The EBS Strategic Vision
Enron Broadband Services, Inc.

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Confidential Document

This document contains an in-depth discussion of the Strategic Vision for Enron Broadband Services (EBS), a division of Enron Corporation. The Strategic Vision is inherently long-term in its perspective. It provides a view of EBS's "end-game" as well as an explanation of how its business must evolve over time to reach that vision. Central to the discussion is a description of the strategic importance of the Enron Intelligent Network (EIN), EBS's Broadband Operating System (BOS), and its future Application Programming Interface (BOS-API) which will enable multiple Application Service Providers to create services using the EIN and the BOS-API. Intimately connected to the EIN are EBS' Bandwidth Intermediation and Content Services businesses which are evolving alongside the EIN and are strategically linked to it. The focus of this document is on strategy. Tactical elements of the business, while mentioned, are not the primary objective of this document.

The purpose of the document is to educate the general audience on the telecommunications environment in which EBS operates, the opportunities created by the evolution of Internet communications, and EBS's unique and powerful market proposition. Also, included is a discussion of key business issues that EBS will face now and in the future.

The document is intended to serve as a reference document for all employees present and future of Enron Broadband Services and as a tool for understanding EBS's strategic vision and the market in which it operates.

ENRON BROADBAND SERVICES STRATEGIC VISION

Forward

EBS's vision of the future predicts a completely wired society. Peoples' lives at work, at home, and everywhere in between will be connected and networked. Appliances will be able to order food. Instead of having to venture out to get a videotape or DVD, entertainment will be downloadable. We will be able to listen to whatever song we want in the car or at home, whenever we want to. The content received (or sent) will depend on individual preferences and context. Content-in-context, as it is known, is key to a new level of end-user experience. This is the experience that EBS is enabling, by taking the world beyond the Internet, beyond plain broadband.

As users begin to demand more bandwidth, the Internet will regress from congested to gridlocked. Today's Internet is simply **unable** to meet future needs. The future, in this case, is not 50 years away; it is near-term. As more and more people go on-line and as more and more lives are conducted on-line, response time at the screen will be ever more critical. Every step of the process, from the Local Area Network to the Metropolitan Area Network to the Wide Area Network, will have to be coordinated and connected with "fatter pipes" that are QoS aware to deliver a high quality experience to the user.(i.e. connections that allow for much higher bandwidth, or broadband capacity).

The Internet industry can be divided into four parts: Content Providers (like Universal), Aggregators (like Yahoo!), Enablers (RealNetworks), and Access/Transport providers (MCIWorldcom). While some players are trying to combine several of these functions, the historical infrastructure has specifically led different players in the Access/Transport layer to deliver separate services like fiber/circuits separately from ATM/Frame Relay. And, in general, the TCP/IP layer has typically been separate from the application layer. **EBS is combining these layers by allowing software to control the network.** EBS is enabling applications to be embedded into the EIN and to use the Broadband Operating System (BOS) to deliver Tiered Quality of Service defined by each application and each end user. This platform will enable EBS' Content Services business. Concurrently, EBS is using Enron Corporation's historical expertise in making markets and the EIN's fiber infrastructure to create a Bandwidth Intermediation business.

The historical Telecommunications infrastructure is binding the traditional telecom carriers (the Access/Transport layer) to an out-dated mindset about their industry. These companies have fundamentally mistaken beliefs (or myths) about the current state and future development of the new telecom industry. The telephony infrastructure that exists today is simply inappropriate for tomorrow's networked world. The traditional carriers' businesses are built on long-distance or local dial tone revenue. As such, telecom companies, particularly since regulation is changing the separation between local and long distance operators, believe that owning the entire network, end-to-end, through all forms of wires and cables, is necessary to "owning" more customers. These companies believe that all the Internet needs is more bandwidth, despite the fact that in order to make money, ISPs are oversubscribing their IP networks. EBS recognizes these approaches as flawed assumptions and outdated thinking.

EBS is not constrained by a telephony-based frame of mind, and can see the needs of the future from a more objective vantage point. EBS is positioning itself as a Broadband company first, and as a network company a distant second. This allows EBS to concentrate on the way businesses and consumers will want to receive data in the future. EBS sees this future as being a rich media experience.

ENRON BROADBAND SERVICES STRATEGIC VISION

Rich media is the basis of a New Medium, an entry point into the world of e-commerce. EBS knows that the high prices of dedicated lines have discouraged explosive e-commerce growth. The current infrastructure, by not allowing for a quality rich media experience, has hampered growth. As more rich media inevitably enters the market, the resulting explosion in bandwidth demand will need to be managed efficiently. EBS will be able to manage that demand through the Broadband Operating System (BOS) which includes the control of Pooling Point Technology, and through the distributed server architecture of the Enron Intelligent Network (EIN).

EBS does not want to be a network for everyone, because that is infeasible. Everyone will require connectivity between networks (known as off-net connectivity) to reach data that he or she finds interesting. EBS is enabling this inter-network connectivity through the deployment of Pooling Points globally to interconnect at the circuit and fiber layer as well as interconnecting at the IP layer via local loop providers to reach end users.

Since the world is poised on the edge of a proliferation of rich media, there are numerous implications to these beliefs and assumptions. High Quality of Service (QoS) providers will be essential and are well-placed to take advantage of the rise in rich media. The careful management of bandwidth will mean that the supply and demand of bandwidth pipelines will need to be better balanced. An Intermediation opportunity exists. Finally, in order to make rich media work, reach will be critical. As a result, Enron will be a customer, a supplier and a partner with Tier-1 Internet Service Providers (ISPs) and local loop players like Ileas/PTAs/CLECs to achieve reach as well as to sell Content and Bandwidth Management Services.

The long-term implications include the eventual establishment of a commodities market in bandwidth (Bandwidth Intermediation); the emerging need for creating, developing, and encouraging broadband applications (Content Services); and the observation that creating an industry standard for the development of these applications is a long-term goal of any network-based technology (Commercialization of the BOS and BOS-API).

EBS's approach to these opportunities is described in this paper. It begins by defining all the products and services EBS is creating. Central to EBS is the EIN. Its structure is described in detail. The revenue opportunities that emerge can be classified into two main categories: Bandwidth Intermediation and Content Services. Bandwidth Intermediation is based on the physical infrastructure that EBS has installed, bought, or traded. Fiber Sales, Physical Intermediation, and Financial Intermediation are all part of Bandwidth Intermediation. As Enron shifts its focus away from physical assets, some of these products will fade away (the entire Fiber Sales category, for instance), while some will shift focus to other companies' infrastructure without requiring Enron to continue to invest large sums in a physical infrastructure of its own. The hardware that is installed will allow Enron to make money in the way it knows best: commodities trading (evolves from Financial and Physical Intermediation), while giving EBS the flexibility it needs for its core service offering.

The areas of value EBS offers today are:

EBS's Bandwidth Intermediation Services which will make it possible to change the entire Telecommunications Industry and how bandwidth is acquired on a day to day basis.
EBS's suite of Content Services that require the Bandwidth Intermediation function and pooling point technology for the scalability needed for these content services. These applications, which today consist of ePowered MediaCast and ePowered MediaTransport, are at the heart of how EBS can help the networked, rich media world.

The Enron Intelligent Network (EIN): the software controlled network that provides Tiered QoS at the IP layer and the application layer. Through the controlling software layer, known as BOS,

ENRON BROADBAND SERVICES STRATEGIC VISION

EBS provides network control and metering. These allow a user – a surfer, an enterprise, an ISP, a content provider – to choose, based on usage, need, and cost, different levels of QoS. Since each tier will be at a different price-point, this flexibility allows for sound financial decisions to be made and for vastly improved control over the quality of the experience a customer has and a supplier provides.

Furthermore, as the BOS API is released to allow third-party developers to create network-controlling software, the number of applications –potential revenue opportunities for Enron – will grow from three to thousands. BOS could become the standard for broadband application development, ensuring a sustainable market advantage. As this occurs the need for bandwidth to be provided at the lowest cost and for high demand peak load bandwidth will become even more important. The pooling point technology will become the method used by the EIN via the BOS to obtain that peak load bandwidth. As the uses of applications occur and the data is collected for the way people conduct business on the ePowered Internet EBS will be able to use this historical and evolving usage data to better buy and sell bandwidth. This is a very important component of the long term viability of the business.

The power of EBS's strategy lies in the interplay of all these technologies. Each on its own is a good idea, a revenue generator. Taken together, however, these technologies support each other in such a way that enormous opportunities are created for EBS. There are short-term elements and long-term elements of EBS's strategy "to be **the** broadband platform". This document outlines the plans EBS has to move from a hardware-based service provider into a bandwidth trading player and a network applications platform that delivers software and intellectual capital to create revenues by providing value to its customers and their end users.

As EBS evolves, its customer base will evolve as well. From an initial customer base of content providers and Wholesale customers. Application Service providers will be established who wish to enter the e-commerce world EBS will grow with its customers, eventually allowing them to complete more of their business on the ePowered Internet. Rich media enables the New Medium to become an important part of a large number of peoples lives by facilitating entertaining and engaging topics to be delivered via the ePowered Internet. Eventually the power of Tiered QoS will allow companies to conduct business-to-business transactions, or to host applications, or to have services delivered via the Net more easily and quickly than today using economics that will allow the users to choose the price they pay based on the value of the service.

ENRON BROADBAND SERVICES STRATEGIC VISION

TABLE OF CONTENTS

ENRON BROADBAND SERVICES STRATEGIC VISION

Executive Summary

Strategic Vision Document

Enron Broadband Services (EBS) is transforming the world into a collection of networked communities. By ePowering content providers, Application Service Providers (ASPs), Local Loop carriers, Internet Service Providers (ISPs), and, by extension, their customers, EBS will augment the Internet with a tiered Quality of Service (QoS)-capable broadband platform. This will give users more control over the priority of their information flow, network administrators more control over the congestion of their networks, and content providers more control over costs and flexibility in defining the experiences they provide to their viewers.

The Enron Intelligent Network (EIN) is the means whereby EBS will accomplish this strategy. The EIN is a communications solution that delivers high-quality, global connectivity services using the Internet Protocol (IP). By combining its highly reliable network that uses Bandwidth Intermediation to obtain bandwidth at the lowest cost, a distributed server architecture, and its patented network control software, the EIN resolves the problems of the current Internet while not eliminating its advantages. **The EIN is an industry first in that it is the first network to integrate software on a large scale and for the purpose of creating a platform for the delivery of broadband application services.**

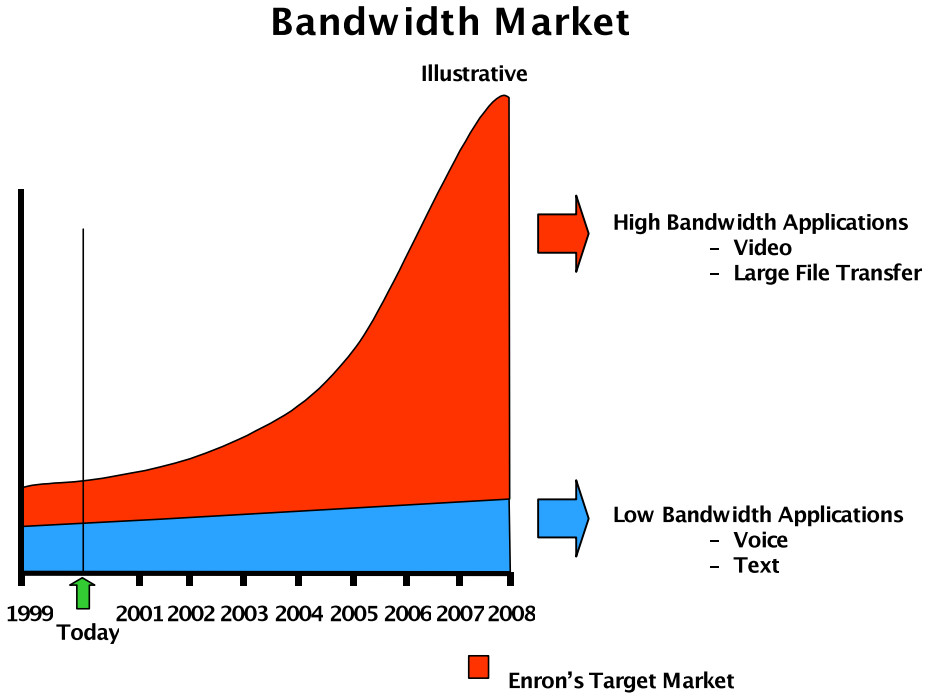
EBS is not just offering capacity on a network, but instead it offers a suite of broadband applications that work over the network. A key differentiator is the messaging bus technology of the Broadband Operating System (BOS), which gives the EIN the ability to program the intelligence needed in the network per application and QoS. BOS allows EBS to deliver bandwidth and applications *on demand* and to price the bandwidth and applications based upon *actual usage*. The Bandwidth Intermediation business provides the long term sustainable ability to obtain bandwidth at the lowest costs and allows Enron Broadband Services to buy and sell bandwidth to create huge revenues and margins at the same time that the Content Services grow in revenues.

The market need for the EIN has emerged from two converging trends: the explosive growth of the Internet and the increasing use of IP technologies for business applications. These trends create an opportunity for a few aggressive networking providers within the next five years. EBS, however, currently enjoys a first-mover advantage and no current player is truly emulating EBS's strategy to its knowledge.

Many companies buy and sell bandwidth but none create financial products that allow the buyer of the bandwidth to have the benefit of the eroding Bandwidth prices ahead of the price erosion occurring in the market. Companies such as Akamai and Digital Island offer solutions to the congestion of the Internet for traditional WEB pages and Banner Advertisements, but they do not have a large private network ,linked to robust servers capable of large numbers of simultaneous streams users coupled with nor caching for Streaming media. Their solutions, since they are Internet-based, are not sustainable for the evolving market for rich media delivery.

ENRON BROADBAND SERVICES STRATEGIC VISION

EBS is enabling Broadband applications which is the fastest growing segment of the bandwidth market. Using the combination of Bandwidth Intermediation services and Content applications services EBS will drive this volume to the sales organization of EBS.



The challenges to overcome are the delivery of a high quality service to the end user while maintaining the ability to provide a dramatic increase in bandwidth with a global reach. EBS's network architecture and go to market approach accomplish this objective. The public Internet is not able to support the increase in traffic that will come with more users and the advent of rich media applications. Data traffic today is deliberately off-loaded and routed through congestion points, security is inadequate, and the so-called "best-effort" routing allows for lost information. The structural layers of the Internet – network providers, service providers, software providers, and content providers – have been working independently, creating an infrastructure based on individual convenience and legacy systems, generally without considering the interaction between the players. Telecommunications carriers have networks that have been optimized for voice, not data. Internet Service Providers (ISPs) are forced to oversubscribe their networks to make money. In short, the public Internet is a **fundamentally flawed model** from financial, business, and technological perspectives for the delivery of low latency, high throughput applications such as rich media.

The goal of EBS to become **the** industry platform for the delivery of broadband applications requires that EBS become the largest buyer and seller of bandwidth in the industry. Both must be achieved. To become the de facto standard for the industry, EBS must deploy and deliver end to end the initial application service of streaming media (MediaCast and MediaTransport) and enable ASPs to deploy ePowered Conferencing Services over the Enron Intelligent Network (EIN) using its Broadband Operating System (BOS). Ultimately EBS will demonstrate to developers and Applications Service Providers (ASPs) that the EIN implementation of BOS works and therefore they should develop software applications that use our Broadband Operating System's Application Programming Interface (BOS-API). They will be able to use the EIN implementation of the BOS to go to market globally with their product. As the BOS becomes installed on non-EBS

networks via the relationships we are creating with distribution partners, these ASPs applications will be able to work on more than the EIN. This willingness to open up the solution to other networks has already resulted in being asked to just extend the EIN into other networks since the incumbents do not have the ability to deploy these services yet on their own.

This linkage between the Bandwidth Intermediation part of the business, the EIN with a Broadband Operating System and the Partnering/Distribution strategy of making deals with the local loop players that want both applications and bandwidth is essential to achieve the EBS objectives. This linkage will accomplish the *objectives of having the leading platform for the delivery of broadband service while being the largest buyer and seller of bandwidth*.

More traditional players believe that owning the physical connection to the end-user is the way to "own the customer." EBS does not believe that this is true in the emerging networked world. Its strategy is to "own the end user" by virtue of their use of broadband applications that are embedded in EBS's network. As a result, EBS's strategy *by design* does not include ownership of the local loop connection to end-users.

EBS's customer targets for the Content Services include:

- Applications Service Providers (ASPs) who create applications
- Content Providers who have audio and visual content to deliver in an enriched way, and
- Small to Medium size companies and Enterprises that have varying and evolving needs for rich media applications that affect the way they communicate with their employees, their customers and their external stakeholders.

EBS's customers for Applications Services using the BOS are:

- Any vertical market focused application that can be hosted in the EIN and made available via the WEB to users that wish to rent the application rather than purchase the software and install it on their computer or server. Examples would be a work flow application for the legal industry or the accounting industry. Others would be an application for healthcare industry that allows hospitals, doctors and the insurance company to share the same records about patients in a secure reliable manner.
- Any new application designed to be hosted in a public network that needs some sort of QoS before it can be made available to users and servers a community of interest.

These organizations in turn serve end-users in both the business and consumer markets and sell the content or application service to those users or create commerce revenues via the network hosted application.

EBS customers for Bandwidth Intermediation/Trading Products are:

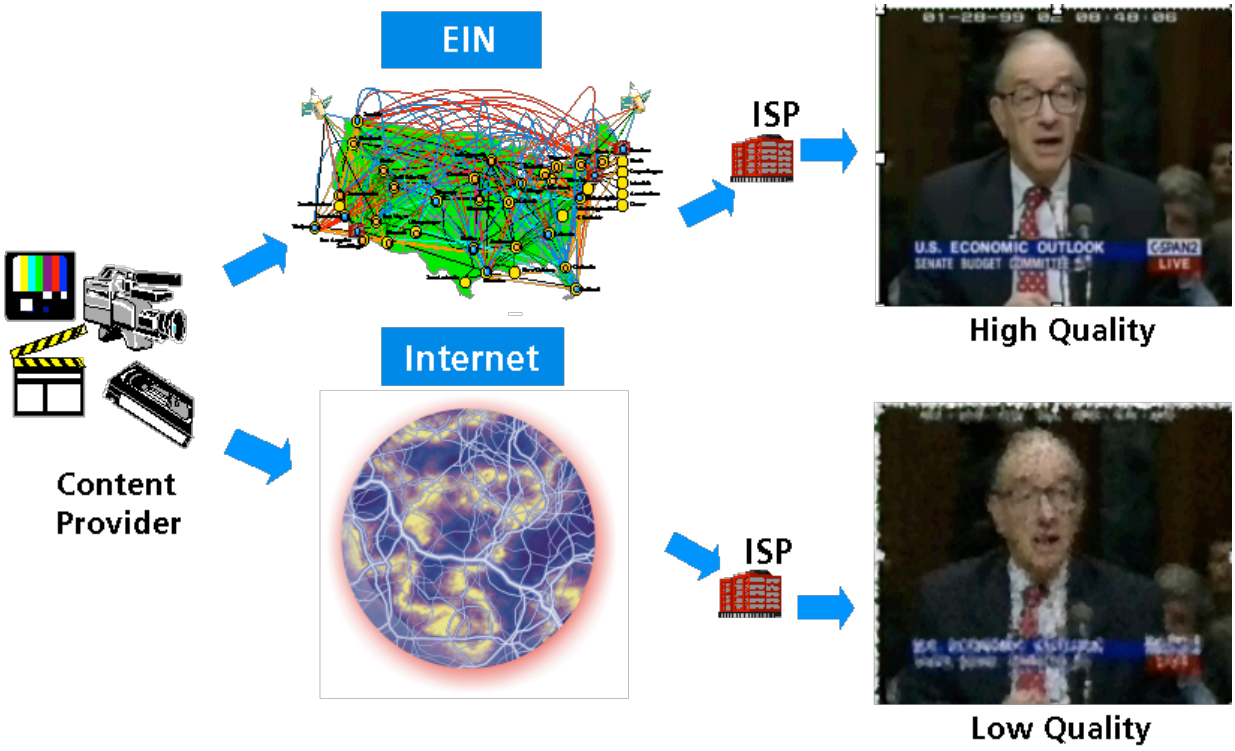
- Internet Service Providers (ISP's)
- Incumbent Local Exchange Carriers (RBOCs & PTTs internationally)
- Interexchange Carriers (IXCs including PTTs internationally) and Wireless providers
- Large aggregators of Long Distance minutes (Long Distance Resellers)
- Large Data Backbone Providers (IBM, Content Providers such as Reuters, Bloomberg, Microsoft)
- Large Enterprise Customers (Bear Sterns, J.P. Morgan, Banc One, Government backbones)

This dual approach to customers facilitates the sales cycle for both services. It helps achieve the objectives of 1) global reach *fast* by using the edges of other carriers' networks to reach installed

customers and 2) capital avoidance due to reduced operating costs by not dealing directly with the local loop for the applications services. It also facilitates a story with wholesale customers (ISPs, CLECs ILECs PTTs and IXCs) to make it possible to sell Bandwidth Financial/Physical Intermediation products (including Pooling Point, EBS TDM and AFTS bandwidth), independent of the EIN or the BOS-API.

The deployment of a working streaming media application service substantiates the claim EBS is making about the linkage between the EIN, the BOS-API and EBS being the largest buyer and seller of bandwidth on the planet. It is essential to make the streaming media services work, (which must use the EIN and includes the use of the pooling point technology to deliver bandwidth on demand with control provided by the BOS) to achieve the goal of becoming the platform for all future applications. The combination of these will make EBS be the largest supplier of bandwidth to the industry.

EBS's initial suite of Content services is focused on Streaming Broadband Applications (ePowered MediaCast, ePowered Media Transport). Later, ePowered ASP applications like Conferencing will be enabled when the BOS and the BOS-API are completed.



Today when text or data are delivered via the Internet, this is a QoS0 experience. Rich media is choppy in a QoS0 experience. Routing around congestion the way Akomie or Digital Island approaches to the problem while using low cost servers that are not able to handle large numbers of simultaneous streams is defined as QoS_1. EBS can deliver Streaming Media and static WEB pages globally via its InterNAP and Level 3 arrangements into the Internet (QoS_2 but bypass the major congestion sites of the Internet.) EBS can also deliver streaming video based upon a one-hop experience (QoS_3). EBS will soon be able to support mission critical data, live feeds, or videoconferences on a scheduled and guaranteed basis to be transmitted over the backbone of the EIN and have a local loop provider willing to provide QoS via the local loop (QoS_4). Ultimately, QoS_5 will be achieved by hooking QoS-aware LAN's directly into EBS's QoS_4 solution.

This will make guaranteed data flows from end-to-end a reality. This will require the BOS to allow the application to communicate with the EIN in order to deliver QoS from the LAN over the local loop MAN to the EIN. Some day the functionality of the BOS on the EIN may be made available to the market as an independent product to run on other networks. A financial model will need to be developed to accommodate this and capture value for EBS.

The ability to maintain a Tiered QoS approach is dependent upon Enron's ability to obtain bandwidth at the lowest costs in the market. This dictates that Enron become the largest buyer and seller of bandwidth in the market. Enron will achieve this goal through the combination of Bandwidth Intermediation arrangements, Enron-owned fiber, and the use of Private and Public Pooling Points through which EBS will aggregate the bandwidth of other players in the industry.

EBS's unique architecture and use of Pooling Points allows EBS to easily add bandwidth when needed. These pooling points serve two purposes. First, they provide a source of bandwidth for ASPs or other industry players for which EBS will deliver applications. This lowers the capital costs of creating Enron's network. Secondly, they enable Enron to create a market for bandwidth.

