

Look Before you Leap - Updated Approach to Building DataCenters and Critical Facilities

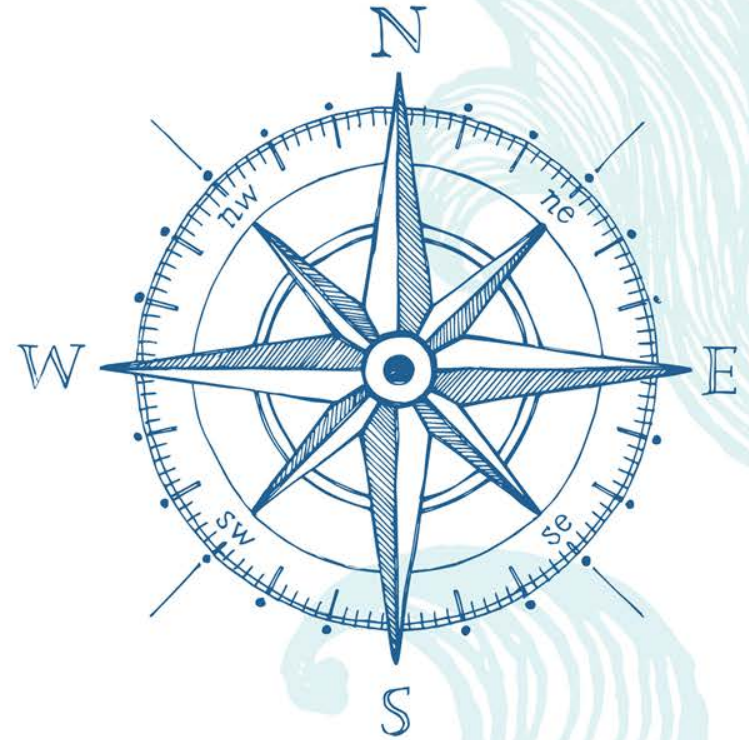
- A little DataCenter History.
- Terminology, Systems, & Innovation
- Project reviews
- Define a comprehensive, integrated network of systems, which inevitably merges functions from different groups.
- Standardized approaches, processes that are more streamlined, lower costs and operations that are more efficient.





**Hewlett Packard
Enterprise**

**Gary Truesdale
DataCenter Consultant
Hewlett Packard Enterprise**





Look Before you Leap - DataCenter Project Parameters

Why build a datacenter?

- Capacity
- Reliability
- Economy



Look Before you Leap - DataCenter Industry

Industry Trends, Terminology, and Resources

- ASHRAE – Recommendations and Energy Standards
- Uptime Institute - DataCenter Tier Structure
- Power Use Effectiveness - PUE
- Title 24 & Free Air Cooling – Economizer
- Rightsizing – How much datacenter to build



Look Before you Leap - IT and DataCenter Timeline

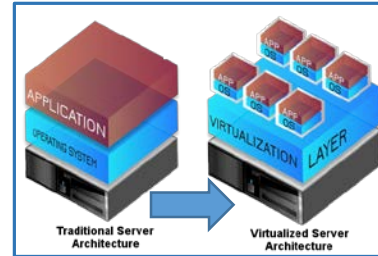
2000

2005

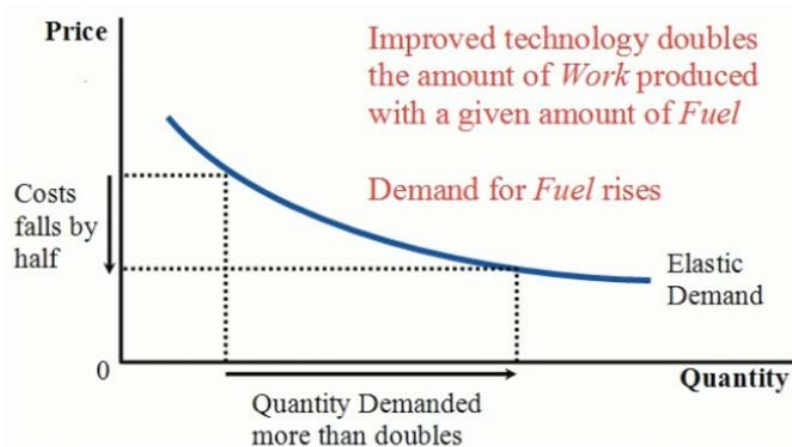
2010

2015

2020



Jevons Paradox



- Rising Cold Aisle Temperatures
- In Row Cooling
- Free Air Cooling
- Containers
- Structured Cabling
- Offline UPS
- Hot Aisle Containment

Power Use Effectiveness - PUE

Power usage effectiveness (**PUE**) is a metric of the energy efficiency of a data center.

