Geographically Distributed Facilities in the Creation of Global E-Business Hosting Services

by

Alvin Wang Graylin

Submitted to the Sloan School of Management and the Department of Electrical Engineering in partial fulfillment of the requirements for the degrees of Masters of Science in Management and Masters of Science in Electrical Engineering

In conjunction with the Leaders for Manufacturing Program at the Massachusetts Institute of Technology

June, 2000

Signature of Author

May 15, 2000
Sloan School of Management
Department of Electrical Engineering

Certified by

Erik Brynjolfsson
Professor of Management
Thesis Supervisor

David Gifford
Professor of Electrical Engineering
Thesis Supervisor

Accepted by

Arthur C. Smith
Chairman, Committee of Graduate Studies
Department of Electrical Engineering

Accepted by

Margaret Andrews
Executive Director, Masters Program
Sloan School of Management

Copyright © Massachusetts Institute of Technology, 2000. All rights reserved.
Abstract

GEOGRAPHICALLY DISTRIBUTED FACILITIES IN THE CREATION OF GLOBAL E-BUSINESS HOSTING SERVICES

by Alvin Graylin

Thesis Advisors: Professor Erik Brynjolfsson
MIT Sloan School
Professor David Gifford
Dept of Electrical Engineering/Computer Science

Intel is entering the online data services market and has planned to deploy numerous high capacity eBusiness hosting facilities on a global basis. Decisions relating to the location of these facilities used in serving eBusiness solutions are based on somewhat different factors than traditional manufacturing plants. With today's advanced communication systems, one may assume that eBusiness Service Providers (eBSP) can adequately serve the global market using a large centralized facility with very fast data connectivity to the global Internet. This analysis will show that this assumption is false.

In fact, there are numerous reasons, both technical and business related, that mandate distributed facility locations, at least in the near term. Since eBusiness hosting is very service-oriented, being close to the customers also provide numerous social and political advantages as well.

Currently, these facility location decisions are not always made using clear decision processes. The goals of this study is to understand the major factors contributing to the need for geographically distributed data hosting facilities, and provide a simple framework and a set of tools and processes that would help management make more objective decisions relating to the location and timing of such facilities.
This page intentionally left blank.
ACKNOWLEDGMENTS

The author would like to thank Karen Graylin, his wife, for all her support and understanding during the process of researching and creating this thesis.

Thanks also go to the faculty advisors, Dave and Erik, who provided their valuable insights and feedback on the ideas contained in this thesis.

The author’s managers and many colleagues at Intel Online Services also provided extensive support during the data gathering and research stage of this project.

And last but certainly not least, the author would like to gratefully acknowledge the support and resources made available to him through the MIT Leaders for Manufacturing program.

This whole project would not have been possible without all their support.
# Table of Contents

ACKNOWLEDGMENTS.................................................................................. III  
TABLE OF CONTENTS................................................................................ IV  
LIST OF FIGURES....................................................................................... V  
INTRODUCTION AND OVERVIEW................................................................. 1  
  BACKGROUND: ...................................................................................... 1  
  PROBLEM STATEMENT: .......................................................................... 2  
  APPROACH AND METHODOLOGY ......................................................... 3  
  PROJECT GOALS AND MEASUREMENTS ............................................... 4  
COMPANY OVERVIEW AND PROJECT SETTING........................................... 5  
  INTEL BACKGROUND ........................................................................... 5  
  IOS BACKGROUND AND ENVIRONMENT ................................................. 7  
MARKET/TECHNOLOGY OVERVIEW........................................................... 13  
  WHAT is eBUSINESS Hosting? .............................................................. 14  
  TELECOMMUNICATIONS INFRASTRUCTURE STATUS AND BRIEFING ....... 17  
  COMPETITIVE ENVIRONMENT .............................................................. 20  
RESEARCH DATA AND ANALYSIS............................................................... 26  
  DRAWBACKS OF GEOGRAPHICALLY DISTRIBUTED FACILITIES ............ 26  
  BENEFITS OF DISTRIBUTED FACILITIES ......................................... 29  
  TECHNICAL FACTORS SUPPORTING DISTRIBUTED FACILITIES .......... 30  
  BUSINESS FACTORS SUPPORTING DISTRIBUTED FACILITIES ............. 36  
  SOCIAL/POLITICAL benefits SUPPORTING DISTRIBUTED FACILITIES ....... 47  
  SUMMARY .............................................................................................. 51  
SITE SELECTION FRAMEWORK, PROCESS AND TOOLS............................ 53  
  3-PHASE FACILITIES DISTRIBUTION FRAMEWORK ............................. 53  
  ANALYSIS ............................................................................................ 55  
  PLAN .................................................................................................... 64  
  EXECUTE .............................................................................................. 67  
RESULTS, CONCLUSIONS, AND RECOMMENDATIONS............................. 70  
  KEY FINDINGS .................................................................................... 70  
  INITIAL RESULTS AT IOS ..................................................................... 71  
  EXTENSION OF LEARNING TO OTHER COMPANIES/INDUSTRIES ........... 72  
BIBLIOGRAPHY......................................................................................... 75  
GLOSSARY................................................................................................. 78  
  SAMPLE MARKET EVALUATION FRAMEWORK DATASETS ................... 86  
  SAMPLE CUSTOMER QUESTIONNAIRES .............................................. 88
LIST OF FIGURES

Figure 1: eBusiness Services Value Chain (Source: Intel) ................................................... 8
Figure 2: IOS eBusiness Platform Stack (Source: Intel) .......................................................... 9
Figure 3: IDS1 - first Intel commercial hosting facility ........................................................... 10
Figure 4: Internet Network Mapping (Source: CAIDA 1999) ....................................... 13
Figure 5: Sample Data Center Layout (Source: Exodus) ................................................... 17
Figure 6: Global Telecom Infrastructure (Source: Telegeography 1999) ............................... 18
Table 1: U.S. based eBusiness Hosters: Revenue, Market Share, DCs (IDC '99) .............. 20
Table 2: Hosting Provider Categories and characteristics (Source: IDC '99) ................... 21
Table 3: CDN vs. Hosting Vendor Comparison Matrix ...................................................... 22
Figure 7: Standard content dataflow diagram ................................................................. 23
Figure 8: Packet Loss impact on transfer times (source Intel '99) .................................... 32
Figure 9: Throughput performance results – unit: kB/sec (Source: Intel '99) .................. 33
Figure 10: High Performance Rack Servers in IDS1 ......................................................... 34
Figure 11: Key Customer Concerns (source: Jupiter 3/99) ............................................. 41
Figure 13: IDS1 Network Operations Center ............................................................... 44
Figure 14: Customer Needs by customer type (source: Giga 3/99) ................................. 45
Figure 15: 3-Phase Facilities Distribution Framework .................................................... 54
Table 4: Sample Factors relating to eBusiness Services Market Analysis ....................... 55
Figure 16: Sample Global Market Analysis Summary (not actual values) ......................... 57
Figure 17: Aggregate Market Attractiveness Ratings Chart (by Region) ......................... 58
Figure 18: Sample Market Maturity Chart (source - IOS, '99 ) ...................................... 59
Figure 19: Sample Market Revenue Forecasts (Y axis scale removed intentionally) .......... 61
Figure 20: Sample Regional Revenue Forecasts for an eBSP (not actual) ......................... 62
Figure 21: Sample Margin Analysis (not representative of actual values) ....................... 63
Figure 22: Sample Facilities Roadmap (not actual) ....................................................... 64
Chapter 1:

INTRODUCTION AND OVERVIEW

Background:

Intel has traditionally been known as a semiconductor company, having been leading supplier of microprocessors and chipsets to the personal computing industry for the last 20 years. Intel derives a large portion of its revenues from this side of its business, but in recent years has begun to diversify into other computing related markets such as network equipment, computer peripherals, and even complete server and workstation systems. In the beginning of 1999, Intel decided to go beyond just providing products to the computer industry and expand into the Internet related services industry. In fact, they have even changed their corporate mission from, "...being the leading building block supplier to the computer industry." to "...being the leading building block supplier to the Internet economy." This is a major shift in strategy for Intel as it marks the first time Intel has ventured into the services business at this scale. The first vehicle for entering the services market will be a new subsidiary called "Intel Online Services" (IOS). They plan on spending several billion dollars over the next few years to enter this business, and have mobilized the entire company to support the transition of becoming a major player in the Internet space.

As the Internet expands in popularity and gains widespread adoption by businesses worldwide, there arises a critical need for these businesses to deliver content and services online in a highly reliable, secure and predictable manner. The success of companies in this highly competitive environment will, in a large part, be based on how well they are able to execute in satisfying the needs of their customers and business partners online. In order to provide a solution for this impending need, Intel has decided to enter the data and application hosting business on a global scale. They aim to provide a standardized data-hosting infrastructure to allow companies to get presence and conduct eBusiness quickly, safely, and very
reliably.

Intel plans to accomplish this by deploying numerous “class A” data hosting facilities worldwide, each filled with thousands of high performance servers, and built to the highest specifications in security and reliability. The facilities will be able to offer a variety of services to companies including server collocation, server system management/maintenance, database management, transaction processing, applications hosting, and even managed enterprise resources planning solutions. These facilities will employ highly rigorous processes in operations and system management to ensure that the customers will always have the highest levels of reliability and up-time, while still maintaining the cost at a reasonable level. The data centers intends to share standardized operating environments, hardware/software platforms, management tools, and operational procedures, which should leverage greater economies of scale and guarantee a higher quality of service.

**Problem Statement:**

The customer base will be worldwide, and the services will be delivered both for local markets, as well as helping companies deliver content and services globally, or at least beyond their own geographical boundaries. There are very different levels of infrastructure maturity, Internet maturity, customer readiness, cost structures and service requirements between each target market. Traditionally, location decisions have mainly been based on financial cost models and executive intuition. However, as this is a service business versus a manufacturing business, and in a new industry, the traditional decision making processes used in deciding facilities locations are inadequate for helping Intel make these decisions. Some key questions they would like answered include:

- Do we need multiple data centers located globally? Why?
- If yes, where should the facilities be placed?
- When should each facility be deployed for best results?
- How large should the facilities be in each location?
- Which services would benefit most from distributed facilities?

With the recent advancements in the telecommunications technologies, there are
some theorists who claim that eBusiness hosting providers needs only a very large
hosting facility in a centralized location with a fat communication pipe connected
to the Internet, and they could adequately serve the needs of online businesses
worldwide. This thesis will present an analysis on the circumstances and solutions
surrounding the need for deploying geographically distributed data hosting
facilities globally to serve the needs of today's businesses. The analysis will be
conducted both from a business and a technical perspective.

Approach and Methodology
The majority of the analysis will be based on a case study of the Intel Online
Services project, but relevant information from companies in the industry and
other related businesses is also considered. The majority of the research for this
study was collected during a six-month assignment by the author as the Regional
Market Development Manager for the Asia/Pacific region. The region included
countries such as Japan, Korea, China, Taiwan, Hong Kong, Singapore, Australia,
Malaysia, India and Philippines. The author personally made visits, sometimes
multiple visits, to all these countries to assess the market environment,
competitive landscape, and partner/customer potential. The APAC region
provides for an excellent case study, as the heterogeneity in Internet maturity and
market environments between its individual markets provides for a fairly
representative case study of the global market.

Secondary and primary research results also contributed greatly the conclusions in
this thesis. Inputs from internal and external subject matter experts were also
crucial for arriving at the final results and recommendations. Some technical
performance evaluations were begun during the study, but only limited results
were ready by the time the thesis was published.

Data for the analysis was gathered through: interviews with relevant experts
(internal and external); first hand experience while participating in the planning
and deployment of the facilities; commissioned primary research results,
communication performance monitoring data gathered during research;
secondary research reports; and academic research in the area. The thesis will
describe the findings in detail and will provide some analysis tools and frameworks developed and employed for this project, which could be applied to other eBusiness or telecommunications related facilities projects on a more general basis. Although the initial frameworks were developed for the evaluating the Asia/Pacific region, they were quickly adapted and applied to the global markets to include Europe/Middle East/Africa and Latin America.

**Project Goals and Measurements**

The goals of the project was to develop a greater understanding for eBusiness facility location decision making processes at Intel (a leading e-Business services provider), and create a set of tools, frameworks and processes that would help to improve upon the existing process. These deliverables are intended to be helpful for Intel in answering their immediate needs, but should also be applicable to any outside vendors facing similar decisions. The real measurement of the usefulness of these deliverables can be measured using two major metrics, satisfaction of people involved in the decision making processes and the long term financial impact of the decisions that were made. The first metrics is somewhat subjective, but can be assessed within the terms of the six-month research period. Unfortunately, the arguably more meaningful metric of financial impact cannot be assessed within this timeframe, and even in the long-term, cannot be evaluated completely deterministically. Since the alternative decisions are not implemented, it would be almost impossible to know if those decisions would have resulted in higher revenue or profits.

In addition to the practical aspect of the thesis, the project is also concerned with the theoretical need for distributed facilities in the first place. My initial position is that such facilities are needed and plan to use the rest of the paper to detail the numerous supporting evidence to this point.
Chapter 2:

COMPANY OVERVIEW AND PROJECT SETTING

This chapter is intended to provide a background on the company, project, and corporate environment. This kind of information helps the reader to properly evaluate the decisions that were made in the rest of the document and the reasoning for those decisions. It is also used to highlight the potential internal conflicts that could arise as a company moves from being a global product manufacturer to becoming a global service provider.

Intel Background

Most people know Intel as the leading supplier of microprocessors for the personal computer industry, where it has kept this position since the advent of the PC in 1980. However, many people don’t know that Intel had actually started out as a memory supplier. At its founding on July 18, 1968, Intel had carved out a unique challenge: to make semiconductor memory practical. This was quite a stretch, considering that silicon memory was at least 100 times more expensive than magnetic core memory (developed at MIT), the leading technology at the time. But Intel’s founders (Robert Noyce and Gordon Moore) felt that semiconductor memory’s advantages — smaller size, greater performance, reduced energy consumption — would convince manufacturers to try the new technology. They left Fairchild Semiconductor to pursue this venture and soon hired Andy Grove as employee number 4. Dr. Grove has played a critical role in developing and maintaining Intel’s leadership position in this highly competitive market.

Intel happened into the microprocessor business when Japanese manufacturer Busicom asked Intel to design a set of chips for a family of high-performance programmable calculators. At the time, all logic chips were custom-designed for each customer’s product. By definition, this process limited the widespread application of any one logic chip. That was all about to change. Busicom’s original design for their calculator called for at least 12 custom chips. But Intel
engineer Ted Hoff rejected the unwieldy proposal and instead designed a single chip, general-purpose logic device that retrieved its application instructions from semiconductor memory. (source: intel.com) After they realized the potential of such a product, Intel decided to buy the product rights back from Busicom for $60,000. They saw it as a way to sell more memories, since each processor needed two memory chips.

In 1971, the first integrated microprocessor, the 4004, was formally introduced. Smaller than a thumbnail and packing 2300 transistors, the $200 chip delivered as much computing power as the first electronic computer, ENIAC.

Soon after the 4004, Intel introduced the 8008 microcomputer, which processed eight bits of information at a time, twice as much as the original chip. As anticipated, both devices began to open up new markets for Intel products. For the first time, affordable computing power was available to designers of all types of products. The chips revolutionized everything from medical instruments to inventory computers for fast-food restaurants, airline reservations systems to gasoline pumps, even pinball games and slot machines.

By 1981, Intel's microprocessor family had grown to include the 16-bit 8086 and the eight-bit 8088 processors. These two chips garnered an unprecedented 2,500 design wins in a single year. Among those designs was a product from IBM: it was to become the first PC. The PC ignited the technology revolution that has led U.S. to where we are today. In between, Intel has released seven separate generations of microprocessors to become the leading supplier of microprocessors, and has never looked back. They recently just released a 1 Ghz version of their Pentium III processor, marking another milestone in processor technology.

Just as Intel was flexible enough to make the switch from being a memory supplier, to becoming the leading processor supplier, it is now trying to transform itself into a new company, a company that will become the "building block supplier to the Internet Economy." This means becoming a leading provider of products and services of all the major infrastructure layers of what makes the
Internet and electronic commerce possible. This ranges from components, to systems, to network equipment and even business services. It realizes the importance of transitioning its business focus with the ever-changing business environment. This is one of the reasons why Intel Online Services was created.

**IOS Background and Environment**

**Group Strategy and Objectives**

Intel Online Services' (IOS) mission is “to be the leading provider of hosted Internet services, business applications, and e-commerce solutions worldwide.” These three service areas are combined into what is called “eBusiness services”. Intel recognizes that as the Internet becomes ubiquitous and businesses all over the world get connected, communication and computing infrastructure services will become an essential part of what makes it possible. It knows it needs to play in this space and play in a big way, or it will not be a leader in the new consolidated computing and communication industry. Although Intel participates in numerous activities in the Internet space, it is still not recognized by the press and public as being a major player there. Intel has long had a significant role in providing office networking and inter-networking equipment. They have invested in and have partnerships with hundreds of internet related companies over the last 5 years. Intel has been strongly involved with industry standard setting in the computing and communication industries for years, but their accomplishments are not highly publicized. On the business side, they have also been successful. In 1998 and 1999, Intel transacted more business through the Internet than any other company in the world. They averaged a run rate of over $1 billion per month in sales over the Internet. All this hasn’t been enough, Intel needs to become part of the fabric of the Internet in order to succeed there in the long-term plans.

