image credit http://eyepluscamera.files.wordpress.com/

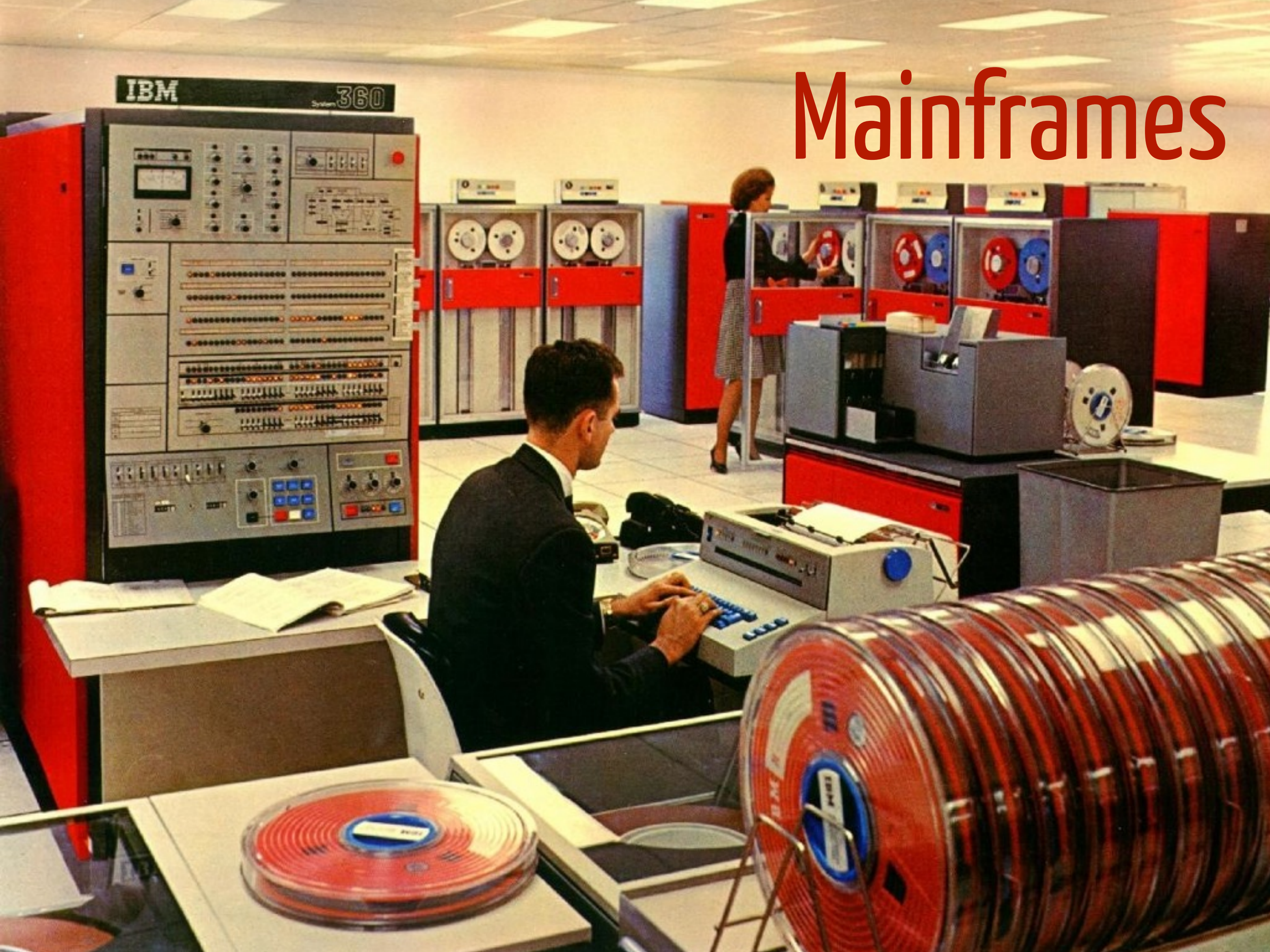
Université Nice Sophia Antipolis

Fabien Hermenier

Cloud compting 101

was cloud computing needed ?

