Media and Content Sector Expectations for 5G

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Introduction – the BBC

- The UK's public-service broadcaster
- 9 UK TV channels

  one TWO three FOUR CBBC CBeebies NEWS PARLIAMENT ALBA

- 10 National Radio Stations (+49 regional/local)

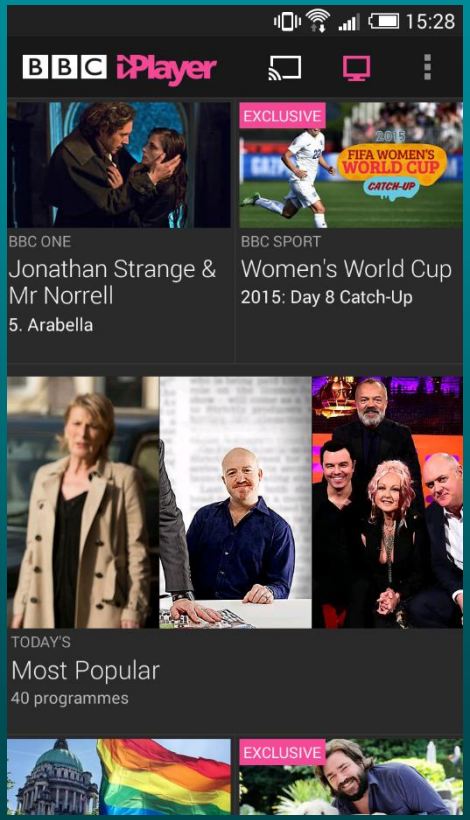
- iPlayer – IP catch-up service
  - ≈10 million requests per day (incl. live streams)
  - Mobile devices and tablets are largest platform (42%)
- 69% of all video viewing time in UK is live

Distribution – fixed reception

- DVB-based
  - Terrestrial: DVB-T/T2
  - Free-to-Air, high QoE
  - 98.5% population coverage
    - 1100 sites (80 main sites)
  - Most popular UK TV platform
    - 50+ TV channels (incl. HD)
    - 25+ radio stations
  - Hybrid DTT/IP platforms
    - FreeviewPlay

Distribution – mobile devices

- Radio
  - FM and DAB (>95% population)
- TV – OTT streaming
  - WiFi
  - 3G/4G
    - Coverage/capacity limitations
    - Data caps
  - Demand for high-quality
- Personalisation – myBBC
  - Broadcast has a role to play



The role of broadcasting

- Live viewing
  - Popularity of live experience
  - Peaks during live events, e.g. the ‘Andy Murray’ effect
- On-demand viewing
  - Concentrated towards certain popular programmes
  - Addition of a long tail
- Offers a defined Quality of Experience
  - Dimensioned to allow everyone to receive good quality
- Applications for both fixed and mobile devices

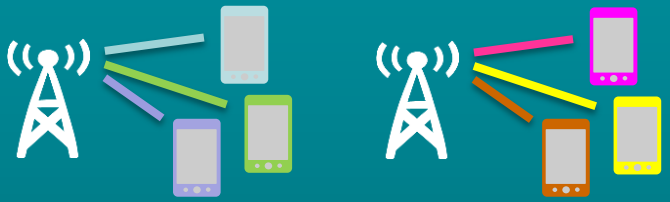
4G Broadcast – Intro (i)

- What is it?
  - Our term for eMBMS
  - The broadcast mode of LTE (4G)

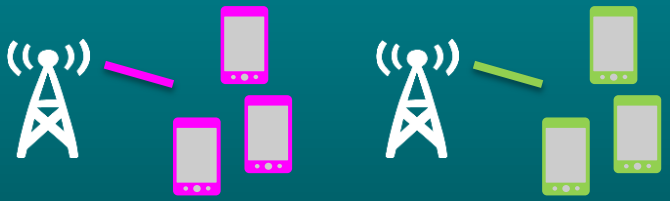
- Useful for delivery to mobile devices
  - Hardware already entering smartphones
  - Worldwide standard (3GPP)
- Data offload on existing MNO networks
  - Ease congestion in certain areas at certain times
  - Existing spectrum
- Not suitable Digital Terrestrial TV replacement
  - Fundamentally limited by its technical parameters

4G Broadcast – Intro (ii)

