影像通訊標準及系統簡介

Introduction to Visual Communication Standards and System

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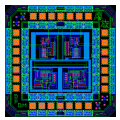
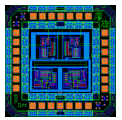
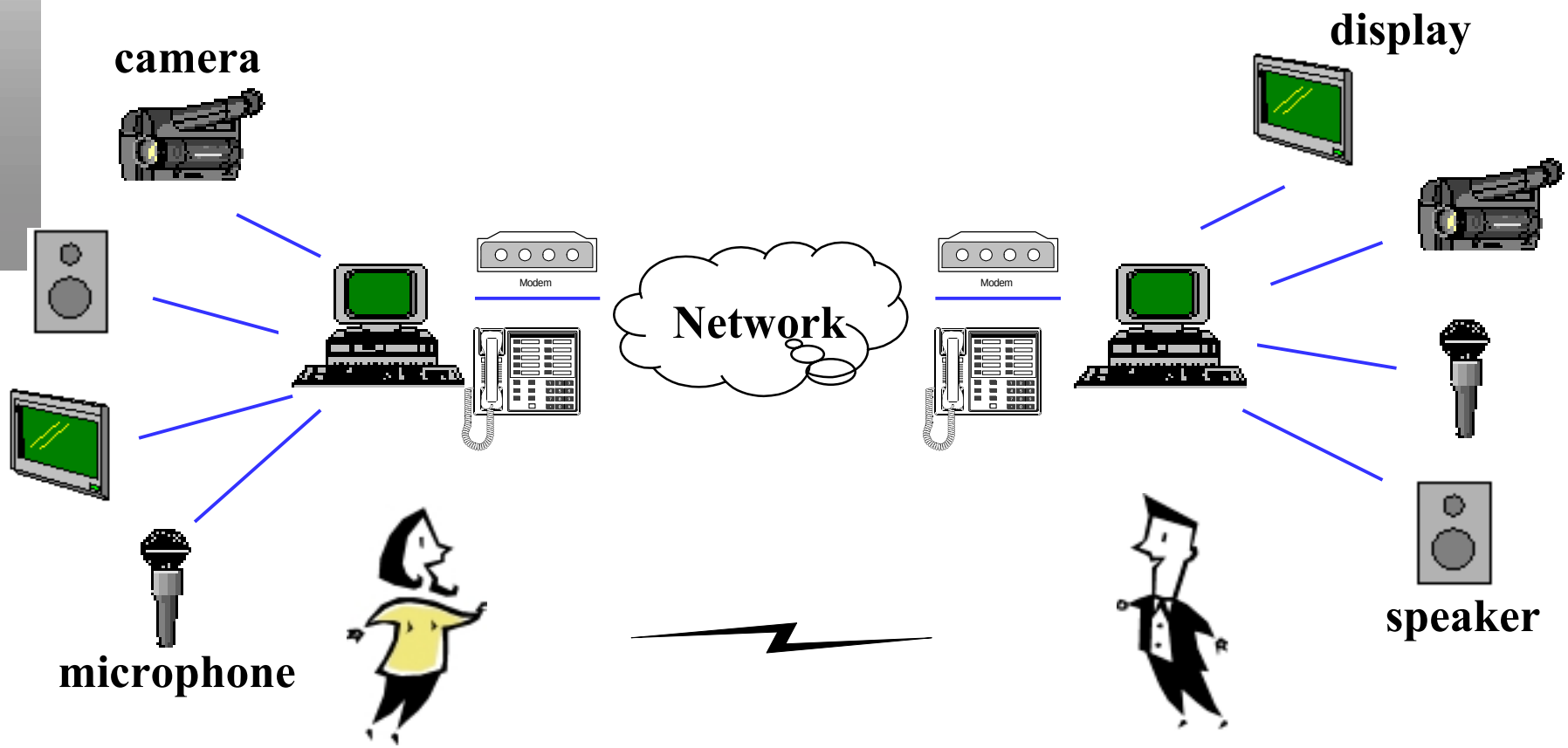


Outline

- *Introduction*
- *Standards for Visual Communication Systems*
- *Compression Technologies*
- *Implementation Issues*
- *Optional Enhancements*

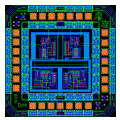


Introduction



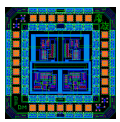
Applications

- *Video Phone*
- *Video Conference*
- *Distance Learning*
- *Broadcasting TV*
- *Video On Demand*
- *Digital Library*
- *Multimedia communication applications*



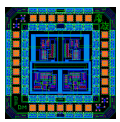
ITU Visual Communication Standards

- *H.310 – Broadband ISDN, ATM LAN*
- *H.320 – Narrowband switched ISDN*
- *H.321 – Broadband ISDN, ATM LAN*
- *H.322 – Guaranteed bandwidth packet switched networks*
- *H.323 – Non-guaranteed bandwidth packet switched network(Ethernet)*
- *H.324 – GSTN, POTS, the analog phone system*



Components of the Visual Communications

Standard	H.310	H.320	H.321	H.322	H.323	H.324
Network	ATM LAN	ISDN	ATM LAN	(QoS) LAN	Ethernet	GSTN (POTS)
Video	MPEG-2 (H.262) H.261	H.261 (H.263)	H.261 (H.263)	H.261 H.263+	H.261 H.263+	H.261 H.263+
Audio	G.711 G.722 G.728 MPEG-2	G.711 G.722 G.728	G.711 G.722 G.728	G.711 G.722 G.728	G.711 G.722 G.728 G.729 G.723	G.723
Multiplexing	H.222.0 H.222.1 (MPEG)	H.221	H.221	H.221	H.225.0	H.223
Control	H.245	H.230 H.242	H.242	H.242	H.245	H.245
Multi-point		H.231 H.243	H.231 H.243	H.231 H.243	H.323	
Data	T.120	T.120	T.120	T.120	T.120	T.120



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T DRAFT REVISED H.32

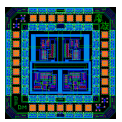
TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(Draft revisions dated 1997-09-2

