IoT Research for South East LEP

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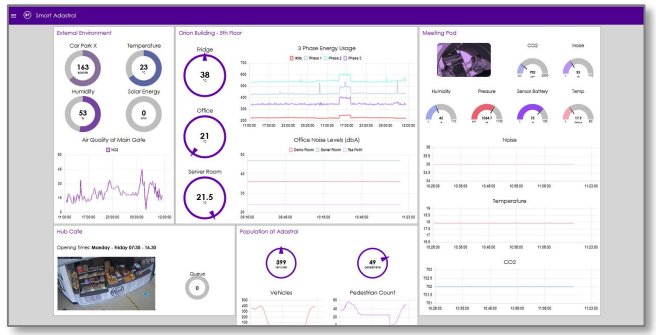
Applied Research

Today's Agenda

- Purposeful Innovation
- What we research and why
- Typical Use Cases
- Deeper Dive
  - Autonomics - making things secure and scalable
  - Cyberphysical Research – UAVs and Robot Highways



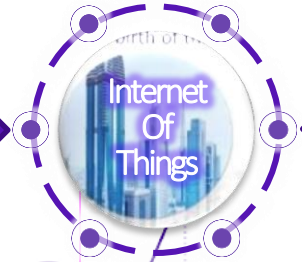
Smart Adastral Dashboard

Example Engagements

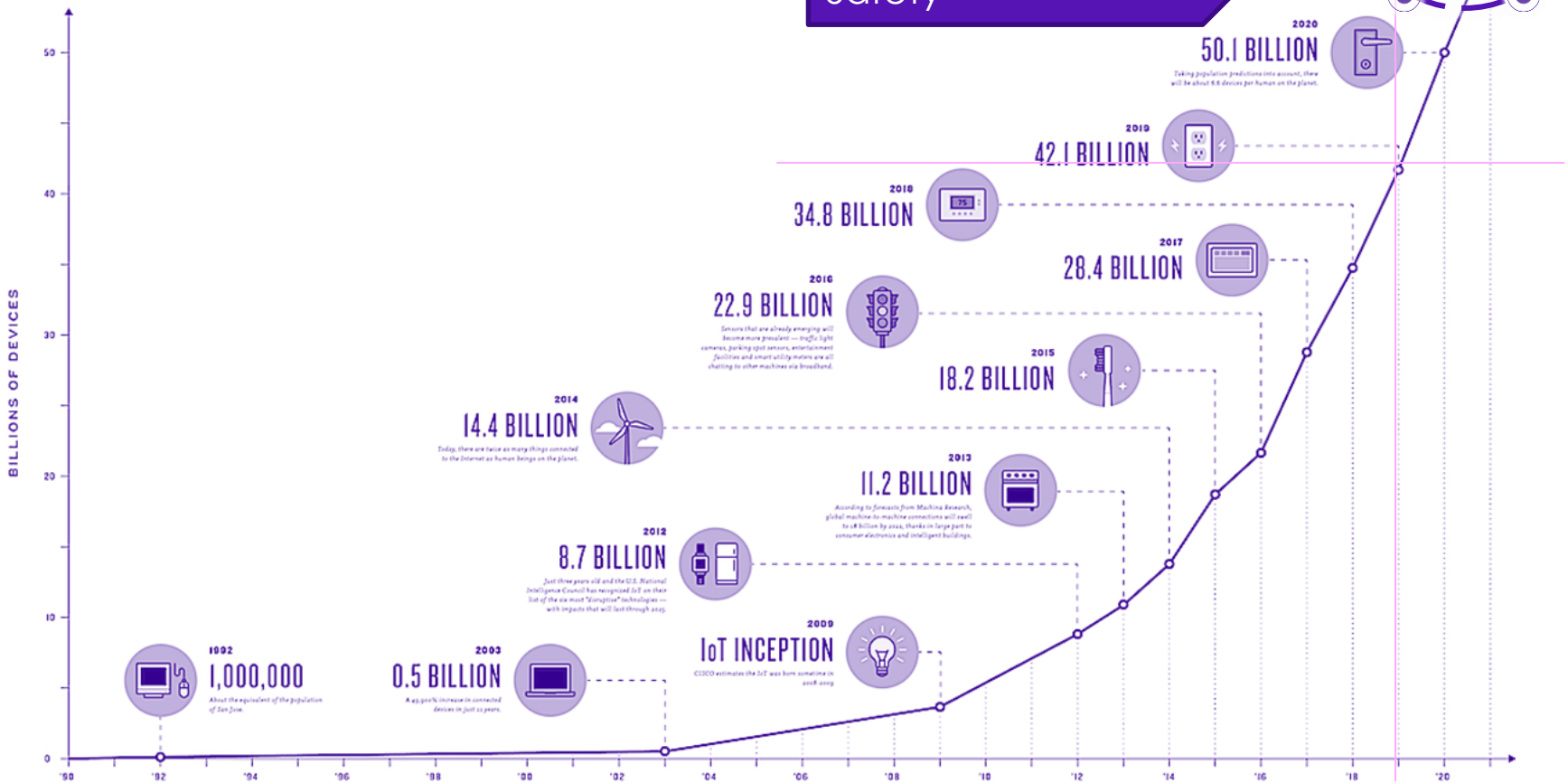
