Eco Datacenter Reality

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Eco – It's About Ecology & Economics

Sun's Comprehensive Eco Strategy

INNOVATE

Eco friendly products and services

ACT

Environmentally conscious operations

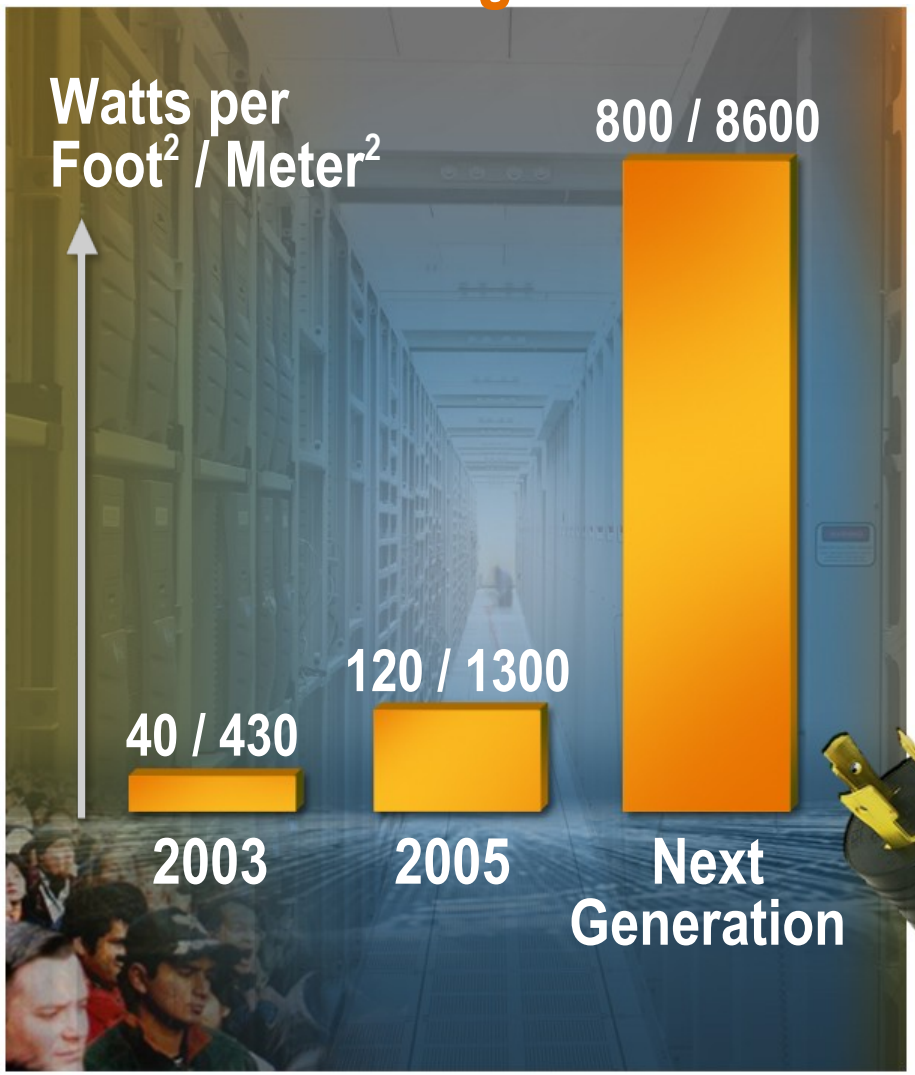
SHARE

Applying transparency and open source values and tools to environmental challenges

Demand and Capacity Are Colliding...

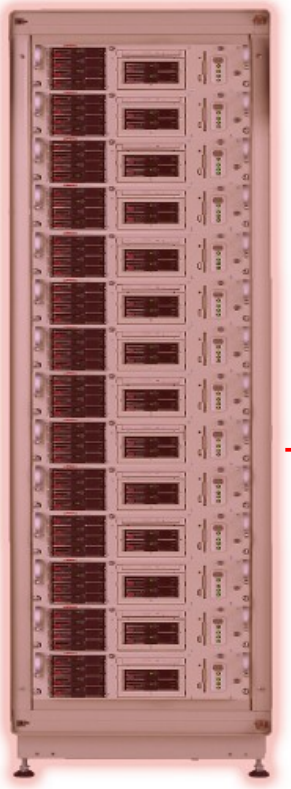
...and data centers are right in the MIDDLE!