LINE TRANSMISSION OF NON-TELEPHONE SIGNALS

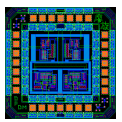
TERMINAL FOR LOW BITRATE MULTIMEDIA COMMUNICATION

ITU-T Recommendation H.324

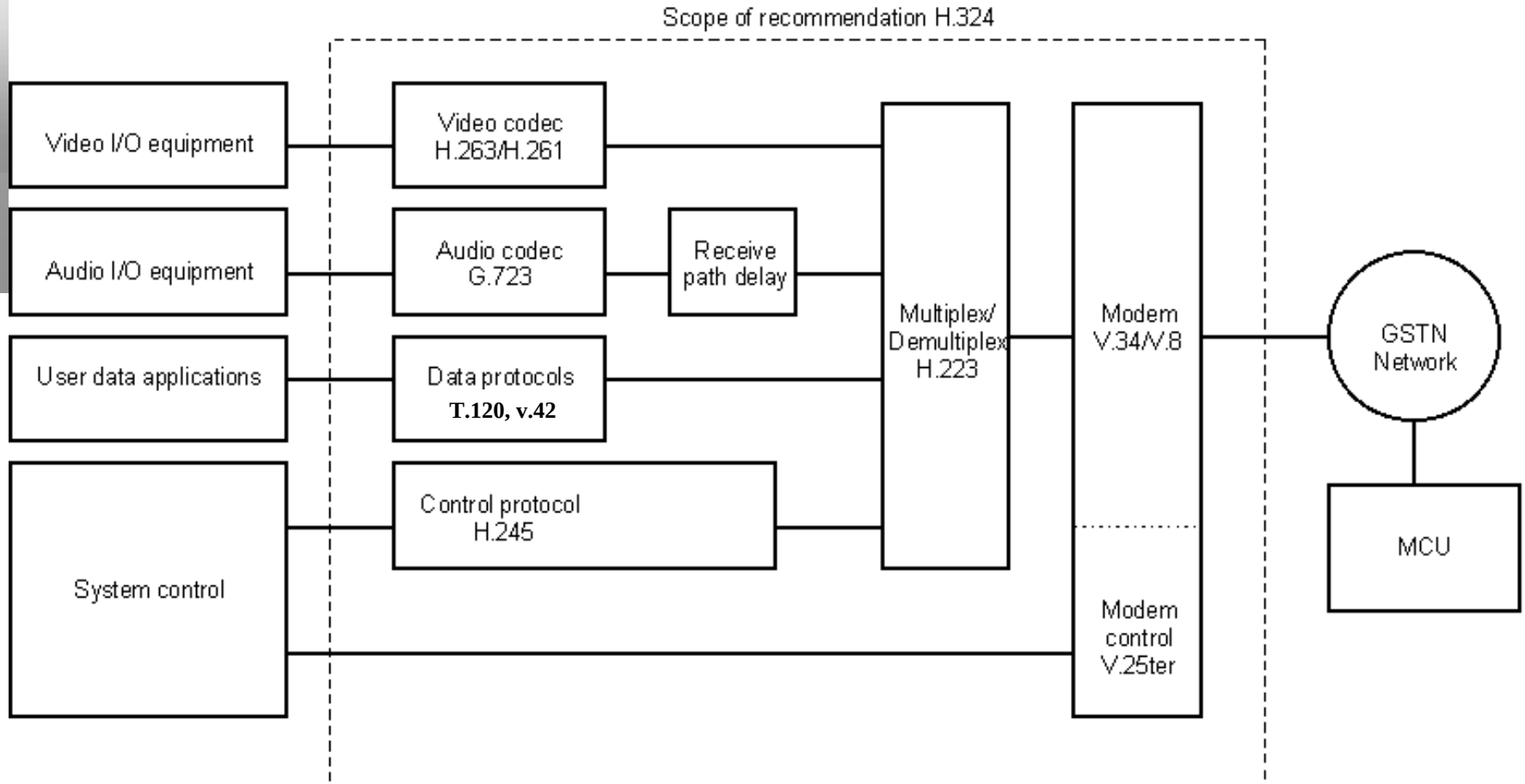


Scope of H.324

- *"cover the technical requirements for very low bitrate multimedia telphone terminals operating over the General Telphone Network(GSTN)."*
- *"provide real-time video, audio or data, or any combination"*
- *"communication may be either 1-way or 2-way."*
- *"the multimedia telephone terminals… can be integrated into PCs, or workstation, or be stand-alone."*
- *"interworking … on the ISDN and on mobile radio networks are also covered."*

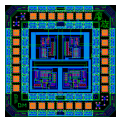


System Overview(H.324)



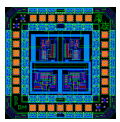
Information Streams of H.324

- Video/Audio streams are continuous traffic carrying moving color pictures.
- Data streams may represent still pictures, facsimile, documents, computer files, computer application data, undefined user data, and other data streams.
- Control streams pass control commands and indications between remote counterparts.



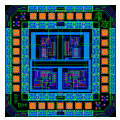
Functional Elements covered by H.324---Data Protocols

- The Data Protocols support data applications such as ***electronic whiteboards, still image transfer, file exchange, database access, audiographics conferencing, remote device control, network protocols, etc***. Standardized data applications include ***T.120*** for real-time audiographics conferencing, ***T.84*** simple point-point still image file transfer, ***T.434*** simple point-point file transfer, ***H.224/H.281*** far-end camera control, ***T.30*** facsimile transfer, ***T.140*** Text conversation protocol, ISO/IEC ***TR9577*** network protocols including PPP and IP
- using buffered ***V.14*** *(asynchronous characters without error control)* or ***LAPM/V.42****(with error control)* ***V.42bits*** *(with data compression)*, ***V.24****(with frame)*. Other applications and protocols may also be used via ***H.245*** negotiation.



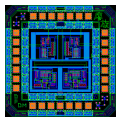
Functional Elements covered by H.324---Control Protocols

- The Control Protocol (***H.245***) provides end-to-end signaling for proper operation of the H.324 terminal, and signals all other end-to-end system functions including *capabilities exchange, opening and closing of logical channels, mode preference requests, multiplex table entry transmission, flow control messages, and general commands and indications.*

