

Server & End point Connectivity Needs

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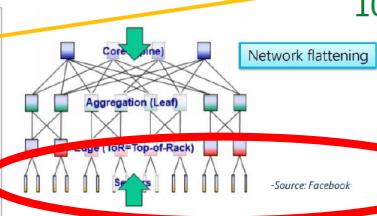
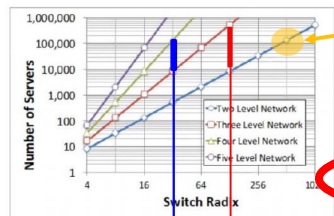
Supporters and Contributors

Introduction

- Servers exist beyond the cloud data center
- Server connectivity comes in a variety of physical form factors over time
- Servers support a wide range of pluggable media
- Servers adopt new Ethernet rates starting around the spec publication date and lasting for the next decade (or longer)

Servers in the Cloud Data Center

Topology Difference



MSFT: Radix 512 networks
100K servers (32MW DC)

- Fewer tiers = decreased latency, lower power
- CPU bandwidth ~ 1G/core
- Volume of servers vs. power grid

Switch Generation	Radix = 32	Radix = 64	Radix = 128
12.8T	400G	200G	100G
25.6T	800G	400G	200G
51.2T	1.6T	800G	400G

Optical interconnects

Inphi

R. Nagarajan, Ilya Lyubomirsky, "Next-Gen Data Center Interconnects: The Race to 800G"

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Inphi

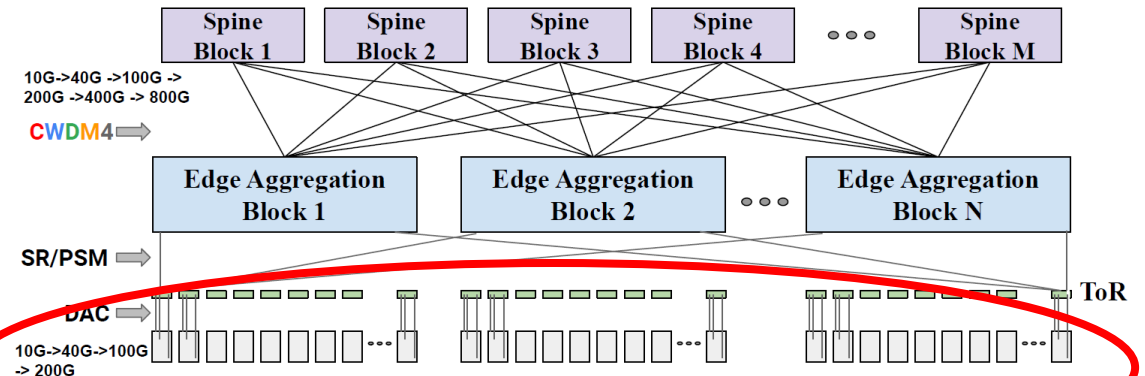
Other CSPs use lower radix

IEEE 802.3 Beyond 400G Study Group

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https://www.ieee802.org/3/B400G/public/21_03/booth_b400g_02_210301.pdf

> 400GbE will be needed in DCN Fabrics



Backward compatibility between generations of interconnects enables smooth upgrade of datacenter networks.

