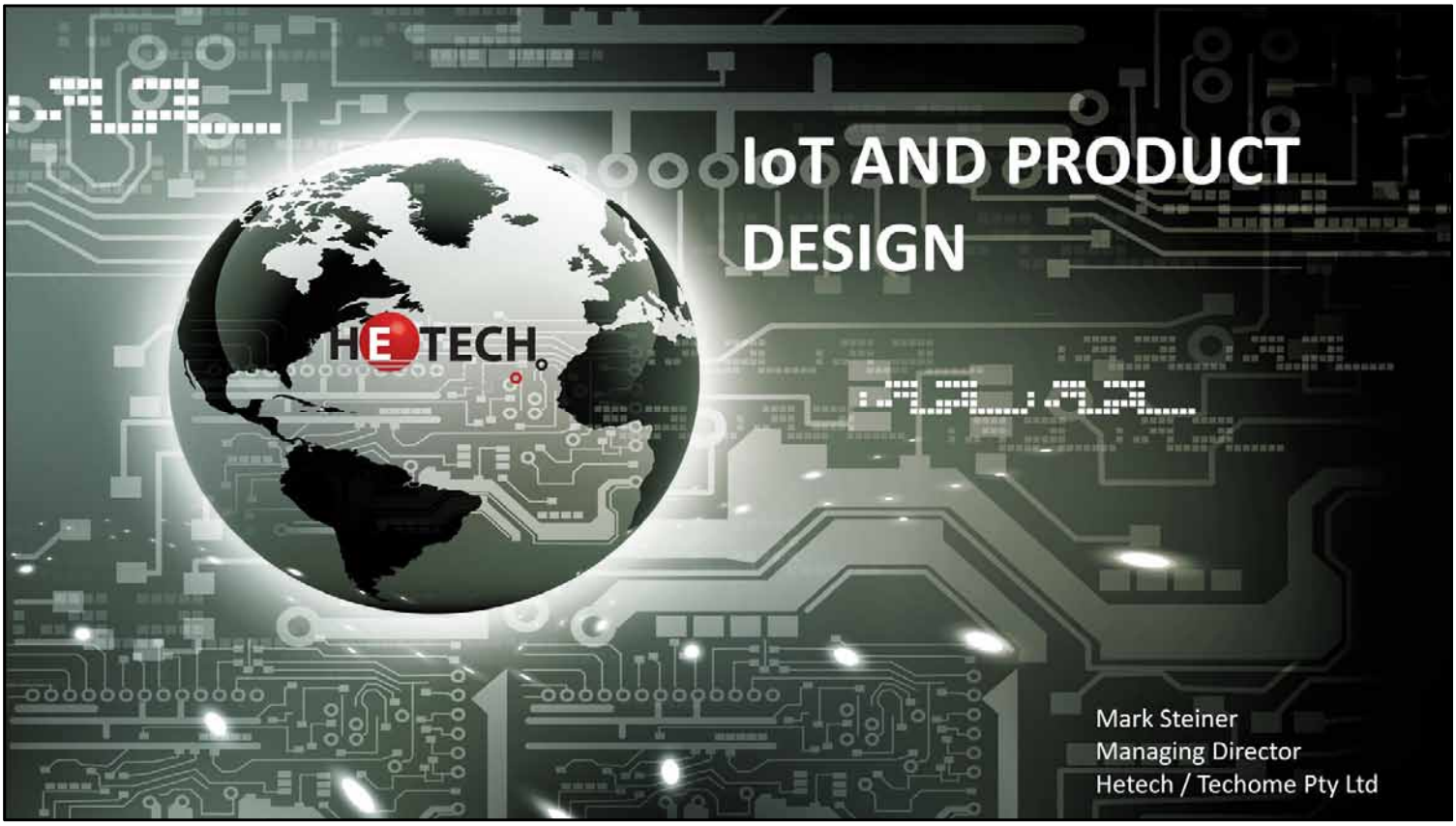


My Name is Mark Steiner MD of Hetech and Techome…..our sister company dealing in Home Automaton / IoT / etc
I have worked with Omega sports timing / Siemens in Telecommunication / Utilities and metering/ load management and now manufacturing of electronic products

Why me and why Hetech /Techome…..well …we design products and we are electronics engineers……..
Many customers ask us about interfaceblity of their products…..bluetooth / WiFi…etc
So….we needed to skill us up…..
Firstly we are NOT experts in IoT technologies…..but we are good at looking at technologies from a holistic /overall point of view..

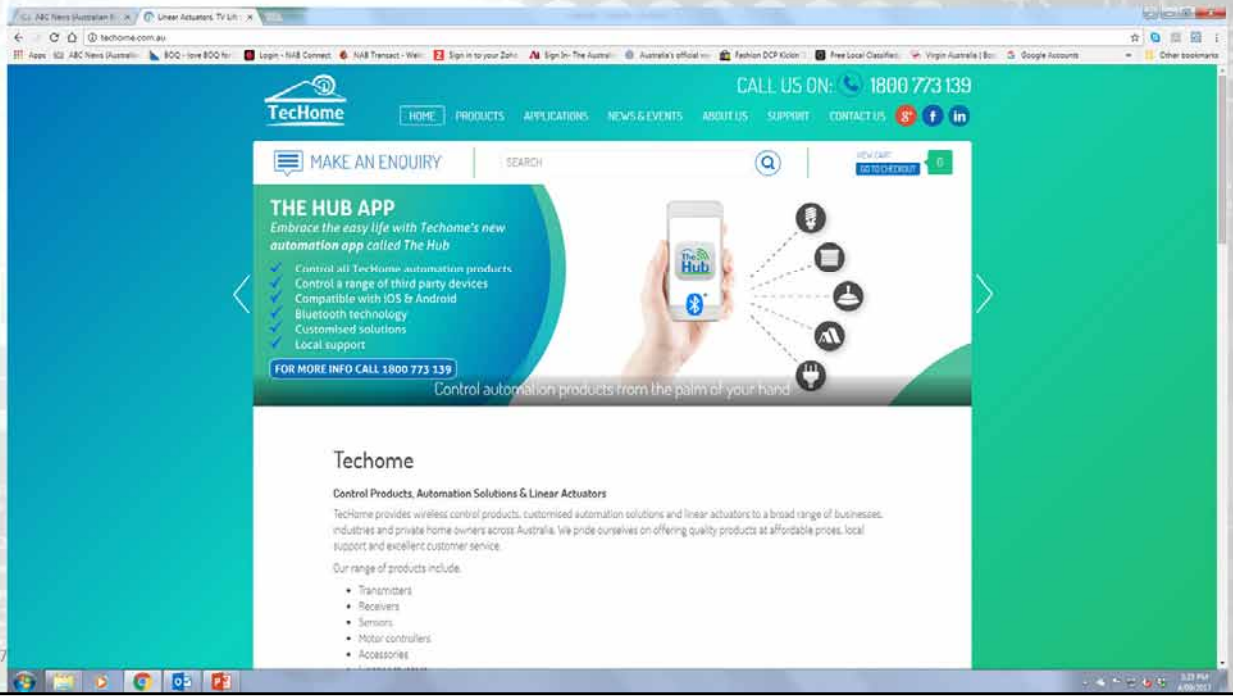
Who is Hetech?

