Digital Agriculture at Work

E-Commerce and the Supply Chain

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What is the supply chain?

- Trucks and warehouses

Supply Chain

- *A network of entities directly or indirectly interlinked and interdependent in serving the same consumer or customer.*
- Manufacturer
- Distributor
- Retailer
- Grower

Supply Chain

A better Supply Chain is a Supply Rope

B2B-Increases efficiencies in the supply chain for all parties, even those not using B2B, but working with a partner that does.

- Single point of entry, efficient, timely, accurate.
- All messaging tied to original order. Acknowledgment, response, ASN, receipt, invoice.
- Allows for systems to track orders, efficient, timely, accurate.
- Single click receiving, efficient, timely, accurate.
- Automated vouchering validation system, efficient, timely, accurate.

How do you measure impact or savings?

- Some of the impacts are hard to quantify.

- What are the savings for being timely?
- What are the savings for being accurate?
- What are the savings for being efficient?
- What is it worth to be a preferred customer?
- What is it worth to be a preferred vendor?

How do you measure impact or savings?

- Studies that have been done by this organization have referenced 15 minutes per purchase order.

- 1,000 PO's= 250 hours
- 10,000 PO's= 2,500 hours- 1 FTE

Who in the organization does it impact?

- Purchaser
- Shipper
- Location receiving
- Accts Payable

Who in the organization does it impact?

- Dispatcher at retail (visibility to inventory in process)
- Location admin functions (one click receiving)
- Procurement (sees the full picture by status)
- Sales (Ability to see full picture of inventory availability)
- Cash flow manager (sees all in process orders)
- Costing manager (accurate cost at time of order)

Where are we?

- Marilyn has the numbers-
- Most basic CP manufacturers
- Largest Seed suppliers
- Distributors, large percent
- Retailers (non-vertical), a few.

Challenges

- Who is going to enable the retailer?
- Distribution needs to engage.
- Accounting systems have to continue to engage.

Final message

- Use what you built!

Digital Ag at Work

November 2018

Development in the Precision Ag space

- SPADE
- PAIL
- ADAPT
- Traceability
- PICS

SPADE

Standardized **P**recision **Ag** **D**ata **E**xchange

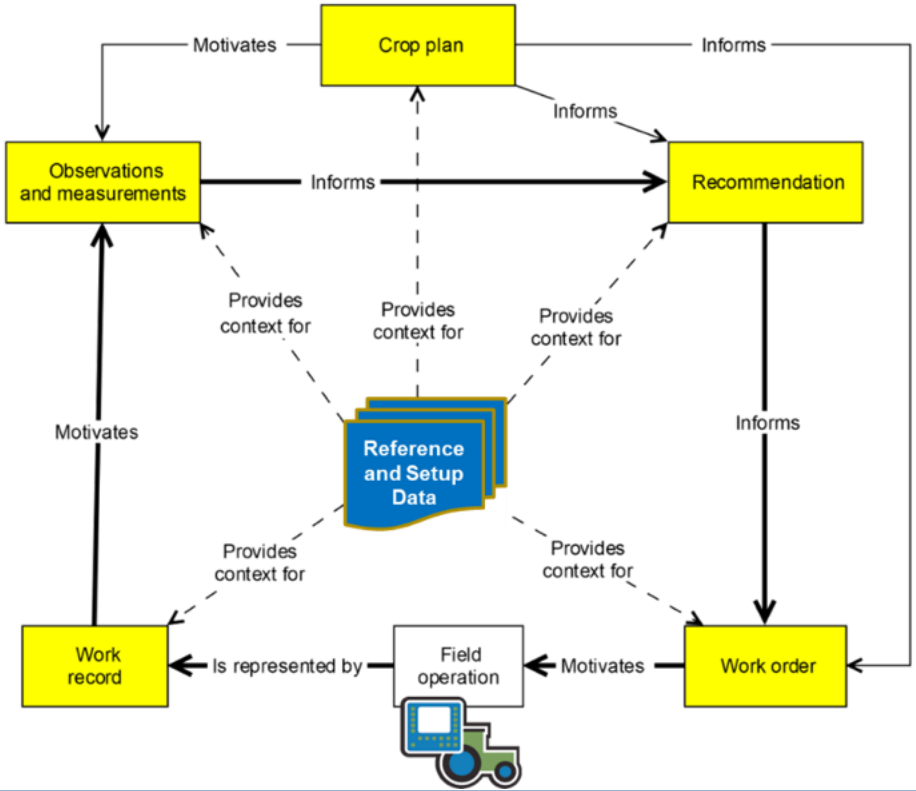
SPADE

- Defined several use cases
  - Seeding
  - Crop Nutrition
  - Crop Protection
  - Harvest
- Core Documents
  - Plan
  - Recommendation
  - Work Order
  - Work Record
  - Observations and measurements

