40GBASE-T Advantages and Use Cases

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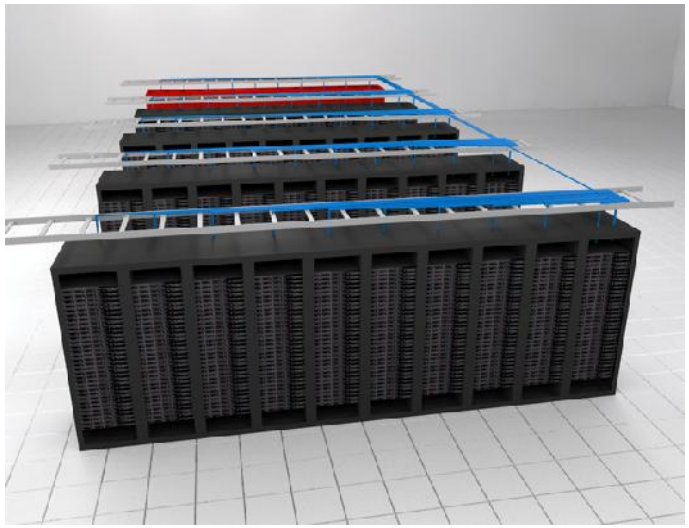
Introduction

- Historical advantage of BASE-T (relative cost, availability, flexibility)
- Comparison of relative cost of 10GBASE-T and predicted 40GBASE-T to other interconnect technology
- Effect of 40GBASE-T on architecture choices

BASE-T Advantages

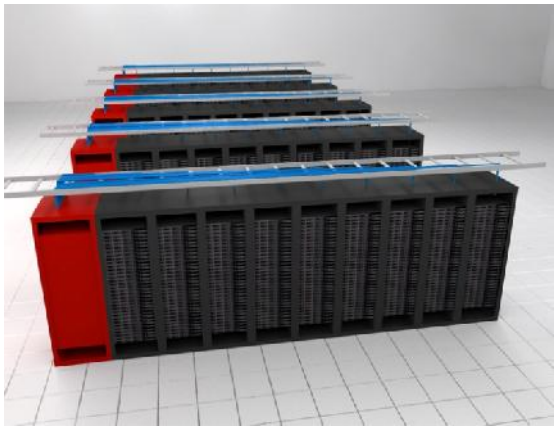
- Least cost access layer alternative when compared to other interconnect technologies
  - Optical (e.g. SR, LR)
  - Direct-Attached
- Structured topology
  - Common physical interface (RJ45)
  - Flexibility and longevity
  - Optimized for small to medium-sized data centers (< 20K square feet)
- Supports auto-negotiation and Power-Over-Ethernet
  - Simple plug and play installation
  - Ubiquitous RJ45 interface simplifies 10GBASE-T to 40GBASE-T upgrade path

Centralized Switching Architecture: TIA-942 Direct Connect



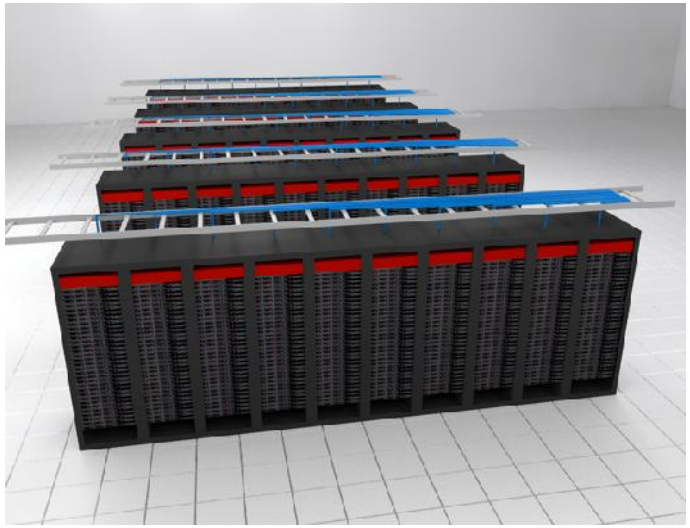
- Pro
  - Lower cost than distributed architectures
  - Simple to design, implement and maintain
  - Minimized network bottleneck
  - Good port utilization
  - Easy device management
- Con
  - Large number of cables
  - Cable overlaps
  - Difficulties in cable pathway design
  - Lack of scalability

