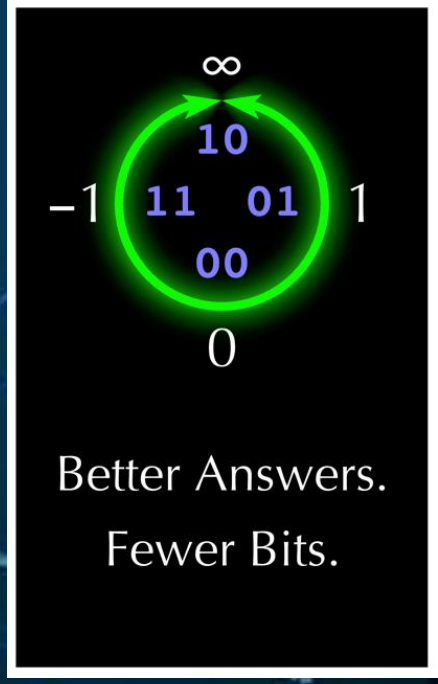
Calligo Technologies, Bangalore, India

High Performance & Beyond.....

ZettaScale Computing with RISC-V and Posits

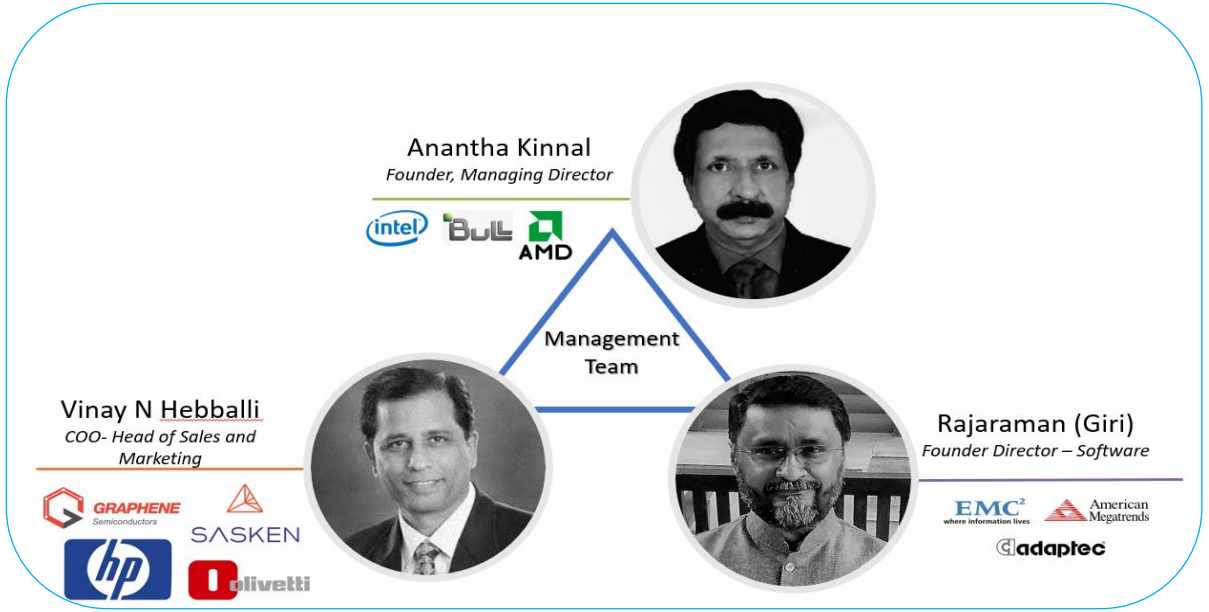


HPC ASIA – TAIWAN
19th Feb 2025

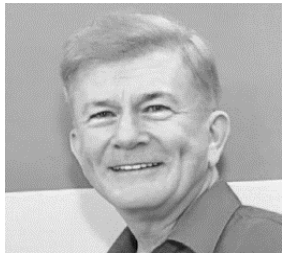
About US

Calligo Tech
High Performance & Beyond

Leadership Credentials



Advisory Board



Dr. John Gustafson

Dr. Theodore Omtzigt

Key Customers

Shell

Flipkart

OGIS International

Institute of High Performance Computing
A*STAR

intel

Seed Investors

KARSEMVEN FUND

U · S T

SFAL
