



DAB+ Multiplexing & Case Studies

World DAB Workshop, Amman Jordan, August 2017

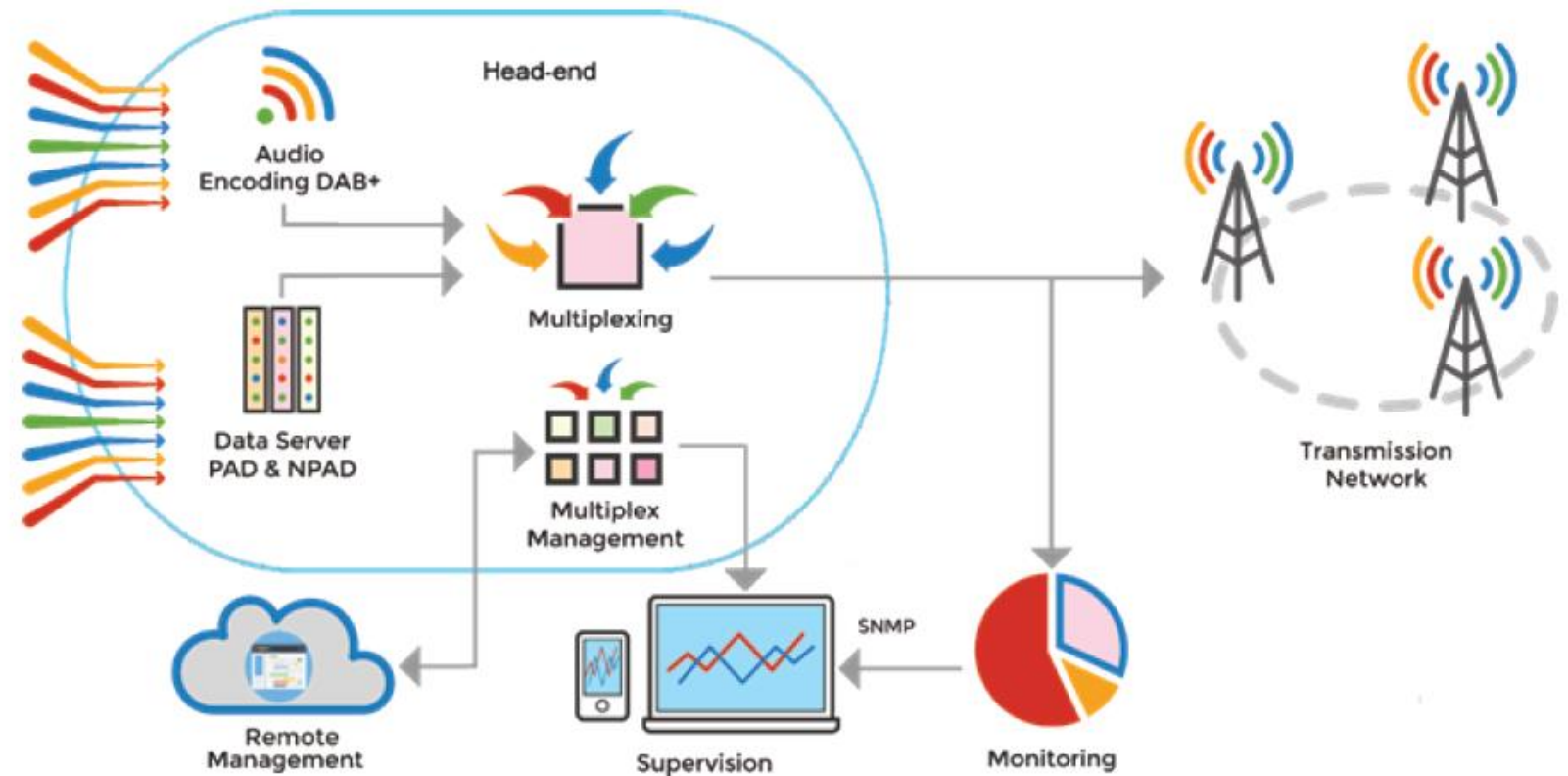
Who are Factum Radioscape?

- 20+ Years of Experience
- 200+ Multiplexers Worldwide
- Systems Deployed in over 30 Countries



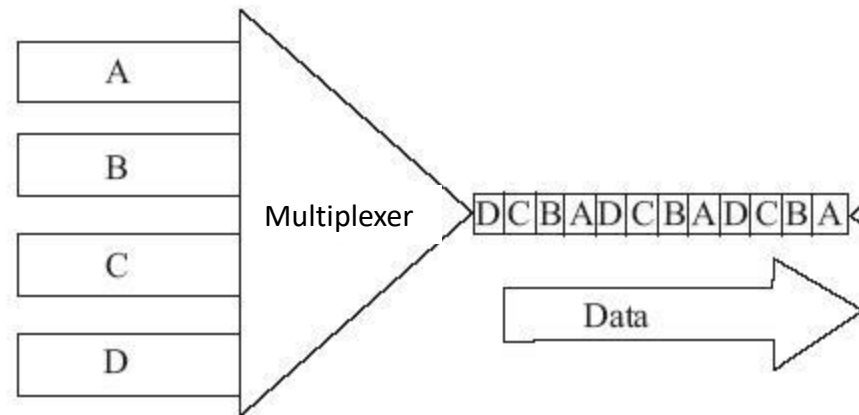
What do we do?

