

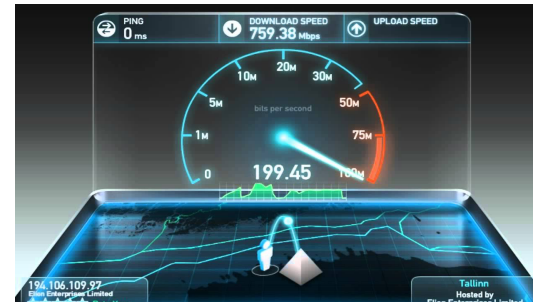
Measurements

What/Why/How?

Andrew W. Moore
Computer Laboratory
University of Cambridge

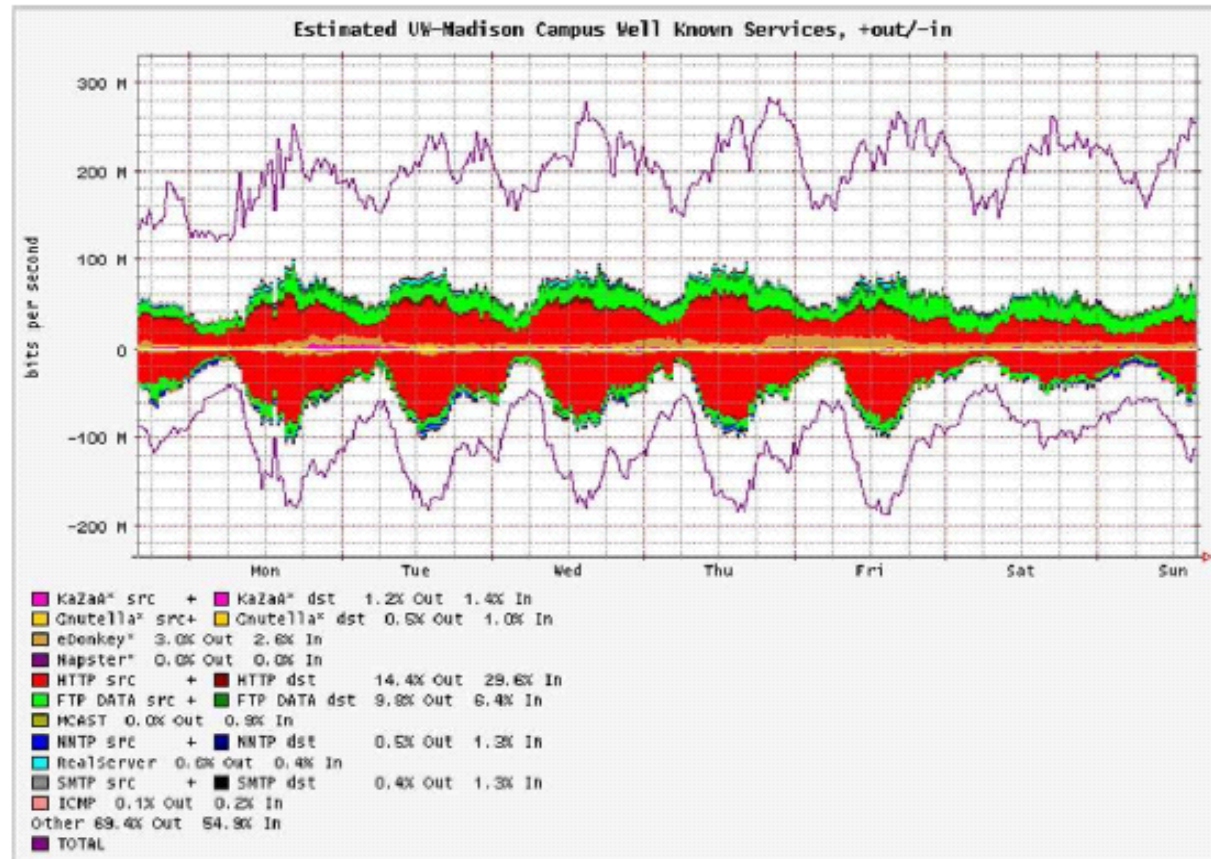
Measurements help us understand...

