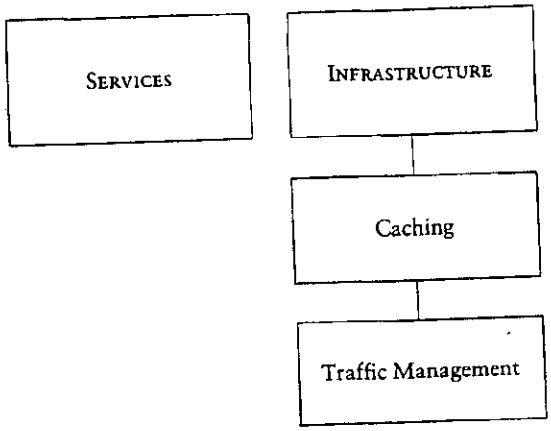
CHART 1.1

Internet Content Delivery Market: Market Segmentation (U.S.), 1999



Source: Frost & Sullivan

SUMMARY OF MAJOR FINDINGS

Market Growth, Opportunities, and Total Forecast

Figure 1-1 illustrates market revenues for the U.S. Internet content delivery market. In 1999, this market generated revenues of approximately $408.7 million, which was an increase of 186.2 percent over 1998. The primary drivers for the U.S. content delivery market include the following:

- Content delivery solutions offer improved performance, reliability, and scalability
- Content delivery solutions eliminate congestion points on the Internet
- High-speed solutions allow efficient delivery of rich content
- Content delivery solutions assist in optimizing bandwidth from expensive locations
- Content delivery solutions provide a value-added service

FIGURE 1-1

Total Internet Content Delivery Market: Revenue Forecasts (U.S.), 1996-2006

Year	Revenues ($ Billion)	Revenue Growth Rate (%)
1996	---	---
1997	0.04	---
1998	0.14	242.4
1999	0.41	186.2
2000	0.91	123.8
2001	1.84	100.9
2002	3.22	75.2
2003	5.09	58.1
2004	7.23	42.1
2005	9.21	27.4
2006	10.90	18.3
Compound Annual Growth Rate (1999-2006): 59.9%		

Note: All figures are rounded; the base year is 1999. Source: Frost & Sullivan

Although the U.S. content delivery market is currently in the development stage and shows signs of growth, the following restraints may hinder the industry's progress:

- Implementing a content delivery solution require various skilled personnel that are short in supply
- Undetected system errors endanger customer relationships
- Customers hesitate to adopt the solution due to the variety of products and services
- Technical constraints within broadband technologies affects the adoption of content delivery solutions
- Difficulty in forging alliances endangers market growth

Analysis by Major Segment

Figure 1-2 presents the percent of revenues by vertical segment for the U.S content delivery market.

FIGURE 1-2

Total Internet Content Delivery Market: Percent of Revenues by Product Type (U.S.), 1996-2006

Year	Services (%)	Caching (%)	ITM (%)
1996	0.0	0.0	0.0
1997	0.0	4.3	95.7
1998	0.0	24.7	75.3
1999	1.7	43.1	55.2
2000	1.5	52.0	46.5
2001	1.8	59.3	38.8
2002	3.4	61.5	35.1
2003	4.6	63.1	32.3
2004	6.4	62.3	31.2
2005	8.7	61.2	30.1
2006	11.2	58.7	30.1

Note: All figures are rounded; the base year is 1999. Source: Frost & Sullivan

U.S. INTERNET CONTENT DELIVERY SERVICES MARKET

In 1999, the U.S. content delivery services market represented 1.7 percent of the total market's revenues. Content delivery services companies generated an estimated $7.0 million. By the year 2006, content delivery services revenues are projected to reach $1.22 billion and its revenue growth can be attributed to the following reasons:

- Content delivery services solve inherent Internet problems
- The increase in Internet business applications requires reliable services
- Demand for real-time data distribution leads to a rise in usage of streaming and multicasting technologies

The U.S. content delivery services market's growth can be hindered due to the following restraints:

- Storing streaming media in distributed servers increases expense for content providers
- Short market history hinders wide scale adoption
- Content Delivery Networks Do Not Address Corporate Policy and Privacy Issues

