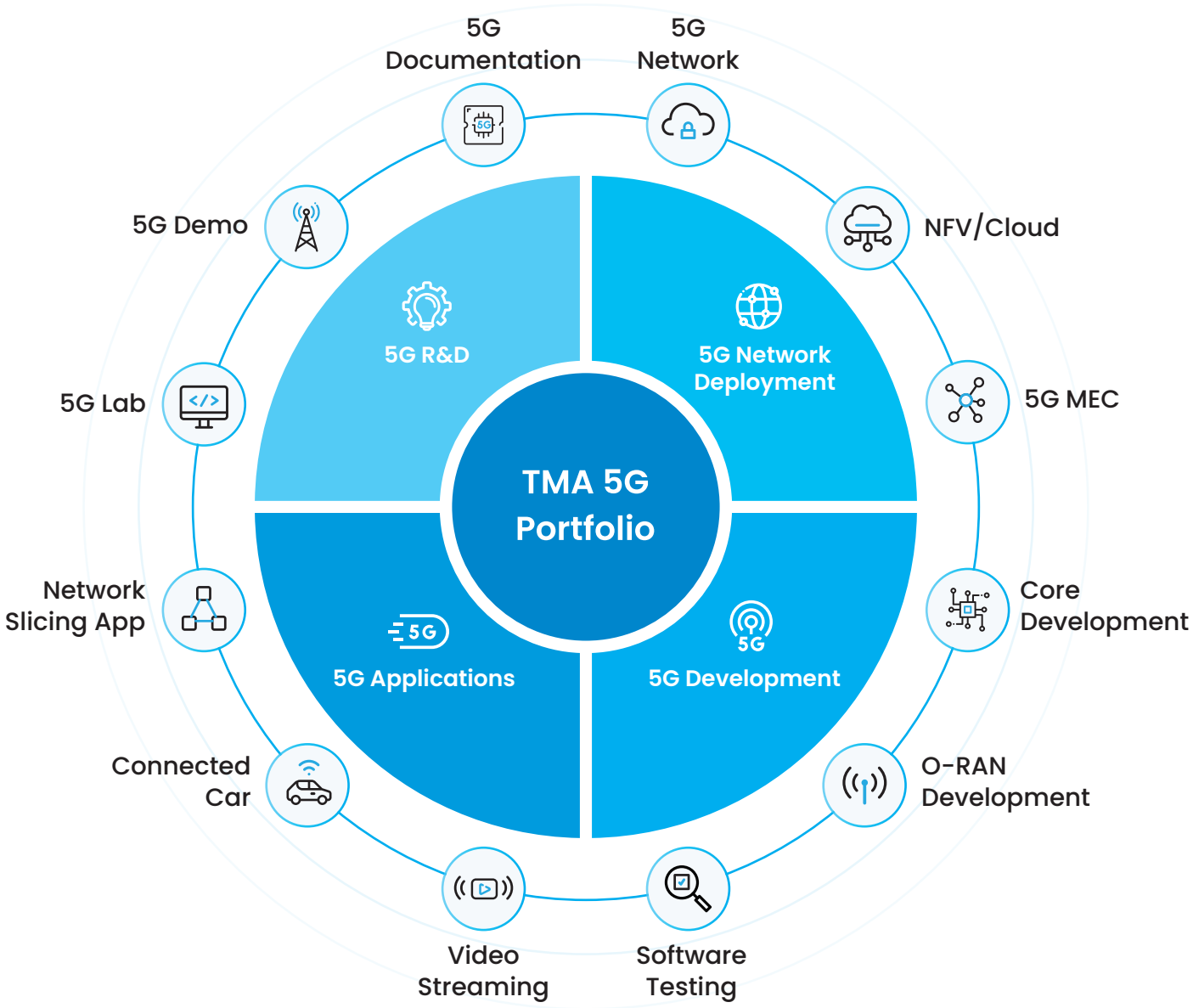
# 5G Center

**29** Years of experience in Telecom

**2,000** Engineers working on Telecom projects for global leading companies

**5G** Private Lab with integrated MEC solution

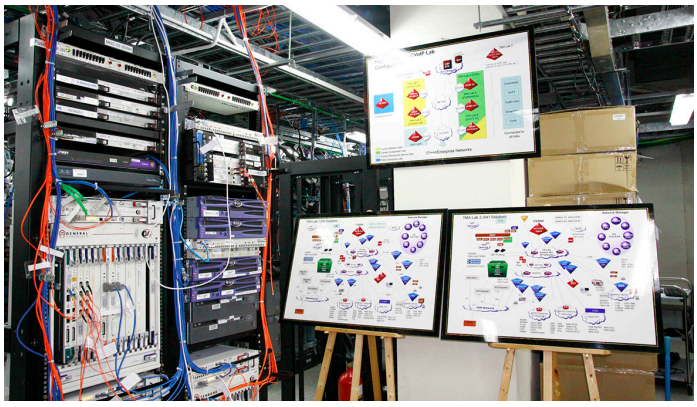



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# Technologies

| | | |
|---|---|---|
| eMBB, uRLLC, mMTC | O-RAN (Open RAN) | Network Slicing |
| Edge Computing | VNF, NFV, K8S Cloud | DevOps Jenkins, CI/CD |
