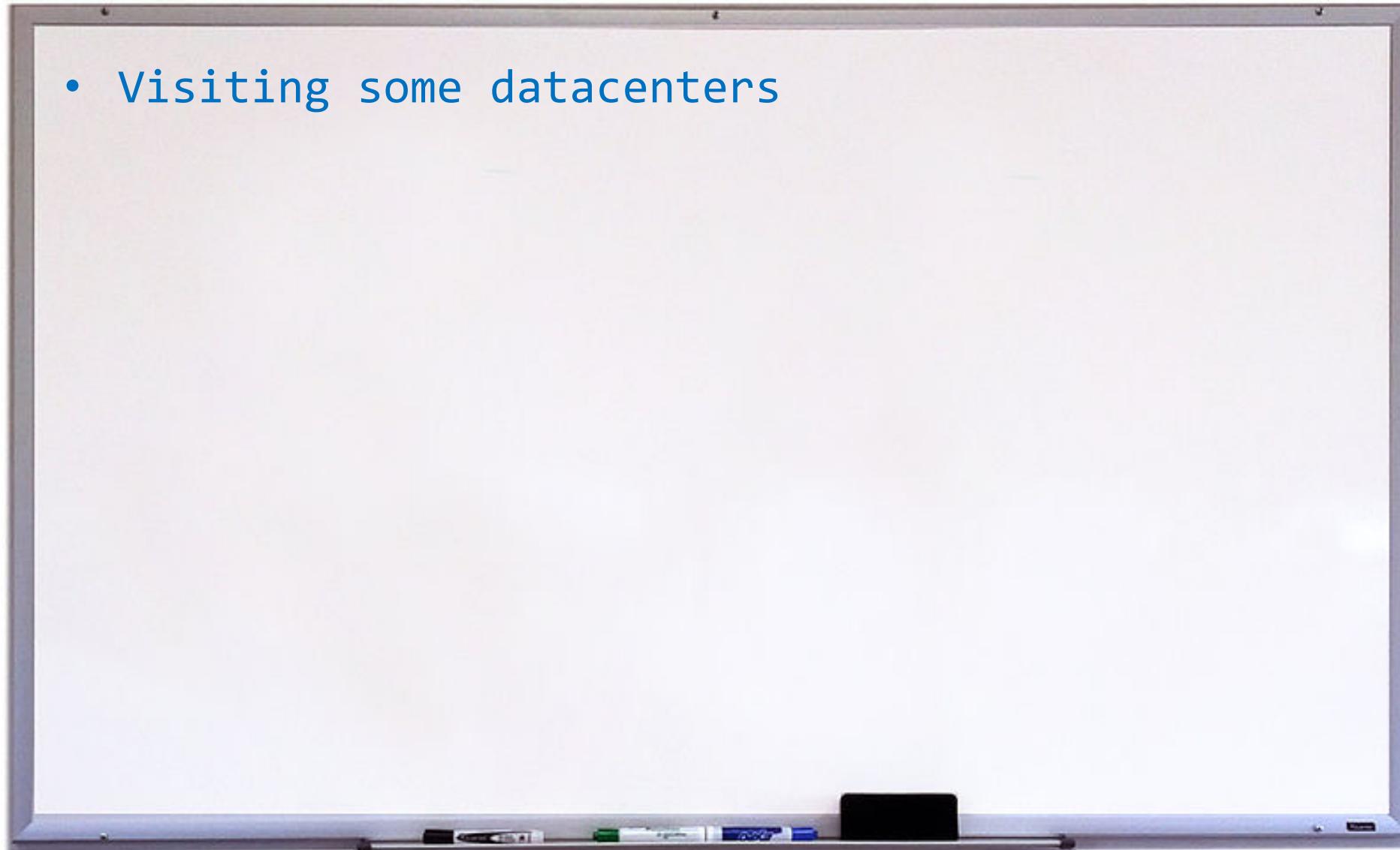


Datacenters

Antonio Brogi

Department of Computer Science
University of Pisa

- Visiting some datacenters





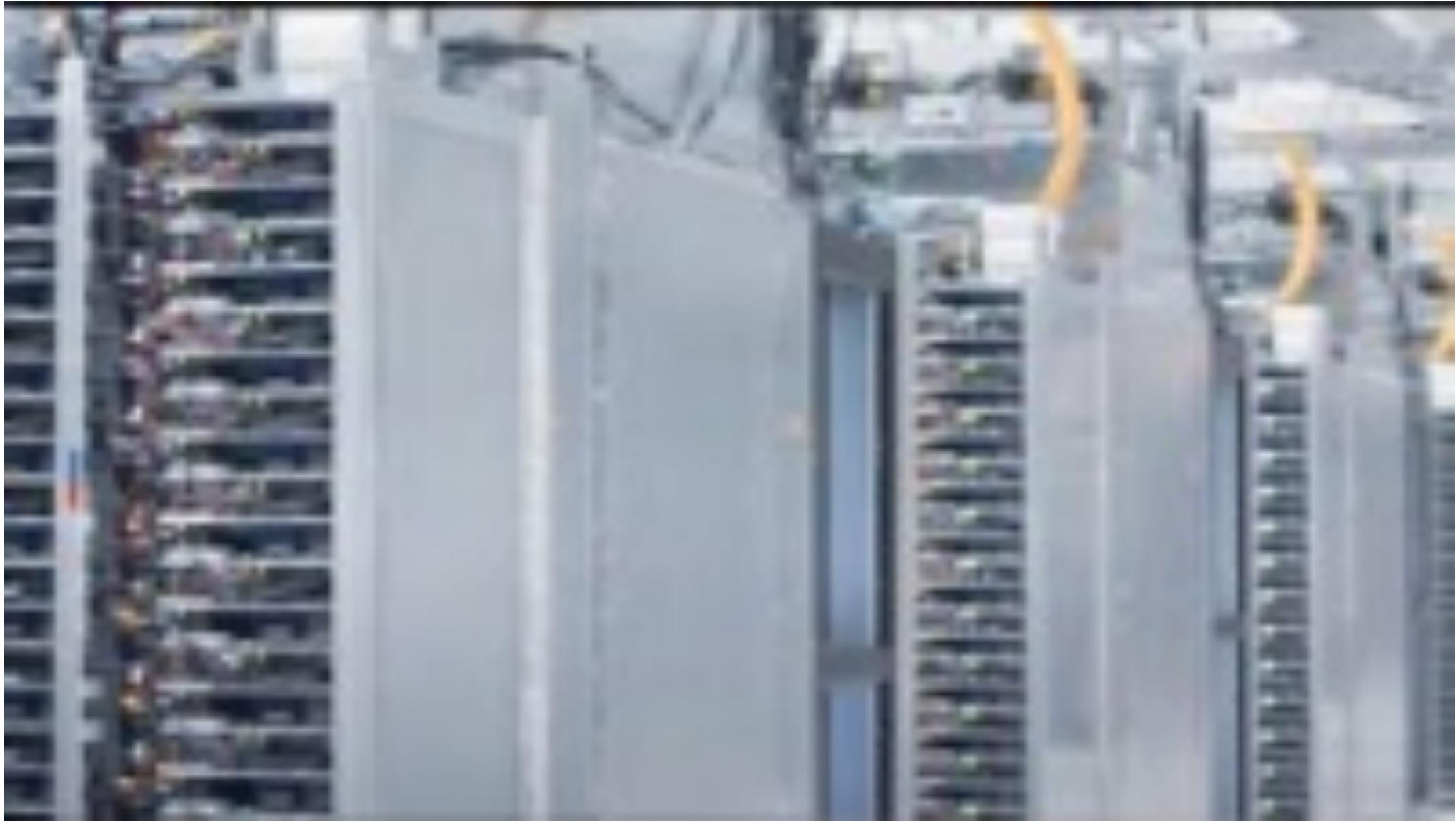
Amazon



Google



Facebook



<https://www.youtube.com/watch?v=avP5d16wEp0&list=LLe8YQrC8Io0ilj1lsacdJRA>



- Employees
- Networking room
- Server floor
 - Data replication
 - Disk destruction
- Cooling towers



