ADAPT: A Rosetta Stone for Agricultural Data

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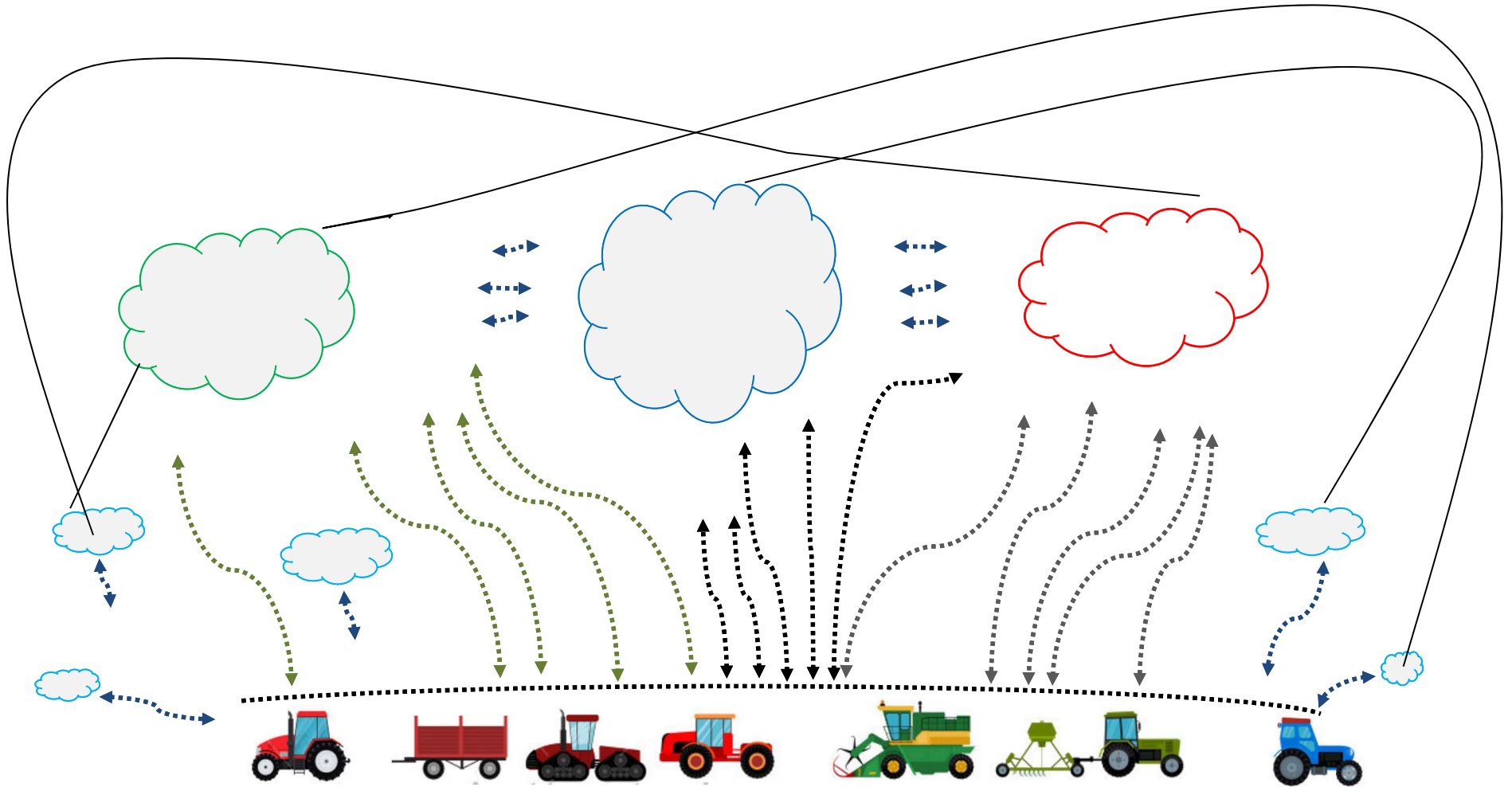*Vice Chair – AgGateway ADAPT Committee*

25 October 2018

ACS
Adifo NV
Ag Connections, LLC
Ag Leader Technology
Ag Retailers Association
AGCO Corporation
AGDATA LP
AgIntegrated, Inc.
Agrian
Agricultural Data Coalition
Agrium Inc.
AgSense
AgTrax
AgVantage Software, Inc.
AgVision
AgWorks, Inc.
Agworld, Inc.
AheadRace Software
Albaugh, LLC
Aligned Ag Distributors
American Farm Bureau Federation
American Feed Industry Association
American Seed Trade Association
Americot, Inc
AMVAC Chemical Corporation
Area-Wide-e-Laboratory for Food, Agriculture & Environment (ALFAE)
ARMtech Insurance Services
Arysta LifeScience North America
Association of Equipment Manufacturers (AEM)
Aurora Coop
AUVSI – Association for Unmanned Vehicle Systems, International
Barcoding Inc.
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BASF Canada

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Brandt Consolidated Inc.
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CF Industries, Inc
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Crop IMS
Crop Production Services
CropLife America
CropLife Canada
CropMetrics LLC
Cultura Technologies
D & K Products
Davis Instruments, Inc.
Decagon Devices, Inc.
Decisive Farming
Digi-Star, LLC
Direct Enterprises, Inc
Douglas Products and Packaging Company LLC
Dow AgroSciences
DuPont/Pioneer
DXC Technology
EFC Systems Inc
Effingham Equity
Elemica Inc.
Entira
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Farm Journal Media
Farmers Edge
Farmers Mutual Hail Insurance Company of Iowa
Farmobile, LLC
FieldWatch Inc.
FMC Corporation
FMC of Canada
Fujitsu America, Inc.
GEOSYS, Inc.
Gowan USA, LLC
Granular
GROWMARK, Inc.
GS1 US
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Heartland Ag, Inc.
Heartland Cooperative
Helena Chemical Company
Husch Blackwell LLP
Independent Data Management LLC
Independent Professional Seed Association
Insero
International Raw Materials, LTD.
IPM Institute of North America
Irrinet LLC
Irrometer Co, Inc.
Iteris, Inc
J.R Simplot Company
John Deere
Junge Control, Inc.
Kahler Automation Corporation
Kansas Farm Bureau
Key Cooperative
Koch Ag & Energy Solutions, LLC
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Mechatronics BV
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Lindsay Corporation
LIPHATECH, Inc
MapShots, Inc

