Introduction to 5G Test Network Finland (5GTNF) ecosystem R&D results and future goals

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Needs for 5G Test Network

5G features:

- Unlimited Broadband experience
- Instant Action
- Things Connected
- Ultra Reliability
- Slicing
- Virtualization
- Energy saving

Source: 5GPPP
Open innovation ecosystem for 5G technology and service development

- Beyond state-of-the-art technologies
- Flexible service configurations
- Standardised and open interfaces
- Extensive access to monitoring and testing data

- Automotive
- eHealth
- Emergency & Public Safety
- Energy
- Factories of the Future
- Media & Entertainment
- Smart Cities

- Multi-site test network developed and maintained by R&D projects in Business Finland 5thGear programme
- Focus on pre-standard experimental technologies

- Support for technology validations and tailored service trials and demonstrations
- Main access sites in Espoo and Oulu
  - Additional site locations in Helsinki, Tampere, Turku, Ylivieska and Sodankylä
Current core test platform with state-of-the-art technologies

- From LTE evolution to 5G radio access
- Provides access for the IoT network (NB-IoT, LTE-M, LoRa) to test your devices and applications
- New frequencies and spectrum sharing
- MEC’s to bring services close to users access
- Network slicing
- C-RAN, SDN and NFV technologies
- eMBMS enables efficient broadcasting to mobile users
- Core network in a cloud environment
- Cloud systems for applications
- Connection between test sites in Finland and worldwide
- Monitoring of selected KPIs from network elements and interfaces for your use case
Architecture in Oulu

Frequency
- 700MHz B28
- 2.6 GHz FDD B7
- 2.1GHz TDD B1
- 2.3GHz TDD B40
- 3.5GHz TDD B42
- 3...5GHz 26...28GHz

RAN
- LTE-NB/M1
- WIFI/BLE
- LoRa
- LTE
- 5G PoC

Edge Processing
- Alternative EPC’s
- MEC

Centralized Cloud
- EPC Core/CWC
- EPC Core/VTT
- IoT Data storage & analytics

Services
- SDM / Nokia Tre
- Other 5G Test Networks
- VPN

IoT Data Storage & Analytics
- Centralized Cloud
- MEC

MEC
- EPC Core/CWC
- EPC Core/VTT
- IoT Data storage & analytics

Other 5G Test Networks
- SDM / Nokia Tre
- VPN
Latest result examples

- Infrastructure with MEC, network slicing and network virtualization, concepts and technologies for RAN cloudification, mobility, security and energy efficiency, TAKE5
- 5G light pole infrastructure with integrated / camouflaged 5G mmW radios, sensors, cameras, information displays and other devices, LUXTURRIM5G
- Concepts and technologies ensuring QoS for critical services in a commercial radio network and enabling temporary deployment in an area without mobile network coverage, CORNET
- Sensing care for long-term health and wellbeing (mMTC), real-time cellular IoT monitoring for sport wearables (mMTC) and 5G in media production and distribution (eMBB), 5GTN+
- 5G enabled solution for smart grid protection (uRLLC), automation in a harbour (uRLLC), maintenance and asset management environment (mMTC) and high capacity data transfer with 60 GHz link (eMBB), WIVE
- MEC based low delay connectivity solution for autonomous vehicles (uRLLC), 5G-SAFE
Ecosystem founding members

Network manufacturers

Operators

Technology and R&D service providers

Testing systems and tools manufactures

Verticals/applications developers

Public organizations

Research organisations
5G Test Network Finland 2019 ->

MISSION

5G Test Network Finland is open and evolving innovation ecosystem supporting 5G evolution and Beyond 5G technology research and validation, vertical industry product development and pioneer company experiments.

VISION

Beyond 5G R&D and utilization of AI and novel cyber security concepts are ramping up and offer excellent business opportunities to both telecom and vertical industries.

