



NORWEGIAN DEFENCE  
MATERIEL AGENCY

# 5G for Military Use



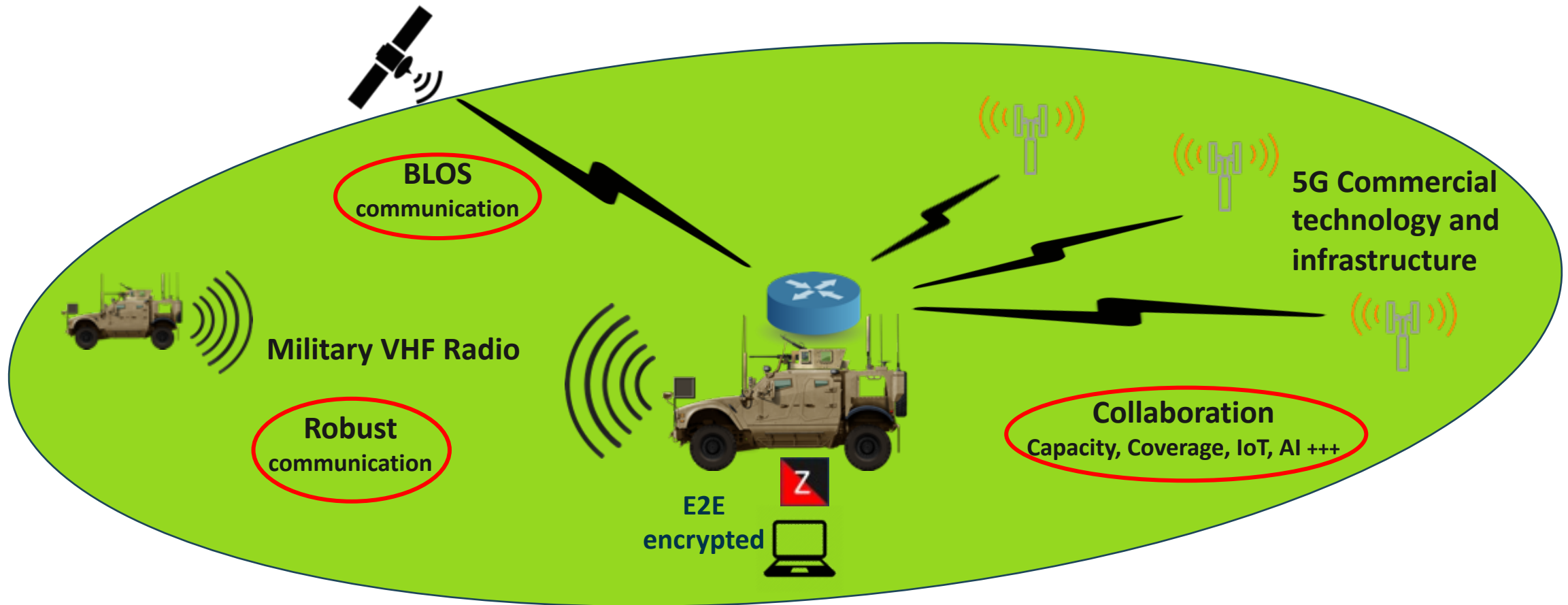
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Kennet Nomeland  
Radio Systems Architect





## *Communication for different scenarios*



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*

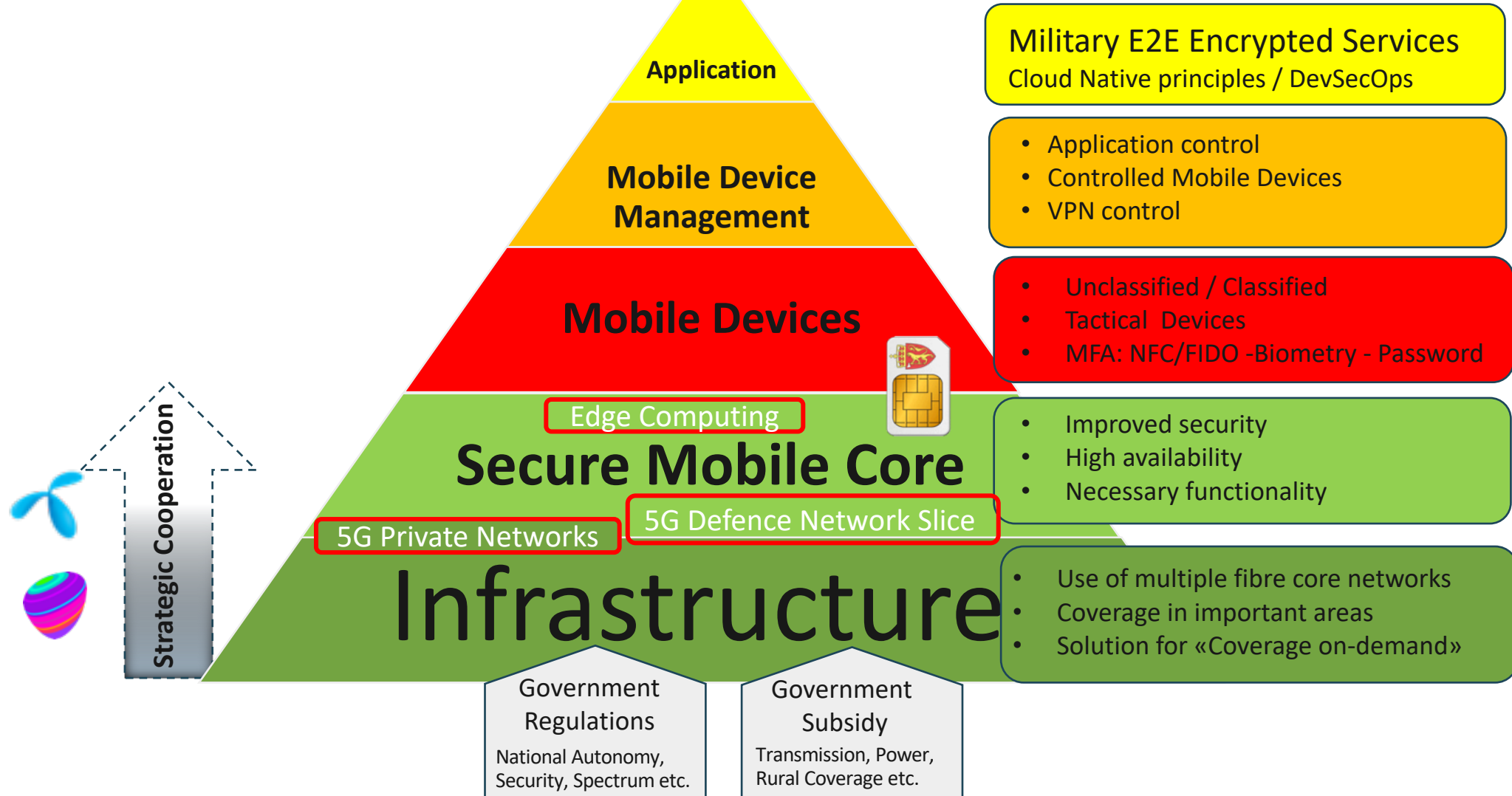
*Dedicated Defence NW slice > Separation from commercial traffic*

