



AIS Annual Investor Day 2016

Digital Transformation at AIS

18 November 2016



Addressing consumer's future demand with AIS technology roadmap

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Chief Technology Officer

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Global Technology Roadmap

Ultra HD Video

HD, 3D and 4K video will be common

Virtual Reality & Augmented Reality

- Use of computer technology to create simulated environment
- Projection of digital content into real environment

Connected Car

Car need connection to network with a very small latency.

Industrial Automation

High reliability machine-to-machine operation.

Internet of Things

Internetworking of devices, vehicles, buildings and other items embedded sensors that enable these objects to exchange data

Wearable Devices

Activity tracking and other application will be implemented.

Agricultural

IoT and automation will change the way of farming

Farmbot

Robot for smart farming with humidity & soil nutrient sensors including watering system.

Farming Drone

Provide complete agriculture process starting from planting until monitoring products.

Smart Home

Enables users to interact with a variety of connected devices at home.

5G

Enhanced Mobile Broadband

- Multi-Gbps data rate
- Extreme capacity



Mission Critical Service

- Ultra low latency
- High reliability
- High availability
- Strong security



Massive Internet of Things





- Low cost
- Ultra low energy
- Long coverage
- High density



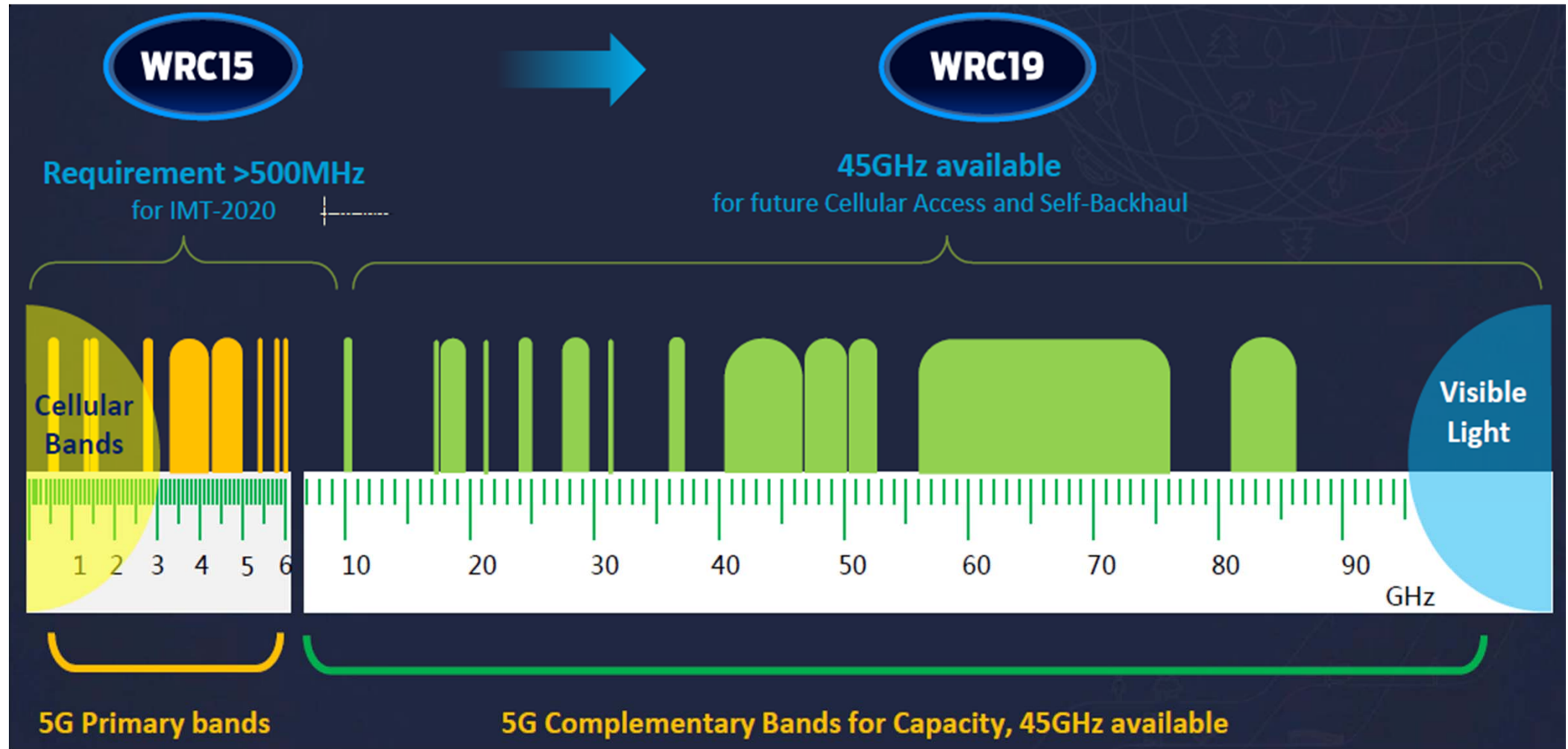
Standard (ITU, 3GPP) and industrial milestones



Diversified Challenges to 5G

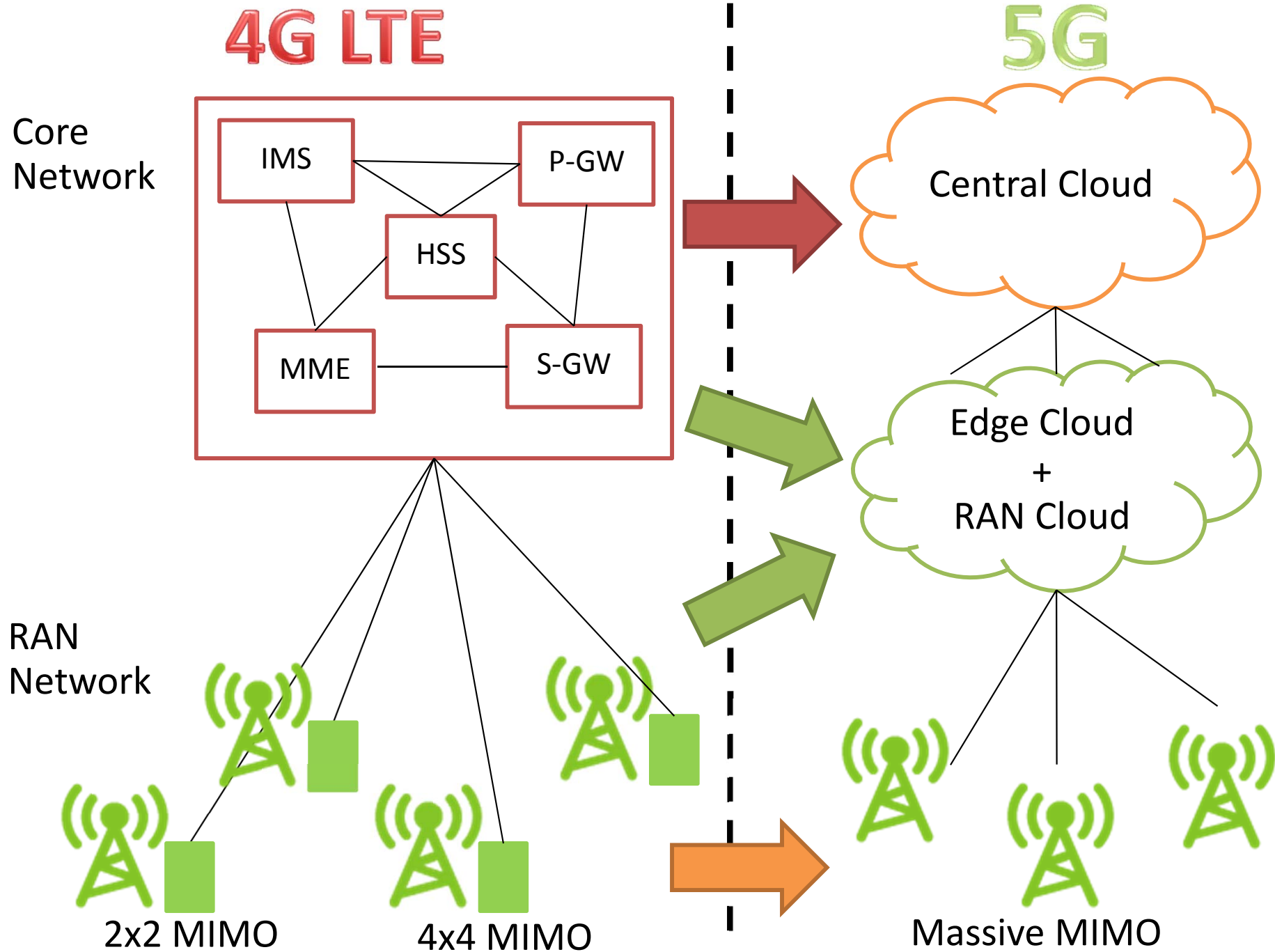
5G	Latency	Throughput	Connections	Mobility
	1 ms E2E Latency 	10G bps Per Connection 	1,000K Connections Per Km2 	500 km/h High-speed Railway 
GAP	30~50x	100x	100x	1.5x
LTE	30~50ms	100Mbps	10K	350Km/h

