BRUNS-PAK
DATA CENTER "HYBRID" SOLUTIONS

Artificial Intelligence (AI) / High Performance Compute (HPC) Impacts to Data Center Facility Infrastructures Trends

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Elements of a Successful Data Center Project
Data Center "Hybrid" Design/Build Solutions

The Efficient Hybrid "2024 Transformation" - Data Center Elements

FACILITY INFRASTRUCTURE (1)

ENERGY EFFICIENC/ESG (2)

COMPUTER HARDWARE/HPC/AI (3)

EDGE COMPUTING (19)

COMPLIANCE (18)

CYBERSECURITY (17)

LEGAL REPERCUSSIONS (16)

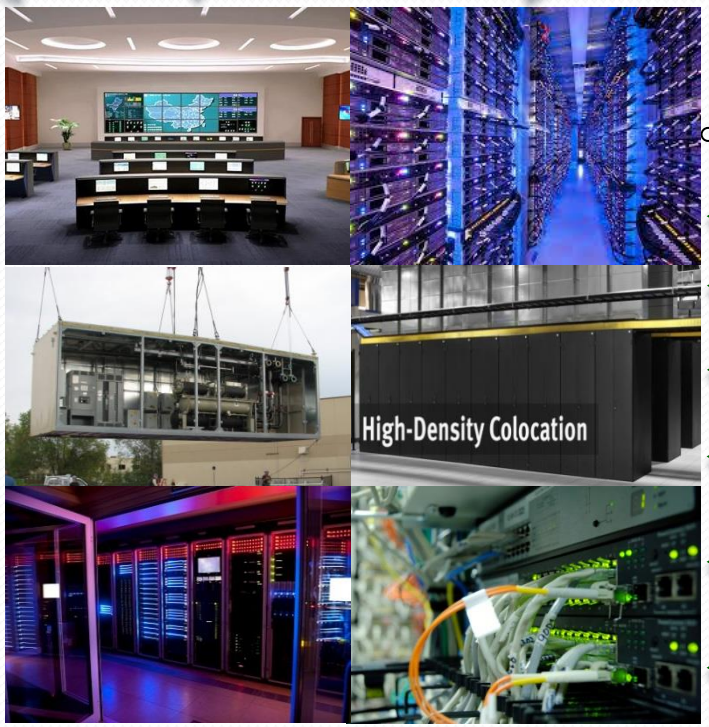
GOVERNMENT/CORPORATE/ UNIVERSITY/NON-PROFIT (15)

CONTAINERS (14)

CAPEX vs. LEASE/OPEX (13)

PERSONNEL (12)

SERVICE LEVEL AGREEMENTS (11)



CLOUD (4)
Internal/
External

DISASTER RECOVERY (5)

CO-LOCATION (6)

MIGRATION/RELOCATION (7)

COMPUTER SOFTWARE (8)

MODULARITY/SCALABILITY /RELIABILITY (9)

COMMUNICATIONS/ NETWORK (10)

