



**ATLANTA, GA**  
**OCTOBER 11-14**

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# UNLEASH THE POWER OF LIMITLESS CONNECTIVITY



**2021 Fall  
Technical Forum**  
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## Wireline Access Network

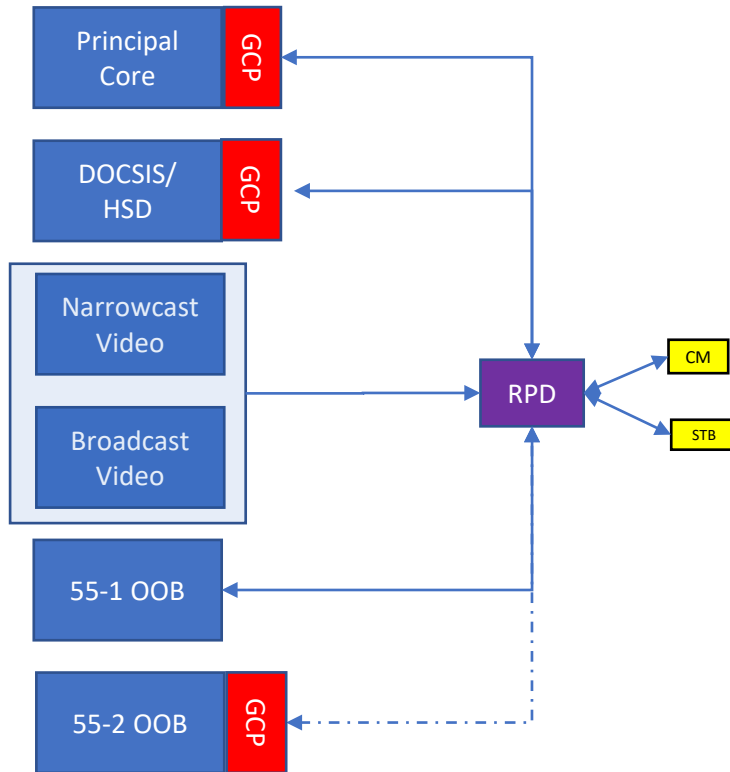
# Lessons from Operating Tens of Thousands of Remote PHY Devices

**Jorge Salinger**

VP, Access Architecture  
Comcast

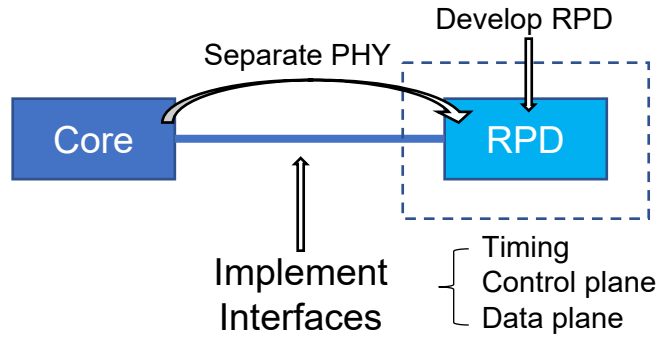
- The need for more network capacity to keep up with growing demands continues to drive the need for better spectral efficiency and node segmentation
- Better spectral efficiency requires, amongst other things:
  - Higher DS MER performance. Analog intensity modulated links and distance between the transmitter and node become limiting factors; moving to digital links is required
  - Moving the entire PHY to the node further helps solve this objective. Both remote PHY and remote MAC-PHY move the PHY layer, implementing DAA
  - Node segmentation involves adding additional equipment into service provider facilities, which reduces available space and increases power requirements
- Moving the PHY layer out of the facility reduces power requirements and allows for CCAP platforms to become denser.
  - The migration to Remote PHY reduce, and even eliminates, the need for headend equipment and all modulation equipment.

