DiBEG
Digital Broadcasting Experts Group

Digital Broadcasting Facilities and System for DTTB

Part 1 ; Studio System for On Air

Oct. 14th 2004

Digital Broadcasting Expert Group (DiBEG)
Hiroshi MAEJIMA (NEC Corporation)

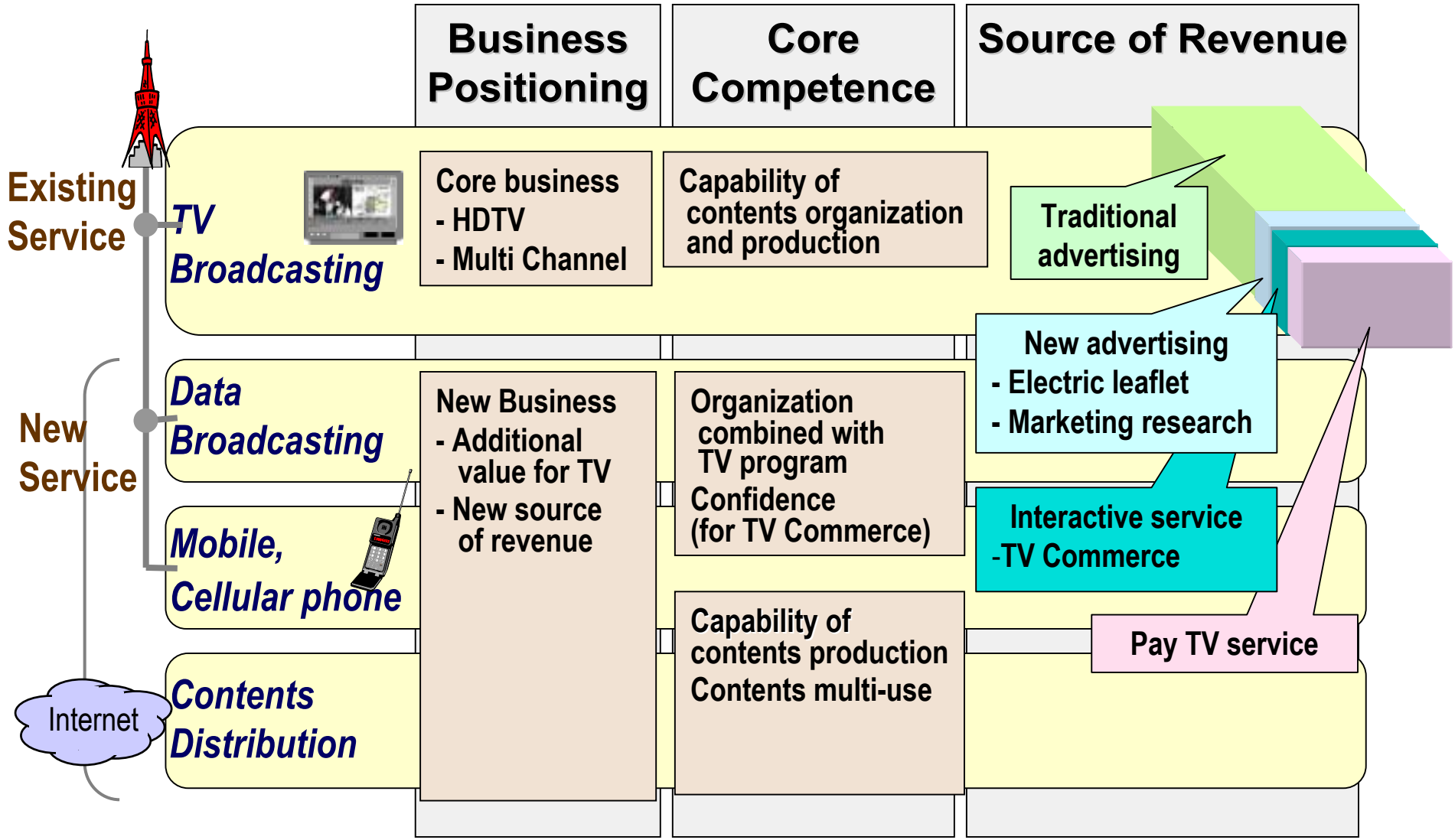
Introduction

Service and Business Revolution by Digital Broadcasting

	Analog Broadcasting	Digital Broadcasting
Service		
·Number of Channel	Single Channel	Multi Channel
·Video Quality	Standard (SDTV)	+ High quality (HDTV)
·Communication	Casting	Interactive
·Target	Viewer	Customer
·Audience Action	Passive	Active
·Where	Home	Anywhere
Business		
·Source of Revenue	Sponsor (commercial station)	+ Subscriber, Industry
·Advertising Target	Mass	+ Segment, One to One
·Media	Broadcast	+ Interactive
·Potential	Low (Stability)	High

Convergence
Broadcast and Telecommunication by Digital

Business and Source of Revenue on Digital Terrestrial Broadcasting



Requirements for Station System in Digital Broadcasting

- Handling HD/SD program materials
- Compatibility with HD/SD mixed broadcasting and simulcast
- Flexibility for audio multi channel
- Compatibility with new services
- Affiliate network interface
- Efficient operations