Unmanned Vehicle Activities

IoT – Internet of Things

Business Drivers
More for Less
Sustainability
Wellbeing
Safety

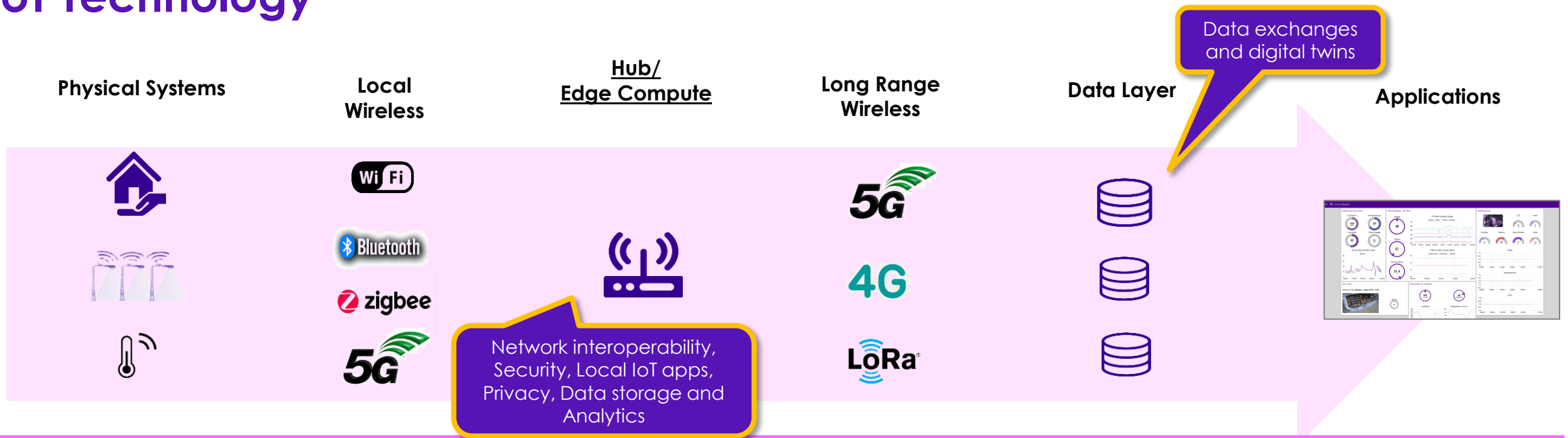


Technology Drivers
Connectivity Options
Battery Life
Device Cost
Artificial Intelligence



*The **Internet of Things** (**IoT**) refers to the ever-growing network of physical objects that are connected to the internet and the **communication that occurs between these objects and other Internet-enabled devices and systems***

