♦ Services and Technical Considerations for the Wireless IP Multimedia Subsystem

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Merging voice over IP (VoIP), multimedia, and third-generation (3G) wireless telephony presents significant opportunities and challenges. The challenges are both commercial and technical. In order for the carriers to deploy the service, wireless multimedia services must be marketable to the end users in initial deployments when user equipment and service is not yet widespread and yet provide enhanced services to users with next-generation terminals. From the technical perspective, wireless systems must provide efficient support for multiple simultaneous data streams with divergent characteristics to support multimedia services. We take example services and step through the wireless IP multimedia subsystem (IMS) showing how these services can meet the commercial needs and the technical challenges the market and users require. © 2002 Lucent Technologies Inc.

Introduction

The wireless IP multimedia subsystem (IMS) provides a flexible architecture for the rapid deployment of innovative and sophisticated features. The IMS utilizes the session initiation protocol (SIP), which is an Internet protocol (IP) application-layer control protocol that creates, modifies, and terminates sessions. The Internet Engineering Task Force (IETF) specifies this protocol (refer to RFC-3261 [8]). SIP technology and session control combined with network intelligence make it possible for the IMS to offer services that make efficient use of the wireless air interface. The IMS must support services with telephony-grade reliability and Internet-grade innovation. It also must support a common set of services to end-user devices (SIP and circuit) independently of how these devices access the network (wireless or wired).

In this paper we describe several features and how they can be implemented in the IP multimedia subsystem. We first describe the architecture of the IMS. We then use this architecture description to walk through several service scenarios. Finally, we discuss the nature of services that the IMS can support.

The IMS builds upon the deployment of a high-speed wireless packet network. After a high-speed wireless packet network is deployed, operators need only add a few IMS nodes to begin offering IMS services. The IMS can scale very gracefully with traffic load. A few nodes can provide IMS service for an entire network. It will be necessary to scale up the network as capacity is needed, but it is not necessary to deploy more IMS equipment to cover a large geographic area.

It will take time to build a large user base of IMS subscribers. The first services available must provide high value even before there is a large user base. The "Expert on Call" service we describe later in this paper

Bell Labs Technical Journal 7(2), 91–104 (2002) © 2002 Lucent Technologies Inc. Published by Wiley Periodicals, Inc.
Published online in Wiley InterScience (www.interscience.wiley.com). • DOI: 10.1002/bltj.10007

is one good example. This service uses the IMS to send multimedia and image data between technicians in the field. It is targeted to business with traveling technicians facing problems in the field that are difficult to describe and communicate with words alone. One can readily see that support for almost any kind of mechanical repair can be greatly facilitated with image data. A large initial subscriber base is not required to make this type of service valuable. A company fielding a handful of technicians can make valuable use of image data between its home office and its handful of technicians long before SIP terminals have attained large-scale market penetration.

Some services are valuable even before we have large wireless IMS penetration because they interwork with landline Internet users or systems. SIP clients can be downloaded into landline-based PCs that enable them to communicate with mobile SIP terminals using IMS features. For example, a multimedia message retrieval system may be useful because both landline and mobile subscribers will be able to leave multimedia messages. Similarly, a multimedia conference feature can be valuable early in the deployment cycle of SIP mobiles because the feature will be used to conference both mobile and landline-based multimedia users.

Before we describe features in detail, it is useful to discuss the IMS itself.

Panel 1. Abbreviations, Acronyms, and Terms

3G—third generation
3GPP2—3rd Generation Partnership Project 2
3GPP—3rd Generation Partnership Project
AAA—authentication, authorization, and accounting
BGCF—breakout gateway control function
CAMEL—customized application for mobile network enhanced logic
CSCF—call session control function
CSE—CAMEL service environment
HSS—home subscriber system
HTML—Hypertext Markup Language
I-CSCF—interrogating CSCF
IEEE—Institute for Electrical and Electronics Engineers
IETF—Internet Engineering Task Force
iMSC—interworking mobile switching center
IMS—IP multimedia subsystem
IP—Internet protocol
ISC—IP multimedia service control
I-SCM—interrogating SCM
L-SCM—local SCM
MGCF—media gateway control function
MGW—media gateway
OSA—open service architecture
P-CSCF—proxy CSCF
P-SCM—proxy SCM
PSTN—public switched telephone network
QoS—quality of service
SCM—session call manager
S-CSCF—serving CSCF
SIP—session initiation protocol
S-SCM—serving SCM
UE—user equipment
URL—uniform resource locator
UTMS—Universal Mobile Telecommunications System
VoIP—voice over Internet protocol

General Architecture

The vision for the IMS core network is maximum flexibility and independence from the access technologies. This is to say that the IMS core network supports end-user equipment via Universal Mobile Telecommunications System (UMTS) packet data, CDMA 3G1x, 802.11, wireline IP network, and other methods of access. The flexibility is accomplished, in part, via a separation of access, transport, and control. The control is further separated into media control, session control, and application control. **Figure 1** illustrates this with a simplified view of the IMS. The radio access network provides the over-the-air connection from the user equipment to the core network. It also provides low-level mobility management. The packet core network provides transport for the signaling and bearer. It also provides high-level mobility management. The IMS provides the control of applications, control of sessions, and media conversion. Within the IMS, we show that media control, session control, and application control are separated in distinct entities.

