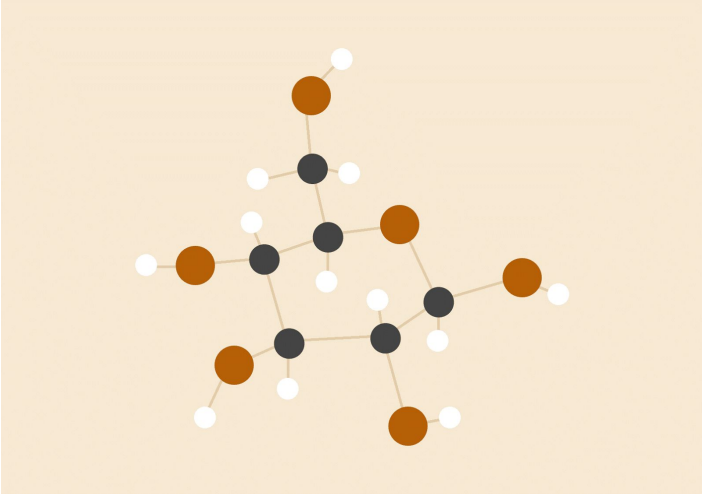

CS6843

Spring 2016

Final Exam/Project - Team 4 - 2:00

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Final Exam – CS6834

You are a team of network architects at a well-known IT consulting firm, Global Tech. Your firm just signed a contract with a mid-size global full service architecture company, Global Design Alternatives (GDA). There are ongoing complaints about slow access to files, email delivery, poor voice quality and various applications crashing due to poorly designed network. The company is planning significant expansion into the new markets by decreasing time-to-market for their core set of products and increasing the global workforce hiring.

Current environment:

GDA is a global company. Main office is in Boston, MA, and regional headquarters are in Paris, France, Buenos Aires, Argentina, and Sydney, Australia. Each regional HQ has accounting/finance, human resources, legal, corporate IT, facilities management, executive management and strategy groups. Total number of employees across all HQ offices is about 600. Global client centers are in Berlin, Atlanta and Tokyo employing approximately 500 high quality designers, engineers and architects. There are additional, lower-level support staff departments in China, Canada, United Arab Emirates and Malaysia employing 3000 people. Sales organization is highly distributed; there are approximately 30 small and medium size offices in each of the major geographical areas (Americas, Europe/Middle East and Asia Pacific) to a total of 1000 employees. Most of the sales employees are mobile. Finally, there are software development centers in Israel, India and Ukraine to a total of 300 employees working on multiple client-server and web-based software projects to support global operations, AutoCAD and other drawing packages, document management systems and many others. There is also an active call-center in Puerto Rico, which supports customer inquiries and complains. The company uses HR application to manage resources, which contains personally identifiable information, such as social security numbers, names and addresses. Finance and Accounting use Financial Management System, which contains specific financial data for the entire organization. Treasury department, which is a part of Finance organization, requires access to trading markets to invest some of the profits in OTC commodities and stocks. Sales and Marketing is managed through a suite of applications, which contain customer specific data. HQ personnel uses special analytics and product development software, which is highly confidential. All apps are developed using Microsoft ASP.NET (i.e. inside the browser) technology. Citrix/VDI is used to access files and folders on the network.

Project Goal:

Redesign global network. Develop new IP addressing schema for each and every office and location. Redesign all local LANs. Re-architect global voice and data networks. Identify ALL relevant protocols, which facilitate any and all forms of communications. Identify and select global data center locations for major functions. Identify all access technologies. Develop application profiles (protocols, security, throughput), acceptable delays and identify and document minimum and recommended bandwidth requirements for each location. Show analysis, draw diagrams and document calculation.

