Session Announcements

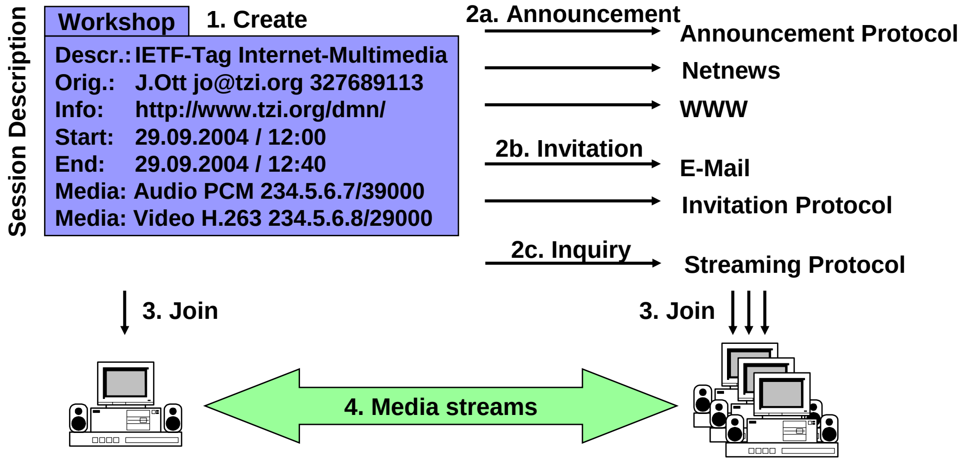
(SAP, RFC 2974)

Session Description

(SDP, RFC 2327)
(SDP, RFC 4566)

Slide contributions by Dirk Kutscher (Uni Bremen TZI)

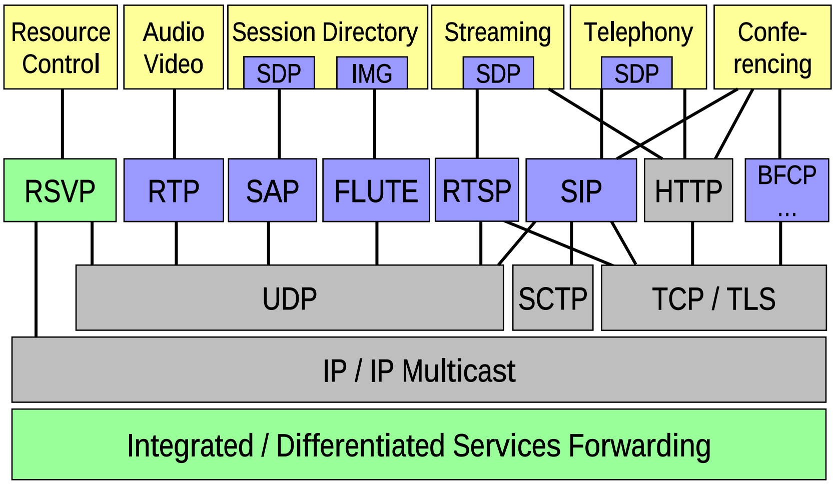
Conference Establishment & Control



Workshop

Descr.: IETF-Tag Internet-Multimedia
Orig.: J.Ott jo@tzi.org 327689113
Info: http://www.tzi.org/dmn/
Start: 29.09.2004 / 12:00
End: 29.09.2004 / 12:40
Media: Audio PCM 234.5.6.7/39000
Media: Video H.263 234.5.6.8/29000

IETF Multimedia (Conferencing) Architecture



Resource Control | Audio Video | Session Directory (SDP, IMG) | Streaming (SDP) | Telephony (SDP) | Confe-rencing

RSVP | RTP | SAP | FLUTE | RTSP | SIP | HTTP | BFCP …

UDP | SCTP | TCP / TLS

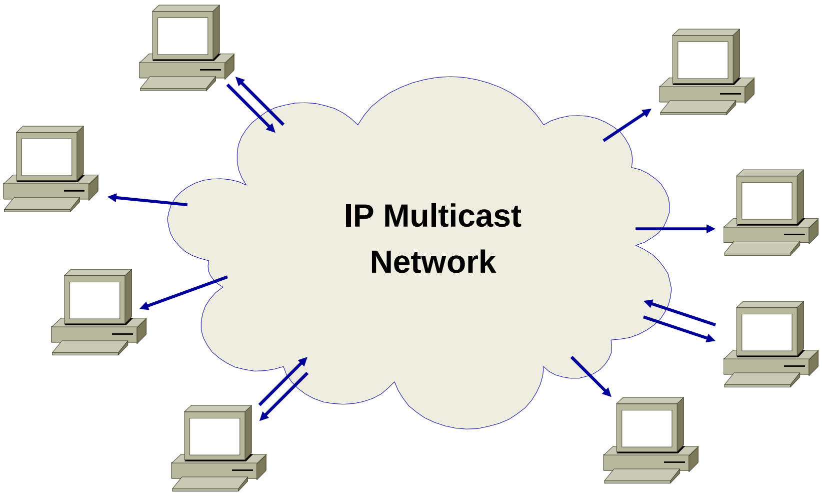
IP / IP Multicast

Integrated / Differentiated Services Forwarding

Session Announcement Protocol (SAP)

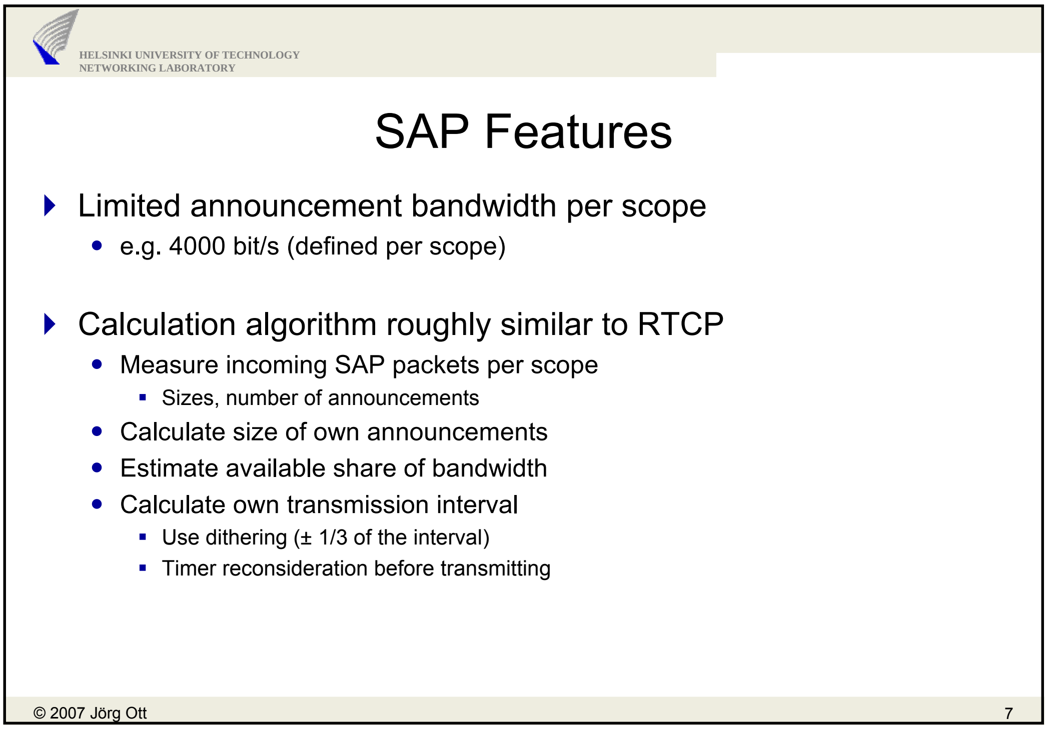
- Announcing multimedia sessions to a broad audience
- Session announcements contain SDP
  - Subject of the session
  - Date(s) and time(s)
  - Media streams and addresses
  - Further information
- SAP Functions
  - New session announcements
  - Modify announcements
  - Delete announcements
  - Support for relays
- Earlier: Coordinate use of multicast address space

SAP Scenario



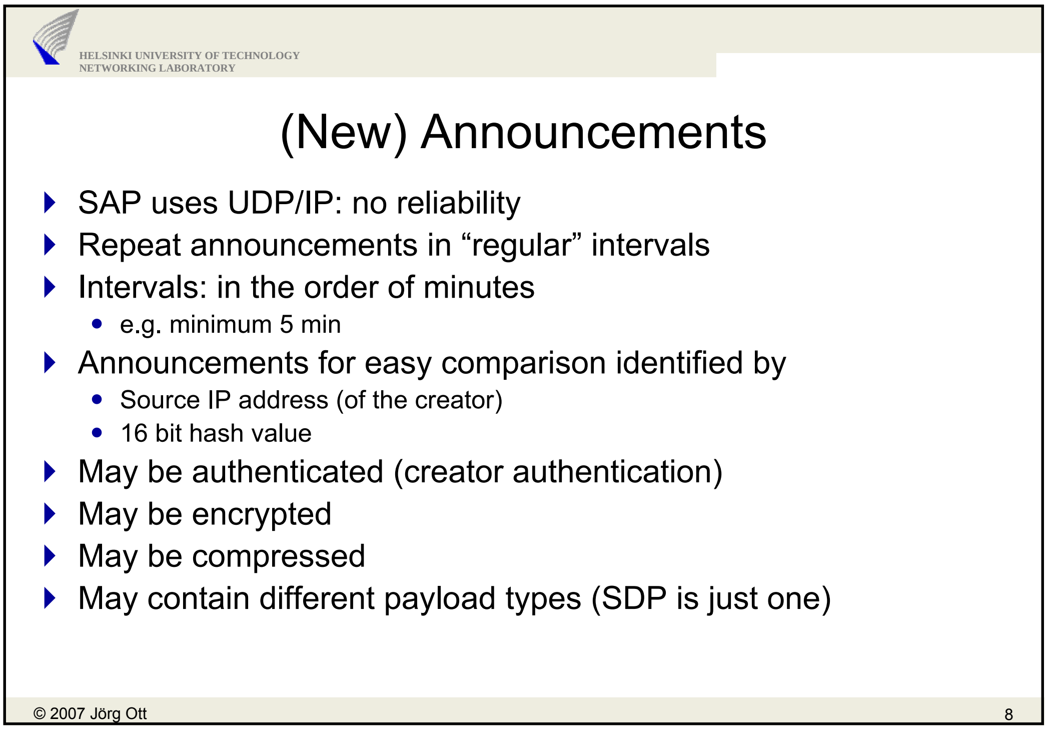
Dissemination of SAP Announcements

- Scope of Announcements
  - Per (administratively defined) multicast address scope
  - Local: 239.255.0.0/16
  - Organization local: 239.192.0.0/14
  - SAP conferences: 224.2.0.0 – 224.2.127.253
  - Other: Global
  - Similar considerations for IPv6
    - Scope identifier built-in into the IPv6 address structure
- SDP descriptions should use addresses of same scope
  - To ensure that receivers can also receive the media streams if they can receive the announcements



