Digital Object Architecture

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Who is NOT the audience

A large part of this meeting's attendees may be managing or dealing with information systems that serve project information to users.

Still, the Digital Object Architecture may ***not*** be for you:

- If your system is going to be short-lived.
  - Our focus is on ***long-term usability*** of information.
- If your system is expected to share information with only a small set of participants.
  - Our focus is on ***sharing*** information with ***large, cross-discipline groups***.
- If your focus is to improve the security or performance or scalability of your system.
  - Our focus is on ***separating implementation*** concerns from ***information usability*** concerns.

Who IS the audience?

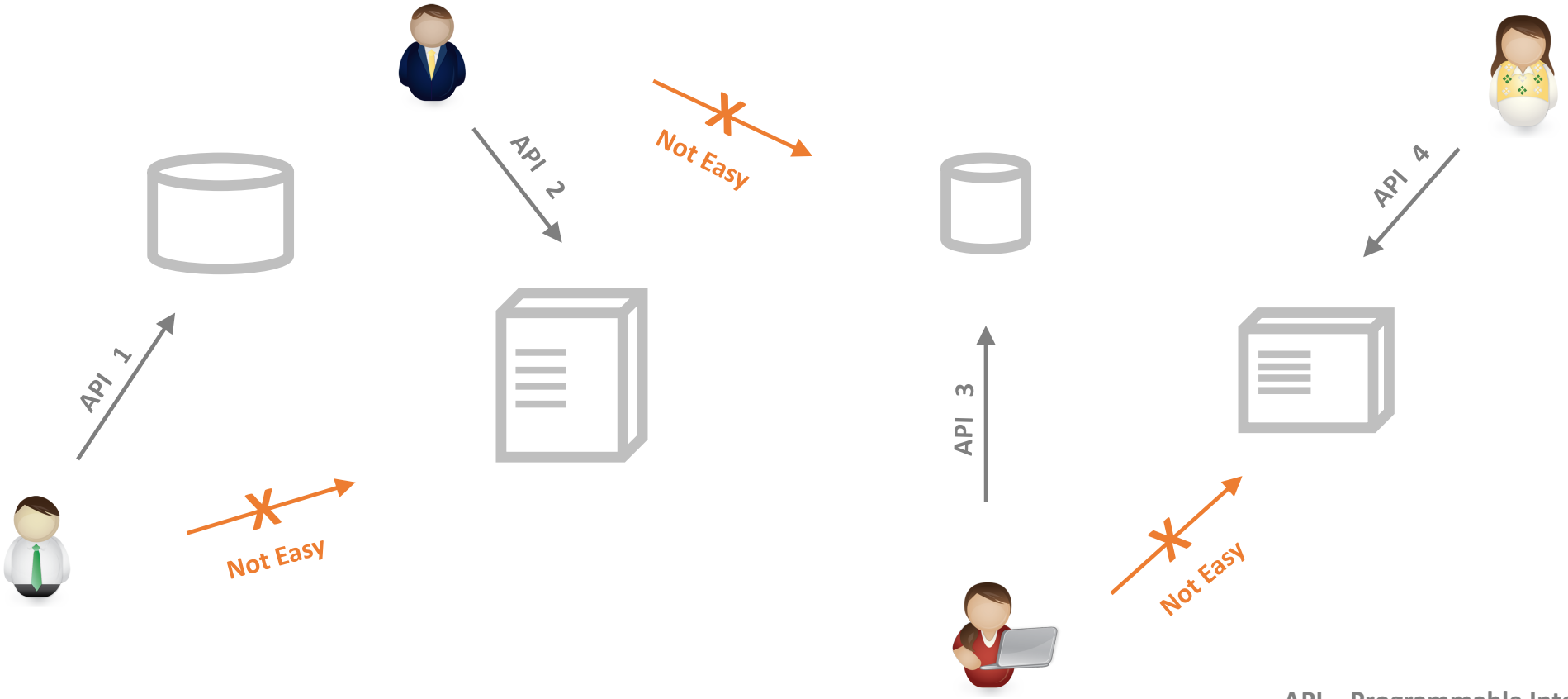
Many times there is ***value*** in information held in different systems.