Intel got it’s success in the computer industry by providing essential components for the PC and it hopes that IOS will be a first step in becoming an essential component of the Internet Economy. The margins in the standard webhosting market is quite thin and it’s not clear that just sticking to providing basis hosting
services is a sustainable long-term strategy. This is why Intel chooses to move beyond basic hosting services to what they call 2nd Generation Hosting, where hardware, software, system management and extensive services are provided to the customer. In providing a richer stack of products and services, it believes it can reap larger revenue share from the customers and deepen the relationship with them. IOS will not try to achieve all this alone. They will employ an extensive partnership strategy in providing products and services that are not core to their business.

IOS sees the current eBusiness services value chain as composed of four pieces: Network Service Providers (UUNet, WorldCom), Operations Services Provider (Exodus, Concentric), Application Service Provider (Oracle, SAP), and Solution Service Providers (iXL, Viant). IOS wants to create a new layer between the Operations and Applications Services layers, called the e-Business Services Platform. This platform is intended to be a standardized set of hardware/software stacks that the industry would adopt and would be able to greatly increase manageability/reliability of the solutions, time to market for development, and greatly reduce overall cost.

The figure below shows a high level depiction of the initial components in the eBusiness services Platform. There are standards all the way from the application level down to the OS and hardware levels. Having these standards in place will be a big help for developers to get products to market, rather than reinventing the wheel for each project. The standardized platforms will also ensure that the operations people will be well trained on the systems and each platform will be
fully validated before entering the production hosting space. There will be some issues with maintaining consistency for international markets, but the goal is to keep the platforms as standard as possible worldwide.

The standardization of the platforms and processes is a natural extension of the well-known Intel process of copy-exactly. This is a process used in the Intel factories where they standardized manufacturing equipment and processes for chip fabrication, and deploy them in exactly the same way to all the factories around the world producing a specific product. This process has been extremely successful for Intel in making chips, and they are extending that into the eBusiness services world. Intel has also been very active in the standardization of technology and platforms in the PC industry, so they know the value in creating and controlling a standard.

IOS is the in-road for Intel into the Internet services sector. If they are successful here, they expect to parley the success into many other new businesses that service the Internet economy.

**Intel Capabilities and Plans**

When people hear that Intel is venturing into the eBusiness Services space, they often react negatively to their move. The general public doesn’t associate the Internet or networking with Intel, but actually, they’ve been involved in this space significantly and have a good chance to do well here.

The eBSP business is concerned with providing highly reliable and secure hosting facilities and services to deliver content efficiently all over the world. Interestingly enough, Intel has quite a bit of experience in this area. Running large
semiconductor fabrication plants are actually quite a bit more complicated than running a data center. The extreme reliability of these facilities is critical to Intel's bottom line, and they have learned how to make this happen. In addition, Intel has been a pioneer in B2B commerce. They did over $12 billion of sales online last year, accounting for about half of all their sales. That made Intel the leading eCommerce company in 1998 and 1999. In addition, Intel has been very active investing in and acquiring Internet and networking companies. Intel has over 300 investments in this space, with a portfolio worth of over $5 billion. That is one of the largest portfolios in venture funding today.

As part of its internal manufacturing, internal networks and B2B commerce systems, Intel currently runs it's facilities 24x7 and at 99.999% availability. Intel is managing over 2500 database and application servers around the world in 93 facilities and 32 countries. Just in the internal network used by Intel is fairly impressive. They pass through over 2 million email messages a day and have acquired over 325 Mbps of dedicated communication bandwidth to these facilities.

The first two commercial hosting facility is already up and running today, one in Santa Clara, California and the other in Washington, D.C. A test and development facility in Folsom, California has also been deployed and will be used to develop new eBusiness platforms and test for the most robust hardware/software combinations. Several other facilities are also being deployed in Asia and Europe. These facilities are massive buildings with capacity for over 10,000 servers and cost on the order of $100 million to build and outfit. Ten to twelve of these facilities are to be deployed around the world in major markets.
Not all will be at the scale of the initial large facilities, but the smaller facilities will still cost in the tens of millions of dollars. Each facility takes 3-9 months to build/deploy, and operational staff can range from several hundred for the large facilities, to several dozen for the smaller facilities. The total budget for the division will in the billions of dollars over the next couple of years.

It's true that Intel has not participated in the eBusiness services business before, but they do have some relevant experience, strong technical expertise, brand value and plenty of resources to attack the problem. Intel is committed to making this business happen, but it will be a major challenge for them both in transitioning the manufacturing mindset of the organization into a service minded focus, as well as in executing on a very complex and demanding set of projects. It will not be easy for them to say the least, but it is a challenge that Intel has the potential to overcome if they show the ability to execute quickly.

**Organizational structure**

Since we are exploring the use of new decision-making processes in a large corporation, it's always helpful to have a general idea of how the organization is structured and power distributed. This helps U.S. understand the organizational dynamics in the study and better evaluate the results.

IOS is one of several divisions under the New Business Group (NBG). NBG is managed by Gerry Parker, an executive VP at Intel who had previously managed all of the manufacturing organization (40k people). The NBG is chartered with creating new businesses outside of the processor world that would result in becoming the next $20 billion business for Intel. Parker reported directly to the CEO, Craig Barrett and Chairman, Andy Grove. IOS is headed by Mike Aymar, a senior VP with over 15 years of experience at Intel, who has managed several other divisions within the company. Within IOS are four major groups: Marketing, Engineering, Operations and Sales. Each group is managed by a director, all of whom have came from other parts of Intel.
Decision making environment
At the time the study was begun, the organization had just recently formed. The division was growing rapidly. Standardized management and decision-making processes were not yet in place. The numerous new hires, who were unfamiliar with the Intel culture and working environment, created an additional challenge for Intel.

With respect to the facilities locations and timing decisions, there were an initial set of sites and general timing. Most of those sites were arrived at through general recommendations from a consulting firm they had hired, and minimal validation of these choices were conducted due to perceived time-to-market pressures. In addition to the consultant recommendations, there were also general geographical preferences that were imposed on the management through personal intuition and implied promises from various senior management at Intel and within IOS. In certain cases, some developing countries were able to get priority over much more mature and sizable markets elsewhere in the world.

In general, the processes that existed lacked the necessary rigor or objectivity one would expect at such a well respected and well operated company. Based on published internal documents, managers from the Operations and the Marketing organizations co-owned updating and editing the "Facilities Roadmap". This roadmap was a document that gave information relating to where a facility will be place, when they deployed, what scale a facility will be and who the partners are for those facilities. This document is a critical piece of what the organization as a whole used in planning their priorities and activities. Although the Roadmap was designed to be a jointly owned document between the organizations, it often seems that there was insufficient communication and cooperation in coming to decisions on the content on these roadmap. Likely it was a cultural difference between the organizations that stem from the history of how Intel had come to facilities related decisions in the past, where they were primarily Operations driven. If Intel is to be successful, in a service-oriented business, that mindset had to change.
Chapter 3:

MARKET/TECHNOLOGY OVERVIEW

This chapter is intended to help the reader gain a general level understanding for the eBusiness hosting market and the technologies that make it possible. It’s assumed that the reader has some level of computer industry knowledge, but not necessarily in the telecom/web hosting industry.

The Internet was started in the U.S. about 25 years ago as a government project, but only really started to blossom into a popular commercial network in the early nineteen nineties after the advent of the world-wide-web and the browser interface. Today, there are over 250 million users and even more devices connected to the Internet, and those numbers are growing at over 50% a year for the next several years. According to recent analyst reports, there will be over a billion users online by the year 2004.

Everyone knows that the Internet is a massive collection of computers and

Figure 4: Internet Network Mapping (Source: CAIDA 1999)
networking equipment world-wide, all connected to each other through a complex web of communications networks of varying sizes, and all accessible to the average online user. It's easy to see why people call it the "web" when we look at the computer visualization of the networks that interconnect the Internet in Figure 3 above. The Internet is a collection of tens of thousands of networks, but there is a small subset of large networks or connectivity providers that form the bulk of the structure. In fact, the top 8 ISPs/NSPs are home to ~95% of all Internet address (Morgan Stanley, Internet Data Services Report, '99). As a result, the majority of traffic flows through them, affording them a high level of power in the data communication space. Their names are listed in figure 4 as well. Most of them are U.S. based networks, but many of them connect servers and users all over the world.

As the size of the Internet grows and the number of users and dollars transacted on the net increases, the importance of scalability and reliability of a company's website increases. It use to be okay for a company's website to be unavailable for short periods of time, but these days, when that happens, the market-cap of that company can drop 20%, equating to billions of dollars. Having an always available and consistently high performance website is critical to the success of companies in the new economy. A company's online operations are now much more than just its public face to the world, it's the company's storefront, support channel, and even supplier interface. And the truth of the matter is that setting up and managing a robust and high performance online operation is not easy. Outsourced eBusiness hosting allows the company to ensure that professionals who specialize in this area are managing their online operations, which provides better economies of scale and higher quality of service. The need for and benefits from outsourced hosting has never been higher, and more companies are turning to hosting vendors to handle this need everyday.

What is eBusiness Hosting?
We've been talking about eBusiness quite a bit thus far in this document, but haven't provided a very detailed discussion on what it really entails. Essentially, eBusiness service providers (eBSP) provide a collection of products, services and
the environment for companies to start doing business on the Internet and keep those operations running 24/7 to meet the growing needs of their customers. These outsourced services can involve a range of activities that include such things as website hosting, database hosting, application hosting, content delivery, load-balancing, commerce enabling, mail/messaging services, disaster recovery, storage systems, ERP hosting, system monitoring/management, provisioning services, online security, etc. Some eBSPs even provide system development or integration, often in partnership with professional system integrators (SI) or web development agencies (WDA).

When hosting services first became available, essentially all they provided was a facility for companies to put their servers and the pipes to connect to the Internet. This is called collocation, and was the first generation of web hosting. These facilities usually provided some assurance of power availability and made available racks where companies can rent space to put their own servers, and a network connection that would allow the servers to reach out and deliver content onto the Internet. All provisioning, setup, monitoring and maintenance are the responsibility of the customer.

The new level of service available through providers like IOS is what is called second generation hosting or fully managed hosting. These vendors go beyond just providing a robust facility, but actually make possible a hands-free process in system setup and management. A combination of hardware, software, and management services are all provided to the customer for essentially the same cost of doing it themselves (and often lower), but with a much higher level of reliability and much less effort. They provide service level agreements to their customers that will guarantee a variety of metrics such as system uptime, trouble response time, network & power availability, performance guarantees, content recovery levels, etc. It makes the life of the customer simpler, and much less stressful. Best of all, it allows companies to focus on their core business of producing products or delivering services, acquiring customers and building their brand, rather than having to worry about all the complexity of running a robust commercial website and its associated services. The biggest reason why most
companies outsource services has to do with a lack of personnel or skill-sets within the company. Today, this problem is worst than ever and the limited supply of people with the skills to setup and manage robust online operations is way over stretched. Having a hosting vendor aggregate and share this limited commodity makes economic and social sense. The eBSP can hire and train specialists in the area and share their resources across many customers, saving on total burden cost of each customer, and providing higher quality of service. As a company grows, the outsourced vendor will be much more likely to have the personnel and skill sets to grow with them. Unlike companies who host internally, eBSPs won't have to hire new staff each time a company needs need services or increases the number of servers. It really is a beneficially relationship that increases value for both the vendor and customer, while keeping total cost of ownership down.

All the services described above are enabled by having a highly secure, reliable, manageable, and scalable operating environment. These are the Class A data center facilities we discuss earlier. Below is the sample layout of a data center server room (see figure 5), which also gives a sense of what a first generation collocation facility looks like and some associated features of such a facility. The major differences in what IOS is doing is that rather than providing racks for customers to fill with their own systems and managing all the systems themselves, IOS provided the whole system solution including the associated management services. So the server rooms are actually off limits to the customers while being accessible only to trained personnel, helping to increase security and improve reliability. The NOCs in the 2nd generation hosting facilities are also much more comprehensive then what is shown in figure 5 (refer to figure 12), allowing them to provide more sophisticated monitoring and control operations than is possible in the earlier facilities.
Telecommunications Infrastructure Status and Briefing

The global Internet communications infrastructure has been growing at an extremely rapid rate. The number of hosts on the net has been doubling almost every couple of years, and so has the total communications bandwidth. There are scores of cross-oceanic fiber projects underway right now, and many more planned. When the advances in compression techniques are combined with all the new development projects underway, it seems certain that a bandwidth glut will arise, and all congestion on the Internet will soon disappear everywhere in the world. This would be a very logical conclusion, but it's not likely to happen for some time.

It's absolutely true that enormous bandwidth capacity is being created. Unfortunately, the geographic distribution of the connectivity has not been growing quite as broad. As a result of questionable NSP pricing policies and
content sources, the majority of the bandwidth available today and those being deployed in the near future, connect other international markets to the U.S. (see figure below) This would not be a major problem if all the content that existed in the world were in the U.S. and no other country in the world wanted to communicate with anyone else except for the U.S. This has been a relatively representative situation in the first few years of the ‘90s, unfortunately, that’s not the case anymore. The Internet is a global phenomenon, thus content and users are sprouting up all over the world. However, the infrastructure has not been put in place yet to support this kind of global communication requirement.

![Global Telecom Infrastructure](image)

Figure 6: Global Telecom Infrastructure (Source: Telegeography 1999)

There is a multi-tiered hierarchy for data communication on the Internet. The base of the hierarchy is the Network Service Providers (NSPs) or backbone carriers. These are players like UUNet and AT&T who own large amounts of data transmission capacity and help their customers transfer data traffic around the world. Their customers are usually the Tier-1 Internet Service Providers
(ISPs) who are major telecom players that then sell/resell connectivity to the smaller Tier-2 ISPs. Large corporations will also buy connectivity directly from the NSPs or the Tier-1 ISPs. Tier-2 ISPs mainly serve individuals and small businesses.

Data traffic between networks is generally transferred in two ways: public exchange points or private peering. Exchange points are facilities where numerous connectivity providers meet to exchange or route traffic to each other’s networks. There are dozens of major exchange points all over the world where data can be transferred, and some of the better-known ones are the MAEs or Metro Access Exchanges. Unfortunately, these public exchange points can get very congested, since network providers don’t want to carry other networks traffic and just passes it on to any available receiver. This practice is called “hot potato” routing, and can lead to heavy packet loss during peak times. To avoid these problems, many major network providers or ISPs have private peering arrangements where they pass traffic directly to each other, bypassing the exchange points all together or used private network access points (NAPs). These arrangements usually occur between providers of similar sizes and traffic patterns.

The financial incentives for having sufficient international bandwidths are non-existent as well. Often connectivity to the U.S. is several times cheaper than equivalent connectivity to a neighboring country or in-region country. As a result, much of the in-region traffic that goes between Asian and European countries today actually goes through the U.S. first before arriving at their destinations. This causes unnecessary delays to the data, greatly reduced efficiencies and causes greater congestion throughout the network. Sometimes, neighboring countries even send data through U.S. networks just to get to each other. For example, until recently, Malaysia and Singapore only had a small 2 Mbps data bandwidth between the two countries for sending Internet traffic. Over a third of the phone traffic in these two countries are with each other, yet less than 2% of their data connectivity was with each other. There are many examples of this type of unbalanced arrangements around the whole.
This U.S. centric connectivity orientation is starting to change as more communication capacity is built up within each of the major regions. However, equitable peering arrangements between various NSPs and local connectivity providers in the regions have been somewhat slow to come. These companies are incentivized to horde traffic and drive up their own status on the totem pole. So sharing traffic and capacity with lesser providers just isn’t happening so quickly. But in time this will change, either through governmental intervention or customer demand.

**Competitive Environment**

The eBusiness Hosting market is a very competitive area to enter, but a rapidly growing market. The overall market is expected to grow from just under $2 billion last year, to over $18.9 billion by 2003 (IDC '99). There are numerous large established players and hundreds of small lower tiered competitors. The

Table 1: U.S. based eBusiness Hosters: Revenue, Market Share, DCs (IDC '99)

<table>
<thead>
<tr>
<th>eBSps</th>
<th>Revenue '99</th>
<th>Share (%)</th>
<th>DataCenters '99</th>
<th>DataCenters '00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exodus</td>
<td>169,109,500</td>
<td>9.3</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>Verio</td>
<td>137,678,000</td>
<td>7.6</td>
<td>9</td>
<td>40</td>
</tr>
<tr>
<td>GlobalCenter</td>
<td>107,460,000</td>
<td>5.9</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>IBM Global Services</td>
<td>98,000,000</td>
<td>5.4</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>MCI WorldCom</td>
<td>80,000,000</td>
<td>4.4</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Qwest</td>
<td>71,500,000</td>
<td>3.9</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Digex</td>
<td>59,800,000</td>
<td>3.3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>57,780,000</td>
<td>3.2</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>GTE Internetworking</td>
<td>48,811,000</td>
<td>2.7</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>MindSpring</td>
<td>36,594,500</td>
<td>2</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>PSINet</td>
<td>31,948,000</td>
<td>1.8</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Concentric</td>
<td>24,564,500</td>
<td>1.4</td>
<td>5</td>
<td>na</td>
</tr>
<tr>
<td>Cable &amp; Wireless</td>
<td>22,316,250</td>
<td>1.2</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Interliant</td>
<td>18,899,377</td>
<td>1</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>9 Net Avenue</td>
<td>17,820,000</td>
<td>1</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Digital Island</td>
<td>14,330,008</td>
<td>0.8</td>
<td>5</td>
<td>na</td>
</tr>
<tr>
<td>Navisite</td>
<td>10,620,000</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EarthLink</td>
<td>8,786,700</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>digitalNATION</td>
<td>4,641,000</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US WEST</td>
<td>4,600,000</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Top 20 subtotal</strong></td>
<td>1,025,258,835</td>
<td>56.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>791,517,043</td>
<td>43.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,816,775,878</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

operating margins are very thin, and in fact, most companies in this industry have yet to see profitability.
In table 1 above, we can see the revenue, market share and data center counts for the leading U.S. based eBusiness hosters. There is a high concentration of market share in the 10 players, and a fairly clear trend that the most successful players in this market tend to have more data center facilities than those who do not. In fact, the leading players are also expected to build much faster than second tier competitors. This trend seems to give credence to the position of the author that having numerous geographically distributed facilities will have a major impact on the success of the eBSP.