Once such a market is firmly established, Enron will be able to decide whether the physical network should be maintained. This approach allows Enron to run its business with significantly less capital expenditure and leverage the core competency of Enron Corporation of making money in inefficient markets. The result is higher Return on Invested Capital (ROIC), an Enron Corp goal. Higher ROIC leads to higher stock valuations.

The promises of the BOS, the Modulus Interagent® Messaging Software, and the ability of EBS to deliver guaranteed QoS for Streaming Services (ePowered MediaCast and ePowered Transport), buffered by Bandwidth Intermediation, has led to an industry-shaking arrangement between EBS and Sun Microsystems. Sun's willingness to go to market with EBS and to define a global operating system that runs on the EIN is a strong validation of the Strategic Plan of EBS.

ENRON BROADBAND SERVICES STRATEGIC VISION

POINT OF VIEW: Why is EBS needed?

TOMORROW'S NETWORKED WORLD

The world is changing at an accelerating rate. Personal technology (i.e. consumer technology beyond today's personal computers (PCs)) is forecast to pervade everyday life in the future world. Silicon Valley's Xerox Palo Alto Research Center, IBM Almaden Research Center, National Semiconductor Corp.'s research center, and SRI International's research center are exploring a post-PC world by developing technologies where context-in-context, not static content, drive product development. Their mission is to make technology aware of its surroundings and of its users, so that it can be integrated into everyday items; in this future, technology becomes invisible to the senses. Scientists aim to link the physical and virtual worlds so that everyday tools such as eyeglasses and sleeping blankets keep their familiar physical function and appearance, but are linked to continuous information networks that link users' networks to all networks regardless of place and time. In this 'networked world', computing becomes pervasive, as computers fade into the background where they are incorporated into ordinary items like key chains, watches, neckties, tables, refrigerators, car stereos, and walls.

The networked future will take time to evolve. However, the momentum required to reach this future is accelerating. The enormous popularity and quick adoption of personal, non-PC technologies such as handheld computers (e.g. Palm Personal Digital Assistants (PDAs)), Sega's Dreamcast gaming console with Internet access, Web-enabled TVs, and Web cell phones are the first steps to more fully networked lives. Demand for such products shows no signs of abating. The worldwide Internet appliance market will grow to 93.7MM units, or $18.8B in sales, by 2003, up from 13.8MM units at $4.6B in sales in 1999[1]. Users will drive developers to create electronic appliances that have user and context awareness; otherwise, lives will become cluttered with function-specific gadgets (e.g. mobile phones, pagers, PDAs).
Content-in-context is key to the end-user, broadband experience that Enron Broadband Service (EBS) is enabling via the Enron Intelligent Network (EIN). The advent of context-enabled technology presents the opportunity to create and deploy infrastructure and applications that require bandwidth intensive content. Once the architecture and applications are established, this networked environment will enable contextually targeted content to reach users based on their individual user profiles. Critical to developing broadband infrastructure and applications is to understand the driving forces behind this future vision: the Internet and broadband content.

INTERNET

The Internet has become vital to both businesses and consumers. The Internet's initial role as an information tool led to its explosive adoption; however, its massive growth outpaced its infrastructure's capabilities. Content providers have moved from providing static information to distributing media rich content that consumes large amounts of bandwidth. Accordingly, the Internet is now plagued with user problems such as congestion (too many users) and latency (long pauses and delays). As broadband applications become the norm, the problems associated with the Web become exponentially more severe as the load per user exponentially increases. Since the number of users will double in the next few years and the usage per user will increase by over two orders of magnitude, the load on the existing telecommunications infrastructure will increase by several orders of magnitude.

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[1] International Data Corp.

Demand for content has moved beyond data into rich media. Partially driven by interactive TV and gaming, users have matured – they want increasingly more media rich Internet experiences. Their demands, however, have overloaded the Web. The Internet, now sometimes known as the 'World Wide Wait', is adequate for static information with minimal media, but the future of content lies in broadband networks that can support rich media with consistent quality. Rich media that is engaging and entertaining requires a high quality of service (QoS) broadband network to support this content-in-context. **The Internet is an inadequate infrastructure to support these needs.** An adequate next-generation, broadband Internet must be capable of handling exponentially growing demand for broadband without loss of quality. Two drivers – e-commerce automation and non-PC products – will drive the development of an alternative to today's flawed Internet.

E-Commerce Automation

Demand for software and e-business related services that enable e-commerce automation is expected to explode over the next several years.[2] e-Commerce automation is defined as the way entities collaborate across the supply chain with customers, suppliers, and partners via technology. Traditionally, computing technologies have focused on the automation of internal processes (*e.g.* Human Resources, Accounting) which are data intensive, and where technology did succeed in connecting distinct organizations the end-result was inflexible and expensive. Tomorrow's products & services will facilitate collaboration across organizations, networks, and entire value chains based on rich media communication. Thus, content will evolve from data to media, as automated e-commerce not only enables transactions, but also facilitates communication. Initially, business-to-business (B2B) e-commerce will dominate this growth, but business-to-consumer (B2C) e-commerce will mature as the general public becomes more tech-savvy. Intense competition will exist between e-commerce vendors to become the industry leaders that host their e-markets. As competition increases in these e-markets, competitors will differentiate their offerings via rich-media content that requires high bandwidth. **Rich media will be their tool to attract users to their communities of interest and affinity groups**. Rich media will create the New Medium experience that is the combination of content-in-context with a delivery system to conduct business/communication in a networked manner.

Non-PC Products

The networked future will place network access everywhere anytime, not just on modem-enabled PCs. Network capability for businesses and consumers will be omnipresent. The business sector will rapidly move into the networked future, as it is an early adopter of new technology. Consumers, however, will move into the networked world in two phases. In the short-term, residential users will connect across networks via interactive TV (*e.g.* Web TV and TiVo). Consumer technology manufacturers will make low cost TV set top boxes available in 2000 that will Web-enable more residences without the need for a PC. This technology will require ease-of-use in order to penetrate the market. Interactive TV will have to be bundled with high-speed connectivity (*e.g.* cable modems and DSL service) to gain acceptance.

In the long-run, consumers will enter the networked world via an array of non-PC personal technologies. Over the next few years, a host of non-PC devices will be introduced to both business and consumer users that will radically change their view of what networking capability is possible without owning a PC. The advent of networked consumer technologies has already begun. In June 1999, Fujitsu's ICL unit and AB Electrolux demonstrated a prototype refrigerator with a flat-panel screen, a bar code scanner, and e-mail capability. A user can check the contents of his/her refrigerator from the office or have the appliance automatically send him/her e-

[2] "GS B2B Conference: The Next Wave," Goldman Sachs Investment Research, 9/7/99.

mail notifications and order replenishments from on-line grocers when items run low. Researchers are also developing an 'emotion mouse' that will ultimately have the capability to receive biofeedback from users, and adjust the interface of technologies (*e.g.* steering wheels and blankets) to users' moods. Non-PC products of the future will possess multi-sensory capability, thus demand for rich media (*e.g.* audio, video) will increase as non-PC products become commonplace.

BROADBAND CONNECTIVITY

Broadband connectivity, the ability to connect to a network at high speeds, is at the core of next-generation e-commerce. Significant opportunity exists in the networked world to create infrastructure and applications that use high bandwidth (broadband capabilities) that lead to widespread e-commerce market acceptance. Broadband capability not only enables media richness that will be desired and required by users, but also it allows e-commerce providers a means to differentiate themselves from competitors. Broadband is also needed for more mundane back-office functions that exist to support critical e-business and e-commerce functions. Back-office demands such as large file transfers of data and internal enterprise communications are mission critical to many enterprises.

Highly differentiated products and services attract large amounts of customers that lead to ubiquity, be it a niche or global market, for a provider's goods or services. Ubiquity enables long-term market share and business opportunity with a provider's marketspace. As broadband applications become ubiquitous, the Internet's structure will become exponentially overloaded. Thus, a guarantee of higher QoS will become increasingly necessary. High QoS provides vendors a stable environment to offer broadband content in which they can offer consistent end-user experiences. Furthermore, Tiered QoS (various levels of broadband capacity quality selected by the consumer) allows the user and the source to make value determinations that map the user's value perception of response time at the screen to their willingness to pay for a particular quality of service. Tiered QoS, with a pricing model that is usage sensitive, is the key to driving the cost back to the source or user and to fixing a key flaw in the business model of the Internet.

The networked future cannot be realized unless information technology (IT) infrastructures are integrated. The lack of integration causes delivery delays that reduce users' response times. Without integration, users' response times at their desktops – or whatever technology they are using to receive rich media (*e.g.* non-PC products) will be inconsistent. In the future, response time must be independent of the location of content sources and content users. The network a user resides on should not factor into his/her QoS. The future of broadband capability & services is only as strong as the weakest link between these infrastructures. To provide seamless rich media, Local Area Networks (LANs), Metropolitan Area Networks (MANs), Wide Area Networks (WANs), and the Internet must be integrated with applications on a distributed server platform to reduce latency and provide the end-user experience needed. This solution must provide the LAN model of a directory enabled service and offer the Tiered QoS needed by each user per community of interest. This Tiered QoS must apply for each enterprise, each department in an enterprise, each small business, and all residences whether wireless or not.

Local Area Networks

LANs are critical in providing high QoS broadband content to the desktop of a user. Congestion on the LAN can reduce the throughput and increase latency which degrades the response time to the screen. The benchmark in the mind of the user is the response time to the screen for an application running on the LAN that is managed properly so there is a sub-second response time

to the screen. Latency on the LAN depends in part upon the interaction of the LAN with the MANs and the WANs that connect it to external content.

The goal of the EIN is to allow an application that is embedded in the EIN to have a response time at the screen of a user be equal to the response time at the screen for that application if it was installed on the LAN in a building minus speed of light delay.

LANs include the concept of a directory to enable LAN end-users to have authorization to use applications or to get information. This directory is a baseline component of the functionality that comes with LAN connectivity. Historically, LANs have been more important to businesses than residences, since LANs enable enterprise-wide applications. The growth in multiple PC homes and networked homes though are taking LANs beyond their core presence in the business world toward the consumer market. As more non-PC products and computers become networked, the more LANs will become commonplace in the home. Eventually, businesses and residences will be networked together regardless of the LAN on which they reside.

Metropolitan Area Networks

MANs, facilitate the interconnection of corporate LANs between buildings in a city as well as enable the interconnection of Corporate Networks to the Wide Area Network for voice and data traffic. They also facilitate the local loop infrastructure that connects end users to the Internet.

The EBS strategy has been to leverage the multiple local loop providers per city to achieve reach within a city and to not be held hostage by the ILEC or any one local loop player since there is more than one provider per market to connect to customers. The other component of the strategy is for EBS to not own the local loop as part of the service demarcation point because it is people, money and systems intensive. This holds true for both Internet access but especially for enterprise solutions. Finally, to scale to have global reach fast and reduce the operating costs associated with delivering services, EBS has chosen to not include the local loop as a part of the service from a physical demarcation perspective. However, EBS plans to extend the QoS notion over the local loop from a partner to the Enterprise, small or large business or the home. This requires the partnering arrangement with the local loop providers to include the notion of a logical demarcation point not a physical demarcation point and make the EBS systems have tools to prove our innocence when trouble shooting the problem.

The MAN will become increasingly important as EBS develops Bandwidth Pooling Points in multiple buildings per city. These pooling points will interconnect all points where fiber optic cables terminate in cities so EBS can function like a virtual Pooling Point regardless of the actual building the other carriers fiber is located in within a city. **The MAN is important as a means of interconnecting ISP PoPs and CLEC,DLEC and ILEC facilities within a city to allow communities of interest networks to become wired together**. MANs will evolve into collections of both business and residential Networks interconnected via broadband capable fiber interconnection. The costs of the local loops can become prohibitive if a company like EBS does not have a low cost way of connecting circuits and wavelengths of light between buildings within a city. This will become a major cost component of the bandwidth Intermediation business for getting bandwidth in and out of a city via a pooling point so the MAN fiber is a very important way of reducing costs. As a result EBS has swapped long haul fiber with Metro Media so we can reduce these costs and grow the volume of local loop circuits to thousands of DS3 per city/market economically. The need for low cost local loop circuits increases as e-commerce provider's network with their customers. The backbone architecture must allow for aggregation of thousands of broadband local loop customers into the EIN to make the future state of a broadband world become a reality.

ENRON BROADBAND SERVICES STRATEGIC VISION

Wide Area Networks

WANs serve as the backbone for corporations that operate in multiple cities, and are the national or global networks (*e.g.* AT&T and MCI/Worldcom's networks) that connect the majority of users. There are several types of WANs that perform differently from a Service Level Agreement perspective as well as use different technologies. Circuit based Wide Area Networks are the most prevalent in the industry since the fiber optic networks deploy Time Division Multiplexing to deliver circuits and all carrier networks use circuits to transport telephony services. Frame Relay and ATM are layer 2 classes of WANs that use a form of statistical multiplexing to deliver WANs to the Enterprise that feel like circuits but share bandwidth between customers on a common circuit based network more efficiently than selling discreet circuits.

Due to their sheer size, WANs are capital intensive both to build and maintain for any individual enterprise. When enterprises build WANs, their engineers must face the tradeoff between capital constraints and the QoS present on the WAN. To provide a high QoS network, enterprises would have to build an extremely high-capacity network to accommodate infrequent spikes in bandwidth demand, which decreases network utilization and capital efficiencies. In response, enterprises often build scaled down networks that cannot handle spikes in bandwidth demand. What results is a WAN where the throughput and response time of most bandwidth is reduced in order to manage network costs. Everyone in the Enterprise is subject to low QoS broadband capacity since the cost of a true broadband WAN is too high for most enterprises.

The EIN allows the enterprise to use a high burst application that needs low latency and high throughput but not load the existing WAN of the enterprise. The goal of EBS is to allow the enterprise to only pay for what they use at the application layer and keep the other enterprise traffic on the existing WAN.

Internet

The Internet has a different set of transmission issues than that faced by LANs, MANs, and WANs. Public IP WANs (those that serve as the Internet backbone) have large amounts of available bandwidth but often each one becomes congested since the goal of an ISP is to oversubscribe their network to make money. Also, no widely used Network to Network routing system exists that avoids the congestion and best-efforts delivery method of today's Internet.

The Internet has congestion at numerous points due to peering and 'hot potato' routing policies at the peering points, such as the NAPs or Metropolitan Area Exchanges (MAEs) where there is no economic incentive to carry traffic over one's backbone. The Internet has end users via dial up modems or LANs connected via the Internet Service Provider (ISP) local loop that can create load over the LAN that is typically greater than the local loop speed. What this means is that the simple, high capacity bandwidth inside the Internet via any ISP (Tier 1 or small) is not enough to create a low latency, deterministic network solution. The infrastructure support required by over a hundred million users simultaneously online from all branches of the Internet is difficult enough in managing today's bandwidth load; however, it will be made worse as broadband applications gain popularity and usage per user increases by several orders of magnitude .

The solution is an intelligent use of bandwidth that can deliver media rich content with consistent service independent of the network-to-network architecture complications. This is the solution that EBS provides to the industry.

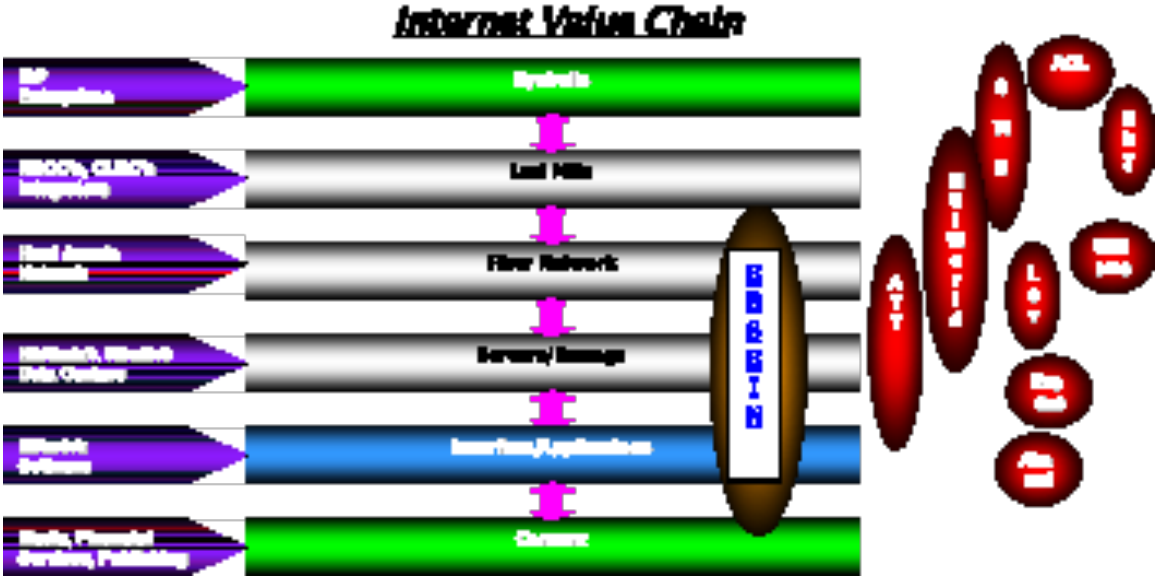
TODAY'S NETWORKED WORLD

INDUSTRY STRUCTURE

The interplay of participants that comprise the Internet industry is complex and constantly changing. Historically, the Internet structure was viewed as the physical networks required to connect users to the Internet. Its traditional players were ISPs who built backbones and sold access via a local loop provider. However, this structure is in flux. Local loop providers, such as Incumbent Local Exchange Carriers (ILEC), Competitive Local Exchange Carriers (CLEC), and Data Local Exchange Carriers (LEC) are now becoming ISPs as they sell local loop connections to end user customers directly as well as sell local loops to other ISPs.

Each of these players have the same requirement to expand their reach geographically and open up new markets to gain more customers. They all have a need for inter-city bandwidth from the markets they are in to markets that they want to open. These players have an ever increasing need for “off Net” footprints and “on Net” utilization of backbone. The also sell local loops to each other in territories where they do not have infrastructure. This means every ILEC, CLEC, or ISP needs bandwidth between cities and there also exists several local loop providers per city so you can make a special deal per city.

As the Internet becomes widely adopted, a more user-centric view of the industry structure is emerging. A new way of defining the Internet's players is to look at the players needed to deliver content/applications to end-users. The model below divides the Internet into key layers of participants needed to deliver content to an audience via the Internet.



EBS will work with industry players to enable the end to end solution but will not own the last mile local loop directly to the customer.

CONTENT PROVIDERS

ENRON BROADBAND SERVICES STRATEGIC VISION

Content providers create and program content for both business and residential end-users to view. Content providers adopt various revenue models. Business content may be sold on a subscription basis that may be time sensitive or on a pay-per-use basis for research content. Advertising revenue models that are common for residential/consumer focused content can be used for frequently accessed content (e.g. weather, stock quotes) where users view information for free, and their use of the content creates the ability to sell advertising space of pay for the cost of delivering the stream

Content providers can also be categorized by the type of content they deliver. Retail content providers are involved in the sale of goods and services to businesses and consumers. There are also content providers who target the consumer and these providers will typically use entertainment content to drive advertising revenue models. Both Business to Business (B2B) and Business to Consumer (B2C) content providers will use their ability to create communities of interest to sell products and services. This is how they drive users to conduct e-commerce. Content Providers need Data storage facilities, local loop providers and connectivity into the Internet to deliver non-deterministic content to the users. They need a deterministic network to deliver serious business content. Today they must build a private WAN if they want to create a service for their customers that requires deterministic delivery of content to make the service deliver the value to their customer.

The EIN represents the first alternative to building a Private Network that delivers Tiers of QoS and prices the usage per stream delivered per user so the service can have degrees of determinism but not create the costs of a private WAN.

Aggregators

Aggregators are service providers that gather content created by more than one source to develop a user experience intended to attract a large Internet audience. Often content aggregators become portals to a wealth of on-line content that is useful and entertaining enough to attract heavy user traffic. This would include companies that incorporate search engines to access content such as Yahoo!, @Home/Excite, Lycos and Infoseek, and Internet-based communities such as iVillage and Snowball. An enterprise may also be viewed as an aggregator in terms of its ability to amass an audience for specific content.

The Portal players will all need to offer streaming media content as a component of the content made available at their site or they will see the advertising dollars dwindle as the New Medium delivered via the EIN becomes the norm in the industry. Color TV made black and white programming a thing of the past within a few years of the introduction of color programming. The Internet will standard will be raised to rich media as content originators use the EIN to deliver differentiated content to their users. Any company not offering that capability will be forced to go the way of streaming content or have their site become passe'.

Enablers

Enablers are technology companies that enhance the functionality of the Web and/or Internet infrastructure (*e.g.* Cisco, Nortel, Lucent, Netscape, Sun, Microsoft). These companies are primarily software driven (*e.g.* browsers and plug-ins), but could also include hardware companies. These enablers technology is usually transparent to the end-user. Examples would include video streaming platforms and software, payment protocols and applications or security approaches. Enron has made a strategic agreement with Sun to jointly develop the BOS for the Sun Solaris platform. This includes the entire Sun developer community. Sun licensed Interagent software owned by Enron and is incorporating it into its Java messaging developers kit, so all

Java developers that need messaging for building distributed applications will be able to take unique advantage of the EIN BOS for applications they want to be installed in the Public Network. Microsoft is promoting the Windows 2000 platform which has a directory model and QoS-aware applications built into it. EBS can deploy these operating systems inside the EIN as needed. EBS intends to work with all forms of enabling technologies to make the vision of a Broadband Networked world become a reality.

Access/Transport

Access/Transport covers the telecommunications infrastructure player in the Internet. This consists of interconnected broadband backbones, twisted copper pair for narrowband access and broadband DSL access, cable (coaxial) for broadband access, direct fiber access/leased circuits, wireless mobile narrowband, wireless “fixed” broadband, and satellite narrowband/broadband. Key players include AT&T, Qwest/U.S.West, MCI/Worldcom/Sprint, SBC Communications, Bell Atlantic, Bell South, Air Touch, Nextel, NexLink, Winstar, Teligent, WNP Communications and many more.

The goal of the Internet industry is to create value in the eyes of the end-user. End users, whether they are consumer or business, comprise the Internet's audience. Key Internet players are determining where value creation vis-à-vis the end-user lies within the Internet model. In the traditional telephony market, the industry paradigm dictated local loop service providers including telephone companies (*i.e.* Access/Transport players) owned the customer by virtue of laying wires to serve them in geographical territories defined by regulation and limited competition. In this regulatory environment, Access/Transport players realized significant revenue. However with the advent of the digital world and the forces of deregulation that model is changing.

The end-user relationship is no longer necessarily owned by the local phone company or cable TV company. With unbundled local loops being mandated by the 1996 Deregulation Act, there is more than one local loop connection provider available per market in each city now. They can provide connections to any ISP who is able to sell a connection to an end user in a home or business and not be controlled by the ILEC or the Cable Provider. So the end user has choices for dial tone, long distance and Internet access but not for cable TV in most instances. Also, all of these providers are fighting to combine all these services over the same connection using different technology approaches.

EBS is enabling the New Medium which means that a distribution partner of EBS can sell a broadband connection to what the user thinks is the Internet but is really an ePowered connection and make it possible for the user to experience the New Medium. This New Medium is interactive but has the quality of TV. This makes the ePowered distribution partner become like the Cable provider and the local and long distance phone company and allows them to provide a new class of entertainment or content for business and education over what is thought of as an Internet connection by the user.

