



VOV / WorldDMB Workshop on Digital Radio Technologies

27-29 July 2013

*The Melia Hotel & VOV HQ Building,
Hanoi, Vietnam*



Supported by



Overview of the DAB+ System

Friday 26 July 2013, Session 2

Dr. Les Sabel - WorldDMB Technical Committee

Overview of the DAB+ System

Overview

DAB Family of Standards

DAB+ Features

Ensemble Structure

System Structure

Network Options

The Future

Overview of the DAB+ System

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>

Overview of the DAB+ System

DAB+ Features

Overview of the DAB+ System

DAB+ Features – Audio - Room for Lots of Services

The image displays a collection of logos for various DAB+ radio services, organized by city and national services. The logos include:

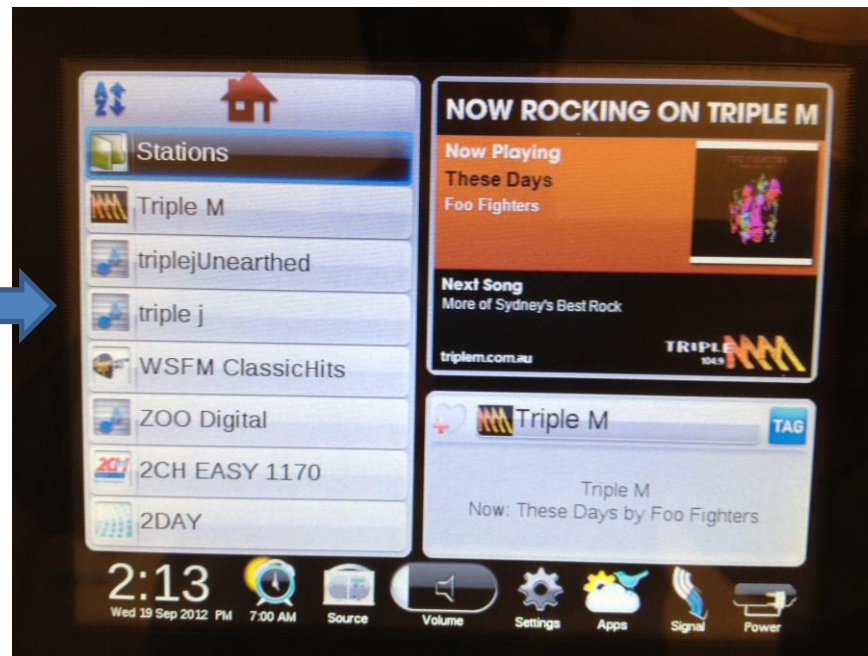
- Sydney:** 2SM 1269-AM, 2GB 875AM, 2CH 1270, 2UE 954 NEWS TALK, Classic Hits WSEW 101.7, 2KY 101.7 AM, 2day, TRIPLE M, my PERTH DIGITAL, 702 ABC Sydney.
- Perth:** mix94.5, 92.9, NOVA 93.7, GPR 93.2, 96fm, 6IX, 720 ABC Perth, ABC Dig Music.
- Brisbane:** 4BC 1116 NEWS TALK, Classic Hits 4KO 693, TRIPLE M 614, b105 105.3, NOVA 106.9 PM, 4BH 88.2, 97.3 FM, RADIO TAB, 612 ABC Brisbane.
- Adelaide:** safm 107.1, Cruise 1323 AM, TRIPLE M, MIX 102.3, FIVE aa, NOVA 91.9, 891 ABC Adelaide.
- Melbourne:** Classic Hits GOLD 104.3, 3mp, Magic 1278, fox, SEN 1116, 3AW 693, NOVA 100 AM, vege 91.5fm, TRIPLE M, MIX 101.1, 774 ABC Melbourne.
- National/Other:** novanation, koffee time to chill, TRIPLE J UNearthed.com, ABC Jazz, RADAЯ, GorillaRadio, Exclusive Pink Radio, Classic Hits WSEW PLUS, ABC Country, Choose the hits, theCrack.

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



SYDNEY'S WEATHER

Mostly fine.




NOW MAX HUM
CITY 22.9°C 24°C 70%
WEST 22.7°C 26°C 65%

www.bom.gov.au



Next Race

12:47 Angle Park Greys Race 7 

Tips by Jim Jacques

1. Twilight Fantasy
7. Genstone Rusty
2. Victa Anity
3. Knight School

Sky Ratings

1. Twilight Fantasy	188	---	→
7. Genstone Rusty	85	---	→
4. Suzy Tee	78	---	→
5. Battle Blitz	78	---	→

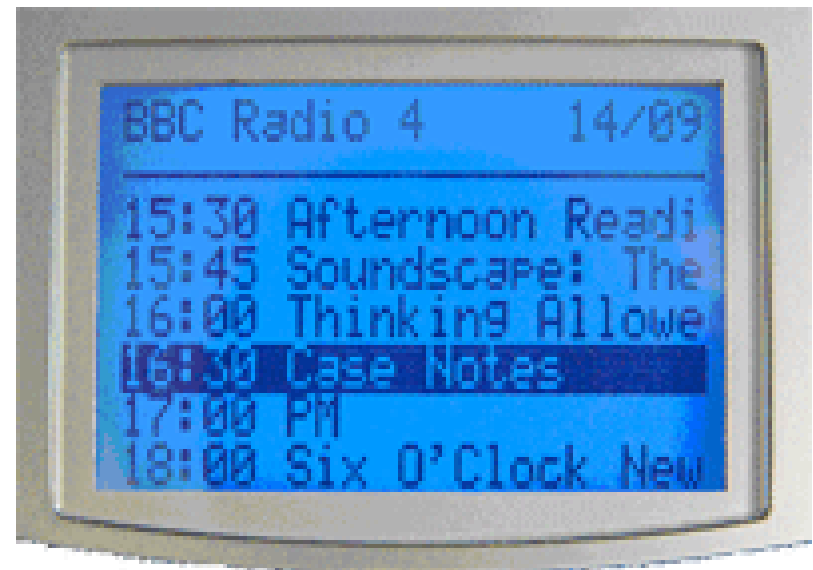
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Data Services – Electronic Programme Guide (EPG)

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



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Data Services - Other

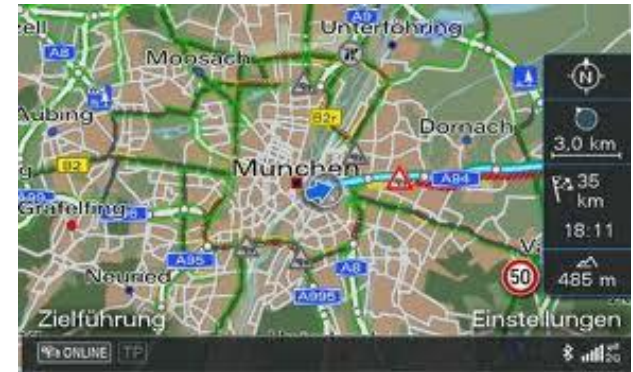
Traffic e.g. TMC and TPEG can provide up to the moment information on

