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Overview of the DAB+ System

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Overview of the DAB+ System

DAB Family of Standards

DAB+ Features

Ensemble Structure

System Structure

Network Options

The Future

An Introduction

Welcome to the DAB Family of Standards

Overview of the DAB+ System

The DAB Family of Standards

The Eureka Family of Standards

- DAB : 1995 Original audio with PAD and data services standard
- T-DMB : 2006 Added video services for Mobile TV and enhanced data streaming
- DAB+ : 2007 Enhanced audio service efficiency

Why DAB+?

- 2.5 times more audio services than DAB due to the use of HE AAC+ v2
- Slightly better coverage – 1 to 2dB better than DAB – better FEC coding
- More flexibility for Programme Associated Data delivery
- PAD content has much stronger error protection

Overview of the DAB+ System

DAB Standards

For detailed description of the DAB+ system refer to the following ETSI standards documents

- EN 300 401   Main document
- TR 101 496-1, -2, -3   Guidelines of use and operation
- TS 102 563   Transport of AAC audio

http://www.worlddab.org

DAB+ Features

Overview of the DAB+ System

DAB+ Features – Audio - Room for Lots of Services

Overview of the DAB+ System

Choose the station from a list

No more need to remember the station's frequency!!!

Station list
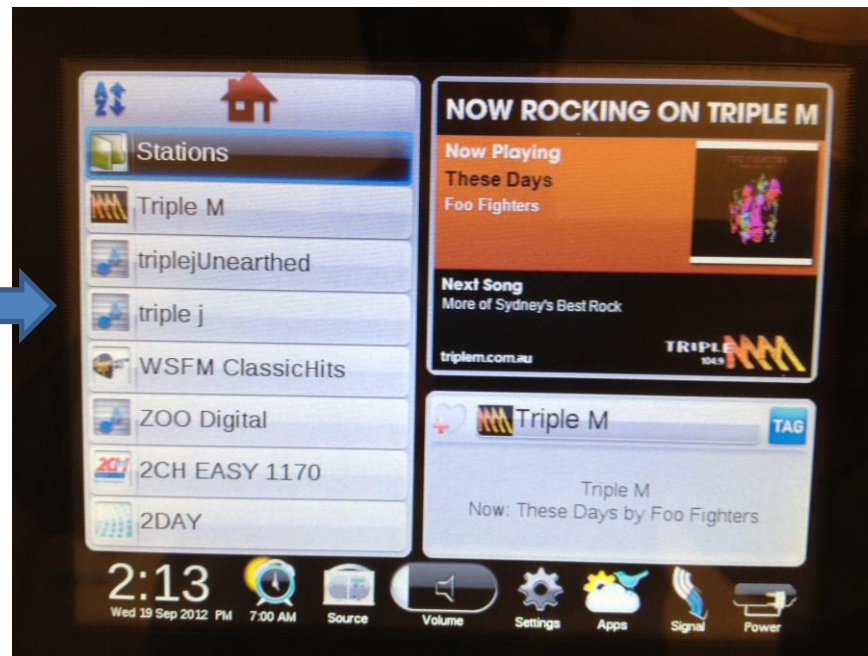
Overview of the DAB+ System

PAD – Scrolling Text (Dynamic Label Segment)

Straight forward, effective

Limited to 128 characters per text segment

All DAB+ receivers have DLS

Good receivers should have options to vary scroll speed

Overview of the DAB+ System

PAD – SlideShow (SLS)

- Further strengthens the audio message
- Standalone advertising during song items
- Promotion of station activities, e.g. OB's
- Traffic and weather reports
- Race / betting and stock market information
- Local news, happenings, community events

Overview of the DAB+ System
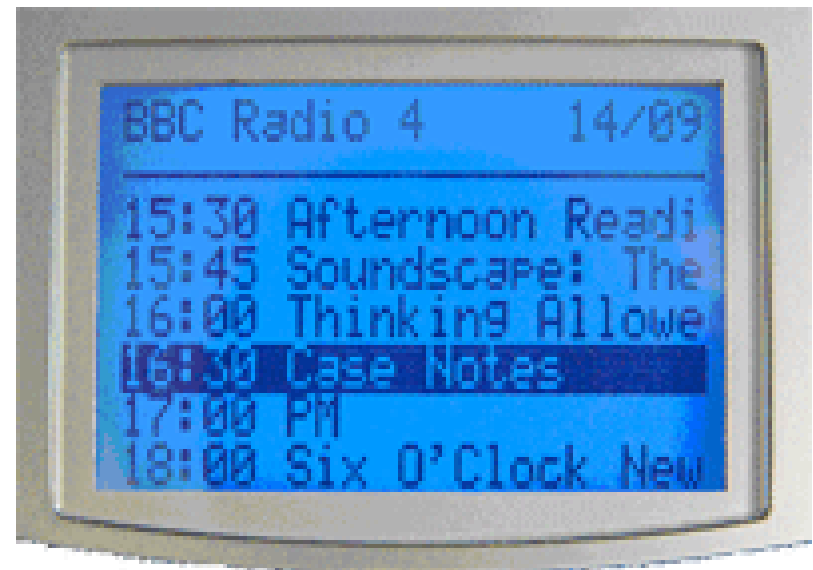
Data Services – Electronic Programme Guide (EPG)

Very useful tool for promotion of programs, talent, competitions

Especially useful for multilingual national broadcasters with scheduled programme slots

Is flexible, can be station, network or ensemble based

Overview of the DAB+ System
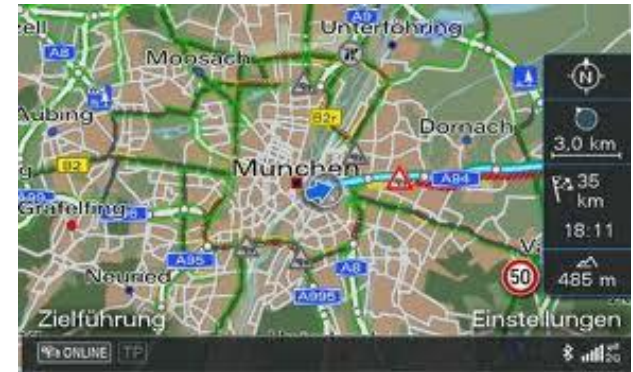
Data Services - Other

Traffic e.g. TMC and TPEG can provide up to the moment information on
• current traffic flow and congestion
• fuel locations and prices
• parking

Journaline
• Hierarchical categorised text service
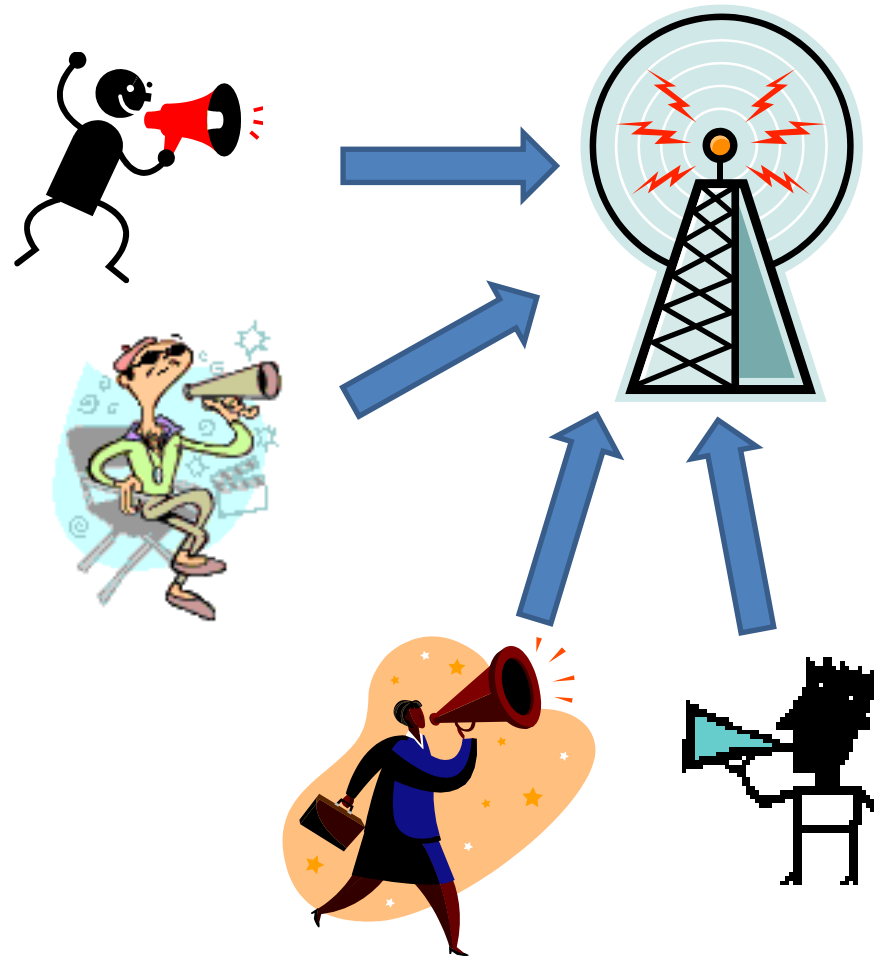
Custom Applications

