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How we design AI accelerator SoC for Data Center Network

MPSoC2024
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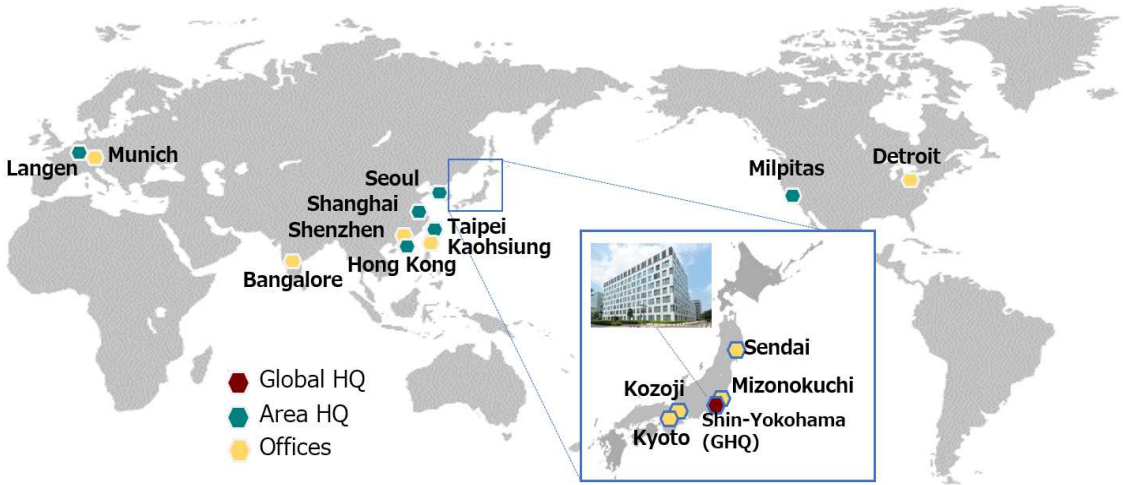
Socionext

Founded in 2015

IPO in 2022

1900+ Engineers, many of 20+ years experts

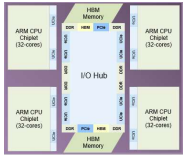
Offices Japan(HQ)/US/EU/China/Taiwan/India/Korea