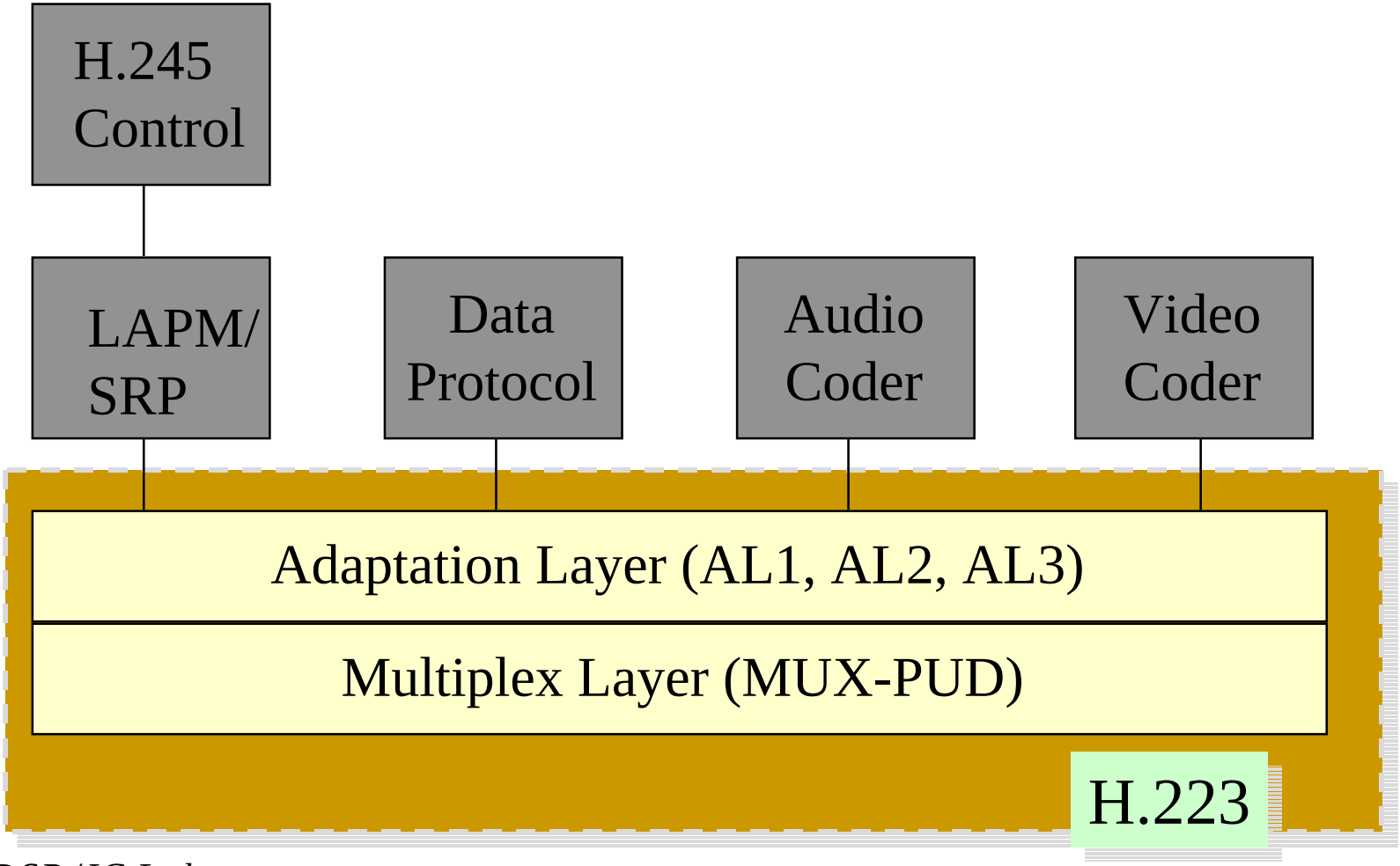


Functional Elements covered by H.324---Multiplex Protocols

- *The Multiplex Protocol (**H.223**) multiplexes transmitted video, audio, data and control streams into a single bit stream, and demultiplexes a received bit stream into various multimedia streams. In addition, it performs logical framing, sequence numbering, error detection, and error correction by means of retransmission, as appropriate to each media type.*

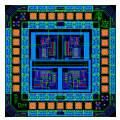


H.223 Architecture



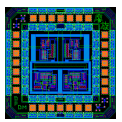
Functional Elements covered by H.324---Modem

- *The Modem (**V.34**) converts the H.223 synchronous multiplexed bit stream into an analog signal that can be transmitted over the GSTN, and converts the received analog signal into a synchronous bit stream that is sent to the Multiplex/Demultiplex protocol unit. **V.25ter** is used to provide control/sensing of the modem/network interface, when the modem with network signaling and **V.8/V.8bis** functional elements is a separate physical item.*



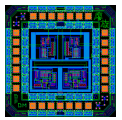
Functional Elements covered by H.324---Video/Audio Codec

- ***H.261/263*** *:Video streams are continuous traffic carrying moving color pictures.*
- ***G.723.1****:Audio streams are real-time and maintain synchronization with the video streams.*



Estimated Processing Requirements

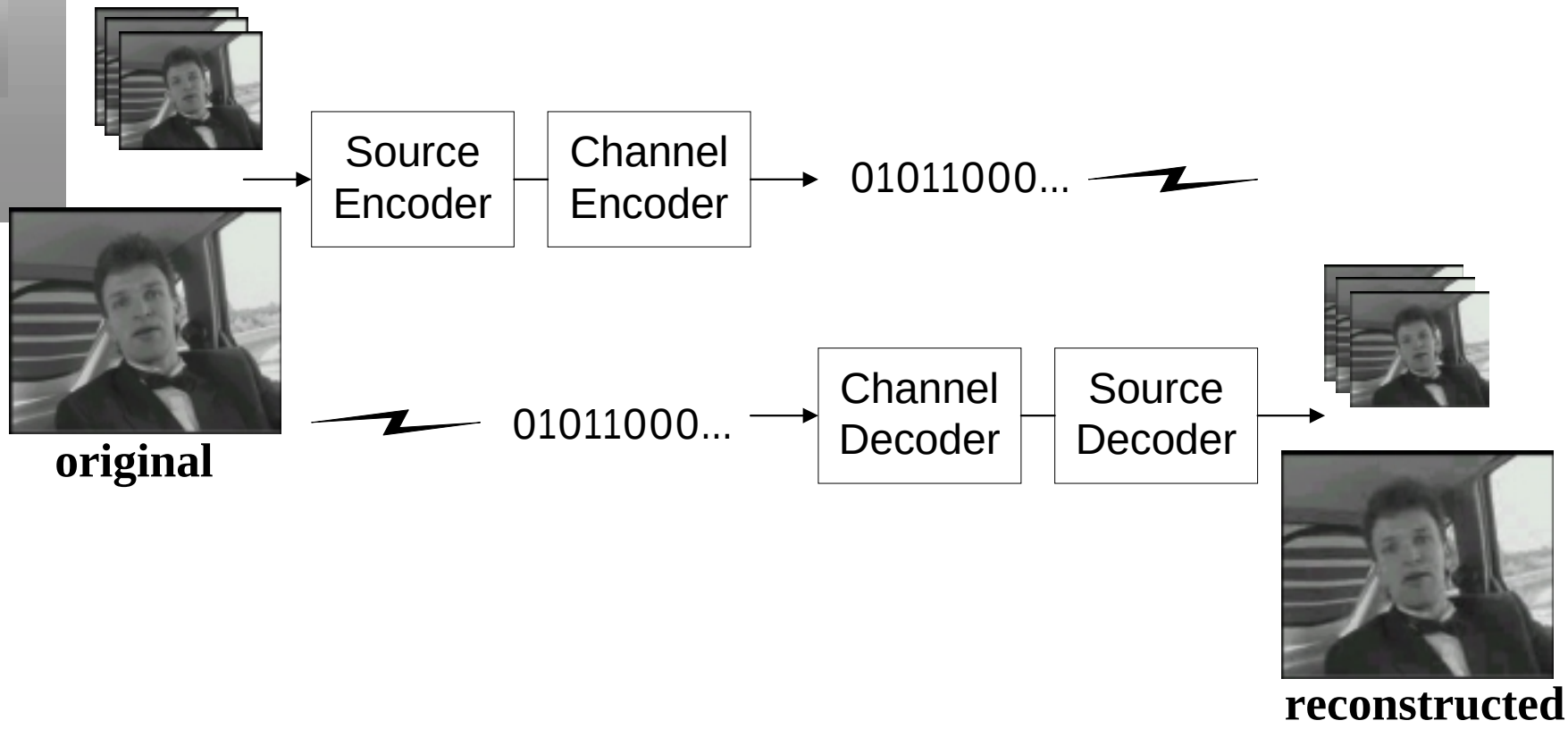
Function	Minimum requirement (MIPS)	Maximum requirement (MIPS)	Comments
H.320 video	40	100	Frame rate : 5~30 Frame size : CIF, QCIF Bitrate : 64K ~ 1.544Mbps
H.320 Audio	5	60	Bitrate : 64k~16kbps
H.324 Video	40	1200	Frame rate : 10 Frame size : SQCIF, QCIF, CIF, 4CIF, 16CIF
Control	10	15	Include H.223, H.245
Speaker phone	5	50	Not in ITU standard Echo suppression Echo cancellation
I/O and overhead	15	50	Operating system
Multi-point			



