Centrum spoločných činností SAV, v. v. i.

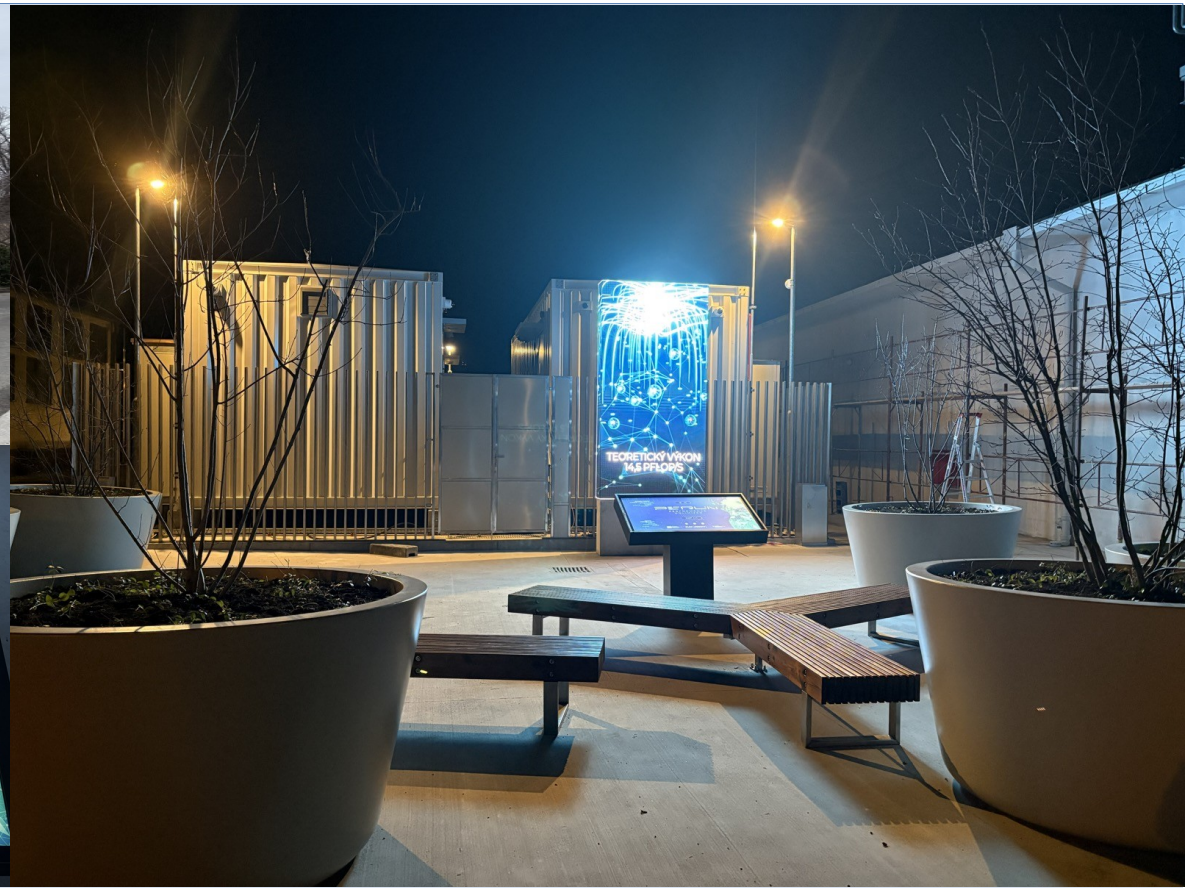
Výpočtové stredisko SAV

Supercomputer PERUN

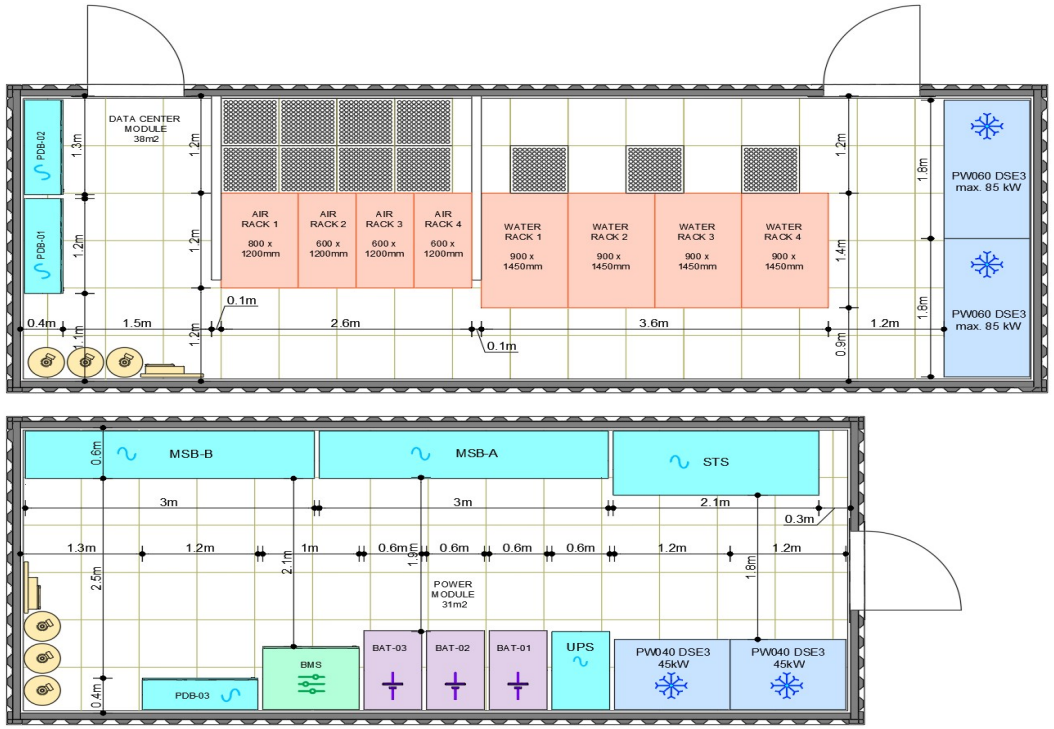
VSSAV, Bratislava, 27/03/2026
(FH)