End-of-Row or Middle-of-Row Switching Architecture



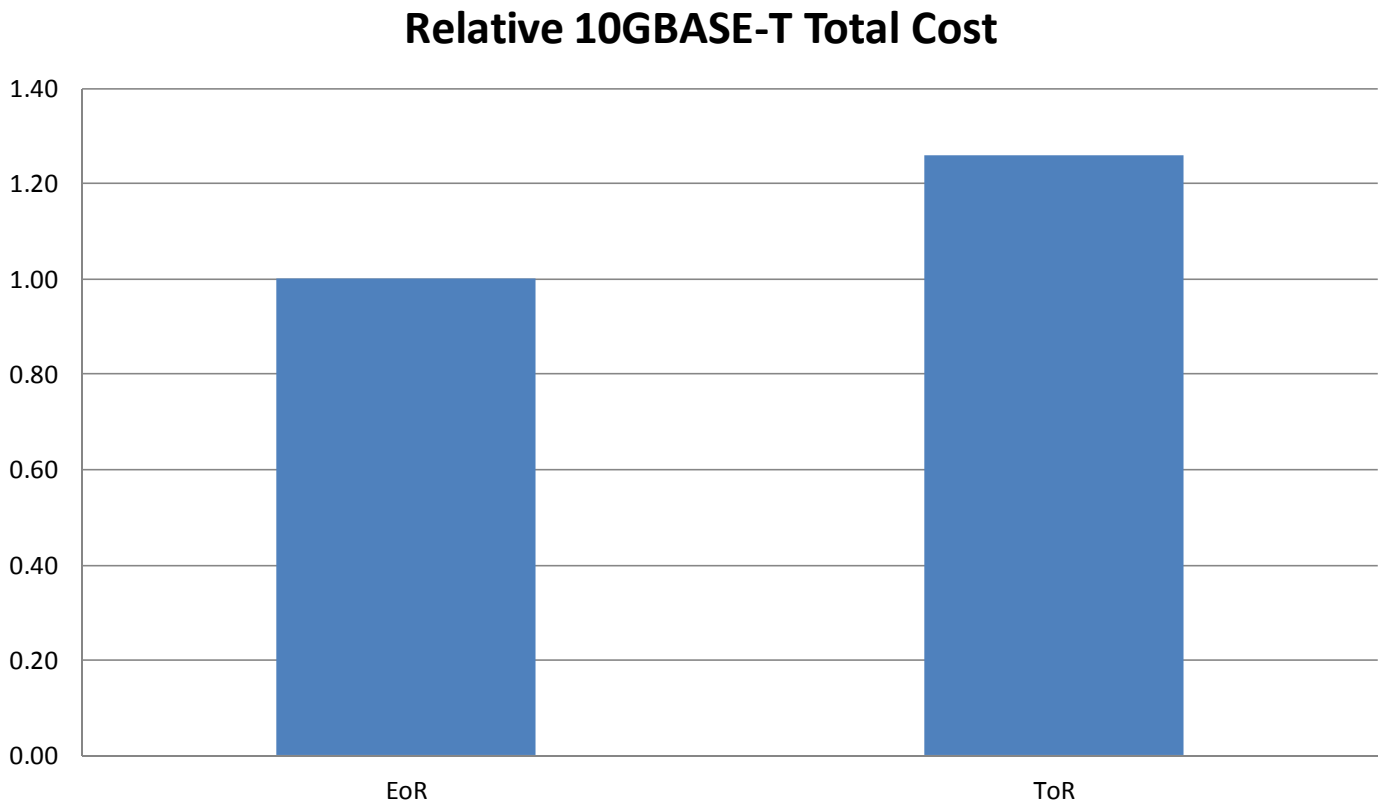
- Pro
  - Fewer number of cables than direct-connect architecture
  - Good scalability
  - Cost effective compared to top of rack (ToR)
- Con
  - More capital expenditure on end of rack (EoR) and middle of rack (MoR) switches
  - Increased management overhead
  - Network stability risks due to potential Layer 2 loops that cause broadcast storm

Top-of-Rack Switching Architecture



- Pro
  - Most efficient cable use
  - Efficient use of floor space
  - Good scalability
  - Easy cable management
- Con
  - More switches to manage
  - Difficult to achieve full port utilization of ToR switch
  - Higher aggregation layer port count
  - Higher spanning tree logical ports in aggregation layer
  - More server-to-server traffic in aggregation layer
  - Potentially higher switch costs
  - Thermal management risks
  - Creation of hotspots