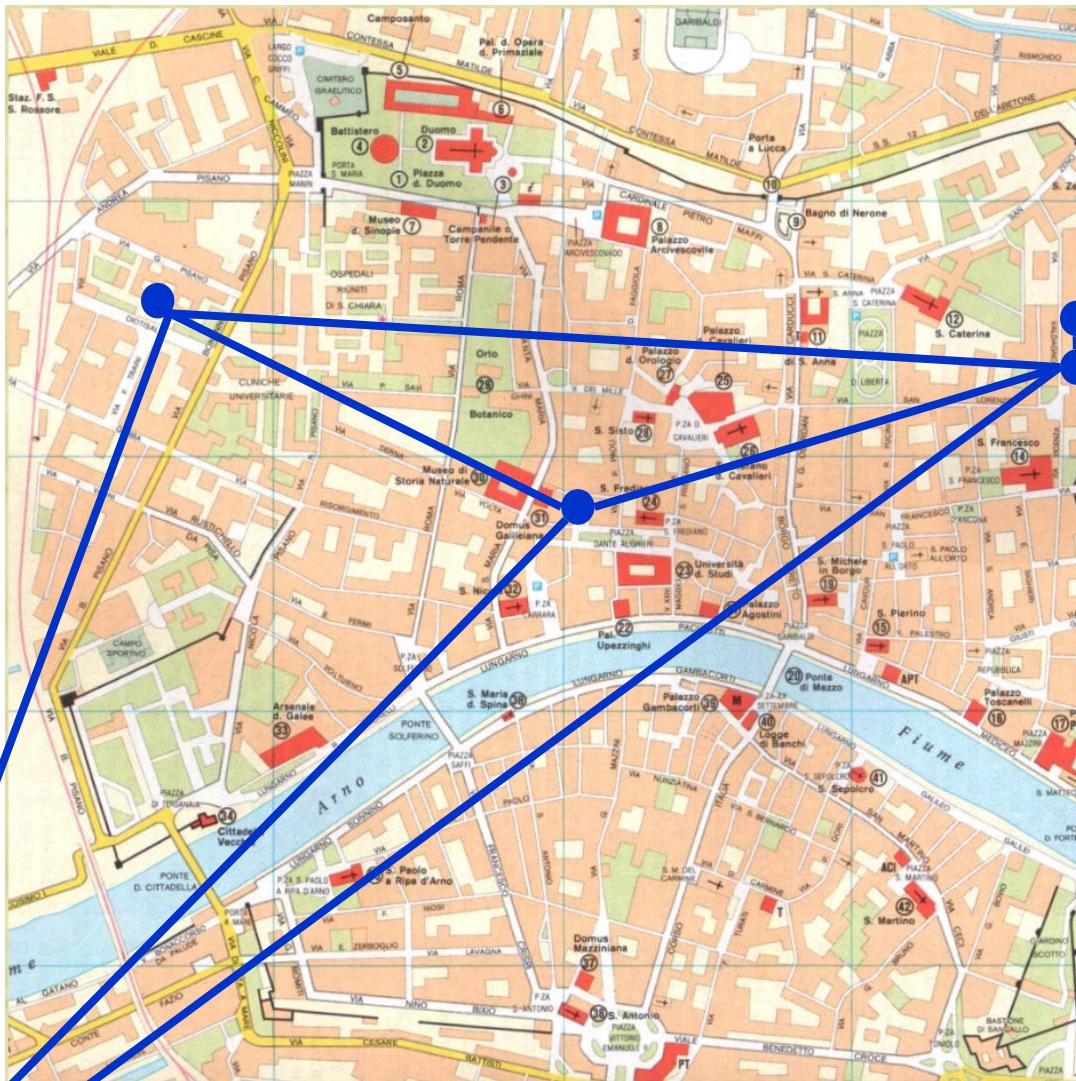
<https://www.youtube.com/watch?v=XZmGGAbHqa0>