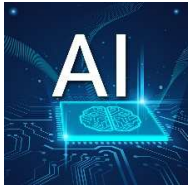
Focus segment

Data Center & Networking

Multi Core CPU



AI Accelerator



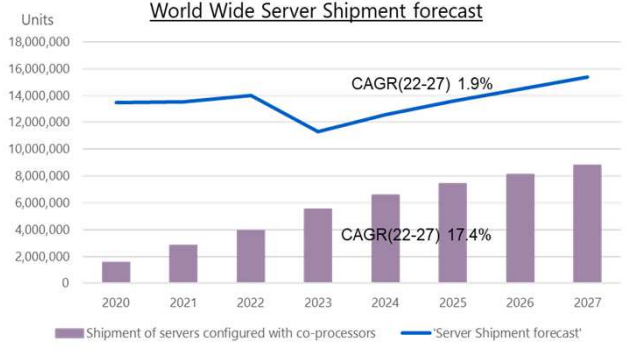
5G Wireless

Wired Network

Storage

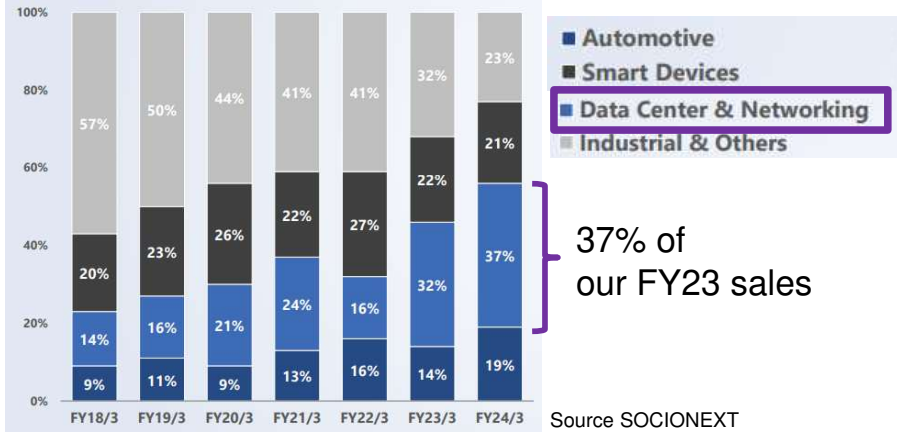
Optical Transporter

The market of server with co-processor is a growing market for CAGR(22-27) 17.4%



Created by SOCIONEXT based on OMDIA Long range server forecast -2H23

Net Sales by Application



Source SOCIONEXT

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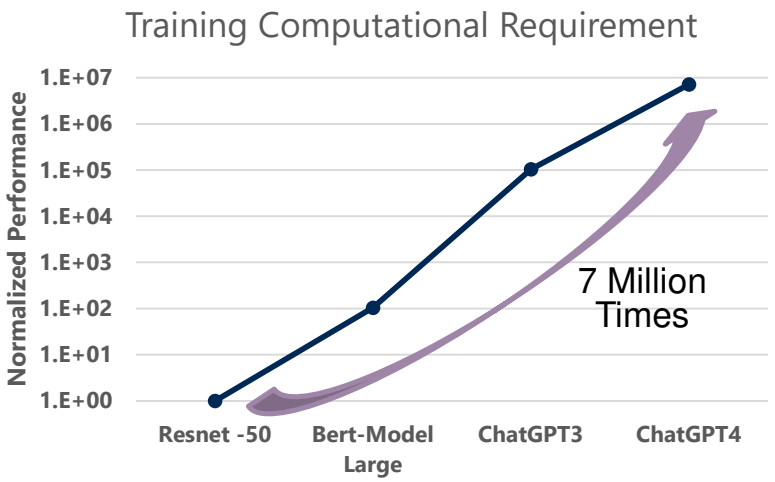
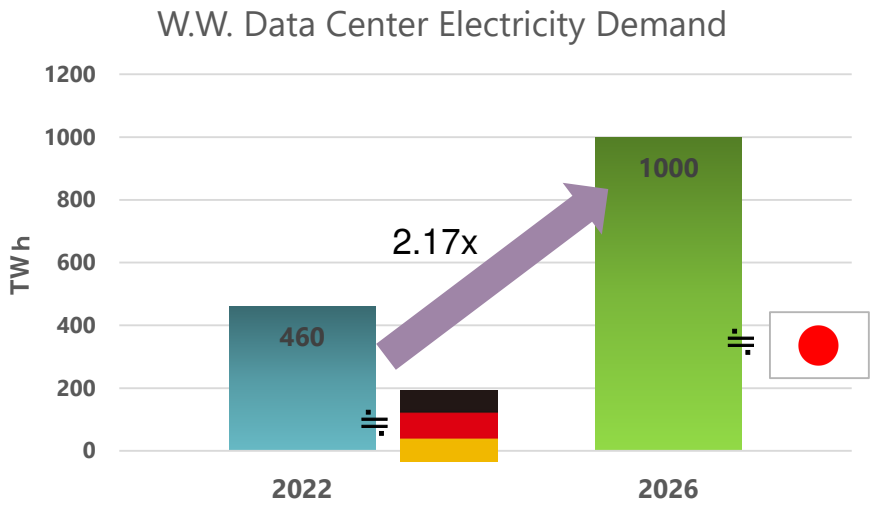
Power consumption issues due to the spread of AI

	2015	2018	2022	2023
AI Model	Image recognition Resnet	Natural language BERT model	ChatGPT-3	ChatGPT-4





Created by SOCIONEXT based on
1 Tom B. Brown et. Al [2005.14165] Language Models are Few-Shot Learners (arxiv.org)
2 Shreyas Saxena et al. [2303.11525] Sparse-IFT: Sparse Iso-FLOP Transformations for Maximizing Training Efficiency (arxiv.org)
3 https://lambdalabs.com/blog/demystifying-gpt-3

