Faculty of Engineering

University of
Strathclyde
Engineering

**Engineering Data;
Cloud based Services for Precision Farming**

Ivan Andonovic
University of Strathclyde

Outline

- Background
- Use Case; Cloud Services for Precision Farming
  - Silent Herdsman Platform
  - *mySilent Herdsman*
- Summary

Background

Engineering Data Principles

- solutions are multi-disciplinary and are far more demanding that those routinely deployed under 'Big Data'
- solutions rely on engineering elegance driven by precise risk and business impacts in order for the
  - derived product/service to be fit for purpose
  - can also be migrated with a minimum of perturbation to large organisations/institutions that have been following entrenched practices for many years or disparate end user communities

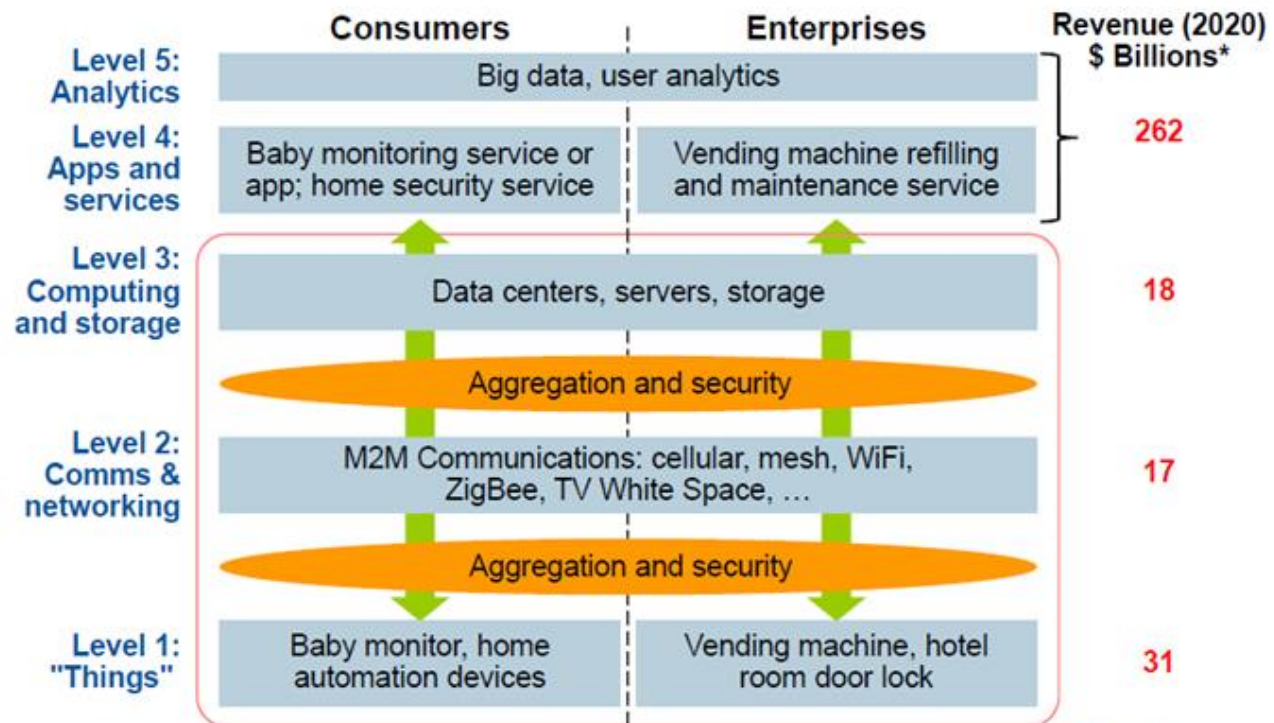# The Internet of Things (IoT) Technology Platform

Engineering Data Principles

- the largest market segment is in multi-data streams utilised to derive services that improve practices, asset performance or production efficiency

- end user involvement from the outset crucial to product success
  - codify knowledge of domain experts and embed into the solution

- any solution must be validated
  - business impact *viz.* return-on-investment
  - technical functionality
  - user experience

- resources required to fully mature service models are lengthy and consistent funding is central to success

IoT;
Many Market Segments

Market Opportunities Extend Well Beyond "Things"

		Consumers	Enterprises	Revenue (2020) $ Billions*
Analytics	Level 5: Analytics	Big data, user analytics		262
Applications	Level 4: Apps and services	Baby monitoring service or app; home security service	Vending machine refilling and maintenance service	
Data Storage	Level 3: Computing and storage	Data centers, servers, storage		18
Security		Aggregation and security		
Wireless	Level 2: Comms & networking	M2M Communications: cellular, mesh, WiFi, ZigBee, TV White Space, …		17
Security		Aggregation and security		
Embedded	Level 1: "Things"	Baby monitor, home automation devices	Vending machine, hotel room door lock	31

Gartner July, 2014

Gartner.

