

# *Data Center Design - From SP to DLC*

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# About Me

## Patrick Finnegan

- HPC Engineer at Purdue since 2002
- HPC Data Center Engineer and Architect since 2012
- DARPA Cyber Grand Challenge Infrastructure
- HPC Architect and R&D
- Collect, Teach, Engineer, and Community Organize around Computer History



# *The Early Days (Circa 2002)*

IBM SP, NCR Teradata...



# *The Early Days (Circa 2002)*

IBM SP, NCR Teradata... and Linux!



# *The Early Days (Circa 2002)*

## IBM SP, NCR Teradata... and Linux!

- 20 Ton CRAC units
- Under floor 120/208V power
- 100BaseT Ethernet woo!



# *First Gen High-Density HPC (2009)*

**7KW per rack, and water!**

- 30A 208V PDUs
- IBM CoolCentric RDHx



# *Bad Ideas along the way*

## Aisle air confinement

- CardboardPlexiglass



# *Bad Ideas along the way*

## Containerized Data Centers

- Does look kinda cool



# *Bad Ideas along the way*

## Containerized Data Centers

- Outside
- Nowhere to work nearby
- Confined spaces



# *Bad Ideas along the way*

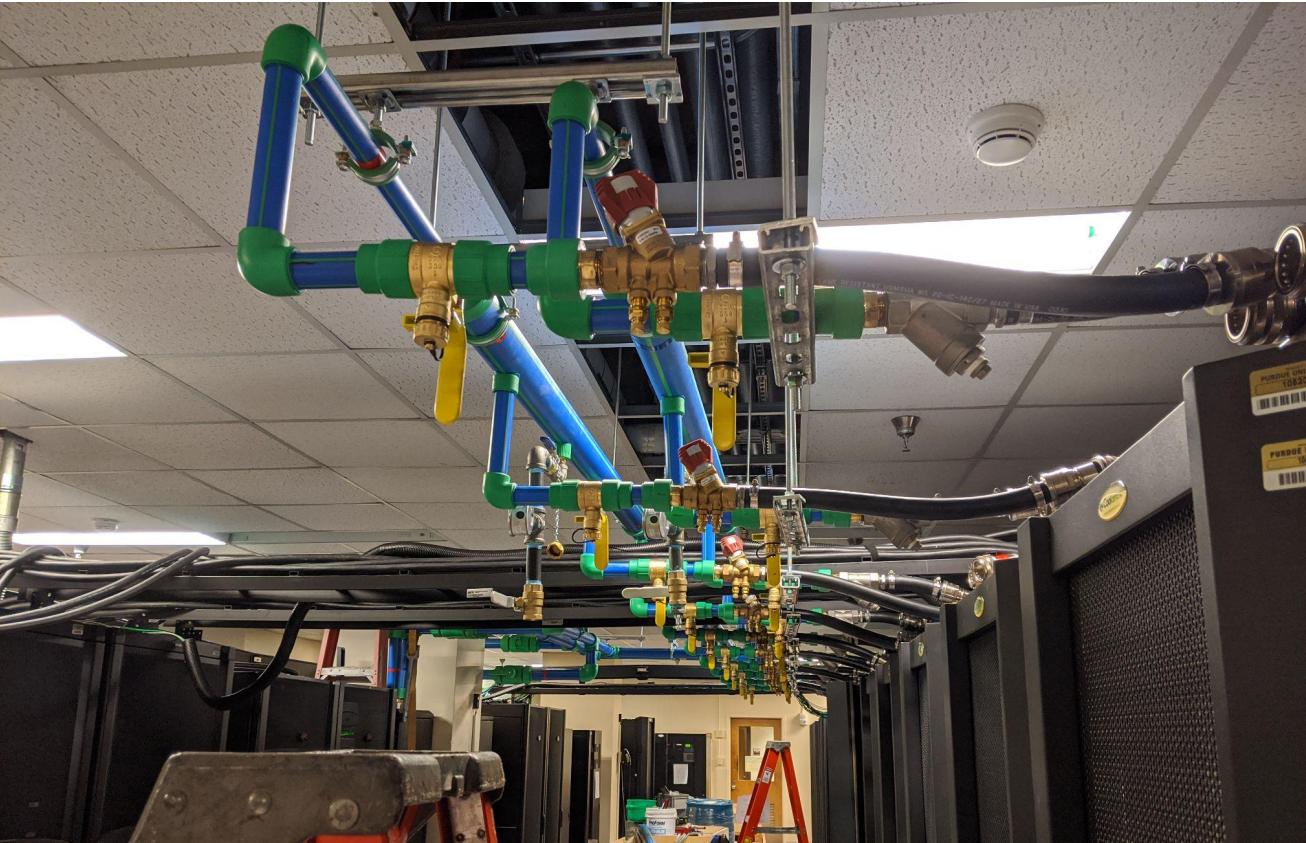
## Moving clusters

- Rework is the enemy
- More expensive in the long run



# *The Way Forward*

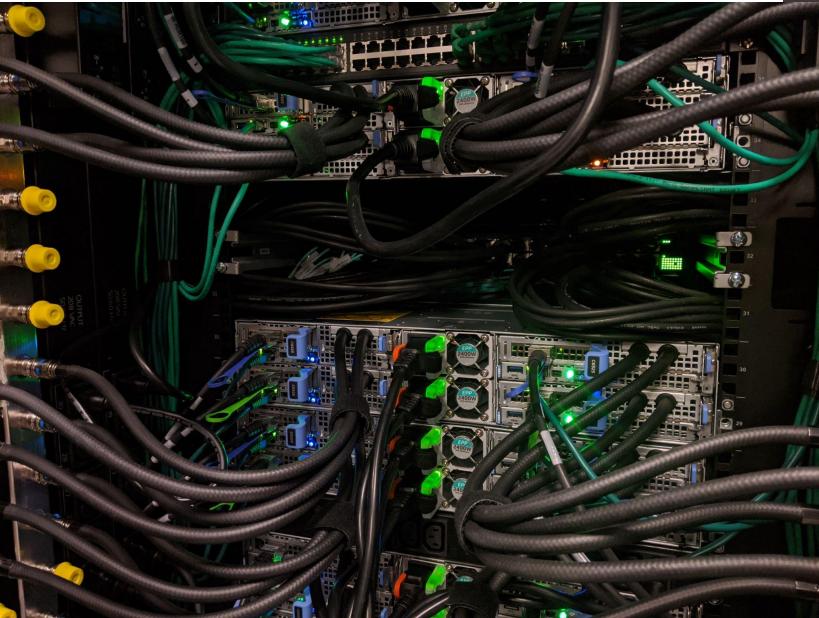
More water!



# *The Way Forward*

More water!

- DLC - water to the chip



# *The Way Forward*

More water!

- Active RDHx - fix airflow



# The Way Forward

## More Power!

- 415V power



# *The Way Forward*

## Bigger racks

- Width - 600mm -> 750mm -> 800mm
- Depth - 1050mm -> 1200mm
- Height - 42U -> 45U and beyond

# *The Future*

## More, more, more: Water and Power!

- 480/277V power
- DLC to GPUs
- 100KW per rack? Maybe...

# THANK YOU

Any questions?