- current traffic flow and congestion
- fuel locations and prices
- parking

Journaline

- Hierarchical categorised text service

Custom Applications



Overview of the DAB+ System

Ensemble Structure

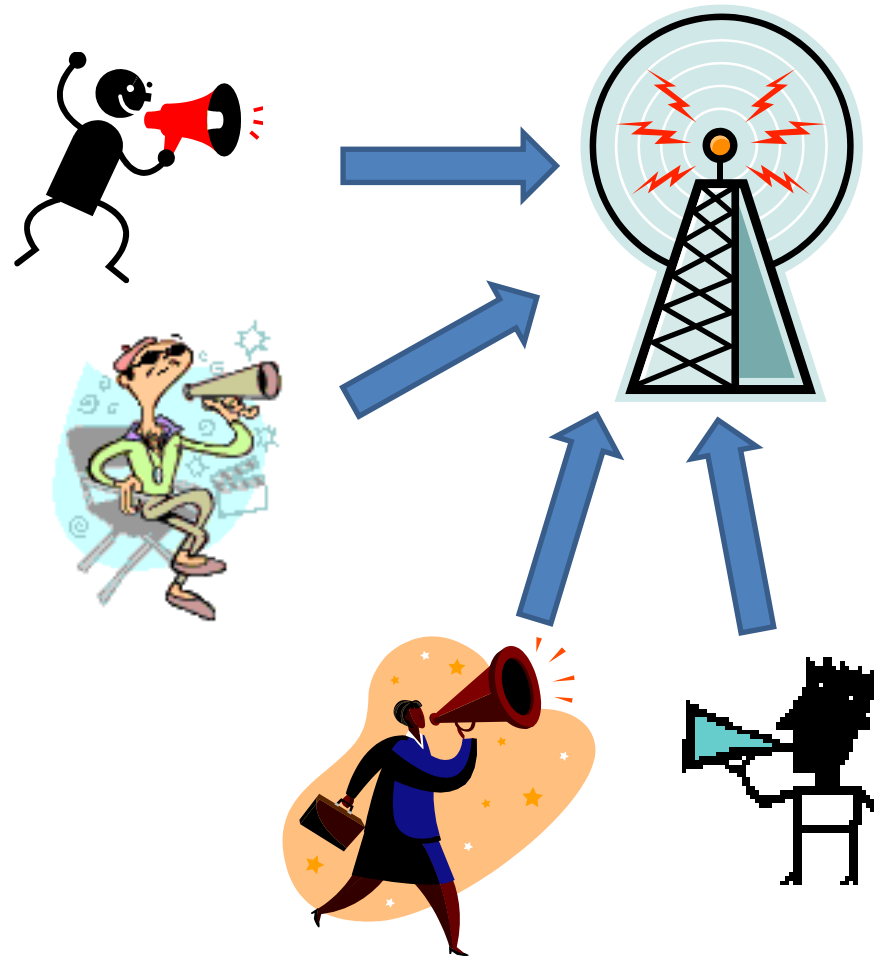
Overview of the DAB+ System

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

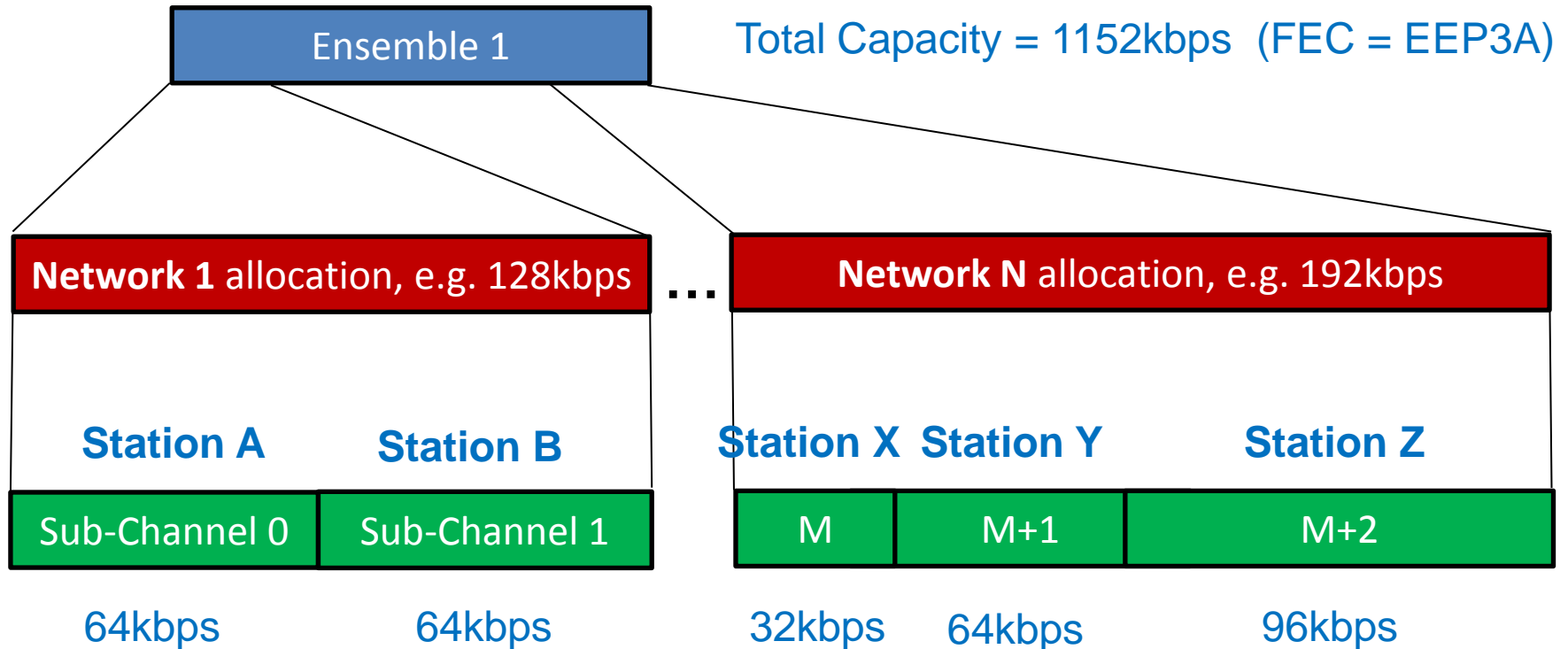
An Ensemble will typically carry multiple services from multiple radio networks, example:

• 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

Overview of the DAB+ System

Ensemble Structure



Overview of the DAB+ System

Ensemble Structure

Each ensemble has

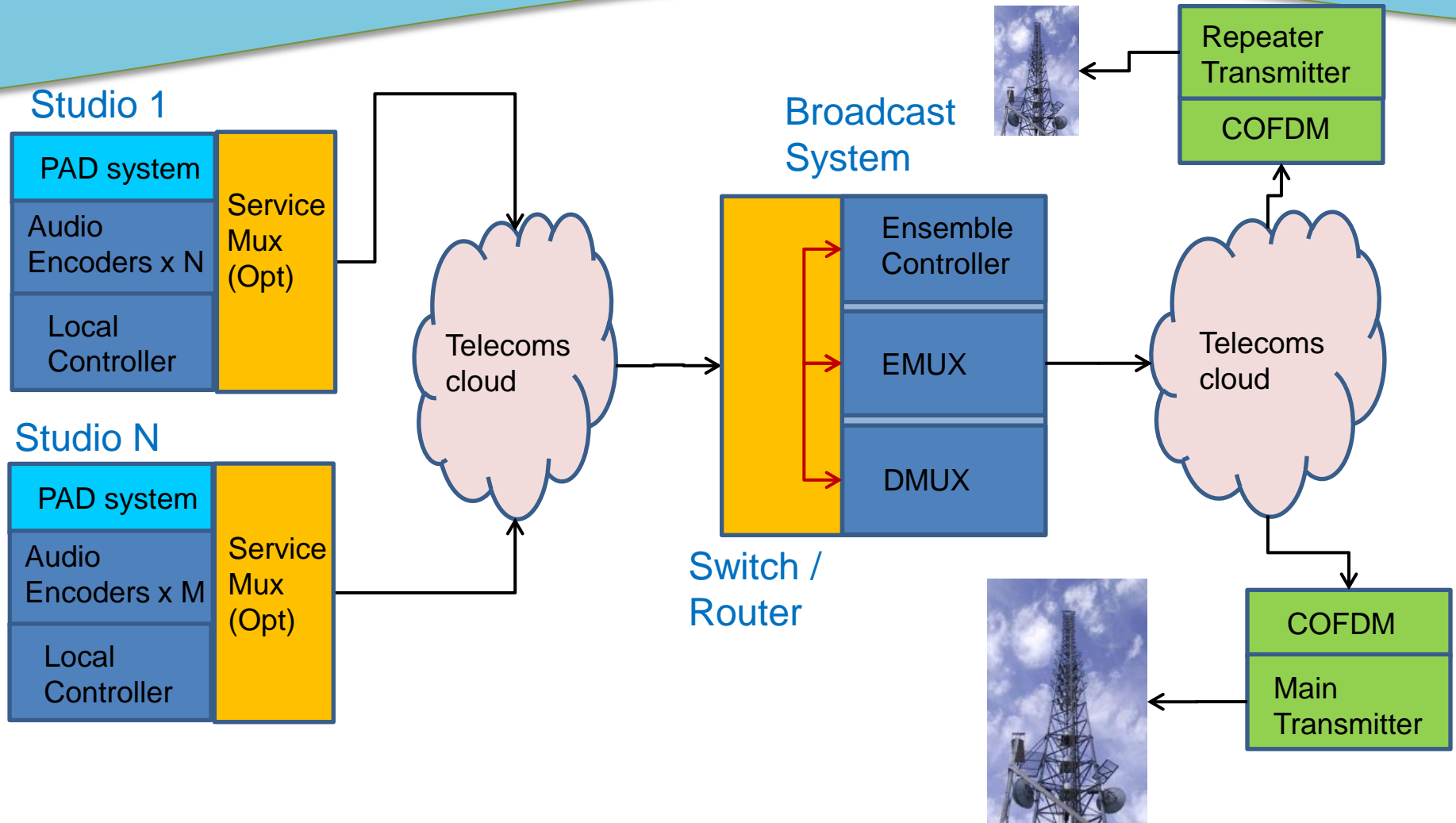
- Its own (unique) Ensemble Label
- Its own Ensemble ID code
- Can carry unique identifying code of the transmitter (TII)
- a Signalling Channel – the Fast Information Channel (FIC)
 - Provides details about all services (stations) carried
 - Labels
 - Bit rates
 - Data location in the stream
 - Provides details of all data services and PAD
 - Provides announcements and warnings