Project Solution:

IP Addresses Outline

The IP addressing schema we have devised will use class A addressing range, 10.10.0.0 ~ 10.255.255.255, for private IPv4 IP addresses. To assign a unique IP for every device, class C subnet masks will be used to subnet up to 254 and 510 devices. Class C was chosen because the maximum number of devices we have pooled into one department is 355, while most locations have devices less than 254 in one department. The VLAN IP corresponds to the IP addresses, which have IP addresses assigned to them so multiple subnets can exist on one VLAN. The VLAN #s are set default (starting from 0) as they are assigned by their department's physical location.

Network Architecture Design Outline

People complain about the slow-access on files, e-mail and VOIP when there is an excess amount of users trying to access the same resource or server. This condition is called performance degrade. The bottleneck may contain different reasons including location, bandwidth, and interface limits. We will specify our network architecture design in the following aspect in order to resolve these problems: (1) server location (2) flow and traffic control (3) clean network environment. The second approach can be further expanded upon with a network design to extend the capability of the servers.

Server location

The physical distance of the servers will reflect in the delay time of access directly. So building the servers at proper locations is an important key point. We will have 1 mirror e-mail server for each main continent (North America, Europe, Asia, etc). These e-mail servers have different web portals, but with the same domain name as e-mail address, just like G-mail web portal in different countries. There will be other individual, general purpose servers (flle server, VOIP) in each branch division unit of the company because these servers require more bandwidth and lower delay.

VLAN - Link aggregation

Link aggregation is a special case of VLAN, which requires software/hardware support on both switches and devices. It allows combining multiple different ethernet interfaces as one virtual interface. This means that the traffic going through the IP on this virtual interface will be distributed amongst multiple physical interfaces, which increases the loading capacity.

Backup and mirror server

Backup and mirror servers will be added into cluster sets (high availability). When the active server is providing the service, the backup (passive) server will be in standby mode and mirroring the data from the active server. The passive server would become active if an accident were to occur for the original active one.

Heartbeat channels used for detecting server down

Extra IP and ethernet interfaces will be assigned for both active and passive servers as heartbeat channels. These channels allow active and passive servers to monitor the status of one another. When the active server goes down and the passive server becomes the new active server, it will take over the VLAN virtual IP on link aggregation interfaces. As a result, users will not notice the IP changes after the servers have switched over.

Clean network environment

By using another type of port-based VLAN to isolate the local network traffic of different offices, we are able to produce a cleaner environment within the local network. Also the subnet mask will be set properly on each device to make sure that they belong to the right subnet. These devices can still access each other through routing protocol.

Relevant protocols

TCP, UDP, and DHCP are the identified relevant protocols for forms of communication. TCP is a reliable, ordered, and connection-orientated protocol known for congestion control through timing out unresponsive users, sequence numbers and acknowledgments for packets arriving in order. A 3-way handshake is necessary to establish a secure connection. TCP is mainly used for regular applications on the internet that rely on transmission such as email and file transfer. UDP is an unreliable and unordered protocol known for raw data transfer through delivering data regardless of order or handshaking. This protocol is loss tolerant and fast, which makes it particularly useful for streaming and VoIP applications as data needs to be transmitted continuously. DHCP is a network protocol for distributing IP addresses to devices on-the-go. Mobile devices connected to the internet will receive an IP address on a lease that is distributed by DHCP. The address is valid while the device is connected to Wi-Fi.

Access technologies

Ethernet and Wi-Fi are access technologies to the internet. Ethernet provides a fast and stable connection to the internet. Main offices, such as headquarters, desire access to the internet at very fast speeds, meaning minimal acceptance delay, in which an coaxial copper wire is used for ethernet cables to connect to cable broadband. Wi-Fi, for lower level offices and crowded offices, such as Sales Organizations, provides masses of people with internet access inside a LAN. This internet access technology conforms to IEEE 802.11 standards, where 802.11/ac standard is used for higher data rate streaming.