SAP Features

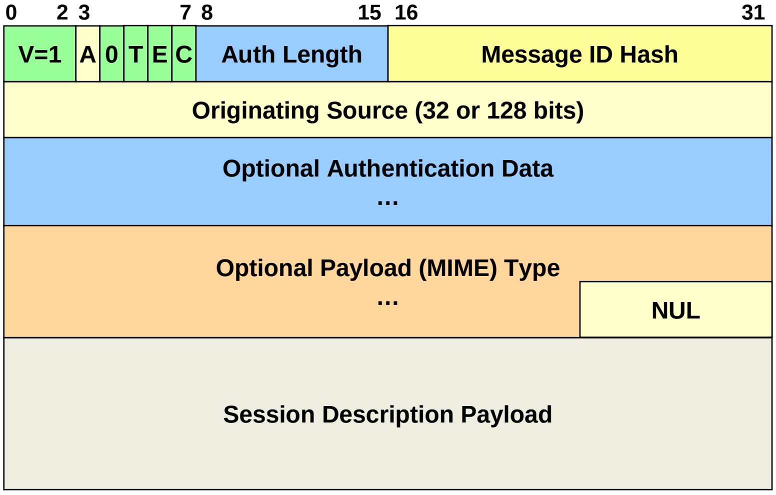
- Limited announcement bandwidth per scope
  - e.g. 4000 bit/s (defined per scope)
- Calculation algorithm roughly similar to RTCP
  - Measure incoming SAP packets per scope
    - Sizes, number of announcements
  - Calculate size of own announcements
  - Estimate available share of bandwidth
  - Calculate own transmission interval
    - Use dithering (± 1/3 of the interval)
    - Timer reconsideration before transmitting



(New) Announcements

- SAP uses UDP/IP: no reliability
- Repeat announcements in “regular” intervals
- Intervals: in the order of minutes
  - e.g. minimum 5 min
- Announcements for easy comparison identified by
  - Source IP address (of the creator)
  - 16 bit hash value
- May be authenticated (creator authentication)
- May be encrypted
- May be compressed
- May contain different payload types (SDP is just one)

SAP Packet Format


0
2 3
7 8
15 16
31
V=1
A
0
T
E
C
Auth Length
Message ID Hash
Originating Source (32 or 128 bits)
Optional Authentication Data
…
Optional Payload (MIME) Type
…
NUL
Session Description Payload

SAP Header Fields (1)

V: Version	—	=1	for SAPv2
A: Address type	—	=0	IPv4 source address
		=1	IPv6 source address
T: Type	—	=0	Announcement packet
		=1	Deletion packet
E: Encrypted	—	indicates encryption of the announcement packet	
C: Compressed	—	indicates that the announcement packet is compressed	
Auth Length	—	Length of the authentication header (0 = no authentication)	

SAP Header Fields (2)

Message ID Hash	—	Unique value per session creator
Originating Source	—	IP address of session creator
Authentication Data	—	Source Authentication information (PGP and CMS formats defined so far)
Payload MIME Type	—	NUL-terminated text string indicating the MIME type of the payload Default: application/sdp

Deleting Announcements

- Explicit Timeout
  - No need to announce sessions after the “end time” in SDP
  - Caveat: the SAP receivers and relays need to understand SDP
- Implicit Timeout
  - Receiver observe repetition of announcement
  - After 10 times the announcement interval (or one hours) with re-announcement the session is removed
- Explicit Deletion
  - Send Deletion packet for a session
  - Message ID Hash and Originating Source must match
  - SHOULD be authenticated (match the original announcement)

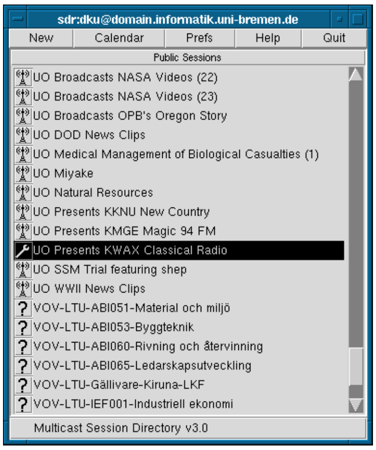
Modifying Announcements

- Replace an existing session description
  - E.g. modify media or start / end times
  - Update description
- Message ID Hash MUST change
- Modifying announcement MUST be authenticated if and only if the original announcement was
- If in doubt, a new session is “created”
  - Prevent denial-of-service attacks
- If proper match is found, the old session information is simply replaced by the new one

SAP Security

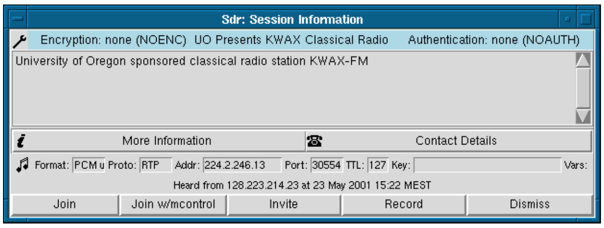
- Encrypted messages for secure information distribution
  - Should be only used with limited size receiver groups
  - Avoid waste of computation resource if many receivers cannot decrypt the message
  - Key distribution out-of-scope
  - Limited applicability, limited usefulness
- Authentication
  - SHOULD always be done
  - Enables at least to verify that two messages are from the same source
  - Proper source authentication requires PKI
- General observation
  - Both is rarely used in practice
  - Current use of SAP in the Internet does not justify the effort...

Session Announcement Tool: SDR



- UO Broadcasts NASA Videos (22)
- UO Broadcasts NASA Videos (23)
- UO Broadcasts OPB's Oregon Story
- UO DOD News Clips
- UO Medical Management of Biological Casualties (1)
- UO Miyake
- UO Natural Resources
- UO Presents KKNU New Country
- UO Presents KMGE Magic 94 FM
- UO Presents KWAX Classical Radio
- UO SSM Trial featuring shep
- UO WWII News Clips
- ? VOV-LTU-ABI051-Material och miljö
- ? VOV-LTU-ABI053-Byggteknik
- ? VOV-LTU-ABI060-Rivning och återvinning
- ? VOV-LTU-ABI065-Ledarskapsutveckling
- ? VOV-LTU-Gällivare-Kiruna-LKF
- ? VOV-LTU-IEF001-Industriell ekonomi

Multicast Session Directory v3.0



Encryption: none (NOENC) UO Presents KWAX Classical Radio Authentication: none (NOAUTH)

University of Oregon sponsored classical radio station KWAX-FM

Format: PCM u Proto: RTP Addr: 224.2.246.13 Port: 30554 TTL: 127 Key: Vars:

Heard from 128.223.214.23 at 23 May 2001 15:22 MEST

Session Description Protocol (SDP)

- All you need to know about a session to join
  - who? — convener of the session + contact information
  - what about? — name and informal subject description
  - when? — date and time
  - where? — multicast addresses, port numbers
  - which media? — capability requirements
  - how much? — required bandwidth
- Grouped into three categories
  - 1 x session, m x time, n x media

Session Level Description

v=0	Version
o=	Owner / creator of the session + unique identifier + version
u=	URL for further information
e=	Contact email address
p=	Contact phone number
b=	Bitrate information
k=	Encryption key information
z=	Time zone adjustment
a=	Attribute lines (for extensions)
c=	Connection (=address) information

Time Description

- Start and end time(s) of a session
  - Plus time zone adjustment
- Regular repetitions
  - Every Tuesday and Thursday, 10 – 12
  - Every day
- Arbitrary repetitions
  - Repeated specification of t= lines

t=	Start, end time (NTP seconds, special case: 0, 0)
r=	Repetitions (interval, duration, offsets)

Media Description

- Define the media streams comprising a conference
  - Media type (audio, video, text, tones, application, ...)
    - Only audio, video, text, tones are well-defined
  - (multicast) address(es) + port number
  - Maps RTP payload types for media to encoding formats
  - Other media level attributes

m=	Media and port specification
c=	IP address specification (inherited from session)
a=	Attributes for this media stream rtpmap:, fmtp:, recvonly, portrait | landscape

SDP Example

Length of Time represented by Media in a single Packet

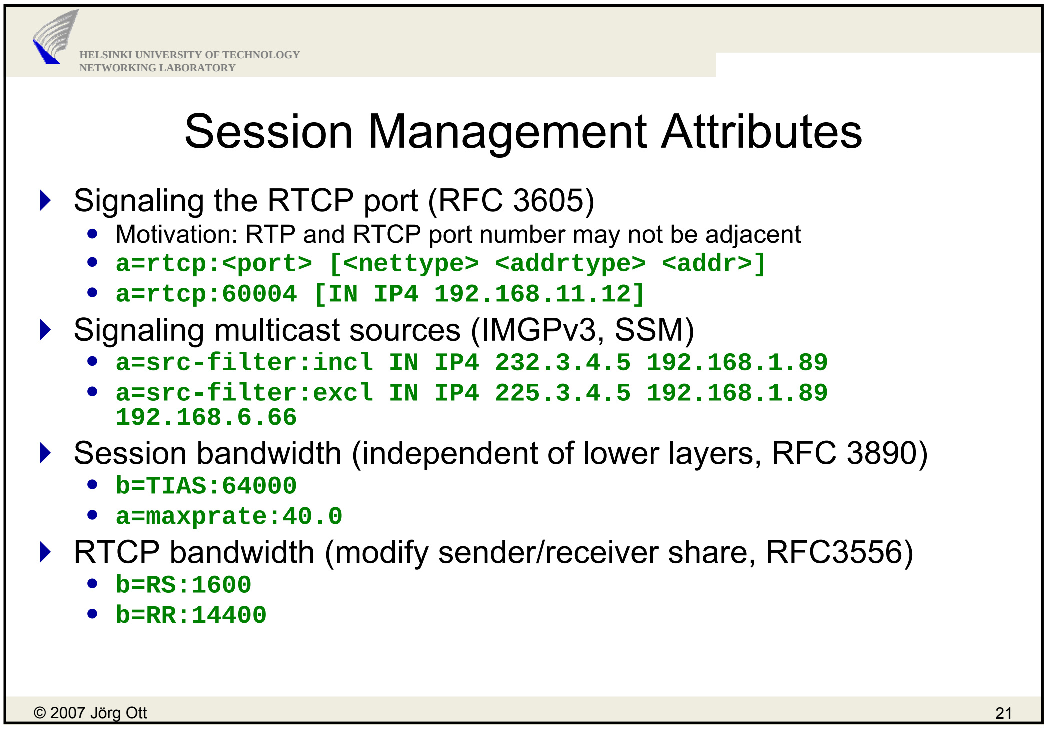
(in SIP: address where originator wants to receive data)

Session Level

```
v=0
o=llynch 3117798688 3117798739 IN IP4 128.223.214.23
s=UO Presents KWAX Classical Radio
i=University of Oregon sponsored classical radio station KWAX-FM
u=http://darkwing.uoregon.edu/~uocomm/
e=UO Multicasters multicast@lists.uoregon.edu
p=Lucy Lynch (University of Oregon) (541) 346-1774
t=0 0
a=tool:sdr v2.4a6
a=type:test
```