Marrone Bio Innovations
Meister Media Worldwide
MFA, Inc.
Monsanto Company
Monsanto Canada Inc
Mosaic Company
Myriad Mobile
National Agricultural Aviation Association
National Crop Insurance Services, Inc.
Nebraska Water Balance Alliance
Netafim Ltd.
Nichino America, Inc.
NEEA - Northwest Energy Efficiency Alliance
Novozymes
Nufarm Americas Inc.
Observant, Inc.
OCI Fertilizers USA LLC
Open Applications Group
Pinnacle Ag
Planet
Plant Impact, Inc.
Praxidyn
Premier Crop Systems, LLC
ProAg
Proagrica
PROKoZ, Inc.
Raven Industries, Inc.
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Rev!Co
RiceTec Inc.
Richardson International
River Valley Cooperative
Rosen's, Inc.
SageInsights
SeediQ, LLC
SenseFly Ltd.
SePRO Corporation
Sierra Pacific
Software Solutions Integrated,

LLC
solutions direkt GmbH
Southern Agricultural Insecticides, Inc.
Southern States Cooperative, Inc
SST Software
Sunrise Cooperative
Syngenta Canada Inc
Syngenta Crop Protection, LLC
Tecgraf Ecnologia EM Computacao Grafica LTDA
TeeJet Technologies
Telvent DTN, Inc.
Tennessee Farmers Cooperative
Tessenderlo Kerley Inc
The Fertilizer Institute
The McGregor Company
Topcon Agriculture
Traders Tec-Systems Controls Ltd
Trimble Navigation Limited
Trisotech
Tucor Inc.
United Services Association, Inc.
United Suppliers
Uptake Technologies Inc.
Valent USA
Van Diest Supply Company
Virginia Dept of Agriculture and Consumer Services
Vita Plus Corporation
Weather Decision Technologies
WEM Automation
West Central Inc.
Wilbur-Ellis
Wysocki Produce Farms, Inc.
XS, Inc.
YASH Technologies Inc.
ZedX

The Inspiration for ADAPT
The Need of a Rosetta Stone

Telemetry X

Telemetry Y

Telemetry Z

FMIS A

FMIS B

FMIS C

SP M

SP N

SP O

Supplier 1

Administration

Trader 2

Trader 1

Supplier 2

AEF
AGRICULTURAL INDUSTRY
ELECTRONICS FOUNDATION

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AgGateway
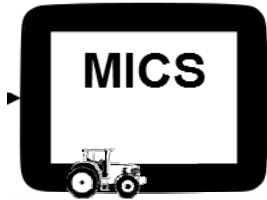Collaboration for eConnectivity

AgGateway
Collaboration for eConnectivity

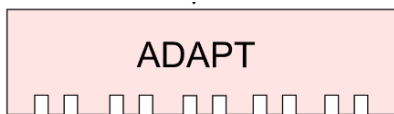AgGateway
Collaboration for eConnectivity
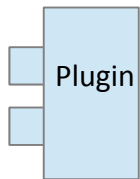
Interoperability Glossary

Farm Management Information System – could be desktop, mobile-based, web/cloud/...

Mobile Implement Control System – "equipment display" or system that collects field data or executes work instructions (from FMIS)

ADAPT Framework – AgGateway open source SDK, integrated into FMIS systems under AgGateway licensing terms

ADAPT Plugin – specific data conversion plugin which can be easily *integrated into a specific instance of ADAPT*. Created by manufacturers and FMIS to allow them to read/write in ADAPT.

Readable Data

Proprietary Data

FMIS

A D A P T   F R A M E W O R K

ADAPT Serialization Plugin

AGCO Your Agriculture Company
MICS Plugin

CLAAS
MICS Plugin

JOHN DEERE
MICS Plugin

TOPCON
MICS Plugin
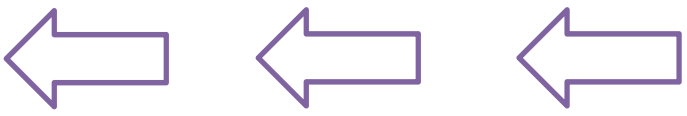
ISOBUS
MICS Plugin

Ag Leader Technology
MICS Plugin

CNH INDUSTRIAL
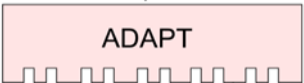MICS Plugin

RAVEN INDUSTRIES
MICS Plugin

Trimble
MICS Plugin
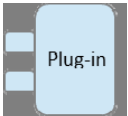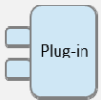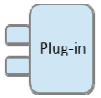
ContextItem & Reference Data API

MICS File

MICS

The 5 Primary Components of ADAPT

	1. ADAPT Data Model	The data elements needed in a wide variety of field operations
	2. ADAPT Framework	Framework managing plugins and data pass through
	3. OEM Plug-ins *(proprietary)*	Created and licensed from a terminal manufacturer on how their data system maps into the ADAPT data model
	4a. ADM Serialization Plug-in *(open-source)*	Used to transfer data from one system supporting ADAPT to another *(FMIS ADAPT to FMIS ADAPT)*
	4b. ISO Plug-in *(open-source)*	Plug-in that will be AEF conformance tested for compatibility with the ISO11783 standard
	5. Reference Data API *(open-source)*	A RESTful API that provides machine-readable ContextItem Definitions to identify geopolitical-context-dependent data

