

Voice Over IP (VoIP) is spreading. What is it, and what are the key issues in using and managing it?

### What is VoIP, Anyway?

“VoIP” is voice over the Internet Protocol (IP). IP is the basic protocol for carrying data over the Internet. In VoIP, voice is digitized, the resulting stream of bits is chopped into packets, and the packets are sent over the Internet using IP. When the packets arrive at their destination, the original data stream is reassembled and decoded to recover the voice.

### The Rise of VoIP

People have been transmitting voice over packet networks for at least 20 years. More recently, people have been using the Internet to chat, and networks such as Free World Dialup have sprung up to connect them. People have also been using shared whiteboard, voice and video programs such as NetMeeting over local area networks and the Internet. These are the harbingers of change.

VoIP is now moving into the mainstream and challenging existing value streams.

- A significant and growing portion of telephone traffic is shifting to VoIP, and operator and manufacturer focus has shifted to VoIP. Global wholesale telephone service prices have fallen to a few cents per minute on liberalized routes.
- Local-area-network (LAN)-based VoIP has all but taken over the PBX (private branch exchange) world. Enterprises are integrating their voice and data networks. Cordless and cellular handsets that use LAN-friendly 802.11 WiFi in enterprise environments have emerged.
- Old and new service providers, including cable operators, have started offering VoIP service over high-speed access lines.

### Why is VoIP Becoming Important?

VoIP is playing a central role in the trend toward near-zero telephone service costs and the rise of productivity-enhancing applications. Shifting to VoIP may be central to business survival this new environment.

VoIP allows the end stations to communicate directly with each other after being linked up by central servers, leading to simpler, more flexible and more economical networks that support voice, data and video.

In the long-distance telephone space, the first impetus for VoIP was to bypass high PSTN termination fees by using the Internet. Now, carriers are looking at the advantages of having a single, simpler Next Generation Network for voice and data with lower service-creation hurdles.

Enterprises are attracted by only having to manage one set of equipment and wires to the desktop rather than two, being able to combine voice, data and video on a common wide area network, and making practical new productivity tools that this integration enables.

The growing availability of low-cost high-speed data access services has opened a way for new local and long-distance service providers to reach customers using VoIP.

### Key VoIP Platform Elements

Unless the traffic level is low compared with network bandwidth, typically a quality-controlled and -managed IP network is needed (in contrast to the raw Internet that only provides a best-efforts service). In a managed network, voice packets are given priority (to minimize jitter and delay), network behaviour under congestion is controlled.

## Key Issues in VoIP (continued)

Call detail records may need to be gathered and processed. Accurate bills need to be generated and presented on time, and invoiced charges collected. Economical ways of doing this at a small fraction of a cent per minute of use are needed.

Productive centralized operations, maintenance, administration and provisioning tools are needed.

Business plans are needed which re-align and bring together the new regulatory and competitive landscapes, markets, segments, bundles, prices, channels, platforms, operations, settlements, billing, collections, finances and profits.

### Protocols in VoIP

In carrier networks, the emerging standard for VoIP is SIP (Session Initiation Protocol).

The ITU-T H.323 suite of standards is common on local area networks, and is supported by many PBXs and used by applications such as Netmeeting.

MGCP (Media Gateway Control Protocol) is used to control interworking devices at the edges of the managed IP network

### Market Structure, Technical and Regulatory Issues

*The old market and regulatory structure is changing.* Voice service prices have fallen to the point where, on liberalized routes, charges set by regulators to defray local incumbent service costs now dominate regardless of distance, increasing the pressure on the “last mile” cost bottleneck. VoIP is playing a central role. How the opportunities and challenges are addressed by new entrants, incumbents, manufacturers and regulators will decide the new market and regulatory structure.

*Select the right codec(s).* Some high compression algorithms, that squeeze voice into a low bit rate to

save bandwidth, sound bad and introduce delay, and should be avoided

*Voice dislikes jitter.* Jitter is rapid changes in the transit delay between speaker and listener. A low-delay transport network, and buffering at the receive end, are needed.

*Voice dislikes delay.* Delays of more than about 100 milliseconds will interfere with conversation. In VoIP, low-bit-rate encoding and IP queuing delays can easily build up to this amount and beyond, so it is important to manage encoding and delay within acceptable limits.

*Voice dislikes echo.* Virtually all of the telephones on the public switched telephone network are two-wire, which means that some of the received speech energy gets reflected back to the talker as echo. Users find delayed echoes highly objectionable. For delays typical of VoIP, echo cancelling is needed.

*Excessive transcoding degrades voice.* If there are too many conversions from one voice encoding standard to another in a call (including voice mail recording and playback), the resulting sound is distorted, so the total quantity of transcodings in the speech path must be managed.

*Legal wiretapping may impact economics.* One of the advantages of SIP is that it allows end stations to talk directly to each other after call setup. If it turns out that central servers must remain in the call after setup in order to do legal wiretapping, then this may impact the economics of VoIP.

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