Overview of the DAB+ System

System Structure

Overview of the DAB+ System

Example DAB+ network



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

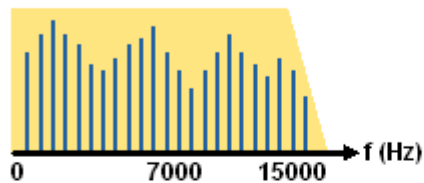
Service labels and abbreviated labels (no more frequencies!!!)

Overview of the DAB+ System

DAB+ Audio Encoding – Spectral Band Replication

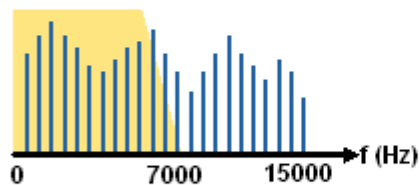
From Computer Desktop Encyclopedia
© 2005 The Computer Language Co., Inc.

MP3 at 128Kbps



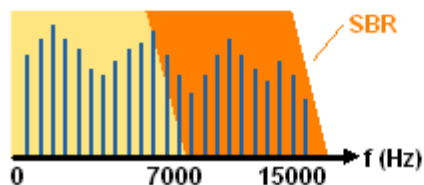
File size

MP3 at 64Kbps (frequencies cut in half)



File size

mp3PRO at 64Kbps (high frequencies SBR encoded)