1. ADAPT Common Data Model

The Rosetta Stone of ADAPT

- ADAPT's power is in its common object model

- A common object model for describing field operations, implemented as a collection of extensible business objects

- It is used to map concepts between various proprietary languages

Grower

PermittedProduct

Id : CompoundIdentifier
CropSeason [0..1] : TimeScope
GrowerId : Integer
ProductId : Integer
ContextItems [0..*] : ContextItem

PersonRole

Id : CompoundIdentifier
PersonId : Integer
Role : PersonRolesEnum
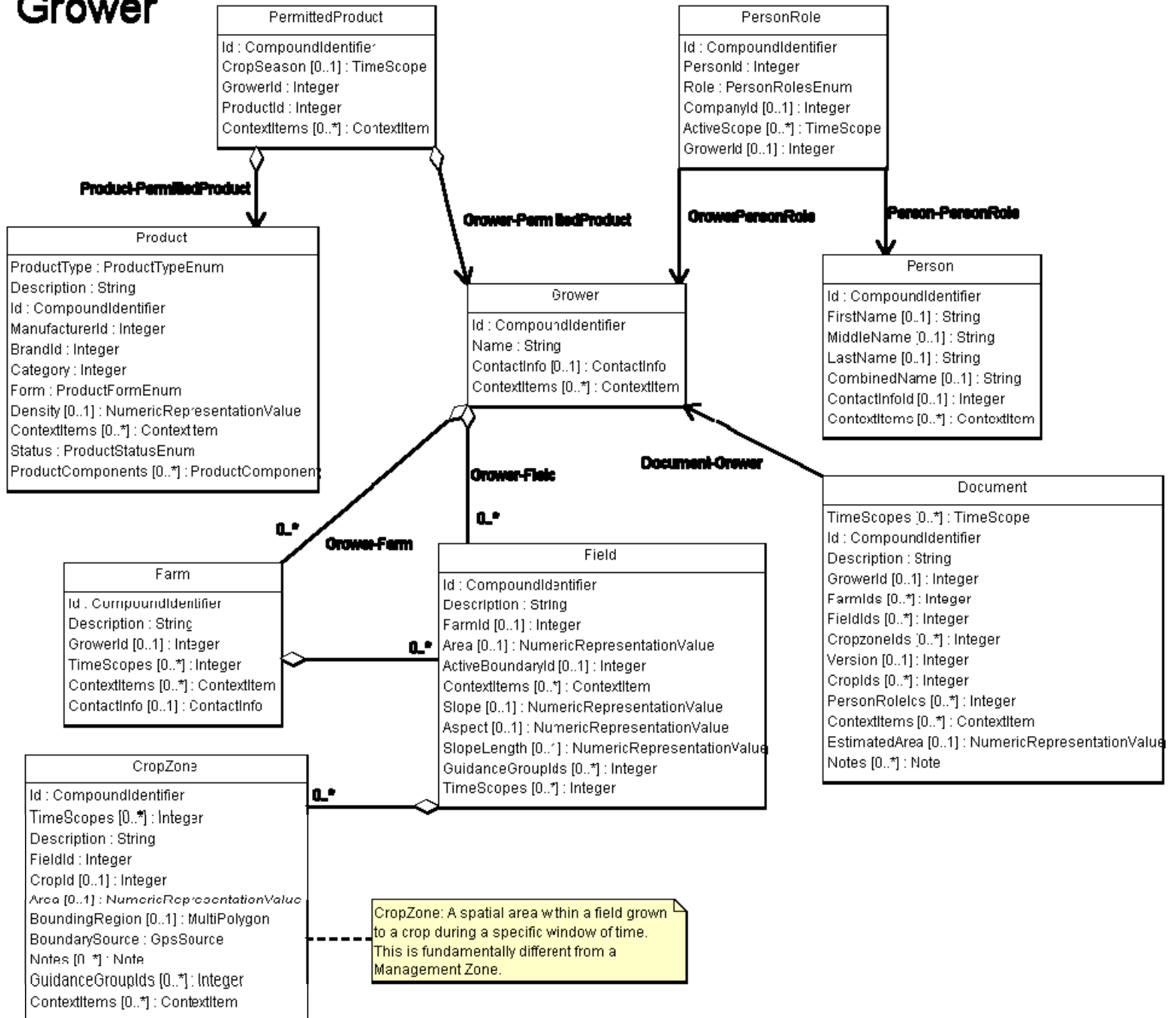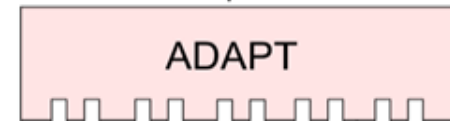CompanyId [0..1] : Integer
ActiveScope [0..*] : TimeScope
GrowerId [0..1] : Integer

Product-PermittedProduct

Grower-PermittedProduct

Grower-PersonRole

Person-PersonRole

Product

ProductType : ProductTypeEnum
Description : String
Id : CompoundIdentifier
ManufacturerId : Integer
BrandId : Integer
Category : Integer
Form : ProductFormEnum
Density [0..1] : NumericRepresentationValue
ContextItems [0..*] : ContextItem
Status : ProductStatusEnum
ProductComponents [0..*] : ProductComponent

Grower

Id : CompoundIdentifier
Name : String
ContactInfo [0..1] : ContactInfo
ContextItems [0..*] : ContextItem