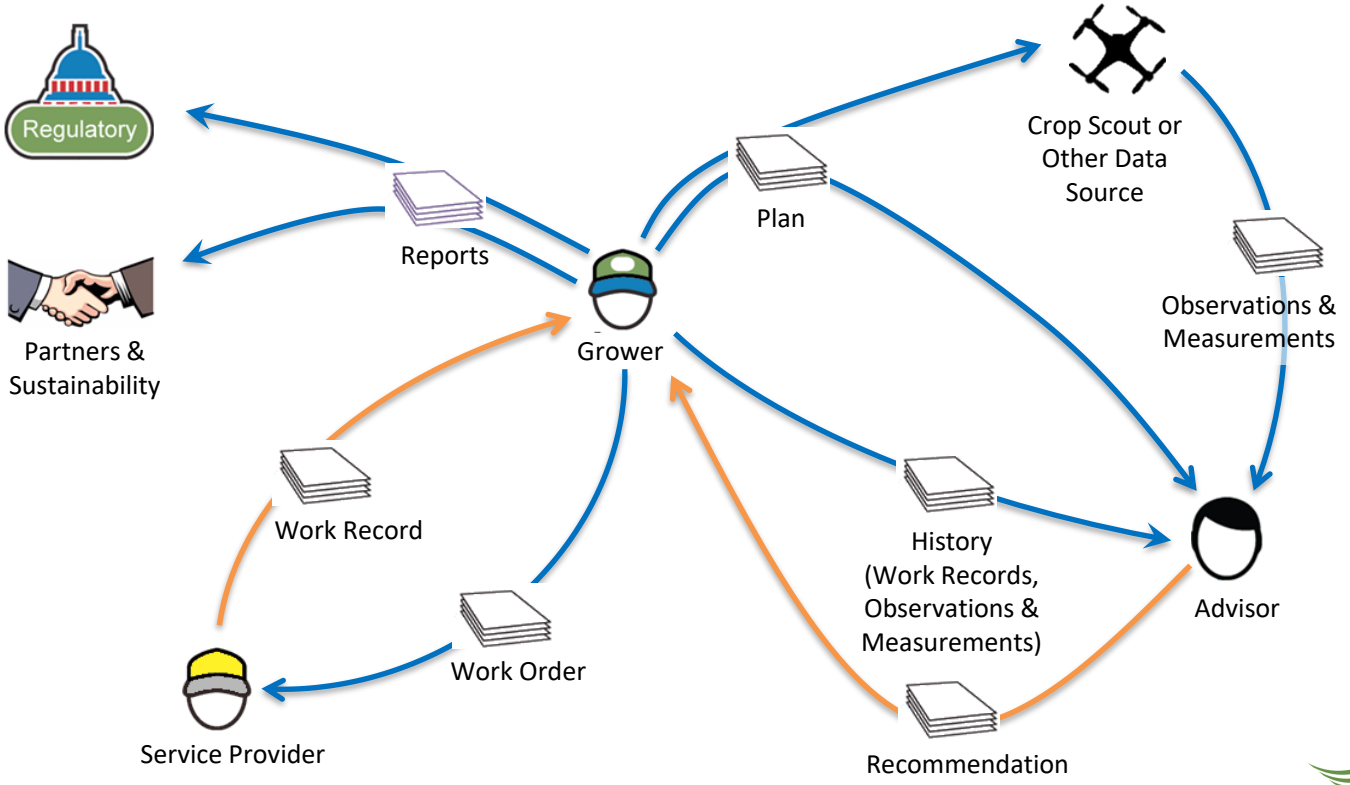
Development Process

- SPADE1
  - Seeding
  - Reference Data API
- SPADE2
  - Harvest
  - Crop Protection
  - Regulatory Report
  - Reference Data API
- SPADE3
  - CART
  - Crop Nutrition
  - Reference Data API

