Black Hat Europe - 2013

ACCUVANT LABS
Security Research and Assessment

MITRE

Meshing Stuff Up:
Ad Hoc Mesh Networks with Android

/whoami (m0nk)

- ~ software engineer for the last 12 years
- I like to:
  - break / embed / repurpose things
  - solder things into other things
  - stare at asm
- Find Me:
  - jthomas@accuvant.com
  - m0nk.omg.pwnies@gmail.com
  - @m0nk_dot

/whoami (stoker)

- <insert infoz here>
- I like to:
  - thing 1
  - thing 2
- Find Me:
  - jrobble@mitre.org
  - mistr.stoker@gmail.com

echo $PROJECT_INFO

- SPAN is an Open Source research project initially funded by the MITRE Corporation for use in Emergency Preparedness and Response situations
- Team:
  - Josh Thomas (Accuvant LABS) - Geek with an idea that used to get paid to lead the effort
  - Jeff Robble (MITRE) - Lead Developer and currently running the MITRE effort
  - Oliver Chong (MITRE) - iOS and Security
  - Sheldon Durrent (MITRE) - Security

echo $PROJECT_INFO

- SPAN is open source and released under the GPLv3
- SPAN is a collaborative effort of private, public and independent contributors worldwide.
- Associated and leveraged projects
  - Wireless Tether for Root Users: http://code.google.com/p/android-wifi-tether/
  - Serval: http://www.servalproject.org/
  - Freifunk: http://start.freifunk.net/
  - OpenWRT: https://openwrt.org/
  - Commotion: https://code.commotionwireless.net/projects/commotion
  - tinc: http://www.tinc-vpn.org/
  - pttdroid: http://code.google.com/p/pttdroid/

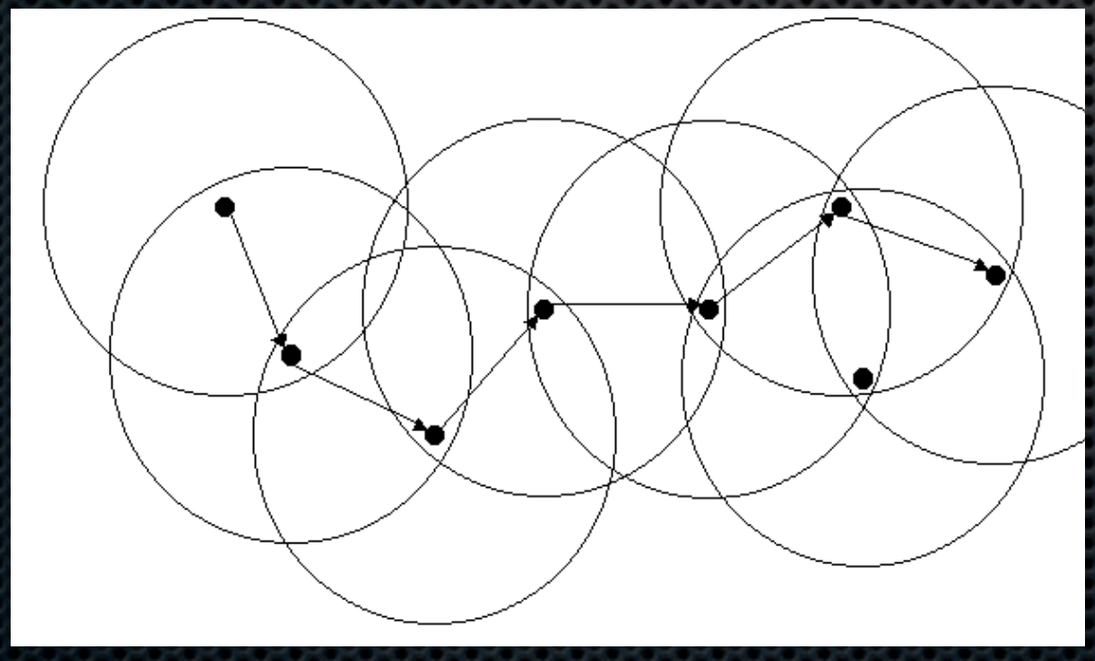
Will he start already?

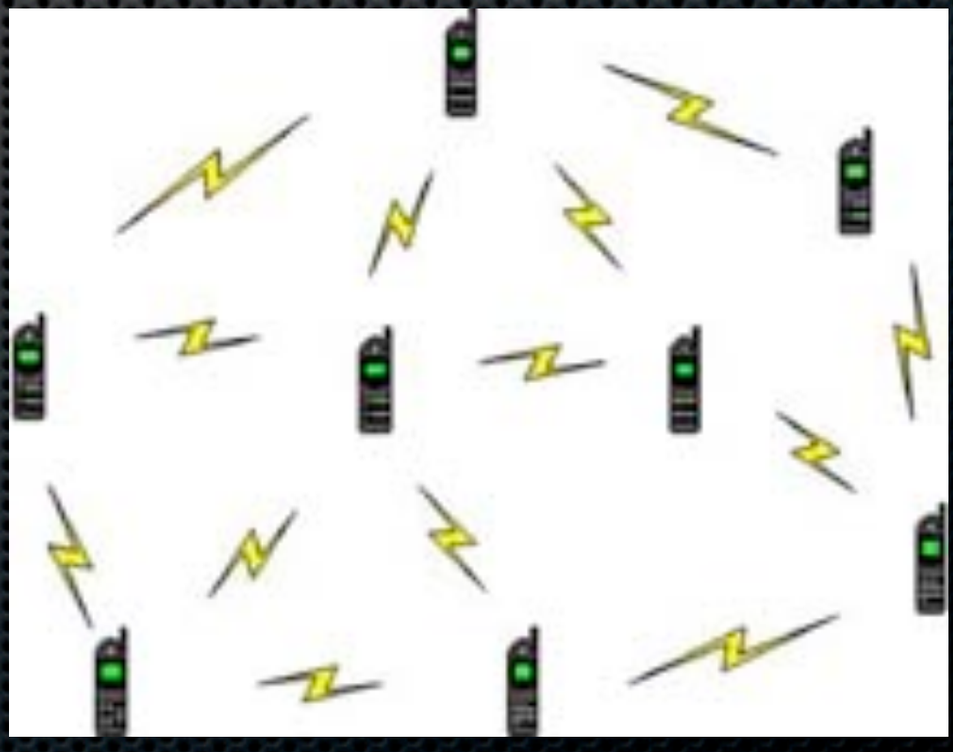
- Mesh? / Why do I care about mesh networks?
- What are they and how do they work?
  - Rooting and Routing
- Notes on Android Development at the Hardware level
- Chat, SMS & VoIP
- Securing the Mesh
- Lessons learned and moving forward!
- </end_session>

- TL;DR:
  - www.omg-pwnies.com
  - https://github.com/monk-dot
  - https://github.com/ProjectSPAN

What's a Mesh Network?

