



生态驱动创新：GPU与RISC-V的
协同赋能汽车智能化

***Ecosystem-Driven
Innovation: GPU and RISC-V
Collaborating for Smarter
Automotive Solutions***



RISC-V in Automotive is Growing Into a \$9Bn Opportunity



47.4% CAGR

RISC-V is used in cars for:

- Real-time microcontrollers
- Infotainment systems
- ADAS controllers

Companies designing RISC-V automotive CPUs include:

- Andes Technology
- SiFive
- Cortus
- MIPS (Mobileye)
- Ventana

Source: The SHD Group, January 2024



What Is Happening in the Automotive Market

Automotive Trends

Rising Vehicle Autonomy



Centralising Architectures



Software Definition



Automotive Challenges

Immense performance demands

Safety certification

Simultaneous processing of lots of different workloads

Hugely complex software development

Keeping up with the latest AI trends

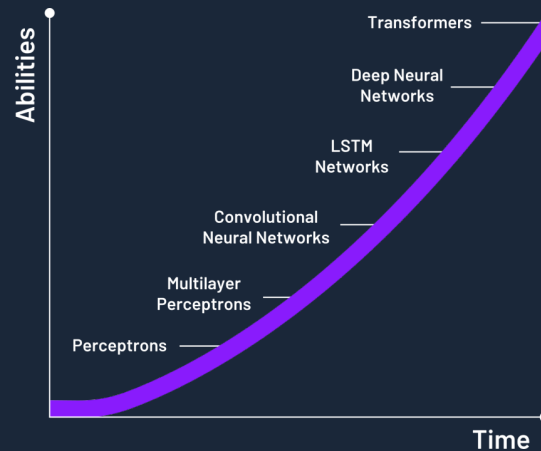


How Can Automotive Keep Up With The Latest Software Trends?

The average
“road life” of a
car is

12

years ...



... but AI models are
still evolving so
quickly ...

In a software-
defined world,
how do we design
AI-ready
automotive
hardware now for
workloads we
don't even know
yet?





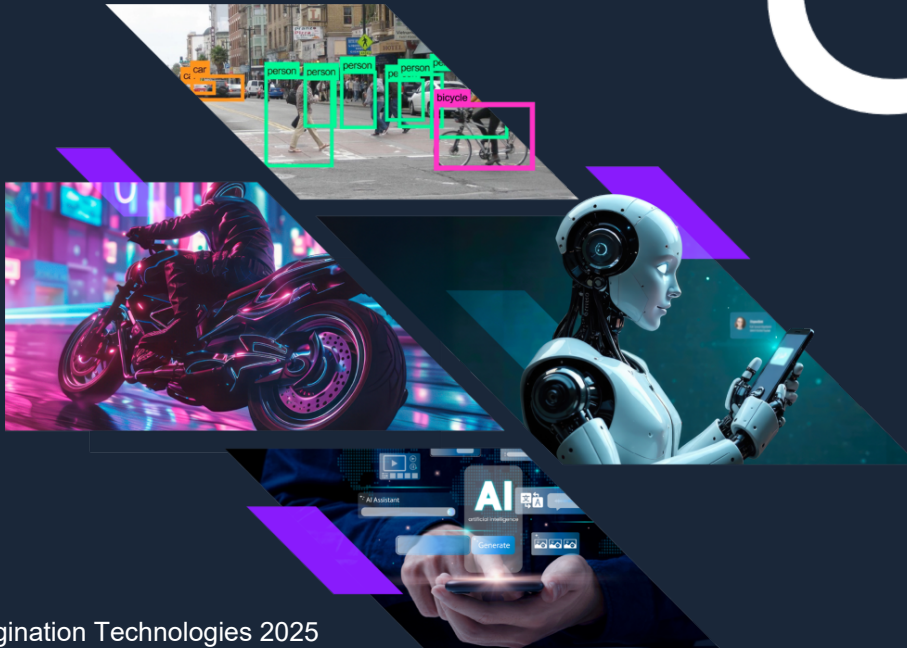
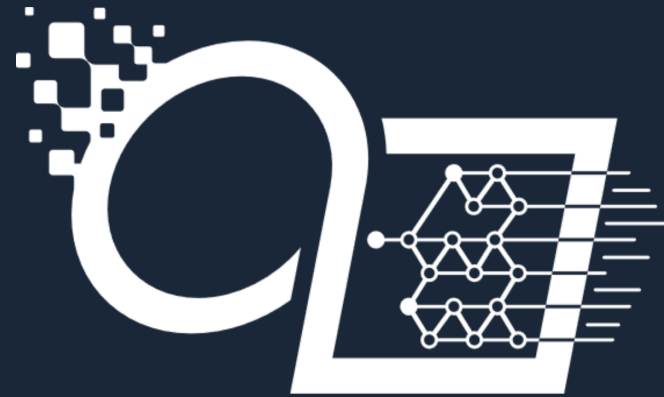
The answer lies in *“Programmable Parallelism”*

