



# **Network Intelligentizing for Future 6G Wireless Networks**

## **How AI will Enable Network Intelligentizing?**

**Vision for Future Communications Summit, Lisbon, November 2019**

**Md Arifur Rahman, PhD**

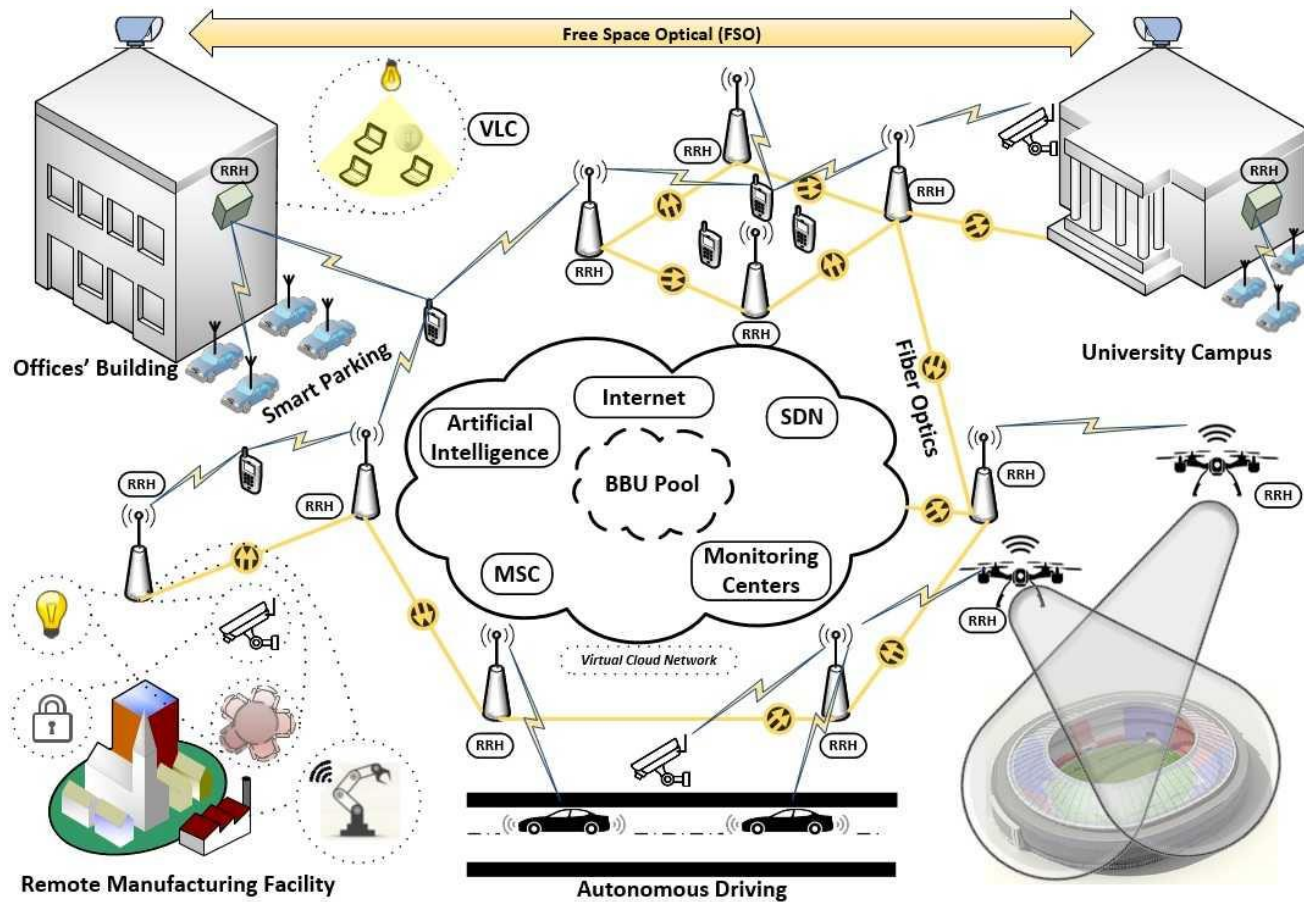


**Part I**

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**Network Intelligentizing Aspects on Future 6G Networks**

# What will be the future 6G network?



\*The future 6G network architecture which will cover everywhere with 6G connections.

