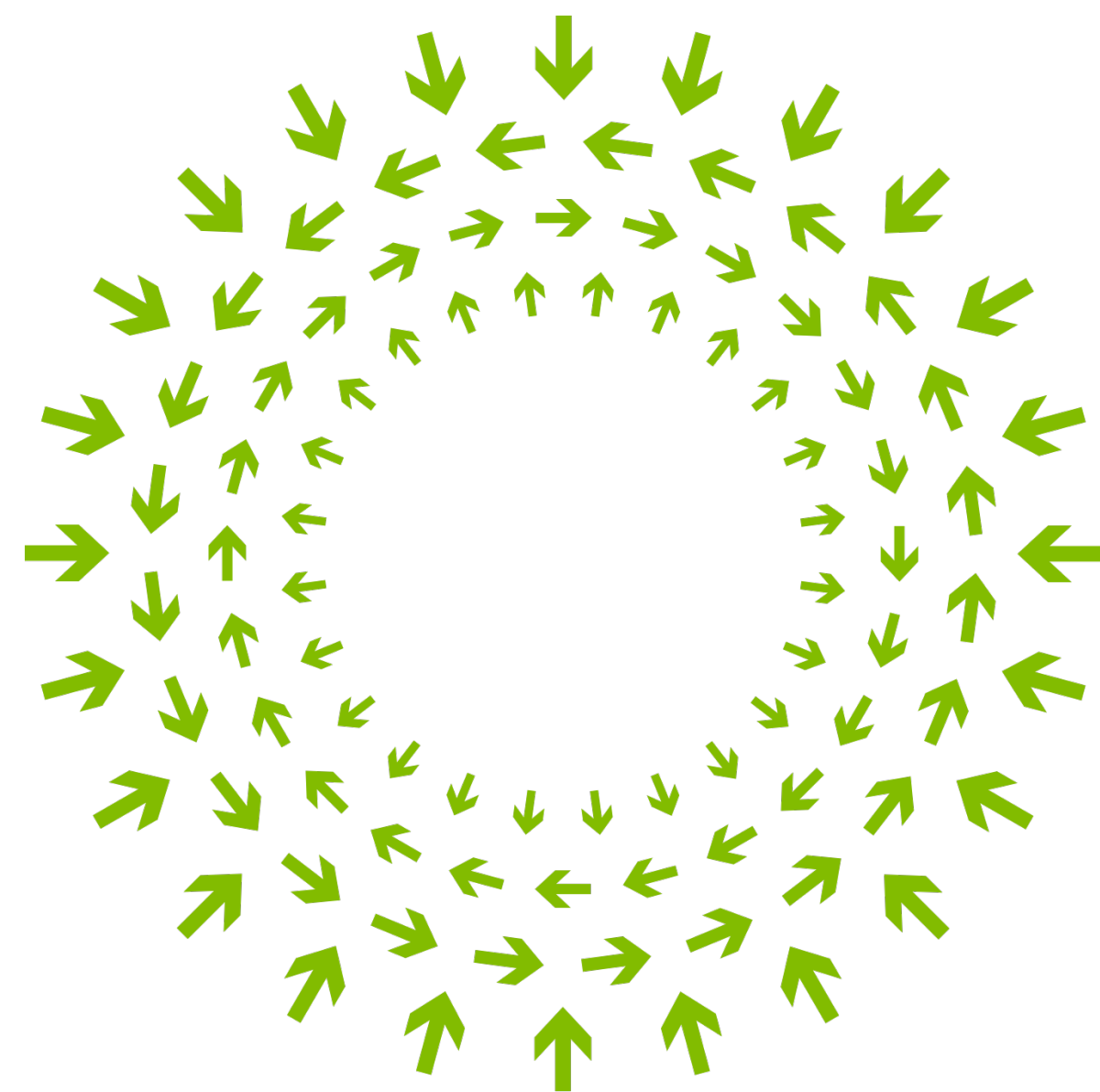
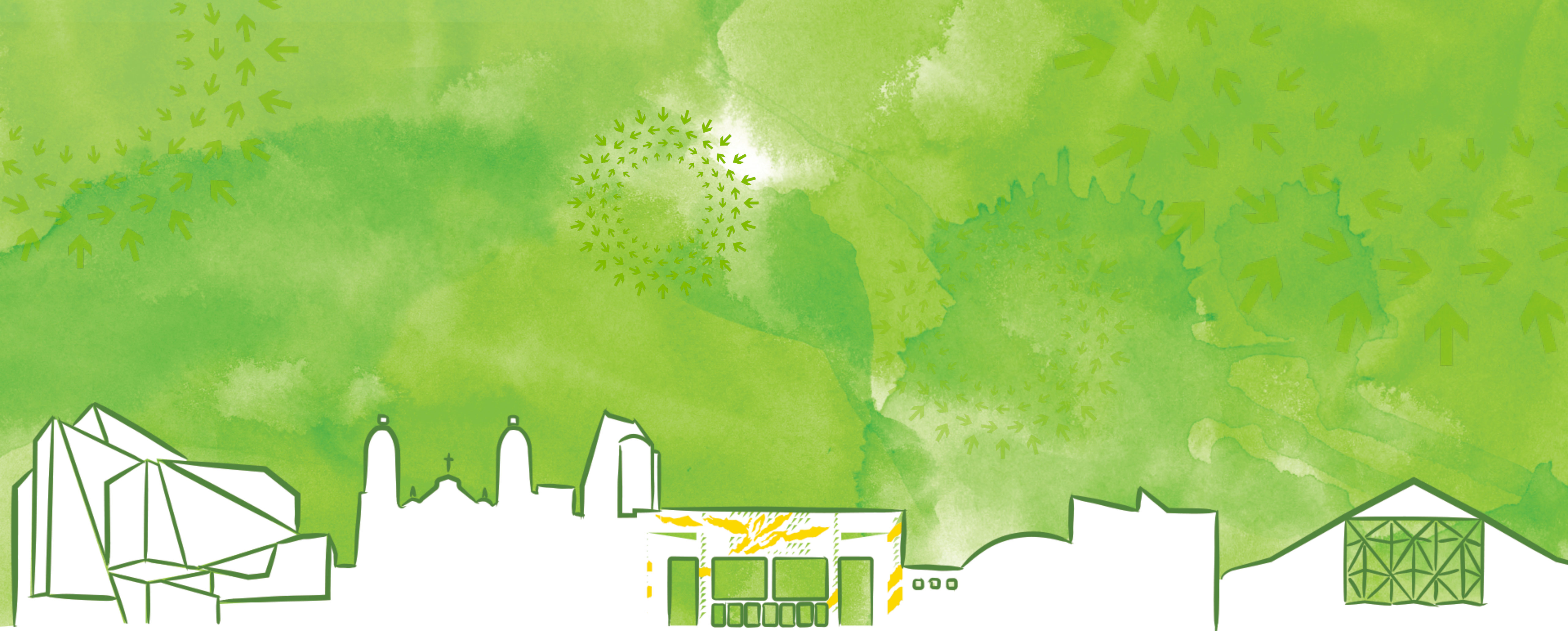




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Compute Project





OCP U.S. SUMMIT 2016 March 9-10 | San Jose, CA

Platinum Sponsor

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BIG SUR

An OCP GP-GPU Server

Kevin Lee
TECHNICAL PROGRAM MANAGER, FACEBOOK

Marcos Peixoto
INFRA PRODUCT PARTNERSHIPS MANAGER, FACEBOOK

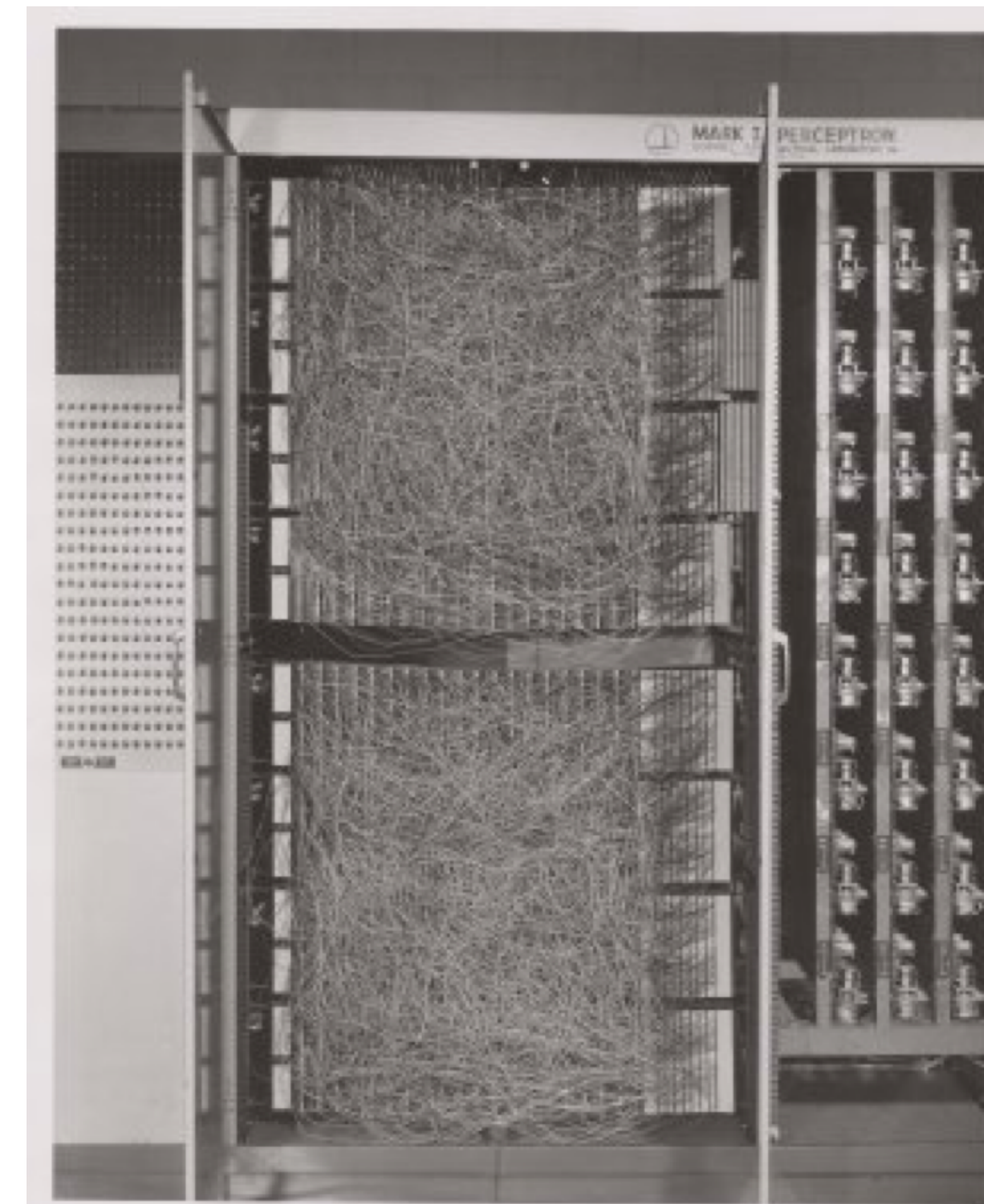
What is Machine Learning?



How do computers solve these problems?