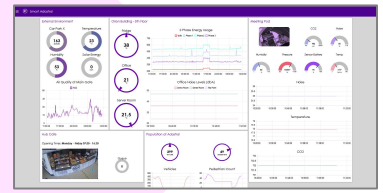
IoT Technology



Wireless Technology	Data Rate	Range	Power Usage	Cost	Typical Applications
2G/3G	1-10 Mbps	Several Miles	High	High	Single legacy sensors – Wide area
4G	40Mbps	Several Miles	Medium	High	Single sensors, local hubs – Wide area
5G MMTC	160bps+	Several Miles	Low	Low	Utilities, retail, buildings – Wide area. Dense deployments – 300k sensors per km^2
NB-IoT	0.1-1Mbps	Several Miles	Medium	Medium	Utilities, retail, buildings – Wide area
Bluetooth	1,2,3 Mbps	~100 Feet	Low	Low	Simple sensors – temperature, CO2 in buildings, health and retail - Local area
LoRa	<50 kbps	1-3 miles	Low	Medium	Utilities, retail, buildings – Wide area
WiFi	0.1-54 Mbps	<300 Feet	Medium	Low	Complex sensors and systems. in buildings, health and retail – Wide area

IoT Use Cases and Projects

Physical Systems	Local Wireless	Hub/ Edge Compute	Long Range Wireless	Data Layer	Applications
	Wi Fi		5G		
	Bluetooth		4G		
	zigbee		LoRa		
	5G				



- Zero Touch Onboarding
- Smart Campus
- IoT Autonomics
- Future BT Smart Hub
- Robot Highways – Agritech (5G)
- CHIP/Matter
- Drone in a box - Surveillance
- BT Surveillance
- Connected Health
- Environmental Sensing

A Smarter Suffolk – project overview

Suffolk County Council (SCC) secured funding for the 'A Smarter Suffolk' project (ADEPT - Association of Directors of Environment, Economy, Planning and Transport).

18-month project (Dec 2019 to May 2021)

Utilise SCC's existing assets, e.g. street lighting columns, to deploy adaptive street lighting and sensor technology in support of local services.

Analysis of data will reveal insights that will help Suffolk County Council run local services more efficiently (cost savings)

- **more efficient use/control of street lighting**
- **targeted gully clearing**
- **smarter (more informed) road gritting**
- **directed waste bin collection and grit bin monitoring/re-filling**

Key partners: **Suffolk County Council, Suffolk Highways, University of Suffolk, BT**

Evaluate and compare sensors/sensor technology in a representative environment (Adastral Park) prior to wider acquisition and deployment.

