NORWEGIAN DEFENCE
MATERIEL AGENCY

Securing 5G for military use

With Public and Private 5G Networks

Kennet Nomeland

Radio Systems Architect

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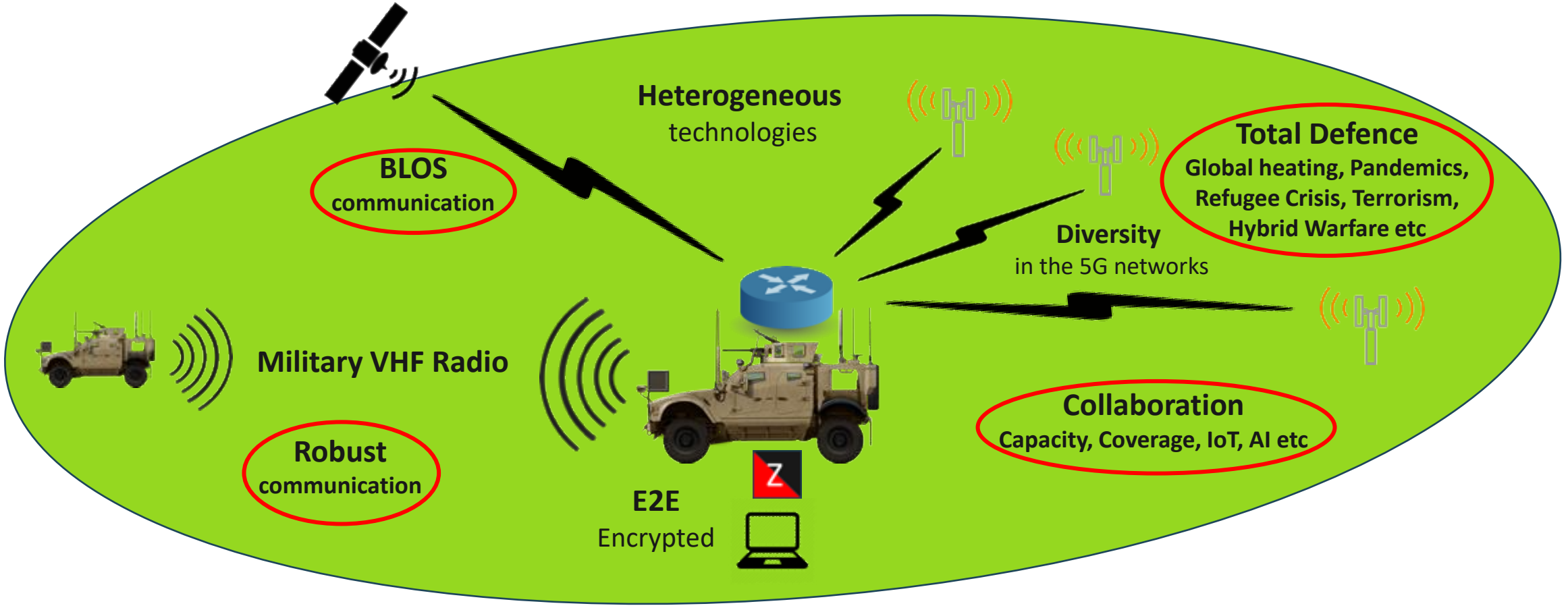
Communication for different scenarios (P.A.C.E)



3GPP ecosystem gives many new possibilities

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Commercial mobile networks plays an important role in war

NATO Article 3

Each NATO member country needs to be resilient to resist and recover from a major shock such as a natural disaster, failure of critical infrastructure, or a hybrid or armed attack

Resilient civil communications systems:
ensuring that telecommunications and cyber networks function even under crisis conditions, with sufficient back-up capacity. This requirement was updated in November 2019 by NATO Defence Ministers, who stressed the need for reliable communications systems including 5G, robust options to restore these systems, priority access to national authorities in times of crisis, and the thorough assessments of all risks to communications systems;