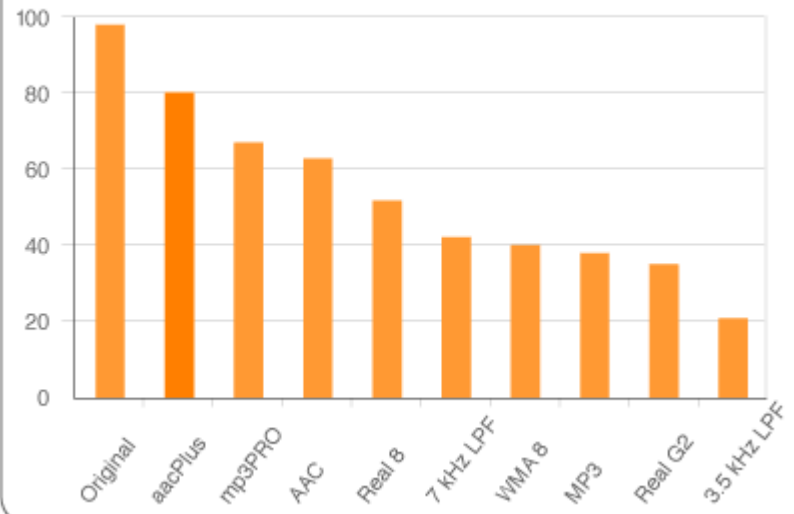
File size

SBR data

Efficient sample rate and bit rate reduction method

Only slight audio degradation

EBU subjective listening test at 48 kbps stereo



Overview of the DAB+ System

DAB+ Audio Encoding

Signal Flow with outer layer FEC

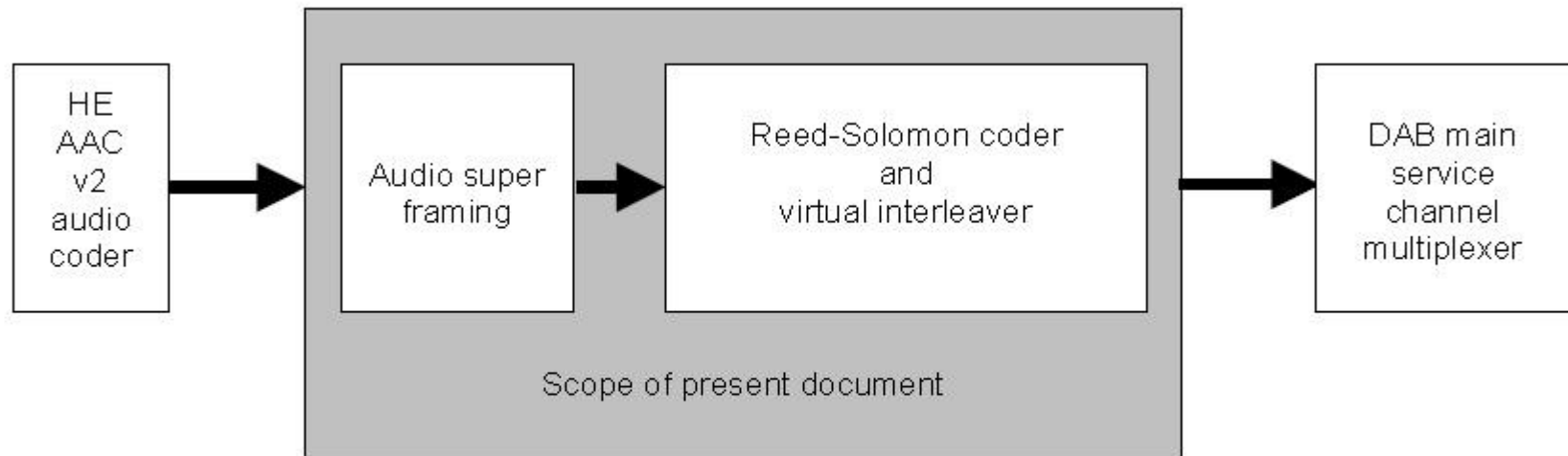


Figure 1: Conceptual diagram of the outer coder and interleaver

Overview of the DAB+ System

Audio - PAD

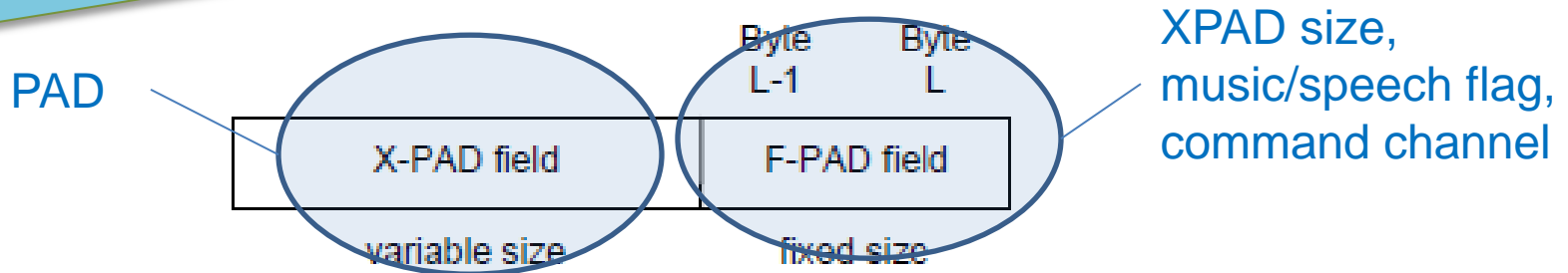


Figure 2: Coding of the PAD field

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

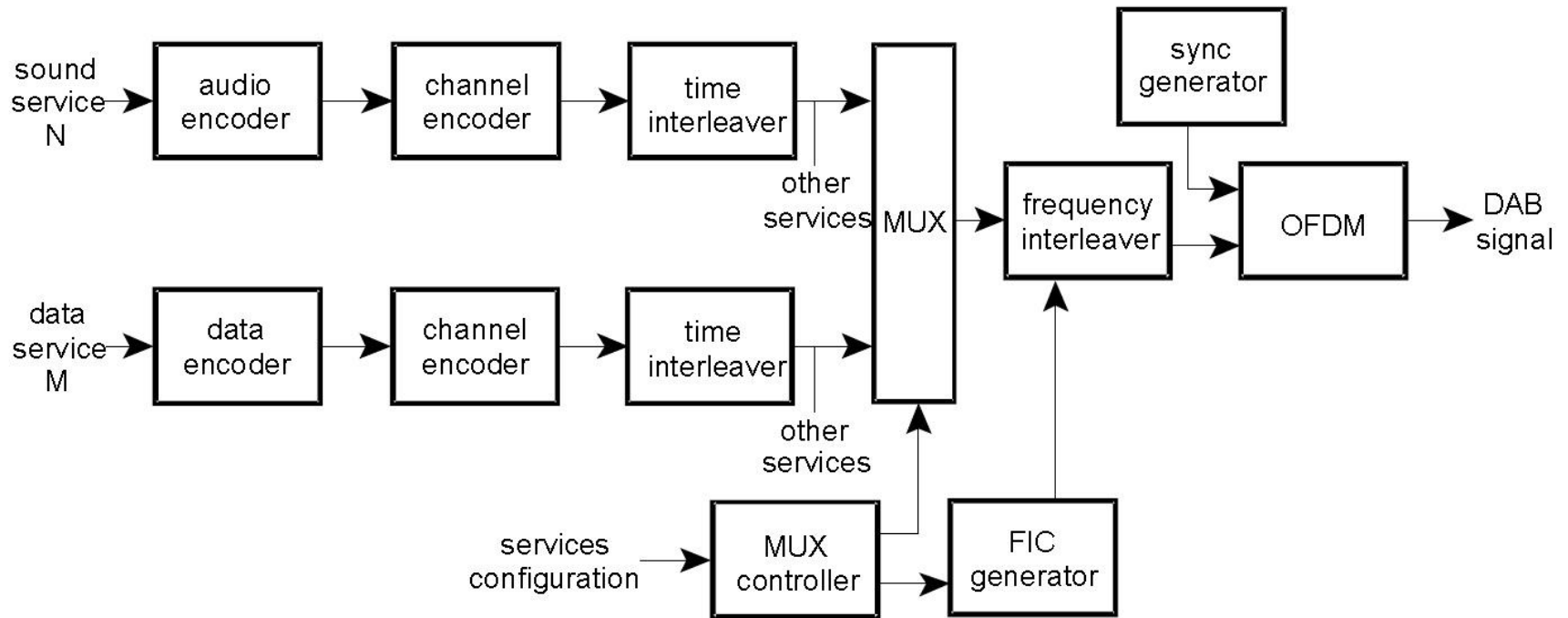


Figure 4.3.1: Conceptual block diagram of the EUREKA DAB system transmitter drive

Overview of the DAB+ System

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

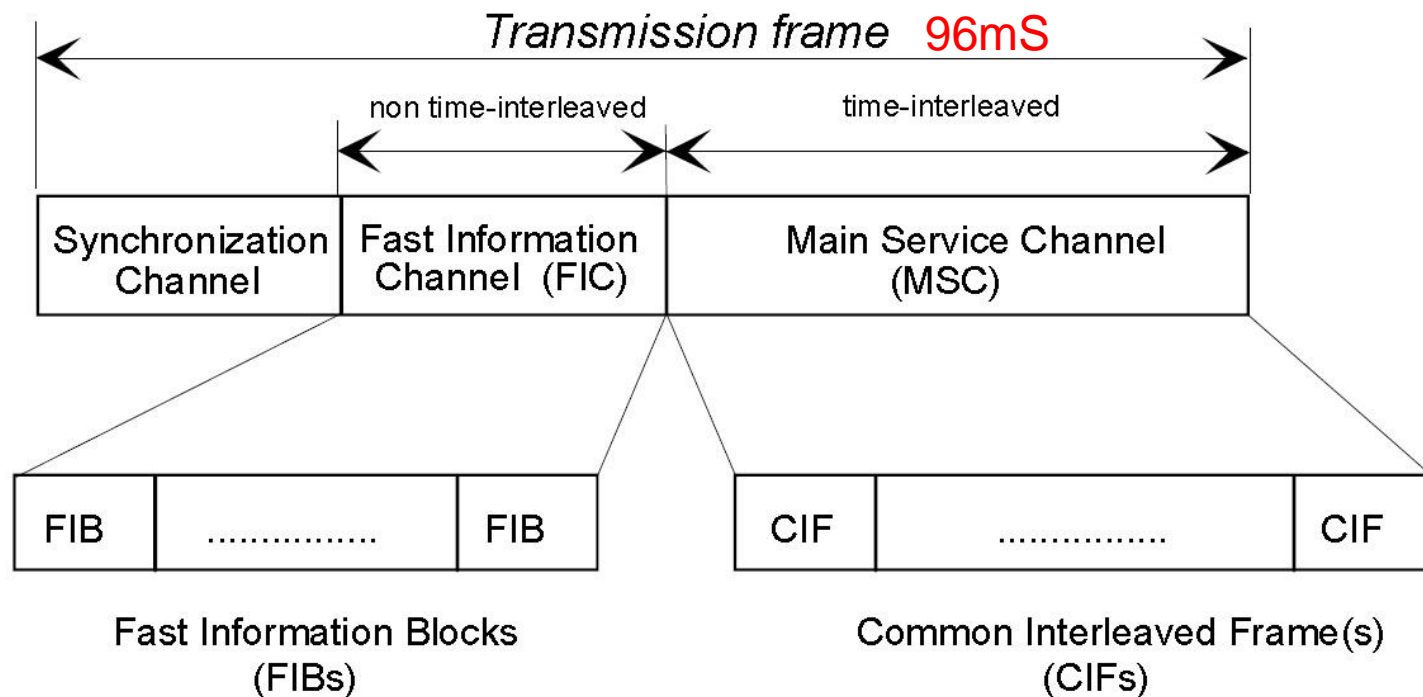
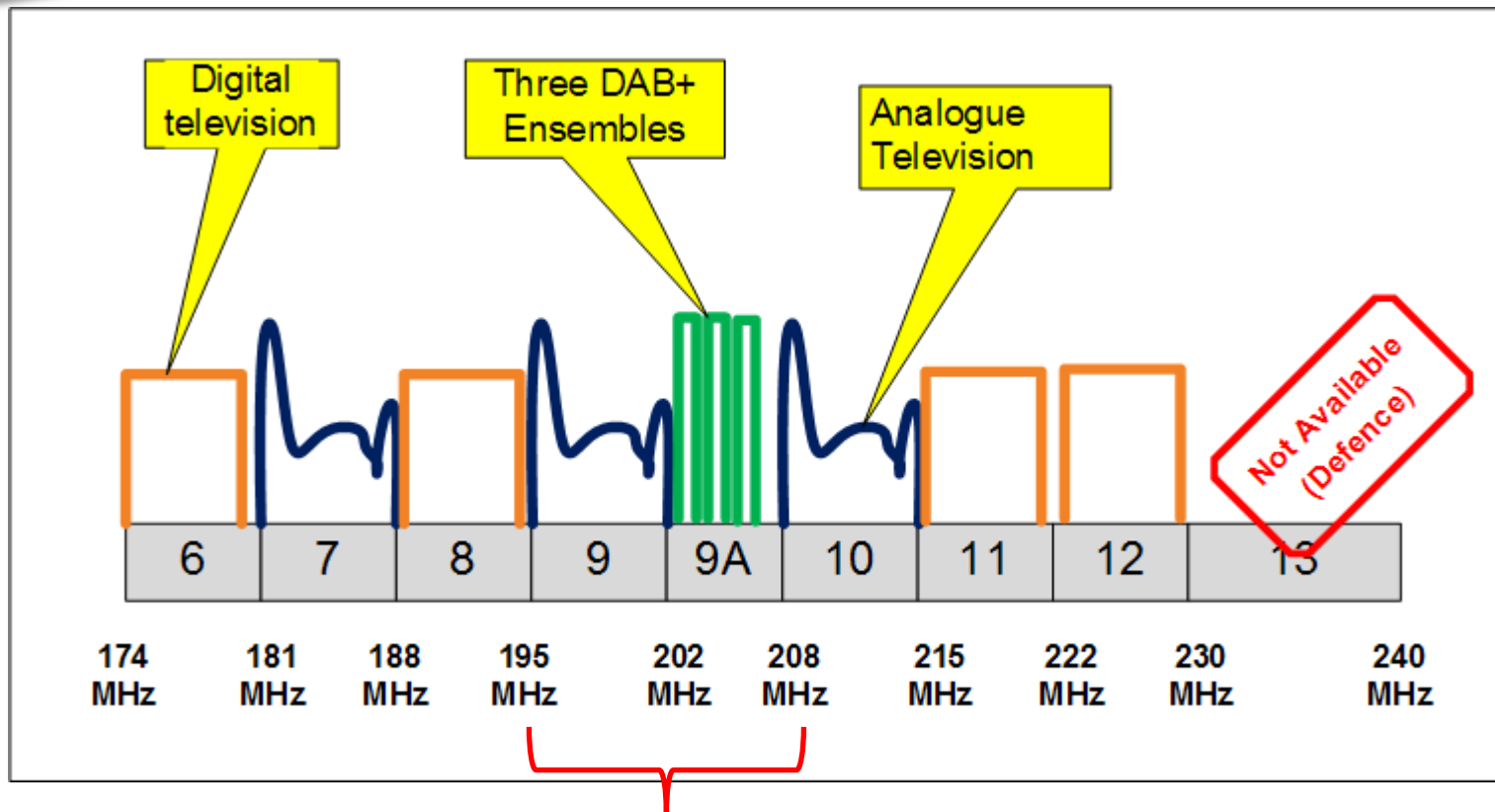


