Challenges in the Implementation of Cloud-based Precision Livestock Management Services Provision

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IoF2020 Dairy Trial; UC2.3 *Herdsman+*

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Outline

- Background
- Internet of Food and Farms
- Integration of Multiple On-Farm Data
- Service Evolution
- Future Challenges
- Business Models

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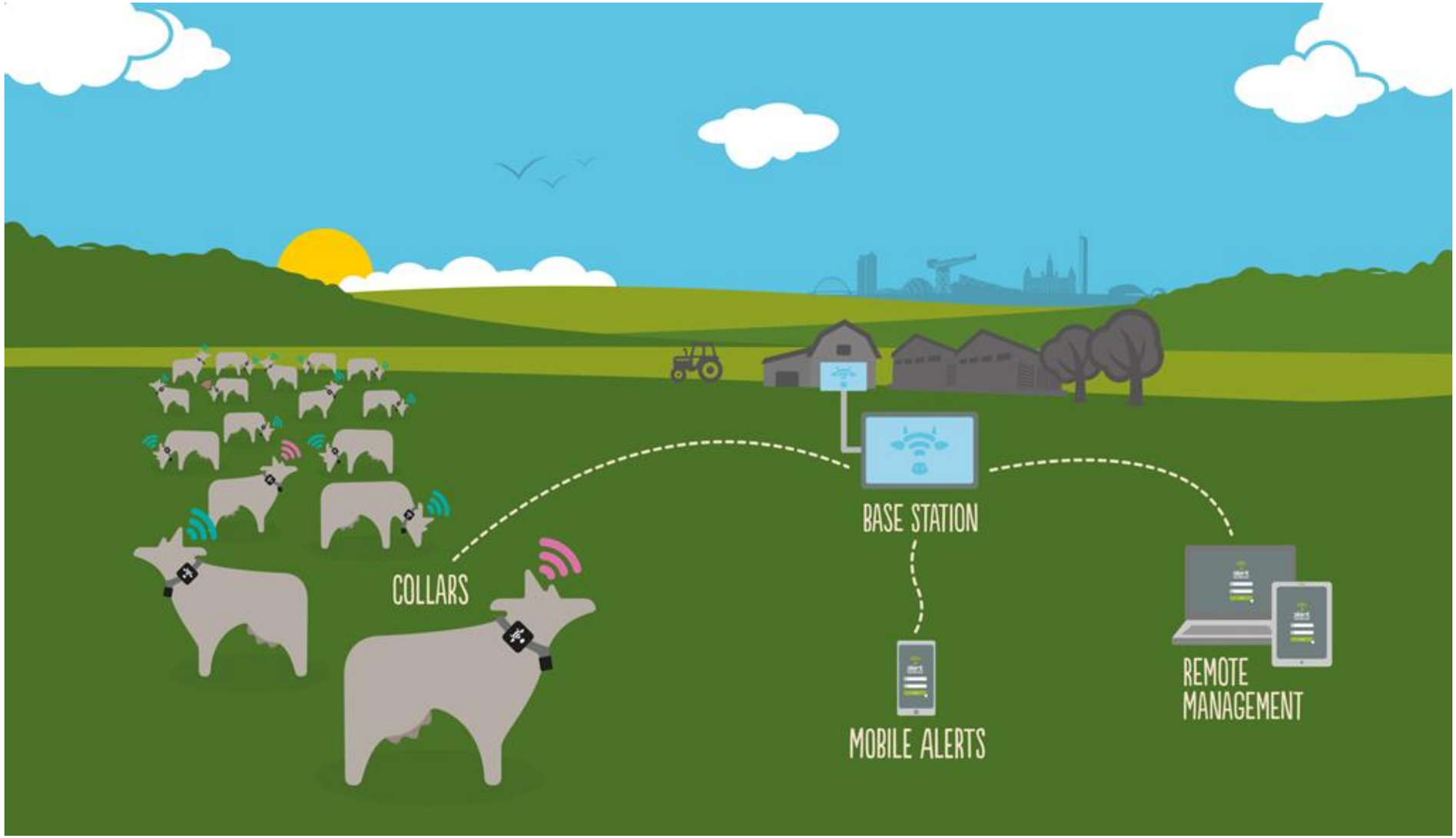
Background



