

# ADAPT: Interoperability through an industry open-source toolkit

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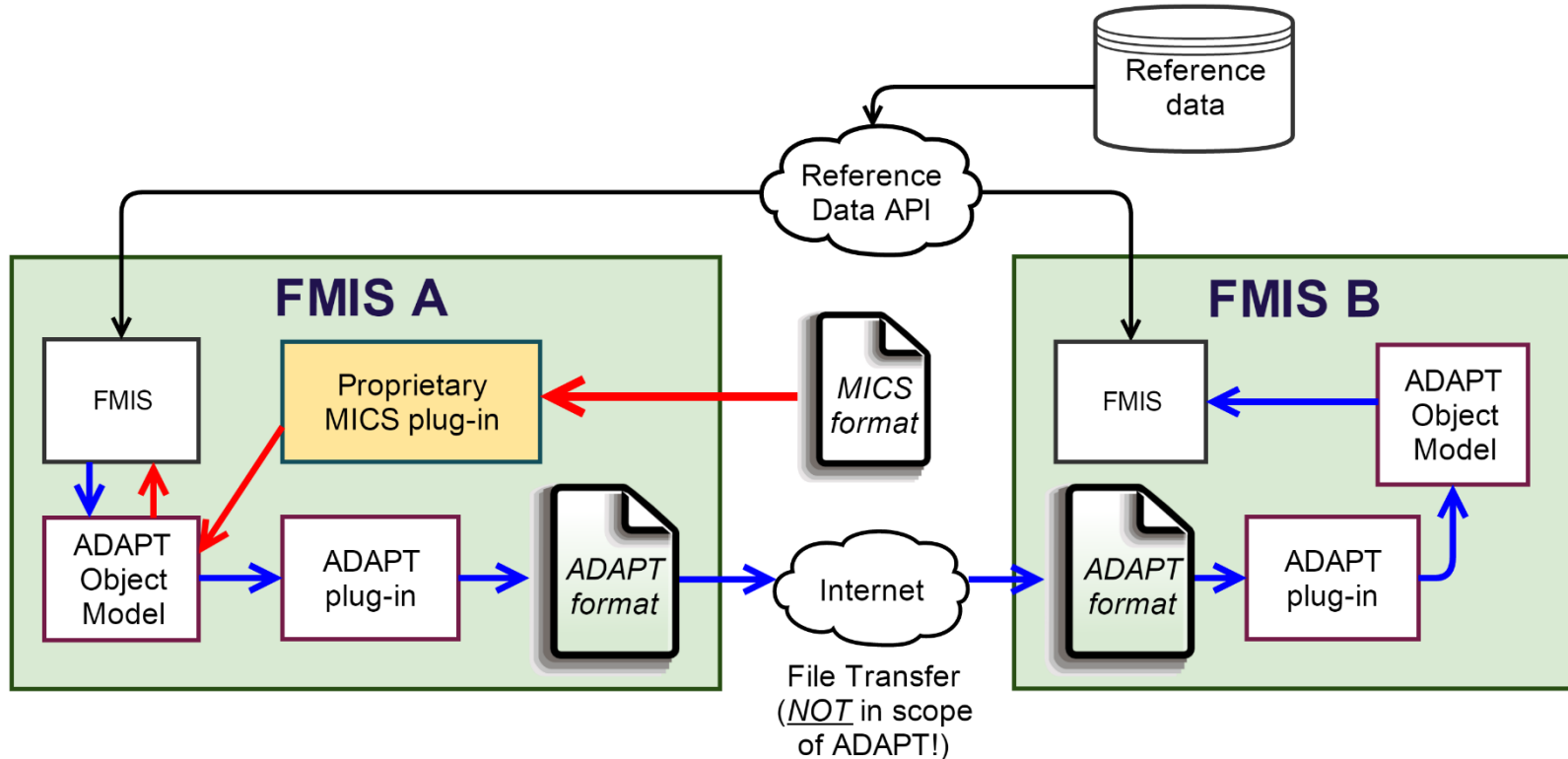
# Motivation for ADAPT

- Different brands of farm equipment and software currently collect and consume data in a variety of proprietary file formats.
- While this is a natural consequence of how the industry has grown, it makes it hard for end-users to “connect the dots” and extract value from the data.
- 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).

# AgGateway and the origin of ADAPT

- Nonprofit consortium of 240+ members
- Mission: Promote, enable and expand eAgriculture.
  - Strong emphasis on implementing existing standards
  - Strong emphasis on collaboration
- Membership
  - Open; over 240 members, primarily businesses.
  - Other organizations typically join as Associate members
  - There is a category for individual memberships.
- Funding: Member dues, project fees, and service subscriptions, dependent on volume of business.
- Authority: De facto (Implementation by stakeholders)
- Expertise: Supply chain and field operations business processes
  - SPADE and PAIL projects provided requirements for ADAPT based on user stories collected throughout the industry.

