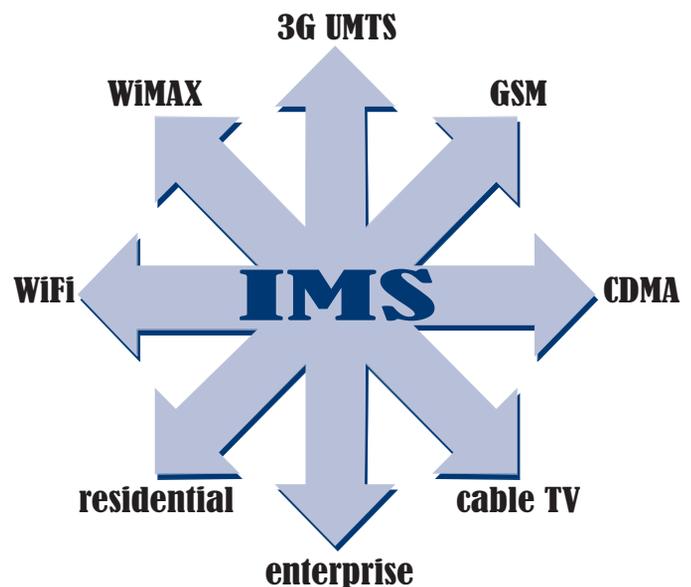


IMS (IP Multimedia Subsystem)

What is IMS?

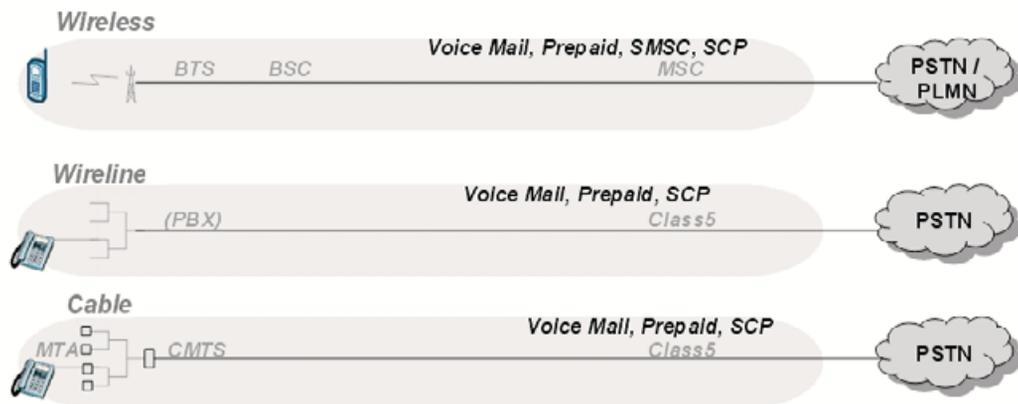
IP Multimedia Subsystem (IMS) has received a lot of attention in the industry recently. IMS refers to a network architecture consisting of an IP-based core network connected to multiple access networks to provide a converged service to wireless, wireline and cable subscribers. Initially, IMS standards were defined for 3G UMTS (Universal Mobile Telephony System) wireless networks (next generation of GSM cellular systems). But, the flexibility of the IMS network architecture has made it attractive to connect other access networks as well. Additional networks, including GSM & CDMA cellular networks, cable TV networks, WiFi networks, WiMAX networks, enterprise and residential networks, are being added to this common IMS core. The addition of these additional access networks to an IMS core network provide market differentiating, leading edge, single number services to end users.



Legacy networks address a specific network access as shown below. Wireless, wireline and cable networks supplied all network components required to provide service, including switching and supplementary services like voice mail, prepaid, Short Message Service (SMS) and other Service Control Processor (SCP) based services.

In contrast, the IMS core network provides a common core network including switching, control and application processing across the multiple access networks offered by a particular operator, as shown below. The IMS core network is often shown as a layered network consisting of a media transport layer, a call control layer and an applications layer. The IMS core network uses standards-based interfaces between key network elements allowing for Best-of-Breed network utilizing common call control and applications allowing for more seamless roll-out of new services.

