LTE for critical communications in rail.
How and when?

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Ancient History

* in telecoms terms
between expectations and reality
Structure

• Critical communications/public safety communications evolution outside rail

• Applicability to rail

• Rail industry actions
Commercial cellular

Benefits of vast success:
• Huge R&D investment and innovation
• Network capacity
• High speed, multimedia

But:
• Not optimized for critical communications
• (Generally) no strong coverage obligations

Image: Sascha Pohflepp
Critical communications

Features:
• Robust
• Excellent group operation
• Priority control
• Direct mode

But:
• Expensive due to limited volume
• Slower evolution than commercial cellular

..etc..
Vision

Critical Communications

Consumer

Commercial

Rail Critical Comms?
Commitment to LTE

National Public Safety Telecommunications Council

Spectrum and US$7bn funding for national US public safety network at 700MHz

Started standards process in 3GPP

Tetra + Critical Communications Association

Committed to LTE for broadband critical communication systems
Public safety scope in 3GPP

System Features
- Proximity services (ProSE)
- Group call on LTE enablers (GCSE_LTE)

Radio Layer Features
- Frequency band/Power support
- High speed rail support
- Radio enablers for system features
Proximity services

- Devices in close proximity communicate directly
- Reduce network load
- Increase radio efficiency
- Communication in areas without network coverage
Group calling enablers

Group Call application server

Group Call Enabled LTE Network

Cell Site

Cell Site

Group Members

Proximity Service Relay

Dispatcher
3GPP Release 12 roadmap

**2013**
- June: Requirements freeze (Postponed from March for public safety work)
- December: Architecture freeze

**2014**
- June: Signalling freeze

**2015**
- Release 12 Implementations available?

**Later phase enhancements….**
Application/enabler split

Critical Communications
Network Application

Open Interface

3GPP LTE
Network Layers

Critical Communications
Handset Application

Open Interface

3GPP LTE
Handset Layers

Looks familiar?!
## GSM-R/ERTMS architecture

<table>
<thead>
<tr>
<th>Operational &amp; Critical Voice</th>
<th>Signalling</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORANE / EIRENE</td>
<td>ERTMS</td>
</tr>
<tr>
<td>GSM-R Voice</td>
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</tr>
<tr>
<td>GSM-R Data</td>
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</tbody>
</table>

- Interface is implicit and GSM-R dependent
Open architecture

Operational & Critical Voice  Signalling

MORANE / EIRENE  ERTMS

Network Interface

“Rail Enabled” Radios
GSM-R / LTE / Other

MORANE / EIRENE  ERTMS

Mobile equipment Interface

“Rail Enabled” Radios
GSM-R / LTE / Other

• Technically viable
• Derisk future radio technology changes
• Enables common platform for safety critical and non safety critical apps
What is a rail enabled radio?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Voice</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group calling</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Functional addressing platform</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Direct mode</td>
<td>Yes</td>
<td>?</td>
</tr>
<tr>
<td>High speed train support</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Priority services</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

In other words, the LTE critical communications requirements!
Transition triggers

- Spectrum
- Regulation
- Product end of life
- New build
- Critical broadband apps (CCTV)

Beyond our control
Use commercial networks

BUT

• Open interfaces decouple apps from infrastructure
  • Don’t need dedicated radio network

• Lots of questions arise
• Utilizes 3rd party spectrum
On train system

- Radio Modules
- Comms Gateway
- User WiFi
- etc.
- IP Bus
- Security

Operational & Critical Voice
MORANE / EIRENE
ERTMS

Signalling

Netovate
Critical comms, multi radio

- Transition scenarios
- Adapt to local circumstances:
  - Spectrum
  - Physical geography
  - Human geography
Rail industry actions

• Not ready to influence LTE technology

• Define GSM-R lifecycle: regionally, nationally
  • Given realistic spectrum assumptions

• Understand what LTE can deliver for operational/critical communications

• Evaluate commercial networks use
Take away

• LTE standards for critical communications also enable GSM-R like applications
  • Becoming available from 2014….

• Decoupling applications from radio network infrastructure is technically desirable

• GSM-R is not forever!
More information

• www.3gpp.org/Public-Safety
• Netovate training event in December, See: netovate.com

Iain Sharp

Director, Netovate

• Cellular applications consultancy
• Training