

CSCI6706: Enterprise Information Systems Architecture

Comparing the needs of setting up an
ASP in Australia vs UK vs Canada

<u>Name</u>	<u>Student ID</u>
Chen Teng	B00151358
Youlian Pan	B00064168
Yongzheng Zhang	B00138095

Professor: Dr. Nur Zincir-Heywood

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Outline:

This report discusses basic needs in setting up an application service provider in three developed countries, Australia, UK and Canada. We provide a general design of an ASP local area network and detailed technical information of major components. There are much similarity among these three countries except the difference in population density, higher labor cost in UK than Australia and Canada. Finally, we provide a budget of ASP with 28 million for a 26 people ASP in the first year and 23 million in the subsequent years.

1. Introduction

Since the 1980s, computer infrastructure and software applications have been developing significantly. Individual enterprises have been benefited through the development of new technology. However, small to medium sized companies are difficult in keeping up the pace with the development of new technology mainly because of funding constraint. They are seeking for leasing a service through application service provider (ASP).

Application Service Providers provide users (clients) with software applications, infrastructure, and related services over the Internet. Key to the ASP concept is that applications are not installed at the end user location (client sites), but instead installed and managed on server site infrastructure provided by the ASP. Users usually access the applications through the Internet via a browser on a contract.

From remote facilities, ASPs host and manage applications and other IT resources including hardware, networking, and operating software, and coordinate ongoing support, maintenance and upgrades of any applications provided to their customers. Through the use of ASPs, companies achieve increased security, reliability and manageability. End-users save money and cut deployment time by shifting the burden of installing, maintaining, and managing applications and infrastructure to the ASP. This can be a significant advantage particularly for client-server and database applications that require server and networking resources.

ASPs generate income by charging customers to access IT resources through a Web browser, local access or dedicated networking arrangements. As more companies turn to information technology to help them streamline business operations and improve strategic positioning, access cutting edge IT resources becomes critically important. ASPs make these

resources available and affordable to a wide range of entities that, instead of acquiring all of the needed software licenses and technology, can contract with an ASP on a subscription basis. The ASP market is growing up and evolving rapidly, especially in the United States and other developed countries. Small to medium sized companies want cost effective access to high-end business applications. Financials, e-commerce and customer relationship management proved to be among the most popular. Their main concerns are the stability, longevity and security of ASP vendor.

As more companies take advantage of this trend in software and services packaging, ASPs will become an important force in the IT Industry. According to IDC, ASP spending will grow to \$7.8 billion by the year 2004. This surge in spending translates to a 92% compound annual growth rate from 1999 to 2004[1].

Australia, Canada, and United Kingdom are all well developed. There are well-established national backbone infrastructures with many Internet service providers in each country. The ASP industry is developing and becoming very attractive. In the following sections, we are going to discuss the needs of establishing an ASP infrastructure in these three countries.

2. General Requirements

2.1. Network Type

One of the first decisions in computer environment design is the selection of the network type – a group of products that work together, even if they are manufactured by different companies. Today's most common network type includes ethernet (IEEE802.3), token ring (IEEE802.5), and ATM (Asynchronous Transfer Mode). Each of these three offers a viable alternative for supporting a local area network (LAN), each with its own costs and performance benefits. Ethernet stands as the prevailing technology and generally is the most appropriate choice for small business LAN. Other than circuit switch used in ATM, Ethernet uses packet switch, which fits well with TCP/IP (Transmission Control Protocol/Internet Protocol) [2].

Since its inception at Xerox Corporation in the early 1970s, Ethernet has been the dominant networking protocol. Of all current networking protocols, Ethernet has, by far, the highest number of installed ports and provides the greatest cost performance relative to Token Ring, Fiber Distributed Data Interface (FDDI), and ATM for desktop connectivity. Fast Ethernet,

which increased Ethernet speed from 10 to 100 megabits per second (Mbps), provided a simple, cost-effective option for backbone and server connectivity [2].

Gigabit Ethernet builds on top of the Ethernet protocol, but increases speed tenfold over Fast Ethernet to 1000 Mbps, or 1 Gigabit per second (Gbps). This protocol, which was standardized in June 1998, promises to be a dominant player in high-speed LAN backbones and server connectivity. Since Gigabit Ethernet significantly leverages on Ethernet, customers is able to leverage their existing knowledge base to manage and maintain gigabit networks. 10 Gigabit Ethernet has been a key member of networking community, because it provide

- Very high bandwidth
- Relatively low cost
- Scalability from 10 Mbps to 10,000 Mbps

Gigabit Ethernet is a viable technology that allows Ethernet to scale from 10/100 Mbps at the desktop to 100 Mbps up the riser to 1000 Mbps in the data center. By leveraging the current Ethernet standard as well as the installed base of Ethernet and Fast Ethernet switches and routers, network managers do not need to retrain and relearn a new technology in order to provide support for Gigabit Ethernet. Thus, we are going to focus on the implementation under Gigabit Ethernet [2, 3, 4].

