LTE for Broadcast

FutureWorks – Broadband Broadcast Convergence

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• LTE for Venue Cast
• LTE eMBMS for nation wide TV
• Implementation
Mobile edge video orchestration: stadium case
Create a new user experience and increase network capacity

- Local video orchestration at the event
- Mobile cameras connected over LTE
- Breakout of video streams from public LTE network at base station
- Users can select and watch High-Definition video streams in real-time
- Local unicast distribution to users
- Video quality management

Use case

Professional cameras
Local production and playout
Central playout

Benefits
- New user experience: high-quality, low-latency video experience & user driven channel selection
- New revenue – event specific packages for media owners as well as for users
- Improve network efficiency & save backhaul

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- High-quality, low-latency video experience
- User driven channel selection

New revenue:
- Event specific packages for media owners
- For users

Improve network efficiency:
- Save backhaul

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Mobile edge video orchestration in action on a race track
Impressions from Oldtimer Grand Prix 2014 – field trial with Deutsche Telekom

Dreamchip HD LTE Cameras inside the Race Cars

Race Navigator giving G-force, Motor Data and Stress Level of Driver

Dr. Schumacher (General manager Nürburgring Gesellschaft) happy to see Livestream on an iPad

iPad app for event visitors

Mobile Studio from Alowerk, Cliptime

Mobile Reporter with HD LTE Camera

Main stream

Car 1
Porsche 935 (1977)

Car 2
Porsche 911 (1972)

Position 1
Mercedes Arena

Position 2
Müllenbach Schriele
Mobile edge video orchestration – field trial with StarHub at WTA event


StarHub and Nokia Networks at the Edge of Mobile Content Delivery

Singapore, 24 October 2014 – Imagine being able to get multiple real-time perspectives of ‘live’ events, such as sports, concerts, awards and parades, in high-definition on your mobile device from wherever you are as a spectator!

This new multimedia experience has become reality following StarHub’s trial implementation of Nokia’s Liquid Applications solution at its 4G mobile base stations within the Indoor Stadium at Singapore Sports Hub, bringing ‘live’ sports action closer to spectators.

For the trial conducted on 21 October 2014, four ‘live’ video feeds of the Rising Stars Finals played at the BNP Paribas WTA Finals Singapore presented by SC Global were delivered concurrently to spectators on mobile devices, giving them different perspectives of the action played out in the court. Spectators were able to zoom in on the action by selecting any preferred camera angle at any time.

“We are excited over the potential in moving digital content to the farthest edge of our mobile network – the base stations. This localized mobile content delivery significantly reduces lags and boosts surfing quality, offering our subscribers the best mobile broadband experience,” said Mr Mock Pak Lum, Chief Technology Officer, StarHub.
Utilisation of DVB-T in Germany ranges from 0.2% to 26.6% of households.

City vs. countryside? Engagement of private TV? Primary or total use?

Overall use varies from 2.2% to 26% households over German states.

0.2% to 17.6% households use DVB-T as the primary source.

LTE 4 TV Broadcast
From Trials to commercial interest

Problem
- Terrestrial TV networks (DTT) have limitations
- Mobile community is looking for new growth opportunities: stepwise evolution scenarios required
- Broadcasters block spectrum required for coverage/digital inclusion
- MNOs need better view on business case

Solution
- Position LTE as future technology for TV broadcast with upside potential towards better services
- Work with Operators to build trust in technology and business case
- Establish global standard to push ecosystem

Benefits
- Ubiquitous Video and TV Across the Full Device Range with global standard
- Growth opportunity for both mobile operators and Broadcasters/Content owners
- Create opportunity to free up spectrum for digital inclusion/MBB coverage

Timeline

Dr. Klaus Ilgner, Director of the broadcast research institute IRT, watching at a LTE Broadcast test terminal connected to the Munich field trial network
Industry first field trial of eMBMS Single Frequency Network (SFN) in Munich, Germany

implemented with commercially available Flexi eNodeB hardware

Q3/14: field trial start
Pre-commercial SFN software

Q3/15: demo center
Drive tests, demos, simulation calibration

Configuration
> 4 locations, 4 cells
> ISD 2 – 19 km
> Nokia Flexi Multiradio 10 BTS commercial APT700 HW
> eMBMS pre-commercial SFN, core network emulation
> Qualcomm test terminals, eMBMS enabled measurement equipment from Rohde & Schwarz (TSMW, ROMES)
> UHF spectrum, 3GPP band 28
> 10 MHz FDD (several SD channels, some HD channels)
Munich eMBMS trial network: spectrum configuration

LTE DL (and UL) operational in 700 MHz band despite presence of DTT multiplexes

DVB-T transmit power: 100 kW ERP per carrier

DVB-T carriers within the trial LTE uplink spectrum produce in-band interference to the LTE receiver in the base station. Therefore notch filters were deployed. In the trial scenario this is relevant only for combined broadcast/unicast use cases.
Smartphone applications to show LTE 4 TV Broadcast use cases
HbbTV example

The demo shows a combined broadcast/unicast use case on a smartphone:
- Switching between different TV broadcast channels
- Unicast overlay with VoD offering (HbbTV like presentation)
- Switching between broadcast and unicast screens
- Screencast via Wi-Fi to a large screen (smartphone as a “set top box”)
eMBMS RS SINR *) compared to single cell RS SINR
Single Frequency Network (SFN) gain

PCI 400  PCI 100  PCI 300

• RS SINR measurement per single PCI over time
• This measurement is performed on the LTE reference signals in the non-MBMS subframes

• RS SINR eMBMS SFN measurement over time
• This measurement is performed only on eMBMS reference signals in the eMBMS subframes
• Blue circled areas show SFN gain
• Red circled area indicates destructive interference

*) Reference Symbol Signal to Interference and Noise Ratio
LTE in broadcast band 470-694 MHz: Supplemental Downlink (SDL)

Supplemental Downlink = additional capacity to exclusive (FDD) band in downlink direction

- Complements LTE capacity for video streaming and intense media use
- Easier to coordinated with DTT use than conventional uplink and downlink operation within the band
- eMBMS as LTE broadcast technology can complement or in the more distant future even replace DVB-T for terrestrial TV distribution in supplemental downlink capacity

SDL may provide win-win between DTT and MBB and ease introduction/migration
Estimate on annual cost of DVB-T vs. LTE Broadcast distribution

€160M annual spend for public broadcast vs. incremental cost of eMBMS capacity for MNO

Annual Cost Analysis: LTE eMBMS

Possible range of cost

- Nokia: LTE 100 MHz
e.g. 25 HD channels HEVC
25x 3.6 Mb/s / 1.5 b/Hz/s = 60 MHz
- Nokia: LTE 40 MHz
- Expenditures of German Public Broadcasters for DVB-T in 2013
- DVB-T Price minus 19% VAT and 50% GM/General Cost

Sensitivity analysis w.r.t.
• # base stations (eNB)
• RF bandwidth for 25 HD channels