



Next generation nødnett in commercial mobile networks?

- Mission possible?

PSCE Conference

Madrid
28th November, 2017

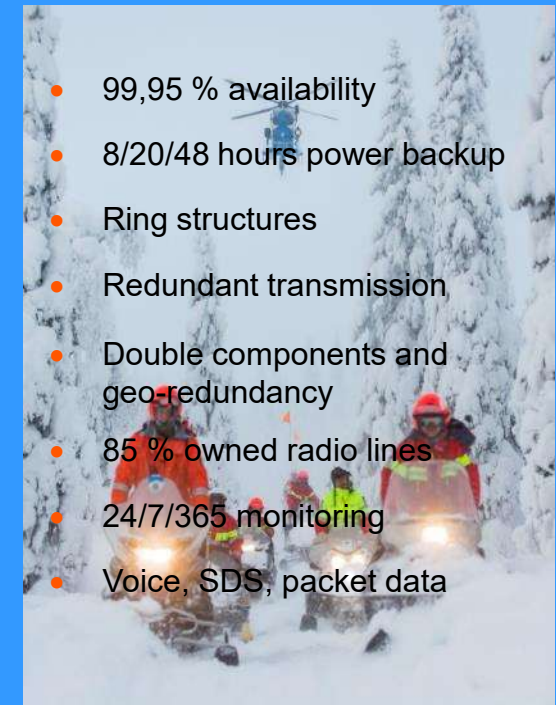
Hans Petter Naper
Chief Engineer
The Norwegian Directorate for Civil Protection



Nødnett – the TETRA PPDR system in Norway



- 2 071 base stations
- 86 % area coverage
- 100 % population coverage
- Helicopter coverage
- 348 road tunnels
- Mobile base stations
- Indoor coverage
- 53 400 radios
- 1,5 million calls per month
- 248 control rooms



- 99,95 % availability
- 8/20/48 hours power backup
- Ring structures
- Redundant transmission
- Double components and geo-redundancy
- 85 % owned radio lines
- 24/7/365 monitoring
- Voice, SDS, packet data

Nødnett is brand new. Why do we have to worry about Next Generation Nødnett already now?

- Nødnett is one of the most up-to-date TETRA PPDR networks in Europe, and will be used at least until 2026
 - Running costs and reinvestments in Nødnett for another 9 years
- Need to develop a PPDR BB system to run in parallel with Nødnett
 - Inadequate, expensive and uncoordinated solutions that do not support joint operations must be avoided
 - Need for BB data already today, MCPTT can come later
 - Lead time? UK started in 2011

The Next Generation Nødnett (NGN) shall operate for decades, after Nødnett

Why didn't we use PLMNs from the start?

- No support for MCPTT in the PLMNs – until now (soon)
 - PTT in 2G/3G: Over-the-top, best-effort, poor performance
 - MCPTT will become possible with LTE i 3GPP Rel 13/14/...
- Challenges with using public networks
 - Capacity challenges
 - Technological security challenges (SS7)
 - Instances of massive outage (ex. HLR/HSS)
 - Poor backup power
 - Non-redundant transmission
 - Coverage issues (getting better all the time!)
 - Lack of national autonomy
 - Bottom-line focus, providing cheap services, not mission-critical services



What shall NGN become?

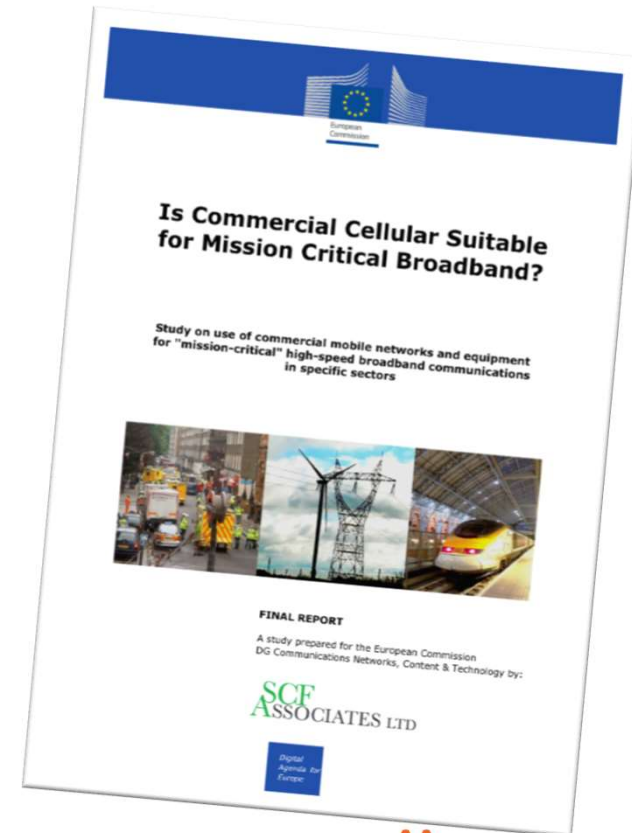
- Initially a basic broadband solution, to be developed over time
- NGN shall support completely new services for PPDR users, as these become available
 - E.g. group communication with video and data, IoT
- NGN shall be based on standardised technology
 - 3GPP 4G, 5G

