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DEPARTMENT OF ELECTRONIC & ELECTRICAL ENGINEERING

## Towards Mobile Fronthaul for 6G Networks

*Tutorial* Nathan J. Gomes





















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Mobile fronthaul key considerations				
Mobile fronthaul involves the insertion of an additional component into the radio access network. This component will cause additional:				
	Signal impairment	Delay		
	Noise and distortion	Application dependent (order ms?) MAC dependent (10km – 20km fiber limit) Synchronization dependent		
Analog RoF	Additive noise, nonlinearity	Minimal additional processing delay		
Digital RoF	Quantization noise Under-/over-sampling	Higher additional processing delay Packetization, queuing delays?		
OFC 2023 Radio-Over-Fiber for 5G and Beyond Systems, Tutorial, Tue 7th Mar 2023			18	

19





## **≜UC Optical Transceiver Requirements** Our Conclusions circa 2010... University of REF Control channels ANALOGUE Kent Subcarrier multiplexing (transmission at IF) so that all radio Uplink Downlink channels can be carried on a single link Ch 4 Ch 1 Ъ S 5 Frequency plan requires a total bandwidth of less than 2GHz 5 <del>С</del> for all radio channels (both uplink and downlink directions) with wide guard bands DIGITAL 1 2 Sampling rate of 153.6MHz extrapolated for 100MHz channel (OBSAI) • Frequency, GHz 4915Mb/s required for 100MHz LTE channel assuming I and Q sample width of 16 bits One CPRI/OBSAI 6144Mb/s channel can only support a single 100MHz radio channel

- Four radio channels require a bit rate of more than 24Gb/s
- Serial link necessary to conserve optical wavelengths (for support of multiple remote radio heads)
- · Cost comparison: several times (perhaps order of magnitude) more expensive than analog approach

























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Efficient Fronthaul Transport				
Packetized transport of digital signals can lead to stati - OK for CU-DU, HLS (midhaul) - depends on DU-RU fronthaul split point, and m	stical multiplexing gains: ust meet MAC latency constraints			
Packet-based Ethernet transport requires: - Frequency synchronization, SyncE or other PHY I - Phase/time synchronization, PTP TSN mechanisms required	ayer framing structure ware shaping (gating), gap-filling look promising			
Assimation and the formation of the form	copoulos et al., "A Converged Evolved Ethernet Fronthaul for the 5G Era", Selected Areas in Communications, 2019			
PON transport requires above, too.				
Co-operative Dynamic Bandwidth Allocation algorithr allocations to inform PON's OLT in granting bandwid	n uses BS's knowledge of downlink and uplink th Pfeiffer et al., PON going beyond FTTH, J. Optical Communications and Networking, 2021			
OFC 2023 Radio-Over-	Fiber for 5G and Beyond Systems, Tutorial, Tue 7th Mar 2023	34		

35