ITU frequency spectrum plan – WRC (World Radio Conference)



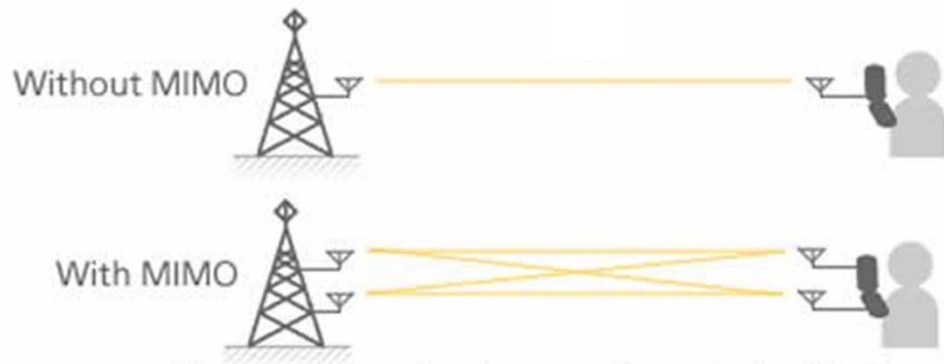
- Current cellular band: 850 / 900 / 1800/ 2100 MHz
- 5G complementary band: 3.5 GHz – 85 GHz

Network topology transformation

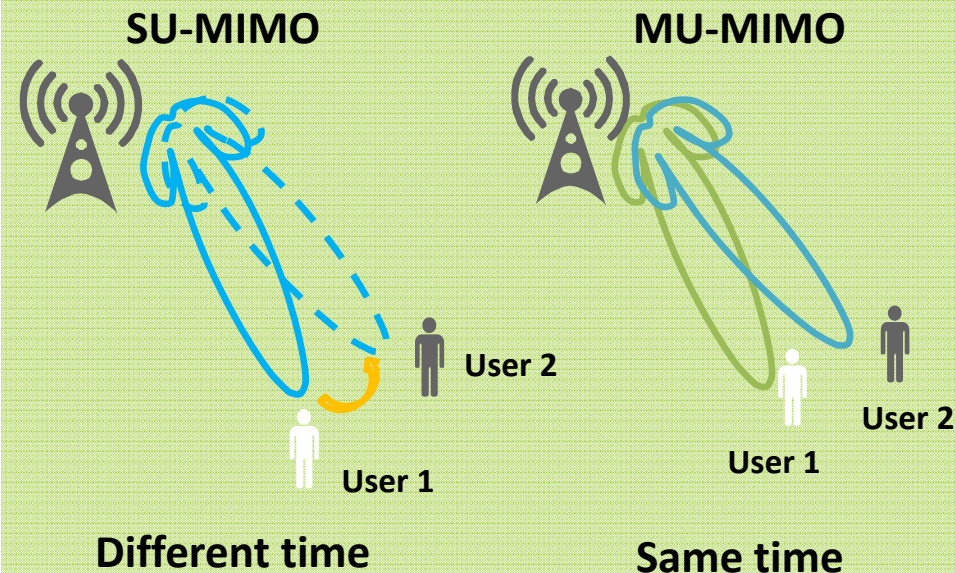


MIMO

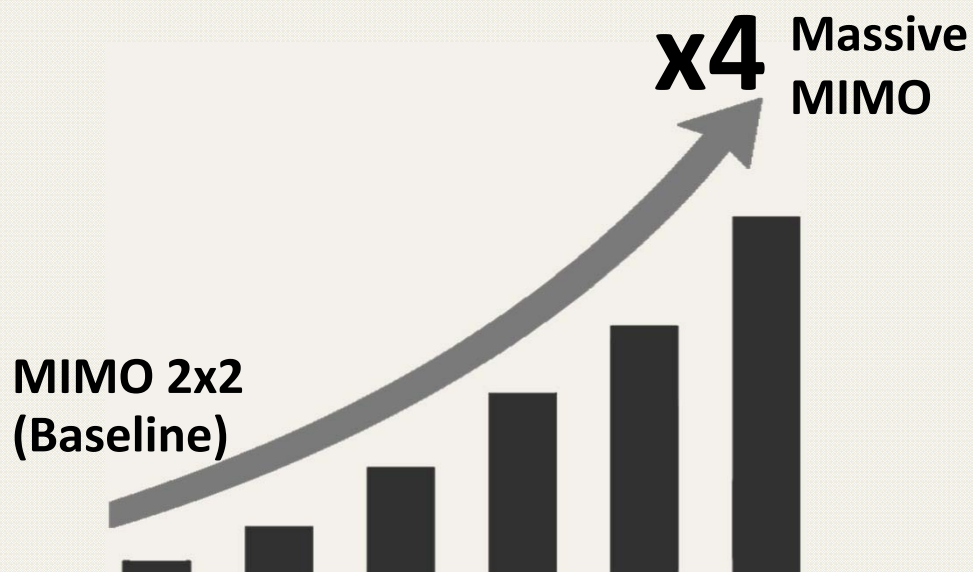
multiple-input and multiple-output
is a method for multiplying the capacity of a radio link using multiple transmit and receive antennas to exploit multipath propagation.



Multi Users MIMO



Massive MIMO capacity gain



What Can Massive MIMO Bring?