- It's exactly like graph theory except:
  - Nodes are shiny electronic gadgets that run out of battery and move around a bunch
  - Vertices are unstable and based on arbitrary signal strength
- The pics are uglier





Ok, but why?

Hurricane Katrina

August 2005

- Over 3,000,000 phone lines went down
- 2000 cell towers knocked out
- Land Mobile Radio (LMR) communications highly degraded
- HAM Radio Operators assisted standard 911 dispatchers
- On scene field reporters exchanged information between victims and authorities

Haiti Earthquake

January 2010

- The 2 main public telephone service providers (Digicel and Comcel) networks went completely down
- Haitian cellular service networks quickly failed with the influx of Red Cross volunteers
- Fiber-Optic and other networks highly degraded

Tohoku Earthquake

March 2011

- Earthquake and the following Tsunami lead to the Fukushima Daiichi Nuclear Power Plant meltdowns
- Degraded and disabled infrastructure across the island
- Forced service providers to limit mobile phone traffic by 90-95%

Recent Worldwide Events

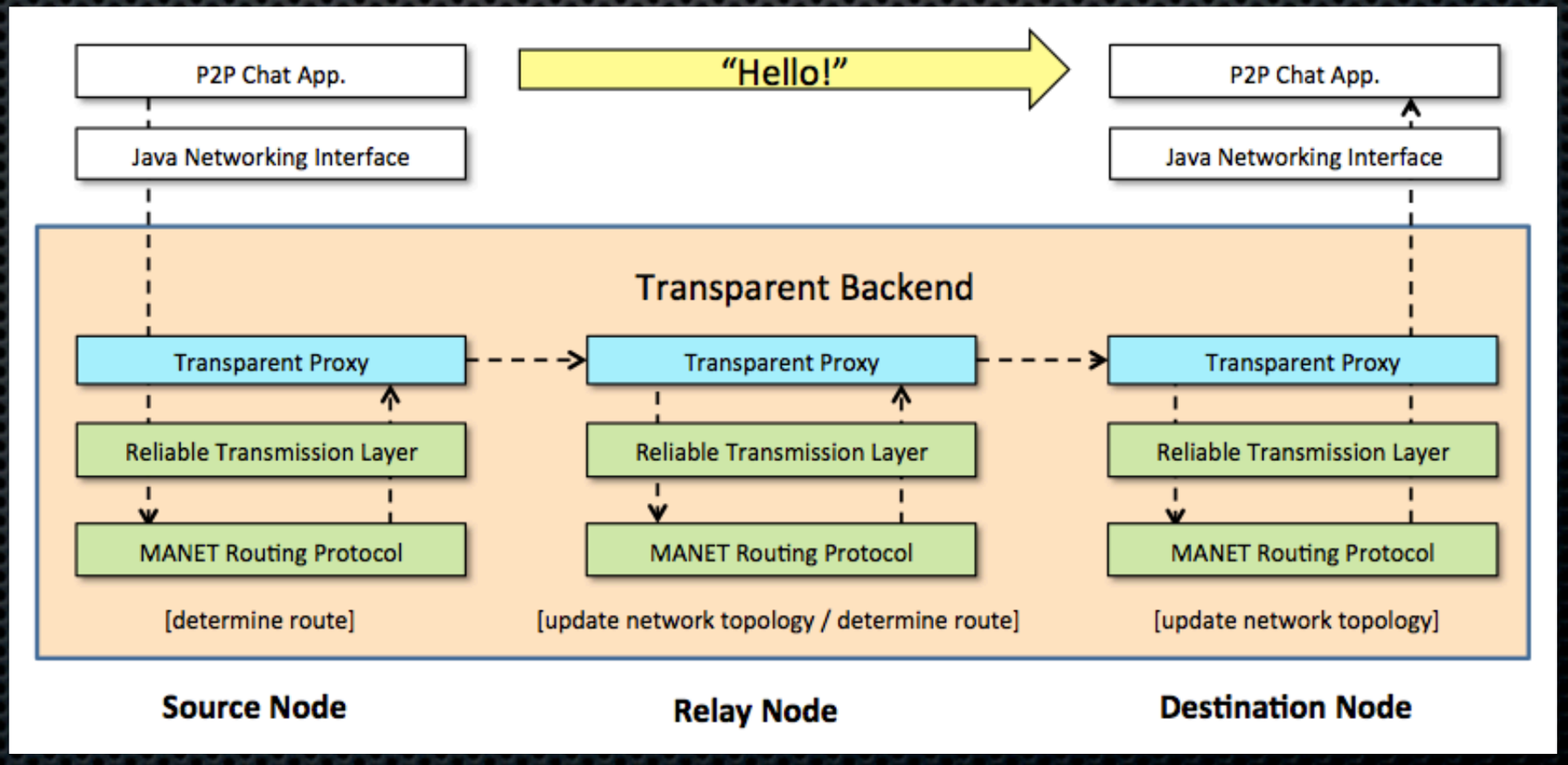
2011 - 2012

- Egyptian Arab Spring Protests
  - President Mubarak cuts off cellular communications during protest
- Hurricane Sandy
  - Twitter proved itself as a viable news and communication outlet when other technologies failed
  - Phones have power when TVs don’t
- Middle East / Israel and Anonymous
  - VoIP & Twitter monitored and manipulated

