The Internet as DIY connectivity for people and things (IoT)

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IEEE Consumer Electronics

Santa Clara Chapter

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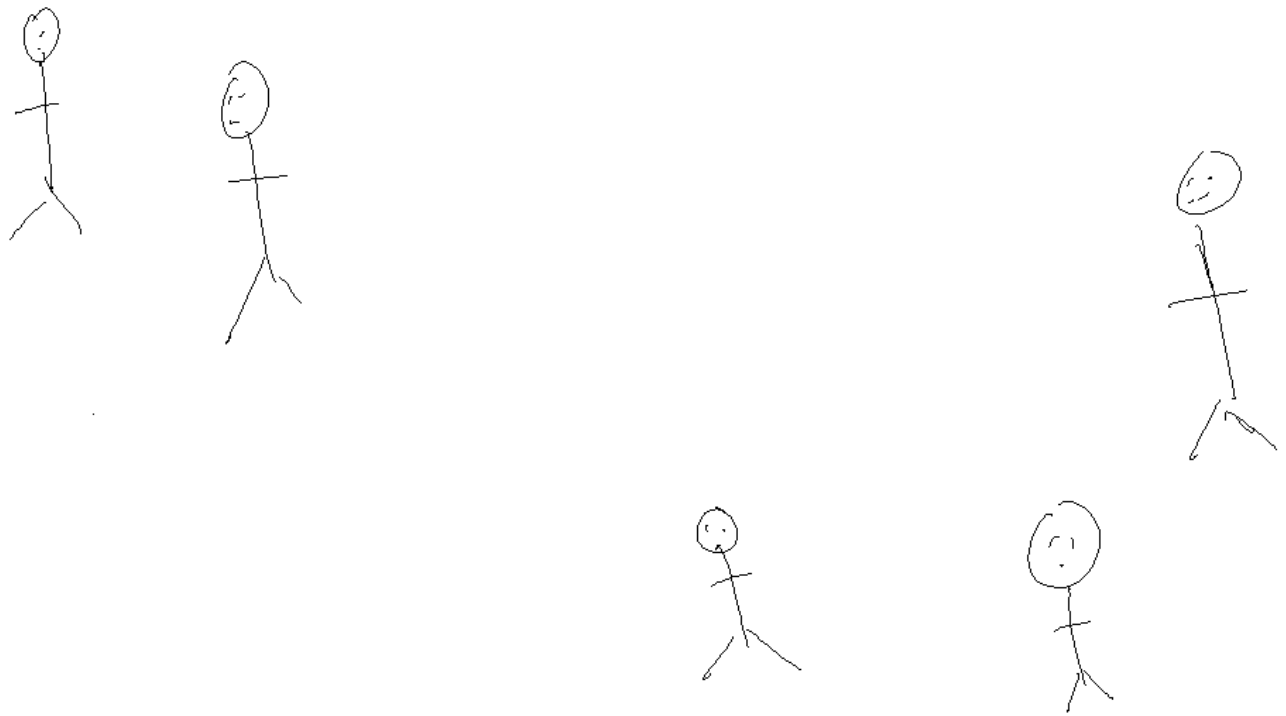
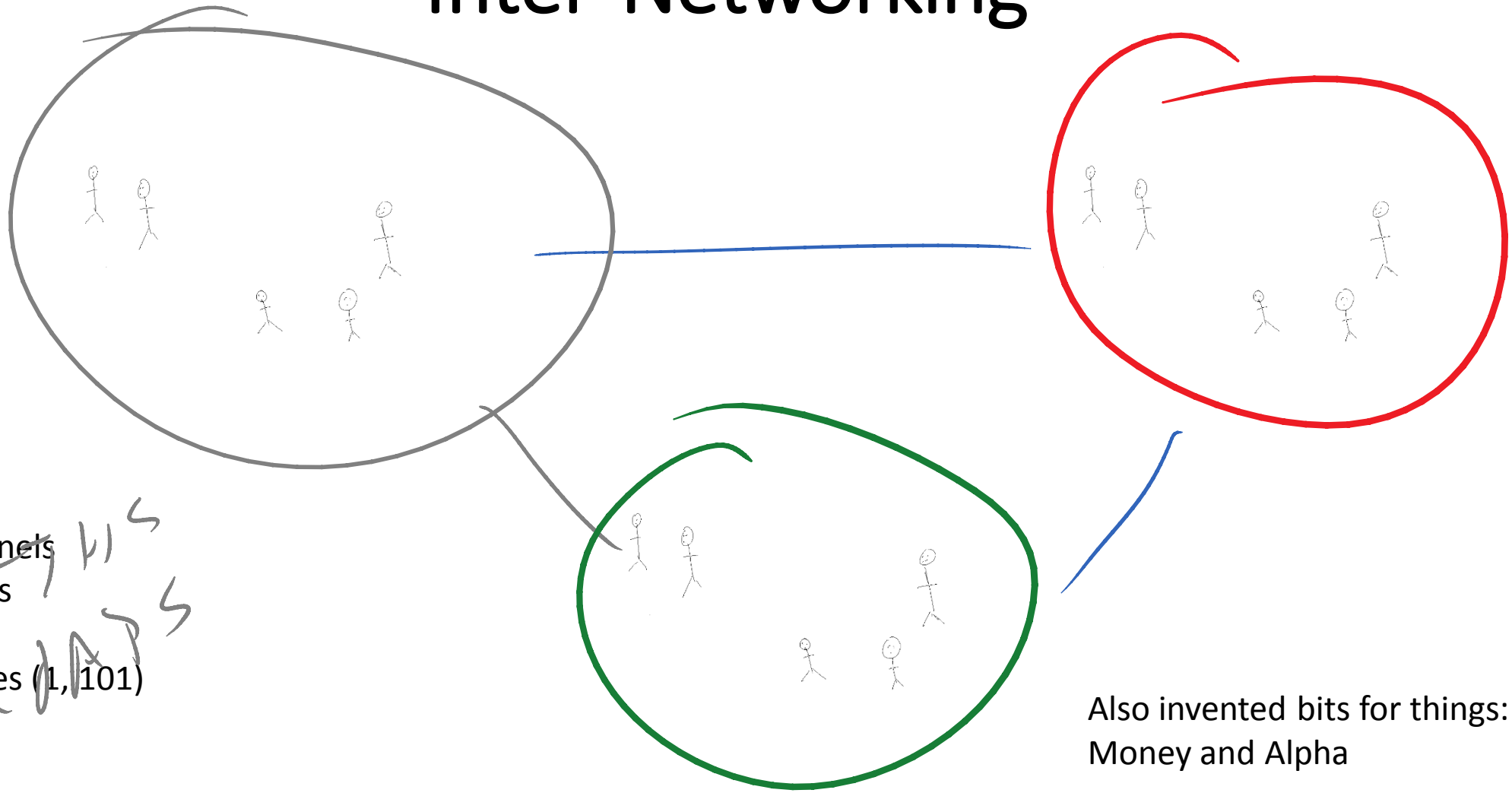
Networking



