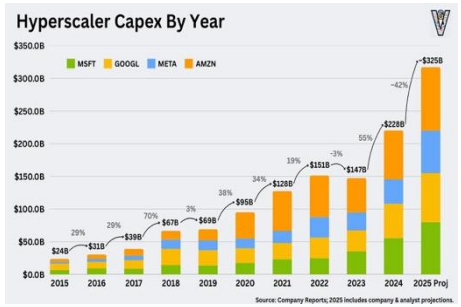
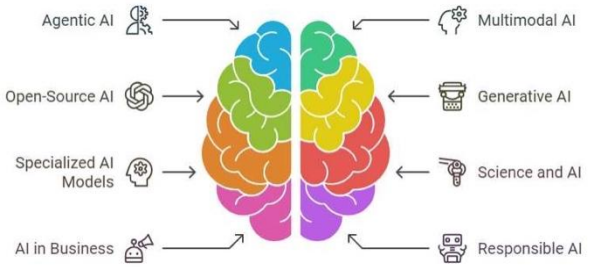




Social Impact

- AI to automate ~50% of current work within 2 decades.
- Personalized AI assistants will augment daily tasks and decision-making.

Economic Growth

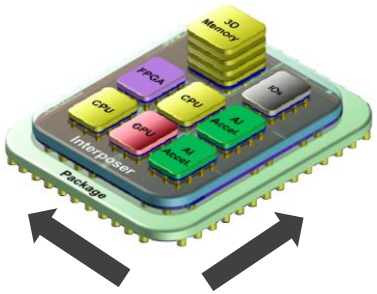
- AI market to exceed $2T by 2030, with rapid, cross-sector adoption.
- Hyperscaler investment level aims to sustain the global AI growth.

Models

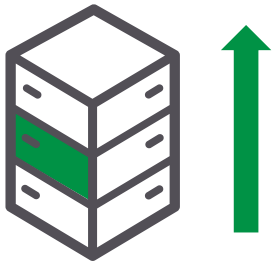
- Foundational models now exceed 1T parameters.
- Agentic AI and Reasoning Models require 100x compute, 20-50x tokens.

Infrastructure

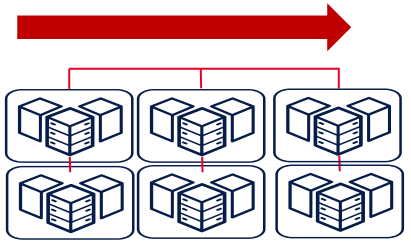
- Interconnects and the network as now the critical bottleneck, require 5-10x more per GPU.
- Energy demands necessitate chiplets, Si-Ph, and novel power-optimized innovations.



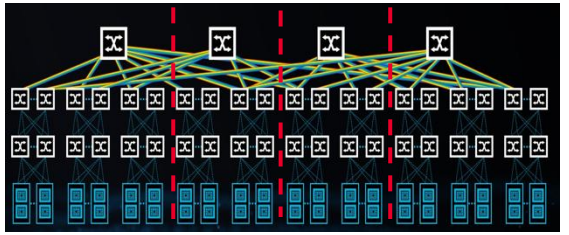
Scale In



Scale Up



Scale Out



Multi-Data Center

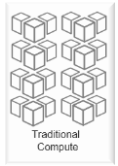
DC to DC - Network

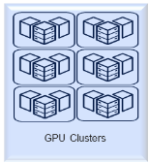
Scales across a region (100km)

Power Capacity, Space Limitations

> 100k xPU
10s of Petab/s
Latency: 100s of us
Coherent Optics

Standards: 800ZR, 1600ZR

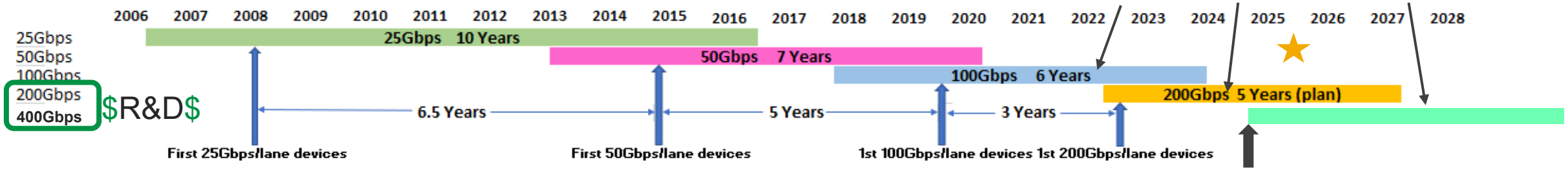




AI models use tokens to process and generate text, enabling features like prediction and generation. It is the compute output