- Demand
- Users
- Services
- Access



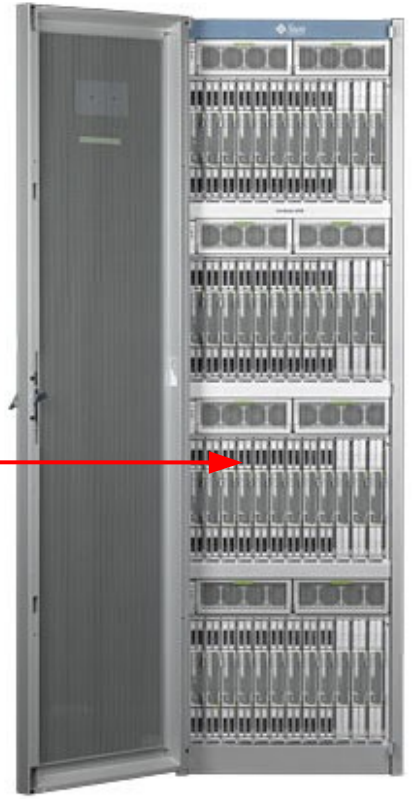
- Power
- Costs
- Space
- Heat

Rack Densities Increasing



Reality:
More compute per watt
More watts per rack

Old racks now fit into a single blade



2000
14 x 3U Servers
28 Processors
2kW Heat Load

27x More Processors
10x More Heat

2007
48 Blade Servers
768 Processor Cores
28kW Heat Load *

* Ranger Project at Texas Advanced Computing Center

Reality: Heterogeneous Data Centers

Industry average is between 4-6kw/cabinet
> 20kw Skyscrapers will be integrated
Must deal with small buildings & skyscrapers

Power In the Data Center

Cost increases exponentially with power requirements

Industry Average		Google	Next Generation
2003	2005	2002	
40 W/ft^2 (430 W/m^2)	120 W/ft^2 (1,300 W/m^2)	400 W/ft^2 (4,300 W/m^2)	800 W/ft^2 (8,600 W/m^2)
2 kW/rack	5 kW/rack	10 kW/rack	20 kW/rack
$400/ft^2 ($4,300/m^2)	$1,500/ft^2 ($16,150/m^2)	$720/ft^2 ($7,750/m^2)	$5,000/ft^2 ($54,000/m^2)
		25 ft^2/rack (2.3 sqm/m^2)	
		$278K/rack	
10k ft^2 (930 m^2) => $4M/year for power	10k ft^2 (930 m^2) => $15M/year for power	Cost of power is 20% of cost of rack	10k ft^2 (930 m^2) => $50M/year for power

50% new data growth yearly
390 GB created every second
30 Billion packages shipped every year
2 Billion text messages sent on a peak day

Sources: California Data Center Design Group, IEEE Micro Article

Sun's Internal Challenge

- Facilities is Sun's second largest expense
  - Real estate, utility, tax, & support costs
- 20+ years of organic growth
  - New products, reorgs, acquisitions
  - Lack of design standards and control of implementations for global technical infrastructure
  - Duplication & inefficiencies
- Multi-Billion dollar IT/R&D Technical Infrastructure Portfolio
  - 1.3 million ft^2 (120k m^2) of Eng & IT space globally (as of 02/2008)
  - 1,533 individual rooms
  - IT Space = 8% of the portfolio (160k ft^2 / 15k m^2 – 365 rooms)
  - Engineering = 92% of the portfolio (1.14M ft^2 / 106k m^2 – 1168 rooms)

GDS

- Manage Global Portfolio
  - > Classify & track portfolio usage
- Internal Lab/DC Design Competency Center
  - > Expertise in lab & datacenter design (standards/operating model/product feedback)
- Application of Lab/DC Competency Center
  - > Dual role – design engineers & consultants (design validation)

Corporate Drive to Reduce Costs

- Spotlight: Santa Clara, CA - 2007
  - > Shed 1.8M ft^2 (167k m^2) of real estate
  - > Compress 202k ft^2 (18.8k m^2) of datacenters space into < 80k ft^2 (7,400 m^2) of new Datacenter space in Santa Clara.
  - > Project included every major business unit in Sun.
  - > 12 month project duration (complete by 06/30/2007).
- Approach
  - > Phase I: Compressed in place to 84k ft^2 (7,800 m^2) at Newark, CA.
  - > Phase II: Built next generation data center in 12 months, and further compressed to < 80k ft^2 (7,400 m^2).

