AIDC地端化與智慧校園

以RoCE v2 實現高速安全的資料交換

Jimmy Wang

Sep. 2025

願亡者得以安息
願傷者盡速痊癒
願災區重獲平安

AIDC地端化與智慧校園

以RoCE v2 實現高速安全的資料交換

Jimmy Wang

Sep. 2025

Climate of AI DC

AI 資料中心的網路需求

AI 大語言模型啟動第四次工業革命

Hugging Face

Models
1,484,462

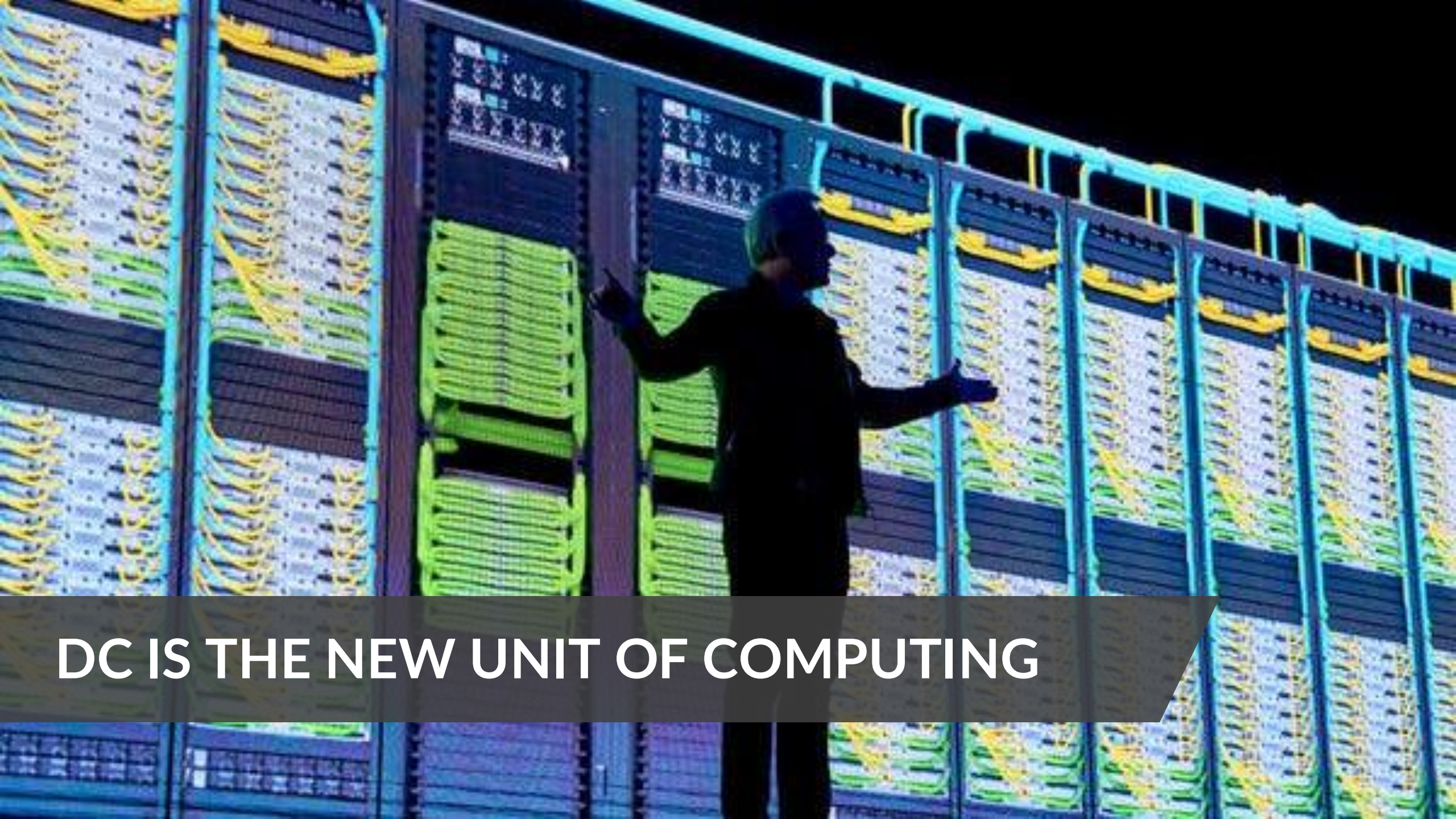
Chatbot Arena
https://lmarena.ai

繁中LLM 聊天機器人競技場
https://arena.twllm.com

Llama 3 From Meta

Microsoft Phi-4

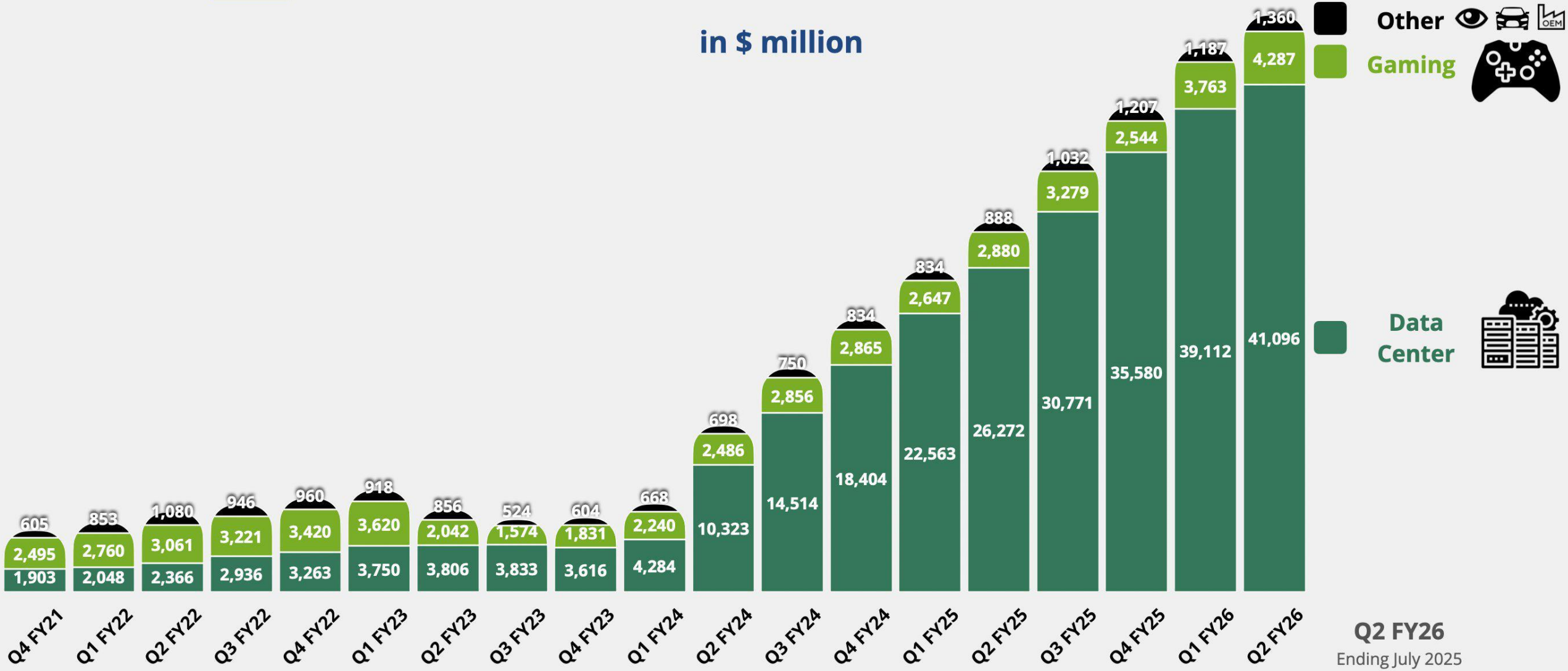
Rank* (UB)	Rank (StyleCtrl)	Model	Arena Score	95% CI	Votes	Organization	License	Knowledge Cutoff
1	1	chocolate (Early Grok-3)	1402	+7/-6	7829	xAI	Proprietary	Unknown
2	4	Gemini-2.0-Flash-Thinking-Exp-01-21	1385	+5/-5	13336	Google	Proprietary	Unknown
2	2	Gemini-2.0-Pro-Exp-02-05	1379	+5/-6	11197	Google	Proprietary	Unknown
2	1	ChatGPT-4o-latest (2025-01-29)	1377	+5/-6	10529	OpenAI	Proprietary	Unknown
5	2	DeepSeek-R1	1361	+8/-7	5079	DeepSeek	MIT	Unknown
5	8	Gemini-2.0-Flash-001	1356	+6/-5	9092	Google	Proprietary	Unknown
5	2	o1-2024-12-17	1353	+6/-5	15437	OpenAI	Proprietary	Unknown
8	6	o1-preview	1335	+4/-4	33169	OpenAI	Proprietary	2023/10
8	8	Qwen2.5-Max	1332	+7/-7	7370	Alibaba	Proprietary	Unknown
10	9	DeepSeek-V3	1317	+4/-4	17717	DeepSeek	DeepSeek	Unknown