- “fun” environment for employees
- different levels of security (badges, biometric eye scanners, underfloor intrusion detection)
- overhead power distribution
- customised server racks
- cooling technology (27 degrees inside, racks in front of air conditioners, cool water, cooling plant and towers)





UNIVERSITÀ DI PISA



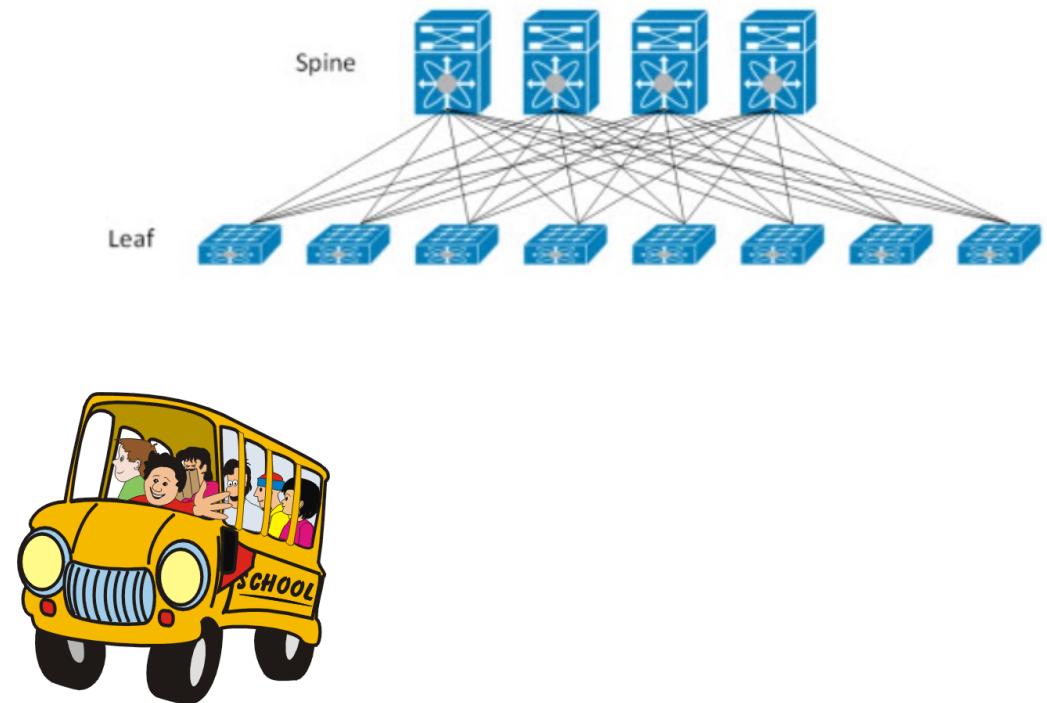
64 racks, ~550 servers
Adiabatic cooling*