## *Edge Computing - the extended cloud*

*Services can run autonomously in the "edge" of the network*



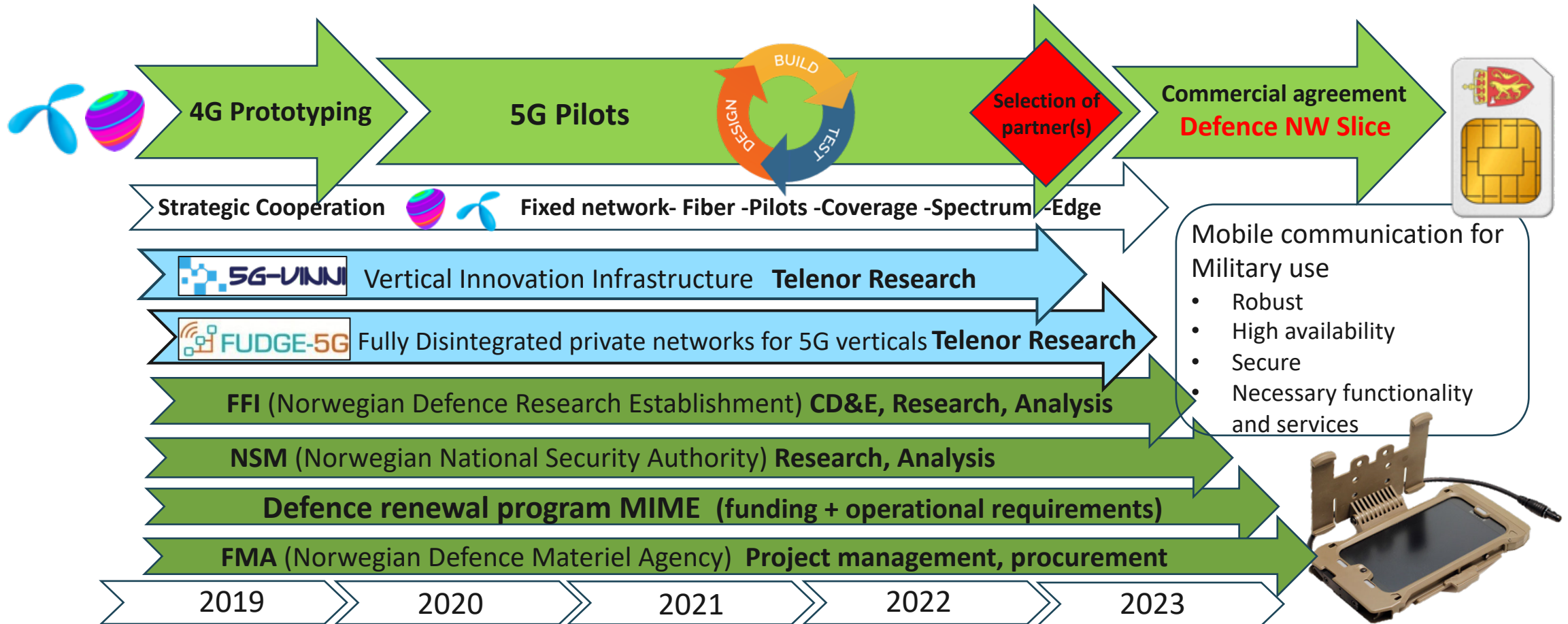
# Securing 5G for military use







## *Broad collaboration & Iterative Development*



*Adapting 5G to military use*

## *Rygge military airbase*

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



Enterprise Edge  
Defence Network Slice



Fiber + SATCOM  
Backhaul







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## *5G New Radio testing at Rygge military airbase*