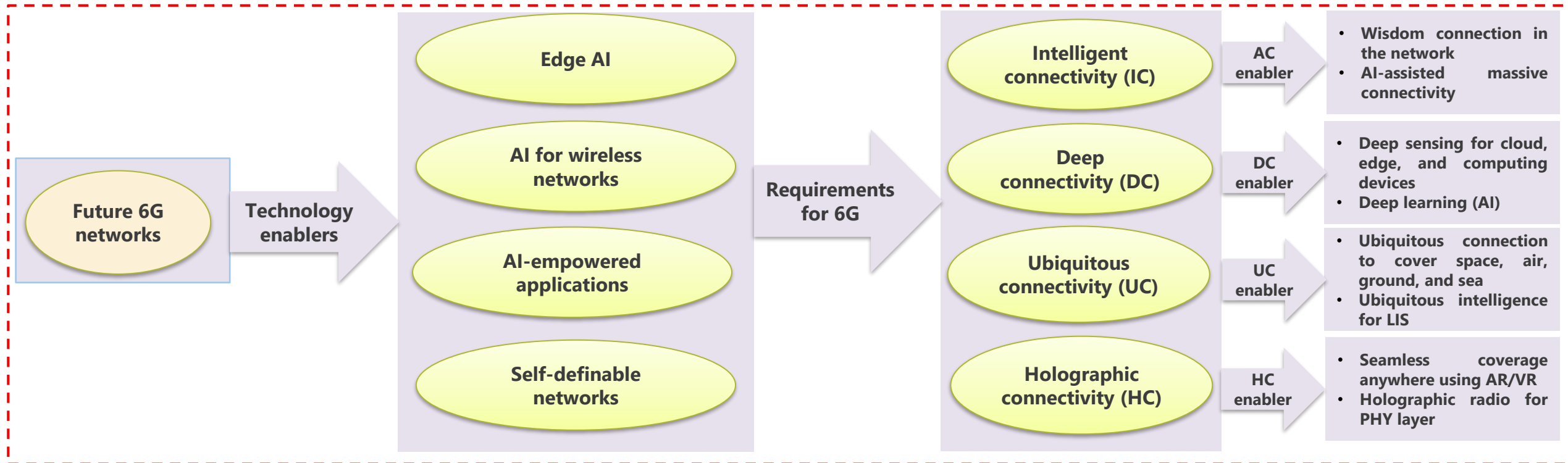
## Smart connectivity of future 6G networks

- Remote radio heads (RRH)**
- Drones**
- Visible light communications (VLC)**
- Base stations (BSs)**
- Network equipments mounted on moving things e.g., autonomous smart vehicles**