- Censorship who and where?
- Twitter human - Real or fake?
- Accountability:
 - “Why are the lights on my modem flashing?” / “Why are the lights on my really expensive router flashing?”
 - Am I getting what I paid for?



Understanding

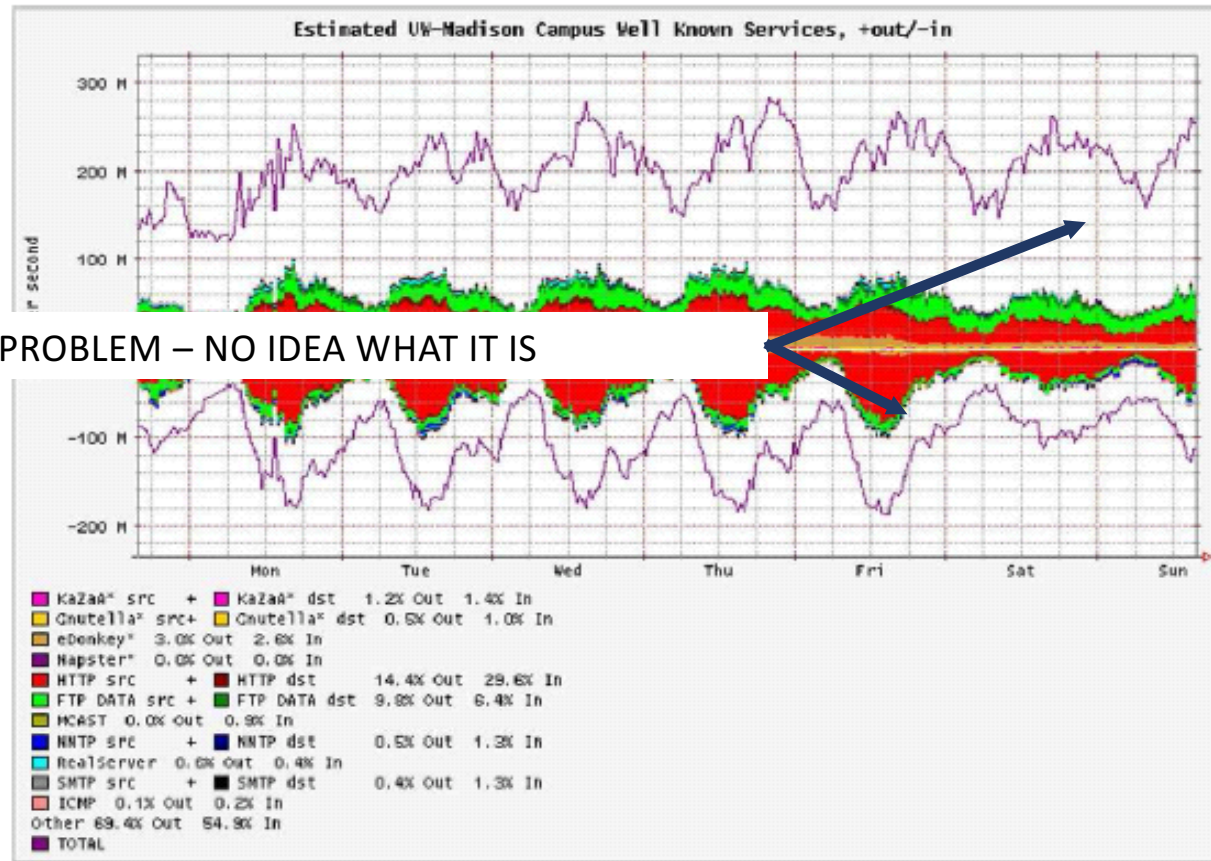
traffic for a large university - not Cambridge



Traffic Distribution of the network of the University of Wisconsin for the week 7-13 Sept. 2003. Courtesy of wwstats.net.wisc.edu

Understanding

traffic for a large university - not Cambridge



Traffic Distribution of the network of the University of Wisconsin for the week 7-13 Sept. 2003. Courtesy of wwstats.net.wisc.edu

Why else?