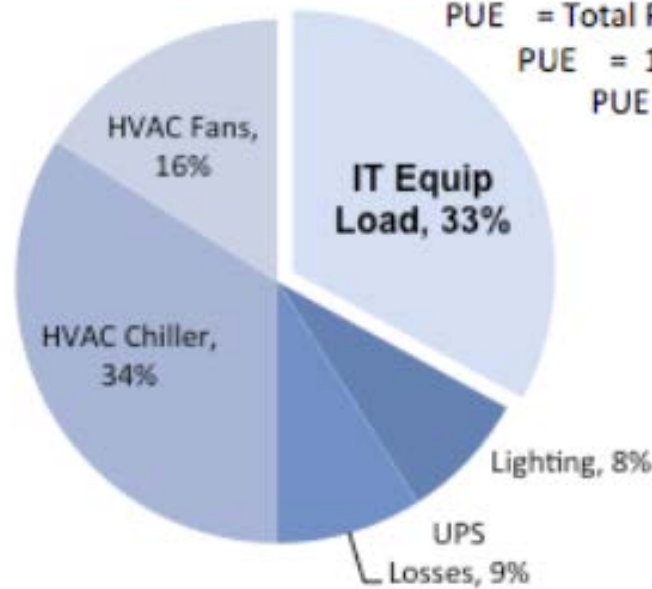
PUE is determined by dividing the amount of power entering a data center by the power used to run the computer infrastructure within it.

Total DataCenter Power

IT Equipment Power

PUE Example

$$\begin{aligned} \text{PUE} &= \text{Total Power} / \text{IT Equip Power} \\ \text{PUE} &= 1 / 0.33 \\ \text{PUE} &= 3.0 \end{aligned}$$





ANSI/ASHRAE Standard 90.4-2016, Energy Standard for Data Centers, establishes the minimum energy efficiency requirements of data centers for design and construction, for creation of a plan for operation and maintenance and for utilization of on-site or off-site renewable energy resources.

**2008 @ Microsoft
PUE = 1**



Microsoft - Enterprises are pushing the operating parameters that server vendors recommend for factors like air temperature and humidity -- and they're finding that servers are often far hardier than they expect. The difference can mean significant data center operations savings.

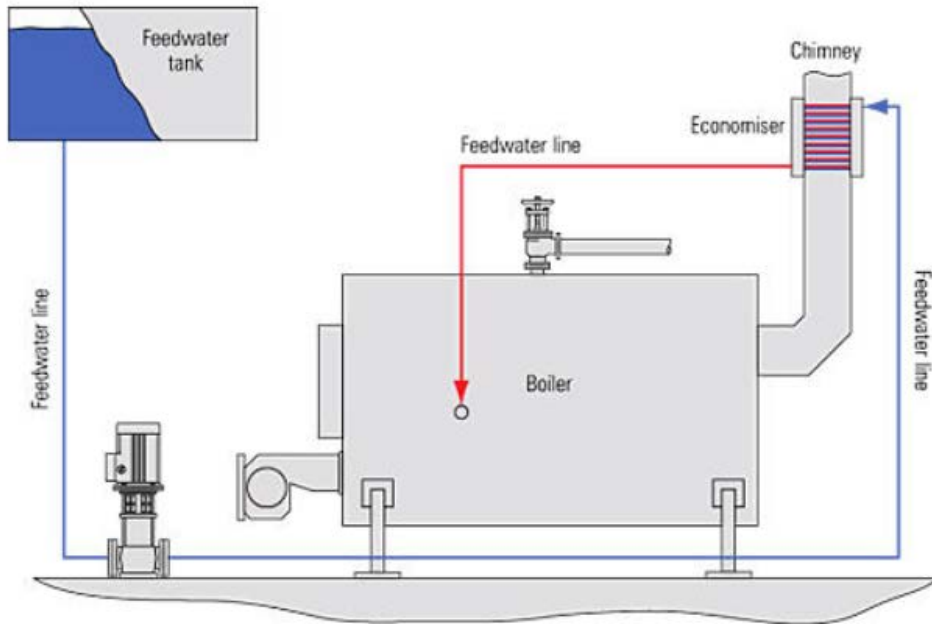
Microsoft Corp. recently found that a little rain, uncontrolled temperature and even leaves sucked into server fans had absolutely no negative effect on servers.

Uptime Institute DataCenter Tier Structure

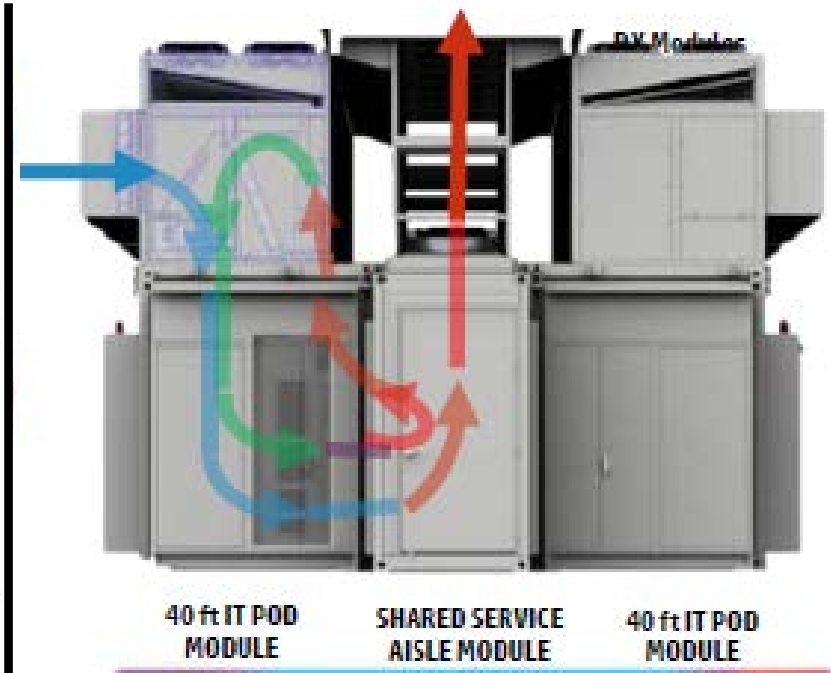
Parameters	Tier 1	Tier 2	Tier 3	Tier 4
Target customer	Small Business	Small enterprise	Large enterprise	Very Large Org/MNC
Component level redundancy	N	Partial N + 1	Fault Tolerant N + 1	Fault Tolerant 2N + 1
Distribution Paths	1	1	Fault Tolerant 2N + 1	Fault Tolerant 2N + 1
Availability	99.671 %	99.749 %	99.982 %	99.995 %
Downtime	28.8 Hrs	22 Hrs	1.6 Hrs	0.04 Hrs
Compartmentalization	No	No	No	Yes
Staffing	None	1 Shift	1 + Shift	24 * 7 * 365
Concurrently maintainable	No	No	Yes	Yes
Continuous cooling	No	No	No	Yes
Months to Implement	3	3-6	15-20	15-20
Year 1 st deployed	1965	1970	1985	1995