1. Formed in 1991
2. 40+ staff
3. Full electronic Turn-key product development (design & manufacturing)
4. Defence/ Mining /Automation /Solar /Scientific

27/4/2015

Hetech is part of the DMD group of companies which includes Hetech and Techome…

www.techome.com.au



Techome - Motion and Automation……..controlling motors with smart controllers….using smart technologies
So we got Opening roof controllers / Light controllers / controllers/ a smart Hub….and an APP.

IoT and Design.....a few points!

1. What is IoT
2. Technologies/Devices/Frequencies
3. Where is IoT used -Applications
4. How is it going to change design....should I care?
5. IoT Obsolescence
6. Manufacturing/ Industrial Design
7. And now what?

Here it is……..I am going to talk a bit technical but look at the overall approach…..So listeners may have watch Simon's presentation yesterday….Simon is from Lxinnovatins in Sydney and he loves IoT.

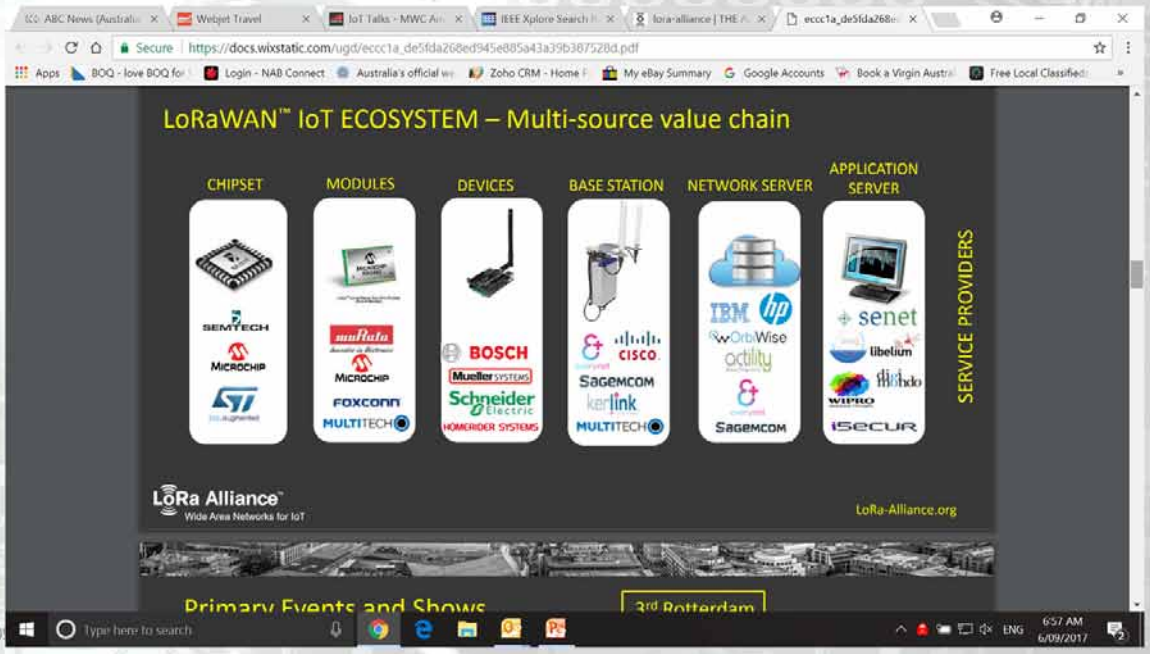
1. What is IoT?

- **Inter-networking of physical devices (smart or connected devices) by exchanging data**
- **All the components that enable businesses, governments, and consumers to connect to their IoT devices, including remotes, dashboards, networks, gateways, analytics, data storage, and security**