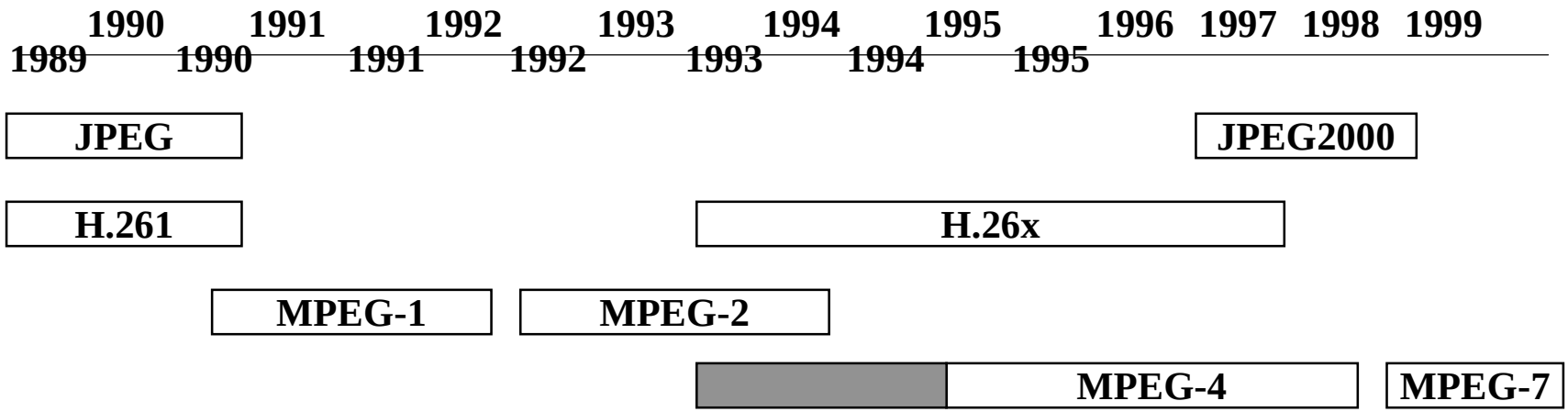
Video Formats

Picture format	Luminance pixels	Luminance lines	Uncompressed bitrate(Mbps)			
			10 frames/sec		30 frames/sec	
			Mono	Color	Mono	Color
SQCIF	128	96	1.0	1.5	3.0	4.4
QCIF	176	144	2.0	3.0	6.1	9.1
CIF	352	288	8.1	12.2	24.3	36.5
4CIF	704	576	32.4	48.7	97.3	146.0
16CIF	1408	1152	129.8	194.6	389.3	583.9

Video Compression



Video Compression Processing



Video Coder

Video Sequence

Marco Block

+

Forward DCT

Quantization

Entropy Coding

0101110...

Inverse Quantization

Inverse DCT

Motion Estimation/ Compensation

0101110...

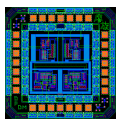
Picture Formats for Video Terminals

PICTURE FORMAT	LUMINANCE PIXELS	ENCODER		DECODER	
		H.261	H.263	H.261	H.263
SQCIF	128 x 96 for H.263[3]	Optional[3]	Required[1,2]	Optional[3]	Required[1]
QCIF	176 x 144	Required	Required[1,2]	Required	Required[1]
CIF	352 x 288	Optional	Optional	Optional	Optional
4CIF	704 x 576	Not defined	Optional	Not defined	Optional
16CIF	1408 x 1152	Not defined	Optional	Not defined	Optional

NOTE 1 - Optional for H.320 interworking adapters.

NOTE 2 - Mandatory to encode one of the picture formats QCIF and SQCIF; optional to encode both formats.

NOTE 3 - H.261 SQCIF is any active size less than QCIF, filled out by a black border, coded in QCIF format.



Differences Between the H.26x Coding Algorithm

	H.261	H.263	H.263+
Picture Size	QCIF, CIF	Sub-QCIF, QCIF, CIF, 4CIF, 16CIF	Sub-QCIF, QCIF, CIF, 4CIF, 16CIF, Custom picture size
Target Bitrate	Px64 kbps (P=1,2, …30)	Below 64kbps	
Frame Format	I, P	I, P, PB	I, P, PB, Improved PB, B, EI, EP
Frame Rate		30 frames/second	15 to 1800 frames/second
Composition of Picture	GOB	GOB	GOB, Slice
Macroblock Size	16x16	16x16	16x16, 32x32
Block Size	8x8	8x8	8x8, 16x16
Search Range	-16~15	-16~+15.5, -31.5~+31.5	-16~15.5, -31.5~31.5, -32~31.5, -64~63.5, -128 ~127.5, -256~255.5
MC Accuracy	integer-pel accuracy	half-pel accuracy	
Filter Effect	spatial lowpass loop filter	bi-linear interpolation for half-pel MC	
VLC Table	pairs (run, level)	triplets (run, level, eob)	
MV Predictor	MV of previous MB	median of 3MVs	
Multi-point	None	None	Up to 4 separate Sub-Bitstreams
Supplemental Enhancement Information		None	Freeze, Resizing, Snapshot, Time Segment, Refinement Segment, Chroma Keying

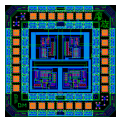
Discrete Cosine Transform

- *Block size: 8 x 8*
- *Two-dimensional DCT:*

$$F(u,v) = \frac{2}{N} C(u)C(v) \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} f(x,y) \cos\frac{2\pi(2x+1)u}{4N} \cos\frac{2\pi(2y+1)v}{4N}$$

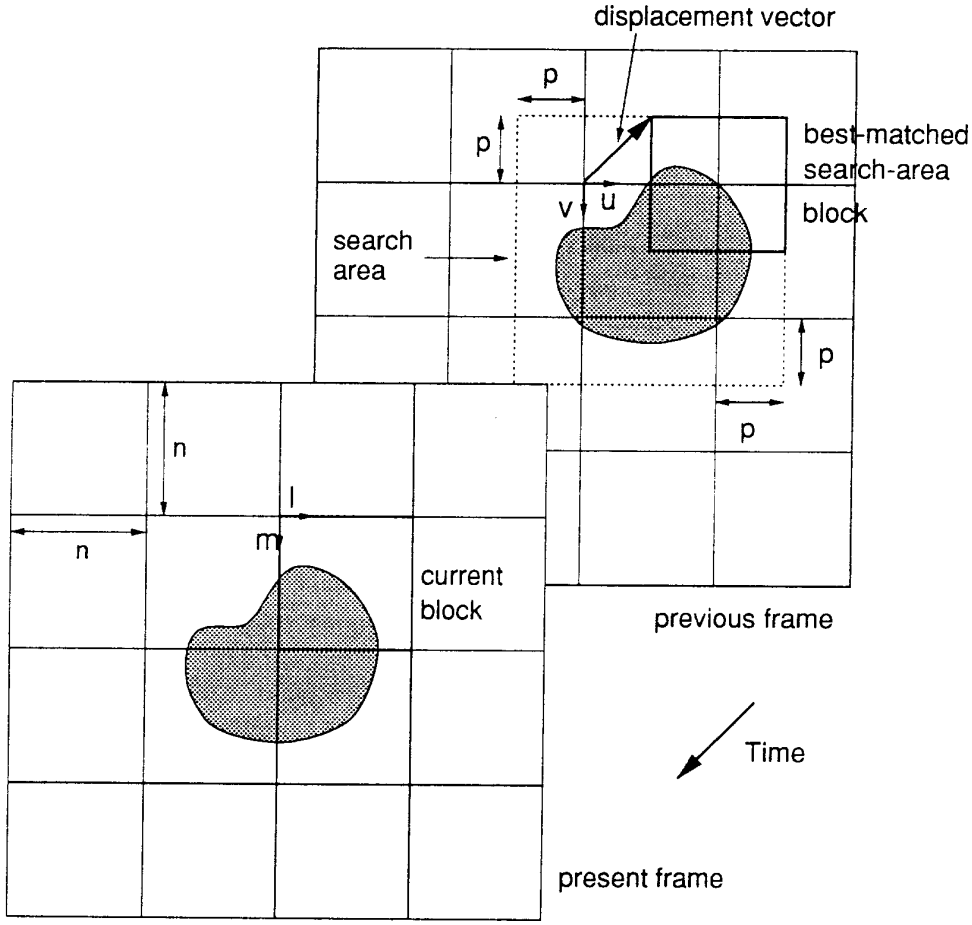
$$C(u), C(v) = \begin{cases} 1/\sqrt{2}, & u,v = 0 \\ 1, & \text{otherwise} \end{cases}$$