(in case you are still not convinced?)

More Examples

- Application identification – *“the users won’t or can’t tell you”*
(think of this as a *helpdesk* tool)
- Performance tracking – *“What is causing my application to go so very slow?”*



Why is it hard?

- All the packets look the same

(same reason its hard to stop bad Internet stuff)

- So many ways from here to there

Armageddon-proof is largely apocryphal

But the Internet routes around failure

- People quite like privacy

Enough said

Oh and scale.....

- The same challenge **of moving packets really fast** is also the same challenges for understanding **what is the traffic doing really fast**
- Where do I look?
- Well there are these Clouds I could look at those?

So what is a cloud anyway?

Well we had a name for them once: “someone else’s computer”

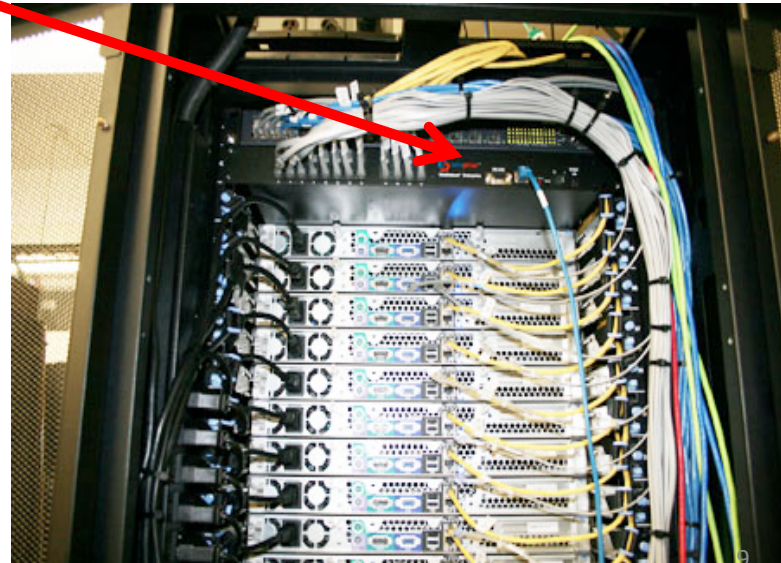
What goes into a cloud facility?

- Servers organized in racks



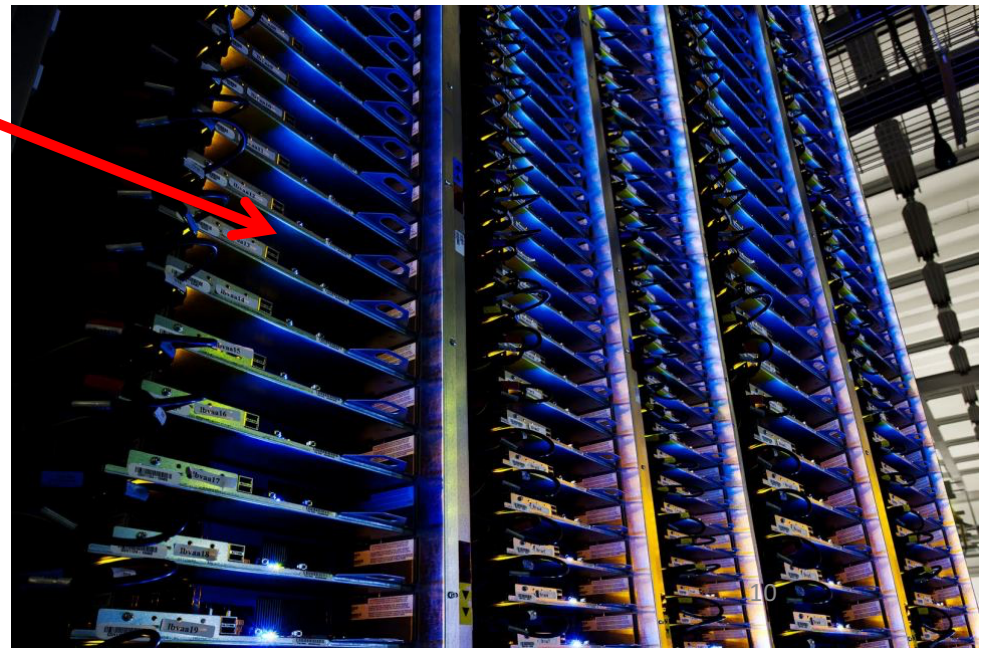
What goes into a cloud facility?

