

# VoIP/VoFR Aggregation and Tandem PBX Bypass on the Cisco 7200 and 7500

## Introduction

The revolution of voice over data networking comes on the heels of new technologies and significant cost reductions in WAN connectivity. Complementing Cisco's recent introduction of Multichannel WAN technology,<sup>1</sup> multiservice capabilities on the Cisco 7200 and 7500 series routers enable scalable voice, video, and data connectivity to hundreds of remote sites.

An integral part of providing multiservice connectivity to remote sites is the ability to switch voice between sites. Some vendors VoFR/VoIP products rely on the PBX to perform this tandem switching of voice calls one location to another. However, tandem switching is generally perceived as a bad thing by most telecom managers for two reasons. First, it ties up two trunks on the PBX by taking a call in on one line and switching it to another. Second, tandem switching of VoIP/VoFR through a PBX can cause degraded voice quality. Voice coming into the PBX must be uncompressed and then re-compressed going out of the PBX.

Cisco's integrated multiservice architecture allows VoFR/VoIP calls to bypass the traditional tandem PBX switch. Cisco performs this tandem PBX bypass in the router, avoiding the use of the valuable PBX trunk lines and multiple voice encodings. This is a huge benefit to deploying large VoFR/VoIP networks.

This white paper describes how enterprise network managers can utilize the Cisco 7500 and 7200 routers with multiservice capabilities to aggregate voice and data from remote sites into central sites and bypass traditional PBXs for switching voice from one site to another.

## Multiservice Remote Site Connectivity

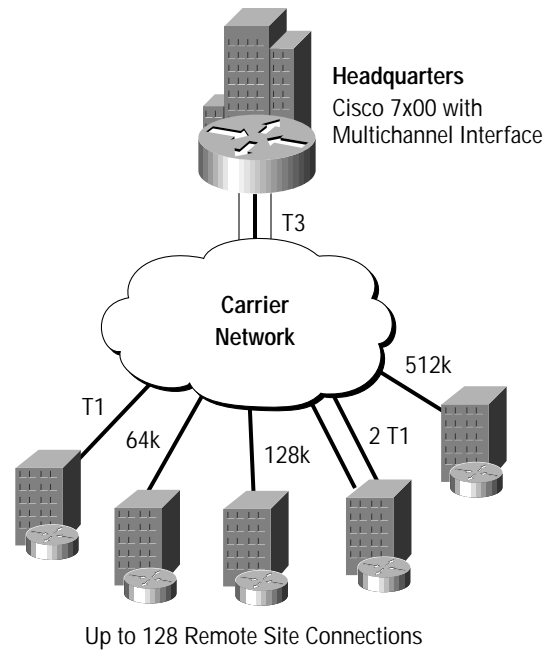
Multiservice aggregation and tandem PBX bypass for VoIP or VoFR calls are not capabilities unique to Cisco's high-end routers. However, the Cisco 7500 and 7200 have taken a strong position in remote site aggregation because of their high port density, multichannel interfaces and high performance that scales Cisco IOS® features across potentially hundreds of remote site connections.

Cisco Multichannel networking technology simplifies the problem of connecting hundreds of remote sites to a central site. With built in CSU/DSUs, multiplexing capabilities, and Frame Relay support, Multichannel interfaces provide up to 128 total leased line connections per interface adapter at a range of speeds from 64kbps to megabits (Figure 1). As remote site performance needs change, or as tariffs alter the cost equation, changing the WAN connection speeds is just a matter of software reconfiguration on the router and a call to the telecom carrier.

1. Cisco White Paper: "Multichannel WAN Aggregation in the Enterprise," Christian Suder, 03/17/1998

Both the Cisco 7200 and 7500 utilize Cisco's most scalable packet switching technology, Cisco Express Forwarding, along with high performance RISC processing to provide robust Cisco IOS feature and service performance. The Cisco 7200 series gives 100 to 300 thousand packets per second of switching performance with a single processor architecture. The Cisco 7500 gives up to 1.3 million packets per second performance with a proven distributed processing architecture.

