



WEIGHTLESS? A NEW M2M CELLULAR TECHNOLOGY

THE PRICE OF BLUETOOTH WITH THE RANGE OF CELLULAR!?

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1. Introduction to Argon Design
2. INSIGHT INTO THE MARKET OPPORTUNITY FOR ?INDUSTRIAL AND M2M
3. How do we enable this market?
4. TV White Space
5. ?WEIGHTLESS? a new global M2M standard to enable markets
6. New propositions for vertical markets
7. How to get involved, join the community
8. IN CONCLUSION?

Some of our clients

Fortune 500
companies,
under strict NDA



FTSE100
company,
under strict NDA



Enabling an Intelligent Planet



Product Specialisms

Embedded Products



Mobile Products



Concept Definition



Product Definition



Electronic Engineering



Software Engineering



Multi/Many/GPU core programming



M2M examples - using variety of communications technology ? part 1

Bluetooth ? ?HUMAN WASTE? MANAGEMENT



GSM ? Remote Pill Dispensing



M2M examples - using variety of communications technology ? part 2

GSM ? Home Shopping



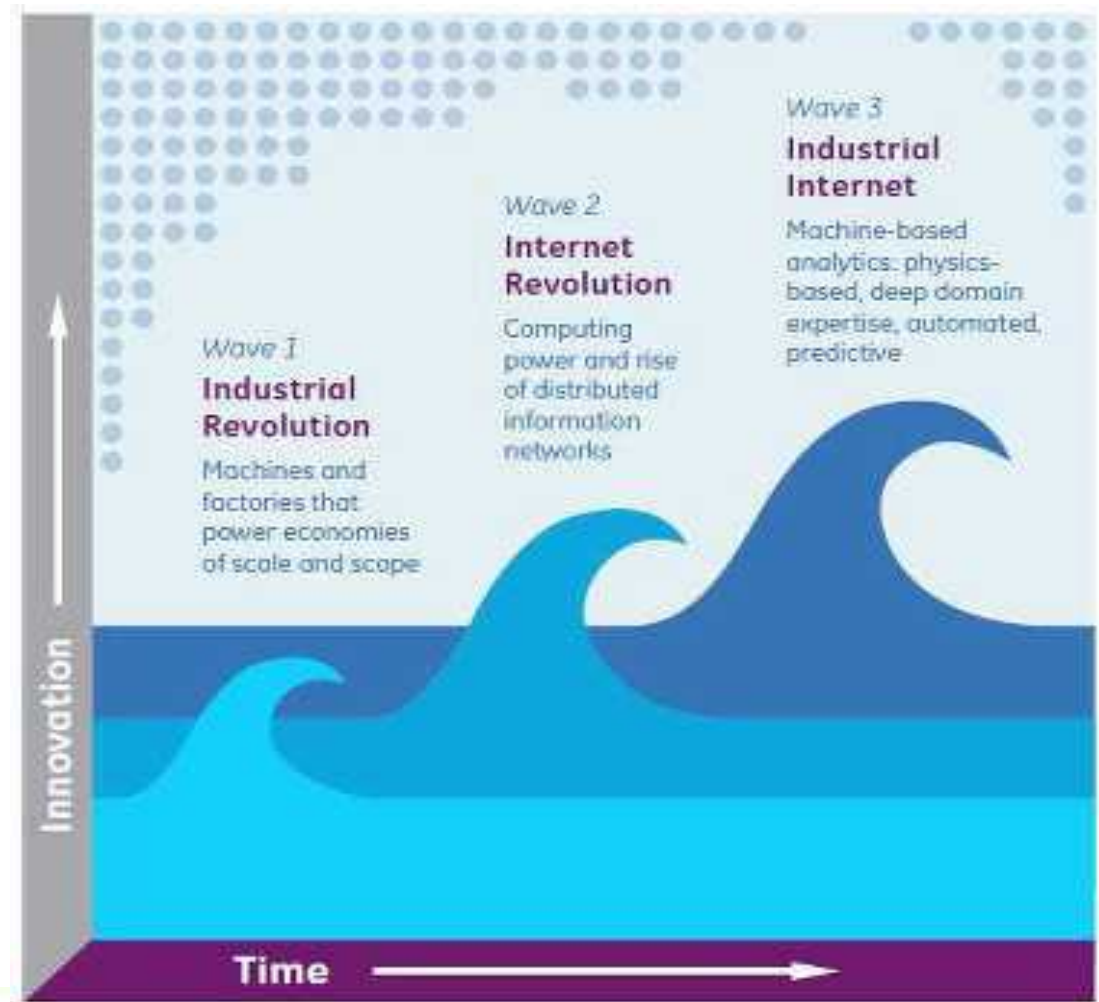
?WEIGHTLESS New Cellular M2M Technology



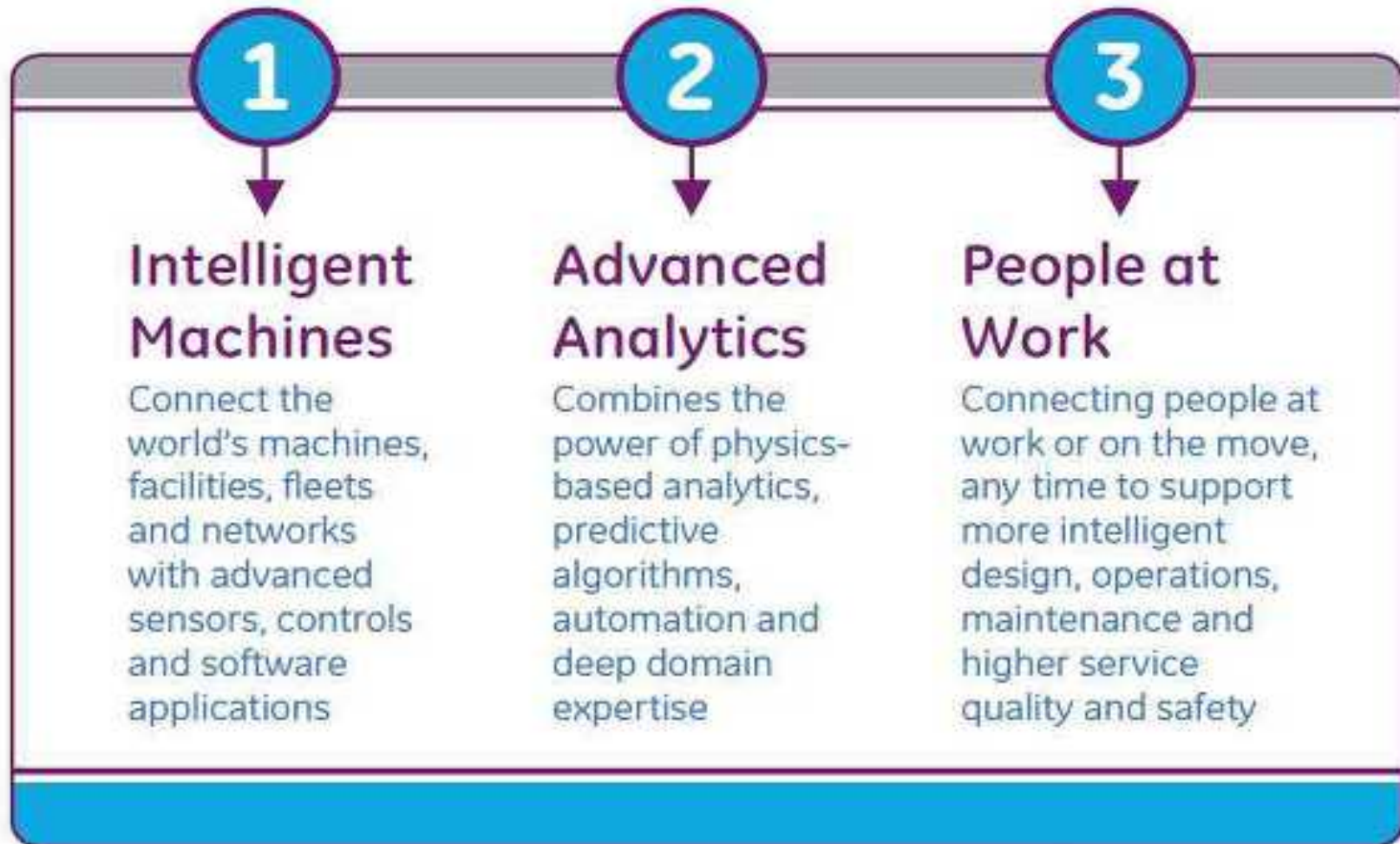
What is the market size for
Tele-Healthcare in
?INDUSTRIAL INTERNET? AND M2M?

Some highlights from the Industrial Revolution White Paper from GE.

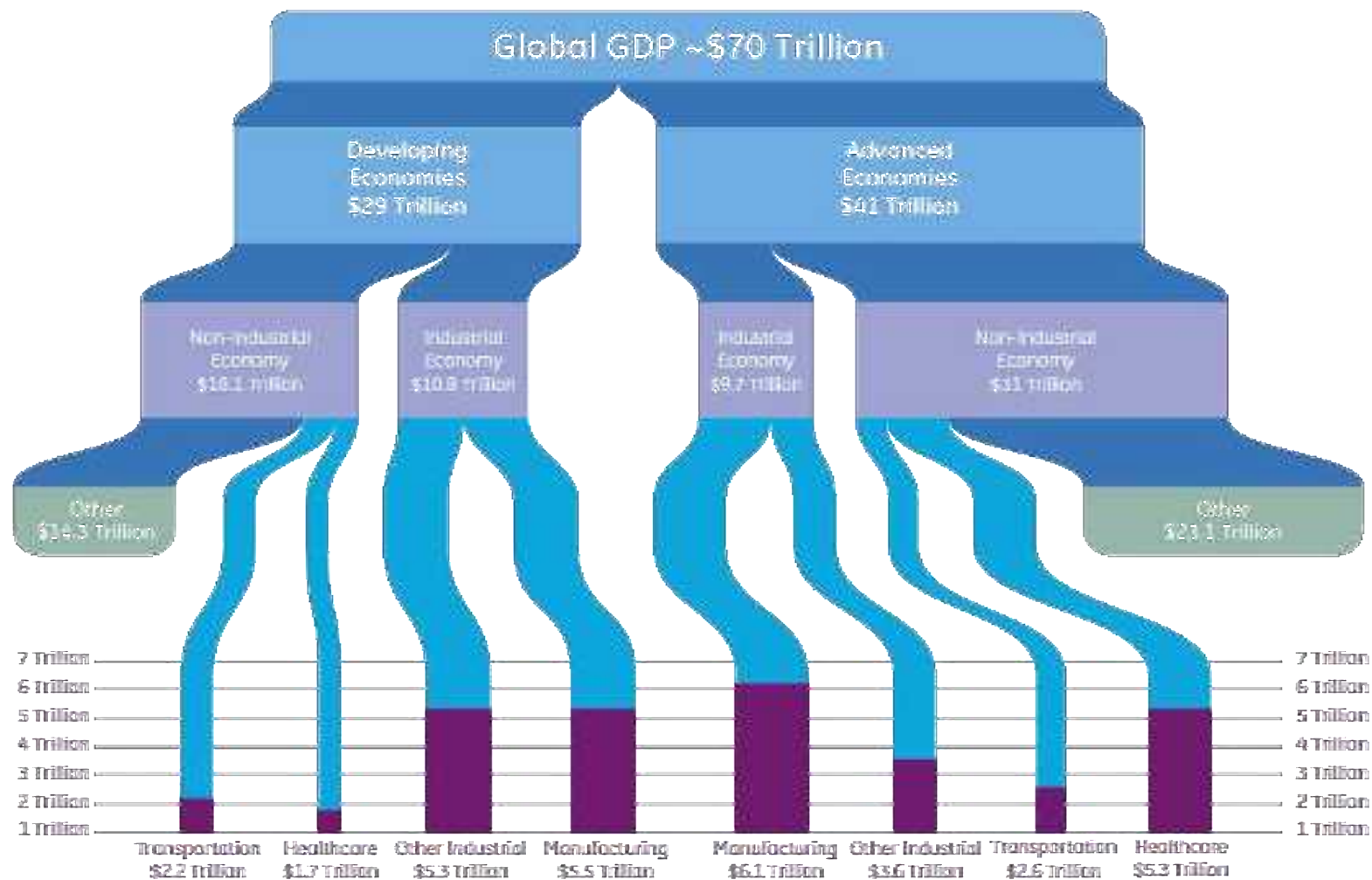
The world is on the threshold of a new era of innovation and change with the rise of the “Industrial Internet”.



