance on media that only some members are strong in.
- *Hard to Find Related Content and People:* No automated way to find related content on Intranet/Internet; randomness to identify "right" people to participate (or consult) on virtual teams.

OVERALL SOLUTION STACK

Technology and globalization are dramatically impacting enterprise organizations. The strong interactive relationship between the changes of the organization and the underlying infrastructure needed to support it [15] forecasts an inflection point or strategic change in the way global teams coordinate.

The needed changes span the entire solution stack including people, process, interaction models, applications, and technology infrastructure/platforms. We will focus on the people and process aspects, then the underlying architecture and standards, followed by the infrastructure and technology platform implications.

Business Process Framework

Figure 3 shows the framework consisting of core business processes for team collaboration, their relationships, dynamic team views, and the aggregating substrate. The virtual team workspace serves as a container for conducting team activities and storing and sharing team information. Teams have meetings that can involve either problem-solving or shared work activities. Because people work on multiple teams, they need cross-team activity management, views that aggregate multiple teams, and the ability to switch easily to the current team context. Each one of these primary components is described next.

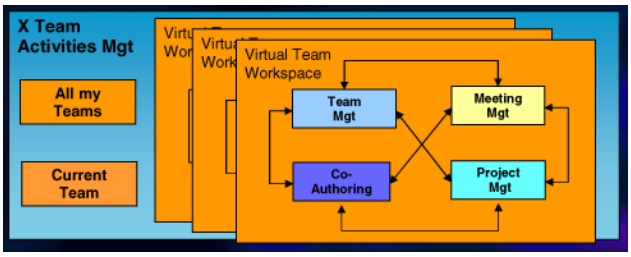

Figure 3: Business process framework

Team Management

Looking at team management from a process perspective leads to questions such as the following:

- What is the work that the team needs to do? Important activities under this question include mission and charter definition, scope, deliverables, roles and responsibilities, timing, and resource requirements.
- How do I get sanctioned by senior management to proceed?
- How do I form my team? Important activities include recruiting team members with the right availability and skills to get the job done, obtaining buy-in from team members' management for members' participation.
- How do I get team members on board with what we are trying to accomplish and help them get to know each other?
- Once the team is performing, how do I keep it performing at optimal efficiency?
- After our work is done, how do we disband, yet still preserve valuable artifacts that point back to the key results of our work?

Team management processes benefit a great deal from services that aggregate and powerfully manage team activities across all teams that a user is participating in. This includes the ability to easily search and share content across team spaces and to summarize and roll up content.

Underlying services for team management throughout the team lifecycle of forming, norming, performing, and disbanding support team activities such as threaded discussions, brainstorming, team self assessment, using team member personas for relationship building, increasing cultural awareness, and providing a launch pad to enhance social interaction and informal communication.

Meeting Management

The core meeting management process is based on effective meeting principles and practices. It includes pre-meeting, during, and post-meeting business processes. Pre-meeting processes involve setting up calendars of people and scheduling resources such as audio bridges,

data and video conferences, and conference rooms and equipment.

During meetings, processes and associated services include real-time usage of the aforementioned resources by the people involved in various roles for the meeting and the capturing of key information from the meeting. Post-meeting processes include preservation of meeting memory via integration with the team's persistent store, as well as ensuring that pertinent items such as required follow-up actions and topics are carried forward and included in future meeting agendas.

We have discovered that there are different interaction styles and activities that lend themselves to either structured, pre-planned meetings as characterized by the core meeting management process described above, or meetings that serendipitously unfold, much like a hallway or chance "water cooler" conversations (ad hoc meetings). Both have their merits. Ad hoc meetings do not have a formal process associated with them, but do need capabilities such as remote presence awareness and management, "click to meet," chat or instant messaging, voice over IP (VoIP), data and application sharing, and video conferencing, if desired.