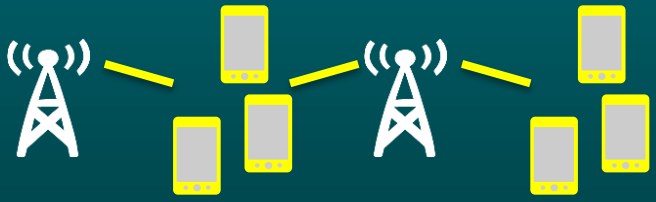
- LTE
  - Multiple unicast streams to each handset within a cell



- eMBMS
  - Single multicast stream to every handset within a cell



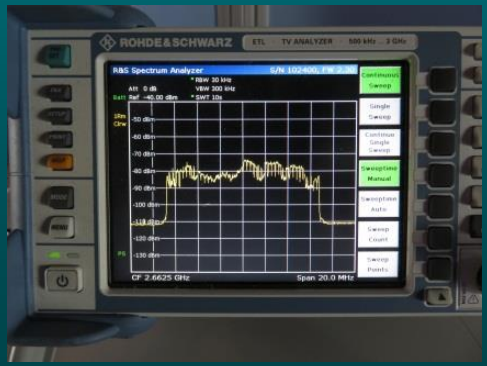
- eMBMS (MBSFN)
  - Single multicast stream to every handset across multiple cells



4G Broadcast Demo, Glasgow

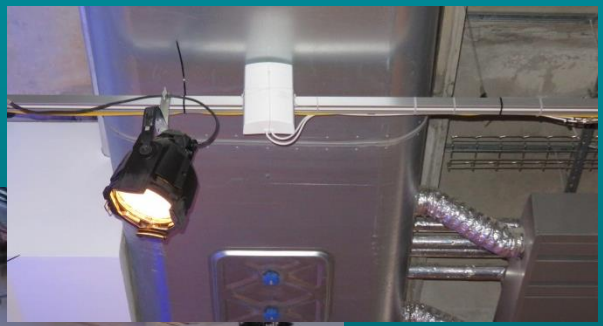
- Commonwealth Games 2014
- Collaboration
  - BBC R&D: Content & Application
  - EE: Network, Spectrum
  - Huawei: Equipment
  - Qualcomm: Middleware
- Handsets, Samsung Galaxy S5
- Spectrum
  - 2.6 GHz frequency
  - 15 MHz bandwidth carrier

GLASGOW 2014
XX COMMONWEALTH GAMES



4G Broadcast Demo, Glasgow

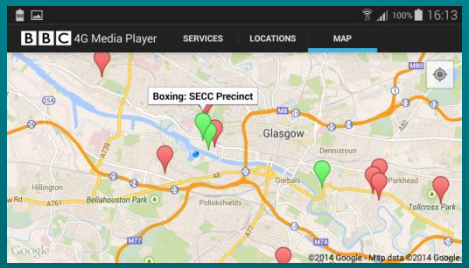
- Local transmission within exhibition hall

