

WW AV Communication



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Contents:

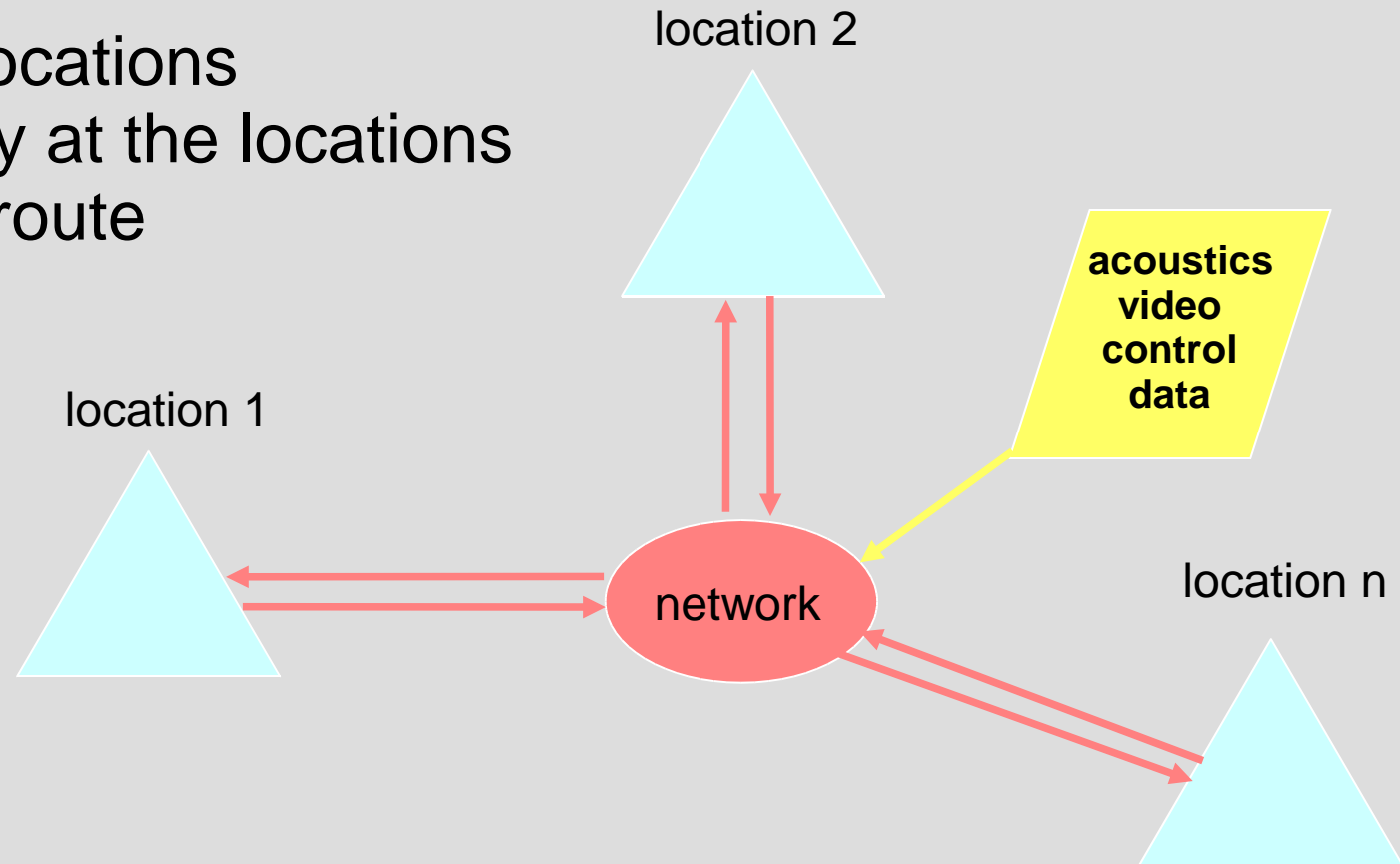
Holistic view on systems for worldwide communication, e.g., for conferences or distance learning. Presentation of the interaction of the different functional groups (software, hardware, space). The parameters and selection criteria of the functional groups will be explained and shown to give the participants the possibility of a holistic view.