SOLUTIONS FOR VERTICALS

- Smart Industries
- Smart Cities and Living
- Smart Mobility
- Smart Health and Wellbeing

PLATFORM R&D

- Beyond 5G Network and Radio enablers
- Artificial Intelligence
- Service security privacy and data management
- Development and integration of test network
Future (2019 ->) targets

- regeneration
  - 3GPP Rel16-, 5G and beyond communication concepts, towards 6G
  - utilization of AI in radio resource and network management and vertical use case implementation, novel cyber security concepts
- vertical use cases utilizing 5G and beyond, AI and cyber security concepts

- interdisciplinary approach
  - co-operation between telecom and vertical (automation, energy, health, safety, media, automotive, buildings, …) area technology and business model experts

- differences compared to existing research;
  - Strong support to verticals
  - Integration of Beyond 5G research, vertical use case design, utilization of AI, cyber security concepts and large area research infrastructure integration

- differences compared to pre-commercial test environments;
  - more future looking, non-commercial (still under standardization and research, utilization of AI, novel cyber security) technologies, flexibility, wide set of tools and co-operation possibilities with wide eco-system
Future goals; Platform R&D

- **Scope:**
  - B5G, cyber security and AI research
  - Development of common network modules/parts
  - Development and integration of test network
  - Platform experiments manager and cross platform orchestrator

- **Technology focus:**
  - *Network Technology enablers:* Edge computing, Network slicing, Industrial Internet, Massive scale autonomous IoT network
  - *Radio Technology enablers:* positioning and tracking, RAN support fo UAV’s, multi-RAT mobility and connectivity, mmw massive MIMO, uRLLC platform, radio enablers for dense 5G networks
  - *Artificial Intelligence:* network management and self healing, mobility and radio beam management, uRLLC and E2E reliability, Media & Entertainment, AI integration to verticals
  - *Service security privacy and data management:* AI applications in Security, Trust and blockchain, DoS vulnerabilities and defencies, Roaming security, Cyber-Security interface for verticals
Future goals; Verticals related R&D

- **Scope:**
  - vertical specific technology R&D
  - Development of vertical specific technology components and solutions
  - Implementation of vertical trials

- **Trial plans:**
  - Harbors, digital factories and smart grids monitoring and control (5GVIIIMA)
  - Monitoring and control of building heating and energy consumption, smart charging and remote inspection with drones (SMART OTANIEMI)
  - Live AR/VR streaming with eMBB network in crowded environments (5G-ENHANCE)
  - Critical communication use cases; search and capture, support to smart rural business and emergency response (PRIORITY)
  - Media production and distribution, video and sensor analysis from a sport match, live virtual reality streaming, athlete positioning technologies for sport wearables (5GEXPERIENCE)
  - Air quality monitoring for smart cities (MEGASENSE)
  - Solutions for healthcare, aquaculture and transport (5G-HEART)
  - Solutions for communications with drones (5G-DRONE)
5G Test Network Finland (5GTF) Summary

- Status
  - The 5G Test Network Finland first phases (->2018) focused on the first 5G releases (up to Rel-15) technologies, development of separate test beds and some vertical use case proof-of-concepts.
  - Commercialization of the first 5G network generation has started. At the same time, B5G R&D and utilization of AI are ramping up and offering excellent business opportunities to both telecom and vertical industries.

- Current R&D activities:
  - Technologies and innovations related to B5G network and radio enablers, cyber security, utilization of AI and business models.
  - Integrated multi-site B5G flexible research test network, flexible sharing of spectrum and infrastructure with MNO’s.
  - 5G and beyond technologies and solutions for vertical industries; smart industries, cities, living, mobility, health and wellbeing and critical communications.
VTT Connectivity R&D - summary

- Cyber security
- Autonomous systems connectivity
- 5G and beyond networks
- Efficient computing and communications
- Antennas and RF technology
- Photonics integration

5G Test Network Finland (5GTNF) – Open innovation ecosystem for 5G and beyond technology and service development
Thank you!

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