It's Time for Mass Scale VDI Adoption

Cost-of-Performance Matters

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Agenda

- Intro to Alacritech
- Business Motivation for VDI Adoption
- Constraint: Performance and Costs to Deliver
- Why Flash Memory Alone Isn't the Answer
- University of Portland Case Study
- Conclusions

Intro to Alacritech

- Founded in 1997 by Larry Boucher
- Inventors of Dynamic TCP Offload
- Technology incorporated into Appliance Solution
- Has always been centered on data acceleration
  - In purpose-built silicon + software
  - With minimal Server CPU

Business Motivation for VDI Adoption

- Alacritech-sponsored survey found:
  - 50% are already using VDI
  - 43% plan to purchase over next 12 months
- Business drivers, in order of importance
  1. Ease-of-management
  2. Data security
  3. Costs: capital, space, cooling, administration
- BYOD influences…
  - IT not thrilled about supporting tablets and smart phones
  - But when the CEO is a user…

The VDI Performance Conundrum

- With the user experience being vital…
- IT must generate acceptable performance for users
    - Slow response times can doom the project
- While delivering acceptable cost-of-performance
    - If the project is too expensive, it's also doomed

Storage Impact on Cost of Performance

- Storage cost is a major component of cost-of-performance
- Presenting real challenges to storage administrators
  - Randomness in IO patterns
  - Higher aggregate IOPS
    - Conventional hard drives are a constraint
- Is flash memory the answer?
- With flash memory, where is the bottleneck?

Imagine a Ferrari at a Stoplight…
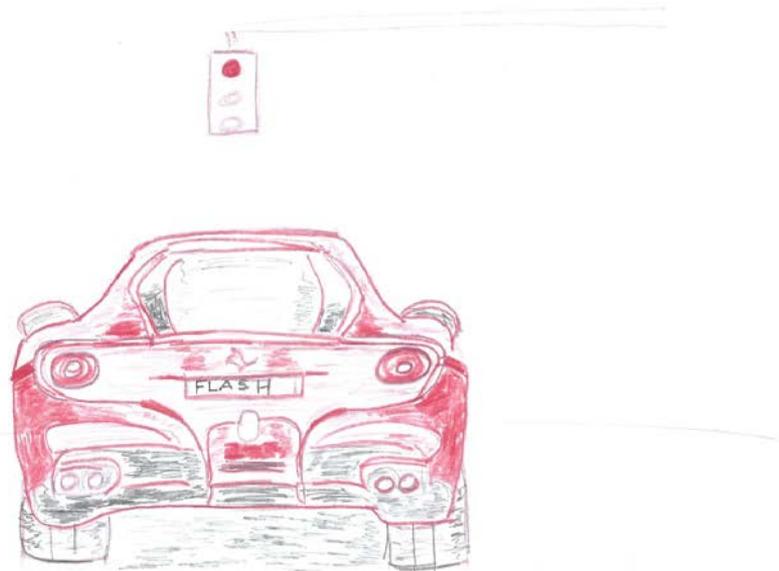
Tracking the Bottleneck to Performance
and Consequently Cost of Performance

- Remember why we virtualized servers…
  - Physical servers were being grossly underutilized
    - < 15% processor utilization was common
- Processor-to-conventional-disk-drive performance gap
  - Disk drives were the bottleneck
- Enter flash memory…
  - Processors are no longer waiting for disk I/O
  - Higher IOPS are generated
  - Random access is 200 times faster
- What's not to like?

Drilling Down…

- In early fileserver design, the processor was the bottleneck
- In 1997 it was10 processors to 102 disk-drives
- But Moore's Law has proved true over a 12 year period!
  - Processor speeds increased by factor of 180
  - Disk drive speeds increased by a factor of 11
- Today's mid-range filer…
  - Require ~ 200 drives to saturate 2 processors
- Flash memory changed the rules overnight
- The bottleneck is once again the processor

How Big of a Bottleneck?

- Simple test conducted:
  - Two identical servers
    - 2 Quad-Core Intel Xeon Processors @ 2.27 GHz
    - 96 GB of DRAM
    - 20 Gbps 400GB SSDs
  - One server equipped with Linux V6 CentOS and EXT 4 file system
  - Other server equipped with Alacritech NFS Bridge SW and 4 Alacritech 10GbE Accelerators

How Big of a Bottleneck?

- Ran popular file serving benchmark using modified NFS mix
  - READ   22%
  - GETATTR   33%
  - LOOKUP   30%
  - ACCESS   14%
  - READLINK   1%
- Results:
  - Linux server achieved an impressive 174K OPS/s
    - Processors became saturated
  - Alacritech server achieved 810K OPS/s
    - 4- 10GbE network accelerators became saturated
    - Processors only 35% busy

