

IMAGINATION TECHNOLOGIES

GPU'S WITH RISC-V BASED FIRMWARE PROCESSOR

kristof.beets@imgtec.com

World leading technologies in GPU, AI, Wireless Connectivity IP and more

>11 Billion

Cumulative chip shipment
with Imagination IPs

\$108M

2018 Revenue

Thousands

Fundamental patents and the
only non-US core GPU patents
holder

~38%

Mobile GPU IP market share

~43%

Automotive GPU IP market
share

#2

In Wireless Connectivity IP

An independent worldwide provider of strategic silicon
Intellectual Property

>900 employees worldwide – 80% engineers

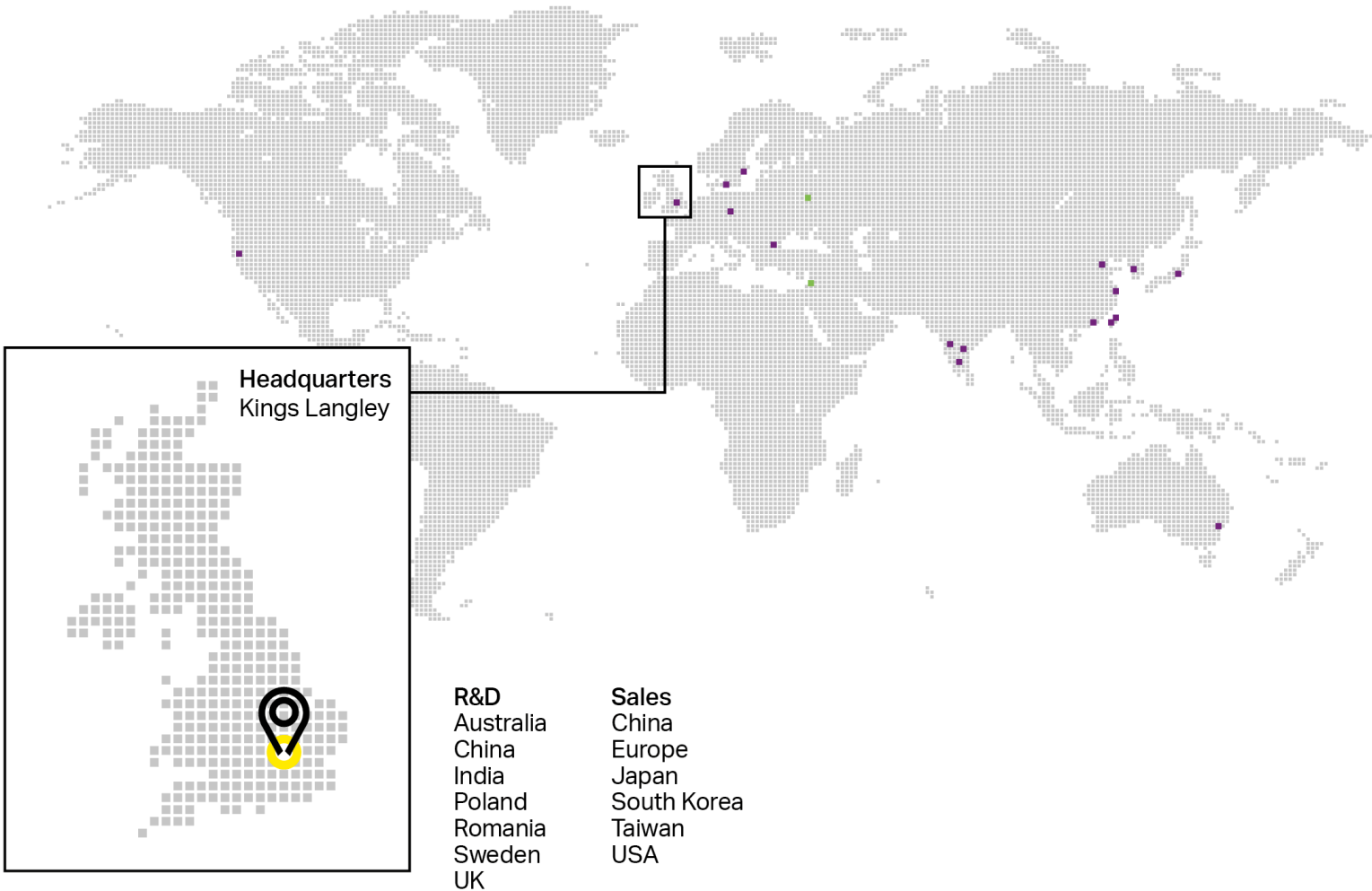
An original IP portfolio with a significant, long-present &
long-term, patent portfolio underpinning it