ISPs application profiles

The global voice server will be set at the HQ of Boston. We then estimate the acceptable delay of other offices. Therefore, the Boston office will have the lowest delay and require higher bandwidth for streaming voice and conference calls. For other medium sized offices (50 ~ 200 users), we would recommend the bandwidth of 250 Mb/s on outgoing network access. This should be enough for most general tasks since most bandwidth used by developer teams are in the local networks. One exception is the client center. For the client center, we double the bandwidth because they might need to have several conference calls with clients. Finally, for the large offices in China, Canada, UAE, etc, we will use multiple independent wires as they will be likely to have more than one building.

Main office

Boston, MA, 210

Regional headquarters

Paris, France, 130
Buenos Aires, Argentina, 130
Sydney, Australia, 130
In accounting/finance, human resources, legal, corporate IT, facilities management, executive management and strategy groups.
Total number of employees across **all HQ offices** is about **600.**

Global client centers

Berlin, 200
Atlanta, 150
Tokyo, 150
Employing approximately **500** high quality designers, engineers and architects.

Lower-level support staff departments

China, 750
Canada, 750
United Arab Emirates, 750
Malaysia, 750
employing **3000** people.

Sales organization

There are approximately **30 small and medium** size offices
major geographical areas (**Americas, Europe/Middle East, Asia Pacific**) to a total of **1000** employees.
Most of the sales employees are **mobile**.

Software development centers

Israel, 70
India, 140
Ukraine, 90
A total of **300** employees working on **multiple client-server and web-based software projects** to support **global operations**, **AutoCAD**, and other **drawing packages** and **document management systems** and many others.

Call Center

Puerto Rico, 100
Supports customer inquiries and complaints.

Main Office – Boston, MA						
Vlan #	Vlan IP	Subnet mask	IP	People	Devices	Department/ Function
0	10.10.0.0	255.255.255.0	10.10.0.1～ 10.10.0.50		50	VOIP
1	10.10.1.0	255.255.255.0	10.10.1.1～ 10.10.1.90	30	90	Accounting/ Finance
2	10.10.2.0	255.255.255.0	10.10.2.1～ 10.10.2.90	10	30	HR
3	10.10.3.0	255.255.255.0	10.10.3.1～ 10.10.3.90	30	90	Legal
4	10.10.4.0	255.255.255.0	10.10.4.1～ 10.10.4.90	30	90	Corporate IT
5	10.10.5.0	255.255.255.0	10.10.5.1～ 10.10.5.60	20	60	Facilities management
6	10.10.6.0	255.255.255.0	10.10.6.1～ 10.10.6.60	20	60	Executive management
7	10.10.7.0	255.255.255.0	10.10.7.1～ 10.10.7.120	40	120	Strategy groups
8	10.10.8.0	255.255.255.0	10.10.8.1～ 10.10.8.90	30	90	Treasury
9	10.10.9.0	255.255.255.0	10.10.9.1～ 10.10.9.50		10	Server
10	10.10.10.0	255.255.255.0	10.10.10.1～ 10.10.10.10		10	Printer
Total				210	700	

Regional HQ – Paris, France						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.26.0.0	255.255.255.0	10.26.0.1～ 10.26.0.40		40	VOIP
1	10.26.1.0	255.255.255.0	10.26.1.1～ 10.26.1.60	20	60	Accounting/ Finance
2	10.26.2.0	255.255.255.0	10.26.2.1～ 10.26.2.15	5	15	HR
3	10.26.3.0	255.255.255.0	10.26.3.1～ 10.26.3.45	15	45	Legal
4	10.26.4.0	255.255.255.0	10.26.4.1～ 10.26.4.60	20	60	Corporate IT
5	10.26.5.0	255.255.255.0	10.26.5.1～ 10.26.5.30	10	30	Facilities management
6	10.26.6.0	255.255.255.0	10.26.6.1～ 10.26.6.30	10	30	Executive management
7	10.26.7.0	255.255.255.0	10.26.7.1～ 10.26.7.90	30	90	Strategy groups
8	10.26.8.0	255.255.255.0	10.26.8.1～ 10.26.8.60	20	60	Treasury
9	10.26.9.0	255.255.255.0	10.26.9.1～ 10.26.9.40		8	Server
10	10.26.10.0	255.255.255.0	10.26.10.1～ 10.26.10.8		8	Printer
Total				130	446	