$$Performance = \frac{Tokens}{(Watt + \$)}$$

Design Priorities for AI/ML Interconnects


2006
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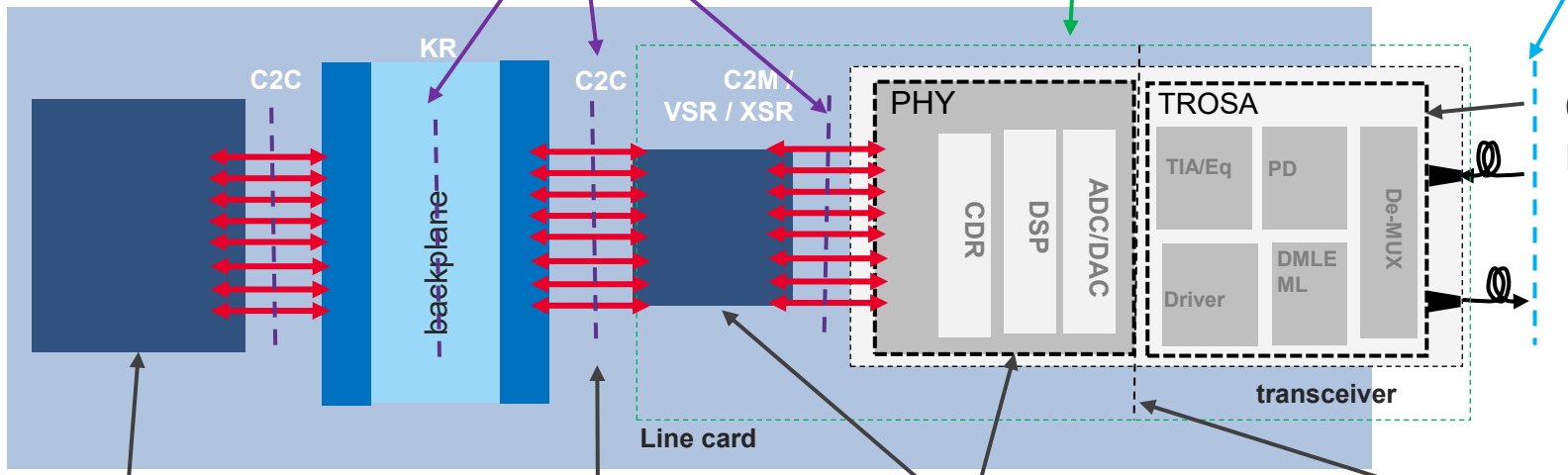
2024
2025
2026
2027
2028
25Gbps
50Gbps
100Gbps
200Gbps
400Gbps
$R&D$
25Gbps 10 Years
50Gbps 7 Years
100Gbps 6 Years
200Gbps 5 Years (plan)
6.5 Years
5 Years
3 Years
First 25Gbps/lane devices
First 50Gbps/lane devices
1st 100Gbps/lane devices
1st 200Gbps/lane devices

-
-
-
-

Digital interface
COM, Jnu, Jrms, EOJ, VEC, SNDR, RLM,
BER, Burst error, FEC margin

Form-factor
QSFP-DD, OSFP112, OSFP-XD

Optical PMD- *100/200G/λ - PAM4/6*
TDECQ, OMA, ER, RIN, overshoot.



Optical Engine - *SiP, InP, LiNbO3*
IL, RL, PDL, SMSR, OSNR .