| Programming C/C++, Java, Python, Go | SDN, Networking | Automation Robot Framework, Python |

Protocols
HTTP/2, TLS, TCP, UDP, SCTP, IP, GTP, NGAP, NAS, PFCP, RRC, PDCP, SDAP, RLC, F1AP, E1AP, E2AP, XnAP.







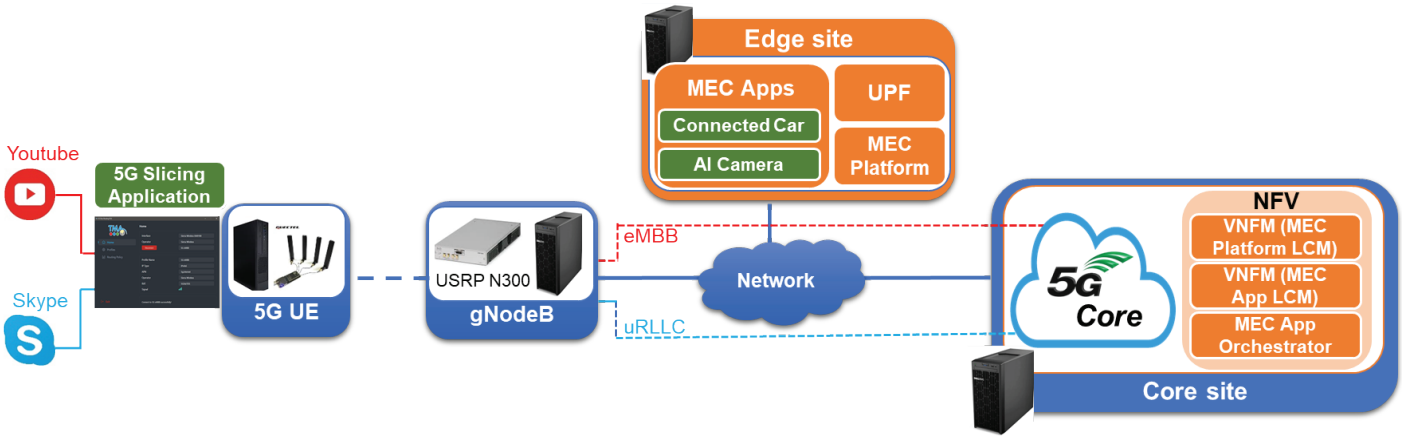
# 5G Services

- Platform Development
- 5G Applications Development
- O-RAN Development
- 5G MEC Deployment
- 5G Core Development
- NFV/Cloud Deployment
- UE Simulation Development
- VNF Orchestration
- 5G Software Testing
- Software Deployment for 5G Private Network
- Private Cloud Deployment
- PoC Implementation