Regional HQ –Buenos Aires, Argentina						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.27.0.0	255.255.255.0	10.27.0.1～ 10.27.0.40		40	VOIP
1	10.27.1.0	255.255.255.0	10.27.1.1～ 10.27.1.60	20	60	Accounting/ Finance
2	10.27.2.0	255.255.255.0	10.27.2.1～ 10.27.2.15	5	15	HR
3	10.27.3.0	255.255.255.0	10.27.3.1～ 10.27.3.45	15	45	Legal
4	10.27.4.0	255.255.255.0	10.27.4.1～ 10.27.4.60	20	60	Corporate IT
5	10.27.5.0	255.255.255.0	10.27.5.1～ 10.27.5.30	10	30	Facilities management
6	10.27.6.0	255.255.255.0	10.27.6.1～ 10.27.6.30	10	30	Executive management
7	10.27.7.0	255.255.255.0	10.27.7.1～ 10.27.7.90	30	90	Strategy groups
8	10.27.8.0	255.255.255.0	10.27.8.1～ 10.27.8.60	20	60	Treasury
9	10.27.9.0	255.255.255.0	10.27.9.1～ 10.27.9.50		10	Server
10	10.27.10.0	255.255.255.0	10.27.10.1～ 10.27.10.10		10	Printer
Total				130	450	

Regional HQ –Sydney, Australia						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.28.0.0	255.255.255.0	10.28.0.1～ 10.28.0.40		40	VOIP
1	10.28.1.0	255.255.255.0	10.28.1.1～ 10.28.1.60	20	60	Accounting/ Finance
2	10.28.2.0	255.255.255.0	10.28.2.1～ 10.28.2.15	5	15	HR
3	10.28.3.0	255.255.255.0	10.28.3.1～ 10.28.3.45	15	45	Legal
4	10.28.4.0	255.255.255.0	10.28.4.1～ 10.28.4.60	20	60	Corporate IT
5	10.28.5.0	255.255.255.0	10.28.5.1～ 10.28.5.30	10	30	Facilities management
6	10.28.6.0	255.255.255.0	10.28.6.1～ 10.28.6.30	10	30	Executive management
7	10.28.7.0	255.255.255.0	10.28.7.1～ 10.28.7.90	30	90	Strategy groups
8	10.28.8.0	255.255.255.0	10.28.8.1～ 10.28.8.60	20	60	Treasury
9	10.28.9.0	255.255.255.0	10.28.9.1～ 10.28.9.50		10	Server
10	10.28.10.0	255.255.255.0	10.28.10.1～ 10.28.10.10		10	Printer
Total				130	450	

Global Client Center - Berlin						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.11.0.0	255.255.255.0	10.11.0.1～10.11.0.40		40	VOIP
1	10.11.1.0	255.255.255.0	10.11.1.1～10.11.1.240	80	240	Designer
2	10.11.2.0	255.255.255.0	10.11.2.1～10.11.2.180	60	180	Engineer
3	10.11.3.0	255.255.255.0	10.11.3.1～10.11.3.180	60	180	Architect
4	10.11.4.0	255.255.255.0	10.11.4.1～10.11.4.50		10	Server
5	10.11.5.0	255.255.255.0	10.11.5.1～10.11.5.10		10	Printer
Total				200	660	

Global Client Center - Atlanta						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.12.0.0	255.255.255.0	10.12.0.1～10.12.0.30		30	VOIP
1	10.12.1.0	255.255.255.0	10.12.1.1～10.12.1.150	50	150	Designer
2	10.12.2.0	255.255.255.0	10.12.2.1～10.12.2.150	50	150	Engineer
3	10.12.3.0	255.255.255.0	10.12.3.1～10.12.3.150	50	150	Architect
4	10.12.4.0	255.255.255.0	10.12.4.1～10.12.4.40		8	Server
5	10.12.5.0	255.255.255.0	10.12.5.1～10.12.5.7		7	Printer
Total				150	495	

