

Enterprise Collaboration Management with Intraspect
A Technical Overview White Paper, July 2001

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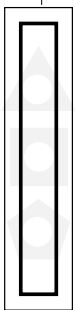


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Summary: This paper describes Intraspect's offerings from a technical perspective. There are four main sections, covering: the technology needed for enterprise collaboration software, how Intraspect addresses the need, the functionality of the Intraspect product line, and how the underlying technology works and can be used to create collaborative applications in the enterprise ecology.

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1 The Challenge and Opportunity of Collaboration

Technology and globalization are changing the nature of work. More than ever, people work in extended business-to-business communities that include consultants, partners, suppliers, customers, and employees from all over the world. We call this collaborative business, or *c-business*SM. Companies who can collaborate effectively can bring products and services to market faster, can increase employee productivity by enabling rapid learning and reuse of knowledge, and can enhance demand from existing customers by sustaining long-term, many-to-many relationships across territories and changes in personnel. Businesses need an infrastructure for collaboration that supports many-to-many communication, coordination, knowledge sharing, rapid learning, and organizational memory. Intraspect Software provides the technology for c-business.

Collaborative Commerce and Enterprise Collaboration Management

According to Gartner Group and other leading analysts, the next generation of Internet applications will be driven by knowledge-centric collaboration and unstructured data as part of a new model of conducting business over the web called Collaborative Commerce. Collaborative Commerce is characterized by seamless integration of process automation, relationship management and business collaboration.

Despite powerful new technologies for integrating systems and processes, the human collaboration around unstructured data is essential to realizing the potential of Collaborative Commerce. Eighty percent of a company's useful knowledge is in unstructured information such as email, documents, and web-based information (Gartner Group). Furthermore, the challenge for human collaboration goes way beyond information sharing. While collaboration was once accomplished largely in meetings or around the water cooler, today's organizations face the daunting task of enabling collaboration across multinational organizations and the extended enterprise with customers, suppliers, and partners.

Until now, tools for collaboration and knowledge management have focused on publishing and accessing data that is already captured by structured processes. Point solutions such as portals, document management systems, and project management tools don't provide the depth and breadth of functionality required to integrate ad hoc knowledge capture, sharing and reuse into enterprise applications. Groupware-based applications are difficult to use and expensive to administer — and therefore have become "shelfware". Adding collaborative features to process-specific software, such as that for customer support, human resources, and product development, often results in "stovepipes" of collaboration.

What is needed is an enterprise platform that is a foundation for all knowledge-centric collaboration, tying together ad hoc and process-specific knowledge work into an environment where people can learn from each other and from organizational information sources. Intraspect and others call this category of software **Enterprise Collaboration Management (ECM)**. The ECM platform provides horizontal collaboration and knowledge sharing features, and ECM applications built on top of the common platform integrate the people-to-people activities of CRM, Supply Chain, and Business Process Management applications. More than groupware or point solutions, an ECM environment offers individuals the

opportunity to tap into the collective expertise of the organization – regardless of organizational or geographic boundaries. ECM solutions offer the opportunity to integrate knowledge-centric collaboration, a relatively untapped component of the corporate value chain, into the evolving Collaborative Commerce market.

Technical Requirements

ECM is not just another name for a general purpose application infrastructure. There are unique requirements and metrics for success. To meet the needs and opportunity outlined above, an ECM solution must provide a technical means for people to:

- work together on **large, distributed, cross organizational teams**
- effectively **communicate** across distance, time zones, and company borders
- develop and sustain **relationships** with colleagues, partners, and customers
- create, gather, and manage **unstructured and semistructured information**, including email and web-based information
- **discuss, analyze, review, and approve** this information collaboratively
- **discover and reuse** the prior work of people in the extended organization
- **learn** on the job from peers and from organizational practices and methods
- **contribute** to an **organizational knowledge** resource

Intraspect builds and supports a premier solution for Enterprise Collaboration Management that meets all of these requirements.

2 The Intraspect Approach


Intraspect provides an environment where people collaborate, using email- and web-based workspaces to manage business relationships, share information, and coordinate work. Simply put, Intraspect creates a place where people do their collaborative work more effectively.



Figure 1: The essential capabilities of Intraspect's ECM solution

All Intraspect solutions offer three essential capabilities (see Figure 1):

- **Web-based workspaces** that provide a place to work with other people --- sharing information, coordinating work, and accessing information in the context of their work. A large virtual community has many workspaces, both personal and shared, and all workspaces are part of a unified "group memory" of on-line work.
- **Many-to-many collaboration** technology to enable employees, customers, partners and suppliers to work together productively without having to know each other's information needs, expertise, access authorization, or work




roles. Many-to-many collaboration technology includes event and concept subscription, push and pull notification, and role-based access and workflow.

- **An enterprise knowledge base** that captures the results of on-line work for learning and reuse. Because people are working together in shared spaces, the information is captured at its point of creation in its original business context, not as a step in a publication process. As the knowledge resource grows with use, it becomes increasingly more valuable for people to re-use than to reinvent.

Together, these three capabilities create a uniquely powerful environment for collaborative knowledge work. The "place" and the "knowledge base" metaphors are closely related: when information is created, gathered, organized, or distributed, it happens in a shared, on-line environment that persistently stores the information. Users experience the "place" as both a common space for working together and as a common resource from which to learn. From the user's perspective, the knowledge base and the on-line work environment are the same thing, called the **group memory**. Each Intraspect group memory is a single knowledge base comprising many workspaces, both personal and shared. A group memory may support an entire company, or there may be a federation of group memories linked together in the large extended enterprise. There is an important difference between collaboration at the level of confined workspaces and the level of group memories: the ability to learn from *other peoples' work*. Intraspect users are not "members" of a set of isolated "rooms", they are members of knowledge sharing communities. They learn from their peers on their current projects, they learn from other ongoing work, and they learn from the collective experience of knowledge work across the extended enterprise.

When users work in this environment, their work is captured and organized in specific **work contexts** such as design projects, financial deals, service engagements, customer interactions, or ad hoc efforts such as publishing marketing documents and sharing links to relevant web content. Intraspect captures the results of this knowledge work – the information and communications – preserved with its contextual metadata including who contributed it, its place in the history of related information, the business purpose of the information, and relationships to other information objects. The result is a knowledge base of how people use information to do their work and manage their relationships. As people use the system, they are effectively contributing to the collective knowledge base, *by simply doing their own work*. This property is a key to Intraspect's successful adoption and spread, as systems that require users to do extra work for the benefit of the organization, such as manually tagging their documents or writing up summaries of what they did, often fail due to low user acceptance.