https://www.nato.int/cps/en/natohq/topics_132722.htm

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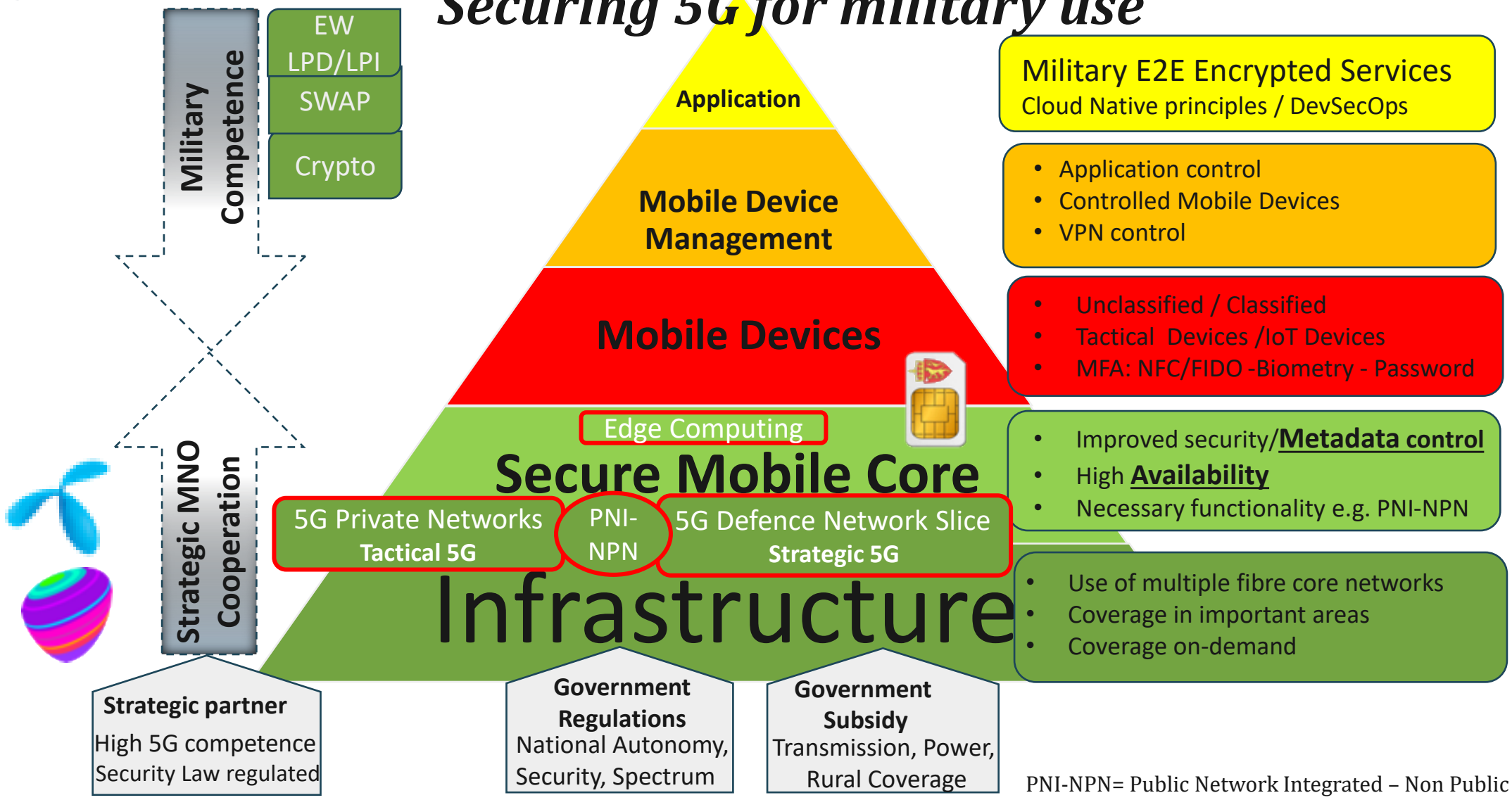

PNI-NPN= Public Network Integrated – Non Public Network

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Broad collaboration & Iterative Development > Key to success

4G Pilots
4G Pilots

Commercial Live 5G
NSA Networks

PNI-NPN SA pilot
PNI-NPN SA pilot

BUILD TEST DESIGN

Selection of partner(s)

Commercial agreement(s)
* eMBB
* Defence NW Slice
* 5G Private NW-aaS ?

Strategic Cooperation

Fixed network- Fiber -Pilots -Coverage -Spectrum - Edge

Strategic 5G 5G-VINNI Vertical Innovation Infrastructure **Telenor Research**

Tactical 5G FUDGE-5G Fully Disintegrated private networks for 5G verticals **Telenor Research**

VINNI-Next
Telenor Research
PNI-NPN pilot

BUILD TEST DESIGN

Pilot networks
Years ahead of commercial networks

5G Scrum Team

SAFe
Scaled Agile Framework

FFI (Norwegian Defence Research Establishment) **Research, Analysis**

NSM (Norwegian National Security Authority) **Research, Analysis**

CVS + HVS Combat Lab (Prototyping, Doctrines)

Defence renewal program MIME (funding until 2030)

FMA (Norwegian Defence Materiel Agency) **Project management, procurement**

2019 2020 2021 2022 2023

5G communication for Military use
- Robust
- High availability
- Secure
- Necessary functionality and services

