Communication for different scenarios
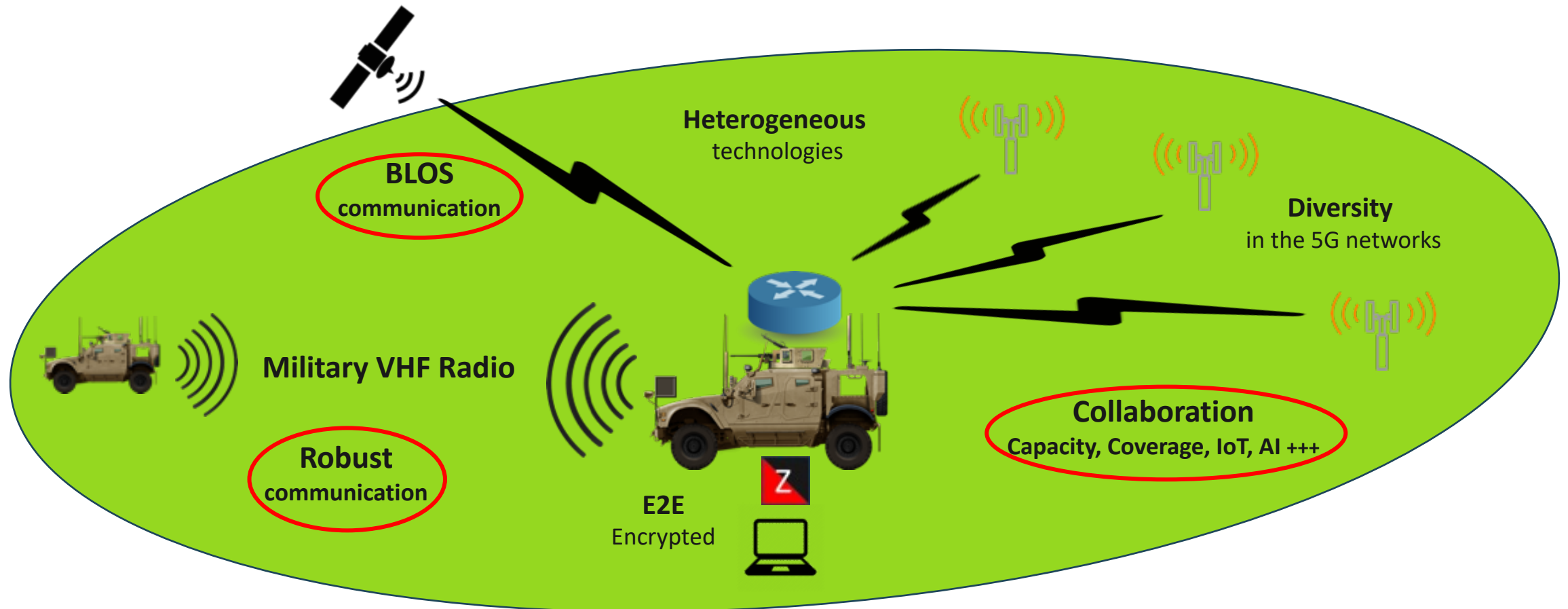
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Heterogeneous technologies

BLOS communication

Diversity in the 5G networks

Military VHF Radio

Collaboration Capacity, Coverage, IoT, AI +++

Robust communication

E2E Encrypted

3GPP ecosystem gives many new possibilities

Why is 5G interesting for military use?

