

# 5G R&D Lab

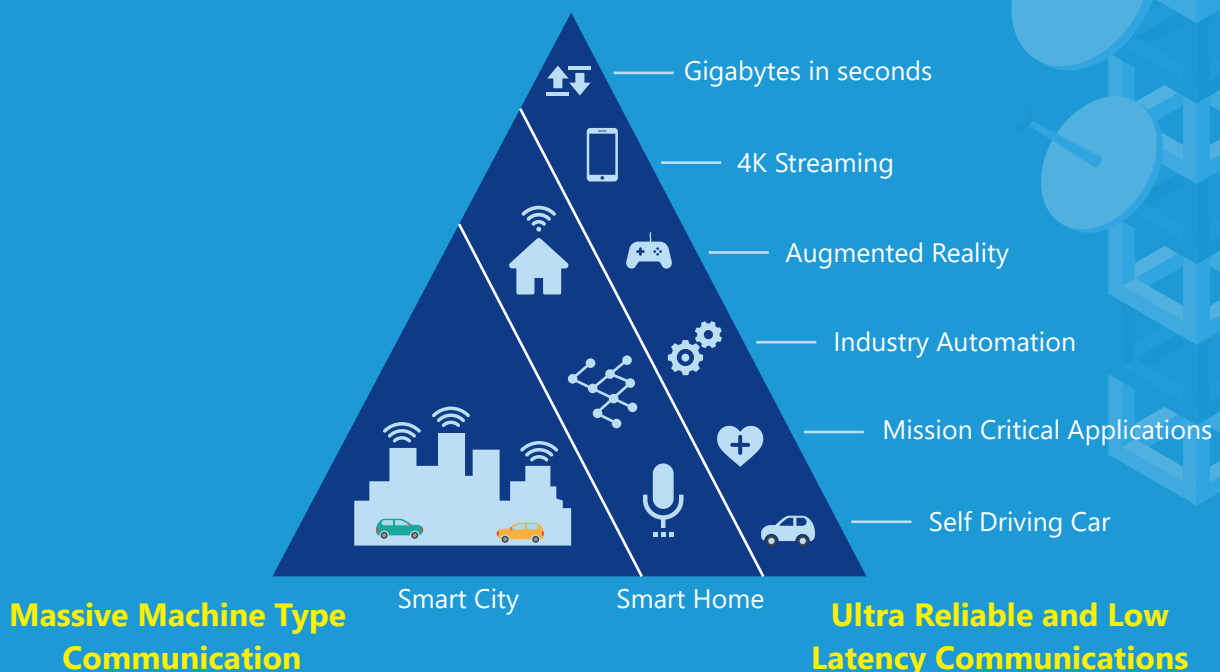
## Why you need 5G Lab?

We all know 5G Network is the key factor to transform industries and society, focusing on 3 sets of defined use cases:

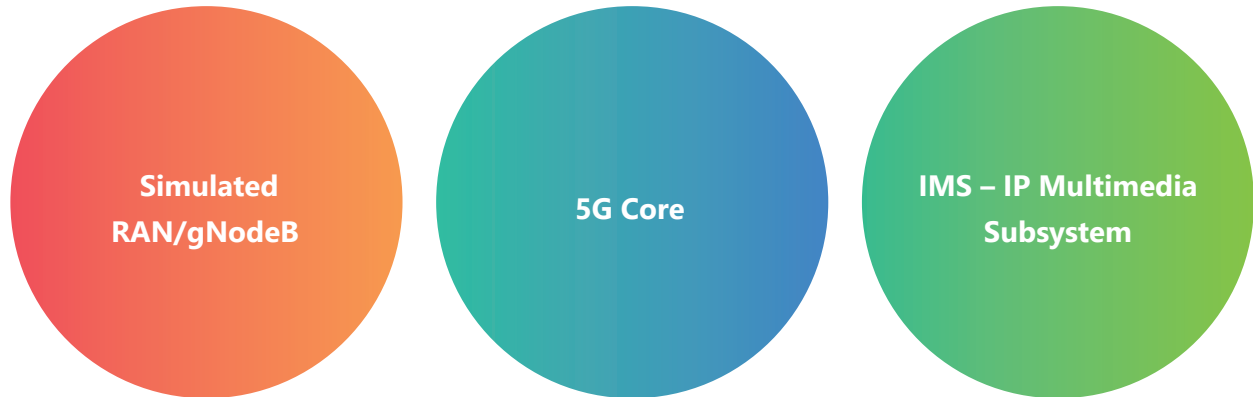
- Enhanced Mobile Broadband (eMBB)
- Ultra Reliable Low Latency Communications (URLLC)
- Massive Machine Type Communications (mMTC)