PUE ~1.2

100 Gbit/sec connection with GARR network

UNIPI network

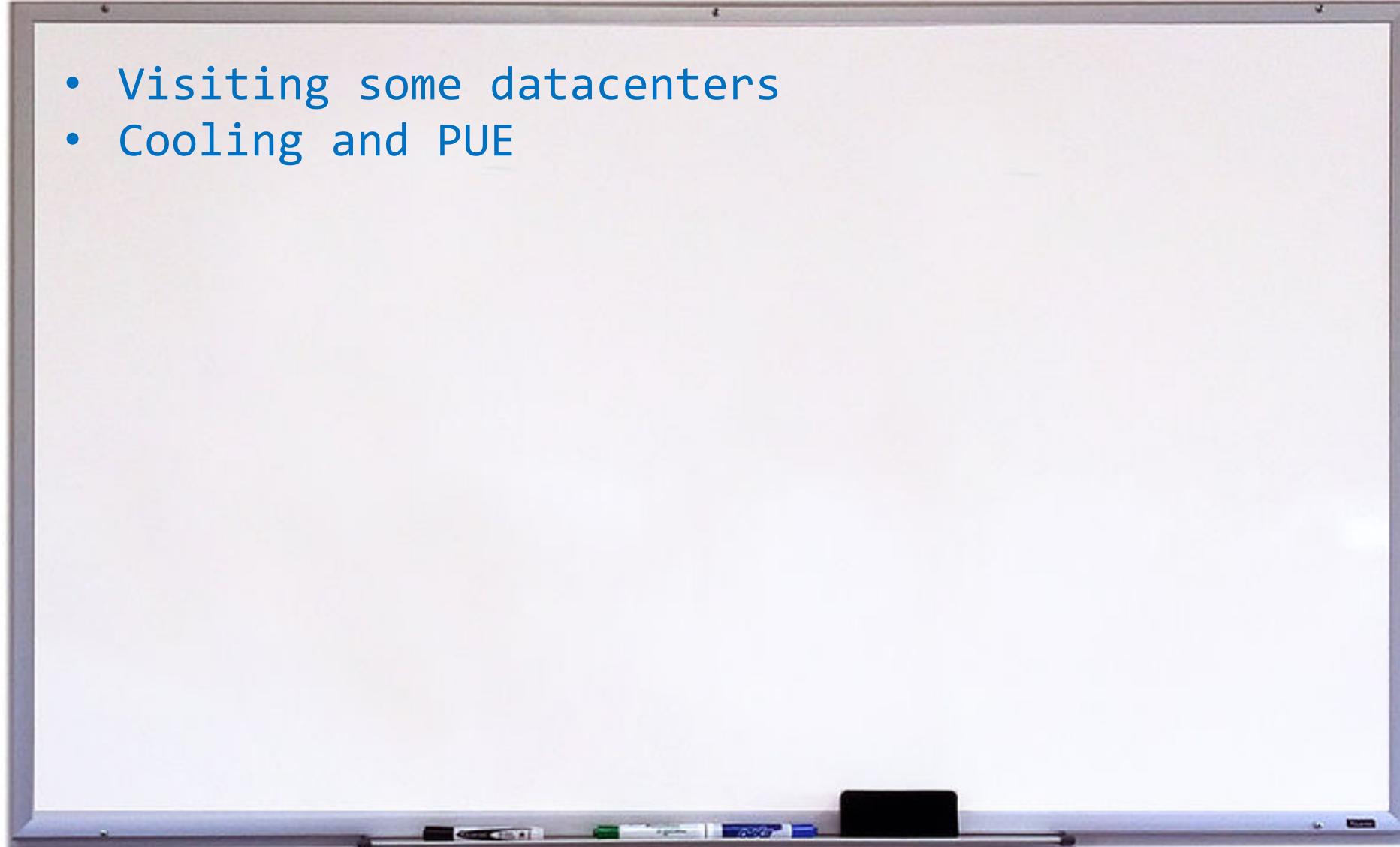
- 9000+ km of fyber
- 400 Gbit/sec DCI – DataCenter Interconnect
 - no **Single Point of Failure**
 - redundancy at L3, L2, physical links
- Spine-leaf topology for east–west traffic**



*Uses evaporation of water to pre-cool ambient air during hottest part of day/year

**East–west traffic within datacenter network, north-south traffic with outside

- Visiting some datacenters
- Cooling and PUE

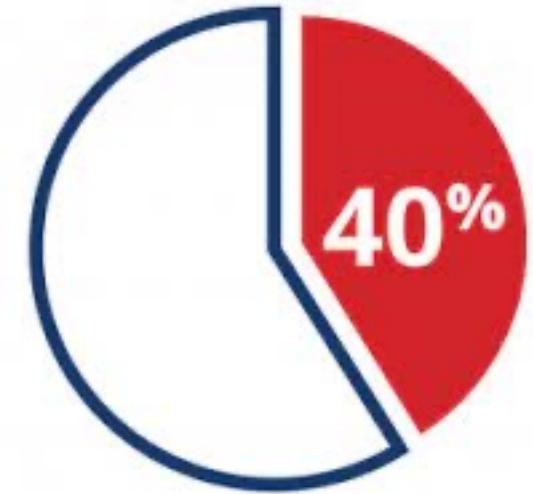


Cooling



~40% energy consumption for cooling

[Cooling Energy Consumption Investigation](#)