- Encoders
- Multiplexers
- Monitoring
- Analysis



Multiplexing & Encoding

- What is a multiplexer?
 - Combines inputs from several sources to produce a single output
 - Each audio source (radio station) is assigned a 'subchannel' with several characteristics
- Main advantage over FM is being able to use shared resource
 - Multiple Audio inputs fed to a common transmission source
 - Considerable efficiency savings



Example – National Commercial UK

D1 National

C181 I T1

Classic FM³ talkSPORT³ Radio X³ LBC³ Heart 80s³ Capital XTRA³ Smooth Extra³ Absolute Radio³ UCB 1³ KISS³ Magic³ Heart extra³ Capital UK³ KISS FRESH³

10.07.2017

Absolute Radio	C1C0	80 kbit/s	Mono	Rock Music
Capital UK	C5DA	80 kbit/s	Mono	Pop Music
Capital XTRA	C37B	112 kbit/s	Joint Stereo	Pop Music
Classic FM	C2A1	128 kbit/s	Joint Stereo	Serious Classical
Heart extra	CFD1	80 kbit/s	Mono	Pop Music
Heart 80s	C1DC	80 kbit/s	Mono	Pop Music
KISS	C5C0	80 kbit/s	Mono	Pop Music
KISS FRESH	CDD1	80 kbit/s	Mono	Pop Music
LBC	C0C2	64 kbit/s	Mono LSF	Varied Speech
Magic	C0C6	80 kbit/s	Mono	Pop Music
Radio X	C4CD	80 kbit/s	Mono	Rock Music
Smooth Extra	C6C0	80 kbit/s	Mono	Easy Listening
talkSPORT	C0C0	64 kbit/s	Mono LSF	Sport
UCB 1	C4CA	64 kbit/s	Mono LSF	Religion
INRIX UK TPEG	E1C000BA	16 kbit/s	Packet Data	

Audio Encoders

- All audio input is encoded to DAB+ audio standard HE-AACv2
 - Mono, Stereo, Dolby 5.1 surround
 - Parametric Stereo, Spectral Band replication techniques available
 - 8 to 256kbps
 - Commonly implemented between 48 – 96kbps per source,
 - 96kbps = approaching CD quality

Data services

- Data services can be added to enrich content:

- DLS, text for radio

- Now playing information
- Twitter feed
- RSS news feed

- SLS, pictures for radio

- Station Logo
- Album Art
- Advertising

- Ancillary Data:

- Electronic Program Guide
- TPEG, Traffic and Travel information



PAD – Program Associated Data

The diagram consists of two blue curly braces on the right side of the slide. The top brace groups the 'DLS, text for radio' section and its sub-items. The bottom brace groups the 'SLS, pictures for radio' section and its sub-items. A third, larger brace on the left side groups the 'Ancillary Data' section and its sub-items. The text 'PAD – Program Associated Data' is positioned to the right of the top two braces, and 'NPAD – Non Program Associated Data' is positioned to the right of the bottom brace.

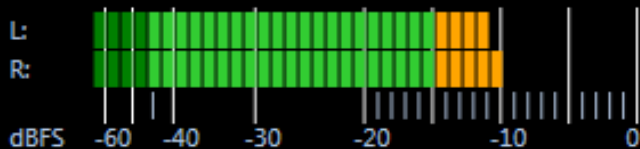
NPAD – Non Program Associated Data



Input FEP: 127.0.0.1[17000]F[0] Ensemble A200 DAB+ Trial Volume
 Playback Spoken Word
 Analysed Spoken Word
 -36.7 dB



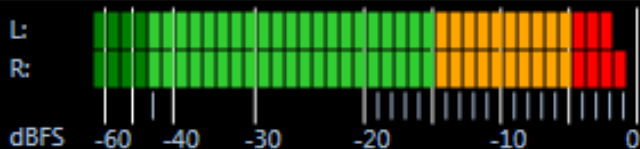
Service label Foreign Program
Format DAB+
Audio mode Stereo (SBR On)
Bit-rate 64 kbps
Sample-rate 48 kHz



DAB+ trial digital radio: This Is Jordan Radio Foreign Program



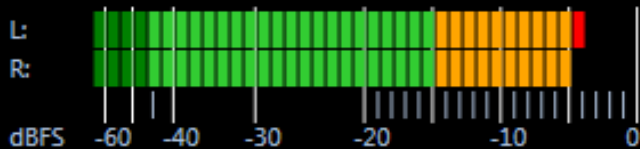
Service label Sport 88.00
Format DAB+
Audio mode Stereo (SBR On)
Bit-rate 80 kbps
Sample-rate 48 kHz



DAB+ trial digital radio: This Is Jordan Radio Amman FM



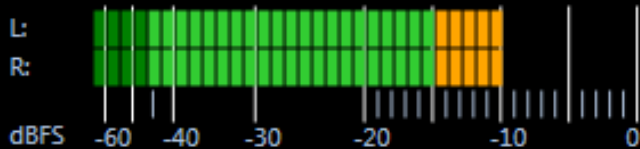
Service label General Program
Format DAB+
Audio mode Stereo (SBR On)
Bit-rate 48 kbps
Sample-rate 48 kHz



