新岸线·NUFRONT

EUHT: IMT-2020 Submission

Dec 2019

START

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Part 01

ABOUT NUFRONT

Nufront Technology Group

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Offices

- Founded in 2004
- R&D Center and headquartered in Beijing
- Branches in Shanghai, Guangzhou, Shenzhen and Tokyo

Employees

- About 1000 employees
- More than 75% are Ph.D. and postgraduate degrees

Focus

- Innovative Wireless Communication Systems for Vertical Market
  - PHY/MAC Protocol, SoC, Products, Deployment,…

Part 02

About EUHT

Overview

- **E**nhanced **U**ltra-**H**igh **T**hroughput
- Specially designed for vertical market from the scratch
  - High throughput
  - Ultra high reliability
  - Ultra low latency
- Started R&D in 2007, Deployed in many scenarios
  - High speed train, Subway, Rural area, Vehicle, Factory …

Main Features

- TDD OFDM
  - Sub-carrier spacing: 19.53KHz, 39.0625KHz, 78.125KHz, 390.625 kHz (for mmWave band)
  - CP: 1/8 , 1/4
- Working frequency bands: sub-6GHz and mmWave band
- Self-contained and flexible frame structure
- Support TDMA/OFDMA/SDMA
- MIMO: up to 8 streams

Self-Contained and Flexible Frame Structure

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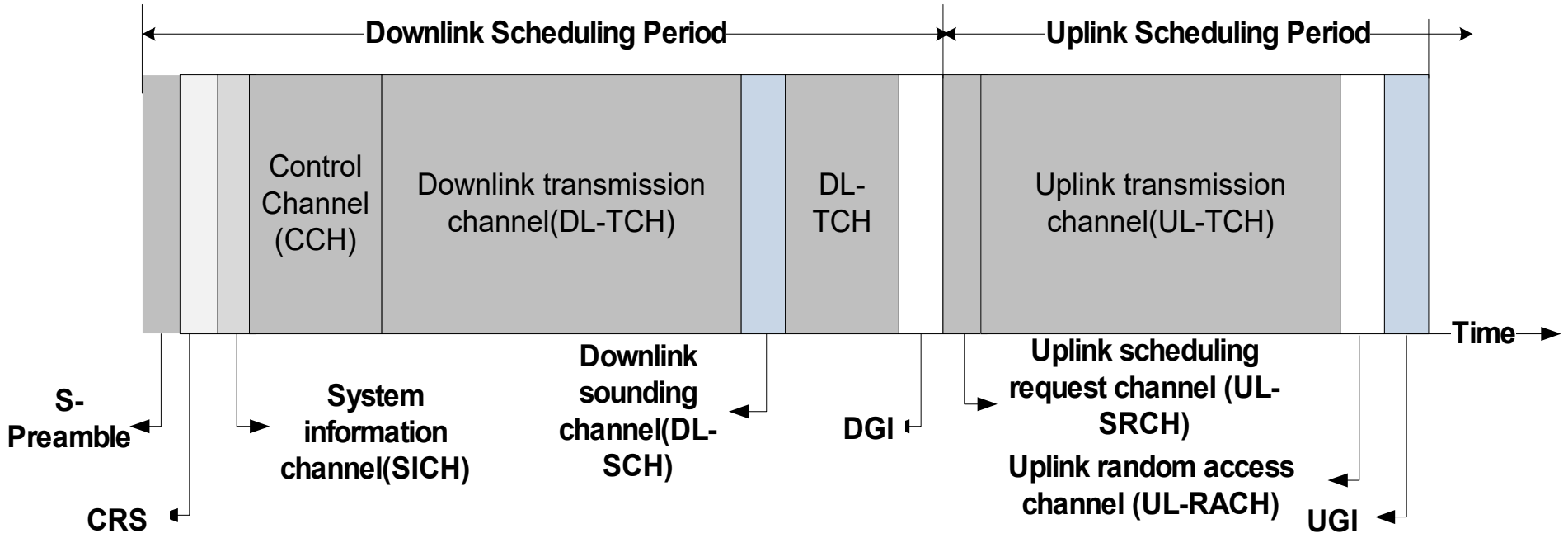

