



**>BUSINESS MADE SIMPLE**

Enabling the Agile Data Center

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Lead Technologist and Visionary

**NORTEL**

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### Introduction – Problem Statement



- > The Data Center is the most critical piece of infrastructure for the IT world – and IT is spending a massive amount of money on it
  - 2006: \$200B, expected to grow to \$260B by 2010 (1)
- > More importantly:
  - Cost of equipment expected to stay flat - ~\$50B
  - OPEX going from \$18B to \$26B
- > Need to address major power and cooling issues
  - Power and cooling going from \$6B to \$8B
- > Service enablement is a key differentiator
  - Time to Service
  - Flexibility and Agility

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(1) - IDC - 2006

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### Half the world's datacenters will run out of power by the end of 2008



"Power and cooling is a pandemic in the world of the data center...by next year, about half the world's data centers will be functionally obsolete due to insufficient power and cooling capacity to meet the demands of high-density equipment."

- Michael Bell, research vice president at Gartner Inc.

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### Gartner



#### >Greatest facility problem:

- 37% Cooling
- 43% Power
  - Data Center Power and Cooling Challenge seminar held at the Gartner IT Infrastructure, Operations and Management Summit 2007

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### Power



- > Demand for power is far outpacing the supply of reliable clean power
- > Processors and computing subsystems were not originally designed with power efficiency in mind
- > "Eleven enterprise heavyweights including Microsoft, IBM, Sun, HP, Intel, AMD, Rackable Systems, and VMWare announced Monday that they have formed a non-profit group called The Green Grid to drive new metrics, technology standards, and best practices for curbing power consumption" – PC World 2007
- > Power costs overtake capital costs per server over server's operating lifetime
- > University of Buffalo, NY USA
  - [UB Green Guide](#)

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### Data Centers and Alternative Energy Sources



"Data centers consume vast amounts of electricity and with rack densities increasing, the amount of electricity they use is increasing all the time.

It is incumbent on data centers to try to find alternative energy sources and to this end we are investigating all avenues in our build out of our fully redundant data centre.

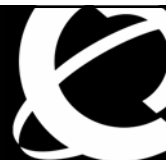
However, I'm afraid we are going to have to rule out cat power, for the moment."