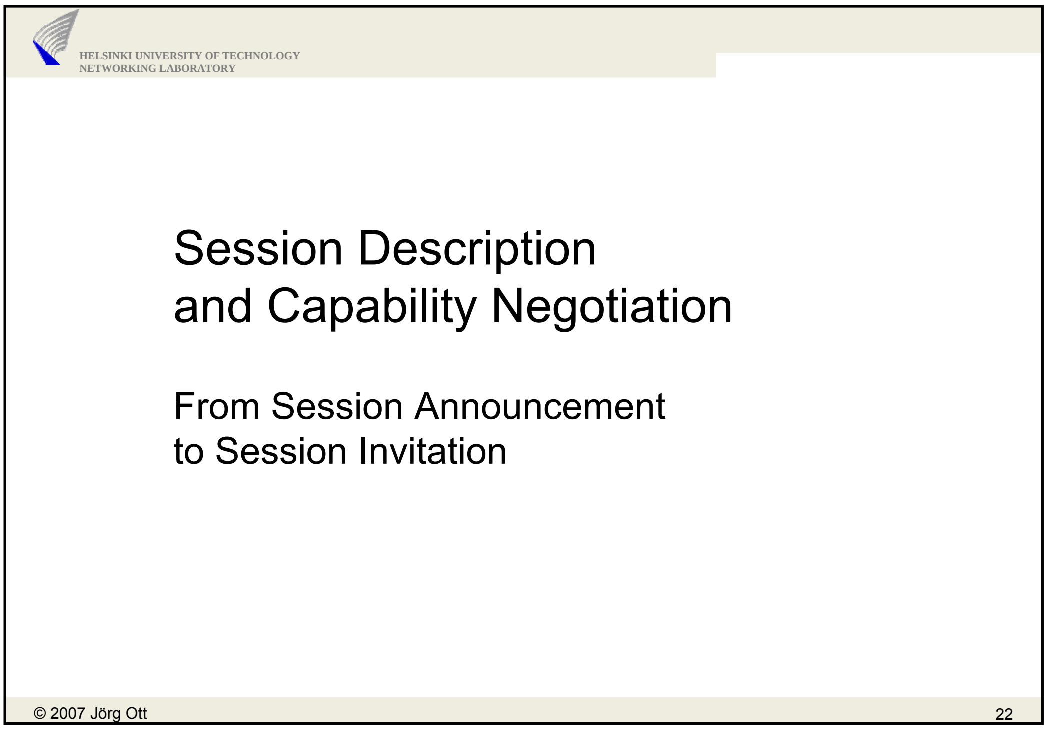
Media Level

```
m=audio 30554 RTP/AVP 0
c=IN IP4 224.2.246.13/127
a=ptime:40
```



Session Management Attributes

- Signaling the RTCP port (RFC 3605)
  - Motivation: RTP and RTCP port number may not be adjacent
  - `a=rtcp:<port> [<nettype> <addrtype> <addr>]`
  - `a=rtcp:60004 [IN IP4 192.168.11.12]`
- Signaling multicast sources (IMGPv3, SSM)
  - `a=src-filter:incl IN IP4 232.3.4.5 192.168.1.89`
  - `a=src-filter:excl IN IP4 225.3.4.5 192.168.1.89 192.168.6.66`
- Session bandwidth (independent of lower layers, RFC 3890)
  - `b=TIAS:64000`
  - `a=maxprate:40.0`
- RTCP bandwidth (modify sender/receiver share, RFC3556)
  - `b=RS:1600`
  - `b=RR:14400`



Session Description
and Capability Negotiation

From Session Announcement
to Session Invitation

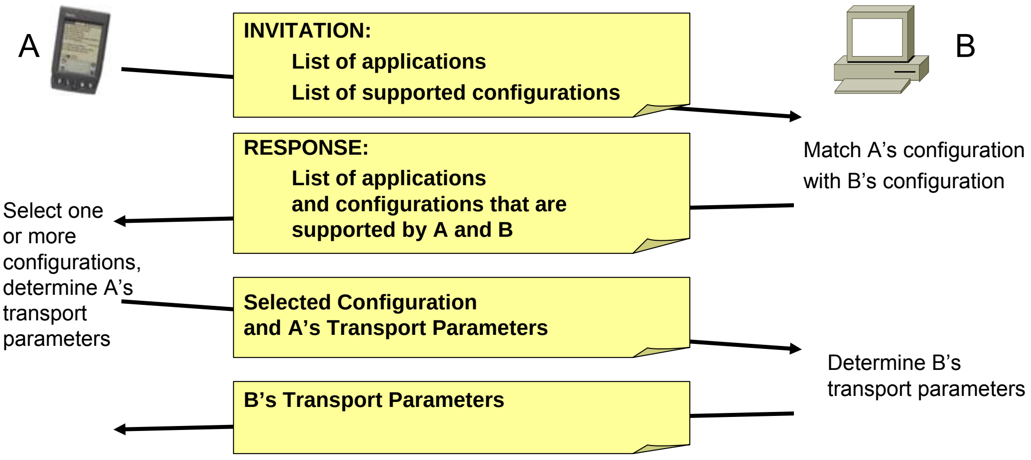
Characteristics of SAP Announcements

- Common view
  - Every SAP-receiver sees the same description
    - Session meta information & scheduling
    - Media description & transport parameters
- Identical transport parameters for all participants
  - IP-Multicast service model:
    - Senders send to a multicast group (IP address)
    - Receivers join (“tune into”) a multicast group

Session Initiation

- Distribute conference configuration
  - Applications
    - Media types, media format parameters
  - Transport Parameters
    - IP addresses, transport protocols, protocol parameters
- Negotiate Parameters!
  - Heterogeneous end systems
    - Different hardware and software capabilities
  - User preferences
- SDP provides syntax mechanisms to express parameters
  - Procedural model for initiation required

Invitation: Conceptual Model



INVITATION:
List of applications
List of supported configurations

Match A’s configuration with B’s configuration

RESPONSE:
List of applications and configurations that are supported by A and B

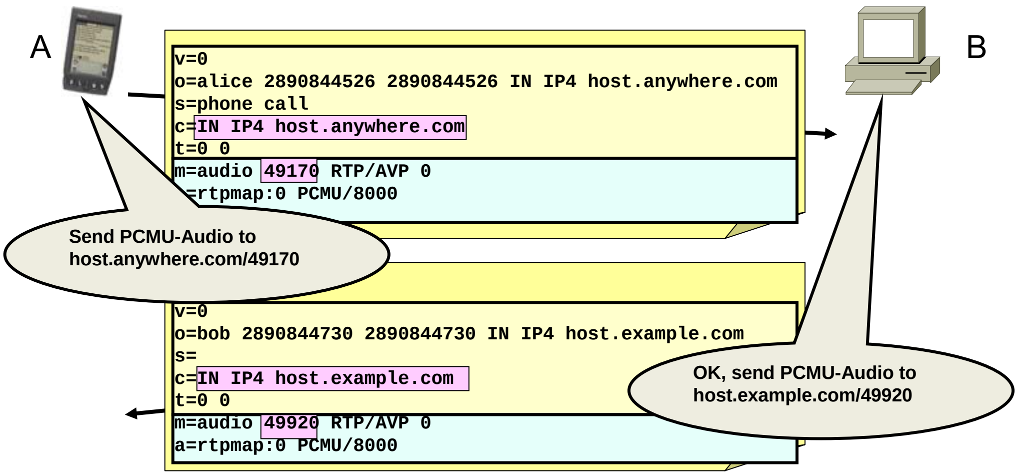
Select one or more configurations, determine A’s transport parameters

Selected Configuration and A’s Transport Parameters

Determine B’s transport parameters

B’s Transport Parameters

Session Initiation with SDP (1)



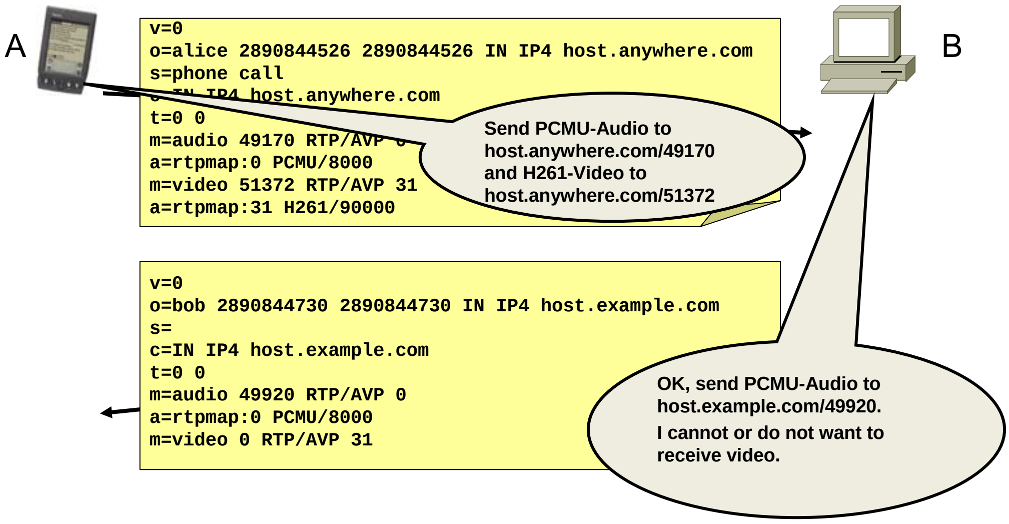
```
v=0
o=alice 2890844526 2890844526 IN IP4 host.anywhere.com
s=phone call
c=IN IP4 host.anywhere.com
t=0 0
m=audio 49170 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

Send PCMU-Audio to host.anywhere.com/49170

```
v=0
o=bob 2890844730 2890844730 IN IP4 host.example.com
s=
c=IN IP4 host.example.com
t=0 0
m=audio 49920 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

OK, send PCMU-Audio to host.example.com/49920

Session Initiation with SDP (2)



```
v=0
o=alice 2890844526 2890844526 IN IP4 host.anywhere.com
s=phone call
c=IN IP4 host.anywhere.com
t=0 0
m=audio 49170 RTP/AVP 0
a=rtpmap:0 PCMU/8000
m=video 51372 RTP/AVP 31
a=rtpmap:31 H261/90000
```

Send PCMU-Audio to host.anywhere.com/49170 and H261-Video to host.anywhere.com/51372

```
v=0
o=bob 2890844730 2890844730 IN IP4 host.example.com
s=
c=IN IP4 host.example.com
t=0 0
m=audio 49920 RTP/AVP 0
a=rtpmap:0 PCMU/8000
m=video 0 RTP/AVP 31
```

OK, send PCMU-Audio to host.example.com/49920.

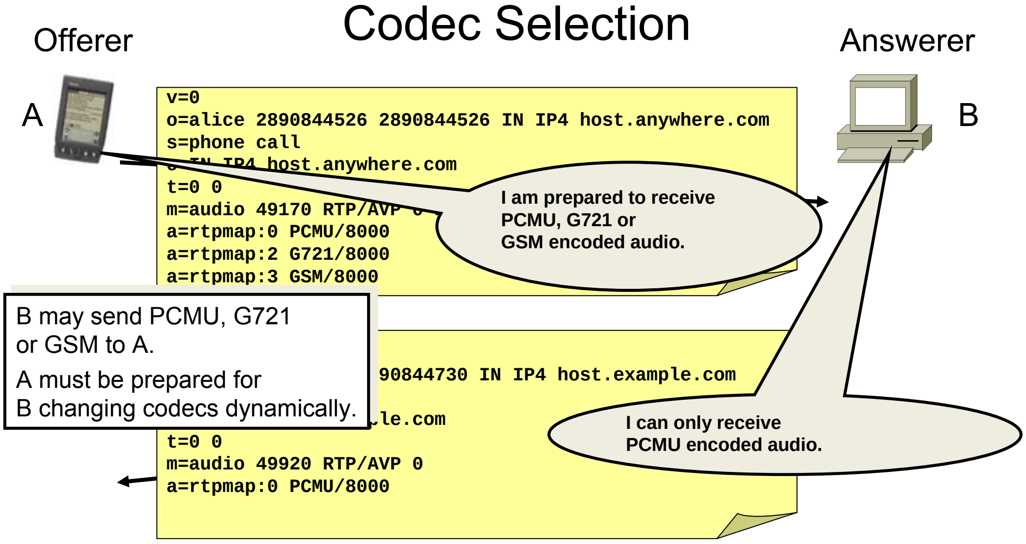
I cannot or do not want to receive video.