High performance – but
general purpose -
compute hardware

An open software stack
supported by highly-
optimised libraries and
compilers

Support for popular APIs
and number formats

Imagination has thirty years' expertise in parallel compute for EDGE GRAPHICS...



...we're now applying that
expertise to **EDGE AI**

Imagination and Renesas Redefine the Role of the GPU in Next-Generation Vehicles

What is the R-Car Gen 5?

- Scalable high-performance platform for centralized vehicle architectures
- Flexible and modular architecture
- Best-in-class power efficiency
- Secure isolation for multi-domain integration
- Supports the move from hardware-defined to software-defined vehicles

Renesas R-Car Gen5 features an Imagination BXS GPU



Imagination

x



RENESAS

Imagination Has Years of Experience in RISC-V

In-house RISC-V CPU expertise

- Imagination has access to hundreds of RISC patents
- Imagination GPUs feature a RISC-V firmware processor

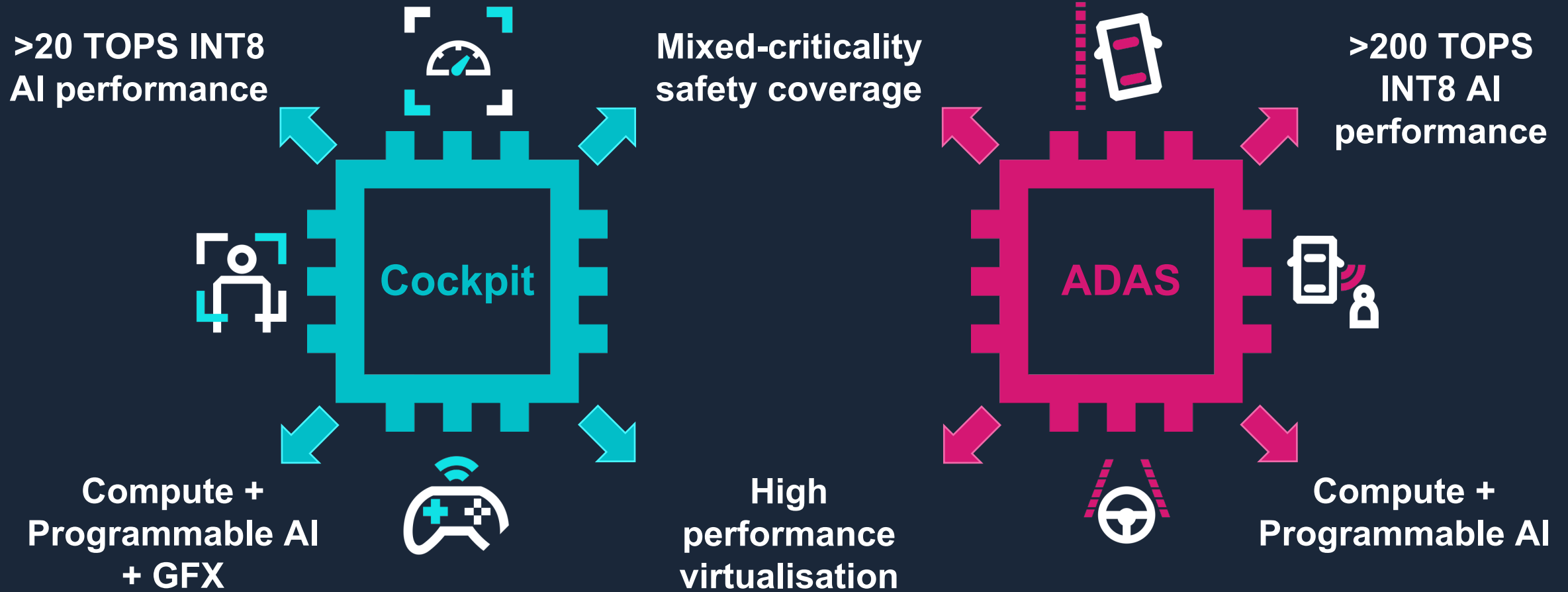
Imagination GPU + RISC-V CPU is proven in silicon – and available for developers