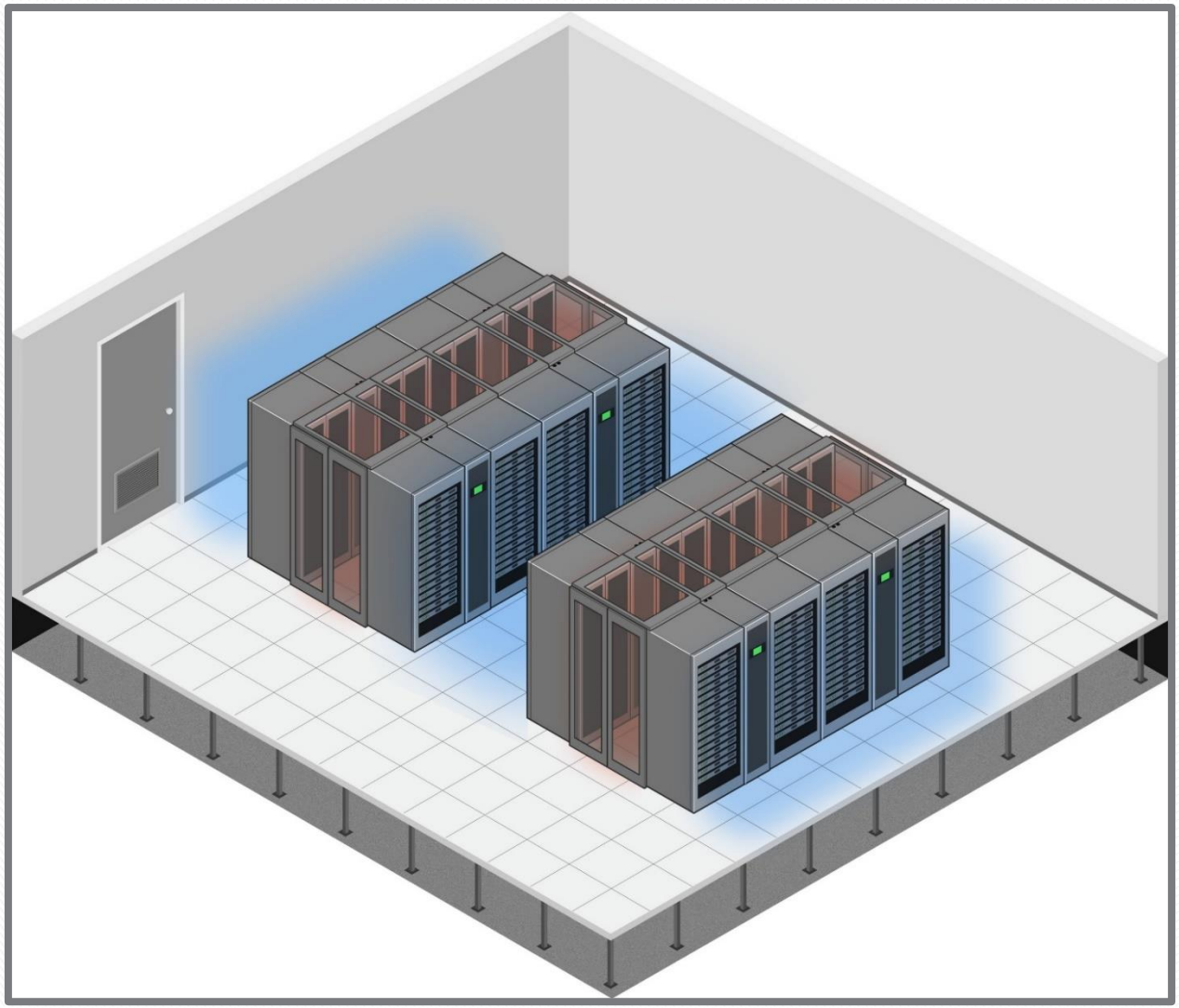
The Impact and Evolution of the Data Center Power Demand (kW) per cabinet and resulting Mechanical Cooling Concepts

AI / HPC

ITEM	DESCRIPTION
A	Air Side (Historical): 15kW
B	Hot Aisle/Cold Aisle Containment: 15kW - 20kW
C	Rear Door Heat Exchanger / In Row Cooling: 20kW - 65kW
D	To the Chip Cooling: 65kW – 120kW
E	Pilot / Test / Beta to the Chip Cooling: 120kW – 250+kW
NOTE: The power densities (kW) per cabinet are approximate and subject to CFD.	