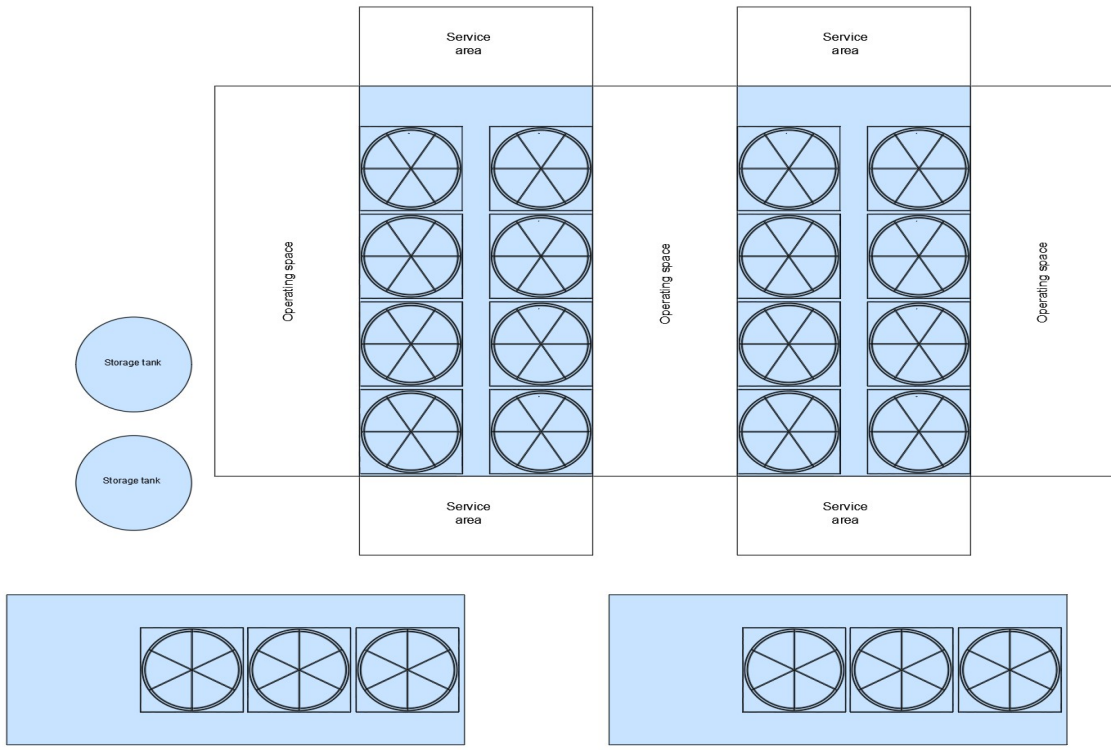
PERUN: COMPLEX (1/2)

?



PERUN: COMPLEX (2/2)





PERUN: SUPERCOMPUTERS IN NUMBERS (1/2)

- **PERUN**
- 60 CPU nodes (cn[001-060])
- 76 GPU nodes (gn[001-076])
- 200Gb NDR Infiniband
- 19200 CPU cores (x86_64)
- 21888 CPU cores (aarch64)
- 304 GPU accelerators (NVIDIA Hopper)
- 125 TB DDR RAM
- 30TB HBM RAM
- ~17 PFlops Rpeak

- **DEVANA**
- 140 CPU nodes (n)
- 8 GPU nodes (n)
- 100Gb HDR Infiniband
- 9472 CPU cores (x86_64)

- 32 GPU accelerators (NVIDIA Ampere)
- 38TB DDR RAM
- 1TB HBM RAM
- ~0.8 PFlops Rpeak

PERUN: SUPERCOMPUTERS IN NUMBERS (2/2)

TOP500

4	**JUPITER Booster** - BullSequana XH3000, GH Superchip 72C 3GHz, NVIDIA GH200 Superchip, Quad-Rail NVIDIA InfiniBand NDR200, RedHat Enterprise Linux, EVIDEN EuroHPC/FZJ Germany	4,801,344	1,000.00	1,226.28	15,794
	...				
125	**PERUN (Slovak Academy of Sciences (SAV))** - BullSequana XH3000, GH Superchip 72C 3GHz, NVIDIA GH200 Superchip, Quad-Rail NVIDIA InfiniBand NDR200, RedHat Enterprise Linux, EVIDEN EVIDEN France	62,016	14.04	18.00	
	...				
162	**PERUN** - HPE ProLiant Compute XD685, AMD EPYC 9535 64C 2.4GHz, NVIDIA H200 SXM5 141 GB, Infiniband NDR400, Rocky Linux 9.5, HPE Technical University of Kosice Slovakia	30,784	10.21	11.43	200

GREEN500

1	420	**KAIROS** - BullSequana XH3000, GH Superchip 72C 3GHz, NVIDIA GH200 Superchip, Quad-Rail NVIDIA InfiniBand NDR200, RedHat Enterprise Linux, EVIDEN CALMIP / University of Toulouse - CNRS France	13,056	3.05	46	73.282
2	171	**ROMEO-2025** - BullSequana XH3000, Grace Hopper Superchip 72C 3GHz, NVIDIA GH200 Superchip, Quad-Rail NVIDIA InfiniBand NDR200, Red Hat Enterprise Linux, EVIDEN ROMEO HPC Center - Champagne-Ardenne France	47,328	9.86	160	70.912
3	225	**Levante GPU extension** - BullSequana XH3000, GH Superchip 72C 3GHz, NVIDIA GH200 Superchip, Quad-Rail NVIDIA InfiniBand NDR200, RedHat Enterprise Linux, EVIDEN DKRZ - Deutsches Klimarechenzentrum	35,904	6.75	110	69.426

