

Delivery Technologies and Business Models for Mobile Television Services 2015

Bangkok, Thailand

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Session 2: Introduction on MTV standards

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Aim

To provide insight into the network architecture and functionality of the different MTV technologies

- T-DMB
- ISDB-T (OneSeg/mm)
- DVB-T2 Lite
- Wi-Fi offload
- Hybrid MB - Tower Overlay over LTE-A+
- Application in different countries - Japan, Korea, Europe....

How to deliver content ?

- Over-the-air (OTA) – most efficient
- Over-the-cable (OTC) – most secured
- Over-the-broadband or Over-the-top (OTT) – growing form of delivery

- How to access content?
 - Free-to-access
 - Pay-to-access



Casting – Information delivery

- **Unicast** is the term used to describe communication where a piece of information is sent from one point to another point. In this case there is just one sender, and one receiver.
- **Multicast** is the term used to describe communication where a piece of information is sent from one point to a set of other points.
- **Broadcast** is the term used to describe communication where a piece of information is sent from one point to all other points. In this case there is just one sender, but the information is sent to all receivers.



Network Architecture

- Internet - network of networks - enables P2P Communication
- Mobile/Cellular are networks - enables P2P Communication via BS (Base Station)
- Both above networks are not designed for broadcasting
- Mobile/Cellular networks - for unicasting
- Internet – for unicasting and multicasting
- Broadcasting NWs has been designed to broadcast – Radio, Television and Data Broadcasting (NWs are broadcast networks by design)
 - Architecture is high tower high power (in general)

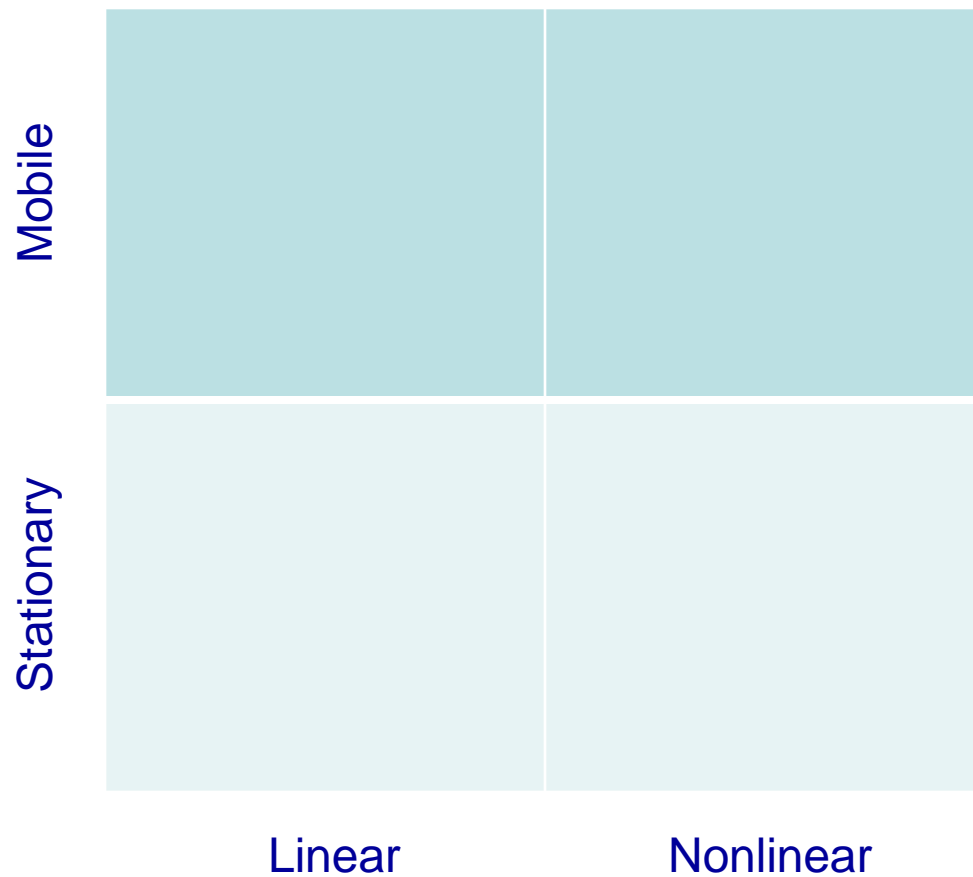


Digital Broadcasting Transmission Technologies

- DVB
- ISDB
- ATSC
- DTMB
- Delivery
 - Terrestrial
 - Satellite
 - Cable
 - Virtual pipe - IP
- DAB
- DAB+
- T-DMB
- Delivery
 - Terrestrial
 - Satellite

Media/TV consumption to be served

- Stationary vs. Mobile
- Linear vs. Nonlinear



Source: Dr Amal Punchihewa © MMRG

MTV - Mobile Television Services

- T-DMB - 2005
- ISDB-Tmm - April 2012
- ATSC-M -
- DVB-T2 Lite

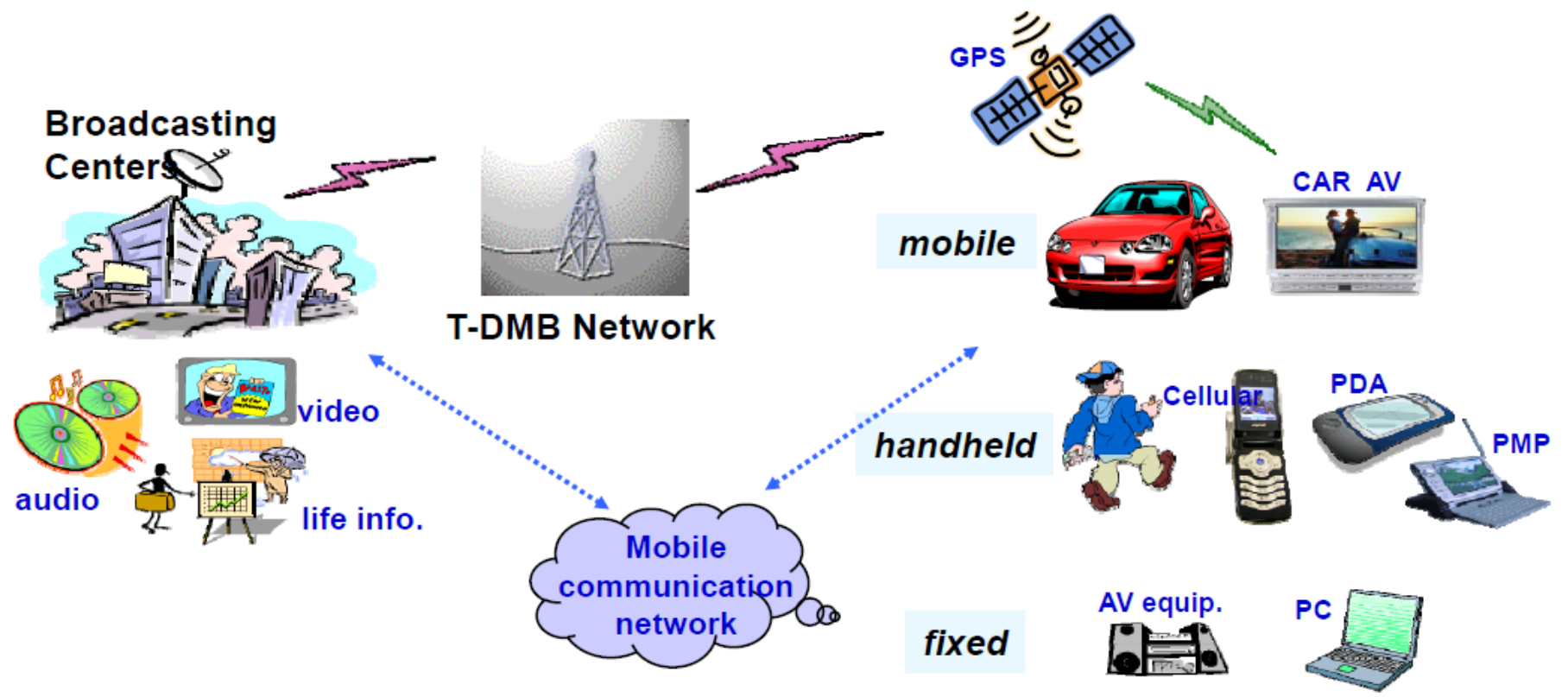
DVB-T 1997, DVB-H 2004, T-DMB 2005, DVB-T2 in 2008, DVB-T2 Lite

What is T-DMB ?