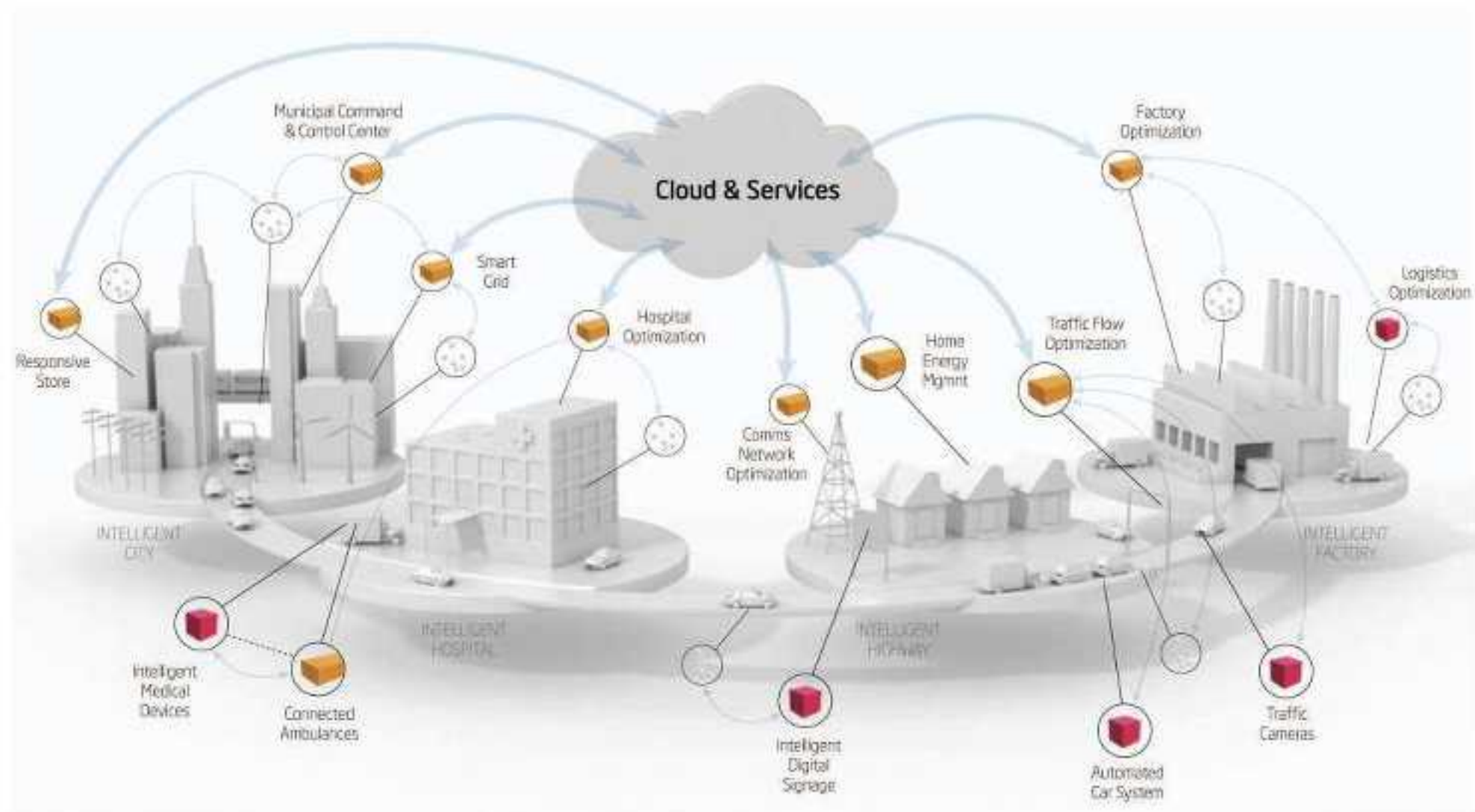
Key Elements to the Industrial Internet



Market Size? - ?INDUSTRIAL INTERNET? IS A GLOBAL MEGATREND



WHAT IS THE ?INTERNET OF THINGS? ?MACHINE TO MACHINE? (M2M)?



M2M Market ? People and Devices



7 Billion on planet Earth ? 2012
8 Billion by 2020



50 Billion devices - 2020
10?S / PERSON (source McKinsey)



MACHINES ?TALK?
differently to humans

Many global markets ? smart agriculture, smart healthcare, smart cities, smart transport, ASSET TRACKING, SMART METERS, SMART GRID, SMART ENERGY STORAGE.



- ❖ **TV White Space** spectrum becoming available!
([http://en.wikipedia.org/wiki/White_spaces_\(radio\)](http://en.wikipedia.org/wiki/White_spaces_(radio)))
- ❖ Could this be used as a new method for wireless transport of M2M data?

What is White Space:

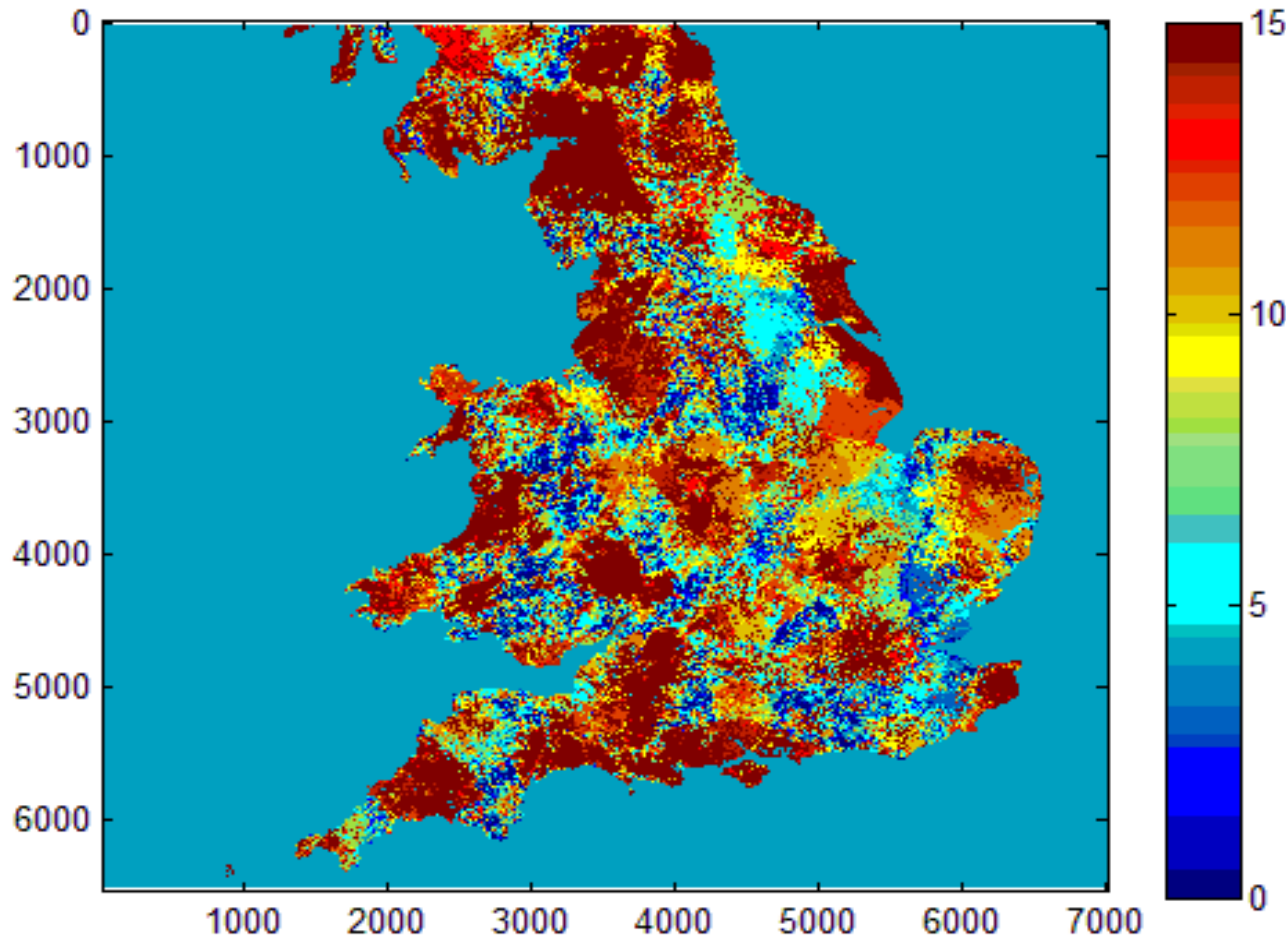
- White Space refers to [frequencies](#) allocated to a [broadcasting](#) service but not used locally
- FCC Approved use of White Space in Sept. 2010
 - ? **Geolocation database** must be queried to confirm frequency is available in that area
 - ? No spectrum sensing sensor required in device (WSD)
- UHF TV Channels 14 - 69 (**470-800 MHz**) of particular interest due to propagation and global harmonization
 - ? UHF travels far and penetrates buildings well
 - ? TV channels are same around the world

White Space Frequencies

White Space Frequencies:

- Are **Unlicensed**
- Are **Free**
- Have **Limits on the power** and antenna height of the unlicensed transmitters
- Unlicensed operators must **not interfere** with licensed users
- Unlicensed operators must **accept interference** from others
- FCC looking for additional White Space frequencies

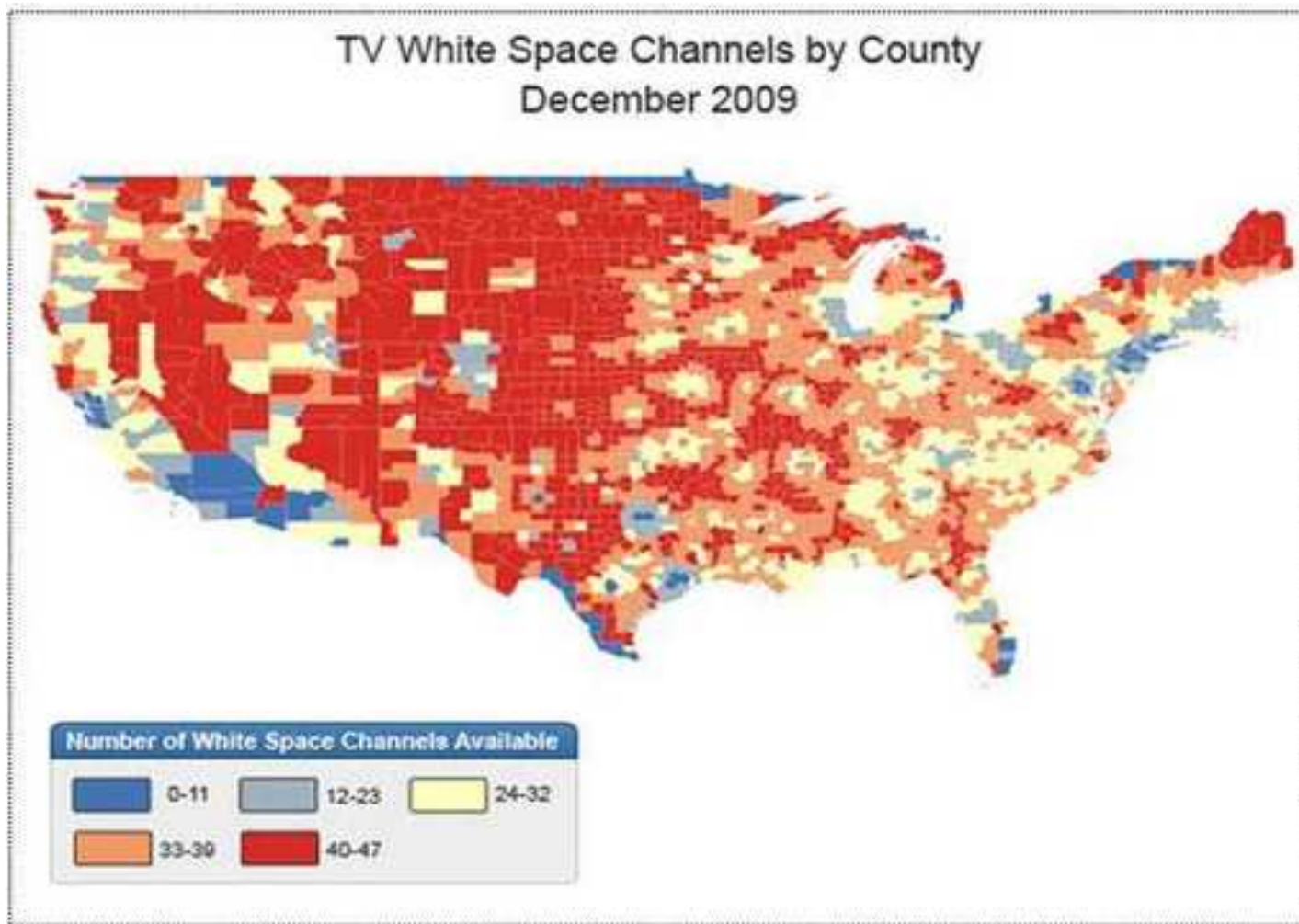
White Space has excellent coverage ? UK ? 98% Coverage