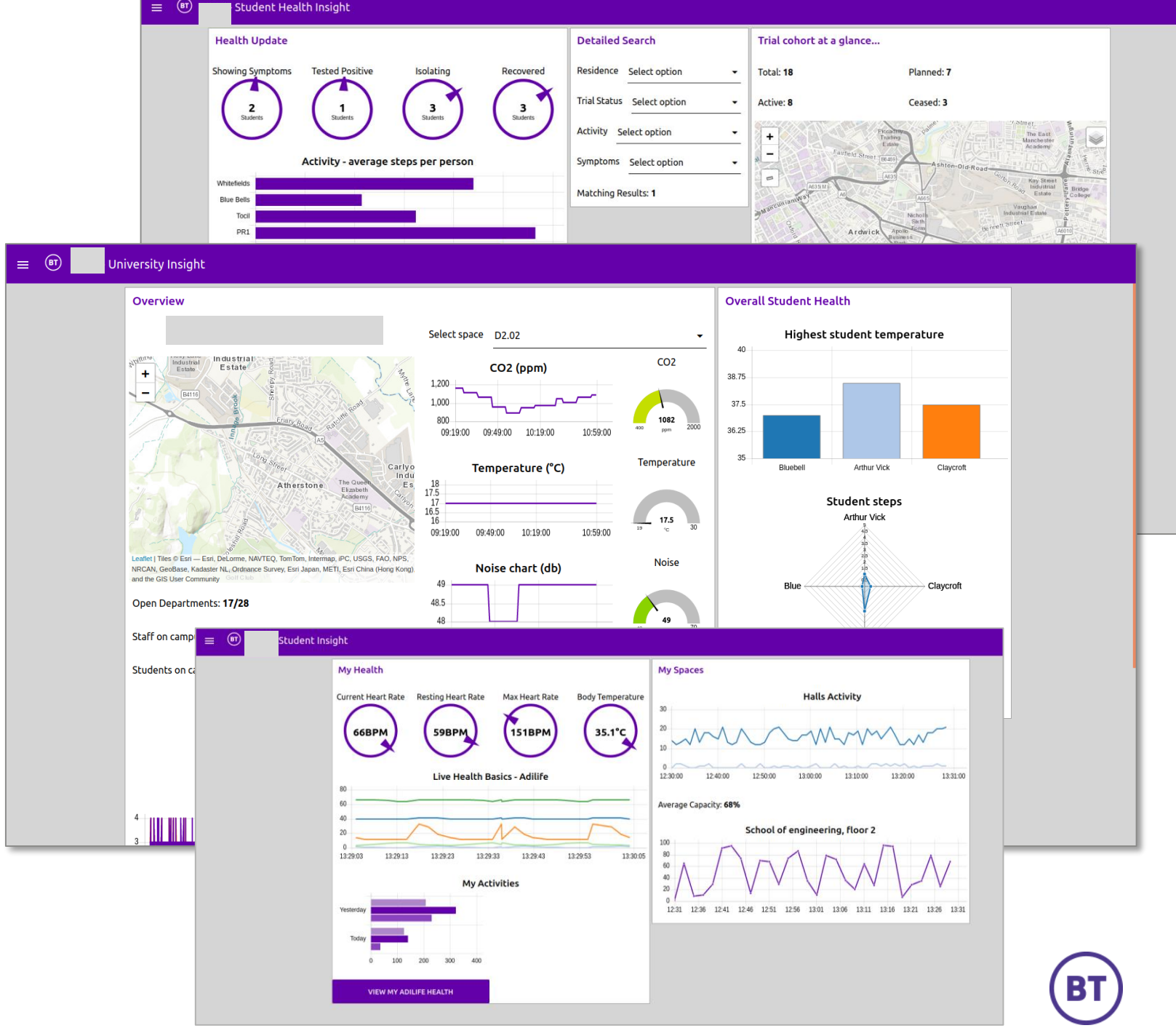
BT are providing a data hub - uplifted Information Exchange (BT Enterprise)

- collate/integrate sensor and lighting data from multiple suppliers
- expose sensor/lighting data via a common API

Adastral Park is being used as test/evaluation environment.

Smart Campus

- Live project with university – innovation alliance
- Health and wellbeing of students and staff
- Use Cases
  - Holistic Well Being
  - Smart Place Optimisation
  - Trusted IoT
- Engagement with users
- Ethics study
- IoT data exchange and analytics
- Using commercial home and health IoT systems



The Deeper Dive…

Future Vision: IoT Autonomics

Legacy System

Problem

Increased complexity in IoT ecosystems due to the need for multiple sensors, networks, security functions, systems spanning from edge to cloud and various vendors.

Introduces:

- Systems Complexity
- Difficult to Manage/Monitor
- New Attack Surfaces
- Challenging to Scale