Tower installed Macro



Wall and Roof-top installed Macro

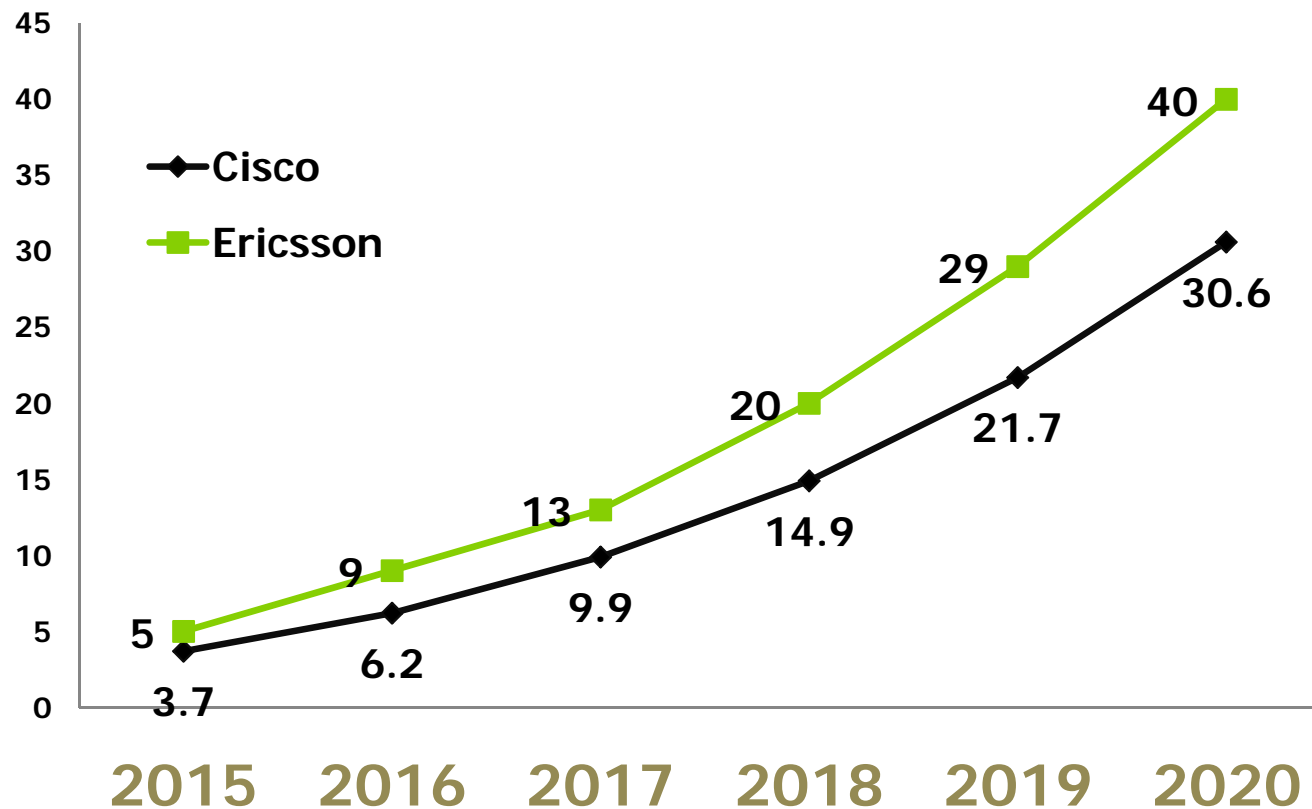


Pole installed Macro



New Technology Leads to the Growth of Global Mobile Data Traffic

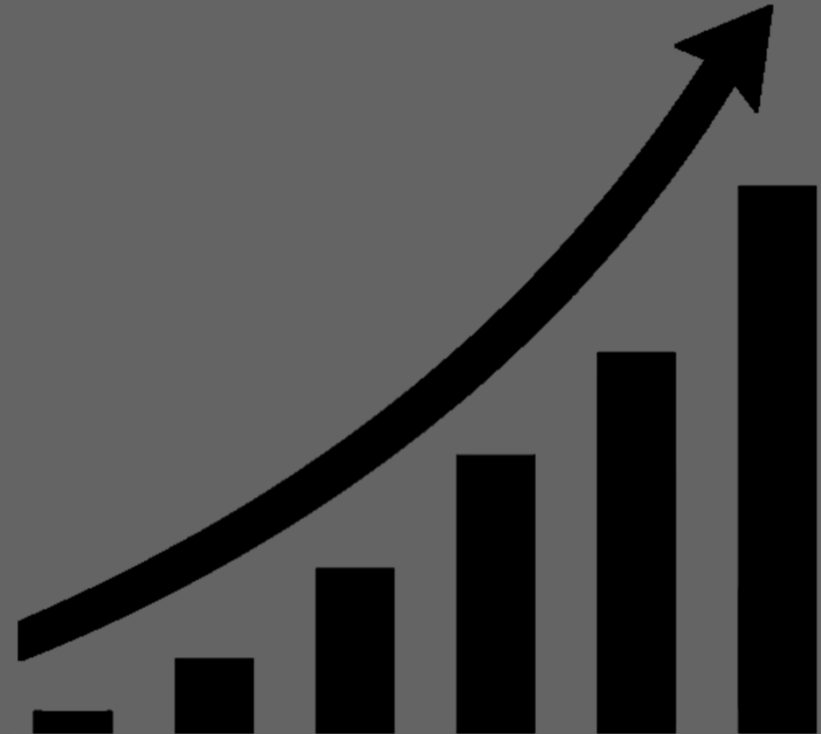
Exabyte
per month



Source:

- 1) Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015 – 2020
- 2) Ericsson Mobility Report, June 2016

Data traffic growth **8** times
in **5** years



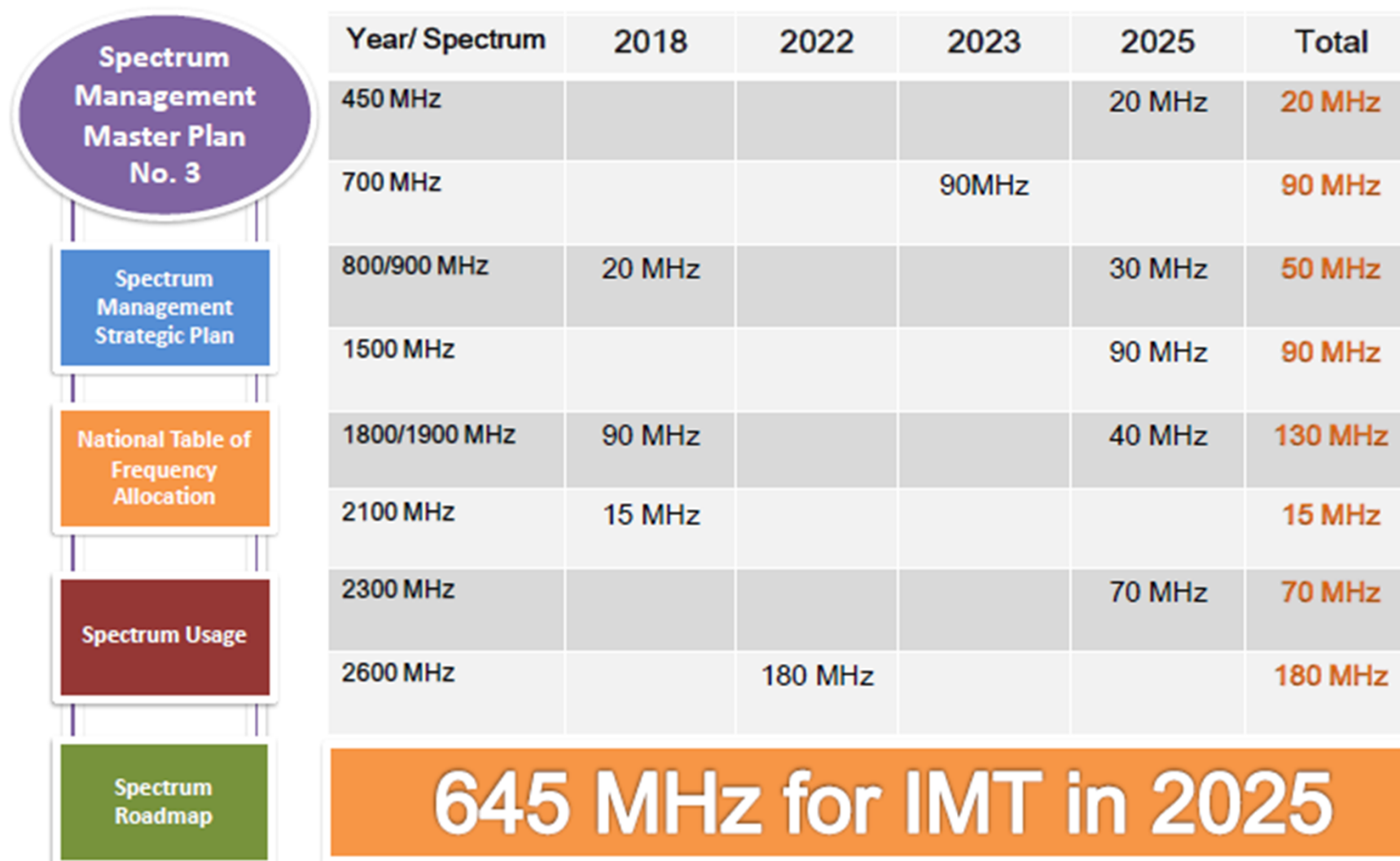
**Can the existing spectrum roadmap
support ?**