In 1999, the U.S. content delivery infrastructure market generated revenues that amounted to approximately $401.7 million. This figure represents 98.3 percent of the total market's revenues of which 43.1 percent of revenues can be attributed to the sales of caching solutions and 55.2 percent can be attributed to the sales of traffic management products. By the year 2006, U.S. content delivery infrastructure revenues are projected to reach $9.68 billion. This revenue growth can be attributed to the following drivers:

- Growth in Internet users increases demand for products
- The increase in web sites fuels the need for intelligent content delivery infrastructure solutions
- Products enable rapid integration of content delivery services for service providers

Market growth within the U.S. content delivery infrastructure segment can be impeded by the following restraints:

- Some products require additional engineering which inhibits wide scale adoption
- Successful history from competing products hastens adoption of caching appliances
- Centralized products require constant upgrades which complicate network administration

Competitive Analysis

In 1999, there were over 34 active market participants in the U.S. content delivery market. Companies in this industry consisted of networking vendors, system integrators, and start-ups focused on content delivery solutions. Key competitive factors include:

- Provide a content delivery solution that can handle all types of data such as static Web content, audio, and video
- Market participants must be able to adapt to rapid technological changes
- Product offerings must be scalable

Technologies

The deployment of wireless technologies for portable devices is expected to be a trend that could affect the growth of the content delivery services market. Since wireless device usage is expected to grow, the demand for content delivery solutions within these devices is also

anticipated to rise. Market participants must pay attention to the technologies that can interoperate with wireless devices and integrate the solution into their service offering.

Conclusions

The U.S. content delivery market is positioned for tremendous growth. The increase in Web usage coupled with the delivery of content and applications to the edge of the network are major drivers to this industry's success. Although in 1999, solutions in this industry were proprietary, majority of the companies realizes the need for open standards. As a result, organizations such as the Internet Content Adaption Protocol (ICAP) and the Broadband Content Delivery Forum (BCDF) were formed.

Market participants who wish to make an impact and improve their competitive advantage must consider the following strategies:

- Develop partnerships in order to strengthen competitive position
- Target global customers
- Establish marketing programs aimed to educate customers
- Develop global sales channels
- Develop products and services based on open standards

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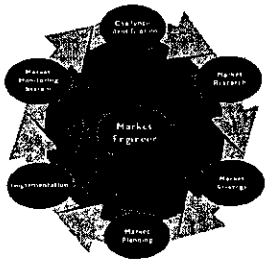
U.S. Internet Content Delivery Markets

Market Engineering

Consulting Report



REPORT #7302-79
June 2000
$3,450

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Frost & Sullivan introduces this Market Engineering consulting report, which contains valuable information for manufacturers, service providers, investors, and distributors competing in this marketplace.

The strategic market information and recommendations in this report are critical to any company striving to improve its market position, maintain a leadership position, or enter this market.

Infrastructure Leads Services for Content Delivery Solutions

The U.S. content delivery market is positioned for tremendous growth. The increase in the use of the Internet coupled with delivery of content and applications to the edge of the network are driving this industry. Because this is a relatively new technology, there is no existing infrastructure to conform to. Companies that can provide content delivery infrastructure are poised to gain a significant share of the market.

This Frost & Sullivan report analyzes the drivers and restraints for the U.S. internet content delivery markets. It will cover the services and infrastructure segments. It gives you the knowledge you need to develop a strategic plan of action, propelling your company straight to the top.

Lack of Standards Limits Growth

Because of a lack of a established infrastructure, companies that compete in this market have tried to offer products and services that are propriety in nature. This made the integration of third-party platforms difficult.

"With the increase in applications accessed over the Internet from a variety of devices, the need for an open, reliable, and affordable content delivery platform is clear," states the author responsible for this report.

In December 1999, content delivery firms and other Internet companies announced their intent to create an open standards-based protocol called Internet Content Adoption Protocol (ICAP). "Although the organization is still in the early stages of development standards, the body's influence is projected to make the impact of this challenge decline later in forecasted period," the author says.

