FARM MACHINE INTEROPERABILITY

Communication standards to unlock the potential of efficient data sharing among farm machines

Coordinators: Claus Sorensen, Aarhus University & Vik Vandecaveye, CNH

Project: IoT-01-2016 Large Scale Pilots (30 million €)

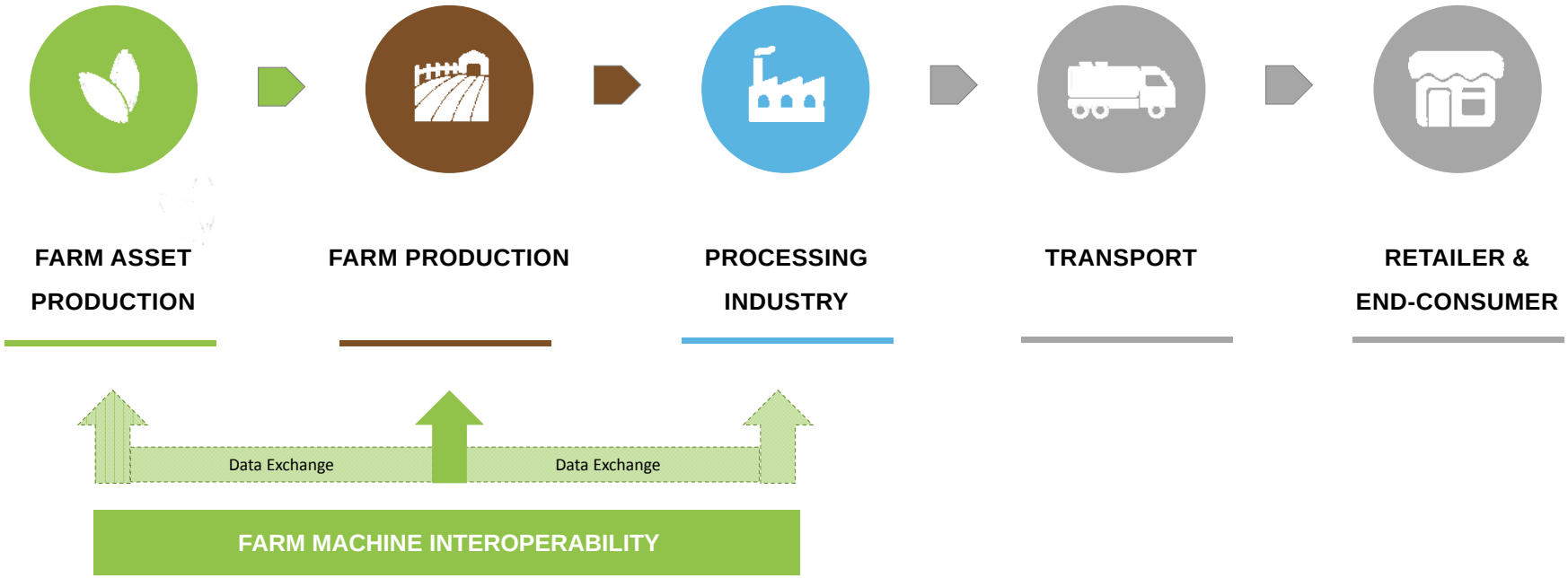
Large Scale Pilot Proposal submitted: Internet of Food and Farm

- Consortium under the lead of Wageningen University and Research
- 73 members, now extending with more members/use cases through open call
- 5 Trials – 19 use cases
  - **Arable (60%)**
    - ✓ Within field management zoning
    - ✓ Precision crop management
    - ✓ Soya protein management
    - ✓ **Farm machine interoperability ←**
      - o CNH Industrial, Agco, 365FarmNet (Claas), Agro Intelligence, Alterra (WUR), Kverneland (Kubota), Aarhus University
  - Dairy
  - Fruit
  - Vegetables
  - Meat

IOF 2020
INTERNET OF FOOD & FARM

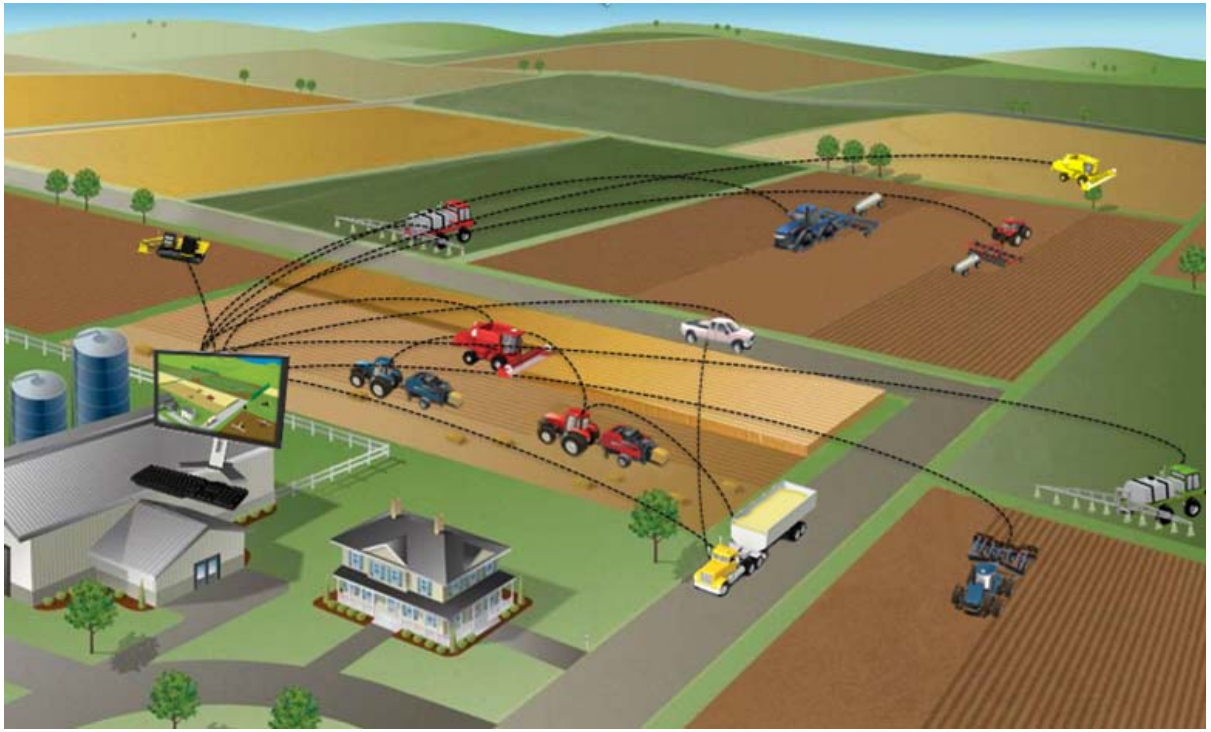
The Value Chain

Enabling Farm Machine Interoperability



Product Impressions

Here is an idea on how our service will enable interoperability



FARM MACHINE INTEROPERABILITY

Use case 1.4: Product Factsheet

Farm Machine Interoperability

IoFieldGateway

Interoperable communication standards for farm machines to unlock the potential of production automation

