Creating a leading position for NL in 6G

Dutch innovations in mobile networks

SNS JU introduction to Dutch National Initiative on 6G
May 8th, 2025
v1.1

Introduction to Dutch National Initiative on 6G

The webinar will provide insights in the 6G research activities in the Netherlands. The individual presentations will answer the following questions:

- The scope of the activities in the Netherlands including the specific research focus, achievements so far, and further planned deliveries
- The different organisations active in the 6G national initiative and their role
- The capabilities of the partners involved in FNS and their possible participation in the upcoming SNS-calls

Agenda

10:00 – 11:05 Introduction – Colin Willcock, Chairman 6G IA

11:05 – 11:15 Introduction to the Dutch 6G Future Network Services Program

Paul Wijngaard (Alliance Director, FNS) – paul.wijngaard@tno.nl

11:15 – 11:30 Research on Intelligent components in Radio Access Networks

Prof. Dr. Ir. Bart Smolders (Full Professor, TU Eindhoven) - a.b.smolders@tue.nl

11:30 – 11:45 Research on Intelligence in RAN and core networks

Prof. Fernando Kuipers (Full Professor, TU Delft) - f.a.kuipers@tudelft.nl

11:45 – 12:00 Research on 6G leading applications and verticals

Jos Berière (Program leader, FNS) - jos.beriere@tno.nl

12:00 – 12:15 Experimentation facilities within FNS

Floris Drijver (Work package lead, FNS) - floris.drijver@tno.nl

12:15 – 12:30 Q&A with the audience

Introduction

Colin Willcock – Chairman 6G IA

Introduction to the Dutch 6G Future Network Services Programme

Paul Wijngaard – Alliance Director

Ambition 6G Future Network Services program

Building a strategic knowledge position for the Netherlands (and Europe) in development and applications of next-generation communication networks (6G)

Strengthen future earning capacity of BV Netherlands, by becoming a leader in development of intelligent components and networks, and their application in most important sectors of Dutch economy

Central core values:
Reliability, Sovereignty and Sustainability

With €315 Mio, substantial investment in creating a leading position for the Netherlands in 6G

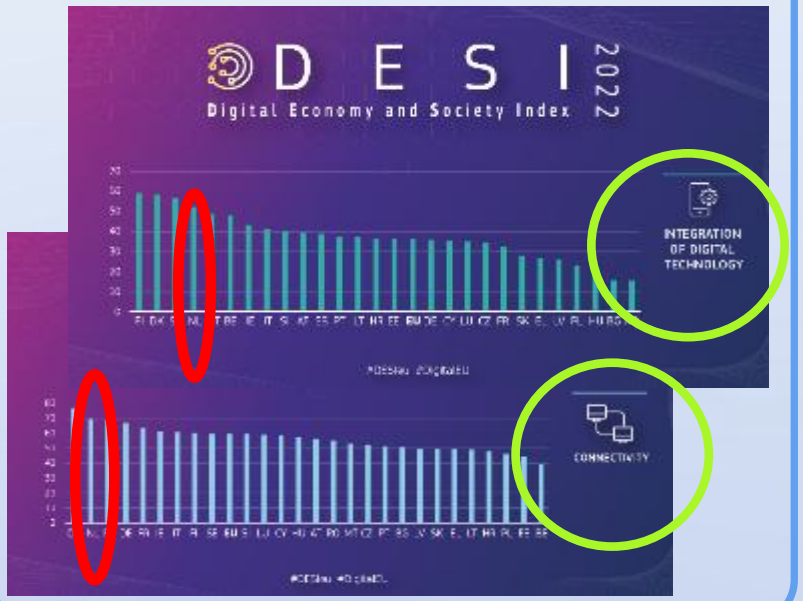
- €315 million National 6G program 2024-2030
  - €203 million Subsidies National Growth Fund
  - €112 million Co-Financing by 60 partners
- Program includes €90 million for Open Calls

The FNS programme aims at building out existing Dutch strengths and also developing new ones

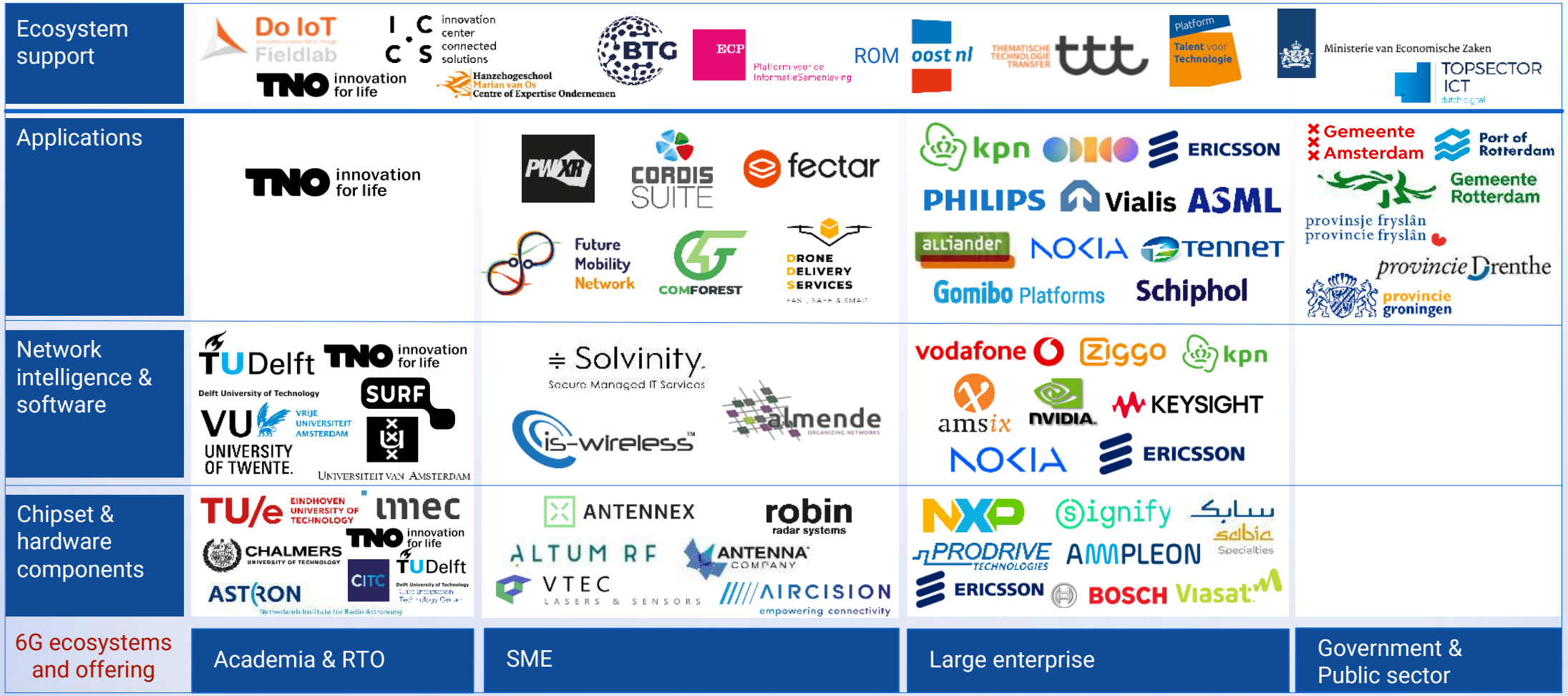
1.
Strong in semicon and radio components

2.
Multi-decade tradition of high-quality research in Computer Systems and Networking

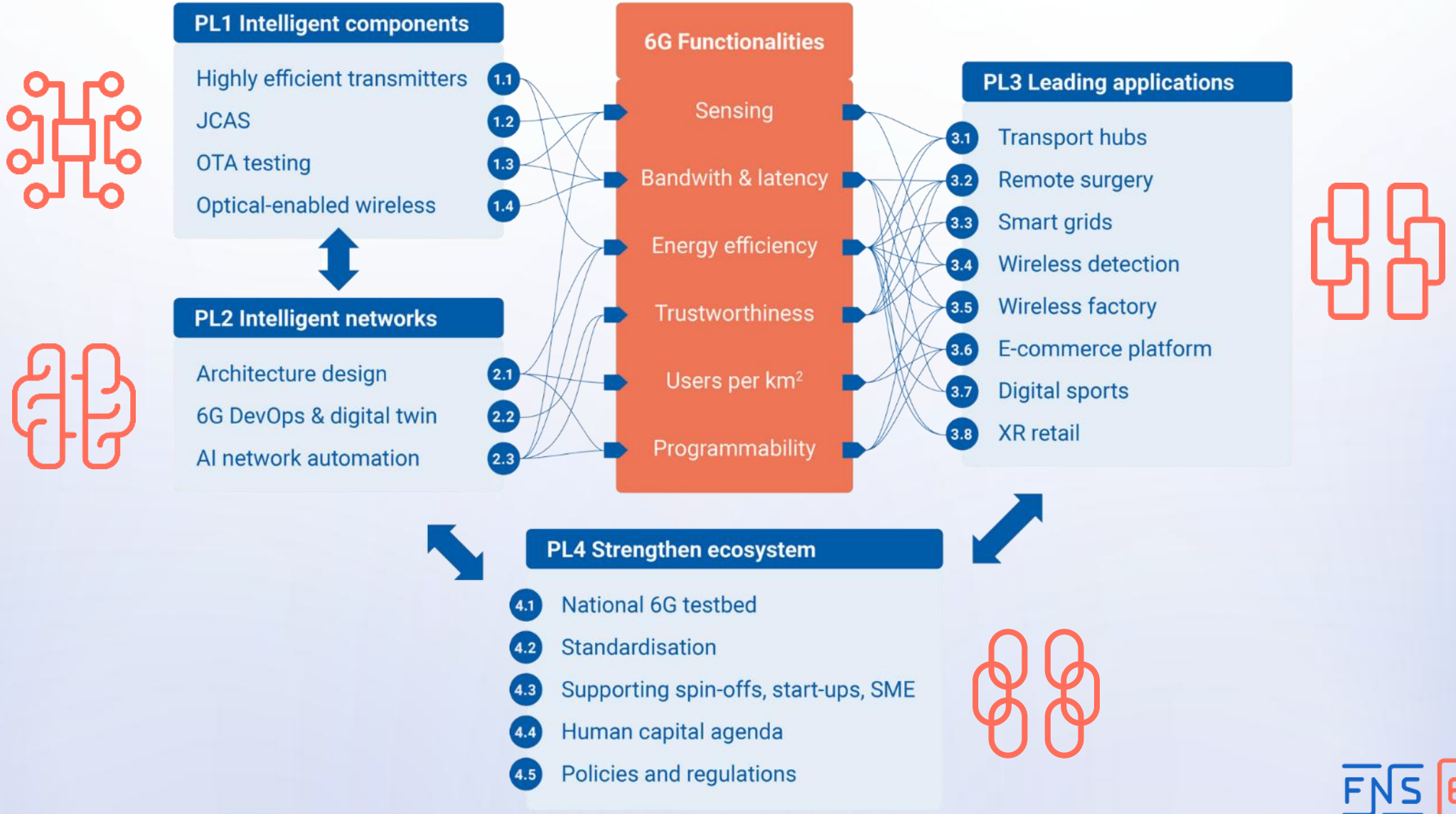
3.
Strong in application of new digital technology in business and society



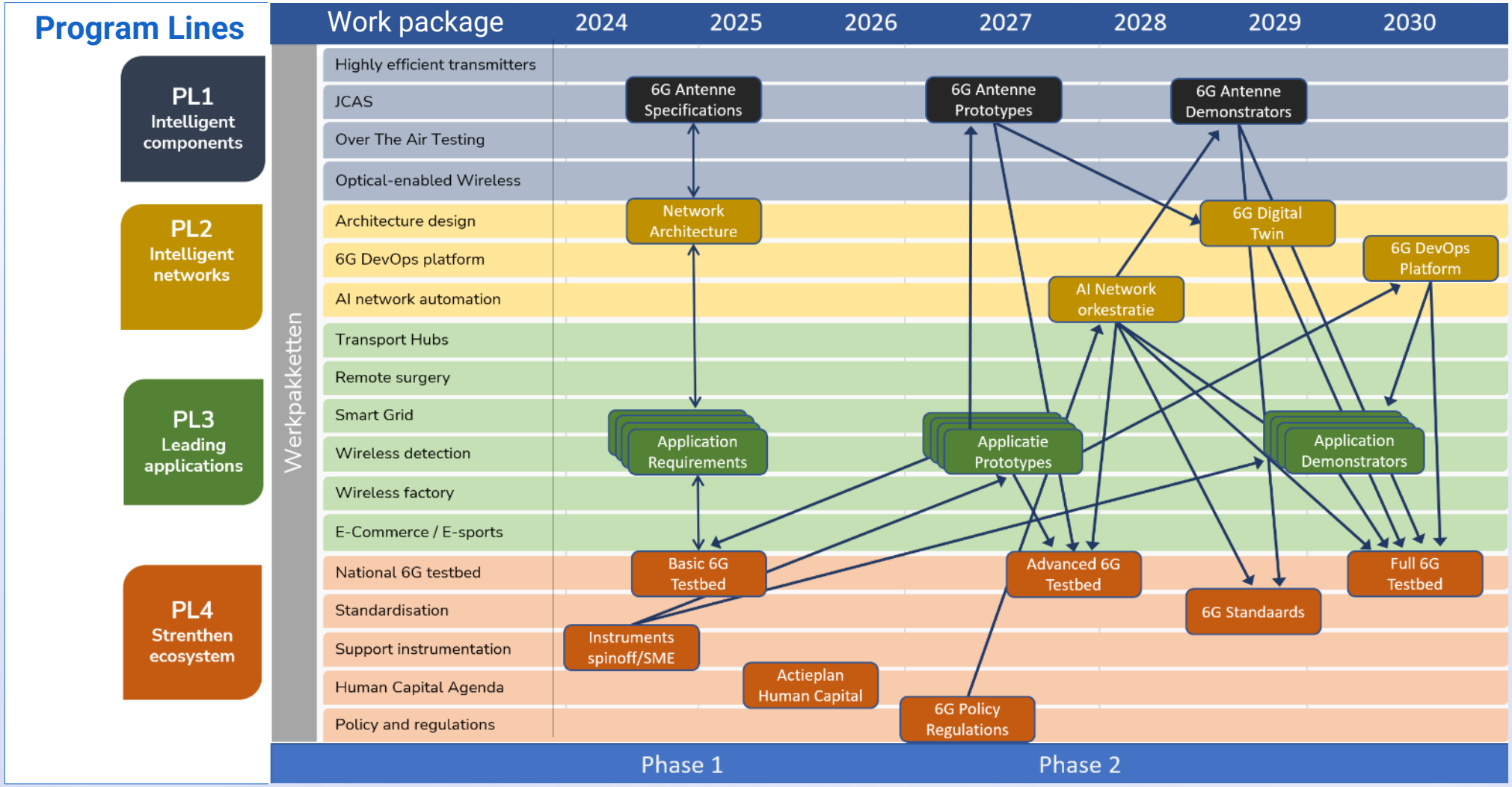
60 partners covering entire value stack



Program Lines and Work Packages



Program Lines and Work Packages alignment



Simplified overview of deliverables in time and relation between activities

KPI Framework

KPI	Threshold value
1. The FNS chain at work	
1.a Lasting commitment consortium partners	*€20 mio private investments / 90% partners*
1.b Requirements broadly supported by consortium	*Approved by 100% of partners involved in the subject*
1.c 6G Testbed baseline with connected locations	*3 locations (Groningen – Delft – Eindhoven)*
2. International positioning and standardization	
2.a International knowledge position	*30 (scientific) publications*
2.b Promotion internationals standards	*Influence in 3 international forums (e.g. 3GPPP)*
2.c Patentportfolio	*15 patents submitted*
3. Human capital	
3.a Amount of PhD's hired by FNS consortium partners	*50 PhD's hired*
3.b Effort R&D staff in FNS	*300 manyear spent on FNS tasks*
4. Development of new products and applications	
4.a Prototypes intelligent components	*5 prototypes hardware*
4.b Modules DevOps platform	*Blueprint plus 4 software modules*
4.c Proof-of-concepts leading applications	*7 sets of requirements – 2 proof-of-concepts*
5. New economic activity and production	
5.a Startups and spin-offs FNS	*12 (potential) startups acquire ticket in TTT call*
5.b SME companies potentially interested in open calls FNS Phase 2	*100 SME companies have intention to subscribe*

SNS R&I Work Programme 2025

Netherlands 6G FNS partners interest to participate in R&I consortia

Europe needs to remain competitive in the global technology race by effectively pooling expertise and resources across national and EU levels.

In doing so we jointly support the EU's strategic goals of digital sovereignty and technological independence by fostering a cohesive and collaborative research and innovation ecosystem.

SNS has recently published the R&I Work Programme 2025.