Domain expertise in GPU, AI, CPU & Connectivity

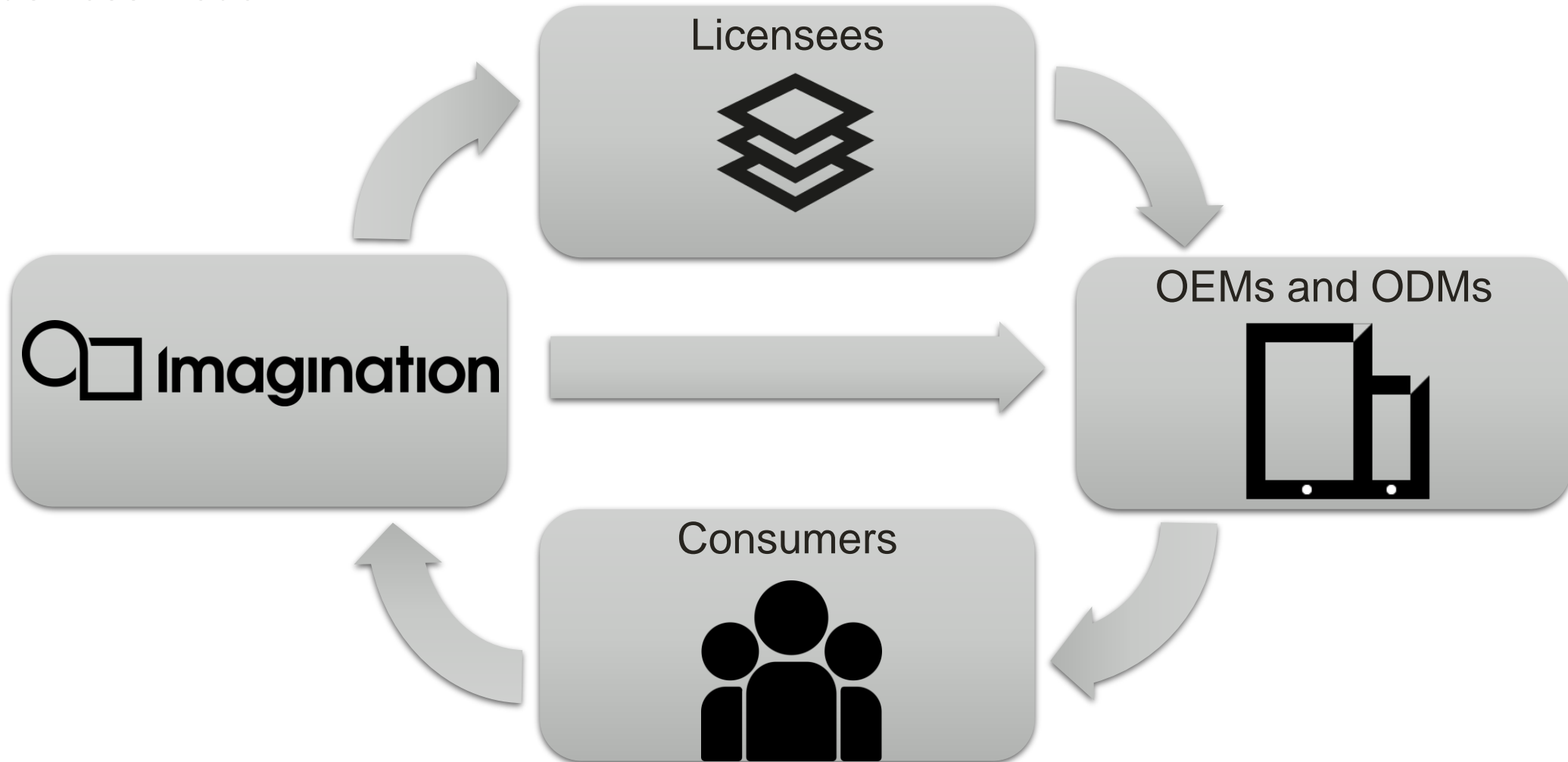
Targeting the fastest growing market segments
including Mobile, Automotive, AIoT, Compute, Gaming,
Consumer