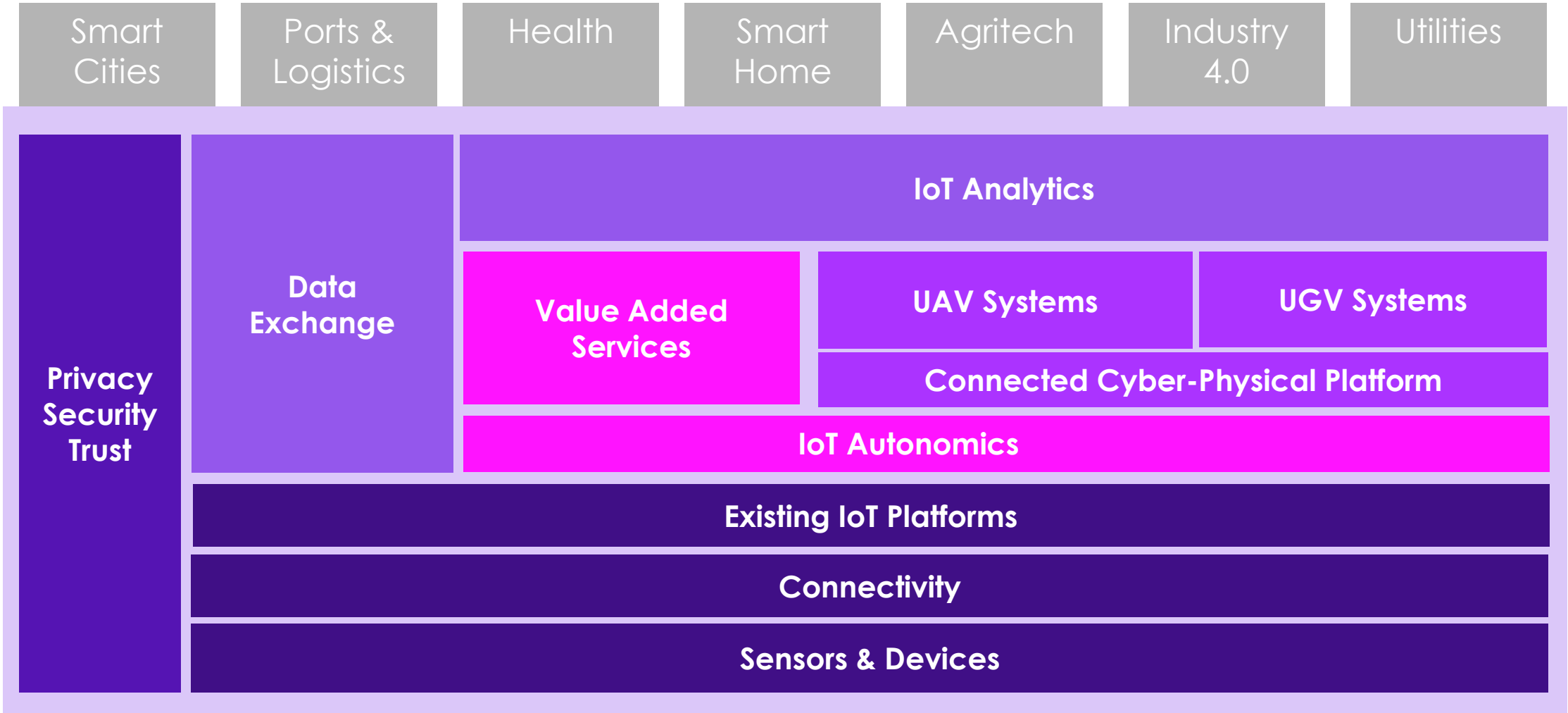
Autonomics Platform

A set of platform capabilities which automate and self-regulate the delivery and management of trusted IoT services.

- Self-configure
- Self-heal
- Self-protect
- Self-optimise

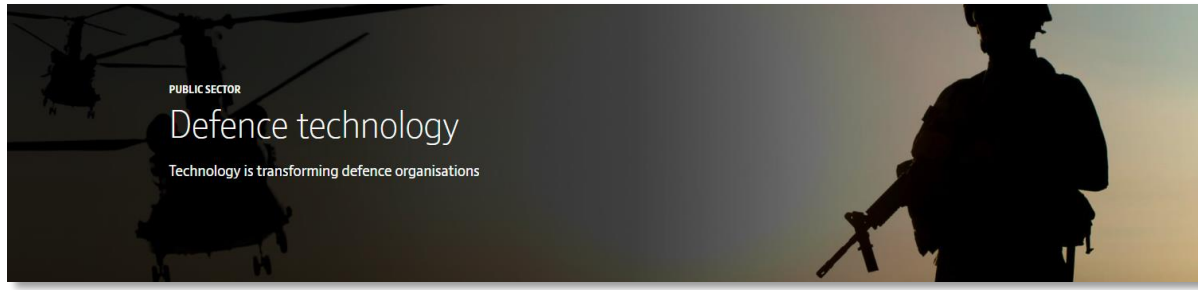
BT

Autonomics Architecture



CyberPhysical (C2P) Research

A **cyber-physical** system (CPS) or intelligent system is a computer system in which a mechanism is controlled or monitored by computer-based algorithms.