Ensemble Structure

Overview of the DAB+ System

Ensemble Structure

Multiple different radio stations transmitting on the same frequency

Multiple different radio stations use the same transmitter

Multiple different radio stations share the cost of that single transmission

Overview of the DAB+ System
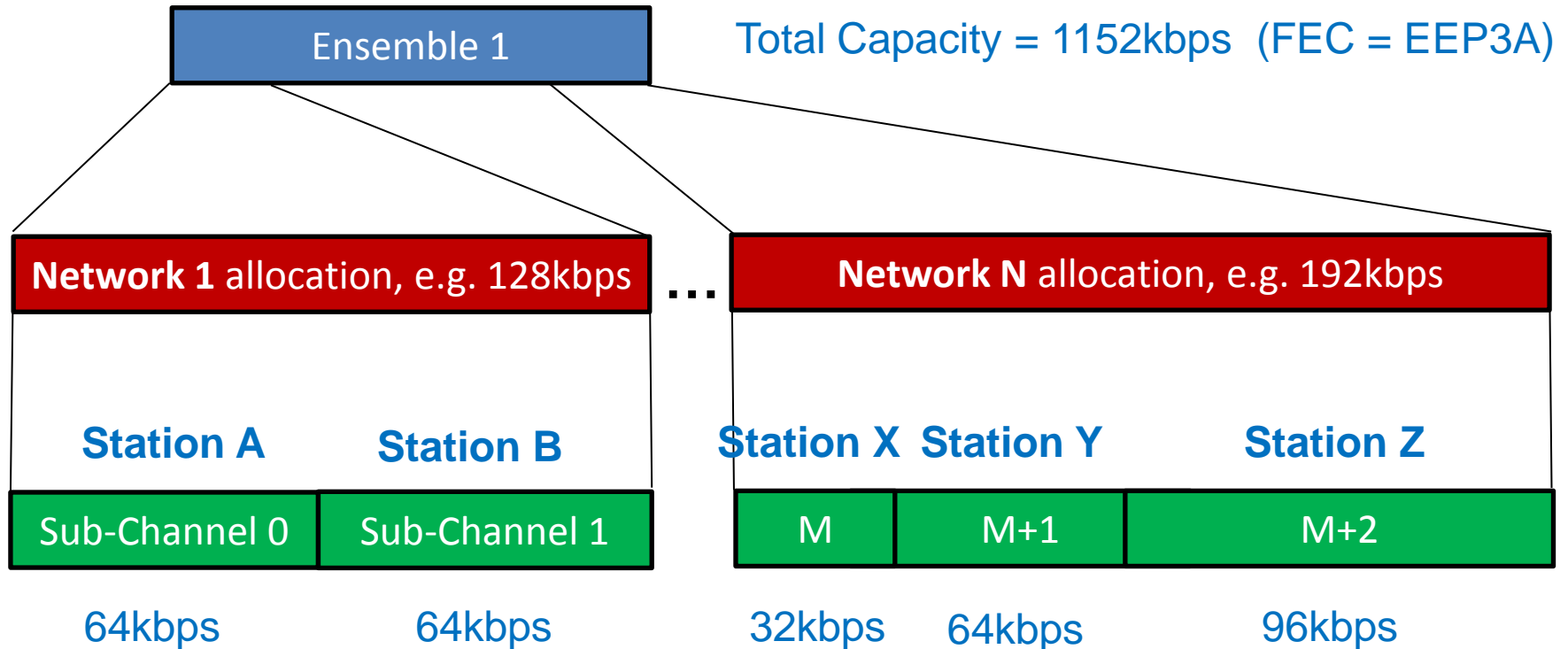
Ensemble Structure

An Ensemble will typically carry multiple services from multiple radio networks, example:

- Network 1 – 2 stations (services)   128kbps
- Network 2 – 4 stations   256kbps
- Network 3 – 3 stations   192kbps
- Network 4 – 9 stations   576kbps
  - **Total 18 stations**   **1152kbps**

- Each network can have their own allocated capacity on the ensemble
  - No other network has access to that capacity
- Each network can **reconfigure** their allocated capacity anytime without impacting the other networks' services
  - **Pop-up services** change their name and sometimes bit rate regularly

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Ensemble Structure

Ensemble 1

Total Capacity = 1152kbps (FEC = EEP3A)

Network 1 allocation, e.g. 128kbps	...	Network N allocation, e.g. 192kbps

Station A	Station B	Station X	Station Y	Station Z
Sub-Channel 0	Sub-Channel 1	M	M+1	M+2
64kbps	64kbps	32kbps	64kbps	96kbps

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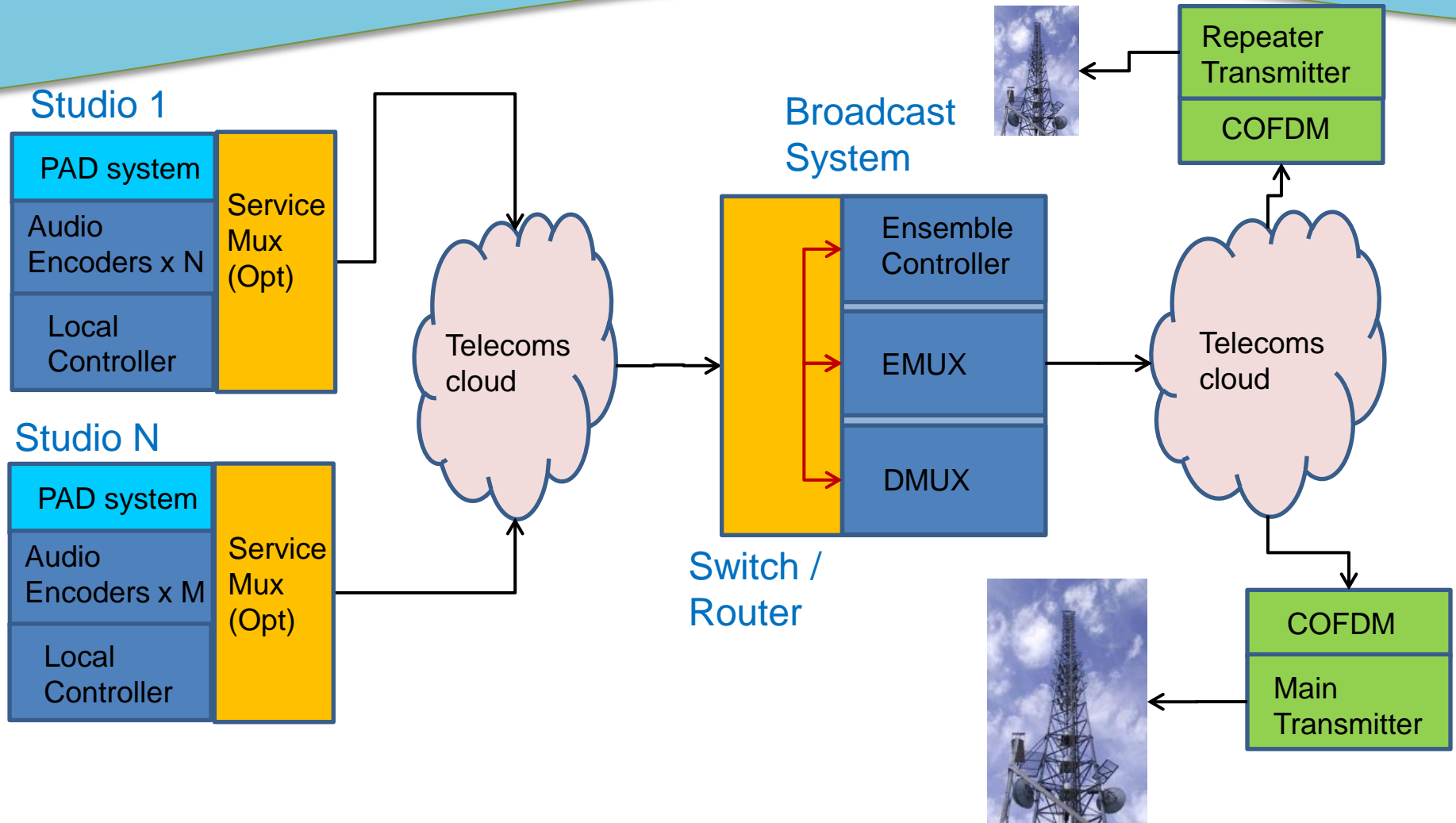
Ensemble Structure