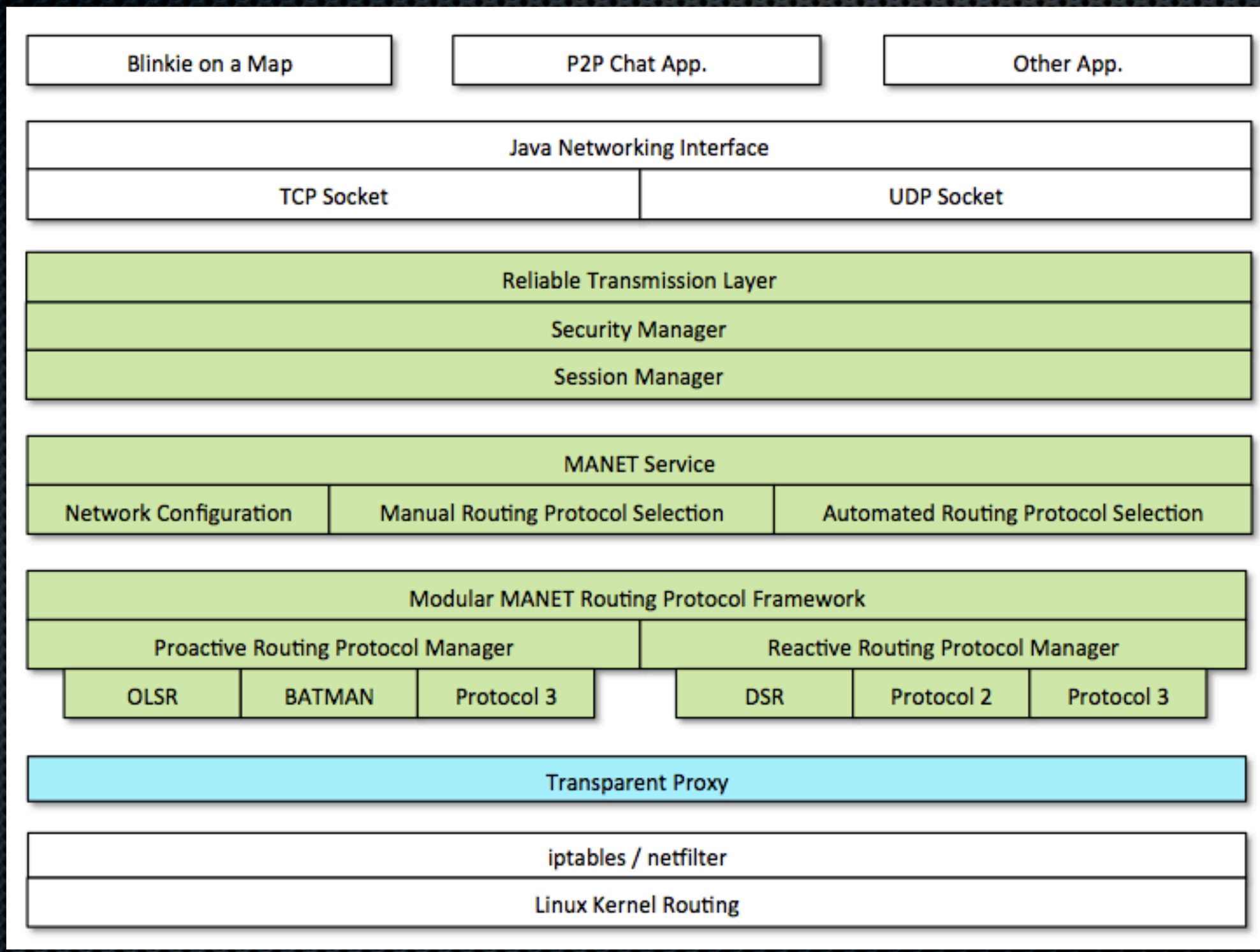
Solution?

The SPAN Project

- There are too many headaches involved in starting MANET research before you actually get to the hard problems
- Simple framework implementation for MANET - Smart Phone AdHoc Networking
- A transparent proxy so normal applications just work



The Stack


Blinkie on a Map
P2P Chat App.
Other App.
Java Networking Interface
TCP Socket
UDP Socket
Reliable Transmission Layer
Security Manager
Session Manager
MANET Service
Network Configuration
Manual Routing Protocol Selection
Automated Routing Protocol Selection
Modular MANET Routing Protocol Framework
Proactive Routing Protocol Manager
Reactive Routing Protocol Manager
OLSR
BATMAN
Protocol 3
DSR
Protocol 2
Protocol 3
Transparent Proxy
iptables / netfilter
Linux Kernel Routing

Easy Problems that are in fact hard

- Getting it running overall
- Per device specialization
  - Hardware diffs
  - AOSP / Kernel customizations
- Network configuration / Ad Hoc joins

Hard Problems that are in fact hard

- Routing
  - Proactive vs. Reactive
  - Sensor based routing
  - Other mesh & routing projects
    - OLSRd
    - SERVAL / BATMAN
    - Byzantium Mesh
    - FreiFunk
- Network Scale / Speed and Power consumption
- Security

Mesh Routing 101 - Proactive vs Reactive

Lesson 1: Proactive Routing

Lesson 2: Reactive Routing

What can we actually do with the Mesh?

Security - It’s never too early / it’s always too late

Lessons Learned and Stories told

Questions? Comments?

