Broadcasters World of Choices

Jukka Hamalainen

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We live in the world of choices

- **525 and 625 line interlaced world**
  - **NTSC, PAL, Secam**
  - **Component origination / program enhancement**
  - **30, 25 and 24 Frames/second origination**
  - **4:3 and 16:9 aspect ratios for TV, more for movies**
  - **Terrestrial transmission using 6, 7, 8 MHz RF bandwidths**
  - **COFDM, ISDB etc.**

- **HDTV & US digital transmission world**
  - **18 ATSC standards**
  - **8VSB, 16QAM, QPSK**

- **Computer world**
  - **Definitely progressive**
  - **VGA, SVGA, XGA**
  - **Producing and distributing program material over the Internet to be shown in small windows, frequently at many new/different frame rates.**

DTV Status in US.

- **Presently there are approximately 100 stations on air**

- **Latest CEA listing early April:**
  - **1080i: 40 stations (3 multiplexed with 480i)**
  - **720p: 32 stations**
  - **480p: 10 stations**
  - **480i: 4 stations**

    - **Note: Major part of the transmissions are 480i upconverted**

- **~1500 to go!**

In which direction are we moving?

- **Progressive production 480p, 720p, 1080p/24Hz.**
- **Data is arriving to the consumer over terrestrial, satellite, cable and is also streamed over the internet.**
  - **–Datacasting was one of the key issues at the NAB convention.**
- **More and more program material is produced using computers or interacting with computers.**
- **Electronic high resolution movie production, higher than 1080p/60Hz.**
- **New technologies such as:**
  - **–ReplayTV**
  - **–TIVO**
  - **–TV Any Time**
  - **–GeoCast**
  - **–WaveXpress**

  are being introduced to the market and are evolving with Datacasting into new broadcast technologies.

In which direction are we moving?

- **What is difficult and expensive still today:**
  - **Conversion between frame rates.**
  - **Interlace to progressive conversion**

- **What is already easy and lower cost:**
  - **Spatial (line rate/pixel rate) format conversion.**

- **Line doubling and field/frame rate doubling is becoming common in many consumer applications.**

Some tough questions!

- **Is 24Hz film true video/TV production?**
- **When it is transmitted as 25Hz HDTV can it be called truly high fidelity, at 4% higher rate than the actual capture speed?**
- **Is 2/3 pull down HDTV.**
- **However film is the only universal program transfer method today!**

- **Why do we treat horizontal and vertical resolution differently, is it just a legacy from interlace?**
  - **Is 4:2:2 sampling just an another legacy from interlace?**
  - **We use CCD's for capturing horizontal and vertical pixels a field or a frame at the time.**
  - **We compress images in 8x8 blocks and don't even transmit every block.**
  - **With the exception of CRT's most new display devices are progressive and are typically written (not scanned) a frame at the time.**

Bit's are Bucks
or Gigabits are Megabucks!

This is true for production as well as for transmission.

Format	Production data rate before compression	Transmission data rate before compression	Data rate difference between frame rates	Notes
1080i 30Hz 1080p 24Hz	1244 Mbps 995.3 Mbps	746.5 Mbps 597.2 Mbps	20%	Interlace versus progressive
720p 60Hz 720p 24Hz	1106 Mbps 442.4 Mbps	663.6 Mbps 265.4 Mbps	60%	
480p 60HZ 480p 24Hz	405.5 Mbps 162.1 Mbps	243.3 Mbps 97.3 Mbps	60%	480i interlaced data rate is 202.8/121.7 Mbps
576i 25Hz 576p 25Hz	207.3 Mbps 207.3 Mbps	124.4 Mbps 124.4 Mbps	0%	Interlace versus progressive at 25Hz

- **Production data rate base: 4:2:2, 10 bits/pixel**
- **Transmission data rate base: 4:2:0, 8 bits/pixel**
- **The data rate bases are the same for both ATSC and DVB**

Receiver displays are also a part of the equation.