Created by SOCIONEXT based on
IEA "Electricity 2024 Analysis and forecast to 2026"

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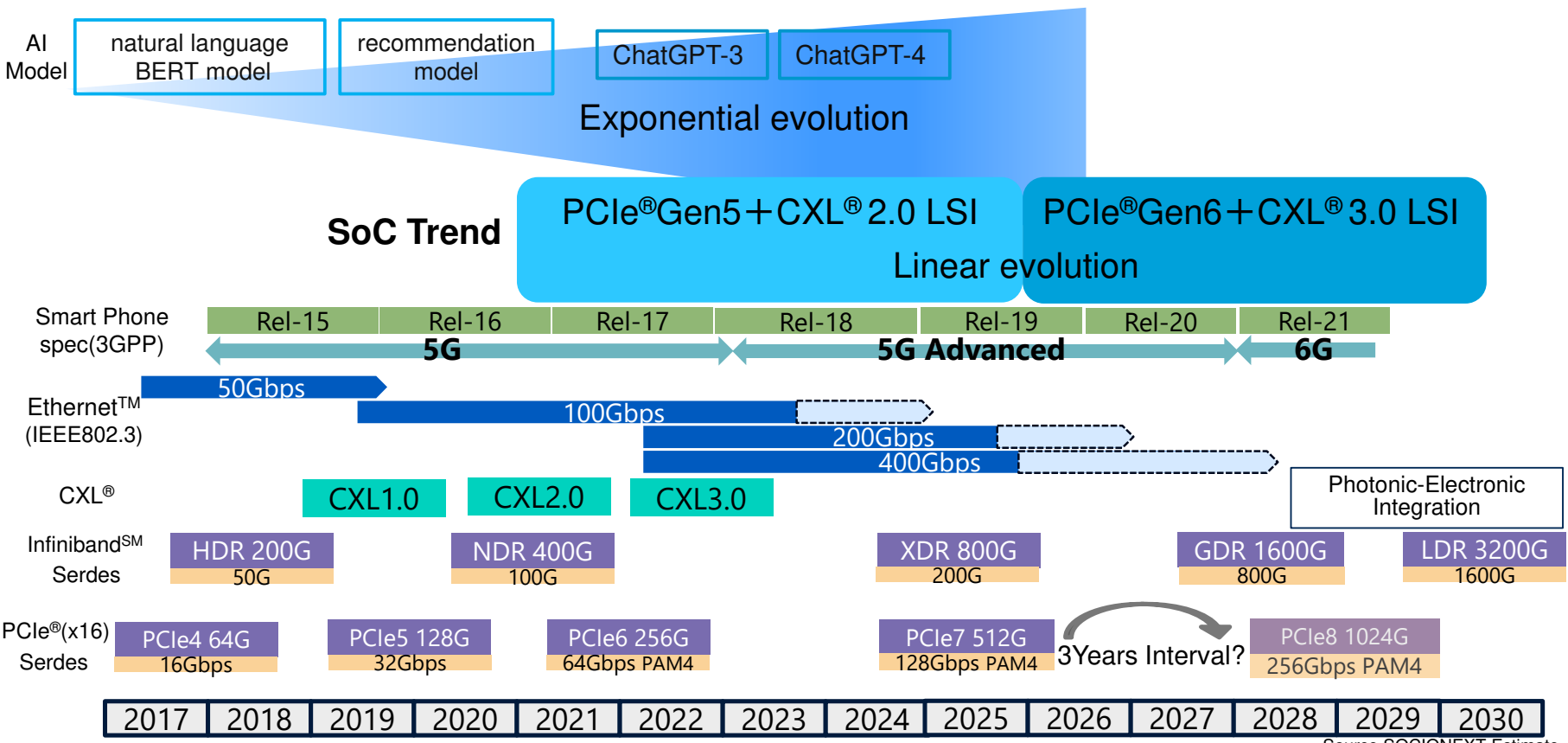
AI & Network Trend