Tuesday, November 7th, 2006  
Cork Internet eXchange

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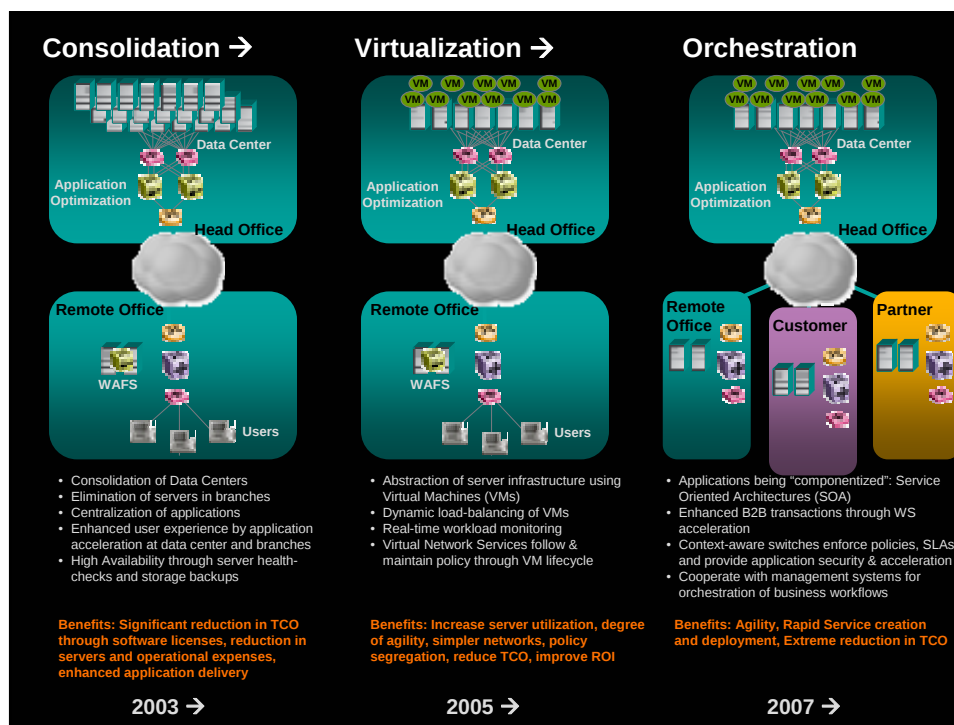
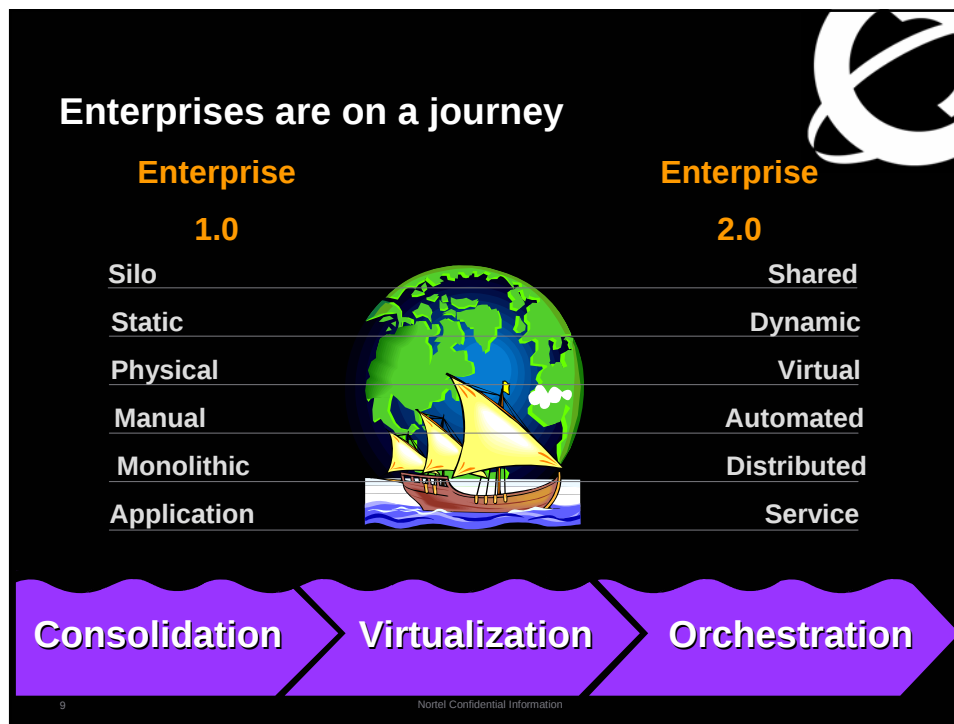
### Cooling



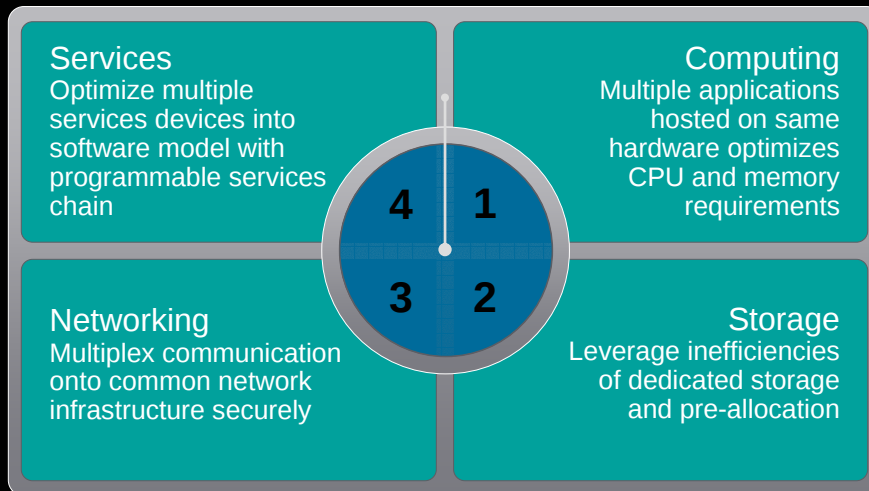
- > Sufficient cooling for a data center is extremely difficult
- > Most DCs are housed in remodeled warehouses
- > Not designed to address thermal management issues
- > Significant over-calculation of cooling requirements based on indicated heat dissipation of devices
- > Introduction of in-server, in-rack and in-row cooling solutions
- > Directly related to power consumption