2.2. Network Cabling Issues

A major part of network implementation involves the installation of a cabling system. A solid cabling system is a good investment that will not only meet out current networking needs, but will last through our next-generation network as well. All modern Ethernet networks follow a star topology, where each device on the network connects with its own cable to a hub or some other device. If our network spans an entire building, we will need to install a cabling system, and designate one or more wiring centers for our network. Cables originate at the location of each device on the network and terminate in a wiring center. On the user end, the cable will terminate with a wallplate and in the wiring center the cable will terminate in a jack on a patch panel. To ensure that our network will work not only for our current needs, but also in the future, be sure to use high-quality cables that conform to well-established standards [5].

We choose fiber optics. Fiber optics work very well in enterprise networks as a backbone infrastructure. Fiber offers exceptional performance for high-bandwidth applications, and is extremely reliable and secure. Fiber is not susceptible to many of the sources of interference that

can play havoc with copper-based cabling systems. Fiber is also considered to be more secure since it cannot be tapped unless you cut and splice the fiber strands – a task that is virtually impossible to accomplish without detection.

2.3. Network Servers

A network server is a network-connected computer system that provides services to network users. The types of servers include file servers, application servers, database servers, e-mail gateways and communication servers, web servers [2].

- File servers are the network computers that specialized in providing shared data storage. Through the interface built into the file server's network operating system, a network administrator can set up a variety of shared folders, and control access to them. A file server offers a private folder for each user. Data stored in that folder will not be visible to any other network user and the ASP employees except the administrator.
- Application servers are to run programs in a network environment. The application may be network versions of commercial, off-the-shelf software that allow multiple users to access and run the program. This avoids loading the program on each user's computer and allows central updates to take place on the server as well.
- A database server is a computer attached to a network that runs a client/server DBMS (database management system). Workstations, acting as clients, can send request to the server over the network. The server then responds.
- E-mail gateways allow users to access Internet e-mail. The gateway provide relay and translation services between the proprietary e-mail system and Internet e-mail system.
- A communication server is a dedicated system that provides communication services for users on a network who need to transfer files or access information on systems or networks at remote locations over telecommunication links or the Internet. The communication server provides communication channels for one or more users simultaneously, depending on the software and the hardware capability.
- Web servers are web-based systems that provide efficient ways to share information, either within the company's private network or externally via the Internet.

2.4. Network Organization: Client/Server

The client/server network model relies on dedicated servers that deliver services to network clients. This model makes clients and servers separate and distinct. Servers are built from larger and more

powerful computer systems, and are dedicated to providing network functions. Clients rely on servers, and do not provide network services to other computers. The advantage of this approach lies in being able to concentrate resources on the server computers to ensure that they are sufficiently powerful to meet the needs of many users, have adequate security features and be highly reliable [2].

2.5. Network Operating System

Network operating systems (NOSs) provide features for controlling LANs and /or internetworking and for serving clients. An NOS provides a set of protocols for accepting request from client and responding to those requests. An NOS also provides a shared file system, although that is not a strict requirement, and a set of security features and controls to control user access to network resources. Selection of NOS affects the low-level network protocols to be used, the way that the servers are administered and the way that users interact with network services. Microsoft Windows NT Server appears to be an appropriate selection for an ASP.

Windows NT offers file and print service, and excels as a network applications server. Windows NT uses a set of high-level network protocols called Server Message Block (SMB) that operates with either NetBIOS or TCP/IP lower-level protocols. Windows NT can be easily configured to operate in a pure TCP/IP environment. NT has become a very popular platform for network applications. Software written for DOS, 16-bit Windows or 32-bit Windows all run well under Windows NT. Applications can be written to run as a native NT service to integrate fully into this environment. NT servers are relatively easy to set up and administer. Any advanced user proficient with Windows 95/98/2000 or with NT Workstation should be able to learn the basics of NT server with a little effort. All the tools for managing NT server are easy-to-use graphical applications [6].

2.6. Connection to the Internet

An ASP is an enterprise with great potential to grow. ASPs usually located in one metropolitan area and provide service to clients through Internet. They connect to the Internet through one of the Internet service provider (ISP), or some ISPs open an ASP service through their existing Internet service and vice versa.

One of the most challenging aspects of implementing an external connection is to determine how fast a link to establish and which of the available technologies to use. The challenge lies in purchasing enough bandwidth to provide adequate performance at the lowest

reasonable cost. In current market, connection costs varies from \$30 per month to \$20,000 a month. In present study, we choose UUNET as our ISP and use a router to connect our LAN with UUNET Internet backbone.

UUNET is a WorldCom company, who owns and operates a global network in thousands of cities throughout North America, South America, Europe and Asia Pacific (Fig 1). UUNET offers a comprehensive range of Internet services to business customers worldwide. UUNET provides Internet access, Web hosting, remote access, multicasting services, and other value-added services, such as virtual private network, managed security, etc. UUNET has well- established backbone in all the three countries in question (Fig. 2, 3).