Look Before you Leap - DataCenter Economizer



Boiler Economizer



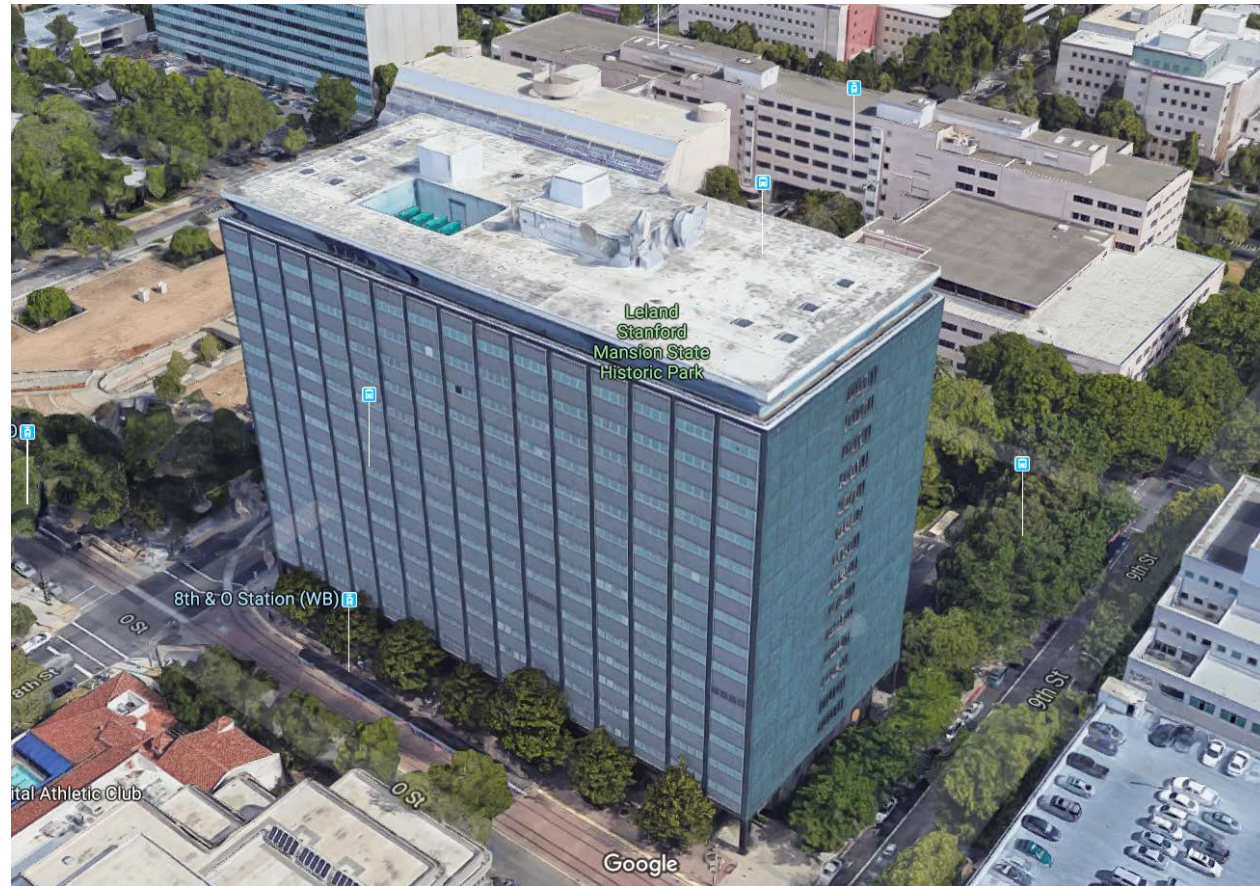
DataCenter Economizer

On July 1 of 2014, the State's Title 24 of the Building Efficiency Standards went into effect. All datacenters built in California after July 1st 2014 will have an economizer mode (Free Air Mode) where air conditioning is not needed. Climate in Los Angeles allows IT equipment to be cooled without air conditioning for the vast majority of the hours per year (Free Air Mode).