Video standard extension of Digital Audio Broadcasting (DAB)

Commenced around May 2005

- Fully compatible with Eureka-147
- Provides video and data services as well as CD-quality audio service



T-DMB Service Features



Mobile

Mobile multimedia broadcasting services

- *anytime, anywhere with any devices*



Personal

Personalized services by handheld receivers

- *Mobile phone, PDA, Notebook PC, PMP, etc.*



Interactive

Bi-directional interactive services linked with mobile communication networks

- *TTI, PPV, on-line shopping, internet access, etc.*



Personal Mobile Interactive Multimedia Broadcasting Services

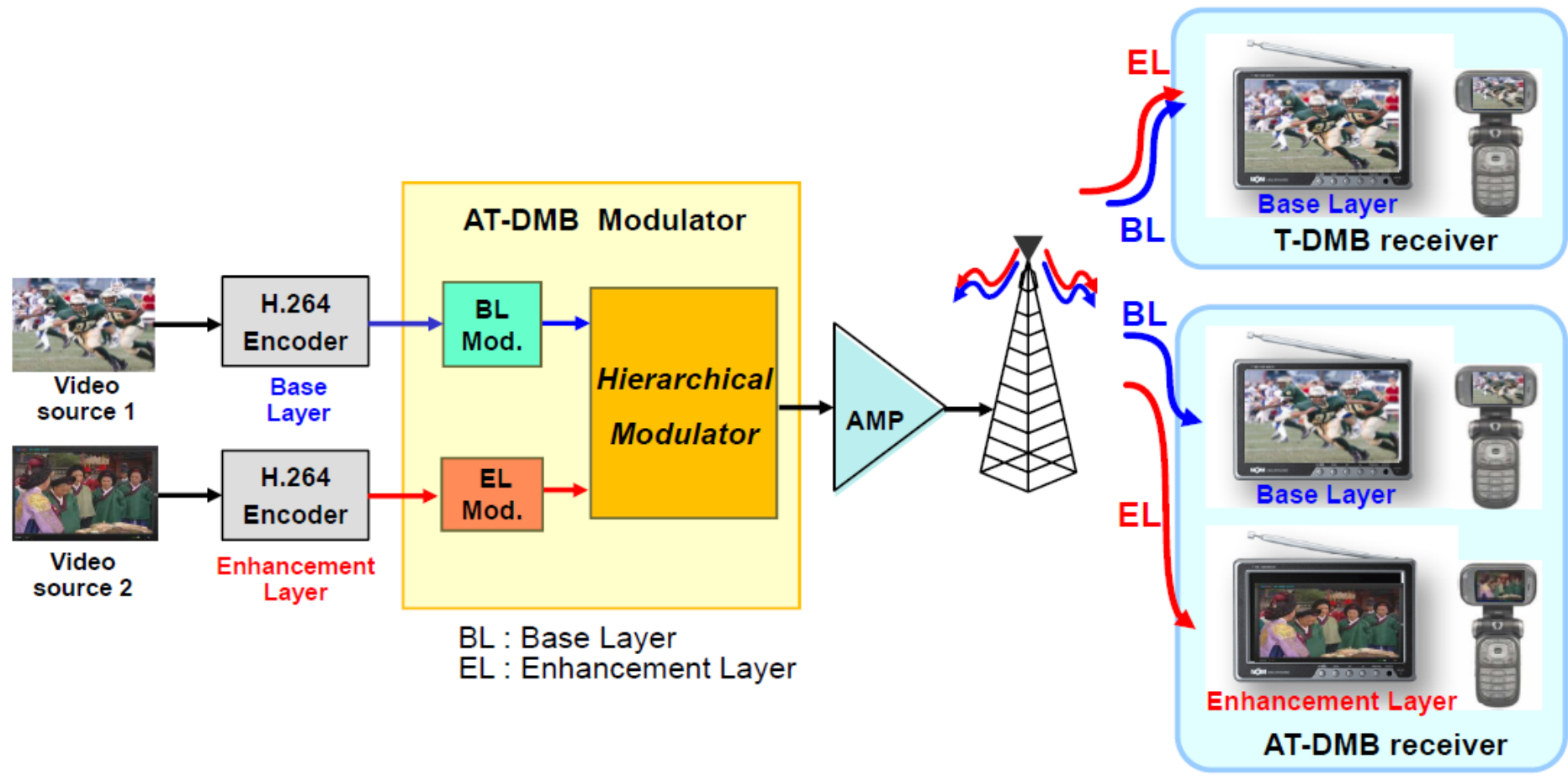
TTI : Traffic and Travel Information, PPV: Pay Per View

Eureka 147 Specifications

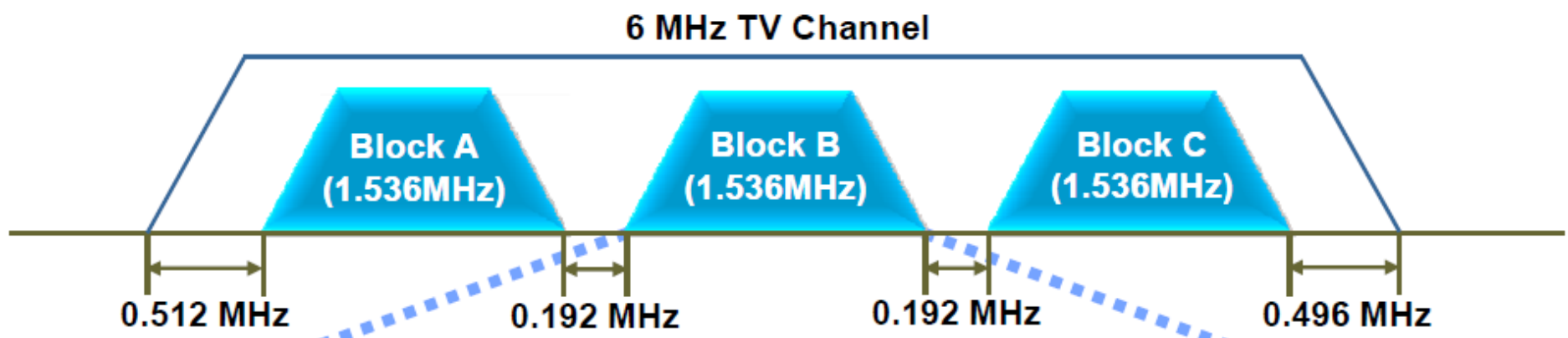
Signal		COFDM			
Modulation		DQPSK			
Channel Coding		Convolutional : variable rate, constraint length = 7			
Time Interleaving	ms	Depth = 384			
Frequency Interleaving	MHz	Width = 1.536			
Effective Data Rate	Mbps	0.8 ~ 1.7 Mbps			
System Bandwidth	MHz	1.536 MHz			
Transmission Mode		I	II	III	IV
Application		Terrestrial (SFN)	Terrestrial /Satellite	Terrestrial /Satellite	Terrestrial /Satellite
Frequency Band	GHz	< 0.375	< 1.5	< 3	< 1.5
Sub carriers		1,536	384	192	768
Sub carrier interval	KHz	1	4	8	2
Guard interval	μs	246	62	31	123
Symbol length	μs	1,000	250	125	500
Frame length	ms	96	24	24	48