Legacy Network Silo's

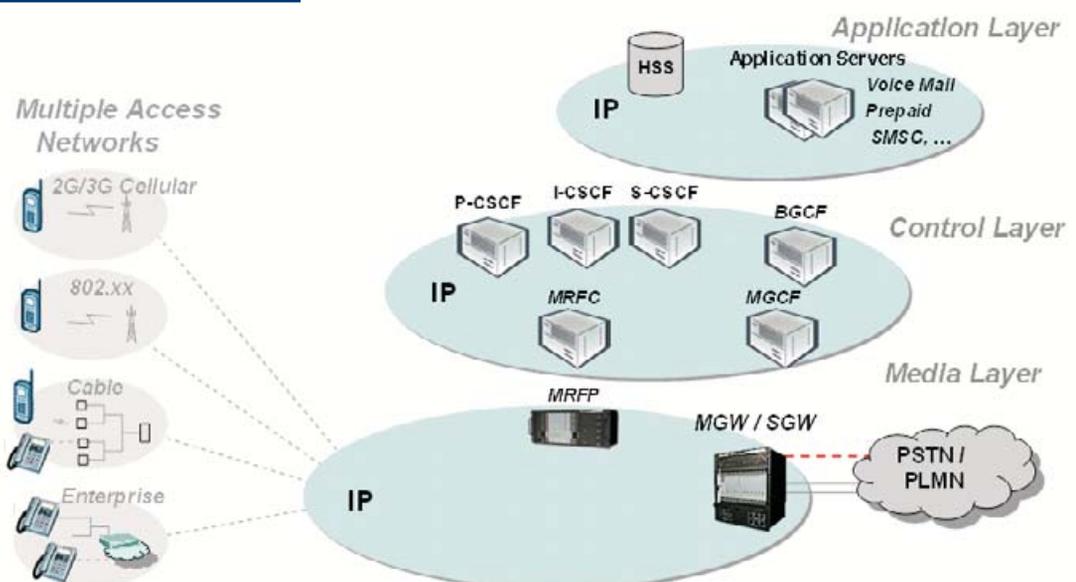


Key IMS network elements include:

- **CSCF** (Call Session Control Function) – Call session control within the core network
- **P-CSCF** (Proxy-CSCF) – first contact point within the IMS core network for the subscriber device. Its address is discovered by the subscriber device. This proxy determines which CSCF will control the call by communicating with the I-CSCF either within network the call originated or within the subscribers Home network, if the subscriber is a Visitor. PDF (Policy Decision Function) may be a part of this element or separate.
- **I-CSCF** (Interrogating-CSCF) - contact point within an operator's network for all connections destined to a user of that network operator, or a roaming user currently located within that network operator's service area. The I-CSCF also checks the HSS to determine which S-CSCF the call should be assigned to. The I-CSCF can also generate CDRs.
- **S-CSCF** (Serving-CSCF) – The S-CSCF performs the session control services for the subscriber device. It maintains a session state as needed by the network operator for support of the services. The S-CSCF passes control to application servers, if required. The S-CSCF routes the call to the PSTN, if required by invoking the BGCF, MGCP and MGW.
- **HSS** (Home Subscriber Server) – Subscriber database containing information about the subscriber and which services they have subscribed to.

- **AS** (Application Server) – Call control can pass to different Application Servers via SIP messages, depending upon the services subscribed to and invoked by the user. Examples of applications include Voice Mail, Prepaid, Unified Messaging, Push-to-talk over Cellular (PoC), etc. Should special voice and/or video bearer processing be required, the AS will invoke the appropriate MRFC / MRFP.
- **BGCF** (Breakout Gateway Control Function) – selects the network in which the connection to the PSTN will be made. The BGCF will either forward the call using SIP to another BGCF for further processing or to a MGCF controlling the desired PSTN access.
- **MGCF** (Media Gateway Control Function) – controls the MGW to send or receive calls to / from the PSTN / Circuit-Switched network. The MGCF uses SIP messages to/from the CSCF or BGCF and uses H.248 (Media Gateway Control) messages to/from the MGW.
- **MGW** (Media Gateway) – performs all of the media processing required to process calls to/from the PSTN / Circuit-Switched network.
- **MRFC** (Multimedia Resource Function Controller) – controls the MRFP to provide media processing required by the Application Servers. The MGCF uses SIP messages to/from the Application Servers and typically uses H.248 (Media Gateway Control) messages to/from the MRFP.
- **MRFP** (Multimedia Resource Function Processor) – performs all of the media processing required to provide media processing in support of the Application Servers for features such as conferencing, voice mail, recording, voice processing, etc
- **PSTN** (Public Switched Telephone Network) – is the legacy circuit-switched telephone network
- **PLMN** (Public Land Mobile Network) – is the circuit-switched roaming network for cellular phone calls interconnecting different wireless service provider networks.

