Rolling out a new VoIP Network for bank

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1. Executive Summary

This project designs and implements Cisco hardware and software based VOIP network for a bank with 50 branches. This design is scalable and cost effective. The design offers redundancy and is capable of handling huge amount of traffic. As an efficiency measure, along with the desire for cost-effective communications, bank management wanted to move to a VoIP platform with all-in-one solution for video conferencing, faxing, call recording and free inter-branch communication.

VoIP refers to the movement of voice traffic over Internet Protocol (IP) based network. To permit the traffic over the computer networks, the analog signals are turned into digital packets. The digital packets have a destination address but they follow no fixed path. To enable VoIP, broadband access, computer, and software; additional hardware such as servers, switches, routers, and others may be required depending on the volume and nature of traffic.

Small business VoIP solutions include hardware and software dedicated to handling voice traffic and offer a variety of calling features previously out of reach for smaller companies using a traditional PSTN phone system. VoIP systems are designed to be flexible and scalable. So whichever system the enterprise choose now will grow along with their business, allowing them to easily add users, upgrade features, and expand into more sophisticated modules as needed.

If an enterprise has already an IP network and a high-speed Internet connection, then the VoIP phone system can be implemented by following three steps.

Step 1: Assessing the needs and choosing the solution for enterprise

The enterprise has two choices when implementing a VoIP system. It can install an IP voice system (or, IP PBX [private branch exchange]) that will handle all aspects of its phone system. Or, if it doesn't want to completely replace its traditional PBX, it can install a voice gateway that works with its analog equipment to add Internet calling to its existing phone system.

Once that decision is made, it is determined that how many extensions and IP handsets are need. For instance, if enterprise chooses to install a voice gateway, it needs to know how many of its existing analog phones are needed to connect along with new IP phones. Cisco's SPA8000 voice gateway, for example, can connect as many as eight analog phones to the IP network.

If an enterprise opts for an IP voice system, it will have a lot more decisions to make about calling features, such as automated attendant, music on hold, and integrated voicemail, in addition to how many phones it will need to connect. For example, Cisco's Small Business Communications 500 Series, supports all of these features and connects up to 100 IP phones.

It's important to figure in the cost of IP phones or soft phones (desktop clients that allow users to make calls through their computers) when the scope of the VoIP installation is determined.

Step 2: Preparing the network of an enterprise

Adding voice traffic to the network can be a significant additional load for the network to carry. It is made sure that it can handle the additional traffic smoothly, with no audible delay during a conversation (referred to as "jitters") or dropped calls. The IP calls are made to sound as clear and as reliable as calls placed on the PSTN.

Voice traffic must be given a higher priority on the network than data traffic. This is called Quality of Service (QoS), and it cuts down on jitters and dropped IP calls.

Step 3: Installing the voice products

This is the trickiest part. Deploying an IP PBX system or adding a voice gateway to the existing network is no small undertaking; it affects the entire network of an enterprise, from capacity to performance. Working with an IT partner ensures that the enterprise gets the right solution to fit its business needs. In addition, a partner can implement a VoIP system with as little disruption to the business as possible.

2. Introduction:

The business environment has changed dramatically within the last decade. Globalization and market liberalization has altered the way a firm competes within this environment and how the firm interacts both with its customers and suppliers. For example:

- Both customers and competition have become global. To cut cost and to ensure easy access to customers, production and sourcing have shifted overseas.
- Technology has become complex and sophisticated.
- The use of communication networks is widely available at many parts of the world.
- More firms than ever are using technology for a variety of tasks and several options exist for technology procurement.
- Through the use of the Internet, customers have access to a wealth of information about products, markets, and a firm's competition.
- Customers have become more demanding in terms of price, features, product quality, delivery, level of service, and responsiveness.
- To manage customer expectations and needs firms have begun to form alliances and partnerships to manage their supply chain.

VoIP services convert the voice into a digital signal that travels over the Internet. If one is calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow one to make a call directly from a computer, a special VoIP phone, or a traditional phone connected to a special adapter.

Two types of protocol have been established to maintain the activities of VOIP. These are explained as following.

i) SIP

The Session Initial Protocol (SIP) was designed by IETF. It is an application layer protocol that establishes manages and terminates a multimedia session (call). It can be used to create two-party multiparty or multicast session. SIP is designed to be

independent of the underlying transport layer it can run on either UDP or TCP Because of the open standards approach.

ii) H.323.