Person

Id : CompoundIdentifier
FirstName [0..1] : String
MiddleName [0..1] : String
LastName [0..1] : String
CombinedName [0..1] : String
ContactInfoId [0..1] : Integer
ContextItems [0..*] : ContextItem

Grower-Field

Document-Grower

0..*

Grower-Farm

0..*

0..*

Farm

Id : CompoundIdentifier
Description : String
GrowerId [0..1] : Integer
TimeScopes [0..*] : Integer
ContextItems [0..*] : ContextItem
ContactInfo [0..1] : ContactInfo

Field

Id : CompoundIdentifier
Description : String
FarmId [0..1] : Integer
Area [0..1] : NumericRepresentationValue
ActiveBoundaryId [0..1] : Integer
ContextItems [0..*] : ContextItem
Slope [0..1] : NumericRepresentationValue
Aspect [0..1] : NumericRepresentationValue
SlopeLength [0..1] : NumericRepresentationValue
GuidanceGroupIds [0..*] : Integer
TimeScopes [0..*] : Integer

Document

TimeScopes [0..*] : TimeScope
Id : CompoundIdentifier
Description : String
GrowerId [0..1] : Integer
FarmIds [0..*] : Integer
FieldIds [0..*] : Integer
CropzoneIds [0..*] : Integer
Version [0..1] : Integer
CropIds [0..*] : Integer
PersonRoleIds [0..*] : Integer
ContextItems [0..*] : ContextItem
EstimatedArea [0..1] : NumericRepresentationValue
Notes [0..*] : Note

0..*

CropZone

Id : CompoundIdentifier
TimeScopes [0..*] : Integer
Description : String
FieldId : Integer
CropId [0..1] : Integer
Area [0..1] : NumericRepresentationValue
BoundingRegion [0..1] : MultiPolygon
BoundarySource : GpsSource
Notes [0..*] : Note
GuidanceGroupIds [0..*] : Integer
ContextItems [0..*] : ContextItem

CropZone: A spatial area within a field grown to a crop during a specific window of time. This is fundamentally different from a Management Zone.
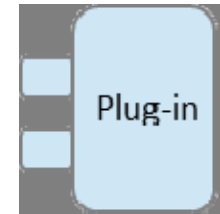
2. Plugin Framework

Framework managing plugins and data pass through

3. OEM Proprietary Plugins

Created and licensed from a terminal manufacturer on how their data system maps into the ADAPT data model.
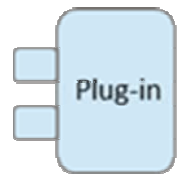
4. Open-Source Plugins

ADM Serialization Plug-in

- Used for lossless transfer data from one system supporting ADAPT to another
- *FMIS ADAPT → FMIS ADAPT*

ISO Plug-in

- Plug-in that will be AEF conformance tested for compatibility with the ISO11783 standard

5. Reference Data API:
Making ADAPT work globally

Geopolitical-Context-Dependent Data

- Each region/country/province has its own geopolitical identifiers

- Need controlled vocabularies *("We call it this/You call it that")*

  - *product names, specifications, seed brand, type, traits*

- These references will be constantly modified

- So, the SPADE Team implemented a RESTful API to provide a updated machine-readable vocabulary of ContextItemDefinitions;

- "Reference Data API" – only uses the identifier you need based on location

Reference Data API
ContextItems

| ContextItem |
| --- |
| Code : String |
| Value [0..1] : String |
| ValueUoM [0..1] : String |
| TimeScopes [0..*] : TimeScope |
| NestedItems [0..*] : ContextItem |

•**Code:** What a given ContextItem contains:

•**Value:** Identifying number (*e.g.* Gov. ID, geolocation, regulatory number)

•**ValueUoM:** Unit of measure for Value.

•**TimeScopes:** Temporal context.

