

Feasibility of a TDD Mode in EPoC

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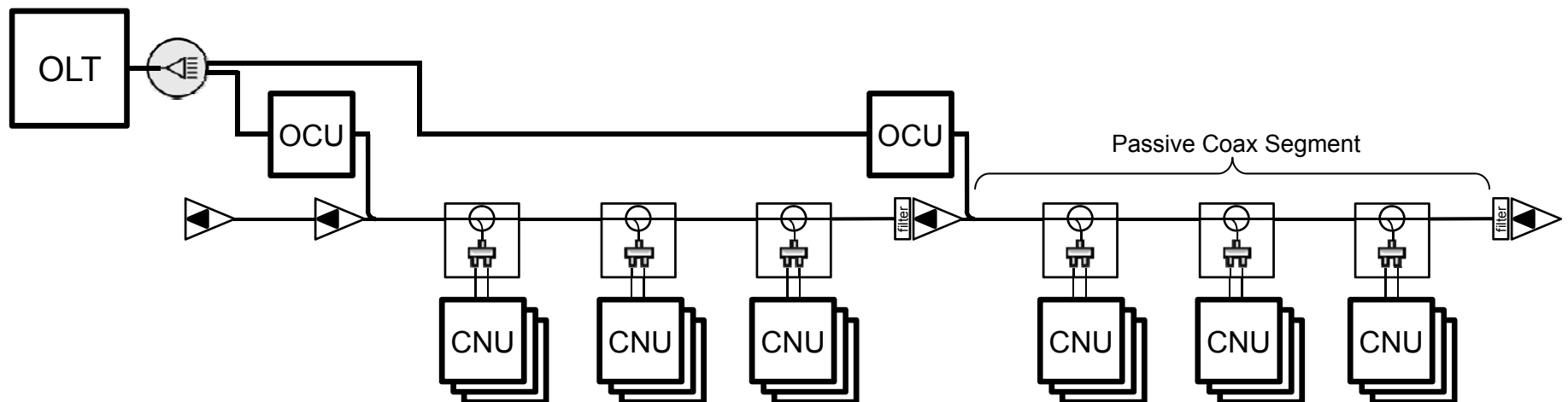
Steve Shellhammer, Qualcomm

Rajeev Jain, Qualcomm

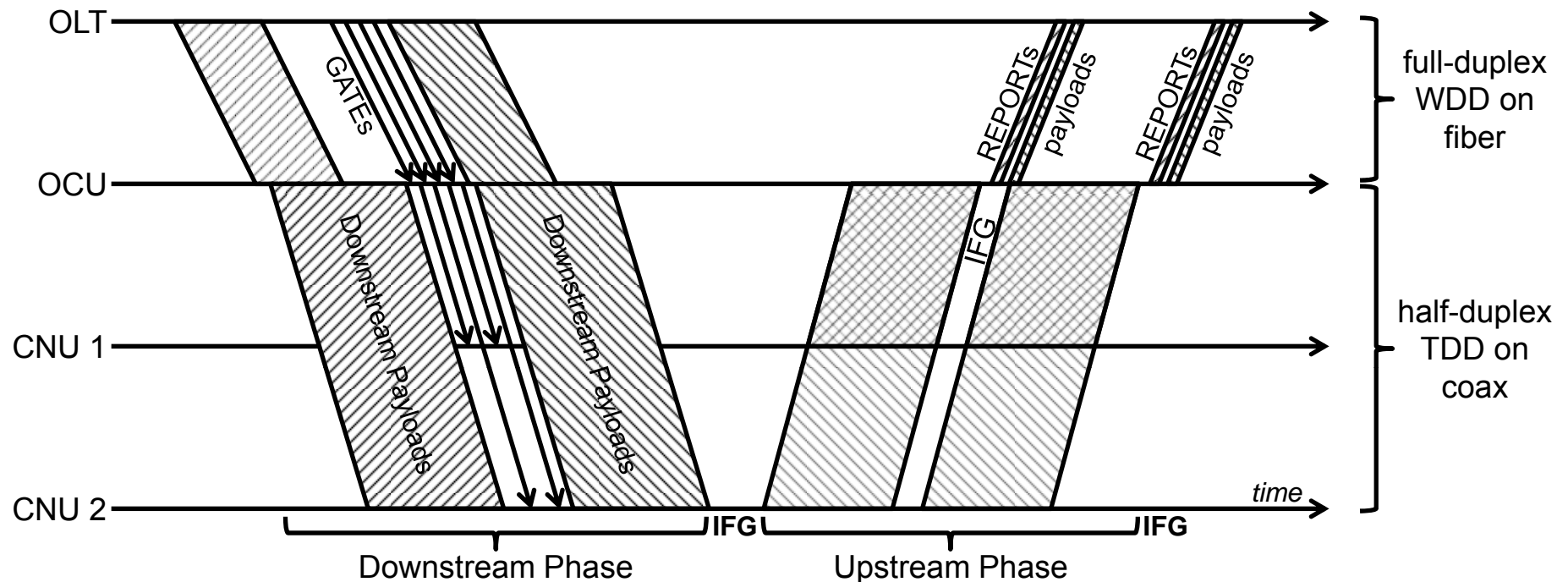
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An EPoC Topology that Supports TDD