Test Results
Direct Implications on Cost of Performance
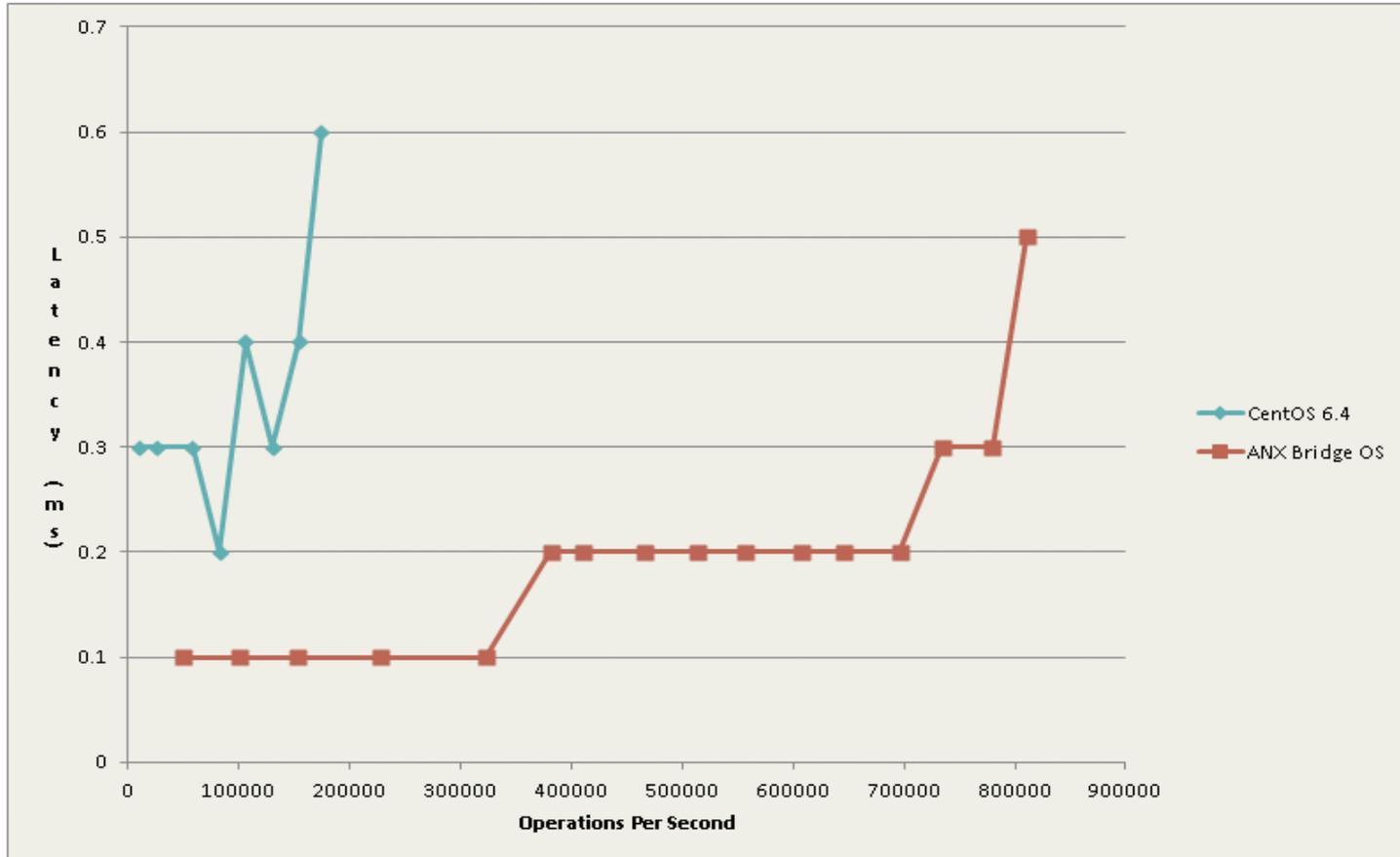
Why Not Add More Processors?

- Simply put, Amdahl's law applies:
    - The amount of performance improvement that can be realized by adding processors is based on the portion of a program that can be parallelized
- With NAS, a fair amount of processing can't be parallelized
- Most NAS systems can't take advantage of more than 8 processor cores before hitting the point of diminishing returns

University of Portland Use Case

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- Made aggressive moves to virtual servers, networks and most recently desktops
  - Achieved a 50:1 virtual machine to physical host ratio
    - Data center is more than half empty
- Initially rolled out VDI to support ~ 200 on campus kiosks, labs, specific class rooms and student-supplied thin-client devices
- Next wave was to roll VDI into state-of-the-art digital library and expand connections throughout campus
  - Support nearly 3,000 users

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- Challenges:
  - NAS filers were experiencing performance bottlenecks
  - Read performance was suffering
    - Modest write %
    - But writes take precedence over reads
    - Contributed to read latency
      - Threatened the viability of the project
      - Used vendor's flash as cache with limited improvement
- Intermediate solution:
  - Install another vendor's array to support VDI reads/writes
  - 100% flash array
  - User initiated writes still handled by filer
  - Effective, but another array to manage
  - Also faced with $160K – additional SSD shelves

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- Hypothesis:
  - Could NFS Acceleration Appliance be of help in
    - Functioning as a virtual read channel
      - Passing writes back to the older filer
        - Many OS generated and not read back
      - Delivering superior performance
        - Leveraging Flash *with* data acceleration
          - Inclusive of optimized TCP Offload
      - Delivering superior performance at less cost
    - If performance was significantly better
      - Could less expensive media be used behind the filer?
    - And could the filer be offloaded enough to provide performance for all supported/stored apps, not just VDI?

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- Results:
  - Read latency improved by over 20%
    - Compared to pure flash array
    - Appliance listed for $90K, compared to $160K SSD drive shelf expansion
  - NFS Acceleration Appliance handled 90% of the requests
    - The appliance CPU < 15% busy
    - Processor cycles given back to NAS so it can do more
    - Appliance has headroom to handle additional load
      - More VDI plus targeted to support database
  - University was able to use less expensive media
    - Using SATA in place of SAS
  - Anticipate total savings in first year to be $200K
    - Forecast $50K savings in storage costs each add'l year

Conclusions

- Successfully rolling out VDI requires being mindful performance and costs
- The use of flash memory can help increase IOPS
- But flash shifts the bottleneck back to the processor
- Using NFS acceleration appliances can
  - Provide data acceleration to a multitude of clients
  - Reduce latency
  - Drive the cost/IOPS considerably lower
  - Enable use of less expensive media behind the filer
  - Benefit all applications supported by filer
  - Simplify management
  - Help ensure a successful VDI rollout
    - Delivering on both performance and cost with gas to spare