CRATOS
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Extranet-based Business Models

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Abstract

After bringing the almost 30-year-old computer network called the Internet into our corporations, we get intranets. Now we intelligently join these intranets to create extranets. These amazingly promising extranet applications combine the best of both worlds. You can take the speed and richness of an intranet application and extend it beyond your firewall with the reach and functionality of the Internet. Done right, you can create an application that dramatically enhances the way your company does business.

One of the most exciting applications today is enhanced ordering systems. These systems tie suppliers more tightly to their customers, benefiting both parties. As the cost of corporate purchase order processes continues to climb, the need for this integration is clear. Unfortunately, the problems of electronic data interchange, incompatible systems and conflicting architectures have impeded a simple solution. But extranet solutions promise to overcome these hurdles.

EXTRANET-BASED BUSINESS MODELS

1. INTRODUCTION: THE THIRD WAVE OF INTERNET EVOLUTION

1.1 The first wave: the public domain Internet and World Wide Web

The Internet and WWW have provided unprecedented ways of linking people with information. With the Web's ubiquitous software and technology, global access to data, text, documents, pictures, sound, animation, video and other information from any Web-enabled computer or workstation is now a reality. The recent awareness and popularity of this medium has been fueled primarily by the fundamental simplicity and adaptability of the Internet's open and standard protocols. More than simply a vehicle for information dissemination, the Internet is leading networking and computing shifts away from closed and expensive proprietary systems to more flexible and cheaper Web technology-based environments.

1.2 The second wave: intranets

Intranets are secured areas that utilize the Internet and WWW technologies to conduct internal communication and collaboration activities. Adopted by companies at an increasingly phenomenal rate, intranets have produced efficiencies for businesses that allow users to manage their organizations more efficiently and effectively “behind the firewall”. To date 2/3 of Fortune 500 corporations and thousands of other companies have already established intranets, the majority of which are being used to manage tasks, information and group work within individual organizations (Forrester Research, 1997).

1.3 The third wave: extranets

The term *third wave* refers to the maturation process in the development of Web technology which is enabling the increasing diffusion of electronic commerce.

An extranet, or extended intranet, is a private business network of several cooperating organizations located outside the corporate firewall. An extranet service uses existing Internet interactive infrastructure, including standard servers, e-mail clients and Web browsers. This makes extranet far more economical than the creation and maintenance of a proprietary network.

Extranets are permeable, yet secure commerce-enabled networks that electronically link distributed organizations or individuals over the Internet in a public, semi-public or private forum. These emerging networks establish *virtual firewalls* to extend the benefits of a company's intranet and enable collaborative business applications across multiple organizations. Secure, collaborative and interactive workspaces serve to connect companies and their customers, suppliers, and other stakeholders, and produce efficiencies in such representative business models as electronic commerce, collaborative publishing, and supply-chain management.

Most costly slowdowns occur not within a particular company, but instead are accumulated throughout the distributed communication and management constructs that define a given business process. Extranets are extremely powerful in that they can mirror, support and streamline these business processes across distributed companies, creating market efficiencies for both internal and external influences. Extranets can control access to information, applications and other capabilities on-the-fly, allowing participating organizations to determine and enforce who has access to what information throughout the on-line business cycle.

Extranets can provide the most logical and immediate benefits for businesses within their *natural markets*. Natural markets consist of groups of partners and alliances that participate in common business scenarios such as buyer and seller, product-to-market, consultant or contractor arrangements, customer service/responsiveness, sales and lead generation, and other established business relationships. Within these natural markets, extranets can achieve breakthrough efficiencies including collapsed cost structures, economies of scale, and other returns on investment for organizations involved with or contributing to this process.

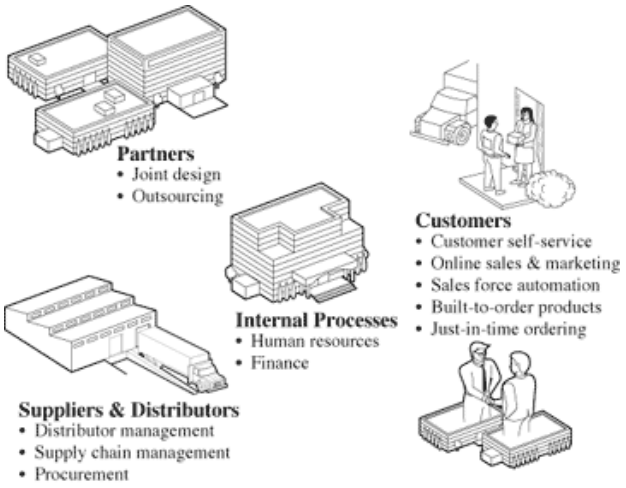

Figure 1 – Communities of stakeholders potentially involved in an extranet

Technical and cost advantages are, of course, very important. But the real significance of extranet is that it is the first non-proprietary technical tool that can support rapid evolution of electronic commerce. There is a lot of talk about the impact of the Internet on retail sales, credit cards and various digital cash and payment settlement schemes. However, the real revolution over the next three to five years will be in systems for global procurement of goods and services at the wholesale level. And this is where extranets will play a critical role.

Prior to the existence of extranets, software solutions that were implemented across different organizations were extremely expensive to build and consisted primarily of customized proprietary programming. These closed systems environments made it difficult, if not impossible, to link the entire product supply chain - manufacturers, suppliers, dealers, off-site contractors and customers - especially if each organization followed a different networking and development plan. Web-based extranets are inherently flexible, scaleable, portable, and extensible to achieve integration across distributed, cross-platform or heterogeneous system environments, and greatly reduce traditional barriers to cross-organizational networking.

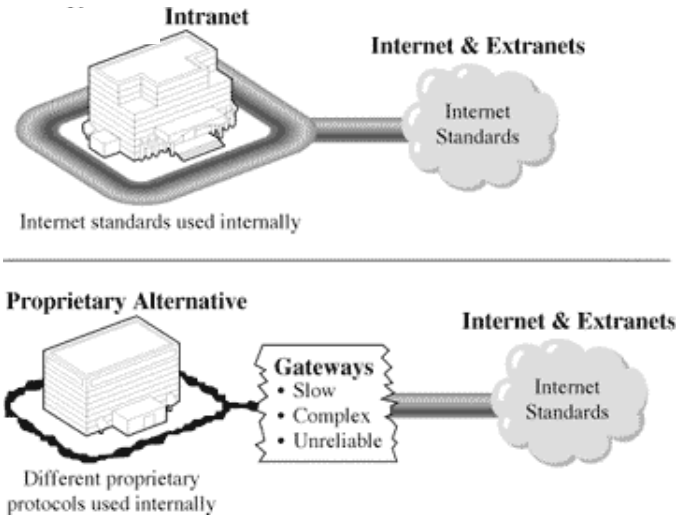

Figure 2 – Conceptual differences between intranet/extranet architectures and proprietary systems

2. THE EXTRANET MODEL

2.1 The strategic role of the extranet

The extranet represents the bridge between the public Internet and the private corporate intranet. The extranet connects multiple and diverse organizations on-line, enabling strategic communities of stakeholders with common interests (*communities of interests*) to form a tight business relationship and a strong communication bond, in order to achieve commerce-oriented objectives. The extranet defines and supports this extended business enterprise including *partners*, *suppliers and distributors*, *contractors*, *customers* and others that operate outside the physical walls of an organization but are nonetheless critical to the success of business operations. With the Internet providing for public outreach or communication, and intranets serving internal business interests, extranets serve the business-critical domain between these extremes where the majority of business activity occurs.

