



Achieving Green Flash Datacenters Requires Balanced System Architecture

Dr John R. Busch

CTO and Founder
Schooner Information Technology, Inc



Position Summary

21st century data centers based on servers with large DRAM caches and hard drive storage typically waste most of their power. Flash memory offers the potential for order of magnitude improvements not only in power consumption but also in performance and space. However, realizing this potential requires balanced system architecture, not just assembling locally optimized pieces. In particular, maximizing flash IOPS in a server is often an exercise in diminishing returns. Effectively balanced systems require software to be optimized for flash memory and for processor core scaling, with high levels of parallelism, granular concurrency control, and intelligent memory hierarchy management. Tightly coupled software, processor cores, DRAM, and parallel flash memory can be designed into balanced system building blocks matching workload characteristics which dramatically cut datacenter power and improve performance while also reducing cost and improving service availability



>> Rack, Power, Pipe, Complexity

U.S. data-centers use more energy than the entire nation of Sweden.

- EE Times

Datacenter equipment is only utilized 6% to 10%.

- William Forrest
Forbes

The number of installed servers in the U.S. will increase from 2.2 million in 2007 to 6.8 million in 2010.

- Frost & Sullivan

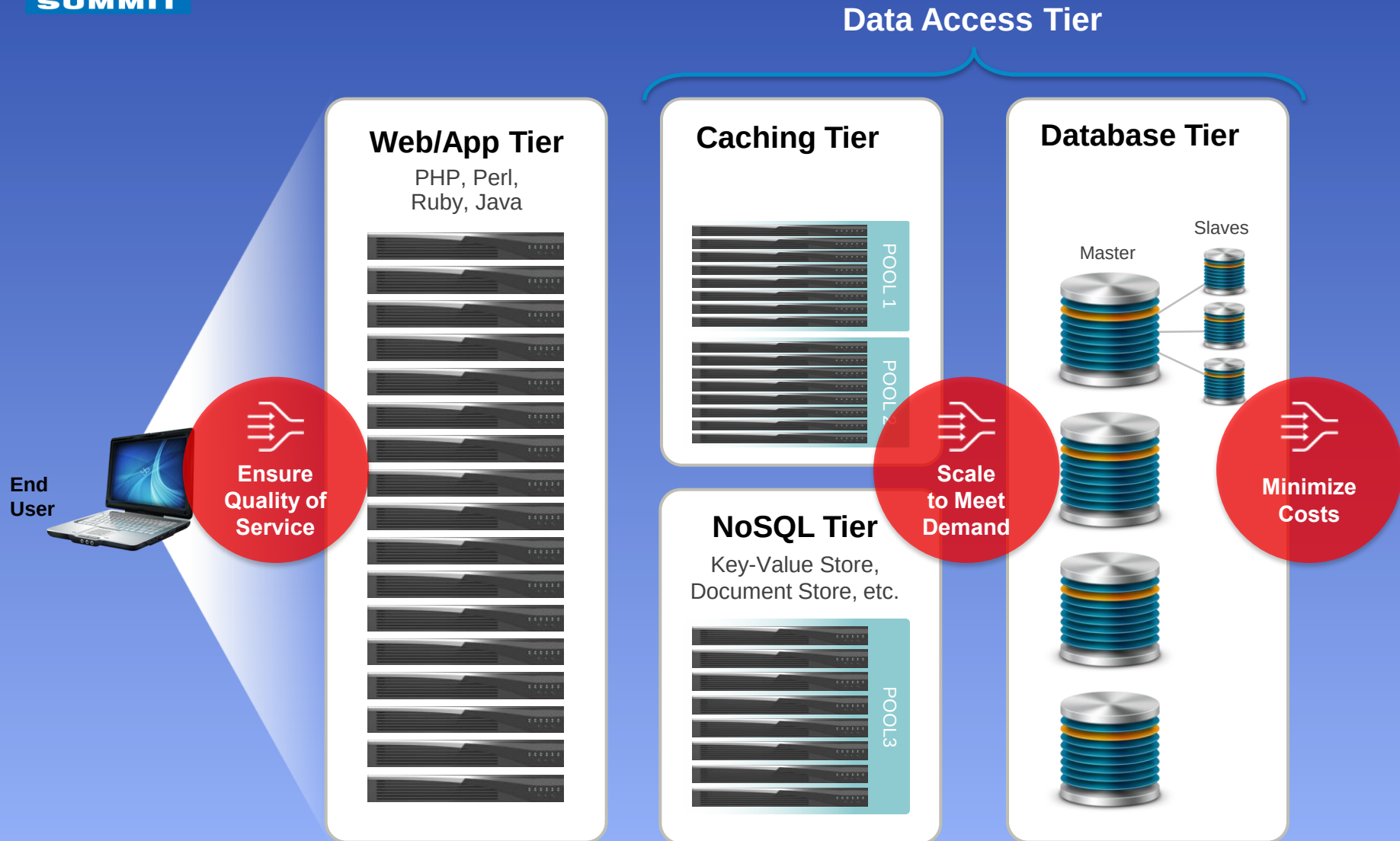
From 2003 to 2008 the data size of the average web page has more than tripled.

