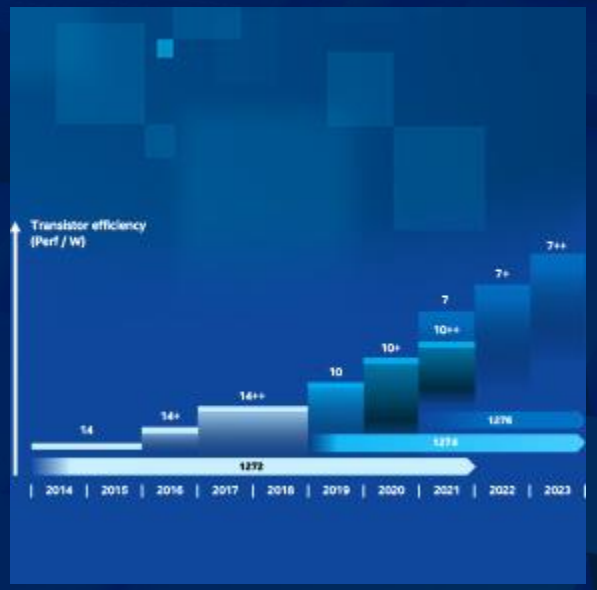
CPU & FPGA

Future Trends & Technology

Dirk Blevins
Intel Senior Platform Architect, Principal Engineer
Networking and Edge Division

