



Centrum spoločných  
činností SAV, v. v. i.



Výpočtové stredisko SAV

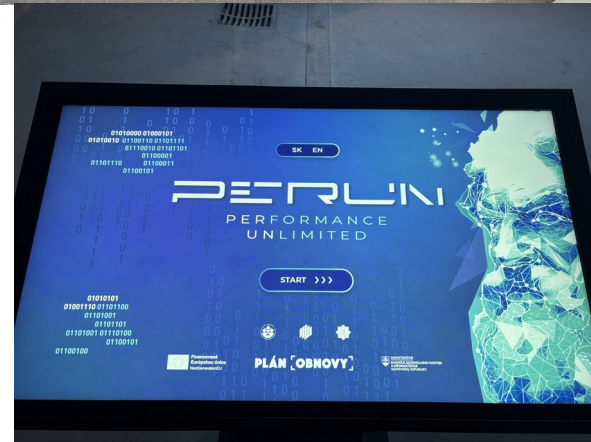
# Supercomputer PERUN

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

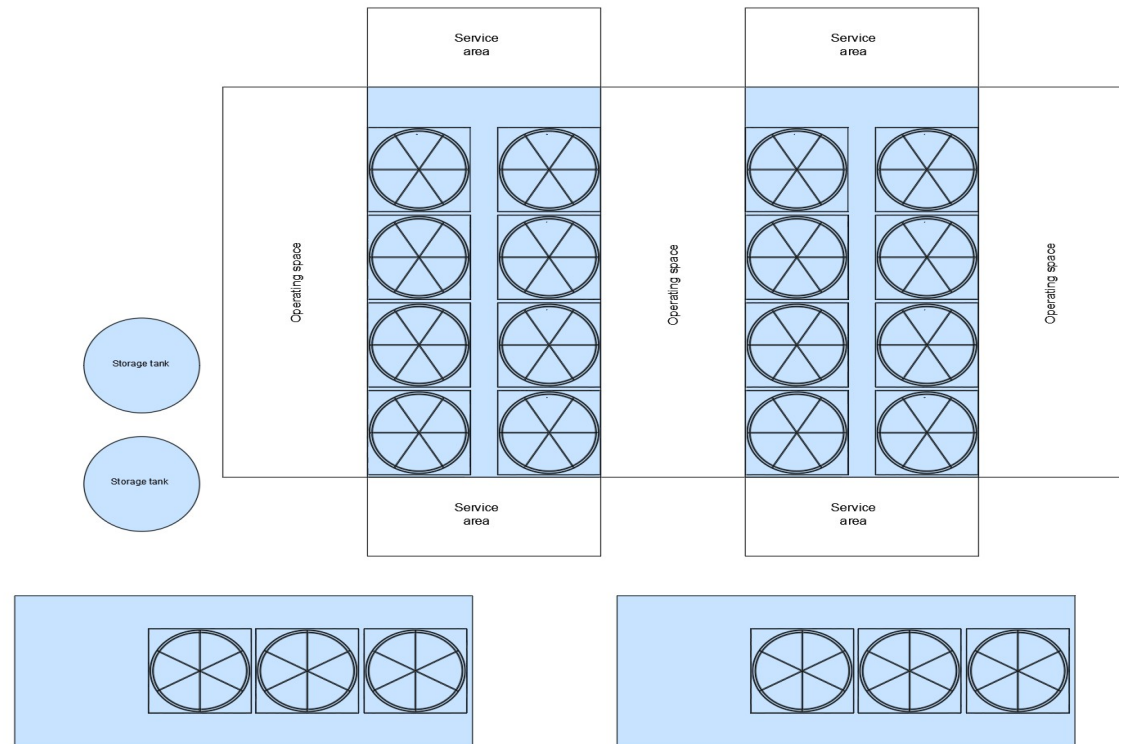
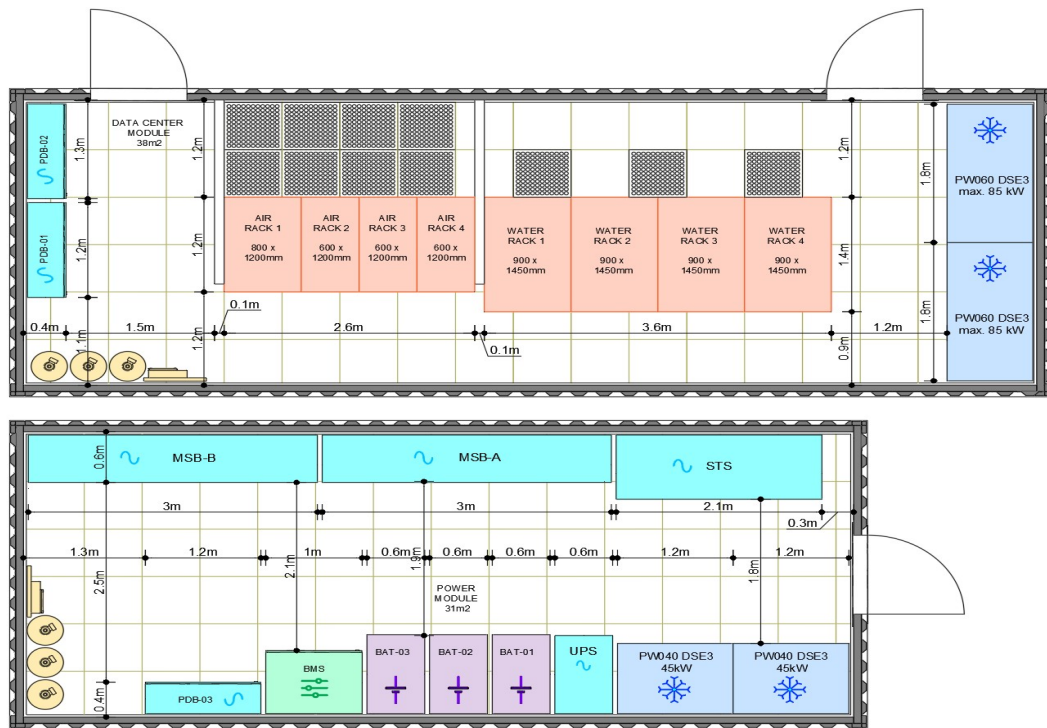
# PERUN: COMPLEX (1/2)