Global Team



Our business model



Imagination

The best solution for embedded graphics, AI, compute and connectivity

Graphics

Broad suite of products covering embedded graphics needs across all markets

Compute

Dedicated Compute & AI hardware IP

Connectivity

Connectivity and broadcast communications
High performance, low power

PowerVR GPU

Scalable cores with best PPA
+ Safety Critical Automotive Cores

PowerVR Ray Tracing

Architecture for advanced modelling of light

PowerVR NNA

PowerVR Neural Network Accelerators
AI Compute Software, Tools & Libraries

EPP

Ethernet Packet Processor

Enigma RF

Wi-Fi, Bluetooth

Enigma IP

Wi-Fi, Bluetooth Digital Radio

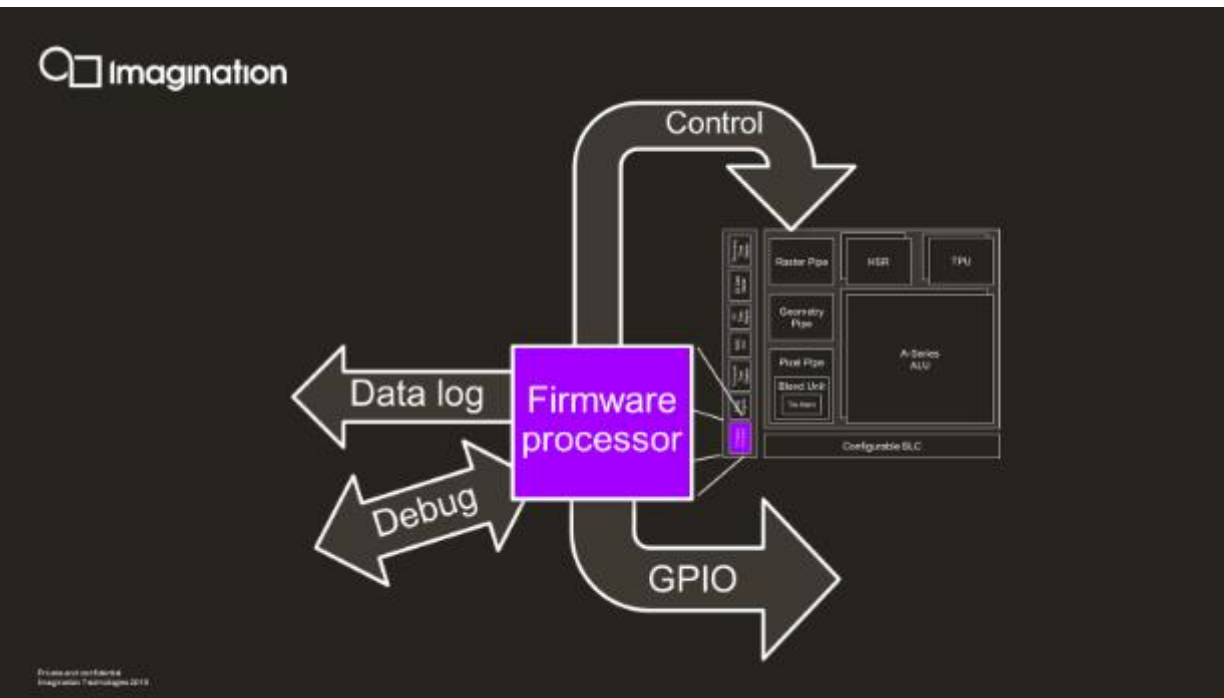
Firmware Managed GPU

Maximal Host CPU offloading while maintaining ultimate flexibility

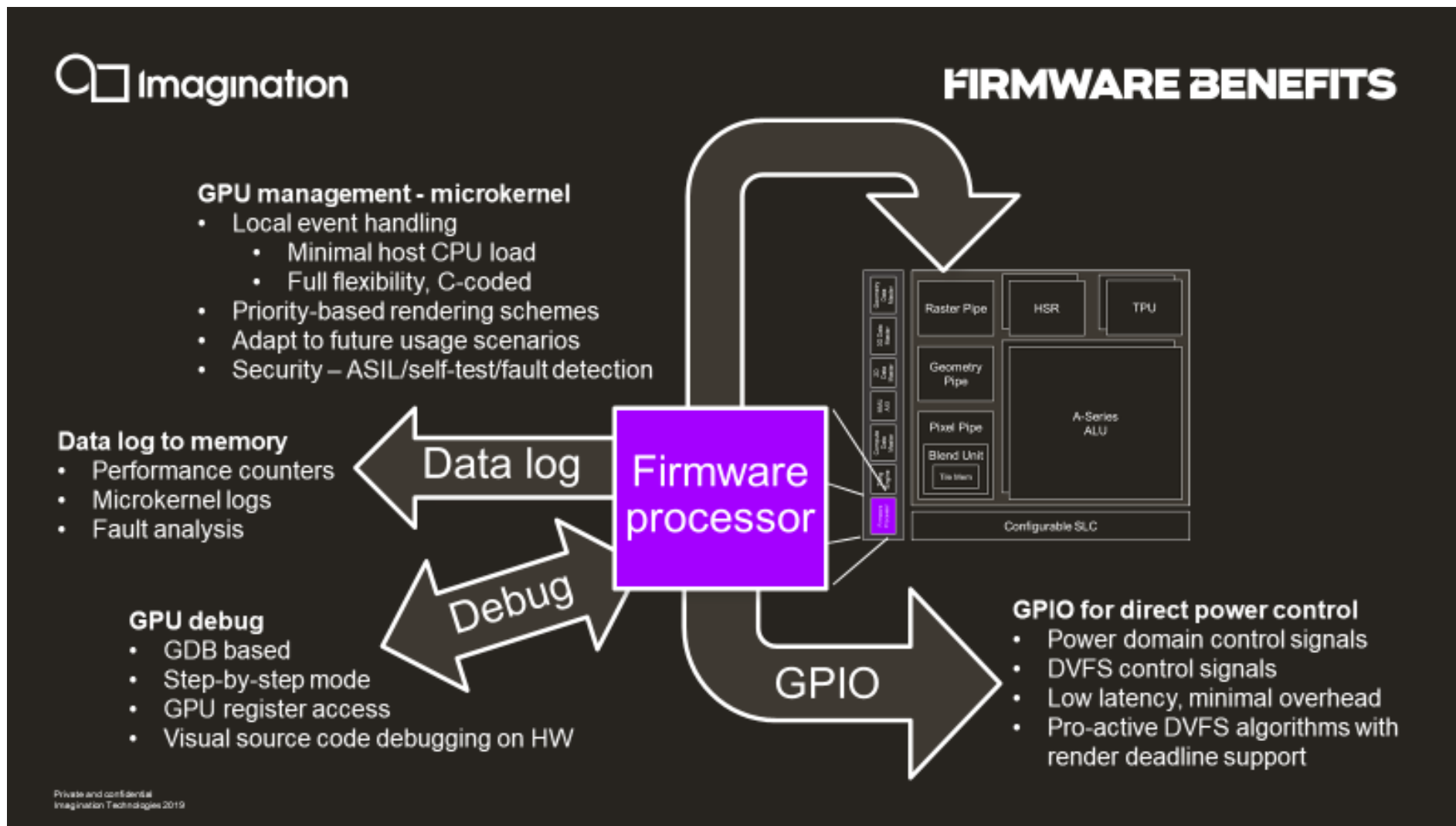
Unique GPU innovation including:

- Concept in use since 1996
- C-Programmable Firmware Code
- Enables:
 - Local Event Handling
 - Performance Monitoring
 - Direct HW Syncs and Control
 - Direct Power Control via GPIO Signals
 - Step Debugging of the GPU
 - GPU Kernel Dump Logs (debug logs)
 - Hardware based virtualisation – multiple clients
 - Programmable workload priority mechanisms

Now based on RISC-V Architecture



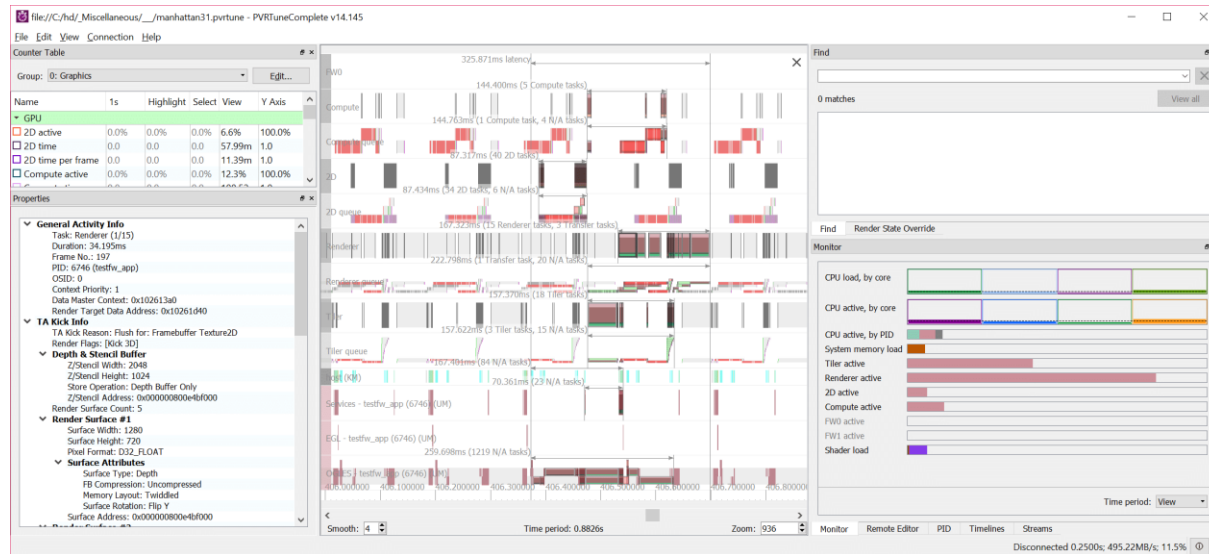
Firmware Managed GPU Benefits



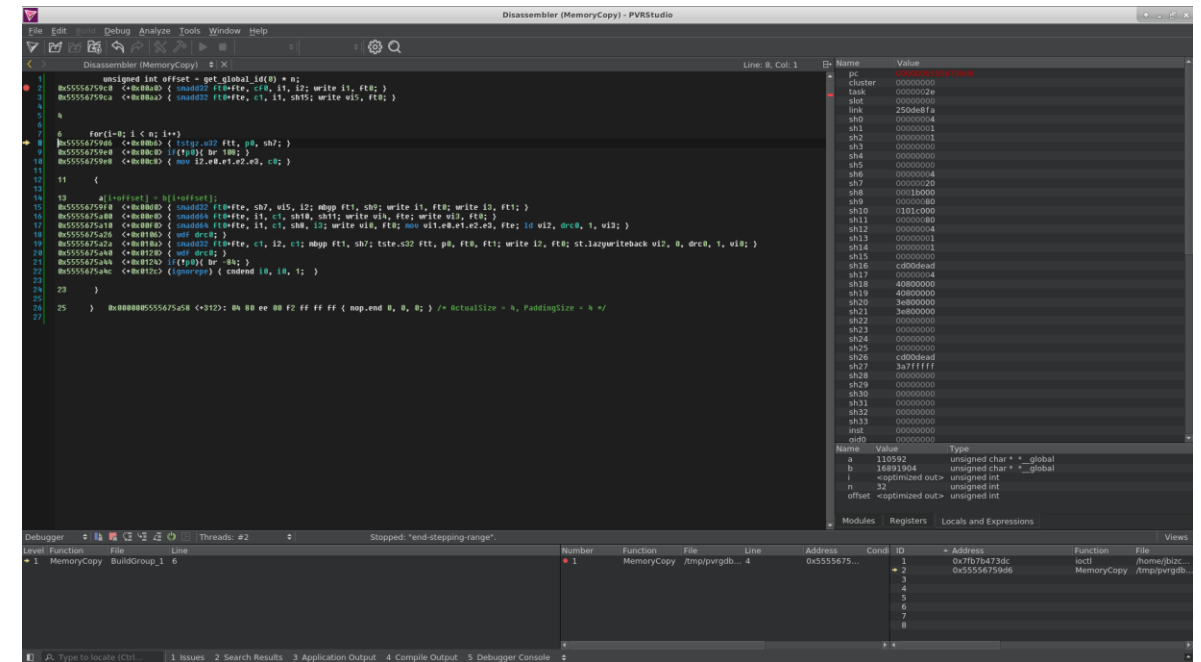
Firmware Managed GPU – Enables Advanced Tool Flows

