THE FUTURE OF THE
INTERNET OF THINGS

#IoTBristol2019
## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:40 – 12:50</td>
<td>Introduction, Housekeeping and Scene Setting</td>
<td>Martin Ewings, Experis</td>
</tr>
<tr>
<td>12:50 – 13:10</td>
<td>Opening Keynote – Combining advanced digital technologies with new business models</td>
<td>Geraldina Iraheta, Digital Catapult</td>
</tr>
<tr>
<td><strong>Session 1: IoT and Business Transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:10 – 13:35</td>
<td>Keynote</td>
<td>Prof. Rob Rolley, UKDSC</td>
</tr>
<tr>
<td>13:35 – 14:05</td>
<td>Panel Session and Q&amp;A</td>
<td>Matthew Evans, techUK, Bryan Lillie, Capgemini, Prof. Rob Rolley, UKDSC, Geraldina Iraheta, Digital Catapult</td>
</tr>
<tr>
<td><strong>Session 2: Harnessing IoT Skills Across Industries – Build, Buy, Borrow and Bridge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:05 – 14:30</td>
<td>Keynote</td>
<td>James Hick &amp; Jill Bassett, ManpowerGroup Enterprise</td>
</tr>
<tr>
<td>14:30 – 15:05</td>
<td>Panel Session and Q&amp;A</td>
<td>Jill Bassett, ManpowerGroup Enterprise, Damon Ballinger, Dowty, Maria Rancel-Lopez, Nationwide, Dr Benedict Gaster, UWE, Serrie Chapman, Women’s Tech Jobs, Evelyn Thompson, QinetiQ</td>
</tr>
</tbody>
</table>
# Agenda

## Session 2: Advancing Manufacturing Through IoT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:05 – 15:30</td>
<td>Afternoon Break</td>
<td></td>
</tr>
<tr>
<td>15:30 – 15:55</td>
<td>Keynote</td>
<td>Charles Paumelle, Microshare</td>
</tr>
</tbody>
</table>
| 15:55 – 16:25 | Panel Session and Q&A        | Matthew Evans, techUK
Charles Paumelle, Microshare
Amar Mundi, HCL
Justin Paul, Zeetta Networks |
| 16:25 – 16:35 | Closing Remarks               | Martin Ewings, Experis                                                    |
| 16:35 – 17:30 | Networking & Drinks          |                                                                           |
THE FUTURE OF THE
INTERNET OF THINGS

#IoT Bristol 2019
Combining the disruptive potential of advanced digital technologies with new business models to accelerate adoption

Geraldina Iraheta
The Global View

Tech in the UK is stronger than ever.

“UK tech companies have received over £6 billion in venture capital funding since 2016. This figure is more than France, Germany and Sweden combined”

– London & Partners
£170BN
Digital tech industries turnover

£97BN
Digital tech industries contribution to the UK economy

£6.8BN
Tech investment in the UK

1.64M
Digital tech jobs

£51K
Average digital salary in the UK

X2
Faster job creation than wider economy
- Market fragmentation
- Data management
- Why do you want IoT?
Driving the adoption of advanced digital technologies
Driving competitive advantage from Advanced Digital Technologies

Develop ecosystems

The nature of advanced digital technologies makes it impossible for any one organisation to stay at the leading edge – so it is critical to develop partnerships with key innovators.

Test new business models

The difficulty for industry in developing the business cases for advanced digital technologies drives a need to look for innovative business models, including shared investment and reward.

Be the disruptive force

Advanced digital technologies are increasingly disrupting whole industries. Knowledge of where the technology landscape is critical to stay ahead of the curve.
Our unique, trusted position
Immersive
Virtual Reality, Augmented Reality, mixed reality and haptics

“The Immersive ecosystem is conservatively estimated to be £152B by 2025”

Future Networks
5G, IoT and Low Powered Wide Area Networks (LPWAN)

“IoT will have a $6.2T impact on the global economy by 2025”

Artificial Intelligence
AI and Machine Learning

“AI has the potential to deliver additional economic activity of ~$13T by 2030”
Applied into high impact industries – advanced digital technologies will only reach their full potential when applied into industry. Digital Catapult work in two industry sectors:

**CREATIVE INDUSTRIES**

Delivering increased research, development and innovation in advanced digital technologies for the creative industries.