Open Standards and Interoperability
A new threat picture > Collaboration in the "Total Defence" is needed

5G New Radio
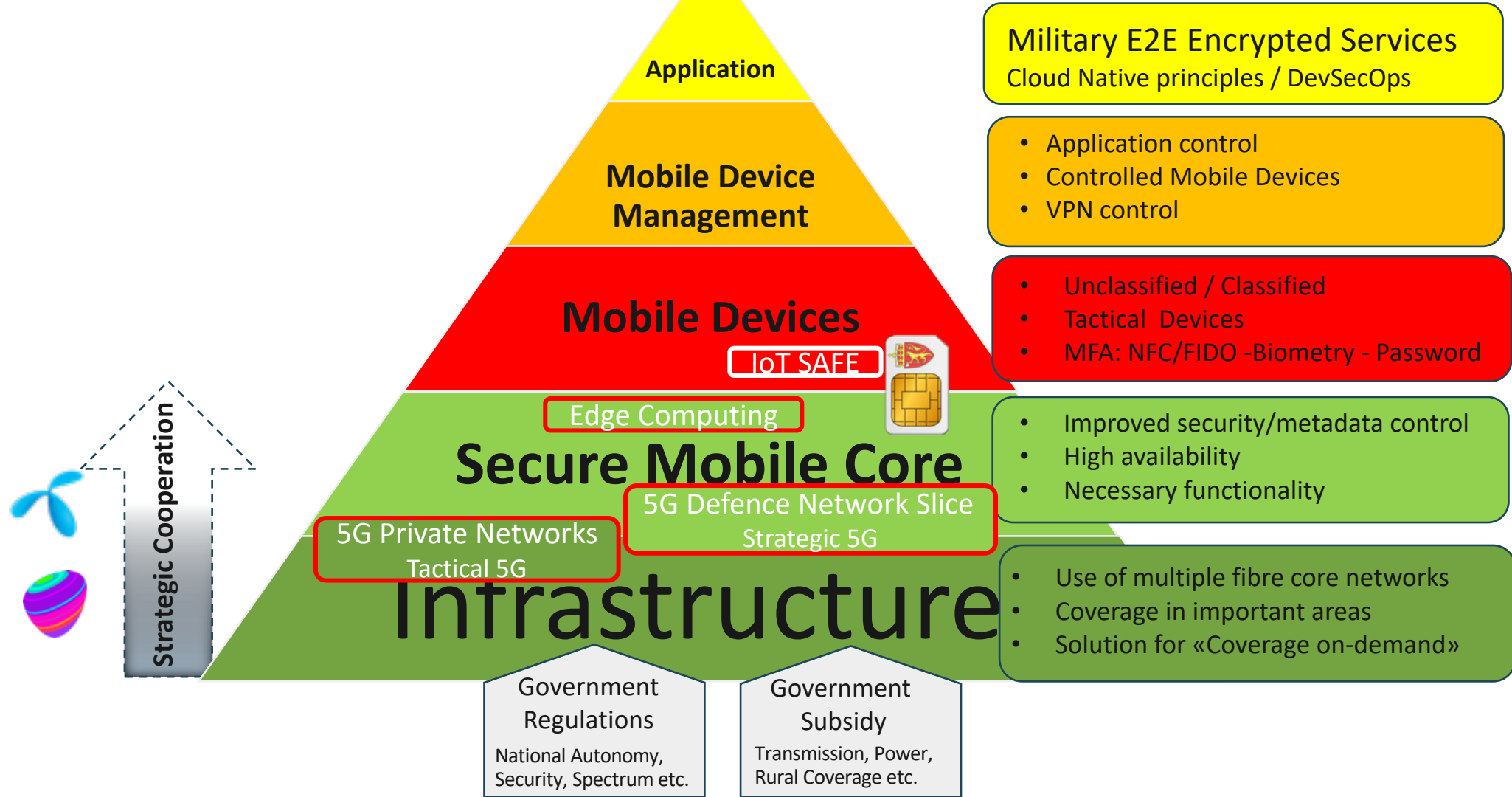*MIMO/Beamforming > More reliable communication*