SDP Offer/Answer Model (RFC 3264)

- For initiation of unicast sessions
- Objective: generate common view of session configuration
- Simple exchange of capability descriptions

- Basic Model:
  - A sends offer to B, including
    - Set of media streams and codecs A wishes to use
    - Transport parameters (where A wants to *receive* data)
  - B sends answer to A
    - For each stream in offer, indicating whether stream is accepted or not
    - For each stream add transport parameters (where B wants to *receive* data)

Codec Selection



```
v=0
o=alice 2890844526 2890844526 IN IP4 host.anywhere.com
s=phone call
c=IN IP4 host.anywhere.com
t=0 0
m=audio 49170 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=rtpmap:2 G721/8000
a=rtpmap:3 GSM/8000
```

I am prepared to receive PCMU, G721 or GSM encoded audio.

```
90844730 IN IP4 host.example.com
le.com
t=0 0
m=audio 49920 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```

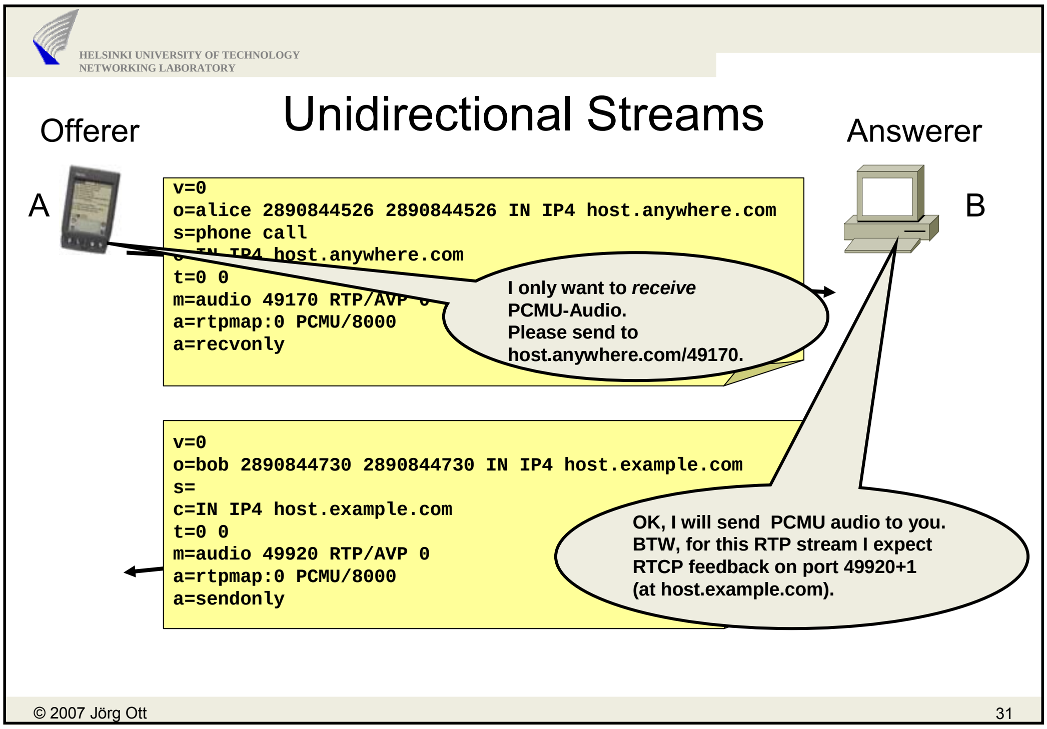
I can only receive PCMU encoded audio.

B may send PCMU, G721 or GSM to A.

A must be prepared for B changing codecs dynamically.

Codec Selection

- Offer can provide multiple codecs for a media stream.
  - Ordered by preference
  - Offerer commits to support all codecs (one at a time)
  - Answerer should generate list of codecs for each stream, maintaining payload type mapping
  - New codecs may be added
- One of N codec selection
  - Offer multiple codecs, but cannot change dynamically
  - Offerer sends codec list “with reservation”
  - Answerer sends back subset
  - Offerer “locks” one codec for session
  - Implemented with `a=inactive` media level attribute…



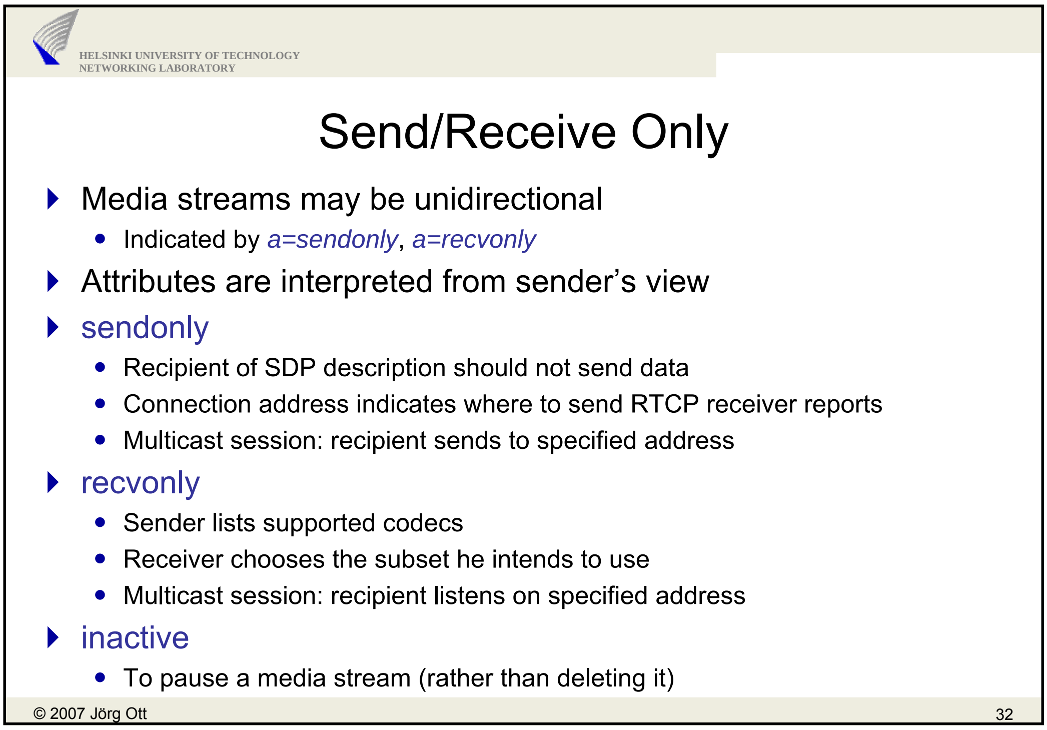
Unidirectional Streams

```
v=0
o=alice 2890844526 2890844526 IN IP4 host.anywhere.com
s=phone call
c=IN IP4 host.anywhere.com
t=0 0
m=audio 49170 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=recvonly
```

I only want to *receive* PCMU-Audio.
Please send to host.anywhere.com/49170.

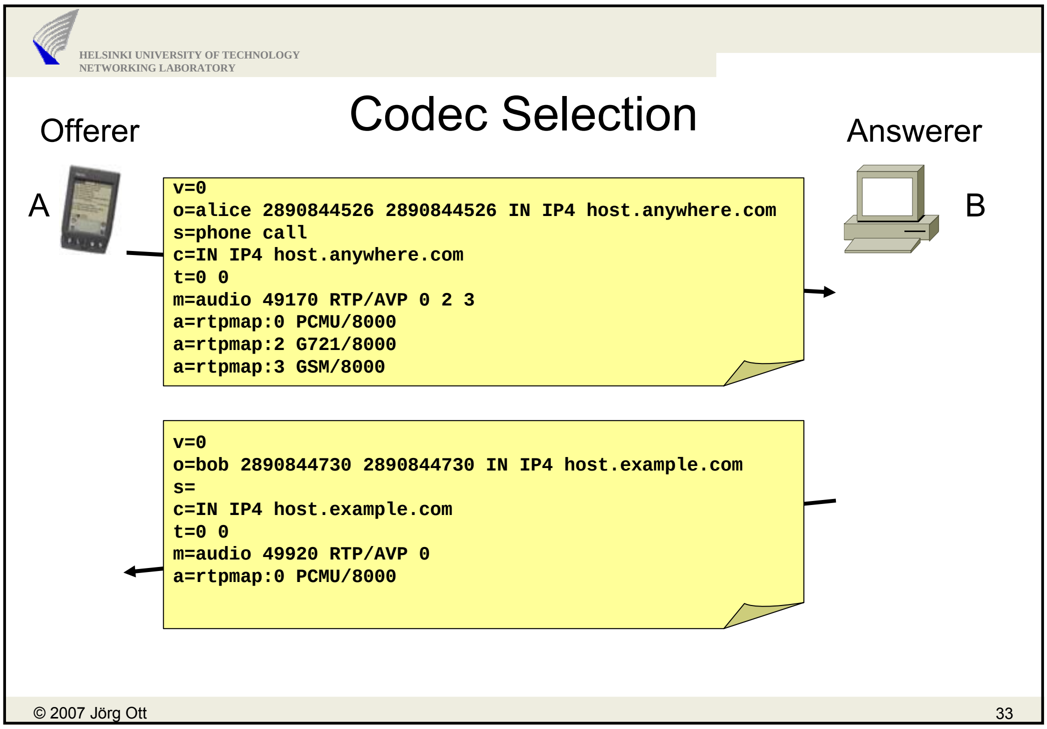
```
v=0
o=bob 2890844730 2890844730 IN IP4 host.example.com
s=
c=IN IP4 host.example.com
t=0 0
m=audio 49920 RTP/AVP 0
a=rtpmap:0 PCMU/8000
a=sendonly
```

OK, I will send PCMU audio to you.
BTW, for this RTP stream I expect RTCP feedback on port 49920+1 (at host.example.com).



Send/Receive Only

- Media streams may be unidirectional
  - Indicated by *a=sendonly*, *a=recvonly*
- Attributes are interpreted from sender's view
- sendonly
  - Recipient of SDP description should not send data
  - Connection address indicates where to send RTCP receiver reports
  - Multicast session: recipient sends to specified address
- recvonly
  - Sender lists supported codecs
  - Receiver chooses the subset he intends to use
  - Multicast session: recipient listens on specified address
- inactive
  - To pause a media stream (rather than deleting it)



Codec Selection

Offerer

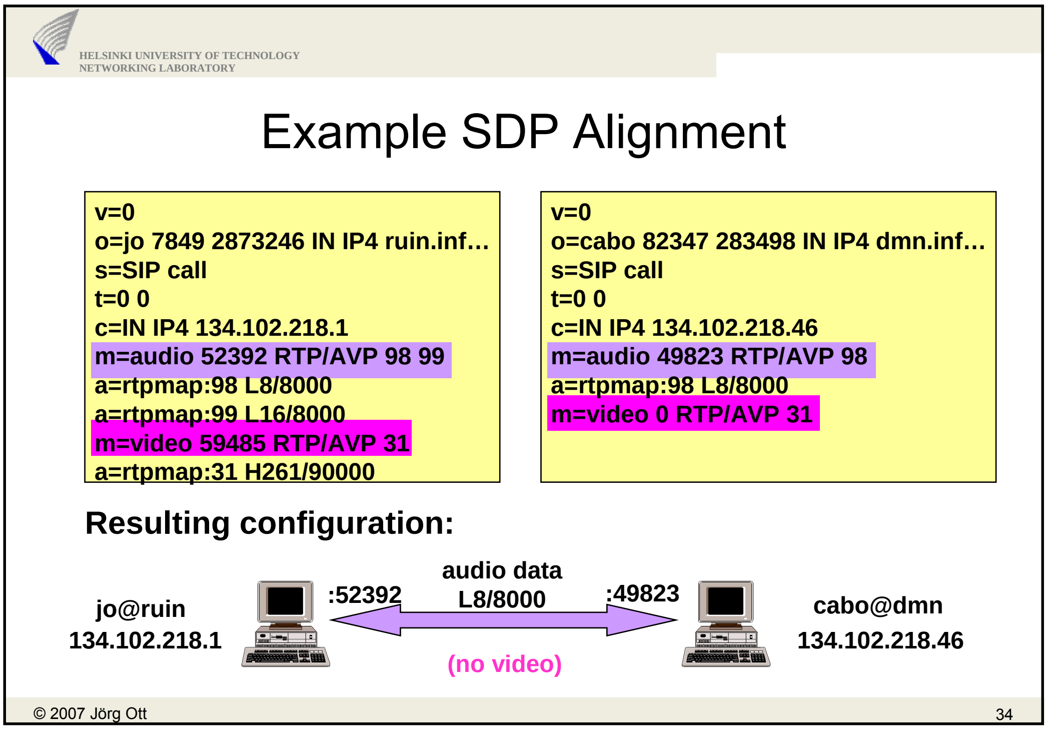
A

Answerer

B