Inter-Networking

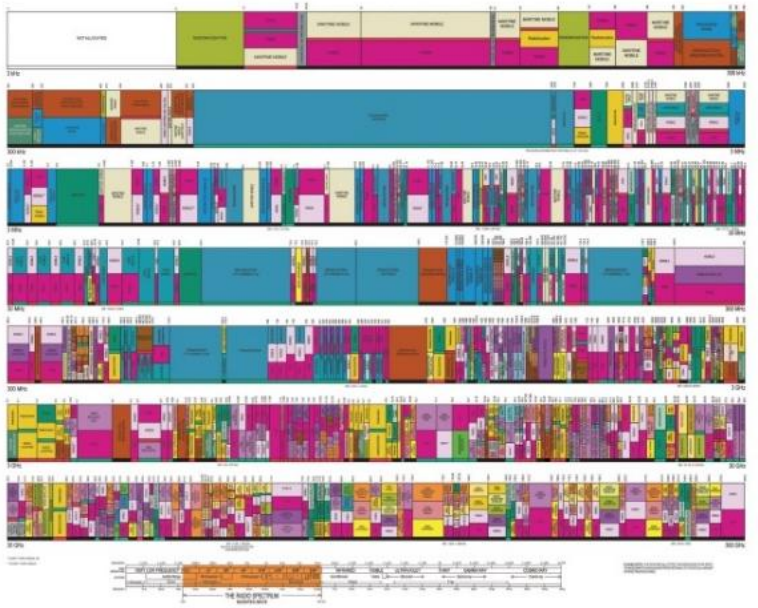


Channels
Tracks
Ruts
Routes (1, 101)