- E.g. T-Head TH1520
- E.g. ESWIN EIC7700X

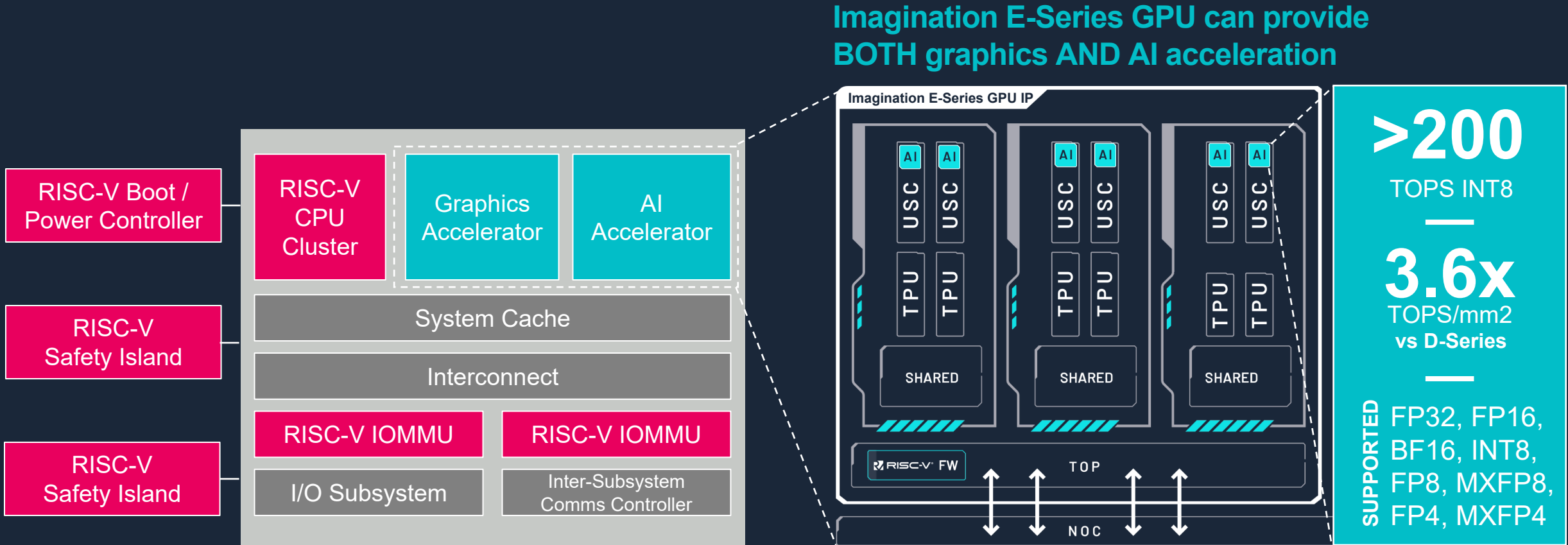




What Do Centralised Controllers Need?



A Scalable RISC-V + Imagination GPU Automotive Compute Subsystem



E-Series neural cores with deeply-embedded AI

- Shares Registers/SRAM with classic GPU ALU USC
- Minimal data travel distance for re-use – near memory compute
- Matches modern OpenCL and Vulkan AI/Compute Extensions

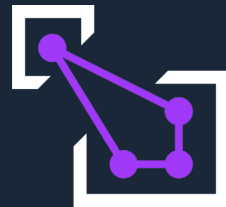


SERIES

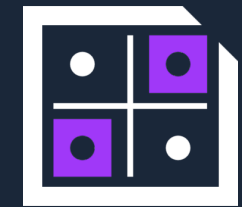
New generation of GPU IP transforming EDGE system design with programmable Graphics & AI acceleration.