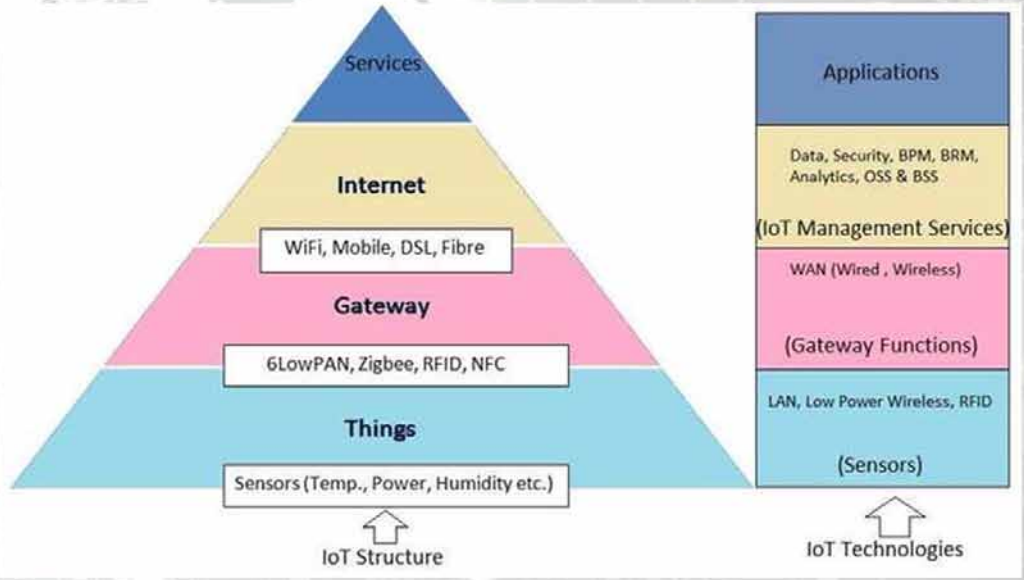
=> Any electronic device communicating!

The **Internet of Things** (**IoT**) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data.

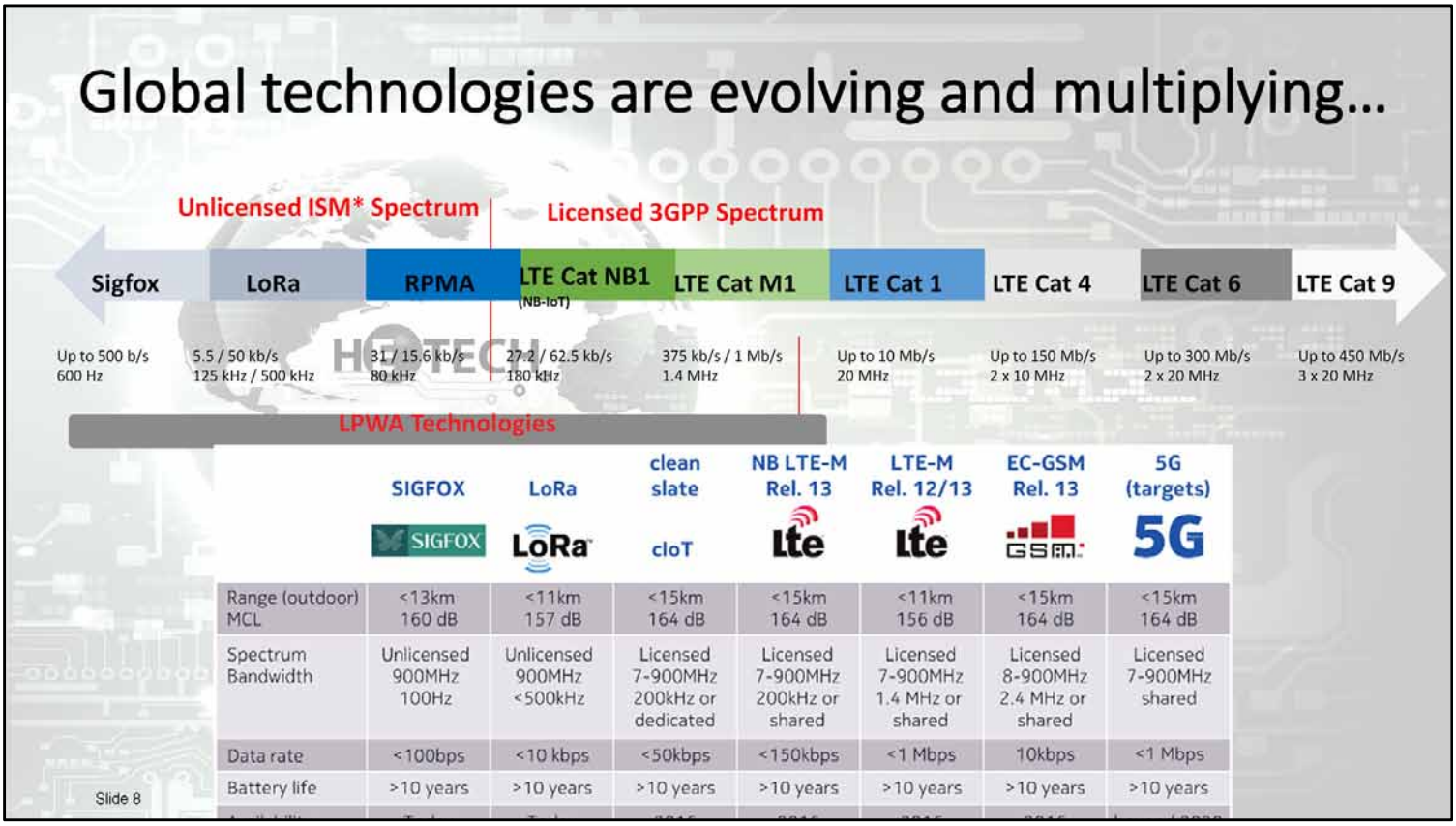
2. Technologies / Communication/Devices



2. IoT Overview



Well….that's the best I could find about an overview…….so the lower you are on the this pyramid the lower the frequency, the lower the data throughput, the longer it takes….but the higher the range of communication



	SIGFOX	LoRa	clean slate cIoT	NB LTE-M Rel. 13	LTE-M Rel. 12/13	EC-GSM Rel. 13	5G (targets)
Range (outdoor) MCL	<13km 160 dB	<11km 157 dB	<15km 164 dB	<15km 164 dB	<11km 156 dB	<15km 164 dB	<15km 164 dB
Spectrum Bandwidth	Unlicensed 900MHz 100Hz	Unlicensed 900MHz <500kHz	Licensed 7-900MHz 200kHz or dedicated	Licensed 7-900MHz 200kHz or shared	Licensed 7-900MHz 1.4 MHz or shared	Licensed 8-900MHz 2.4 MHz or shared	Licensed 7-900MHz shared
Data rate	<100bps	<10 kbps	<50kbps	<150kbps	<1 Mbps	10kbps	<1 Mbps
Battery life	>10 years	>10 years	>10 years	>10 years	>10 years	>10 years	>10 years

NB=Narro band
3GPP = 3rd generational Partnership project
LTE = Long Term Evolution …..a 4G mobile communications standard.

