Siemens PAVE360

Automotive system development using accelerated pre-silicon simulation environment

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Decisions made today have very long-term consequences, the SDV needs a new development methodology

Traditional vehicle challenges

Longevity
HW lifetime >15 years

Field updates
SW updates & feature upgrades for >7 years

Long development cycle
HW specification ready ~3 years before production

…will only get worse thanks to…

Complexity of SDV
Hyper competitive
Shorter design cycles

…meaning..

It **takes years** for new physical hardware

....too late for SW development

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Regardless of whether they are developing a semiconductor, ECU or even full vehicle architectures, automotive players face the same challenges

Automotive
Challenge

| Long, expensive development cycle	Integration storm	Lack of "full system view"	Continuous updates & integration
Conflicts with speed of innovation, increasing vehicle complexity	Closed solutions from multiple vendors increases integration effort	How can performance of entire system be measured, across multiple teams?	Integration only starts on system completion, updates are costly
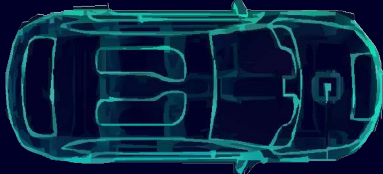
PAVE360
digital twin
delivers

Shift left! Develop SW pre HW	Easy system configuration	Metrics to drive decision making	Early start for system integration
Digital twin enable parallel HW and SW development	Integrate digital twin, HW and tools from multiple vendors	Generate a unique set of metrics, for mixed domains	Integrates elements at every stage of development

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That's why Siemens, Arm and ecosystems partners are working together To "shift-left" the SDV

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Shift the SDV left with **PAVE360** accelerated pre-silicon development environment

arm

Uses PAVE360 to enable developers to access the new **Arm Cortex-A720AE** pre-hardware

aws

Hosts PAVE360 to provide **unprecedented simulation speeds** on the cloud for the Cortex-A720AE

First partners are developing software for the SDV and the Arm Cortex-A720AE today, with PAVE360
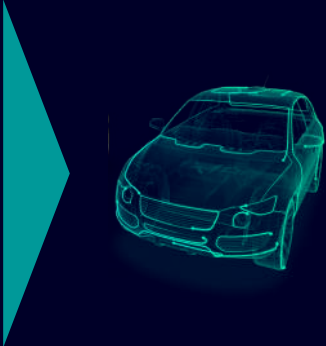
BlackBerry® QNX® | **EB Elektrobit** | **sensory** | **TATA TATA TECHNOLOGIES** | **TIER Ⅳ**

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Arm's ecosystem support for virtual prototyping
Siemens provide first Arm A720 AE CPU support