Slides and Papers:
https://github.com/monk-dot

Actual Code:
https://github.com/ProjectSPAN

Easy link:
http://www.omg-pwnies.com

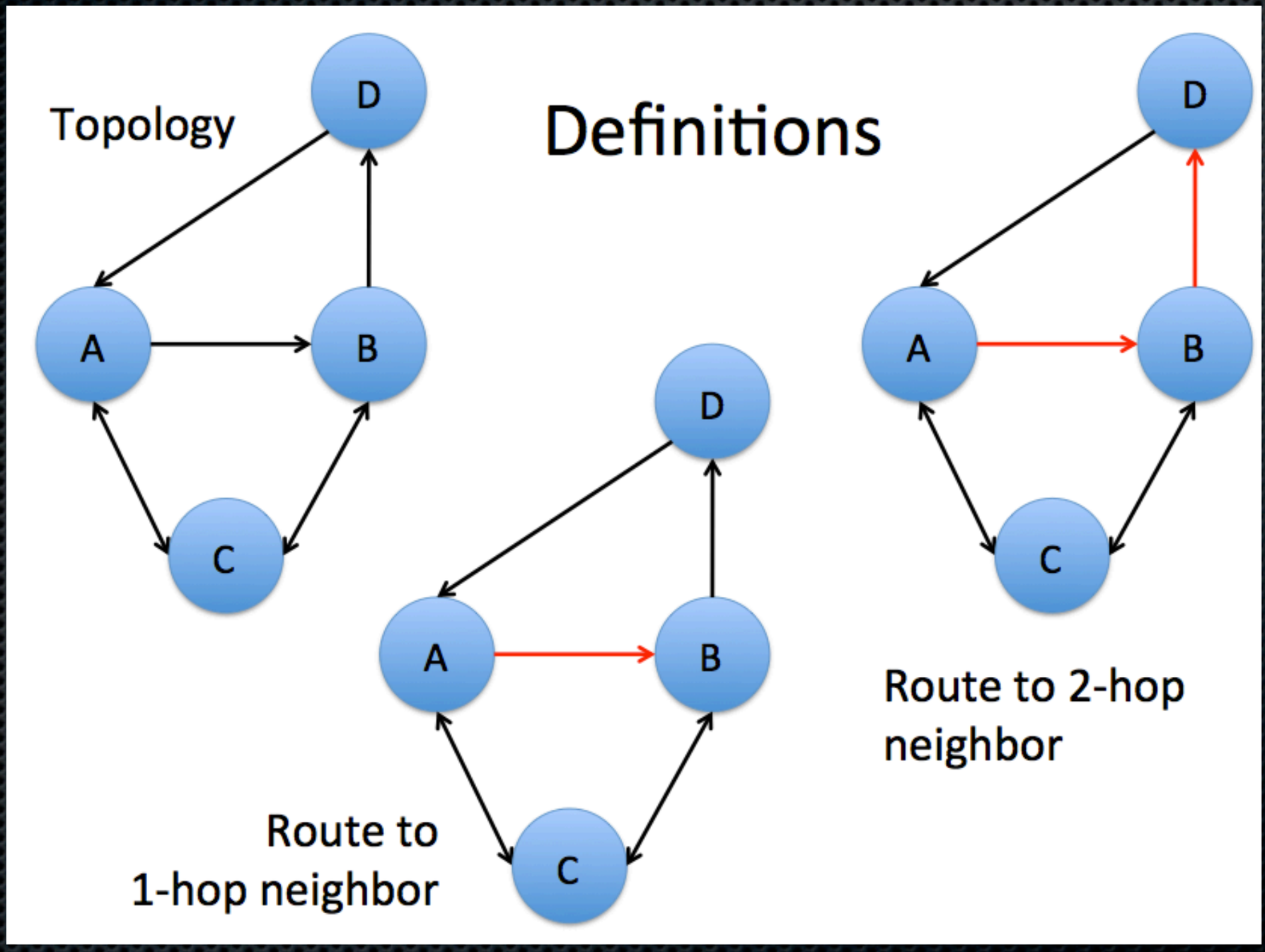
- </talk>

The Links

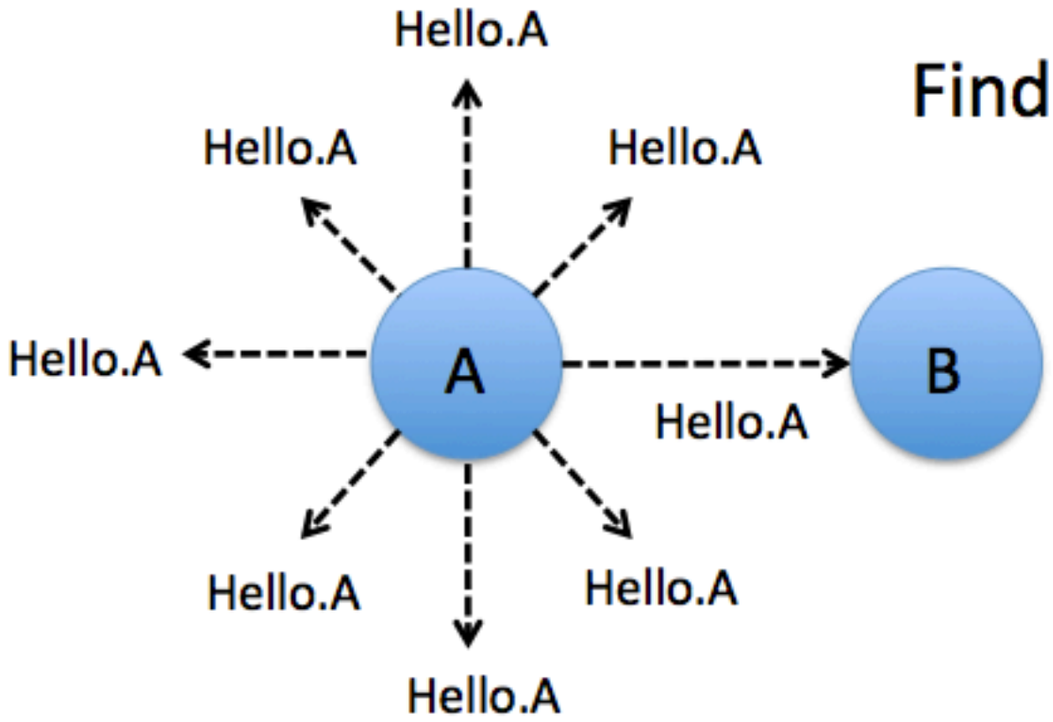
- http://code.google.com/p/android-wifi-tether/
- http://www.olsrd.org
- http://www.servalproject.org
- http://berlin.freifunk.net
- http://project-byzatium.org

