MAXIMIZING MISSION CAPABILITY

BY MITIGATING

TRAPPED POWER CAPACITY

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An insight to power usage in the US and Federal data centers.

2008

In 2008, 61 billion kWh were consumed by data centers in the US.

Approximately 6 billion kWh were federal servers.

(source: Brown et al, 2008)

2013

In 2013, 91 billion kWh were consumed by data centers in the US.

Approximately 10 billion kWh were federal servers.

(source: NRDC, 2014)

Lets put these power values in perspective

39 billion kWh is the annual electricity consumption for all the households in the state of Michigan at a cost of $3.8 billion.

(source: Brown et al, 2008)

2013

In 2013, 91 billion kWh were consumed by data centers in the US.

Approximately 10 billion kWh were federal servers.

(source: NRDC, 2014)

A reflection on the power usage statistics in the US and federal data centers

Imagine, just for a moment,
the impact if the Utility over built their infrastructure by 30-40%

Is there a difference between Stranded Capacity and Trapped Capacity?

YES!

Stranded Capacity is a PHYSICAL constraint!

Stranded Capacity = Insufficient Power or Space or Cooling to support intended loads

Stranded capacity is that capacity for which there is insufficient distribution – there's a bottleneck in either a parent tier or in another system that prevents all the input power from being distributed.

The Power Permit was developed to manage Stranded Capacity ONLY

- Tracks power, space, and cooling on existing and new systems
- Any refreshes or changes to IT systems go through a vetting process
- On site walk down verification to confirm any infrastructure changes
- Creates awareness across all users on power management

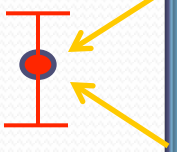
Trapped Capacity is a MANAGERIAL constraint!

During the summer 2015 on site measurements were performed on an HPC system to understand the magnitude of the problem.

The empirical data and research proved that IT systems were being under utilized by 40-50% of their provisioned power.

The question was WHY?

An explanation of Trapped Capacity - identifying the problem



IT = Soft Requirement (Large Error Bar)

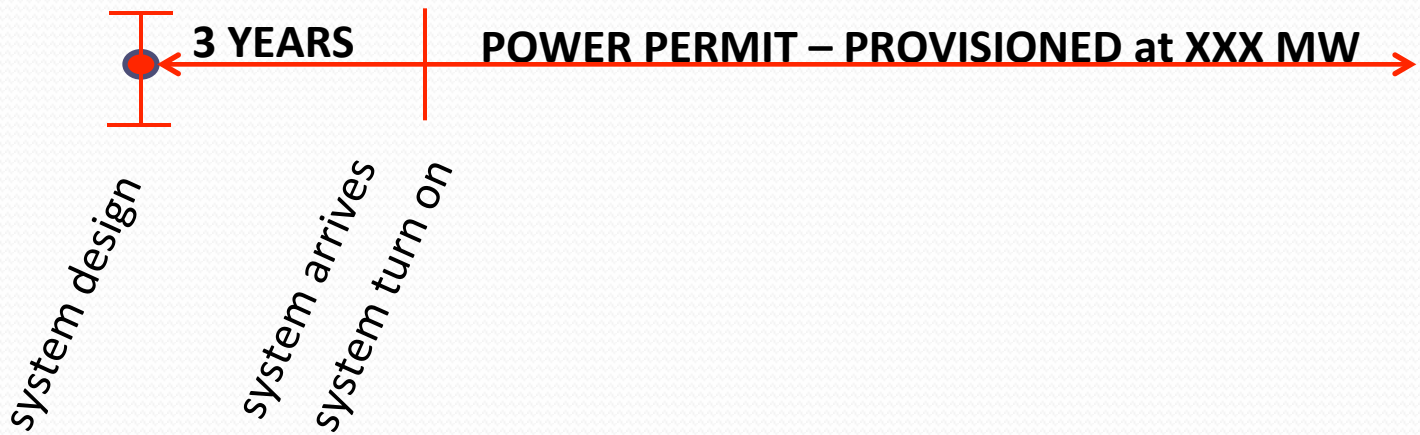
Infrastructure Organization = Hard Requirement (Provision and Build)

The same requirement means different things to different people

OK – and so what?

