

AI / Machine Learning for Strengthening Communication Infrastructure for Future Smart Cities



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Sustainable Development Goals (SDGs) as Common Vision

UTokyo Future Society Initiative

<https://www.u-tokyo.ac.jp/adm/fsi/en/sdgs.html>

SUSTAINABLE DEVELOPMENT GOALS 17 GOALS TO TRANSFORM OUR WORLD



As of 2018/4/5, **170 SDGs projects** have been registered
<https://www.u-tokyo.ac.jp/adm/fsi/ja/projects.html>

UTokyo FSI promotes SDG-oriented projects in a wide range of fields throughout the University, and showcases them as actions taken by the University as a whole.

In particular, **in regards to collaboration with the industrial sector, the University utilizes the SDGs as a basic common vision for new business growth.**



EU-Japan Jointly Funded Project on 5G Mobile Network (PIs: Akihiro Nakao@Utokyo and Tarik Taleb @Aalto Univer

<https://www.u-tokyo.ac.jp/adm/fsi/en/projects.html>



5G! PAGODA

A network slice for every service!



EUJ-01-2016 - 5G - Next Generation Communication Networks

Our Partners



THE UNIVERSITY OF TOKYO



NEC

NEC Networks & System Integration Corporation



Funding Size

EU Total cost:

EUR 2.2M

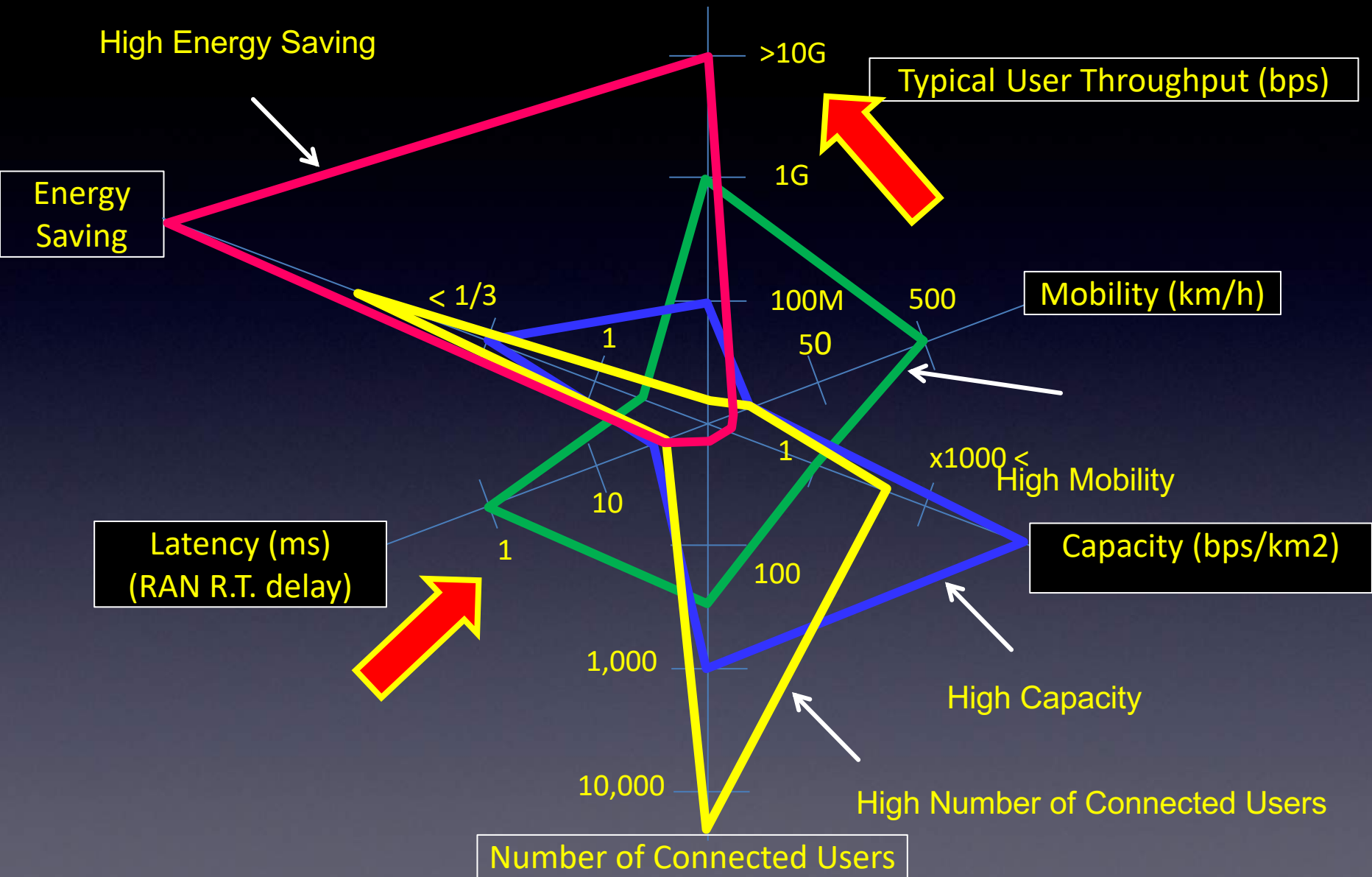
JP Total cost:

225 M JPY

Duration: 3 years
(2016-2019)

5G!Pagoda is funded by the European Commission's H2020 program under grant agreement n° 723172.

5G Mobile Key Performance Indicators (KPI)



Connected Car



Civil Engineering



Video streaming from drone



Stadium Entertainment



Smart Station



Smart School



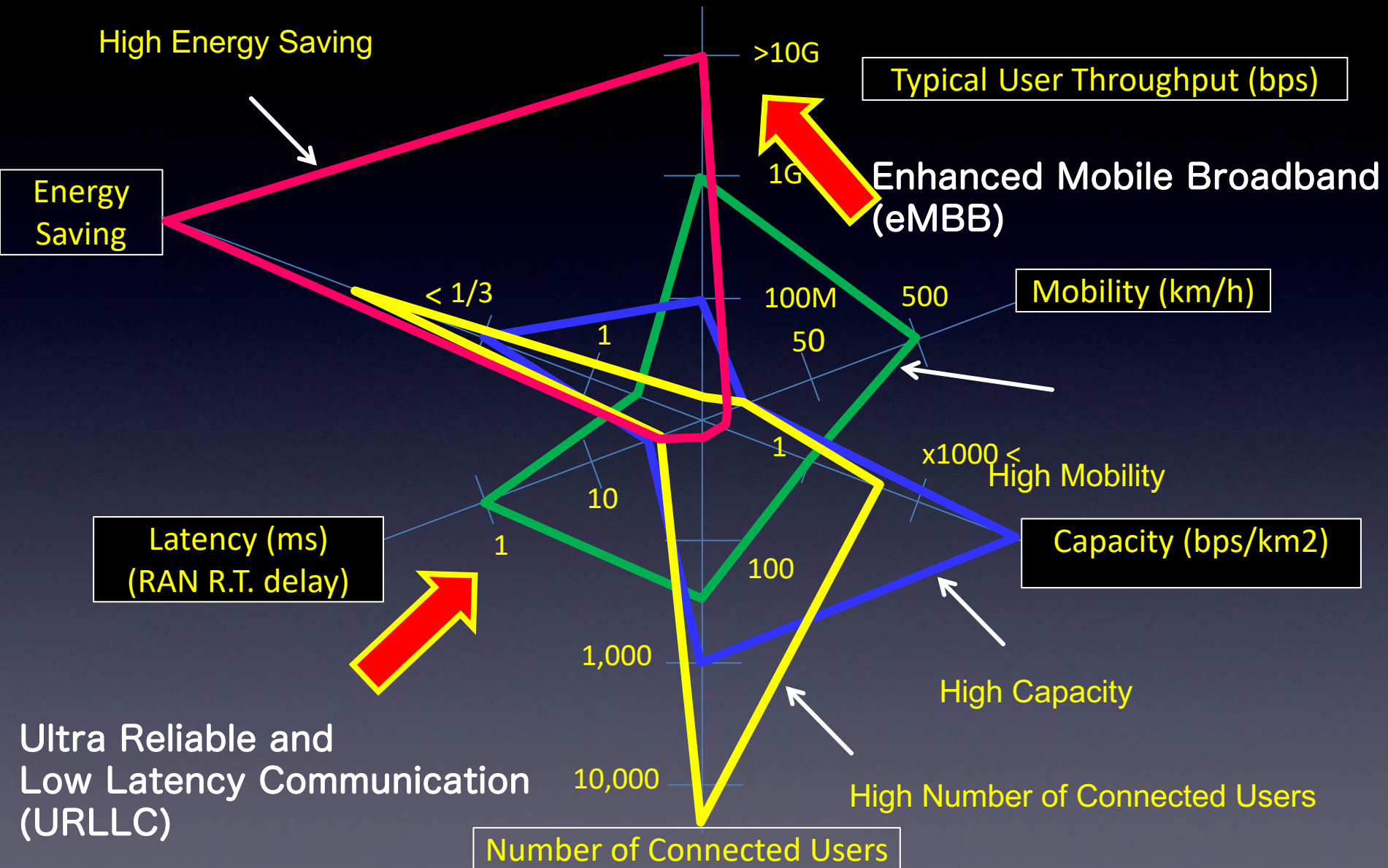




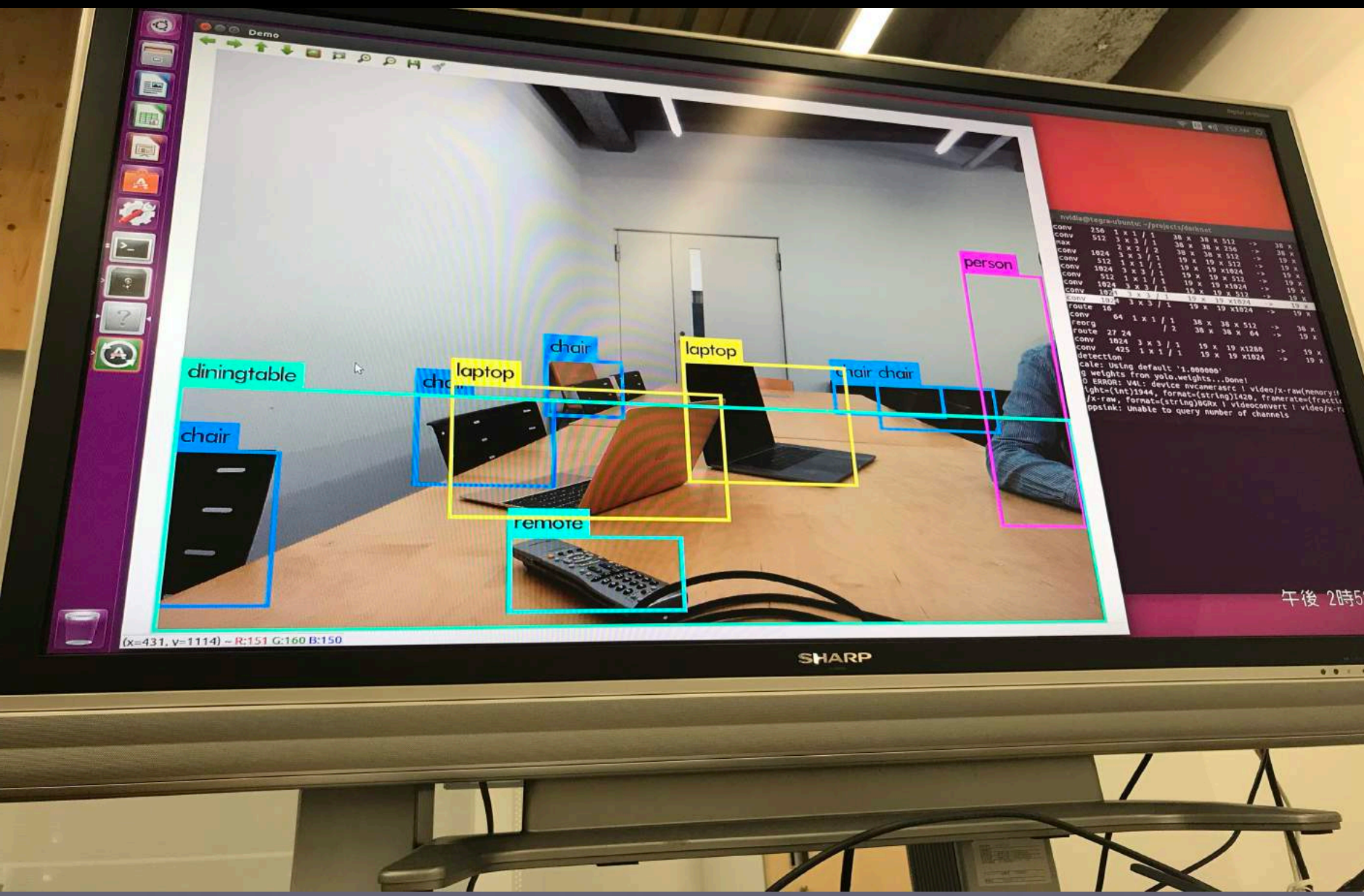
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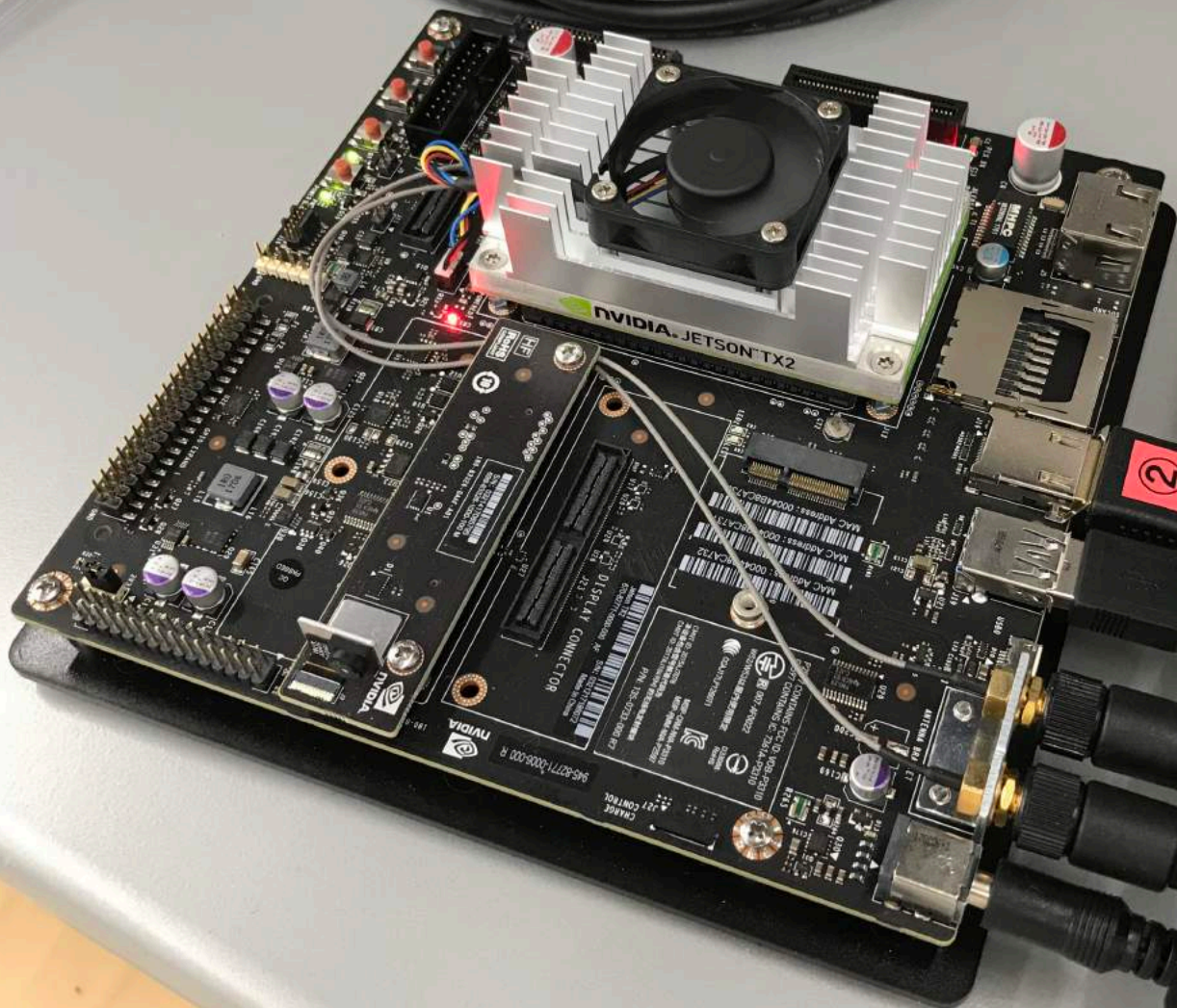


