

# Arm in HPC

Toshinori Kujiraoka  
Sales Manager, APAC HPC Tools

Arm



# Arm Technology Connects the World



## Arm in IOT

21 billion chips in the past year

Mobile/Embedded/IoT/  
Automotive/GPUs/Servers

## Partnership is key

**We design IP, we do not  
manufacture chips**

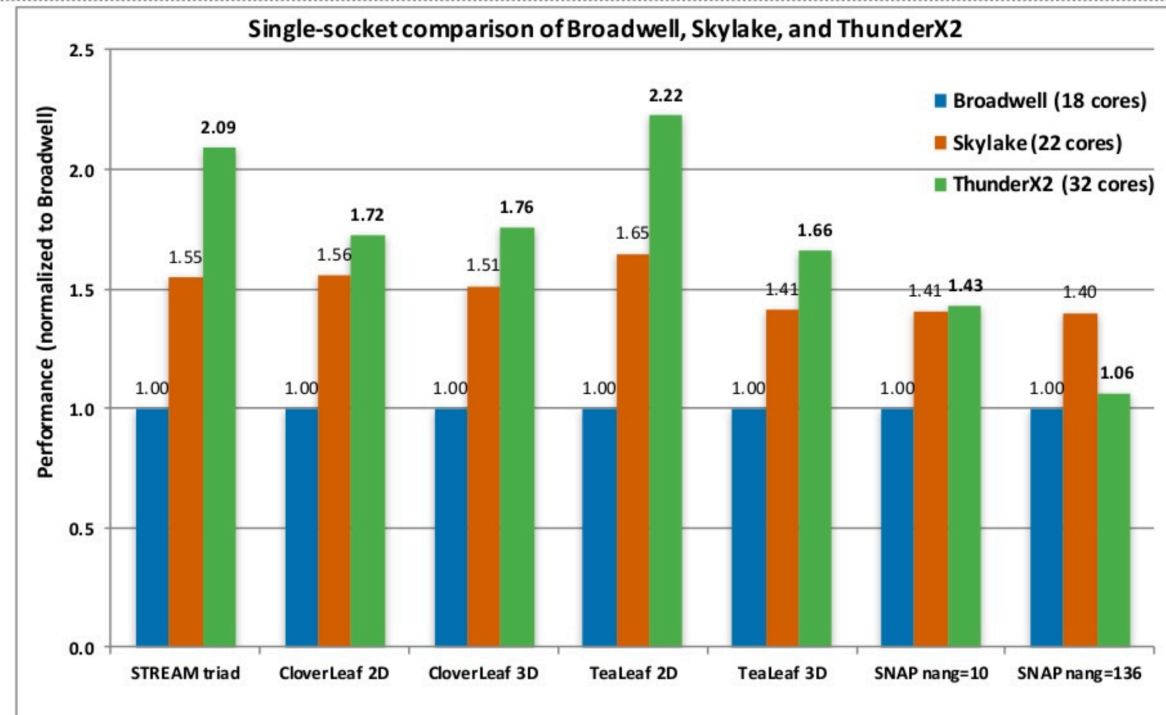
**Partners build products  
for their target markets**

## Choice is good

One size is not always the  
best fit for all

HPC is a great fit for  
co-design and  
collaboration

# Data center-class performance



@simonmcs <http://gw4.ac.uk/isambard/>

7

bristol.ac.uk



# Arm's business model (HPC focus)

## Arm IP

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

## Si Partners



## Platforms



## Deployments





# 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



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

f t in G+ p | @ 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**



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



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.

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



# Arm HPC Software Ecosystem



**Job schedulers and Resource Management:**  
SLURM, IBM LSF, Altair PBS Pro, etc.

**HPC Applications:**  
Open-source, Owned, and Commercial ISV codes

**App/ISA specific optimizations, optimized libs and intrinsics:**  
Arm PL, BLAS, FFTW, etc.

**Parallelism standards:**  
OpenMP (omp / gomp), MPI, SHMEM (see below)

**Programming Languages:**  
Fortran, C, C++ via GNU, LLVM, Arm & OEMs

**Debug and performance analysis tools:**  
Arm Forge, Rogue Wave, TAU, etc.

**Filesystems:**  
BeeGFS, Lustre, ZFS, HDFS, GPFS

**User-space utilities, scripting, containers, and other packages:**  
Singularity, Openstack, OpenHPC, Python, NumPy, SciPy, etc.