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System:

- two or more locations
- AV technology at the locations
- transmission route



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Topics:

Integration in the sender and receiver rooms

Technology

Networks

Standards

Infrastructure

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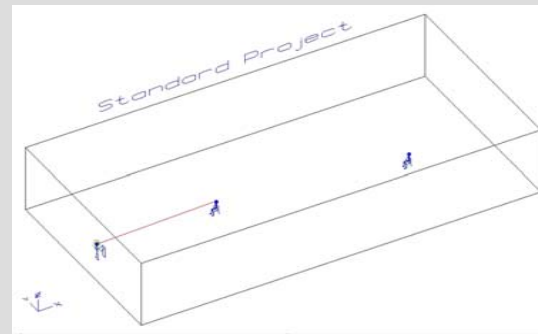
Integration in the sender and receiver rooms

Room acoustics
designed for language

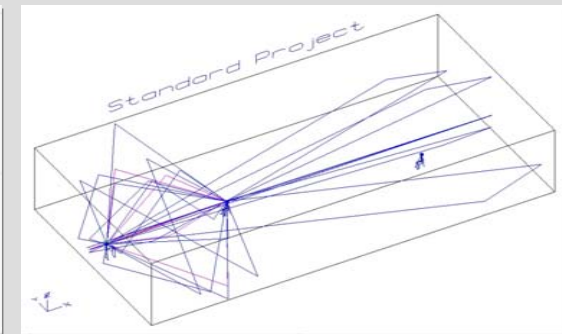
reflection properties

minimize noise level with
the in-house technology

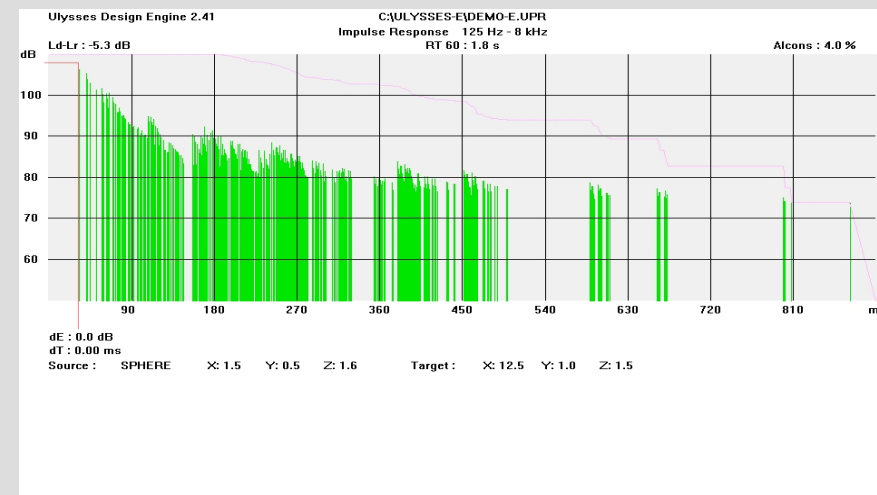
sound insulation to the
adjacent rooms



direct unpitched sound



reflections



energy vs. time, reflectogram, reverberant sound

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Integration in the sender and receiver rooms