Lucent Technologies' architecture for the IMS described in [7] is illustrated in the subsequent figures. With this architecture, both SIP wireless/wireline user

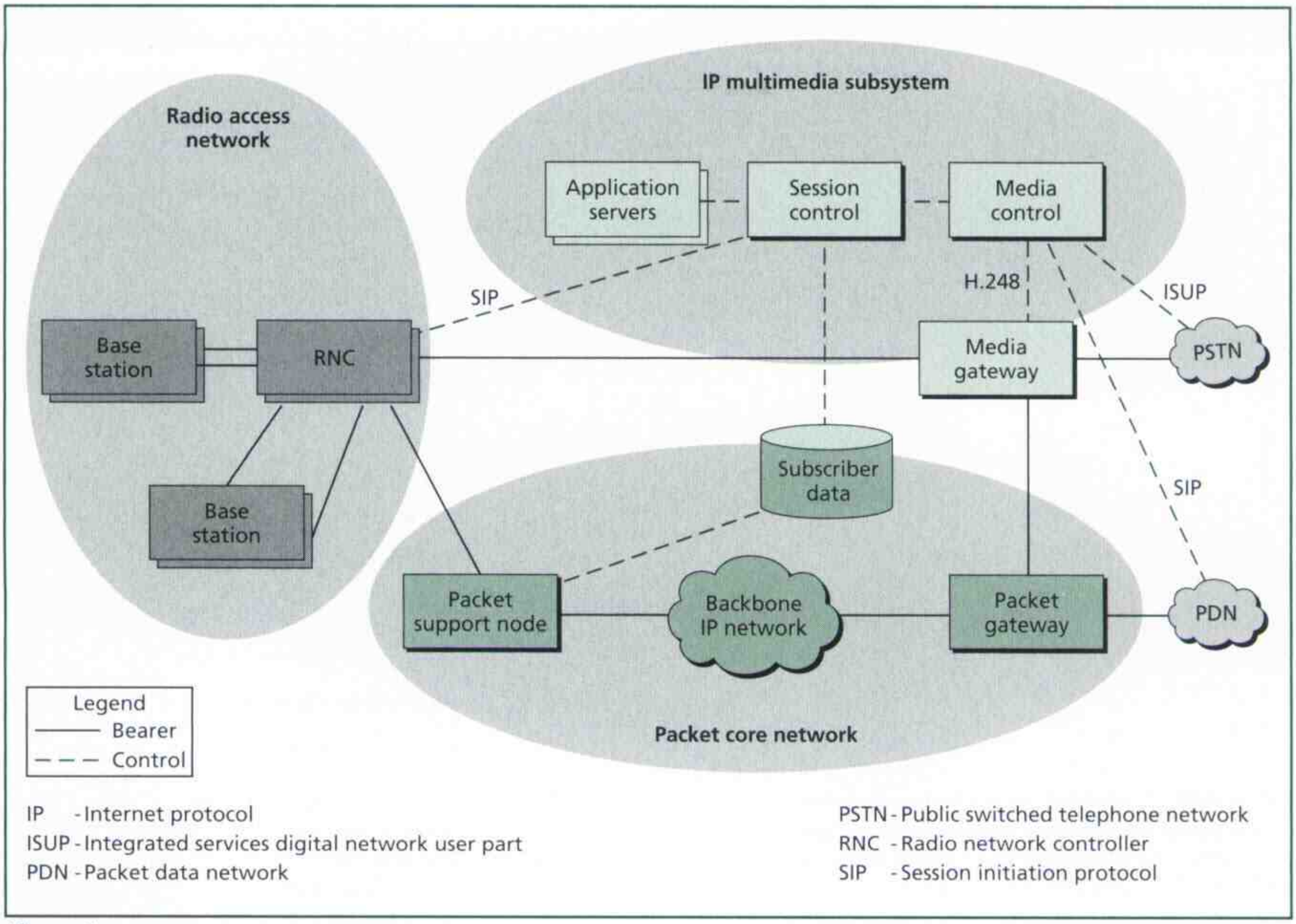


Figure 1.
IP multimedia subsystem and connected networks.

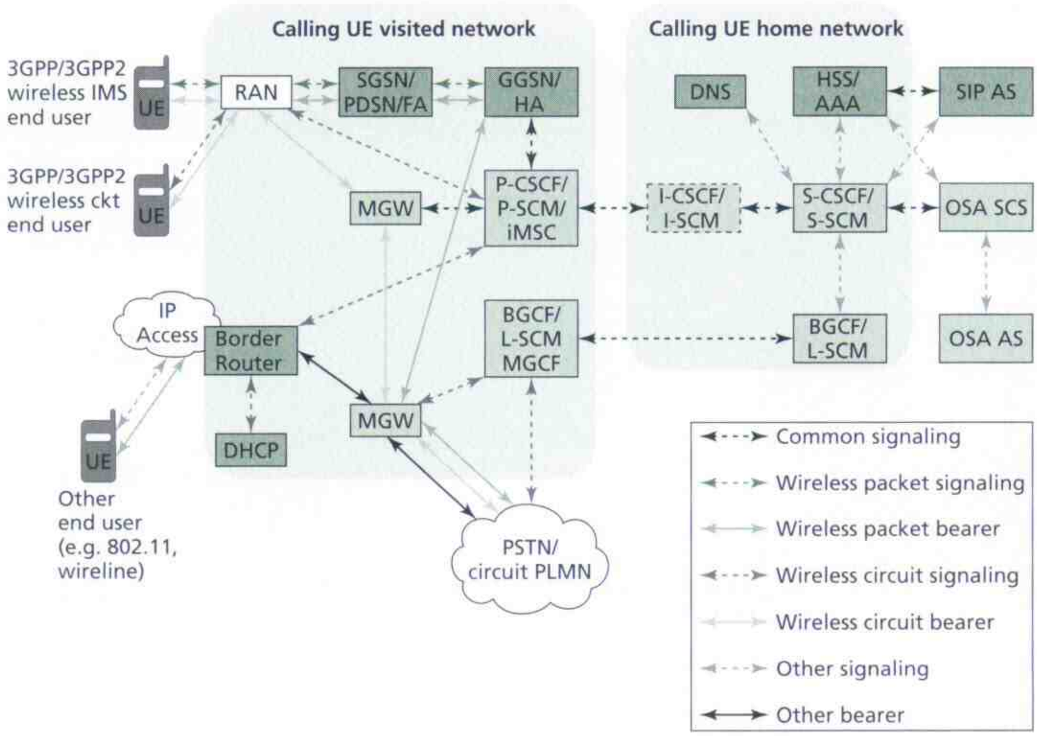
equipment and legacy circuit mobiles are supported. This allows for a high degree of hardware and software reuse. For example, there will be no need to develop a feature twice—that is, one version on the circuit system and one version on the packet system. A feature implemented in the IMS can be made available to both SIP wireless/wireline terminals and legacy circuit mobiles.

