N/ACIP standards, recommendations, protocols for audio

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Presentation plan

- Why IP ?
- N/ACIP interoperability standard
- Protocols
- Networks

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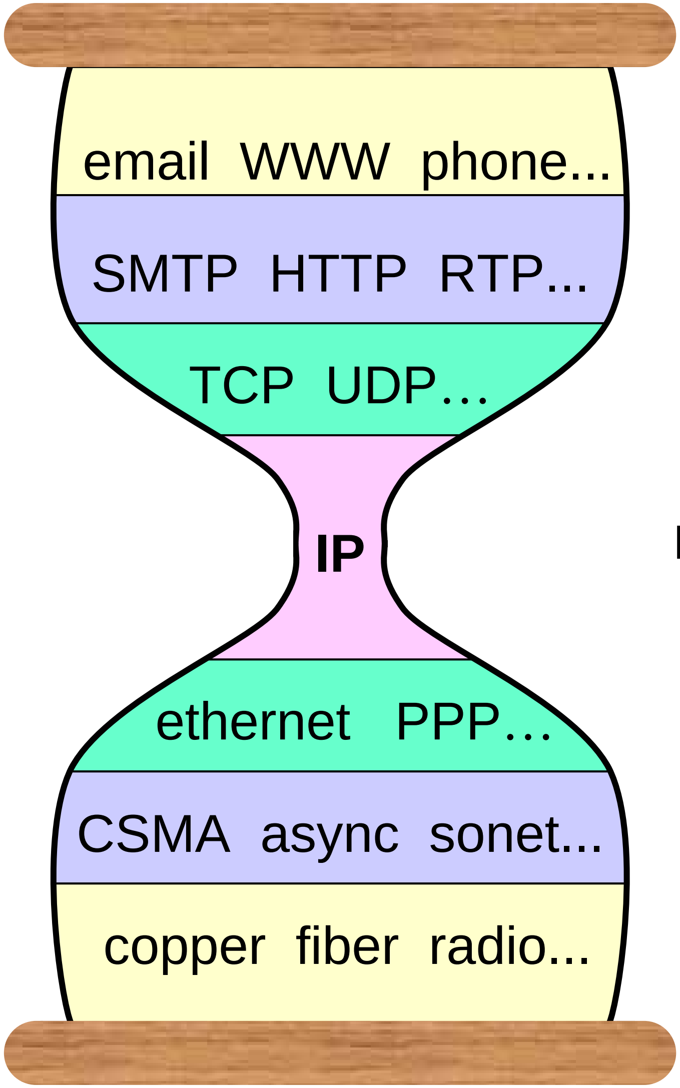
Why IP ?