Customer & Provider

FMIS & Service Providers

Price per Data volume or communication

Joint Service Company
of Farm Machine Manufacturers

Major Challenge

One of the problems that farmers face is the lack of interoperability of farming equipment due to different digital standards.

Core Product Features

A digital gateway for seamless data transmission between field machinery and FMIS for supporting cross-over pilot machine communication and prescription farming

Multi-vendor ADAPT Plugins - Off-line interoperability. 1st version of proprietary format ADAPT Plugin, followed by 1st version of ISOXML format ADAPT Plugin

Cloud API - Interoperability in real time communication. Implementation of the EFDI standard being developed by AEF

Automation Communication - Bi-directional interoperable communication of data and field tasks

Here is what we aim to improve

- Enabling cross-vendor communication and automation
- Guarantees communication security
- Enables development of automation services based on IoT data
- Faster IoT uptake

Product User Story: Farmers

Farm Machine Interoperability

Without our Product or Service	With our Product or Service	Here is the difference
Inefficient data transfer Currently data is predominantly transferred manually between machinery and FMIS.	**Effortless data transfer** Seamless data transfer by a common application programming interface and data modelling.	Hands free data collection: the means to collect data from various sources without manual interference.
Field work decisions made on information from previous years A potential risk of under/over estimation of field work resources	**Access to data in real time** A dashboard for monitoring farm activities in real time based on data from vehicles and other data sources	Improved field work efficiency, executional optimization and precision due to the elimination of information latency.
Proprietary data formats and hardware Currently too many problems of sharing data between machinery brands and FMIS	**Data from different machinery brands at one place** Machines connects to any FMIS of user's choice	Novel possibilities to combine data from vehicles and other data sources to optimise the next agronomic production cycle and fulfill compliance regulations

Target User – Medium to large size farms (100 – ∞ ha)

Product User Story: FMIS Providers

Farm Machine Interoperability

Without our Product or Service

Large set of proprietary data formats and hardware
Endless Implementation with high costs in order to provide an appropriate range of brand freedom

Decision Support on the field could be inconsistent
Without adequate synchronization of data the FMIS's functionality can lose credibility and reliability

Limited offer for online data transfer
Currently data is shared in real time, if the FMISs and Machine-Platforms have a common API, otherwise the transfer is only manual.

With our Product or Service

Farmer's data sources work together
Regardless of the farmer's machine choice, FMISs can use a single service to convert different formats and present them to the farmer

Real Time Decision Support
A harmonized sync of data from machine telemetry and sensors in the field with FMISs enables real-time analysis faced of unexpected changes.

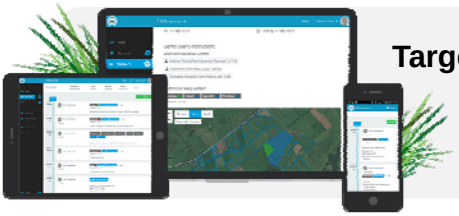
Increase of online data transfer
By optimizing and harmonizing APIs among actors, a wider range of data transfer possibilities can be offered without the use of external media, fast and secure for the farmer

Here is the difference

Saving time and effort to convert different formats and models lets FMISs redirects some of the development capability to improve analysis and support tools **without compromising the interoperability of the systems.**

Reducing the latency period in data transmission between FMIS and Machines, Farmers can profit of a "just in time" decision support during task performance, capture new master data or detect gaps in the data.

Online data transfer means: collect data, make them available for the farmer as soon as possible and avoid gaps in order to analyze the data and obtain value from them.



Target User – Farm Management Information System Providers

Product User Story: Farm Machine Manufactures

Farm Machine Interoperability

Without our Product or Service	With our Product or Service	Here is the difference
Proprietary telemetry services Many manufacturers are using proprietary or non-standardized interfaces and messaging systems	**Standard for telemetry services** A single connection methodology	Enabling access to data and decision support through one interface
Limited services for machinery Manufacturers are limited by their own solutions and large efforts are needed to provide new services	**New services for connected machinery** New potentials for manufacturers by making the machines connected to other related industries	New business possibilities combining data from machinery, other data sources and services

Target User – Farm Machine Manufacturers

Use case 1.4: MVP Time Plan

Farm Machine Interoperability

Dec 2017

- Off-line interoperability
  - 1st version Proprietary ADAPT Plugin
  - 1st version ISOXML ADAPT Plugin

