Japan's Experiences for Digital Terrestrial TV Broadcasting

part-1

Studio perspective

SET 2007 Congresso

Aug. 24th ,2007

DiBEG Japan

Yoshiki MARUYAMA

TV Asahi

DiBEG

Digital Broadcasting Expert Group

Contents

- *Implementation of digital television studio*
- *Master control system*
- *Contents distribution center*
- *Audio production*
- *STL*
- *Digital television broadcasting optical fiber network*

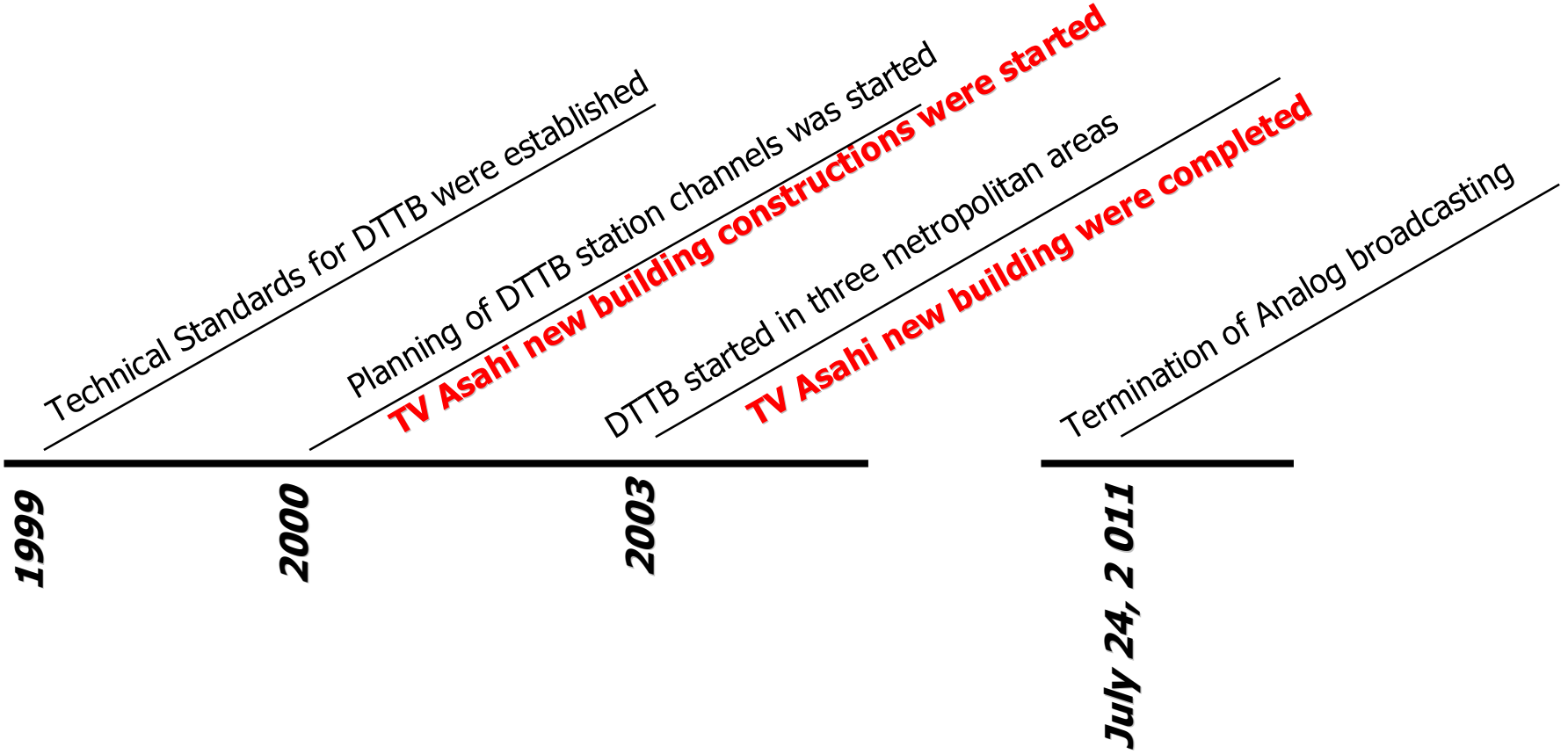
tv asahi

Implementation of Digital television studio

tv asahi

Migration Plan

Schedule for Digitalization of Broadcasting in Japan



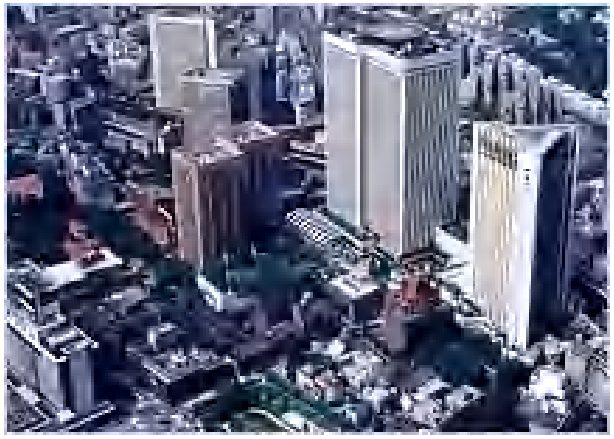
Shifted to the new site

TV Asahi's Head Quarter was shifted to new site of "Roppongi hills" from Ark Hills premise on Mar.2003. to secure the space of new digital broadcasting facilities and to commence digital terrestrial broadcasting on Dec. 1st, 2003 .

Roppongi Hills

Mar31st.2003

moved



Ark Hills

tv asahi

Construction of the new building

Construction progress

Building Outline

Construction period: Aug.1st 2000–Mar.31st2003

Building Area: 9,469.74m^2

Number of Stories: eight stories above the ground and three underground stories.

Total Floor Area: 73,700.43m^2

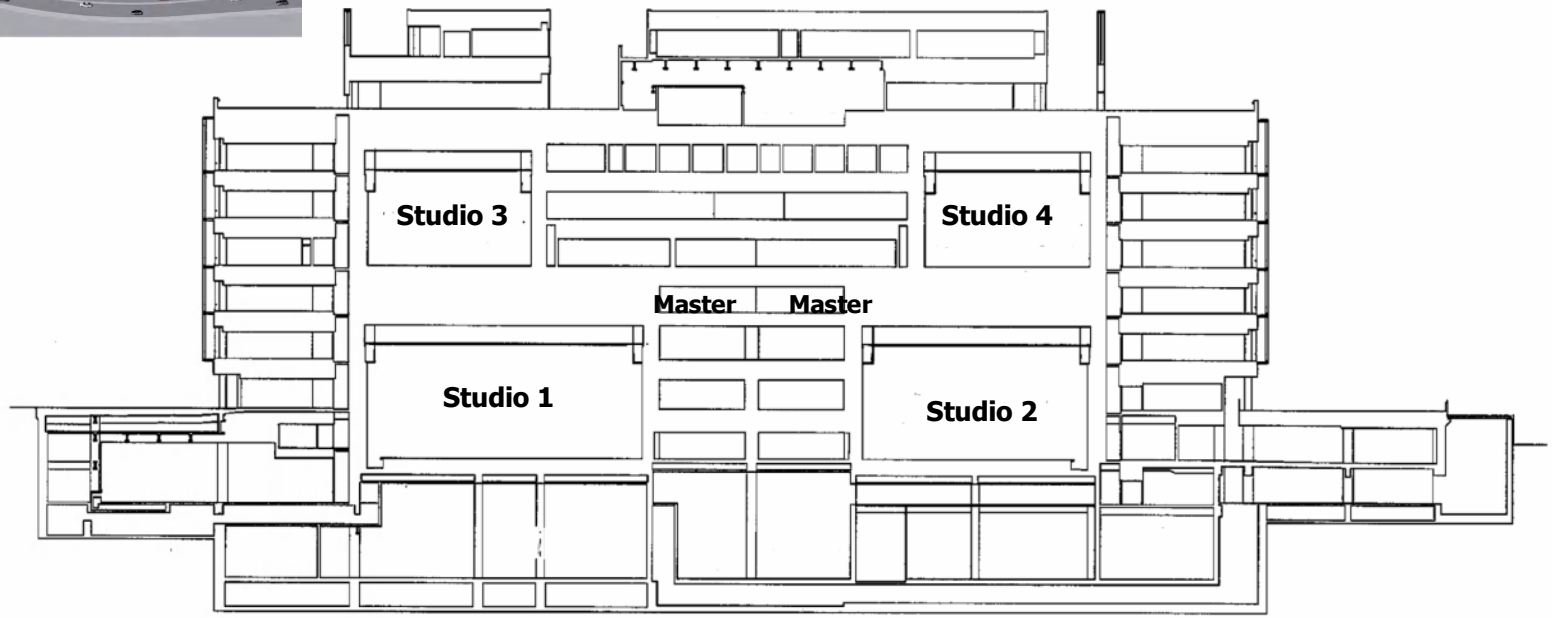
Power Supply: 66kV Loop Substation

Private Power Generator: Gas Turbine PG. 3,500kVA 6.6kVx2

UPS: 1000KVAx2 Redundant operation

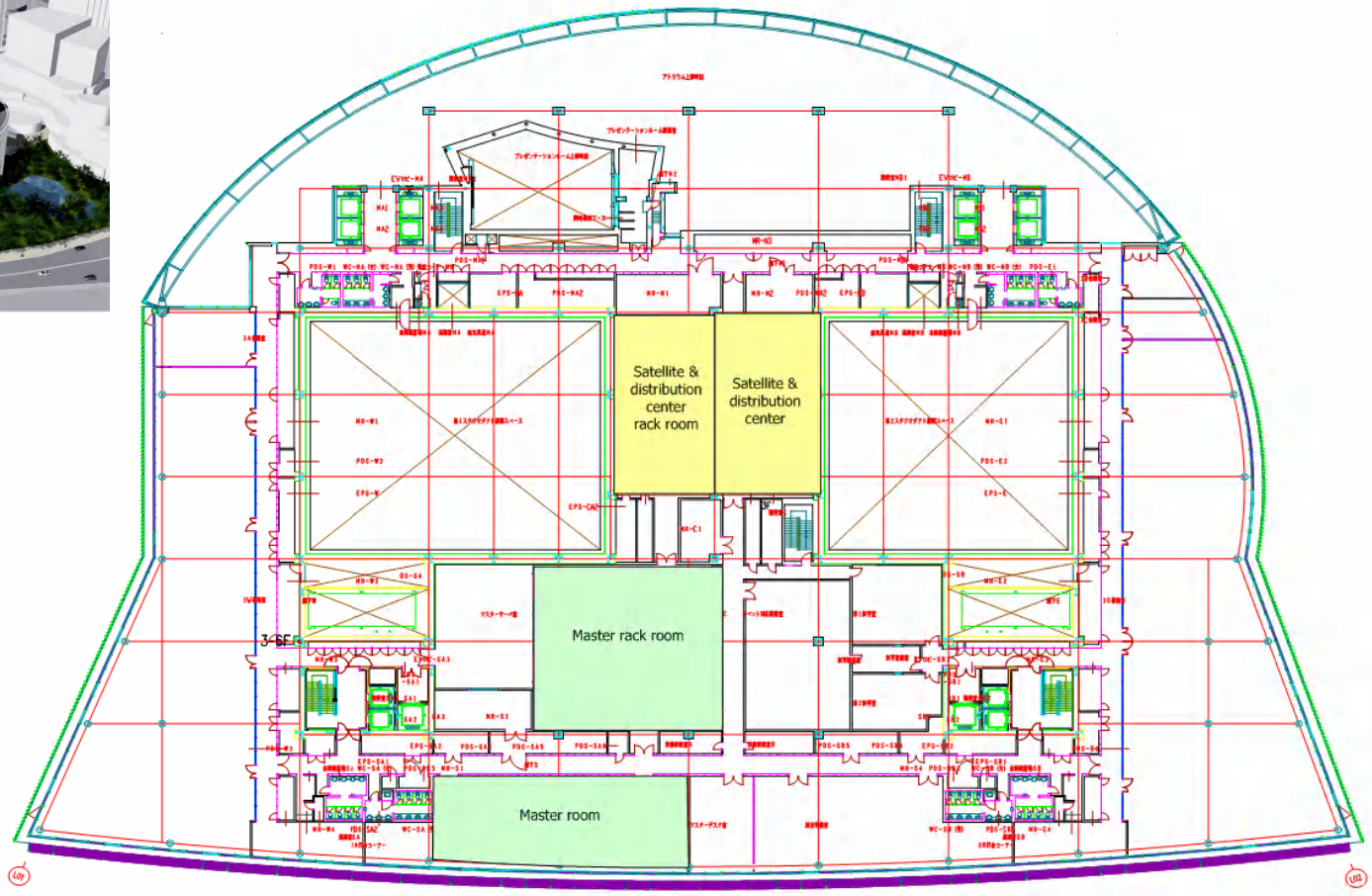
New building

TV Asahi has installed full digital broadcasting systems for Analogue & Digital terrestrial television broadcasting at new building.