SEMICONDUCTOR FABLESS ACCELERATOR LAB
K-Tech CoE for Fabless

Calligo Technologies –Products & Solutions

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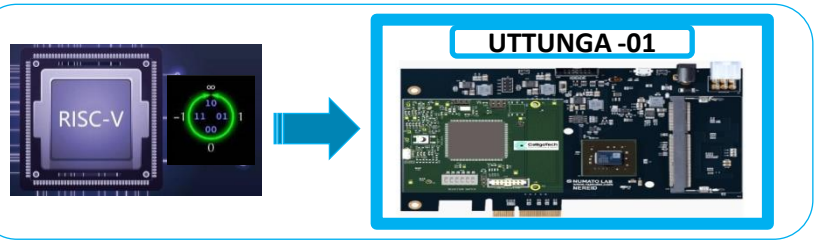
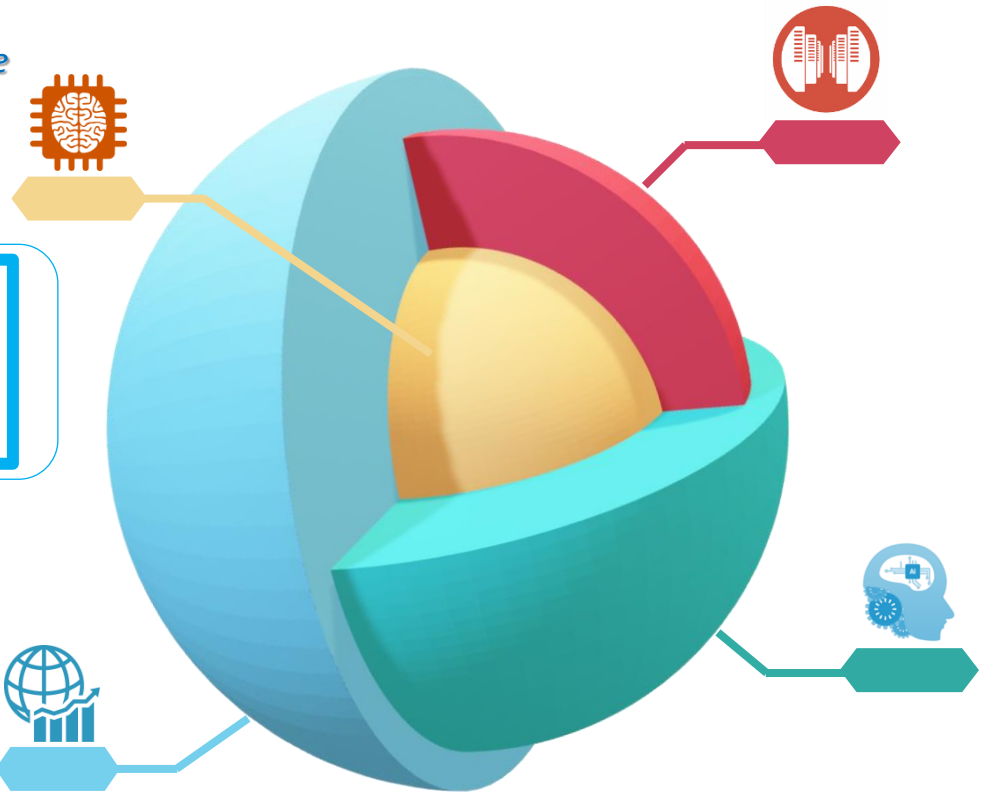
High Performance & Beyond

Silicon & Systems

Solution:

- *Coprocessor (PNU)*
- *Posit-enabled RISC-V (CRISP) – CPU core*
- *Now Built ASIC for HPC/AI Acceleration*
- *Accelerator Card being built*
- *64 Core SoC initiated*





Big Data

Platform Product created – Calligo Intelligent Data Analytics Platform (CIDAP)

