Modern Network Hardware

Akshay Narayan, MIT CSAIL

Papers

FreeFlow: Software-based Virtual RDMA Networking for Containerized Clouds

Direct Universal Access: Making Data Center Resources Available to FPGA

Stardust: Divide and Conquer in the Data Center Network

Blink: Fast Connectivity Recovery Entirely in the Data Plane

Where is this hardware?

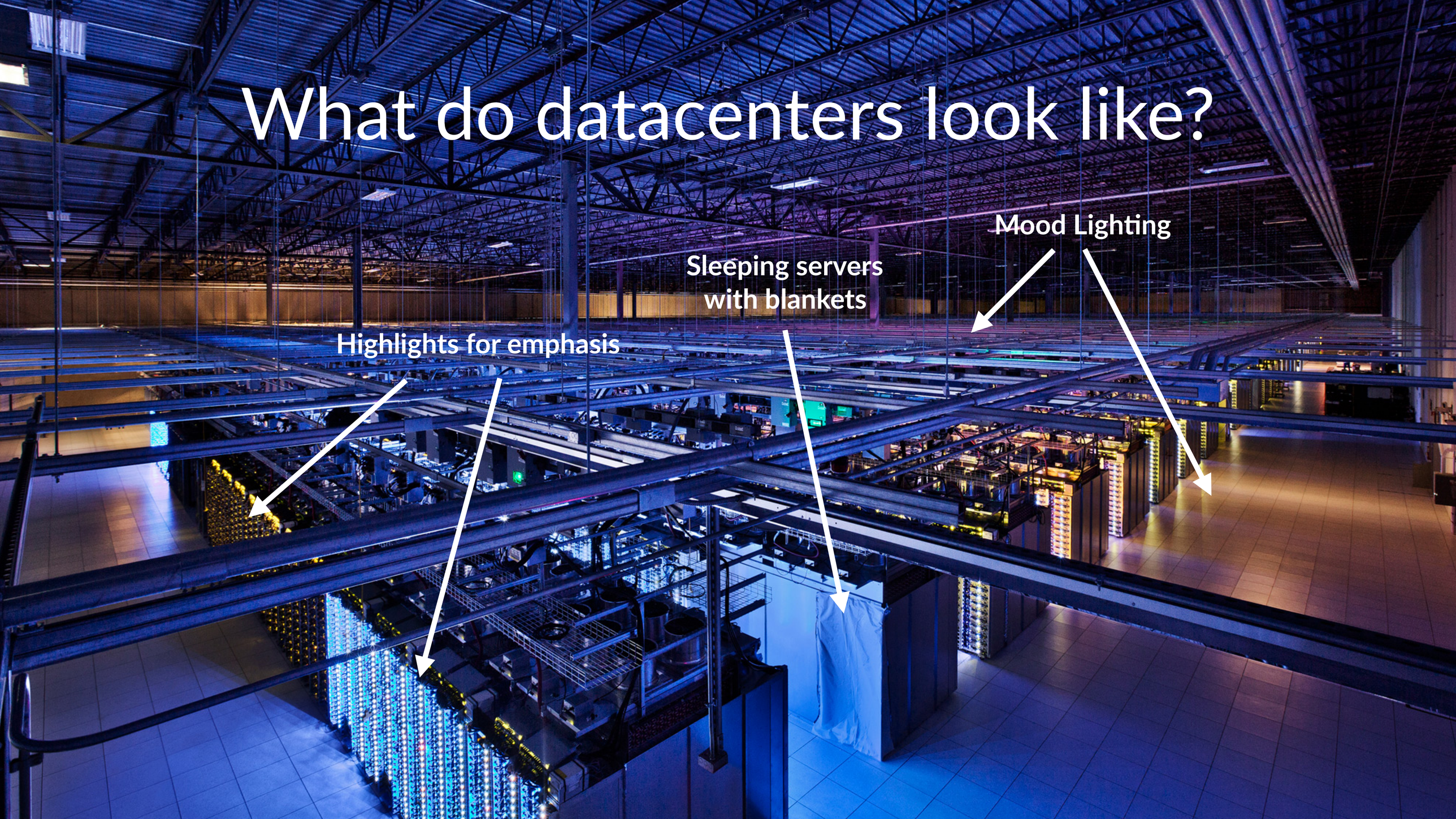
FreeFlow: Software-based Virtual RDMA Networking for Containerized Clouds

Direct Universal Access: Making Data Center Resources Available to FPGA

Stardust: Divide and Conquer in the Data Center Network

Blink: Fast Connectivity Recovery Entirely in the Data Plane

What do datacenters look like?