DC IS THE NEW UNIT OF COMPUTING

NVIDIA Revenue Breakdown

in $ million



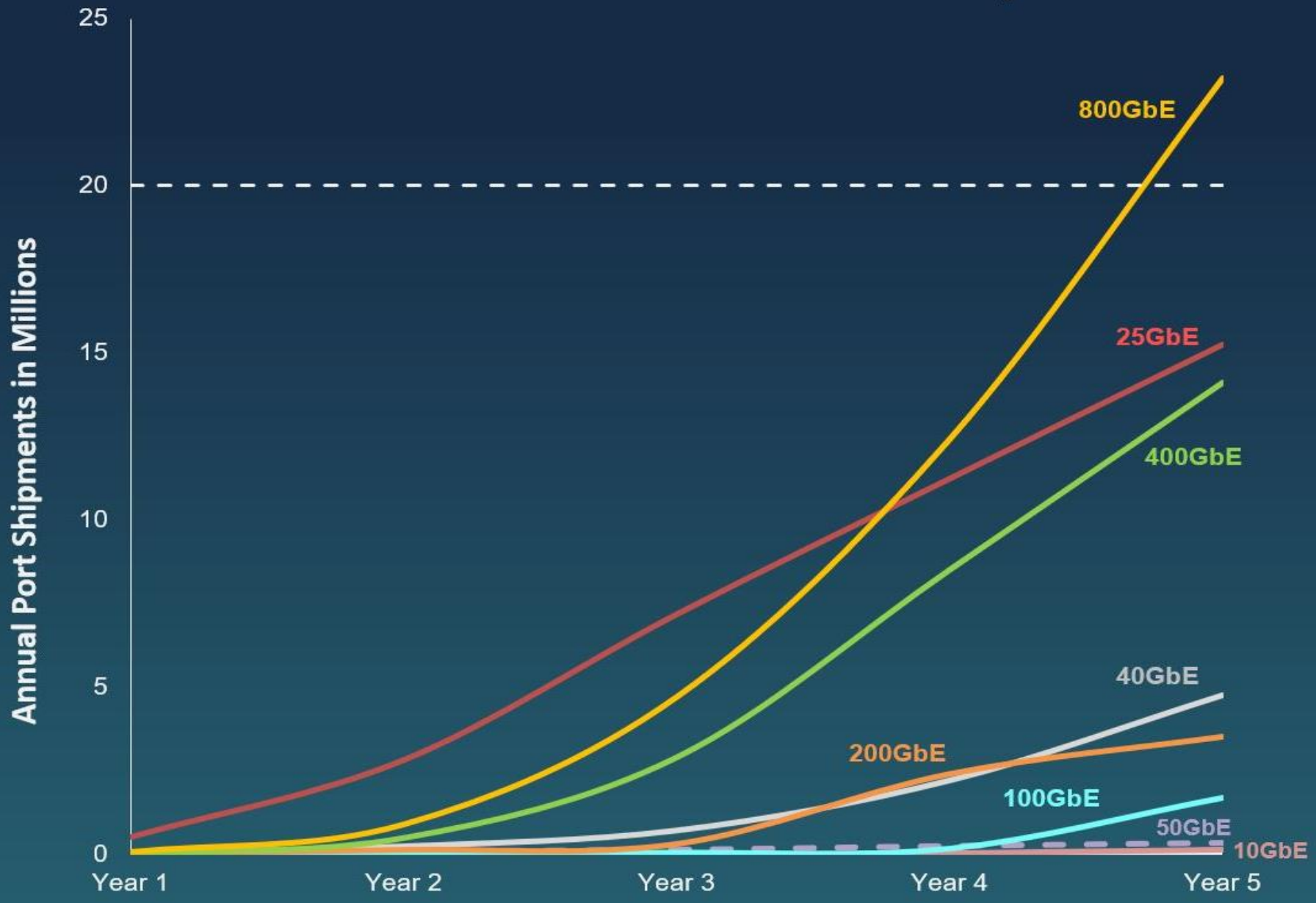
Q2 FY26
Ending July 2025

HOW THEY MAKE MONEY

appeconomyinsights.com

APP ECONOMY **INSIGHTS**

Data Center Ethernet Switch Annual Shipments



Year 1 Equals:

2023 for 800GbE

2016 for 25GbE

2018 for 400GbE

2011 for 40GbE

2019 for 200GbE

2012 for 100GbE

2020 for 50GbE

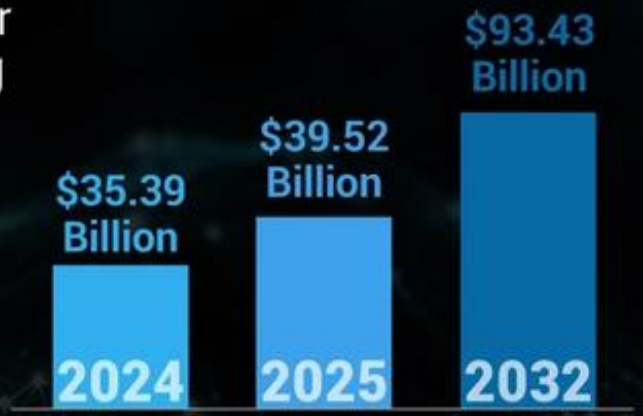
2001 for 10GbE

CREHAN RESEARCH Inc.

DATA CENTER NETWORKING MARKET

FORTUNE BUSINESS INSIGHTS

Data Center Networking Market to grow at **13.1% CAGR** during 2025-2032



INDUSTRY DEVELOPMENT

Equinix partners with Singapore's GIC and Canada's CPPIB to expand data center infrastructure across the U.S.

NORTH AMERICA

$11.07 Million 2023

$11.95 Million 2024

Asia Pacific | Europe
Middle East & Africa | South America

TRENDS

Adoption of Multi-Cloud & Hybrid Cloud Networking in Enterprises

DRIVERS

Proliferation of Cloud Computing in Businesses

GLOBAL, BY INDUSTRY

IT & Telecom 21.3%
Media & Entertainment
Government & Defense
Manufacturing | BFSI
Healthcare | Retail
Others

BY COMPONENTS

Hardware | Software
Services

AI Data Center: Market view

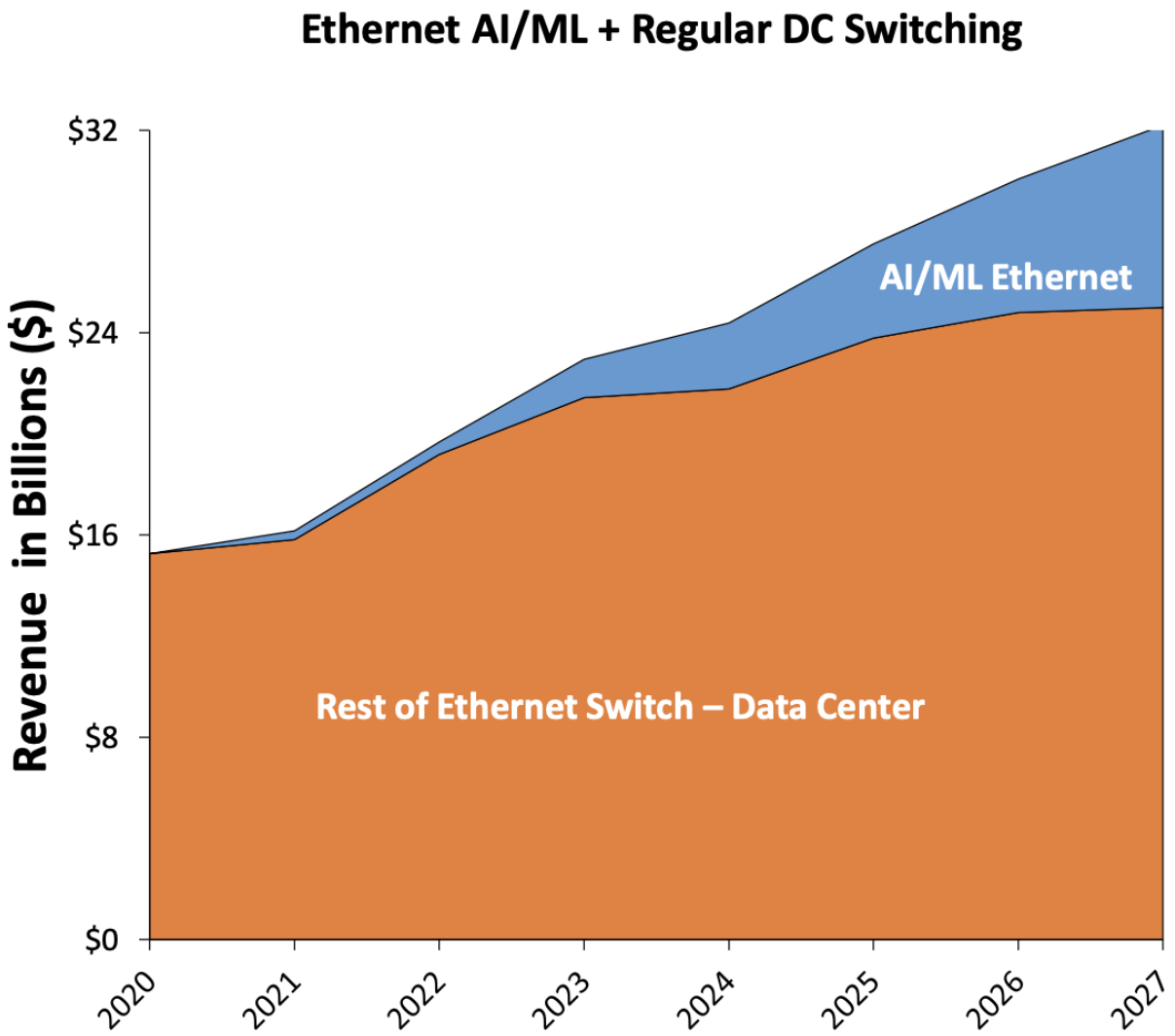
InfiniBand is fading away, Industry is pivoting to Ethernet