Mainframes

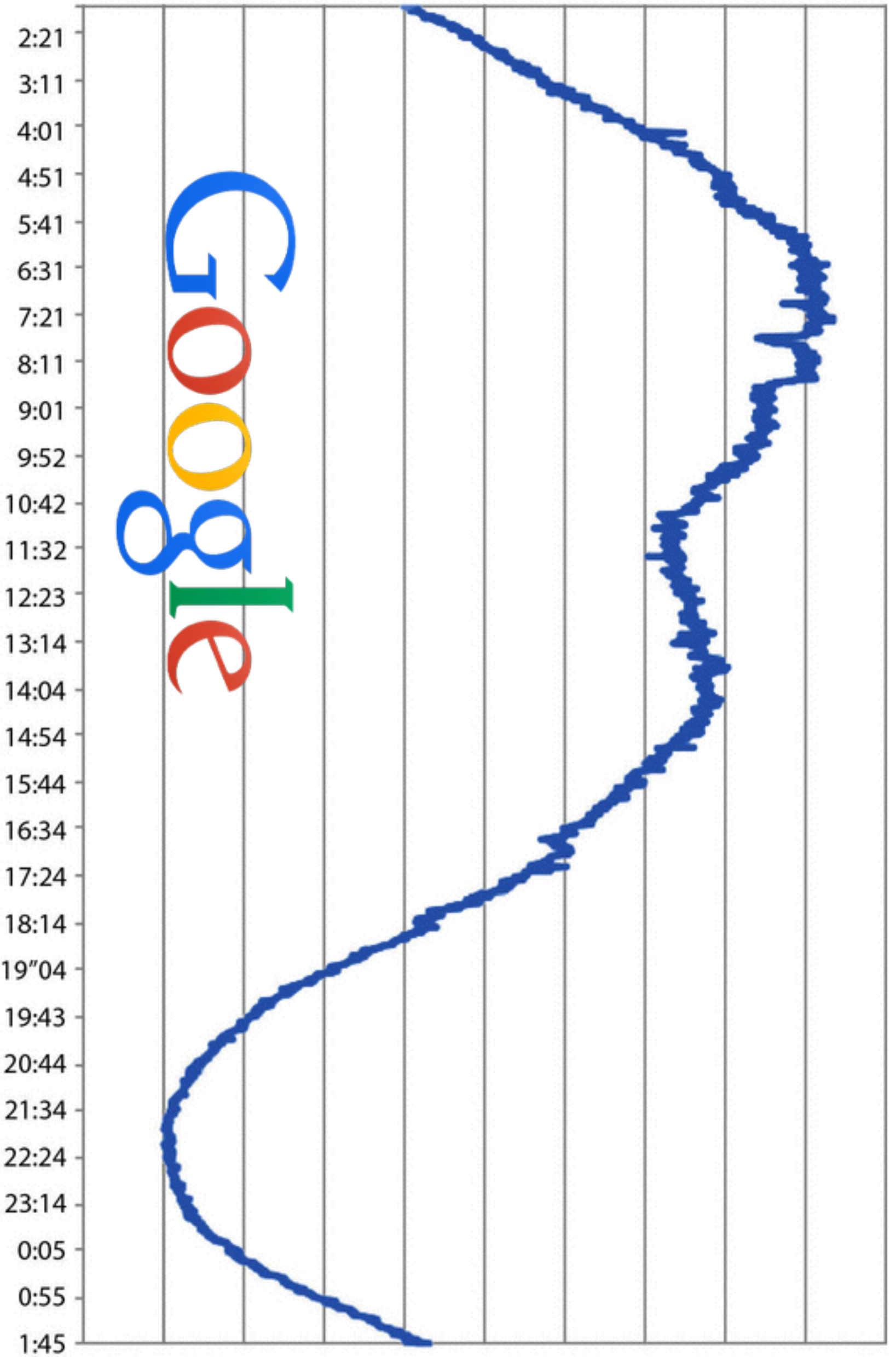


Then came with affordable PCs

Then we spread out the load for security, performance, manageability

Then we bought tons of servers to support load spikes

Amazon X-mas 2013
426 items sold each second


Google
2:21
3:11
4:01
4:51
5:41
6:31
7:21
8:11
9:01
9:52
10:42
11:32
12:23
13:14
14:04
14:54
15:44
16:34
17:24
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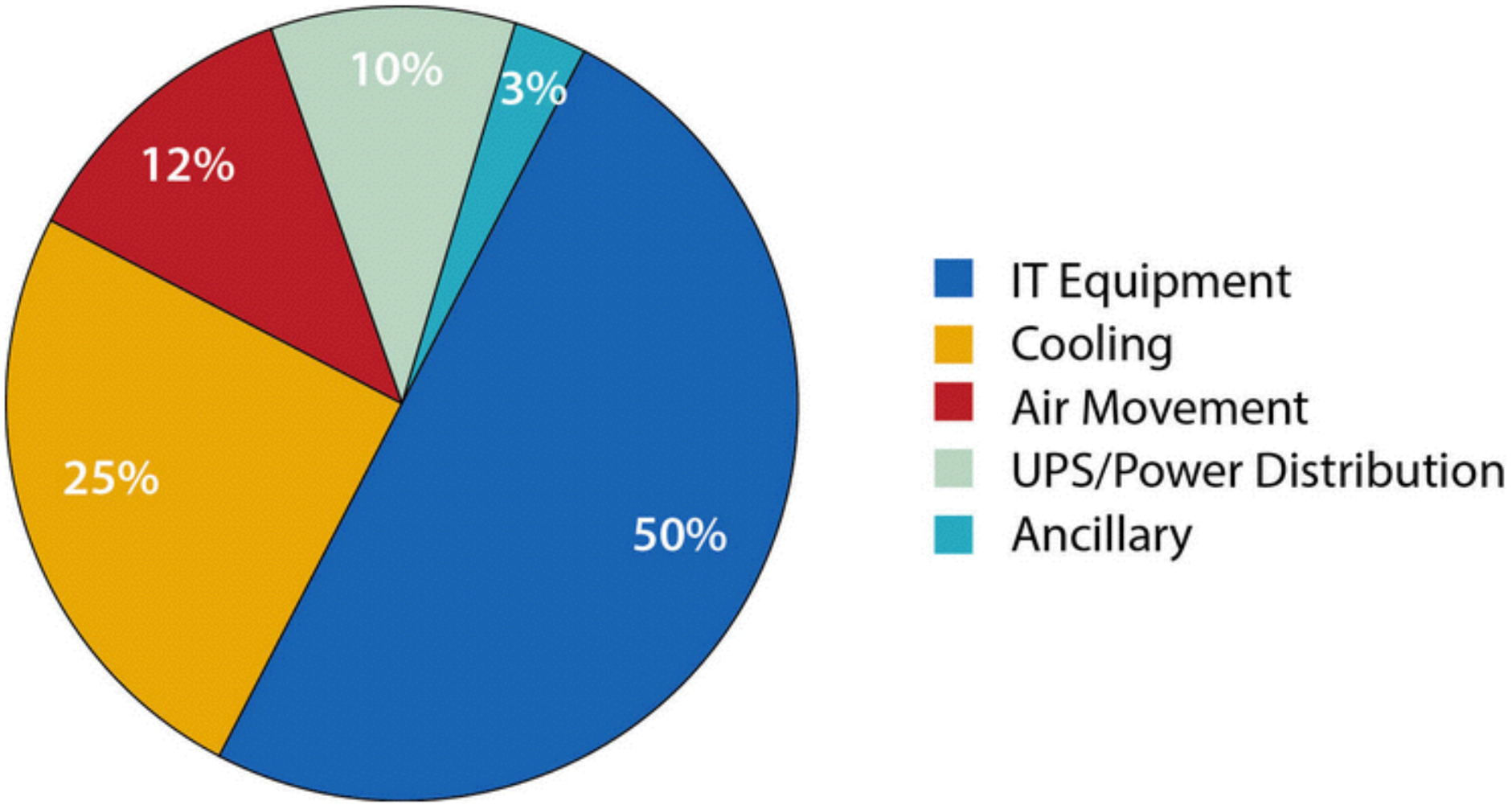
19"04
19:43
20:44
21:34
22:24
23:14
0:05
0:55
1:45