5G Mobile Key Performance Indicators (KPI)

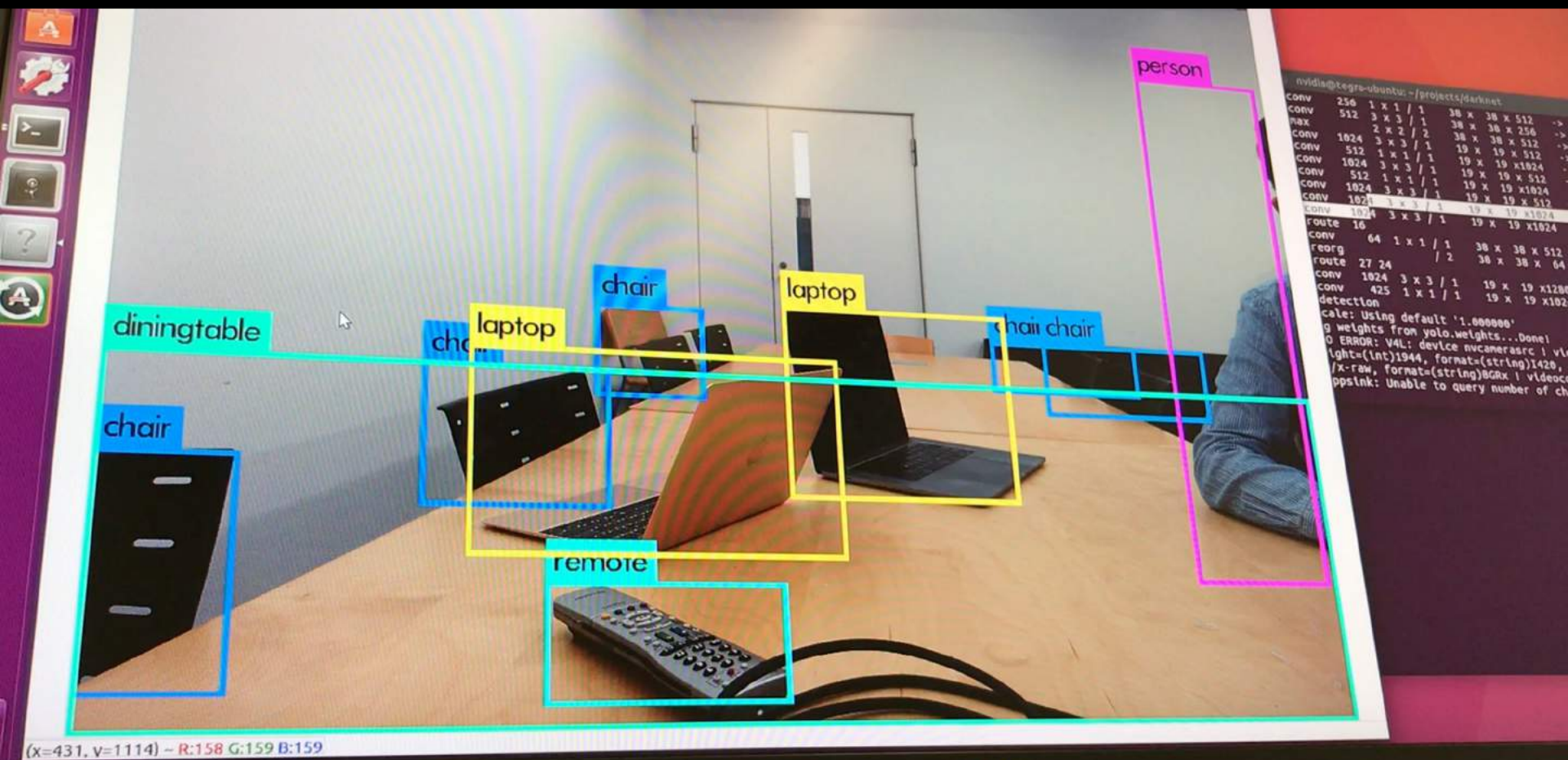