arm

" Today, in a series of industry firsts, Arm and our ecosystem are unveiling the latest Arm Automotive Enhanced (AE) processors alongside new virtual platforms, all made available to the industry from day one to accelerate automotive development cycles by up to two years."
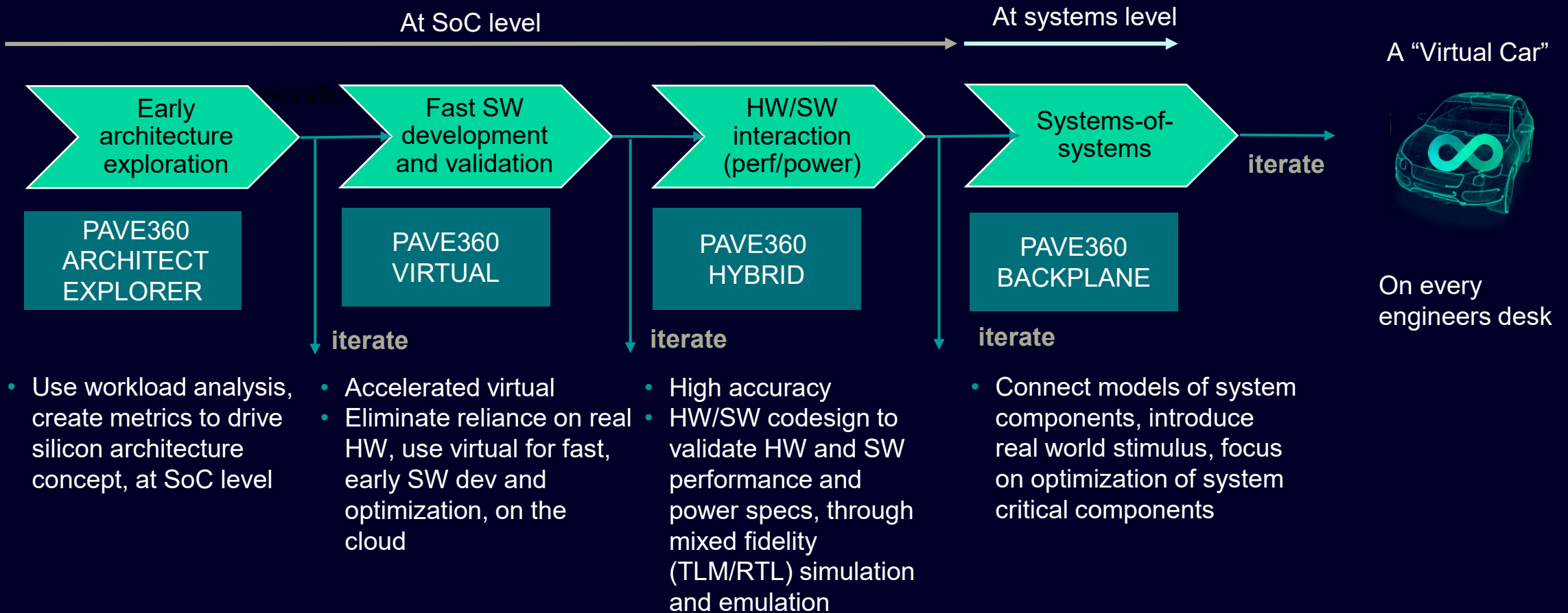
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"Our partnership with Arm, supporting an accelerated simulation environment with Cortex-A720 AE CPU, is helping to address automotive industry challenges by reducing time-to-market for SDV software through the availability of accelerated automotive platforms well ahead of silicon."
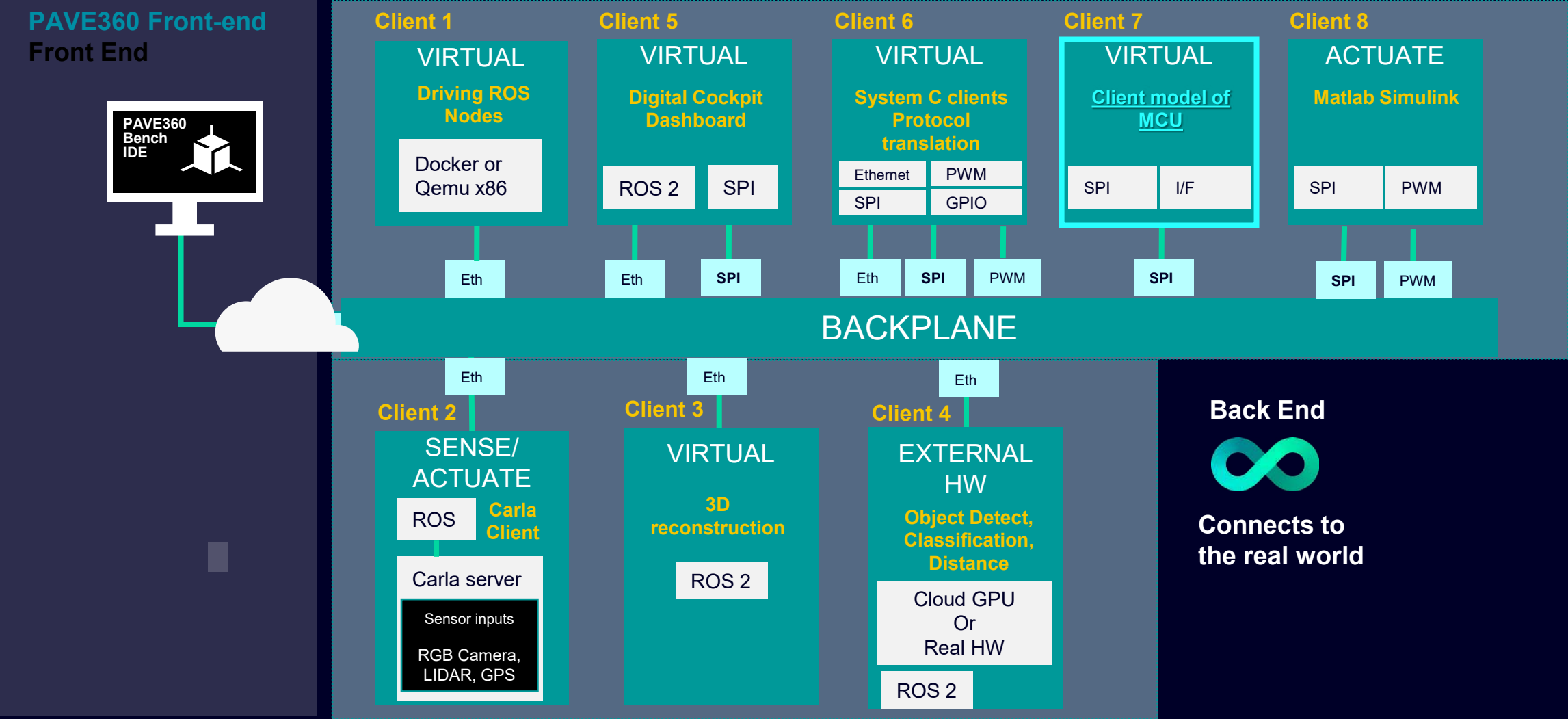
Source: https://www.arm.com/markets/automotive