Spotlight: Hardware Replacement

- 88% space compression
- 61% utility reduction
- $9M cost avoidance
- 2.2MW to 500Kw
- 450% compute increase
- 550 racks to 65
- 3,227 tons CO2 reduced
  312 Cars off the road
- Minimal downtime
- Completed in 3 months
- 2:1 Server, 3:1 Storage
- 2,915 devices replaced

Reality:

ROI Sweet Spot = >4 to 1 replacement ratio

Spotlight: CA Engineering Datacenter

- 72k ft^2 (7,700 m^2) DC
- 26k ft^2 (2,415 m^2) Mechanical Service Yard
- 9MW scalable to 21MW
- Largest Liebert/APC installs
- Shed 1.8M ft^2 (167k m^2)
- 15 Buildings to 2
- 152 Datacenters to 14
- Completed in 12 months
- $1.2M Utility Rebates $250k Innovation Award
- 39% more efficient than ASHRAE std (.489 kW/ton)
- Reduced opex 30%

Reality:

Modular, scalable, future-proof and highly efficient in 63% less space. Under budget & on schedule.

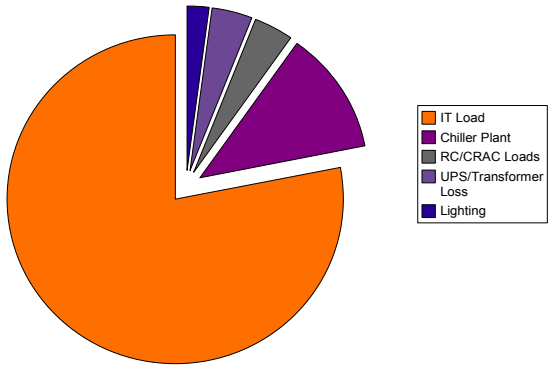
Power Utilization Effectiveness (PUE)

SCA11-1500 Data Center Efficiency Benchmark

- 573 kW less support power compared to industry target
- 36% More efficient than the industry target and almost 50% better that industry average
- $400,000 Annual opex savings compared to typical data center ($0.08/kWh)

SCA11-1500 Software Datacenter PUE		
Load	**kW**	**% of Total Load**
IT Load	798	78.02%
Chiller Plant	126	12.28%
RC/CRAC Loads	39	3.84%
UPS/Transformer Loss	39	3.86%
Lighting	20	2.00%
Total Load	1023	
Total Support Loads	294	
PUE	**1.28**	
DciE	**78%**	

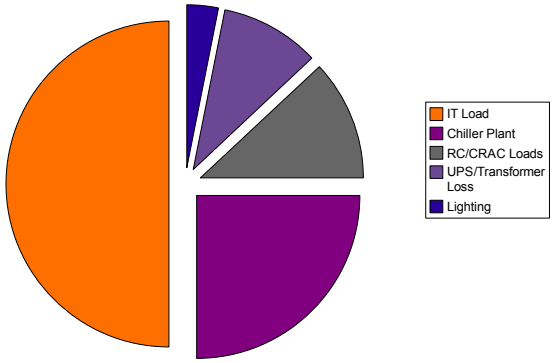
SCA11-1500 Power Use



Typical Datacenter PUE		
Load	**kW**	**% of Total Load***
IT Load	798	50.00%
Chiller Plant	399	25.00%
RC/CRAC Loads	192	12.00%
UPS/Transformer Loss	160	10.00%
Lighting	48	3.00%
Total Load	1596	
Total Support Loads	798	
PUE	**2.00**	
DciE	**50%**	

*Source: EYP Mission Critical Facilities Inc., New York

Typical Data Center



Camberley (UK) Datacenter

- Consolidation and relocation of EMEA mission critical datacenter
- 80% space reduction – 2,200 ft^2 (204 m^2) down to 450 ft^2 (42 m^2)
- 3,600 ft^2 (334 m^2) total build-out
- 50% utility reduction
- Base cooling with Liebert XDO - (first install of XDO in EMEA)

Reality:

Modular, scalable, fully redundant datacenter supporting the long term growth.

Prague (CZ) R&D Datacenter

- Datacenter supporting the growing engineering site
- 2,600 ft^2 (242 m^2) of modular datacenter
- Liebert XD, base cooling under 10%, first install of XD in EMEA
- Highly efficient, expandable datacenter

Reality:

Modular, scalable, fully redundant datacenter supporting the long term growth.