Acquisition

Remote

Editing Information

Server

NLE

News Program

TV Network

Host Computer

Production

Contents Holders

Video Network

Studio Sub

News Program

Network & Asset Management

On Air System

Master Control Switcher

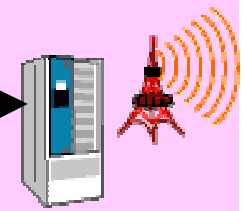
On Air Server

Router

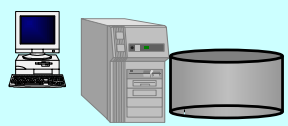
Encoder MUX

Data Broadcasting

Transmitter



Archive



Interactive Server

Contents Authoring Center

Distribution Server

Internet

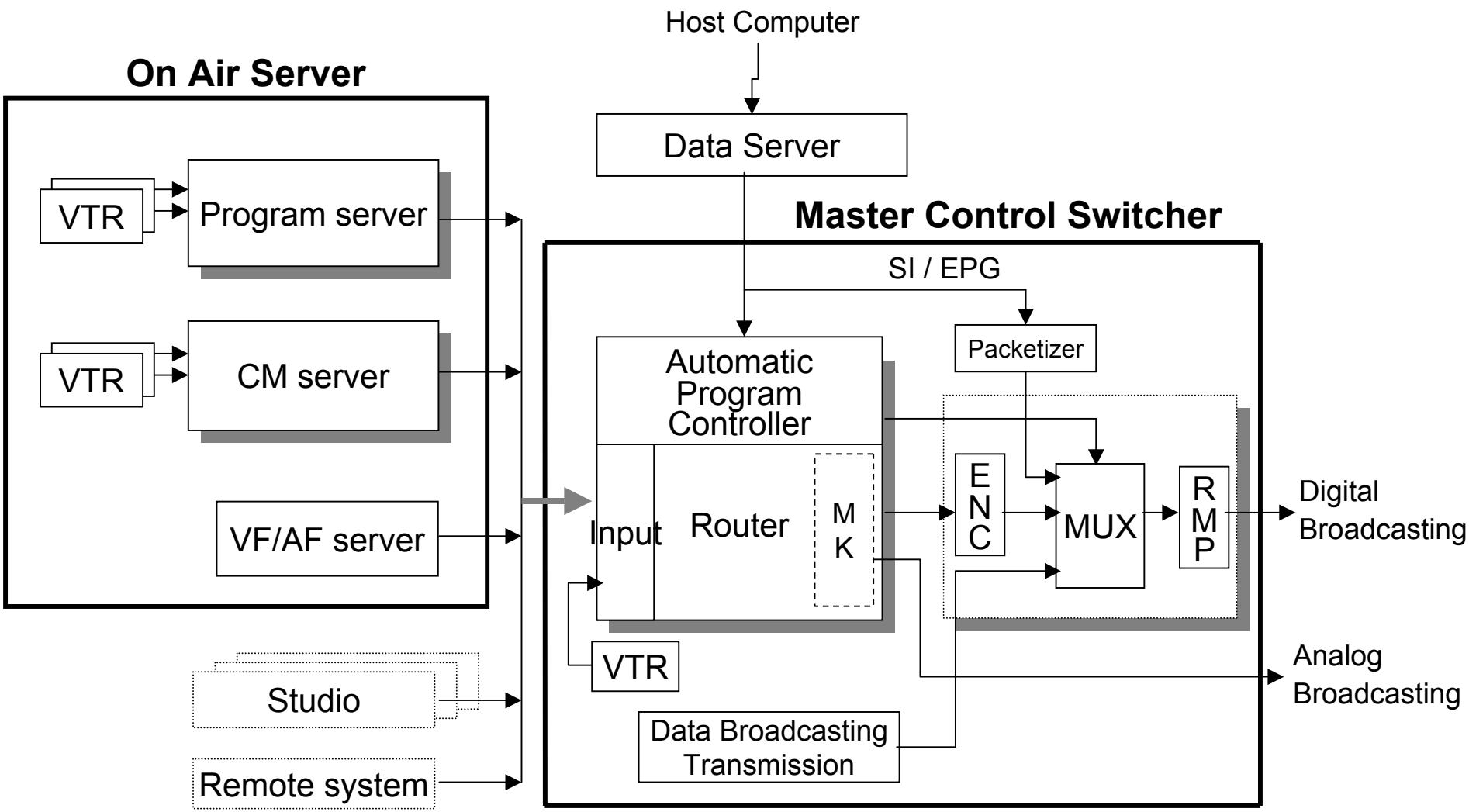
Broadband or Mobile NW

WEB Basic System

- Quick and flexible production and transmission work
- Handling HD/SD program materials
- External network interface

- Preservation and rights management for second use of program materials

On Air System Block diagram



Notes ; MK : Mix and Keyer SI / EPG : Service Information / Electric Programming Guide
ENC : Encoder MUX : Multiplexer RMP : Rights Management and Protection

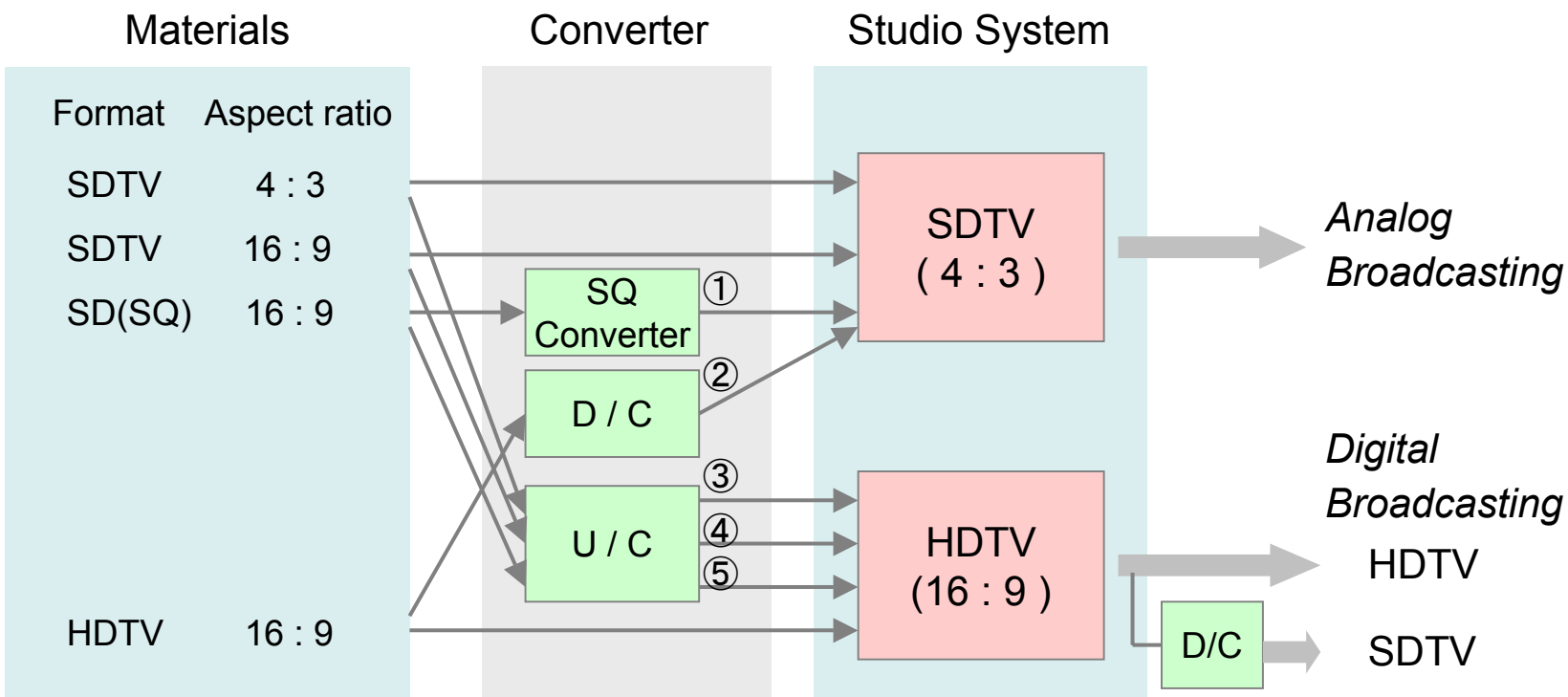
On Air Server

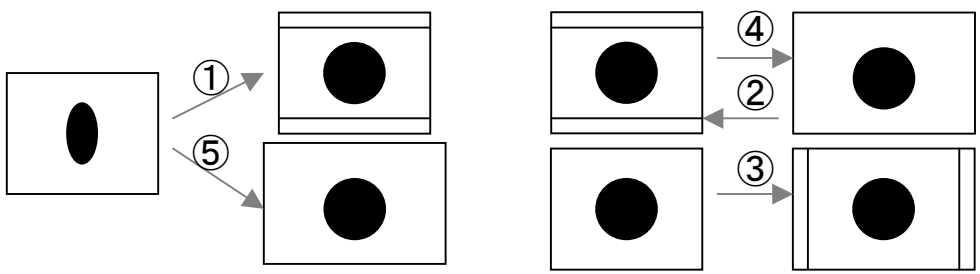
Additional Requirements regarding On Air Server for Digital Broadcasting