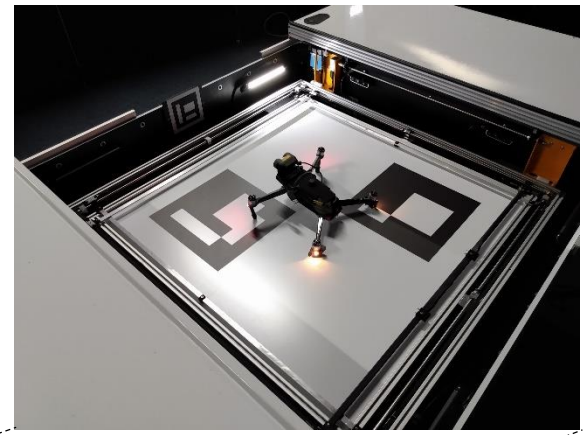
- **Why BT?**
  - Increasing customer need
  - Own use, leading expertise
- **C2P Challenges**
  - Economics
  - Complexity
  - Safety
- **Translates into…**
  - Industry engagements – Future Flight (CAA, Altitude Angel, M4 Corridor)
  - Safety driven approach to complex systems
  - Autonomics of flight and the risk management around it
  - Extensive test facility at Bentwaters Parks

openreach

BENTWATERS PARKS

Example UAV Surveillance Use Case

- Weatherproof enclosure – Drone In A Box
- Evaluating autonomous flight operations
- Safety cases and oversight
- Impact on regulation