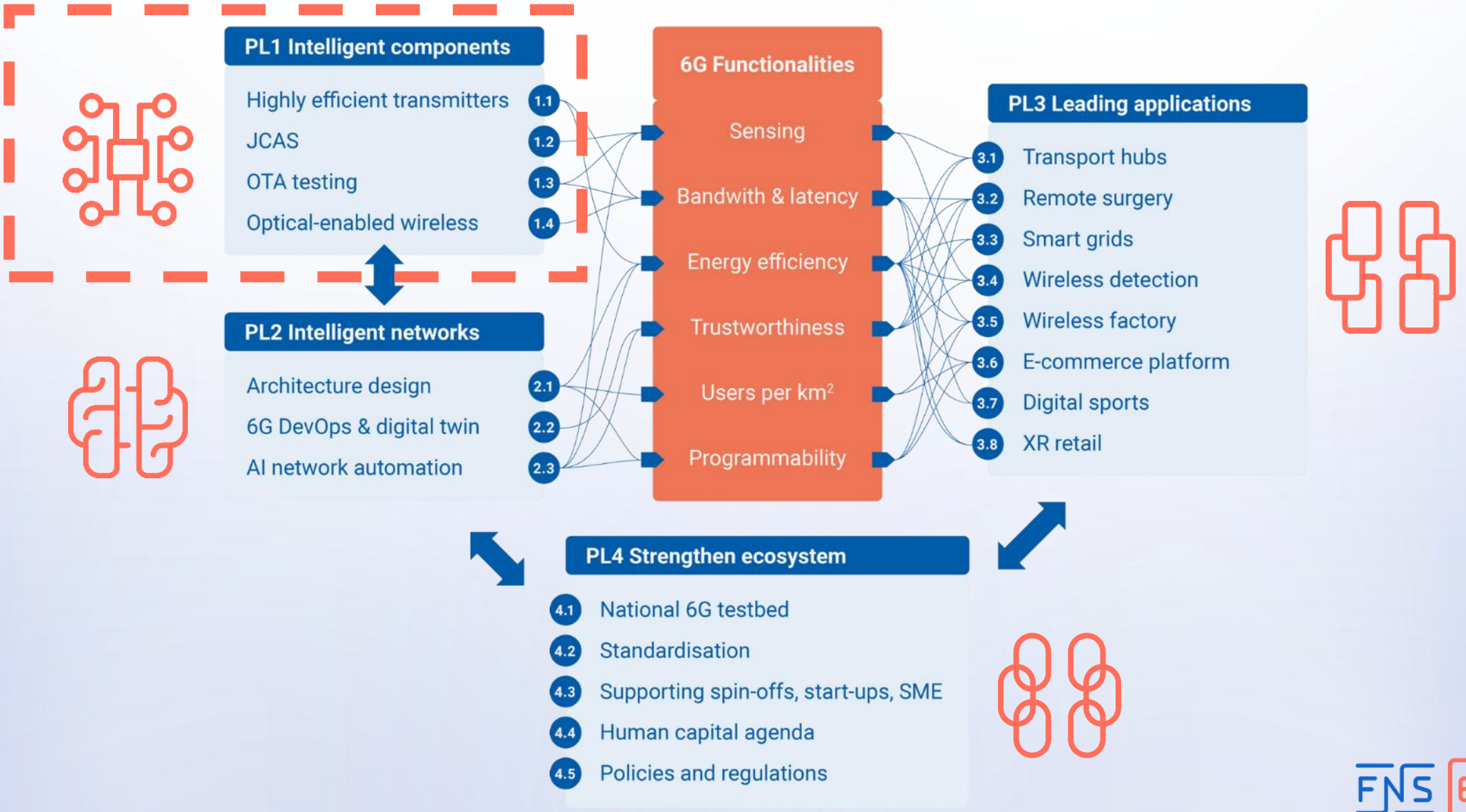
The partners in the Netherlands 6G FNS program have extensive experience in EU projects and are eager to integrate their results, capabilities and experimental platforms into new call proposals.


WP4.2
Standardisation & International alignment
Toon Norp (TNO)
WP3.5 Wireless 6G Factory
FUTURE 6G NETWORK SERVICES
We create a leading position for the Netherlands in 6G

Research on Intelligent Components in Radio Access Networks

Prof. Dr. Ir. Bart Smolders – full Professor TU Eindhoven

Program Lines and Work Packages: Program Line 1



The PL1 team represents the strong Dutch market

BART SMOLDERS
PROGRAM 1 LEAD

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

John Gajadharsing
WP 1.1 LEAD

AMPLEON

Martin Stehouwer
WP 1.2 LEAD

NXP

Gabriele Federico
WP 4.3 LEAD

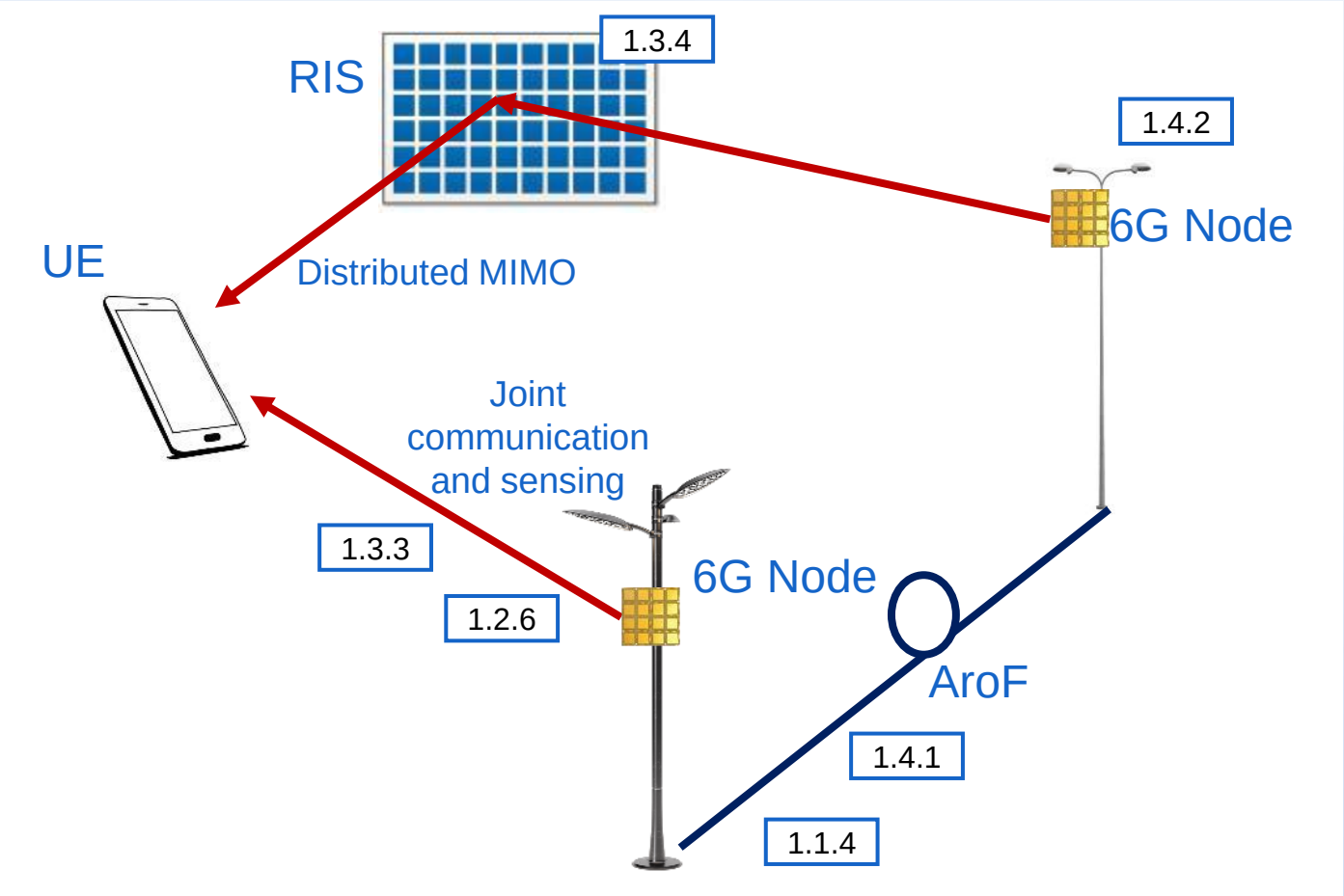
TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Jean-Paul Linnartz
WP 1.4 LEAD

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

FNS 6G

Visual System Concept



- Focus on <28GHz frequencies and Sub-terahertz
- JCAS
- Radio over Fiber in combination with Distributed radio Arrays

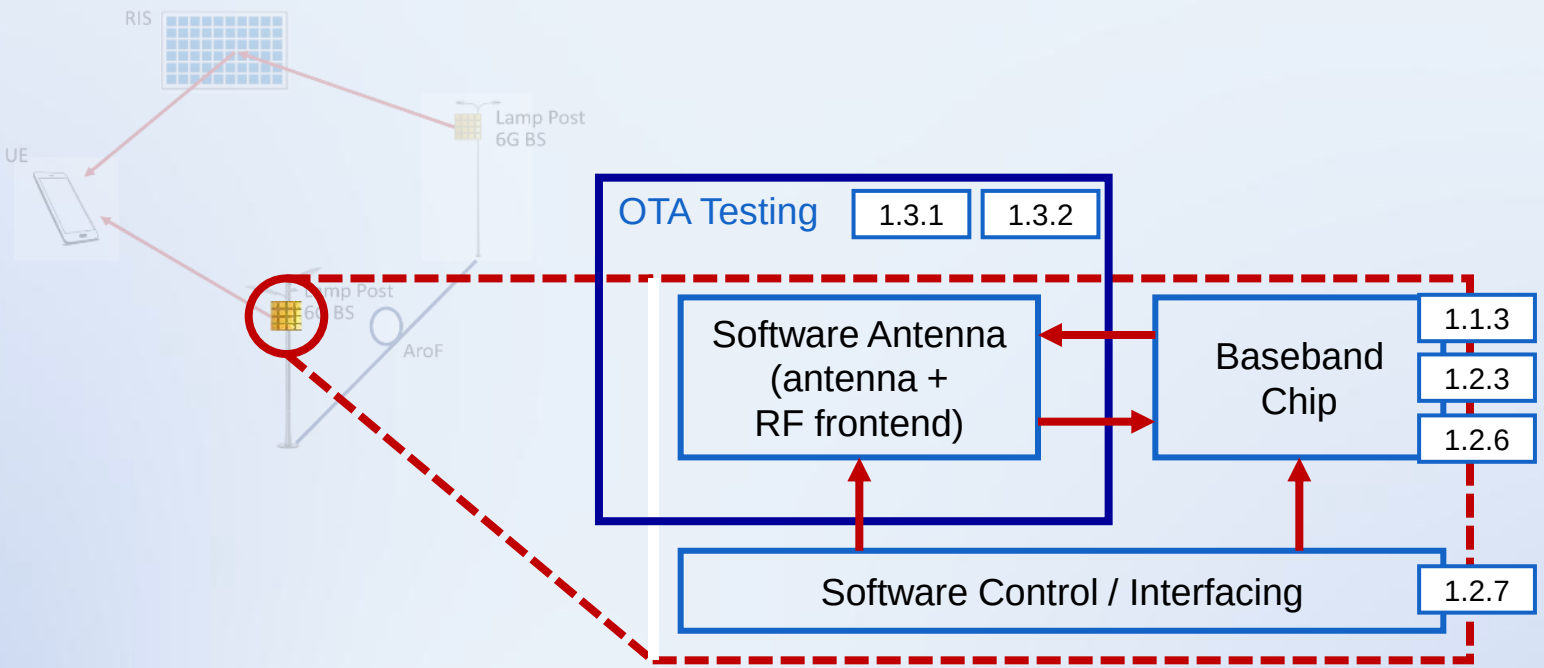
WP1.1 Highly efficient transmitters
- Task 1.1.1: System specifications of future transmitters
- Task 1.1.2: Efficient transmitter PA's (Power Amplifiers)
- Task 1.1.3: Digital architectures
- Task 1.1.4: Synchronization
- Task 1.1.5: Thermal management

WP1.2 Joint Communication and Sensing (JCAS)
- Task 1.2.1: JCAS system specifications
- Task 1.2.2: JCAS mm-wave RF integrated circuits (RFICs)
- Task 1.2.3: Baseband architectures supporting a large bandwidth
- Task 1.2.4: Antenna Array in Package (AAiP)
- Task 1.2.5: Dual-band/mode phased arrays
- Task 1.2.6: Beamforming concepts for JCAS
- Task 1.2.7: Radio resource management (RRM)

WP1.3 Over-the-Air (OTA) testing
- Task 1.3.1: Test specifications for OTA testing
- Task 1.3.2: Efficient test strategies
- Task 1.3.3: 6G propagation channels
- Task 1.3.4: RIS structures to improve coverage

WP1.4 Optical-enabled wireless communications
- Task 1.4.1: Integration of optical chips with radio-based systems
- Task 1.4.2: 6G lamppost access points

6G Radio



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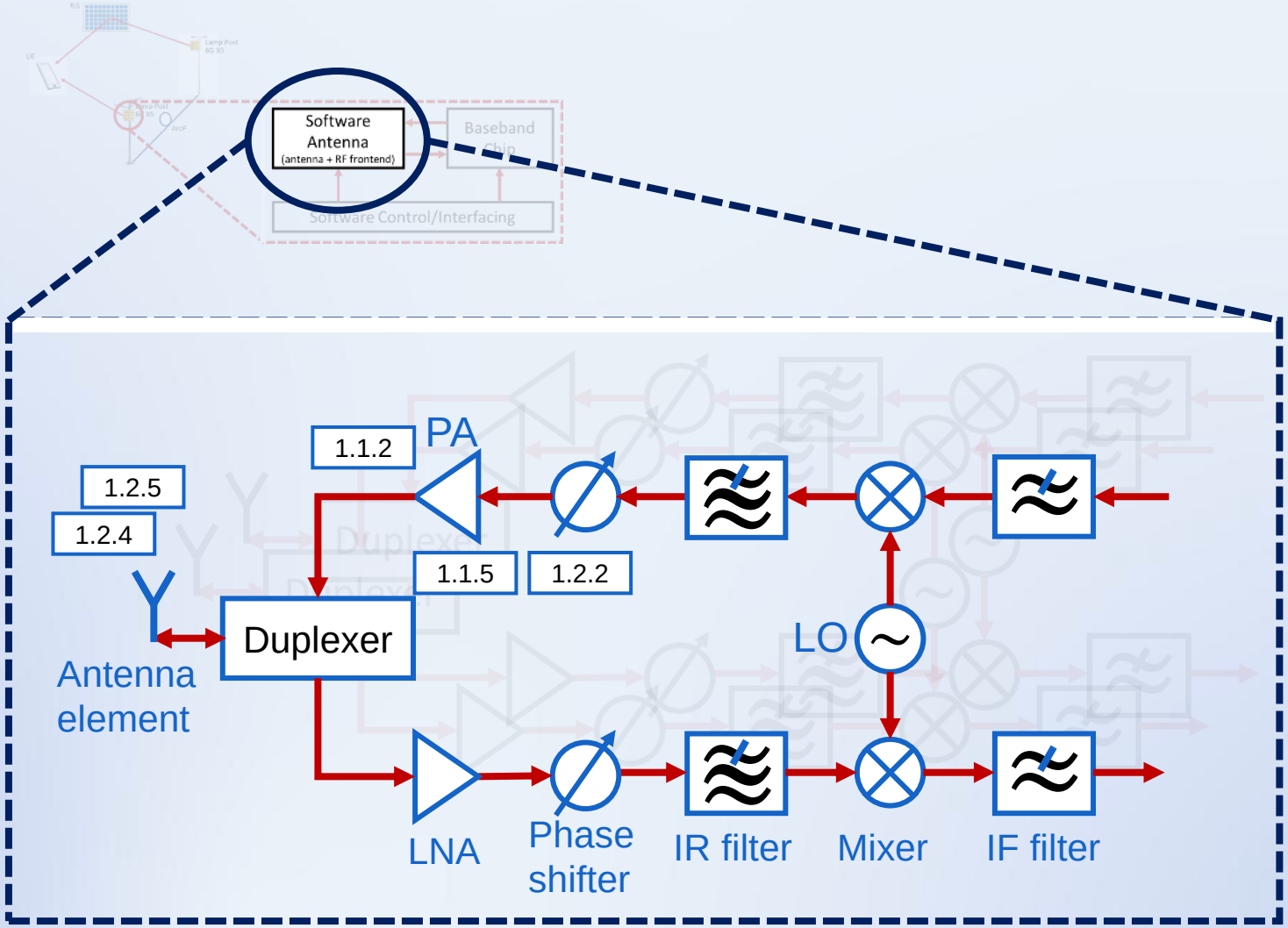
Software Antenna



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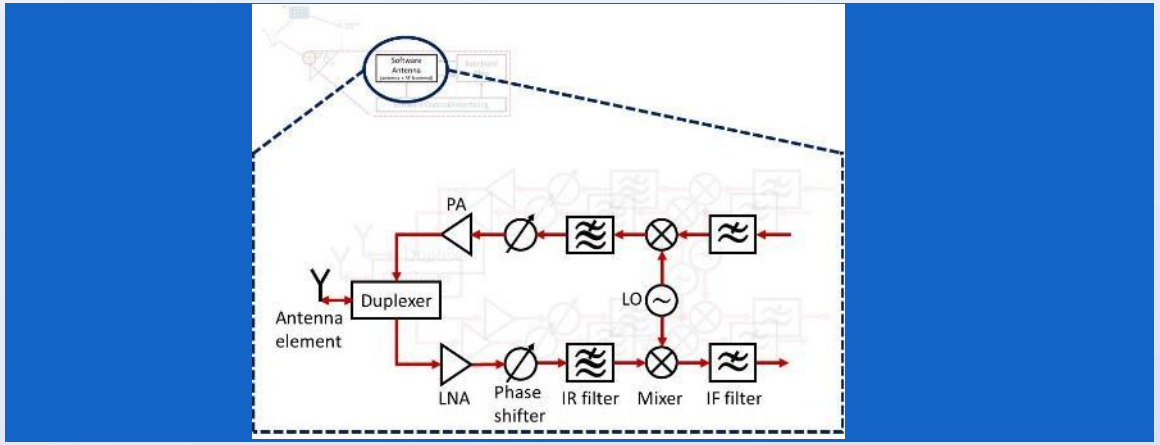
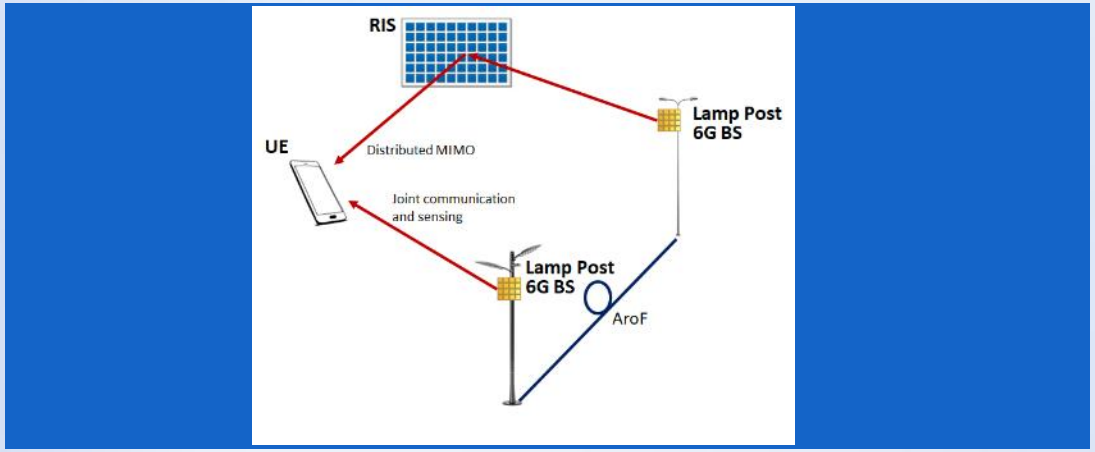
WP1.1 Highly Efficient Transmitters

The aim of this work package is to develop new concepts and further optimize existing semiconductor technologies to realize electronic chips (Integrated Circuits) and apply them in software antennas that can generate highly efficient electromagnetic power for 5G and 6G systems that operate with frequencies above 6 GHz.