- DAA nodes use SFP+ transceivers which allow the use of standard ITU channel DWDM mux / demux equipment
  - This allows for greater efficiency of outside plant fiber utilization vs. CWDM channels used for analog transmission today
  - Commercial services and other Ethernet links can share the same fiber more easily
  - Having Ethernet at the node location allows options like offering PON or Ethernet services from a deep network location
- Digital Ethernet links are more reliable than analog AM links
  - Analog AM links require maintenance to maintain light level as the resulting RF signal level is directly related
  - Ethernet links have a large range of receive power and light level is not directly related to performance
- Moving the PHY to the field paves the way for full duplex (FDX) DOCSIS
  - FDX operation requires the PHY to be located at the node location



- Multivendor platform – simpler and quicker to implement than a single platform solution
- Core components use GCP and engine components do not
- All RPD functions except DOCSIS and 55-2 OOB are configured by the principal GCP core
- Leverages existing legacy video platform by keeping it simple. Video engine does simple encapsulation of MPEG with DEPI header with static PW.
- OOB implemented as separate components; both require processing in the RPD and in the headend, and interface with existing legacy HW/SW

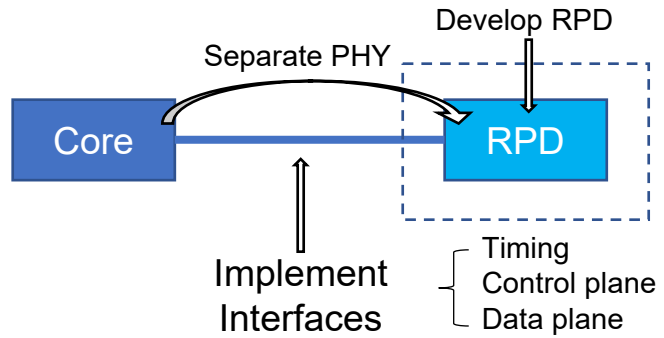
## 1. RPHY Base Implementation



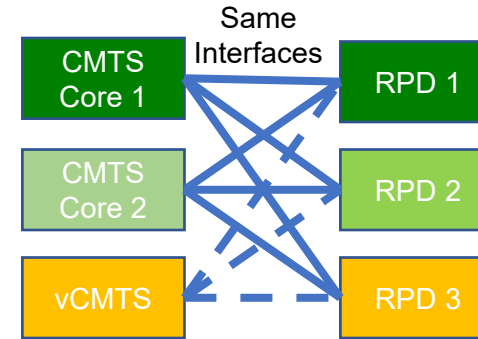


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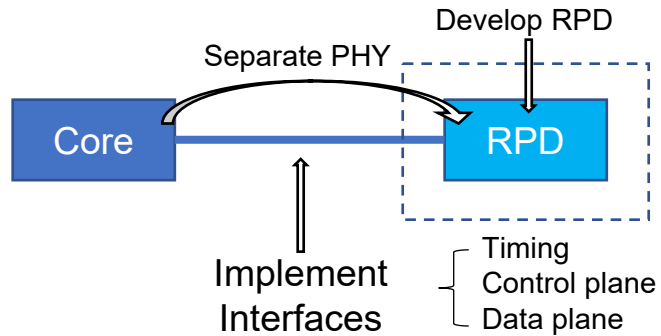
## 2. Core-RPD Interoperability



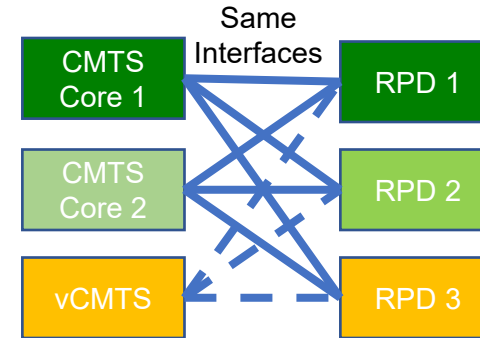
- Address non-vendor-specific interaction
- No exact match of CCAP, node and encryption footprint
- Need one vendor's R-PHY node/RPD with another vendor's core

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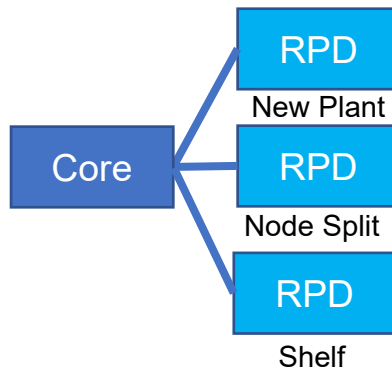


