Smart Farming

Markus Dillinger,

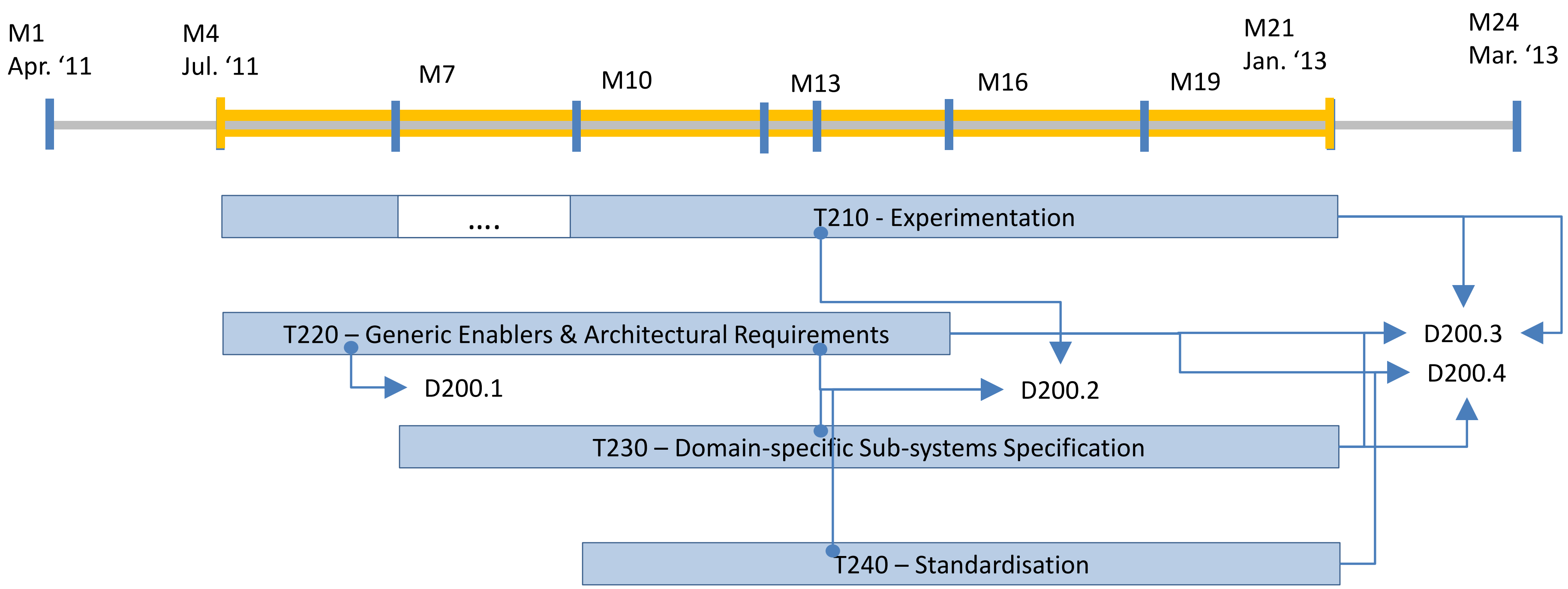
Huawei Technologies Düsseldorf GmbH

Markus.Dillinger@huawei.com

WP200 Objectives

- O2.1 The overall aim of this WP is to define the key technical aspects related to smart farming, spanning from the architectural requirements and the specification of the required mechanisms and domain sub-systems to the definition of the pilot system for experimentation.
- O2.2 Develop a small scale prototype pilot system to demonstrate the key features of the smart farming use case.
- O2.3 Evaluate and assess the architectural aspects and defined mechanisms and assess the penetration of smart farming services and their impact to the end-users.
- O2.4 Define the architectural requirements of the smart farming area and their links with the generic enablers implementing the key objectives of the core platform for the future internet.
- O2.5 Monitor and coordinate the standardization activities related to smart farming focusing on sensor data harmonization and interoperability.

WP2 Facts and Figures
Tasks Timeline



Smart Agri-Food

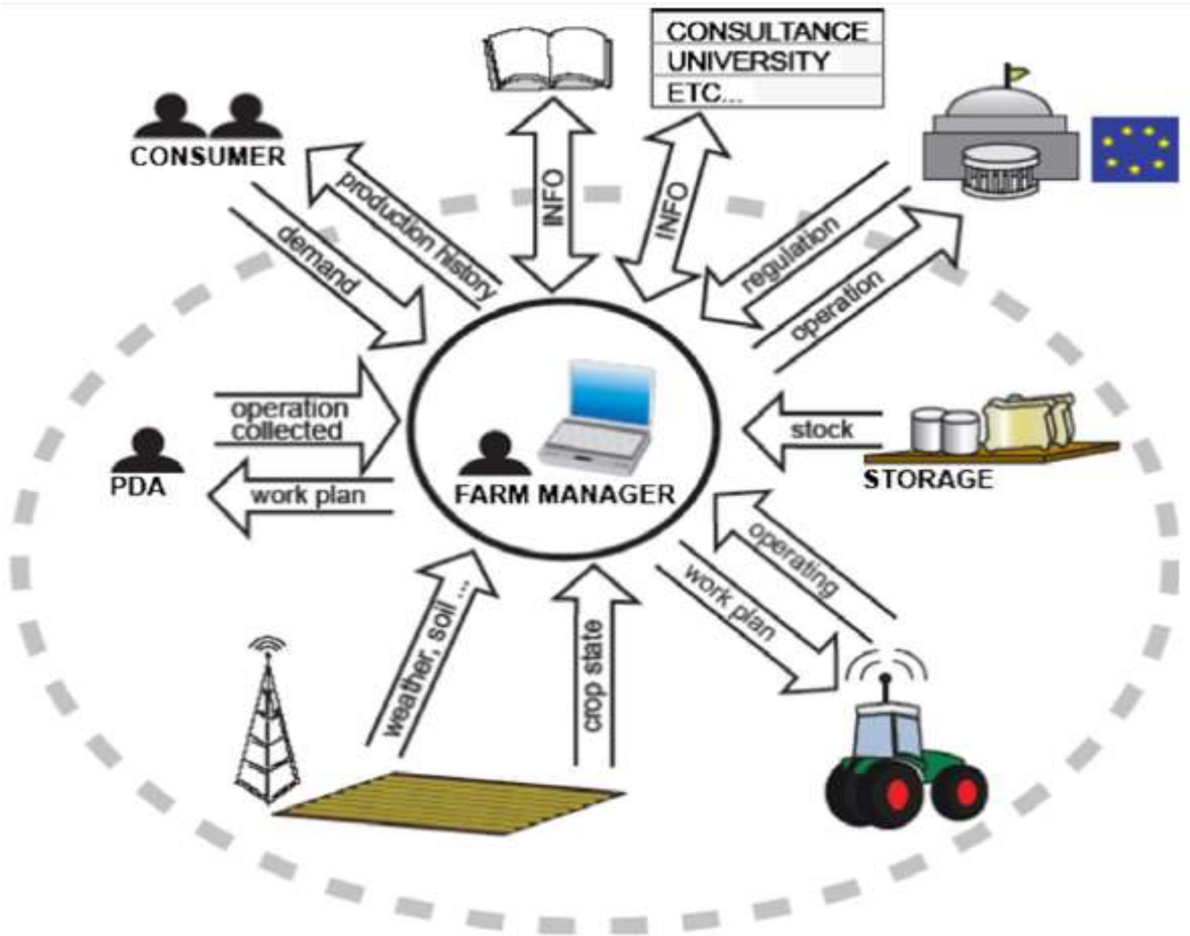
WP200 Deliverables

- D 2.1 First Report on Smart Farming Architectural Requirements and Sub-system (M6)
- D 2.2 Detailed Specification for Smart Farming Experimentation: Generic Enabler, Sub-system and Architectural Requirements (M14)
- D 2.3 Final Report on Validation Activities, Architectural Requirements and Detailed System Specification (M21)
- D 2.4 Smart Farming Awareness: Final Assessment Report (M24)