DAB+ trial digital radio: This Is Jordan Radio General Program



Service label Holy Quran
Format DAB+
Audio mode Stereo (SBR On)
Bit-rate 32 kbps
Sample-rate 48 kHz




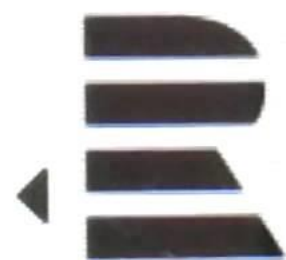
DAB+ trial digital radio: This Is Jordan Radio Holy Quoran



11:00



Other Music 



Radio Wave^{CH}

Libe(re)c! Týden ve stínu Ještědu

TELEKO DAB



CRo RADIO WAVE

RADIO

4/Schaffhauserstrasse

18:02

NAV



Swiss Pop+



MEDIA

SRG SSR D01

APP



PHONE

CAR

VOICE

DAB



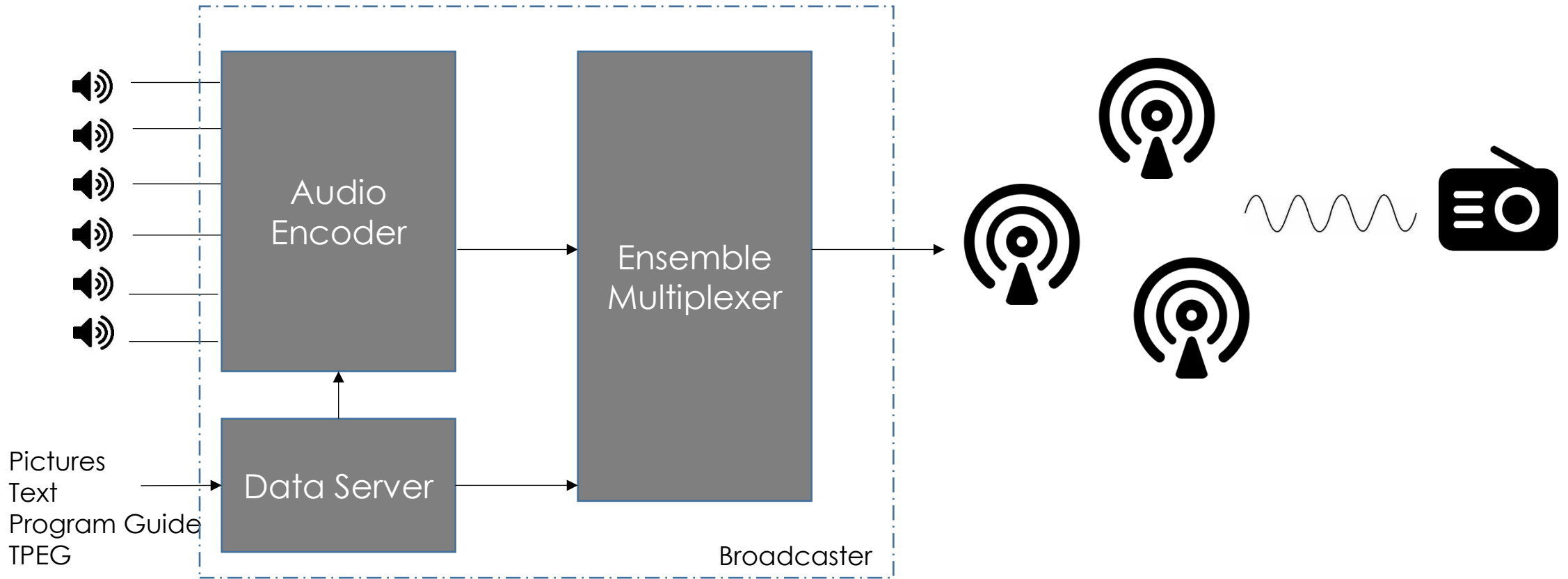
MENU



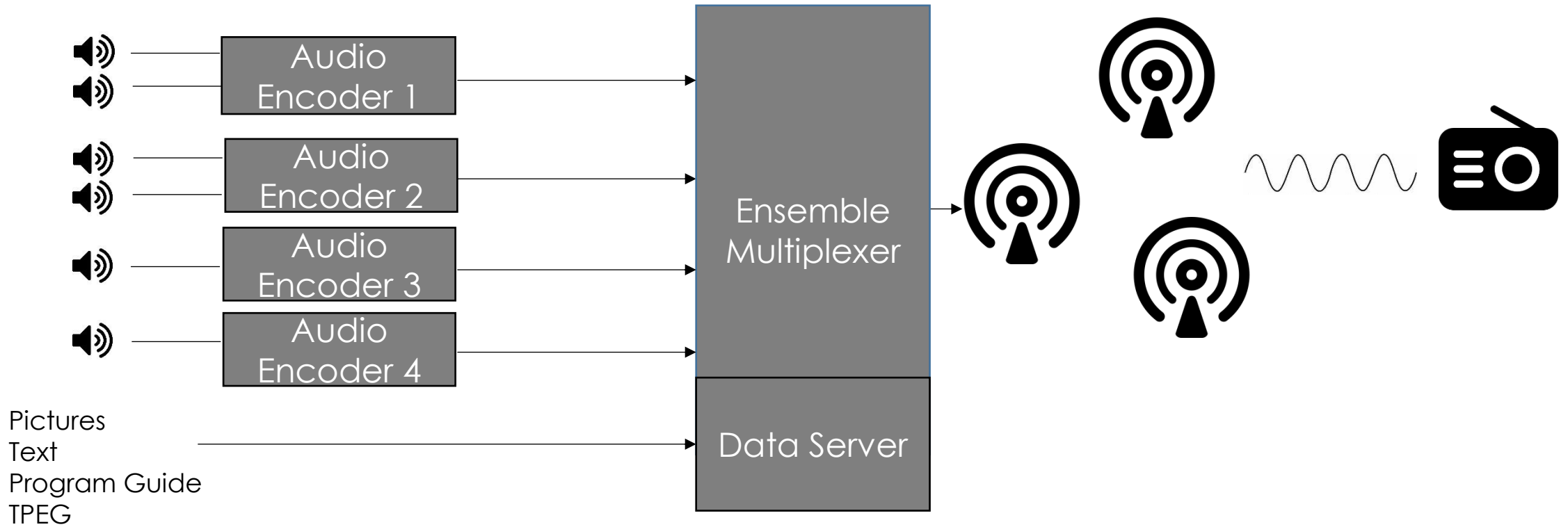
The broadcast chain

- The process of getting audio services to listeners
 - Audio source
 - Encoder(s)
 - Contribution Link
 - Multiplexer
 - Distribution Link
 - Transmitter
 - Receiver