To connect with UUNET, an ASP can provide services to customers with different requirements based on their affordability. Since UUNET has a well-established network backbone world-wide, it also provide ASP with good scalability when reaching to the stage of global application services.

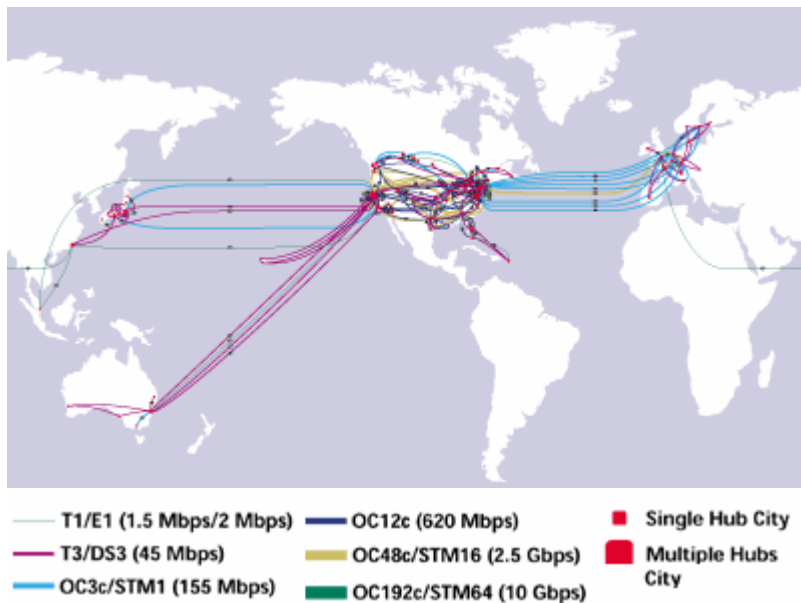


Fig. 1. Global network owned and operated by UUNET. Redrawn from:
<http://www.uu.net/network/maps/>

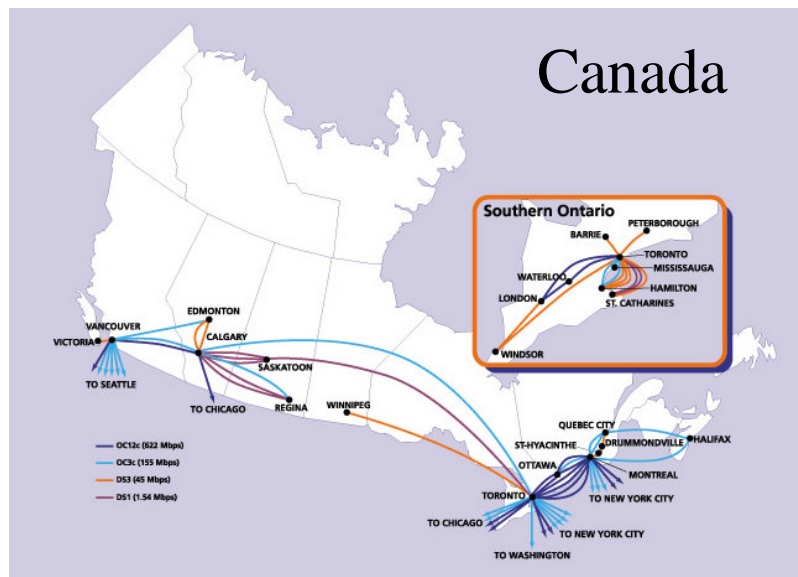
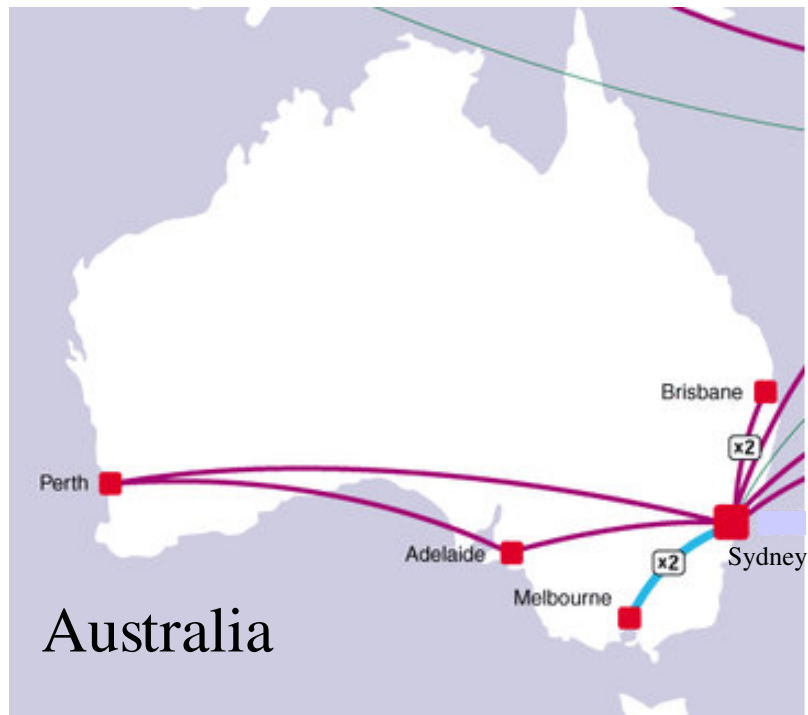