Network Slicing
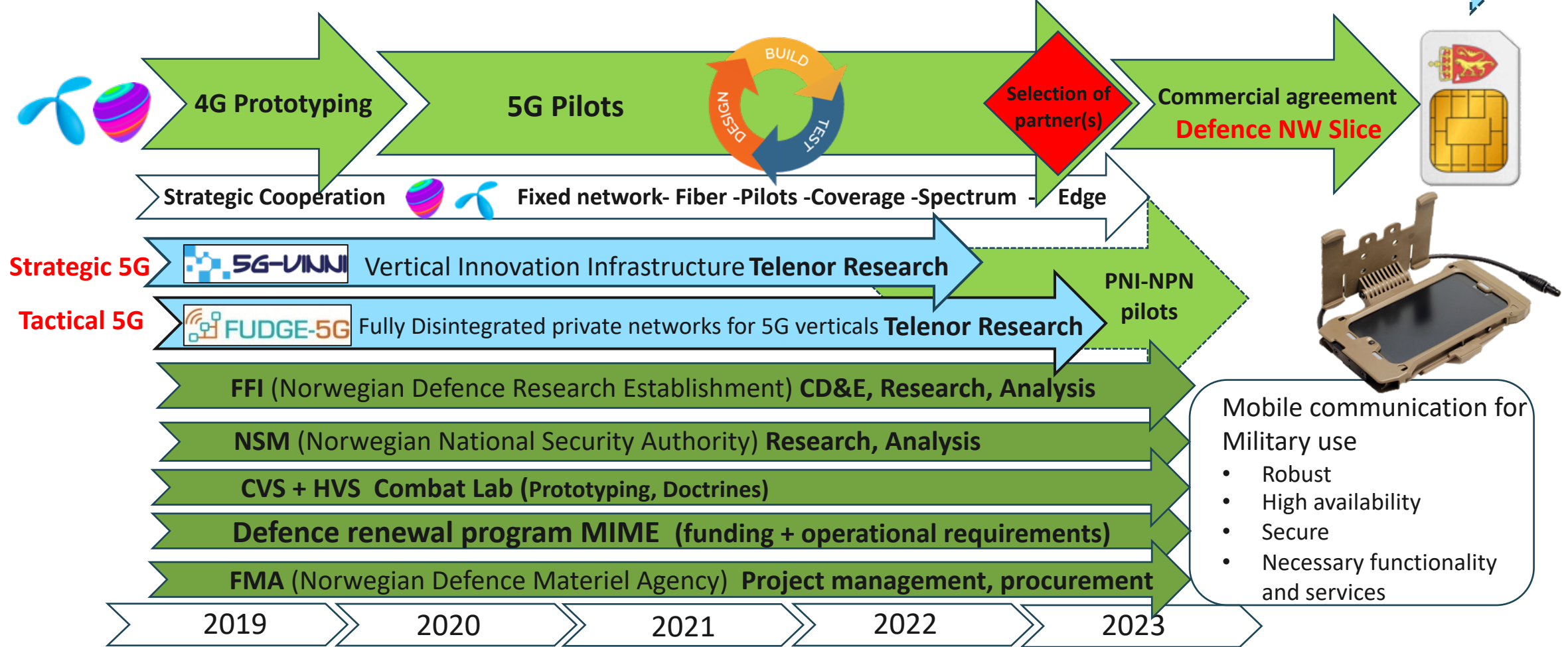*Dedicated Defence NW slice > Separation from commercial traffic*