Bangalore (India) R&D Datacenter

- 50%+ reduction on equipment footprint
- 17% power reduction
- 154% Compute capacity increase
- 3,000 ft^2 (280 m^2) Datacenter
- 16 Datacenters down to 1
- Innovative design in the region - PCQuest award for best IT implementation in 2007

Reality:

Modular, scalable, fully redundant datacenter supporting the long term growth.

Trondheim (Norway) R&D Datacenter

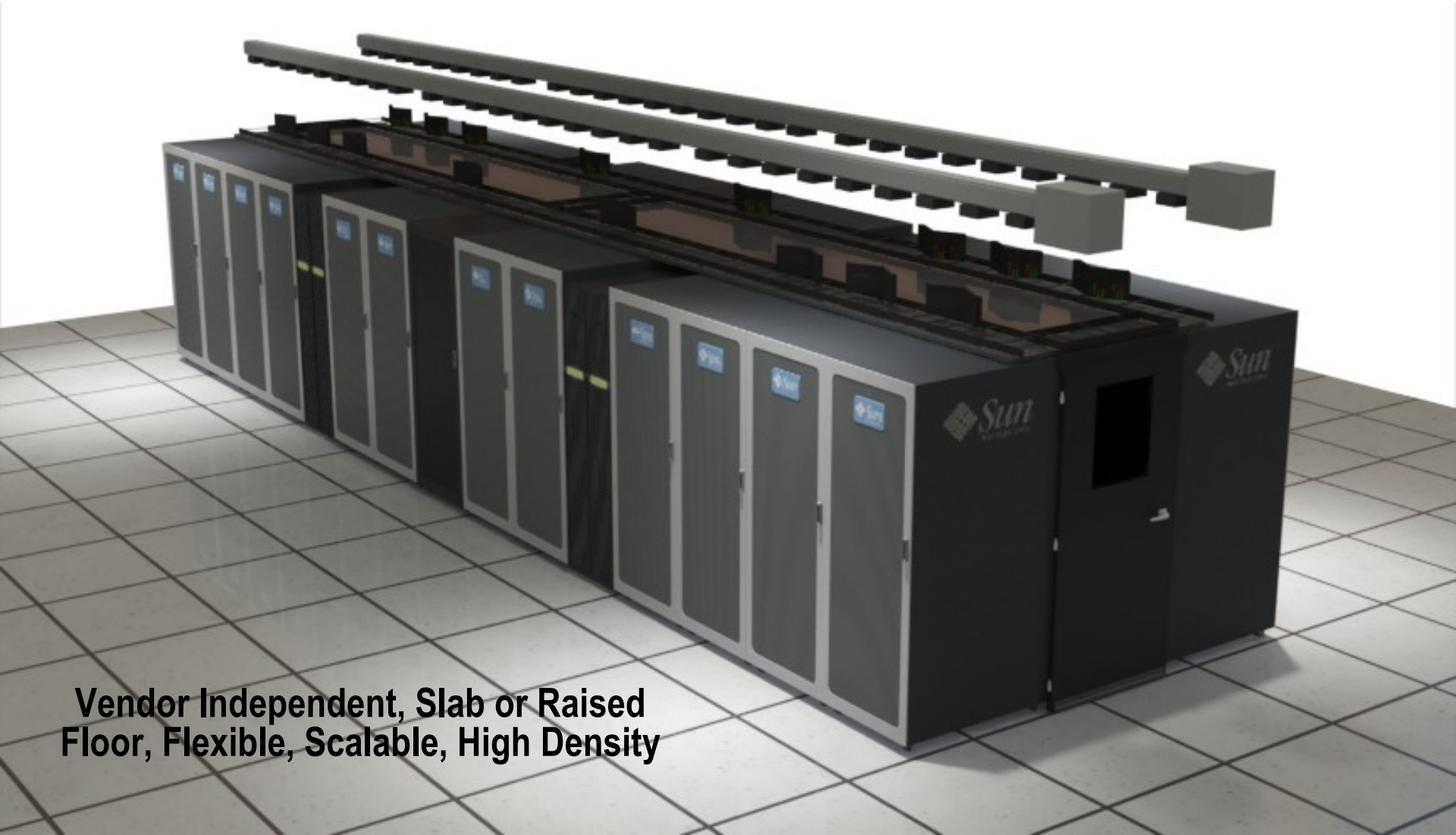
- Consolidation of four R&D labs into new datacenter
- Database stress testing
- High density – 10kW/rack, expandable to 16kW/rack
- 1,190 ft^2 (110 m^2) datacenter
- Second highest density in our portfolio

Reality:

High density datacenter expandable to support next-gen equipment.