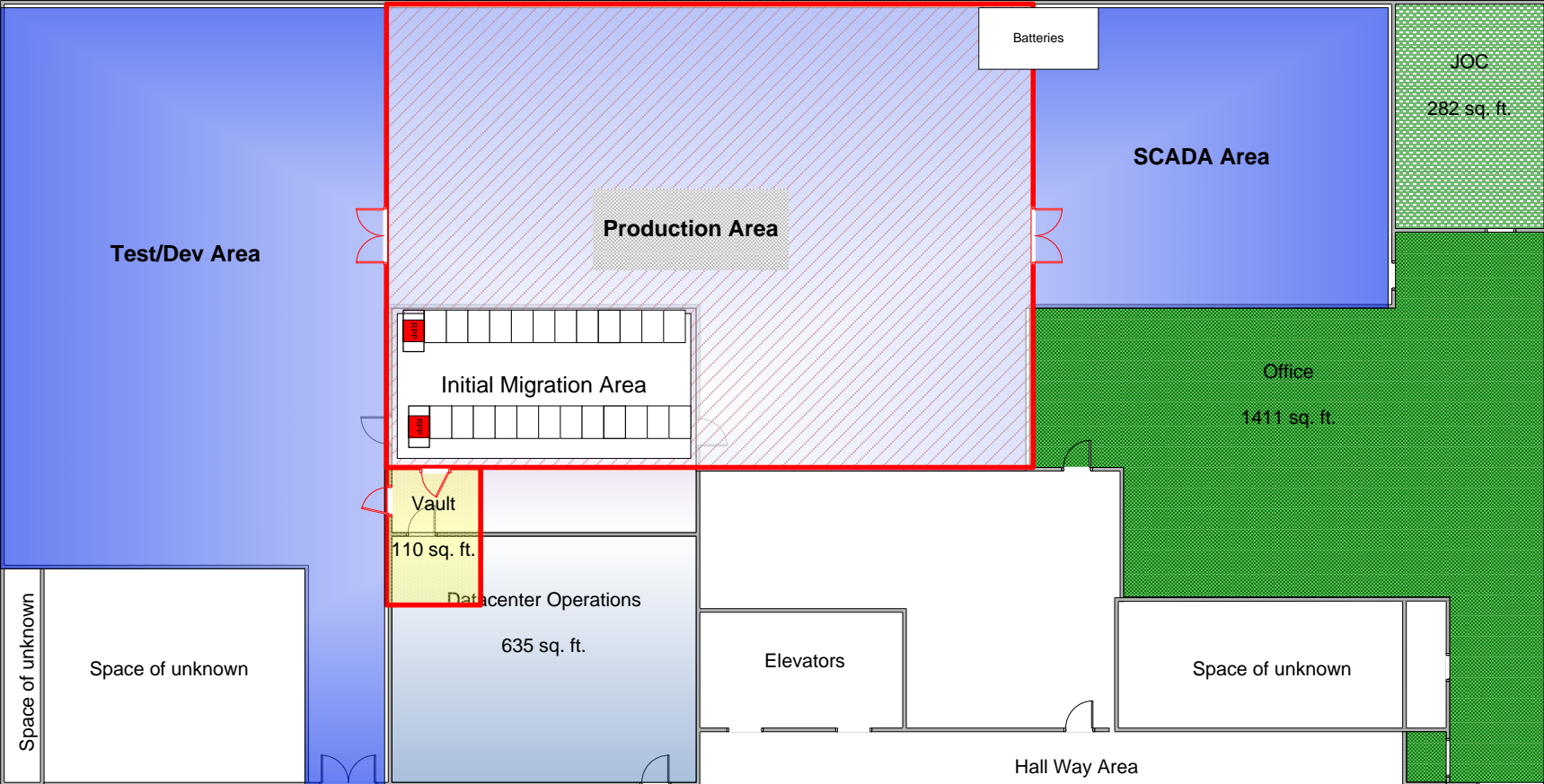


Look Before you Leap - Traditional DataCenter Project

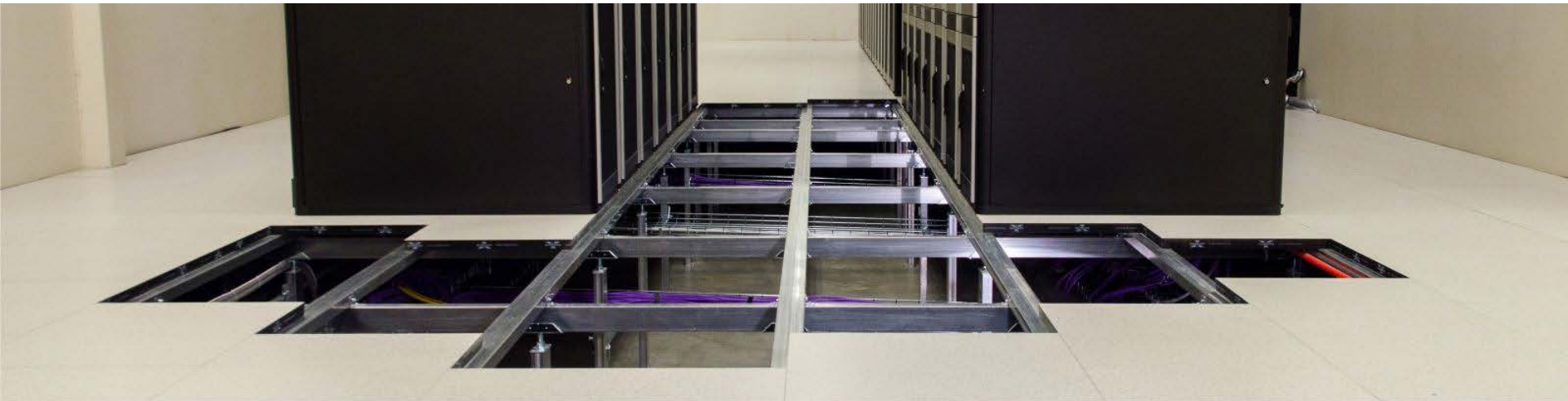
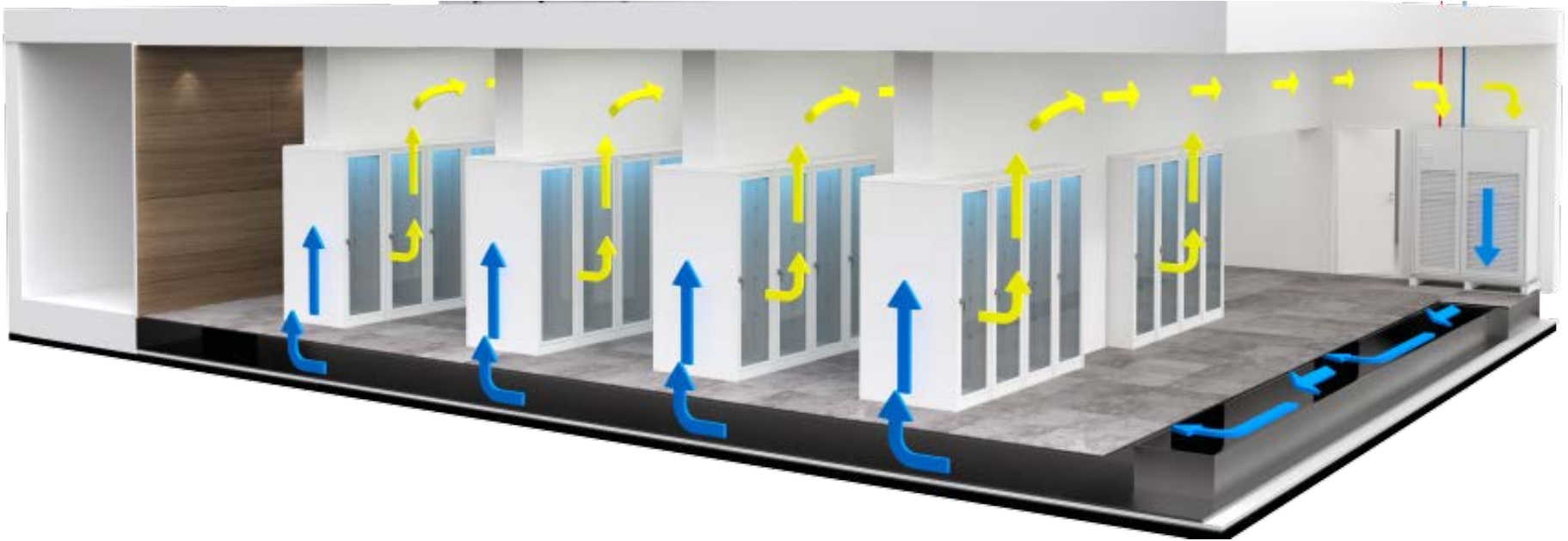
- Deploy greenfield datacenter within an existing datacenter.