**MANUFACTURING**

Increasing the number of trailblazer companies working with advanced digital technologies in UK manufacturing.
The value of 5G in the UK

Potential to add £173bn of UK GDP

- Much faster download speeds, better connections, reduced network delays
- Pathways to new business models
- Huge opportunities to unlock major economic and societal benefits

Underpins future development of digital applications

Digital Economy ‘DNA’

- Data
- Networks
- Artificial Intelligence
Future Networks

5G, IoT and Low Powered Wide Area Networks (LPWAN)

IoT Forecasts:

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>20-30bn</td>
<td>Average</td>
</tr>
<tr>
<td>2030</td>
<td>£352bn</td>
<td>Global: $14Tn</td>
</tr>
</tbody>
</table>

- ARM: “1 trillion IoT devices by 2035”
- Ericsson: “28bn IoT devices by 2021”
- IEEE: “30bn by 2020”
- Gartner: “20.4bn by 2020”
- IBM: “1 Trillion IoT devices by 2020”
- IHS: “30.7bn by 2020”
With the UK leading the 5G race in Europe, businesses need to seize this moment of merging technologies to fast track their prototyping and rollouts of IoT and other 5G applications to get an edge in their day to day operations or even revolutionise their business models.
### Technology Facilities & Programmes

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Machine Intelligence Garage</strong></td>
<td>Which is helping UK AI companies with leading-edge computation resources.</td>
</tr>
<tr>
<td><strong>5G &amp; future network testbeds</strong></td>
<td>5G testbed based in Brighton &amp; our LPWAN “Things Connected” networks</td>
</tr>
<tr>
<td><strong>Reality capture studio &amp; Immersive Labs</strong></td>
<td>The world’s first commercial Volumetric Capture Studio, Pioneering Motion Capture Studio and four immersive labs.</td>
</tr>
<tr>
<td><strong>Cyber101 Bootcamps</strong></td>
<td>Supporting next generation world-class cyber security early stage businesses</td>
</tr>
<tr>
<td><strong>DLT Field Labs</strong></td>
<td>An opportunity to de-risk innovation and explore real-world deployment of distributed ledger technology to solve business challenges</td>
</tr>
<tr>
<td><strong>Future Networks Lab</strong></td>
<td>An opportunity to de-risk innovation and explore real-world deployment of distributed ledger technology to solve business challenges</td>
</tr>
<tr>
<td>RAF</td>
<td>GKN</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Mobile asset monitoring and tracking through LPWAN</td>
<td>Partnering on the new Global Technology Centre in Bristol</td>
</tr>
</tbody>
</table>
Wiggin Special Metals

Producers of large ingots of specialist metals.

Dyer Engineering

Fabricators of metal solutions that go through multiple processes
Market disruptors

Drayson Technologies

Lacuna space
Our unique, trusted position

Collaborate

Experiment

Understand

Demo
Combining the disruptive potential of advanced digital technologies with new business models to accelerate adoption

Thank you

www.digicatapult.org.uk

@DigiCatapult

Digital Catapult
THE FUTURE OF THE INTERNET OF THINGS

#IoTBristol2019
Innovation In Action

Prof. Rob Rolley
Head of Innovation

April 2019
Innovation in Action - Content

• Introduction

• Context & Background

• My Top 10 requisites for successful innovation

• Example of Innovation in action

• Summary
A joint commitment from UK government and the UK defence industry to grow the UK’s global export market share in air, land, naval and intelligent systems to global strategic partners with ‘team UK’ solutions.

Launched Farnborough International Airshow 2012
UKDSC Strategic Aims

FOCUS ON THE CUSTOMER

- Working closely with government and industry to develop strategic relationships with our customers, focused on their needs.
- Determining compelling propositions, promoting collaboration and advocating leading edge UK solutions, whilst considering potential synergies with UK MOD.

DEVELOP CAPABILITY

- Exploring capabilities, technologies and their future maturation plans to understand potential differentiators in the international market.
- Identifying ‘interventions’ to maximise the impact of UK capabilities; stimulating innovation and facilitating collaboration.