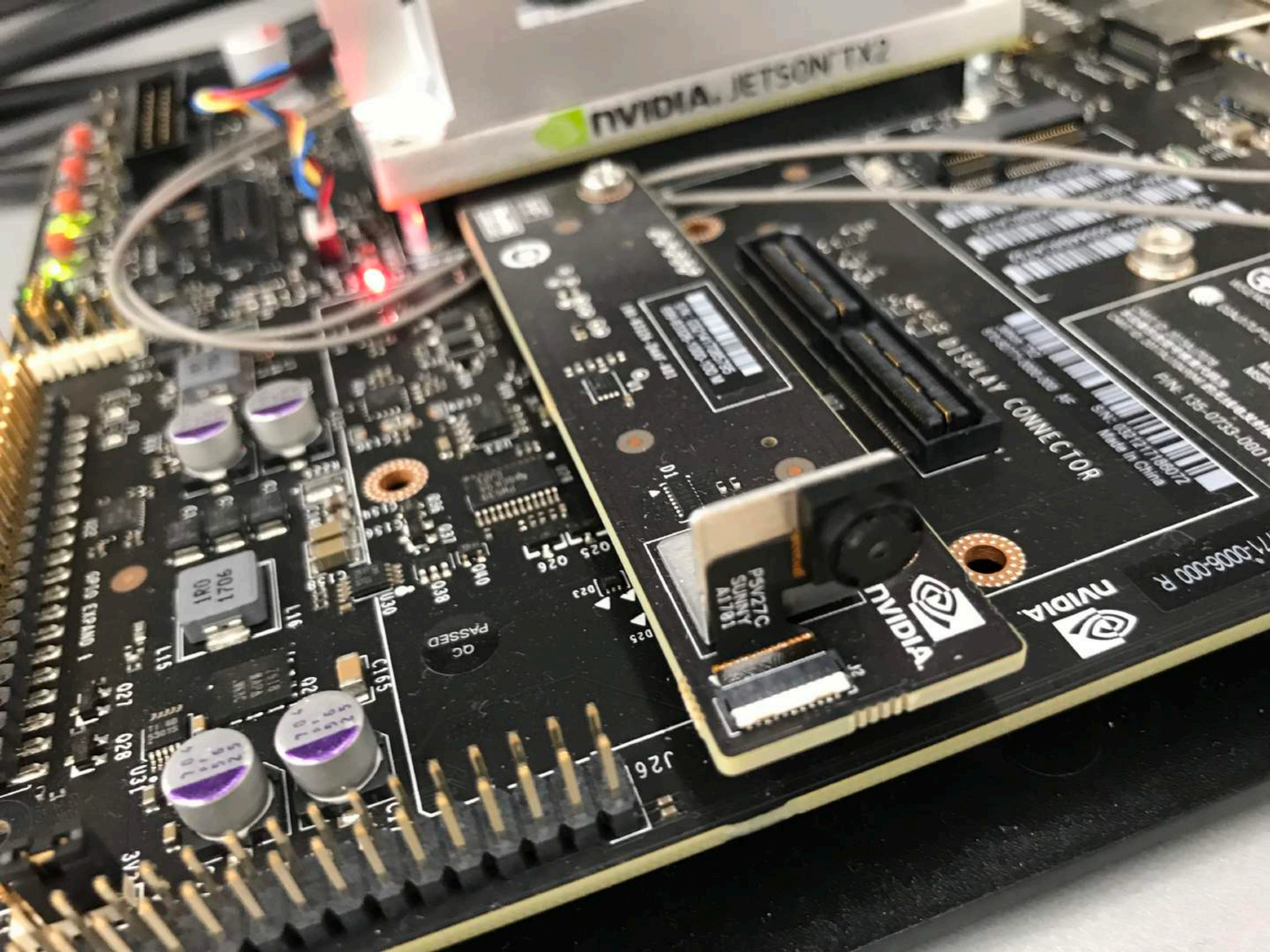
Real-Time Object Recognition via Deep Neural Network