Lucent's common IMS architecture implements the functional entities defined in the 3rd Generation Partnership Project (3GPP) and the 3rd Generation Partnership Project 2 (3GPP2) reference models. Refer to 3GPP TS 23.002 [4] and 3GPP2 TSG-S All-IP NAM [6]. In this section and in **Figures 2** and **3**, we have shown both 3GPP and 3GPP2 equivalents.

One aspect of the IMS that becomes apparent in these figures is that the application control and session control can be in a different network from the media control. In particular, roaming users may use services and service control that resides in their home network even while using a visited network for access. This is called *home control* and is discussed in [7].

The call session control functions (CSCFs)/session control managers (SCMs) are divided into proxy (P-CSCF/P-SCM), interrogating (I-CSCF/I-SCM), and serving (S-CSCF/S-SCM) entities in order to support home control. The Lucent architecture also includes a new functional entity called the interworking mobile switching center (iMSC) for support of circuit mobiles by an IMS core network [7]. Figure 2 shows connections through the IMS core network to the PSTN or circuit PLMN. Figure 3 shows connections through the IMS core network to an IP land network.

The serving CSCF/SCM can be thought of as the heart of the IMS core network. It performs registration, authentication with the home subscriber system (HSS),



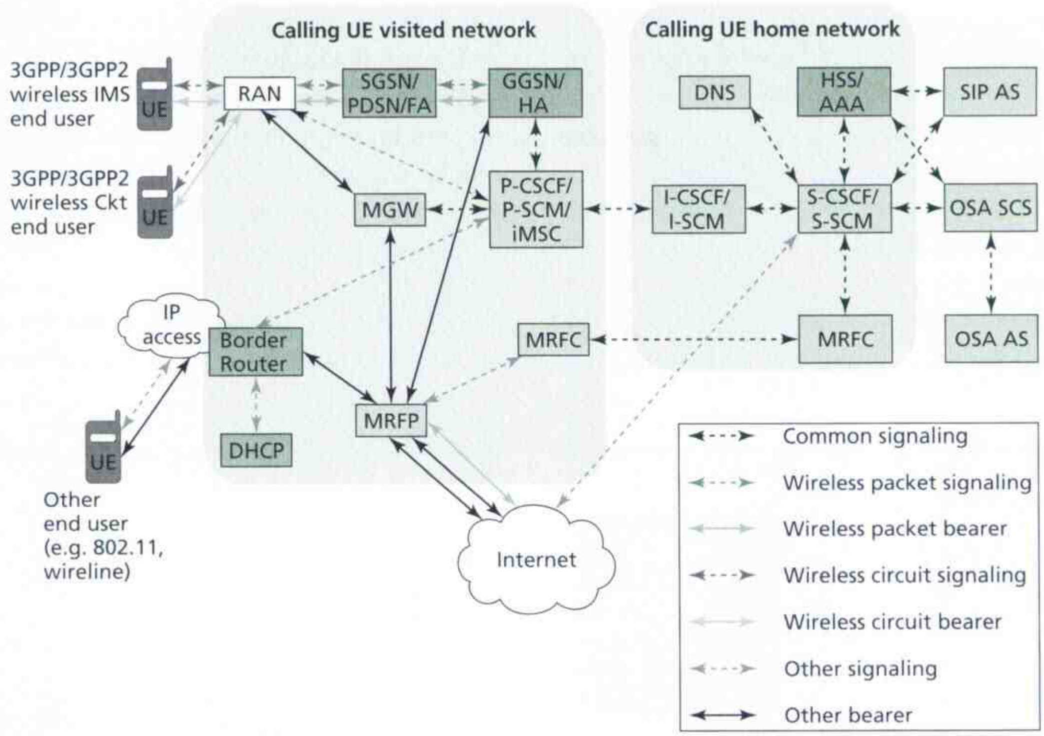
3GPP	- 3rd Generation Partnership Project
3GPP2	- 3rd Generation Partnership Project 2
AAA	- Authentication, authorization, and accounting
AS	- Application server
BGCF	- Breakout gateway control function
DHCP	- Dynamic host configuration protocol
DNS	- Domain name server
GGSN/HA	- Gateway general packet radio services node/ home agent
HSS	- Home subscriber system
I-CSCF	- Interrogating call session control function
iMSC	- Interworking mobile switching center
IP	- Internet protocol
L-SCM	- Local service control manager
MGCF	- Media gateway control function
MGW	- Media gateway
OSA	- Open service architecture
P-CSCF	- Proxy call session control function
PDSN/FA	- Packet data service node/foreign agent
PLMN	- Public land mobile network
P-SCM	- Proxy session call manager
RAN	- Radio access network
SGSN	- Serving general packet radio services node
SIP	- Session initiation protocol
UE	- User equipment

Figure 2.
Multi-access IMS UE call to PSTN/circuit PLMN.

call or session set up, and accounting. It also provides a control and access node for external application servers, which provides end-user services. The S-CSCF/S-SCM resides in the home network of the subscriber and provides service to the subscriber regardless of where she/he roams or accesses the network.

The proxy CSCF/SCM is the first IMS core network entity contacted by a mobile during registration or origination. It directs the SIP messaging to the home network of the subscriber. The P-CSCF/P-SCM is also involved in the negotiation of quality of service (QoS) for the call.

During registration the I-CSCF/I-SCM is the entity that chooses the S-CSCF/S-SCM that will henceforth support the registering user equipment (UE). The interrogating CSCF/SCM is also the first IMS core network entity contacted during a call termination. The I-CSCF/I-SCM determines the S-CSCF/S-SCM to handle the call. Stage 2 registration procedures are specified in 3GPP TS 23.228 [3].



3GPP - 3rd Generation Partnership Project
3GPP2 - 3rd Generation Partnership Project 2
AAA - Authentication, authorization, and accounting
AS - Application server
DHCP - Dynamic host configuration protocol
DNS - Domain name server
GGSN/HA - Gateway general packet radio services node/home agent
HSS - Home subscriber system
I-CSCF - Interrogating call session control function
iMSC - Interworking mobile switching center
MGW - Media gateway
MRFC - Media resource function controller
MRFP - Media resource function processor
OSA - Open service architecture
P-SCM - Proxy session call manager
RAN - Radio access network
SGSN - Serving general packet radio services node
SIP - Session initiation protocol
UE - User equipment

Figure 3.
Multi-access IMS UE call to wireline IP telephony system.