Each ensemble has

- Its own (unique) Ensemble Label

- Its own Ensemble ID code

- Can carry unique identifying code of the transmitter (TII)

- a Signalling Channel – the Fast Information Channel (FIC)

    - Provides details about all services (stations) carried

        - Labels

        - Bit rates

        - Data location in the stream

    - Provides details of all data services and PAD

    - Provides announcements and warnings

System Structure

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Example DAB+ network

Studio 1

| PAD system |
| Audio Encoders x N |
| Local Controller |

Service Mux (Opt)

Studio N

| PAD system |
| Audio Encoders x M |
| Local Controller |

Service Mux (Opt)

Telecoms cloud

Broadcast System

Switch / Router

| Ensemble Controller |
| EMUX |
| DMUX |

Telecoms cloud

Repeater Transmitter

COFDM

COFDM

Main Transmitter

Overview of the DAB+ System

DAB+ Audio

HE AAC+ V2 audio encoding table combinations

Sampling rate (kHz)	SBR on	Sub-channel data rates (kbps)					
		Stereo		Parametric Stereo		Mono	
		Min	Max	Min	Max	Min	Max
48	no	24	192	-	-	16	176
24	yes	24	136	24	48	16	64
32	no	24	192	-	-	16	168
16	yes	24	136	24	48	16	64

Coding Technologies / Dolby AAC+ implementation

Service labels and abbreviated labels (no more frequencies!!!)

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DAB+ Audio Encoding – Spectral Band Replication

From Computer Desktop Encyclopedia
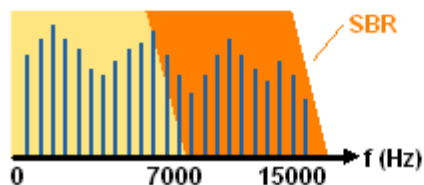© 2005 The Computer Language Co. Inc.

MP3 at 128Kbps
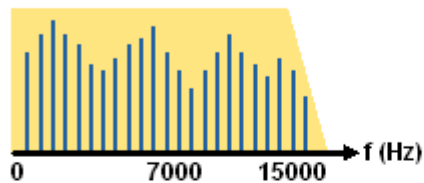
File size

MP3 at 64Kbps (frequencies cut in half)
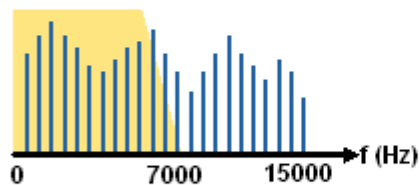
File size

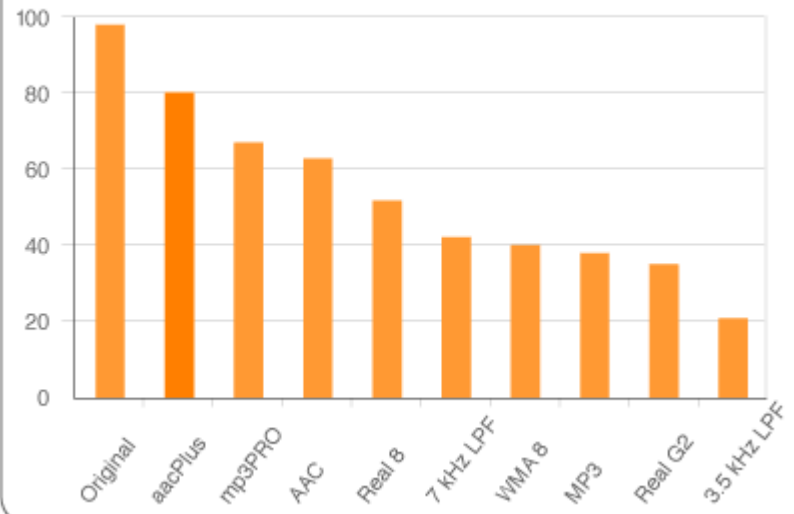**mp3PRO at 64Kbps (high frequencies SBR encoded)**

SBR

File size

SBR data

Efficient sample rate and bit rate reduction method

Only slight audio degradation

EBU subjective listening test at 48 kbps stereo

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DAB+ Audio Encoding

Signal Flow with outer layer FEC
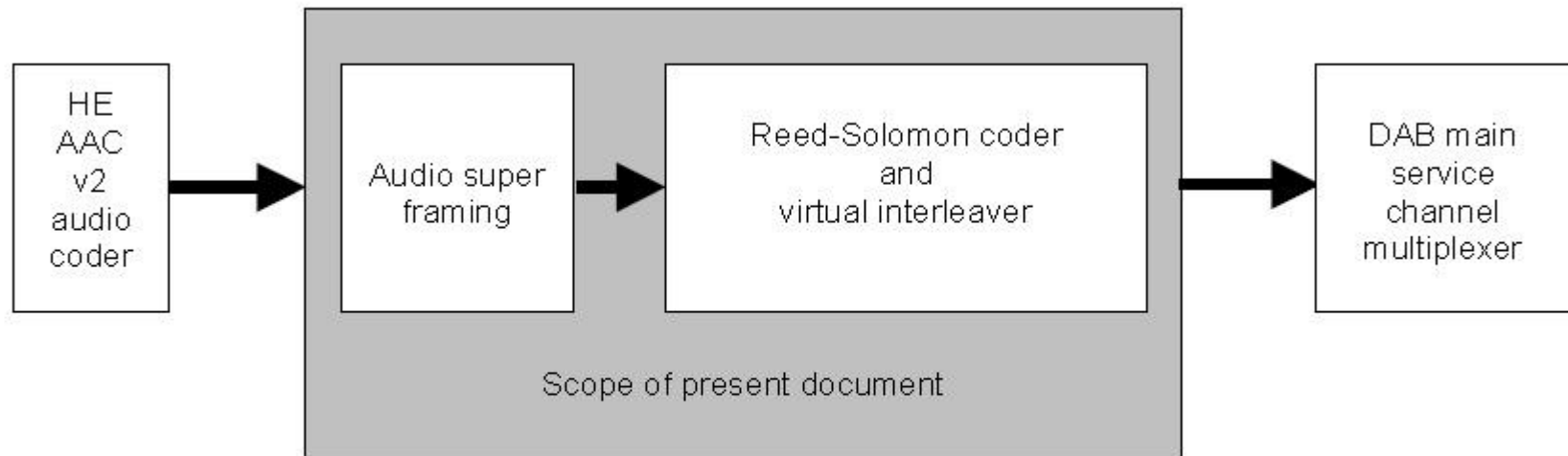
Figure 1: Conceptual diagram of the outer coder and interleaver
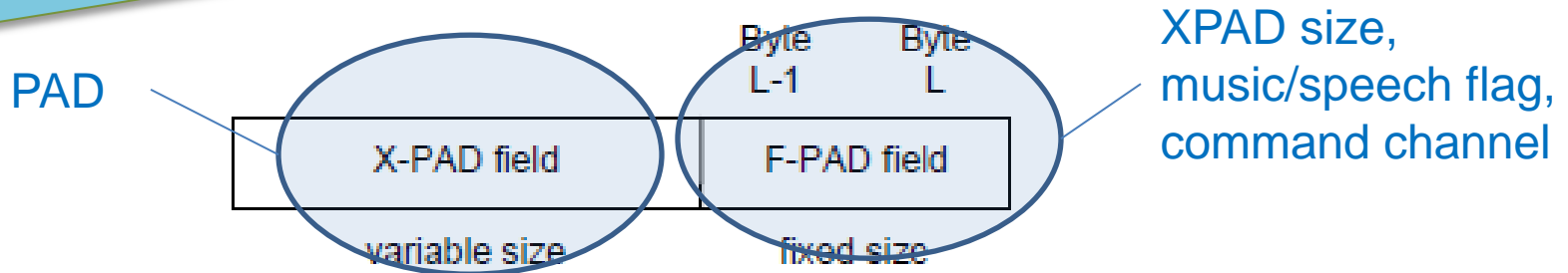
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Audio - PAD

