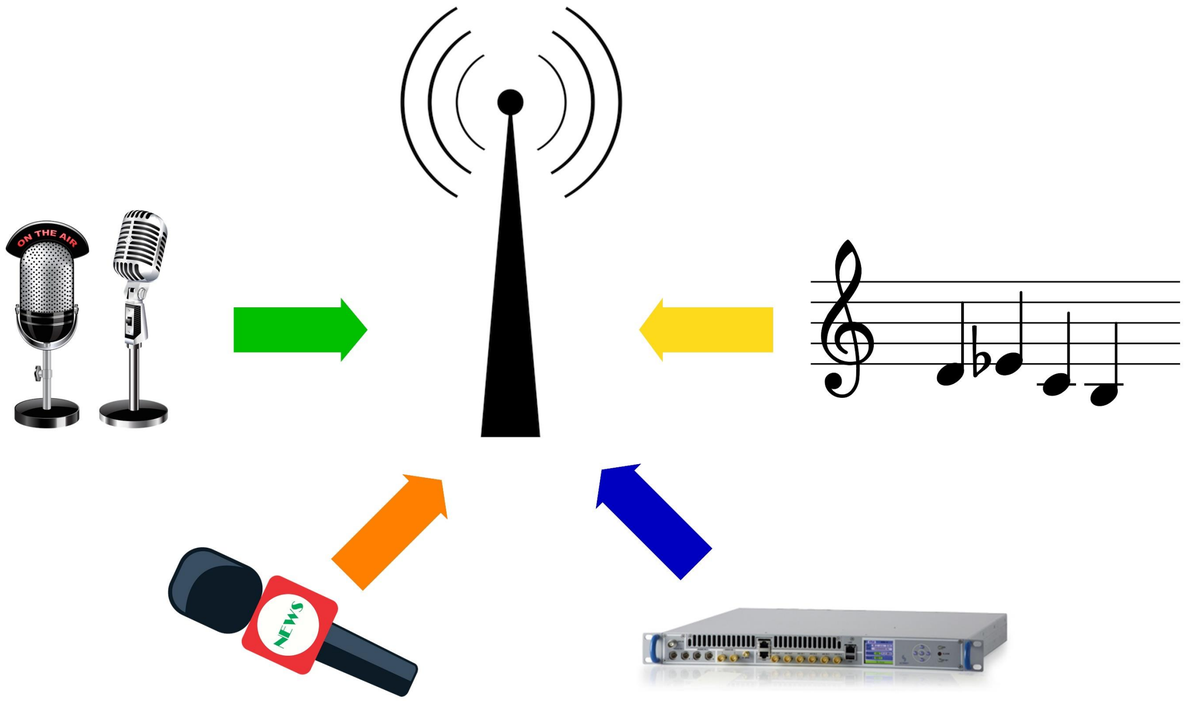
DIGITAL BROADCAST

screen

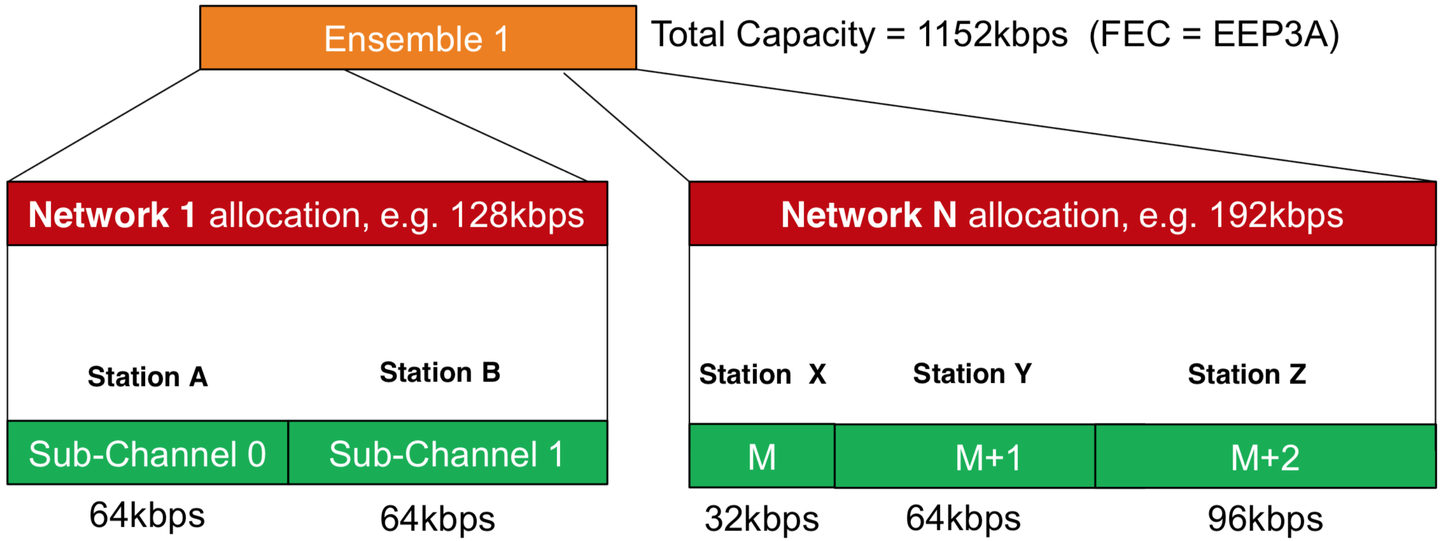
DAB - Ensemble Structure

Ensemble Structure



- Multiple different radio stations transmit on the **same frequency**
- Multiple different radio stations use the **same transmitter**
- Multiple different radio stations **share the cost** of that single transmission

Ensemble Structure



	Stations (services)	Capacity used
• Radio network 1	2	128kbps
• Radio network 2	4	256kbps
• Radio network 3	3	192kbps
• Radio network 4	9	576kbps
	Total 18 stations	**1152kbps**

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

- 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

Ensemble Structure

Each ensemble has