Artificial Neural Networks

- Basic model has not evolved much since the 1950s
- The first learning machine: Frank Rosenblatt's Mark I Perceptron, built at Cornell in 1958
- The vast majority of practical applications of machine learning today use template matching



Use Cases

- Text Processing and Relevance
- Language Understanding
- Language Modeling
- Artificial Intelligence
- Machine Learning
- Computer Vision

Additional GP-GPU Use Cases

- Oil and Gas - Seismic processing
- Banking / Financial - Fraud detection
- Automotive - Self driving cars
- Medical/Pharma - Diagnosis, Drug discoveries
- Defense/Intelligence - Weapons simulation, homeland security
- Data Science/Analytics - Comb through Big Data

Data center



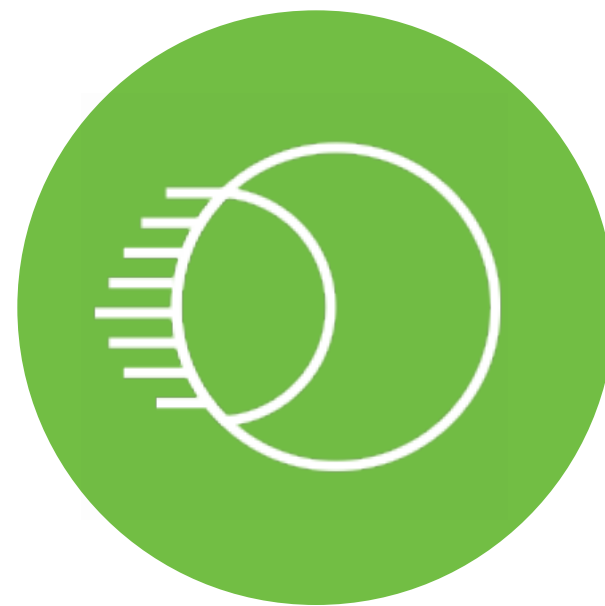
Server



Storage



Network



Big Sur



Big Sur

Specifications

- Supports up to 8 PCIe Gen3 full height, dual-slot cards
- Designed to support dual socket SSI EEB compliant server motherboard
- Can host up to 300W acceleration cards per slot
- Open Rack v2 compatible; 4OU chassis
- 8 x 2.5" SATA drives



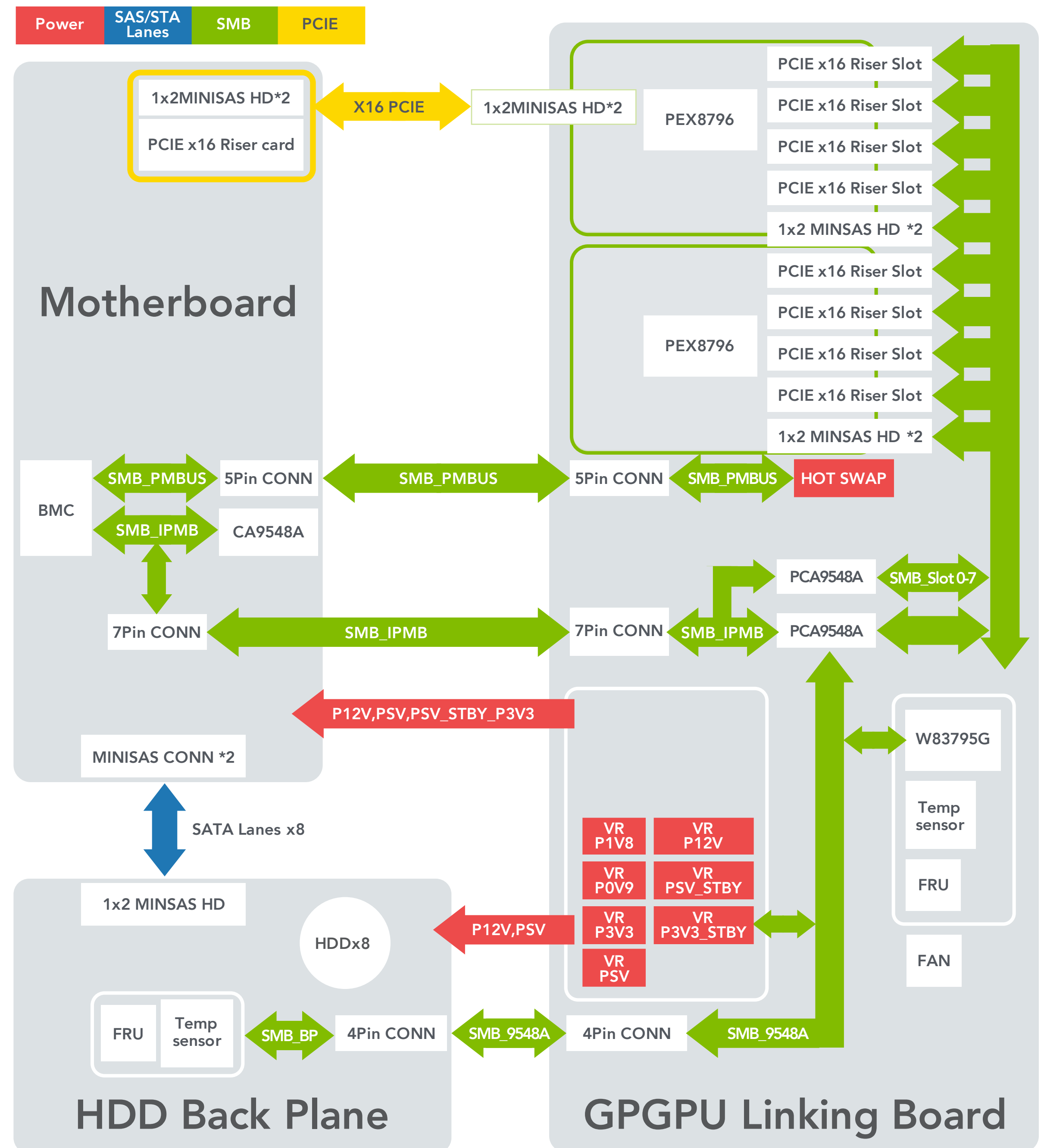
Big Sur Architecture

3 major areas:

→ Motherboard

→ Linking board

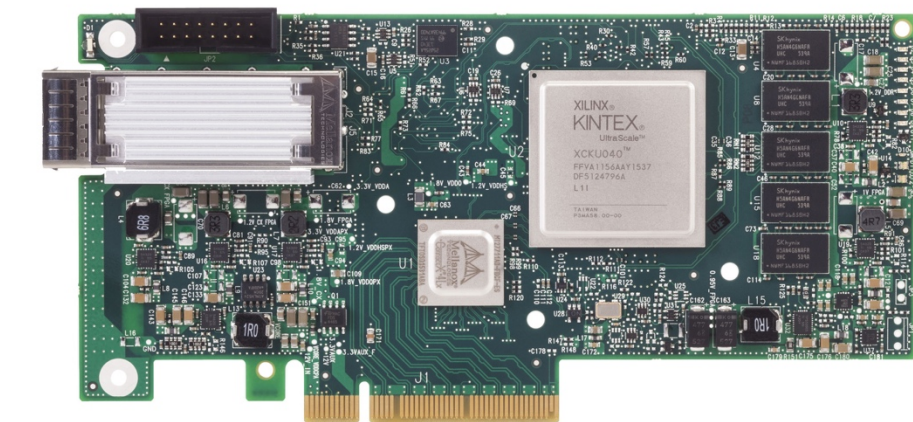
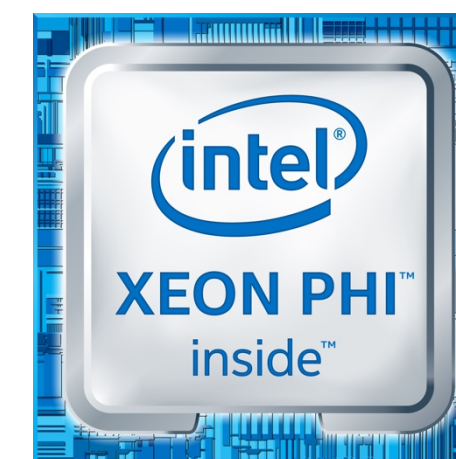
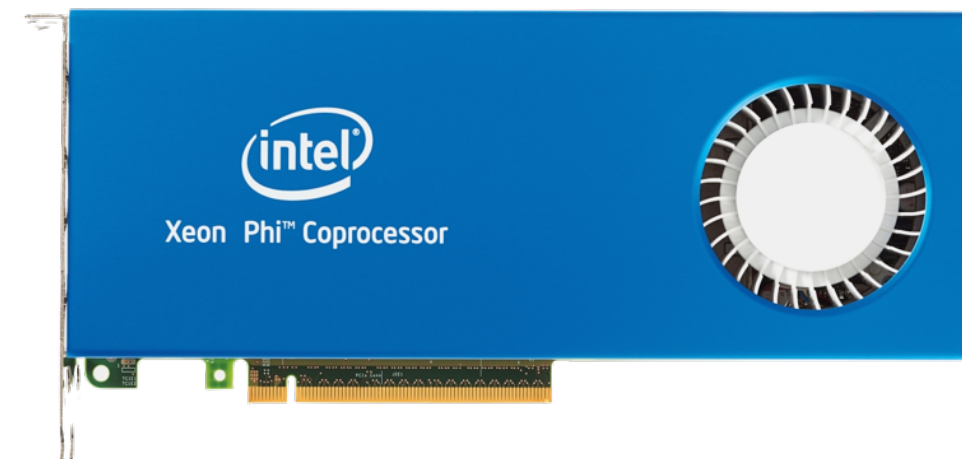
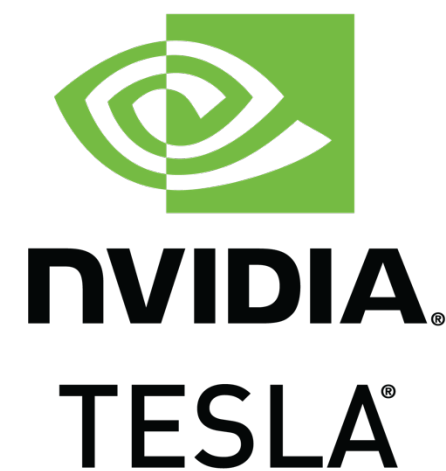
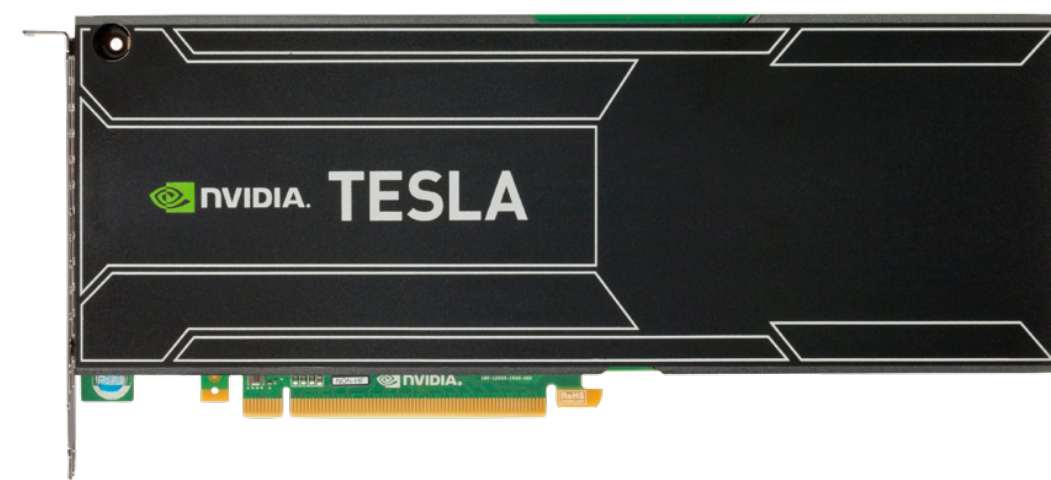
→ HDD/SSD backplane