The many-to-many collaboration technology is also essential to the solution. Today, people are asked to work in large virtual teams, created quickly and for ad hoc goals, spread around the world, and comprising colleagues, customers, and partners. At this scale of collaboration, people need technology to support the basic human activities of communication, building relationships with people working across territories on different schedules, coming up to speed on the project, and coordinating their work. They cannot rely exclusively on point-to-point communications, such as email or phone, because it is difficult to have individual conversations with that many people, and because it is practically impossible to know who needs to know or who could answer a question in such virtual teams. They also need to know that it is safe to put information in a shared space, trusting that appropriate access controls restrict the information that others can see and contribute.



Since Intraspect's collaboration technology makes it *possible* for people to work in large virtual teams – where working with point-to-point tools does not scale – people on such teams have a natural incentive to put their information in the shared environment. Again, the personal need to collaborate provides the personal motivation to contribute information to an on-line resource, where it can be captured, discovered, and reused.

The same capabilities that give individuals benefits for using the system also provide benefits to the organization. First, the enterprise knowledge base captures valuable information about how the organization solves problems, makes decisions, and delivers services. This information is re-used by individuals when they learn from the collective resource. It is also a gold mine of material for organizational learning efforts, such as the identification of best practices, the resolution of recurring support issues, and the capture of knowledge about product requirements and design across the entire product lifecycle.

Second, the sponsoring organization can achieve a level of relationship management with their clients and partners that far exceeds what can be done with individual account representatives. Within appropriate security limits, everyone on the team can see the history of the many-to-many relationships between the people working for the service provider and customer, or between product developer and partner. In knowledge-centric business-to-business activities, human relationships drive the innovation and create the sustained value of partnering.

Third, as the composition of these virtual teams changes with employee turnover and mobility within the organizations, the basic knowledge of the team is available for new people to learn, and the inter-company relationships and commitments can be stable.

In the end, the success of any collaboration solution is determined by the people who use it. Adoption is not optional: people must want to use it, and use it effectively. Collaboration tools that are hard to learn, install, or use will fail to accomplish the organizational objectives. A hallmark of the Intraspect approach is that it supports the way individuals normally work in their existing environments, rather than requiring them to change how they work to suit the tool. In particular, Intraspect integrates deeply with users' email, web, and desktop applications without requiring the user to install anything. People who use email, file systems, or the web have the skills and tools for using Intraspect.

In short, Intraspect works because it provides a compellingly useful environment for collaborative work, one that people want to use for personal gain, is easy to learn and use, and gets more valuable for all with increased usage. The net result is rapid adoption, productive use, and accelerated return on investment.

3 Intraspect Products

The Intraspect product line has offerings at two levels, a core application platform and a family of packaged business applications that are built on top of the platform. The platform product, called simply **Intraspect 4**, provides the basic horizontal capabilities required for enterprise collaboration management. The applications, called **Intraspect Applications**, provide customized data, workflow, and user experiences that support specific business processes. Today, Intraspect offers three applications: **Services Collaboration**, which is targeted at professional

services organizations, **Customer Collaboration**, which complements existing sales, support, and marketing CRM applications, and **Product Collaboration**, which brings enterprise collaboration capabilities to the product development lifecycle. Intraspect 4 and the Intraspect Applications are described in more detail below.

In addition to providing a comprehensive set of features needed for enterprise collaboration, Intraspect also provides the infrastructure on which collaborative applications can be built, deployed and managed. We will discuss the application development infrastructure in the Technology section.

3.1 Core Features of Intraspect 4

Intraspect 4 offers users an integrated set of features for knowledge-centric, collaborative work. As illustrated in Figure 2, the Intraspect server is a locus for both working with information and coordinating work with others. The core features of Intraspect 4 include a set of capabilities for managing unstructured information (bottom of Figure 2), discovering, contributing, and collaborating around information (left side of Figure 2), and keeping informed actively and passively (right side of Figure 2). Together, these features and capabilities create a compelling environment for technical support of collaborative knowledge work. All features were designed and implemented together, and are tightly integrated to reinforce each other. For example, any piece of information that is contributed through any means is also indexed for discovery through search, can be shared and discussed, and can be the subject of personal subscription and dissemination to target audiences. This section overviews each feature from the user's perspective (a later section will describe the technology used to implement these features, and other documents available from Intraspect cover the detailed functional specifications for the products).

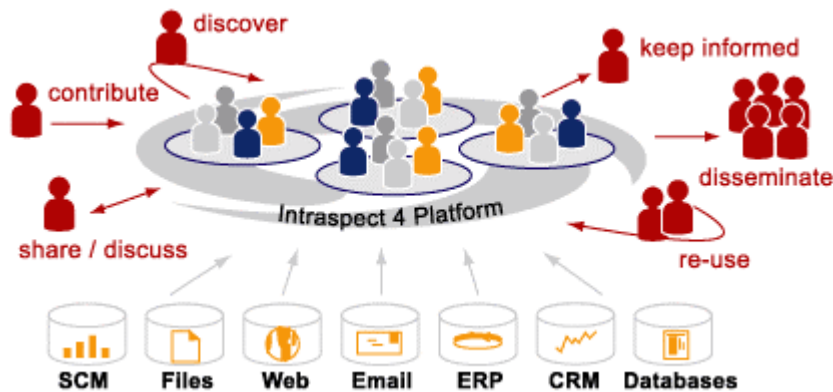


Figure 2: Core features of Intraspect 4

3.1.1 Managing Unstructured Information

Intraspect is designed to support any information that knowledge workers experience on or through their computer. Today, that includes all information in any format that can be stored as a file, sent over email, or referenced with a web URL. The data formats supported by Intraspect include documents or files of any kind, email messages and their attachments, web pages in formats such as HTML, anything encoded in XML, graphical images, audio or video recordings, and reports or other content available by web interfaces to enterprise applications.


All information managed by Intraspect is afforded the following capabilities:

- **Reliable Data Storage.** Information is either stored in the Intraspect repository, or it is hosted on some other web-based service. Information stored in Intraspect is kept in a reliable, secure, backed-up database. To the users, this means that if they put something in Intraspect, it is safely stored. To the enterprise, it means the information has been captured in a reliable, shared database and not lost in file systems or email boxes.
- **Search Indexing.** If the information is of a common format containing text, its contents are fully indexed for search. This includes the proprietary formats of desktop productivity applications such as spreadsheets, presentations, and word processing documents. It includes enterprise reports. It includes multimedia documents delivered in Adobe Acrobat. It even includes web content stored in other servers; if someone adds a URL to Intraspect, the server indexes the content it identifies as if the content were stored locally in Intraspect. If any content changes, whether stored locally or remotely, Intraspect automatically updates its search index.
- **Automatic Publishing.** All information objects are assigned permanent web addresses (Uniform Resource Locators, or URLs), which facilitate collaboration around these objects by reference without distributing multiple copies. The URL is guaranteed to never change, which means it can be reliably referenced in hyperlinks, bookmarked, search indexed by crawlers, and sent around by references in email messages. In effect, every document, file, or email message sent to Intraspect is automatically published.
- **Access Control.** All information is protected securely with access control over who can see and work with it. Access policies are created and maintained by end user interfaces. Control can be delegated to the appropriate level of user, eliminating the need for IT intervention. In fact, there is no "super user" who has anonymous access to all content; all access policies are explicit and enforced. There is no way for a programmer to develop a tool that can circumvent the security by accessing information over an API. The net effect of this level of security is that people can understand and trust the conditions under which their information is being exposed.
- **Metadata.** All information objects, whether they are documents or email messages or folders or user profiles, can be tagged with custom types and attributes. The types give the information object a purpose or role within the business context, such as "Statement of Work" or "Customer". The attributes give properties (e.g., industry group, description of deal) and relationships (e.g., customer for whom this work is delivered, best practice document for this methodology, person who approved this). Custom metadata is optional – the system works fine without it – but when supplied the metadata embed the information in a rich knowledge base representing its purpose and context within the organization.

3.1.2 Collaborative Workspaces

Intraspect makes it easy for any user to create a secure place in the group memory where documents, e-mail, web pages, or any other information objects can be organized, preserved, published, shared, and retrieved for later reuse.

Every user starts with built in workspaces for personal private work, which is only readable by the user, and for personal published work, which is readable by others. Personal workspaces are important to a collaboration environment because people need to work on something themselves and then selectively share the materials with others. This gives the full benefits of working in the on-line environment to the



user, and eliminates the issue of people having to switch tools or duplicate files when they want to share information.

Each group memory also contains any number of shared spaces, which are organized hierarchically in the manner of an enterprise information portal. Workspaces provide the business use context for content that is discovered, created, or otherwise contributed by users. There is no inherent boundary between spaces, such as the walls of a room; all spaces live in a richly interconnected knowledge base. The main difference among shared spaces and personal spaces is access control (who can see and work in the space). All workspaces can have any number of shared folders and threaded discussions. They can have any kind of information, and can be linked to any other space.

From the user's perspective, vanilla workspaces are like familiar folder hierarchies and threaded email conversations. They can be customized to contain special purpose objects other than conventional documents and messages, however. For example, using technology described in a later section, one can create custom objects to represent issues, tasks, events, dashboards, and other semistructured information objects. An important property of Intraspect is that it allows all objects of any type to be put together into the same context. For example, in a single folder one might find a threaded email discussion, documents of various types, some email messages mailed in individually, bookmarks to web pages, and enterprise reports published dynamically through a web-based application. Rather than forcing the user to go to separate places in an intranet for discussions, shared files, and applications, Intraspect combines them all in the same space, capturing the content and the context of use.

Collaborative spaces can look just like folders, but they can also be rich, task-specific work environments drawn from a library of predefined collaboration models, such as project spaces and customer extranet spaces. These sophisticated workspaces, called c-spaces™, can contain custom content such as best practices and template documents. They can have custom appearances, such as a customer extranet that is co-branded with the customer and provider logos. They can have custom, carefully designed security policies that allow groups of people with different roles from multiple organizations to safely work together, knowing that they are sharing information using visible and approved policies. And they can have custom user interface and workflow, designed to support specific work practices, such as running projects or doing customer support.

3.1.3 Sharing and Discussing Content

In any workspace, users can *selectively* share content with others. Using access control, described above, end users decide which access policies are appropriate to their content. Within the *same* folder, for instance, one can put documents that only the owner can see, selectively publish some but not all documents, allow some people to jointly edit some documents but not others, and so forth. The fine control over access is important in large-scale cross organizational collaboration, where one wants to preserve the original context of content by selectively allowing others to see or manipulate it.

Intraspect also offers a variety of ways to discuss things using threaded discussions and comments.

Threaded discussions

Intraspect discussions capture sequences of messages organized by their conversational topics or threads (each thread is a new topic message and its branching tree of replies). Messages are contributed by either email or the web interface. Messages can include attachments, including documents and other messages. All messages in a discussion, including their attachments, are stored and indexed for full-text search. Users can start a discussion from any folder, which puts the context of a discussion in the workspace where the collaboration is happening, rather than on a list of unrelated discussions. Discussions are started and managed by end users, not administrators, and the user can assign email addresses. Users can choose to have copies of messages that are sent to discussions routed to through email to a list of recipients to the discussion, or they can access them directly with the web interface.

Intraspect discussions can be used to involve "outside" participants in on-line collaborations, independent of whether they are registered Intraspect users. This allows "outsiders" to receive copies of shared information and to contribute documents and commentary via their own email clients. Discussions can be used as archives of conversations by simply putting the email address of the discussion on the CC of the messages in the conversation. Discussions can also be used as email distribution lists, in which specified people receive copies of all message traffic going through the discussion.

Commenting on information objects

Commenting about shared information is a common form of collaboration. We all get email messages that contain attachments or pointers to information with a few lines of commentary about why the information is relevant or worth investigating. Commenting is a structured way to talk about other information. Comments can be quick one-liners, akin to yellow sticky notes, or full-blown memos with attached documents. Like email, comments can form conversational "threads" of replies. Unlike traditional email messages, Intraspect comments are linked with but not part of the referenced information. The referenced information can be a document stored in Intraspect or a web page hosted on another web server but represented in Intraspect as a Web Document. Only one copy of the referenced information is stored and its context of use is visible right from the comment. This is "collaboration around shared content" as opposed to collaboration around institutionalized conversations (mailing lists). Commenting is also a powerful end-user technique for creating and capturing meta-data about shared information. People can say why a piece of information is relevant, good or tagged with a particular attribute (e.g., "highly recommended"). By using such conventions in the text of comments, end users can invent and maintain their own collaborative review processes without programming databases, designing forms, programming workflow, or buying into special purpose applications.

Managing multiple conversations about the same information

Intraspect comments have a unique property that is particularly useful for collaborative review of content such as documents or web pages. Comments are situated in *contexts*, represented by workspaces in the Intraspect group memory. Since Intraspect objects can have multiple contexts, there can be multiple streams of independent commentary on a single web page or document. Each folder in which a document appears can have its own threaded commentary about that document. This allows, for example, Engineering and Marketing to add their separate perspectives to the same specification document. With access control, these multiple conversations may be kept private while the document discussed remains public.

