Datacom Equipment Trends

- Communication - Extreme Density
- Compute Servers - 1U
- Communication - High Density
- Compute - 2U
- Storage Servers
- Workstations (Stand alone)
- Tape Storage

Year of product Announcement

Heat Load Per Product

- 1992
- 1996
- 2000
- 2004
- 2008
- 2012

©2000-2005 IMEX Research
Moore’s Law: Intel Chipsets

Source: Intel.com
Next-Gen Data Center - Observations

- WW, there are 5.1 million data centers (you are not alone)

- **Now costs $100-175M to build a large data center**
  - ~$1005/Sqft, $40,000/Rack, $2,500/Server, 2.5U
  - 82% of installed equipment (Srvr,Stg,Ntwk) has only 10% utilizn.
  - For every $1 invested in new IT infrastructure, $7 spent to maintain
  - For every $1 in new Server spending, 50c spent on Power & Cooling /2006
  - Virtual Servers growth will outstrip growth of Physical servers by 50% with an associated rise in managing virtual servers
  - Blades increasing Power/Rack by 10x Need Power/Cooling, Weight, Solutions to pursue
Power & Cooling Expenses on the Rise

$20.0
$40.0
$60.0
$80.0
$100.0
$120.0

CAPEX New Server Spending
OPEX New Server Spending
CAPEX Power & Cooling
OPEX Power & Cooling

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

©2000-2005 IMEX Research
Datacenter Power & Cooling Costs

Power & Cooling Expenses ($B)

©2000-2005 IMEX Research
Power System Elements’ Efficiency

- Power Station
- Transmission
- Transformer
- Cabling
- Cooling
- Auxiliary
- UPS
- SIS
- Power supply
- DC/DC Conversion
- CPU

Grid \hspace{1cm} Data Center \hspace{1cm} IT Components

©2000-2005 IMEX Research
Data Center Power & Cooling Ecosystem

- Cooling Tower
- Chiller
- Pump
- Electric Power Grid
- UPS/Transformer
- Utility Meter
- Power Distribution
- Air Handler
- Computer Room
- Data Center
- CRAC UNITS

©2000-2005 IMEX Research
Blanking Panels Prevent Recirculation
Traditional Data Center Environment

Image from “Keeping Your Data Center Cool: There is Another Way”, IBM March 2005
Module Cooling Solutions

Pumped Refrigerant Embedded cooling

Overhead Cooling Modules

Floor Mount Cooling

# of Racks
Existing Strategies & Implications

- **Supplemental Cooling System for high-density racks** must accomodate data center in Advance, limited to 10kW per rack.

- **Disperse High Density Equipment amongst data center** can cause cabling problems, must use blanking panels.

- **Allocate a specific area for high density racks** can be used only if segregating high density equipment is possible.

- **Implement Virtualization Software** manageability of software.
TCO Savings with Virtualization

995 Servers Pre VZ → 78 VZ Servers

Cost over 3 years

$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$-

w/o VZ

w VZ

Provisioning
Downtime
Disaster Recovery
DC Real Estate
Power & Cooling
Network
SAN
Hardware
VZ SW & Supp