Fig. 2. National backbone in Australia and Canada own and operated by UUNET. Redrawn from <http://www.uu.net/network/maps/> (Australia) and <http://www.uunet.ca/eng/network/maps> (Canada). Legends are same as those on Fig. 1

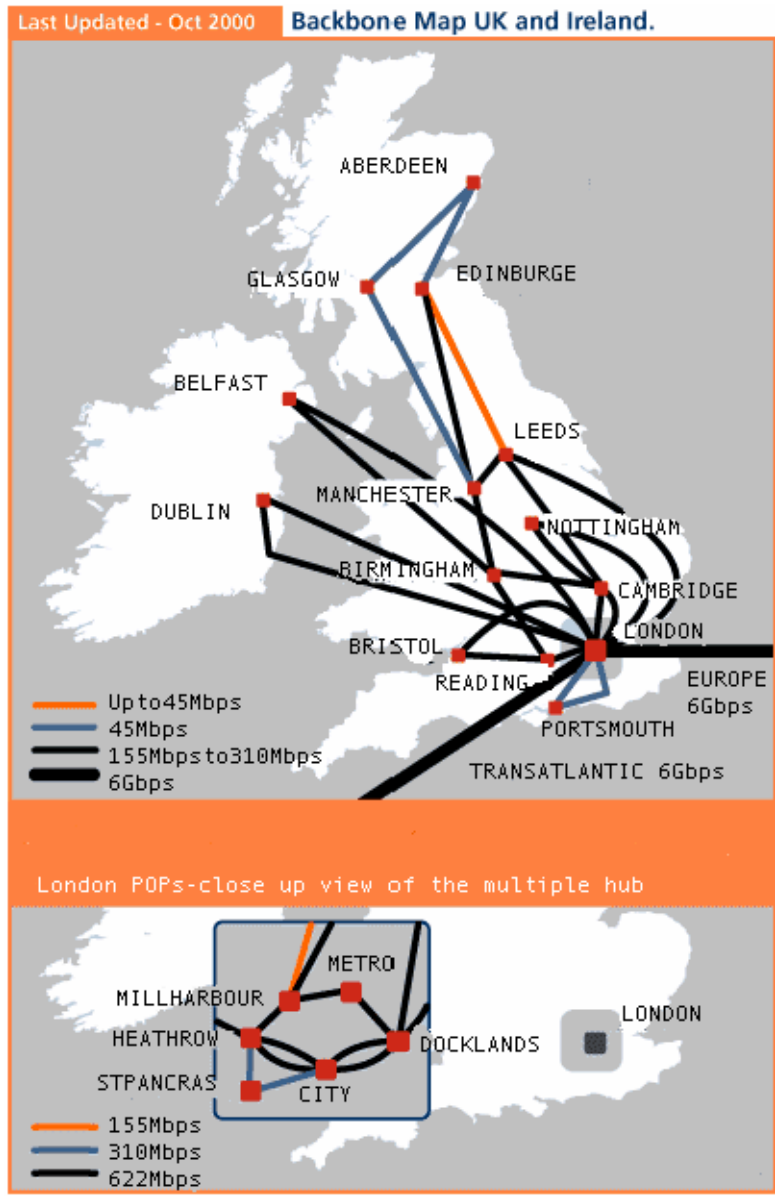


Fig. 3. National backbone in the United Kingdom. Redrawn from <http://www.uk.uu.net/network/>

3. Network Design

3.1. Overall Design

The most important point of setting up ASPs in these three countries is to design a high-performance, cost-effective and high-security Local Area Network. We use the same architecture in all of three countries. Figure 4 describes our design of an ASP LAN.

We use Cisco Switch Clustering technology in our LAN architecture. This new technology takes scalability and manageability beyond stacking and allows us to:

- Build and manage up to 16 Catalyst desktop switches, regardless of location, via a standard Web browser and a single IP address.
- Easily add additional switches as our LAN grows.
- Perform easy software upgrades to add features and update interconnected switches with a simple point and click interface.
- Troubleshoot and perform changes from anywhere on our network.
- Mix and match products and media to meet our price and performance need.

Cisco Visual Switch Manage is a powerful, web-based management tool needing no installation and included for free with Catalyst 2900 XL and 3500 XL switches. It allows us to configure and manage stacks and switch clusters and to administer software upgrades through a standard Web browser. In this architecture, all the servers (Application Server, Database Server, Web Server, Communication Server, File Server and Email server) are linked to one Catalyst 3500XL switch, so these servers are all located at the same physical place. All the workstations are linked to two (or more) Catalyst2900XL switches depending on the number of network segments. Basically two segments are sufficient at the beginning, one serve for technical support (call center), the other for managements (performance, account, configuration, fault and security)[11].