LoRa = Group of companies have come up with a Low Power Long range protocol **LoRa** Alliance™ Technology. LoRaWAN™ is a Low Power Wide Area Network (LPWAN) specification intended for wireless battery operated Things in a regional, national or global network. LoRaWAN targets key requirements of Internet of Things such as secure bi-directional communication, mobility and localization services.

Sigfox is a French company founded in 2009 that builds wireless networks to connect low-energy objects such as electricity meters, smartwatches, and washing machines, which need to be continuously on and emitting small amounts of data.

2015 Nokia Networks, Ericsson and Intel teamed up to promote Narrow-Band Long-Term Evolution (NB-LTE) technology as a wireless connectivity solution to facilitate growth of the Internet of Things (IoT) segment.
The announcement has set the stage for a showdown at this week's 3GPP meeting in Phoenix, Arizona, at which various groups and firms will present submissions for future LTE releases, as well as 5G. That includes technologies that will allow LTE to support crucial requirements for the IoT such as long battery life and cheap modules.
NB-LTE is seen by some as a direct challenge to Huawei Technologies, who is backing Narrowband Cellular IoT (NB-CIoT), which has already gained operator support from heavy-hitters like Vodafone and China Unicom.

The main difference between NB-LTE and NB-CIoT comes down to how much of existing LTE networks can be repurposed for IoT. Huawei declined to comment for this post on the differences, but critics of NB-CIoT's "clean slate" approach point out that it requires new chipsets and doesn't seem to be backwards compatible with any LTE network older than Release 13.

NB-LTE, by contrast, "can be fully integrated into existing LTE networks, works within current LTE bands and does not need an overlay network", according to a Nokia spokesperson responding to telecomasia.net via email. In other words, NB-LTE uses more of the existing ecosystem and thus promises better economies of scale.

Tech fights in the 3GPP are nothing new, of course. It's also worth mentioning that the GSM Association's Low Power Wide Area Network (LPWAN) Initiative aims to develop complementary IoT standards for the 3GPP that include both adapted LTE and clean-slate technologies like NB-CIoT.

LPWA Definition

Low-Power, Wide-Area (LPWA) network is a generic term for a group of technologies with the following key characteristics:

- Low power, long battery life (often in excess of 10 years)
- Wide area connectivity and coverage penetration characteristics

- Limited data communications throughput capacity
- Narrowband operation and reduced system complexity

LPWA technologies complement existing cellular mobile networks and short range technologies, enabling wide area communications at lower cost points and better power consumption characteristics for far greater deployment location freedom.

Technology comparison

Feature	2G (GSM / GPRS)	Cat M1 (Full duplex)	Cat M1 (Half duplex)	Cat NB1 (NB-IoT)	Ingenu (RPMA)	LoRa	SigFox
Application focus	Mobile connectivity / M2M	Mobile connectivity / M2M		M2M	M2M	M2M	M2M
Radio Spectrum	200 kHz 3GPP Licensed [1]	1.4 MHz 3GPP Licensed [1]		180 kHz 3GPP Licensed [1]	80 MHz ISM Unlicensed [2] Global 2.4 GHZ Band	125 kHz (typ) ISM Unlicensed [2] 868 MHz (EU) / 915 MHz (USA)	600 Hz ISM Unlicensed [2] 868 MHz (EU) / 915 MHz (USA)
Guaranteed Quality of Service (QoS)	Yes	Yes		Yes	Yes	No	No
Responsiveness	milliseconds => seconds	milliseconds	milliseconds => seconds	seconds => minutes	seconds	seconds => minutes	sec's => min's (140 Tx / day limit)
Roaming	Global	Global		Global	Global	Local [3]	Single network
Peak Data Rate	Up to 85.6 kb/s (DL) Up to 42.8 kb/s (UL)	1 Mb/s (DL/UL)	375kb/s (DL/UL)	27.2 / 62.5 kb/s (DL/UL)	31 /15.6 kb/s (DL/UL)	5.5kb/s (125-bw) 50kb/s (500-bw)	100b/s (UL) 500b/s (DL) [4]
FOTA	No	Yes		Yes	Yes (broadcast channel) [5]	No	No
Range / MCL [6]	Above ground / 139.4 / 144 dB [6]	Basement / 155.7 dB		Underground / 164 dB [7]	Underground / 167 dB	Underground / 161 dB	Underground / 161 dB
Mobility	Vehicular (300kmh) (full handover)	Vehicular (300kmh) (full handover) [8]		Vehicular (100kmh) (no handover)	Vehicular (100kmh+) (full handover)	No	No
Voice Support	Yes (GSM)	Yes (incl. VoLTE) [9]		No	No	No	No
Battery life	5-10yrs	5-10yrs		10yrs+	10yrs+	10yrs+	10yrs+
Cost (Module or eBoM)	$	$$	$	$	$+ (currently)	$	$

Notes:
1. 3GPP Licensed spectrum in 450MHz and 700MHz – 3.5GHz
2. ISM (Industrial, Scientific, Medical) unlicensed spectrum
3. LoRa Public and Private networks are operated by entities in specific areas, there is no guarante of cross-network operation
4. UL: Max 140 mssg w/ payload up to 12 bytes; DL: Max 4 mssg w/ payload up to 8 bytes
5. Separate broadcast channel allows multicast of FOTA, etc. to all devices at once
6. GSM has MCL (maximum coupling loss) of 139.4 dB, GPRS of 144 dB
7. NB-IoT uses Single-Tone signalling in the UL to ensure reliable operation to the cell-edge
8. MNO support initially only in Idle Mode, will support Connected Mode in future FW rel.
9. Future FW release