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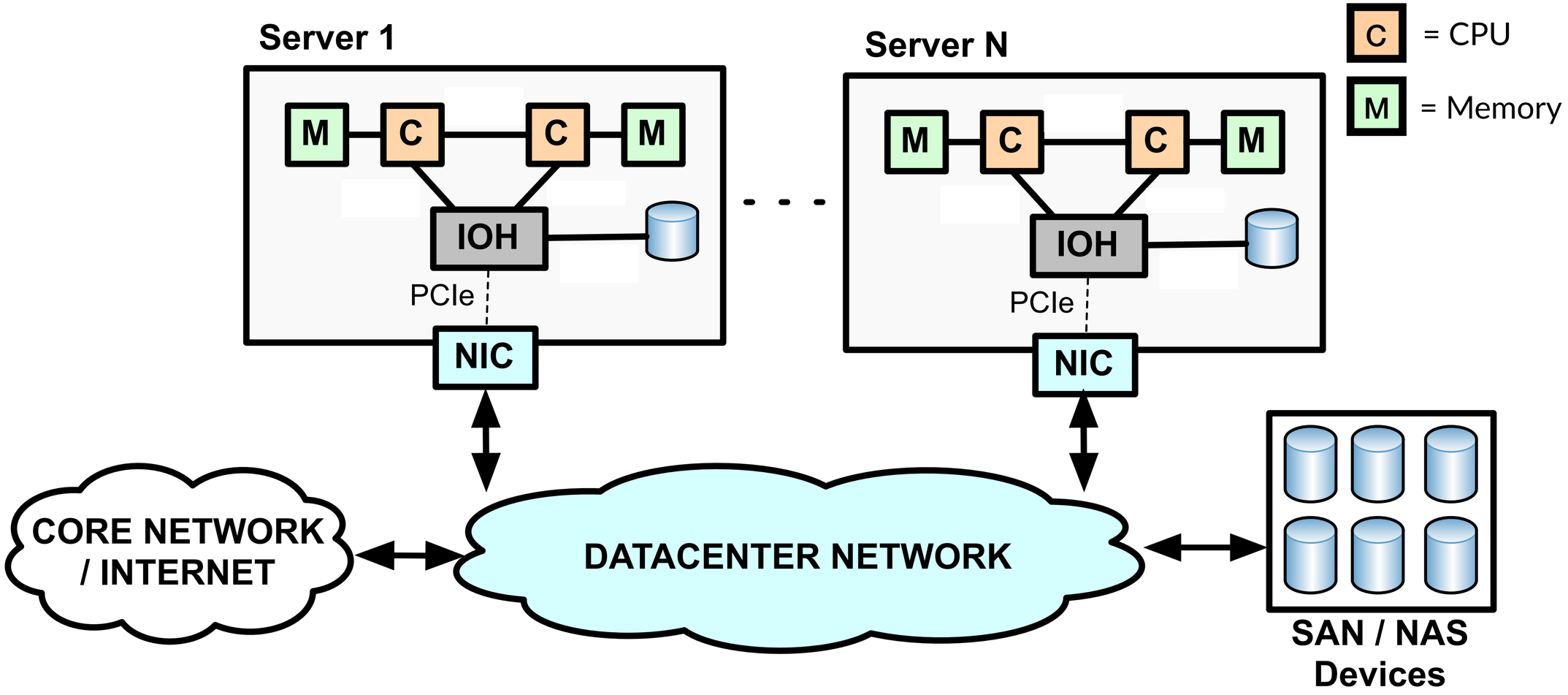
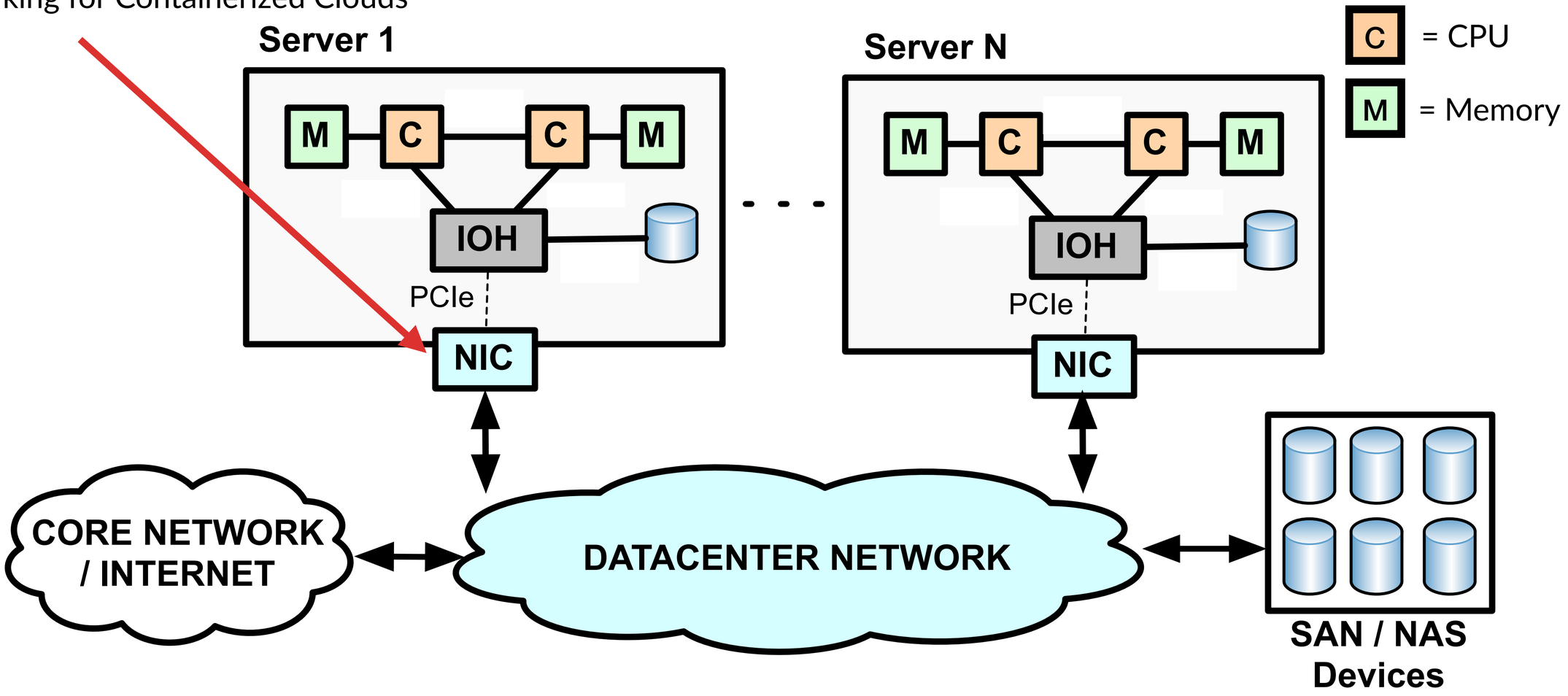


