# Arm in HPC

Brent Gorda
Sr. Director HPC

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# About Arm

## Arm does not:

- Build silicon
- Build supercomputers

## Arm Does:

- Research/Create IP
  - Mobile, IOT, networking, automotive
  - Servers (more on this later)
- SW & Toolchains
  - Arm HPC SW group (DSG)
  - Open Src: Linaro, OpenHPC

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# Arm's business model (HPC focus)

## Arm IP

Armv8.x and extensions, Neoverse IP roadmap
SVE Scalable Vector Extension

## Si Partners

## Platforms

## Deployments

Software ecosystem

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# Vanguard Astra by HPE

WORLD'S MOST POWERFUL ARM SUPERCOMPUTER

- 2,592 HPE Apollo 70 compute nodes
  - 5,184 CPUs, 145,152 cores, 2.3 PFLOPs (peak)
- Cavium Thunder-X2 ARM SoC, 28 core, 2.0 GHz
- Memory per node: 128 GB (16 x 8 GB DR DIMMs)
  - Aggregate capacity: 332 TB, 885 TB/s (peak)
- Mellanox IB EDR, ConnectX-5
  - 112 36-port edges, 3 648-port spine switches
- Red Hat RHEL for Arm
- HPE Apollo 4520 All–flash Lustre storage
  - Storage Capacity: 403 TB (usable)
  - Storage Bandwidth: 244 GB/s

# Recent Announcements

CRAY

**GW4, the Met Office, and Cray Power Up the Largest Arm-Based Supercomputer in Europe**

Email | Print Friendly | Share

November 11, 2018 13:00 ET | **Source:** Cray Inc; The GW4 Alliance; The Met Office

**"Isambard" Supercomputer to Be Used for Scientific Research and Building the Next Generation of Computing Technology in the Exascale Era**

Atos

Home / Newsroom / CEA acquires BullSequana supercomputer from Atos equipped with Marvell ThunderX2 Arm-based processors

## CEA acquires BullSequana supercomputer from Atos equipped with Marvell ThunderX2 Arm-based processors

**Paris, Bruyères-le-Châtel, November 8 2018**

Atos, a global leader in digital transformation, announces it will provide its BullSequana X1310, Atos' first Arm®-based supercomputer, to the CEA (French Alternative Energies and Atomic Energy Commission)'s Military Applications Division (CEA/DAM). The machine will include the new Marvell® ThunderX2® 64-bit processors.

## ARM IS THE NNSA'S NEW SECRET WEAPON

November 7, 2018 Nicole Hemsoth

few years ago, but the
key supercomputing sites
hopes of reaching efficiency
xpile simulations.

Data Centre • HPC

## HPE donates 3 mini-supercomputers to UK universities boning up on Arm

### Muscling in Arm supers message on road to exascale

By Chris Mellor 16 Apr 2018 at 15:35 12 SHARE

HPE is donating three Apollo mini-supercomputer clusters to a trio of UK universities to help build Arm supercomputing expertise and promote its Apollo gear.

The universities are the Edinburgh University's Edinburgh Parallel Computing Centre (EPCC), the University of Bristol, and the University of Leicester. Installation should be completed this summer 2018 as part of a three-year project called Catalyst UK.

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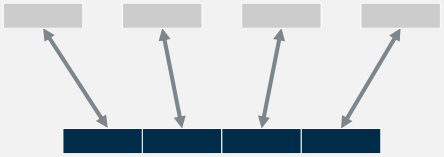
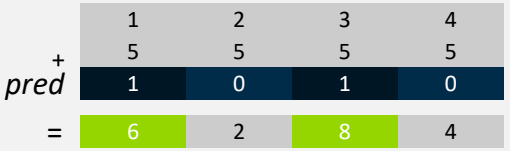
# SVE is Arm's next generation SIMD ISA