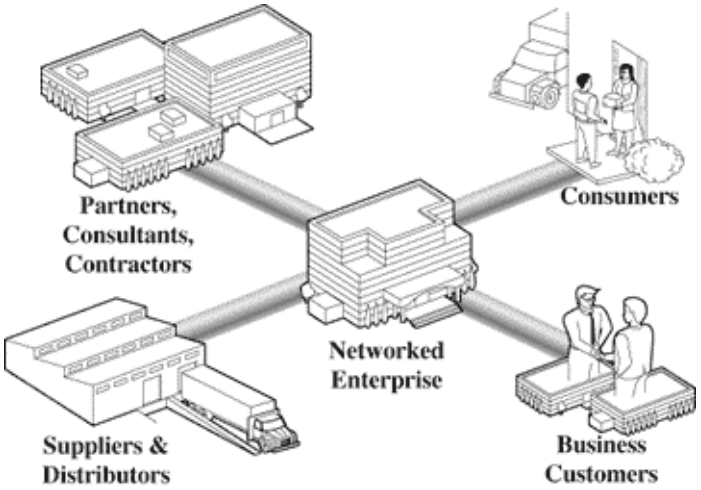

Figure 3 – The extranet model

The unification of robust enabling technologies and ubiquitous access through the Web is resulting in unique and interesting market dynamics that are changing the way many companies are doing business. Interactive communities are beginning to emerge that exist solely in cyberspace, where information travels faster, more cost effectively, and with greater accuracy when compared to other forms of communication and information exchange. These interactive communities are the driving and sustaining force behind the extranet concept, and their insatiable collective need to access content when, where, and how they want to see it will continue to push the limits of what is technologically possible.

Extranet solutions built to engage and support these interactive communities are designed to emphasize and foster customer relationships. As successful businesses know, the cost of obtaining a new customer far outweighs the cost of maintaining a current one. With commerce-enabled extranets, companies are now able to establish and maintain one-to-one relationships with each of their customers, members, staff or others at very low cost through the Web, offering a customized and individualized experience that can be dynamically generated or modified based upon a user's privileges, preferences, or usage patterns. Information entered by the user (registration form, on-line surveys, etc.) can be compiled with statistics and other information that is captured automatically by the system (searches performed, products purchased, time spent in each site area, etc.) to provide the company a complete picture for each and every visitor of the system. This comprehensive user profile offers unprecedented opportunities to present relevant information, advertising, product and service offerings and other content to a qualified, targeted interactive user community on a one-to-one basis.

2.2 Characteristics of Emerging Interactive Communities of Interests

Emerging interactive communities on the Web are comprised of individuals and organizations who are demanding that increased value be delivered through these on-line solutions. The static brochure Web site is fast becoming an outdated marketing tool that does not effectively serve the needs of business. Extranet solutions couple the power of the Web with true business purpose. As a result, several dominant characteristics are emerging for supporting this interactive business model.

One of the strongest characteristics of the on-line interactive community is an active member-centric focus. With the ability to capture both active (user-entered) and passive (system-recorded) information throughout the user's on-line experience, the site owner now has a wealth of information that can be used for promotional efforts, customized offerings, and other incentives to entice the user to return to the site and conduct future business. Integration with other forms of more traditional communication such as e-mailing lists, global-faxing, and direct mail extends the reach of the Web site beyond the software browser and executes a more inclusive strategy to engage individuals and organizations at whatever technology level they reside.

Another characteristic for these interactive business models is a change in the way content is presented. In the early stages of the Internet's development, "content is king" was the credo followed by many as they established their company's on-line presence. Today, lack of information is no longer the concern; quite the opposite. As a result, the emerging interactive communities are substantially more discriminating in their need for relevant, value-added information. This, combined with the fact that the WWW remains a user-driven medium with content being requested or specifically selected with each click of the mouse, presents the ongoing challenge to keep the users interested and engaged in an interactive service. The new paradigm for information dissemination through the Web involves presenting *content in context*. This requires not only knowing your user community and providing the business-critical information that will be of interest to them, but also offering the capability for the user to control their own system environment. Extranet applications (for instance, intelligent agents) that dynamically control and generate pages based upon user's privileges and/or preferences can instantly display relevant information to the user, presenting content in the manner in which he/she wishes to receive it.

The third major characteristic is transaction management activities. Millions of people have already made their way to the Web, and the accompanying flow of currency is not far behind. According to a recent market study [1], Internet-based sales represented 73.8% - or $733.1 million - of all electronic sales in 1996. That figure is projected to grow to $4.27 billion by 2000, accounting for 85.0% of all electronic sales. The circulatory system of the new digital economy is quickly being established, due in part to the business-oriented demands of the emerging interactive communities. SET, SSL and other industry standards are gaining wide acceptance and use for Internet-commerce activities; however, robust commerce-oriented solutions will also be required to effectively support the various on-line business models [2]. Extranet solutions are specifically designed to support the various revenue models of the Web. Advertising and promotion of goods and services, acquisition of *market intelligence* from consumers, subscriptions, pre and post sales support, on-line retail sales and delivery services [3] as well as communication between traders and supply chain management operations all present complex challenges for both front and back office operations.