AL_{CONS} - **Articulation Loss Of Consonants** (Artikulationsverlust von Konsonanten)

nach Peutz, Davis & Davis

$$\%AL_{CONS} = \frac{200 \cdot D_x^2 \cdot RT_{60}^2 \cdot N}{V \cdot Q}$$

Abstand Lautsprecher-Zuhörer → D_x

Nachhallzeit → RT_{60}

„Anzahl“ der Quellen (D/R Leistungsverhältnis) → N

Raumvolumen → V

Bündelungsfaktor → Q

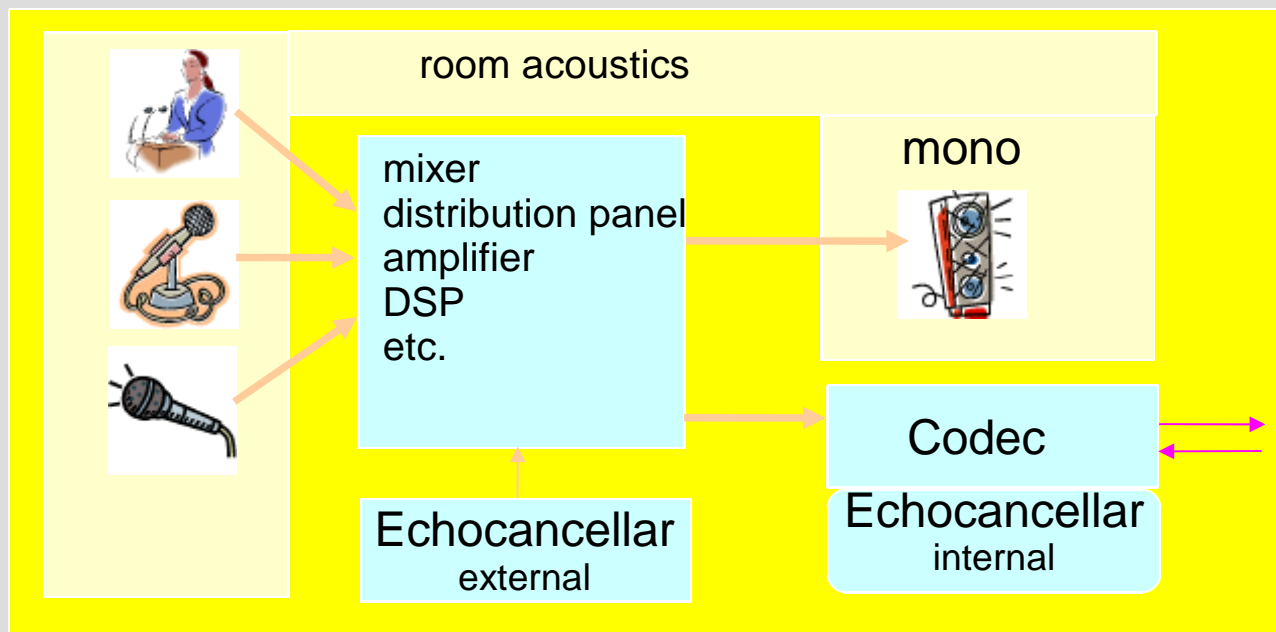
| | | | | | | | | | | | |
|----------|------|------|------------|------|--------------|-----|-----|----------|-----|-----|--------|
| 100 % | 80 % | 60 % | 33 % | 20 % | 11 % | 7 % | 4 % | 2 % | 1 % | 0 % | ALcons |
| schlecht | | | mangelhaft | | befriedigend | | gut | sehr gut | | | |
| 0 | 0,1 | 0,2 | 0,3 | 0,4 | 0,5 | 0,6 | 0,7 | 0,8 | 0,9 | 1 | STI |

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Integration in the transmission rooms