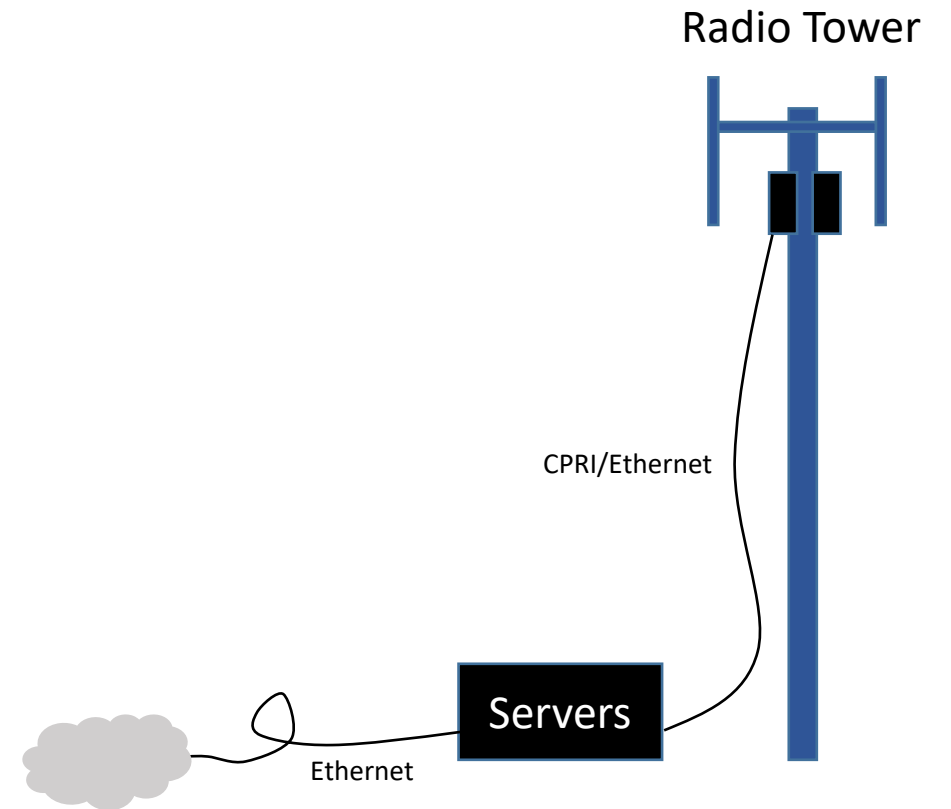
Google

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https://www.ieee802.org/3/B400G/public/21_03/lam_b400g_01a_210329.pdf