The POD Architecture

- A group of racks or benches with a common hot or cold aisle used as a building block to simplify datacenter design for power, cooling, & cabling.



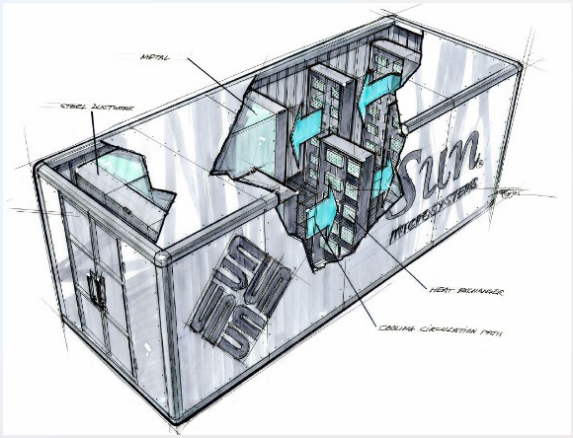
The POD Architecture

- A group of racks or benches with a common hot or cold aisle used as a building block to simplify datacenter design for power, cooling, & cabling.

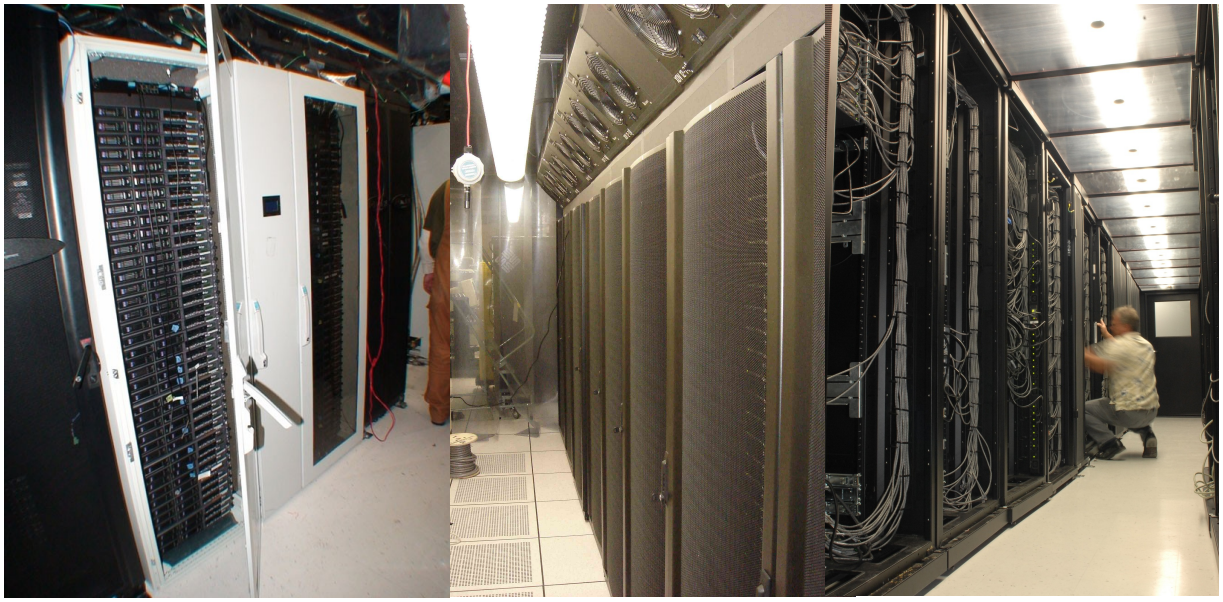
Vendor Independent, Slab or Raised Floor, Flexible, Scalable, High Density