Figure 2: Transmission mode independent description of the FIC and MSC

Overview of the DAB+ System

DAB+ Transmission – Australian channels



Overview of the DAB+ System

RF Spectrum

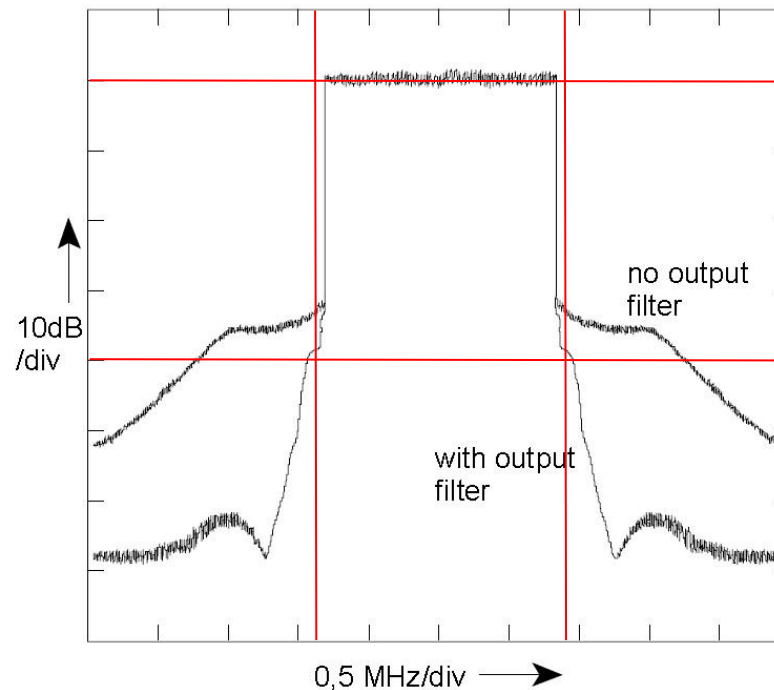


Figure 4.3.4: Example of DAB transmitted signal spectrum (VHF band III)