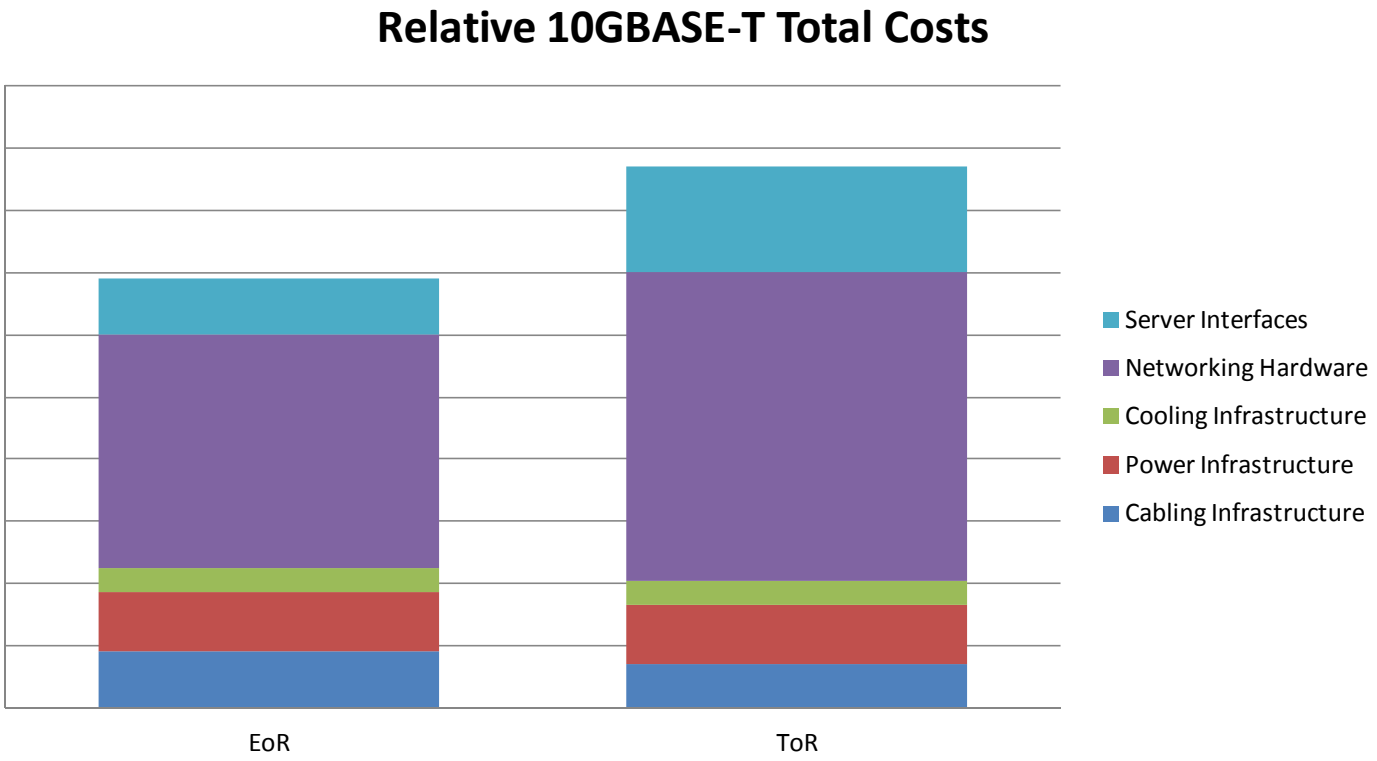
EoR vs. ToR – Relative Costs



- Roughly a 26 percent increase in cost using ToR with Direct-Attached cabling

Source: Anixter Inc.

EoR vs. ToR – Relative Costs (Detailed)



- Reduced cabling costs with ToR
- Increased cost of ToR architecture driven by network electronics and server interfaces

Source: Anixter Inc.

Category 8 Goals

- Reduce 40GBASE-T equipment power consumption
  - Reason for modifications in channel length and shielding
- Support End-of-Row and Top-of-Rack data center deployments
  - 30 meter reach with 2 connectors is sufficient
- Support auto-negotiation for backwards compatibility
  - Same 4-pair twisted-pair cable as prior categories

Data Center Twisted-Pair Migration Roadmap

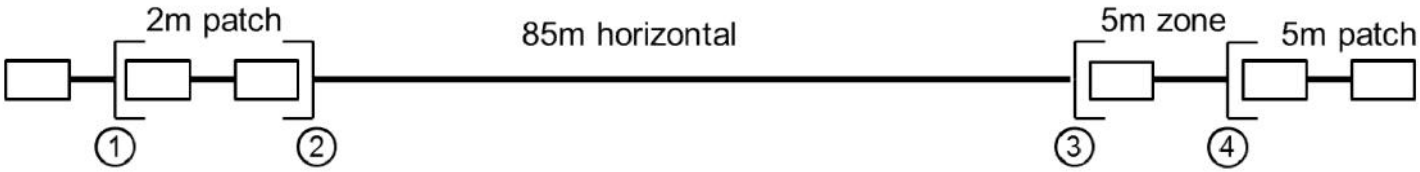
Category	Maximum Bandwidth	Maximum Application Data Rate	Maximum Reach	Number of Connectors in Channel	Cable Construction
6	250MHz	1000BASE-T	100m	4	Unshielded or shielded
6A	500MHz	10GBASE-T	100m	4	Unshielded or shielded
8	2000MHz	40GBASE-T	30m	2	Shielded only