Server Ethernet Beyond the Cloud Data Center

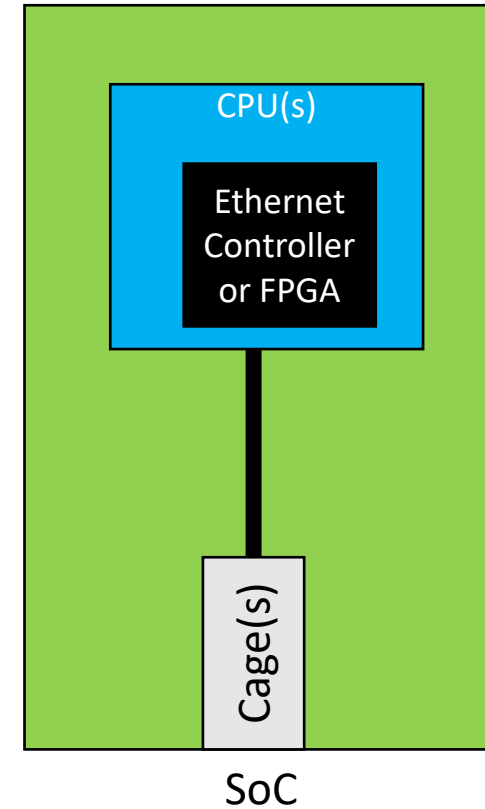
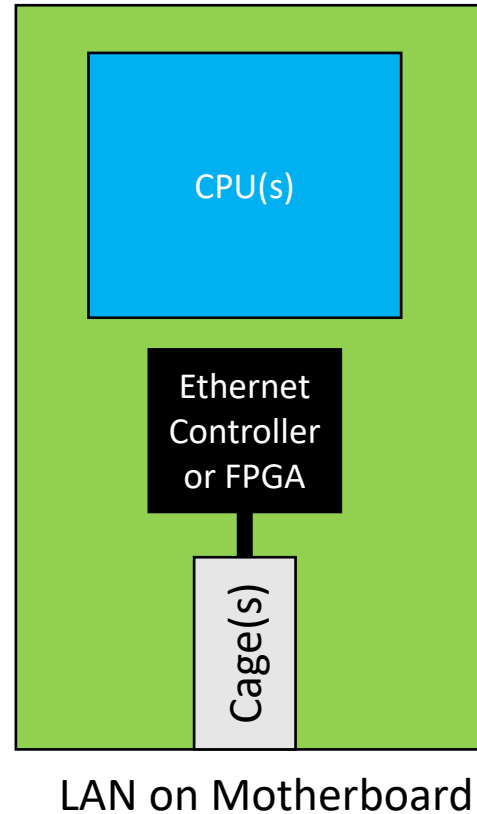
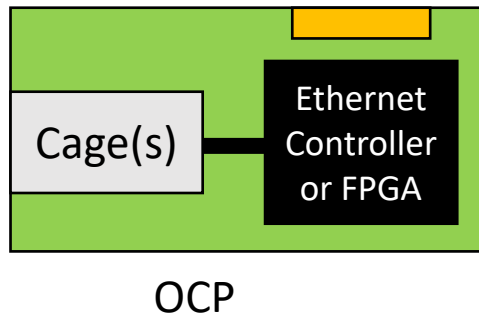
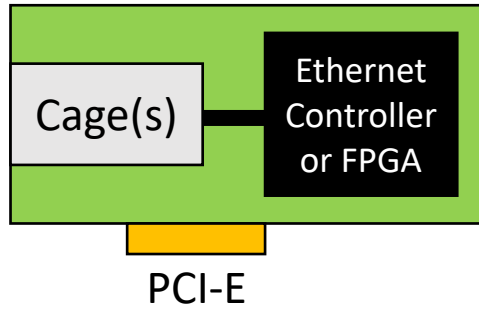
- Cloud scale data centers is only one of the server usage models that need high bandwidth Ethernet
- Server compute is rapidly expanding in areas outside of the data center, such as network infrastructure core, edge and access