Where is energy spent ?

cloud computing to the rescue

n/datacenters

National Institute of Standards and Technology
U.S. Department of Commerce

2011

> “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

1

On-demand self-services

self-provisioning,
no human intervention

2

broad network access

availability over the network
standard mechanisms

3 resource pooling

multi-tenant
virtual or physical resources
on-demand allocation
location independance

rapid elasticity

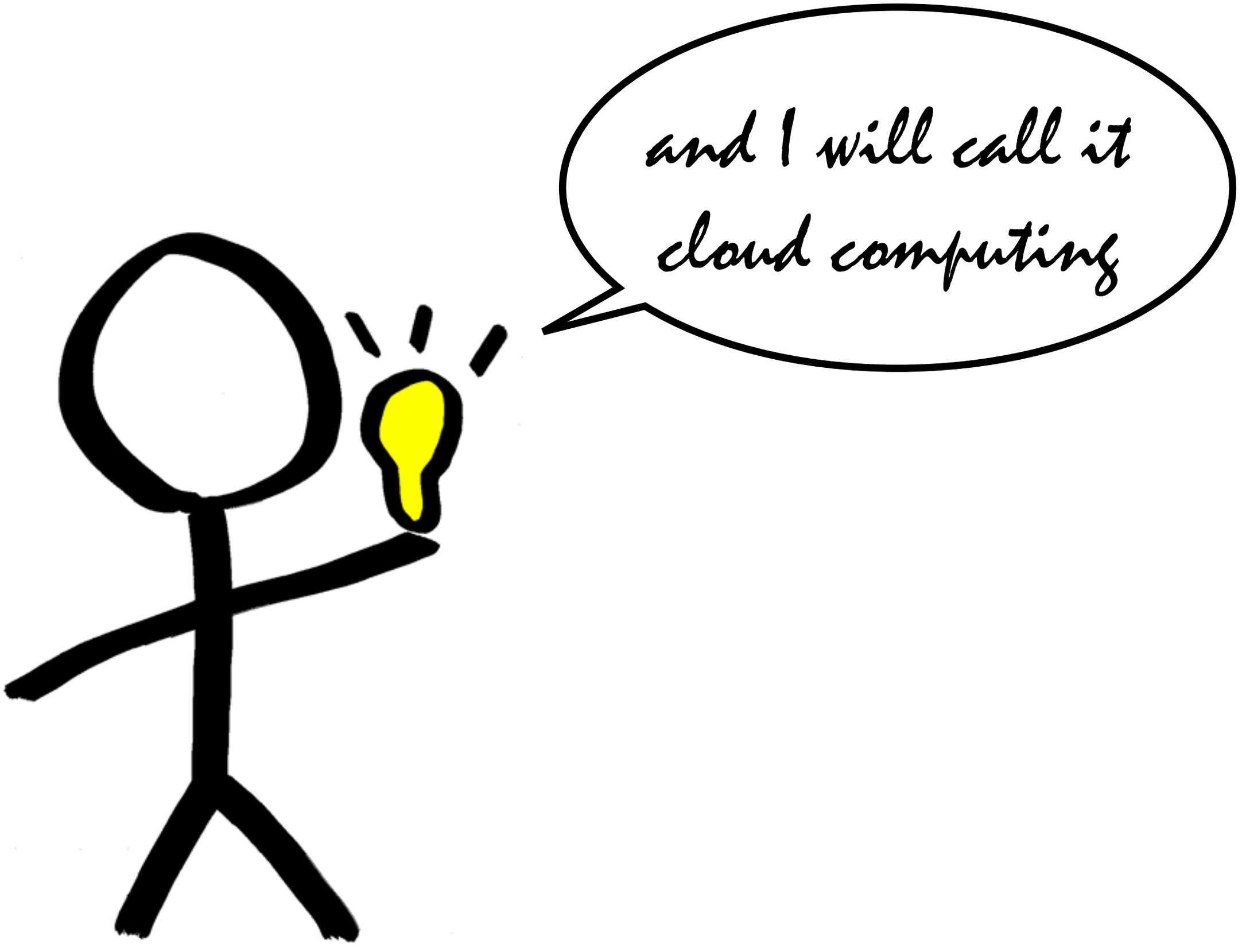
fast (de-)allocation of resources
scale to infinity