Future Trends & Technologies



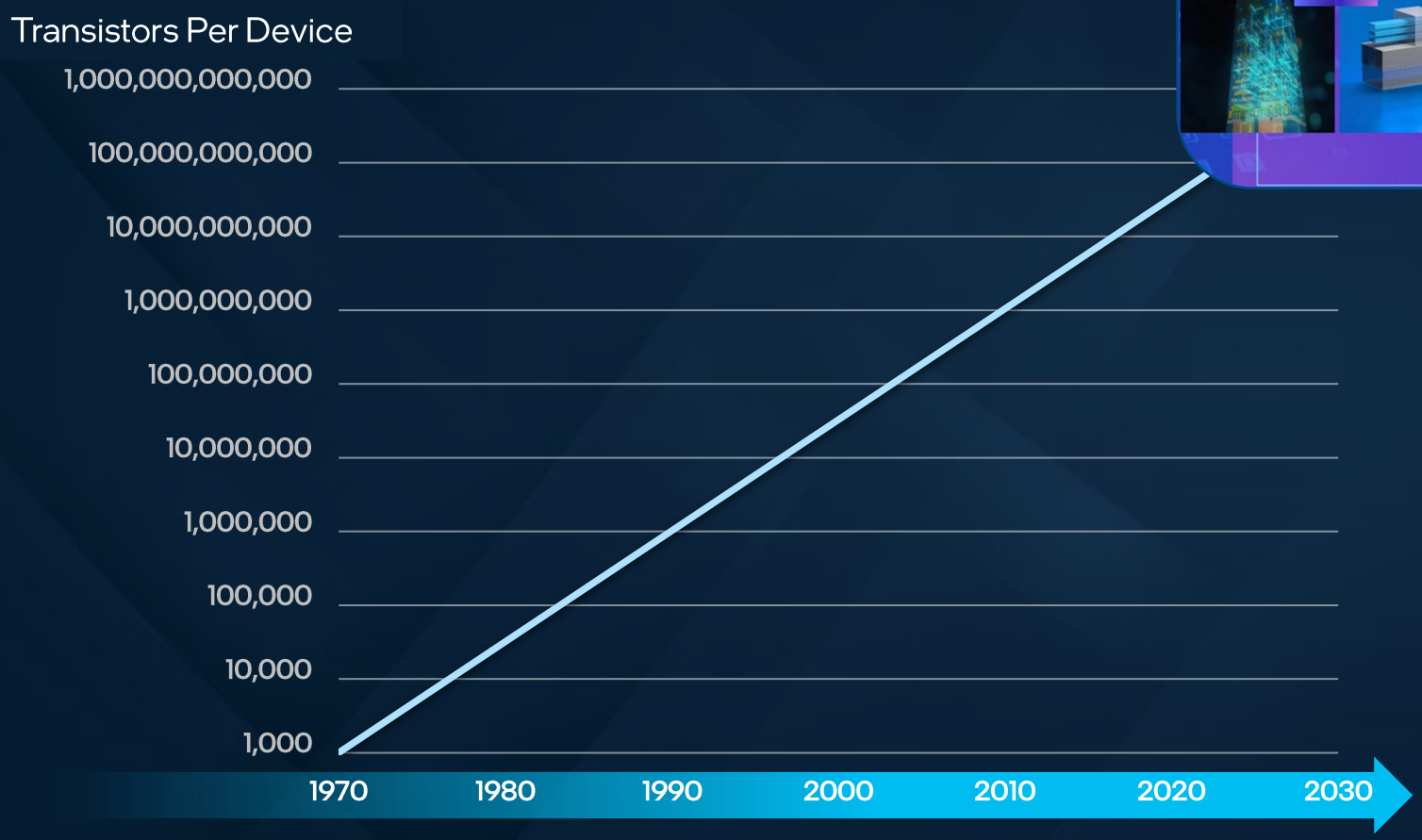
Moore's Law

Technologies

HW Aware SW

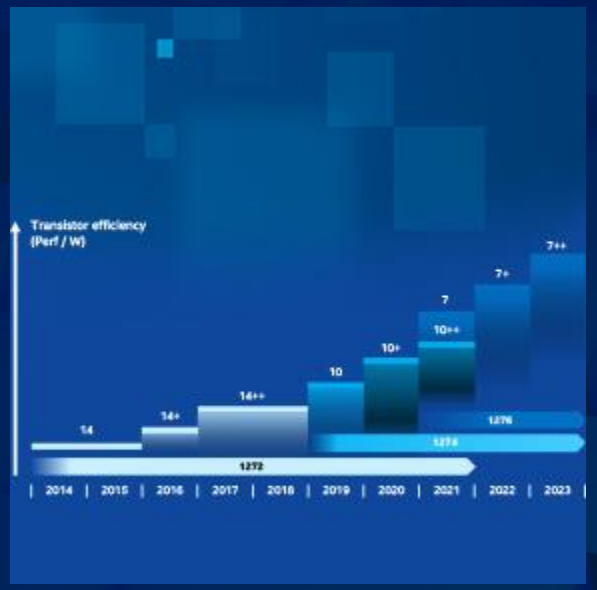
Datacenter Advancements Fuel Future Technologies Trends

Higher Core Counts Critical For Efficiency



Intel internal analysis of Intel products. Future projections based on products still in design. Future transistor counts are projections and inherently uncertain.

Future Trends & Technologies: More than Moore



Moore's Law

Technologies

HW Aware SW

Adjacent Technologies Must Keep Up With Core Counts

Technology Trends

Intelligent Connectivity

Intel® IPU
CXL
PCIe Gen5
100G+ Ethernet
TSN

Improved Memory & Storage

DDR5
NVMe

Acceleration

GPU
FPGA
Intel® DL Boost
Intel® AMX

Security

Intel® SGX
Intel® QAT™
Intel® PFR

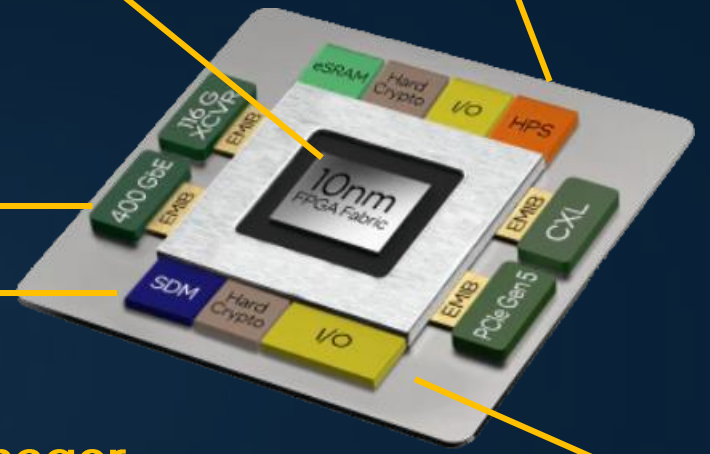
Advanced Technologies

Intel® AgileX™ FPGA

Hard IP Processor System
- Quad Core ARM64 CPU Subsystem

Next-Generation Architecture
- New Micro-Architecture and 10nm process
- 40% higher performance or 40% lower power