While Access/Transport networks remain key to broadband development, value sources are shifting from Access/Transport networks to other industry players. Today, by virtue of market valuations, it appears that access/transport providers such as ISPs (*e.g.* AOL) are creating value along the Internet's value chain, primarily in terms of their ability to secure large subscription bases and to establish strong brands. Leading Portal/e-Commerce providers (*e.g.* Amazon.com) also have significant power in the marketplace in terms of capturing consumer mindshare and amassing 'eyeballs'. This allows them to drive advertising and e-commerce revenue.

ENRON BROADBAND SERVICES STRATEGIC VISION

Despite the revaluation of the Internet's value chain, players continue to define the services offered in terms of the functional layers of the OSI model, and let that dictate their business strategies. For example, as content/applications are sent between two end-users (See End Users 1 & 2 in diagram below) it must traverse each of the OSI layers to go end to end. Service offerings like Private Lines (circuits) or dark fiber are only at the physical layer so the application developer must determine how to make the application work with TCP/IP and the network architect for each application and project must determine if they will use ATM, Frame Relay which ride on circuits or use raw bandwidth (Circuits). The product managers of the individual services, Circuits, Fiber, ATM, Frame Relay or IP Services must define that service at that layer and build an organization that deals with the selling, installation and maintenance of services at that layer.

So each Carrier Service at a layer is only concerned with how the end user or enterprise plugs into their network at the correct points of demarcation on that carriers' network at that layer. There is no notion of making the application work end to end up and down the stack in any of these carrier class services.

No single layer of the OSI model can resolve all the QoS and economic issues associated with delivering deterministic applications like streaming media content across the local loop and the backbone from end-user to end-user via multiple service providers networks. The application must go up and down the OSI stack and may need QoS functions at several layers to achieve end to end QoS at a price that is economical for connecting a target audience.

The application/content source will need to use more than one service (Circuits, ATM, Frame Relay) from more than one service provider to make the application reach all the intended audiences who are spread out geographically in different cities and countries across the world. The tariff anomalies of pricing services end to end at one layer tend the make the network service cost prohibitive to roll out at a layer (Circuits, ATM, Frame Relay) and have the reach needed for the audience of the content or application. No consistent policy exists to ensure QoS in this approach today unless the end to end service is delivered over a single network providers backbone and local loop. This is the only way to ensure control of the load on the network and the delay induced into the network.

The Internet at Layer 3 does not deliver any ability to control QoS at any point in the end to end link. Inherently the Internet means multiple backbones are traversed using a non deterministic protocol IP and no standard exists end to end to make it work in a deterministic manner. The standards like RSVP and MPLS do not even provide for total deterministic delivery with no packet loss. Another difficulty is that each router vendor has implemented those QoS Protocols differently so there is no way to implement even something like RSVP across all networks since someone like Cisco is not in all networks. Even if Cisco did exist in all Internet networks, the same version of Cisco routers running the same version of QoS protocols that would follow the same set of implementation rules to deliver IP end to end using these QoS protocols, does not exist.

Application Data Flow

Broadband Service Provider

EBS is approaching the Internet model in a new manner. EBS's strategy is to bridge the gap between the need for local loops and the backbone from one provider as well as between the layers of the OSI model. EBS is defining itself as a new class of provider a "Broadband Service Provider".

This eliminates the gaps between the horizontal layer way of thinking that exists in the industry today. This strategy focuses providers on delivering a holistic, high QoS end-user experience all the way to the desktop, not just to a demarcation point of a PoP in a city. EBS is thinking in terms of a logical point of demarcation that is different from the physical point of demarcation and the need for messaging to allow this occur is why Interagent and the BOS become so important.

While EBS is part of the Access/Transport player with its EIN, it is positioned across both the Access/Transport and Enabler players via the Bandwidth Operating System (BOS). **EBS is the first communications company to integrate software (*i.e.* BOS) into the network on a large scale for the purpose of developing a platform (*i.e.* BOS-API) to be used by third-party application service providers (ASP) to allow them to control QoS end to end. This means they can deliver an application/content across multiple network service providers' networks using different service layers as needed for the application to work in a deterministic manner end to end at an economically feasible price.**

Therefore, EBS not only provides a service to transport packets end to end but also provides a way for an application developer or ASP to deliver their application to their target audience. It also enhances the functionality of a Broadband Application end-user experience. EBS can provide great value in the broadband industry, but key to capturing this value is to create demand pull from end-users for ePowered™ Web experiences. To capture end-user mindshare, it is important EBS brand the ePower™ experience with end-users even though EBS does not sell directly to end-users. Since EBS will sell through its ISP partners and by virtue of the experience it enables the content providers to create a unique or differentiated service offering.

EBS's approach is non-traditional because it is looking at the end-to-end user experiences, rather than just looking at delivering a service at a layer to the point of demarcation. This accepted

approach limits the view of traditional industry players. Despite the fact EBS looks beyond its demarcation line, it cannot at present guarantee QoS beyond it. This will require an arrangement with local loop access providers to create a QoS4 where the local loop is also QoS aware and tiered QoS is possible across the local loop. While this is a key issue that is still being addressed by EBS, EBS stands out from other industry players by keeping the end-user experience in mind when making business decisions, rather than focusing efforts on defining services that ride only on its own infrastructure.

QoS3 is so much better than the Internet that it is a differentiated experience today and allows a user with a broadband local loop (ADSL,T1,DS3, OC3) to get a high quality of service as long as the local loop is not oversubscribed. This is more than adequate to get the user experience defined for the New Medium and get user wanting to connect to the EIN via an ePowered Distribution partner to use the New Medium to be entertained, learn more, conduct business or purchase goods.

This QoS3, and QoS 4 approach is very unique since EBS is working on testing end to end even though the service is not on the EBS network end to end. The end user customer is connecting to a local loop providers network or ISP's network and is not connected directly to the EIN but is delivered the New Medium experience via the EIN. The source is connected directly to the EIN but they want to reach an audience that is connected to the Internet. This is accomplished by the EIN which touches all the edges of the Internet.

While distribution to customers connected to the EIN via ISP's is key to EBS's business, EBS is really positioning itself to enable the content/applications side of the industry since that is where all eCommerce or eBusiness will be conducted. EBS will allow a content or an application source to plug into the EIN (running the BOS) and obtain usage sensitive billing to pay as they go and have access to millions of eyeballs via the EBS EIN Distribution Partners (ISPs,CLECs,ILECs PTTs). **In that sense, EBS is the first Global three letter (NBC, ABC, CBS, CNN) Network for the New Medium (not TV, Radio or Print or the Internet as it exists today). The source plugs in once to the Global Headend EBS and gets access to the global audience of viewers/users for their community of interest.**

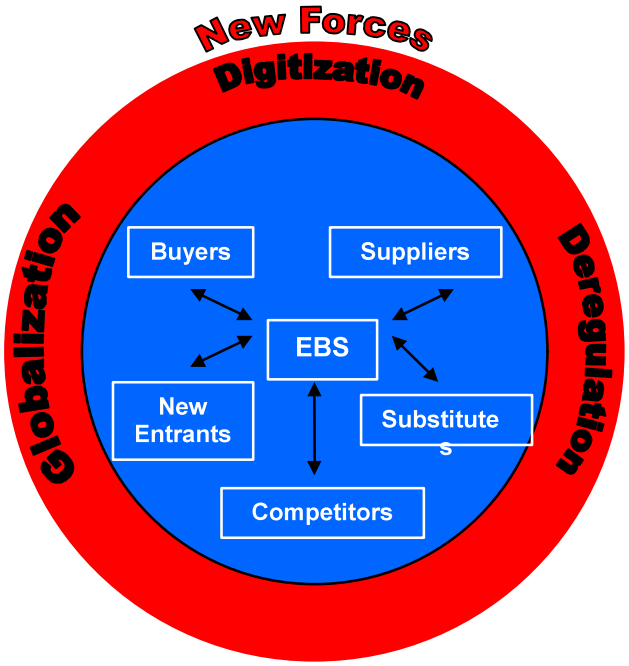
As the content providers become the eCommerce sites of the future, EBS will become involved in all forms of eCommerce and eBusiness since the driving force is the users that come to look at the new broadband site or use the New Medium.

Additionally, EBS is deriving even more value from its carrier position through its advanced fiber transport solutions (AFTS) business and Bandwidth Intermediation offerings to the Enterprise, ISPs,CLECs, ILECs, PTTs and IXC carriers. The use of the Bandwidth Manager Technology to connect EBS to multiple fiber backbones allows EBS to offer Broadband Services at the Circuit/Optical layer at the same time we offer Broadband application layer services to the users.

TRADITIONAL MARKET FORCES

EBS's future profitability will be determined by the five traditional sources (Buyers, Suppliers, Substitutes, New Entrants, and Competitors) of competitive pressure and by the three new market forces (Deregulation, Digitization, and Globalization) inherent in the Digital Economy. In coming to an agreement on EBS's strategic vision, it is imperative that each of these forces influences the dialogue that occurs.

The New Market Forces



Source: Unleashing the Killer App.

The following sections discuss market forces in the context of **Content Services** (See the Business Plan section for more definition). Despite the fact Broadband Services represent a new market, significant competitive activity is occurring in this marketspace, thus market force analysis is appropriate in this high-growth industry. On the other hand, market forces analysis has limited usefulness with respect to **Bandwidth Intermediation** (See the Business Plan section for more definition) for two reasons. First, bandwidth intermediation is a nascent industry, so the value of the market forces analysis is limited. Although there are other companies attempting bandwidth exchanges, the market is not structured enough to conduct traditional market forces analysis. Second, Enron is uniquely positioned to take advantage of its leadership in the power and gas trading markets and of its first-mover status in bandwidth trading. Market forces analysis has less applicability to Bandwidth Intermediation at this point, because Enron's first-mover advantage entails setting the context for all of these market forces.

The Broadband Operating System will allow EBS to offer Tiered QoS to any application developer to give them the same ability to craft network based services that are economical to their target audience. Since many ASPs are trying to roll out their services to the different target markets they wish to serve each needs a tunable business model to create a market for their individual services. EBS can become the enabling market for force for any application to reach a target audience.

Buyers

In fully analyzing buyer power, it is important to look at two factors -- product quality, and buyer power versus supplier power:

ENRON BROADBAND SERVICES STRATEGIC VISION

Product Quality

In a majority of industries, aggressive companies rely on e-commerce initiatives for their competitive advantage. Increasingly, companies are turning to high bandwidth content to differentiate their e-commerce products and services. EBS has recognized that the more its clients rely upon high QoS broadband delivery to support or differentiate their e-commerce offerings, the less price sensitive they are because broadband services are crucial to their business success. High QoS broadband streaming, transport and conferencing is critical to nearly all customers targeted in EBS's sales and marketing plan. As a rule of thumb, if the customer produces broadband content or applications, timely, low latency, no packet loss delivery of that material is essential to the differentiation of that customer's product or service. Product quality supports differentiation efforts, which makes buyers less price sensitive; thereby, decreasing buyer power.

Bargaining Power of Buyers vs. Sellers

Currently, buyers of Internet-based or non-Internet-based broadband services have higher bargaining power than sellers do. What drives this relationship is that many firms are selling Web-based media casting, media transmission and conferencing, and few of them are differentiated from one another since they all use the Internet as the backbone. However, as EBS's target customers fully realize EBS's value proposition (*i.e.* high QoS broadband on a usage priced basis) as superior alternative to the public Internet, they will begin to view EBS as having fewer true competitors along EBS's product lines. This will increase EBS's bargaining power vis-a-vis its customers. Four factors determine bargaining power are:

1. *Size and concentration of buyers relative to suppliers*
   In the mid- and long-term, a few large broadband service suppliers with global scope and scale will compete to offer the highest, most flexible QoS. Demand for high QoS will exponentially grow; nearly all enterprises in competitive markets that communicate to substantial numbers of stakeholders will demand broadband services as a means to provide differentiated content-in-context. Buyers will be numerous, thus highly fragmented, and they will be more small- and medium-sized in terms of revenue compared with broadband service providers. This factor points to EBS as a supplier of Broadband enabled audiences as having higher bargaining power.

2. *Buyers' information about suppliers' products, prices and costs*
   Information that customers can use to compare broadband service providers is not accurate today. The streaming media services delivered via the EIN/BOS is not understood by the market either today. Soon, accurate information will become more readily available and the EIN will become the new standard others are compared to. It will be difficult to remain opaque in an industry where information transparency and reduced transaction costs are competitive realities. The EIN story, if understood, is so compelling that the content or applications source can see a real difference in EBS since the EIN with the BOS allows immediate product differentiation on their part so they can leverage the EIN to set themselves apart in the industry they serve. The knowledge of the benefits of the EIN is the not widely dispersed so other solutions appear to be comparable. This factor points to EBS as a supplier having lower bargaining power until the true value of the service is more clearly understood. This is rapidly changing since some content sources are going to market on the EIN and using the Broadband Content to differentiate their company and services. As the awareness of the EIN increases and it becomes apparent that the services available as a result of being ePowered are differentiated and can reach a global audience, the demand for the EIN will put EBS in a stronger bargaining position.

3. *Buyers' costs of switching suppliers*
   Switching costs break down according to the size and industry of the customer. There are two classes of customers to consider. Those that are sources of applications or content who buy from EBS and the end users who consume the application or content Switching costs include potential service interruptions, swapping out customer premise equipment (CPE), legal, and other costs of entering into a new service contract. Smaller end user customers and those who do not own their own CPE may face significant switching costs. Large customers and those who own their CPE may have few barriers to switching broadband suppliers unless the content is integrated into the daily lives of the users in the business or home and the differentiated content comes from the EIN ePowered sources.

   Since large applications/content customers generally will consume more services, they will likely have high bargaining power with EBS. They will have it diminished if they want to reach the audience delivered via the EIN. The key to signing up and keeping content/applications sources is the combination of the Tiered QoS delivered via the EIN and the audiences delivered via the Distribution reach of the EIN. This will make it difficult to switch from the EIN since any one carrier may have Tiered QoS but they will not have the reach of the EIN. They only get any content/application source to their end users connected directly to their network.

4. *Ability to vertically integrate*
   A handful of telecom firms may have the ability to vertically integrate by acquiring their own broadband service capability. A small number of firms will vertically integrate due to the barriers to entry described below (See New Entrants). However this factor strongly points to buyers having less relative bargaining power since they will not be able to get QoS and reach unless they build their own private network which includes reach into the local markets via the ISP's.

Buyer power has been high for EBS, as long as buyers view new Internet-based QoS solutions (*e.g.* Akamai, Digital Island) as viable e-commerce platforms. During this period, it is critical EBS actively build demand pull for its broadband services, so that EBS's Internet-based competitors do not capture significant buyer mindshare. EBS has started telling the Tiered QoS story in a new way so that buyers' bargaining power does not further increase. EBS's recent success in creating demand pull is limiting bargaining power of the buyers since they have no other choice for delivering differentiated content in a robust reliable manner to their target audience. Buyer power will continue to decrease as customers realize Internet-based broadband service providers cannot provide high QoS because their services are based upon the Internet's flawed business and infrastructure models.

EBS will experience considerable market pull and decreased buyer power at this time as buyers realize high QoS broadband services can support their rich media e-commerce offerings. Given this viewpoint, EBS should position itself to capture end-user mindshare prior to this juncture before competing broadband services establish brand equity with customers and end-users. If EBS's marketing does not fully take advantage of its first-mover advantage, buyer power may increase if EBS does not successfully market and sell its product in the early stages of the broadband services industry. Therefore, it is imperative EBS make the streaming services work for the early adopters that want to redefine the Internet experience and create the New Medium using the Tiered QoS approach to differentiate their eCommerce or eBusiness sites using the EIN**. EBS must establish a defined integrated marketing communications program that builds EBS's parent brand and its ePowered brand before its first-mover advantage is negated.**

ENRON BROADBAND SERVICES STRATEGIC VISION

Suppliers

Since the technology and communications industries are dynamic and highly competitive, no one company can succeed on its own. A critical element of high-technology strategy is to assemble technologies from recognized leaders to deliver a complete, best-of-breed solution that can keep a company ahead of its competition. In response, EBS has developed partnerships with Sun Microsystems, Cisco Systems, and Inktomi, Real Networks and Compaq. Microsoft has the potential to become a key partner since they now understand the concept of eyeballs reach via distribution partners. These development partners are contributing key technologies, technical support and in most cases actual EIN development resources. By combining EBS's partners' resources with its own, EBS is creating a virtual development team.

As EBS forges alliances with technology suppliers, it must protect its interests with active contractual negotiation to avoid giving away competitive leverage. Meanwhile, EBS's alliances also have to enable its partners to be successful in creating new, high value add technology. As a result of these alliances, EBS becomes somewhat dependent upon them to accomplish the product development advances that EBS needs to develop its broadband platform. For example, Cisco's inability to ramp up development on its high-speed Gigabit Switch Routers was a competitive setback for EBS. In the meantime, Cisco has been very visible in the marketplace with plans for the wireless industry. There is potential that Cisco's interests are spit between optical broadband and wireless. In this regard, EBS's suppliers have significant competitive power over EBS. Strategic relations with alliance partners need to balance the requirement to leverage their market clout with the need for EBS to be separate from the technology wars in the industry.

Undeniably, EBS does not have the expertise to develop network components such as routers and switches; therefore, alliances are an important component of EBS's strategy. Its alliances must share the risk and rewards of the relationship in a manner that protects EBS's business and forces suppliers to meet alliance agreements.

Substitutes and Competition

Competition from substitutes (*i.e.* narrowband solutions) and competitors (*i.e.* broadband solutions with limited reach or lower QoS) to EBS's products and services will inevitably accelerate over the next year as the demand for broadband content increases. Currently, EBS maintains a first-mover advantage. The EIN is now the most advanced scalable broadband network with global reach, and it offers the most advanced tiered QoS, automatic self-provisioning and advanced integrated network software. Competition exists via any product or service that end-users view as a substitute. Competition will evolve as the EIN is successful at becoming the only true Broadband deliver platform. EBS much grab reach from ISP's and other edge delivery platforms so that as the QoS advantages per application diminishes the competitive advantage will be the broadband enabled eyeballs that are connected to the edges of the EIN.

The extent to which the threat of substitutes and competitors will threaten EBS and constrain broadband services depends on: 1) the propensity of buyers to substitute or to choose competitors; and 2) the price/performance tradeoff of those alternatives. Certainly some enterprises view narrowband solutions as substitutes for EBS. However, as rich media served up via a directory with Tiered QoS becomes the standard for helping to create the New Medium and more customers' experience EBS QoS, the propensity of buyers to substitute Internet-based solutions for a BOS-enabled network will diminish. EBS's quality will become apparent because the price/performance tradeoff between Internet-based solutions and dedicated networks are and will continue to be markedly inferior to EBS's offering. In regard to the threat of competition for

Bandwidth Intermediation/Trading services, EBS is less than one year ahead of Williams in development of self-provisioning bandwidth capacity. EBS must establish strong brand equity with its customer base while it is ahead of Williams, or any other competitor, to minimize this competitive threat.

When a product or service has few threats from substitutes and competitors, demand is inelastic. Likewise, when that threat increases, demand is more elastic. Today, customers may view private networks, virtual private networks (VPN) and the Internet as close substitutes for the BOS-based platform. To the extent that is the case, demand for EBS products and services will be price sensitive. But, successful, continuing differentiation of the EIN, the BOS platform, and EBS applications will allow customers to realize that, as of yet, there are no real substitutes.

As the gap between price and performance characteristics of Internet-based and non-Internet-based broadband solutions widens, the industry in which EBS competes will narrow to include only other broadband service providers offering end-to-end, high QoS solutions. According to today's competitive intelligence, no similar competitor exists; therefore, EBS's application suite of ePowered Media Cast, ePowered Media Transport and ePowered Conferencing have no real competitors in the broadband sector. However, competition exists. Williams is developing similar broadband capabilities to EBS, and is believed to be less than one year behind EBS in development. EBS's main competitive advantage against Williams is that EBS's automatic provisioning functionality can be accessed via a desktop. Two competitors – Akamai and Digital Island – exist in the Internet sector. While today they are narrowband solution providers, they are likely exploring broadband solutions. Furthermore, these competitors are ahead in branding their services -- Akamai is 'Akamaizing' websites. In the long-term, competition will exist, thus it is important that EBS use its first-mover advantage to minimize the threat of substitutes and competitors by accelerating time-to-market and building its brand equity.

New Entrants

EBS's shaper status in broadband networking is moderately sustainable as long as a physical network is a competitive advantage. In this regard, the EIN is a competitive advantage because the capital requirements to build a competing network are immense. The ability to use bandwidth from other networks via the bandwidth managers will allow EBS to grow reach fast at the raw bandwidth (circuit) layer and allows EBS to make deals globally with the PTTs and global IXCs versus build a network. The competitive advantage of a fiber based physical network is not a long-term one. Possibly the ability to use the bandwidth from other networks is will be duplicated by other players. The ability to have application that run on the BOS and the corresponding BOS-Application Programming Interface (API) are at the core of EBS's long-term competitive advantage since it includes the notion of controlling raw bandwidth demands via the EBS pooling points. EBS will experience greater threats from new entrants as they are intellectually-based assets, not capital intensive assets but so it is critical to continue to link the BOS-API to the notion of Tiered QoS for applications driven by a directory and the underlying raw bandwidth being controlled by grabbing bandwidth as needed from the pooling points.

The EIN will allow EBS to bring the BOS to market in a controlled environment that can provide consistently high QoS, thus creating a significant barrier to entry for broadband services entrants. The EIN provides a proving ground for EBS. Nevertheless, as this network advantage erodes, the BOS and the BOS-API will bear competitive pressures. EBS must continuously reinvest in its intellectual capital to minimize the ongoing threat of new entrants. Specifically, while BOS will first be established by delivering the functionality of ePowered Media Cast and Transport, as it gains users, it will need to expand into more and more avenues of broadband offerings.

ENRON BROADBAND SERVICES STRATEGIC VISION

NEW MARKET FORCES

Deregulation (Domestic)

Deregulation Implications for Broadband Services

As the communications market converges, regulators and policymakers are under increasing pressure from diverse interests to ensure the swift deployment of Broadband Services to end-users.

Broadband policy in the United States is largely guided by the Telecommunications Act of 1996 (The Act). The Act directed the FCC to drive the development of advanced services as quickly as possible by creating a new regulatory model that is designed to break down regional monopolies and encourage open competition among service providers. Among other things, The Act was designed to:

- Drive competition among providers of different technologies to develop broadband solutions across multiple platforms (*e.g.* traditional telephone, cable, wireless)
- Increase market access for long-distance Interexchange Carriers (IXCs) and increased entry for a broader spectrum of companies, such as CLECs and utility companies.

In order to promote greater local competition, the Act outlined a 14-point compliance checklist for Regional Bell Operating Companies (RBOC) that encourages open access to their networks for competitive providers. In exchange for unbundling their networks, the RBOCs would receive regulatory relief to provide nationwide Internet/data and long-distance services once the FCC determines the 14-point checklist is met.

The implications of the Act as it stands today are that since it encourages the development of multiple access technologies to end-users, EBS must remain flexible to support these technologies as they emerge, namely xDSL, DOCSIS (cable modem) and wireless. EBS should also look to exploit the opportunities presented by the new deregulatory models of the Act by creating entities that both absorb regulatory risk and can provision services and compete within the local loop.

Government Regulation of Bandwidth Products

While the 1996 Telecommunications Act was a major overhaul of how telecommunications services are provided in the U.S., it barely touches upon the Internet itself, and is not regarded as a foundation for Internet policy. However, with the subsequent implementation of the Act by the FCC (and its Universal Service order), it has become clear that there are new standards emerging regarding what services are considered regulated by the FCC and state Public Utility Commissions and those which are not.

- *Telecommunications Services* – The transmission (transport), between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent or received. These services are regulated using mostly older telephony models.
- *Information or Enhanced Services* - Often considered the same, these services provide a value-added component such as storage/retrieval, transformation or processing of the information, or making information content available via telecommunications (*i.e.*, Internet access). Information Services are generally not regulated.