Image from P. Gao et al., OSDI 2016

Datacenter Host Hardware

FreeFlow: Software-based Virtual RDMA Networking for Containerized Clouds



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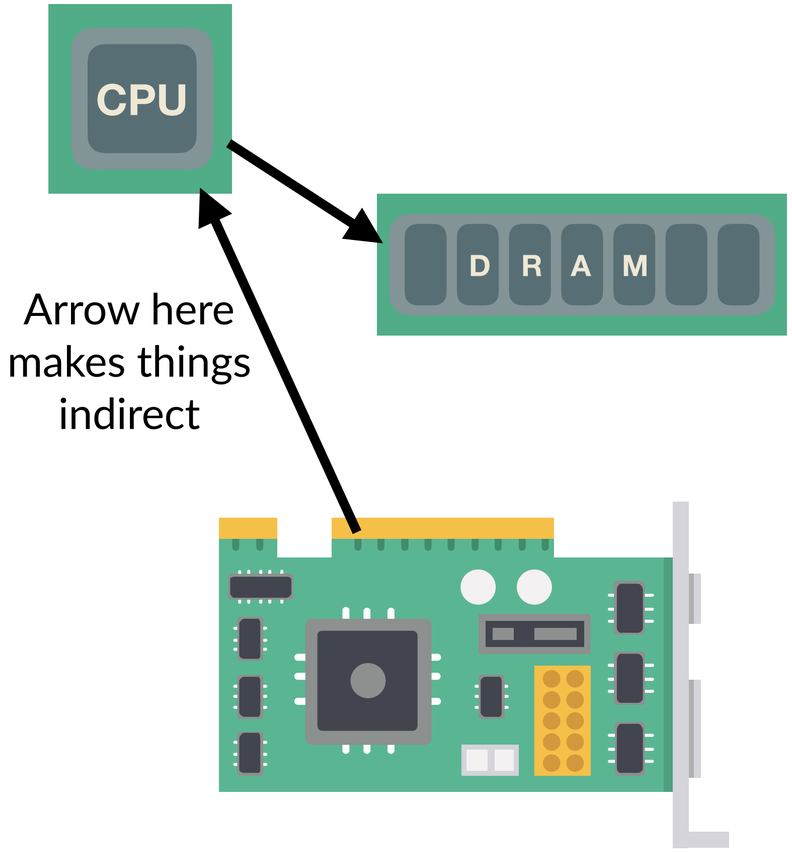
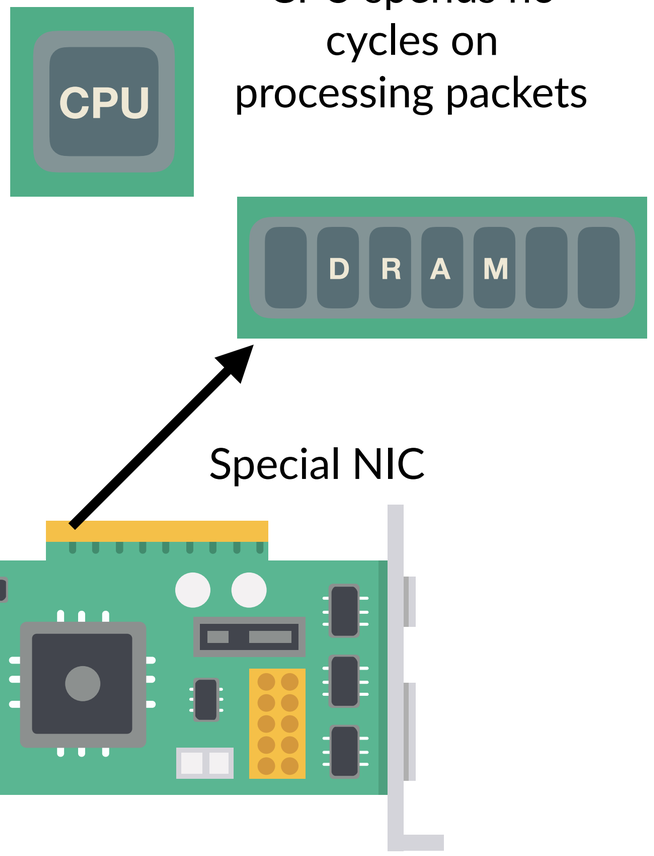
What is RDMA?

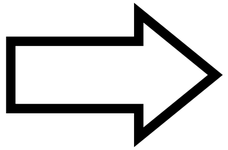
"Remote, Direct Memory Access"



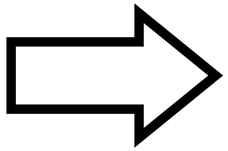


NIC Image from @graziaprato via Justine Sherry

Ok, so “Virtual RDMA for Containerized Clouds”?

“Container”  compute isolation + filesystem isolation + network interface isolation for processes

How can we let containers use RDMA?

“Virtual RDMA Networking”  Software pretending to be a RDMA NIC which talks to the real RDMA NIC

Datacenter Host Hardware

Direct Universal Access: Making Data Center Resources Available to FPGA

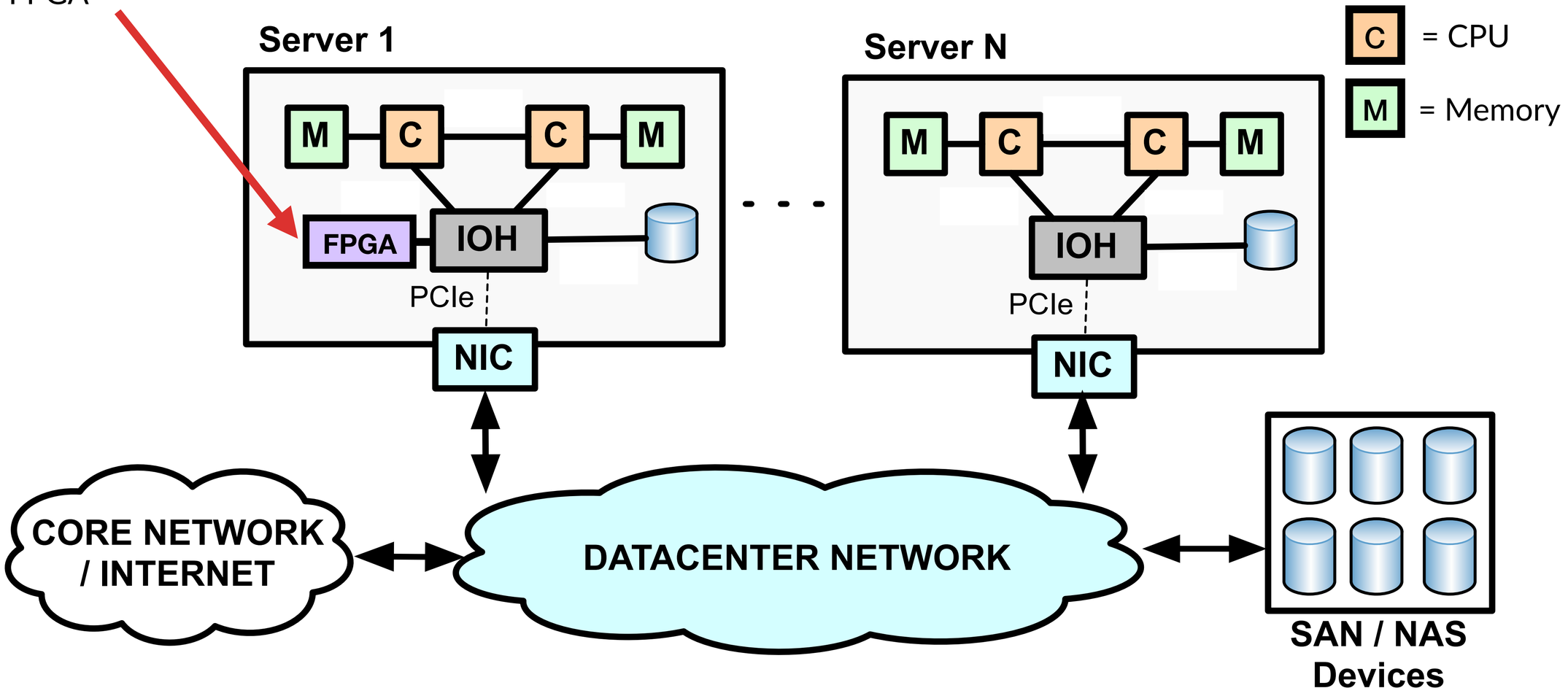


Image from P. Gao et al., OSDI 2016

What is an FPGA?