- Servers organized in racks
- Each rack has a `Top of Rack' (ToR) switch



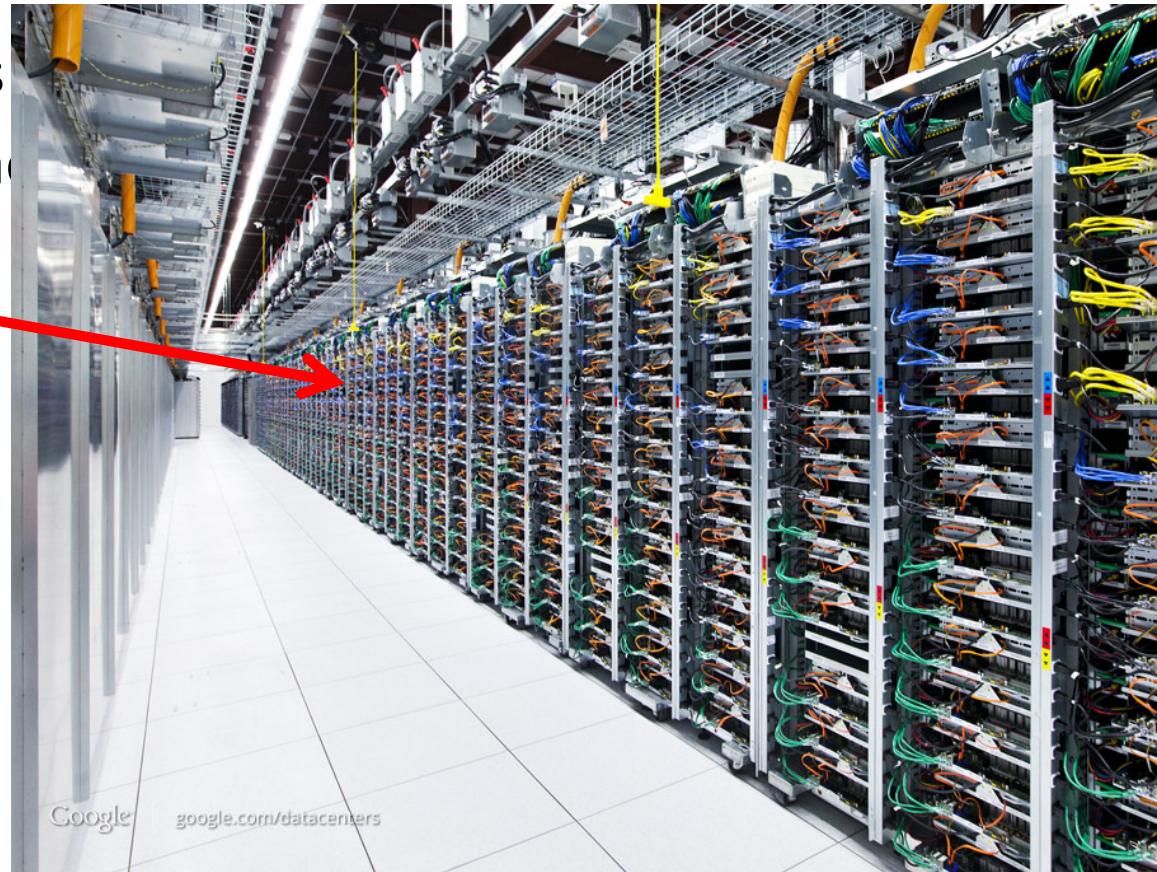
What goes into a cloud facility?