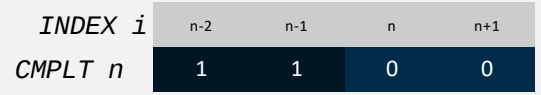


Gather-load
and scatter-store

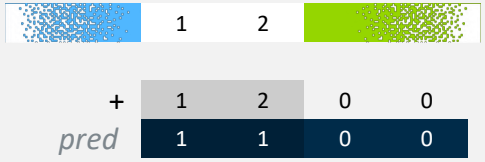



Per-lane predication

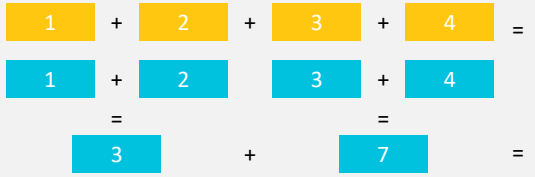
```
for (i = 0; i < n; ++i)
```




Predicate-driven loop
control and management




Vector partitioning and
software-managed speculation




Extended floating-point
horizontal reductions

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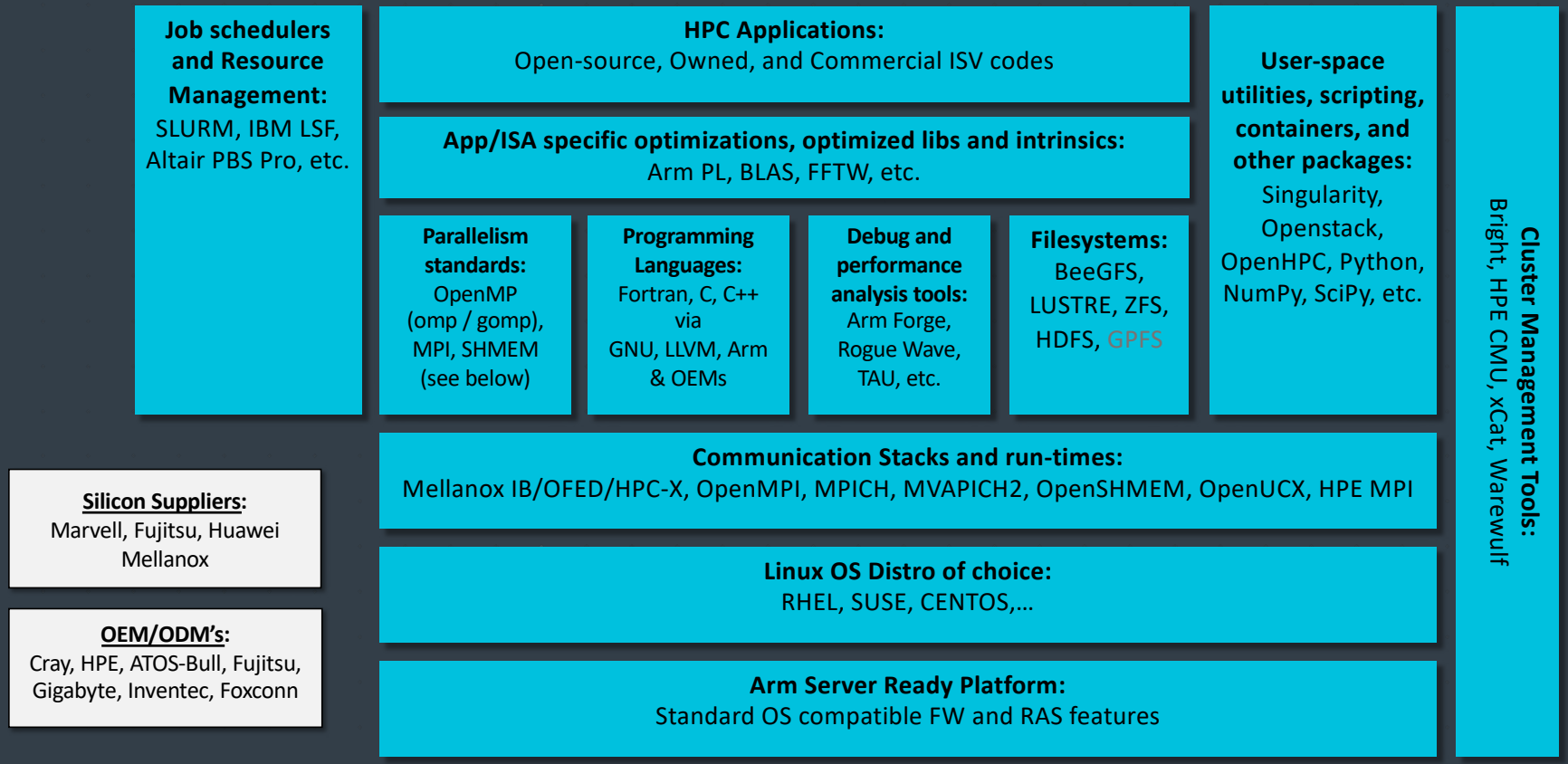
# Arm HPC Software Ecosystem




