

# Arm in HPC

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# Arm Technology Connects the World



## **Arm is everywhere**

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

# Arm's business model (HPC focus)

## Arm IP

Armv8.x and extensions, e.g. SVE  
Neoverse IP roadmap

## Si Partners

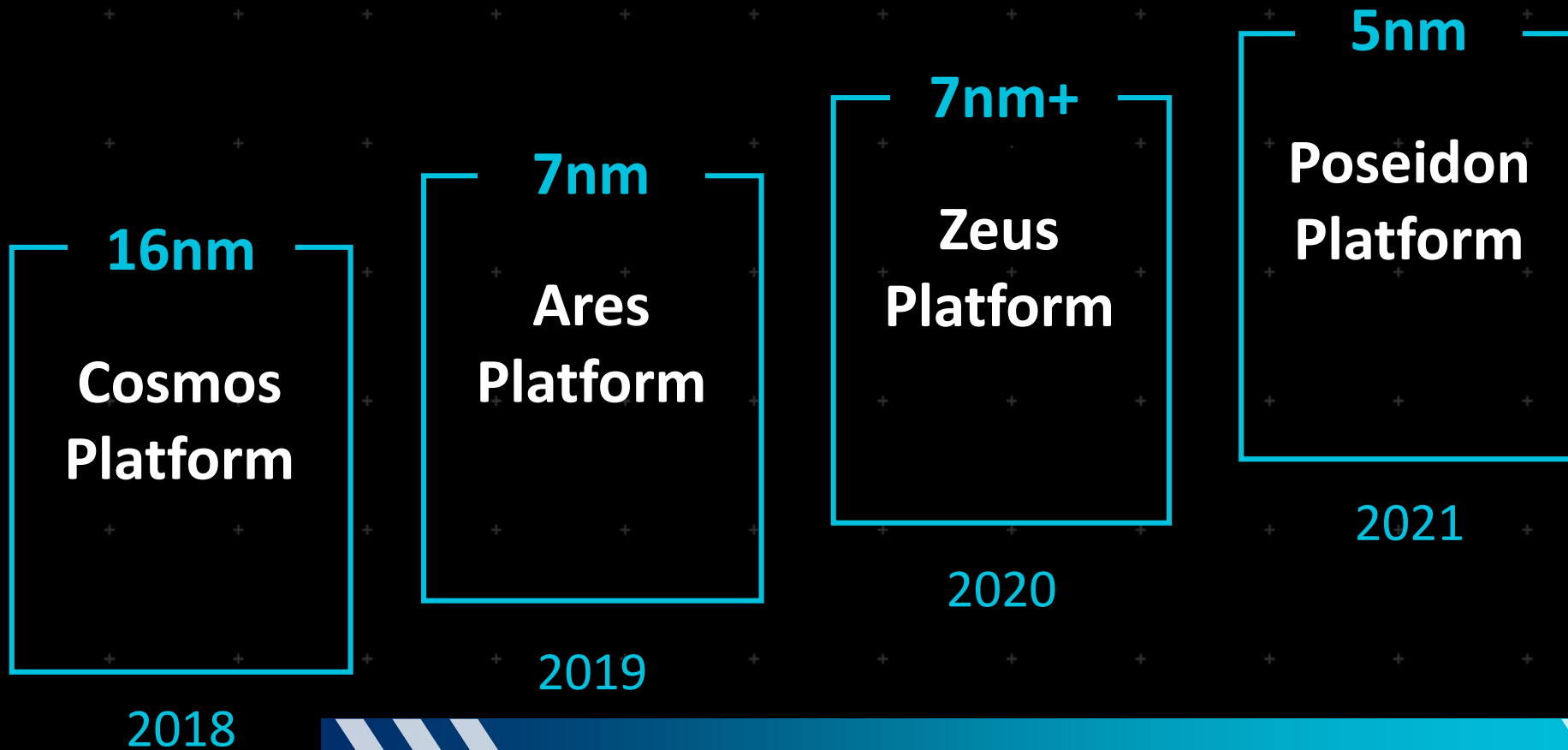


## Platforms Deployments



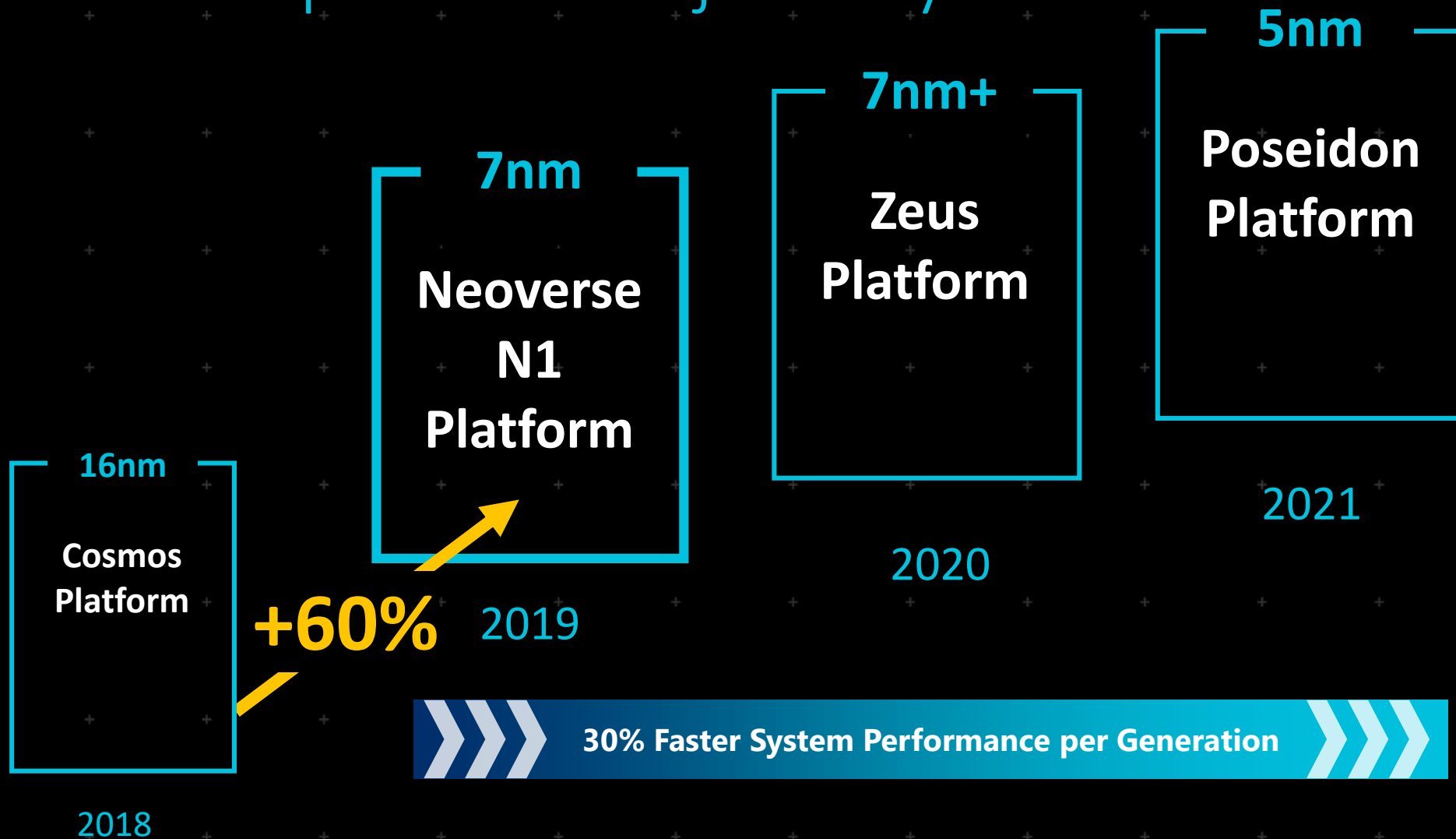
Software ecosystem & support

Each generation brings faster performance and new infrastructure specific features



30% Faster System Performance per Generation + New Features

# Quantum leap starts the journey!





# 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

# Arm Forge Professional

A cross-platform toolkit for debugging and profiling HPC applications



Commercially supported  
by Arm



Fully Scalable



Very user-friendly

## State-of-the art **debugging** and **profiling** capabilities

- Powerful and in-depth error detection mechanisms
- Memory debugging
- Sampling-based profiler to identify and understand bottlenecks
- Available at any scale (from serial to petaflop applications)

## Easy to use

- Unique capabilities to simplify remote interactive sessions
- Innovative approach to present quintessential information to users

## The de-facto standard for HPC development

- Available on majority of the Top500 machines in the world
- Fully supported by Arm on: x86, IBM Power, Nvidia GPUs, etc.

# Vanguard Astra by HPE

#203 in the Top500 @ SC18, #38 on HPCG list

- 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
- 8 Memory channels/socket
  - 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







# arm NEOVERSE

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

Thank You!