“Weightless” a new M2M/IoT cellular technology
“The price of Bluetooth with the range of cellular!”

Matthew Bailey – VP Marketing Argon Design
Co-Chairman Weightless Marketing SIG
1. Introduction to Argon Design
2. Insight into the market opportunity for “Industrial Internet” and IoT/M2M
3. How do we enable this market?
4. TV White Space
5. “Weightless” – a new global M2M standard to enable markets
6. Examples of enabled vertical opportunities
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
Argon Design Client M2M examples - part 1

Bluetooth – “Human Waste” Management

GSM – Remote Pill Dispensing
Argon Design Client M2M examples - part 2

GSM – Home Shopping

“Weightless” – New Cellular M2M Technology
What is the market size for “Industrial Internet” and M2M?
Industrial Internet; Pushing the Boundaries of Minds and Machines

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”.

Wave 1
Industrial Revolution
Computing power and rise of distributed information networks

Wave 2
Internet Revolution
Machines and factories that power economies of scale and scope

Wave 3
Industrial Internet
Machine-based analytics: physics-based, deep domain expertise, automated, predictive

Confidential Neul Ltd 2013
www.neul.com
Market Size? - “Industrial Internet” is a Global Megatrend

Global GDP ~$70 Trillion

- Developing Economies $29 Trillion
  - Non-Industrial Economy $18.1 Trillion
  - Industrial Economy $10.8 Trillion
- Advanced Economies $41 Trillion
  - Industrial Economy $9.7 Trillion
  - Non-Industrial Economy $31 Trillion

Other $14.3 Trillion

Other $23.1 Trillion

Source: MIT Sloane Review December 2012
What is the “Internet of Things” (IoT) or “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 water, smart agriculture, smart healthcare, smart cities, smart transport, asset tracking, smart meters, smart grid, smart energy, financial…and so on……..

TV White Space spectrum becoming available! (http://en.wikipedia.org/wiki/White_spaces_(radio))

Could this be used as a new method for wireless transport of M2M data?
White Space has excellent coverage – UK – 98%

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

Copyright © Weightless Ltd | www.weightless.org
White Space coverage – USA

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

TV White Space Channels by County
December 2009

Number of White Space Channels Available

- Blue: 0-11
- Light Grey: 12-23
- Yellow: 24-32
- Orange: 33-39
- Red: 40-47
How could we enable the M2M market?

Are current technologies sufficient?

Do we need new technologies?
Enablement – M2M Tele-Communication Requirements

- 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 with the M2M specification

- **GSM/CDMA**
  - Designed for humans **not for machines** – can’t guarantee delivery
  - 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 – 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 860 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 firstWhitespace ASIC

**neultrino** 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 M2M Weightless Eco-system parts!

Courtesy of Neul 2013
Two types of Networks using "Weightless" over White Space

**National Networks**
100k – 1M devices / base station

**White Space/Weightless National Network**

**Private Networks**
< 1k’s devices / base station

**White Space Weightless Private Network**

0 - 10km
Network/trail deployments February 2013...

BLUE = Pending trails
“Weightless” - Perfect M2M tele-communications solution

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

<table>
<thead>
<tr>
<th>Application</th>
<th>GPRS</th>
<th>3G/4G</th>
<th>Weightless</th>
<th>802.11af</th>
<th>802.22</th>
<th>Mesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>?</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Healthcare</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Media tablets</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Asset tracking</td>
<td>?</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Smart grid</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Point of sale</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Rural broadband</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
<td>×</td>
</tr>
</tbody>
</table>
“Weightless” / TV White Space solutions
- 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!
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
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
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 could Smart Water benefit from Weightless?

- Proper M2M solution
- Increased technology benefits
- Solve existing problems
- Reduced business costs of existing solutions
- New technology architectures / business models
- Enable new business propositions
How to know more and get involved.
Finding out more…

For further information

- [www.weightless.org](http://www.weightless.org)

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
- You can get involved - join the Weightless community
- You can start to build “Weightless”/White Space Smart Water solutions today
- Argon Design is well placed to develop technologies, products and solutions for Smart Water M2M solutions.
An open source cellular telecommunications technology perfectly aligned to IoT/M2M markets

Matthew.Bailey@argondesign.com

Office Number
+44 1223 422355

www.weightless.org
www.argondesign.com
https://twitter.com/Argon_Design
http://www.linkedin.com/company/511683