The lack of overlapping work hours in which to schedule meetings is a critical issue for teams spanning multiple time zones, such as 24x7 software teams [6]. A cross-Pacific team may have only one or two hours of overlapping work time; the same is true of an Israel and US West Coast team. When you add to this different week patterns and national holidays, the amount of available overlapping time becomes even smaller. The compensating behavior is to stretch the workday at both ends. To solve this problem we have had to think seriously about a new meeting type: the asynchronous meeting. This would increase the time span of the meeting event to include a range of available working hours. The asynchronous meeting would be more bounded and structured than a serial hand-off of work, and would require special design features to maintain interactivity. Activities could be completed anywhere within the time window that the asynchronous meeting takes place.

Team members are assigned activities with pre-conditions and deadlines to start and complete them. A workflow scheduler suggests possible open timeslots to assignees that do not violate the start and deadline conditions Assignees can place the activities on suggested open timeslots in their calendar most convenient to them and within their normal work day. Activities that lend themselves to asynchronous meetings include preparing assigned sections of content for documents or presentations; review and annotation of presentations and documents by team members; gathering and summarizing information that the team needs to take into consideration; and completion of other tasks assigned in prior meetings.

A status-monitoring view enables the team members to see everyone's progress towards completion of the asynchronous activities. Personalized reminders go out automatically relative to an individual's time zone and calendar prior to their own settings for task start, at task start and due times, and for overdue tasks.

Asynchronous meetings do not preclude real-time interaction. For example, if two team members happen to notice that they are both online in the asynchronous team workspace they can initiate an ad hoc meeting for a quick real-time dialog. This is one reason that the ability to easily switch between both modes of collaboration is needed.

Often, asynchronous meetings precede real-time meetings where the team gathers to do the types of activities that lend themselves to real-time interaction such as reaching consensus and making decisions, discussion of complex topics that have some ambiguity, and in general to promote team norming and storming.

Project/Program Management

The project/program management core process supports project or mission teams throughout the project lifecycle. This capability leverages and augments the team collaboration workspace, asynchronous, and real-time collaboration capabilities. Additional project management processes and services include the project lifecycle framework, issue tracking, project schedule tracking, task assignments, resource management, critical path management, workflow management, and status reporting.

Co-Authoring

The co-authoring core process includes collaborative creation of unstructured content such as documents (our initial scope) and specialized content creation (future scope) such as Web authoring, software coding, and complex designs. Collaborative services such as in-line markups, annotations, comments, and review and approval are also included in the co-authoring capability. Co-authored content is stored and managed in the Team Collaboration Workspace while it is work in progress (WIP).

Team Collaboration Workspace

The team collaboration workspace is the primary substrate that enables teams to organize and manage the work that they must do together. This includes creating, sharing, and managing documents, e.g., unstructured content, asynchronous discussions, polling and team surveys, meetings, decisions, and action required (AR) tracking. The primary mode of interaction with the workspace is asynchronous or non-real-time, although team members

may visit the workspace simultaneously. Tight integration with communication and real-time collaboration tools, such as instant messaging and application sharing, allow team members to connect with each other while in the team workspace if desired. Capture and storage of real-time collaboration sessions to the team workspace for future reference is also supported. Meeting workspaces that support effective meeting practices enable capture of pre-, during, and post-meeting collateral.

Cross Team Activities Management

This capability collects information across multiple teams from the personal, topical, and business perspective. It provides services to manage team activities across all teams that a user belongs to, a subset or all teams in a business group, and teams working on related projects. Examples include the ability to easily find and share content across team spaces and to summarize and roll up content across teams, as well as to provide a common interaction model across multiple teams for the core collaboration processes and capability areas. This capability is essential to creating the integrated experience desired by users when using team collaboration tools.

Contextual Views

This capability provides contextual collaboration, or the ability to connect and collaborate with others from your current context, which is at the forefront of attention. A simple example of contextual collaboration would be integration of presence awareness and instant messaging with e-mail and the team collaboration workspace, or the ability to conduct in-line discussions within on-line documents. A more complex example involves embedding core team collaboration processes and capabilities with specific business processes and applications, such as product design, allowing collaboration to take place within the context of the business process.

Electronic Person

Electronic Person bundles information about what individuals choose to share with others. It includes both static and dynamic profile data. For example, Electronic Person may include picture(s), location information, presence and availability data, a bio, a resume, an emoticon that reflects mood or emotions, or time of day. Electronic Person also serves as a convenient launch pad to contact the associated person(s) via convenient communication channels such as instant messaging, email, soft or regular phone, and/or video. Electronic Person is depicted in Figure 2 as pictorial profile cards of people on the team. It is our mechanism for bringing more expression into the collaboration environment and for helping people to get to know each other better and to increase social interaction and cultural awareness among team members who are not located in the same place.