Source SOCIONEXT Estimate

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Integrated Technology for AI accelerator

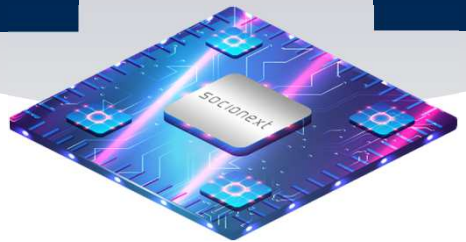
Symphony of technological breakthroughs

Integrated Technology

- AI-Model
- AI-Implement Architecture
- Processor
- Network Architecture
- LSI Design using Advanced Technology
- Large Scale LSI Design
- 3D-IC
- Process

Customer Solution

Socionext Solution



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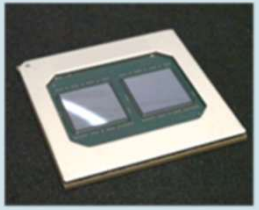
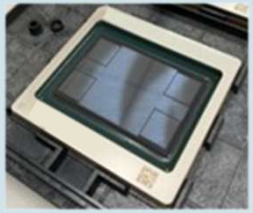
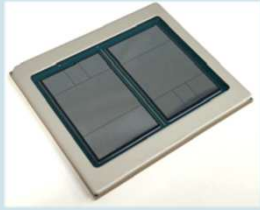
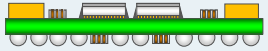
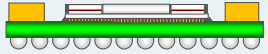
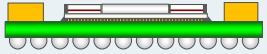
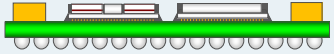
Socionext Integrated Technology

Integrated Technology	Socionext Solution
Large Scale LSI Design	✓ Advanced Package Solution ✓ Chiplet Design
Processor	✓ Multi-Core CPU
LSI Design using Advanced Technology	✓ Clock latency reduction structure

Chiplet Package Experiences

	Device-1	Device-2	Device-3	Device-4
Appearance				
Structure	 2x SoC Die Capacitor	 1x SoC Die 4x HBM2E Si interposer w/ capacitor	 1x SoC Die 4x HBM2E Si interposer	 4x SoC Die 4x HBM3 Bridge/RDL interposer
Package	MCM-FCBGA	2.5D-FCBGA	2.5D-FCBGA	2.5D-FCBGA

Multi-Core CPU Chiplet

- Collaboration with Arm and TSMC on 2nm Multi-Core CPU Chiplet

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PR20231018_01_207

Press Release

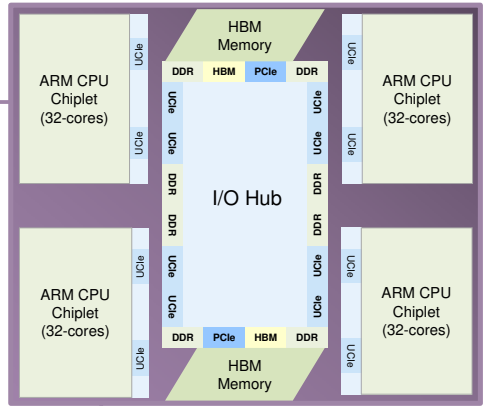
Socionext Announces Collaboration with Arm and TSMC on 2nm Multi-Core Leading CPU Chiplet Development

Next-Generation Compute Chiplet-based Proof-of-Concept Leverages Arm Neoverse CSS Technology and TSMC Silicon Process Along with Advanced Packaging Technology

[Yokohama, Japan October 18, 2023] --- Socionext today announced a collaboration with Arm and TSMC for the development of an innovative power-optimized 32-core CPU chiplet in TSMC's 2nm silicon technology, delivering scalable performance for hyperscale data center server, 5/6G infrastructure, DPU and edge-of-network markets.

This advanced CPU chiplet proof-of-concept using Arm® Neoverse™ CSS technology is designed for single or multiple instantiations within a single package, along with IO and application-specific custom chiplets to optimize performance for a variety of end applications.