- **CRT's are getting better, like many old techniques before they will be replaced.**
  - **Cannot compete in brightness and contrast ratio against some new developments.**
  - **Difficulty in resolution, convergence in the corners**
- **Plasma panels, a new emerging technology.**
  - **Still too expensive for main consumer applications**
  - **Pixel addressed, basically a progressive device, but interlaced version has been produced. The advantages of interlaced panels are somewhat questionable.**
- **LCD panels.**
  - **Great as computer displays, some lag in fast motion, difficulties in making large size units.**
- **DLP (mirror devices), another great promise, also pixel addressed and basically a progressive device.**
  - **Single chip unit has potential as home projection device, at this moment lower cost than plasma panel.**
  - **As of 1999 DLP's are used in movie theaters around the world.**

Display devices.

- **All new display devices mentioned here are pixel addressable. This means that the received signal in most cases must be spatially format converted in the display device.**
- **Plasma and DLP are digital devices, which means that the whole transmission all the way to the human eye can stay digital, the eye becomes the D/A converter.**
- **Even in case of CRT's there is a "sweet spot", an ideal beam size, shadow mask design etc.. Therefore when different TV formats are displayed, the best images can be seen if the incoming image is converted to this ideal format. This might also be the most economical solution.**

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Actual transmission standards

Data rates before compression (4:2:0 signal): pixels/frame ($Y+C_r+C_b$) x 8bits x frame rate

Active Lines	Horiz. Pixels	Image Aspect Ratio		Field/Frame Rate				Data rates before compression
				a)	b)	c)	d)	
1080	1920		16:9	60I		30P	24P	a) 746.5Mbps c) " d) 597.2Mbps
720	1280		16:9		60P	30P	24P	b) 663.6Mbps c) 331.8Mbps d) 265.4Mbps
480	704	4:3	16:9	60I	60P	30P	24P	a) 121.7Mbps b) 243.3Mbps c) 121.7Mbps d) 97.3Mbps
576	720	4:3	16:9	50I	(50P)	(25P)	(24P)	a) 124.4Mbps b) 248.8Mbps c) 124.4Mbps d) 119.4Mbps

Actual production standards

Data rates before compression (4:2:2) : pixels/frame ($Y+C_r+C_b$) x 10bits x frame rate

Active Lines	Horiz. Pixels	Image Aspect Ratio		Field/Frame Rate				Data rates before compression
				a)	b)	c)	d)	
1080	1920		16:9	60I		30P	24P	a) 1244 Mbps c) " d) 995.3Mbps
720	1280		16:9		60P	30P	24P	b) 1106Mbps c) 553.1Mbps d) 442.4Mbps
480	704	4:3	16:9	60I	60P	30P	24P	a) 202.8Mbps b) 405.5Mbps c) 202.8Mbps d) 162.1Mbps
576	720	4:3	16:9	50I	(50P)	25P	(24P)	a) 207.3Mbps b) 414.7Mbps c) 207.3Mbps d) 199.1Mbps

Possible production standards

Data rates before compression (4:2:0) : pixels/frame ($Y+C_r+C_b$) x 10bits x frame rate

Active Lines	Horiz. Pixels	Image Aspect Ratio		Field/Frame Rate				Data rates before compression
				a)	b)	c)	d)	
1080	1920		16:9	(60I)		30P	24P	a) 933.1Mbps c) " d) 746.5Mbps
720	1280		16:9		60P	30P	24P	b) 829.5Mbps c) 414.8Mbps d) 331.8Mbps
480	704	4:3	16:9	(60I)	60P	30P	24P	a) 152.1Mbps b) 304.1Mbps c) 152.1Mbps d) 121.6Mbps
576	720	4:3	16:9	(50I)	50P	25P	24P	a) 155.5Mbps b) 311.0Mbps c) 155.5Mbps d) 149.3Mbps

SMPTE Engineering Committee Report on Advanced System Control Architecture

- **EBU and SMPTE have recognized the varying new requirements effecting systems design, and in the latest issue of the SMPTE Journal (May, 2000) they are soliciting comments on the Report on the Advanced Systems Control architecture, which report was published in this issue of the journal.**

- **The work was started by EBU/SMPTE Task Force, this published report was prepared by S22.02, SMPTE Advanced System Control Architectures Working Group.**

SMPTE Engineering Committee Report on Advanced System Control Architecture

Executive Summary

- **Many different organizations within the broadcast industry have already recognized the need for a comprehensive control and monitoring environment for studio equipment. Due to differing product lines and marketing direction, each of these systems will have likely been derived from a different set of requirements. It is likely that varied enabling technologies that already exist within the network and computing industries would have also been incorporated into these systems.**
- **This published document provides an overview of an Advanced System Control Architecture that attempts to unify the existing proposed systems. It is a living document that will be used to capture the considerations of the of the considerations of the Advanced System Control ad-hoc group.**

SMPTE Engineering Committee Report on Advanced System Control Architecture

Executive Summary, cont..