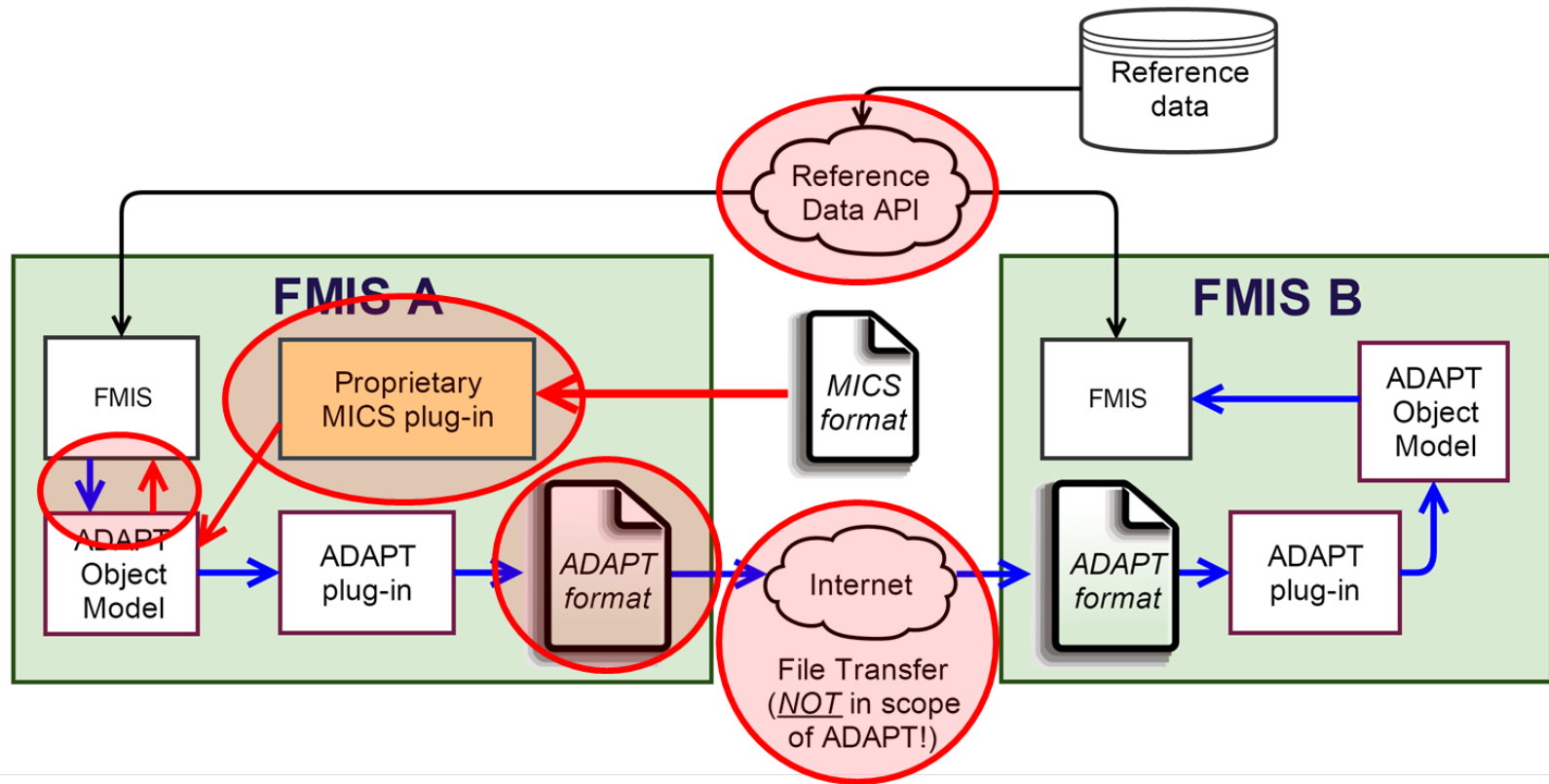
# General overview



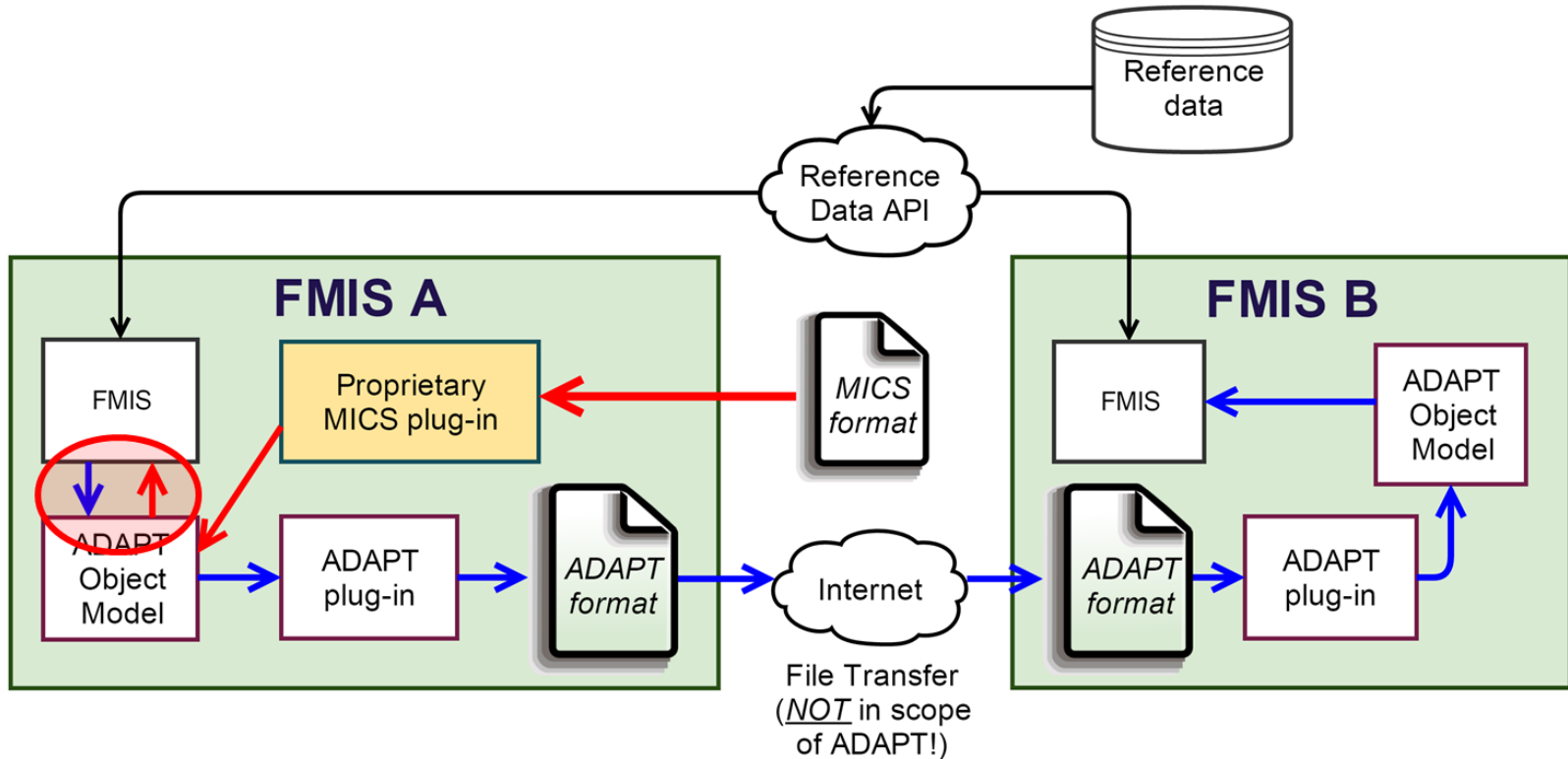
Two examples:

- The red arrows show data imported from a farm machine.
- The blue arrows show an FMIS-to-FMIS data transfer.