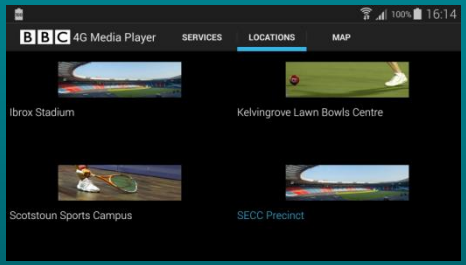


4G Broadcast Demo, Glasgow

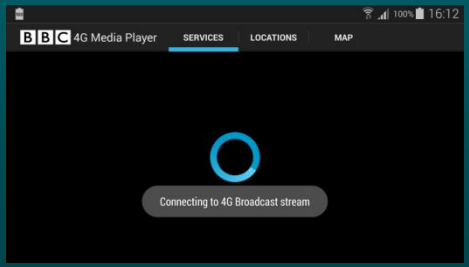
BBC Application

- Two concepts:
  - A dedicated events-based application



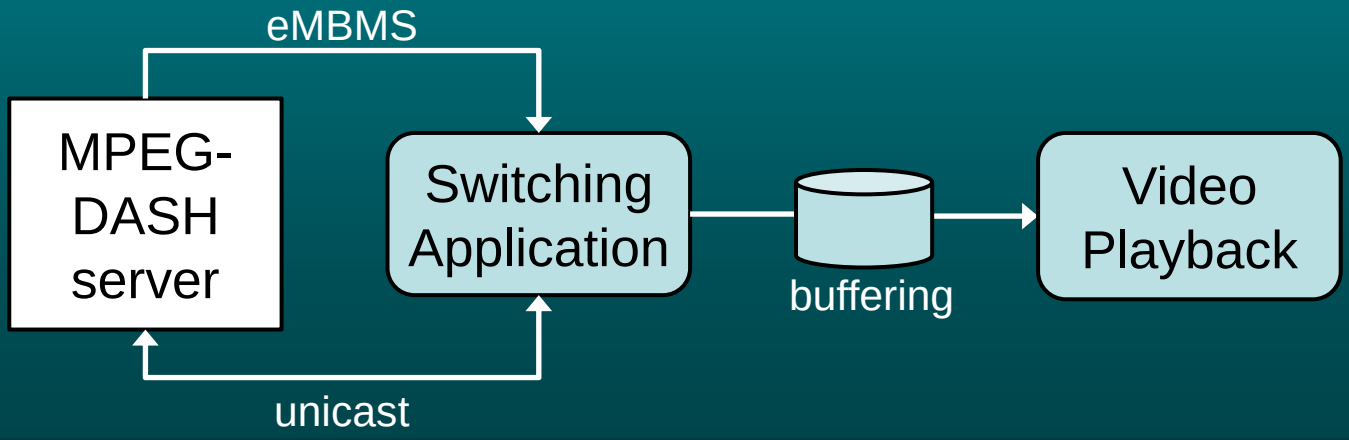


  - eMBMS as a underlying technology (iPlayer demo)



Application-based switching (i)

- Possibility of seamlessly switching between eMBMS and unicast dependent on availability
  - Application-based – not standards reliant
  - Segmented video format provides timestamps
  - Introduces some delay



Application-based switching (ii)

- Between eMBMS (4G Broadcast) and WiFi (Unicast)

4G Broadcast Demo, Wembley

4G Broadcast Demo, Wembley

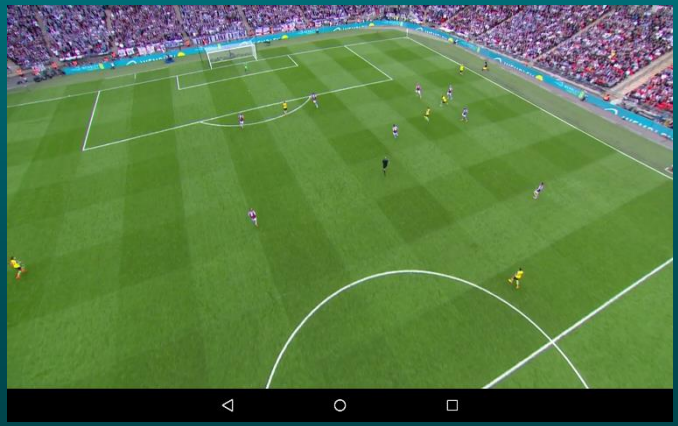
- EE – Lead partner of Wembley Stadium
  - Demonstration at FA Cup Final
- Commonwealth Games partners plus…
  - EVS – Multi-angle replays
  - Intellicore – EE App development
- BBC Sport Digital
  - Integration into BBC Sport App
- BBC Sport/Arena TV
  - Access to additional feeds from OB Truck
- Coverage in corporate boxes to circa 30 tablets