S-Preamble	Sync , AGC	**UL-SRCH**	Service Request Channel
CRS	Fine Sync	**UL-RACH**	Random Access Channel
SICH	Broadcast Information	**DL-TCH**	DL Traffic Channel
CCH	Resource Allocation Information	**UL-TCH**	UL Traffic Channel
DL-SCH	DL Channel Measurement	**DGI**	DL Guard Interval
UL-SCH	UL Channel Measurement	**UGI**	UL Guard Interval

Flexible and Efficient for Various Scenarios

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Scenarios	Requirements	Impact of System Design
Home broadband access	Static	Sparse Pilot Density, Long frame length downlink-dominant
Wireless video surveillance	Static	Sparse Pilot Density, Long frame length Uplink-dominant
Metro video surveillance	High vehicle speed	Dense Pilot Density, middle frame length Uplink-dominant
HST passengers network service	Very High vehicle speed	Denser Pilot Density, short frame length Downlink-dominant;

- **Different requirements for Different application scenarios**
- **EUHT is extremely flexible and easy to adapt to given scenario**
  - *Frame length : 0.1ms ~ 14 ms*
  - *Pilot Density: 0.04ms ~ 14ms Pilot interval*
  - *DL/UL ratio can be fine-tuned in unit of one OFDM symbols*

Meet the IMT-2020 Requirement

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- Indoor / Dense Urban / Rural eMBB
  - both average and 5-percentile spectral efficiency surpass the requirements
- URLLC： *>99.99999%*
  - For evaluation configuration A (4 GHz), Channel model A
- mMTC： *135,900,382 / 625 kHz*
  - For evaluation configuration A (ISD=500m) with full buffer system level simulation followed by link level simulation; Channel model A
- Mobility: up to *500km/h*

Evaluation Results from BUPT and Tsinghua University

- BUPT (Beijing University of Post and Telecommunication) and Tsinghua University
  - The Top Universities in Wireless Communication in China
- Evaluation is based on M.2412 and the results show that EUHT can meet the IMT-2020 requirements in all five test environments

EUHT: multiple industrial and national standards

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- Industrial Standard for Wireless Communication (2012)
  - YD/T 2394-2012
- National Standard for Cooperative Vehicle and Road Communication (2014)
  - GB/T 31024-2014
- Industrial Standard for Realtime HD Video Surveillance transmission in Metro (2016)
  - CJ/T 500-2016
- National Standard for Wireless Communication (2018)
  - GB/T 36454-2018

Part 03

EUHT Applications

EUHT Project Case — Jingjin Intercity High-Speed Rail

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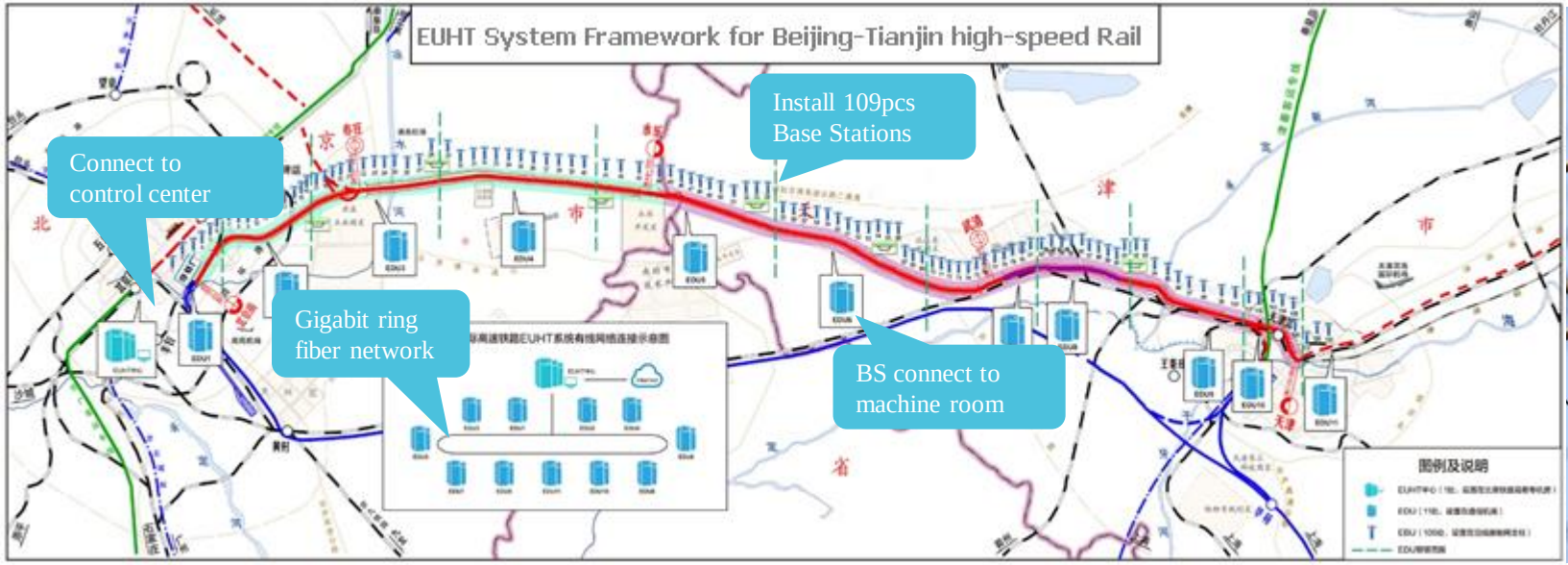

