Digital Twins in Farm Management

Illustrated by cases from FIWARE Accelerators SmartAgriFood and Fractals

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Abstract - The Internet of Things (IoT) provides a vision of a world in which the Internet extends into the real world embracing everyday objects. The interaction between real/physical and digital/virtual objects is an essential concept behind this vision. In the IoT, physical objects are accompanied by rich, globally accessible digital counterparts, which contain both current, historical and future information on that object's physical properties, origin, ownership, and sensory context. Such digital twins enable things to become context aware and to sense, communicate, act, interact, exchange data, information and knowledge.

The introduction of digital twins as central means for the farm management has the potential to revolutionize agriculture. It removes fundamental constraints concerning place, time, and human observation. As a consequence, farming operations would no longer require physical proximity, which allows for remote monitoring, control and coordination of farm operations. Moreover, digital twins can be enriched with information that cannot be observed (or not accurately) by the human senses, e.g. sensor and satellite data. A final interesting angle is that digital twins do not only represent actual states, but can also reproduce historical states and simulate future states.

This presentation will introduce the concept of digital twins and illustrate its application in agriculture by some cases of the Smart Agri-Food and Fractals projects (2014-2016). As part of the FIWARE Accelerator Programme, these projects have promoted the uptake of Future Internet technologies in the European farming industry with a special focus on SMEs and start-ups. They provided direct funding, mentoring, coaching, technical support and networking. Smart Agri-Food has started with the 50 most promising companies and selected 17 SMEs to proceed in phase 2. Fractals supported 44 SMEs especially in areas which are considered as "white spots" (Balkans, South East Europe).
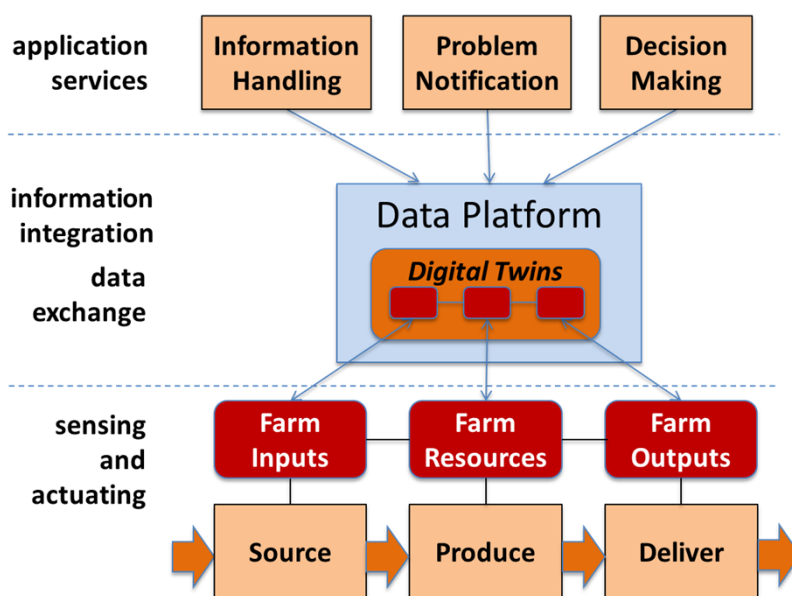
Figure 1. Management of farm operations based on Digital Twins

Case	Topic	Objects
Dairy Monitor (Connecterra, NL)	Heat detection, health analysis and location services	Dairy cattle
Open PD (Espiral Pixel, PT)	Identification of plant pests and diseases	Crops
INSYLO (Ubikwa Systems, SP)	Monitor stocks of the silos of the livestock farms and optimize the replenishment	Feed Silos
FarmTelemetry (Lesprojekt, CZ)	Fleet management, tracking machinery and energy monitoring	Farm equipment
OLIFLY (HarphaSea, SI)	Monitoring of olive fly occurrence and expanding	Olive trees
BeeZon (GR)	Apiary monitoring to identify diseases, pest infection, pesticide exposure and toxicity	Bee colonies

Source: www.smartagrifood.com / fractals-fp7.com