Figure 1 Remote Site Interconnection on the Cisco 7x00

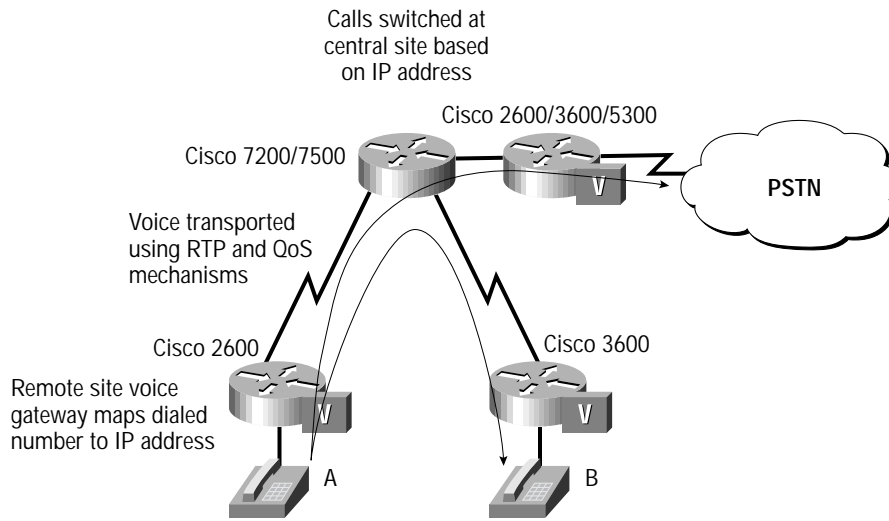


### VoIP Aggregation and Tandem PBX Bypass

Voice over IP is the most flexible choice for voice transport since it can run over any layer one or layer two infrastructure. This flexibility is particularly important in heterogeneous environments where remote sites may be interconnected with both leased line and Frame Relay links.

Since voice is transported as an IP packet using the real time protocol (RTP), any router that can scale QoS across the remote site links can "switch" voice packets. In the example below (Figure 2), the Cisco 2600 router handles the translation of the dialed number to an IP address and forwards voice and control packets to the central site Cisco 7200. If phone 'A' dialed a number at another branch office, phone 'B', the central site router bypasses any PBX in the network and forwards the voice and control to the voice gateway at that branch site, in this case the Cisco 3600 router. If the call from 'A' is outside the dial plan, voice packets are forwarded first to the central site Cisco 7200 and then to the PSTN via a voice gateway at the central site.