Advanced Network and Memory Options
- Transceiver Tiles 16G, 28G, 32G, 56G, & 116Gbps
- Coherent Processor Attach with Compute Express Link (CXL)
- DDR 4/5, High Bandwidth Memory (HBM)
- Ethernet – 10G, 25G, 50G, 100G, 200G, 400G – Hard IP
- PCIe Gen3, Gen4, and Gen5



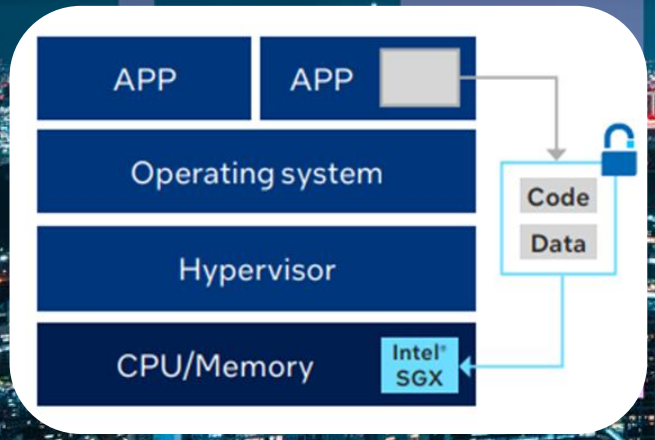
Secure Device Manager

Extensive Software Support
- Leading EDGE EDA with Intel® Quartus™ Prime Software
- OneAPI Ecosystem

Memory, I/O, & GPIO
- 1.2V GPIO & 1.5V LVDS
- DDR & LPDDR

Security Technologies

Intel® SGX



Intel® QAT™

Intel® PFR

Intel® Software Guard Extension

- Deliver smallest potential attack surface for threat enabled environments providing data security and privacy in any environment
- Up to 1TB protected enclaves for Code and Data
- Protected Offload enclaves to HW accelerators
- Broad software ecosystem support

Intel® Quick Assist Technology™

- Compress or Encrypt Data in Any State
- Up to 100Gbps of symmetric cryptography
- Up to 80K ops/s public key encryption
- Up to 70 Gbps of compression

Intel® Platform Firmware Resiliency

- Protect against permanent denial of service attacks
- Supports Platform Root of Trust and NIST 800-193 industry standards
- Open Solution built on Intel® MAX® 10 FPGAs

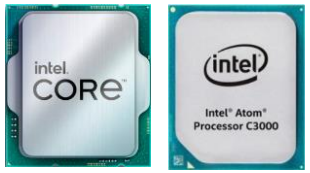
Performance varies by use, configuration, and other factors. Learn more at https://www.intel.com/PerformanceIndex.
Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates.
See configuration disclosure for configuration details.

Intel CPU Technologies

- Maximum Core Count
- Greatest Scalability
- Largest Feature Set
- PCIe Gen5
- IPU
- DDR 4/5
- Large # PCIe Lanes
- Intel® AMX
- Intel® SGX
- Intel® QAT™
- Intel® PFR

- Optimized Core Count
- Longer Life
- Greater Integration
- PCIe Gen4
- Integrated Ethernet
- DDR 4
- Intel® SGX
- Intel® QAT™
- Intel® PFR