Range, Capacity and Robustness in different frequency bands







## ***FUDGE 5G pilot***

*5G Private Network*



Cell on Wheels

Fully Disintegrated private networks for 5G verticals (FUDGE)

- EU funded 5G pilot
- Started in September 2020 – Running until February 2023
- Fully autonomous 5G Private Network built on a trailer
- COW equipped with Edge for PPDR / Military Use Cases

Goal:

- Utilize both **Public** and **Private** 5G network (NPN)
- 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**



***5G Private Network***



## 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)



5G Private Network  
/ Cell on Wheels



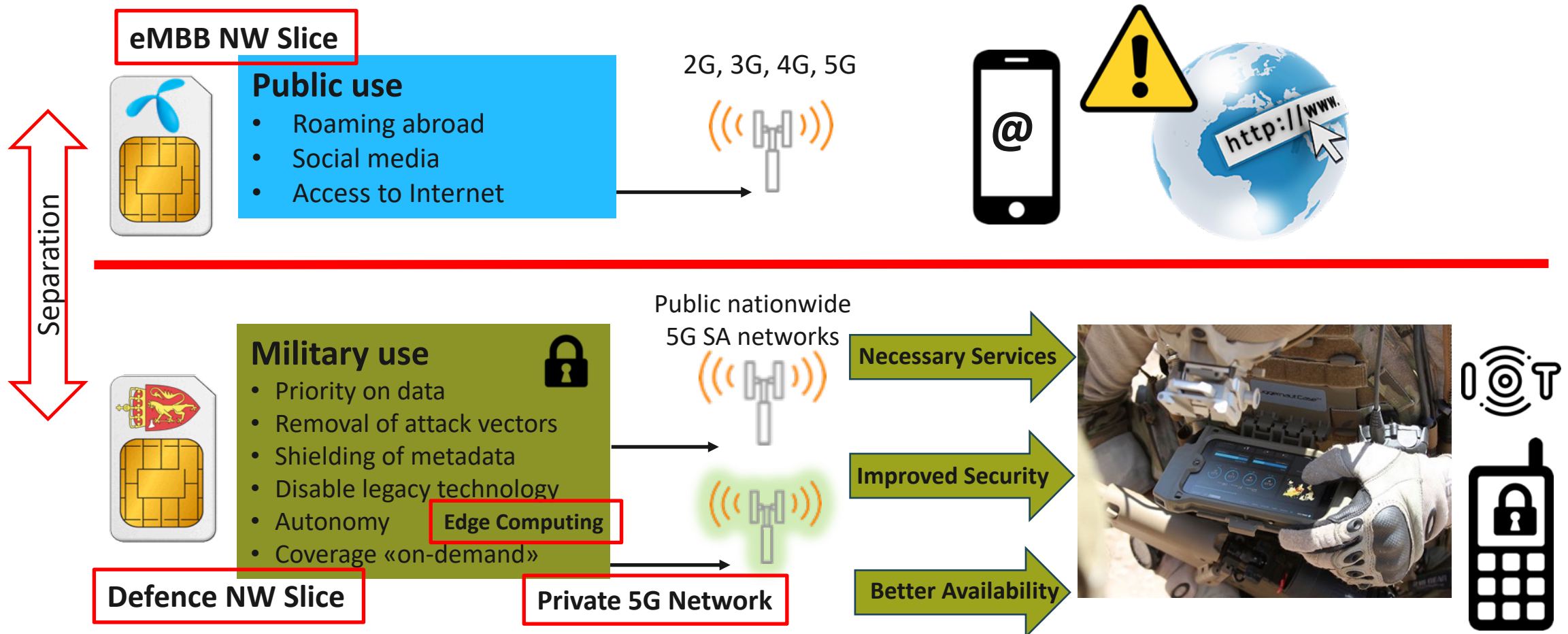
Fixed 5G Network  
gNodeB+ Enterprise Edge