Electroacoustics

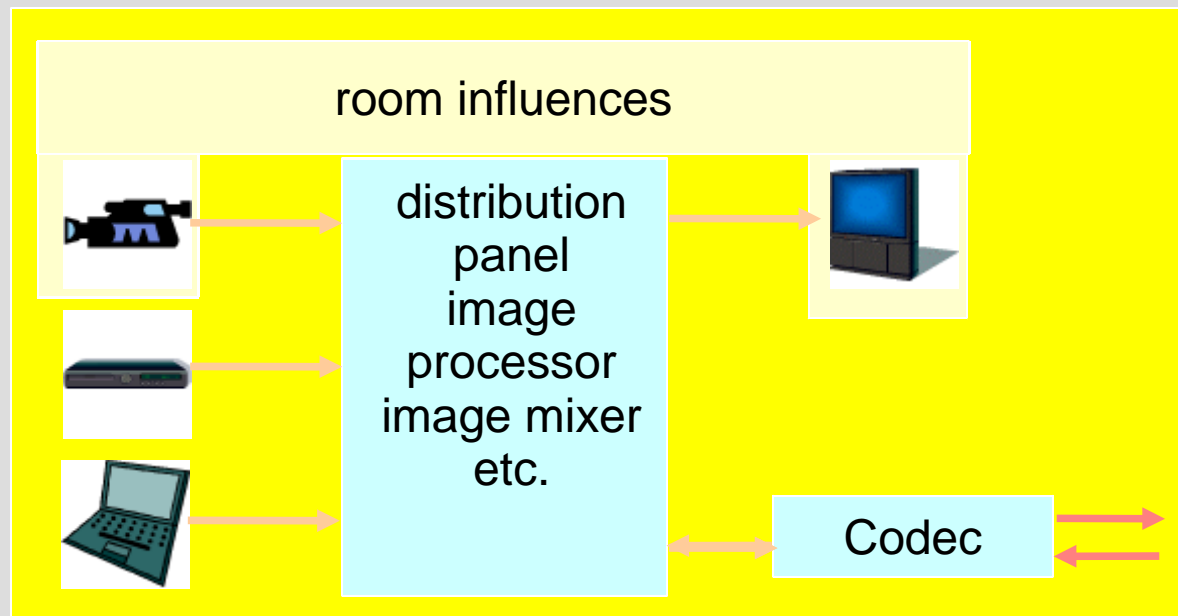


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Integration in the transmission rooms

Video technology



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Integration in the transmission rooms

operational unit

Control technology

loudspeaker

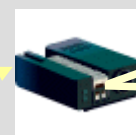
audio



connection



Projektion



control



Codec

operational unit



camera



player



video



interface
in-house
technology



in-house
technology



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Integration in the transmission rooms

Method:

The signals to be transmitted are digitalized (video, audio, control).

The signals are condensed to be enabled for the transmission network.

The device carrying out this task is called Codec.



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Networks

- ISDN
 - Integrated Service Digital Network
 - synchronized data transmission
- IP
 - Internet Protocol
 - packet-oriented service