"Field Programmable Gate Array"

"Temporal Computing"

Small amounts of data at a time

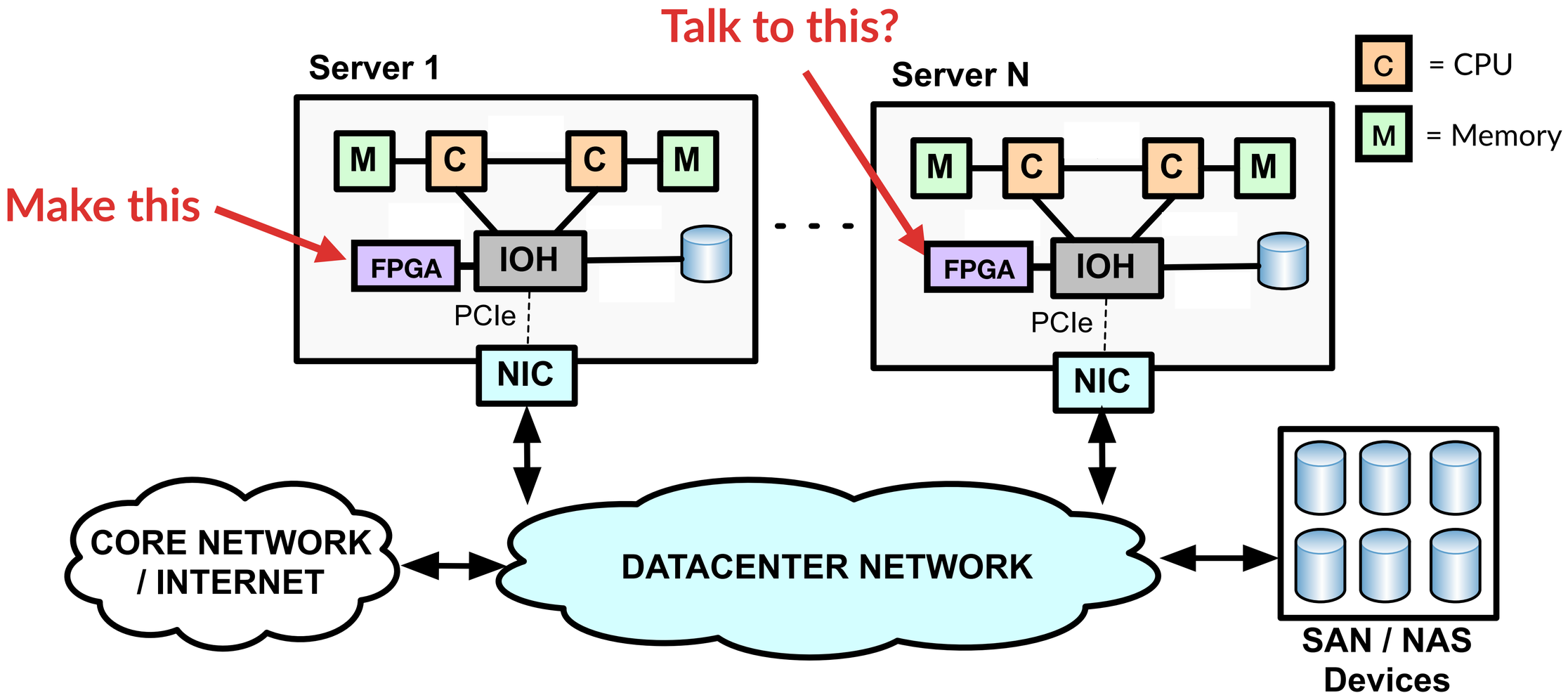
Switch to doing different things quickly

"Spatial Computing"

Large amounts of data at a time

Switch operations slowly

“Make DC Resources Available?”