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

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



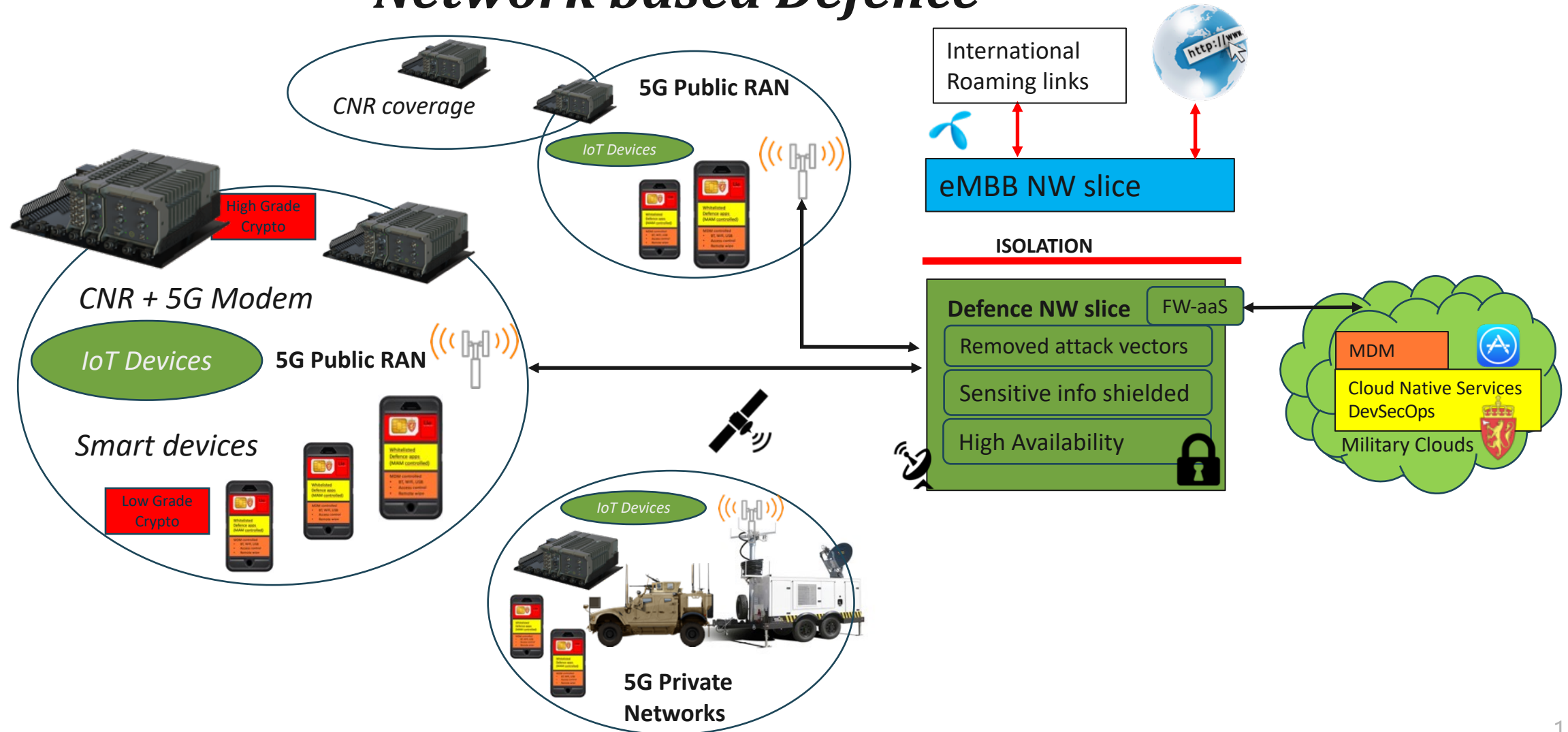
# *Network Slicing to separate Public and Military traffic*







# Network based Defence







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# *Autonomy*

Enabled by **Edge Computing** and **5G Private Networks**



**5G Core**  
Central Data Center  
Oslo

**Autonomous Edge in strategic important areas**  
Defence Slice with full 5GC functionality + Services running in the Edge is providing services in important areas (airport, hospital, naval base) even when the central 5G DC is not available

**Fiber Cut**

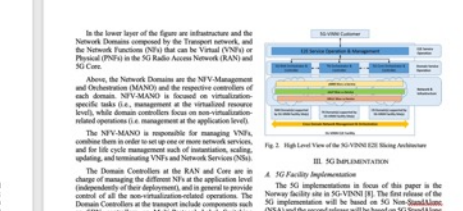
**Defence Slice has dedicated 5G Core also in Edge**  
Important Services available in our Defence NW Slice: Voice, Video, Chat, PTT (Application Function)

**Autonomous Edge (MEC) connected to gNB (basestations) Rygge Airbase**

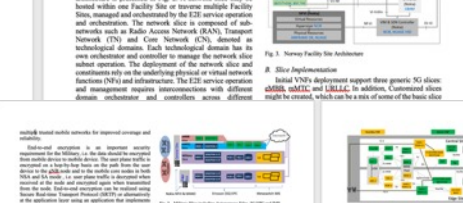
**5G Service and Slice Implementation for a Military Use Case**

PIG Gonzalez, Andres Gonzalez, Khalid Mubashir, Jon Pitar, Antonio Dindia, Sam Kristian Berg, Steffen Gjelstad  
"5G Service and Slice Implementation for a Military Use Case"  
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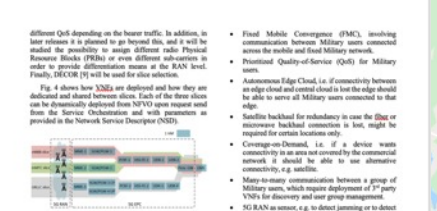
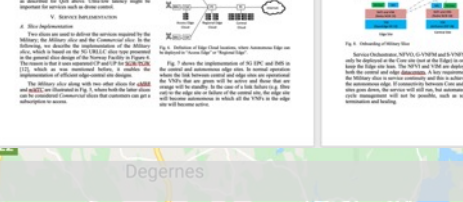
**1. INTRODUCTION**  
Network Slicing [1] [2] is one of the most revolutionary concepts in 5G, defining a partitioning of the network resources into different virtual networks [3] to serve the same 5G infrastructure while maintaining full isolation. Technically speaking, Network Slicing is implemented as a logical network end-to-end across the network architecture, by leveraging isolation of network slices for each service. The main services for the Military, and services requirements for each service, are: Voice, Video, Chat, PTT (Application Function).  
The main contribution of this paper is to define services for the Military and the design and implementation of the network slice for these services, using the 5G Service and Slice Implementation for a Military Use Case. The main contribution of this paper is to define services for the Military and the design and implementation of the network slice for these services, using the 5G Service and Slice Implementation for a Military Use Case.