Cross-section view

New building



Plan view 2nd floor

tv asahi

Technical design concept

1. Full HD-SDI & Full digital system in house
2. System phase management
3. One source-multi use

Digital signal interface

1. Digital HD
   HD-SDI (1080i) BTA S-004B (SMPTE-292M)
   Component serial digital
   1080i/59.94Hz

2. Digital SD
   SMPTE-259M (270Mbps)
   Component serial digital

3.Embeded audio
   SMPTE-299M
   8ch:equivalent of AES/EBU 4pair/Fs48kHz/24bit

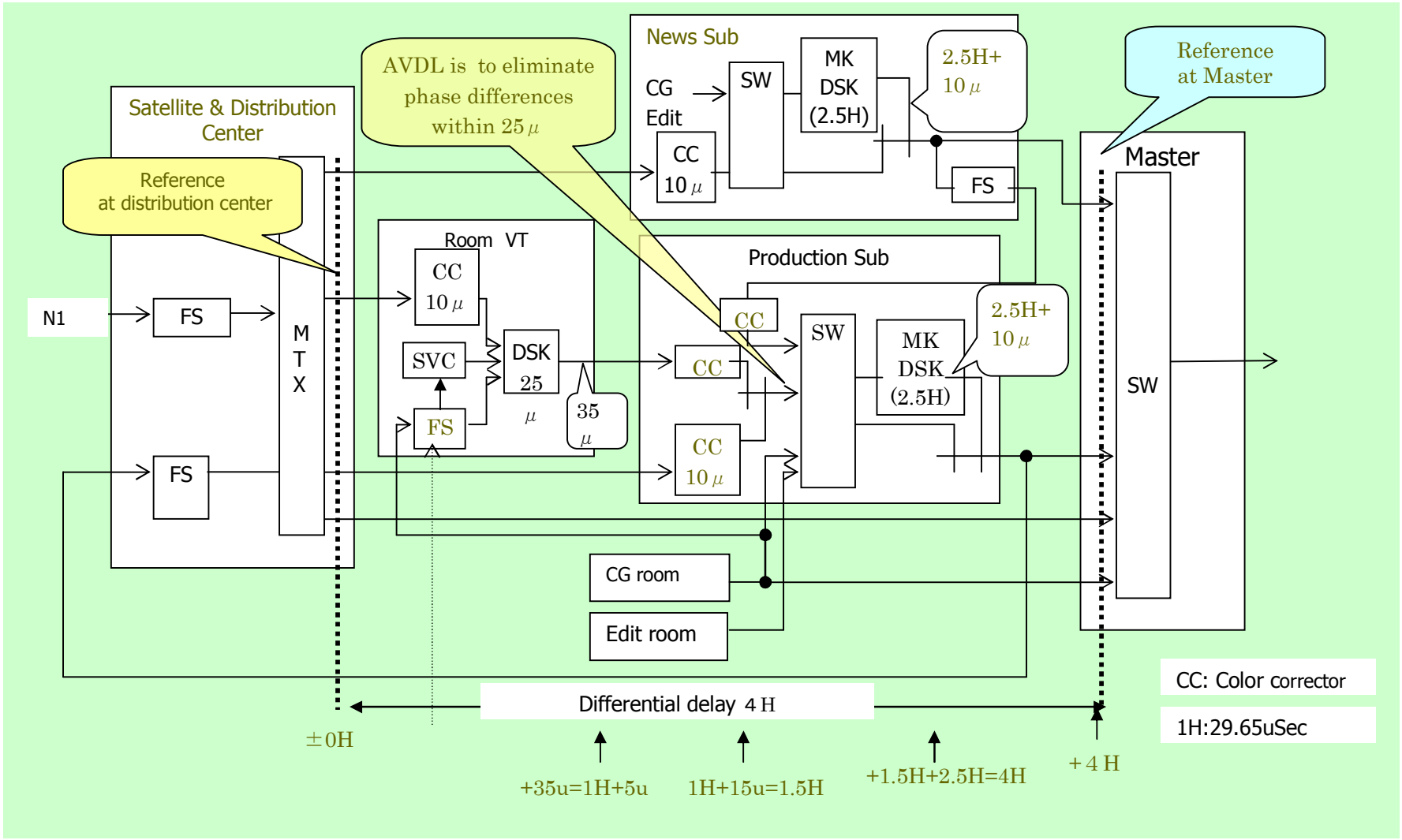
tv asahi

System phase delay management 1

1. HD signal is primary used in the house.
2. In the house, the signal from the distribution center is the least and the signal from the studio is the most delayed.
   Because the studio equipments such as switcher, MK/ DSK, color corrector generate latency.
3. To maintain seam-less switching at the studio, input signal to switcher should be no phase delay difference.
4. AVDL (Automatic video delay line) is the device to cancel the phase differences automatically.

tv asahi

System phase delay management 2

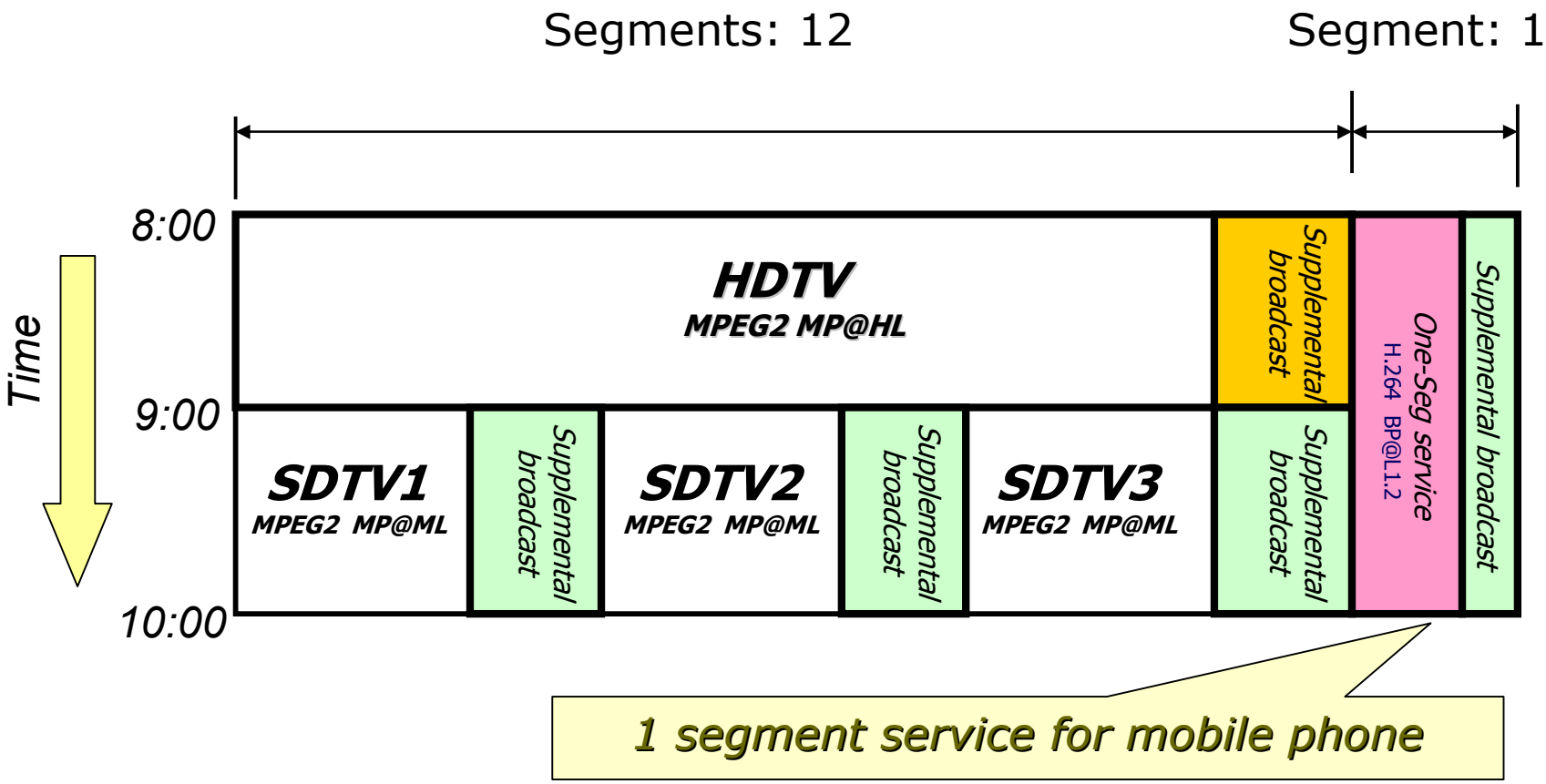


Master system

Requirements of Master System

- Multi format solution
  - rate-free matrix 1080i/720p/480p/480i
- Multi channel solution
  - up to three SD programs
- High reliability
  - three redundant system
  - current/backup/test or maintenance
- High flexibility
  - Easy expansion and renovation
- Effective use of servers
  - CM server/program server/CG server

Required applications



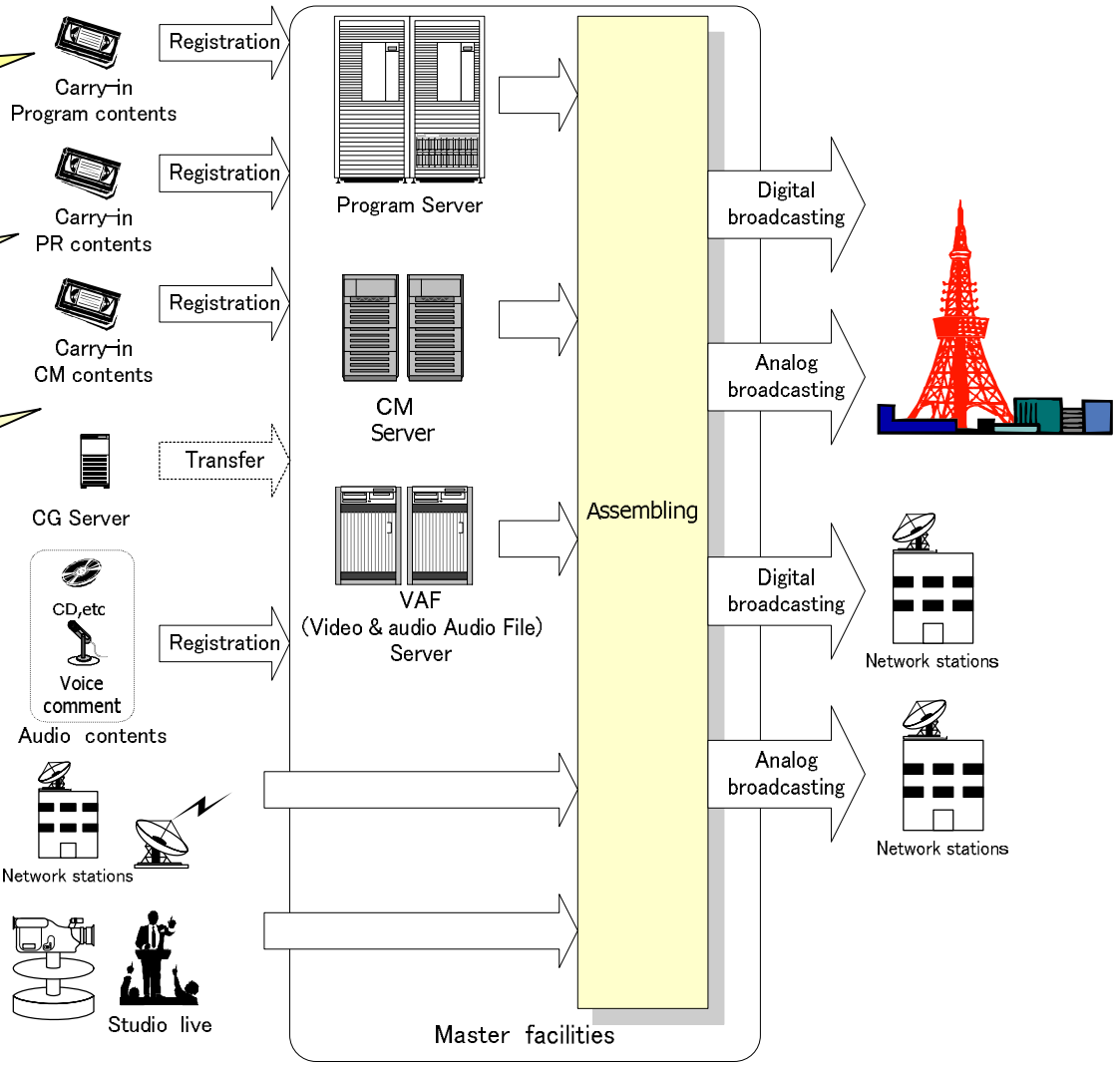
Conceptual diagram of Master

Carry-in Guideline
VTR format:
D2/HDCAM/HDCAM-SR/digital β cam/HD-D5 are acceptable.

Program Server:
Pinnacle systems
MSS900
HD 120H or SD 300H
Raid 3

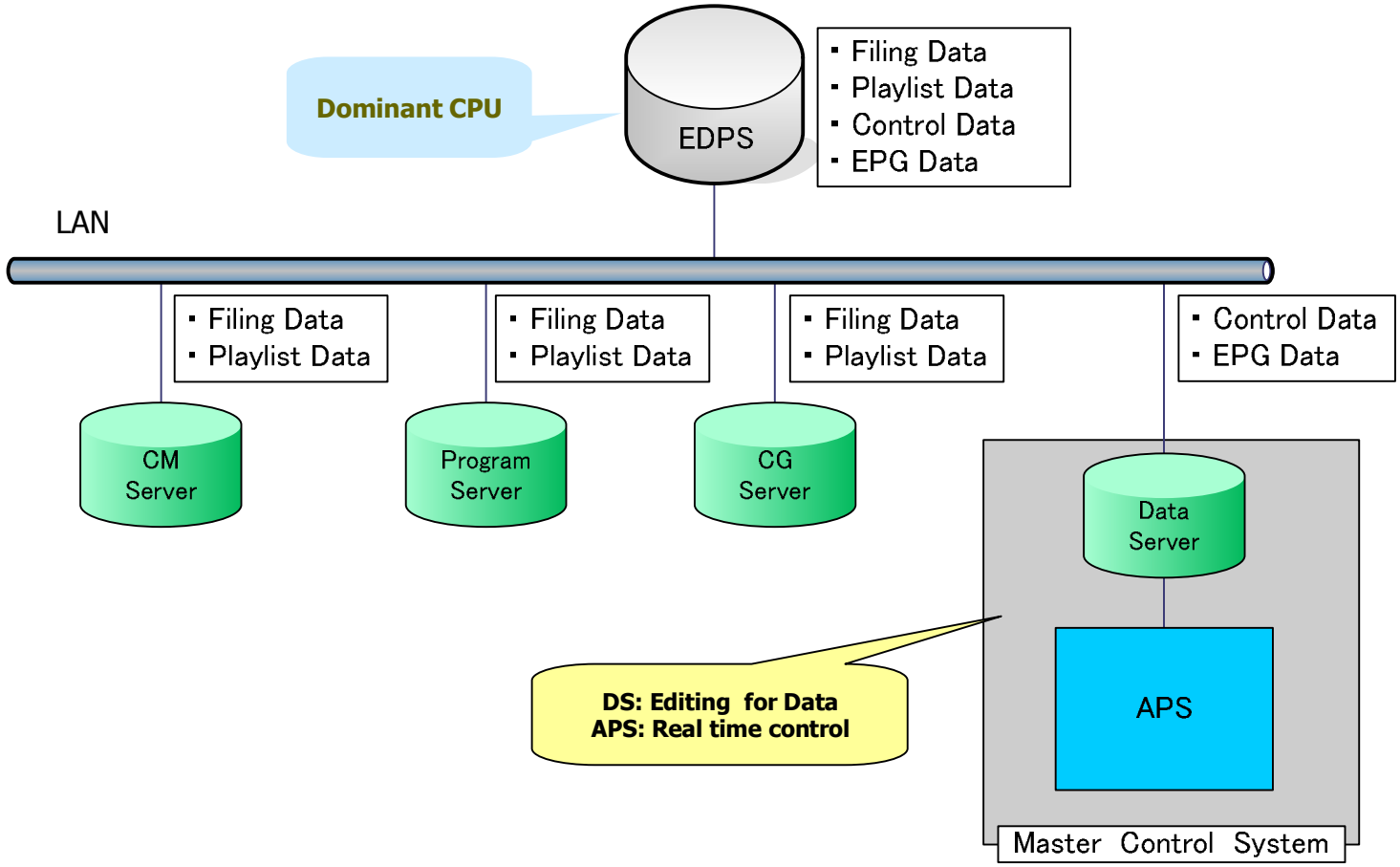
CM Srever:
Sony MAV-2000
HDx1 72H
SDx1 90H
M-Raid 6