**Cluster Management Tools:**  
Bright, HPE CMU, xCat, Warewulf

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

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

**Communication Stacks and run-times:**  
Mellanox IB/OFED/HPC-X, OpenMPI, MPICH, MVAPICH2, OpenSHMEM, OpenUCX, HPE MPI

**Linux OS Distro of choice:**  
RHEL, SUSE, CENTOS,...

**Arm Server Ready Platform:**  
Standard OS compatible FW and RAS features

# Porting of HPC apps to the Arm platforms

➤ The platform 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



# Arm HPC Community – [Arm.com/hpc](https://arm.com/hpc)

## Communication Portals

- [Arm.com HPC resources](https://arm.com/hpc)
- [developer.arm.com/HPC](https://developer.arm.com/HPC) (HPC Ecosystem Landing page)
- [community.arm.com/tools/HPC](https://community.arm.com/tools/HPC) (HPC Blogs, Forum)

## Arm HPC User Group Community

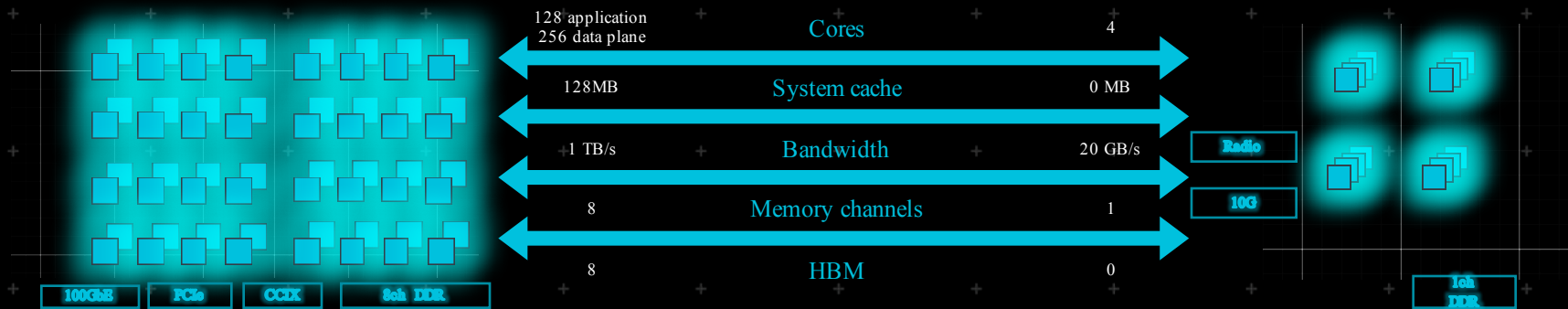
- [Gitlab HPC Packages Wiki](#) (software ecosystem)
- [Arm-HPC @ Groups.IO](#) (<=NEW)

Supporting Arm HPC Community end-users and developers.