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## Enabling Agility

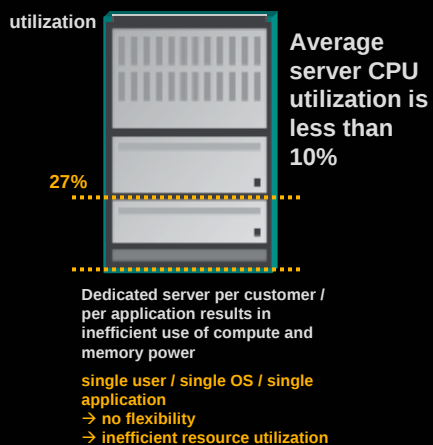


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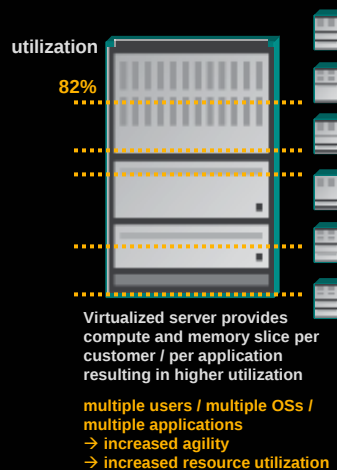
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## Computing

### > Old Model



### > New Model



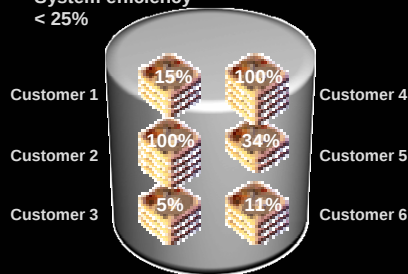
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## Storage

### > Old Model

System efficiency  
< 25%

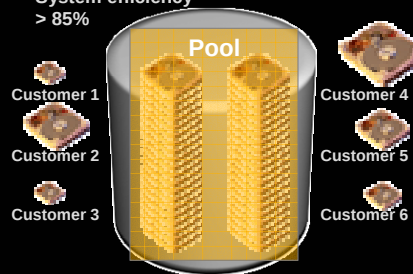


Dedicated disks per customer /  
per application results in  
inefficient use of storage

Finite storage increments  
→ no flexibility  
→ inefficient

### > New Model

System efficiency  
> 85%



Virtualized disks hides  
underlying discrete disk  
infrastructure resulting in higher  
utilization and flexibility

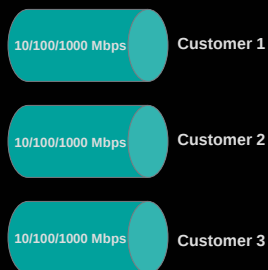
Infinite storage increments  
→ increased flexibility  
→ increased resource utilization