- its own Ensemble Label
- its own unique Ensemble ID code
- can carry a unique identifying code of the transmitter (TII)

Signaling Channel – the Fast Information Channel (FIC)

- Provides details about all services (stations) carried
- Service labels
- Bit rates
- Data location in the stream
- Provides details of all data services and PAD
- Provides announcements and warnings

FIC provides a range of signals from the head-end system to the receiver

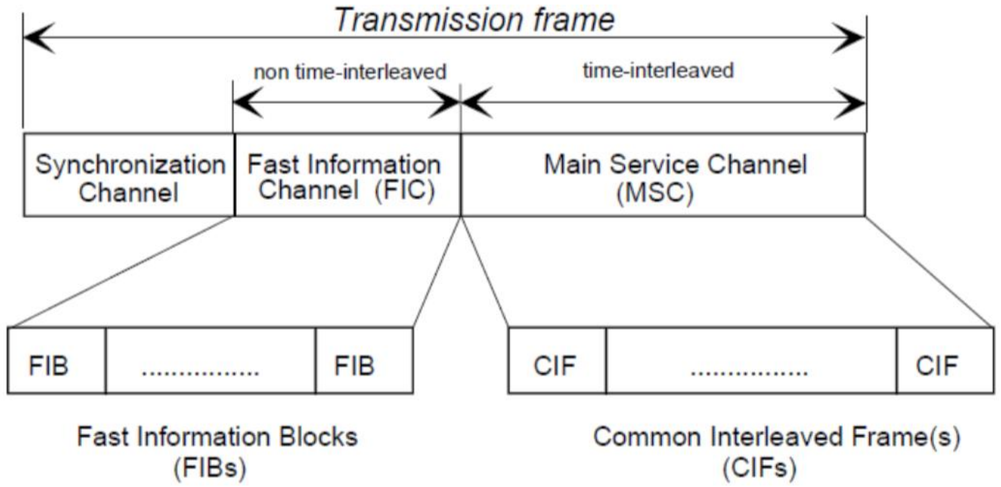


FIG type number	FIG Application
0	MCI and part of the SI
1	Labels, etc. (part of the SI)
2	Labels, etc. (part of the SI)
3	Reserved
4	Reserved
5	Reserved
6	Conditional Access (CA)
7	Reserved (except for Length 31)