Enable extensive developer workload optimisation and problem solving

PVRTune – Hardware Performance Profiling



PVRStudio – Hardware assisted GPU Debugger



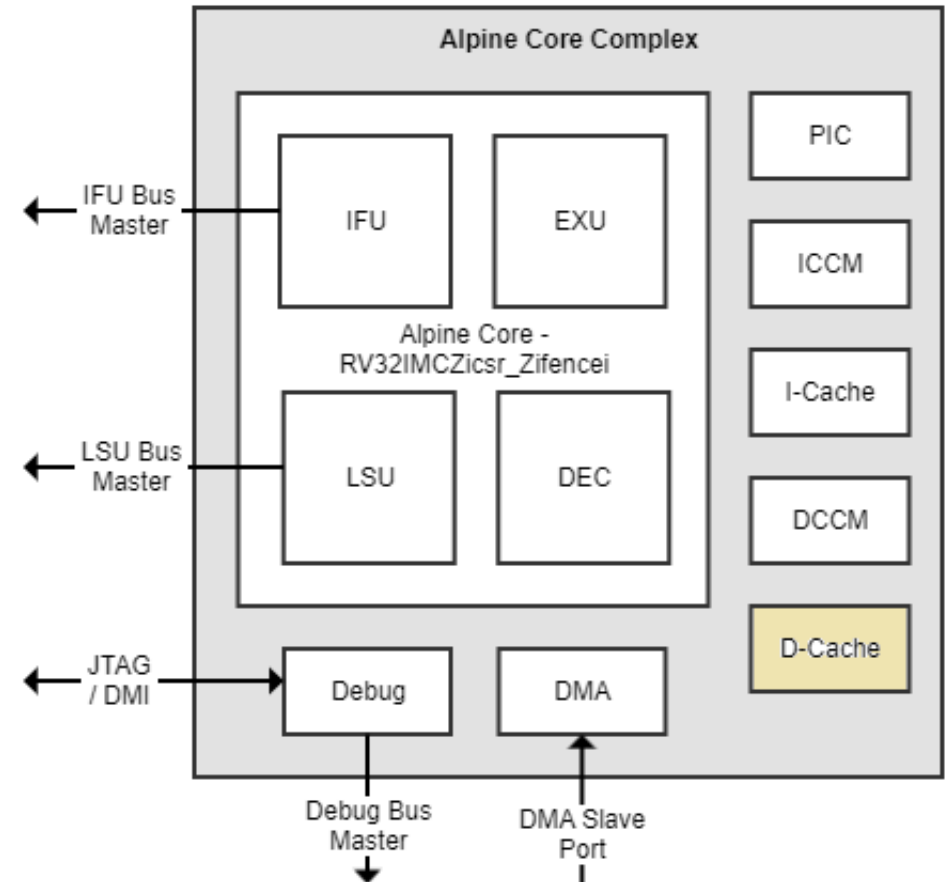
- Firmware manages performance counters
- Efficient sharing of data with host for analysis