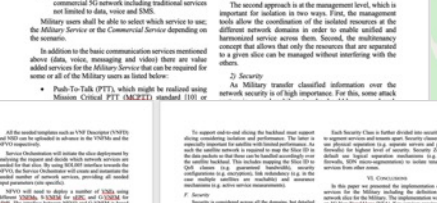
**2. SERVICE REQUIREMENTS**  
The Military is an advanced consumer of communication technology and services. There are often very specific communication services such as critical communication requiring high security and high availability. Other important requirements are end-to-end security, end-to-end encryption, and end-to-end integrity. The Military personnel also use commercial services such as mobile voice and broadband. Furthermore, the Military wants the future communication services to be based as far as possible on standards and Commercial Off-The-Shelf (COTS) solutions to enable interoperability, faster service delivery, to avoid lock-in, and increase innovation.  
To meet these, the Military has recently taken up design, building, and operating their own communication network services. However, it becomes more practical for the Military to use the commercial network with the



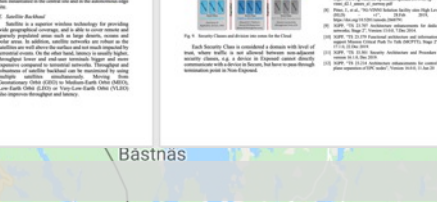
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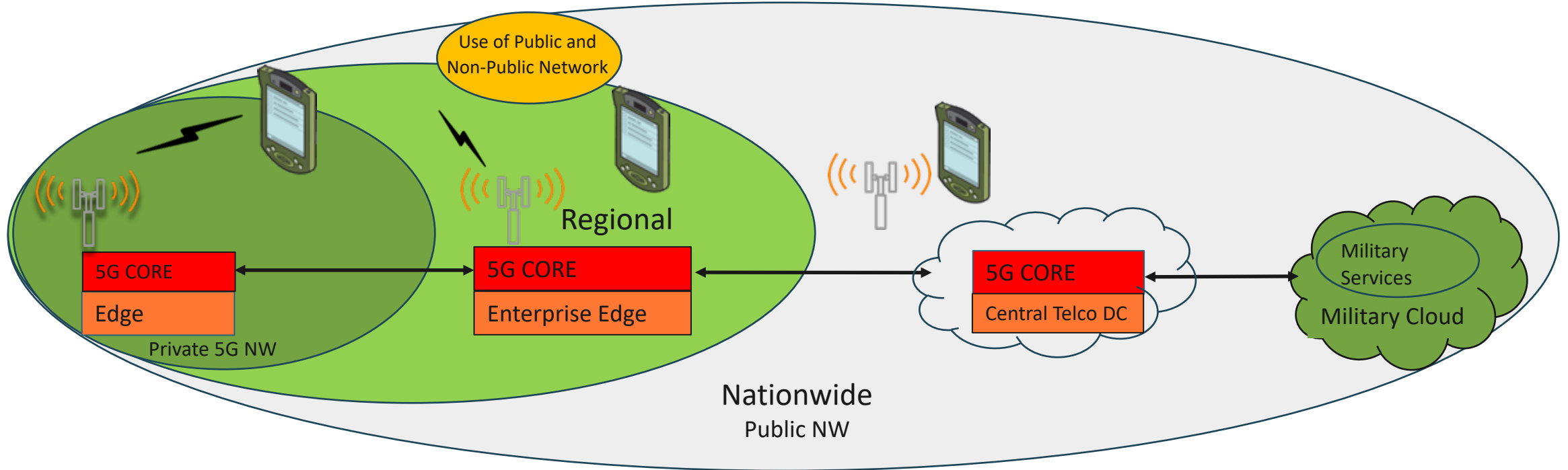


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## 5G Private Networks (NPN)