PERUN: MANAGEMENT MODULE

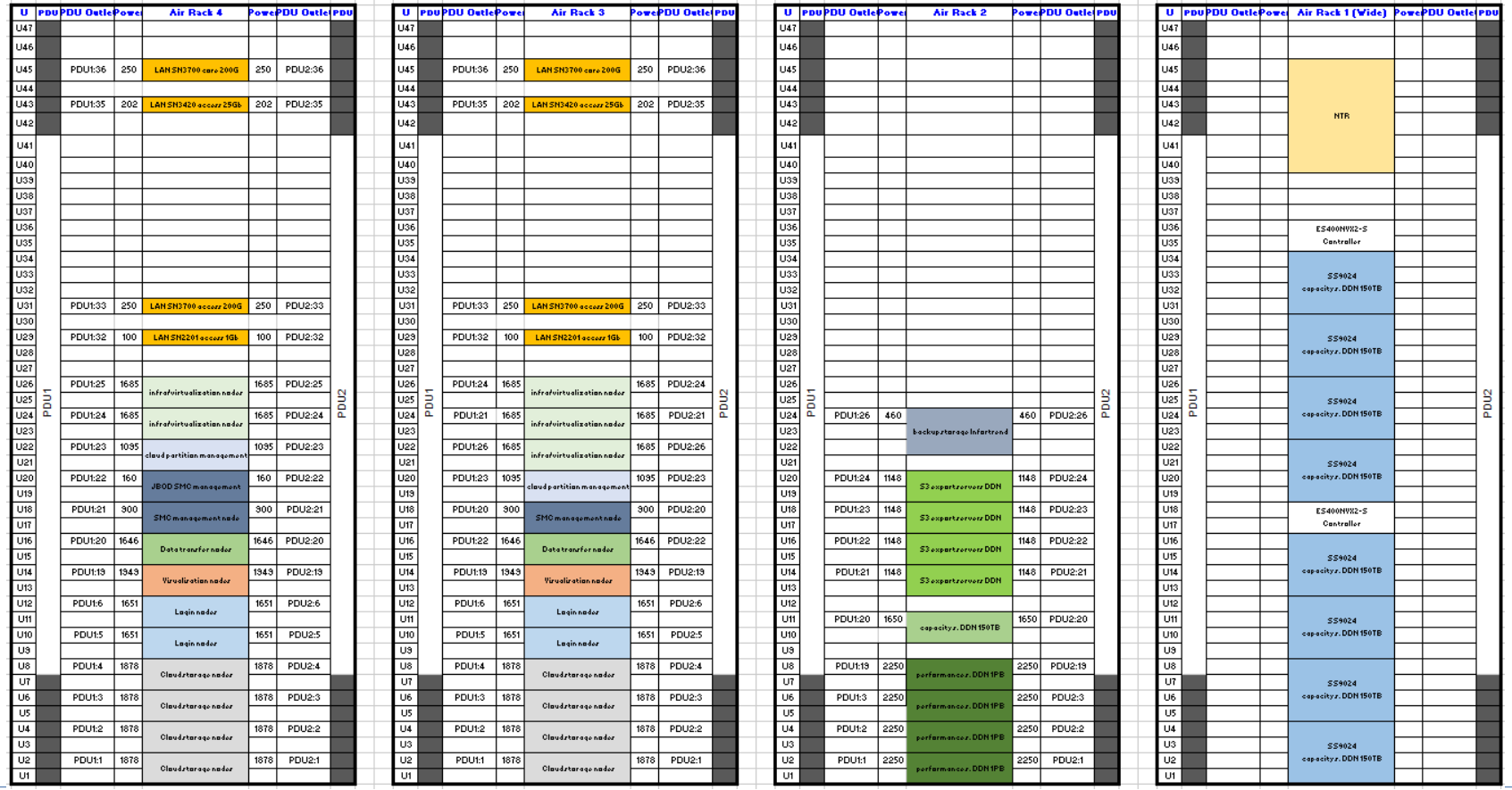
200Gb Ethernet

2x Cloud Mgmt nodes

2x Data Transfer nodes

2x Vizualization nodes

8x Cloud Storage nodes



PERUN: BULLSEQUANA XH3000 DLC RACK

1x Front Compute PDU

6x Front DLC PSU Shelves

38x standardized slots for Compute & Switch blades

1x Pump PDU

1x Power Management Controller

1x Rear Compute PDU

6x Rear DLC PSU Shelves

1x Expansion Tank

2x Management switches

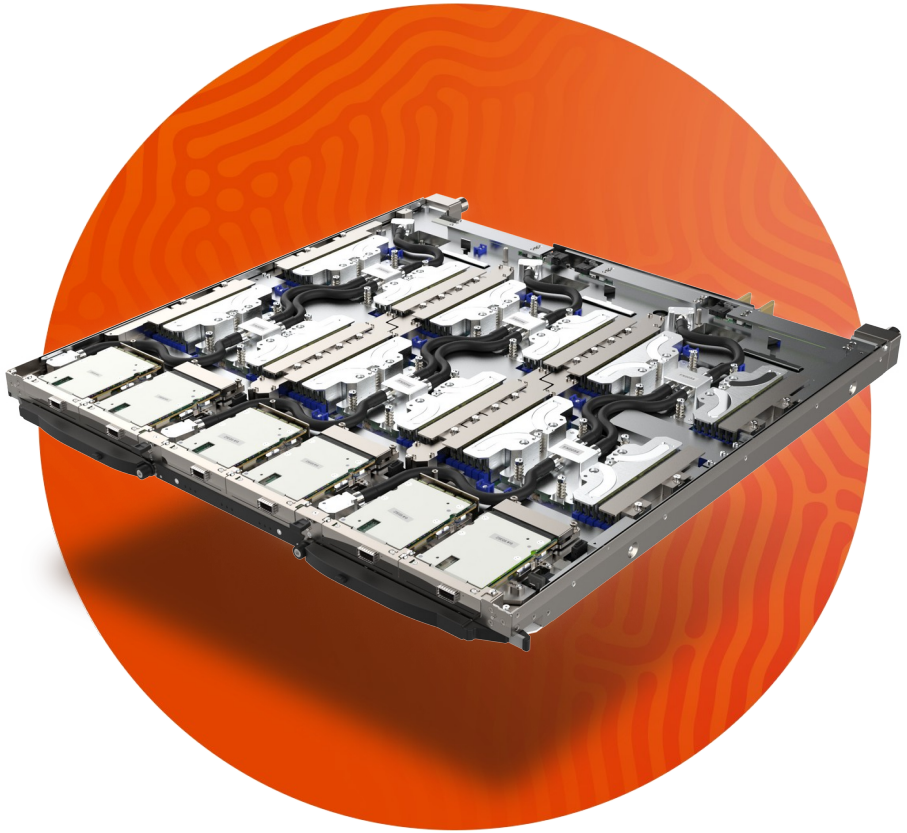
2x Hydraulic Pumps

1x Heat Exchanger

PERUN: CPU MODULE

- **BullSequana XH3420 blade**
- 1U blade with 3 cpu compute nodes
- complete DLC cooling

- **CPU node (std/hm) cn[001-045-060]**
- 2× AMD Turin 9845 160c @3.25 GHz (5x)
- 1152 GB DDR5 RAM @5600 MT/s (4x)
- 2304 GB DDR5 RAM @5600 MT/s (8x)
- 3.84 TB local NVMe SSD drive (2x)
- 7.68 TB local NVMe SSD drive (2x)
- 200 Gb/s NDR Infiniband interconnect (2x)