- Then re-built the entire datacenter
- Virtualization
- Tier 1+
- 500 kW
- 5000 sq Feet
- PUE – 2.0
- Free Air Cooling – Economizer



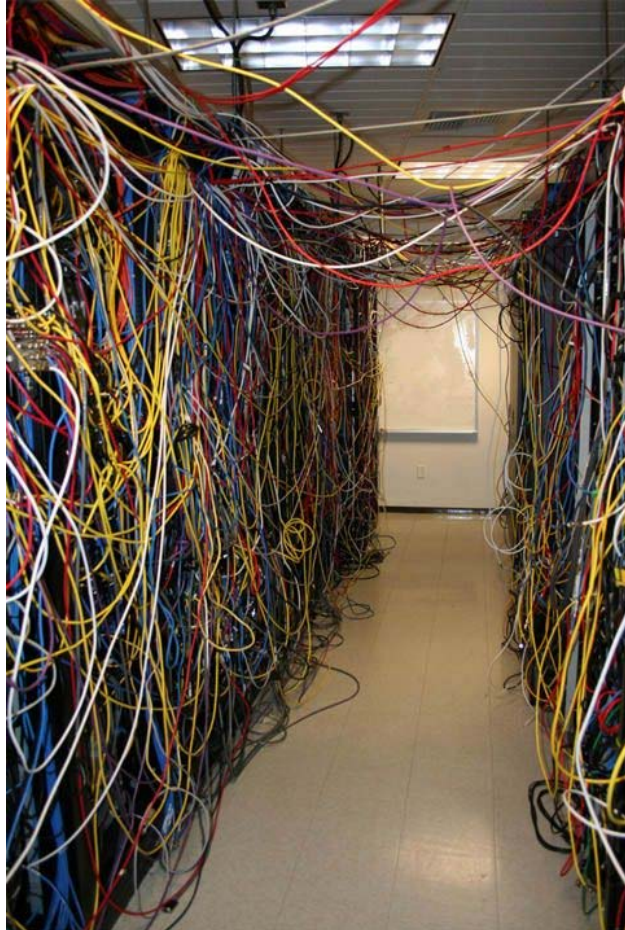
Look Before you Leap - Traditional DataCenter Project



