5G CHAMPION

5G Communication with a Heterogeneous, Agile Mobile network in the Pyeongchang Winter Olympic competition

WP6 - 5GCHAMPION Trial at OG Venue: Experience of immersive 5G services: Korea-Finland connected

Ilgyu Kim/ETRI and Aki Korvala/Nokia
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Content of this presentation

- **EU background, Aki Korvala**
  - What was the EU challenge?
  - What was done and when in Oulu?

- **Korean background, Ilgyu Kim**
  - What was the Korean challenge?
  - What was done?
  - Preparation for demos

- **What 5GChampion demos are about? Aki Korvala**
- **What happened in Gangneung and in Oulu? Ilgyu and Aki**
  - Video from Oulu
  - Video from Gangenung
EU background
**EU: What was the EU specific challenge?**

- **To design and build a system that will:**
  - Be ready within 18 months and to be shown in 2018 Olympic games
  - Meet 2 pillars of 5G KPI’s:
    - Speed => Giga bits per second
    - Latency => millisecond latency
  - Have an easy interface to add "what ever latency or speed hungry" 5G application on top of it
  - Easy to deploy
EU: What was done and when in Oulu? POC system part

- 5GPOC system: Design areas....

UE
- RF board
- Digital board
- Mechanics
- RF SW
- MCU SW

BTS
- Json
- Matlab

- FPGA SW
- Python
EU: What was done and when in Oulu? For demos

General management:
- HW acquisition for demos
- Logistic planning for demo and people
- Partner management

1. Oulu - Gangneung
   - Live streaming
     - Special school program

2. Remote IoT
   - Live streaming
     - Korea events

3. Demo places:
   - Agreements of usage
   - Volunteers
   - IP connectivity

PR:
- VR class design
- Business cards
- 360 videos
- Roll-ups
- Fliers

Coding for IoT:
- Python
- Json
- Arduino/Raspberry
- Android
- IOS
- Amazon cloud
EU: Some pictures how we did achieve 5G Champion demos.

5G Oulu team ready for Olympics
Korean background
Korea: What was the Korean specific challenge?

- Focus on mmWave wireless backhaul for MHN (Mobile Hotspot Network)
  - Development of Gbps level mmWave moving wireless backhaul system
  - Apply for the system on moving vehicle (Subway Train and BUS)
  - World first demonstration on running subway train
  - World first commercialization of mmWave moving wireless backhaul (for subway train)
  - Demonstration of the system in conjunction with Olympic game (in Ganeung area using BUS)
KR: What was done and when in Korea?

- Development of 1.25 Gbps of wireless backhaul (MHN) and field test
  - 5 mRUs was deployed (2.5 Km) in Seoul subway line 8
  - 1.25 Gbps backhaul link performance test was done in Seoul subway (2017.2)
  - Seamless handover was achieved
KR: What was done and when in Korea?

- **BMT of 1.25 Gbps of wireless backhaul for Seoul subway train**
  - Wi-Fi service test was done (2017.6)
  - MHN technology has passed the Bench Mark Test of Wi-Fi services for Seoul subway (2017.12)
  - World first Gbps level high speed Wi-Fi service (in train) will be launched in this year on one of the Seoul subway lines, and then extended to whole lines.
KR: What was done and when in Korea? POC system part

- Development of 5 Gbps of wireless backhaul (MHN-E) and field test
  - Lab and Field test using BUS in ETRI (~ 2017. 12)
  - Field test using BUS in Gangneung Yolkog street (~ 2018. 2)

(Link performance, Field)
• Preparation of 5GCHAMPION booth in Ganeung ICT Squire
  ▪ Request the booth for MSIT/NIA/Olympic committee (2017.2)
  ▪ Get the final confirm for the 5GCHAMPION Booth (2017.11)
  ▪ Give the basic layout of the 5GCHAMPION booth to NIA

• KOREN deployment on ICT Squire for inter-continental operation
  ▪ Request to NIA to connect KOREN on ICT squire (2017. 11)
  ▪ KOREN deployment on ICT Squire (2018. 1)
KR: Preparation for Demo (Olympic place, Gangneung)

- **Apply for the frequencies of EU and KR on Gangneung area**

  5GCHAMPION (KR-EU 5G project)

  KR 5G PoC
  - Gangneung IoT Street (BUS)
  - BW: 1 GHz
  - 25.1432

  EU 5G PoC
  - Gangneung K-ICT Booth
  - 26.5
  - 800 MHz
  - 27.3

  KT 5G Services
  - Olympic Venue
  - 27.5
  - 28.35
  - 850 MHz

- **Outdoor BUS demo preparations**
  - Deployment of mRU and mDU, mGW (2018. 1)
  - Pre field test on Gangneung Yolgok street (2018. 2)
What 5GChampion demos are about?
5GCHAMPION DEMONSTRATION

In Finland (Oulu)
- Interactive VR-IoT
- 360 video streaming

In Korea (Gaengeung)
- Interactive VR-IoT
- 360 video streaming
- Augmented reality
- Super 3D multiview

- Distance ~14000km
- Latency ~300ms
What is the 5G with these demos?

**In Finland (Oulu)**
- Interactive VR-IoT
- 360 video streaming

**In Korea (Gaengeung)**
- Interactive VR-IoT
- 360 video streaming
- Augmented reality
- Super 3D multiview

**Massive broadband with IOT-Data and remote control. >1Gbps and 0.3ms latency**
Possible use cases:
- Remote surgery
- Remote controlled drones and unmanned vehicles
- Remote controlled factories
- 5G events: 360 video+IOT data in VR-classes to get more experience.

**Massive broadband. >1Gbs…5Gbps**
Possible use cases:
- Fibre like speed Over The Air
- Unpacked 4k/8k video delivery
- AR enhanced maintenance in factories
- VR gaming in network
- Virtual 3D presence
What happened in Gangneung and in Oulu
Some pictures how we did achieve 5GChampion demos..

- 3D multi-view with mmWave 5G backhaul (Gangneung ICT Square)
  - Indoor environments

![Diagram of 3D multi-view display](image)

Demo. for vice-minister of MSIT (Feb. 2 2018)
KR: Some pictures how we did achieve 5GChampion demos..

- KR-EU inter-continental PoC Services (Gangneung ICT Square)
  - Real-time streaming 360 degree video from EU to KR
  - Interactive Augment Reality with Maps
Some pictures how we did achieve 5G Champion demos.

- **3D multi-view with mmWave 5G backhaul (outdoor)**
  - Demo. using BUS (Yulgok street nearby ICT Squire)
VIP visit

Finnish Prime Minister Mr. Juha Sipilä visited K-ICT center 20.2
With Finnish Olympic committee members
And some fun..
• 40 volunteers from UOULU, Business Oulu, Nokia, Kastelli-school and City library were showing 5GChampion demos to school age childrens and to Oulu citicens during 20-22.2

• Press visit:

• Visitors:
  ▪ 100 per day for Library
  ▪ 400 people on Kastelli –school Tuesday, 300 in Wednesday(20-21.2)
Kastelli-school had a presentations whole demo time for spectators in City –library and in K-ICT.
Short video clip about 20-2 day from Oulu