µTCA®
Focused SKU's

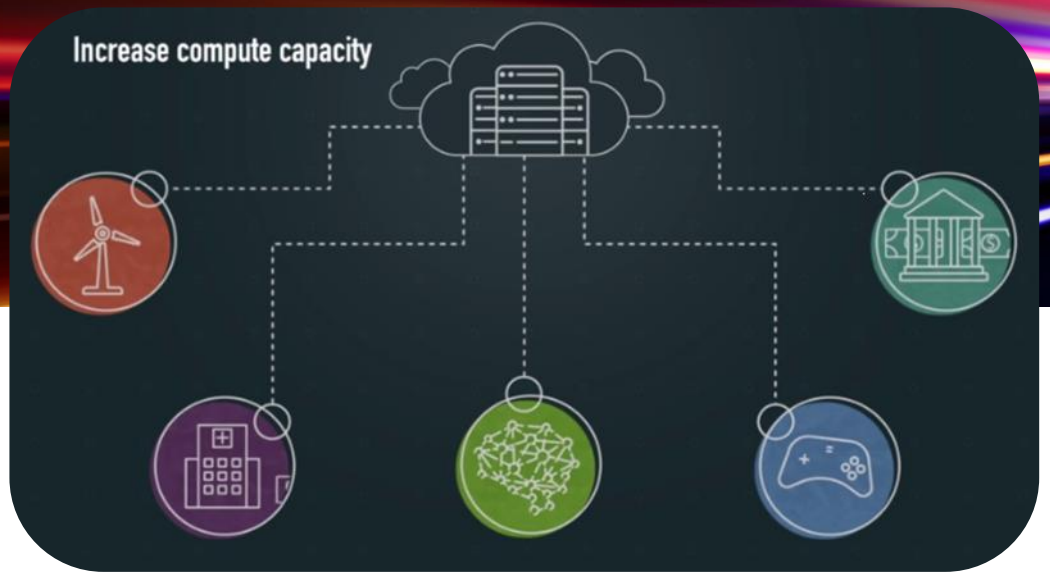


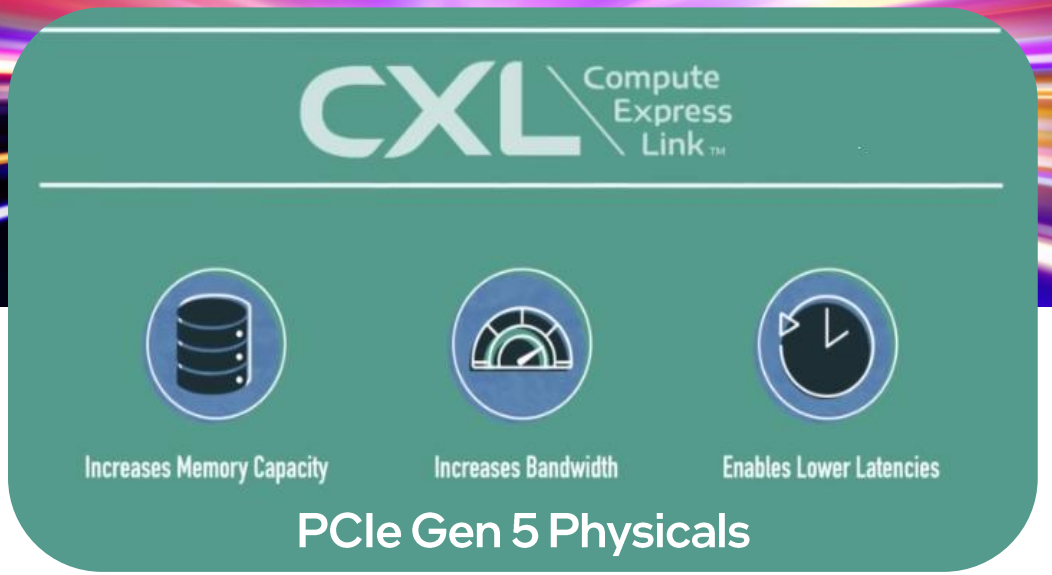
µTCA®
Focused SKU's

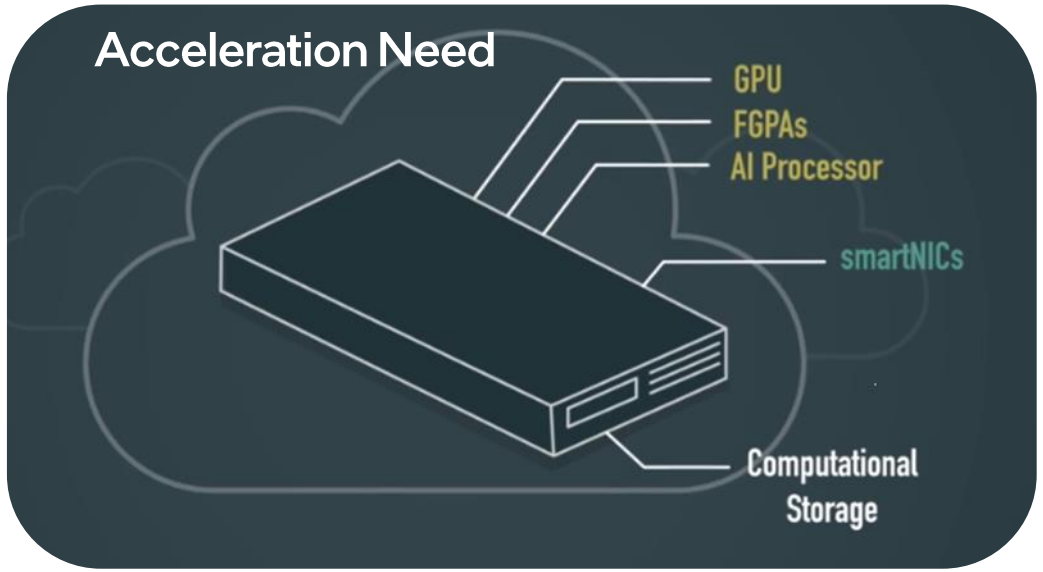
- Optimized Core Count
- Power Optimized
- Focused Integration
- Integrated GPU
- Integrated Ethernet
- Intel® QAT