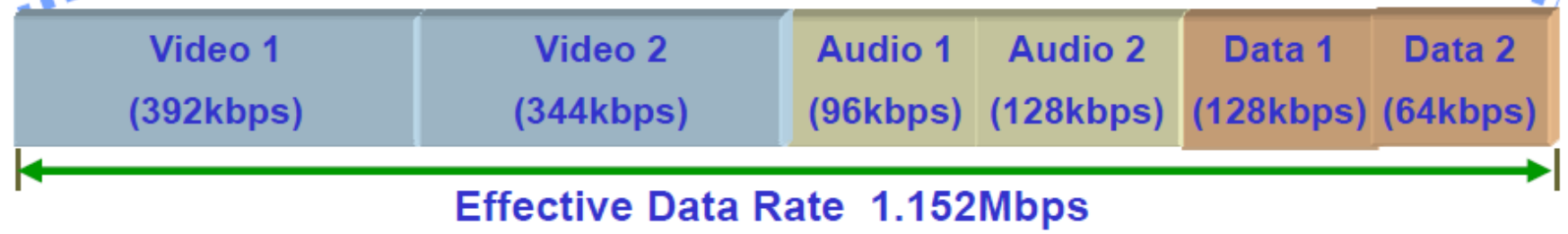
T-DMB



T-DMB Frequency Allocation



Example



T-DMB Services

Audio only service

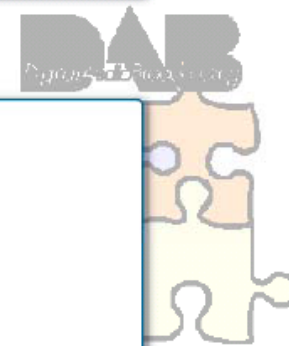
- **Stereo (CD-like)**

Video service

- **Video : VCD quality (7" LCD)**
- **Audio : Stereo (CD-like)**
- **Program related Data**

Data service

- **Electronic Program Guide**
- **Headline news, Weather**
- **Traffic, Navigation**
- **Slide show, Broadcasting Web Service, etc.**



Traffic Information
TPEG/DGPS



CD Like High Quality Audio
Additional Data Service

R-Commerce
Purchase
CD/Ticket



T-DMB Devices

Types of T-DMB Devices in Korea



Phone



In-Car/PMP



Digital Camera



Laptop & USB



ISDB-Tmm - Services

Services

- Real-time service
- Download service

High-quality Real Time Service

- Watching live videos just like conventional mobile television
- Offering higher quality video programs

Live Concerts

Enjoy live programs such as sports, news, and music.

Live News

Sports game

Storage Type Service

- Storing contents to mobile handsets automatically.
- Enjoying favorite contents at their own convenience (downloading files).

Movie/Drama

Newspapers

Audio file

Novels

E-Magazine

Various types of contents

Can be used anytime Anywhere.

Store contents to your mobile handsets.



Technical Features of ISDB-Tmm

(1) High Quality Media Coding

- ITU-T H.264 / MPEG-4 AVC
- MPEG HE-AAC, MPEG Surround

(2) Advanced Inter-media Interaction

- Interaction between communications and broadcasting

(3) High Efficiency File Delivery Protocol

- Efficient File Transmission for Mobile Environments with AL-FEC
- Lost data in broadcast channel can be compensated with communication channels

(4) Advanced Power Saving Mechanism

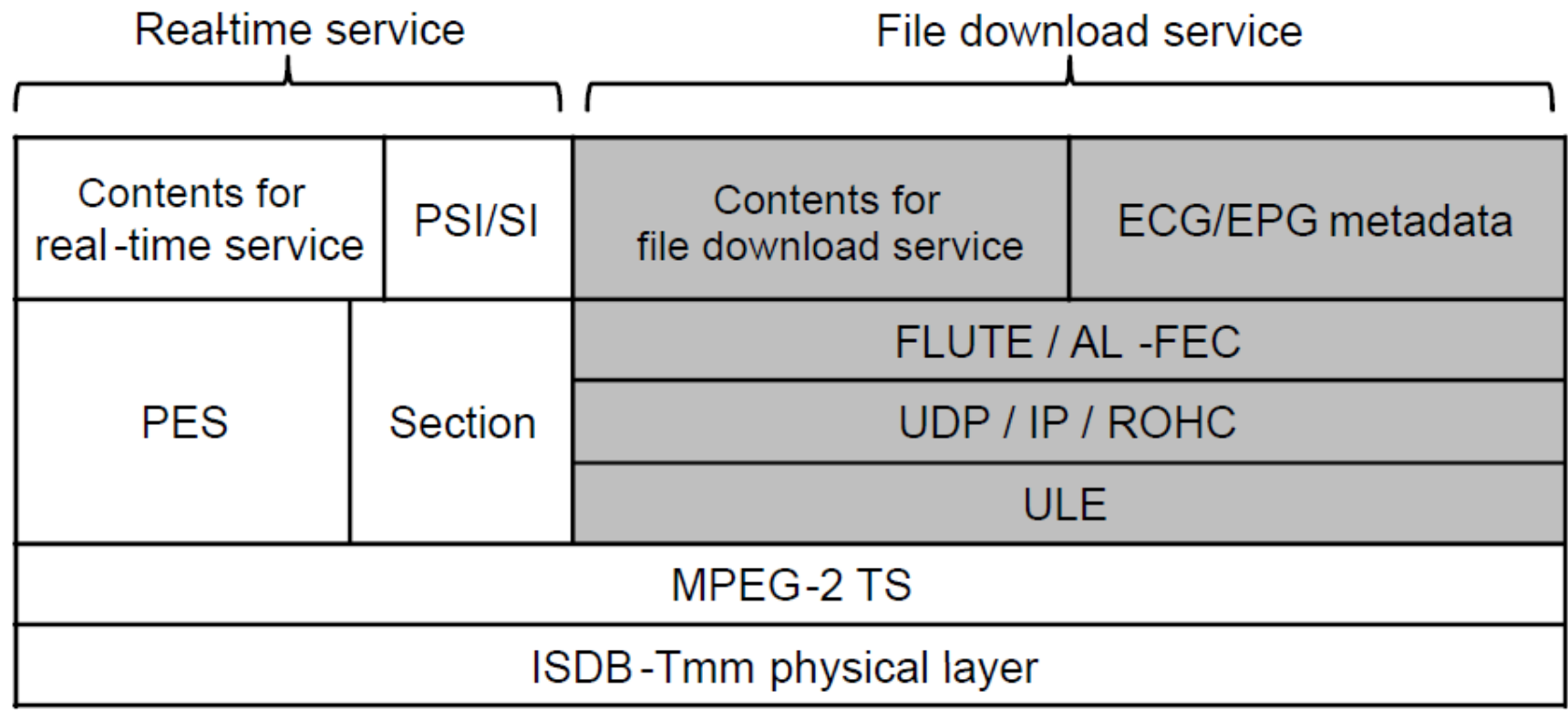
- Partial segment reception is supported
- Intermittent reception for file download is supported by using advanced meta-data

Technical Specifications of ISDB-Tmm

	ISDB-Tmm	ISDB-T (Terrestrial Digital TV, "One-seg")
Segment Allocation	<p>Any combination of 13-seg/1-seg format</p>	<p>6/7/8MHz (13 segments)</p>
Multiplexing	MPEG-2 Systems	
Modulation	OFDM (DQPSK, QPSK, 16QAM, 64QAM)	
Frequency Band	VHF Band	UHF Band
Transmission Data Rate	7.3Mbps / 13 segments (16QAM) 561kbps / 1 segment(16QAM)	One-seg : 416kbps / 1 segment (QPSK)



ISDB-Tmm Protocol Stack



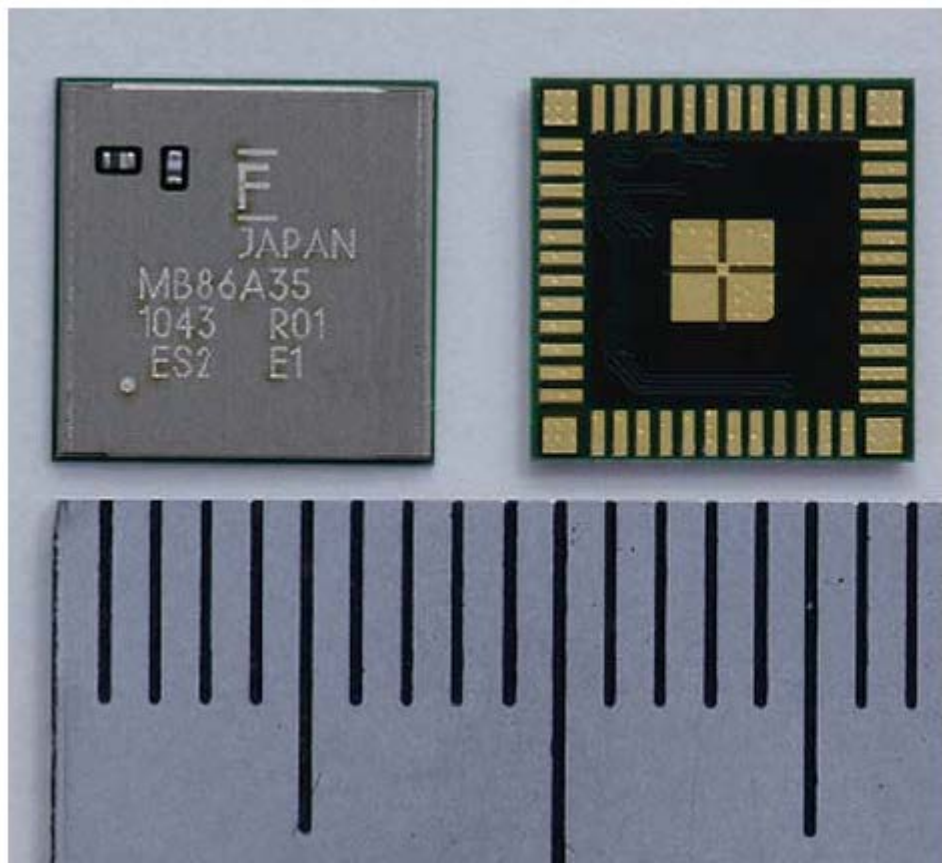
UDP: User datagram protocol
 IP: Internet protocol
 ROHC: Robust header compression
 ULE: Unidirectional lightweight encapsulation
 TS: Transport stream