Also invented bits for things:
Money and Alpha

Stage One of “digital”: Within Channels

- Distinct symbols
  - Alphabets & Bits
  - Conquered distance (and time)
- Messages as freight
  - Providers like RRs
  - Paper ➔ Wires
  - Wireless as virtual wires
  - Speech as Message Units



Stage Two of Digital: Discovering bits

- Talking telegraph was analog
  - Lost the regenerative ability that symbols provided
    - **Distance became difficult!**
  - Needed an explicit understanding of symbols to move ahead
- Bell Labs (Shannon) digitized speech
  - First stage of any technology is substitution
  - Implicit assumption: speech is within wires (AKA channels)
  - Distance became easy again.

Stage Two: Still in the pipes

- Still provider-centric
  - Pipe-based business models and architectures
- Digital technology
  - Also gave us digital computing
  - Set stage for the future
- Legacy is implicit in the language we use
  - “Communications” confuses EE sense of unrelated human sense
    - Like confusing “work” in Physics with “work” as labor

Stage Three: Doing it Ourselves (DIY)

- Packet Radios as DIY Connectivity without “Providers” (1970’s)
  - ALOHAnet: Simple packet radio
  - If packet got lost can retry
  - Network is now just a social construct!
  - Ethernet was Aloha on a Coax

Stage Three: And there was Internet

- The Internet was “discovered” or “invented”
  - Just as Copernicus created the construct we call the solar system
  - But our “stories” stay stuck in the old paradigm
- Escaping the Procrustean limits of layering
  - Think Resources!

Local Connectivity

- Not just IP, remember IEEE-488?
  - Device on a plane
- Can focus on relationships between devices
  - They are “just there”
  - Not constrained by the physical topology
- There is no ISP
  - Just common facilities as a resource
  - Applications deal with failures or hiccups gracefully

(Inter)connecting the LANs

- Also interconnecting existing Wide Area Networks
- **Defining Constraints**
  - No knowledge beyond the individual packet
  - “Message” (the meaning) only understood by the apps outside
  - Bits on the wire are just bits with no intrinsic meaning
- “End to end argument”

Tunneling through “Telecom”

- Packets and nothing but the packets ➔ IP
- TCP is an application library and a protocol for cooperation
- TCP is not a layer but simply a technique

Apple in Talks With Comcast About Streaming-TV Service

Companies Discuss Service That Would Try to Bypass Web Congestion

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By SHALINI RAMACHANDRAN, DAISUKE WAKABAYASHI and AMOL SHARMA CONNECT

March 23, 2014 8:36 p.m. ET

Apple wants to make the service on its Apple TV as good as cable, and to do that, it's talking to Comcast, the largest cable company in the nation, about a potential tie-up. Amol Sharma reports on MoneyBeat. Photo: AP.

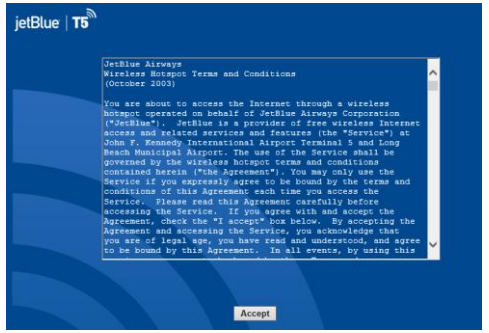
SS7 all over again

Running out of “Internet”

