Leveraging **Traditional** Technologies in **Non-Traditional** Ways

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Cloud Hype

- Cloud is marketing hype (and everyone knows it)
- ... but so was the horseless carriage and flight
- Rode closely behind the Ruby on Rails marketing hype
- Poorly defined, but Amazon AWS sets the standard
- ... initially anyway.
- Enterprise Web Hosting 2.0?

Cloud is Evolution

- Mainframes give way to Mini-Computers
- Mini-Computers give way to Micro-Computers
- Micro-Computers networked together
- Networked systems act as a cluster
- Cluster evolves and becomes the grid
- Micro-Computer Virtualized into the Cloud

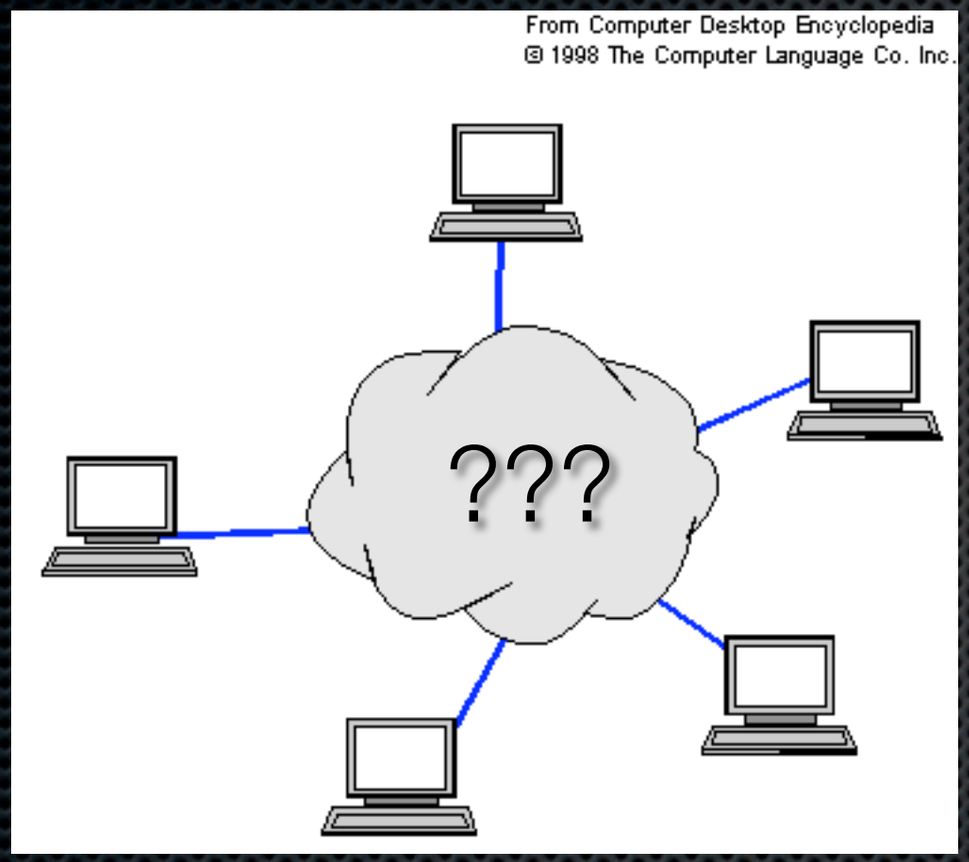
Moore & Co.: Breaking Laws

- Cloud is the result of excess storage, CPU, RAM, and bandwidth
- Virtualization is the enabling technology
- Predictions that Appliances will replace servers were right.... but not in the expected way.

Redefining the OS & Net

- The OS now serves dual roles:
  - As a platform for other OS's (Hypervisor)
  - As an application environment (Guest)
- Hypervisor is the guardian of resources
- Guests are light-weight application environments that are highly portable and granular
- The Network is the backplane/bus.

A Perspective Change



Old Perspective

Customers are in the cloud.
You connect to it.