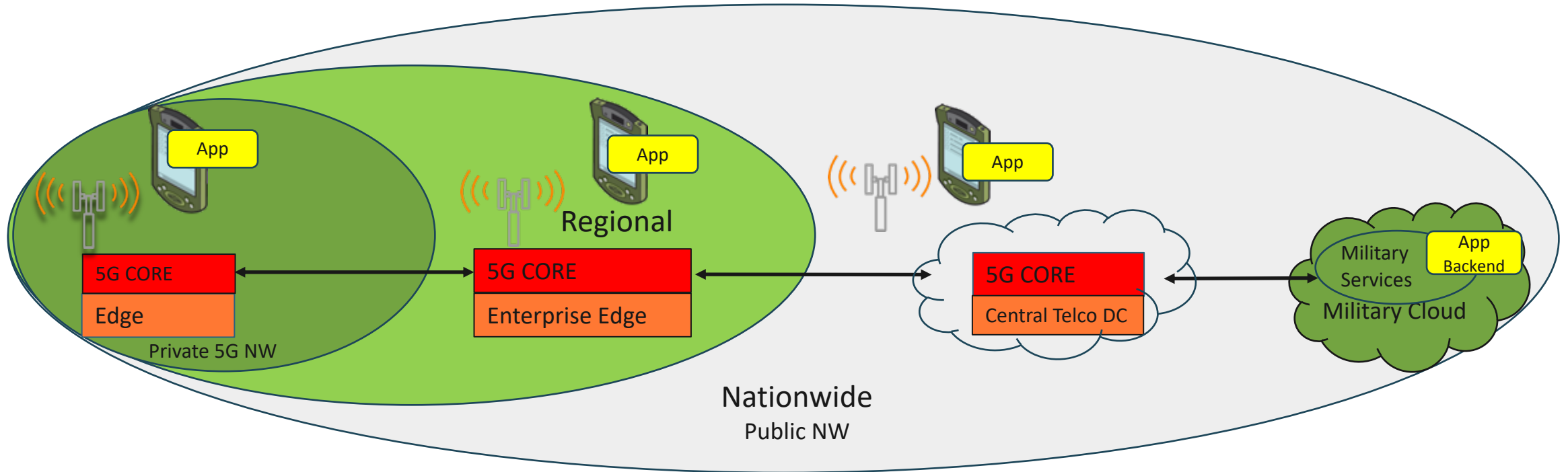
## From a **Telco** perspective

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





## *Edge Computing – The extended cloud*

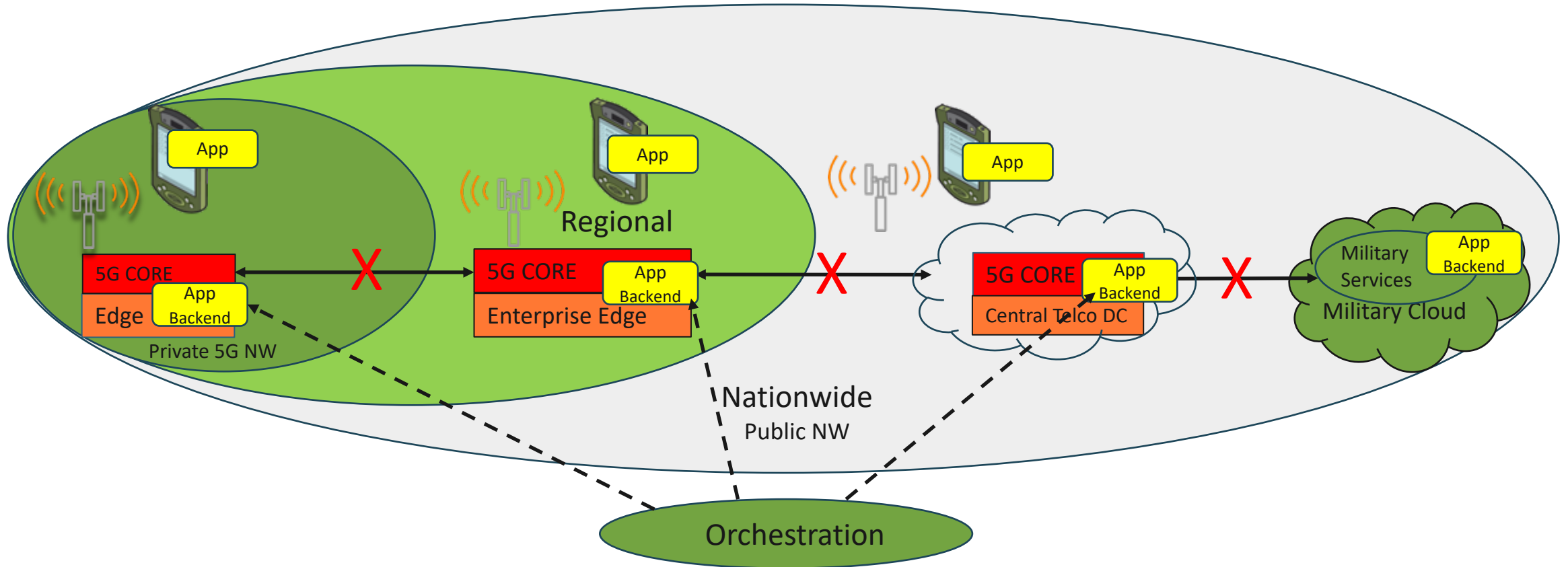


## From a **Service** perspective

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



## *Edge Computing – The extended cloud*

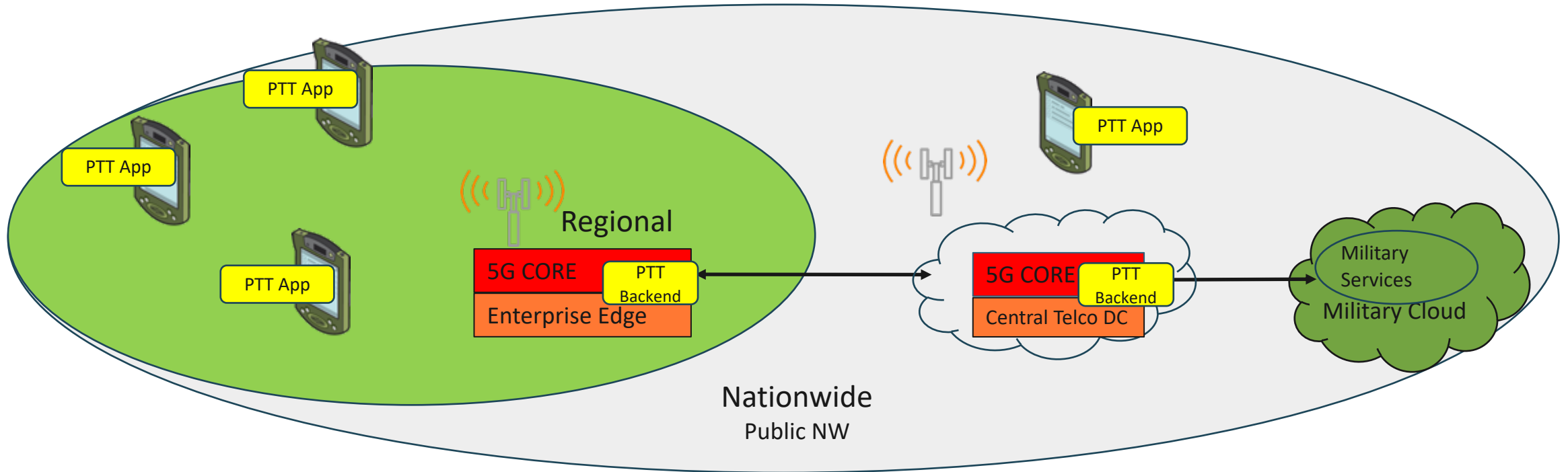