Current challenges

- From 6 to 9 – 11 Billion People in 2050 at least a doubling of the world-wide food demand
  - efficient resource utilization & reduction of ecological footprint
  - efficient production processes and community involvement
- Rural depopulation
  - automation and higher efficiency
  - solutions easier to use
- Risks for worldwide diseases (e.g. BSE, swine-flu, EHEC)
  - Improve disease identification & information services
  - Quick and competent advisory of countermeasures to farmers
- End-customers trend to certified ecological products
  - Information about production parameters (e.g. applied chemicals etc.)
  - Certification of products through autorities
- Commercial pressure on small farmers for ICT investment

State-of-the-art and shortcomings



Solution is on-site centric and has disadvantages:

- Databases and intelligence
- Certain investments per farmer needed
- Local IT is single-point of failure
- Local IT might hamper external access of other stakeholders

Network-(hybrid) centric solution is needed !

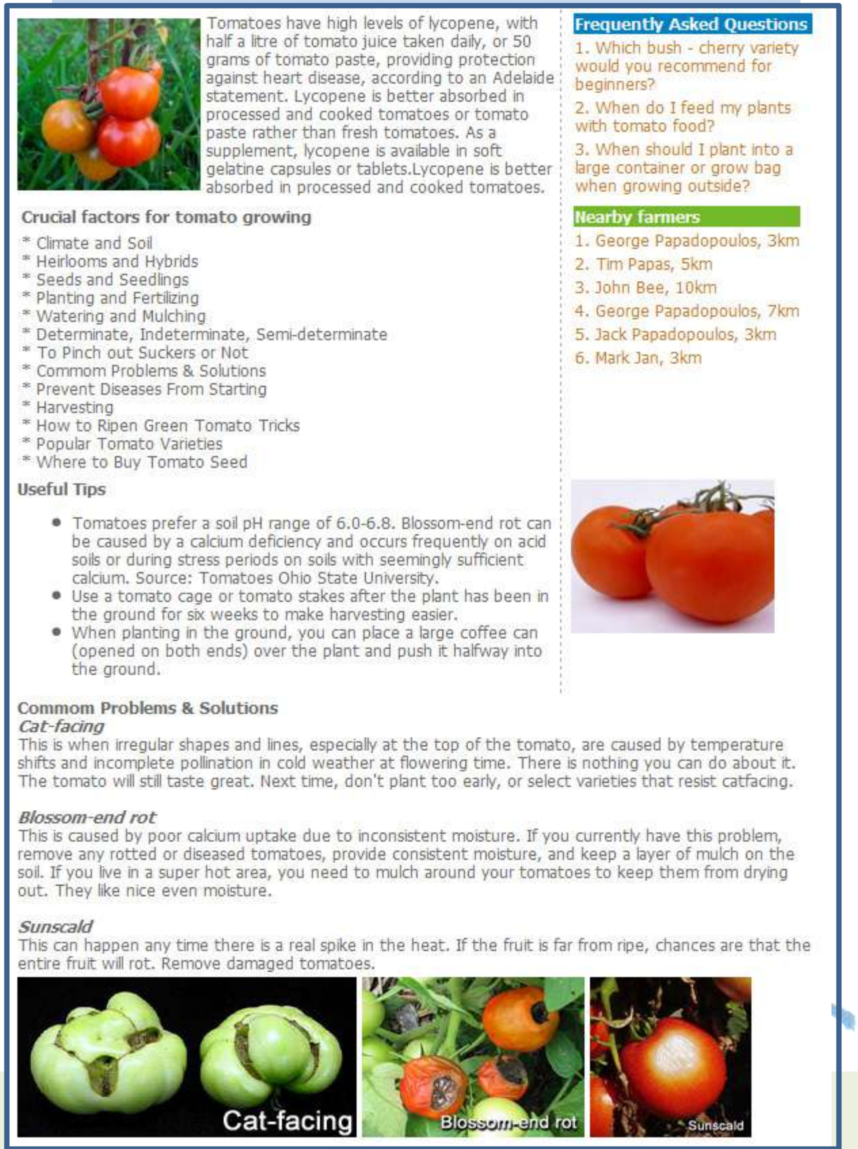
*) Soerensen et al, 2010

Challenges of greenhouse - example

- Current challenges:
  A number of vertical and closed FMIS systems that focus on specific tasks. No interworking. No automated analysis and countermeasures for problems

- Requirements for FI:
  Manage collected data and provide new services with added value
  Help farmer take precise decisions
  Present information in a unified way
  Take advantage of Future Internet capabilities
  - secure, efficient, trusted and reliable environment
  - open, dynamic and decentralized access to the network connectivity service and information *[Papadimitriou et al, 2009]*