**Silicon Suppliers:**
Marvell, Fujitsu, Huawei Mellanox

**OEM/ODM's:**
Cray, HPE, ATOS-Bull, Fujitsu, Gigabyte, Inventec, Foxconn

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# Porting of HPC apps to the Arm platforms

- The software just works – porting in 2 days is the common experience

| | | | | |
|---|---|---|---|---|
| GROMACS | LAMMPS | CESM2 | MrBayes | Bowtie |
| NAMD | AMBER | Paraview | SIESTA | UM |
| WRF | Quantum ESPRESSO | VASP | MILC | GEANT4 |
| OpenFOAM | GAMESS | VisIT | DL-Poly | NEMO |
| BLAST | NWCHEM | Abinit | BWA | QMCPACK |

Build recipes online at https://gitlab.com/arm-hpc/packages/wikis/home

Chem/Phys | Weather | CFD | Visualization | Genomics

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# Arm HPC Community – Arm.com/hpc

## Communication Portals

- Arm.com HPC resources
- developer.arm.com/HPC (HPC Ecosystem Landing page)
- community.arm.com/tools/HPC (HPC Blogs, Forum)

Arm HPC User Group Community

- Gitlab HPC Packages Wiki (software ecosystem)
- Arm-HPC @ Groups.IO  (<=NEW)

Supporting Arm HPC Community end-users and developers.

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# Preparing for the next wave of computing

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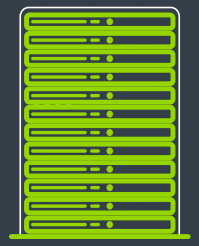

**40M**

Servers

**400EB**

Monthly Bandwidth

**1B**

HD Video Sensors

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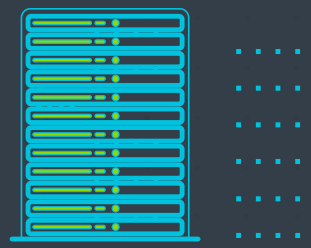

HPC

IOT, embedded, handheld

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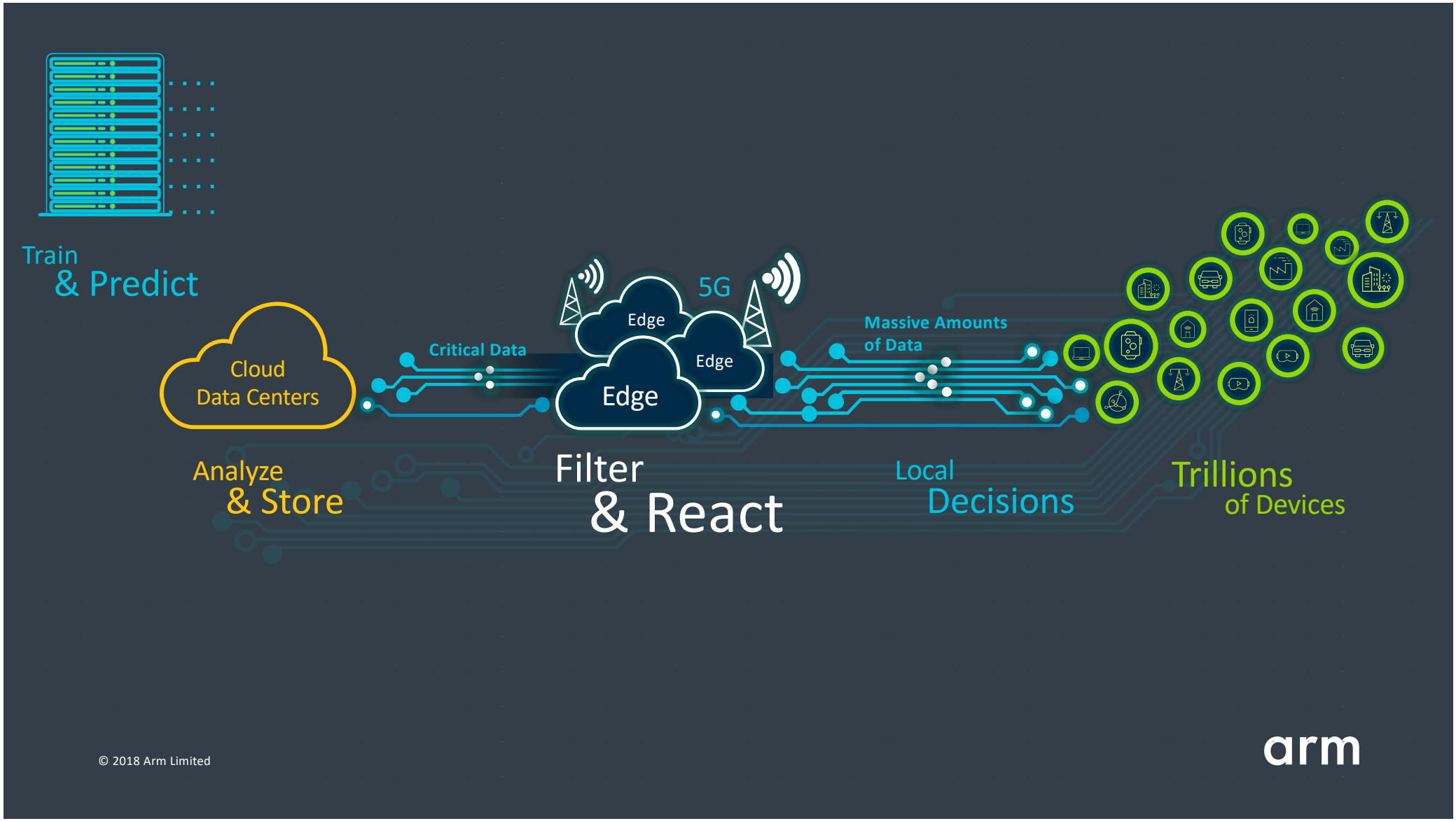