How to utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services  
(Cloud Native principles)





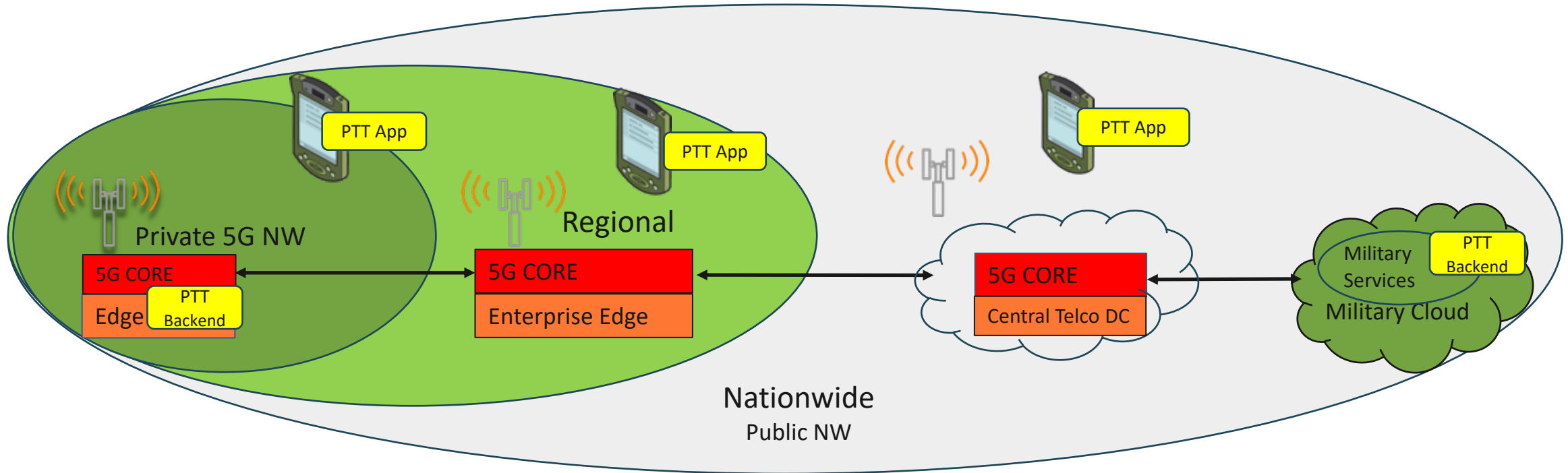
## *Edge Computing – The extended cloud*



Services offered in close cooperation with a strategic MNO partner

Application Function in Defence Network Slice + Enterprise Edge

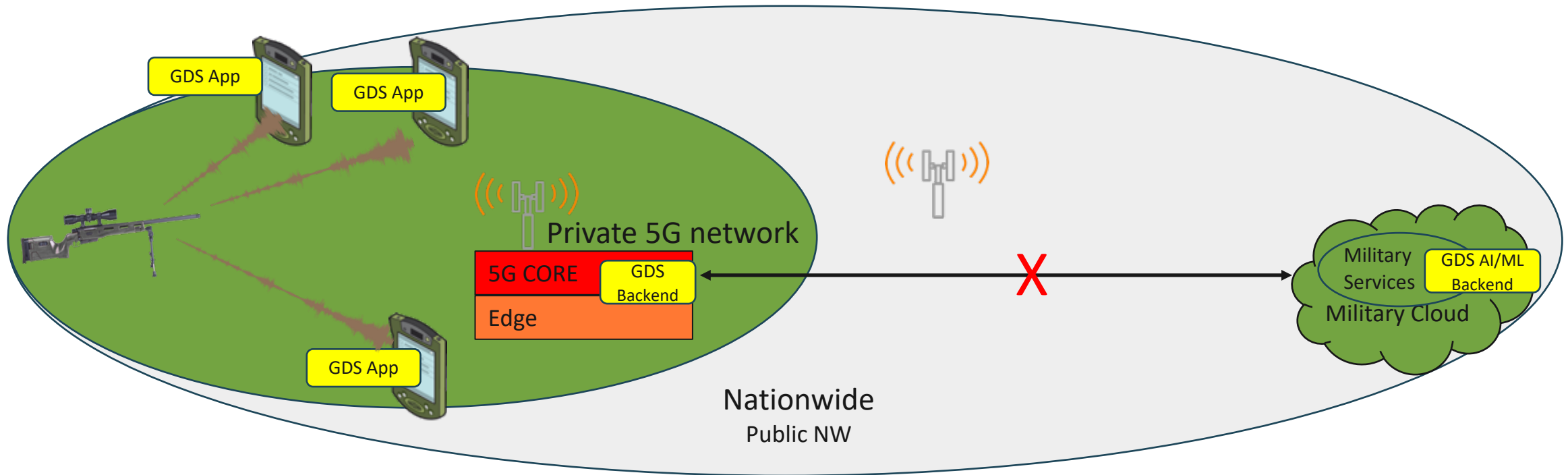
## *Edge Computing – The extended cloud*