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Shift Left methodology, a digital twin that grows with your design

Pre-silicon digital twin ∞

At SoC level →   At systems level →

A "Virtual Car"

Early architecture exploration	Fast SW development and validation	HW/SW interaction (perf/power)	Systems-of-systems

iterate →

PAVE360 ARCHITECT EXPLORER

PAVE360 VIRTUAL

PAVE360 HYBRID

PAVE360 BACKPLANE

On every engineers desk

iterate

iterate

iterate

- Use workload analysis, create metrics to drive silicon architecture concept, at SoC level

- Accelerated virtual
- Eliminate reliance on real HW, use virtual for fast, early SW dev and optimization, on the cloud

- High accuracy HW/SW codesign to validate HW and SW performance and power specs, through mixed fidelity (TLM/RTL) simulation and emulation

- Connect models of system components, introduce real world stimulus, focus on optimization of system critical components
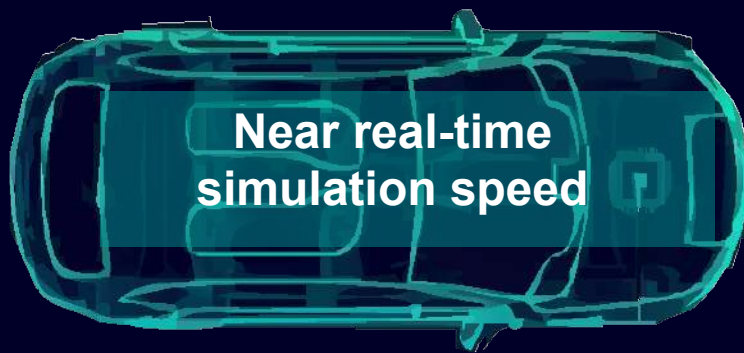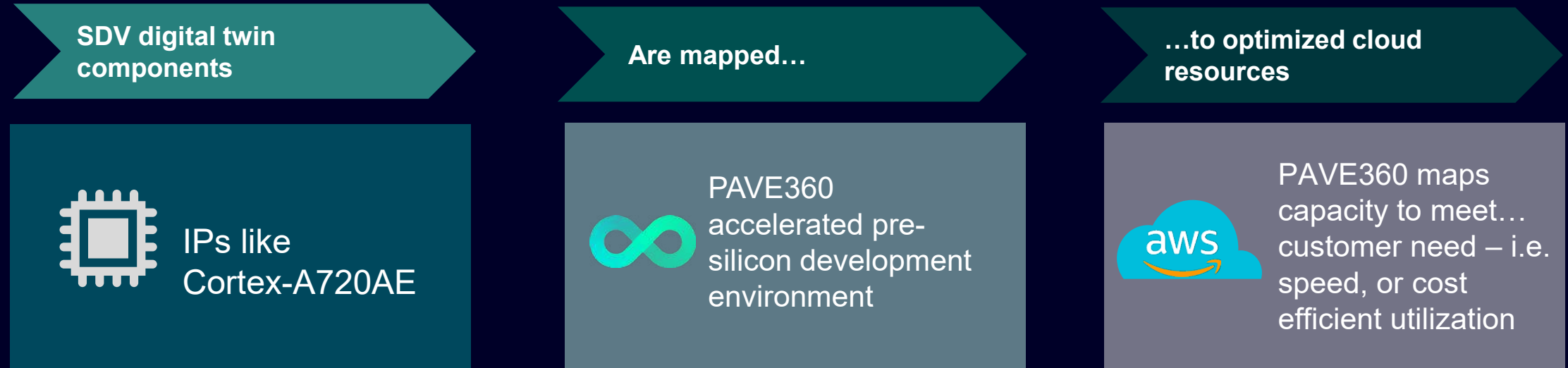
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Customer Success Story: Major APAC Tier 2 Silicon Vendor
Validate new concepts for next gen MCUs in real world context