PNI-NPN= Public Network Integrated Non-Public Network

Adapting 5G to military use

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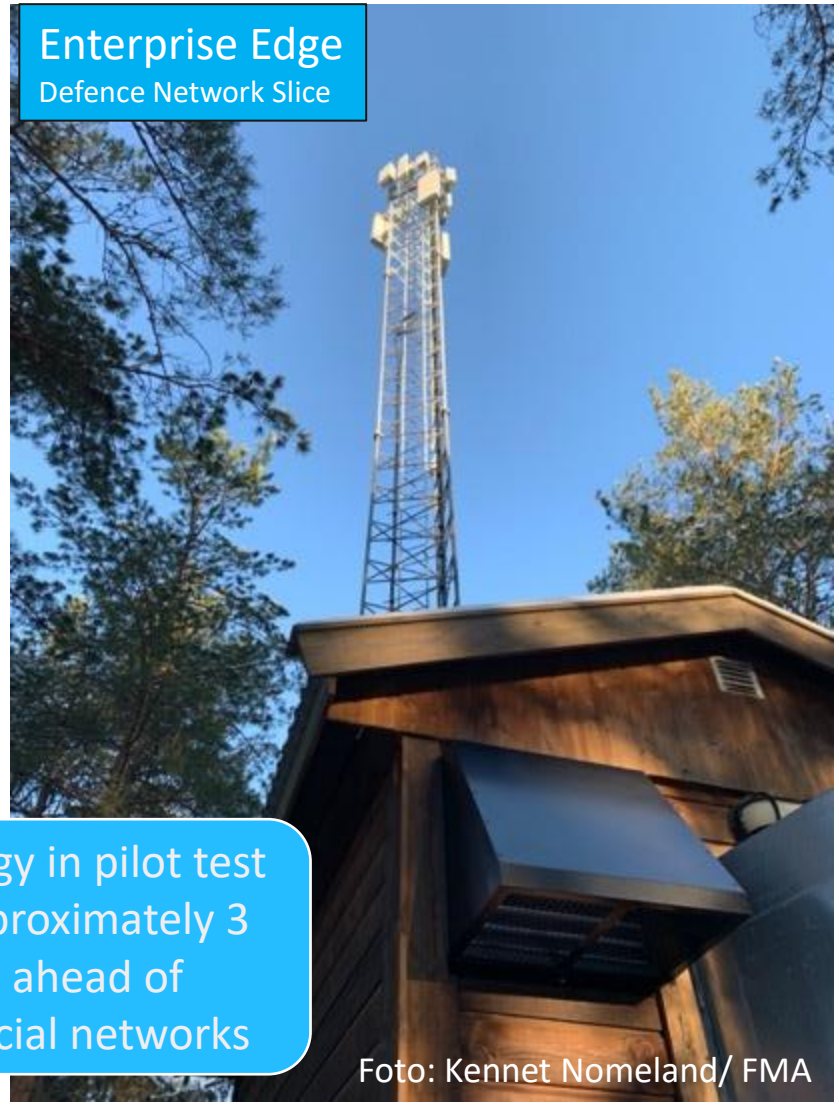
Rygge military airbase

Strategic 5G

5G-VINNI

890 MHz frequency spectrum
64x64 MIMO antennas – mmWave + C-band

Enterprise Edge
Defence Network Slice



Technology in pilot test beds approximately 3 years ahead of commercial networks

Foto: Kennet Nomeland/ FMA

Fiber + SATCOM
Backhaul

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5G-VINNI

FUDGE-5G

5G New Radio testing

- Range, Capacity and Robustness in different frequency bands
- Use of “NATO bands” for Tactical 5G > Spectrum Strategy
- Verify 5G SA ecosystem in NATO frequency bands






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Network Slicing to separate Public and Military traffic

eMBB NW Slice

Public use
- Roaming abroad
- Social media
- Access to Internet

2G, 3G, 4G, 5G

Separation

Military use
- Dedicated 5GC -Only Data
- Shielding of **Metadata**
- Removal of attack vectors (No Roaming /No Internet/No E.164)
- No legacy technology
- SUCI support
- Autonomy

Public nationwide **5G SA network(s)**

Edge Computing

Defence NW Slice
Strategic 5G

PNI-NPN

Private 5G Network
Tactical 5G

Necessary Services

Improved Security

Better Availability

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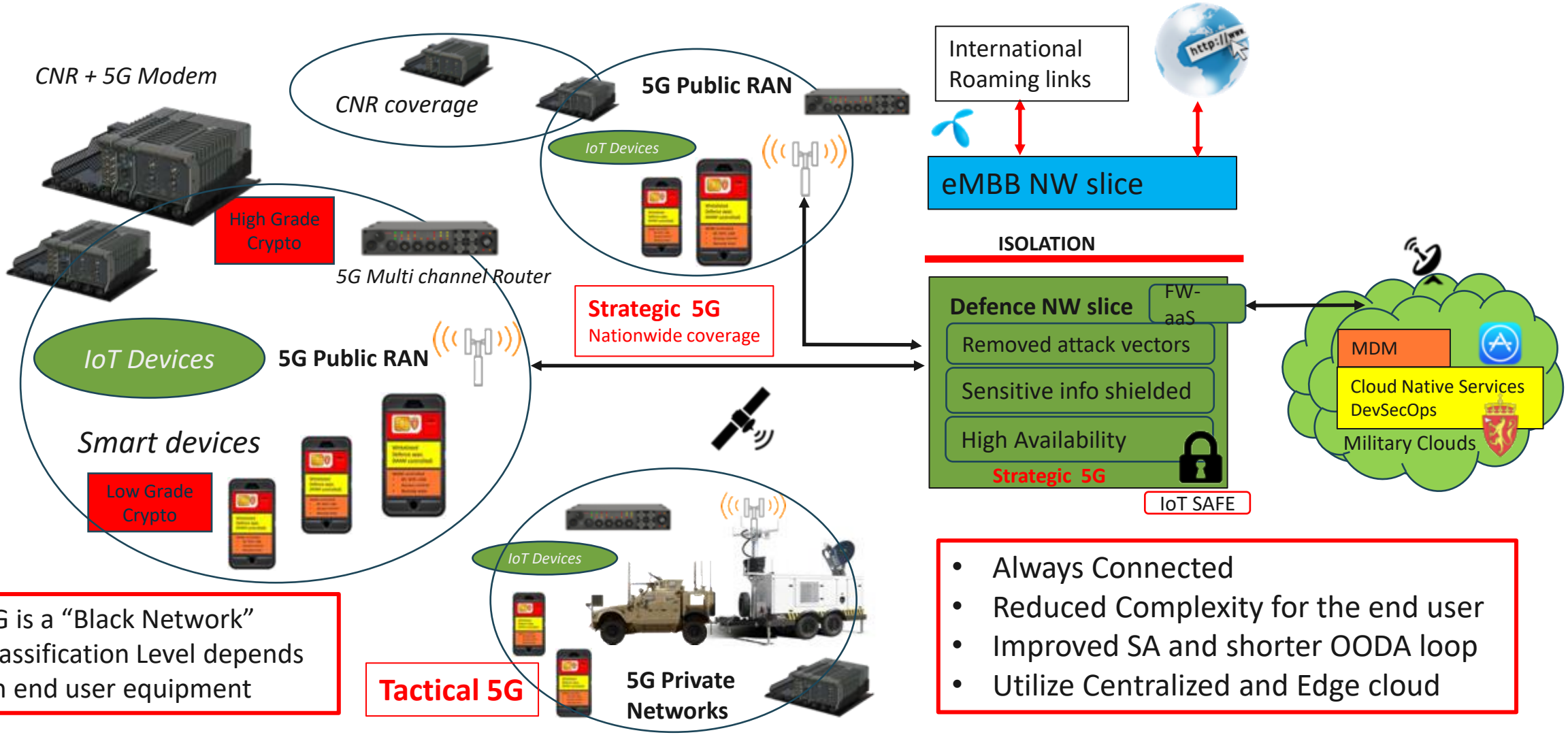
Vision - Network based Defence



