

# CLOUD COMPUTING CONCEPTS with Indranil Gupta (Indy)

## INTRODUCTION TO CLOUDS

Lecture D

WHAT'S NEW IN TODAY'S CLOUDS

#### Four Features New in Today's Clouds

- Massive scale.
- II. On-demand access: Pay-as-you-go, no upfront commitment.
  - Anyone can access it
- III. Data-intensive Nature: What was MBs has now become TBs, PBs and XBs.
  - Daily logs, forensics, Web data, etc.
  - Humans have data numbness: Wikipedia (large) compress is only about 10 GB!
- IV. New Cloud Programming Paradigms: MapReduce/Hadoop, NoSQL/Cassandra/MongoDB and many others.
  - High in accessibility and ease of programmability
  - Lots of open-source

Combination of one or more of these gives rise to novel and unsolved distributed computing problems in cloud computing.



### I. Massive Scale

- Facebook [GigaOm, 2012]

   30K in 2009 -> 60K in 2010 -> 180K in 2012
- Microsoft [NYTimes, 2008]
  - 150Kmachines
  - Growth rate of 10K per month
  - 80K total running Bing
- Yahoo! [2009]:
  - 100K
  - Split into clusters of 4000
- AWS EC2 [Randy Bias, 2009]
  - 40,000 machines
  - 8 cores/machine
- eBay [2012]: 50K machines
- HP [2012]: 380K in 180 DCs
- Google: A lot



#### What does a datacenter look like from inside?

A virtual walk through a datacenter

• Additional reference:

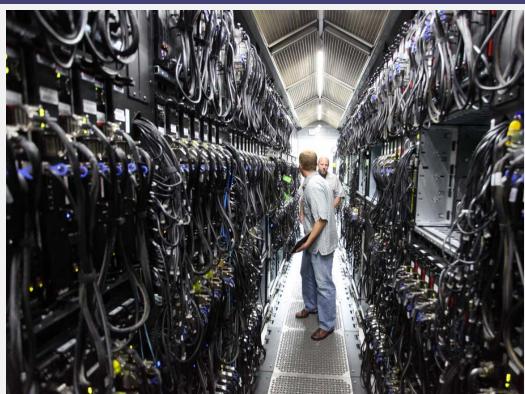
http://gigaom.com/cleantech/a-rare-look-inside-facebooks-oregon-data-center-photos-video/





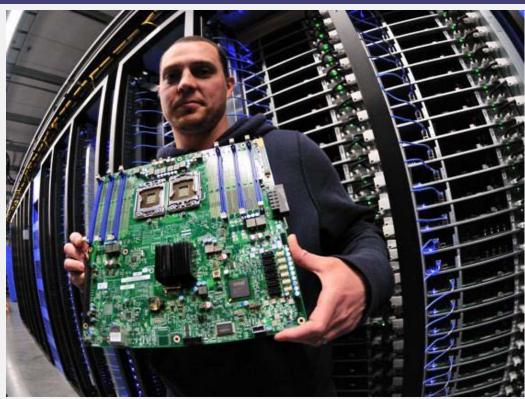
#### Front





#### Back





#### Inside

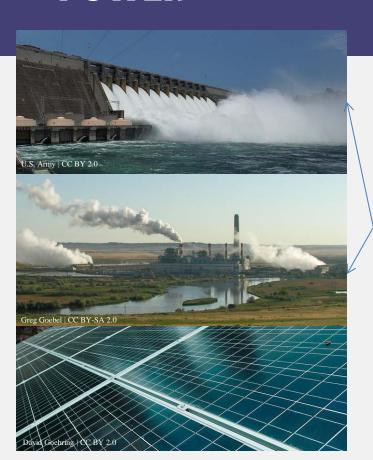




Some highly secure (e.g., financial info)



## **POWER**



- WUE = Annual Water Usage / IT Equipment Energy (L/kWh) (low is good)
- PUE = Total Facility Power / IT Equipment Power (low is good e.g., Google = 1.11)

Off-site

On-site



## **COOLING**



- Air sucked in
- Combined with purified water
- Moves cool air through system



#### EXTRA - FUN VIDEOS TO WATCH

- Microsoft GFS Datacenter Tour (Youtube)
  - http://www.youtube.com/watch?v=hOx All1pQIw
- <u>Timelapse of a Datacenter Construction on</u> the Inside (Fortune 500 company)
  - <a href="http://www.youtube.com/watch?v=ujO-xNvXj3g">http://www.youtube.com/watch?v=ujO-xNvXj3g</a>