Core Documents



Core Document Flow

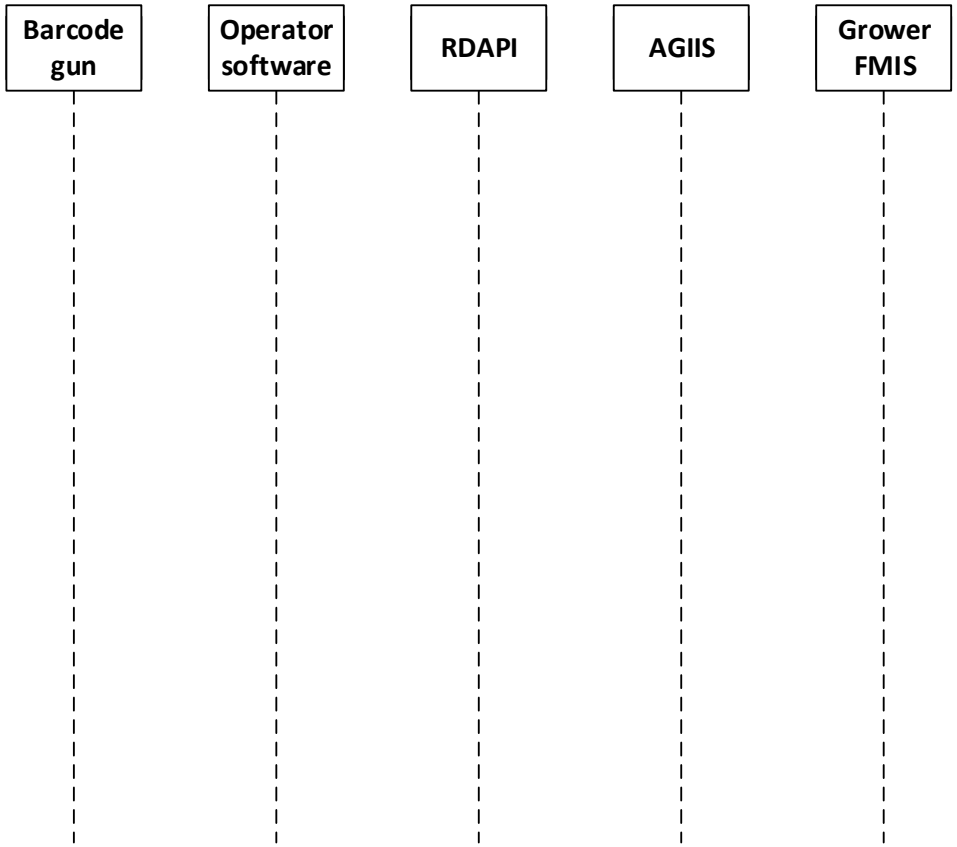


Reference Data API

Use Case 1: Populating a Work Record from a barcode on a jug

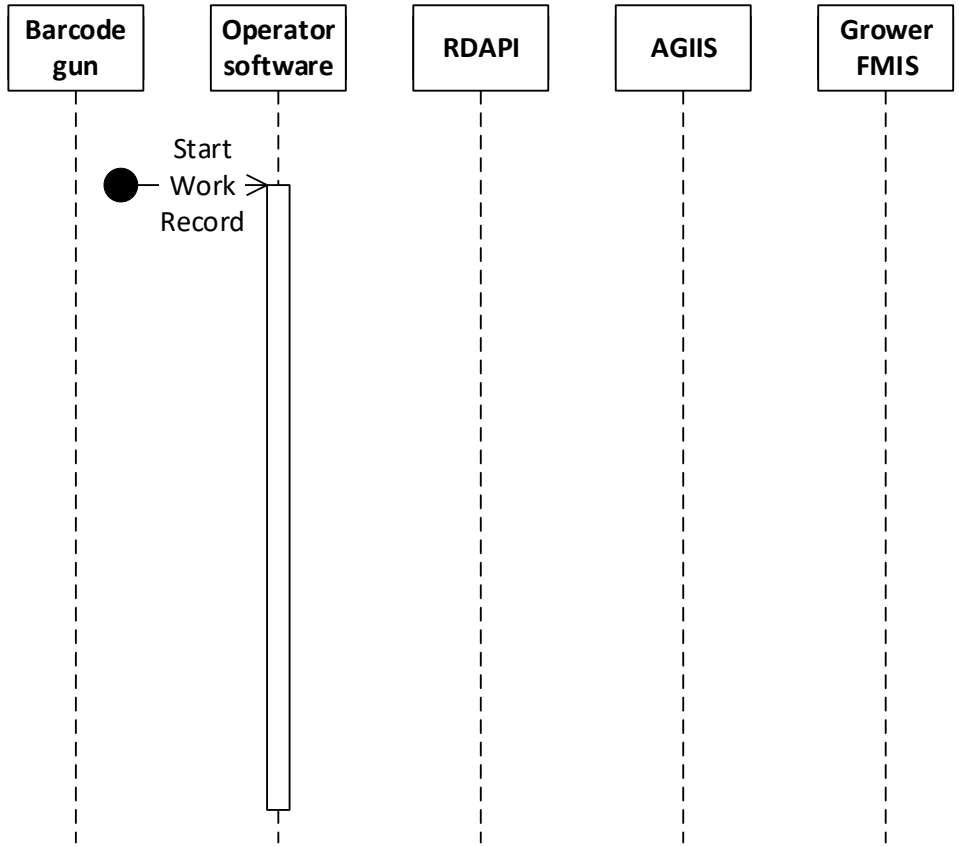
Setting it up

- An operator wants to document a field operation.
- For simplicity, assume it involves a total product, and total sprayed area
  - rate = total product / total area
- A barcode gun will be used to capture the identity of product(s) as they are poured into the sprayer tank.



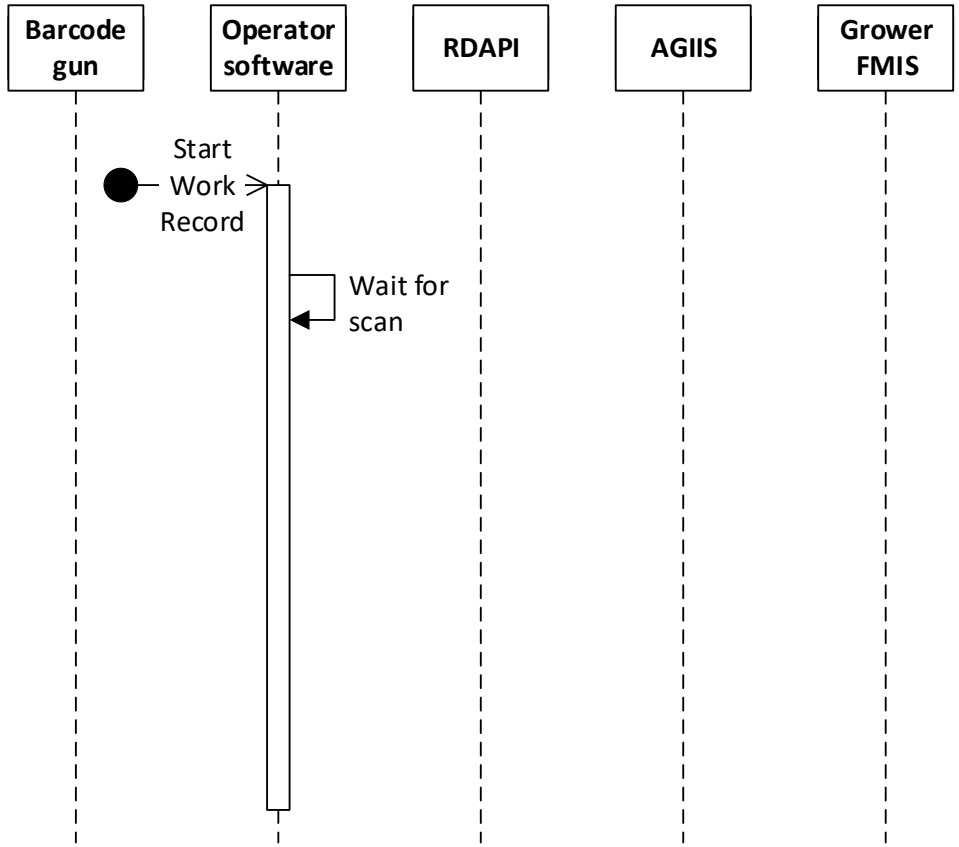
1: Start Work Record

- The operator starts the (handheld) recording software and initializes a Work Record.
- The operator's software asks preliminary data about the field operation, such as the total sprayer tank volume and total field area.



