



Arm in HPC

Brent Gorda
Sr. Director HPC

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

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

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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

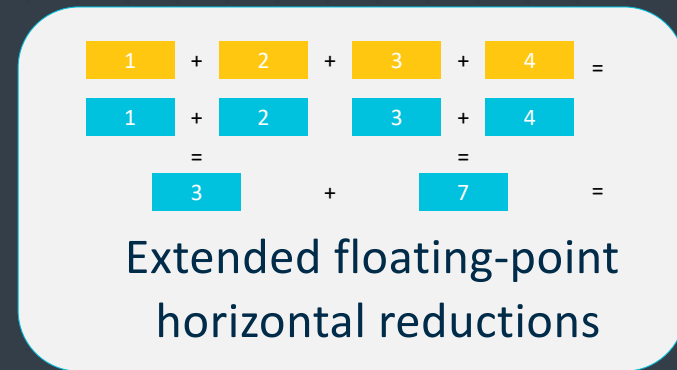
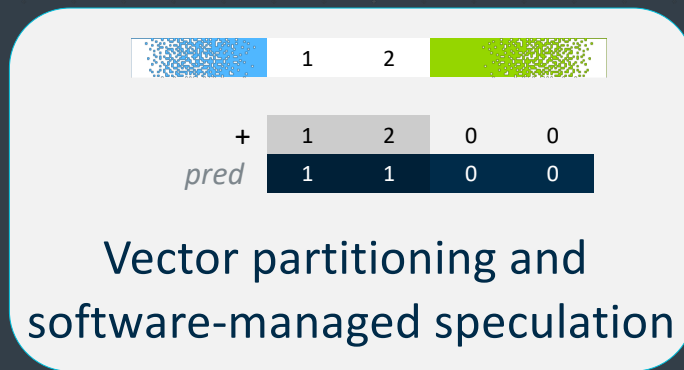
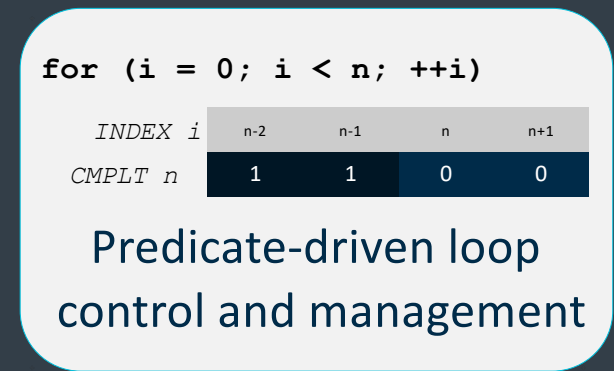
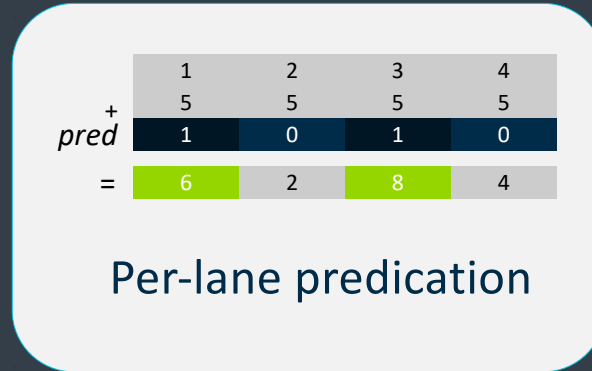
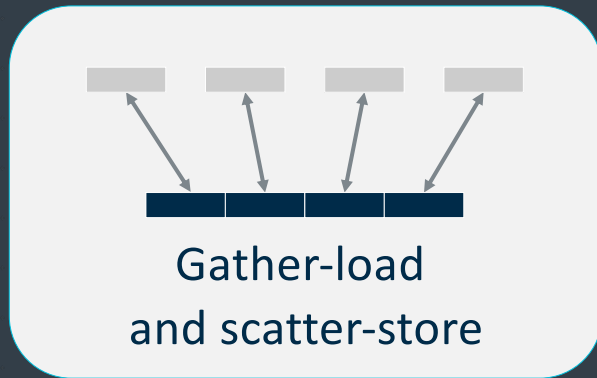
12 SHARE

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 pile simulations.