**Ultimate
EDGE efficiency**
+35% FPS/mW



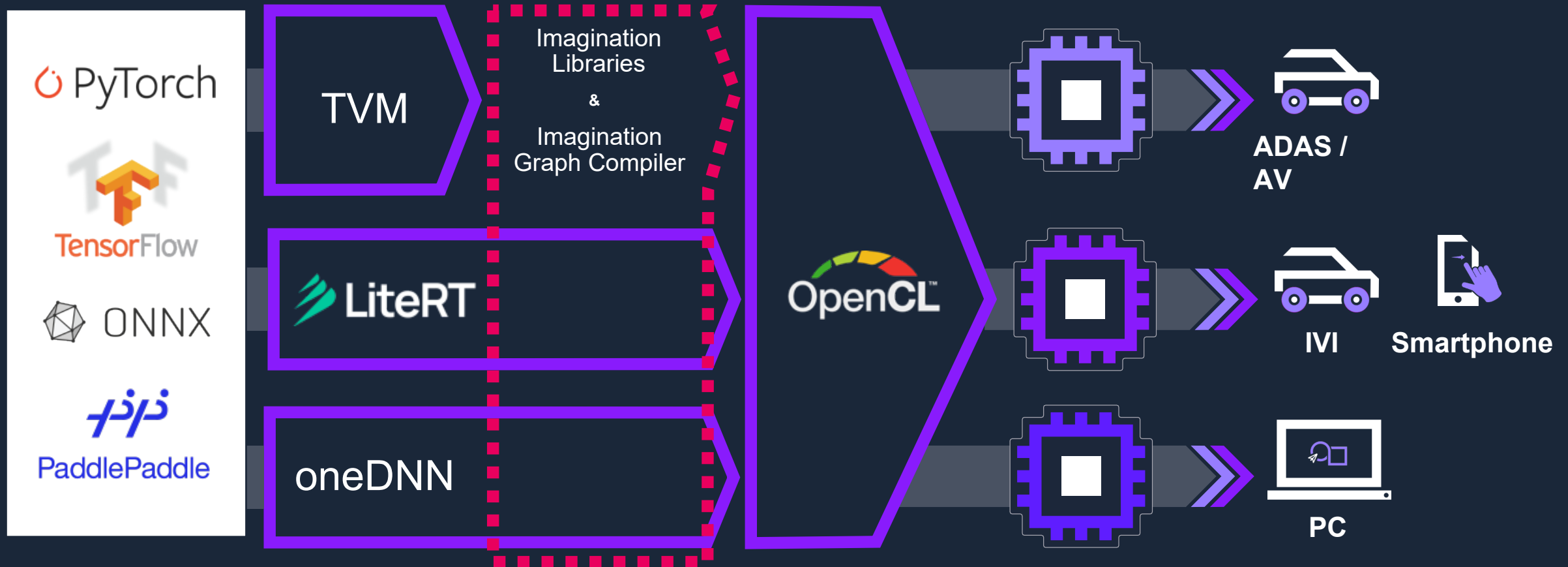
AI for every device
scaling from **2 – 200 TOPS**



**Developer &
system flexibility**
for Graphics, AI – or
Graphics + AI

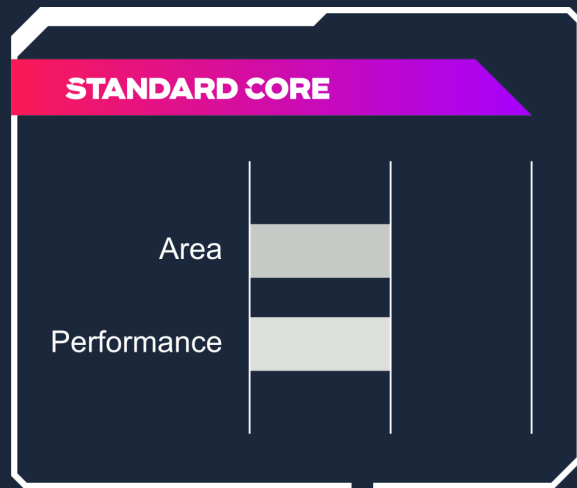


Imagination Provides Clear Paths For Porting Models Onto E-series Hardware

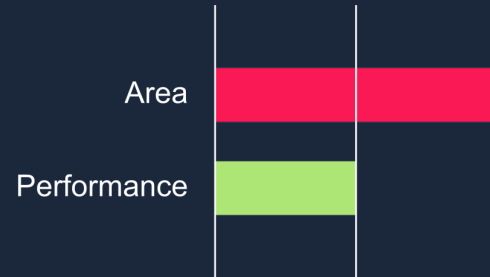


Frameworks for developing and training models

Imagination Delivers ASIL-B Safety At Half The Area, Or Twice The Performance, Of Existing Methods