What are Highly Efficient Transmitters?

Existing transmitter architectures currently simply provide insufficient energy efficiency, resulting in a large part of the supplied energy being converted into heat instead of electromagnetic energy that is emitted. Major gains can be achieved here by moving to novel mixed signal transmitter architectures implemented with a high degree of integration and miniaturization in the software antennas.





Why do we use highly efficient transmitters?

When using frequencies above 6 GHz, an array of a large number of small antennas is used to compensate for the increased propagation loss. Each antenna element is connected to a power amplifier (PA), which means that hundreds to thousands of PAs are required per base station. Achieving very high PA efficiency is crucial in combination with wideband digital architectures, excellent synchronization and thermal management.

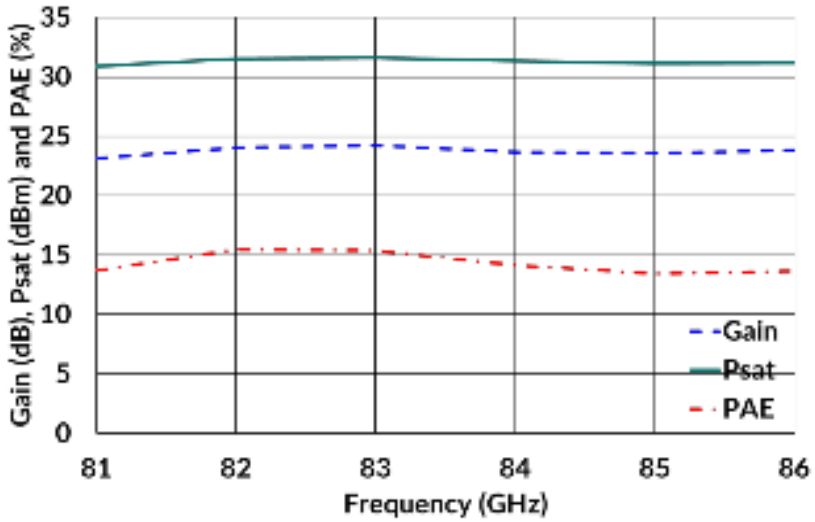
Partners: University Eindhoven & Twente, Bosch, Prodrive Technologies, Sabic, TNO CITC & Nano- instruments

WP1.1 example: First test results of E-band power amplifier

Altum RF

- Fabless high frequency semiconductor company based in Eindhoven, the Netherlands
- Focus on high frequency GaAs and GaN MMIC for 6G telecom applications, such as high data rate backhaul, and non-terrestrial networks (NTN)
- Participating in Future Network Services (FNS)
  - Partner in PL 1: Intelligent components
  - Investigating new amplifier and other high frequency components for high frequencies
  - Working closely with TU/e and other partners in FNS

First results; high power amplifier for E band.
Measured results



ALTUM RF

FNS 6G

WP1.2 Joint Communication and Sensing (JCAS)

Work Package 1.2 develops prototypes to support the Joint Communication and Sensing (JCAS) such as hardware components, millimetre wave (mmW) signal synthesis and analysis and resource management.

In WP1.2, 13 partners collaborate on 7 tasks, aiming to deliver approximately 10 prototypes and 10 technical papers.

What is JCAS

The 6G network brings the connected world to the next level by combining communication and sensing in one system.

Applying beamforming in the 6G millimeter wave (mmW) bands enables sensing based on radar technologies.

This provides spatial knowledge of the physical surroundings and localisation of users.

Knowledge of location and surrounding enables series of services including safety features.

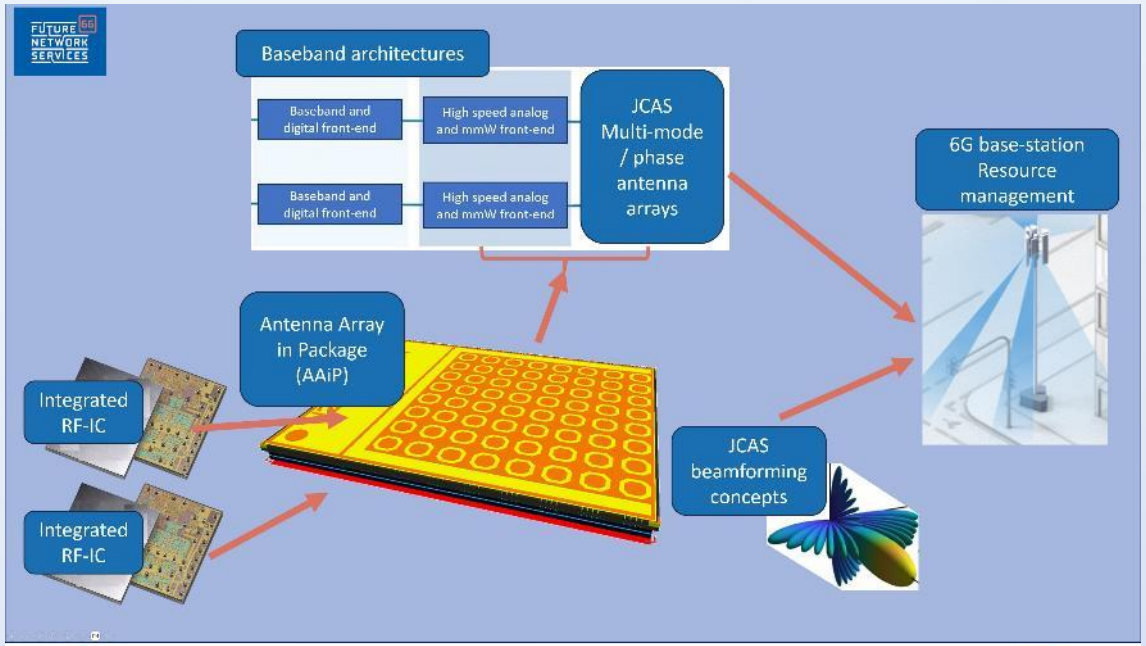
WP1.2 Joint Communication and Sensing (JCAS)

Hardware and architecture development

- Prototyping of efficient mmW integrated circuit RF components.
- Prototyping of Advanced Antenna Arrays in Package (AAiP) required for beamforming applications.
- Advanced baseband architectures supporting high data rates and sensing capabilities in future the 6G networks.

Beamforming and radio management

- Prototyping of dual band and dual mode phased arrays along with the synthesis of beamforming signals.
- Development of software and algorithms to ensure the high-speed data transfer **and** enhance surrounding and location sensing capabilities → received signal analysis.
- Implementation of radio management algorithms and system simulations to optimize the use of the hardware and available frequency resources.



TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY · NXP · TU Delft · imec · TNO innovation for life · CITC · ALTUM RF · ANTENNA COMPANY · robin radar systems · UNIVERSITY OF TWENTE. · Viasat · sabic · ANTENNEX

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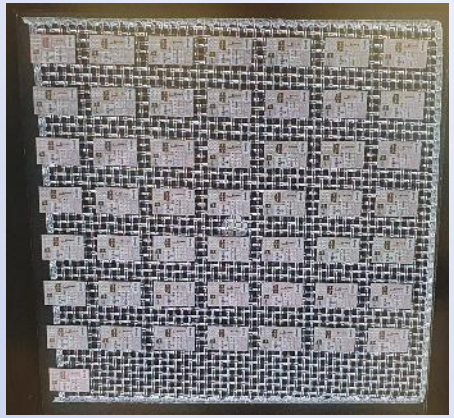
WP1.2 Example First proof of 60 GHz mmW IP at NXP

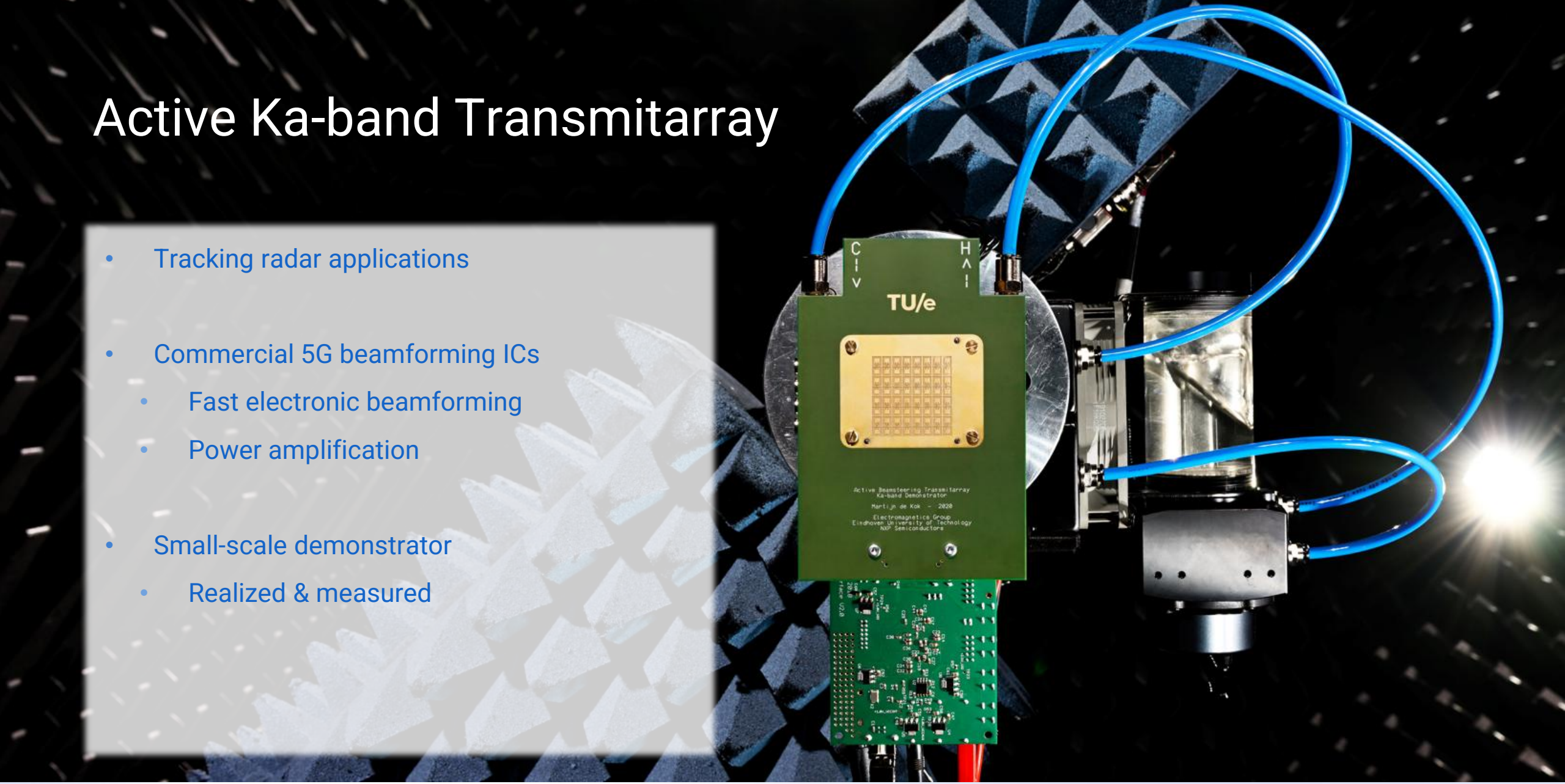
Accurate 60.5 GHz Free Running Oscillator (FRO)

- The first silicon with IP’s serving the development of NXP’s mmW IP
- Developed by NXP-Nijmegen team
- Tested and works as expected



Active Ka-band Transmitarray

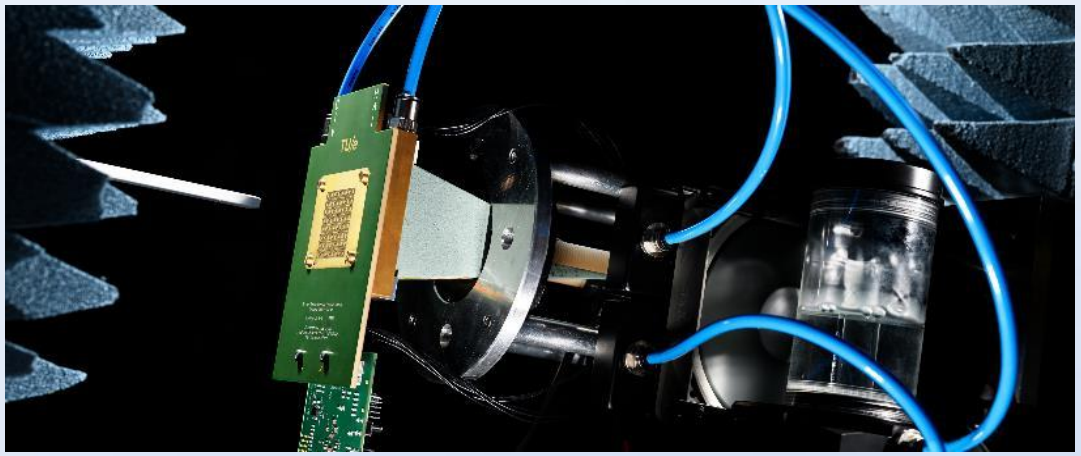
- Tracking radar applications
- Commercial 5G beamforming ICs
  - Fast electronic beamforming
  - Power amplification
- Small-scale demonstrator
  - Realized & measured



M. de Kok, A.B. Smolders, and U. Johannsen, “Active Ka-band Transmitarray for Ka-band Monopulse Tracking Radar,” *publication pending,* 2022.
m.d.kok@tue.nl

WP1.3 Over-The-Air (OTA) Antenna Testing

6G software antennas behave as 'black boxes', converting bits to electromagnetic waves and vice versa. Unlike 4G and 5G, 6G components lack connectors, challenging testing methods. In response, WP 1.3 aims to address these testing challenges by enhancing OTA testing techniques. Additionally, the work package seeks to improve 6G propagation channel models and coverage by leveraging Reconfigurable Intelligent Surface (RIS) systems



Tasks

The project includes four tasks:

- defining OTA test specs for 6G components;
- devising efficient test strategies for software antennas with millions of settings;
- creating accurate 6G propagation channel models;
- developing RIS structures to enhance coverage.

Partners:

CHALMERS UNIVERSITY OF TECHNOLOGY

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

TU Delft

ANTENNEX

kpn

TNO innovation for life

ERICSSON

Deliverables

The project's deliverables include specifications and prototypes. Specifications will be developed by all partners, while prototypes include an OTA test facility for software antennas, RIS systems, and an upgraded channel sounder for 6G. Demonstrators consist of an OTA test facility and RIS systems for NLOS communication.

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WP1.3 example: Reverberation chamber with extended measurement capabilities between 18 – 140 GHz

TRANSMITTING

- Total radiated output power
- Power Spectral Density
- PAPR
- IIP3, OIP3, P1dB
- ACPR, ACLR
- Power-added efficiency
- Drain efficiency
- Power gain
- Spectral regrowth
- intermodulation products
- Radiated in- and out-of-band emissions
- LO leakage
- Harmonic distortion
- Chirp rate/linearity
- Etc..

RECEIVING (limited by DUT)

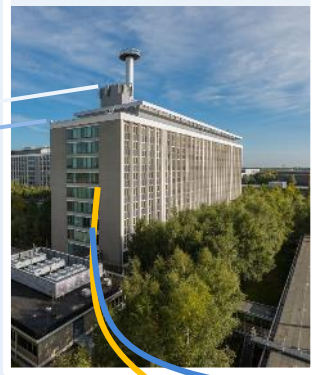
- Receiver gain
- Linearity
- IIP3, IIP2, P1dB
- Efficiency
- Harmonic distortion
- in- and out-of-band emissions
- Etc..

More functionalities to be released in future on the same hardware platform.

WP1.4 Optical - Enabled Wireless Communication Networks

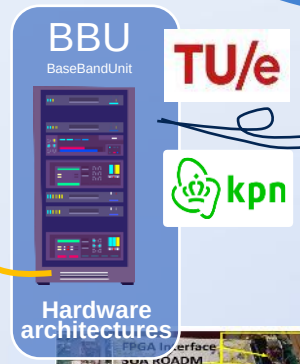
WP 1.4 studies the convergence of light and radio-based systems. Light can be used as an alternative communication concept (optical wireless) that offers interesting possibilities, not only in the network to connect base stations but also in the link to the subscriber.

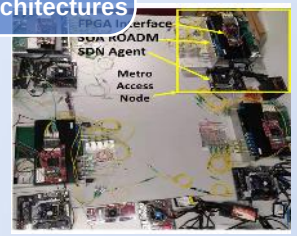
Backhaul

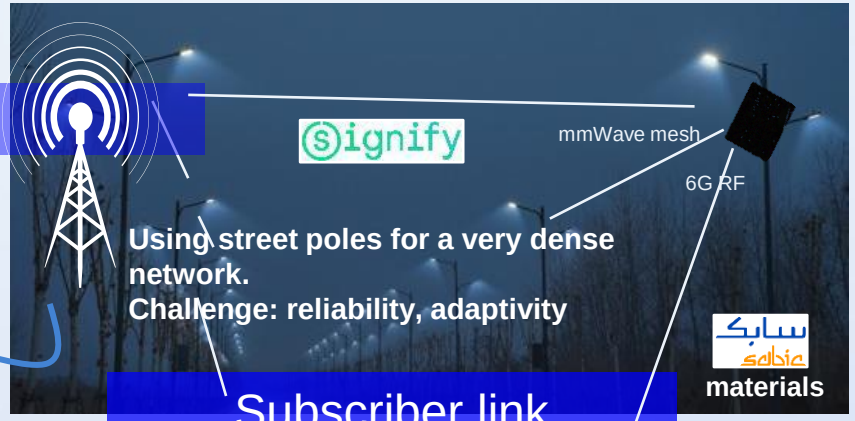


Fronthaul

Optical fronthaul to very dense net of cooperating APs
- over fiber
- wireless







Subscriber link

Optically fed RF nodes

RF

6G intends to vastly enhance network performance for every user, but also to connect for more devices. This calls for novel approaches in connecting a dense grid of access points, such as analog Radio-over-Fiber and optical links. TU/e and industrial partners smartly combine advanced optical and RF technologies to reach unprecedented rates at high Quality of Service.