?



# 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	<b>JUPITER Booster</b> - 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	<b>PERUN (Slovak Academy of Sciences (SAV))</b> - 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	<b>PERUN</b> - 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	<b>KAIROS</b> - 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	<b>ROMEO-2025</b> - 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	<b>Levante GPU extension</b> - 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

		Air Rack 4				Air Rack 3				Air Rack 2				Air Rack 1 (Wide)							
U	PDU	PDU	Outlet	Power	PDU	PDU	Outlet	Power	PDU	PDU	Outlet	Power	PDU	PDU	Outlet	Power	PDU	PDU	Outlet	Power	
U47																					
U46																					
U45	PDU1:36	250	LAN SH3700 core 200G	250	PDU2:36	PDU1:36	250	LAN SH3700 core 200G	250	PDU2:36											
U44																					
U43	PDU1:35	202	LAN SH3420 access 250G	202	PDU2:35	PDU1:35	202	LAN SH3420 access 250G	202	PDU2:35											
U42																					
U41																					
U40																					
U39																					
U38																					
U37																					
U36																					
U35																					
U34																					
U33																					
U32																					
U31	PDU1:33	250	LAN SH3700 access 200G	250	PDU2:33	PDU1:33	250	LAN SH3700 access 200G	250	PDU2:33											
U30																					
U29	PDU1:32	100	LAN SH2201 access 1G	100	PDU2:32	PDU1:32	100	LAN SH2201 access 1G	100	PDU2:32											
U28																					
U27																					
U26	PDU1:25	1685	infra/virtualization node	1685	PDU2:25	PDU1:24	1685	infra/virtualization node	1685	PDU2:24											
U25																					
U24	PDU1:24	1685	infra/virtualization node	1685	PDU2:24	PDU1:21	1685	infra/virtualization node	1685	PDU2:21											
U23																					
U22	PDU1:23	1095	cloud/partition management	1095	PDU2:23	PDU1:26	1685	infra/virtualization node	1685	PDU2:26											
U21																					
U20	PDU1:22	160	JBOD SMC management	160	PDU2:22	PDU1:23	1095	cloud/partition management	1095	PDU2:23											
U19																					
U18	PDU1:21	300	SMC management node	300	PDU2:21	PDU1:20	300	SMC management node	300	PDU2:20											
U17																					
U16	PDU1:20	1646	Data transfer node	1646	PDU2:20	U16	PDU1:22	1646	Data transfer node	1646	PDU2:22										
U15																					
U14	PDU1:19	1949	Virtualization node	1949	PDU2:19	U14	PDU1:19	1949	Virtualization node	1949	PDU2:19										
U13																					
U12	PDU1:6	1651	Log in node	1651	PDU2:6	U12	PDU1:6	1651	Log in node	1651	PDU2:6										
U11																					
U10	PDU1:5	1651	Log in node	1651	PDU2:5	U10	PDU1:5	1651	Log in node	1651	PDU2:5										
U9																					
U8	PDU1:4	1878	Cloud storage node	1878	PDU2:4	U8	PDU1:4	1878	Cloud storage node	1878	PDU2:4										
U7																					
U6	PDU1:3	1878	Cloud storage node	1878	PDU2:3	U6	PDU1:3	1878	Cloud storage node	1878	PDU2:3										
U5																					
U4	PDU1:2	1878	Cloud storage node	1878	PDU2:2	U4	PDU1:2	1878	Cloud storage node	1878	PDU2:2										
U3																					
U2	PDU1:1	1878	Cloud storage node	1878	PDU2:1	U2	PDU1:1	1878	Cloud storage node	1878	PDU2:1										
U1																					
U47																					
U46																					
U45																					
U44																					
U43																					
U42																					
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U28																					
U27																					
U26																					
U25																					
U24	PDU1:26	460	backup storage/infratand	460	PDU2:26																
U23																					
U22																					
U21																					
U20	PDU1:24	1148	S3 export server DDN	1148	PDU2:24																
U19																					
U18	PDU1:23	1148	S3 export server DDN	1148	PDU2:23																
U17																					
U16	PDU1:22	1148	S3 export server DDN	1148	PDU2:22																
U15																					
U14	PDU1:21	1148	S3 export server DDN	1148	PDU2:21																
U13																					
U12																					
U11	PDU1:20	1650	capacity, DDN 150TB	1650	PDU2:20																
U10																					
U9																					
U8	PDU1:19	2250	performance, DDN 1PB	2250	PDU2:19																
U7																					
U6	PDU1:3	2250	performance, DDN 1PB	2250	PDU2:3																
U5																					
U4	PDU1:2	2250	performance, DDN 1PB	2250	PDU2:2																
U3																					
U2	PDU1:1	2250	performance, DDN 1PB	2250	PDU2:1																
U1																					