4

5

measured service

metering capabilities
transparent reporting

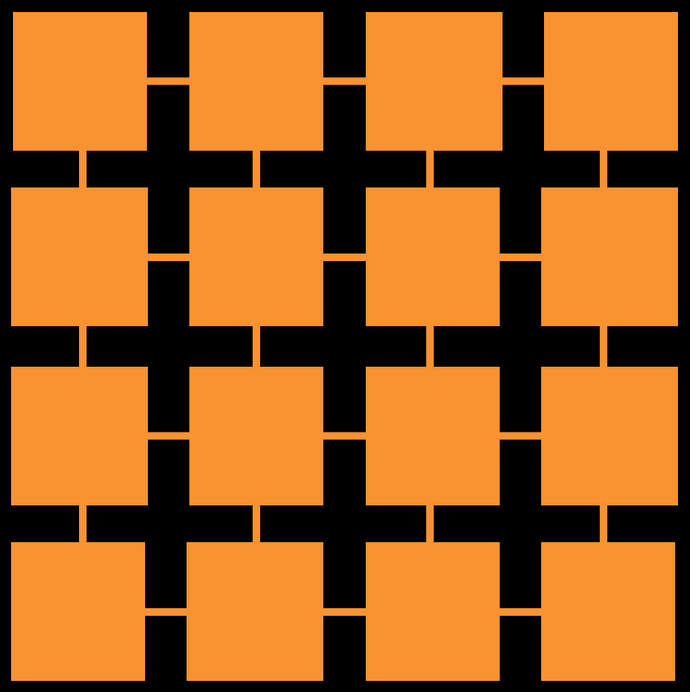

and I will call it
cloud computing

Cloud Computing

origins

“If computers of the kind I have advocated become the computers of the future, then computing may someday be organized as a public utility just as the telephone system is a public utility... The **computer utility** could become the basis of a new and important industry.”

John McCarthy, 1961



cluster computing

loosely coupled co-located servers
single tenant
non-interactive workload
rigid jobs