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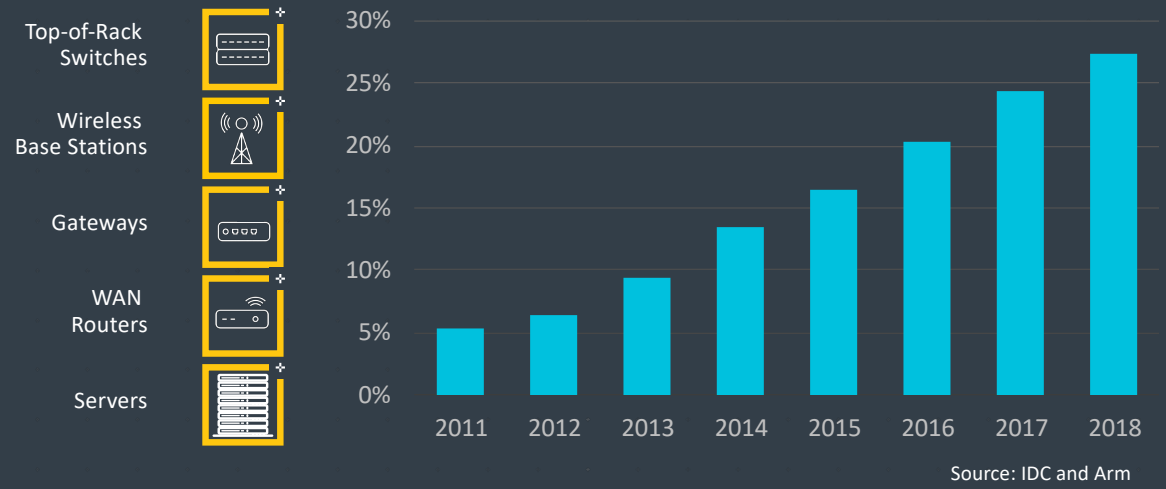