NTR

ES400HW02-S  
Controller

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

ES400HW02-S  
Controller

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

SS9024  
capacity, DDN 150TB

# 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)

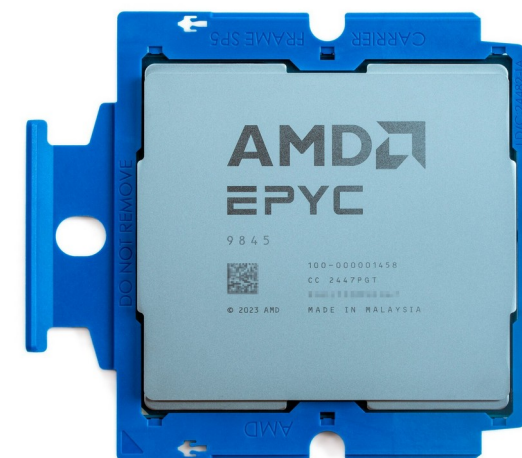
- **HPC**

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

# PERUN: CPU PROCESSOR (2/2)

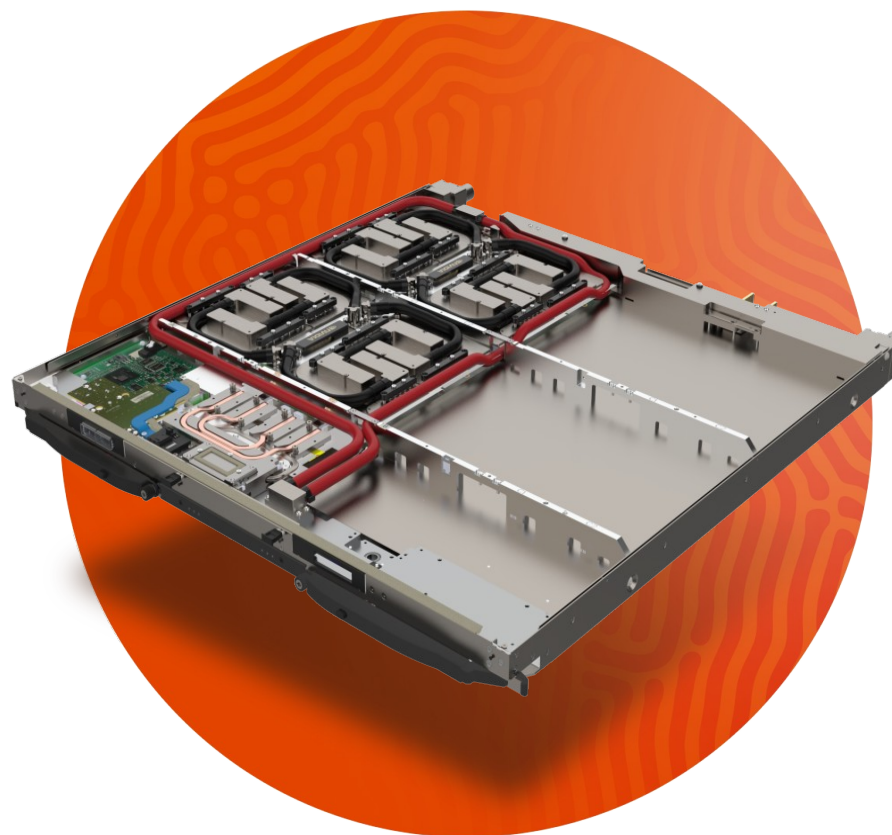
- **Memory subsystem**
- 12-channels DDR5 RAM
- Speed: >5000 MT/s
- Throughput: >500 GB/s per socket
- L3 cache: 320 MB
- L2: 1 MB / core
  