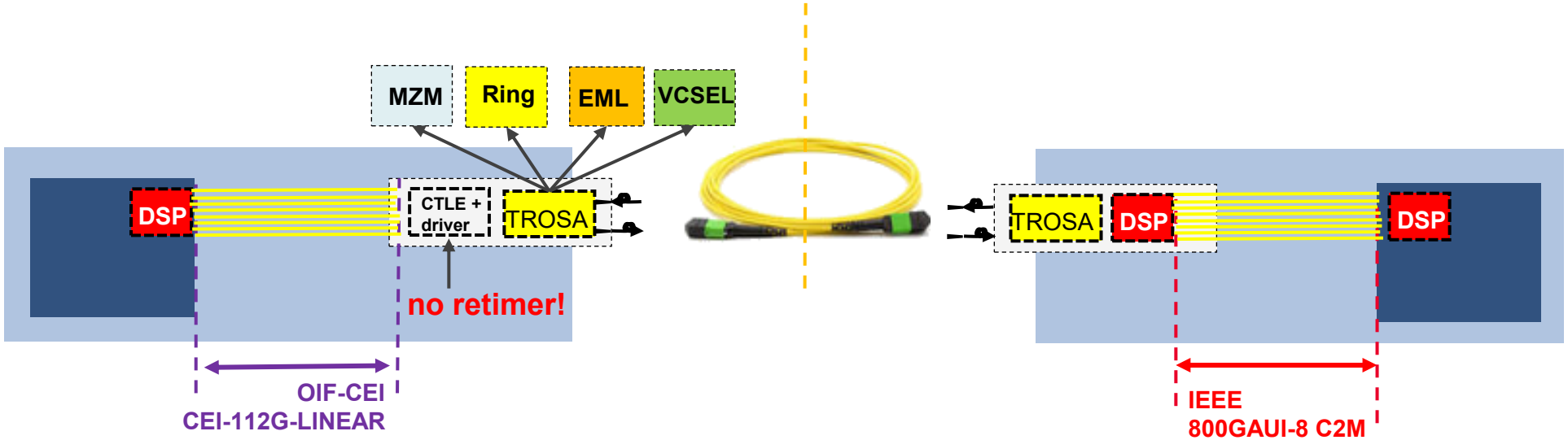
Switch ASIC - Packet loss,
FLR

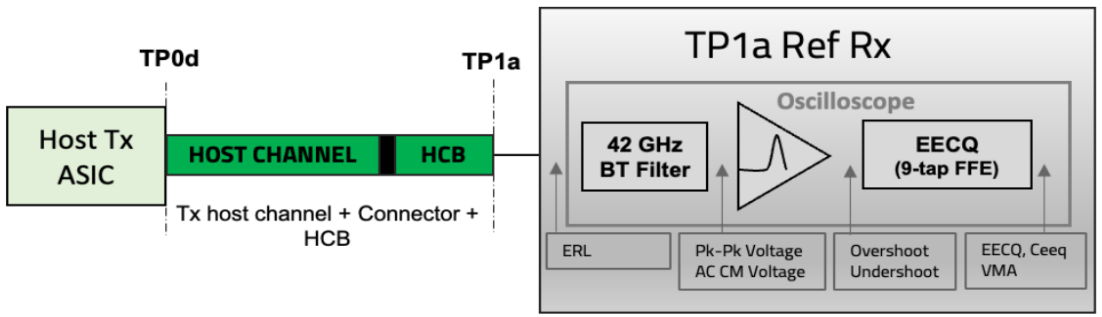
PHY & HOST - SNDR, ENoB,
digital equalizer
(CTLE, FFE, DFE, MLSE)

Analog interface
SNDR, Enob, Ω

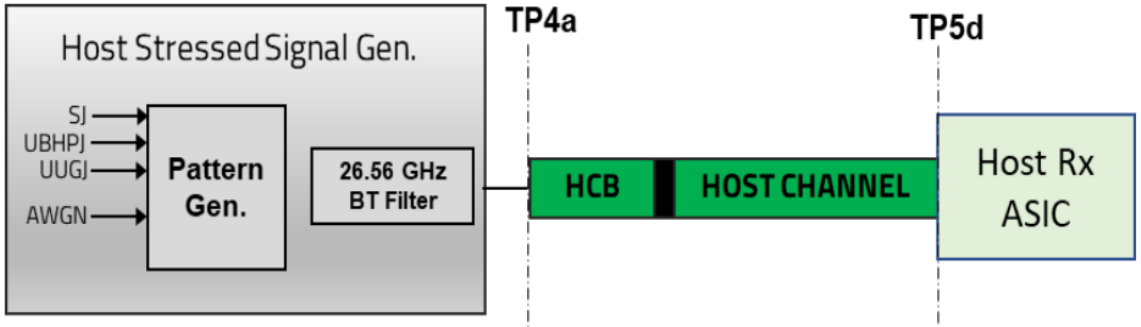
Channel- *PCB, cable*
IL, ERL, COM

KEYSIGHT





→ T&M equipment to emulate a reference module



→ T&M equipment to emulate a reference host

Keysight solutions for the industry

- ✓ Prototype of novel "*EECQ*" metric available on FlexDCA
- ✓ *N1077B* – 64Gbd SM & MM CDR
- ✓ M8050A unmatched performance as "LPO"-compatible host (Tx and Rx)
  - Up to 20dB channel (de)-embedding with *M8042A* pattern generator
  - Advanced equalization capabilities and sensitivity of *M8043A* error detector