Edge Computing - *the extended cloud*
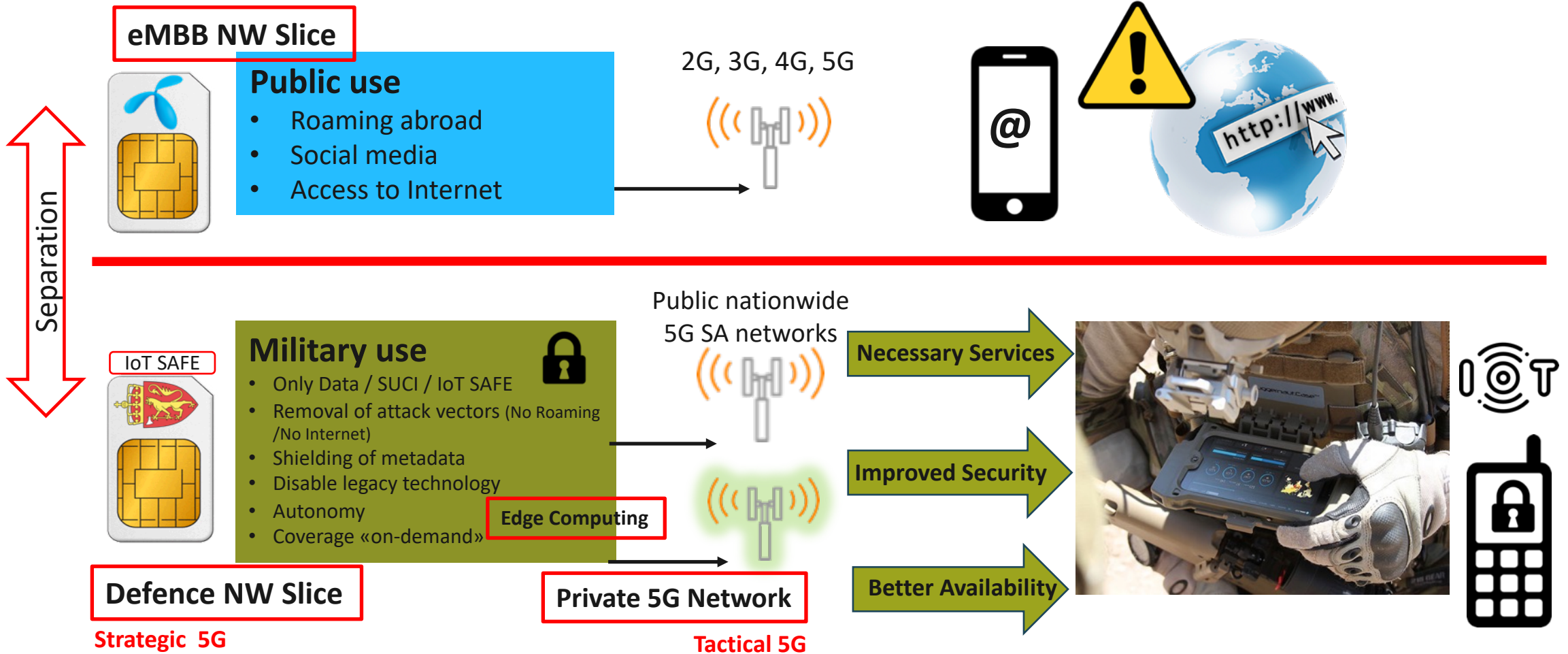*Services can run autonomously in the "edge" of the network*

Foto: Johan Ludvig Holst/ Forsvaret

Securing 5G for military use

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Application

Mobile Device Management

Mobile Devices

IoT SAFE

Edge Computing

Secure Mobile Core

5G Defence Network Slice
Strategic 5G

5G Private Networks
Tactical 5G

Infrastructure

Strategic Cooperation

Military E2E Encrypted Services
Cloud Native principles / DevSecOps

- Application control
- Controlled Mobile Devices
- VPN control

- Unclassified / Classified
- Tactical Devices
- MFA: NFC/FIDO -Biometry - Password

- Improved security/metadata control
- High availability
- Necessary functionality

- Use of multiple fibre core networks
- Coverage in important areas
- Solution for «Coverage on-demand»

Government Regulations

National Autonomy, Security, Spectrum etc.

Government Subsidy

Transmission, Power, Rural Coverage etc.