Leveraging CPU chiplets, and customized application-specific chiplets, multiple target applications can be supported. When new chiplets become available, a cost-effective package level upgrade path can be supported.



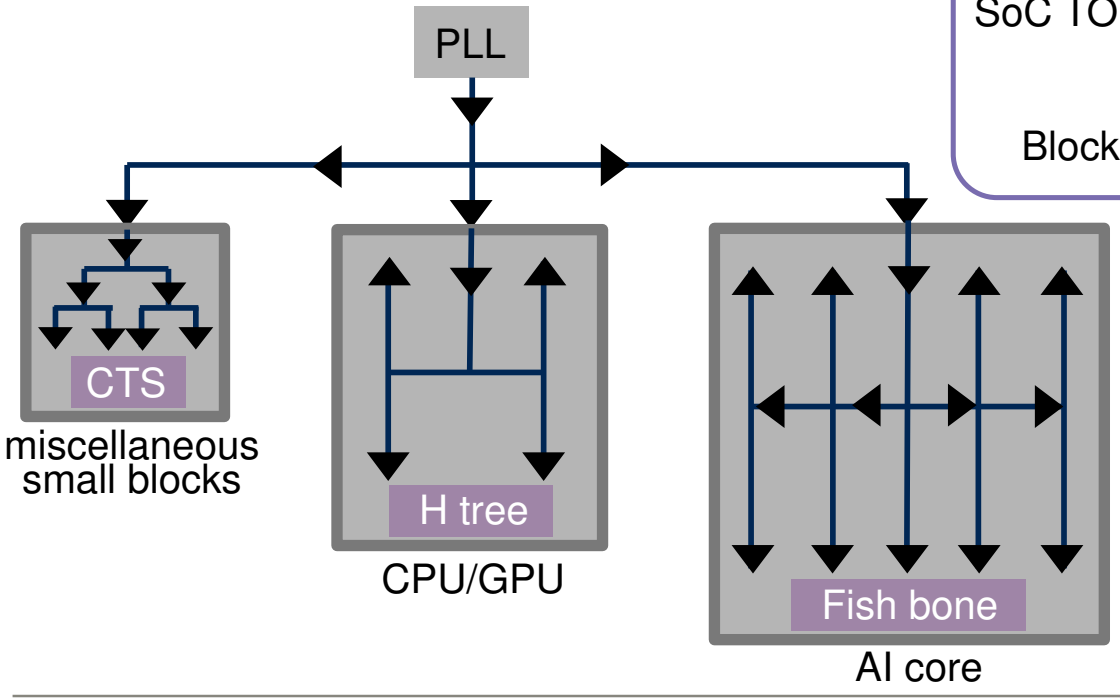
128 CPU core HPC Soc(Image)

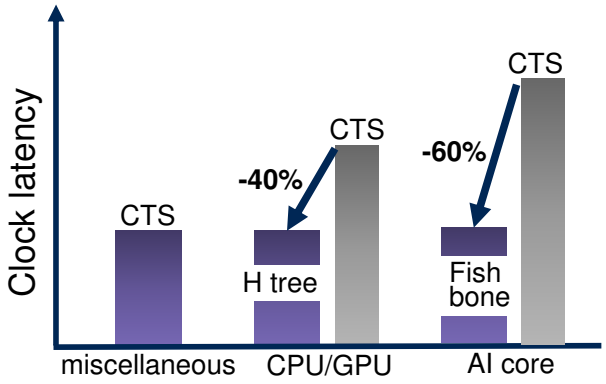
Clock latency reduction structure

Minimize latency and skew by using three different clock structures

Explore the best clock structure

SoC TOP	✓ Search for clock distribution path ✓ Evaluate on chip variation
Block	✓ Analyze clock skew and latency ✓ Determine clock structure





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Summary

- ✓ Data center semiconductors will continue to drive technology.
- ✓ On the other hand, it is also a factor contributing to the global power challenge.
- ✓ Socionext aims to balance technology evolution and power challenges with Integrated Technology.