Big Sur

Modularity

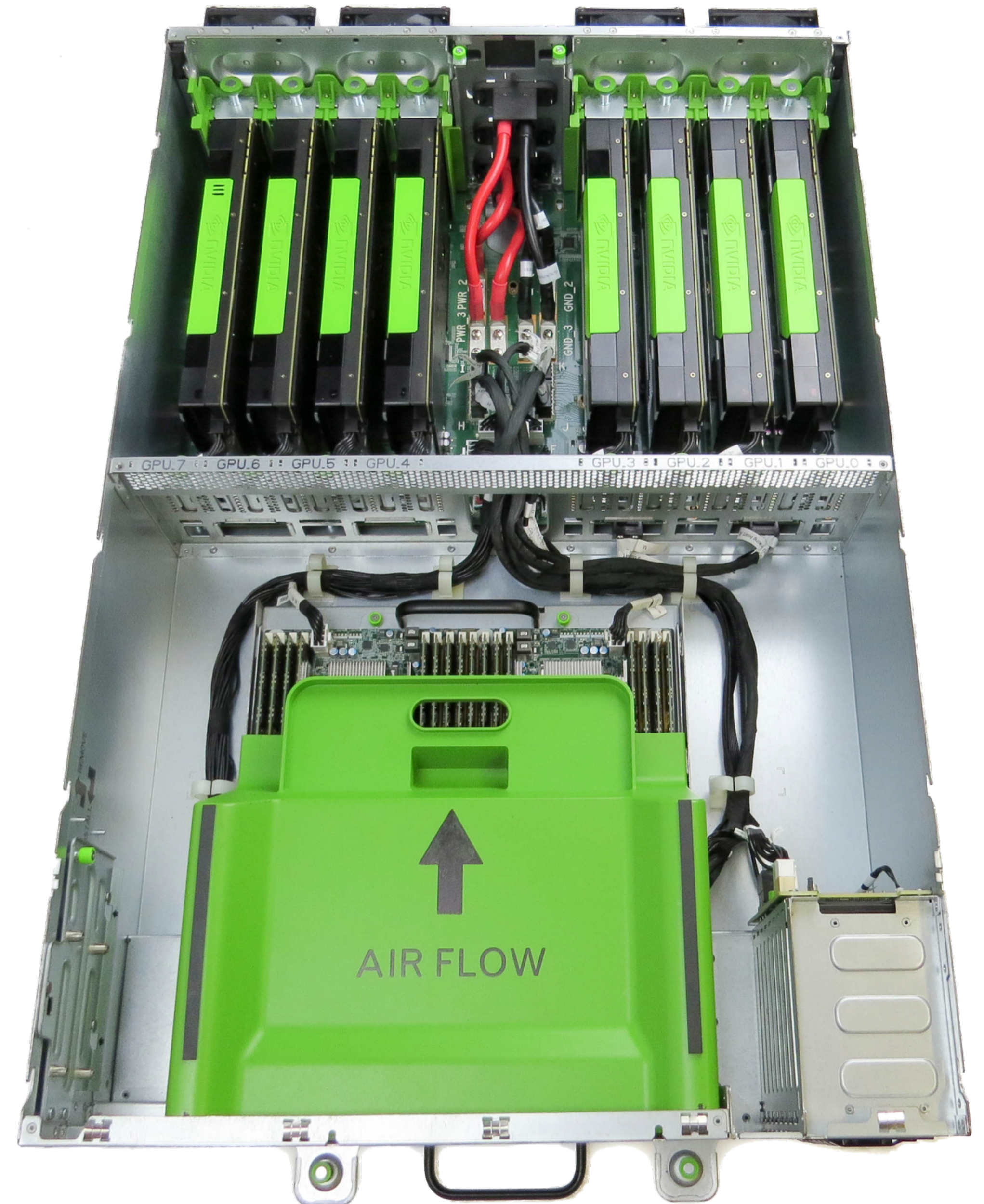
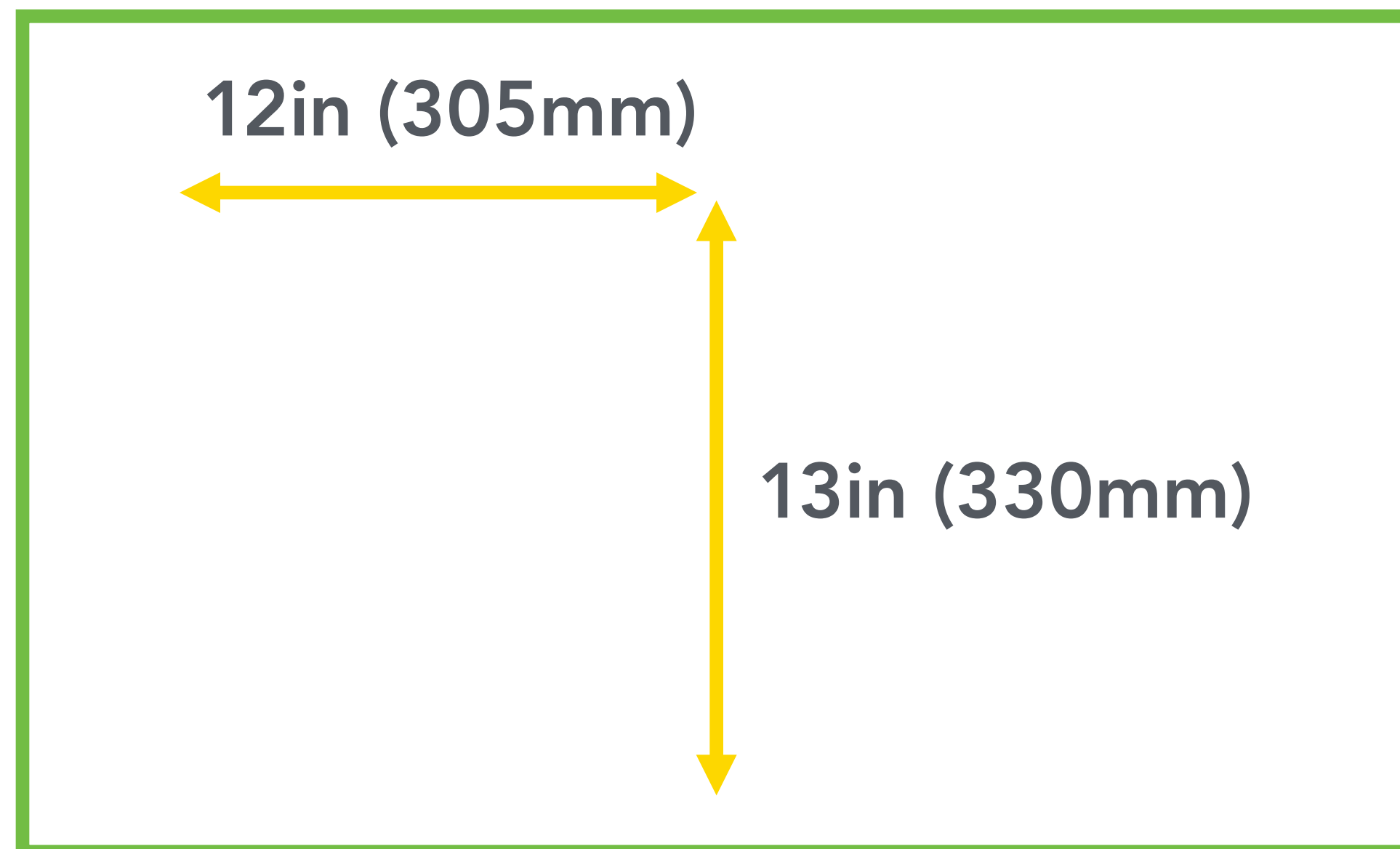
Supports up to 8 PCI-e Gen3 full height, dual-slot cards



Big Sur

Modularity

- Supports dual socket SSI EEB compliant server motherboards



Big Sur

Modularity

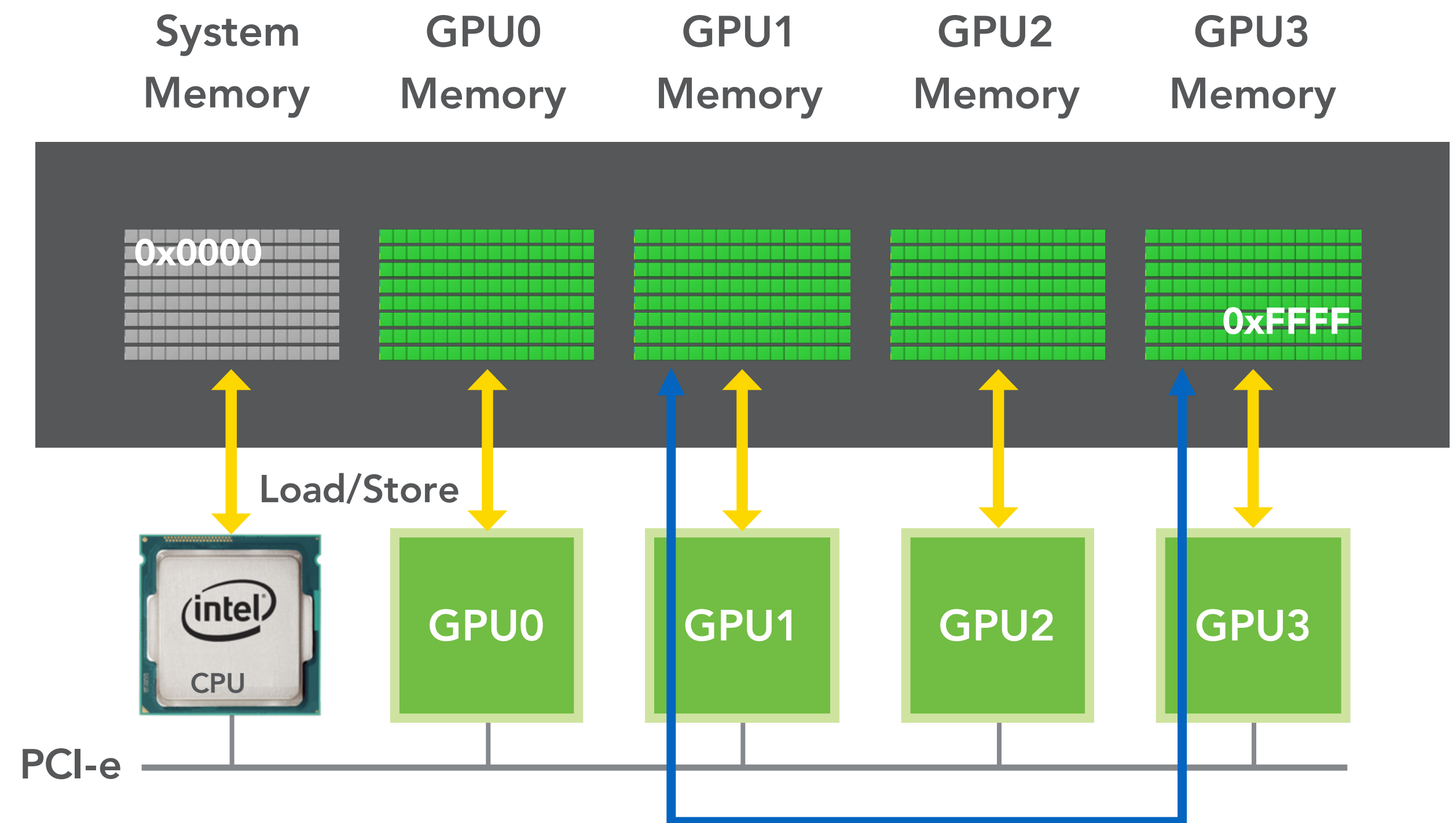
→ Open Rack v2
compatible



Big Sur

Flexible topology

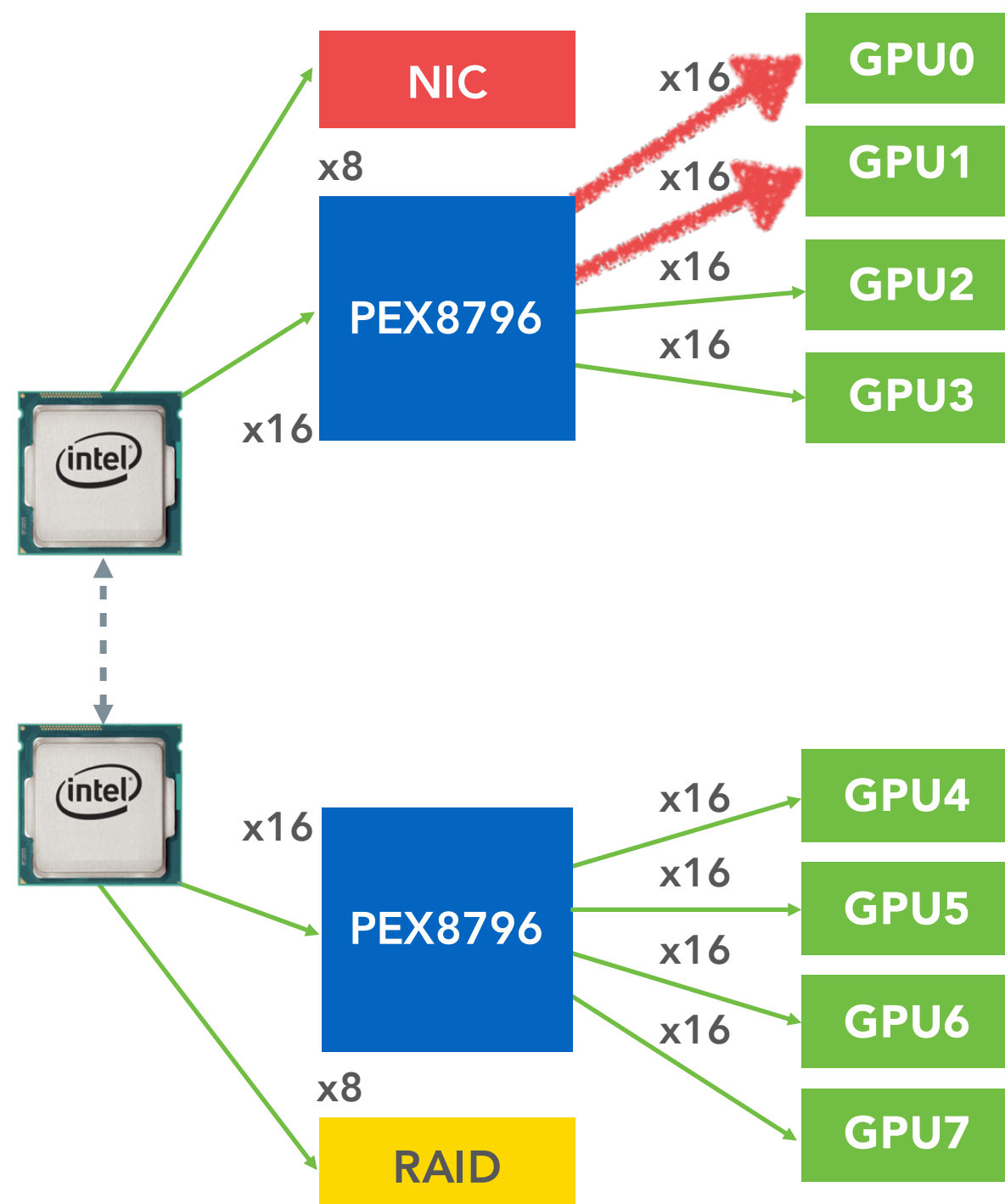
- Direct memory access
- Direct memory transfers
- One address space for CPU and GPU memory