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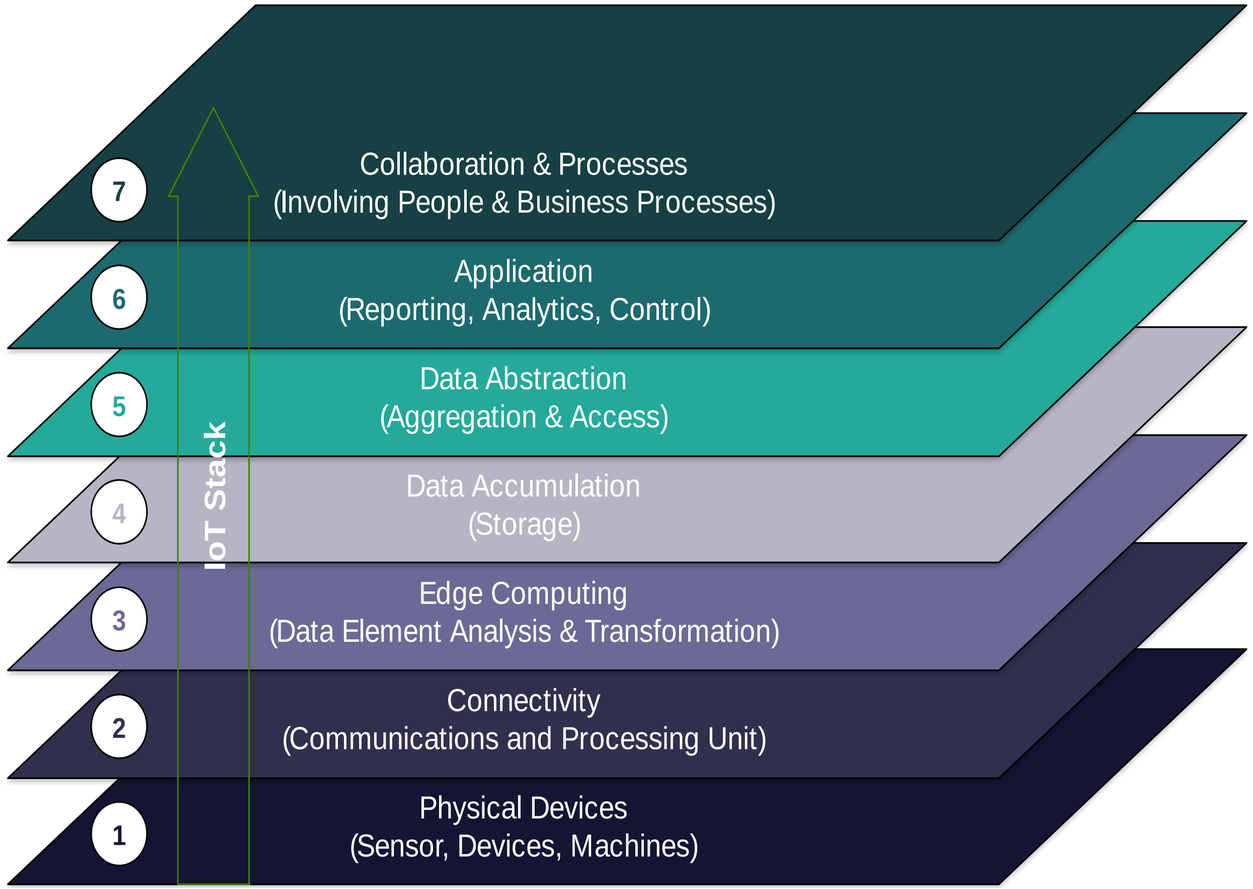
Internet of Food and Farms (IoF)

- **multiple log-in capability e.g. farmers*, members of the supply chain (e.g. vets, artificial inseminators) can remotely access the information***
- ***potential service e.g. fertility and health provisioning***
- **visualisation of the key conditions of individual animals**
- **data accumulation on-farm PC and on the Cloud**
- **edge processing based on artificial intelligence software that reduces the volume of data that requires to be transmitted**
- **low power wireless connectivity**
- **sensors generating raw measurements**