  - *Most large coefficients concentrate on the upper-left corner*
  - *Quantization and zig-zag scan*



Discrete Cosine Transform

Motion Compensation/Estimation



Motion Compensation/Estimation

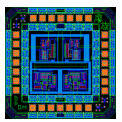
Original

Reconstructed

Difference

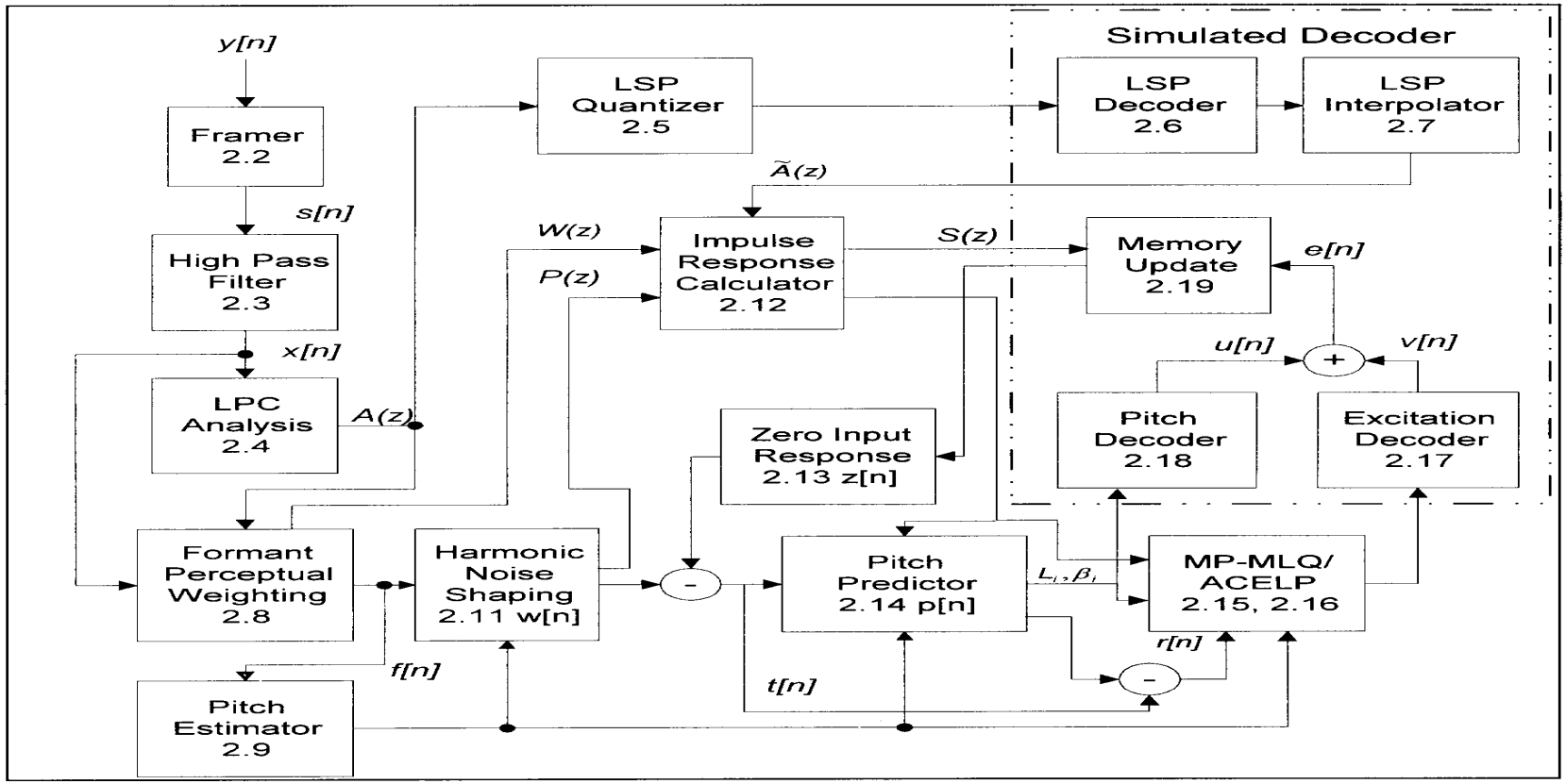
G.723 General description

- *Bit rates: 5.3 or 6.3 kbit/s*
  - *It is possible to switch between the two rates at any 30 ms frame boundary.*
- *Linear prediction analysis-by-synthesis coding*
- *Frame size: 30ms, 240 samples at 8kHz sampling rate.*

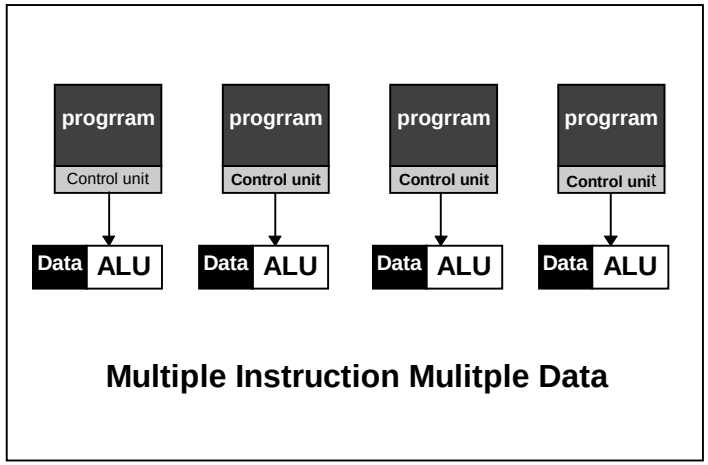


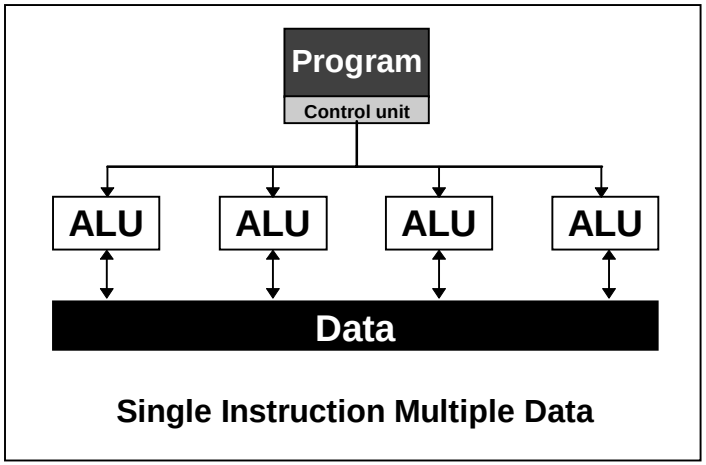
G.723 Architecture

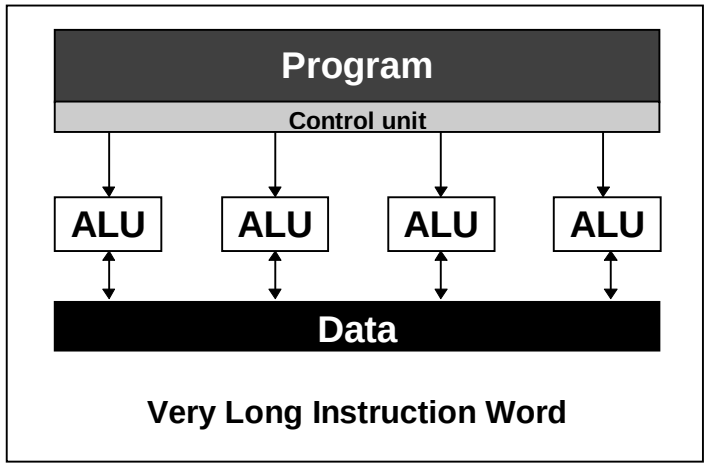
Draft Recommendation G.723 - Dual Rate Speech Coder for Multimedia Communications Transmitting at 5.3 & 6.3 kbit/s

