

such as RADVISION, support this version in their 3G-324M protocol toolkit. The minimal version to be supported is version 3. Support for the higher versions enables a richer set of call-control services. The rising video-codec protocol, H.264, requires advanced H.245 support with generic capabilities exchange.

Because 3G-324M rides on a channel that was opened between two communicating parties, it doesn't need any addressing like H.323. The gateway (e.g., between 3G-324M, H.320, H.323, and SIP) is expected to provide the interoperability between different networks. This gateway can be realized rather easily.

3G-324M for H.245 operation requires Numbered Simple Retransmission Protocol (NSRP) and Control Channel Segmentation and Reassembly Layer (CCSRL) sub-layers support. NSRP is defined in H.324/Annex A. Essentially, mobile terminals shall support the NSRP and the SRP mode. If both terminals start the session in Level 0, the SRP mode shall be used. If Multiplexing Level 2 is used, both terminals shall start with NSRP mode.

The CCSRL sublayer is used for carrying the large H.245 packets that are required for operation. H.245 provides the following functions: master-slave determination, capability exchange, logical channel management, multiplex table management, mode-change request, and miscellaneous commands and indications. The explanation for each function follows:

The **master-slave determination** figures out which terminal is the master at the beginning of the session. Due to the fact that H.245 is a symmetric control protocol, it's necessary to determine the master terminal. That terminal has the right to decide the conditions in case of conflict.

The **capability exchange** exchanges the capabilities that both terminals support. These capabilities include the mode of multiplexing; type of audio/video codecs; data-sharing mode and its related parameters; and/or other optional features.

Logical channel signaling opens/closes the logical channels for media transmission. This procedure also includes parameter exchange for the use of this logical channel.

Multiplex-table initialization/modification adds/deletes the multiplex-table entries.

The **mode request** requests the mode

of operation from the receiver side to the transmitter side. In H.245, the choice of codecs and parameters is decided at the transmitter side. This choice takes into account the decoder's capability. If the receiver side has a preference within its capability, this procedure is used.

The **round-trip-delay measurement** enables an accurate quality-characteristic measurement.

The **loop-back test** is useful for device test during development or in the field. It helps to assure proper operation.

Miscellaneous call-control commands and indications request the modes of communication, flow control like conference commands, and jitter indication and skew. Or they can indicate the conditions of the terminal to the other side.

To provide these functions, H.245 defines the messages to be used and the procedures for handling those messages. Using Abstract Syntax Notation 1 (ASN.1), H.245 defines each message parameter that effectively provides readability and extensibility. To encode these ASN.1 messages into binary, it utilizes the Packed Encoding Rule (PER). It thereby realizes very bandwidth-effective message transmission. After the multiplexing-level synchronization between the communicating parties is completed, the first logical channel opened (channel 0) is H.245 call control. It has CCRL and NSRP, which ensure that the H.245 channel will be highly reliable. It also will be able to use large packets during operation.

3G-324M-ENABLED DEVICES

In order to operate 3G-324M services, handheld devices, base stations, gateways, and servers must all support this protocol. The handheld-device category includes all types of handheld devices, including 3G PDAs, smart phones, and feature phones. Those devices are the clients of the service, which can operate video-call initiation and receiving and video on demand (VOD). The service also can operate data-entry services while a call session is active, such as dual-tone multiple-frequency (DTMF) signals for an e-commerce transaction.

The base station is the network device of the operator. It authenticates the served client's handheld devices. The base station also initiates a bridge between the handheld device and a backbone packet-switched and circuit-switched network (with E1/T1 ports interfacing the backbone). The base station should comply

with the following 3G-324M-related call-setup specifications:

- 3GPP TS 24.008: mobile radio interface Layer 3 specification
- 3GPP TS 27.001: General on Terminal Adaptation Functions (TAF) for mobile stations (MSs)
- 3GPP TS 29.007: General requirements on interworking between the public-land mobile network and the integrated-services digital or public-switched telephone networks
- 3GPP TS 23.108: Mobile radio interface Layer 3 specification core network protocols; Stage 2 (structured procedures)

The gateway also plays a vital role in 3G-324M's success. It bridges the 3G-324M circuit-switched and IP network (H.323 or SIP) signaling. The gateway translates the call-setup mentioned above into Q.931 (H.323) or SDP (SIP) messages. The call control of the H.245 over CS is transformed into H.245 (H.323) over IP or to SDP (SIP). The codecs are transformed as well. If there are no common codecs in the capability-exchange phase (H.245 or DSP capability-exchange procedure), a transcoding is performed.

Lastly, the servers enable add-on services like auditing, video mail, and video on demand. They should have 3G-324M if they're interfaced directly with the base station's CS ports. The servers also may support DTMF to enable user controls like record, playback, or menu operation (OSD).

3G video telephony is paving its way toward the mass market month after month. Every day, mobile-device quality is enhanced, coverage improves, and there are more countries and 3G subscribers to call. The problems of carrying video-telephony communication over IP in a public 3G network won't be solved in the near future. Yet the 3G-324M solution does offer hope (**FIG. 4**). It is the only working 3G protocol with a rapidly growing number of subscribers. Most importantly, it boasts acceptance by all 3G technology camps including W-CDMA, TD-SCDMA, and CDMA200. Across the globe, equipment developers and service providers are embracing this protocol for their 3G solutions. ■

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