Data Center Networking - AI/HPC - Market and Forecast – 650 Group					
	2024	2025	2026	2027	2028
Share Revenue (%)					
Ethernet - Frontend	23%	30%	34%	30%	34%
Ethernet - Backend	23%	41%	44%	51%	50%
InfiniBand (Switching Only)	54%	29%	22%	19%	17%

DC Network CapEx: Market Transition with AI

Investments in some enterprise DCs are being paused…

to make way for investment in AI DCs



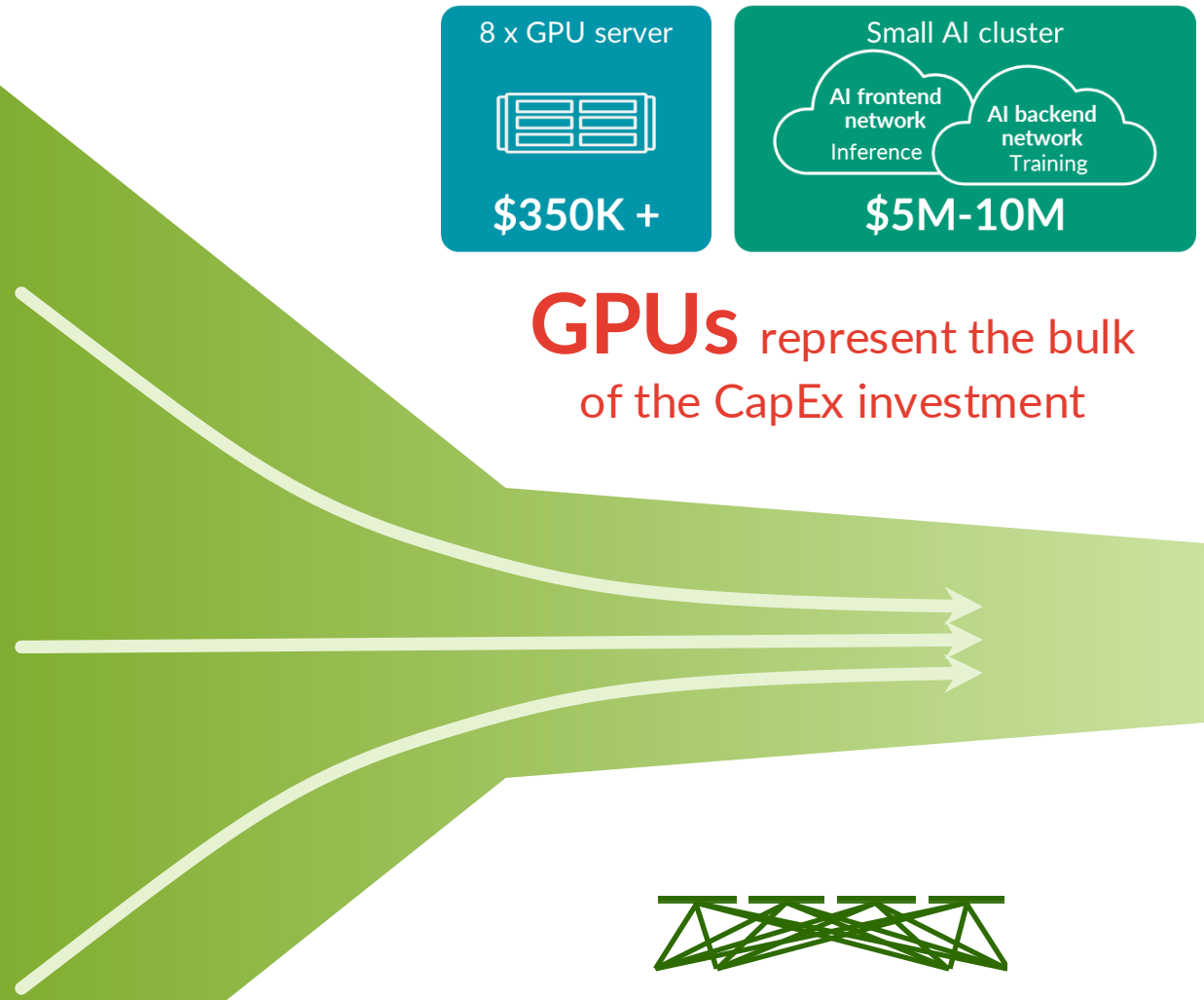
Source: 650 Group, 2023

Avoid an Infrastructure Bottleneck

If the network is a bottleneck that delays training job completion, expensive GPU time is wasted, and training becomes network-bound instead of compute-bound

Juniper Mission for AI Data Centers

Unlocking the full potential of AI with unparalleled network performance and ease of operations



GPUs represent the bulk of the CapEx investment

The network connects GPUs in distributed training

xAI

HIGH-PERFORMANCE BACKEND AI DATA CENTER NETWORKING

THE CHALLENGE

- Accommodate large-scale and efficient GPU cluster and server connectivity.
- AI training is compute-intensive , with traffic flows that break traditional data center networking
- Efficient use of GPU cycles. (Job completion time)

THE SOLUTION

- Juniper QFX5240 for 800G leaf spine connectivity
- Enabling the same form factor for both Front and Back-end AI clusters
- Efficient Load balancing and congestion control for RDMA traffic

WHY JUNIPER?

- **Junos feature richness** for congestion management with ROCEv2
- **AI Lab for POC** for various load balancing scenarios
- **Lightening responsiveness to needs**
- **Better supply chain** for switch and optics with Juniper

AI Technology on Juniper

SambaNova SYSTEMS

CORPORATE PROFILE

- Founded 2017; Series D (backed by SoftBank Google Ventures, BlackRock, et al.)
- Builds AI hardware and integrated systems to run AI applications from the data center to the cloud
- Purpose-built enterprise-scale AI platform is the technology backbone for the next generation of AI computing

THE SOLUTION

- Juniper QFX and PTX series fabric for high density, performance & scalability to move massive volumes of data
- Automation across design, deployment & operations of the network lifecycle with Juniper Apstra