If you are interested in ***extracting value*** from ***information*** that is ***held in multiple, disparate systems***, then you may find the presented approach potentially useful.

This means, if you are an

- *Information Producer*: Your goal should be to ***share information*** on a ***long-term*** basis to ***groups unrelated to your project*** in a way that is palatable to those groups.
- *Information Consumer*: Your goal should be to ***find, access***, and ***use*** information served by various producers.

Current state of information systems



API – Programmable Interface

“Not Easy”

The ***opportunity cost*** of extracting value from information distributed across systems is too high because

- Every system has its own API.
- Systems move, evolve, and re-implemented over time.

Dealing with heterogeneity and evolution requires front-loaded engineering effort ***before*** the actual science or business cases can be pursued.

“Not Easy”

Current solutions are based on small-scale collaborative efforts:

- The collaborators define common standards.
- They engage in reduced, but still substantial, engineering efforts to interoperate and extract value from distributed information.
- Even then, new collaborators pay ”participation fee” in the form of engineering effort to adapt their systems to the newly defined standards.

Global interoperability solutions that cut across domains and disciplines are lacking.

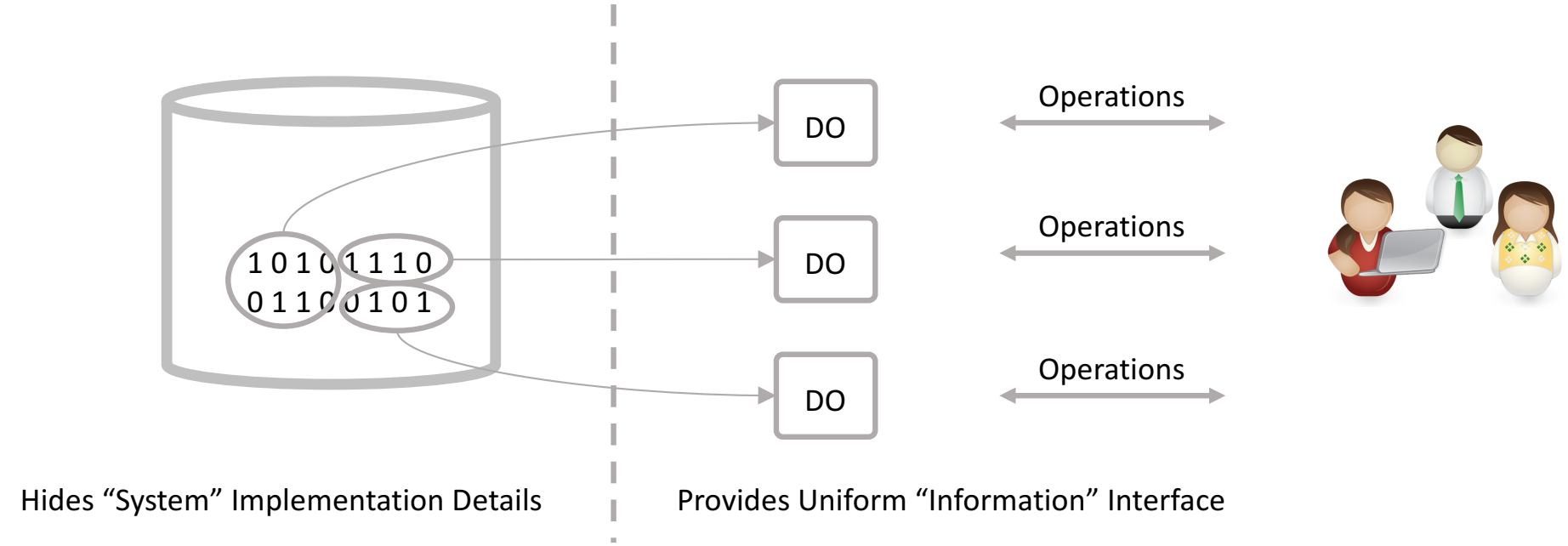
Our vision

We envision a different computing world.

We would like collaborative efforts to focus on implementing a ***widely-applicable*** standard that would work across scientific and business enterprises.

Cornerstone: Digital Object (DO)

An important tenet of our approach is to move from a system-centric world to an information-centric world.