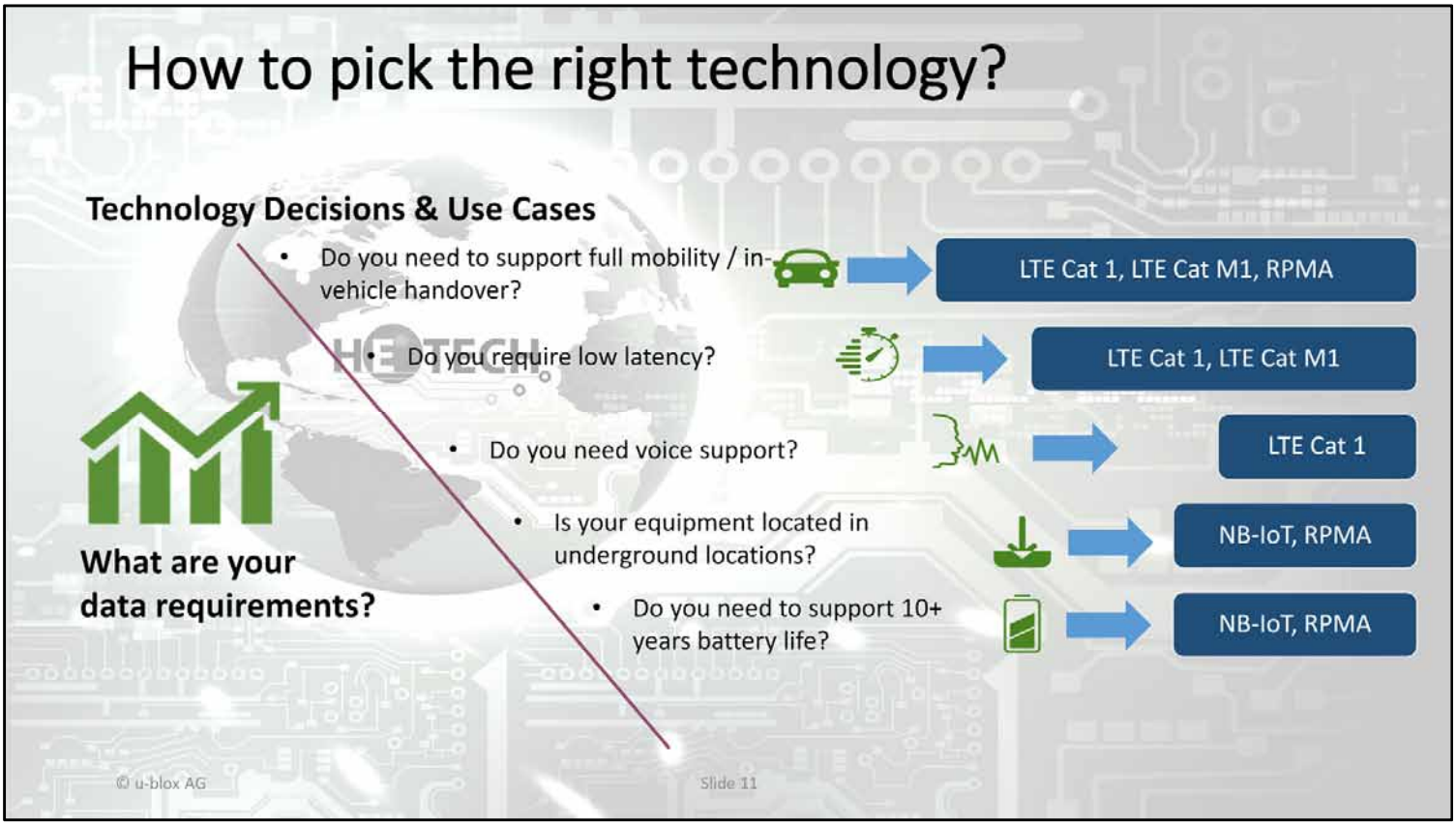
Comments / Speaker Notes:

• The air interfaces supported by u-blox can all provide global roaming. LoRa is deployed by local entities and cross-network communication is not guaranteed.

• All new air interfaces supported by u-blox can support FOTA.

• Of the u-blox air interfaces, NB-IoT and RPMA provide best in-building penetration and longest battery life, although LoRa and Sigfox performance is similar (yet at much lower data rates and higher latency).

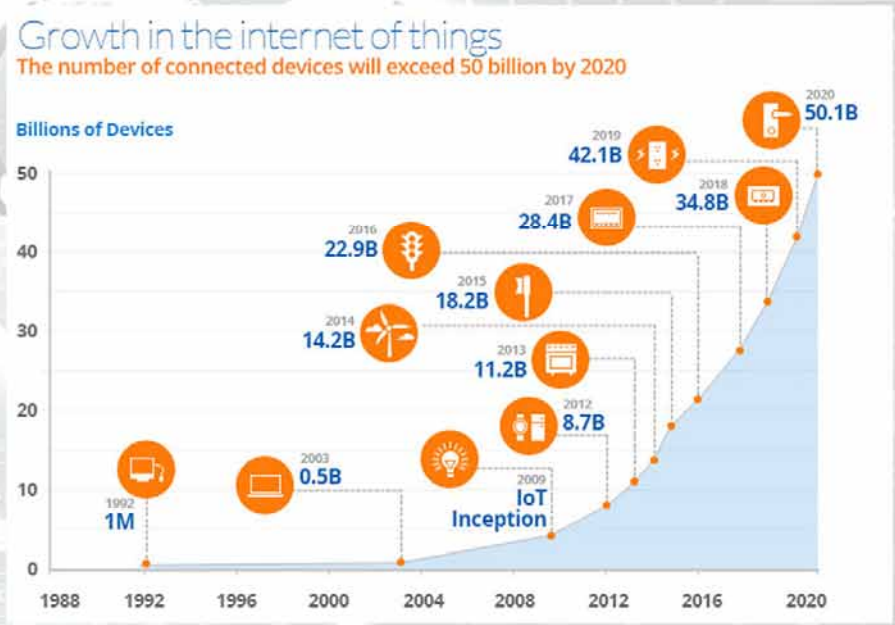
• Cat M1 is the best LPWA air interface to support mobility or voice use cases.