These three switches are linked to another Catalyst3500XL switch, which is linked to the router. We use Cisco3600 router to get our LAN connected to UUNET backbone. To provide security management, we set up a firewall between the Internet and the router, and we also integrate an intrusion detection system in the firewall. There have been many commercial security products in the market. We apply Cisco PIX 515 not only for its excellent comprehensive performance but also for compatible configuration and operation. We also apply Cisco CacheEngine 570 to improve accelerate content delivery and optimize bandwidth usage.

3.2. Technical details of major components

The Cisco 3600 series Router [12]: The Cisco 3600 Series is a family of modular, multi-service access platforms for medium and large-sized offices and small Internet Service Providers. With over 70 modular interface options, the Cisco 3600 family provides solutions for data, voice video, hybrid dial access, virtual private networks (VPNs), and multi-protocol data routing. The high-

performance, modular architecture protects customer' investment in network technology and integrates the functions of several devices into a single, manageable solution.

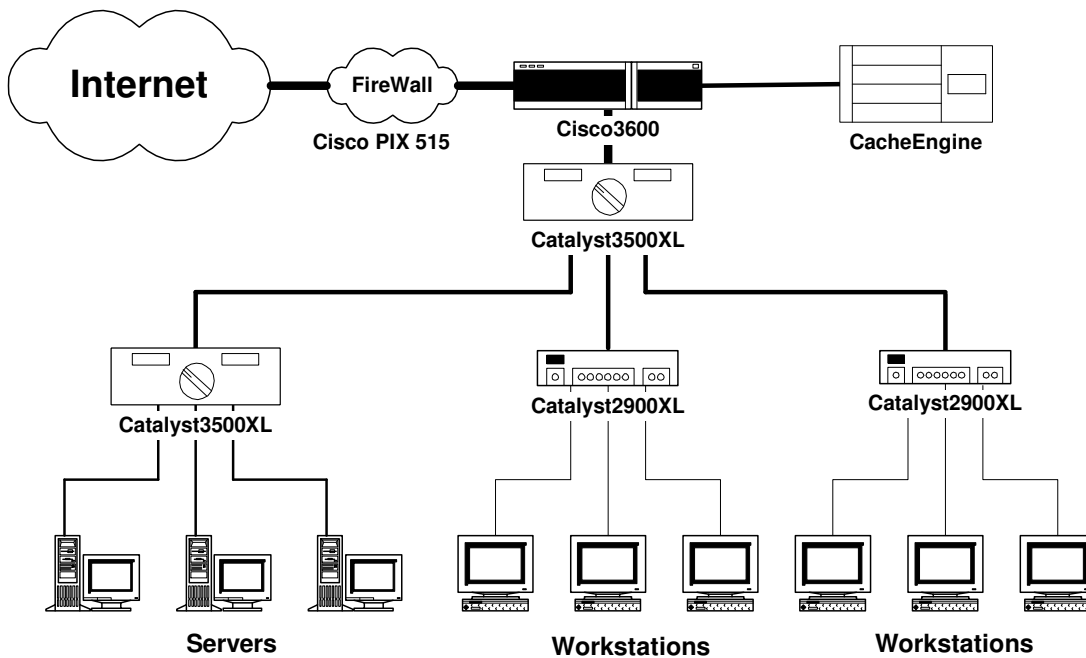


Fig. 4. General local network design. See text for details.

The Cisco 3600 series is a multifunctional platform that combines dial access, touring, and LAN-to-LAN services and multi-service integration of voice, video and data in the same device. The Cisco 3600 series includes the Cisco 3660, the Cisco 3640, and Cisco 3620 multi-service platforms. As modular solutions, the Cisco 3660, the Cisco 3640, and Cisco 3620 have the flexibility to meet both current and future connectivity requirements. The Cisco 3600 series is fully supported by Cisco IOS (internet operating system) software, which include analog and digital voice capability. With all these function, we reserve the great potential for the ASP to grow.

Cisco Secure PIX 500 Firewall [13]: The Cisco Secure PIX Firewall is the dedicated firewall appliance in Cisco's firewall family and holds the top ranking in both market share and performance. The Cisco Secure PIX Firewall delivers strong security and, with market-leading performance, creates little to no network performance impact. The product line enforces secure access between an internal network and Internet, extranet, or intranet links. The new Cisco Secure PIX 525 is the latest and largest addition to the PIX 500 series and is intended for Enterprise and Service Provider use. It has a throughput of 370 Mbps with the ability to handle as many as

280,000 simultaneous sessions. The 600Mhz CPU of the PIX 525 can enable it to deliver an additional 25-30% increase capacity for firewalling services.