## Arm Based Processors

## #1 Market Share

within the Infrastructure space

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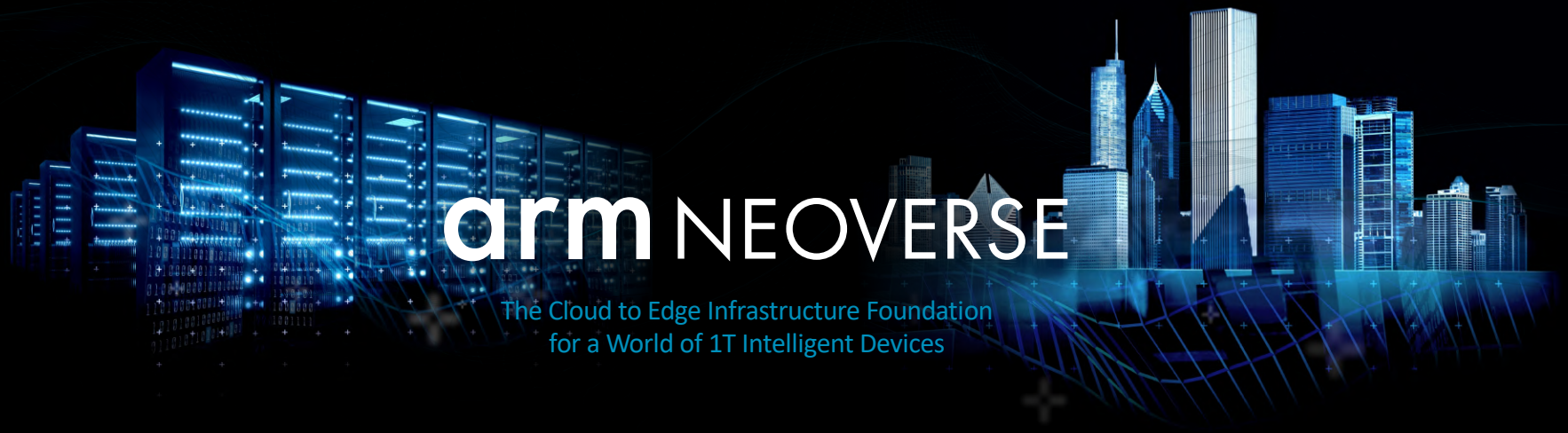

# arm NEOVERSE

The Cloud to Edge Infrastructure Foundation
for a World of 1T Intelligent Devices

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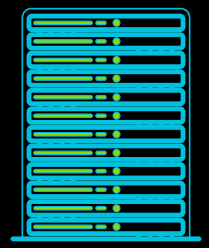
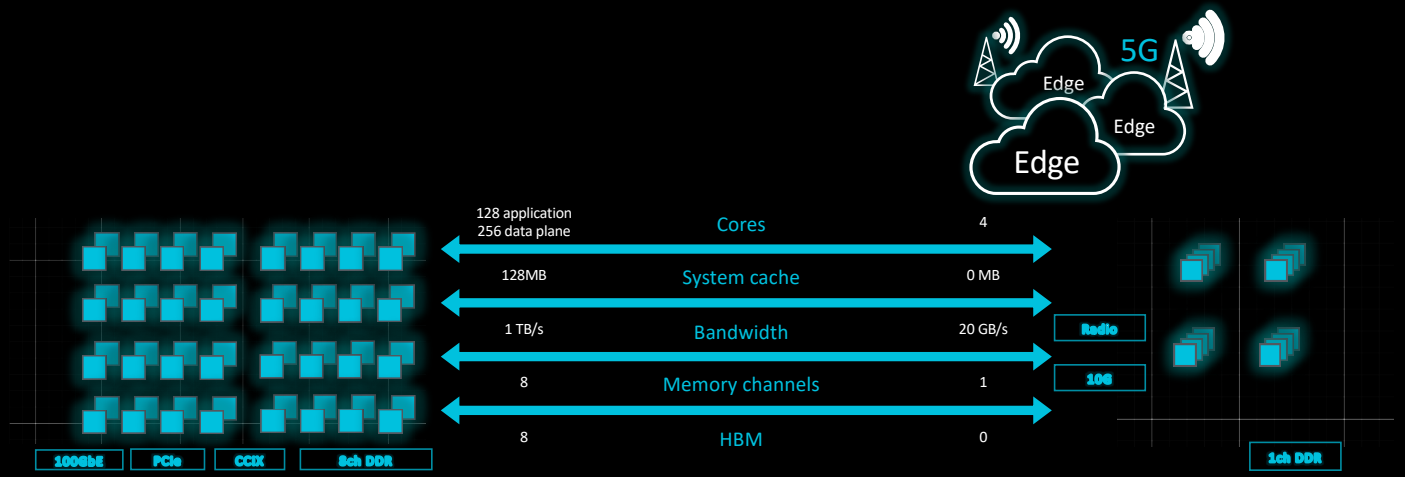
# Scalable from Hyperscale to the Edge