5G is a "Black Network"
Classification Level depends on end user equipment

- Always Connected
- Reduced Complexity for the end user
- Improved SA and shorter OODA loop
- Utilize Centralized and Edge cloud

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FUDGE 5G pilot

5G Private Network

FUDGE-5G

Cell on Wheels

Tactical 5G

Fully Disintegrated private networks for 5G verticals (FUDGE)

- EU funded 5G pilot - Running until March 2023
- Fully autonomous 5G SA Private Network
- Equipped with Edge for PPDR / Defence Use Cases

Goal:

- Utilize both **Public** and **Private** 5G network
- Utilize centralized Clouds, 5G and Edge to create **Better** and more **Robust** services
- Leverage 5G SUCI security concept (Subscription Concealed Identifier) to **mitigate IMSI catcher problems**

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Full Autonomy

FUDGE-5G

Cell on Wheels

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Full Flexibility

FUDGE-5G

Cell on Wheels

Tactical 5G

Foto: Kennet Nomeland/ FMA

Mobile Private 5G SA NW
Dedicated Spectrum
7:3 DL/UL TDD Frame Structure
Guarantied QoS/Coverage
Backhaul via commercial 4G/5G or Satcom (OneWeb/SpaceX trails)


FUDGE-5G
Cell on Wheels
Tactical 5G

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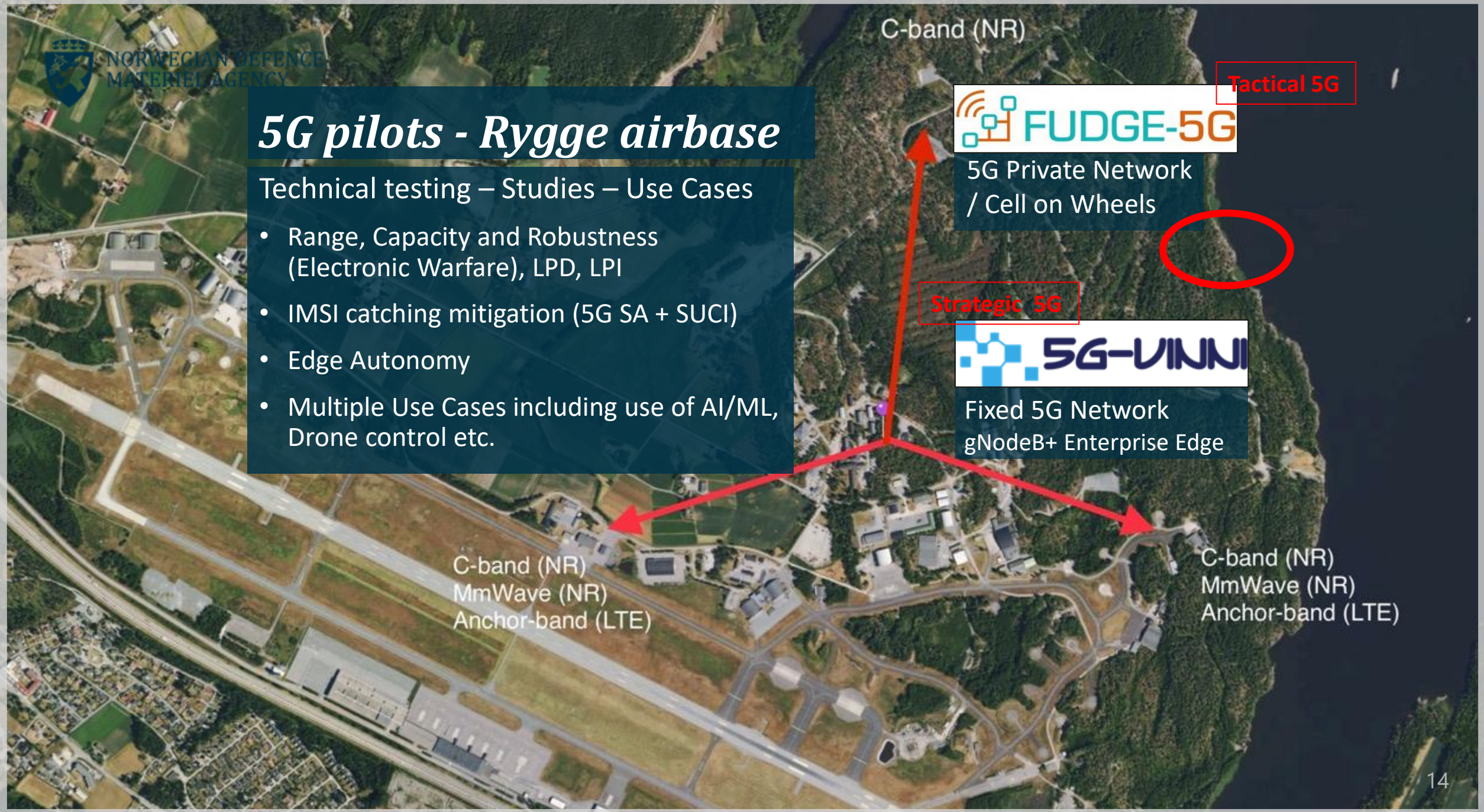
5G pilots - Rygge airbase