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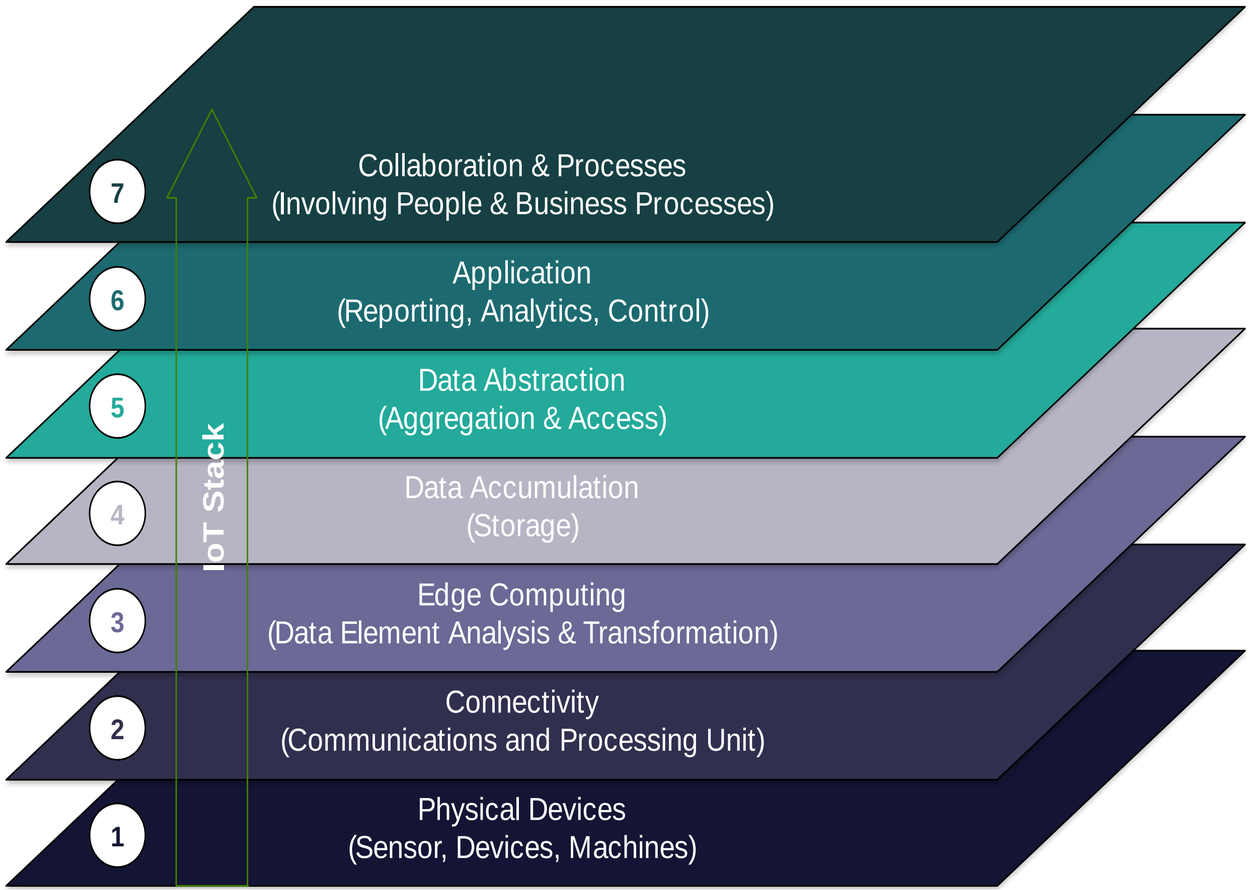
Internet of Food and Farms (IoF)- Value?