HPC

Cloud
Data Centers

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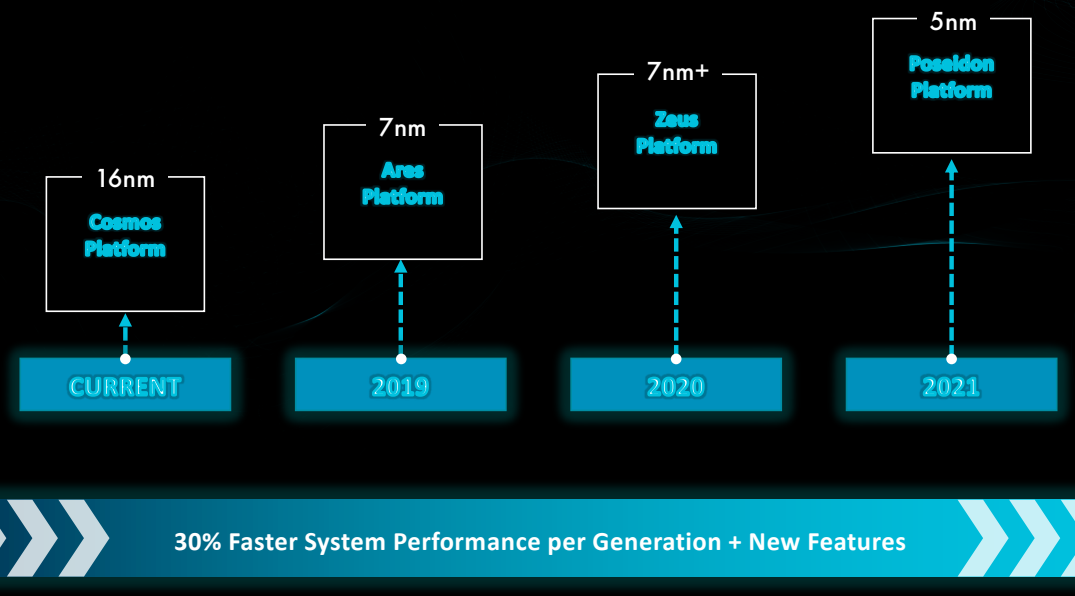
## Infrastructure Roadmap Leverages Process Nodes

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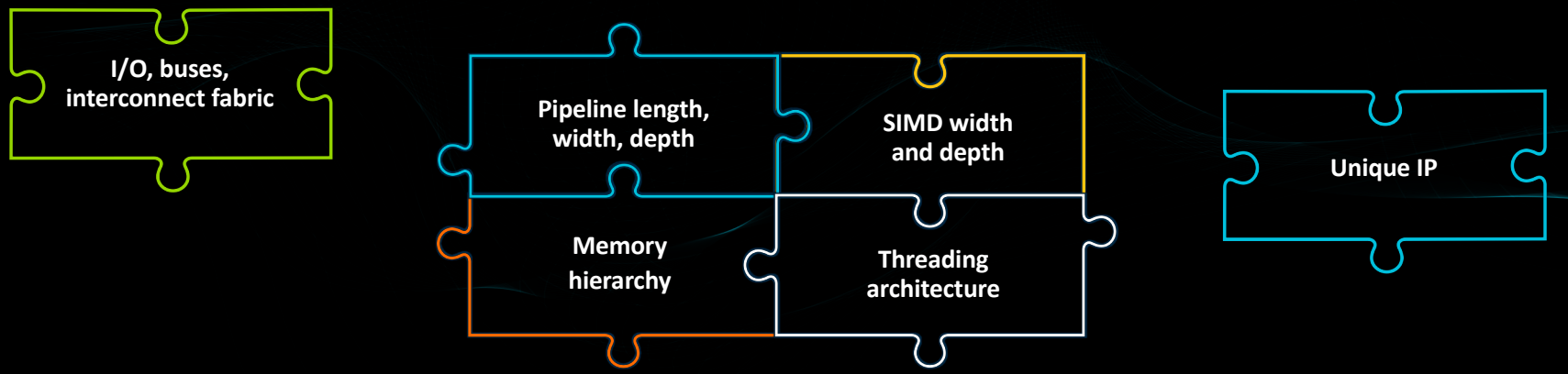
# World-class solutions from Neoverse Architecture Partners

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# World-class Neoverse Ecosystem

**Silicon**

tsmc, MARVELL, HISILICON, AMPERE, BROADCOM, Mellanox TECHNOLOGIES, SAMSUNG, Qualcomm, FUJITSU, MEDIATEK, GLOBALFOUNDRIES, XILINX, NXP, achronix SEMICONDUCTOR CORPORATION, HUAXINTONG 华芯通, BLUWIRELESS, cadence, SYNOPSYS, Mentor