Feb 2019

- Interoperability in Cloud API
  - NGSI-LD

Dec 2019

- Interoperable near real-time data exchange
  - Task data in ADAPT using EFDI

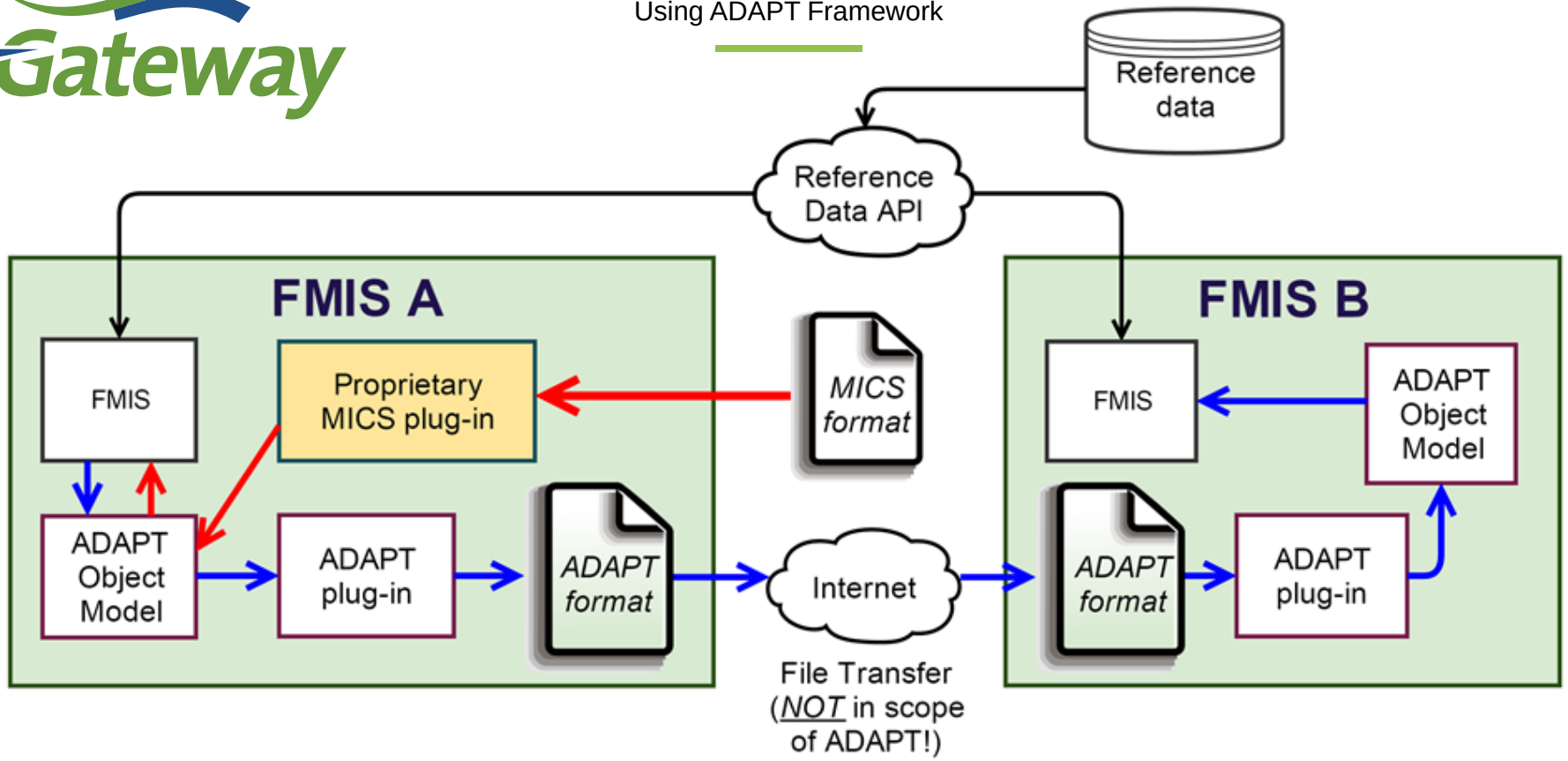
Jun 2020

- Bi-directional interoperable communication

1st MVP | 2nd MVP | 3rd MVP | 4th MVP

Off-line interoperability

Using ADAPT Framework



AgGateway (2016)

1st MVP

Off-line interoperability

Using ADAPT Framework

- From a developer stand-point:
  - C#.NET; https://github.com/ADAPT/
  - Starting; please visit the website: https://adaptframework.org/
    - Look at the application notes
    - When having technical issues, adapt.feedback@aggateway.org
      - There is also a bi-weekly ADAPT Technical Committee meeting
  - ADAPT: Very broad data model!
    - Planned task, Logged task
    - But also: Irrigation, Weather, Scouting

