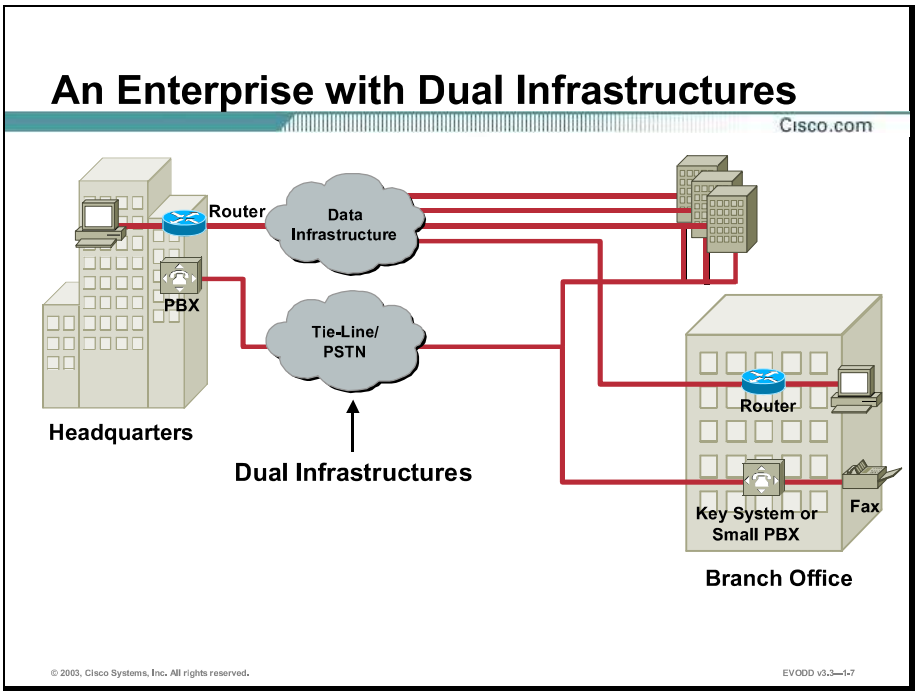
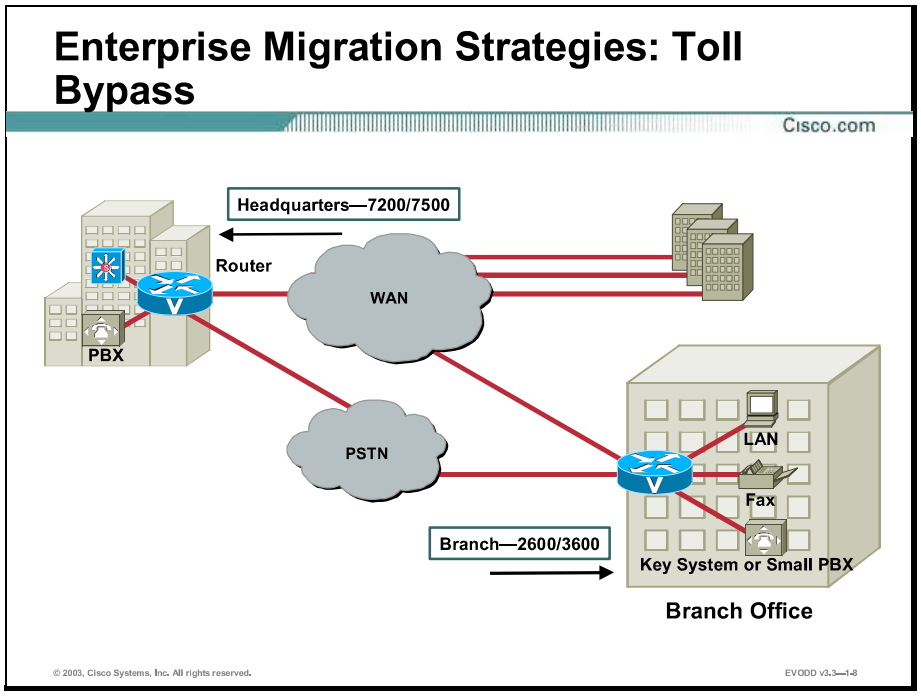


This figure illustrates a typical enterprise: a corporate headquarters and a branch office. The headquarters has a PBX voice network and a Cisco 7500 router. The branch office has a key system, or small PBX voice network, and a Cisco 2600 router. Enterprises support the expense of dual infrastructures, one for data and another for voice.