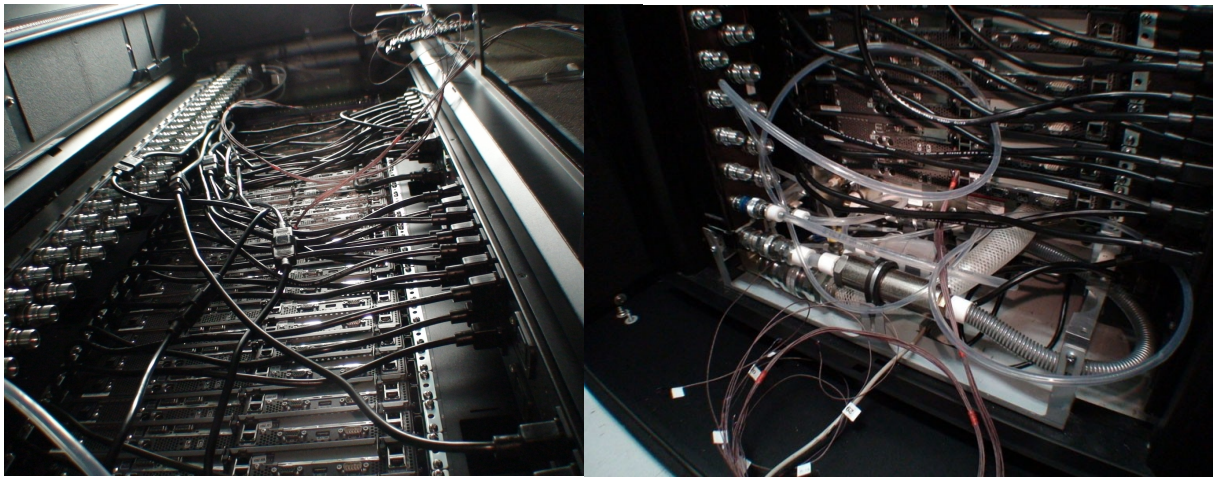
Modular, Mobile Datacenter

- Integrated, high-efficiency power & cooling up to 25kW per rack!
- 305 RU in only 160 sq ft.
- Customizable payload (Sun and 3rd party gear compatible)



Industry: Sun Hosting Chill-Off





- Lead: Silicon Valley Leadership Group
- Testing: Lawrence Berkeley National Labs
- Host: Sun Microsystems
- Participants:
  - APC In-Row RC, Liebert XD, Rittal Liquid Racks & Spraycool, IBM Blue
- Testing five cooling technologies side by side with mirrored environments & hardware to measure efficiencies.
- Industry published report June 2008

Best Practices = Competitive Weapon

- Align Facilities, IT & Engineering
  - Partnering nets significant short term & long term savings
    http://www.sun.com/aboutsun/environment/docs/aligning_business_organizations.pdf
- Hardware Replacement
  - Apply new hardware solutions and extend the life of your DC
    http://www.sun.com/aboutsun/environment/docs/creating_energy_efficient_dchw_consolidation.pdf
- Simplify Datacenter design with the POD concept
  - Power: Modular, Scalable, Smart
    http://www.sun.com/aboutsun/environment/docs/powering_energy_efficientdc.pdf
  - Cooling: Adaptable, Scalable, Smart
    http://www.sun.com/aboutsun/environment/docs/cooling_energy_effiicientdc.pdf
  - Cabling: Distributed vs Centralized
    http://www.sun.com/aboutsun/environment/docs/connecting_energy_efficientdc.pdf
  - Measurement: Visibility gives you power to control
    http://www.sun.com/aboutsun/environment/docs/accurately_measure_dcpower.pdf
- Video: http://www.sun.com/aboutsun/environment/media/datacenter_tour.xml