Upgrade Path

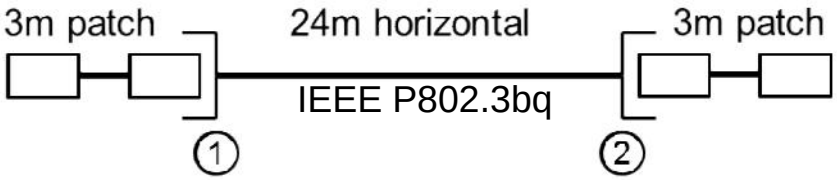
1G to 10G

10G to 40G

Category 6A Channel



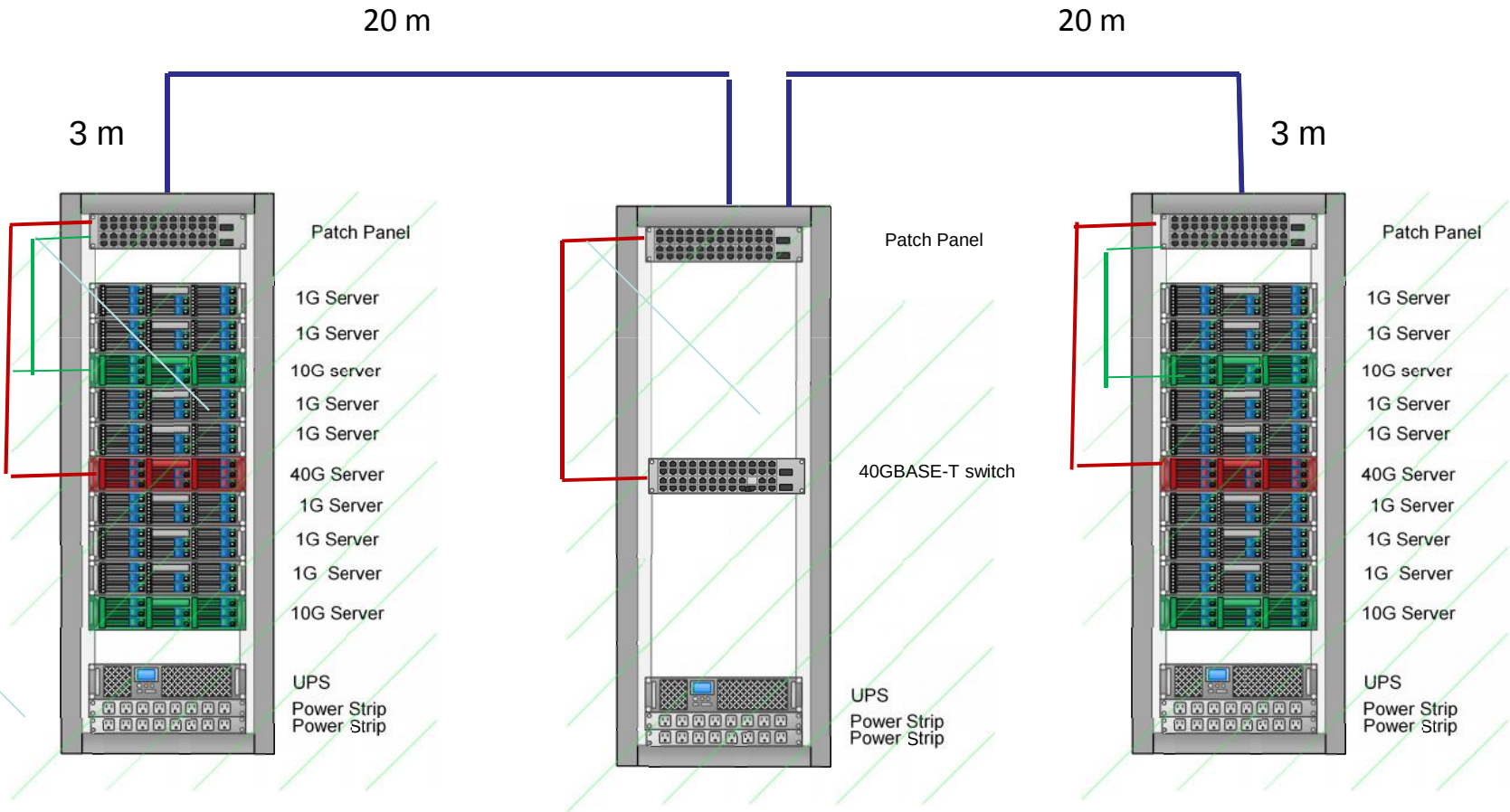
Category 8 Channel



How to Future Proof Today

- Limit copper reach to 30 meters with only 2 connectors in the channel
- Ensure deployment can support shielded copper cabling
- New technologies like Application Centric Infrastructure (also called leaf-spine) can present new opportunities