The Broadcast Chain – single site model

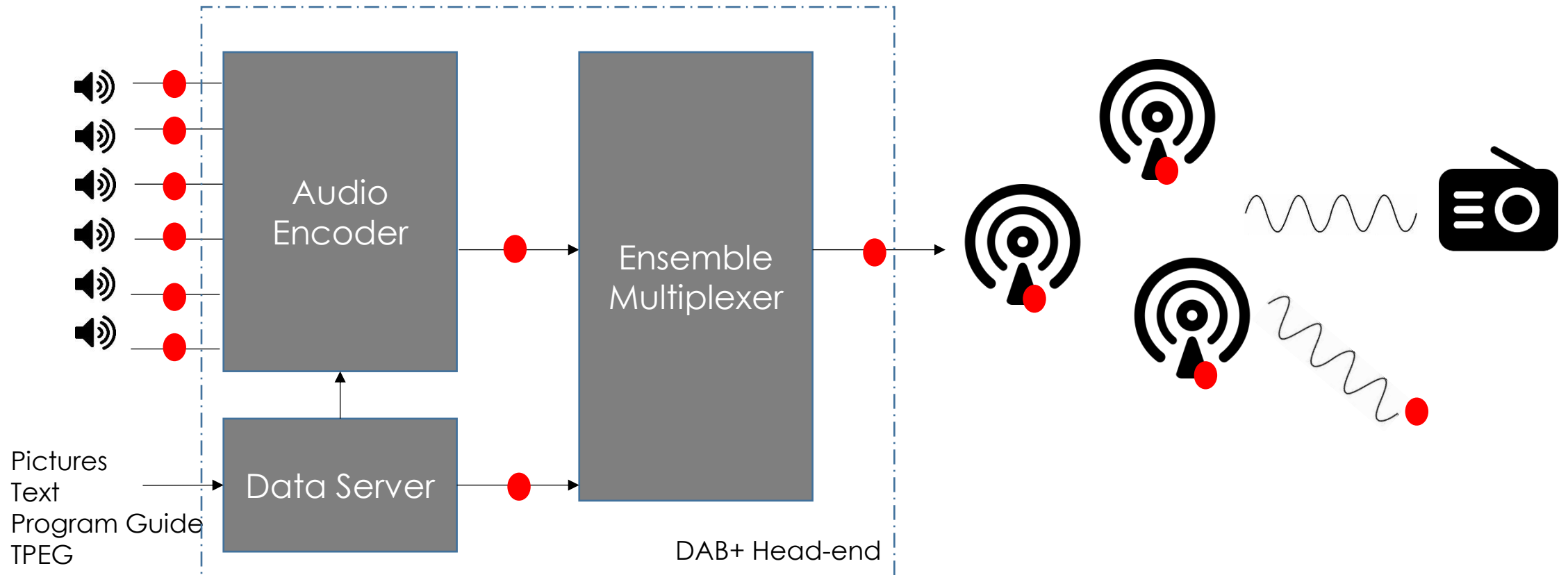


The Broadcast Chain – multi site model



Monitoring and supervision

- Due to IP nature, it is possible to monitor broadcast at many points





Field Monitor

Input RF: 185360
Playout Not playing a subchannel
Analysed