EBS's Broadband products and services exist in both these categories. Products such as ePowered Media Cast, a streaming media product, would be classified as an Information Service and therefore exempt from federal and state regulation as well as Universal Service support programs. However AFTS, a service that uses DWDM technology to provide virtual private networks to carriers, ISPs, and enterprise customers, is a telecommunications service and subject to Universal Service as well as state PUC regulation when offered on an intrastate basis.

EBS must actively manage its regulatory risk by ensuring that its advanced, Internet applications products are designed, product messaged, and marketed within the parameters of Information Services. EBS also needs to recognize and identify its services that resemble Telecommunications Services and mitigate negative impacts from more aggressive regulation of these services.

Enron's Government and Regulatory Affairs group will provide support to EBS in this area by helping to manage EBS's regulatory risk as well as ensure regulatory and policy compliance across the company.

Regulation (International)

Regulatory models and regimes outside of the United States vary greatly. Few countries have adopted the pro-competitive model of the U.S.. Instead they continue to have a regulatory structure that is favorable to their incumbent carriers. In some countries, the pro-competitive model is slowly being adopted. Japan, for example, has more licensed carriers than ever. These carriers are, however, subject to varying degrees of regulatory scrutiny, depending on the type of license they hold.

Over the next three years, EBS can expect to see major overhauls in telecommunications policy abroad, specifically, in Asia and Europe, due to the profound impact of the Internet and the growing dominance of the U.S. in e-commerce. These major regulatory reforms will most likely be in the form of a convergence of regulatory regimes (*e.g.*, information technology, telecommunications and the Internet) all being housed under one regulatory construct. Moreover, in Europe, the European Commission is starting to look towards a common telecommunications and Internet policy. The convergence of regulation may have a significant impact on EBS. For example, EBS may be regulated more like a broadcasting company than a telecommunications company in some countries.

Consequently, as EBS enters foreign markets, it will have to be acutely aware of potential regulatory challenges. These challenges will range from basic licensing issues, tax implications, on-line privacy concerns, the level of encryption technology allowed, mandatory levels of service, and content regulation, among others. EBS must examine regulatory issues as it examines new market entry.

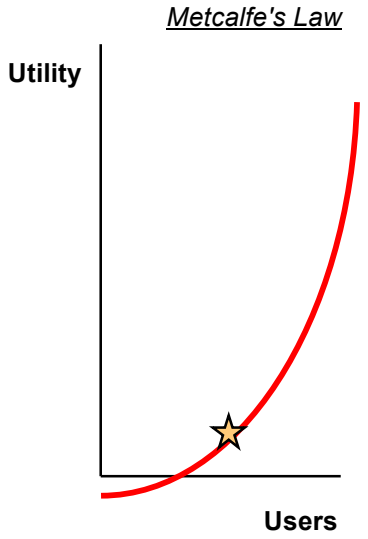
ENRON BROADBAND SERVICES STRATEGIC VISION

Digitization

Technology has accelerated the pace of change in every industry. Traditional business practices and standards are being redefined at breakneck speed due to the impact of killer applications (*i.e.* killer apps -- technology whose impact extends far beyond the purpose for which they were invented). “Killer apps” manifest themselves as goods or services that establish entirely new industry categories, and by being first to market with a technology, they establish dominant market positions that provide exponential returns on investment. Given the benefits “killer apps” bring to their stakeholders, they are regenerative, but “killer apps” are also destructive in that they can make technologies, investments, and companies obsolete. Pace of change brought by killer apps will continue to accelerate. Moore's Law states the power of technology doubles every eighteen months. The digital future (See Vision of the Future section) is inevitable and inexorable -- rapid change will happen.

EBS has an opportunity to become “the killer application platform” since it delivers a New Medium (Broadband enable Applications) to a large audience via the EIN using the BOS. Content is increasingly turning to rich media. High QoS broadband is the only method by which high QoS rich media can be distributed, thus broadband will revolutionize Internet content which will become the New Medium. Undoubtedly, as broadband demand increases there will be industry needs for standards in infrastructure and applications. However, competition will likely be intense, as the rewards for the killer broadband apps will be lucrative, so time is of the essence. Metcalfe's Law states that the value of a network grows exponentially, thus once an industry standard has been established, its value to everyone multiplies exponentially. The BOS/EIN has the potential to reach critical mass as the Broadband platform since it will have global reach fast if we execute on our Distribution strategy and sign up and install our distribution links as fast as possible. Companies who learn how to adapt to the change inherent in Metcalfe's Law will experience an unprecedented prosperous future. EBS must thrive on change in order to meet the demands of a high-technology market but the BOS Platform approach allows thousands of companies to develop killer applications in their industry and reach critical mass fast via the reach of provided by the EIN and the Distribution partners. **This means that new applications can be rolled out rapidly by plugging into the Tiered QoS aware EIN and use the BOS to grab the QoS needed for the application and the target audience.**

A sense of urgency has to pervade EBS's entire organization to meet the time demands that will inevitably occur within the broadband industry. There is a point in the diagram of Metcalfe's Law at which technology reaches critical mass (See Metcalfe's Law diagram below).



At the point of critical mass, the market realizes the value of the technology, and the technology's value increases exponentially as it becomes pervasive in the market. If EBS is to realize exponential return on invested capital (ROIC), it must be paranoid. A figurative pack of wolves is at its heels waiting to join the broadband services market. In response, EBS must execute on its strategic plan to get the initial broadband streaming media service offering (i.e. Media Cast) out to market globally as soon as possible to reach critical mass of what is perceived to be the first true broadband platform for delivering streams. The EIN enables the BOS to earn a reputation as the platform to get global reach for any broadband content or applications. This approach will drive the use of the EIN and the BOS development efforts.

Globalization

The globe can be thought of as a large network. As Metcalfe's Law states, the larger the network of a technology, the greater value it creates. For EBS's network and correspondingly its ROIC to grow as large as possible, it must become the de facto broadband standard across global networks. The capital requirements for Enron to build its own global scale, broadband network are prohibitive. EBS's operating system must have the capability to communicate across disparate network infrastructures. This capability will expand the BOS standard globally, and establish EBS as the broadband services platform, if it beats its competition to market.

EBS will gain de facto standard leadership position as a result of deploying the first global streaming media infrastructure. Once major ISP's, ILECs, CLECs, PTTs and Cable Providers use the EIN to deliver streaming media services and content to their customers around the world, the EIN will become the de facto industry standard and offer unprecedentedly large global audience reach. When EBS defines a business model for interconnecting the EIN to all the Internet's edges and to local providers, the EIN will reach over 100 million customers in less than 2 years. Critical mass for the EIN is accelerating with the recent adoption of the EIN by ISP's, US West, and several International PTT and ISP partners. Already, content originators are reaching their target audiences faster and more economically than possible with non-EIN bandwidth solutions like Digital Island or Akamie but for flat file WEB pages not for Streaming Media and not for QoS2, QoS3 or QoS4 streams.

Relationships like the recent agreement with Sun for making the BOS an application platform for Solaris developers will drive another class of development to occur around broadband

applications that have nothing to do with streams. Those applications will be enabled via the EIN to have global reach because of the Distribution Partners (local loop providers) and the customers connected to their networks that EBS brings to the table when a content source signs an agreement with EBS to be ePowered.

TELECOM INDUSTRY MYTHS

Myths that have evolved in the telecommunication industry have provided EBS an opportunity to realize a high return on invested capital by redefining the way high bandwidth (*i.e.* broadband) is developed. Defining and understanding these myths are important when framing EBS's strategy in the marketplace. The business practices legacy telecommunication companies have developed over the years have provided the world with a reliable network of telephone communications. However, the business practices required for telephony will be inappropriate for enabling the networked world of tomorrow. It is critical that employees understand these myths in order to adopt a common vision. EBS can fully exploit its opportunity with a common understanding of what that opportunity is and how EBS's strategy relates to it. EBS can take advantage of the industry wisdom that would say our approach is flawed ahead of the industry understanding what EBS is doing to gain reach of eyeballs and gain relationships with companies focused on the New Medium versus incremental improvements over the Internet. Those legacy industry beliefs and practices are outlined below:

1. *Owning cables and wires means owning the customer*

Traditional carriers feel that without wire-based connectivity, the customer is stranded -- they have no alternative (*e.g.* wireless), and once a company comes in to connect a wire, the customer is held captive by the high switching costs associated with running new wires into the home or business.

2. *Long-distance and dial-tone(local phone service) revenue have been viewed as the major pots of gold*

Long-distance providers traditionally desired dial-tone revenues and vice versa. These two goals (increasing these revenues for both the IXC and LEC) were the main focus of traditional telecom companies. That approach has kept traditional carriers from keeping pace with technology. Slowly, carriers are awakening to the possibility of other (data services based) sources of revenue, but this activity is taken with Myth 1 in mind: Own the cables, own the customer.

3. *Owning the network end-to-end is necessary and desirable*

This myth created a flurry of mergers and acquisitions. AT&T bought TCI and MediaOne; Worldcom bought MFS, MCI, and Sprint; and Regional Bells are buying each other out and building new fiber networks. These carriers believe that as the ends of networks are owned, the more customers are owned (*i.e.* as Myth 1 shows).

4. *More bandwidth at cheaper prices will fix all networking problems*

The traditional telecom industry believes congestion is the sole cause of the Internet's declining QoS. It further believes this congestion can be fixed simply by increasing the width of the pipelines carrying content. Their rationale is: the cheaper the bandwidth, the more people will be able to afford it, which will increase demand. Accordingly, they believe that cheaper bandwidth also means it will cost less to expand the network.

5. *Oversubscribing the IP network (from both a port and a bandwidth perspective) is the main/only way for ISPs to make money*

Price competition has led to an industry average of approximately 8-10 times over-subscription of ISPs' IP networks. The only way for ISPs to recover their network investments is to ensure that there will be as little excess bandwidth as possible, thus the oversubscribed networks. The market does not recognize the adverse quality effects this has on the Web-access experience for users. For customers, price, not QoS, is the driving differentiator among ISPs.

6. *Only facilities based bandwidth sales can make money*

Reselling other peoples circuits or bandwidth is a narrow margin business and is not a long-term sustainable way to make money. This is true given the inefficient way bandwidth is sold, delivered and the long-term nature of contracts. The wisdom is "you must produce your own bandwidth on your own fiber or you loose". Another way of saying the industry wisdom is "he who has the biggest fiber based fully owned footprint with the most capacity wins".

ASSUMPTIONS & BELIEFS

EBS believes the industry myths outlined above have created an unresponsive industry to users' needs. By reviewing what the world will need in the future, EBS has determined that new technological and business models are required from telecommunications companies in order to deliver the products and services that will enable the future vision (See Tomorrow's Networked World). With that future state in mind, EBS has developed the following list of core beliefs that serve as the basis for its strategic plan.

1. *Rich media is the basis of a New Medium, which will be the business entry point for the future of e-commerce*

Rich media delivered via Tiered QoS broadband services is essential in creating a New Medium that can differentiate itself from print, radio, television, and today's Internet. Rich media communicates more effectively than today's Internet experience of static pictures and text, choppy audio and video, and small Java applets. Visual and emotional impact have been proven to work. Engrossing entertainment will draw new consumers and create new sources of revenue to the New Medium. Once rich media enters the market and defines the New Medium, customers will rapidly adopt the New Medium. This will become the cost of entry for content providers, ISPs, ASPs, and other rich media stakeholders to effectively compete in e-commerce. The EIN/BOS will become the de facto standard way of delivering the New Medium if we get reach fast and make the services work as planned.

2. *Pricing models of dedicated private lines and/or virtual private networks (Frame Relay or ATM) discourage full e-commerce potential*

As seen in Myth 0 above, the high prices of dedicated lines promote poor QoS on the Internet by forcing ISPs to oversubscribe their networks to recuperate costs. The Internet is fundamentally flawed from the business and a technology model perspective. Therefore, in order to obtain the high QoS (the fast response time that users appreciate) required for rich media, a content provider today would be required to build or buy its own private network. However, the same high prices that cause congestion by encouraging oversubscription discourage businesses from investing in a private network – the network is too expensive, and has insufficient reach to justify the expense. Companies, therefore, experience a major roadblock (*i.e.* cost of reach) towards

differentiation via rich media. The e-commerce potential offered by rich media is ignored due to the prohibitive cost, small reach or the poor quality. EBS is offering a solution to all of these services.

3. Bandwidth demand will exponentially increase and must be managed efficiently

Increasing bandwidth to meet demand at current usage efficiencies is not a scalable solution. As more consumers get broadband connections, the backbone will need exponential upgrades to ensure QoS. One end-user will create network loads equivalent to 1200 simultaneous phone calls (100 Mbps); this user will also demand more than bursts of data, as today, but will demand continuous high-bandwidth flows for more hours per day. Bandwidth capacity will ultimately become a commodity, but demand will be so high, even though the price per bit-per-second will drop exceedingly low, that the volume will most likely overshadow the commoditization of high bandwidth.

Additionally, increasing overall available bandwidth capacity will not work. Broadband is necessary for a rich media experience, but alone it is not sufficient. The ISPs will continue to oversubscribe their networks, which will lead to congestion no matter how much bandwidth is ultimately available. Even if the ISPs change their business model, bandwidth capacity is not the only bottleneck. Routing and server capacity major problem for delivering a fast response time at the screen with high quality streams. Server capacity and storage can other areas where the network needs to deliver capacity for the applications services and to manage bandwidth utilization efficiently.

4. Mission-critical applications for geographically dispersed entities require local replicas of data

For the foreseeable future, data storage costs will be lower than bandwidth capacity costs. In order to balance the costs of running a global business, it will be cheaper to store replicas of data, rather than spend money transporting it back and forth to all users who need access. This implies that distributed server architectures are needed to fulfill the requirements of storage and low latency.

5. Off-net connectivity for networking is inevitable because all users will belong to multiple communities of interests

A single-vendor, global network that reaches all users is infeasible (case-in-point: even monopolist pre-divestiture AT&T was not the only dial tone and long-distance network in North America). Therefore, users will require information from networks other than their own (*i.e.* off-net) and content providers will need to provide data to users not on their service provider's network. As users access off-net data, each ISP's architecture is designed to remove the user from its network and onto the next as quickly as possible. A user may pass through several networks in this manner before reaching his data. This is problematic in that the connections between ISP networks (MAEs and NAPs) are points of congestion. Accessing off-net data (unavoidable) means flowing across different networks. This involves flowing through congestion points (inherently) and, in the case of incompatible data networks, may involve massive efforts in code rewriting.

6. Raw Bandwidth can be bought at a price that it can be sold for a profit even if you do not own the fiber by using proven Enron approaches to building markets for commodities.

Enron has proven that it can make a market before in gas and electricity. Enron is applying their skills to the bandwidth market. Bandwidth can be bought from other carriers via the Pooling Point technology and EBS will be able to make money from the volume they create using Bandwidth

Intermediation as the means to create volume and customers. As a commodity market evolves in raw bandwidth EBS will also be a leader in making the market evolve. *IMPLICATIONS*

If EBS's assumptions and beliefs about the industry are true, the logical results of them lead to short-term and long-term opportunities for any company willing to pursue them.

IMPLICATIONS

Short-term Implications

1. Inexpensive bandwidth providers and high-QoS providers (i.e. broadband infrastructure and application providers) are needed to enable killer-app rich media applications to be developed and deployed, because rich media cannot be distributed via today's Internet in a differentiated manner with high QoS since the Internet is a narrowband infrastructure.

2. A bandwidth trading opportunity exists due to an imbalance between supply and demand. Incremental bandwidth expansions on large networks provide insufficient overall supply for escalating bandwidth demand, while incremental bandwidth expansions on small networks provide localized overabundance of bandwidth supply. Furthermore, an infrastructure that enables trading deals also creates a financial intermediation opportunity, making it possible to economically extend out-of-the-money bandwidth contracts.

3. Reach is critical for a broadband services solution because Metcalfe's Law (*i.e.* the utility of a network increases with the number of users squared) dictates that reach is critical. A broadband services provider can establish broad global reach, and a correspondingly large customer base, by connecting to Tier-1 ISPs, because Tier-1 ISPs connect all ISPs to backbone architecture.

Long-term Implications

1. Early private bandwidth trading markets will evolve into commodity markets. Bandwidth trading will hasten commoditization by facilitating distribution across the network (*i.e.* backbone and edge), thus creating market liquidity.

2. In order to create a broadband services platform, bandwidth must become more accessible on demand in an easily usable form. Applications need to be written and deployed using a Standardized platform to utilize the network's bandwidth. As Accessibility (*i.e.* reach) is provided for in the short-term, Usability gathers momentum with high bandwidth capability. This is critical because the key factors in creating and sustaining competitive advantage with technology are Accessibility, Usability, and Standardization.

3. Accessibility and Usability give networks competitive advantage. In order to make this advantage sustainable, the network's Usability needs to be based on and become the industry Standard: the platform upon which all the applications are written.(*i.e.* EIN/BOS & BOS-API).

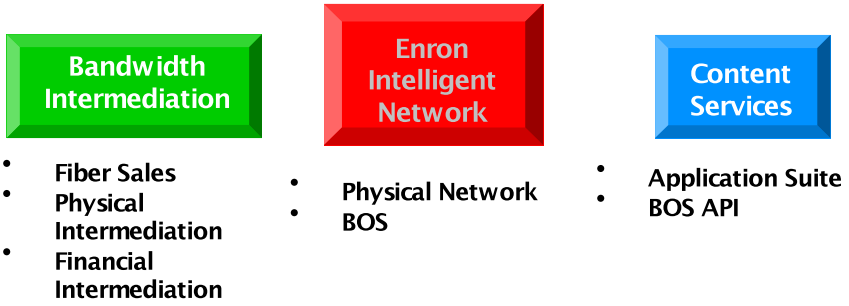
ENRON BROADBAND SERVICES STRATEGIC VISION

PRODUCTS AND SERVICES: What does EBS do?

The first section of the paper describes a largely theoretical world: future point of view, compiled industry analyses, observations, and assumptions and beliefs regarding what broadband opportunities exist in the rapidly evolving world of telecommunications. These theories form the basis of EBS's strategic plan. This Section will describe this plan: the way EBS intends to take advantage of its opportunities today and in the future. Defining Section I as merely theoretical does not reduce its importance. Since the theory, analysis, and assumptions stated above form the basis of the strategic plan below, they are crucial in the understanding and acceptance of the strategic plan.

EBS transcends traditional network technology companies by bridging the gap between physical offerings (*i.e.* Access/Transport), Content Providers/Aggregators and software offerings (*i.e.* Enablers). The three sections below represent EBS's attempt to gain Accessibility through physical technologies and bandwidth intermediation, Usability via broadband applications, and Standardization via BOS by combining these offerings in a differentiated manner, with the BOS platform bridging the gap between the hardware and software offerings. EBS's business organization is roughly organized around these three strategic areas. The following diagram explains how EBS's assets fit within this organization:

EBS Business Organization



EBS is able to combine these three notions into one common network and services delivery architecture. The business model and physical footprint create economies of scale that no individual Carrier, Content Source, Service Provider or Enterprise economically create on their own.

This unique approach yields a network that has more combined fiber miles and bandwidth than any individual carrier since other carrier networks are combined via the EBS pooling points.

ENRON INTELLIGENT NETWORK

EBS's long term sustainability is the EIN comes from the Broadband Operating System controlling the EIN. As Tom Gros says " the bandwidth pooling points are the pump that injects the life blood into the EIN". The EIN is a physical network including the pooling points with a smart operating system (BOS) that controls it.. It is a communications solution that delivers high-quality, global connectivity services using the Internet Protocol (IP) and separates itself from the Internet with the ability to provide for two unmet needs: guaranteed bandwidth and Tiered network quality. Using the BOS (Broadband Operating System) to control the quality of service over the network, the EIN will allow IP networking to match the quality of traditional TDM (Time Division Multiplexed) telephony, while providing significant cost advantages. A flexible design allows the BOS to be independent of the data link and physical layers of the network (see OSI layer diagram below). Thus BOS can be deployed on the most advanced physical network technologies (*e.g.*, EBS's DWDM optical network) and can be easily adapted to future network technologies.

OSI Layers

Layer	OSI Layer	EBS
7	Application	
6	Presentation	EIN Software
5	Session	
4	Transport	
3	Network	EIN Network
2	Data Link	

ENRON BROADBAND SERVICES STRATEGIC VISION

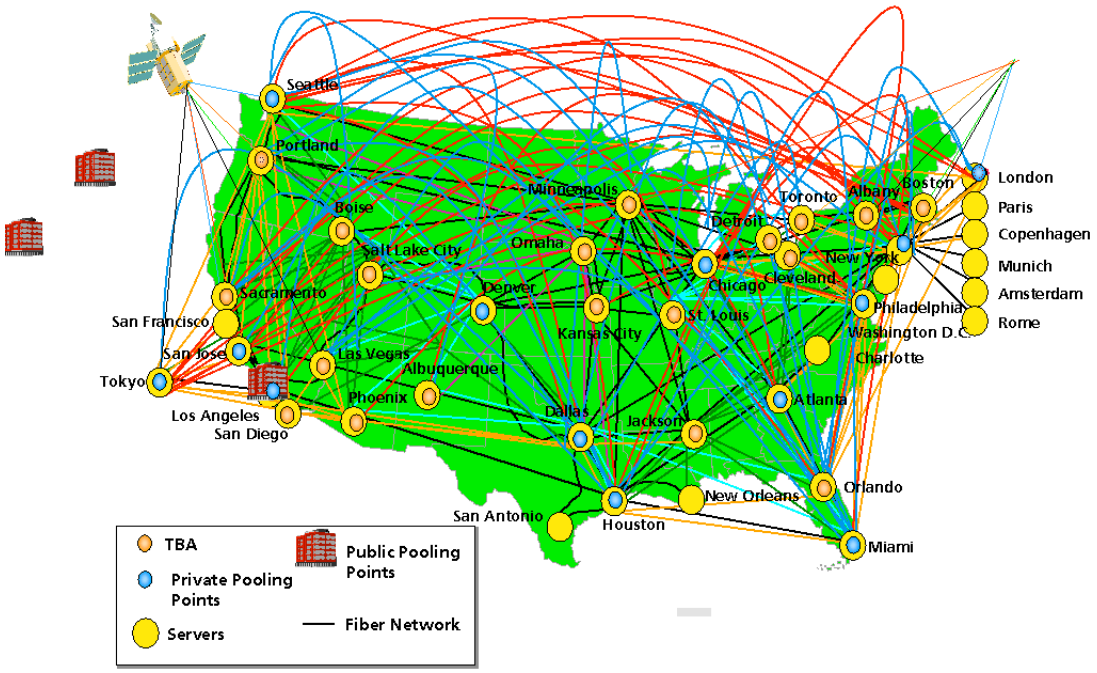
1	Physical

Through the EIN's architecture, EBS provides broadband with global reach, tiered QoS, and a vehicle for the introduction of a wide range of broadband applications. The initial uses for the EIN and BOS will concentrate on the ePowered applications focused on delivering streaming media.(ePowered Media Cast, ePowered Media Transport, and ePowered ASP delivered Conferencing). The EIN provides a controlled environment to prove and perfect the delivery mechanisms of these initial applications. Once the technology gains acceptance, the BOS and other broadband applications will begin to propagate beyond the boundaries of the EIN. Further detail on the physical network and the software (BOS) that compose the EIN follow.

PHYSICAL NETWORK

The Physical Network that comprises the EIN today is a fiber-optic network that reaches over 400 Points of Presence (POPs) with 12,000 miles of fiber. It consists of best-of-breed components, including Ciena multiplexers, Cisco routers, clustered Sun Enterprise Servers, and Lucent Bandwidth Managers. In addition, through partnerships with Level(3) and InterNAP, there are secondary servers and better-than-Internet routes globally.