Technical testing – Studies – Use Cases

- Range, Capacity and Robustness (Electronic Warfare), LPD, LPI
- IMSI catching mitigation (5G SA + SUCI)
- Edge Autonomy
- Multiple Use Cases including use of AI/ML, Drone control etc.



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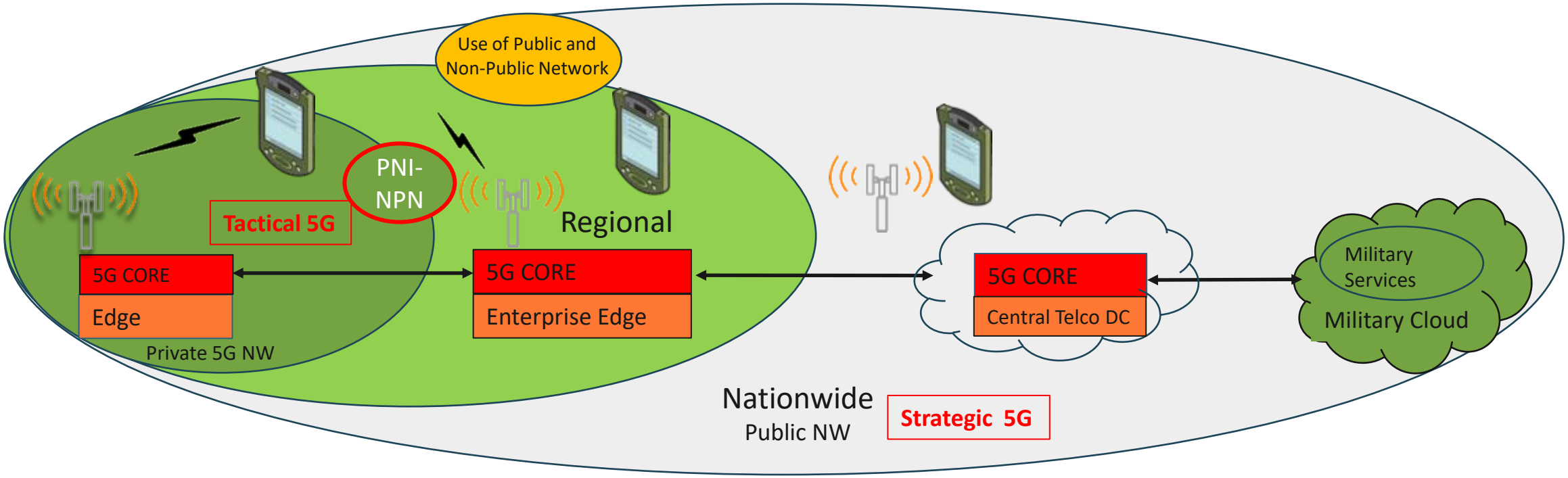
5G Private Networks