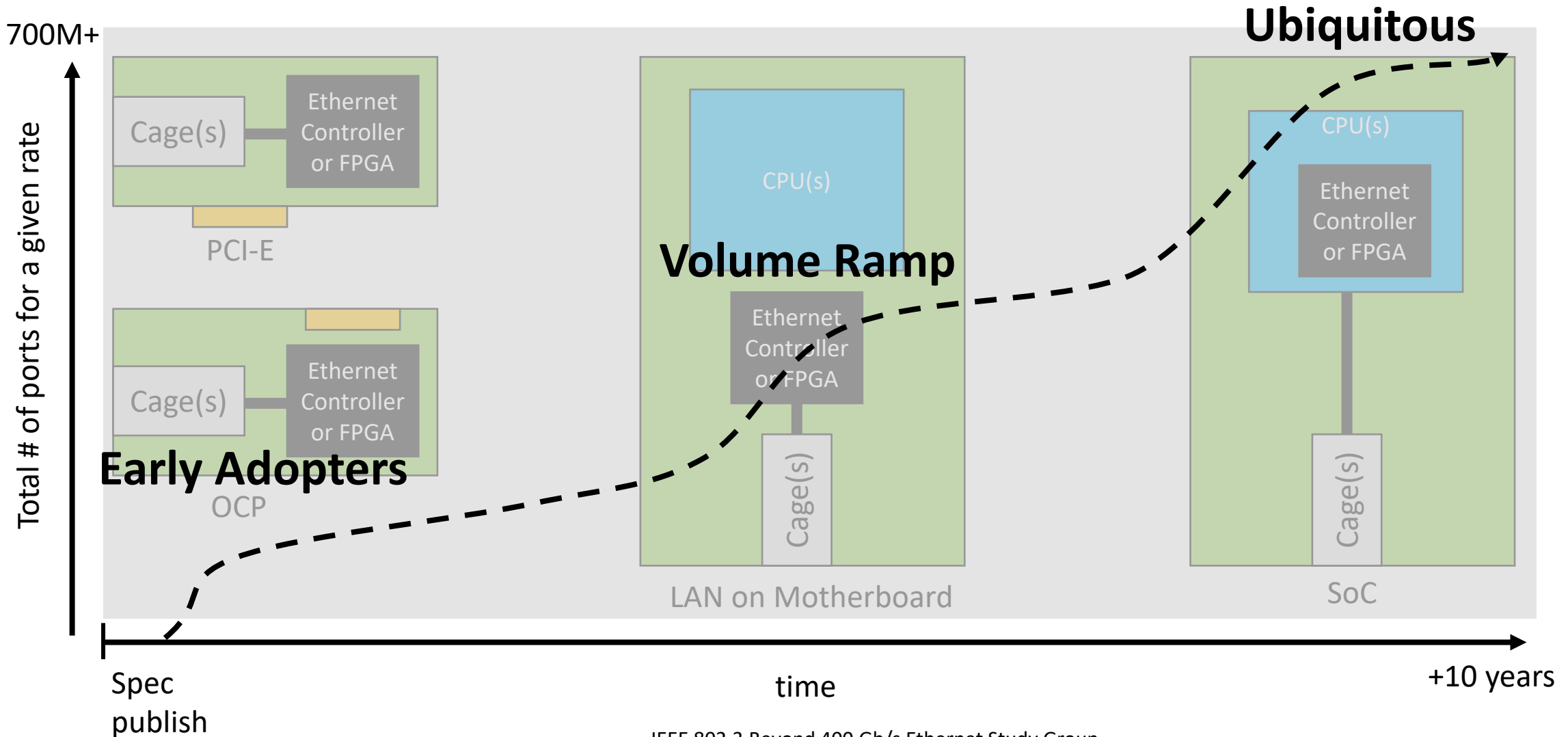
Key Points:

- People typically think of servers sitting at the lowest point of the data center network
- Servers needing high bandwidth Ethernet are used elsewhere, too.