New Perspective

You *are in the cloud.*
Customers connect to it.

Inside the Cloud

- Consequences of being inside the cloud
  - Physical Locations (datacenters) must work together
    - Resources should be available globally
    - Redundancy extends outside the firewall
    - One site should compliment another (GLB) to best serve customers
- A realization that the world is a big place (and its wrapped in fiber optic cable)

Time to Re-Architect

- Virtualize Everything
- Change your perspective
- ... welcome to cloud.

What about the other stuff

- I thought a cloud was about...
  - AutoScale / Scale on demand (“click click grow”)
  - Pay as you go ($/CPUhr; $/GB)
  - Software as a Service (SaaS)
  - blah blah blah
- These are features of made possible by the cloud, not the cloud itself.
- Think about it.... is AWS “Cloud” or “Shared Hosting”?

A friendly reminder...

Do this:

Not This:

Classes of Cloud Storage

- Storage ***in*** the cloud
  - Sharing data so you don't have to
  - Customer/User Facing
  - Example: HTTP, WebDav, FTP, etc.

- Storage ***behind*** the cloud
  - Supporting virtualization infrastructure
  - Private & Isolated
  - Example: NFS, CIFS, iSCSI, FC, etc.

When the Line Blurs

- Problems pile up quickly when private storage becomes publicly accessed, with out being designed that way.
- Example: NFS/CIFS Server starts storing customer uploads/downloads.

It ain't what you got...

it's how you use it.

NFS in the Cloud

- Still an excellent way to provide shared storage between nodes
- pNFS and NFSv4.1 continue to keep NFS viable
- NFSv4 ***is*** Internet Friendly
- Performance is tricky, but it always has been.
- Key is to minimize head movement... When possible dedicate small number of disks to a share, rather than pool up various client shares together.

iSCSI in the Cloud

- iSCSI can be the key to efficient virtualization
- Most forms of virtualization still host guest OS's on some form of block storage. iSCSI makes that storage portable
- Combined with iSNS you can easily create *instance directors*
- The result is "light" nodes in racks (disk only for root/boot/swap of hypervisor)

Distributed Storage

- NAS Storage with a Cloud Perspective
- Important new products:
  - EMC Atmos
  - Sun Project Celeste
  - Nirvanix
  - Hadoop (HDFS)
  - Cleversafe
  - pNFS
  - See: UC Berkely OceanStore

Lest We Forget...

- For all the joys of Distributed Storage, it's still based on traditional storage (filesystem, interconnect, disk)
- Performance tuning becomes even more demanding
- With IO's coming from more and more directions, disk latency (seek) adds up quickly, and can easily get out of control.
- Effective caching (WriteBack, FS Cache) more important than ever.

Observability in the Cloud

- Just as with a real cloud, when flying into it your biggest fear is hitting something else
- Putting so many resources in close proximity can make traditional performance observability methodologies obsolete
- Tools like DTrace are essential to see into those puffy storm clouds. Without it, your flying blind.

10g Ethernet & Infiniband

- As more and more data is stored in DRAM (memcache, etc) wire latency becomes a bigger issue
- 10g Ethernet is the future. Networks will be flat and VLAN's will do all the work.
- Infiniband is cheap (who'd of though), low latency, and has stable RDMA today... and extremely viable interconnect for new datacenter backends.

Global Distribution

- Content Distribution Networks (CDN's) such as Akamai or Nirvanix are essential. You either buy it or build it.
- Hosting solutions extremely appealing due to this dilemma... buying it is cheaper than building it, and increasingly one of the hyped features of the Cloud
- Combined with international law, technologies swift pace, and cost of skilled IT, building it is extremely difficult.
- Hybrid solutions are best; keep what you have and get the distribution via Cloud providers or services.

Flexibility is the Key

- Whatever road you take, keep change in mind
- Design light and granular
- When it comes to disk, less is more. Do not over commit your spindles
- Always plan ahead

What was old is new.

(again)

Thank You.

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