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SCALE SMART

Outdated Architectures Are Holding Back the Cloud

Flash Memory Summit Open Tutorial on Flash and Cloud Computing
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Business' Most Valuable Asset: Its Data

Data

- Most important and valuable component of modern applications and websites
- Driving revolutionary changes in computing and the internet
  - New opportunities for generating revenue
  - More efficient use of current business processes and infrastructure
- Data access downtime or poor performance has a major cost to a business' bottom line

The Mission-Critical Imperative

the social network

“Let me tell you the difference between Facebook and everyone else, we don't crash EVER! If our service is down for even a day, our entire reputation is irreversibly destroyed!

Facebook and Google invest hundreds of millions of dollars every year on custom software and hardware infrastructure to optimize availability, performance, administration, and cost

Mission Critical Imperative

- Maintaining data availability and response time is critical for key classes of businesses
  - Web 2.0
  - eCommerce
  - High-volume websites
  - Telecommunications

- IT departments and application developers seek architectures and deployments providing
  - high service availability
  - resilient performance scalability

- Meet rising service demand while controlling capital and operating expenses

Cloud Requirements and Challenges for Scaled Enterprise Services

- Cloud providers must deliver:
  - guaranteed service availability, performance, and elastic scale
  - multi-tenant management and security
  - and a net TCO savings vs. dedicated data centers

- Barriers in deploying enterprise class services into the cloud at scale
  - For many classes of applications and services:
    - the realized performance and availability characteristics of cloud deployments are disappointing at scale
    - the large quantity of cloud instances needed to support scaling a deployment drive the cost of cloud deployment to unacceptable levels
  - Opportunity for flash, but innovation is required

Current Cloud Virtualization : Successes and Limitations

- Cloud server-virtualization
  - Provisioning application instances in virtual machines on servers
    - combine existing applications with multi-core systems to increase utilization
    - elasticity of service capacity through dynamic provisioning of more or fewer application instances based on the current workload demand.
- Successes
  - applications that scale horizontally and can run under a VM hypervisor within a server's DRAM (eg web application tier)
  - works well for low volume apps and services (start-ups, new games, …)
- Problems : scaled production databases
  - virtualization kills performance if they do not fit in DRAM
  - limits ability to exploit flash memory for database performance

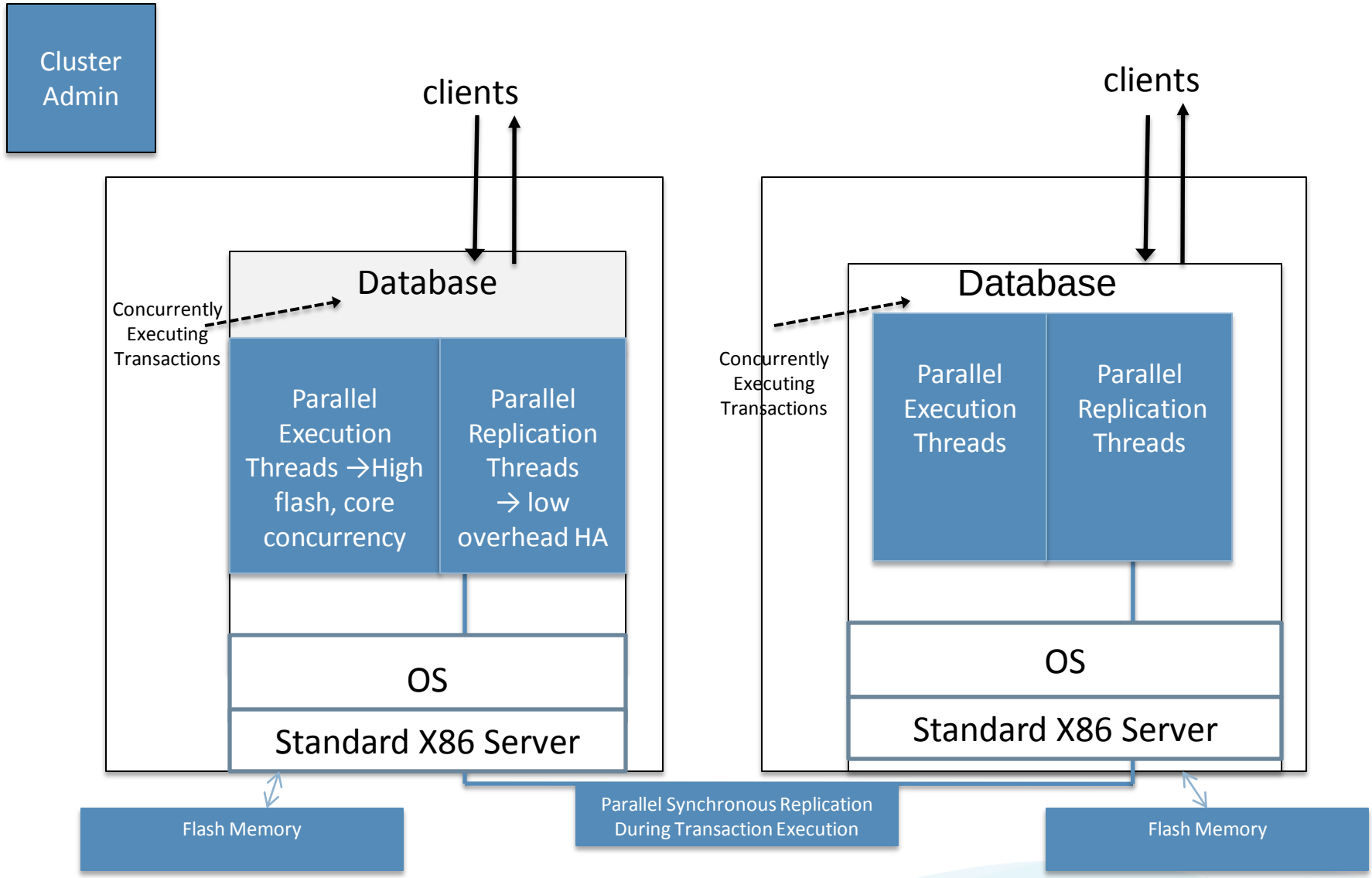
Cloud Virtualization Impact on Production Databases