Services offered from 5G Private Networks (NPN) and Military Clouds



## *Edge Computing – The extended cloud*



## From a **Service** perspective

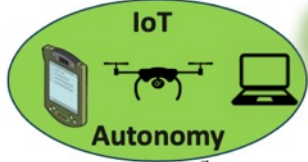
How to utilize centralized clouds, 5G and Edge to create **Better** and more **Robust** services



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5G Private Network

5G CPE



EDGE

Cloud Native  
Services

Military Cloud

Cloud Native  
Services

5G Core DC

5G Core DC

Cloud Native  
Services

Military Cloud

5G Core DC

5G Core DC

Enterprise  
EDGE

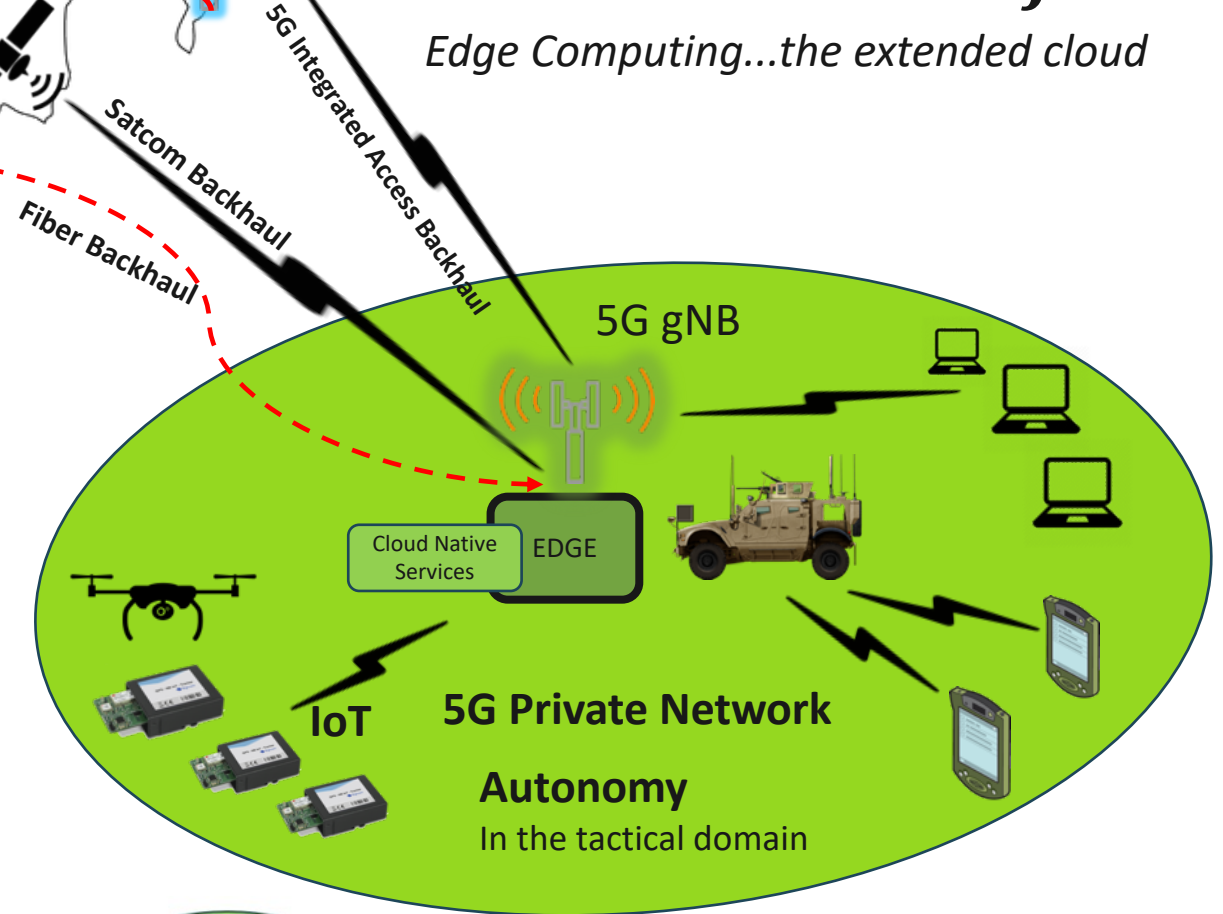
Cloud Native  
Services

In strategic important areas



# Network-based Defence

*Edge Computing...the extended cloud*



(Cloud Native principles)





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## *5<sup>th</sup> Generation Changes Everything*



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Foto: Morten Hanche/ Forsvaret