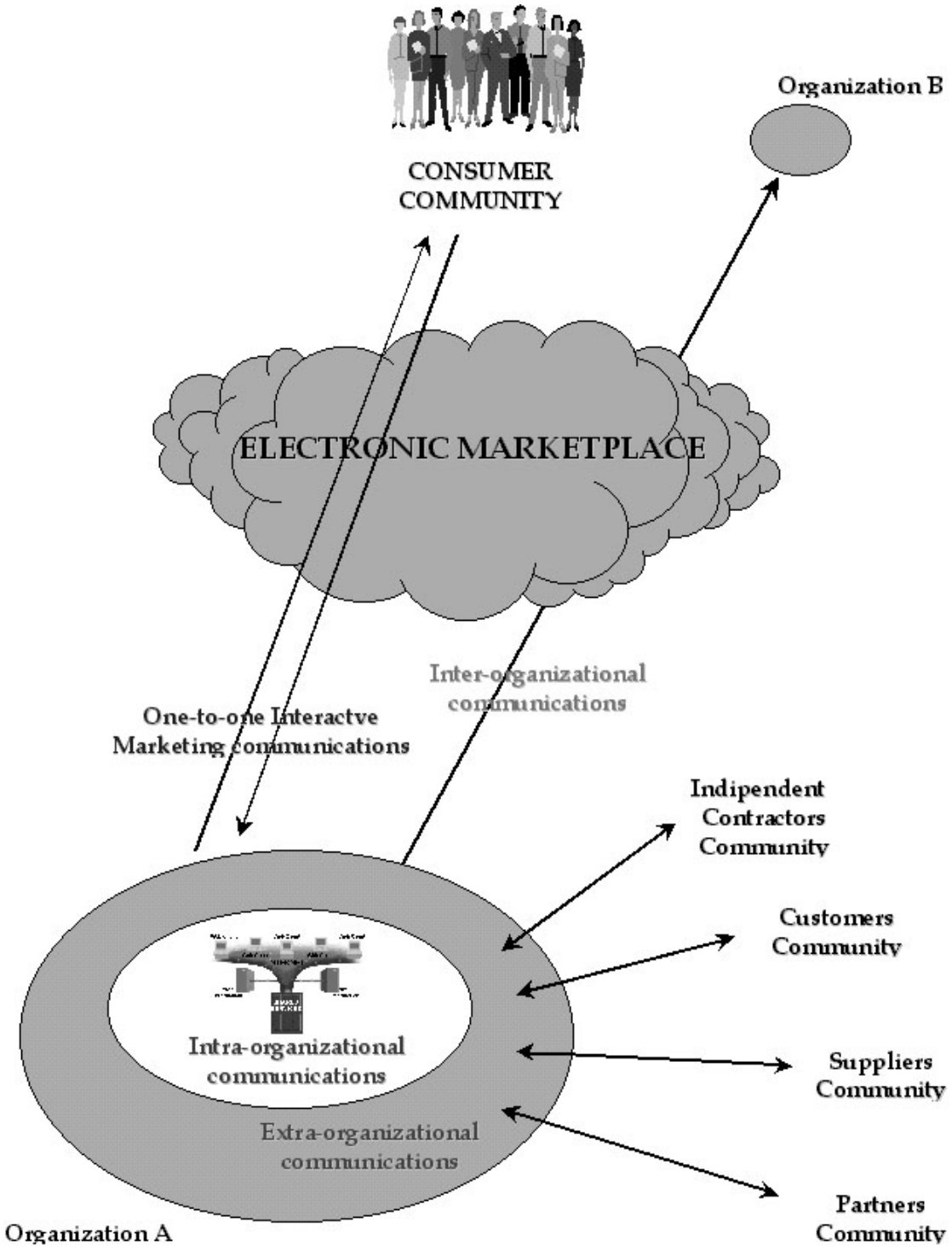

Figure 4 – Inteactive communications between communities of interests

2.3 The Knowledge Factory

On a more fundamental level, the extranet is also likely to redefine the business evolution of a conventional corporation into ***the knowledge factory***. It will radically change the way private and public sector organizations would conduct their business in the new Internet-driven global economy.

The concept of the knowledge factory is critical to the evolution of extranet-based business models. To survive and prosper in the new *information economy*, organizations must position themselves as high-tech enterprises, evolved into knowledge factories and able to be internationally competitive. For such enterprises - whether manufacturers, government agencies, banks or catalog stores - knowledge engineering has to be their core competence, the principal strength that keeps them in business.
Knowledge engineering is understood here as the business of:

1. gathering relevant data from suppliers, customers and other key sources (such as academia, the business community or the government)
2. adding value by creating information (that is, new knowledge), often jointly with strategic partners
3. disseminating (selling) the added-value products/services to the customers

As a mission-critical corporate tool, extranet has to support every one of these core functions, more effectively and economically than traditional concepts and tools.

Every traditional factory in the old economy is a well defined and distinct entity.
Its information infrastructure normally includes *input, processing, and output* as the three principal elements.

In the new economy, global competitive pressures induce very short product/service development cycles. As well, the risk associated with misjudging clients needs and partners abilities to deliver is high. Hence, the extranet-supported global information infrastructure of the knowledge factory must also include its clients, suppliers and partners. It must support efficient feedback mechanisms to maintain services quality and automatically track changes in the environment and in the customer preferences and priorities.

In the knowledge economy, no organizational framework could be created once and forever. The knowledge factory's output must be uniquely positioned on the international market, thus satisfying individual needs of its clients. Its sales cycle has to be short but productive. The introduction of the feedback system is essential for the long term evolution and prosperity of the service.

Moreover, every corporation has to vigorously protect its competitive information and is often obliged not to divulge private data on its clients and partners.
Every knowledge factory has somehow to resolve the contradictions of constantly sharing data with its existing and potential customers, partners and suppliers on new product lines, thus uncovering and addressing their evolving needs and of gathering information on their abilities, needs and preferences while protecting vital individual and corporate data from its competitors and nosey Internet bystanders.

3. EXTRANET SCENARIOS

3.1 Electronic Commerce

Electronic commerce conducted through extranets can be performed and managed more effectively, efficiently and profitably than with traditional avenues of business exchange. Extranets can provide a new channel for the selling of merchandise, intellectual property and subscription services securely over the World Wide Web, while simultaneously streamlining the "natural market" buyer-seller relationships that comprise the merchant value chain.

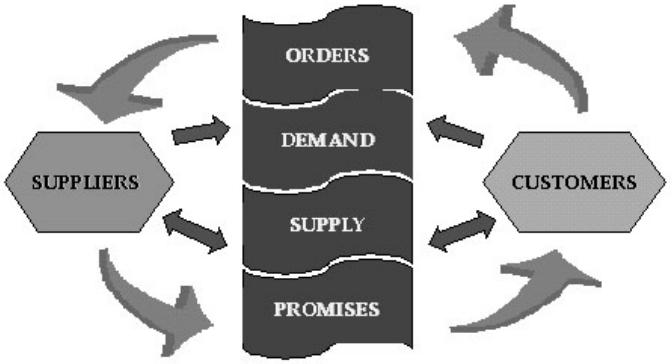

Figure 5 - Electronic Brokerage Model

By using electronic networks to offer sale goods and value-added information services on-line, firms can reduce the costs of searching for and dealing with customers or suppliers, achieving an **electronic brokerage** effect. For example, the SouthWest Airlines Web site (www.southwest.com) which allows consumers to search for and compare ticket prices and availability before ordering, Federal Express' Web site (www.fedex.com), which allows customers to send, track and confirm overnight packages, and SportsWarehouse (www.sportswarehouse.com), which allows firms to order from a variety of premier sporting goods through the World Wide Web, are all using Internet-based technology to their business advantage. These services all connect different buyers and sellers through a shared information resource and provide engines for searching the data. They help the customers to quickly, conveniently and inexpensively evaluate the offerings of various suppliers, with the convenience of working from their own personal computers. The electronic brokerage effect can increase the number of alternatives as well as the accuracy of the alternative ultimately selected, while decreasing the cost of the selection process. Also, conducting merchant activities through an extranet transfers more of the selling function to the customer, bringing transactions to a more time and cost efficient conclusion.