Ensemble E000 DEMO
Field Strength 52.68 dB μ V/m
BER 0.00E+000

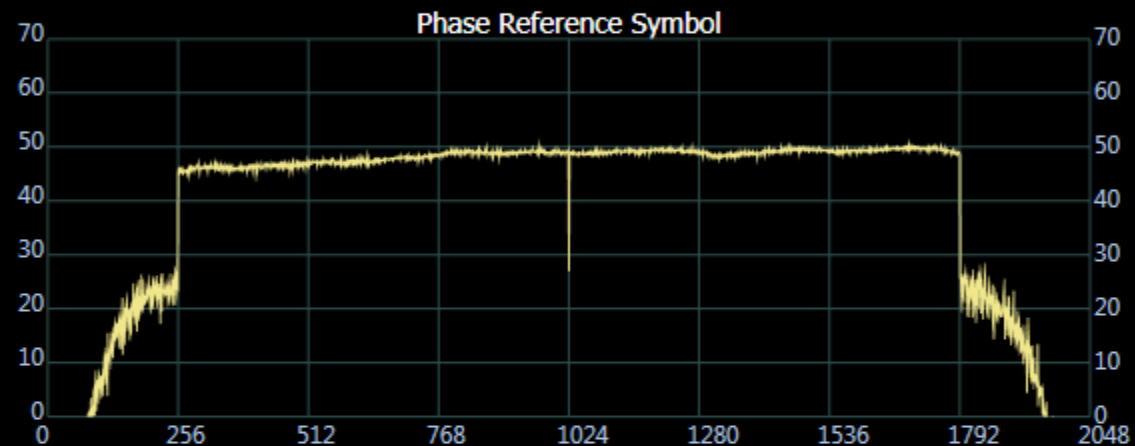


Volume -10.0 dB

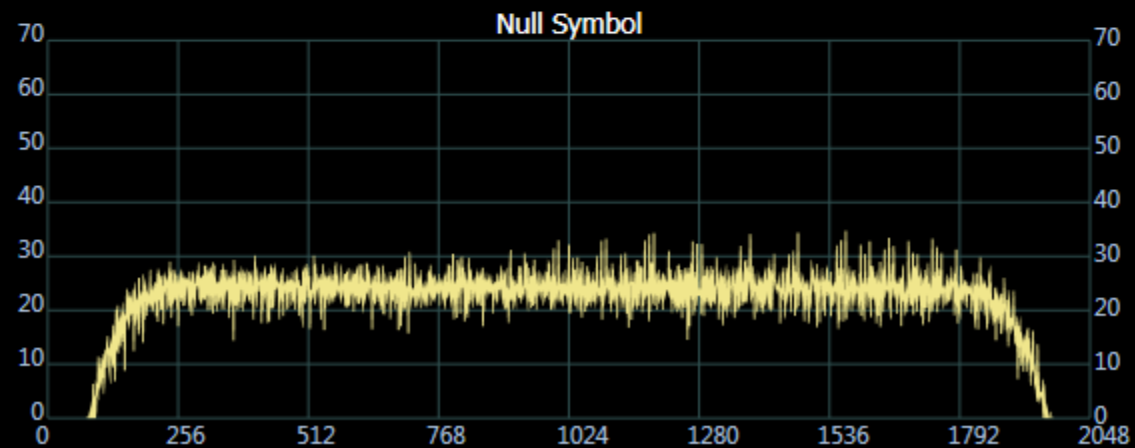
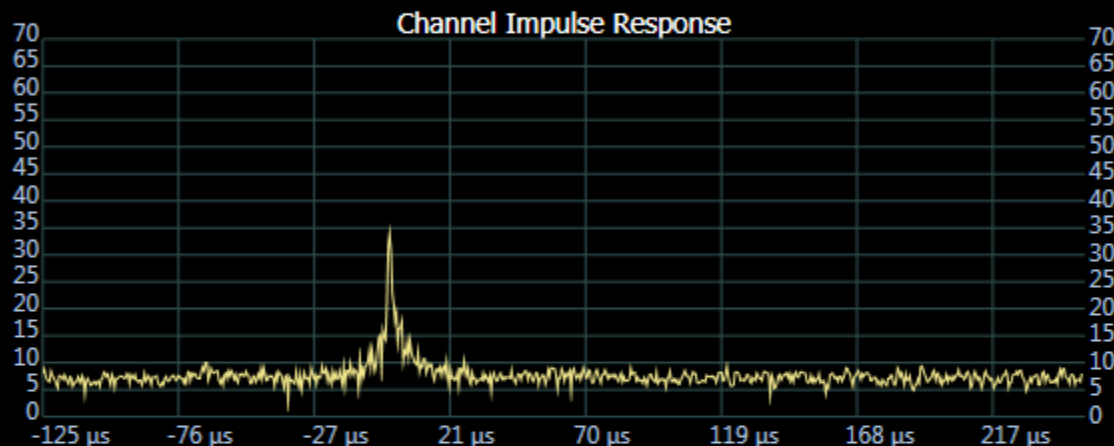


GPS Status

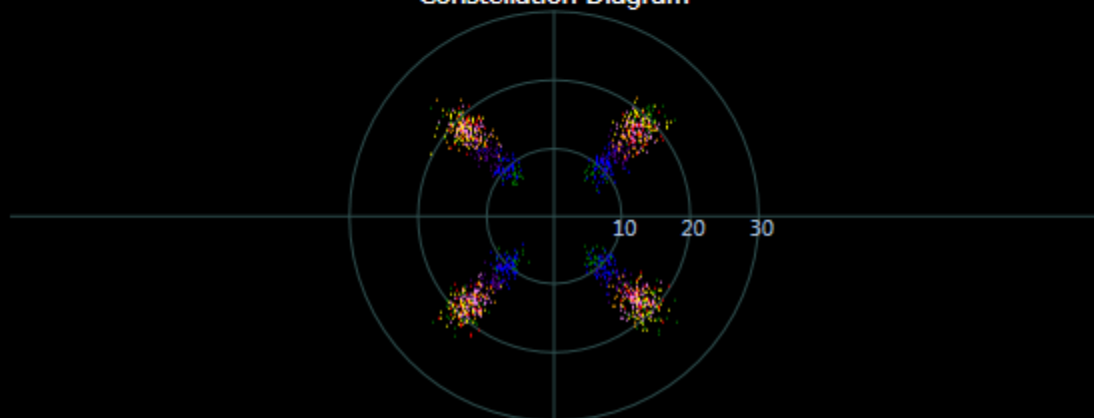
Refresh rate Every 576ms Start MER Calibration