Digital Object Approach

Digital Object

- ***Bits*** (your project information).
- ***Identifier*** (helps users locate and interact with the digital object).
- ***Type*** (helps users learn the minimal set of supported operations).

Mechanisms are defined to

1. ***Represent*** information as digital objects.
2. ***Discover*** identifiers (of digital objects) based on some matching criteria.
3. ***Locate*** digital objects (in a network) from identifiers.
4. ***Interact*** with digital objects using operations.

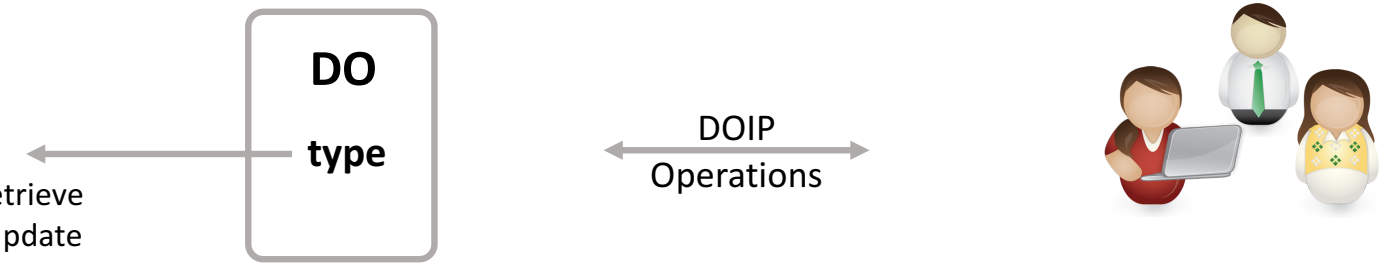
4. Interaction: DOIP

The only mode of interaction with digital objects is via operations.

DOIP is the operation-invocation protocol.

DOIP defines a ***single method*** for tunneling ***any*** operation request.

Requests take the form: [client id, DO id, operation id, and input].



Lists operations

- Basic operations such as retrieve
- Operations to create and update
- Project-specific operations

The expected input and output forms should be described for each operation.

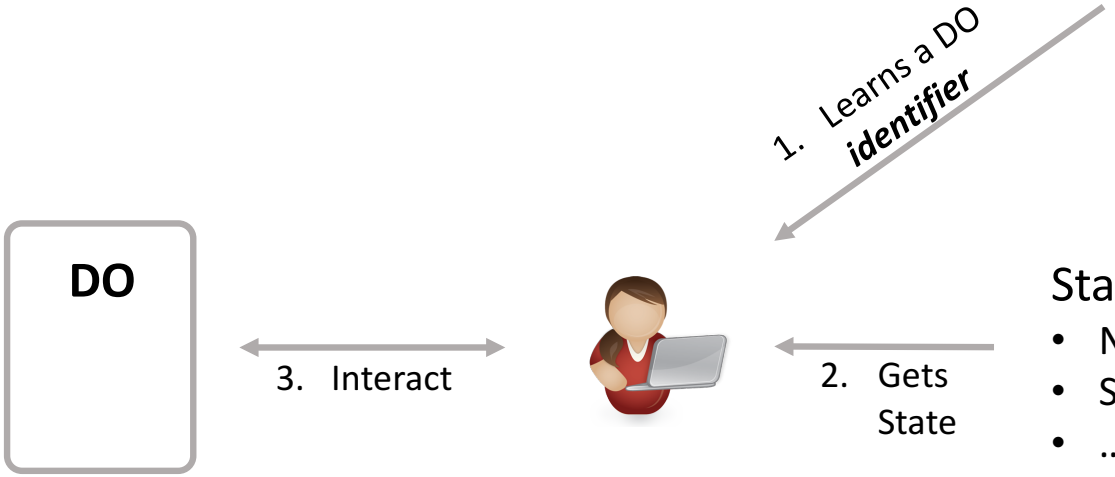
Types are also expected to be managed as DOs.

Access Controls can be enabled.

Different clients can be listed different operations.