Example for future farmer interface

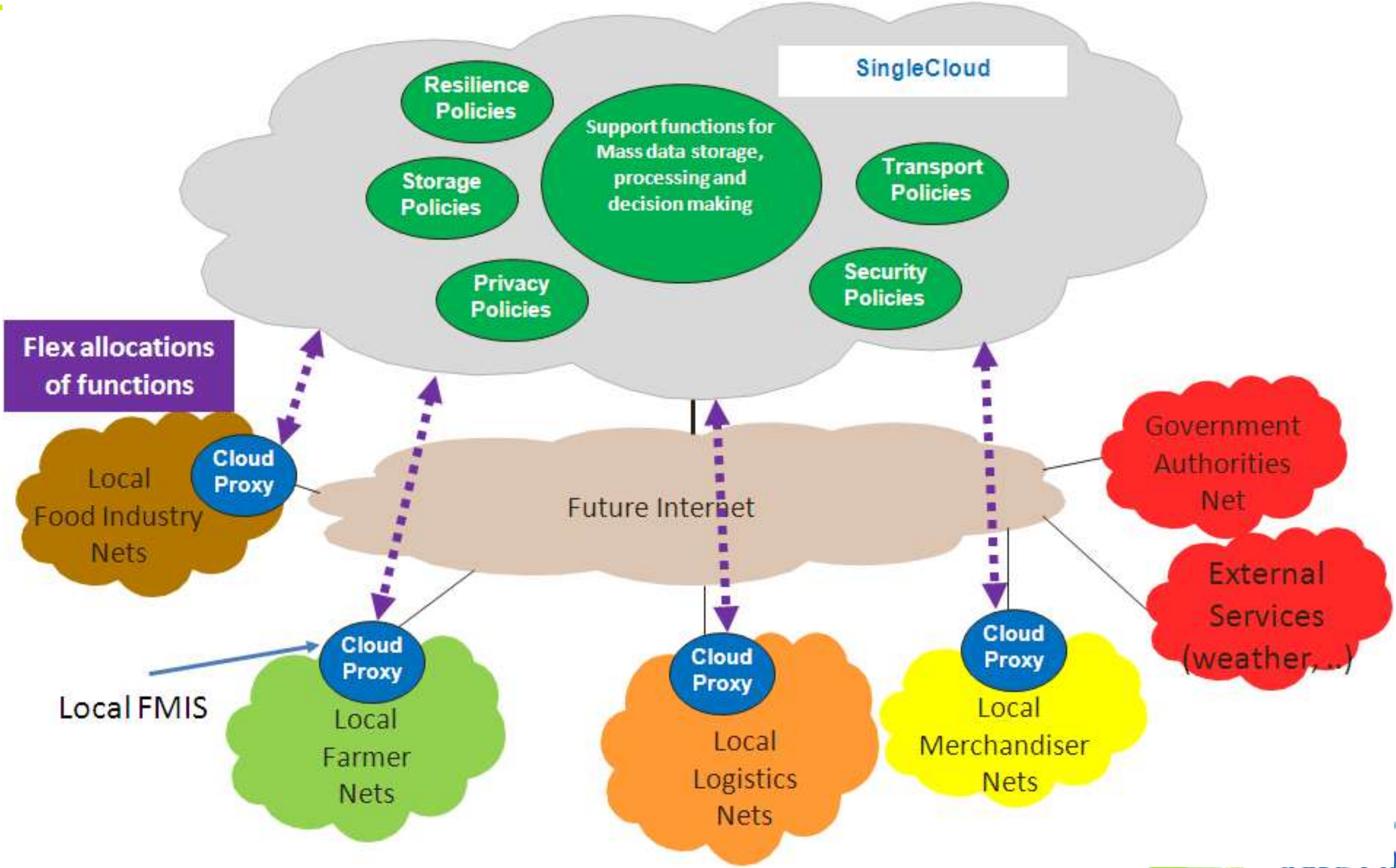


Key achievements of WP200

- WP200 started at July 2011. The first deliverable was submitted to CEC. During this period the members of WP200 have managed to
  1. ICT Market Analysis
  2. Analyze the state of the art in the research area and identify a number of open issues
  3. Produce 29 use cases
  4. Analyze these use cases and identify functional requirements
  5. Aggregate related functional requirements into functional blocks
  6. Identify requirements for the FI core platform
  7. Specify the first version of the smart farming subsystem
  8. Organize the proof of concept actions

Smart Agri-Food

Vision for FI application potentials
hybrid network architecture

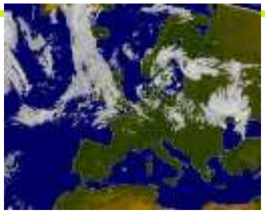


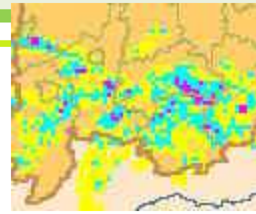
Vision for FI application potentials
General

- Facilitate the interaction among service providers and stakeholders
- Create a scalable virtual global environment of cooperation
- Support the trustworthiness of services and stakeholders through opinion mining and social networking techniques
- Allow the composition and tailor-cut of services into personalized services for every farmer
- Enable the dynamic creation of knowledge to better react in future situations
- Distribute information and intelligence to support even areas with poor networking services (to be expected in rural areas)
- Enable the cooperation with the network infrastructure to provide better services
- Introduces the notion of ”autonomy” both on control operations and also on the management operation of the system

Vision for FI application potentials

Process Controls any (all) ag machines, Intelligence Anywhere in Variable Ad-Hoc-Networks