- Firmware runs GDB Server
- Direct Access to HW Registers for debug

Adopting RISC-V as the processor of choice for GPU Firmware Processing

Introducing the RISC-V architecture into the GPU

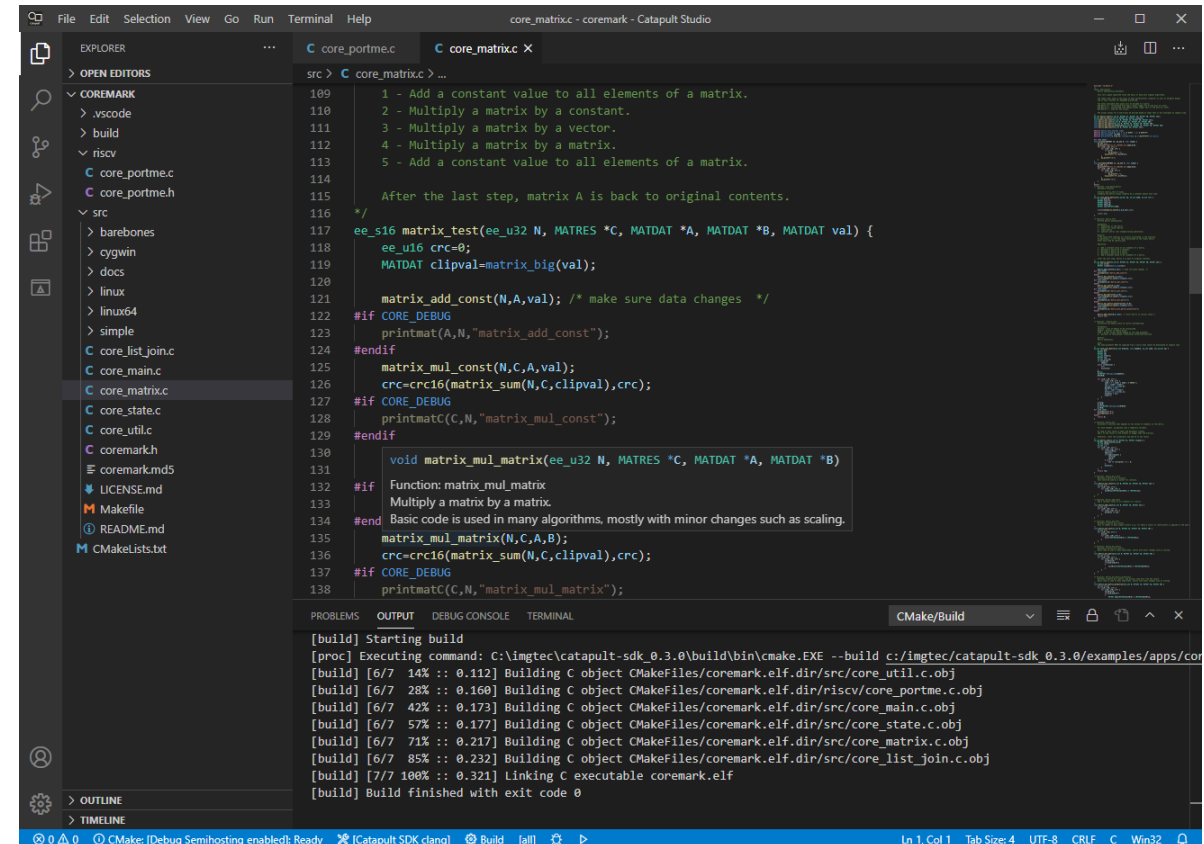
- Adopting RISC-V to receive benefits from a modern and dynamic CPU architecture
- Alpine core is an adaption from Western Digital's SweRV, but with D-cache support
- ECC support to meet functional safety requirements
- Up to 40% faster than previously used processors



RISC-V Tools – Imagination’s “Catapult” SDK

We offer a fully-featured RISC-V SDK, including:

- Latest versions of GCC and LLVM compilers, with performance enhancements for SweRV/Alpine
- Optimized `picolibc` C library
- *Catapult Studio* IDE, based on VS Code
- Alpine simulator with GDB support
- Available for Linux, Windows and macOS