IMPROVE VALUE OF INVESTMENT

- Identify core defence enabling technology and services and investigate novel funding constructs.
- Optimising investment through cross sector innovation and targeted funding model and aligned investments which improves efficiency and maximises return.
• DSC is focused on Export led “Capability Theme“ opportunities.
• Synergy with Defence and Security Accelerator.
• Synergy with Industrial Strategy Challenge Fund.
“Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology”

Henry Chesbrough of University of California

“Innovating with partners by sharing risks and rewards”

Roland Harwood of 100% Open
My definition of Open Innovation
Top 10 tips for successful Innovation No 1

Executive Champion
Top 10 tips for successful Innovation No 2

Commercial Agility
Top 10 tips for successful Innovation No 3

Space to Innovate
SME friendly approach to IP
Top 10 tips for successful Innovation No 5

Understand the real need

"Question: why do customers need our products? Ooo, a live one."
Creating the Environment to gain Understanding
Top 10 tips for successful Innovation No 6

Network Power

Put the work into the Networks
### Top 10 tips for successful Innovation No 7

#### Academia

<table>
<thead>
<tr>
<th>Country</th>
<th>Institution</th>
<th>Overall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>University of Oxford</td>
<td>94.6</td>
</tr>
<tr>
<td>Germany</td>
<td>LMU Munich</td>
<td>83.9</td>
</tr>
<tr>
<td>Italy</td>
<td>Scuola Normale Superiore di Pisa</td>
<td>83.9</td>
</tr>
<tr>
<td>Russia</td>
<td>Lomonosov Moscow State University</td>
<td>82.8</td>
</tr>
<tr>
<td>France</td>
<td>École Normale Supérieure</td>
<td>80.9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Wageningen University &amp; Research Center</td>
<td>79.9</td>
</tr>
<tr>
<td>Sweden</td>
<td>KTH Stockholm</td>
<td>78.8</td>
</tr>
<tr>
<td>Spain</td>
<td>Autonomous University of Barcelona</td>
<td>78.8</td>
</tr>
<tr>
<td>Belgium</td>
<td>KU Leuven</td>
<td>76.9</td>
</tr>
<tr>
<td>Ireland</td>
<td>Trinity College Dublin</td>
<td>76.9</td>
</tr>
<tr>
<td>Switzerland</td>
<td>ETH Zurich – Swiss Federal Institute of Technology</td>
<td>74.8</td>
</tr>
<tr>
<td>Denmark</td>
<td>University of Copenhagen</td>
<td>63.2</td>
</tr>
<tr>
<td>Austria</td>
<td>University of Vienna</td>
<td>62.0</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>VSB – Technical University of Ostrava</td>
<td>61.7</td>
</tr>
<tr>
<td>Cyprus</td>
<td>University of Cyprus</td>
<td>60.2</td>
</tr>
<tr>
<td>Estonia</td>
<td>University of Tartu</td>
<td>58.5</td>
</tr>
<tr>
<td>Greece</td>
<td>University of Crete</td>
<td>58.5</td>
</tr>
<tr>
<td>Portugal</td>
<td>Instituto Superior Tecnico Lisboa</td>
<td>58.5</td>
</tr>
<tr>
<td>Norway</td>
<td>University of Oslo</td>
<td>55.3</td>
</tr>
<tr>
<td>Iceland</td>
<td>University of Iceland</td>
<td>54.6</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>University of Luxembourg</td>
<td>54.6</td>
</tr>
</tbody>
</table>

© UK Defence Solutions Centre 2018
Innovation Process

Top 10 tips for successful Innovation No 8

Innovation Process

- Convert into innovation challenge
- Challenge colleagues to suggest creative solutions
- Collaborative idea generation
- Combine & evaluate ideas
- Develop ideas
- Implement most promising ideas

Corporate innovation = implementation of creative ideas in order to generate value, usually through reduced process costs, increased income or both.
Top 10 tips for successful Innovation No 9

Look Inwards
Top 10 tips for successful Innovation No 10

Stopping Quickly and Learning

Success is not Guaranteed

What Most People Think

What Successful People Know

Win

Fail

Fail

Fail

Win

Fail

Fail
Innovation in Action Example - Challenge Projects

### Phase 1 Projects | Phase 2 Projects
--- | ---
Agile, Immersive Mission Training | 12 | 2
Persistent Surveillance from the Air | 10 | 4
Big Data & Autonomy for Defence | 24 | 6

- The UKDSC is sponsoring in partnership with MOD the Innovation Challenge, which is an MOD-funded competition to create new technologies to solve defence challenges.