DUAL-CORE LOCK STEP



2x

area cost of
standard core

WORKLOAD REPETITION



1.5x

performance
of standard core

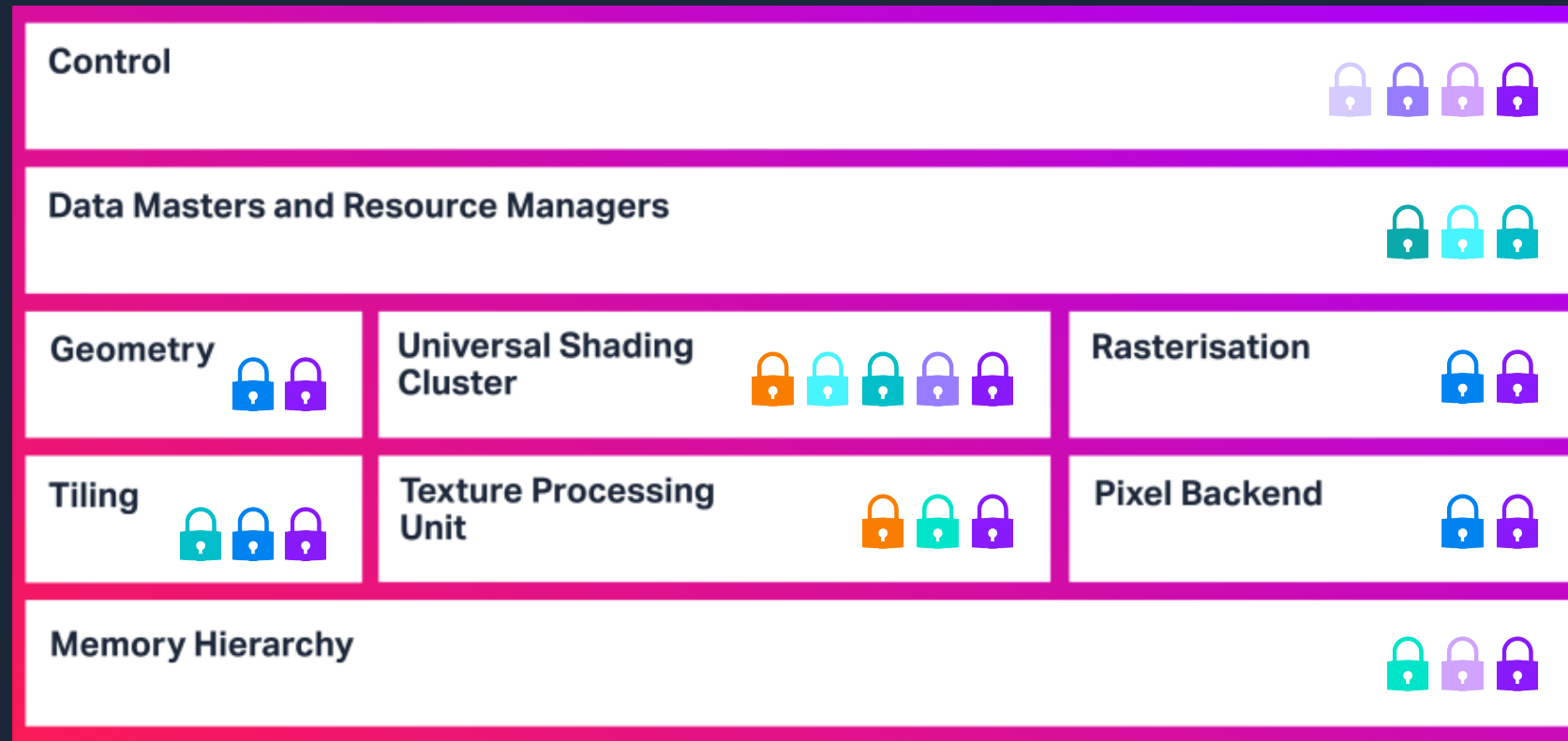
IMG DXS



Same performance
as standard core,
minimal area increase

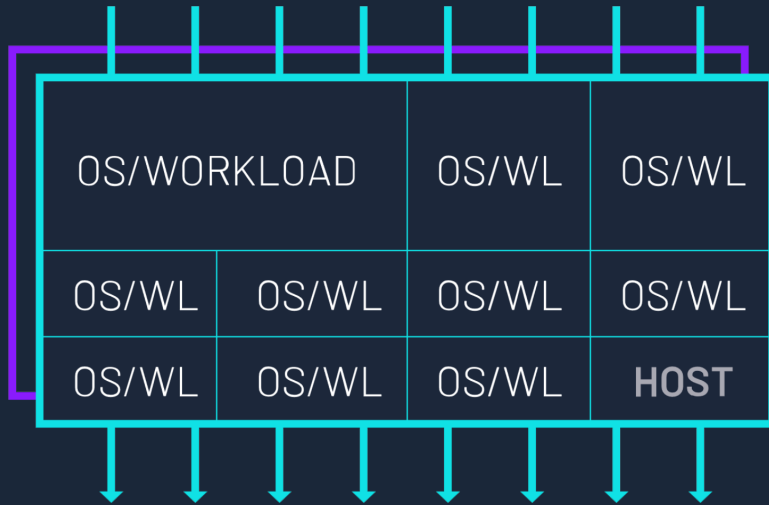


Distributed Safety Mechanisms Bring Low-Cost Functional Safety to Automotive



- Error Correction Code (ECC)
- Parity
- Watchdogs
- Dual Core Lockstep
- Function Specific Replication
- Pipeline Coherency
- Scheduler Interlocks
- Cyclic Redundancy Checks (CRC)
- Tile Region Protection
- Safety Pairs