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Datacenter Network Hardware

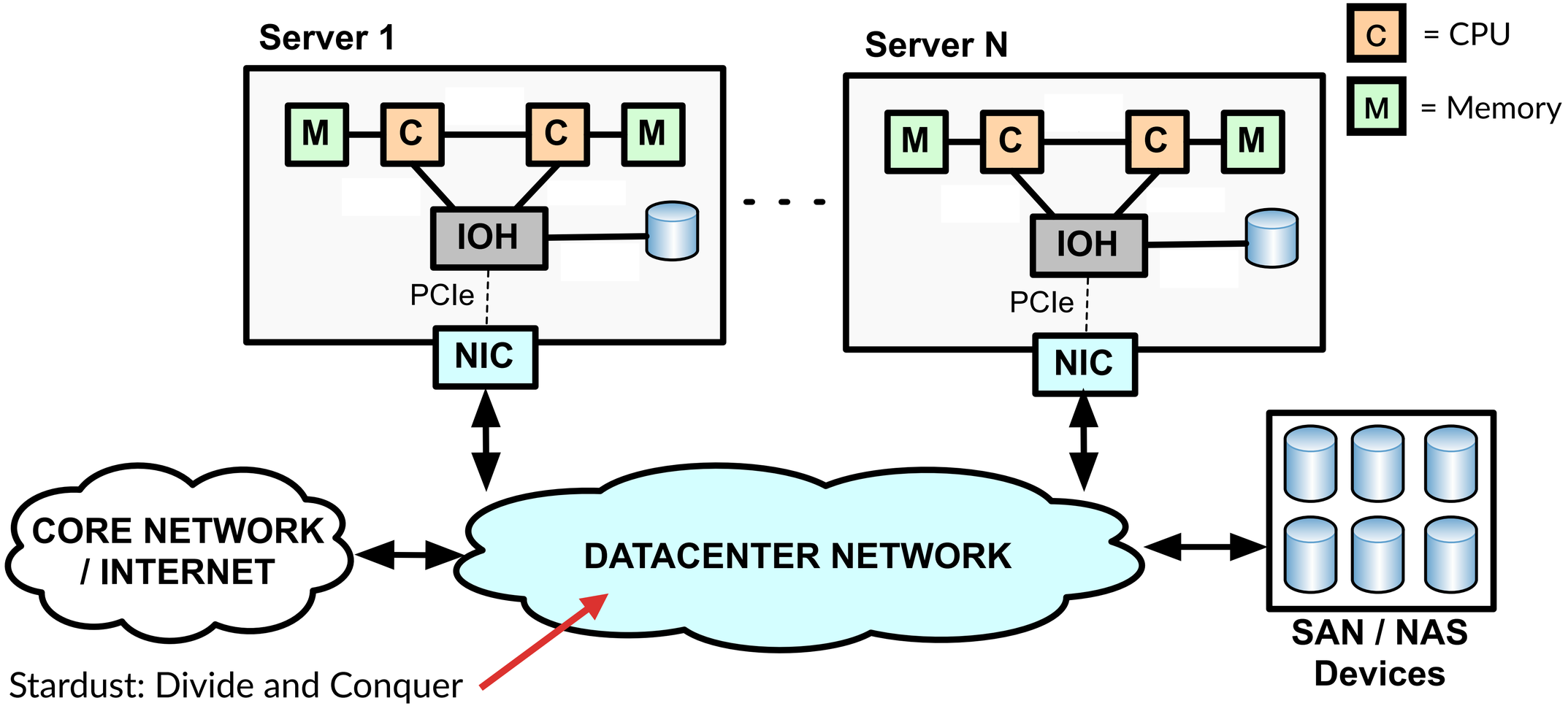
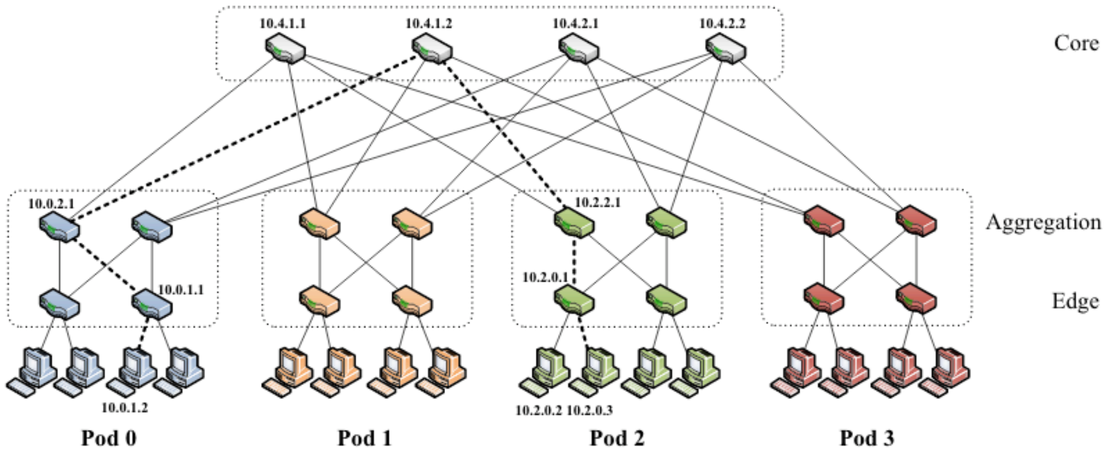
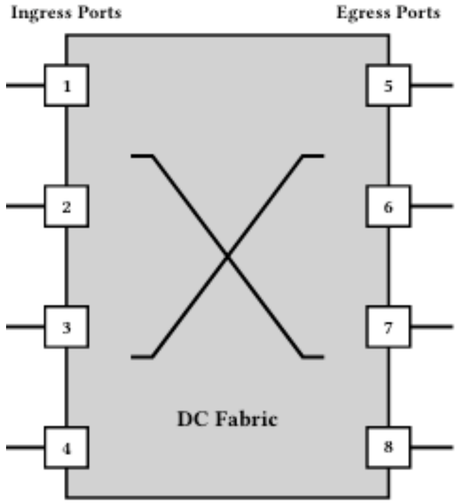


Image from P. Gao et al., OSDI 2016

The Dream: One Big Switch



Conventional design: fat-tree network



What users want: “One Big Switch”