SI: Service information
 PSI: Program specific information
 EPG: Electronic program guide
 ECG: Electronic contents guide
 PES: Packetized elementary stream
 FLUTE: File delivery over unidirectional transport
 AL-FEC: Application layer forward error correction



Tuner Hardware

- Advances in chip design...



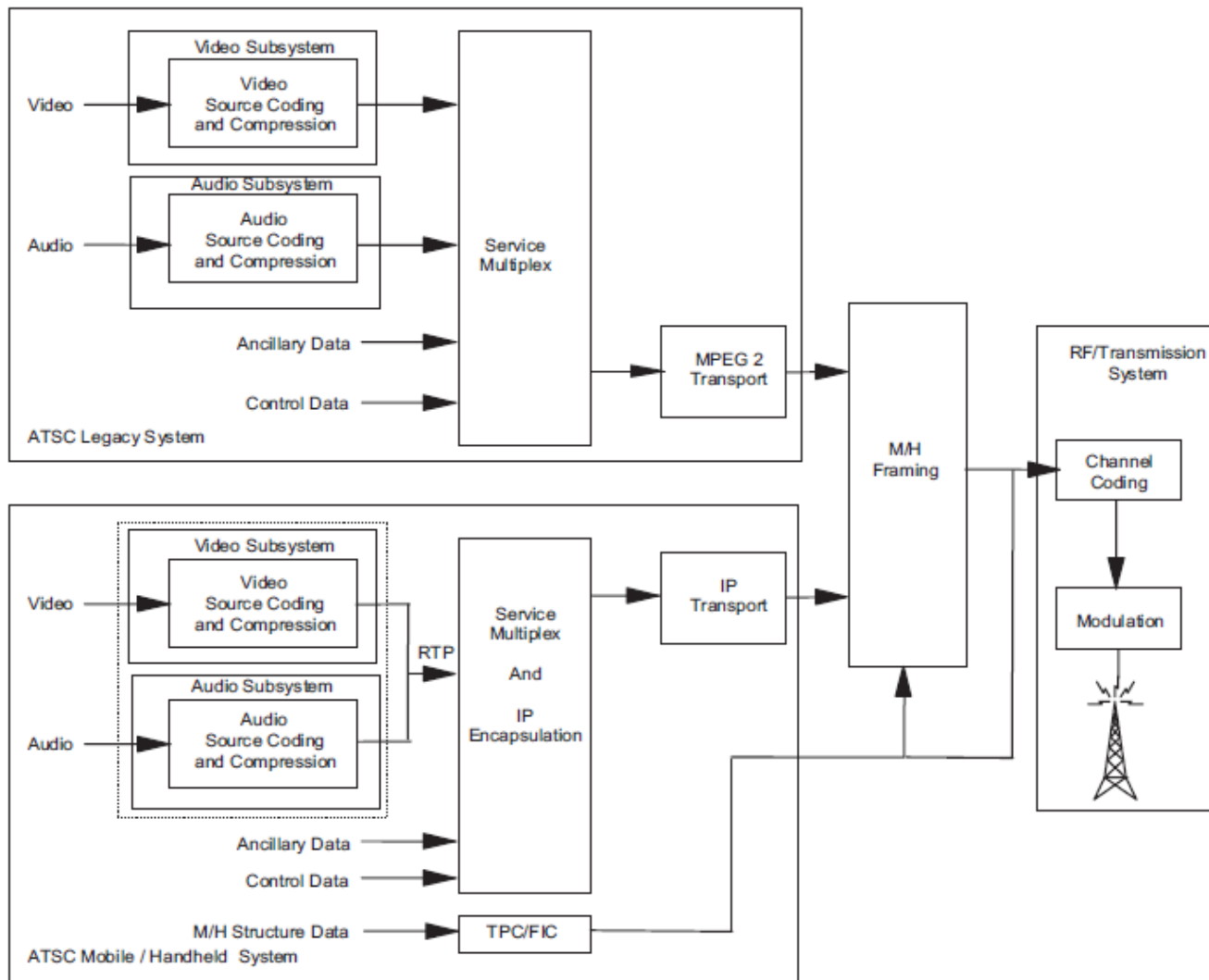
- ISDB-T
- ISDB-T (One-seg)
- ISDB-Tsb
- ISDB-Tmm
- DVB-T
- 6/7/8MHz multi-band