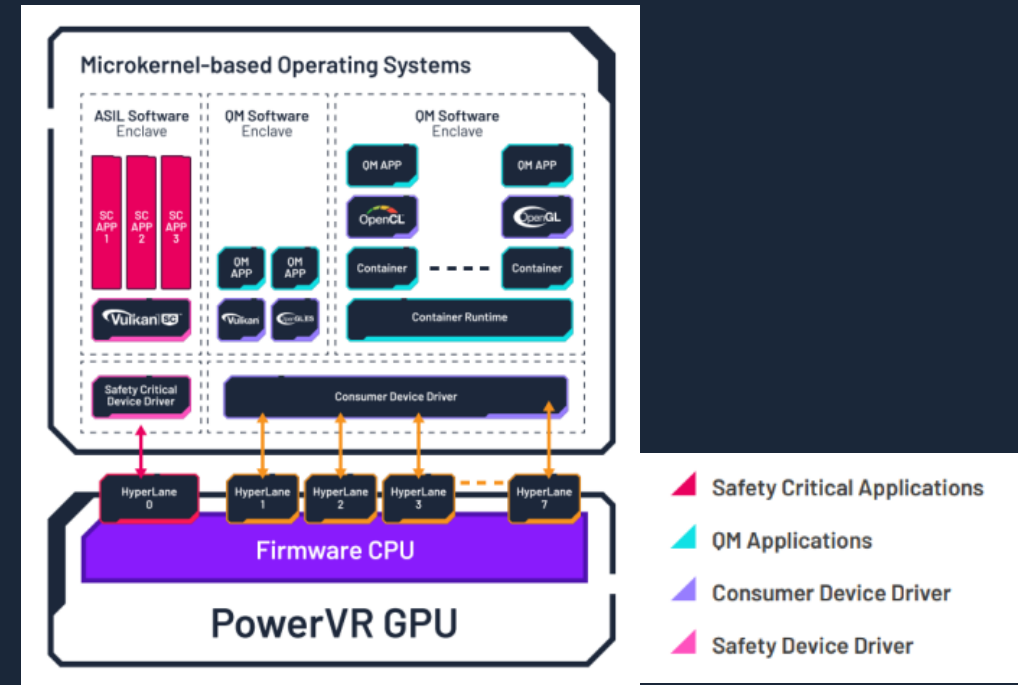
Imagination Processors Support Multi-Domain & Mixed Criticality Multitasking



Up to 16 virtual machines

supported in hardware per core, with QoS, workload prioritisation, denial of service mechanisms, mixed-safety support etc.

The GPU can render to the cockpit, infotainment unit, rear-seat displays AND handle driver monitoring workloads and voice interactions simultaneously.



Using an advanced virtualisation feature to mix workloads of different safety criticalities within a single operating system.

This helps lower overall software system complexity.