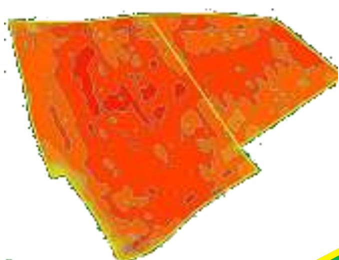




ehicles "order" fuel, spare parts, transfer trailers

Process controller calculates and broadcasts directives to operators

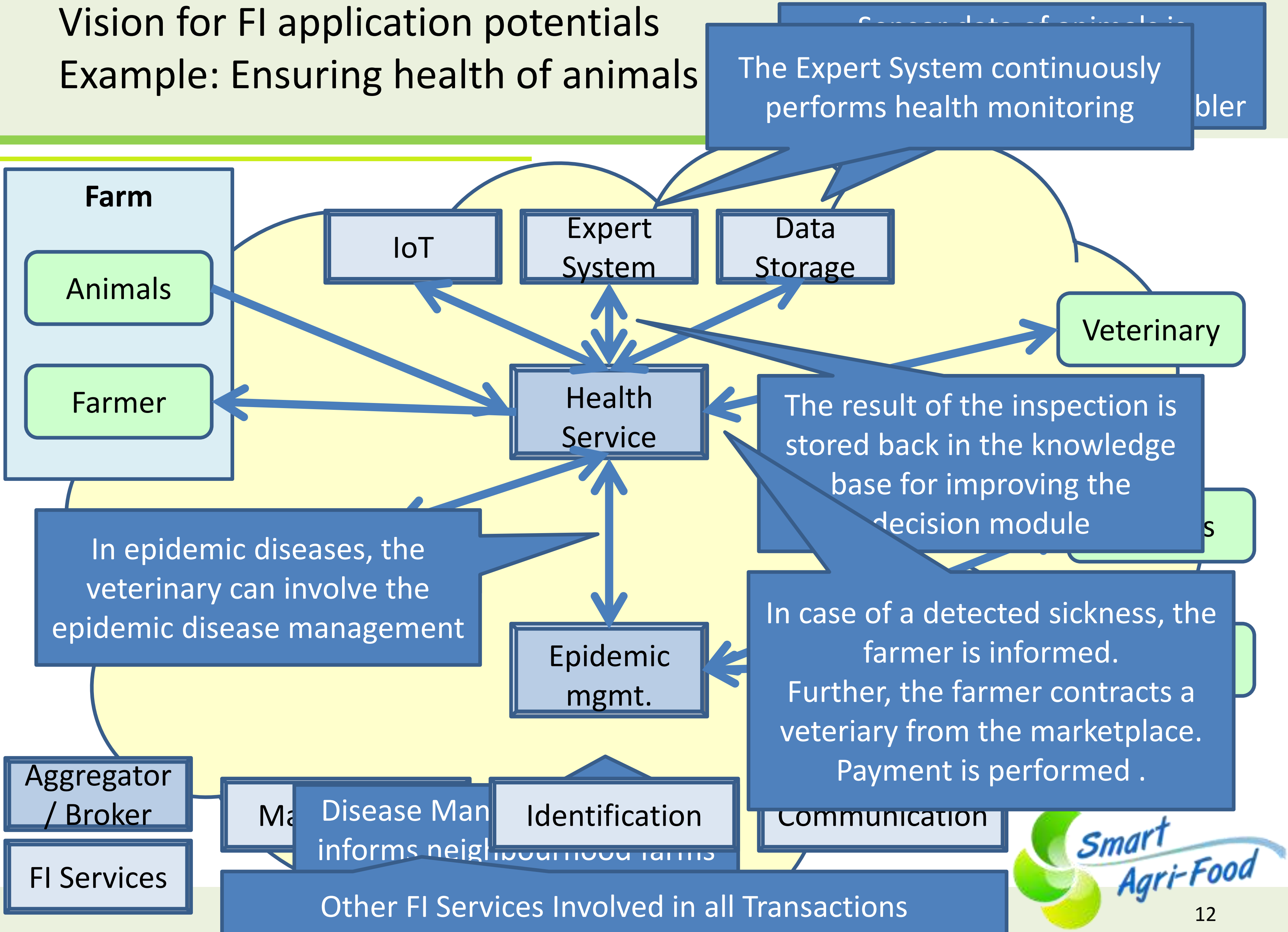
MANUFACTURING EXECUTION SYSTEM



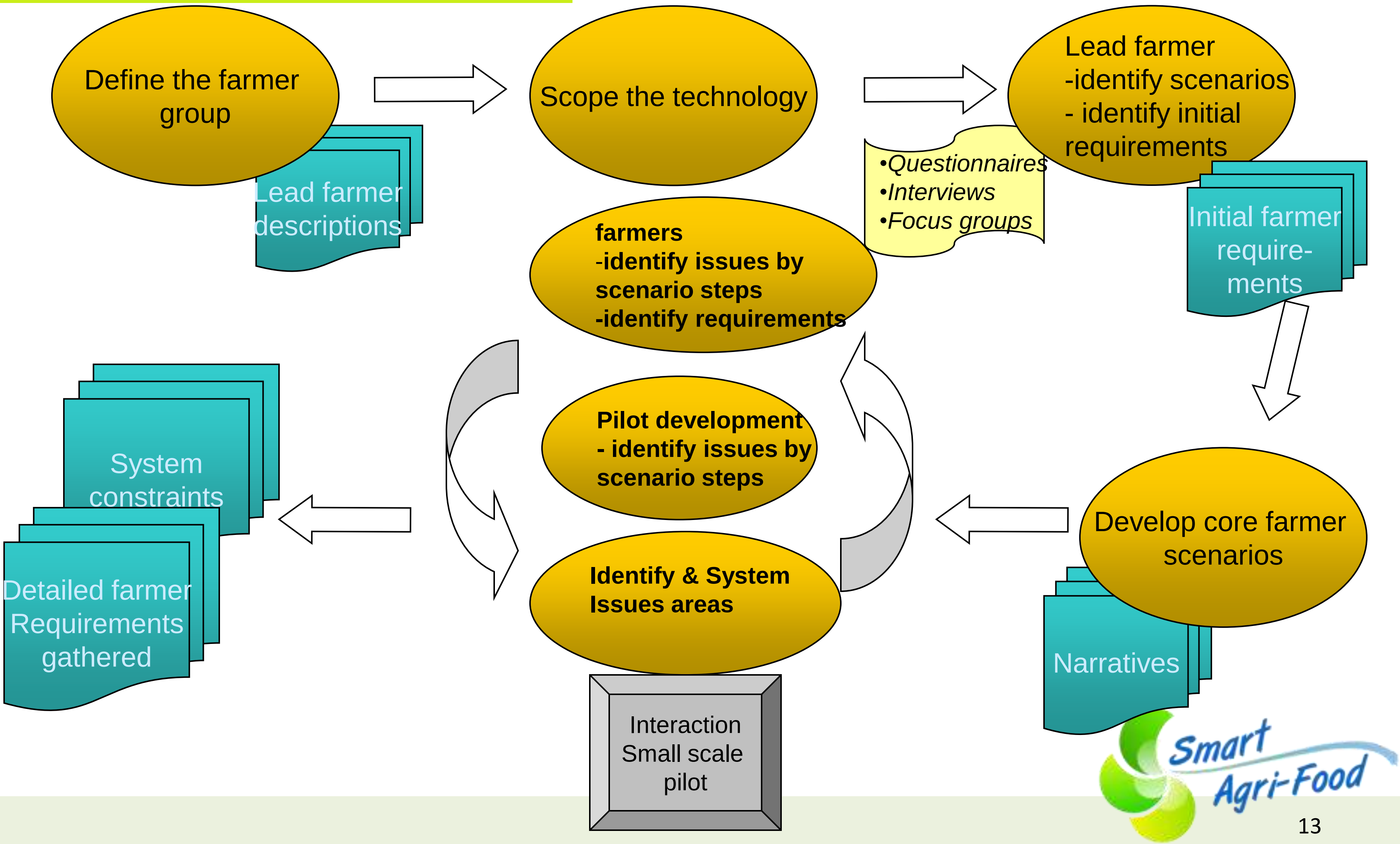
Dispatcher is i … bout approaching th … erstorm and can trigger new optimization criteria

Central system calculates routing on field and road.

Vision for FI application potentials
Example: Ensuring health of animals



Eliciting farmer requirements by using small scale pilot



Small scale pilot – farmer interface for spraying and greenhouse use case (1/2)

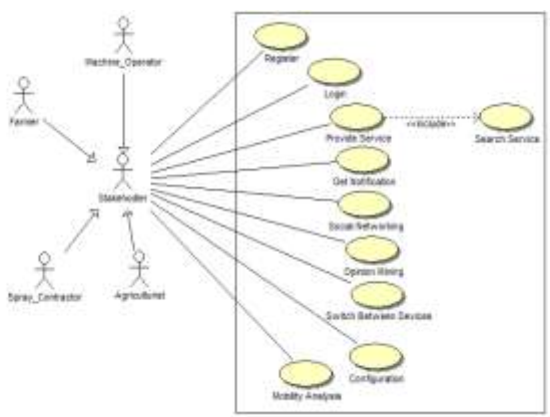
Small scale pilot – farmer interface for spraying and greenhouse use case (2/2)

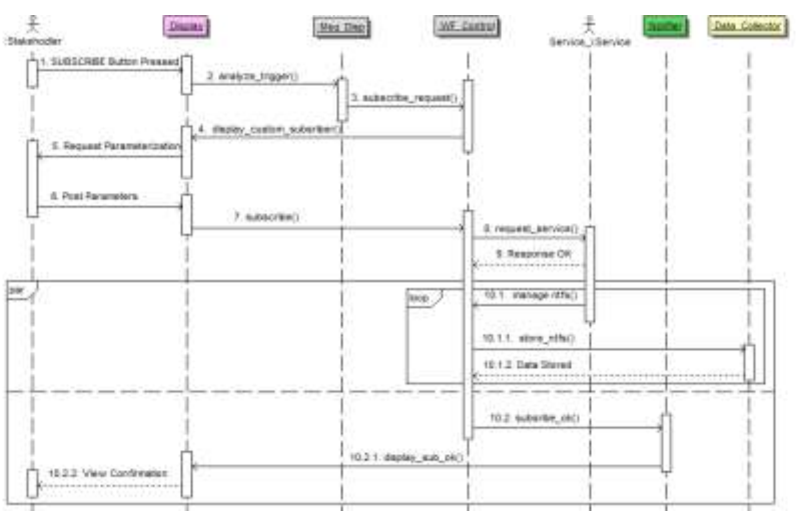
Envisaged conceptual prototypes

- Two prototypes
  - Smart Spraying (MTT-JD): The goal is to demonstrate a better fleet management of farming machinery in open fields by composing data from different services and reacting fast in changing situations. MTT will design the technical solution while, JD will provide the necessary data about farming machinery.
  - Greenhouse management: (OPEKEPE): The goal is to demonstrate a number of issues like smart decision making, statistical analysis, fault identification, switching between local or remote operation, social networking, opinion mining, composition of services. NKUA will develop the technical case and OPEKE will provide data for green house management operations and real users.
- Note that the two pilots will interwork since the the production of the overall system will be made in cooperation

Next Steps

- Detailed specification of interfaces and functional blocks
- Selecting the most promising technological solutions
- Implementation of the two proof of concept approaches
- Revisiting requirements, especially those defined for the FI core platform
- Technical meeting organized in November – Start Implemented in December