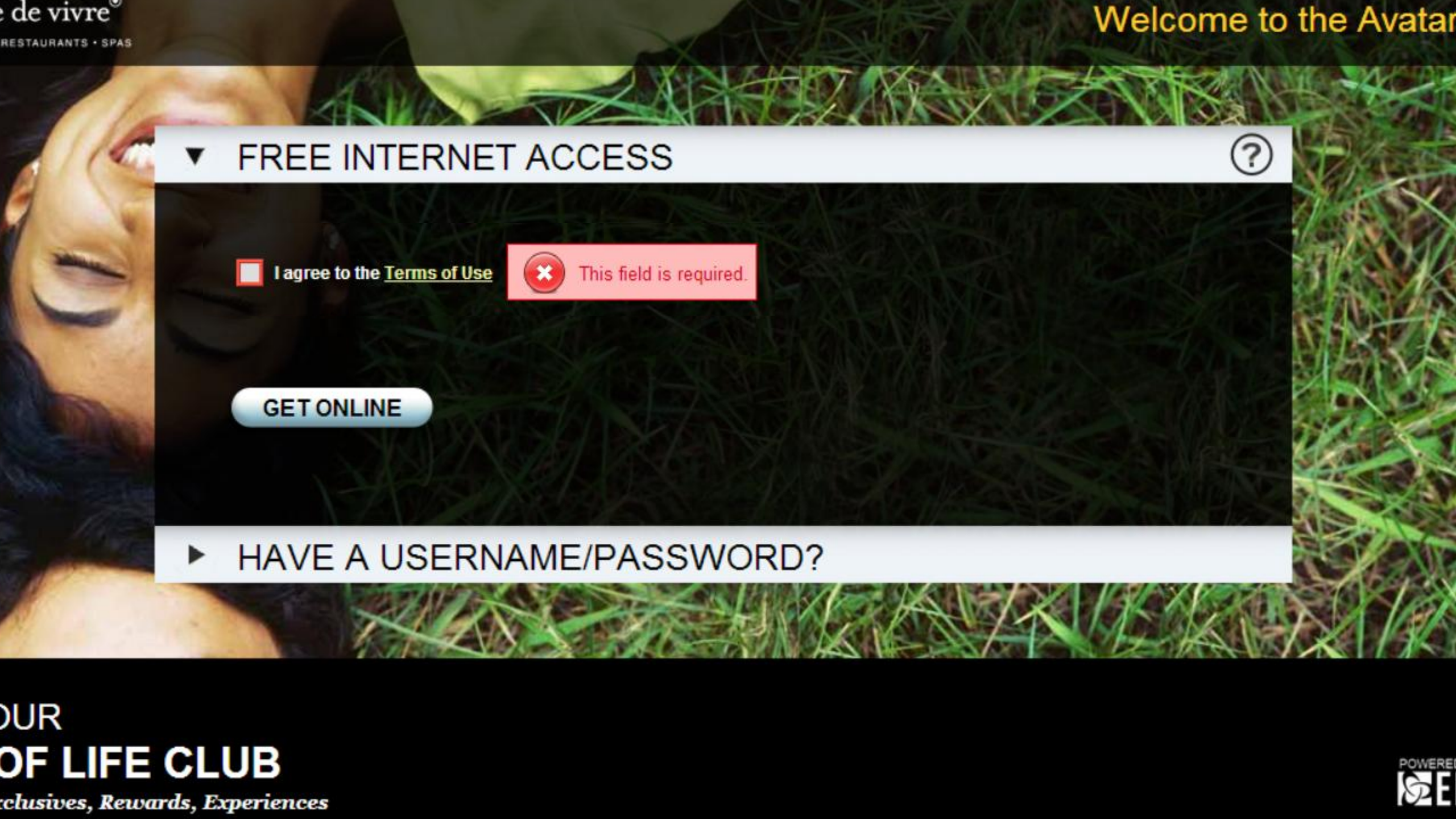
- The Internet is a technique
  - How do you run out of a technique?
  - You don’t – you’ve ceded control to others
- Is like running out of French toast
  - When you have an abundance of
    - Bread
    - Milk
    - Eggs

Problems with Telecom

- **Inherent Conflict of Interest**
  - More Connectivity
  - The fewer services they sell, we buy others' content
- Borders
  - Default is failure at "access points"!
  - Local connectivity depends on Stage Two era gatekeepers agreeing!
    - Internet "Providers", venue owners, chipmakers
  - A Lack of resilience
    - Understanding "Best Efforts" is liberating



Border Crossing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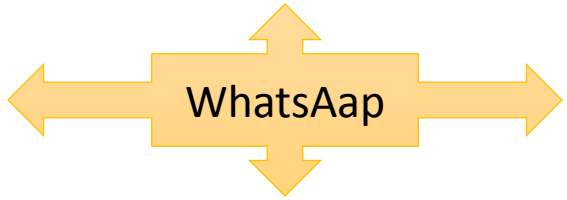
DETAILS EARN REDEEM SUPPORT JOIN NOW!