- *Built using HPC HW and SW stack*
- *Infinitely scalable Compute and Storage*
- *AI-enabled, across all layers*

Seamlessly Scalable to address growing transaction needs

High Performance Computing (HPC)

Application-specific

- *Parallelization & Optimization (aka Code Modernization)*
- *Hardware - enabled acceleration*

intel. oneAPI Technology Partner

AI / ML / DL

Edge Analytics Platform created

- *Video, Audio & Image Analytics*
- *Text Extractor*
- *One M2M Ready, HPC Ready*
- *Very low power, highly scalable*

Accomplished

- *CHE – Health Solution – **Patented***
- *CIS2 – Surveillance Solution*

Conventional Journey to Zettascale Computing

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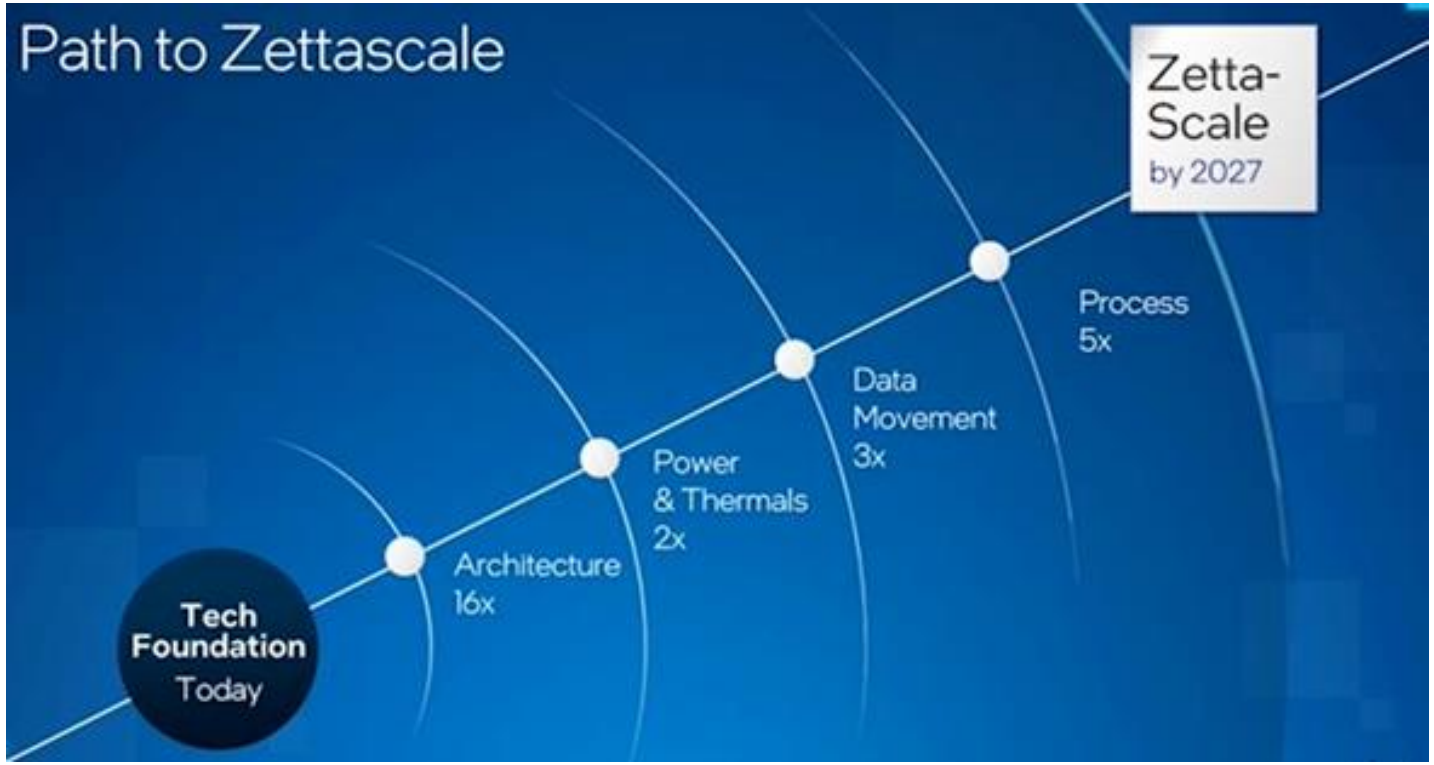
Tera Scale	Peta Scale	Exa Scale	Zetta Scale
•2010	•2018	•2022	•2027