1st MVP

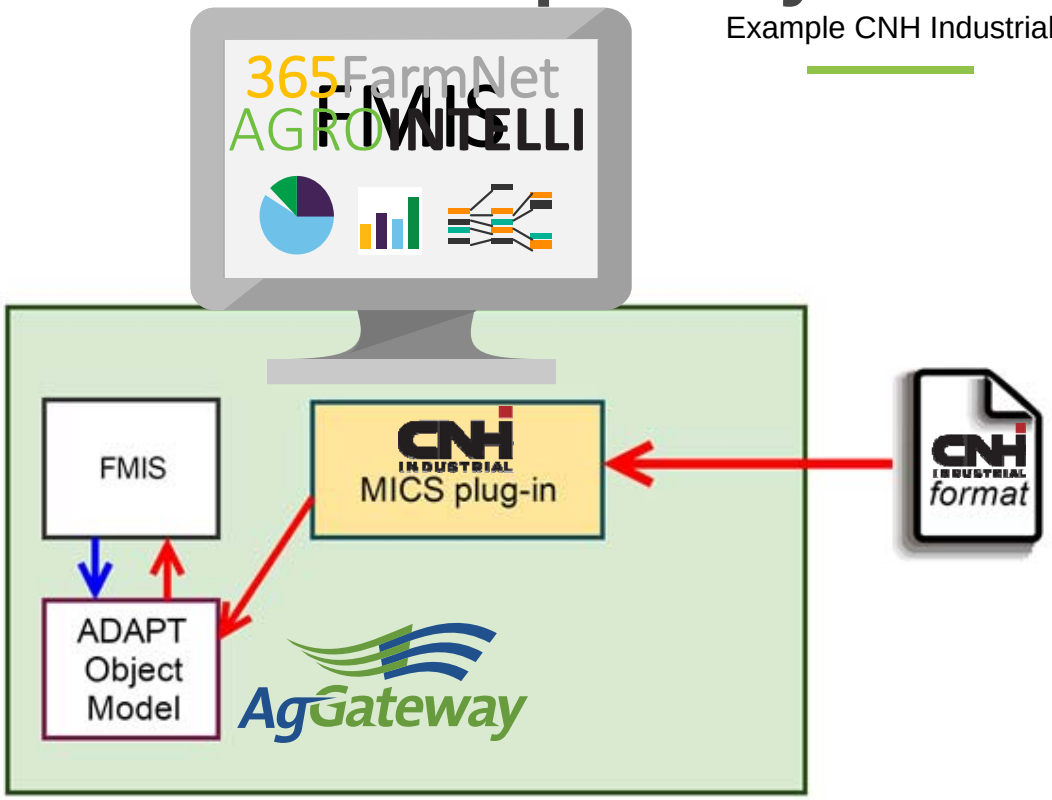
Proprietary ADAPT Plugin

Example CNH Industrial

1st MVP

Proprietary ADAPT Plugin

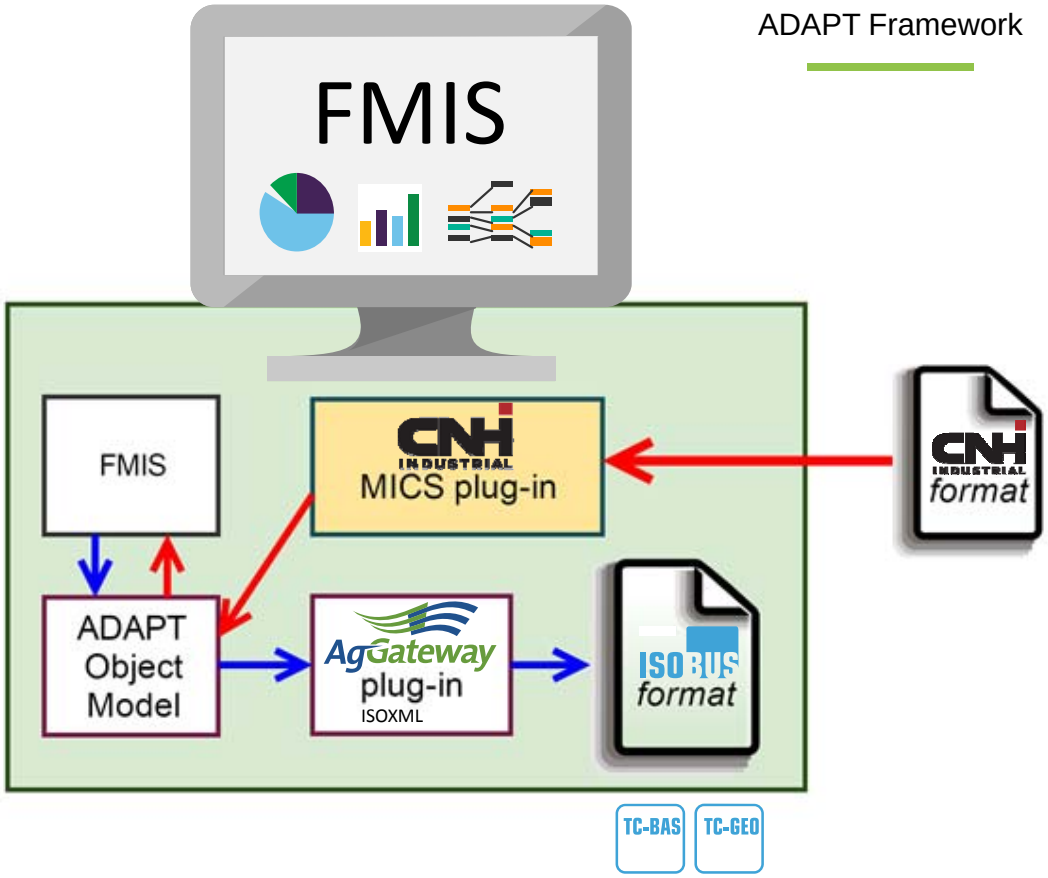
Example CNH Industrial



1st MVP

ISOXML ADAPT Plugin

ADAPT Framework



ISOXML (ISO 11783-10)

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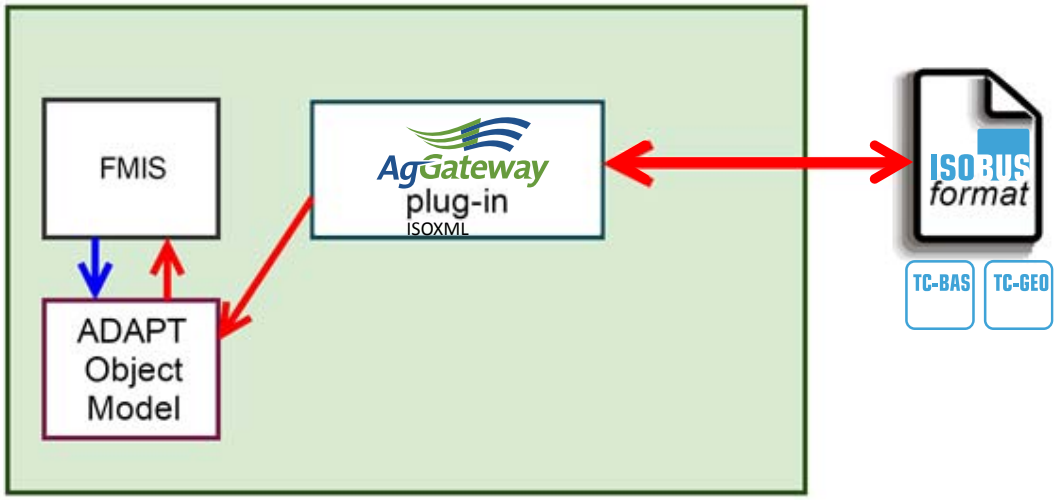
1st MVP

ISOXML ADAPT Plugin

ADAPT Framework



AEF Certified

ISOBUS

UT TECU AUX-N
TC-BAS TC-GEO TC-SC
... ...

www.aef-isobus-database.org

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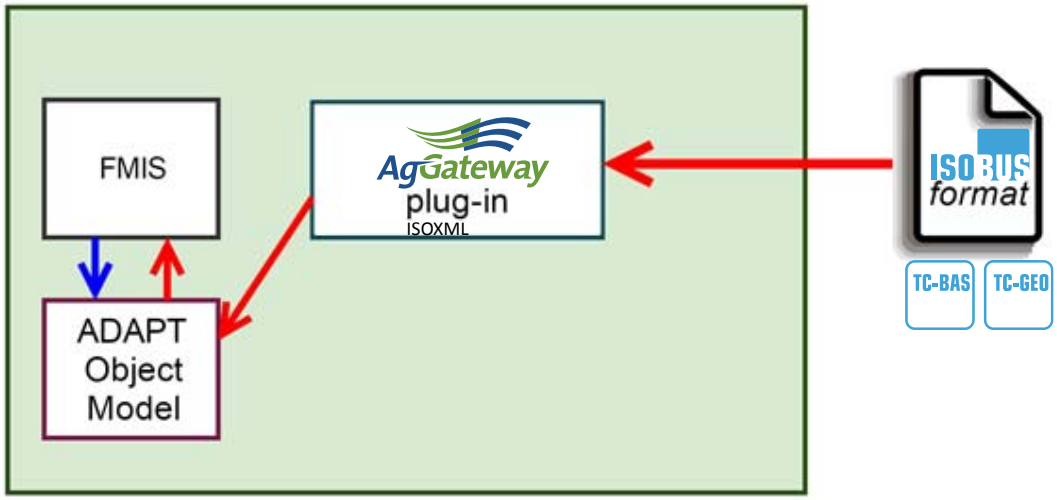