Power Usage Effectiveness

$$\text{PUE} = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

PUE does **NOT** measure degree
of usage of renewable energy

- Visiting some datacenters
- Cooling and PUE
- Datacenter management



Planning



Install and manage racks
and connections

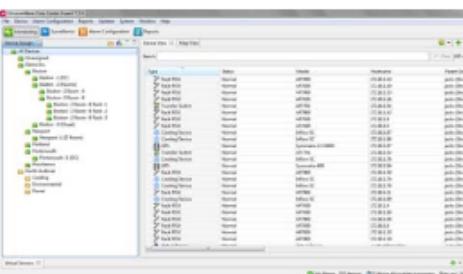
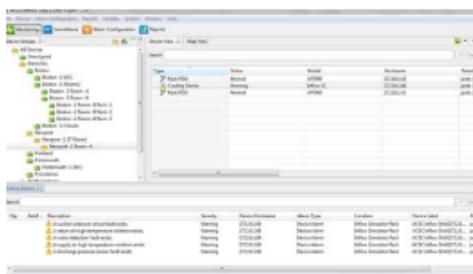


The cable spaghetti nightmare

Cabling!



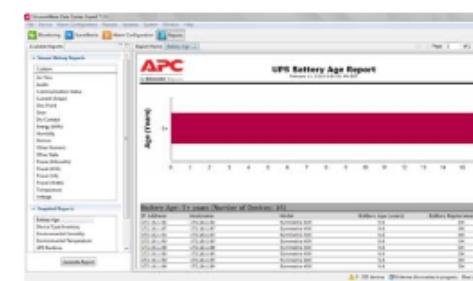
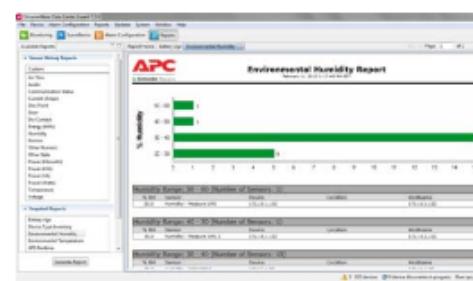
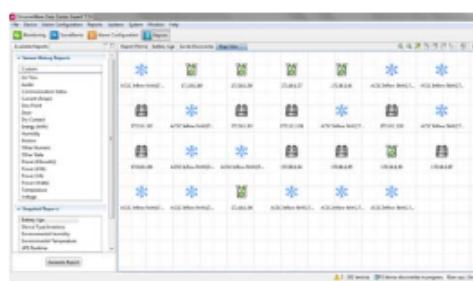
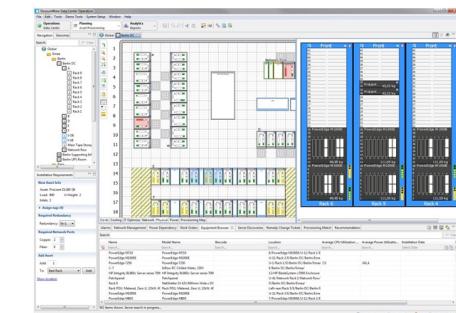
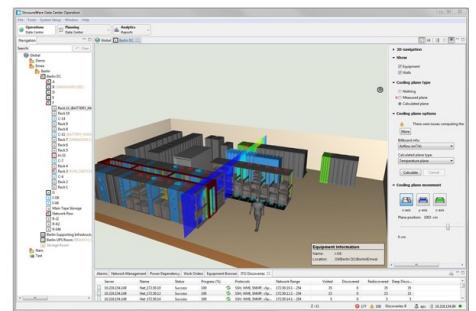
DCIM – Data Center Infrastructure Management



Infrastructure and device monitoring

Centralized monitoring of multi-vendor physical infrastructure:

- power,
- cooling,
- security and
- environment.
- Generating user-defined reports and graphs.
- Instant fault notification and escalation enable quick resolution of critical infrastructure events, supporting your data center facility and IT Service Management processes.