- **HPC**
- Sparse matrices
- FEM / stencil calculations

- **Power**
- TDP: 320–400 W configurable
  
- **HPC**
- High compute performance / W



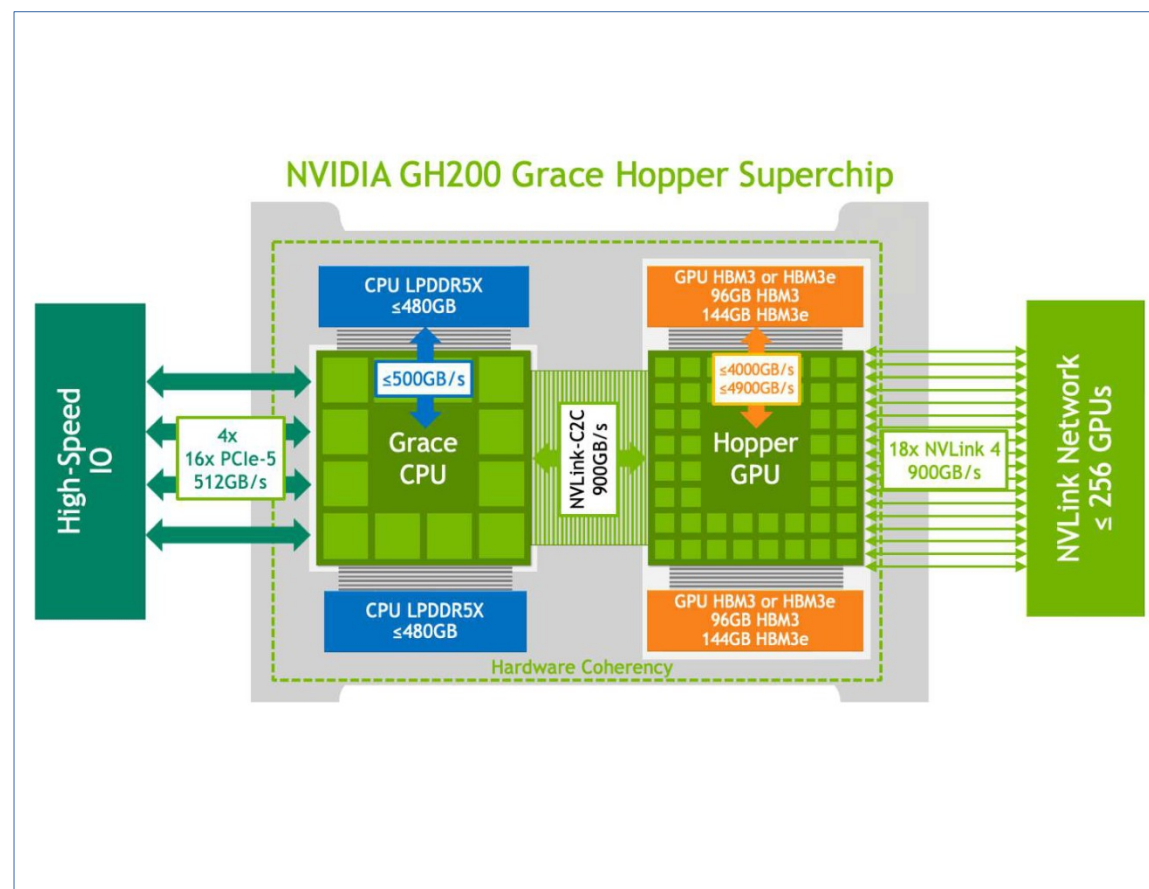
# PERUN: GPU MODULE

- **BullSequana XH3515-HMP blade**
- 1U blade with 1 gpu compute node
- complete DLC cooling
  
- **GPU node gn[001-076]**
- 4x 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)