IMG B-SERIES

New levels of performance

BXE

BXM

BXT

BXS

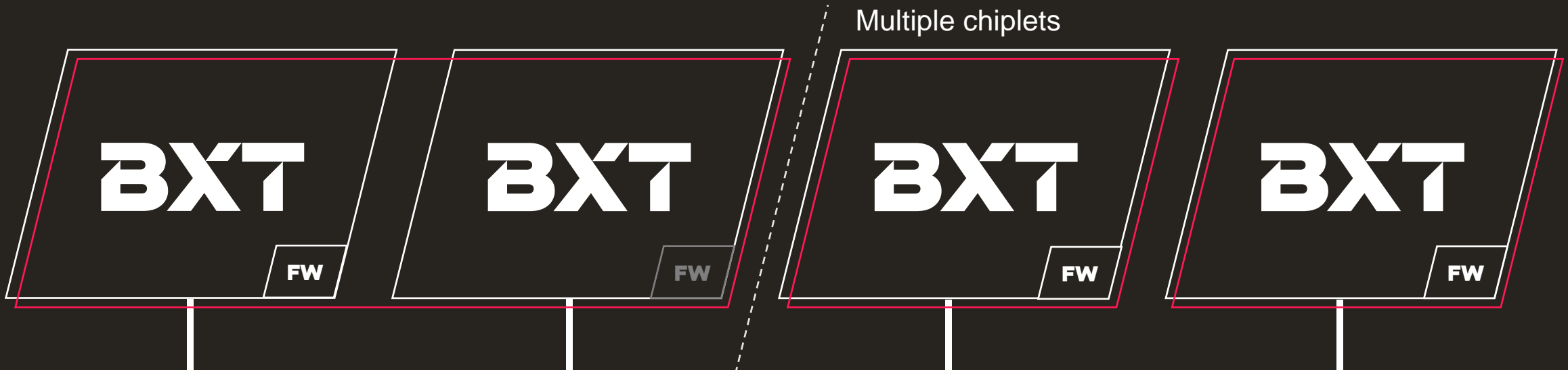


Scaling mobile to the cloud

**High-performance
High-efficiency scaling blocks**

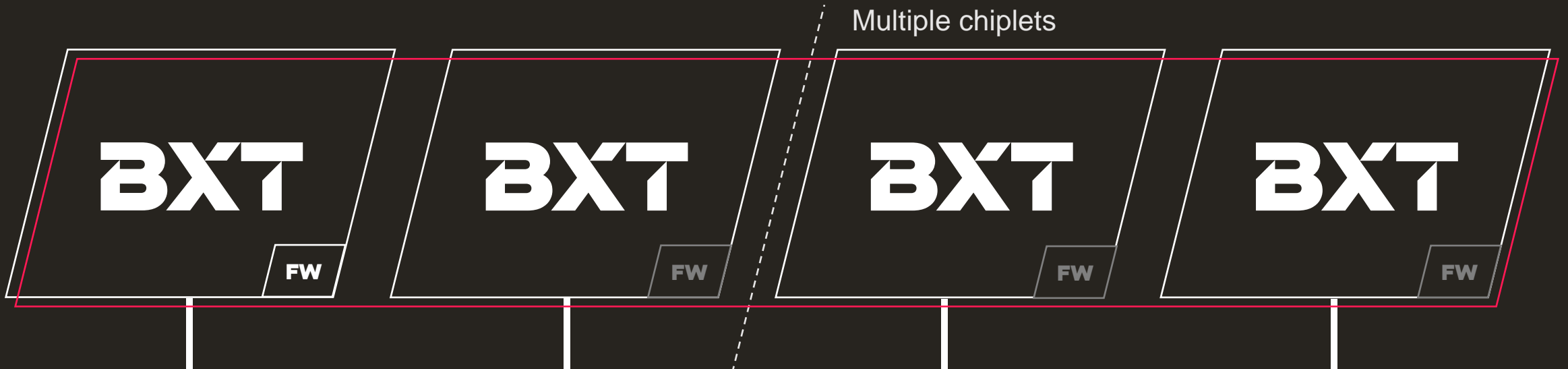
**Decentralised design
Greater flexibility
Improved layout**

MULTI-CORE



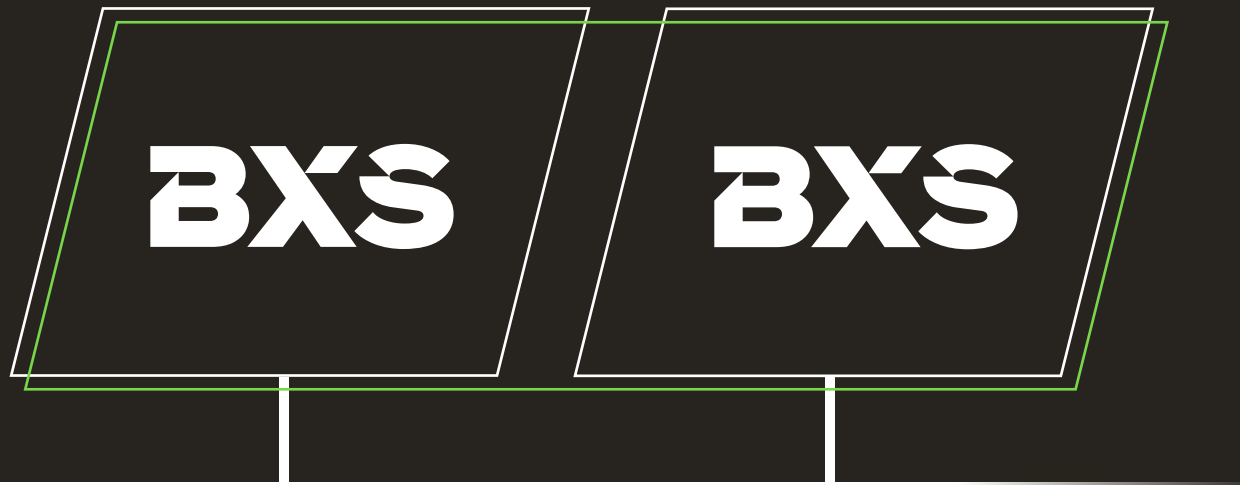
Full flexibility
Multi-primary core scaling

MULTI-CORE



Full flexibility
Multi-primary core scaling

BXS - AUTOMOTIVE



BXS MC2

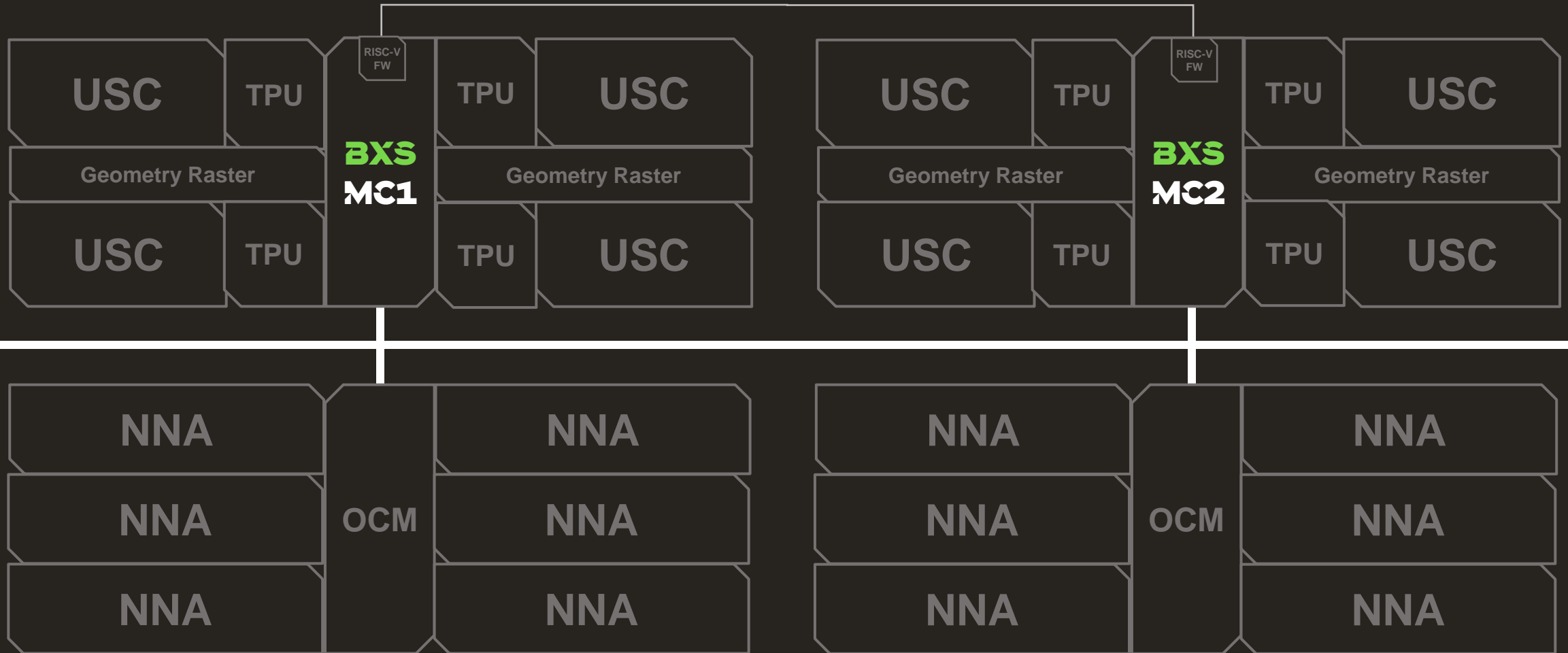
**Automotive-focused
performance scaling**