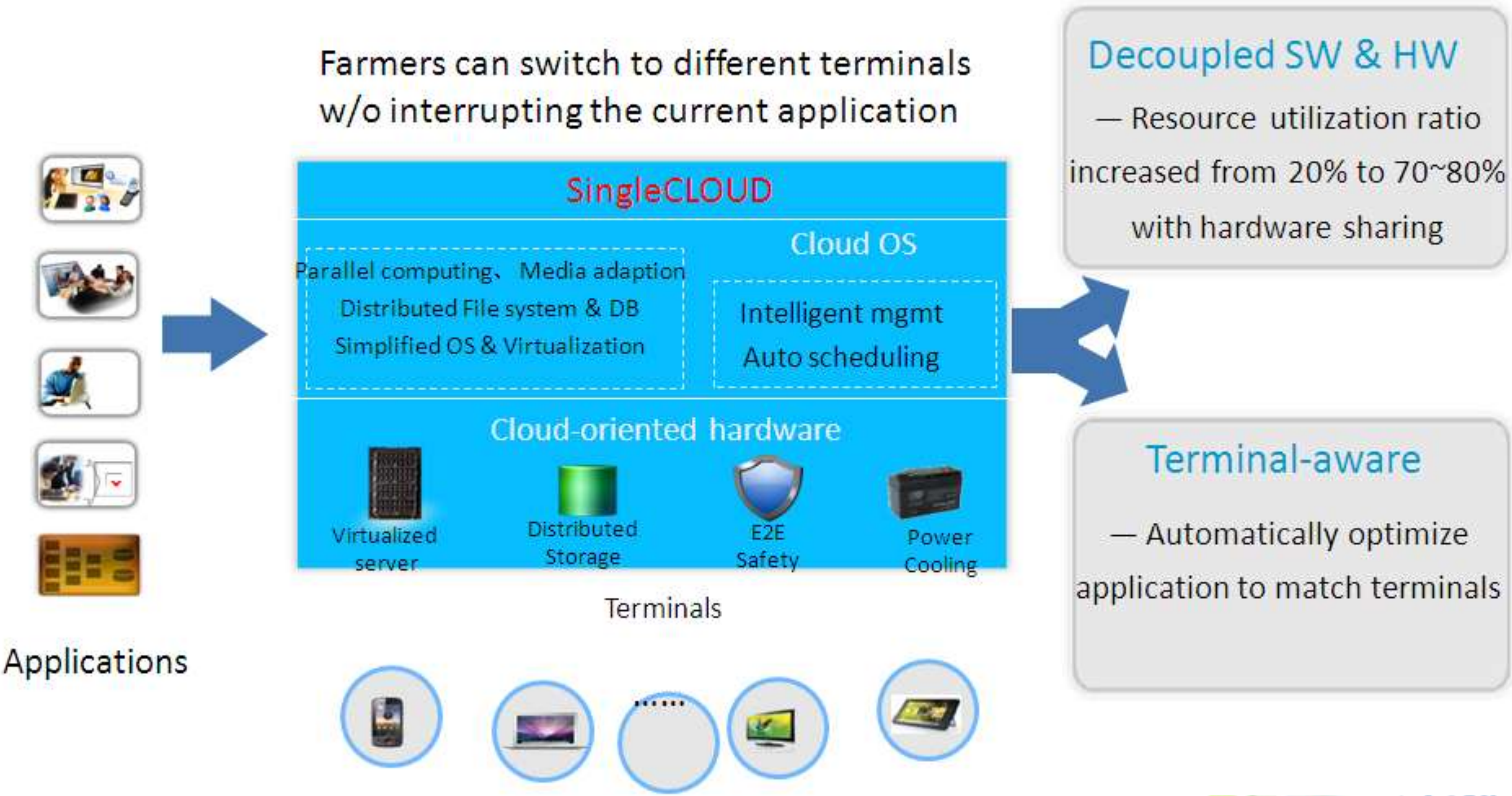




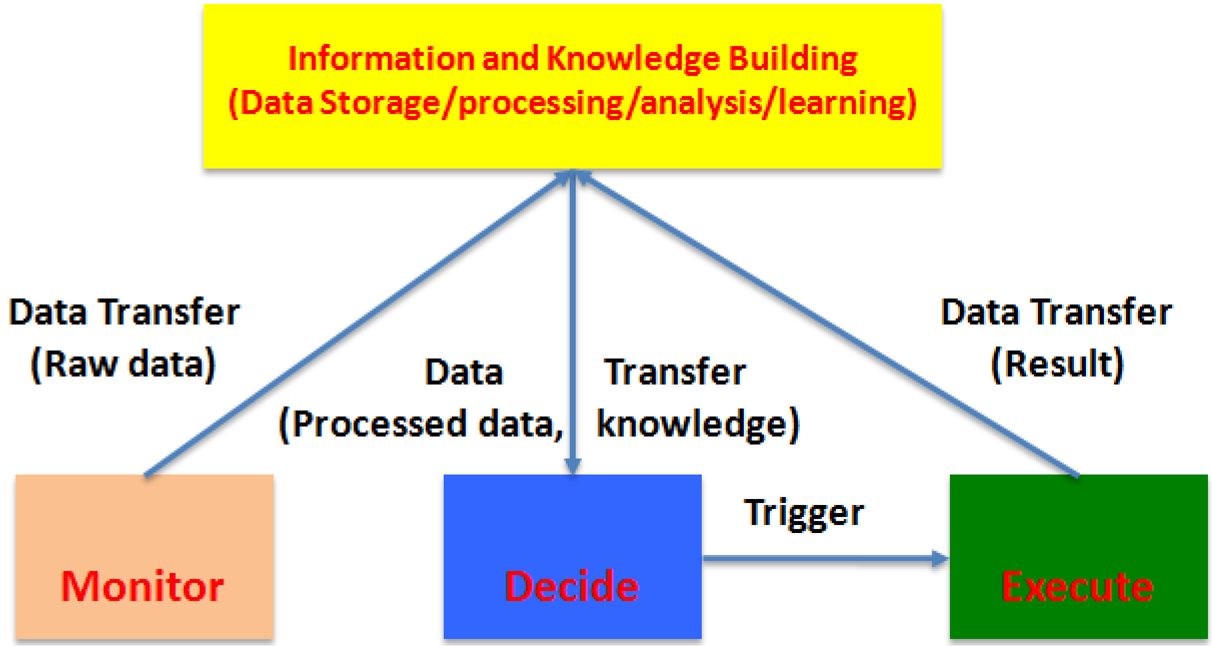
Future partners expected to be involved in the phase II

- Farming Management Information System companies (e.g. Landata Eurosoft)
- Microgrid vendors for solar, biogas, etc. ?
- Chemical providing company (e.g. BASF)
- Companies that can form a real end-to-end trial (farmer to supermarkets)????
  - Farmer, machinery syndicate, or customer farmer
  - FMIS vendor
  - Infrastructure (HW / cloud)
  - Integrator
  - Energy (solar, wind, biomass, ...)
  - Electronic vehicles charging