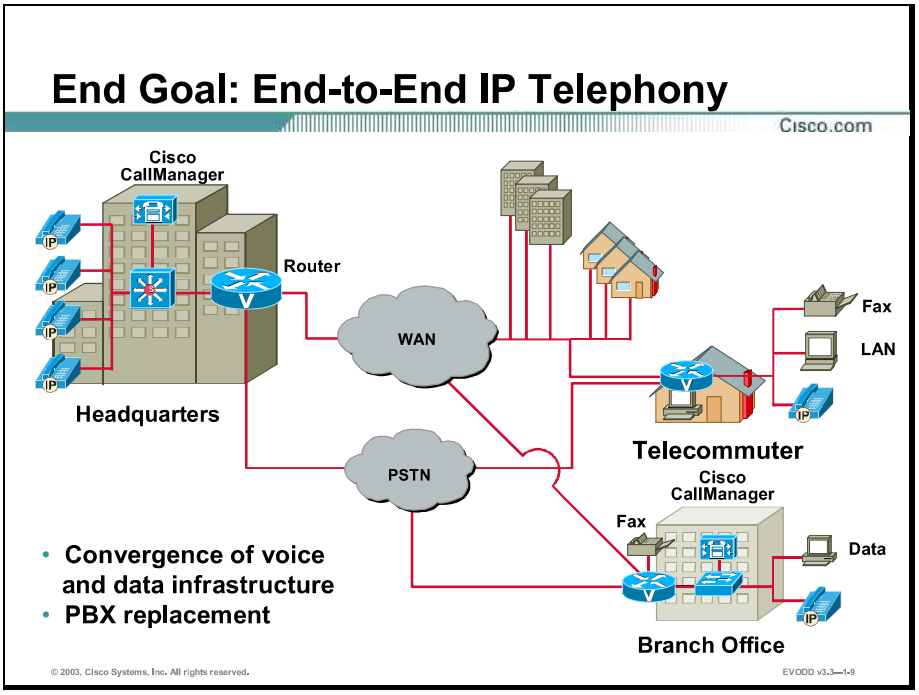
Although the Voice over Data design includes PBX replacement and end-to-end IP telephony, enterprises can take advantage of many interim strategies available for route replacement.

The figure shown here illustrates a typical enterprise that is replacing some voice lines by moving traffic to voice-enabled routers. This process, called toll bypass, allows customers to bypass the PSTN and use the packet network for long-distance (or toll) voice calls.

The enterprise maintains the PSTN for overflow traffic, as well as the PBX and key system for the branch office. This coexistence is common when IP telephony is installed in new branch offices, or when branch offices are replacing key systems.

End Goal

This topic discusses new telecommunications applications.



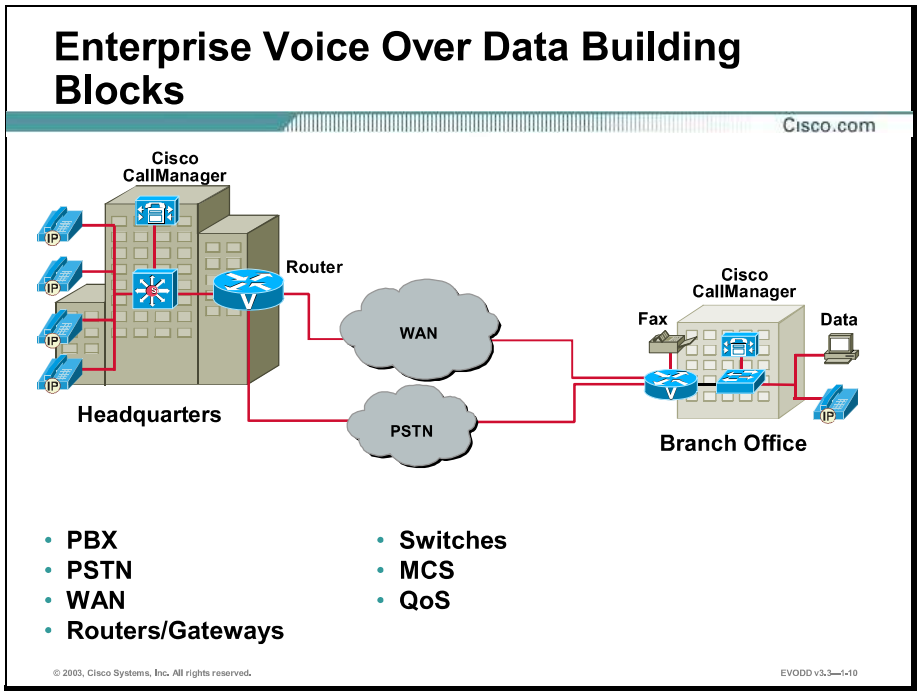
Voice over IP (VoIP), Voice over ATM (VoATM), and Voice over Frame Relay (VoFR) are all recent telecommunications applications. The challenge of integrating voice and data networks is fast becoming a priority for many network managers. Organizations want solutions that help take advantage of the excess capacity for voice and data transmissions on broadband networks, and use the Internet and company intranets as alternatives to more costly mediums.