The Plight of Telecom

- A simple financial problem
  - Meaning is no longer inside the wires so neither is value
  - Bits are not a consumable and value doesn't correlate with quantity
  - Railroad model based an owner excluding others – requires borders
- Collateral damage
  - Must make failure the default
  - Innovation must first profit a gatekeeper

Financing Borderless Connectivity

- Funding shared facilities like we do sidewalks and roads
- Hire people to install (and maintain) the infrastructure
  - Pay for time and materials
- Aligns incentives and we can discover new possibilities
  - Drives Moore's Law!
- We become owners like with the early PCs
  - Have an abundant resource to explore
  - Abundance is discovered not inherent
- "Infrastructure" because "utility" implies a provider



Home Networking Circa 1995

- “Home networking” comingled
  - Home Automation
  - Data networking
- *And now with broadband*
  - Just IP Addresses like phone numbers
  - Back to Hush-a-phone – no webcams
  - Another triple play service
    - Carriers owned the interior of the fat pipe
    - Used it to sell their services

At Home

- Ingredients
  - NAT to share a single connection
  - RF Intercom phones
  - Experience with Ethernet from 1973
- Architecture and User Experience
  - Packet connectivity without apps
    - Sold as web sharing
  - IP “just works” (DHCP et al)
  - Networking level just works (HomePNA ➔ Wi-Fi)
  - Hidden behind that darn firewall

Lessons of Home Control

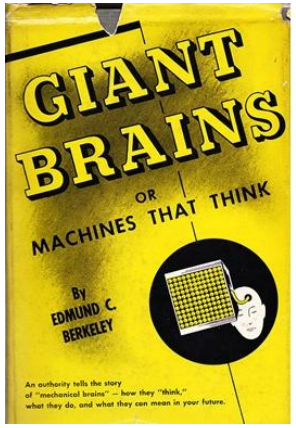
- Start with stable relationships
  - Light switch to light fixture (and now, bulb)
- Constraints
  - Work entirely within home
  - Not dependent upon physical topology – shared driveway
- Not the Internet out there
  - Need to invent local solution
  - And use the Internet and IP as a solution
  - *IPv6, DNS are not a firm foundation – just possible resources*

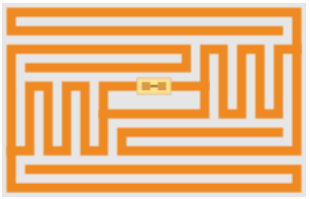
Local ➔ Global

- Start with local connectivity
  - As with LANs
  - No need for borders if “being there” is enough
- Start at home
  - Buy pipe through telecom (AKA broadband)
  - Apartment buildings (MDU) and communities w/fatter pipe
  - Interconnect, coalesce and repeat at scale
- End game
  - Common infrastructure