Table 2: Hosting Provider Categories and characteristics (Source: IDC '99)

<table>
<thead>
<tr>
<th>eBSP Type</th>
<th>Focus/Characteristics</th>
<th>Competitive Advantages</th>
<th>Vulnerabilities</th>
<th>Sample Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network service providers (NSPs)</td>
<td>National backbone with major metro presence, Global assets or alliances, Bandwidth providers</td>
<td>Low-cost bandwidth, Own network control, Global reach, potentially Good will</td>
<td>Single network at mercy of peering, Focus on pipes, not applications Distracted by other businesses</td>
<td>UIUC, AT&amp;T, PSINet</td>
</tr>
<tr>
<td>Datacenter providers (DCPs)</td>
<td>Many centers in the United States, one or more in Europe and Asia/Pacific, large plans</td>
<td>Broad market presence, IT infrastructure expertise, Scalable assets, Relative network independence</td>
<td>Network QoS, Differentiation of service, Low barriers to entry Applications knowledge</td>
<td>IBM Global Services, Intel Online Services, Exodus</td>
</tr>
<tr>
<td>Applications network providers (ANPs)</td>
<td>Smaller-scale combination of above two categories, Targeted customer solutions and applications focus</td>
<td>Applications knowledge, Premium services, Systems integration, eCommerce, Web strategies</td>
<td>Limited footprint, Resources, Market power</td>
<td>US Internetworking, Corio</td>
</tr>
<tr>
<td>Web-hosting ISPs (WHISPs)</td>
<td>ISP with backbone, result of acquisitions, roll-up strategy, Diverse infrastructure, Primarily shared hosting</td>
<td>Market share, brand, Economies of scale, Market distribution channel for partners of all sorts</td>
<td>Quality consistency, Integration of acquired assets, Distance from customer</td>
<td>Verio, Level 3, AboveNet</td>
</tr>
<tr>
<td>Midmarket hosting specialist</td>
<td>One or two datacenters, Regional or niche markets, Dedicated hosting</td>
<td>Innovative approaches, High level of customer attention, Agile, responsive management</td>
<td>Market reach, Network costs, Keeping pace with technology</td>
<td>Concentric, SNNetAve</td>
</tr>
<tr>
<td>Content Distribution Networks (CDN)</td>
<td>Helps eBusinesses deliver digital content to users quickly and reliably, Targets high-volume sites</td>
<td>Extensive network of Servers worldwide creates base infrastructure, Extensive relationships with ISPs and hosters worldwide hard to duplicate, Solving a major pain for customers, that they are willing to pay for</td>
<td>Reliant on ISP and other hosting providers (no facilities), Reliant on NSPs (no communications pipes)</td>
<td>Akamai, Sand Piper</td>
</tr>
<tr>
<td>Low-end volume hosting</td>
<td>Single small datacenter or colocated with big player, Mass market, Standard offers</td>
<td>Aggressive marketing, Low price, Little customer commitment required</td>
<td>Ability to add value, Customer care capabilities, Scalability</td>
<td>harvard.net</td>
</tr>
<tr>
<td>VARs, resellers, Web developers</td>
<td>No formal datacenter, Bandwidth from single ISP, Competent but not scalable services</td>
<td>Account contact, knowledge, Customer attention, Channel value</td>
<td>Hosting is not core business, just a customer service for account control</td>
<td>iXL, Razorfish,</td>
</tr>
</tbody>
</table>
There are actually many classes of eBSPs, all with different areas of focus and service offerings. Table 2 describes generally what the different classes are and how they differ from each other. IOS fits into what IDC calls the DCP (data center provider) due to its global nature, large scale and facilities based focus. However, IOS wants to position itself beyond just providing data center facilities. It wants to become a full service eBSP that provides all levels of services to Global 2000 companies and leading internet dotcom’s. Having the right scale allows for many advantages, and IOS hopes to leverage its massive resources in carving out a piece of the eBusiness services pie. In the longer term, it also intends to provide application hosting for enterprise solutions, like ERP and CRM, as well as mission critical storage networks and mail systems.

In the recent year, content distribution networks (CDN) like Akamai and SandPiper, have gotten a lot of press coverage and public attention. CDNs are companies that deploy large numbers (thousands) of servers around the world, very close to the access points of end-users, and cache frequently used pieces of data on these servers. By being closer to the customer, and using intelligent routing algorithms, they are able to deliver content significantly faster than traditional eBusiness hosters who serve data out of centralized locations. CDNs generally don’t own their own facilities, and don’t own any communication pipes, but they do own the edge servers.

Table 3: CDN vs. Hosting Vendor Comparison Matrix

<table>
<thead>
<tr>
<th>Services</th>
<th>IOS</th>
<th>Exodus</th>
<th>Akamai</th>
<th>Sandpiper</th>
<th>Inktomi</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Collocation</td>
<td>/</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managed Hosting</td>
<td>X</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Management</td>
<td>X</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Monitoring</td>
<td>X</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm. Bandwidth Procurement</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Environment</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Hosting</td>
<td>/</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eCommerce Services</td>
<td>/</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disaster Recovery</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise Storage Systems</td>
<td>X</td>
<td>/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Content Mirroring</td>
<td>/</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streaming Content Services</td>
<td>/</td>
<td>X</td>
<td>/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content Acceleration Services</td>
<td>/</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content Acceleration Solutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Legend: X - Full Support; / - Partial Support; blank - no support
To help the reader better understand the difference between this new emerging
class of eBSPs, let’s do a quick comparison between CDNs and more traditional
web hosting providers like Exodus and IOS. As table 3 above shows, there’s
actually very little overlap in services being provided by the CDNs and the more
traditional eBSP hosters. The hosters are generally responsible for everything that
makes the data available and reliable, and allows for the content to get out to the
rest of the world, whereas the CDNs are more concerned with how quickly the
data gets to the customers and how to allow for stable delivery of content during
times of extreme demand. So maybe a good way to think about it is on a linear
distance scale from the data origin to the end-user. The standard hoster takes
care of everything before the first mile, the NSPs and major ISPs are responsible
for carrying the content to the POPs (point of presence), the CDN caches
frequently used data and routes content requests to the optimal edge-servers for
serving up the data, and the final delivery is done by the ISP to the end-user via
whatever access method the user employs. However, it should be noted that
players like Akamai has announced intention to expand their services into the
space of the traditional eBSP by providing things like performance monitoring,
disaster recovery, full mirroring, application services, and even commerce
services. In time, there will likely be some head-to-head confrontation between
these two groups of service providers.

Some hosting providers are starting to employ using edge servers themselves or
deploying better traffic management software within their DCs to provide better
quality of service to end-users. This move greatly reduces their dependency on CDNs to deliver the data, and may lead to a more direct head-to-head competition between these players going forward. Right now, a CDN like Akamai has much more access point than the hosting providers, which number in the order of hundreds of locations. Akamai's ability to execute on deploying and maintaining these servers has lead to their current success. However, going forward in the long-term, their financial success is questionable, due to the niche focus of the CDNs, their limited revenue generation model, and heavy dependency on network and facilities providers. Akamai's total revenues for 1999 amounted to about $4 million, which resulted in a net loss of over $57 million for the year. Their gross margin was a whopping -100% for '99. They already have over 90% market share of the content acceleration market with over 300 major content sites using their services, but still only has a relatively smaller revenue run rate. The total upside potential for this market niche is questionable. For Akamai to have revenues that somewhat justified its stock price, it would need to ramp revenues over 200X in the next few years. As competition from other CDNs and the eBSPs ramp up, and as the general internet communication infrastructure begins to mature, the margins and revenue potential for all CDNs will begin to fall even more. Right now, the CDNs are taking advantage of a short-term phenomenon of uncooperative data transfers between major players, and lack of edge server presence by the eBSPs in various locations to take a quick lead in capturing customer relationships. In a way, the eBSPs are letting the CDNs do the work right now, because they get more revenues from the CDNs than the CDNs from the content providers. If the market becomes to show signs of large profit potential, the eBSPs and the NSP/ISPs can raise prices to the CDNs to strip away any undue profits. Even with potentially good negotiation power due to data traffic, the actual amount of data being "Akamized" compared to the total flow of data on the internet is miniscule.

The existence of improved third party traffic optimization solutions from companies like Inktomi and SightPath also pose stiff competition for the CDNs. These new packages allows any company to readily deploy CDN-like services at a
minimal cost. Even Intel is getting into the edge-server business by developing stand-alone solutions for edge-servers that can be deployed in any POP around the world quickly and cheaply. It's only a matter of time, before edge-server services becomes a commodity check-off item.

A probable outcome in the next few years is that CDNs will coexist with eBSPs, but will operate as a relatively low-margin business providing a niche service to the eBSPs and the content providers. The likely long-term scenario is that the CDNs disappear all together either being acquired by other companies looking for vertical integration (i.e. Digital Island/Sand Piper) or just go out of business all together due to the market pressures associated with encroachment from other players in the industry. Their short-term market success is surely not justified, and their long-term business success potential also looks bleak.
Chapter 4:

RESEARCH DATA AND ANALYSIS

This chapter will discuss the various data that was collected and researched during the study, which relates to the hypothesis of the need for geographically distributed facilities. It discusses the benefits and drawbacks from the business, social/political and technical perspectives of having distributed eBusiness hosting facilities.

Drawbacks of Geographically Distributed Facilities

It may not be immediately obvious that having geographically distributed facilities is not always the optimal solution. If we look at most physical goods, these industries very often use numerous distribution centers placed strategically around its markets to serve the needs of their customers on a timely basis. Shipping products across the country or ocean can be very time consuming and costly. Some readers may say that eBusiness hosting is not a physical good, that there aren’t big transit times and the transport costs are negligible. But then look at other information services like the telephone system. Telephone companies have switching offices and operators in just about every city. So why should eBusiness hosting services be any different.

Some might argue that eBusiness hosting is just the creation and management of a centralized digital data supply, which can be delivered on a network to almost any place on earth practically instantaneously. The network is the Internet, a public global collection of servers, network equipment and transport media, which can be leveraged at almost no cost to the eBSP. The end customer is pulling the data from their system and really doesn’t care, and shouldn’t care where it’s all coming from. With today’s global broadband networks, all this sounds very plausible. Ideally for the eBSP, this type of scenario could be a major benefit to them. Below are the many advantages of
having a large centralized eBusiness hosting facility versus building a global network of distributed hosting facilities.

- Lower capital/operating expenditure
- Lower logistical/management complexity; faster time to market
- More straightforward technical management problem
- Centralized staffing
- Simpler people management issues
- Greater focus and more efficient use of human and capital resources

**Lower capital/operating expenditure**

There’s no question that building one large centralized eBusiness facility would be the most cost effective method for delivering eBusiness Hosting facilities. There is no duplication of resources, greater economies of scale, less external dependencies and more efficient use of human resources. In aggregate, building a dozen medium-sized Class A facilities all over the world, will cost many times the cost of building the same capacity in a centralized location. If we evaluate the project from purely risk-reduction perspective, then having all these facilities really adds to the downside in case the project fails.

**Lower logistical/management complexity; faster time to market**

Logistically speaking, managing the build-out and operations of a single facility is many times simpler than doing the same simultaneously for numerous facilities across the world. The increased complexity will often lead to extensive delays in time to market, and reduce reliability in the long term. Having to compromise decisions due to various local requirements, the platforms and processes of the facilities become heterogeneous, which could lead to inefficiency and downtime. Even in getting simple things like building permits and locating contractors could take significantly longer when dealing with international locations. If we add in all the complexity that arises due to tax, currency, and legal differences associated with each target market, this becomes a real logistical nightmare.
More straightforward technical management problem

The technical challenges of bringing up numerous international hosting facilities are not small either. Since the facilities need to be able to provide redundancy for each other, and allow for remote system management to reduce operational costs, the technical complexity has just increased exponentially. The technology to do these things are not readily available, and the ones that are available, are not particularly robust. To really implement such a system correctly, it's very important to have the goal of distributed management and monitoring be considered from the beginning of the design process. If that were not done, a complete redesign would likely need to be implemented in order to support this requirement.

Since the distributed facilities will be running international OS and application, and potentially using local systems and equipment, the potential for incompatibility and other errors rise dramatically. Extensive testing is required to ensure quality and reliability, but still, there isn't a way to guarantee the level of stability that can be expected from a centralized facility. In fact, often redesigning the entire software stacks are needed to support country specific requirements that exist for various locations.

Centralized staffing

Finding qualified people to do the job is a common difficulty in the technology business. In fact, the lack of trained people is the biggest reasons why companies are outsourcing their eBusiness hosting services in the first place. But now, we need to compound that problem by the number of facilities that will be deployed, and add in the issue of lesser-developed countries into the equation. The difficulty here is clearly not a simple problem to solve. Also finding management talent with international experience is very difficult, but completely required if the remote facilities are expected to deliver the expected results.
Simpler people management issues

As an organization expands in size and location, it's natural that people management issues grow along with it. In fact, it grows exponentially. Keeping the staff of a single facility performing at high levels and with high moral is difficult enough. But if we multiply that by a dozen facilities, and across cultures and languages, we can easily see the problem getting out of control.

Greater focus and more efficient use of human resources and capital

In order for any business to succeed, it must be able to focus on delivering its products and services so as to satisfy the needs of its customers and partners. This is even more critical when there are very limited human resources to attack the problem. For example, if it takes x number of people to set up operations in a facility or design/test a software stack for a single language, it takes the n times x people to do the same thing for n facilities and languages. These kinds of things are not very scalable and hence will result in delays for release in the initial target market and potentially reduce the quality. As decisions on various locations and requirements often change, some of the work done by these people could very well be wasted, which could lead to frustration and a lower moral. The ambiguity and fluidity of plans can also cause infighting within the organization and reduce overall output.

When there is a lack of focus in the organization and extensive delays, it makes room for competitors who do have focus to come in and take away market share. Biting off too much is a dangerous mistake, so these decisions need to be considered carefully.

Benefits of Distributed Facilities

As we can see, if eBusiness hosting services had a choice, they would definitely choose to deploy large centralized facilities versus numerous distributed facilities. If there was little impact on the viability of the business, the benefits of centralized facilities are enormous. However, based on the research done for this report, it seems the tradeoffs from not having distributed facilities at this
time would have too large of an impact on the success of the business for them not to pursue this path. Although having a single large facility sounds great in theory, currently the needs and benefits of having them geographically distributed are overwhelming. As technology, customer sentiments, and regulatory policies change, and when international communications infrastructure providers deploy facilities worldwide, the arguments for having geographic distribution becomes weaker. At some point, third party content distribution and system management partners could solve most of the technical issues associated with a centralized facility and customers may begin to change their psychology about the importance of physical access to their systems. But within the next couple of years, this need will not likely disappear. There are also numerous business and political benefits associated with being located in a country. Those benefits will not go away anytime in the foreseeable future.

**Technical Factors Supporting Distributed Facilities**

**Supporting Factors**

In general, the key technical benefits that come from having distributed facilities are in the areas of improved latency, throughput, scalability and reliability. These are the criteria that customers care about, and all these areas can see significant improvements when local facilities are employed. Together, these factors contribute to the customers' perception of quality of service (QOS). Better QOS means more satisfied customers and potentially higher margins. I must point out that the local facilities do not necessarily need to be owned or even operated by the eBusiness service provider to enjoy the benefits, but they do need to have some influence on the operations/system management of the facilities.