- Handling HD/SD Program Materials
  - Diversification of incoming program materials
  - Compatibility of broadcast equipment with HD
- Compatibility with Simulcast
  - Simulcast of digital and analog broadcasting is required for a given period
- Efficient Operations
  - Filing of diverse program materials to server
  - WEB preview (low resolution quality) by Personal Computer

Basic Concept of HD/SD Mixed System

- **Analog broadcasting : SD system**
- **Digital broadcasting : HD system**



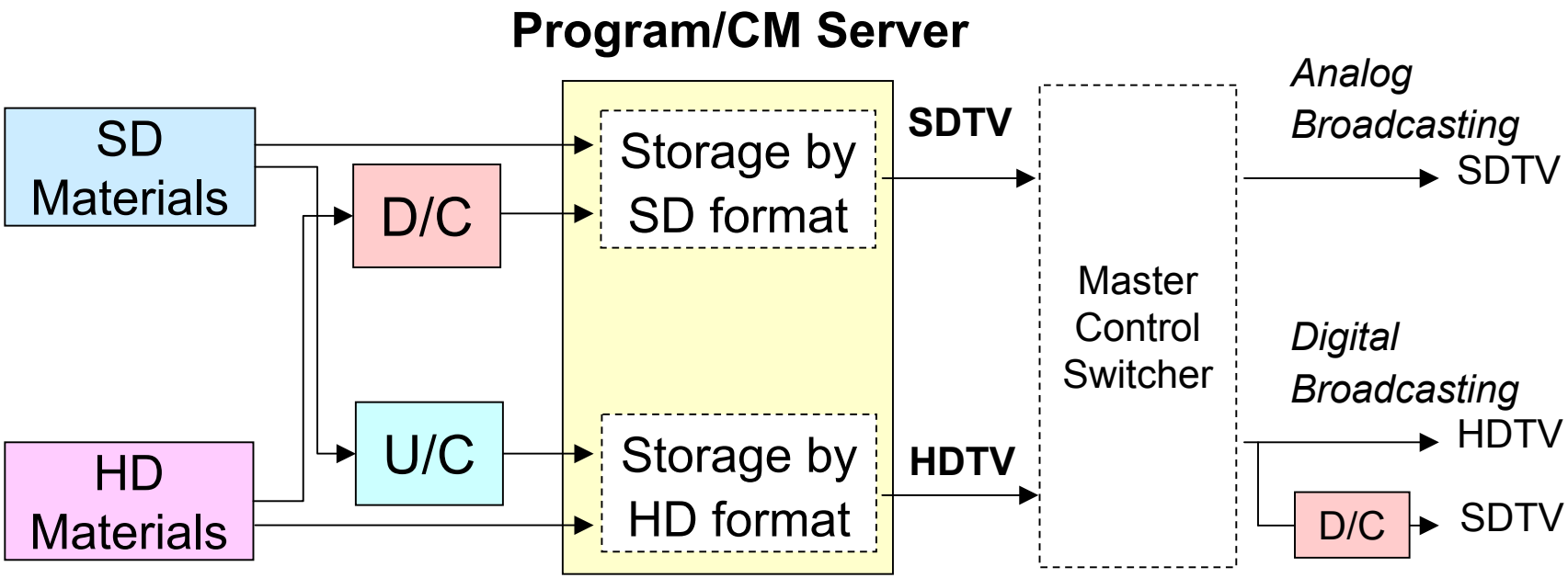


Notes; SQ : Squeeze

Handling HD/SD Signals and Compatibility with Simulcast (1)

Method 1 Filing to match with on-air format

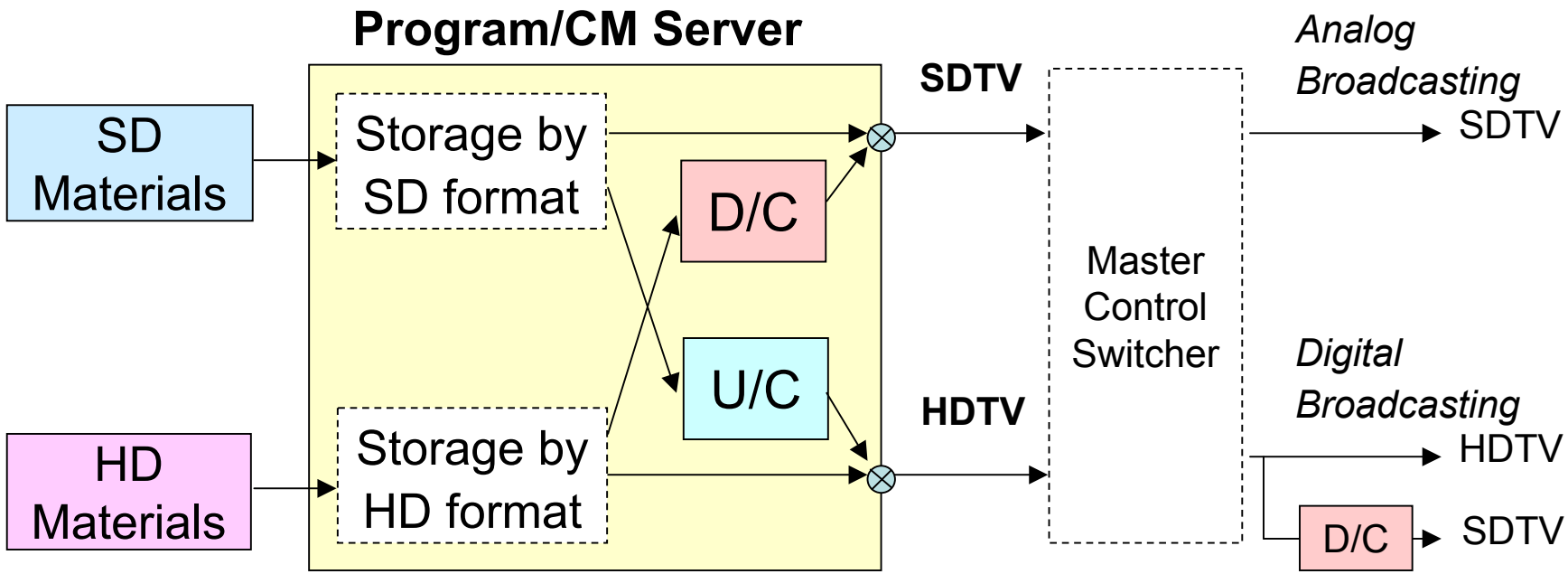
Major method in Japan



- Merit
  - Reliable preview including conversion of aspect ratio
  - Fixed on air control timing (There are no converter in output part)
- Demerit
  - A massive storage is required because of filing SD and HD format