PERUN: CPU PROCESSOR (1/2)

- **AMD Turin 9845 (x86_64)**
- 160 cores / 320 threads (SMT)
- Architecture Zen 5c (dense cores)
- Base/Max Frequency ~3,25/~3,7 GHz

- **HPC**
- Extremely high parallelism
- CFD (OpenFOAM)
- Molecular dynamics (LAMMPS)
- Monte Carlo simulations

- **Instruction sets**
- AVX-512 (512-bit)
- AVX-512 VNNI, BF16 (AI / mixed precision)

- **HPC**
- High theoretical FLOPS performance
- Linear algebra (BLAS, LAPACK)
- FFT
- hybrid HPC + AI workloads

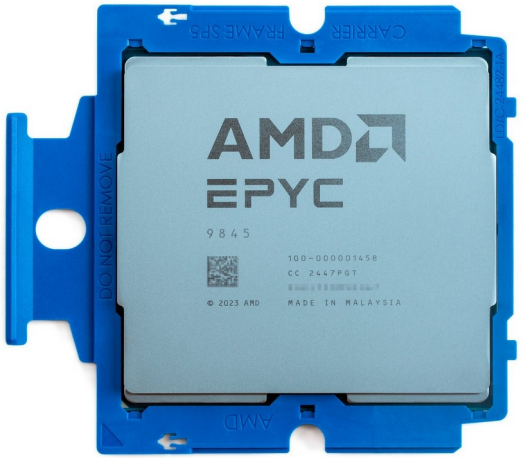
PERUN: CPU PROCESSOR (2/2)

- **Memory subsystem**
- 12-channels DDR5 RAM
- Speed: >5000 MT/s
- Throughput: >500 GB/s per socket
- L3 cache: 320 MB
- L2: 1 MB / core

- **HPC**
- Sparse matrices
- FEM / stencil calculations

- **Power**
- TDP: 320–400 W configurable

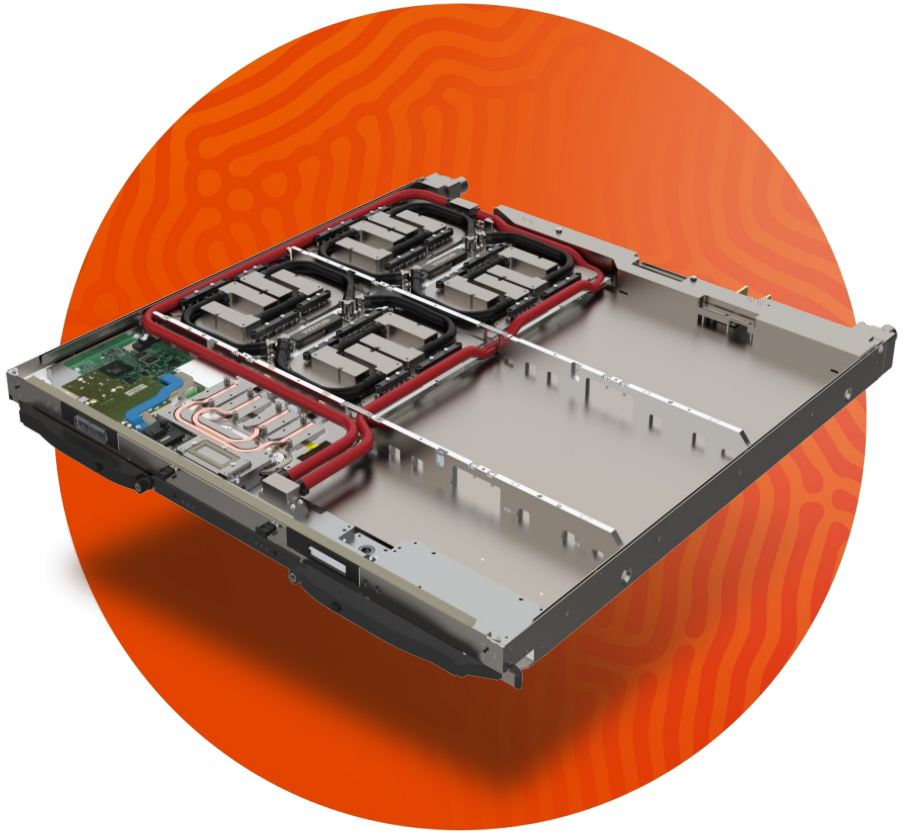
- **HPC**
- High compute performance / W