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## Networking

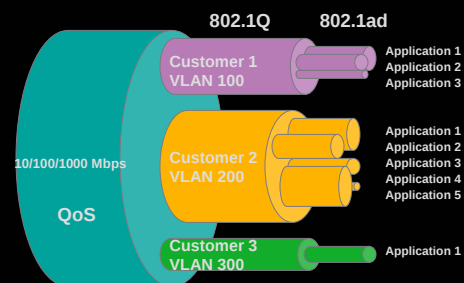
### > Old Model



Dedicated links per customer /  
per rack results in inefficient use  
of bandwidth and cabling

Finite link increments  
→ limited flexibility

### > New Model



Virtualized links provides improvement  
in bandwidth utilization and adds  
discrete control per customer and per  
application

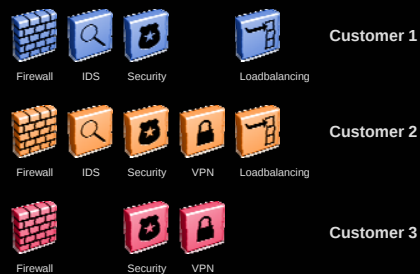
Infinite link increments  
→ flexibility

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## Services

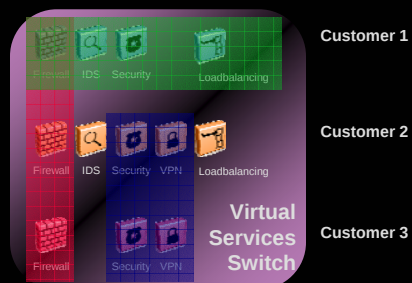
### > Old Model



Dedicated discrete devices per customer / per rack based on service needs

Limited by discrete devices

### > New Model



Virtualized services hosted off a single services solution with scalable processing modules provides greater flexibility and improved efficiency

Ultimate in service flexibility

Role Based Administration

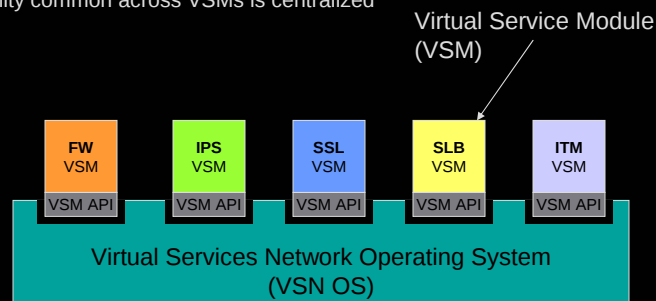
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## Virtual Services Operation

### Key Features

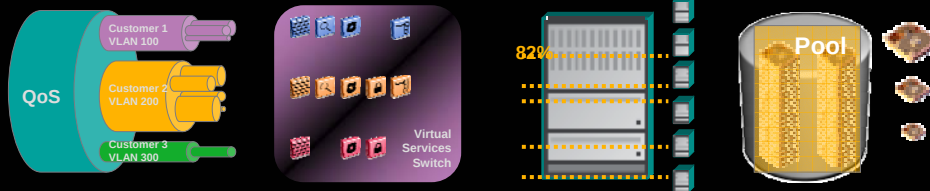
- Ability to plug and play multiple services in desired combinations
- A Service operates independent of other services
- Service is insulated from the implementation platform
- Functionality common across VSMs is centralized



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## Complete Virtualization



Complete service flexibility with bandwidth, services, CPU/memory and storage control per customer