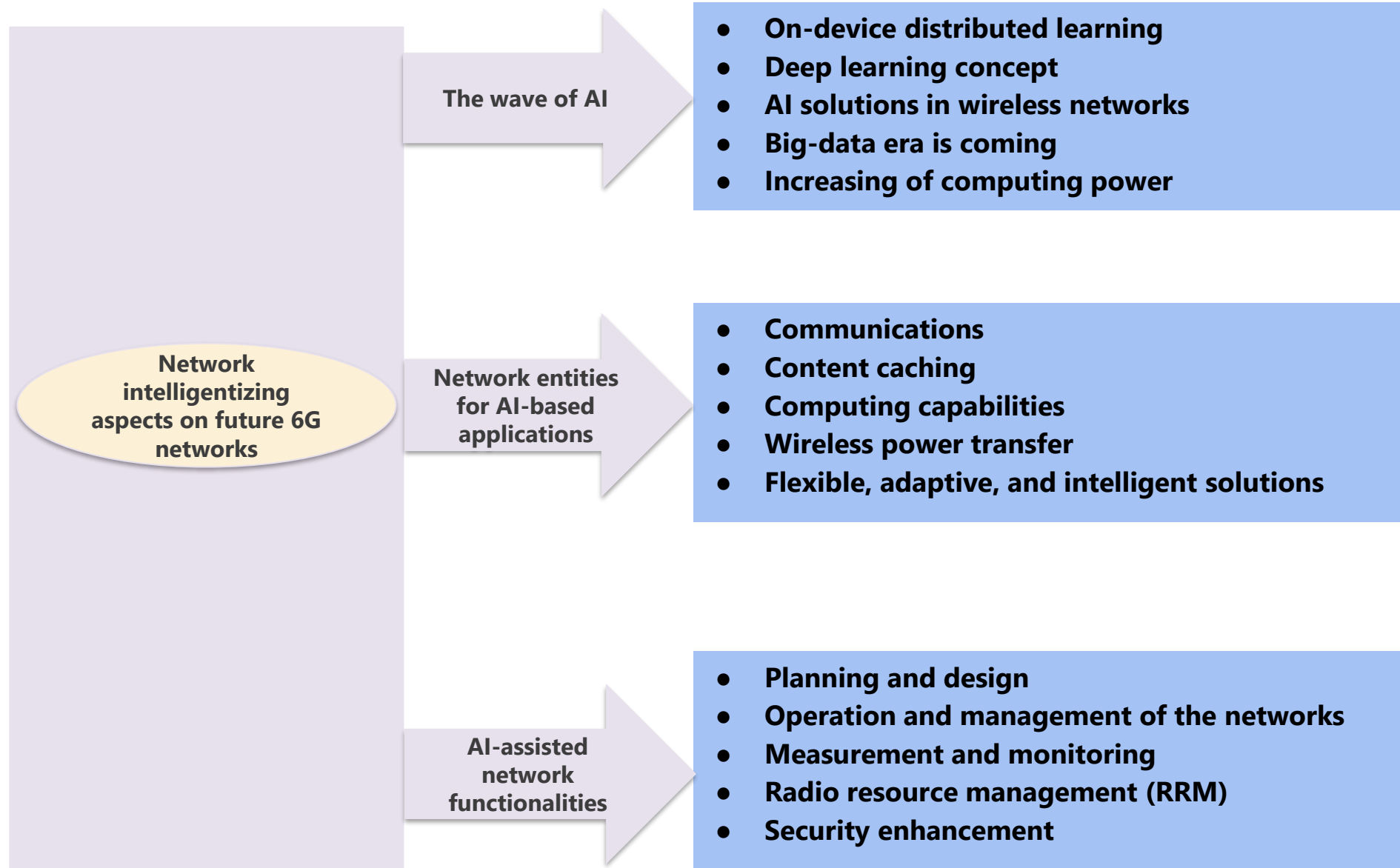
## Network architecture of future 6G

- Cell-free smart surfaces with ultra-high frequencies**
- Temporary hotspots served by drone mounted BSs**
- Network in a spray i.e., Air-duct/Water-duct**
- Using cars as fog/edge devices**
- Water duct communications**