EBS Combined Fiber/Pooling Point/Server Network Connectivity



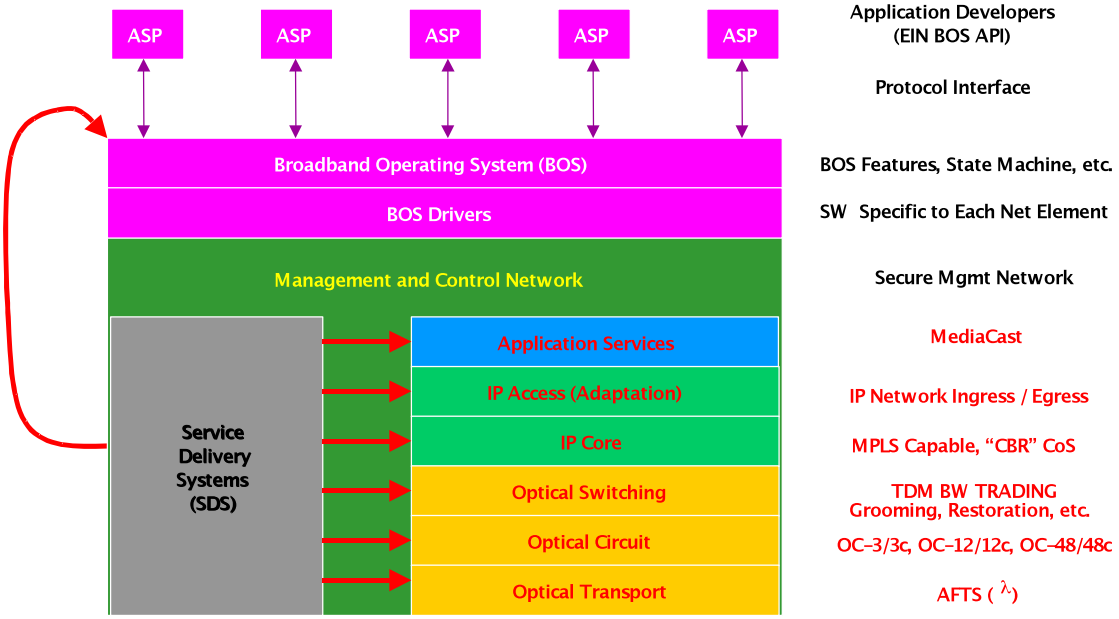
BROADBAND OPERATING SYSTEM

The BOS is a services platform that provides tiered QoS on a pay-as-you-go basis. At its heart lie three pieces: a bandwidth scheduler to move files quickly and reliably; the Service Delivery System (SDS), a collection of metering and billing functions; and a messaging system that allows

the BOS to communicate with and control the network hardware. Its strength lies in its ability to provide varying levels of QoS, to monitor network usage more precisely than anything else available today, and to charge clients on a usage basis. The usage of the network becomes a self-policing act, as customers select higher quality bandwidth with the knowledge it will cost more than lesser QoS levels.

The BOS is a software platform that resides in the thin layer (middleware) between applications and the physical network. It allows an application to communicate with and control the physical network in order to provide a high level of service.

Eventually, the BOS will be sold as its own entity. EBS will call a network that has the BOS on top a BOS Network. The EIN is the world's first BOS Network. The EIN, EBS's core (today), is a BOS Network whose BOS Servers are owned by Enron. As EBS continues to place its servers on other bandwidth (ePower), that bandwidth will become part of the EIN.



The features of the BOS are as follows:

Scheduled Bandwidth

Scheduled bandwidth is the ability to create real-time reservations to block off a time period. The ultimate goal is to achieve minimum 1-minute chunks, minimum 100ms lead time, during which bandwidth (minimum 100kbps, maximum OC-3; bi-directional; asymmetric) is reserved for a specific customer (point-to-point or multi-point). Customers may be enterprises, Internet Service Providers (ISP), or applications. Functionality exists or will exist to alter reservations: cancel, extend/shrink, expand/constrict, reschedule, recur (including calendaring functions), and slide. The BOS will manage reservations (See Bandwidth Inventory Management). The BOS will allow the user to query the reservation status. Reservations will be used when the highest levels of Quality of Service (QoS) are required, and would be priced accordingly (See SDS below).

Bandwidth Inventory Management

ENRON BROADBAND SERVICES STRATEGIC VISION

The Bandwidth Inventory Manager is the engine that operates the scheduler. It has the ability to automatically (and manually, when necessary) keep track of available capacity and scheduled bandwidth. This capability assigns bandwidth when requested and when available, and returns error codes and alternatives when requested bandwidth is unavailable. Once bandwidth is reserved, the reservation is immediately reflected in the Scheduling System. This engine eventually will have the ability to reoptimize delivery routes. This entails changing the scheduled paths to balance the network's load. This may also include sliding more flexible reservations. For example, a request that data be moved “by Tuesday at noon” may have originally been scheduled for Monday at 3am, but may now slide to Tuesday at 6am.

Uses of Scheduled Bandwidth

Using its Bandwidth Reservation System, the BOS provides guaranteed schedulable bandwidth, which allows for high QoS (*i.e.*, prioritized data will arrive more quickly and more reliably than today's best-effort routing allows).

There are two fundamental uses for this aspect of the BOS:

1. Very high bandwidth demands for specialized data applications (e.g., moving critical files to the edge of a distributed server network, live streaming feeds, etc.)

2. High-speed, guaranteed, schedulable transport, as a supplement service for corporate enterprises wishing to balance the load on their network for critical file transfers, without over-provisioning it.

The BOS will eventually allow a user to schedule 1-minute chunks of time of 100kbps to OC-3 capacity, with a lead-time that will approach 0 (say 100 ms).

Usage-Based Metering

Provided by SDS, usage-based metering is the ability to determine how much bandwidth was used and for what purpose(s). Any user of the BOS, EBS or a licensee uses this for internal optimization. This may be used for internal billing on an application-by-application basis, for pricing determination, or for rescheduling purposes. This function of the BOS is critical for providing users with the metrics needed to determine the value of higher levels of QoS. It is also critical for the owner of a BOS Network in order to charge users appropriate amounts.

Network Control

Network control consists of the functions that control the physical network, specifically the routers.

Messaging

This is the link between the scheduler, the applications, the SDS, and the routers. It is provided by InterAgent™ and allows the software to control the flow over the network. It is this messaging bus that links the data-driven to the physical. The Client on the Desktop will need to communicate with the EIN to allow EBS to prove our innocence to the user when a problem exists at the application layer. This will enable remote troubleshooting to occur to test the application all the way to the desktop via the local loop even if EBS does not provide the local loop or the edge equipment. This is a very important function to make the business scale long term and still maintain a quality of service that is able to be tested and defined accurately to the desktop.

The Interagent software will assist in the creation of this type of functionality to make the EIN a unique solution in the industry.

Directory Services

Directory services provide the BOS data storage that serve as a repository for:

- IP addresses
- User information
- Security information

These allow for much greater flexibility in interacting within the network. This is what makes the BOS an Operating System for the Broadband network. By allowing the software to react to different users (through the user profile) and different applications differently, it can provide differing levels of quality, and differing levels of access to e-commerce transactions. The EIN will need to develop a method of working with all types of Directory models so the LAN directory can interact with the EIN as needed to obtain those s

Other Aspects of the BOS

Tiered Quality of Service

QoS is essentially the level of quality that the flow of data experiences. High QoS means that the flow is not interrupted along its path from origin to destination. High bandwidth does not guarantee high QoS (although it does allow for more data to flow uninterrupted). The BOS allows for high QoS along a BOS Network by giving applications the ability to assign a high priority value to certain flows (imagine a police car with its lights on) or by reserving bandwidth for a specified flow of information (imagine a lane on a freeway with your name on it).

Additionally, the EIN allows for “Tiered QoS” through its network architecture. If we define QoS1 as the quality of Internet traffic (*i.e.*, poor), QoS4 would be a scheduled and reserved pipe. The EIN's architecture allows for QoS2 and QoS3. QoS3 is a “one-hop” experience. When a source and a destination both have ePower (that is, the source data is on the EIN and the recipient is connected to an ISP that is attached to the EIN), the recipient of the data is able to receive the data directly from his/her ISP’s server, which is just one hop away. If the recipient is not on an ePower ISP, he receives the data through InterNAP or Level 3. These EBS partners have routing algorithms and Service Level Agreements (SLAs) with networks that allow their data to traverse the globe with fewer hops than normal Internet traffic. QoS2, as this level of service is called, allows for a statistically better experience than merely using the Internet.

Secure Data Stream

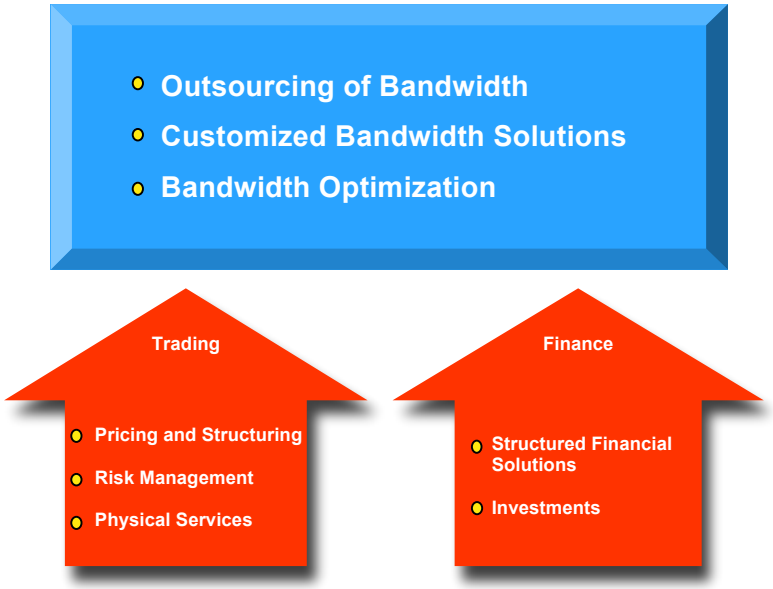
The BOS provides Authentication and optional Security with the ability to encrypt data to prevent others from seeing confidential information. This encryption and decryption is optional, and occurs at the expense of transport speed. The BOS's security control is limited to the demarcation points of the BOS.

ENRON BROADBAND SERVICES STRATEGIC VISION

BANDWIDTH INTERMEDIATION

Bandwidth Intermediation represents revenue streams that stem directly from the Physical Infrastructures (*i.e.* EIN and BOS Networks) that Enron and others build and maintain. EBS's physical network and its ability to cross-network with others' infrastructures enables Enron to immediately take advantage of the short- and long-term intermediation opportunities. EBS can exploit these opportunities by capitalizing on its core physical assets (*i.e.* rights-of-way along Enron Corp.'s pipelines) and its core competencies (*i.e.* Enron Corp.'s trading capability).

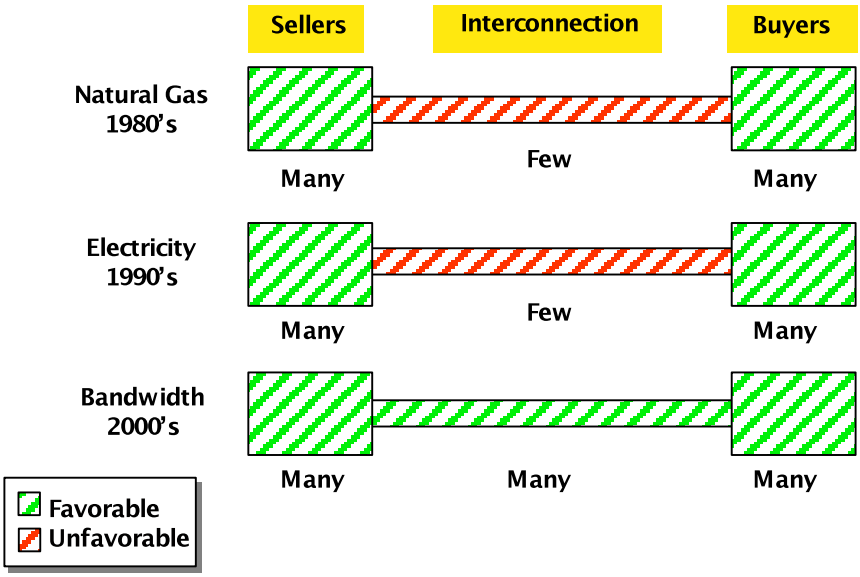
Intermediation



EBS will be able to participate in the Bandwidth Intermediation market without having to wait on the incumbents to work with Enron. This situation did not exist when Enron created the market in Gas and Electricity.

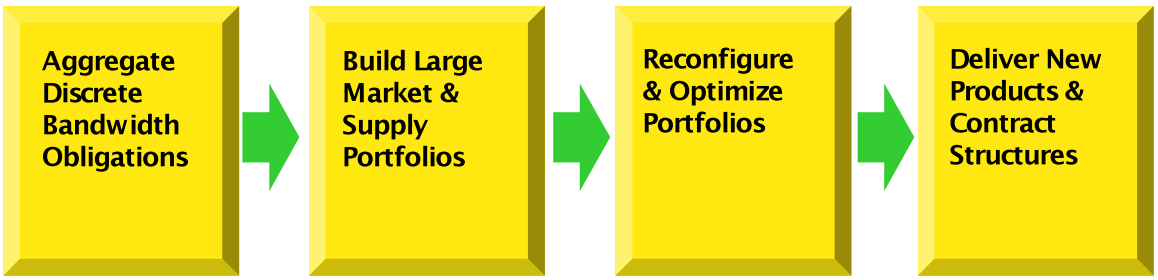
ENRON BROADBAND SERVICES STRATEGIC VISION

Ease of Creating a Commodity Intermediation Business



EBS will create a series of Bandwidth Management Products and allow the buyer of bandwidth services form EBS to have an evolution of services occur over time that will eventually dramatically change the rules about how bandwidth is bought and sold.

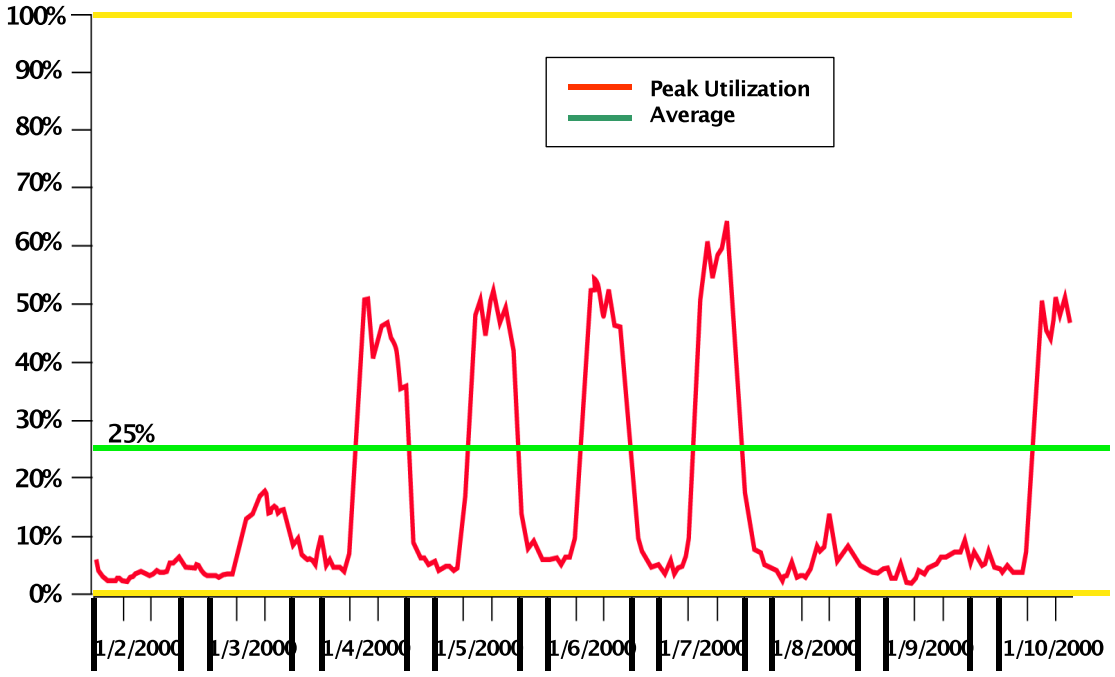
Bandwidth Management



Bandwidth that is bought today is inherently inefficient in the way it is bought and utilized. These inefficiencies are increased by orders of magnitude as broadband applications become the norm since the peak load per user and per group of users become so large that huge sums of bandwidth must be provisioned months ahead of the load or the quality of service will be degraded. Since the public network understands loads with respect to voice traffic well the industry will not see a need for a new more efficient way of managing bandwidth until the huge peak loads associated with Broadband applications becomes more prevalent.

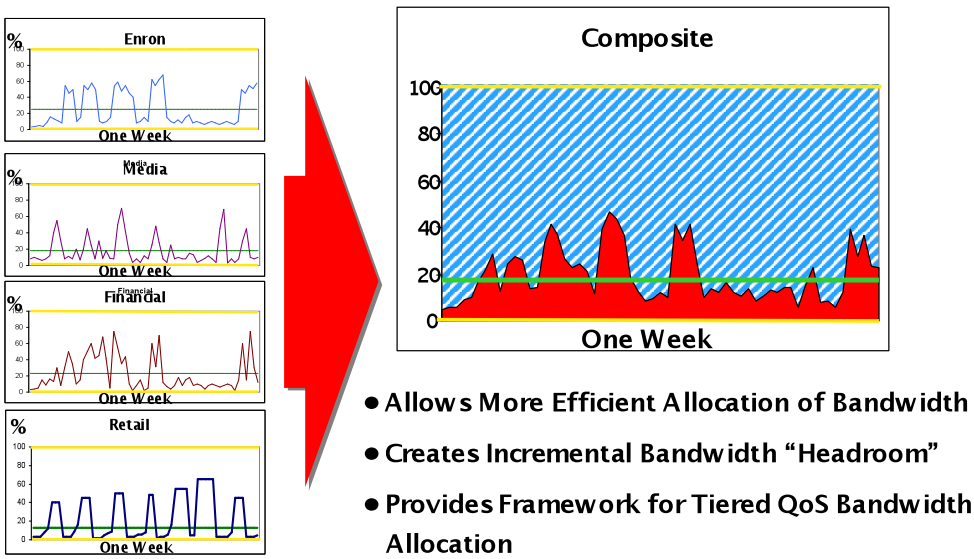
ENRON BROADBAND SERVICES STRATEGIC VISION

Bandwidth Management – Typical Capacity Utilization



EBS can aggregate the sum of inefficiently utilized bandwidth and combine those inefficiencies to make it possible for EBS to make money while still saving the customer on inefficient uses of their individual bandwidth.

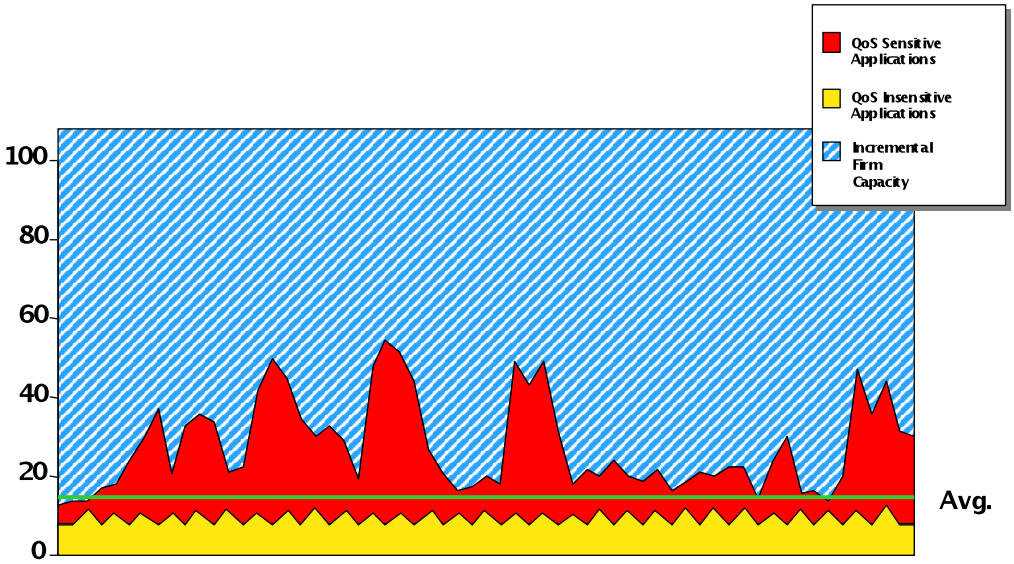
Aggregate Discrete Bundles of Bandwidth



EBS can reconfigure the portfolio it develops by aggregating the requirements of multiple customers and their inherent inefficiencies into one set of requirement for EBS that can

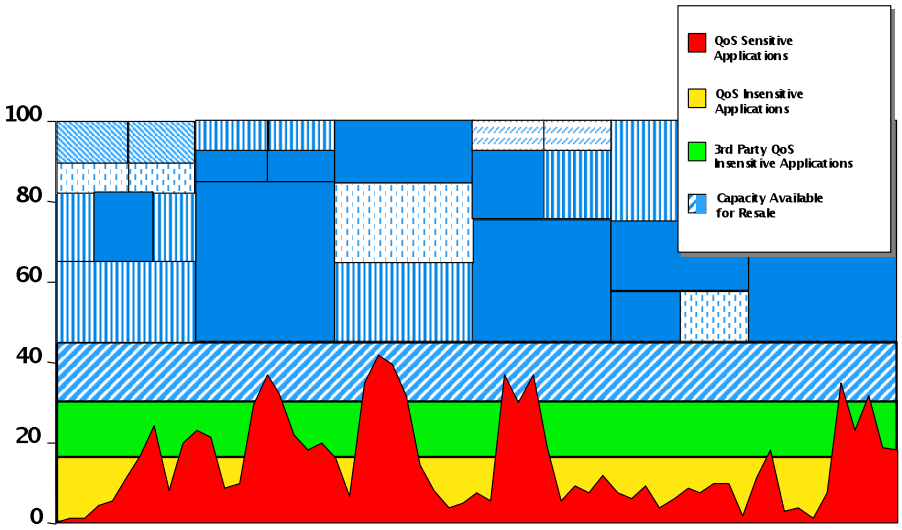
be managed. The combination of this load and the load created by the EIN for Broadband application services will allow EBS to gain more efficiency .

Reconfigure and Optimize Portfolios



Once EBS is able to develop a sufficient inventory of circuits from Bandwidth Intermediation contracts and the EBS Private and Public Pooling Points are in place EBS will be able to gain efficiencies in providing bandwidth that are not possible for other industry player today. The combination of highly deterministic QoS applications with less deterministic applications and the notion of providing raw bandwidth in time slices shorter than on month duration will allow EBS to offer high QoS applications but not waste the bandwidth that would be needed for high burst Broadband applications.