**Latency/Throughput**

Latency (response delay) and throughput (transfer rate) for data communication are greatly affected by the transport channel in getting from the source to the destination. These metrics are also what affects the users experience with the service and the content. Everyone knows that it takes time for electric/light
signals to travel from one point to another. The farther the points are apart, the longer the potential delay. However, the distance is not necessarily the major reason why location affects the latency and throughput of the data. Much of it has to do with the path the data took to get from point A to point B, also known as its route. If the data originates and ends within the network of the same provider, the latency and transfer rates are usually very acceptable. However, if many changes of networks are needed (hops), the results can vary widely depending on how the data are handled by each provider. Latency is important, but is mainly a concern for more time sensitive applications like video or voice conferencing and some commerce applications, where things are happening in real-time. The more important metric to most users is transfer rate. This is how long it takes a certain amount of data to be transmitted over the network to the user. The transfer rate can be affected by many factors, but the main issues are network and server congestion. If a network or exchange point is overloaded, the data transmissions will often be rerouted causing delayed or lost (dropped) all together. Dropped packets must be resent and combined with the successful packets at the destination for the data to be useful by the end user. Packet loss can have very dramatic effects on the overall throughput rates, particularly in secured commerce environments. Below are the Intel results relating how packet loss can affect the transfer times of a standard set of data on both 40 bit and 128 bit secured/encrypted transfer environments. The data shows that a 30% packet loss rate can increase transfer times by several X. (see figure 8)

The more hops that are in-between the data and the viewer, and the more congested the link, and the worst the packet loss will be. Just consider a user who is four hops away from the content server. If there is 5% packet loss on each network, the final customer could see a 19% packet loss rate. It's easy to see that having properly placed servers around the world can have very significant impact on the performance of the service.
Server congestion usually results when data/content servers are overloaded by user requests, and cannot effectively handle them. In extreme cases, the server will sometime fail due to the overloading, resulting in site downtime. Having servers and facilities around the world would allow for more efficient routing of requests to avoid network congestion, shorten the transfer path and reduce the number of hops needed to reach the end customer. Several vendors today provide specialized software, hardware, and service solutions to allow vendors to take advantage of the benefits of geographically distributed facilities. These companies include Sandpiper, Sightpath, and Akamai. This can make a very significant impact on the end-user experience. Akamai Networks, a company that specializes in content delivery services employ this methodology to an extreme (servers in over 150 locations worldwide), and claim to have throughput improvements of 10-100x over traditional single location solutions. These benefits can easily be seen when we consider the distribution of rich media like video and audio content. Since these types of media are usually quite large in size, it puts a strain on the transmission network and can potentially cause excess congestion on certain networks. This can be exaggerated when numerous users
try to view the same large files simultaneously, and are all hitting the content server for that piece of data. If the data of interest could be mirrored (full duplication) or cached (duplication of frequently used content) closer to the end user, the congestion on the outbound bandwidth of the content server could be alleviated and in fact, a much smaller transmission pipe would suffice in serving the user needs. This improves both performance and costs.

Geographically distributed servers will also enable load-balancing of the servers to reduce server congestion and enable greater scalability. Below is a graph of server throughput performance comparing data originating from servers inside and outside of the country. The three colored lines (blue, green and red) represent the transfer rate of the fastest quartile, the median and the slowest quartile of the samples made. The data clearly shows that the in-country server consistently provides higher transfer rates for all three quartiles. This finding is fairly consistent across most developed countries, and especially true for the slowest

Figure 9 Throughput performance results – unit kB/sec (Source: Intel '99)
quartile. The slowest quartile is probably the most important, as it is the poorest performance which result in customer dissatisfaction.

Scalability

Scalability of the service is critical to the success of operating the eBusiness hosting facilities, and to the success of the customers whose sites and applications face the end-customer. The rates of demand growth for online companies today are enormous. Sites can grow from a few hundred users to millions of users within months or even weeks. To make the situation worse, the demand on the servers are not consistent. There could be major variations in demand between times of day, day of week or randomly depending on special events or promotions. The peaks and valleys resulting from the rapid growth and wild variations can create havoc on the underlying server systems. Being able to handle this problem is critical to the survival of today's online companies, and thus they need to ensure that their hosting solutions are highly scalable.

The scalability of eBusiness hosting services is affected by the general architecture and design of the solutions, the choices made in the software systems and tools, the capacity/choice of hardware, communication capacity, and the networking solutions. Since geographically distributed servers balance the request load to the servers nearest the end customers, it reduces the need for expensive higher capacity hardware and the need for very high capacity communication infrastructure to the home hosting site. As the site discovers new demand from its customers, they simply need to add servers in areas where the demand is greatest, and hence support the growing needs of the market. Since the solution had always been architected to support distributed servers, adding new servers as
needed should be trivial. As the demand scales, the geographical load-balancing reduces the stress on each individual server allowing better performance and scalability, while adding to the theoretical reliability of the system.

**Reliability**

The reliability or availability of the system is one of the most important concerns of the customers of eBusiness hosting service providers. It's vital to these customers that their sites and services are up and running 24/7, 365 days a year. This means that whenever an end-customer wants to access the site, it's always available. In today's global Internet environment, the concept of business hours no longer exists.

By having numerous servers all over the world serving up data to the end-customers, less stress is put on any single server greatly reducing the chance of overloading the systems. In addition, having numerous servers increases the redundancy of the service, thereby greatly increasing the potential availability of the servers. If for any technical or physical reason (power outage, earthquake, fire, etc), certain servers go down, there will be backup redundant systems in other locations that can take over the load of the disabled servers. For example, if a server currently has 99% availability, just by having a redundant server elsewhere in the world, the theoretical availability goes up to 99.99%. That's a 100x decrease in downtime, and we haven't even considered the benefits associated with load reduction. If redundant servers were located in the same location, there would not be independence in their availability, which would not produce such a dramatic improvement. The redundant systems also allow for easy implementation of planned downtime for maintenance or support. All this creates a greater sense of security for the content/service provider, and delivers a better level of service to the end-user. Without having geographically distributed facilities and servers, this level of redundancy could not be provided by the eBusiness hosting vendor.

Overall, it's clear that there are many significant positive technical impacts for eBusiness hosting providers to have facilities distributed geographically. There
are other ways to achieve similar results without having their own facilities around
the world, but these are tangible benefits that come from having such facilities
worldwide, without creating unnecessary external dependencies.

**Business Factors Supporting Distributed Facilities**

The technical arguments for having geographical distribution of facilities are
fairly strong, but the numerous business benefits are potentially stronger. Since
the business benefits are not all tangible, the basis for the arguments are
generally arrived at from dozens of interviews with potential customers,
partners, government representatives and internal personnel. The general
classes of benefits can be broken down into: Economies of Scale/Learning,
Increased Market Power, Customer Perception/Preferences, New Service
Offerings. Each class of benefits will be discussed below. It's true that
absolute costs goes up as a company expands, but it also gathers benefits in
other ways that reduce its marginal cost and increases its potential to succeed in
the marketplace.

**Economies of Scale/Learning**

Basic economics tells us that as companies get larger and more experienced
they gain economies of scale and improve their processes to gradually reduce
costs. The eBusiness hosting industry is no different. As IOS expands out into
new markets, they expect to reap significant cost savings versus companies who
operate solely in those markets. Intel is well known for their copy exactly
methodologies and they expect to apply these processes to the construction,
platform design and operations of their data center facilities. Since the
processes and designs are only created once, theoretically, there would be
significant cost benefits from sharing the work between multiple facilities.
There will of course be some minor adjustments needed for each location, but
the general setup should be similar, and the operational processes should be
exactly the same.

The software and hardware platforms are also expected to be uniform, thereby
enhancing manageability, reducing validation costs, and improving costs
through volume discounts from vendors. There are significant costs associated with developing and validating the optimal platforms for scalability, reliability, and security. If the development costs can be shared between the centers, it should provide IOS an advantage over smaller scale competitors. It is also expected that any operational learning that is obtained in one facility would be transferred to all the others, thereby accelerating the learning curve, and providing improved quality of service to the customer.

One of the biggest costs associated with operating hosting facilities is the high cost of broadband connectivity, particularly international connectivity. Much of the useful data on the Internet today resides in the U.S., so most countries have very high communication bandwidth to the U.S., but not to other neighboring countries. If the hosting provider can reduce the need for international connectivity by handling local market demand with local servers, significant cost savings can be reached. However, it should be noted that local connectivity in many international markets are quite expensive, sometimes several times the price of the same bandwidth in the U.S., so the aggregate savings on connectivity may not be as large as one may expect.

By properly selecting the facilities location, there are also start-up and operational costs saving potential in geographically distributing the data centers. As many of the other markets being targeted by IOS have lower labor and materials costs than the U.S., the build-out and operational expenses associated with these facilities should be lower. The lower costs will allow them to better compete with local competition, yet provide the world class quality associated a global player. This will be particularly true for emerging yet sizable markets like China, Brazil, and India. In addition to costs savings, there is also potential for significant tax advantage as well. Many countries today want to promote foreign direct investment and hence provide tax benefits and investment incentives for large international companies. These benefits can be quite sizable if properly leveraged by the eBusiness hosting provider.
Since labor costs are usually less expensive in many of its target markets, IOS can also leverage this low-cost high-skilled labor force to support remote operational management or software development for higher cost markets. In addition to cost benefits, this also helps to alleviate the tight labor market for skilled labor that exists in the U.S. and other more developed countries.

**Increased Market Power**

As companies expand in scale and reach, so grows their market power. In the eBusiness hosting business, there are scale benefits beyond pure cost reduction. Since there are significant interdependencies between network providers (NSP), access providers (ISP) and eBusiness hosting providers (eBSP), the larger your share of traffic, content or connectivity, the more negotiation power you have in the relationship. This interdependence exists between companies within the same type and between the various layers. Network providers have bandwidth that needs to be utilized or they will lose money. The ISPs bring lots of traffic, but want to be able to connect to content and services quickly and cheaply. The eBSPs hold the content, but need to utilize the NSPs to deliver it to the ISPs and their customers efficiently and cheaply. Some players act in multiple levels, which create even more complexity in the relationships.

In general, the larger the share you have in any of the three commodities of traffic, content or connectivity, the more power you have in negotiating preferential pricing and terms. Many large NSPs/ISPs make special arrangements amongst each other to freely trade traffic on each other’s networks to reduce costs and improve access (peering). This usually occurs between players of the same size, so there are equitable benefits to be gained on each side. So in order for an NSP or ISP to establish peering relationships with major players, it needs to be a major player as well. This creates a large incentive for these players to want to aggregate as much traffic/content as possible and thus it would provide beneficial arrangements to large eBSPs who can help it do that.
The more networks the eBSP is connected to, the faster it can deliver content between networks and from its customers. This forms a virtuous cycle where more content leads to better performance which leads to higher traffic and better prices. It's clear to see that scale is critical in this business, and having internationally distributed facilities plays a key role in establishing more and stronger relationships with ISPs and NSPs, thus improving its potential for success. In fact, if the eBSP has enough connectivity and content relationships around the world, it can begin to peer with lesser tier ISPs in the local markets, since it is theoretically providing greater value to the ISP than it's getting back in return for access to the ISP's users. As an example, a major Asian NSP was willing to provide heavy discounts to IOS for using their network and facility because it believe IOS could bring in significant content and traffic, and provide access to a major international NSP.

If the eBSP properly plays the game, there's a potential for it to turn itself into an Internet exchange point, where multiple NSPs and ISPs exchange traffic and source content. If this happens, than the eBSP build even more negotiation power against the other vendors, and can play them off each other in bidding down the access charges and providing better levels of service. At that point, they become a NAP (network access point) or central aggregation point for telecom providers. In the U.S., there are already several major NAPs, but many international markets haven't yet established such facilities. An aggressive eBSP with a local facility has the opportunity to get in early, scale quickly and become the recognized NAP for that market. In addition, the heavy investment associated with a broad-based expansion signals that the vendor is serious about staying in the business and provides a barrier for entry for potential competitors that should keep the eBusiness services marketplace a little more stable.

**Improved Customer Perception/Preferences**

Being a company’s eBusiness Hosting Provider is a critical service that is relied on by today’s businesses. If an online company’s site goes down for a few hours or even minutes, it could mean a 10%-20% drop in that company’s market cap (i.e.
eBay, E*Trade). This is serious business to eCommerce companies, and who they choose to be their vendor depends greatly on their perception of the ability of the vendor to meet its service, reliability and performance needs as it matures and expands. The price of the service is really only secondary. So the brand and credibility of the eBSP is extremely important, since it's such a big part of the decision process for its customers.

Many things play a role in determining the perception of the eBSP in the eyes of its customers, but location happens to be one of those things. There are two major concerns when it comes to facility location for the eBSP customer:

- Can I get access to my equipment?
- Are they located close to my customers?

eBSP customers seem to have a need to be physically close to their servers so they would theoretically be able to see or touch the system if something goes wrong. This need probably comes from the traditional IT experience where IT professionals monitor and maintain their servers personally, and are responsible for making sure things don't go down. In the normal collocation hosting scenarios, this need is quite important and real. However, with the new managed hosting solutions, there is practically no need for a company's IT people to physically touch the server hardware. In fact, in a managed hosting facility, the customer is not even allowed to touch the systems as the machines are locked up in a secure environment. System management can be handled remotely, and the physical operations can be performed by personnel at the eBSP. Still, this experiential bias from the past greatly affects the customer's trust for the vendor and they consistently prefer companies that have a physical location near their offices. (Also see Jupiter results below) In time, this concern will likely fade, as vendors prove their capabilities and improve quality of service.
Another explanation for companies wanting to have a local facility is that it shows commitment to the market and the country. Companies don’t want to move vendors often, and want to make sure that they will be around for a while. If the

![Figure 11: Key Customer Concerns (source: Jupiter 3/99)](image)

> "Please rate your hosting firm on..."

- Performance and reliability
- Security
- Application knowledge
- Tech support
- Global capability
- Proactive monitoring
- Vision

Average of 22 Fortune 1,000 companies that use hosting

![Figure 12: Hosting Provider Feedback (Forrester 6/99)](image)
eBSP is ready to invest tens or hundreds of millions in a data center facility, it lends greater credibility to the commitment of the vendor.

The second major location concern of the eBSP customers relates to their customers. They want to be able to efficiently serve their customers anywhere in the world. Since the Internet is global, most online businesses are serving customers on a global basis and they feel that their customers will get a better user experience if there are hosting facilities that are geographically located near their major markets. This is a valid concern, and the major reasons were discussed in an earlier section in this chapter. For almost every MNC (multinational corporation) customer we talked to, one of the first things they wanted to know was where our facilities are located and when they would be deployed. The Forrester data below shows that customers are concerned about the global capabilities of their eBSPs, and want to see more global deployment from them. Unless an eBSP can show that they can properly serve the needs of their customers, most commerce/content companies would keep looking. They are willing to settle for a less optimal solution in the short-term, but they need to see that broad-based geographical expansion is in the plans. Geographical distribution is vital to build customer trust and credibility, so even if there were no technical merits, eBSP may still choose to deploy facilities globally.

Another issue with customers is their perception of the quality of support services. Even if the actual hosting facilities are not located near the customer, they still want to have access to local technical and sales support services. No technology or service is full proof, and problems will arise. They want to make sure that there are people they can call on to fix their problems and take responsibility for issues that arise when it happens, not when they come into work the next day. Having a facility nearby gives them this sense of security. It means that there will be local language support personnel, who are available at the same hours they will be awake, who are familiar with the operating environments they use and could be reached via a local call versus expensive long distance calls. For countries or markets that doesn’t warrant full-fledged facilities, having a customer sales and support center nearby may be sufficient for most customers.
This brings us to the matter of sales channels. Since eBSPs depend on external sales/referral channels for a large portion of their revenues, it's extremely important for them to have close and supportive relationships with their channel partners. The channels could range from ISPs/NSPs (i.e. Dacom, UUNet), to system integrators (SI – i.e. PWC, Andersen), or web developer agencies (WDA – i.e. Proxicom, RazorFish), and even referrals from existing customers. The channel partners can be local or multinational companies, and having sales/support centers or data centers near their facilities can be very helpful in getting mind share from and building strong relationships with channel partners. The partners often want to use the facilities for their development cycles and for validation processes. Since most international markets have their own operating system versions and local language support issues, the validation and integration process for these channel partners will play a significant role in allowing for rapid deployment to the customers and for the channel partners themselves to better understand the usage of the eBSP's hardware and software platforms.

If the facilities are nearby, they have a higher tendency to use them and build confidence in recommending the services. It's critical for a sales channel to believe in what they sell or recommend, so this level of close interaction allows for the channel partners to build the knowledge or data they need to close a sale with local customers.

In addition, the facilities aid in the selling process. Seeing the level of security, the operational processes and the impressive high technology in the centers usually create a greater sense of trust in the vendor. This is particularly true for IOS facilities which were designed to be customer showpieces in their features and layout. You can get a sense of that from the picture of the IDS1 Network Operations Center (NOC) below. It looks very impressive and is intended to remind customers of the NASA control center.
With many industries, pricing is the biggest decision criteria when choosing suppliers, but in the eBusiness hosting industry, it’s really a secondary concern. Since the services are mission critical to the operations of the today’s new economy companies, they tend to be more willing to trade off price for other factors that are higher on their list of concerns. Below is a study done by Giga on key buying concerns. It clearly shows that pricing is one of the lesser issues in the minds of the customers, particularly the eCommerce companies. By having facilities worldwide, an eBSP can more easily offer different pricing plans and make possible premium high-margin services to global customers. This will allow for adjustments to local cost differentials, competitive pricing and local promotions, without enabling various forms of pricing arbitration from their customers. This kind of freedom is a benefit that can yield dividends long term.
Enables New Service Levels and Offering

With the deployment of data center facilities and servers around the world in major markets, the benefits go beyond just cost advantages and market presence. There are actually new levels of service and new services all together that can now be provided. In the competitive market environment for eBusiness services, any level of differentiation can mean the difference between success and failure.

In the last few sections, we've already discussed the performance and reliability advantages associated with having multiple facilities. For customers that see their sites and content as mission critical, these are services that build customer loyalty and increases sales margins. In this business, a seemingly small change in service level agreements, can mean very significant differences in fees (i.e. an uptime guarantee of 99.9% vs. 99.99% can result in a doubling of fees or more). Response times, transfer rates, and bandwidth utilization will also see major improvements. eBSPs will now be able to significantly improve SLA (service level agreements) to take advantage of the capabilities made possible by the facilities infrastructure. As an added service, backup storage to offsite media
(i.e. tapes), can now be provided in near real-time for customer data and applications. Customers will never be afraid of losing their valuable information again.