Implementation of New Technologies Key to Market Share

"The products and services in this industry involve technologies that are constantly developing and improving," states the author. "Companies in this space must quickly incorporate the latest technologies in order to maintain product and service differentiation. Failure to do so could result in product obsolescence and a loss of revenues."

This report highlights challenges and opportunities in the emerging market for content distribution and delivery. It analyzes technology trends that include dynamic caching technology, intelligent content delivery, streaming media, satellite technology, and integrated circuit technology. This report puts strategic, up-to-the-minute marketing information at your company's disposal.

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   5. Award Category: Strategic Alliance Innovation, Inktomi Corporation
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12. Database of Key Industry Participants

This chapter presents a comprehensive database of the key industry participants with names, addresses, and phone numbers. It is provided as a support tool to aid clients in acquisition searches, continuing research, strategic alliances, and market monitoring.

(See columns at right.)

13. Market Engineering Supplement

A. Introduction
B. Strategic Significance of the Market Engineering Measurements
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   4. Recommendations for Corporate Management and Business Development

WAYS THIS REPORT CAN HELP YOUR COMPANY SUCCEED

1. Craft a Strategic Business Plan

Use Frost & Sullivan's up-to-the-minute market measurements of competition and customer base—not just your own sales—to calibrate and refine your business plan. Your company is at great risk if you rely only on internal measurements.

2. Generate New Product Ideas

Tap Frost & Sullivan's "New Product Development" and "Market Strategy" sections to form a multidisciplinary task force to identify new product opportunities. Each task-force member should read and analyze this report and be prepared to brainstorm possible new product ideas that could be created to better address the market.

3. Create an Action Plan to Be Proactive in the Market

Change your company's strategy from reacting to the market to becoming aggressively proactive in it. Create action plans to address each market, competitive, and technical trend this report covers.

4. Forge a Competitive Strategy to Build Your Market Share

Your task force's in-depth analysis of the competitors covered in this report will reveal information to aid you in gaining market share or protecting your current share from competitive attack.

5. Design an Acquisition Strategy to Make Your Business Grow

Use this report to identify specific companies with complementary skills and assets that could make excellent acquisition targets to expand and improve your company.

DATABASE OF KEY INDUSTRY PARTICIPANTS

Certain companies listed below may be profiled in this report. To find out whether a particular company is profiled, contact your Account Executive.

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Adero, Inc.
Akamai Technologies, Inc.
Alteon WebSystems
America Online
American Multiplexer Corporation
ArrowPoint communications
AT&T corporation
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Check Point Software Technologies, Inc.
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Fantastic Corporation
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Fourelle Systems, Inc.
Fresher Information Corporation
Geocast Network Systems, Inc.
GlobalCenter, Inc.
Globix Corporation
Hughes Network Systems
HydraWEB Technologies
iBeam Broadcasting Corporation
IBM Corporation
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InfoLibria, Inc.
Infoseek
Inktomi Corporation
InterNAP Network Services Corporation
InterPacket Networks, Inc.
INTERVU, Inc.
IP Multicast Initiative (IPMI)
IRCache
iSyndicate
Lara Networks Inc.
LOAD Media Network, Inc.
Loral CyberStar
Lucent Technologies
Lycos
MicroCast, Inc.
Microsoft Corporation
Mirror Image Internet, Inc.
National Science Foundation
NaviSite, Inc.
NetInformer Corporation
Network appliance, Inc.
Nortel Networks Corporation
Novell, Inc.
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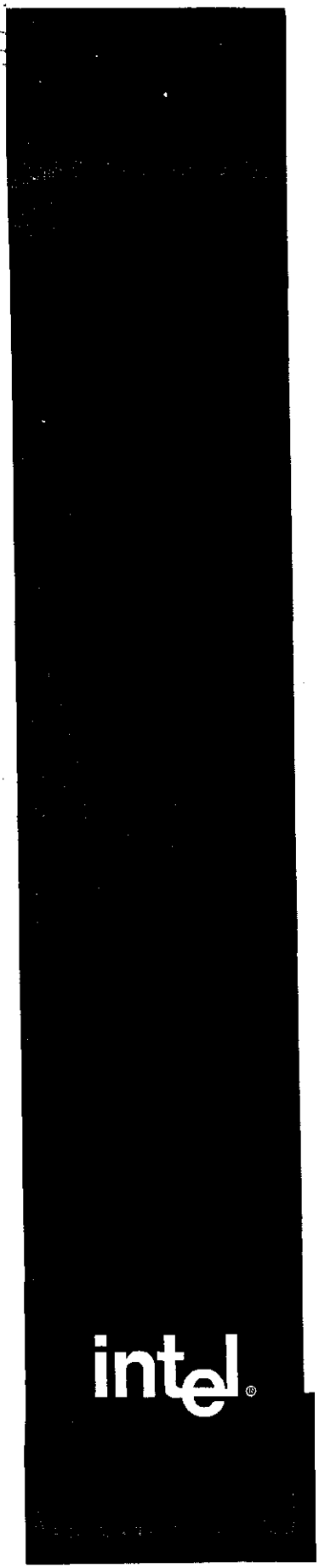
ORIGINAL