RPMA

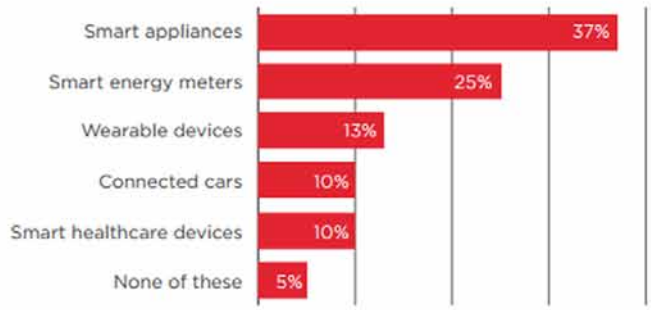
- Underlying **technology takes more processing power** (and thus actual power)
- 2.4 GHz can have more **interference and more propagation loss** than sub-GHz alternatives

3. Growth of IoT devices?



So why do we need to worry and care?.....well these things are growing like mushrooms…so they can't be ignored anymore…..so here we go…..a few stats

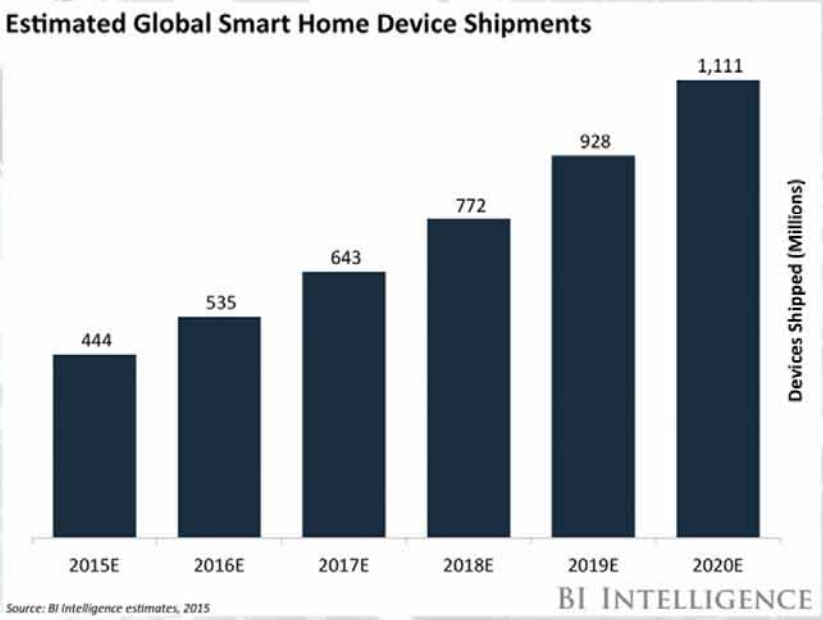
3. Where is IoT used?



1. Smart Homes
2. Wearables
3. Connected Cars
4. Energy Engagement
5. Industrial Internet
6. Smart Cities
7. Agricultural
8. Smart Retail
9. Health Care

3. Where is IoT used?

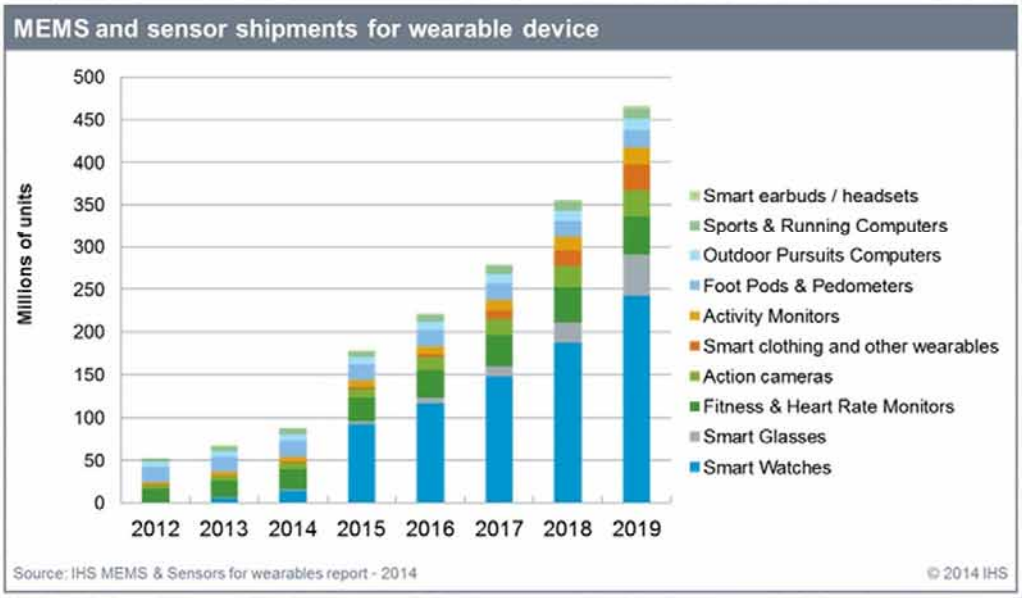
Smart Homes



Techome….has developed products (controllers, etc) connecting to Bluetooth (first) and Wifi…

3. Where is IoT used?

Wearables



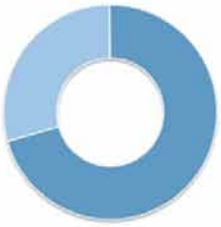
3. Where is IoT used? Utilities

IoT Opportunity: Utilities

Adoption

71%

of respondents are actively pursuing IoT initiatives.