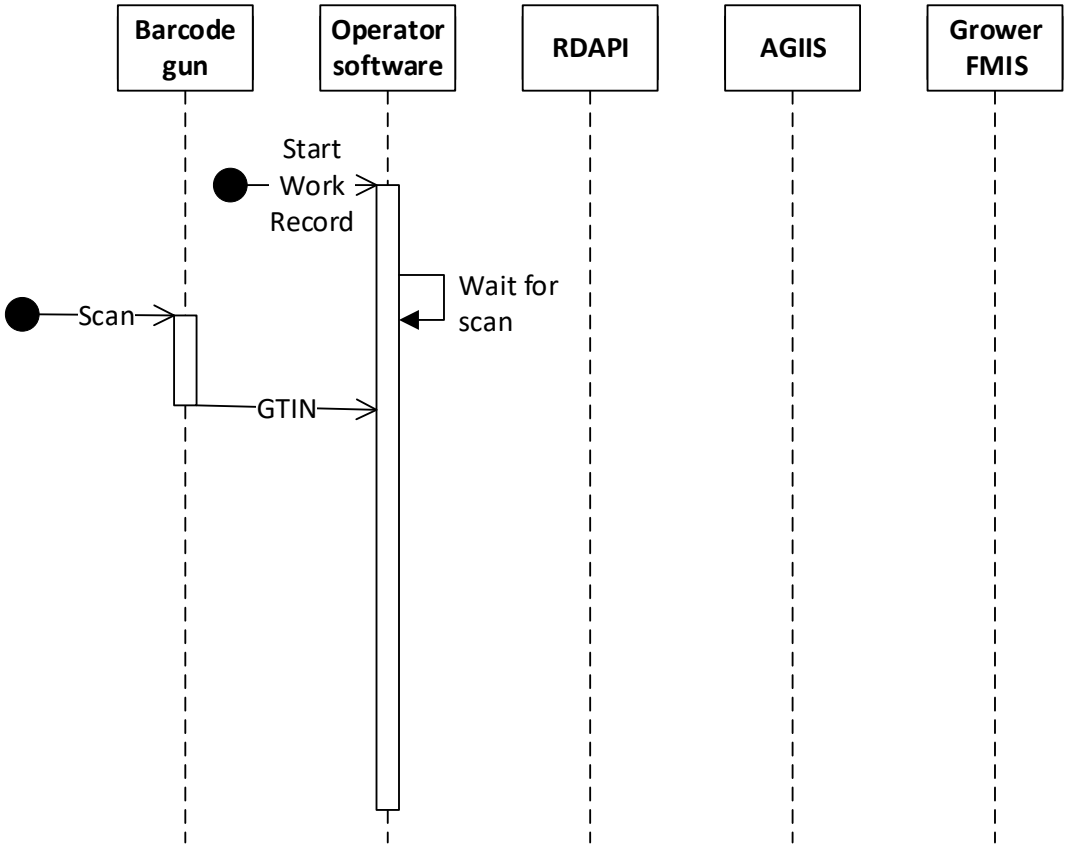
2: Waiting for scan

- Following data entry, the software pauses until a barcode is scanned.



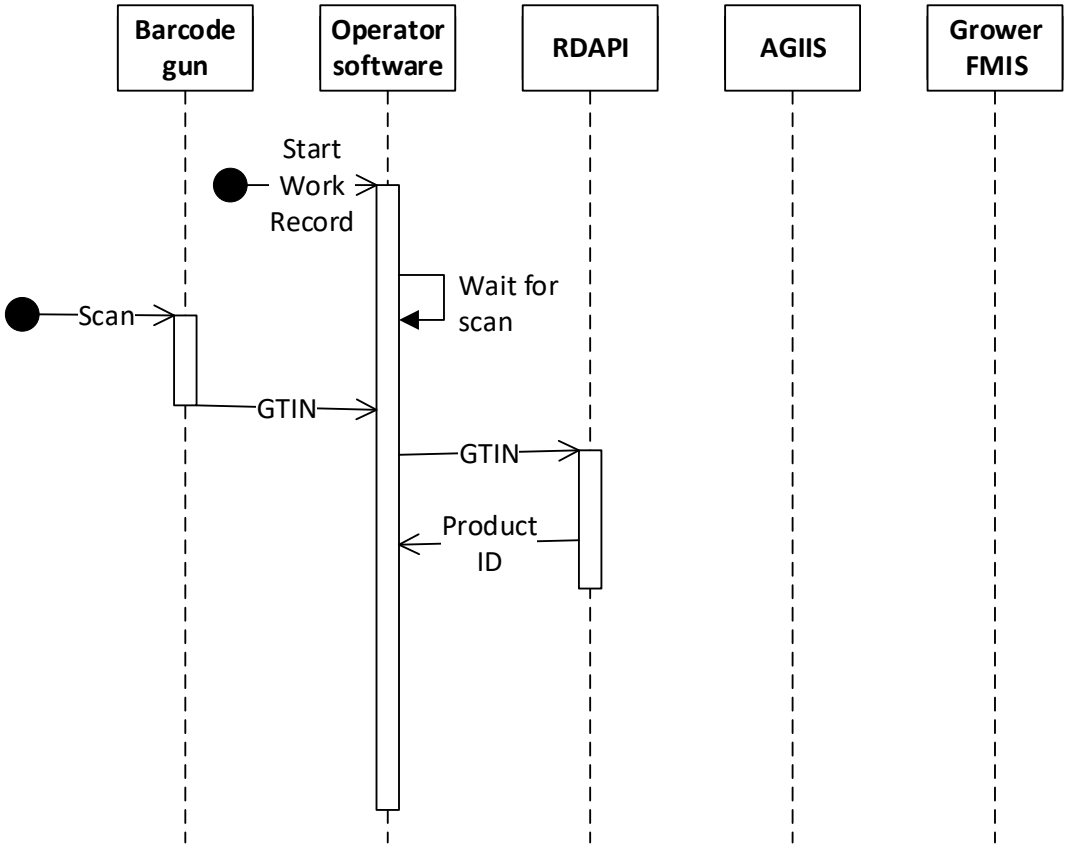
3: Scan a product

- The operator scans a barcode (assumed GTIN) on the product container and pours the product into the tank.