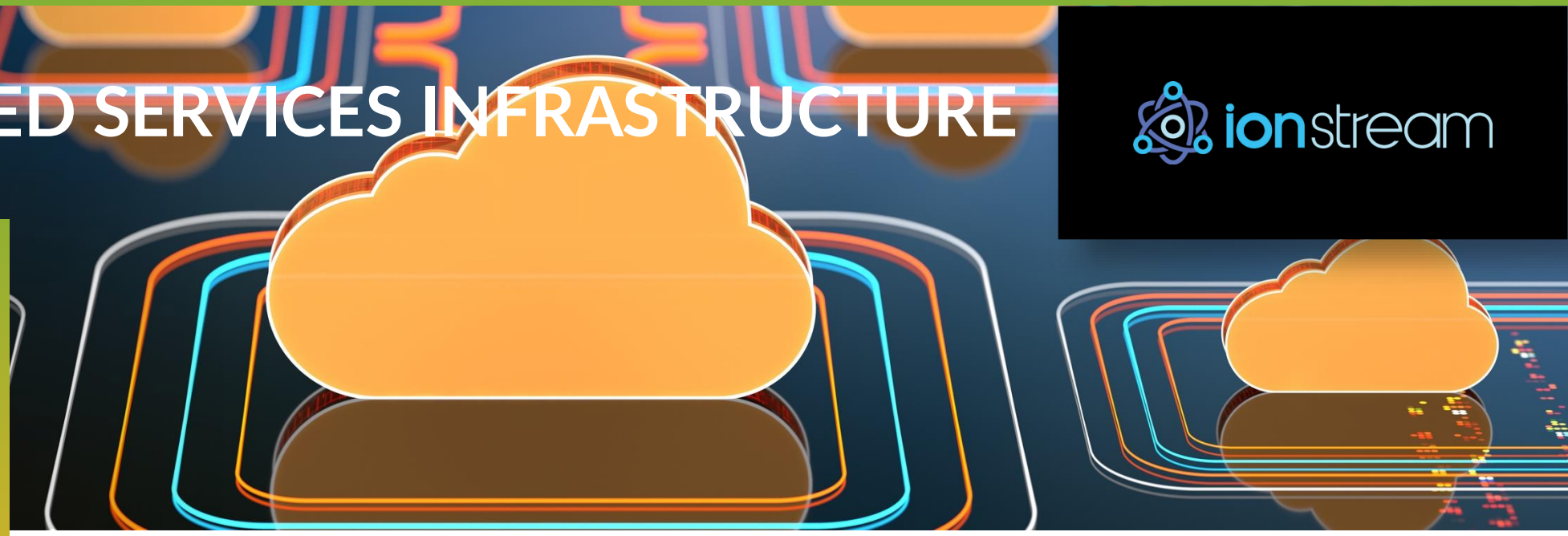
THE RESULTS

- **Accelerate high-performance ML model building across industries** enabling customers to deploy AI in days, not months
- **Eases the construction of ML infrastructure & delivers enhanced capabilities and efficiency** for ML model training, inference, and high-performance computing
- **Five times better performance** than traditional GPU architecture

"In AI, data flow is king. We need the lowest network latency and the highest bandwidth possible, and the performance of the Juniper QFX5200 switches has been phenomenal,"

Vijay Tatkar, Director of Product Management

AI MANAGED SERVICES INFRASTRUCTURE



HIGH-PERFORMANCE AI INFRASTRUCTURE SOLUTIONS FOR ENTERPRISES

THE CHALLENGE

- Unfamiliarity with NVIDIA InfiniBand
- Lengthy lead times from Cisco, Arista and NVIDIA
- Pricing from Arista/Cisco was high and slow to respond to ionstream's questions

THE SOLUTION

- AI GPU pod features Juniper's cutting-edge QFX 5240 powering 800GbE infrastructure
- Data center networking foundation empowers flexible GPU-as-a-service offerings to full service on-site deployments.
- Apstra Premium (future order)

THE RESULTS

- Insights provided by specialist team on current and future designs **established instant credibility**
- Extensive competitive evaluation proved **Juniper's superior ability to deliver** easy-to-deploy/operate, scalable networking driving faster time-to-value for AI clusters
- JVDs enable **quick spin up of AI-as-a-Service** to attract new clients

"We're able to deliver accessible, first-class AI transformation for our customers"


Next Gen of AIDC

從早期採用者. .到大眾市場

專有人工智慧	不斷演進的人工智慧解決方案
單一來源的 A100 和 H100 GPU	競爭激烈的 GPU 供應商市場不斷擴大
封閉式 Nvidia AI/ML PyTorch 框架	PyTorch 2.0 擴展了 GPU 支援和生態系統
緊耦合的專有 InfiniBand AI 網路	開放式乙太網 Fabric 可實現 Tb 速度 - “以太網絕對適用於人工智慧訓練” SaaS 供應商網路運行與工程主管
單一供應商創新	行業驅動的創新，UEC

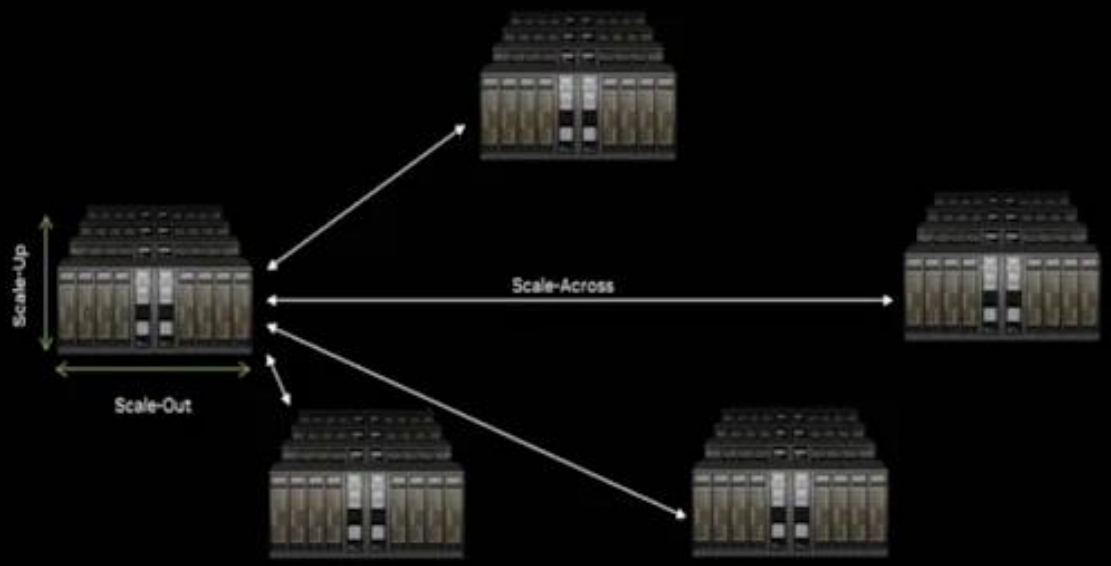
JUNIPER NETWORKS


Activity Monitor
My Processes
CPU
Memory
Energy
Disk
Network
Search
Process Name
% CPU
CPU Time
Threads
Idle Wake Ups
Kind
% GPU
GPU Time
PID
User
Finder 8.4 21:05.38 12 2
Control C... 5.2 2:40.12 14 23
Ollama 5.0 20.27 30 74
http://127... 3.1 1:07.24 5 22
Dropbox 2.8 29:03.63 134 16
iTerm2 2.3 2:54:00.91 10 8
Activity... 2.1 4.03 5 4
McBopo... 1.6 29.63 5 0
Ollama G... 1.1 16.06 8 14
Google C... 0.9 1:23:42.56 47 6
Acrobat 0.8 7:35.48 35 100
mdworke... 0.7 0.15 4
loginwind... 0.7 10:33.07 6 1
Dropbox... 0.7 6:17.08 22 5
Window... 0.6 14:54.22 5 2
Google C... 0.4 28:35.28 18 7
Windows... 0.4 45:16.87 33 14
System: 3.11%
User: 4.15%
Idle: 92.74%
CPU LOAD
New Chat
Today
請介紹台北101
你是powershell專家
請幫我開發一個powershell,列出密碼在14天內要到期的使用者
gpt-oss:20b

NVIDIA announce Scale-Across solution

NVIDIA Introduces Spectrum-XGS Ethernet to Connect Distributed Data Centers into Giga-Scale AI Super-Factories

Distributed AI between remote locations, overcoming power and physical limitations



- Scaling AI beyond the data center requires new infrastructure
- Spectrum-XGS unifies multiple data centers into the world's largest supercomputers
- Integrating scale-out and scale-across
- Auto-adjust load balancing based on scale-across distance
- 1.9X higher NCCL multi-site performance