Keysight participation in industry standards

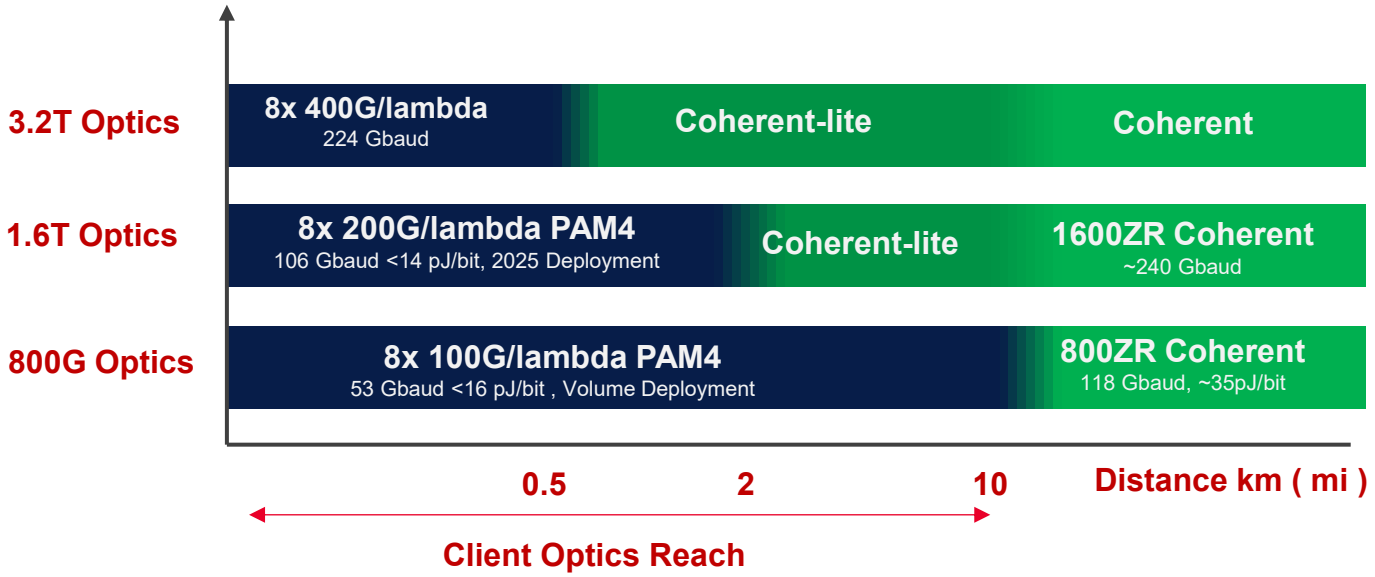
- ✓ OIF CEI-112G-Linear project
  - Technical contributions (EECQ, overview, Tx test)
  - Partnering with industry (MACOM, Eoptolink, Innolight, etc.)
- ✓ LPO MSA member
- ✓ LPO test dry run at InfiniBand Plugfest'24