Broad collaboration & Iterative Development

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- 4G Prototyping
- 5G Pilots
- BUILD / DESIGN / TEST
- Selection of partner(s)
- Commercial agreement **Defence NW Slice**

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**

PNI-NPN pilots

FFI (Norwegian Defence Research Establishment) **CD&E, Research, Analysis**

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

CVS + HVS Combat Lab (Prototyping, Doctrines)

Defence renewal program MIME (funding + operational requirements)

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

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

| 2019 | 2020 | 2021 | 2022 | 2023 |

Adapting 5G to military use

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
- Only Data / SUCI / IoT SAFE
- Removal of attack vectors (No Roaming /No Internet)
- Shielding of metadata
- Disable legacy technology
- Autonomy
- Coverage «on-demand»

IoT SAFE

Public nationwide 5G SA networks

Necessary Services

Edge Computing

Improved Security

Defence NW Slice

Strategic 5G

Private 5G Network

Better Availability

Tactical 5G

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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

Fiber + SATCOM
Backhaul

5G-VINNI

5G New Radio testing at Rygge military airbase
Range, Capacity and Robustness in different frequency bands

14

Network based Defence

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CNR + 5G Modem

CNR coverage

5G Public RAN

IoT Devices

High Grade Crypto

5G Multi channel Router

Strategic 5G

IoT Devices

5G Public RAN

Smart devices

Low Grade Crypto

IoT Devices

5G Private Networks

Tactical 5G

International Roaming links

eMBB NW slice

ISOLATION

Defence NW slice   FW-aaS

Removed attack vectors

Sensitive info shielded

High Availability

Strategic 5G

IoT SAFE

MDM

Cloud Native Services DevSecOps

Military Clouds

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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

Tactical 5G

UPS/Battery bank

Solar panel

Combat Lab

OpenSpeedTest™

DOWNLOAD 1432.5 Mbps   PING 20 Jitter 0 ms   UPLOAD 135.3 Mbps

Edge Data Center

Full Flexibility

FUDGE-5G
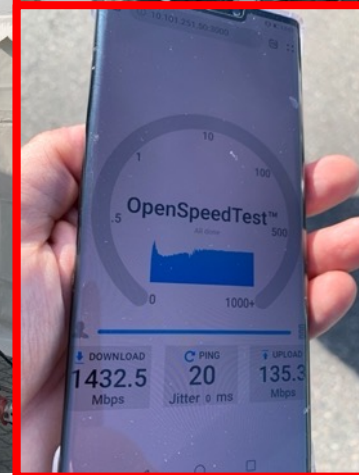
Cell on Wheels

Tactical 5G

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)

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Remote TV production via 5G

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FUDGE-5G

NRK

Remote TV production via 5G
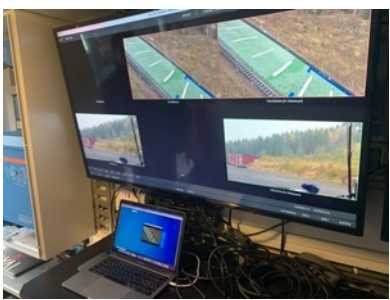
Radar Altimeter & 5G interference test

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FUDGE-5G

Cell on Wheels

Tactical 5G

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.

C-band (NR)

Tactical 5G

FUDGE-5G

5G Private Network / Cell on Wheels

Strategic 5G

5G-VINNI

Fixed 5G Network gNodeB+ Enterprise Edge

C-band (NR)
MmWave (NR)
Anchor-band (LTE)

C-band (NR)
MmWave (NR)
Anchor-band (LTE)