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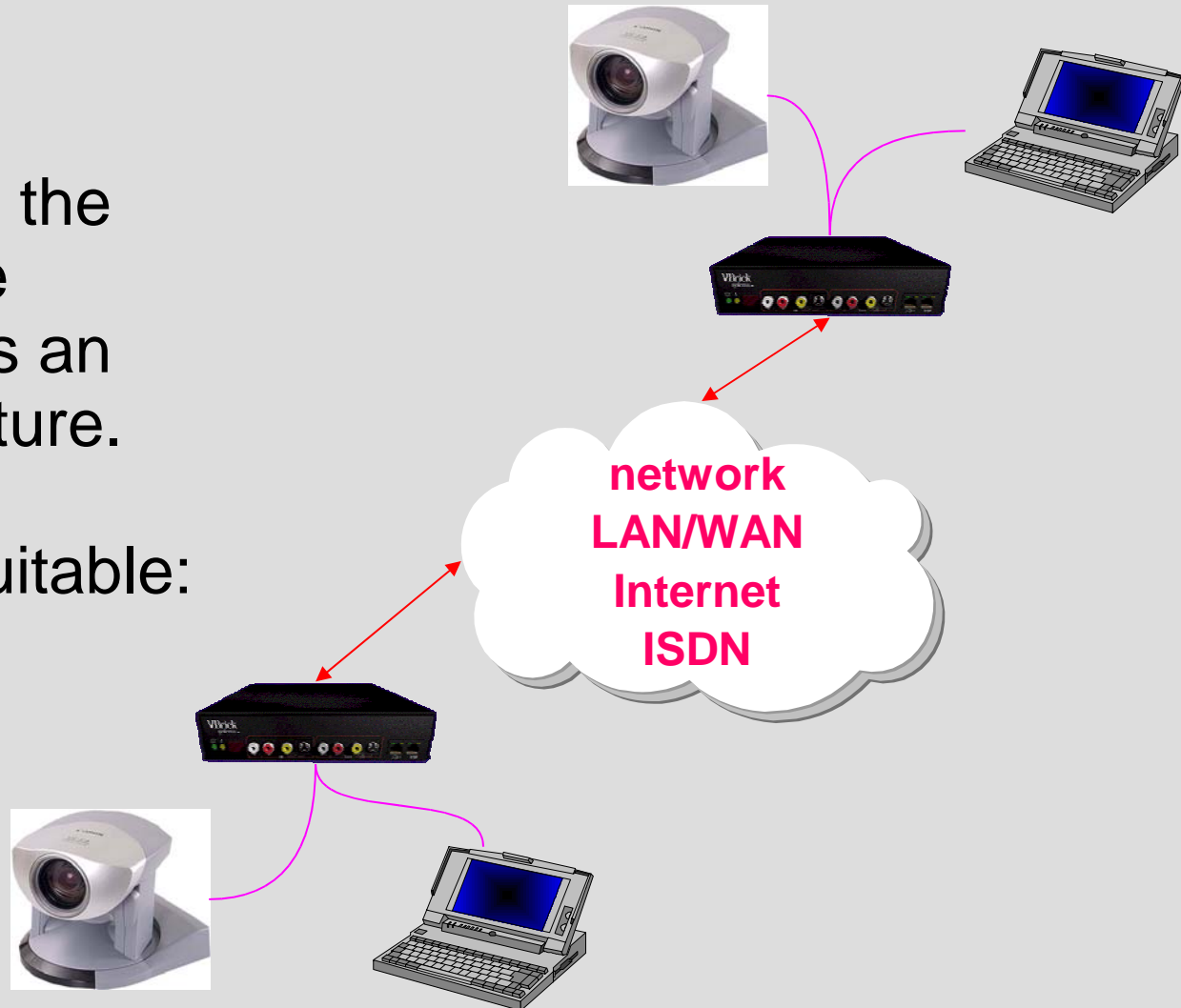


Technology

The transmission of the signals between the participants requires an adequate infrastructure.

The following are suitable:

- ISDN networks
- IP networks



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Compression/decompression

is, typically, data reduction ('lossy' algorithm) and never real data compression ('lossless' algorithm). It is attuned to effectively reduce the size of digital AV data!

As the capacity of the networks is limited, the digitalized signals must be adjusted to the data rate of the networks used!

ISDN: 128 – 768 kbit/s / IP networks: up to 100 Mbit/s



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ISDN networks

- synchronized service
- very widespread
- guaranteed bandwidths



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ISDN connections

- basic connection S_0 (BRI)

2 B channels = $2 \times 64\text{ kbit/s} = 128\text{ kbit/s}$

1 D channel = 16 kbit/s

- primary multiplex connection S_2M (PRI)

30 B channels

1 D channel = 16 kbit/s

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Distinctive features of ISDN

- multiplexing
 - multiplexer = Inverse Multiplexer (IMUX)
 - uses several connections
 - example: $3 \times S0 = 3 \times 2 \times 64 \text{ kbit/s} = 384 \text{ kbit/s}$

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IP networks

IP (LAN, WAN, VPN, WLAN, DSL, ADSL, ATM, etc.)