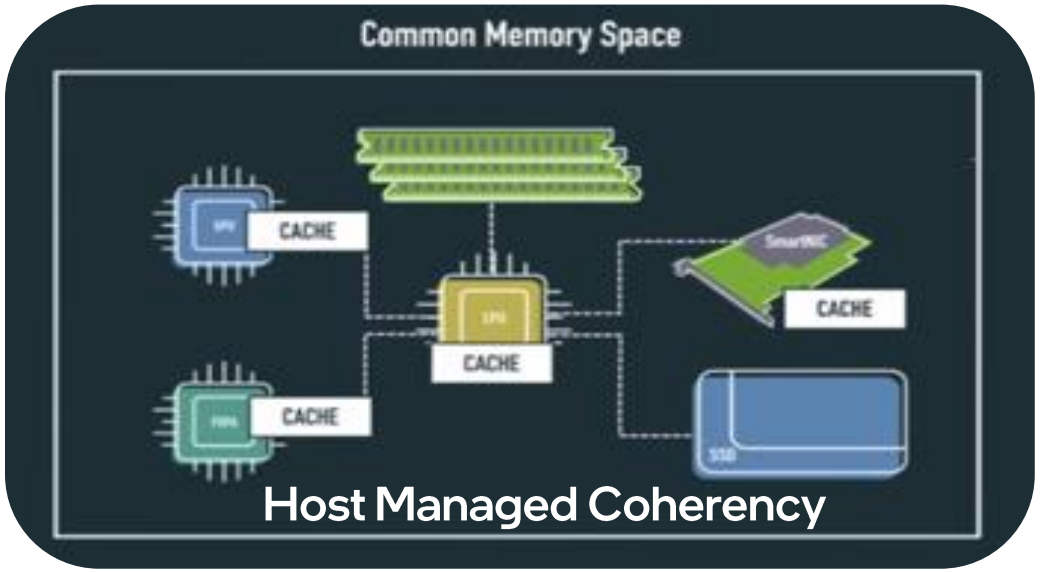
CXL

https://www.computeexpresslink.org/resource-library









CXL Evolution

CXL 1.1

CXL.io
CXL.cache
CXL.mem

CLX.io

- Similar to PCIe Gen 5.0
- Initialization
- Link-up
- Discovery
- Enumeration
- Register Access