VAF system:
Toshiba VIDEOS
Flush memory
Still picture 3600 frame
.tif format
Motion 30min
Audio 8H
.wav format
Audio format:
MIC/CD/DAT/MO/6mm



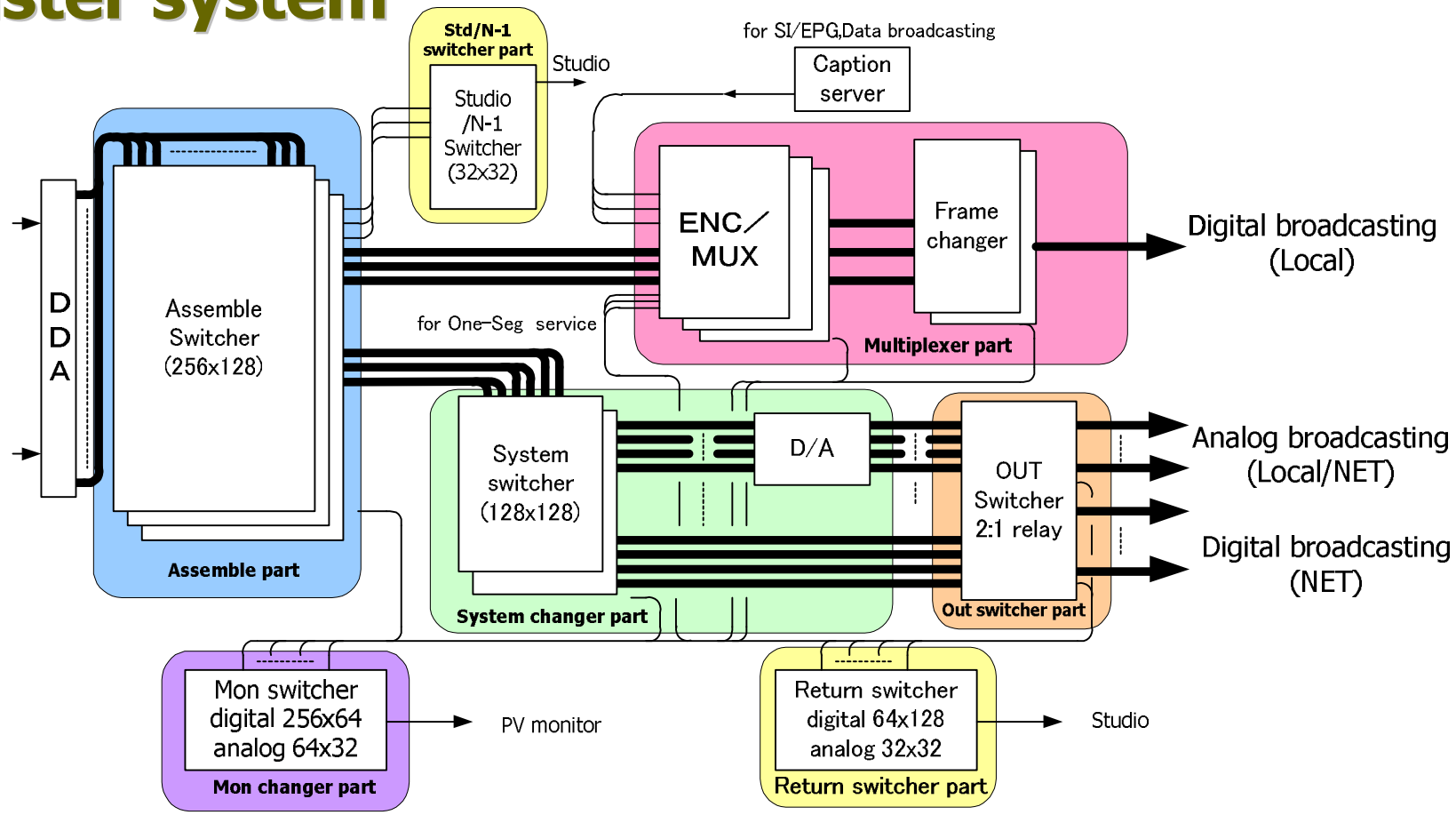
Conceptual diagram

EDPS (management of business & broadcasting data processing system) manages program and CM material data.