IMS Network Architecture



All this leads us to a move towards convergence – *Service Convergence* (e.g. wireless, telephone, cable, video, text-based and voice-based instant messaging, email, etc.), *Network Convergence* (one common IP core network with multiple access networks) and *Device Convergence* (e.g. landline phone, cellular phone, PDA, computer, etc.). Device Convergence and Service Convergence may manifest themselves separately or together depending upon the user and/or the operator's service offering. For example, a user may want to use a single device that can perform multiple functions over multiple networks like a PDA-based cell phone that can access cellular as well as wireless broadband networks (like WiFi or WiMAX networks). Likewise, a user may use multiple devices accessing a common service over multiple devices with the application seamlessly handing over between the different access networks and different devices - for example, a user may start an application (e.g. call, conference, video call, etc.) on his computer, hand the session off to his cell phone as he drives to work and then hand off the session to his work computer when he arrives. This convergence will allow operators to offer converged services to their subscribers providing access anywhere whether they are home, at the office, in the car, traveling, etc. No longer is the issue simply a matter of having a packaged bundled bill; but rather it is a matter of having the ability to offer branded content and communications to subscribers no matter where they are and what device they are using. The converged operator is looking to serve new markets with new access technologies or for that matter expand his reach into new devices, providing more effective service bundles – to expand and defend their territory.

An important aspect of this converged solution is the ability to flexibly launch new services in a fast and scalable manner. New, intelligent devices are opening up the market for many new exciting service offerings making time to market even more critical than it is today, in order to stay ahead of the "competitive pack." But, there is a level of unpredictability as far as which service offerings will be successful and what will provide true differentiation, etc. So, having a mechanism to cost-effectively roll-out new service offerings across multiple access networks is a key requirement. It is an interesting future, we are headed into. IMS promises to provide this converged solution.

The IMS core network was defined to use SIP (Session Initialization Protocol) for call control to pass control of the call / sessions between different call handling elements. Because SIP is a simple protocol and relatively agnostic to the application using it, it provides a good method to use for call control, especially when the future services are not defined yet. It was envisioned to have the user devices themselves will initiate calls/sessions providing an excellent method to effectively leave the "door open" for new features / capabilities over time. The IMS standards built into the core network the necessary checks and balances to manage the SIP sessions – a critical, required function in order to control and bill for application usage over the core network. H.248, a robust media gateway control protocol, is used to control media gateways, and in some cases, media servers, providing for flexible media processing within the IMS core network. The combination of standards-based protocols like SIP and H.248, among other protocols, provides for a flexible, powerful core network upon which to build additional services. Because of the use of these standards-based protocols and clear definition of functions of various network elements, operators are able to deploy "best-of-breed" Network Elements to optimize their ability to offer leading edge services as

well as optimize their CapEx expenditures.

The IMS core network is defined as a layered network consisting of a media transport layer (e.g. voice, video, data, etc.), call control layer (e.g. SIP control, transport control, etc.) and applications layer (to provide added functionality to the IMS core network). A key benefit of the IMS core network is the use of this common application layer while reusing common transport and call control layers to provide multiple services to users across multiple access networks. This will allow operators to provide their subscribers with access to common applications across divergent networks. More importantly, as alluded to above, as new applications are developed, they can be added to this common application layer cost-effectively re-using the existing network elements and existing access networks, effectively lowering the initial costs to deploy new features.

AudioCodes' Product Portfolio

AudioCodes is well positioned with a comprehensive set of media gateways, access gateways and media servers to fit into any IMS-compliant network. AudioCodes has a long history of providing lead-edge VoIP media gateways and media servers for wireline, wireless and cable networks, since the early days of VoIP when it was being deployed globally for toll-rate arbitrage opportunities. From the beginning, AudioCodes has put emphasis on voice quality, which was verified in a recent ETSI "bake-off" of leading media gateways where AudioCodes' media gateway was the only media gateway to meet or exceed all of the requirements of the tests performed.