GRIMME

CASE IH

FENDT

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NEW HOLLAND AGRICULTURE

365FarmNet

Kverneland

AGCO Your Agriculture Company

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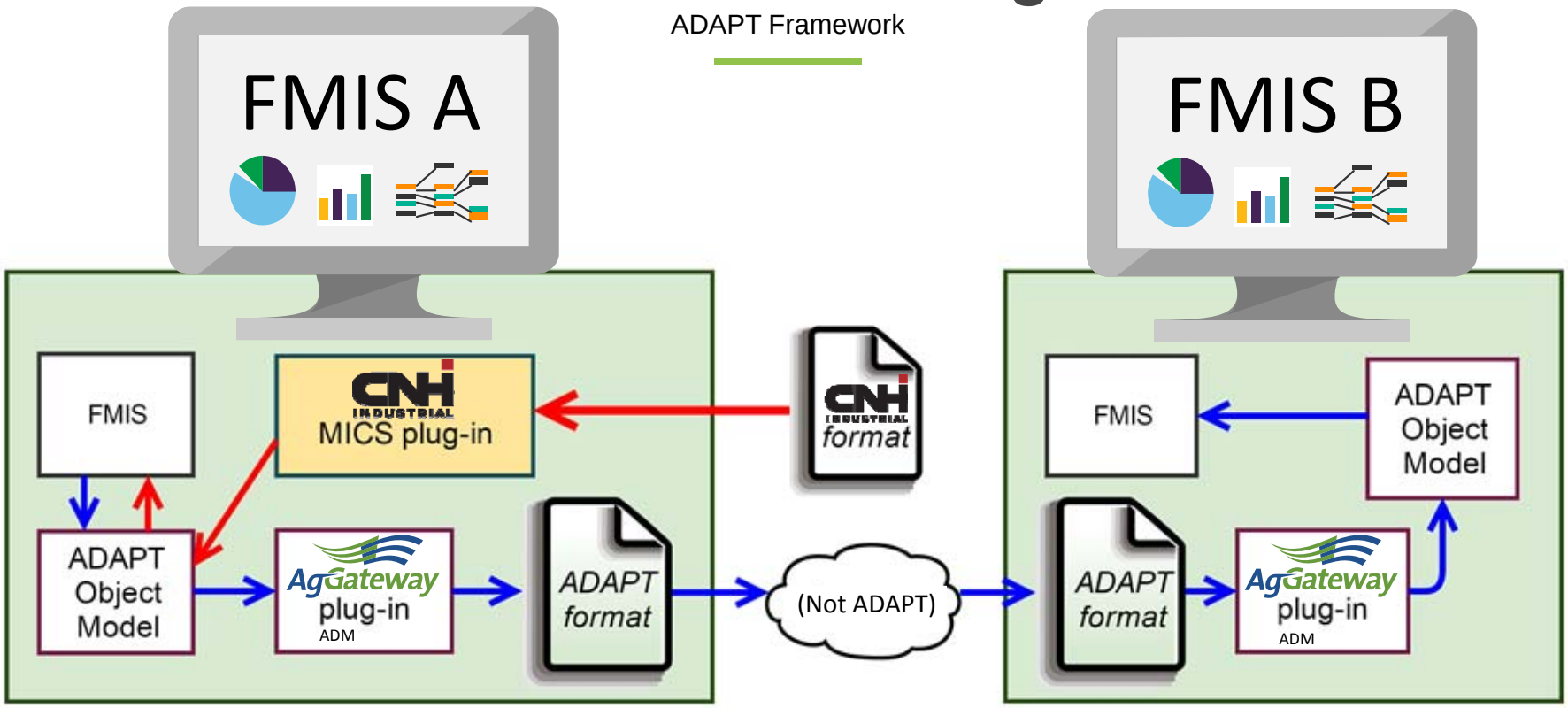
ADM ADAPT Plugin