Flexibility: Supporting mixed applications with BASE-T over structured cabling

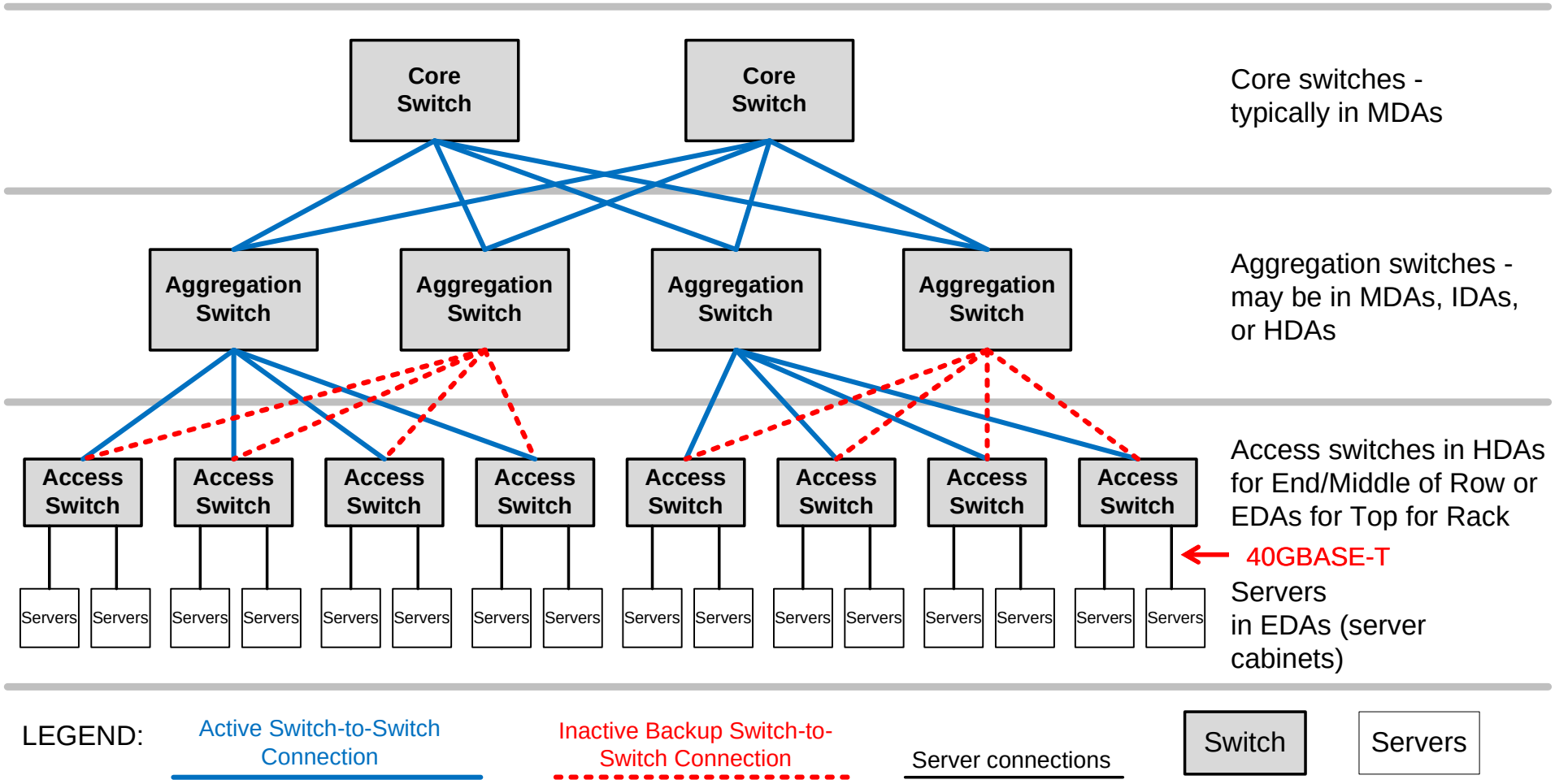


Where can 40GBASE-T be used?

- 40GBASE-T will work anywhere in a data center where 30 meter connections will reach. This includes:
  - Anywhere in the classic 3 level hierarchy
  - For the fat-tree / leaf-and-spine / interconnected fat-tree fabric architecture
  - For full-mesh, interconnected meshes, and centralized switch
  - For virtual switch

Source: Jonathan Jew, editor of TIA-9432-A, VC TIA TR42.1

Traditional Three-Tier Data Center Architecture



Note – Access switch to server connections can use 40GBASE-T with Category 8 Cabling