For calls that include a PSTN endpoint, media gateways (MGWs) must be assigned for the bearer path. These MGWs will provide the vocoders needed to convert from compressed speech to 64-Kbps PCM. MGWs may be assigned from the home network, visited network, or a third-party network. The breakout gateway control function (BGCF)/local session control manager (L-SCM) is asked by the S-CSCF/S-SCM to choose a network from which a MGW will be assigned. Once this is done, the BGCF/L-SCM of the chosen network then chooses a media gateway control function (MGCF) to support the call. The MGCF chooses the actual MGW. The MGCF also performs the task of SIP/ISUP interworking between the IMS core network and the PSTN. Stage 2 call/session setup procedures are specified in 3GPP TS 23.228 [3]. The IMS protocol based on SIP is specified in 3GPP TS 24.229 [1].

The MRFC/MRFP provides conference bridge resources, tones and announcements, and transcoding between IP terminals if needed. Figure 3 shows the anticipated enhancements to the architecture for allowing the MRFC/MRFP in the visited network.

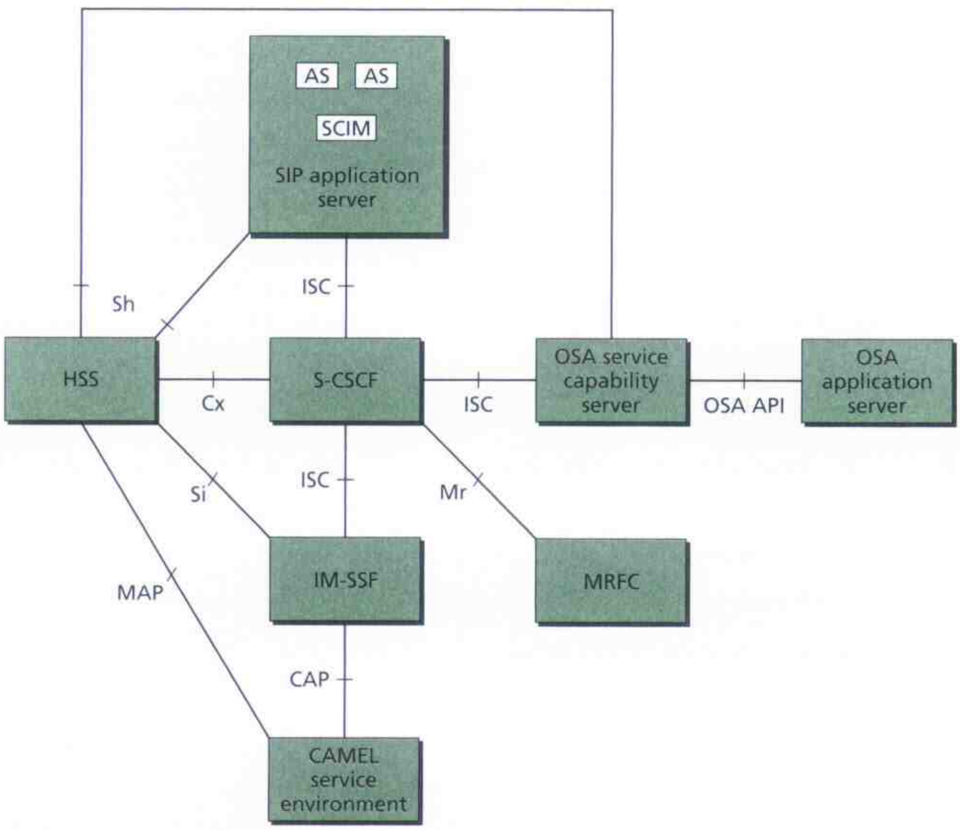
Finally, the HSS (AAA server with data bases) provides subscriber and service data for the IMS.

Figure 4 describes the 3GPP service architecture provided via the IMS core network. This model is specified in 3GPP TS 23.218 [2]. A similar model is specified in [6] by 3GPP2.

All IMS Services are provided by the application server logical entities. There are three types of application servers:

- SIP-based,
- Open service architecture (OSA)-based, and
- CAMEL service environment (CSE)- or wireless intelligent network (WIN)-based.

The S-CSCF/S-SCM communicates with all three types of application servers via the IP multimedia service control (ISC) interface, which is based on the SIP protocol. The service capability interaction manager (SCIM) provides a coordination/interaction function for other SIP-based application servers. The OSA service capability server (SCS) provides an interworking function between S-CSCF/S-SCM and OSA application servers. The IM-SSF provides an interworking



API - Application programming interface
AS - Application server
CAMEL - Customized application for mobile network enhanced logic
CAP - CAMEL application protocol
HSS - Home subscriber system
IM-SSF - IP multimedia-service switching function
ISC - Service control interface
MAP - Mobile application part
MRFC - Media resource function controller
OSA - Open service architecture
SCIM - Service capability interaction manager
SCS - Service capability server
S-CSCF - Serving call session control function
SIP - Session initiation protocol

Figure 4.
Services architecture.

function between S-CSCF/S-SCM and CSE. CSE is intended to provide legacy services only. The application server logical entities may be implemented as independent network elements. It is also possible that one or more application server logical entities may be co-located with the S-CSCF network element.

The HSS stores user- and service-related data on behalf of each application server (or its interworking entity) associated with the network. When requested, the HSS sends this per-subscriber service data to the application server over the intra-operator Sh or Si interface. At registration time, the HSS data is sent to the S-CSCF over the Cx interface. The data includes filter criteria used to specify conditions for involving application servers to provide services. The S-CSCF applies the filter criteria to determine the need to forward SIP requests to application servers. See 3GPP TS 23.218 [2] for further details on filter criteria.

Example Service Scenarios

The following subsections will show example services demonstrating the network capabilities and new service opportunities available with the third-generation (3G) network.

"Expert on Call"

Real-time audio-visual telephony can be used in a variety of environments. In "Expert on Call" service, videotelephony is used in a business environment. This scenario also illustrates simultaneous video/voice and file transfer within a single session.