Cisco's Cache Engine 500series solutions enable service providers and enterprises to accelerate content delivery, optimize WAN bandwidth utilization, and control access to content. The Cisco network caching solution is architected and optimized to work as a single caching system, pairing:

- Content-aware internetworking equipment, running Cisco IOS software's industry-leading WCCPv2 protocol
- Network-integrated Cache Engine 500 series products that are managed and designed like networking products and can be transparently inserted into the network.

It's key features and benefits are:

- **Network-Integration:** Cisco Cache Engine 500 series products are network-integrated caching solution because they are managed and designed like high-density networking products and are transparently inserted into the network. As a result, they have a low cost of ownership, enabling you to cost-effectively deploy your Cisco caching solution on a wide scale and gain the benefits of caching throughout your entire network,
- **Content Access Control:** The Cisco network caching solution, in conjunction with Websense Enterprise software, enables administrators to monitor, manage, and report on employee access to non-business and objectionable content. This high-performance content access control results in increased employee productivity, lower bandwidth usage and reduced legal liability.
- **Transparent Caching:** Using WCCP, Cisco Cache Engine 500 series products can be deployed without requiring any changes to your existing network architecture, client browsers, or end servers. WCCP-enabled routers transparently redirect specified traffic to network caches. These cache engines can transparently receive traffic from one router or many routers, resulting in low deployment cost. Cisco cache engines can also operate in proxy mode so they are compatible with networks using proxy servers.
- **Fault Tolerance and Fault Prevention:** The Cisco caching solution provides both cache fault tolerance and networking fault tolerance, eliminating any single point of failure. If a cache engine fails, traffic is automatically redistributed among other engine cluster members. If all cache engines in a cluster fails, traffic will no longer be redirected to them and the traffic is forwarded upstream. Cisco Cache Engine 500 series products

can also dynamically adapt to prevent network or application-level problems associated with traditional caches. These cache engines dynamically determine when to allow traffic to bypass them, proactively preventing overload and source IP authentication problems.

- **Scalable Clustering:** Network administrators can easily scale their cache engines to handle heavy traffic loads through the clustering capabilities in the Cisco WCCP protocol. Cisco clustering technology enables each cache member to work in parallel, resulting in linear scalability. Clustering cache engines greatly improves the scalability, redundancy, and availability of your caching solution. You can cluster up to 32 cache engines to scale to your desired capacity.
- **Ease of Use:** The Cisco Cache Engine 500 series products are easy to use. They can be managed using traditional Cisco IOS management capabilities, allowing administrators to leverage Cisco IOS device management familiarity and accelerate learning curves. In addition, the devices can be managed via the cache engine's intuitive Web GUI. Installing a cache engine is a simple process that requires very few commands.

Cisco Catalyst 3500 Series XL Switches [11]: The Catalyst 3500 Series XL is a family of stackable 10/100 and Gigabit Ethernet switches with unprecedented scalability. They deliver superior performance, manageability, flexibility, and unparalleled investment protection. The Catalyst 3512 XL and 3524 XL are ideal for companies that require a low entry price but need the flexibility to scale their workgroup beyond 12 to 24 ports, simply and affordably. The Catalyst 3508G XL is designed for companies that need to scale their stack of Catalyst 3500 XL switches to up to 10 Gbps while maintaining a single point of management.

- Advanced architecture incorporates a switching fabric of 10-Gbps and a forwarding rate of seven million packets per second to deliver wire-speed performance across all 10/100 ports.
- Cisco Switch Clustering technology lets you connect a Catalyst 3500 XL switch with up to 15 additional Catalyst 3500 XL, 2900 XL, and 1900 switches---even if they reside in different wiring closets or buildings---and manage them through a single IP address.
- Two fixed Gigabit Ethernet ports on the Catalyst 3512 XL and 3524 XL deliver up to 4-Gbps of aggregate bandwidth to Gigabit Ethernet backbones and servers or between

switches. Eight fixed Gigabit Ethernet ports on the Catalyst 3508G XL deliver up to 5-Gbps aggregate bandwidth to a stack of Catalyst 3500 XL switches or to a cluster of Catalyst 3500 XL, 2900 XL, and 1900 switches.

- Gigabit Interface Connector-based (GBIC-based) Gigabit Ethernet ports give you a choice of standards-based 1000BaseSX or 1000BaseLX/LH, or Cisco GigaStack GBICs.
- The GigaStack GBIC provides a low-cost, independent stacking bus with a forwarding rate of up to 2-Gbps in a point-to-point configuration or 1-Gbps in a daisy-chain configuration.
- End-to-end virtual LANs (VLANs) span multiple Cisco routers and switches through standards-based 802.1Q and Cisco Inter-Switch Link (ISL) protocols (enterprise edition only).
- Cisco Group Management Protocol (CGMP) enables a switch to selectively forward routed IP multicast traffic to targeted multimedia end-stations only, reducing overall network traffic.

