Datacenter Efficiency

Holistic Approach to Improving TCO & ROI through Optimizing Performance and Power

Ryan Waite
General Manager, High Performance Computing
Microsoft Corporation
Some premises for this talk

- As a civilization we are better because of science and technology
  - Science paradigms: empirical -> theoretical -> computational
- As the HPC community we are about to double again
  - Beowulf clusters lowered the bar to do big scale computing
  - Cloud computing is Beowulf 2.0

- Today’s talk: how do we build efficient data centers that make it cheap for a broader community to do scale computing
The Personal Mainframe.

And how to know if you need it.

When hundreds of people in different places need the same information.

When your software costs are always higher than you planned on.

When some people need a decision-making tool and others need a number-cruncher.

You can solve a lot of problems with a DECsystem-10 or DECsystem-20. The Personal Mainframe® computers from Digital.

Everyone needs to use the computer? With The Personal Mainframe, up to 512 users can work interactively at their own terminals.

Lots of different applications? The Personal Mainframe does everything from computer-aided design and scientific research to marketing reports and payroll.

Worried about software costs? People who use it say The Personal Mainframe is the easiest system they've ever worked with. The DBMS complies with CODASYL specifications. All the languages, from COBOL to FORTRAN, are highly interactive. And since applications are easy to maintain, your highly paid programmers can spend their time developing new software.

The Personal Mainframe can help your 5-year computer plan, too. It's easy to expand or upgrade without losing any software. You can also extend it to a communications network with other Personal Mainframes, smaller computers from Digital, even computers from other vendors.

When people are waiting in line for their applications.

When you can't predict how you'll be using your computer next year.

We'll help you choose The Personal Mainframe that's right for you, whether you're in engineering, research, manufacturing, business, government, or education.

Send for our brochure, "The Personal Mainframe and how to know if you need it." Or call 617-467-6434.

You just might discover the answer to all your computer problems.


In Canada: Digital Equipment of Canada, Ltd.

Digital
We change the way people work.
Huge Global Scale 24x7

- Windows Azure: 500M Active Live IDs, 59 markets and 36 languages
- Windows Live Hotmail: 355M Active Accounts
- bing: Over 4B WW Queries Each Month
- msn: Over 459M Unique Users
- Windows Live Messenger: Over 303M Users, 76 markets and 48 languages
- Zune: Over 6M Songs In The Catalog
- XBOX LIVE: 25M Users
- Windows Live Essentials
- Microsoft Advertising: 14B Ads Per Month
- Microsoft Exchange Hosted Services: 2-4 billion emails per day

200+ CLOUD SERVICES

PC, MOBILE, TV/HOME
Microsoft Datacenter Scale

Microsoft has more than 10 and less than 100 DCs worldwide

Multiple global CDN locations

Quincy, Washington 27MW 100% Hydro power
San Antonio, Texas 27MW Recycled water for cooling
Chicago, Illinois Up to 60MW Water side economization, Containers
Dublin, Ireland Up to 50MW Outside air cooling, PODs

"Datacenters have become as vital to the functioning of society as power stations."

The Economist
Understanding Datacenter Construction Costs

Where the costs are:
- >80% scale with power
- <10% scale with space

- Land: 0%-2%
- Core & Shell (Building): 5%-9%
- Architectural: 4%-7%
- Mechanical / Electrical: 70%-85%

Reduce!
In a typical datacenter:

For every watt in server power there can be another 0.5 to 1 watt consumed for power distribution losses and cooling.

**PUE**: Power Utilization Effectiveness

\[
PUE = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}
\]
Server Hardware Design Considerations

- The Datacenter is the Server
- Performance/Watt/Dollar
- Drive change in the industry through strong partnerships
- Deliver value to online service partners through customized designs
Cost Reduction Strategies

- Right-size the Server
  - Eliminate unnecessary components
  - Use higher efficiency power and cooling
  - Optimize for performance/watt/$

- Reduce Infrastructure Costs
  - Operate servers at higher temperature
  - Use free air cooling where possible
  - Eliminate chillers

- Drive server consolidation with virtualization
- Leverage advanced power management technology
- *Do not strand power*
The sweet spot is often at low power processors, especially when system price and power are considered.

Your mileage may vary!
Microsoft’s Datacenter Evolution

Generation 1

Colocation

Server
Capacity
~2 PUE
20 year Technology

Generation 2

Density

Rack
Density and Deployment
1.4 – 1.6 PUE
Minimized Resource Impact

Generation 3

Containment

Containers & Pods
Scalability and Sustainability
1.2-1.5 PUE
Air & Water Economization
Differentiated SLAs

Generation 4

Modular

ITPAC
(Pre-Assembled Components)
Reduced Carbon, Rightsized
1.05-1.20 PUE
Faster Time to Market
Chicago Datacenter

- $500M+ investment
- 700,000+ square feet
- 60 MW Total Critical Power
- 3400 tons of steel
- 190 miles of conduit
- 2400 tons of copper
- 26,000 cubic yards of concrete
- 7.5 miles of chilled water piping
Paradigm Shift to Ultra-Modularity

- Modularize and pre-manufacture the entire datacenter
- Lower the Total Cost of Ownership
- Increase scalability and right time to market
- Standardize components to improve operations and reliability
Microsoft’s Future Datacenters

- No mechanical cooling
- Ultra-efficient water utilization
- Relentless focus on renewable materials

- Near-JIT deployment
- Low initial capital investment
- Scale with business demand
- Deploy 1 to 10,000+ servers at a time
Building a More Efficient Datacenter...

- Holistic optimization of server and datacenter design
- Platform energy efficiency remains a major focus area (Performance/Watt/Dollar)
- Workload analysis is critical to rightsizing

Beowulf 2.0

- We can continue to grow the HPC community
- Cloud computing reduces barriers for doing distributed computing
- Cloud computing provides cost effective computing for the masses
Microsoft Datacenter Resources

- Global Foundation Services website: www.globalfoundationservices.com