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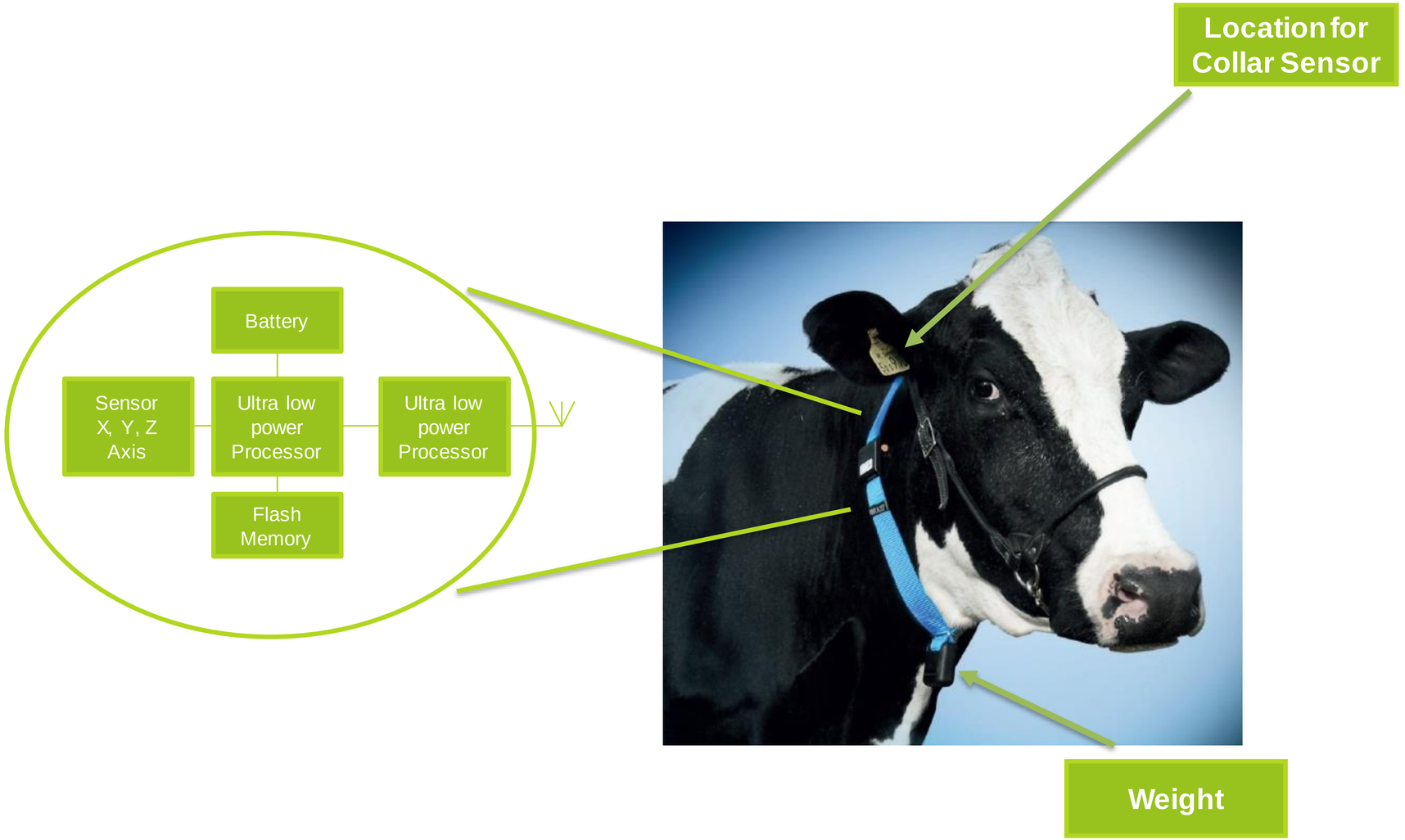
Smart Collars

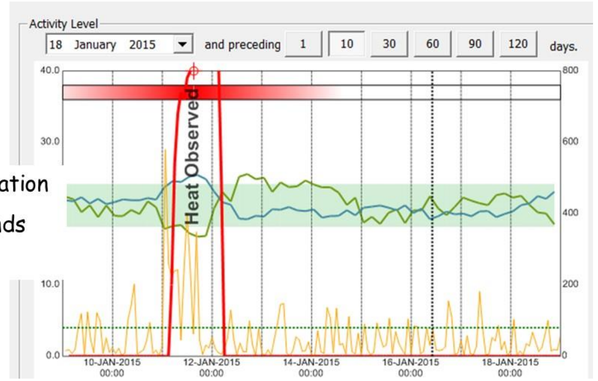


Decision Support

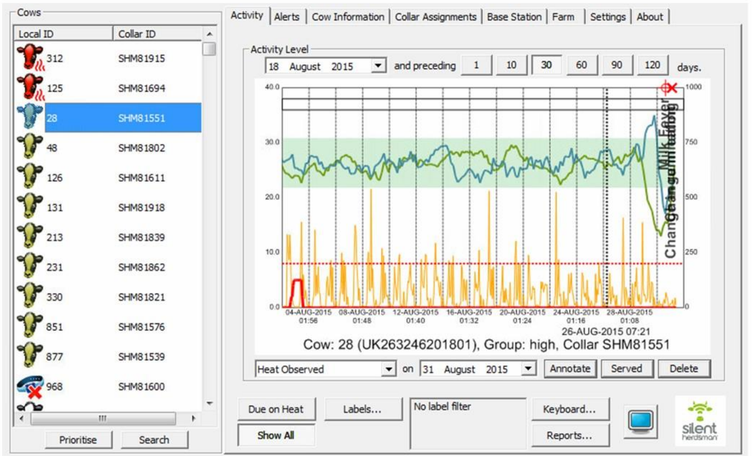
Oestrus

Normalised Eating/Rumination

Flagged when out of bounds (green shade)