PAVE360 Front-end
Front End

PAVE360 Bench IDE

Client 1

VIRTUAL

Driving ROS Nodes

Docker or Qemu x86

Eth

Client 5

VIRTUAL

Digital Cockpit Dashboard

ROS 2 | SPI

Eth | **SPI**

Client 6

VIRTUAL

System C clients Protocol translation

Ethernet | PWM
SPI | GPIO

Eth | **SPI** | PWM

Client 7

VIRTUAL

Client model of MCU

SPI | I/F

SPI

Client 8

ACTUATE

Matlab Simulink

SPI | PWM

SPI | PWM

BACKPLANE

Eth | Eth | Eth

Client 2

SENSE/ ACTUATE

ROS | **Carla Client**

Carla server

Sensor inputs

RGB Camera, LIDAR, GPS

Client 3

VIRTUAL

3D reconstruction

ROS 2

Client 4

EXTERNAL HW

Object Detect, Classification, Distance

Cloud GPU Or Real HW

ROS 2

Back End

Connects to the real world

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Accelerated pre-silicon SW simulation development environment

SDV digital twin components

Are mapped…

…to optimized cloud resources

IPs like Cortex-A720AE

PAVE360 accelerated pre-silicon development environment

aws — PAVE360 maps capacity to meet… customer need – i.e. speed, or cost efficient utilization

Near real-time simulation speed

What does this mean for software application developers?

- Embedded environment as close to the target SoC as you'll get
- Native cloud development of complex vehicle software
- In familiar IDE based environment
- Near real-time simulation speed, much faster than traditional methods

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Accelerated pre-silicon development environment Early Access Release
Arm Cortex-A720 AE Virtual SoC model

HW:
- **Arm Cortex A720 AE x14**
- **GIC V3**
- **Memory**
- **Virtual Storage**
- **Virtual Networking**
- **Pl011 UART**

SW:
- SOAFEE EWAOL Linux
- TFLite + Benchmarks

SOAFEE

Tools:
- PAVE360 Bench IDE for Metrics & Analysis

Benchmarks	Apps	Apps

SOAFEE EWAOL Linux

Web Console / REST API

System Configuration Console, … access

PAVE360 Bench IDE

Trace Configuration Metrics Visualization

Arm Cortex A720AE Virtual SoC

Cortex A720 AE x14	Memory	GIC V3	PL011	vNetworking	vStorage

ARM64 Host in the cloud

CPU | Memory | Storage | Networking | GPU | Devices

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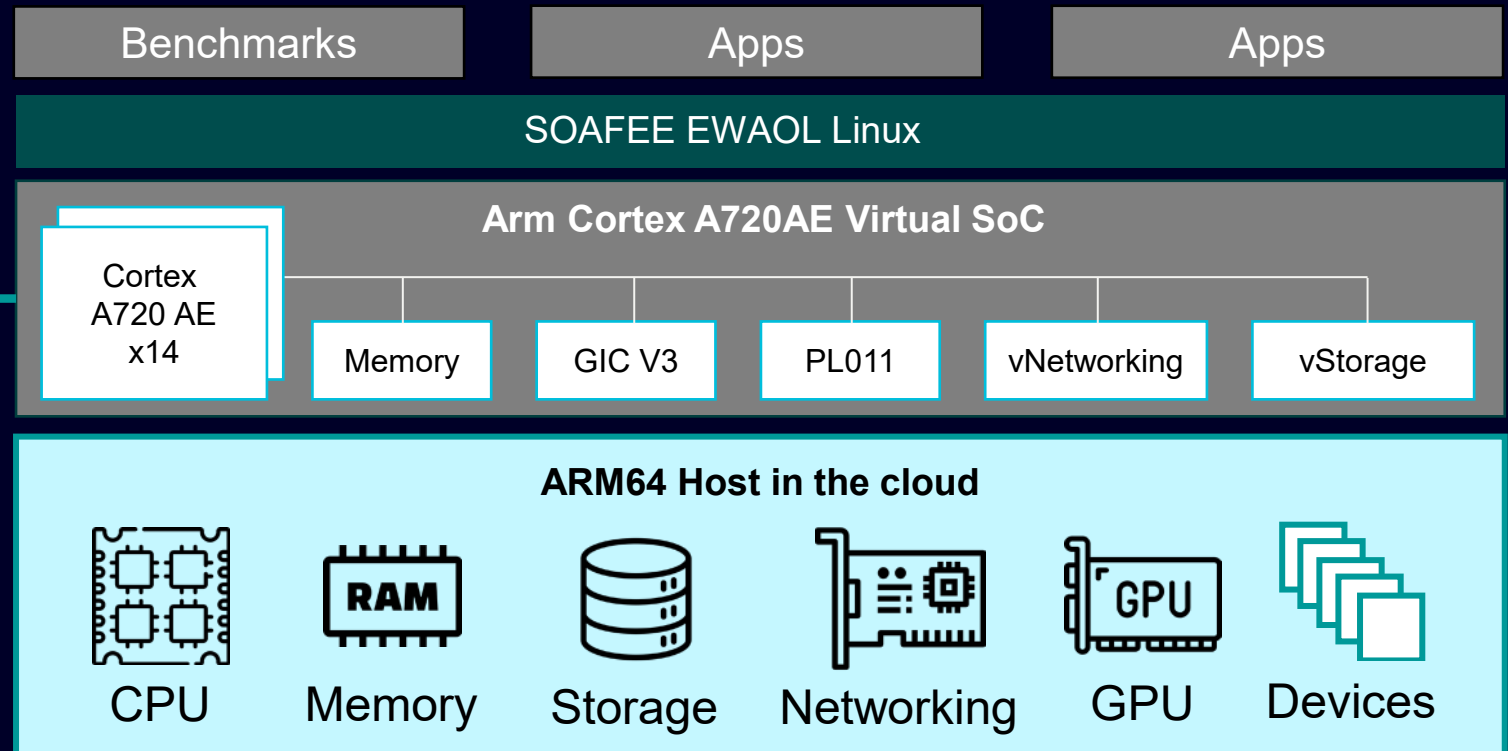
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Accelerated pre-silicon development environment demo