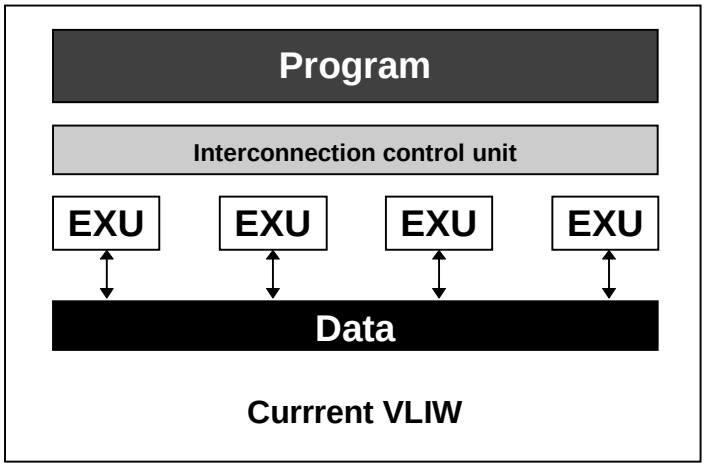


Parallel Architectures for Media Processor









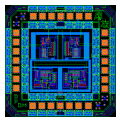
Announced Media DSP Architectures

	TI C80	Chromatics Mpact	Philips Tri-Media	TI C6x	Samsung MSP-1
Architecture	4 x 64b DSP's + 32b RISC + cross-bar	VLIW/SIMD 4 ALUs ME engine 792b bus	VLIW 25 exec units + VLD	VLIW 8 instr/clk 2 MACs/clk cond. exec.	32-way SIMD + 32b RICS
Clock	40 MHz	62 MHz	100 MHz	200 MHz	100 MHz
Peak Perf.	1.2 Gops	2 Gops	4 Gops	1.6 Gops	6.4 Gops
Memory	DRAM 400 MB/s	RAMBUS 500 MB/s	SDRAM 400 MB/s	SDRAM 400 MB/s	SDRAM 800 MB/s
Programming	compiler + assembler	in-house	VLIW compiler	VLIW compiler	compiler + assembler

ISCAS'97

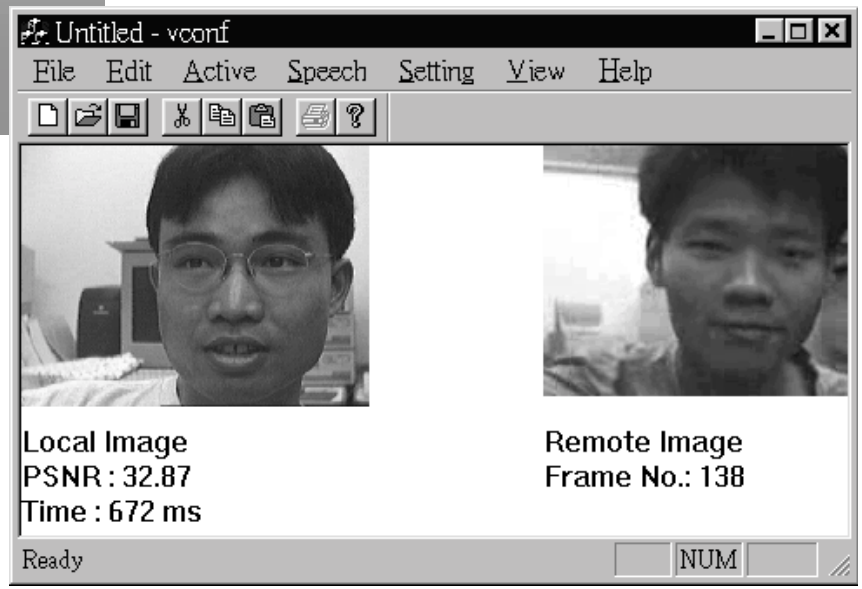
Performance Issues

- *Computation Complexity : HW/SW co-design*
- *Bitrate : Network Interface*
- *Quality : Subjective test*
- *Latency : for two-way communication*
- *Cost :*
- *Losslessness : Optional*
- *Power Consumption :*