Planning and Building a Data Center

Meeting the e-Business Challenge



Executive Summary

As the Internet access market matures, Internet Service Providers (ISPs) are facing significant competition and challenges to profit. The businesses that will succeed in this market must either:

- Achieve the economies of scale necessary to support a low price business model; or
- Offer added value, typically in the form of specialized services such as applications hosting to justify a premium price.

Both of these goals require the right facility and management.

Many service providers are attempting to make this transition but lack sufficient information on how to develop and implement a data center of such scope. This document provides a high-level overview of the requirements for successfully establishing and operating an Internet data center in today's marketplace. It offers some of the key steps that need to be taken, including project definition, prerequisites and planning.

Table of Contents

Meeting the Market Challenge

Today, many service providers are aiming to differentiate themselves and increase profitability by offering a range of Web-based services targeting business customers. At the same time, the market for outsourced Web services is growing rapidly as small- and medium-sized businesses seek to migrate from traditional hosting options—such as co-location—to newer, service-focused hosting methods. Forrester Research has projected that this market will grow from $152 million at the end of 1998 to more than $5.3 billion by 2003.

Together, these factors have led to the emergence of a new type of business provider in the Internet marketplace. These service providers have moved beyond traditional Web hosting and access to more diversified, complex Web-based business services. One such example is the Application Service Provider or ASP. ASPs are companies that provide services to deploy, host, manage and rent access to an application from a centrally-managed facility.

The ability to provide more robust services to customers raises significant new challenges for traditional service providers in the areas of performance, scalability, availability and security. Adding to these challenges is the unpredictability of such a dynamic market. The service provider must be able to manage, transparently deliver and back-up vast quantities of data for a wide range of clients. The infrastructure must be able to scale quickly, and when it comes to providing more comprehensive services (such as applications), a significant additional investment in support and implementation skills is required.

In order to construct a data center that can meet the challenges of the new market, there are three basic areas of data center definition and development:

- **Facilities:** including building, security, power, air-conditioning and room for growth
- **Internet connectivity:** performance, availability and scalability
- **Value-added services and the resources to support their delivery:** service levels, technical skills and business processes

The aim is to provide customers with the physical environment, server hardware, network connectivity and technical skills necessary to keep Internet business up and running 24 hours a day, seven days a week. The ability to scale is essential, allowing businesses to upgrade easily by adding bandwidth or server capacity on demand.

Item	Standard	Optional (chargeable)
Network Monitoring	Y	-
Server Monitoring	Y	-
Web Server	Y	-
E-mail Service	Y	-
Hardware Support[1]	Y	-
Backup[2]	Y	-
Remote Management[3]	Y	-
Web Usage Analysis/Monitoring[4]	-	Y
Firewall	-	Y
VPNs	-	Y
IDS	-	Y
Load Balancing[5]	-	Y

For custom solutions, it is recommended that hardware support should only be provided if the following conditions are met:
1. The data center supplies and manages the hardware (i.e. the customer cannot supply additional hardware).
2. A backup system is in place.
3. Remote management is provided via a recognized software application and is limited to the facilities provided by that application.
4. A standard analysis tool is implemented.
5. Load balancing is only offered after a suitable hardware solution has been evaluated and tested.