- **The intent of this document is to**
  1) provide a system overview
  2) to identify specific areas of SMPTE effort
  3) to solicit input from interested parties

- **SMPTE is about to embark on standardization in this area. SMPTE encourages users, researchers, and vendors to participate by joining the Advanced Systems Control Architecture working group. Information on upcoming meetings, which are open to the public, can be found at http://www.smpte.org/engr.**

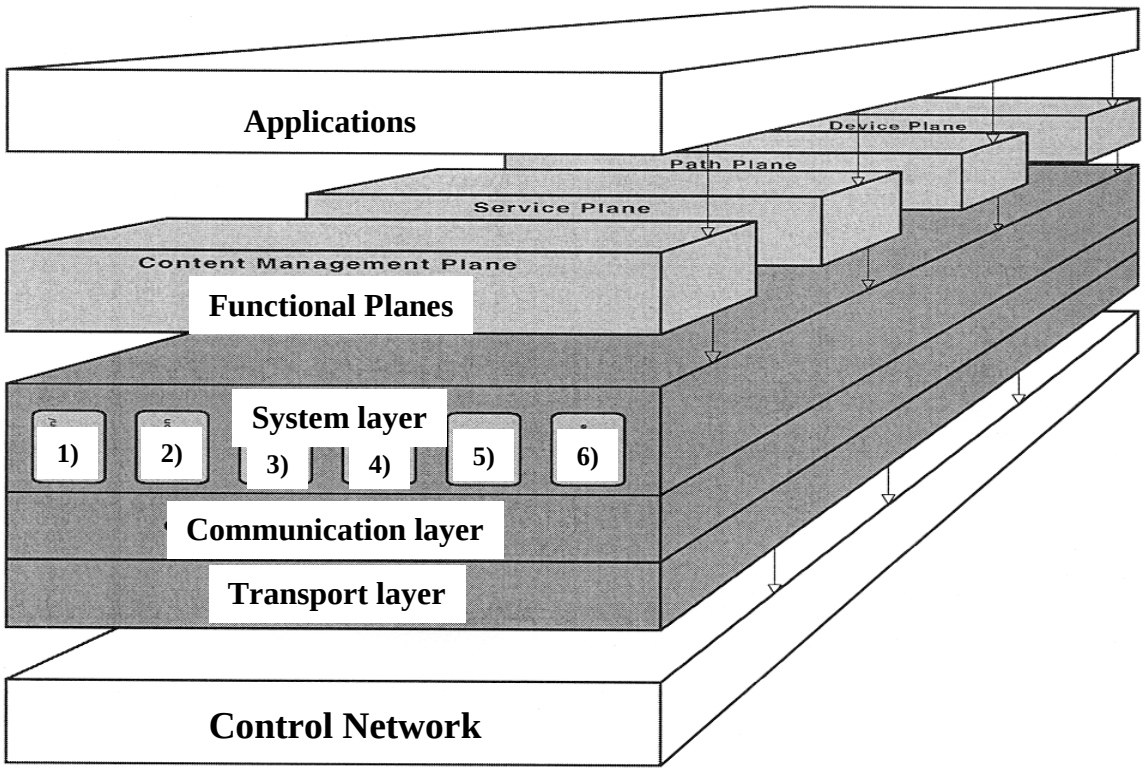
SMPTE Engineering Committee Report on Advanced System Control Architecture

Architectural Overview

An overall architecture will need to meet the following requirements:

1) **Flexible enough to accommodate varying enabling technologies where possible.**
2) **Independent of specific technologies where possible.**
3) **Scalable to a range of platforms and environments.**
4) **Extensible to adapt to emerging technologies.**
5) **Modular in nature allowing functional pieces of the system to be used as building blocks.**
6) **Offer a viable migration path for existing facilities.**

SMPTE Engineering Committee Report on Advanced System Control Architecture



Functional Planes:
- **Device Plane**
- **Path Plane**
- **Service Plane**
- **Content management Plane**