2

Spectrum Roadmap

Thailand frequency spectrum roadmap

IMT Roadmap (Outlook)



3

Capacity Enhancement

Capacity Enhancement



NO
New Spectrum



Solution



More
Capacity



Stable
KPI

Other solutions to increase network capacity

Network
Capacity

=

Spectrum
Quantity

X

No. of
site

X

Spectrum
Efficiency

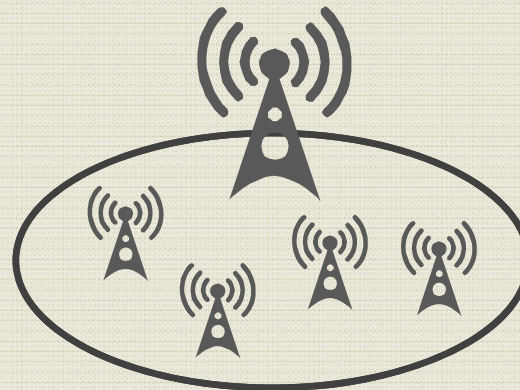
Increase no. of site



6-Sector

Space Multiplexing

✓ "6-Sector"



Site Densification

✓ "Small Cell"

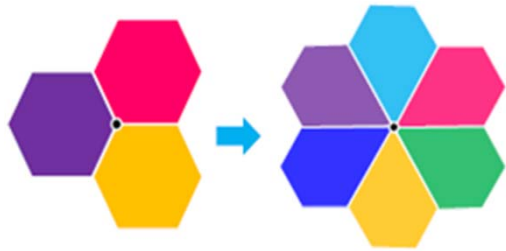
Increase Spectrum Efficiency



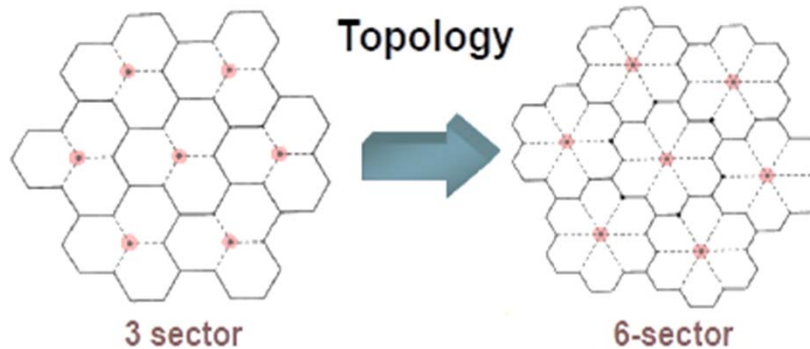
New technology

- ✓ License + Unlicensed
- ✓ MU-MIMO
- ✓ QAM

6 Sector



From concept to deployment



75% of sites in Bangkok
implement 6-sector technique

Sites

Reuse Existing Site, No
Need New Site Location

Hardware

Reuse Existing
Equipment, Saving
Hardware

**Benefit of
6-Sectors**

Efficiency

Rebuilding Site, Quick
Deployment

Capacity & Coverage

Sectors Expansion, No
New Spectrum

Data volume



Small Cell

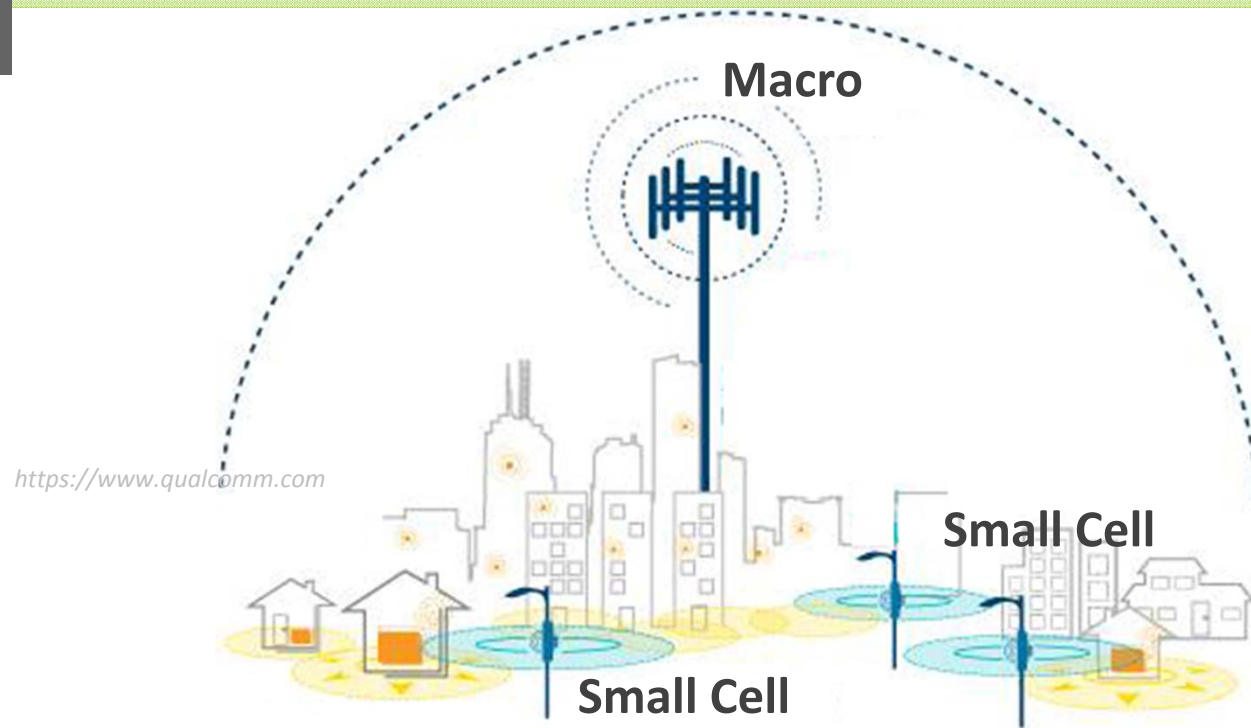
Small cells : low-height radio access nodes to increase network capacity

Small Cell BKK

2,613 Sites

Easy Macro more than

2,000 Units



Deployment Area of Small Cell

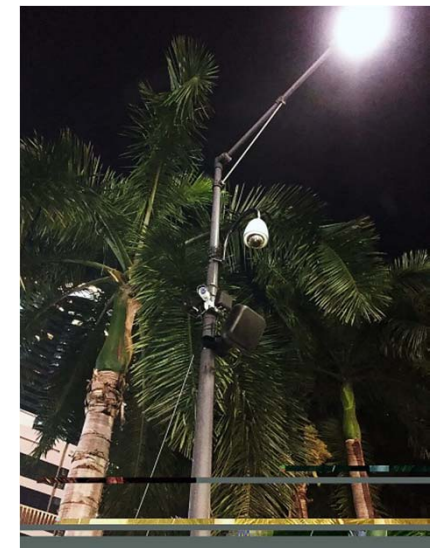
- Commercial Street
- Residential Area
- Tourist Spot