FA Cup – Content

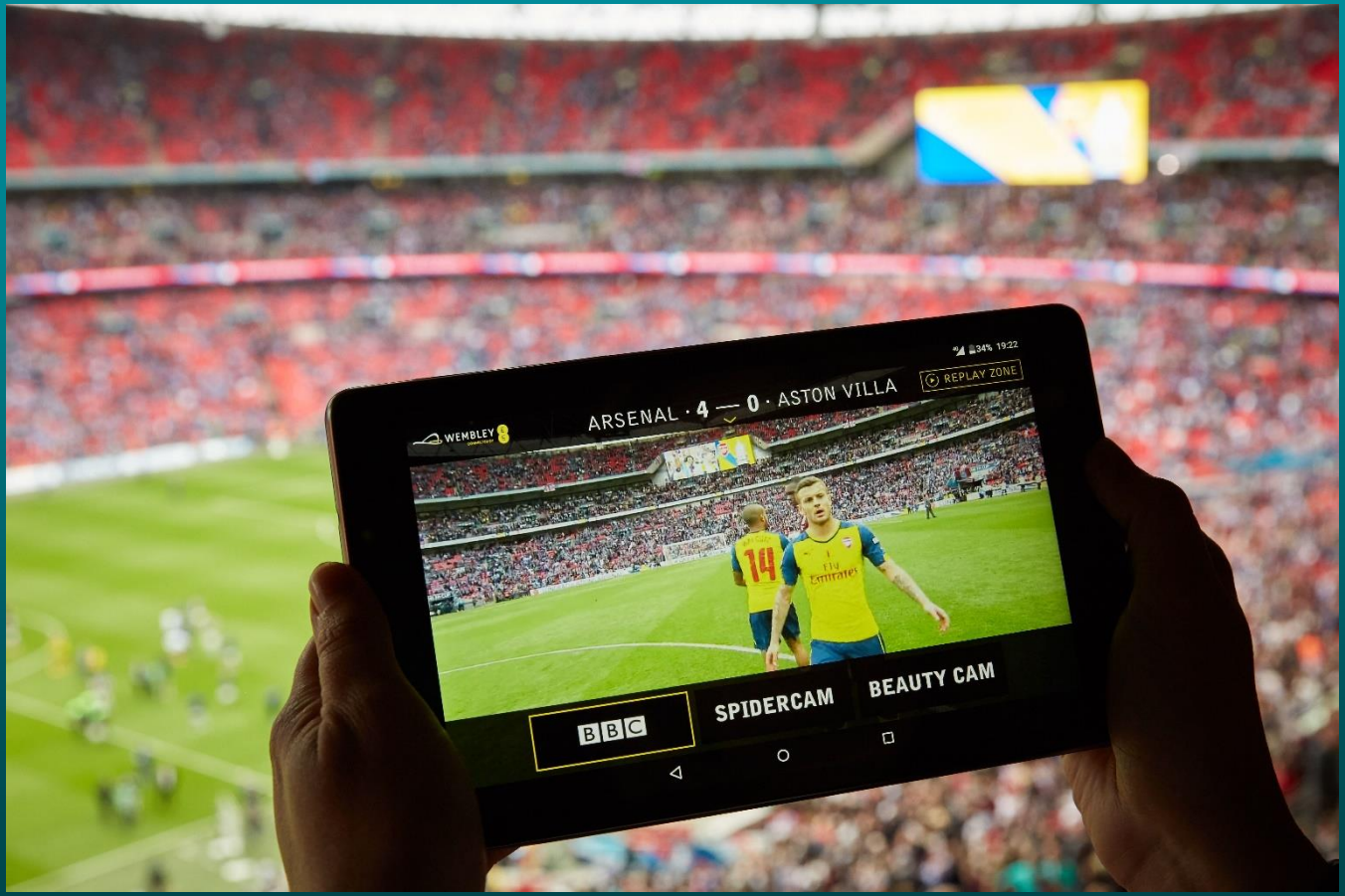
- Broadcast
  - Live streams
    - BBC One — Direct from BBC playout centre
    - SpiderCam — OB Truck via dedicated IP link (StageBox)
    - BeautyCam — OB Truck via dedicated IP link (StageBox)
  - Highlights packages
- Unicast
  - Multi-Angle replays – slave equipment inside OB truck