Quality services and products require a voice access gateway to link the data and telephony networks. When sending voice over data networks, you must use this technology to ensure the quality of voice over streaming data.

The voice-processing technology must handle greater and variable delays, cancel echoes from the telephony side so that the voice does not sound mechanical, and mask gaps caused by dropped packets during congestion.

The data network must adapt to variable networks and conditions, ensure the correct end-to-end connections, and handle the call setup translation for different types of networks, connections, and internetworking.

The goal of Voice over Data networking is the convergence of voice and data infrastructures into a single multiservice network. In a typical enterprise, this infrastructure will support voice, video, and integrated data, giving telecommuters the same access to corporate information services as onsite employees. Because of this technology, the enterprise is able to replace the PBX with an end-to-end IP telephony solution.



A large organization must implement an end-to-end IP telephony solution in phases. Because each phase of the project builds upon the previous phase, the organization must understand the building blocks used throughout deployment and stay focused on the goal. The figure illustrates the location of each building block in the client solution. These building blocks include:

- **PBX:** Unless the organization is implementing a new installation, it must verify that its current PBX system is part of the new solution. Most organizations will implement the new solution slowly and leave the current PBX in place as they perform toll bypasses.

- **PSTN:** Because the organization is implementing a total Cisco IP telephony solution, it must have access to the PSTN. The organization uses the PSTN as a failover path, and to call locations that are not connected to its private network.

- **WAN:** The WAN is the current wide area data network for the client. In the figure shown, the client will also use it for calls between geographically dispersed locations.

- **Routers:** An organization must have routers in place as part of its data network. Some of these routers (such as the Cisco 2600 and 3600 routers) can support voice interfaces.

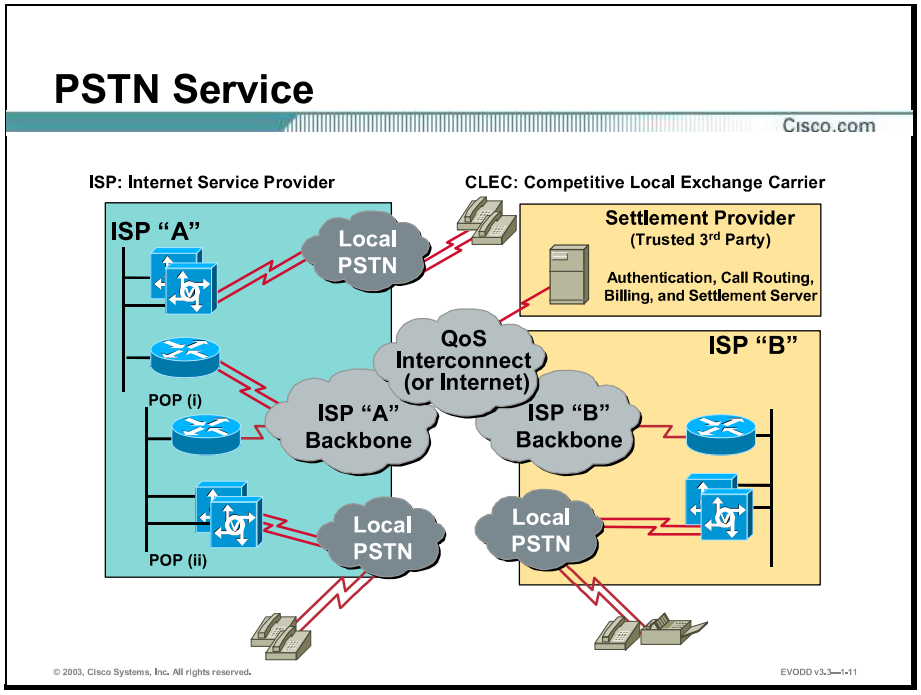
- **Switches:** When the data network transmits voice, the amount of bandwidth use increases. The network infrastructure must be able to handle the added traffic. Therefore, shared media hubs should be replaced with switches, due to collision issues. Also, some Catalyst switches support in-line power for Cisco IP Phones.

