



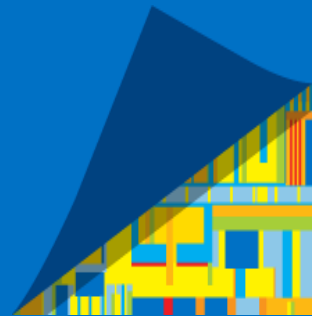
Demand Response Interface to datacenters beyond HPC

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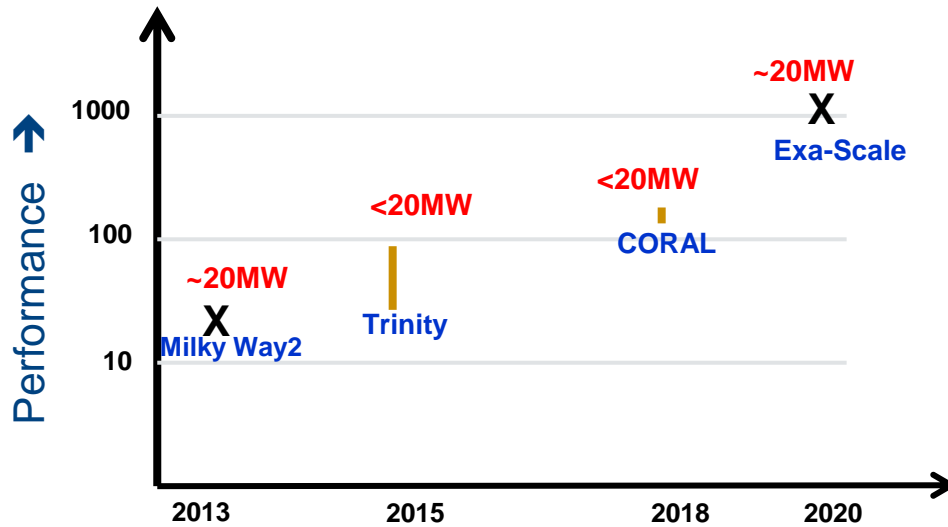
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Power-performance expectations for future supercomputers

Power-performance expectations of future Supercomputers

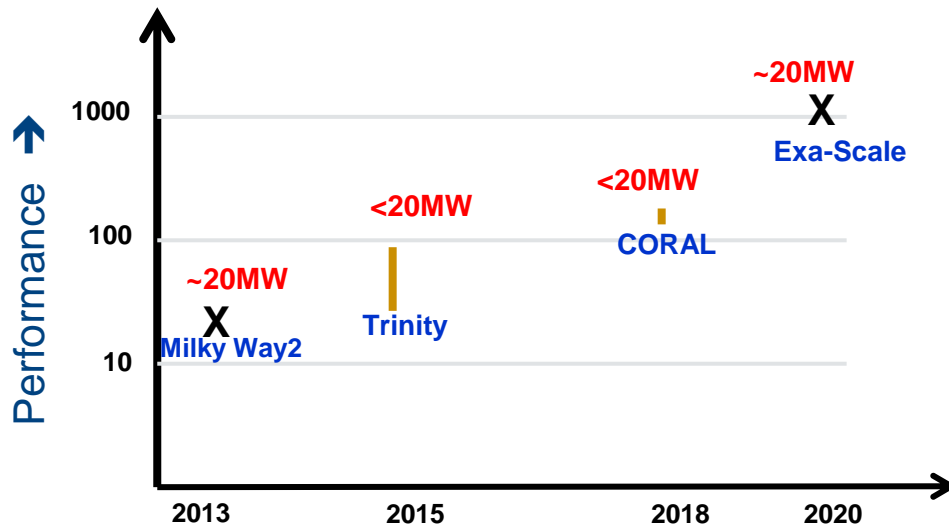


With growing demands facility may not get all the power asked for

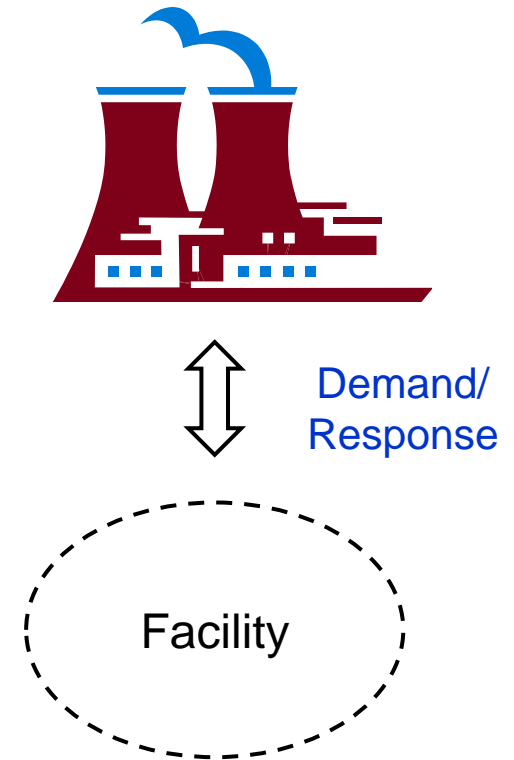
Performance expected to grow at exponential scale while power has to be flat

Power-performance expectations for future supercomputers

Power-performance expectations of future Supercomputers



Performance expected to grow at exponential scale while power has to be flat



**Future Supercomputers:
Allocation of power will be limited and dynamic**

Power Challenges and Opportunities

Not just HPC

- Growth in demand for power in all datacenters
 - More servers using high performance processor → more power
- Cloud usage model
 - Virtualized servers with capacity on demand
 - Ability to shift load geographically
- Opportunities
 - Precision in demand (Low excess or “over Demand”)
 - Improvement in energy efficiency → lower demand

**HPC systems may get more power
if other datacenters are less conservative**

Role for demand response

- Use of Demand Response
 - Minimize the “over” demand
 - Monitor and track use of energy
 - Optimize scheduling of work
 - Efficiency and pricing
 - Optimize pricing
 - Use incentive programs
 - » Most incentive programs are unused
 - Peak pricing control
 - » Role of local production of energy
 - Real time pricing

**Demand-Response key to “right size” the provisioning
and reduce cost**

Challenges for adoption

- Control systems
 - Optimized control to comprehend local demand, local generation of energy and allocation by utility

- Industry standard interfaces
 - Ease of use and interoperability
 - External facing interface
 - Defined and developed by industry
 - Monitoring and control interface
 - Data Center Infrastructure Management (DCIM)

Interface needs automated controls to feed the right information

The Green Grid: A key enabler

- The Green Grid
 - International organization focused on end to end resource efficiency
 - Vendor neutral – ~200 members
 - Several examples of competing vendor driving for better solutions
 - Focused on technical matters: metrics, how to, BKMs
 - Followed by vendors, industry, policy makers and governments
 - Good place to drive wider deployment of Demand-Response
 - Workgroups focused on Utility and DCIM
- Example: Power Usage Effective (PUE)
 - Not a measure for efficiency but led to improving efficiency
 - Green Grid Data center maturity mode (DCMM)
 - PUE: Product impact, Influenced designs & processes for datacenter
 - Most data centers implement monitoring
 - Many improved PUE from over 2.0 to sub 1.5.

Summary and Call to actions

- Right size of demand/allocation will benefit everyone & HPC
- Must use Industry standards for interfaces
 - Internal and external
 - Easy to implement
 - Allow interoperability
- Green Grid provide venue to build the momentum



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