Deployment Scenarios of Small Cell



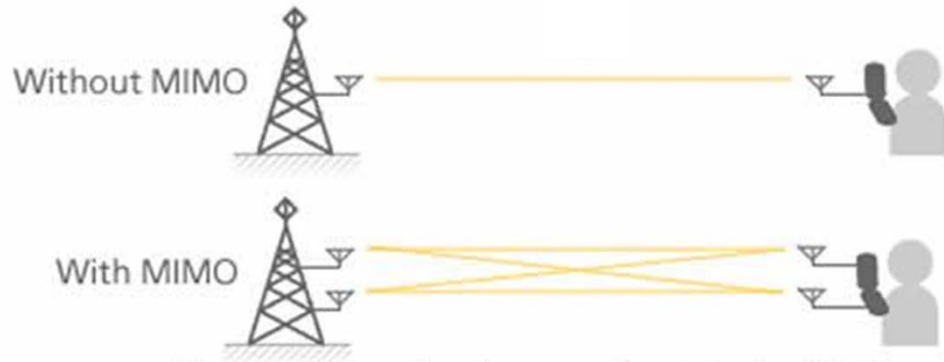
Easy Macro



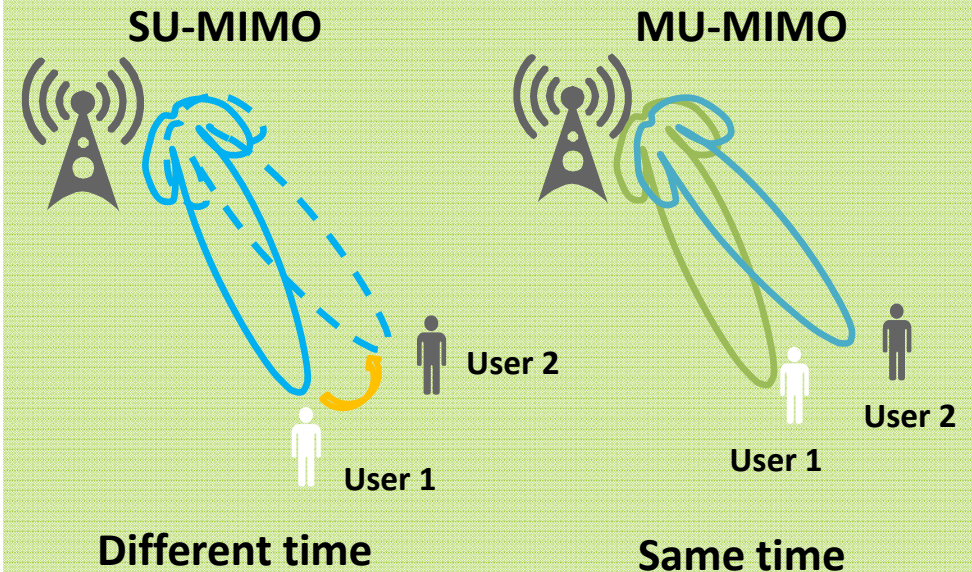
MIMO

multiple-input and multiple-output

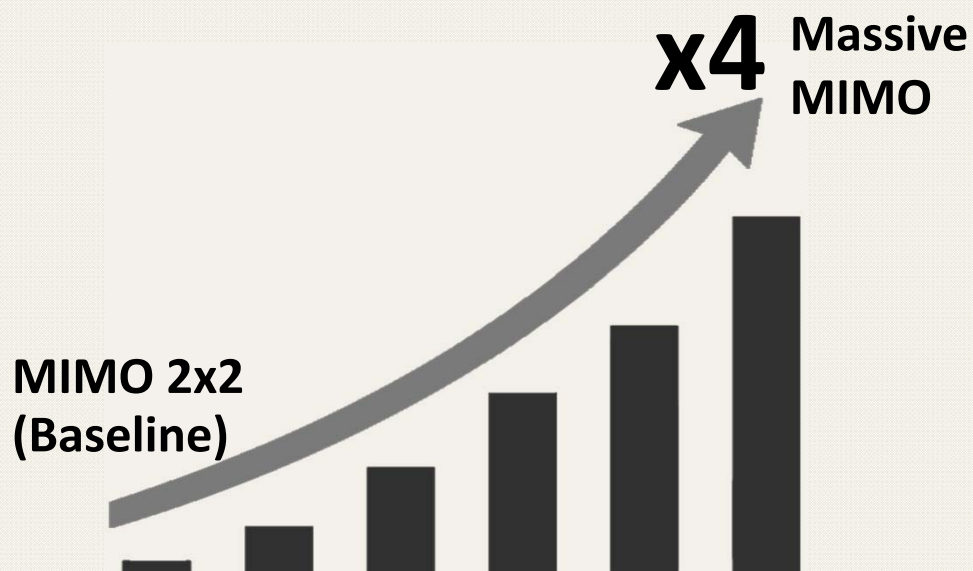
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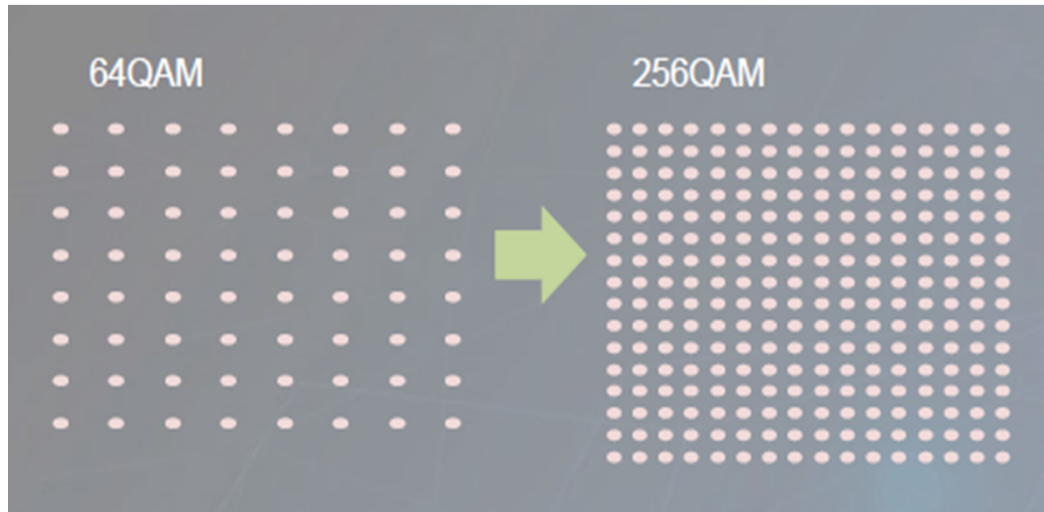


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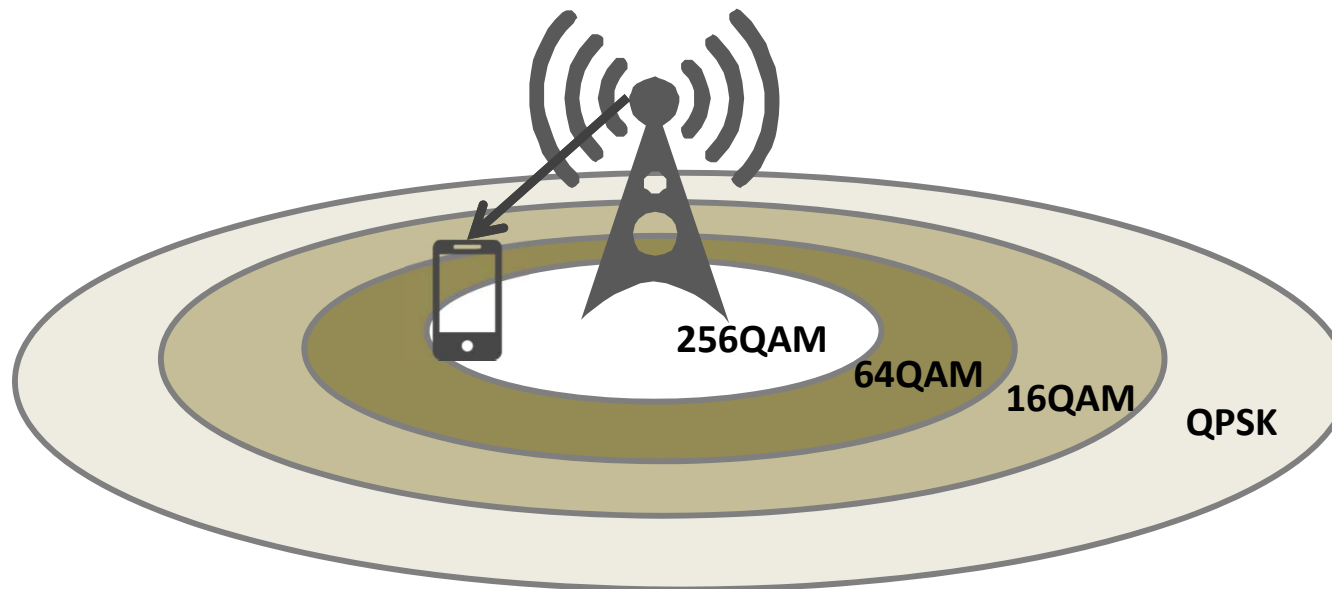
QAM