Partners: University Eindhoven, KPN, Signify, Sabic, TNO, IMEC, VTEC

Enhancing the performance of devices for 6G mass-market client devices and for the indoor infrastructure

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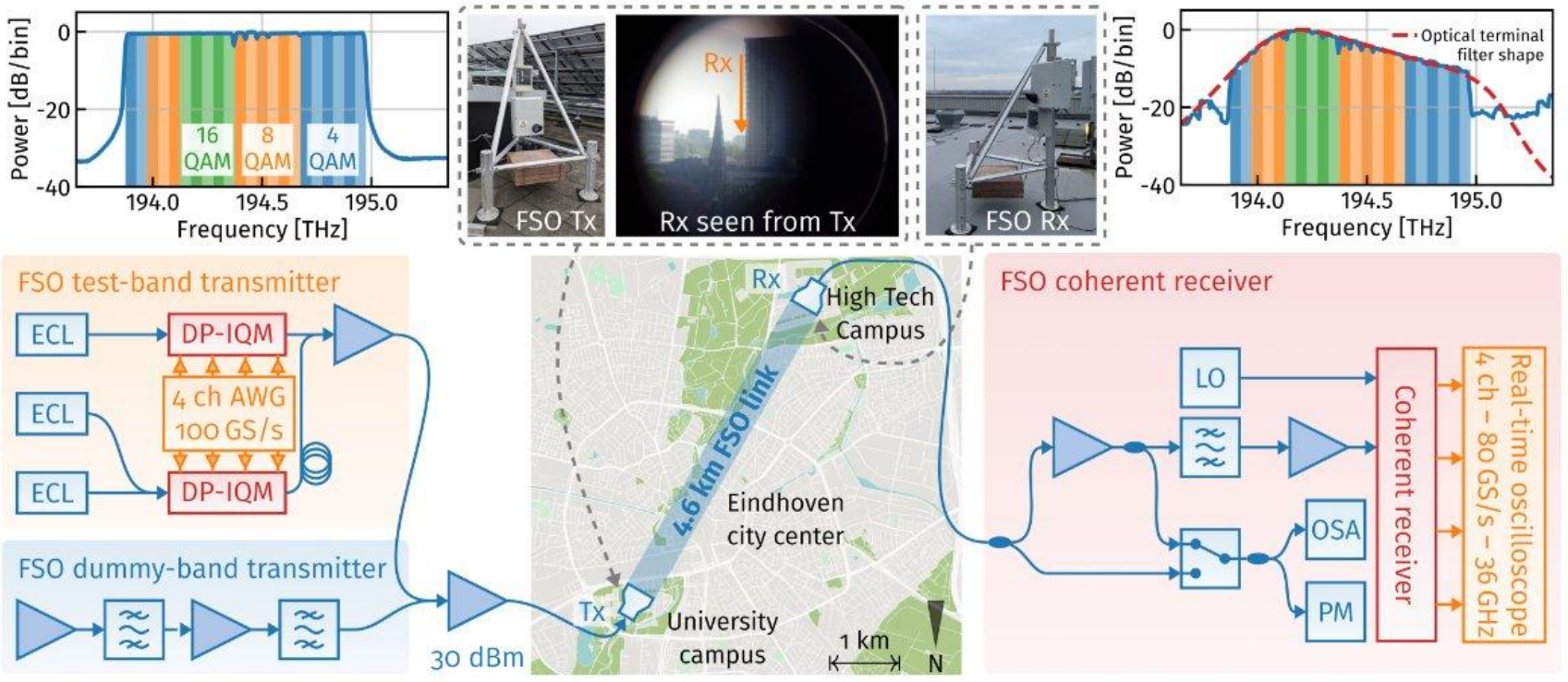
WP1.4 Example: Highlight 1: World Record on FSO link



De Telegraaf NIEUWS LIVE SPORT ENTERTAINMENT FINANCIEEL VROUW LIFESTYLE WAT U ZEGT

Gelijktijdig streamen van 1,9 miljoen Netflix series in HD

Nederlandse onderzoekers realiseren snelste draadloze verbinding ooit over grote afstand

Door LENNO VAN DEKKEN
3 uur geleden in WETENSCHAP

EINDHOVEN - Onderzoekers van de Technische Universiteit Eindhoven (TU/e) zijn erin geslaagd om de snelste draadloze datatransmissie over de langste afstand ooit in een stedelijke omgeving op te zetten met infrarood licht.

- Distance 4.6 km connecting TU/e Flux to HTC 37 building
- Data has 22 WDM channels with 50-GHz spacing
- Optical coherent transmission with QAM-4, 8, and 16 and DSP creates 5.7 Tbps
- Optical pre-amp to mitigate the effect of turbulence
- Active acquisition, pointing and tracking system to minimize link outage

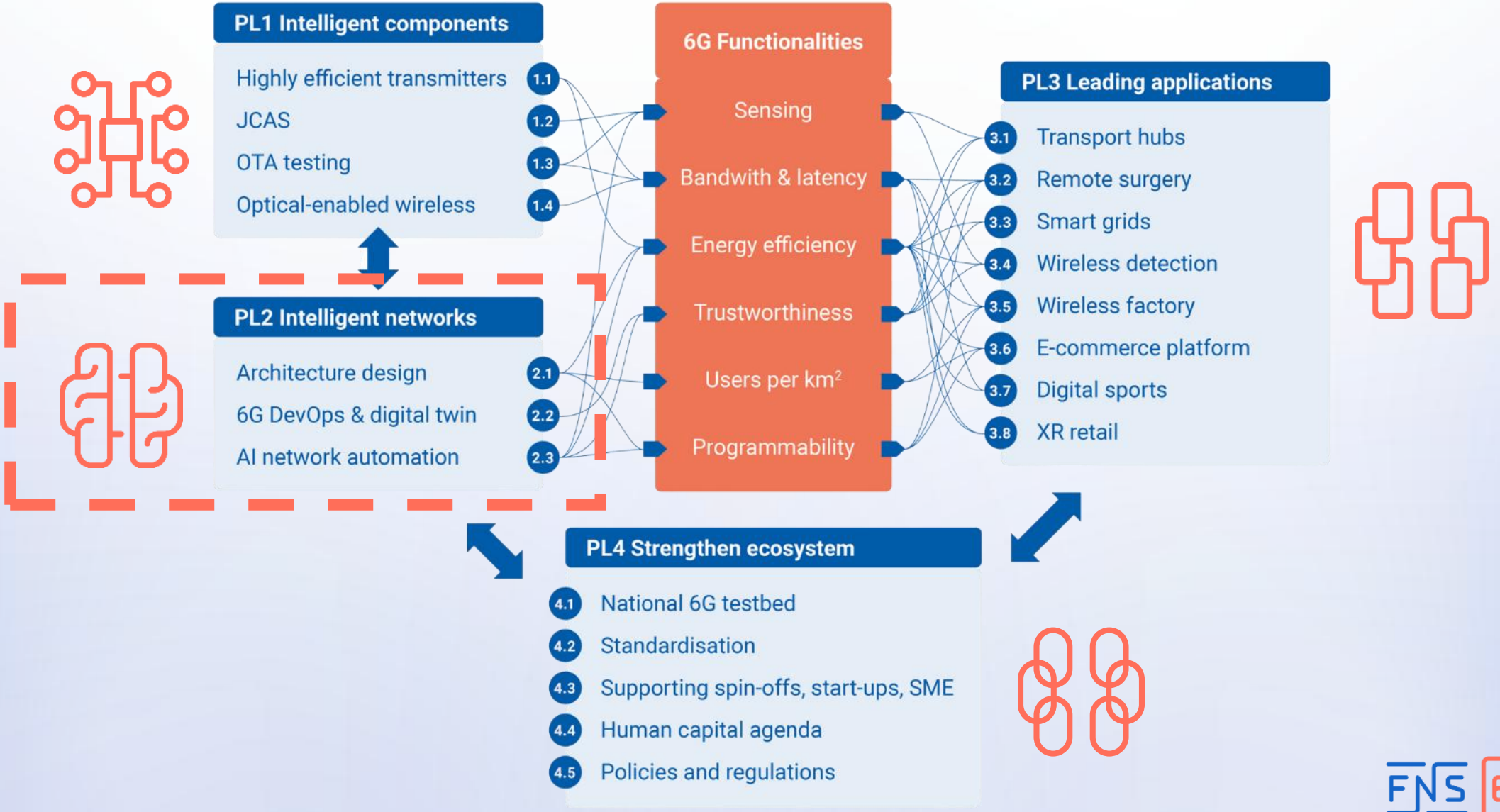
TU/e AIRCISION kpn FNS 6G

FUTURE 6G NETWORK SERVICES

Research on Intelligence in RAN and core networks

Prof. Fernando Kuipers – Professor at Delft University of Technology (TU Delft)

Program lines and work packages: program line 2



The PL2 team combines a strong scientific foundation with a strategic business perspective

FERNANDO KUIPERS
PROGRAM 2 LEAD

TU Delft Delft University of Technology

Vincent van Beek
CO-LEAD

Solvinity
Secure Managed IT Services

Borgert van der Kluit
WP2.1 LEAD

TNO innovation for life

Alexandru Iosup
WP2.2 LEAD

VU UNIVERSITY AMSTERDAM

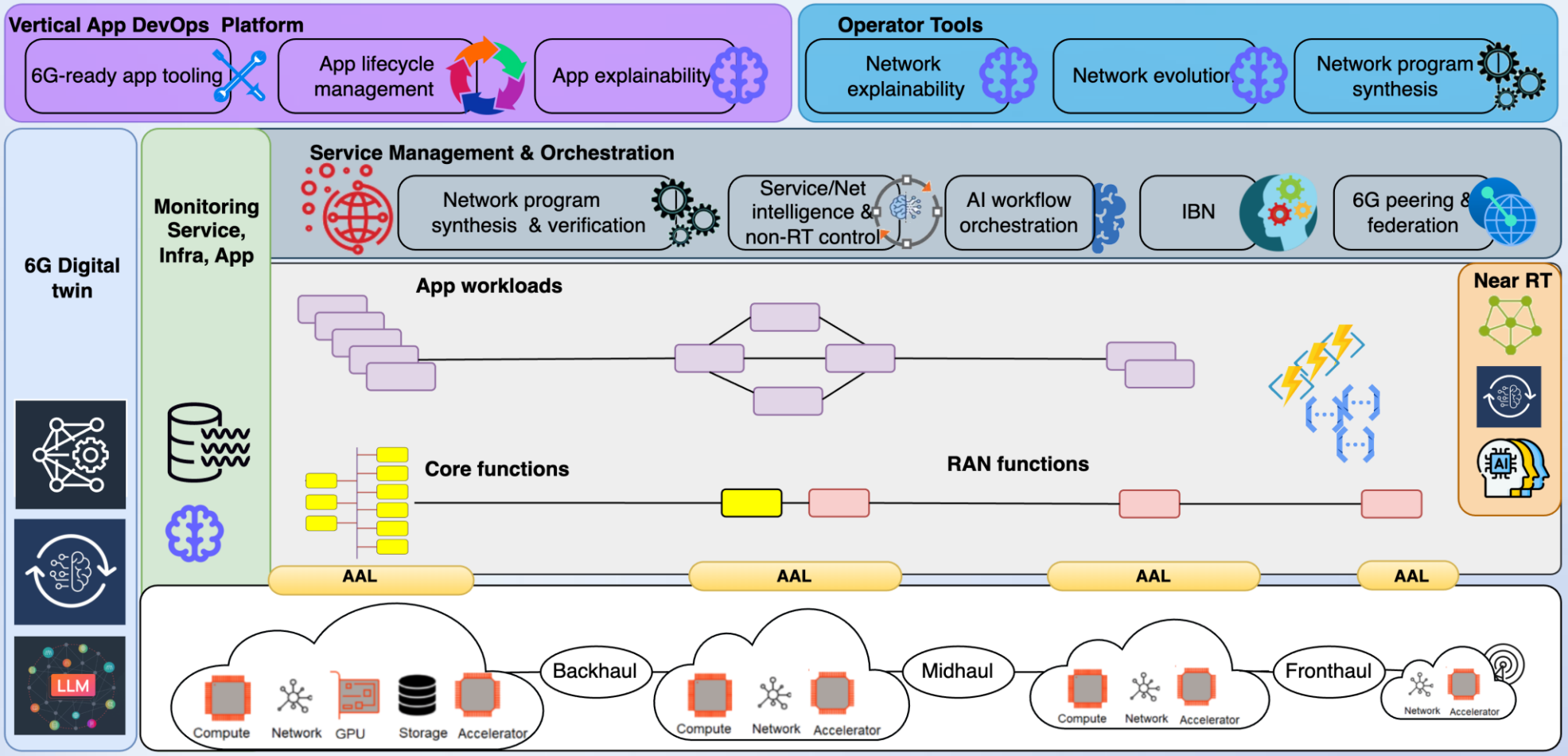
Chrysa Papagianni
WP2.3 LEAD

UNIVERSITEIT VAN AMSTERDAM

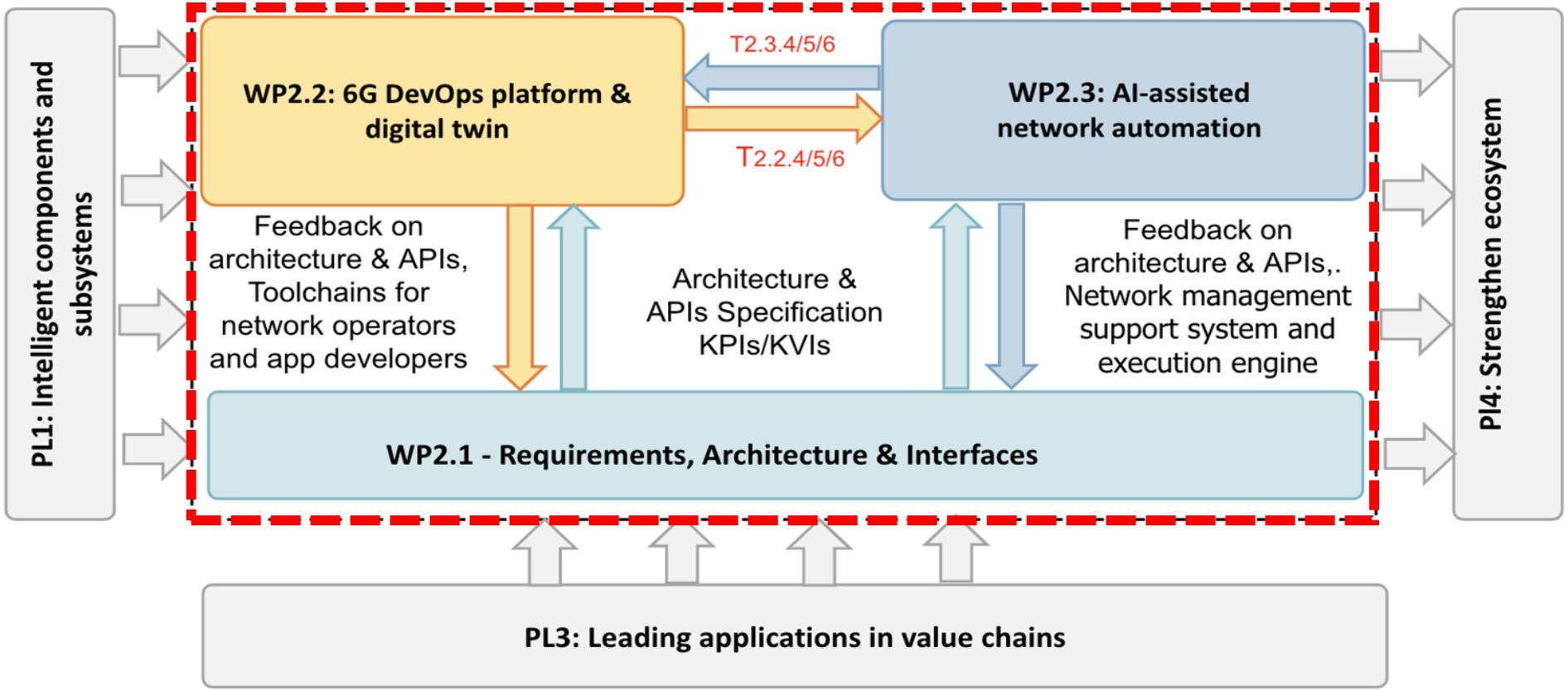
FNS 6G

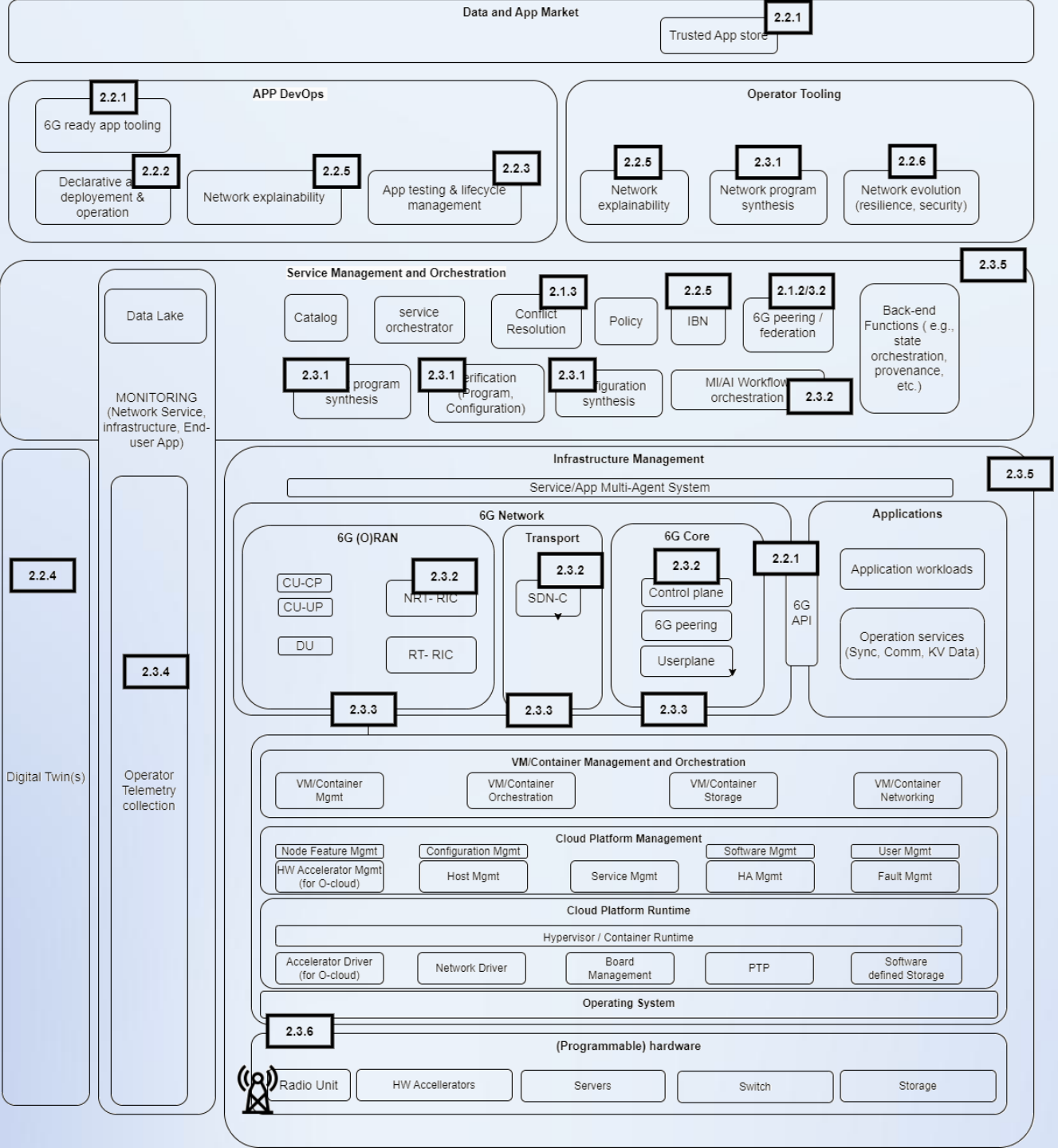
PL2 system overview

Goal: To develop the AI-based algorithms and software modules for efficient and reliable 6G network orchestration and application development.