In a single module

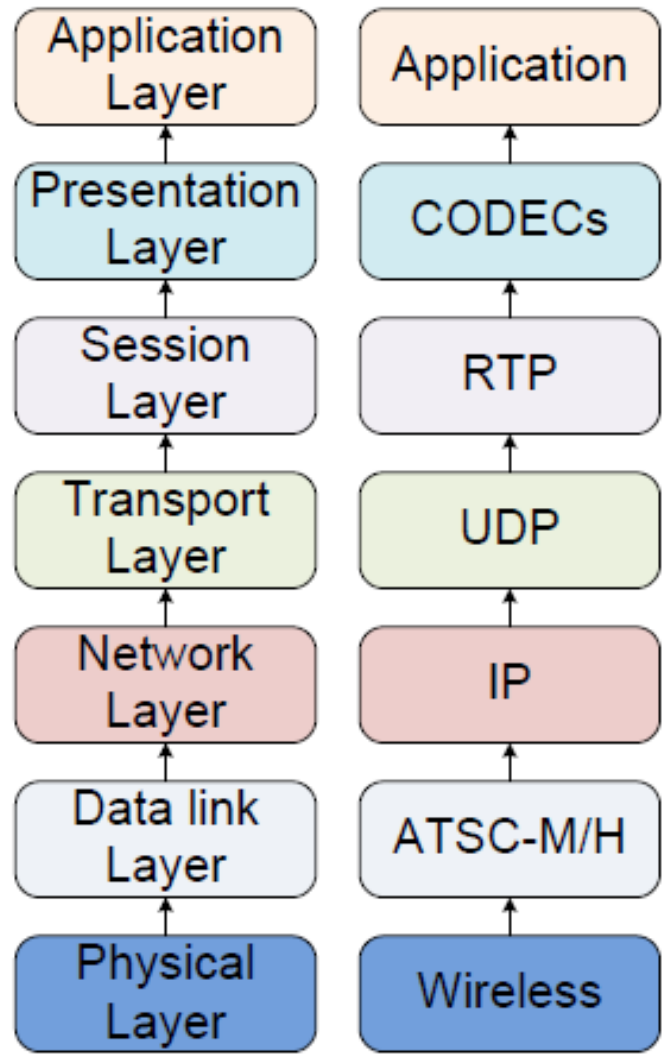
Source: <http://jp.fujitsu.com/>



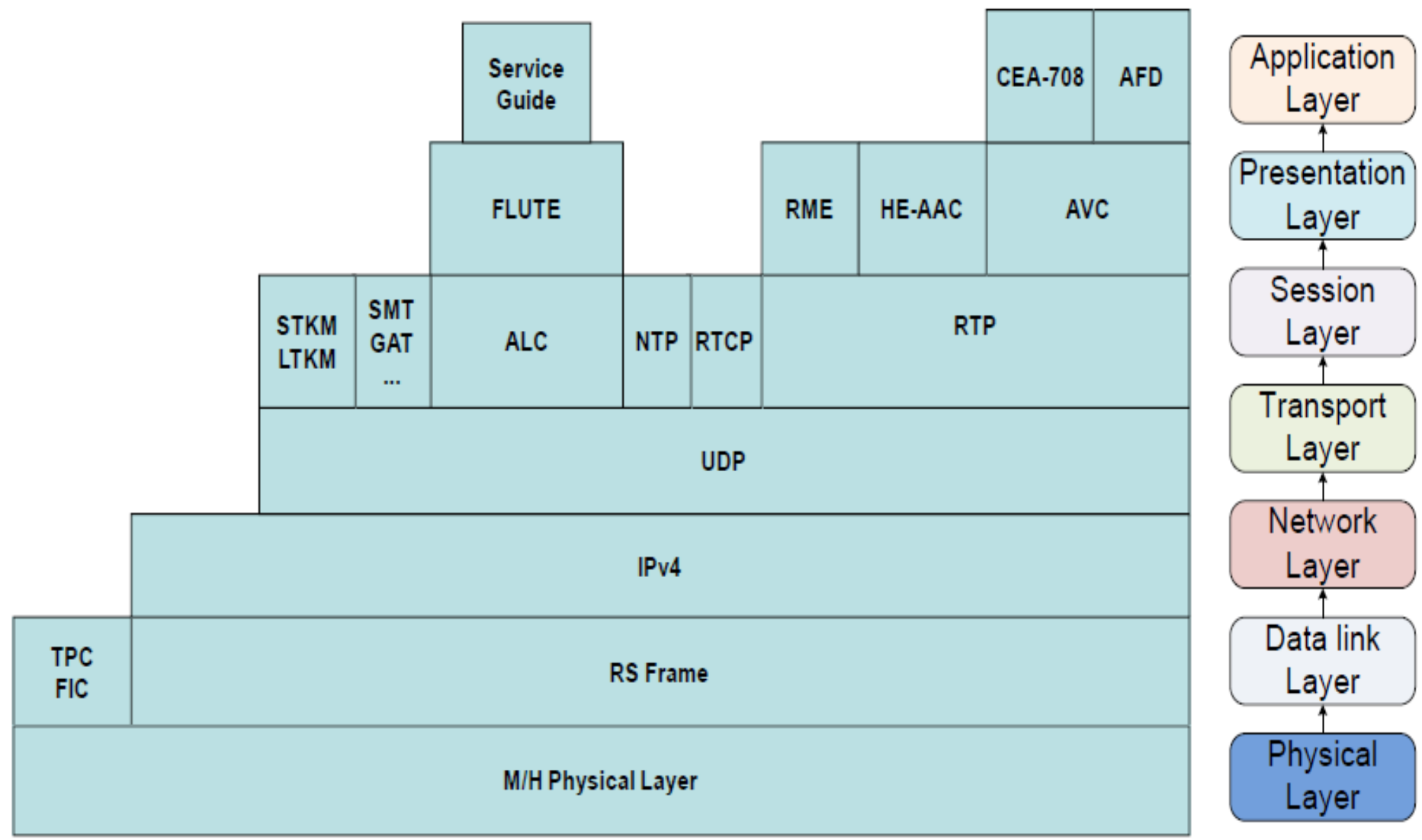
ATSC-M



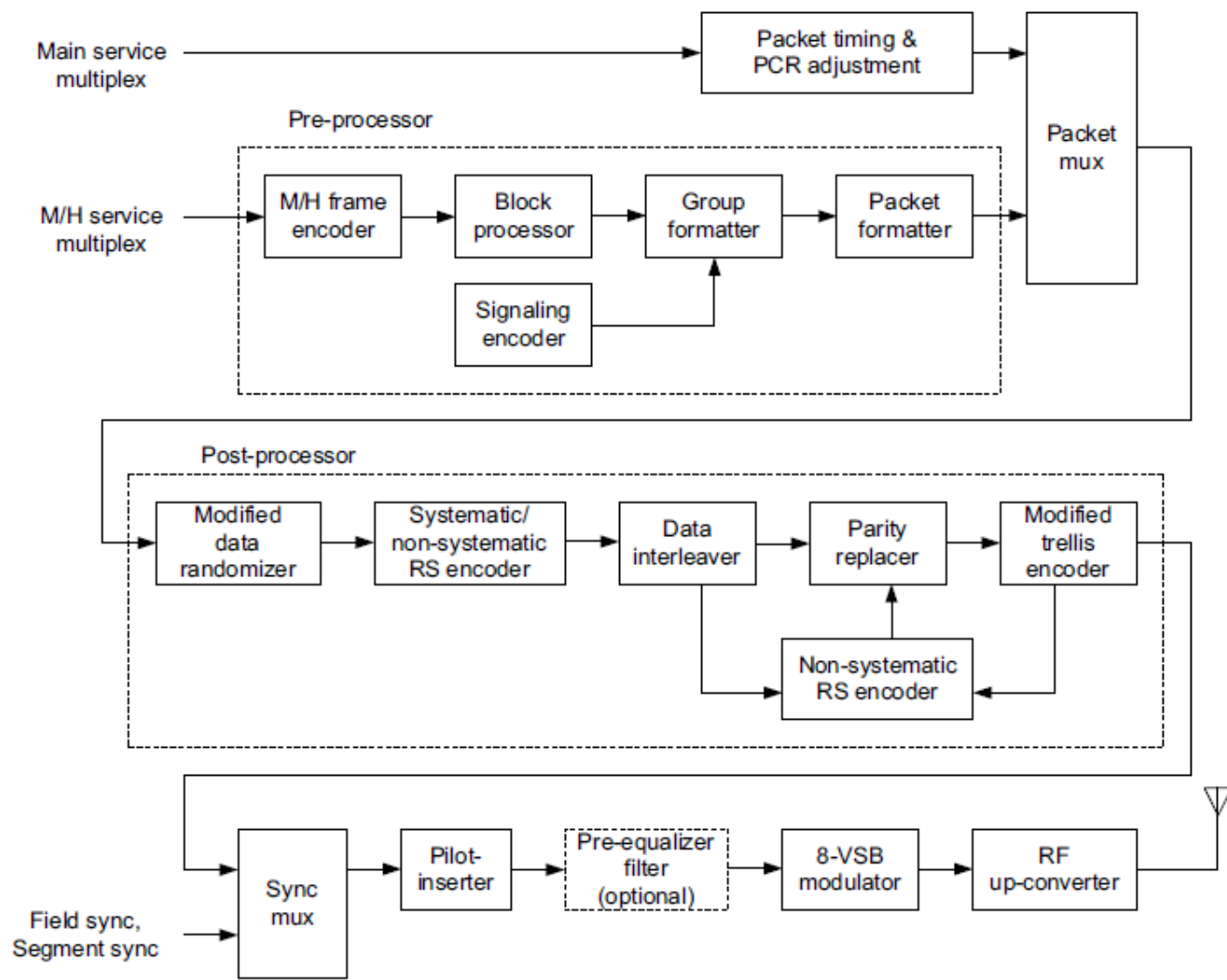
OSI reference model with ATSC-M/H components