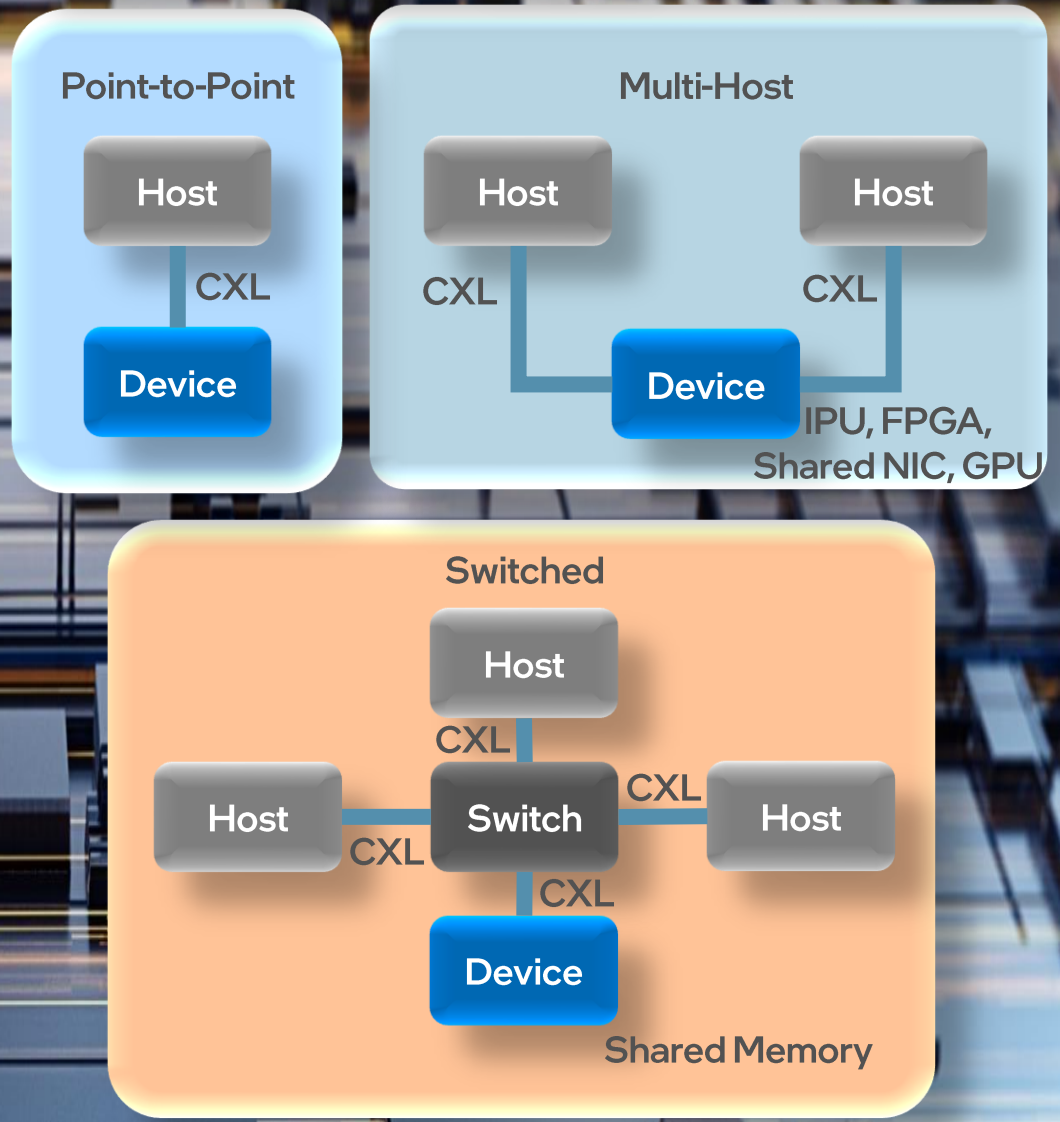
CXL.cache

- Defines Device & Host Interactions
- Efficiently Cache Host Memory
- Low Latency
- Request & Respond Approach

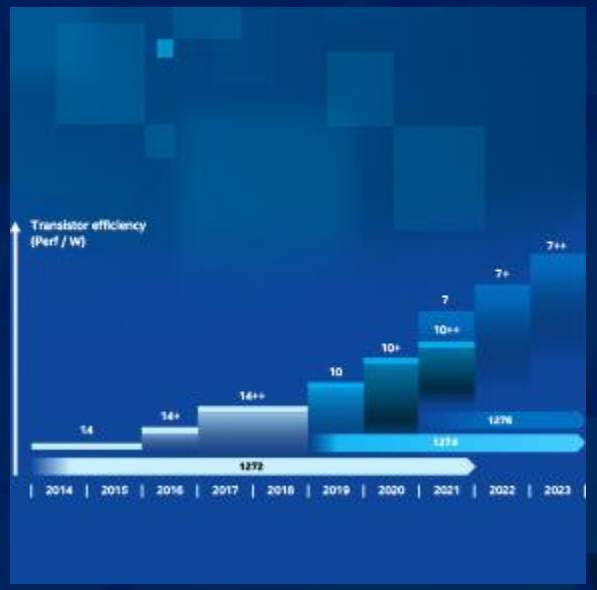
CXL.mem

- Device Attached Memory Access using Load & Store Commands

CXL 2.0



Future Trends & Technologies: More than Moore



Moore's Law

Technology

HW Aware SW

Silicon Must Be Built To Enhance The Software

The Future Requires 10x Change

Hardware

+

Software

+

Acceleration

Hardware Aware Software

Encryption

011010110110
110101101011
001011010100

Up to
4.2X
more encrypted web server connections on 3rd gen Intel Xeon processor

Enhanced Crypto Acceleration

Data Compression

Up to
2X
Data Compression for RocksDB on 4th gen Intel Xeon processor

Intel In-memory Analytics Accelerator (IAA)