Various relationships between WPs & PLs





PL2 tasks

WP2.1 Requirements, architecture & integration

- T2.1.1: Requirements for an intelligent multi-stakeholder 6G network
- T2.1.2: Architectural principles & interfaces for agile interoperability
- T2.1.3: Holistic coordination, system integration & demonstration

WP2.2 6G DevOps platform & digital twin

- T2.2.1: 6G-ready app development
- T2.2.2: Declarative app deployment and operation
- T2.2.3: App testing and life-cycle management
- T2.2.4: Models & simulation for a 6G digital twin
- T2.2.5: Intent-based networking & explainability
- T2.2.6: Resilient & secure network evolution

WP2.3 AI-assisted networking

- T2.3.1: Network program/configuration synthesis & verification
- T2.3.2: AI-based network management algorithms
- T2.3.3: Real-time in-network operations
- T2.3.4: Automated telemetry & reporting
- T2.3.5: 6G runtime system for the digital continuum
- T2.3.6: Hardware-software co-design

Not all blocks are addressed in FNS (from other 6G programs), and each block can have multiple subblocks.

WP2.1: requirements, architecture & integration

This work package focuses on the research and development of architectural principles, coordination frameworks, and innovative interfaces that provide applications ('agile') access to the underlying network infrastructure and allow realizing system-wide goals such as performance, sustainability and reliability.

T2.1.1: Defining requirements, KVI & KPIs for multi-stakeholder 6G

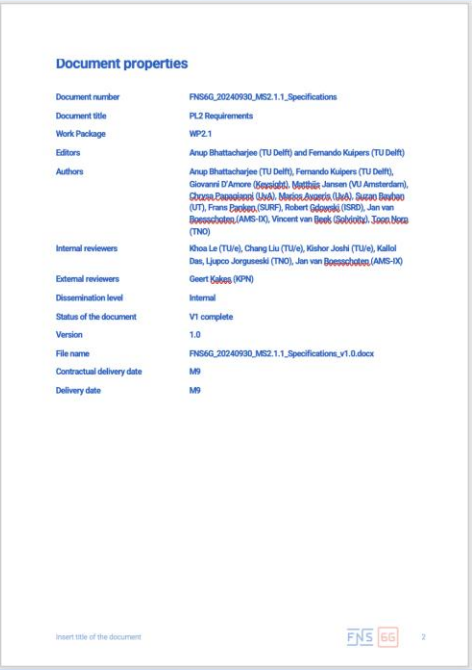
- Defining requirements with input from PL1 & PL3.
- Alignment with international (SDO) ecosystem (PL4).
- Dataset collection & Data-driven requirements analysis.

T2.1.2: End-to-end architecture

- Development of a multi-stakeholder 6G architecture blueprint based on T2.1.1 requirements.

T2.1.3: Integration

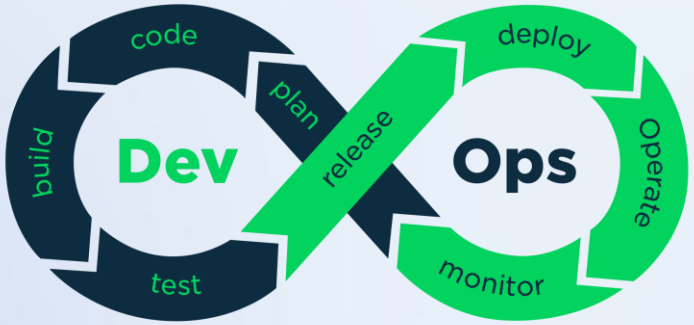
- Development of holistic coordination mechanisms.
- Integration of demo systems into a demo of demos.



Partners: TNO, Almende, AMS-IX, ISRD, Keysight, KPN, Solvinity, SURF, TU Delft, TU/e, UT, UvA, VodafoneZiggo, and VU.

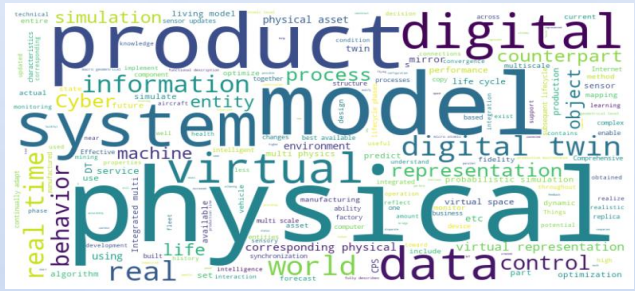
WP2.2: 6G DevOps platform & digital twin

This WP will reduce complexity for 6G app providers and network operators through a comprehensive DevOps platform, including a 6G Digital Twin. The WP will contribute to Program Line 2's architecture, and deliver software and algorithms, tested and benchmarked.



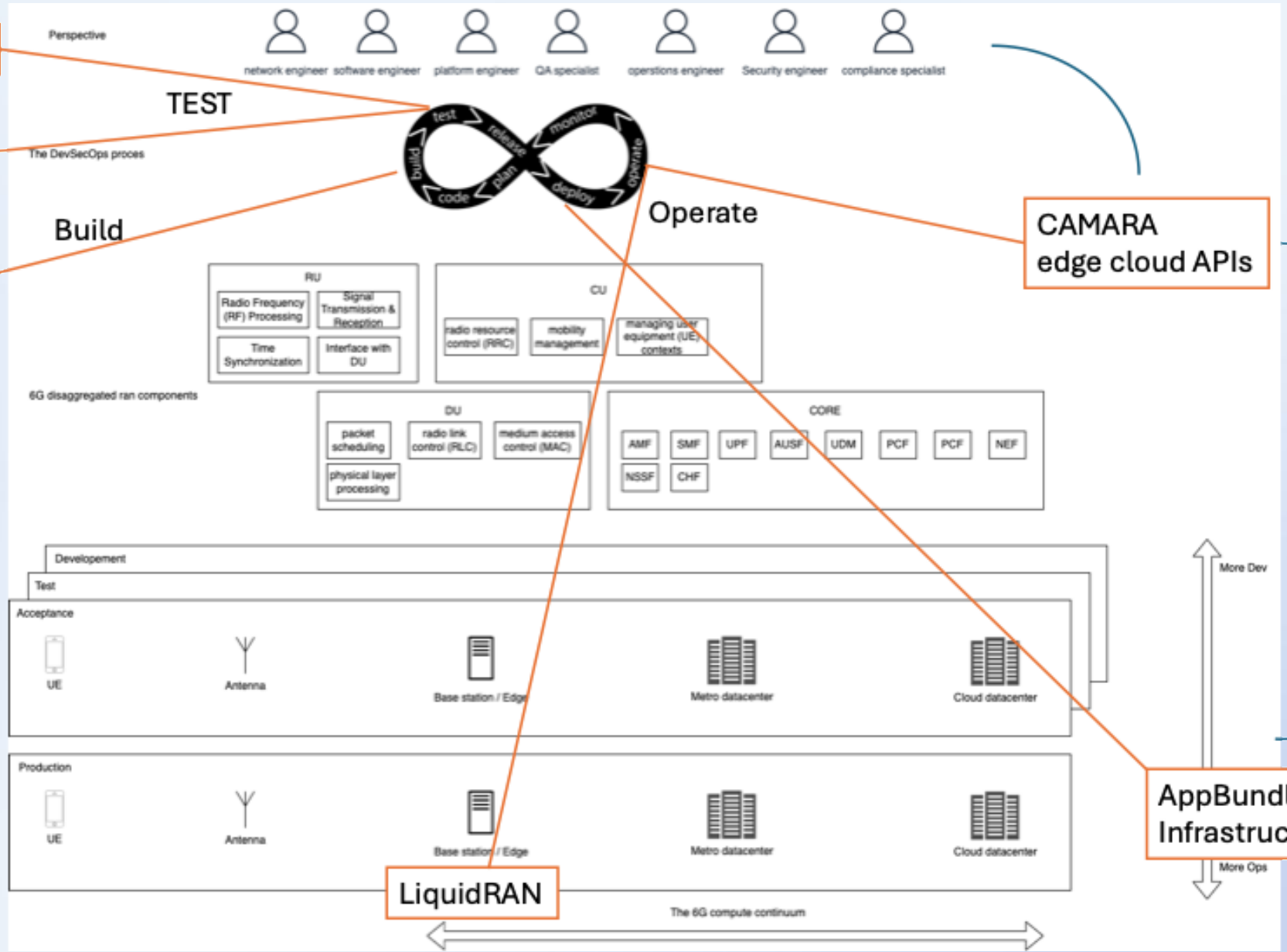
T2.2.1-3: DevOps work will develop front- and back-end services, and software for declarative app deployment and operation.

T2.2.4-6: Digital twinning will cover full-stack 6G networks, linked to telemetry from WP2.3.



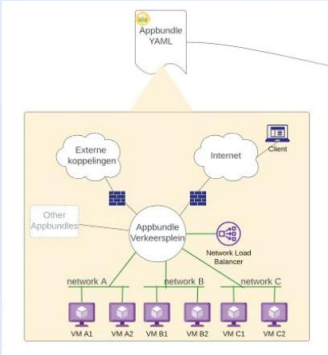
Partners: VU, Almende, AMS-IX, ISRD, Keysight, KPN, Solvinity, SURF, TNO, TU Delft, TU/e, UT, UvA, and VodafoneZiggo.

6G DevOps platform (T2.2.1-3)



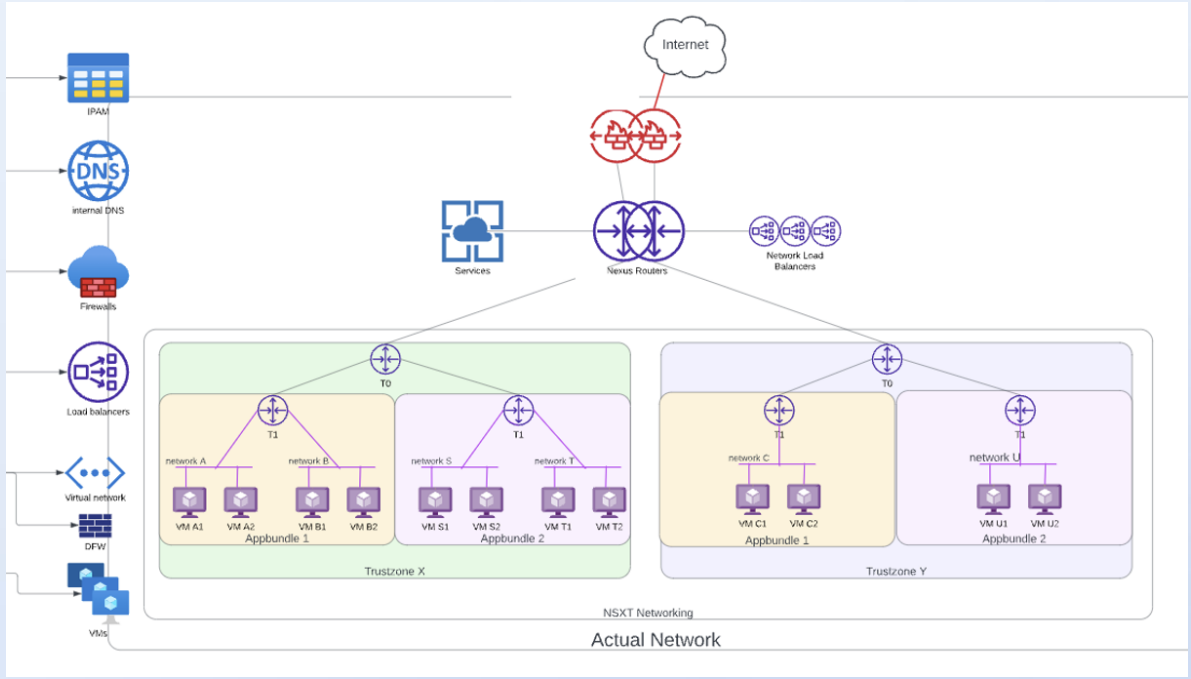
Example: declarative infrastructure management (Solvinity & VU)

Desired State



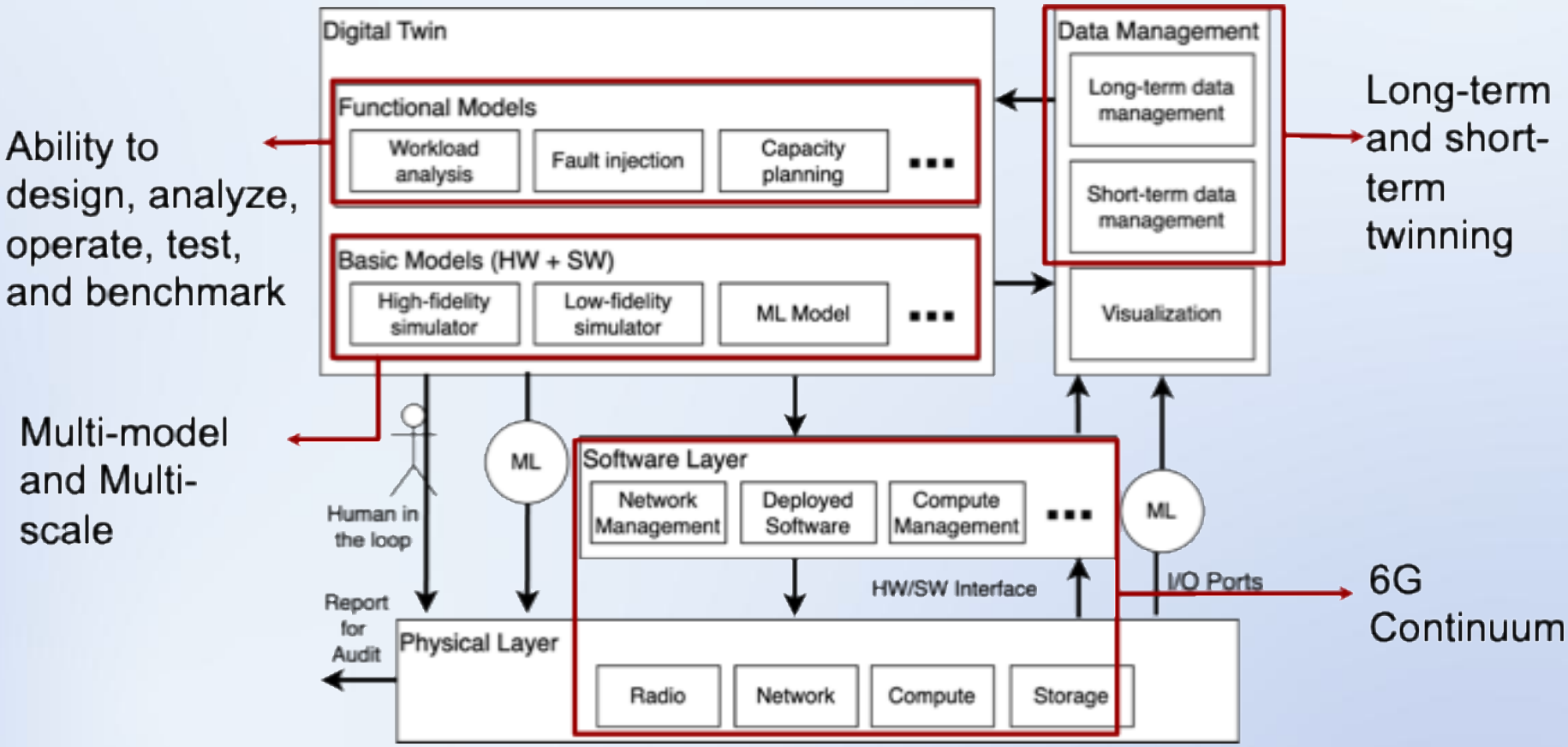
Reconciliation

Actual state of the infrastructure



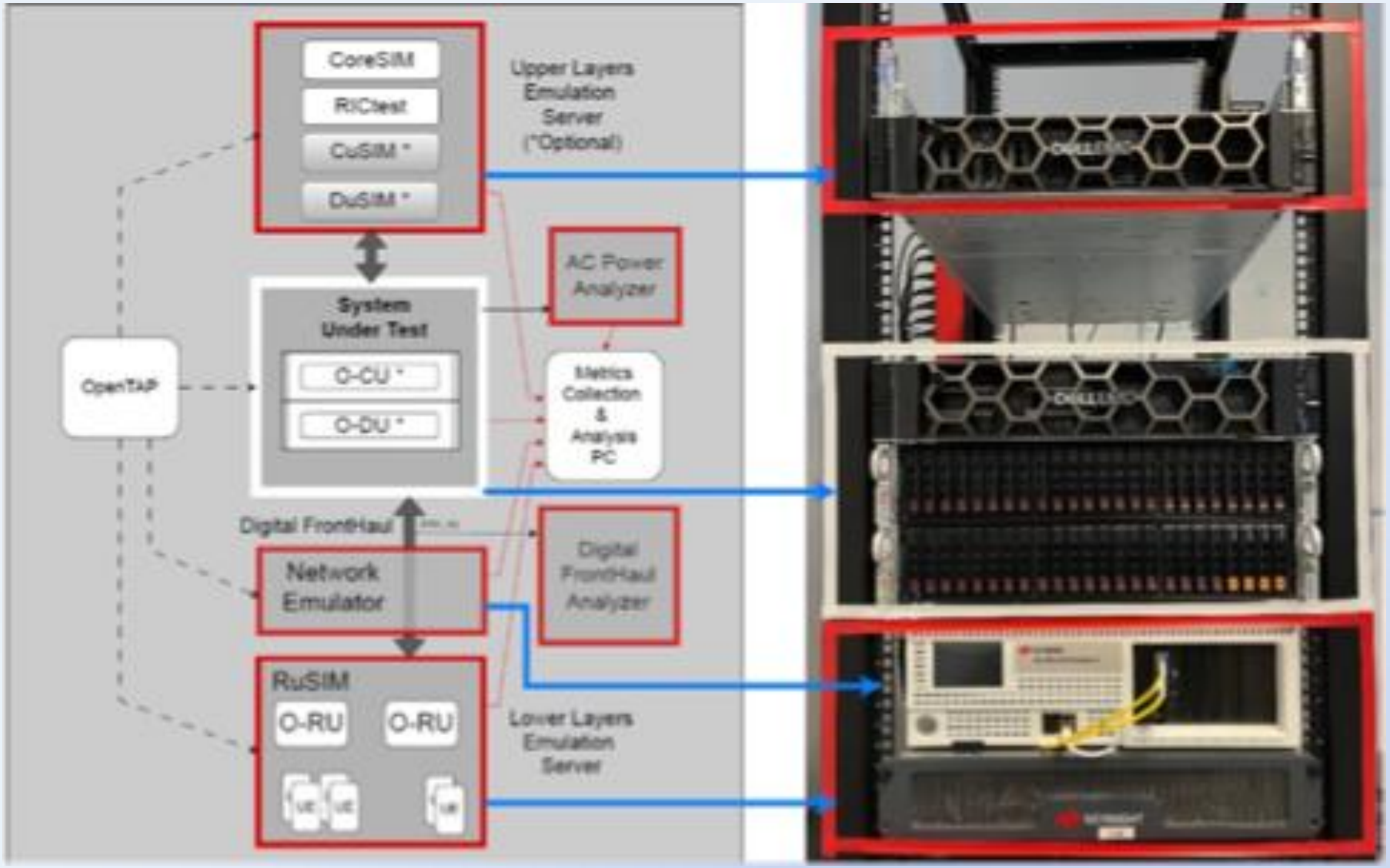
6G Digital Twin (T2.2.4-6)

- Digital Twin blueprint in preparation.



