

TIM 50, LECTURE #8 (7/25/17)

Agenda

1. Presentation by Tom Gill on
CIO Role in a High-Tech Company
2. The Evolution of IT
 - Data Centers
 - Virtualization
 - Cloud Computing

1. Data Centers

What is a Data Center today?

- Large server & storage farm
in a huge building (Google, Amazon, Microsoft)
 - used for data processing, web-site hosting,
business applications,
 - giant IT hardware warehouses
 - racks of servers
 - storage arrays
 - network switches
- } Look for
pictures &
videos on
the Internet.

Data center challenges

- Resource management
 - How to efficiently manage server & storage resources
 - applications have variable, unpredictable workloads
 - want high performance but low cost
 - automated resource management
 - energy costs; servers consume high amounts of energy;

Large data center

Monthly costs

\$3M/month → equipment

\$1M/month → power & cooling infrastructure

Can we achieve economies of scale with data centers (DCs)?

- Large DCs are cheaper to buy and run than smaller ~~data~~ centers
 - Lower prices when buying equipment in bulk
 - cheaper energy rates
- (Software) Automation allows smaller number of system administrators to manage thousands of servers
- General trend is toward mega data centers to achieve economies of scale
 - as large high-tech companies have 100,000s of servers, price/server decreases;
Amazon, Google, Microsoft
- This trend has led to the growth of Cloud Computing (the commoditization of IT)

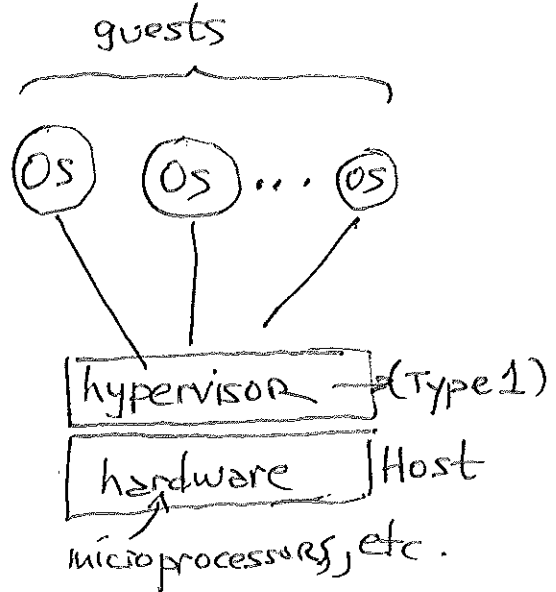
Virtualization is a key trend

that facilitates the use of Cloud Computing

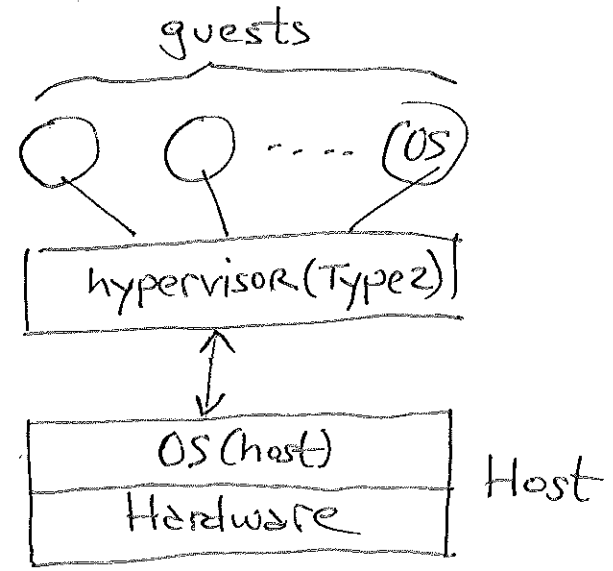
→ Attributes:

- A hypervisor (or supervisor of Operating Systems) or Virtual Machine Monitor (VMM) is computer software or firmware that runs Virtual Machine
- Computer on which the hypervisor runs is called the Host monitor
- Each virtual machine is called a guest
- Two main types of Virtualization
 - Type 1 hypervisor runs on bare metal (i.e. on computer hardware)
 - Type 2 hypervisor runs on a host OS & the guest OS runs inside the hypervisor

Type 1 ("bare-metal")



Type 2:



What can be virtualized:

Everything: processors, storage, network
 vSAN NSX

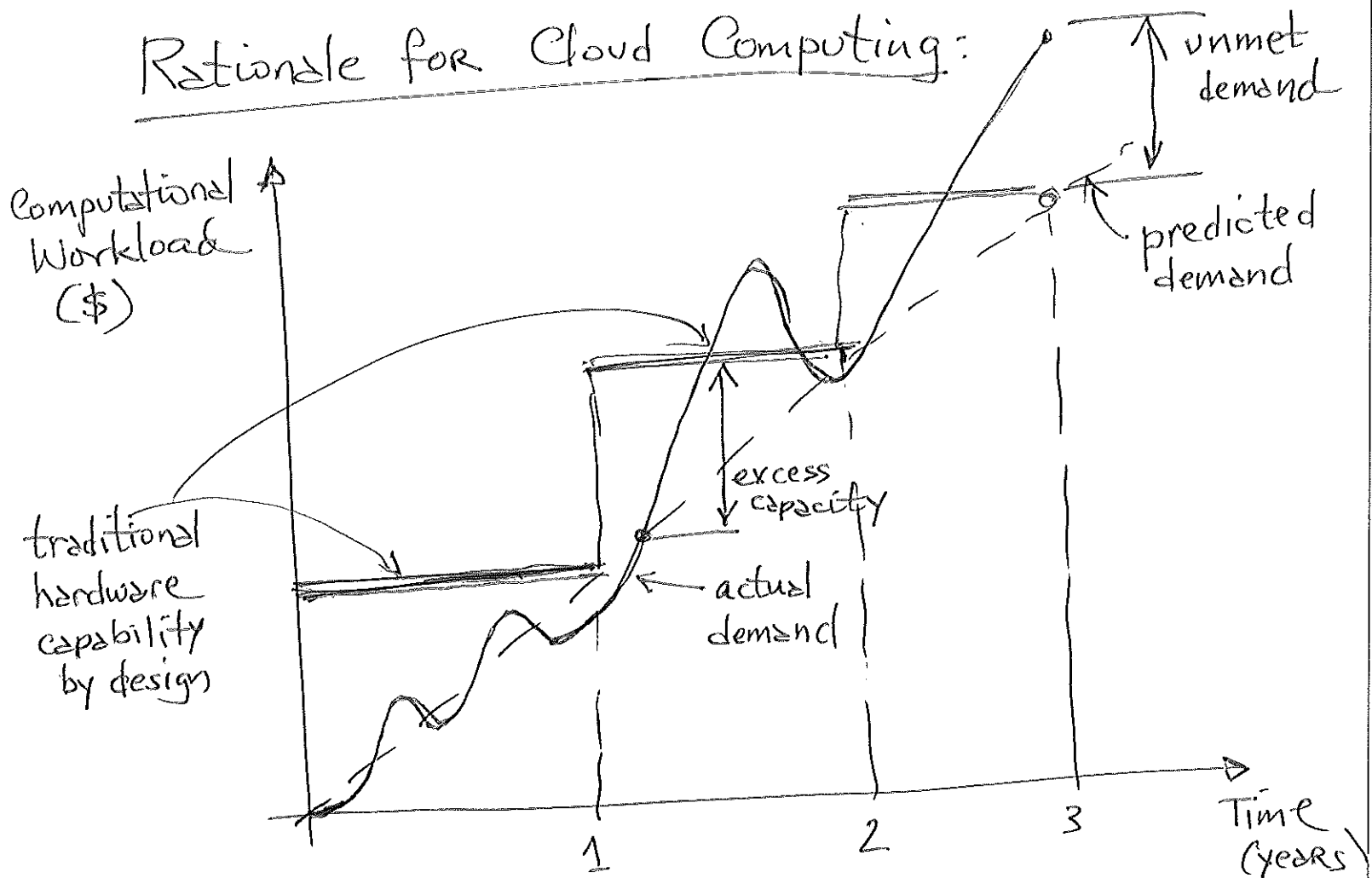
Virtualization Vendor

The largest: VMWare
 Major project: vSphere

Cloud Computing:

Basic idea: provide IT to users the same way we provide utilities such as electricity, gas, phone service, ...

Rationale for Cloud Computing:



Two problems:

- excess capacity (supply exceeds demand)
- unmet demand (demand exceeds supply)

⇒ Cloud computing provides the elasticity to match supply & demand

Why cloud computing?

- Traditional hardware makes it difficult to accommodate to unpredictable demand
- Cloud computing allows you to "dial-in" resources, on demand, to adjust to actual demand
- For a given organization you do not need to invest for demand that might/might not arise. Instead you can focus your efforts (engineering, time, resources) into designing a suitable virtual architecture to support your core business needs, the products & services you offer.
- Advantages of cloud computing
 - Scalable ("capacity is elastic")
 - On-demand
 - Pay-as-you-go
 - focus your engineering on what the company is good at
 - improves time-to-market
 - facilitates innovation

Three types of Cloud Services:

1. Software as a Service (SaaS)

examples: g-mail; Salesforce.com

CRM software hosted
off the cloud

SaaS: hosted applications managed by the
application providers

2. Platform as a Service (PaaS)

examples: Microsoft Azure; Google App Engine

provide software platforms to let you build
your own applications.

3. Infrastructure as a Service (IaaS)

example: Amazon Web Services (AWS):

provides raw IT infrastructure
so you can do whatever you want:

you rent raw resources (Virtual
machines) to do whatever you want.