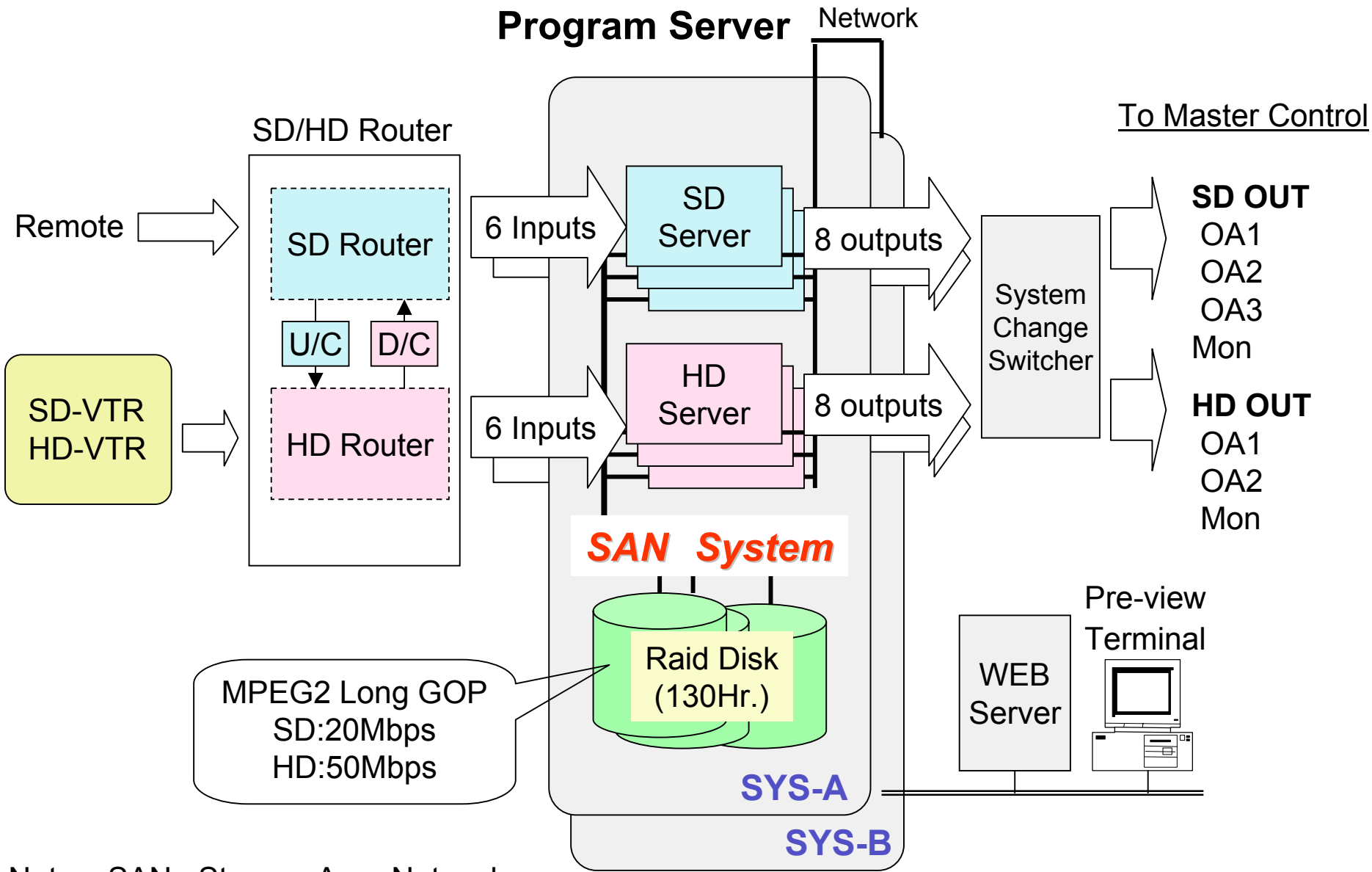
Handling HD/SD Signals and Compatibility with Simulcast (2)

Method 2 Filing to match with materials format



- Merit
  - Easy filing operation because of storage by original format
  - Minimized storage capacity
- Demerit
  - Control matching with output switch and D/C, U/C is required
  - Complex preview system is required for format conversion

System Example ; Tokai-TV Program Server System



Notes; SAN : Storage Area Network

Tokai-TV Program Server System

Master Control Switcher

Additional Requirements regarding Master Control Switcher for Digital Broadcasting (1)

- Handling HD/SD Program Materials
  - Compatibility of broadcast equipment with HD
- Compatibility with HD/SD Mixed Broadcasting and Simulcast
  - HD program assembly for digital broadcasting
  - SD program assembly for analog broadcasting
- Flexibility for Audio Multi-Channel
  - Embedded audio processing (Multiplex to SDI ancillary data)
- Compatibility with New Services
  - SI / EPG transmission, Captioning transmission
  - Data Broadcasting, Broadcasting service for mobile and cellular
  - High compression HD encoder

Additional Requirements regarding Master Control Switcher for Digital Broadcasting (2)