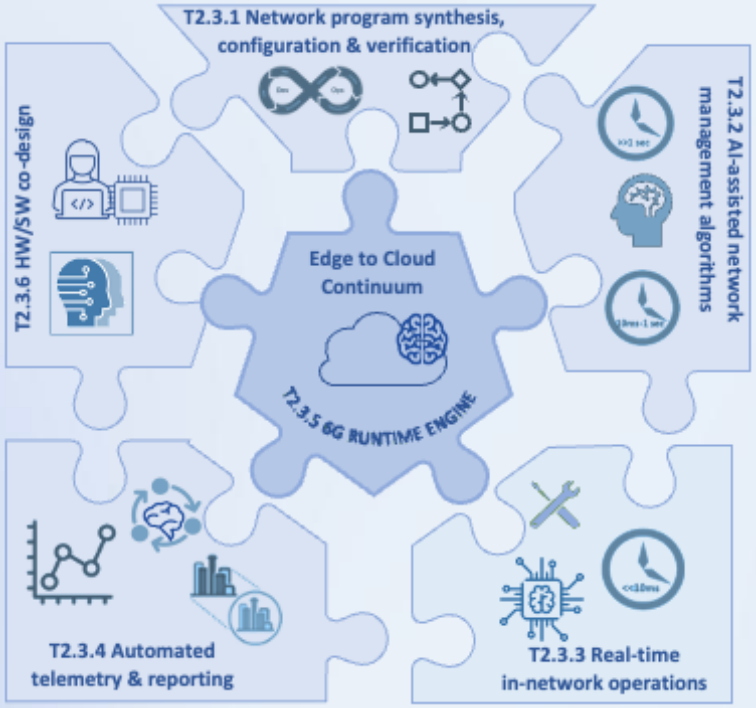
Example: digital twin for testing (Keysight & TU/e)

- Using digital twins of surrounding components to validate real components (O-CU and O-DU in the middle here).



WP2.3: AI-assisted networking

Goal: Design, prototype and demonstrate using PoCs the Orchestration, Management, Control and Data-plane of 6G system. Enable the underlying programmable network and computing infrastructure to operate autonomously, powered by artificial intelligence.



AI-native: *Having intrinsic trustworthy AI capabilities, where AI is a natural part of the functionality, in terms of design, deployment, operation, and maintenance.*

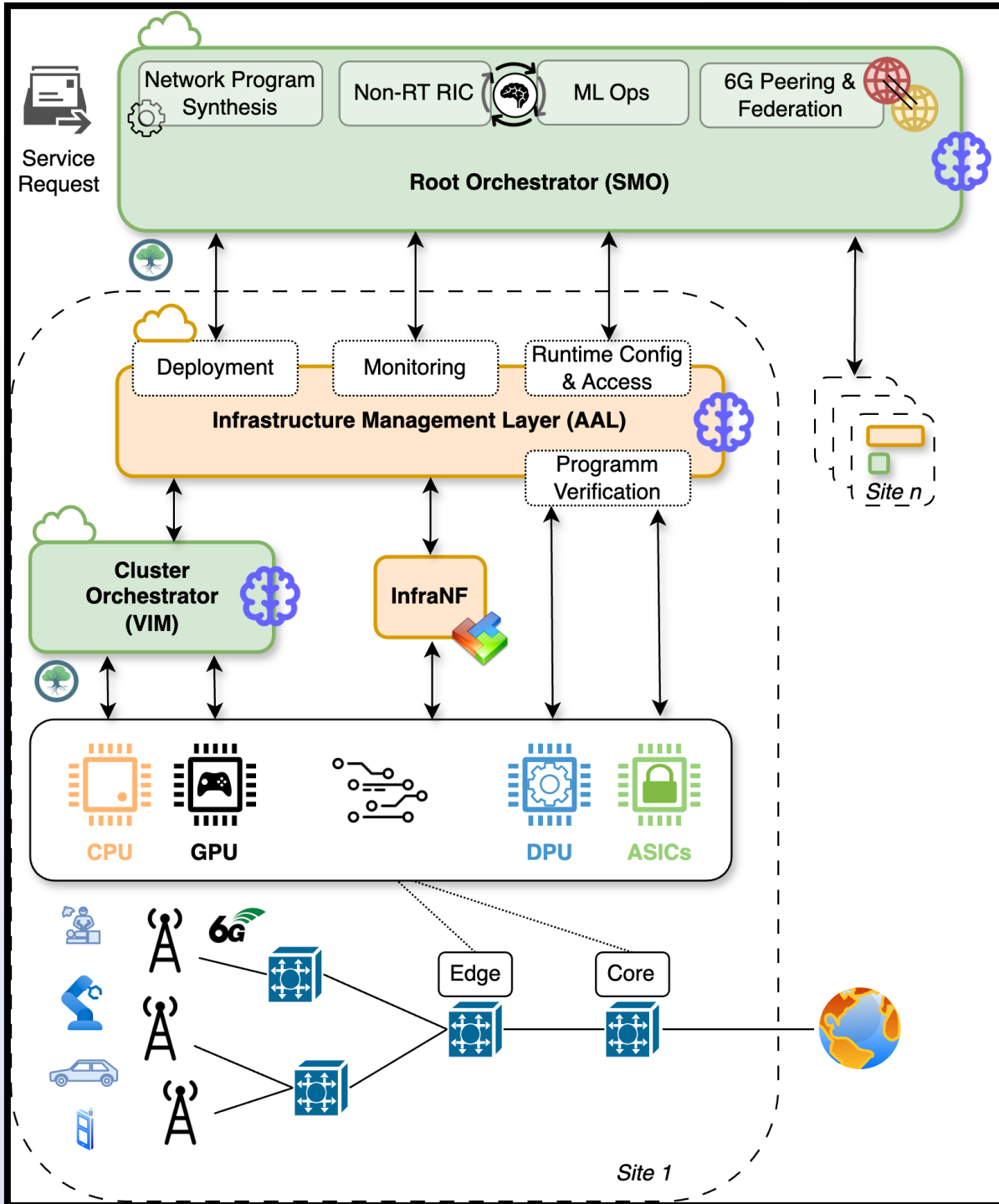
Cloud-native: *Cloud native is an approach to building and running network services that exploits the advantages of the cloud computing delivery mode, for improving the scalability, agility, and resilience of the telecom network.*

Deep Network Programmability: *the ability to program the network fabric both vertically (control and data planes) and horizontally (end-to-end).*

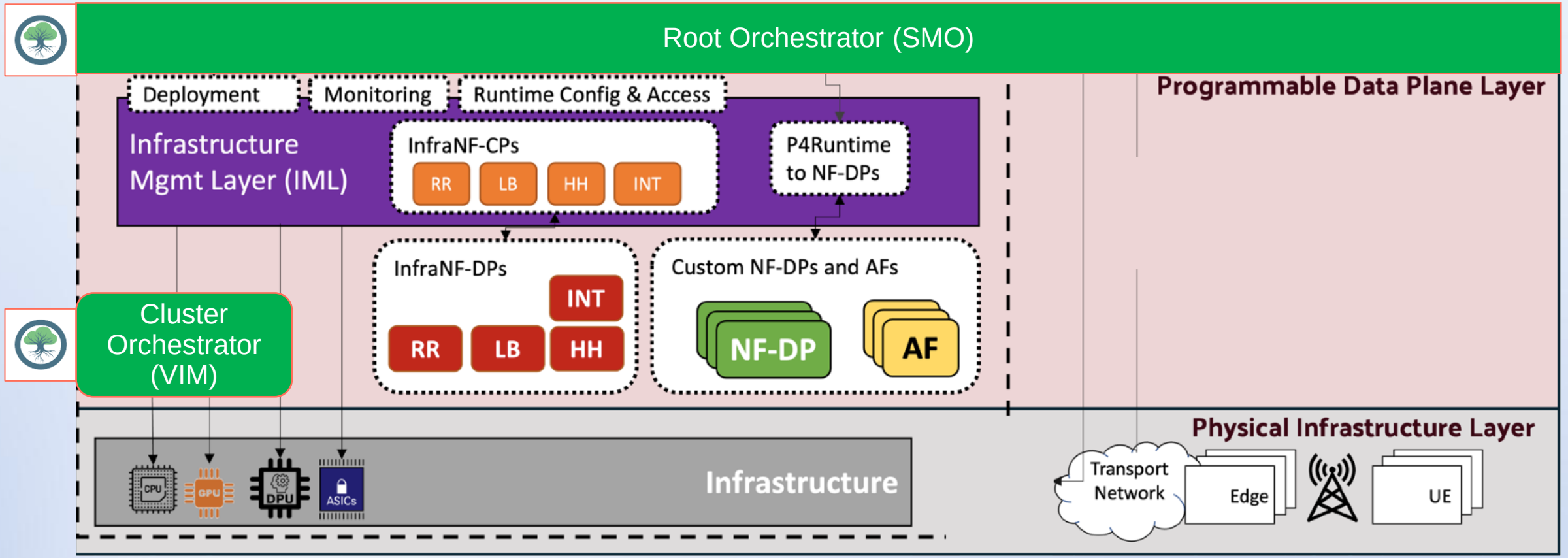
Partners:
UvA, AMS-IX, Ericsson, ISRD, Keysight, KPN, Nokia, NVIDIA, Solvinity, SURF, TNO, TU Delft, TUE, UT, VodafoneZiggo, and VU.

WP2.3 tasks

- T2.3.1: Network program/configuration synthesis & verification
- T2.3.2: AI-based network management algorithms
- T2.3.3: Real-time in-network operations
- T2.3.4: Automated telemetry & reporting
- T2.3.5: 6G runtime system for the digital continuum
- T2.3.6: Hardware-software co-design



Example: Oakestra (TU Delft) + IML (Ericsson & UvA)



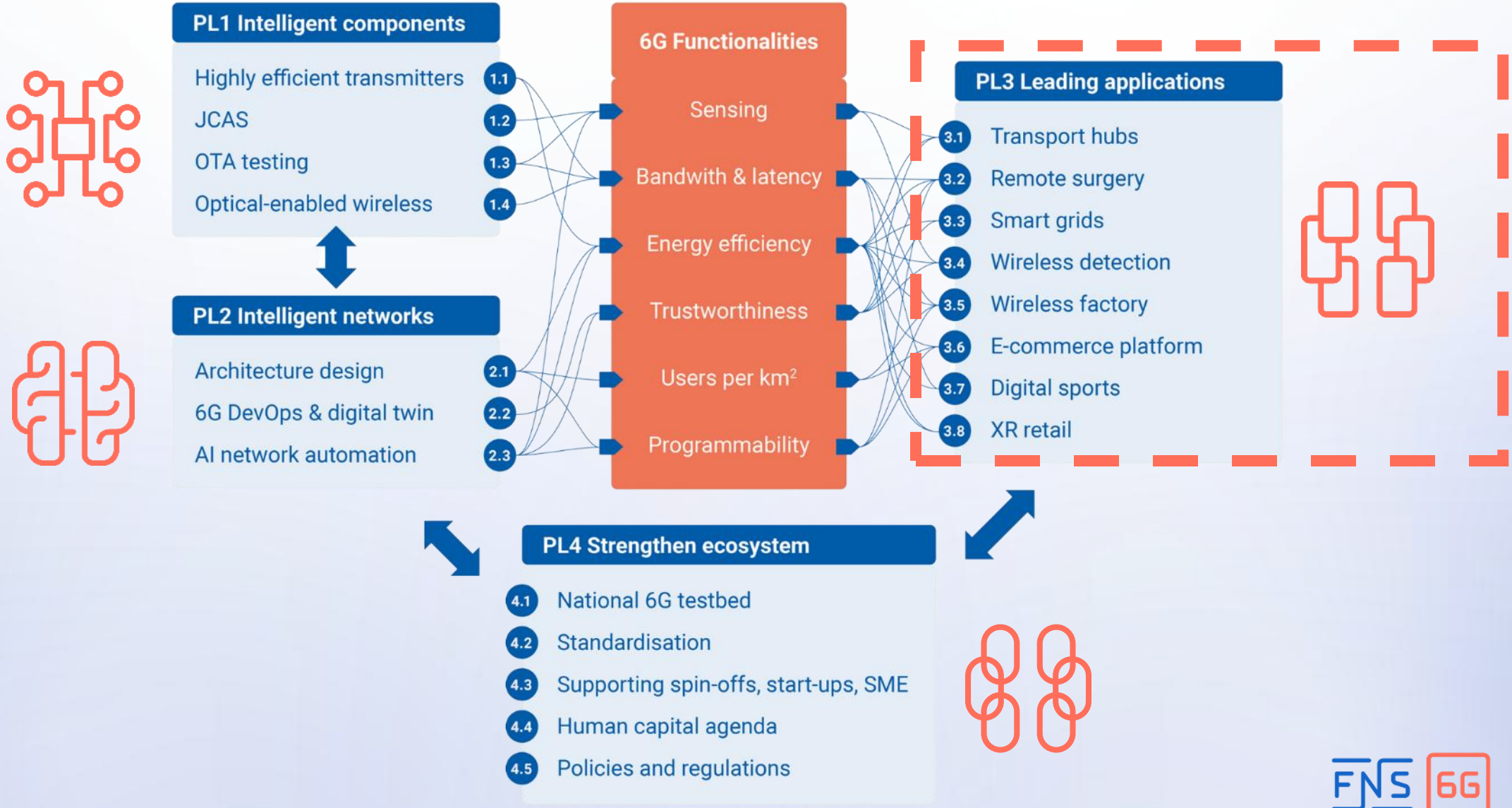
Sneak Peak
Research on 6G leading applications and verticals