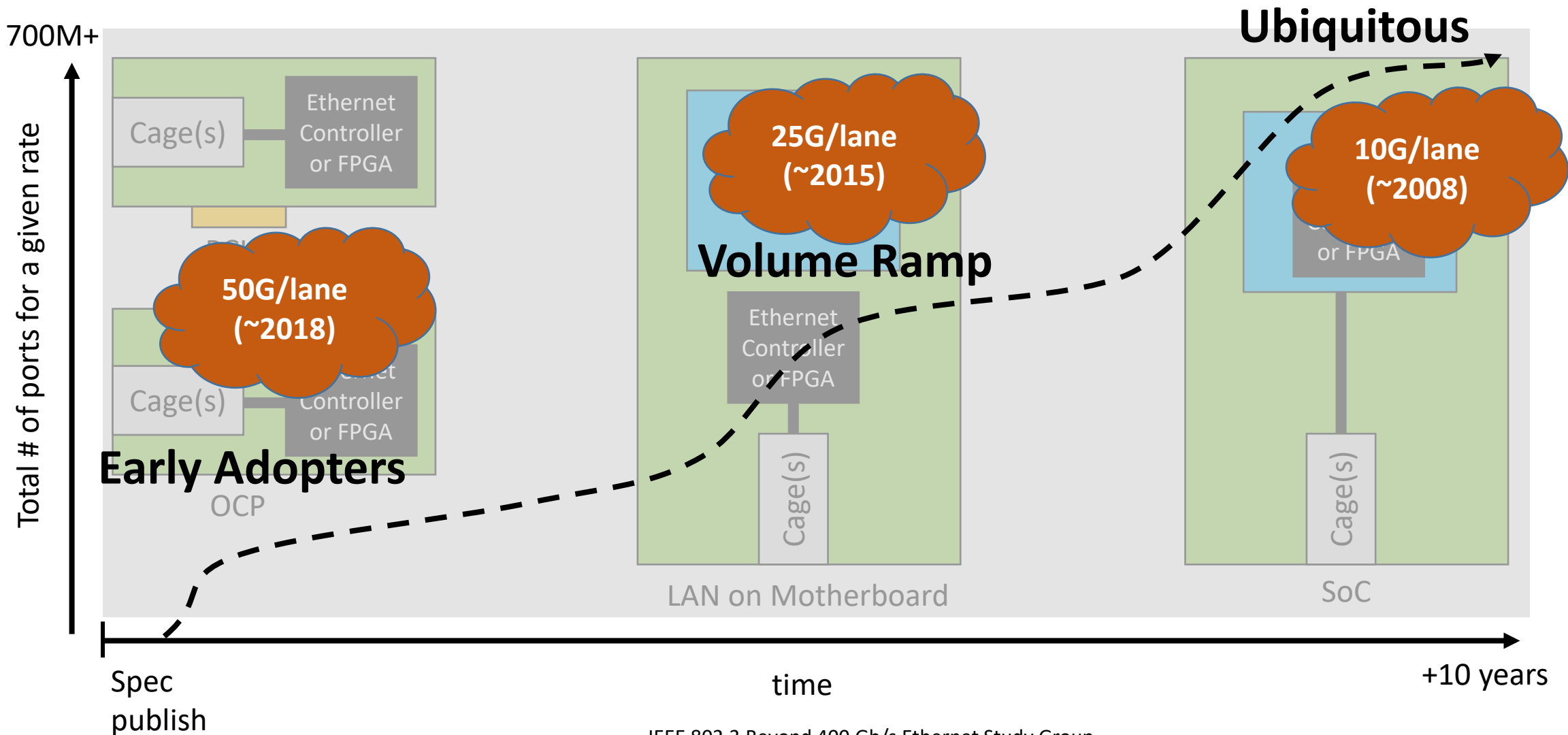
Common Server Ethernet Implementations



Server Ethernet Implementation Timeline

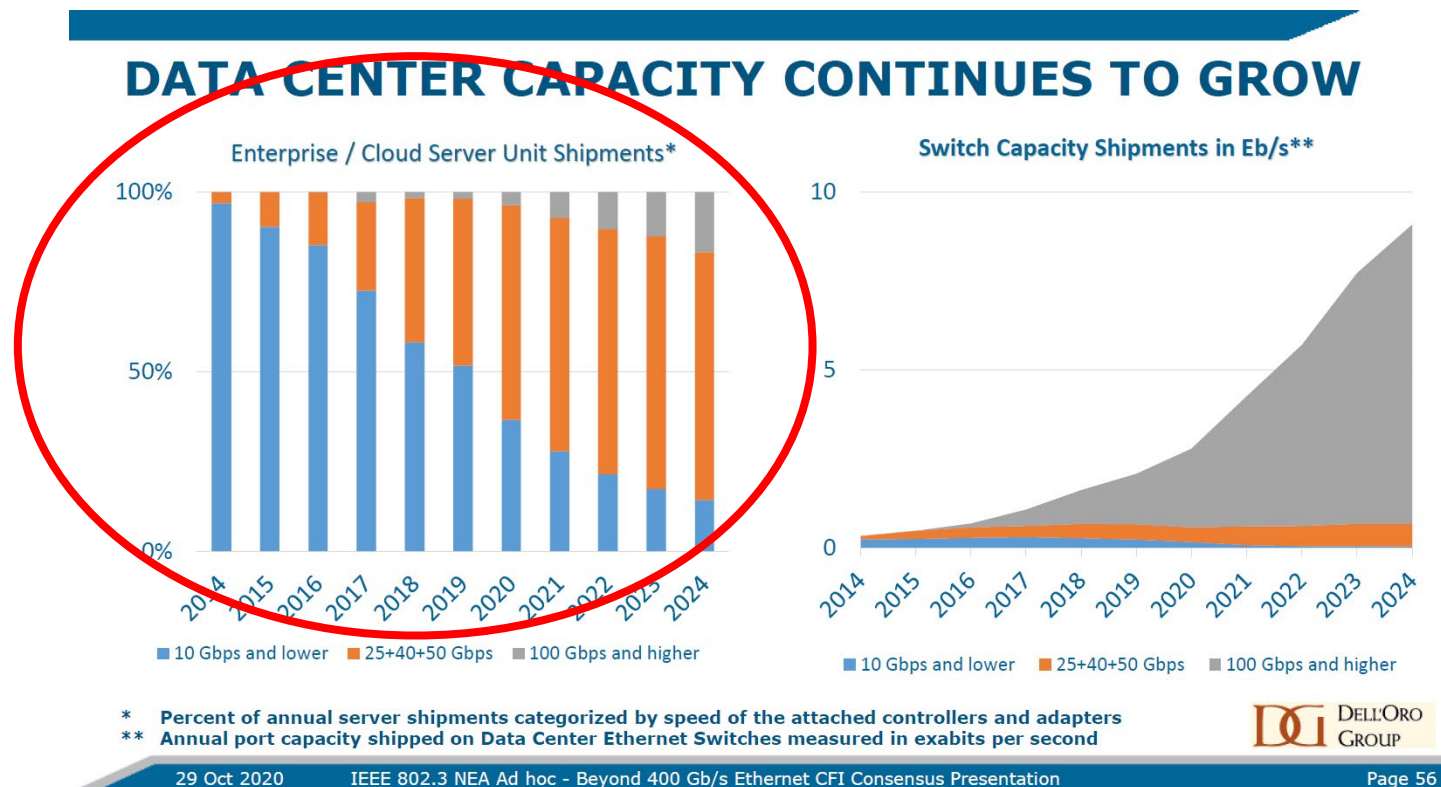


Server Ethernet Rates Today



Key Points:

- While some servers progress to the fastest PMD rates quickly, a sizable portion of the server connections transition much later
- PCB materials, connector choices, etc. for new PHY types must be broad market viable in a ~decade, when servers ramp these rates in volume



https://www.ieee802.org/3/ad_hoc/ngrates/public/calls/20_1029/CFI_Beyond400GbE_Rev7_201029.pdf

Server Pluggable Media Implications

- Except for cloud scale operators, the pluggable media specifics are usually not known in advance
 - An end customer provisions a server with their desired pluggable media of choice at time of installation
- Any Ethernet PHY type that can physically fit into the cage will be inserted and servers are expected to support them all