- Affiliates Network Interface

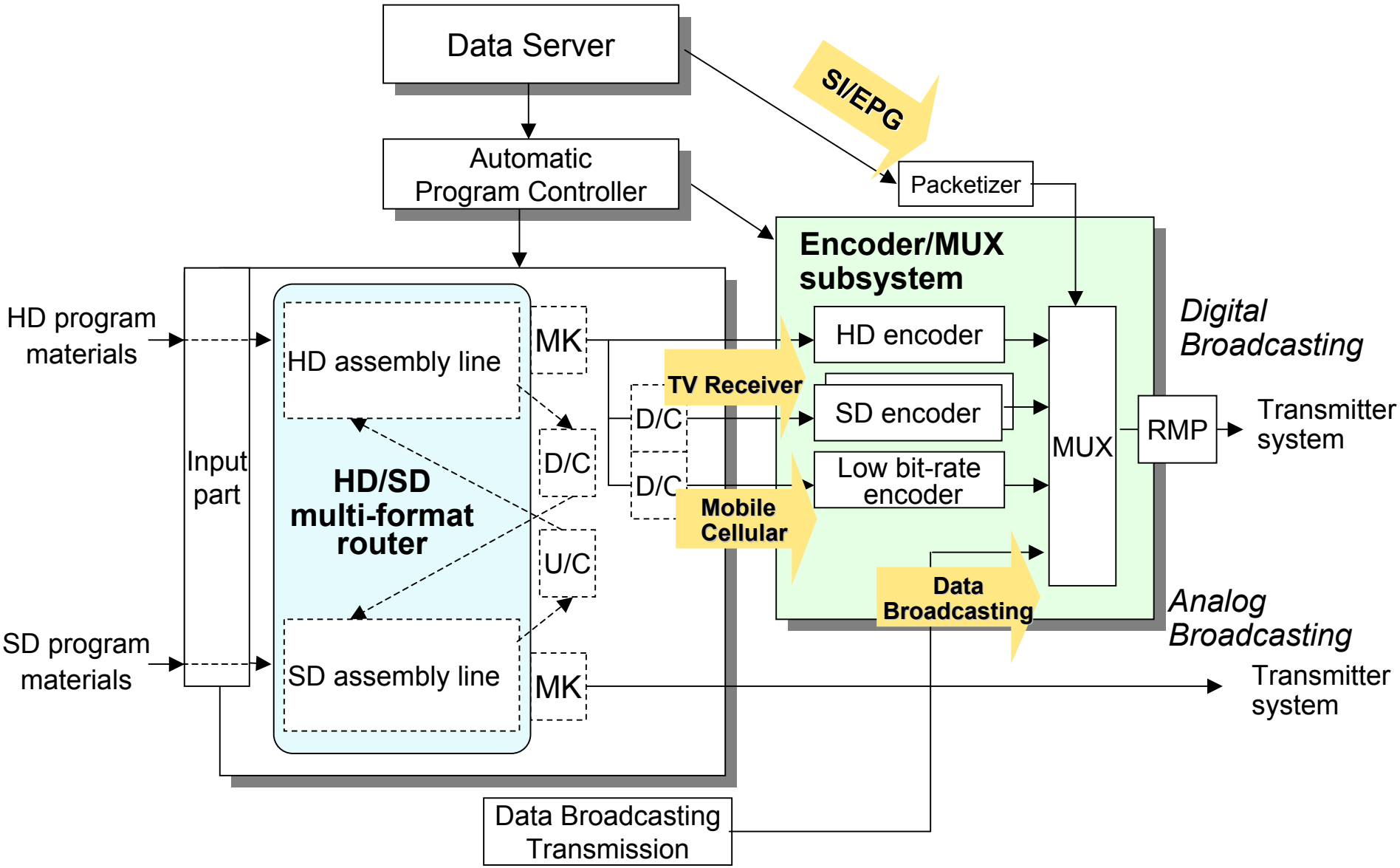
  - HD and SD program transmission between key station and local station

- Efficient Operations

  - Integrated monitoring system

  - Monitoring of MPEG transport stream

Master Control Switcher Block Diagram

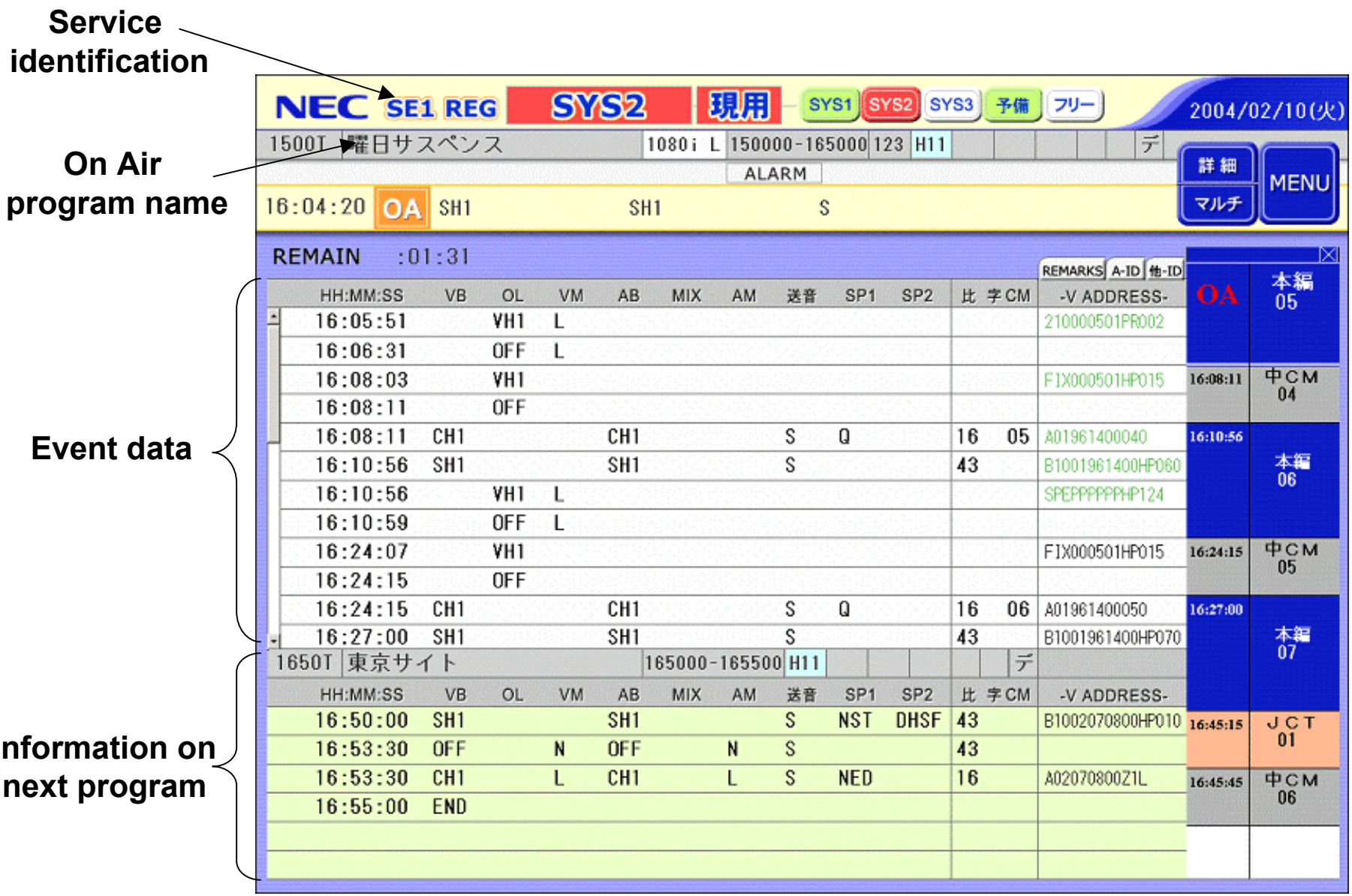


Notes; RMP : Rights Management and Protection

Characteristics of Switcher and Controller Block

- Input part
  - Input signal format : HD-SDI, SD-SDI or Analog
  - HD signal : Transferred to the HD assembly line
  - SD signal : Transferred to the SD assembly line
    (Analog signals are converted to SDI by A/D converter)
  - Audio embedded processing is carried out by Multiplexer for multi-channel audio (5.1Ch surround etc.)
- Program assembly part
  - Adopting HD/SD multi-format router
  - Composed of HD assembly line for digital broadcasting and SD assembly line for analog broadcasting
  - HD signals are inputted to SD assembly line through D/C for analog broadcasting
  - SD signals are inputted to HD assembly line through U/C for digital broadcasting
- Controller (APC)
  - Execution of base material switching, OL processing and MIX processing
  - Control of assembly and transmission of programs on data received from Data Server
  - Transfer of PSI (Program Specific Information) data to MUX and control of encoder