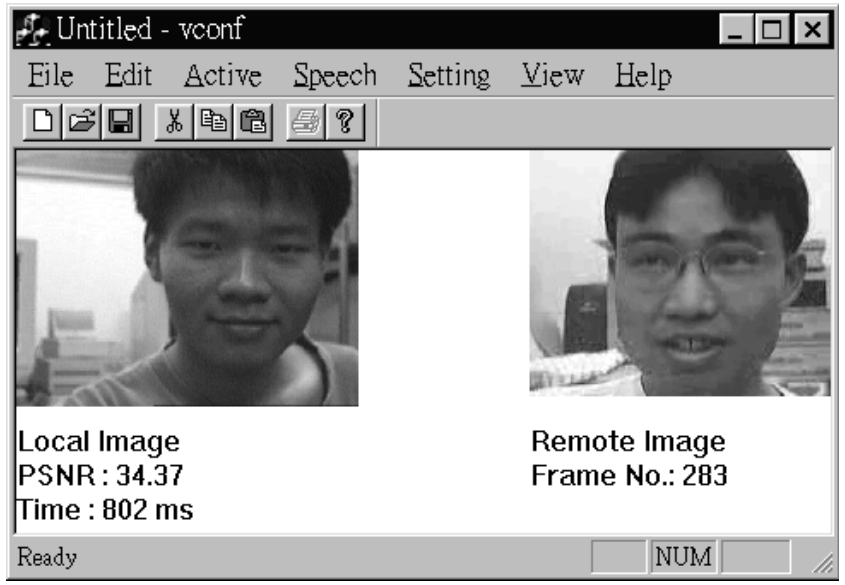


Prototyping Platform

- *A snapshot of the video phone system.*

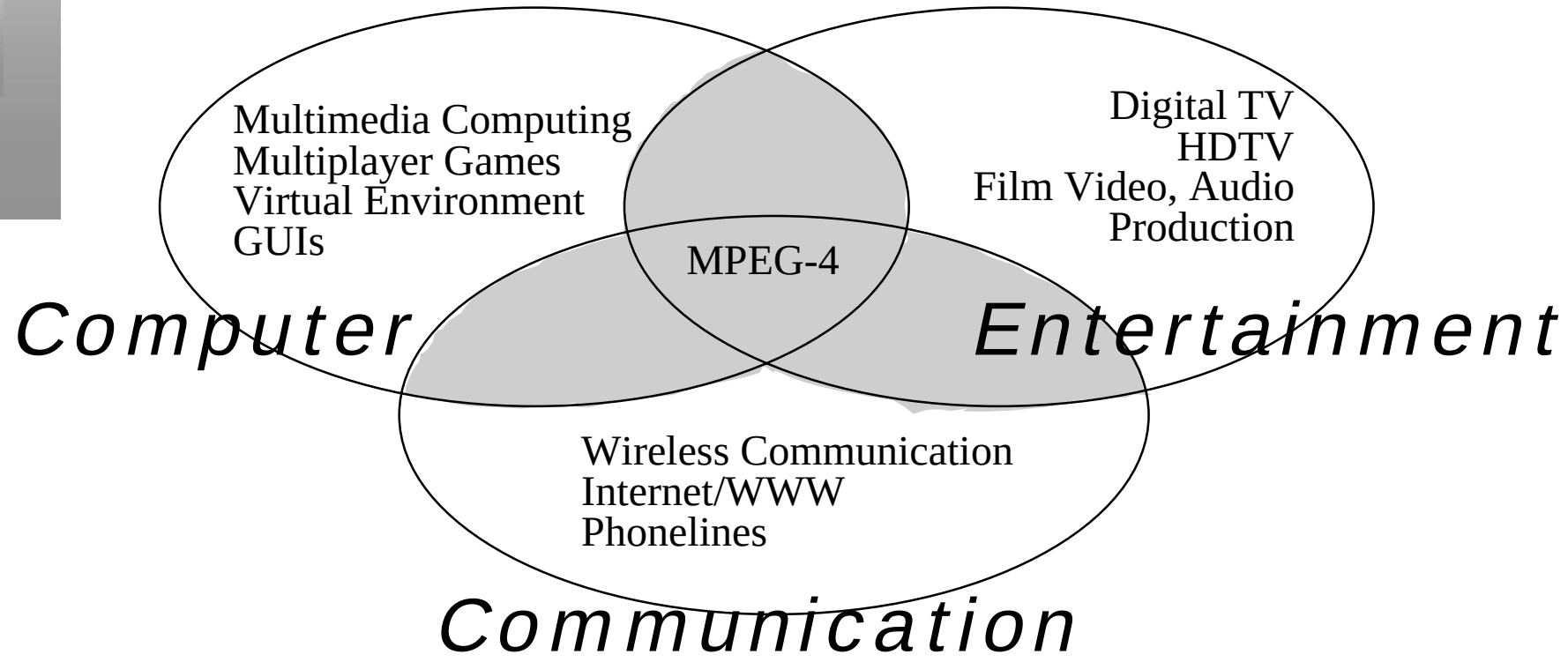


Local Site

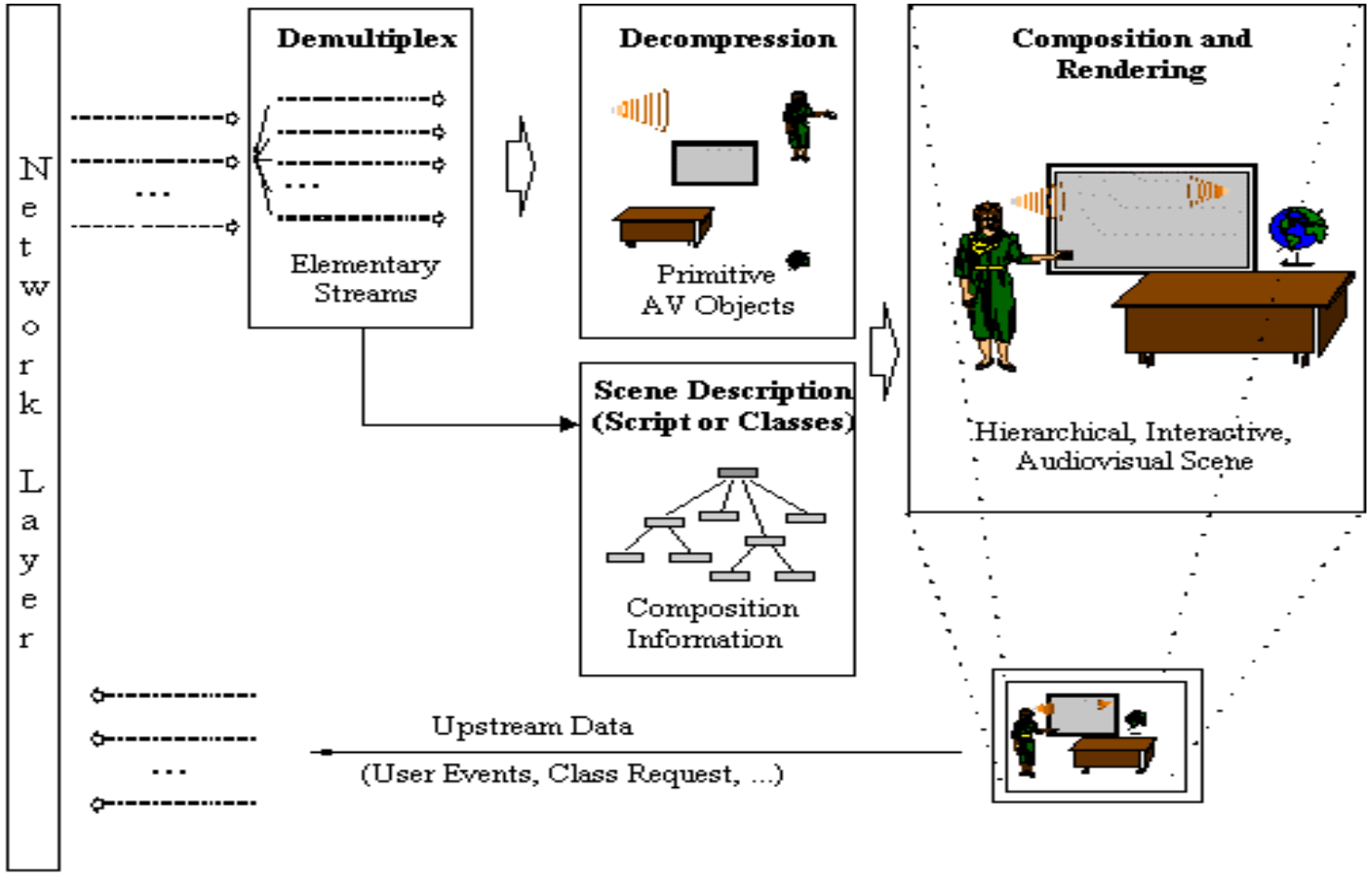


Remote Site

MPEG-4 Industries

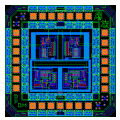


Multimedia Communication



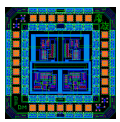
Interoperation and Enhancements

- *Interoperation*
  - *Speech only terminal*
  - *H.324 terminal over ISDN (**H.324/I**)*
  - *H.324 terminal over mobile radio (**H.324/M**)*
- *Enhancement*
  - *Encryption*
  - *Multipoint Consideration*