A field technician can use videotelephony and multimedia when debugging a problem. If the technician is not able to solve the problem, the technician can institute a multimedia call with another technician in the field or an expert back at the office. With the imaging capability of multimedia, the field technician can actually show colleagues the field problem encountered and receive assistance via multimedia responses (e.g., display diagrams, demonstrate a procedure). See **Figure 5**.

With a little imagination, one can visualize many scenarios that can benefit from videotelephony. One scenario that exists today is the one in which cameras are placed in ambulances to provide visual feedback of a patient's condition to emergency room doctors. The video is sent over a wireless data connection. The doctors who have used this service have found the early visual feedback useful. Work is now under

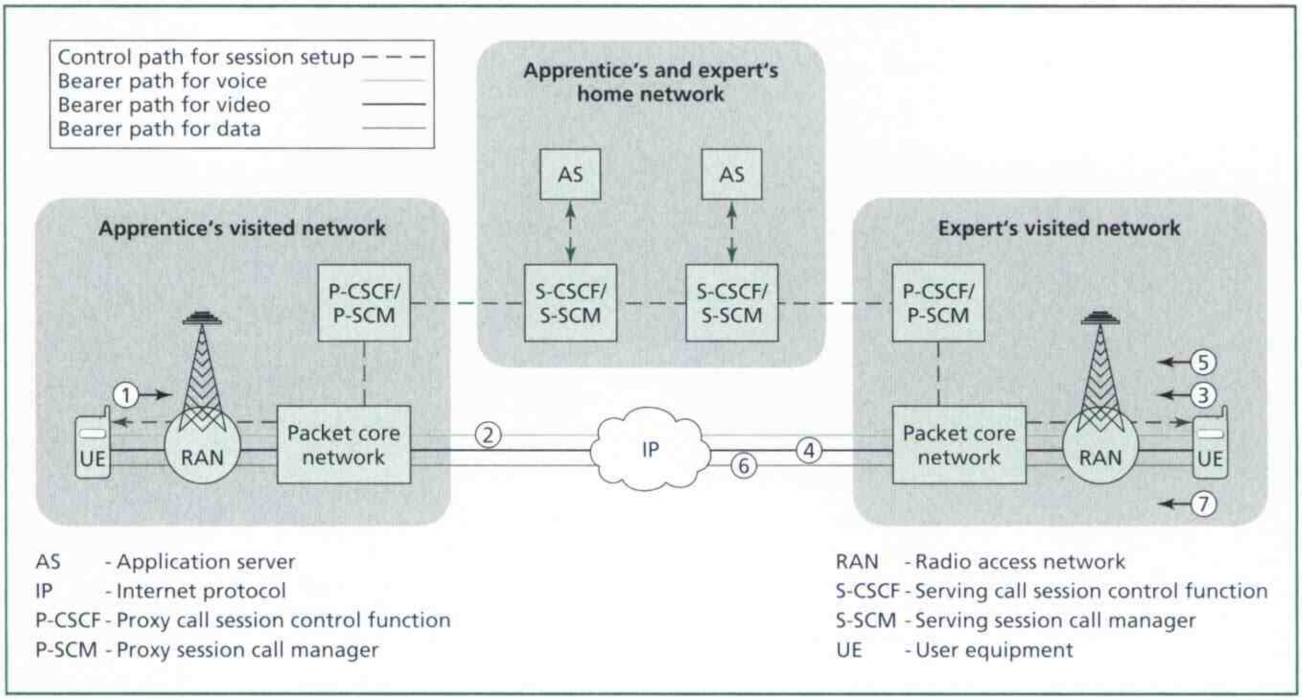


Figure 5.
"Expert on Call."

way to make the wireless video system portable for paramedics to take on foot with them. The IMS SIP system could be part of the solution.

The call flow for "Expert on Call" is as follows (numbered steps correspond to numbers in Figure 5):

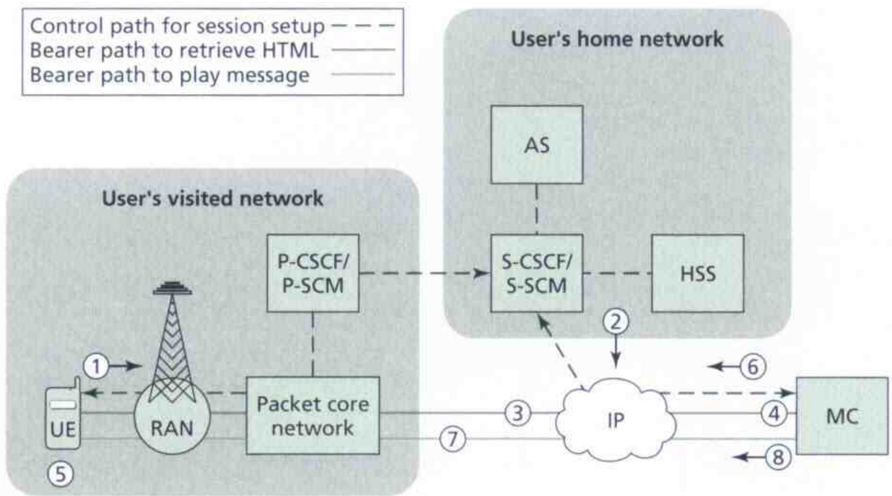
1. Voice session is initiated from apprentice to expert.
2. Voice bearer path is established between apprentice and expert.
3. Multimedia session for video is initiated from expert to apprentice.
4. Bearer path for real-time video is established between expert and apprentice.
5. Data session is initiated from expert to apprentice.
6. Bearer path for data is established between expert and apprentice.
7. Expert sends necessary schematics to apprentice.

Retrieving Multimedia Messages

SIP and voice over IP allow for a greater degree of flexibility in the richness of capabilities that can be provided in a unified messaging service. A user wants to check his/her messages. The user dials 1-800-Message Center and logs in. The message center sends back a text list of all messages including sender name, date, time of message, and length of message.

After highlighting one of the messages, the user is given two options of operation on the message: play the message or return the phone call. In response to the instruction to play the message, the message center responds by streaming the audio message to the UE. If the user requests that the call be returned, the message center sets up a new session and media stream from the user to the phone number left by the message sender. See **Figure 6**.