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5G Private Networks
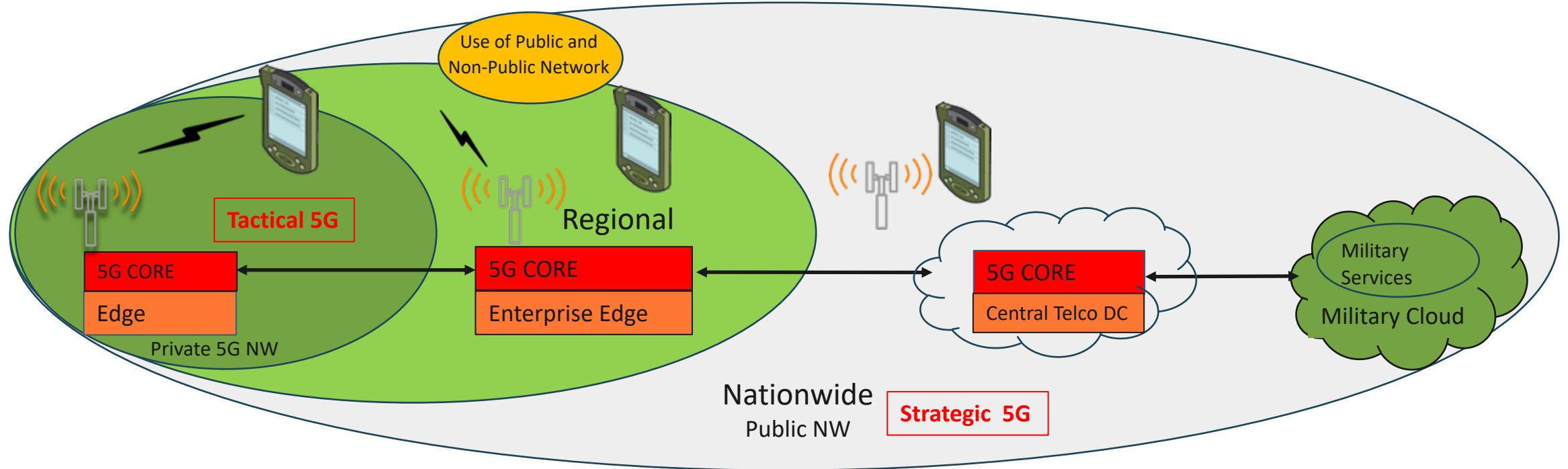
From a Telco perspective

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

Edge Computing – The extended cloud
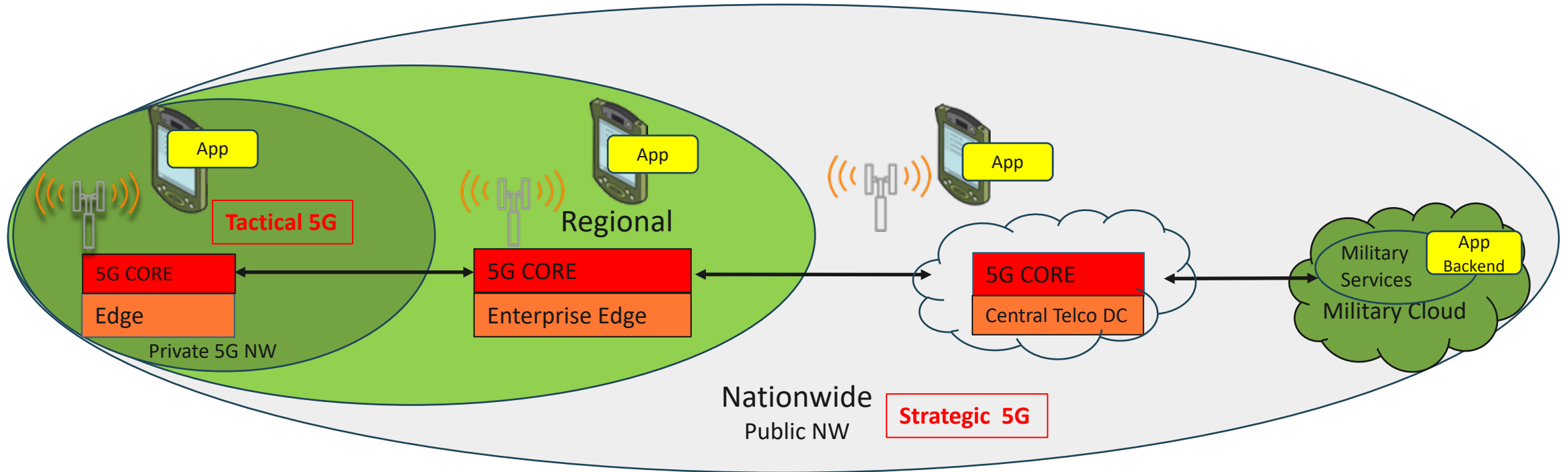
From a **Service** perspective