<table>
<thead>
<tr>
<th>Project Area</th>
<th>SME</th>
<th>Academia</th>
<th>Large Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agile, Immersive Mission Training</td>
<td>9</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Persistent Surveillance from the Air</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Big Data &amp; Autonomy for Defence</td>
<td>16</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

DSEI 2015 Innovation Challenges Launched
- 6 Phase 2 projects launched Sept 16
- Autonomy & Big data 24 Phase 1 projects
- Persistent Aerial Surveillance (PAS) 10 Phase 1 projects
- 4 Phase 2 projects launched June 16

- OXBOTICA
- Leonardo
- MIRA
- Polaris
- Creatac
- Counting Lab
- Amethyst Research Limited
- QinetiQ
- Glyndwr University
Glyndwr- Low SWaP Optics

Aims;
To develop low SWaP optics for HAPS and Small Satellite applications
Phase 1 Achievements:
• Reduced weight of primary optic by 60%
• Equivalent optical performance
Phase 2 Achievements:
• Weight reduction of 80% - assembly weighs less than 2kg.
• Physical length reduced to 350mm
• 10 cm resolution @ 23000m (visual)

Potential Future Developments;
• Ability to cue, locate, system integration, utilisation of alternative sensors such as LIDAR or Dual Band IR

Field of view from 24km
View from Naked eye
Resolution from Optics
Why was it different?

• 100% Funding for Phase 1 and 2 established
• Promoted and facilitated collaboration throughout the developments. Worked transversally through the projects, looking for opportunities. UK Defence customers want to procure a Military Capability not a component
• Facilitated access to end users
• Provided access to Integration facilities, and opportunities to showcase outputs.
• Always focused on exploitation and transition across valley of death

Innovation Challenge Networking Event supported by UKDSC
Capability Proving – 50/50 Co-Investment

• £4M Budget, first to utilise **co-investment** (50:50 MOD/Partner funding)
• Combines all 3 Innovation Challenges into a single Capability Proving phase – the first!
• Leveraged a potential £7.5M Industrial Co-Investment
• 4 Proposals funded, combined value £11M, £5M from MOD
• Commences Oct 2018 for ~2 years.
News story

Millions awarded to defence firms leading fight for modern battlefield

Defence firms with cutting-edge ideas ranging from laser radars to Artificial Intelligence have been awarded over £10 million after being named winners of the MOD and Defence Growth Partnership (DGP) Innovation Challenge by Defence Minister Stuart Andrew.

The winners provided innovative solutions to key strategic future demands for UK defence in autonomy and big data. The companies and their groundbreaking technologies will receive combined investment and support worth over £4 million from the MOD and £6 million from industry partners to see their full development.
Top ten tips for successful Innovation

1 + 1 = 3
THE FUTURE OF THE INTERNET OF THINGS

#IoTBristol2019
Harnessing IoT Skills
Build, Buy, Borrow and Bridge Talent
Harnessing the Internet of Things

- Devices are talking to devices, and generating huge volume of data in the

- To unleash the full potential of IoT, different skills are required than in the past
Growing Cyber Security Threats

► Every time one device is connected to another…

...It becomes a potential door for cyber criminals to break in and access sensitive data
Businesses need to **capitalise** on the promise of IoT without exposing themselves to dangers…

...and that all starts with **talent and skills**
Invest in learning and development programmes to grow your internal talent pipeline.
Recruit externally for talent that cannot be built in-house in the required timeframe.
Cultivate communities of non-permanent workers to complement existing workers
Help people to move up into new roles within your organisation.
# The Skills Revolution

**Forces Are Changing the Business Landscape**

<table>
<thead>
<tr>
<th>Competitive Forces</th>
<th>World of Work Forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Global &amp; Local Competition</td>
<td>• Shrinking Skill Availability</td>
</tr>
<tr>
<td>• Changing Value Creation Driving New Business Models</td>
<td>• Constant and Rapid Technology Evolution</td>
</tr>
<tr>
<td>• Changing Value of Scale</td>
<td>• Increased Market Transparency, Sophistication &amp; Complexity</td>
</tr>
<tr>
<td>• Economic Instability</td>
<td>• Redefinition of Brand Loyalty</td>
</tr>
<tr>
<td>• Compressed Margins</td>
<td></td>
</tr>
<tr>
<td>• Heightened Risk</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employer Trends</th>
<th>Employment Drivers</th>
<th>Individual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workforce Platforms</td>
<td>Open Access to Jobs</td>
<td>Flexibility vs Security</td>
</tr>
<tr>
<td>Labour Consumption</td>
<td>Employability</td>
<td>Increased Career Responsibility</td>
</tr>
<tr>
<td>Skill Mobility</td>
<td>Productivity over Potential</td>
<td>Income Stability &amp; Wage Stagnation</td>
</tr>
</tbody>
</table>