- Commercial use: Jan 2017
- 120km, 109 Base stations
- 150Mbps @ 300km/h
- 100% Handover Success ratio @ 300km/h

EUHT Project Case — Guangzhou Metro

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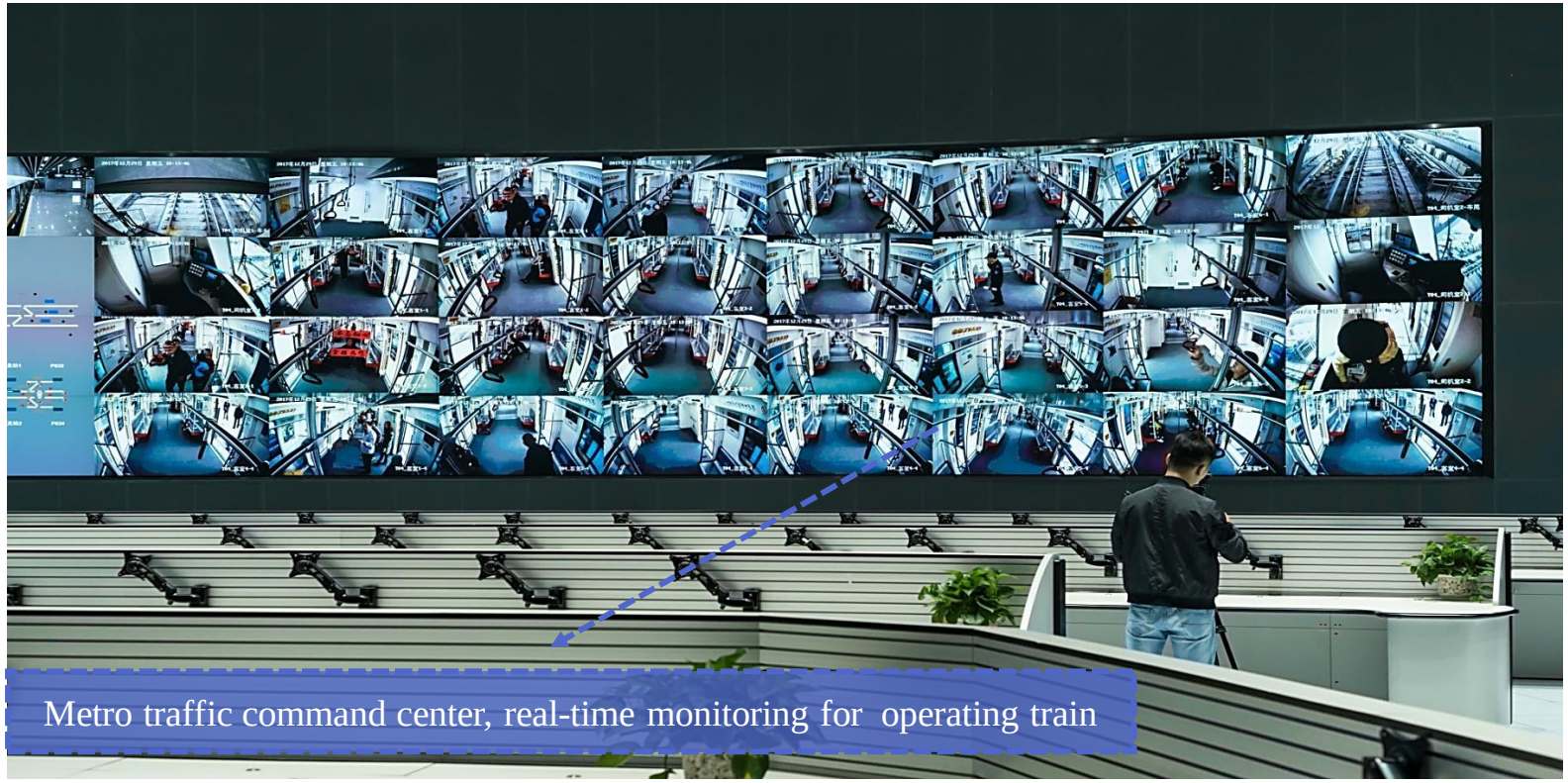