3.1.4 Contributing and Managing Content

Intraspect allows users to contribute to the shared space using their preferred information tools. Electronic information can be added in any of three modes, each of which supports a way that people work with information. Users who are most comfortable with web interfaces can upload documents through the upload function of a web browser. Users most comfortable with the desktop file system can copy and paste (or drag and drop) documents directly into Intraspect using the Web Folders feature of Microsoft Windows. Users who have information to contribute from their email environment can send in messages or content directly from their email programs. Intraspect accomplishes this without requiring the user to replace or modify their web browser, desktop environment, or email applications. Once contributed, documents, email messages, attachments, or anything contributed to Intraspect is effectively published with all the properties listed above such as search indexing and access control.


Contribution by email is a powerful differentiator for Intraspect. Every workspace object in Intraspect can be given an email address by end users. To contribute by email, people just mail to the address of a place in Intraspect. The ability to email content into the workspace allows people to contribute while on the road. It also allows people to automatically capture the content of email-based correspondence without forcing an extra step. For example, a customer-facing employee can capture all of the threads of an email conversation into Intraspect by simply adding the email address of a workspace to the CC line of email with the customer. Email is used for contributing documents as well as messages. For example, one can submit a proposal or deliver a report by mailing it into a folder, with an empty email message body. Intraspect recognizes that this is an upload, rather than a comment, and strips away the extra email message.

With the mail-in capability, end users can devise their own email-based collaborative processes with no administrative help. For example, a hiring manager can create a folder in Intraspect, give it an email address, and post the email address on the Jobs section of the web site. Job applicants then mail their resumes or application forms directly into the appropriate folder in Intraspect. The hiring manager has a secure, web-based, searchable, presorted, historically organized archive of the applications for each job. Each application is then amenable to collaborative review using the commenting feature described above, and the contribution can initiate automatic notifications using the subscription feature described below.

Intraspect also provides simple, easy to use **document management** capabilities appropriate for collaboration. Documents can be locked (check-in/check-out) so that people don't accidentally write over each other's files. Documents can be versioned, so that a historic lineage of a document is captured. The versioning also allows collaborative review by email of each version, and these threaded conversations are also kept with the versions. Documents can also be put up for review, with integrated workflow for approval.

3.1.5 Search and Discovery

In a large-scale enterprise collaboration environment, it is critical to be able to find information through query and search. Intraspect offers sophisticated full-text search that has been tuned for collaborative knowledge sharing tasks. The search engine can match natural language phrases, factoring out small differences in word order and word endings. The system also ranks search hits by degree of match (sometimes called relevance); documents that better match the query phrases appear higher in the ranking. The same interface lets users find documents they've



already seen (e.g., find Word documents collected in the past month that mention "collaborative commerce") and discover what their colleagues have collected on a given topic (e.g., find web pages or email messages about "wireless CRM"). There are also search tools for finding people by their self descriptions or by the materials that they have contributed.


Intraspect's search capability combines traditional full-text search with relational database query over meta data. End-users can restrict searches by information type, author, date, or any other meta data. For example, one can search for all Excel documents less than a month old that mention a customer's name. When combined with Intraspect's ability to support custom types and attributes, the result is a powerful tool for analysis and reporting. For example, one can search for all recent documents that are of type "Trouble Reports" whose "Customer" attribute matches the customer's name, and which mention the word "wireless". This combination of full-text search and relational query is fully driven by the end-user, and requires no programming or configuration. Furthermore, new special types (such as Trouble Report) and attributes (Customer) can be added dynamically by end users, and the search and query engine automatically indexes the metadata appropriately.

Intraspect's search capability scales to large communities, for several reasons. The underlying search technology can handle millions of documents, so the raw volume of content is not a bottleneck to scale. The important factors in the scalability of search are the selectivity of queries and the relevance of results when drawn from a large document collection. To help the selectivity of the query, Intraspect allows the ability to add metadata constraints to the query to narrow down the search. For example, there may be thousands of documents that mention "wireless" but only one or two that are Trouble Reports for the Acme account. To help with relevance of results, Intraspect arranges the document collection to be rich in potentially relevant content. The only content that is searched is content that some knowledge worker has decided to use in their work. Whether a document they created, an email message they forwarded, or a web-based report they used in research, the information is inherently more relevant to the business of the community if it has been "collaboratively filtered" in this way. Intraspect users report that the system consistently comes back with relevant information. In contrast, many people have experienced the results of unfiltered search over the Internet, in which too many documents match a query.

3.1.6 Keeping Informed with Subscription Agents

In any large organization, it is impossible to monitor every conversation, check every information source, and keep track of every project. Furthermore, in the many-to-many collaboration situation, one cannot know whom to keep informed proactively. Intraspect overcomes these problems by offering subscription agents. As people collect, create or discuss information, agents can be triggered to inform others who are interested in the content. The originators need not anticipate the information needs of others and the information seekers don't have to know whom to ask.

Subscription is a general information-processing concept that has been applied to a variety of information types under various marketing concepts such as "personal web pages," "push," and "search agents." Subscription is essentially a service that delivers a stream of information to fulfill an information need stated by a subscriber. Stock quote services, news clipping services and subscription to public email distribution lists are familiar examples of subscription services.



Intraspect provides a Universal Subscription™ service, which delivers a subscription service for all types of information in the shared environment. The unique power of Intraspect subscriptions is the precision by which one can indicate interest and completeness across all information sources. For each kind of information object, there is an appropriate subscription service with special benefits:

- **Subscription to Workspaces.** To keep informed of the collaborative activities in a project, a user can subscribe to the project's folder. When any document in that folder is uploaded or collected, the user is informed of what happened, when and by whom. When combined with subscriptions, folders become collaborative "in baskets" for workflow. For example, when the Deliverable document is ready, it is put in the Deliverables folder. Parties interested in the deliverables, like the customer team and the global account team monitoring progress, can subscribe to be notified automatically as deliverables are delivered. The person doing the delivering does not need to know who should be informed when the deliverable is ready.
- **Subscription to documents.** A common collaborative task is to put up a document for review. By subscribing to a document, the Intraspect user can ask to be notified automatically when anyone makes a comment about that document. This allows free commentary without forcing the commentator to decide who should be sent a copy or when they want to be notified. Subscription to a document also informs the interested party when the document is revised.
- **Subscription to web-based information objects.** In Intraspect, web documents are like any other file or document in the system except that their source is a remote web server. Web information objects include not only documents, like HTML and Acrobat files, but also virtual documents such as the results generated by an Internet search engine. When a user subscribes to a web document, he or she will be informed when the web page changes at the remote web server. Intraspect efficiently polls remote web servers, using HTTP standard protocols, to determine whether a web page has changed. The same subscription machinery also informs when someone comments on the web document. This is handy for collaborative review of web materials hosted remotely, such as web-based prototypes or proofs.
- **Subscription to messages and comments.** Intraspect allows users to subscribe to individual messages. This is very useful for getting questions answered: a question is posted to a general discussion list and the user is notified only when that question is answered. The same service is available by subscribing to an Intraspect comment: the subscriber will be informed if anyone responds, or expands upon the comment.
- **Subscription to search.** Subscription is an especially powerful tool when applied to search. As described above, Intraspect allow users to focus their searches on specific object types, by people, by time and by matching natural language text. The search parameters allow one to specify an information need with great precision. Thus, search is a natural compliment to subscription. When a search is issued, the search hits are those objects that currently match the query. When a search is subscribed to, the user is notified when any objects are created or collected that match the query in the future. Subscribed searches are matched against the real-time flow of information events in the group memory, supporting both instantaneous and periodic, summary notifications.