Actively Pursuing

Not Considering

N=84 (Weighted)

Drivers and Barriers

Top IoT Drivers

1. **Better customer service and support**
2. **Lower operational costs**
3. Business process efficiency/operations optimization and control
4. Product and/or service improvement and innovation
5. Information Technology optimization and/or modernization

49%

of respondents cite developing a sustainable business model/ proving ROI as the number one barrier.

Budgets

6.6%

of the average IT budgets is being allocated to IoT initiatives...

Considerations

Lower data acquisition costs

Automate contingent operations

Integration of consumer technologies

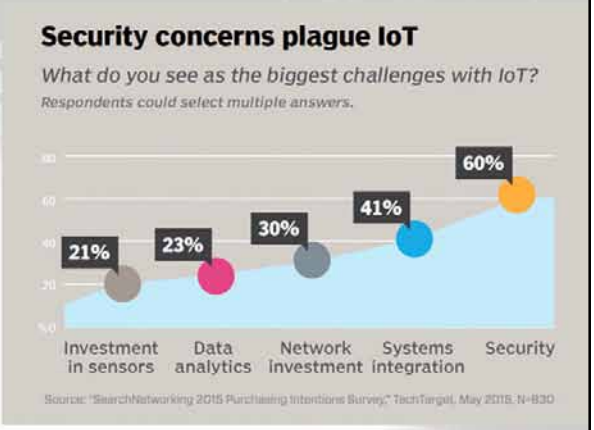
	National Grid	Utilities
GBP Rev	14,147,153,700	IoT Allocation
IT Budget %	2.8%	6.6%
IT Budget	396,120,304	
Capital Budget	114,874,888	
Est. IoT Allocation	26,143,940	

Rev Source: Wikipedia, 2014

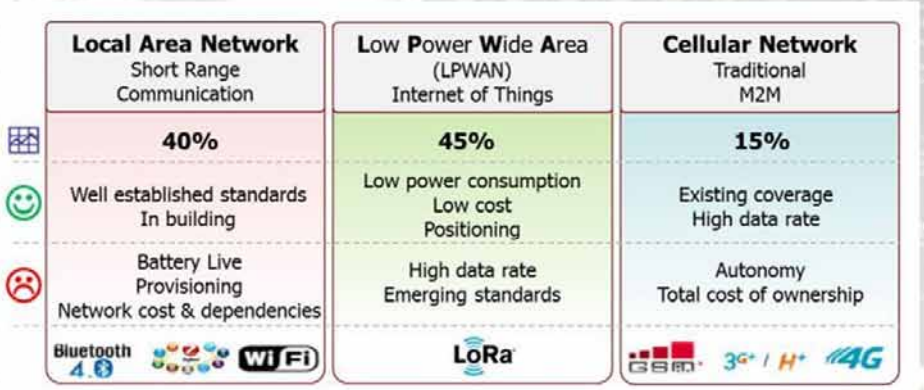
Source: Global Technology and Industry Research Organization, 2014

Data security / Privacy

- **Do we have control over the data?**
- **Do we know what is used where?**
- **Are there options?.....use some platforms but not others?**
- **Cyber hacking / identity theft**



4. What does it mean for Electronic Design (1)



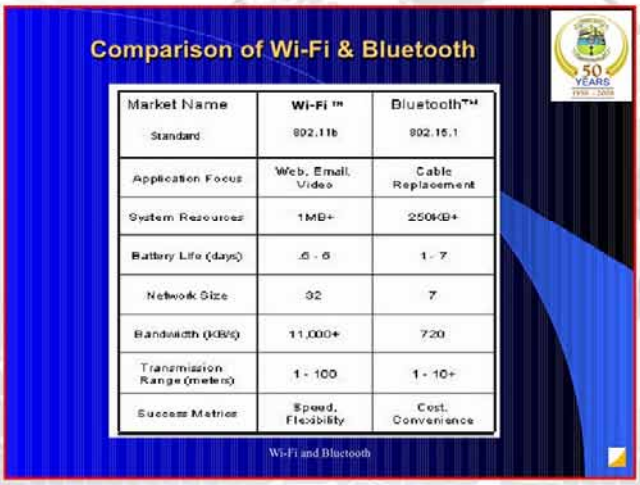
What market is my product sold into?

What is the application?

Benefits for the user?

Ok….let's talk about design….as you are all mostly designers….
Being a "good" engineer lets talk technology and networks…..
Depending on the application which technology /network is best….
In the home you may get away with Wifi / Bluetooth…….
Outside the house….3G/4G……
Smart metering / water metering……LPWA network…..low power long range

4. What does it mean for Electronic Design (2)



Market Name	Wi-Fi ™	Bluetooth™
Standard	802.11b	802.15.1
Application Focus	Web, Email, Video	Cable Replacement
System Resources	1MB+	250KB+
Battery Life (days)	.5 - 5	1 - 7
Network Size	32	7
Bandwidth (KB/s)	11,000+	720
Transmission Range (meters)	1 - 100	1 - 10+
Success Metrics	Speed, Flexibility	Cost, Convenience

What technology do I use?

- Bluetooth vs WiFi
- Sigfox vs LoRa
- 3/4/5G

- Which supplier / company do I work with / use their technology?

Bluetooth vs WiFi……we come across this a lot …..why one or not the other…the table will explain it…..watch BT 5 coming out….longer range / IP address
But always keep the application and the customer / markets in mind.