Real-Time Object Recognition via Deep Neural Network





NVIDIA JETSON TX2

DISPLAY CONNECTOR



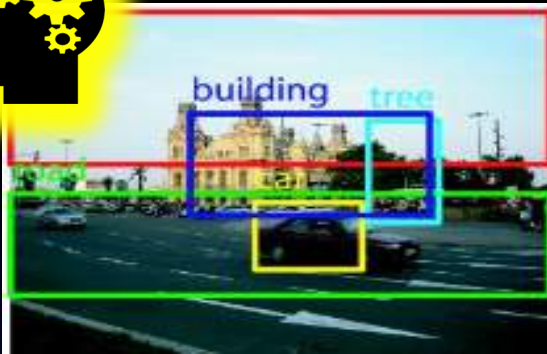
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NVIDIA
P927C
SUNNY
AL101

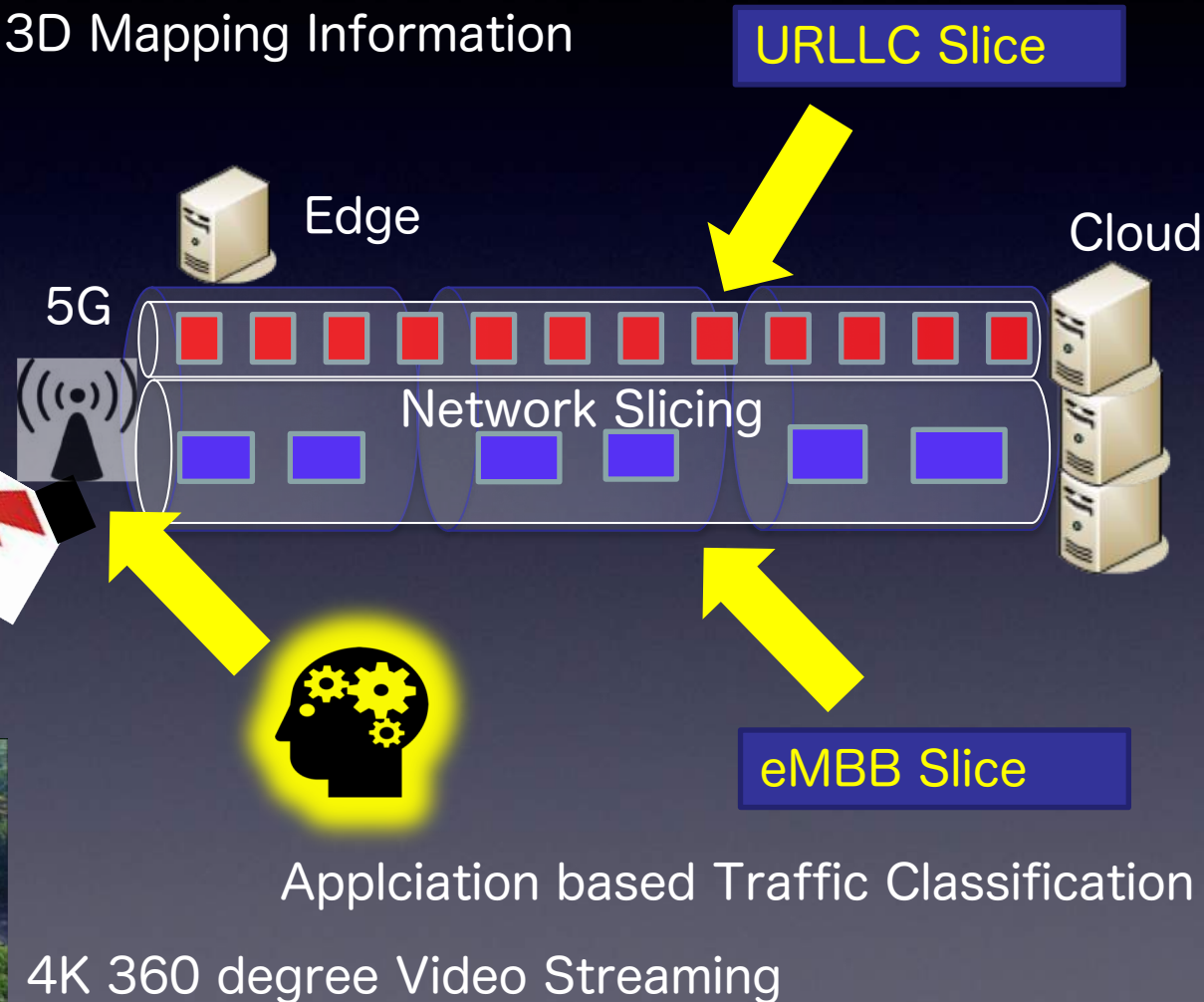
OC
PASSED



Network Slicing for URLLC and eMBB



Object Recognition by DNN
3D Mapping Information



Application-based Traffic Classification

Remote console of programmable network node (FLARE)



Smartphone connected to our MVNO

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Mobile Network Prediction for 2021

Visual Networking Index (VNI)

5.5B



The number of mobile users

12 B



The number of mobile terminals connected

7x



Global increase in mobile network traffic

In 2021, mobile traffic will amount to 48.3 EB per month

1EB = 10^{18} B

3.3x



Global increase in data center traffic

15.3ZB



Global annual data center traffic

1ZB=1000EB = 10^{21} B

1 Zettabyte

The amount of data that has traversed the Internet since its creation

50% of citizens share data by 2019: Gartner

Gartner predicts that by 2019, 50 percent of citizens in million-people cities will benefit from smart city programs by **voluntarily sharing their personal data.**



Predicts 2017: Government CIOs Are Caught Between Adversity and Opportunity

<https://www.gartner.com/doc/3510217/predicts--government-cios-caught>

<https://www.canadianunderwriter.ca/keyword/predicts-2017-government-cios-are-caught-between-adversity-and-opportunity/>

Utilization of Mobile / IoT Data

Data Type / Field	Project	Summary