Global Client Center - Tokyo						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.13.0.0	255.255.255.0	10.13.0.1～10.13.0.30		30	VOIP
1	10.13.1.0	255.255.255.0	10.13.1.1～10.13.1.150	50	150	Designer
2	10.13.2.0	255.255.255.0	10.13.2.1～10.13.2.150	50	150	Engineer
3	10.13.3.0	255.255.255.0	10.13.3.1～10.13.3.150	50	150	Architect
4	10.13.4.0	255.255.255.0	10.13.4.1～10.13.4.40		8	Server
5	10.13.5.0	255.255.255.0	10.13.5.1～10.13.5.7		7	Printer
Total				150	495	

Lower-level support staff department - China						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.14.0.0	255.255.255.0	10.14.0.1～10.14.0.200		200	VOIP
1	10.14.1.0	255.255.255.0	10.14.1.1～10.14.1.250	250	250	Department1
2	10.14.2.0	255.255.255.0	10.14.2.1～10.14.2.250	250	250	Department2
3	10.14.3.0	255.255.255.0	10.14.3.1～10.14.3.250	250	250	Department3
4	10.14.4.0	255.255.255.0	10.14.4.1～10.14.4.100		20	Server
5	10.14.5.0	255.255.255.0	10.14.5.1～10.14.5.20		20	Printer
Total				750	990	

Lower-level support staff department - Canada						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.15.0.0	255.255.255.0	10.15.0.1～10.15.0.200		200	VOIP
1	10.15.1.0	255.255.255.0	10.15.1.1～10.15.1.250	250	250	Department1
2	10.15.2.0	255.255.255.0	10.15.2.1～10.15.2.250	250	250	Department2
3	10.15.3.0	255.255.255.0	10.15.3.1～10.15.3.250	250	250	Department3
4	10.15.4.0	255.255.255.0	10.15.4.1～10.15.4.100		20	Server
5	10.15.5.0	255.255.255.0	10.15.5.1～10.15.5.20		20	Printer
Total				750	990	

Lower-level support staff department - United Arab Emirates						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.16.0.0	255.255.255.0	10.16.0.1～10.16.0.200		200	VOIP
1	10.16.1.0	255.255.255.0	10.16.1.1～10.16.1.250	250	250	Department1
2	10.16.2.0	255.255.255.0	10.16.2.1～10.16.2.250	250	250	Department2
3	10.16.3.0	255.255.255.0	10.16.3.1～10.16.3.250	250	250	Department3
4	10.16.4.0	255.255.255.0	10.16.4.1～10.16.4.100		20	Server

5	10.16.5.0	255.255.255.0	10.16.5.1～10.16.5.20		20	Printer
Total				750	990	

Lower-level support staff department - Malaysia						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.17.0.0	255.255.255.0	10.17.0.1～10.17.0.200		200	VOIP
1	10.17.1.0	255.255.255.0	10.17.1.1～10.17.1.250	250	250	Department1
2	10.17.2.0	255.255.255.0	10.17.2.1～10.17.2.250	250	250	Department2
3	10.17.3.0	255.255.255.0	10.17.3.1～10.17.3.250	250	250	Department3
4	10.17.4.0	255.255.255.0	10.17.4.1～10.17.4.100		20	Server
5	10.17.5.0	255.255.255.0	10.17.5.1～10.17.5.20		20	Printer
Total				750	990	