SVE is Arm's next generation SIMD ISA



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

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

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

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 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

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

Communication Portals

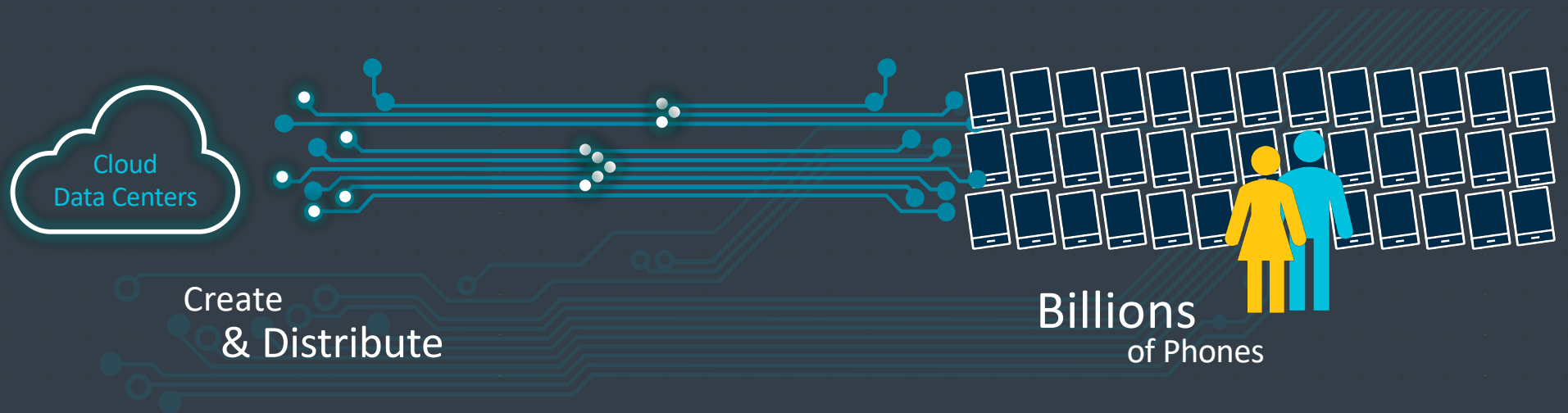
- [Arm.com HPC resources](https://arm.com/hpc)
- developer.arm.com/HPC (HPC Ecosystem Landing page)
- community.arm.com/tools/HPC (HPC Blogs, Forum)

Arm HPC User Group Community

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

Supporting Arm HPC Community end-users and developers.

