DATA SHARING COALITION

Final deliverable Weed Robot use case

June 2021

Management Summary

1. The use of data generated by IoT devices is becoming increasingly important in several industries, including agriculture
2. In certain IoT cases, different data services from scanning, analysing and acting parties can be combined to create value
3. This use case focuses on sharing IoT data to combat ‘volunteer potato’, a specific type of weed, in a cost-efficient way
4. Data sharing context is characterised by the need to integrate different, low-latency data services
5. Given this context, harmonisation of data services and a low-latency data exchange infrastructure are key in use case design
6. This use case design can easily scale to other use cases that combine scanning, analysing and acting data services

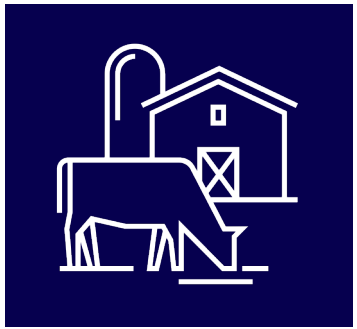
The use of data generated by IoT devices is becoming increasingly important in several industries, including agriculture

Developments in IoT

The number of **businesses that use IoT technologies** worldwide has increased from 13 percent in 2014 to about **25 percent in 2019**

IoT technologies have already **given rise to a number of landmark applications** in sectors as diverse as Industry 4.0, smart cities, smart homes, connected cars, and e-health

Companies have started using IoT to **maintain direct connections to remote devices**. This constant monitoring makes predictive maintenance possible and improves efficiency and equipment uptime



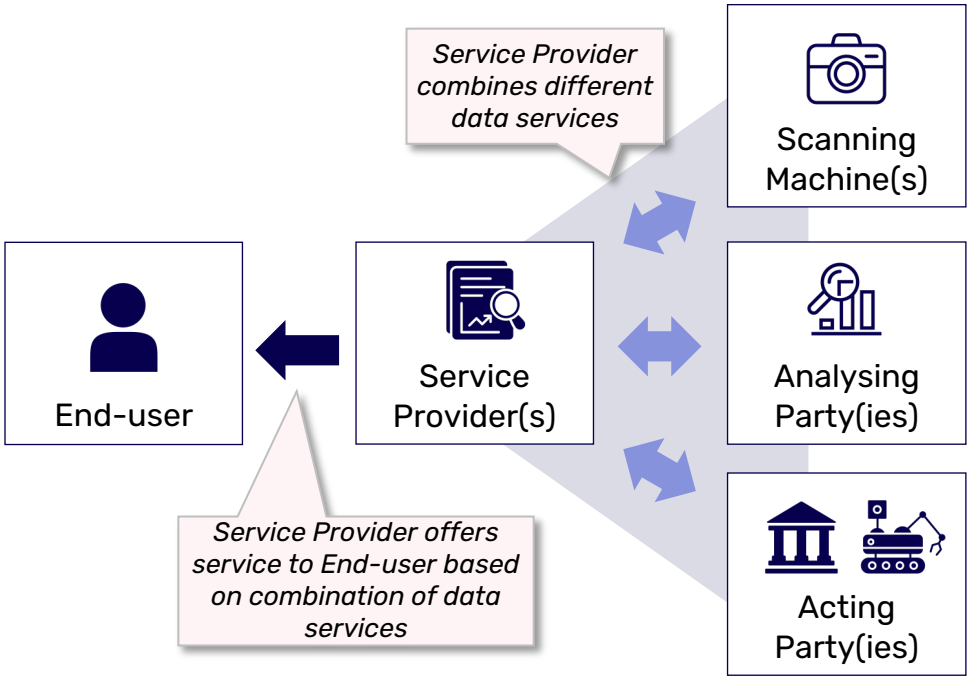
IoT in Agriculture

The application of IoT in agriculture could enable use cases across many aspects of farming, resulting in an estimated global productivity increase of up to 9 percent for the industry

Source: McKinsey, 2019 ; McKinsey, 2020, Data Sharing Coalition analysis

In certain IoT cases, different data services from scanning, analysing and acting parties can be combined to create value