•**NestedItems:** Used for multi-attribute data. Enables a hierarchical organization of nested ContextItems (*e.g.* survey connected to a field)
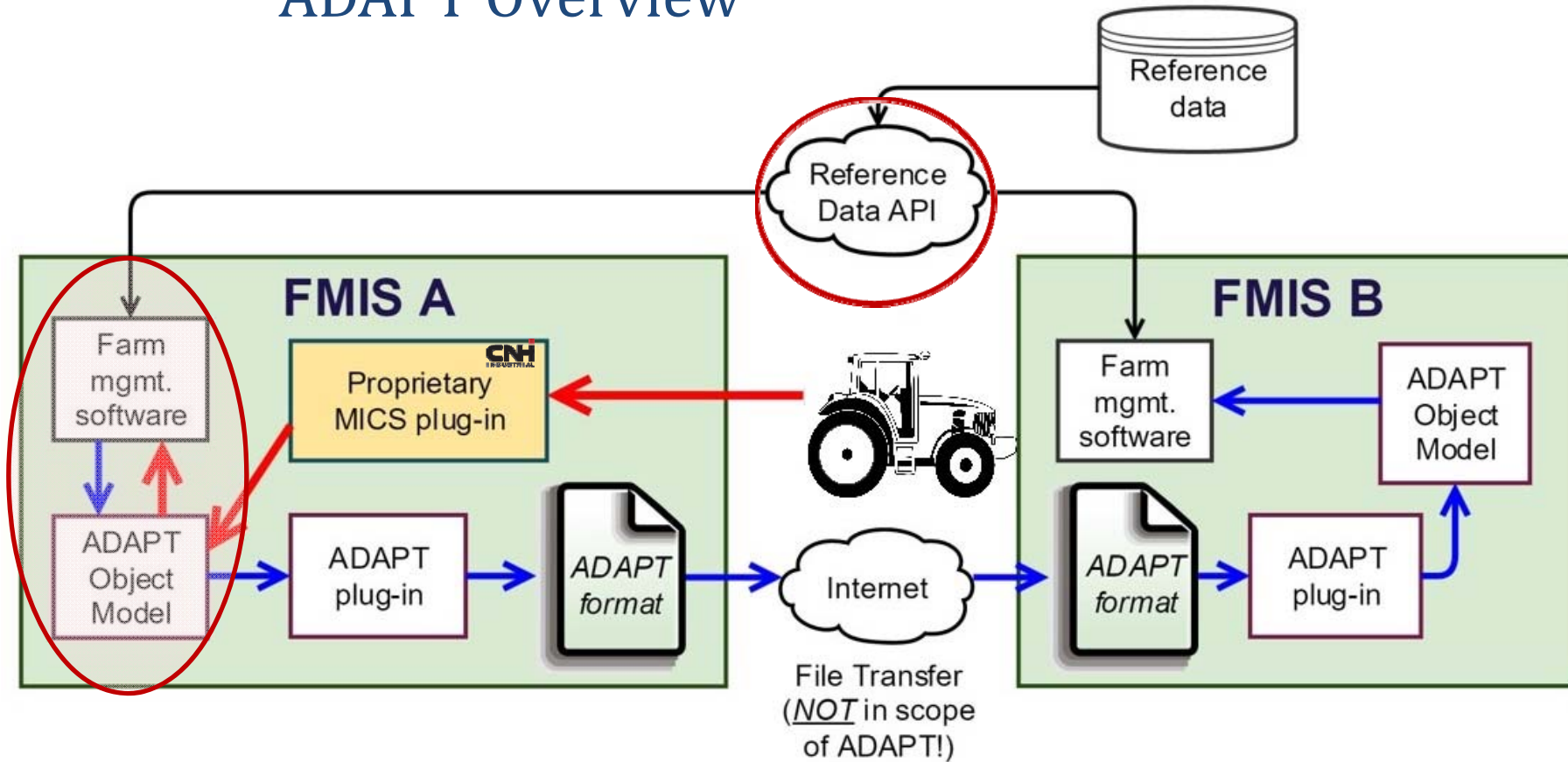
ADAPT Overview
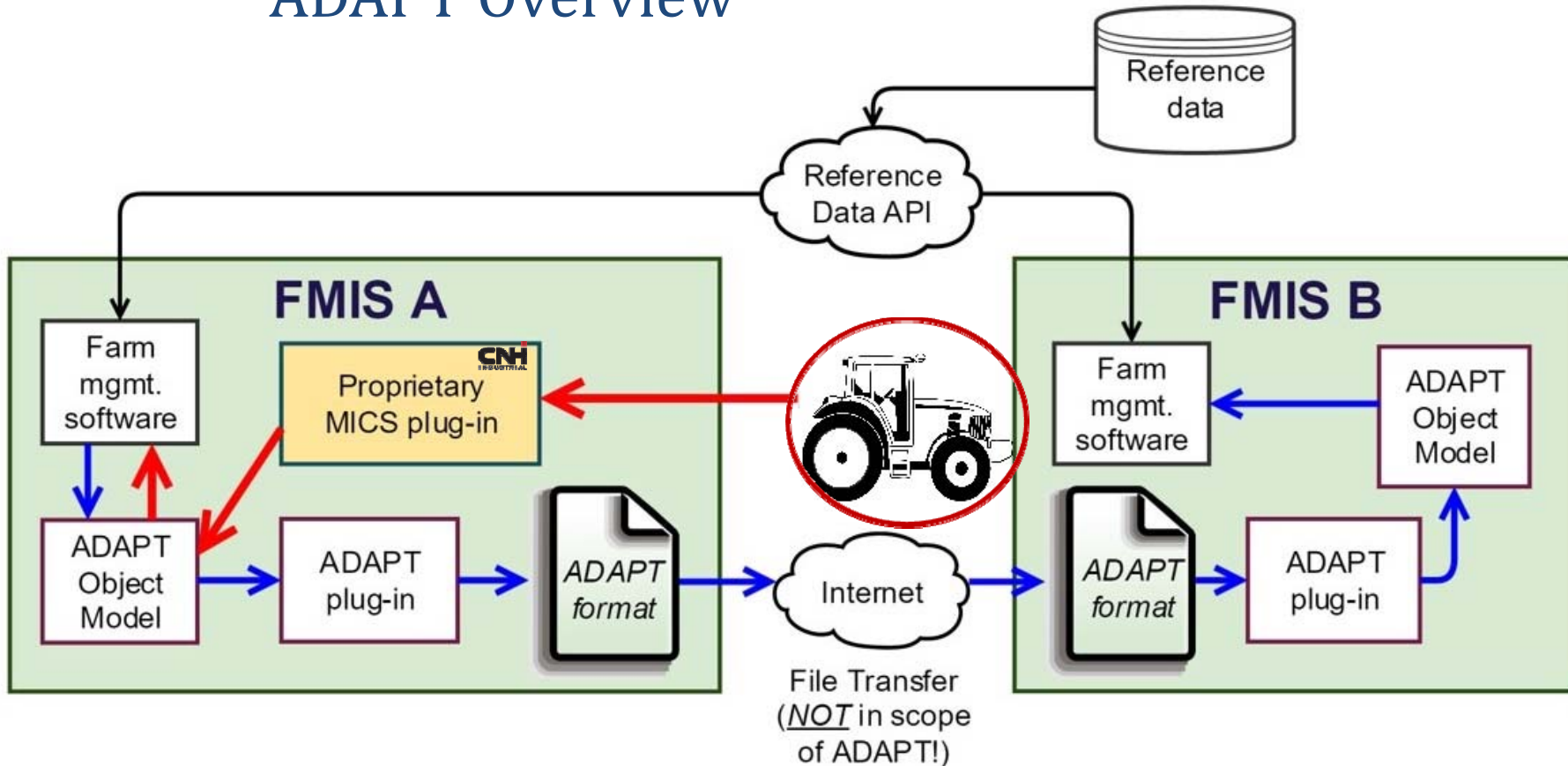