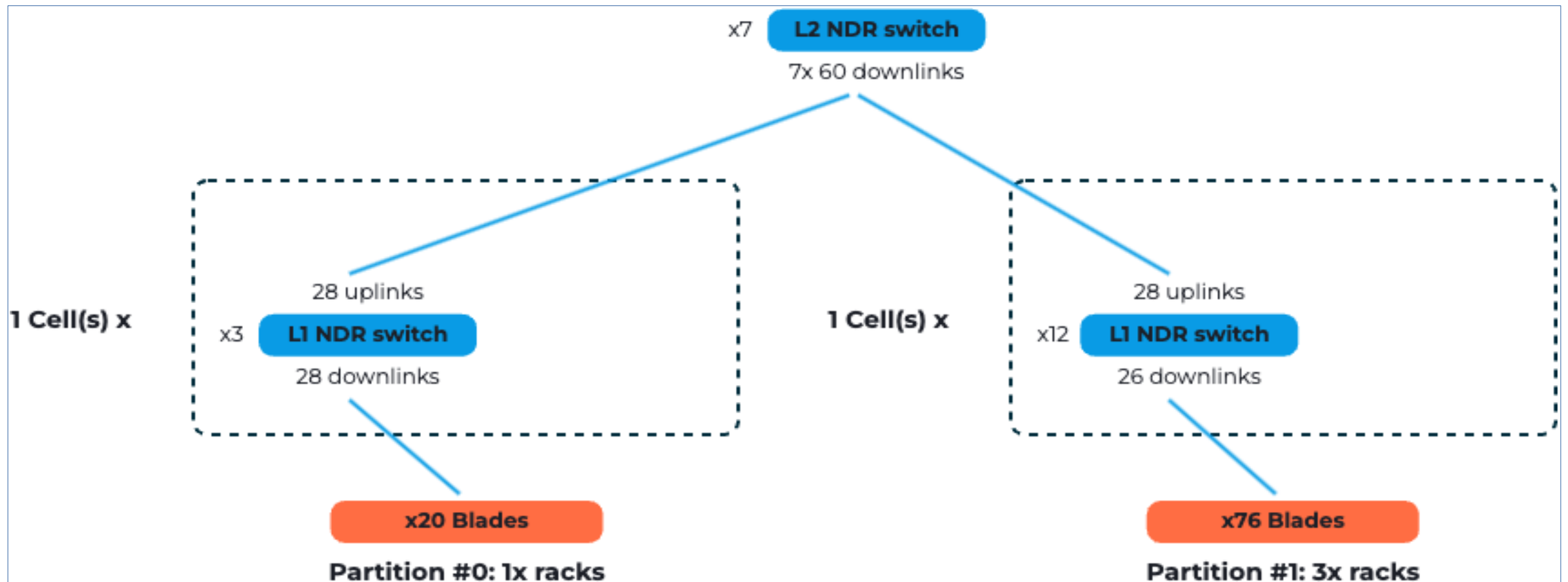
- **Memory subsystem**

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

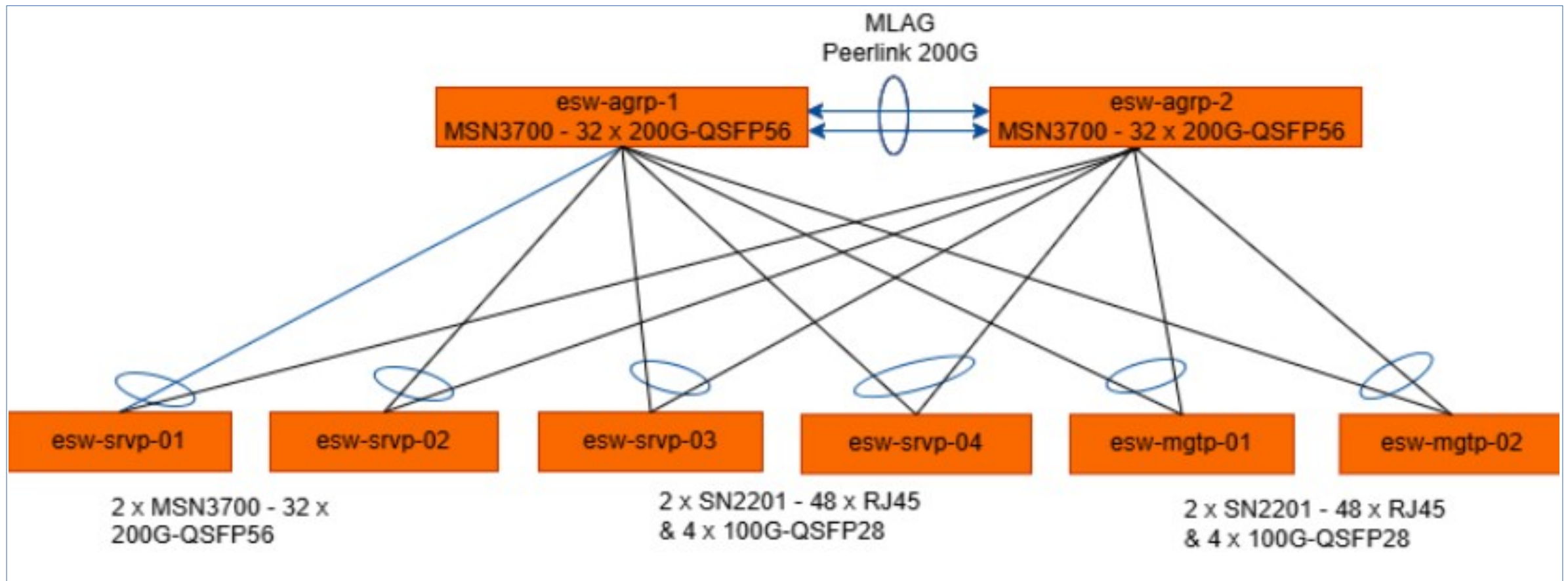
- **HPC**

- 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)