Number of TV channels available (each=8MHz) taking all factors into account

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Other territories ? White Space coverage ? USA ? virtually total



Number of TV channels available (each=8MHz) taking all factors into account

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How could we enable the M2M market?

Are current technologies sufficient?

Do we need new technologies?

Enablement ? M2M Tele-Communication Requirements Summary

- Has to be a wireless solution
- Support for large quantity of terminals. 100k -> 1 million per cell
- **Long battery life** ? 10 years
- **Low costs** terminals, < \$2 for connectivity
- **Low cost** service - \$10/year/node
- Low data transmission rates Kbit/min not Mbit/sec!
- 0-10km (outdoor) 0-5km (indoor) - distance terminal to mast
- Coverage inside buildings
- Privacy and protection of data
- Scheduling of data exchange and guaranteed delivery
- Broadcast messages
- Mobility across borders and territories, national coverage



Current technologies struggle to meet the M2M specification

- GSM/CDMA
 - Designed for humans **not for machines** ? CAN'T GUARANTEE every
 - Poor battery life
 - High costs ? terminal, monthly contract
 - CAN'T SUPPORT ENOUGH NODES PER BASE STATION
 - High barrier to entry - spectrum is not free
 - Real life issues
 - JAPAN TSUNAMI??CELLULAR NETWORK CRASHED! Disaster!
 - New York 9/11 ? overloaded cellular network
- Zigbee / Bluetooth ? great for small ranges only..
- Wifi ? great for small ranges, high power



However, they **do have** a part to play in M2M

Therefore to fully enable the M2M market a new suitable wireless technology is needed

Weightless ? The First Global Standard for Wireless M2M Connectivity.



- ✓ Designed specifically for the M2M market
- ✓ Credible SIG board ? ARM, CSR, Neul, Cable Wireless
- ✓ Open source, open standard, royalty free
- ✓ Roadmap looks great!
 - ✓ Weightless V1.0 Standard is here ? currently over 800 members world wide.
 - ✓ White Space spectrum is coming - ratified in USA Q3 2012, UK expected Q2 2014 (ala bluetooth)
 - ✓ Weightless technology is coming ? Neul first provider (base station, silicon, development kit)
- ✓ Interest exponentially increasing, and pilot trials starting
 - ✓ UK brands such as BT - national UK network
 - ✓ Global territories such as Europe, Asia, Africa, Philippines ? 7000 islands
 - ✓ Argon clients (UK, Europe, Africa)

First Weightless Products are out! (NEUL)



Iceni ? World first Whitespace ASIC



neutrino Dev Kit
Link any device to Neul's Network
Simple PHP/JavaScript coding



horizon v2
>24Mbps broadband
US, UK and worldwide markets



Cloudbase 2
Macro and femtocell variants
Multi channel operation
High gain, multi element antennas

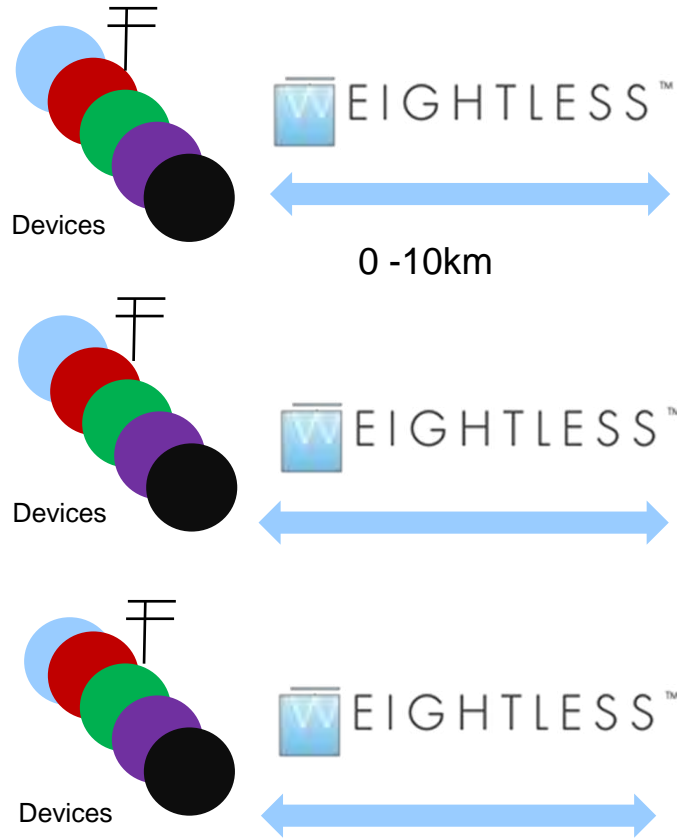
Other manufacturers busy making Eco-system parts too!