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Use Case;
Cloud Based Services for
Precision Farming

The Need;
Precision Livestock Farming (PLF)

- core to satisfying the increasing world-wide demand for animal products of good quality whilst heavily reducing environmental load and resource use

- animal wellbeing is at the start of a supply chain linking farmer profitability, product quality, consumer satisfaction and environmental sustainability
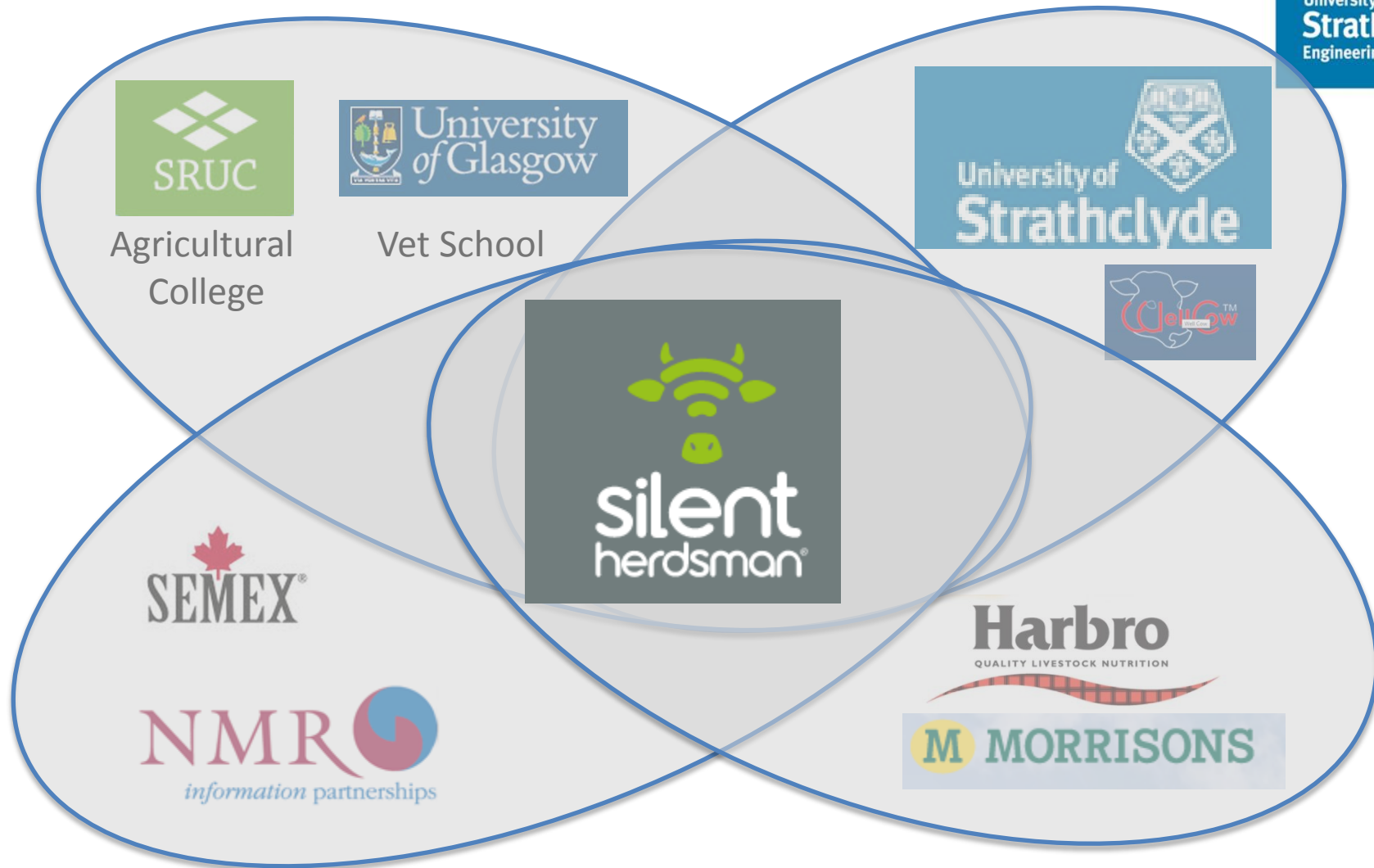
- production efficiencies in the sector are poor