Look Before you Leap - Traditional DataCenter

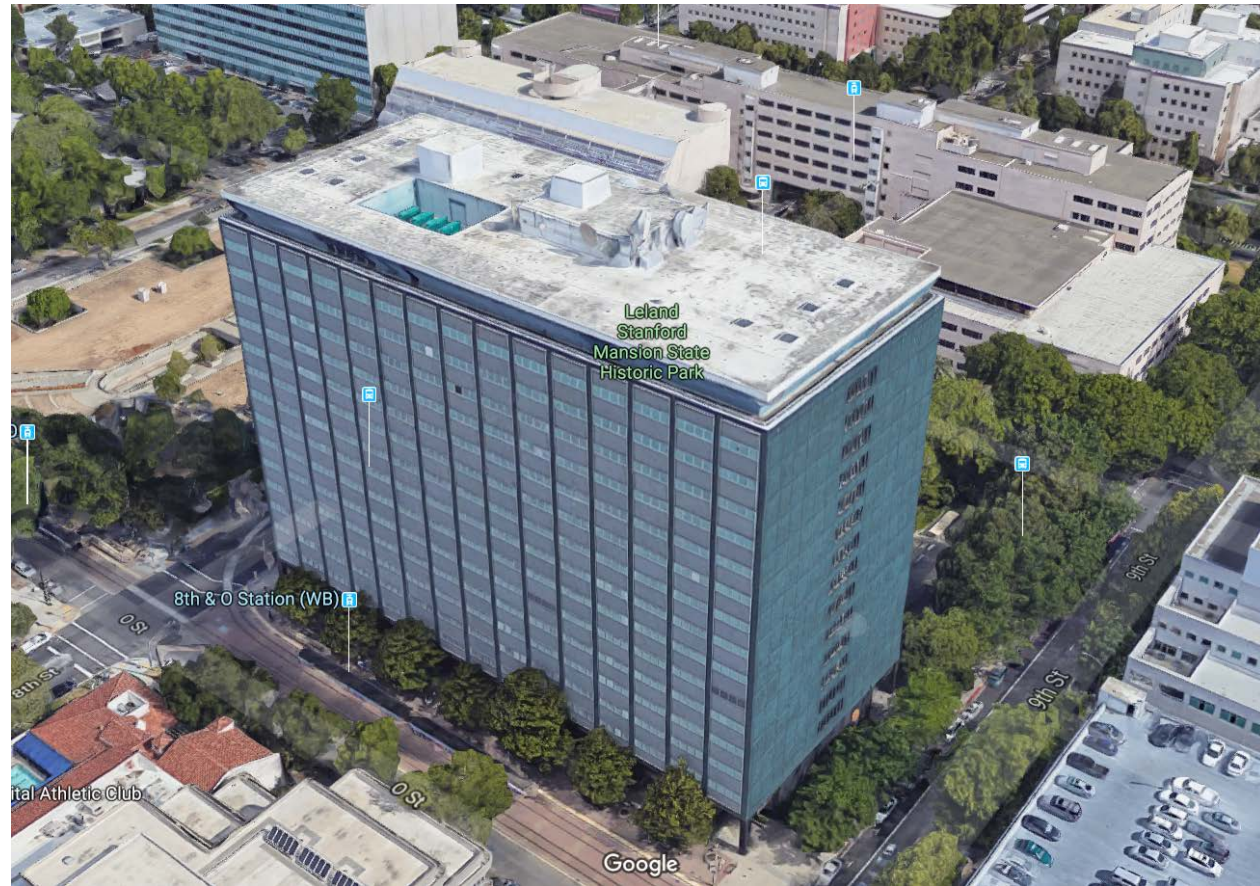


Look Before you Leap - Structured Cabling



Look Before you Leap - Traditional DataCenter Project

- Deploy greenfield datacenter within an existing datacenter.
- Then re-built the entire datacenter
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- Tier 1+
- 500 kW
- 5000 sq Feet
- PUE – 2.0
- Free Air Cooling – Economizer
- **Cost 3M DataCenter**