AI

Ai

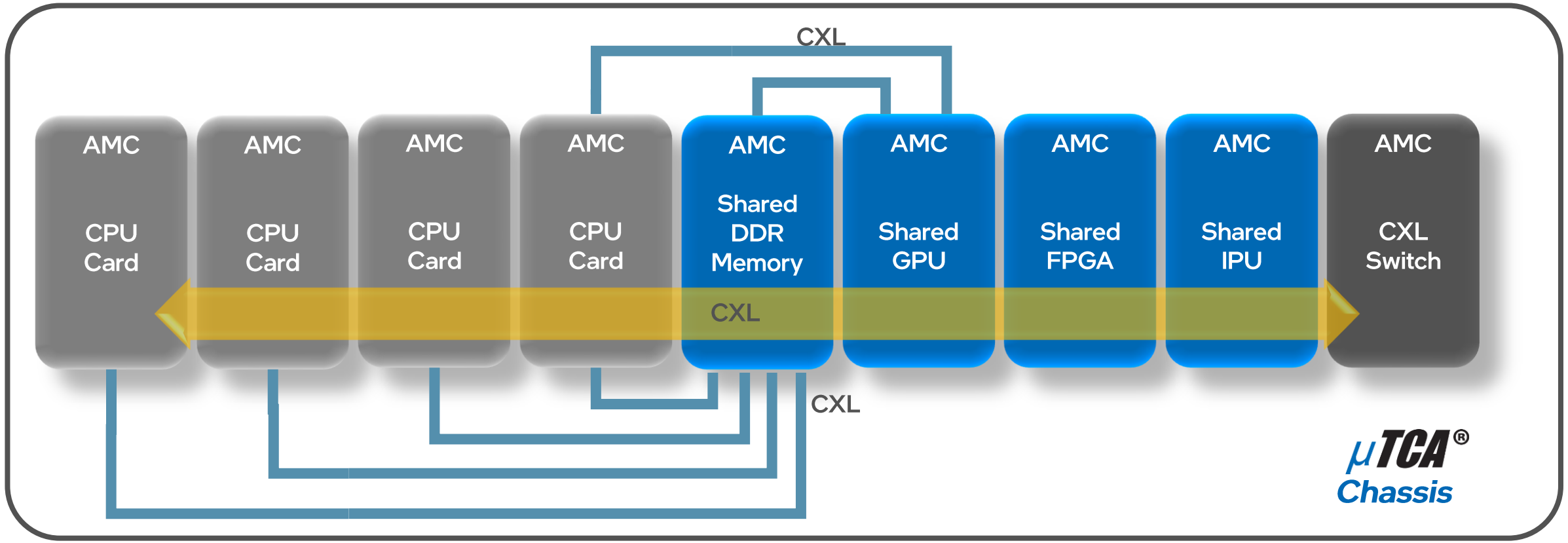
Up to
30X
AI Inferencing on 4th gen Intel Xeon processor

Intel Advanced Matrix Extensions (AMX)

See intel.com/performanceindex for workloads and configurations. Results may vary.

Technology Usage in uTCA® Environment

- Lower Latency
- Increased Bandwidth/Performance
- Increased Memory Capacity
- Acceleration
- Fully Coherent Systems
- Security



Key Learnings

- Moore's Law is alive and well driving smaller geometries creating new design challenges such as capping higher I/O voltages
- Component power is increasing creating need for new power delivery & cooling innovation
- Signal integrity on PCBs is increasingly difficult at 100G+ Ethernet and PCIe Gen4+ speeds, creating the need to consider lower loss solutions such as cabling (copper or optical)
- Future computing scale requires radical change driving a need for Hardware Aware Software
- Acceleration for specialized compute workloads like AI, ML, Security offload, etc. is required to achieve future performance needs and these accelerators may come in various forms such as new CPU instructions, FPGAs, IPUs, GPUs, Shared Memory via CXL, or other.

Technology is changing faster than ever, and we must be ready to adapt!

Thank You

intel