- packet-oriented service
- service quality is critical

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Data rates networks

A data rate (also called data transmission rate or transmission speed) is the amount of data transmitted within a certain time unit. Along with the latency time (response delay), it is one of the units measuring the efficiency of computer networks.

- minimum: 128 kbit/s
- maximum: up to 8 Mbit/s

However, image and audio quality also depend heavily on the computing performance of the Codec!

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Data rates networks

Effects of a data rate that is too low

- audio:
the bandwidth of the reproduction is too small
- video:
the more dynamics in the image, the more image errors (image artifacts) appear

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Standards

ITU-T standards

ITU-T: International Telecommunication Union - Telecommunication Standardization (previously: CCITT)

Goals

Alignment and promotion of international cooperation in communications engineering

e.g.,

H audio-video and multimedia systems

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Standards

'H. standards' are recommended norms for compression in real-time multimedia applications. They are used, e.g., for video conferences via network connections.

Recommendations for audio, video and data compression and for control tasks:

- H.320, H.323 and H.324 for real-time multimedia applications
- H.264, H.263, H.264 and T.120 for audio and video transmissions
- H.239 for data compression
- H.221, H.231, H.242 and H.243 for control tasks
- The difference between H.320 and H.323 is that H.320 was developed for direct connections (ISDN), while H.323 has a connection via the Internet and data exchange via packets.
- H.324 was optimized with H.263 (<64 Kbps) for transmission via modem.

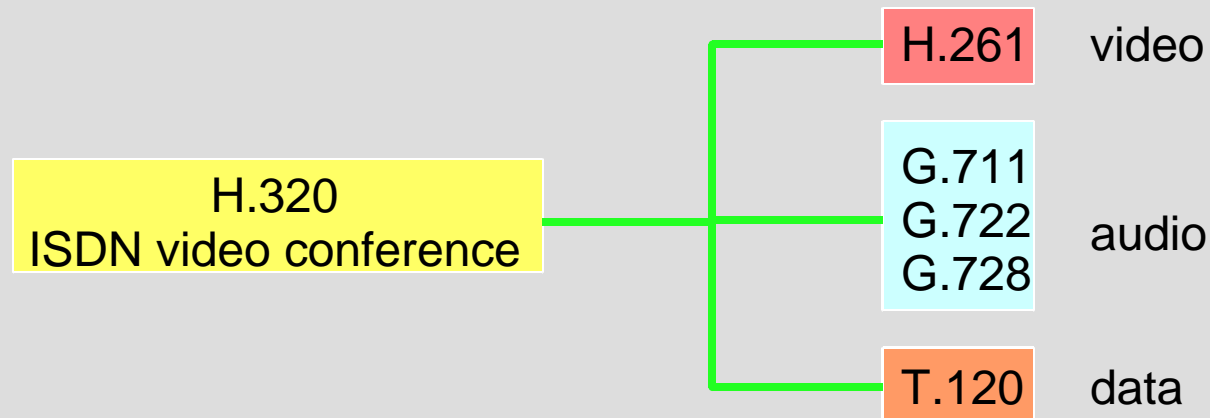
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Standards