-websiteoptimization.com

For every 100 units of energy piped into a data center, only three are used for actual computing.

- U.S. Department of Energy

Typical Scale-Out Datacenter Deployment



Schooner Data Access Appliance

1

The Schooner Appliance for
MySQL Enterprise™ with InnoDB



+



2

The Schooner Appliance for
Memcached/NoSQL



High-
Capacity
Cache

+

Persistent
Key-Value
Store

+

100%
Memcapable

- **Integrated, turnkey appliance**
 - Complete hardware / software solution
 - 100% certified plug-and-play
 - IBM partnership
- **Blazing performance**
 - 8x performance improvement
 - 1/8 the power and rack space
 - 50% lower TCO over 3 years
- **Extreme availability**
 - Data & service availability
 - Transparent to the app
 - 90% less downtime

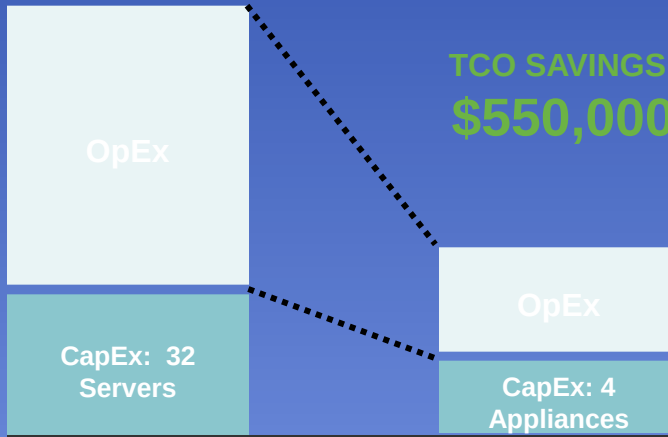


Tightly Integrated MySQL Flash Database Performance , Consolidation, TCO

3 Year TCO (2 TB MySQL)

TCO: \$832,000

TCO: \$282,000



Without Schooner

32 servers, 17.9 kW

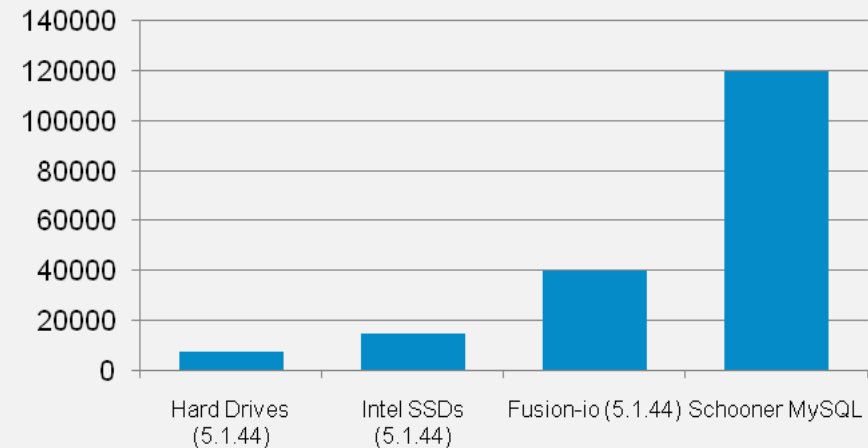


With Schooner

4 Schooner appliances, 1.8 kW



Transactions per Minute per 2U,
DBT2 with 1,000 Warehouses



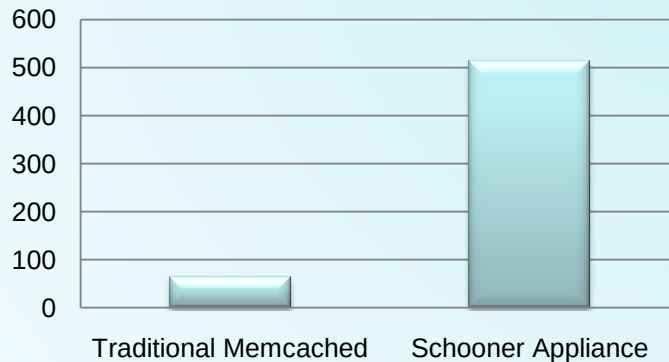
Tightly Integrated NoSQL Flash Systems

Performance, Capacity, and Availability

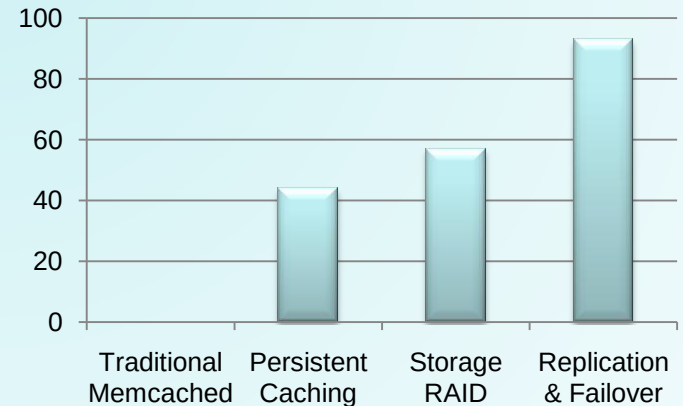
Memcached /
NoSQL
Flash Memory
SUMMIT

Schooner vs.
Traditional
Memcached

Cache Capacity per Node (GB)