Preparing for the next wave of computing





40M

Servers



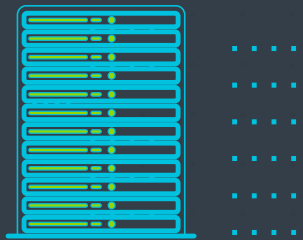
400EB

Monthly Bandwidth



1B

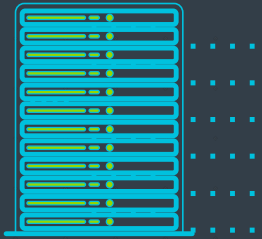
HD Video Sensors



HPC



IOT, embedded, handheld

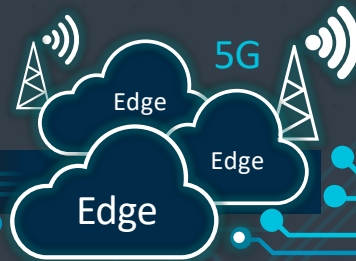


Train
& Predict



Analyze
& Store

Critical Data



Filter
& React

Massive Amounts
of Data

Local
Decisions

Trillions
of Devices



Top-of-Rack
Switches



Wireless
Base Stations



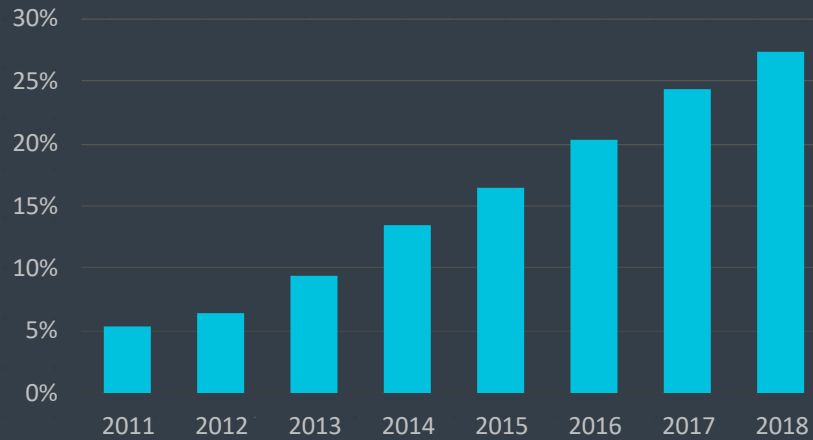
Gateways



WAN
Routers



Servers



Source: IDC and Arm

Arm Based Processors
#1 Market Share
within the Infrastructure
space

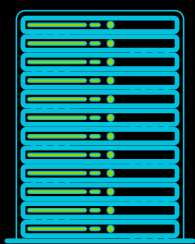




arm NEOVERSE

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

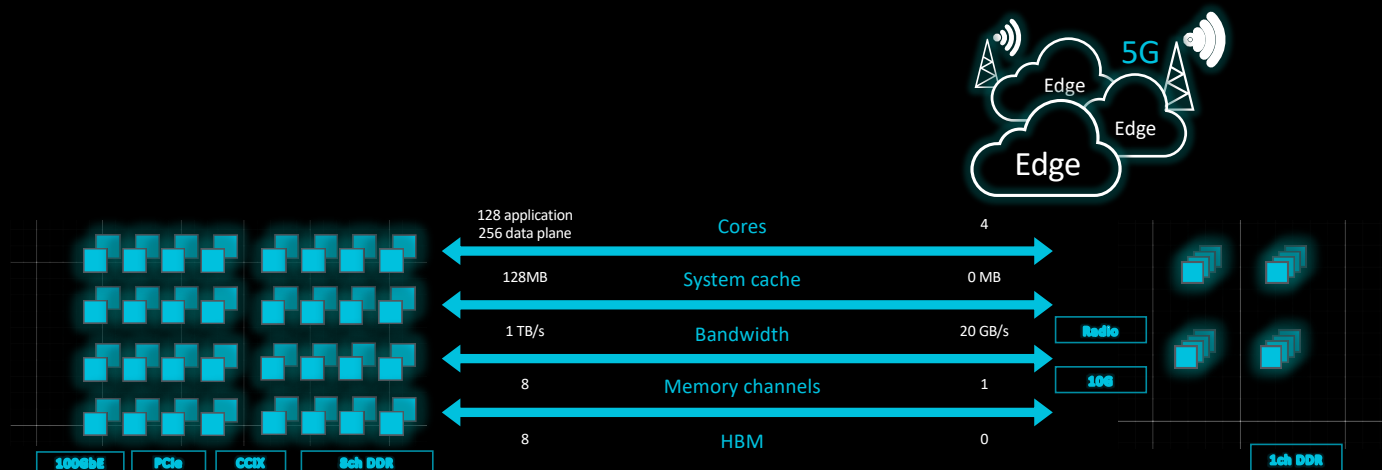
Scalable from Hyperscale to the Edge



HPC

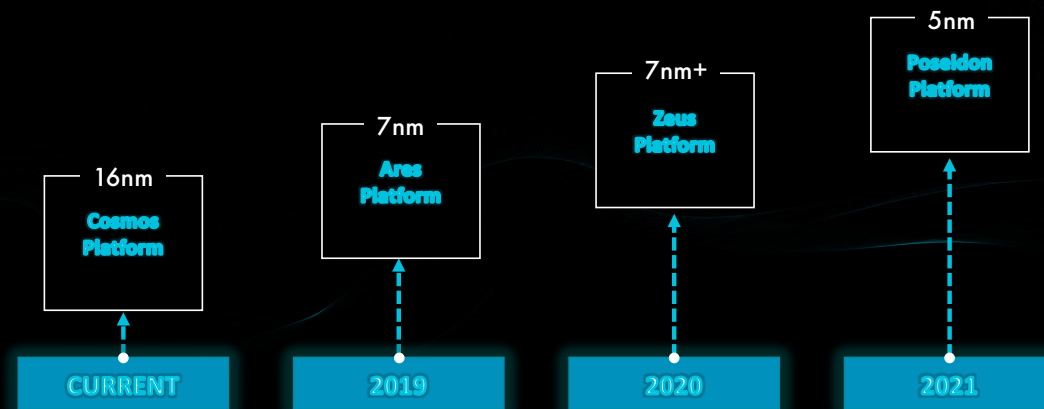


Cloud Data Centers



arm NEOVERSE

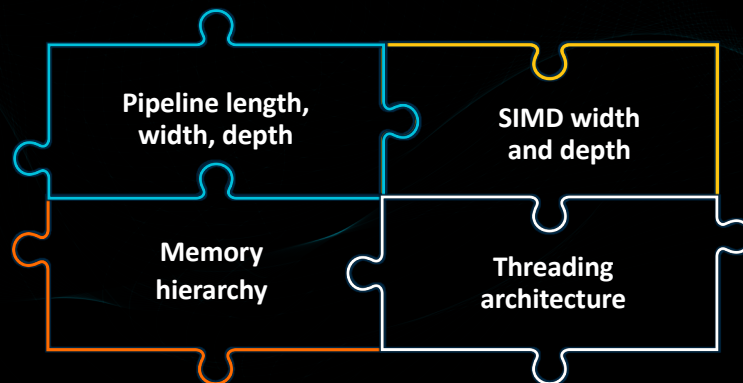
Infrastructure Roadmap
Leverages Process Nodes