```
v=0
o=alice 2890844526 2890844526 IN IP4 host.anywhere.com
s=phone call
c=IN IP4 host.anywhere.com
t=0 0
m=audio 49170 RTP/AVP 0 2 3
a=rtpmap:0 PCMU/8000
a=rtpmap:2 G721/8000
a=rtpmap:3 GSM/8000
```

```
v=0
o=bob 2890844730 2890844730 IN IP4 host.example.com
s=
c=IN IP4 host.example.com
t=0 0
m=audio 49920 RTP/AVP 0
a=rtpmap:0 PCMU/8000
```



Example SDP Alignment

```
v=0
o=jo 7849 2873246 IN IP4 ruin.inf…
s=SIP call
t=0 0
c=IN IP4 134.102.218.1
m=audio 52392 RTP/AVP 98 99
a=rtpmap:98 L8/8000
a=rtpmap:99 L16/8000
m=video 59485 RTP/AVP 31
a=rtpmap:31 H261/90000
```

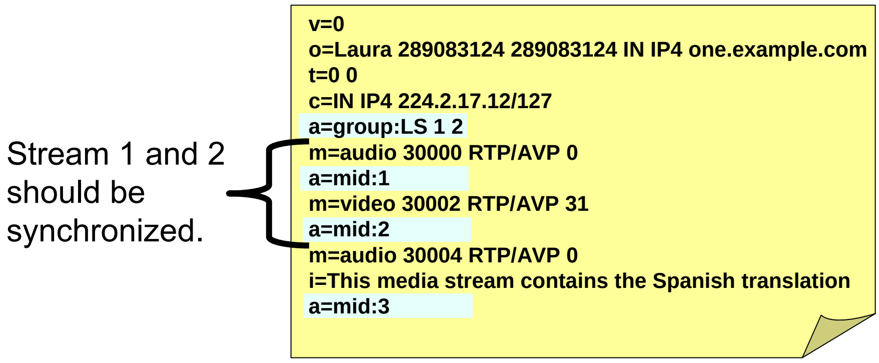
```
v=0
o=cabo 82347 283498 IN IP4 dmn.inf…
s=SIP call
t=0 0
c=IN IP4 134.102.218.46
m=audio 49823 RTP/AVP 98
a=rtpmap:98 L8/8000
m=video 0 RTP/AVP 31
```

Resulting configuration:

Grouping of m= lines in SDP

- Observation:
  - Multiple m= lines in SDP have no relationship to each other
    - Independent media streams
    - usually different media types
- Problem:
  - Want to express synchronization relationship
    - Lip synchronization
  - Concept of “flows” that consist of several media streams
    - Streams encoded in several formats
    - May be streamed from different hosts/ports
    - Useful application in some IP telephony scenarios

Example for Lip Synchronization



Stream 1 and 2 should be synchronized.

```
v=0
o=Laura 289083124 289083124 IN IP4 one.example.com
t=0 0
c=IN IP4 224.2.17.12/127
a=group:LS 1 2
m=audio 30000 RTP/AVP 0
a=mid:1
m=video 30002 RTP/AVP 31
a=mid:2
m=audio 30004 RTP/AVP 0
i=This media stream contains the Spanish translation
a=mid:3
```

ANAT Grouping

- Alternative Network Address Types (RFC 4091)
  - Allows expressing IPv4 and IPv6 address alternatives

```
v=0
o=bob 280744730 28977631 IN IP4 host.example.com
s=
t=0 0
a=group:ANAT 1 2
m=audio 25000 RTP/AVP 0
c=IN IP6 2001:DB8::1
a=mid:1
m=audio 22334 RTP/AVP 0
c=IN IP4 192.0.2.1
a=mid:2
```

FEC Grouping

- Group basic and FEC data (draft-ietf-mmusic-fec-grouping-05.txt)

```
v=0
o=adam 289083124 289083124 IN IP4 host.example.com
s=ULP FEC Seminar
t=0 0
c=IN IP4 224.2.17.12/127
a=group:FEC 1 2
a=group:FEC 3 4
m=audio 30000 RTP/AVP 0
a=mid:1
m=application 30002 RTP/AVP 100
a=rtpmap:100 ulpfec/8000
a=mid:2
m=video 30004 RTP/AVP 31
a=mid:3
m=application 30004 RTP/AVP 101
c=IN IP4 224.2.17.13/127
a=rtpmap:101 ulpfec/8000
a=mid:4
```

Further Groupings

- Alternative RTP profiles
  - Dealing with combinatorial explosion of options
  - E.g. AVP and AVPF, AVP and SAVP
- Layered coding and scalable (video) coding
  - Convey dependencies across different RTP sessions
- Alternative addresses?
  - Multicast vs. unicast distribution, e.g. for a media streaming offer
- …
- Currently design team formed
  - Resulting solution may but need not use grouping

Simple Capability Declaration in SDP

- Observation:
  - Capability negotiation/declaration in SDP too limited
  - Session description describe both session parameters and capabilities without clear distinction
  - Simultaneous capability restrictions cannot be expressed
    - *“Supporting multiple codecs for one media type, but only one per session”*
- Simcap: add SDP attributes to explicitly express capabilities

Simcap Example

Sender is willing
to receive and send
G.729 (18)
and telephone-events.

Additionally, it declares the following capabilities:

- PCMU-Audio (0)
- telephone-events (different events)
- Fax-Relay over UDP and TCP

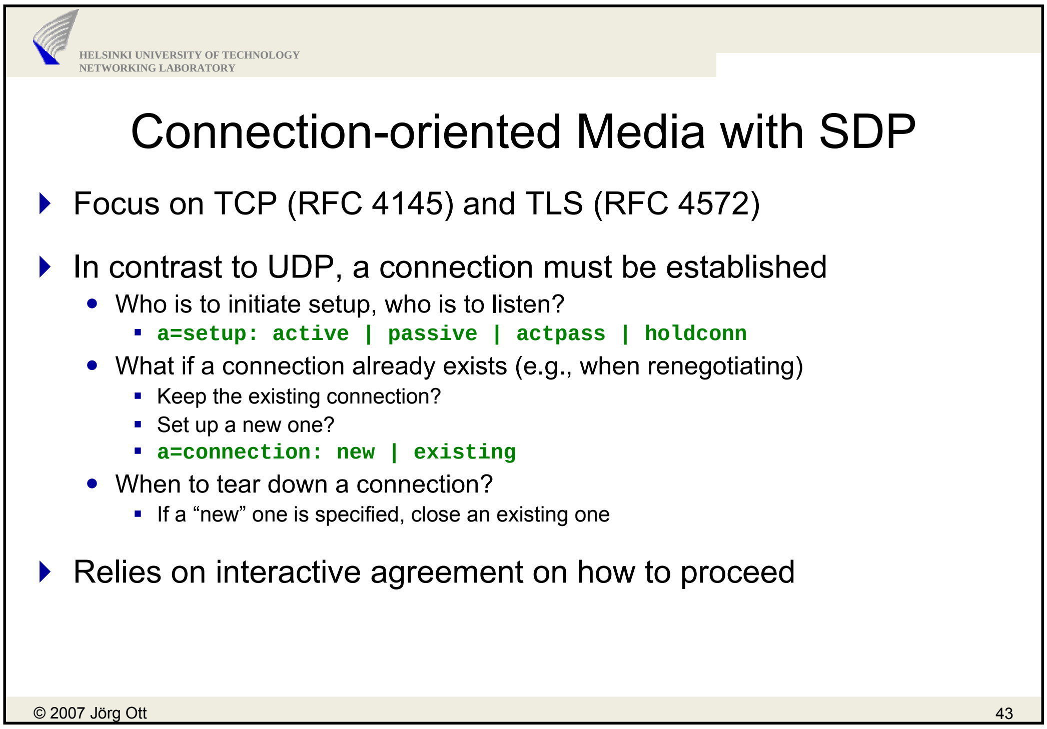
```
v=0
o=- 25678 753849 IN IP4 128.96.41.1
s=
c=IN IP4 128.96.41.1
t=0 0
m=audio 3456 RTP/AVP 18 96
a=rtpmap:96 telephone-event
a=fmtp:96 0-15,32-35
a=sqn: 0
a=cdsc: 1 audio RTP/AVP 0 18 96
a=cpar: a=fmtp:96 0-16,32-35
a=cdsc: 4 image udptl t38
a=cdsc: 5 image tcp t38
```

Simcap Example

Semantics:

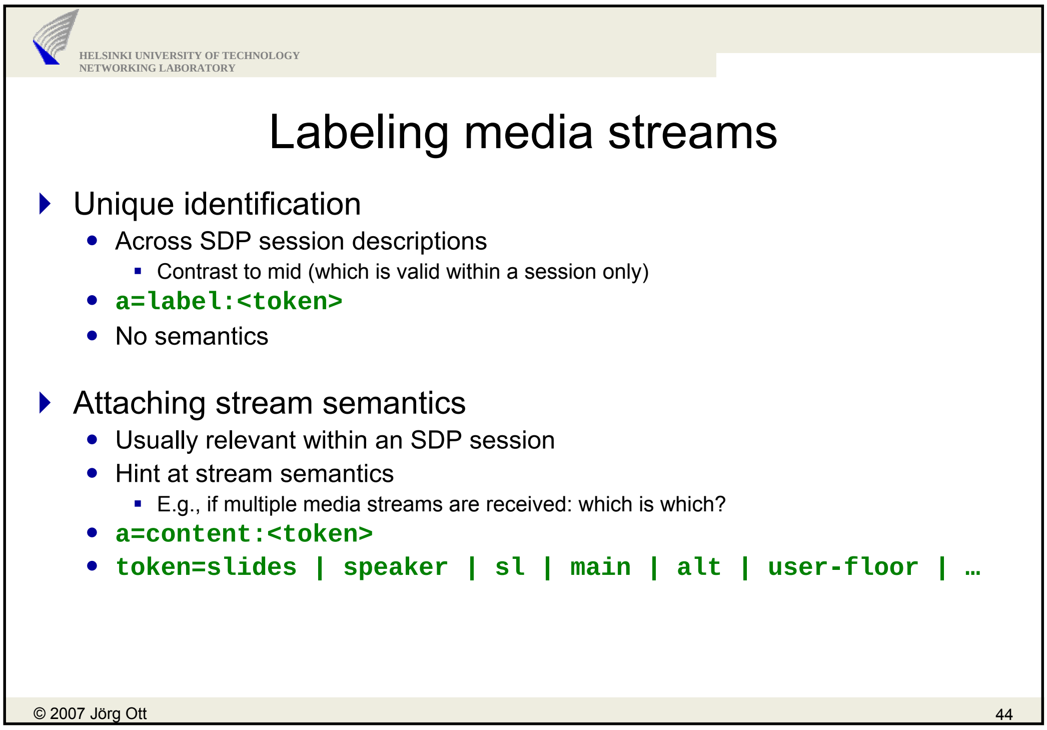
- a=sqn: declares a sequence number
- a=cdsc: declare one or more capabilities
- a=cpar: additional parameters for a declaration