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# 5G R&D Lab




## 5G LAB COMPONENTS

### Hardware

- PC i7 (X64 HW)
- USRP B210/N300
- Adlinktech MECS-6110

### UE

- Quectel: RM500Q-GL
- Sierra: XR-90
- 5G Phone

### Software

- gNB: srsRAN
- 5GC: Open 5GS

### Release

- 3GPP release 17

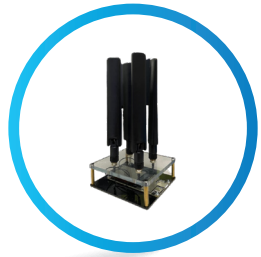
### Bandwidth (UL/DL)

- 60 Mhz
- 30 Mps - 100 Mps

### 5G NR SA TDD Configuration

- Frequency band: n41
- SCS: 30kHz

Uplink-Configurations: 64QAM max
Downlink Configurations: 256QAM max



UE



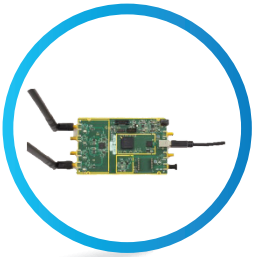
USRP N300



Adlinktech MECS-6110



PC



USRP B210

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# 5G R&D Lab

## 5G LAB CONFIGURATION

5G UE/Modem

Simulated RAN/gNodeB
(use USRP B210, USRP N300 for RU)




5G Core

5G MEC
(MEP, MECM, MEAO)

## SUPPORT FUNCTIONS

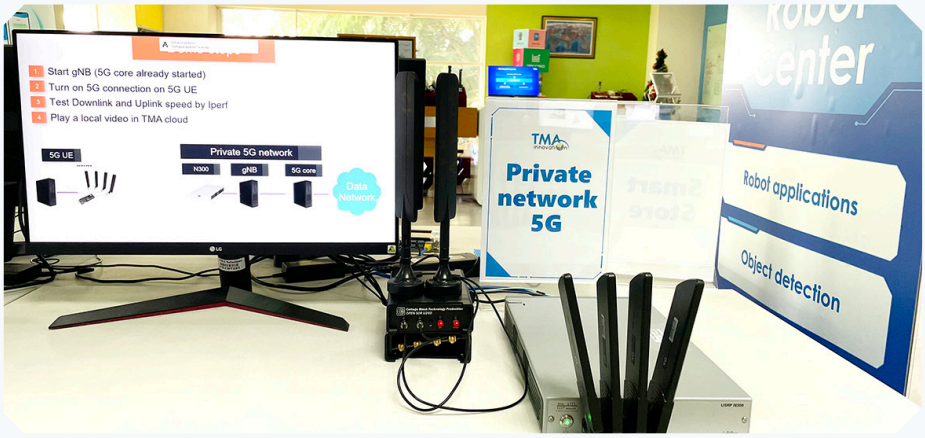
Full operation of 5G core:
AMF, SMF, UPF, AUSF, N3IWF,
NSSF, NRF, UDM, PCF