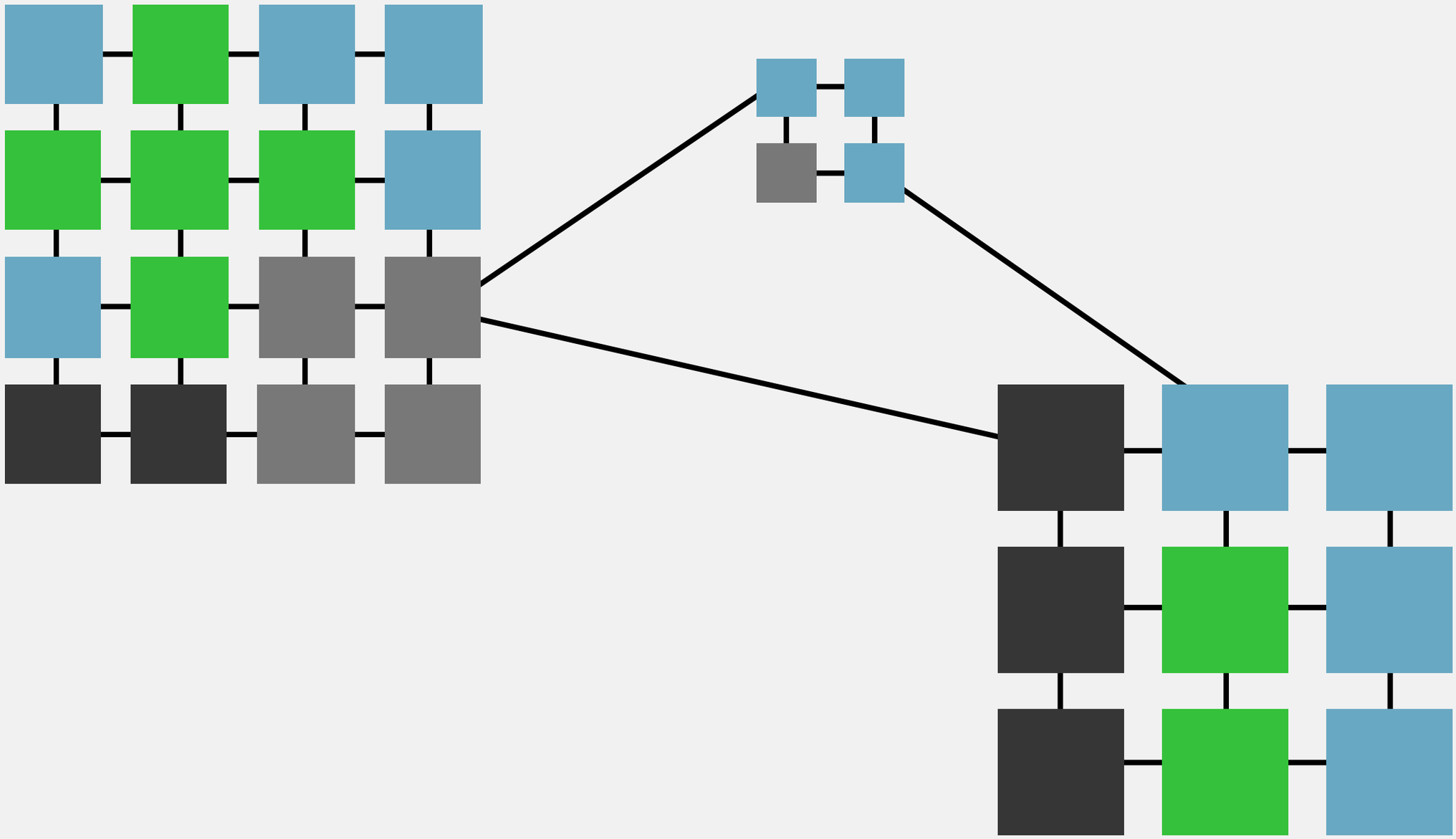
80s

Cloud or not ?

- [ ] on demand self-services
- [ ] broad network access
- [ ] resource pooling
- [ ] rapid elasticity
- [ ] measured service

Cloud or not ?

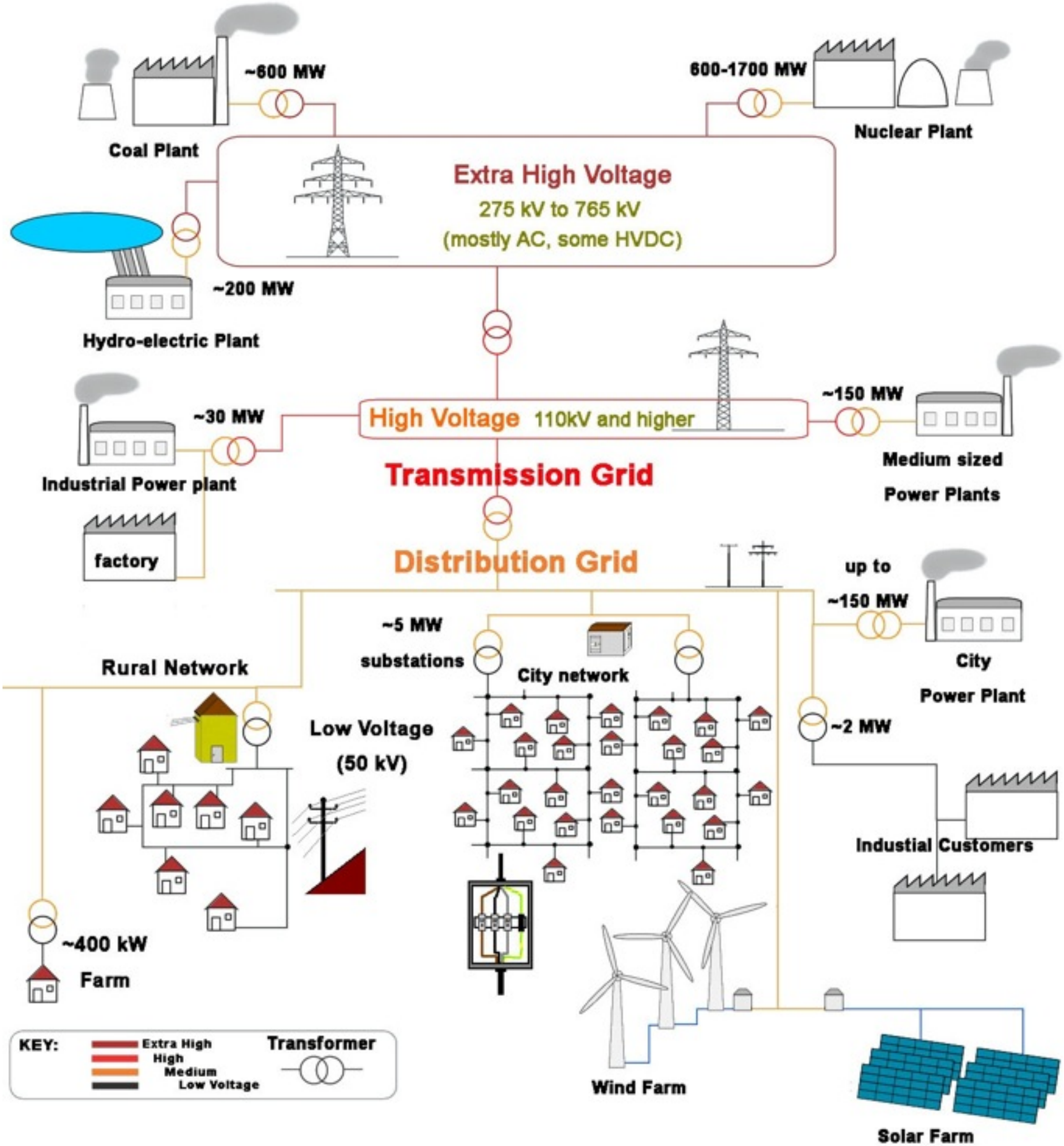
- [ ] on demand self-services
- [x] broad network access
- [ ] resource pooling
- [ ] rapid elasticity
- [x] measured service