Courtesy of Neul 2013

Two types of Networks ? ?WEIGHTLESS? OVER WHITE SPACE SPECTRUM

National Networks

100k ? 1M devices / base station

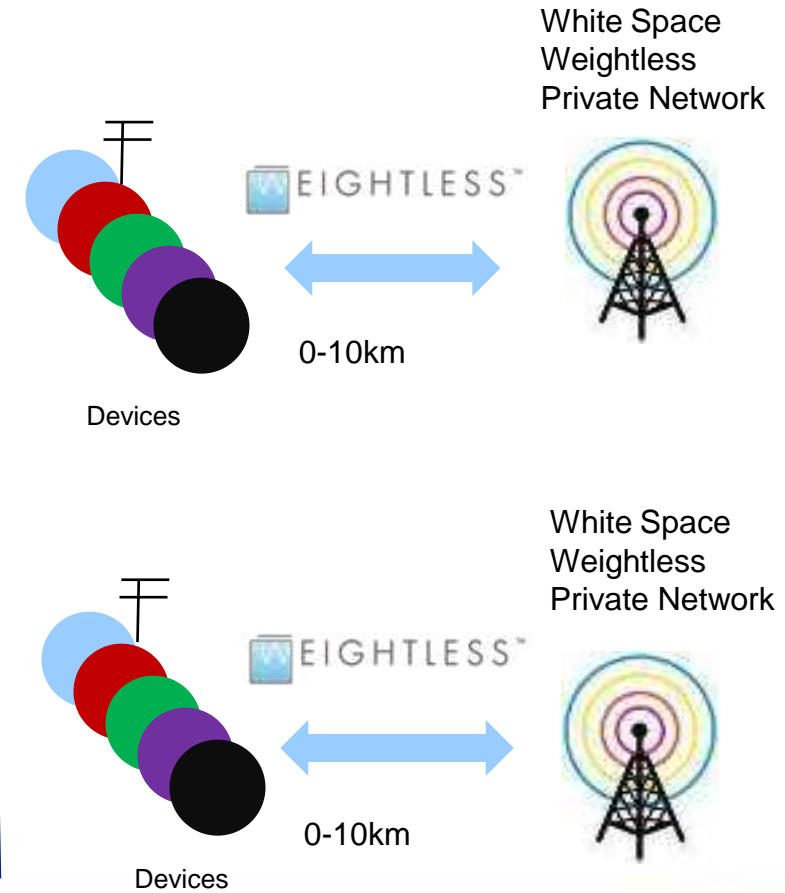


White Space/Weightless National Network



Private Networks

< 1K?S DEVICES base station

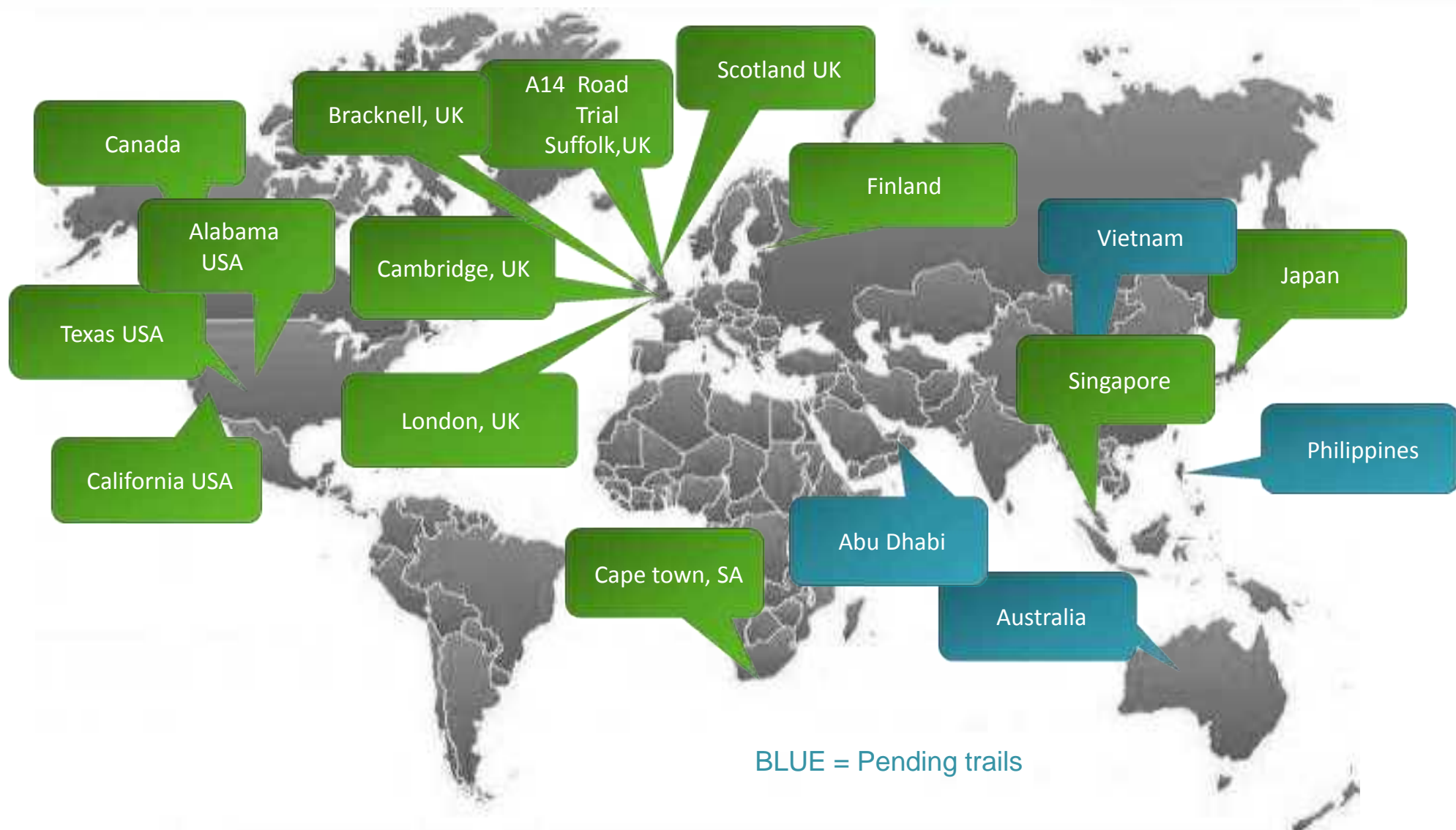


White Space Weightless Private Network



White Space Weightless Private Network





BLUE = Pending trails



?WEIGHTLESS? Perfect M2M tele-communications solution

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Application	Population coverage	Battery life	Mobility	Terminal lifespan	Cost / terminal	Cost / month
Automotive	98%+	N/A	High	15 years	<\$50	<\$5
Healthcare	98%+	Months	Medium	5 years	<\$5	<\$1
Media tablets	80%+	Days	Medium	3 years	<\$5	<\$2
Asset tracking	98%+	Years	Medium	10 years	<\$2	<\$0.5
Smart grid	99%+	Years	None	20 years	<\$2	<\$1
Point of sale	95%+	Days	Low	5 years	<\$5	<\$5