Web-based capabilities such as on-line catalog/product displays, virtual *shopping-cart* functionality, and on-line credit card processing allow customers from around the world to shop 24 hours per day, with little or no additional labor or overhead expense to the firm. Additionally, capabilities such as electronic preference tracking and automatic customer notification/updates provide unprecedented ways of establishing one-to-one relationships with each and every on-line customer who shops within an extranet. Information volunteered by the customer as well as that recorded throughout the user's on-line experience (purchasing patterns, time spent shopping, frequently searched items, etc.) provides a complete customer profile for order fulfillment and proactive customer relationship building.

By using extranets to reduce the costs of coordinating and managing a particular buyer and seller relationship, firms can also achieve an electronic integration effect. An example would be an extranet system that connects a retailer's point of sale terminals to a supplier's delivery system, decreasing the likelihood of a retailer going out of stock on popular goods. Another example is the integration of CAD/CAM systems between a computer chip design firm and a silicon foundry, that allows the designers of a chip to monitor the manufacturing process and to have more flexibility in changing their designs.

This effect manifests itself when technology is used not only to facilitate communication but also to tightly couple processes at the interface between stages of the value chain.

Examples of interorganizational electronic integration that can be performed with an extranet solution include Electronic Data Interchange (EDI) activities such as product specifications, order status inquiry/reports, invoice generation and tracking, and other similar business process information. Integration can also include synchronous or asynchronous interfaces with legacy systems and databases such as electronic funds transfer, inventory control systems, point of sale (POS) systems, contact management databases and accounting/billing systems.

Whether extranets are utilized to bring about brokering or integration efficiencies, these networks can greatly reduce or in some cases eliminate the costs and traditional complexities of cross-organizational coordination and commerce. By being able to effectively manage the many buyers and sellers with an extranet network, a merchant can acquire more experience, level the load of production across many customers, and capitalize on economies of scale, all of which generally lead to more efficient production and business processes.

3.2 Sales and customer service

Before the advent of Internet-based technologies, companies traditionally relied on paper transactions, face-to-face meetings, phone calls and other repetitive communications to conduct sales and customer support activities. These extremely laborious and cost intensive activities have long been considered compulsory drains on company resources due primarily to the individualized processes associated with each customer or account. For those organizations that manage a direct sales effort or deal with VARs, ISVs, SIs or other third-party marketing vehicles, however, the challenge exists to harness the power of the Internet to put the right information in the hands of the people who need it in a cost-efficient manner. Extranets permit companies to preserve the integrity and distinctiveness of these one-to-one relationships, while reducing the time and effort involved in managing the sales or customer service process. Extranets can offer improvements to the selling function making employees more productive, supporting the customer throughout the sales process and assisting the “acclimatation” of new sales representatives or third-party marketers.

At a fundamental level, Extranets can provide a single, unified tool that offers immediate access to information, materials and data needed to support the sales process from prospecting through closing a deal, and account management. Information on a customer or competitor - including financial reports, recent news articles and press releases - is instantly available through any Web-enabled computer and is protected by a robust extranet security architecture. Customer presentations, proposals and contracts, marketing literature, templates, internal forms, and product slicks can all be made accessible through the Web or available for downloading, depending upon a **user’s access rights and privileges.**

More than a static data repository, however, sales or VAR representatives can automatically initiate a workflow or procedure, eliminating the hurdles of needing to know who to call or awaiting for approvals or confirmations. Integration with e-mail gateways and pager systems give the ability to send *alert messages* to appropriate personnel across multiple departments or organizations, greatly reducing the disconnects that frustrate customers and compromise business deals. Task management and groupwork tools within an extranet can instantly display where bottlenecks exist so that appropriate action can be taken. Additionally, fully or semi-automated communications ensure that customers, managers, system integrators or other personnel are kept informed at each stage of the sales/implementation process.

Perhaps one of the most notable impacts that extranets can provide for a given sales initiative is in **the lessening of the learning curve** for new sales reps or others integral to the customer acquisition process. For a new representative, each day lost to training, system updates, or other downtime is a day of not reaching quota. For dynamic and especially high-growth firms, integrating new hires or partners into the knowledge and information network that exists within every business is crucial for reaching peak effectiveness and profitability. Extranets can dramatically ease the burden of acclimatation and learning for new employees, affiliates or strategic partners.

Electronic commerce has interesting implications when combined with an effective extranet-based sales initiative. An entire customer experience (or selected parts) can be managed including qualification, sale, delivery, and on-going support - all securely and effectively through the World Wide Web. This integrated sales process is currently being used by such companies as Virtual Vineyards (www.virtualvin.com), a company that sells wines through the Web and TESCO (www.tesco.co.uk), a virtual supermarket which has reproduced on the Web the shopping experience. Firms can greatly reduce the labor cost required in qualifying, closing and processing a sale and simultaneously capture customer information for future support services.

Customer support in all its forms (help desk, e-mail, voice mail, etc.) can be greatly facilitated with an extranet solution. For example, at relatively low cost, each customer can be provided their own private and personal workspace that can be automatically updated with information such as on-line newsletters, tips for product effectiveness, promotional campaigns, customer surveys and other client-oriented content. This information can be distributed electronically to a broad customer base or can be tailored by individual or customer group (i.e., different information delivered based on product type/model, customer preferences or customer histories).

Feedback mechanisms to report problems or questions to a customer support representative can be automatically forwarded to a corresponding Web-based conference, e-mail or pager, and these requests can then be managed through the extranet to a point of resolution. For example, if a customer request requires a phone call or on-site visitation, the request can be effectively queued and automatically forwarded to the appropriate staff member for assignment and follow up.

Other benefits offered by an extranet to enhance a firm's customer support function include integration of back office operations such as call/issue logging, reporting, and analysis to evaluate employee effectiveness and to guide future product development efforts. Integration with billing and help desk systems can also be achieved to bring increased contribution and accountability to the customer support life cycle.

3.3 Product-to-market scenario

The costs that can be incurred across the entire supply chain - from order management and the sourcing of raw materials through installation of finished products at a customer site - can account for a major portion of a product-oriented company's balance sheet. Couple this with a business environment that consists of fierce competition and low profit margins and you have a market situation that can greatly benefit from the advantages of an effective extranet presence.

One advantage of extranet systems is that they are neither industry nor product dependent. Extranets can effectively track performance measures to address critical areas of operations. Results can then be used to drive change and cost reduction initiatives. Extranets can serve to manage an organization's metrics to optimize productivity and quality assurance initiatives. Regardless of whether you are producing high-tech software or dresses, extranets can map to and support virtually any business model or process for bringing products to market.

Specifically, the Web potentially offers certain classes of providers participation in a market in which distribution costs or cost-of-sales shrink to zero. This is most likely for firms in publishing, information services or digital product categories, although companies dealing in harder goods may benefit from disintermediation or even the eventual elimination of costly middlemen.