RackTables

Hello, RackTables Administrator. This is RackTables 0.17.0. Click here to logout.

MyCompanyName: Main page

Search:

Rackspace A grey server rack icon.

Objects A grey server unit icon.

IPv4 space A vertical stack of IP addresses icon.

Files A folder icon.

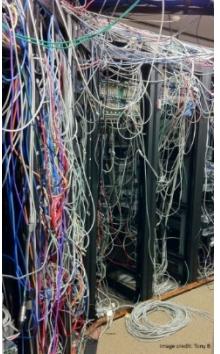
Configuration Two wrenches icon.

Reports A line graph icon.

IPv4 SLB A stack of server icons.



"Stupid" things NOT to do in your data center



Cable gaffes are a safety hazard



No food or beverages allowed
in the data center



How many keys to your data center have you given out?
Do you have a spreadsheet with names associated with keys?
When is the last time you propped the exit door open so you could carry in all of those blades and cable? How much time was that open door left unattended?

Documentation

How exactly did you map out that net?
What are the domain credentials?
Which server does what?

...



Prevent electricity failures (e.g., due to accidentally shutting off power, lack of battery backups, no generator, pulling too much power from a single source)

- Visiting some datacenters
- Cooling and PUE
- Datacenter management
- Dealing with outages

- Get available quickly: get up - get ready - get focused
- Handle your panic
- Follow the **checklist(s)**

Why checklists?

*Q: What would you do first in case of **fire** in the DC?*



Checklists are important

- To ensure quality of operation (whoever the operator)**
- To reduce employees' liability**



Business Continuity & Disaster Recovery: 6 lessons learned

- 1. Maintain a full copy of your mission critical data outside your production region**
150+ miles away and/or a separate power grid
- 2. Test your BC/DR plan in a realistic way to ensure it actually works**
An untested plan is a failed plan
- 3. Ensure production changes are properly reflected in the BC/DR plan**
Keep your BC/DC plan aligned with your production environment
- 4. Have a plan that is consistent and accessible even in the event of a major disaster**
E.g. even if primary infrastructure is destroyed
- 5. Always have several people fully trained on the BC/DR plan ... preferably some of whom are outside the production region.**
People can get sick, leave company or become unavailable in a disaster
- 6. Remember Murphy's Law: "Whatever can go wrong, will go wrong."**
Try to have contingency plans "if this fails then ..."

Some of weirdest datacenter disasters

Life is what happens while you are busy making other plans [J. Lennon]



Lightning hit main power and backup generators of Amazon and Microsoft data centers in Dublin



Yahoo's data center in Santa Clara witnessed a downtime for almost 12 hours. Squirrels chewed down the cables through which data got transferred



Hurricane Sandy caused disrupted a number of businesses operating in and around Newark. Data center business was the worst hit among the businesses