Smarts here, there and everywhere

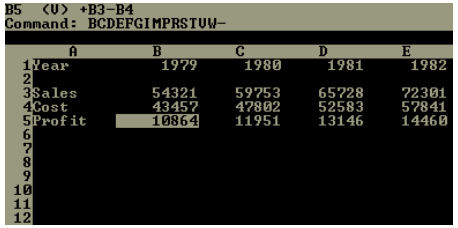
Strowger Switch

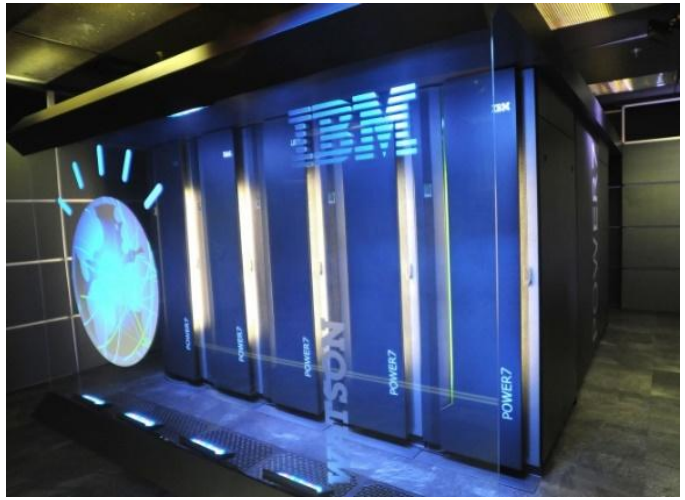




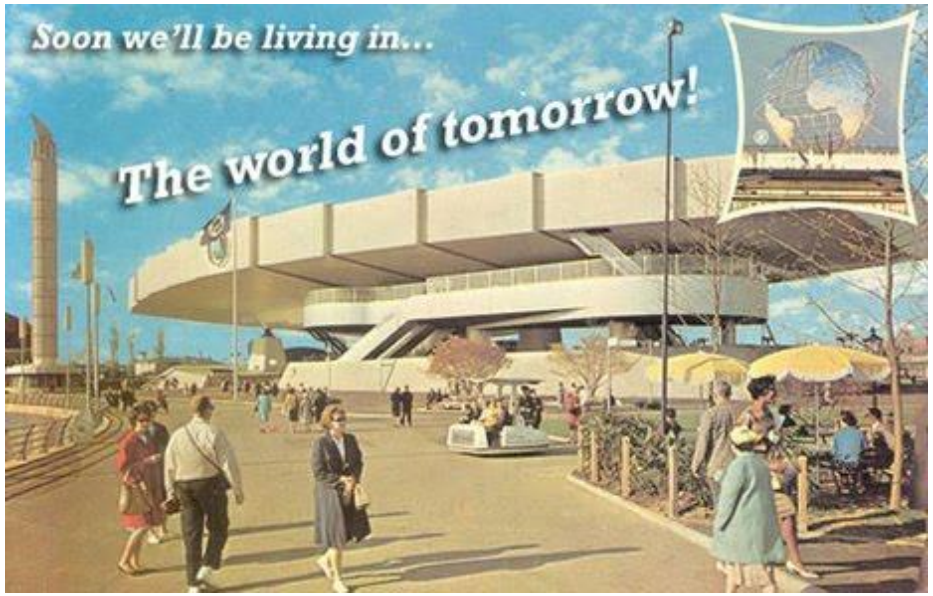
RFID

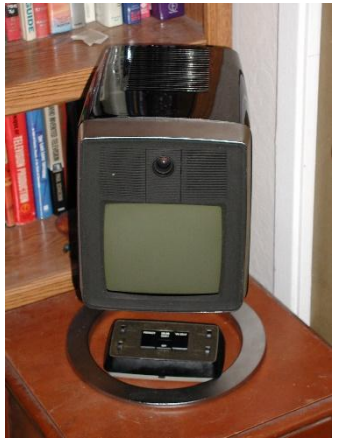
Multics





That future that was to have been



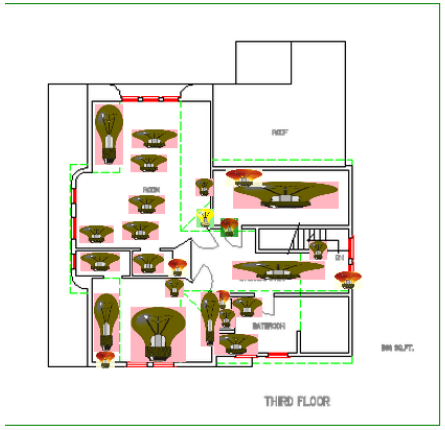


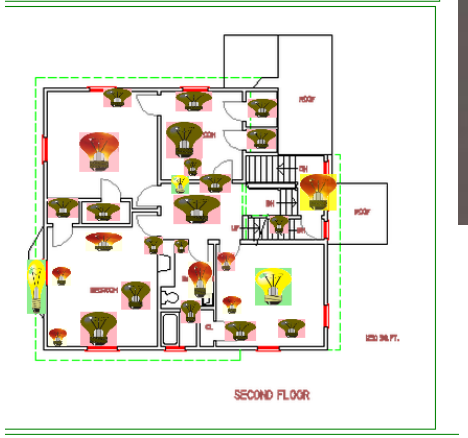
Classic view: Automation

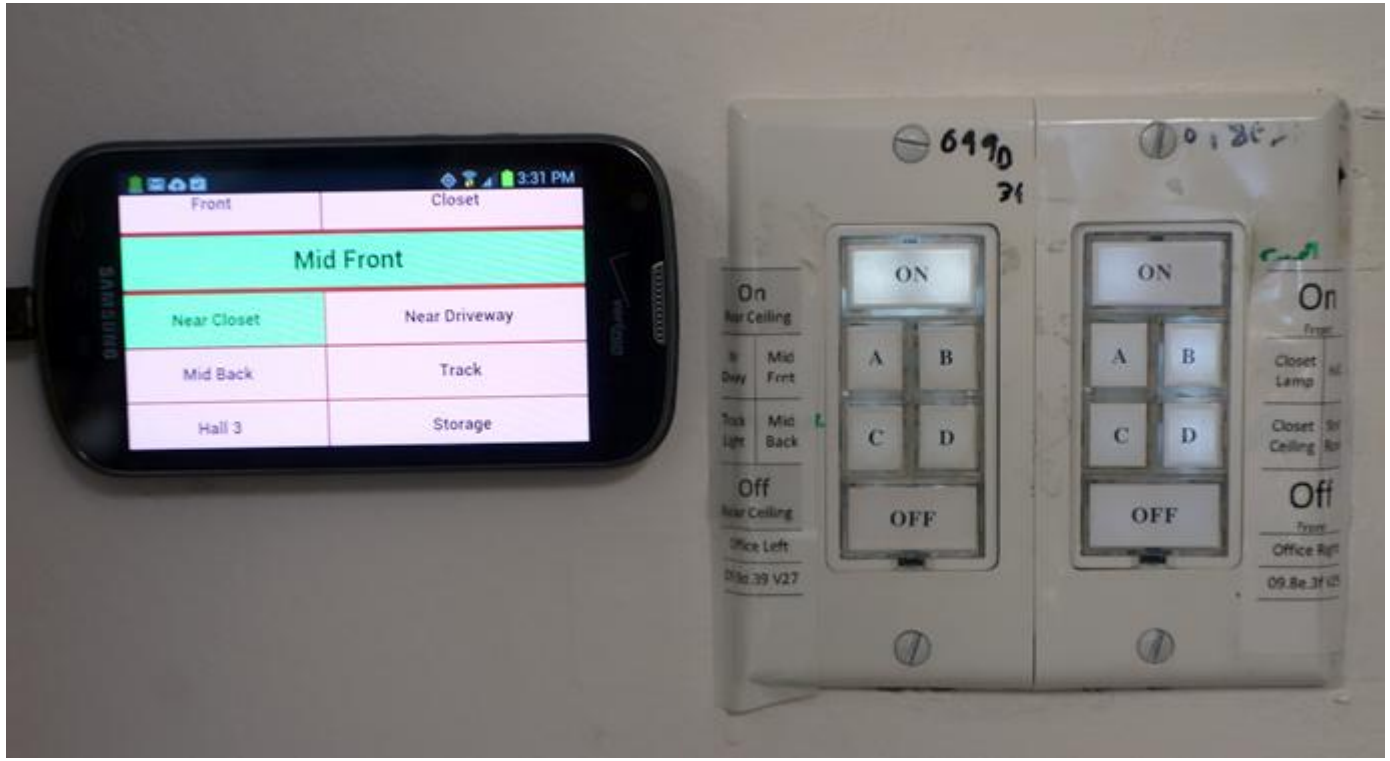
Remaking

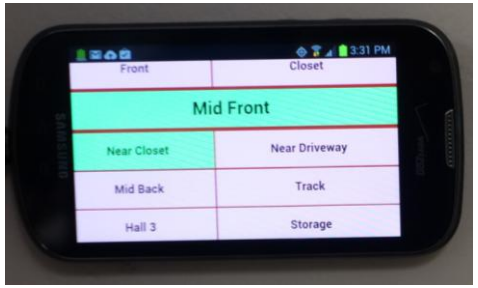
- Classic – Build devices for a purpose
  - High value applications
  - High cost building blocks
- Remaking with low cost resources