A. Traditional Data Center Air Flow (Air Side) 15kW

B. Hot Aisle/Cold Aisle Containment 15kW – 20kW



C. Rear Door Hx Airflow (In Row Cooling) 20kW – 65kW

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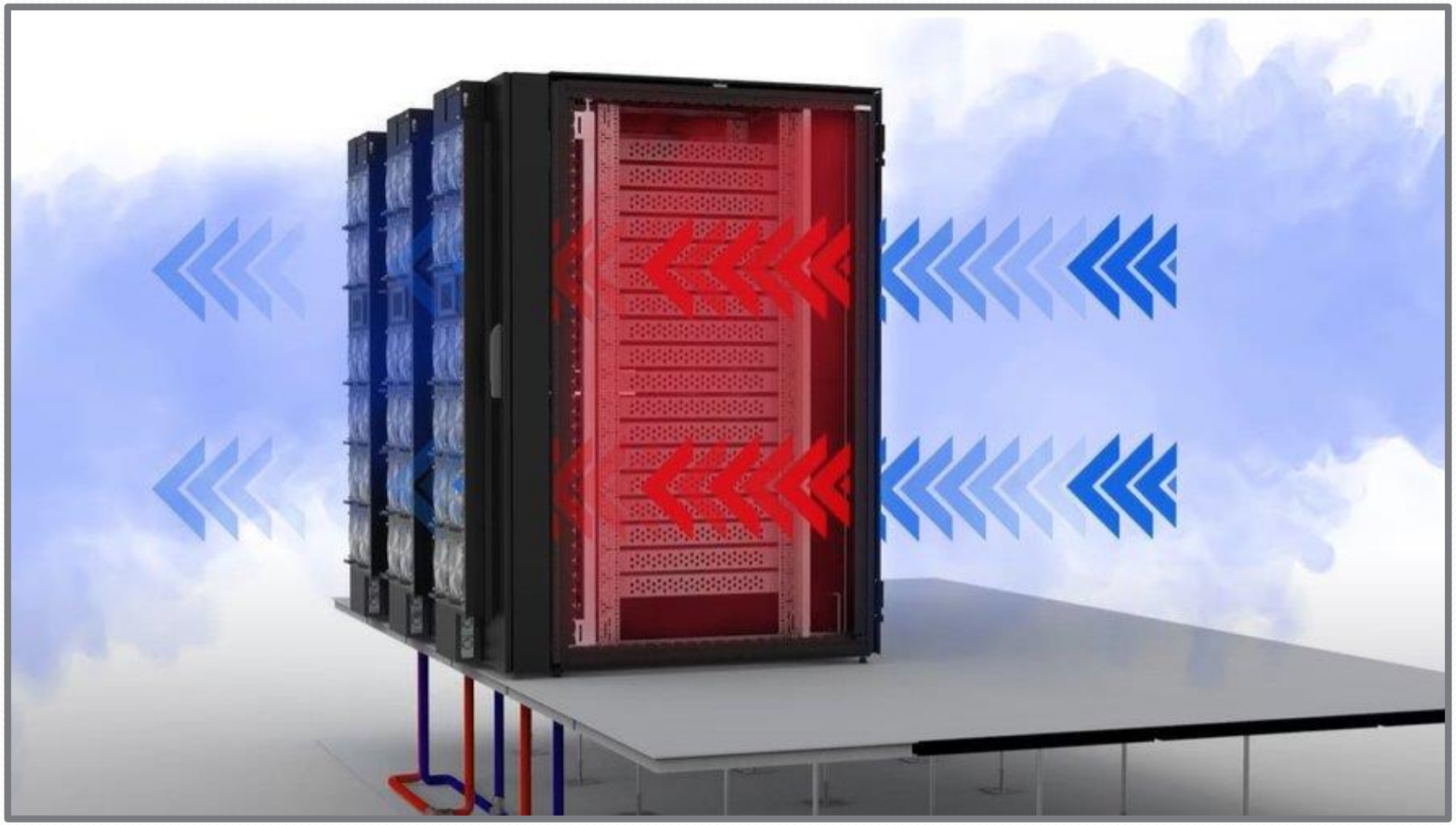
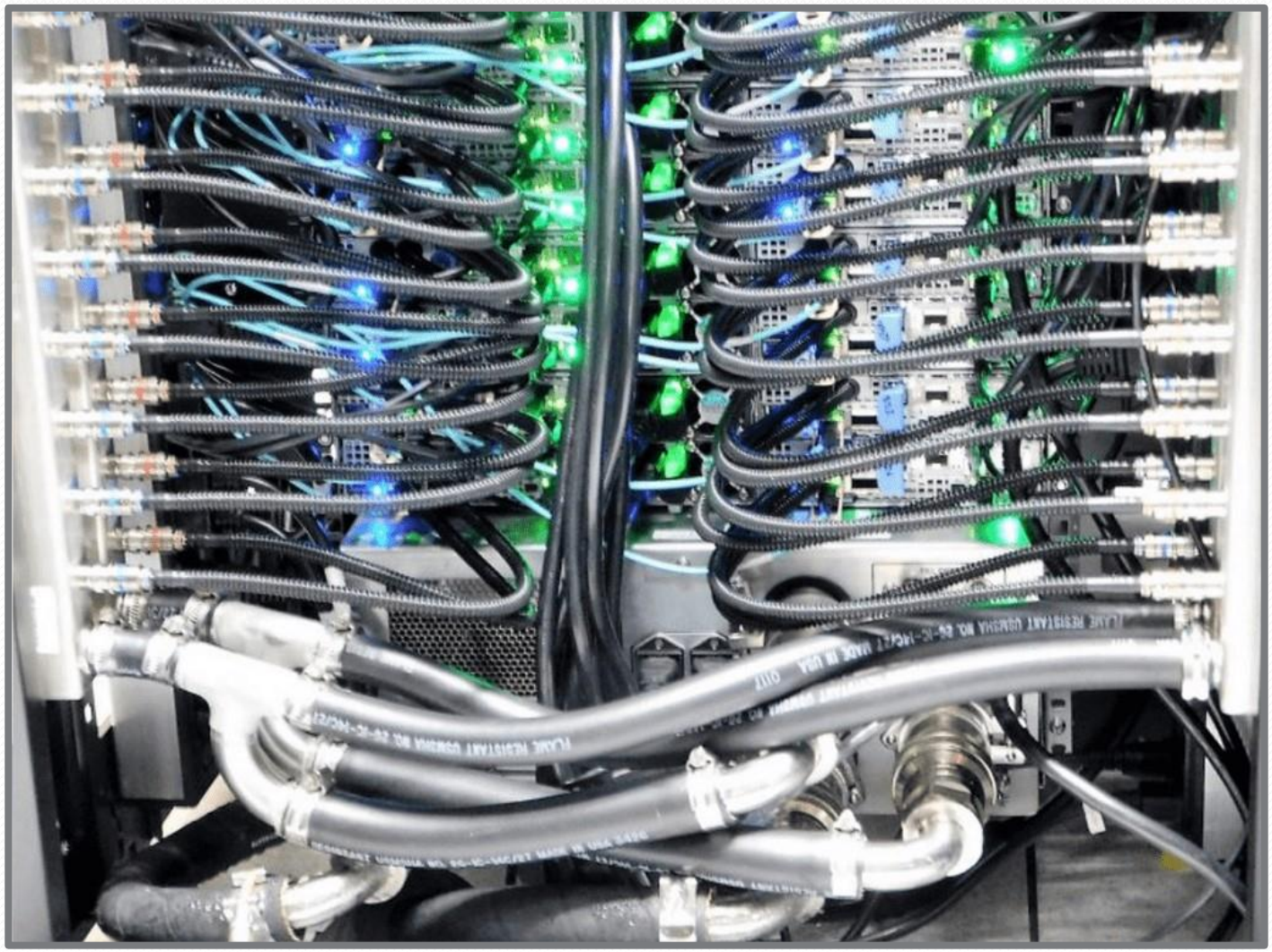