Source: ANSI/TIA-942-A-1

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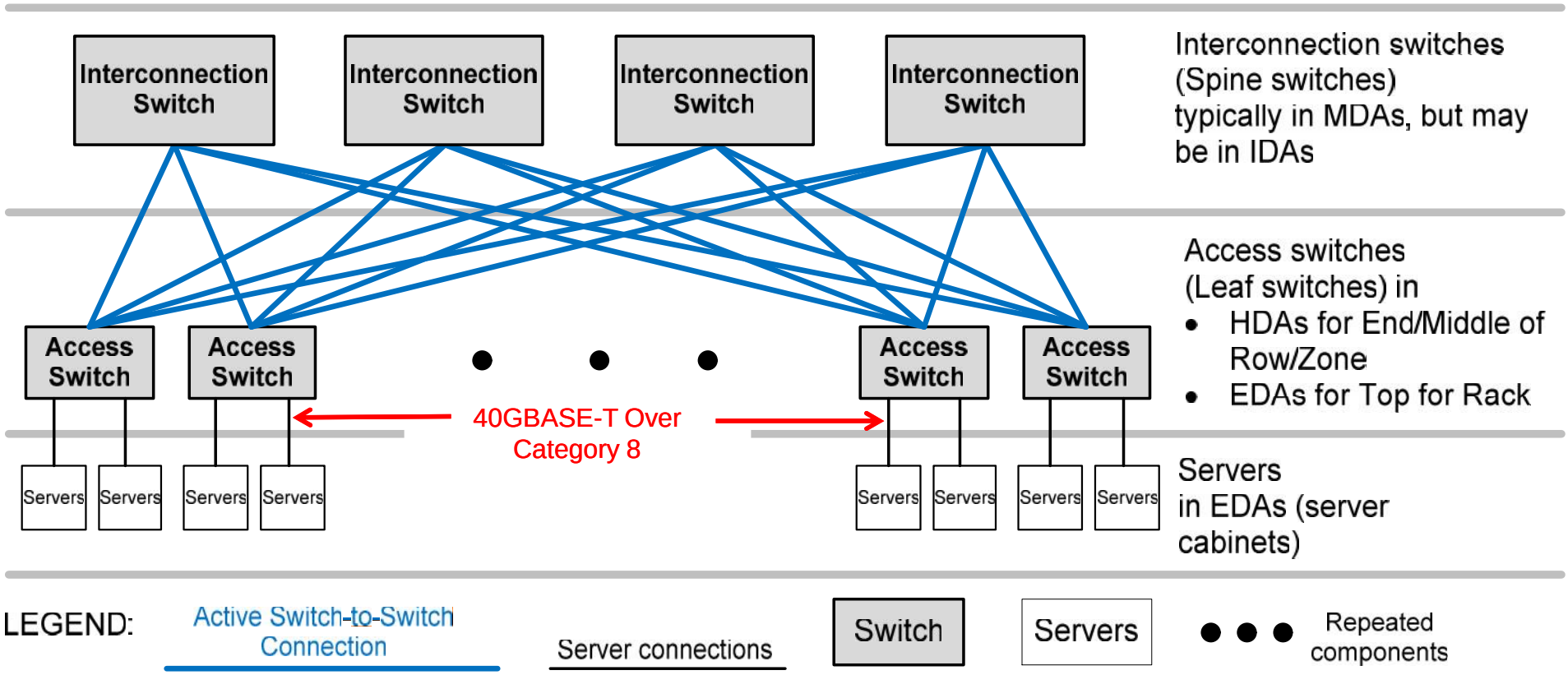
Data Center Fabric – Fat-Tree/Leaf and Spine



Source: ANSI/TIA-942-A-1

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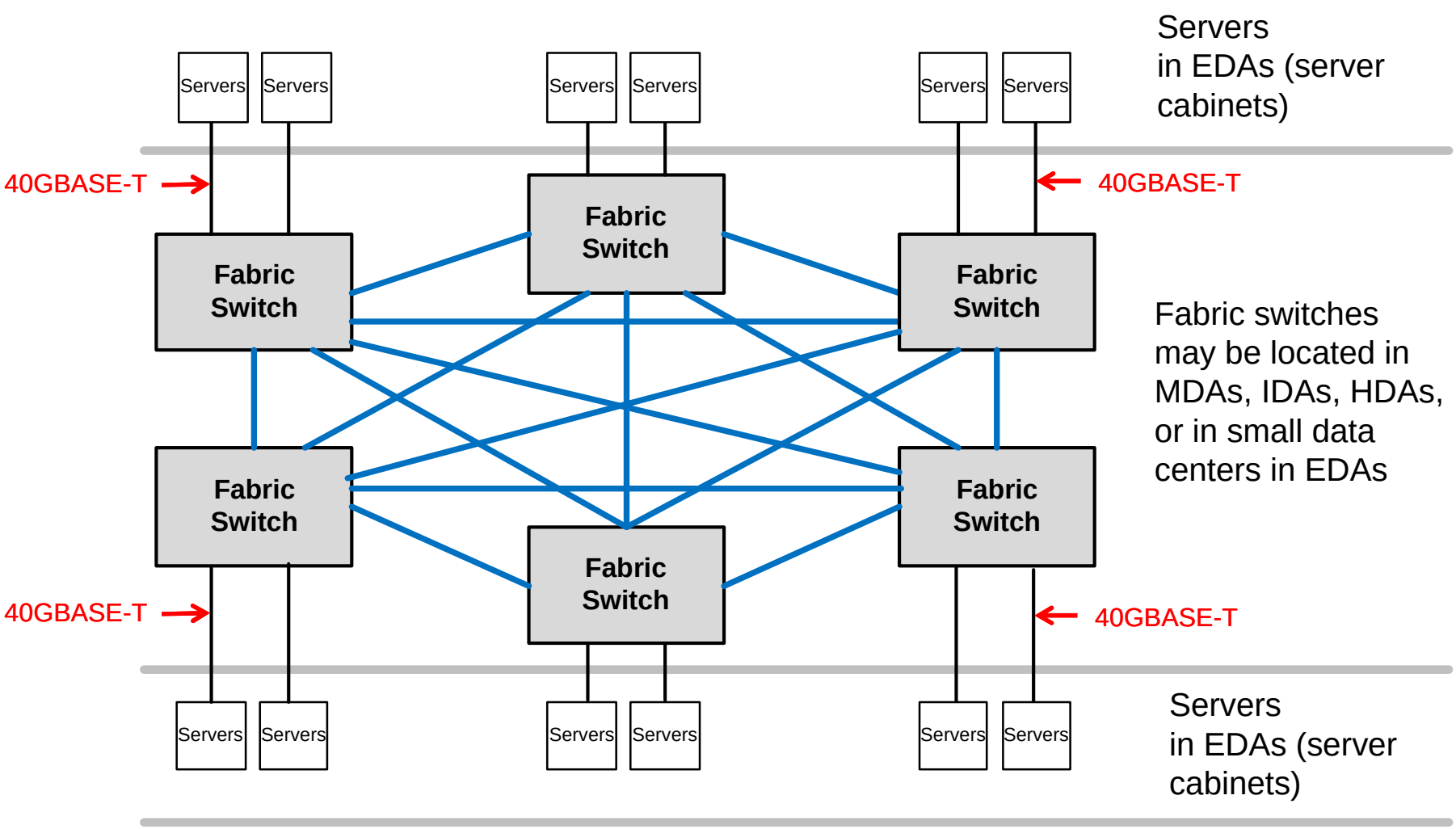
Data Center Fabric – Full Mesh