Minimum configuration

Structure of H.320



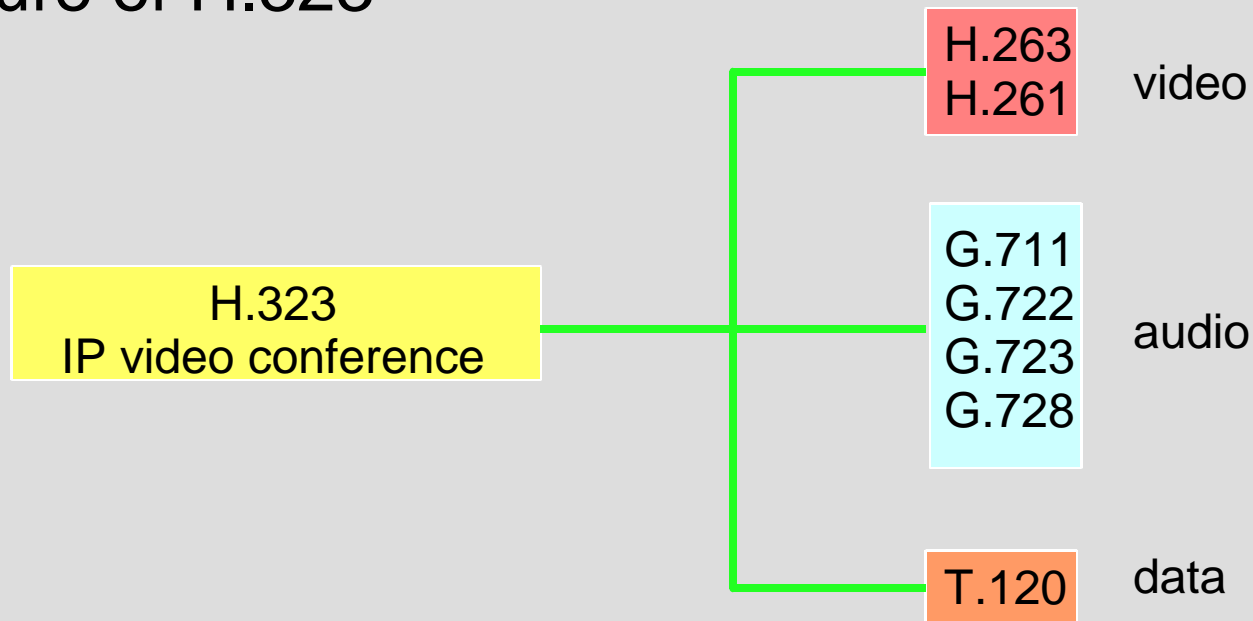
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Standards

Minimum configuration

Structure of H.323



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Types of connections

Point-to-point communication

Multipoint communication (requires MCU)

- integrated MCU
 - normally up to four video conference participants
 - suitable for spontaneous conferences
- external MCU
 - number of participants depends on the MCU
 - parallel conferences are possible

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Security

Protection against wire tapping

- video conferences can be tapped just like phone conversations

remedy: encoding

- confidential and person-related conferences require encoding

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Coding process

symmetrical:

is typically used for encoding large amounts of data

- DES – Data Encryption Standard (56 bit)
- 3DES – Triple DES (112/192 bit)
- AES – Advanced Encryption Standard (128/192/256 bit)

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Coding process

asymmetrical:

- longer key (e.g., 1024 bit)
- requires high computing efficiency
- is used to exchange keys

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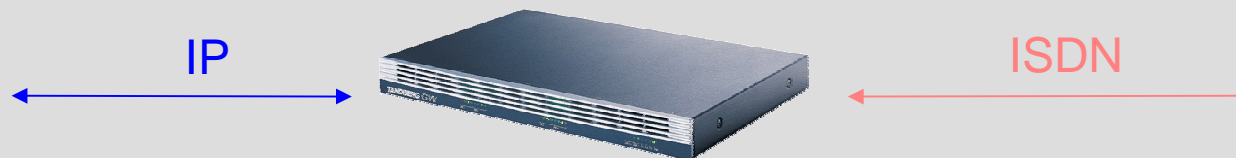


Infrastructure

Gateway

Interface of H.320 and H.323

- crossover from IP to ISDN and vice versa
- several participants in a parallel manner



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Infrastructure

Gatekeeper

standard in the H.323 network

management of bandwidth and participant



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Terminal units (clients)

Stand-alone:

- individual user surface
- easy to use
- fail-safe
- suitable for room integration
- requires external PC for data conferences

PC-based:

- data and video conference on one Windows surface
- ideal for 'Wintel' users
- operation is partly complex
- operational stability is insecure