Look Before you Leap - DataCenter in a HighRise

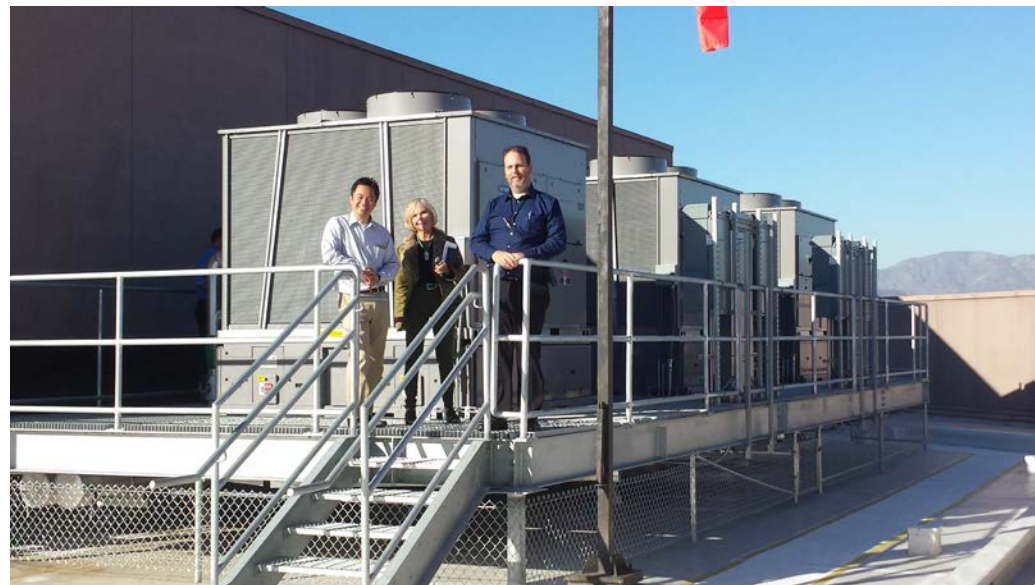
- Deploy Modular Unit in a Highrise
- General Purpose
- Tier 1+
- 500 kW
- 2000 sq Feet
- PUE – 1.4
- Free Air Cooling – Economizer



Look Before you Leap - DataCenter in a HighRise



Look Before you Leap - DataCenter in a Highrise



Look Before you Leap - DataCenter in a HighRise



DataCenters in Buildings



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Look Before you Leap - DataCenter in a HighRise

- Deploy Modular Unit in a Highrise
- General Purpose
- Tier 1+
- 500 kW
- 2000 sq Feet
- PUE – 1.4
- Free Air Cooling – Economizer
- **Cost 5M DataCenter**



Look Before you Leap - Modular DataCenter

- Water Cooled Container based DataCenter
- High Performance Compute
- Tier 1
- 500 kW
- 400 sq Feet
- PUE – 1.25
- Cost 1.25M



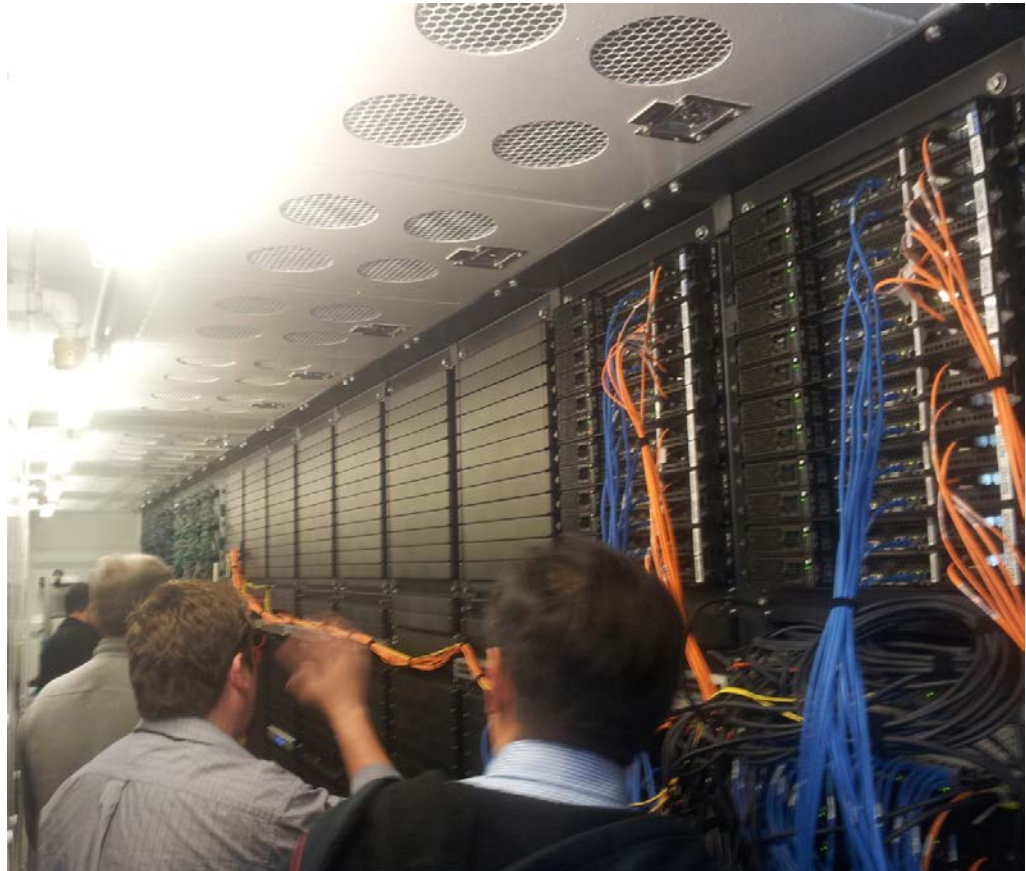
- Site located on campus adjacent to chilled water and power
- DataCenter delivered and installed in one day
- Turn-on and test - 1 week
- All installation requirements for POD-1 and POD-2 included in initial facility effort allowing for flexible build-out leveraging modular components.