***Table 1:** "Standard" and "Optional" Maintenance and Support Options—Managed Services*

Assumptions and Limitations

It is assumed that the reader is already familiar with the basic business planning and investment requirements that must be met when setting up a data center. Therefore, while the commercial objectives in establishing a data center are considered by this document, it does not probe the specific areas of business planning or investment. Rather, this document assumes the reader is seeking input on the three major areas of data center definition and development, namely:

- Facilities: building, security, power, air-conditioning, growth, etc.
- Internet connectivity: performance, availability, scalability etc.
- Value-added services and the resources to support their delivery: service levels, technical skills, business processes, etc.

For the purposes of this document, the report is written for a data center which has a total floor capacity of between 1,000 and 30,000 square feet of space and is operated by a team that specializes in facilities management.

Service Definitions

In today's market, it is highly recommended that an Internet data center offer two different product levels: managed services and co-location services.

Managed Services

Managed services are dedicated server products built to a defined standard and offering a Common Operating Environment (COE)—standard operating system, standard network management, standard monitoring tools. Managed services are monitored and maintained in-house by the data center's own technical and support staff, with a complete maintenance and support contract. Reporting

is provided to alert customers of any events and to respond to any calls for assistance from the customer.

The first step is to develop a baseline service definition for managed services. This service definition specifies the maintenance and support that are defined as standard. The definition can then be expanded to encompass "optional" or additional maintenance and support elements that can be added and charged for on an item-by-item basis.

Table 1 contains a matrix of the typical maintenance and support elements that can be supplied as a part of standard managed service, together with a list of possible optional items.

Co-location Services

Co-location is the provision of racking space, power and network connectivity (frequently referred to as "power, ping and POP") to servers supplied by the customers. The attraction to the provider is that co-location offers relatively straightforward revenue generation against a minimal outlay. However, in order to be effective, co-location services must be supplied on the following basis:

- All switches and network management equipment for the co-location systems should be owned and managed by the data center
- Customers are responsible for installation and management of the equipment in the racks
- Services are governed by a clearly defined "Terms and Conditions Contract" which clearly specifies the extent to which the service is being supplied, the limitations of liability and the support and reporting from the data center to the customer.

Generally speaking, providing added monitoring services to co-location customers is not recommended. If additional services are requested, they should be negotiated on a case-by-case basis, and full consideration must be given to the additional skill sets, tools and other requirements that may be needed.

As customers supply the equipment found in co-location racks, often this equipment is poorly suited to the task and a possible risk to the data center infrastructure. An opportunity for service providers to gain additional revenue and stabilize any risk is to sell data center products to their customer, specifically products that have already been validated and deployed in other areas of the data center.

Advanced Services

Example: Application Service Provision

Front office applications are ideal candidates for the ASP deployment model. Most companies implementing front office systems need to serve a geographically dispersed sales force or engineering staff and must provide reliable customer service via the Web. The operating characteristics of these applications place a premium on a reliable and centralized approach to systems management.

Just about any kind of application can be delivered by an ASP. Enabling technology from companies such as Citrix*, GraphOn* and SCO* allow current applications to be leveraged in an ASP environment. The only difference in the application (unless it was re-written for the Web) is that it is running on a central server managed by the ASP as opposed to on the end-users desktop or the company's server.

With operations managed by a service provider, companies can have the infrastructure and skills platform they need to deliver high levels of service to their distributed workforce and customers. It allows midsize companies to rapidly deploy front office applications and provides a reliable computing platform 24 hours a day, seven days a week.

For the service provider, simply hosting the application software remotely is only part of the job. The ASP has to perform a role that combines the responsibilities of an ISP, a traditional outsource service provider and a value added reseller (VAR) from which you might have purchased a non-customized software application. In the near future, more ISPs will become ASPs; ISPs will partner with software vendors and VARs to offer ASP-applications for in-house use, rather than renting them over the Internet.