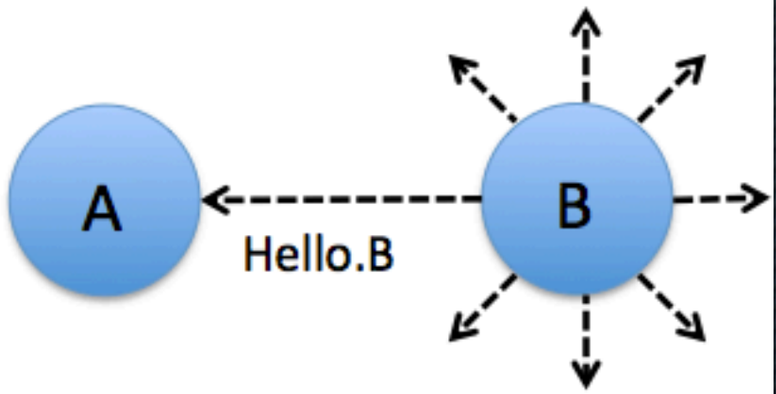
Backup Slides

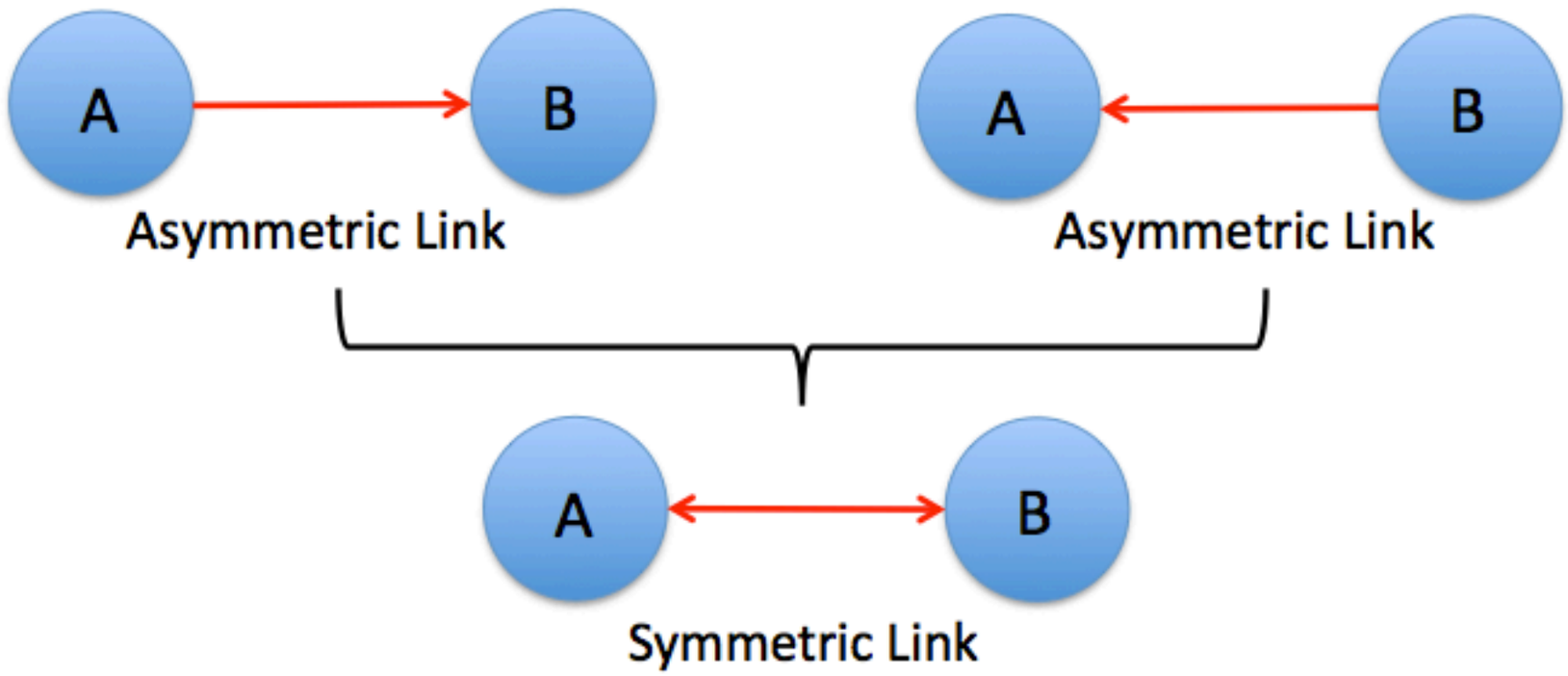
Routing Protocols (Pics or it didn't happen)