Application	GPRS	3G/4G	Weightless	802.11af	802.22	Mesh
Automotive	✓	✓	✓	?	✗	✗
Healthcare	✗	✗	✓	✗	✗	✗
Media tablets	✓	✓	✓	✗	✗	✗
Asset tracking	?	✗	✓	✗	✗	✗
Smart grid	✗	✗	✓	✗	✗	✓
Point of sale	✓	✗	✓	✓	✗	✗
Rural broadband	✗	✓	✓	✗	✓	✗



?WEIGHTLESS? / TV WHITE SPACE SOLUTION

- Some new market opportunities

SMART ?CONNECTED? REMOTE HEALTHCARE

- Aging population – in-home monitoring for health and wellbeing
 - Heart rate, blood pressure, temperature, position
 - Lowers total health care costs
 - Assisted Living
- Panic button alarms and emergency notification
- Rural community remote diagnostics and disease management
 - Reduces barriers to access
- Medicine dosage notification and delivery
- Low cost network Infrastructure and ARPU (device) KEY
- Ubiquitous standard for device interoperability
- **Simpler architectures!**



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SMART Disaster Prevention and Protection

- Disposable sensor modules that activate automatically
- Safe, instantaneous environmental monitoring
- Pollution, radiation, temperature, vibration...
- Difficult or dangerous places
- Low cost and long battery life for sensor modules
- Simple to deploy infrastructure



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SMART Energy ? Source to Consumer

- Smart Meters:
 - Domestic demand management and In-Home display for energy consumption monitoring
 - Consumer control of energy management and use
 - Japan already deploying to 10 million homes
 - UK procurement process begun – contracts awarded Q42012
 - 28 Million meters installed & commissioned by 2016
- Smart Grid:
 - Saves generating capacity and allows enhanced control of load
 - Annual savings of ~\$2Bn for UK Plc alone, \$100Bn worldwide



SMART Cities – intelligent infrastructure

- City Wide sensor networks – the backbone of the city
- Parking and traffic management – direction to empty spaces
- ‘Smart’ Litter bins – emptied on demand
- Environmental monitoring – traffic flow control to reduce CO2
- Street Light optimization – activated by movement
- Electric Vehicle (EV) re-charging points (EVSE)
- Road condition monitoring – variable speed limits, ice gritting...
- Integrated traffic management – flow and congestion

PLEASE PARK ON L4 498



SMART Logistics – Where is that container?

- Shipping lines own 20m containers
 - They have good visibility of location of every container on ships and in major ports
 - But the containers then go to any of 8000 trucking companies in the US.
- There is no standard way to track these shipments
 - Shipping lines have no visibility of location of containers, delays etc
 - Consequence - one in three containers is moved empty, costing \$30 - \$40bn/year
- Better visibility of location of containers moving by road
- Low cost, long battery life tracking unit permanently attached to every container
- Track every container, all of the time, minimizing empty shipments and saving \$bns



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SMART Transport – Infrastructure to driver

- Fleet management
 - Reduce emissions, consumption & costs
- 'Pay as you drive' (PAYD) car insurance
- Intermodal Asset tracking
- Road pricing & congestion charging
 - Enabled across entire road network
- Emergency incident response
 - Platform for Event Data Recorder (EDR)
 - Automatic notification of incidents, severity of incident, vehicles involved & substances being carried
 - Improved response times & minimised disruption



How to know more and get involved.

WORLDWIDE MEMBERSHIP



Finding out more

For further information

www.weightless.org

<http://www.argondesign.com/news>

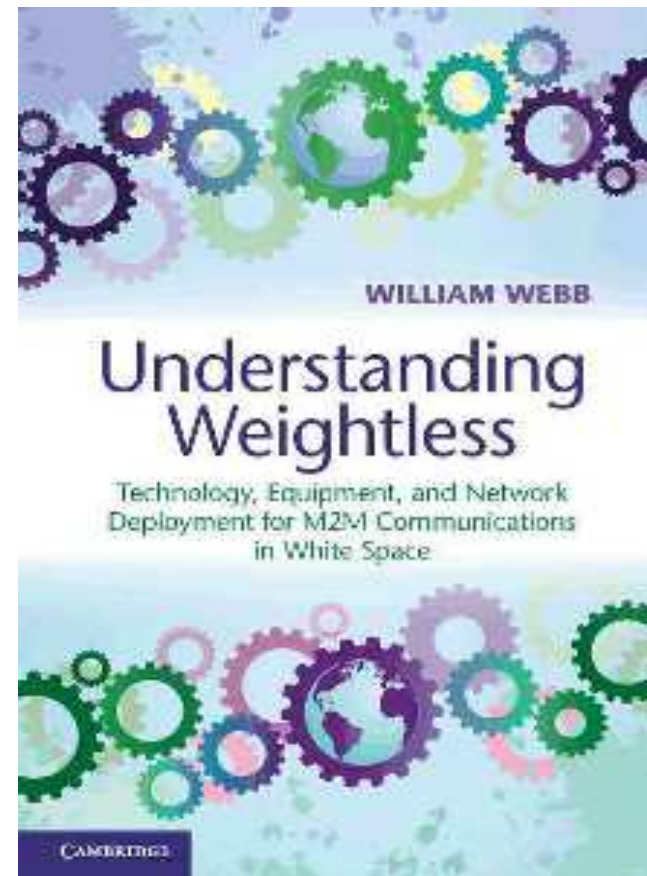
Buy the Book!