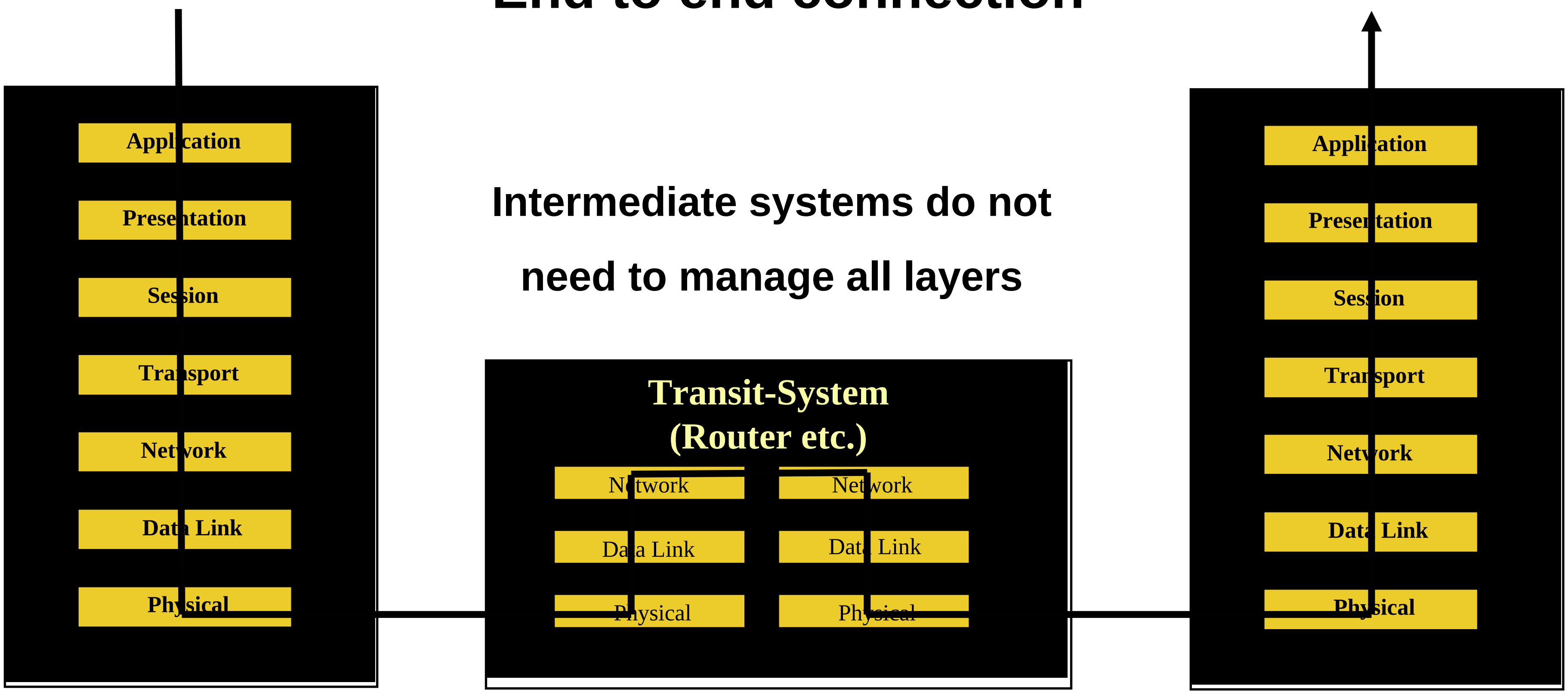
Layered approach

Source: http://www.cs.columbia.edu
(Henning Schulzrinne)

Why IP ?

End to end connection

Intermediate systems do not need to manage all layers



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EBU project group N/ACIP

- Interoperability standard (now version 0.6)
- This document is expected to be completed during 2007, after more inputs from manufacturers and broadcasters.
- The standard is based on IETF RFC's for SIP and RTP over UDP
- A meeting with all manufacturers and EBU members will take place at IBC in September 2007
- Best practice for the deployment of Audio over IP to EBU members
- Recommendations to manufacturers: definition of common network profiles, Workflows, MMI, Security….
- Tests and measurements on networks and end units

15 Manufacturers are active in our work

- AEQ, Spain
- AETA, France
- APT, Ireland
- AVT, Germany
- Comrex, USA
- Digigram, France
- Harris, USA
- Mandozzi, Switzerland
- Mayah, Germany
- Musicam, USA
- Orban, USA
- Prodys, Spain
- Telos, USA
- Tieline, Australia
- Youcom, NL
- (+8 more, not yet active)

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Protocols

- RTP: Realtime Transfer Protocol (RFC3550, RFC3551) on top of User Datagram Protocol (UDP)
- TCP is optional,
  - Pros: Reliable delivery & Passes more easily through firewalls
  - Cons: Causes longer delay, problems with congestion avoidance mechanism.
- SDP : Session Description Protocol (RFC4566)
- SAP : Session Announcement Protocol (RFC2974)
- SIP : Session Initiation Protocol (RFC3261)
- Offer/Answer model for SDP (RFC3264) for codec negotiation

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Audio coding

- Minimum set of codecs for compatibility
- A: Mandatory codecs (A minimum set, always to be found)
  - G.711
  - G.722
  - ISO MPEG-1 and MPEG-2 Layer II
  - PCM 16 bits, 20 bits, 24 bits
- B: Recommended codecs
  - MPEG-4 AAC, MPEG-4 AAC-LD
  - MPEG-1/2 Layer III
- C: Optional codecs
  - Enhanced APT-X, MPEG-4 HE-AACv2...

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Two types of equipment

- General contribution equipment for all types of contribution (fixed or remote)
- Portable

Ethernet, 3G, HSPA

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Packet loss recovery

- **Packet loss recovery methods**
- **FEC: Forward Error Correction**
  - **Redundancy packets for loss reconstruction at receiver side**
  - **No return channel necessary**
  - **IPTV: Pro MPEG COP-3 (SMPTE 2022-1), Digital Fountain Raptor codes**
- **Retransmission**
  - **Receiver ask sender for retransmission**
  - **Increased delay**
  - **Use of RTCP messages (RFC4588, need RTP/AVPF)**