**Cloud**

annapurnalabs an amazon company, Alibaba.com, Bai du 百度, Tencent Cloud, Azure, packet

**Platforms**

HUAWEI, Hewlett Packard Enterprise, CISCO, ERICSSON, NOKIA, ZTE中兴, Inventec, Uit创新科, GIGABYTE, PEGATRON, Telco Systems A BATM Company, ENEA

**Operators**

SoftBank, vodafone, EE, orange, Sprint

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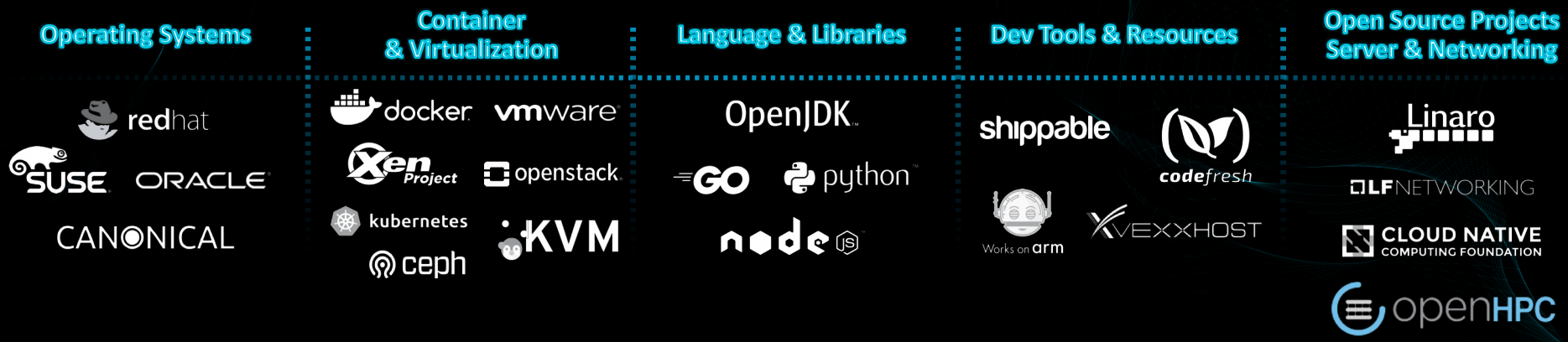
# Endorsed by a Broad and Growing Open Source Ecosystem

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# AWS Graviton

AWS Insider.net

THE INDEPENDENT RESOURCE FOR AMAZON WEB SERVICES

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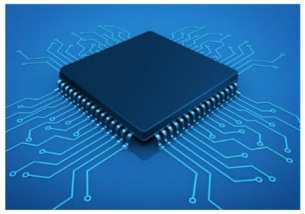
## With Arm-Based 'Graviton' Chips, AWS Takes Aim at Intel

**By John K. Waters ▪ 11/29/2018**



Amazon Web Services (AWS) announced some important news at this week's re:Invent conference for datacenter managers watching the rapidly evolving Arm processor market.

The company's new Arm-based server processor, dubbed AWS Graviton, is now **immediately available**.

## AWS Expands Compute Instances With Graviton A1 And Makes Arm Neoverse Real At re:Invent

**Moor Insights and Strategy** Contributor

Enterprise & Cloud

*Straight talk from Moor Insights & Strategy tech industry analysts*

POST WRITTEN BY

**Matt Kimball**

**Matt Kimball** is a senior datacenter analyst covering servers and storage at Moor Insights & Strategy

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# AWS Graviton announcement

## Introducing Elastic Fabric Adapter

Posted On: Nov 26, 2018

Elastic Fabric Adapter (EFA) is a network interface for Amazon EC2 instances that enables customers to run HPC applications requiring high levels of inter-instance communications, like computational fluid dynamics, weather modeling, and reservoir simulation, at scale on AWS. It uses a custom-built operating system bypass technique to enhance the performance of inter-instance communications, which is critical to scaling HPC applications. With EFA, HPC applications using popular HPC technologies like Message Passing Interface (MPI) can scale to thousands of CPU cores. EFA supports industry-standard libfabric APIs, so applications that use a supported MPI library can be migrated to AWS with little or no modification.