- Databases in production cloud environments:
  - provide additional data partitioning (very small data bases)
  - provide additional caching layers to minimize I/O (breaks ACID)
  - provision many more database instances than in a non-virtualized environment

- Net Impact
  - drives up application and management complexity
  - increases cost
  - reduces service availability and data integrity

- Less than 10 percent of production data-tier server workloads are virtualized today.

Tightly-Coupled Database Design with Flash Memory and Synchronous Replication >> High Performance + High Availability

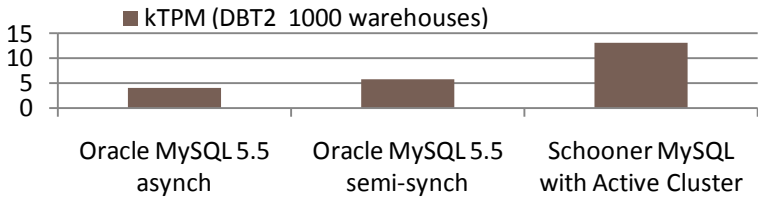


Tightly Coupled Database Design Enables Effective Vertical Scaling with Commodity Flash Memory and Horizontal Scaling with High Availability

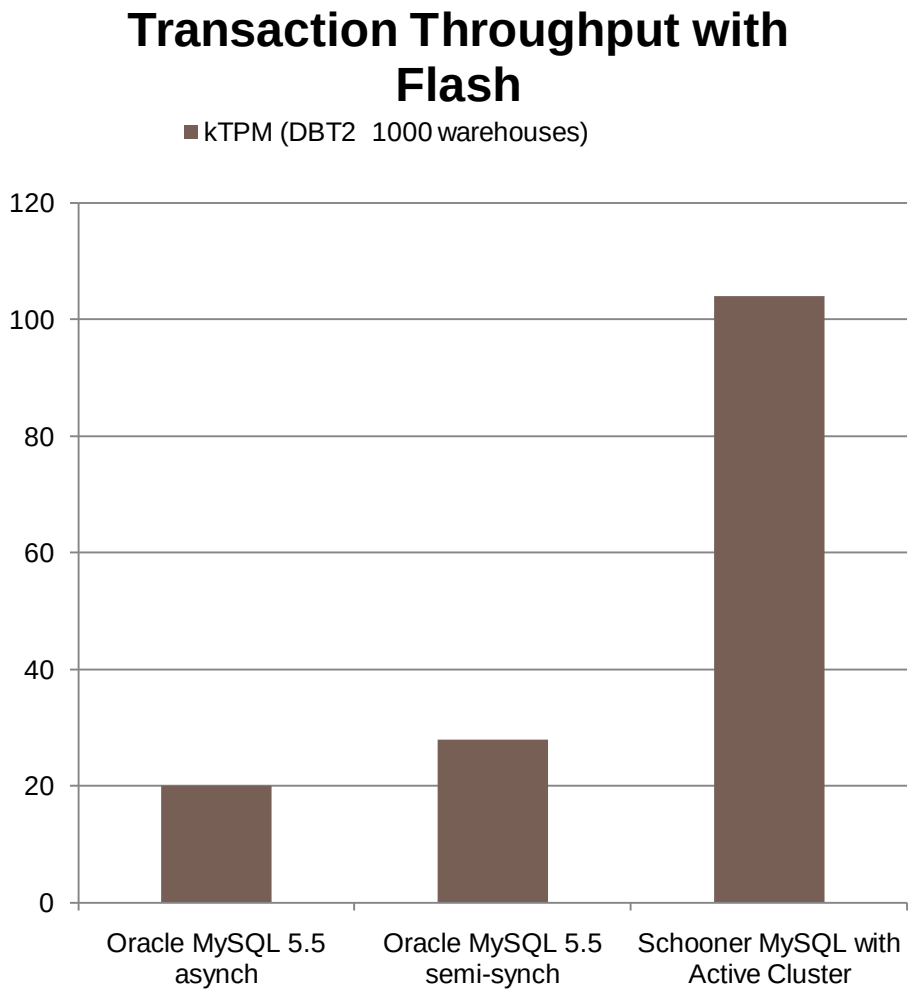
DBT2 open-source OLTP version of TPC-C
- 1000 warehouses, 32 connections
- 0 think-time
- Result metric: TPM (new order)

Measurement Configuration
- 2 node Master-Slave configuration
- 2 socket Westmere
- 72GB DRAM

Transaction Throughput with Hard Disc Drives



Transaction Throughput with Flash



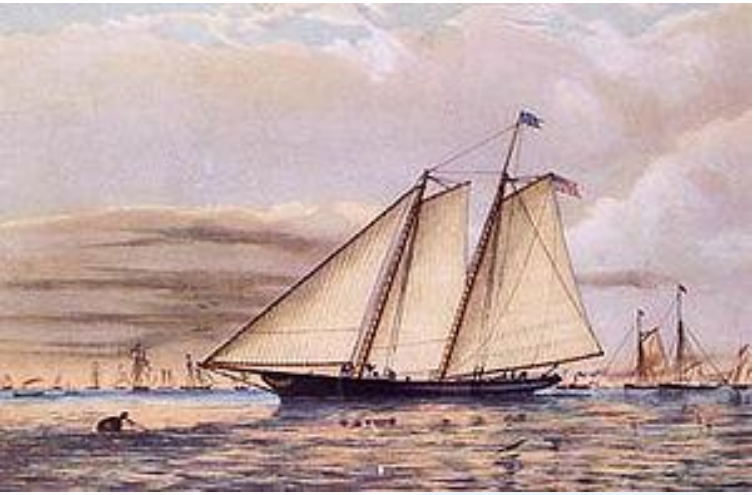
Fusing Cloud + Flash + Optimized Databases

- Short term
  - virtualized machine instances for the web and application tiers
  - non-virtualized, vertically scaling data-tier solutions
    - Exploit balanced commodity, flash-based, multi-core system configurations
  - custom management APIs and tools to link together in a hybrid cloud

Fusing Cloud + Flash + Optimized Databases

- Longer Term : Innovation Required
  - Need improved virtualization technologies
    - Flash optimized virtualization cutting flash access overhead
    - unified virtual administration model
      - applicable to all tiers in the data center including flash-optimized data tier
      - dynamic provisioning, management, monitoring, and accounting
  - Large potential Quality of Service and TCO Benefits
    - increased performance, scalability, and service availability
    - reduced capital and operating expenses

Thank You!



Schooners, first built in the 1700s, applied an innovative design to the standard cargo sailing ship, enabling stupendous levels of speed and range. They enabled a set of visionary companies to enter new markets on a global basis. Where can a Schooner take your company?