Megaco-H.248 / SIP

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SIP: *Session Initiation Protocol*

- Developed by MMUSIC WG
- Work now carried on by SIP WG
- Lightweight signaling protocol for Internet conferencing
  - Text-based (similar to HTTP)
  - Uses e-mail like URLs (user@domain/host/numeric addr)
SIP: SIP Actors

- **Client**: the application that establishes the connection

- **Server**
  - **User Agent Server**: application that directly contacts the user
  - **Proxy Server**: application that forwards requests to other servers
  - **Redirect Server**: application that returns a new address to the client
SIP: SIP methods

- **Header**
  - INVITE: invite in session
  - ACK: confirm connection
  - BYE: tear down call
  - REGISTER: sign up with a server
  - UNREGISTER: “leave” server

- **Payload:** carries protocols for Session (and media) description (SDP or others)
SIP: **SIP responses**

- **1xx**: Informational (e.g. wait, alerting user)
- **2xx**: Success
- **3xx**: Redirection
- **4xx**: Client error (request has bad syntax)
- **5xx**: Server error (request failed)
- **6xx**: Global failure (request invalid at any server)
SIP: SIP operation in redirect mode

1. INVITE ricagni@sip.italtel.it
2. Location Server
3. Location: gricagni@sip.cin.it
4. 302 Moved temporarily
   Location: gricagni@sip.cin.it
5. INVITE gricagni@sip.cin.it
6. 200 OK
7. ACK gricagni@sip.cin.it
8. 200 OK
SIP: SIP operation in proxy mode

cin.it

1. **INVITE** g ricagni@ sip.cin.it
2. 195.31.130.206
3. g ricagni
4. **INVITE** g ricagni@ 195.31.130.206
5. 200OK
6. 200 OK
7. **ACK** g ricagni@ sip.cin.it
8. **ACK** g ricagni@ 195.31.130.206
9. 200 OK
10. 200 OK
Develop a protocol to control Media GWs from centralized elements (Media GW controllers)

Signaling GWs interface MGCs with the SS7 network to allow for interoperability between PSTN and the Internet

Media Gateways:

- **Trunking GW**: GW between telephone ntwk trunks and VoIP ntwk *(or VoATM, VoFR)*
- **Access GW**: GW between ISDN BRI/PRI and VoIP/(ATM/FR)
- **Residential GW**: GW between a few telephones directly attached (RJ11) to the GW and VoIP NTKW. *May collapse in an IP phone*
- **NAS**: GW that provides access to the Internet
- **IVR**: the Megaco protocol can also be used to control an IVR to collect digits, play announcements, send FAX etc.
“Intelligence” outside of MGs and handled by MGC:

- MG focuses on audio signal translation
- MGC handles call control, routing, signalling, interworking between signalling systems
Megaco: The Overall Architecture

CO: Central Office
MGC: Media Gateway Controller
SG: Signalling GW
TGW: Trunking GW
AGW: Access GW
RGW: Residential GW

VoIP

Q.931/Q.SIG

RJ11

PBX

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Megaco: Protocol Concepts

◆ **Terminations**: sources and/or sinks one or more streams (MM)
  ◆ **Permanent** (physical)
    ◆ may also exist outside of a context
  ◆ **Ephemeral** (e.g. RTP port)

◆ **Context**:
  ◆ contains terminations
  ◆ created when the 1st Termination is added
  ◆ destroyed when the last termination is subtracted
  ◆ all terminations in a CTX can be connected
  ◆ “null CTX”: contains all term. not assoc. with other terms
Megaco: Protocol Concepts

- Transactions
  - all or nothing
- Events
  - e.g. Off-hook On-hook
- Signals
  - e.g. play dialtone, ring
MEGACO suits a wide range of very different Terminations

- Variations are accommodated by allowing Terminations to have optional Properties, Events, Signals and Statistics
- In order to achieve MG/MGC interoperability, such options are grouped into Packages
  - Most of the extension to the protocol are normally accommodated through ad-hoc packages
- Each Termination must implement a set of such Packages
- MGCs can audit a Termination to determine which Packages it realizes
Megaco: Command Format

- Command Name(Parameters)
  - TerminationId
  - LocalTerminationState
    - e.g. rcvonly, sndrcv
  - LocalTerminationDescriptor, RemoteTerminationDescriptor
    - description of the media flow in each direction: e.g. IP address of the endpoint, port, codec etc.
  - EventsDescriptor
    - list of events to be reported (triggers)
  - SignalDescriptor
    - list of signals to be applied at the termination (signals are tones and announcements to be generated by the MG)
Megaco: Commands

- **Add**: adds a termination to a CTX (might also create the CTX)
- **Modify**: modifies the properties, events and signals of a termination
- **Subtract**: deletes a Termination from its CTX (might also delete the CTX)
- **Move**: moves a Termination to another CTX
- **AuditValue**: returns current state of properties, events, signals and statistics of Terminations
Megaco: **Commands**

- **AuditCapabilities**: returns all possible values for Termination properties, events and signals
- **Notify**: used by MGs to notify events to the MGC
- **ServiceChange**: used by
  - MGs to notify to the MGC that a group of Terminations is about to be taken out of service or has just been returned to service
  - MGs to register with an MGC upon restart
  - MGCs to announce a handover to the MG
  - MGCs to instruct the MG to take a Termination or group of Terminations in or out of service

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Megaco: Transactions

- Commands are grouped into Transactions, identified by a TransactionID
  - Ordered Command execution is guaranteed within a Transaction
  - Ordering *of Transactions* is NOT guaranteed
- TransactionRequest
- TransactionReply: groups all responses to a TransactionRequest
- TransactionPending: notifies that the Transaction is still actively being processed
  - Should restart the Transaction timeout
Megaco: Residential GW Example

Request notification of off-hook event

CTX= null
MODIFY(T1; ; ; ;R:hd; )

Response (200)
User lifts the handset and a notification is sent to the MGC.

