The (I)IoT Problem

Marcel Kyas

Háskólinn í Reykjavík

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What is IoT?

- Smart things that you should buy!
- Things (devices) communicating using standardized protocols?
- Things (devices) communicating using Internet protocols (IPv6, UDP, TCP, HTTP, ...)?
- Things (devices) connected to the Internet (other devices, cloud, ...)?

What is IoT?

Internet of Things (IoT) (ISO/IET)

infrastructure of interconnected objects, people, systems and information resources together with intelligent services to allow them to process information of the physical and the the virtual world and react

- objects:
 - things that can act
- people?
 - infrastructure of people
- systems:
 - collection of things
 - services
- information resources: things that can provide data
 - sensors
 - data bases

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Examples

- HP JetDirect print server (1991)
- NEST Smart Thermostat
- Philips Hue Smart Bulbs
- August Smart Lock
- Lively Personal Emergency Response System
- Automatic Car Tracking Adapter

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What is IIoT?

- Application of IoT in industry
 - transportation
 - energy
 - manufacturing
- Focus on machine to machine communication
 - instrumentation
 - sensors
 - machines

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Examples

- DHL's IoT Tracking and Monitoring
- Cisco's Connected Factory
- Oceanit Laboratories' Smart Cement

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History and Vision

- Embedded systems
 - process data from real world
 - influence the real world
- Ubiquitous computing (Weiser, 1992)
- Context dependent computing (Shilit, Anders and Want, 1994)
- Kevin Ashton (Schoenberger, 2002): "we need an internet for things, a standardized way for computers to understand the real world"

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The Problem

- Everyone tells us (I)IoT is great!
- But 76% of all IIoT projects fail (Cisco)
- Complexity
- Loss of control
- Security
- Safety
- Reliability
- Wrong incentives
- Technical concerns
- Societal concerns



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Switch on the light

- Previously:
 - A switch breaks current to light bulb
 - Need to walk to the switch, flip it, light is on
- The IoT light bulb:
 - Wireless transmitter sends message to hub
 - hub sends to cloud service
 - find the light bulb
 - last settings
 - cloud service sends message to hub
 - hub forwards to light bulb



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Privacy

Loss of Control: Personal Identifiable Information

- IoT stores data in the cloud (medical devices)
- Collects data without me knowing or consenting
- I cannot verify what is happening
- Even if I understand the risks, there is nothing that I can do
- data leaks, back doors, access by authorities



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Cnet, February 8, 2015

Reliability

- Network failure? Heating / air conditioner go haywire
- Phone battery drained? Cannot open the door?
- Cloud service crashed? Does not fail to dumb, but to unavailable
- Manufacturer bankrupt? Congrats, you have a paper weight
- Devices do not interoperate, everything comes with its own app and cloud service



New York Times, Jan 13, 2016

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Security

- "Time to market" more important than "mature product"
- Cannot sell security as a feature
 - No budget for security
 - No user interface
- Aquarium thermometer hacked? Cloud hacked?
 - Access to the whole network!
- Life time of the product exceeds support time
- Work done by engineers, not security specialists



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Safety

- Peoples lives depend on heating, door locks, or medical devices
- Also big concerns about self-driving cars
- My neighbour's devices make me afraid

I see how well built my IoT toothbrush is. How can I trust that they do it better with autonomous cars?



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Wrong Incentives

- Support costs money, but does not generate income!
- Profit margins are small, market is competitive, why produce quality?
- The faster it breaks, the higher my turnover.
- Users have no incentives to secure systems



Of 10 IoT-connected home security systems tested, 100% are full of security FAIL

HP researchers tested 10 of the newest connected home security systems and discovered the Internet of Things-connected security systems are full of security FAIL.

