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Data Center Networks

Topologies, Architectures and Fault-Tolerance Characteristics

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Preface

Large-scale data centers form the core infrastructure support for the ever expanding cloud based services. Thus the performance and dependability characteristics of data centers will have significant impact on the scalability of these services. In particular, the data center network needs to be agile and reconfigurable in order to respond quickly to ever changing application demands and service requirements. Significant research work has been done on designing the data center network topologies in order to improve the performance of data centers.

In this book, we present a detailed overview of data center network architectures and topologies that have appeared in the literature recently. We start with a discussion on various representative data center network topologies, and compare them with respect to several properties in order to highlight their advantages and disadvantages. Thereafter, we discuss several routing algorithms designed for these architectures, and compare them based on various criteria: the basic algorithms to establish connections, the techniques used to gain better performance and the mechanisms for fault-tolerance. A good understanding of the state-of-the-art in data center networks would enable the design of future architectures in order to improve performance and dependability of data centers.

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Acronyms

ABT	Aggregated Bottleneck Throughput
APL	Average Path Length
ARP	Address Resolution Protocol
BFD	Bidirectional Forwarding Detection
BSR	BCube Source Routing
CDN	Component Decomposition Number
DCN	Data Center Networks
DFR	DCell Fault-tolerant Routing
ECMP	Equal Cost Multi-Path
EoR	End of Row
IBA	InfiniBand
IP	Internet Protocol
IPv4/IPv6	Internet Protocol Version 4/6
LCS	Largest Component Size
LDM	Location Discovery Message
LDP	Location Discovery Protocol
LISP	Locator-Identifier Split Protocol
MAC	Medium Access Control
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NIC	Network Interface Card
OSPF	Open Shortest Path First
PBB	Provider Backbone Bridging
RFR	Routing Failure Rate
RSM	Replicated State Machine
SCS	Smallest Component Size
TCP	Transmission Control Protocol
ToR	Top of Rack
TRILL	Transparent Interconnection of Lots of Links
UTP	Unshielded Twisted Pair
VLAN	Virtual Local Area Networks

VLB	Valiant Load Balancing
VM	Virtual Machine
WDM	Wavelength Division Multiplexing