30% Faster System Performance per Generation + New Features

World-class solutions from Neoverse Architecture Partners

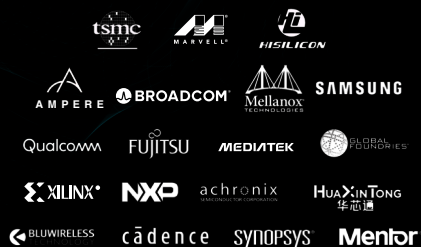
I/O, buses,
interconnect fabric



Unique IP

World-class Neoverse Ecosystem

Silicon



Cloud



Platforms

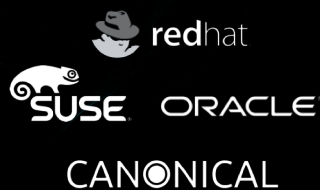


Operators



Endorsed by a Broad and Growing Open Source Ecosystem

Operating Systems



Container & Virtualization



Language & Libraries




Dev Tools & Resources



Open Source Projects Server & Networking



AWS Graviton



THE INDEPENDENT RESOURCE FOR
AMAZON WEB SERVICES

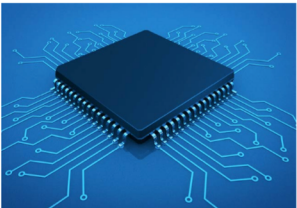
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With Arm-Based 'Graviton' Chips, AWS Takes Aim at Intel


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



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.

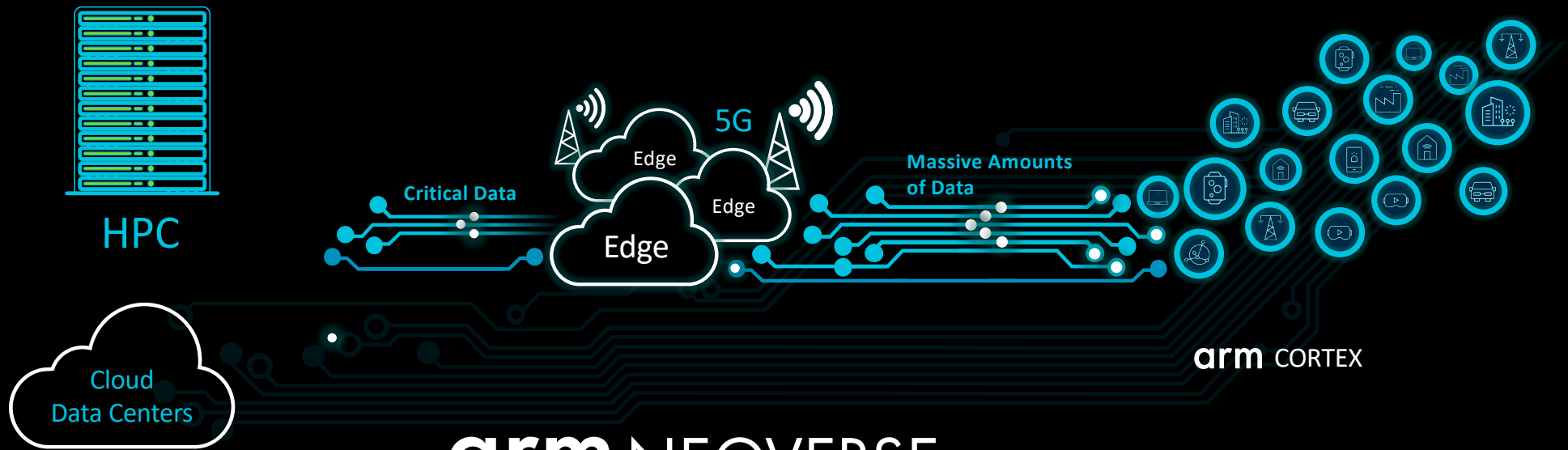
EFA is available as an optional EC2 networking feature that you can enable on C5n.9xl, C5n.18xl, and P3dn.24xl instances. Additional instance types will be supported in the coming months.



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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Thank you

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Arm