# Five key concepts about ADAPT

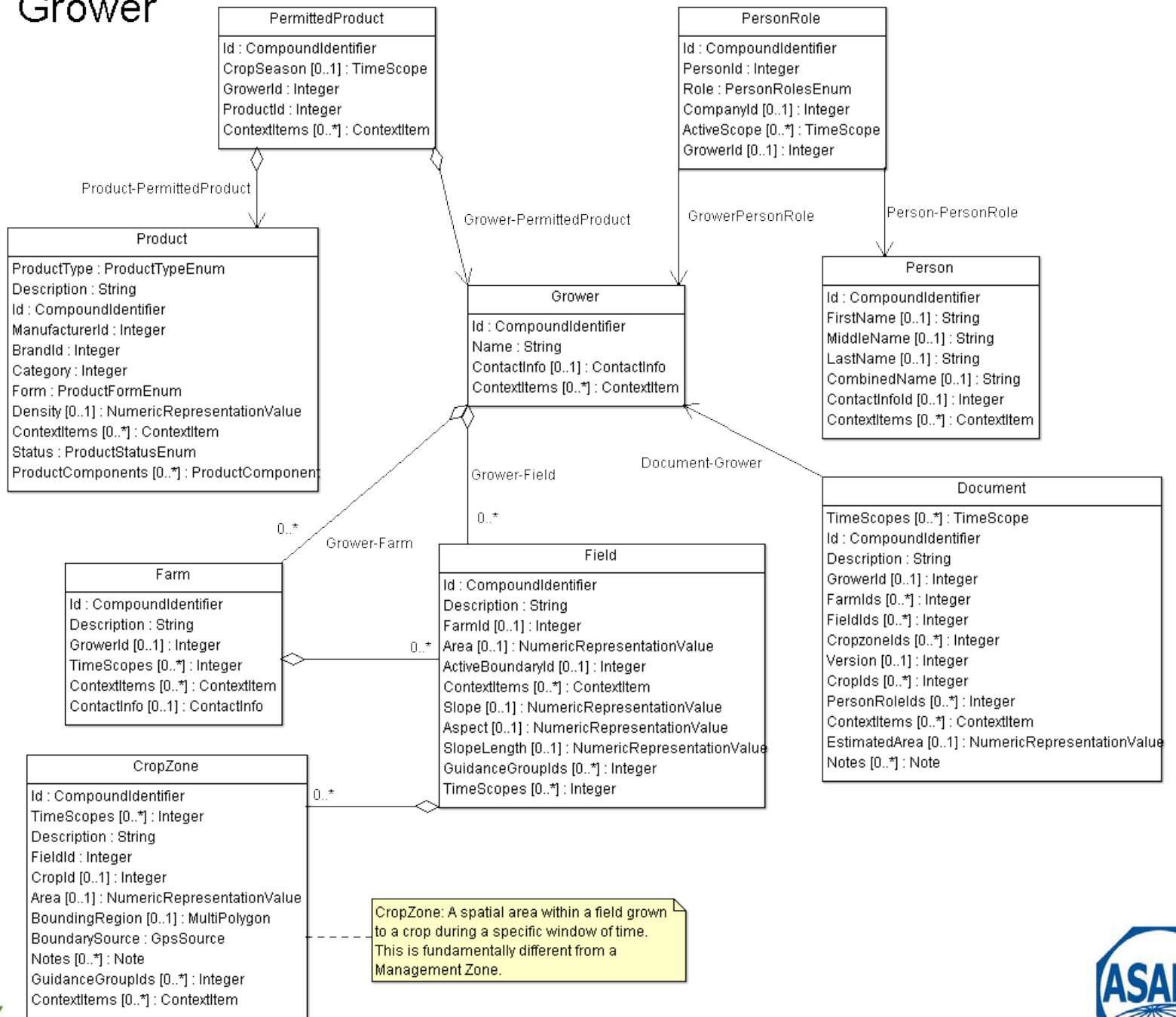


# 1: ADAPT's power is in its common object model

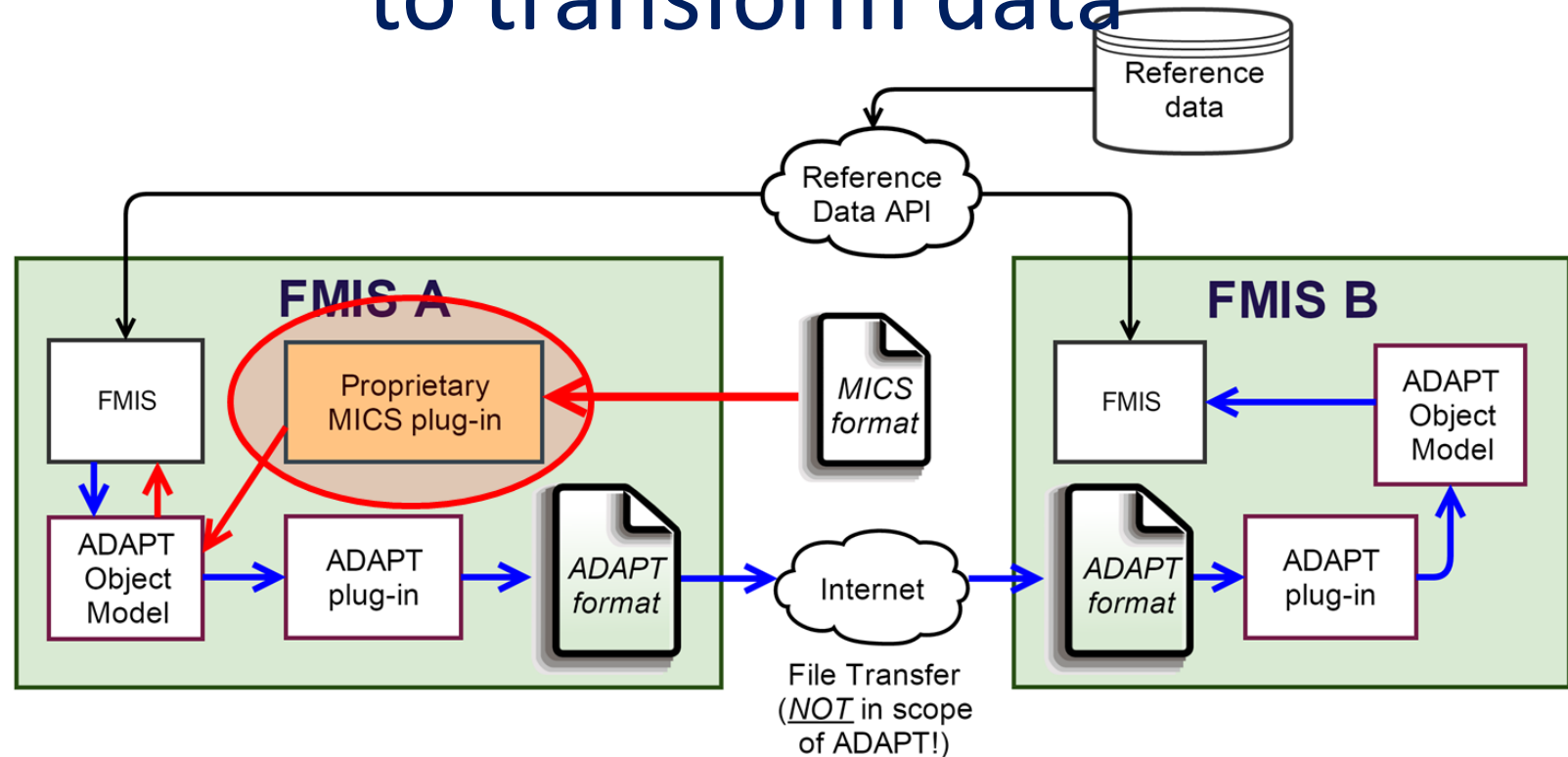


- Direct result of data requirements from SPADE/PAIL as well as participating stakeholders.
- Initial cut of the model was overly large and skewed heavily towards North America.