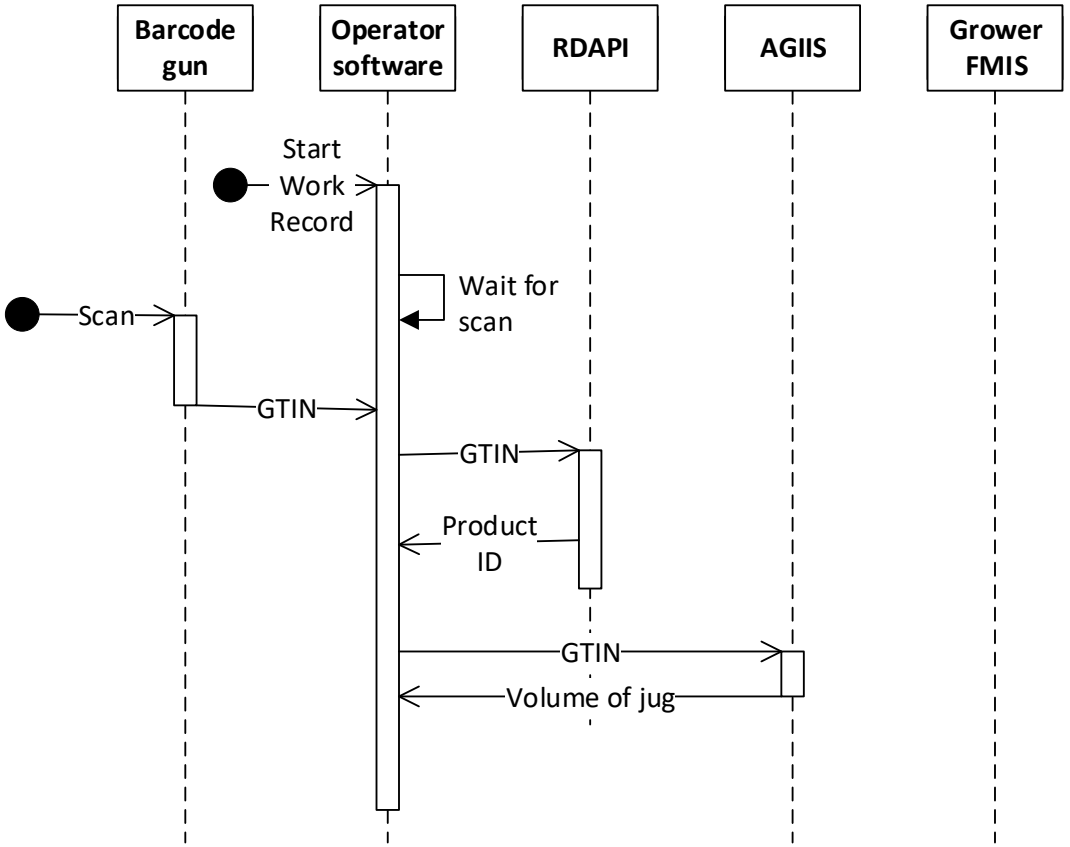
4: Query RDAPI

- The software uses the GTIN to query the RDAPI to get a unique ID for the product / formulation in the jug.