- **Media convergence server (MCS):** Cisco CallManager (CCM) software runs on the MCS. The MCS replaces the PBX and allows the administrator to implement a complete IP telephony solution.

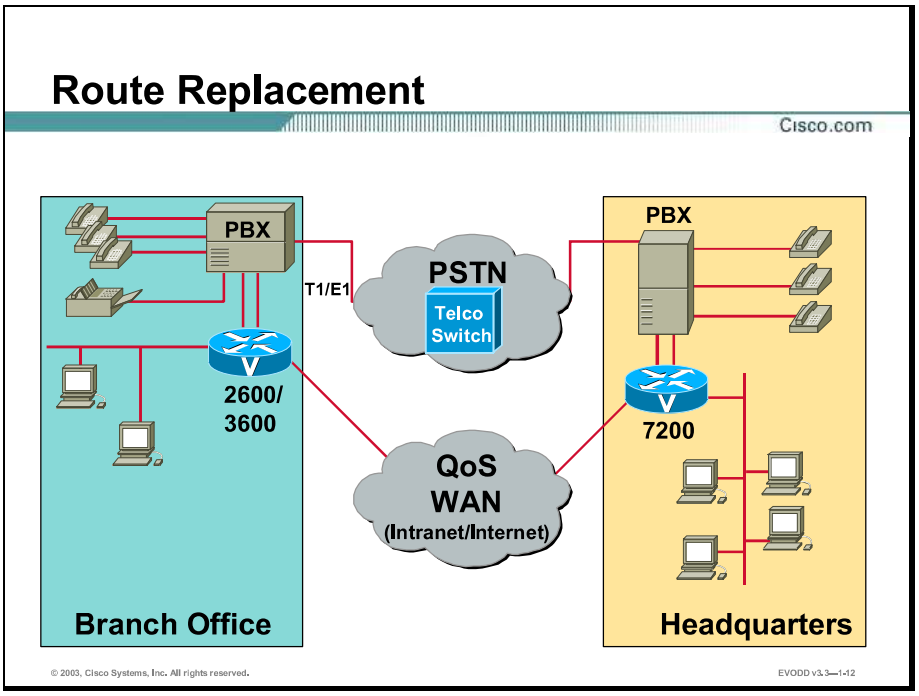
- **Quality of service (QoS):** As data and voice packets are moved to the same network, the organization needs to implement QoS to ensure that voice traffic has priority over data traffic, and that it moves in a timely fashion.