- We subsequently reduced the model to a simple set of “universal” objects with the “geopolitical context” data handled by the ContextItem System.

# Grower



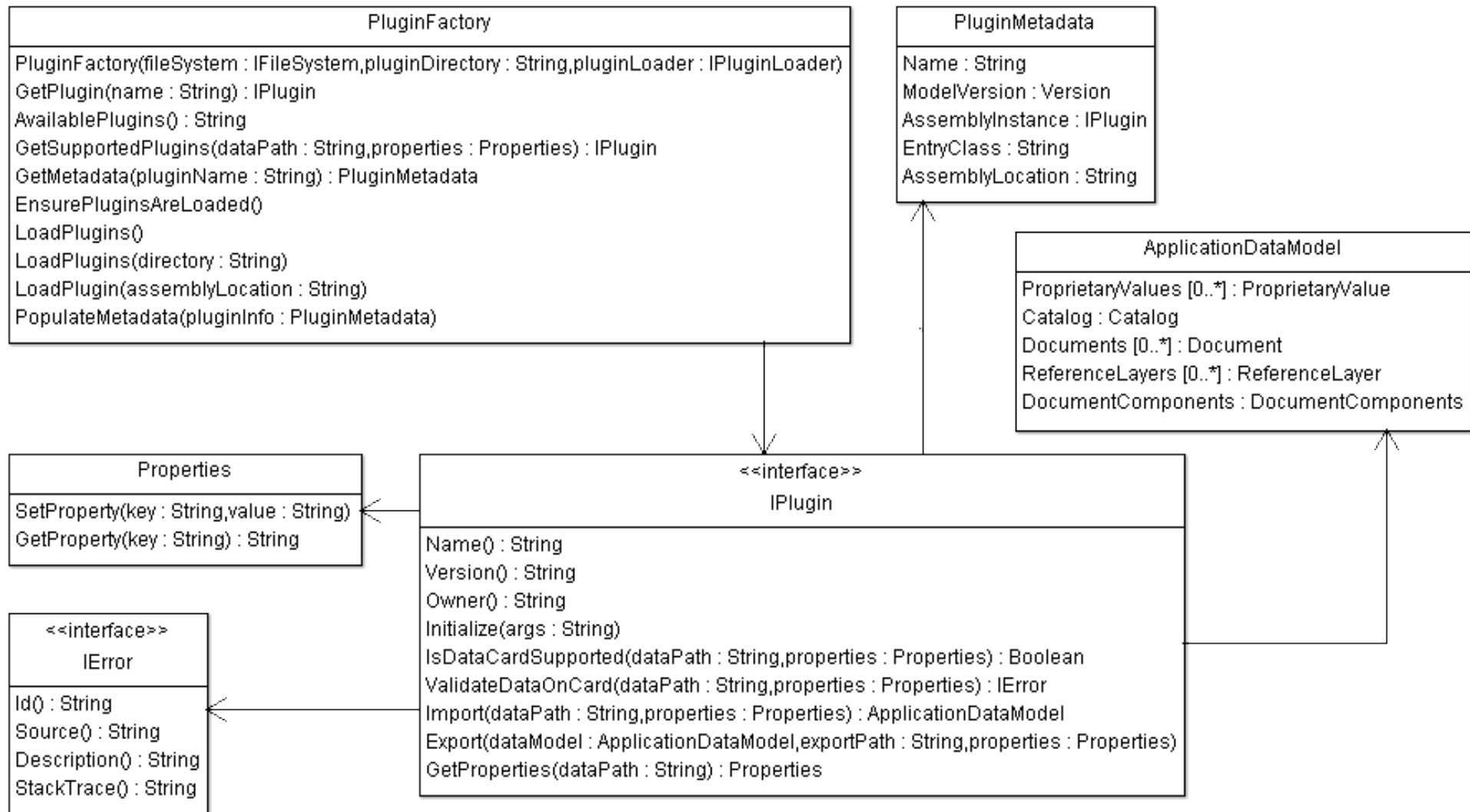
## 2: ADAPT uses a plug-in architecture to transform data