H 323 is a standard designed by ITU to allow telephones on the public telephone network to talk to computers (called terminals in H 323) connected to the Internet.

A gateway connects the Internet to the telephone network. In general, a gateway is a five –layer device that can translate a massage from one protocol stack to another. The gateway here does exactly the same thing. It transforms a telephone network message to an Internet message. The gatekeeper server on the local area network plays the role of the registrar server, as we discussed in the SIP protocol.

3. Project Scope:

The project is aimed at providing efficient solution capable of handling huge amount of traffic. Some of the advantages of this project are as follows:

Cost Effective Solution:

The initial setup and ongoing costs are generally less for operating a VoIP system than a more traditional phone system. As VoIP works off the internet connection, there is no need for a traditional phone line. This means that the enterprise only needs to deal with one account, one bill, for both internet and phone.

Calls from PC to PC over the internet are free. Calls from PC to landline usually have a cost attached but the rates are significantly less than with a traditional phone line.

Accessibility:

A VoIP phone system is distinctly different from a traditional phone system. Distance or location makes no difference to a VoIP system, whether one is calling the head office on the other side of the country or making a call to the other side of the world. As long as they both have an internet connection, communication is possible.

Voice Quality:

If the enterprise has a reliable or high speed internet connection with good bandwidth, it should experience voice quality that is the equal of, if not better than a traditional phone connection.

Extra /Less Expensive Features:

Traditional phone services have a selection of extra features for which one usually pays more. VoIP is different. It comes with a wide selection of extra features like call forwarding, call waiting, voicemail, caller ID, three-way calling and more. One can also send data like documents and pictures while engaging in conversation.

VoIP also has the advantage of allowing the enterprise, its staff, and its clients to hold video conversations, access and exchange data files, and more, while the conversation is ongoing. This allows for more integrated and flexible meetings that can seamlessly include people from multiple office locations throughout the world.

4. Project Requirements:

After VOIP network completely deployed we need to verify the latency and quality of the voice and also verification required for handling the huge amount of traffic.

5. Project Objectives:

1. Provide efficient solution for the requirements of the organization and users.
2. Improve network redundancy and capable huge amount of traffic.
3. It must be cost effective, fast, secure and scalable.
4. The network technologies that we used in this project must be usable/compatible for at least 5 years.

6. Reason for Issue/Reissue:

As an efficiency measure, along with the desire for cost-effective communications, bank management wanted to move to a VoIP platform with all-in-one solution for video conferencing, faxing, call recording and free inter-branch communication.

7. Terms and Abbreviations:

UDP	User Datagram Protocol
TCP	Transmission Control Protocol
IETF	Internet Engineering Task Force
PSTN	Public switched Telephone Network

7. Reference Design

The figure shows the sample network design overview that is mostly used in a bank. In bank lots of devices are connected to each other like IP phone PCS, printers etc.

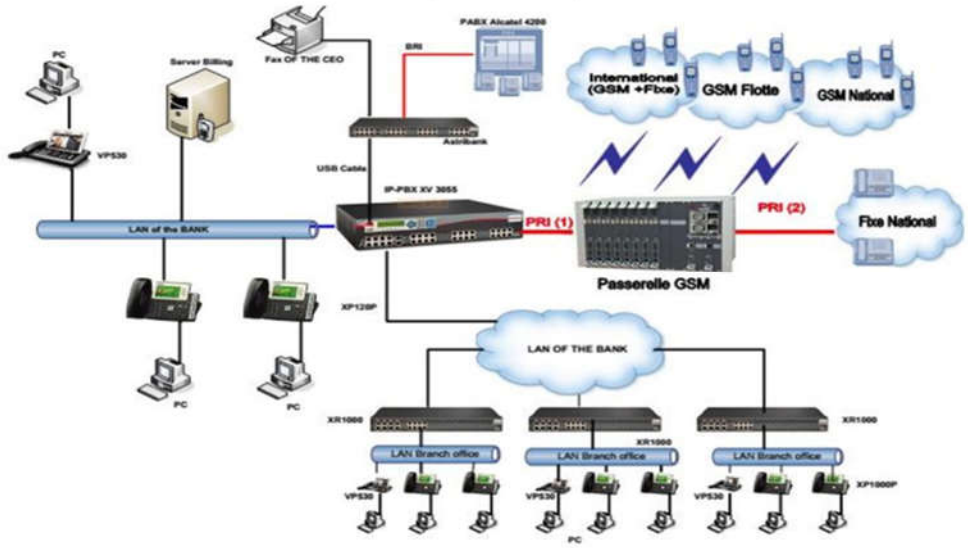

Figure 1: Sample Overview of Network

7. Data Center Design Overview:

Mostly in offices and banks they want to establish an internal network to ensure that outsiders do not connect to it and to ensure security.