Illness



Rumination drop in heat

Lameness

Normalised Eating/Rumination

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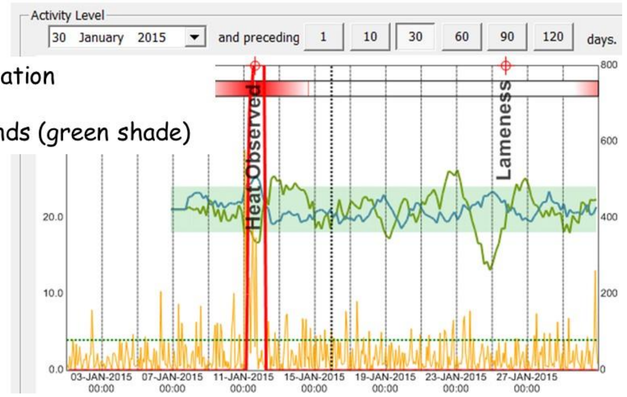
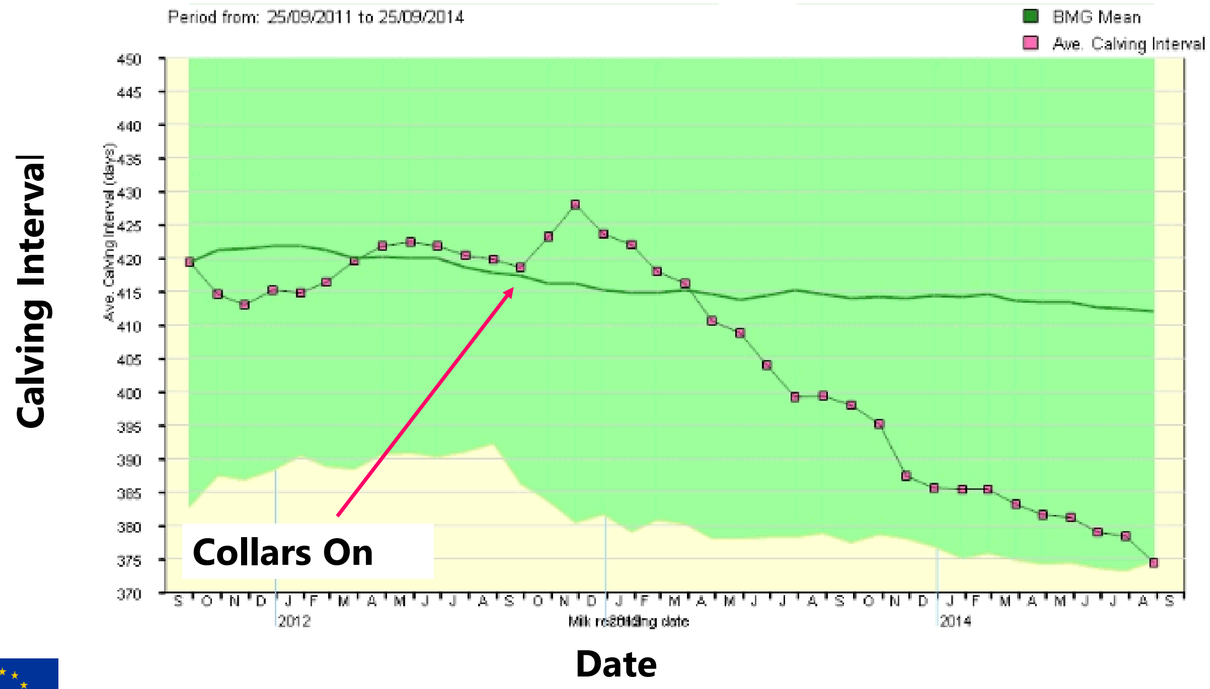


Optimising Pregnancy; *'Calving Interval (CI)'*

- CI is an industry accepted metric for herd fertility/pregnancy performance
- if a heat event is missed and the cow does not become pregnant, then the CI increases
- 21 days of lost production results per missed pregnancy e.g. in the UK currently the cost penalty is > £5 per day per cow if the animal is not pregnant viz. >£100 lost revenue
- in the example of the impact of the deployment of the collars on a working farm in the UK (below), the CI has improved from 415 before the collar to 375 after collar deployment
- a 40-day improvement in the CI for 500 cow herd translates to >£100k additional revenue for a ~£35k outlay to purchase the entire system with collars for all animals