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Market forces

- Forced use (Smart Meter)
- Hard to get TVs without hard drive, smart, or cloud
- Vendor lock-in trumps open standards
- No required security standards (first steps GDPR)
- standards that exist designed to protect business models

What if my landlord uses IoT in my apartment



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Technical concerns

- I want to use it in my LAN, not the Internet
- Configuration/administration impossible without keyboard and screen
- Everything needs to be charged
- Small, cheap, always lost
- You do not realize that the light bulb is member of a botnet



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Societal concerns

- Hardware is broken, software is buggy
- There is no security, everything has back doors
- My data is in the cloud, it may get lost/into the wrong hands
- Get used to a world without privacy
- Don't know what my devices do and to what it talks to



The German distributor of talking doll My Friend Caula insists it is safe to use but takes backing claims "very

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Cannot do it, won't even try

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Expectations

- Budget devices create different expectations than expensive devices
- But they are all similar
- YouTube App stopped working on many Smart TVs
 - Sorry, app is made by Google



Support

- Average life time of a freezer: 15 to 20 years
- Average, not maximum
- 20 years ago:
 - Nokia 5110
 - Windows 98
 - Yahoo! Search was most popular, AltaVista
 - Google, Inc. founded
 - Amazon only sold books
 - Buffalo boots
 - Halldór Laxness died
 - Spice Girls "Spice Up Your Life"
 - Páll Óskar "Minn hinsti dans" (1997)
- dot-com-crash March 10, 2001



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20 Years of Support?

- Windows 98 was supported until 2006
- RedHat Enterprise Linux 7 years
- Mozilla web browser 1 year
- Windows XP: 12 years

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20 Years of Support?

- Nexus 4
 - Introduced November 2012
 - Discontinued November 2013
 - 1 Million Units sold
 - End of Support May 2015
- Today 2 years support from release date



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What are the promises of IoT?

"What are the real world problems being solved by IoT at your organization or by one of your clients?"

"Automotive software - most cars today have 100 million lines of code. We're quickly evolving from sensor-driven cars to self-driving cars. The auto industry is not used to the lifecycle required for updating IoT devices.

Most car recalls today are software related. Ultimately software related recalls will be handled remotely."

The central promise of IoT!

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The central promise of IoT!

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Scenario

- Our company sells airbags
- does not function correctly, puts life at risk

Industry 3.0

Recall, billions of damages, threat of bankruptcy

Industry 4.0

Firmware update via Internet.



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IoT: Optimizing Cost

IoT is a strategy of the industry to reduce cost

- Methods to reduce cost:
 - (1) Skip processes, cheaper parts (reduce quality)
 - (2) Drop features (loss of functionality)
 - (3) Leaner processes
 - does not happen often, people protect their jobs

IoT: Optimizing Cost

Epiphany

- IoT is about companies, not customers!
- Your data is our product
- Advantages to customers are incidental at most
 - "I can update the device myself!"
 - I can segment my network to keep devices from leaking data
- Great opportunity to externalise liability and consequential costs



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M. Kyas (RU)

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What should we do?

- (I)IoT problem is aggregation of known problems
- big data and no security
- loss of trust
- planned obsolescence
- lack of liability
- smart in the cloud reduces cost of device
- "Après nous le déluge" startup mentality

Change the rules

- GDPR/Lög um persónuvernd og vinnslu persónuupplýsinga
 - Incentives for secure design (25 gr)
 - Incentives to protect data (32 gr)
 - Fines (83 gr)
- Data economy: only store and process what is absolutely necessary
- Critical infrastructure: fine for failures, full liability for consequential damages
- Require full support for at least seven years
- Manufacturer liability, cf. cars, fridges
- Require insurance to guarantee after bankruptcy
- This is a European project

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Summary

- (I)IoT is hyped, little measurable benefit to users
- (I)IoT systems are too complex
- Wrong market incentives
- Change Rules to sustain IoT
- Less bleak for IIoT
 - Know why you roll out
 - Measure benefits
 - Everything has its cost
 - firewalls increase latency
 - crypto increases cost
 - . . .



A sounds of wooks and 1 pointed out that the "Internet of Things" was a disaster waiting to harmon

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