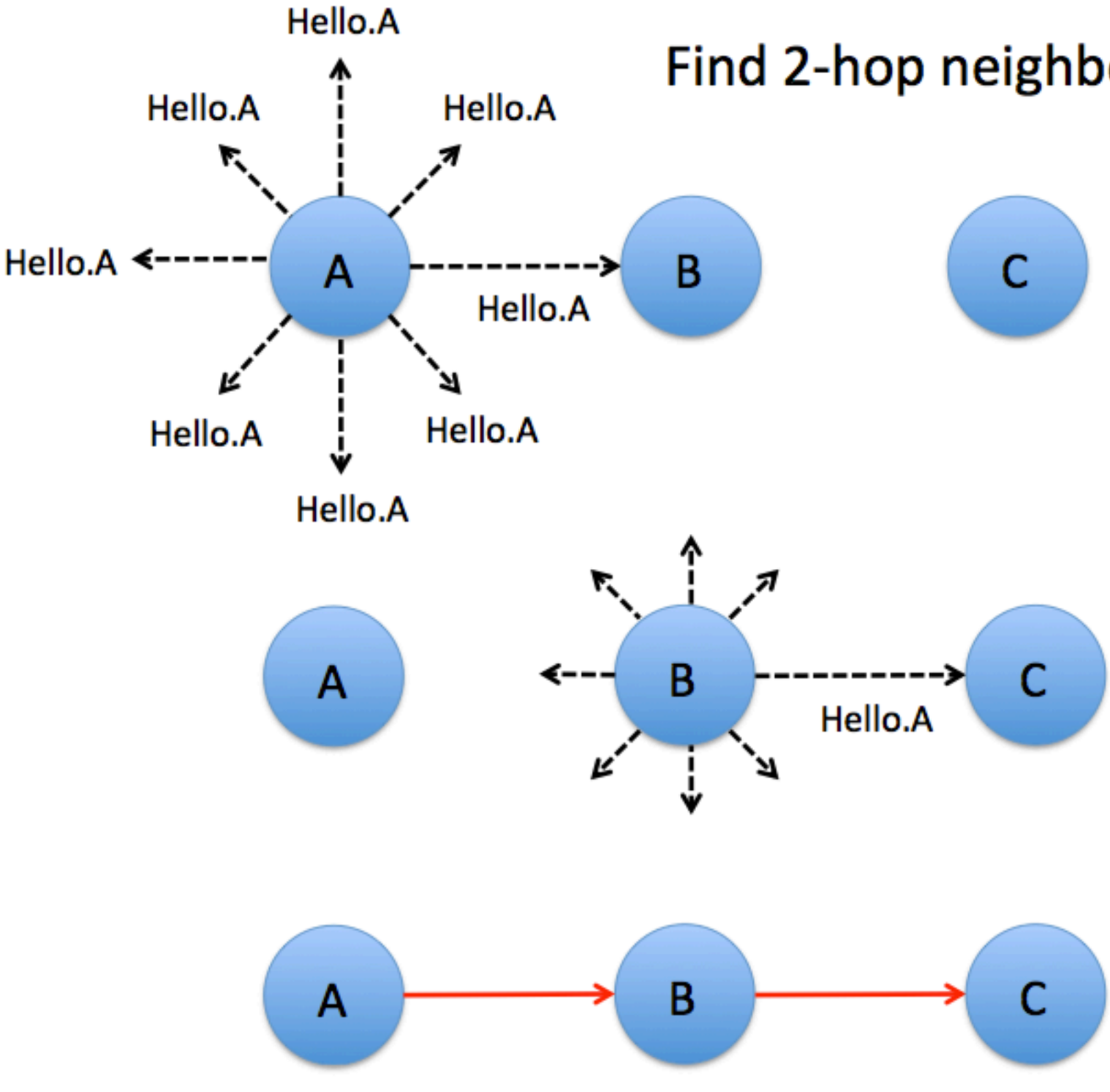
Find 1-hop neighbors

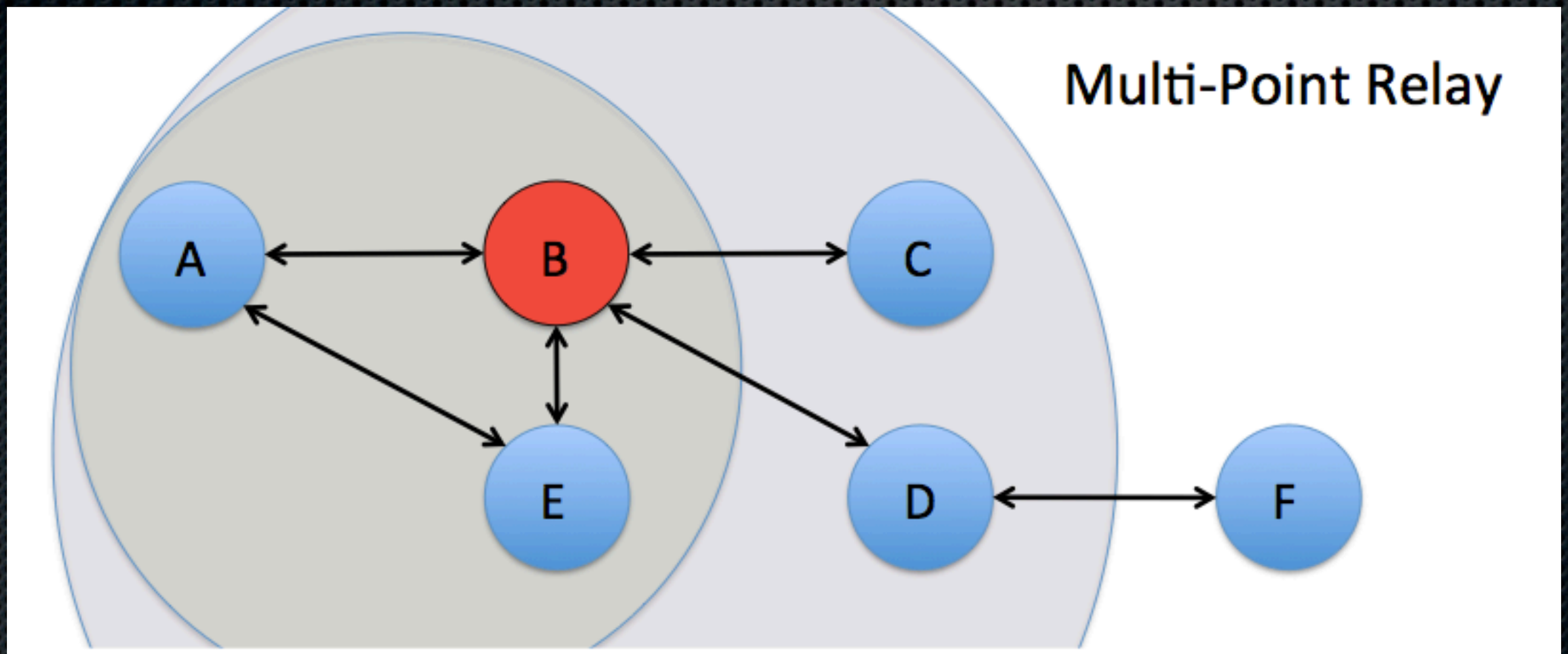