dB



Constellation Diagram



Monitoring and supervision

- Using the correct arrangement of monitoring tools it is possible to ensure very high services
- In the UK 99.8% up time in SLA is common
- This is only possible if we understand every aspect of our network
- SNMP, Network Management Systems (NMS) can translate high amounts of data into an easy to understand picture
- Provides insurance in case of failures – you will know where the problem lies immediately.

Case study 1 - UK

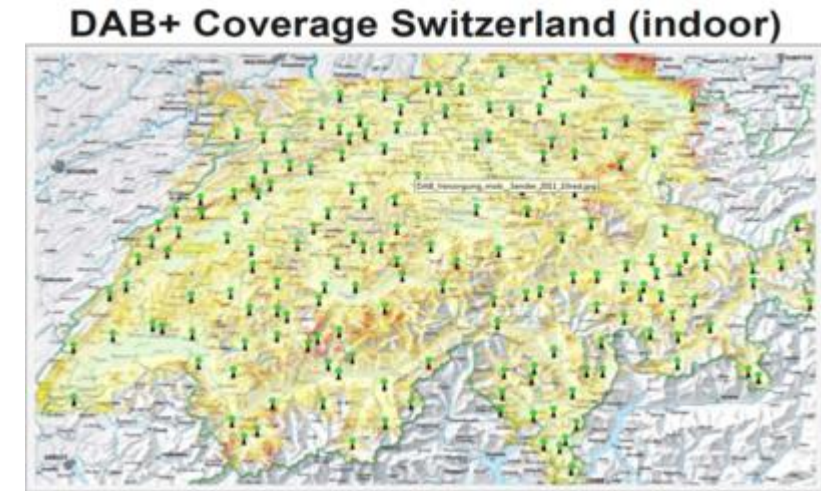
- 60 Multiplexers
- Over 300 radio stations
- BBC – Adds and removes channels daily
 - Sport events
 - Parliamentary coverage
- Pop up stations
- Small scale DAB



Stations
broadcasting
for only one
month

Case Study 2 - Switzerland

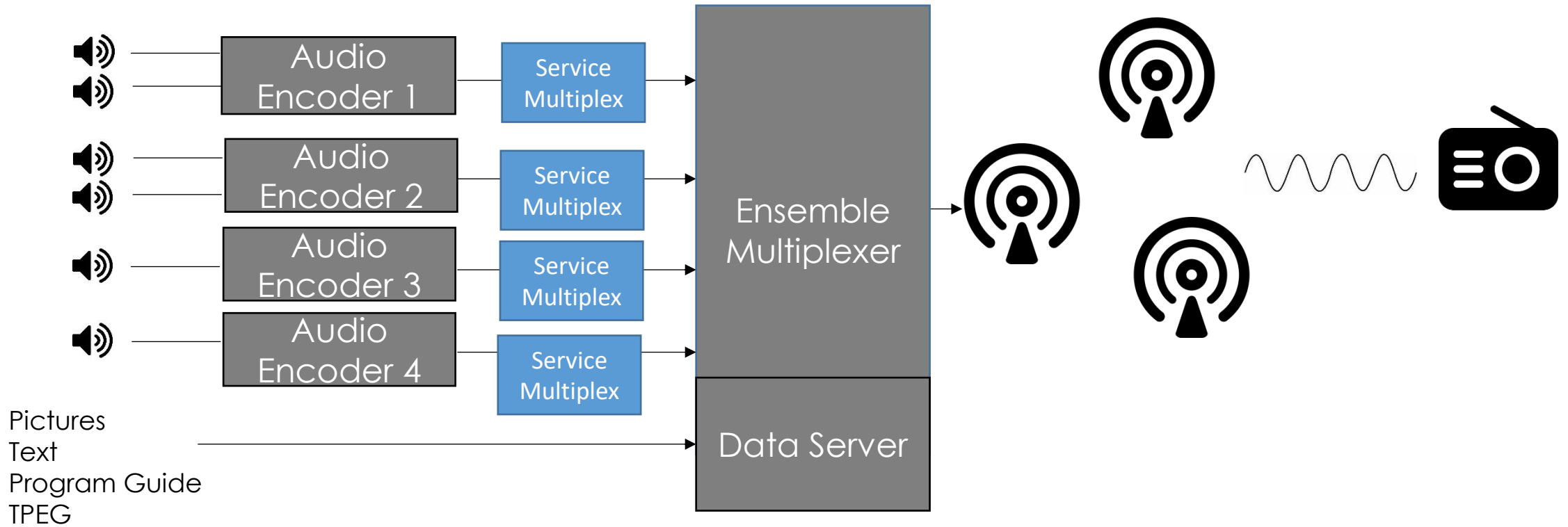
- Challenging terrain requires extensive planning
- Have to produce everything in 4 languages:
 - French, German, Italian & Romansch
- Use announcements for emergencies
 - Avalanche warnings
 - Traffic accidents
- Liberty Media distributing DAB over cable on subscription
- IP system based on existing IT infrastructure
- Audio over IP/Satellite input