Different roles in certain IoT cases

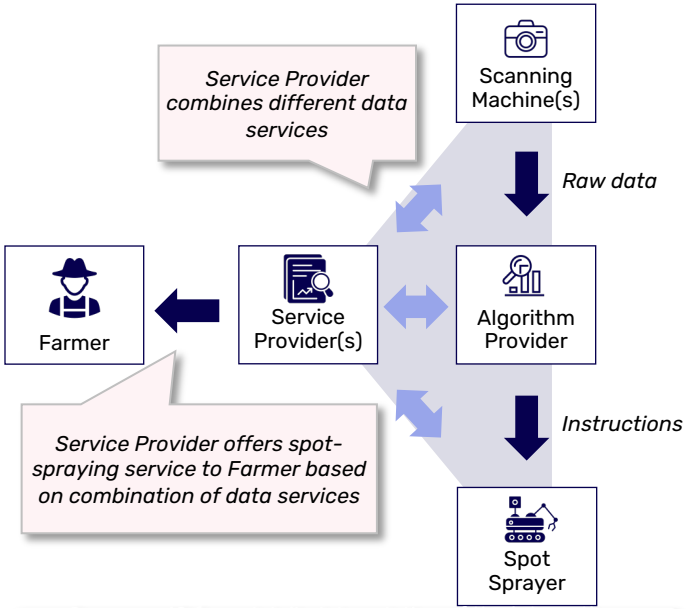


Description

- In certain IoT cases, there are three functions that can be combined in order to create new value towards an End-user: scanning, analysing, and acting
  - The **scanning functionality** generates raw data through sensors, cameras, etc.
  - The **analysing functionality** analyses the raw data and creates instructions from it
  - Finally, the **acting functionality** performs an action or service based on these instructions
- These functions can be performed by different parties, but need to be combined in order to create new value. This requires integrating data services from these parties and enabling them to share data with each other
- As this integration can be quite complex, a Service Provider often orchestrates the combination of these three functionalities in an offering for End-user

This use case focuses on sharing IoT data to combat ‘volunteer potato’, a specific type of weed, in a cost-efficient way

Use case interaction model



See page 10 for a detailed description of the interaction model

Use case introduction

Explanation of use case:

- In certain crop fields, “volunteer potato” (potatoes laying in a field because of crop rotation) cause weeds that need to be located and sprayed with pesticide, as they are harmful for other crops
- It is essential that spraying is done with very high accuracy, as inaccurate pesticide spraying can spoil crops and is harmful for the environment.
- However, farming is a low-margin business, and manually spraying crops is too costly and the supply of labour in the market is very limited
- In this use case, a robot drives across the land with cameras mounted on the front (scanning) and pesticide spot sprayers on the back to combat these weeds (acting)
- The cameras fixed on the front of a robot act as a scanning machine to take pictures of the land. These pictures (raw data) are then shared with the Analysing Party
- An Algorithm Provider acts as the Analysing Party to process these images, identify the location of weeds and generate spraying instructions for the Spot Sprayers
- The Spot Sprayers on the robot are the Acting Party and spray only on the exact location they are instructed
- A Service Provider combines the data services of these various actors to provide a simple and concrete service to the Farmer (e.g. a clean hectare of field with limited use of pesticide)

Added value of use case:

This use case leads to increased accuracy and efficiency of pesticide spraying and enables that this task can be performed by a machine instead of a (more expensive) human. This ensures costs-savings.

Parties involved in the use case:

KPN introduced this use case in the Data Sharing Coaliton, as they are exploring how their Data Services Hub[1] can provide an exchange infrastructure for these type of use cases. They ensured alignment with AgroIntelli, a major producer of smart farming robots, and the Wageningen University.

[1] *KPN Data Services Hub* is a generic data exchange infrastructure that KPN provides (more info)

Data sharing context is characterised by the need to integrate different, low-latency data services

Non-exhaustive

Key factors in data sharing context of this use case

Necessary to integrate different data services

In order to create value in this use case, different data services need to be integrated (scanning, analysing, acting). These data services all adhere to differing rules and standards. This means that the Service Provider needs bespoke implementations for each data service, which is an inefficient and costly process

Need for low-latency data services

A single robot is fitted with a scanner at the front and spot sprayer at the back. Within the few seconds it takes for the robot to drive across a specific spot, the data from the scanner must be shared and translated into instructions that are shared with the spot sprayers. For this, all data services need to be performed with very low latency (delay in services as a result of data being 'in transit').