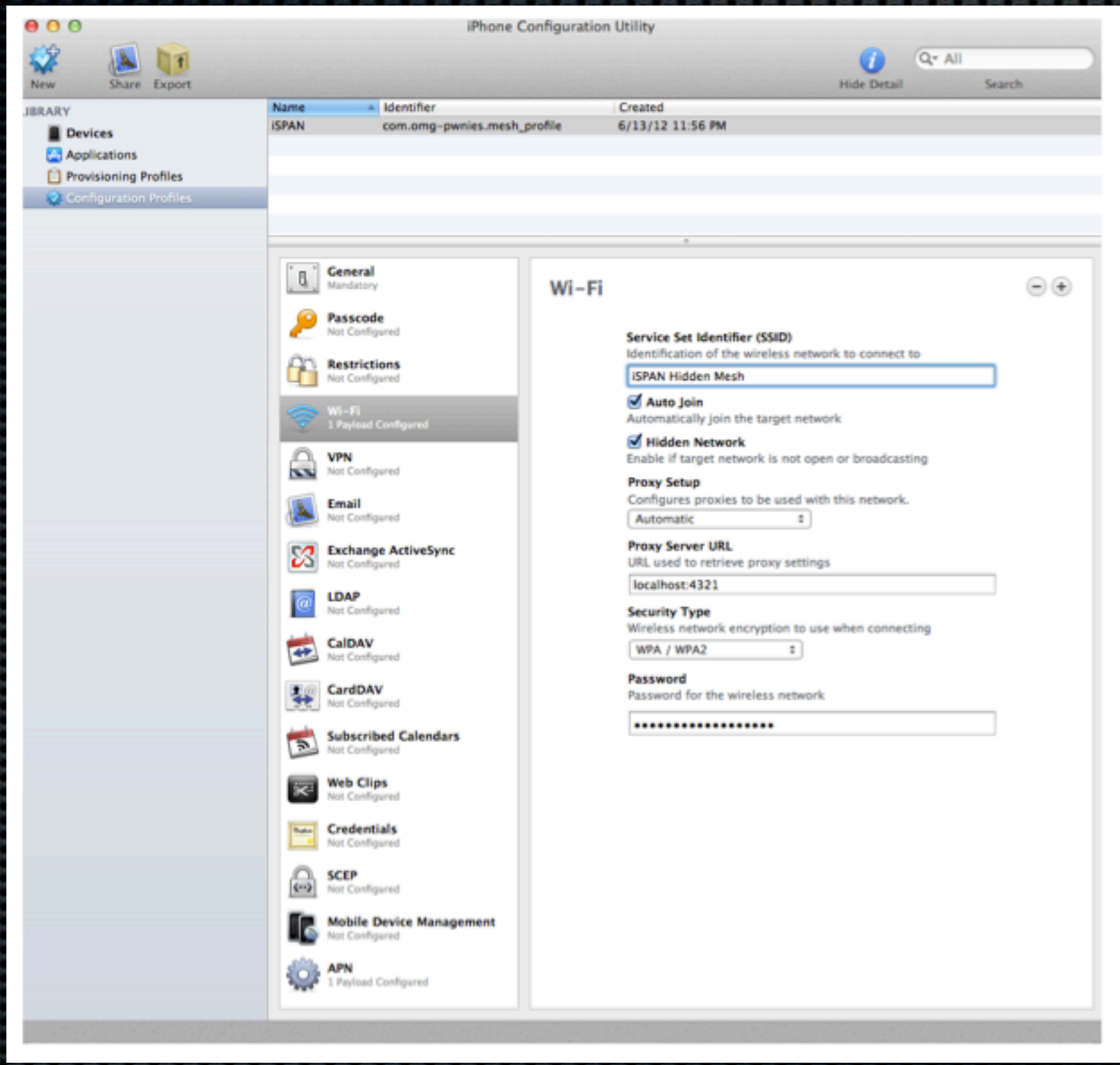


Find 2-hop neighbors




Multi-Point Relay
A
B
C
E
D
F

What about iOS?