Software Development Center - Israel						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.18.0.0	255.255.255.0	10.18.0.1～10.18.0.30		30	VOIP
1	10.18.1.0	255.255.255.0	10.18.1.1～10.18.1.120	30	120	Global operations support
2	10.18.2.0	255.255.255.0	10.18.2.1～10.18.2.80	20	80	AutoCAD support
3	10.18.3.0	255.255.255.0	10.18.3.1～10.18.3.40	10	40	Drawing packages support
4	10.18.4.0	255.255.255.0	10.18.4.1～10.18.4.40	10	40	Document Management systems support
5	10.18.5.0	255.255.255.0	10.18.5.1～10.18.5.50		8	Server
6	10.18.6.0	255.255.255.0	10.18.6.1～10.18.6.8		8	Printer
Total				70	326	

Software Development Center - India						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.19.0.0	255.255.255.0	10.19.0.1～10.19.0.40		40	VOIP
1	10.19.1.0	255.255.255.0	10.19.1.1～10.19.1.200	50	200	Global operations support
2	10.19.2.0	255.255.255.0	10.19.2.1～10.19.2.200	50	200	AutoCAD support
3	10.19.3.0	255.255.255.0	10.19.3.1～10.19.3.80	20	80	Drawing packages support
4	10.19.4.0	255.255.255.0	10.19.4.1～10.19.4.80	20	80	Document Management systems support
5	10.19.5.0	255.255.255.0	10.19.5.1～10.19.5.50		10	Server
6	10.19.6.0	255.255.255.0	10.19.6.1～10.19.6.8		8	Printer
Total				140	638	

Software Development Center - Ukraine						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.20.0.0	255.255.255.0	10.20.0.1～10.20.0.40		40	VOIP
1	10.20.1.0	255.255.255.0	10.20.1.1～10.20.1.140	35	140	Global operations support
2	10.20.2.0	255.255.255.0	10.20.2.1～10.20.2.140	35	140	AutoCAD support
3	10.20.3.0	255.255.255.0	10.20.3.1～10.20.3.40	10	40	Drawing packages support
4	10.20.4.0	255.255.255.0	10.20.4.1～10.20.4.40	10	40	Document Management systems support
5	10.20.5.0	255.255.255.0	10.20.5.1～10.20.5.50		10	Server
6	10.20.6.0	255.255.255.0	10.20.6.1～10.20.6.8		8	Printer
Total				90	418	

Sales Organization - Medium Office (80 people)						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.21.0.0	255.255.255.0	10.21.0.1～10.21.0.10		10	VOIP
1	10.21.1.0	255.255.255.0	10.21.1.1～10.21.1.30	10	30	Department1
2	10.21.2.0	255.255.255.0	10.21.2.1～10.21.2.30	10	30	Department2
3	10.21.3.0	255.255.255.0	10.21.3.1～10.21.3.255	60	255	Mobile Users
4	10.21.4.0	255.255.255.0	10.21.4.1～10.21.4.20		4	Server
5	10.21.5.0	255.255.255.0	10.21.5.1～10.21.5.10		10	Printer
Total				80	339	

Sales Organization - Small Office (40 people)

Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.22.0.0	255.255.255.0	10.22.0.1～10.22.0.5		5	VOIP
1	10.22.1.0	255.255.255.0	10.22.1.1～10.22.1.15	5	15	Department1
2	10.22.2.0	255.255.255.0	10.22.2.1～10.22.2.15	5	15	Department2
3	10.22.3.0	255.255.255.0	10.22.3.1～10.22.3.255	30	255	Mobile Users
4	10.22.4.0	255.255.255.0	10.22.4.1～10.22.4.20		4	Server
5	10.22.5.0	255.255.255.0	10.22.5.1～10.22.5.5		5	Printer
Total				40	299	

Sales Organization - America						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.23.0.0	255.255.254.0	10.23.0.1~10.23.1.100	80	355	Medium office1
2	10.23.2.0	255.255.254.0	10.23.2.1~10.23.3.100	80	355	Medium office2
4	10.23.4.0	255.255.254.0	10.23.4.1 ~ 10.23.5.100	80	355	Medium office3
6	10.23.6.0	255.255.254.0	10.23.6.1 ~ 10.23.7.60	40	315	Small office1
8	10.23.8.0	255.255.254.0	10.23.8.1 ~ 10.23.9.60	40	315	Small office2
Total				320	1695	