Data sharing context

- *Every data sharing use case has its own data sharing context. This context is determined by factors such as the nature of the data that is shared, the actors that are involved, who controls the data, et cetera.*
- *This data sharing context is very relevant, as it influences the requirements for the use case design*

Given this context, harmonisation of data services and a low-latency data exchange infrastructure are key in use case design

Data sharing context

Differing data services

Low-latency data services

Key elements of the use case design based on data sharing context

Non-exhaustive

Harmonisation of data services

Common, multilateral agreements on various aspects of data services (e.g. security, business model, authorisations) between Service Providers and Scanning, Analysing and Acting parties minimise the differences between their data services. This decreases the efforts and costs required for a Service Provider to combine different Scanning, Analysing and Acting data services.

Being able to easily combine different data services from various parties will result in more diverse value propositions to end-users and a decreased risk of vendor lock-in. Together with KPN, we created a first outline for these multilateral agreements. See p. 12 for more details

Low-latency data exchange infrastructure

This use case requires an infrastructure that allows low-latency data sharing to support scanning, analysing and acting in an extremely short timeframe. The KPN Data Services Hub, combined with their 5G network, provide an infrastructure which supports this low-latency data sharing

This use case design can easily scale to other use cases that combine scanning, analysing and acting data services

Design can be adapted easily for other use cases that combine scanning, analysing, acting

- The outline of common agreements that we created for this use case can be applied to other use cases in which Scanning, Analysing and Acting data services need to be combined
- The main difference with these other use cases is the nature of the scanning, analysing and acting data service: What raw data results from the scanning service, what analysis is performed on this data and what action is performed based on the instructions from the analysing service
- This means that most of the design for this data sharing use case can be reused to enable other use cases, as long as agreements that apply specifically to a certain data service are modified (e.g. data standards, service level agreements, etc.)

Non-exhaustive

Potential use cases that combine scanning, analysing and acting data services[1]

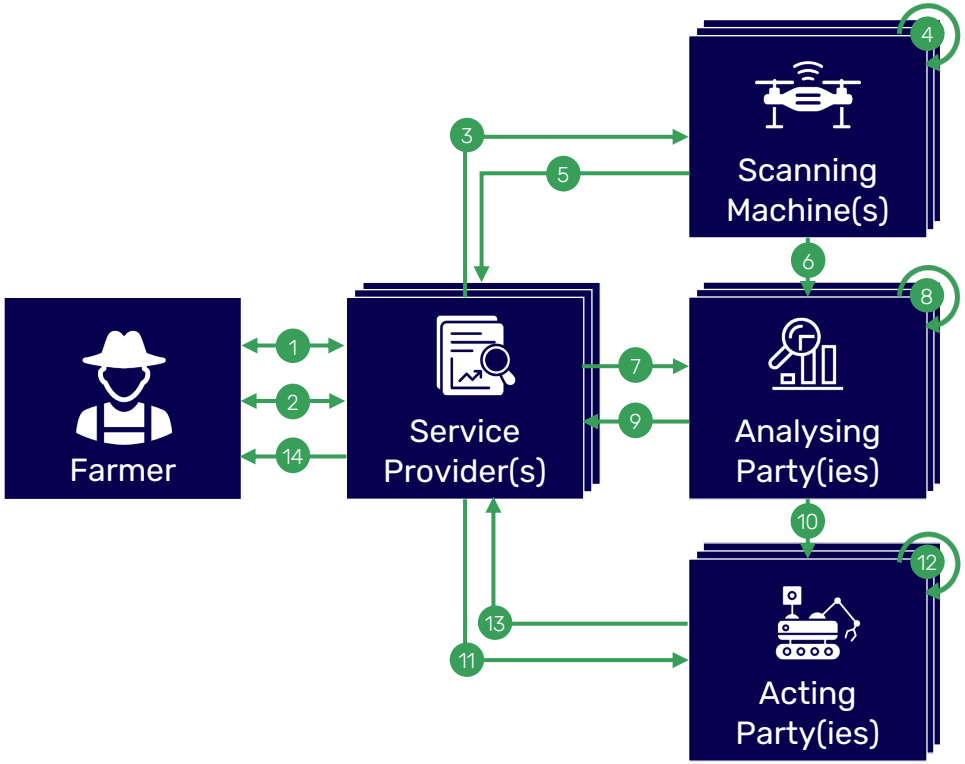
Emergency services
A drone can share images of coastal lines to be analysed by emergency services to recognise and act on people drowning