PERUN: GPU MODULE

- **BullSequana XH3515-HMP blade**
- 1U blade with 1 gpu compute node
- complete DLC cooling

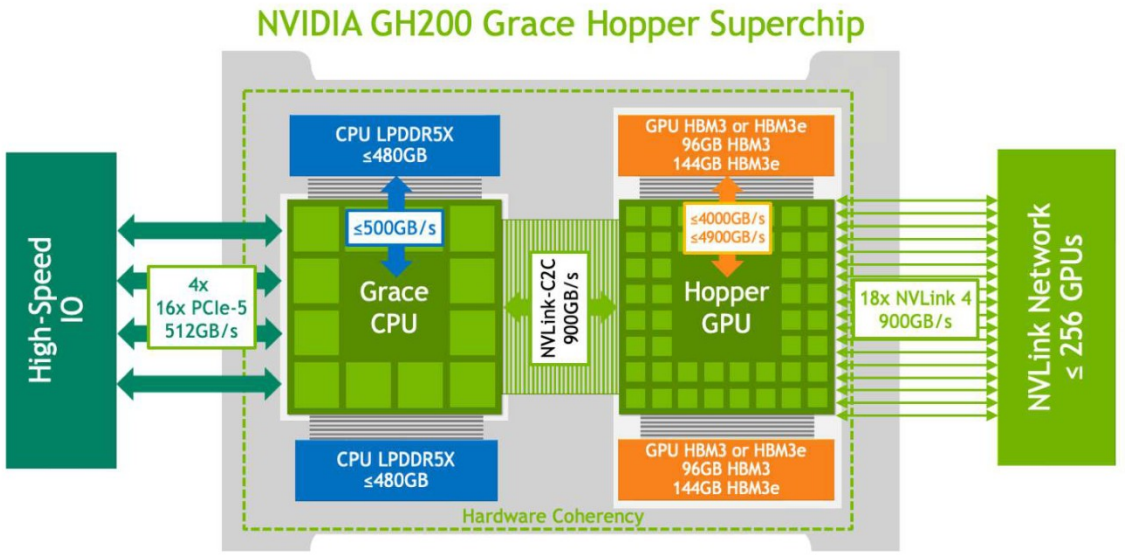
- **GPU node gn[001-076]**
- 4× GH200 Grace Hopper Superchip (?x)
- 4x 128 GB LPDDR5 RAM (~2x)
- 4x 96GB HBM3 RAM (~2.5x)
- 3.84 TB local NVMe SSD drive (1x)
- 4x 200 Gb/s NDR Infiniband interconnect (4x)



PERUN: GPU SUPERCHIP (1/2)

- **NVIDIA GH200**
- CPU Grace (aarch64) + GPU Hopper
- NVLink-C2C Interconnect
- CPU a GPU as one logical unit

- **HPC & AI**
- Hybrid architecture → usefull for:
- MPI + GPU acceleration
- Heterogenous workloads
- AI workloads



PERUN: GPU SUPERCHIP (2/2)

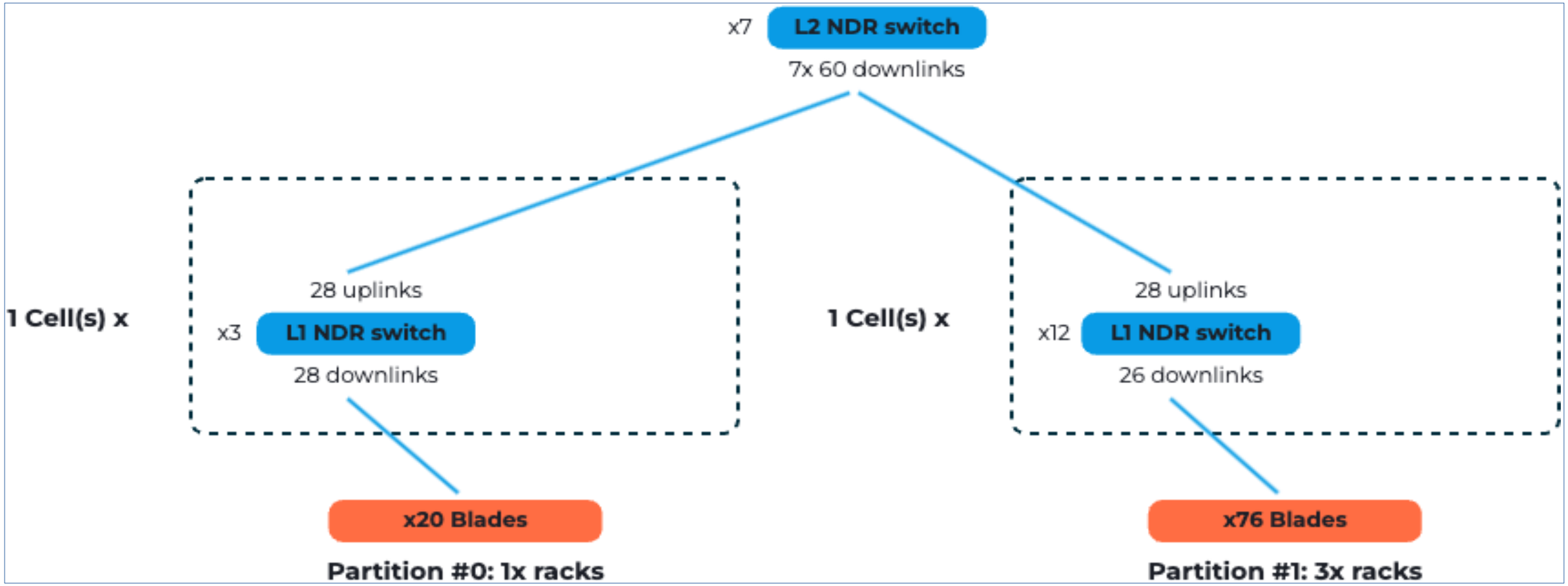
- **CPU–GPU interconnect**
- NVLink-C2C: ~900 GB/s bandwidth
- ~7× faster than PCIe Gen5
- Cache-coherent memory access

