Internet of Radio Light Introduction

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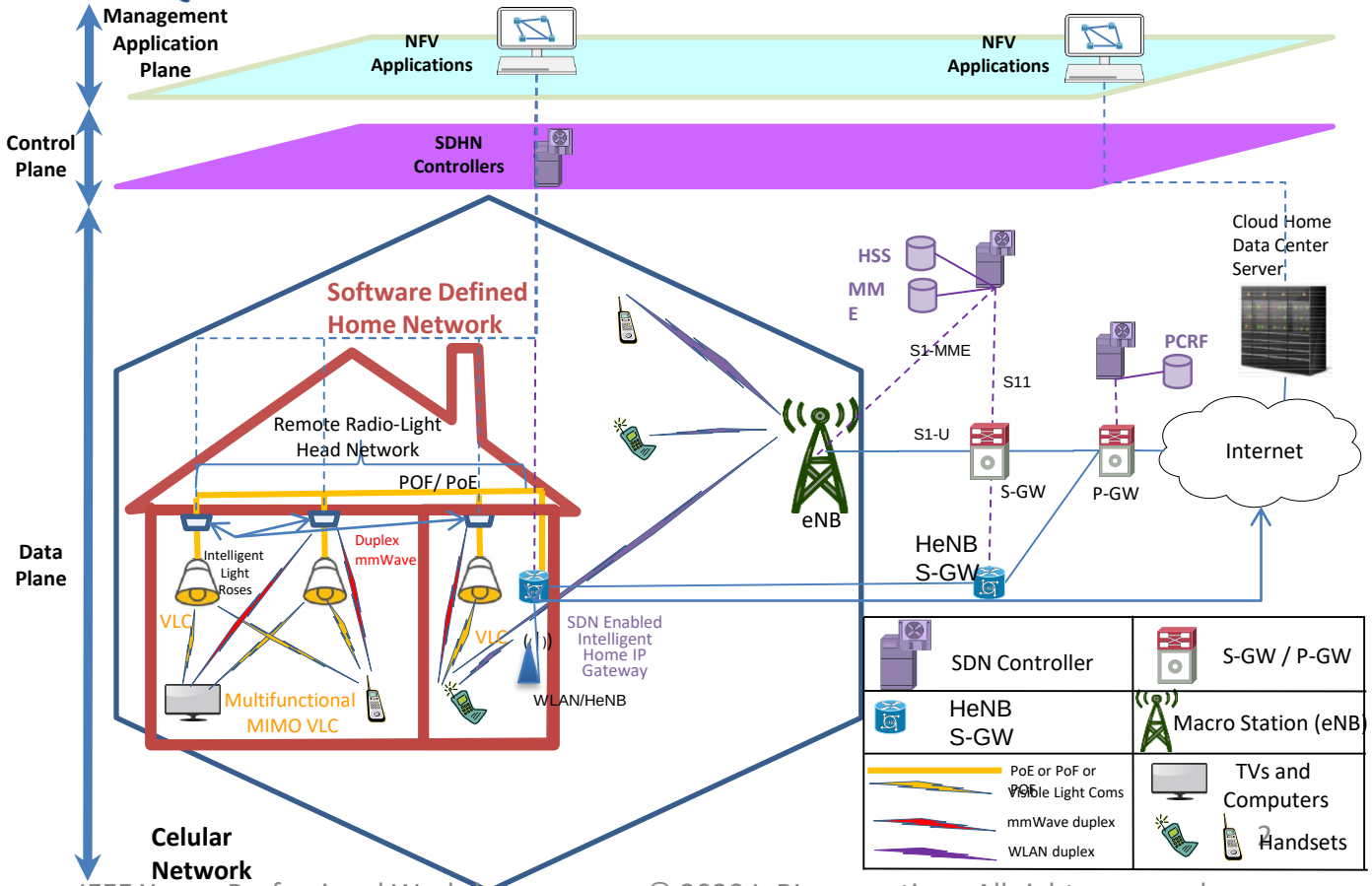
IoRL System Concept