Big Sur

Flexible topology (GPUs)

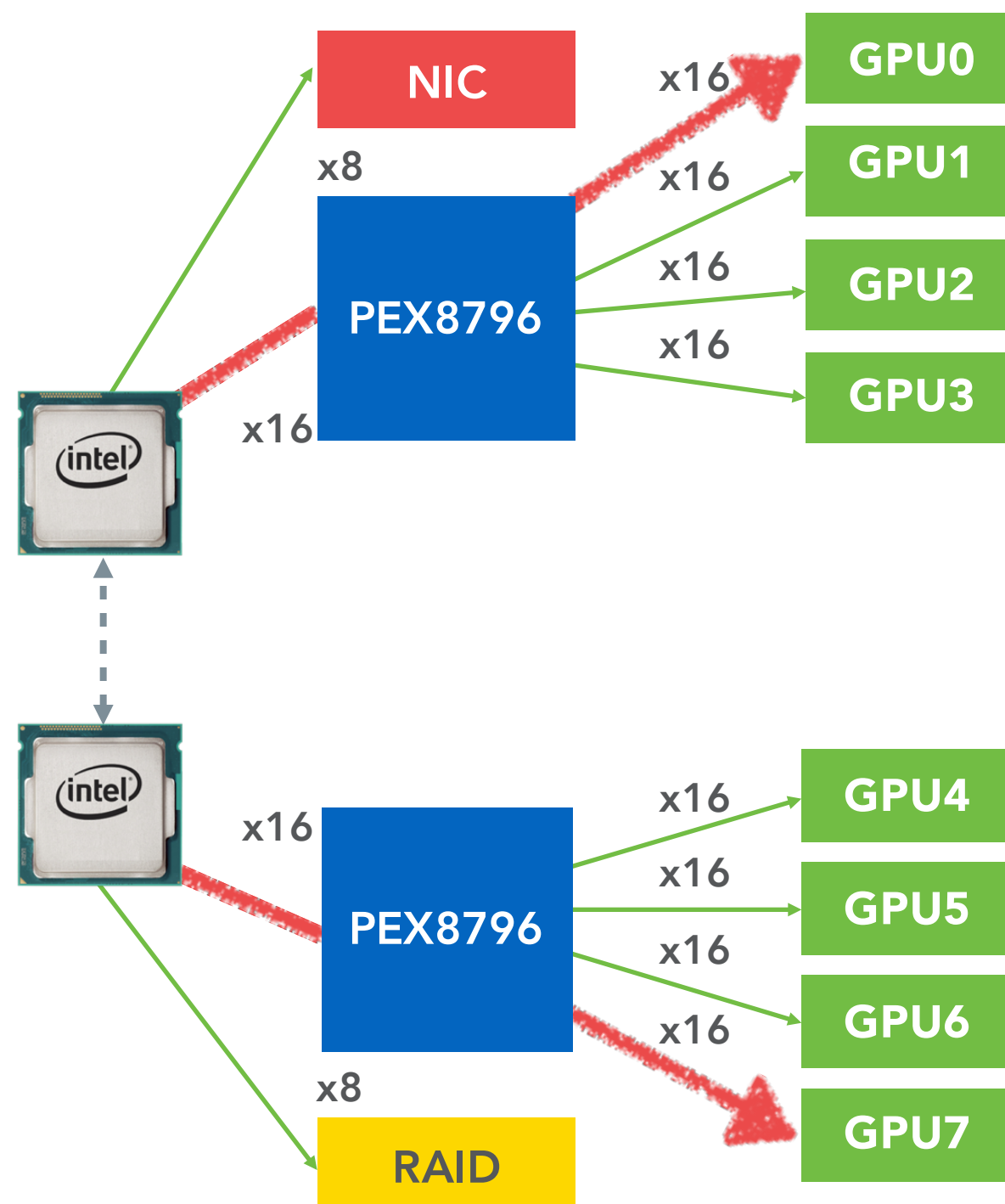
→ Balanced config



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Flexible topology (GPUs)

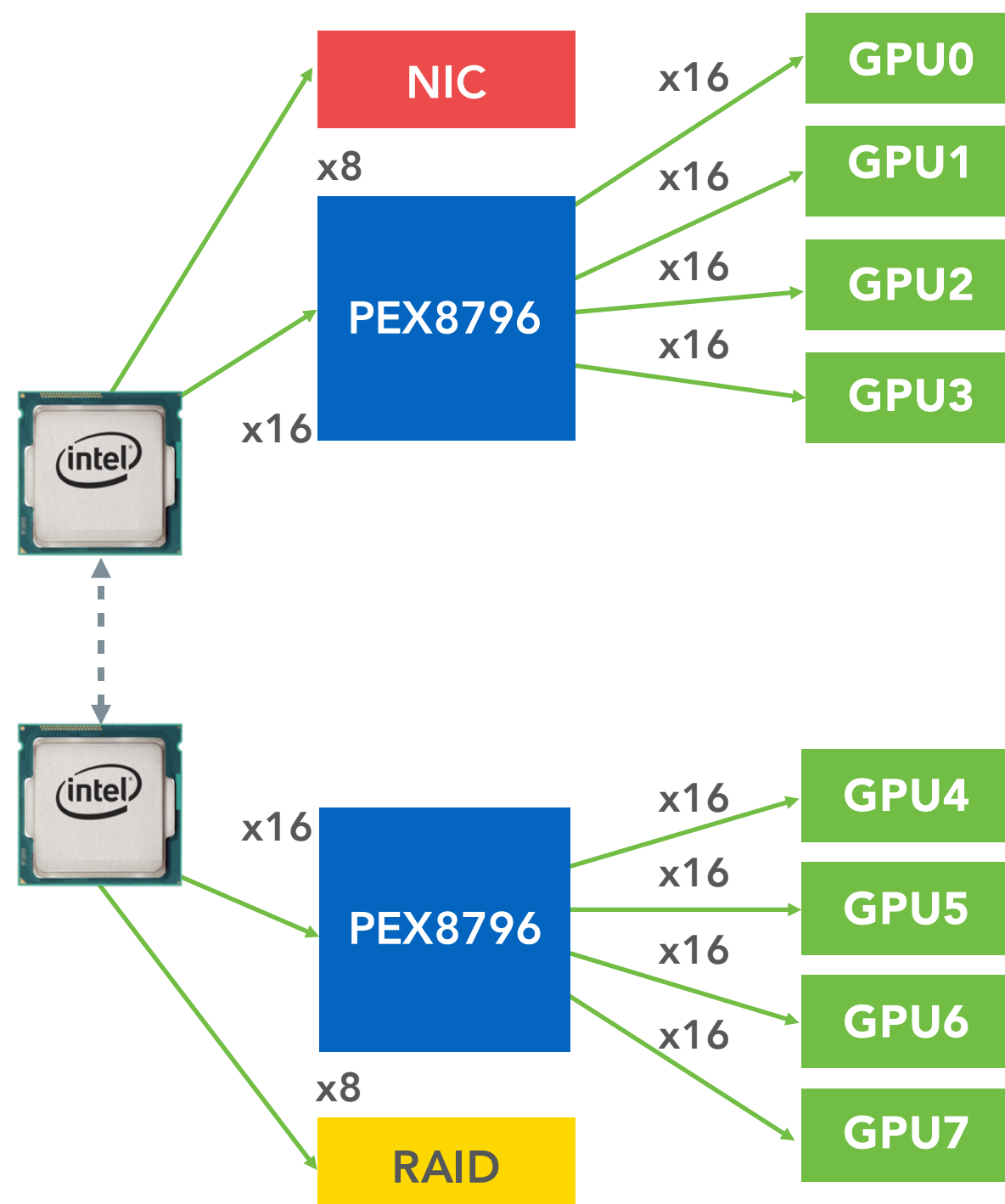
→ Balanced config



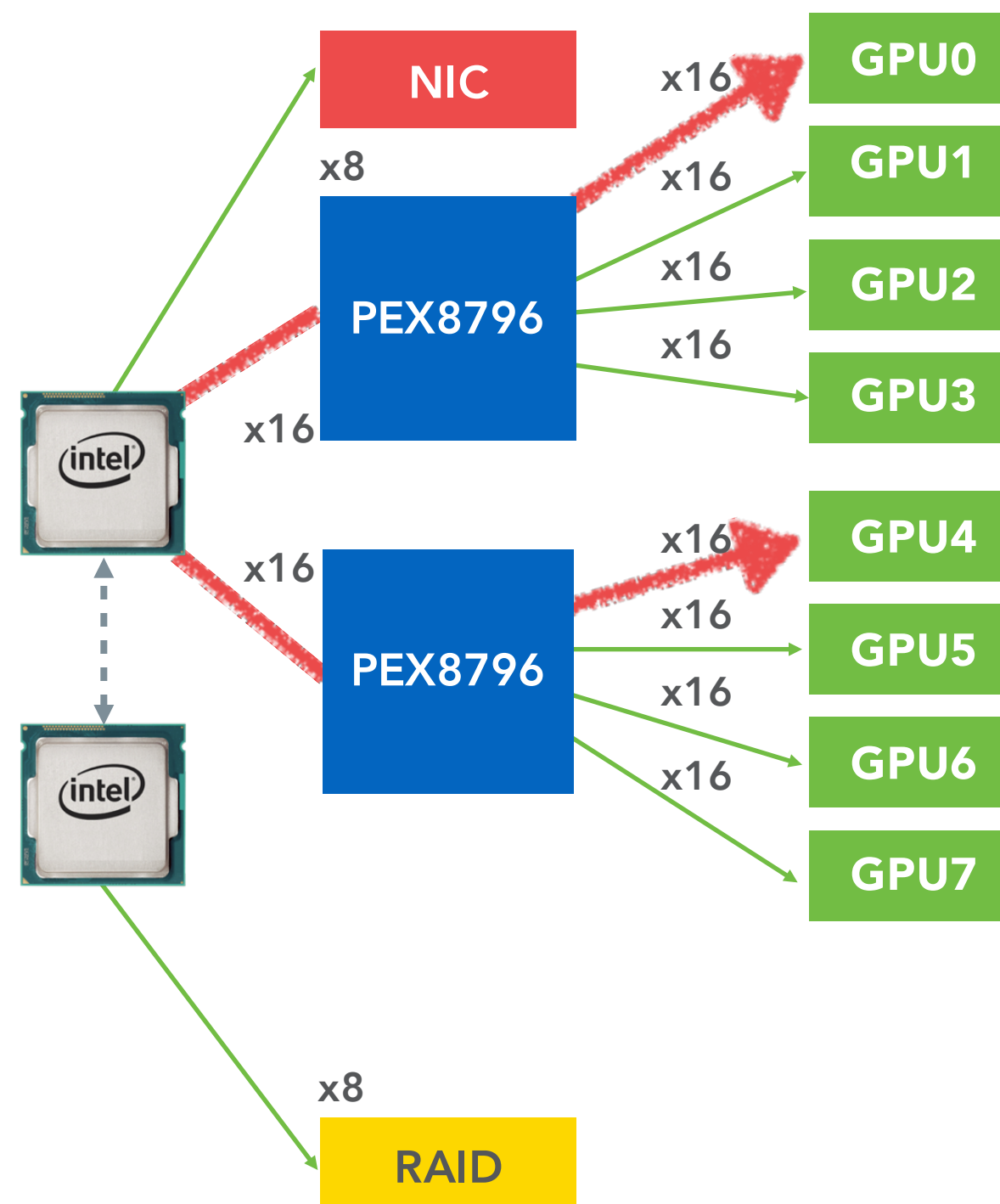
Big Sur

Flexible topology (GPUs)