- **HPC**
- Reduces bottlenecks between CPU a GPU
- No explicit data copy (cudaMemcpy)

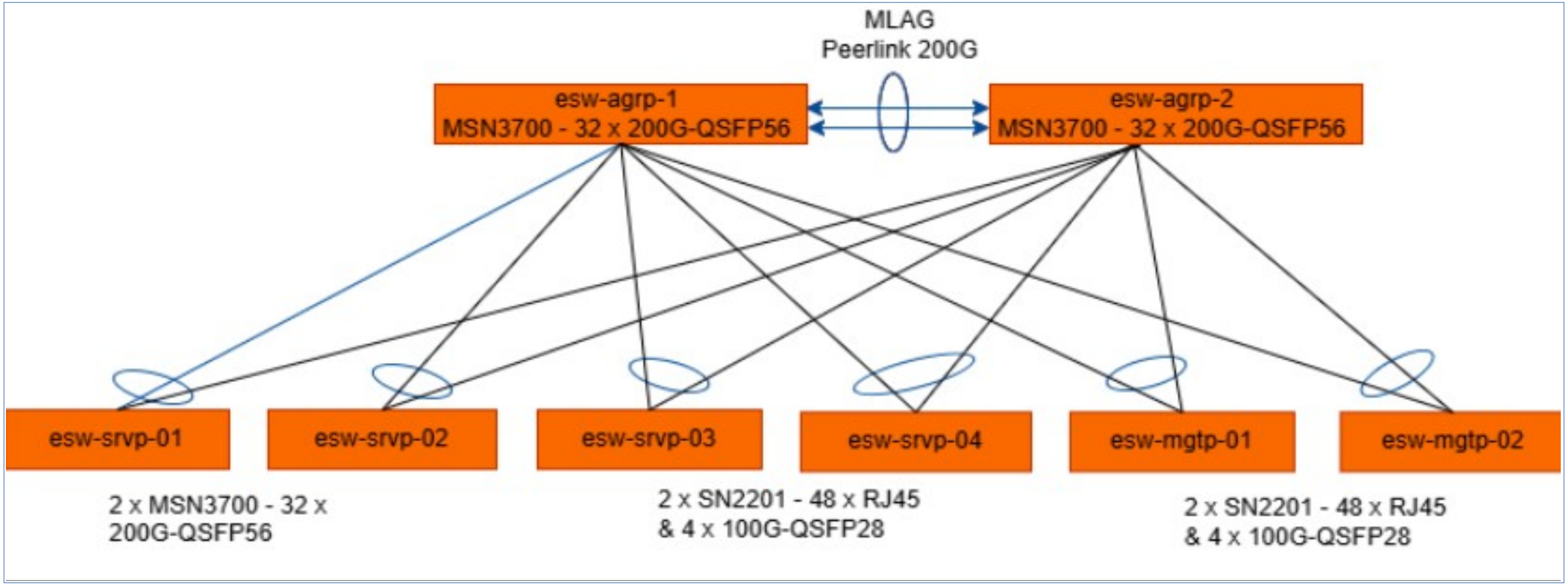
- **Memory subsystem**
- HBM3 GPU RAM with high throughput
- Shared system memory between CPU a GPU
- Unified address space (unified memory)

- **HPC**
- memory-bound workloady
- Large datasets (climatic data, genomics, AI)
- One of the best architectures for memory demanding HPC

PERUN: NETWORKING (1/2)