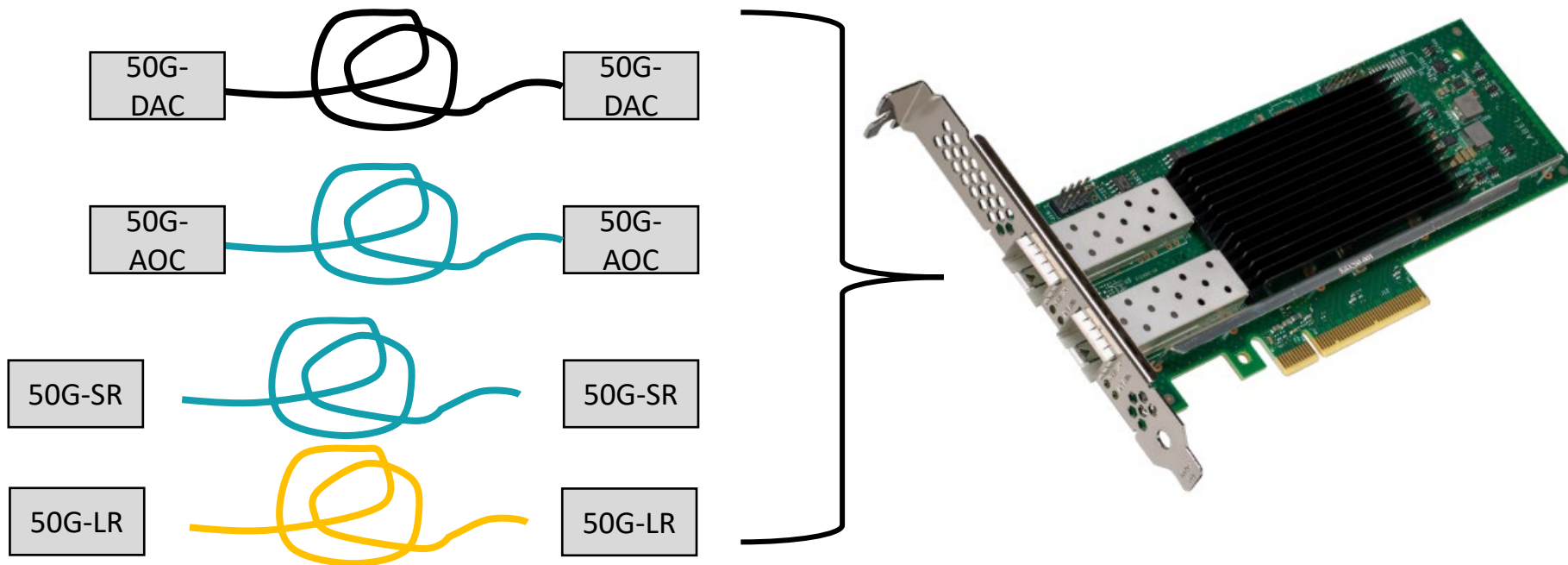
Partial List of Common Optical Module Types for Servers – 1H'2021

- 1G-SX
- 1G-LX
- 10G-SR
- 10G-LR
- 10G-ER
- 10G-ZR
- 40G-SR4
- 40G-LR4
- 40G-FR
- 40G-ER4
- 25G-SR
- 25G-LR
- 25G-ER
- 50G-SR
- 50G-FR
- 50G-LR
- 100G-SR4
- 100G-SR2
- 100G-LR4
- 100G-ER4
- 100G-DR2
- 200G-SR4
- 200G-DR4
- 200G-FR4
- 200G-LR4

This list does not include the multitude of passive copper cables, active copper cables, AOCs, multi-rate modules, consortium modules, enhanced performance modules (i.e. no FEC operation), nor new modules in development

Server Ethernet Customer Choice Example

- These PHY types support the same FEC (RS544), same electrical signaling (26.56 GBd PAM4), same BER requirements ($<1E-12$)