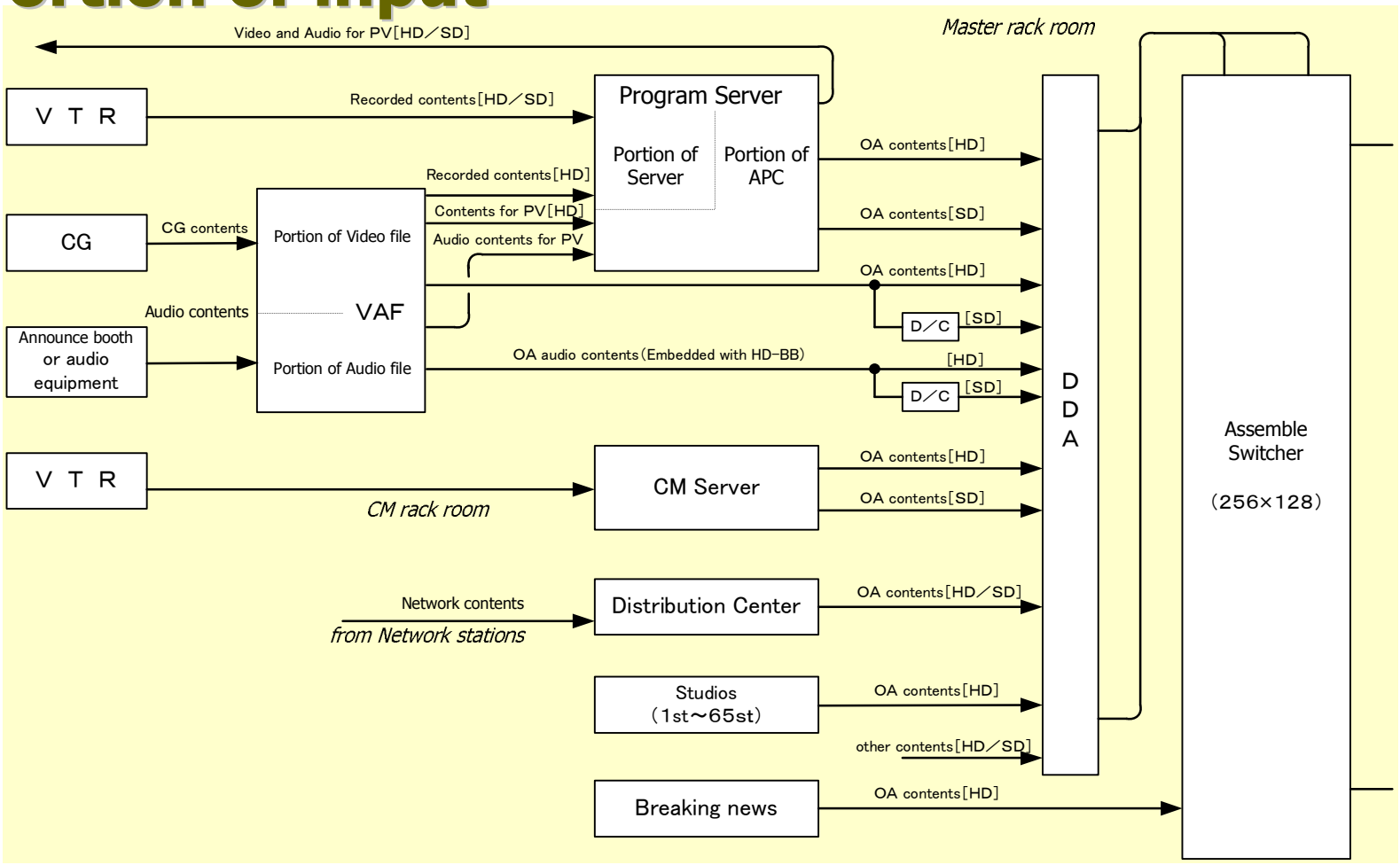
Conceptual diagram

Master system



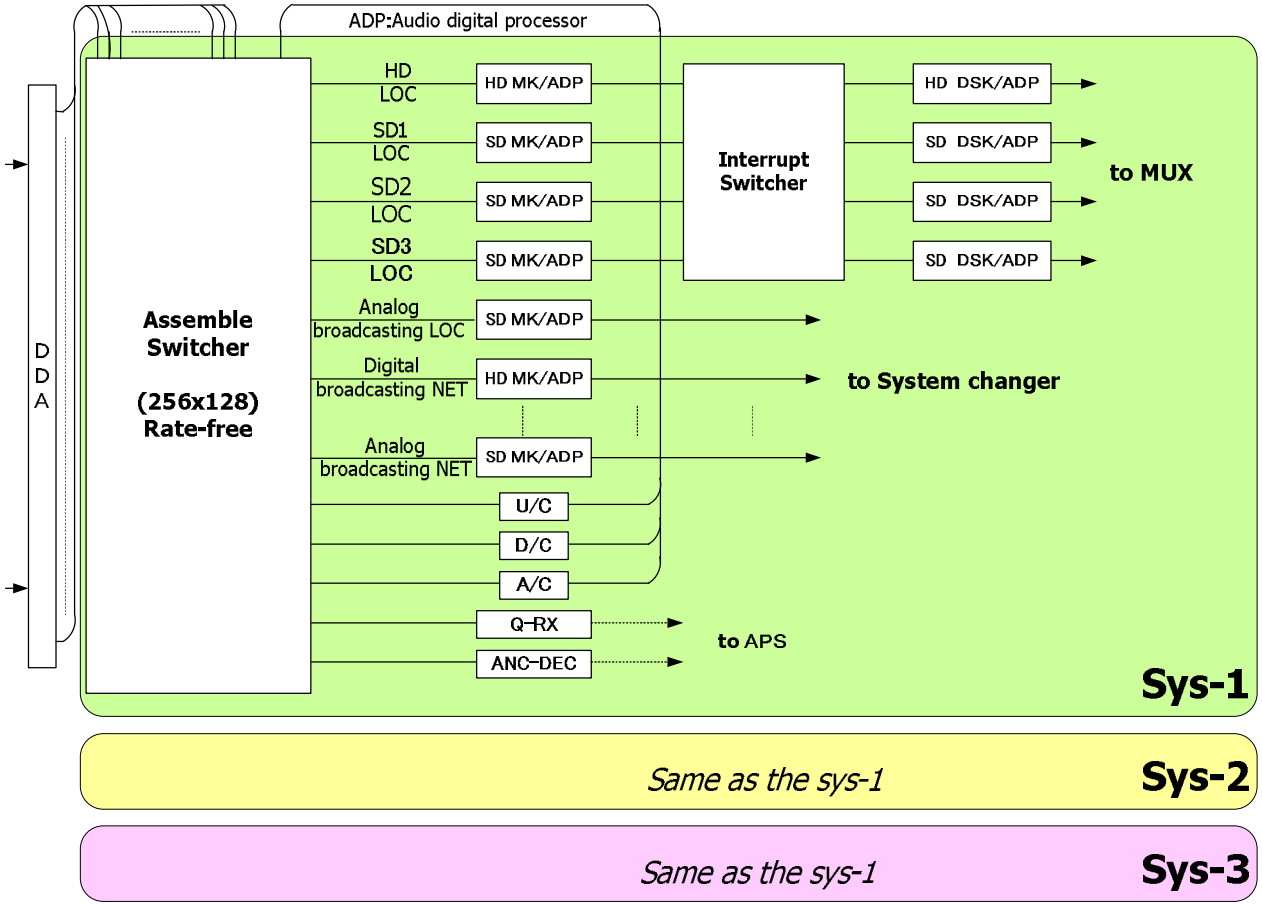
Conceptual diagram

Portion of input



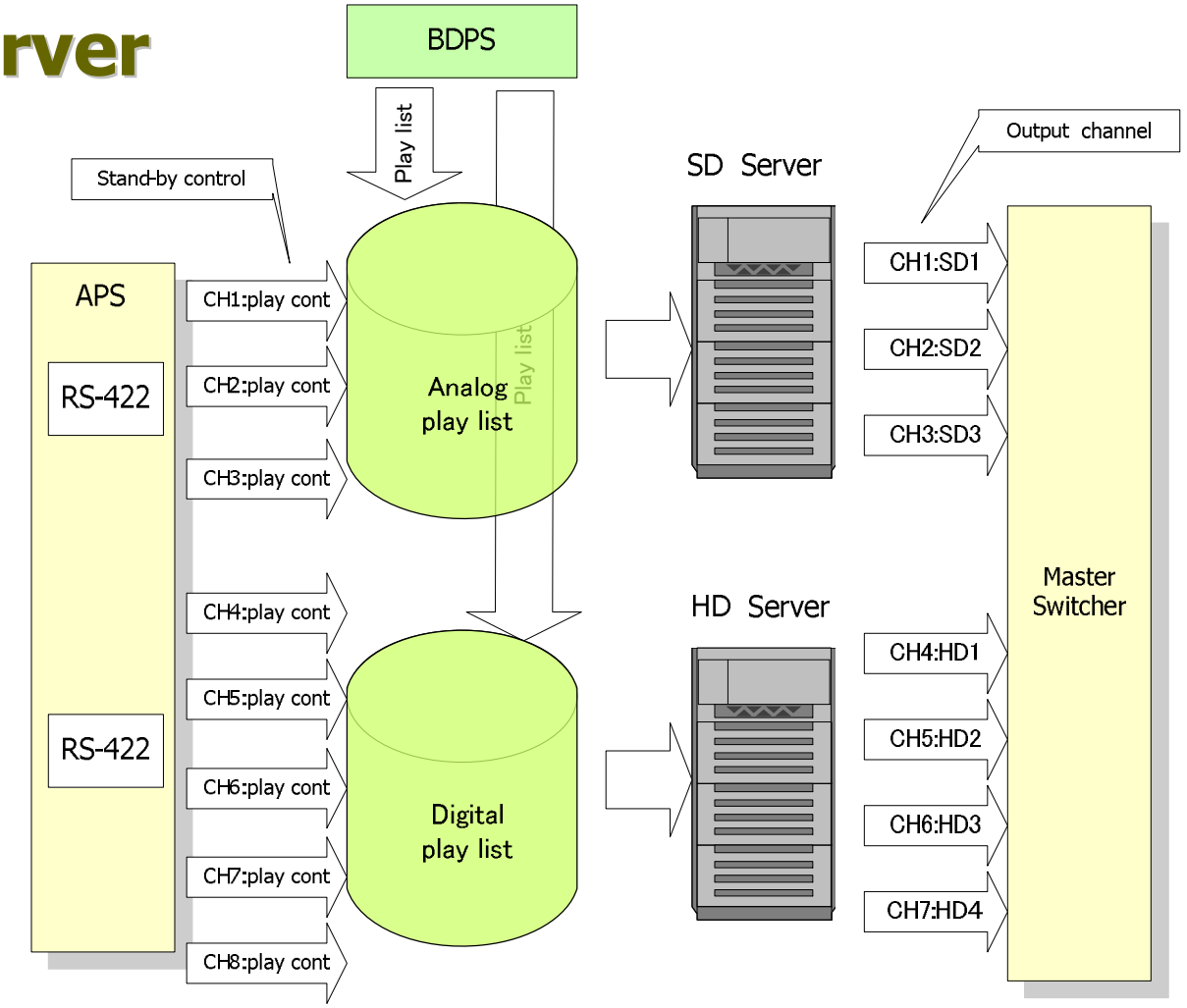
Conceptual diagram

Portion of assembling



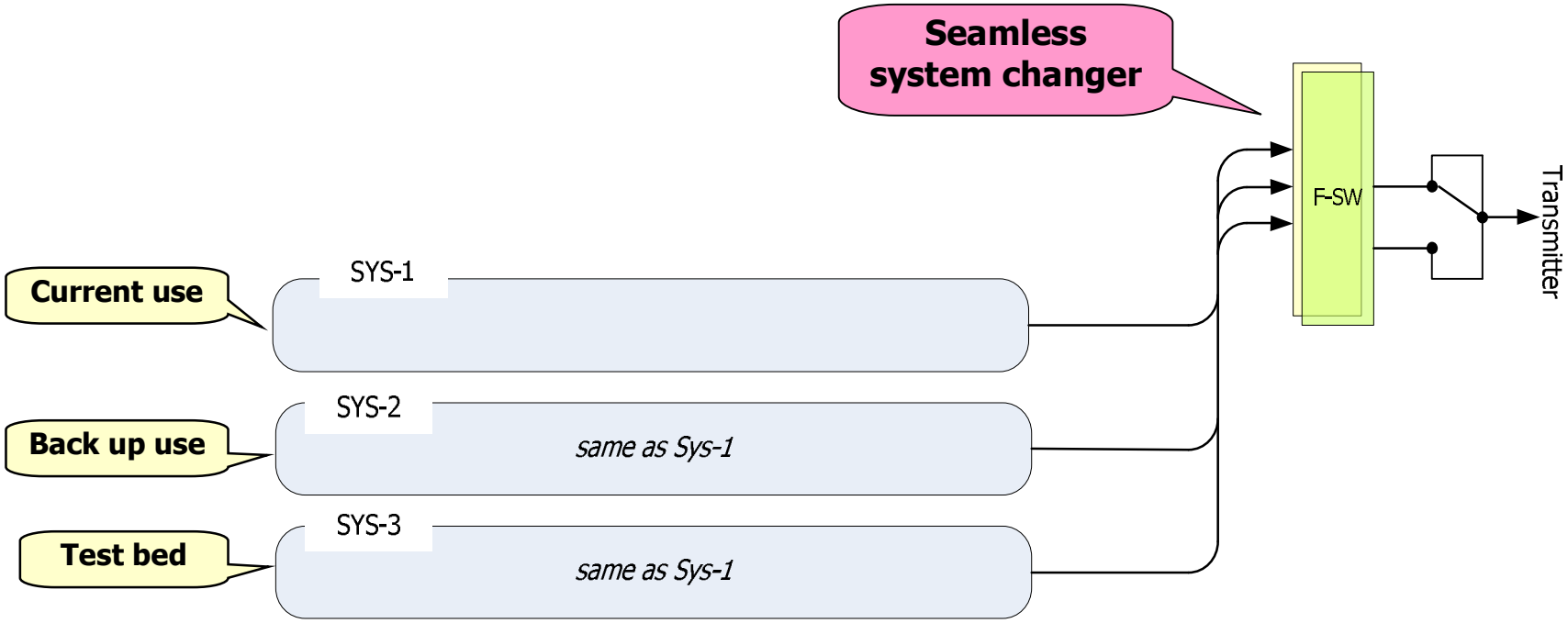
Conceptual diagram

CM Server



Three redundant system

Provision of test environment is essential in the age of digital.



HD/SD switching failure

TV Asahi's master system conforms with ARIB STD B21"Receiver for digital broadcasting", appendix 1"the method of switching the video format".

Therefore, seamless switching is assured even HD to SD or from SD to HD program.

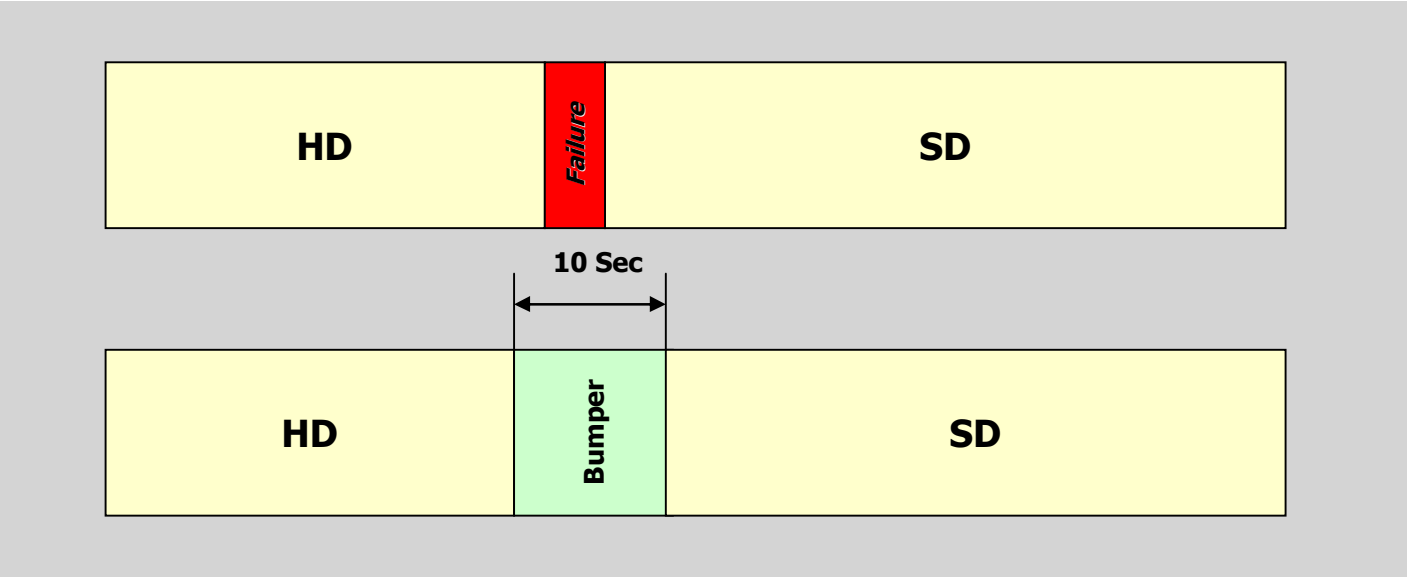
However, unfortunately it is true that seamless-switching-incapable receivers are in the marketplace.

To prevent video failure for the non-standard receivers, TV Asahi provides "Guideline of carrying in contents ".

HD/SD switching failure

TV Asahi's guideline of carrying in contents: "to prevent switching video failure".

10 second bumper such as no value picture is required to be inserted between SD and HD program.



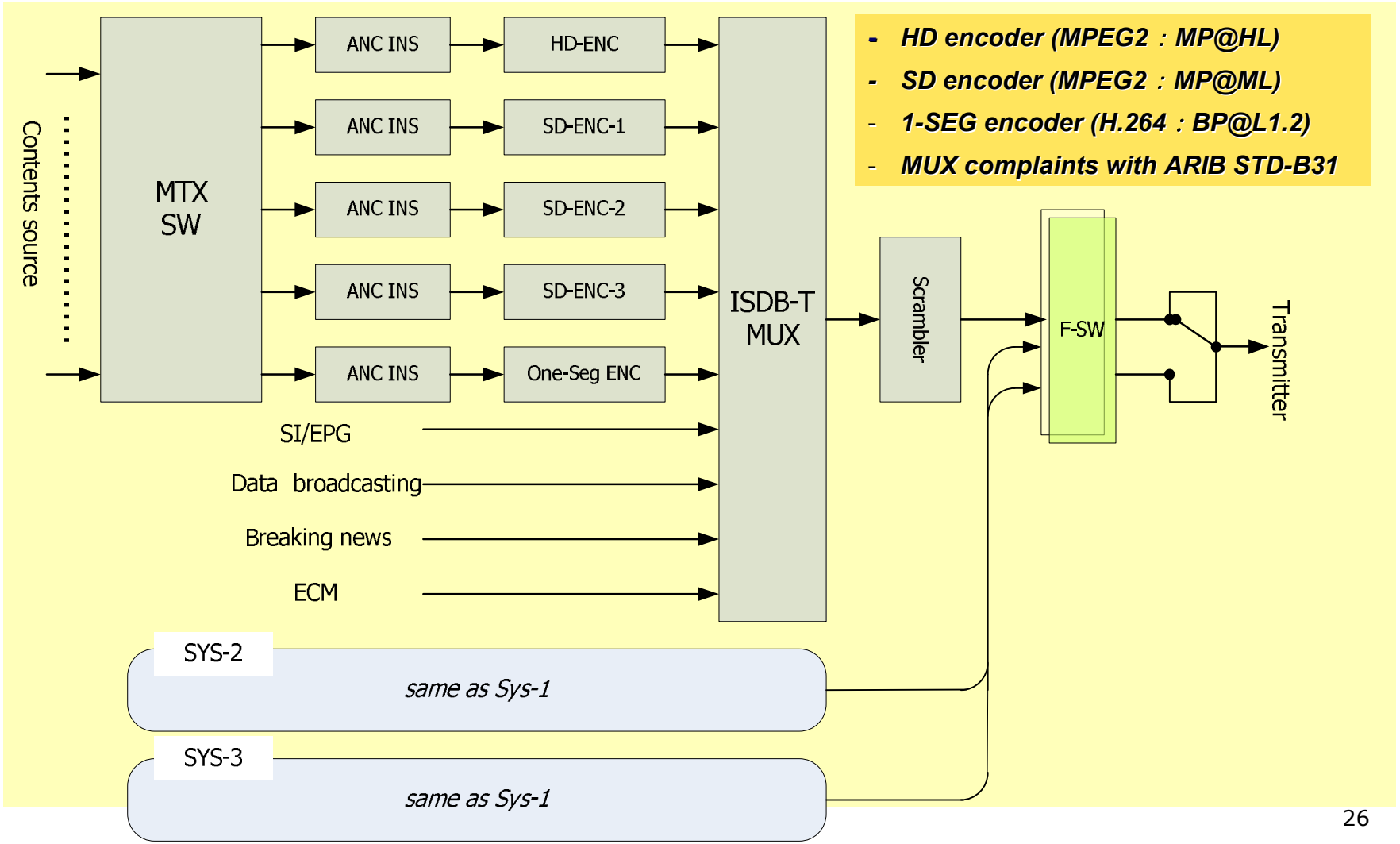
tv asahi

APS (Automatic program control system)

Feature

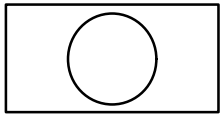
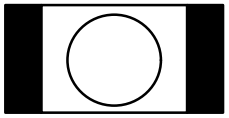
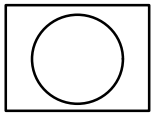
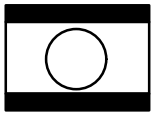
- Assembling and delivery
- Rate-free matrix for assembling
- Format conversion with D/C, U/C
- Aspect conversion with A/C
- Embedded audio processing
- Caption broadcasting
- Data broadcasting