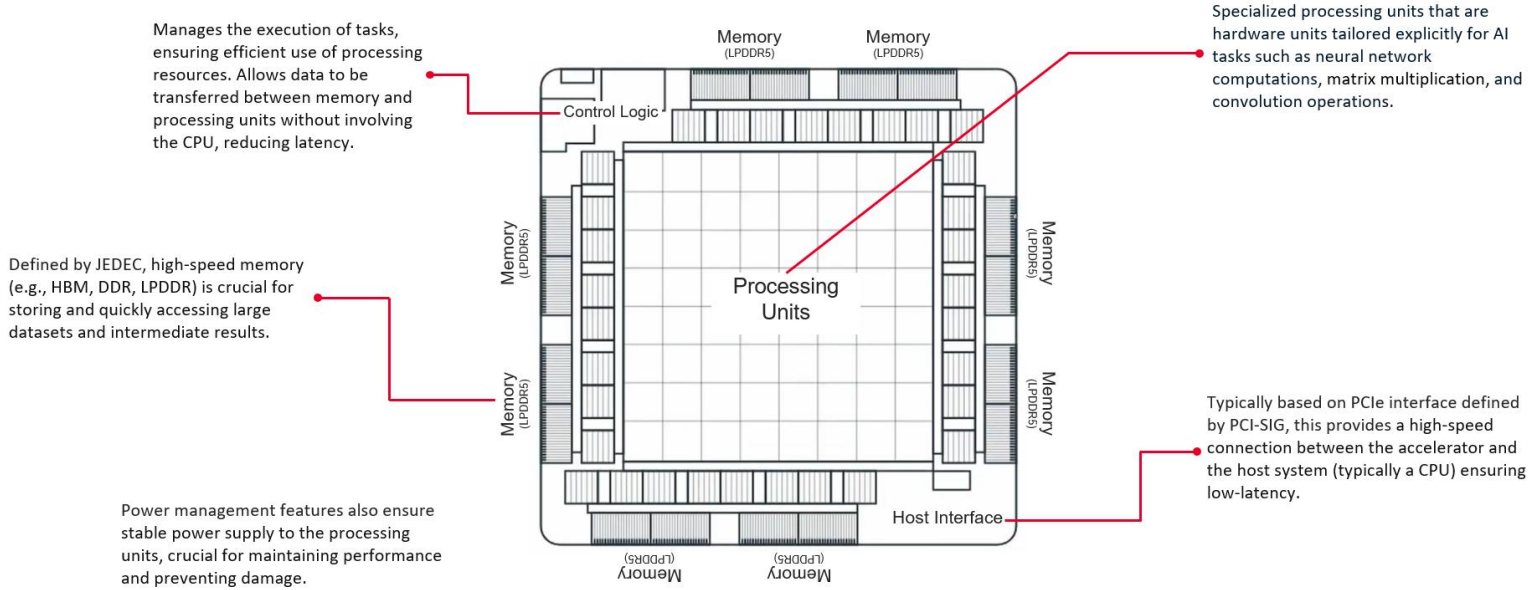
Public demo

- ✓ **World's first LPO interop demo** @ ECOC'23 (OIF-CEI)
- ✓ **interop demo @OIF-CEI booth** @ OFC'24
  - M8050A as LPO-compatible host Tx & Rx
  - N109x for TP2 optical measurements
  - N1060A for TP1a/TP4 electrical measurements
- ✓ **LPO functional test @ OFCC'24**
  - G800GE as LPO-compatible host Tx & Rx
  - N109x for TP2 optical measurements
  - N1060A for TP1a/TP4 electrical measurements

Alternative to IM/DD (PAM4) solutions for short reach interconnects

"Coherent Lite" refers to a simplified, power-efficient and low-cost implementation of coherent optical transmission, aimed at short-reach (500 m – 10 km) connections within data centers and between campus buildings.



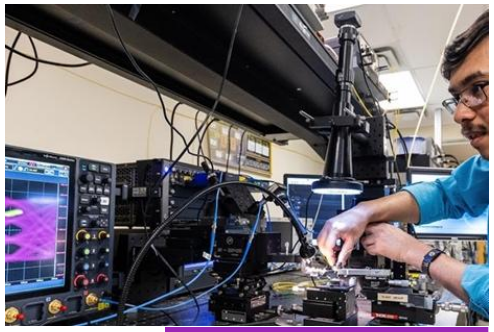


AI chips are crucial for autonomous vehicles as they process large amounts of data in near real-time, enabling the vehicle to react to its surroundings like the human brain

Edge computing brings applications and computing power closer to data sources like IoT devices, using AI chips to run ML tasks on edge devices. This allows AI algorithms to process data locally in milliseconds

AI chips accelerate ML and deep learning algorithms, enhancing the development of large language models (LLMs) that understand and generate natural language.

AI chips' ML and computer vision capabilities are crucial for robotics, enabling robots to perform complex tasks and transform our world. They



$$\sigma_{ideal} = \left(\frac{OMA}{6Q^{-1}\left(\frac{2}{3}SER_{target}\right)}\right)$$

RMS noise added to i
to achieve the target

$$CQ = 10\log_{10}\left(\frac{\sigma_{ideal}}{R}\right)$$

RMS noise added to a
to achieve the target E

$$R = \sqrt{\sigma_n^2 / C_{eq}^2 + \sigma_s^2}$$

noise of ref. Rx (scope

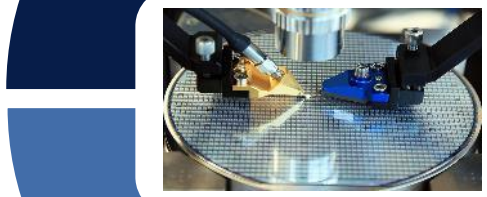
Physical layer

Protocol

N1046A
Sampling Heads
>100 GHz BW

UXR RTS, OMA
Up to 110GHZ BW

N1032A/B Optical
Reference Receiver
120+ GHz BW



N4372E LCA *110 GHz*

M8050A BERT
120 Gbaud

M8199B AWG
*256 GS/s & **80** GHz BW*

KEYSIGHT

AresONE 800GE
2/4/8-port QSFP-DD800 and OSFP800 test Solutions

G800GE-02
OSFP800, QSFP-DD800 & Coaxial Models

IxNetwork and IxVerify Software Solutions


KEYSIGHT