FUDGE-5G



From a **Telco** perspective

How to utilize both **Private** and **Public** 5G networks

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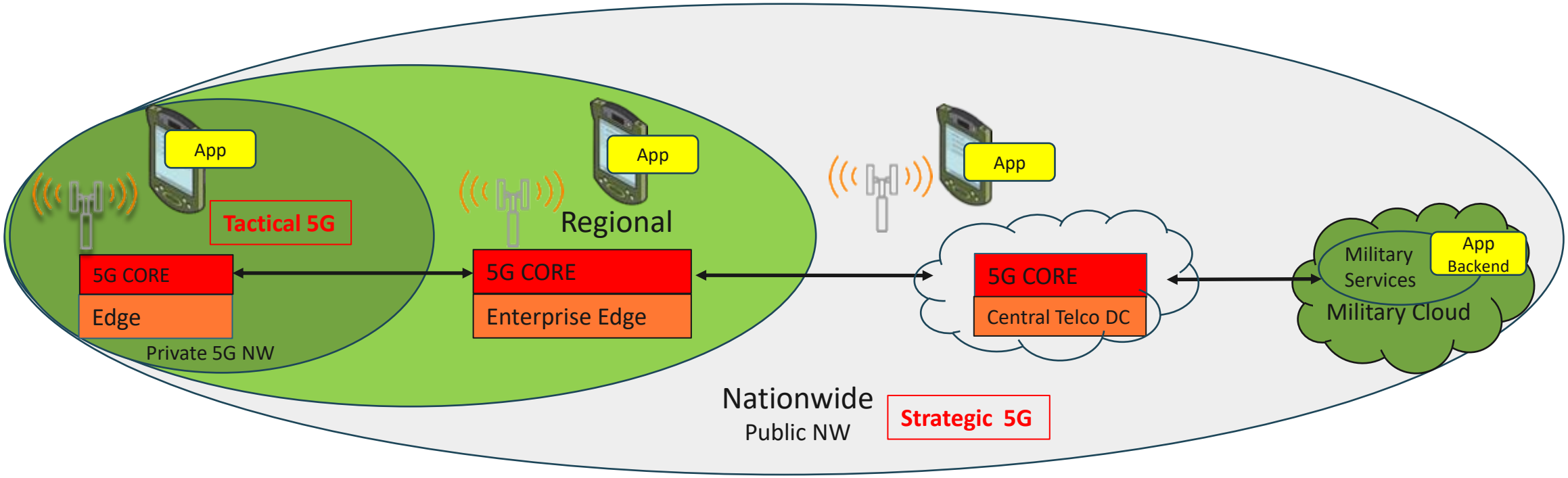
Edge Computing – The extended cloud



From a **Service** perspective

How to utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services

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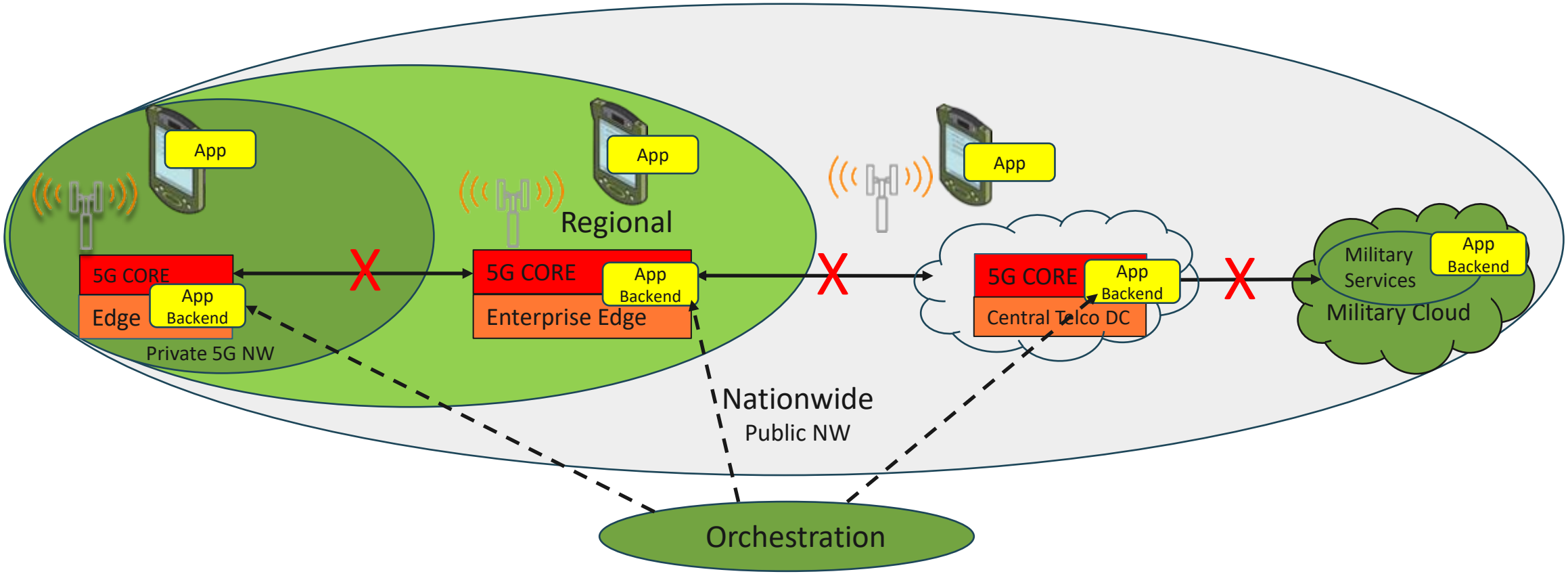
Edge Computing – The extended cloud