- The **red** arrows show data import from a farm machine.
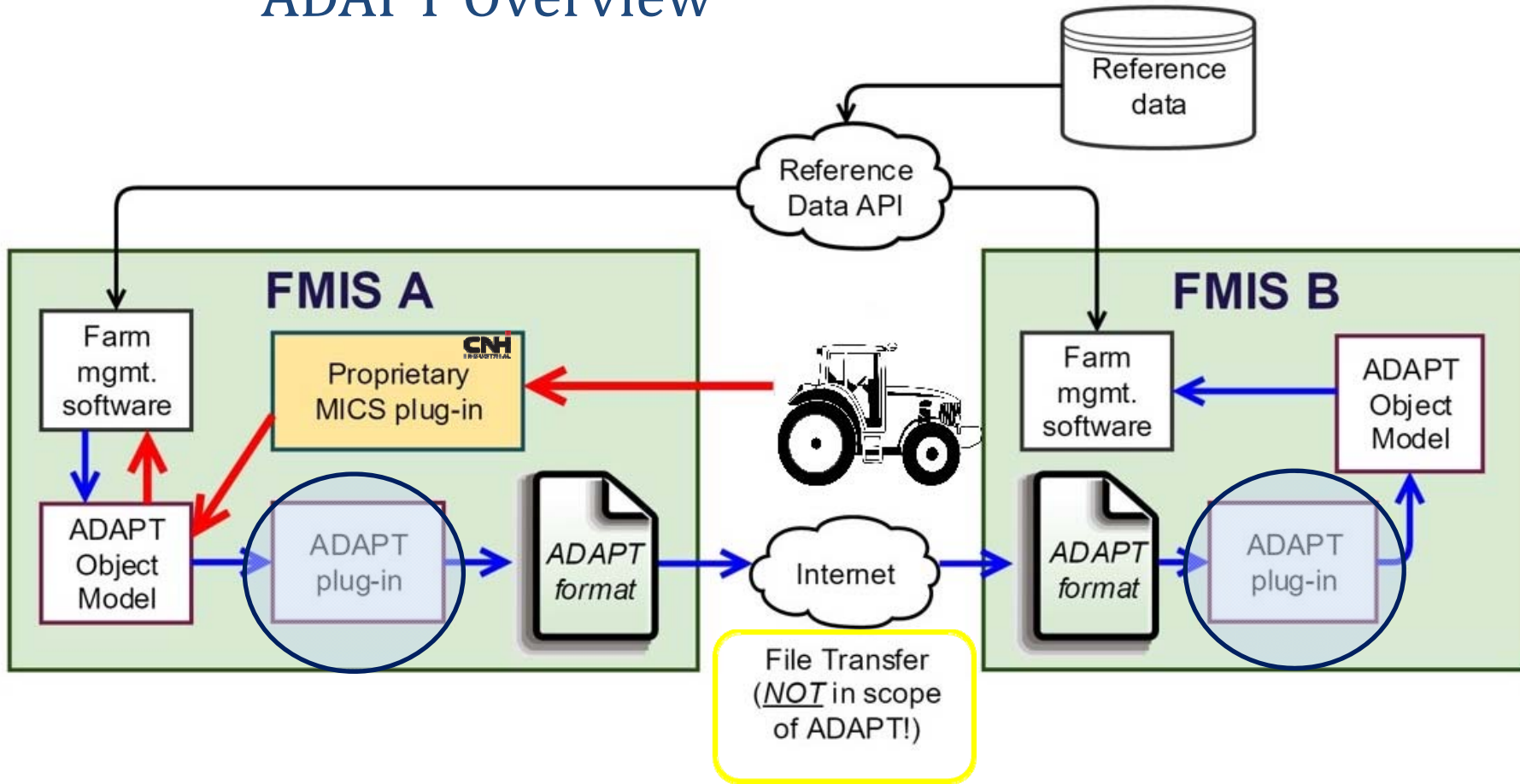- The **blue** arrows show an FMIS-to-FMIS data transfer.
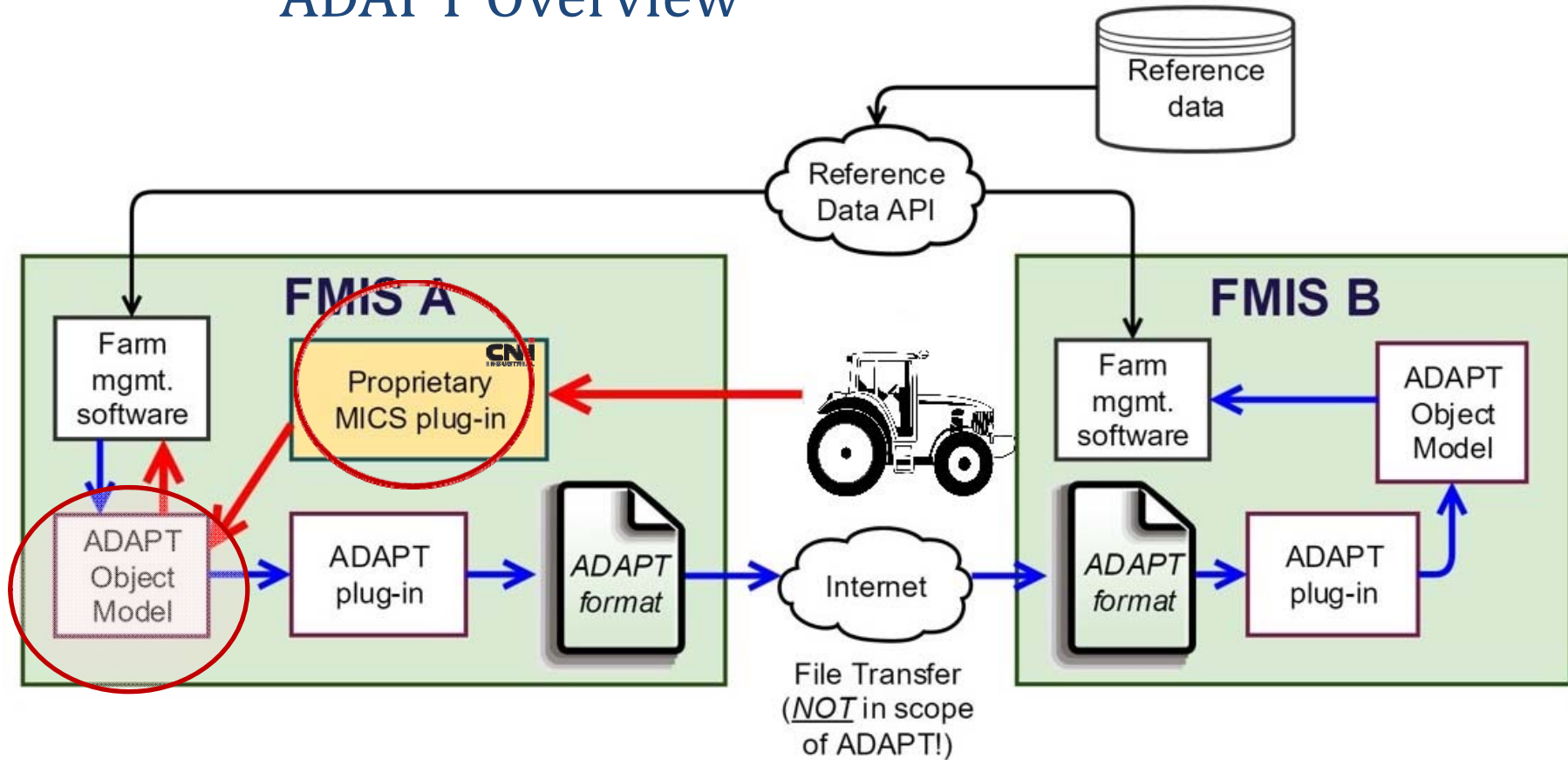
ADAPT Overview