Redundancy goes beyond just customer systems and applications, it also applies to the operations monitoring and control. With multiple command centers (NOCs) and remote monitoring and control capabilities, customer servers can be managed even if the systems fail in any one NOC or just that domain specific expertise was not available in any specific location. This capability can reduce labor costs and improve quality of service.

With multiple facilities around the world, several types of new services are now possible. Examples would include more robust disaster prevention and recovery services where full site duplication or mirroring can now be offered to customers with very large traffic or who demand extremely high uptime levels. If anything happens to one site, the redundant systems would turn on or take over.

Some forms of content distribution services will also be possible. Since the web servers will be connected directly to numerous NSPs and ISPs, the number of hops to most customers will be very low, and with some intelligent routing within the data centers, extremely high performance can be achieved. Rich content distribution services will also be made more efficient. As the content can be duplicated in each data center and on the edge-servers, the need for all users to access data from the home content server is greatly reduced. Rather, the end-users would just pull content from the nearest servers. This means now the eBSPs can offer streaming video and audio content. The ability to do more real-time applications is now possible. Applications like video conferencing or voice over IP (VOIP) and time sensitive commerce/database will now see dramatic improvements in latency, throughput, and cost.

The trend in the future is for software vendors to put their applications on the network and hosted by eBSPs so that end-users can just download and run these applications online when they need it, versus buying a CD-ROM and
installing it on the users' systems. This is called the ASP (Application Service Provider) model, and would be made much more responsive and cost effective with a distributed facilities infrastructure. Applications like transaction processing and online gaming where low-latency is demanded can now be serviced by the eBSP, where as previously, many of these vendors retained their own private networks to handle their customer demand.

These are just a few of the potential new services that are made possible by having distributed facilities and services. As technology and user needs develop, it's clear that having servers located around the world close to the customers will yield far-reaching benefits.

**Social/Political benefits Supporting Distributed Facilities**

In the U.S., people take for granted the value of social and political benefits of deploying operations internationally. In more mature and politically free countries like the U.S., these factors have less impact on the success of the company. However, in developing countries or more controlled countries like China, India, Malaysia and even parts of Europe, the commitment to build high capital investments in a country can dramatically improve the publics and government's view on the company. Also, the financial impact of such projects has deeper reaching consequences on the city or region where they will be built. Many international cultures base a great deal of their business decision making on the relationship built up between individuals and companies. In order to succeed in such environments, there is no substitution for being in the country, building relationships and showing a real sense of commitment and joint risk taking.

**Social Benefits**

The social impacts were somewhat discussed in the earlier customer perception section, but here we will look at the issue from a slightly different perspective. Beyond just creating better customer perception, having local facilities really do create a deeper connection with the local market. If the facility is sizable, many individuals will be employed in the facilities and financial impact will be made on
the local economy, either at a city or regional level. There may only be dozens or hundreds of people affected in the beginning, but creating new employment in a relatively high-paying high-skilled area, is of real value to the local economies.

The initial capital investment in building these facilities also create income and employment for local individuals and businesses. Often, in lesser-developed countries, these kinds of development create real news and interest amongst the local market. There will be significant awareness within the country or region about the activities without having to do much marketing activities. When marketing activities are combined, the effectiveness of those activities are improved when combined with the predisposition of the audience towards locally based companies and the mind-share already created by the press.

The press attention also allows for a chance to educate the local market and the future customers of the eBSP. The eBusiness Services industry is relatively new in the U.S., and very new in most other places in the world. This means that demand needs to be generated through large amounts of education and relationship building. Both activities can be enhanced or accelerated with the presence of a local facility.

The need for relationship building goes well beyond potential customers, it's integral to every part of operating a business in many markets. The ability to sign on leading suppliers, partners and channels can all be improved when there is mind-share created through the popular press, social exchange and personal contact. Their level of commitment to supporting the eBSP can also be enhanced through deeper relationship building and a sign of long-term commitment to the market.

Political Benefits
The importance of government support and approval in many international markets is often underestimated. In many cases, it's the difference between major success and total failure. The governments in many countries can provide both benefits and detriments to businesses trying to enter a market. Generally the
areas of impact of governments are associated with three major areas: Regulatory, Partnership and Financial.

**Regulatory Impact**

In the eBSP business, this relationship with government is even closer, as telecommunication is a heavily regulated industry in most countries. Since eBSPs leverage the communication infrastructure and often is in control of content to the end-user, the concern from many governments is very critical. The U.S. government generally provides companies operating in the country with much freedom in how to conduct their businesses. However that’s not the case in a lot of countries. The regulatory and administrative bodies of the government can often limit or even prevent companies from operating in ways that is needed for them to succeed. Just to do business in some countries, there needs to be approval from the local government or regulatory bodies. These approvals can take on the order of weeks, months or sometimes even years. When there is governmental support at very high levels, these approvals are processed much faster. Major delays do spell disaster in faster moving technology or communication industries.

In relations to the eBSP business, the governmental bodies are usually concerned with economic growth, technology transfer, social welfare, content control and protecting national companies from foreign competition. For example, China is very interested in foreign investments, technology transfer and content control, Malaysia is very interested in economic development and job creation, and Singapore is most interested in economic growth and content control. Particularly for foreign entities, there needs to be significantly value-added to the country, or their concern with protecting local companies will cause significant delays in approval or reduction of benefits. One of the best ways to gain the support and confidence of the local governments is through direct foreign investments in local capital-intensive projects. This addresses almost all their major economic, technology and social concerns and gives them a greater sense of control over content. Often the local competition is somewhat behind in technology or
process compared to the foreign entrant, so the governments may even have greater incentive for getting the entrant in the market and cooperating with the local players to improve their capabilities.

**Partnership Impact**

Strong strategic partnerships in the eBSP business are one of the most important concerns in successful operations. The eBSP depends on NSPs to provide connectivity and sometimes even housing. It depends on support from local ISPs to provide access to customers. There is a need to build local sales and support channels to acquire and service customers. With strong governmental support, the effort in identifying and building partnership relationships can be greatly improved. In many countries, the telecommunication providers are usually government owned or government related entities, so there is a significant impact in how the government's view of a business will affect which partnerships it recommends or allows.

In most of these countries, it would be a great advantage to be able to have an exclusive partnership with the leading incumbent telecom provider and so as to get protected access to its massive customer base. They often have monopoly ownership to the telecom connectivity and customer base in the country. Partnering with such an entity would mean access to a sustained stream of customers, instant credibility, abundant bandwidth and low cost connectivity. However, if the local government doesn’t believe in the capabilities or commitment of the eBSP, it’s unlikely that they would allow it to operate in the market and certainly wouldn’t provide partnership access to the leading incumbent. In a country like China, Joint Ventures (JV) are the only way for foreign entities to enter the market, so having the right partner/s really do matter. Even in more developed countries like Japan or Korea, having the right partner is vital. There are very strong ties that exist between corporations, so having the wrong partner could mean being locked out of large segments of the customer base. Often getting the right partners and having strong government support are
closely tied. In most places outside of the U.S., it's not just about economics and profits, it's about relationships.

Even with channel partners, having the right support from government entities could have major impact on who wants to work with you, how fast they come to such a decision, and at what terms they want to partner. We saw this several times in countries like China, Malaysia and Singapore, where governments had strong influences over the commercial markets.

**Financial Impact**

Of course we can't overlook the direct financial impact associated with having favorable government support. Many countries have special privileges or tax benefits that could be handed out by the local governments to appropriate recipients. Often these privileges are reserved for big name or high investment companies. Usually these privileges are associated with building offices or facilities in special areas or economic zones. The long-term financial impact of these benefits can sometimes far outweigh the initial capital expenditures, and the relationship effects are certainly significant.

For example, many countries will hand out benefits such as tax free status, reduced tax status, duty free import privileges, reduced facilities leasing costs, preferred access to applicant pool, and preferential pricing on operating expenses (utility, connectivity, power, etc). Over time, these kinds of benefits can really add up, and make the overall financial returns on the investment quite attractive. The total benefits could easily be in the millions of dollars for countries with a sizable market. All these benefits are made available, if there was significant local investment. Building and operating data center facilities (even smaller scale facilities) would qualify companies for these benefits. When combined with the numerous other technical, business and social benefits, the decision to deploy facilities in markets with preferential treatment become even easier.

**Summary**

This chapter clearly shows that deployment of geographically distributed facilities
is not a trivial task, and comes with issues relating to costs and complexity. However, if we weigh that against the total benefits associated with proper international deployment and what that enables, the benefits do outweigh the costs. There are many ways to implement the actual deployment process so as to minimize the costs and reduce the initial complexity, but that is beyond the scope of this document. It suffices to say that with proper planning, and liberal use of facilities and operations outsourcing, the benefits of geographic distribution can be enjoyed with a limited impact on overall cost, schedules and complexity.
Chapter 5:

Site Selection Framework, Process and Tools

Chapter 4 described the many reasons why having geographically distributed facilities can be beneficial for eBSPs. In this chapter, we will discuss how an eBSP could objectively decide how to place those facilities in order to get the best results. Here we are concerned about the key questions of where and when to deploy. The tools and processes discussed can also provide some guidance on what scale the facility needs to be.

These processes were developed during the research project with IOS, and applied in the process of determining the overall facilities roadmap for the division. Although the factors considered in the analysis where the key concerns for IOS management and personnel, I believe these factors have general applicability to eBusiness service facilities in general. There may be a need to make minor adjustments to specific factors or usage processes when applying these tools outside of IOS, but the general framework and evaluation process could be applied with minimal modification.

3-Phase Facilities Distribution Framework

For the general decision making process, it's often helpful to have a framework and a set of tools to work with. This helps to solidify the process and ensure consistency between individuals. The general process consists of three phases: Analysis, Planning, and Execution. Under each phase are several sets of activities that should be conducted in order to arrive at an objective solution. The framework is relatively straightforward to understand and easy to follow. It does take some effort and rigor to follow-through, but the results will be superior to intuition and guesstimation techniques used in many corporations. It may take slightly longer to get started, but the time and money saved as a result of better decisions in the long-term will more than make up for the initial efforts. Poor decisions in the early analysis can create long-term impact that could endanger the
viability of the entire project. It's critical that enough time and rigor is allowed in the early stages to ensure proper decision-making. This will result in less direction changes in the later phases and broader buy-in from the team involved. If the process is rushed, many valid issues will not be heard or identified, and hence will not be taken into account in the execution plans. Frequent changes in plan leads to lower team moral, higher costs, and massive inefficiencies.

Below is a summary diagram of the framework and its underlying components. The remainder of the chapter will follow the flow of the process and describe the tools and techniques associated with each of the phases. It's important to note the phases need to be iterated after each deployment, so as to learn from the new information gained from the last round, and include those learnings into the next implementation. The iterations will accelerate over time as the analysis and planning sections can be significantly shortened, since only minor changes to occur after the first couple of rounds.

![3-Phase Facilities Distribution Framework](image)

---

**Figure 15**: 3-Phase Facilities Distribution Framework
Analysis

The analysis phase is probably the most important phase of the process, as all the other phases build on the findings here. However, it is often the phase that is given the least attention. Conducting a rigorous analysis based on real data will yield strategies that have a much higher likelihood of success.

Market Analysis

The first step is to understand the market environment and potential in the countries/regions that are being targeted. This means not just a cursory look at major market statistics (i.e. GDP, population), but rather a detailed analysis of the factors that directly relate to the services that are being provided. Conducting this analysis on a global basis (at least major markets) is recommended so as to allow for clear comparison of the markets with the same lenses. Many times a thorough analysis will bring out surprises in markets that would have went by without notice. Table 1 below is an example of potential consideration factors used in evaluating the target markets for an eBSP. More detailed market analysis worksheets are available in the appendix sections.

Table 4: Sample Factors relating to eBusiness Services Market Analysis

<table>
<thead>
<tr>
<th>Market Size/Potential</th>
<th>Infrastructure/ Tech. Readiness</th>
<th>Social/ Political Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Customer/ Partners Identified</td>
<td>Current Network Capacity/ Sophistication</td>
<td>Availability of Gov. Support (1-5)</td>
</tr>
<tr>
<td>Ability to Spend for Data Services (1-5)</td>
<td>External Connectivity Bandwidth (Mbps)</td>
<td>Stability of Gov. (1-5)</td>
</tr>
<tr>
<td>Expected 2003 Market Share (%)</td>
<td>Ability to Support other countries (1-5)</td>
<td>Stable Legal System</td>
</tr>
<tr>
<td>Competitive Strength/ Position (1-5)</td>
<td>Robustness of Power and Facilities (1-5)</td>
<td>Availability of Skilled Labor (1-5)</td>
</tr>
<tr>
<td>Internet User '99 (M)</td>
<td>General IT/ Computing Maturity</td>
<td>Attractive Cost Structure (Labor Costs)</td>
</tr>
<tr>
<td>Internet User '03 (M)</td>
<td>Electronic Financial Systems Readiness</td>
<td>Channels Identified (% of Market Covered)</td>
</tr>
<tr>
<td>Total Urban Population (M)</td>
<td>Teledensity (%)</td>
<td>Strategic Importance to Mgmt (1-5)</td>
</tr>
<tr>
<td>97 GDP PPP (U.S.$ T)</td>
<td></td>
<td>e-Commerce Urgency (% of Company with Website)</td>
</tr>
</tbody>
</table>
It's important to provide numerical representations of the results, so that fair comparisons can be made between markets. The factors should be arrived at through extensive discussion with internal and external domain experts so as to ensure proper representation of the key concerns. As not all factors are as important, specific weightings need to be given to each factor (i.e. range of 1-5). The weightings are quite important as they can have a major affect on the aggregate scores. Be sure the weights correlate with the requirements and goals of the project. It's key to make sure that all major stakeholders participate in deciding the weightings, and they are agreed upon prior to the undergoing the study. A couple of rounds of peer review are also recommended. This is also helpful in gathering support for the results in the future steps. It's important that people generally agree with the measurement factors upfront, or the results will have little value later on in the process. (some example worksheets are in the appendix section of this document)

It's best to keep the sources of data consistent across markets (i.e. same research firm) if at all possible, since there is large variance between sources for the same datasets. A sample market analysis worksheet for a subset of markets done for the IOS analysis is attached in the appendix. This can be used as a reasonable guide for how to layout the content.

The data can be gathered from a combination of secondary and primary research. Since the evaluation factors/criteria are known upfront, the data gathering process is usually fairly straightforward and can be done in a relatively short time. If time allows, it is also recommended that personal interviews be conducted by the team with experts in each of the target markets to validate and supplement the external research. Market research data in many international countries cannot be fully trusted. The interviews would also be a great way to get to understand the special market needs. Since each market has different characteristics in relation to technology maturity, social compatibility, supplier power, financial infrastructure, and governmental involvement, they all need to be considered individually when operations are setup. Understanding the requirements of all the key stakeholders in each market is critical for smooth entry and operations in the markets.
Below is a sample chart of a global market analysis displayed in the three dimensions of Social/Political Compatibility, Infrastructure/Technology Readiness, and Market Size Potential. The chart is also broken into four quadrants, each with a primary action associated for the eBSP. When displayed in this format, the location roadmap and general priority becomes much clearer. The responsible person can easily weed out for immediate market entry the countries that don’t appear in the upper right hand quadrant. If there are countries which appear on the final roadmap that didn’t fit into the upper right quadrant, there should be other substantial justification for them to be there. This just helps to add rigor to the whole process. Market will not just appear on

roadmaps because a particular vice president really enjoyed his/her last visit to the country.

To present the analysis results in an even more simplified way, all the major factors and categories can be summarized into one single aggregate market score. This score is the sum product of the category weights and the category scores. Of
course all the categories and sub-categories are normalized so that the scores can be easily compared. (More detailed worksheets available in the appendix) In the sample chart below, you see that each market has an aggregate score, and three priority levels are slated for the various markets (Top Tier, Next Phase and Delay Development). The top tier markets should be enter as soon as possible based on other constraints, where as the next phase markets are those that should be considered once facilities in the top tier markets have been deployed. Since in the eBSP business, geographic distribution is important, the countries are sorted by market regions so that appropriate countries in each region can be evaluated versus other in-region markets and markets in all other regions. In some companies, markets are only compared against others in the same region, which can sometimes lead to poor tradeoffs when deciding market priority. When making a global facilities deployment roadmap, a global perspective is required. An aggregate scoring process really allows the evaluation results of the markets to be communicated efficiently within the organization and to upper management.

![Aggregate Market Rating](image)

Figure 17: Aggregate Market Attractiveness Ratings Chart (by Region)
Once the major target markets have been identified using the previous tools, the question of which order to deploy them becomes very important. There are many factors that will affect the actual deployment order. These could be issues such as availability of facilities, availability of personnel, or legal approval. However, knowing the market maturity of the target markets can give an objective sense of urgency on where the facilities would ideally be placed so as not to fall too far behind in the competitive space. Figure 18 below is the sample output of the market maturity worksheet, which compares the time lag of major markets against the leading Internet market (U.S.). (More details about the factors used in developing the timeline are available in Figure 23 in Appendix A.) With this maturity timeline and the market evaluation tools, the ideal global roadmap should fall into place. Then it’s just a matter of accounting for real world issues that prevent the eBSP from following through the ideal arrangements.