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## 3. Use Cases

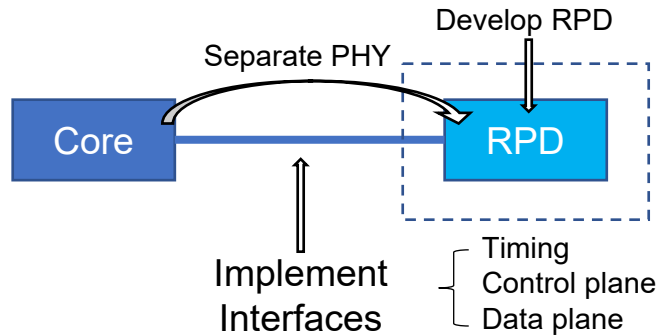


- Features for each case
- Spectrum difference DS and US
- Capacity and performance differences
- Different device architecture

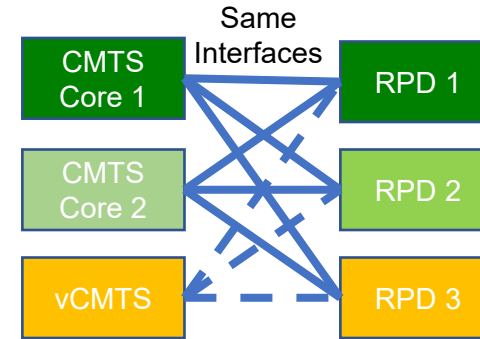


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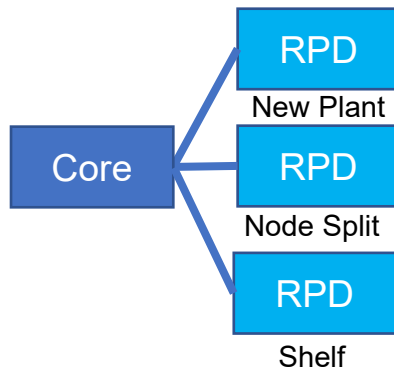


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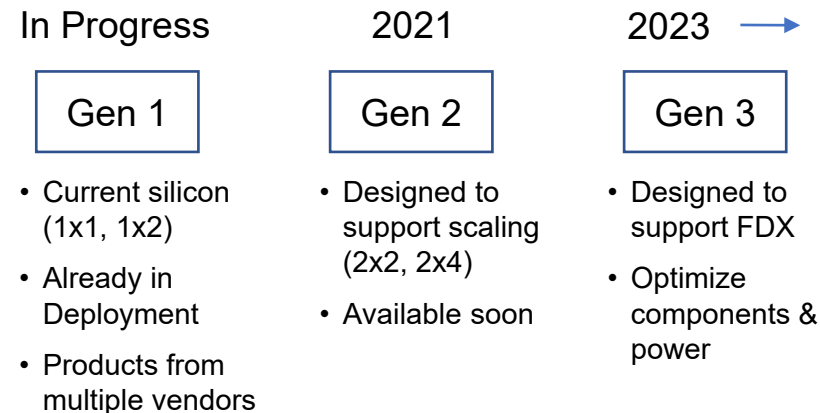
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## 4. Generations



# Lessons from Operating 10s of Thousands of Remote PHY Devices

- Use of modern monitoring systems is critical, such as moving to streaming telemetry
  - Currently available open-source tools make monitoring much easier
  - More scalable telemetry makes data acquisition easier and troubleshooting faster
  - Moving to streaming telemetry from the RPD
- Plant powering can become very impactful
  - Previously normal maintenance procedures did not cause perceptible outages
  - Very short power interruptions now cause five to 10 minute outages
  - New node components help mitigate problems
- Scaling to thousands of RPDs requires smooth provisioning process and approaches
  - Multiple information sources brought into a single configuration
  - Smart back-end and field tools are required to prevent and/or identify errors
- Software and hardware management tools become essential
  - Software upgrades for RPDs is much closer to CPE upgrades than CMTS upgrades
  - Keeping track of hardware versions and use cases is paramount for configuration



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# Thank You!

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