PAD

X-PAD field
variable size

Byte L-1   Byte L
F-PAD field
fixed size

XPAD size, music/speech flag, command channel

Figure 2: Coding of the PAD field

Table 10: Maximum bit rate of F-PAD and X-PAD data

AAC core sampling rate	Maximum bit rate for F-PAD data (2 bytes)	Maximum bit rate for X-PAD data (196 bytes)
16 kHz	267 bps	26 133 bps
24 kHz	400 bps	39 200 bps
32 kHz	533 bps	52 267 bps
48 kHz	800 bps	78 400 bps

Typical use: SBR on @ 24kHz core sampling rate, 3 frames per super-frame, 1 super-frame per 120mS

Overview of the DAB+ System

Audio Bit Rates v PAD Bit Rate

Need to ensure the correct balance between audio bit rate, audio settings and PAD

Audio bit rate =

Sub-Channel bit rate *0.9 – PAD bit rate

Sub-Channel bit rate (kbps)	FEC Overhead 10%	Payload capacity (kbps)	PAD (kbps)	Audio bit rate (kbps)
32	3.2	28.8	1	27.8
32	3.2	28.8	2	26.8
32	3.2	28.8	4	24.8
32	3.2	28.8	8	20.8
48	4.8	43.2	1	42.2
48	4.8	43.2	2	41.2
48	4.8	43.2	4	39.2
48	4.8	43.2	8	35.2
64	6.4	57.6	1	56.6
64	6.4	57.6	2	55.6
64	6.4	57.6	4	53.6
64	6.4	57.6	8	49.6
64	6.4	57.6	16	41.6
80	8	72	1	71
80	8	72	2	70
80	8	72	4	68
80	8	72	8	64
80	8	72	16	56

Overview of the DAB+ System

Signal Flow - Transmitter
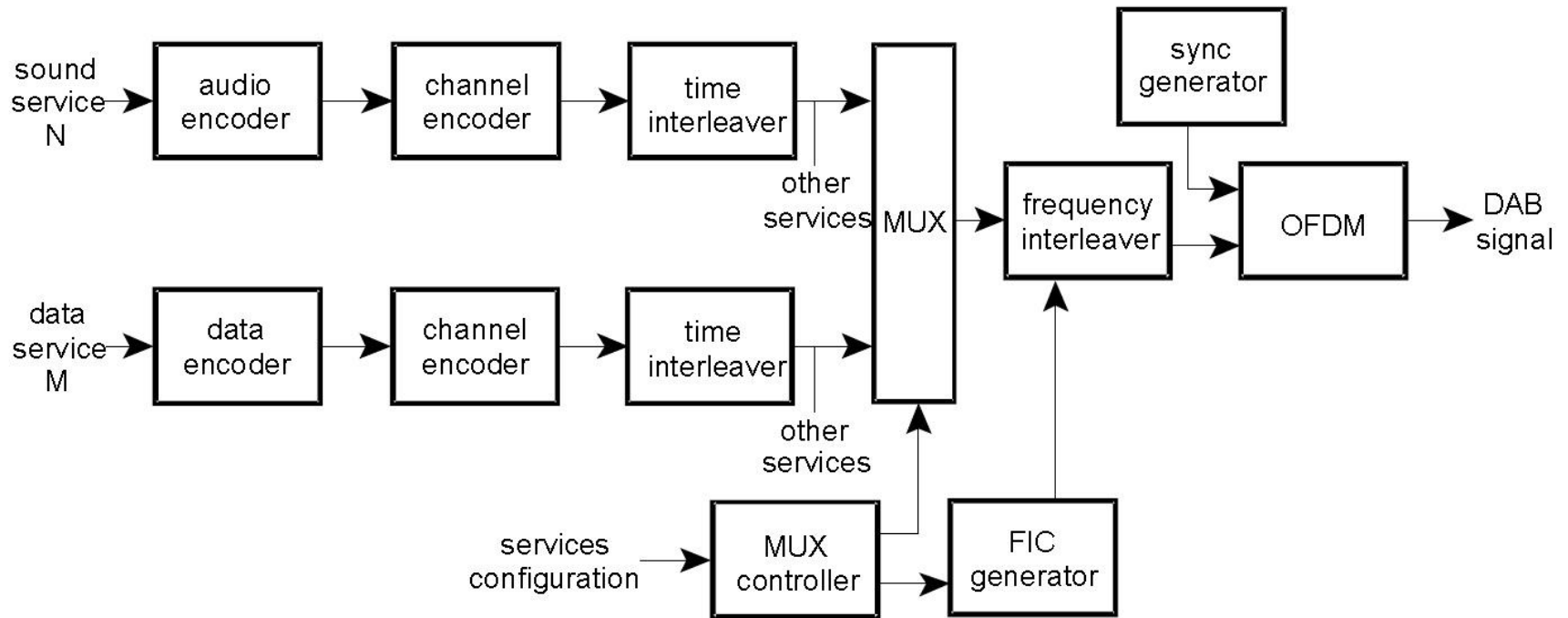
Figure 4.3.1: Conceptual block diagram of the EUREKA DAB system transmitter drive

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FEC Code Rate Comparison

FEC Code	Code Rate	Capacity (kbps)	Number of 64kbps channels	Approximate power required relative to 3A
1A	1/4	576	9	-3 to -6dB
2A	3/8	864	13	-2 to -3dB
3A	1/2	1152	18	0
3B	2/3	1536	24	+3dB
4A	3/4	1728	27	+6dB

Overview of the DAB+ System

Transmission Structure - Overview

Signalling and service information is sent in the Fast Information Channel
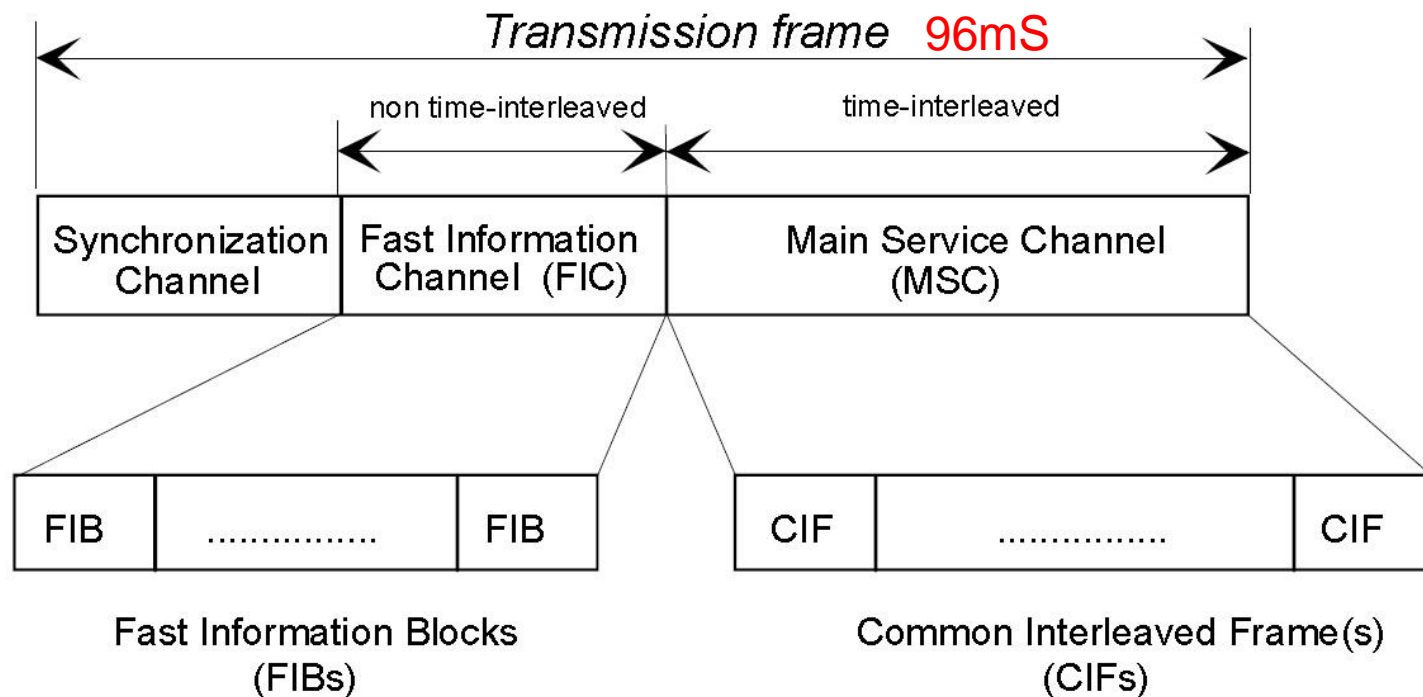
Figure 2: Transmission mode independent description of the FIC and MSC