ADAPT Framework



1st MVP

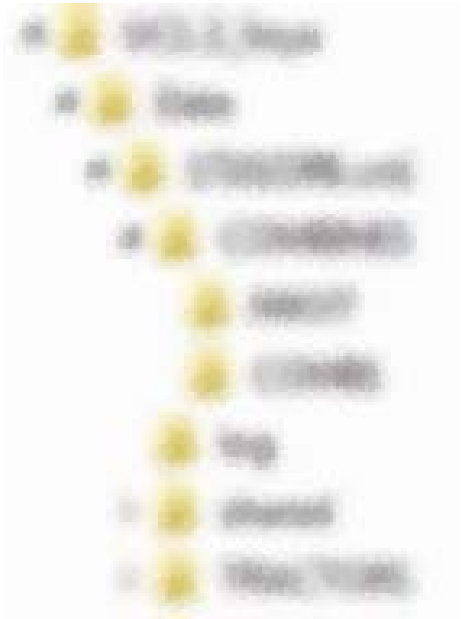
Off-line interoperability

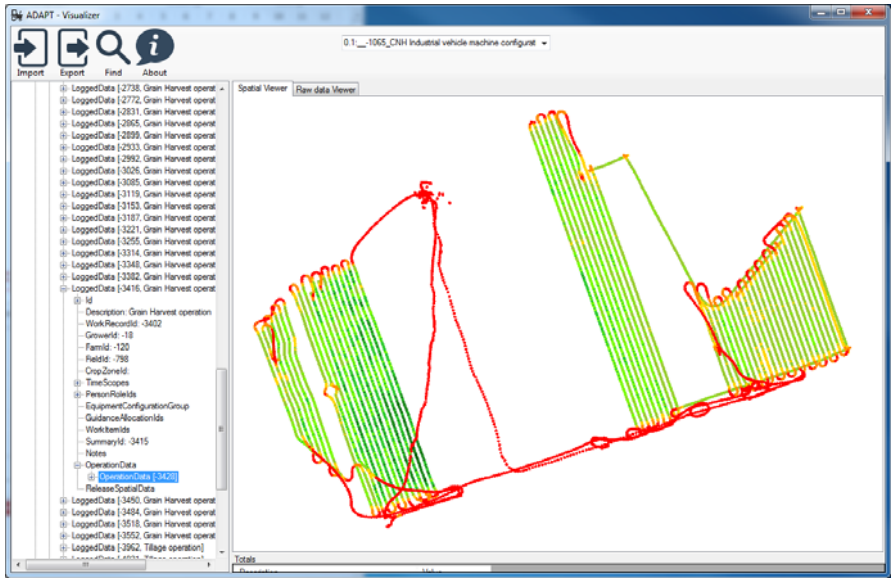
1st MVP

Proprietary format

CNH Industrial

Proprietary format → ADAPT Data Model





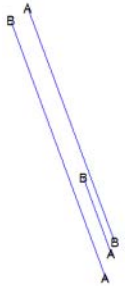
1st MVP

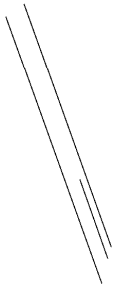
Proprietary format

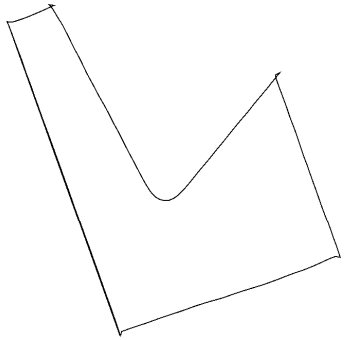
CNH Industrial

Guidance lines → ADAPT Data Model → ISOXML format

Use case:
Soya Protein
Management







CASE IH

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Proprietary format

CNH Industrial

Flowrate → ADAPT Data Model → ISOXML format

Use case:
Soya Protein
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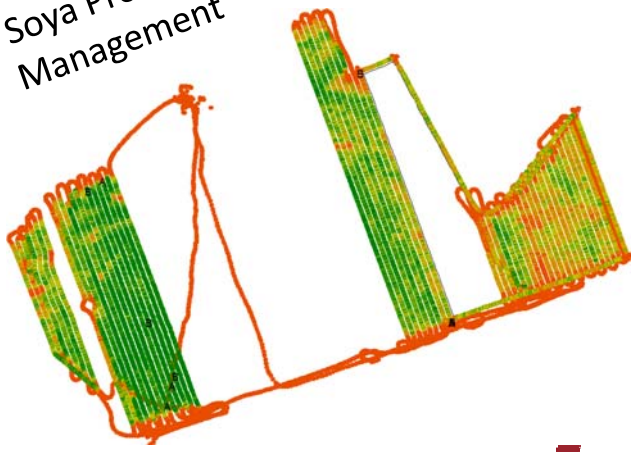

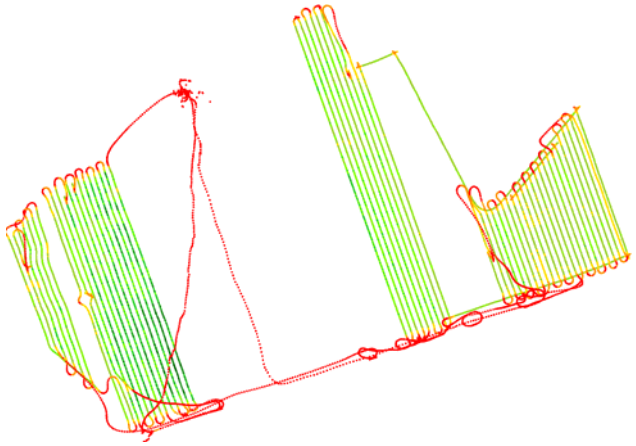

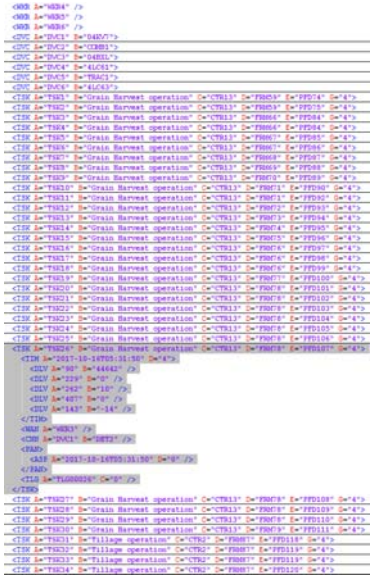

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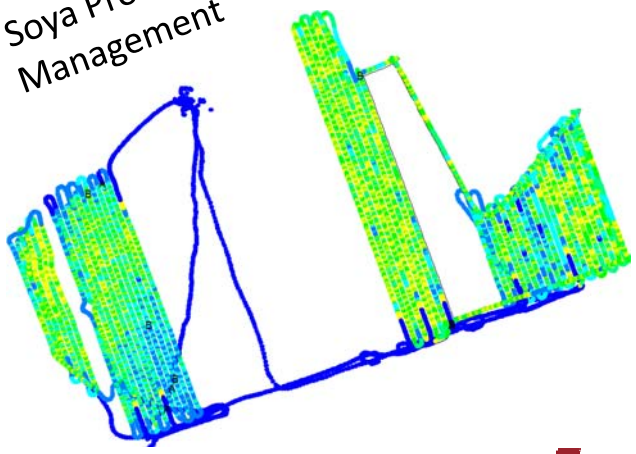
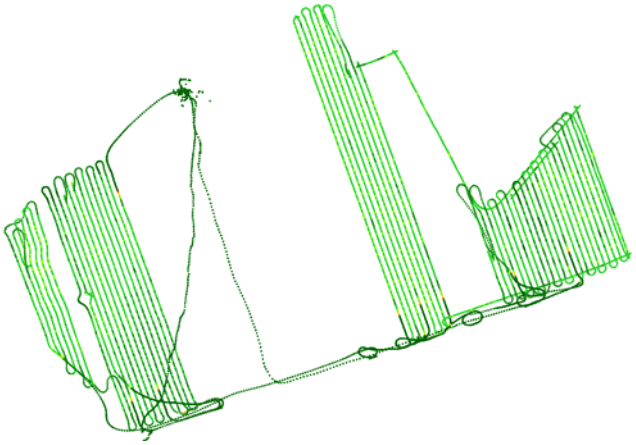
Proprietary format