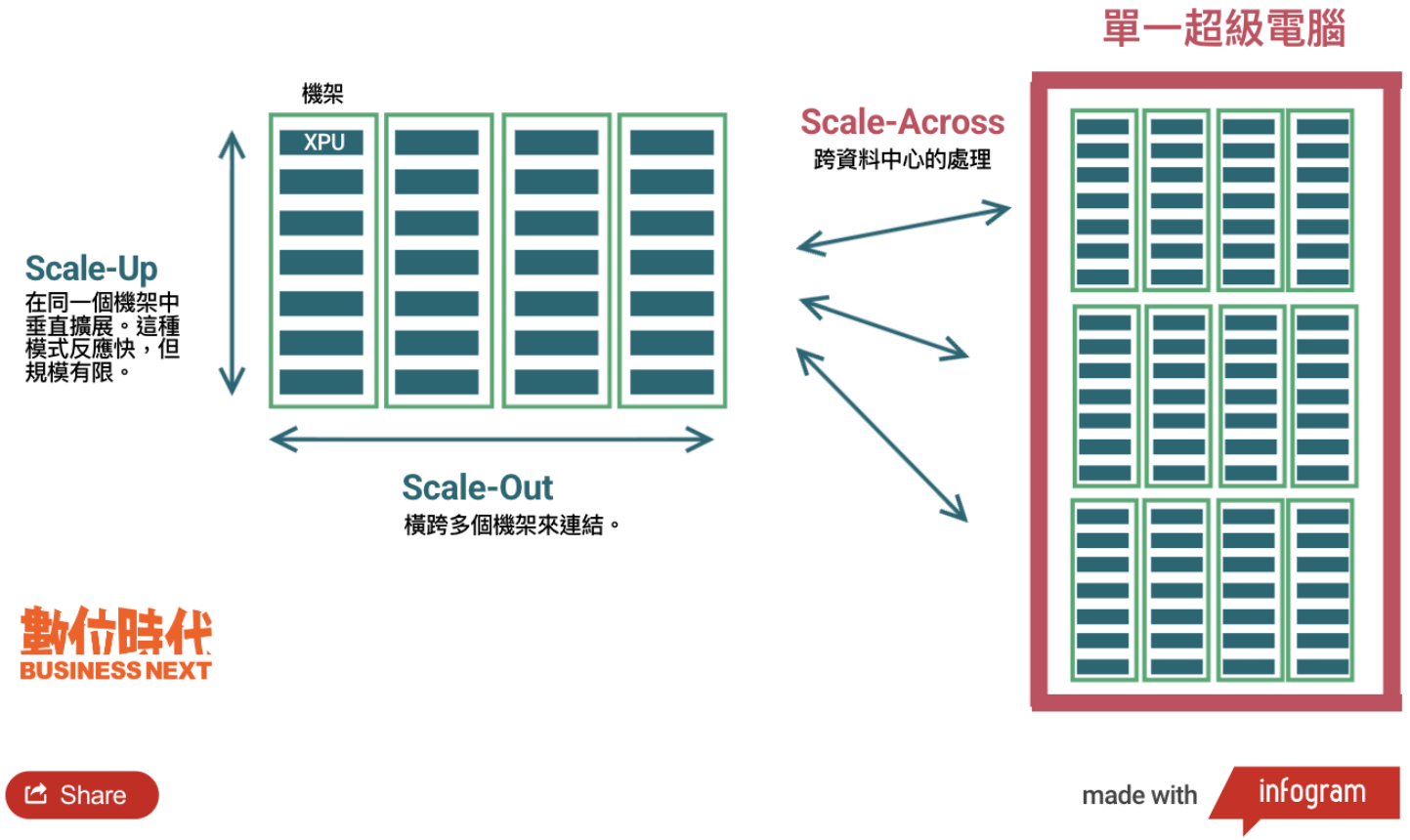
What is Scale Across

Scale-Across是什麼？

目前企業建構AI基礎設施時，主要採取垂直擴展（Scale-up）與水平擴展（Scale-out）兩種連結模式，輝達的「Scale-Across」，可讓多個資料中心透過新一代交換技術互聯，形成如同單一超級電腦的運算體系。

- Scale Across」與傳統的「Scale-Up」（單一機櫃/伺服器擴容）和「Scale-Out」（橫向擴展更多機櫃/增加伺服器）不同，強調的是跨資料中心的協同運算能力。

- 突破了單一資料中心的規模及電力限制，能把多個城市、甚至不同國家的運算資源整合起來共同執行AI和大型運算任務。




NVIDIA
DGX
SPARK

Technical Specifications*
Architecture NVIDIA Grace Blackwell
GPU NVIDIA Blackwell Architecture
CPU 20 core Arm, 10 Cortex-X925
+ 10 Cortex-A725 Arm
CUDA Cores NVIDIA Blackwell Generation
Tensor Cores 5th Generation
RT Cores 4th Generation
Tensor Performance1 1 PFLOP
System Memory 128 GB LPDDR5x, unified system memory
Memory Interface 256-bit
Memory Bandwidth 273 GB/s
Storage 1 or 4 TB NVME.M2 with self-encryption
USB 4x USB TypeC

Ethernet 1x RJ-45 connector 10 GbE
NIC ConnectX-7 Smart NIC

Wi-Fi WiFi 7
Bluetooth BT 5.3 w/LE
Audio-output HDMI multichannel audio output
Power Consumption TBD
Display Connectors 1x HDMI 2.1a
NVENC | NVDEC 1x | 1x
OS NVIDIA DGX™ OS
System Dimensions 150 mm L x 150 mm W x 50.5 mm H
System Weight 1.2 kg

Shaping the Next Step Forward

JUNIPER NETWORKS

GPUs are expensive and scarce

Single GPU

$33K +

8 x GPU server

$350K +

Small AI cluster

AI frontend network
Inference

AI backend network
Training

$5M-10M

Large AI clusters

$100s M

Data center CapEx comparison

	Traditional DC	AI Training DC
Compute	55%	80%
Storage	35%	14%
Network	10%	6%

Backend AI DC switching TAM:
$3B (2023)
65% CAGR (2022-2027)

Meta claimed last year that 33% of elapsed time in AI/ML is spent waiting for the network

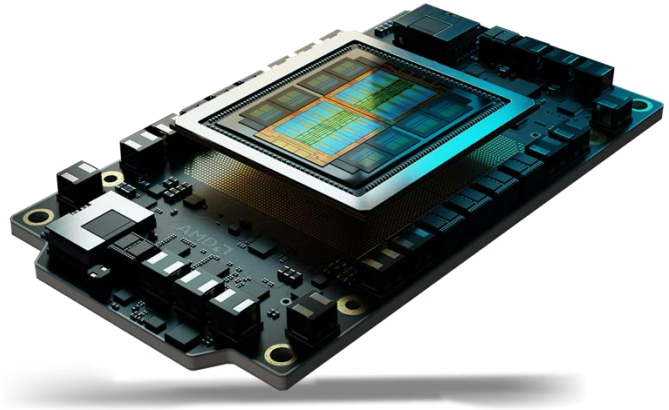
Source: Dell'Oro

...the network is critical

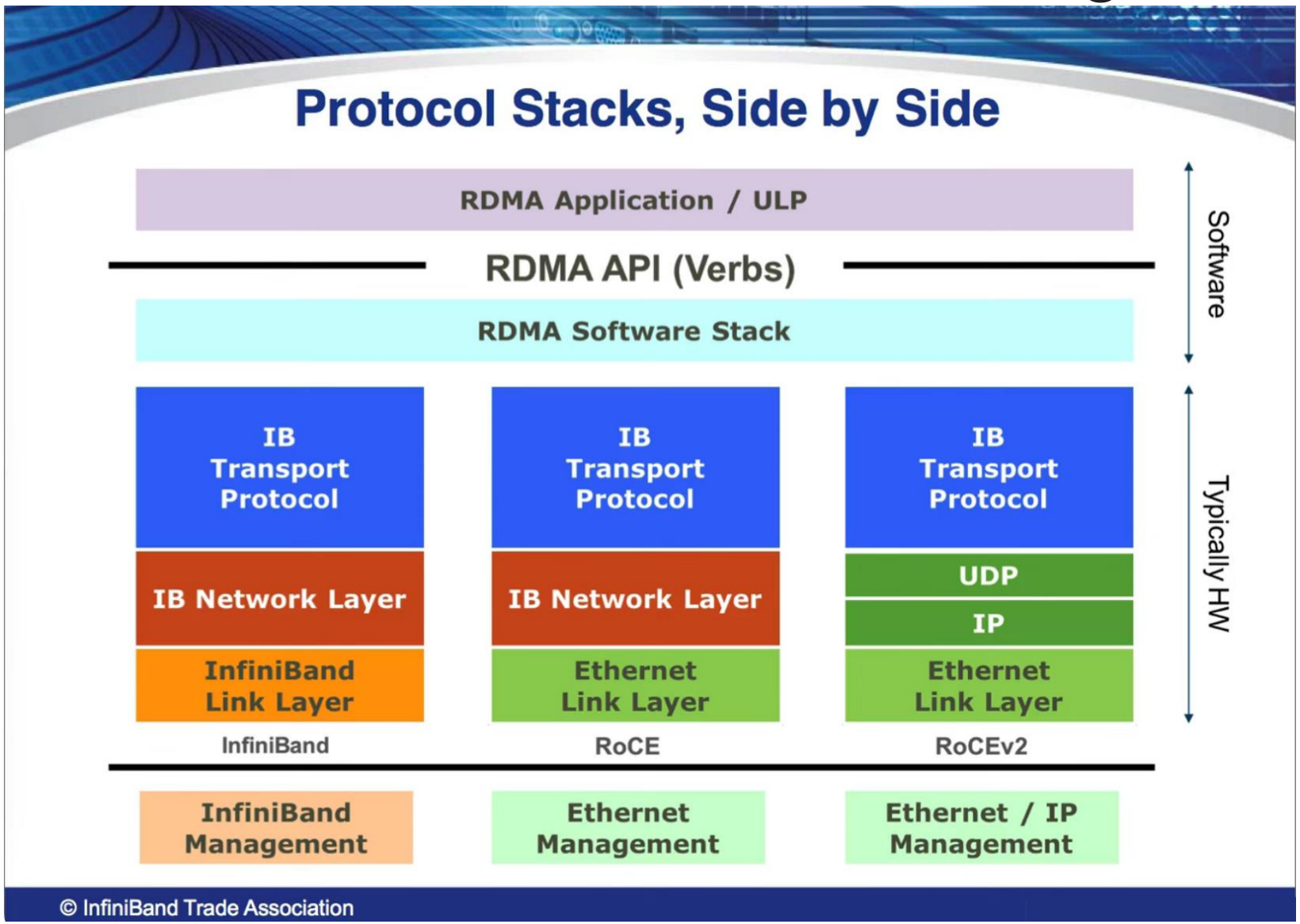
JUNIPER NETWORKS

Step Forward

- Market Trend of GPU/CPU/Memory resource
  - NVIDIA is priced beyond the reach of many users.
  - Most models aren't tied to AMD or Intel GPUs; in fact, multi-vendor deployments are already common.
  - The majority of AIDCs now use multi-vendor computing architectures