Overview of the DAB+ System

DAB+ Transmission – Australian channels
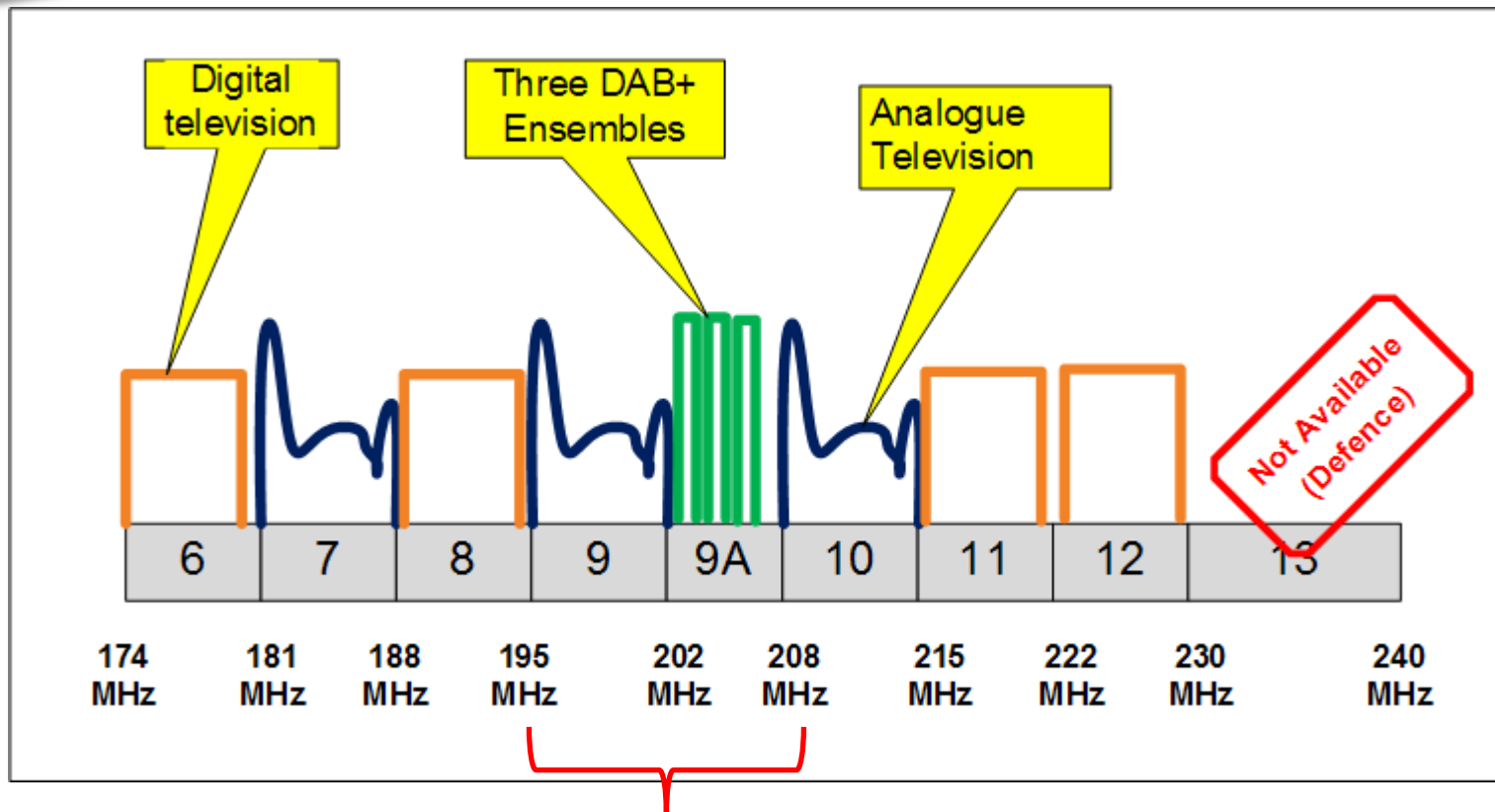
Overview of the DAB+ System

RF Spectrum
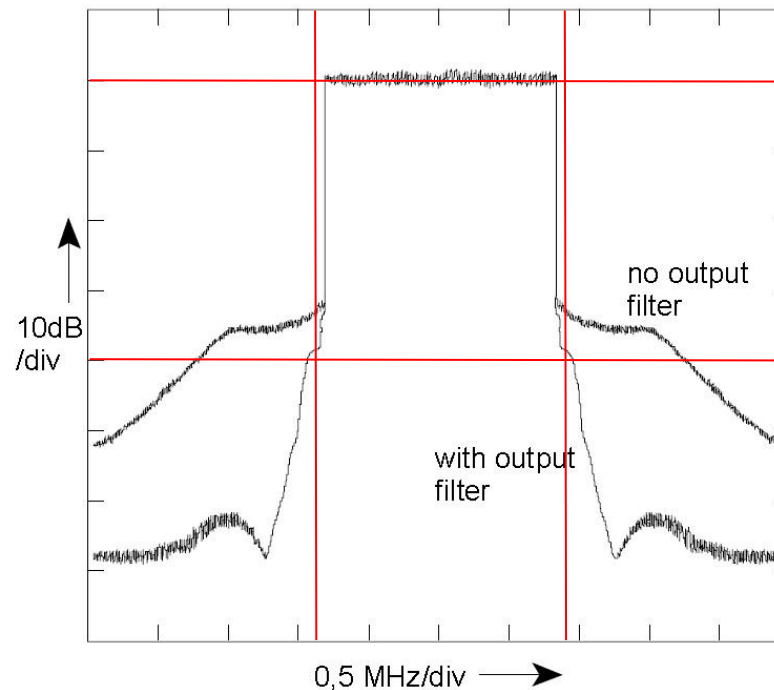
Figure 4.3.4: Example of DAB transmitted signal spectrum (VHF band III)

Signal bandwidth = 1536 carriers at 1kHz each => 1.537MHz
Channel bandwidth = 1.712 MHz