Location Information	NTT Docomo “Mobile Spatial Statistics”	Provide population statistics from the anonymized location data of mobile phones
Automobile Probe	Toyota “Telematics Service”	Provide traffic information and statistics generated from telematics data for improving traffic congestion and public safety
Automobile Probe	Sony Assurance Inc. “Telematics Insurance”	Analyze customers’ telematics record and provide cash back for safety driving
Medical Information	NTT Docomo Health-Care ”Moveband3” Omron Health-Care “Wellness Link”	Provide services for improving health and life style by visualize and analyze activity data obtained from wearable smart wrist bands.
Financial Information	Hitachi Financial API Service	Enable personal asset management across multiple financial accounts

Challenges

- Flexible Communication Infrastructure
- In-Network Machine Learning
- Edge computing for Data Analytics
- Sensing / Inference without privacy violation
 - Operational Data
 - Traffic Data
 - Social Network Application Data
- Viable Use Cases for Smart(er) Cities

Conclusion

- AI and Machine Learning already started playing a significant role in telecommunication
- Serious investment in SDG 9 (Industry Innovation and Infrastructure) and SDG 11 (Sustainable Cities and Communities) necessary for “Smarter Cities”
- Academia, Industry, Government, SDO, close collaboration is a must
- UTokyo has formed “Study Group” on AI/ML for telecommunication with 10+ industrial partners and Government (MIC and TTC) together with academic society (IEICE).