Mostly in bank we use Wall Mount Rack. Wall mount rack is designed to be attached to the wall, in order to save floor space and fit in areas where other racks can't. It is generally in open frame or cabinet style, and mainly used for housing network equipment like fiber patch panels and switches.

We implement this rack on each branch. In this rack we will place switches and routers.

Figure 2: Wall Mount Rack

8. Design Requirements:

To create a VOIP network we need racks for router and switch placement. For 50 branches we need multiple routers and multiple switches that should be placed in the racks.

9. Hardware Requirements

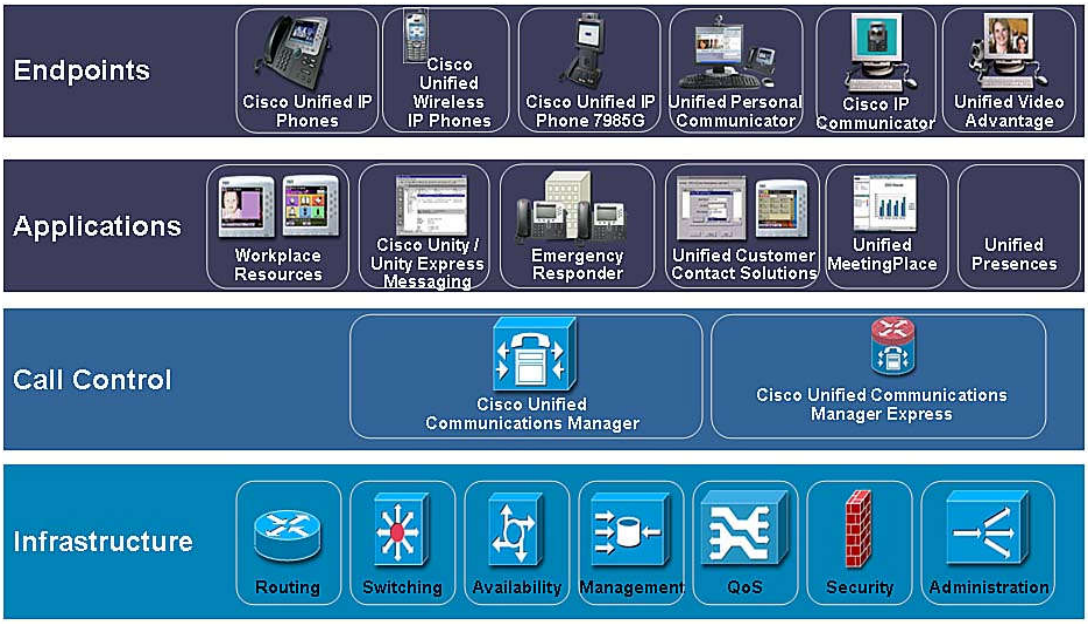

Figure 3: Hardware Used in this project

10. Design Overview:

This is the sample design in which two braches remotely connect with VOIP network. All the configuration i.e. switches and routers configurations are mentioned below.