- Fiber overlays existing cascade (not necessarily to last active)
 - OCU couples onto Passive Coax Segment between actives
 - only certain segments need fiber & OCU (e.g., where business services subs are)
 - RF signals filtered out before next downstream amplifier
- Spectral Re-Use of full TDD band (e.g., above CATV) is possible
 - Independent scheduling domain on *each* passive segment, if desired
 - TDD datarate flexibly shared by only those CNU's sharing a passive segment



Technical Feasibility of TDD for EPoC



- OLT transmits payloads destined for CNUs during TDD downstream phase
 - OCU selects downstream payloads by LLID for ~realtime relay onto coax
 - including GATES scheduling payloads for subsequent TDD upstream phase
- OLT schedules upstream payloads from CNUs during TDD upstream phase
 - OCU demultiplexes OFDMA transmissions on coax → TDMA on fiber
 - » e.g., in same manner as described by Boyd, et.al. at March SG meeting
 - including REPORTs informing OLT scheduler of upstream ingress

Economic Feasibility of TDD for EPoC

- Economic feasibility of FDD EPoC over Active HFC already claimed
 - Boyd et. al. at March SG F2F
- What about a TDD mode of EPoC?
 - Would TDD maintain that economic feasibility?
 - Yes
 - Costs would be no more than DOCSIS or FDD EPoC
 - e.g., several cost-effective TDD-based EoCs in the China Access market
 - » on passive coax (e.g., MDUs)
- TDD mode provides a valuable alternative to FDD
 - For MSOs whose FDD bands are already fully occupied
 - lack of maneuvering room can gridlock new broad spectral allocations
 - Flexible use & spatial reuse of high-RF spectrum
 - relatively wider, contiguous, and unused spectral allocations

Feasibility of TDD for EPoC (backup slide)

- OLT-Scheduling of upstream traffic:
 - OLT receives CNUs' REPORTs from upstream phase
 - informing OLT scheduler about upstream ingress
 - received after $\sim 100\mu\text{s}$ propagation over fiber
 - OLT scheduler processes those REPORTs
 - producing schedule of upstream traffic for all CNUs
 - » requires some processing time (software)
 - OLT transmits resultant upstream schedule as GATEs to CNUs
 - received by CNUs during the downstream phase
 - » after $\sim 100\mu\text{s}$ propagation over fiber
 - Note: two $\sim 100\mu\text{s}$ prop. delays is small fraction of TDD MAC Cycle (1~2ms)
 - so OLT's request/grant loop delay remains within one MAC Cycle
- IFG period length depends only on coax segment
 - TDD IFG efficiency not impaired by fiber length (20km, $100\mu\text{s}$ propagation)
 - since $\text{OLT} \leftrightarrow \text{OCU}$ link is full-duplex WDD