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

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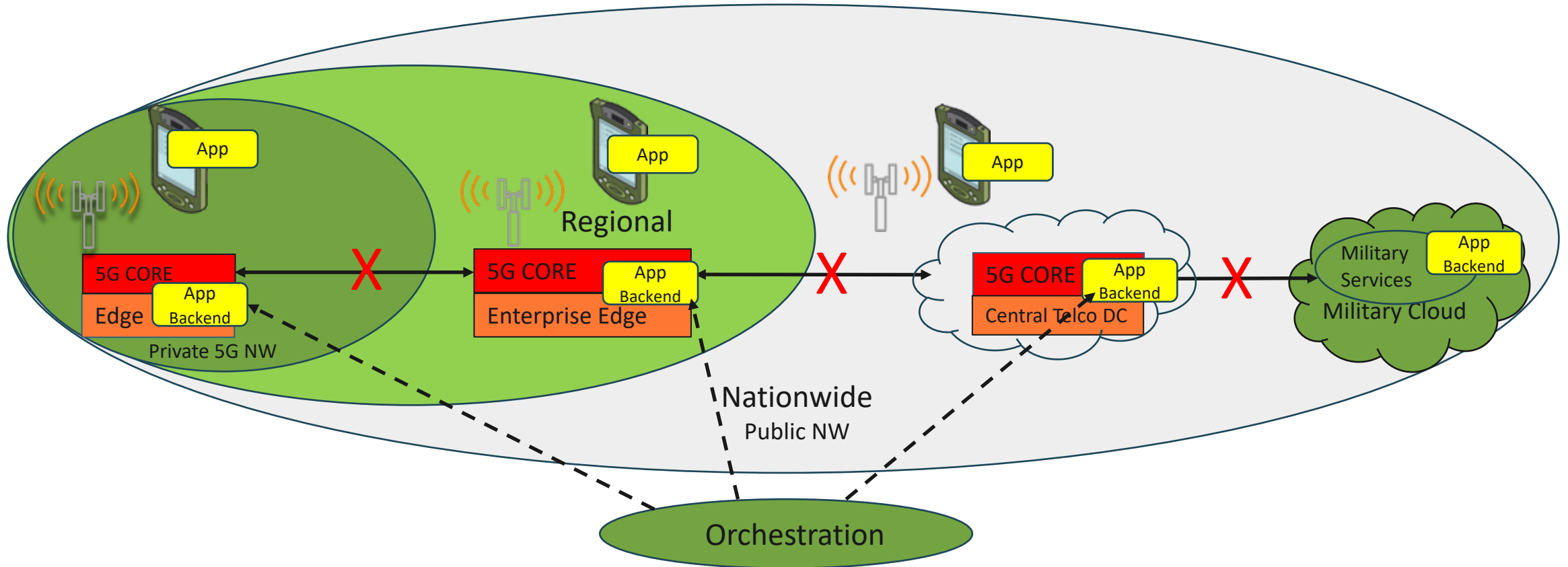
How to utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services
(Cloud Native principles)

High Mobility Command Post

5G Drone control

- BLOS Drone control via 5G network
- Distribution of live video from the drone to relevant personnel
- GNSS independent
- AI to improve Situational Awareness