# arm NEOVERSE

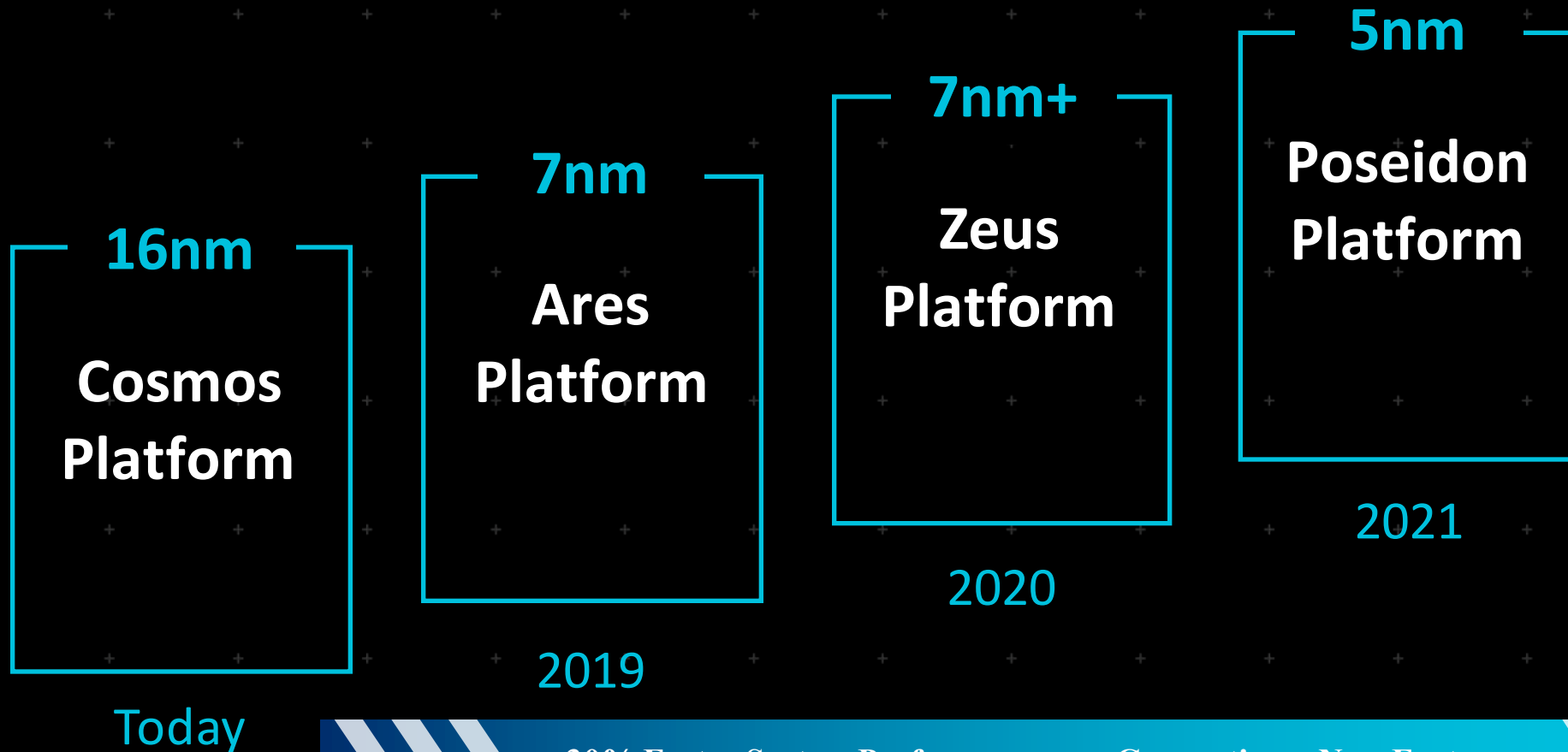
## Infrastructure Roadmap

### Leverages Process Nodes

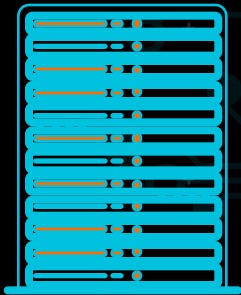




Each generation brings faster performance and new infrastructure specific features