grid computing

Ian Foster et al. 2001

Power Grid Analogy



Power grid

multiple providers

heterogeneous sources

multiple clients

abstract source

live consumption

location

doing * at

Computing grid

virtual organisation

heterogeneous hw.

multiple applications

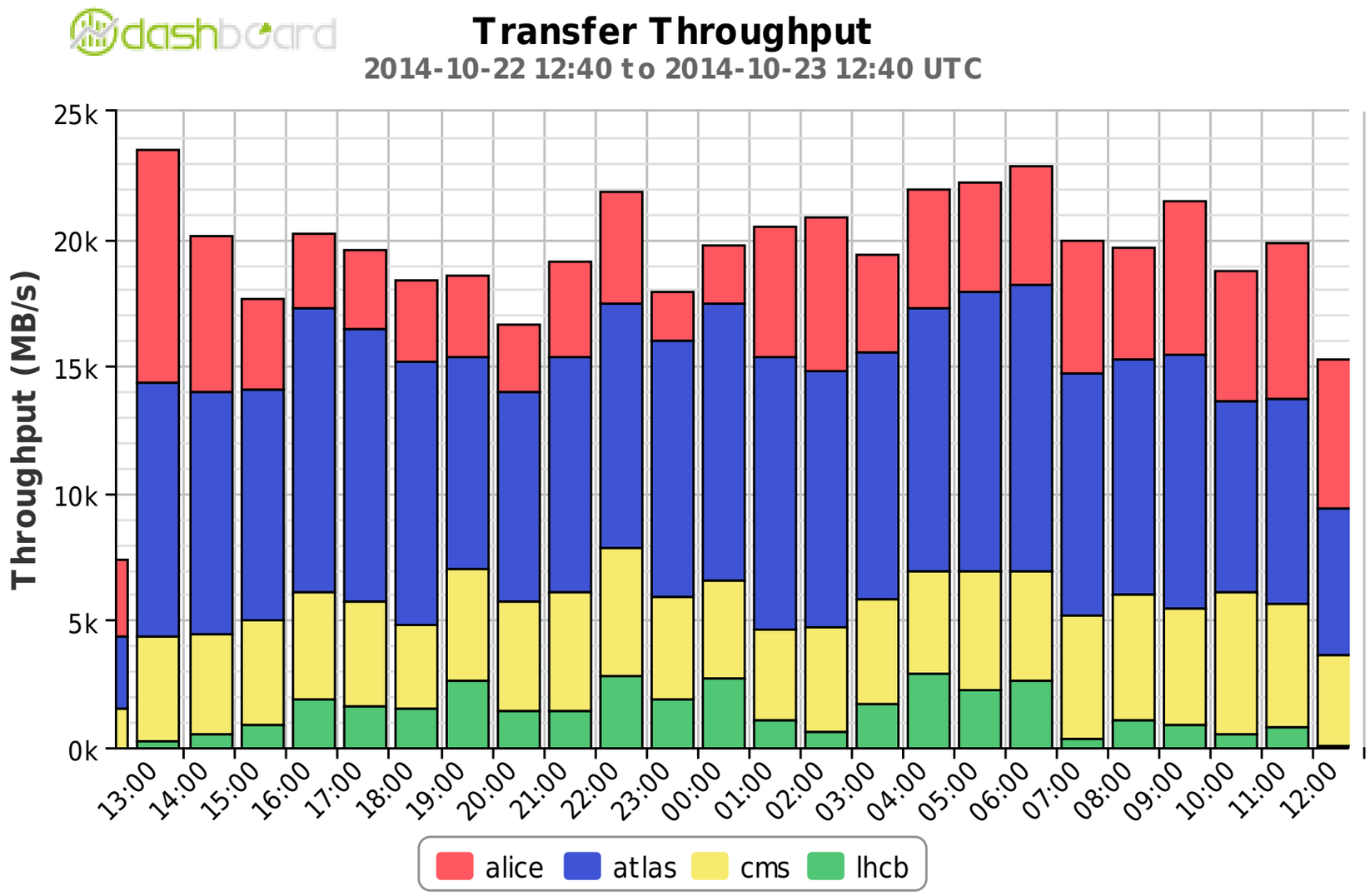
abstract resources

batch jobs

independence

large scale

Worldwide
LHC Computing grid



170 centres to analyse 30 PB / year

Cloud or not ?

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- [ ] rapid elasticity
- [ ] measured service

Cloud or not ?

- [ ] on demand self-services
- [x] broad network access
- [x] resource pooling
- [ ] rapid elasticity
- [x] measured service

Client 1

Client 2

Client 3

Application Service Provider

95+

remote access to dedicated applications

service oriented

pay as you go

Cloud or not ?