The Solution; Silent Herdsman

- is the total addressable/accessible market significant?
  - 1 billion cattle worldwide
- what is the exact market need?
  - Minimum Viable Product specification?
  - fertility impairing milk production
    - lower pregnancy rates result in lost milk production days; 21 days per missed heat equivalent to ~£100 of revenue
- what is the technology solution to optimise pregnancy rates
  - what is the core raw data on which to fashion the solution? temperature? activity?
  - cost; use commercial-off-the-shelf components
  - ease of deployment, use and maintenance
  - scalability
  - global solution - internationalisation
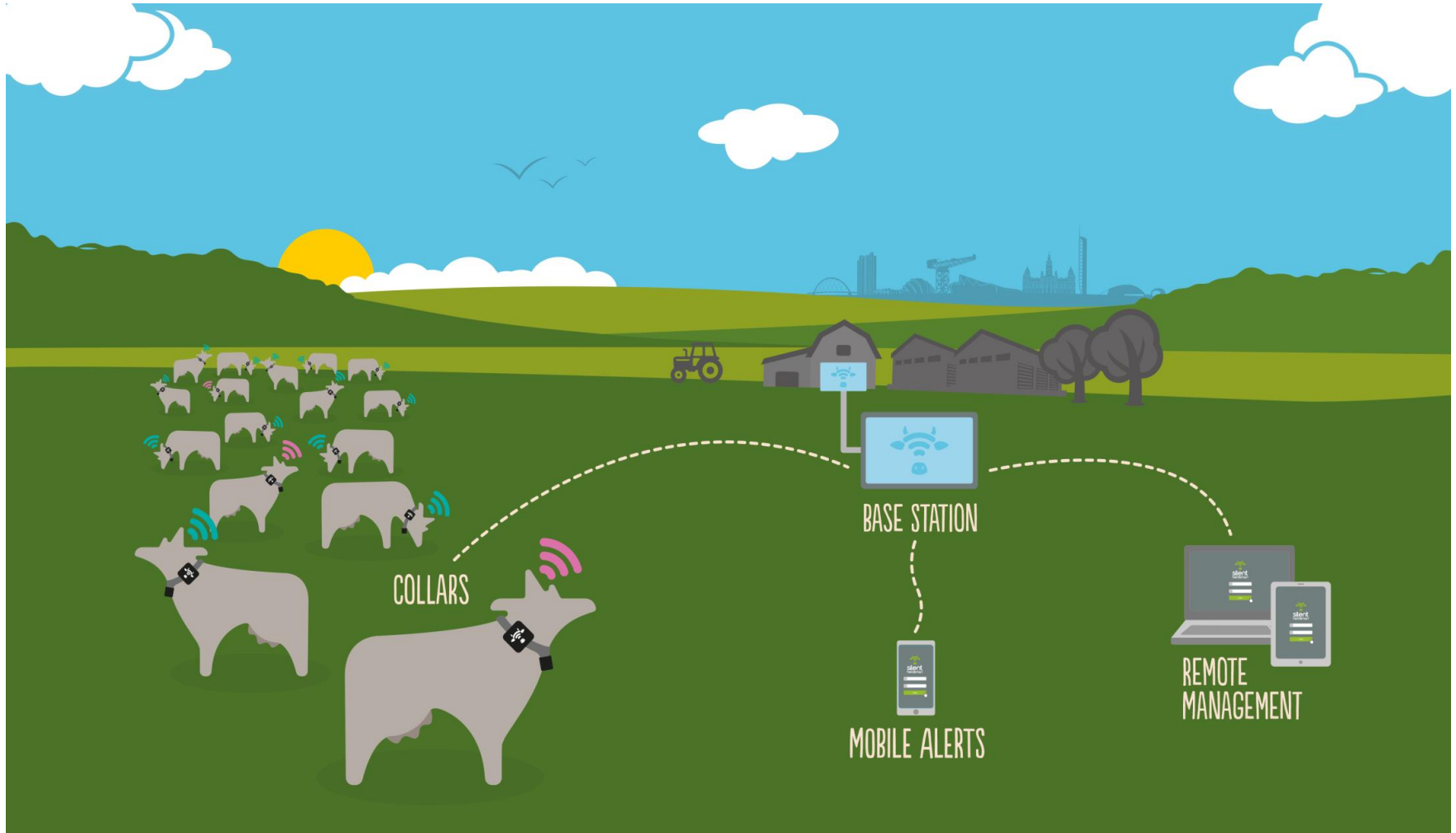
The Solution; Silent Herdsman