Encoder , MUX


Contents source
MTX SW
ANC INS
HD-ENC
ANC INS
SD-ENC-1
ANC INS
SD-ENC-2
ANC INS
SD-ENC-3
ANC INS
One-Seg ENC
SI/EPG
Data broadcasting
Breaking news
ECM
ISDB-T MUX
Scrambler
F-SW
Transmitter
SYS-2
same as Sys-1
SYS-3
same as Sys-1
- HD encoder (MPEG2 : MP@HL)
- SD encoder (MPEG2 : MP@ML)
- 1-SEG encoder (H.264 : BP@L1.2)
- MUX complaints with ARIB STD-B31

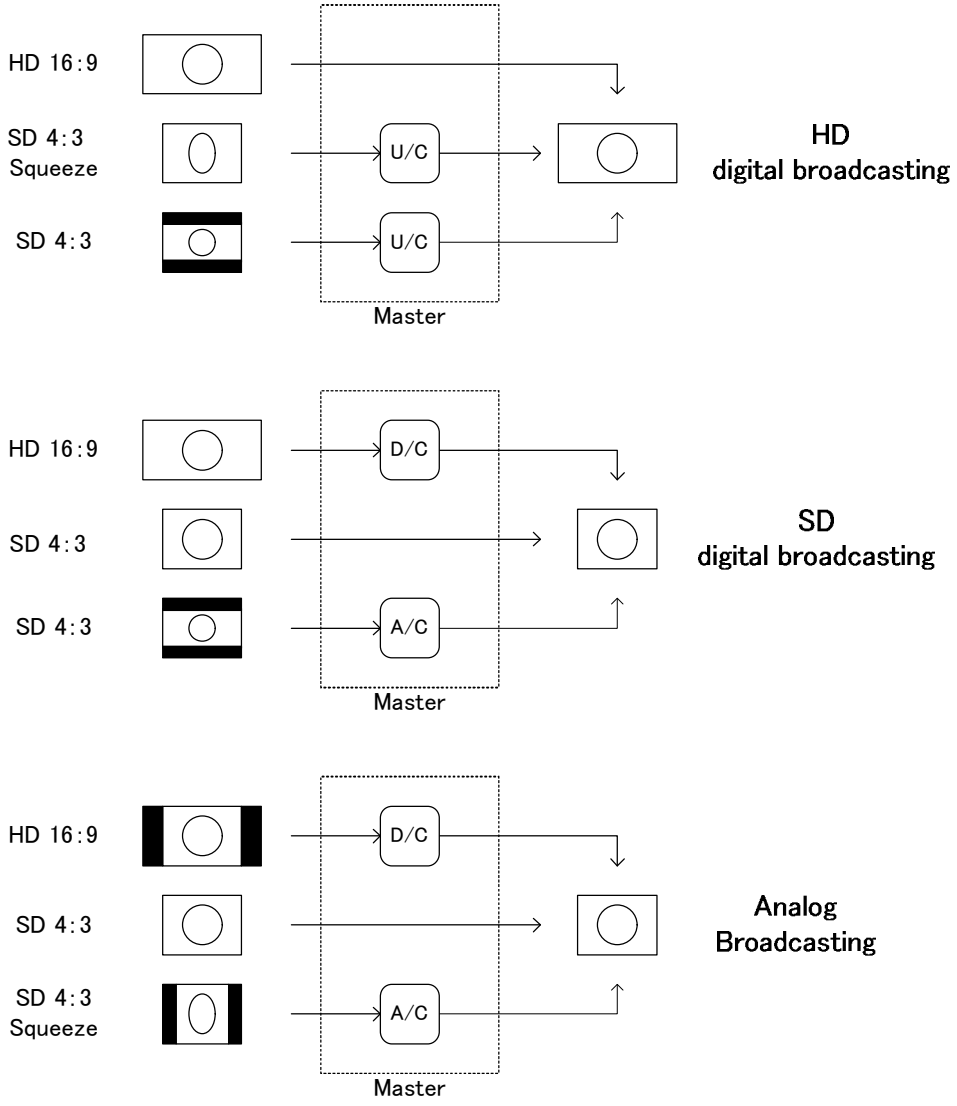
Aspect ratio converter 1

Example of aspect converting

Input format			Output format		
Format	Aspect ratio	Sample picture	HD 1080i	Analog	
				no designation	designation
HD	16:9		No operation	D/C letter box	D/C side cut
	4:3		No operation	D/C side cut	no request
SD	4:3		U/C side panel	No operation	no request
	16:9		U/C vertical clearance	No operation	no request

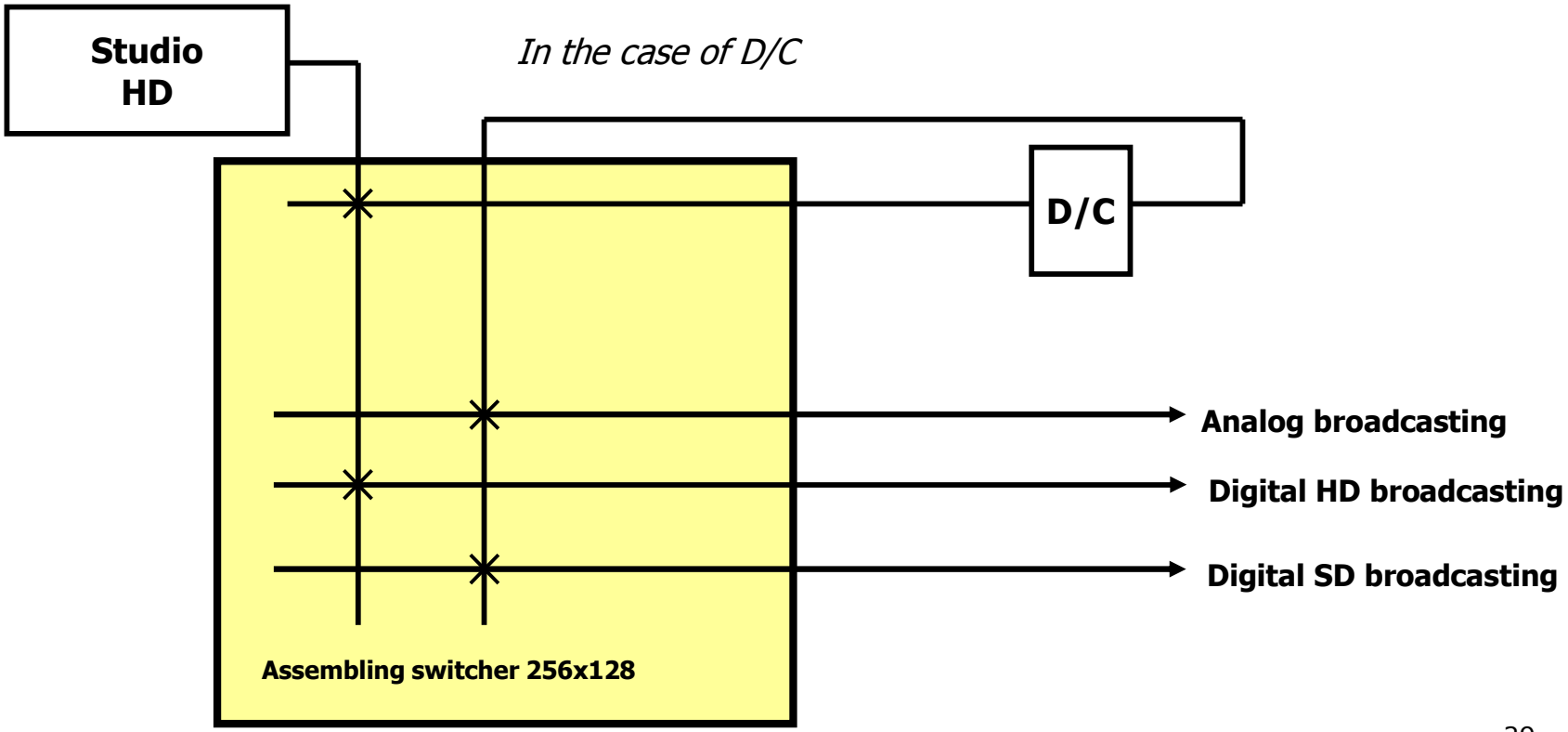
tv asahi

Aspect ratio converter 2



Re-entry switcher

To eliminate the pre-switcher, TV Asahi introduced re-entry switcher. Re-entry is effective for compact size of system.



Test environment is essential factor

Necessity of redundant system and test environment

In the digital broadcasting age, test environment is essential factor .

Because in contrast with analog signal performance , TS signal performance is quite difficult to determine the reason of sudden failure.

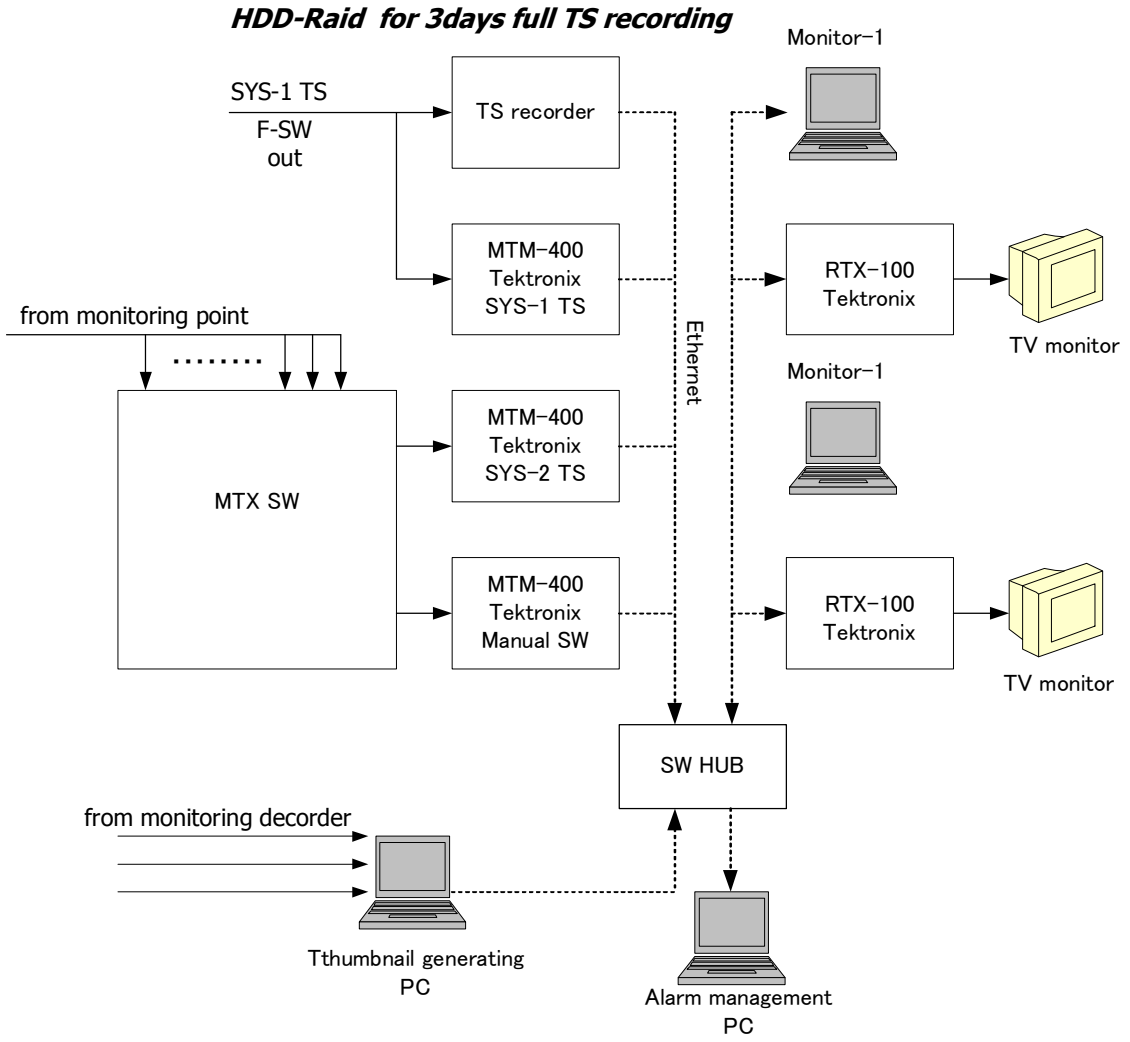
Therefore redundant system is essential, in the case of sudden failure, system change from current to back up is single correct answer.

Furthermore, system 3 is utilized as test bed for verification of event ignition time.