- DSB has been tasked by the Ministry of Justice and Public Security to study the feasibility of using commercial networks for future PPDR communication
- An NGN group within DSB has been established

Is Commercial Cellular Suitable for Mission Critical Broadband?

SCF Associates as tasked by Digital agenda Europa,
EU commission, 2014

- (...) commercial LTE networks could support mission critical needs but only if certain conditions are met
- These conditions would fundamentally change the operating environment for the commercial mobile networks



Dedicated network vs. commercial solution

- Today's Nødnett has a dedicated radio and core network, transmission is a mix of leased lines and dedicated radio links
 - The government has a long-term (until 2026) contract with Motorola Solutions for operations and maintenance of Nødnett
 - Nødnett security has been criticised
- «All of telecoms Norway» take for granted that the next Nødnett shall be realised in commercial networks
 - A future solution must satisfy absolute requirements from the **users**, the **national security authority**, and the **telecommunication regulator**
 - At the same time cost efficient solutions must be found

The significance of the 700 MHz band

A possible dedicated network requires access to low radio frequencies. 700 MHz is the only alternative the next 15 years.

- Nkom (the regulator) assumes that the 700 MHz band will be auctioned around EOY 2018. Strong commercial pull.
- It is urgent to find out if the NGN requirements can be satisfied by commercial operators, we need a [clear view](#).
- A decision regarding 700 MHz and NGN in the short term will have huge long-term consequences.
- The decision is probably irreversible.





Nkom's recommendation to the Ministry of Transport and Communications

- Award the complete 2x30 MHz MFCN 700 MHz spectrum to commercial operators
- Facilitate NGN through electronic communication laws and regulations
- The government procures a service to cater for the needs of PPDR and military users from commercial players

Joint DSB / Nkom “memorandum” conclusion:

- A decision on how to conceptually realize NGN, should be made in parallel with a decision regarding the 700 MHz band.
- It will be a clear advantage to reach an NGN decision soon, so that the 700 MHz band can be auctioned and taken into use.
- When choosing a solution for NGN, there must at the same time be an intention on how the solution shall be realized **financially**, in order to satisfy the needs for **coverage**, **functionality**, **robustness** and **security**.

This is very much in accordance with PSCE’s policy review letter to BEREC of March 2017

NGN in commercial networks?

PPDR usage

60-70.000

Special subscriptions in mobile network(s)

Unique requirements:

Reserved capacity for PPDR users

Instant connection

Group communication

Robust

No eavesdropping

Cost?

Who pays?

Networks for all needs



NGN in commercial networks

Assumptions

- Technically possible with 4G
- 4G coverage will become at least as good as Nødnett today (Nkom)
- Robustness can be increased by using e-comm laws + government programs
- Availability can be improved with increased robustness + national roaming
- Security can be strengthened by applying security legislation and regulation

Do we have a **clear view**?

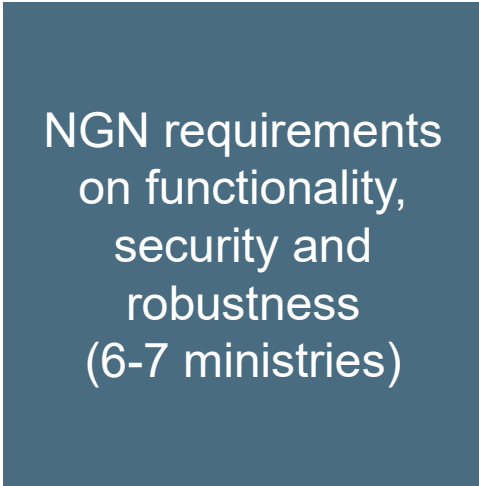
- Threats are developing and changing
 - Will the solution be adequate in the long term?
 - Will the solution become secure enough?
- **How to avoid pulverization of responsibility?**



Someone must take an overall responsibility to ensure that the solution becomes “good enough” for all stakeholders



Commercial mobile networks and operational models
(Ministry of Transport and Communication)



NGN requirements on functionality, security and robustness
(6-7 ministries)

Like this?