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

Overview of the DAB+ System

Network Options

Overview of the DAB+ System

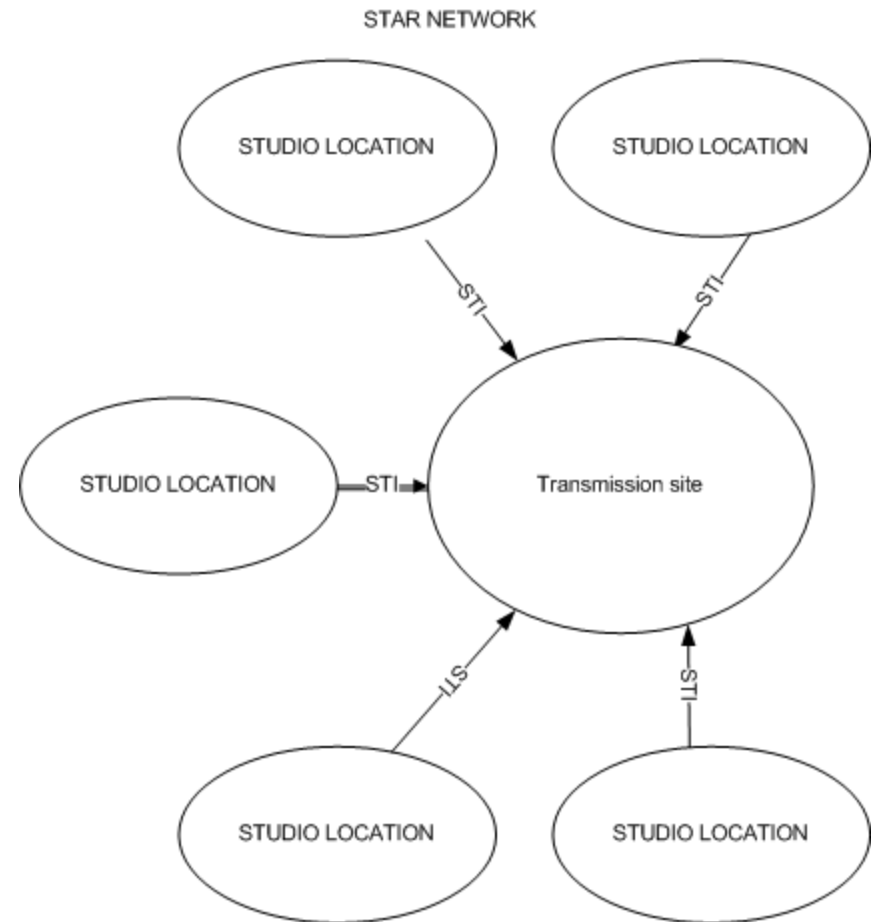
Star Network

Central multiplexing equipment

Individual links per studio site

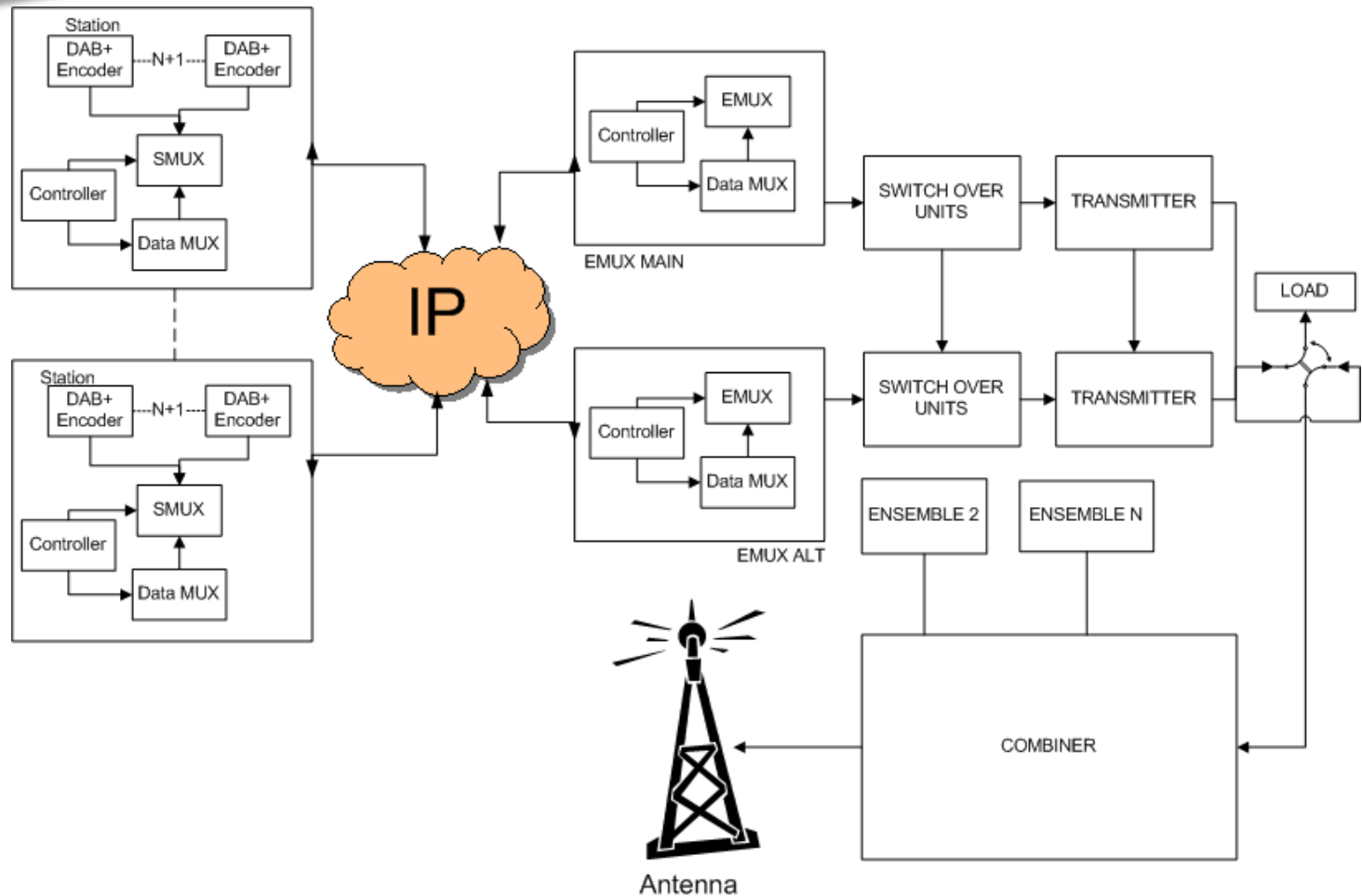
Stations are in control of their content