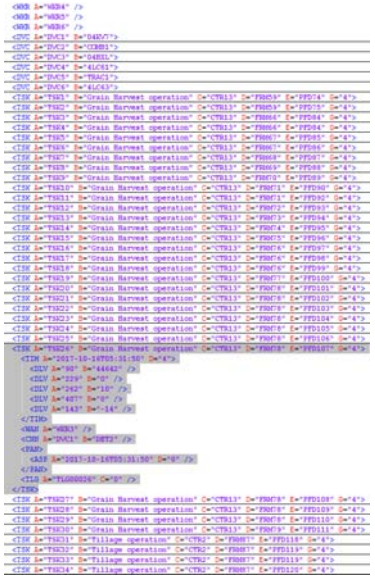
CNH Industrial

Reference moisture → ADAPT Data Model → ISOXML format

Use case:
Soya Protein
Management







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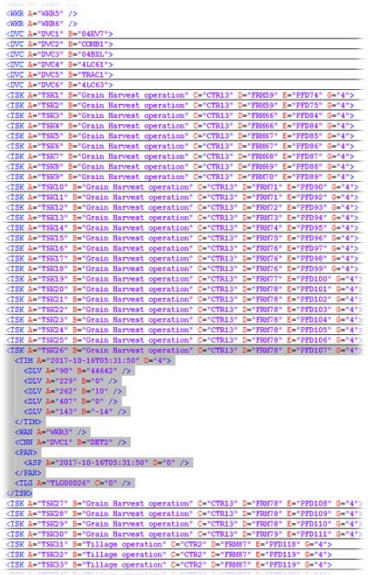
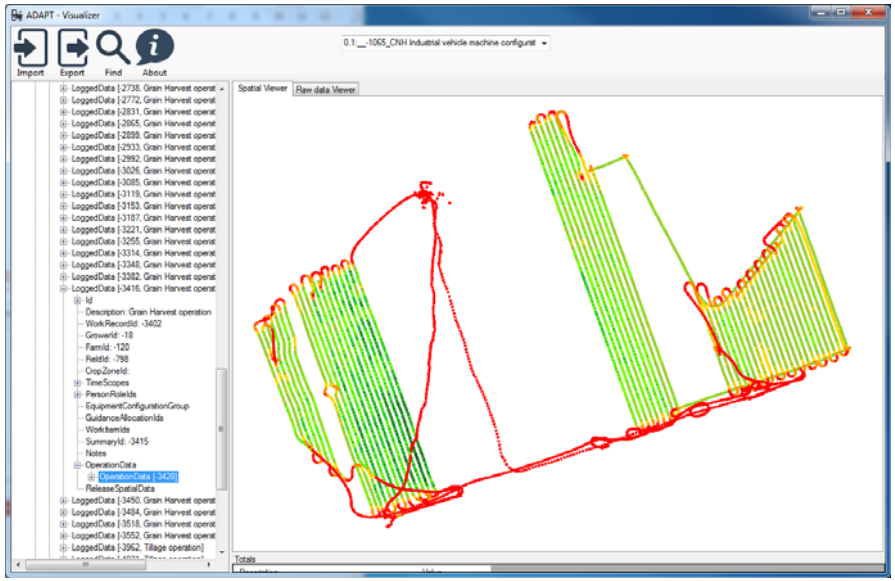
ISOXML format (ISO 11783-10)

ISOXML ADAPT Plugin

ISOXML format ⟷ ADAPT Data Model





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ISOXML format (ISO 11783-10)

ISOXML ADAPT Plugin

Field boundary ⟷ ADAPT Data Model

Kverneland

AgGateway

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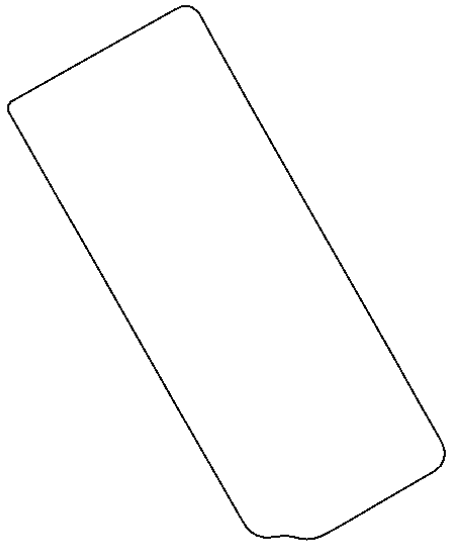


1st MVP

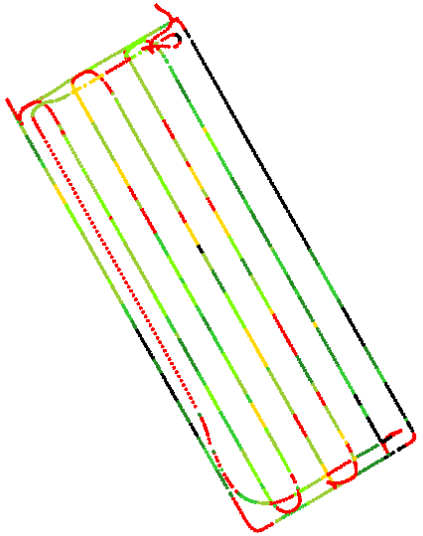
ISOXML format (ISO 11783-10)

ISOXML ADAPT Plugin

As-applied rate ⟷ ADAPT Data Model

Kverneland

AgGateway



1st MVP

ISOXML format (ISO 11783-10)