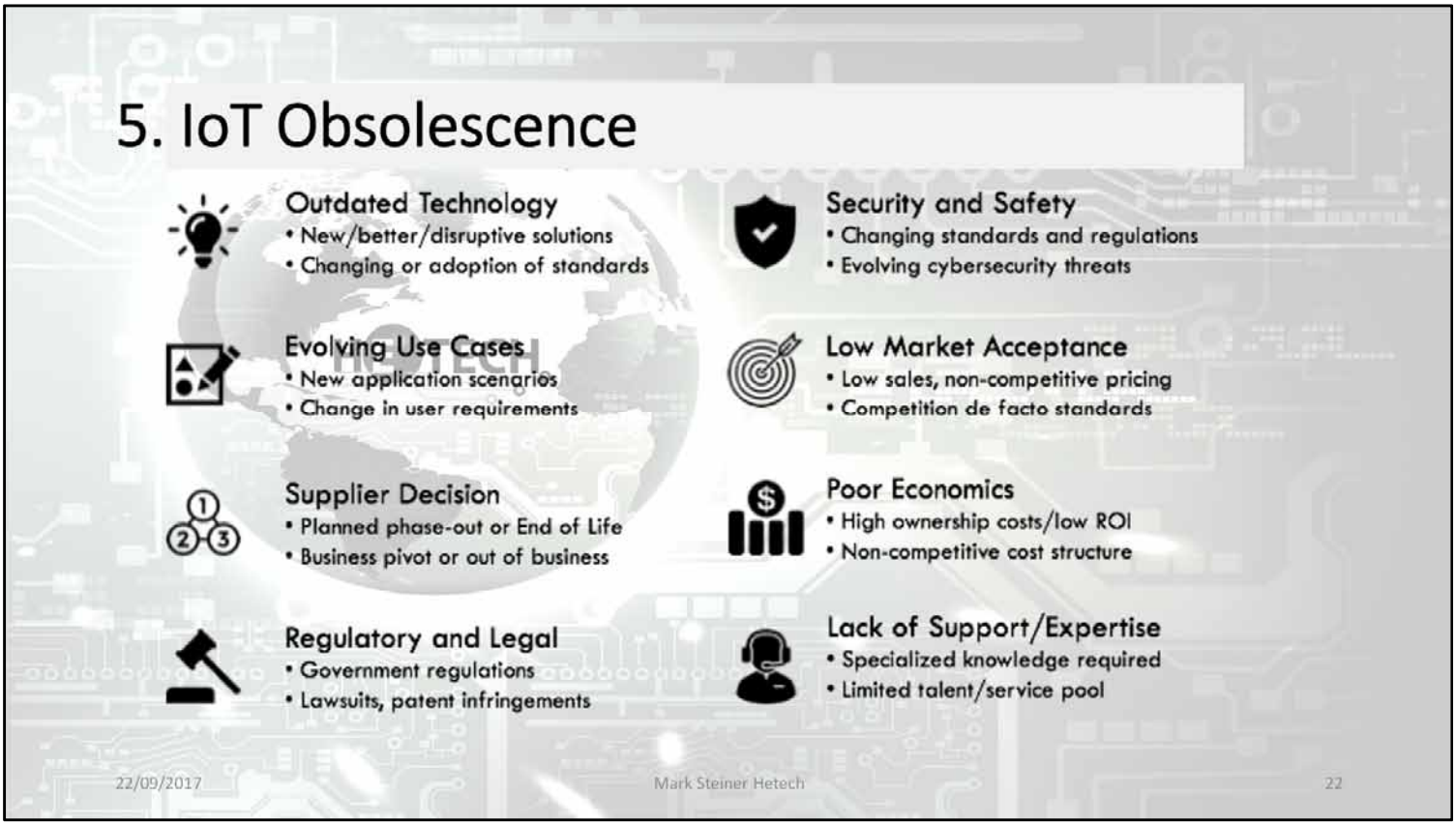
4. What it means for electronic Design (3)

1. When building smart products, user experience is key
2. The importance of electronics placement has never been greater
3. The placement of electronics must be based on shape, material, distance and location
4. In order to align your concept development closer with reality and build a cost-effective IoT product, you must understand smart component pricing
5. Design and costs are strongly intertwined
6. Physical prototypes will get you closer to reality
7. The importance of integrated cross-platform testing
8. Decided to go smart? Build your smart application first!
9. Getting ready for production

Source: Seebo –IoT concept development A-Z

4. IoT Electronic Design Checklist

Choose right technology
Understand customer /consumer needs
Cost
Modularity – Future proofing
Obsolescence
Smart Application – Interface – Data Management



Just a quick word on obsolescence……this IoT world is fast moving and changing a lot…new players come and go….technologies still new and may adapt / change

6. IoT and Manufacturing

- Involve manufacturer at the beginning
- Check capabilities of manufacturer
- What processes are required?
- Low – high volumes? Outsourcing
- Prototype runs
- Cable looms
- Conformal coating / potting
- Mechanical enclosures and assembly

Overall the manufacturing process is not much different for IoT as it is for any new product…..I do mentioned it here because many design engineers forget that their product eventually needs to be manufactured….and the design must be DfM…
Keep in mind if it is a consumer product or industrial commercial

6. IoT and Plastics

- Wireless…needs to be able to penetrate RF
- Connectors provision
- Talk to IoT experts

Well…..keep enclosures and plastics in mind when you design products…..this is the 21st century and the times with square / black boxes are over…..talk to industrial designer.

7. ….and now what?

- Stay tuned on what's happening in the market (driverless cars, utilities, home/industrial automation)
- Be involved with the IoT community
- Try to future proof designs
- Always keep costs in mind
- User is king…be critical

…… useful links and blogs

- www.seebo.com
- www.u-blox.com
- www.everythingiot.com.au

..... useful links and blogs

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How do best-in-class companies build **compelling smart product concepts**? Register today to learn a proven methodology for developing smart product concepts, as used by successful manufacturers. Take the opportunity to discuss your questions with our panel of Internet of Things (IoT) experts.

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Who should attend:
product managers, engineers, and innovation officers of industrial machinery, commercial equipment or consumer goods.

…… conferences/expos

- The IoT Smart Summit London
  Date: 19 - 20 September, London,UK
- Mobile World Congress | ctia 2017
  Date: 12 - 14 September, San Francisco, USA
- European Utility Week (EUW)
  Date: 3 - 5 October /Amsterdam /Holland
- Everything IoT Summit
- Date: 11-12 October, Sydney, Australia

…… some success stories!

Fitbits…….no explanation required
Smart metering…..meter reading / home automation / electricity distribution / etc
APPs…..connect more people to more devices…

…… and that's it!

- Questions?