How to utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services
(Cloud Native principles)

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5G Use Cases

Foto: Theodor Obrestad/ Forsvaret

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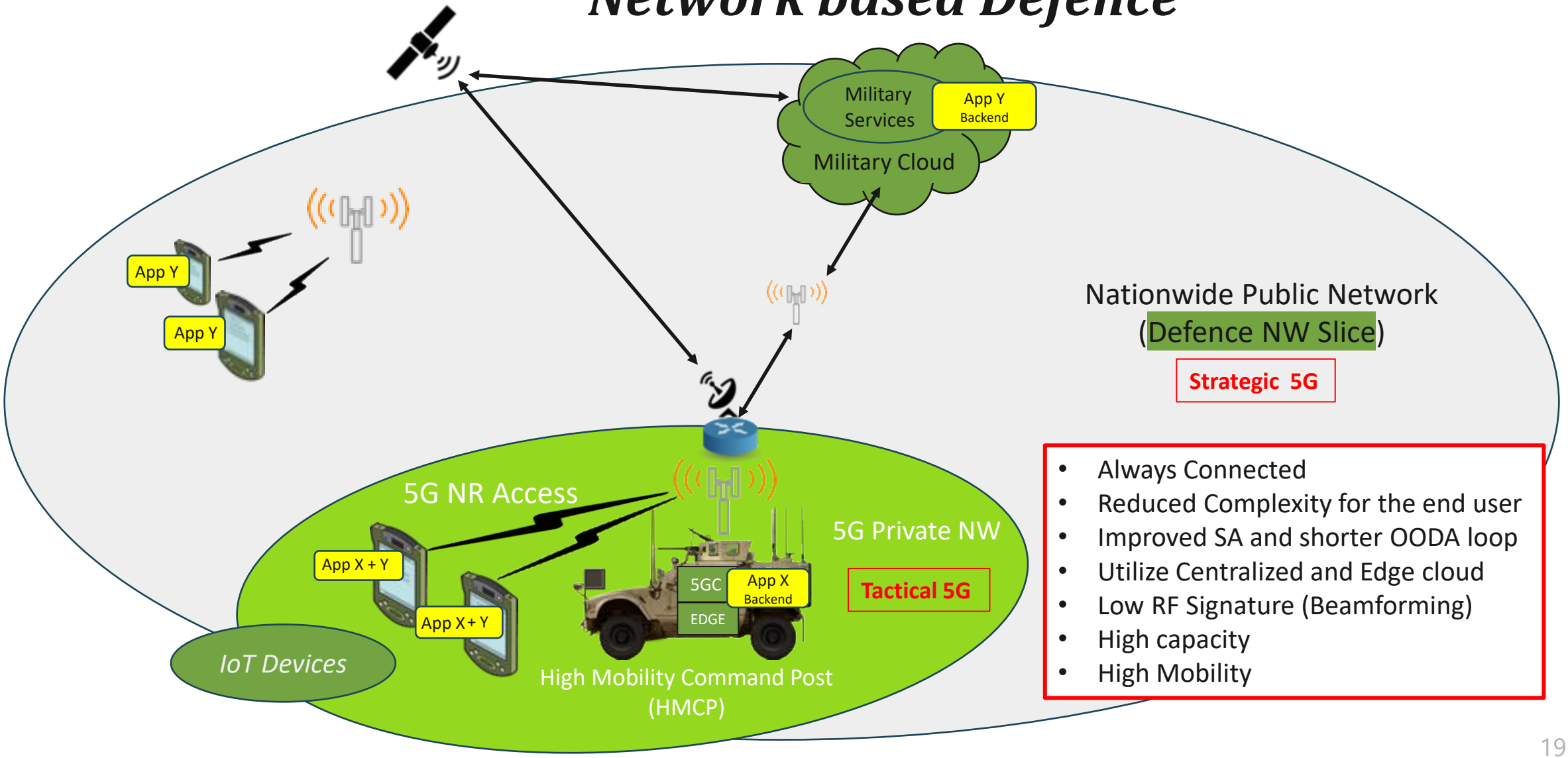
Network based Defence



- Always Connected
- Reduced Complexity for the end user
- Improved SA and shorter OODA loop
- Utilize Centralized and Edge cloud
- Low RF Signature (Beamforming)
- High capacity
- High Mobility

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Smart Port

Cold Response 22

NATO
OTAN

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Smart Port

Optical Video Sensors
Thermal Video Sensors
Gunshot Detection System
Drone Detection System
Counter UAS System

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Internet of Military Things
over 5G