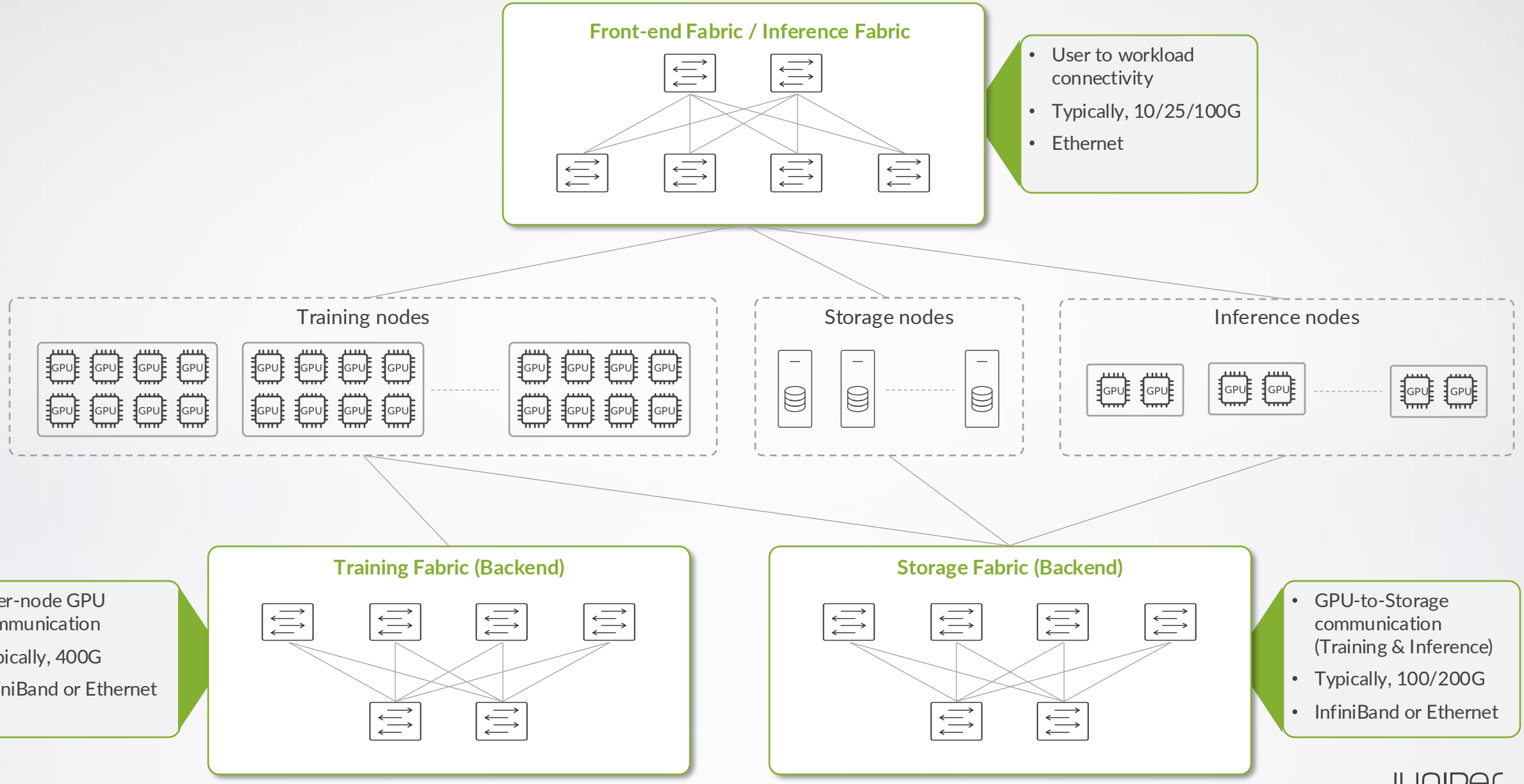


What is RoCEv2 (RDMA over Converged Ethernet v2)



https://www.youtube.com/watch?v=8kTAXhujn08&t=143s

AI Data Center fabrics



Ultra Ethernet Consortium

Formed to create a new communication stack for Ethernet that is high-performance and open:

> **Our Mission**
>
> Deliver an Ethernet based open, interoperable, high performance, full-communications stack architecture to meet the growing network demands of AI & HPC at scale

Adopting a clean slate approach to developing a complete communications stack for AI and HPC. A 1.0 Spec is planned for 2025 publication. UET is more than just a RoCEv2 replacement.

Juniper's view:

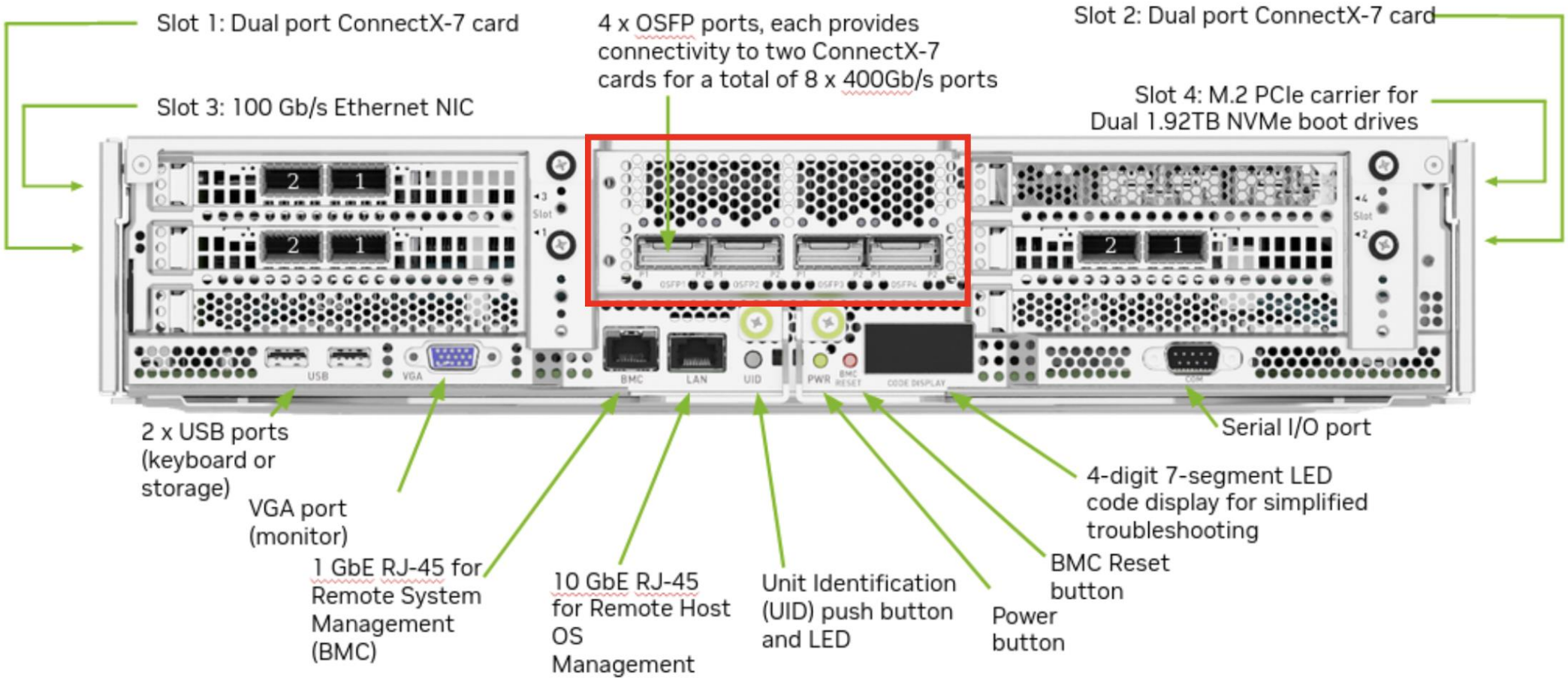
- Juniper is a General Member of UEC since Nov 2023
- A full spec for UET will take time to develop and even more time for adoption by hardware vendors
- A full communication stack will take significant time to develop so while we intend to participate in UEC, we will also be focused on tuning and optimizations for RoCEv2 which is heavily used in AI/ML today

https://www.juniper.net/us/en/the-feed/topics/ai-and-machine-learning/juniper-networks-ai-data-center-and-ultra-ethernet-consortium-uec.html