Architecture and Standards

The solution approach is based on a services-oriented architecture with well-defined, standard interfaces for services that are exposed to application developers, system engineers, and other shared application service provider sources. We add another level of value-added abstraction by collecting services into assemblies of services that define common core collaborative business processes–which we call business process service groups. Examples of business process service groups include meeting management (pre, during, post) and team management. Figure 4 shows the high-level conceptual architecture.

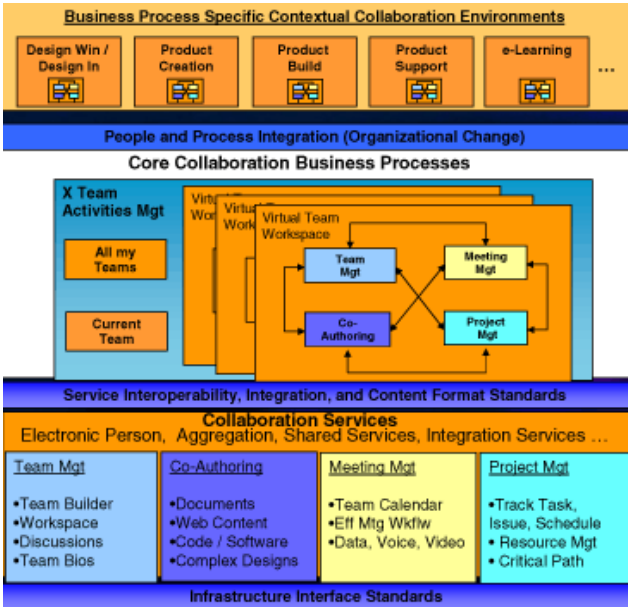

Figure 4: Conceptual architecture

The top layer is the business process-specific contextual collaboration view that is based on vertical business processes that make up a horizontal product lifecycle. The boxes in this layer represent business applications in the different vertical customer segments that have embedded core capabilities based on collaborative activities that most teams engage in. These core collaboration business processes are shown expanded in the middle layer and were discussed previously. The middle layer shows how the core collaboration processes are inter-related and used across multiple team workspaces. It also includes an aggregation function to provide cross team, personal, and contextual views. The bottom layer shows lower-level collaboration services that are collected into business process service groups that realize the higher-level business processes in the middle layer. The collaboration services can also be assembled differently to form processes more specific to the business need and/or called individually by applications. The thinner layers between the primary layers represent standards and integration

between services and the infrastructure, as well as organizational considerations for assimilating collaboration capabilities and processes to improve the way teams work together.

Industry standards key to enabling collaboration include the following:

- **VoIP:** voice, multimedia conferencing.
- **SIP:** session initiation protocol. SIP is a text-based protocol, similar to **HTTP** and **SMTP**, for initiating interactive communication sessions between users. Such sessions include voice, video, chat, interactive games, and virtual reality.
- **SIMPLE**: SIP extensions for Instant Messaging and Presence Awareness.
- **CPIM**: Common Profile for Instant Messaging/Chat, Presence Awareness.
- **ebXML**: eBusiness XML.
- **HumanML**: Human Markup Language. HumanML is designed to represent human characteristics through XML. The aim is to enhance the fidelity of human communication.
- **xCal:** XML DTD for iCalendar.
- **iTIP:** calendar free/busy time.
- **VideoML:** Video Markup Language.
- **MPEG4:** Video Compression.
- **SMIL:** Synchronized Multimedia Integration Language that enables simple authoring of interactive audiovisual presentations. SMIL is typically used for "rich media"/multimedia presentations that integrate streaming audio and video into images, text, or any other media type.