Quadrature amplitude modulation



30%

higher throughput in cell center by 256QAM technique

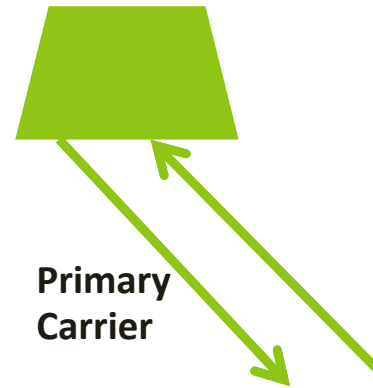


LTE Licensed + LTE Unlicensed

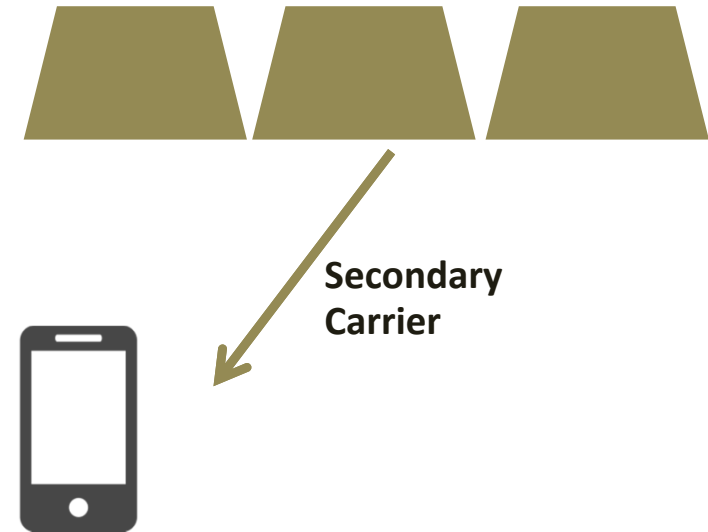
LTE in unlicensed spectrum

would allow cellphone carriers to boost coverage in their cellular networks, by using the unlicensed 5 GHz band

LTE licensed band



LTE unlicensed band



Throughput Testing



AIS Mini MWC @ Peak Throughput = 1.03Gbps



Digital Thailand @ SpeedTest=873Mbps

DU Meter Stopwatch - #1		
	Incoming	Outgoing
Elapsed time	30 min 39.1 sec	
Total of data transferred	240.1 GB	992.4 KB
Maximum transfer rate	1.2 Gbps	36.4 kbps
Average transfer rate	1.1 Gbps	4.4 kbps
Current transfer rate	1.1 Gbps	3.5 kbps
Stop Help More >> Close		

Capacity Enhancement



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Other solutions to increase network capacity

Network
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Spectrum
Quantity

x

No. of
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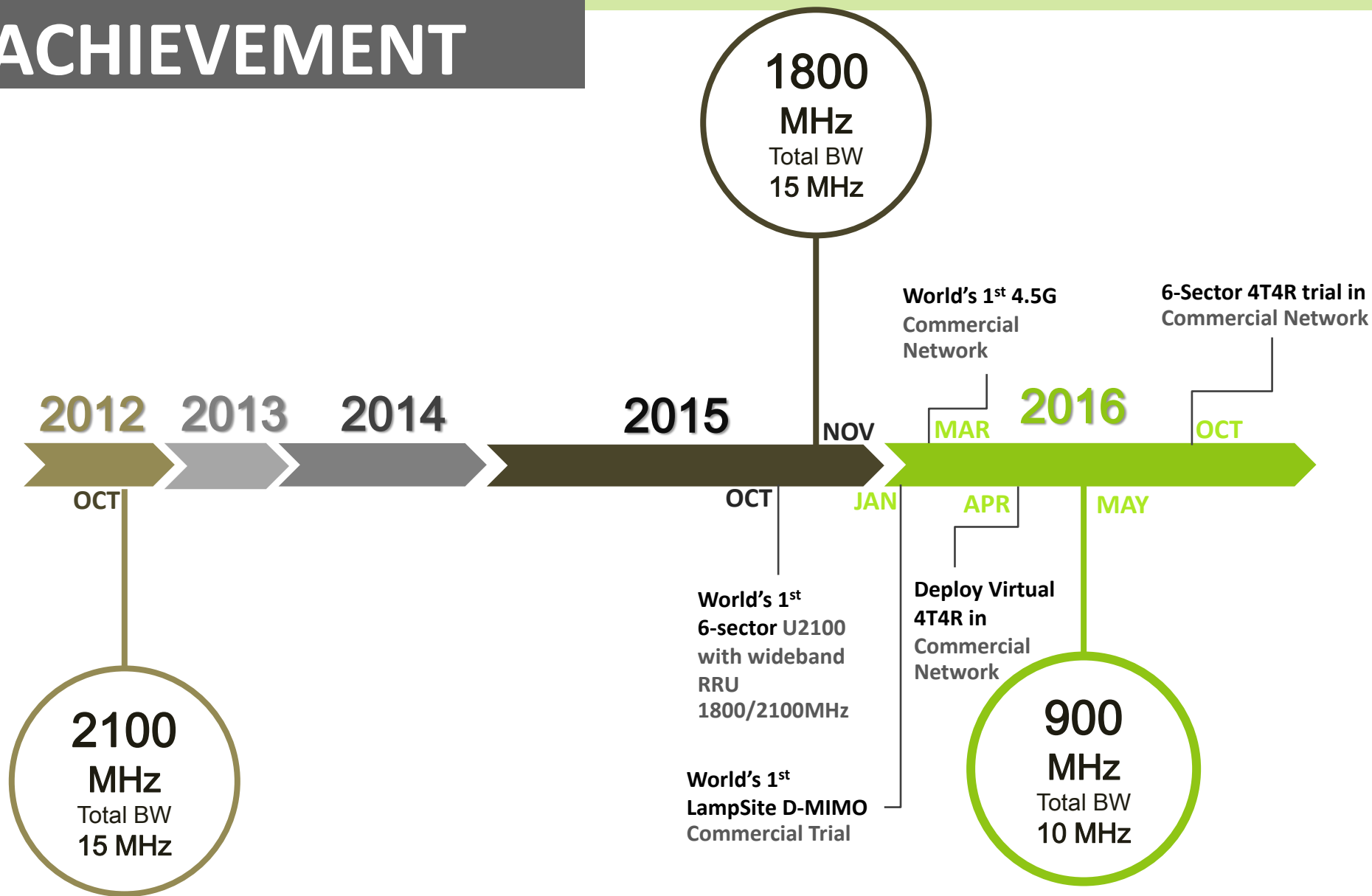
Spectrum
Efficiency

Capacity Gain

Increase **4-10** Times



TIME LINE ACHIEVEMENT



PUBLISHED ANNOUNCEMENT



JAN

AIS vision 2016 @ Siam Paragon DL 403Mbps

- CA 1.8GHz (15MHz) + 2.1GHz (10MHz)
- MIMO 2x2

MAR

AIS 4.5G @ Siam Center DL 530Mbps

- LAA 2.1GHz (15MHz) + 5GHz (20MHz) + 5Gz(20MHz)
- MIMO 2x2
- 256QAM

MAY

Digital Thailand @ Queen Sirikit convention center

DL 874Mbps

- LAA 2.1GHz + 5GHz + 5GHz
- MIMO 4x4
- 256QAM



2016

4

Network and Service Differentiation

DIGITAL LIFE

SERVICE PROVIDER



FORCE & TREND

Power of
OTT

Government
Policy

Generations

Elder
Society

Global Trend

Vertical



Agricultural



Energy



Education



Home



Health



Transportation



Retail Business

INFRASTRUCTURE



Communication
System e.g. 3G, LTE,
NB IoT, LoRa



Software
Applications



Sensing Technologies



Data Analytics
Solution



Hardware and
Software System



Telematics,
Positioning
Technology



M2M technology is boosting ease and efficiency in the agricultural sector

M2M technology is boosting ease and efficiency in the agricultural sector

2 Field sensors can report data on metrics such as nutrients, moisture and the weather to determine which areas need more water and fertilizer.