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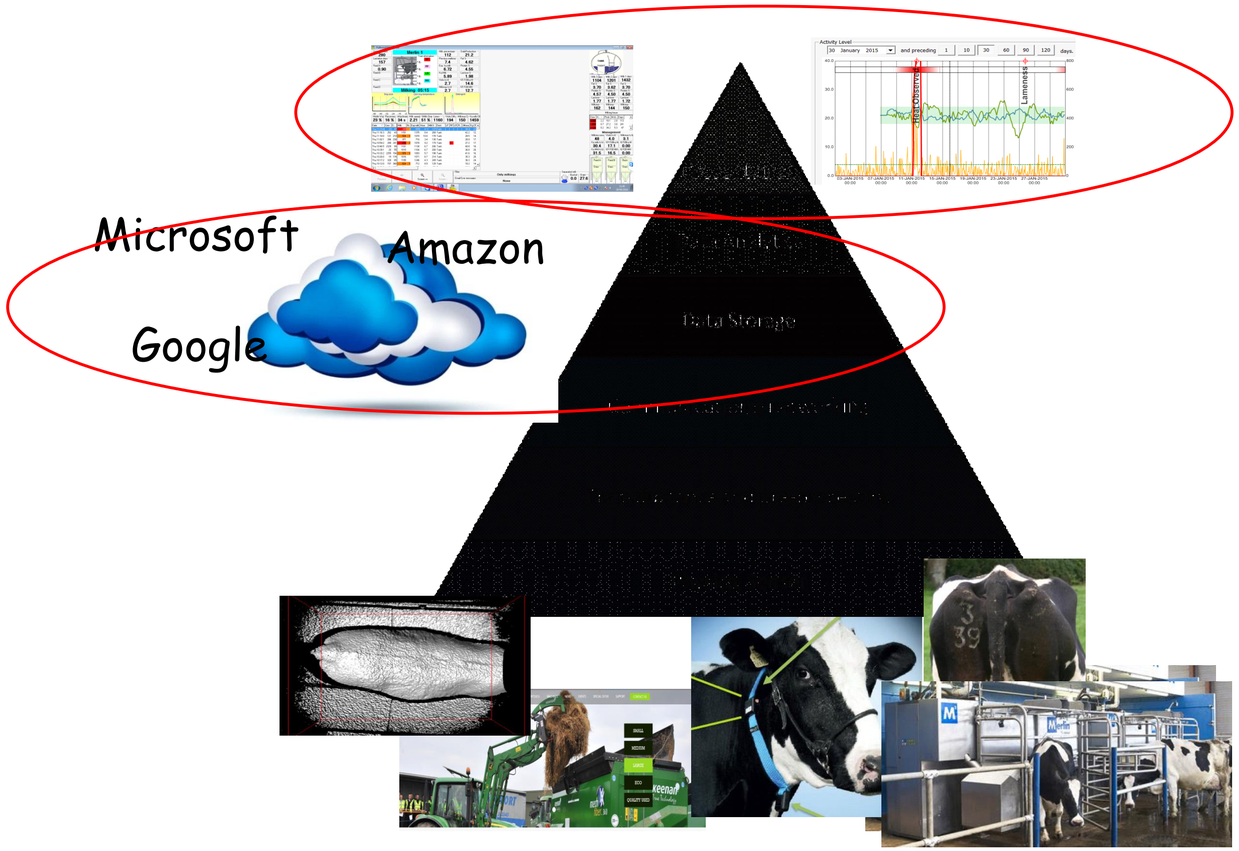
Integrated On-Farm Data Platform: Migration to ‘Services’

- all on-farm data is integrated into one database platform
- data streams must be synchronised to enable impactful derivation of information
- all data streams are structured to enable cleansing, mining and analysis of the combined data through advanced (artificial intelligence) software
- the combined data are analysed to determine correlations between input to output parameters for each individual animal
- basis for a range of services informed by both input/output features
- visualisation and dissemination of alerts through multiple channels