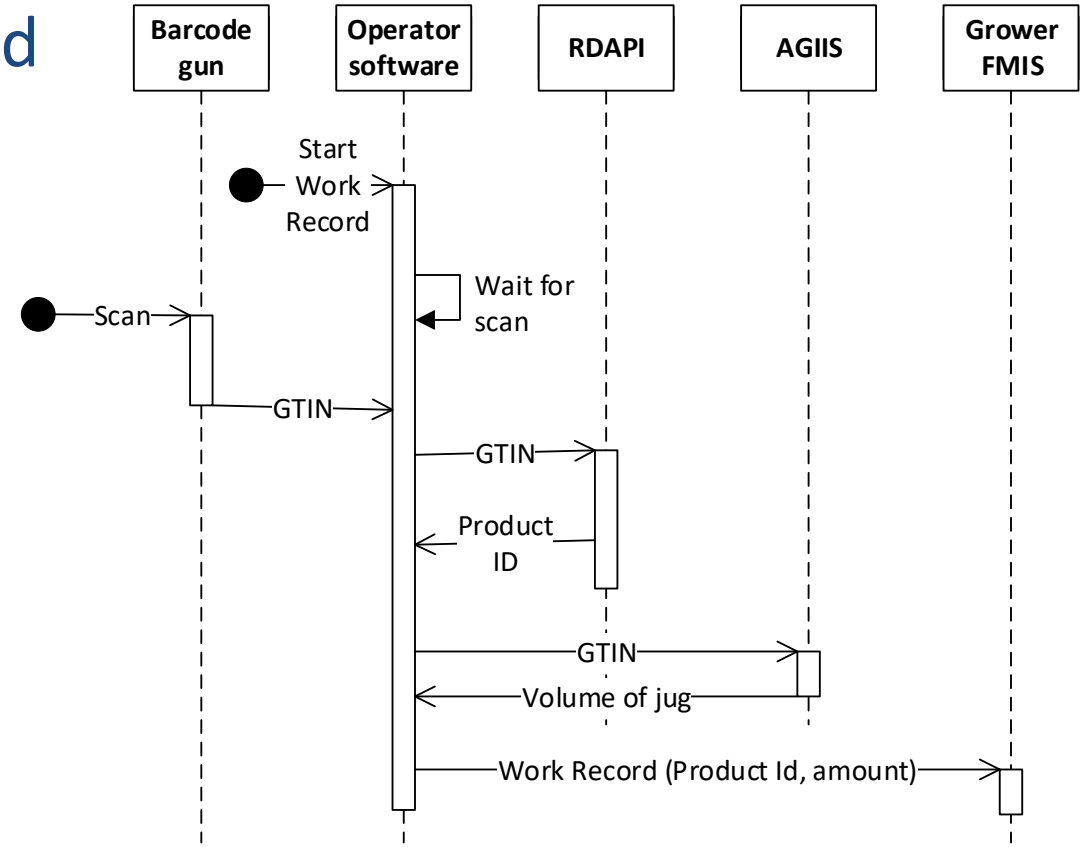
5: Get AGIIS Data

- The software now uses the GTIN to query AGIIS to get the volume of the scanned container.
- That way the amount of product put into the tank can be captured without further user data entry.



6: Save the Work Record

- Armed with the product / formulation identifier and the amount put into the tank, the system can resolve the rate, and the Work Record can be saved.



Recap

- The Precision Ag Council's SPADE, PAIL, and ADAPT projects have been tackling product /equipment identification issues on the field operations – supply chain boundary for years.
- We believe the Reference Data API system allows:
  - Providing data that is critically-important for field operations
  - Synergy with AGIIS (e.g., for large growers that track inventory)
  - Creative business models (e.g., freemium)
- What we need from YOU
  - Learn more, so you can commit to this vision!
  - Consider delivering reference data in this new way that makes it machine-readable.
  - Host an API if you want; otherwise distribute the data though a partner!

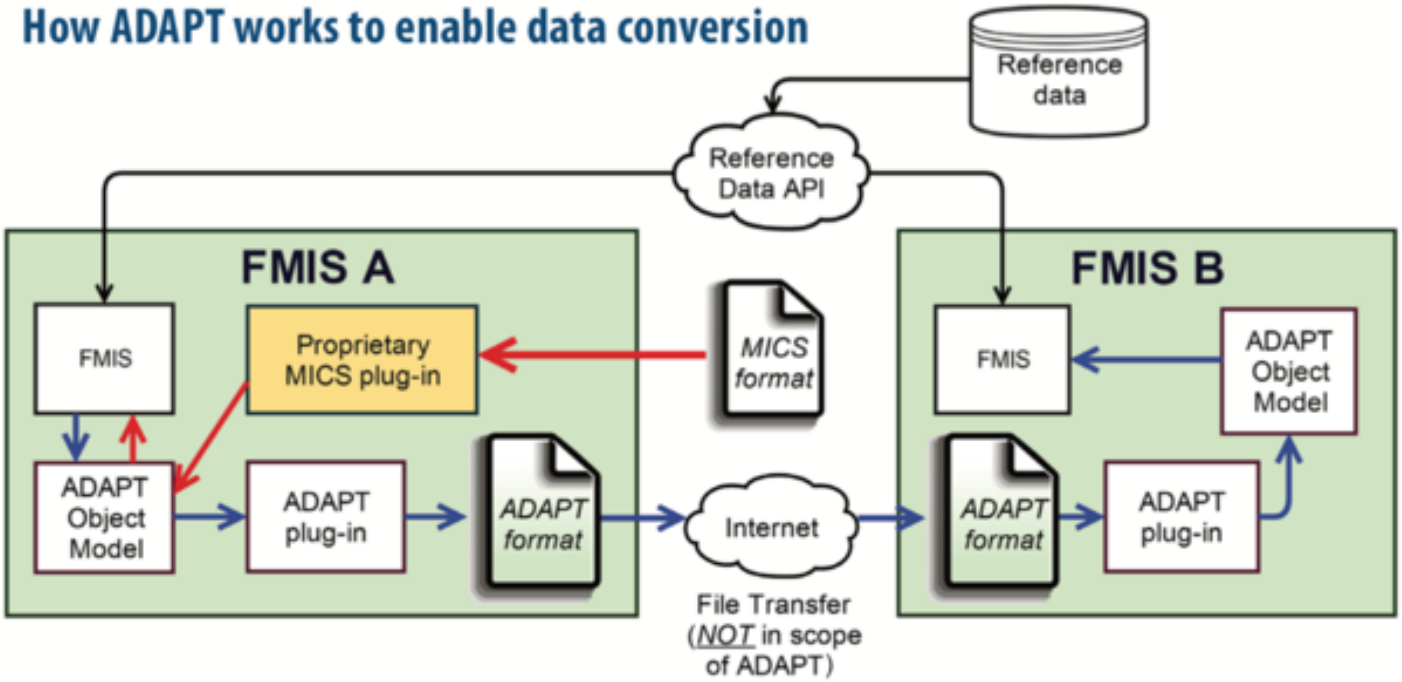
ADAPT

Ag Data Application Programming Toolkit

AgGateway
Collaboration for eConnectivity

Agreeing on ***how things talk to each other***

- Ag Data Application Programming Toolkit (ADAPT):
  - A common object model for field operations.
  - A set of data conversion plug-ins (both open source and proprietary).
  - A plug-in management framework.
- ADAPT's goals:
  - To enable communications between Machine / Implement Control Systems (MICS) and Farm Management Information Systems (FMIS) as well as among different FMIS.
  - To be geo-political-context-independent (strong emphasis on enabling international use).
- Open-source implementation:
  - Eclipse public license
  - Learn more at www.adaptframework.org