Case study 3 - Australia

- Long distances and time zone challenges
 - ABC broadcast across 3 time zones
- Local content
 - Content is produced in Sydney but for each city, localised content
- Service multiplexing
 - Introduces an intermediary step between encoder and multiplexer
 - Gives broadcaster complete control over their allocated bandwidth
 - Ensures that there is 'firewall' between competing entities
 - Co-operation through separation

The Broadcast Chain – multi site model



Case study 4 – South Africa

- Congested FM network
 - There is no more space for new services in Johannesburg
- Complex licence arrangements
 - FM operators in Pretoria are not allowed to broadcast in Cape Town
- Digital radio needed for growth in the market
 - Best avenue for growth is DAB+ and multiplexing on a common frequency
- Highly co-operative approach
 - SABC (state broadcaster) is sharing the multiplex with 14 other broadcasters

- Factum Radioscape own and operate a multiplexer, broadcasting 11 Radio stations from 3 sites to over 1m people

- BBC Wales
- BBC Cymru
- Nation Radio
- Dragon Radio
- Cheesy FM
- Capital Liverpool
- Dee on DAB
- Wirral Radio
- Chris Country
- Love 80s
- Sandgrounder

BBC | radio wales

BBC | radio cymru



Chris Country

- Started as internet station
- Now on 3 multiplexers in the UK
- UKs only dedicated country channel
- Has grown from a few hundred listeners to 50,000 (Rarjar Q2 2017)
- Attributes listener growth and engagement to digital radio