- development methodology
  - establish relationships with end users, domain experts and other industries operating across the supply chain
  - establish access the test environments to
    - develop initial solutions
    - verify initial solutions performance
    - validate solution performance in representative markets
- product roadmap in place at the outset
  - cloud-based platform that quantifies performance and efficiency of individual animals and provide key information to stakeholders within the supply chain
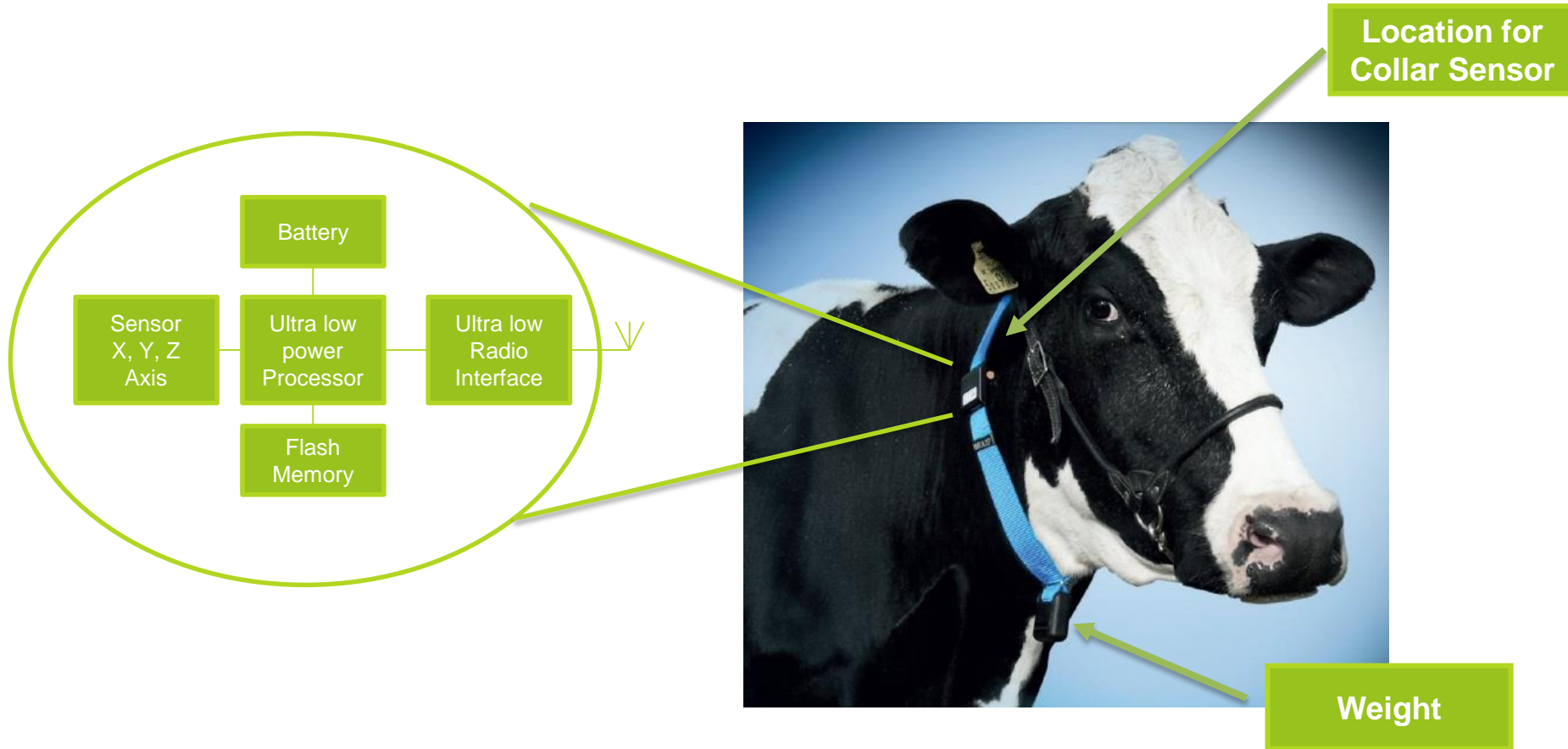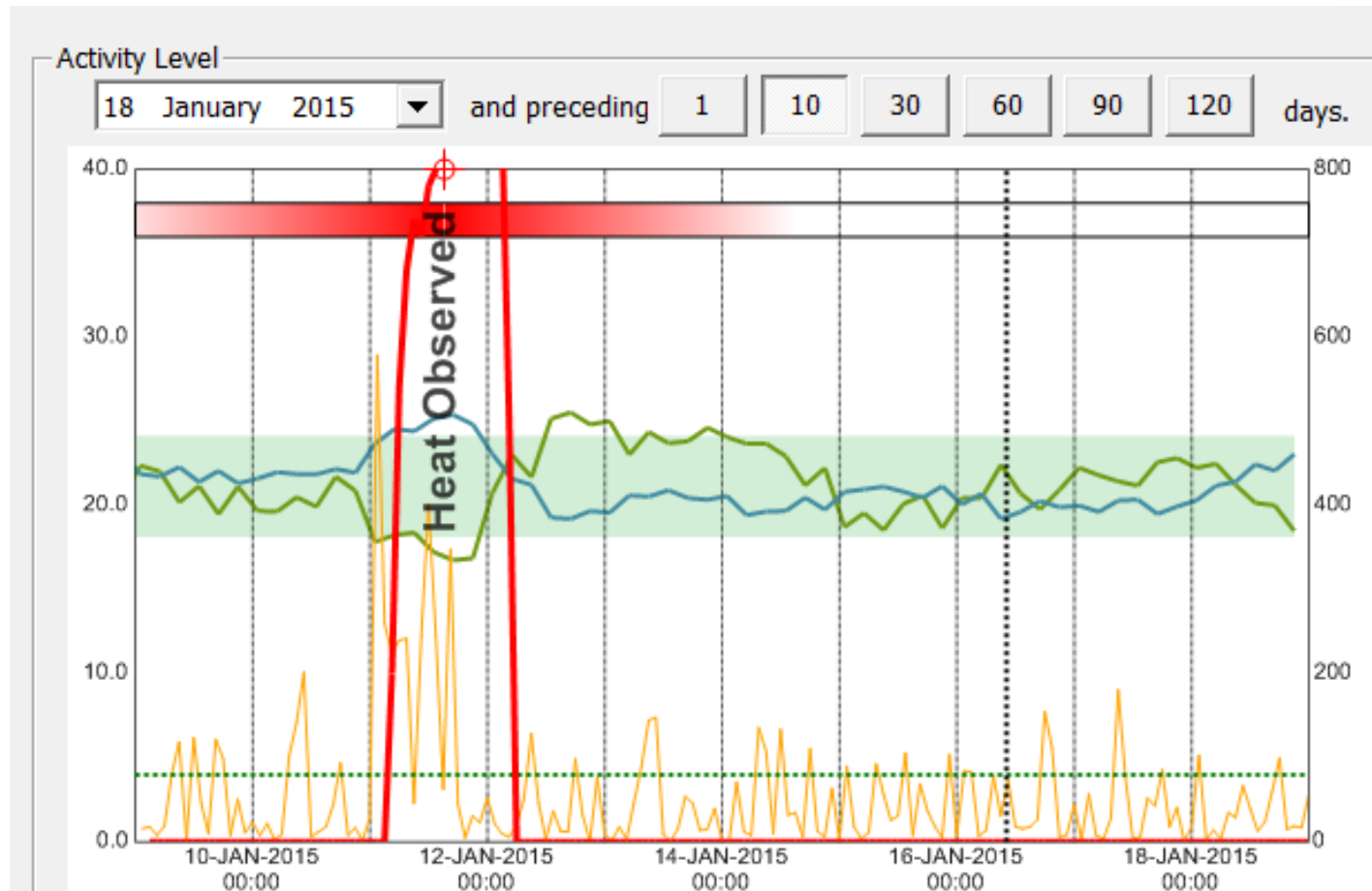
Development Methodology