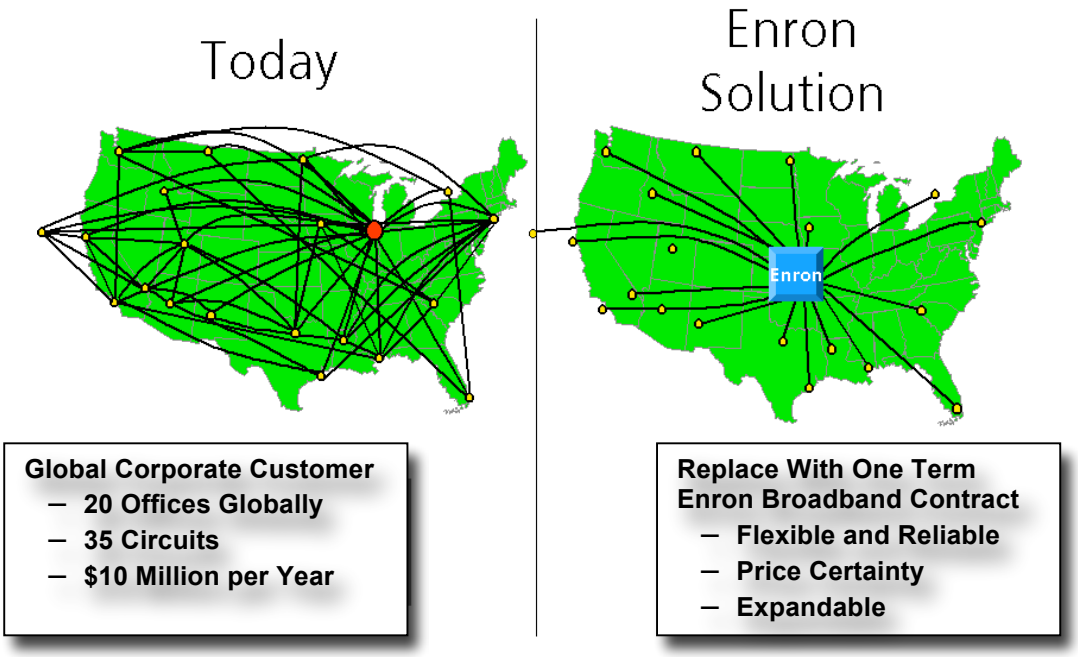
New Product and Contract Structures



By Identifying Non-QoS or Time Sensitive Applications and Routing Them Over Alternate Routes or in "Time Troughs", Enron Can Create More Firm "Headroom"

ENRON BROADBAND SERVICES STRATEGIC VISION

Enterprise and Carrier customers will be able to outsource their entire network to EBS in ways not possible with traditional service offerings from Carriers.



FIBER SALES

Sale of fiber, already providing revenue for EBS, is a way for EBS to recuperate network capital costs and fund future ventures. It also allows EBS to start relationships with carriers and large enterprise customers that lead to other types of business relationships.

Dark Fiber

Dark fibers are fiber-optic strands that have been earmarked for sale, not for use, by the installer. Of the 144 strands that EBS installed and continues to install along Enron's rights-of-way, 132 have been earmarked for sale or trade.

Advanced Fiber Transport Solutions (AFTS)

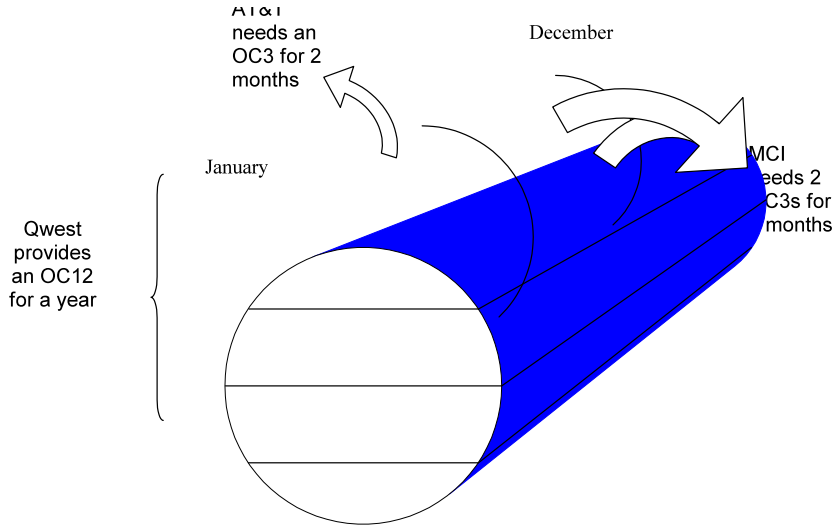
Each fiber can carry multiple “channels” or wavelengths (See DWDM in the glossary). Individual channels on a strand that EBS does not wish to use can be sold (as an analogy to selling a single strand in a bundle of fibers). EBS has the opportunity to redefine the role of wavelengths of light by using optical technology that allows the provisioning of wavelengths of light to occur in a very flexible manner. This is a key to the long-term scalability of the network bandwidth and will require some sort of optical switching in the future to allow the wavelengths of light to be allocated for use in an occasional manner routinely. Pooling Points at the optical layer seems inevitable and EBS can lead the charge in this arena. The use of local loop fiber to extend Metropolitan reach to other sites is also inevitable to keep to cost of interconnecting long haul fiber in cities.

Time Division Multiplexing (TDM) Services

EBS is creating inventory of circuits over the fiber that is installed on one of the wavelengths of light. This inventory will be used for the pooling points as well as selling it on an individual circuit basis. This inventory will be expanded in an opportunistic manner as demand creates need for inventory.

PHYSICAL INTERMEDIATION

EBS is creating inventory of circuits over the fiber that is installed on one of the wavelengths of light. This inventory will be used for the pooling points as well as selling it on an individual circuit basis. Physical Intermediation occurs in 'pooling points', rooms that allow multiple companies to plug bandwidth connections into a common switch. The result is a point through which circuits may be connected via the Bandwidth Manager between different networks, effectively adding bandwidth capacity to any given network by expanding one's access to other networks. An entire trading industry arises from pooled bandwidth capacity; whereby, a company with excess bandwidth capacity along a certain route can sell its capacity to a company or companies that need(s) it via pooling points. While this activity occurs today, collecting the parties under one organization can eliminate the search costs associated with partners finding one another and shorten the time required to provision the connection. In short, physical intermediation enables a liquid market to develop for bandwidth. By using pooling points, EBS can take advantage of economies of scale by buying large blocks of bandwidth at volume discounts. Scale economies combined with the reduction in search costs creates an arbitrage opportunity: dicing those large blocks into smaller bandwidth and shorter time period chunks (See figure below) allows EBS to sell the pieces for more than the cost of the whole. The flexibility of the pooling points will continue to evolve: Time Division Multiplex (TDM) bandwidth will be traded first and ultimately Dense Wave Division Multiplexing (DWDM) will trade in this context.



Private Pooling Points

Private pooling points are EBS-controlled pooling points that allow it to be the sole intermediate. EBS will lease large blocks of bandwidth capacity at these points, and carve them into smaller (usually one-month) chunks to be sold/leased to other players. As technology evolves, QoS over

IP will become available, allowing Enron to realize more intermediation benefits and charge higher rates.

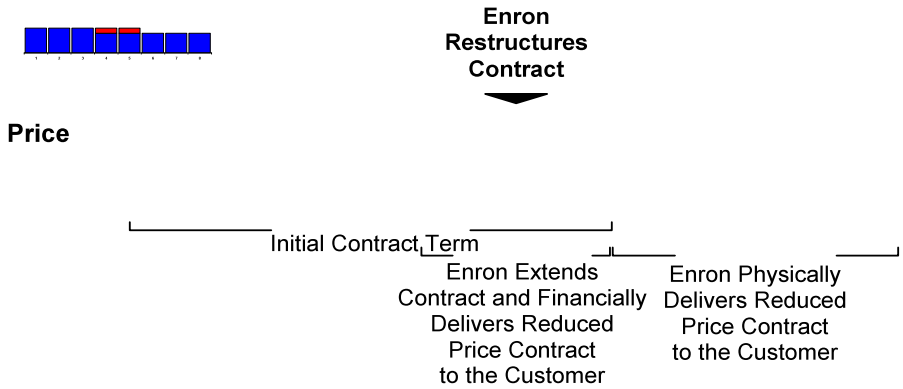
Public Pooling Points

Eventually, there will be non-Enron controlled, or public, pooling points of commodity bandwidth trading (a public, liquid market). This effort will be given a jump-start with New York, Los Angeles, and London public pooling points. Unlike the private pooling points, public pooling points will have a 3rd party (*e.g.* PriceWaterhouseCoopers) overseeing all transactions. As the liquid market develops via public pooling points, some private pooling points will become public, while, as technology permits, others will begin to have more flexibility in carving bandwidth capacity (*e.g.*, one-hour chunks vs. one-month chunks, or the ability to allow QoS over IP).

FINANCIAL INTERMEDIATION

The pooling points EBS establishes will allow for Financial Intermediation (*e.g.* Bandwidth Derivatives). These financial products are perfectly analogous to the products in which Enron Capital Trading deals. One service, "blend and extend", lets Enron alleviate high-cost contracts between two parties. Enron takes over the contract from the buyer and offers him another contract that lowers the annual payments, but which extends the contract an additional number of years (See figure below).

Sample Financial Intermediation Deal



CONTENT SERVICES

APPLICATION SUITE

The development of applications that run over BOS Networks are a strategic step in establishing the BOS as a standard platform for the delivery of streaming media. EBS is taking a unique approach by embedding application software into the network. EBS is not just selling capacity over a network as a traditional telecom provider might do. It is ultimately selling a platform that delivers broadband applications over BOS Networks. In order to establish the BOS as the industry standard, the burden lies with EBS to create initial applications to demonstrate the capabilities of its network and to attract customers to those applications in order to prove the BOS's capabilities and to establish it as a standard.

In response, EBS has developed an initial suite of Broadband Applications (ePowered Media Cast, ePowered Media Transport, and later ePowered ASP delivered Conferencing applications) that address fundamental needs for creating and distributing broadband content. As leading content developers recognize the importance of high QoS bandwidth to ensure that their content-in-context reaches end-users in a differentiated manner, they will discover that EBS's products address their needs. EBS's initial application suite addresses today's user needs. As market needs and technologies change in the rapidly developing broadband industry, the definitions and requirements for each product will change as well. The following are descriptions of EBS's **streaming media application suite**:

ePowered Media Cast

ePowered Media Cast provides Tiered QoS (*i.e.*, high video & audio quality at an error-free, high transfer rate) streamed media using the BOS as its delivery platform. ePowered content (*i.e.* content delivered via a BOS-enabled network) delivers stereophonic sound, large viewing windows, and can provide virtually error-free high bit-rate low latency steaming video ePowered Media Cast provides content providers and Webcasters a distribution platform for live, on-demand, and scheduled video to both commercial and consumer desktops, and it scales to exponential simultaneous user growth. ePowered Media Cast is uni- and multi-cast enabled. ePowered Media Cast clients reach end-users with more targeted content, and customers pay on a usage basis. EBS will establish the benchmark for streaming media services that will enable the New Medium. This offering will change the expectations on what people will consider the baseline for an online experience in the future.

ePowered Media Transport

ePowered Media Transport is a Web-enabled application that facilitates the global delivery of broadcast quality video signals using ePowered networks. ePowered Media Transport offers flexible, affordable broadcast TV transport by allowing the user to select video quality and delivery times that fit their needs and budget. ePowered Media Transport provides an alternative to satellite and land-based networks. ePowered Media Transport is available as an occasional or dedicated service. ePowered Media Transport is priced on a usage basis. This service can also feed the content origination of Media Cast services so it is part of a continuum of steaming services.

ePowered ASP provided Conferencing

ENRON BROADBAND SERVICES STRATEGIC VISION

ePowered Conferencing will be delivered via an ASP that wants to be in the conferencing space. There may be more than one entity in the conferencing space that would conferencing services. This capability may also be applied to other Application Service Providers (ASPs) that want Web-based video conferencing and collaboration capabilities. ASP end-users can access videos via Web portals and participate in virtual meetings without special training, hardware, or software. ASP that are ePowered in the Conferencing space will standard Web tools, and have a single Web interface, thereby increasing its ease-of-use versus today's competing specialized (and expensive) videoconferencing products. ePowered Conferencing replaces current market offerings by providing a hassle-free conferencing experience. This application will integrate videoconferencing with data-rich streaming media. ePowered Conferencing will have a usage-based pricing model

ePowered Conferencing should proliferate as e-commerce websites incorporate more advance customer service technologies due to embedded conferencing and collaboration functionality in customer relationship management software and processes.

Future Applications

Future application development by EBS is dependent upon what functionality evolve into mission-critical applications for broadband content providers. This application suite should only consist of products that provide core functionality that can be leveraged across multiple verticals. Ancillary applications should be developed by third-party ASPs. EBS's current application suite should be viewed as a dynamic asset base. If customer demands wane from today's products' functionality, EBS should have the organizational flexibility to alter current products or offer replacement applications that fulfill core customer needs.

BROADBAND OPERATING SYSTEM – APPLICATION PROGRAMMER INTERFACE (BOS-API)

The BOS and the BOS's Application Programming Interface (BOS-API) represent the mechanism by which broadband services interact with physical infrastructures. The difference between EBS and other network providers is that EBS provides network intelligence (*i.e.*, InterAgent™) and the means to tap into that intelligence (*i.e.*, the BOS and the BOS-API). By creating an Application Platform, EBS creates a standard API that application developers can depend upon and other network providers can use. By opening up the BOS and the BOS-API to ASPs and networks, EBS encourages the rapid adoption of the BOS and the BOS-API as industry standards upon which broadband networks and applications can be developed by being ePowered. EBS has the potential to create significant demand pull for ePower networks and applications by branding ePower in the marketplace before competition increases (See Marketing section for further detail). As EBS's business evolves, the platform will become a revenue and market share source that will reduce if not eliminate EBS's reliance on building, maintaining, and monitoring its own physical network. Capital expenditures associated with a physical networks will ultimately not be at the core of a competitive advantage, thus Enron Corp.'s goal of increasing ROIC via intellectual based assets will be met (See Evolution below).

The BOS-API platform allows third-party developers to write additional applications to add more user- or task-specific functionality. Most of the functions described in the Broadband Operating System section will be available as function calls within an Open API. This will allow third-party application developers to easily harness the BOS's abilities when creating applications. This will make the BOS more attractive to developers, which will allow for more application development,

which will make the BOS a standard platform. Specifically, this will allow enterprises to wrap the BOS around their networks, which will give them full control over QoS within the enterprise.

Relationships with companies such as Sun or Microsoft will allow the EIN to enable their operating systems to become network based operating systems, not stand alone operating systems. These companies will work with edge device manufactures to get their operating systems embedded into consumer and business devices which will communicate with the EIN using the BOS API. The Sun relationship proves that computer operating system companies like Sun are looking to have their operating systems embedded in a public network service provider like Enron, since EBS can ePower their operating system and make it available for developers on a global basis. As more partnering occurs, the BOS will become ever simpler to use (as Sun incorporates its heart into Java) and even more of a standard platform (as EBS partners with Microsoft to utilize directory services technology).

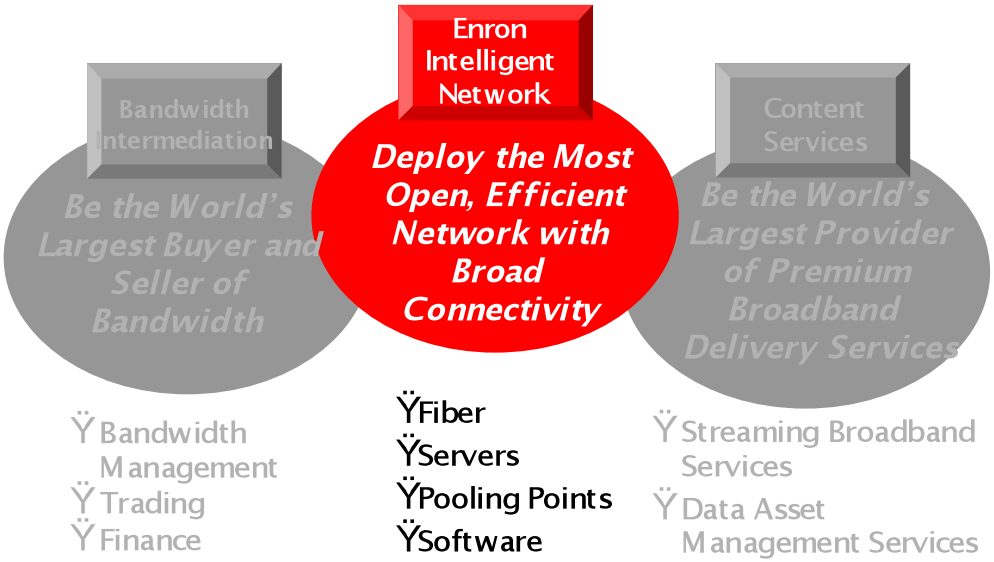
ENRON BROADBAND SERVICES STRATEGIC VISION

BUSINESS CASE: How will EBS be profitable?

COMBINED LAYERS

Each of the product and technology layers described in Products and Services can provide EBS with enormous revenue opportunities. More importantly, they can also work together to deliver an end-to-end solution for a higher-quality, data-delivery experience.

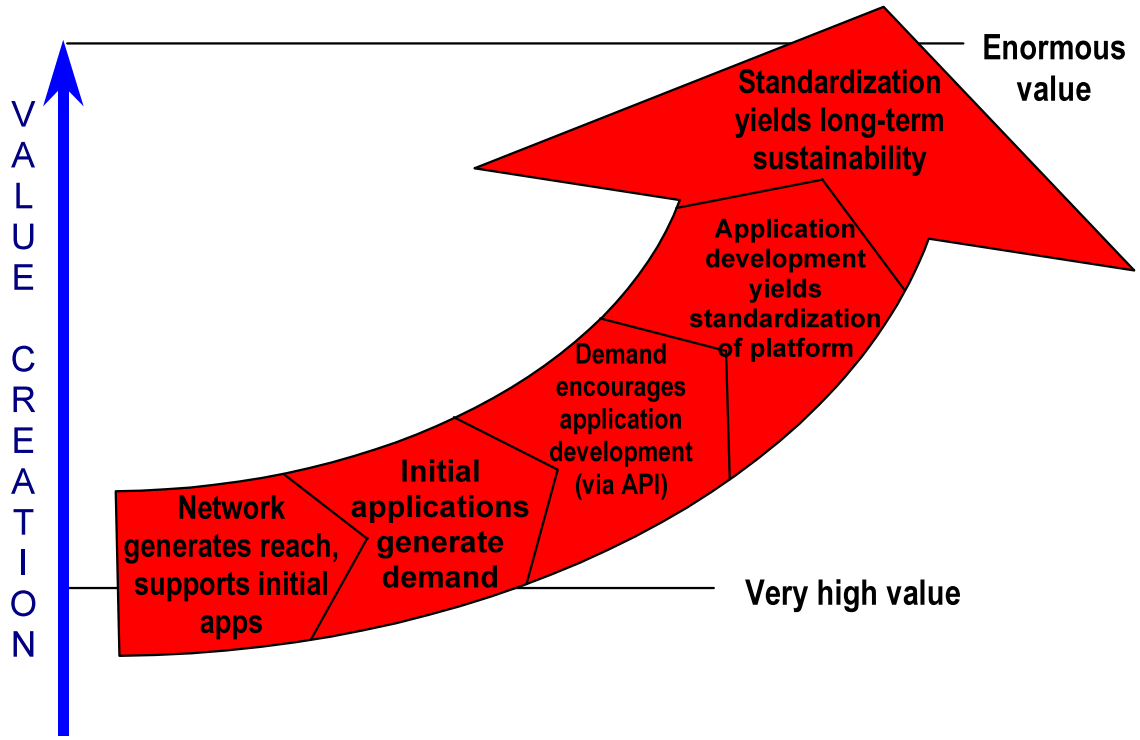
Enron Broadband Services



Bandwidth Intermediation will provide a rich initial revenue source for EBS as the bandwidth capacity market begins and moves toward a more traditional commodities market structure. It also will provide a constant source of high-quality bandwidth for the EIN (Enron's BOS Network) so that ePowered applications via the BOS can be proven in the marketplace.

Content Services' application suite (i.e. Streaming Media applications like ePowered Media Cast, ePowered Media Transport, ePowered ASP provided Conferencing, and/or future EBS applications) will serve as vehicles to build demand for high QoS broadband capacity. The suite will also provide EBS with revenue sources from either traffic fees, revenue-sharing, or both. Furthermore, the application suite's high QoS performance via the EIN will create demand for further broadband applications. EBS will then develop further core applications and license the BOS API to ASPs creating further revenue streams. The proliferation of BOS-API based applications will establish the BOS as an industry delivery standard; thereby, creating the basis for a long-term business.

EBS Earning Power Potential



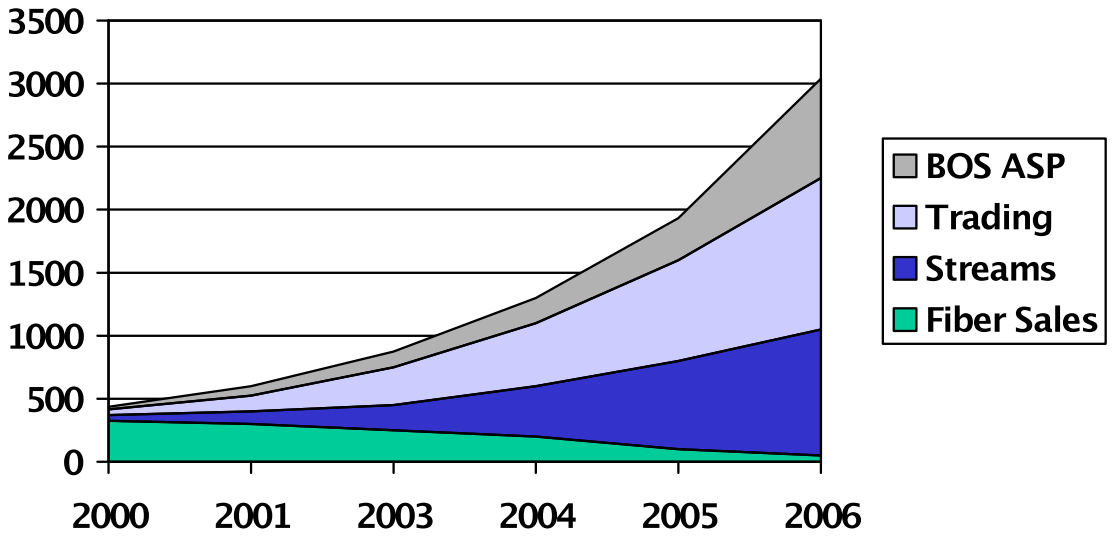
The earning power of EBS's structure is enormous (See diagram above). The revenue potential from the network alone provides enormous short-term value, with significant, long-term value realized through commodities trading. When the potential value of the initial application suite is added, the upside is lucrative. Furthermore, adding the enormous value provided by the proliferation of such applications and the standard platform they are based upon, makes a more than compelling argument for developing an organization to create this value for itself and to distribute value to the world: ePower it.

The ePowered suite of applications are supported by the EIN. To make the initial move into Very High Value requires that the applications (especially ePowered Media Cast) work at the IP layer, with tiered QoS and directory services. As the industry recognizes the possibility of ePower (provided by the EIN), the EIN's power (provided by BOS) will be viewed as more and more essential. As they support each other, both BOS and the applications gain importance in the broadband-enabled world. Once the self-perpetuating cycle begins, the climb up the arrow to Enormous Value begins. As vertical markets realize the value of the BOS through the horizontal application suite, they will begin to work with EBS to develop more industry-specific applications. The sales process moves from a model that asks "Can you use ePower?" to a model that asks "How can you use ePower better?" As the new ePower industry opens up, third-party application developers will hope to tap into the earning power of the EIN and other BOS-enabled networks.

The Conceptual Revenue from the combination of the different services is as follows:
The revenues created from Dark Fiber and AFTS services will diminish over time as the fiber inventory is sold out and minimal new fiber is built by EBS. The streaming services will create some revenues in 2000 and continue to grow over the next 6 years to become significant. The Trading revenues will consist of Bandwidth Intermediation Service both financial and physical as well as revenue generated from the sale of bandwidth in a liquid market. The mix of these

revenues will evolve as market conditions change. The BOS API will create revenues for applications riding on the EIN by allowing any ASP to plug into the EIN once and reach a global audience of customers who will use the ASP that is ePowered. This will include eCommerce applications that will reach their target audience via the EIN. This chart does not show any revenues from the licensing of the BOS to run on other networks.