Image from M. Al-Fares et al., SIGCOMM 2008

Image from S. Agarwal et al., SIGCOMM 2018

Big Switches

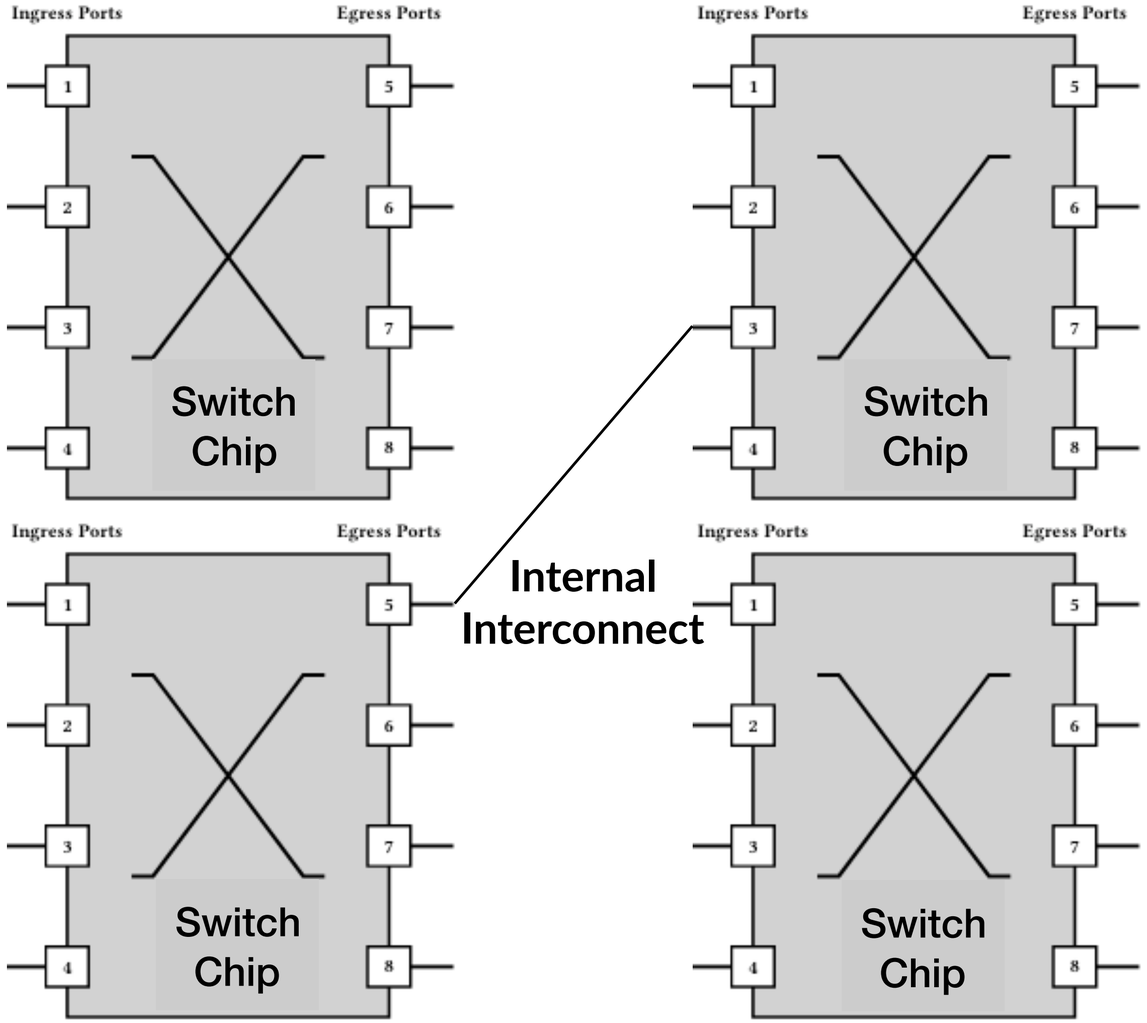
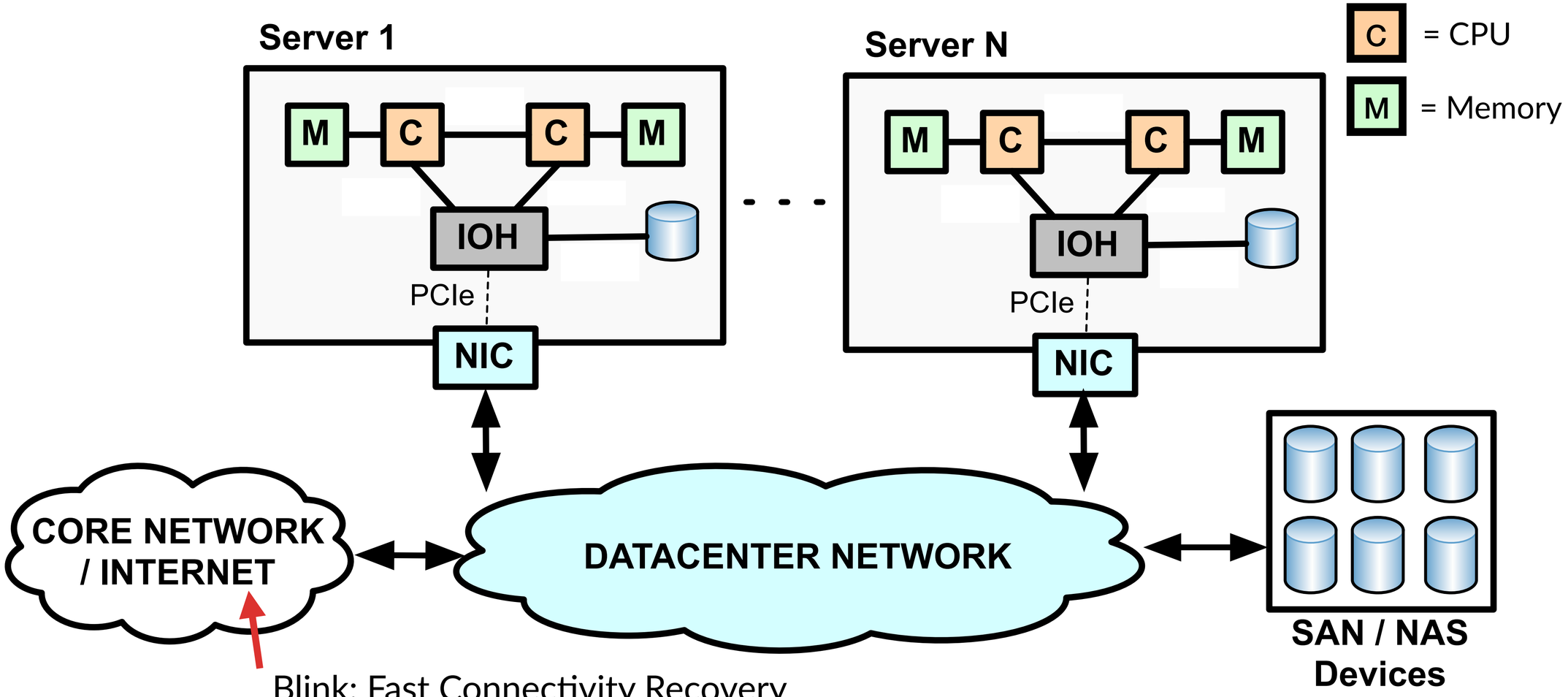