Service implementation is key. While there are minor changes to the hardware requirements for applications hosting, the ability to manage customer relations, track faults and implement change management requires specialists and solid business processes.

Customer expectations and requirements need to be defined and understood. Depending on the skills required, this can be handled by an account manager or technical project manager. This person will be the focal point of contact for all aspects of the implementation including arranging space in a racking neighborhood, requesting IP addresses and bandwidth allocation, checking availability of hardware and software and supervising the configuration and testing of equipment. When these steps are completed, this person is responsible for hand-over to the customer and the Internet data center operational environment.

Infrastructure: Layout

This section considers the building infrastructure requirements, such as power and lighting, that must be met in order to implement an Internet data center.

Building Layout

Most buildings constructed in the last ten years have been built with consideration for the requirements of computers and their support. However, in order to provide state-of-the-art, scalable Internet facilities, it is essential that any building considered for the role provides:

- Raised floors to permit adequate cabling and trunking
- Redundancy of power, such as generator systems (and possibly batteries) to support the core main supply
- Availability of fiber-optic, high-speed data connectivity
- Temperature control with separate cooling zones
- Sophisticated smoke detection and fire suppression systems
- A wide range of physical access and security safeguards (swipe card restrictions, closed circuit television monitoring, 24x7 security and security breach alarms)

To deliver the highest levels of reliability, a number of redundant subsystems are necessary. These include multiple fiber trunks coming into the building from multiple sources and multiple switching and routing of data within the building. Fully redundant power is also required on the premises, with multiple backup generators.

In addition, for a facility to be effective it is essential that it be located in very close proximity to major public and private Internet interconnects. This will keep interconnection overhead to a minimum and enable the service provider to remain competitive within the premium service marketplace.

Operation

Operating a dedicated data center environment requires a specialized team. This should include security staff to manage access to the building, as well as engineers with the skills to maintain the building infrastructure. When it comes to the network infrastructure, requirements include technical and support specialists to build and support the servers, as well as network specialists to deal with the routing, scaling and data security.

Internal Layout

Floor design and layout for housing the servers should be related to the target market sector and price of the service. Floor layout is almost always a trade-off between security, rack density, revenue potential and manageability.

To offer a wider choice of services to meet customer requirements, while at the same time maximizing efficiency in cabling, it is recommended that the floor layout be broken down into technical suites and racking neighborhoods. The major benefits of this approach are scaling and flexibility.

Some of the technical suites can be kept vacant and outfitted later as the data center's capacity or number of servers under management grows. And, by implementing new technical suites only when needed, the decision to equip them with racking neighborhoods, private cages or secure vaults can be deferred. These considerations are examined more closely below.

The Technical Suite Concept

A technical suite is an enclosed area of the data center with the infrastructure already in place to provide a secure location for hosting either managed or co-located customer systems. A technical suite holds one or more racking locations and provides:

- Dedicated network trunking to all racking neighborhoods located within the suite
- Dedicated power and air-conditioning—in larger suites, AC should be zoned

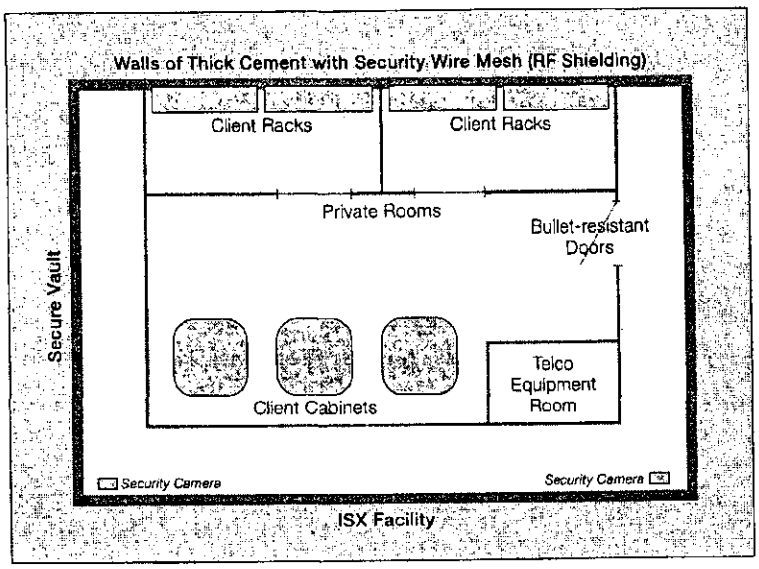


Figure 1: *Typical Technical Suite "Secure Vault"*

- Suspended floors and ceilings for additional cable access

Lighting, fire protection and security is provided to a standard specification in each suite. Access to technical suites can be restricted via security access controls such as swipe cards.