30% Faster System Performance per Generation + New Features



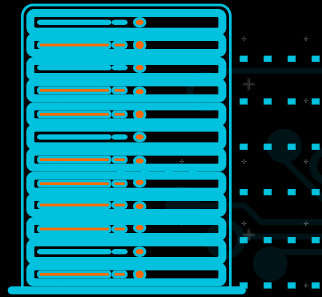
HPC

arm CORTEX

arm NEOVERSE

Cloud  
Data Centers

Analyze  
& Store

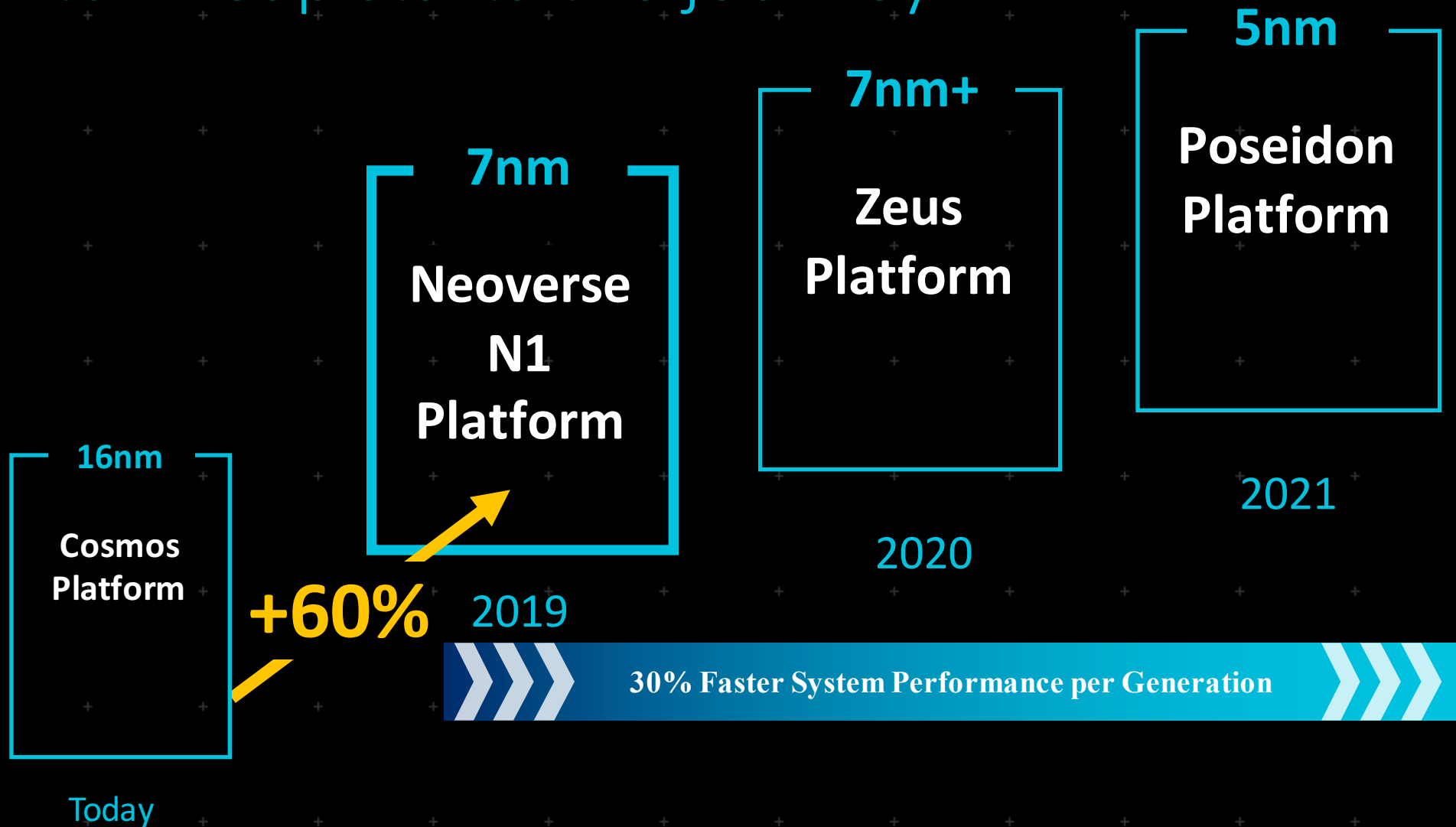


Train  
& Predict





# Quantum leap starts the journey!



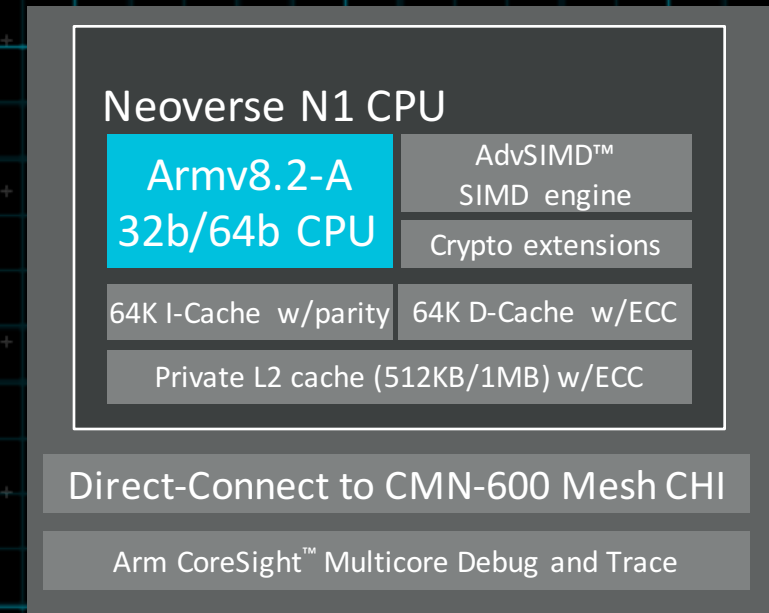
Special thanks to Ashley and her team

**arm** NEOVERSE

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

Thank You!

- System performance focus
  - I-cache coherency
  - 1MB private L2 cache
  - Streamlined Direct-Connect to N1 interconnect
- Fully Armv8.2 compliant
  - Server-class RAS system support
  - Infrastructure-specific architecture features
- Market leading power efficiency
  - +30% over Cosmos CPU (iso-process)



30%



better performance / Watt



News

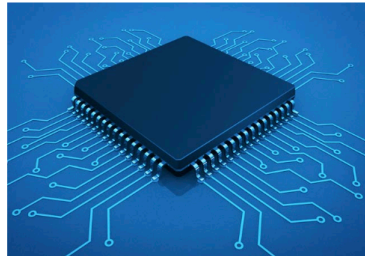


# With Arm-Based 'Graviton' Chips, AWS Takes Aim at Intel

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



# 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.