Predictive maintenance
By scanning machinery like windmills, rails, and factories and sharing images with an analysing party, organisations can predict when maintenance is necessary to prevent malfunctions and high costs

[1] These are use cases KPN is currently working on

APPENDIX

This use case enables data sharing between Service Providers, Scanning Machines, Analysing Parties and Acting parties



High-level steps

Steps in process

1. The Farmer gives the Service Provider an assignment to provide a specific service
2. The Service Provider requests and receives the necessary authorisations from the Farmer for collection and sharing of data on his land
3. The Service Provider gives the Scanning Machine(s) the assignment to perform a certain scanning activity on the Farmer's land
4. The Scanning Machine performs scanning
5. The Scanning Machine shares raw data from step 4 or from previous data collection with the Service Provider
6. The Scanning Machine shares raw data from step 4 or from previous data collection with the Analysing Party
7. Service Provider instructs Analysing Party to perform certain analysis
8. Analysing Party analyses raw data and creates instructions for acting parties
9. Analysing Party shares modified data (instructions) with Service Provider
10. Analysing Party shares modified data (instructions) with Acting Party
11. Service Provider gives Acting Party instructions to perform activity based on modified data
12. Acting Party performs certain activity
13. Acting Party provides a summary/report/confirmation of activity to Service Provider
14. Service Provider provides Farmer with summary/report/confirmation of assignment

Requirements across nine building blocks need to be fulfilled to enable the interoperability and trust between actors in use case

Requirements entail what is needed to realise this use case and can include standards, tools and agreements

Non-exhaustive
For the full list of requirements for this use case, feel free to contact the Data Sharing Coalition

Highlights of requirements in this use case[1]:

Business model

- It should be clear for all actors involved how service pricing is determined

Governance

- Roles, responsibilities and duties should be clearly defined
- Organisations that become a member of the network must conform and adhere to the agreements

Legal agreements

- Legal agreements should define the parties involved, services provided, terms and conditions, and liabilities of all services

Operational agreements

- There should be clarity on what data is generated and what it is used for
- There should be common agreement on data deletion/retention policies and actors must act in line with these policies

Metadata

- Metadata should be used to describe the service, the actors involved, transaction requirements and the data used before a data service

Security

- Information security measures should be in place to protect data in storage and in transit
- The security requirements of each use case should be fit for purpose of the use case risks

IAA

- Actors must be able to identify other actors with sufficient assurance
- All authorisations must clarify relevant parameters of granted access (what data, to whom, for how long, etc.)

Exchange protocol

- A common low-latency distribution channel must be in place for all data exchanges between actors
- There needs to be agreement on the frequency of data sharing (real-time, batch, etc.)

Data standards

- All parties must agree on the format of data
- There should be a common understanding of minimum data quality

[1]Note: These requirements are based on insights from the Data Sharing Canvas

DATA SHARING COALITION

This use case was introduced in DSC by KPN as part of their efforts to realise a wide range of IoT data sharing use cases

Use case actors

- KPN introduced this use case in the DSC to explore how their Data Services Hub[1] can provide a generic data sharing infrastructure for facilitating a wide range of data sharing use cases in which scanning, analysing and acting data services need to be combined
- The Weed Robot use case is a practical first step towards this end goal
- KPN ensured alignment with AgroIntelli, a major producer of smart farming robots, and the Wageningen University, who is doing extensive research on this topic

kpn

WAGENINGEN UNIVERSITY & RESEARCH

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Timeline of the use case

	November 2020 – January 2021 **Phase 1: Requirements**	January 2021 – May 2021 **Phase 2: Design**
GOAL	Scope use case and determine what needs to be in place to enable the use case	Determine what agreements are necessary to harmonise different data services
KEY DELIVERABLES	• Use case scope • Interaction model • List of generic requirements for sharing data	• Outline of potential agreements that harmonise Scanning, Analysing and Acting data services • End deliverable summarising insights and learnings

[1] *KPN Data Services Hub* is a generic data exchange infrastructure that KPN provides (more info)

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