3. Location

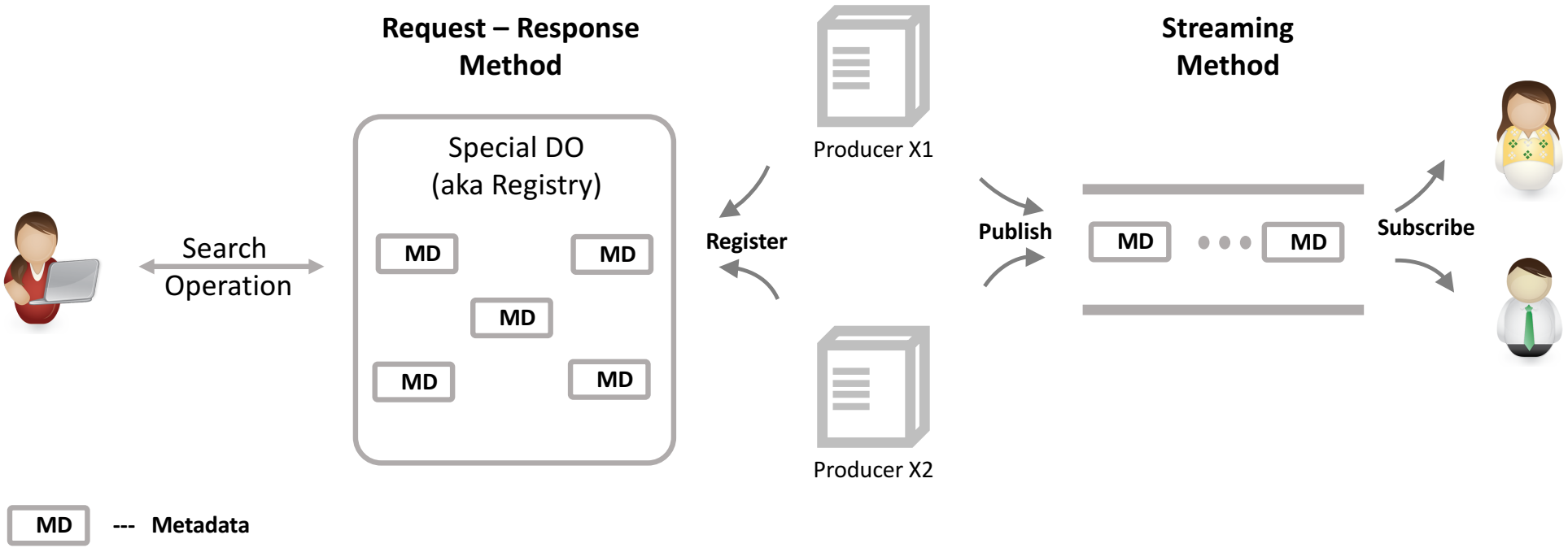
Users can obtain location and endpoint information from identifiers using the Handle protocol.



2. Discovery

Users may want to discover digital object identifiers based on some criteria:

- E.g., identifiers of DOs from producer X or type Y or keyword Z or with geo-tag [lat, long].
- Here are select few ways to enable discovery:



1. Representation (as digital objects)

Users may represent new and existing information as digital objects in multiple ways.

- ***On-the-fly*** digital objects that aggregate information from multiple sources of data (not discussed in this presentation).
- ***Streaming*** digital objects to present sensor streams (also not discussed).
- **Mapped** digital objects that act as ***views*** of project data (discussed next).

1. Representation (as digital objects)

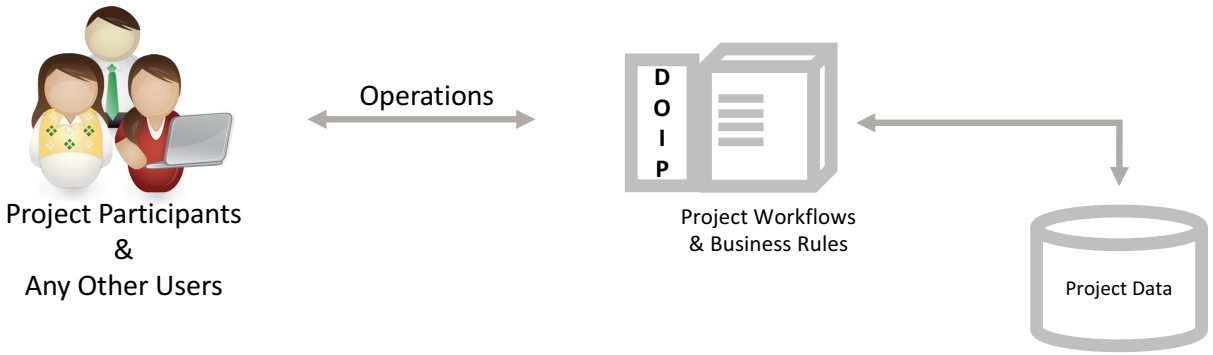
Mapped Digital Objects: There are two key questions to answer:

1. What ***operations*** are ***supported*** by your digital objects?
   - Note that some amount of processing can be performed on the client-side.
   - In the next few slides, we assume we are dealing with only server-side processing.

2. Do you have users relying on project-specific APIs?
   - The answer to this question informs some of the architectural decisions.

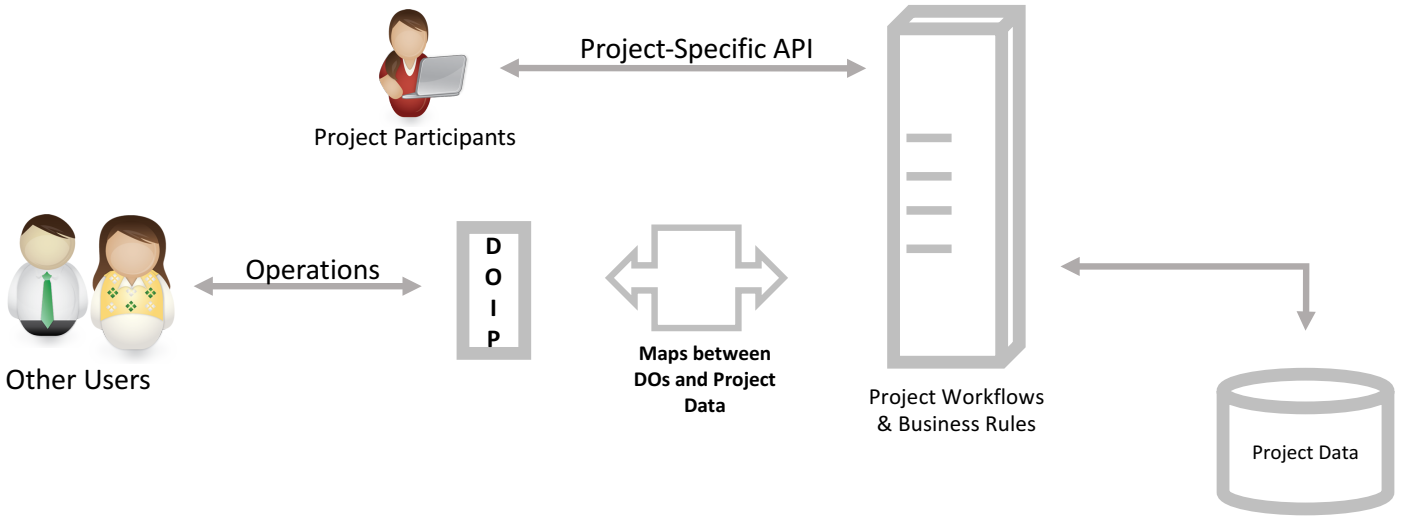
1. Representation (as digital objects)

Scenario: All users can work with DOIP interface.



1. Representation (as digital objects)

Scenario: Project-specific APIs are leveraged.



More nuances of mapping between project data and DOs are discussed in the presentations that follow.

Why follow the Digital Object Approach?

The greatest ***threat*** to the ***usability*** of ***information*** is its ***disappearance***.

Information moves, systems get re-implemented, formats change, data models evolve. These events impede accessibility and usability.

The Digital Object Architecture cannot stop those events.

The greatest ***power*** it offers is ***levels of indirection*** that help encapsulate those inevitable events via the notion of ***resolvable identifiers*** along with a simple ***operation agnostic protocol***.

This enables system managers an opportunity to serve digital objects, operations, and types consistently across time and enterprises.

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