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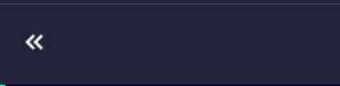
Home

Platform

Firmware

Serial Console

Welcome to Arm® Cortex-A720AE Virtual SoC Reference Platform

A web interface to bring up supported reference software environments for the Arm Cortex-A720AE Virtual SoC model.

> Get Platform Details

> Upload Firmware Images

> Connect to Serial Console

Help

Contact Us

Toggle Theme

About & legal information

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PAVE360
External hardware demo

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PAVE360 Multi Client Cloud Autonomous ADAS Reference Design
System-of-systems with real world stimulus optimized using cloud resources

PAVE360 front end

Client Login

PAVE360 Bench IDE

AWS Cloud Login

system config visualization metrics

Client 1

VIRTUAL

PLANNING
Route Planning Trajectory

ETH

Client 2

SENSE / ACTUATE

VIRTUAL
Vehicle / Sensors

ETH

Client 4

VIRTUAL

ADAS
AI Inferencing ARM Native

ETH

ETH

Client 3

VIRTUAL

PERCEPTION/ZONAL
Stereo Camera 3D Reconstruction

ETH

Client 5

VIRTUAL

Digital Cockpit
Dashboard

BACKPLANE

aws
AMD EPYC – x86_64

aws
AWS Graviton2 – ARM64

Client 6 "MARV"

EXTERNAL HARDWARE

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PAVE360 system-of-system clients in more depth

🔍 **Explore vision-based 3D detection algorithm for production**

Client 1

PLANNING

Route Planning Trajectory

Destination route planner and provides steering, acceleration and braking

Client 3

PERCEPTION ZONAL

Stereo Camera 3D Reconstruction

3D detection running in real-time on zonal controller. Without GPU or accelerators.

Client 4

PERCEPTION CENTRAL

ADAS
AI Inferencing Accelerated

3D detection DL model on central ADAS controller.

Deployable to accelerators: NPUs, GPU or CPU. Runs natively on Arm Graviton2.

☁ **aws**

AWS Graviton2 – ARM64

Client 2

SENSORS / ACTUATORS

CARLA Simulator
Vehicle / Sensors

CARLA driving simulator with environment and vehicle with sensors

Client 5

VISUAL

Digital Cockpit Dashboard

Digital cluster displaying ADAS and vehicle information

☁ **aws**

AMD EPYC – x86_64

Client 6

EXTERNAL HARDWARE

MARV

Validate steering, acceleration and braking actuators
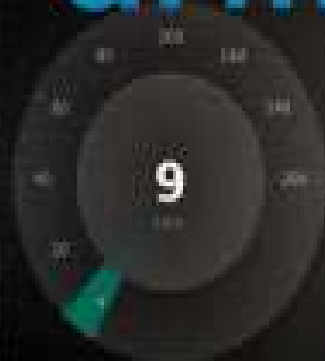
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PAVE360
SDV success story

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VOICES ON arm

TECH TALKS

Serial Console

Serial console for the Arm Cortex-A720AE Virtual SoC Reference Platform

Power: On

Disclaimer

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