IoT: What is the Problem?

"How to explain to your boss that IoT won't make the company rich...."

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RIPE 72 / 2016-05 / Copenhagen, Denmark

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Internet of Buzz

The criteria for buzzworthiness:

- New(ish)
- Technological
  - ...but not enough that it is *hard*
- Growing, and will certainly grow more
- You can sort of imagine how it might be cool

Nobody wants to be left behind!

IoT: Completely New & Different!

A Big Thing for Bosses, not at all like:

- Web 2.0
- Virtualization
- SDN
- Cloud computing
- OpenStack
- …

Internet of Things: IoT

A short IoT definition:

- Today's Internet connects *people*
- Tomorrow's Internet will connect *things*
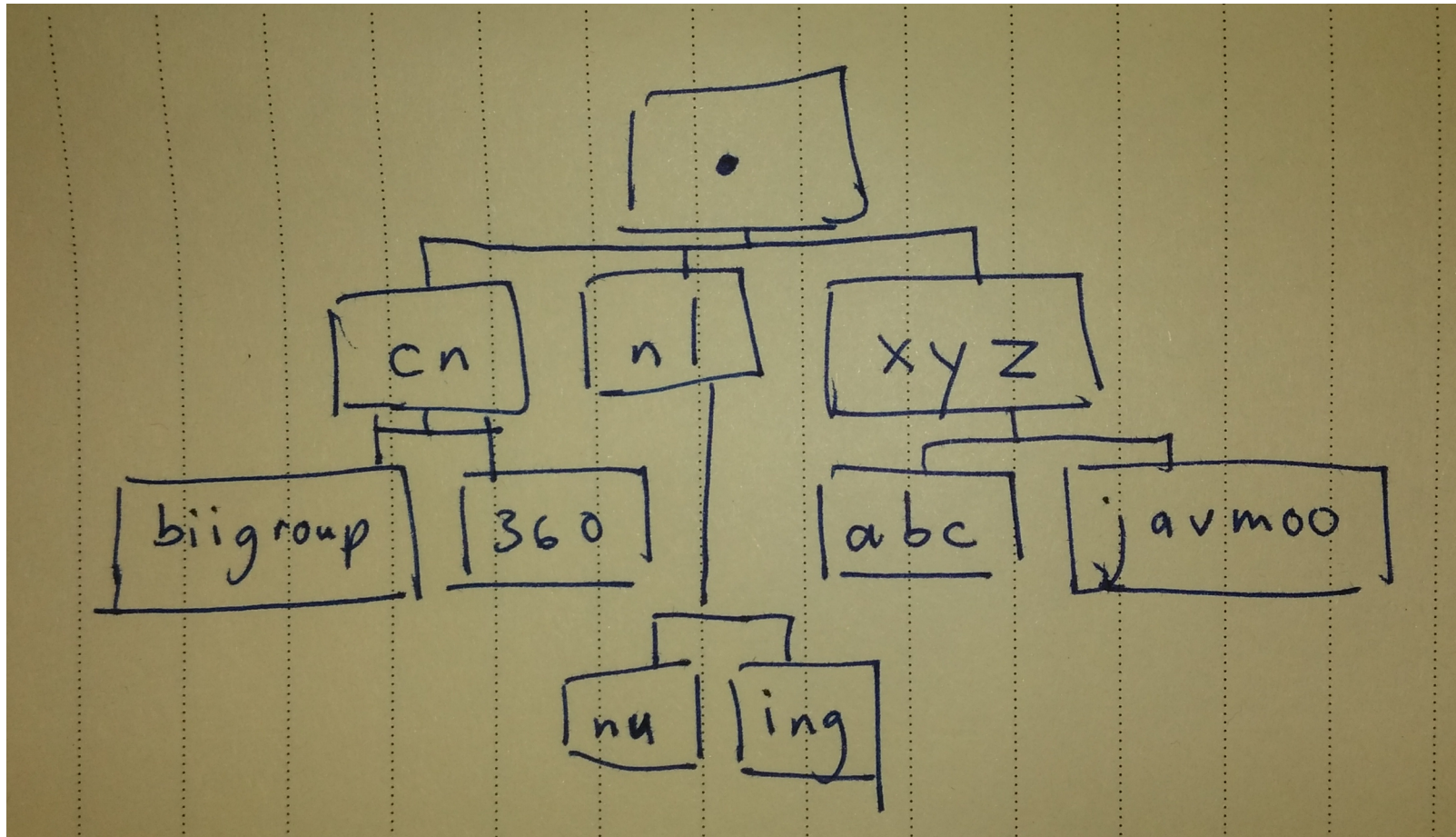
Question 1:
Will it Scale?