Network Options

Overview of the DAB+ System

Star Network

Central multiplexing equipment

Individual links per studio site

Stations are in control of their content

Privacy
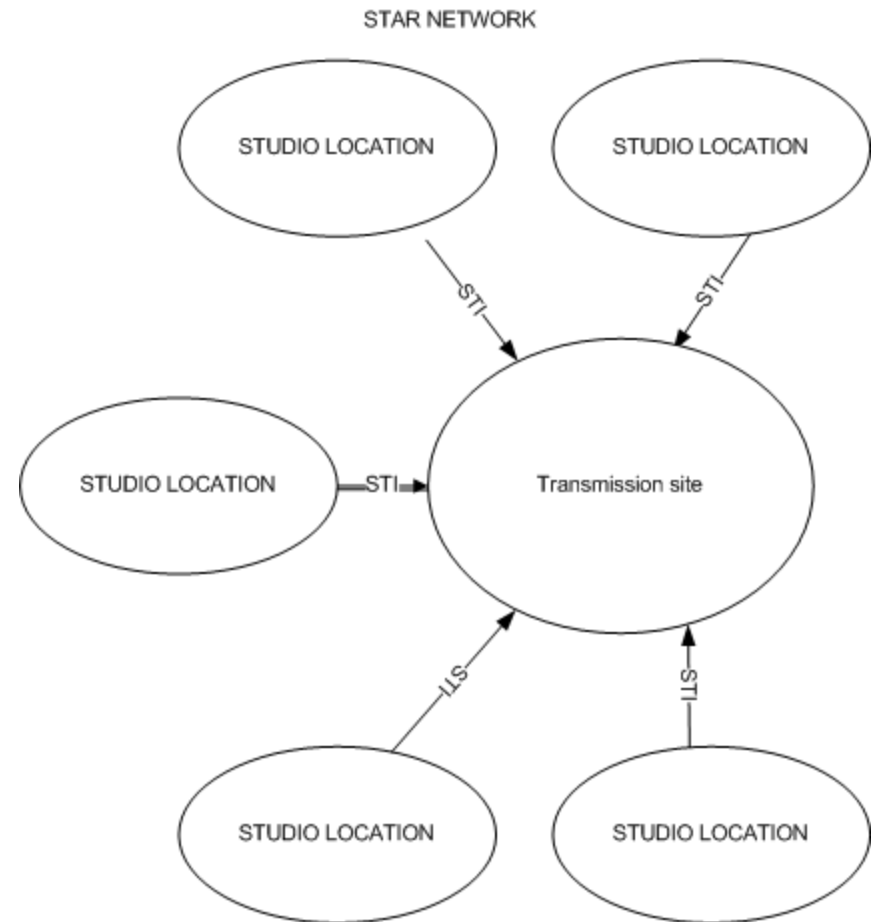
STAR NETWORK

Overview of the DAB+ System

Star Network - Details
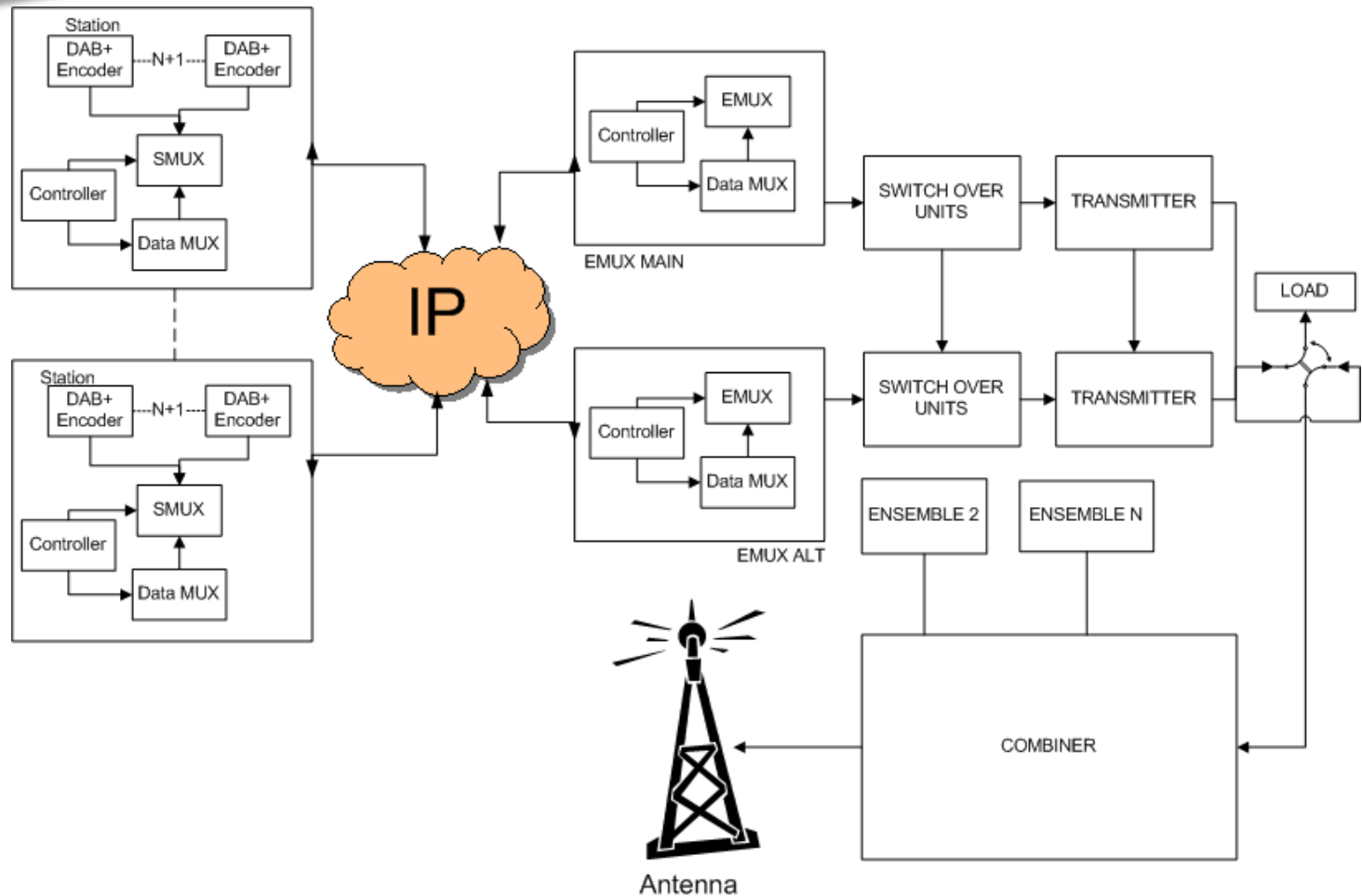
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Mesh Network