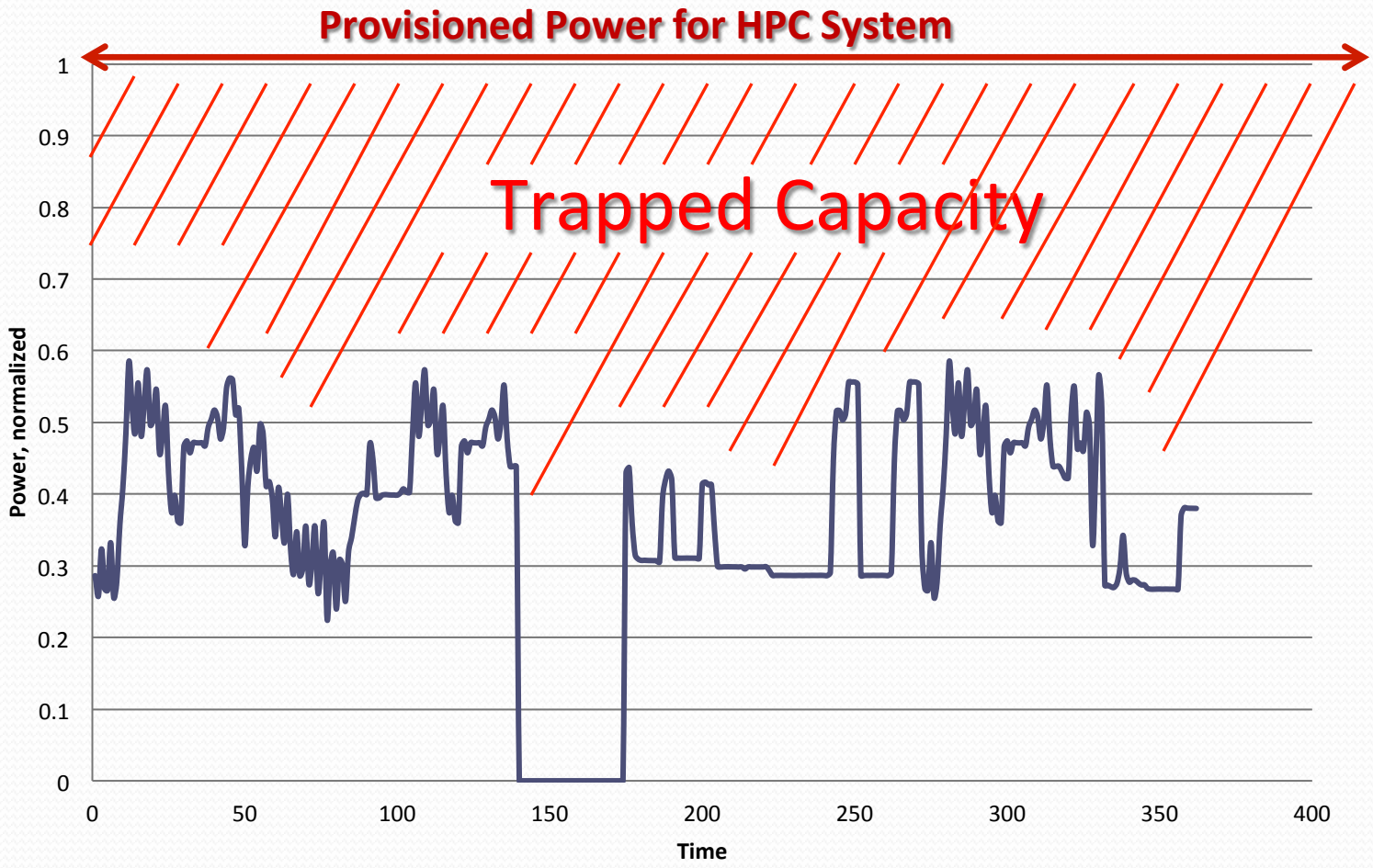
The provisioned power value remains in the power permit until the system is designed, bid, and comes on line. This process can take up to three years. In addition, monitoring the system load for one year to confirm actual power use is a total of 4 years!