TS monitoring and recording system

MTM400

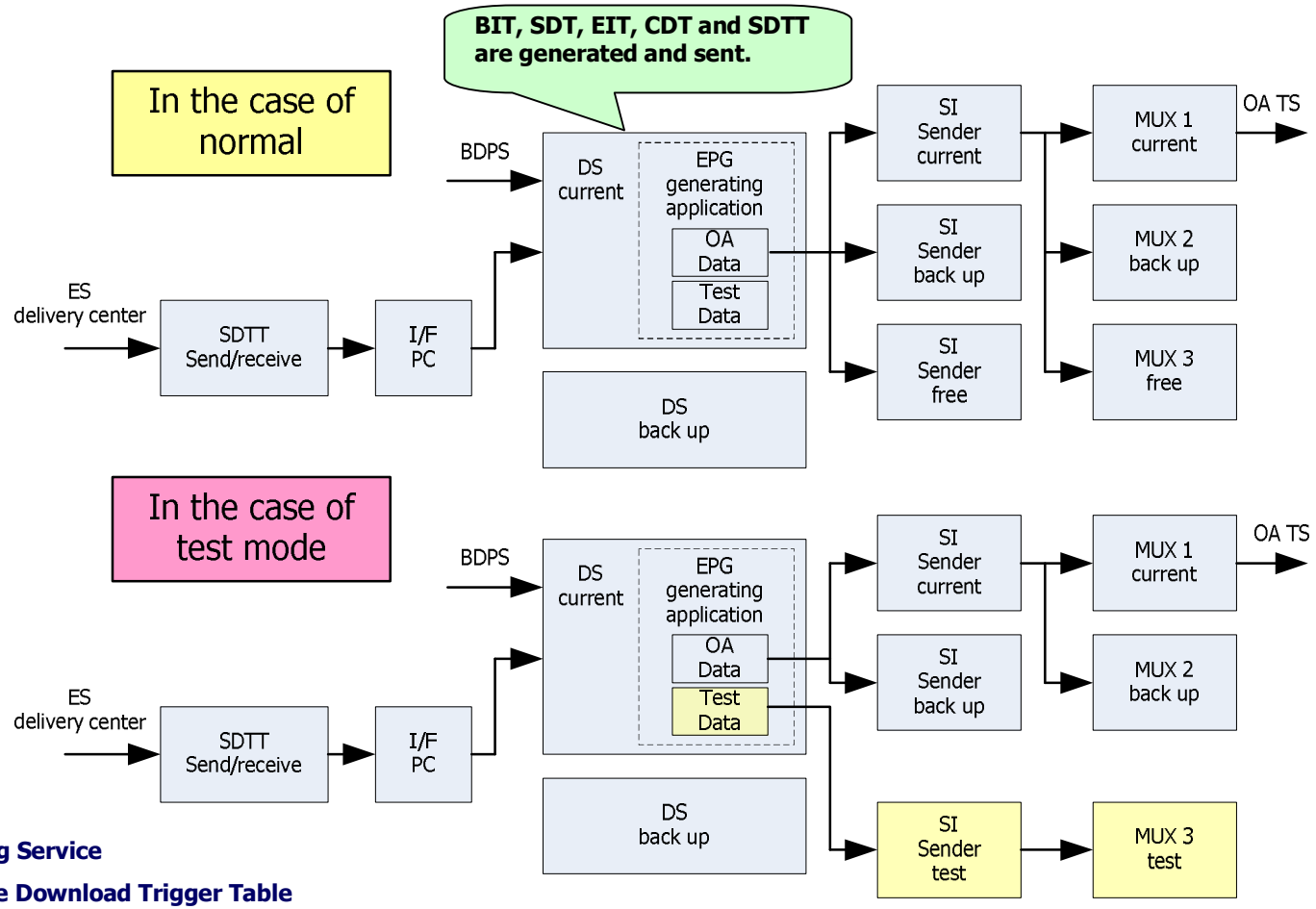
TS monitor



SI/EPG system

SI: Service Information

Various information designed to improve the convenience of program selection, specified by the ARIB standard.



ES : Engineering Service

SDTT : Software Download Trigger Table

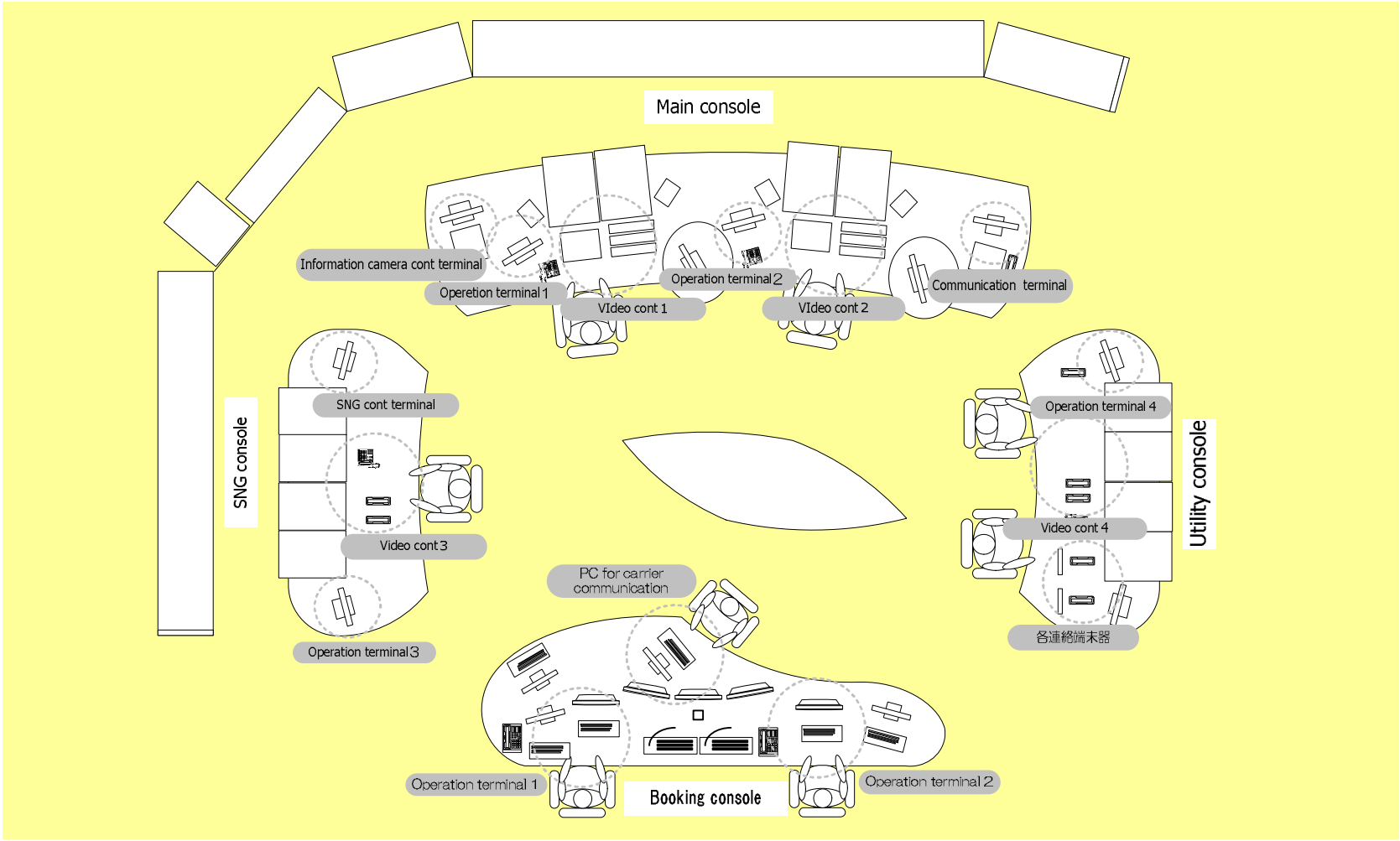
Contents distribution center

Design concept

- Centralized information management with any PC terminals.
- Realization of multitasking, such as coordinating of SNG, coordinating of FPU, booking for NTT lines, any other business.
- Comfortable environment for 24 Hours duties.
- Only embedded audio contents are acceptable by MTX.