- Servers organized in racks
- Each rack has a `Top of Rack' (ToR) switch
- Then multiply....



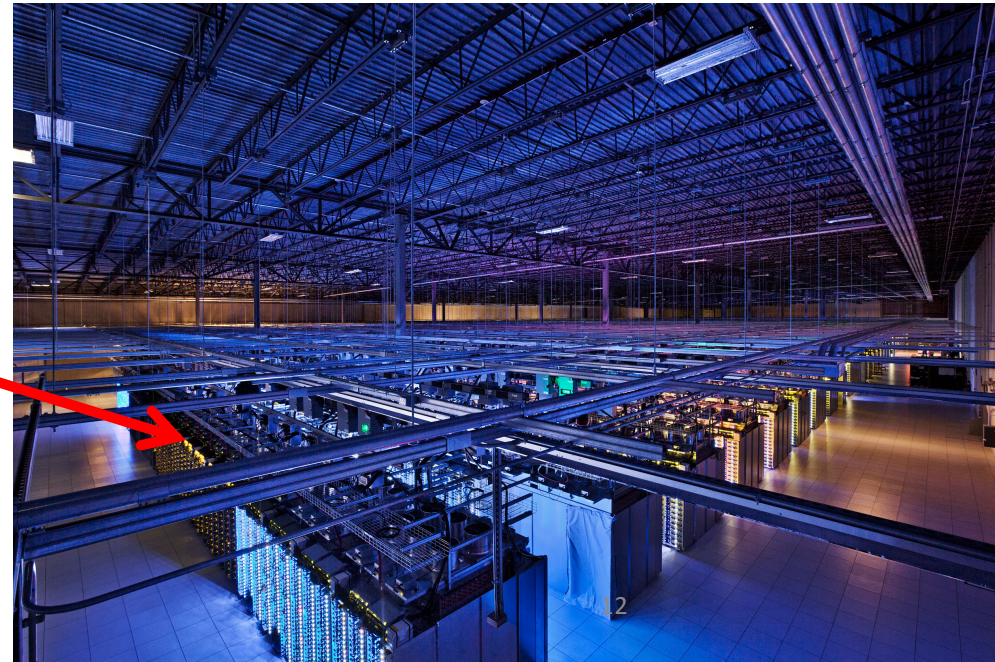
What goes into a cloud facility?

- Servers organized in racks
- Each rack has a `Top of Rack
- Then multiply,
- And multiply...



What goes into a cloud facility?

- Servers organized in racks
- Each rack has a `Top of Rack' (ToR) switch
- Then multiply,
- And multiply,
- And multiply...



What makes a cloud facility different?



What makes a cloud facility different?