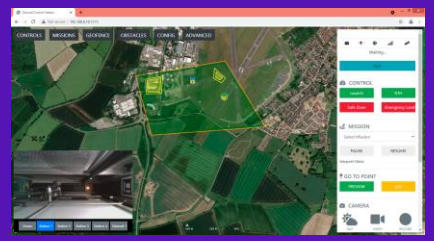
Target

DJI Ocusync

Drone In A Box

5G, 4G, Ethernet, WiFi, Broadband

Command and Control Centre



Mission Control

Surveillance Platform

Custom Analytics and Control

Business Logic

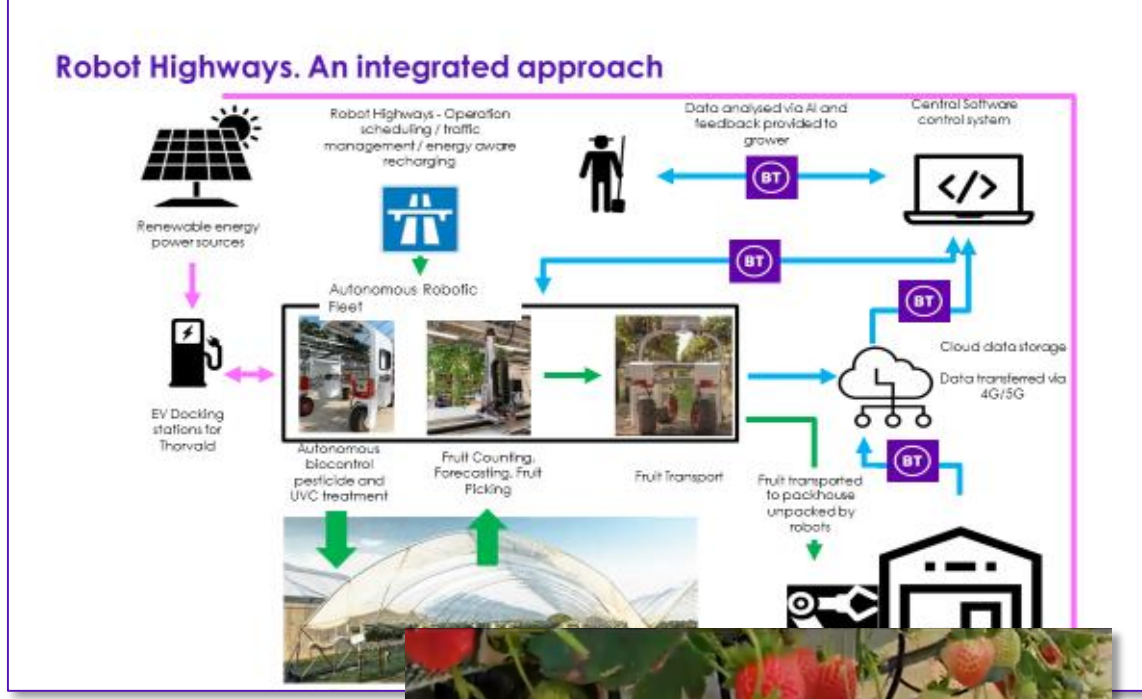
Robot Highways Use Case

1. In partnership with University of Lincoln, Saga Robotics and Clockhouse Farm, Kent

2. Research and understand the implications of cyber-physical systems on IoT architectures – 3 years

3. Evolve our edge computing research to include actuation and robotics

4. Research and develop an edge/cloud architecture to guarantee scalability of the Industrial IoT (agritech) solutions ensuring the optimum balance is achieved between edge processing and cloud processing on 5G.



Innovate UK

BT

Further IoT Slides

Drone usage in BT

Use Cases	Examples	Benefits
Cable Delivery	To span, rivers, valleys and over trees and unsafe structures	None ballistic safe solution. Engineers never in harms way. New cost effective routes opened up
Delivery of Spares by Drone	Deliveries to remote locations where traditional methods are unavailable or too slow	Time and cost savings. This solution is able to operate when Ferries and Helicopters are not.
Asset inspection	Pole testing Mast inspection Building inspection	Climbing cut to a minimum. Fast and cheap
Aerial survey	Radio line of sight survey	Cost effective, saves climbing
3D Modelling Photogrammetry	Modelling of assets, AI used to identify inventory	Taking asset management and planning to a new level
5G Network Splicing	Using drones to build aerial networks.	Emergency response network coverage

Smart Adastral

External Environment

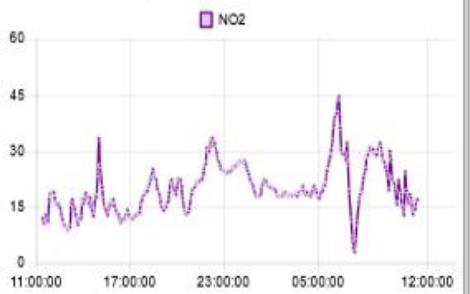
Car Park X: 163 spaces

Temperature: 23 °C

Humidity: 53 %

Solar Energy: 0 kWh

Air Quality at Main Gate



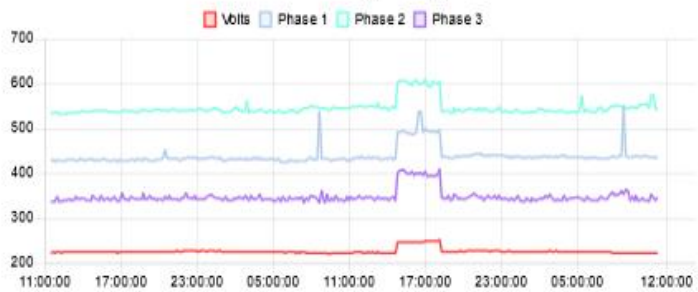
Orion Building - 5th Floor

Fridge: 38 °C

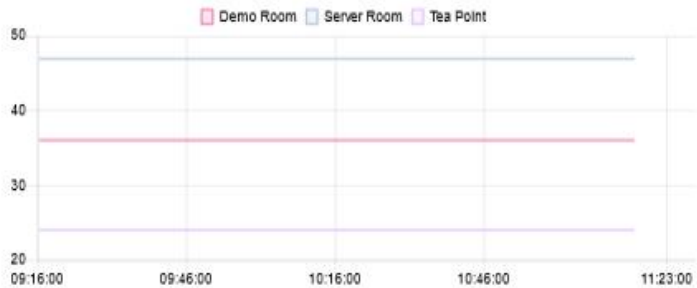
Office: 21 °C

Server Room: 21.5 °C

3 Phase Energy Usage



Office Noise Levels (dbA)



Meeting Pod

CO2: 702 ppm

Noise: 35 db

Humidity: 42 %

Pressure: 1034.7 mb

Sensor Battery: 75 %

Temp: 17.9 Celcius

Noise

Temperature

CO2

Hub Cafe

Opening Times: **Monday - Friday 07:30 - 16.30**

Queue: 0

Population at Adastral

399 vehicles

49 pedestrians

Vehicles

Pedestrian Count