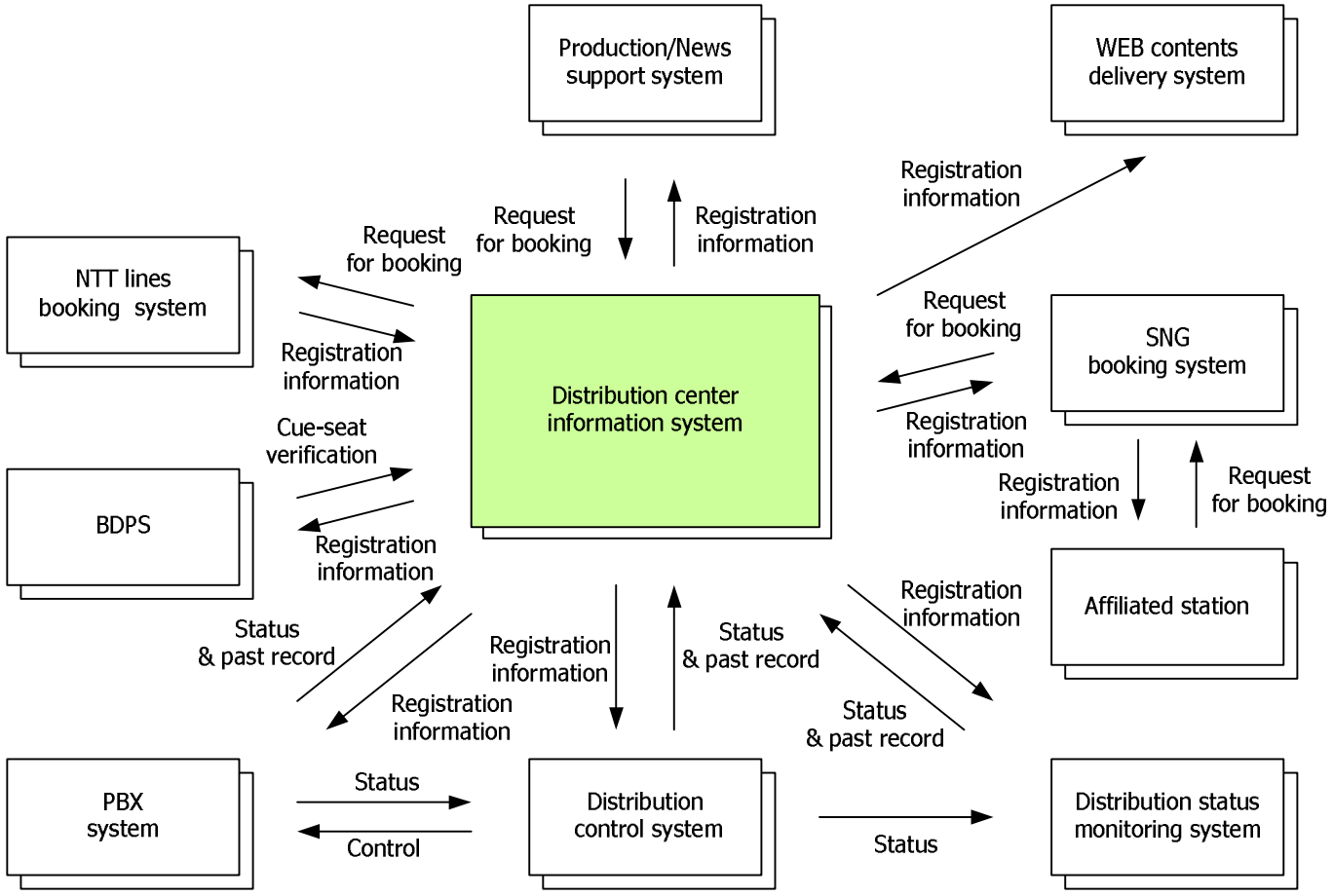
tv asahi

Layout of working area



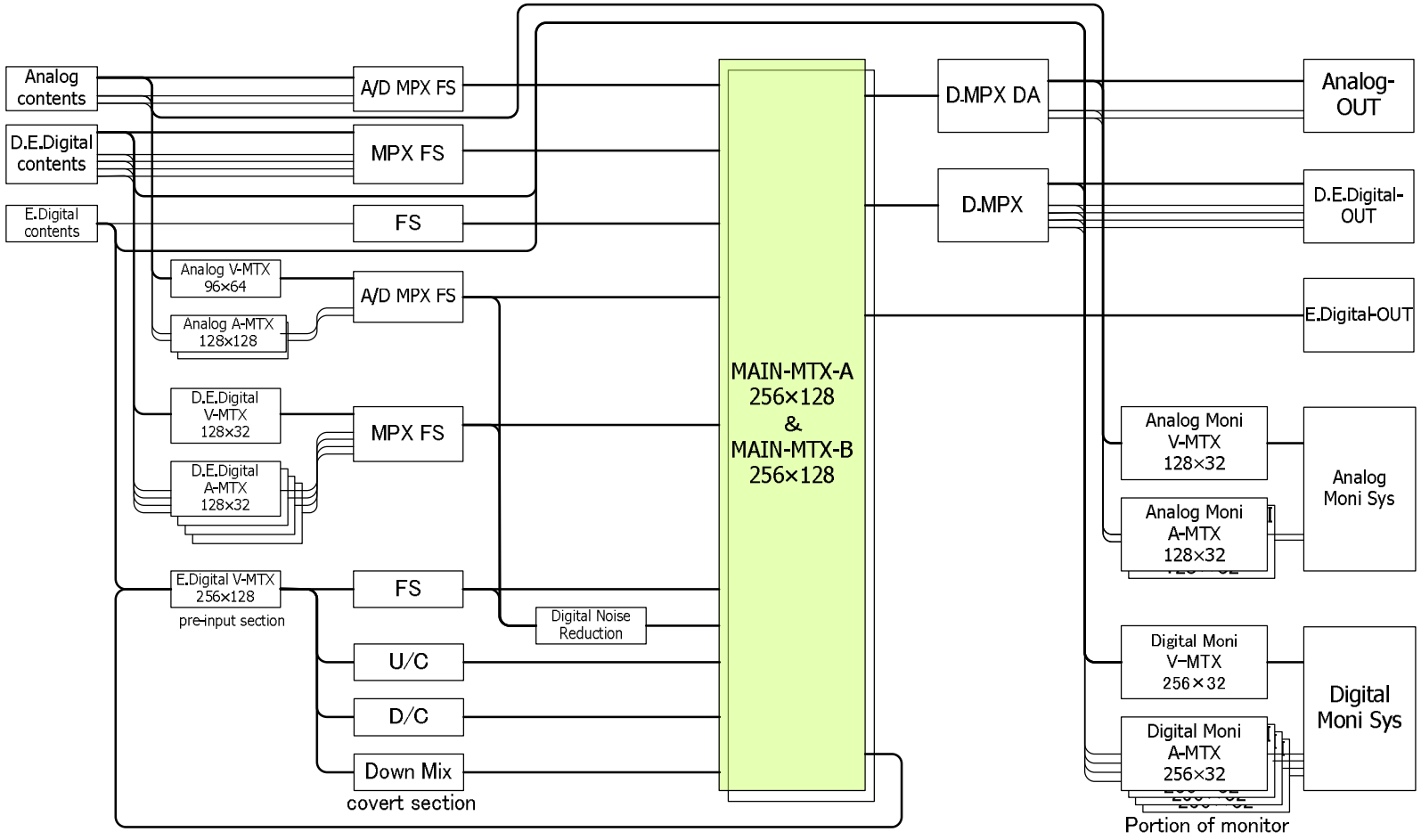
Conceptual diagram

Information management system



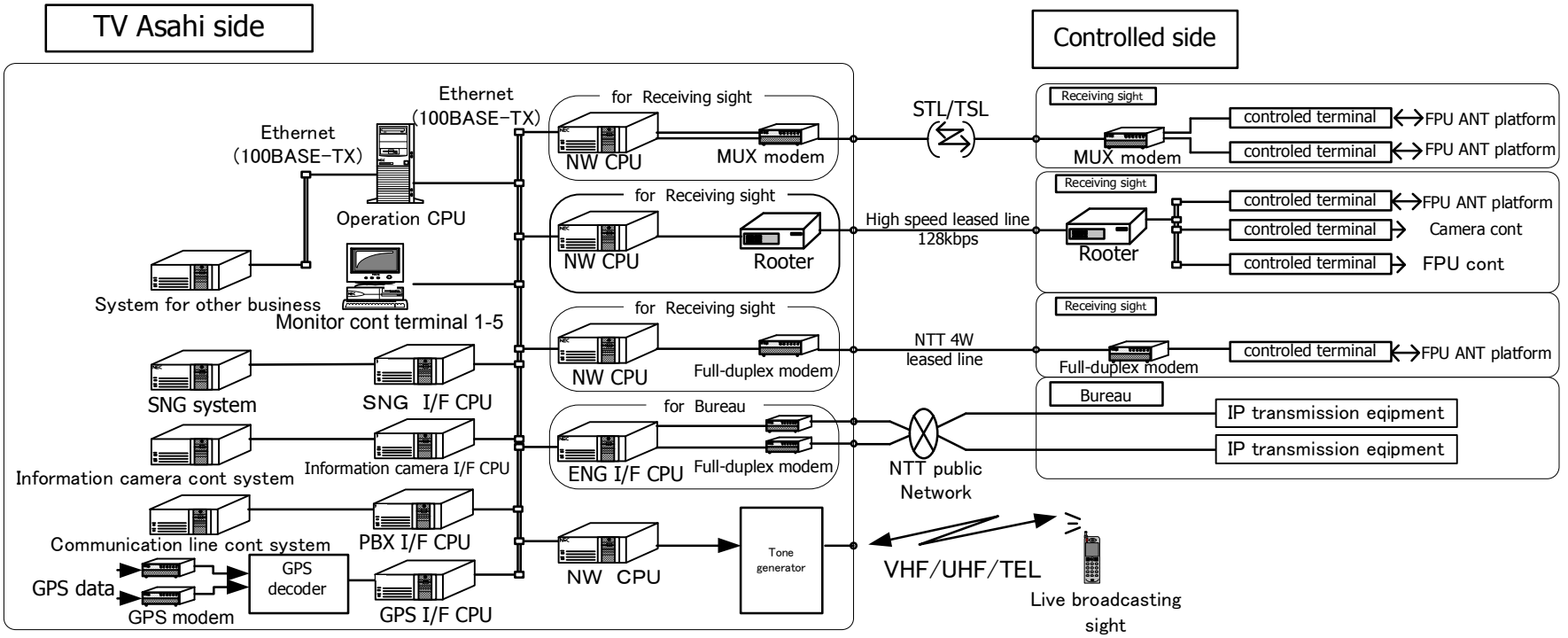
Conceptual diagram

Distribution system



Conceptual diagram

Control system network



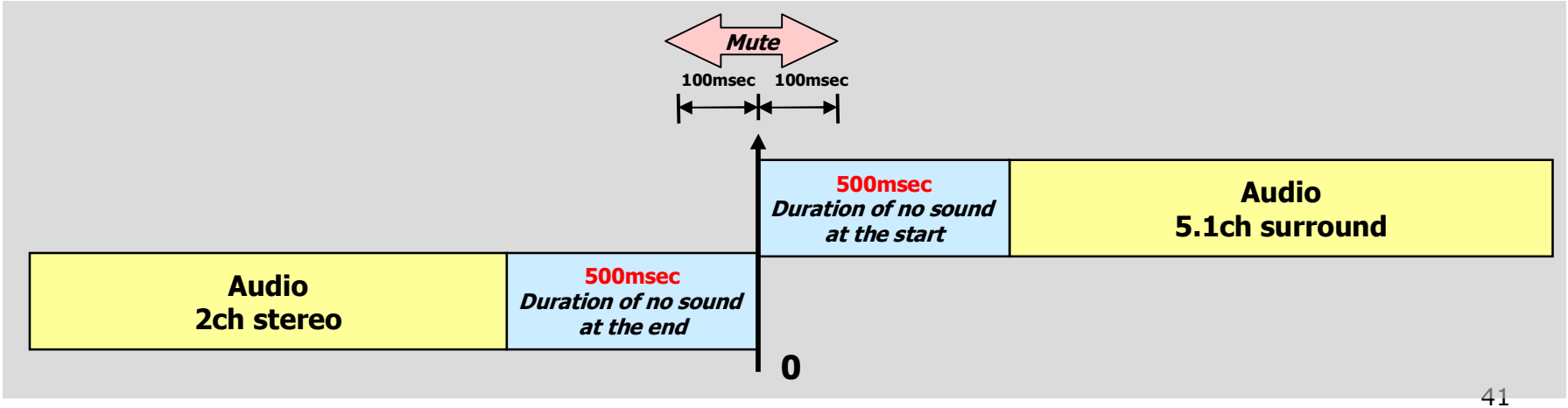
Audio production

Audio production concept

- Audio signal in house is HD-SDI, Fs 48kHz/24bit 8ch embedded , equivalent to AES/EBU 4ch.
- Audio signal is transferred to every studios via delivery center.
- All studio audio mixers are acceptable 5.1ch surround audio, that means all studios are equipped 8ch surround monitors.

5.1ch/stereo switching audio failure

- At the moment, audio switching takes 210msec of failure duration from stereo program to 5.1ch program or from 5.1ch program to stereo program.
- To prevent the switching failure, master insert mute signal for 200 mSec , in addition TV Asahi established "Guideline of carrying in contents " in order to incapable receivers. Guidelines require the duration of no sound area at the start and end of broadcasting contents.



STL

TV Asahi

Tokyo Tower

Microwave

For transmitting the television program from studio to transmission site, a transport stream studio-to-transmitter link (TS-STL) is primary used.
TS method is 64QAM modulated by ISDB-T format broadcasting TS signal.
This method gains the performance of less signal degradation.

Transmitter power	0.5W/1W/2W
Frequency deviation	within ±20ppm
Occupied bandwidth	below 7.6MHz
Modulation method	64QAM
Transmission rate	below 40.2Mbps

Optical cable

STL via optical cable

Optical transmitter is available to transmit OFDM signal from studio to transmitter site via optical cable.

- **10-200MHz Bandwidth.**
- **QAM, PSK or OFDM signal transmission is available.**
- **Long haul transmission - Optical loss budget is 25dB.**
- **Fully manageable through Simple Network Management Protocol (SNMP).**
- **Having console port for setup and monitoring parameters.**
- **Web-GUI inside- Setup and monitoring parameters from usual Web-browser.**

THE FURUKAWA ELECTRIC CO., LTD.

Requirement of SFN relay station

- To implement SFN relay station, following requirement must be met in order to establish synchronism between station-to-station.
- IFFT sample frequency should be synchronized with the studio and the broadcasting station ,or among the broadcasting stations.
- Synchronized methods are as follows;

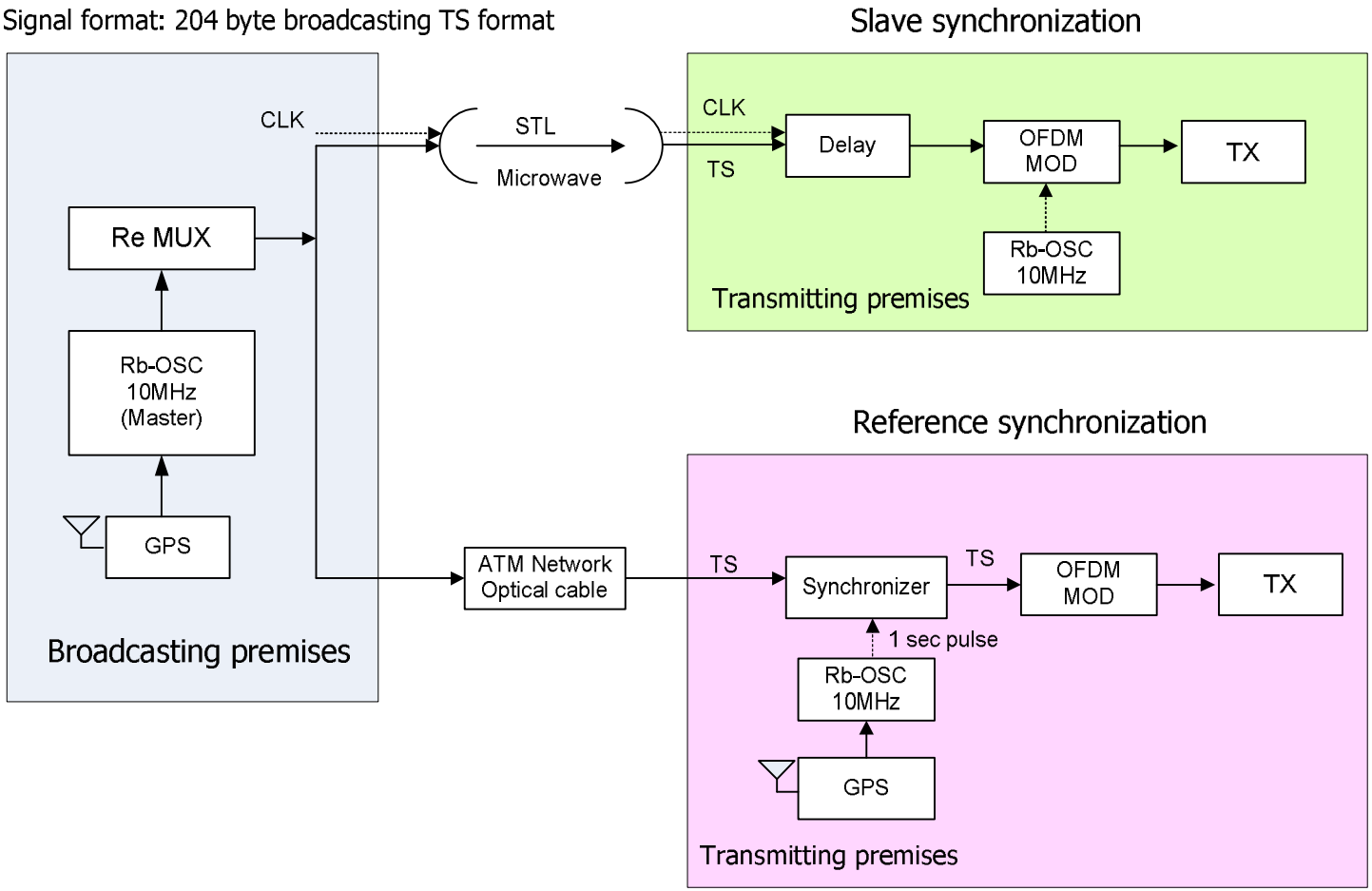
1. Slave synchronization

   The clock of modulator in each transmitter is synchronized to the clock of MUX in studio.

2. Reference synchronization

   This method synchronizes the studio and all the broadcasting stations by GPS other than the terrestrial digital broadcast wave.

Synchronized methods



tv asahi

Digital television broadcasting optical fiber network

Digital television broadcasting network

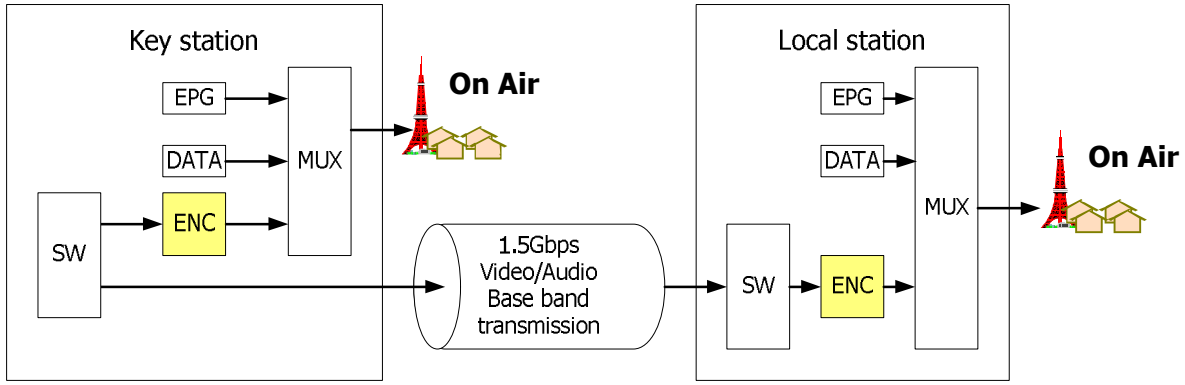
The National Association of Commercial Broadcasters in Japan (NAB) is an incorporated organization whose membership consists of commercial broadcasters in Japan.

To establish the infrastructure of the relay service from key station to affiliated network stations, NAB has nominated NTT communications (NTT Com) as main carrier in 2002.

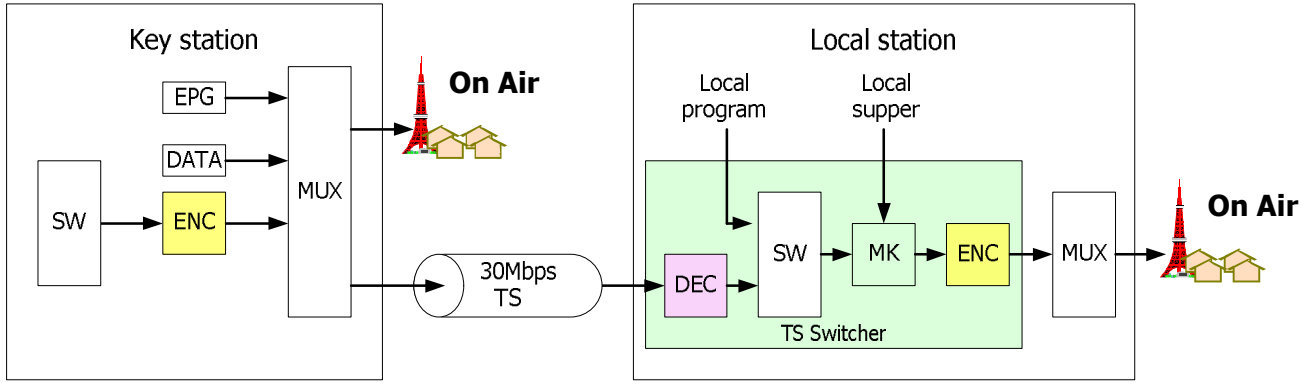
NTT showed us the solution of "17Gbps backbone ATM network".