By applying subscription to the power of full-text search, extended with parameters for meta-data such as person, workspace, date and object type, end users can create information flows that support many of the business

information needs that formerly required programming. Some examples include:

"Inform me when a particular news feed service mentions a topic of interest to me"

"Inform me when anyone mentions my client's name or product in the group memory"

"Inform me when anyone discovers a web page that mentions our product"

"Inform me when the department manager says anything about my area of responsibility in a message, comment or report"

"Inform me about everything the CEO says"

Notification Mechanisms

Intraspect supports subscription agents with two notification mechanisms: an interactive HTML display of notification events and email reports. The HTML display --- part of the user's "personal page" --- shows up-to-the-minute status on all subscriptions and allows users to sort and manipulate the display to make sense of the data. One can click directly from the screen to the objects mentioned in the display (the documents, messages, comments, etc.). The email reports list the latest notifications on a periodic basis, such as each morning. Immediate notification by email is also supported. The email messages contain pointers to the information being described as URLs. Most modern email systems allow users to click directly from the URL in a message to launch the information in a web browser.


3.1.7 Disseminating Information to Others

Intraspect enables end-users to notify or deliver content to the members of a group, either through e-mail or a browser. This enables large-scale communication to target audiences within the community. Using subscription, one can direct the notifications to a list of external email addresses, customizing the message. For example, one can automatically inform a list of partners when a new version of the partner toolkit is ready by simply subscribing the partners to be notified when anything changes in a particular folder where the toolkit is published. The partners would receive an email message containing a URL link to the new toolkit whenever it was changed. The person who updates the toolkit does not have to know whom to inform, and the list of people to inform can be managed by a person with different access rights than the people who create and publish the content.

One can also directly inform people of specific content in Intraspect using a feature called "Tell People". Using the Tell People function, an Intraspect user clicks on an Intraspect object (such as document or folder), enters the email addresses of people to inform, and the system will mail them a link to the content or place. For outside participants who are not Intraspect users, one can also include a copy of the document content. Experience with this simple but powerful feature has shown that people learn to send each other URL links rather than attach large documents to email messages, and as a result the load on the enterprise email system --- and the lives of modem users on the road --- improve.

3.1.8 Support for the Mobile Worker

Intraspect's design goal is to support the knowledge worker in all contexts, reaching out to the applications and environments in which they work. Knowledge workers are often mobile, carrying their computers on the road and connecting to the network infrequently. For the mobile worker, Intraspect offers an offline capability. While on-line, users select content to take with them. They can select individual documents, such as presentations, or entire workspaces, such as client



engagement spaces. They synchronize this content to their laptops using the Microsoft Internet Explorer web browser (there is no Intraspect software to download or install). When they are off-line, they can read the content that has been cached by the Internet Explorer. They see not only documents, but a full web experience with navigation, metadata, and so forth. To make a contribution while offline, they click on links in the off-line user interface that open their email client to the appropriate address and send in a message. When they reconnect to send mail, the content is delivered into the appropriate place in the on-line Intraspect workspace. Users can post messages to discussions, comment on materials to review, and even contribute documents from the off-line environment.

3.2 *Intraspect Applications*

Customers have identified three areas where collaboration is mission critical and Intraspect has built specific applications for each: Services Collaboration, Customer Collaboration, and Product Collaboration. Intraspect applications provide specific features that are core to the business functions, workflow and processes within these disciplines. They are built on the open, extensible Intraspect 4 platform, and are easy to deploy and use. Intraspect Applications complement existing PSA, CRM and SCM tools and applications currently in use to manage business functions, by providing a place to engage – a workspace to actually "do the business".

3.2.1 Services Collaboration

Professional service organizations need the ability to harness knowledge and experience across the organization, and Services Collaboration equips their people with secure web-based workspaces to share work and collaborate effectively with each other and clients in the delivery of professional services.

Built on the Intraspect 4 platform, the Services Collaboration application features a series of components specifically developed for IT and customer support organizations, resource managers and consultants. By integrating collaboration technologies with knowledge management and project/process management, Services Collaboration offers specific functionality targeted at facilitating service delivery, business development, streamlining personnel management, effectively managing projects, and closely monitoring client and customer relationships, as well as a user-defined, customizable dashboard view into key business items across an organization. Beyond the general-purpose features of Intraspect 4, the Services Collaboration application provides the following tools and data types customized for the services business processes:

- Client engagement workspaces for managing projects, aligning resources, disseminating effective practices and methods, and delivering projects.
- Opportunity workspaces for working on potential business, with tools for tracking progress, preparing proposals, and collaborating on strategy.
- Workspaces for managing large accounts across client engagements and opportunities.
- Issue tracking and reporting on key project metrics.
- Tools to identify experts and manage staffing of projects, including a candidate tracker and resume management.
- Extranet workspaces for negotiating issues, approving deliverables, and managing tasks with Clients.
- Tools for managing the development and dissemination of best practice and methodology materials.

- Highly-customizable "executive dashboards" that provide a global view across departments and projects, including projects, tasks, issues, opportunities, and customer relationship information.

3.2.2 Product Collaboration

Technology companies gain a competitive advantage by being first to market with new and innovative products. The success of a product development organization largely depends on the group's ability to rapidly implement innovative ideas. The more effectively one can harness customer input—along with the organization's knowledge and experience—the more successful the product development efforts will be. Intraspect Product Collaboration is a packaged application expressly designed to help development and marketing groups achieve their objectives. It equips people with secure web-based workspaces to share their work and collaborate seamlessly with each other, and with customers, partners and suppliers throughout the product lifecycle.

Built on the Intraspect 4 collaboration platform, the Product Collaboration application features a series of components specifically developed to give development and marketing organizations a unified view of the product design, development and launch process. The application also gives suppliers and customers a way to participate in product lifecycle activities from concept and development to marketing and delivery. By integrating collaboration technologies with knowledge management and project/process management, Product Collaboration plays a vital role in helping to bring innovative products to market faster. Specific tools include:

- Secure, collaborative workspaces for product development and marketing professionals to align their concepts and requirements with those from customers and suppliers. Development teams use customer input captured throughout the product lifecycle to refine product concepts and specifications.
- Tools and data types for managing the collaborative creation and review of requirements specifications, functional specifications, and design documents.
- Collaborative workspaces for Product Development Projects, with special support for organizing work by both Development and Marketing people around features and release status.
- Project workspaces for orchestrating product launch activities.
- Tools and data types for issue tracking and management.
- Product dashboards enable development teams to track product status, issues and resolutions throughout the lifecycle.