→ Balanced config



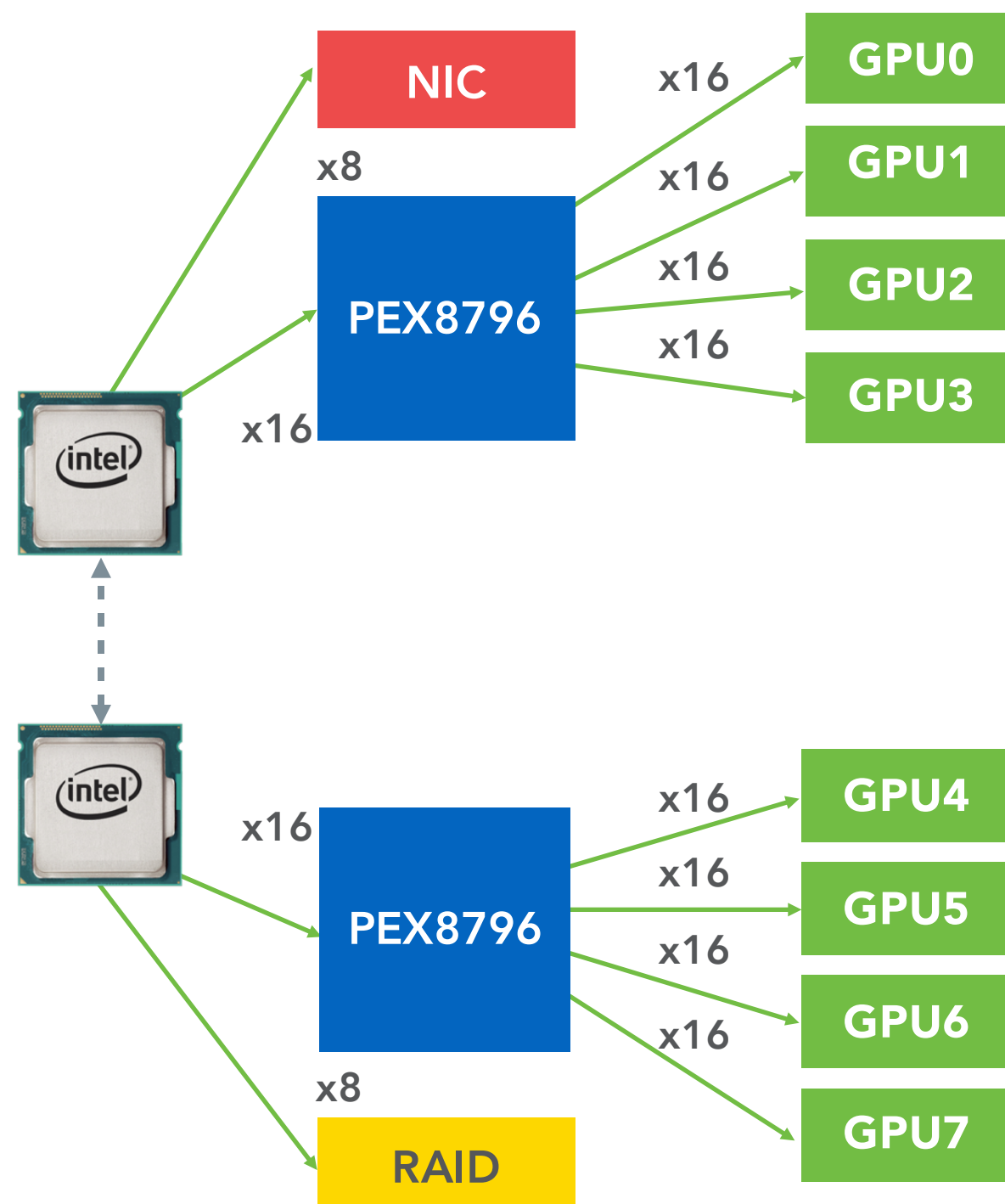
→ Common config



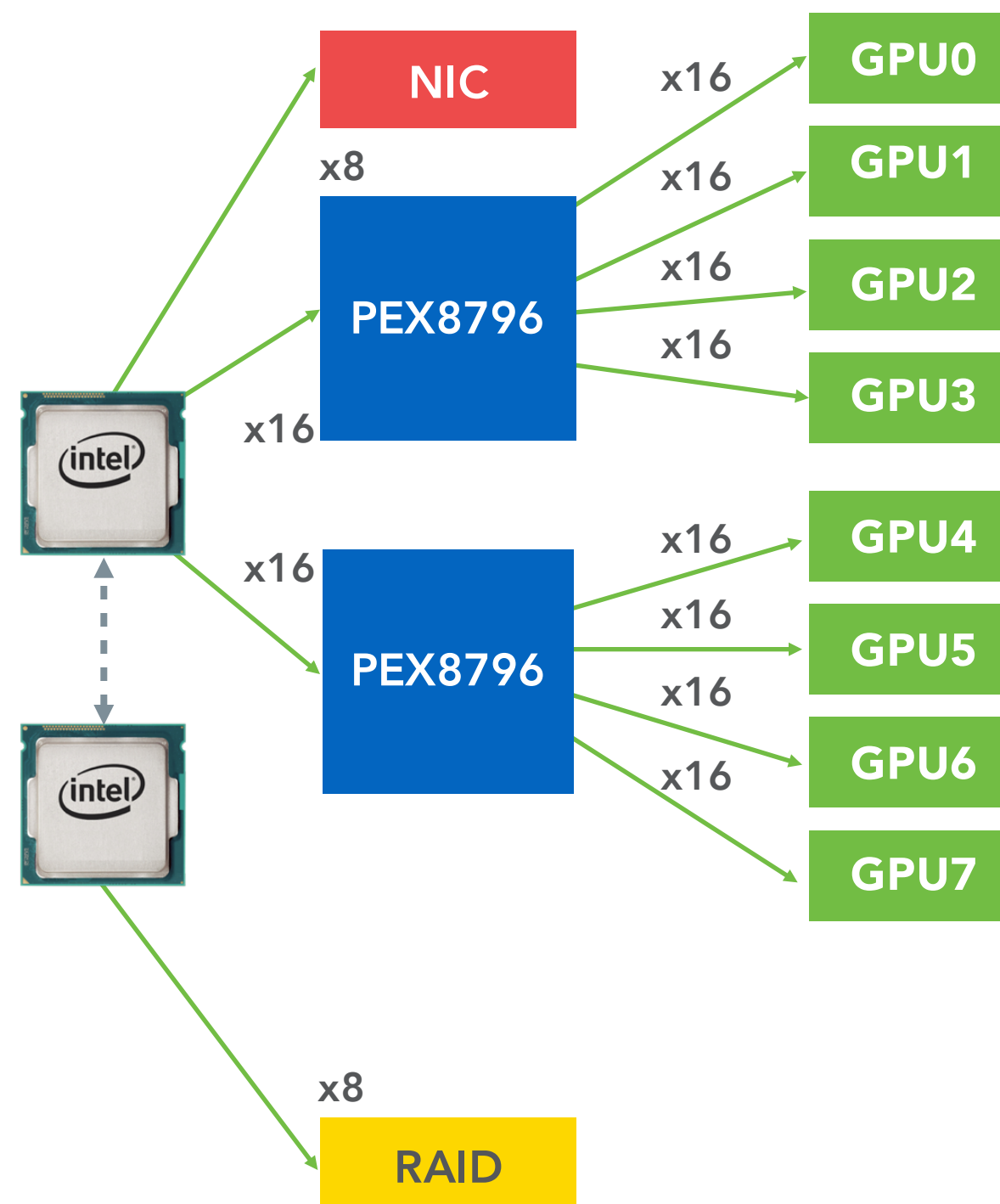
Big Sur

Flexible topology (GPUs)