Image from S. Agarwal et al., SIGCOMM 2018

Internet Network Hardware



Blink: Fast Connectivity Recovery Entirely in the Data Plane

Image from P. Gao et al., OSDI 2016

The Internet

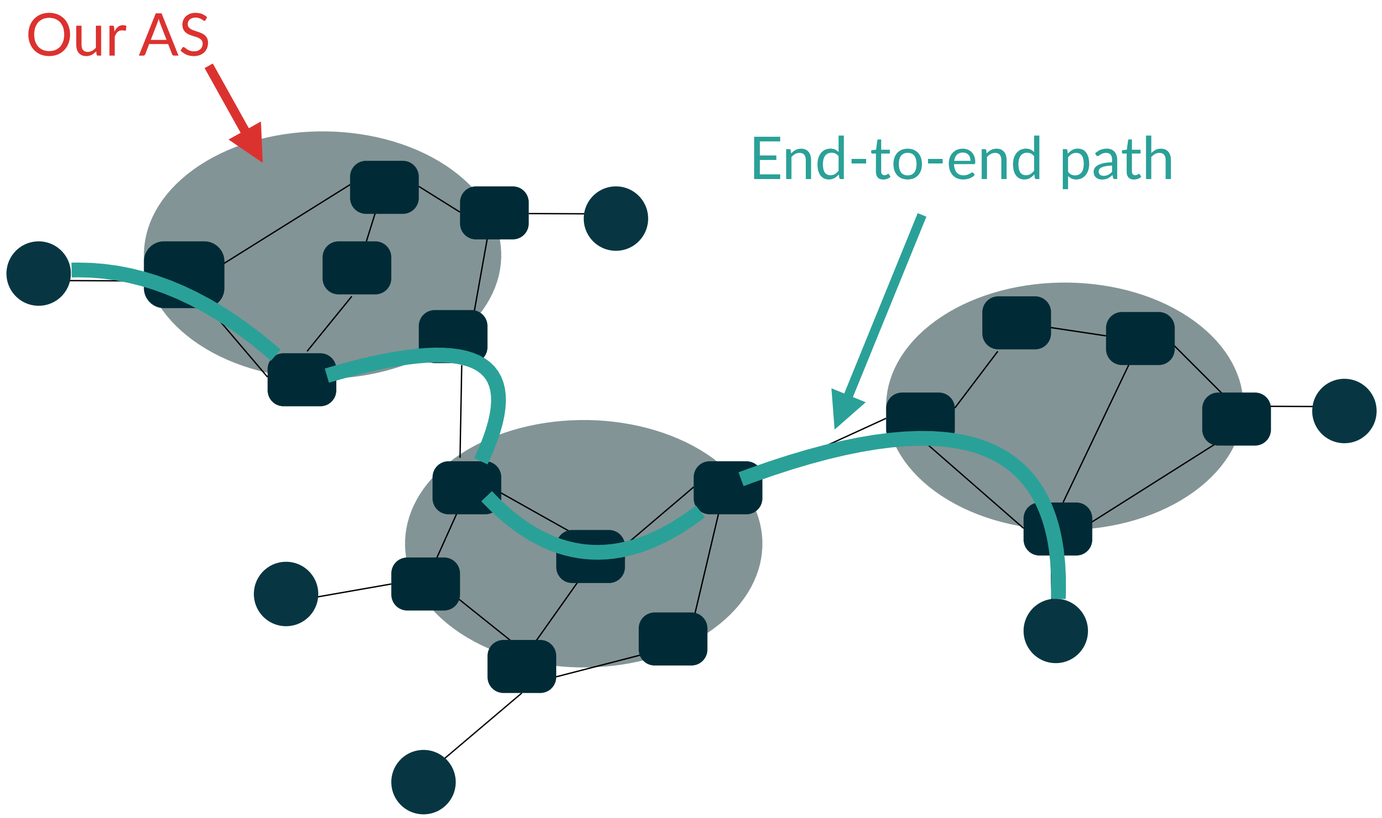


Image adapted from S. Ratnasamy, UC Berkeley CS 168

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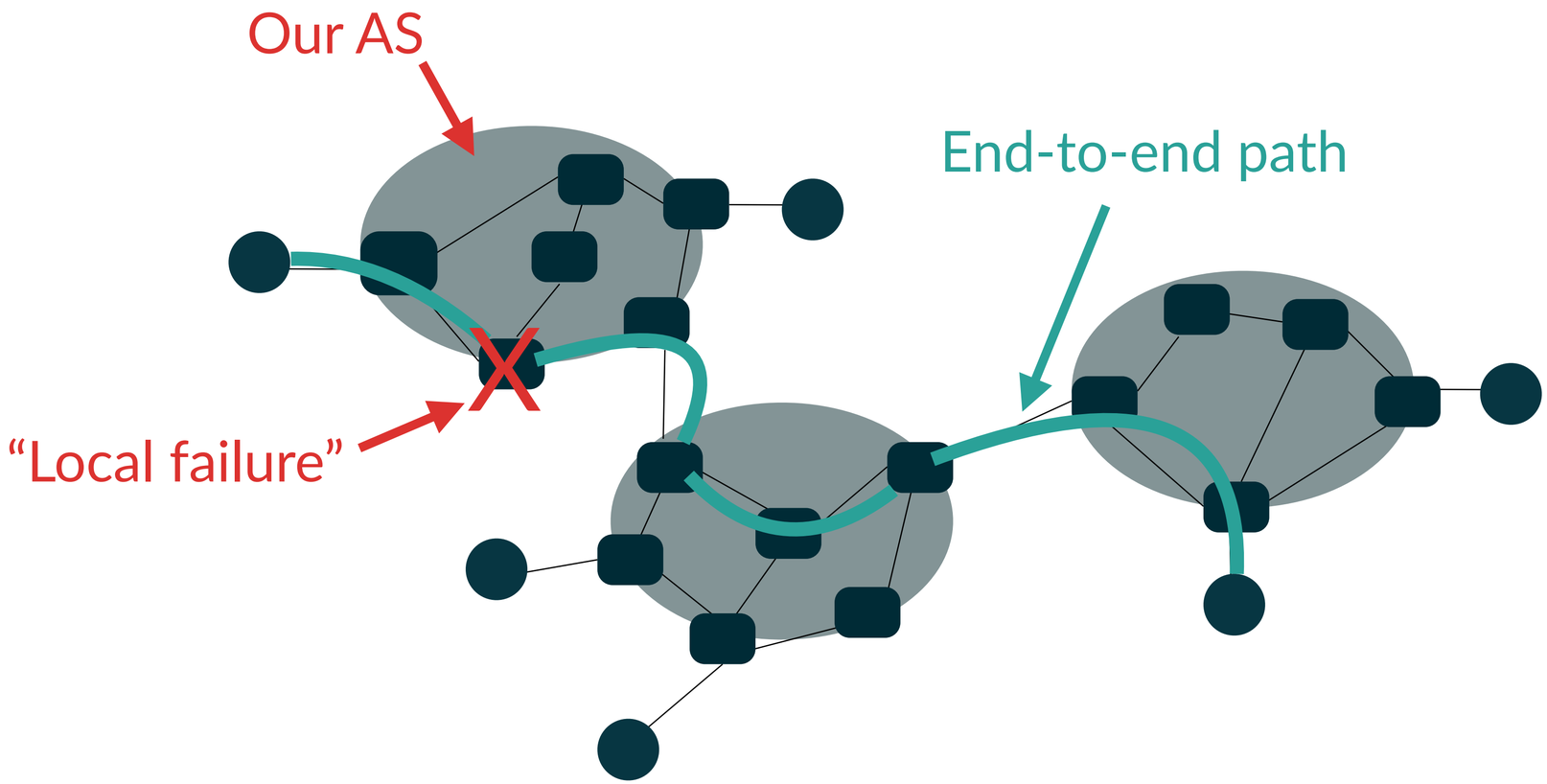