Transmission sites



Moel-Y-Parc – 300W



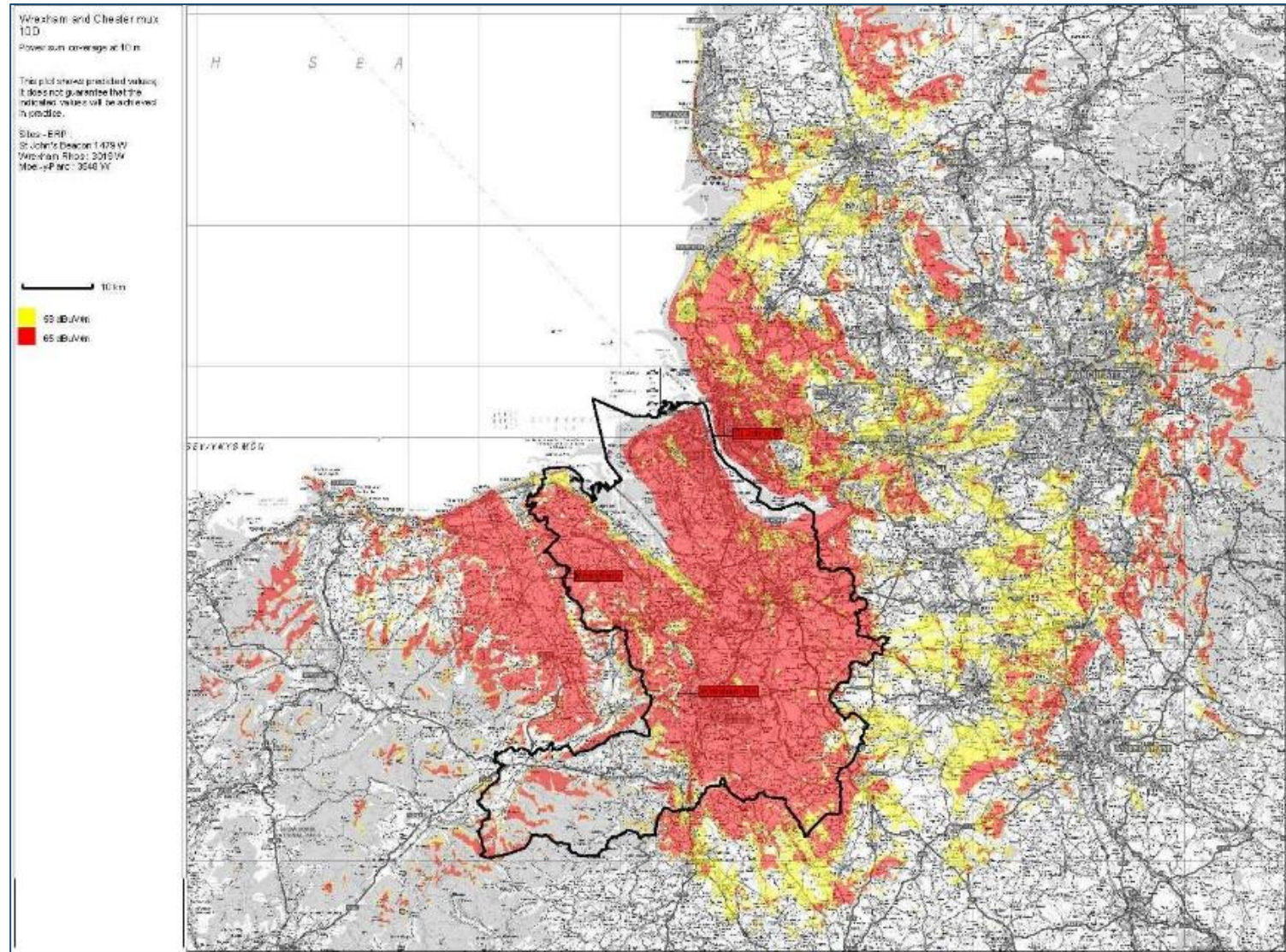
Wrexham Rhos -350W



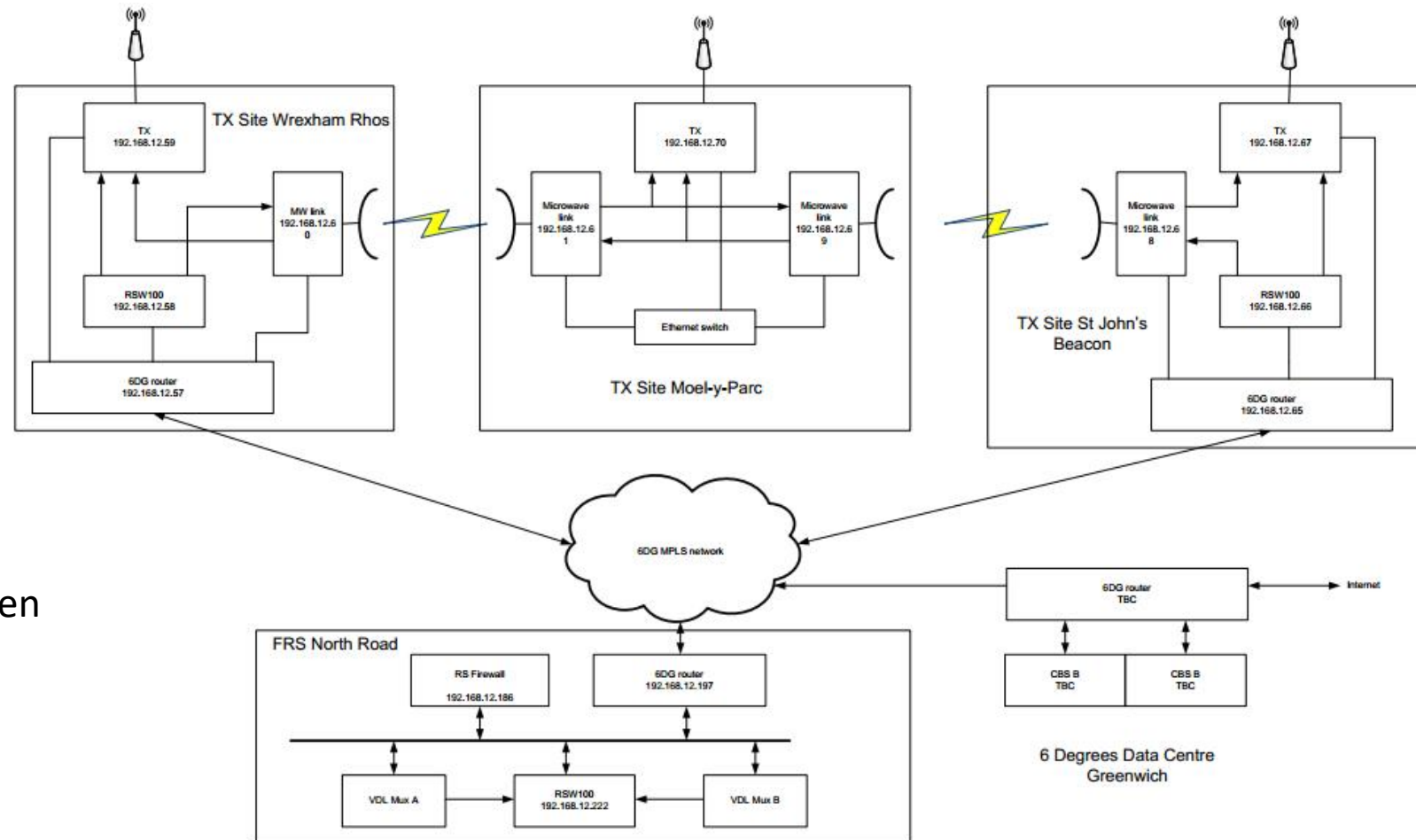
St Johns Beacon – 150W

Coverage & Planning

- OFCOM licenced area
- Planning required to get best coverage
- SFN the way to go covering a hilly area:
 - Liverpool
 - Manchester
 - Chester
- Many, many field tests!



SFN Management



- Three transmitters operating in SFN
- Common timing source (GPS)
- Bidirectional microwave links between
- Managed and operated in London

In summary

- Multiplexing and encoding is an efficient means of broadcasting high quality, spectral efficient audio services
- There are several ways to arrange the multiplexers and encoders
- DAB+ is creating growth in many countries
- SFN planning is critical to ensure excellent coverage
- Monitoring and analysis tools can ensure excellent service