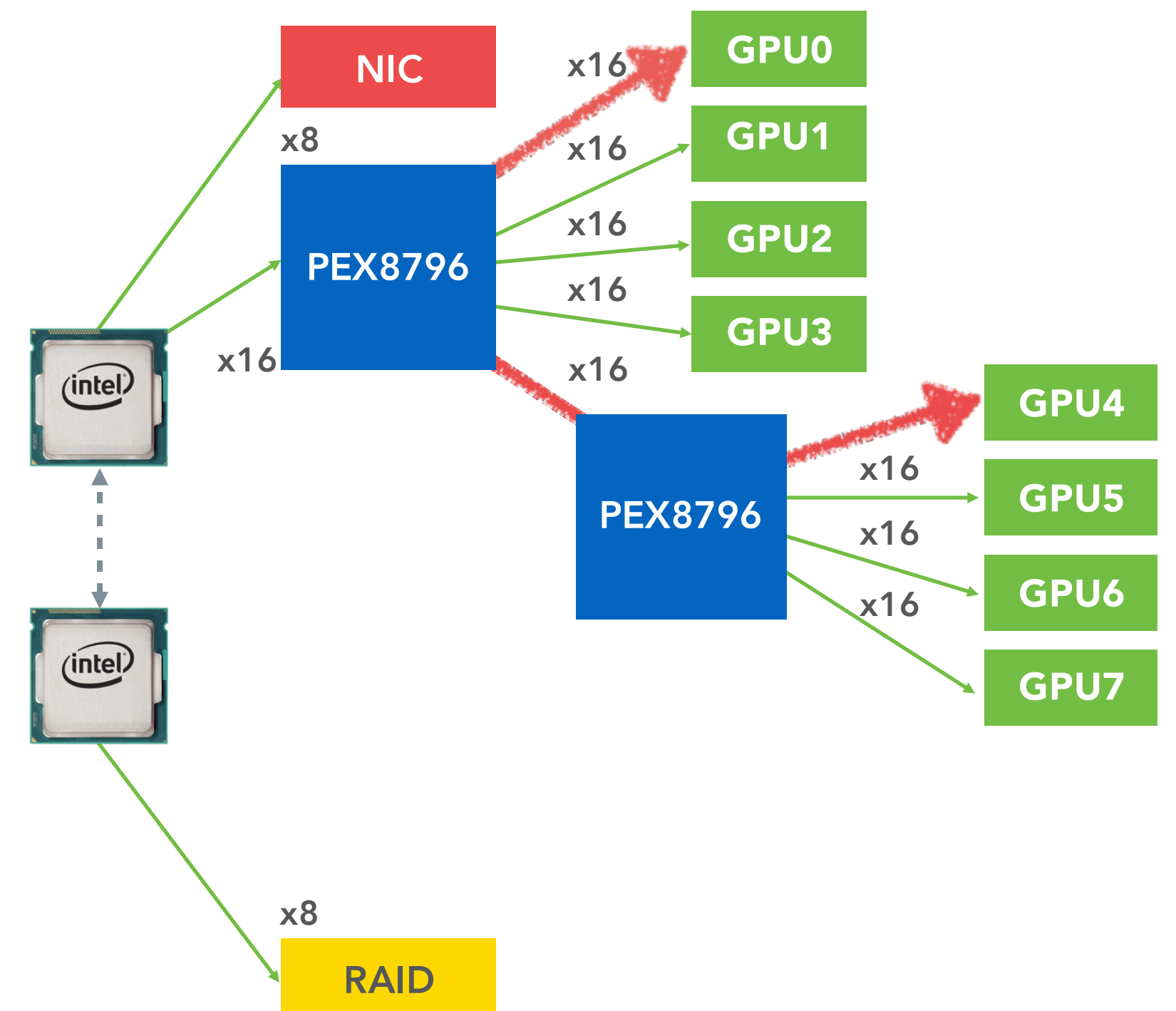
→ Balanced config



→ Common config



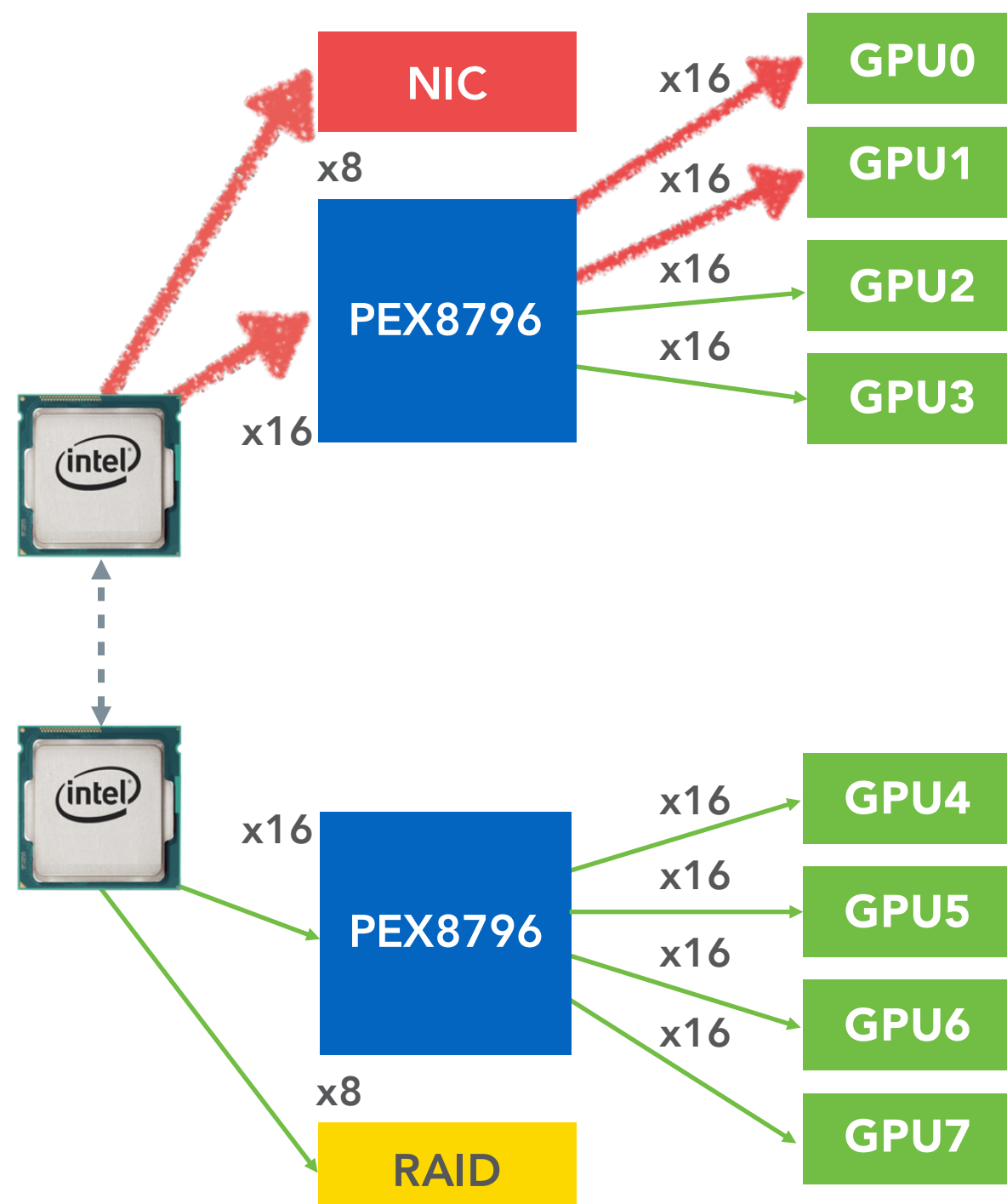
→ Cascaded config



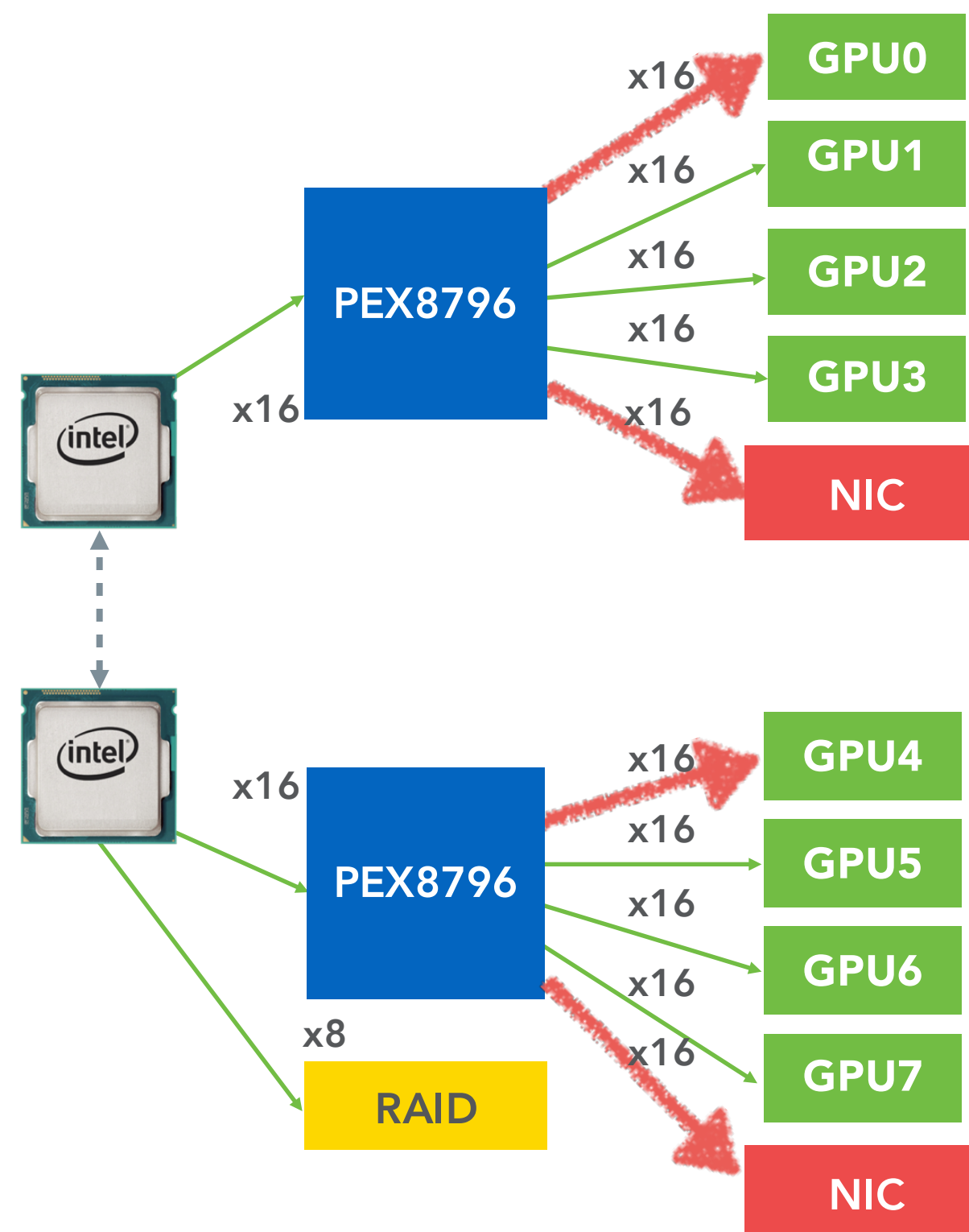
Big Sur

Flexible topology (NICs)

→ Balanced config



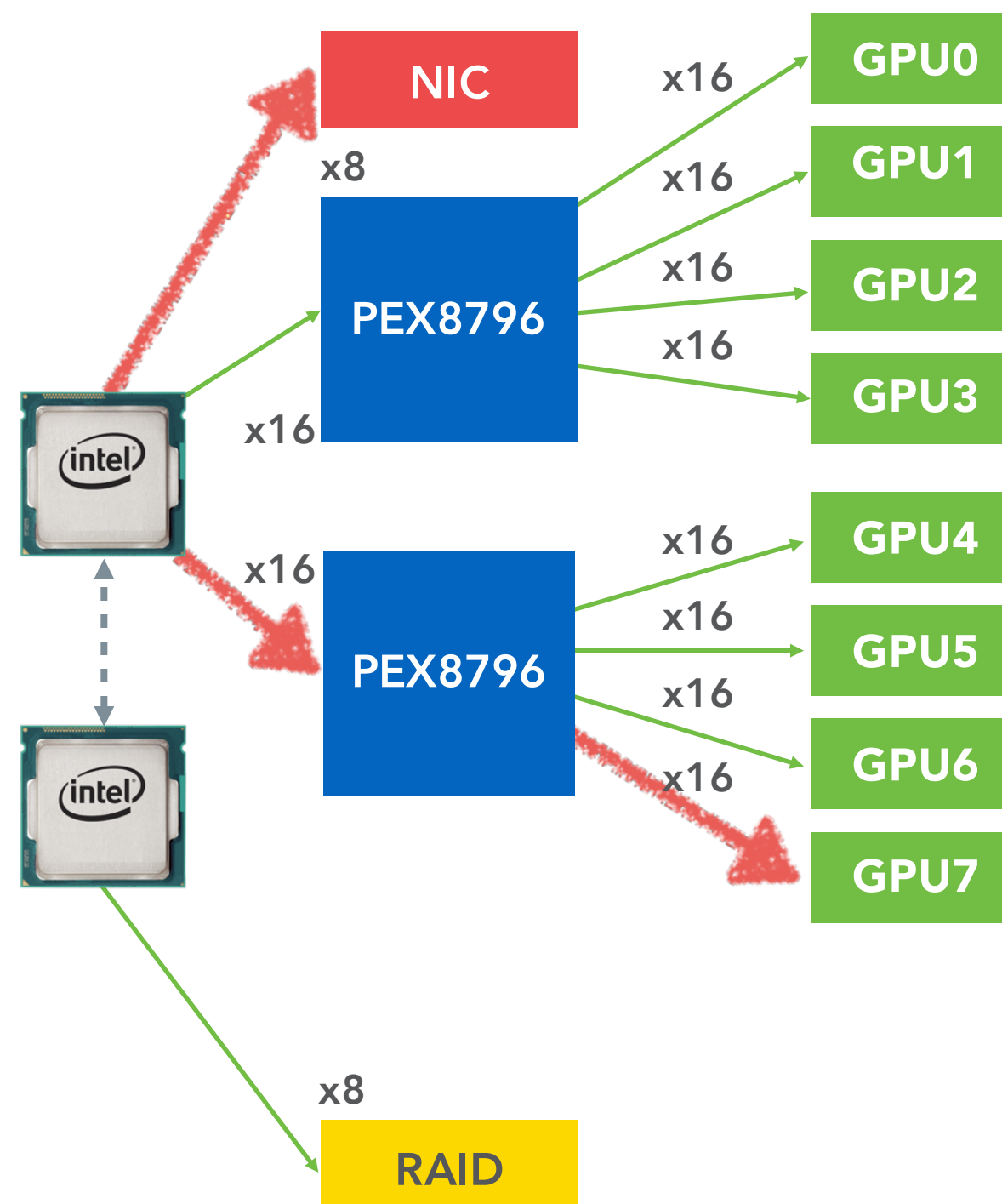
→ Balanced config (Optimized for RDMA)



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Flexible topology (NICs)