Moreover, suppliers, distributors, wholesalers and retailers can access and contact each other directly, potentially eliminating some of the marketing costs and constraints imposed by such interactions in the physical world. This may also have the effect of streamlining the channel and making the process more efficient mainly due to reduced overhead costs through such outcomes as uniformity, automation and integration of management processes. Extranets give visibility and insight into potential slowdowns or inefficiencies that can adversely affect overall productivity. With advanced workflow management tools, a costly backlog or delay can be immediately recognized and dealt with before compounding into a larger problem. If a problem cannot be easily resolved, affected personnel across multiple organizations can be immediately notified of the situation and appropriate measures can be taken.

Extranets allow for the effective management of multiple vendors, contractors and other contributors to the production process. Not only can this translate into capturing and serving a potentially larger market share, but also provides more options for selecting the most dependable and strategically aligned partners for future business development.

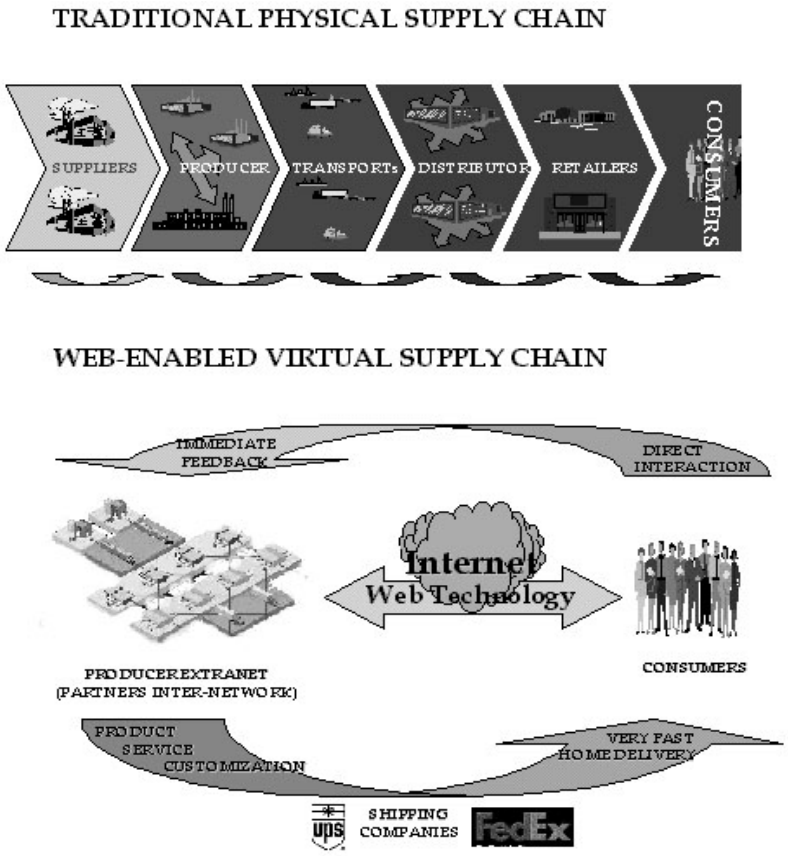

Figure 6 - Supply chain re-definition and disintermediation process

3.4 Contractor/distributed partner scenario

Today, more than ever, a distributed team-based approach is gaining favor as the preferred method of doing business. In many instances, projects are staffed with *virtual teams* of managers, consultants, administrative assistants and others drawn from offices and practices all over the world. These teams can come together for an assignment based on their expertise and may never work together again. So the ability to get up to speed quickly on each other's specific areas of expertise is key.

Geographic distance, lack of personal knowledge of individual contributors and the diverse agendas make locating knowledge and information - let alone leveraging it - a **cross-organizational challenge**. Extranets are ideally suited to institutionalize the time-effective sharing of information and skills among employees and teams to a mutually beneficial end.

Representative projects where the management of distributed teams is especially useful are proposal writing, subcontractor relationships, document-driven revision and exchange, group committees or task forces, multi-national collaborations, and other activities that require contributions or inputs from a geographically dispersed community.

In some instances, especially within complex organizations, the objectives involve interdepartmental cooperation, with representatives from Marketing, Product Development, R&D, Production, Distribution, Accounting and other divisions joining together to produce a given result. Frequently, however, the project also involves inputs from other organizations, with their various departments and influences all contributing to the good of the project. Effectively managing all of these entities, with secured access to relevant information, naturally lends itself to the open, scaleable, and extensible system environment of a Web-based extranet.

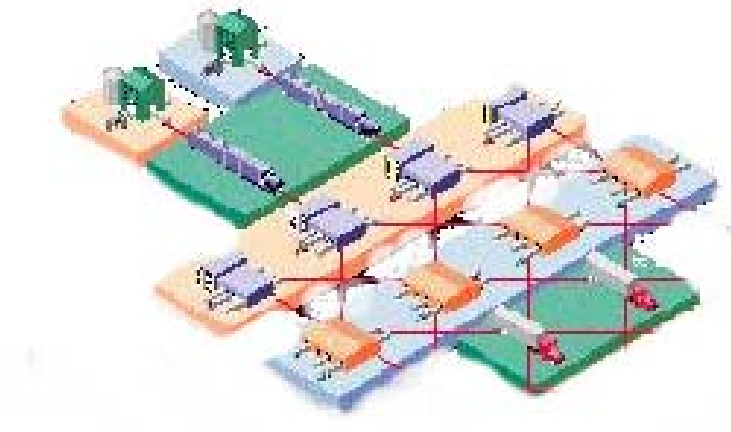

Figure 7 - Cross-organizational Web-based extranet model

4. KEY REQUIREMENTS OF AN EXTRANET

Internetworking of unrelated, distributed organizations poses unique challenges for an extranet to be successful. Regardless of the type of business or number of organizations involved, the following are the key requirements that should be satisfied in order to create an effective multi-organizational extranet architecture.

4.1 Extranets require a Web-centric network and business model

The integration and coordination of a diverse and distributed group of business entities and individuals, each with potentially dissimilar networking and computing environments, requires the commitment to an open-systems platform that supports universal standard protocols for information exchange. The Internet and in articular the World Wide Web provide the ideal platform to fulfill these requirements. The Web can support a wide range of data types for distributed information transfer and offers a flexible development environment for site and application assembly, transaction management, and software deployment activities.

4.2 Extranets must be goal-oriented

Extranets are most effective if they support a common goal, objective or process that benefits all of the organizations involved. Business objectives such as cutting inventory acquisition times from weeks to days, guaranteeing customer response time within an hour, or even having the ability to customize a product while still on the assembly line are all possible using an extranet networking environment. Working toward a specific goal not only helps determine the success of the extranet, but helps justify buy-in practices for all of the participating organizations. With a well-focused objective, extranets can be developed to serve the business interests of commercial, governmental or non-profit organizations.

4.3 Extranets must be future-oriented and legacy-sensitive

Successful extranets are designed to produce immediate benefit for the participating organizations and simultaneously prepare for future enhancements to the on-line system environment. It is not necessary for a company to discard its existing infrastructure in favor of a totally new direction. Extranets can breathe new life into existing business processes by integrating legacy systems, enhancing communication systems and improving employee productivity through the utilization of Web server and browser technology. Effective extranets also provide the extensibility to integrate "best of breed" technologies to position the system for future enhancement and integration with advanced applications. Extranets can become a meaningful and practical tool to translate a corporation's vision into reality.