```
v=0
o=- 25678 753849 IN IP4 128.96.41.1
s=
c=IN IP4 128.96.41.1
t=0 0
m=audio 3456 RTP/AVP 18 96
a=rtpmap:96 telephone-event
a=fmtp:96 0-15,32-35
a=sqn: 0
a=cdsc: 1 audio RTP/AVP 0 18 96
a=cpar: a=fmtp:96 0-16,32-35
a=cdsc: 4 image udptl t38
a=cdsc: 5 image tcp t38
```



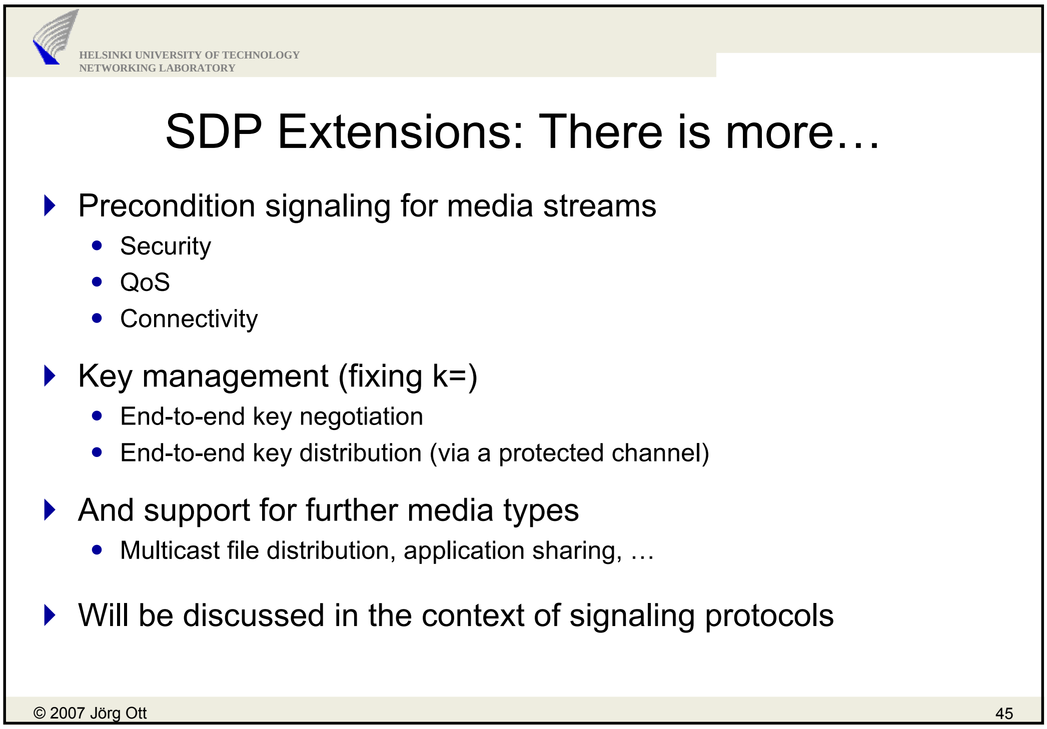
Connection-oriented Media with SDP

- Focus on TCP (RFC 4145) and TLS (RFC 4572)
- In contrast to UDP, a connection must be established
  - Who is to initiate setup, who is to listen?
    - `a=setup: active | passive | actpass | holdconn`
  - What if a connection already exists (e.g., when renegotiating)
    - Keep the existing connection?
    - Set up a new one?
    - `a=connection: new | existing`
  - When to tear down a connection?
    - If a “new” one is specified, close an existing one
- Relies on interactive agreement on how to proceed



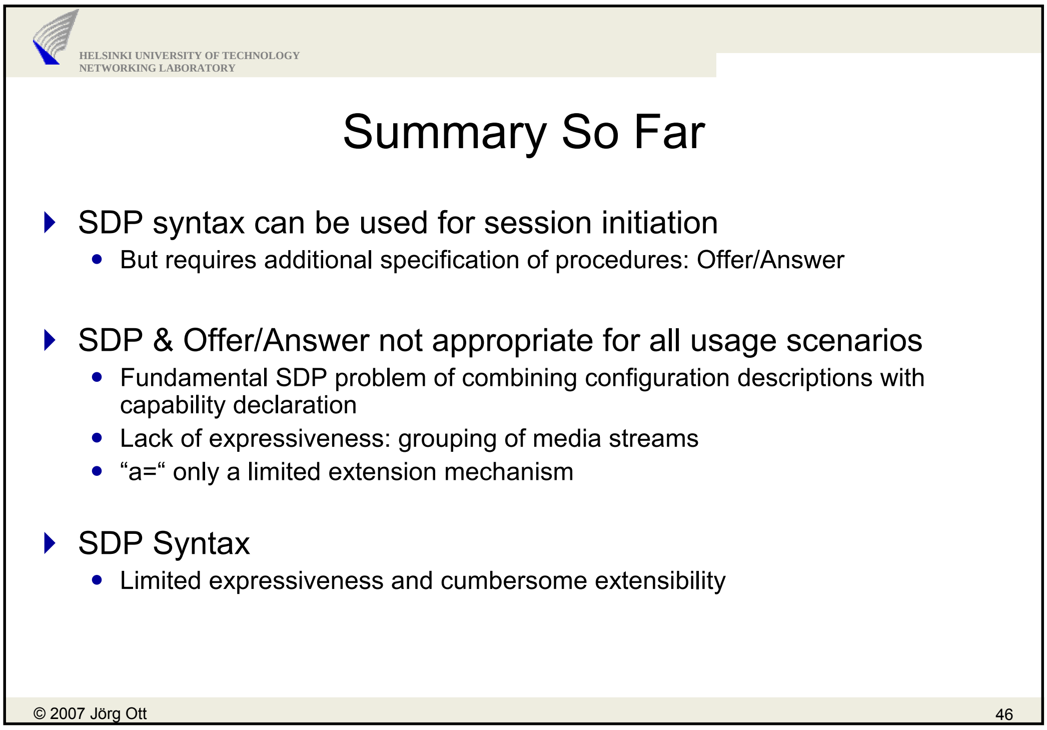
Labeling media streams

- Unique identification
  - Across SDP session descriptions
    - Contrast to mid (which is valid within a session only)
  - `a=label:<token>`
  - No semantics
- Attaching stream semantics
  - Usually relevant within an SDP session
  - Hint at stream semantics
    - E.g., if multiple media streams are received: which is which?
  - `a=content:<token>`
  - `token=slides | speaker | sl | main | alt | user-floor | …`



SDP Extensions: There is more…

- Precondition signaling for media streams
  - Security
  - QoS
  - Connectivity
- Key management (fixing k=)
  - End-to-end key negotiation
  - End-to-end key distribution (via a protected channel)
- And support for further media types
  - Multicast file distribution, application sharing, …
- Will be discussed in the context of signaling protocols



Summary So Far

- SDP syntax can be used for session initiation
  - But requires additional specification of procedures: Offer/Answer
- SDP & Offer/Answer not appropriate for all usage scenarios
  - Fundamental SDP problem of combining configuration descriptions with capability declaration
  - Lack of expressiveness: grouping of media streams
  - “a=“ only a limited extension mechanism
- SDP Syntax
  - Limited expressiveness and cumbersome extensibility

SDP Syntax Issues

- Basic set of description elements for media sessions
  - IP addresses, port numbers, RTP payload types, parameters
- Extensibility: new session / media level attributes
  - `a=<keyword>:<value> ...`
  - Senders can use arbitrary attributes:
    - Important attributes cannot be distinguished from unimportant ones
    - Name clashes (misinterpretation) cannot be excluded
  - In principle, allows for any kind of extension
    - Grouping, constraints, …
- SDP workarounds rather clumsy, inefficient, …

Fixing SDP…

- The grand idea (in 1999): SDPng
  - More expressiveness
    - For individual media and their combination
    - Often only very basic media descriptions available
  - Real negotiation functionality
  - Extensibility
  - More explicit (e.g., semantics for media sessions)
- Major issue: syntax choice (XML)
  - Not backwards-compatible (deployment, vendor know-how, code re-use)
  - Back in the late 1990s, XML considered “too expensive” for endpoints
- Result: no buy-in from vendors → little motivation → dead
- But: conceptual elements survived

SDP Next Generation (SDPng)

- Being designed to address SDP’s flaws…
  - Limited expressiveness
    - For individual media and their combination
    - Often only very basic media descriptions available
  - No real negotiation functionality
  - Limited extensibility (clumsy, hard to coordinate)
  - No semantics for media sessions (only implicit)
  - Also: Avoid second system syndrome!
    - Simple, easy to parse, extensible, limited scope
- Major issue: syntax choice (XML)
  - Not backwards-compatible (deployment, vendor know-how, code re-use)
  - Back in the late 1990s, XML considered “too expensive” for endpoints
- New approaches to capability negotiation presently discussed

Intelligent Endpoints

- Intelligent endpoints with support for
  - Multiple codecs and format parameters
  - Different applications (e.g., audio, DTMF, video, games)
  - Many transport parameters
    - RTP/UDP/IPv4, RTP/UDP/IPv6, Security, Source-Specific-Multicast…
  - AAA & security parameters

Must be expressible in configuration descriptions!

Intelligent Endpoints

- Heterogeneous end systems
  - Different capabilities
  - Different user preferences
  - Dynamic configuration

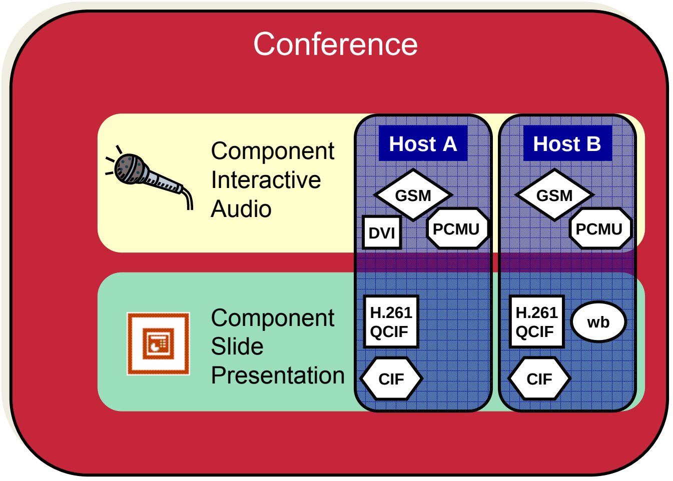
Interoperability requires dynamic negotiations of parameters!

Specific Requirements

- Expressiveness
  - Describe all required configuration parameters
- Extensibility
  - No fixed parameter set
  - Profiles (“packages”) for new configuration parameters
- Support for Negotiation
  - Derive commonly supported configurations from individual configuration descriptions (for $n \geq 2$)
- Compatibility
  - Drop-in replacement for SDP in SIP applications

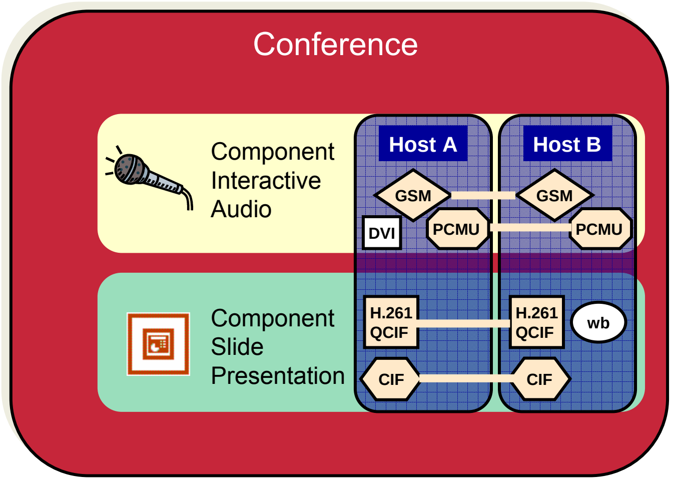
SDPng's Conference Model

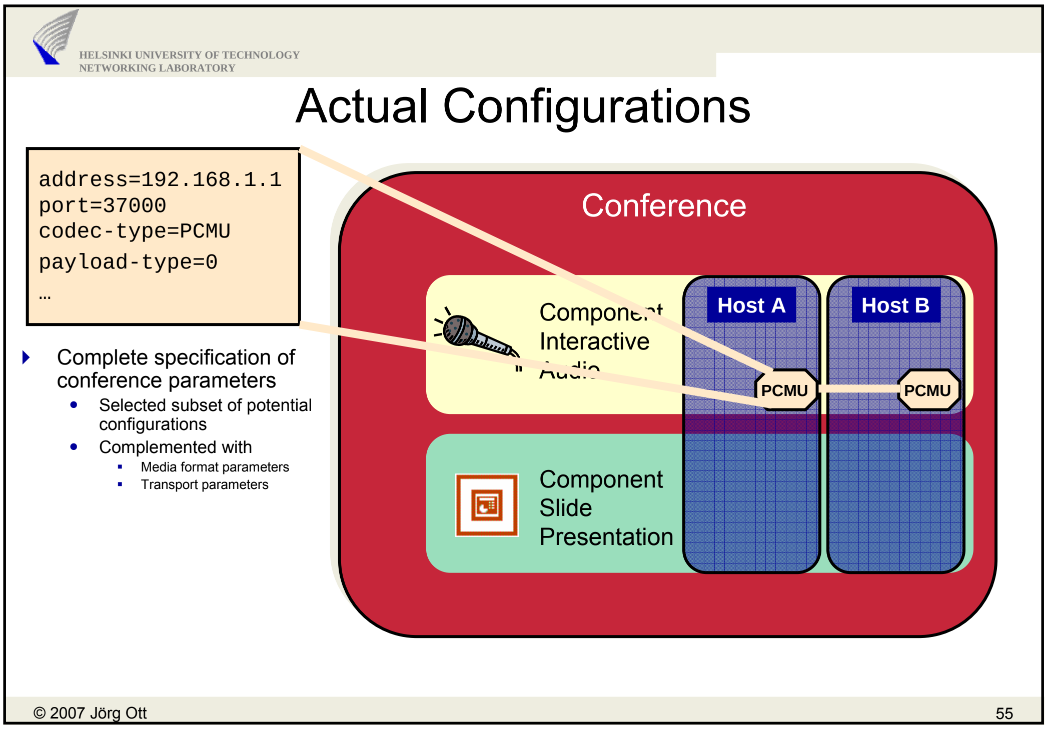
- Components in a conference
  - Individual cooperation functions
  - Characterized by the service they provide (not by their technical implementation)
- Implementations of components
  - Depend on endpoint capabilities and user preferences
  - Use of implementations must be configured or negotiated



Potential Configurations

- Configurations for implementing a component
  - Common capabilities
  - Not a complete conference description, e.g., no transport parameters
  - Dynamic set of parameters
    - Can change over the course of a conference

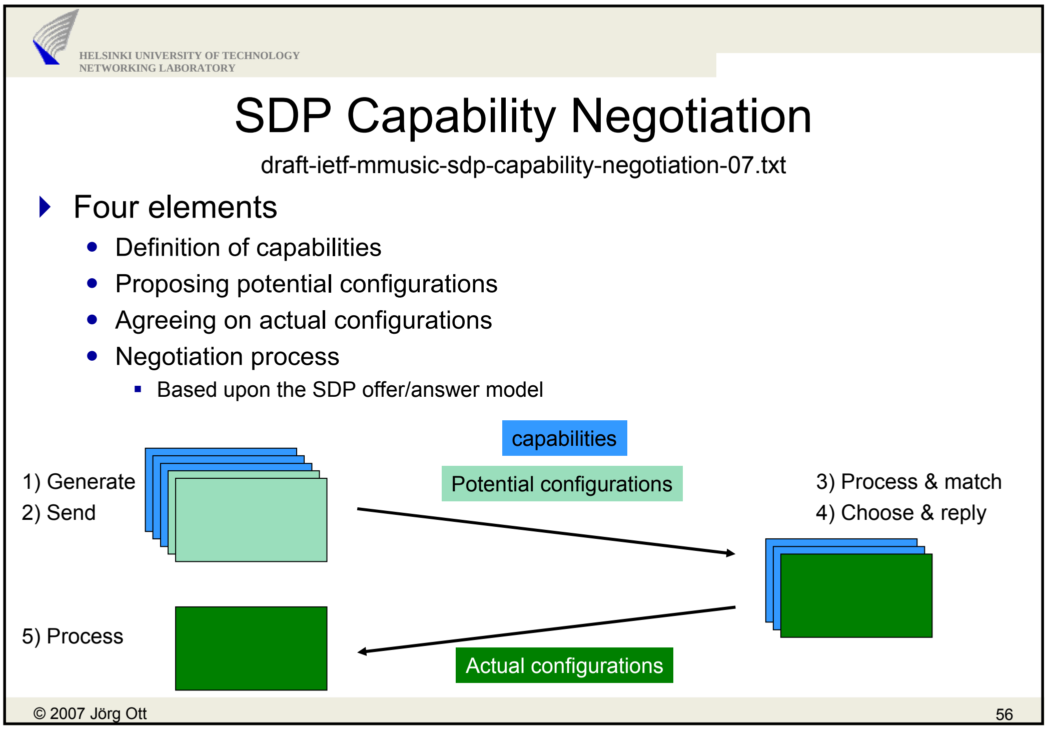




Actual Configurations

