DELIVERY OF NEW PACKET-BASED SERVICES OVER CABLE: THE PACKETCABLE™ CONCEPT

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Extended Abstract

CableLabs, and its member companies, are developing a packet network to overlay on cable, which will deliver a new family of services. Generically called "PacketCable™," these services could be any useful features capable of being transported by a packet network. The technical underpinning of this overlay network is the Internet protocol (IP) running over standard cable modems. The following extended abstract discusses the conceptual framework and focus of the PacketCable development effort.[1]

PACKETCABLE SERVICES

Any data or information service that lends itself to packet-based transport is a potential PacketCable service candidate. We anticipate that the initial PacketCable service set will be Packet Voice and Packet Video for business and residential markets. Our approach to providing these services is described below. Over time, it is likely that other IP-based business and residential services will be added to the product line. Key factors differentiating the PacketCable concept from the market are: the North American footprint represented by CableLabs' member companies; cable networks' ample bandwidth, enabling broadband packet-based services such as video; and the capability of packaging a unique set of packet-based services customized to users' needs.

As envisioned, Packet Voice will provide a PSTN-like (Public Switched Telephone Network) experience to users by providing all the enhanced features of circuit-switched telecommunications systems. Consumers will originate and receive voice calls using either their existing telephones or a multimedia personal computer (PC). Using the service, consumers will encounter normal PSTN-like audible tones, such as a dial-tone when going off-hook, a busy signal if the receiving station is off-line or engaged in another call, or ringing. In addition, consumers will receive the equivalent of today's CLASS Services (*e.g.*, call waiting, call forwarding, and 3-way calling).

Packet Video is an audio and video conferencing service that will enable consumers to place and receive video calls. At the customer premises, we envision delivering a symmetrical service through a cable modem, and terminating in one of three premises device options:

1. a special adapter we call a Multimedia Terminal Adapter (MTA), interconnecting a television set, video camera, and a standard telephone;

2. a cable television OpenCable™ digital set-top, equipped with a PacketCable client, interconnecting a television set, video camera, and a standard telephone; or

3. multimedia PCs equipped for video conferencing (plus any required peripherals).

We also envision some asymmetrical applications using one-way Packet Video with two-way audio. For example, live video conferencing with a call center representative where the customer sees and hears the Customer Service Representative (CSR), and the CSR only hears the customer.

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1. The authors note the contributions of many other individuals, collectively representing the membership of the PacketCable product definition group, for their contributions to the production definition concept.

PACKETCABLE NETWORK SUPPORT

Conceptually, the PacketCable development effort focuses upon the higher application layer, with the presumption that network-layer services, and those below, will be provided by the DOCSIS modem or the OpenCable set-top box delivered through a hybrid fiber/coax (HFC) cable network. The exception is the requirement for quality of service created by the isochronous[2] PacketCable services.

Within this context, our development effort assumes PacketCable services will utilize a "cable intranet," or private IP network, that uses edge devices, known as clients, to perform protocol conversions that permit communications between subscribers directly connected to those devices. It also allows PacketCable subscribers to originate and terminate calls to stations connected to the PSTN through other edge devices, known as PSTN gateways.

A "cable intranet" consists of interconnected IP networks operated locally by the individual cable companies and interconnected, managed-IP backbones (such as @Home and RoadRunner/MediaOne Express). Such interconnect capabilities will give the PacketCable service a North American footprint (*i.e.*, allowing PacketCable subscribers to make calls throughout North America to other subscribers without having to interface with the PSTN). In instances where connectivity with the PSTN is desired, such connections may be accomplished through conventional interconnect means. This may include leveraging the existing presence of some MSOs and their affiliates in the CLEC (Competitive Local Exchange Carrier) and CAP (Competitive Access Provider) markets to provide these interfaces.

2. A descriptive terminology to describe a datastream that has a guaranteed, constant time relationship, or a signal in which the time intervals between consecutive bits have the same duration.

PACKETCABLE INFRASTRUCTURE

The infrastructure required to deploy PacketCable services in a local geographic area, consists of three categories of equipment:

- a logical gatekeeper, consisting of a set of servers, to manage most aspects of the service connections;
- clients homed on the Packetcable server group; and
- local gateways used to enter or exit the IP network to the PSTN.

This architecture can be expanded to cover a larger "On-Net" footprint by interconnecting local PacketCable networks using a hierarchy of directory servers and IP gateways. The actual media connections between local IP networks, over which the voice and video packets are transmitted, are made through a series of IP gateways, which function as private network access points called C-NAPs (Cable - Network Access Points). The PacketCable directory-server hierarchy and C-NAP gateways permit calls to be originated by a PacketCable client in one gatekeeper zone. The calls are terminated to a PacketCable client in any other gatekeeper zone served by PacketCable, regardless of who operates the system.

SPECIFICATION EFFORT

Whenever possible, our preference in creating a PacketCable specification is to utilize existing technical standards or known service-quality parameters where they exist. For example, Packet Voice is an isochronous service, the quality of which is very sensitive to packet loss, "jitter,"[3] and overall network latencies (delay). The PacketCable development effort will specify an acceptable range of values for these parameters. Moreover, we require Packet Voice be compatible with the basic functions of ITU recommendation H.323. Similarly, Packet Video is

also an isochronous service, the quality of which is very sensitive to packet loss, "jitter," video/audio "skew,"[4] and overall network latencies. This two-way symmetrical service will be based primarily on ITU H.263, supporting different grades of video quality.

Our investigation of these relevant technical standards, however, reveals that they are incomplete to specify and to support fully the deployment of interoperable IP voice and video services over cable networks. Consequently, the PacketCable committee is currently in the process of developing a functional specification to deliver the services noted above that "fills in the gaps" of these technical standards. The PacketCable committee hopes to complete this specification with the goal of delivering commercial products for consumer and business applications within the next 9–12 months.

3. The time elapsing between the emission of the first bit of a data block or packet by the transmission client, and its reception by the receiving client, is known as the network transit delay. The variation of this delay over time, or the extent to which it varies from packet to packet, is known as "jitter."

4. Video/audio "skew" refers to the stringent type of synchronization that occurs when speech is played out at the same time the image of the speaker is displayed. In the case of video conferencing, this is also known as "lip-synchronization."