# The Vision of AI in Future 6G Networks



# Network Intelligentizing Aspects on Future 6G Networks

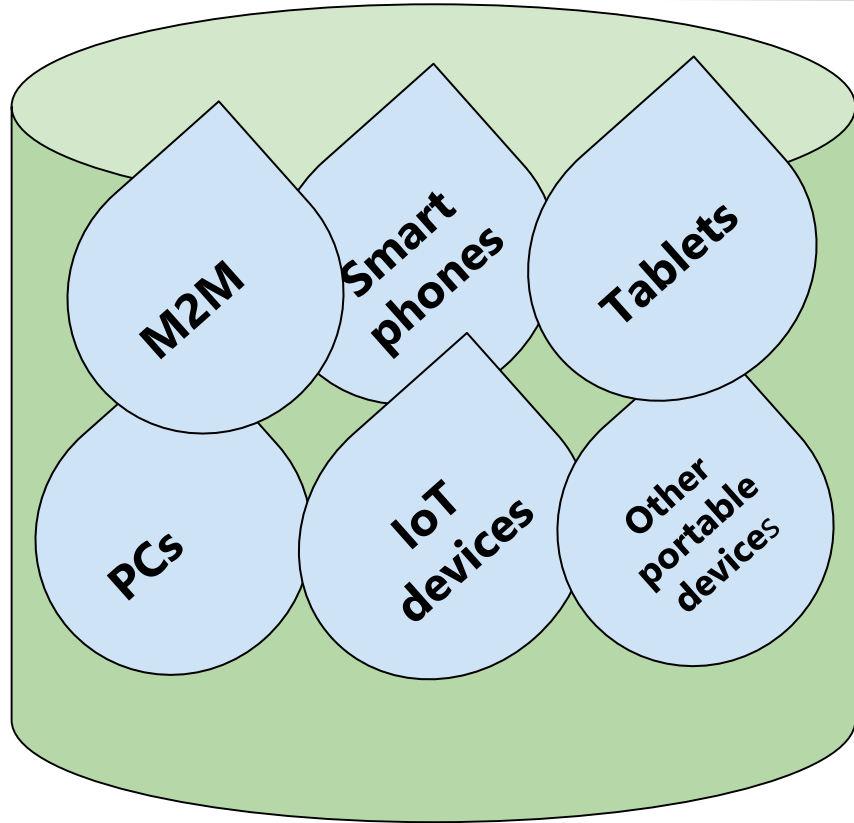


**B**

**Part II**

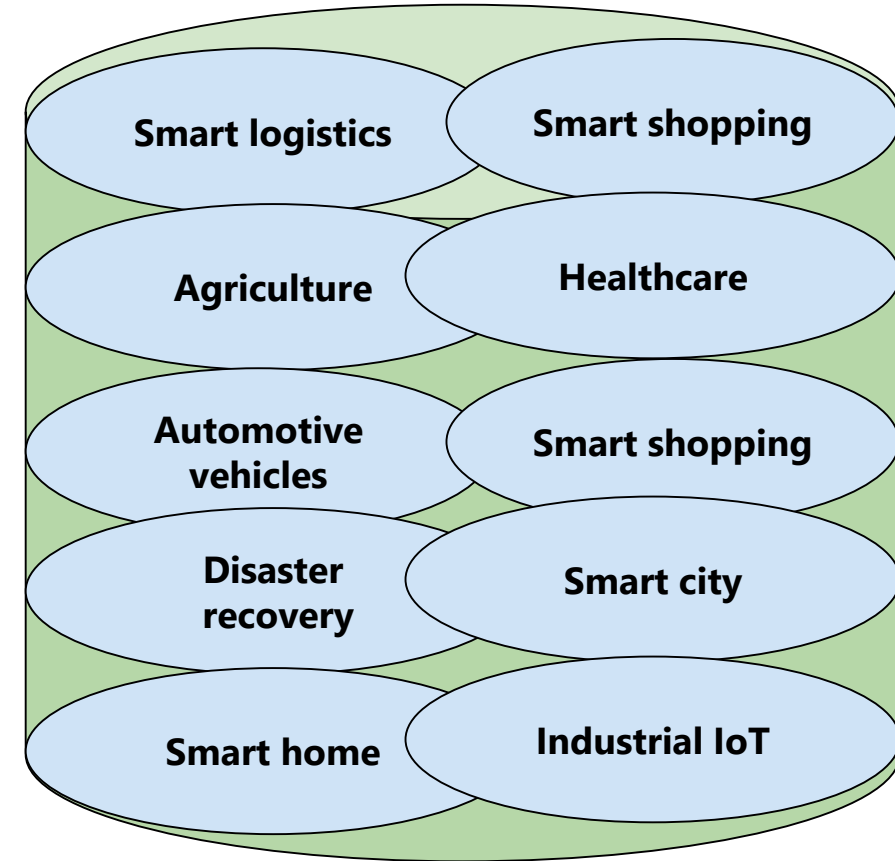
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**AI enabled network revolution**



## Massive growth of devices

In 2020, global IoT devices will grow to 50 billion, 6 times more than the device in 2011.



## Massive growth of data

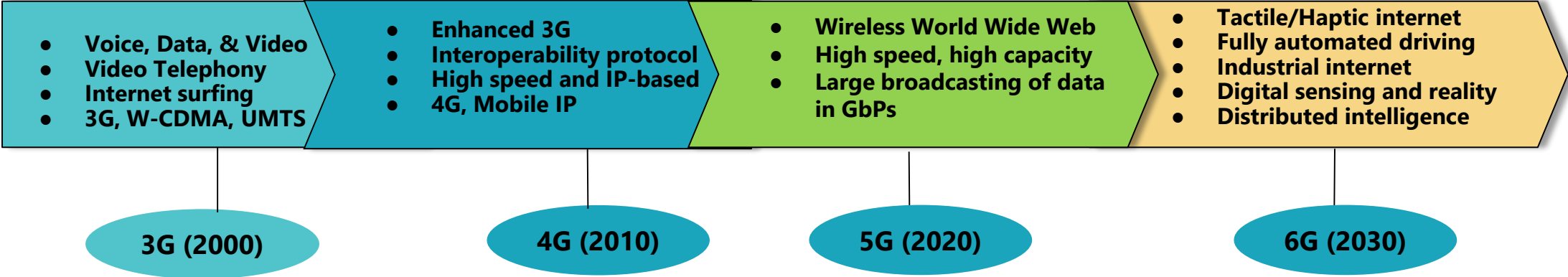
- In 2020, 35 EB per month data traffic will be generated as a mobile data traffic
- In 2020, global data amount will increase upto 40 ZB and it is 50 times more than in 2011

\*Source: Comp TIA, CISCO

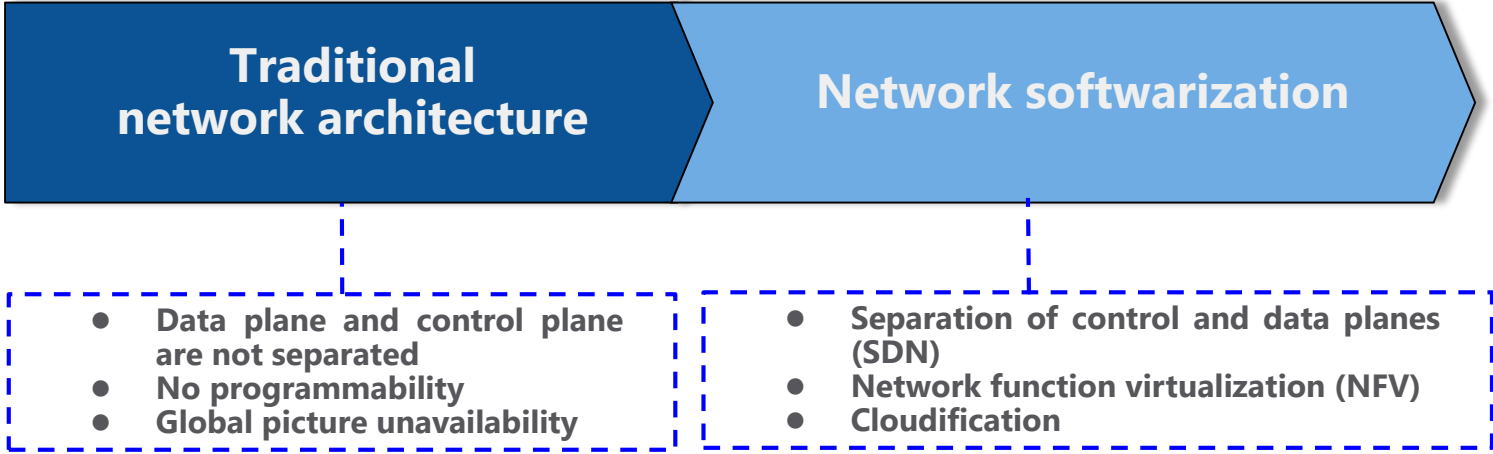
# Challenges on the Wireless Communication Industry [2/2]



The evolution on wireless networks



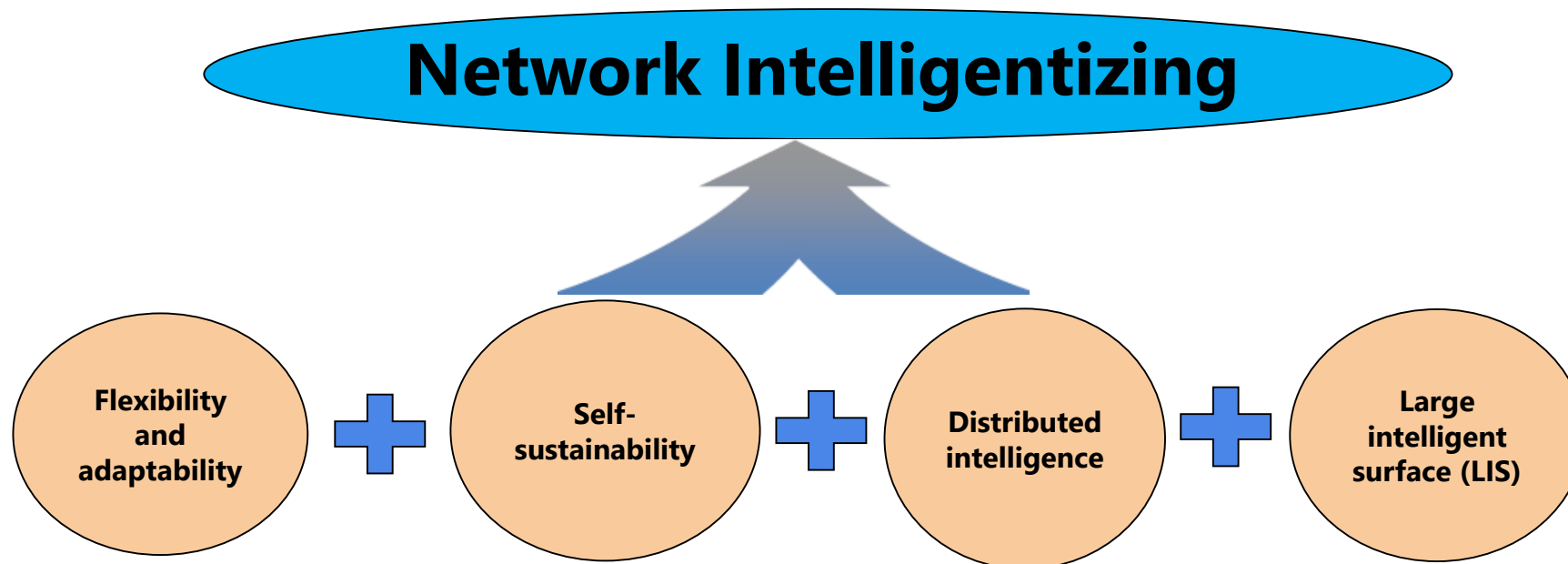
The trend of network architecture evolution

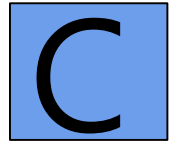




# Importance of intelligentizing the future 6G networks

- ❑ Influence advanced wireless communications and mobile computing technologies
- ❑ Enable AI-enabled applications at different edge devices of the networks with limited computational capability and energy resources
- ❑ Scaling up distributed training and inference over the cloud, network edge, and end devices
- ❑ AI-enabled security enhancement
- ❑ AI could adaptively adjust and optimize the networks
- ❑ Realize fully end-to-end automated network architecture



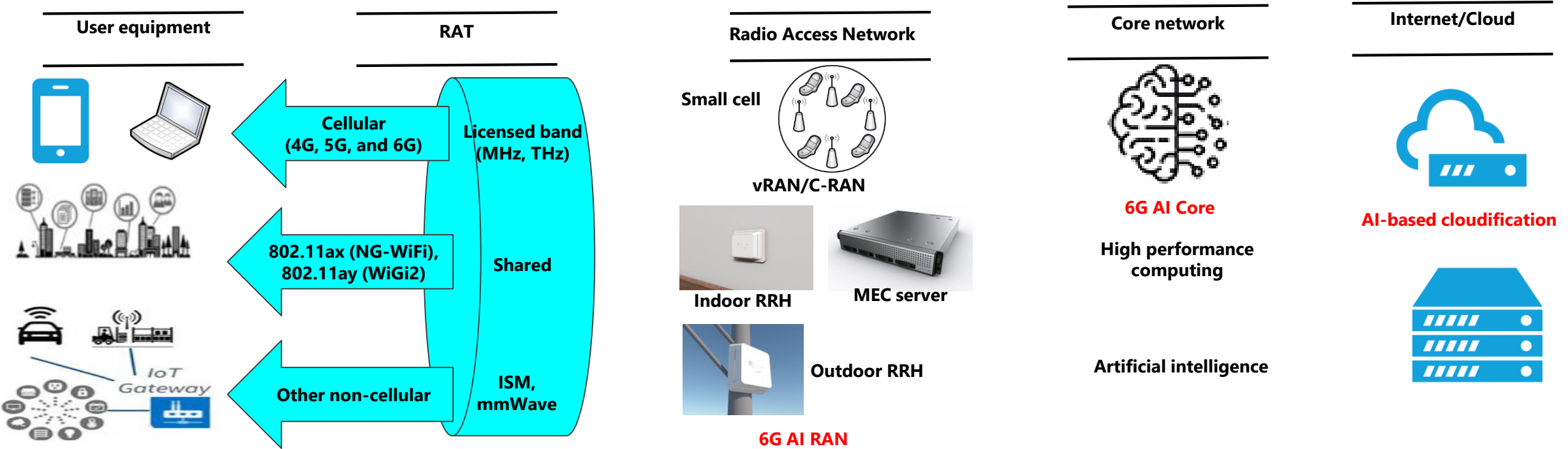


## **Part III**

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## **Roadmap on network intelligentizing**

# Potential of AI in Future 6G networks



## Large-scale intelligent surface

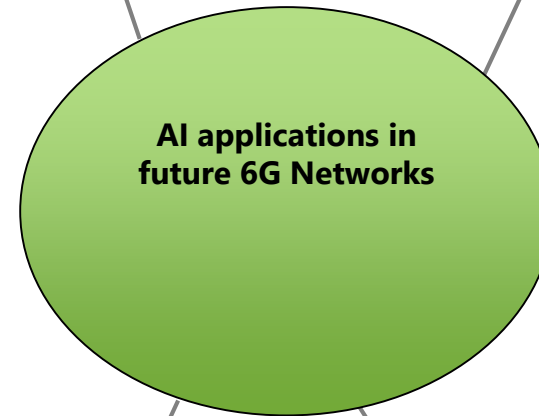
- ### AI for radio access network optimization
- AI-assisted PHY layer
  - AI for network/MAC radio resource management

- ### AI for Operation and management of the networks
- Network design and planning
  - Critical network management

# Application of AI in future 6G networks

## AI for PHY layer

- Signal detection, classification, and compression
- Channel encoding and decoding
- AI-assisted positioning, sensing, and localization
- Channel estimation and equalization
- AI compatible edge devices



## AI for operation and management

- Dynamic network orchestration
- Dynamic slice management
- Control and policy enforcement
- Critical network management
- Measurement and monitoring
- Security enhancement

## AI for MAC layer RRM

- User clustering for cell-free smart surfaces with ultra-high frequencies
- Dynamic scheduling of resources
- Adaptive power control
- Interference management

## AI for higher layer RRM

- AI-assisted brokering mechanism for RAN slicing
- Slice admission control
- Slice scheduling
- Handover management
- Mobility management

# Open question: How AI will enable network intelligentizing?

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- ❑ **AI will enable network intelligentizing based on the following aspects:**
  - ❑ Real-time conversations amongst the network entities
  - ❑ Combination of AI-designed underlying network topologies and AI-driven SDN
  - ❑ Intelligent operation and management of the networks
  - ❑ AI in RAN to optimize the network resources
  - ❑ AI-based mobile applications
  - ❑ Intelligent wireless communication
  - ❑ Proactive maintenance



# Contact details

Md Arifur Rahman

[a.rahman@is-wireless.com](mailto:a.rahman@is-wireless.com)

IS-Wireless,

ul. Puławska 45b

05-500 Piaseczno / near Warsaw

Poland

Phone +48 22 123 8297

**Mobile: +48 663 268 958**

[www.is-wireless.com](http://www.is-wireless.com)

[info@is-wireless.com](mailto:info@is-wireless.com)