Commercial
mobile networks

Next
Generation
Nødnett




Experience:


Commercial
mobile networks


Special
functionality and
adaptations with
commercial
potential


- Robustness
- Security
- Not spots
- AGA
- National autonomy
- ...


Commercial networks are OK if this is taken care of

- 
- Priority**
- Specified by 3GPP
 - Who, when?

- 
- Coverage**
- Rural areas
 - AGA
 - Transportable base stations

- 
- Functionality**
- Local autonomy
 - Direct communication

- 
- Aligned operations**
- Users must know the actual coverage situation
 - Approval of planned work

- 
- Robustness**
- Backup power
 - Redundant transmission
 - National roaming

- 
- Ubiquitous security**
- Access control
 - Physical protection
 - Security cleared personnel
 - Information handling
 - Ownership
 - Equipment vendors
 - Sub contractors
 - National independence

QoS step 1: Prioritisation in LTE

- QoS Class identifier (QCI)
 - Defines rules for prioritisation of data packets in a node (e.g. base station)
 - MCPTT signalling and user data has the highest priority level
 - Can be changed dynamically

QCI	Resource Type	Priority Level	Example Services
1	GBR	2	Conversational Voice
2		4	Conversational Video (Live Streaming)
3		3	Real Time Gaming
4		5	Non-Conversational Video (Buffered Streaming)
65	Non-GBR	0.7	Mission Critical user plane Push To Talk voice (e.g., MCPTT)
66		2	Non-Mission-Critical user plane Push To Talk voice
5		1	IMS Signalling
6		6	Video (Buffered Streaming) TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
7		7	Voice, Video (Live Streaming) Interactive Gaming
8		8	Video (Buffered Streaming) TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
9		9	Video (Buffered Streaming) TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
69		0.5	Mission Critical delay sensitive signalling (e.g., MC-PTT signalling)
70		5.5	Mission Critical Data (e.g. example services are the same as QCI 6/8/9)

Annotations:

- MCPTT (red arrow) points to QCI 65 and 69.
- MC Data (green arrow) points to QCI 70.
- Telephony over LTE (VoLTE) (blue arrow) points to QCI 1, 2, 3, 4.
- Internet browsing etc. (blue arrow) points to QCI 6, 7, 8, 9.

3GPP Rel 12

QoS step 2: Release of capacity (pre-emption)

ARP – Allocation and Retention Priority

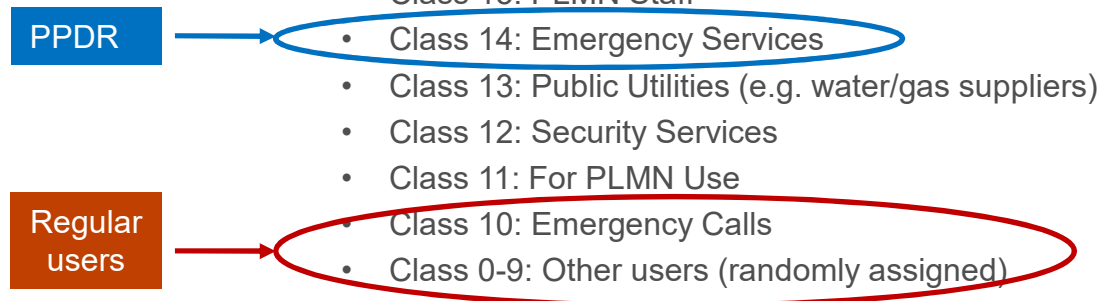
- Services (users) can be assigned ARP levels 1-15, where 1 is highest priority
- Services with higher ARP level can pre-empt services with lower ARP level
- Levels 1-8 can be assigned to services for PPDR users or e.g. business critical users