Lets consider an actual example……


3 YEARS
POWER PERMIT – PROVISIONED at XXX MW
system design
system arrives
system turn on

Power for full HPC

Obfuscated data, normalized

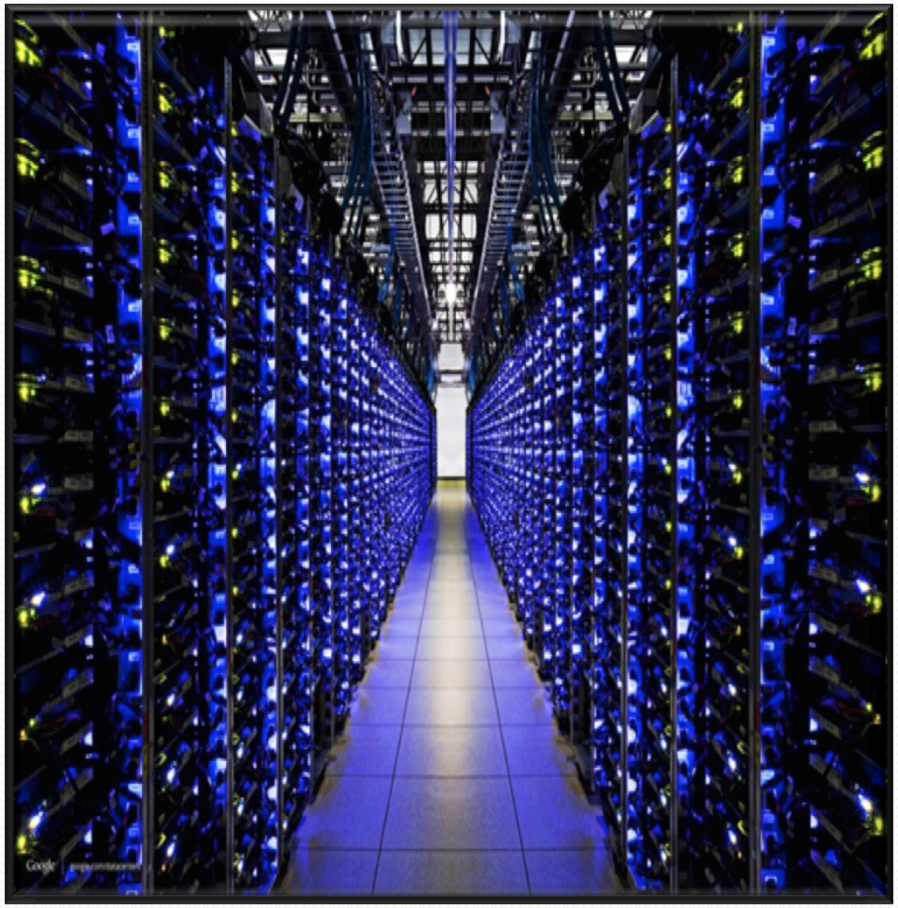


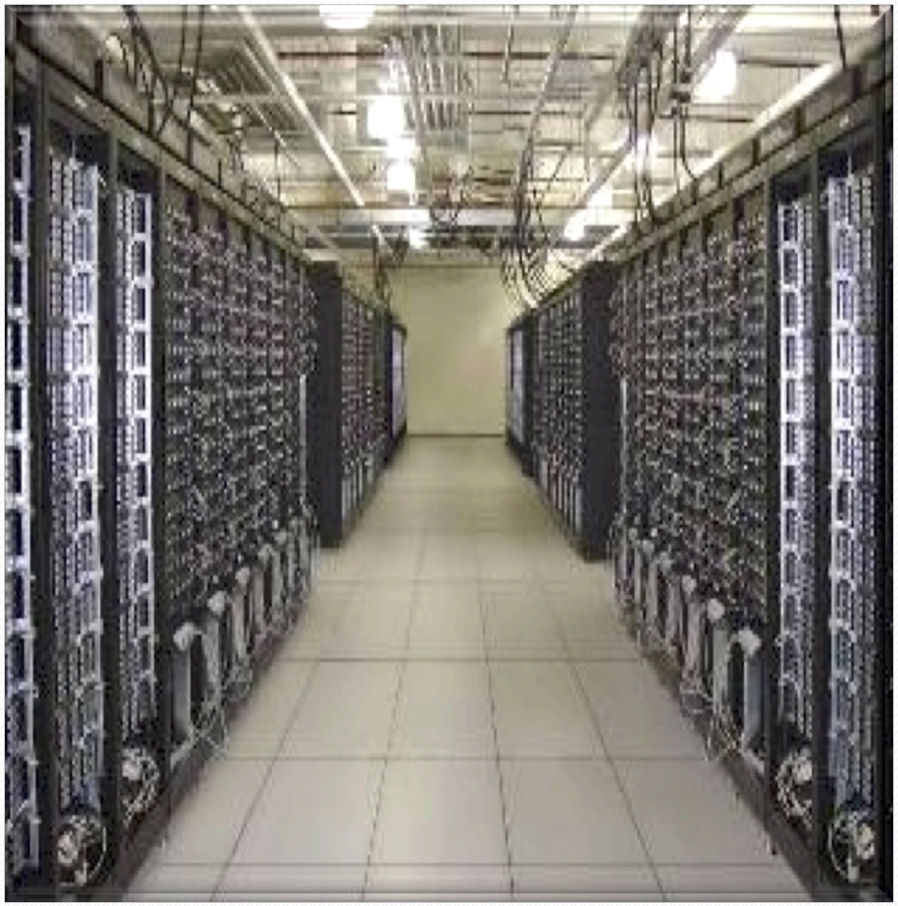
The on site measurements indicated that millions of dollars were not being fully utilized

Trapped capacities in the power permit reduced the available site power, implying that there is a less power to support mission.

Trapped capacities under-utilize high capitol costs of power and cooling resources which results in high installation, operating, and maintenance costs.

Trapped capacities under-utilize expensive IT Components in hardware stacks (CPU, Memory, Disk).





Executive Order: EO 13514
Mandates that all federal agency heads must implement energy conservation measures.

It is important for Federal agencies to understand and control data center power because it increases utility infrastructure costs.

Power monitoring – finding common ground between Infrastructure and IT planners

← BIG **Granularity** SMALL→

Site Building Room System Rack Chassis Components

Infrastructure Management
Stand-alone
SCADA network

Power Information bridge

IT Customer
Management node
Intelligent Rack PDU
Rack mounted ATS

A thought on shifting the paradigm of power responsibility.

Managing Power, Space, and Cooling resources is a *shared responsibility* between all users, Data Center Managers, IT and infrastructure designers, and Operations and Management.

The advantages of Power Monitoring of HPC's

Modify power permit process to include trapped capacity management.