ATSC Protocol stack



ATSC-M Transmission

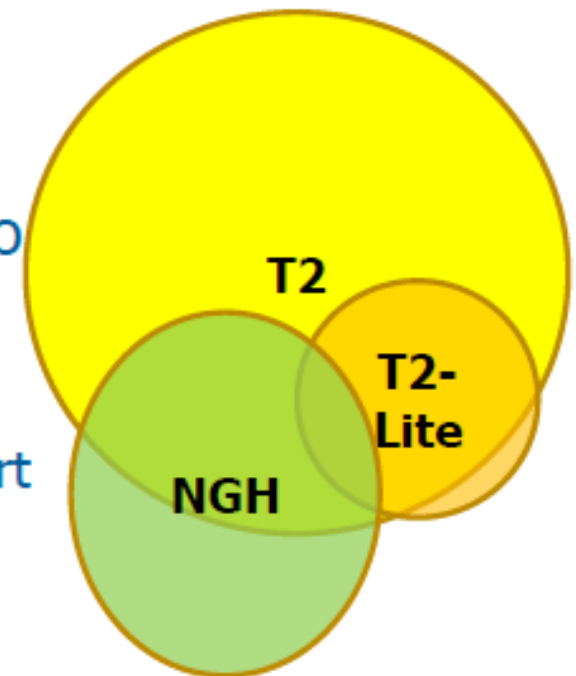


DTV-T

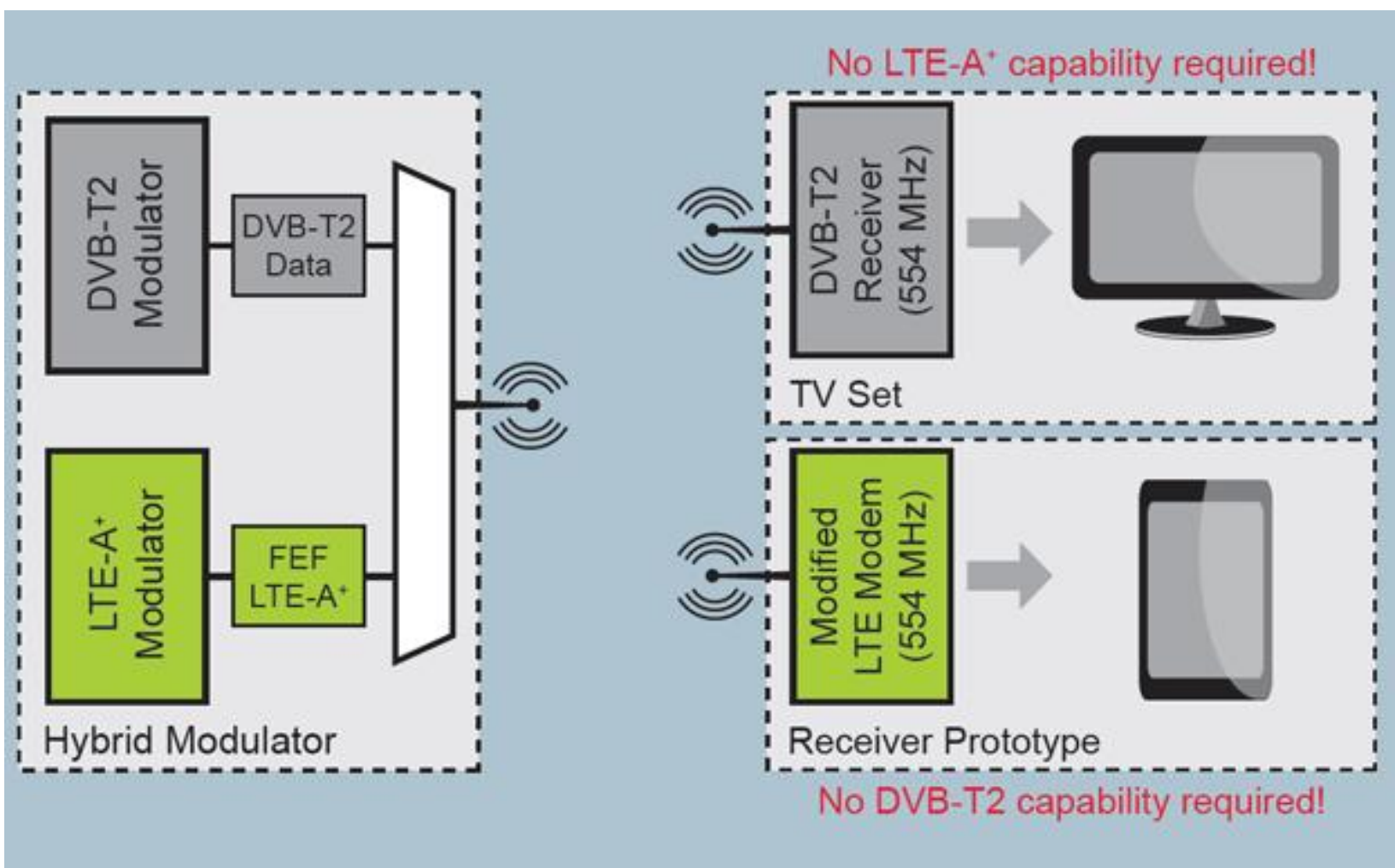
Technology	Main Features
ATSC	<ul style="list-style-type: none">▪ A 8-VSB Transmission technology developed by ATSC▪ Suitable for HDTV
DVB-T	<ul style="list-style-type: none">▪ COFDM transmission technology developed by Europe's DVB Group▪ Advantageous in mobility
ISDB-T	<ul style="list-style-type: none">▪ BST OFDM(Band-segmented Transmission OFDM) transmission technology▪ Developed by Japan

Broadcasting to Mobile - NGH

- DVB-T2 covers fixed as well as mobile use cases
- DVB-T2-Lite is basically a subset of T2 to support mobile for terrestrial broadcasters
 - Ideal solution for a broadcast network to start mobile services
 - Will be supported in DVB-T2 chipsets
 - FEF-TDM structure allows total flexibility
- NGH is the ultimate air interface for all types of mobile broadcast
 - Can be combined with T2
 - Highest efficiency and operational flexibility



DVB-T2 Lite



T2 Transmission Parameters



	DVB-T2	T2-Lite
Data rate	25.24 Mbit/s	1.02 Mbit/s
Channels	1 x UHD TV	Mobile TV
Video coding	HEVC	H.264
Number of carriers	16K	16K
Modulation	256 QAM	QPSK
Inner coding	2/3	1/2
Guard interval	1/128	1/128
Pilot Pattern	PP7	PP7
Frame Length (data symbols)	70	70
Required C/N Ratio	20.3 dB	2.9 dB

DVB-T2 Lite specifications

- A maximum bitrate of 4 Mbits/sec for each service
- Limitations on the FFT size to exclude the 1K and 32K carrier modes
- Prohibition of the use of rotated constellations in 256-QAM
- Possibility for only short FEC frames ($N_{ldpc} = 16200$)
- Limitation of the size of the time interleaver memory (approximately half the size of normal DVB-T2).
- two new LDPC error control code rates, $1/3$ and $2/5$, more options for mobile reception
- Through use of FEF allowing different FFT size and Guard interval in transmissions
- T2 lite signal ignored by normal DVB-T2 receiver

Mobile reception

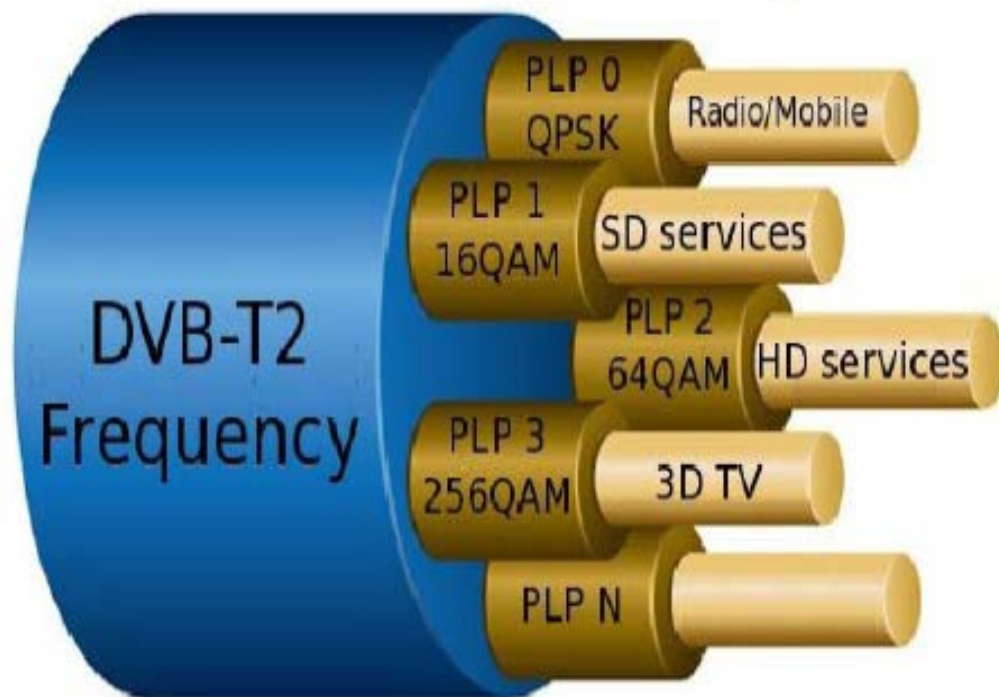
- The commercial focus on DVB-T2 is primarily on stationary reception (beyond SDTV), but DVB-T2 is also designed to work well in mobile/handheld conditions
 - deep time interleaving
 - supports power saving by time slicing
 - enables the introduction of “T2-Lite” or DVB-NGH services via Future Extension Frames (FEF)
 - T2-Lite is part of the DVB-T2 standard (from v.1.3.1)
 - DVB-NGH is based on DVB-T2