Look Before you Leap - Modular DataCenter

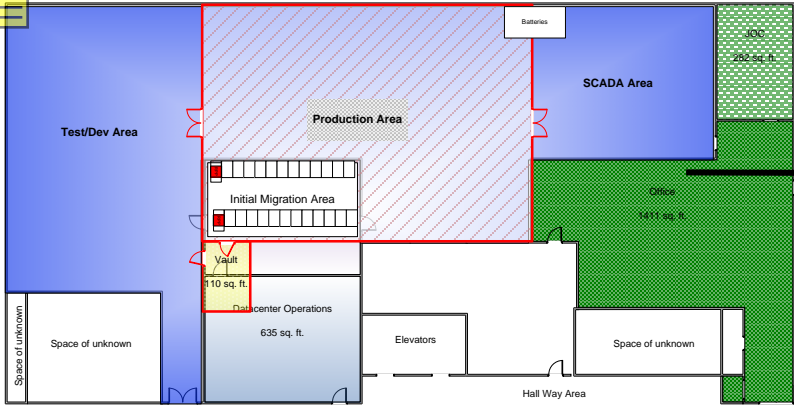


Look Before you Leap - Modular DataCenter

- Water Cooled Container DataCenter
- High Performance Compute
- Tier 1
- 500 kW
- 400 sq Feet
- PUE – 1.25
- **Cost 1.25M**



- Site located on campus adjacent to chilled water and power
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\$14,182,978



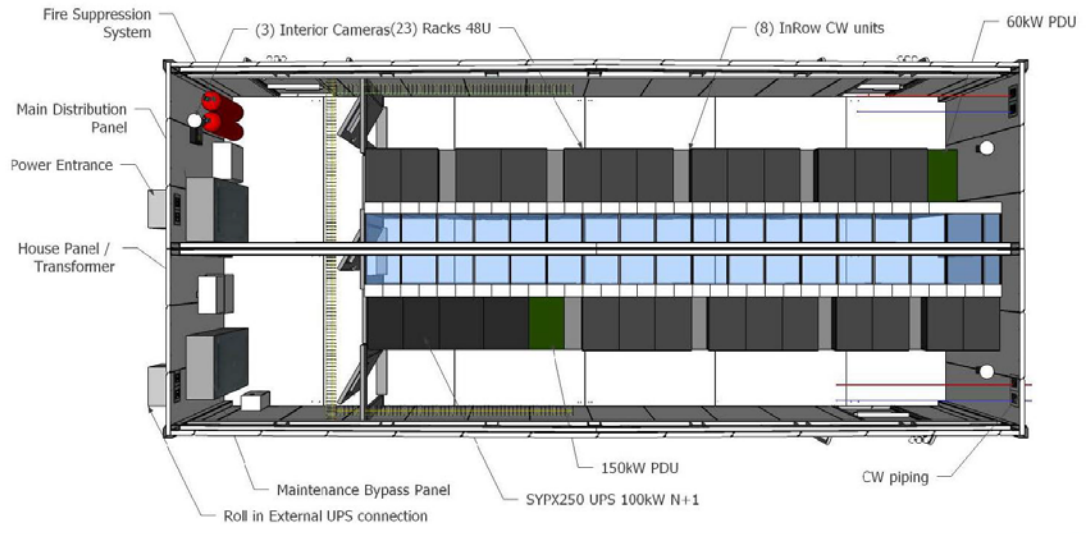
\$7,820,000



\$12,828,085

DataCenter	Total IT Load - kw	Power Cost - \$/kWh	PUE	Hours/Year	Loss	DataCenter Cost	Annual Power Cost	Power Cost 10 Years	Decade Cost
Traditional	500	0.12	2	8760	6%	\$ 3,000,000.00	\$ 1,118,297.87	\$ 11,182,978.72	\$ 14,182,978.72
Modular	500	0.12	1.25	8760	0%	\$ 1,250,000.00	\$ 657,000.00	\$ 6,570,000.00	\$ 7,820,000.00
Highrise	500	0.12	1.4	8760	6%	\$ 5,000,000.00	\$ 782,808.51	\$ 7,828,085.11	\$ 12,828,085.11

Look Before you Leap - Modular DataCenters Today



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Look Before you Leap - Modular DataCenters Today

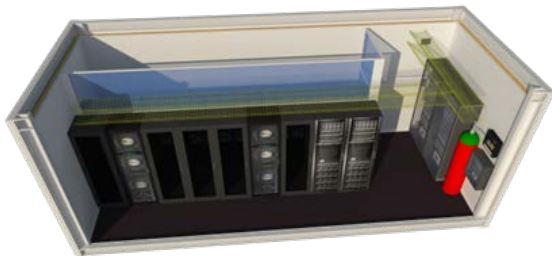


Micro Datacenter - what's inside the unit



Look Before you Leap - Modular DataCenters Today

What business problems are we solving with Modular Datacenter?



Rapidly deploy IT where the business needs it

Meet compute needs for IoT

Applications/ workloads enabled anywhere and
in a protected environment

Remotely Manageable + Software Defined

Built-in: fire, cooling, power and environmental
systems in the box

Integrated turnkey IT solutions which are
pretested and certified for edge workloads



Thank You!