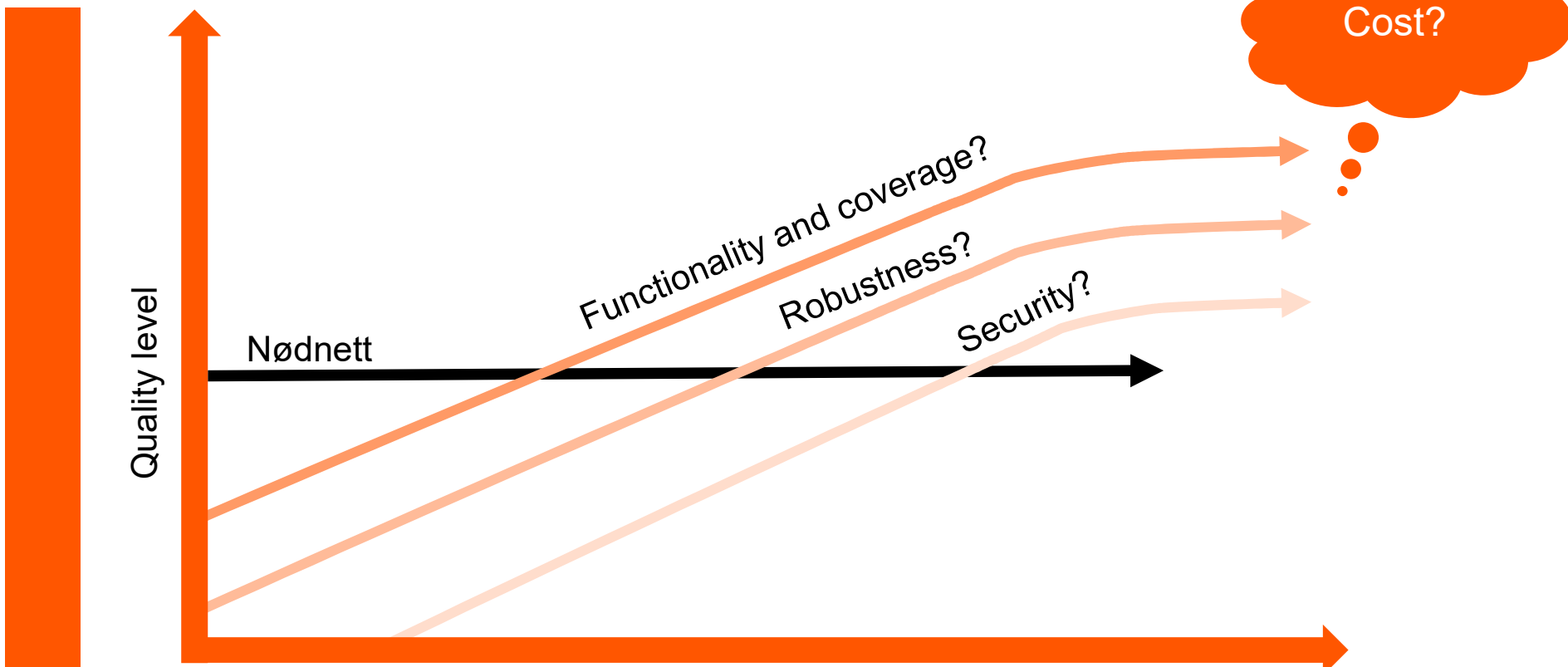
QoS step 3: Avoid too many users accessing the mobile networks simultaneously

- Access Class Barring

- Different users types can be assigned different access classes (3GPP 22.011):



In heavy load situations, the network can instruct users with (randomly selected) access classes in the 0-9 range to refrain from accessing the network



Current activity: RFI process

- DSB's NGN group is working on an RFI to be sent to Telenor, Telia and ICE, to be issued December 8th, mid-January responses
- Understand the mobile networks designs
- Robustness, SLA levels, weak points
- Security in technology as well as organisation
- PPDR functionality
- Utilize national roaming?

- PPDR users demand and deserve broadband
- Questionable if 2x10 MHz is enough
- A dedicated 4G PPDR network not able to cover all evolving needs
- 700 MHz spectrum too valuable for PPDR only
- Face it: 700 MHz is in the process of becoming awarded to commercial networks pan Europe
- Luckily: UK, USA and Korea lead the way

- Introduction of public safety communication in commercial networks is a cultural change
- Not simple! Not cheap!
- More players than before must be involved
- Challenging to define a good process with a precisely placed responsibility structure
- Norway's NGN group searches for a **clear view**