![Global Internet Market Maturity Timeline](source- IOS, '99)

Figure 18: Sample Market Maturity Chart
Customer Analysis

Probably the most important stakeholder to understand is the customer, particularly since their needs and wants vary dramatically between markets and customer types. The analysis is used to evaluate what exact services the customers need in each market, what the market specific requirements are for that market, and their willingness or ability to pay for the service. All this data is compiled into a document call the Customer Requirements Document (CRD), which is used by the product marketing and engineering groups to design the right service offerings and pricing schedules. In order to develop deep understanding in the customers' mindset, it's recommended that several types of research techniques be used simultaneously to ensure completeness. These techniques include secondary customer analysis be major research firms, contracted primary research based on focal groups, interviews and surveys. Again, direct experience for the project team to interact with the customers are critical in both helping to understand the results of the reports and validate the data that is gathered. During internal meetings with customers, its helpful to use a standard questionnaire, so that the results can be analyzed quantitatively after a significant set of interviews has been gathered. Attached in the appendix is a sample customer interview questionnaire. Using the same type of standard forms for interviews potential suppliers, partners and even competitors are also recommended.

Technical Analysis

Essentially, a good technical analysis of the market gives the eBSP a thorough understanding of the technical maturity of the market and the communication infrastructure, any market specific technology or compatibility considerations, and the difficulty (viability) in deploying the required services in the targeted market. The customer, supplier and channel interviews are also very helpful in completing the technical analysis of the market. Significant amounts of time is needed in having the right technical experts in the eBSP talk with local technology suppliers and service companies to evaluate the questions above. All this data will be extremely useful in understanding the time, man power and cost required to
provide the required services in the market. It also should assess how ready the customers are for the intended services. All this data will play a significant role in helping decide the market entry order and priority.

**Financial Analysis**

Since most companies are in business to make money, the financial analysis of the project is quite important to determining whether or not to pursue a project. This seems obvious, but not all project managers do a thorough financial analysis prior to embarking on the execution of a project. Usually the excuse of time-to-market and unpredictable market environments are used to eliminate this essential step in the decision analysis process. Even still, a first order financial analysis based on known data needs to be conducted.

![Asia Revenues by Country](image)

Figure 19: Sample Market Revenue Forecasts (Y axis scale removed intentionally)

It is recommended that both a top down and a bottoms-up approach be taken in the financial analysis process. The top down approach takes into account the high-level market statistics like market size and growth, and assumptions on market share and costs. The accuracy of the data and assumptions are very important, so pay special attention to verifying that they have grounding and take the conservative approach to using market numbers from market research firms. This process should provide a general first level approximation on where the market is heading, and whether a project has any potential for viability. This
information can be gathered and calculated relatively quickly, but too often is not
done. Once this information is available, it can be included in the analysis
framework for making the overall recommendations. In the figures below, you
will see the outputs of some of the high level analysis. One is a per market
revenue forecast based on reasonable assumptions, and the second is the
profitability chart for one of the regions in question. There are more tables in
Appendix A on page 86 that describe the underlying worksheet format.

![Sample Revenue Forecasts](image)

Figure 20: Sample Regional Revenue Forecasts for an eBSP (not actual)

After this, a detailed bottoms-up approach should be conducted for each of the
markets that the eBSP decides to enter. This is to verify that the assumptions in
the top-down model are correct, and take into account detailed cost/revenue
factors that come into play when real operations are to be deployed in a certain
location. This process takes a little more study to ensure accurate inputs, but
there will be less markets to evaluate, and the results can be used for helping guide
the pricing analysis as well as the negotiation arrangements with vendors, channel
and suppliers. Below is an example of the output of a bottoms-up margin
analysis for two separate revenue models. In the chart below, easy to see that the
Model 2 is preferred no matter what the scale of the facility is. This information
is also very helpful for finding out the minimum economic scale of facilities so that proper attention can be made in the site selection and overall planning considerations. Due to the analysis results from this process, IOS was actually able to eliminate several potential facilities configuration due to economic viability issues.

![Revenue Model Comparisons](image)

Figure 21: Sample Margin Analysis (not representative of actual values)

Although financial analysis is quite important, we need to realize this is just one part of the analysis framework. Some companies make their market entry decisions purely on a financial analysis basis, and optimizes the total expected return over time. Unfortunately, any pure financial analysis requires the liberal use of assumptions on market and market share data for each targeted country. With all the uncertainty in forecasted market potential numbers, the uncertainty on costs over time, and the unexpected affects on pricing and market share due to competition, it would be misguided to expect to decide on entering a market just from data arrived at using these assumptions.
Plan

Now that we have gone through the process of gathering and analyzing all the necessary data, it’s important to make use of that data fully in establishing the various levels of plans for the organization. This section describes the basic in the facilities planning processes. There is much more worked needed in the service, technology, marketing, sales planning aspects to make the data centers successful, but that is beyond the scope of this document.

**Facilities Roadmap**

The facilities roadmap is one of the most important documents in the planning process and a critical communication tool for the internal organization and to partners and customers as well. Internally, the roadmap is used in prioritizing all the resources of the organization, and evaluating if sufficient resources even exist. This document creates direction and focus for the organization, and should not be altered lightly, as the ramifications of the changes can be far ranging. Externally, customers and partners depend on the information on the roadmap to plan out their resources, capabilities and schedules. As the Internet is global, the data center roadmap is a map for the globalization plans of the eBSP.

Above is a sample roadmap to help the reader get a better feel for what types of

---

**Data Center Roadmap**

<table>
<thead>
<tr>
<th>Data Center</th>
<th>Partner &amp; Location</th>
<th>(time units removed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>US NW (SEA)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>UK (London)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>US East (WDC)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>France (Paris)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mexico (? Mexico City)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Singapore (? Singapore)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>India (? Bombay)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Japan (? Osaka)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PRC (? HK)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Germany (? Frankfurt)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Australia (? Sydney)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Israel (? Jerusalem)</td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**

(Note: Times, order and locations are not representative of actual plans)

- Size A - Full-size Class A DC
- Size B - Smaller than Size A
- Size C - Outsourced facility
- Implementation Begun

Figure 22: Sample Facilities Roadmap (not actual)
questions are answered. The facilities roadmaps are concerned with location, timing, facilities type, partner support, and facilities expansion and build-out schedule. Essentially, it is a one-page summary of where the organization is heading in the near future. Since everyone is marching to this plan, making sure to have a sound and stable roadmap is key to the overall success of the organization. Spending some extra time here to make sure there is general agreement from all major stakeholders is essential in making sure the roadmap isn’t too dynamic a document.

**Capacity Planning**
Just as manufacturing companies spend enormous amounts of time on matching production capacity with market demand, the eBSP needs to plan its service and server capacity according to the market needs. Since services are unlike products and can’t be inventoried or redistributed as needed, careful planning may be even more important here. Working with the sales force on customer demand forecasts together with data gathered from the earlier market analysis work will help balance market potential with market realities. Having over capacity can lead to excessive costs, execution delays and increased complexity, while being under capacity may lead to losing market share and satisfaction of customers. The capacity planning process should be considered within the context of the roadmap as well, so that the project planners can assess the over service capacity of the organization at any one time and the capacity at any of the local markets. Safeguards must be put in place so that capacity and capabilities of each facility can be ramped quickly if the demand realities exceed the forecasts.

**Partner/Facilities Plan**
An eBSP can enter markets in several ways, green-field development (option 1), build-out an existing facility (option 2) or build-out a portion of an existing facility (option 3). Depending on the capacity and time to market requirements set forth from the previous analysis, it will unusually be fairly self-evident which of the solutions are the most appropriate. Greenfield projects, where pretty much everything is created from scratch provides the most control to the eBSP in meeting all their requirements, but will usually cost the most and take the longest
Building-out an existing facility will be slightly faster than green-field projects, but you will have much less flexibility in location and partners, and may be forced to accept unwanted or non-optimal solutions due to legacy from the previous owner. The building out a portion of an existing facility will usually be the cheapest and fastest solution, but has less scalability than the other solutions, puts the eBSP to be under more some control by the facilities owner, and may create a relatively high operating expense stream.

For markets where long-term market demand will be large, and full technology control/flexibility is critical, then option 1 is likely the best option. These would be places like the U.S. and the UK. For markets where the existing facilities are quite adequate in meeting most of the major requirements, and the market demands a major facility, then option 2 should be chosen. These may be places like Japan, Singapore and Australia. For markets where demand is still limited or where entry timing is the most critical piece, then option 3 is probably the best choice. Option 3 can be a long-term solution for smaller markets, and an intermediate quick time-to-market solution for larger markets that would be followed by an option 1 or 2 deployment. These may include locations like Korea, China, and India.

It should be noted that entering a market usually involves selecting both a facility or location, and several partners in the market to support various aspects of the market entry. As discussed in the analysis section, having the right partners can be the most important factor in determining the success of the project in a market. Often telecom partners would also make very good facilities partners as well, since they have the type of facilities that the eBSP is looking for and the facilities are already outfitted to connectivity and security needed to operate. So choosing the major market partners first will be helpful, as this will likely influence or limit the choices in facilities locations. The marketing and business groups within the organization need to work very closely with the operations and facilities planning groups to make sure these partner and market requirements are included in the final facilities selection process.
As part of the selection process, often detailed request-for-proposals (RFPs) are sent out to the leading partner candidates to evaluate their ability to meet the overall demands on the local partner. Items to consider include such things as technical infrastructure, network performance, service quality, scalability, domain knowledge, and support capabilities. Having the partner selection, facility capacities and market needs in mind, the site selection teams can move forward in determining the most appropriate facilities that will meet the technical, strategic and market requirements. These steps sound simple enough, but are too often not done properly in many organizations.

**Deployment Plan**

As with any major construction project, very detailed deployment and facilities plans are needed to ensure proper execution. Since these facilities are supposed to be theoretically identical in features and capabilities, much of the plans can be reused for facilities of the same class, and even some cross tier sharing is possible, as the lower-tiered facilities are really offering subsets of services of the higher-tiered ones. This is one of the major scale benefits of having multiple facilities. The development and design costs for the facilities need only be bared once for the entire organization. However, it’s important to realize that none of the facilities will be exactly identical, so market adjustments need to be accounted for. Usually acquiring local market experts in resolving these issues have proved to be the most efficient ways to proceed.

**Execute**

The third stage of the Facilities Distribution Framework is the execution stage. This stage is probably the most conventional portion of the three stages, so it will not be discuss in much detail here. The most important thing to remember while executing the deployment plans is to record the learnings that come out of each experience so that they may be reapplied into the later facilities. It is recommended that specific processes are put in place so that such learnings are not lost, and can be uniformly transferred to existing and future projects.

**Secure Facility/Site**
Securing the actual site or facility starts off the actual deployment process. With that in place, the local market partners have likely have been selected as well. The rest of the organization can feel secure in executing on their responsibilities and know that plans will not be in a state of constant change. Careful attention should be paid to the legal contracts and the payment schemes with the local partners. It's best if synergist goals and incentives are put in place so that a competitive situation is not created, but rather that all partners should benefit from the success of the operation. Otherwise, the partnership relationship will fail and the eBSP will have succeeded in creating a well-trained competitor.

Acquire Staffing
Having competent and hardworking staffing is a vital piece to deploying the facilities. This is particularly true due to the technology intense nature of the business and the importance of service quality to the customers. Unfortunately, the kind of staffing needed for running these facilities and servicing the customers are a rare commodity. It is likely that the initial staffing, and maybe even longer term, will come from the local partners or be sourced from a local contracting house. It is recommended that personnel from the headquarter operations be deployed to the distributed sites to train and manage the local staff. Over time, the management of each facility should be transferred to local personnel, as common processes and culture are in place.

Facilities Build-out
There are several tiers of facilities, each with slightly different demands for the build-out process and scale to worry about. The larger facilities will need to have NOCs in place to manage and monitor the facilities and communicate with the rest of the facilities network. However, the smaller facilities that lie without a lease facility will likely not have a local NOC or have a very minimal configuration. It is also recommended that the facility not be built-out all at once, but in phases that just stay ahead of customer demand. The underlying network, security and monitoring infrastructure should be deployed at the beginning, but the server and storage units need not be all installed at the very beginning. The cost of these pieces of equipment can be quite high ($10-$200k/server), and their
value drops exponentially with time. There is also a relatively short leadtime for acquiring these components, so delaying the rollout has very little negative consequences, but can mean enormous cost savings.

The actual build-out is relatively straightforward and should be easily contracted to most local or international service companies. Some of the more intricate areas of the deployment can also be carried out by a trained team of deployment experts, which the eBSP has formed especially for handing this task. After a few rounds at this, the specialist team should be able to turn around facilities on a rapid rate due to the enhanced camaraderie and the benefits of learning.

**Deploy Services**
Once the facilities, equipment and staffing are in place, the next step is to deploy the services. Since all the testing and validation was done in advance, there should not be any major roadblocks in the deployment of the software and services. However, this is the first time that the full combination of the local network environment, locally distributed servers and equipment, some combination of localized software, potential partner specific applications, and lesser skilled personnel are combined. This combination will usually mean problems, but they are mainly integration issues that should be readily solved by the professional integration team and local experts. Now it’s time for the hard part to start, serving the needs of the customers.
RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Key Findings

There are two major findings of the study. First, the geographic distribution of eBusiness hosting facilities provides enormous advantages from the business and technical perspective. There are some significant drawbacks associated with deploying distributed facilities, however, the combination of all the advantages provides sufficient reason to warrant major eBSPs to deploy in such a fashion. Second, there is a significant need for a rigorous and objective decision-making process in coming to a facilities location decision. Unfortunately, the time-to-market pressures put on by the market often force management and organizations to make these highly important decisions hastily. The benefits of using a rigorous process far outweigh the initial time and effort associated with applying it. By applying a simple framework for the decision analysis, the expended efforts can be somewhat reduced, and the results are much more likely to produce an objective recommendation. In addition, the process helps to gain automatic buy-in from all major stakeholders.

Geographically Distributed Facilities

Below are the key benefits from each perspective. When taken in aggregate, the benefits are overwhelming on the side of geographic distribution.

Technical

- improved quality of service
- improved throughput
- reduced latency
- increased reliability
- enables greater scalability

Business

- enables new services offerings
- allows for country specific pricing
- leverages economies of scale
• enhances organizational learning
• spreads development effort and costs
• enables improved local support
• creates network externalities
• increases negotiation power

Social/Political benefits
• improved customer perception
• enhanced preference in vendor selection criteria
• expand mind-share in marketing
• deepen supplier relations
• allows greater tax benefits
• expedites legal approval
• strengthens government support
• intensifies partnership arrangements

Decision Making Processes
Due to the rapid rate of change in this industry, moving quickly without all the answers and then learning iteratively through experience is pretty much required. This is not to say don’t do the analysis. In fact, it’s quite the opposite. Do all the research, analysis and planning possible based on the time and resource constraints, but then execute quickly based on these plans. There will need to be changes and improvements in the plans, but at least there is some confidence that the plans have real basis. The little time spent upfront to do the analysis will pay off multiple folds, if it means not having to backtrack on decisions made earlier.

Initial Results at IOS
The major findings of the study were applied directly to IOS where the study was conducted. IOS management had already decided to deploy facilities worldwide prior to the start of the study, but minimal validation had been conducted due to perceived time-to-market pressures.

The study acted both as a way to validate the decision that was made to go global, as well as being a driving function to bring greater rigor and objectivity to the location decision process. The analysis processes and tools created during the study were applied beyond just the Asia/Pacific region where the study was
focused, but was adopted for U.S. for all geographical regions. The
standardization of the analysis techniques and data finally allowed for uniform
comparison of across markets and across regions. Even standard planning and
analysis documents were standardized as a result of the study. For example, the
country and regional market requirement documents, the country and regional
marketing plans, and even contracted market research contents were all
standardized to the formats created during the study.

As a result of the study, there were multiple changes in the facilities roadmap on
the target markets to be entered and the timing of the entry. The benefits of
these changes lie in the fact that they helped to align the target markets with the
market potential, urgency and viability of success in those markets. The revised
roadmap will likely not be altered significantly, as it is actually backed by real
analysis, whereas the old roadmap changed every few weeks, and pieces of data
came in or executives made visits to various markets. Having a data backed plan
means that the organization will buy in to the results, and not be constantly
distracted by an ever-changing goal. The changes are distracting and at times
demoralizing, as people may loose weeks or months of work from such changes.

The financial impact of the resulting roadmap and process changes is difficult to
gauge due to the interrelation between the various activities and groups, but it’s
clear that faulty decisions in this realm can mean lost revenues and wasted
expenditures on the order of tens or even hundreds of millions of dollars. In fact,
if the plans are not properly calculated, it could mean total failure of the entire
venture, and a loss of several billions of dollars of investment. Execution,
however, is probably just as important. The best plans in the world will fail if not
properly executed. Now the challenge for IOS is to execute on their plans and
acquire a critical mass of customers and partners. Then they need to really deliver
the superior quality services to their customers that they promise, and continue to
do it on a consistent basis going forward in time and across all markets.

**Extension of Learning to Other Companies/Industries**

Although the content and results of this document focused on IOS and the eBSP
sector, the findings and processes can easily be applied more generically to other companies in the sector and potentially even to other sectors or industries as well. The need for geographical distribution of eBSP facilities is mainly a result of the inadequacy of the current global communication infrastructure, the lack of cooperation within the telecom industry, the need to build market bread and power. For any eBSP who wants to scale, they need to play on a global level, but to provide adequate services globally, it still takes having servers and people distributed around the world. This can be done through deploying their own facilities, but can also be implemented through a variety of outsourcing arrangements. The right answer will vary depending the capabilities of the vendors and goals of the eBSP, but being geographically distributed is unavoidable at this time.