Before enabling these new applications, we need to understand and experience the actual capability of 5G Network. So, it's important to have a 5G Lab with basic 5G functionalities

### Enhanced Mobile Broadband

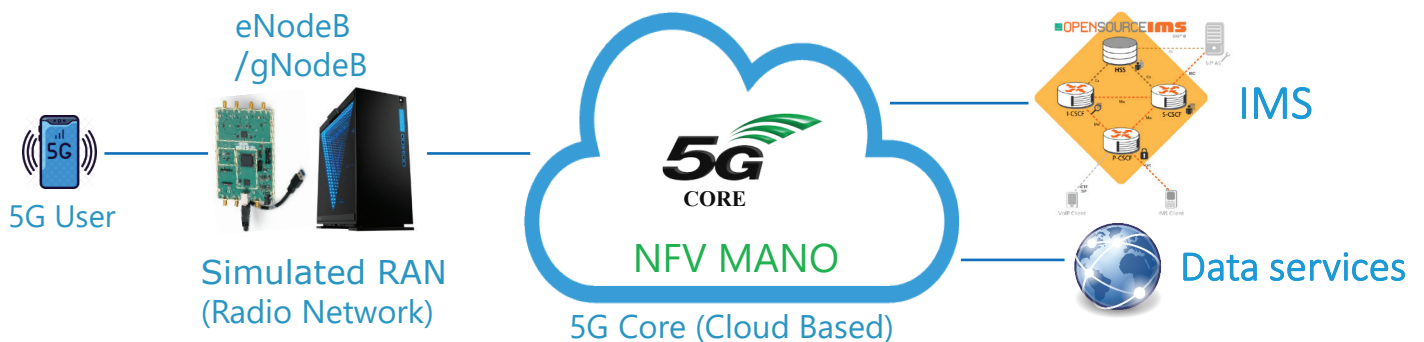


## 5G System Configuration:

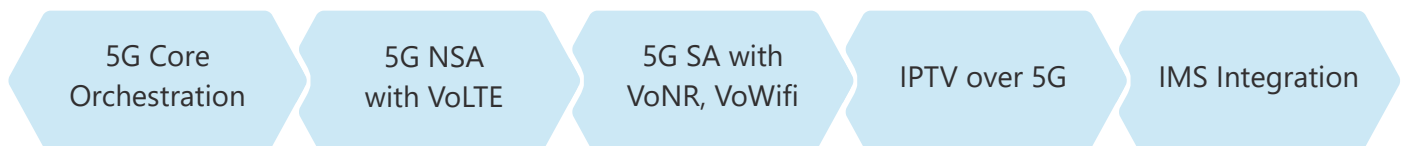


### Support Functions

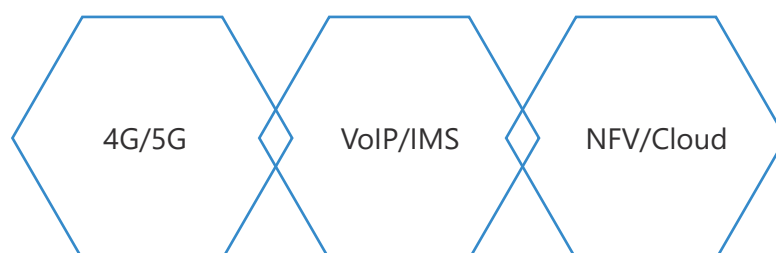
- Full operation of 5G core: AMF, SMF, UPF, AUSF, N3IWF, NSSF, NRF, UDM, PCF
- 5G Orchestration
- Operation, Administration and Management (OAM) of 5G Core
- gNodeB in NSA 5G System (with 4G EPC Core)
- gNodeB in Standalone 5G System (with 5G Core)