Home and Museum Verticals

Building Research Establishment Home

- Internet of Radio-Light Office
- AV Streaming to UHDTV
- 360º AV Streaming to VR Headsets
- < 10cm Location accuracy of UE
- Intra Building and Inter gNB Handover
- Home Video Security Monitoring
- DoS and Rogue Tx Network Security Monitoring

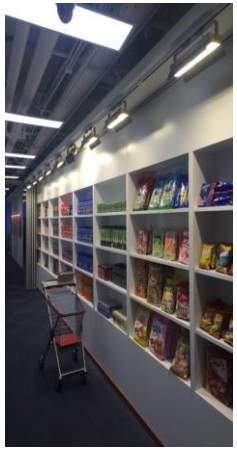
Musée de la Carte à Jouer

- < 10cm Location accuracy of UE
- Location Based Data Access Applications
- Monitoring of UE Locations Applications
- Guiding of UE Applications
- Interaction with Internal/External Database Applications
- 360º AV Streaming to VR Headsets
- Museum Video Security Monitoring
- DoS and Rogue Tx Network Security Monitoring

Train Station and Supermarket Verticals

❑ Nuevos Ministerios Station Platform & Tunnel

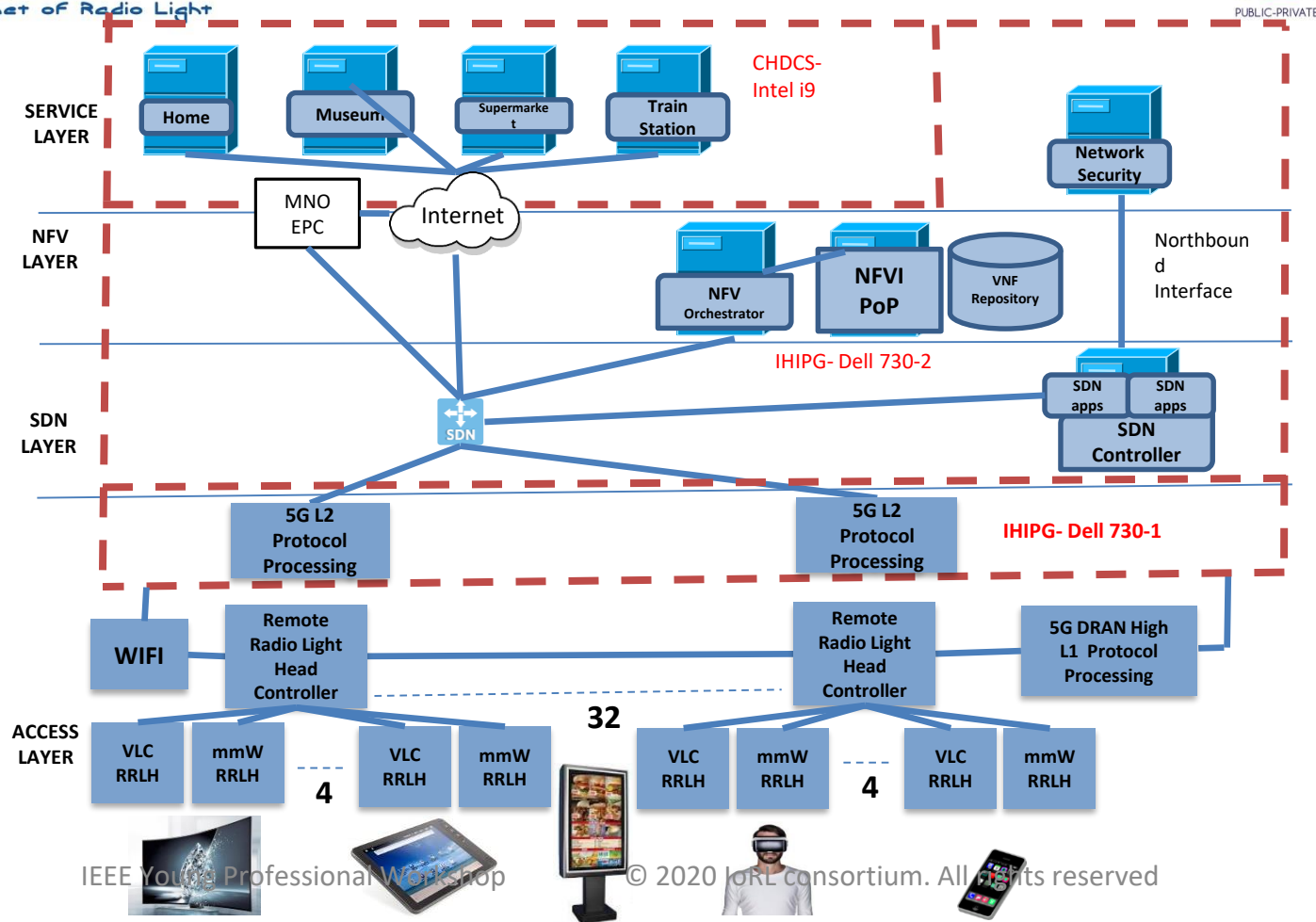
- Monitoring of UE Locations Applications
- Location Based Data Access Applications
- AV Streaming to UHDTV
- Video Conferencing
- DoS and Rogue Tx Network Security Monitoring
- Eavesdropping Network Security Monitoring



Chinese Supermarket

- Interaction with Internal/External Database Apps
- Location Based Data Access Applications
- Monitoring of UE Locations Applications
- Guiding of UE Applications
- AV Streaming to UHDTV
- Video Security Monitoring
- Video Conferencing
- DoS and Rogue Tx Network Security Monitoring
- Eavesdropping Network Security Monitoring

Architecture



Innovative Products

- ❑ Distributed RAN
- ❑ 40GHz PCB Horn Antenna
- ❑ 40GHz Transceiver Module
- ❑ VLC Transmitter LED
- ❑ VLC Photodiode Receiver with Optical Lens
- ❑ Remote Radio Light Head
- ❑ 5G Test User Terminal
- ❑ 4k Picture in Picture 5G TV

Innovative Virtual Network Functions

- Multisource Streaming Server
- Follow-Me TV Service
- Load Balancing Service
- Distributed Network Security Services
  - Denial of Service,
  - Sniffing
  - Rogue Scanning
- Indoor Location Services
  - Artificial Intelligent Anchor Point Estimating
  - Machine Learning Data Fusion

Innovative Applications

- ❑ Tetherless Virtual and Augmented Reality Headset
- ❑ Location Based Data Access
- ❑ Location Based Monitoring and Guiding
- ❑ Virtual Tourism
- ❑ Multiplayer Gaming
- ❑ 4k Picture in Picture TV

Key Performance Indicator Achievements

- 42 Mbps was obtained on the VLC system with 10MHz bandwidth, 4-QAM and SCS=30kHz on the Viavi testbed
- VLC Coverage area 1m x 1m per Light head – making it suitable for personal area networks
- VLC location accuracy 3.5 cm
- 310Mbps was obtained on the mmWave system with 100MHz bandwidth, 64-QAM and SCS=30kHz on the Viavi testbed.
- 70Mbps using 100MHz bandwidth with 4-QAM and SCS=30KHz at mmWave in the laboratory using the Runel testbed
- mmWave coverage area 2m x 6m
- Less 0.5ms latency has been measured at 10 MHz bandwidth at the physical layer between the UE and the DRAN.

Potential

- RRLH Controller and DRAN designs could be enhanced to operate at 400MHz bandwidths with 64-QAM and SCS=30KHz at mmWave to produce 1240Mbps per RRLH Controller in a final commercial FPGA/ASIC system.
- This 1240Mbps is scalable since it can be provided to each of up to 32 RRLH Controllers in rooms in a building to a total of 10Gbps from a 10Gbps Ethernet ring home network.

Publication Achievements

- 30 Peer Reviewed Journal Publications
- 45 Peer Reviewed Conference Publications
- 12 Public Presentations
- 3 Keynote Presentations
- 6 Invited Talks
- 9 Workshops
- 22 Exhibitions and Demos
- 1 Cost White Paper
- 2 EU White Papers on (1) Architecture (2) Verticals
  - 3 others in preparation (3) Indoor Networks (4) Artificial Intelligence (5) MEC

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- This presentation reflects the author's view, only, and the Commission is not responsible for any use that may be made of the information provided.

Thank you for your attention

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