Silent Herdsman Platform

Smart Collar
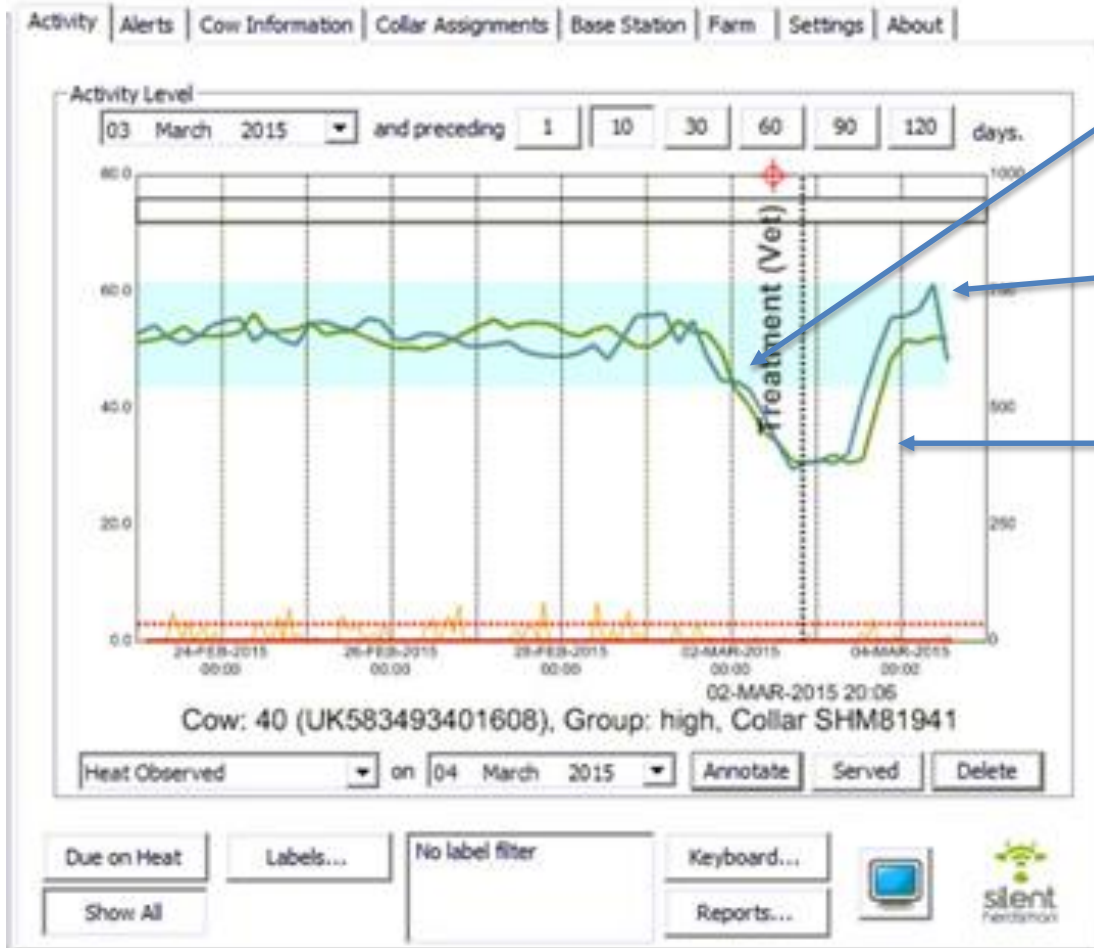

Battery

Sensor X, Y, Z Axis — Ultra low power Processor — Ultra low Radio Interface

Flash Memory

Location for Collar Sensor

Weight

Commercial in Confidence

Oestrus Service

Health Service

‘Health’ Alert (ill cow) when both fall 30 % below cow average
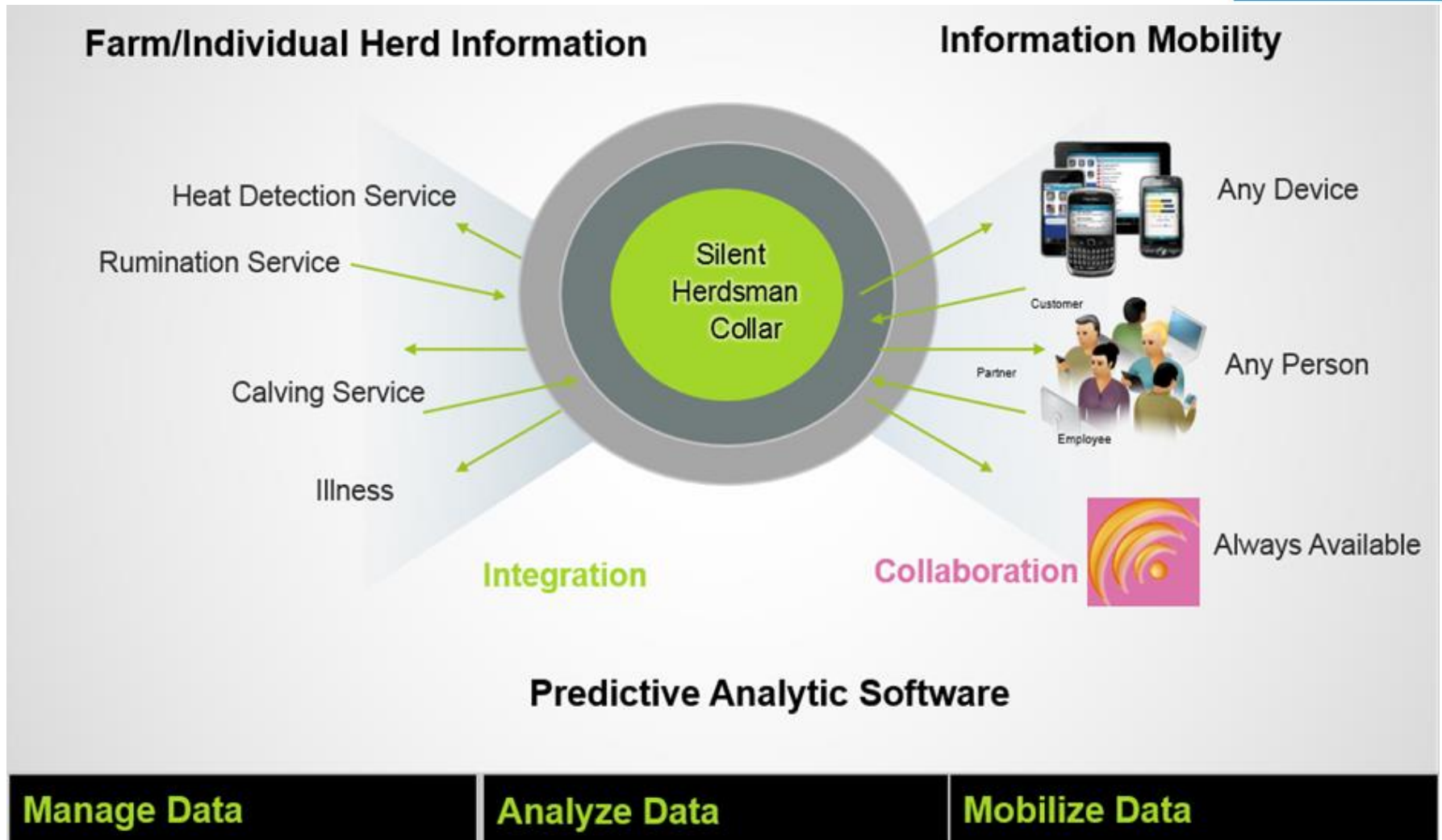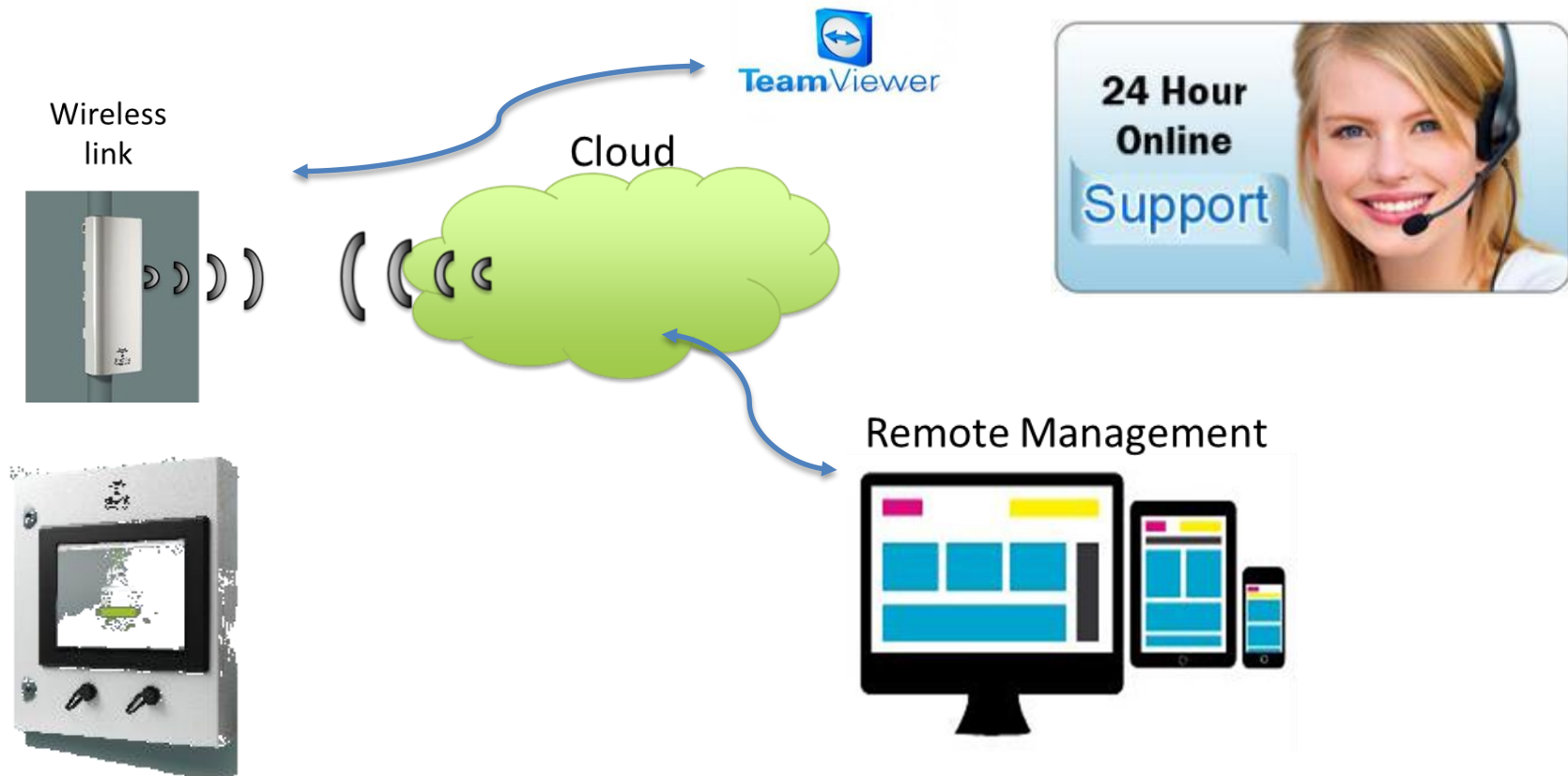
Eating

Rumination

mySilent Herdsman

Multiple Services

mySilent Herdsman

- on-line ensures customer service and strategic data opportunities
- full off-line operation guaranteed

Data Volume

***Note**; the Silent Herdsman **smart collar reduces** the volume of data from the 3-axis accelerometer prior to transmission*

- *nevertheless* the volume of data from **~600 farms** with **~100 collars** per farm generates ~**600 GBbytes** of data per collar feature e.g. heat indication **over 1 year**
- **1% of total number of cattle with ~1000 collars** per farm translates into;
    - ~10,000 farms
    - **~100 Tbytes** of data over a year per feature
    - increases with number of connected farms and per collar feature