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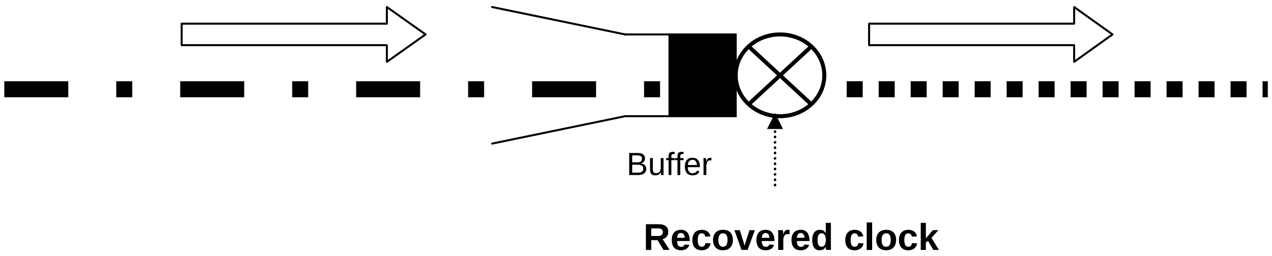
Clock recovery



- IP networks are asynchronous: no clock
- Receiver clock must be estimated and reconstructed
- Difficulty: estimate the long term drift avoiding the network jitter delay.
- Clock adaptation: Sampling rate conversion/adaptation or Frame drop
- Other approach: External clock source (GPS, etc)

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Delay

- The delay is always longer than in conventional networks
- A short delay is needed for two-way communication
- There is a trade-off between delay and robustness.
  - A short delay (20 ms) means a short jitter buffer. Higher network jitter or delay jumps will create interruptions.
  - A very long jitter buffer (seconds) can compensate a bad network. This can be OK for a one-way circuit
- Packet recovery mechanisms always increase the delay
- Many suggest to use Error Concealment (instead of FEC)

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Signalling with SIP

- **Signalling and control of session**
  - **Parameters from the stream**
  - **Connection setup and termination**
  - **Audio codec negotiation**
  - **Presence**

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SIP wireless handheld

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In 3 or 5 years time SIP will be common in mobile devices

Interoperability with broadcast contribution units

Network Issues

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The Internet

- The Internet, a public IP network
  - Common router queues, congestions
  - Internet “noise”: Flood attacks (DoS: Denial of Service), scans,...
- Interconnections in Internet Exchange Points
- Dynamic routing (BGP)
  - Sudden latency increase, losses, packet disorder
- Absolutely no end-to-end guaranty is possible nowadays
- Guarantee is possible only on dedicated managed IP networks

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Networks

- Sufficient robustness with audio over IP depends mainly on the quality of the IP network.
- The Internet is unreliable and so unsuitable for long live transmission.
- Internet is used more and more, for news, due to its availability and low cost, with a calculated risk of loss of the signal.
- Internal, well managed IP networks, can provide a sufficiently good Quality of Service.
- The WAN can be used both for conventional computer traffic, audio file transfer and streaming for live contribution of programmes.
- There are reliable methods, such as MPLS, to separate computer IP traffic from the audio streams.
- Audio over IP will gradually replace many of the traditional circuits that are in use today. Telcos will phase out old systems and move to IP.
- Both PCM Linear and various compressed formats at higher bitrates can be used for a stable contribution over IP. Don't go down too low bit-rate!

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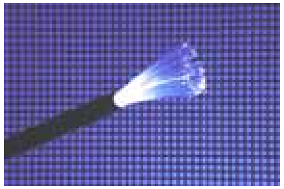
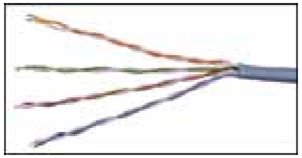
Last mile access

- Last mile to the end user
- Fiber optic
  - High quality but expensive

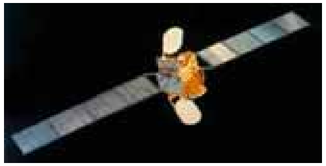


- Copper with xDSL
  - ADSL: Asymetrical uplink/downlink (bandwidth), SDSL: Symetrical uplink/downlink
  - Bit errors lead to single packet losses



- Mobile (3G/UMTS, Wimax)
  - Unreliable, no solutions with guaranteed QoS nowadays
  - HSDPA/HSUPA: shared channel

- Satellite
  - Long delays, high costs, often shared bandwidth



- Wireless
  - Wifi: no guaranty due to frequency sharing

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Summary

- ACIP interoperability standard proposal driven by manufacturers and broadcasters
- Based on common IETF standards (RTP, SIP, etc)
- Audio over IP will replace ISDN codecs
- SDH/J.57 and other older systems will be phased out
- The Internet will be unreliable for a long time
- Managed private networks provide broadcast robustness
- Similar issues for video are handled by the N/VCIP group

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Thank you ! – Questions ?

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