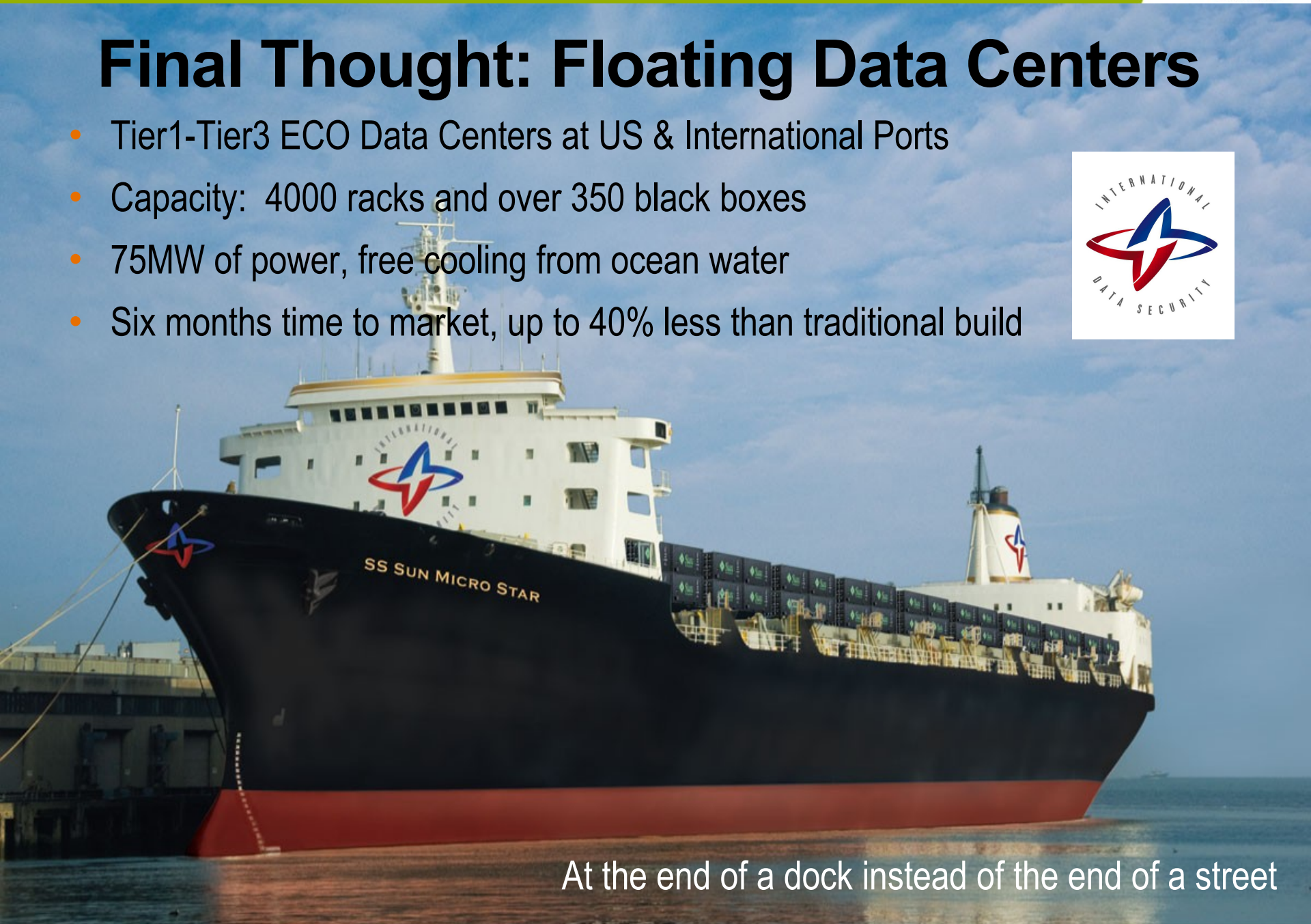
Activity

Tracked $4B in Data Center construction in progress or starting in last four months.

Make it green and it will save you green.

Final Thought: Floating Data Centers

- Tier1-Tier3 ECO Data Centers at US & International Ports
- Capacity: 4000 racks and over 350 black boxes
- 75MW of power, free cooling from ocean water
- Six months time to market, up to 40% less than traditional build



At the end of a dock instead of the end of a street

Resources

- Green Grid
  - Home page - http://www.thegreengrid.org/home
  - PUE and DCIe metrics white paper - http://www.thegreengrid.org/gg_content/
- Lawrence Berkeley Labs (LBL)
  - Self Benchmarking Guide
  - LBL Data Center Project - http://hightech.lbl.gov/datacenters.html
  - Data Center Energy Use - Presentation
- Telecommunications Industry Association (TIA)
  - Home page - http://www.tiaonline.org/
  - TIA-942 Data Center Standards Overview

Products Featured

- APC (American Power Company)
  - Product Information - http://www.apc.com/products/
  - Hot Aisle Containment
  - InRow RC Air Conditioning
  - In Rack Power Distribution Units
  - NetBotz Surveillance Appliances
  - NetBotz Environmental Appliances

Products Featured (cont'd)

- Liebert Power and Cooling
  - An Emerson Network Power Company - http://www.liebert.com
  - Liebert XD Refrigerant Based Cooling Modules
    (XDV, XDO)
- Universal Electric Corporation
  - http://www.uecorp.com/
  - Starline Track Busway
    (March 2008 Press Release)

Thank You

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