NVIDIA – DGX-H100 Doc

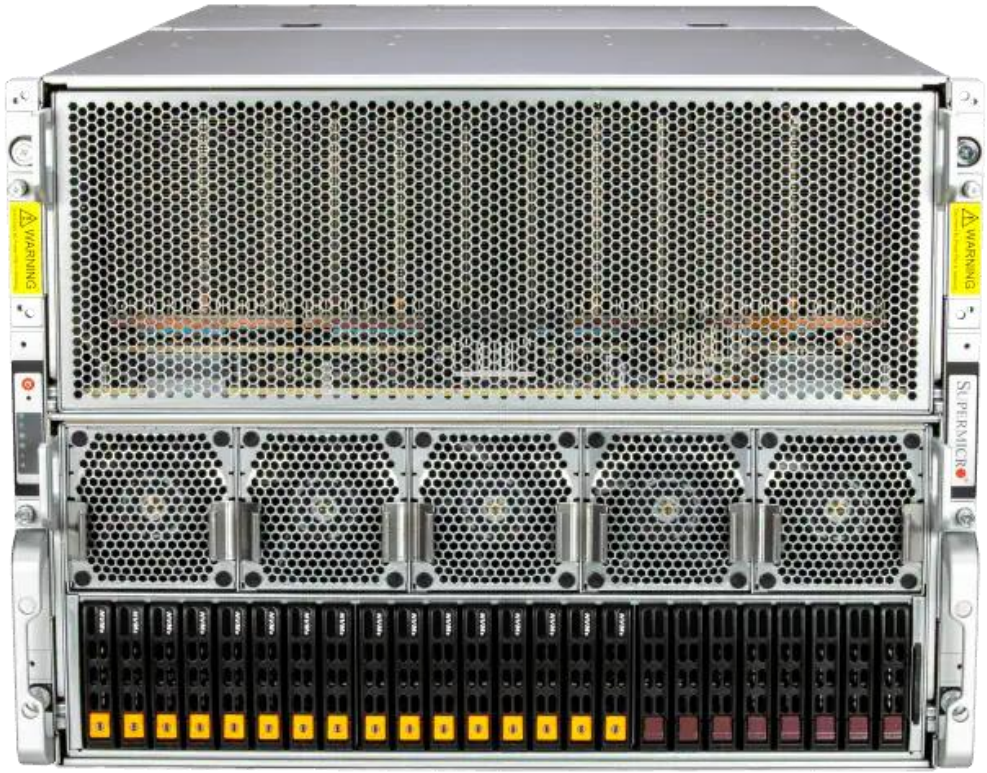
DGX H100 – Network Ports

DGX H100 - NVIDIA Server with GPUs to accelerate deep learning applications



AMD Instinct MI300x Systems

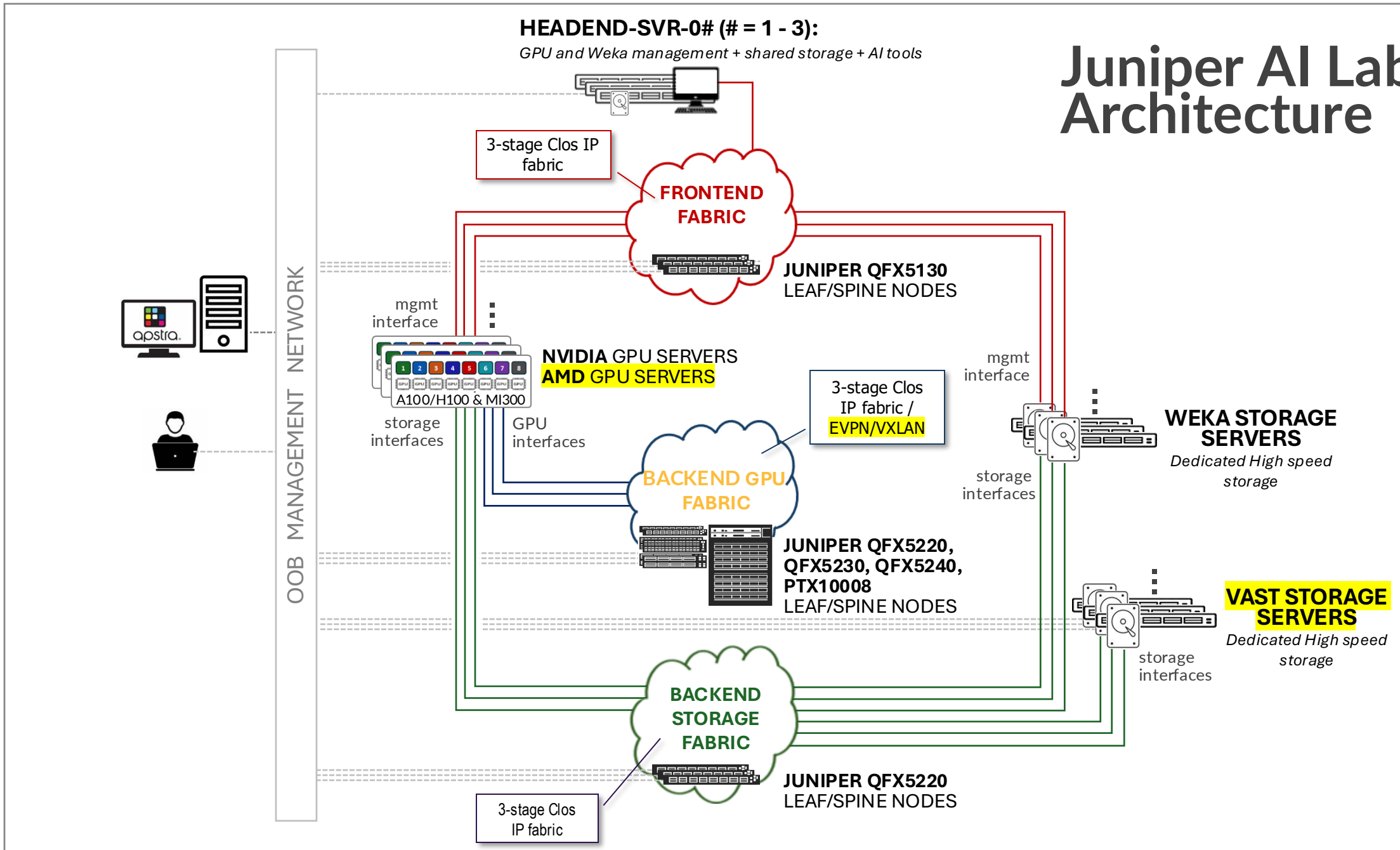
- 8 Rack Unit
- 4 x AMD EPYC/Genoa 9554 CPU
- **8 x AMD Instinct MI300x GPU / 192GB**
- 2TB Memory (20x96GB)
- 4 x Samsung 1.92TB SATA
- 16 x Samsung 3.8TB NVMe
- **8 x Connect-X 7 400G QSFP112 or Broadcom BCM57608 400G (thor 2)**
- **4 x Connect-X 7 200G dual port QSFP112**
- Power consumption: 9,600W / system
- BTU: 32,675 / system



→ 2 x Supermicro AS-8125GS-TNMR2 Dual AMD EPYC 8U GPU SuperServer

→ 2 x Dell PowerEdge XE9680 6U GPU Rack Server

Juniper AI Lab Architecture



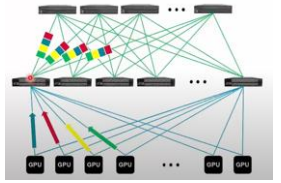
Open Ethernet offer best TCO with performance