Figure 2 VoIP Tandem Switching on the Cisco 7x00

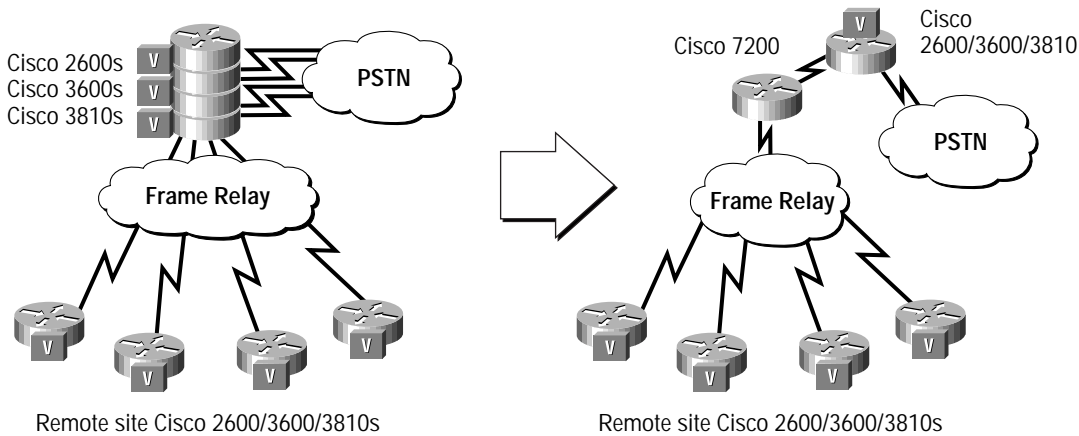


### VoFR Aggregation and Tandem PBX Bypass

On Frame Relay links, high quality levels of service for voice and video are provided by the new FRF.11 and FRF.12 standards. These standards are now supported on the Cisco 7200 and planned for the Cisco 7500, so that these routers can act as central site VoFR aggregators for remote site Cisco 2600, 3600, and 3810 platforms.

To prevent large data packets from introducing unacceptably long delays, remote sites connecting to central sites via low CIR Frame Relay links require FRF.12 fragmentation. To work, both the central site router and the remote site router need to support FRF.12. FRF.12 support in the Cisco 7200 allows central sites to scale to large numbers of remote site connections without the need for mirror image routers at each end of the link (Figure 3).

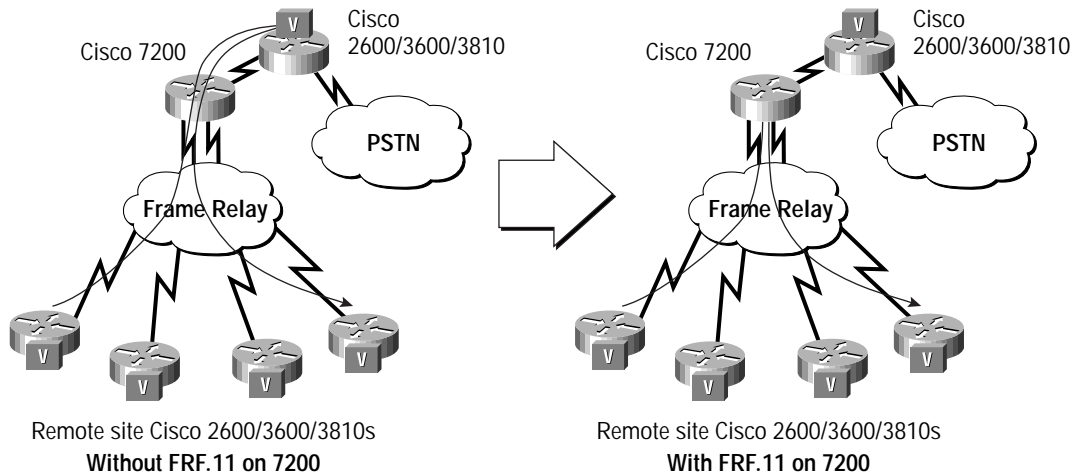
Figure 3 Consolidation of Links with FRF.12 on Cisco 7200



FRF.11 is not required on routers that do not terminate voice calls. However, this means that in order for VoFR calls to be tandem switched in the network, PVCs from remote sites need to terminate on an FRF.11 enabled router. In networks with non-collocated gateways, extra PVCs may be required. This increases the complexity of the network and decreases the network efficiency since voice must often cross the same link twice on separate PVCs.

As shown in Figure 4, FRF.11 support on the Cisco 7200 allows it to understand FRF.11 subchannel addresses, and tandem-switch voice calls from one PVC to another. This eliminates the need for the calls to traverse the link between the Cisco 7200 and the Cisco 2600/3600/3810 gateway twice. No extra Frame Relay PVCs are needed, and the collocated Cisco 3600s just terminate traffic.

Figure 4 VoFR Tandem Switching Avoidance on the Cisco 7200



## Summary

The performance, density and flexibility of the Cisco 7200 and 7500 have made them the routers of choice for enterprise WAN data connectivity. As new voice and multiservice features are added to these platforms, their existing position as central site aggregation routers will be extended to include VoIP and VoFR aggregation and tandem PBX bypass functionality.



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