AudioCodes' Mediant™ family of media gateways has been designed to become the heart of media/bearer processing within these IMS-based networks, providing the appropriate voice processing required to complete and handover calls between divergent access networks and the existing PSTN, as required. These divergent access networks typically require different vocoders, protocol and signaling support, so maximizing voice

quality will naturally dictate minimizing the number of vocodings required in a given call and naturally increase the number of vocoders required to be supported on a given IMS media gateway. The Mediant™ media gateways provide the necessary media gateway functions, including vocoding, jitter buffer processing, echo cancellation, tones generation/detection, T.38 fax processing, announcements, IP forking,,etc, effectively achieving voice quality which is best in class ... AudioCodes' Mediant™ media gateways have been designed as IP-based systems to support wireline (carrier VoIP & enterprise VoIP), wireless (CDMA, UMTS, GSM, WiFi, & WiMAX) and cable access networks, with all of the appropriate vocoder support, signaling support and control protocol support required by each of these networks, making the transition to a combined, converged IMS-based core network a relatively simple task. AudioCodes' media gateways currently support existing wireline, CDMA, UMTS, GSM and cable vocoders and additional vocoders are being constantly added as required, making AudioCodes' Mediant™ media gateways an excellent choice to fulfill the current and future needs of the IMS core network. The Mediant™ media gateways are controlled by the Media Gateway Controller Part (MGCP) using H.248 messaging. Additionally, in enterprise applications, Mediant™ media gateways can be controlled directly by using SIP for SIP-to-PRI or SIP-to-CAS applications, which require a built-in MGCF.

The Mediant™ family of media gateways can scale from 2016 Voice over IP (VoIP) and/or Cellular over IP channels in the small compact carrier grade Mediant™ 3000 to over 48,000 VoIP and/or Cellular over IP channels in a standard 7' Telco rack with three Mediant™ 8000 shelves. The Mediant™ 5000 is situated between the Mediant™ 3000 and Mediant™ 8000 – rounding off the product family. The platforms can be deployed with a variety of circuit interfaces (such as E1, T1, DS3, STM1, OC3) and IP interfaces (Fast or Gigabit Ethernet) allowing flexibly for packet to circuit and packet to packet voice connections. ATM interfaces (STM-1, OC-3c) are optionally available as well.

AudioCodes' IPmedia™ media servers provide the MRFP (Media Resource Function Processor) capabilities enabling the playback of tones and announcements in the network, as well as a platform which can be utilized by applications added to the IMS core network to provide bearer processing, including conferencing, CALEA processing, audio & video codec processing, IVR, speech recognition, among other media processing functions. The IPmedia™ MRFP is controlled using Megaco/H.248 by the MRFC (Media Resource Function Controller). The IPmedia™ media servers can also be controlled by using SIP. Similarly, the IPmedia™ 2000, 3000, 5000 & 8000 media servers can scale from 120-16,000 channels to address the growing media processing needs of operator IMS networks.

Additionally, AudioCodes' MediaPack® analog gateways and Mediant™ 1000/2000 digital gateways can serve as both R-MGF (Residential Media Gateway Function) and A-MGF (Access Media Gateway Function) for interfacing with legacy circuit switched devices in IMS/TIPHON networks. The MediaPack® R-MGF/A-MGF is controlled using MGCP or H.248 by an AGCF (Access Gateway Control Function). MediaPack® gateways are also

available with an integrated R-MGF/A-MGF exposing a SIP interface.

The AudioCodes' Advantage

The following lists several reasons why an operator would be interested in deploying AudioCodes' media gateway and media server solutions:

IMS Ready: Since the inception of VoIP, AudioCodes' media gateways have been working in distributed network architecture, now adopted by IMS. Additionally, our bullet-proof, IMS-compliant H.248 control protocol supports the necessary functions for IMS deployment. AudioCodes' media platforms also inherently include SIP session control, which is the prevailing session control mechanism in the application and control layers thus allowing service providers to develop and introduce new services quickly and flexibly.

Best of Breed: AudioCodes' portfolio of media gateways and media servers are built on years of experience providing over 13,000,000 VoIP channels. AudioCodes is a pure-play VoIP equipment provider concentrating on providing leading edge, full-featured media gateways and media servers. AudioCodes' focus on continual improvement provides our customers with the latest technologies and capabilities. AudioCodes enables operators to deploy a true, best-of-breed IMS core network, allowing operators to pick and choose best-of-breed network elements, maintaining healthy competition and breaking away from the monolithic voice architecture of the past decades.