Privacy



Overview of the DAB+ System

Star Network - Details



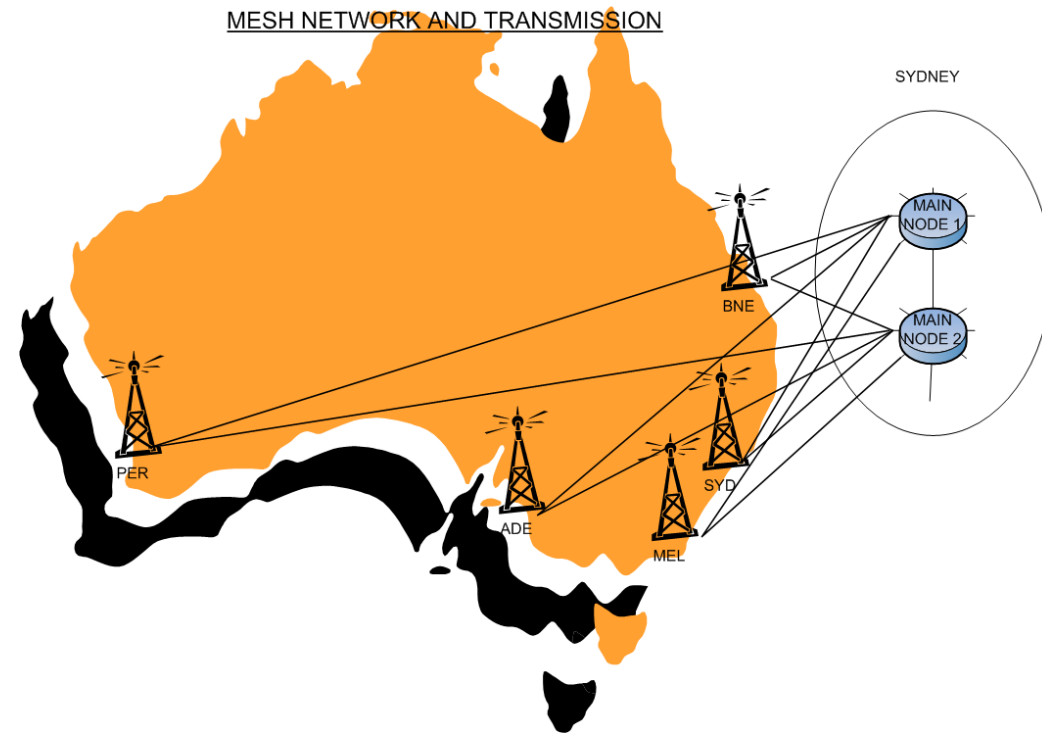
Overview of the DAB+ System

Mesh Network

Transparent interconnect
between sites

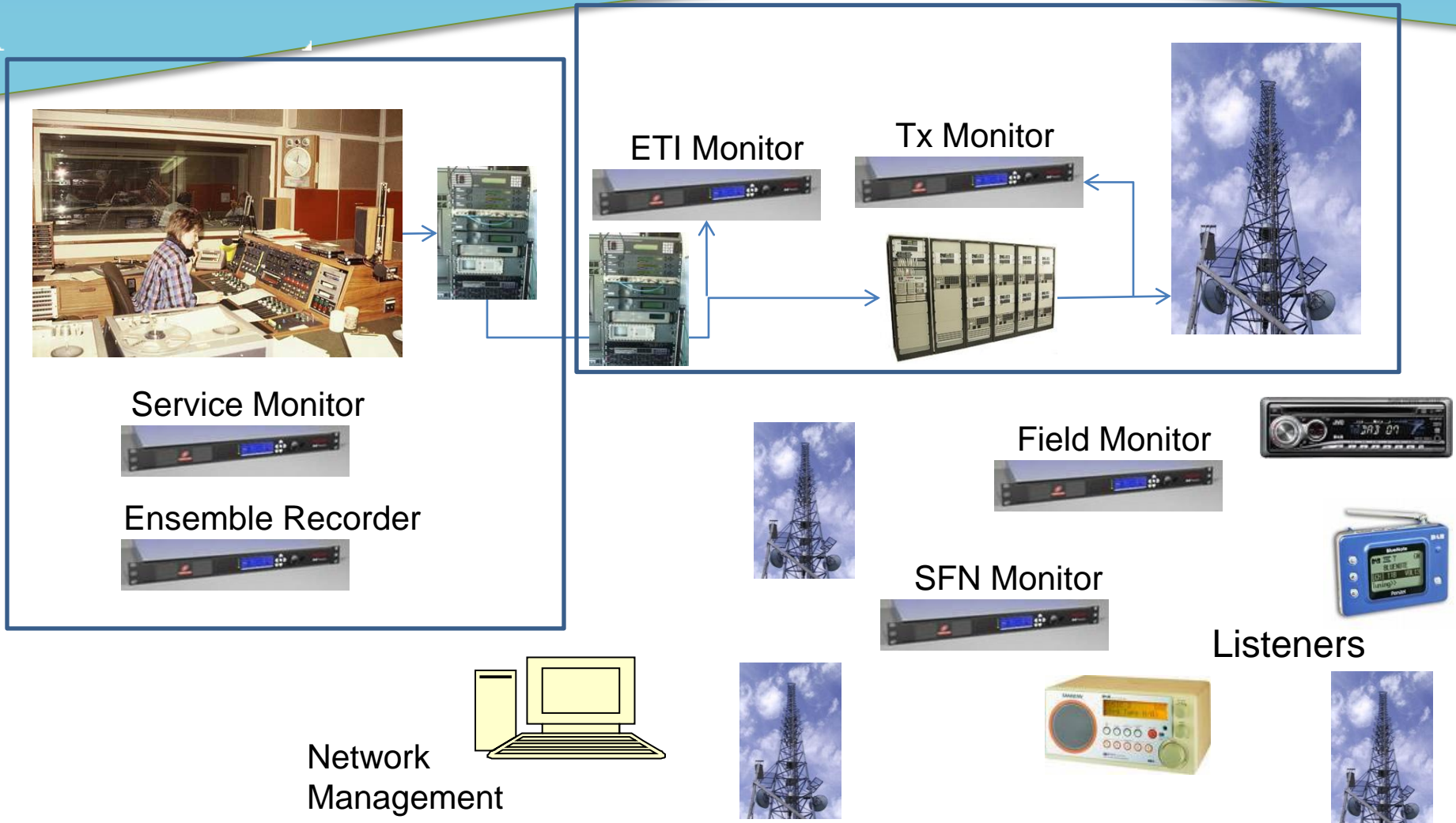
High Redundancy and Reliability

Typically uses a multicast
enabled VPN



Overview of the DAB+ System

Monitoring Equipment - Overview

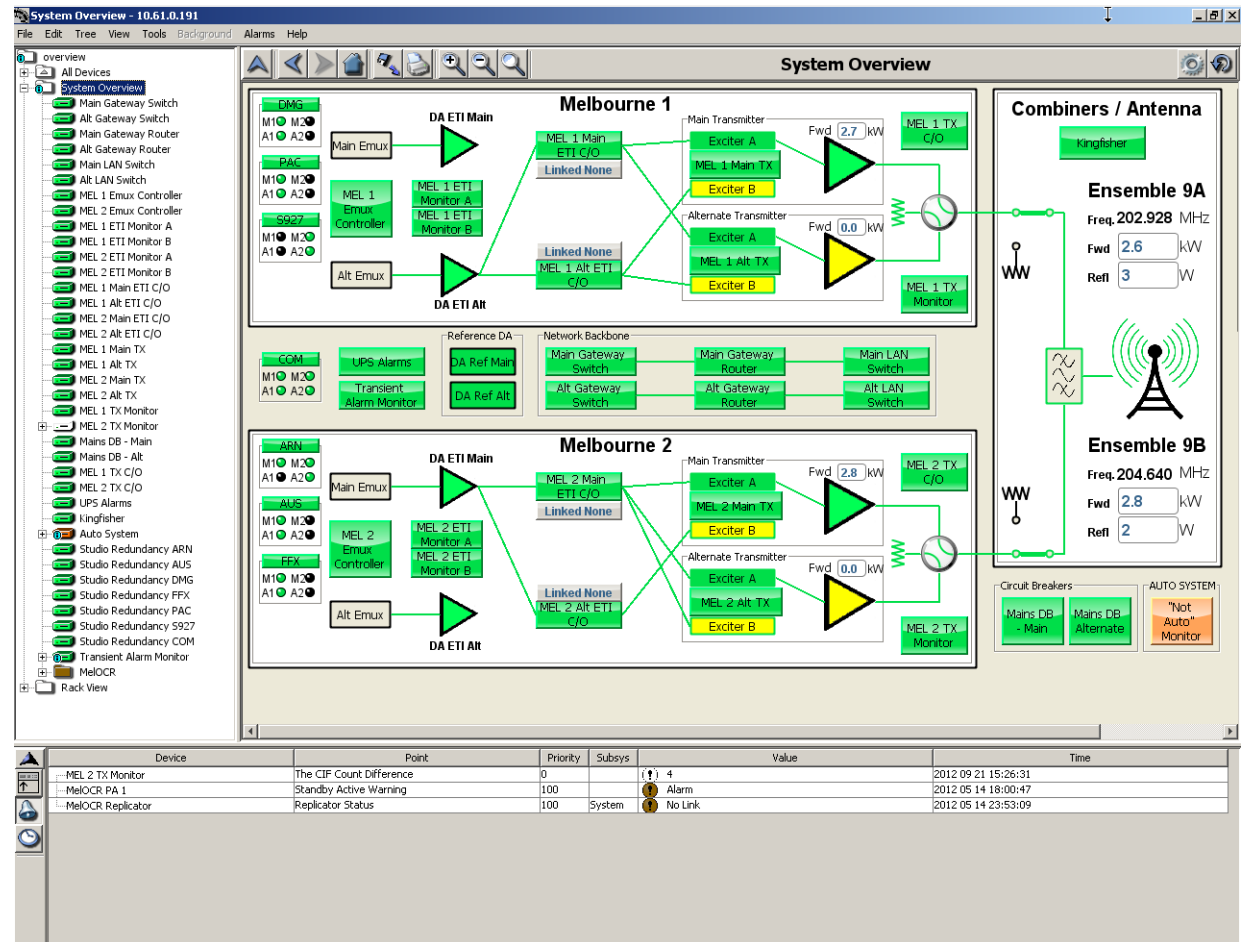


Overview of the DAB+ System

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



Overview of the DAB+ System

The Future

The Future – Hybrid Radio

DL+ and CAT-SLS are examples of Hybrid Radio

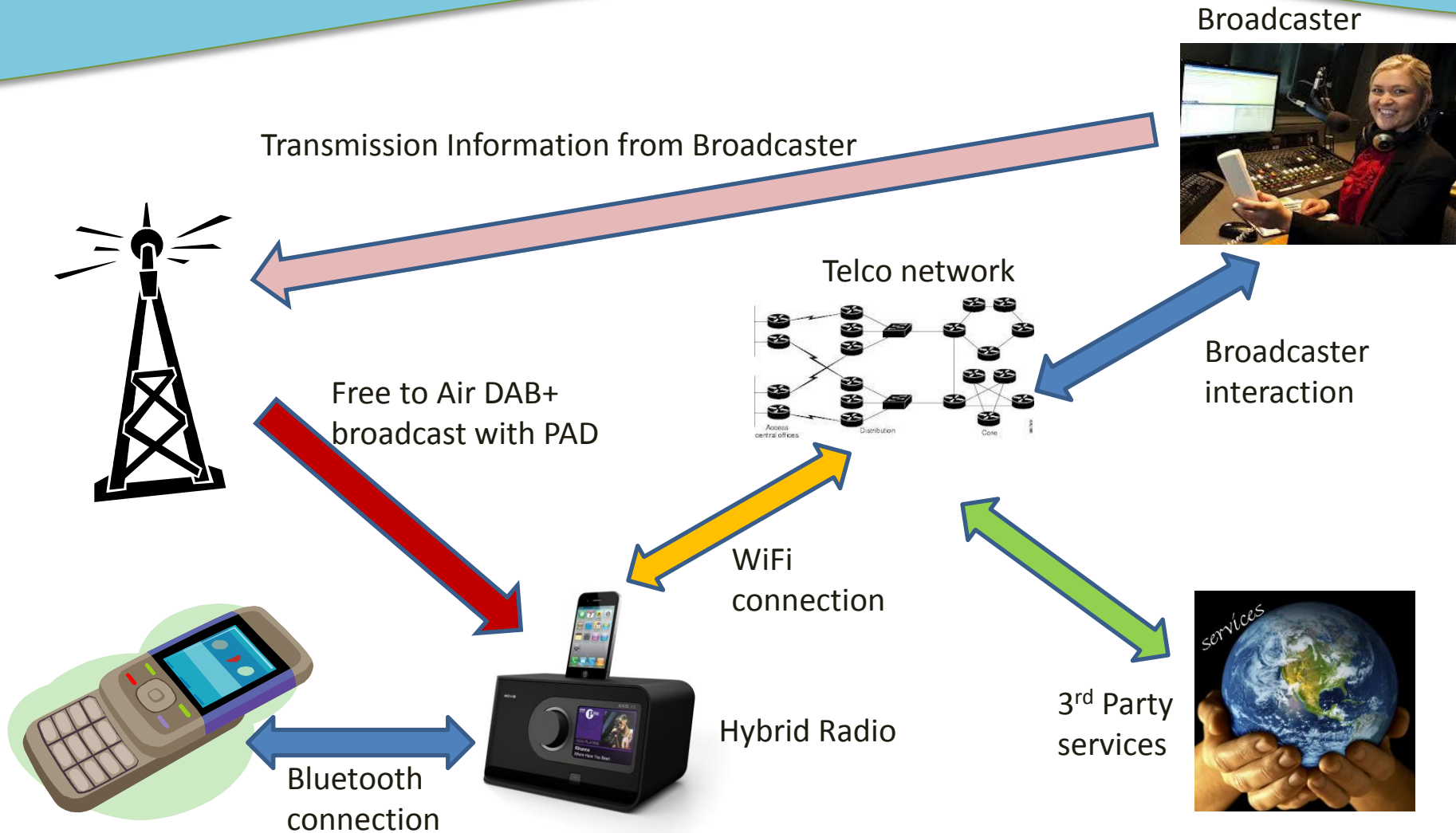
Providing More Information to listeners on demand

Tagging and reminders for later content use

The standards are being written now!