## Available Demo Package:



## Technologies:



## TMA Capability

Telecom & Network Testers

600+

Telecom Developers

300

C/C++

250

Python, Golang

100

Cloud, DevOps

100

Java

450

Big Data/Analytics

150

## Our Services

**5G Lab System Verification**

**5G Features/Modules Development**

**Customer Support:**

5G Field Validation

PoC/Demo Host

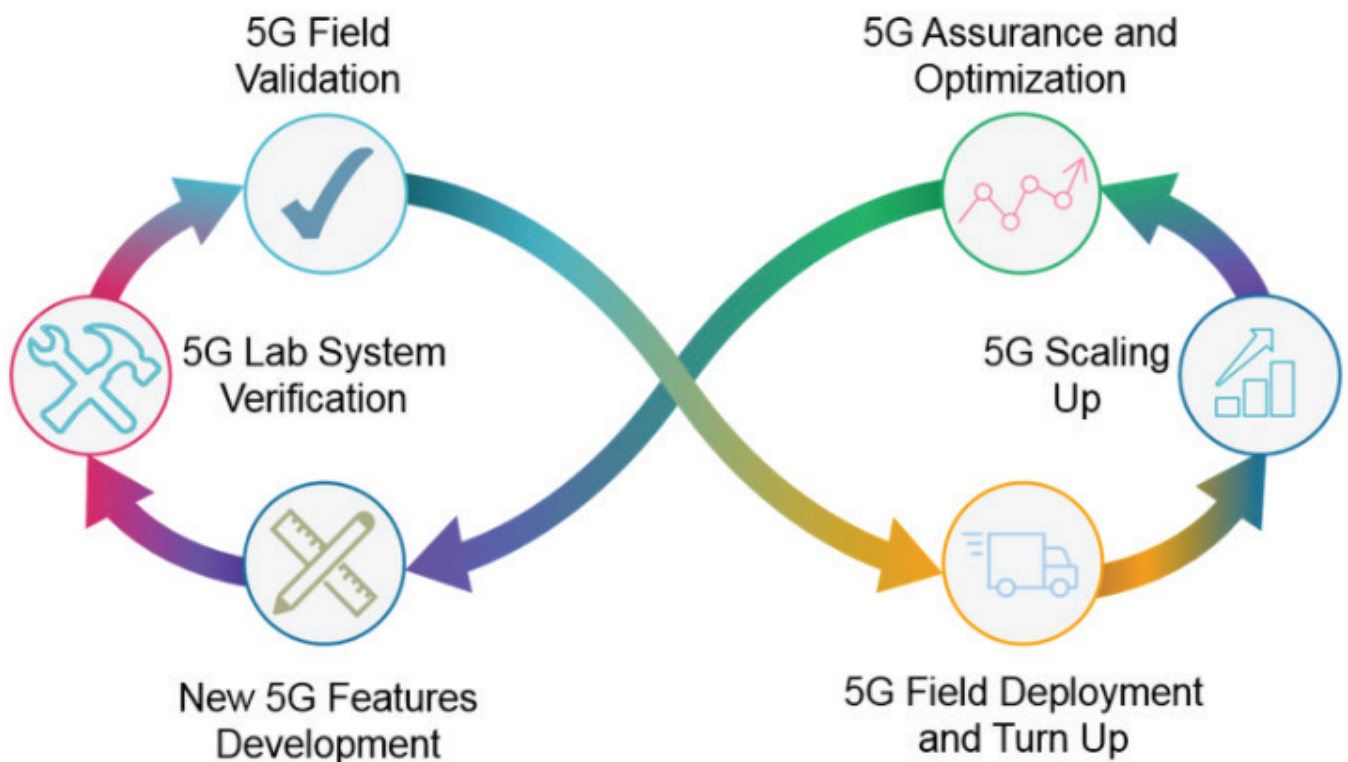
**System Deployment:**

Field Deployment

Orchestration

Optimization

Scaling



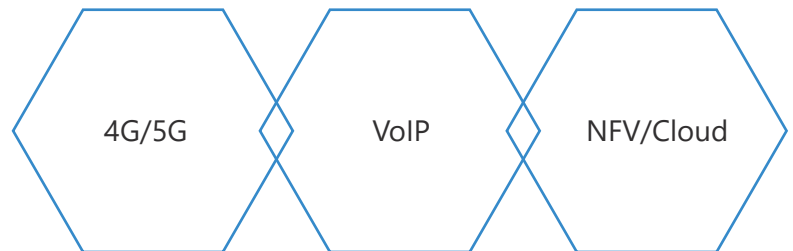


# Software Testing

## Service:

- Functional test
- System/Solution test
- Integration test
- Performance test
- Security test

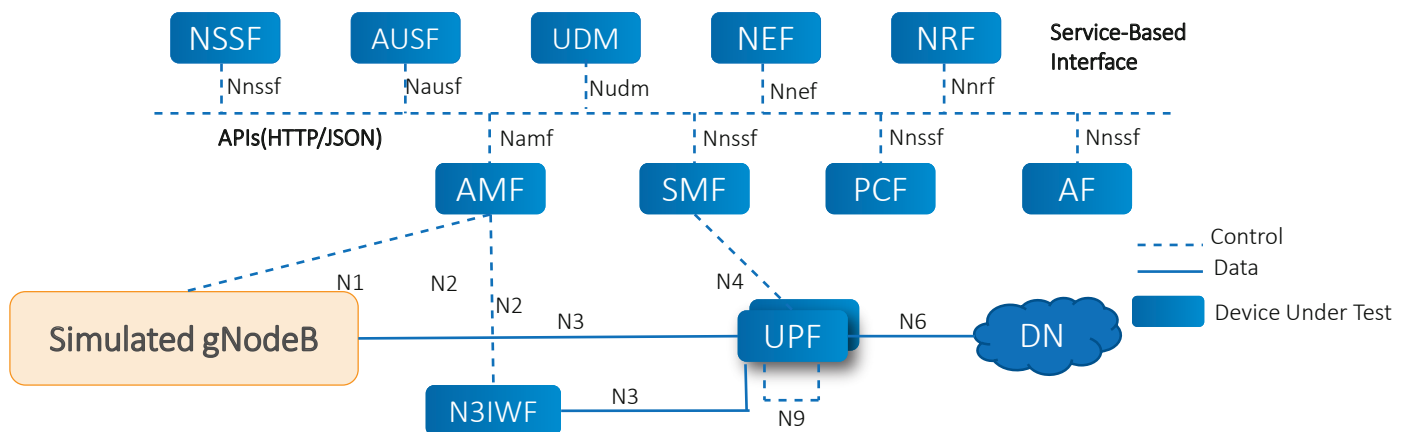
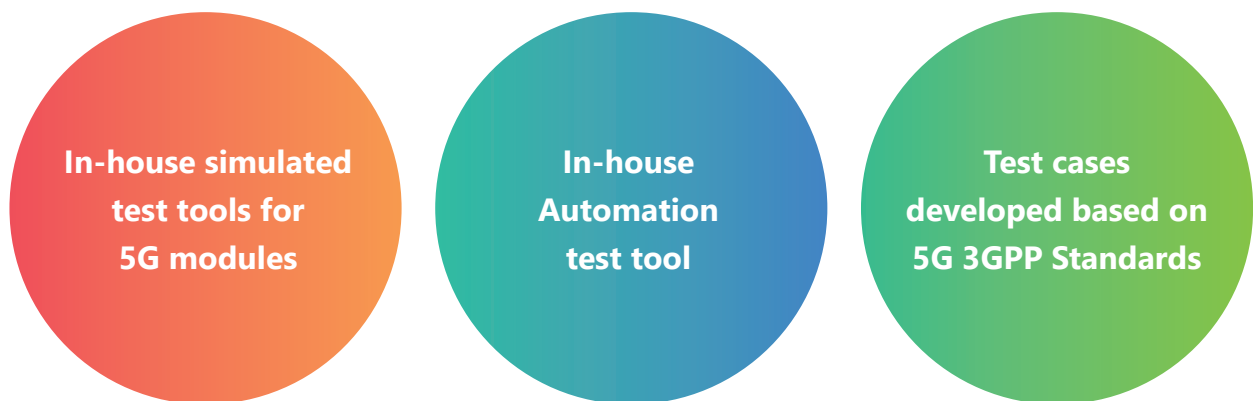
## Technologies:



## Protocol

HTTP/2, TLS, TCP, UDP, SCTP, IP, GTP, NG-AP, NAS, PFCP

## Test resources



## Software Development

### Service:

- Protocol development
- Product development
- VNF development
- Test tool development

### Programming:

C/C++

Python

Golang

Linux Bash Shell

## System Deployment

### Service:

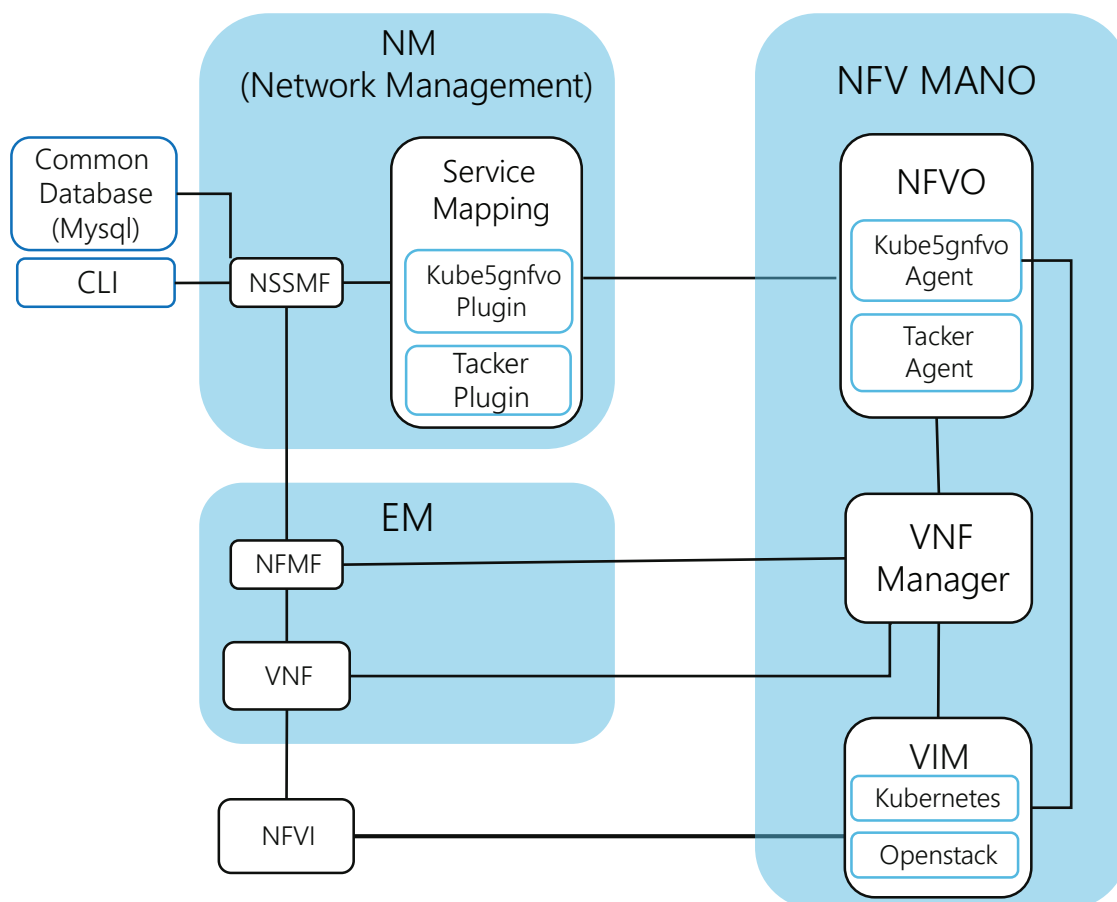
- Private Cloud Deployment
- MANO NFV Deployment
- VNF Deployment
- IMS Deployment