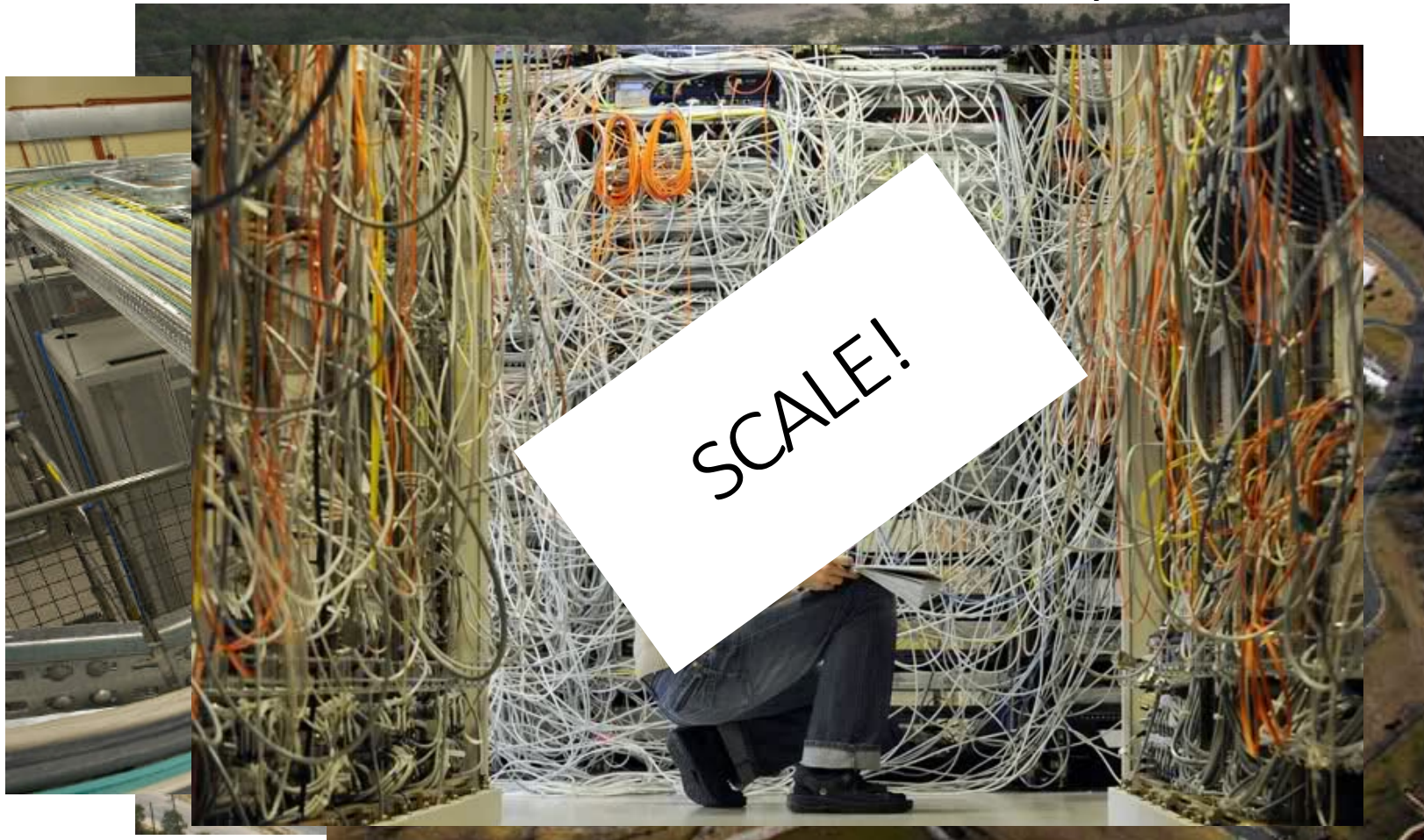
What makes a cloud facility different?



What makes a cloud facility different?



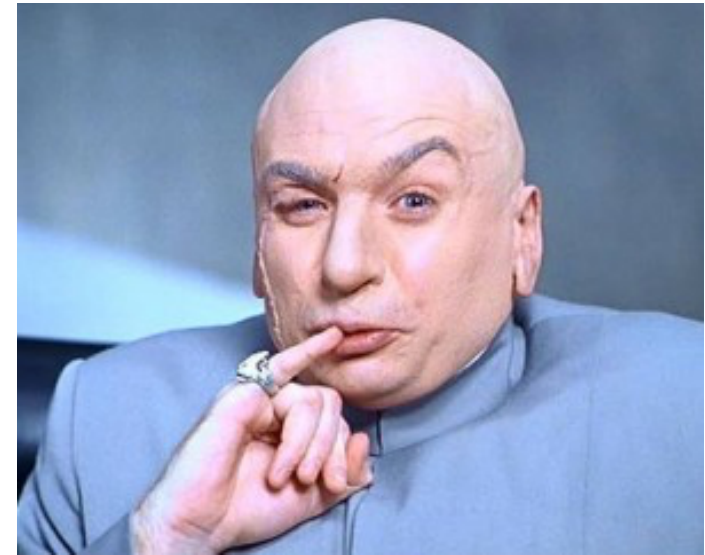
What makes a cloud facility different?