39

5G Drone control

- BLOS Drone control via 5G network
- Distribution of live video from the drone to relevant personnel
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Network-based Defence
Edge Computing...the extended cloud
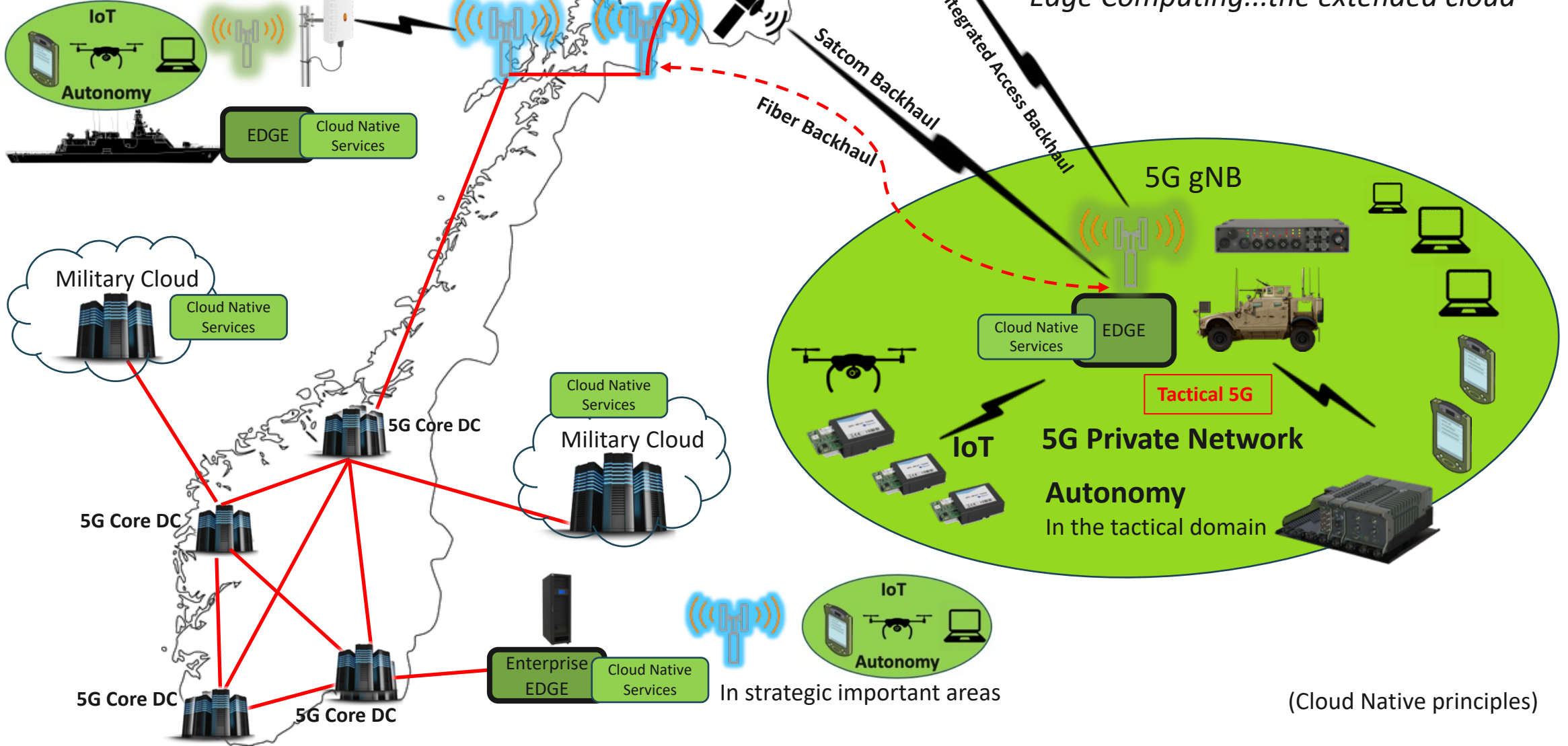
...Currently, the 5G-VINNI and FUDGE 5G trials in Norway would be considered the most advanced ongoing 5G trial projects in Europe... .

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5ᵗʰ Generation Changes Everything

Kennet Nomeland
Radio System Architect
Norwegian Defence Materiel Agency

Foto: Morten Hanche/ Forsvaret

49