Example of Controller Display



Characteristics of Encoder/MUX Subsystem

- Encoder
  - HD encoder and multiple SD encoder for HD/SD mixed broadcasting
    * HD encoder is required high compression and high quality for effective use of bandwidth
  - Including audio encoder (Dolby AC-3, MPEG1-L2, AAC etc.)
  - Low bit-rate encoder for mobile and cellular
    * Standardized H.264 in Japan
  - Multiplex of captioning data to MPEG-2 transport stream

- MUX
  - Multiplex of each transport streams, above encoder outputs and data broadcasting
  - Multiplex of SI/EPG data and PSI

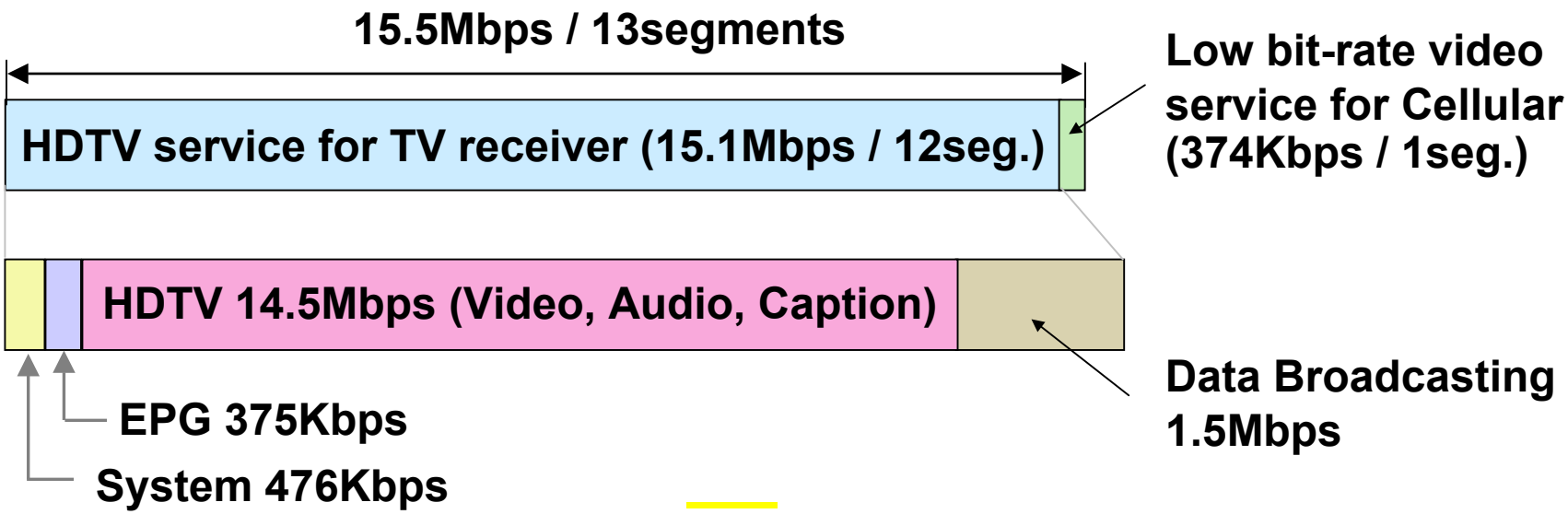
    SI : Service description table, Broadcaster information table, Event information table etc.

    PSI : Program association table, Program map table, Network information table etc.

    * SI/EPG section data is transferred by data server and converted to packet data through packetizer

Background of HDTV Encoder Development

Example of ISDB-T



High compression(11~14Mbps) and high quality HDTV encoder is indispensable

NEC VC-5300 HDTV Encoder

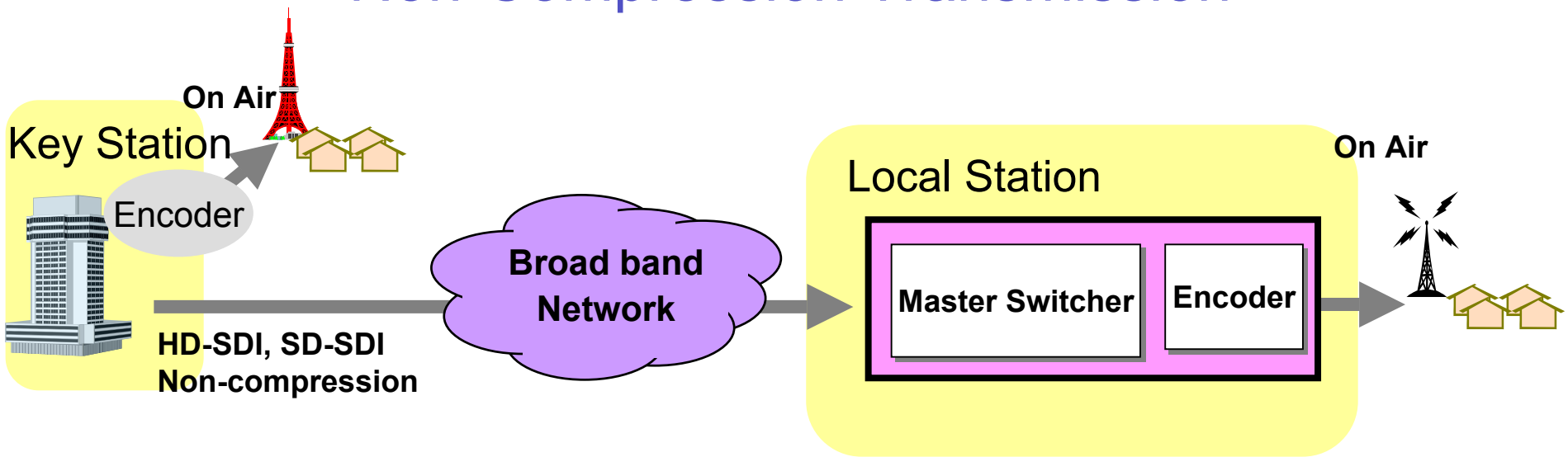
Characteristics of VC-5300 HDTV Encoder

- Adopting 1 chip HD coding LSI
- Multi-format
  - Compatibility with 1080i, 720p, 480p, 480i
- High compression encoding
  - Adopting high compression algorithm by pre-analysis processing
- Compatibility with embedded audio and integrated MPEG-2 AAC
  - Input Audio : Embedded audio or AES/EBU
  - AAC coding circuit : 5.1ch surround mode, 2ES
- VBR (Variable Bit Rate) encoding
  - Optimization of encoding rate matching with input video
- Adopted by major broadcaster for terrestrial digital broadcasting
  - 12 out of 19 stations in Tokyo, Nagoya, Osaka area