How big exactly?

- 1Million servers [Microsoft]
 - less than google, more than amazon
- > \$1B to build one site [Facebook]
- >\$20M/month/site operational costs [Microsoft '09]

But only $O(100)$ sites



Measuring at datacenter scale... what could possibly go wrong?



- **Active** Measure by asking others

Are you there?.....Yes.....

This one leads to network overload as everyone *ping's* everyone

- **Passive** Measure by looking at what goes past

...,blue car, blue car, red car, ...

This one is scary for privacy/security and needs lots of kit

- Simply put, a lot of data makes it hard to find the right data
- Network measurement was big (data) before Big Data



Thanks.

- With the right data....
- **Active Armour** – systems that automatically identify/adapt-to irregular behaviour
 - Self-defending household firewall, interface-card, and access-point
- **Better/faster/cheaper and as-yet unimagined services.....**

Sky's the limit!

If there is time....

- (or a Q. about it.)

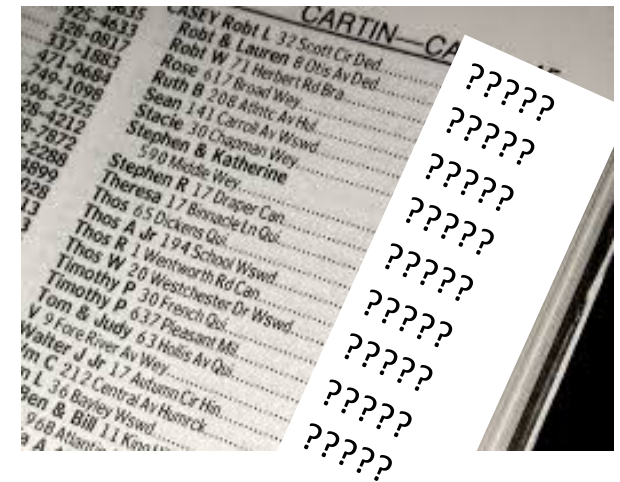
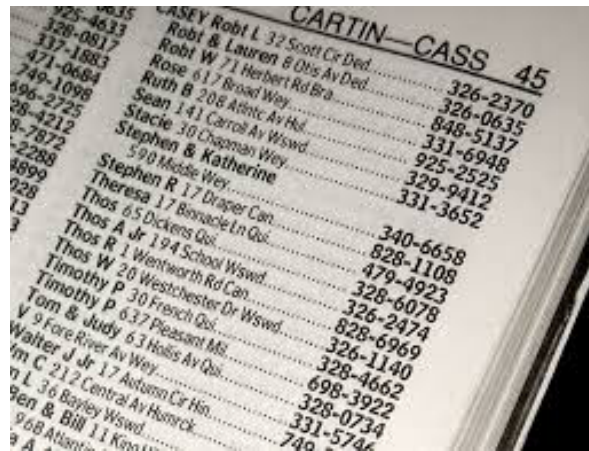
For a significant fraction of Friday;
there was a lot of *broken Internet*

- ...*“My Internet is broken”.... “Have you tried turning it off and on again”...*
- Who do you call virgin media? Google? the computer-maker? The barrista in the wifi hotspot? A helpful grandchild? Or a helpful grandparent?
- It depends....

How do you call emergency services if you don't know the phone number?

For a significant fraction of Friday;
there was a lot of *broken Internet*

Reason?



The Internet telephone directory (DNS) was broken

People could only call numbers they memorised