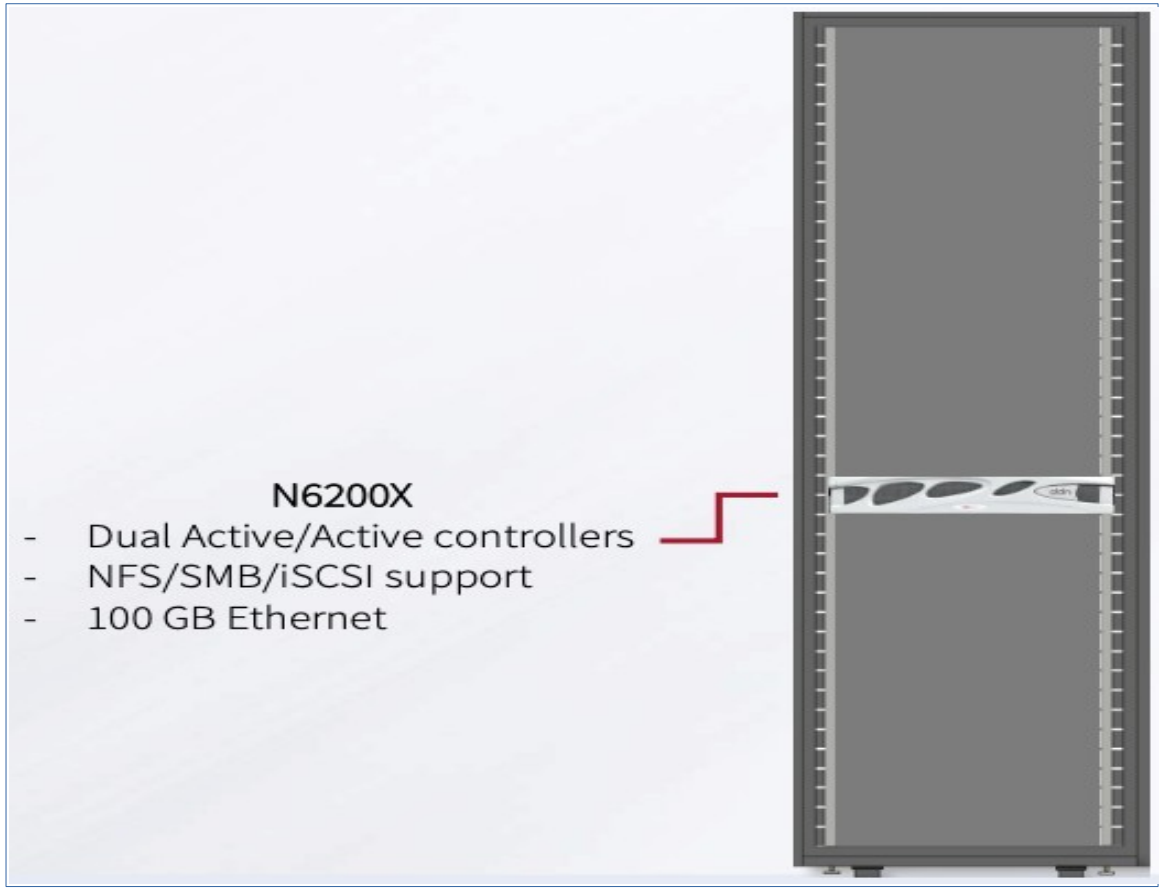


PERUN: NETWORKING (2/2)



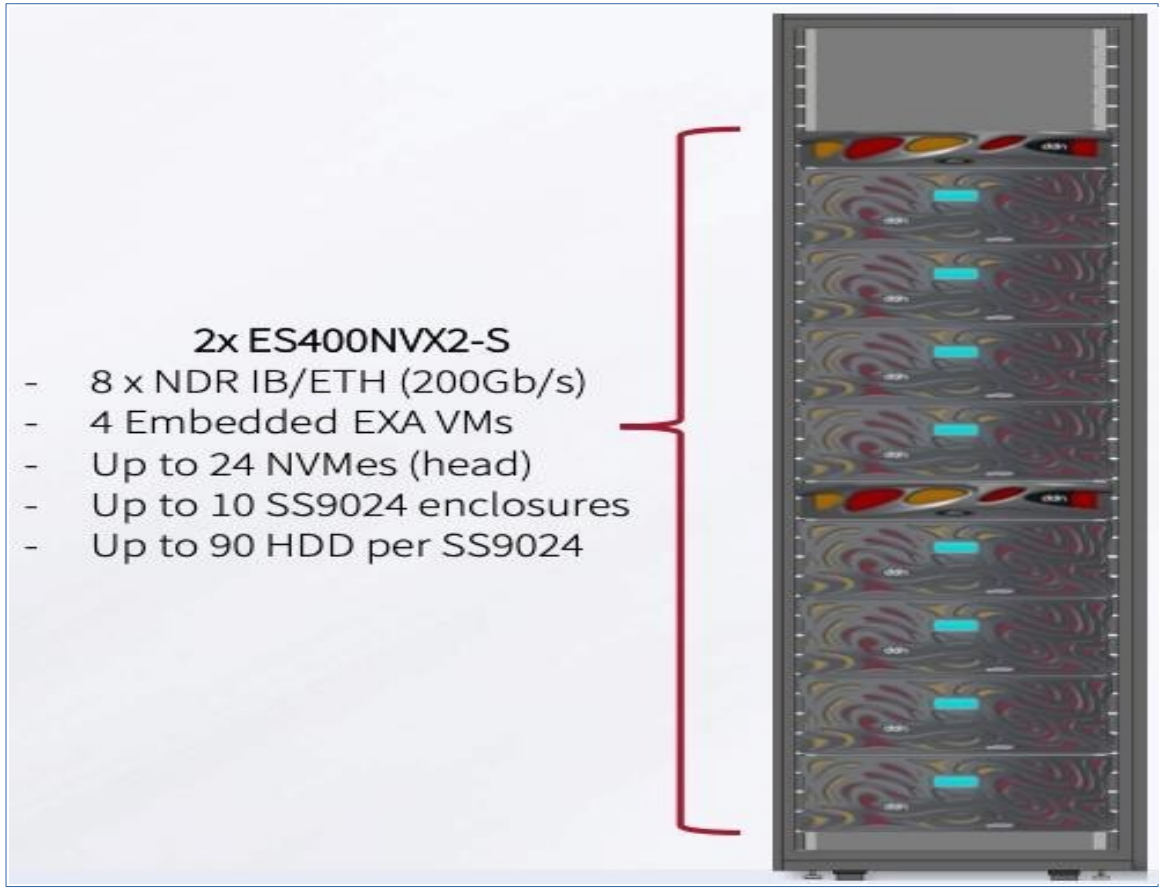
PERUN: HOME STORAGE

Solution details	
Usable capacity (NVMe)	**~ 258TB**
Aggregate IOPS (4K)	**> 100k**
Number of files (max)	**1 billion**
Max Sequential Reads (Dual Controller)	**~ 20 GB/s**
Max. Sequential write (dual controller)	**~ 8 GB/s**
NVMe	24 x 15.36TB
Logs	NFS, SMB, iSCSI
100GB Ethernet ports	4
Rack drives	2
Plugs (C14)	2
Consumption max	Approx. 1.6 KW