4.4 Extranets require powerful software applications

An extranet supported by powerful software applications and tools will serve its enterprise community effectively and efficiently. Applications are the keys to an extranet's success and should be scalable to meet the growing and changing demands of the user community.

4.5 Extranets require coordination and commitment

Effectively coordinating and managing a system across multiple organizations is a complex endeavor and should not be understated or overlooked. Management must commit to and adopt standards, methodologies and practices throughout their organization to support the utilization of the extranet environment.

5. ADVANTAGES/BENEFITS OF AN EXTRANET

An extranet offers impressive advantages and benefits to a distributed group of *organizations with common goals or objectives*. These advantages can be justified based upon **cost**, **time**, and other **resource efficiencies** that can be recognized across the various organizations. Extranet solutions, however, should be developed and supported with robust software tools to ensure they can meet both the immediate and long term requirements of the organizational group. Specific advantages that an extranet can provide if developed with a flexible, scalable, open and secure architecture solution are briefly analysed below.

5.1 Ease of set-up, use and maintenance

Extranets should be simple to set-up, use and maintain. The time it takes to develop a complete and functioning extranet with a robust Web-standard software solution amounts to days or weeks, rather than months or years with proprietary networks solutions. Modifications can also be implemented with little or no interruption to the extranet's activities.

5.2 Scalability

Extranets require the flexibility to grow to include additional users or organizations, or to expand to a new hardware server array without compromising the system's usability or integrity. Solutions written using non-industry standard format or proprietary architectures can significantly restrict an extranet's ability to scale to include new users, applications, servers or other components. Extranet solutions eliminate the lock-in strategies used by software vendors and allow for greater extensibility of the extranet to meet the growing and changing demands of the on-line user community.

5.3 Versatility

An extranet should serve fundamental business activities such as document exchange, collaborative discussion groups, on-line submission forms, database queries, etc. yet have the ability to be customized to satisfy a particular business purpose. For example, companies transferring text or document files have different requirements than those that transfer movies, video clips, other multimedia files to be viewed on-line. Some organizations may wish to sell directly on-line through the extranet and others may wish to only automate the back office operations. Regardless of the business objective, extranets require versatility to accommodate a dynamic company's changing mission, goals and objectives.

- ***Security*** - Security is perhaps the single most important characteristic possessed by an extranet that serves multi-organizational interests. Ensuring that all participant and contributor content is protected within a secure and accountable framework provides the basis for system usability and dependability. Although no system is ever 100% secure, recent advances in security technology provide extranets with security that exceeds industry standards and protects on-line information and intellectual property.

- ***Cost and ROI*** - Costs associated with building, launching and maintaining an extranet presence are remarkably low and can be easily justified with immediate efficiencies and cost savings for the organization. Preliminary results from an International Data Corporation (IDC) return on investment study of intranets (of which extranets are a natural extension) found that "*payback periods ranged from six to twelve weeks, ... the cost of an intranet is quickly recovered - making the risk associated with an Intranet project low*." Throughout this study, IDC cited individual companies that experienced returns on investment exceeding 1700% within the first year of implementation [4]. Given that extranets can produce efficiencies across multiple organizations, this success could easily be magnified by an effective implementation and management of an extranet presence.

- ***Results*** - The simplest answer to what benefits an extranet offers are multiplatform interoperability, time and cost efficiencies, ease of use and management. The mix of low buy-in and maintenance cost, simplicity, and ubiquitous interface commands a second look at what extranets can do for today's complex business environments.

6. CONSIDERATIONS ON IMPLEMENTING AN EXTRANET

Despite the simplicity and ubiquitous nature of Internet technologies, building a successful extranet is not an effortless process, nor is success guaranteed. An extranet cannot just grow from a myriad of desktops throughout the enterprise. The best approach is probably a proactive one, thinking in terms not of control but in term of access segmentation policies, establishing rules and priorities for users.

The following considerations for extranet implementation, while by no means comprehensive, try to offer practical advice for those companies considering extranet solutions for their business.

6.1 Cross-organizational involvement and participation

An extranet, as every chain, is only as strong as its weakest link. Involvement at all levels of the business process is critical if an extranet is to succeed. Unfortunately, the extranet can be complicated by differing work methodologies, company priorities and individual agendas. This is why *consensus on a common goal or objective* is so important. Senior officer support across all of the organizations, and early buy-in and involvement by the different business entities, helps establish a level of ownership that will sustain the project. Communication and committees for group decision-making can go a long way to alleviate potential complications.

Feedback is also a key part of an extranet. Soliciting comments, questions or suggestions from the entire user community ensures the relevancy and usefulness of the system. Also, usage statistics and similar reports that highlight frequently accessed pages and documents can be generated, providing the basis for including new content and making critical information easier to access.

6.2 Maintenance of the information

Maintaining the information should be the responsibility of all creators of information throughout the extranet construct. Information should not be duplicated within the system, but rather should be integrated with automated processes to support the business model. With a wide range of people entering data, a simple-to-use information submission process is needed. To avoid the need to understand HTML, forms can be established to allow submission or modification of any part of the information in an extranet system. Anyone with appropriate access should be able to add a new message to the daily alerts, modify a step in the sales/distribution process or update a customer profile quickly and easily from any Web-enabled workstation.

To make the system maintenance process more cohesive, some organizations are instituting Extranet Web committees or councils to promote and facilitate the use of the extranet as a knowledge and information dissemination vehicle. In addition to designating cross-organizational standards such as a document and style guides, and providing user training and support, the cross-organizational and cross-functional collaborative nature of the council fosters and promotes best practices while avoiding structural or bureaucratic hurdles.

6.3 Training

Extranet training and support usually consists of two challenges: training on specific system functionality and use, and supporting the behavioral changes across the various organizations needed to make the solution successful.

The first of these two challenges is remarkably easy to address. The point-and-click and intuitive nature of the browser makes it easy for users to be instantly engaged in on-line business activities, with little or any formalized training. Additionally, context-sensitive on-line help and on-line user support mechanisms (i.e. FAQs) make it easy for users to find the answers they need quickly and effectively.

Solving the second challenge can range from being relatively easy to dauntingly complex. Corporate culture often presents challenges to knowledge sharing. The participating organizations need to keep the goal of the extranet at the forefront and build a collaborative and team-oriented culture to support it. Frequently, certain degrees of business reengineering are required. These short term liabilities, however, are commonly erased given the long-term increased profitability and efficiency that results from effective extranet implementation.

7. EXTRANET TECHNICAL STRUCTURE

A typical extranet solution is comprised of three levels of components needed to support a distributed virtual cross-organization network. These levels consist of core system-level capabilities, application-level capabilities and interface layers for both group and individual work.