```
address=192.168.1.1
port=37000
codec-type=PCMU
payload-type=0
…
```

- Complete specification of conference parameters
  - Selected subset of potential configurations
  - Complemented with
    - Media format parameters
    - Transport parameters



SDP Capability Negotiation

draft-ietf-mmusic-sdp-capability-negotiation-07.txt

- Four elements
  - Definition of capabilities
  - Proposing potential configurations
  - Agreeing on actual configurations
  - Negotiation process
    - Based upon the SDP offer/answer model

Mapping to SDP…

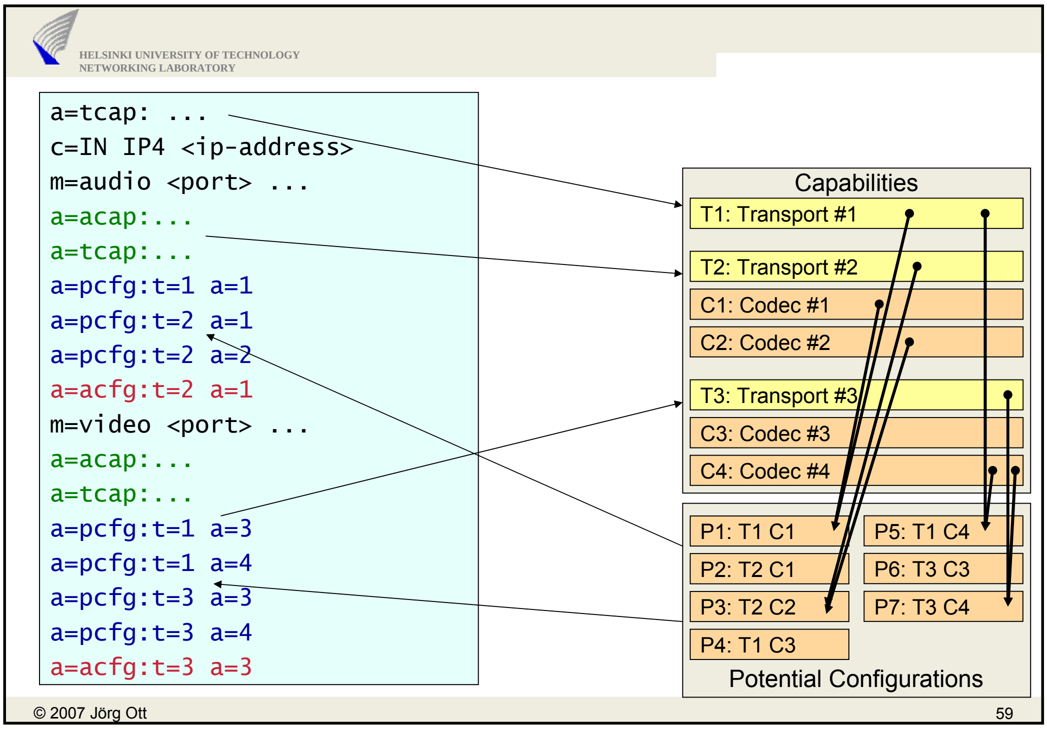
- Reminder