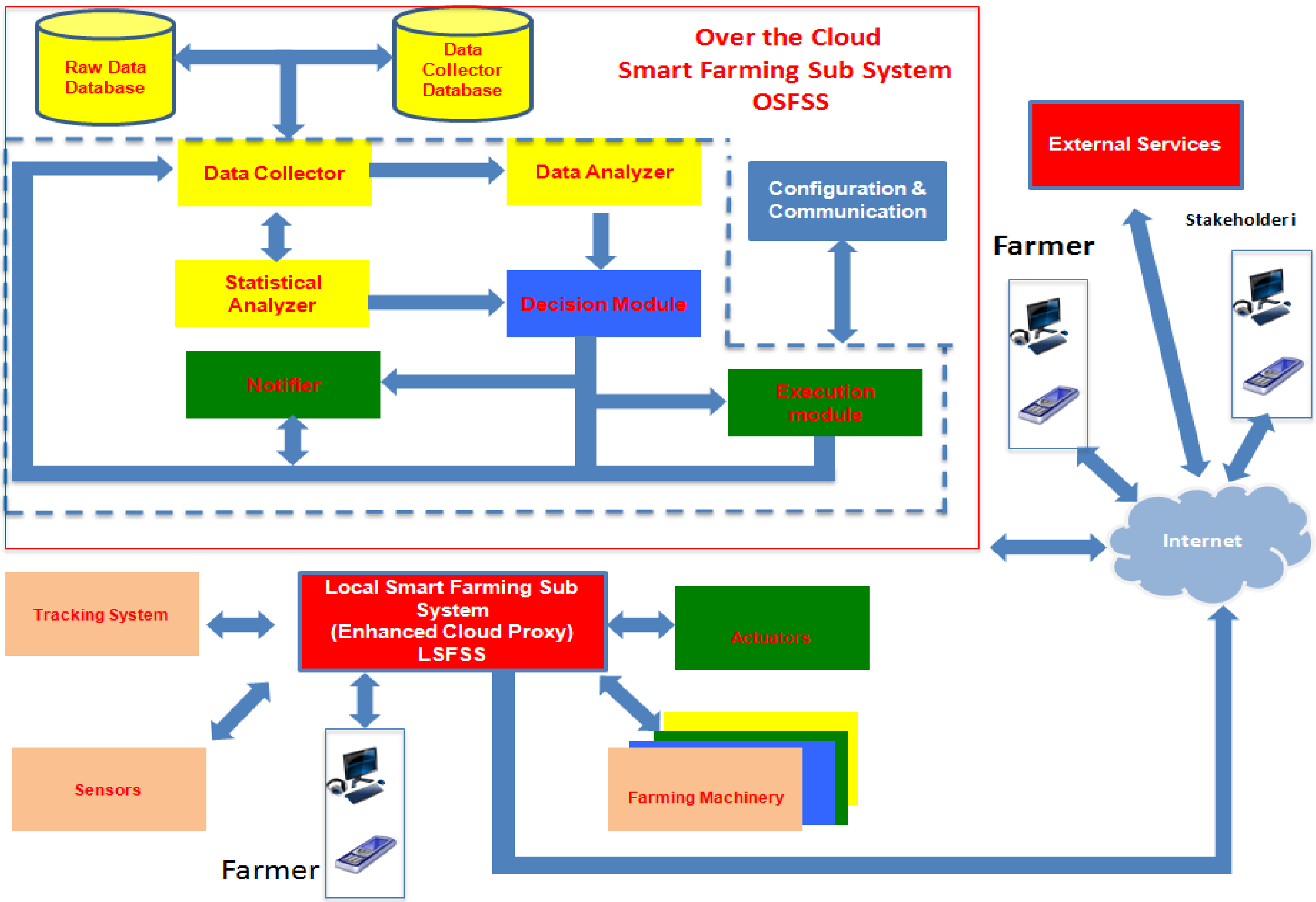
Network-centric Solution for Modern and Cost-effective Farm Management



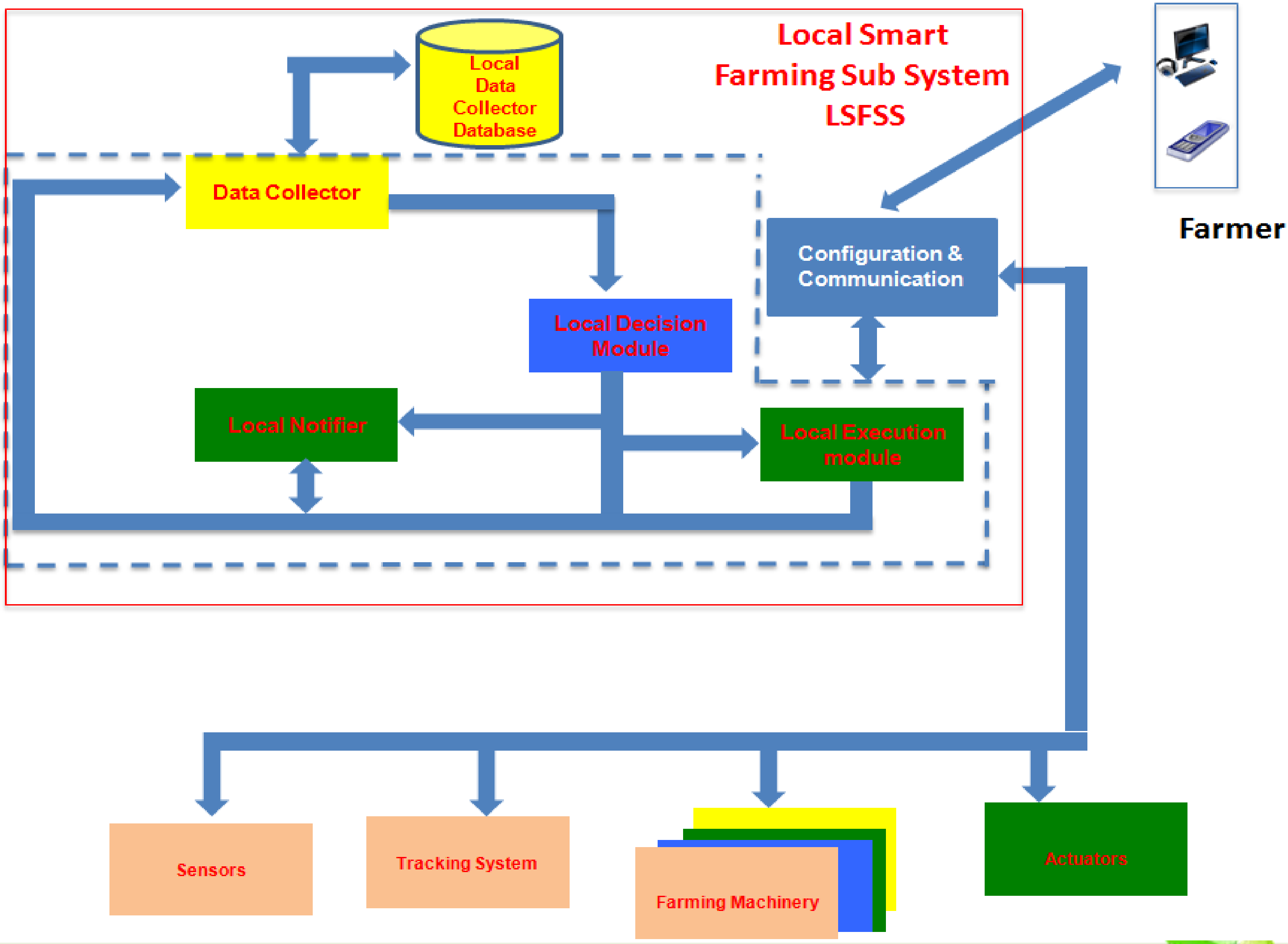
The Smart Farming Subsystem Architecture (1/3)
Generic operation principles