FA Cup – Outside Broadcast

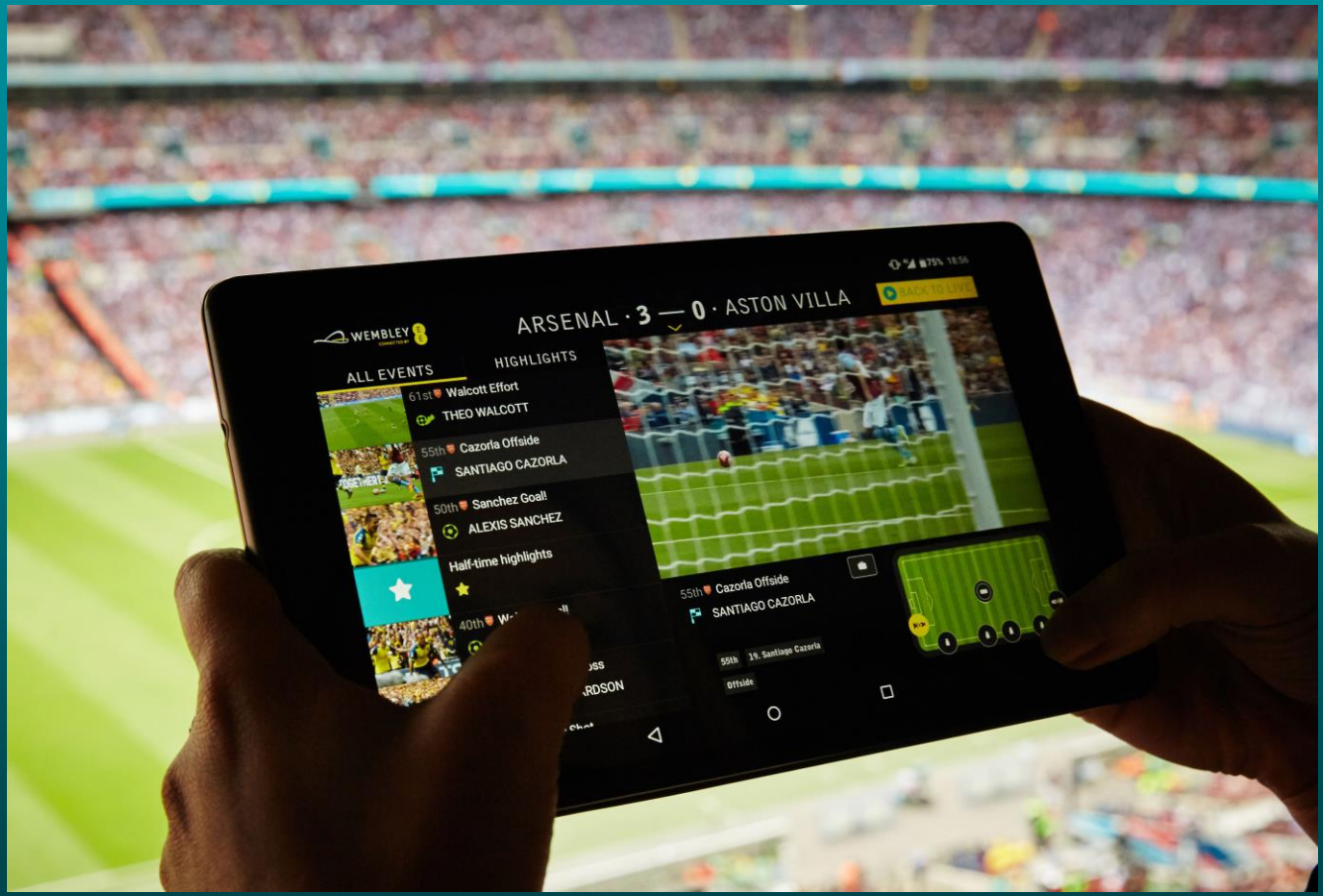
BeautyCam and SpiderCam



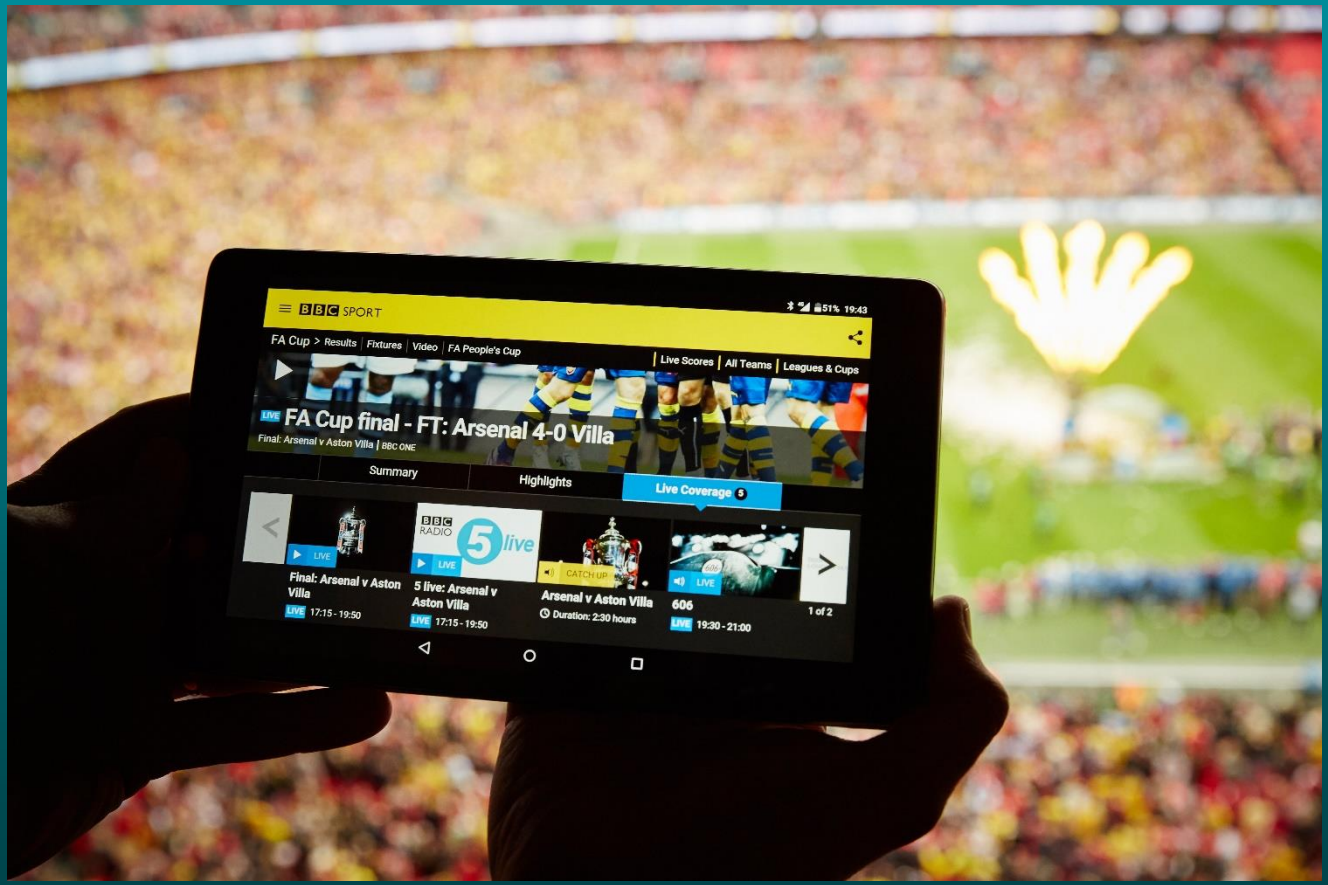
EE App – Live Feeds



EE App – ‘Replay Zone’



BBC Sport App Integration



Today – 4G Broadcast

- Works well
  - Good picture quality in congested environments
  - Efficiency benefits from 2-3 concurrent users per cell
  - Delay an issue within the stadium environment
    - But less of an issue away from it
- Current limitations
  - Supports small cell sizes only
  - Lack of capacity sharing (statistical multiplexing)
  - Not Free-to-Air
  - No support for standalone (shared) transmissions

Tomorrow – 5G (i)

- Increased (‘Infinite’) capacity
  - mmWave
  - MU-MIMO
  - Reduced latency
- …but achieving this will require:
  - Dense cell and antenna deployments
  - Significant backhaul capacity
- Unlikely to be available everywhere

Tomorrow – 5G (ii)

- Integrated broadcast mode
  - Segmentation of content
  - Intelligent caching on device to maximise benefit
  - Seamless unicast/broadcast switching/combining
  - Provide efficiency over the air-interface
- Flexible physical layer
  - Network topology, frequency bands
- Capabilities
  - Free-to-Air and broadcaster-defined QoE
- Efficiency
  - statistical multiplexing, stand-alone transmissions

Summary

- Today
  - Fixed delivery – dedicated network
  - Mobile delivery – Over The Top on WiFi/3G/4G
  - 4G Broadcast
    - Seen some of our work so far
    - Works well for delivery to mobiles
    - Has limitations
- Tomorrow – 5G
  - ‘Infinite’ capacity is unlikely to be available everywhere
  - Technical benefits to be had from an integrated broadcast mode