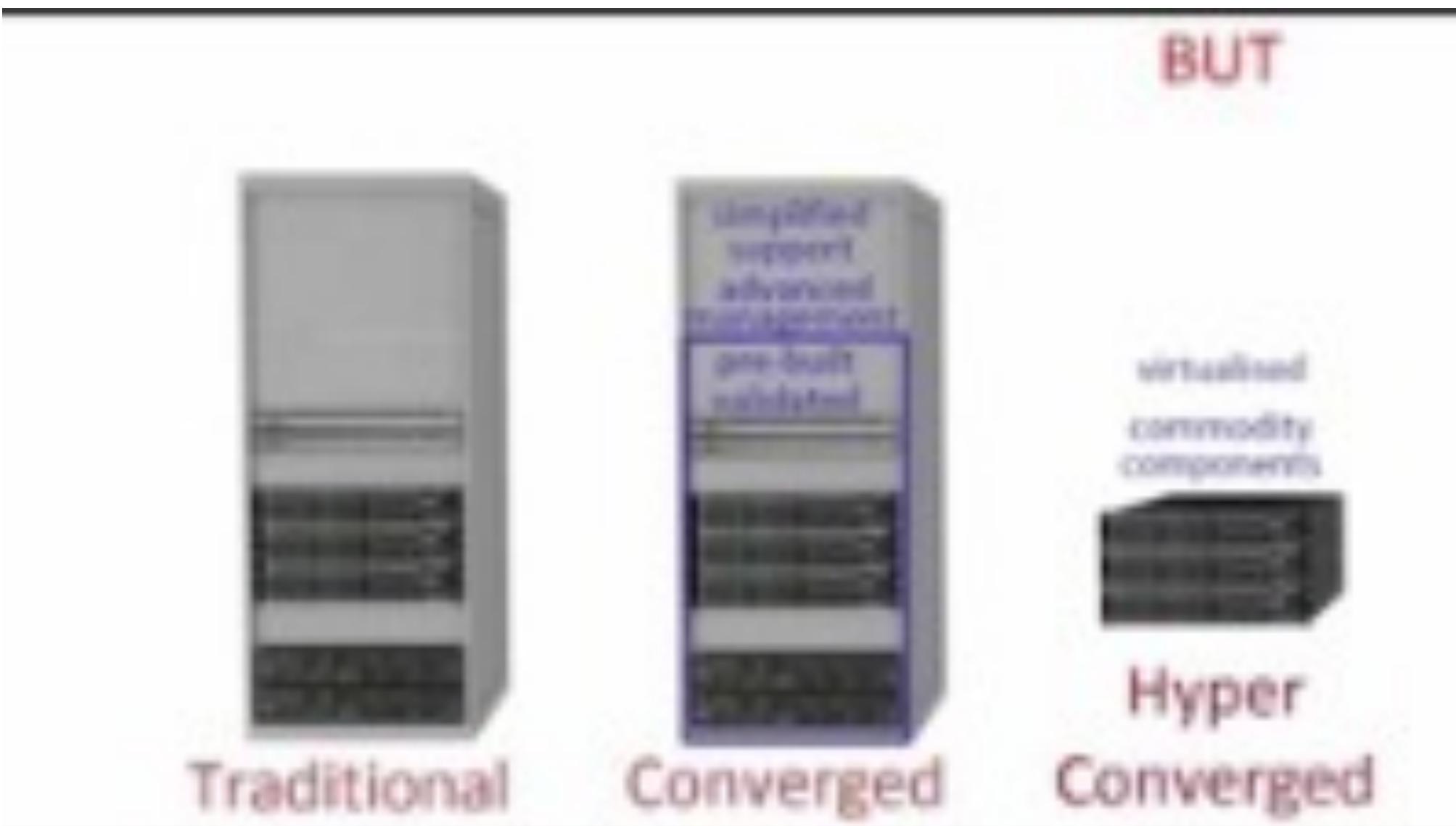
Ship accidentally dropped its 2 tonne anchor on the under sea cables which carried traffic from continent to continent



Truck driver drove into power transformer at Rackspace data center in Texas

- Visiting some datacenters
- Cooling and PUE
- Datacenter management
- Dealing with outages
- Hyper-converged infrastructure

Hyperconvergence ...



Hyperconvergence ...

hyper converged

Traditional DC infrastructure

- separate servers, networking and storage components
- issue: component compatibility

Converged infrastructure

- pre-tested, validated design
- advanced management tools

Hyper-converged

- combine virtualised server+networking+storage into a single box !
(hypervisor + software-defined storage + software-defined networking)
- minimized hardware costs, scalability
- great, but with some limitations, e.g.,
 - cannot increase storage without increasing compute
 - non-virtual DB applications cannot use the (virtualized) storage
 - not cheap software



**On-prem infrastructure is
critical to hybrid multicloud**

Virtualization

Servers

Networking

Storage



- Visiting some datacenters
- Cooling and PUE
- Datacenter management
- Dealing with outages
- Hyper-converged infrastructure