ISOXML ADAPT Plugin

Machine, Implement & section configurations

ADAPT Data Model

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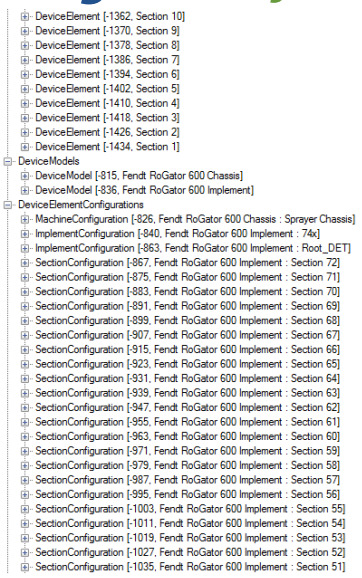
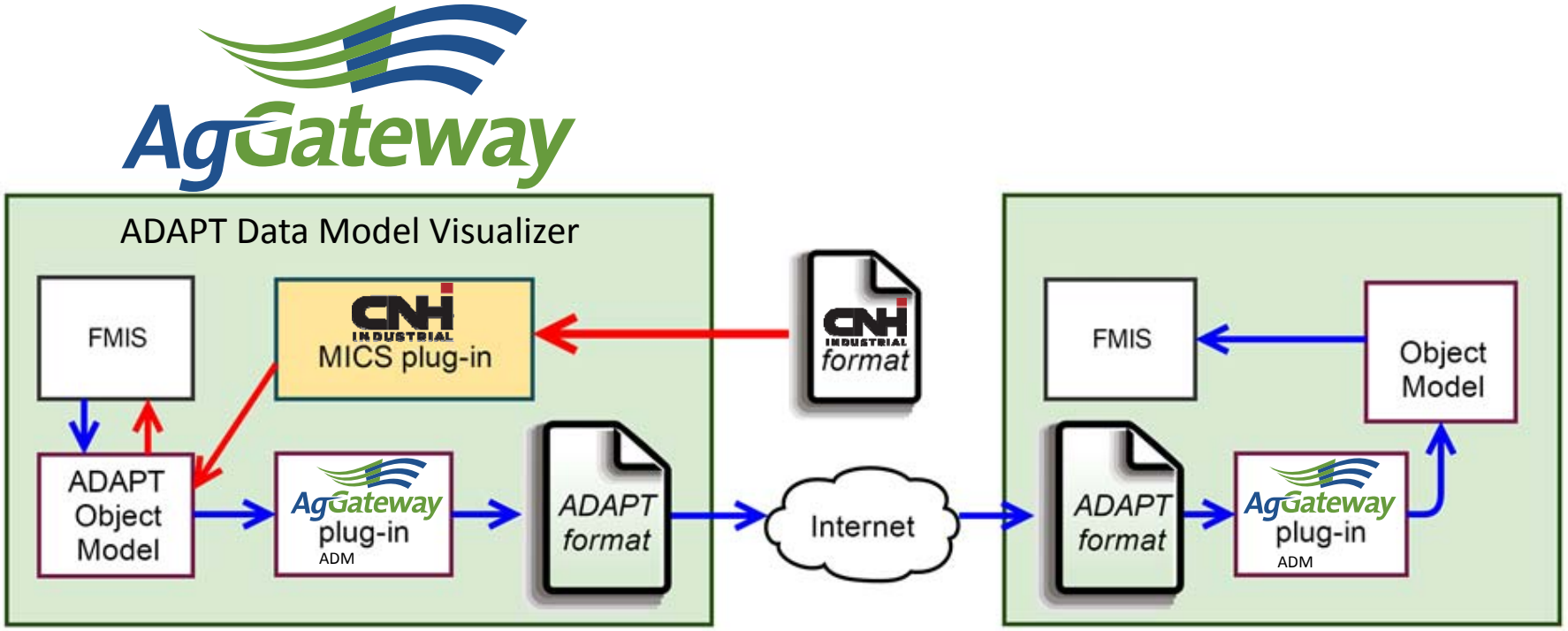


2nd MVP

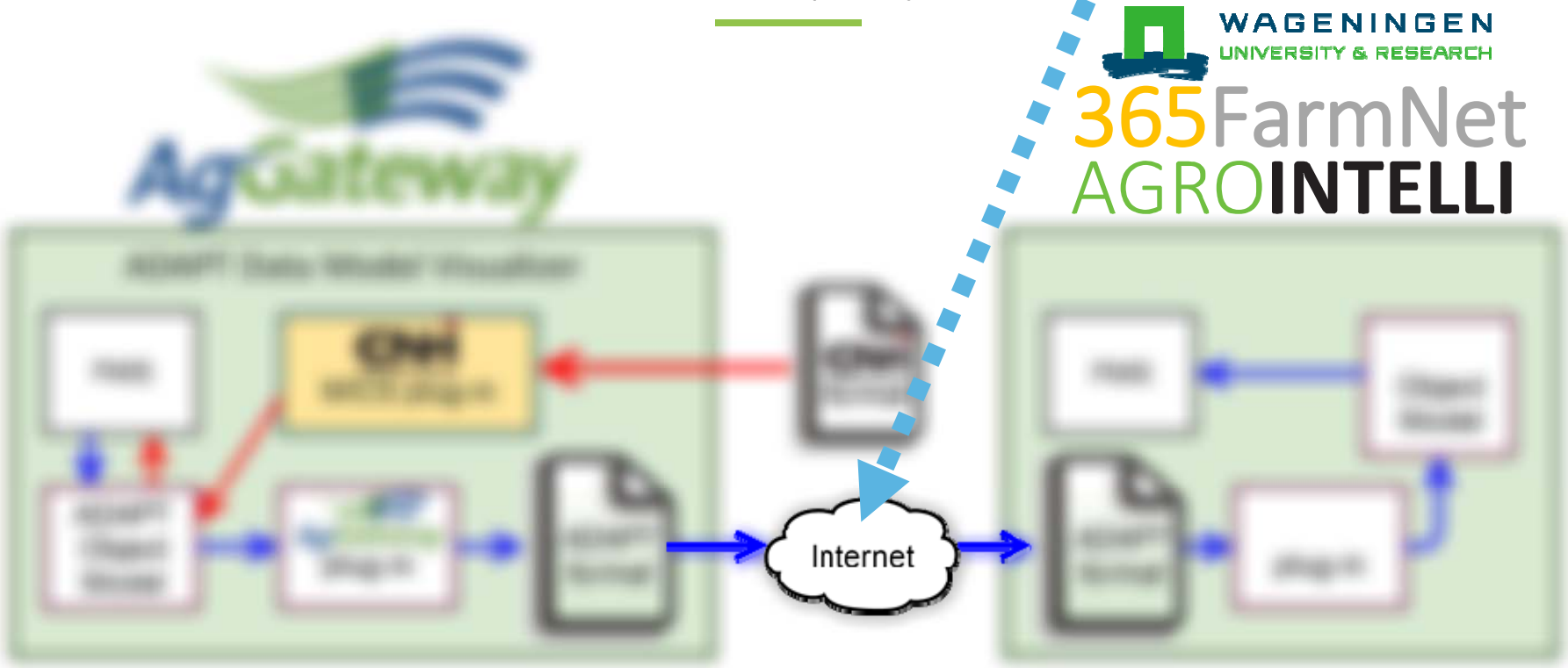
Online Interoperability



2nd MVP

Using ADAPT in Cloud API

Online Interoperability



1st MVP

ADAPT framework

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- Starting; please visit the website: https://adaptframework.org/
  - Look at the application notes
  - When having technical issues, adapt.feedback@aggateway.org
    - There is also a bi-weekly ADAPT Technical Committee meeting