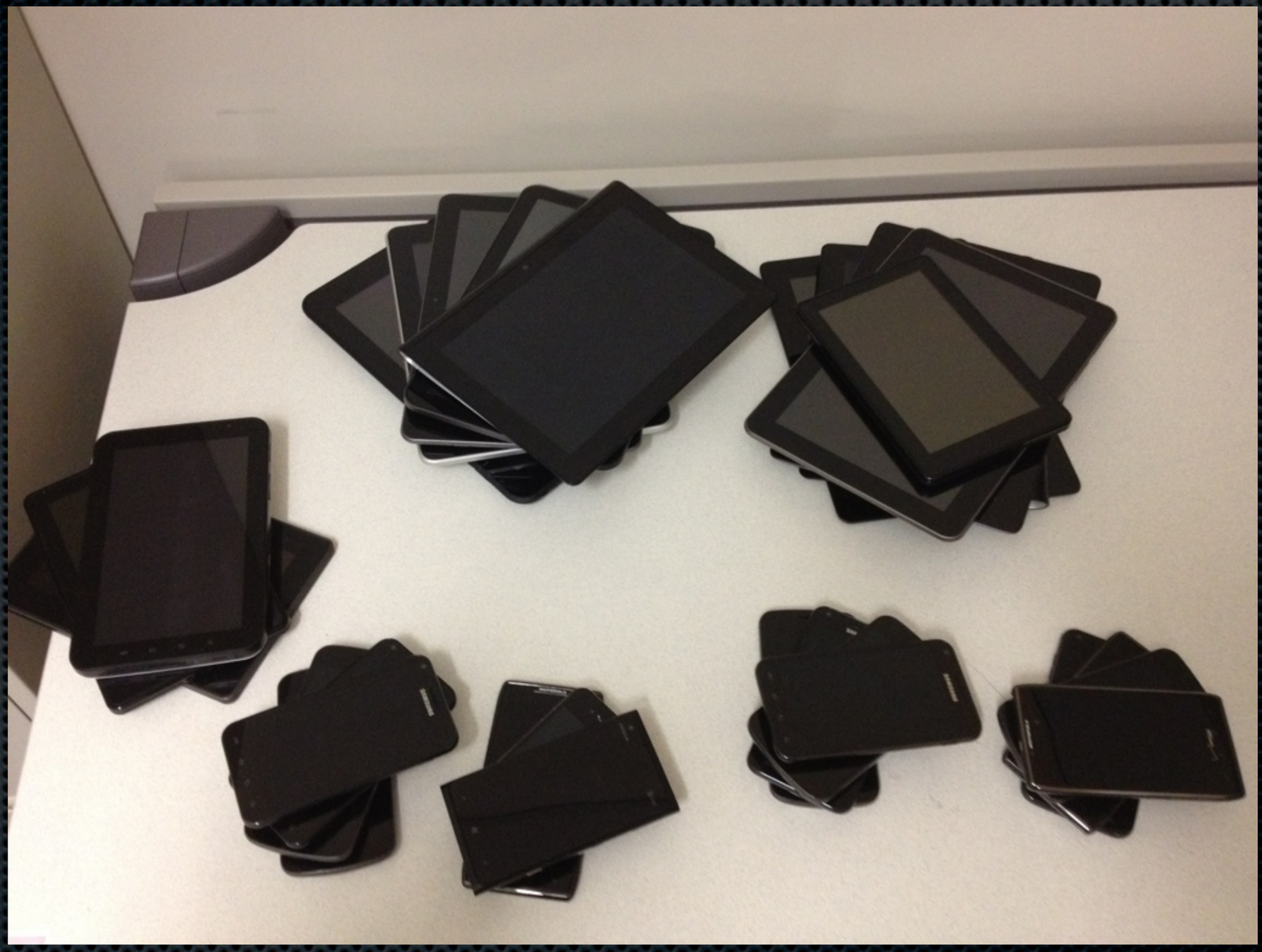


Getting to know your friendly chip vendors!

- Broadcom 4329 - Samsung Galaxy Nexus, Samsung Nexus S 4G, Nokia Lumia 900, older iPhones, Asus Transformer Prime, many more
- Broadcom 4330 - Samsung Galaxy TAB 10.1, Samsung Galaxy S II / Epic Touch 4G, iPhone 4S, many many more
- Broadcom 4334 - iPhone 5, Samsung Galaxy S III
- TI WL1285C - Motorola Razr / MAXX
- Qualcomm - A ton of Android Phones

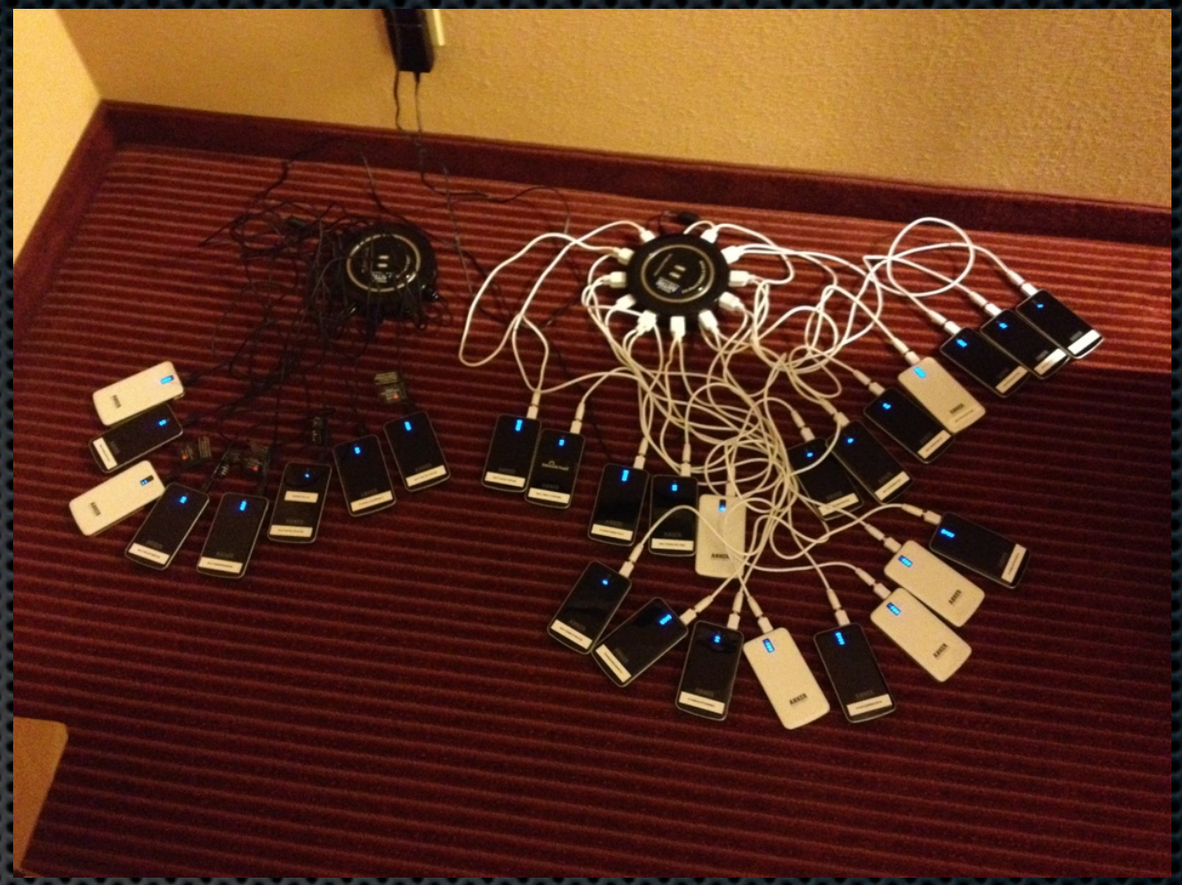
- All behave differently, all are quirky

A Short story in 7 Pictures & 9 Words



Terrorists love Baseball

Hotels hate me



Snipers hate Engineers