Route Replacement

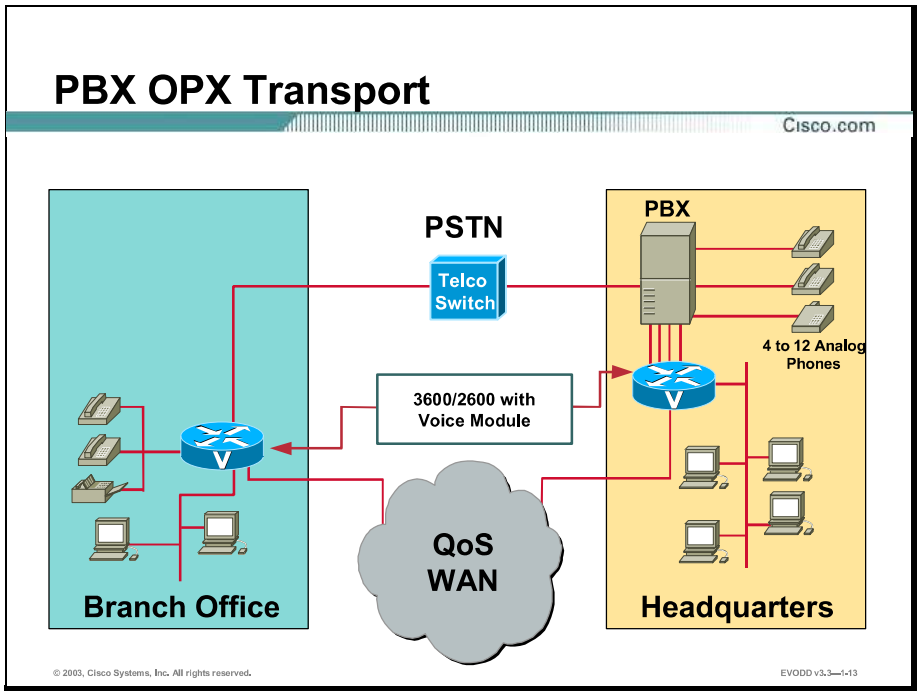
This topic focuses on IP WAN route replacement, an early step in IP telephony migration.



Internet telephony service providers and competitive local exchange carriers (CLECs) take advantage of data infrastructures and implement one of the IP telephony applications— they carry voice over their data networks. These new competitors (to traditional local exchange carriers [LECs] and long-distance companies) also use gateways to connect to the PSTN, relying on a trusted, third-party settlement provider to handle billing. Users set up voice rates as part of their Internet service provider (ISP) packages, creating a public alternative to the traditional PSTN.



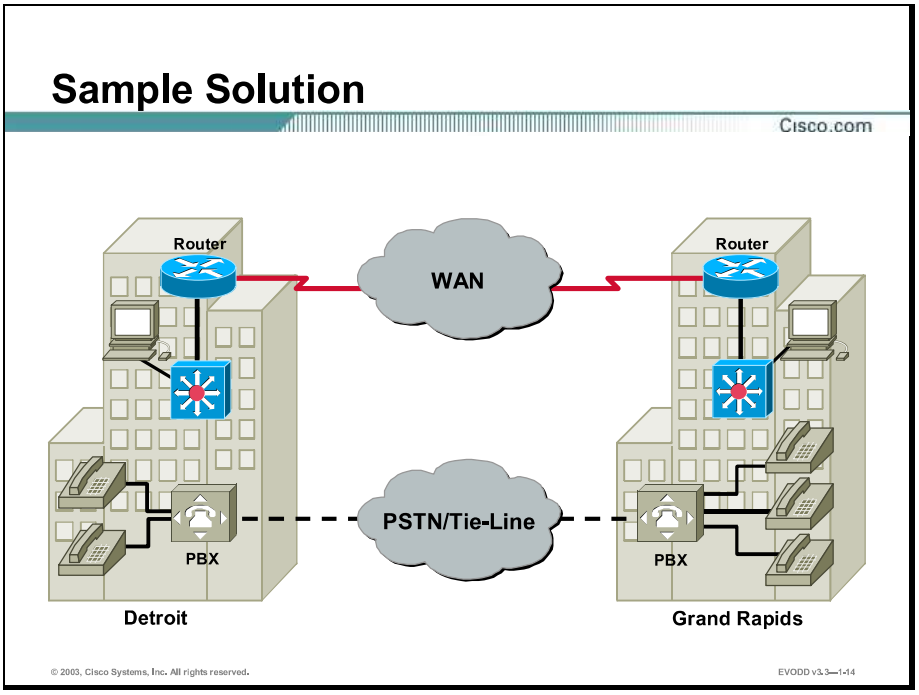
Route replacement is a common application for Voice over Data networking today. Traffic moves from either leased voice lines or the PSTN, and runs over the data infrastructure, where additional bandwidth handles the traffic. With data and voice converged on the same network, organizations use bandwidth more effectively and eliminate waste. To implement this strategy, an organization must have voice-enabled routers and updated software. The cost of this equipment is much less, however, than upgrading the legacy PBX hardware.