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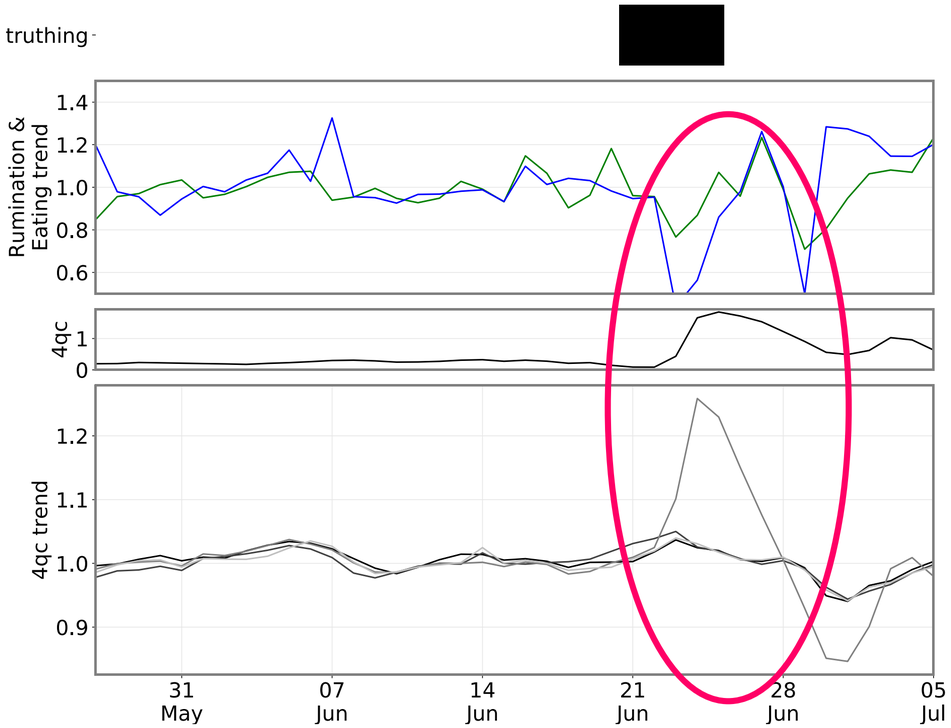
Optimising Welfare; *Mastitis*

- Mastitis has been verified as being one of the most damaging economic illness states which compromises milk yield
- if Mastitis is diagnosed, then the animal needs treatment through antibiotics which translates into days lost of milk production due to ‘stripping’
- the production per day lost is on average, 30 litres
- it takes on average, 7 days to return the cow to production health dependent on the antibiotic
- the condition equates to ~210 litres lost and at the current price is a loss of revenue of ~£70 per cow per occurrence
- on average, 20% of the herd size suffer from critical Mastitis which for the 1.8M population of dairy cattle in the UK, translates to an industry loss of around £24M, not including the cost of the treatment

Farmer Observation

Collar Output

Robot Output



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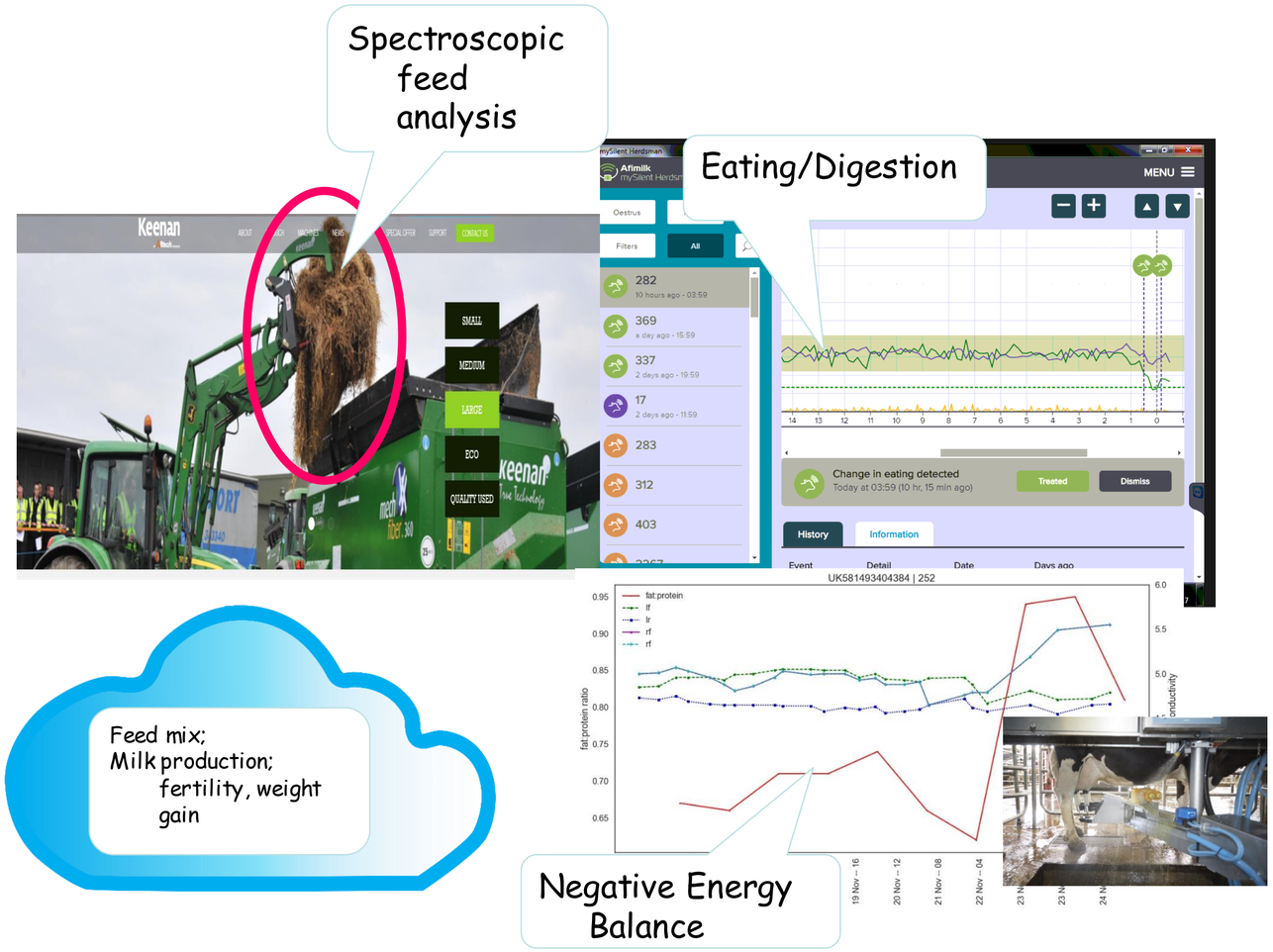
Potential **Services; *Feed Service***