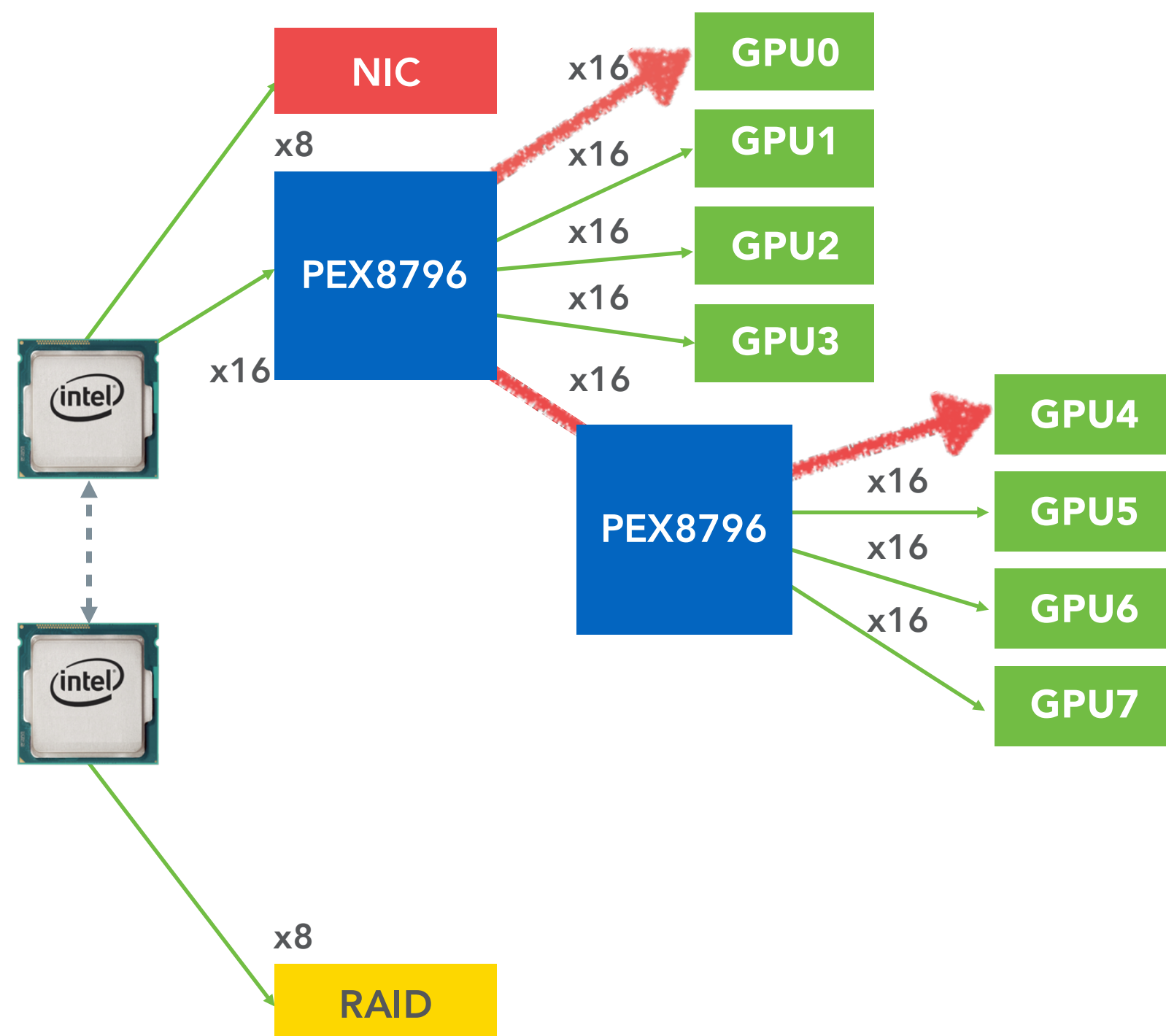
→ Common config



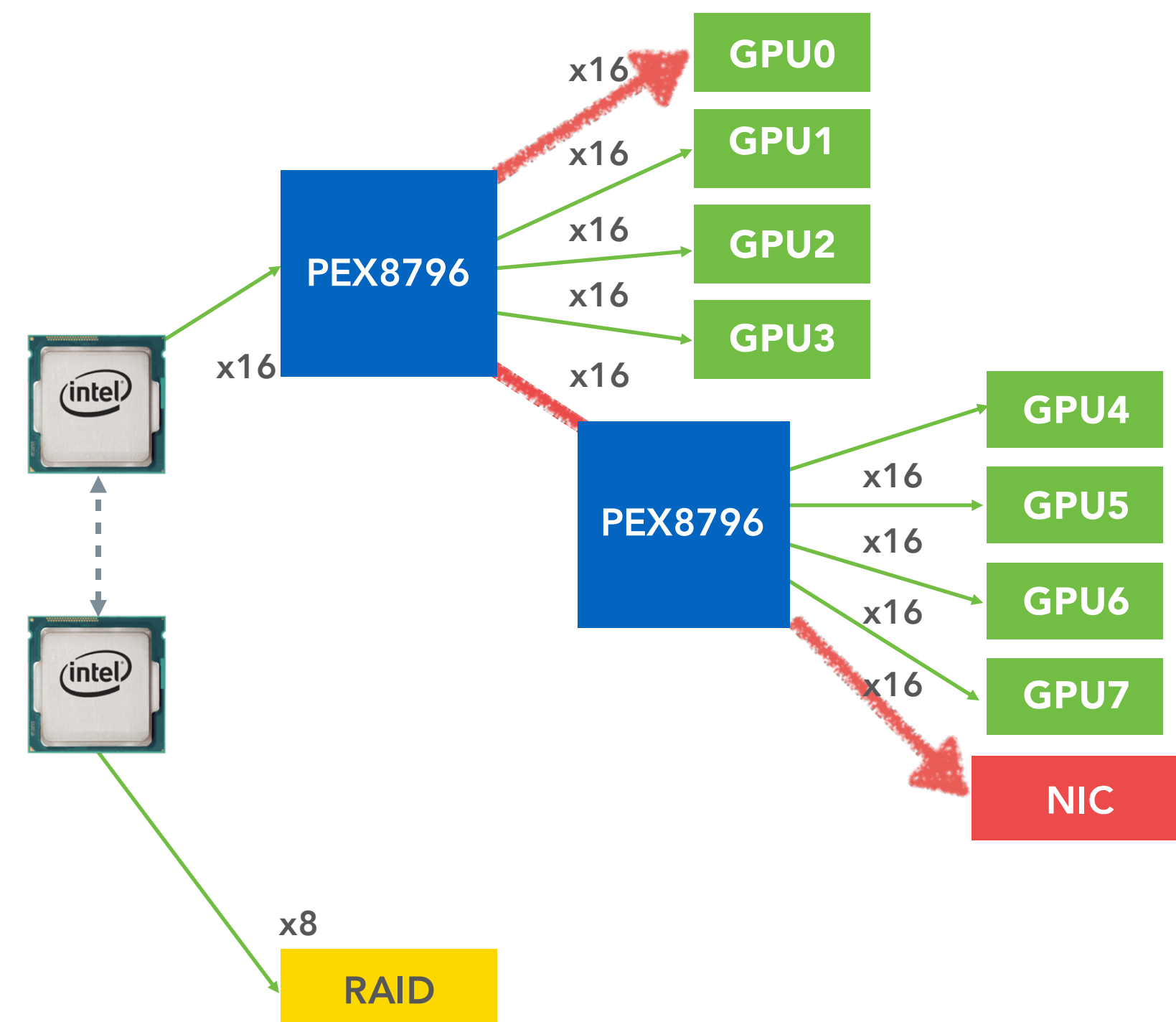
Big Sur

Flexible topology (NICs)

→ Cascaded config



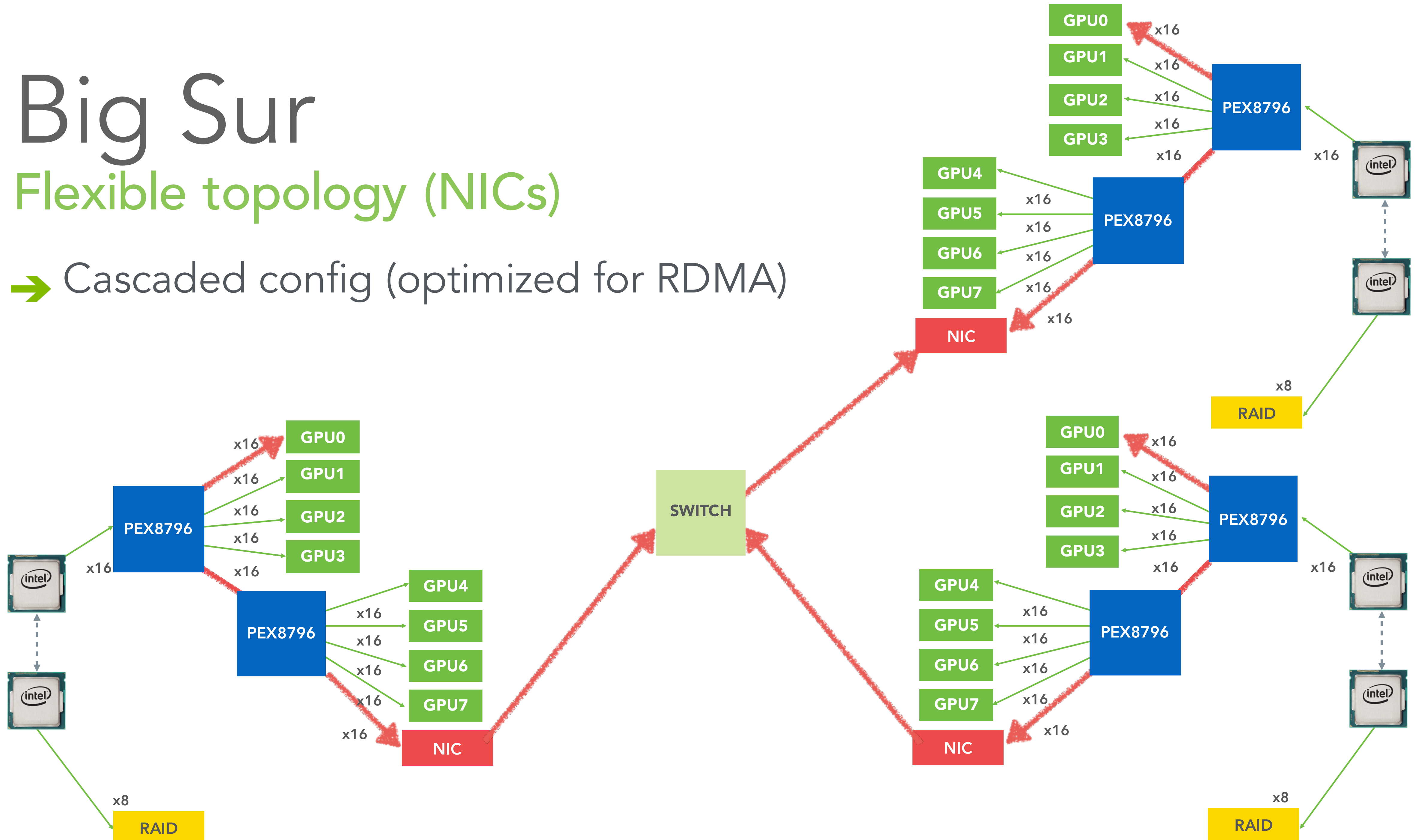
→ Cascaded config (Optimized for RDMA)



Big Sur

Flexible topology (NICs)

→ Cascaded config (optimized for RDMA)