Cisco's Catalyst 2900 series XL is a full line of 10/100 autosensing Fast Ethernet switches that offer outstanding performance, versatile modularity, and easy-to-use management. The Catalyst 2900 series XL includes five models with different port densities, configuration options, and pricing to meet a broad range of network design requirement [11].

CiscoWorks2000: LAN Management Solution(NT, Solaris) [14]: The CiscoWorks2000 LAN Management Solution features a comprehensive set of Web-based management tools for configuring, administration, monitoring, and troubleshooting the campus network. The LAN Management Solution consists of operationally focused tools useful in managing the day-to-day operations of critical services and links found in an enterprise campus network. These tools include scalable topology views, sophisticated configuration, Layer 2/ Layer 3 path analysis, traffic monitoring, end-station tracking, and device troubleshooting capabilities. The following applications are included in the LAN Management Solution offering:

- **Campus Manager:** A suite of Web-based applications designed for managing today's Cisco-powered switched networks. Intelligent discovery and display of Layer 2 networks on browser-accessible topology maps; Configuration of virtual LAN(VLAN)/LAN Emulation(LANE) and asynchronous transfer mode (ATM)

services with assignment of switch ports to those services; Link and device status display based on Simple Network Management Protocol(SNMP) polling; Identification of Layer 2 configuration discrepancies; A path trace tool for diagnosing connectivity problems between end stations, and Layer 2 and Layer 3 devices; Automatic location and correlation of information on users by media access control(MAC), IP address, NT or NetWare Directory Services(NDS) login or UNIX host name, with their physical connections to the switched network.

- **Content Flow Monitor:** A web-based performance monitoring application for managing Cisco server load balancing device. Provides network managers immediate insight to the performance of Cisco server load balancing elements, such as LocalDirector; Significantly reduces network management complexity by providing proactive performance-monitoring capabilities to Cisco server load balancing; Presents a color coded view of up-to-date device health status, service availability, detailed device configuration, and statistics; Provides performance statistics, such as total number of flows and cache entries per forwarding agent, total number of connections and packets per virtual server, and failover unit type and status per LocalDirector.
- **Traffic Director:** A comprehensive, remote monitoring - based network traffic monitoring and troubleshooting application that provides LAN managers with early visibility into switched network issues and problems before they become critical and potentially cause service degradation. Used within the LAN in conjunction with Cisco SwitchProbe devices, TD software provides all the necessary tools to monitor link performance and utilization; Troubleshoot and isolate problems in the network, as well as provide real-time and historical statistics, graphs and reports for network capacity planning; Can use data collected by the wide range of Cisco SwitchProbe devices, which are offered separately.
- **Resource Manager Essentials:** Resource Manager Essentials is a powerful suite of Web-based network management applications for small to large-scale enterprise networks. Provides network inventory and device change management; Device configuration and software image management tools; Network availability and syslog analysis; Powerful integration links to Cisco Connection Online (CCO) along with Cisco`s partners and third parties

3.3. Budget

Table 1. Equipment Cost

Item	Unit price (US\$)	Qty	Amount (US\$)
Cisco 3660 10/100 E 6-Slot Module Router-AC, Installed Main Memory: 32 MB	9,579.99	1	9,579.99
Cisco 3600 1-Port Fast Enet Module	2,000.00	1	2,000
Cache Engine 505	4,057.33	1	4,057.33
Cisco PIX 515 Firewall 2*RJ45 Ports	3,582.00	1	3,582.00
Catalyst 3500 GigaStack GBIC Stacking Switch Module	199.99	2	399.98
Catalyst 3508GXL 8 Port 1000BTX Switch Enterprise	3,649.99	2	7,299.98
Catalyst 2924C-XL-EN Switch 24 10/100 Port Enterpr	\$2,189.99	2	4,379.98
Cabling			20,000.00
Workstations and servers			40,000.00
subtotal			~91,000.00
Tax (15%)			13,650.00
Total			~104,650.00

Internet connection: \$20,000.00

Software cost:

Operating system: \$100,000.00

Local general software \$200,000.00

Application software

First year: \$200,000.00

Subsequent years: \$100,000.00

Staff: One president: \$120,000.00 per year

One system manager: \$100,000.00

One system developer: \$60,000.00

One database manager: \$80,000.00

One database developer:	\$60,000.00
One ASP developer:	\$60,000.00
15 technical supporters:	\$45,000.00 x 15 = 675.000
(Call center)	
Two secretaries:	\$35,000 x 2 = 70,000
Three other supporting staff:	\$35,000 x 3 =105,000
Total salary:	\$1,331,000.00 per year
Plus 20% benefit:	\$266,200.00
Total salary cost:	\$1,597,200.00
Incidental:	\$200,000.00 per year

Overall budget: First year: \$2,830,000.00

Subsequent years: \$2,330,000,00 per year

4. Perspectives and special needs of setting ASP in each country

4.1 Australia

Australia comprises a land area of about 7,692,030 square kilometers, with population of 19 million (Table 2). Most of Australia's population is concentrated in coastal regions in the South East (including Melbourne and Sydney), and in the East around the Brisbane area (Fig. 2). The population is concentrated in urban centers, with half the area of the continent containing only 0.3% of the population, and the most densely populated 1% containing 84% of the population. It's Internet users accounts for 42.10% population.