- [ ] on demand self-services
- [ ] broad network access
- [ ] resource pooling
- [ ] rapid elasticity
- [ ] measured service

Cloud or not ?

- [ ] on demand self-services
- [x] broad network access
- [x] resource pooling (not real hw resources)
- [ ] rapid elasticity
- [x] measured service

2002 computers on demand.

Deploy full custom stacks (OS to applications)

emulab

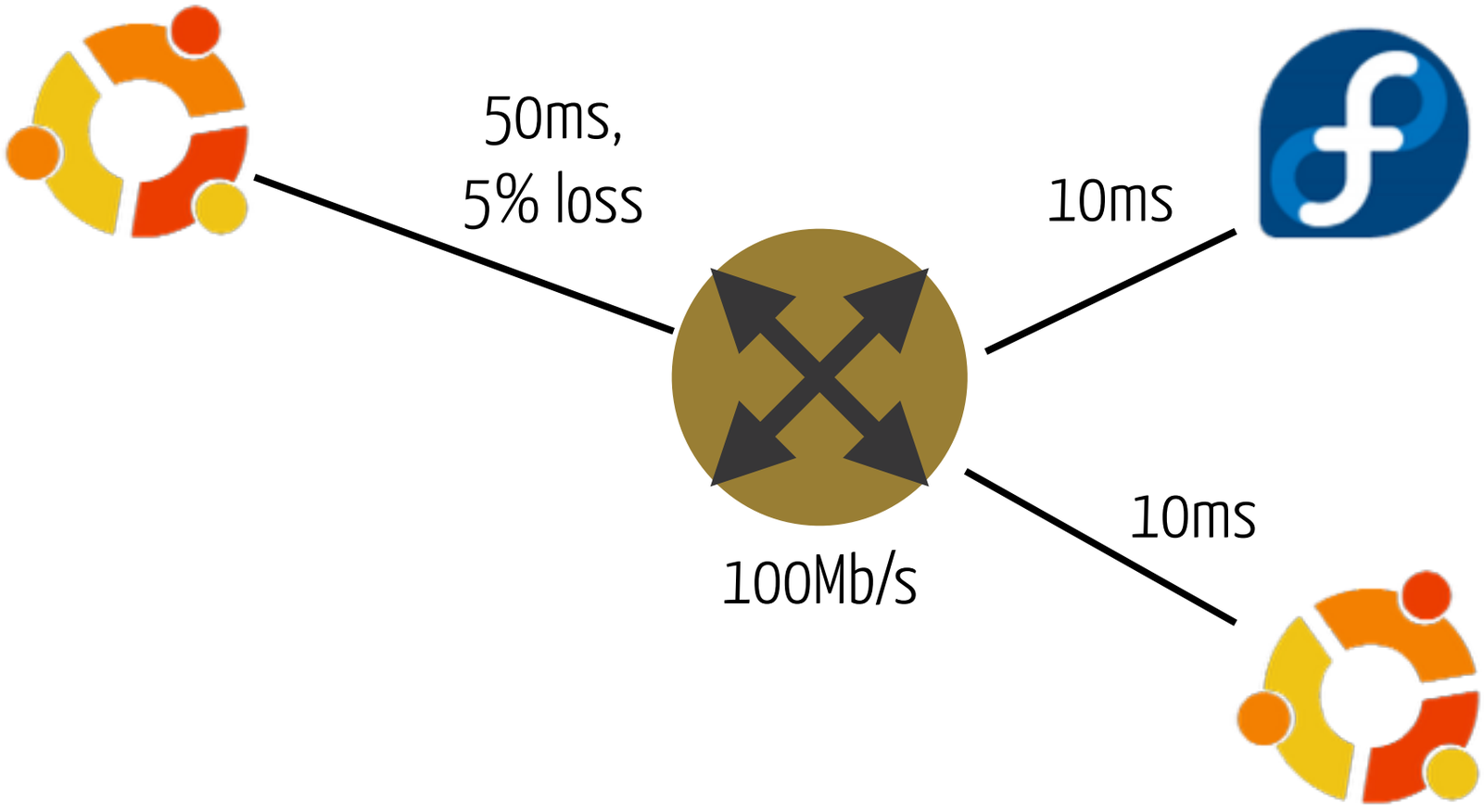
PLANETLAB

to (re)deploy reproducible network experiments

multi-tenant,
(limited on purpose) resource pooling,

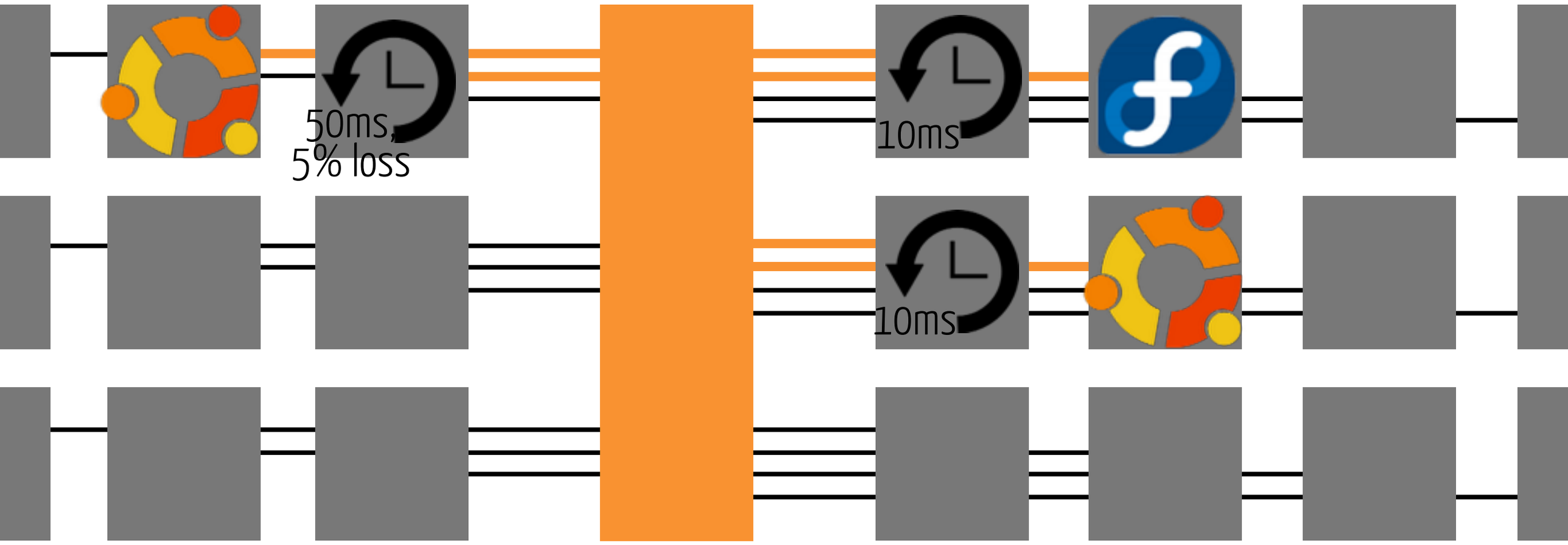
emulab

to (re)deploy reproducible network experiments



emulab

to (re)deploy reproducible network experiments



Cloud or not ?

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Cloud or not ?

- [x] on demand self-services
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- [ ] rapid elasticity
- [x] measured service

2001+

Service **O**riented **A**rchitecture