Individual sheep wearing wireless devices can create a mesh network to give them connectivity across areas where there's no mobile or Wi-Fi signal.

Farmers can map the density of seedlings and optimize sowing. They can even get recommendations on subcontractors that might be best placed for the job.

Viticulturists use sensors to measure the ambient temperature, humidity, atmospheric pressure and the wetness of leaves in vineyards.

Smart collars for cows use accelerometers to monitor how the animals move and can identify when a cow comes into heat or gets sick.

Farm vehicles equipped with telematics can report their location, fuel consumption and fertilizer supply to the farm office or a farmer's smartphone.



Transportation



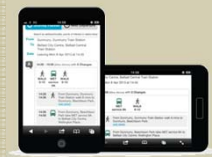
SMART Transportation



Automated fare
collection system



Automated vehicle
location system



Interactive journey
planner for all modes



Car sharing, Cycle
sharing system



Parking information
system



Intelligent signal
system



Real-time monitoring
system



Real-time traffic
information system

SMART HOME

Home security:

Lights, locks, and garage doors can be controlled via mobile apps so users always have peace of mind that their homes are protected

Home entertainment:

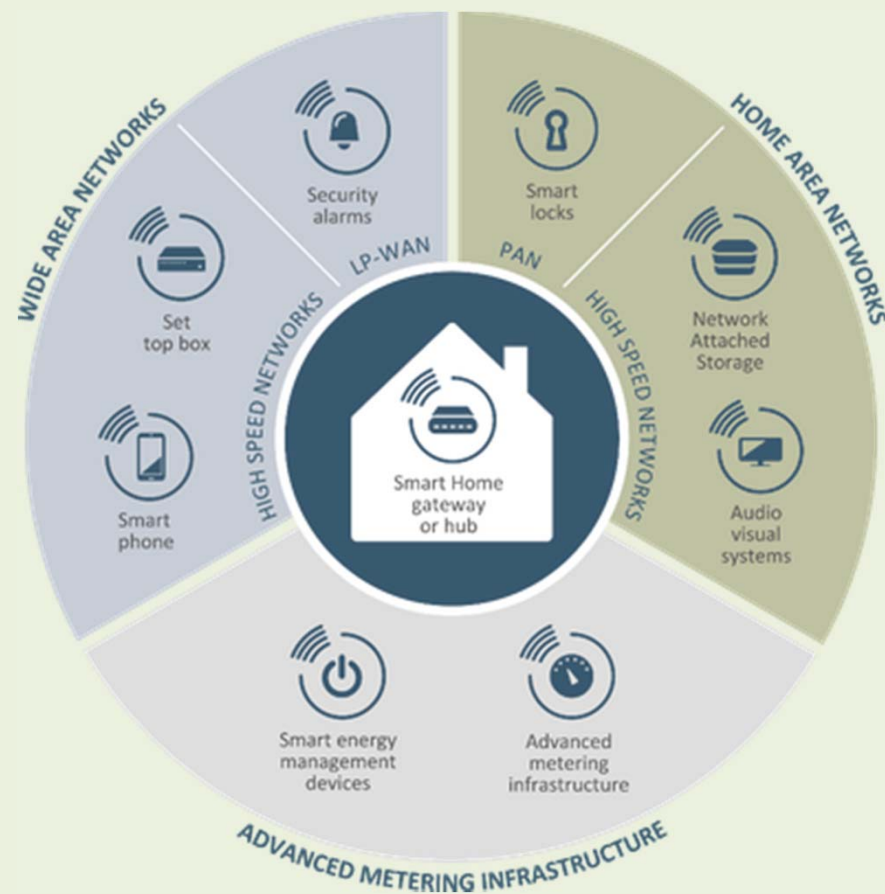
Smart speakers are another hot offering in the smart home space, as they provide high-quality sound across the entire home. Rather than being tied to a single device, these systems can be controlled via mobile apps.

Smart appliances:

In the large appliance space, LCD touch screen controls are becoming popular as they provide more flexibility and control for cooking meals, washing dishes, and other essential tasks.

An intelligent ecosystem:

The true benefit of the smart home is the convenience and peace of mind that comes from having full control over household operations.