Progressive Scale achieved using:

- Architectural enhancements
- New Power & Thermal features
- Approach to Data Movement
- Improvements in Process Technology
- New Data formats for AI

RISC-V & Posits for Zettascale computing

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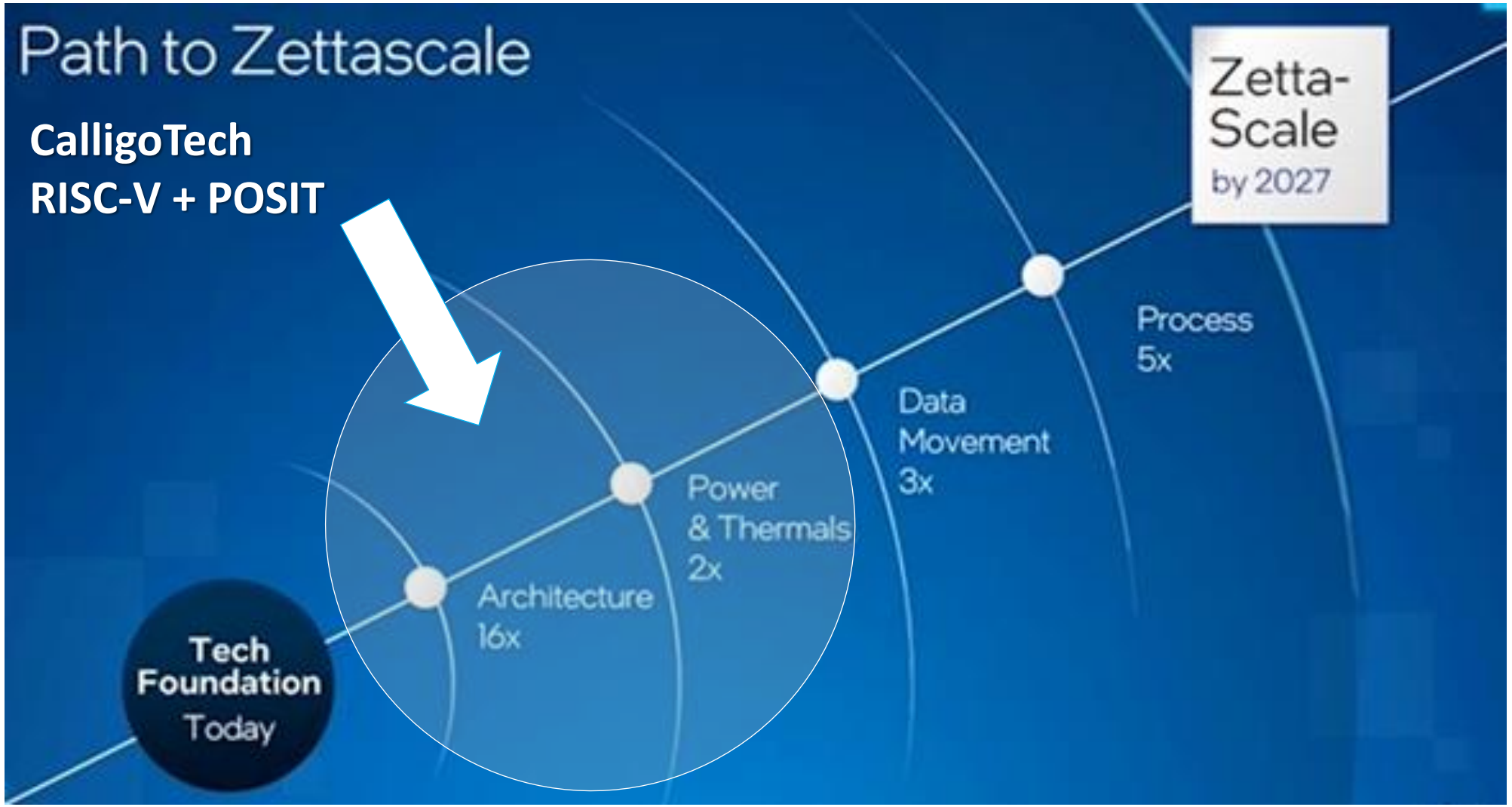
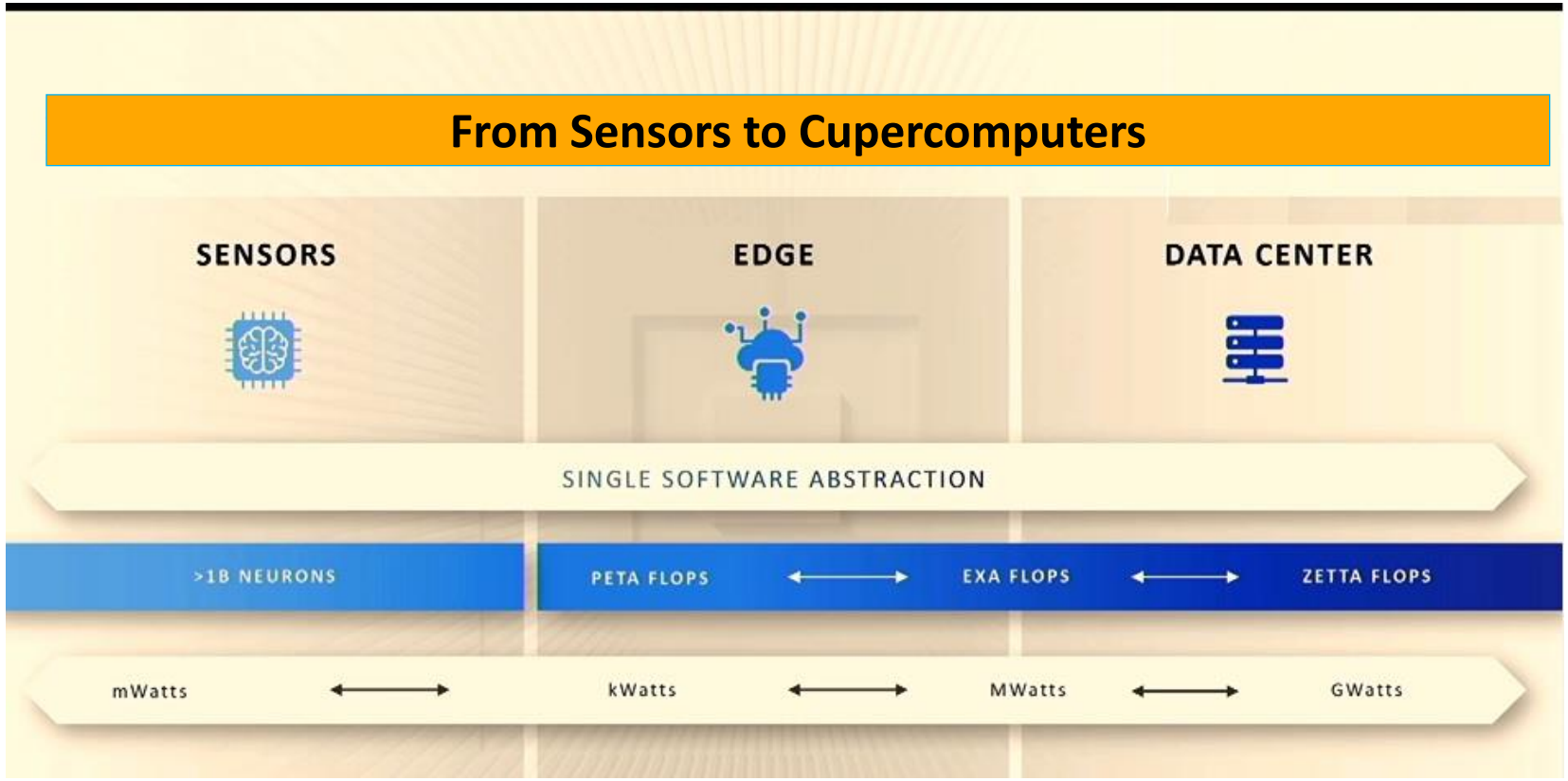