System Layer:
1) Identification / Naming
2) Configuration
3) Security
4) Fault Recovery
5) Status / Alarms
6) Studio Time

This diagram shows the relationship between the key architectural components of the system

SMPTE Engineering Committee Report on Advanced System Control Architecture

Functional planes

Functional planes exist as the front line interface between the studio applications and the functionality of the control system. The four functional planes are defined below:

1) Content Management

- **Manages content in the studio**
- **Understands physical storage allocation for the content**
- **Performs activities including Content Distribution, Content Creation, Scheduled Operations, and Storage Management**
- **Presents a view of content as required for *data streaming***

SMPTE Engineering Committee Report on Advanced System Control Architecture

Functional planes, cont..

2) Service

- **Combines multiple content streams into complete services**
- **Maps services onto resources available in the *path plane***
- **Abstracts the mapping of content to individual pieces of equipment**
- **Uses content sources to create paths**

3) Path

- **Facilitates the physical connection between devices for the purposes of data streaming**
- **Manages the physical links between devices**
- **Manages the resources required for these connections**

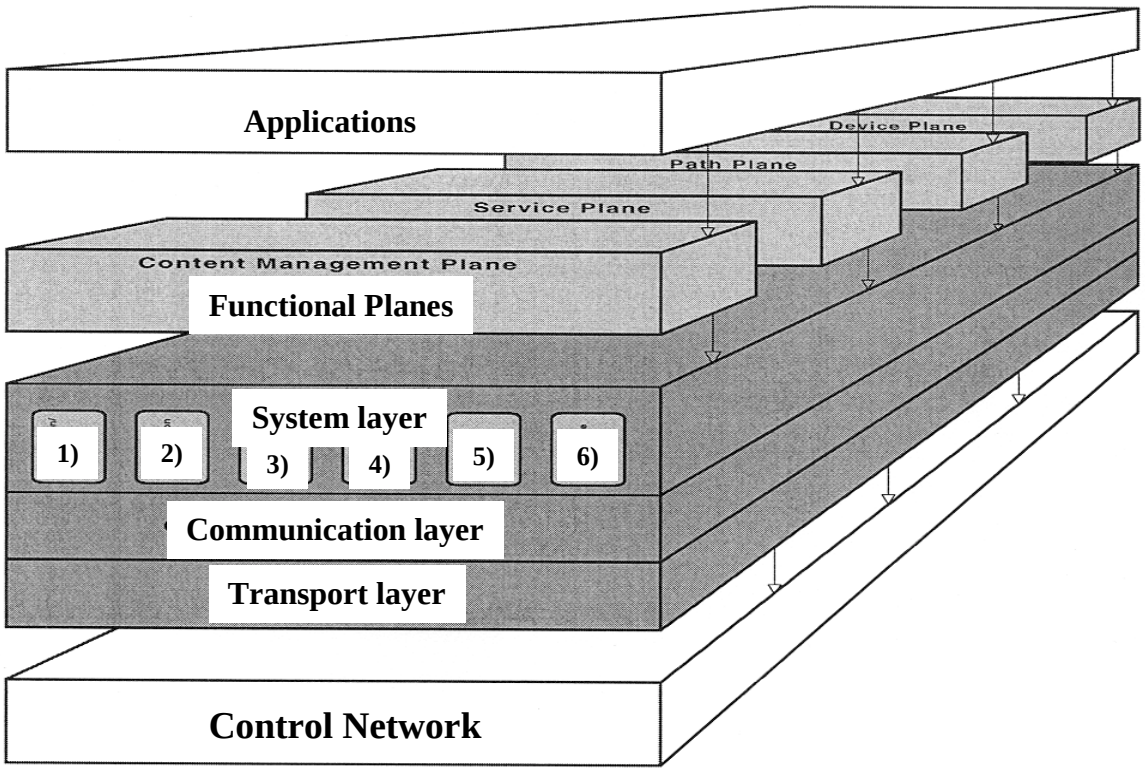
SMPTE Engineering Committee Report on Advanced System Control Architecture

Functional planes, cont..

4) Device

- **Contains the interfaces used to access studio equipment**
- **Provides specific information for device IO capability (ports)**
- **Based on a SMPTE defined hierarchy of functional classifications**
- **Provides for extensive interfaces**

Importance of the total system planning.



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