RAN functions with
simulated gNodeB

5G Components &
System Orchestration

Support both 5G SA
(Standalone) and 5G NSA

Support edge computing
with MEC platform




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# 5G Case Studies

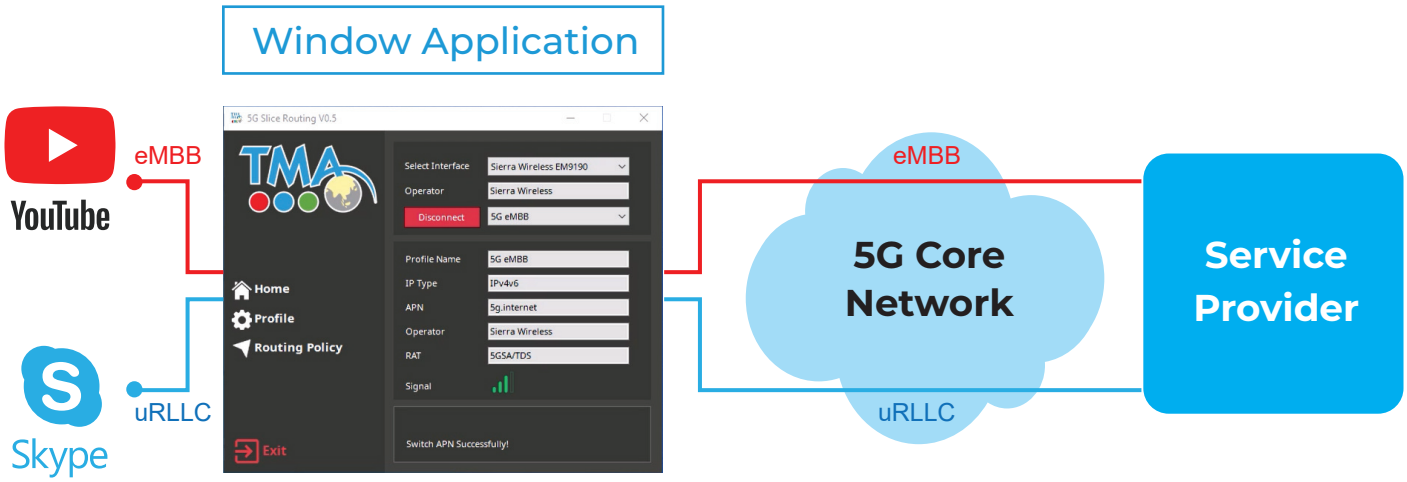
## 5G NETWORK SLICING WINDOW APPLICATION

### Window Application's functions

- Start multiple PDU sessions to different 5G network slices
- Automatically route app traffic to appropriate 5G network slices

### Window Application's key features

- Manage Interface, Profile
- Manage Routing Policy for specific application
- Display network connection characteristics
- Automatically switch network slice based on APN and Routing Policy