How ADAPT works to enable data conversion
Reference data
Reference Data API
FMIS A
FMIS
Proprietary MICS plug-in
ADAPT Object Model
ADAPT plug-in
ADAPT format
MICS format
Internet
File Transfer (NOT in scope of ADAPT)
FMIS B
FMIS
ADAPT Object Model
ADAPT format
ADAPT plug-in

ADAPT

2019 ASABE AE50 winner for *Agricultural Data Application Programing Toolkit (ADAPT) framework, and ISOBUS Plugin*

- ADAPT framework downloaded over **12,000** times
- ADM plugin downloaded over **5,000** times
  - Enables communication between farm management systems
- ISO plugin downloaded almost **3,000** times
  - Starting point to convert files in ISO 11783 format
- Trimble Ag announced the release of two ADAPT plugins at the mid-year meeting
- **ADAPT Framework Version 2.0** to be released (release candidate announced on 10/24)
  - Includes phase 1 of PAIL support and some breaking changes – see release notes at https://github.com/ADAPT/ADAPT/releases
- ADAPT OSS project promoted at meetings in North America, South America, Europe, etc.

Visit adaptframework.org for more info

PAIL

Precision **A**g **I**rrigation **L**eadership

Scope: Irrigation Data Exchange

Observations

Operations

PAIL Content

- **Field Observations**: an agricultural implementation of ISO 19156. Easily leveraged into other precision ag domains.
- **Irrigation Recommendations and Work Orders**, based on core content work from SPADE.
- **Irrigation Work Records** that can provide traceability of how much water was applied, when and where.
- **Data Exchange Schemas**: XML schemas (JSON-compatible) for encoding Observations and Operations data sets.
- **ADAPT Compatibility**, so you can easily exchange irrigation data with other ADAPT-enabled systems.

PAIL Is Now a National Standard!

American Society of
Agricultural and Biological Engineers

ANSI/ASABE S632-3 JUN2018
Approved June 2018 as an American National Standard

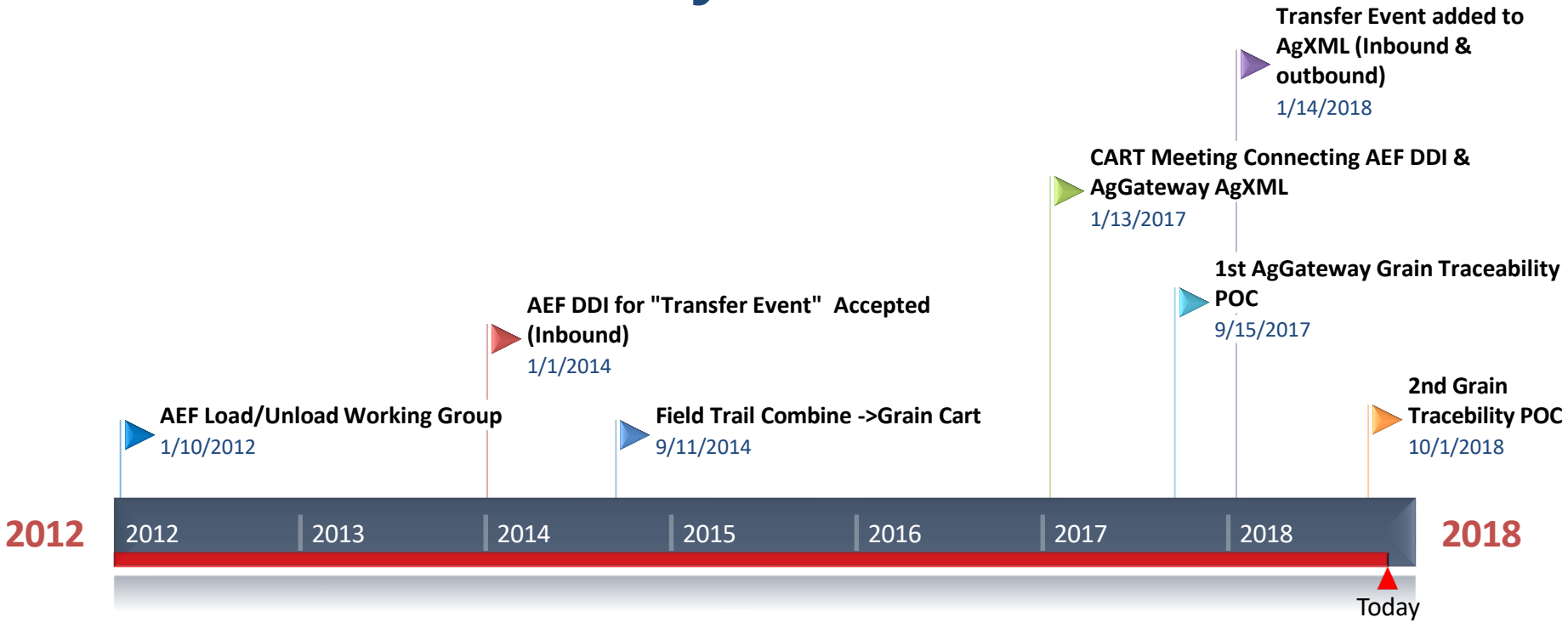
Precision Agriculture Irrigation Language: Irrigation System Operations

Developed by the X632 Committee. Approved as an ASABE standard and ANSI June 2018.