Source: ANSI/TIA-942-A-1

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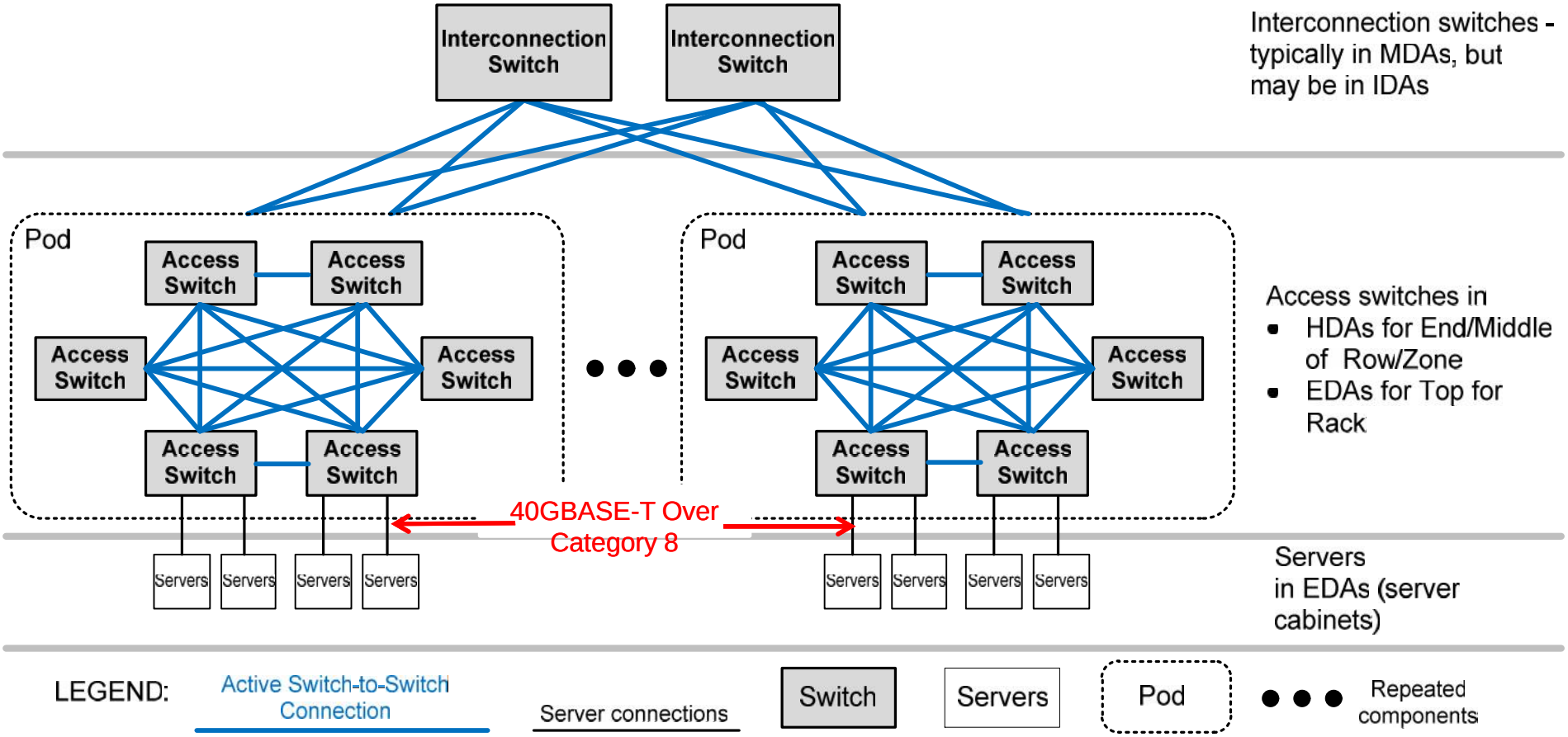
Data Center Fabric – Interconnected Meshes