D. To the Chip Cooling 65kW – 120kW



D. To the Chip Cooling 65kW – 120kW

E. Liquid Immersion (Pilot/Test/Beta to the Chip Cooling) 120kW – 250kW

Data Center Trends

The 2024 Results of HPC/AI Deployments

1) Tremendous speed of processing results. What took weeks/months of processing application data can be decreased within hours/days.
2) Data center facility improvements are designed/deployed to accommodate a modular/scalable/flexible/reliable "HPC/AI" deployment.
3) Many end user HPC/AI applications do not require tier III/IV A/MEP superstructures. See end user support.
4) Large data center real estate consolidation results realized by deployment of "HPC/AI" loads from legacy less dense loads.
5) HPC/AI is delivering real time data to the client community results in increased profits, market share, revenue, and marketing visibility.
6) Overall "risk" to "HPC/AI" deployment critical.
7) Computational Fluid Dynamic (CFD) models are critical to establish energy efficiency modular/scalable solutions.

Data Center Trends

8) HPC/AI is being designed from a mechanical standpoint to operate in higher inlet (°f) temperatures.

9) Most all compute manufacturers continue to deploy HPC/AI now and in the future based on ROI.

10) 2024 HPC deployments at BRUNS-PAK up to 120kW per cabinet. Pilot: Liquid Immersion ±250kW

11) Survey of CIO industry leaders found that 75% believe if their business does not address AI/HPC by 2025, they face bankruptcy.

12) OPTION: Retrofit/renovate/upgrade legacy data centers to meet HPC/AI objectives vs. modular vs. new.

13) HPC/AI expected to double data center power usage in the next three years.

Data Center Trends

Conclusions

- ✓ HPC/AI deployments are growing at an expediential level.
- ✓ The growth of HPC/AI is based on the increased use of technologies like internet of things (IoT), machine learning (ML), and now quantum computing.
- ✓ The initial rates of return of "properly deployed" HPC/AI is reporting less than three (3) years.
- ✓ The industries served by HPC/AI are exploding.
- ✓ Compute manufacturers including Nvidia, IBM, Dell, HPE, and Lenovo will continue to develop high powered compute racks.
- ✓ Cloud/colocation/EDGE/container/enterprise data centers continue to evolve to address the optimal solutions.
- ✓ Overall solution resilience critical.