Digital television broadcasting network

Base band transmission



Broadcasting TS transmission



tv asahi

Commercial broadcast requirement

- Base band transmission: Commercial broadcasts
  Non-Compressed HD-SDI
  less delay
  network running cost ⇨ High
  easy production
- Broadcast TS transmission: NHK
  Broadcast TS
  much delay
  network running cost ⇨ Low

Service menu

HD non-compressed HD-SDI 1.483Gbps

Audio signal is embedded : Fs 48kHz/24bit max 8ch , equivalent to AES/EBU 4ch

SD non-compressed SD-SDI 425Mbps

Audio signal is embedded : Fs 48kHz/24bit max 8ch , equivalent to AES/EBU 4ch

HD compressed HD-SDI 151Mbps

Audio signal is embedded : Fs 48kHz/24bit max 8ch , equivalent to AES/EBU 4ch

NTSC non-compressed (analog) 143Mbps

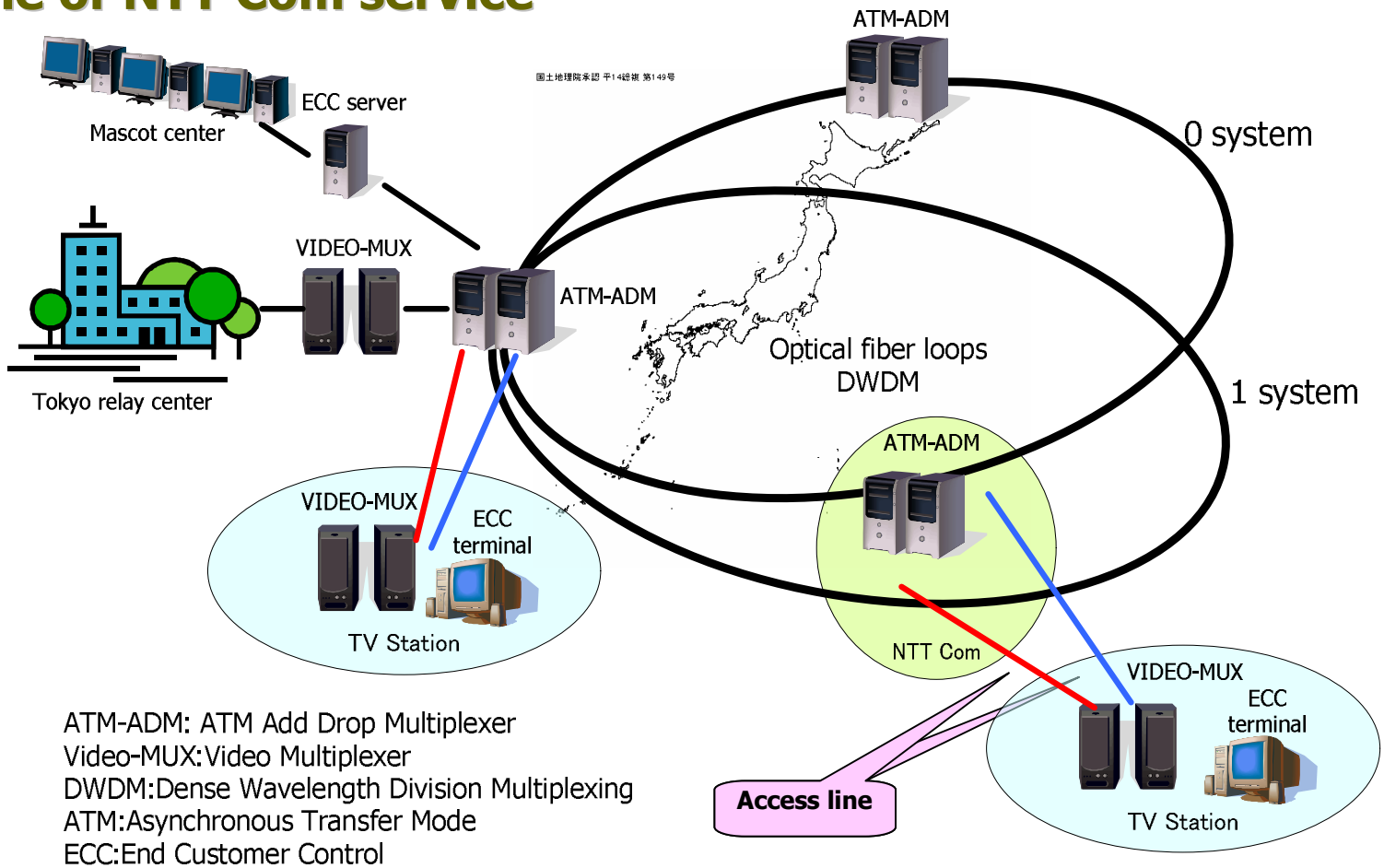
NTSC compressed 61Mbps

DVB-ASI 120Mbps

DVB-ASI for data broadcasting 8Mbps

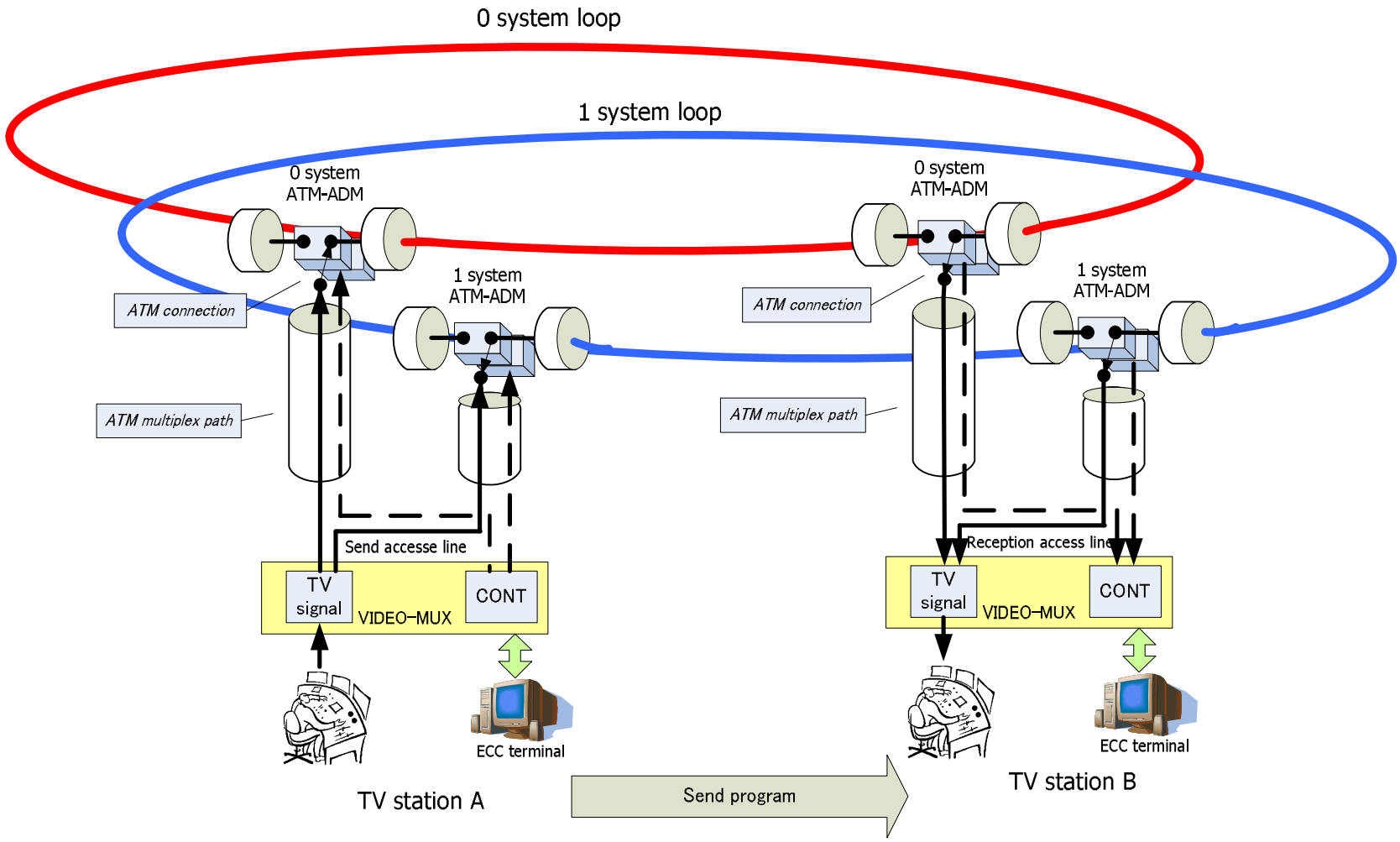
NTT Com service

Outline of NTT Com service

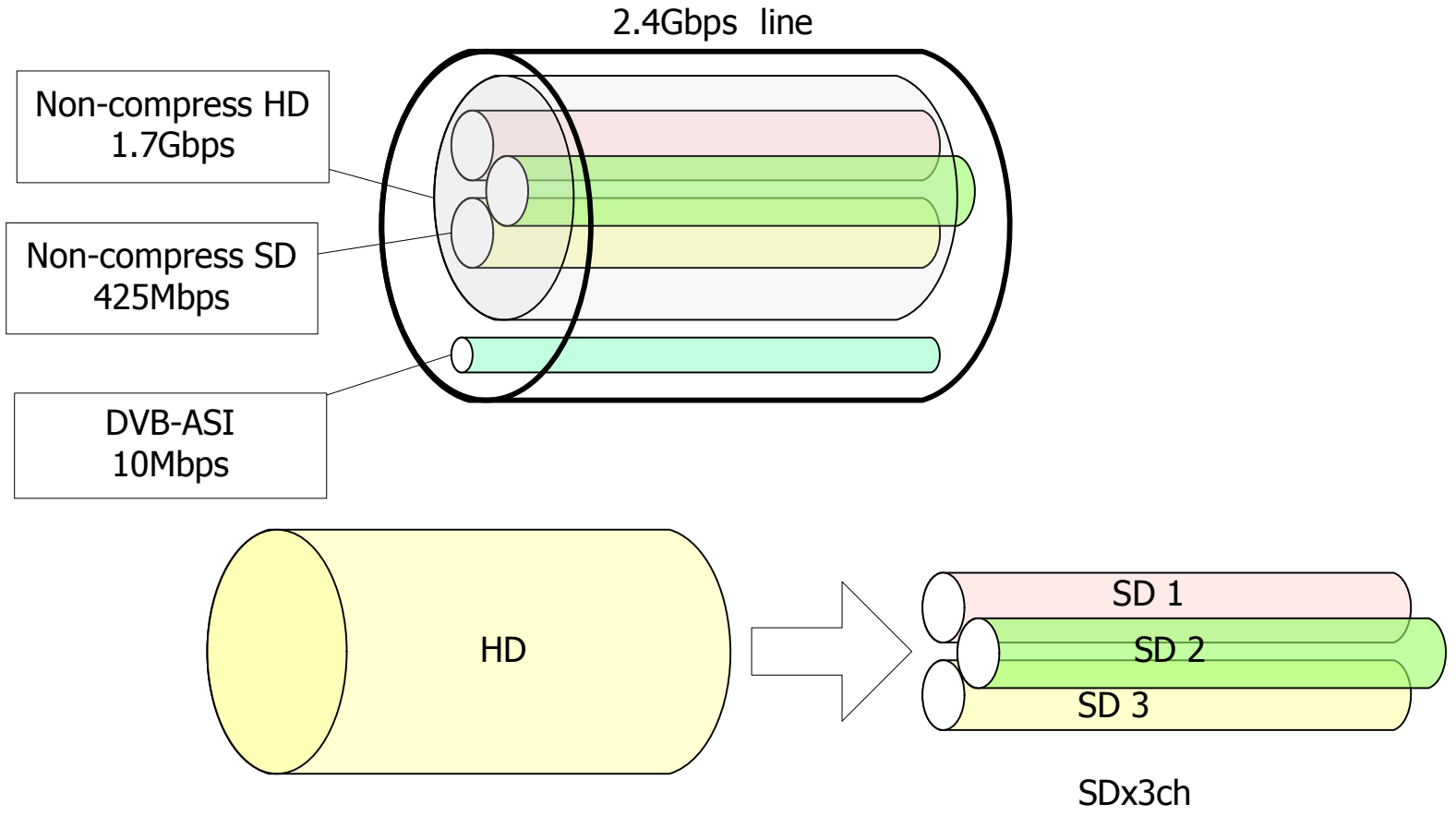


ATM-ADM: ATM Add Drop Multiplexer
Video-MUX:Video Multiplexer
DWDM:Dense Wavelength Division Multiplexing
ATM:Asynchronous Transfer Mode
ECC:End Customer Control
MASCOT:Digital-Multiplex Assignment & Control of Television Network

Access line


0 system loop
1 system loop
0 system
ATM-ADM
1 system
ATM-ADM
ATM connection
ATM multiplex path
Send accesse line
TV
signal
VIDEO–MUX
CONT
ECC terminal
TV station A
Send program
0 system
ATM-ADM
1 system
ATM-ADM
ATM connection
ATM multiplex path
Reception access line
TV
signal
VIDEO–MUX
CONT
ECC terminal
TV station B

Accommodation concept



SET 2007 congresso

Thank you
for your attention !
END

Digital Broadcasting Expert Group
http://www.dibeg.org
mail: info@dibeg.org