The Conceptual Revenue from the combination of the different services is as follows:



BUSINESS EVOLUTION

EBS's stated goal is "to be **the** broadband platform". In order to become the ubiquitous broadband operating system, EBS has adopted a three-step approach. The first step is to create a physical presence and a stable operating infrastructure by building and running the most advanced scalable network with global reach (*i.e.*, the EIN). The second step is to create market liquidity by becoming the largest buyer and seller of bandwidth in the world (*i.e.*, Bandwidth Intermediation). The third step is to provide value-added services (*i.e.* ePowered Media Cast, ePowered Media Transport, and ePowered ASP delivered Conferencing and other applications) and a network platform (*i.e.* BOS) to lead the market in delivery of broadband content and application services. By not only creating a broadband infrastructure, but also creating market liquidity and value-add applications and an intelligent operating system, EBS builds the basis for an application development platform (*i.e.* BOS-API) that will drive a majority of broadband applications to EBS's BOS. In effect, with this strategy, EBS creates an intelligent network environment upon which ePowered applications can perform with Tiered QoS. With high QoS broadband dependent upon ePower, EBS establishes itself as the industry standard for end-to-end broadband end-user experiences.

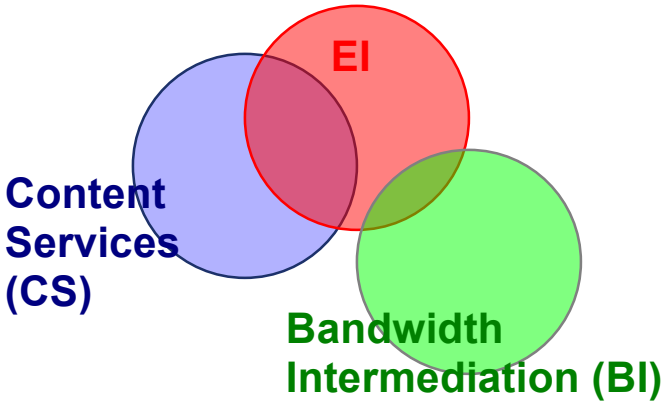
The definition of EBS will – and must – continue to change, transform, and evolve over time. The future can never precisely be predicted; therefore, EBS's strategy must remain flexible to adapt to changing market forces. Due to the dynamics of the market in which EBS operates, it cannot think that what is competitive today will carry it through to the future. In addition, EBS cannot afford to wait until its goal -- the end product -- is technologically achievable before it begins to

develop and sell products. EBS can, however, establish a technically feasible path that pursues the direction it must go, with the flexibility to change when it is needed.

The following diagrams visually represent how EBS's strategy is defined today, and how it is expected to evolve. Each component of EBS's strategy is represented, with the size of each component's circle defining the strategic importance it plays as time goes by.

Today (Winter 2000):

EIN: Physical + Software



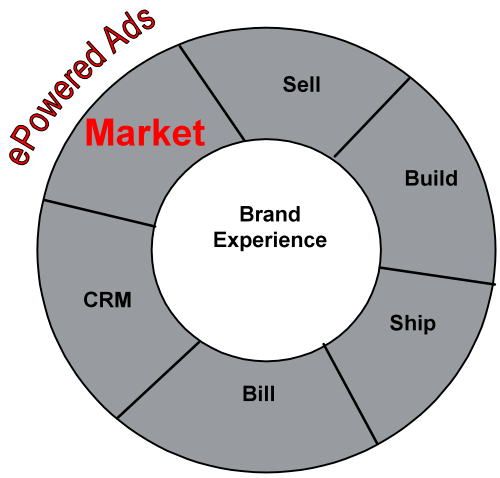
The EIN is composed of a rudimentary BOS, riding on servers and routers, connected to switches, which link fiber. The EIN is at the heart of EBS's offerings today. This infrastructure allows EBS to pursue Bandwidth Intermediation (Fiber Sales, Physical Intermediation, and Financial Intermediation as described previously) and Content Services (ePowered Media Cast, ePowered Media Transport, and ePowered Conferencing). These three circles represent EBS's entry strategy into the position of e-commerce enabler.

Marketing Entry Point

Enron's initial goal is to gain entry into the e-commerce marketspace by increasing the effectiveness of traditional marketing and advertising functions with a New Medium – ePowered applications that deliver high QoS rich media (See Entry Point diagram below). One can say that if the Internet resembles an interactive newspaper or magazine (with respect to its power as a marketing tool), the New Medium resembles, in an analogous way, an interactive television, with all the marketing power such a tool would provide. ePowered applications will enable marketing and advertising to deliver rich media content with high QoS, so that message recipients receive consistent delivery and low latency. This strategy allows new businesses to achieve broad customer reach with a richer marketing tool than the Internet allows, but without incurring the expense of building a private broadband network.

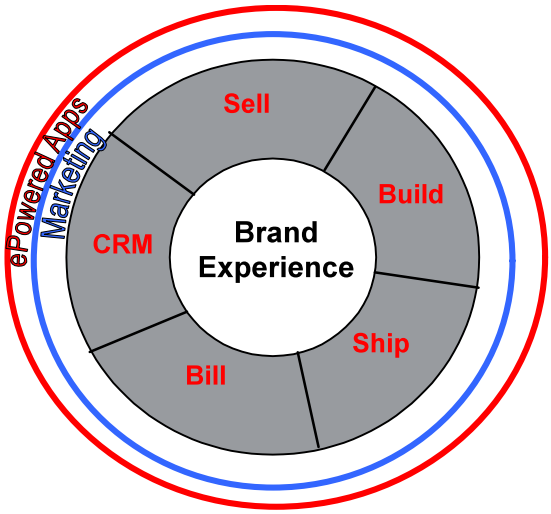
ENRON BROADBAND SERVICES STRATEGIC VISION

EBS's e-Commerce Entry Point -- ePowered Enterprise Marketing

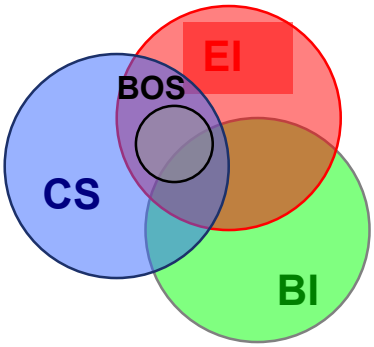


Marketing and advertising is the first entry point for EBS into e-commerce. However, ePower has the potential to broadband enable all company functions (See Fully ePowered Enterprise in figure below). With a fully ePowered e-commerce company, an enterprise's consumers can interact with the business along any point in the vendor's value chain. For example, customers not only will receive ePowered marketing and advertising messages, but can also interact via the New Medium with distributors and customer response functions (*e.g.* ePowered Conferencing with Amazon.com's customer care). Fully broadband enabled e-commerce firms can market themselves via rich media along any point in their business process (Note the presence of marketing throughout the entire organization in the diagram.), rather than through today's traditional marketing function that uses TV, radio, and print media. Firms can use rich media to convey marketing messages consistent with their brand identity at any phase of a user's experience with a firm (*e.g.* sales, shipping, or billing). Marketing becomes interactive with an ePowered vendor. Customer experiences are stronger because the entire value chain is not only responsive, but also relevant to their needs.

Fully ePowered Enterprise



NEAR-TERM (1 YEAR FROM NOW)



In the near-term, the BOS become more fully developed. Fully-tiered QoS is available. With that, ePowered Media Cast and ePowered Transport can prove the EIN and BOS are truly ePowered and worth paying a premium. The BOS-API will be released and a certain set of capabilities will exist that ASPs can use to develop Tiered QoS service offerings on the EIN.

EIN: Commodities + Services

At this point, the network will be partially sold, traded, or leased to other interested parties to the point it is economical to divest of assets. Recognizing that Enron Corp. has issued a directive to increase ROIC, the capital-intensive aspects of the network may begin to be divested, under the assumption that the control that Enron has via the BOS be retained. More development work will continue on broadband applications, refining them and bringing them to market, as well as developing new ones. As the BOS is further refined, third-party developers can be given the BOS-API to start their own development of broadband applications. It is at this time that the pricing decisions are made regarding the BOS: will it be licensed, sold, leased, or something else? The business model will be market driven and could range from revenue sharing of e-Commerce revenue from sales of goods, to price per megabyte delivered, to price per hour of usage.

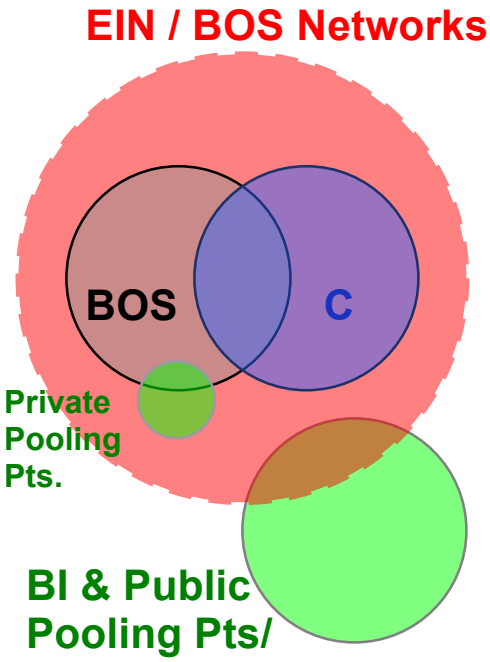
Fully tiered QoS will begin to appear. As more broadband uses are made available to the market, EBS's services and the strength of BOS as a scheduling (QoS4) mechanism will begin to be demanded by the ASPs who want to reach a target audience. The reach of the EIN will make it possible for the ASP to go to market and gain access to their customer base fast with the QoS their customer is willing to pay for or they will be willing to pay for.

Core Business Functions

Enabling the entire business cycle, not just marketing, will begin to be a priority for customers. As this happens, the ability to host applications, not only stream video, will gain importance. The power of the EIN will be most appreciated by the business community first, as its power to almost instantaneously transport mission-critical files becomes known. Burgeoning virtual businesses that do not have the resources or desire to build a private network will see EBS as an advantage.

ENRON BROADBAND SERVICES STRATEGIC VISION

LONG-TERM (TIMEFRAME UNCERTAIN)



By this time, the BOS should begin to be established as an industry standard. The EIN may no longer be the only network that uses BOS as a QoS control. BOS Networks begin to establish. Third-party application developers use the BOS API to bring their own broadband products to market on the EIN or on other networks.

BOS: Applications + Standardization

The physical network may be fully divested at this point (to the extent possible while still maintaining service). EBS could introduce a "bandwidth academy", a forum for developers to learn how to utilize the functionality of BOS. This may evolve from a tutorial forum at first, to a broadband venture fund. Just as Intel has set aside enormous capital to fund new ventures – which would, of course, help maintain Intel's chips as the de facto industry standard – EBS could do the same to help fund third-party developers of BOS-based broadband applications. As high QoS broadband capacity becomes essential, having the first-to-market applications based on a single technology would help establish EBS as a firmly entrenched long-term player in this enormous industry (See Size of Opportunity).

Commodities Trading

As EBS continues to move along the spectrum towards an intellectual capital firm (*i.e.*, software, more specifically, BOS), bandwidth trading and intermediation will begin to divide the firm's focus. To avoid a strategic schism, Enron should move the trading services away from EBS and towards a division that has trading as its core skillset (i.e. moving bandwidth trading to ECT). The EIN or other BOS networks will still have the ability to self-provision bandwidth, but the financial functions (derivatives, trading) would be moved to a group whose expertise is trading.

Enabler of Tomorrow's Networked World

As hundreds, or even thousands, of software and hardware developers develop broadband applications, users will demand high QoS broadband. Not only large businesses, small offices, and home offices will demand it, but households will begin to as well. Networks will become so prevalent, even the smallest file transfers may need to be prioritized. As households begin to have their own networks, the software may need to be installed to allow a medical device to have higher priority than a refrigerator's "empty milk" message. Families will be willing to pay their cable operator more for a high-priority Superbowl digital television stream than for their children's lower bandwidth Saturday morning cartoons. In the networked world, there will be a high QoS network controller. The advantage will go to the first mover – the one who can have the most applications and application developers using his system. It is the belief of EBS that BOS will be that system and that EBS will be the first mover.

SALES STRATEGY

At present, EBS is largely pursuing a direct sales strategy. This is important in order to ePower the entire value chain as previously discussed. It will ultimately be important to pursue a mix of direct and indirect sales channels to leverage EBS's relationships with businesses at different levels of the value chain to their greatest advantage.

Strategic Alliances

The ePowered broadband services platform creates a tremendous opportunity for EBS to structure relationships with hardware and software vendors who wish to have ePower built into their technology. The potential universe of ePowered services that can be created to bring a broad range of benefits to customers is vast. For example, Cisco, Sun, Intel, and Real Networks are examples of the caliber of company that is working with EBS. In addition, Compaq, Novell, Dell and many software companies could become partners with EBS if EBS determines it is in its interest to make deals with them.

Channel Programs

The development of channel programs is paramount to EBS's success and critical to its speed to market. At minimum, EBS's channel program strategy should be a set of turnkey marketing tools that ISPs or content companies can use to market their ePowered services. Beyond this, opportunities to create synergy among EBS's clients need to be explored (e.g. linking content providers with ISPs)

Strategic Sales

Sales efforts both direct and indirect should be as strategically targeted as possible. This includes focusing on relationships that will bring the greatest strategic value to EBS, such as:

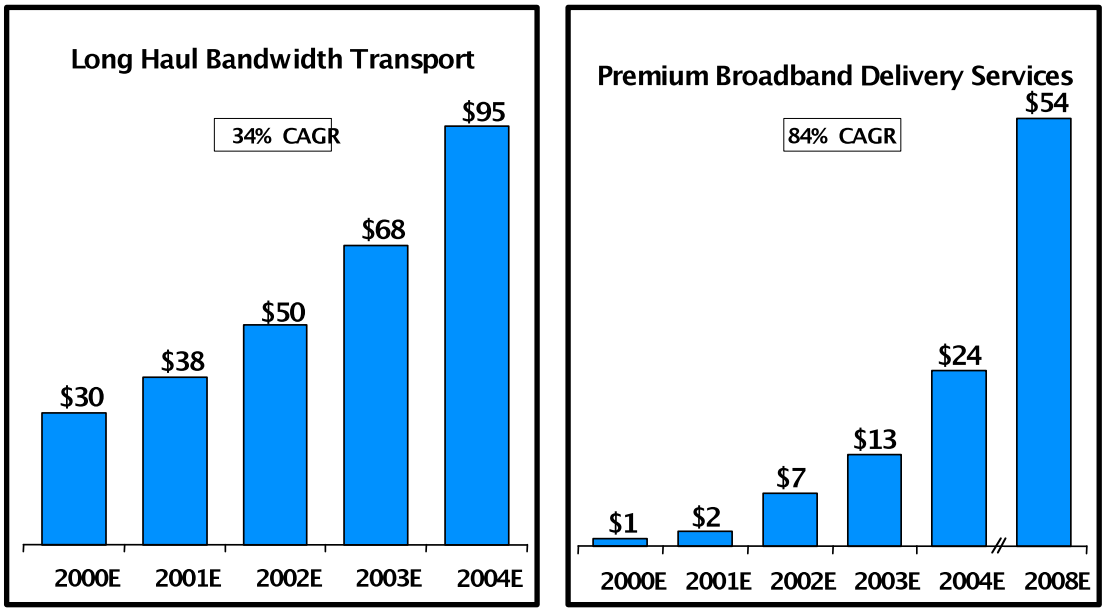
- Those with "marquis" companies that create credibility and buzz around EBS
- Those with applications that will showcase EBS's technology
- Those with companies that will agree to participate in the marketing and education process of end-users
- Those with potential to be become killer applications that will quickly drive the BOS's market penetration

MARKET ANALYSIS: Who are EBS's customers?

DEMAND DRIVERS

EBS will be going after the raw bandwidth market using Bandwidth Intermediation at the same time that it is enabling the New Medium which will drive the consumption of Broadband services. EBS intends to be a major player in both of these arena's which will position EBS as the leader in delivering broadband services.

Market Opportunity - U.S.
(Revenues in Billions)



Source: Dataquest; J.P. Morgan; Lehman Brothers; Morgan Stanley Dean Witter; Enron Analysis

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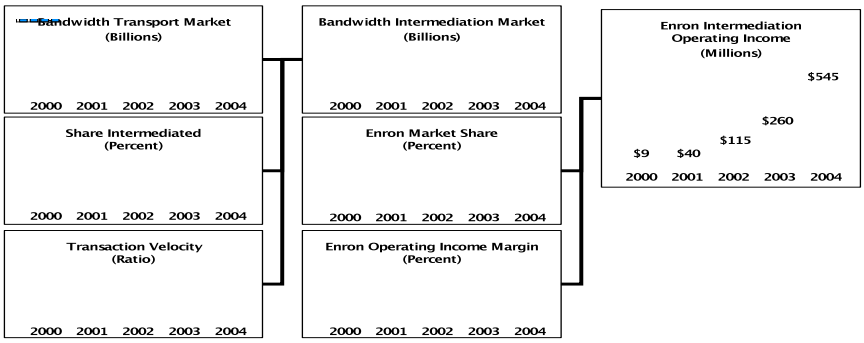
Bandwidth Intermediation is a very large opportunity to create revenues and profits for EBS while it allows the EIN to have the lowest cost bandwidth available at all times.

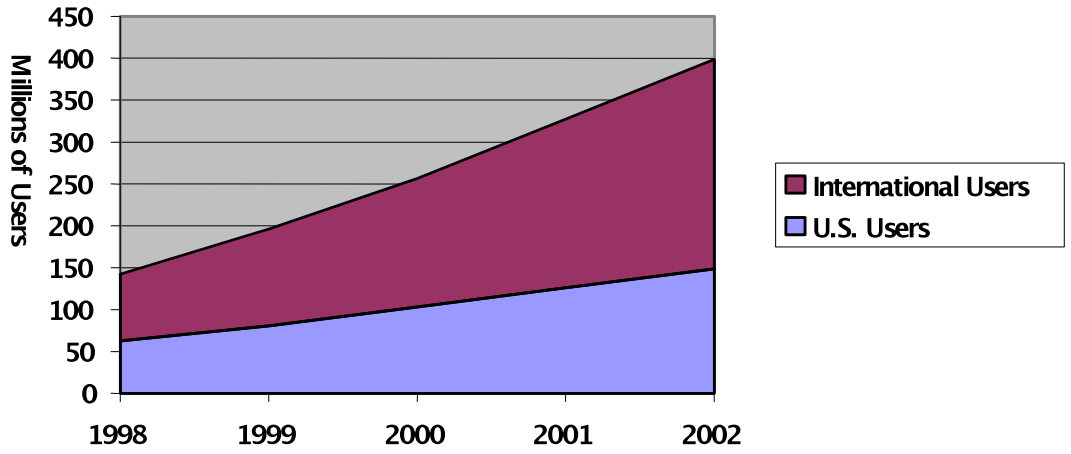
Bandwidth Intermediation Opportunity
(U.S. Only)



Source: Dataquest; Lehman Brothers; Enron Analysis

Evidence is mounting that the Internet is rapidly becoming a mainstream medium in the United States, as well as globally. Today, the U.S. is the largest and leading marketplace in the global digital economy with the greatest proportion of on-line users: 24% of all households (approx. 25 million) and 24% of the white-collar business base (approx. 24 million). Growth over the next few years is projected to continue at a rate of 24% per annum (See figure below) in the United States and 33% internationally.

Projected Growth in World-Wide On-Line Users



- It is projected that by 2003, 65% of all U.S. workers and 50% of all U.S. households should be on-line
- Globally, 4% of households are on-line today with penetration projected to grow to 11% by 2003, for a total of 500 million end-users worldwide
- Internet traffic is doubling every 100 days

EBS is focused on the fastest growing part of the market which is the Broadband Services market.

E-commerce is growing at a phenomenal pace as well, again with the U.S. as the leading market. Average on-line household shopping in the U.S. is projected to double between 1999 and 2003[3]. Business-to-business e-commerce is also expected to have tremendous growth, although projections vary widely (see figure below). In Europe, e-commerce development is expected to be slower due to language constraints, lower PC penetration, and usage-based pricing for local calls.

U.S. e-Commerce Forecasts

$Billions	1999	2003	Source
Business-to-Business	$109-$139	$540-1500	Forrester, Goldman Sachs, Yankee
Business-to-Consumer	$20	$144	Forrester

The growing demand among consumers to surf and transact on-line is driving more and more companies leverage the Internet to complement their existing business channels. This phenomena is fueling website growth. Firms are recognizing the benefits of using the Web to

[3] Forrester Research

conduct business: higher productivity, lower costs, better customer satisfaction, and new business opportunities. Today only 10% of U.S. businesses (mostly large companies) have active websites; however, it is expected that by 2004 more than 60% of all companies in the U.S. will utilize Web technology (See figure below). It is expected that since the U.S. is the world leader in Internet technology, other leading developed regions (e.g. European and Asian markets) will eventually follow the U.S.'s adoption patterns.

U.S. e-Commerce Firms

Business Size	Today	By 2004
Large	90%	98%
Medium	50%	95%
Small	10%	70%

Most of the growth in business websites will be driven by small and medium sized enterprises (SMEs) which are not as well represented on-line today as large businesses. SMEs are a lucrative market; they account for 99% of all U.S. businesses.

While demand for Internet services continues to grow, EBS and others believe that Internet users want more relevant user experiences from the Internet. Human beings are inherently visual and prefer full active communication (e.g. motion video and audio to static, text-based information).

Some observations that support this thesis follow:

- The effectiveness of broadband rich media advertising versus dial-up or narrowband advertising proves that broadband content improves brand recall.[4] This is due to the fact that people engage with broadband media for longer periods of time. It follows that recall on broadband ads was 34% higher than narrowband
- Consumers are adopting new digital technologies faster than ever before

These demand drivers indicate a tremendous opportunity for companies such as EBS that can provide the critical applications and infrastructure enabling companies to participate more fully in the digital economy and allowing end-users to enjoy Internet information in the way they most enjoy receiving it: rich media.

SUPPLY DYNAMICS

To fully enjoy the benefits of rich media applications, end-users must have an end-to-end broadband connection. The growth of broadband services is constrained today by lack of ubiquitous broadband connectivity to the home. Once these bottlenecks are removed for Broadband applications the EIN/BOS infrastructure can enable other applications that need low latency, high throughput. These will be driven by Applications Service Provider partners and strategic partners like Sun MicroSystems and their developer channels. These relationships with developers will likely enable:

- ***Next Generation Financial Applications:*** Connectivity is changing the way financial markets work. These markets have the highest level of security and reliability needs. Current applications require expensive private lines since security and reliability needs are not met with other alternatives. The EIN offers the potential to inexpensively connect

[4] @Home Network

trading and transaction processing systems, drastically reducing the cost of connecting to global markets.

- ***Click-to-Talk:*** As call centers move from telephony to online services, the ability for networks to dynamically route mixed format communications in a synchronized manner is growing. The EIN is well positioned to handle distinct types of information, such as voice/video, transactions, or custom web pages in a managed way.

- ***Interactive Online Gaming:*** As online gaming takes advantage of Internet, a new breed of game is emerging. Sony has begun to build modems into all their Playstation products. Intelligent, fast connections are what enable interactive multiplayer games. Possibilities include adding audio streaming of voice messages from player to player, adding music streaming from Sony's music business, enabling friends to find each other, and forming virtual teams. All of these applications can benefit from network connections to be intelligently managed with high performance bandwidth.