It's also useful to realize that eBusiness hosting is really just a service-oriented business, not a communications business. As with most service-oriented companies, there are major benefits associated with being close to partners and most importantly, the customers.

Finally, enforcing proper rigor and applying standardized analysis processes in strategic decision-making has wide applicability across companies and industries. All the tools in the framework are purely data driven and should be sourced from actual or researched numbers, which helps to take away personal biases within the decision makers. Forcing the citing of sources helps to make sure that there was some research done to validate the entries. The criteria for making the decisions are agreed upon prior to getting the data, so that the results will not be argued or become political if the recommendation that was derived didn't match the expectation of certain stakeholders. Having a standardized process means that results can be verified by all parties involved, and the mental model for evaluating the results will be consistent. It also makes training new team members and adjusting to role changes a lot less painful. Both these things happen regularly in today's fast pace corporate environments.

Having a multi-factor evaluation framework also helps to reduce the purely
financial based analysis for decision making that exists in many companies. Due to the enormous amounts of uncertainly in financial assumptions used in comparing markets, a solution arrived at with purely financial means will likely not be an optimal solution. Since the presented framework encourages analysis on many fronts, including a financial analysis, and consideration of all the results to form the final decision, it allows for a more realistic picture of the situation to be created, thereby enhancing the likelihood of success. As the framework has feedback built in, the company can easily adjust its strategies to changing market environments.

The general data analysis and decision making framework and tools introduced in this document can easily be adjusted to provide value to a range of companies and industries. The key indicator categories of Market Potential, Social/Political Compatibility and Technology/Infrastructure Compatibility are general enough that they could be applied to multiple industries, by just adjusting the weighting on the indicators and modifying the factors that are used to calculate the scores. The general 3-stage analysis process and feedback framework is also generally applicable to multiple companies and industries. The real lesson to remember from all the tools and processes is to practice data driven decision making based on a systematic analysis and get all the key stakeholders involved. This will lead to better decisions that will have the support of those who carry them out. Proper planning and flawless execution is what wins the wars in the business world. The processes discussed in this document will hopefully make it easier for companies to address the problem of properly analyzing and planning market entry points and timing.
BIBLIOGRAPHY

Market/Analyst Research

This report provides a comprehensive description of the status of the telecommunications infrastructure on a global basis. The data ranges from network capacity and connectivity, to telecom traffic patterns between major markets. Very useful information for optimizing location determination of telecom related facilities and services.

An consolidation of Internet related statistics from various major market research companies on the status of the global Internet environment. Covers data ranging from user buying habits to eCommerce market sizing.

Howard Hsu, “IT Services Criteria: Satisfaction and Perception(Asia/Pacific)1999” IDC, June 1999, 201 pages
An analysis of needs and buying criteria for IT services professionals for outsourced IT services in Asia Pacific. Very relevant information for understanding user needs and formulating market entrance strategies.

Howard Hsu, “Asia Pacific IT Services Report”, IDC, Jun 1999, 107 pages
An analysis of the state of the Asia Pacific IT services market, and a source of numerous economic and infrastructure data relating to the APAC region.

Howard Hsu, “Mission Critical Support Services in Asia Pacific”, IDC, 1999, 11 pages
Discussion on elements of a highly reliable IT support infrastructure. Highly relevant material relating to the types of services that are planned as offerings in our case study.

Morgan Stanley, “Global Telecommunications Primer” June 1999, 200 pages
A comprehensive survey of key communications technologies and major markets on a global basis. Provides useful data on infrastructure status and profiles of key telecom players.

Morgan Stanley, “The Internet Data Services Report” August 1999, 175 pages
A survey key trends, services, and major players in the Internet Data Services Market. Excellent discussion on what the major Data Services consist of and how they are used by the customers.

Rajiv Gupta, Tim Storey, “Asia Internet Report” July 1999 Goldman Sachs, 175 pages
This report provides some good content on analysis of internet business models, country specific internet maturity, market trends, and detailed company profiles of leading Asian Internet related companies. Much of the data found here would be useful in completing the market evaluation frameworks for determining market timing and location decisions.
Academic Resources:
Bartmess, A., and Cerny, K., “Seeding Plants for a Global Harvest,” McKinsey Quarterly, 2 (1993), 107-132. This article proposes a strategic approach to plant location. A process that identifies the key sources of customer value and attempts to build competencies through its selection of site locations can build a global network of capabilities. Cost modeling is useful, but only as a final step after the best strategic sites have been identified.

Brush, T.H., Maritan, C.A., Karnani, A., “The Plant Location Decision in Multinational Manufacturing Firms: An Empirical Analysis of International Business and Manufacturing Strategy Perspectives,” Production and Operations Management 8(2) 1999, 109-131. This paper presents an analysis of results from a survey of 162 plant managers regarding the critical factors for plant location. The authors use the data to examine differences in factor importance between foreign or domestic locations and between integrated versus independent plants. The data from the survey is given and provides an excellent set of factors and their relative importance as noted by a large group of industry representatives.

Eppen, G.D., Martin, R.K., Schrage, L., “A Scenario Approach to Capacity Planning” Operations Research 37 (4): 517-527. This paper describes the development and use of a scenario planning model to determine plant location. A number of plant configurations are allowed to satisfy a set of possible product demands that vary by year. The optimization routine solves for the factory arrangement which produces the best worst case result.

Ferdows, K., “Making the Most of Foreign Factories,” Harvard Business Review, Mar-Apr 1997, 73-88. By managing the functions performed at various global sites, a company can build a network of robust facilities. Most sites begin as small single function facilities. Developing the sites over time will make them more valuable and more productive. A strategy which identifies functions and capabilities to add to a site over time creates a competitive advantage for the company.

MacCormack, A.D., Newmann, L.J., and Rosenfield, D.B., “The New Dynamics of Global Manufacturing Site Location,” Sloan Management Review, 35(4): 69-80. This article examines changes in the global trading environment, in manufacturing practices, and in production technologies. These changes have created a new environment for manufacturing site location which will tend toward smaller scale flexible plants that are located in the major economic regions of the world in areas with high labor skills. An alternative process for making the plant location decisions is presented that focuses on intangible factors and leaves cost modeling to a final stage.

Owen, S.H., and Daskin, M.S., “Strategic Facility Location: A Review,” European Journal of Operational Research, 111 (1998) 423-447. This paper reviews the body of literature using logistical or mathematical models to determine optimal facility location. The authors detail the recent development of dynamic models which utilize an extended time horizon and stochastic models which incorporate the uncertainty of factors such as demand or cost.

Internet sources:

IOE page, “CIA World Fact Book 1999”,
A comprehensive collection of demographic, geographic and economic information on most countries in the world. An invaluable resource for getting vital information for doing market comparison studies.

A summary of the quality of internet communications in various regions and countries. The data is gather via monitoring equipment positioned throughout the world which send signals to each other and records the response characteristics.

“The Atlas of Cyberspace”,
http://www.cybergeography.org/atlas/isp_maps.html

“Internet Exchange Points”, http://www.ep.net/
Useful resource for getting information on public and private internet exchanges around the world.
GLOSSARY

24/7 – Full-time, continuous service; i.e., 24 hours a day, 7 days a week, and 365 days a year.

Access – A term referring to the means by which a person or computer accesses the Internet. Also see Connectivity.

Alias – A hostname that replaces another hostname, such as an alias that is another name for the same Internet address. For example, www.company.com could be an alias for server03.company.com.

API – Application Programming Interface. The software that an application program uses to request and carry out lower-level services performed by the computer’s operating system.

ATM – Asynchronous Transfer Mode. A high-speed cell-switching network technology that handles data and real-time voice and video. ATM provides “bandwidth on demand” by charging customers for the amount of data they send.

Bandwidth – The volume of data that the transmission lines can carry. Telephone lines have the lowest bandwidth. Fiber optics has the highest bandwidth. Bandwidth is usually measured in Megabits (Mb). Internet throughput is usually measured in Megabytes (MB).

BDC – Backup Domain Controller

Bit – The smallest unit of information in a computer, equivalent to a single zero or a one. The word "bit" is a contraction of a "binary digit." Eight bits are needed to create a single alphabetical or numerical character, which is called a "byte."

BPS – Acronym for "bits per second" used to define data rate capacity. Note that bps is distinct from BPS which defines "bytes per second" and is primarily used for defining actual Internet throughput.

BPS, TBPS, GBPS, MBPS, KBPS, TBPS, GBPS, etc. – Refers to data transmission rates. B usually means bytes and b usually bits. There are eight bits in a byte. T is for Tera (one trillion bits or bytes, G is for Giga (one billion bits or bytes), M is for Mega (one million bits or bytes) and K is for Kilo (one thousand bits or bytes).

BRI – Basic Rate Interface. An ISDN service referred to as 2B+D. BRI provides two 64-Kbps bearer, digital channels, plus a 16-Kbps delta channel. Integrated Services Digital Network (ISDN) terminal adapters replace modems as the customer-premise connection to this service, for direct connections of data and voice transmissions.
**Browser** — Shorthand for web browser. A program, such as Netscape's Navigator or Microsoft's Internet Explorer, which "reads" hypertext and displays it as formatted text and images. Browsers allow users to view the contents of a site and navigate from one site to another.

**Bytes** — Bytes are typically a sequence of eight bits put together to create a single computer alphabetical or numerical character.

**Cache** — Caches store information where you can get to it fast. For example, a web browser cache speeds things up by storing the text and graphics of web pages you have visited on our hard drive so that when you go back to the page, everything doesn't have to be downloaded all over again.

**CGI (Common Gateway Interface)** — Often referred to as CGI scripts. When a web client accesses a URL with a CGI script, the HTTP server executes the CGI program, passing to it any data provided by the client in a query string. The output of the CGI script is then returned to the originating client by the HTTP server specified in the original URL. CGI scripts are often used to create data entry forms and other simple applications.

**Co-located hosting** — A web hosting service where the customer brings their own equipment into a vendor's data center. By co-locating their equipment, customers can take advantage of our abundant bandwidth, sophisticated data centers and 24 x 7 monitoring services. Co-location is distinguished from Shared or Dedicated-hosting services where the customer relies on high performance servers provided and managed by the vendor.

**Connectivity** — A term referring to the means by which a person or computer is connected to the Internet. Hosting Service offers high-speed connectivity for corporate customers who wish to access the Internet at speeds ranging from 3Mbps to 155Mbps.

**Daemon** — A persistent process that responds to requests as they arrive, without human intervention. Server processes, such as those for HTTP and FTP, run as daemons.

**Dedicated hosting** — A web hosting service where a Hosting Service provides a high performance super server that is dedicated to the needs of a single customer. Dedicated services include 24 x 7 management of the server hardware and software by Hosting Service for a customer's website(s).

**Dial-up** — Access to the Internet via a modem and telephone line, which requires that the modem dial a phone number when Internet access is needed. Dial-up modem speeds are generally limited to speeds of 28k to 56k. Dial-up access is contrasted with dedicated lines that are
always available, and in the case of Hosting Service's Connectivity Edge, offer speeds of 3Mbps to 155 Mbps.

**Domain** – An Internet domain refers to a networked computer accessible through a host, or domain, name. A domain identity includes a distinguishing suffix such as .com (commercial), .edu (educational, primarily in the U.S.), .net (network operations), .gov (U.S. government). Most countries also have a domain. For example, .uk (United Kingdom), .au (Australia).

**Domain name** – A name for a computer that distinguishes it from all other computers on the Internet. This name is mapped by DNS to a unique IP address.

**DNS** – Domain Name System. When you send email or point a browser to an Internet domain such as yahoo.com, the domain name system translates the names into Internet addresses (a series of numbers looking like: 123.123.23.2). The term refers to two things: the conventions for naming hosts and the way the names are handled across the Internet.

**Download** – A term referring to the act of transmitting information across the Internet to a particular computer. It can be used as a verb, as in "I downloaded it off the Hosting Service website," or as a noun referring to the information being downloaded. Download is usually associated with large file sizes, but it can include any digital information, whether graphic images, software, text, music, video, etc. The software industry has taken the lead in providing "software downloads," but the digital revolution ensures that people will be downloading all forms of digital data in the Internet future.

**eBSP** – eBusiness Service Provider, a company that provides internet hosting, application services and system management services to other businesses.

**Encryption** – Encryption is the transformation of data into a form unreadable by anyone without a secret decryption key. Its purpose is to ensure privacy by keeping the information hidden from anyone for whom it was not intended, including those who can see the encrypted data. Encryption may be used to make stored data private (e.g., data that is stored on a potentially vulnerable hard disk), or to allow a non-secure communications channel to serve as a private communications channel. Encryption is sometimes described as the process of converting plain text into ciphertext.

**Extranet** – A controlled business computer networking application that uses Internet technology to link businesses with their suppliers, customers, or other businesses that share common goals.

**Firewall** – A set of software and hardware systems that reside between an organization's internal network and the rest of the Internet. It is designed to prevent unauthorized access to the organization's.
network from unauthorized users.

**FTP** – File transfer protocol is the method used on the Internet to copy a file from one computer to another. Using FTP, you can search through directories on computers around the world, locate a file, and transfer a copy of it to your machine.

**Hit** – A term referring to a web server receiving an HTTP request from a client browser. Typical hits occur when a browser sends a request for an HTML page, or an inline graphic that appears on the page. Each discreet element of the web page is registered as a "hit" in the website's log file. Downloading a page with many graphic elements will generate many hits. Though "hits" are a common measure for web traffic, they are not as relevant a measurement as "page views."

**HTML (Hyper Text Markup Language)** – Hypertext Markup Language codes data content in hypertext documents for platform-independent presentation. HTML documents are appropriate for delivering information across the World Wide Web.

**HTTP (Hypertext Transfer Protocol)** – HTTP is a standard protocol for delivering hypertext material across an Internet. HTTP is stateless: when a client makes multiple requests to a single HTTP server, each request is treated independently. HTTP servers do not remember the earlier requests. The stateless protocol allows HTTP servers to respond to requests quickly.

**Internet** – The network that spans the globe and connects thousands of universities, companies, and other organizations, originally started by ARPA in the early 70s. The Internet hosts the World Wide Web (WWW).

**IP address** – A series of four numbers, each from the range of 0 to 255, separated by periods, which uniquely identify a node (usually a computer) on an Internet. Although the underlying IP relies on these numeric addresses, people usually use host names, which are easier to remember and are automatically converted to IP addresses by the Domain Name System (DNS).

**ISDN** – Integrated Services Digital Network. An international telecommunications standard for transmission over digital lines running at 64 Kbps.

**ISO9000** – International Standards organization 9000 Series. A standard that outlines the requirements for the quality system of an organization. It is a set of generic standards that
provide quality assurance requirements and quality management guidance.

**ISP** – Internet Service Provider. A vendor who provides direct access to the Internet.

**IT** – Information Technology. Data processing and operations.

**ITU** – International Telecommunications Union. An organization that defines and adopts telecommunications standards. ITU-TSS is the replacement organization for the International Consultative Committee for Telegraphy and Telephony (CCITT).

**IXC** – Interexchange Carrier. A carrier that provides long-distance telephone service.

**Java** – Java is a network-oriented programming language invented by Sun Microsystems that is specifically designed for writing programs that can be run on a variety of operating systems.

**LAN** – Local Area Network. A short-distance data communications network, typically within a building or campus, used to link together computers and peripheral devices under some form of standard control.

**LATA** – Local Access and Transport Area. One of the local geographical areas in U.S. within which a local telephone company may offer telecommunications services, local or long distance.

**LEC** – Local Exchange Carrier. A carrier that provides local telephone service.

**Local Loop** – A fixed telephone line connection that provides wide-area connectivity, often constituting "last mile" transport between an ISP and a commercial customer. Contrast with dial-up.

**Log file** – A file in which a program records events as they occur for the purpose of analysis at a later time, for diagnostic or measurement purposes. Example: most web server administrators configure their web server to record each "hit" requested and whether they responded successfully.

**Mirror site** – Because the Internet population has exploded in recent years, a single web server can't always cope with all the requests coming in from around the world. One solution is to create an exact copy of a server—a process called mirroring.

**MTBF** – Mean Time Between Failure. The average time a component/system works without failure.

**OC3, OC12, OC48** – OC stands for Optical Carrier and is used as a measurement of transmission capacity for a particular circuit. An OC3 circuit can transmit 155 Mbits in each direction. An OC12 can transmit four times as much data as an OC3, for a capacity of 620 Mbits. An OC 48 can transmit four times as much data as an OC12. Etc.

**OEM** – Other Equipment Manufacturers.
**OS** – Operating System. A software system that manages the basic operations of a computer system.

**Page views** – A term used as a measurement of website traffic that calculates the number of individual pages viewed by distinct customers during a specified period of time.

**PBX** – Private Branch Exchange. A small version of the telephone company’s larger central switching office.

**POP** – Point of Presence. The place where a line from a long-distance carrier (IXC) connects to the line of the local telephone company or to the user if the local company is not involved.

**Port** – A logical channel in a communications system. Each server program, for example, has a unique port number associated with it, defined in the Network Information Service "services" database. HTTP defaults to port 80. HTTPS defaults to port 443. FTP defaults to port 21.

