



# 5G mmWave Communication: Network Architectures and Platforms

**Dr. Geng Wu**

**Chief Scientist, Head of Intel 5G Research and Standards**

[geng.wu@intel.com](mailto:geng.wu@intel.com)



# The evolution towards 5G: compute and communications



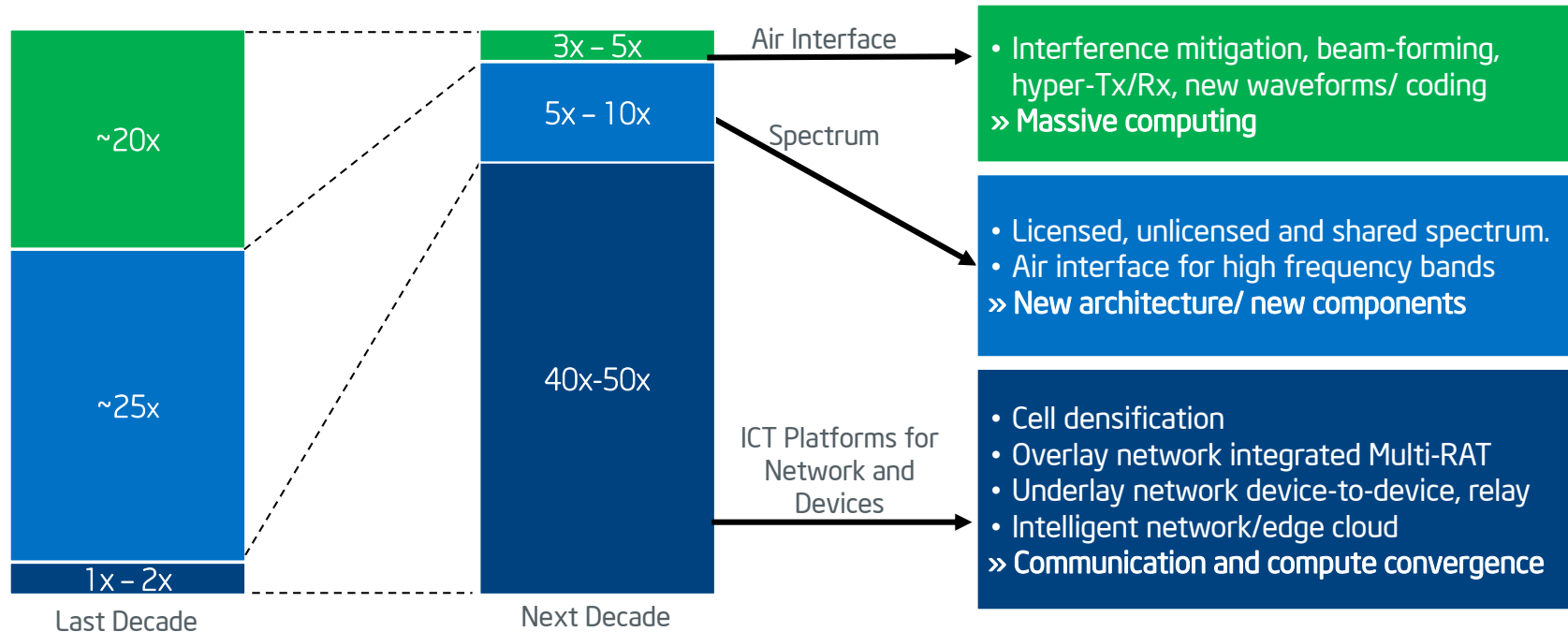
Market demands lead to 5G:

- 1G-4G were focused on improving communications,
- Communications & processing are diffused across networks and mobile devices
- Scalability, Versatility, Energy Efficiency
- Capacity, Intelligence and User Experience

5G = compute & communications

# 5G requirements on network and device platforms

Wireless technology is at a turning point. Future performance is measured in bit/s/Hz/m<sup>2</sup>/joule.

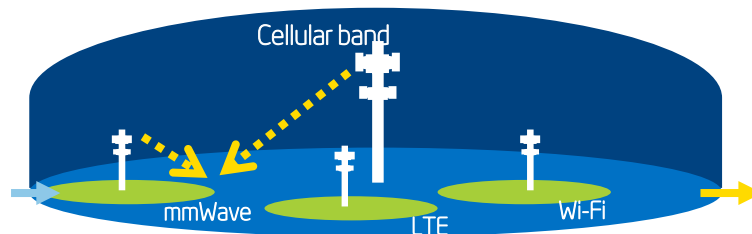


"5G Network Capacity - Key Elements and Technologies," IEEE Vehicular Technology Magazine, March 2014

# 5G network architecture trend 1: Overlay networks for high frequency bands and energy saving



Avoid excessive handovers in traditional heterogeneous networks

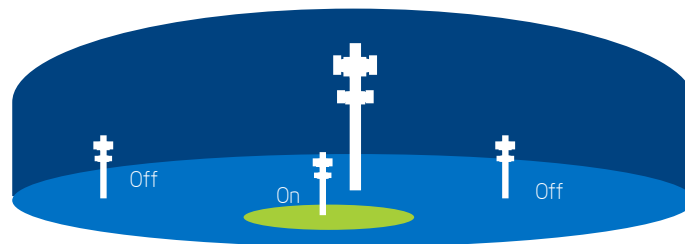


Control plane anchored at macro-cell, user plane from small cells

User experience for now, new RAT @ high frequency bands for future



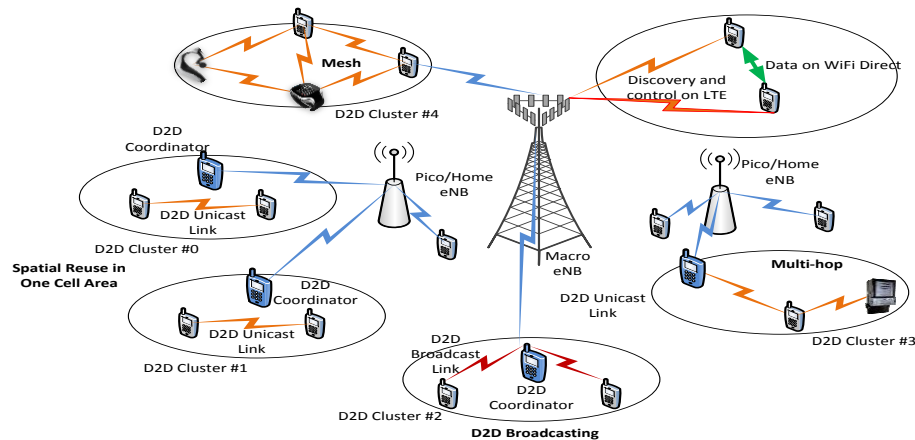
Incremental small cell deployment according to traffic growth



Turn off selected cell sites at light traffic hours

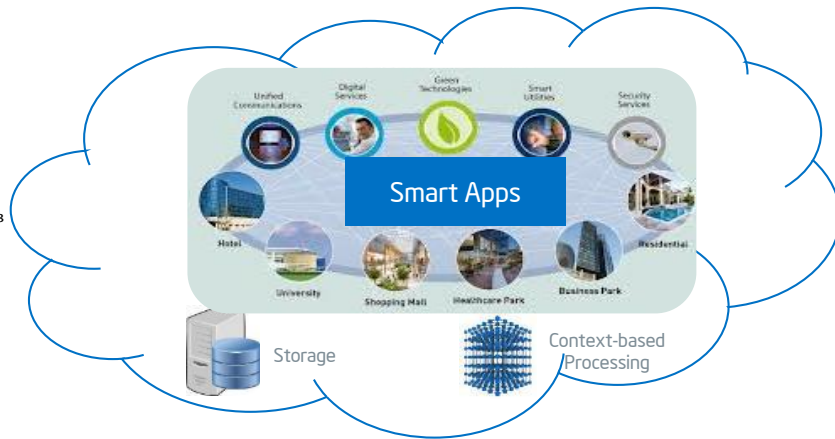
Coverage for now, network energy saving for future

# 5G network architecture trend 2: Underlay networks for things/wearables and proximity services

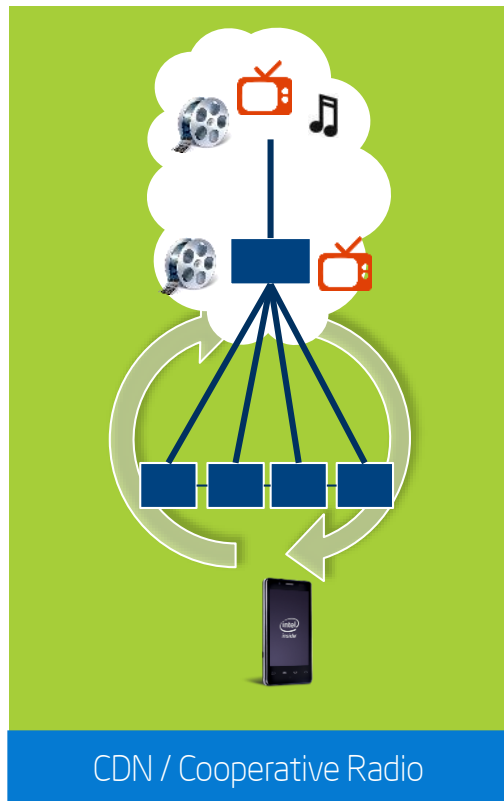
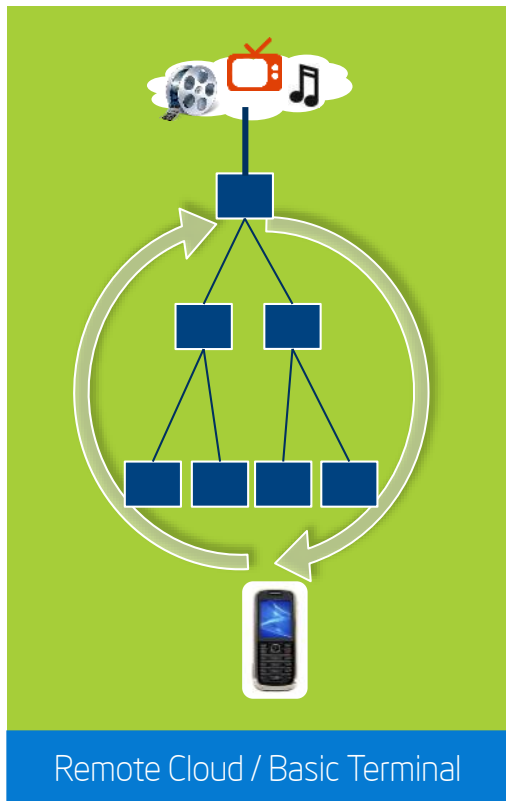


Many devices, types of devices, connections  
Many moving underlay network clusters

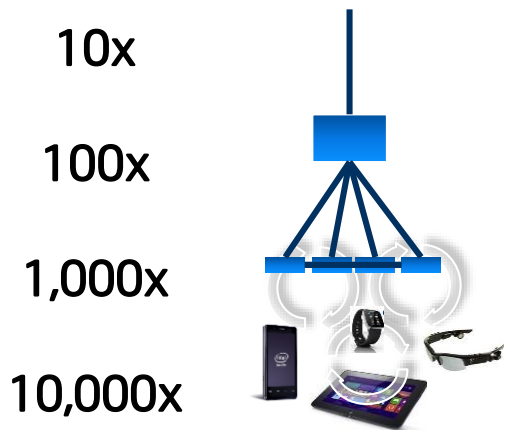
One big intelligent and information network  
Compute, storage, networking



# 5G network architecture trend 3: Cloud expansion to network edge and to devices

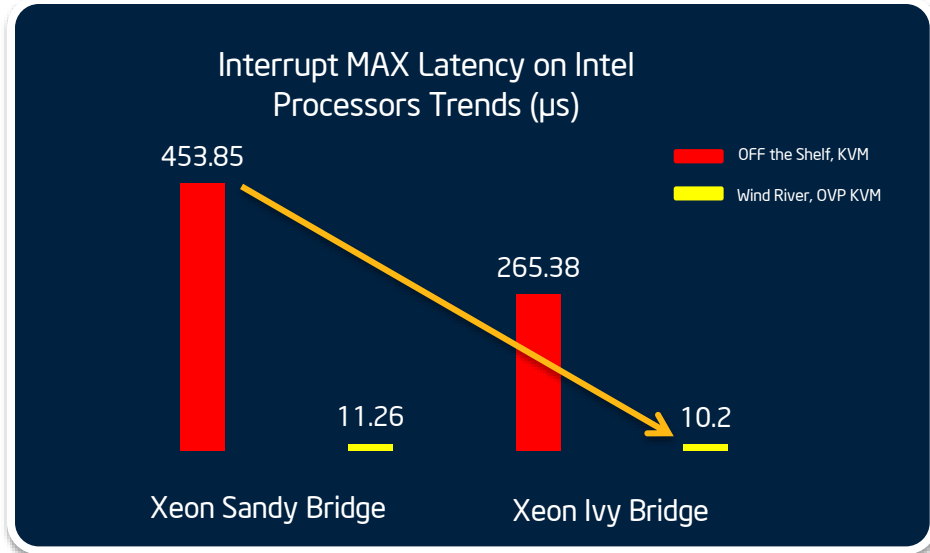


# 5G network platforms: cloud evolution of 5G networks



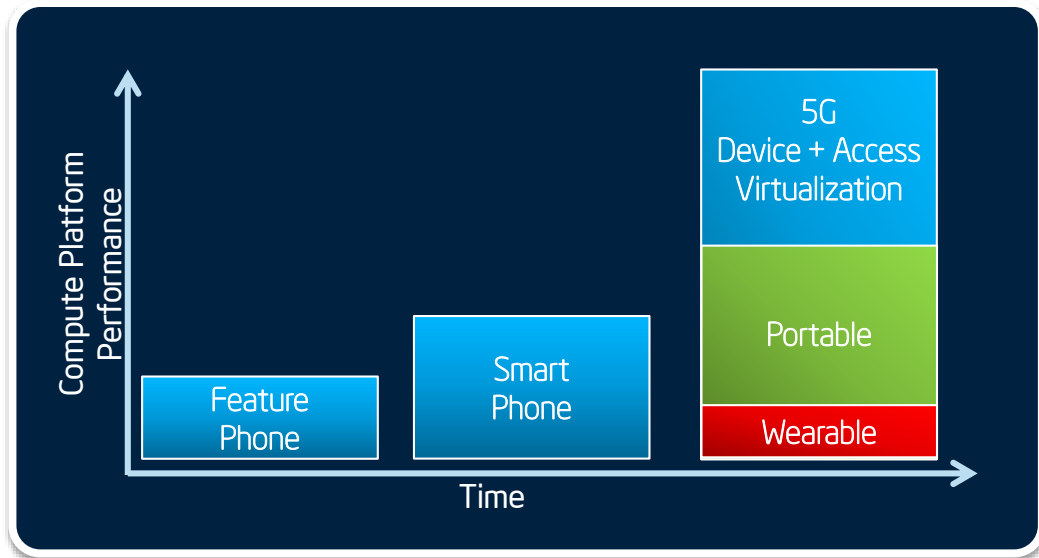
*5G network capacity scaling*

- Cloud RAN architecture plays a pivot role in network densification and cooperative networking.
- Real time workload for air interface related signal processing requires complete hardware + software platform solutions.



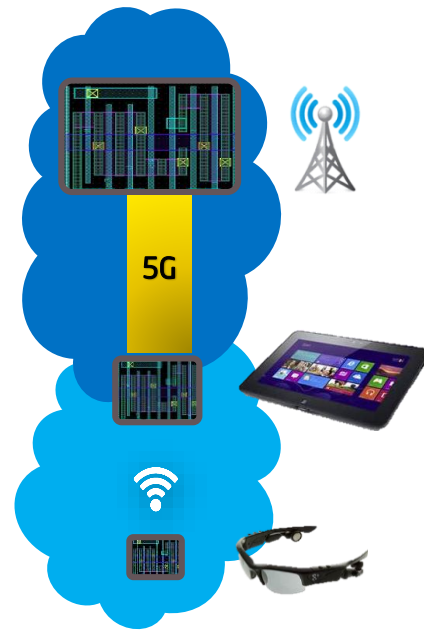
- Edge cloud shortens the distance between an user and his contents/services, matches 5G air interface capability.
- Data, information, and intelligence intensify around user. Edge cloud efficiency becomes crucial.

# 5G device platforms: virtualization of 5G device and access



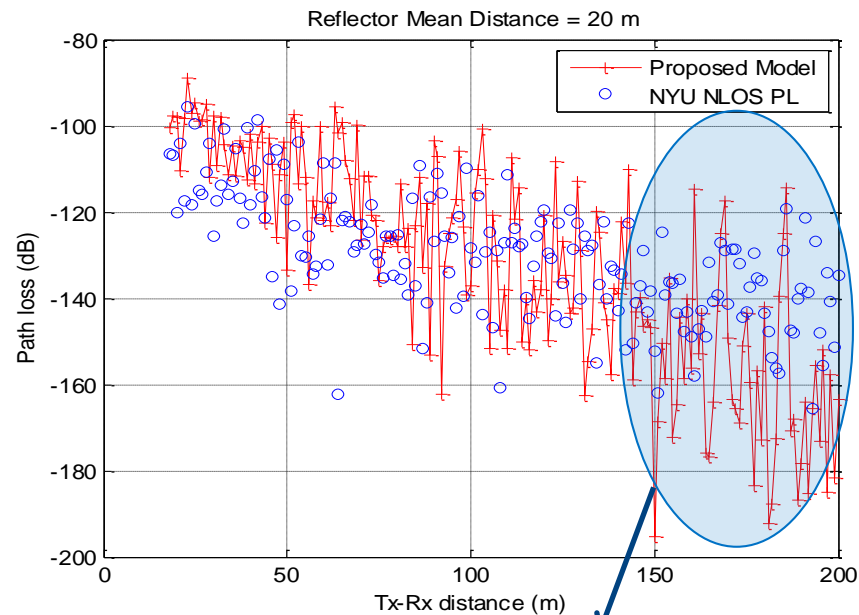
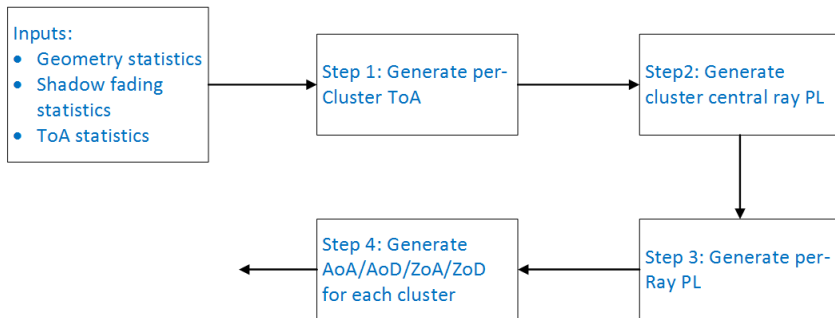
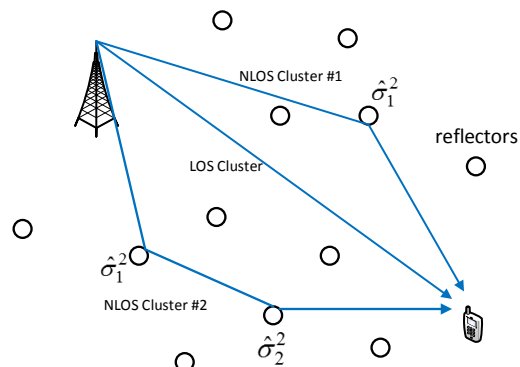
*5G d+a virtualization for scalability, versatility, energy efficiency*

- Future applications require intensified compute and communication but often smaller device form factor
- 5G high data rate + low latency radio links enable mobile device + access virtualization across the air interfaces
- 5G services are immersive. Sensing, intelligence and contents require edge cloud and device + access virtualization
- Breaking computing barrier through communication may transform consumers' relationship with network





# mmWave channel modeling



"Channel Model for millimeter-Wave Communications Based on Geometry Statistics", IEEE GLOBECOM 2014

# Intel 5G research and technology development



Intel Strategic  
Research  
Alliance on 5G



P5: Efficient Hardware/Software and Platforms  
for 5G Network Elements and Devices