Reduction in Downtime (%)



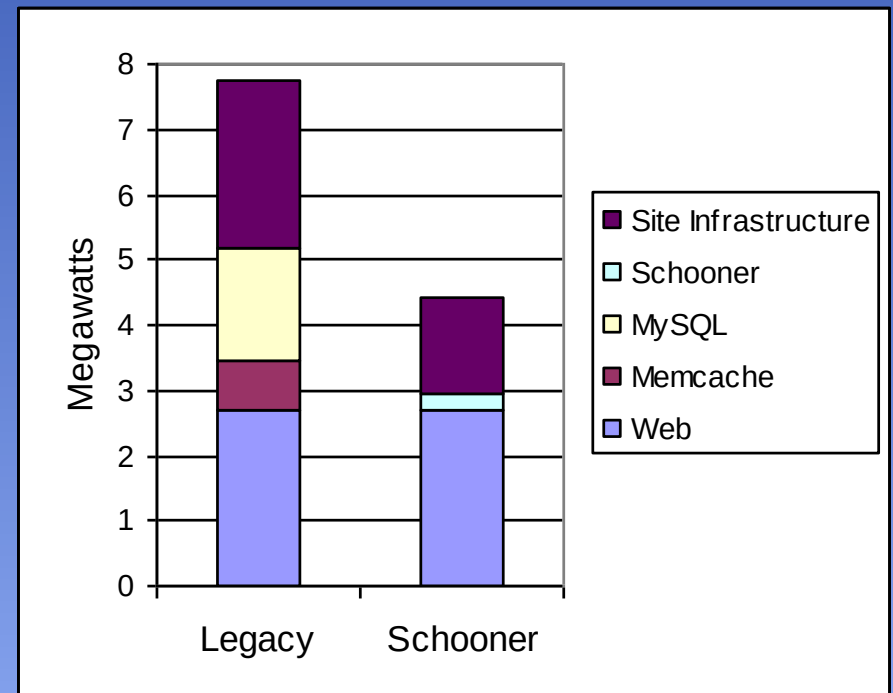
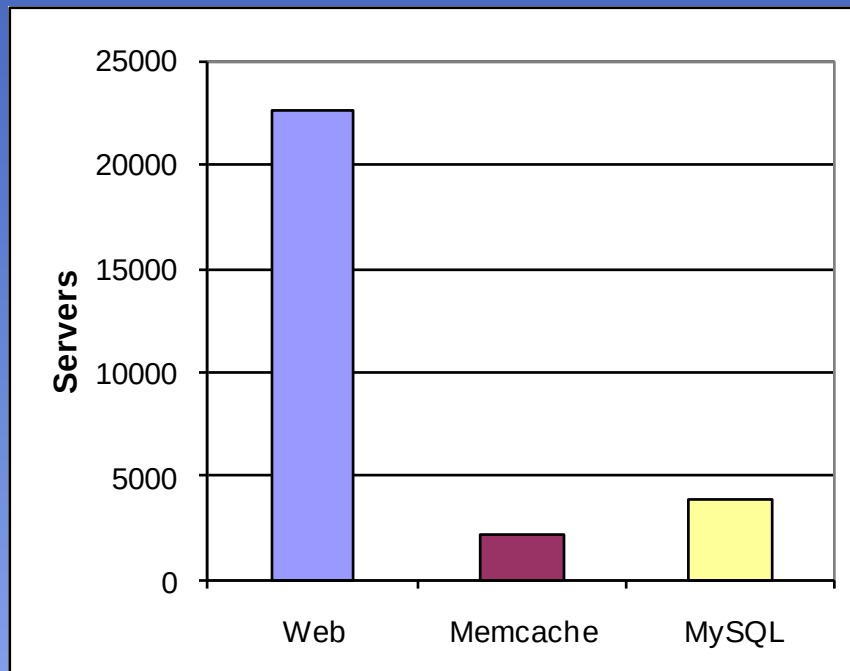
Schooner vs.
NoSQL
Alternatives

TPS/Node, Random Queries	In DRAM	In Flash
CouchDB	1,000	1,100
Cassandra	10,500	1,790
MongoDB	49,000	4,000
Schooner MySQL	115,000	101,000
Schooner NoSQL	310,000	160,000

Note: NoSQL benchmark is a key-value random query of 32M and 64M 1kByte items, on the same hardware (dual quad-core Intel Nehalem processors with 64 GB of DRAM and 8 parallel Intel X25E flash drives).



Tightly Integrated, Balanced Flash Based Systems : Data Center Power Reduction



Cloud → Hybrid