```
m=audio 54321 AVP/RTP 0 8 96
a=rtpmap:96 g729
a=...
m=video 54545 AVP/RTP 32
a=...
```

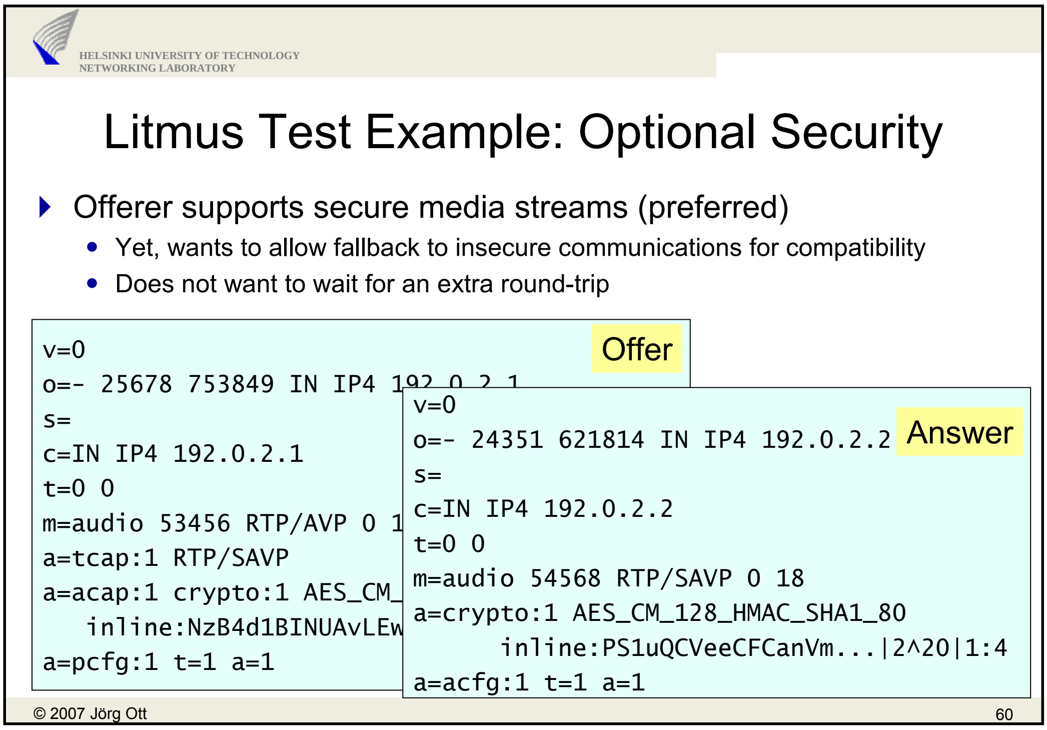
- Requirements
  - Must be expressed in SDP syntax
  - Backwards compatibility
  - Operate in one round-trip (offer/answer exchange)
  - Extensible
  - Not too verbose (messages can already grow quite large)
  - …

Basic Approach and Syntactic Elements

- Backwards compatibility leaves SDP attributes as the only option
- Extensibility: feature tags
  - Supported: `a=csup:foo,bar,crunch`
  - Required: `a=creq:zompel`
- Capability descriptions
  - Transport capability: `a=tcap:<n> RTP/AVP`
  - Media level attribute: `a=acap:<m> rtpmap` …
- Configuration negotiation
  - Potential configuration: a=pcfg:<k> <n> <m>
  - Actual configuration: a=acfg:<k> <n> <m>
- Offer/answer extension allowing to include capabilities



```
a=tcap: ...
c=IN IP4 <ip-address>
m=audio <port> ...
a=acap:...
a=tcap:...
a=pcfg:t=1 a=1
a=pcfg:t=2 a=1
a=pcfg:t=2 a=2
a=acfg:t=2 a=1
m=video <port> ...
a=acap:...
a=tcap:...
a=pcfg:t=1 a=3
a=pcfg:t=1 a=4
a=pcfg:t=3 a=3
a=pcfg:t=3 a=4
a=acfg:t=3 a=3
```



Litmus Test Example: Optional Security

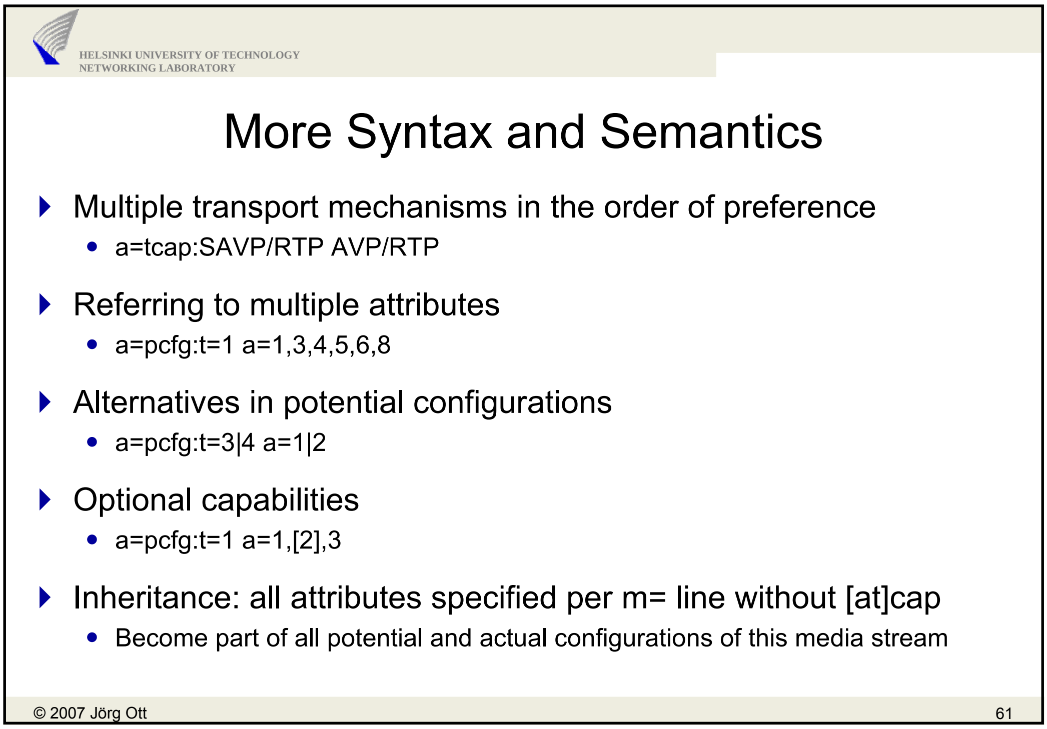
- Offerer supports secure media streams (preferred)
  - Yet, wants to allow fallback to insecure communications for compatibility
  - Does not want to wait for an extra round-trip

Offer

```
v=0
o=- 25678 753849 IN IP4 192.0.2.1
s=
c=IN IP4 192.0.2.1
t=0 0
m=audio 53456 RTP/AVP 0 1
a=tcap:1 RTP/SAVP
a=acap:1 crypto:1 AES_CM_
   inline:NzB4d1BINUAvLEw
a=pcfg:1 t=1 a=1
```

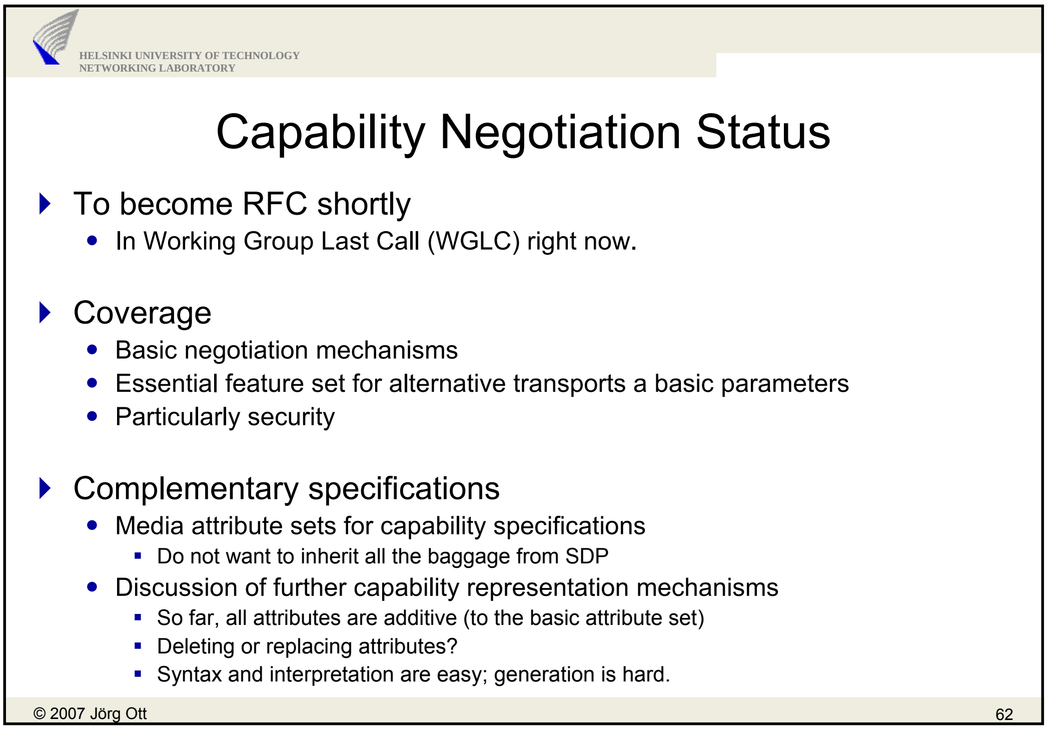
Answer

```
v=0
o=- 24351 621814 IN IP4 192.0.2.2
s=
c=IN IP4 192.0.2.2
t=0 0
m=audio 54568 RTP/SAVP 0 18
a=crypto:1 AES_CM_128_HMAC_SHA1_80
      inline:PS1uQCVeeCFCanVm...|2^20|1:4
a=acfg:1 t=1 a=1
```



More Syntax and Semantics

- Multiple transport mechanisms in the order of preference
  - a=tcap:SAVP/RTP AVP/RTP
- Referring to multiple attributes
  - a=pcfg:t=1 a=1,3,4,5,6,8
- Alternatives in potential configurations
  - a=pcfg:t=3|4 a=1|2
- Optional capabilities
  - a=pcfg:t=1 a=1,[2],3
- Inheritance: all attributes specified per m= line without [at]cap
  - Become part of all potential and actual configurations of this media stream



Capability Negotiation Status

- To become RFC shortly
  - In Working Group Last Call (WGLC) right now.
- Coverage
  - Basic negotiation mechanisms
  - Essential feature set for alternative transports a basic parameters
  - Particularly security
- Complementary specifications
  - Media attribute sets for capability specifications
    - Do not want to inherit all the baggage from SDP
  - Discussion of further capability representation mechanisms
    - So far, all attributes are additive (to the basic attribute set)
    - Deleting or replacing attributes?
    - Syntax and interpretation are easy; generation is hard.