Reduced complexity leads to smaller silicon size (-50%) and lower power consumption



Wide range of bitrate vs. robustness

- Space division multiplexing



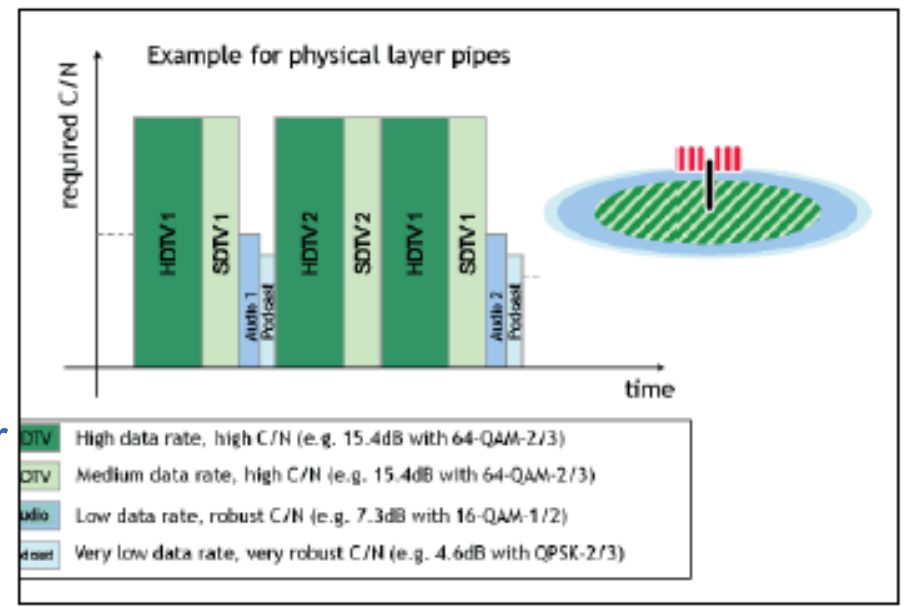
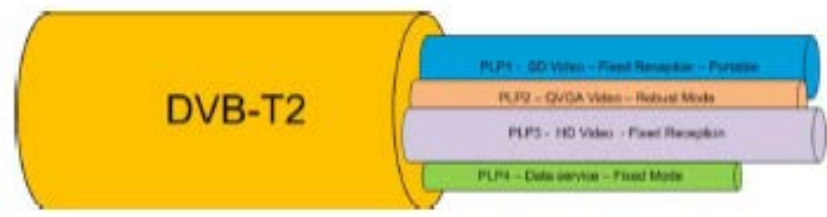
Common parameters : 8 Mhz channel, FFT size 8K, pilot pattern PP1 and Guard Interval 1/4

PLP	Content	Reception	Modulation	Code rate	Bit rate	C/N
1	HD/3D	Rooftop antenna	256 QAM	3/4	18.6 Mbps	23 dB
2	SD	Indoor antenna	16 QAM	3/5	4 Mbps	11 dB
3	Mobile/radio	Mobile reception	QPSK	1/2	0.5 Mbps	3 dB



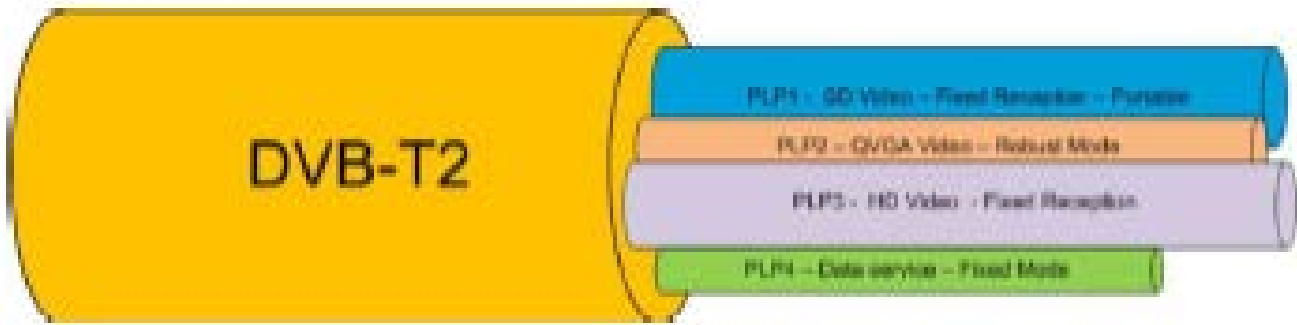
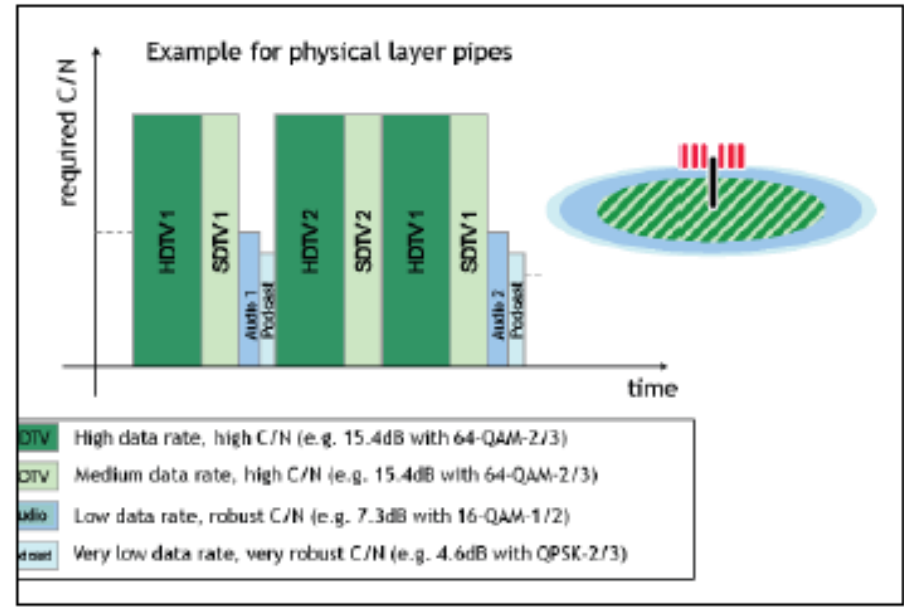
Multiple PLPs

- Possibility to prioritize robustness for selected “high-priority” services
 - ➔ prioritized services (e.g. public service) will “serve longer” in bad reception conditions
- Capacity and coverage can be further improved by Time Frequency Slicing (TFS), which uses multiple PLPs
 - Each PLP is frequency hopping over several RF channels ➔ increased frequency diversity
- Limitation ➔ different FFT size not allowed