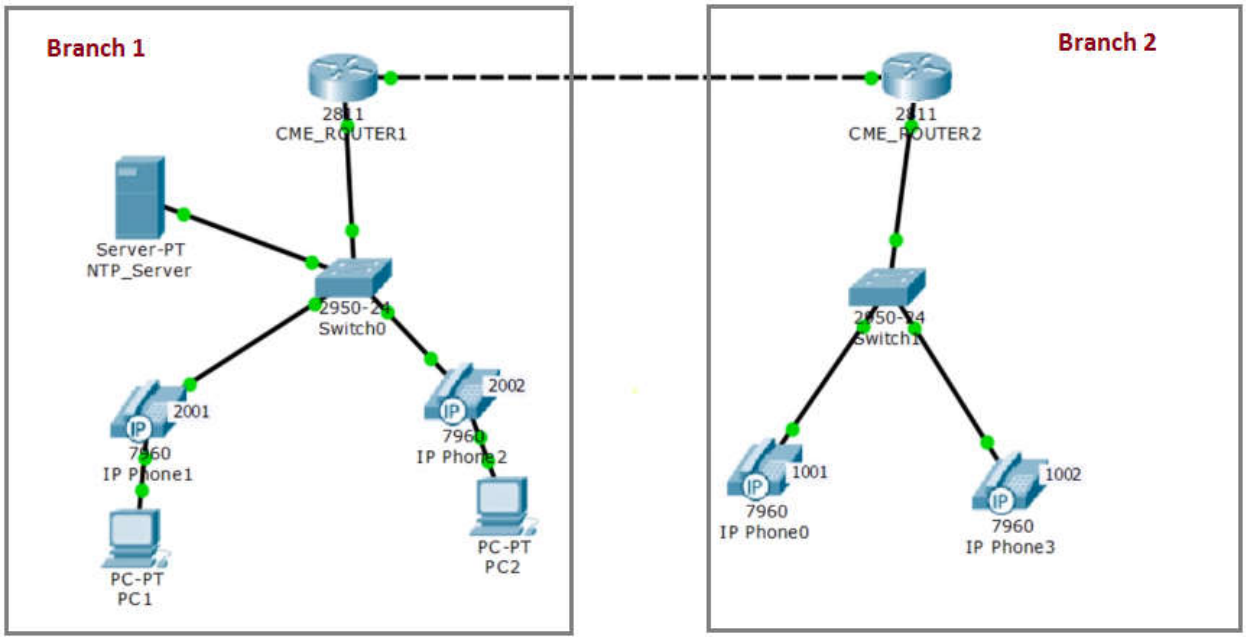

Figure 4: VoIP Network Topology

11. Configurations

a. Load Balance Configuration

b. Firewall Configuration

c. Switches configuration

```
//create the voice vlan
Switch(config)#vlan 10
Switch(config-vlan)#name VOICE
//assign ports to the VOICE vlan
Switch(config)#interface fa0/10
Switch(config-if)#switchport  voice vlan 10
Switch(config)#interface fa0/13
Switch(config-if)#switchport  voice vlan 10
//configure the port connected to the router as a Trunk
Switch(config)#interface fa0/1
Switch(config-if)#switchport mode trunk
```

d. Router configuration

```
//DHCP pool for ip phones
Router(config)#ip dhcp excluded-address 192.168.1.1   192.168.1.99
Router(config)#ip dhcp pool VOICE
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#option 150 ip 192.168.1.1
```

```
//Define the maximum number of ip phones and directory numbers
Router(config)#telephony-service
Router(config-telephony)#max-ephones 2
Router(config-telephony)#max-dn 3
Router(config-telephony)#ip source-address 192.168.1.1 port 2000

Router(config)#ephone 1
Router(config-ephone)#mac-address 000C.CF11.56A5
Router(config)#ephone 2
Router(config-ephone)# mac-address 0001.435C.B27A
//define the numbers for the phone
Router(config)#ephone-dn 1
Router(config-ephone-dn)#number 1001
Router(config)#ephone-dn 2
Router(config-ephone-dn)#number 1002
Router(config)#ephone-dn 3
Router(config-ephone-dn)#number 1003
//button configuration
Router(config)#ephone 1
Router(config-ephone)#button 1:1
Router(config)#ephone  2
Router(config-ephone)#button 1:2
```

12. Conclusion:

Since VoIP turns voice into Internet-friendly data packets, it can and will replace the rigid, packaged phone services that most companies still use. And because it will allow businesses to create their own customized phone applications, it will shift control of phone services from providers that have historically defined (and limited) them to the companies that use them. VoIP will serve as the unifying platform for such applications, supporting ever more customized, intelligent, and strategic uses of voice communications. As some innovative firms are already showing, this flexibility can fundamentally affect how companies use voice to compete, allowing them to set up and conduct business in ways that simply couldn't have been done before.

Due to the elimination of long-distance phone charges, many companies see an immediate benefit to their net income. Obviously, results vary depending on the structure and logistical position of company locations. Firms spread out in different states, regions, and/or countries achieve savings through inter-company communications, whereas, other firms with high volume long-distance calls associated to sales may reap more benefits from daily business operations.

13. References:

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3. http://www.packetworks.net/blog/business-voip-the-benefits-disadvantages-and-how-it-works.htm
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