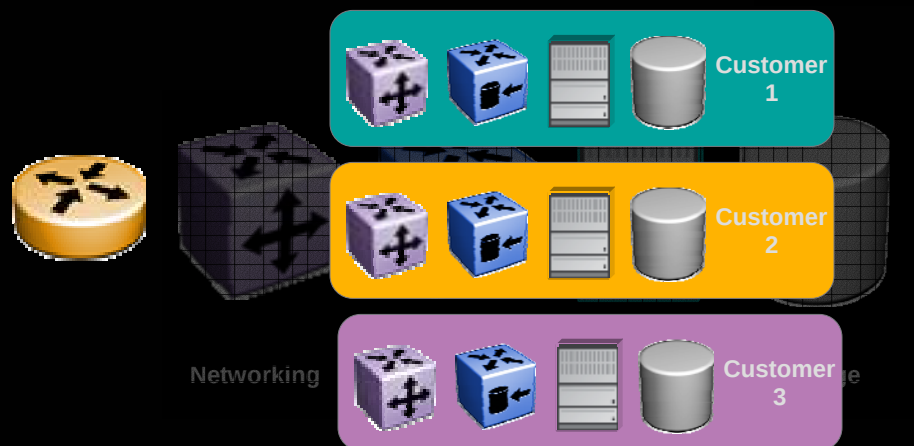
Significant improvement in efficiency and utilization drives down power and cooling costs

Enables full virtual rack provisioning

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## The Agile Data Center



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## Orchestration

> Provides capabilities associated with the composition and coordinated execution of services

> Orchestration provides

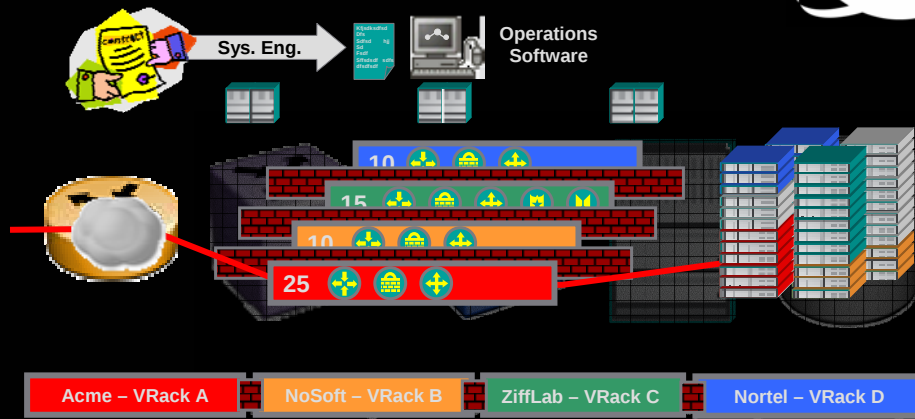
- Management of synchronous, stateless (short-running) flows with complex interaction patterns, such as parallel invocations and time-bound executions with possible cancellations
- Management of long running, stateful, asynchronous flows where processes may need to wait for events to fire. For asynchronous invocations, callbacks with correlated request-response patterns may also need to be supported
- Parallel service invocations with support for AND-join and OR-join conditions.



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## Orchestration



Reducing TTM from Weeks to Hours

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### Virtual Rack Service Level Agreements



- > Each Virtual Rack has a unique SLA that defines the resources available to the rack
- > System or Rack administrator can modify resource assignment as needed
- > Provision networking infrastructure using a few the clicks within management software without changing any physical cable

- > Bandwidth Allocation

- Guaranteed Bandwidth ("CIR")
- Burst Bandwidth ("EIR")
- Bandwidth Threshold Notification
- SLA Bandwidth Reporting

Virtual Rack 1 - Acme

Virtual Rack 2 - NoSoft

Virtual Rack n - ZiffLab

- > Resource Allocation

- Memory, Contracts, Policies, SLB Groups, VIPs, Concurrent Connections etc...

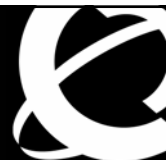
- > Abuse Protection

- L2 Limits (Broadcast and Spanning Tree)
- UDP Blast Protection
- SYN Flooding
- ICMP, TCP, UDP Rate Limits
- IP Access Control

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### Conclusion



- > The Data Center is a strategic area for the IT world
  - IT is taking back control of the applications (centralization) following the mainframe model
- > New technologies must address critical pain points including power, cooling, efficiency and flexibility
- > Nortel is helping introduce a new architecture to enable the agile data center - maximizing system efficiency and flexibility and minimizing service enablement time

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