3.2.3 Customer Collaboration

Companies invest a tremendous amount of resources to acquire and retain valuable customers. To achieve a greater return on their investment, companies need to increase the profitability of each relationship, and success depends on providing a seamless customer experience. The ability to harness customer data—and the organization's knowledge and experience—improves the ability to satisfy customers. Intraspect Customer Collaboration provides secure web-based workspaces that allow customers and employees to share their work and collaborate effectively. Throughout the customer lifecycle, employees and customers alike can take advantage of the workspaces to interact and engage in a more productive relationship.

Built on the Intraspect 4 collaboration platform, the Customer Collaboration application features a series of components specifically developed to give sales,

marketing and support organizations a unified view of the customer account. More importantly, the application gives the customer a unified view of the product or service providing company. By integrating collaboration technologies with knowledge management and project/process management, Customer Collaboration plays a vital role in helping the organization facilitate sales development, manage accounts, and deepen customer relationships. Specific tools include:

- Co-branded extranet workspaces feature a highly customizable interface that incorporates your brand, your customer's brand, and even partner brands.
- Account management workspaces that enable account teams to bring together the resources and experience to accelerate sales cycles.
- Spaces where sales teams collaborate around responses, references and pricing in a central location.
- Special support for capturing and responding to customer requests and input.
- Dedicated workspaces to align local and global teams for integrated interactions with that customer.
- Capturing all interactions in a central workspace to a "living history" that helps reduce the impact of employee turnover on customer relationships.

4 Technology

This section describes how the Intraspect technology works, how it is organized, and what it offers for building on the platform. The Intraspect 4 platform provides the architecture and infrastructure on which collaborative applications can be deployed and managed. The Intraspect solution consists of three layers: Collaborative Platform Services, Application Building Services, and Applications developed by Intraspect and its partners (Figure 3). Let us consider each layer in turn.

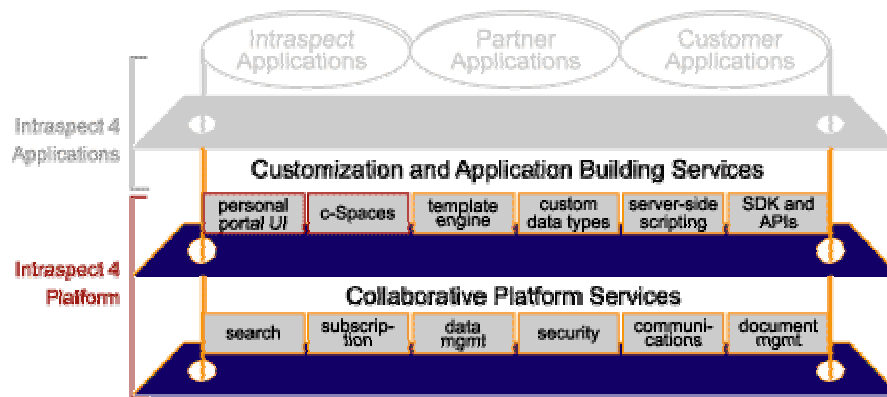


Figure 3: Three layers of Intraspect's technology: platform services, development tools, and applications

4.1 Collaborative Platform Services

The key collaborative platform services of Intraspect are a set of capabilities required of an Enterprise Collaboration Management solution. Intraspect delivers all of these capabilities in a single, tightly integrated package. They are: search, subscription, data collection, data management, document management,

communications and messaging, and security. Each will be briefly described here; other documents available from Intraspect will go into more detail.

4.1.1 Search

Intraspect provides a search mechanism for locating information from anywhere in the group memory and displaying it in the context in which it was previously used. Full-text indexing of all data allows retrieval by textual content, custom metadata, information type, author, date or location in the group memory. Intraspect combines a high performance commercial information retrieval engine with proprietary query preprocessing that optimizes for the kinds of queries performed in a collaborative, knowledge reuse environment. Intraspect is unique in its handling of meta data: it seamlessly combines relational queries, such as “find all objects of type X with attribute Y” and information retrieval queries, such as “find all documents containing the name “George Bush” and the noun phrase “oil industry”. End users don’t need to know the difference; they just need a user interface that makes it possible to learn how to ask for information.

Intraspect provides a flexible user interface for query solicitation, result list presentation, and query reformulation. Each aspect of the search can be customized. One can create many custom query forms for different kinds of searches (e.g., find a document that you know is in there; find an expert by what they have written; find a prior proposal in a given area; find a best practice for delivering a given practice). One can show the search results with context (which is powerful for deciding relevance), or create custom “reports” that show the search results as rows and columns of objects and their attributes.

Because search is such a powerful tool, few people have learned all the ways to use it to solve their business needs. Even developing a specific search query can be an iterative exploration process. In this sense, learning to use the power of search tools is another form of knowledge work that Intraspect can help to make available for sharing and reuse. Once a user has achieved the desired results from a query, he or she can save the search query, thus making it a *persistent query*. This creates an Intraspect object that serves as a kind of virtual folder whose contents are those items that match the query. The persistent search object can be named (“how to find out what we know about customer X”), put in folders and even commented on as if it were any other information source. When combined with customized result list formatting, the persistent search capability is to the world of unstructured data what enterprise report generation interfaces are to structured data.

4.1.2 Subscription and Notification

Intraspect offers a mechanism that notifies users, either through e-mail or a browser, when information is modified or when new relevant information is added to the group that matches an area of interest to the user. A user can subscribe to relevant information in the form of folders, documents, links to web sites, e-mail, discussions and search queries.

- Subscriptions to folders and documents are achieved through forward triggers on database transactions. In other words, when some transaction occurs on a folder or document, the event is immediately queued for subscription. Notification are then delivered to those who have requested to be told of these events. Because Intraspect has developed both the data transaction code and the subscription processing code, it can efficiently scale this service. Products that rely on polling for change are inherently inefficient.