- The Haves vs The 'Rest of Us'
Skills Availability In IoT And Cyber Security

17% increase in cyber security jobs over the last quarter

20% Contractor day rates for cyber security climbed by 20%, while permanent salaries dropped by 2%

Most in-demand jobs

**CYBER SECURITY:**
- Security Engineers
- Consultants
- Architects
- Analysts

**IOT:**
- Software Engineers
- Consultants
- Technical Architects
- Testers
THE FUTURE OF THE
INTERNET OF THINGS

#IoTBRistol2019
# Agenda

### Session 2: Advancing Manufacturing Through IoT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:30 – 15:55</td>
<td>Keynote</td>
<td>Charles Paumelle, Microshare</td>
</tr>
<tr>
<td>15:55 – 16:25</td>
<td>Panel Session and Q&amp;A</td>
<td>Matthew Evans, techUK, Charles Paumelle, Microshare, Amar Mundi, HCL, Justin Paul, Zeetta Networks</td>
</tr>
<tr>
<td>16:25 – 16:35</td>
<td>Closing Remarks</td>
<td>Martin Ewings, Experis</td>
</tr>
<tr>
<td>16:35 – 17:30</td>
<td>Networking &amp; Drinks</td>
<td></td>
</tr>
</tbody>
</table>
Connectivity options for Industrial Internet of Things (IoT)
Smart Facilities Management
The Internet of Things (IoT) is the ability to connect **physical devices** to a **network** to **transfer data** without requiring human-to-human or human-to-machine interaction.
The Internet of Things (IoT) is the ability to connect **physical devices** to a **network** to transfer **data** without requiring **human-to-human** or **human-to-machine** interaction.
IoT connectivity

Data Rate

Range

Power
Cost?
Data Rate

- GB/s
- MB/s
- Bytes/s

Data vs. Range

- 5G
- 4G/LTE
- LTE-M
- NB-IoT
- LoRaWAN
- sigfox

Meters vs. Kilometers

(*) Expected range from 1 access point
Low Power Long Range (LPWA)

(*) Expected range from 1 access point
Low-Power Networks
Unlicensed or licensed?

Unlicensed Spectrum
- sigfox
- LoRaWAN
- WEIGHTLESS

Licensed Spectrum
- NB-IoT
- LTE-M
- INGENU
Select the right connectivity for your project

- Costs
- Modules & connectivity
- Open vs. Proprietary?
- Regional availability
- Uplinks/Downlinks?
- Product availability
Why we use LoRaWAN

- All sensors are connected to a Long-range, low-power LoRaWAN network
- LoRaWAN is an emerging open standard for IoT connectivity, using free-to-air radio frequency (868 MHz in Europe) adopted in the UK by BT, IoT Scotland & Digital Catapult amongst others
- All transmissions are fully encrypted from device to cloud
- One network gateway covers several floors
- Devices and gateways are pre-registered on the LoRaWAN network server so can be installed by non-IT personnel
- Microshare supports public and private network deployments
Typical LoRaWAN Architecture

- **End Devices**
- **Gateways**
- **Network Server**
- **Application Server**
- **Users**

- 4G
- On-premise
- Cloud
Full on-premise LoRaWAN architecture

- **End Devices**
- **Gateways**
- **Network Server**
- **Application Server**
- **Users**
Microshare offers complete IoT Smart Building solutions including wireless sensors, dedicated network and data access in a single kit.

Wireless battery-operated sensors → Long-range self-contained wireless network → Apps to visualise data and receive alerts

is available from the Microsoft Azure Marketplace
Case study: Mace Group

The data produced from the Microshare IoT sensors has enabled us to rethink how we schedule the cleaning services to offer an enhanced customer experience. We can now clearly see the trend of when demand peaks and have been able to respond by putting a robust cleaning schedule in place that can flex with these peaks.”

Ron Dudley-Scales, Operations Director at Mace Macro
Contact

Charles Paumelle, co-founder
cpaumelle@microshare.io
+44 798 414 0314
@cpaumelle

https://microshare.io
THE FUTURE OF THE INTERNET OF THINGS

#IoTBRistol2019