Simple Processor RISC-V + Simple Coprocessor using Posits

Highly power-efficient CPU core

Challenges to ZettaScale Computing



- Energy Efficiency
- Exascale Algorithms
- Resilience and Correctness
- Parallelism
- Data Movement

RISC-V+POSIT

Thesis

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For 50 years, “floating point operations per second” has been *the* currency of HPC performance. “FLOPs.”

The end of Moore’s law and the rise of AI (Machine Learning) have made us realize that IEEE floating-point format (1985) is long overdue for replacement.

This is a watershed, a revolution. And it is well underway.

posit | ˈpäzət |

noun *Philosophy*

a statement that is made on the assumption that it will prove to be true.

The revolution is underway.

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Interest from industry

Interest from universities, labs

Advantages of Posits:

- Posit number system is powerful - One simple example to prove strength of posits is computation of Pi:
  - Pi(golden) = 3.14159265358979323846264338327950288419716…….
  - Pi (using Float64) = 3.141592621803283691 41
  - Pi (using Posit32) = 3.1415927410
  - Pi (using Float32) = 3.1415929794
- Higher accuracy, similar or larger dynamic range compared to Floats
- Bitwise reproducible answers on all systems - not possible with Floats
- Simpler, smaller, faster circuits
- No overflow or underflow, follows Knuth's guidelines
- Dot products are exact, Addition is associative.
- Multiplication is simpler… no "subnormals"
- Flexible number system – just enough bits based on the application needs
- And many more….

Uttunga Accelerator Board

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Hardware:

- Uttunga Accelerator powered by TUNGA - Octacore Posit-enabled RISC-V CPU
- TUNGA Silicon consumes less than 2W, offering 3.2GPOPS (Posit operations Per Second)
- Each RISC-V Core (RV64IMAFDC) as Processor and Posit Numeric Unit as Coprocessor
- Posit configurations supported - <32,2>,<64,3>; uses the same opcode map as F & D to keep compiler the same
- QUIRE 512-bit accumulator in each core using Custom Type 0 instructions

Board comes with:

- 4GB DDR4 memory
- 128MB BPI & SPI flash memory
- Console interface over USB Mini Com
- 1Gig Ethernet
- PCIE Gen3

Software:

- Platform running familiar Linux OS with Software tools
- RISC-V version of Linux ver5.9.0, GCC version12.2.0
- Enhanced C/C++, Fortran Compilers and Math Libraries supporting native Posit computations
- Pytho9n V3.8.17, Octave
- No source code modifications needed
- Supports OpenMPI, OpenMP, Eclipse with JTAG and OpenOCD

Platform for Posit-based HPC experiments

Progressive adoption of RISC-V with Posits:

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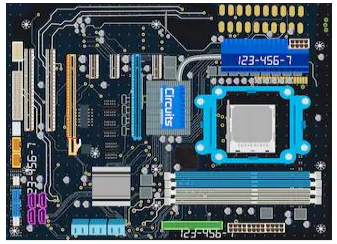

2 General Purpose Computing

General purpose computing :

- Many-core CPU
- No need for Host CPU
- As self-booting Mother-board
- Low Average Selling Price, High-volume
- Ideal platform for HPC & AI

Availability – 2H26

Accelerated Computing 1

As an Accelerator:

- Multi-core CPU, needs host CPU
- Runs its own micro-kernel Linux
- As add-on boards for standard servers
- Software-defined for different HPC verticals
- Target customers
  - Supercomputing Centers world-wide
  - Enterprise HPC customers – Oil & Gas, Manufacturing, Life Sciences, Automobile, Aeronautical, BFSI, Retail, Transportation, etc
  - AI infrastructure on Cloud mainly for AI-Model-Training

Availability – TODAY (Shipping since July'24)

Thank You

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