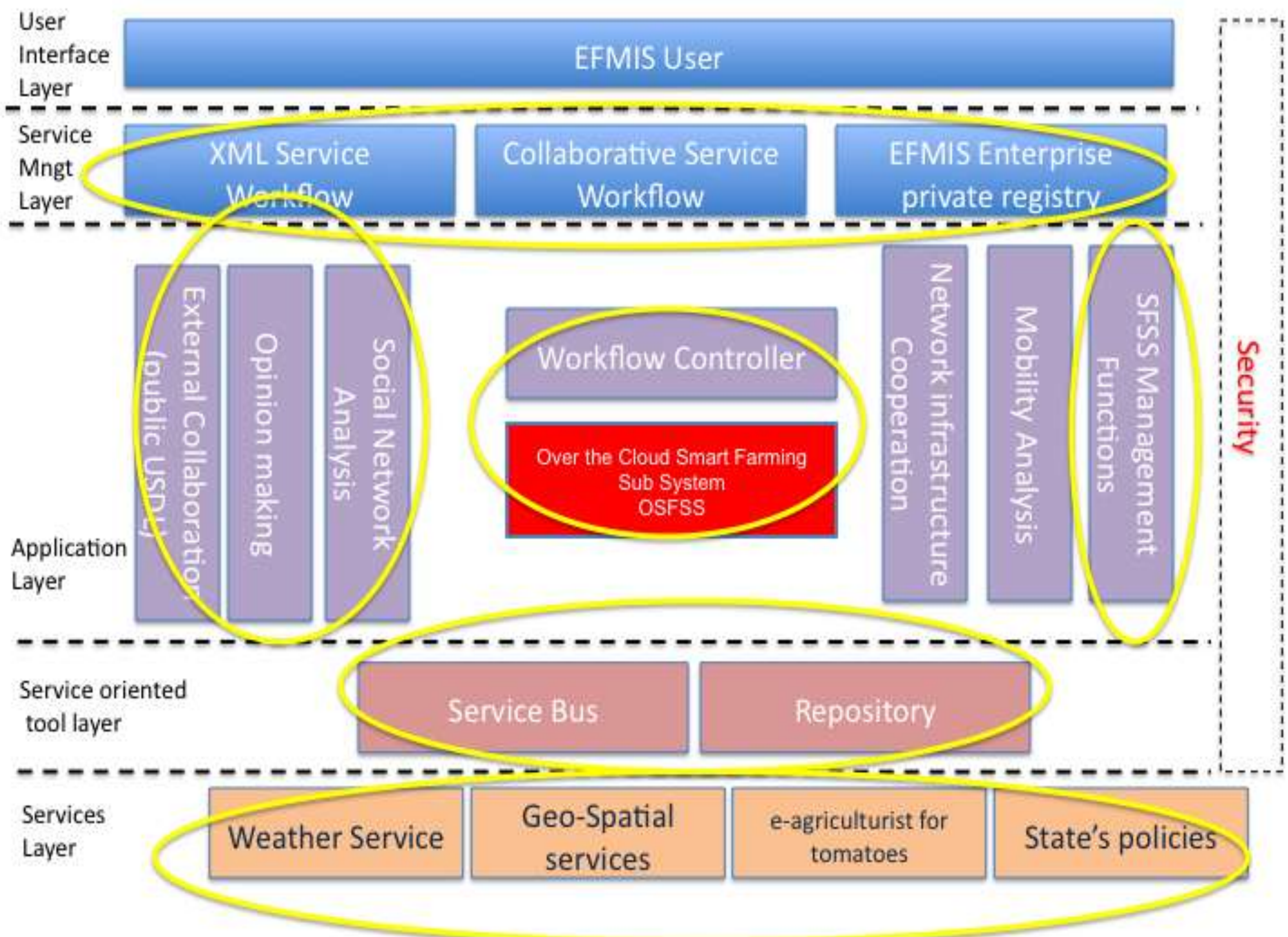
The Smart Farming Subsystem Architecture (2/3)
OSFSS



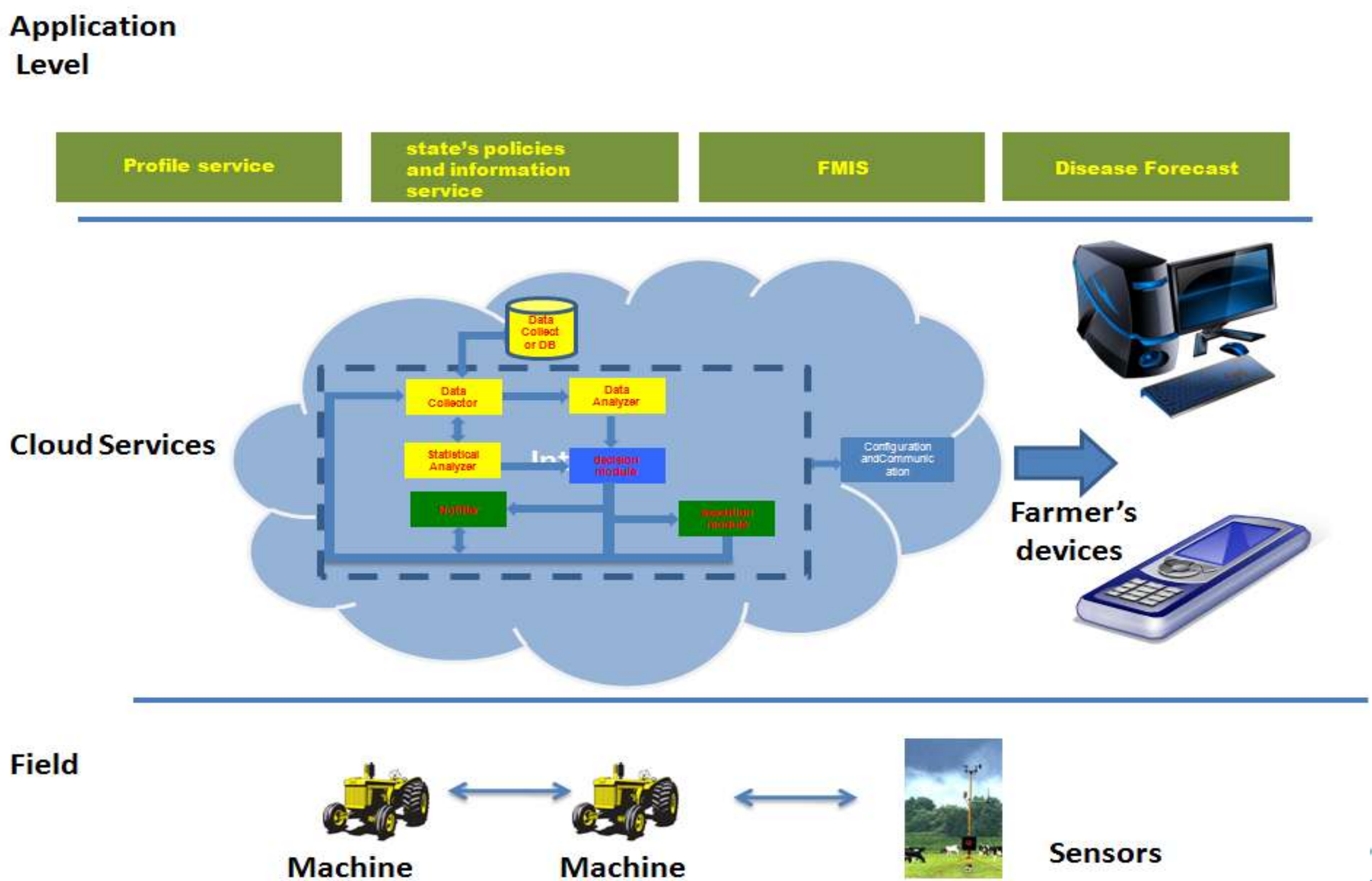
The Smart Farming Subsystem Architecture (3/3) LSFSS