Technology Infrastructure Implications

The underlying technology infrastructure needed to support global team collaboration faces the following challenges:

- *Infrastructure Readiness:* Network, security, mobility, and information management infrastructures will require significant and costly upgrades to enable our vision for collaboration.
- *Desktop Real Estate and Design:* Designing for an integrated solution may require 3D interfaces or multiple screens. At the same time, the platform needs to work on small mobile devices and low-bandwidth networks. Design for flow [10, 20] experience is essential for asynchronous teaming.
- *Inter-company is hard:* Security, legal, interoperability issues are magnified for heterogeneous environments.

Several emerging platforms present an opportunity to explore alternative environments to anticipate and influence the global team coordination inflection point. These platforms include software developed by Intel Research and HP Labs, including PlanetLab [16, 17], Miramar [18], and Croquet [19]. We have begun engaging with developers and researchers to further explore these platforms and their role in the overall solution architecture.

CURRENT PROGRESS AND ROADMAP

In 2003, we conducted the virtuality index research, and developed the vision concept, architecture, and five+ year roadmap to get to the vision. A reuse program was also begun with the goal of broadly sharing components and saving money by not having redundant development efforts.

The 2004 implementation focus has been to lay the foundation for consolidating redundant tools into a common platform, providing some common workspace templates for teams, meetings, and simple projects, and to eliminate redundant products in the environment. We have augmented the reuse program with developer standards and guidelines specific to our collaboration platform and are validating component certification processes with real components targeted to land in the environment. In 2004, we also conducted research in emerging usage models, supporting capabilities, technologies for asynchronous and ad hoc meetings, social networking, adaptive physical workplaces (conference rooms and offices), converged communications, expressivity via Electronic Person, and multi-tasking. Detailed reference and solution architectures for capabilities to be implemented in 2005 have also been developed.

In 2005 implementation priorities include the integrated project management platform, SIP-based ad hoc meetings infrastructure with initial 1:1 and 1:2 usage models, secure external collaboration, simple document approval processes, digital conference rooms, and some targeted integration with enterprise and line of business portals. We also hope to lay the foundation for the Electronic Person. Research will continue in the areas of asynchronous meetings, expressivity, multi-teaming implications such as multitasking, and mobile collaboration needs. We will also develop interactive prototypes of the vision concept to validate feasibility, acceptance, and to evolve the interaction design and underlying infrastructure requirements. Cross-repository integration and search, and integrated workflow capabilities are some of the infrastructure components

needed to support multi-teaming. Again, the design of detailed architectures for 2006 implementations will be informed by research and technology development projects.

In 2006, we will begin to introduce effective meeting processes for asynchronous meetings and pre-scheduled real-time meetings, as well as for managing teams throughout their lifecycles. The processes will be embedded into the environment via workflow tools. Mobile collaboration will see some improvements such as roaming voice conferencing. In 2006, significant information and content management infrastructure upgrades such as the meta data registry will be available.

During 2007, we will upgrade multi-party ad hoc meetings, integrated multi-media conferencing, and integration of team workspace and office applications with business intelligence for collaborative decision making. We will also implement a seamless multi-teaming interface, enhance Electronic Person expressivity, and upgrade portfolio management and richer user interface shell constructs. By 2007, we expect to be reaping the benefits of our re-use program more broadly, which will also accelerate the move towards contextual collaboration.

CONCLUSION

Changes in the global business environment are apparent in many dimensions. They are regularly reported and analyzed in the business press. Our own study of Intel employees confirms the generalizations found in the marketplace and gives us an idea of how Intel is trending in terms of distributed teaming. We have described an approach for understanding the organizational situation, and have responded to it as information technology researchers and designers. We now have a strong concept of the desired user experience. We have identified social and technical factors involved in remote teaming, and defined core team collaboration processes

Since interactions that people previously conducted face to face happen increasingly over the network, it is critical that collaboration tools maintain context and interactivity to promote fluid and sustained communication. This requires interoperability of tools, architecture, and processes as well as new capabilities never imagined when collaboration applications were first invented.

Our architecture provides the foundation for global team collaboration processes and capabilities that integrate with business applications.

To maintain alignment with our vision and make progress against our roadmaps requires strong links between research, technology path finding, proof of concept prototyping, architecture, and the implementation program.

Establishing enterprise-scale core collaboration solutions that allow some customization into specific business process contexts increases the value of information technology to the business.

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