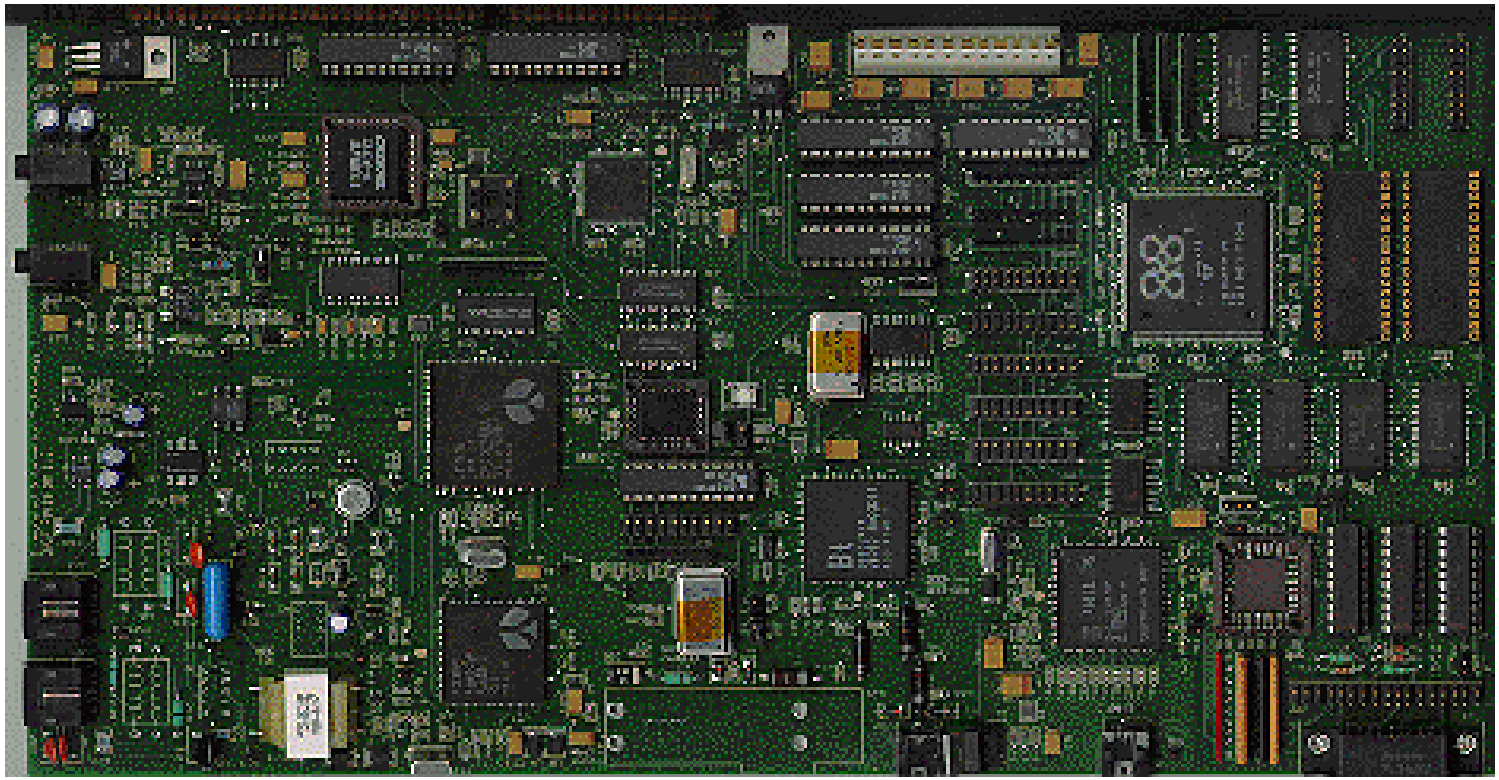


Where to get more information

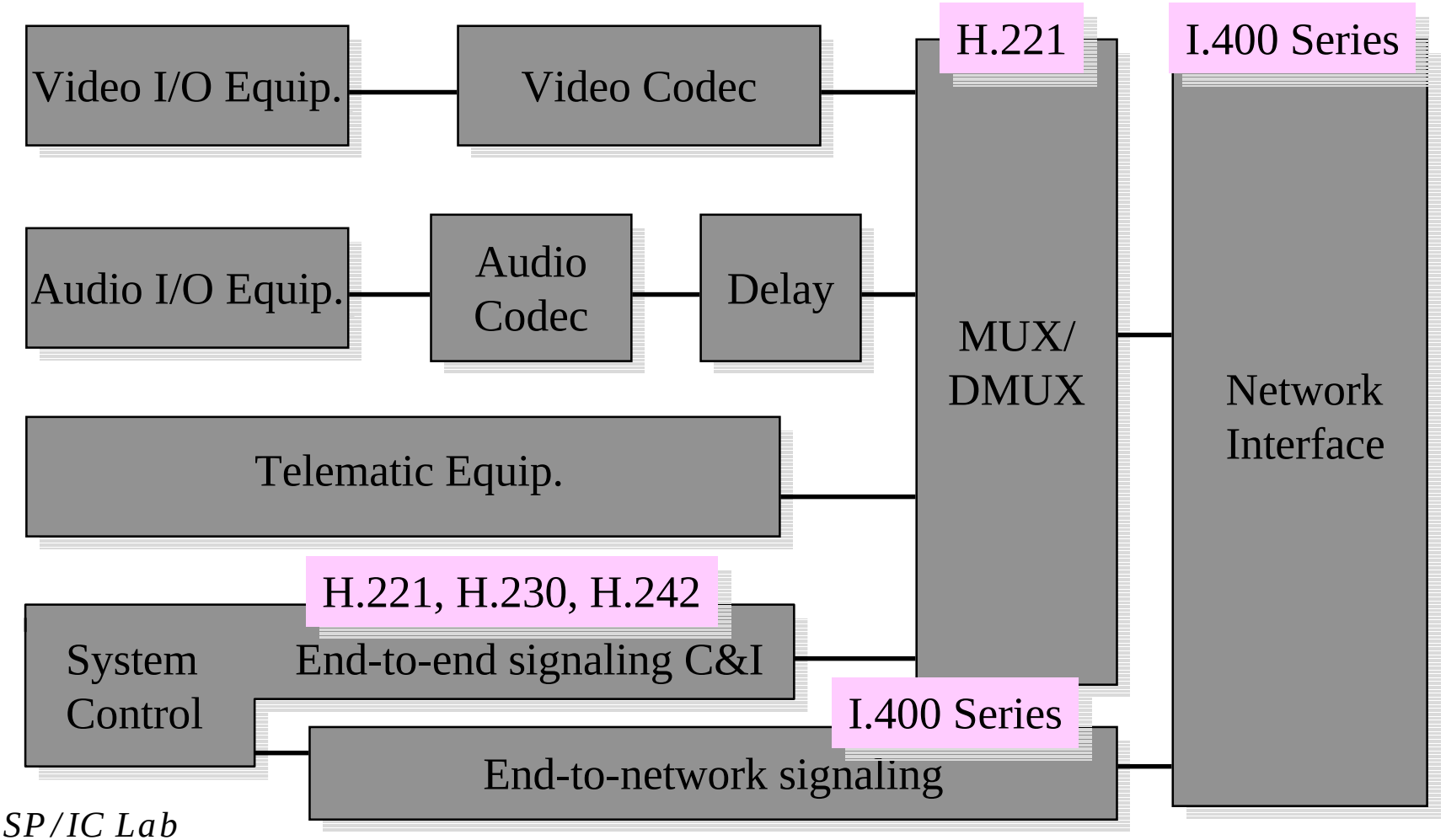
- *New ITU-T Standard Drafts*
  - *H.320 suite: ftp://standard.pictel.com/avc-site/DraftRec*
  - *H.324 suite: ftp://standard.pictel.com/h324-site/*
  - *H.323, H.310, H.321 suite: ftp://standard.pictel.com/avc-site/9801_Gen/*
  - *H.263+ video: ftp://standard.pictel.com/video-site/h263plus*
- *ITU-T Standard Documents*
  - *Can be purchased from http://www.itu.ch*



Prototyping Hardware



H.320 Architecture



H.323 System Structure