This service demonstrates multiple media streams of varying QoS within a single SIP session. When a subscriber initiates a call to his/her message center, the IP phone should indicate that it accepts an HTML response. The message center would then answer with a menu html page listing all the messages for the subscriber. When the caller chooses one of the voice messages, then the message center initiates another dialog or media stream for the current call session. This media



AS - Application server
HSS - Home subscriber system
IP - Internet protocol
MC - Message center
P-CSCF - Proxy call session control function
P-SCM - Proxy session call manager
RAN - Radio access network
S-CSCF - Serving call session control function
S-SCM - Serving session call manager
UE - User equipment

Figure 6.
Message retrieval.

stream will use QoS values appropriate for streaming audio, video, or text depending on the type of message being retrieved. An additional option that the message menu html page could give the user is the option to call the message sender back. When this option is chosen, the message center then initiates a call between the subscriber and the message sender by setting up a new session with the message sender. This dialog or media stream will use the QoS values appropriate for real-time or interactive service depending on whether the call is voice based or text based.

The call flow for retrieving multimedia messages is as follows (numbered steps correspond to numbers in Figure 6):

1. User initiates a session to retrieve messages from a message center.
2. Session control server (S-CSCF or S-SCM) interacts with message center.
3. Bearer path is established between user and message center.
4. HTML-based menu is downloaded from message center to user.
5. User selects message to be played; request is sent to message center.
6. Message center initiates multimedia session to play message.
7. Bearer path for message is established.
8. Message is played to user.

Data Conferencing

SIP and the IMS architecture enable flexible and efficient data conferencing. In this example, a user is traveling for an important meeting and needs to update the sales materials with the latest information before presenting it to a potential customer. So the user initiates a data conference call to colleagues using a laptop computer with a 3G wireless plug-in card. Some colleagues are back at the office accessing the data conference server via a campus-wide IEEE 802.11b network and others are working from home with wireline or 3G wireless access to the data conference server. The user starts up a data application and shares it with colleagues to collaboratively update the materials. As conferees are taking turns editing the presentation materials, additional applications such as whiteboard or text chat may be opened and shared among the participants. In addition, files may be transferred between participants on the call. Upon completion of the data conference call, the materials in the remote laptop contain the latest information available for the customer. See **Figure 7**.

The advantage of this data conference service over existing products is in efficiency and the integrated handling of multiple media streams among participants. The data conference server is receiving the new and updated information from one participant and sending copies of the information to the other participants in the conference call. Existing data conferencing products rely on the application in the user equipment to send copies of the information to each participant, which consumes more transport bandwidth.

The call flow for data conferencing is as follows (numbered steps correspond to numbers in Figure 7):

1. UE A initiates session to establish data conference (e.g., se.group@dataconf.provide.com).
2. Session control server (S-CSCF or S-SCM) interacts with the necessary application server; group member information is obtained from the HSS.
3. Application server initiates procedures to allocate resources and establish dialog sessions with each member of the group (UEs B, C, and UA D).
4. Bearer paths are established between the conferencing resources and each active member of the group.

Multimedia Finder Service

SIP and voice over IP allow for a greater degree of flexibility in the richness of capabilities that can be provided in a finder service. In this example, a tourist is visiting Chicago. While in downtown Chicago, the tourist and family try to decide what places to go to that day. To help decide, they take out an IP phone and dial 1-800-Chicago. A Chicago application server answers the call and returns an html menu with a number of Chicago destinations, such as the Field Museum, Adler Planetarium, Shedd Aquarium, and Sears Tower. When the user selects the Field Museum hyperlink, the call is directed to the Field Museum. A Field Museum representative answers and provides information on that day's special exhibits. See **Figure 8**.

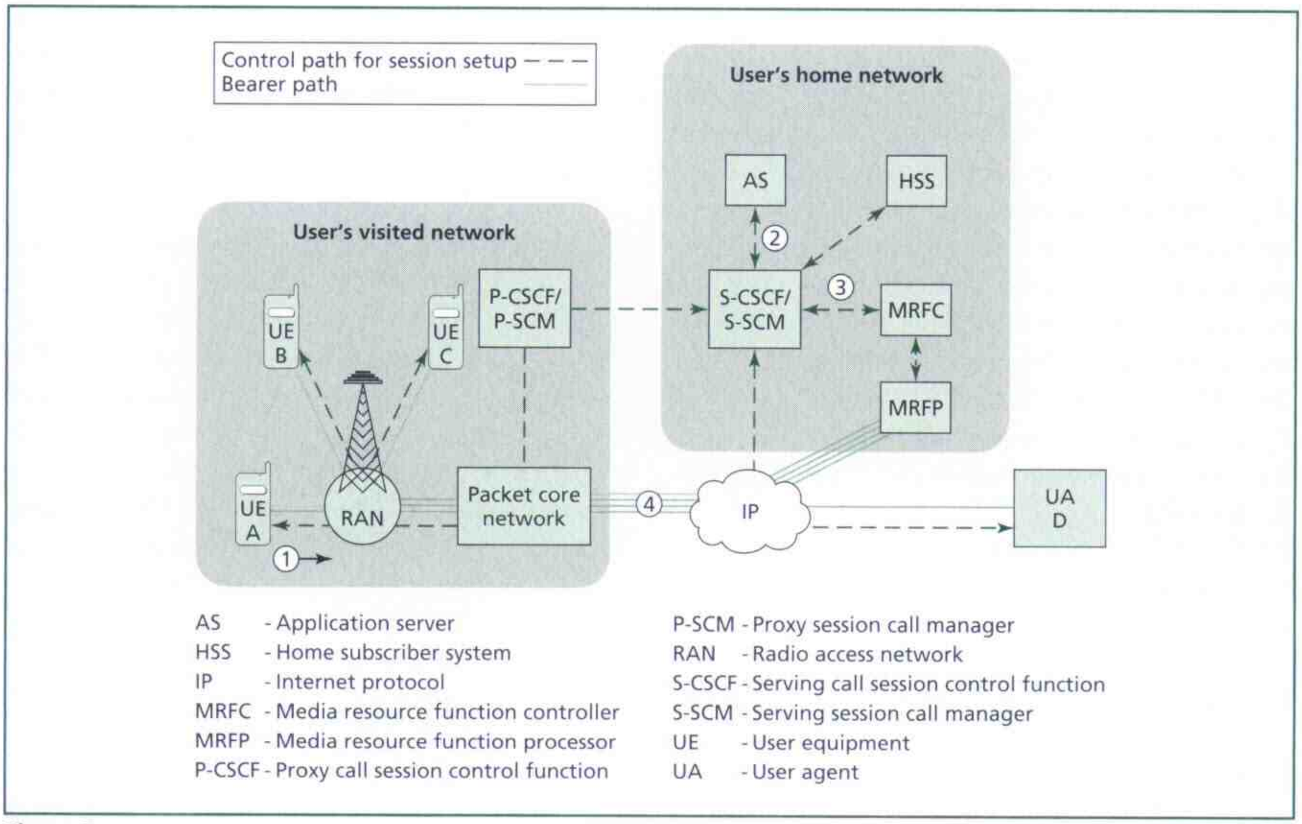


Figure 7.
Data conferencing.