Infrastructure



Wide Area Connectivity Protocols



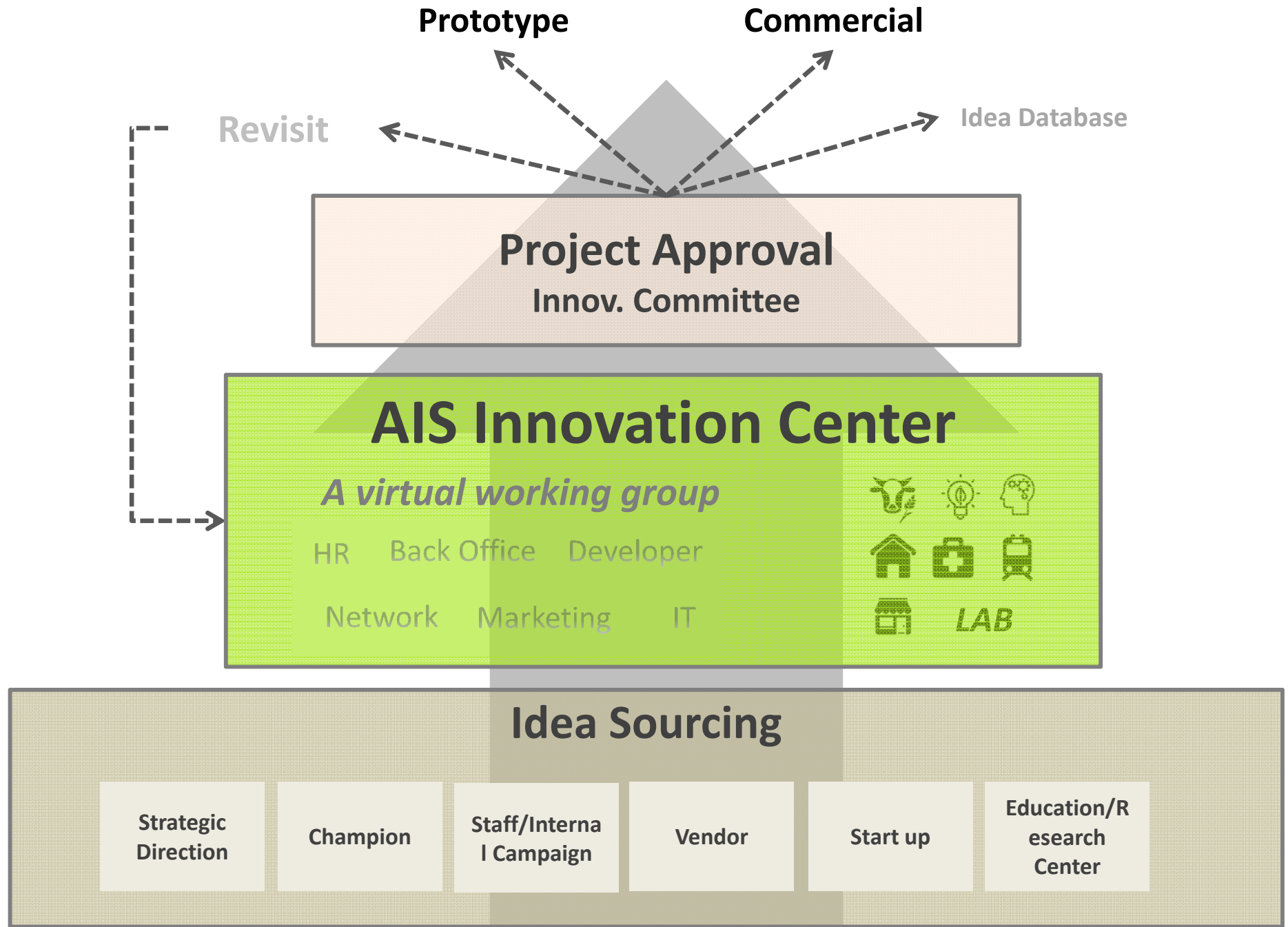
Local Connectivity Protocols



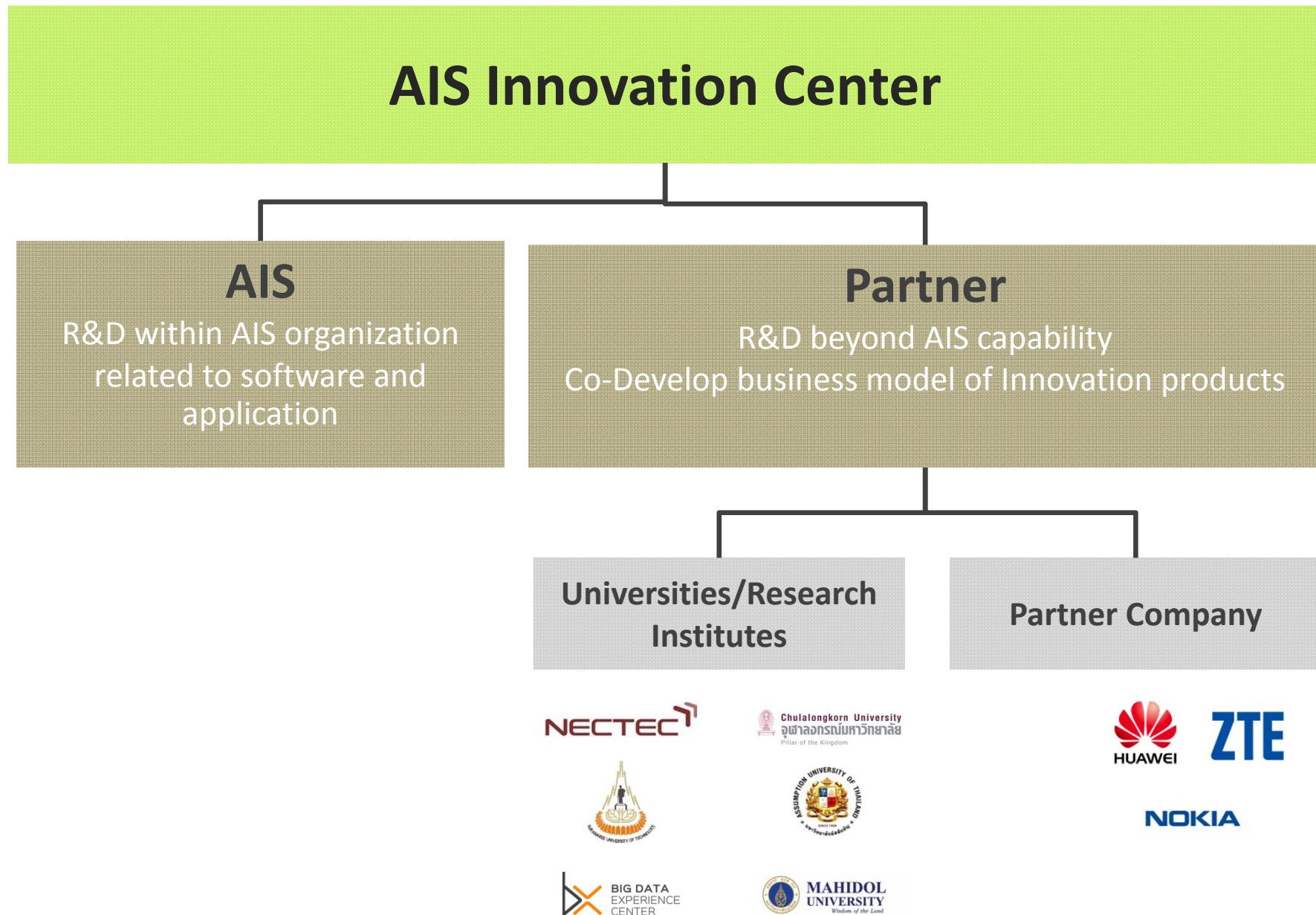
Innovation Framework

Innovation Collaboration Office

Dedicated Organization

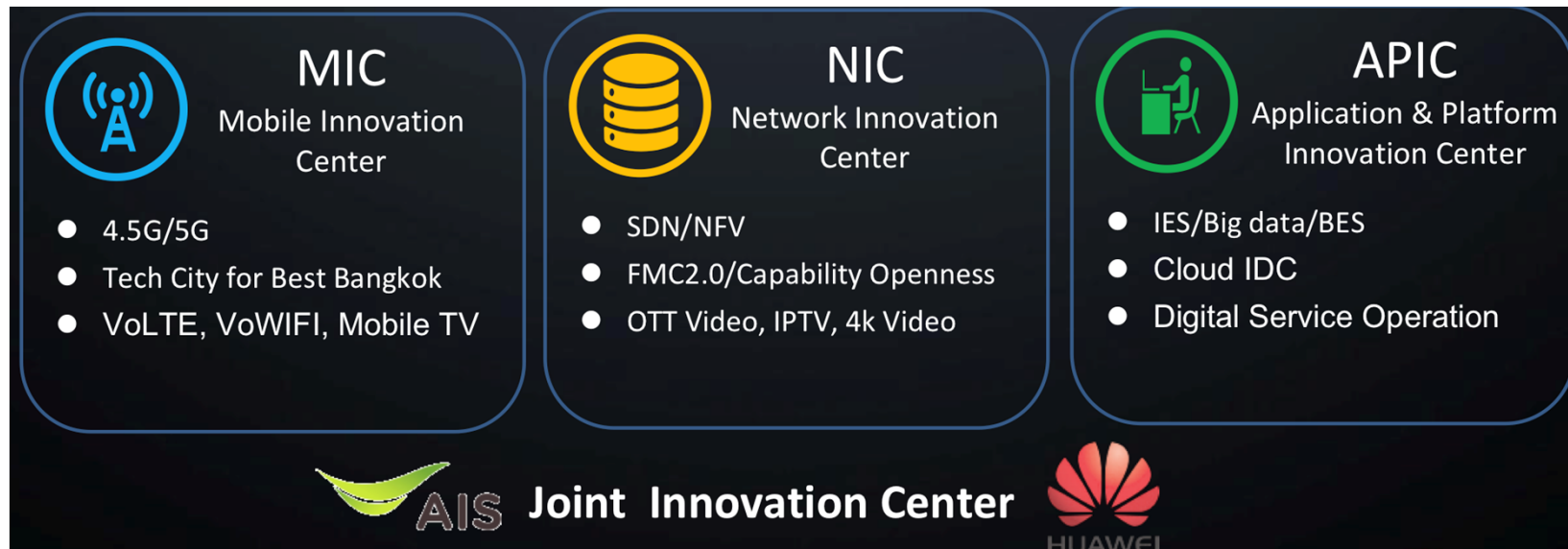


AIS Innovation Center



AIS-Huawei Joint-Innovation-Center JIC

“Supporting **AIS competitive advantage** development by **breakthrough** the limitation of technology follower by **joint research innovation** technology, product and platform with selected supplier that strong in the R&D and willing to open access to their R&D”



Some of Achievements

HSPA 6 Sectors
double capacity

Wide Band RRU
fast LTE roll out



Q&A