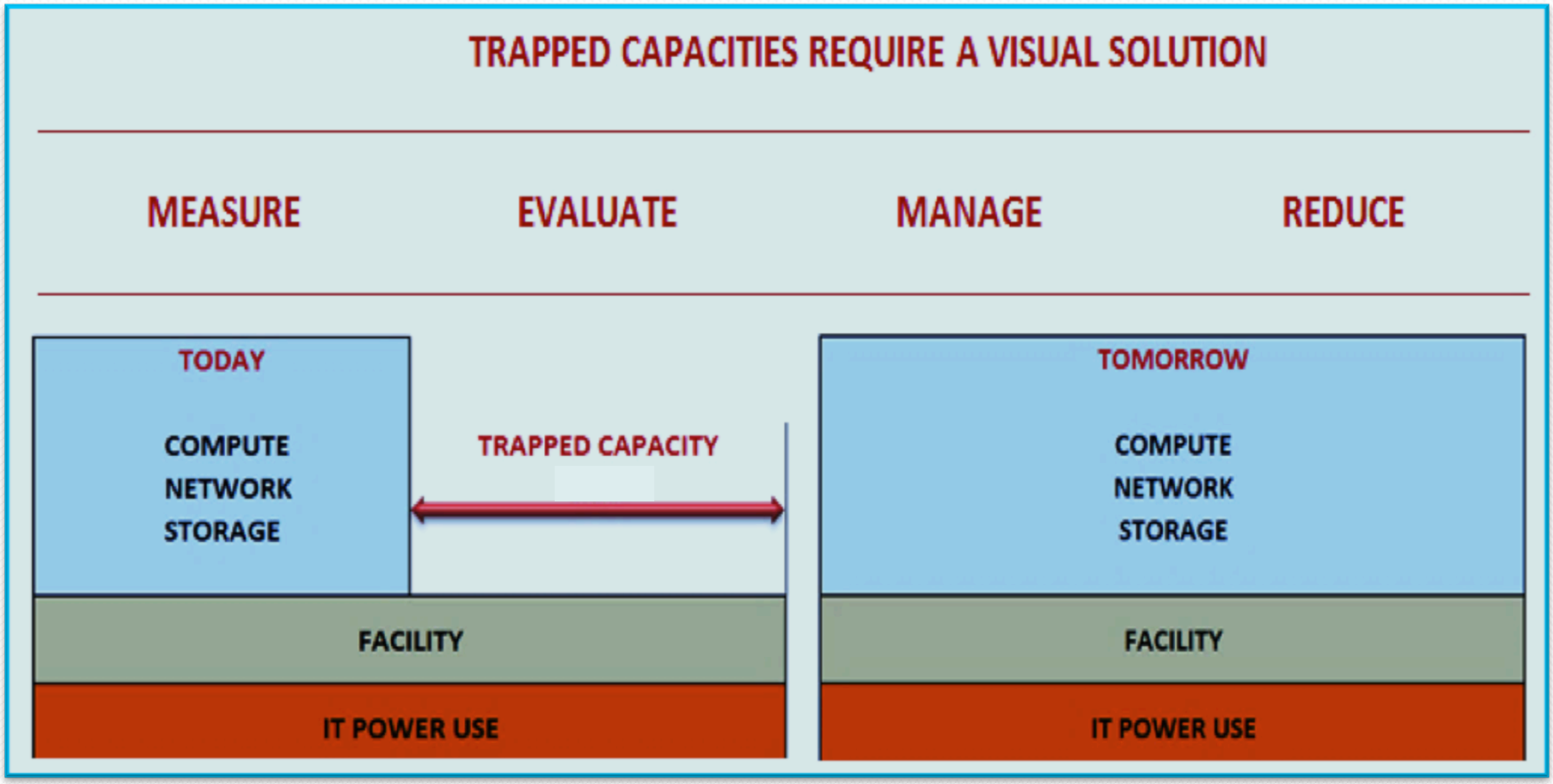
Implement power monitoring at rack and system level to obtain empirical power data and insert a SoW in all new purchases.

Trapped Capacity Mitigation Strategy

Develop an information technology infrastructure library (ITIL) to monitor and control all power capacities.

Institute a Total Cost of Operation/Ownership (TCO) metric to keep track of the costs associated with Trapped Capacity.

Where we are now, and where we want to be, requires a visual solution.



What we have

What we want

Thank you!

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