



# Two-Sided Marketing to Incent Internetworking Networks of Things - Gnawing away@IoT Silos

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Tallinn, 18.7.15



# History of Mobile Cloud

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- Smart Phone disintermediates Cellular
  - Cloud/Web disintermediates telco
  - Cloud/Web end run ISPs
- But wait ... we missed something
- Internet was meant to democratize
  - Flatter, P2P, Decentralized
  - Devices (in pocket&home) powerful enough
  - Uplinks nearly fast enough now
- How to reboot?



## Old school capitalism & socialism

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- See *Future Perfect: The Case For Progress In A Networked Age* , by Steven Johnson

<http://www.amazon.com/dp/1594488207>

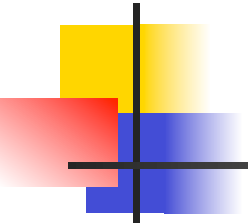
- There's a good case made for new ways of doing business
  - Not a *Legrand Star* or a *Hayek Hub*, but
  - **A Baran Web....**



## Taking sides...

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- Alec Broers wants Big Companies
  - Like Intel, IBM, etc
  - ex IBM, VC Cambridge, now chair of house of lords ctee on S&T
- Andy Hopper likes what we do
  - Head of dept CL
  - 10 startups, 2 IPOd....
- Who do you believe?
  - Time for science (experiment w/ biz model)



# Cambridge has been doing new business cases for some time

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- ARM
  - Mostly fabless chip designer
  - More chips than intel out there...
- RealVNC
  - Open source desktop virtualisation
  - Millions of users...
- Ubisense
  - Actually, fairly traditional h/w -> IPO
  - Used by BMW on production line.



## More radical

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- Xen
  - Open Source - the Cloud (Amazon EC2)
  - Engaged with ALL of industry (not just 1 preferred initial customer)
  - Intel AND AMD
  - Microsoft and Sun/Oracle and HP ...
  - Acquired by Citrix for 500M USD.
    - Pretty much standard value in expertise
    - 50 kernel hackers with PhDs:)
  - Big 2nd customer was Tesco... ..



# More radical still

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- Raspberry Pi
  - Charity
  - 500,000 units shipped in 6 months.
  - Doubled application rate to University CS
- HAT
  - Building Open Buildings
  - Internet of things - to be seen
- Unikenel Systems
  - Signpost ... ..disintermediation
  - Open Source, decentralised, appstore

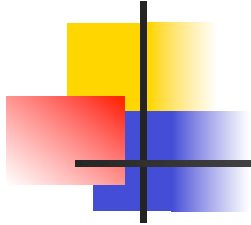


# HAT:Internet of Things

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- Thing 1 - we need an app store to network legacy (and new) appliances
  - Commodity Appliance Thing
- Thing 2 - we need a new app store for people to contribute apps to federate (and isolate) Systems of Things
  - Home Appliance Thing
- See Dr Seuss for more details:  
[http://www.youtube.com/watch?v=fj\\_xwgLW\\_4I](http://www.youtube.com/watch?v=fj_xwgLW_4I)





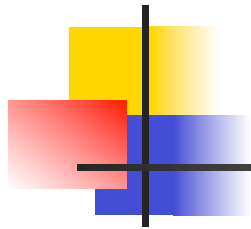
**How to will it work?  
Well let me tell you,  
We collect data using things  
Named Thing 1  
And Thing 2**



# Internet of Things

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- Need a grass roots (cottage industry)
  - Therefore need to give people tools
  - Equivalent of knitting needles+wool
    - Or sewing machines and thread (better)
    - Or even looms
- Hence need 3D Sculpters & Printers
  - But also need to give them **upload** capability
  - Moral equivalent of knitting pattern contributions made to magazines & books
  - But 3D CATs uploaded to websites
  - 3D HATs are easy (c.f. Fresnel project:)
- Hence need 3D scanners too



# Render Unnecessary

<http://ffffff.at/free-universal-construction-kit/>





# Intellectual Property is Theft

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- See aforesaid book for why
- Patents are not capitalism,
  - they are monopolistic
  - Long patterns incentivize companies to hide background longer term knowledge
  - 10 year pharma pattern is longer than the survival rate of someone's creativity
  - So blocks the sideways flow of innovation
  - Especially in methodologies



# Alternatives

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- Xensource worked without IP protection because....
- A big incumbent cannot catch up with 5, or even 50 smart people working on an exciting new idea
  - Throwing 500 people (at MSR) doesn't work
  - Old news (c.f. Mythical Man Month)
- So novel S/W doesn't need any protection than raw speed of development



## Some possible exceptions

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- Modest, but useful, genuine h/w innovations -
  - e.g. Dyson bagless vacuum cleaner
  - Patent lifetime perhaps could be shorter
  - Invention to market cycle\*2 == 5 years?
- Peer Patent Review
  - Deals with scale out of
    - Finding prior art
    - Detecting obviousness << patent >> sufficiency