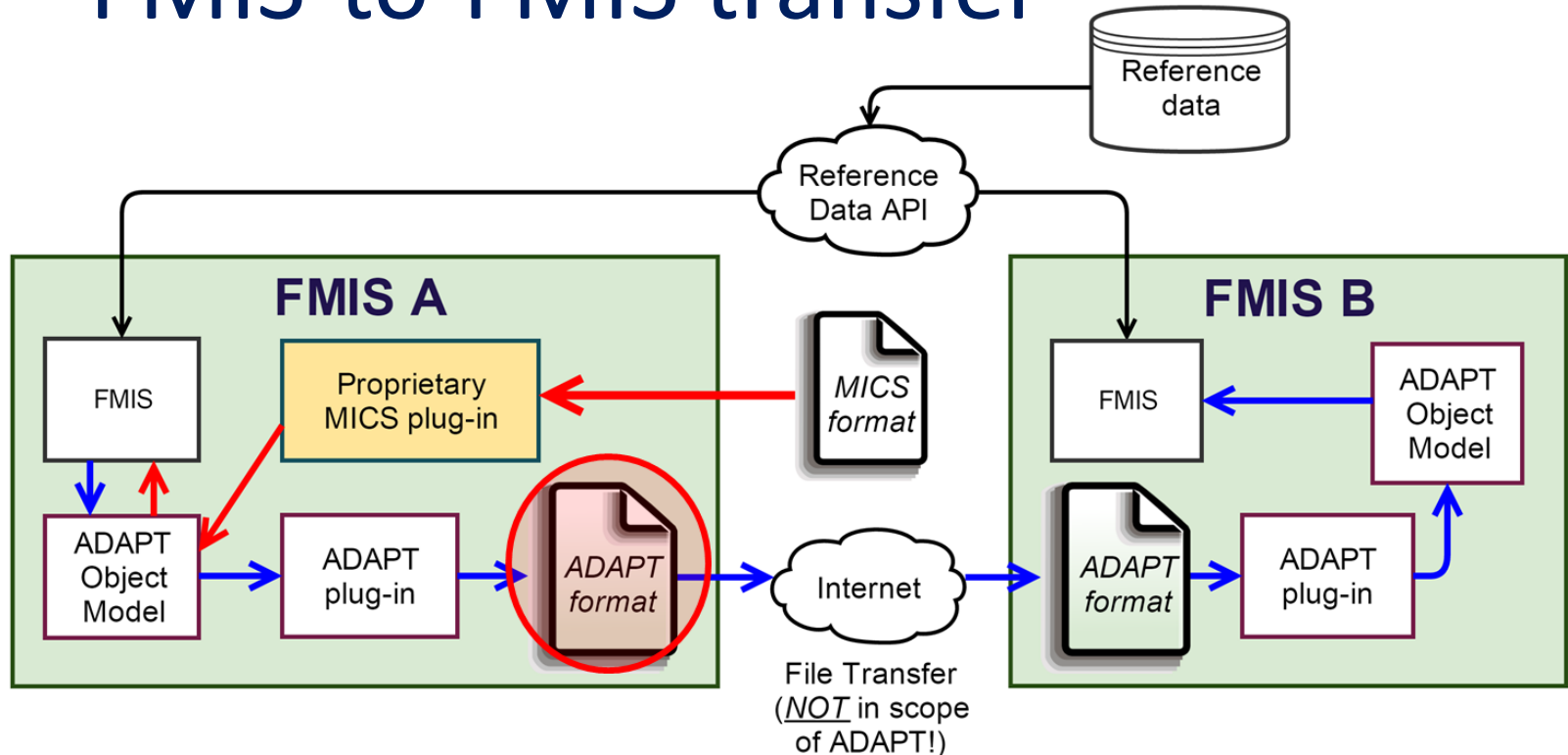
- A "plug-in" is defined as an external library, loaded at runtime, that contains the format conversion logic.
- It is responsible for mapping data bi-directionally between the common object model and another set of (often proprietary) business objects.
- Plug-ins are licensed by their developer: Anyone can build a plug-in for ADAPT; the developer is free to license their plug-in based on their business needs.