Multiple PLPs

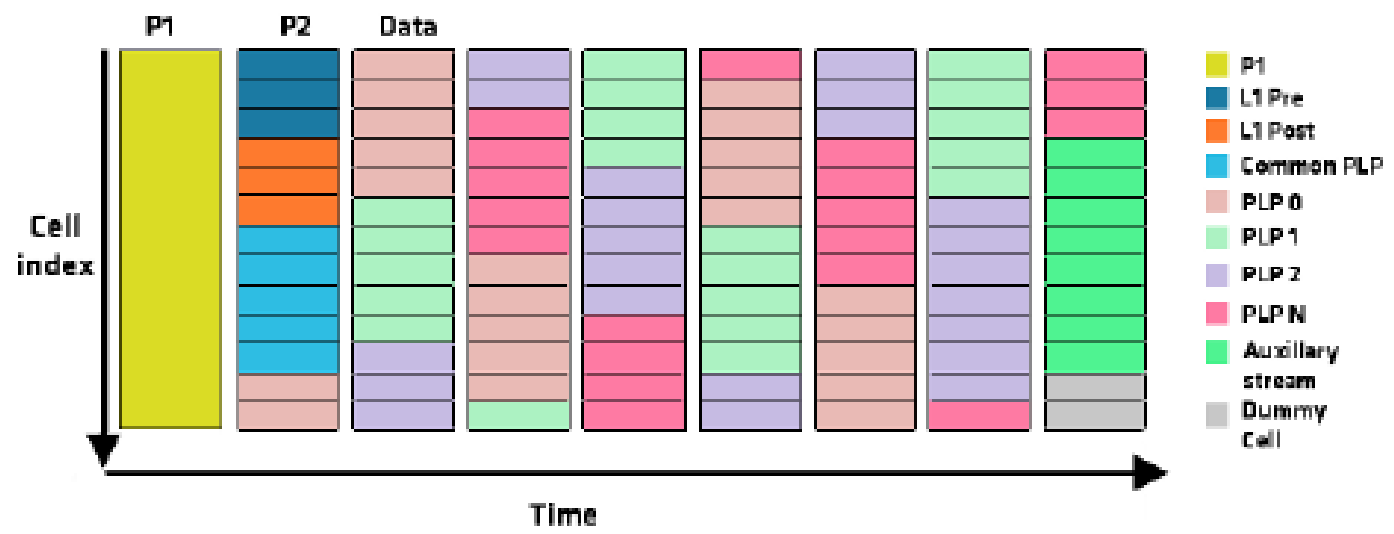
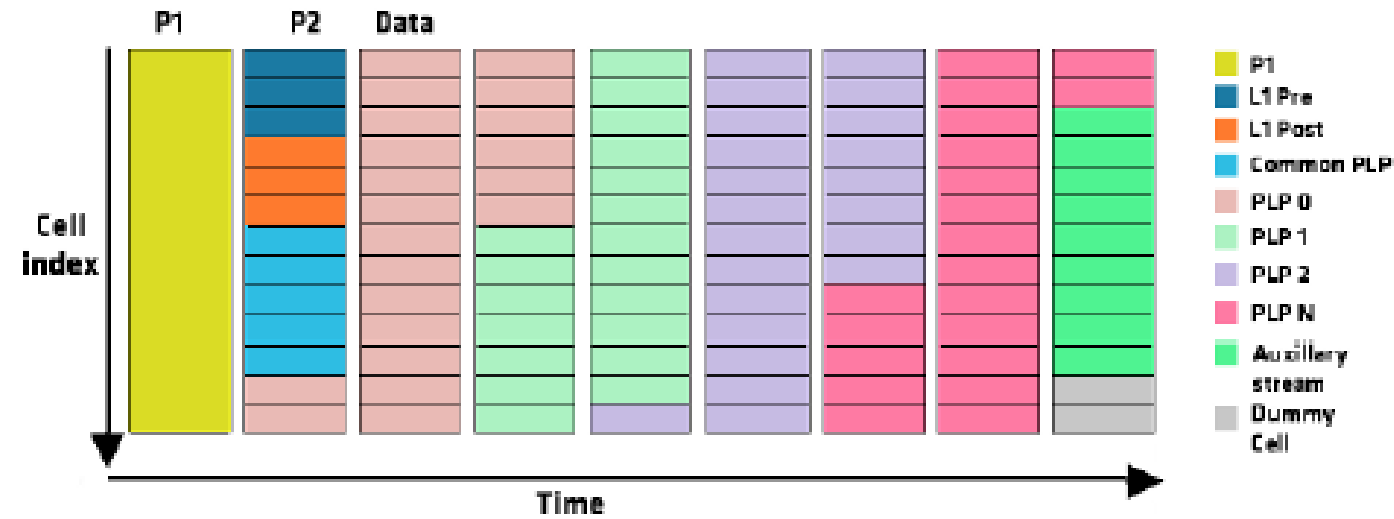
- Possibility to reach different kinds of receivers and reception conditions with a single RF signal
 - HDTV to roof-top directional antennas in PLPs with "normal" robustness PLPs
 - Mobile receivers with robust PLPs



PLP for various services

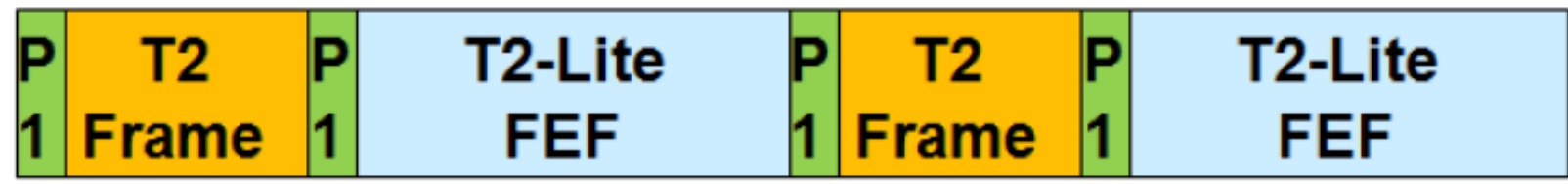
Power saving PLP

Time slicing Mobile robustness



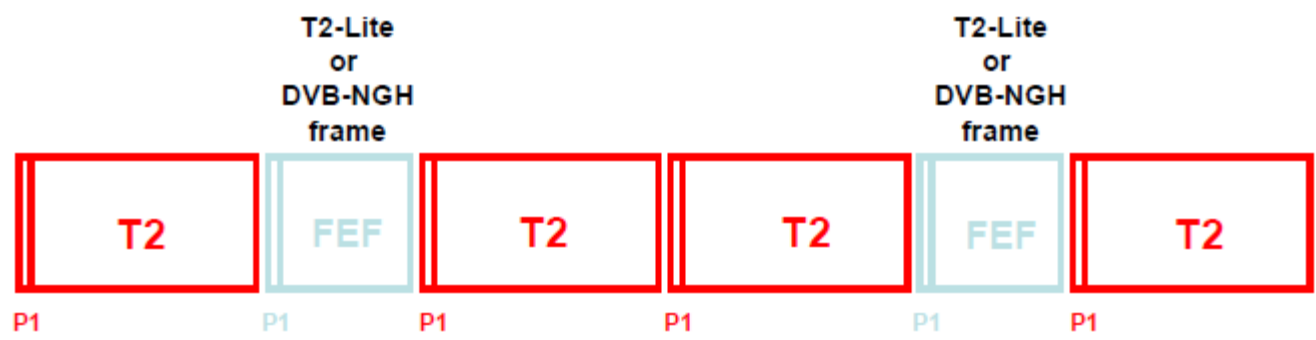
Future Extension Frames (FEF)

- DVB-T2 is based on a Frame structure
- Each Frame starts with a P1 preamble specifying the content type
- FEF allow to mix different FFT sizes and guard intervalls in one channel.
- FEF allow to combine different technologies in one frequency channel
- FEF could also support LTE frames together with T2



Future Extension Frames (FEFs)

- A mechanism that allows a future system to be sent as “Future Extension frames” in T2 time slots
 - No restrictions in the allowed content of the FEF
 - FEF may use DVB-T2 Lite (mobile, specified subset of DVB-T2)
 - Future transmission of the DVB Next Generation Handheld (DVB-NGH) standard currently developed by DVB
- The FEF mechanism does not exist in DVB-T
- Allows flexible capacity allocation to fixed and mobile services by adjusting the size of T2 frame and FEF



Future Broadcasting NGB

- Countries starting digital should consider DVB-T2
 - “no point” to start DVB-T today
- Multiple PLP:s- common infra structure for Radio and TV?
- DVB-T2 with 1.7 MHz BW to replace T-DAB
- Chinese Digital TV system standard DTMB will present a new DTMB-A , which is a similar to DVB-T2- but probably has a few years to implementation

Classification of Media Delivery

	Video service with managed QoS	Video service with unmanaged QoS
(Semi interactive) traditional broadcast networks	Traditional 1 	
(Interactive) integrated networks	Wired IBB 2 	OTT
	Wireless IBB 3 	OTT - wireless
(Fully interactive) duplex networks	4 IPTV	5 OTT 6 Wireless OTT

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To summarise

- T-DMB, ISDB-Tmm, ATSC-M and DVB-T2 lite
- Efficient and effective broadcasting to mobile devices is possible