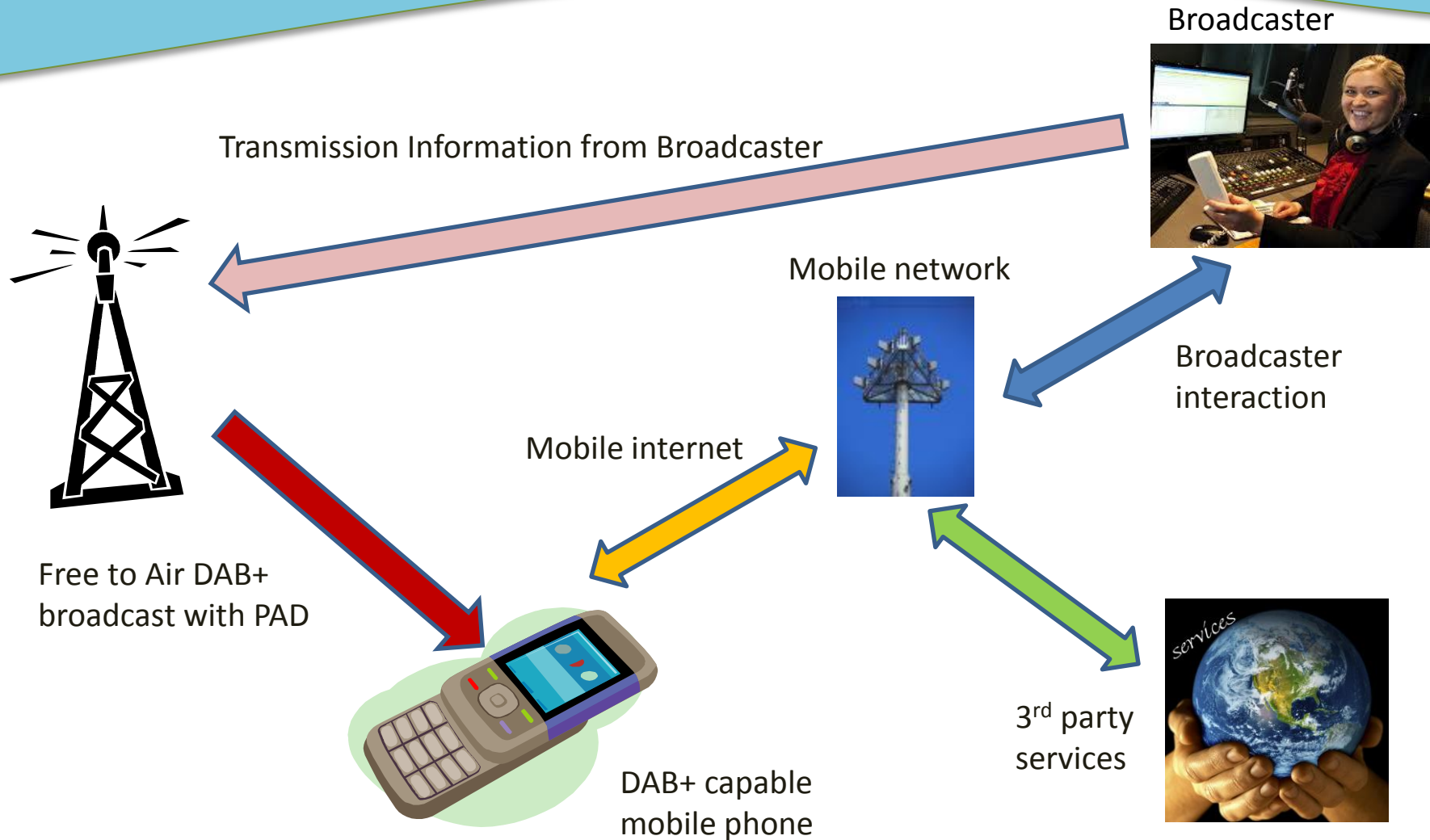
What is Hybrid Radio

Home operation



What is Hybrid Radio

Mobile operation



Hybrid Radio Use Cases

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



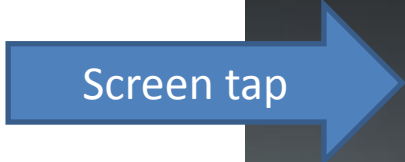
Screen tap

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

A screenshot of the Harvey Norman website. The page is titled "Cameras" and features a navigation menu with categories like Computers, Gaming, TV & Audio, Cameras, Phone & GPS, Appliances, Fitness, Furniture, Bedroom, Bathroom & Flooring, and BIG BUYS. A search bar is at the top right. Below the navigation, there are promotional banners for PhotoCentre and a sign-up offer. The main content area is titled "Cameras" and includes a sidebar with sub-categories like Digital Cameras, Digital SLRs, Compact System Cameras, Digital Video Cameras, Action Cameras, Crash Cameras, Home Security, Buying Guides, Frames & Albums, Photo Frames, Photo Albums, and Accessories. The main content area displays "Featured Products For Cameras" with five product cards: Canon EOS 700D DSLR Camera Single Lens Kit (\$978), GoPro HD Hero3 Action Camera - White Edition (\$268), Sony DSC-W710 W Series Cyber-Shot Digital Camera (\$147 ea), Canon EOS 100D DSLR Camera Single Lens Kit (\$897), and Samsung DV150F Smart Camera - Pink (\$177). Each card includes an "Add To Cart" button and a "Find In Store" button. At the bottom, there are links for "Add To Compare List" and "Add To Wish List" for each product.

Hybrid Radio Use Cases

More Information: Use Case example 2 – Artist information



Listeners can access more information about the current artist

Hybrid Radio Use Cases

More Information – Use Case Example 3 – public information

SYDNEY'S WEATHER

Mostly fine.



NOW	MAX	HUM	
CITY	22.9°C	24°C	70%
WEST	22.7°C	26°C	65%

www.bom.gov.au

Button press

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


Bureau Home > Radar Images > 64 km Sydney (Terrey Hills) Radar Loop

64 km Sydney (Terrey Hills) Radar Loop

View the current warnings for New South Wales

Loops	Single images	Radar Site Information	Other Radars	Radar Help
Radar	64 km	128 km	256 km	512 km composite
Rainfall	6 min	1 hour	Since 9 am	24 hour

Image by Bureau of Meteorology. For related Warnings, see www.bom.gov.au



TerreyHills 19/06/13 07:36UTC 000.5e1 064km -1

Rain Rate: Light Moderate Heavy

Map features:
 Weather observations
 Locations
 Range
 Topography
 Lakes & major rivers
 River catchments
 Forecast districts
 Roads
 Railways

Hybrid Radio Use Cases

More Information – Use Case Example 4 – sports results



TAB.COM.AU Login: TAB SKY

Next to Jump 3 minutes 6:07 PM
QLD Greyhounds Albion Park Race 8 Surepick Form Ratings Best 8 395m

SKY RACING **SKY SPORTS RADIO**

rentalcars.com CAR HIRE LONDON Book Today & Pay Later

Home Watch Radio **Racing** Sports Programs Guide Connect About

Home > Racing

Race Details

<<< Bendigo Harness R2 Shepparton Greyhounds R10 >>>

8 BELMONT BET NOW

Twitter.Com/rwwa_thor 0-68 Hcp

Start Time: 6:30PM 19 Jun 2013
Distance: 1400m
Track: GOOD3 T1
Weather:
Exotic Legs: DD2 Q4
Live on:

Belmont Today: 1 2 3 4 5 6 7 8 LIST

Chef & Best
IT'S A GAME CHANGER
Chicken & Camembert
FROM \$8* EACH PICK UP
*Limited time only. Conditions apply.

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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