**Multi-core + TRP highly
efficient additional
redundancy**

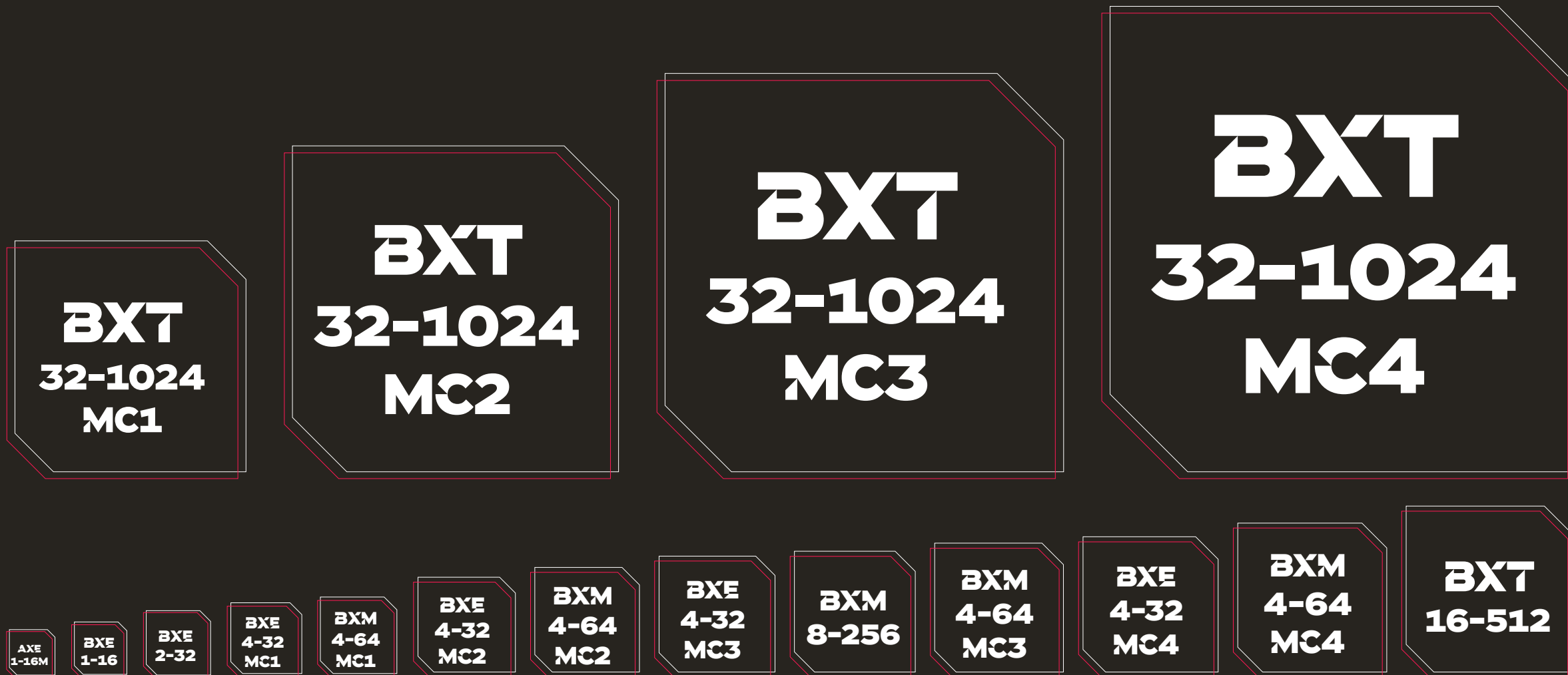
**Safety delivered without
high cost of lockstep**

Hardware Virtualisation

BXS AUTONOMY ARCHITECTURE



GPU RANGE



THANK YOU