- The **red** arrows show data import from a farm machine.
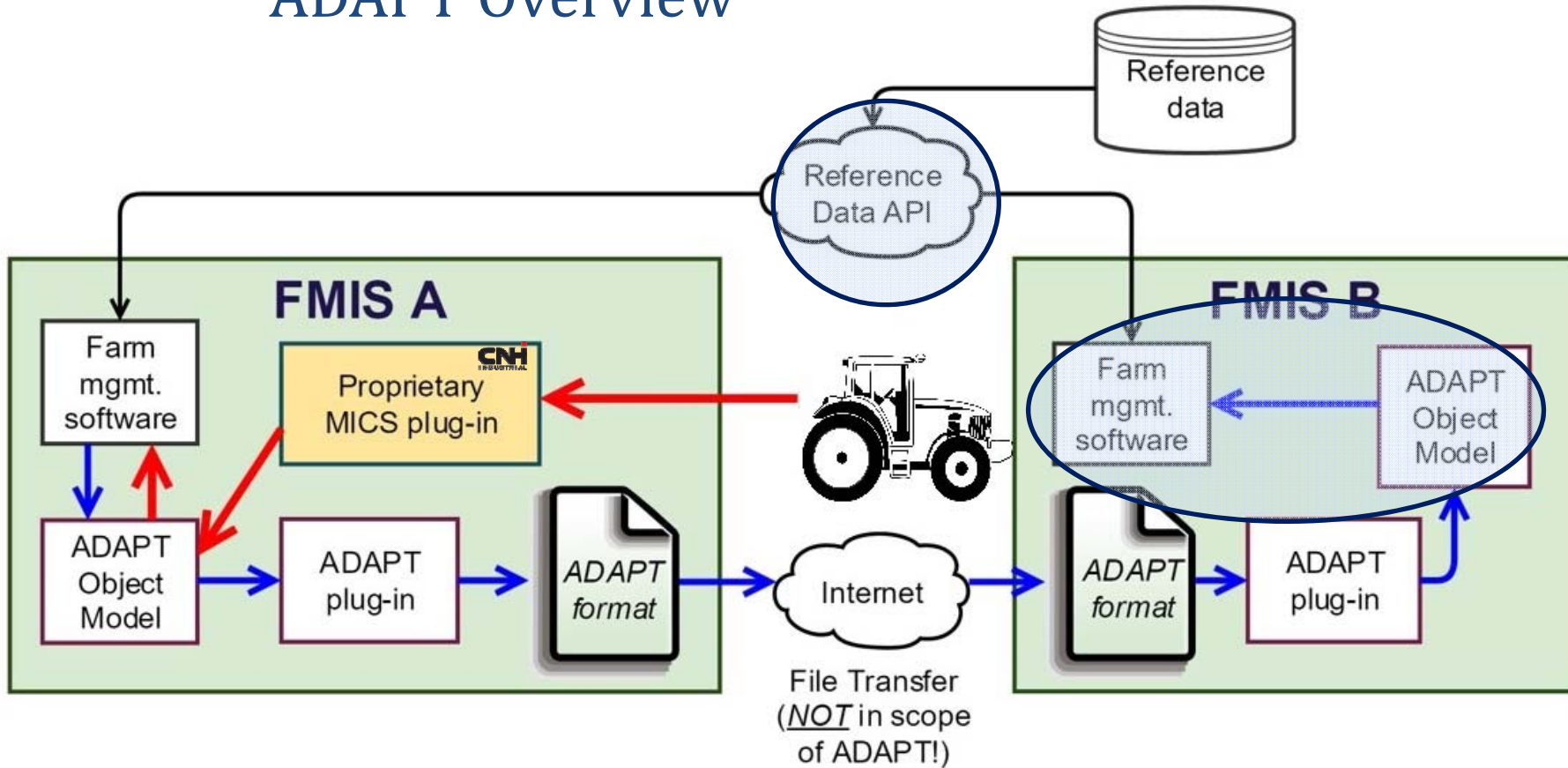
ADAPT Overview