Image adapted from S. Ratnasamy, UC Berkeley CS 168

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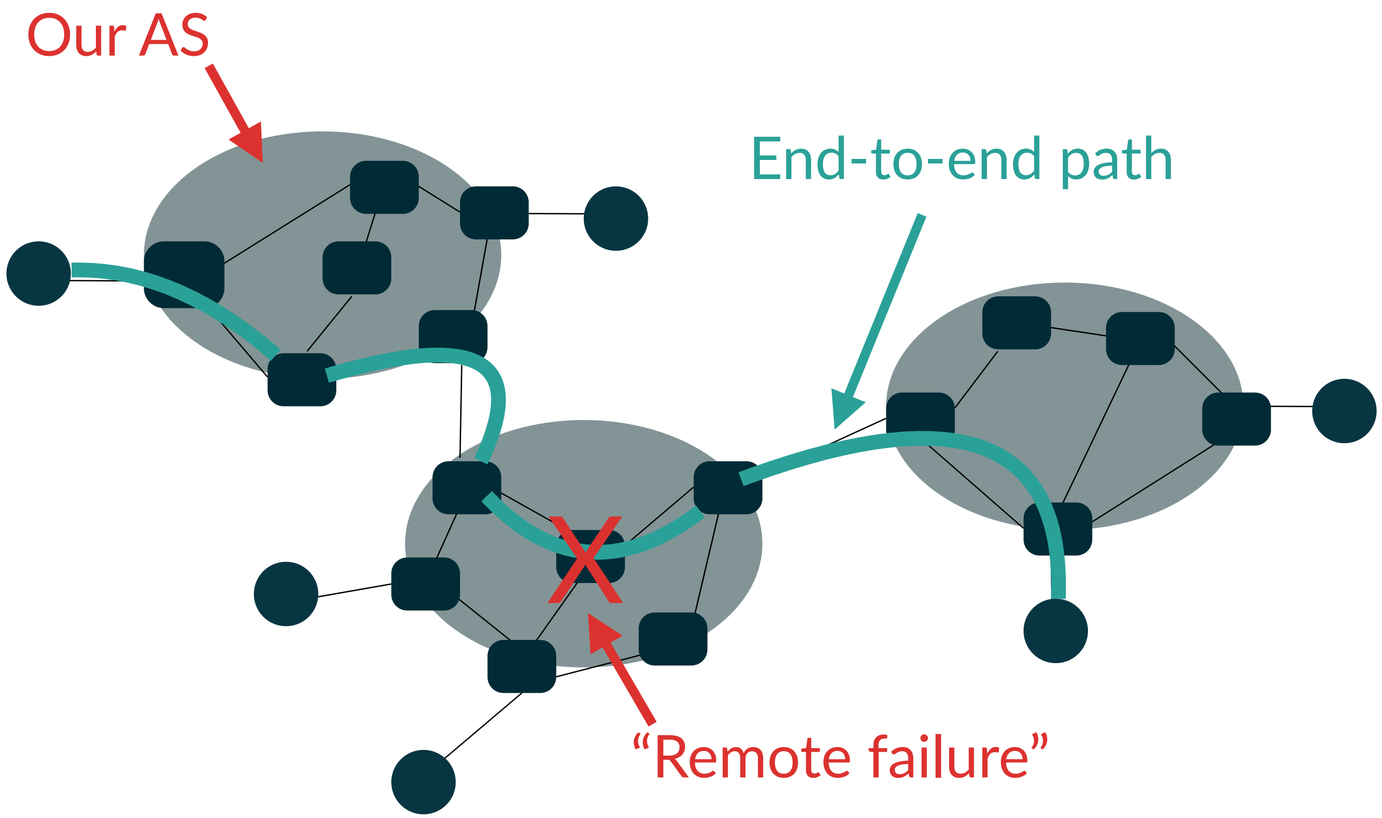

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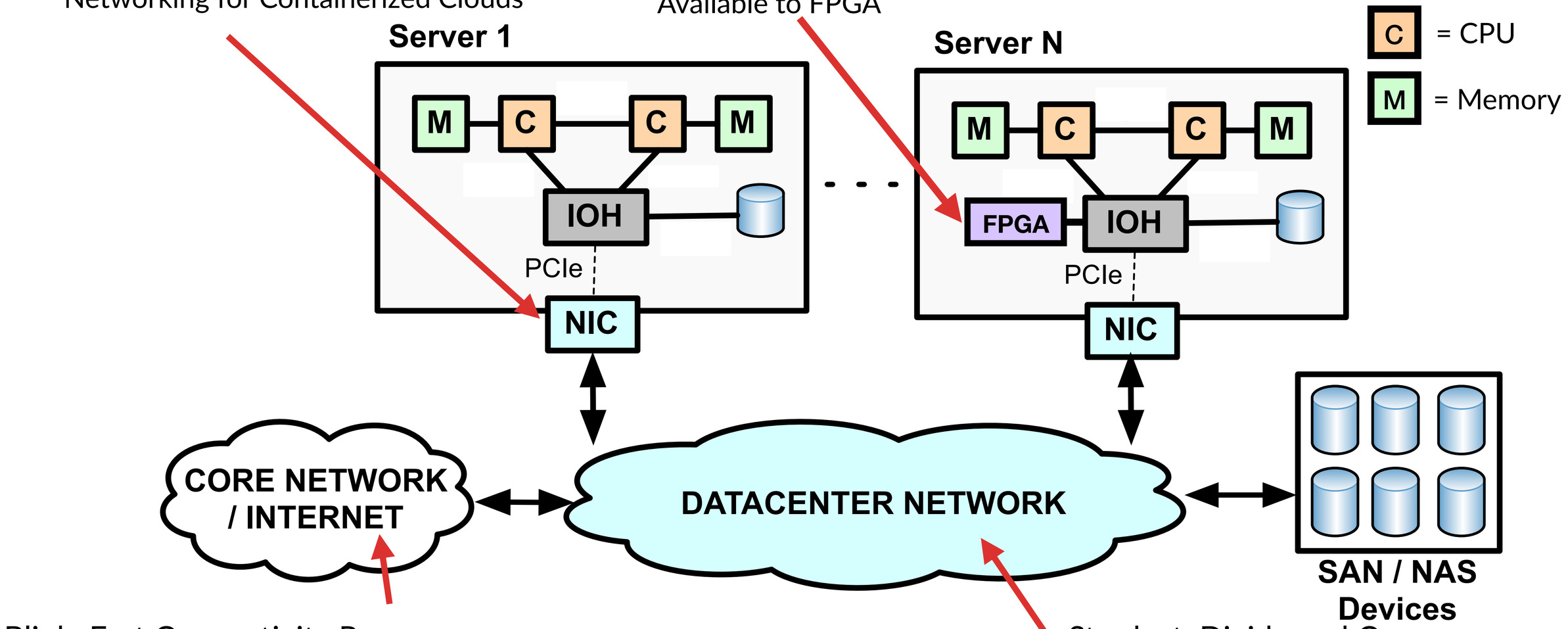

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