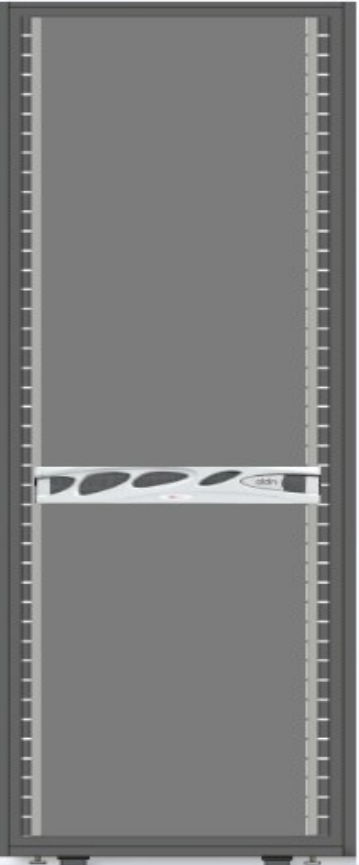


# PERUN: HOME STORAGE

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

**N6200X**

- Dual Active/Active controllers
- NFS/SMB/iSCSI support
- 100 GB Ethernet

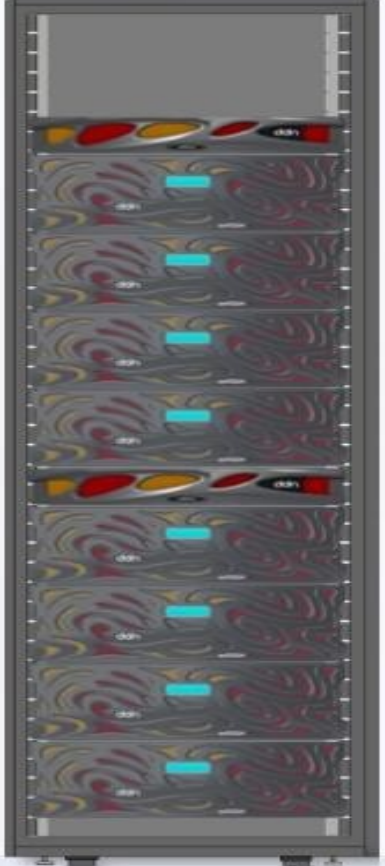


# PERUN: PROJECT STORAGE

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 x 20 TB
NDR200 IB ports	16
Rack drives	36
Plugs (C20+ C14)	4+ 32
Consumption max	Approx. 13 KW

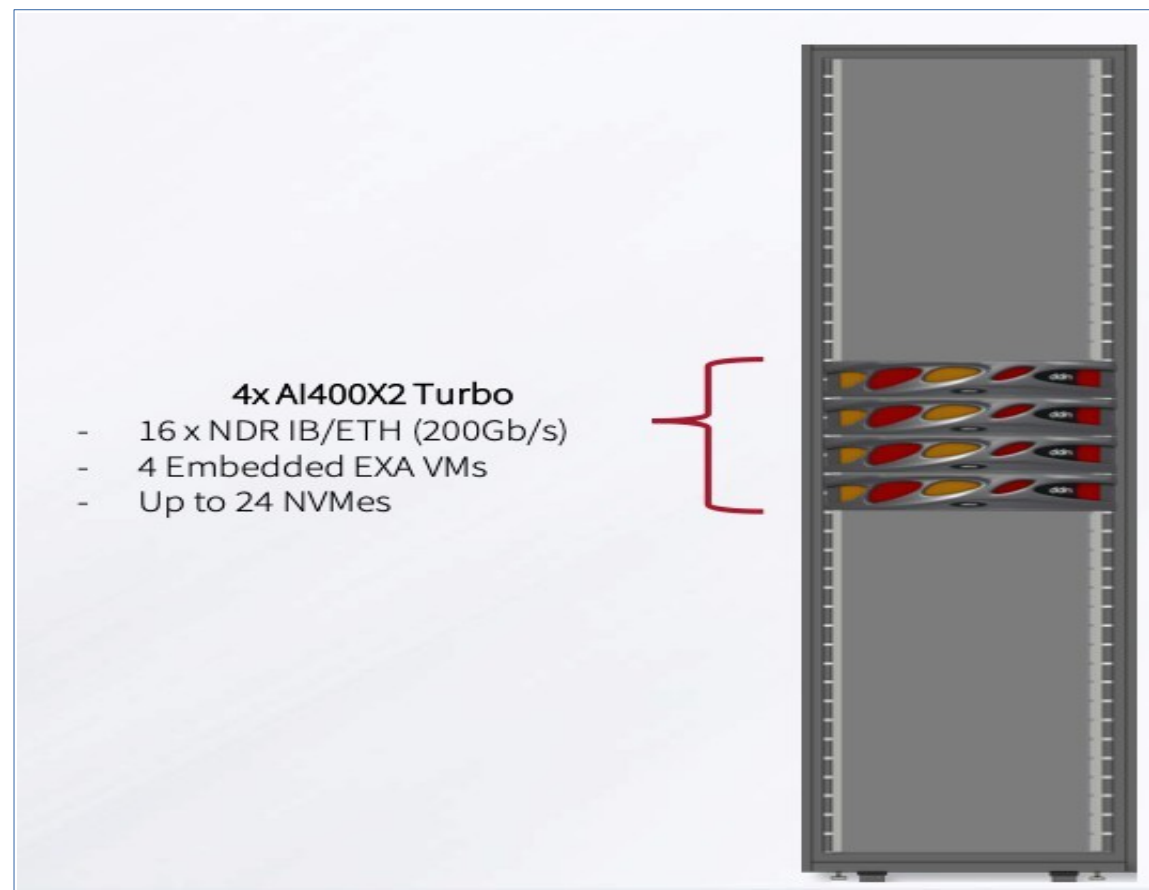
**2x ES400NVX2-S**

- 8 x NDR IB/ETH (200Gb/s)
- 4 Embedded EXA VMs
- Up to 24 NVMe (head)
- Up to 10 SS9024 enclosures
- Up to 90 HDD per SS9024



# 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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