- Internet scaling: always a problem

- Internet scaling: so far, so good!

  - /etc/hosts → DNS

  - IPv4 address A/B/C → CIDR

- 10000x as many computers now

- IoT may mean 10000x more!

Scaling: Horizontal Scaling

- Adding capacity by adding more machines
- Non-trivial, depending on the technology
  - SQL or financial: difficult to scale like this
  - Rise of NoSQL and blockchains
- Works great for web services!
  - Google, Amazon, Baidu, …
- Won't scale the whole Internet

Scaling: Hierarchical Scaling

Scaling: Hierarchical Scaling

- Use a tree to allow growth
- Old computer science technique
  - Used in many algorithms and data structures
- Applied to the network
  - IP addresses
  - DNS
- No obvious limits to scaling on earth!

Internet's 3 Fundamental Techs

1. Addresses: IP

2. Routing: BGP

3. Names: DNS

Addresses: IP

- Currently moving from IPv4 to IPv6
- Enough for IoT… and more!
- Hierarchical addressing
  - But SLAAC uses a /64 per segment
  - Current IPv6 only uses /8 of the IPv6 space
- Solved, but IPv6 is necessary

Routing: BGP

- Internal vs. External

- Internal: do *not* scale to the Internet
  - Have other useful properties
  - Usually used inside each company

- External: BGP
  - *Not* hierarchical, but does hide information
  - No "true" view of the Internet

- Unresolved scaling issues!!
  - SDN changing both internal & external

Naming: DNS

- Many past & present sources of names
  - UUCP, X.500, mDNS, Tor/i2p/..., p2p, …
- Internet naming means DNS
  - Another hierarchy
- Many challenges with current DNS
  - Security, evolution, …
- Alternates proposed
  - DHT, Handle system, …
- DNS remains the best! :)

Answer 1:
Will it Scale?

- Addresses: yes

- Routing: probably

- Naming: yes

Question 2:
So what *ARE* the challenges?

1. Compatibility

2. Obsolescence

3. Security

IoT: Compatibility

- Companies strive for "vendor lock-in"
  - Creates isolated systems, "walled gardens"
- Internet has many proprietary protocols
  - Even with obvious benefits of open protocols!
- Struggle for openness continues in IoT

IoT: Obsolescence

- My solar water heater

- Possibly 1998?

- Not networked

- Works great :)

IoT: Obsolescence

- Traditional appliances lasted years
- How old is your phone? ;)
- No good solutions for updating old hardware
  - Not *impossible*, just no solutions now
- Economic models are mismatched
  - Money earned only at sale time
  - 3-year old IP-TV will never see new firmware...
  - Perhaps open source can help?

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IoT: Security

- Current Best Practice: patch bugs
  - Works okay for phones/laptops (auto-update)
  - Can it work for unattended systems?
- Some prior examples, all extreme
  - Space probes, wilderness sensors
- New standards may help

Can IoT Make ~~Me~~Us Rich?

- Short answer: No.

- Long answer: Yes. Simply identify people who want to spend money to fix the problems with compatibility, obsolescence, and security. Engage with them, and solve their problems. Do this for lots of people over a long period of time.

- Better answer: No, but you can make a living at the same time as having fun and making the world a better place.

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Bonus Slide: Conspiracy Theory!

- Age Old Telco vs. IP Battle
  - RIPE started (partially) to get around telcos!
- IP won!
- Telcos don't like the open Internet.
- Governments don't like the open Internet.
- Vendors don't like the open Internet.
- Answer: IoT
  - 5G protocols, proprietary equipment, … ☹