7.1 Core System-Level Capabilities

Core-system capabilities represent the fundamental underpinnings required for any successful Web presence. These capabilities, however, take on new importance and priority when supporting an extranet that is responsible for business reputations and livelihoods. Examples of core capabilities as they apply to an extranet solution are as follows:

- ***Security Policy*** - Security and accountability within an extranet are paramount. Participating organizations must be able to seamlessly interact and exchange information with confidence that proprietary information or content is protected from both the public Internet as well as designated extranet members who should not be privy to certain information. For example, suppliers may need to communicate with distributors, but this information should be secured from the view of the retailers. The security model must be flexible in its architecture and should be able to provide access controls based on individual, group, organization, transmission type or other extranet business criteria.

- ***Account management*** - Individual extranet users or user groups can be given user IDs and passwords for entry into the system that define access privileges and rights to the system. Management of these accounts, especially if the number of users is very large, can be a time consuming and labor-intensive task. Effective account management tools should be present within an extranet to reduce the costs associated with account maintenance and also to provide quick turnaround time for user addition or modification requests for system access.

- ***Transaction management*** - At the heart of every extranet are transactions. Every request made to the system is a transaction in one form or another. Transactions can include on-line purchases of products, requests for the status of a delivery, transmission of a financial report or other requests/submissions made to the extranet environment. Regardless of the type of transactions, an extranet must possess the capabilities to manage those transactions and to deliver the desired result to the satisfaction of both users and system administrators.

- ***Dynamic Web site assembly*** - Effective extranet solutions are designed from the ground-up to address the team-driven, component-based assembly of dynamic Web sites and applications. Components are the building blocks of a Web site and can include HTML files, Java applets, ActiveX controls, application modules and other aspects of an on-line presence. Easy integration of a diverse range of Web components into cohesive and reliable applications enables the rapid assembly and deployment of large-scale, business-oriented extranet systems.

- ***Site Operations*** - Smooth operation of the extranet requires extensive site and system management tools. User account management, user registration, authentication systems and encryption technology all control who is able to view and manipulate data within the system. The ability to perform site operations and maintenance activities remotely through the Web browser eliminates the burden of client-dependent or other proprietary software throughout the extranet. With point-and-click execution of site administration and enhancement, the need for HTML or C++ programming is greatly reduced or even eliminated in some cases. Additionally, robust system utilities such as error logging, system reporting, event monitoring and notification (i.e. when the system is down) and other capabilities ensure system integrity for the extranet community.

- ***Multi-platform compatibility*** - Given the complexity of organizations' varied legacy systems and databases, an effective extranet solution must be open, portable and interoperable with different industry standards across multiple platforms. Compatibility with industry standards must be achieved at the operating system, HTTP server and database server levels, to allow for maximum leverage of existing systems architectures within extranet integration and implementation.

- ***Extensible and scalable architecture*** - Extranets require significant flexibility, extensibility and scalability in their architecture to accommodate the inevitable changes that occur within a collaborative of dynamic, forward-thinking organizations. Several aspects of an extranet that can have a direct bearing upon the scalability and extensibility of an extranet presence are described below:
    - *Industry Standards* - proprietary elements that exist within an extranet's architecture can severely hamper the flexibility to interface with new applications, the portability for the system to be moved to a larger HTTP or database server and the scalability to incorporate

new components, users, or features. Organizations within an extranet cannot afford to be "held hostage" by any single vendor due to lock-in strategies instituted by software companies. Extranets are best built upon industry standards, such as the HTTP or SQL protocols, to allow for maximum flexibility in system growth and sustainability.

- *Software Architecture* - extranets are most effective when built with software code that is able to accommodate large numbers of concurrent users. CGI, PERL, and other popular scripting languages have severe limitations when integrated within Internet environments with large user communities. C++ and other object-oriented programming languages are recommended for extranet software platform and application development due to their compatibility and proven reliability.
- *Deployment Versatility* - Successful extranet technologies should be deployed seamlessly across Internet, intranet and extranet environments. This allows organizations working together to be linked within a controlled networked environment (extranet), yet simultaneously maintain complete autonomy and security for proprietary internal information (intranet), and use the same system architecture and tools sets to communicate with the public-at-large (Internet).

- ***Hosting and maintenance*** - Depending on the number of organizations and participants, appropriate bandwidth and other connectivity considerations must be addressed. System response time and uptime are of critical importance, especially if the extranet is the sole source for business-critical information. Around-the-clock support is also required to guarantee system integrity and optimal extranet performance.

7.2 Application-Level Capabilities

As the PC world learned in the early 1980s, most successful technologies are those with core business applications. The same holds true for extranets. Functionality described in the "core-level capabilities" section only provides the foundation for businesses to experience market efficiencies. Applications, however, are the key to true, sustainable business advantage for an extranet environment.

Applications allow people to communicate, exchange files, purchase goods or services, conduct information searches, manage operations, monitor business details, subscribe to services and perform other activities throughout an on-line environment. Applications provide the business-critical functionality for extranets to serve as valuable tools for electronic commerce or other collaborative business objectives.

Extranet solutions must be extensible to include the addition or modification of applications to meet changing business goals and objectives. The ability to integrate with "best of breed" applications and technologies allows the extranet to extend its functionality to better suit the needs of the company. Applications that are developed and integrated into the extranet must inherit the overall security architecture of the system and maintain the integrity of the existing components of the extranet environment. Otherwise, extranets run the risk of becoming disparate islands of application computing rather than a cohesive, integrated solution for the system administrators and the user community.

It is crucial to build up an integrated collection of business-critical Web applications that can be deployed within an extranet. Additionally, a very flexible platform is required to easily integrate applications or technologies within its open architecture. Examples of applications are:

- sales management applications
- subscription applications
- Web-conference applications
- document managent applications
- secure search applications

Extranet Web-based applications greatly empower a site to fulfill the great promise of the Internet. That is, to seamlessly communicate across a distributed network of heterogeneous platforms and systems to unify a community through on-line communication, collaboration and commerce.

7.3 Interface Layers

Interface layers are the bridges between software programming and graphical user presentation that exist within any software product. Effective and robust interface layers are especially important within an extranet given the individual and group work focus that permeate each application and component of the system. With advanced interface layers and capabilities, both individual users and user groups can be assured of a relevant and useful experience as they work, collaborate and communicate within the extranet environment.

Effective extranet interfaces address four main interaction scenarios: individual, one-to-many, two-way, and many-to-many interactions. Several examples of interface-oriented technologies that support these interactive scenarios are as follows:

- ***Dynamically-generated content and interfaces*** - Web-software development firms have incorporated the capability to dynamically generate content based upon a user's rights, privileges or preferences. With these advanced solutions, Web HTML pages are created "on-the-fly" with content, databases, applications or other components being referenced and selected based upon the user's queries. These pages are constructed with each request that is made to the system, so users not only see the most current system information, but also view it in a manner that can be defined by the individual or extranet site administrators. With this technology, multiple users can simultaneously access the same system and **the same set of data** but see **different information** with entirely different and customized views.