In addition, each technical suite will normally be designated as either an area for managed or co-location systems, since each has potentially different racking layouts and power requirements. With managed services, all racking space, servers and connectivity are supplied to the customer. With co-location services, only the racking space, power and connectivity are provided. Co-location customers normally supply their own servers.

Secure Vaults

The use of technical suites allows the development and incorporation of secure vaults within the data center environment, if necessary. Essentially, a secure vault is a technical suite designed to provide far higher levels of client and data security than a "standard" technical suite. A typical secure vault is shown in Figure 1.

Racking Neighborhoods

Racking neighborhoods are generally located within a technical suite and comprise one or more floor-mounted racks capable of supporting a number of hosting servers. Each neighborhood within a technical suite provides:

- Dedicated network switching from the technical suite network trunking to the servers mounted in the neighborhood
- Dedicated power distribution to all racks within the neighborhood
- Localized air conditioning
- Secure, key lock access to individual racks within the neighborhood

Private Cages

Neighborhood racks can be optionally located in a secure private cage within a technical suite. A cage offers higher security than a standard neighborhood because access is required to the cage as well as the racks it contains. Cages are more economical for the service provider than going to the expense of setting up secure vaults.

Neighborhood racks offer the most economical use of the available space. Racking space can be rented out either as a whole or in part.

When rented as a whole, one racking unit is used per customer. This allows all of the customer's primary servers to be located together in one rack, with their backup servers located in another dedicated rack within another neighborhood. Renting neighborhood racks in part allows smaller customers to economize by paying only for the space they actually need to host their servers. This approach requires deploying mixed customers per rack.

Technical Suite	Servers / 10,000 sq. ft (max)	Racks / 10,000 sq. ft (max)
Managed	1500[1]	400
Co-location	N/A[II]	400

[1]Based on 3.75 servers per rack—future advances in high density server design and technology should significantly increase this ratio.
[II]Dependent on the type of systems to be hosted

Table 2: *Server and Rack Capacity per Floor.*

Center Capacity

Total server capacity depends on the type and size of systems accommodated in each technical suite and the size of each technical suite. With space held at such a high premium in the data center, it is important to note that highest density, rack-mount systems will offer the service provider better economies. Table 2 shows typical capacity based on 10,000 square feet of floor space.

Facility

The building service infrastructure includes power, security, fire control and air conditioning. Based on today's market requirements, recommendations can be made in each area.

Power Specification

Main power to an Internet data center should be supplied by the regional electric power utility. To reduce reliance on one feed, which would present a single point of failure to the business, separate feeds into the building are recommended. Once inside the building, the power should be distributed via at least two means to the individual technical suites and other protected areas. This will again prevent any single point of failure in the power supply from adversely affecting the business. One option is using two separately fed, UPS-protected sets of circuits in each room and power from both at each rack.

Advances in server technology are creating more powerful and compact units that consume more power. This means the facility must be constructed to deliver more power in the future. It is strongly recommended that a minimum of 300W per square meter be provided to all technical suites, with the caveat that this requirement could be significantly higher if the density of servers exceeds that outlined in Table 2.

Power supplied to each area should be terminated in a main distribution panel. Ideally, each area has power distribution units (PDUs) within each technical suite.

These PDUs provide individual power to each rack within a suite through an individually switched and fused supply. Each rack can draw an average of 6 amps, with a maximum rating of 20 amps. Special consideration must be given to customers who have special power requirements such as additional sockets or DC supplies.