Source: ANSI/TIA-942-A-1

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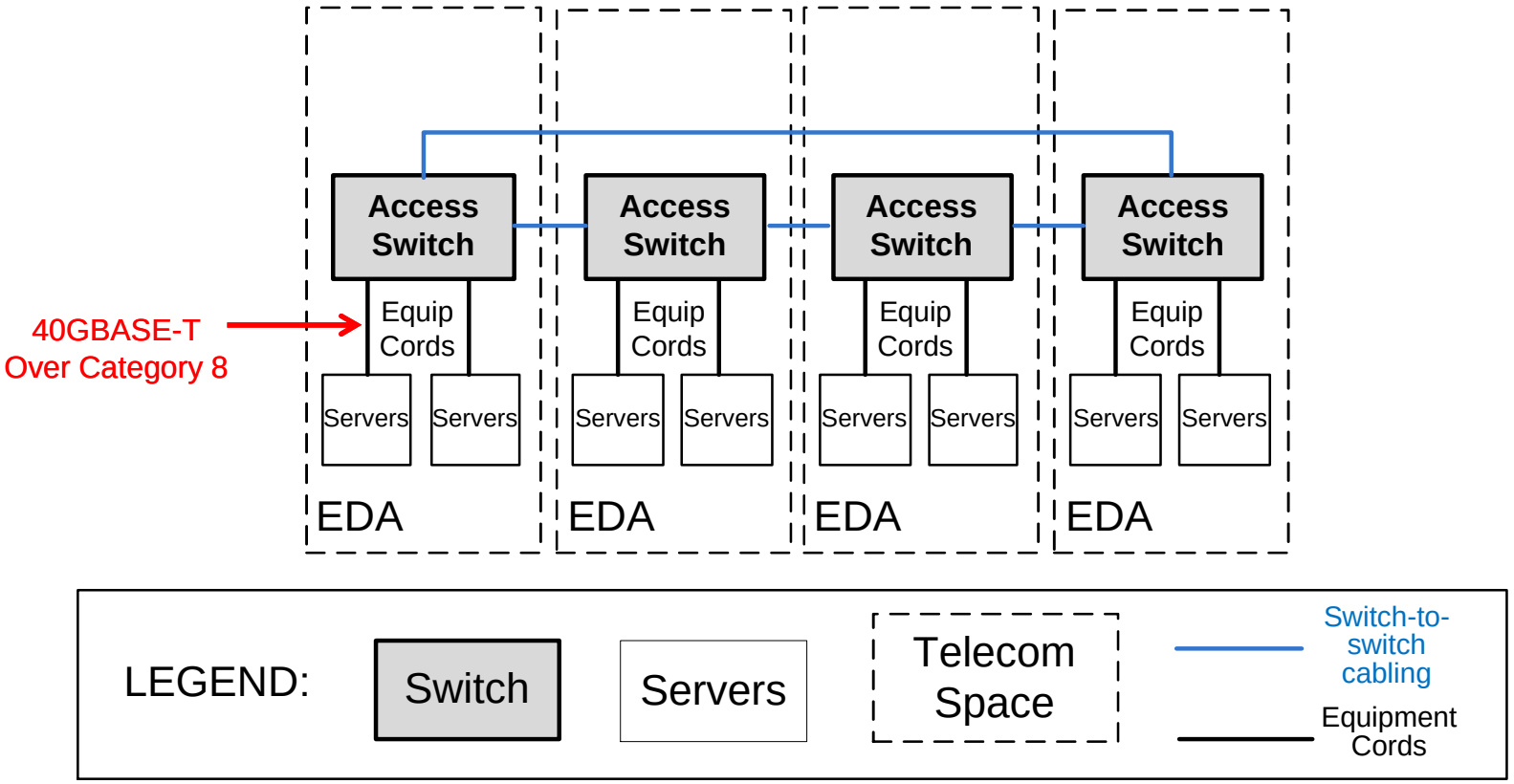
Data Center Fabric – Virtual Switch Architecture



Source: ANSI/TIA-942-A-1

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Summary

- Future proofing is possible today if you:
  - Design facilities to accommodate 30m of copper (24m link with 6m total of patch cords)
  - Design for only 2 connectors in a channel
  - Design so shielded can be accommodated
- BASE-T still retains traditional advantages
  - Low cost
  - Easy to deploy
  - Auto-negotiation for plug and play and backwards compatibility

THANK YOU!

QUESTIONS?