Transparent interconnect between sites

High Redundancy and Reliability

Typically uses a multicast enabled VPN

MESH NETWORK AND TRANSMISSION

SYDNEY

MAIN NODE 1

MAIN NODE 2

BNE

PER

ADE

MEL

SYD
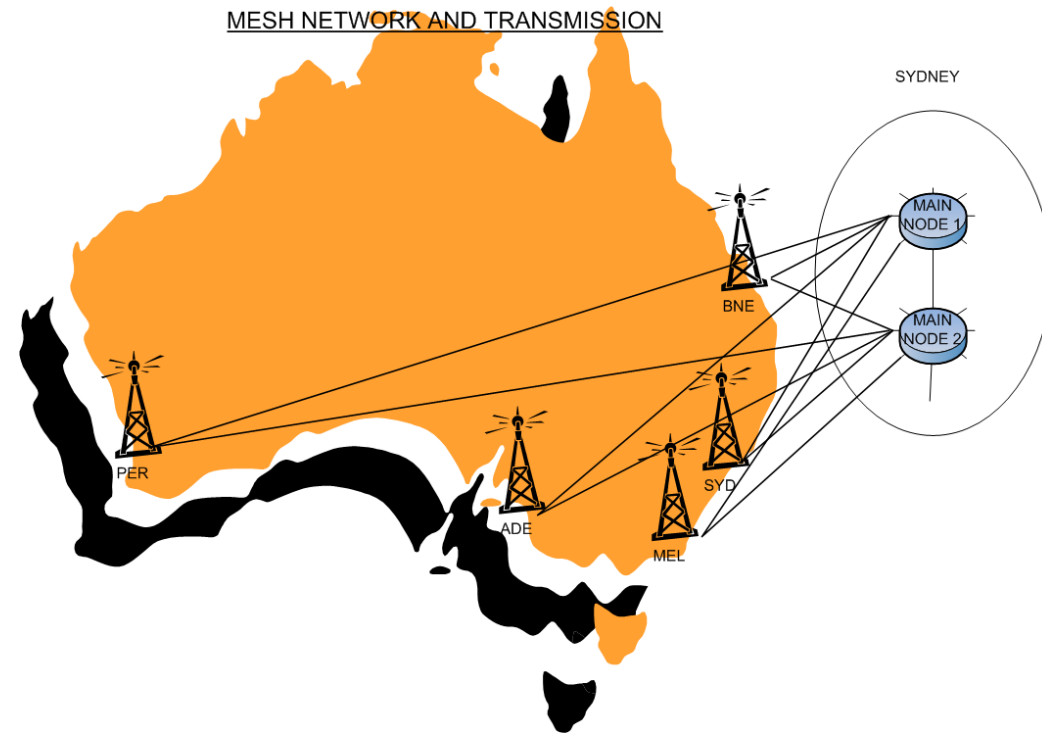
Overview of the DAB+ System

Monitoring Equipment - Overview

Service Monitor

Ensemble Recorder

ETI Monitor

Tx Monitor

Field Monitor

SFN Monitor

Listeners

Network Management
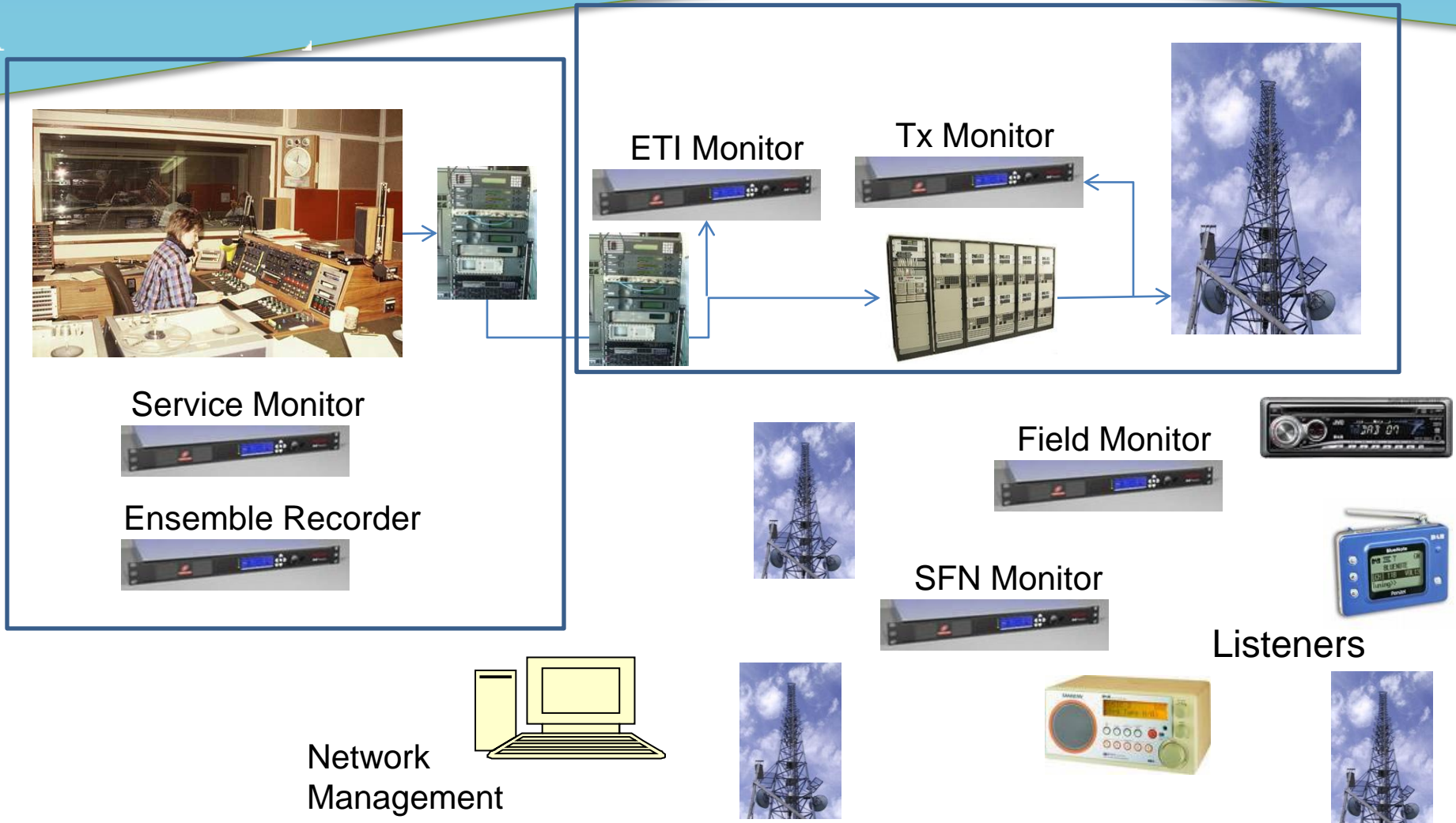
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Network Management System

Network Management is essential for rapid fault detection and correction

Remote access via web interface allows best grade of service
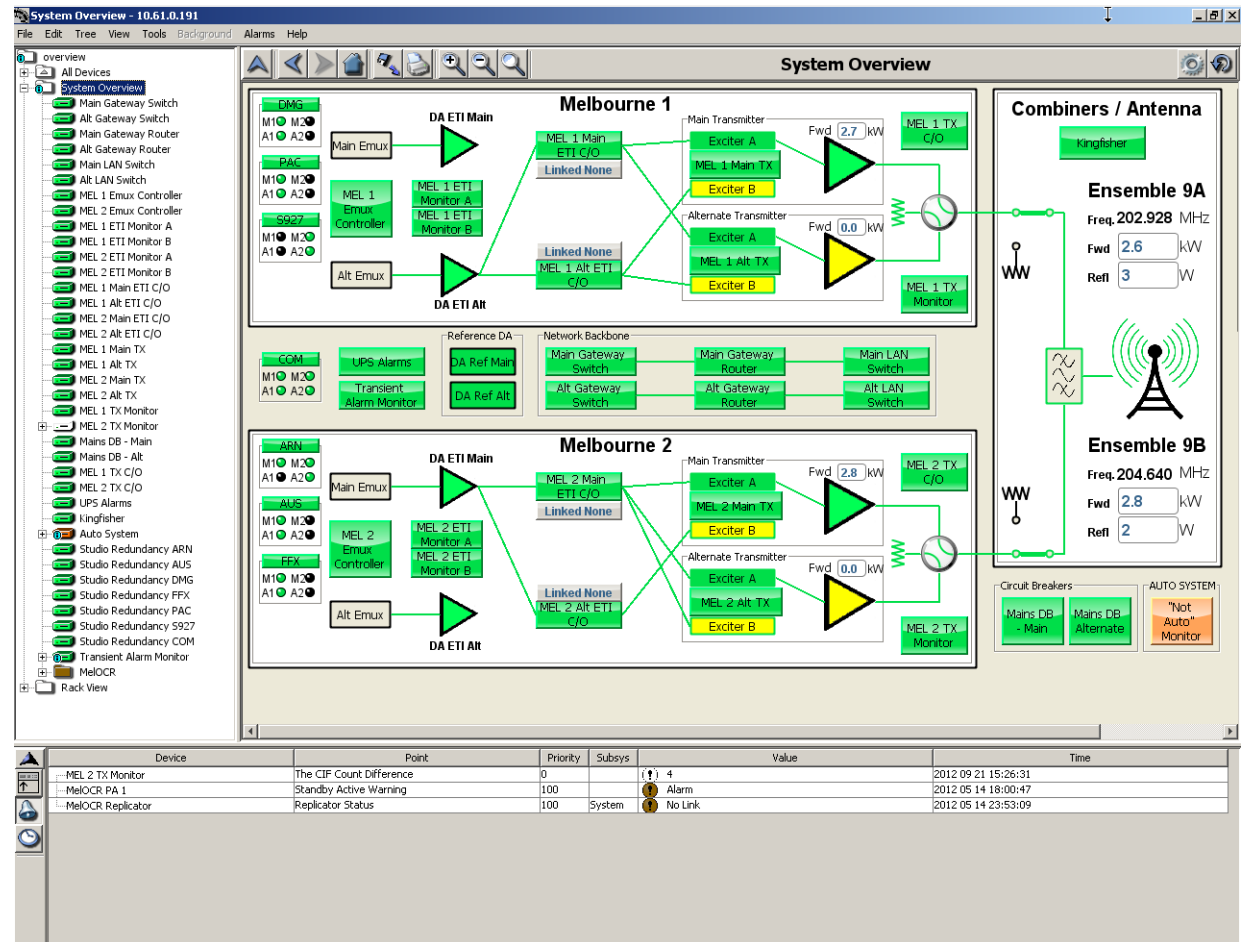
Overview of the DAB+ System

Examples of DAB+ multiplexer and transmitter equipment

The Future

The Future – Hybrid Radio

DL+ and CAT-SLS are examples of Hybrid Radio

Providing More Information to listeners on demand

Tagging and reminders for later content use

The standards are being written now!