MGC requests to play dialtone, to collect digits according to a digit map, and to notify in case of hangup.

CTX= MGC$T1$hd $\rightarrow$ NOTIFY (T1;hd)
MODIFY(T1;;;;R:hu,dgtmap;S:dl) $\rightarrow$ Response (200)

NOTIFY(T1;digits) $\rightarrow$ Response (200)

Megaco: Residential GW Example
MGC requests the creation of a new CTX, the addition of T1 and of an ephemeral receive only packet termination (RTP/*), indicating a choice of codecs.

MG acknowledges the creation of the new CTX, returns the name of the CTX, the name of the newly created Termination (RTP/777), the IP and port where it accepts traffic, the chosen codecs, and a choice of codecs for the other endpoint.

At this point MGC performs E.164 to IP translation (routing).

MG acknowledges the creation of the second CTX, the addition of T1r and of a packet termination (RTP/*), indicating a choice of codecs and the data related to the other endpoint (IP1, port1, codecs1, etc.).
Megaco: Residential GW Example

The media gateway acknowledges the ringing request to ring the physical device.

- MGC requests termination T1r (the one associated with the physical device) to ring.
- Response (200).

MG acknowledges the request to play the ringing tone and forwards to the 1st media GW the IP address, port and codecs chosen by the other GW.

- Modification
  - CTX=C1r
  - MODIFY(T1r;;;;;S:rg)

- Media Gateway
  - CTX=C1
  - MODIFY(RTP/777;;codec1;IP2,port2, RTP, codec2;;)

- MG acknowledges the request
  - CTX=C1
  - Response (200)

Phone

Media Gateway

MGC

Media Gateway

Phone

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Megaco: Residential GW Example

MGC acknowledges an off-hook event

CTX=C1 RESPONSE(200)
MODIFY(RTP/777; sendrcv;;R:hu;)

MG acknowledges MGC requests termination T1 to change state in send+receive (it was rcvonly), and to notify MGC in case of user hangup

CTX=C1r NOTIFY(T1r; hd)

The RTP data flow can start

CTX=C1 RESPONSE(200)

Phone

RJ11

Media Gateway

RTP

Media Gateway

Phone

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Megaco: Residential GW Example

All the deleted terminations report traffic statistics, therefore the CTX itself. Termination T1r is requested to notify the off-hook event.

MGC

All the deleted terminations report traffic statistics, therefore the CTX C1 (and therefore the CTX itself). Termination T1 is requested to notify the off-hook event.

Media Gateway

Phone

RJ11

Subtract (RTP/777)

CTX=C1 Response (RTP/777, statistics)

Subtract (RTP/444)

CTX=C1r Response(T1r, statistics)

RJ11

Phone

Media Gateway

Subtract (RTP/444)

CTX=C1r Response(T1r, statistics)
Megaco: **Transport**

- MGCs: must support TCP AND ALF
- MGs: must support TCP OR ALF or both
  - At startup, MG issues the ServiceChange method on a different port depending on the transport it wishes to use
- ITU-T wants to add Sigtran as an option on both
Megaco: RSVP and DIFFSERV support

- (will be) Part of the “IP Package”, in the form of SDP(Megaco)/Annex C(H.248) extensions
- MGC will be able to instruct the MG to
  - mark packets of a specific service with a given DSCP
  - send out RSVP PATH messages for the specified service
Megaco: Security

- IPSEC Authentication Header is mandatory
  - origin authentication
  - data integrity
- IPSEC Encapsulating Security Payload is optional
  - confidentiality (payload encryption)
- An interim solution is devised for those cases where the OS does not support IPSEC
Megaco: Deadlines

- Jan 99
  - Requirement document approved as RFC

- Feb 2000
  - Last Call ended on March 7th
  - Draft standard
Megaco: Performances: RGWs, 1 MGC

Off-hook (Dialtone), Digits

\[ \text{Tra} = 30ms \]

\[ \text{Trm} = 30ms \]

Ringing

\[ \text{Tra} = 30ms \]

Notify: \( Tcr = 15ms \)

Reply: \( Tcr = 15ms \)

Add: \( Tcr = 15ms \)

Reply: \( Tcr = 15ms \)

Modify: \( Tcr = 15ms \)

Reply: \( Tcr = 15ms \)

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Megaco: Performances: RGWs, 1 MGC

PDD = 2 Tgc + 2 Tra + 8 Tcr + Trm = 720 ms
Megaco: References

- draft-ietf-megaco-reqs-10.txt (To-Be RFC)
- draft-ietf-megaco-protocol-07.txt (To-Be RFC)
- draft-ietf-sigtran-performance-req-01.txt
The Real OSI Model

9. Political
8. Financial
7. Application
6. Presentation
5. Session
4. Transport
3. Network
2. Link
1. Physical