- the optimisation of feed mix for target performance goals – enhanced milk production yield/quality; reduction of waste; management of green house gas emissions
  - fertility
  - weight gain
  - higher levels of fat content
- data stream combinations
  - feed analysis
  - energy/eating periods - collar
  - milking robot outputs



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Services Evolution

- ***Fertility;*** improving milk yields per individual animal through increasing the likelihood of a successful pregnancy. Produce statistics on pregnancy rate versus sire.
- ***Pedigree;*** optimisation of the pedigree of particular herds for milk yield or beef quality.
- ***Health;*** a record of diseases and treatments. For key health states e.g. mastitis and lameness, the number of cases and comparison with previous records will allow an estimate to be drawn on the level of risk of re-infection for each animal
- ***Feed****;* optimising feed mixes for (say) improved health or milk quality
- ***Veterinary;*** on line veterinary service which aids the scheduling of farm visits and promotes preventative health practices.
- ***Drug;*** **minimizing use of drugs e.g. identify early mastitis and treat through milk stripping**
- pro-active identification of appropriate drugs and optimisation of drugs for particular health conditions on per animal or per herd basis
- ***Herd Management;*** the implementation and provision of a complete herd management system will enable the rapid adoption of compatible systems

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IOF 2020 INTERNET OF FOOD & FARM

Future Challenges

- *Extensible, standardised on-farm data acquisition network; 'plug n' play'*
- *Scalable, integrated database supporting multiple data streams with standardised data format that enables cleansing, mining and processing of combined data*
- *Ease of deployment and maintenance; reduction in required infrastructure*
- *Robust, low-cost Internet access e.g. 5G evolution – shared spectrum access*
- *Data ownership/monetization agreements across the supply chain*
- *User Interface(s) that provide the most fulfilling experience for different stakeholders within the supply chain*
- *Location information per individual animal; any solution must not compromise the lifetime of battery operated technologies*
- *Evidence-based value proposition for the migration to a recurring monthly charge viz. service provision*

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IOF 2020 INTERNET OF FOOD & FARM

Business Models

- *the traditional business model entrenched within the dairy sector is outright direct purchase based on a Return-on-Investment (ROI) assessment*
  - *must prove the ROI which for start-ups is lengthy due to yearly evaluation of cow performance*
- *migration to services dominated business models*
  - *'hybrid' model where the infrastructure enabling the service is at cost price and the service is at a reduced price per month*
  - *a fully priced pre month cost*
    - *this is a revolutionary move to a new business model that the dairy sector to date, is yet to be convinced of*
    - *a potentially effective route to increase adoption is to create a 'service bundle' comprising traditional communications/Internet with agri-centric services*

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