With the addition of geolocation service (not shown in Figure 8), the following additional service types are also possible. A user wanting to find and decide on a place to eat dials 1-800-restaurants on an IP phone. A "restaurant finder" application server answers the call and returns an html menu with different categories of restaurants. A choice of fast food restaurants, for example, results in a list of fast food restaurants within five blocks from the user's location. Selecting the hyperlink for a particular restaurant in the list redirects the call to that restaurant.

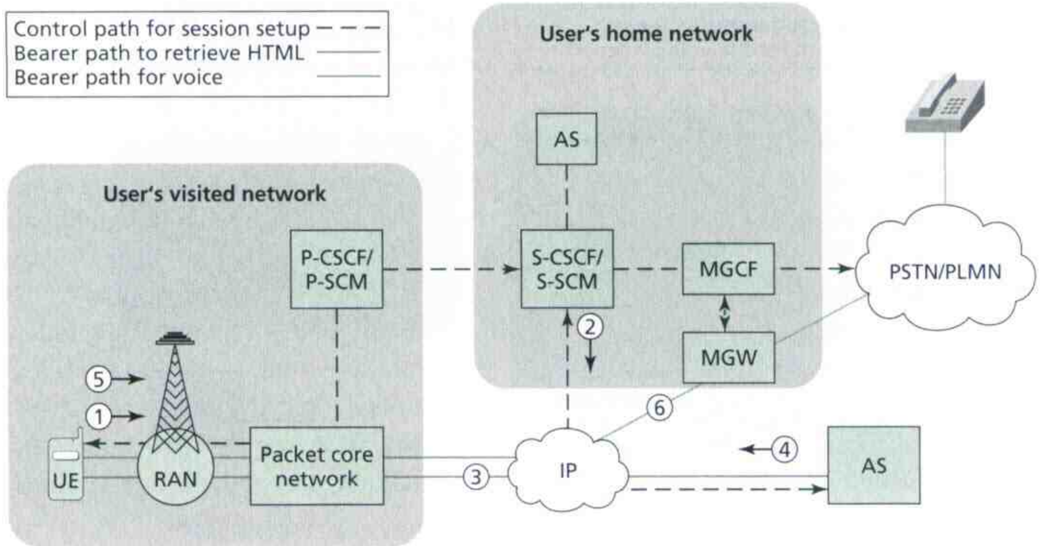
In another example, a user wishes to find the nearest gasoline station. Placing a call to 1-800-gasoline could produce a list consisting of Amoco, Shell, Mobil, and other service stations. When the caller selects a business, the finder service application server will initiate a call redirection to the business. The session is converted from an html session to a voice session, changing QoS for the bearer appropriately.

The call flow for the multimedia finder service is as follows (numbered steps correspond to numbers in Figure 8):

1. User initiates a session to a service number to locate a Chicago attraction (e.g., 1-800-CHICAGO).
2. Session control server (S-CSCF of S-SCM) recognizes the number and interacts with the necessary application server.
3. Bearer path is established between user and application server.
4. HTML-based menu is downloaded from application server to user.
5. User selects the Chicago attraction; user client initiates a voice session to the restaurant.
6. Voice bearer path is established.

"Dial-a-Video Clip"

SIP and the IMS architecture can enable a more convenient and efficient user interface for some applications. A user can use an IP phone to dial a



AS - Application server
IP - Internet protocol
MGCF - Media gateway control function
MGW - Media gateway
P-CSCF - Proxy call session control function
PLMN - Public land mobile network
P-SCM - Proxy session call manager
PSTN - Public switched telephone network
RAN - Radio access network
S-CSCF - Serving call session control function
S-SCM - Serving session call manager
UE - User equipment

Figure 8.
Multimedia finder service.

1-800-videoclip service or enter a SIP URL to view a multimedia presentation such as a movie trailer.

When a subscriber initiates a call to a video-clip service, the IP phone indicates that it accepts streaming video/audio. The video-clip service then responds by downloading the latest video clip. For example, 1-800-CNNnews could cause a clip of the latest news to be downloaded and displayed on an IP phone. Dialing 1-800-StarWars could cause a clip of the Star Wars movie trailer to be downloaded and displayed on an IP phone. A SIP session would be set up between the IP phone and the video application server with the appropriate bearer QoS set for video streaming. See **Figure 9**.

The call flow for "Dial-a-Video Clip" is as follows (numbered steps correspond to numbers in Figure 9):

1. User initiates session to special number to retrieve video clip (e.g., 1-800-STARWARS).
2. Session control server (S-CSCF or S-SCM) recognizes number and directs session to application server.
3. Bearer path for streaming video is established between user and application server.
4. Video clip is downloaded to user.