composable unassociated, loosely coupled units

exponential grows since 2001
private and public services to support its growth

Two pizza rule

If a team can’t be fed by two pizzas then it is to big

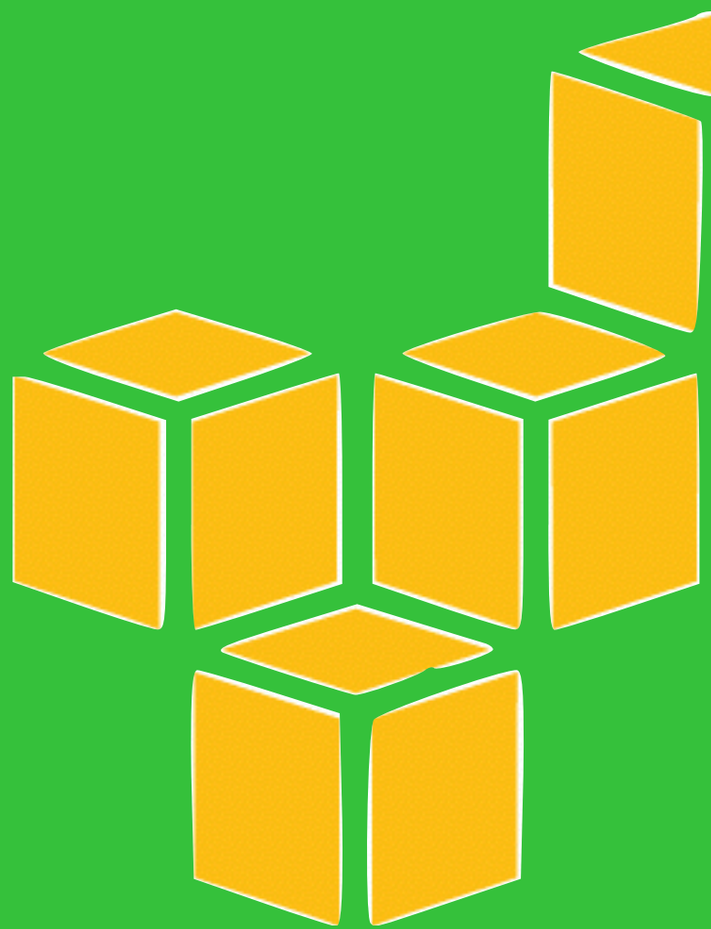
- Jeff Bezos (founder/ CEO of amazon.com)

800 x

tons of API, mini-services devoted to automation, flexibility, on-demand services for public and private use

2006

scalable web services for other
websites or client-side applications



SOAP & REST over HTTP

pay as you go

elastic *-oriented services

*data, network or computation

Cloud !

- [x] on demand self-services
- [x] broad network access
- [x] resource pooling
- [x] rapid elasticity
- [x] measured service

RECAP

“I have a dream, it was about Utility Computing”

John McCarthy - 1961

web
+ grid computing
+ resources on demand
+ service oriented architectures

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cloud computing (2006)