H.323, Megaco/H.248 and Soft-Switches

INSE 7110 – Winter 2006
Value Added Services Engineering in Next Generation Networks
Week #5
Outline

1. H.323
2. Megaco/H.248
3. Soft-switches
H.323

1. Introduction
2. Functional entities
3. Signaling protocols
4. H.323 vs. SIP
H.323: Introduction

An umbrella ITU-T standard including

– signalling standards:
  • H.225.0
  • Q.931
  • H.245
– Others (e.g. H.324 Terminal for low bit rate multimedia communications)
H.323: The functionality entities

Terminals
- End point
- Used for real time two way multimedia communications with another end point

Gatekeeper
- Control how terminal access networks
- Provide address translation

Gateway
- End point
- Used for communications between H.323 terminals and terminals in the PSTN

Multipoint control unit (MCU)
- Provides centralized conferencing functionality
H.323 signaling: Registration Admission and Status (RAS)

Key features

- ASN.1 based messages
- Request / reply protocol
- Signaling between end-points
  - Terminal or gateway
  and
  - Gatekeeper
- Use unreliable channels
  - Retries
  - Timeouts
RAS: Gatekeeper discovery …
RAS: Admission request ...
H.323 signaling: Call Set Up (H.225)

Key features
- ISUP signaling (Q.931) based
- ASN.1 based messages
- Transaction oriented protocol
- Signaling between end-points
  - Terminal or gateway and
  - Gatekeeper
- Use reliable channels
RAS: Call set up - No gatekeeper ...

Call Signalling Messages

Endpoint 1

Setup (1)
Call proceeding (2)
Alerting (3)
Connect (4)

Endpoint 2

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RAS: Call set up - 1 gatekeeper ...

- Setup (1)
- Call proceeding (2)
- ARQ (3)
- ACF/ARJ (4)
- Alerting (5)
- Connect (6)

RAS Messages

Call Signalling Messages
RAS: Call set up - Two gatekeepers ...

Endpoint 1  
ARQ (1)  
ACF/ARJ (2)  

Gatekeeper 1  
Setup (3)  
Call proceeding (4)  
Alerting (7)  
Connect (8)  

Gatekeeper 2  

ARQ (5)  
ACF/ARJ (6)  

Endpoint 2  

RAS Messages  
Call Signalling Messages  

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H.323 signaling: Media signaling (H.245)

Key features
- ASN.1 based messages for
  - Master/slave determination
  - Capabilities negotiation
  - Logical channel signaling
- Several modes
  - Request/reply
  - Commands
  - Indications
- Signaling between end-points
  - Terminal or gateway
  - Gatekeeper
- Use reliable channels
H.323 signaling: Master / slave determination

```
INCOMING
AWAITING
RESPONSE

IDLE

OUTGOING
AWAITING
RESPONSE

DETERMINE.indication  REJECT.indication  DETERMINE.confirm

DETERMINE.request  REJECT.indication  DETERMINE.confirm
```
H.323 signaling: Capabilities exchange

- IDLE
- AWAITING RESPONSE
- TRANSFER.request
- REJECT.indication
- TRANSFER.confirm
H.323 signaling: Capabilities exchange

- IDLE
  - TRANSFER.indication
  - REJECT.request
  - REJECT.indication
  - TRANSFER.respor

- AWAITING RESPONSE
H.323 signaling: Logical channels

- ESTABLISH.request
- ESTABLISH.indication
- ESTABLISH.response
- ESTABLISH.confirm
- OpenLogicalChannel
- OpenLogicalChannelAck
H.323 signaling: Logical channels

T103
2
3
0

outgoing

RELEASE.request
CloseLogicalChannel
RELEASE.confirm
CloseLogicalChannelAck

incoming

RELEASE.indication

2
0
H.323 signaling: An important feature - Fast connect

Introduced as an afterthought in H.323
Allow call set up and logical channel set up using a single message
- FASTCONNECT
  - Include as parameter fast start to indicate that logical channel should be opened
  - May be refused by the other end (Fast connect refused)
H.323 signaling: Putting it together … alternative 1

1 ARQ
2 ACF/ARJ
3 Setup
4 ARQ
5 ACF/ARJ
6 Connect

Call Signalling Channel Messages

RAS Channel Messages
H.323 signaling: Putting it together…alternative 2

H.245 Control Channel Messages

Call Signalling Channel Messages

RAS Channel Messages

1. ARQ
2. ACF/ARJ
3. Setup
4. Setup
5. ARQ
6. ACF/ARJ
7. Connect
8. Connect
9. H.245 Channel
H.323 signaling: Putting it together - alternative 3

1. ARQ
2. ACF/ARJ
3. Setup
4. Setup
5. ARQ
6. ACF/ARJ
7. Connect
8. Connect
9. H.245 Channel
10. H.245 Channel

Gatekeeper Cloud

Endpoint 1

1 2 3 8 9

4 5 6 7 10

Endpoint 2

H.245 Control Channel Messages
Call Signalling Channel Messages
RAS Channel Messages
Megaco / H.248

1. Introduction
2. Genesis
3. Concepts
4. Protocol
5. Call cases
Megaco/H.248: Introduction

Primary motives for decomposing gateways between PSTN and next generation networks:

– Scalability
– Specialization
– Opening up of market to new players

Side-effect

– Possibility of using the part of the decomposed gateway for call control
  • Soft-switches
Megaco/H.248: Introduction