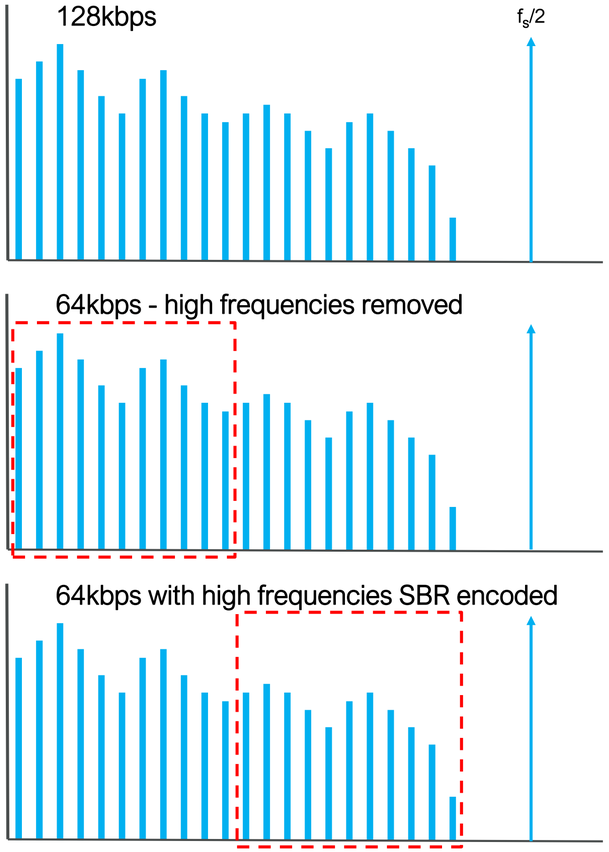
FIG type/extension	Description
FIG 0/0	Ensemble information
FIG 0/1	Sub-channel organisation
FIG 0/2	Service organisation
FIG 0/3	Service component in packet mode
FIG 0/4	Service component with CA in stream mode
FIG 0/5	Service component language
FIG 0/6	Service linking information
FIG 0/7	Configuration information
FIG 0/8	Service component global definition
FIG 0/9	Country, LTO and International table
FIG 0/10	Date and time
FIG 0/11 and 0/12	Reserved
FIG 0/13	User Application information
FIG 0/14	FEC sub-channel organisation
FIG 0/15 and 0/16	Reserved
FIG 0/17	Programme Type (PTy)
FIG 0/18	Announcement support
FIG 0/19	Announcement switching
FIG 0/20	Service component information
FIG 0/21	Frequency information
FIG 0/22 and 0/23	Reserved
FIG 0/24	OE services
FIG 0/25	OE announcement support
FIG 0/26	OE announcement switching
FIG 0/27 to 0/31	Reserved

- **2.5 times more audio services** than DAB due to the use of HE AAC+ v2
- **48kbps DAB+** vs **128kbps DAB** service with equal audio quality
- DAB+ Improve coverage of 1 / 2 dB better than DAB
- Improved signal robustness for Program Associated Data delivery

DAB DAB+

System Structure Audio

HE AAC v2 audio encoder → Audio super framing → Reed-Solomon outer FEC encoder → Virtual interleaver → Main service channel multiplexer

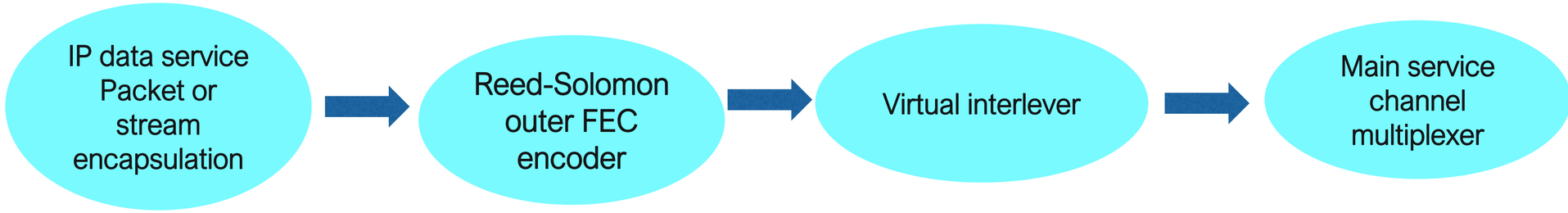


Sampling rate (kHz)	SBR on	Sub-channel data rates (kbps)					
		Stereo		Parametric Stereo		Mono	
		Min	Max	Min	Max	Min	Max
48	no	24	192	-	-	16	176
24	yes	24	136	24	48	16	64
32	no	24	192	-	-	16	168
16	yes	24	136	24	48	16	64

DAB+ audio coding-spectral band replication (SBR)

System Structure IP data

Data services

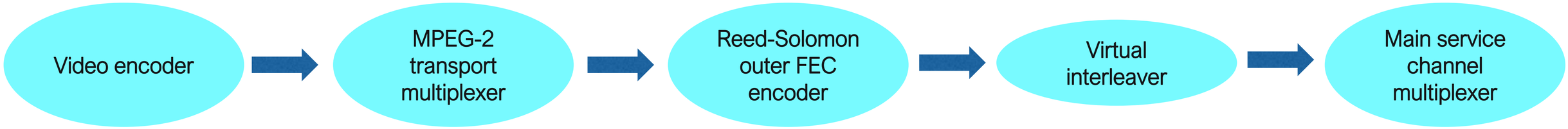


Enhanced Packet Mode

- UDP
- Add RS(204,188)

- Need specific applications to process the data on the receiver
- Can be made secure though the use of encryption / Conditional Access

Video services : T-DMB
Video service structure
Example receiver e.g. LG smartphone



Forward Error Correction (FEC) codes are applied per sub-channel

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

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