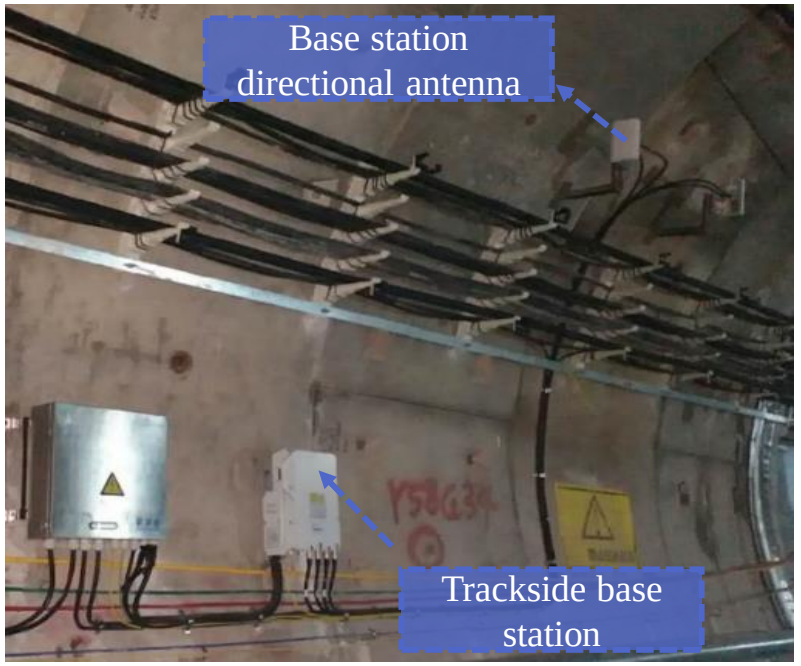

- Commercial use: Dec 2017
- 410Mbps @ 120km/h
- 30 channel HD-CCTV per train

EUHT Use Case — Beijing Vehicle Networking Park

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- *V2V for* ***Platooning***
  - ***exchange the information of vehicles with high reliability and low latency***
- ***V2I for HD video transmission to control center***
  - ***remote control***

EUHT Project Case —Broadband Coverage in Rural Areas

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- 2015 ~ Present
- Most cost effective solution to solve the “last mile” problem
- Single Base station coverage > 2km
- 5,000 villages, 1 million families

GSK CNC (Computerized Numerical Control) Factory

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- May 2018
- Replace cable to support flexible manufacture
- Reduce the maintenance cost

EUHT Project Case — 8K Ultra-HD Live Transmission

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- Jan 2019, with China Telecom
- 130~200 Mbps, low error, low latency
- Commercial use in Basketball World cup

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Thank You

END