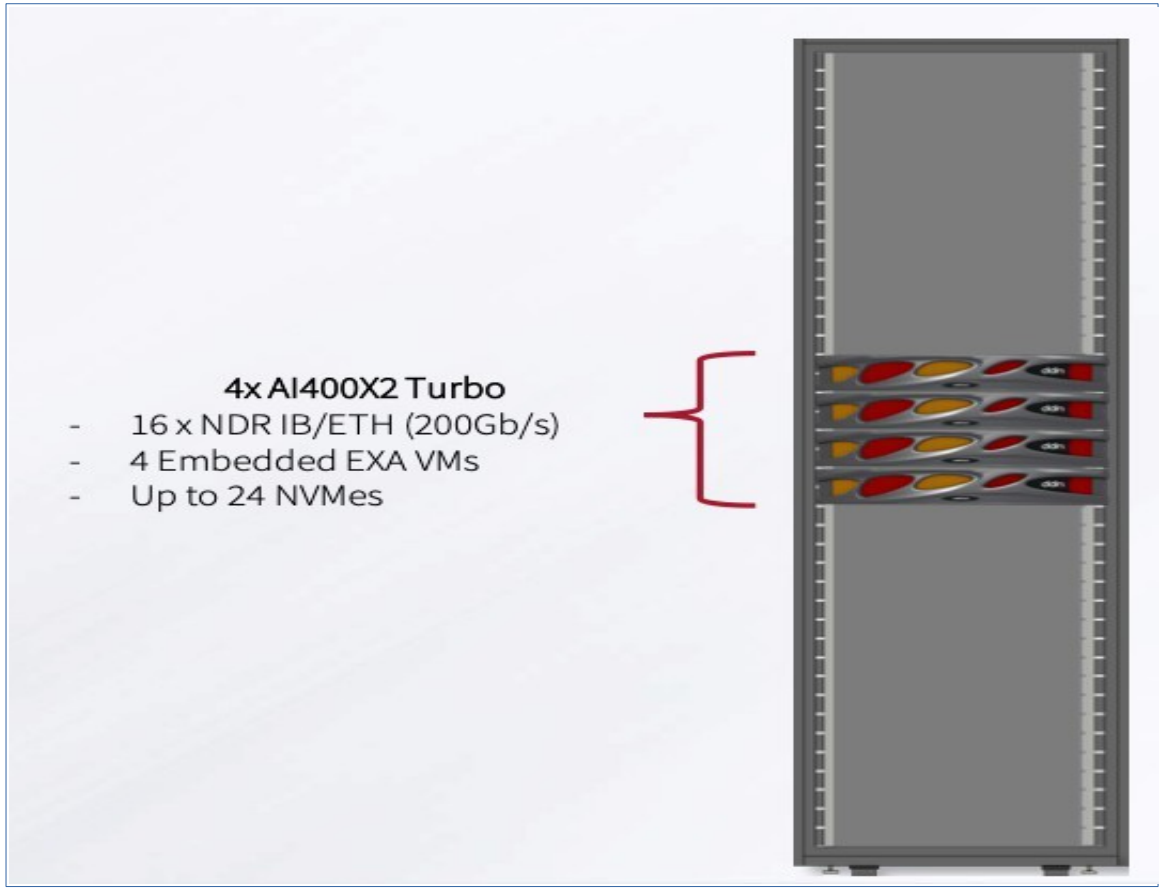
PERUN: PROJECT STORAGE

Solution details	
Usable capacity (NVMe/HDD)	**0.53/10.15 PB**
Aggregate IOPS (4K)	**> 1 million**
Number of files (max)	**1 billion**
Max. Sequential reads (NVMe/HDD)	**~ 170/100 GB/s**
Max. Sequential Write (NVMe/HDD)	**~ 120/95 GB/s**
Total NVMe	48 x 15.35 TB
Total number of HDDs	656× 20 TB
NDR200 IB ports	16
Rack drives	36
Plugs (C20+ C14)	4+ 32
Consumption max	Approx. 13 KW



PERUN: SCRATCH STORAGE

Solution details	
Usable capacity (NVMe)	**1.06 PB**
Aggregate IOPS (4K)	**> 2 million**
Number of files (max)	**1 billion**
Max reads	**400 GB/s**
Max. write	**260 GB/s**
Total NVMe	96 x 15.36 TB DWPD1
NDR200 IB ports	32
Rack drives	8
Plugs (C20)	8
Consumption max	Approx. 10 KW



PERUN: SLURM

```
[holka@login04 ~]$ ./showpartitions -N
Partition statistics for cluster perun at Tue Jun  9 17:59:33 CEST 2026
           Partition       #Nodes       #Cores    #Cores_pend  NodeLimit  TimeLimit    NODEINFO    NODELIST
        Name State Tag  Total  Idle  Total  Idle  Resrc Other   Min  Max   DD-HH:MM  Cores    RAM
   cpu_short    up (D)     45    43  14400 14076      0     0     1    2    1-00:00    320 1098GB  cn[001-045]
    cpu_long    up         45    43  14400 14076      0     0     1    1    4-00:00    320 1098GB  cn[001-045]
cpu_hm_short    up         15    15   4800  4800      0     0     1    1    1-00:00    320 2197GB  cn[046-060]
 cpu_hm_long    up         15    15   4800  4800      0     0     1    1    4-00:00    320 2197GB  cn[046-060]
   gpu_short    up         78    74  22464 21312      0     0     1    4    1-00:00    288  488GB  gn[001-078]
  gpu_medium    up         78    74  22464 21312      0     0     1    2    2-00:00    288  488GB  gn[001-078]
    gpu_long    up         78    74  22464 21312      0     0     1    1    4-00:00    288  488GB  gn[001-078]
     testing    up          4     4    640   640      0     0     1    1          30    160  550GB  login[01-04]
   gpu_bench    up         78    74  22464 21312      0     0     1 infi   infinite    288  488GB  gn[001-078]
Tag:   (D) Default; (H) Hidden; (R) Root-only
State: (@) Some nodes are pending a reboot; ($) Some nodes are in maintenance mode
[holka@login04 ~]$
```

PERUN: QUESTIONS & ANSWERS

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