  - Using available components
  - Redefining the meaning in software
  - Creating meta-devices

On/Off: The 0 and 1 of the physical world



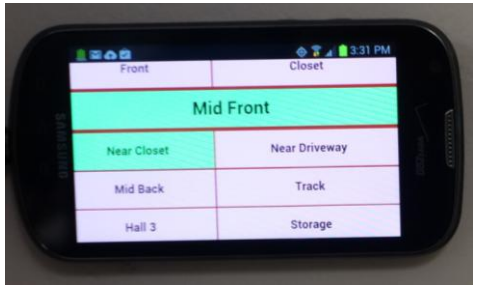






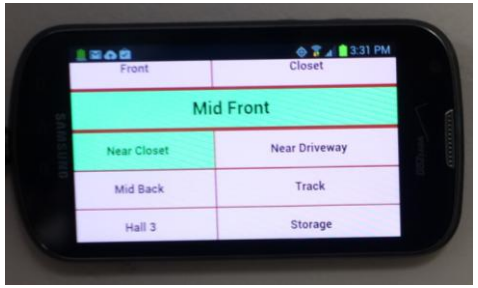
I Learn by Building Something

- Device: Generic cell phone
  - $100 retail
  - Only use on Wi-Fi
  - **Acts** as a “light switch”!
- HTML5 with TypeScript (JavaScript Evolving)
- Insteon – because it turns real things on and off
- Wi-Fi and generic IP
- Velcro now, 3D printing in the future
- *And shims and illusions and >25 years of working-around*