- ***Personal workspace*** - The ability to dynamically generate and control content and display for the extranet community introduces a multitude of possibilities for customizing group and individual interfaces within the system. Much the same as the desktop area within the Windows™ operating system, a personal workspace should represents each extranet member's individual workspace on the Web. This area can be dynamically generated and customized according to user preferences with options such as displaying previously saved searches, viewing "checked-out" documents, conferencing with extranet members or other users and other features that create a relevant experience for the individual user. Users also have the option to make aesthetic changes to the look and feel (text and background color, graphics, animation etc.) of the view.

- ***Account management and security model*** - How extranet members view information must be defined, controlled and supported by a robust account management and security architecture. The model must be flexible to absorb and synchronize an extranet's dynamic interest and user base, and simultaneously should be powerful and precise in its ability to keep proprietary information secured from the public or from unauthorized extranet members. A successful security and site model is controllable from an individual user or group user level, allowing changes to be effectively executed for the whole or for specific users. Additionally, effective extranets record and track each user's activity throughout the system for site enhancement analysis as well as system accountability.

- ***Browser detection & support*** - An effective extranet solution should support a comprehensive set of browser software features and controls and should be continually updated with the latest HTML versions and functionality, allowing the extranet to automatically inherit the advancements made by such browser software powerhouses as Netscape and Microsoft.

8. Overview of Extranet Standards

Software producers, networking providers, security products companies, systems integrators and technology companies in related areas, are all committed to define implementation standards for interconnecting businesses and customers.
This industry agreement will make extranets easier to build and connect to each other.
The standards agreed upon extend to firewall configurations, certificate authorities, metadirectory sites, software distribution practices, and data formats for the exchange of personal information.

8.1 Internet technology open application standards

Internet technology is radically altering the shape and broadening the scope of enterprise computing. Increasing numbers of organizations are abandoning the earlier networking model of competing proprietary protocols. Instead, these enterprises are simply adopting Internet protocols as a common networking infrastructure that can be used for everything from serving Web pages to retrieving email to running client-server applications. A new type of software called crossware consists of on-demand applications that run across networks and operating systems and are based entirely on open Internet standards like HTML, Java, and JavaScript. These features and trends represent key building blocks of extranets and networked enterprises.
This broad use of Internet technology is now supported by the existence of open application standards that offer a range of features and functionality across all client and server platforms:

- HTML and HTTP support platform-independent content creation and publishing and information sharing
- Java, JavaScript, and Common Object Request Broker Architecture (CORBA) enable platform-independent software development and the creation and deployment of distributed objects
- Simple Mail Transfer Protocol (SMTP), Internet Message Access Protocol (IMAP), Multipurpose Internet Mail Extensions (MIME), Secure MIME (S/MIME), Network News Transport Protocol (NNTP), and Real Time Protocol (RTP) are just a few of the available standards that provide email, discussion, and conferencing capabilities, allowing for platform-independent messaging and collaboration
- Lightweight Directory Access Protocol (LDAP), X.509, and Simple Network Management Protocol (SNMP) offer directory and security services and network management capabilities

8.2 Internet technology: the next level

Today the technology is in place to extend existing intranets beyond company boundaries to reach a much larger audience (business partners, suppliers, independent contractors, and customers), allowing enterprises to reap even greater benefits from their existing investments in open standards-based networks. More specifically, deploying applications based on open Internet application protocols enables enterprises to simplify and enhance their communications with business partners, suppliers, and customers.

The potential gains that this approach offers enterprises are clear and compelling. But creating an extranet also involves a number of challenges. Security is a central issue, for example, because enterprises must retain appropriate control over access to online content while opening up a portion of their corporate information system to new user communities. (It is one thing to keep customers up-to-date on the latest product and pricing information, but quite another to give them access to company financial data.)

8.3 Standards for efficient extranet implementation

This section tries to be a virtual roadmap for efficient implementation of an extranet, providing a collection of Internet standards and *best practices.*

- ***LDAP intelligent directory services*** [5] store and deliver contact information, registration data, certificates, configuration data, and server state information. These services provide support for single-user logon applications and strong authentication capabilities throughout the extranet. The key benefits are:
  - users can search for contact information across enterprises, partners, and customers using the same interface and protocols as internal corporate directories
  - a standard format for storage and exchange of X.509 digital certificates allows single-user logon applications and secure exchange of information via S/MIME
  - replication over open LDAP protocol allows secure distribution of directory data between enterprises
  - extranet applications rely on fast and flexible queries of structure information

- ***X.509 v3 digital certificates*** [6] provide a secure container of validated and digitally signed information. They offer strong authentication between parties, content or devices on a network including secure servers, firewalls, e-mail and payment systems. They are a foundation for the security in S/MIME, object signing, and Electronic Document Interchange over the Internet (EDI INT). Digital certificates can be limited to operate within an intranet or they can operate between enterprises with public certificates co-issued by the company and a certification authority such as VeriSign. Certificates surpass passwords in providing strong security by:
  - authenticating identity
  - verifying message and content integrity
  - ensuring privacy
  - authorizing access
  - authorizing transactions
  - supporting non-repudiation

  The main benefits are:
  - digital certificates eliminate cumbersome login and password dialog boxes when connecting to secure resources
  - each party can be confident of the other's identity
  - digital certificates ensure that only the intended recipient can read messages sent
  - sophisticated access privileges and permissions can be built in, creating precise levels of authority for Internet transactions

- ***S/MIME message transmission*** [7] uses certificate-based authentication and encryption to transmit messages between users and applications. S/MIME enables the exchange of confidential information without concerns about inappropriate access.

- ***vCards*** [8] provides a structured format for exchanging personal contact information with other users and applications, eliminating the need to retype personal information repeatedly.

- ***Signed objects*** [9] allow trusted distribution and execution of software applications and applets as part of an extranet. With signed objects, tasks can be automated and access to applications and services within the extended network granted based on capability. A digital certificate is used with a signed object to authenticate the identity of the publisher and grant appropriate access rights to the object.

- ***EDI INT*** [10] provides a set of recommendations and guidelines that combine existing EDI standards for transmission of transaction data with the Internet protocol suite. By using S/MIME and digital

signatures, EDI transactions between enterprises can be exchanged in a secure and standard fashion.

Together, these standards create a comprehensive infrastructure that enables crossware applications to inter-operate across the Internet and the intranets of business partners, suppliers, and customers. They also serve to provide a secure environment that supports much more than simple exchange of HTML pages between enterprises. Open standards provide the most flexible, efficient, and effective foundation for enterprise networking.

At the begining of 1998 it seems clear that extranet technology represents the most promising future for enterprise networking.

9. CONCLUSION

Enterprise intranets have exhibited clear benefits and are becoming ubiquitous, extending themselves beyond company boundaries to reach business partners, suppliers, independent contractors, and customers (extranets).

The new era of the extranet, the so-called *third wave* of the universal Internet concept, has just begun. As a powerful enabler of worldwide electronic commerce, the extranet is poised to trigger a revolution in the structure and operations of commercial enterprises and complex organizations – in general – leading us into the 21st century Information Age.

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