- Subscriptions to web documents are triggered by Intraspect's web monitoring service. An Intraspect web document is like a bookmark: it is a URL reference to a data object hosted on some other web server. The remote content can even be password protected. Unlike a bookmark, an Intraspect web document will can monitor the remote content for change (hourly, daily, or weekly). When the content does change, Intraspect can then trigger subscription notifications to those who are interested in the web content. Again, because Intraspect has developed the machinery for managing web documents and the subscription mechanism, this monitoring process can scale. Alternative approaches such as periodically crawling the remote web site are less efficient.
- Subscriptions to searches are achieved through a high performance profiling engine designed to find news clippings in real time by pouring over thousands of documents an hour. The processing of search subscriptions happens at the same time as the search content is indexed: as the new content is indexed, it is quickly compared against all outstanding search subscriptions. If there is a match, the subscription notifications are efficiently queued. This approach is vastly more efficient and results in more timely notifications than re-issuing all of the subscribed search queries periodically.

4.1.3 Data Collection through HTTP, WebDAV, and SMTP

Electronic information can be added to the group memory through the upload function of a web browser, by using the Web Folders feature of Microsoft Windows, or by e-mailing directly to a specified location within the group memory. The HTTP upload function is achieved through a standard document post capability. The other two data collection channels are more interesting.

To achieve desktop integration, Intraspect implements a WebDAV server. WebDAV is an Internet standard for accessing documents over the web protocol HTTP using XML encoding of data. Intraspect was early to market with a WebDAV capability and has refined it in subsequent releases.

To achieve email integration, Intraspect implements an SMTP server, which is described below under Communications Services. The key capability is that end users can assign their own email addresses to their workspaces, without involving administrators or possibly conflicting with other email namespaces. Anything mailed to these addresses is effectively contributed to those workspaces. Intraspect also implements an LDAP server that offers an address book service for looking up email addresses within the Intraspect server. For example, a Microsoft Outlook user can enter "Acme" and have the address book functionality find all email addresses in the Intraspect server containing "Acme" and offer to put them on the To field of the message. Again, this address book functionality is achieved without anything to download or add to the email application.

4.1.4 Data Management System

Intraspect includes an embedded database subsystem that stores all information objects such as documents and folders and links to external information. The data management subsystem maintains all persistent state, including relations among objects and queues for processing messages and subscriptions. The database is fully transactional with ACID properties. All persistent content is maintained in a database. Systems that keep some of their data in a file system (perhaps storing only the metadata in the database) are vulnerable to data integrity problems on system failure. Intraspect's architecture ensures that no partial transactions, or incomplete backups, are allowed. Intraspect also manages the mapping from its

object model to the underlying database technology. This allows the product to optimize caching and locking at the application transaction level, which helps performance and load management.

4.1.5 Document and Content Management


Any content submitted to the Intraspect 4 platform can be put under document management services. Here are some details on how the document management technology works.

- **Document publishing and identity** is achieved by unique URLs that are independent of folder path and never change. This allows collaboration around references to these documents, even as their contents and filenames change. For example, if an Intraspect user posts the file `wirelessdraft1.doc` to the Intraspect group memory and calls it “Wireless Strategy for Acme”, the document’s URL remains the same as new versions, with filenames such as “`wirelessdraft2.doc`” and “`wireless-the-last-final-version.doc`” are uploaded. Publishing to a web server that uses the file system as its namespace and repository will change the URL on every change to the filename or parent folder, breaking the hypertext links to the document.
- **Document locking** is a collaboration feature that allows users to declare that they have “checked out” a document so that they can change it safely. Locking is different from access control, which determines who has the *right* to potentially change the document. Intraspect provides long duration locking so that people can collaboratively edit documents without accidentally writing over each others’ work. The locking is implemented at the platform level, so it is enforced across all interfaces that have a locking concept. For example, if someone opens a PowerPoint document in Microsoft Office 2000 using web folders, the Office software locks the document using the WebDAV protocol. If Intraspect sees a lock request over WebDAV, it enforces it over HTTP (e.g., the web interface shows a lock icon and prevents others from replacing the contents while it is locked).
- **Document versioning** allows a sequence of versions of the “same” document to be captured. When a document is put under versioning, Intraspect automatically creates a sequence of documents with unique URLs (preserving the stable identity for the most recent version). Furthermore, Intraspect allows independent commenting on each version. This is useful for capturing collaborative review of content such as specification documents or creative content for clients.
- **Approval workflow.** Intraspect also supports an approval workflow process that makes it easy to route a document around for approval. Reminders are sent by email. Access control is enforced.

4.1.6 Communication Services.

In effect, Intraspect offers an entire user interface through email. Using only their email client, users can:

- Upload a document to a folder
- Post a message to discussion
- Copy/forward an email message to folder
- Comment on a document by email
- Receive an FYI by mail (“Tell People”)
- Receive an approval reminder by email
- Receive a notification by email



To achieve email integration, Intraspect implements an SMTP server. This is not a replacement for a mail management and delivery system such as Microsoft Exchange, Lotus Notes, or POP3 servers. Intraspect's SMTP server integrates into any email infrastructure that can send and receive Internet mail – but it does not interfere with the security or reliability of the enterprise mail system. It parses all common forms of MIME encoding, which is how email formatting and attachments are implemented. The way Intraspect's SMTP service is implemented, any virus or security protection given to the enterprise mail infrastructure can be automatically afforded the Intraspect server.

4.1.7 Security and Access Control

Intraspect allows users to easily decide which individuals or groups can read, modify, delete or find information contained in the group memory. Project teams quickly can develop and deploy access control policies suitable for extended teams throughout the c-business community. Five tiers of permissions can be assigned across a broad spectrum that ranges from any combination of users and named groups to the individual objects within a given space. Intraspect access policies are information objects in the same group memory as all other objects, and so they also are governed by access policies. This uniform, granular access machinery makes it possible to delegate to different people the right to change a policy, the right to change the membership of a group mentioned on a policy, and the right to change policy that governs an object. This flexibility supports a range of collaborative models in the same shared environment, and avoids the IT administrative bottleneck that burdens first generation groupware systems.


Access control is implemented deep in the platform services. All access and transactions, through the user interface or any of the APIs, obey the access policies. This means, for instance, that one cannot discover the existence of an object through search, and that one cannot anonymously change the content of some object without permission.

4.2 Customization and Application Building Services

The Intraspect 4 platform provides several mechanisms that allow users to customize the core product for specific applications. These include functions for modifying the user interface, for designing document and project workflows, for categorizing information with application-specific labels, and for applying business specific rules. Intraspect uses these mechanisms to build its own products and to provide access to them for partners for their own collaborative applications. The APIs provided also allow the platform to be integrated with other enterprise applications. Examples include mechanisms for interfacing to corporate portal products providing critical collaboration capabilities to their publication infrastructures and ERP systems for merging the benefits of people-to-people collaboration with the transaction-based applications typically used to run the back office.