Media Gateway controller

Media gateway control protocol

Media Gateway  Media Gateway  Media Gateway
Megaco/H.248: Genesis

A long history starting in 1998
- Simple Gateway Control Protocol (SGCP)
  - Text based encoding, limited command set
- IP Device Control Protocol (IPDCP)
  - A few more features to SGCP
- Media Gateway Control Protocol (MGCP)
  - Merge of SGCP and IPDC
- Media gateway Decomposition Control Protocol (MDCP)
  - Binary encoded
- Megaco / H.248 (Joint IETF / ITU-T specifications)
  - A compromise
    - Both text based and binary encoding
    - A wide range of transport protocols(e.g. UDP, TCP, SCTP)
Megaco/H.248: Concepts - Termination

Source or sink of media
- Persistent (circuit switched) or ephemeral (e.g. RTP)
- IDs
  - Unique or wildcard mechanism (ALL or CHOOSE)
- Properties/descriptors
  - Unique ids
  - Default values
  - Categorization
    - Common (i.e. termination state properties) vs. stream specific
    - For each media stream
      - Local properties
      - Properties of received streams
      - Properties of transmitted streams
    - Mandatory vs. optional
      - Options are grouped in packages
Megaco/H.248: Concepts - Termination

Examples of properties/descriptors

- **Streams**
  - Single bidirectional stream
    - Local control: Send only – send/receive ...
    - Local: media received
    - Remote: media sent

- **Events**
  - To be detected by the MG and reported to the controller
    - On hook / Off hook transition

- **Signals**
  - To be applied to a termination by the MG
    - Tones
    - Announcements

- **Digit map**
  - Dialling plan residing in the MG
  - Detect and report events received on a termination ..
Megaco/H.248: Concepts - Context

Context (mixing bridge)
- Who can hear/see/talk to whom
- Association between terminations
- May imply
  - Conversion (RTP stream to PSTN PCM and vice versa)
  - Mixing (audio or video)
  - Null context
    - Terminations that are not associated with no other termination (e.g. idle circuit switched lines)
  - Topology
  - Precedence
Megaco/H.248: Protocol - Commands

- Add termination to a context
- Modify the properties of a termination
- Subtract a termination from a context
- Move a termination from a context A to context B
- Audit (values or capabilities)
- Notify
- ServiceChange (specific type of notify – terminations about to be taken out of service)
Megaco/H.248: Protocol - Transactions

Possibility to send several commands in one go

- Transaction Request
- Transaction Reply
- Transaction pending
Several alternatives

An example

- **UDP/IP**
  - Unreliable, timeouts / resends
  - At most once functionality required (Receivers should keep track of received commands)
Megaco/H.248: PSTN / NGN Interconnection …

INVITE

ISUP “INVITE” to PSTN

OK

ISUP “OK” to MGC

ACK

Add RTP stream to context

Add PCM stream to context

RTP

PCM

User in NGN — MGC — MG — User in PSTN
Megaco/H.248: Conferencing ...
Megaco/H.248: Megaco IP phones

Phone considered as a media gateway ...

- Terminations
  - User interface
  - Audio transducers
    - Hands free
    - Headset
    - Microphone

- Interactions
  - Add
  - Move
  - Subtract
  - Modify
Soft-switches

1. Introduction

2. Overview

3. A simplified call case
Soft-switch: Introduction

A “side effect” of media gateway decomposition
- Aggressively promoted by the soft-switch consortium, now known as the International Packet Communication Consortium (IPCC)
  - Adoption of existing standards (e.g. SIP, H.323, MGCP, Megaco)
- Gateway controller (plus some additional features) acts as a switch
  - Switching in software instead of hardware
- Can act as local exchange (class 5) or toll centre (class 4)
  - Lower entry costs for new incumbents
  - New local telephony networks and “by pass” for long distance call providers
- Soft-switches vs. classical switches debate
  - Scalability
  - Reliability
  - QoS
Soft-switches: Overview

Soft-switch (Media Gateway Controller + Some intelligence)

- ISUP
- H.323 or SIP
- MGC protocols

Media Gateway  Media Gateway  Media Gateway
Soft-switches: Overview

An example of soft-switch as class 5 replacement ...

- Soft-switch
  - Signaling (e.g. ISUP, SIP)
  - MGC protocol
  - Media Gateway (Residential gateway)
  - Media (i.e. RTP)

- Soft-switch
  - MGC protocol
  - Media Gateway (i.e. Residential gateway)

...
An example of soft-switch as class 4 replacement ...

Soft-switch

Signaling (e.g. ISUP, SIP)

MGC protocol

RTP for media

Soft-switch

Media Gateway

ISUP signaling

PCM for media

Class 4 switch

Media Gateway

PCM for media

ISUP signaling

Class 4 switch
Soft-switch: A simplified call case (Calling card)

Caller                  Local exchange        Soft-switch          MG                  MG                  Soft-switch       Local exchange

Call to access number  (I.e soft-switch) →

Verification (e.g. account, Digit analysis) →

Info request (e.g. card number, Callee number) ←

Call request (e.g. SIP, SIP-T) ←

Call request (ISUP) →

PCM ←

RTP ←

PCM →
References ...

1. Moderassi and S. Mohan, special issue, Advanced Signaling and Control in Next Generation Networks, IEEE Communications Magazine, October 2000 – Include papers on:
   - H.323
   - SIP

2. Additional references on Megaco/H.248
   RFC 3525 (The protocol)
   RFC 3054 (IP Phone)