Though it is still in its infancy, ASP industry is poised to take off in the Asia/Pacific region, with five countries – Australia, Hong Kong, Korea, Japan and Singapore – leading the wave of acceptance. Australia ranked second behind Japan in a 1998 survey of Asia/Pacific businesses most favorable for investment in sensitive telecommunications industries. Australia has a well-developed infrastructure base despite its geography and relatively small population. Traditionally receptive to technology-based innovation, Australia has been an early adopter of ASPs.

Table 2. Comparison of population and network industry in Australia, Canada, and UK[15, 16, 17]

	Australia	Canada	United Kingdom
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Total land area (km ²)	7 692 030	9 220 970	241 590
Population (Million)	19.200	30.764	59.750
GDP (billion US\$)	389.7	612.0	1 400
GDP per capita (US\$)	20 050	19 320	24 640
Internet hosts (1999) (Per 10000 People)	417.2	365.7	240.9
Internet Users	42.10%	38.67%	28.45%
No. Existing ASPs	220	~400	~400

There are 220 ASPs in Australia at present according to the ASP-list. Their services range from financial services to full range of web-based and wireless services and web hosting. Some of the companies are originally an ISP. They provide both ASP and ISP services. Among the 220 ASPs, many are American ASP branches.

To establish a new ASP in Australia can take the advantage of existing resources and expertise in the region. Though with a small population, it has also a great potential to expand the services to the whole Asian-Pacific region. With co-existing companies, setting a new ASP definitely face great challenge.

The network design and software issue remains the same as described above.

4.2. Canada

Canada has population of 31 millions, nearly 90% of the population is concentrated in the region near the US/Canada border. Internet users account 38.7% population (Table 2). As an affluent, high-tech industrial society, Canada today closely resembles the US in per capita output and market-oriented economic system. The Information Technology market of Canada is growing rapidly. According the ASP list, there are about 400 ASPs in Canada. However, much more cost effective ASP companies are in great need. So there will be a steady increase in ASP market [7].

By neighboring with United States, setting an ASP in Canada facing great competition with many US ASPs. This has to be put in consideration.

4.3. United Kingdom

The UK has dense population with Internet users accounted for 29.5%. The UK and Europe present a bigger opportunity for ASP than the US because of the number of small and medium enterprises (SMEs) in the region. The ASP model is appealing to SMEs as often they do not have any IT infrastructure at all. The ASP market's fiscal model is based on usage, per seat, per month, which is very attractive and perfectly calculable. ASP was also appealing to companies who are

finding it difficult to hire staff to manage and install IT systems. The ASP market is growing at a rate of 92 per cent per year and spending in this market is expected by analysts to grow to \$7.8bn by 2004. Analyst IDC said the ASP market generated around \$296m in 1999. Though UK is now more than six months behind the ASP market in the US, the UK will be one of the largest regions in the market over the next few years. The ASP market is very small in Europe at the moment. The areas in which it will grow the most are the UK, Nordic regions and Benelux. Telecoms are important in this market and these countries have the right infrastructure for hosting these types of application. A survey revealed that two thirds of businesses in the UK and Germany expected to purchase application services from an ASP over the next 18 months. The industry sectors most attracted to the ASP model in these regions are banking and financial services, transport and utilities, and travel and tourism.

Connections to the Internet in UK are of very low cost for mobile users (generally being limited to the cost of local telephone call). Connections at higher speeds to corporate LANs are also much more cost-effective than hitherto. New service offering, including ADSL (Asymmetric Digital Subscriber Line) and cable modems offer the tempting prospect of (virtual) permanent bandwidth at very low cost per unit. All these factors warrant the potential of growth of ASP in UK.

5. Conclusion

All the three countries discussed above have well-developed Internet infrastructure and many well established Internet service providers, some of them are now providing application services, such as financial services, web hosting, legal services, etc. Many new ASPs are emerging in the last two years; they usually purchase an Internet connection through existing ISP. All the three countries are very much similar, in political, economic systems and therefore have similar need except for UK will need more funding to set-up and annual cost because the labor cost in the Europe is much higher than in the rest of the world. Australia and Canada are very much the same.

Though the percentage of population who connected to Internet is not very high in UK compared to the other two countries, UK has many small and medium sized enterprises. They usually would purchase services from ASPs instead of having their only IT department. Thus the ASP model especially appealing to UK.

Application Service industry is growing globally. Though now centered in developed countries, ASP model is suitable to developing countries as they have limited resources. Many

enterprises in developing countries are not able to have an IT department and infrastructure. Purchasing application services is a cost-effective approach. Therefore, ASP industry enjoys fast healthy growth these years and this will continue in the next decade or so.

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