Jos Berière – program leader FNS

Research dreams do not pay bills, global business impact does

EU collaboration
is key
to be of significance
in 6G

PL3 connects vertical / application requirements to 6G



The team is characterized by Dutch entrepreneurship

ROBERT DIJKERMAN
(BUSINESS REP.)
NOKIA

JOS BERIÈRE
(PROGRAM 3 LEAD)
TNO innovation for life

PRACHI
SACHDEVA
TNO innovation for life

FRANS
HAMSTRA
WP 3.1 LEAD
DRONE DELIVERY SERVICES

DANNY
RUIJTERS
WP 3.2 LEAD
PHILIPS

ROBBIN
HOF
WP 3.3 LEAD
Gomibo Platforms

BENNO
BEUTINK
WP 3.4 LEAD
CORDIS SUITE

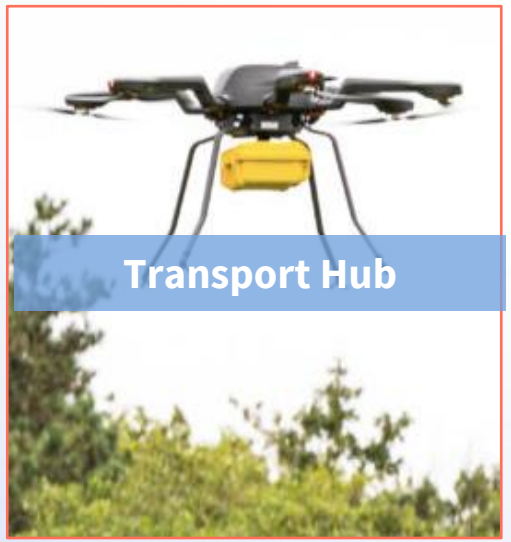
PETER
KORTENHOEVEN
WP 3.5 LEAD
PWXR

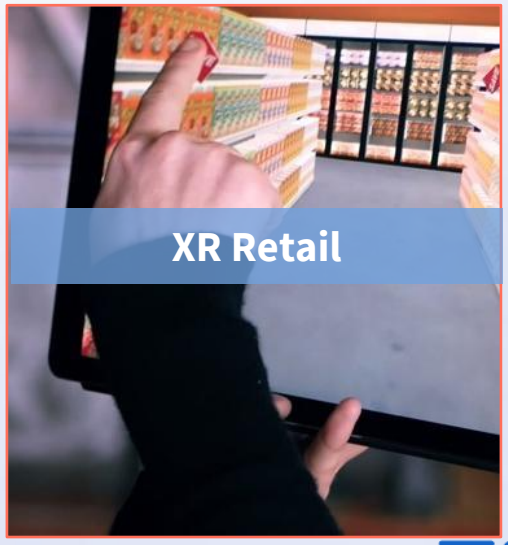
DANNY
VROEMEN
WP 3.6 LEAD
Vialis

SERGE DE
MUL
WP 3.7 LEAD

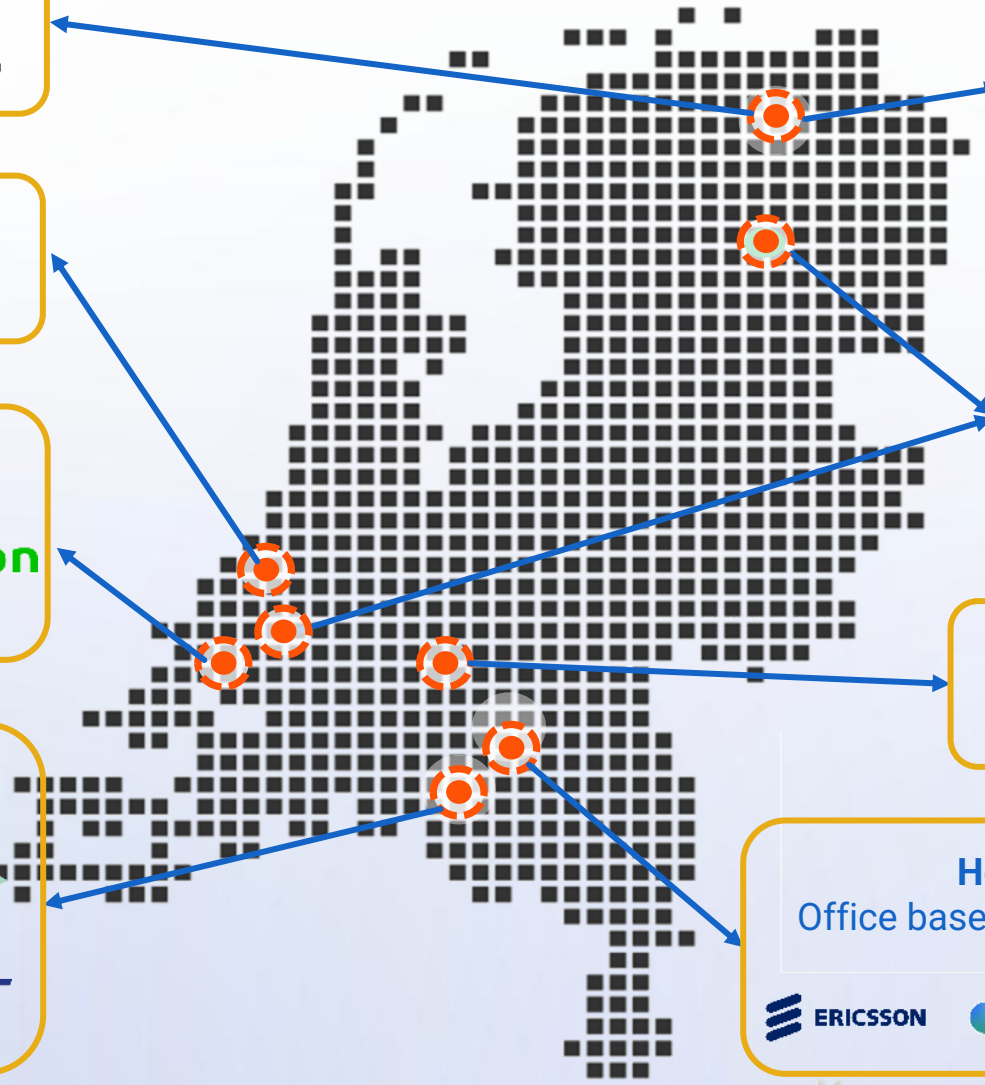
EUGENE
KUIPERS
WP 3.8 LEAD
fectar

Eight diverse 6G use cases for development & testing





Our efforts leverage existing hubs of innovation



Ecommerce Platform

ODIDO TNO

Exergaming

PWXR ODIDO

Wireless Detection

Vialis RADARXENSE kpn NOKIA Gemeente Rotterdam

First 6G wireless factory (live)

CORDIS SUITE kpn TU/e BRAINPORT Digital Factory TNO Weidmüller ASML NXP

BVLOS Drones 3D coverage

DRONE DELIVERY SERVICES ERICSSON ODIDO TNO

Grid Interactive Buildings

fudura NOKIA BRAINS 4 BUILDINGS Do IoT Innovation in Internet of Things Fieldlab COMFOREST alliander TU Delft THE GREEN VILLAGE

XR Retail

fectar kpn

Health Campus

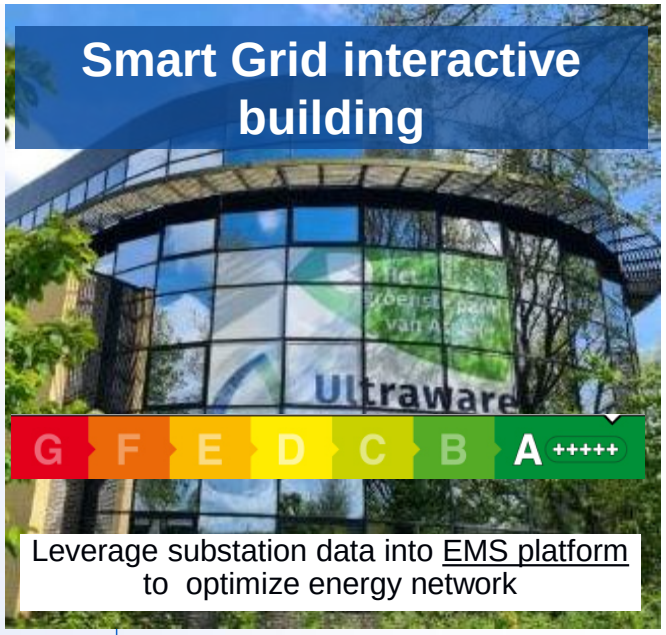
Office based image guided therapy

ERICSSON ODIDO PHILIPS TNO

FNS 6G

6G offers long term competitive advantage in digital strategies

Smart Grid interactive building



Leverage substation data into EMS platform to optimize energy network

Transport Hub

Leverage connectivity & detection to ensure safe flight of drone platform & U-Space

Wireless Detection

Leverage 6G sensing & localization data to train AI (IPR) & into platform

XR Retail

Leverage 6G sensing & localization data to improve XR platform

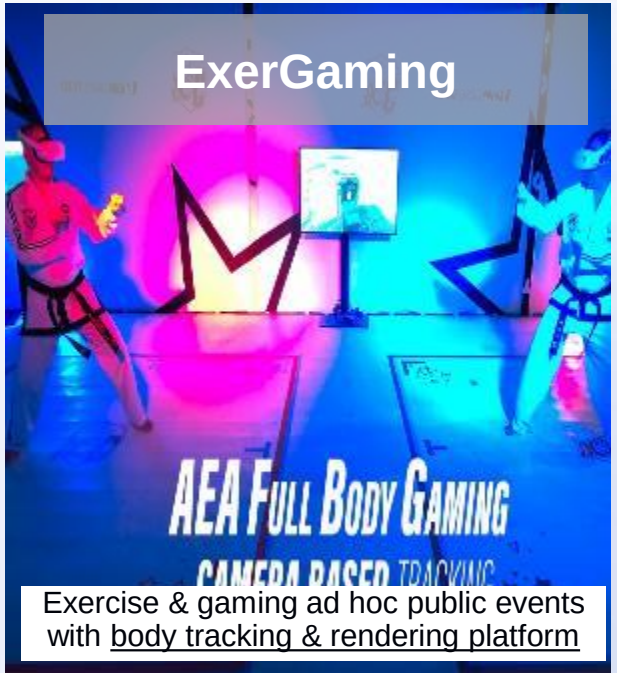
6G Wireless Factory

Access data inside machine with lowcode platform to improve productivity

Image Guided Therapy

Integrate all medical equipment of office-based clinic into platform for one user exp

ExerGaming

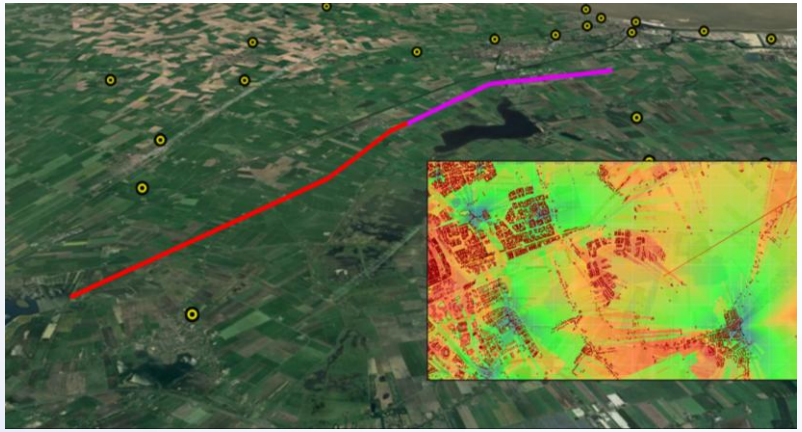


Exercise & gaming ad hoc public events with body tracking & rendering platform

6G E-Commerce

Leverage deeper access 6G network to improve E-Commerce platform experience

Transport Hub – status update ~500 days



The challenge

- Mass UAV flights need connectivity
- Mobike networks are 3d capable, but scale poorly
- 6G is designed natively for 3D coverage & detection
- Netherlands to lead the EU standard in relevant transport corridor
- Competitive advantage for DDS, network operators and drone manufacturing

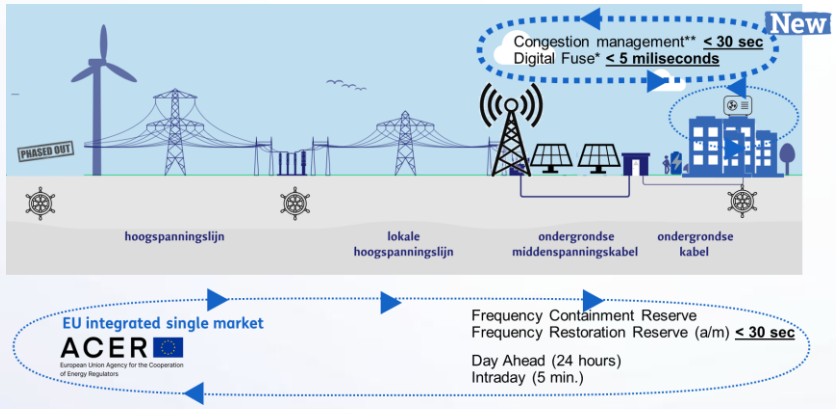
Unique capabilities

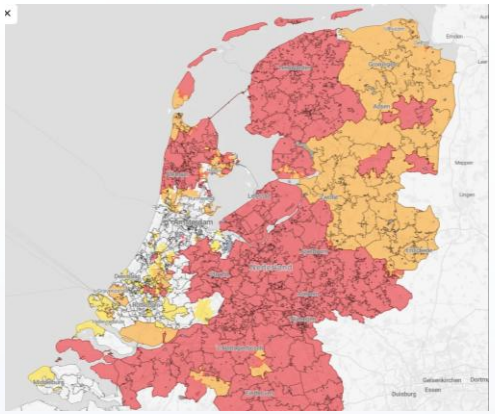
- ✓ Most advanced networks in Europe
- ✓ Successful public-private collaboration
- ✓ Urban transport
- Advanced Dutch UAV transport platform
- Research into detection (programline 1)

Intermediate outcome

- ✓ ETSI approved, 3GPP SA1
- ✓ Showcase Global MWC / CCW
- ✓ Most advanced measurements in Europe
- Most advanced flight Assen-Groningen (Q3)

Smart Grid Interative Building - status update ~500 days





European Commission

The challenge

- Flexible energy assets (buildings, batteries, EV, …) are increasing
- No resilient scalable architecture to leverage these flex assets
- 6G to decentralized exchange data to reduce congestion & improve uptime
- Competitive advantage for Comforest (a.o.) by increasing its platform offering

Unique capabilities

- ✓ Most congested electricity grid
- ✓ Part of NCDD / Actie Agenda (policy)
- ✓ High Voltage / Low voltage / Behind meter competence in one place
- Most advanced deployment in EU (Q4)
- TuDelft Research into AI grid simulation
- Research into resilience, determinism and power consumption (PL1 & PL2)

Intermediate outcome

- ✓ Radio Spectrum Policy Group (European Commission) usecase adoption
- Feasibility and value of decentralized architecture

Consortium partners

COMFOREST, TenneT, alliander, NOKIA, TU Delft

Collaborating partners

Coalitie Duurzame Digitalisering, ENEXIS, cellnex, FNS, 6G

Image Guided Therapy (IGT) – status update ~500 days

The challenge

- Overall demand for Image guided Therapy is increasing
- Increasing productivity is needed through specialized software
- Todays on premise wired deployments limit innovation
- 6G enabled solution from cloud would facilitate office-based clinics

Unique capabilities

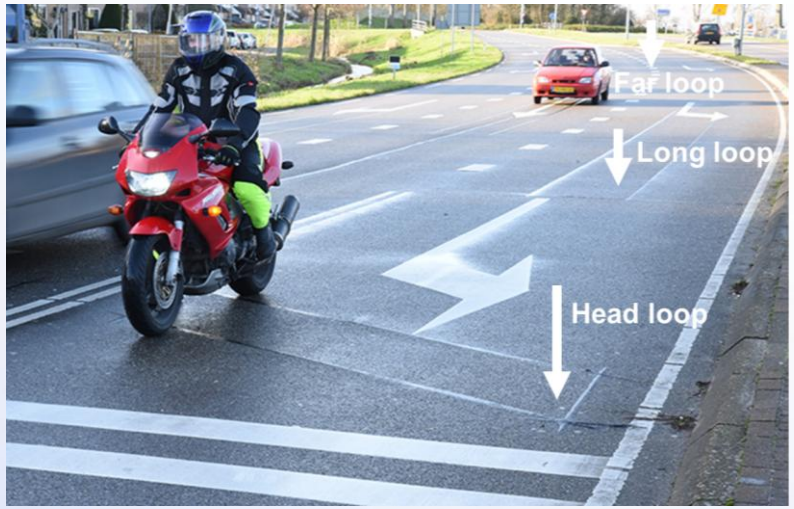
- ✓ Philips globally market leader in IGT
- ✓ PoC installed @Best Philips Campus
- ▪ Integrated in Philips cloud

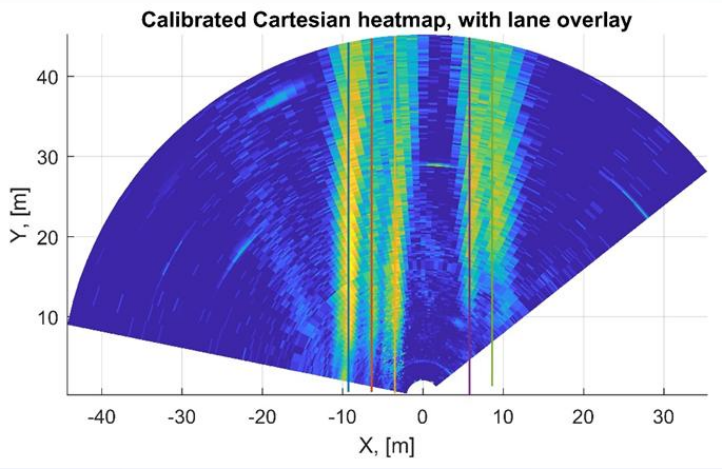
Intermediate Outcome

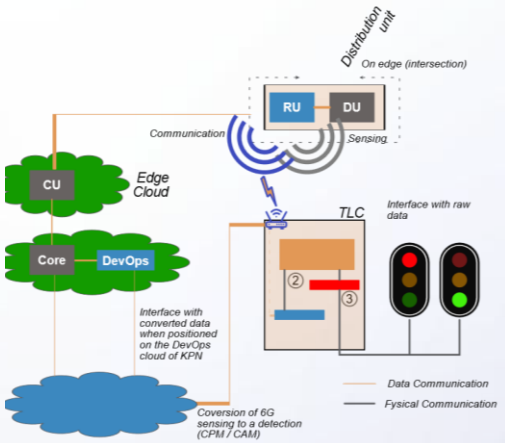
- ▪ Demonstration operating room setup for simple IGT
- ▪ Feasibility to meet realtime medical requirements over mobile

PHILIPS ERICSSON FNS 6G

Wireless Detection Loops – status update ~500 days







The challenge

- Various traffic management usecases benefit inclusivity, efficiency and safety
- However, inductive loops offer limited data and maintenance causes disruptions
- Integrating sensing into traffic mngnt cloud enables various usecases while reducing maintenance disruptions

Unique capabilities

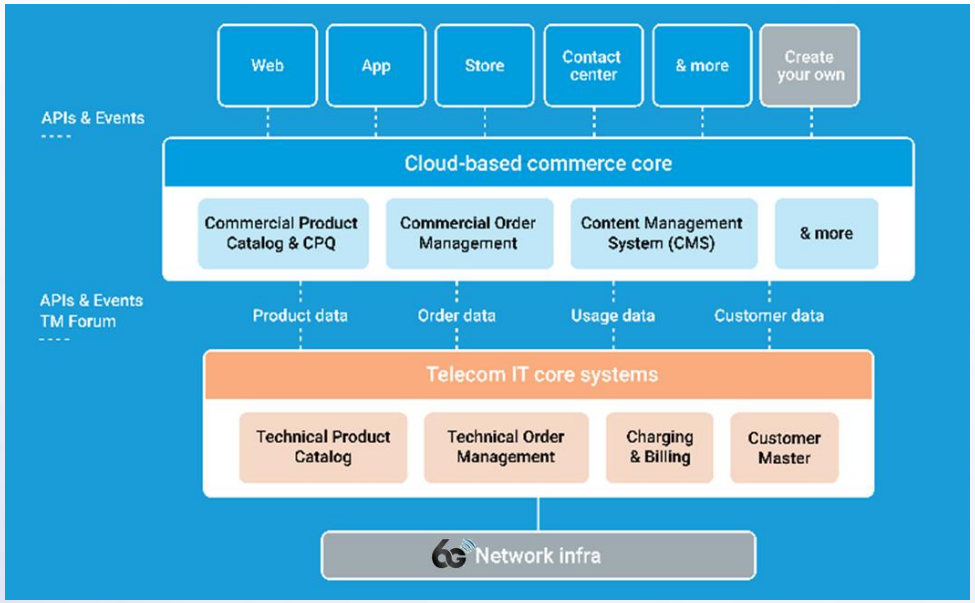
- ✓ NL is most advanced in traffic mngmnt in cities for vehicles & bikes
- ✓ Renowed Radar technology fitting a 6G cloud native architecture
- Integration of communication & sensing

Intermediate Outcome

- ✓ ETSI approval of sensing usecase
- Demonstration on intersection comparing to inductive loops

Vialis Gemeente Rotterdam TNO kpn NXP NOKIA RADARXENSE FNS 6G

eCommerce Platform for 6G telco's



The underestimated IT challenge of 6G

- 5G services are sold through M(V)NO, but the customer facing IT (BSS /OSS) is foremost designed for mass market
- IT roadmaps are highly burdened
- To capture the value of new pioneering, longtail 5G/6G products & services the customer experience, cost & time to market needs also to be addressed in a standardized omnichannel approach.