- The **red** arrows show data import from a farm machine.

ADAPT Overview

- The **blue** arrows show an FMIS-to-FMIS data transfer.

ADAPT Overview

The **blue** arrows show an FMIS-to-FMIS data transfer.

# ADAPT is an Open Source Software (OSS) project

Business Advantage:
- An Open Source _community_ provides a way for individuals and companies to collaborate on projects that would be difficult to achieve on their own.

- No service fees.

Technical Advantage:
- With source code readily available, users will help you debug quickly and _promote rapid code enhancements_.

ADAPT Status: Ever Evolving
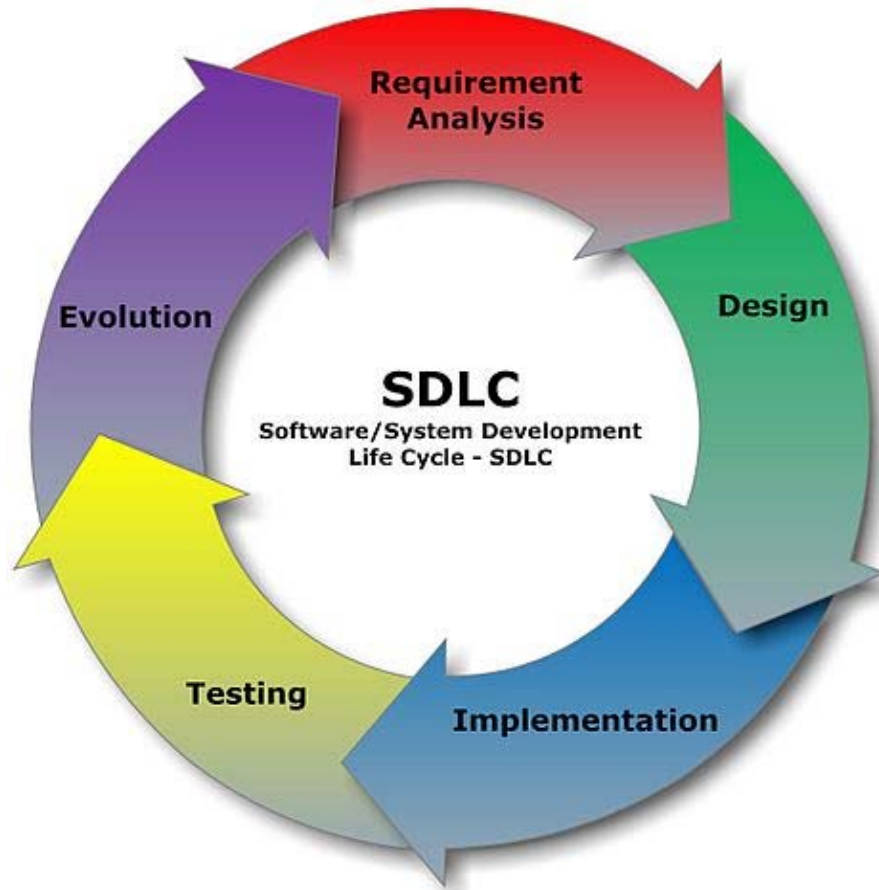
Future direction

- Technical
  - Include Observations & Measurements
  - Full integration of PAIL
  - Containers, container use, supply-chain interfacing
  - Extensible, API-mediated representation system
- Business & Technical
  - Recruit more plug-in writing companies
  - Work on encapsulating report descriptions
  - Incorporating a more formal provenance model

Committed to Support ADAPT

Committed to Plugin

- **AGCO Corporation**
- **Ag Leader**
- **Claas**
- **Case IH**
- **Climate Corporation**
- **Deere & Company**
- **Hemisphere GNSS**
- **Kverneland**
- **Müller-Elektronik**
- **New Holland**
- **Praxydin**
- **Premier Crop Systems**
- **Raven Industries**
- **Topcon Precision Agriculture**
- **Trimble Navigation**
- *IoF 2020 (Proof of Concept)*

Committed to Integrate Framework

- **365FarmNet**
- **Ag Connections (Syngenta)**
- **Ag Integrated Corporation**
- **Agrian**
- **Conservis**
- **EFC Systems**
- **Fairport Farm Software**
- **Kverneland**
- **Mapshots (Corteva)**
- **Premier Crop**
- **MyAgData**
- **Red Wing Software**
- **SSI/AgVance**
- **TechnoFarming**
- **ZedX**

Getting Started
Talk to Others in the Community

Many resources are available at AdaptFramework.org

- Links to GitHub repositories
- Links to ADAPT Overview
- Links to ADAPT Application Notes
- Links to Frequently Asked Questions
- Links to online videos

- Constructive feedback is always helpful and contributions are welcome. Please use adapt.feedback@aggateway.org

Thank You

To learn more, go to
AdaptFramework.org
Or
AgGateway.org

IoF2020.eu