EFA is available as an optional EC2 networking feature that you can enable on C5n.9xl, C5n.18xl, and P3dn.24xl instances. Additional instance types will be supported in the coming months.

## Introducing Amazon FSx for Lustre

Posted On: Nov 28, 2018

Amazon FSx for Lustre is a fully managed file system that is optimized for compute-intensive workloads, such as high-performance computing and machine learning. You can leverage the scale and performance of FSx for Lustre to process your file-based data sets from Amazon S3 or other durable data stores.

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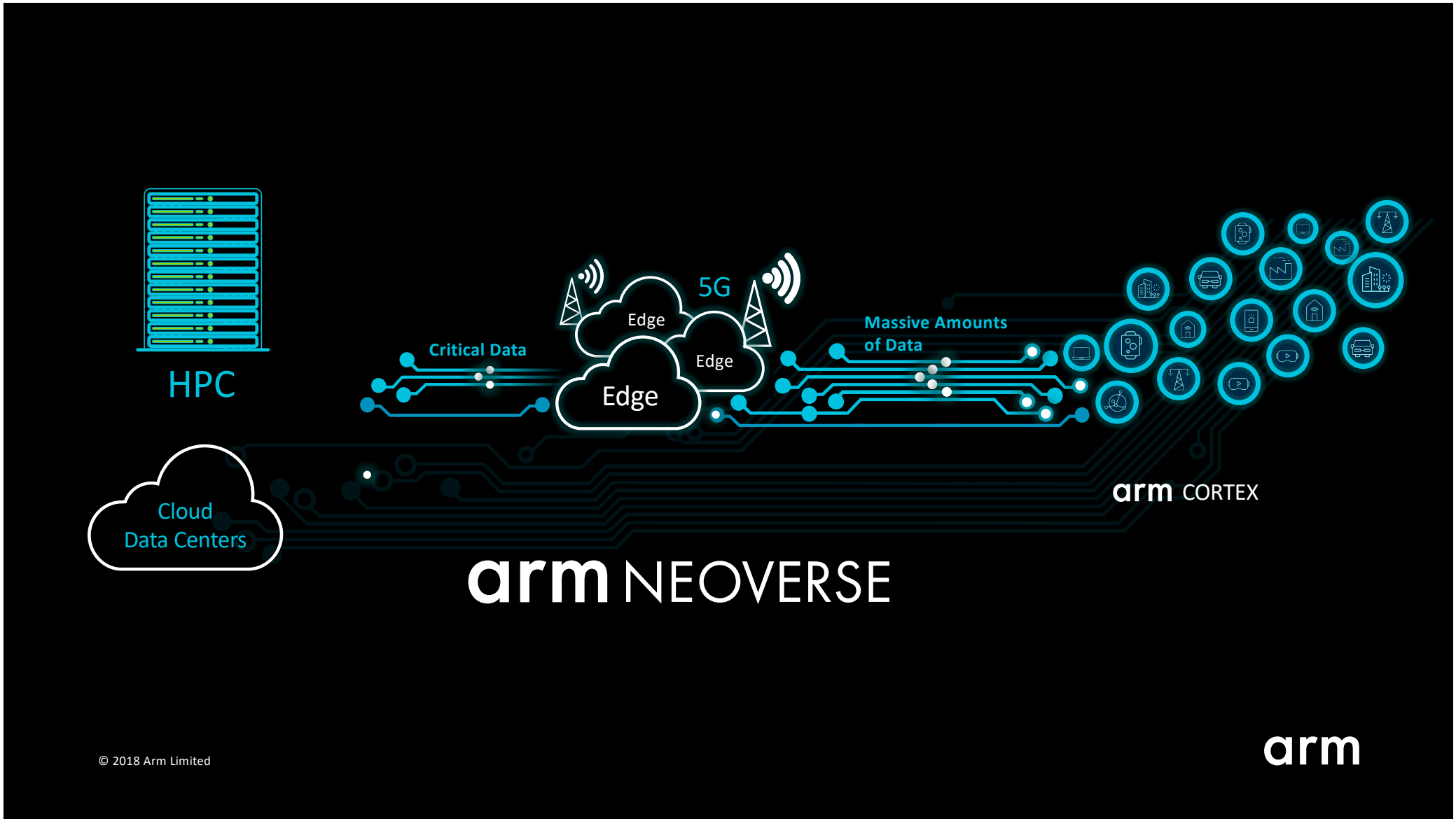


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# Thank you

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