InfiniBand

Propriety Mellanox NICs and Switches

AI Optimized Ethernet

Shallow Buffer, Deep Buffer across leaf and spine



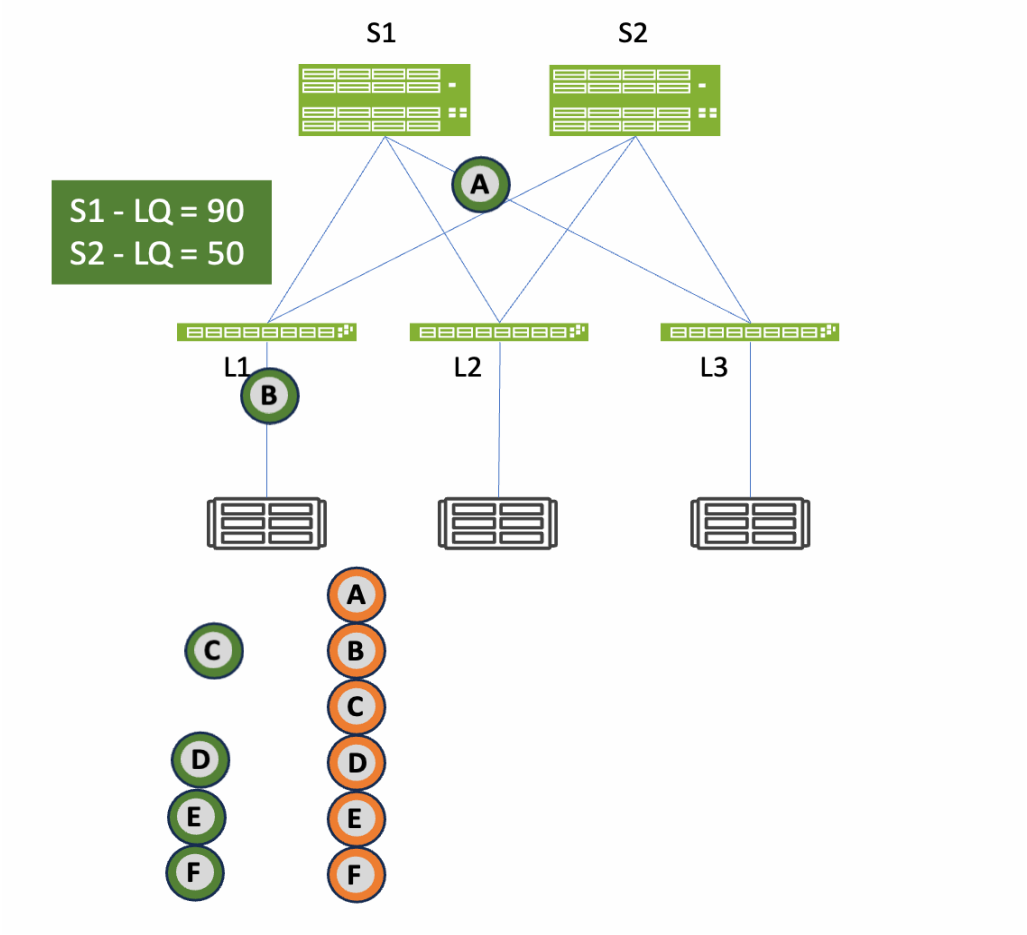
Scheduled Fabric

Cell or Ethernet-based disaggregated chassis

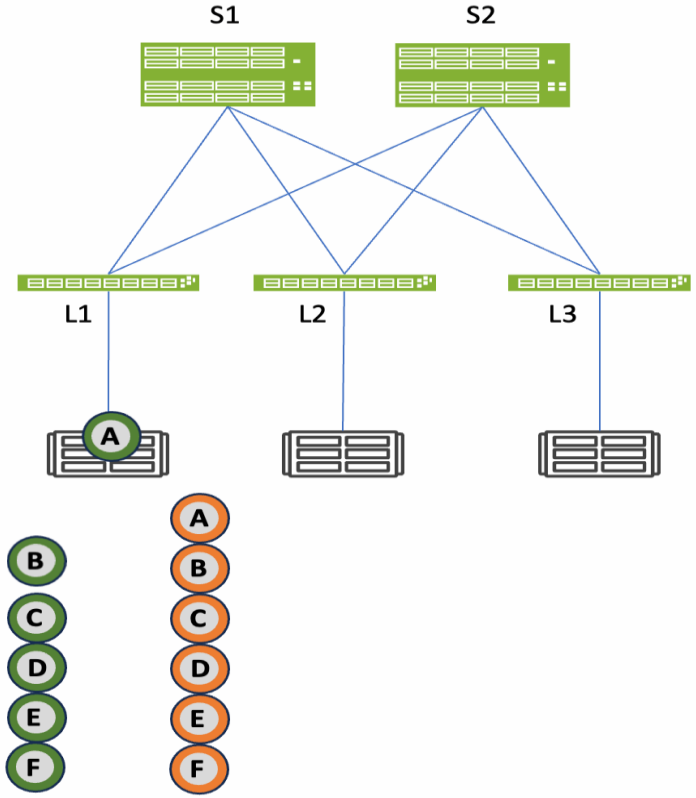
	InfiniBand	AI Optimized Ethernet	Scheduled Fabric
Vendor Lock-In	Yes	No	Yes
Operational Consistency	No	Yes	No
Cost	Higher	Lower	Higher
Scale	Central/Limited	Distributed/Higher	Central/Limited
Performance for AI workloads	Yes	Yes	Yes

Network-based Dynamic Load Balancing (DLB)

DLB flowlet mode



DLB packet mode



Apstra 服務可視化的效益

Benefits
- planning/ bandwidth
- verify firewall rule
- Geo IP
- DDoS Attack
- troubleshooting
- Service awareness

Juniper Apstra™

MGMT

sFlow, IFA

PTX, QFX

支援NG-AI的網路設備應為考量重點

維運

ANSIBLE

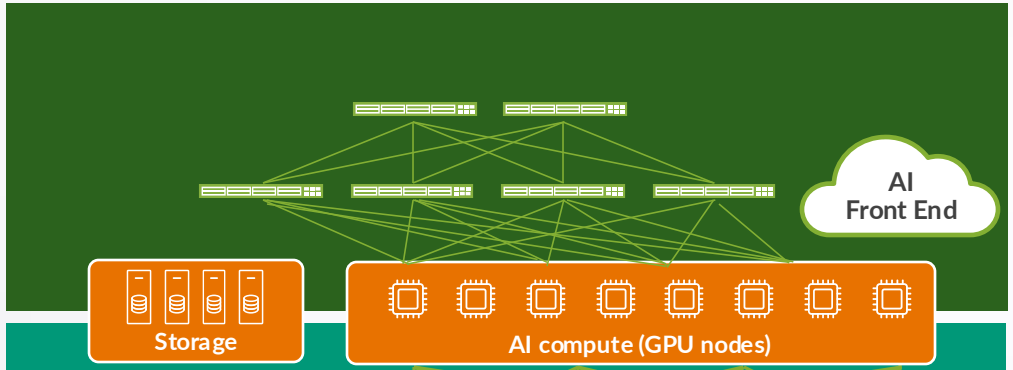
Terraform

Juniper Apstra™

融合 AI NetOps

一致的人工智慧平臺 NetOps 工作流程和自動化，提供操作簡單性、速度和可靠性

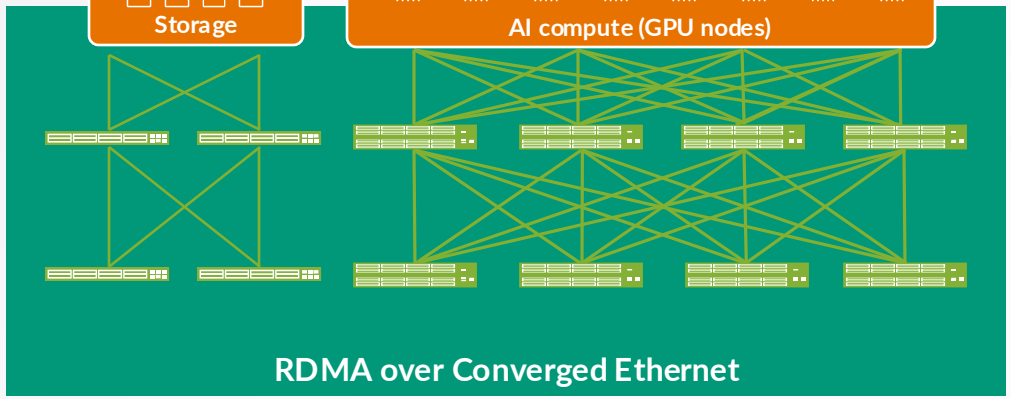
前端



100G/400G/800G 乙太網矩陣

QFX5120, QFX5130 交換機為開放式乙太網 Fabric 提供最佳性價比

後端



GPU 高效人工智慧基礎設施

新型高密度 400G/800G PTX, QFX 交換機為開放式乙太網 Fabric 提供最高容量和規模

IBN + AIOps 配有人工智慧擴展和先進的流量管理，可提供靈活性和更高的經濟性

JUNIPER NETWORKS


Thank you
JUNIPER NETWORKS
Driven by Experience™