The customization layer includes the following key technologies:

- **Template Engine.** The template architecture controls the appearance and functionality of the web interfaces. The template engine executes the templates to generate output sent to web browsers or other web agents. Template files are a mix of HTML or other output and Java method calls (templates are syntactically similar to JSP pages). Intraspect allows multiple views of the same group memory, each a complete and coherent user interface. The Intraspect 4 platform ships with a functionally complete library of HTML templates that expose the general features of Intraspect 4. Specialized application functions can be built using templates from the



default library or new templates can be added and integrated into other applications. The programmatic sections of templates use a Java subset that is documented in the Software Developers Kit (SDK). Since the templates are text files containing mostly HTML, no special development tools such as compilers are required to create custom extensions to the user experience.

A key property of Intraspect's presentation architecture is the clean separation of read-only presentations, driven by templates, and side-effecting transactions, implemented by server-side scripts using the Java API. The template engine provides a safe "sandbox" in which user interface designers can creatively explore possibilities, without risking any change to code that implements a transaction (in other words, UI code cannot damage the underlying server or database). Errors in templates are fully encapsulated, producing only error messages and not server crashes.

- **A Reference User Interface including a Personal Portal UI.** Intraspect ships with hundreds of predesigned templates, which provide user interfaces for common features and operations. It includes interfaces for personalizing the information presentation, such as those found in portal products. It includes interfaces for search, form-based editing, and so forth – all customizable. Changing these templates does not require changing the underlying data model. This speeds development of new user interfaces, customer branding and support for specific work processes, and allows specific elements of the user interface to be surfaced into other applications, like portals or customer management solutions.
- **C-Spaces.** C-Spaces are project spaces that allow users to set up secure areas within the group memory without IT involvement. Organizations can define preferred project models which include default documents and links. Users run a simple wizard that prompts for project roles and assigns users their access rights. The Intraspect 4 platform manages role and access policies.
- **Custom Data Types.** The Intraspect 4 platform allows solutions to extend the default data model to represent objects specific to business processes and vertical domains, such as task objects in professional service projects or deal objects in financial services. These data types and their accompanying user interface and workflow can be created and used without any change or interruption to the underlying platform's data storage and service.
- **APIs.** In support of third-party developers building applications using the Intraspect platform, Intraspect provides application programmer interfaces, or APIs. The HTTP API is for operating on the Intraspect server through web-browsers and for integration with other web-based applications. All of the information in Intraspect is available in extensible mark-up language, or XML, format, which is accessible over the HTTP API. In addition, Intraspect provides a complete Java API, which allows Intraspect to integrate with enterprise applications, document management systems, relational databases or any other applications that can be accessed by a Java program. The Java API can be run over HTTP or run locally on the server.
- **Server-side scripting.** Using standard scripting languages, programmers can extend the set of operations available over HTTP for use in web interfaces and in integrating other applications. Server side scripts call the Java API.
- **Software Developers Kit.** The Intraspect 4 platform has a fully documented set of APIs and tools to support developing robust and scalable solutions.

4.3 Integration into the Enterprise Ecology

Figure 4 depicts how the Intraspect platform integrates within the existing information technology infrastructure of the extended enterprise.

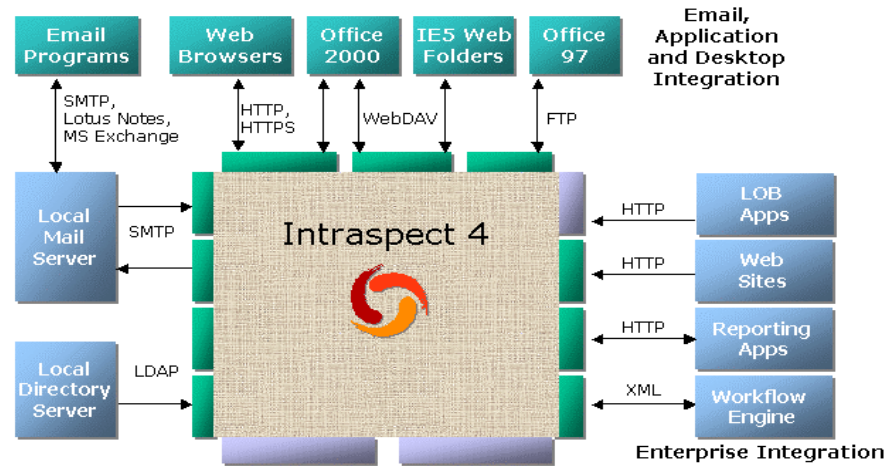


Figure 4: Intraspect integrates into the enterprise ecology via standard protocols

- **Integration with E-mail.** E-mail contributions to the group memory are accomplished through the use of the industry-standard simple mail transfer protocol, or SMTP. Intraspect also includes a built-in lightweight directory access protocol, or LDAP, server that allows users to search and browse Intraspect e-mail addresses directly from their existing e-mail application.
- **Integration with Web Browser.** Intraspect's web-based user interface runs under Microsoft Internet Explorer and Netscape Navigator. The server interacts with web agents over HTTP using the standard Java Servlet architecture. Intraspect comes with its own HTTP server, and also supports the use of other web servers, including Microsoft's IIS server.
- **Integration with Desktop Applications.** Intraspect includes a web-based distributed authoring and versioning, or WebDAV, server, which allows folders within Intraspect to have the appearance and functionality of file system folders within the Microsoft Windows environment. Intraspect also includes a file transfer protocol, or FTP, server that allows information transfer between applications that use this protocol such as Microsoft Office and Apple or Unix desktops.
- **Integration with Other Sources of Electronic Information.** Intraspect includes an HTTP client that collects and monitors the content of external web pages, including those that provide access to reports from web-compliant applications. An optional feature of Intraspect is a crawler module for connecting to Lotus Notes databases. All of the information in Intraspect is available in extensible mark-up language, or XML, format, which is accessible over the HTTP API. The WebDAV server also supports programmatic data exchange, including file contents and custom metadata, using XML over HTTP.

5 Summary

Intraspect has created a comprehensive, integrated set of capabilities to provide a premier Enterprise Collaboration Management solution. While the underlying architecture combines many technologies and thrives in the demanding enterprise ecology, ultimately Intraspect's strength lies in the simplicity of the driving ideas: *support knowledge workers in their existing work practices and tool environments, help them work effectively in large collaborative communities, capture the information they use and create, and make it available for others to learn from.* All of the Intraspect products and technology support this model. The Intraspect 4 platform provides a suite of features that help people work with information and other people from email, the desktop, the web, and the road. Intraspect Applications extend the platform features with data types and services that support more deeply the work practices of professional services, customer interaction, and product development. The better that the software supports how people actually work --- or want to work --- the more useful it is to capture the fruits of their labors in the context of their work. The more authentic and complete and contextual the information that is captured, the more valuable the resulting knowledge base is for everyone in the extended enterprise running on Intraspect.

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