UNDERSTANDING WEIGHTLESS? AVAILABLE FROM
Amazon

Join the SIG

Be part of the business community

Zero-G ? monthly magazine



Conclusions

- ✓ The market size for Industrial Internet is vast
- ✓ There will be billions of IoT/M2M devices by 2020.
- ✓ Current wireless tele-communication technologies are limited in M2M
- ✓ We need a proper M2M wireless tele-communications open standard
- ✓ ?WEIGHTLESS? MEETS THE TECHNOLOGY/BUSINESS CASE FOR M2M MARKETS
- ✓ The technology and spectrum is becoming available across the globe
- ✓ You can get involved - join the Weightless community
- ✓ YOU CAN START TO BUILD ?WEIGHTLESS?/WHITE SPACE SOLUTIONS TO
- ✓ Argon Design is well placed to develop technologies and products for M2M solutions.



An open source cellular telecommunications technology
perfectly aligned to IoT/M2M markets

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Backup Slides

What might the costs be for a National
?WEIGHTLESS? HEALTH CARE Network?

UK Healthcare Network ? Weightless

- To achieve coverage of the UK and 26.4 million households (UK Gov - O.N.S. 2012)
 - Approx £55m network capex!
- \$0 spectrum costs if we use Whitespace!
- GSM 3G equivalent cost about £4.5 Billion!
- Weightless Network is 100 times cheaper than 3G!

[Weightless is an excellent business case](#)



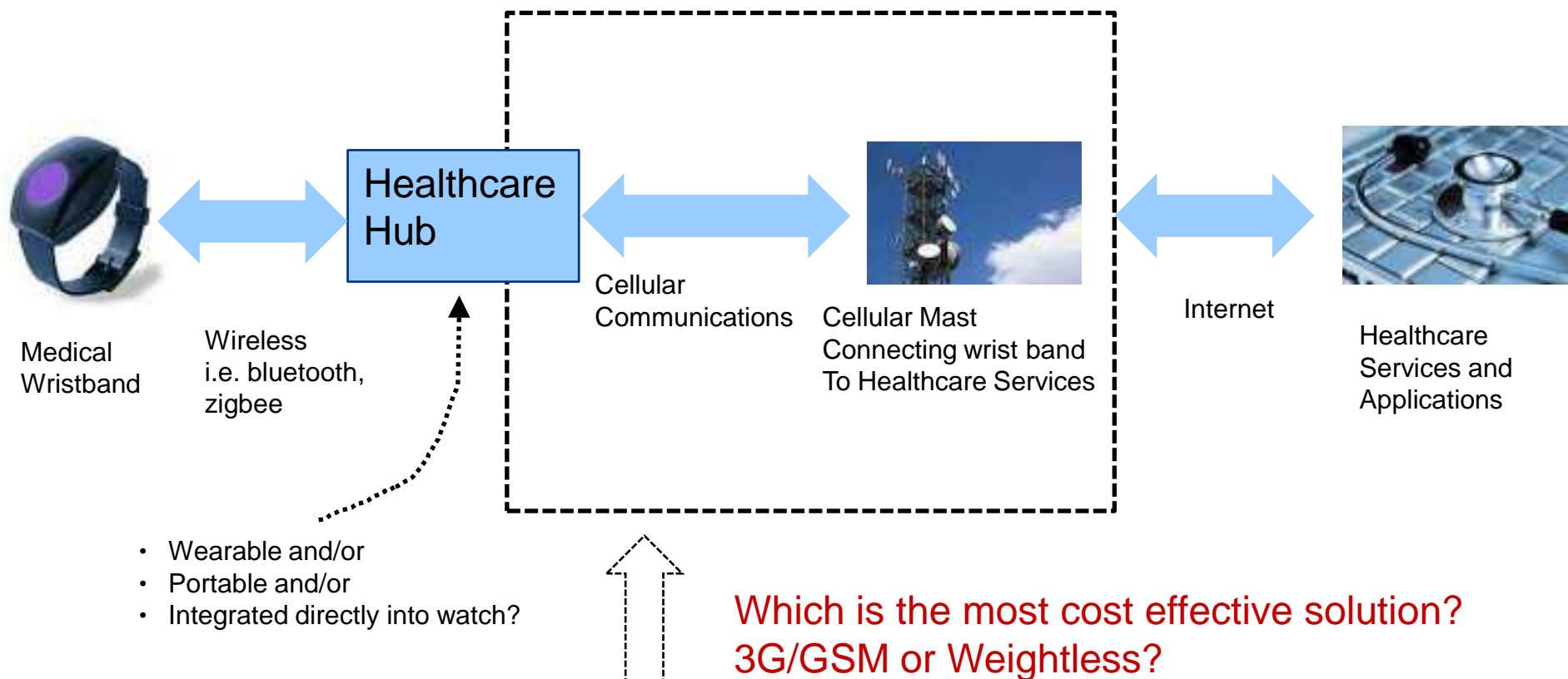
A Tele-healthcare business case

COMPARING ?WEIGHTLESS? / WHITE SPACE

3G/GSM/CDMA

Tele ? healthcare service for 3 million people ? example (part 1)

Connect 3 million people that are wearing medical devices, connected into a PORTABLE (AWAY FROM THE HOME) ?HEALTHCARE HUB? THAT IS CONNECTED TO HEALTHCARE service



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Tele ? healthcare for 3 million people ? (part 2)

Assumptions:-

- Healthcare Hub costs about £20 without cellular connectivity
- The Hub needs cellular connectivity to communicate to the tele-healthcare service
 - GSM 3G modem in the Hub for cellular connectivity at this volume is £10. Thus, a 3G connected Hub = £20 + £10 = **£30**.
 - Weightless modem in the Hub for cellular connectivity at this volume is £1. Thus, a Weightless Hub = £20 + £1 = **£21**.
- Monthly 3G contract costs per Hub is about **£1/month** (GPRS data connection - 1 Megabyte/month)
- Monthly Weightless contract costs per Hub is about **£5/year**

	Cost of 3 million connected Hubs (£Millions)	Contract cost per YEAR of 3 million connected Hubs (£Millions)	Total cost over 1 year (£Millions)
GSM 3G	90	36	126
Weightless	63	15	78
Weightless Saves	27	21	48

Weightless is **40%** the cost of a 3G/GSM solution.

WITH THE PROFITS IN YEAR 1 YOU COULD BUILD YOUR OWN SPECIALIST Healthcare National Network!