Big Sur

Design methodology

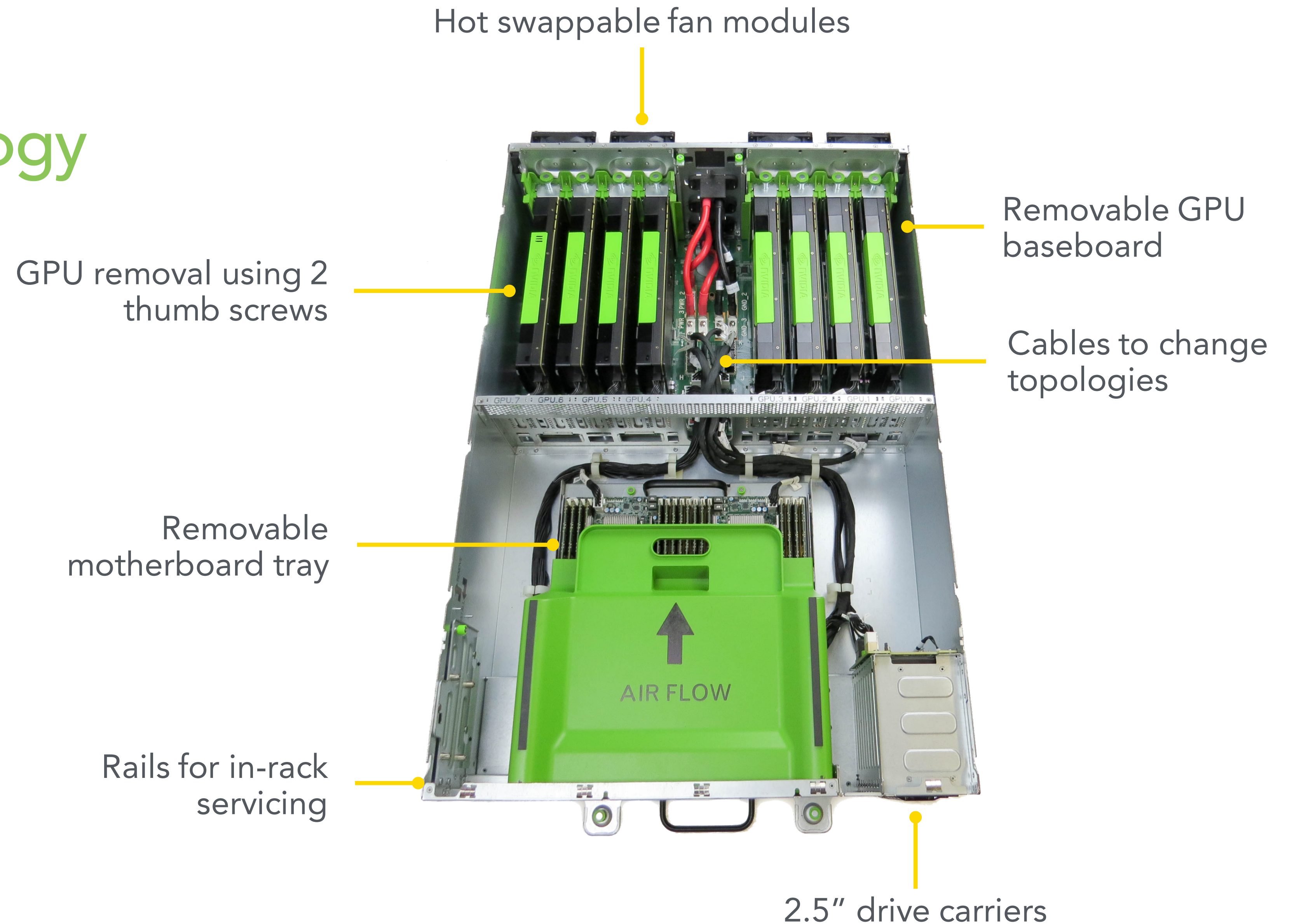
- Serviceability
- Thermal efficiency
- Performance



Big Sur

Design methodology

➔ Serviceability



Big Sur

Design methodology

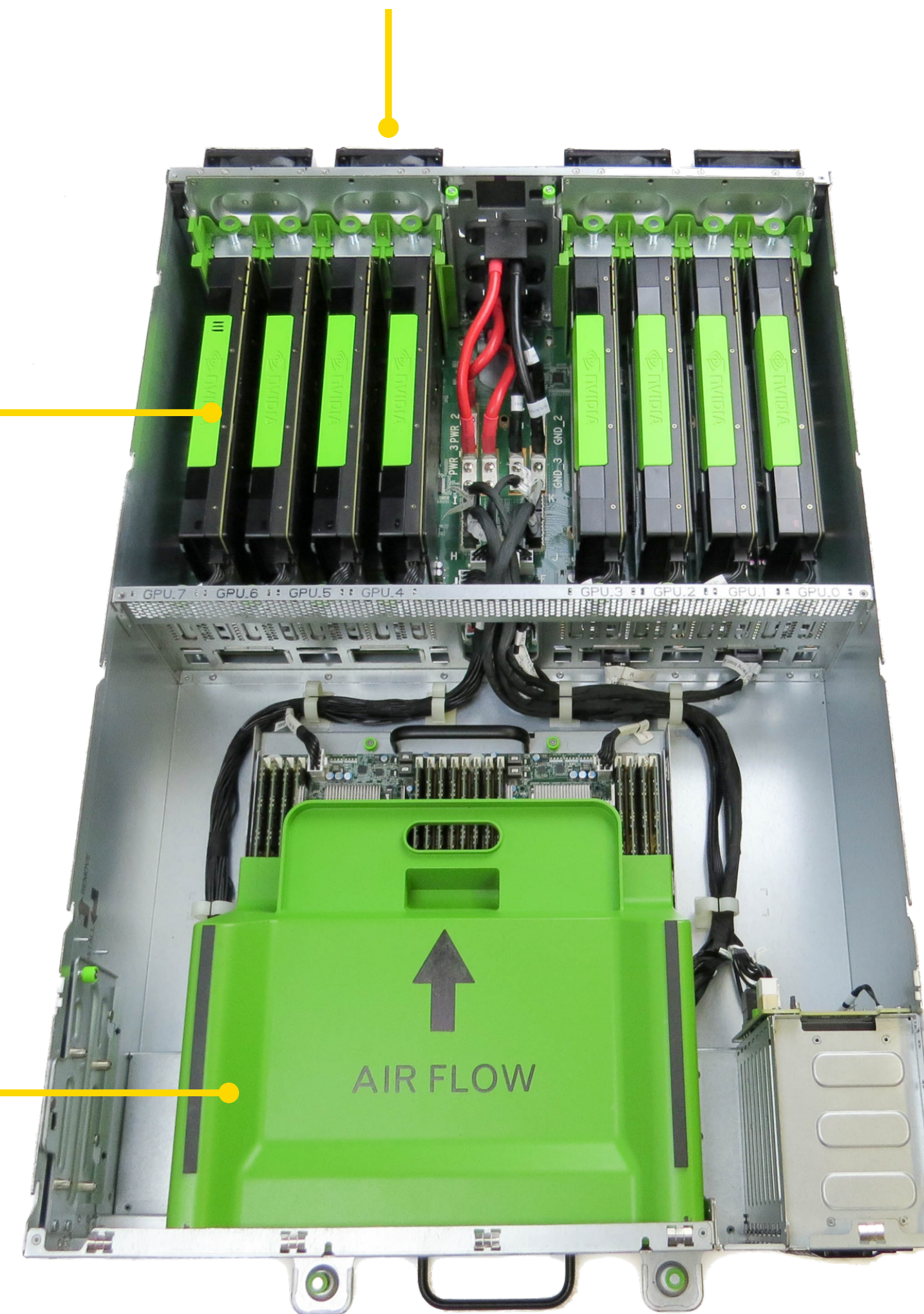
→ Thermal efficiency

4 large 92x76 mm dual fan modules

GPUs placed in series

Optimized air duct

40U chassis



Big Sur

Design methodology

➔ Performance

- High bandwidth
- Low latency

Nvidia Tesla M40 Peer to Peer Test

Bidirectional P2P=Enabled Bandwidth Matrix (GB/s)

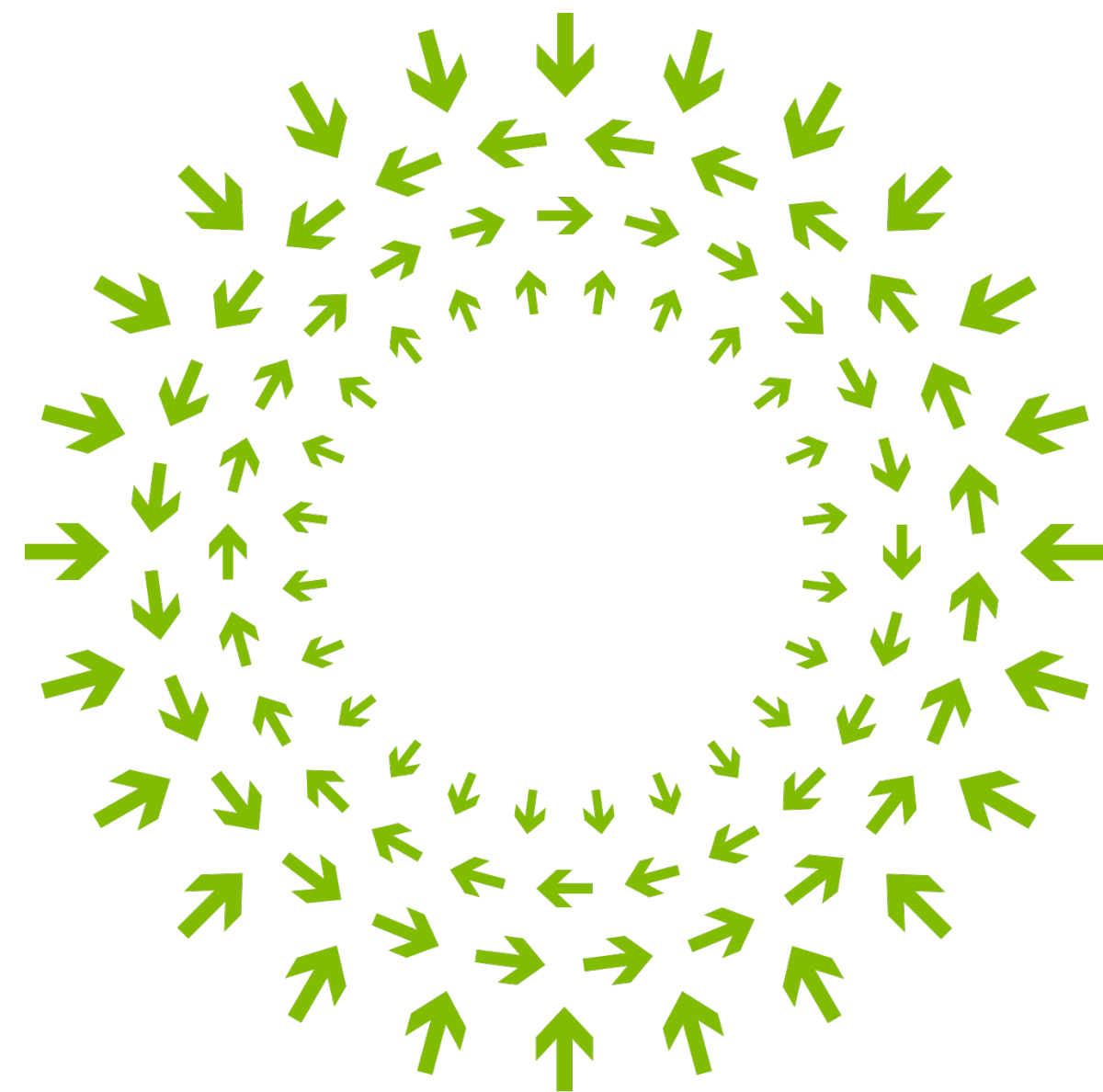
D\D	0	1	2	3	4	5	6	7
0	106.98	25.01	25.02	25.01	25.00	24.99	25.01	25.01
1	25.04	106.94	25.03	25.01	25.02	25.04	25.02	25.02
2	25.03	25.02	107.10	25.01	25.03	25.00	25.04	25.03
3	25.03	25.04	25.01	107.01	25.01	25.01	25.01	25.03
4	25.01	25.02	25.01	25.01	107.44	25.02	25.02	25.02
5	25.01	24.99	25.01	25.00	25.00	107.42	25.03	25.01
6	24.98	25.00	25.01	25.00	25.02	25.02	107.41	25.01
7	24.99	25.01	25.01	25.01	25.01	25.04	25.02	107.42

P2P=Enabled Latency Matrix (us)

D\D	0	1	2	3	4	5	6	7
0	5.51	8.32	7.96	8.06	6.68	6.82	6.86	6.78
1	7.99	5.16	7.96	8.10	6.83	6.70	6.68	6.68
2	8.01	8.16	5.02	8.04	6.66	6.66	6.84	6.86
3	7.92	7.93	7.79	5.10	6.81	6.88	6.80	6.72
4	7.88	8.16	7.79	8.19	4.48	6.69	6.75	6.76
5	7.96	8.17	7.91	7.93	6.73	4.51	6.93	6.82
6	7.91	8.11	7.94	8.26	6.88	6.72	4.48	6.73
7	8.04	8.22	7.88	8.11	6.78	6.89	6.90	4.49

Thank You





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