Resilience

Higher service levels can be offered when there are a number of sources. Competing hosting companies differentiate themselves on the quality of their power resilience. As a minimum, two-fold resilience should be provided in the form of:

- Uninterruptible power supply (UPS) to each area or neighborhood. This includes a recommended minimum (or equivalent) of 600 Kva capacity supplying 3 phase 240v AC to each neighborhood and a UPS battery run time of several minutes. The longer the run time, the greater confidence customers will have in power availability. Run time should at least equal the time it takes to bring the generators on line.
- Diesel generator backup configured to start automatically within seconds after a main power source failure to provide power to all relevant services. The generator should be running at full load within the UPS battery run time. Diesel fuel must be readily available on-site for continuous generator running over several hours and available off-site for continuous running over several days as a contingency. On-site storage tanks should be capable of being filled while the generators are running.

Building Security and Access Control

Building and network security is a highly visible component of service and very important to customers. With that in mind, a robust security policy supported by a workable set of procedures, skills and tools is essential.

The security policy is required to manage access to the data center and monitor activity within the building. This activity is normally needed 24 hours a day, every day of the year. This should be supported, where required, by the use of closed-circuit television (CCTV) to monitor the exterior of the data center and also the corridors and technical suites within the building.

Physical access to technical suites and other areas of the building should be controlled and monitored on an ongoing basis, preferably by a swipe card facility to maintain and control access to restricted areas.

All staff joining the data center should be security screened and subject to the same access controls as visitors to the building—including swipe card access.

Fire Control

It is crucial that the building be protected by a fully automated fire detection and suppression system. These systems are typically zoned throughout the building and linked into a battery backup system. An ideal system would provide automated detection, announcement and control of a fire condition before damage occurs. A manual override to the system is recommended.

All technical suites should be equipped with FM200 (or equivalent) gaseous extinguishing systems. These systems are designed to provide rapid discharge and flame suppression in the event of a fire. This minimizes the damage to equipment and reduces danger to personnel. The chemical deploys after a 30-second countdown and slows the fire by preventing combustion.

Air Conditioning

Equipment performance and life span can be significantly improved by housing the system under optimum environmental conditions. Typically, this should be around a constant 68° F, plus or minus 3° F, with humidity at a constant 45%-50%. Cooling units should be placed over walkways or hallways, never over racks.

Staff Facilities

Considerations need to be given to the provision of staff facilities. Many of the personnel working at the data center will be required to work on shift, be on call or put in longer than average hours. It is therefore recommended that staff should be provided with a rest area away from the main technical suites, including a kitchen facility. Overnight secure parking is recommended for on-call staff who may not be able to rely on public transportation.

Systems Infrastructure

Designing network access into the data center requires significant commercial and competitive consideration—greater resilience is gained by having multiple carriers (Telco & ISP). The cost of bandwidth is a major driver for investing in products that allow more efficient management of bandwidth in the facility. Products such as caching technologies, load balancers and switches should be reviewed and deployed.

Typically, fiber cable running over multiple SDH rings and dark fiber ducts enters the data center at both ends of the building. Ideally, the cables will come from competing Telcos and different Telco exchanges. It is then distributed throughout the building using data risers at opposite ends of the structure. This enhances the resilience of the telecom network infrastructure. Data access should also offer multiple connections to the Internet—such as nodes on the ISP's network.

Designed to accelerate and improve the overall performance of the data center, Intel offers the following products:

Intel® NetStructure™ 1500 Cache Appliance
This Internet Caching Appliance is designed to enable caching solutions that can significantly alleviate bandwidth constraints, improve access and boost Internet performance.

Intel® NetStructure™ 7110 e-Commerce Accelerator
This drop-in, scalable appliance processes up to 200 secure cps, improving Web site performance by up to 50 times by offloading encryption processing.

Intel® NetStructure™ 7170 Traffic Director
This advanced Layer 4-7 traffic management and load balancing solution enables priority error-free service levels to be set for specific customers or URLs for improved site performance.

Intel® NetStructure™ 7190 Multi-site Director
This comprehensive traffic management solution offers a choice of efficient traffic routing methods so that requests may be sent to the fastest-responding site or to the best site for optimal performance.