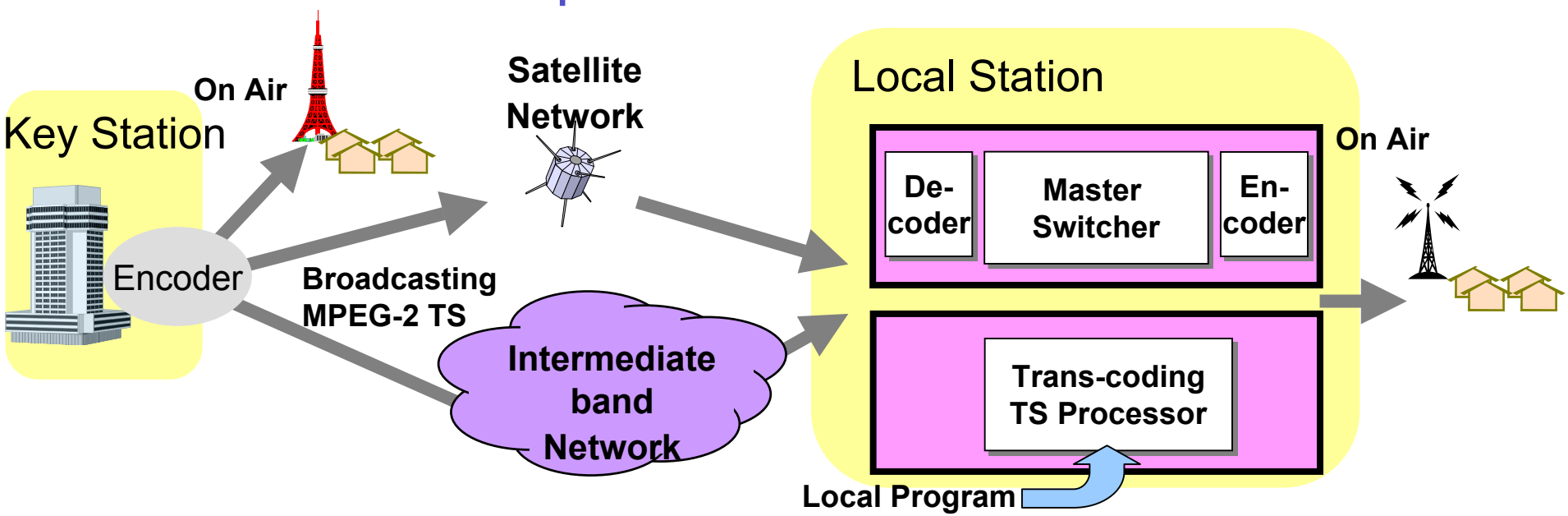
Comparison of Transmission Method of Affiliate Network

	Non-Compression	Compression
Delay	Approx. 0(zero)	Approx. 1sec
Picture Quality	Preservation	Quality down * only can be improved by transcoding technique
Network	Requires broad band network HD-SDI:1.4Gbps, SD-SDI:270Mbps	Available both satellite and terrestrial intermediate band network Cost effective Broadcasting TS rate:Approx.22Mbps
Results in Japan	Commercial stations	NHK

Non-Compression Transmission

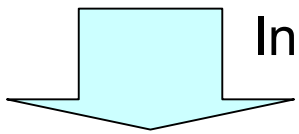


Compression Transmission



Why is the Integrated Monitoring System Important in Digital Broadcasting ?

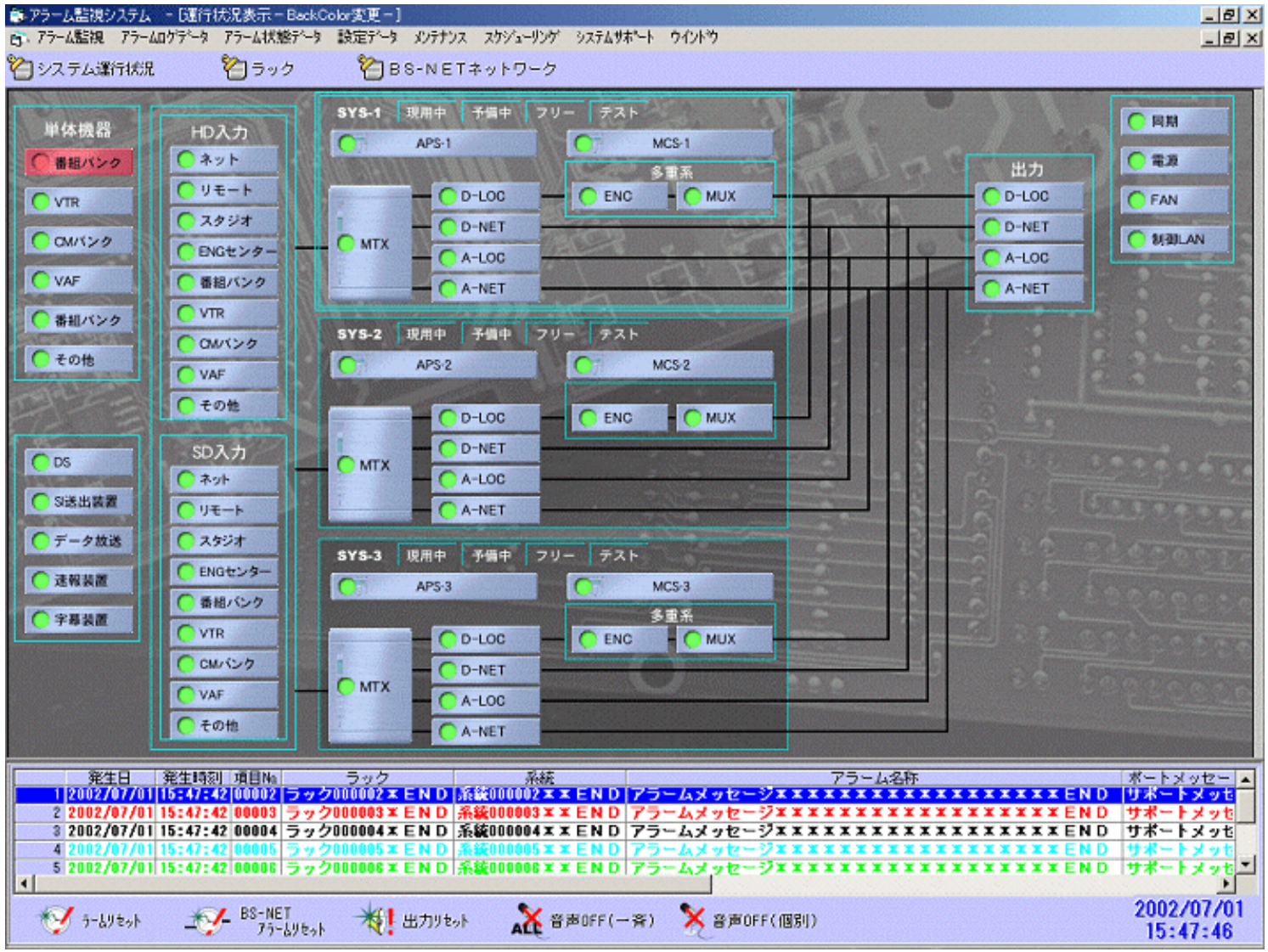
- Monitor of both digital broadcasting and analog broadcasting
- Monitor of specific items on digital broadcasting
  - Multi-channel (Service and audio)
  - MPEG-2 transport stream monitor