# Employee Owned Business models

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- Good karma
  - Works outside of business too
  - Incentive alignment without toxicity
- What if society is the employer?
  - So government is the employee
  - So how to use EOB in government?
- Sort of
  - Uber
  - Airbnb



# Mezzanine Conclusions, Discussion

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- Today HAT, REMS, Ocaml Labs
  - <http://hubofallthings.com/hatoutputs/hat-briefing-papers/>
    - Especially HAT Code of Practice!
  - <http://www.cl.cam.ac.uk/~pes20/rems/>
  - <http://www.cl.cam.ac.uk/projects/ocamlabs/>
  - Platform (free), toolchain (free), service (tbd)
- Tomorrow,
  - World Peace and an end to Hunger?
- Live long and prosper







# DO\$H - Decentralized Object Storage Help (need better name 😊)

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- How to incentive decentralized system?
- Lets think about monetizing ...
- Not just token payment...



# Background to P2P and Virtual Currencies

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- Peer-to-peer systems avoid infrastructure
  - Eschew centralised ownership/management
  - Examples:
    - Internet (originally), Usenet
    - Mesh wireless nets
    - Mobile Ad Hoc Nets (MANETs)
    - Opportunistic/mule nets are examples



## P2P #2

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- Mutual exchange of resources
  - Layered on another (infra or p2p) net
  - Structured v. Unstructured, DHT, Key, Value stores, in Cloud (Cassandra etc)
- Storage
  - BitTorrent, Freenet, Eternity
- Computation
  - SETI@Home, ClimatePrediction.com
- Service (e.g. Presence)
  - Skype (originally)



# Virtual Currencies

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- No currency - direct barter
  - Air Miles
  - Subway tokens
  - Exchanges - credit cards, paypal
- New:: BitCoin, Ripple, Properties
  - Decentralised Mint
    - no Owning/coercion
  - Decentralised Verification
    - mutual benefit in verifying == p2p store/check
  - Non-inflationary (BitCoin)



## Mint/Verify BitCoin - crypto

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- Basic trick is "proof of work"
  - Mitigates both forgery&double spending
- P2P verification entails keeping history
  - Transaction chain->not strictly anonymous
- Various possible problems like hoarding
  - Plus finite total (eventual) number of BitCoins -> possible loss impact
- "Alien Technology"



## P2p incentives and currencies

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- We've been trying to get incentive alignment in p2p
  - Bittorrent uses tit-for-tat tokens
  - Did same in our work on mesh wifi
  - With deflationary currency to deal with
    - People leaving with money in their pocket
    - People joining/starters...
- Then along comes bitcoin (and ripple)
  - But....



# Objections to BitCoin

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1. Proof of work is a waste of energy
2. Not anonymous (at least not as much as some people think)
  - We don't like 1, but we don't mind 2.
  - So.....



## DO\$H: an anonymous idea (by me)

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- To fix some elements of bitcoin
  - And p2p storage systems
  - Blockchain (integrity/append only log)
- Specifically,
  - Want to fund the Personal Cloud vision
  - with backup/resilience
  - other goodness properties





# Personal cloud

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- Everyone keeps their personal data
  - In their pocket
  - In their home hub, or car or bike
- But want backup (or nearby copies)
  - Could crypt and put in cloud
  - Or crypt and put in friends/family
  - Or even (many) arbitrary other users stores
- How to pay for cloud storage/cpu?



# Monetizing Personal Data

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- Don't "*put all our eggs in one basket*"
- s/facebook/personal cloud/
- Monetize data *case by case* basis
  - Idea also from HAT project
  - Have relationship with many vendors of goods and services - loyalty cards etc
  - They don't have usage data - we do
    - in personal cloud - home power, fridge, fitbit, scales, washing machines etc



## Model is they pay us

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- Supermarket/pharmacy pay us for data
- In DOSH
- Generate DOSH coins by crypting our data - i.e. useful
- So we get adverts, but they don't leak data
- we also get DOSH, and could give BACK in exchange for no ads (just storage)



## DOSH is quite like BitCoin

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- But not deflationary - but bounded by people and goods used
  - so can't hyperinflate due to sustainability of world
- Keep BitCoin model of auditable verification chains
  - so can discourage use for Silk Road #3



## Two more ideas

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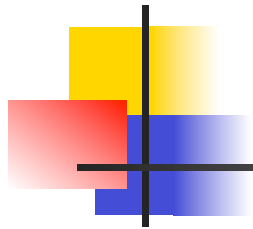
- Could source randomness for hashes DOSH protocol from non-co-ercable places
  1. Sustainable energy sources (solar/wind) contain natural randomness, which can be observed/recorded but aint easy to fake/force
  2. Could also use 3D printers DRM random source (and so mark real world goods 3D printed with BitCoin verification hash



## Have some pieces

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- <http://perscon.net/>
  - <http://nymote.org/software/irminsule/>
  - Need to do open source DOSH
  - And find some seed users...
- 
- You didn't hear this from me



# Who Am I?

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