Best Voice Quality: Field-proven voice quality provides our customers with the products that contribute to a good end user experience, as indicated in the recent rigorous ETSI media gateway voice quality testing. End user experience has proven to be a critical component in providing a top notch service to subscribers.

Scalability: AudioCodes' Mediant™ media gateway and media servers can scale up and down cost effectively, from 30 channels in a 1 RU chassis up to 48,000 cellular or VoIP channels per 7' Telco rack. The multiple solutions available provide the right solution for each network deployment.

Flexible Converged Platform: While the IMS goal is to be an access agnostic solution, in reality, supporting different access networks is not trivial as each access network requires a different solution due to either legacy issues or unique characteristics of that particular access network, including support for different vocoders, signaling and control procedures. AudioCodes' history of providing cellular, cable and wireline solutions, enables AudioCodes media gateways and media servers to effectively address the requirements of multiple access networks within a common platform. AudioCodes products already have the vocoders (like GSM-EFR, AMR, EVRC, iLBC, G.729A, etc.), protocols and signaling variants necessary for operation with GSM, UMTS, CDMA, WLAN, cable and wireline access networks to enable interoperability with an IMS core network

- enabled typically with only configuration and software changes.

Widely Interoperable: One of the main concerns of service providers while designing their IMS based core deployment lies with the potential difficulties surrounding integration of a multi-vendor, multi-element network. AudioCodes focus on best of breed media components pushed our products to interface with far more Softswitches, media gateway controllers and media server applications than any other vendor. This experience and commitment of working interop between best of breed components allows AudioCodes to more readily interop with other “best-of-breed” network elements within an IMS core network. While standards are open and interoperating between network elements should be an easy task, it is often not as easy and AudioCodes’ history of interops has proven invaluable in bringing a solution to market.

Future Proof: As expected, the future will bring requirements for capabilities not anticipated in today’s standards. As standards evolve to handle the changing landscape of features and capabilities, it is important for operators to choose network equipment that is flexible enough to cost-effectively evolve to handle new services and new network signaling and architecture. Selecting intelligent media platforms, that are based on in-house written DSP code and have the hardware and software architecture to support multiple media formats and access networks, is becoming increasingly important in order to respond in a timely manner when new capabilities like new vocoders, new signaling enhancements, new protocols, etc. are required. Protecting the investment in the media plane by using media platforms that can be flexibly evolve by the virtue of SW configuration between the different media functions like Media Gateway, Transcoding Gateway (TrGW) and Media Resource Function (MRF) provide an important cost benefit as well as future protection for the unpredictable balance of PSTN ports vs. IP ports. This allows the operator to take advantage of the original PSTN media gateway ports deployed and re-use them flexibly for either connectivity to new packet networks or as media processing resources for new applications and services.

Summary

AudioCodes’ mission is to “Lead Network Convergence towards IMS by Providing Carrier Grade, Converged Media Gateways and Media Servers”. Whether implementing a basic Fixed / Mobile Convergence network or a complete IMS based network, AudioCodes is ready to provide the required media gateway and media server solutions. Kindly contact an AudioCodes’ representative if you would like additional information. Additional information is also available on our web site at www.audiocodes.com or by sending an email to Info@audiocodes.com.

About AudioCodes

AudioCodes Ltd. (NASDAQ: AUDC) enables the new voice infrastructure by providing innovative, reliable and cost-effective Voice over Packet technology and Voice Network products to OEMs, network equipment providers and system integrators. AudioCodes provides its customers and partners with a diverse range of flexible, comprehensive media gateway and media processing technologies, based on VoIPerfect™ – AudioCodes' underlying, best-of-breed, core media gateway architecture. The company is a market leader in voice compression technology and is a key originator of the ITU G.723.1 standard for the emerging Voice over IP market. AudioCodes voice network products feature media gateway and media server platforms for packet-based applications in the converged, wireline, wireless, broadband access, and enhanced voice services markets. AudioCodes enabling technology products include VoIP and CTI communication boards, VoIP media gateway processors and modules, and CPE devices. AudioCodes' headquarters and R&D facilities are located in Israel with an R&D extension in the U.S. Other AudioCodes' offices are located in Europe, the Far East, and Latin America.

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