- ***Interactive Remote Education/Medical Care:*** The possibilities for cost-effective video conferencing over IP to enable new education and medical applications are large and far-reaching. The quality and effectiveness of videoconferencing can be greater enhanced over traditional teleconference or Internet collaboration.

- ***Software distribution for publishers:*** As commerce moves online, a natural transition to online software publishing is emerging. Ideally, software companies would like to automatically publish and distribute upgrades of software directly to their customers. However, software upgrades require 1.) Intelligence about the devices being installed to; 2.) High bandwidth as large programs can take time to transfer; and 3.) Reliable connectivity to avoid "half-completed" activities. Currently, automatic updating of software is performed only over private, secure networks and in business-to-business applications. EIN features make it possible for dynamic software to perform these types of operations in an IP environment. Once enabled, the possibilities for reducing software distribution costs and enhancing advanced services are endless.

- ***Emerging online markets:*** As the advantages of business connectivity are realized, market makers are leveraging the aggregate power of formerly fragmented businesses. The ability to dynamically align the inventory and services of many separate entities is a value that enables the creation of virtual market places. These emerging applications require connectivity and a high degree of bandwidth, as the pictures, call centers, and related transaction information are moved from one entity to another based on a standardized set of interfaces.

- ***Virtual private network for retailer:*** A national retailer represents another example of how the EIN can add value to an application. Imagine a retailer who decides to use EBS's network to link their retail POS systems with their back-office transaction processing systems (managing pricing, inventory, etc.). Each transaction is "written" to the BOS API, with security and message delivery information attached. The EIN takes each packet of information and assures it is delivered in the most efficient way, routing the data based on published interests. Such a solution would be a very cost-effective "private network," offering reach to the distributed locations of the retailer.

- ***Messaging as an integrating technology for decision support systems (DSS):*** Interesting possibilities for intelligent applications emerge if EBS makes its message oriented middleware (InterAgent) capabilities available to applications. These tools, which are central to our network, enable integration of applications in a new and dynamic way.

For example, assume a national retailer publishes their transactions to our network as a way of connecting their many stores. The EIN can easily be configured to route these messages dynamically to any other process with the right security and interest patterns. Possibilities include routing the information directly to a data warehouse; dynamically updating a supplier's replenishing system; or even updating executive information system running on a desktop over the Internet. Each transaction has message delivery information attached and the EIN is already assuring that it is delivered in the most efficient way, routing the data based on published interests. InterAgent routing agents can feed a real-time aggregation process that provides summary data to a "dashboard" in real-time. A data warehouse can be automatically updated as each sale hits the register. A store buyer can view sales figures in real-time during a promotion. An executive desktop can have a dashboard reflecting real-time store-by-store sales totals. Such linkages, enabled by the EIN, can form the backbone for integrating multi-company supply chain information.

Today, the business market is more widely wired with broadband connections than the consumer market; however, the bottlenecks in the residential local loop are quickly being removed with the rollout of xDSL and cable modem technologies (See figure below).

U.S. Broadband Last Mile Connectivity

	Today	2004
Residential Market	Extremely small	Approx. 30MM
Business Market	Approx. 12MM	Approx. 48MM

In the United States, growth in broadband connectivity in the residential market will be enabled by the rapid rollout of DSL by ILECs and CLECs and of cable modem rollout (DOCSIS) by cable companies. Cable companies have been in the lead in their rollout for the past couple of years, but most analysts project DSL will overtake cable modem penetration.

Analysts vary in their opinions about which technology will ultimately be more successful, but their latest reports project each technology will reach a parity level of approximately 30% of household penetration by the year 2005 driven by the eventual price/benefit competitiveness between them.

In Europe and other parts of the world, some variations on the U.S. Internet model will occur. Some markets, particularly in Europe, are likely to see wireless solutions more quickly that the United States. For example, in Europe wireless is more advanced due to pan-European GSM and the use of smart cards; whereas, the U.S. has been slower to develop a national wireless market because it has extensive physical infrastructure in place. In the U.S., wireless is not as well positioned for Personal Communications Services (PCS) since users pay for each call made or received on their mobile telephone. Other markets have developed a "calling party pays" model, which has helped to drive penetration in the consumer market. In addition, cable penetration rates are generally not as high as satellite penetration rates in some countries, and DSL technology issues are highly country dependant. As a result, further work will be required to solidify market entry strategies into foreign markets.

CUSTOMER NEEDS

Wholesale customers

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The industry wisdom of all IXCs, Incumbent LECs, CLECs, DLECs, ISPs and long distance providers it to expand their network globally to own the customer directly in each market. The wholesale opportunities to provide circuits between the major markets and second tier markets is tremendous. The use of financial instruments to blend and extend contracts will make EBS a key player in the supply side of raw bandwidth sold to these companies. As the pooling points are deployed over time and EBS makes deals for major amounts of bandwidth EBS will be able to sell large amounts of circuit based bandwidth to these major carrier customers and use the pooling points to deliver on these contracts over time. This will not only drive expansion of the number of pooling points needed it will drive the ability for the EIN to expand to server more customers with all the services of EBS not just raw bandwidth services sold in a wholesale channel to carriers. EBS will focus on those customers that are willing to buy these types of services to make sure the initial customer needs are met.

Customer's Willingness to Sell Optionality

Customer's View on Bandwidth Prices	Willing	Less Willing	Not Willing
Bullish	Buy Zero Cost Collar - OR - Sell stream of Naked Puts	Buy Reverse *Enron Corridor* - OR - Sell Put Swaption *(Blend and Extend)*	Buy Swing Option
Neutral	Contract Monetization - OR - Sell Covered Calls	Buy Route Call Swaption	Cross-Commodity Swap
Bearish	Forward Sale -OR- Sell At-The-Money Calls	Buy *Enron Corridor* *(Bear Spread)*	Buy Capacity Put

Content Providers

Content providers will seek solutions that can differentiate their content with end-users. EBS's approach should resonate with them for this reason. The content providers that choose to create the New Medium and use the EIN to deliver it to their customer base will gain market share in their target audiences. As this occurs EBS will have many vertical market focused players approach EBS to become ePowered to reach that audience via the EIN and the edge partners connected to the EIN. This should have a snow ball effect and drive all New Media content to EBS.

Enterprises

Some enterprise clients may have considered building their own networks to avoid the quality and security concerns with Internet delivery, but were deterred by the cost of doing so. In this case, vendors that have technologies or products aimed at resolving the bottlenecks of the Internet are attractive to them. EBS's opportunity is to demonstrate how it can help resolve clients problems

more cost-effectively than building or leasing a private network and how its solutions are more viable today and in the long-term than solutions that are based on the Internet's flawed model.

Applications Service Providers

The basic needs of application developers include:

- Global bandwidth
- Scalable, secure infrastructure
- Guaranteed QoS
- Solutions that adapt to change rapidly and cost effectively
- Access to development/IT expertise

EBS will allow any ASP that wants to reach a global audience to plug into the EIN one time and have Tiered QoS available to create a differentiate product for their target customer base via the EIN and the ePowered distribution partners that have end user customers connected to them.

REVENUE OPPORTUNITIES

The market for EBS's Broadband Services is extremely large. Streaming will open a new distribution channel which will be able to reach audiences like never before. Applications will take advantage of streamed media include advertising, sales, broadcasting, videoconferencing, training, corporation information dissemination, education, newscasts, special events, and entertainment (e.g. Interactive TV).

Analysis provided by McKinsey estimates that the market for Internet services in the U.S., which is defined as including basic Internet access, premium broadband delivery, and Web/application hosting will grow at an annual compounded growth rate of 35% between 2000 and 2004 going from $35 billion to $117 billion. EBS is focused on the most explosive element of this market, premium broadband delivery services, which will account for $24 billion by 2004.

U.S. Market for Internet Services

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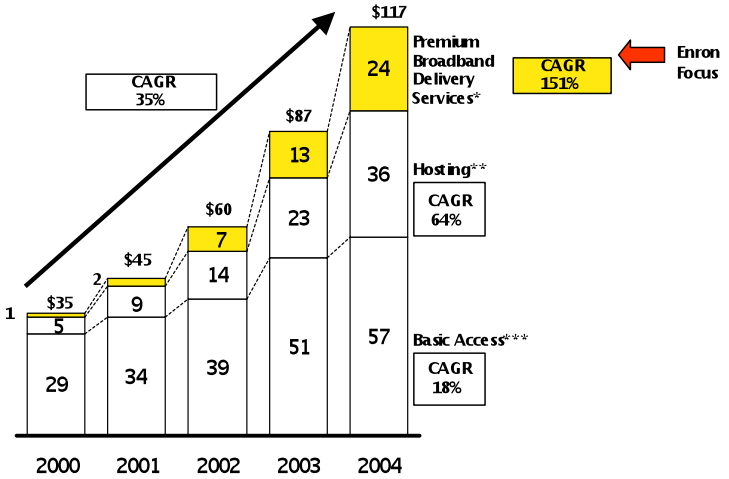
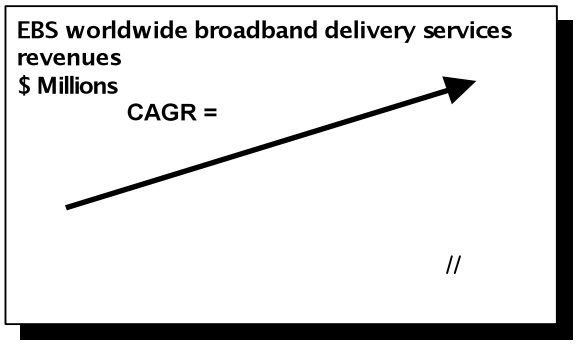


* Defined As Delivery of Primarily High Bandwidth Content and Applications Requiring Guaranteed/TieredQoS; J. P. Morgan Forecasts U.S. Market Size for "Intelligent Delivery Network Service" of $24.7 Billion in 2004; Morgan Stanley Dean Witter Projects a $44 Billion U.S. Market for "Intelligent Content and Application Distribution" in 2004

** Defined As Colocated and Shared/Dedicated Web Hosting and Application Hosting (Source: IDC; J.P. Morgan; Forrester; Morgan Stanley Dean Witter)

*** Defined As Business and Consumer Narrowband (Dial-up) and Broadband (Cable, DSL, T1/OC3/DS3, Internet Access, (Source: Morgan Stanley Dean Witter)

McKinsey estimates that EBS's share of the U.S. and global market will grow at an annual compounded growth rate of 96% starting from a base of $55 billion in 2000 and growing to $11.7 billion by 2008.

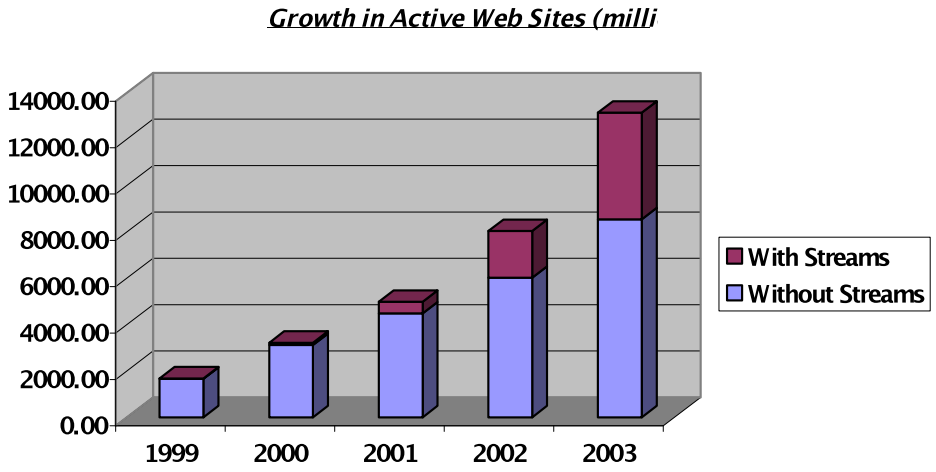


Several markets are logical targets upon which EBS can base revenue projections of Broadband Services. These markets are: 1) Streams hosting on websites; 2) Global voice traffic; 3) e-Commerce transactions and subscription services; 4) Worldwide advertising; and 5) Traditional hardware, software and integration services businesses. Below is market sizing for each of these markets and a rationale for how EBS can derive revenue from them. Separate work is being undertaken by McKinsey to develop overall market sizing for both Broadband Services and EBS market share forecasts.

Streaming on Web Sites

As broadband access enables streaming media, the use of rich media in websites will increase dramatically as firms try to differentiate themselves. The streaming market is growing in two ways. First, there is strong growth in the number of new websites. Secondly, only a small proportion of existing websites currently use streaming media, but that is expected to change. As

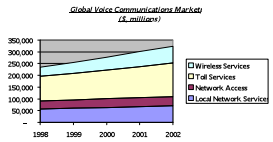
the demand for content-in-context grows, the use of streaming media by these websites should grow dramatically. For discussion purposes, the graph below represents website growth overlaid with EBS's forecast that the proportion of websites that incorporate streaming media will grow from 2% in 1999 to 25% in 2003, for a grand total of 4.6 billion websites incorporating streaming media over the next three years.



Source: IDC and Enron Communications Inc.

Global Voice Market

Once e-conferencing is widely available, EBS believes it will significantly change the way both business and residential users communicate. ePowered Conferencing will open to everyone with an e-conferencing enabled technology, not just those with traditional videoconferencing equipment. Businesspeople are likely to find many applications for e-conferencing. Consumers, given the mobility of today's family, will use e-conferencing to stay in touch and bridge the miles separating them. For this reason, e-conferencing will replace some of traditional voice telephony traffic.



Source: 1999 Multimedia Telecommunications Market Review and Forecast

e-Commerce

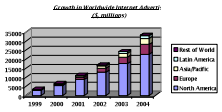
The e-commerce market is another revenue source from which EBS may be able to derive revenue, to the extent that EBS prices on the basis of transactions and not streams. The e-commerce market is large and extremely dynamic and EBS can insert itself into the value chain and revenue stream using the streaming media applications to gain access to the sites and the developers and then use the BOS-API story to get them to become fully ePowered applications.

Advertising Revenue

EBS believes that by opening the Web to rich media a New Medium will be created. And, as the Internet becomes more pervasive with the advent of broadband-enabled content, more advertising will shift from traditional print, radio and TV advertising to the New Medium. Today rich media advertising accounts for less than 1% of all on-line ads. Furthermore, the amount of advertising taking place on the Internet is miniscule compared to traditional advertising media; however, a significant opportunity exists in rich media advertising.

Worldwide Internet ad spending will reach $33 billion by 2004, 67% of which will be spent inside of the U.S[5]. Newspapers and direct mail are projected to each lose 18% of their revenues as advertisers shift to Web-based advertising. A shift to performance-based advertising (*i.e.* pay-per-click, pay-per-lead or pay-per-customer) is expected, meaning that portals will be in a position to demand a share of revenues generated for their marketing partners. In fact, performance-based spending is projected to make up to 50% of all on-line ads. EBS would expect to have revenue opportunities from the growth of on-line advertising either in the form of streams hosting or directly from ad revenue.

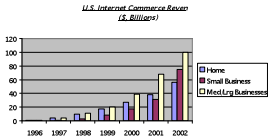
[5] Forrester Research

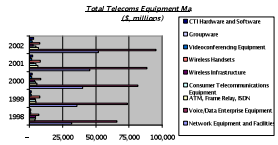


Source: Forrester Research, Inc.

Traditional Hardware, Software, and Integration Services Markets

Hosted applications will allow consumers and businesses to access applications when needed. By hosting an application, such as MS Office, on a network device, the enterprise does not need to own routers or servers. The premise is to drive the average cost of ownership down with shared infrastructure. This will create a market for leased applications whose revenues will be derived from what was formerly a capital expenditure.





Source: 1999 Multimedia Telecommunications Market Review & Forecast

Analysts project the growth of the Internet data services market will be phenomenal. Recently, the market was estimated to have revenues of $19.1 billion (1998). Further forecasts estimate demand will surge to $80.3 billion in 2004 and $156.6 billion by 2009.[6] ASPs will partake in this growth, and to the extent that EBS provides the underlying infrastructure for their applications, so too will EBS.

CUSTOMER TARGETING

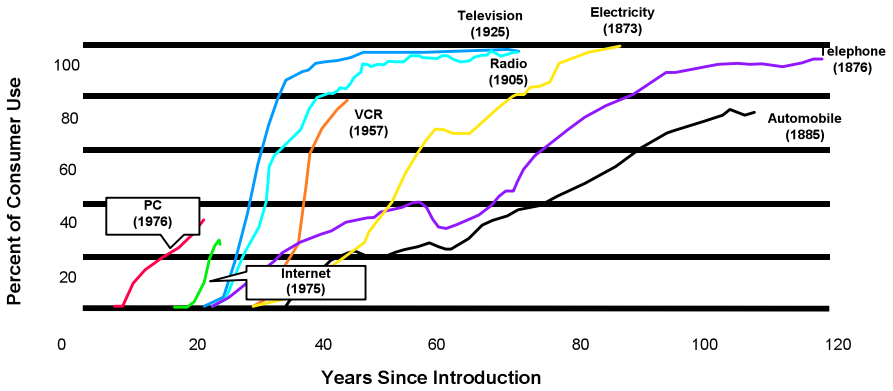
It is important to point out that EBS's approach is to design and enable end-to-end broadband solutions for the end-user, both residential and business, although EBS's direct customer will never be the end-user. While EBS should have brand recognition among them, it will not sell directly to them. EBS's customer will be firms that sell to an end-user or that have content that needs to be ePowered. EBS's target clients include content sources, ASPs, enterprises, and aggregators such as ISPs.

Initially EBS needs to focus on enabling applications that target the business end-user for two reasons: 1) Today there is better IP-based broadband connectivity to enterprises than to residential homes; and 2) Success in the business market will de facto create demand among consumers since the residential on-line audience today is still largely an affluent, white collar demographic. EBS's endgame is to reach out to the consumer market because it represents large opportunities for EBS; however, the business market is a more logical place to be aggressive. This does not mean the groundwork for serving consumers should be delayed, because it is important to position EBS to serve the consumer market as well as the business market in the long-term. Laying the groundwork includes: 1) Attracting key content providers for the consumer market; 2) Signing up the ISP market; and 3) Creating business relationships with DSL providers

[6] Morgan Stanley Dean Witter

and eventually cable companies in order to drive the penetration of their technologies in the local loop.

Consumer products – Penetration and Time



In the start-up phase of the business, EBS has selected vertical markets to target based upon the following criteria. They are industries or pockets within industries that:

- Are early adopters of technology
- Consume the highest value information -- market moving data
- Have executive decision support
- Involve highly technical individuals that need to impart knowledge to others
- Require access to information to successfully do their job
- Typically make money for the company
- Drive future directions of their company
- Are responsible for producing revenue results.

The result of initial analysis has been to target several verticals: Financial Services, Media and Entertainment, and Government. Target enterprises should also belong to the Fortune 500 and Global 2000. Specialized marketing strategies are being developed within each Vertical group. In addition to target vertical markets, EBS is also targeting companies that can enable us to accomplish global reach. These are primarily ISPs.

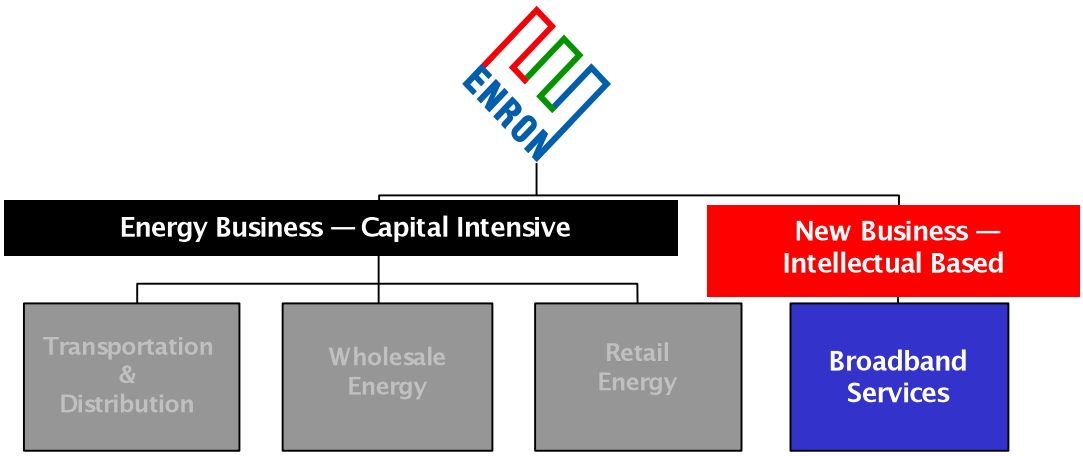
NEXT STEPS: When will EBS be successful?

RETURN ON INVESTED CAPITAL

Enron Corp. believes the Digital Economy is creating extraordinary opportunities for wealth creation. Liberalization of regulated markets, increasing capital mobility, and technology advances are creating enormous opportunities for companies that are not only intelligent, nimble and fleet enough to understand new market structures and economics, but also are able to shape the structures of these new industries as they form. With the opportunities the Digital Economy has created, Enron Corp. sees significant areas where it can exploit its competencies by shaping new industries to realize significant wealth creation for its stakeholders.

Enron Corp.'s strategy for the Digital Economy moves Enron from a capital intensive corporation (*e.g.* pipelines) to an intangible asset (*e.g.* intellectual property such as trading intellect, and brands) driven business (See diagram below). As such, Enron's peer group changes from traditional capital intensive firms (*e.g.* Exxon) to intangible based firms that have shaped industries (*e.g.* Microsoft, Coca-Cola). Inclusive in this change is a reevaluation of how Enron is valued in the marketplace, and by what metrics Enron's businesses should be measured. Historically, Enron's stock has traded at multiples of approximately 15-times. With its new peer group, Enron's comparable multiple changes to approximately 25-times. In order to realize this change in market capitalization, Enron has adopted return on invested capital (ROIC) as the key metric to measure incremental value creation driven by this capital light, intangible heavy business strategy that will increase Enron's share price.

Enron Corp's Capital Light, Intangible Heavy Approach



ROIC is the key metric by which Enron will measure its businesses. EBS is to create incremental ROIC growth by using its intellectual assets to generate significant revenue with little financial risk. The basis for Enron's intangible assets is and will continue to be Enron's intangible networks, brands, and the intellectual capital, talent and creativity of its employees. These intangibles are the differentiation source of Enron's products and services, the scale advantages at relatively low cost, and the world class capabilities in risk mitigation, market making, creative structured finance and infrastructure development. These intangibles have allowed Enron to

shape the structure of new industries and influence the paths of their evolution, and they are what will enable Enron to shape the broadband industry.

EBS will be the broadband industry shaper by executing the intangible heavy, capital light strategies described in this strategic plan. This strategy, includes:

- Developing intelligent routing software (e.g. BOS)
- Creating a global network via BOS Networks
- Extending proven Enron intellectual capital (e.g. intermediation) to new industries (e.g. Bandwidth Intermediation)
- Developing intellectual assets (e.g. ePowered Media Cast, ePowered Media Transport, ePowered Conferencing)
- Developing the leading open applications platform (e.g. BOS-API)
- Creating franchise and licensing rights to it (e.g. EIN, InterAgent, BOS, BOS-API, ePowered application suite)

The key notion to understand is that as each service offering is deployed by a content provider, content aggregator, ASP or eCommerce source using hosted applications in conjunction with streaming media the revenue per user increases, the revenue per service type increases and the sharing of the local loop infrastructure as well as the backbone and infrastructure allows each service to create incremental revenues and profits that make the total service offering an exceptional return on invested capital.

This is illustrated on the next page: