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Introduction to the ITU-T SG15 Standardization of OTN for 5G Bearing

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Outline

- Introduction to ITU-T Study Group 15 (SG15)
- Recent and current work in SG15 on 5G bearing
- Results of the recent Q11/15 Interim meeting
- Thoughts on OTN “3.0” and 5G
- Questions and Answers

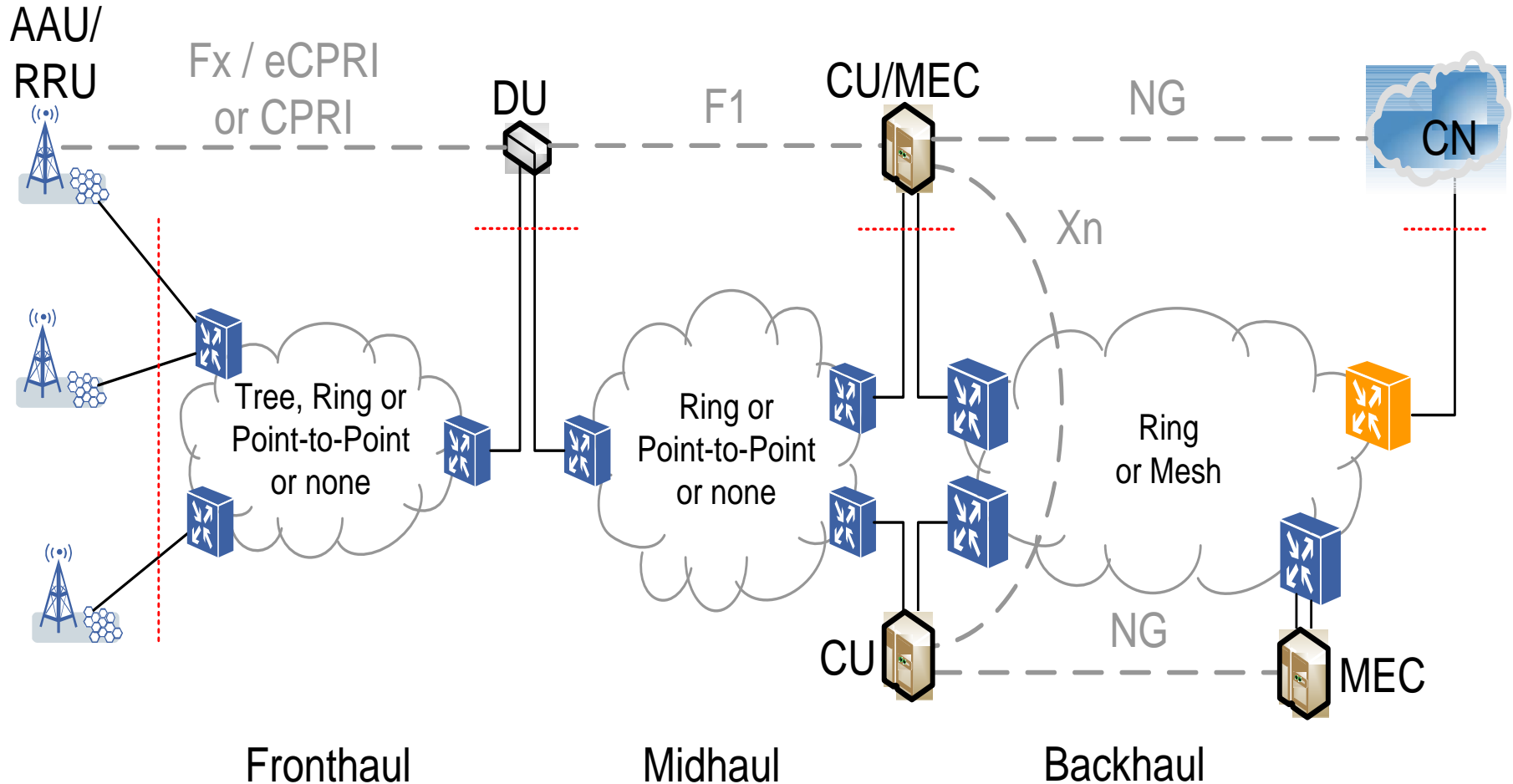
Executive Summary

- Support for 5G will require a combination of existing and emerging transport network technologies
- ITU-T is the ideal standards organization to address transport networks to support 5G
 - ITU-T is unique in its expertise
- ITU-T is currently actively involved documenting the requirements for 5G transport networks
 - ITU is also considering technologies to address these requirements
- Chinese network operators are taking a lead role in the ITU-T work

The need for 5G Transport Network Standardization

- The transport network will need to evolve for optimum support of 5G/IMT2020. For example:
 - The Fronthaul and Backhaul bandwidths will increase dramatically
 - The Middlehaul is being added to the wireline access network
 - Network slicing is increasingly important
- Many standards organizations are becoming involved.
- The ITU-T is well positioned to capture the transport network requirements, which helps clarify what portions of the work are best suited to different groups

Illustration of 3GPP interfaces and network partitions



- 5G functional interfaces are shown in gray. They are logical point-to-point interfaces, independent of the transport network topology.

Introduction to ITU

- ITU (International Telecommunication Union) is the primary international telecom standards organization
 - ITU is a Special Agency of the United Nations
 - The ITU-R Sector covers Radio Communications
 - For example, it produced IMT-2020
- ITU-T SG15 focusses on standards for wireline carrier networks
 - Access networks, including Passive Optical Networks (PON) and DSL (e.g., G.fast)
 - Optical networks (L0), including the G.694.2 CWDM and G.694.1 DWDM wavelength grid
 - Metro / core L1 network protocols, including G.709 and G.798 for OTN and G.707 for SDH
 - Network management, including ASON
 - L2/L3 Packet networks for carrier transport, including Ethernet (G.8013) and MPLS-TP (G.8113.1)
 - Protection and restoration (G.873.1 for OTN, G.8031 and G.8032 for Ethernet, G.8131 for MPLS-TP)



SG15 Expertise for 5G Bearing

- ITU-T SG15 is unique in the wide range of its expertise to address 5G bearing (transport) requirements, including:
 - Network architecture (Q12)
 - L1 signal formats for Fronthaul (PON in Q2 and p2p in Q11)
 - L1 signal formats for Middlehaul and Backhaul (Q11)
 - Synchronization, including timing distribution and jitter (Q13)
 - Network management (Q14)
 - Optical network parameters (Q6)

Introduction to Q11 of SG15 (Q11/15)

- Q11/15 Scope – “Signal structures, interfaces, equipment functions, and interworking for optical transport networks”
- Areas of responsibility include specification of:
 - Specification of transport signal structures, such as GFP, and OTN, SyncO, and FlexO
 - Specification of adaptations of client signals into server transport layers
 - Specification of all equipment functions, supervision related to the OTN networks
 - Investigation of 5G mobile front haul and backhaul transport network requirements
- Noteworthy standards created by Q11/15 include:
 - G.709 – *Interfaces for the Optical Transport Network (OTN)*
 - G.798 – *Characteristics of optical network hierarchy equipment functional blocks*
 - G.709.x – *Flexible OTN (FlexO) interfaces*
 - G.Sup56 – *OTN transport of CPRI signals*
 - G.707 – *Network node interface for the synchronous digital hierarchy (SDH)*

Recent and current 5G transport work in SG15

- GSTR-TN5G *Technical Report ITU-T – Transport network support of IMT-2020/5G*
 - Released February 2018
 - High level descriptions and requirements to help guide future standards work

Recent and current 5G transport work in SG15 (continued)

- G.Sup.5gotn *Application of OTN to 5G Transport*
 - Documents and specifies how the current OTN/FlexO standards (G.709, G.709.x, G.798) standards can be used to support 5G transport applications
 - The “M-OTN” (Mobile-optimized OTN) profile of OTN
 - Project approved by Q11 in February 2018, with target release in October 2018
 - The draft outline includes:
 - 5G reference architecture and requirements (from the 3GPP documents)
 - 5G transport network architecture, including C-RAN and D-RAN
 - Network slicing support in OTN
 - Frequency and time synchronization in the OTN network
 - Survivability techniques in OTN networks to support 5G
 - Potential enhancements to OTN will be explored for potential new work items

Recent and current 5G transport work in SG15 (continued)

- G.ctn5g *Characteristics of transport networks to support IMT-2020/5G*
 - Specifies the characteristics and requirements for L1 or L2 transport network protocols to support 5G
 - Project approved by Q11 in February 2018, with target release in October 2018
 - The requirements may lead to new work items for new or enhanced L1 or L2 protocols
 - The outline includes:
 - 5G reference architecture and requirements (from the 3GPP documents)
 - 5G transport network architecture and characteristics
 - Transport network Operations, Administration and Maintenance (OAM) requirements
 - Network slicing requirements
 - DCN support
 - Frequency and time synchronization in the transport network
 - Survivability techniques in transport networks to support 5G

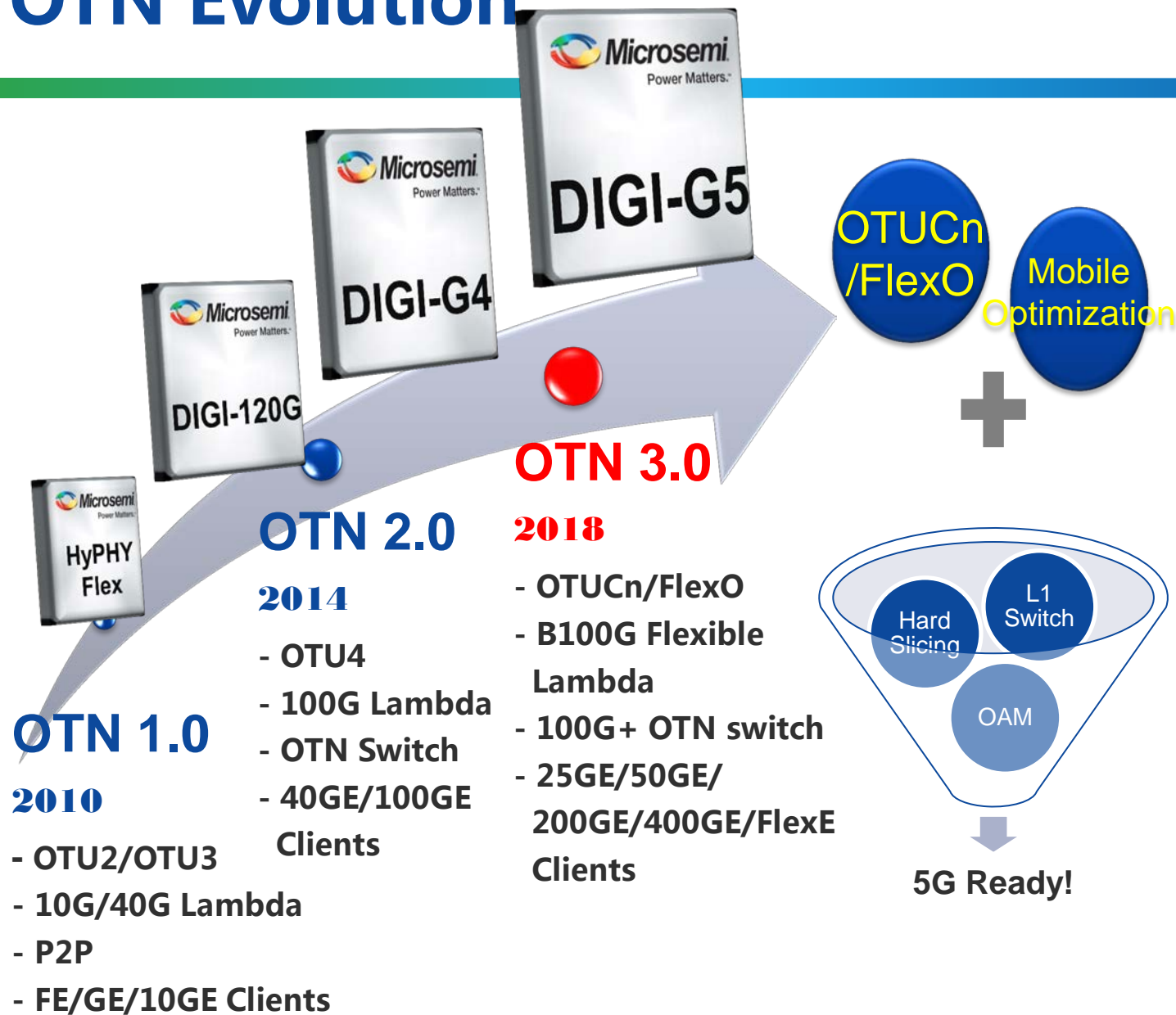
Results of the Q11 Interim Meeting

- Q11 met 4-8 June in Beijing, hosted by China Telecom and Huawei
- Over 90 contributions, most addressing 5G transport topics
- Progress on G.Sup.5gotn and G.ctn5g:
 - Significant content was added for the 3GPP requirements, RAN deployment architectures, synchronization and survivability sections
 - Additional work is needed on network slicing and OAM, and completing the other sections
 - The areas for additional content will be completed through formal email correspondence work and contributions to the October SG15 meeting
- 5G transport technical proposals were considered
 - Q11 is preparing to move quickly when there is agreement on the transport network requirements and new work items
 - Potential OTN enhancements were considered (M-OTN extensions)
 - Potential protocols to address the G.ctn5g requirements were discussed, including SPN (Slicing Packet Network)

Active Q11 Participation from China network operators

- China Mobile and China Telecom have been the primary network operators driving the Q11 work
 - China Telecom led the efforts to launch G.Sup.5gotn
 - China Mobile led the efforts to launch G.ctn5g
 - Together they have submitted over half the G.Sup.5otn and G.ctn5g related contributions
 - China Telecom and Huawei hosted the meeting
- China Telecom, China Mobile, Huawei, FiberHome and CAICT/MIIT each sent multiple delegates and contributed multiple contributions to the meeting

OTN Evolution



OTN 3.0 Adds Flexible Rates and Optimization

OTN Native Characteristics

“OTN 3.0” and 5G

- OTN has a long history of evolving to meet new needs and utilize new technology advances
- OTN is a natural fit for 5G L1 network slicing layer.
 - Slices (ODUk/ODUflex) are hard isolation, switchable, and support end to end OAM
 - Through optimization in design and implementation, OTN has been proven to deliver 1 μ s level latency and Class C PTP synchronization, which are critical for 5G
- The “OTUCn” $n \times 100$ G structure and associated “FlexO” PHY are ideal for M-OTN applications
 - Flexible, modular frame format
 - Higher bandwidth aligns with the 5G Midhaul and Backhaul requirements
 - Direct reuse of 100G, 200G and 400G Ethernet PHY modules
 - Long-reach FlexO optical interface options with more powerful FEC have been standardized
 - OTN switching provides deterministic low latency
- Potential further OTN optimizations for 5G are being considered

Questions?



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