Unique capability

- Standardized modular omnichannel design
- Optimal experience (fast) & very efficient implementation

Intermediate outcome

- Go live modules
- Interface descriptions to facilitate integration

Gomibo.

Exergaming

Active Esports Arena: Uniting Motion Capture Tech. No noticeable delay, just seamless real-time body tracking. Jump, crawl, and bend in a virtual world. Combat youth sports dropout rates with immersive, active XR gaming.

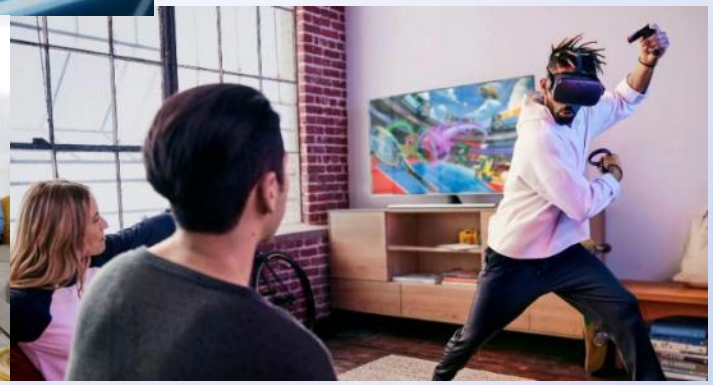
Bridging the Gap: Active Esports Arena
The challenge of engaging youth in physical activity, especially among 14–16-year-olds facing rising sports dropout rates, is met by integrating physical movement into gaming via wireless technology. This bridges gaming with physical activity, addressing inactivity while also enabling future training, prevention, and educational efforts.

Inspiring Sports Participation
School competitions demonstrated remarkable efficacy in encouraging movement without participants even realizing it. The impact was so significant that 25% of non-sporting attendees sought trial lessons at local sports clubs afterward, inspired by the talent-focused program implemented during the intervention.

Exergaming

NOW: Exergaming reduce drop-out 10-14 yr
Special local event setup ~50k equipment
Body is the controller 2 vs 2 players

2030: Exergaming as a new genre for the mass
No special equipment – only smartphones
Several locations with sufficient room many to many



Smartphone camera & 6G Edge processing for E-Sports Body tracking

INNOBEWEEGLAB

GEASSOCIEERDE AANGESLOTEN BIJ

Rapportage-Active-Esports-Arena.pdf (innobeweeglab.nl)

XR Retail

The work package focuses on optimizing XR retail experiences through AR form factor minimization, 6G integration to enhance user experience and affordability, collaboration with retail partners, and delivering a demonstrator in a retail setting by Q2 2025.

AR-Enhanced Retail Experiences on the Go

By 2030, AR glasses will transform street shopping, offering interactive, location-based product views and instant access to retail information. Users can visualize products, check availability, and compare features in real-time as they walk past stores. AI-driven remote shopping assistants will provide personalized recommendations, handle inquiries, and facilitate purchases, blending digital convenience with physical environments to create a seamless, engaging shopping journey.

Impact of 6G on AR Glasses Form Factor and Market Entry

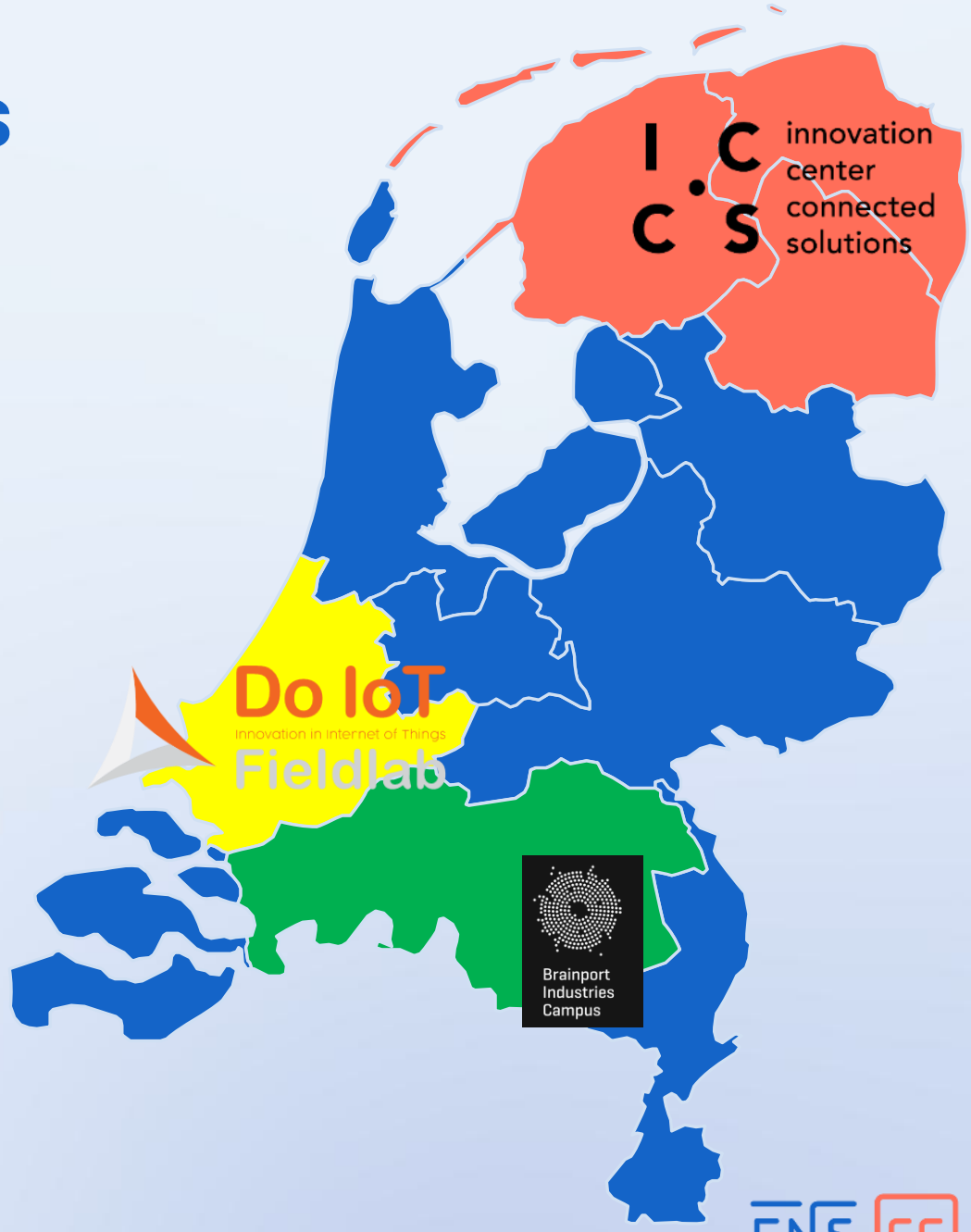
6G-enabled cloud rendering and ultra-low latency will revolutionize AR glasses by reducing on-device compute power needs. This minimizes GPU requirements, battery consumption, device weight, and heat generation. Consequently, AR glasses will become lighter, more comfortable, and energy-efficient. These advancements lower production costs, enabling broader market entry and adoption at reduced prices, making AR accessible to a larger consumer base.

Experimentation facilities within FNS

Floris Drijver – Work package lead, FNS

Fieldlabs / 5G facilities

From 5G to FNS 6G Fieldlabs



FNS 6G

Why is a 6G Fieldlab different?

Timing

Focus

Why is a 6G Fieldlab different?

Timing

Maturity of technology

Availability of Equipment

Why is a 6G Fieldlab different?

Focus

Connectivity

Cloud-Integrated Connectivty

WP4.1: 6G Testbed

We’re building the premier 6G testbed in the Netherlands, connected to other European testbeds, with a deeply committed ecosystem of partners who view the endeavor as integral to their business success.

Cutting-edge 6G testbed
- ✓ Central 6G core at TNO in The Hague.
- ✓ Field labs connected throughout the Netherlands.
- ✓ Based on flexible, open solutions.

Stimulating innovation
- ✓ Eight signature use cases with companies.
- ✓ Supporting SMEs to test their use cases.
- ✓ Capacity building and knowledge exchange among field labs.

6G roadmap
- ✓ A fully integrated roadmap incorporating technologies developed in FNS aligned with 6G standardisation.

This work package has been divided into 3 tasks

PL4.1 National 6G testbed

T4.1.1
Development and **operation**

LEAD: Floris Drijver (TNO)

- **Design, realisation**
- **Onboard new initiatives/testbeds**
- **Technical onboarding of use cases/innovation projects. Phase 1 focus: PL1, PL2, PL3**
- **Operation of ICT infrastructure at test-sites and daily technical support**

T4.1.2
Stimulating **innovation**

LEAD: Bin Hu (TU Delft)

- **Activate and connect SMEs**
- **National SME funding scheme via RVO → WP 4.3**
- **Supervise companies with their experiments**
- **Actively connect and bring together regional field labs**
- **Develop communication tools**
- **Knowledge sessions, webinars, annual FNS networking event**

T4.1.3
Roadmap development

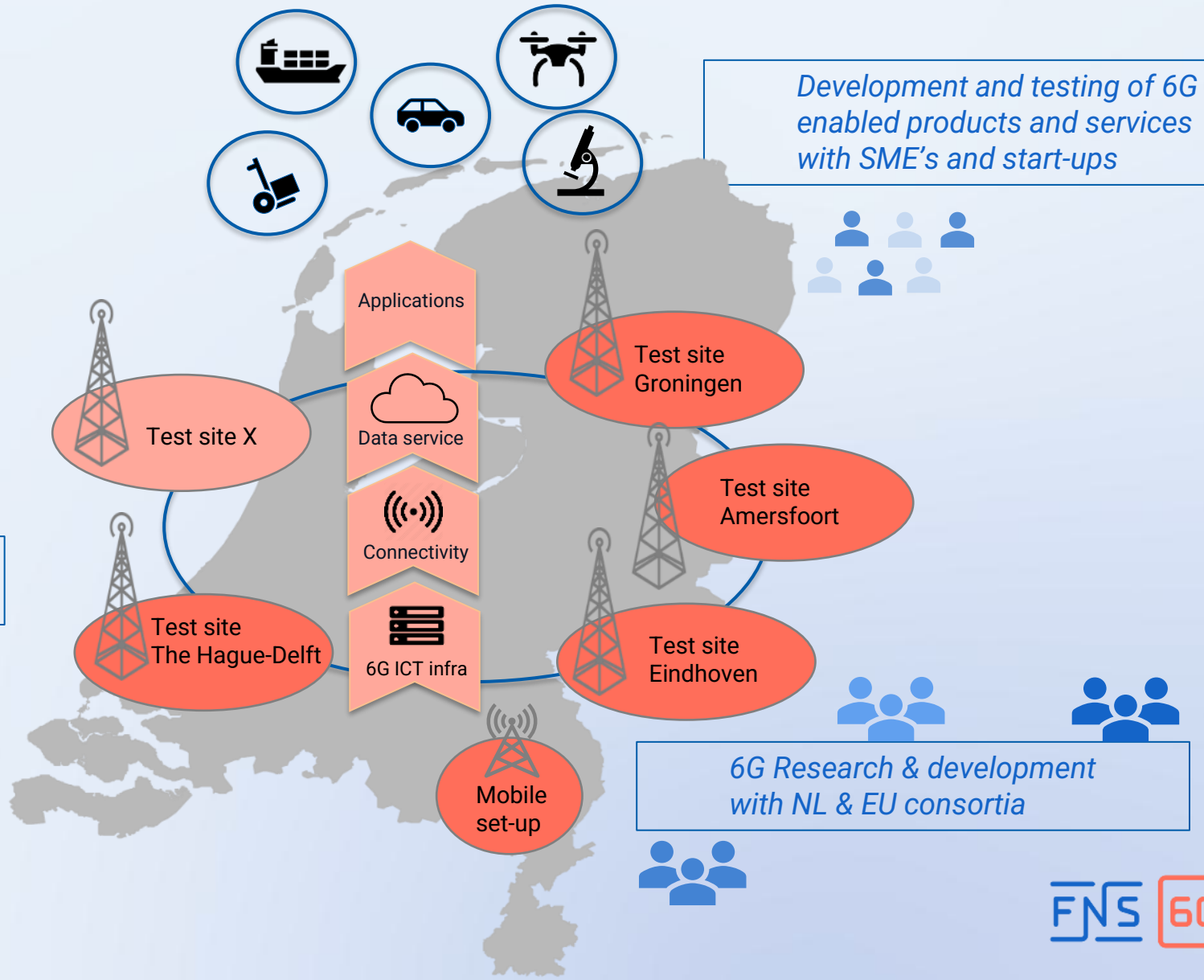
LEAD: Pascal Heijnen (TNO)

- **Technology roadmap & service roadmap**
- **Knowledge library of 6G use cases**

Testbed locations located throughout the Netherlands

Nationwide mobile networking
test center & **development community**

1. Development and operation
2. Stimulating innovation
3. Roadmap development

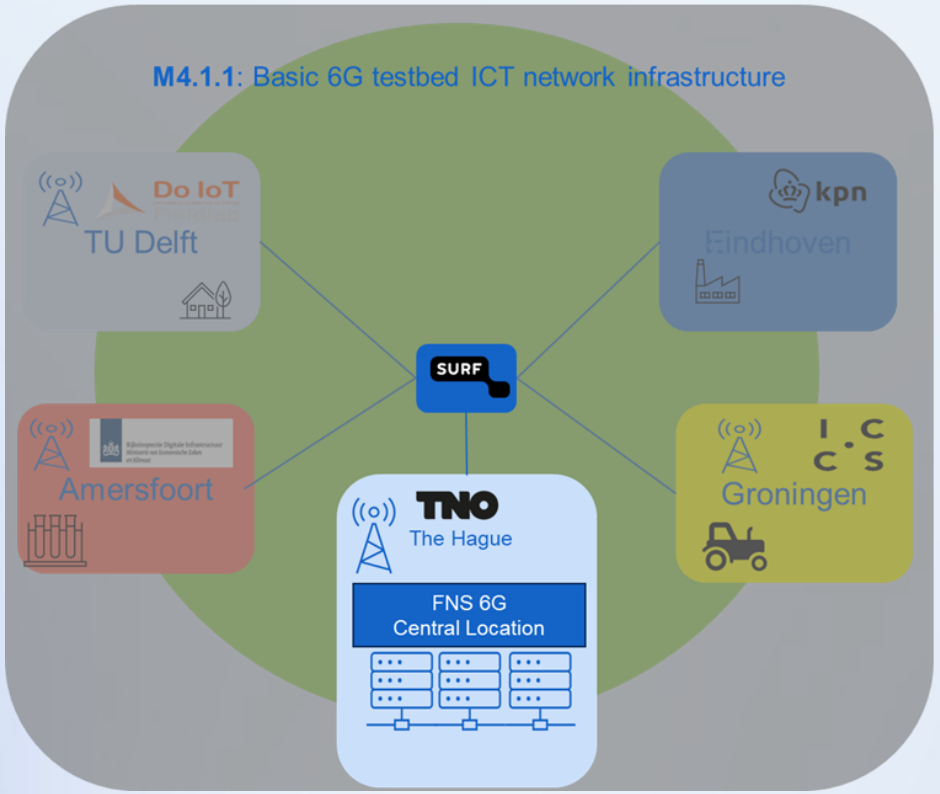


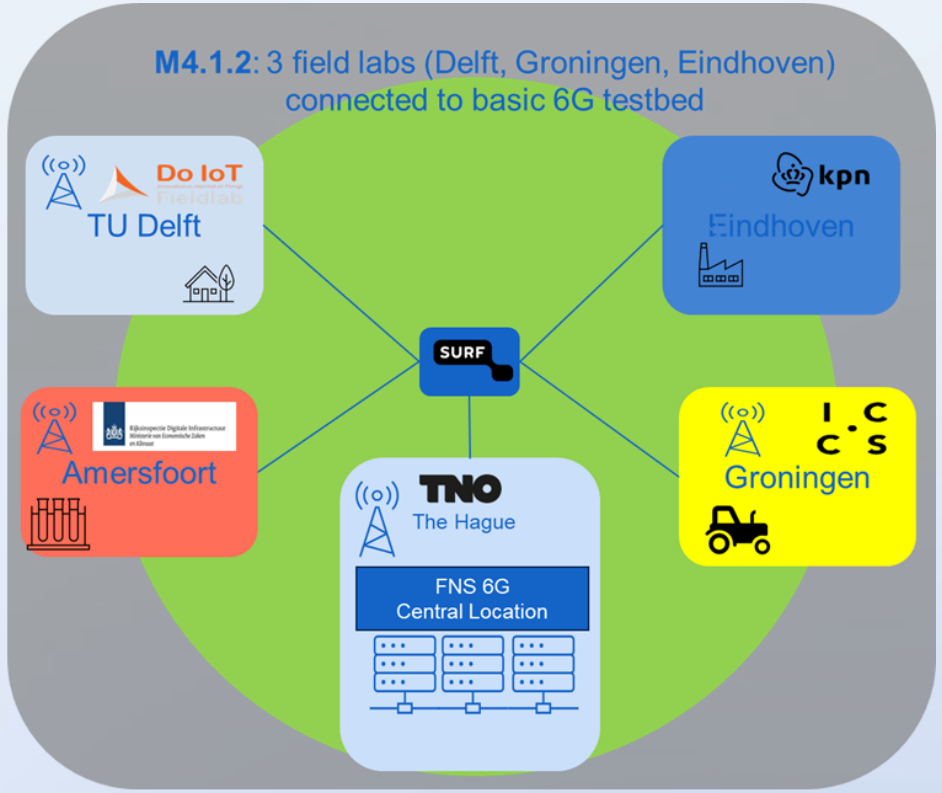
Development and testing of 6G enabled products and services with SME's and start-ups

Innovating, working, and learning together in Learning communities

6G Research & development with NL & EU consortia

Milestones and Deliverables of Phase 1





M4.1.1 Basic 6G testbed ready: DEC 2024

- The basic infrastructure design is implemented at TNO DHA and SURF.
- Designs to connect fieldlabs to the Basic 6G testbed

M4.1.2 Three Fieldlabs connected: JUN 2025

- 6G Infrastructure deployed at the three fieldlabs and integrated together to form the national 6G testbed

Q&A

FUTURE NETWORK SERVICES 6G

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