### Technologies:

4G/5G

VoIP/IMS

NFV/Cloud



## Customer Support

Onsite  
deployment

Remote  
maintenance

Issue  
troubleshooting

## Demo/PoC Host

### Service:

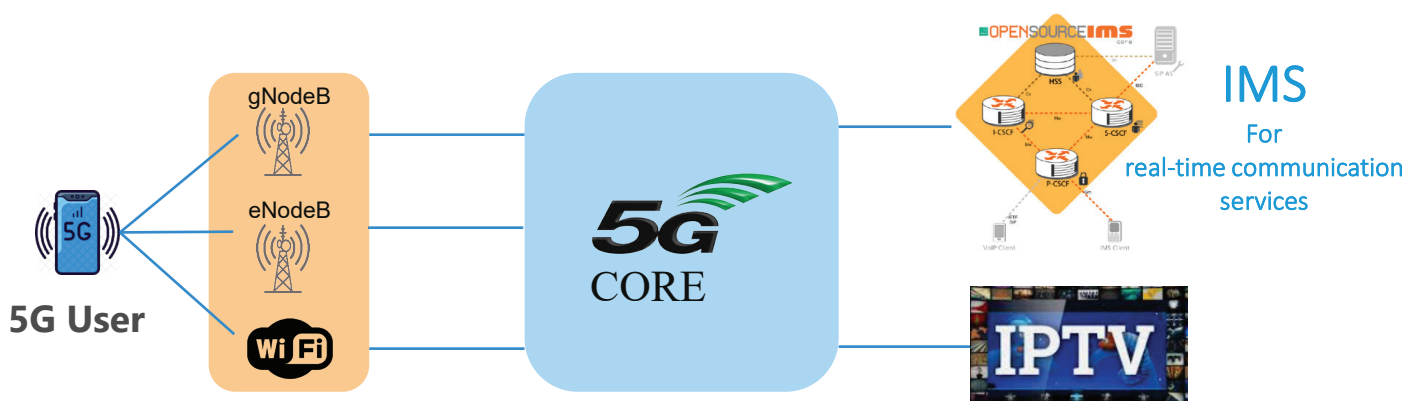
- NSA 5G system deployment
- Full SA 5G system deployment
- VoNR with IMS Integration
- IPTV application over 5G
- On-demand functions

### Technologies:

4G/5G

VoIP/IMS

NFV/Cloud



# Case Study

## LTE Solution Verification

### Service:

- Software Testing
- Functional testing
- Performance and load testing
- Test Tool Development

### Technologies

- Telecom/Network: E-UTRAN, GTP, NFV
- Infrastructure(NFVI): OpenStack, HyperV, VMware ESXi, KVM, Virtualized Network Functions (VNFs), Element Management System (EMS)
- NFV MANO for Cloud Management
- Automation Test: att, Ysim, ICARUS, mp3, pstats, tsh
- Protocols: GTP, Diameter, Radius, TCP/IP, IPv4, IPv6

**Products under test:** MME,SGW,PGW,PCRF,OCS