Inbound

GRAIN TRACEABILITY

Grain Traceability Timeline



AgGateway
Collaboration for eConnectivity

Key Concept - Transfer Event

IoT Opportunity

A Transfer Event is the movement or transfer of a product or commodity from one container to another container. Any transfer event can be specified by:

- A timestamp or data/time range that the transfer occurred
- Source container ID
- Target container ID

Harvest Transfer Events

Field -> Combine

Combine -> Cart

Cart -> Semi

Semi -> Elevator

Truck -> Bin

Observations & Measurements per Load

Field	Combine	Cart	Semi	Truck
				

Total Yield	Container ID	Total Mass	Total Mass	
Average Moisture		Container ID	Moisture	
?			Grain Quality Certs*	

ISO 11783 AgXML

AgGateway Collaboration for eConnectivity

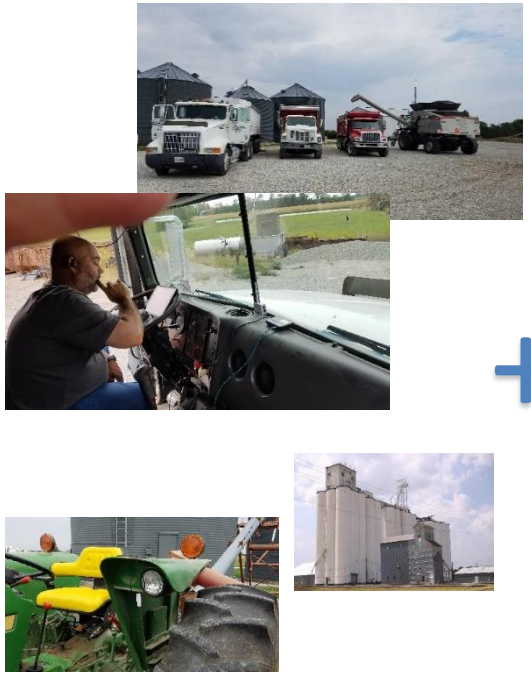
Grain Traceability

TECHNOLOGY

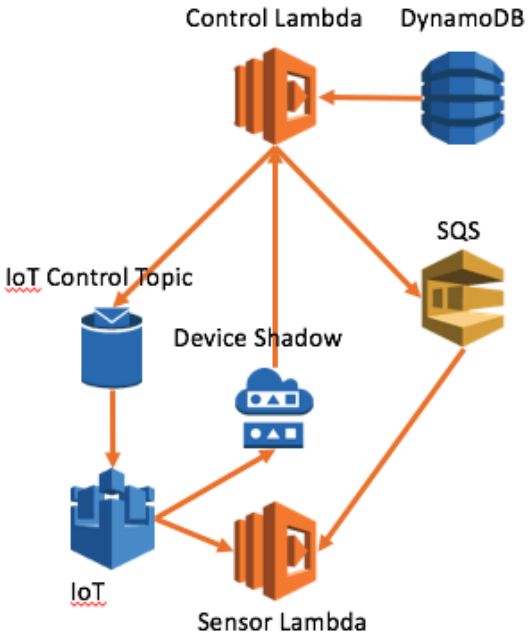
2017 POC Container Detection and Identification

IoT Beacon Hardware

Harvest Containers/Vehicles



AWS IoT Platform



2018 POC Container Detection and Identification

Proprietary IoT Software

- Gateway & beacon
- Store & Forward
- Battery & 5v power
- BLE & WIFI scans
- *GPS option*
- *LoRa option*

+

Harvest Containers/Vehicles

+

Proprietary IoT Portal

aws

2018 Lessons Learned

- Store & Forward reduced data loss but connectivity is still an issue
  - LoRa networks may be worth a try
  - Reconnection after a loss of WIFI may be improved with software
- “False Positives” are unavoidable without drastically changing normal work-flow
  - “Ask Jeremy” (IoT agents) would reduce most
  - “Data fusion” would nearly eliminate this issue
    - CAN messages such as auger status
    - GPS would also help resolve uncertainties
- “False Negatives” are difficult to detect and requires more in-field experience
- Once transfer events are correctly documented the data processing required to answer typical traceability questions are well understood
- Enhancements made to support traceability in ISO 11783, AgXML and ADAPT appear to be sufficient.

Value Propositions – Why Bother

- Grower
  - Improve crop performance reporting by incorporating:
    - Scale readings from grain cart
    - Quality observations & measurements at elevator
  - Harvesting process improvement
    - Initiate AgXML CommodityMovementMessage with:
      - Grower name/ID
      - Truck ID
      - Field(s) origin
      - ~Moisture content
- Marketing
  - Validate origin for non-gmo and organic grain sales

Next Steps

- Develop “Ask Jeremy” mobile app integrated with the IoT portal
- Software to enable on-board GPS
- Software POC to validate the interface between FMIS (ISO 11783) and Grain Elevator software (AgXML)

SEED TRACEABILITY

Bar Code Data Capture

Account	jwtevis@vis4ag.com
Date/Time	11/6/18 1:19 PM
Latitude	44.85194521
Longitude	-93.80963147
Type	CODE_128
GTIN	00884464693479
Lot Number	LV71575

Bar Code Data

0100884464693347910LV71575

AgGateway
Collaboration for eConnectivity

Remaining Issues/Challenges

- In-field capture of bar code data
- Transfer of data to from data capture device to FMIS or MICS

PICS

Post-Image-Collection Specification

Pain Points addressed

- Band Order
- Band Definition
- Acquisition time and duration
- Projection Information
- PICS compliance and versions

"Before PICS we had to talk to the customer for hours, even days, to understand the content of their images, and everyone got frustrated. With PICS it takes seconds, and the computer does it alone."

Nathan Stein, senseFly

Summary

- Digital Ag is at work today, are you helping your growers to make the change?
- Data driven decision making by growers isn't just a fade.

- Now is a great time to "*Get Plugged In*" with the resources AgGateway has available to help you help your growers


Never Give Up!

QUESTION?