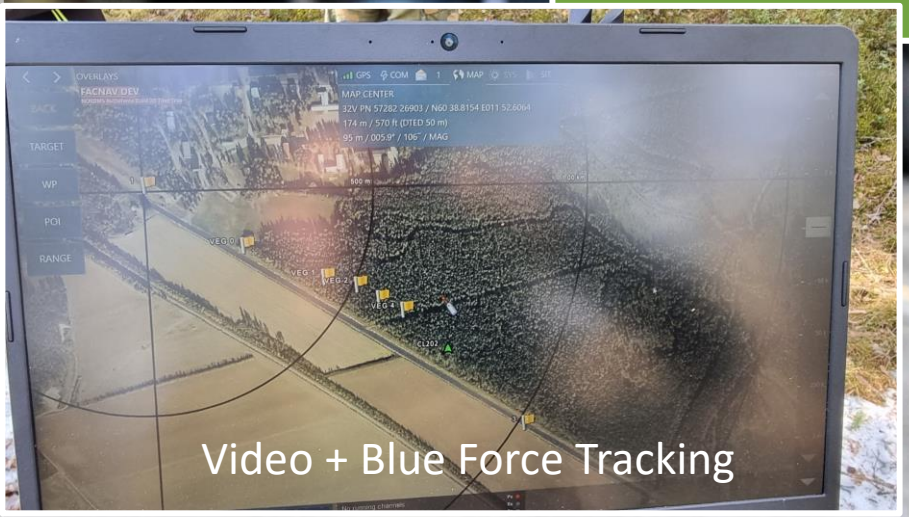

Foto: Torbjørn Kjosvold / Forsvaret

Cold Response 22

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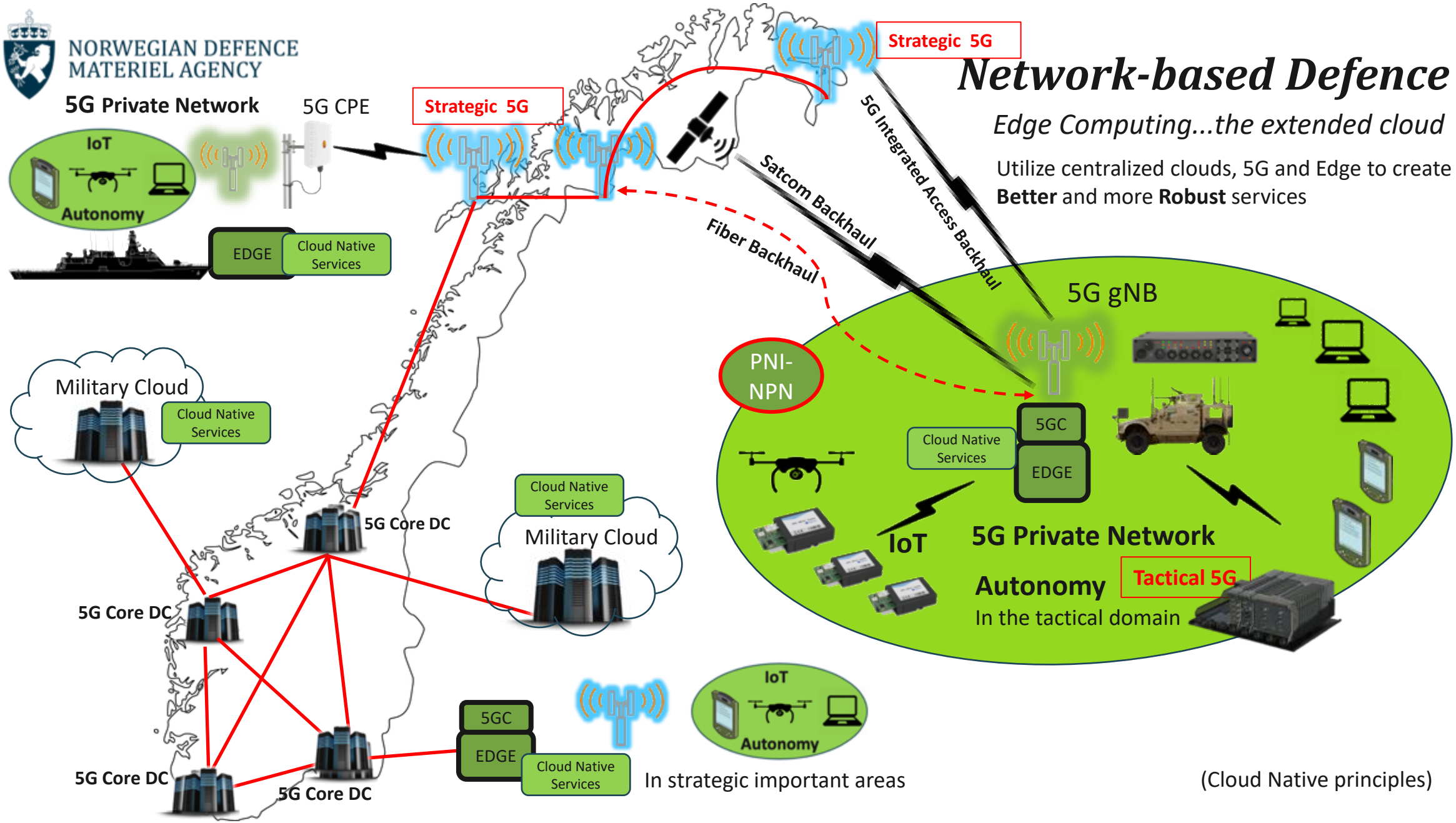
Network-based Defence

Edge Computing...the extended cloud

Utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services



In strategic important areas

(Cloud Native principles)

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5th Generation Changes Everything

Kennet Nomeland
Radio System Architect
Norwegian Defence Materiel Agency

Foto: Morten Hanche/ Forsvaret