Sales Organization - Europe/Middle East						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.24.0.0	255.255.254.0	10.24.0.1~10.24.1.100	80	355	Medium office1
2	10.24.2.0	255.255.254.0	10.24.2.1~10.24.3.100	80	355	Medium office2
4	10.24.4.0	255.255.254.0	10.24.4.1 ~ 10.24.5.100	80	355	Medium office3
6	10.24.6.0	255.255.254.0	10.24.6.1 ~ 10.24.7.60	40	315	Small office1
8	10.24.8.0	255.255.254.0	10.24.8.1 ~ 10.24.9.60	40	315	Small office2
Total				320	1695	

Sales Organization – Asia Pacific						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.25.0.0	255.255.254.0	10.25.0.1~10.25.1.100	80	355	Medium office1
2	10.25.2.0	255.255.254.0	10.25.2.1~10.25.3.100	80	355	Medium office2
4	10.25.4.0	255.255.254.0	10.25.4.1 ~ 10.25.5.100	80	355	Medium office3
6	10.25.6.0	255.255.254.0	10.25.6.1 ~ 10.25.7.60	40	315	Small office1
8	10.25.8.0	255.255.254.0	10.25.8.1 ~ 10.25.9.60	40	315	Small office2
5	10.25.10.0	255.255.254.0	10.25.10.1 ~ 10.25.11.60	40	315	Small office3
Total				360	2010	

Call Center – Puerto Rico						
Vlan #	Vlan IP	Subnet Mask	IP	People	Devices	Department/ Function
0	10.29.0.0	255.255.255.0	10.29.0.1~10.29.0.20		20	VOIP
1	10.29.1.0	255.255.255.0	10.29.1.1~10.29.1.100	100	100	Call-center
2	10.29.2.0	255.255.255.0	10.29.2.1~10.29.2.100		20	Server
3	10.29.3.0	255.255.255.0	10.29.3.1~10.29.3.20		20	Printer
Total				100	160	

ISPs Application Profile

Location (users)	Telecom	Protocol	Acceptable Delay	Recommended bandwidth
Boston, MA (210)	Verizon	TCP, UDP, DHCP	10 ms	2 x 1Gb / s
Paris, France (130)	Orange S.A.	TCP, UDP, DHCP	200 ms	250Mb / s
Buenos Aires, Argentina (130)	Telecom Argentina	TCP, UDP, DHCP	150 ms	250Mb / s
Sydney, Australia (130)	Telstra	TCP, UDP, DHCP	250 ms	250Mb / s
Berlin (200)	Deutsche Telekom AG	TCP, UDP, DHCP	200 ms	1 Gb / s
Atlanta (150)	AT&T Uverse	TCP, UDP, DHCP	75 ms	500MB / s
Tokyo (150)	Nippon Telegraph & Tel	TCP, UDP, DHCP	250 ms	1 Gb / s
China (750)	China Telecom	TCP, UDP, DHCP	300 ms	2 x 1Gb / s
Canada (750)	Rogers	TCP, UDP, DHCP	50 ms	2 x 1Gb / s
UAE (750)	Etisalat	TCP, UDP, DHCP	200 ms	2 x 1Gb / s
Malaysia (750)	Time	TCP, UDP, DHCP	250 ms	2 x 1Gb / s
Israel (70)	Bezeq	TCP, UDP, DHCP	200 ms	250Mb / s
India (140)	BEAM Telecom	TCP, UDP, DHCP	300 ms	250Mb / s
Ukraine (90)	Ukrtelecom	TCP, UDP, DHCP	250 ms	250Mb / s
Puerto Rico (100)	Claro Puerto Rico	TCP, UDP, DHCP	150 ms	250Mb / s