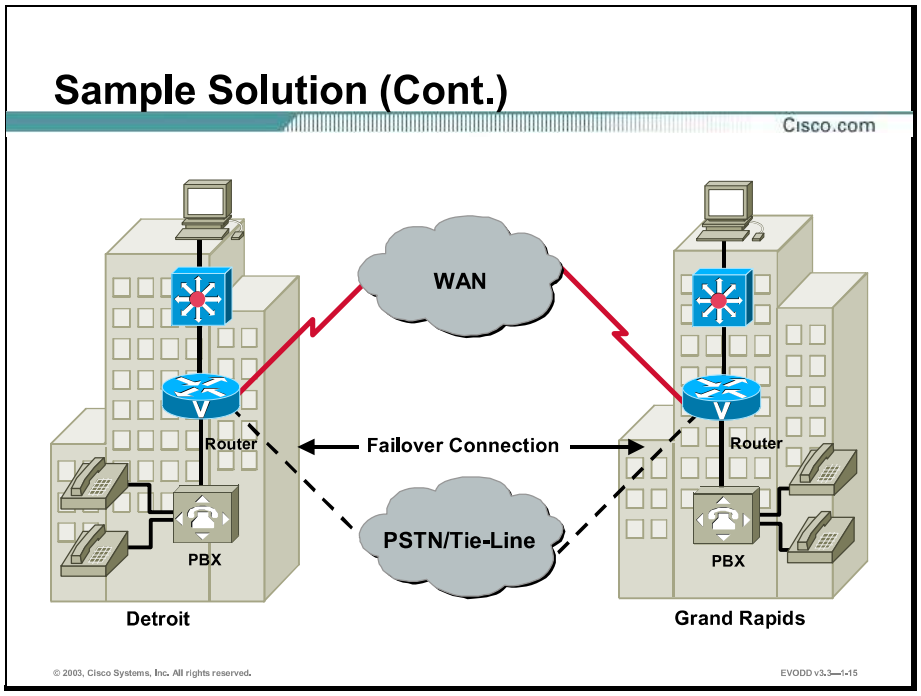
Another common application of Voice over Data is an Off-Premises eXtension (OPX) for a branch office. In the figure shown here, the branch office receives its dial tone from the PBX at the main office. The numbers and extensions appear as if they are located with the PBX, which is one way to avoid toll charges back to the main office. Voice modules are voice feature cards that go into a router or a switch to support voice services.

IP Telephony

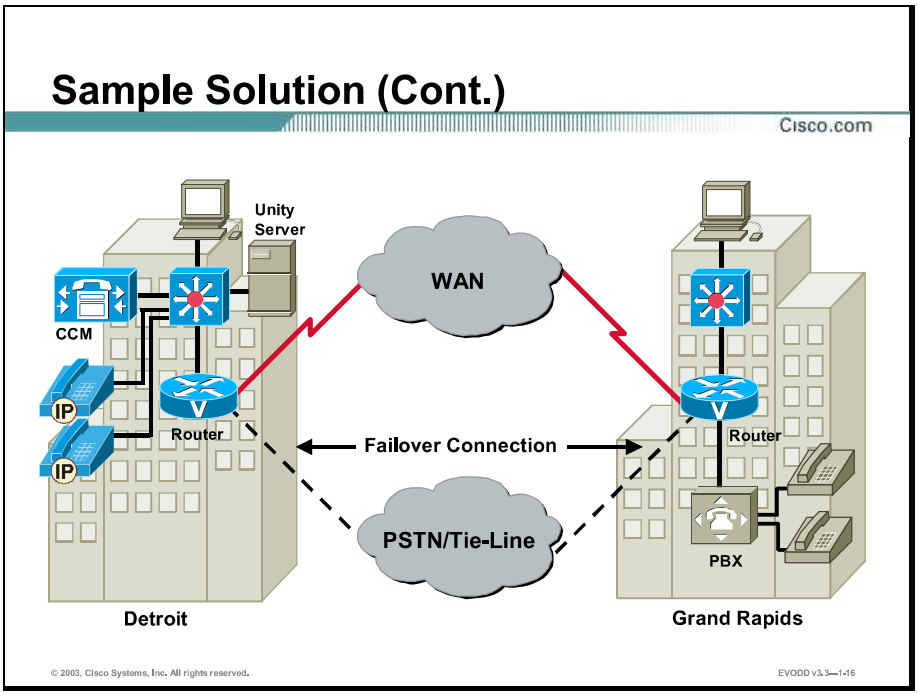
This topic illustrates the process of designing an IP telephony solution for a client.