What is Hybrid Radio

Home operation

Broadcaster

Transmission Information from Broadcaster

Telco network

Broadcaster interaction

Free to Air DAB+ broadcast with PAD

WiFi connection

Bluetooth connection

Hybrid Radio

3rd Party services
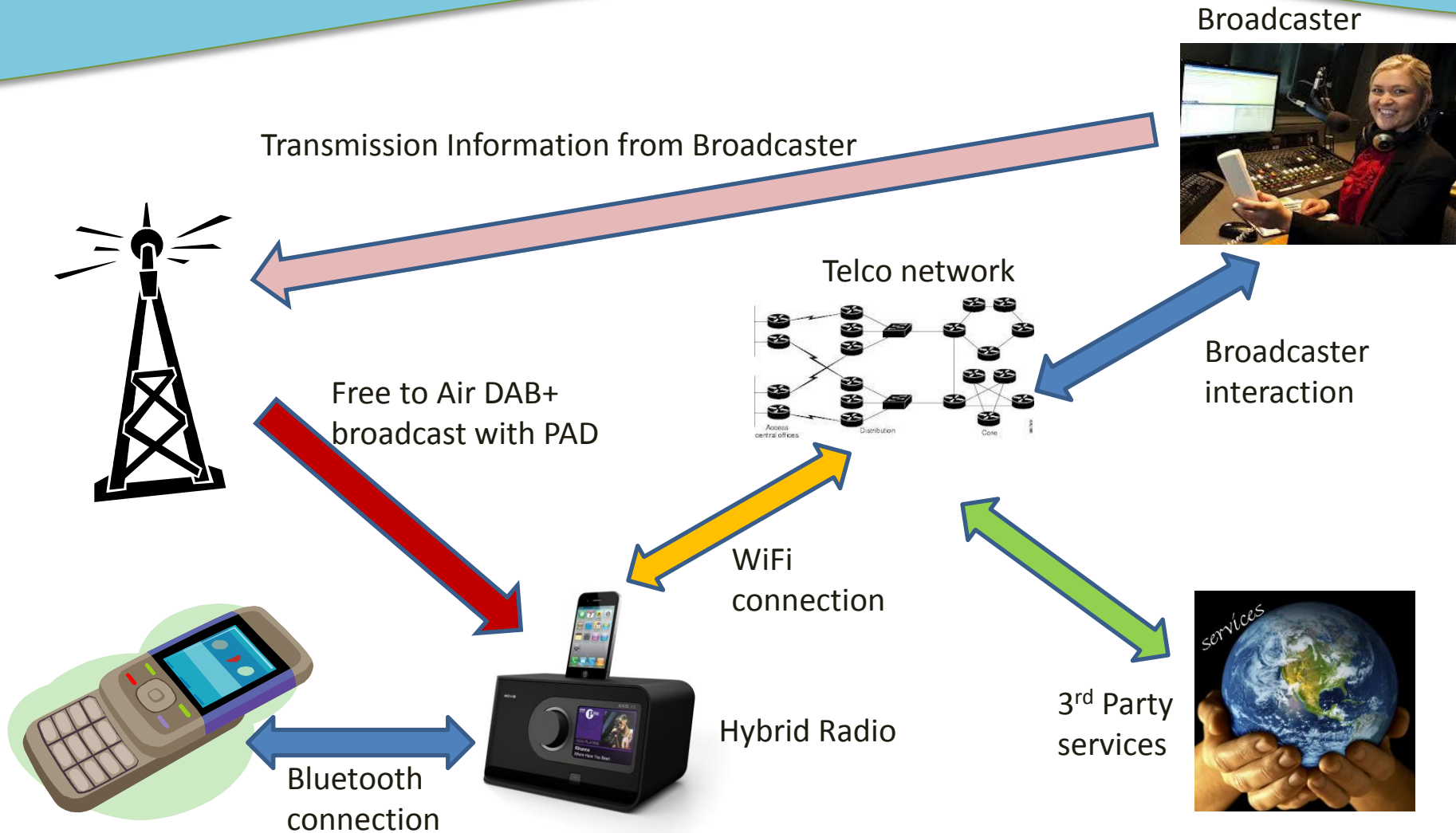
What is Hybrid Radio

Mobile operation

Broadcaster

Transmission Information from Broadcaster

Mobile network

Broadcaster interaction

Mobile internet

Free to Air DAB+ broadcast with PAD

DAB+ capable mobile phone

3rd party services
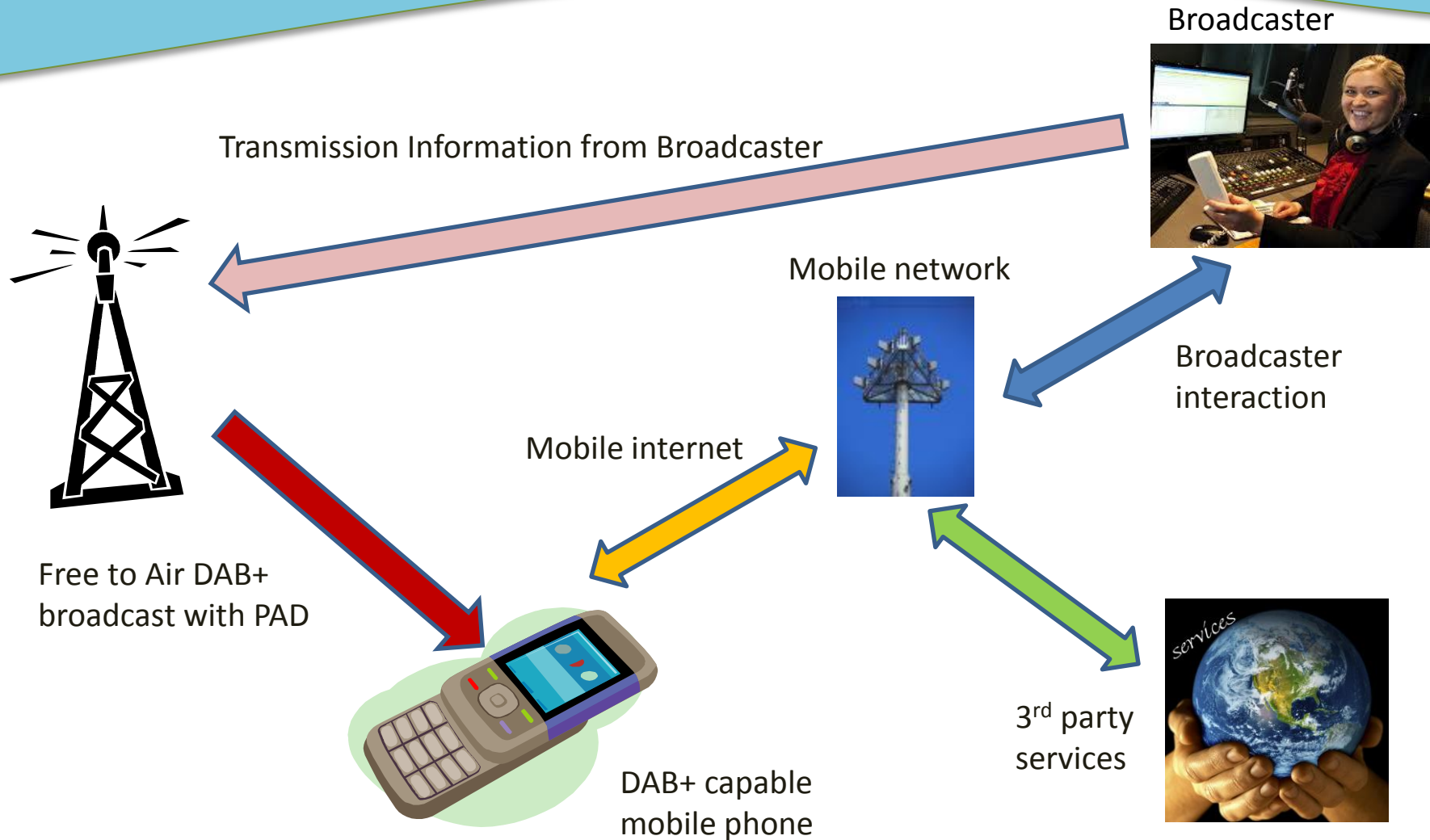
Hybrid Radio Use Cases

More Information: Use Case Example 1 – connection to an advertiser

Screen tap

Accessing a website from a URL delivered associated with a product / service being advertised

Hybrid Radio Use Cases
More Information: Use Case example 2 – Artist information

Screen tap
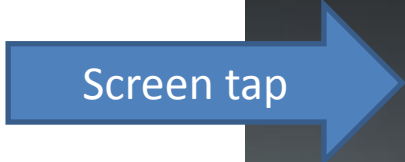
Listeners can access more information about the current artist

Hybrid Radio Use Cases
More Information – Use Case Example 3 – public information

Button press

Accessing a website from a URL delivered associated with the information provided

Hybrid Radio Use Cases
More Information – Use Case Example 4 – sports results

Screen tap

Drives listeners to use additional broadcaster facilities

What sport is on tonight, previous results, betting

Overview of the DAB+ System

Summary – Top Tips

1. DAB+ is the best Digital Radio delivery system available
2. Proven technology
3. Cost effective infrastructure
4. Deployed worldwide and expanding rapidly
5. Very flexible operation for broadcasters
6. Huge range of receiver products
7. Great features including scrolling text, images, EPG and data services
8. Many new developments including Interactivity

Overview of the DAB+ System

Thank You

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