Compatibility with IoT Designs

- multiple log-in capability so that other members of the supply chain can remote access to the information e.g. vets, AI (7)
- e.g. fertility and health service (6)
- visualisation of the key conditions of individual animals (5)
- data accumulation either at a local on-farm PC or the cloud (4)
- e.g. on collar processing based on artificial intelligence software that reduces the volume of data that requires to be transmitted (3)
- low power wireless connectivity (2)
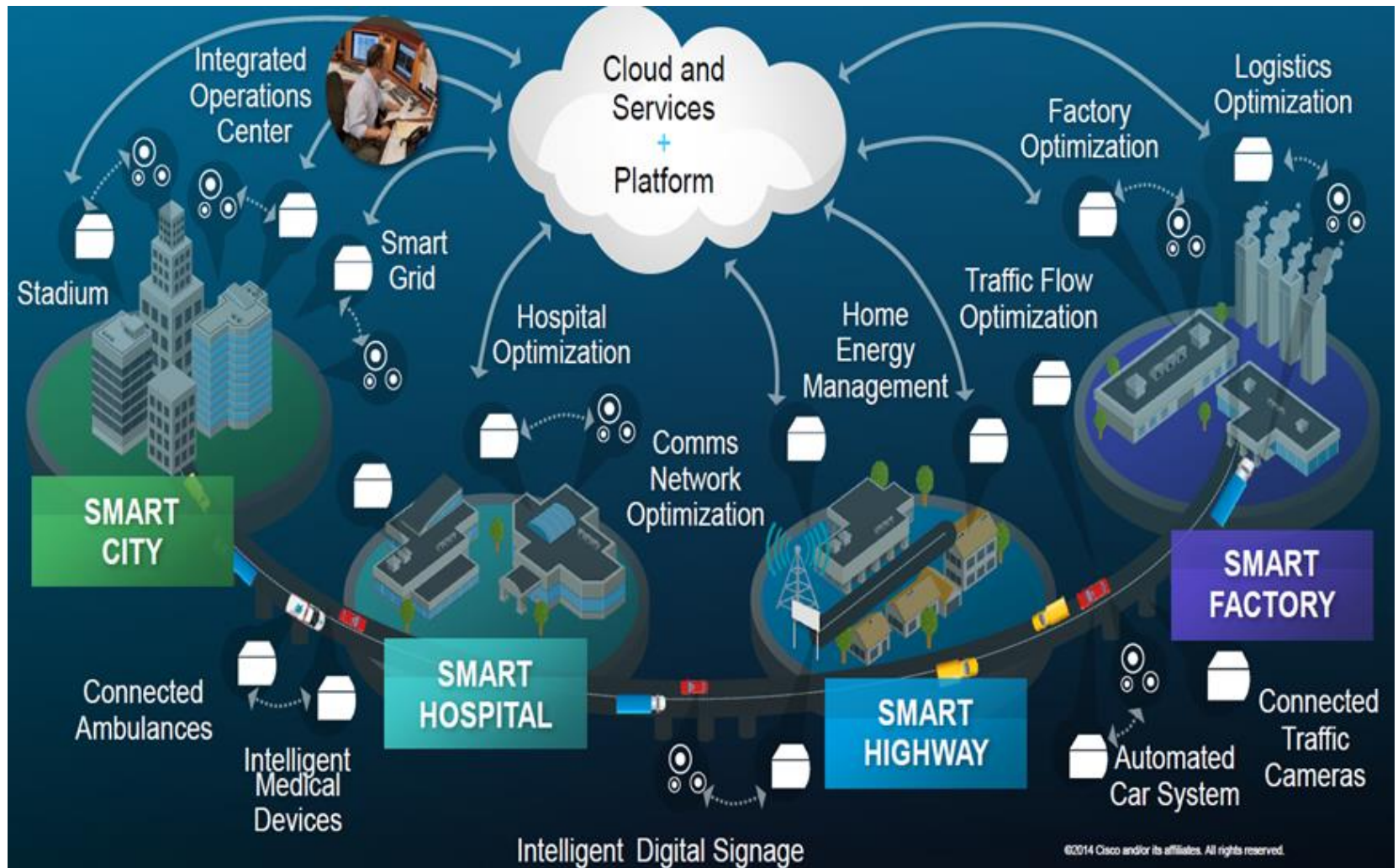- e.g. accelerometer based neck mounted senor is the measurement engine (1)

IoT World Forum Reference Model

Levels

7 Collaboration & Processes (Involving People & Business Processes) — Center

6 Application (Reporting, Analytics, Control)

5 Data Abstraction (Aggregation & Access)

4 Data Accumulation (Storage)

3 Edge Computing (Data Element Analysis & Transformation)

2 Connectivity (Communication & Processing Units)

1 Physical Devices & Controllers (The 'Things' in IoT) — Edge Sensors, Devices, Machines, Intelligent Edge Nodes of all types

Summary;
Massive Opportunties