Increase of monitoring items

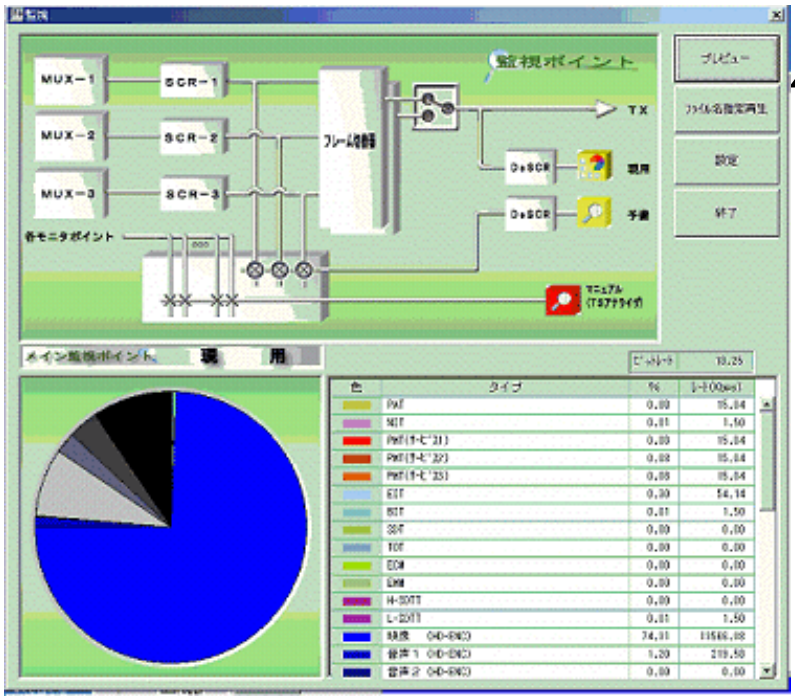
Not increase the number of operators

Example of Integrated monitoring Display



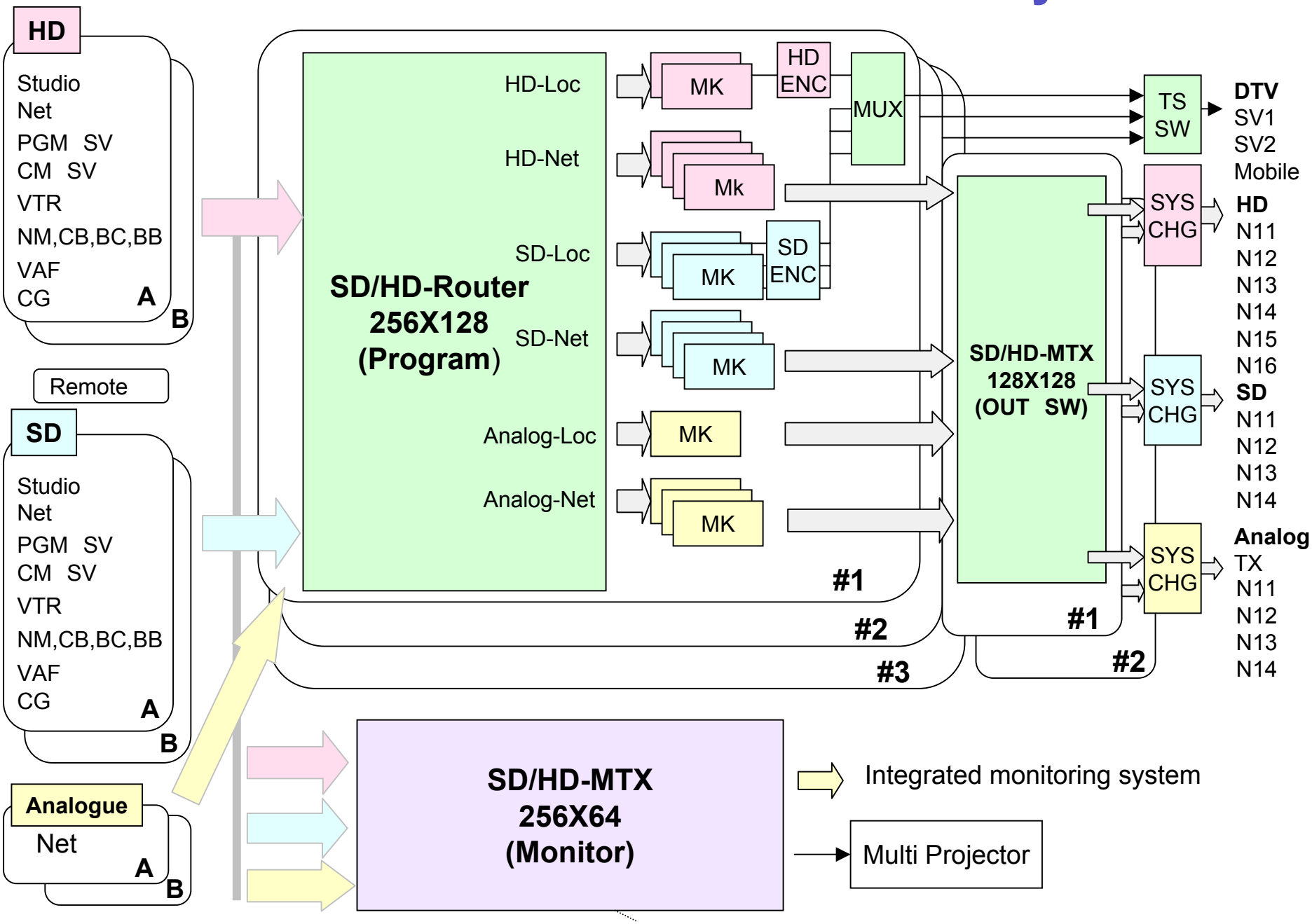
Example of TS monitoring Display

Examples of monitoring screen and error log



- TS is constantly monitored at monitoring points, and the error log can be displayed.
- When there is any failure in video/audio/data, the TS of the corresponding period can be withdrawn from the accumulation device and regenerated.

TV-Asahi Master Control Switcher System



Characteristic of TV-Asahi Master Control Switcher System

- Massive and SD/HD Multi-format System
  - SD/HD router ; 256 x 128
- High Reliability
  - Triple redundant system
  - Input part ; Dual
- Scalability
  - Easy extension by addition of MK part
  - Software update by using Test part
- Efficient monitoring and operations
  - Integrated monitoring system
  - Multi-monitor, Touch panel

TV-Asahi Master Control and Remote

Master Control Room

Remote Center