A client asks you to design a Cisco IP telephony solution. The client is interested in implementing route replacement to test the reliability of this solution before moving to a complete Cisco IP telephony solution. The company has two locations with a PBX at each end. Each location has a WAN in place to access the main server located in Detroit, Michigan. Your goal is to deliver a complete Cisco IP telephony solution.



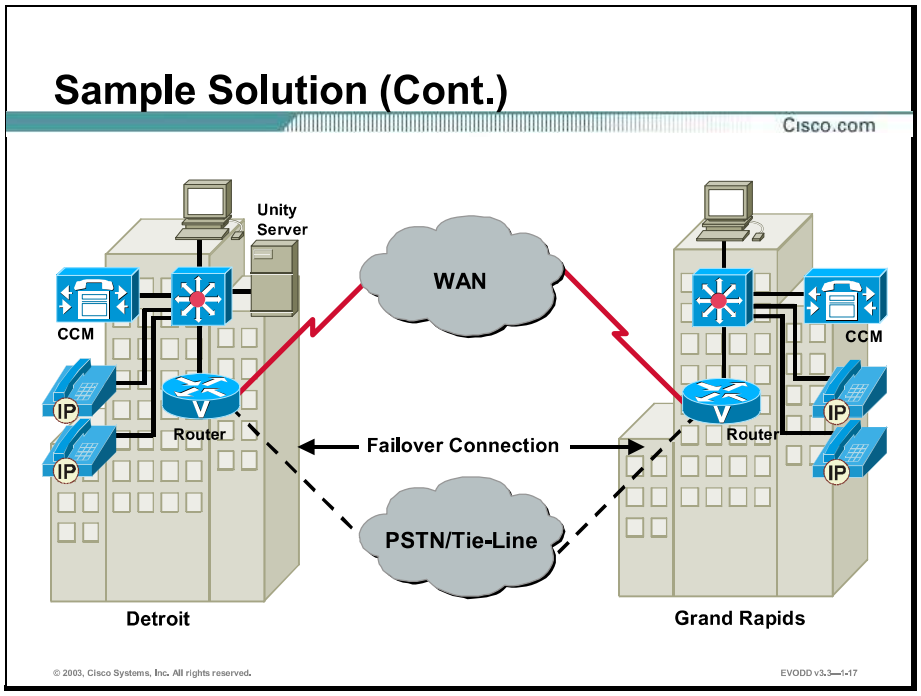
The client has three choices to implement route replacement: use the existing routers; upgrade the existing routers; or purchase new, voice-enabled routers. The PSTN connection still exists for failover purposes.



Router replacement is complete, and the satisfied client wants to convert one office to a complete Cisco IP telephony environment.

To create a Cisco IP telephony environment, you must install CCM. The CCM installation process includes IP Phones, because digital PBX telephones do not work in a Cisco IP telephony environment. Changes include the addition of the PSTN failover path on the Detroit side and the addition of a voice gateway. Because CCM is IP-based, it requires a gateway for converting voice that travels over the PSTN. This gateway is not always a stand-alone device. When the client is satisfied with the results, installing CCM in Grand Rapids, Michigan, is the next step.

Note	Analog telephones can coexist in an IP telephony environment. In addition, Cisco supports shrink-and-grow migrations, in which legacy PBX systems and IP Phones coexist with (CCM).



After installing CCM and IP Phones in Grand Rapids, you can continue building the solution by installing a Cisco Unity server (unified messaging). Cisco Unity is just one example of an add-on application within the Cisco IP telephony environment. Cisco is developing more applications for Cisco IP telephony environments that will allow customers to continue building solutions to meet their specific needs.