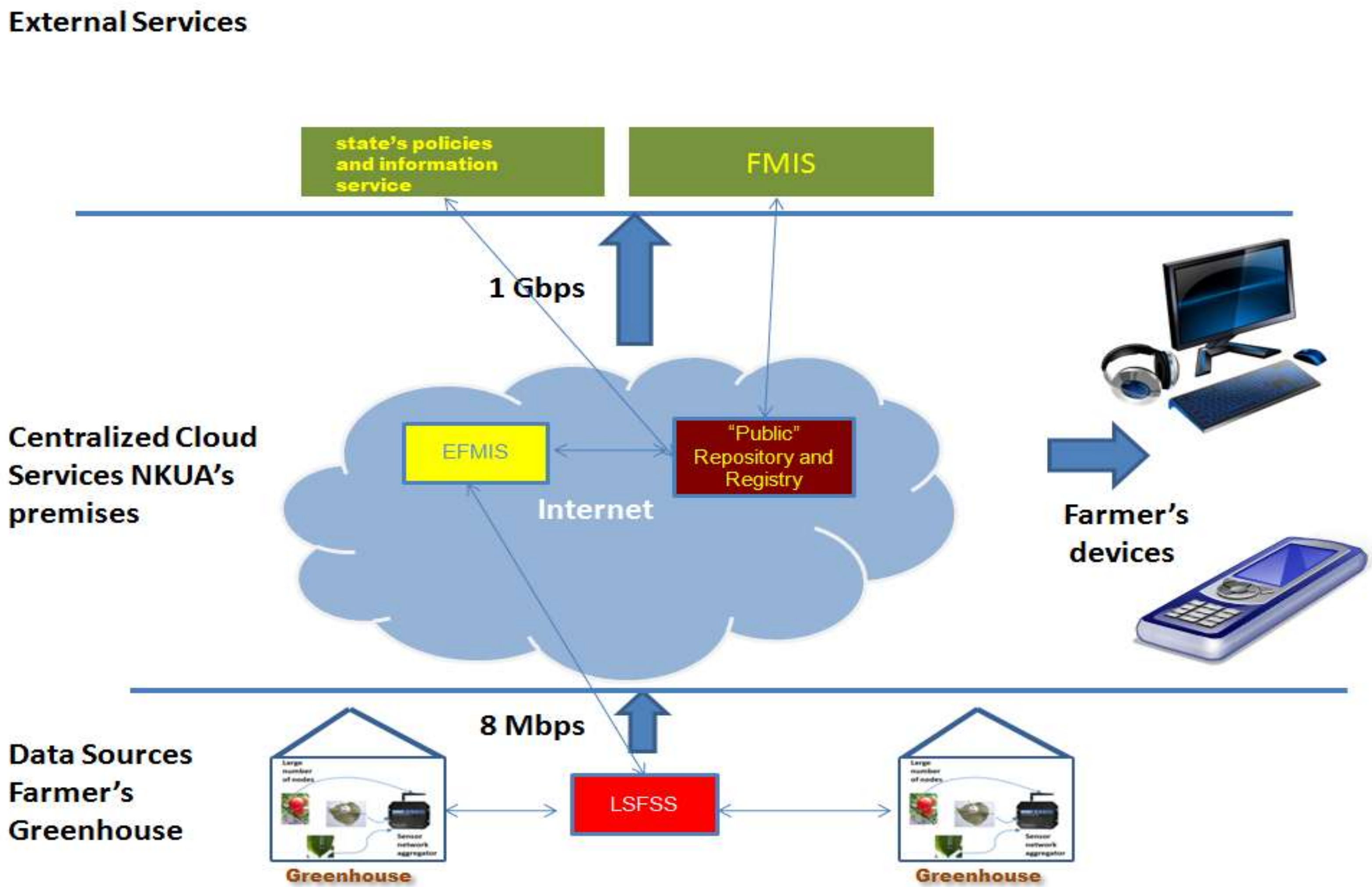
Prototype description



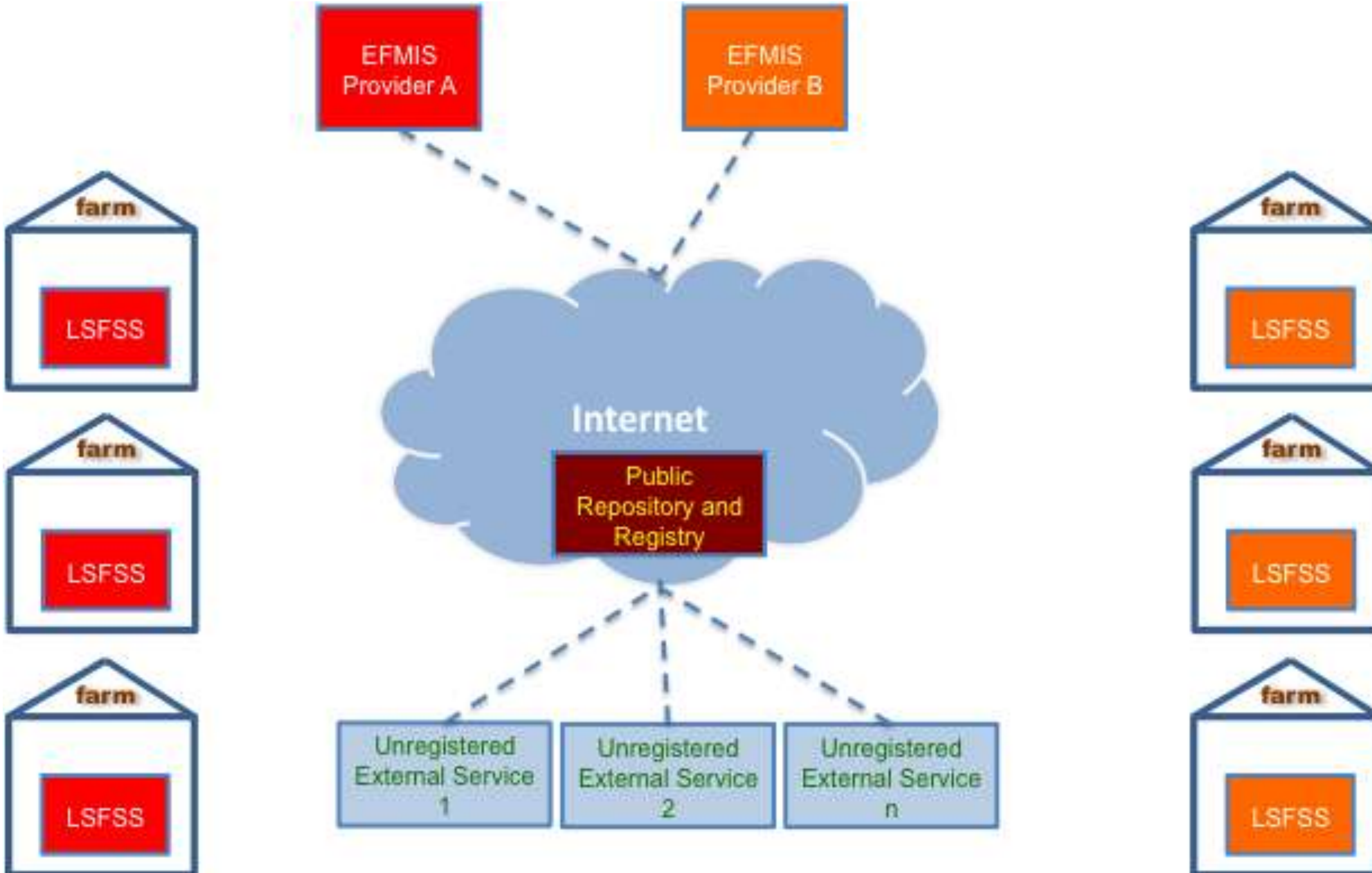
Prototype description - Spraying



Prototype description - Greenhouse



Cooperation among EFMISs/Unregistered services/Farmers



The main contributions of WP200 Smart Farming Subsystem (1/2)

- To enable the cooperation among FMISs/Stakeholders/Farmers in a seamless way
- To enable farmer's/services' portability from one FMIS to another
- To enable service discovery and usage outside the domain of the serving FMIS
- Social network analysis and mobility analysis will enable the cooperation of farmers registered to the same or different FMISs
- Reliable schemes for the evaluation of the stakeholders (from simple voting and reputation schemes to opinion mining schemes) is also possible.
- Farmers will have access to the global market environment independently of the FMIS is currently serving them

The main contributions of WP200 Smart Farming Subsystem (2/2)

- The architecture provides for cognitive solutions that allow the system to learn dynamically and optimize its farm control operations
- The intelligence is split in two places (locally and in the cloud) to serve farms that do not have stable links to the Internet
- FI-Ware solutions will enable a better cooperation of the services with the end-devices as well as the underlying network infrastructure. These enablers have been also considered
- Autonomic solutions have been considered for the management of the overall system