DIY fun and discovery

- Low barrier to utility and entry
- Avoiding *premature* monetization
  - About capturing rather than sharing
  - Marketecture rather than exploration and new paradigms
- We have all this wonderful technology
  - But need appropriate business models



Resources Rather than Solutions

- Sensors, actuators – on/off
- Interactive surfaces and imaging
- Borderless Connectivity
- Computing devices
- HTML5 as the new OS
- Resilient platforms and protocols
- Techniques like Bitcoin and QR Codes
- And services cloudy or whatever with APIs

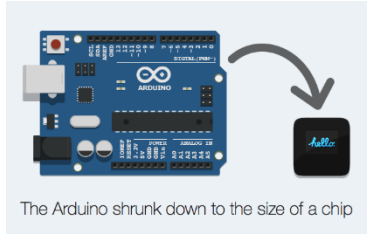
Understand Mongering

- Fish Monger
  - Teach a man to fish and you lose a customer
- Fiber Mongers
  - Learn to use existing resources and you lose a customer
- Big data mongers: Mass Data vs. knowledge.
- Smarts mongers: They capture knowledge.
- Chip mongers and their standards
- *Speech Mongers: Cable and Telcos own the borders*

Making it Easy

We can solve hard problems but not easy ones

Need to justify high cost solutions



Or we can create opportunity for DIY and what seems mundane.

Channel thinking is endemic

- Silos: Technology embedding purpose
  - Purpose built into the infrastructure
  - Gatekeepers who control pipes
  - Message rather than bit protocols

USB Cable
Ethernet
HDMI w/Ethernet

Messages passing / Channels Again

- Dependence: Messaging protocols – Content Aware Gateways
  - Analog Telephone wires and video RG-6
  - SS7, Bluetooth, USB, SATA, Cellular, Zigbee stacks, IEEE-1394, HDMI, IR etc.
  - *Providers or Chip companies adding "value" by handling the messages*

New Paradigm: End to End just bits

- Bit protocols – Content indifferent
  - IP as a resource
  - MAC packets within a bridged “network” and BLE and other radios
  - Email or large datagrams
  - Serial tunnels
- Best Efforts
- References
  - Bitcoin and QR Codes (and new topologies)
  - URLs

Case Study: Connected Healthcare

- Original: Local radio to phone dialer
- Current stage relaying via cell phone (or Wi-Fi)
  - Bluetooth has to be setup carefully
  - The account has to be setup just right
  - Authentication must work
  - Must have the right cell carrier
  - Can’t Extend coverage
  - Wi-Fi hits WEP/WPA border crossing
- Borderless Ambient Connectivity “just works”

PHILIPS Lifeline

powered by at&t

Business ⇔ Technology ⇔ Paradigms

Telecommunications, Radio etc.

- Technology
  - Value in the pipes and services
  - Transporting meaning
  - Radio as a business model
  - Broadband invites control
- Business of providing
  - Pipes behind paywalls
  - Only profitable bits carried
  - Services built in (SS7)

The Internet, Borderless Connectivity

- Technology
  - Distributed “smarts”
  - Value is outside of infrastructure
  - Transporting bits
- Business
  - Common infrastructure
  - User/Community owned facilities
- Anyone can provide services
  - Must discover what works

(Public) Policy Implications

- Understand silos as the new monopolies
  - Focus on creating opportunity rather than just enumerated solutions
- Can start locally with borderless ambient connectivity
  - Using the existing Internet as a facility

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Challenges … and Opportunities

- Bit Rot, Compositing “Intelligence”, Buffer Bloat, Binary Blobs
- Accepting risk in return for opportunity
- New Literacy
  - Concepts like binding and reference
  - New social and trust models
  - Understanding dynamic systems and accepting ambiguity
- Meta systems and sub systems
- Identity
- 3D Printing
- *We’re at the beginning of the beginning*

For More …

- Bob Frankston
- http://Frankston.com