**Private peering** – An arrangement between two Internet backbone providers to exchange traffic between their two networks. By setting up such an arrangement, it facilitates a faster, higher quality exchange of traffic that avoids the congestion found at public peering points.

**Public peering** – Arrangements between a large number of Internet Backbone and web hosting providers to exchange traffic between the various networks. Public peering points include the MAEs and the NAPs. Congestion has become a serious problem at the public peering points, as an increasing number of providers dump traffic into them, overloading the routers at the core of the peering points.

**RAID** – RAID (redundant array of independent disks) is a way of storing the same data in different places (thus, redundantly) on multiple hard disks. By placing data on multiple disks, input/output operations can overlap in a balanced way, improving performance. Since multiple disks increases the mean time between failure (MTBF), storing data redundantly increases fault-tolerance.

**RBOC** – Regional Bell Operating Company. There are seven RBOCs, each of which own two or more Bell operating companies.

**Shared hosting** – A web hosting service where a vendor provides a single server that is shared by multiple web hosting customers. Shared hosting is a very economical solution for smaller websites, and websites that don't require complex custom applications.

**S-HTTP (Secure Hyper Text Transfer Protocol)** – An encryption protocol used to allow private communication on the Web. Allows encryption, digital signatures, authentication, or any combination of these, at the application level. Contrast with SSL.

**SLIP (Serial Line Internet Protocol)** – Serial Line Internet Protocol is the other
popular protocol for connecting a computer to the Internet over a dial-up phone line.

**SNA** – Systems Network Architecture. The IBM total description of the logical structure, formats, protocols, and operational sequences for transmitting information units between IBM software and hardware devices.

**SONET** – High-speed fiber-optic network constructed in rings so that data can be re-routed in the event of a fiber cut.

**SSL (Secure Sockets Layer)** – Uses PKI technology to transparently protect application-layer data and protocols (HTTP, FTP, Telnet).

**T1 or T1 Line**
T1 designates a measurement of transmission capacity for a particular circuit. A full T1 line can transmit 1.544 Mbps in each direction.

**T3 or T3 Line** – A T3, also known as DS3, designates a measurement of transmission capacity for a particular circuit. A full T3 line can transmit 45 Mbps in each direction.

**TCP (Transmission Control Protocol)** – A communications protocol used for situations that require a continuing connection between two programs across a network, which is more than the underlying Internet Protocol (IP) is designed to provide. Often called TCP/IP in reference to the IP that underlies TCP.

**Telnet** – A protocol that enables a user on one machine to log onto another networked machine.

**URL (Uniform Resource Locator)** – A unique address consisting of a string of characters that precisely identifies an Internet resource’s type and location. URLs typically have four parts: the first identifies the protocol; the second identifies the domain name; the third identifies the directory path, and the fourth identifies the document file name. Sometimes, the URL includes a fifth part known as the anchor name or bookmark, which points to a specific location within the document file.

**VPN** – Virtual Private Network. A software-defined network offering the appearance, functionality, and usefulness of a dedicated private network, but at a lower cost.

**WAN** – Wide Area Network. A network that uses common carrier-provided lines that cover an extended geographical area.

**Web page** – A document consisting of one or more screens that are displayed via a browser. A web page is referenced by one URL.

**Web server** – A program that responds to requests from web clients. A web client requests one resource at a time. The resource can be an HTML document, a GIF image, an MPEG movie, or any of the types of resources defined by MIME.

**Website** – A virtual location on the web. A
URL that serves as the top-level address of a website will be said to point to that website's home page. That page serves as a reference point, containing pointers to additional HTML pages or links to other websites.

**World Wide Web**  
(WWW) - The collection of all the resources (HTML documents, images, and other files, as well as CGI interface programs) accessible on the Internet mainly via HTTP but also via older protocols and mechanisms, such as FTP or Gopher, which are supported by most web browsers. The emergence of web browsers has made access to these resources achievable to a broad base of users beyond the more technically savvy traditional users of the Internet who relied on less user-friendly access tools than currently available browsers. Often referred to as "the Web," WWW or W3.
## Sample Market Evaluation Framework Datasets

### Market Size/Potential

<table>
<thead>
<tr>
<th>Metric</th>
<th>Australia</th>
<th>HK</th>
<th>India</th>
<th>Japan</th>
<th>Malaysia</th>
<th>PRC</th>
<th>S. Korea</th>
<th>Singapore</th>
<th>Taiwan</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Market Size (US$ Biz commerce Spending)</td>
<td>453</td>
<td>93.4</td>
<td>4.3</td>
<td>600</td>
<td>29</td>
<td>21.38</td>
<td>87.4</td>
<td>54.1</td>
<td>65.4</td>
<td>168.1</td>
<td>4404</td>
<td>1177</td>
</tr>
<tr>
<td>2003 Forecasted Size (US$ Biz-spending)</td>
<td>4586</td>
<td>1490</td>
<td>448</td>
<td>10000</td>
<td>868</td>
<td>2224</td>
<td>2304</td>
<td>945</td>
<td>1526</td>
<td>21600</td>
<td>474000</td>
<td>10030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metric</th>
<th>Australia</th>
<th>HK</th>
<th>India</th>
<th>Japan</th>
<th>Malaysia</th>
<th>PRC</th>
<th>S. Korea</th>
<th>Singapore</th>
<th>Taiwan</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propensity to Outsource (%)</td>
<td>53%</td>
<td>30%</td>
<td>72%</td>
<td>20%</td>
<td>50%</td>
<td>30%</td>
<td>54%</td>
<td>35%</td>
<td>50%</td>
<td>37%</td>
<td>50%</td>
<td>18%</td>
</tr>
<tr>
<td>Ability to Spend for Data Services (1-5)</td>
<td>5</td>
<td>3.5</td>
<td>1.5</td>
<td>5</td>
<td>3</td>
<td>3.5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Expected 2003 Market Share (%)</td>
<td>29</td>
<td>20</td>
<td>30</td>
<td>15</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Competitive Strength/Position (1-5)</td>
<td>4.8</td>
<td>4.9</td>
<td>0.77</td>
<td>12</td>
<td>0.8</td>
<td>6</td>
<td>4</td>
<td>0.67</td>
<td>1.25</td>
<td>6.9</td>
<td>15.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Internet User '99 (M)</td>
<td>8.3</td>
<td>2.2</td>
<td>8.75</td>
<td>22</td>
<td>2.8</td>
<td>16.09</td>
<td>5.67</td>
<td>1.8</td>
<td>4.25</td>
<td>22.4</td>
<td>32.2</td>
<td>7.4</td>
</tr>
<tr>
<td>Total Urban Population (M)</td>
<td>18</td>
<td>6.7</td>
<td>197.2</td>
<td>112.5</td>
<td>12.54</td>
<td>37.12</td>
<td>3.3</td>
<td>41.07</td>
<td>57.4</td>
<td>11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>197 GDP PPP (US$ T)</td>
<td>0.394</td>
<td>0.175</td>
<td>1.53</td>
<td>3.08</td>
<td>0.227</td>
<td>4.29</td>
<td>0.631</td>
<td>0.984</td>
<td>0.306</td>
<td>1.32</td>
<td>1.813</td>
<td>348.8</td>
</tr>
</tbody>
</table>

### Infrastructure/ Tech. Readiness

<table>
<thead>
<tr>
<th>Metric</th>
<th>Australia</th>
<th>HK</th>
<th>India</th>
<th>Japan</th>
<th>Malaysia</th>
<th>PRC</th>
<th>S. Korea</th>
<th>Singapore</th>
<th>Taiwan</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Network Capacity/ Sophistication</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Future Network Capacity/ Sophistication (2002)</td>
<td>4.5</td>
<td>4.5</td>
<td>3</td>
<td>5</td>
<td>3.5</td>
<td>3.5</td>
<td>4.5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>External Connectivity Bandwidth (Mbps)</td>
<td>155</td>
<td>250</td>
<td>168</td>
<td>785</td>
<td>250</td>
<td>300</td>
<td>559</td>
<td>300</td>
<td>123</td>
<td>245</td>
<td>215</td>
<td>619</td>
</tr>
<tr>
<td>Ability to Support other countries (1-5)</td>
<td>3</td>
<td>2.5</td>
<td>3</td>
<td>3.5</td>
<td>2.5</td>
<td>3.5</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Robustness of Power and Facilities (1-5)</td>
<td>4</td>
<td>4</td>
<td>4.5</td>
<td>3.5</td>
<td>3</td>
<td>4</td>
<td>4.5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>General IT Computing Maturity (PC Penetration)</td>
<td>30.8%</td>
<td>14.6%</td>
<td>1.0%</td>
<td>12.8%</td>
<td>4.1%</td>
<td>1.0%</td>
<td>13.0%</td>
<td>21.3%</td>
<td>8.7%</td>
<td>26.0%</td>
<td>27.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Electronic Financial Systems Readiness</td>
<td>4</td>
<td>4.5</td>
<td>1.5</td>
<td>3.5</td>
<td>3</td>
<td>2.5</td>
<td>3.5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Teledensity (%)</td>
<td>48.3%</td>
<td>65.2%</td>
<td>1.7%</td>
<td>63.5%</td>
<td>14.4%</td>
<td>10.0%</td>
<td>35.8%</td>
<td>45.7%</td>
<td>50.2%</td>
<td>57.7%</td>
<td>55.2%</td>
<td>56.5%</td>
</tr>
</tbody>
</table>

### Social/ Political Compatibility

<table>
<thead>
<tr>
<th>Metric</th>
<th>Australia</th>
<th>HK</th>
<th>India</th>
<th>Japan</th>
<th>Malaysia</th>
<th>PRC</th>
<th>S. Korea</th>
<th>Singapore</th>
<th>Taiwan</th>
<th>France</th>
<th>Germany</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Gov. Support (1-5)</td>
<td>3.5</td>
<td>3.5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3.5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Government Bureaucracy/Corruption (1-5)</td>
<td>4</td>
<td>3</td>
<td>1.5</td>
<td>3</td>
<td>4</td>
<td>2.5</td>
<td>3.5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Stability of Gov. (1-5)</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Availability of Skilled Labor (1-5)</td>
<td>4</td>
<td>3.5</td>
<td>3.5</td>
<td>4.5</td>
<td>4</td>
<td>4</td>
<td>4.5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Attractive Cost Structure (Labor Costs)</td>
<td>2</td>
<td>1.5</td>
<td>3.5</td>
<td>1.5</td>
<td>3.5</td>
<td>2.5</td>
<td>1.5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Channels Identified (% of Market Covered)</td>
<td>10%</td>
<td>30%</td>
<td>30%</td>
<td>15%</td>
<td>40%</td>
<td>30%</td>
<td>20%</td>
<td>20%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Strategic Importance to Intel (1-5) Reason?</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e-Commerce Urgency (% of Company with Website)</td>
<td>45%</td>
<td>30%</td>
<td>18%</td>
<td>28%</td>
<td>30%</td>
<td>22%</td>
<td>18%</td>
<td>30%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Figure 23: Sample Market Data Entry Worksheet (not actual/worksheet subset)
Figure 25: Sample Market Scoring/Normalization Worksheet (not actual/worksheet subset)

Figure 24: Sample Market Readiness Timeline Worksheet (not actual)
## Sample Customer Questionnaires

**Company Name:**

**Company Contact:**

**Contact Phone:**

**Intel Representative:**

**Company Brief:**

### Data Types

<table>
<thead>
<tr>
<th>Data Types</th>
<th>Customer Data</th>
<th>Question</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Web Server</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1. Quantity/Architecture | | | IA, SUN, Vendor (Compaq or Dell)?  
(# of servers today)  
(# of servers in 1 year)  
2 now, 5 next year |
| 2. O/S | Version/service pack/language | NT 4.0, Service Pack 4 |
| 3. What web server? | Name/version/language | IIS/Apache/Netscape/etc. |
| **Database Server** | | | |
| 5. Quantity/Architecture | (number of servers/Type)  
(# of servers today)  
(# of servers in 1 year) | IA, SUN, Vendor (Compaq or Dell HP Netserver, IBM Compaq)? |
| 6. DB Engine | (Version/Language) | SQL, Sybase, Oracle, etc. |
| 7. Size of dB | | 2GB |
| **Application Server** | | | |
| 9. Quantity/Architecture | (number of servers/Type)  
(# of servers today)  
(# of servers in 1 year) | IA, SUN, Vendor (Compaq or Dell HP Netserver, IBM Compaq)? |
| 10. Application Name/version/language | Homegrown or purchased app? | e.g., Pandesic uses SAP |
| 11. Function of Application | | Inktomi: search engine |
| 12. Transaction Volume | (hits/day/week/etc..) | x hits/day/week/month |
| 13. Projected Transaction Growth Rate | | e.g., 10x in Q4 (acquisition) |
### System Management/Hosting

<table>
<thead>
<tr>
<th>Question</th>
<th>Who are you hosting w/today?</th>
<th>Dacom, PSINet, NTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Data Host</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colocation or Managed Platforms or Shared Disk</td>
<td>2 Colo, 5 managed</td>
<td></td>
</tr>
<tr>
<td>If not managed: Would you want to use Managed Services? Why?</td>
<td>Yes, less hassle</td>
<td>No, want freedom</td>
</tr>
<tr>
<td>Availability, reliability, performance metrics</td>
<td>What do you track? How often?</td>
<td></td>
</tr>
<tr>
<td>What is your current system availability? (Do you think you need better availability? Would you pay for it?)</td>
<td>% of uptime, # of hours of planned downtime</td>
<td>99.9%; yes will pay 10% more for 99.99%</td>
</tr>
<tr>
<td>Cost per server? Type and Cost</td>
<td>Colo - $2000/rack Managed $5000/server</td>
<td></td>
</tr>
<tr>
<td>How important is a secured facility to you? How does your hoster provide this right now?</td>
<td>Would you pay more for this?</td>
<td>Guard, limited access, key card</td>
</tr>
<tr>
<td>System Management Services</td>
<td>What System Management Services do they provide?</td>
<td>Backup, Load Balancing, Virus Detection, Reporting,</td>
</tr>
<tr>
<td>Load Balancing Capability (if not, do you want it; would you pay for it?)</td>
<td>Do you have it? What is it?</td>
<td>Cisco LocalDirectors, unique h/w solution</td>
</tr>
<tr>
<td>Mirroring/Global Load Balancing (if not, do you want it; would you pay for it?)</td>
<td>Would you want your data mirror outside of your country</td>
<td>Yes, need it and will pay for it</td>
</tr>
<tr>
<td>Backup Technology (if not, do you want it; would you pay for it?)</td>
<td>What HW/SW do you use for backup?</td>
<td>UNIX/NT backup, Legato, Cheyenne, EMC, ATL</td>
</tr>
<tr>
<td>Backup Strategy (if not, do you want it; would you pay for it?)</td>
<td>What is your backup strategy? How often?</td>
<td>Onsite/offsite? Incremental/Full? Daily/Weekly?</td>
</tr>
<tr>
<td>Disaster Recovery Strategy (if not, do you want it; would you pay for it?)</td>
<td>What if your data center goes down?</td>
<td>Mirrored site in Dallas, full system recovery in 1.5 hours</td>
</tr>
<tr>
<td>Firewall support? Do you want it, would you pay for it?</td>
<td></td>
<td>Yes, very important. Our data is critical to U.S.</td>
</tr>
<tr>
<td>Data encryption/Secure servers? Do you want it, would you pay for it?</td>
<td></td>
<td>Yes, we need to keep privacy when processing transactions.</td>
</tr>
<tr>
<td>Customer Reports (if not, do you want it; would you pay for it?)</td>
<td>What reports do you generate from these metrics?</td>
<td>Web trends, etc.</td>
</tr>
<tr>
<td>Question</td>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>30. Does customer have block diagram of their solution?</td>
<td>If so, attach soft copy of system block diagram</td>
<td></td>
</tr>
<tr>
<td><strong>Connectivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. Current ISP/Host</td>
<td>Who is your current ISP/Web Host?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uunet, Sprint, PSI Net</td>
<td></td>
</tr>
<tr>
<td>32. How much bandwidth from internet to customer?</td>
<td>How much do you provide your customer today?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 Mbps; $2000/month</td>
<td></td>
</tr>
<tr>
<td>33. How much burst capacity does customer use/how often?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/10 Mbps</td>
<td></td>
</tr>
<tr>
<td>34. How important is the ability to choose from different carriers from your hoster?</td>
<td>Not important, Very Import, can low cost...</td>
<td></td>
</tr>
<tr>
<td>35. Remote Access from customer site</td>
<td>How do you remotely monitor, manage, transfer data?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VPN, ISDN, frame relay, extranet (T1 full, T1 partial), etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Customer Needs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. What other services would you need from a quality Hosting provider?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Do you need any ecommerce services from your hoster? (would you pay for it?)</td>
<td>Ecommerce server packages; Transaction processing, Certificate authentication;</td>
<td></td>
</tr>
<tr>
<td>38. What problems have you had with your current suppliers?</td>
<td>Bandwidth issues; uptime issues; latency issues; cost</td>
<td></td>
</tr>
<tr>
<td>39. Do you plan to expand your target customer base beyond your local market? If yes, when and why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Customer Service</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40. What hours do you need to be able to reach customer service?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41. Is English support staff sufficient? (if not, what language is needed?)</td>
<td>If not, what language?</td>
<td></td>
</tr>
<tr>
<td>42. What period do you prefer to be billed for services? Are English bills okay?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>