# The Plug-In Manager

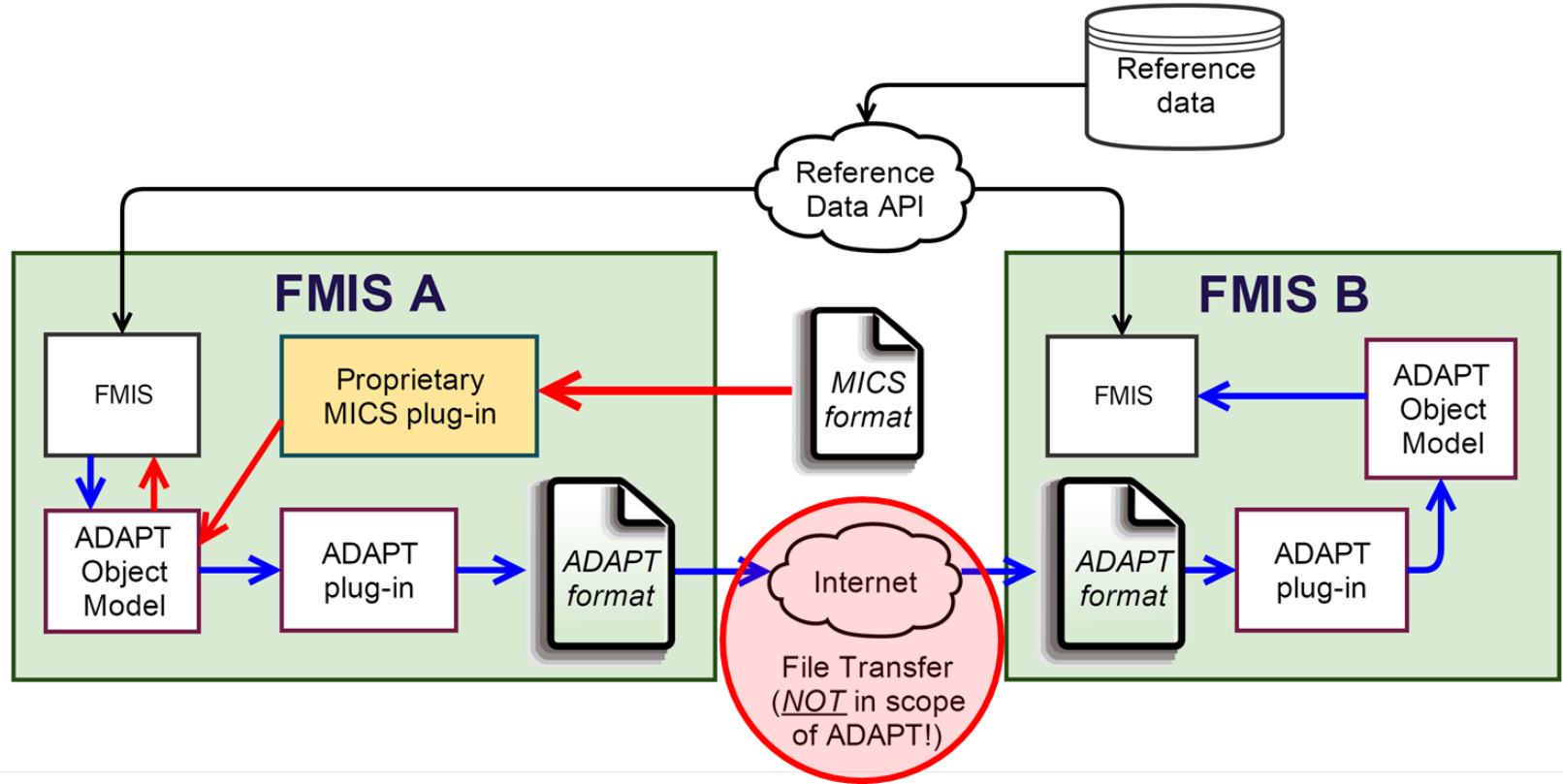


# 3: ADAPT serialization enables loss-less FMIS-to-FMIS transfer



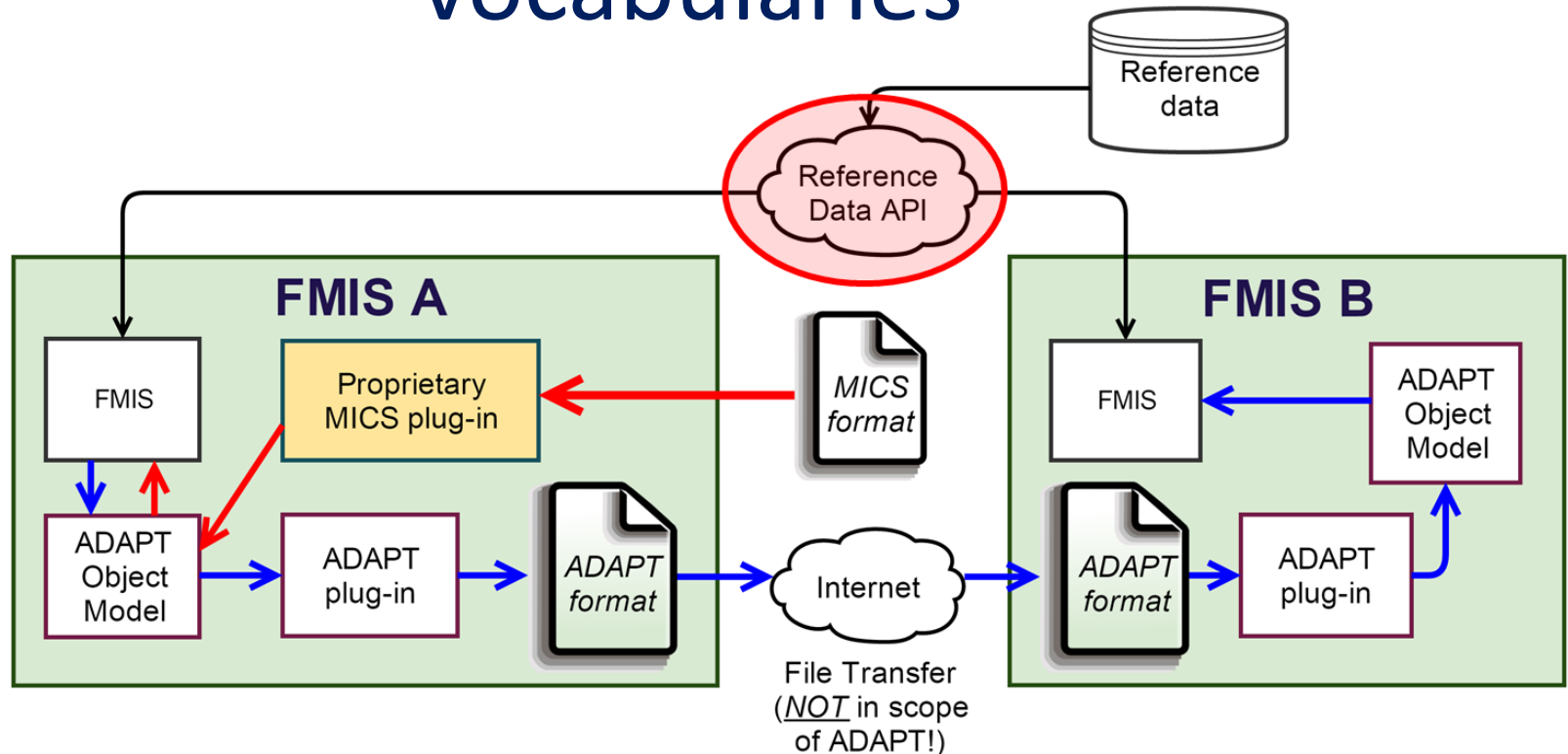
- The proprietary plug-ins identified so far are inherently “lossy”.
  - ADAPT’s object model is a comprehensive superset of individual companies’ contributions.
- Realized the need for a “lossless” plug-in to exchange business data among FMIS.
- ADAPT Serialization plug-in uses a mix of JSON and ProtoBuf to serialize the entire common object model for persisting to storage, or packaging for transport.

# 4: ADAPT is NOT a file transfer mechanism



- ADAPT does not contain logic or a specification for authentication or authorization.
- ADAPT Serialization Plug-in will persist a model to disk for manual movement.
- Nothing prevents a developer from including file transport in their plug-in, however.

# 5: ADAPT leverages the use of controlled vocabularies



- There is a lot of power in shared meaning!
- Representation System & Unit System (external data, loaded at runtime, remotely updatable).
- Reference Data
- ContextItem System

# Licensing

- The ADAPT team was diligent in exploring options for the licensing of deliverables, settling on:
  - The open-source Eclipse Public License for the common object model, the plug-in management tools, and some community-supported (e.g., basic serialization) plug-ins.
  - Allowing individual plug-in writers to license their individual libraries as they choose.
- These choices balanced a set of requirements, including:
  - supporting various manufacturer and service provider business/commercialization models,
  - respecting companies' investments in patent portfolios, and
  - promoting broad participation from both established industry players and startups alike, while providing a governance process that would seek to ward off unhelpful forks in code but enable participants to create derivative products.

# Discussion

- Preserving identity in a distributed environment without central naming authority
- The many meanings of time
- Expediency vs Consensus
- Documentation is challenging!
  - Collaboration tools (wiki), webinars, screencasts, XML source code documentation
- The power of ONE (integration)

# 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

# Questions?

(Including how you can participate)

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