# 5G Case Studies

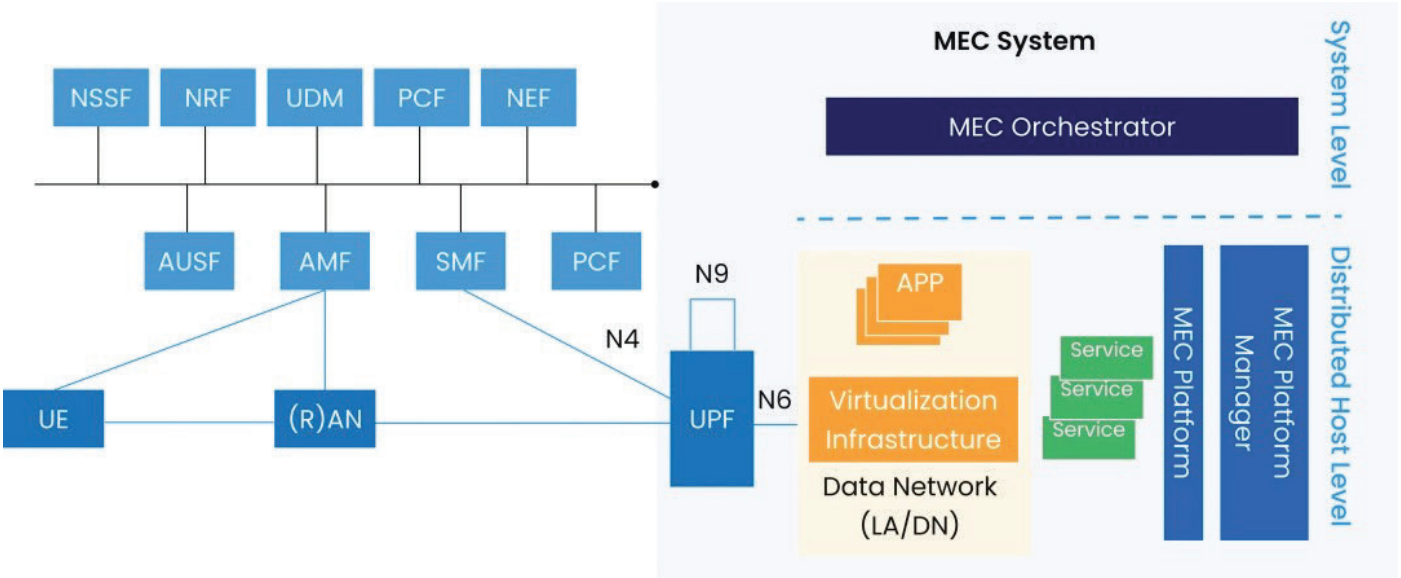
## POC - 5G MEC SYSTEM

### PoC Product

- Provide an application deployment platform close to the end users (edge site). This MEC platform helps to deploy real-time, compute and resource-intensive applications like video caching, augmented reality, virtual reality, and Internet of Things at the edge
- Help decrease congestion & latency at 5G Core site

### PoC Description

- Follow ETSI standard
- 5G Core Network (gNB, Core), 5G Apps
- MEC system includes:
  - MEC Platform (MEP)
  - MEC Manager (MECM)
  - MEC App Orchestrator (MEAO)
- Technologies: Edge Computing, Traffic steering, DNN, LADN



# 5G Application

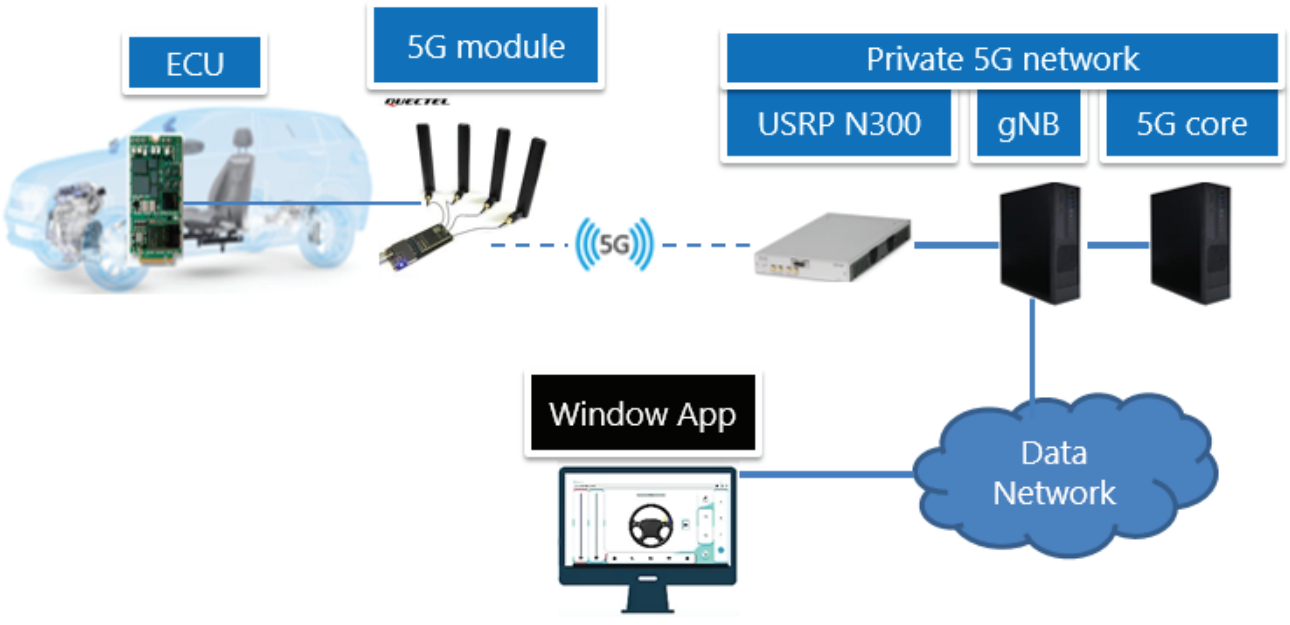
## CONNECTED CAR UNDER 5G PRIVATE NETWORK