Service Types

In this paper we have examined five sample services that can be provided via the IMS. The IMS can support many new services so it is not possible to describe a meaningful fraction of them here. The international standards development organizations and the 3GPP organizations have acknowledged that it would be a futile exercise to define and standardize services, as the number and possible variations of the services is practically limitless. Indeed one of the most important aspects of the IMS is that it supports feature deployment without requiring feature standardization. This is accomplished through the combination of downloadable SIP clients in the UE and home control in the network. Although service standardization is not required, the bodies have agreed to facilitate interoperation of the equipment from various vendors

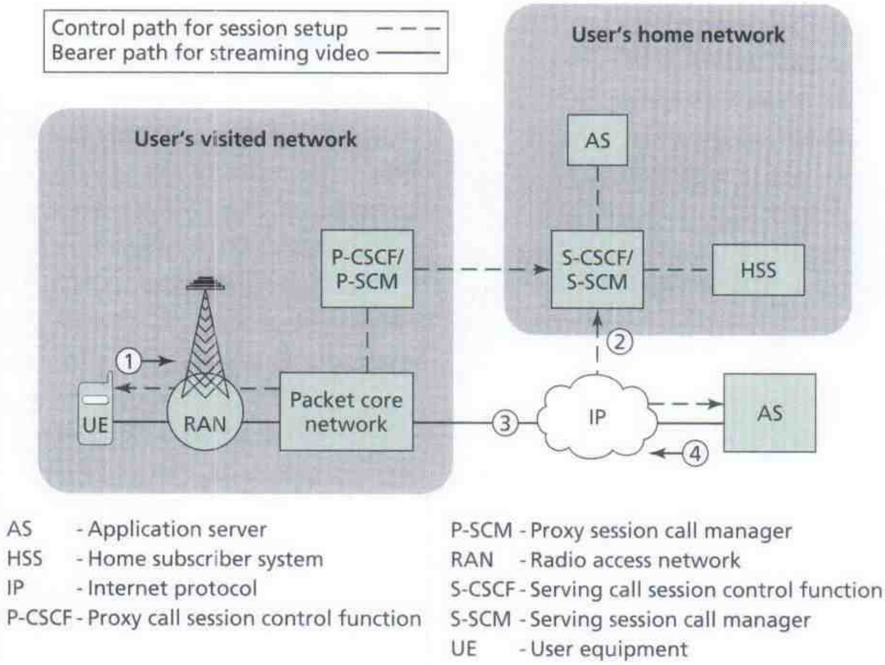


Figure 9.
"Dial-a-Video Clip."

by standardizing various basic building blocks or tool kits, which can then be used by vendors and network operators to develop and customize services. Although the actual building blocks identified by each body may seem different, in aggregate they each provide a self-consistent and complete set of building blocks that can be used to provide services to the end users. Refer to 3GPP TS 22.101 [5].

The following subsections outline some of the envisioned services both from a business perspective and from the point of view of the network capabilities necessary to support the services.

Types of Services by Market Opportunity

Much work has been done in various forums to describe 3G services and service types [9]. Some of the types of 3G IMS services that will be offered to mobile customers are described below. These illustrate the range of market opportunities for the IMS.

- *Mobile professional*—More and more professionals work in mobile virtual offices. This service type will provide mobile professionals the same service and support that they can receive from fixed Internet connections. The "Expert on Call," multimedia messaging, and data conference features we discussed are examples of this service type.
- *Image*—The inclusion of full motion color imaging to a mobile will be one of the breakthrough capabilities offered by the 3G network. Applications include access to medical, topical, and law enforcement experts, and the like. The "Expert on Call" feature we discussed is just one example of this type of service.
- *Enhanced conferencing*—The 3G network will allow the mobile user to join multimedia conferences and seamlessly allow users with legacy equipment to participate in the conference. This type includes the Data Conference feature discussed earlier.
- *Push services*—This service type is so named because the network "pushes" information to the mobile. Similar in some cases to Internet banner ads, push services can be used to inform mobile users of various sales promotions by businesses in the immediate area around the mobile's current location.

- *Tourist services*—The enhanced 3G mobile station can be used to replace guide books and similar appliances by allowing multimedia access to the tourist bureau in the area of the mobile's location. Maps, directions, still photos, movie clips and the like can be provided to the mobile user. We see landline network examples of these services today. At some theme parks today, a guest can make restaurant or theater reservations via fixed location kiosks along the park's midway or at some of the local hotels. The service includes, for example, provision of the day's menus and a chart of the remaining available seats. This same service could be provided via the mobile station allowing the user to make reservations at restaurants or theaters. The multimedia finder service is an example of this type of service.
- *Multimedia and mixed-media services*—This general class is an area ripe for inventiveness and market differentiation for network operators. This general class includes services with asymmetrical bandwidth requirements in the uplink and downlink directions as well as bandwidth requirements that change during a single session.

Network Model

As covered in a previous section when the general network architecture was presented, the 3G IMS network consists of a relatively small set of elements. These elements alone or in concert with other elements provide network level attributes that will support new service concepts. These network capabilities include:

- *GPS/assisted GPS*—The Global Positioning System will be used for both providing positioning information and the accurate synchronization required for multimedia services.
- *Dynamic bandwidth control*—SIP is the basis for the robust bandwidth capabilities of the 3G network.
- *Media and control interfaces*—As the 3G network will not be the only network in existence, the edge of the 3G network will have the capability to interwork the media and control traffic with other network types. Examples of other networks are the existing PSTN, legacy mobile systems, and the wired Internet.
- *Charging and billing*—New capabilities to allow usage sensitive billing have been defined. In a 3G network, resources required may change during a session and are asymmetrical.
- *QoS*—New QoS requirements and classes have been identified to support the wide range of multimedia and mixed-media services envisioned for 3G services. As the bandwidth/network resources required during a session may change, the QoS attributes required during a session may change.
- *Security*—All of the security issues and concerns of existing networks will be dealt with in the 3G network. In addition, peer-to-peer security arrangements and trust relationships are being defined between home and visited networks.

Conclusion

We have presented services that target a range of market segments from mobile professionals to early adopter individual users. The data conference and expert on call features are examples of features that have high value for mobile professionals even before SIP user equipment is widely deployed. These services also can make use of the embedded base of PCs with landline Internet access. "Dial-a-Video Clip" and the multimedia finder are examples of features that can bring in the early adopter, individual user. The video clip concept is well established in the landline Internet. Mobility adds additional utility to the feature, and the IMS assists in making it user friendly. The multimedia finder feature integrates mobile location information with multimedia to provide a new type of service not possible with previous technology. We have used these services to illustrate how the IMS supports new value-added capabilities. There are many more services that can and will be deployed with even the initial IMS systems.

*Trademark

CDMA2000 is a trademark of the Telecommunications Industry Association.

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(Manuscript approved August 2002)

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