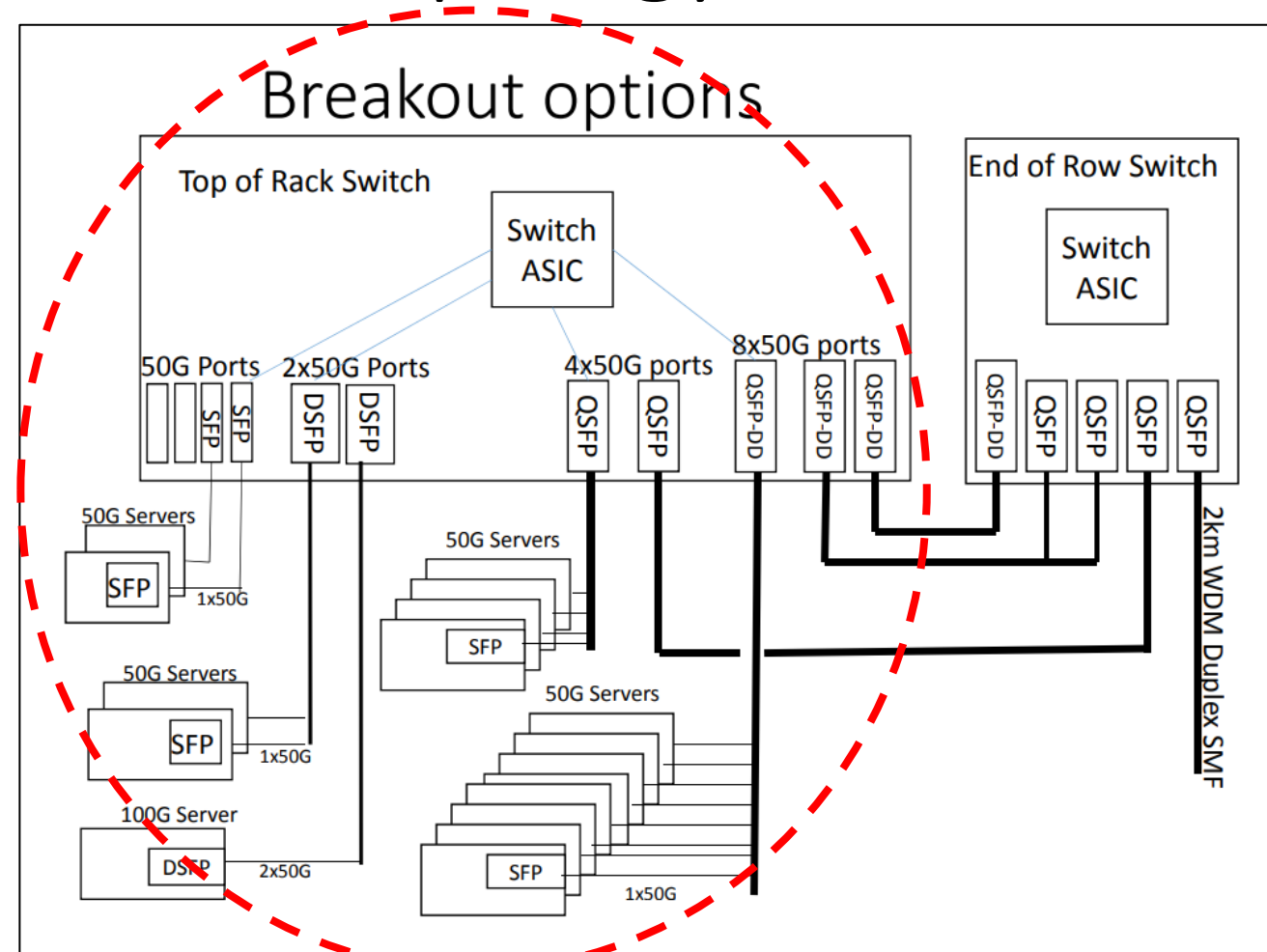


Key Points:

- Front panel pluggable form factors are essential for end user choice and flexibility
 - CPO solutions are generally not suitable for server applications
 - OBO solutions may have merit
- Compatibility and commonality between the electrical interfaces (e.g. AUIs) and electrical PHY types are needed to cost effectively support the breadth of pluggable modules used by servers
 - Signaling type, signaling rate, FEC choice, etc.

Server Ethernet Connection Topology

- Servers extensively use single-lane or two-lane electrical interfaces and PHY types
- Breakout use cases of four-lane and eight-lane types are critical for server Ethernet connectivity



https://www.ieee802.org/3/50G/public/Jan16/palkert_50GE_NGOATH_01_0116.pdf

Key Points:

- 800 GbE to the server are special cases or a long time away
- Single-lane 200 GbE and two-lane 400 GbE are important breakout cases for servers

Summary

- Server Ethernet goes beyond the data center
- Servers take new Ethernet rates over a long timeline
- Servers need compatible electrical interfaces and PHY types for maximum flexibility
- Servers will require single-lane 200 GbE and two-lane 400 GbE support

Thanks!