### Application Functions

- Connected Car (by Remote Control) - Car is connected to 5G network and can be controlled remotely by mobile app or window app:
  - Control accelerator/brake to increase/decrease speed
  - Control Steering wheel
  - Turn on/off lights, trumpets
  - Turn on driver assistance features like Cruise Control
  - Video streaming

### Technologies

- Computer vision and AI image recognition
- C/C++, Python, OpenCV
- ECU programming
- Protocol: CAN, TCP/IP, USB, Ethernet
- Wireless: 5G, Wifi




A window app controls car via websocket protocol

# 5G Application

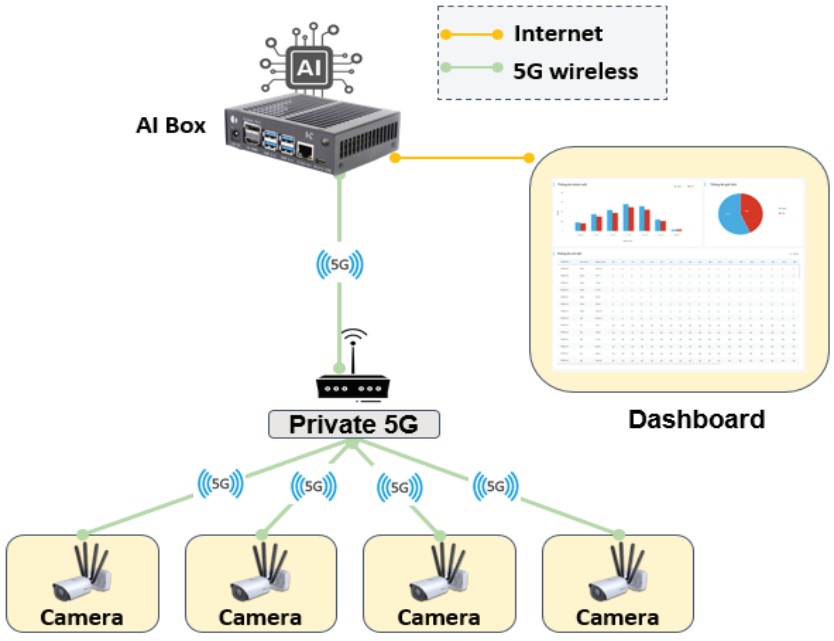
## AI CAMERA UNDER 5G PRIVATE NETWORK

### Application Functions

- Object Detection: people, vehicle, specific objects
- Face Recognition; Age/Gender Detection
- Extract and store information from video/stream
- Behavior analysis
- Active observation & incident warning
- License Plate Recognition
- Text/Digit Detection and Recognition (OCR)
- Edge processing and Centralized processing
- Network connection with private 5G network

### Technologies

- Computer Vision
- Image Processing
- Deep Learning
- Object Tracking, Multiple Camera Processing
- Python, OpenCV, Tensorflow, Pytorch, Caffe, TensorRT, OpenVINO, Onnx
- Restful API, MQTT



# Contacts


Vietnam: +84 28 3995 1060
+84 28 3995 1059
Australia: +61 411 276 342

North America: +1 844 224 4188
Europe: +33 7 44 77 49 24
Japan: +81 50 5490 9867

Email: sales@tmasolutions.com

Website: www.tmasolutions.com