Working With Partners To Build The Best RISC-V Systems

Just adding CPUs and GPUs to the same die doesn't make a system heterogeneous.

What matters is:

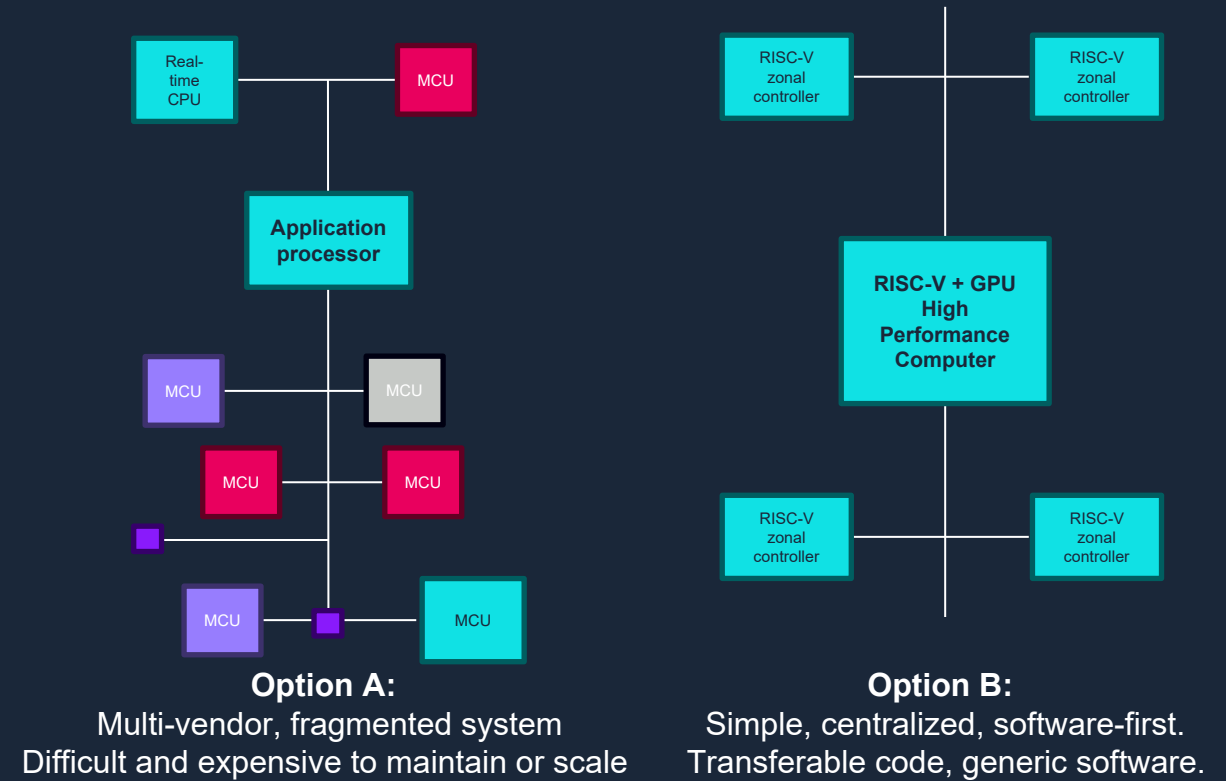
- How engines interact with shared memory
 - How scheduling decisions influence latency
 - How coherence policies, fabric layout, and cache sizing shape performance
-

Real heterogeneity is about architectural cooperation — not just integration.



Scalable Compute for Software Defined Vehicle

- Companies require platforms that are resilient to supply chain and global disruptions
- RISC-V can be deployed across entire automotive spectrum, dramatically improving TCO
- GPUs are essential for real-time visualization, sensor fusion, display pipelines and parallel AI workloads
- OEMs need customizable, flexible IP to optimize platforms for best perf and power, as well as scaling to support future needs



The Joint Advantage of RISC-V & Imagination GPU IP



A collaborative approach that brings together best-in-class RISC-V and GPU IP, safety certified and purpose-built for the next wave of automotive compute

THANK YOU

Resources available via the Imagination website

- **White Paper:** A New Era in Edge AI
- **White Paper:** Innovation in the Field of Distributed Functional Safety
- **White Paper:** Virtualisation Explained
- **Case Study:** Imagination and Renesas Redefine the Role of the GPU in Next-Generation Vehicles

