

Consolidated Object Standards Project

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Outline

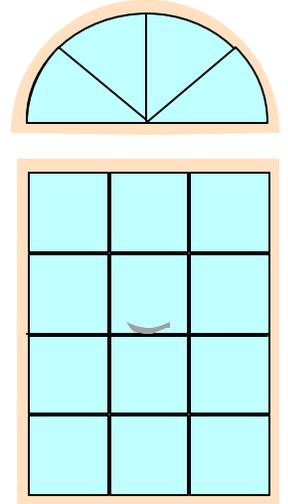
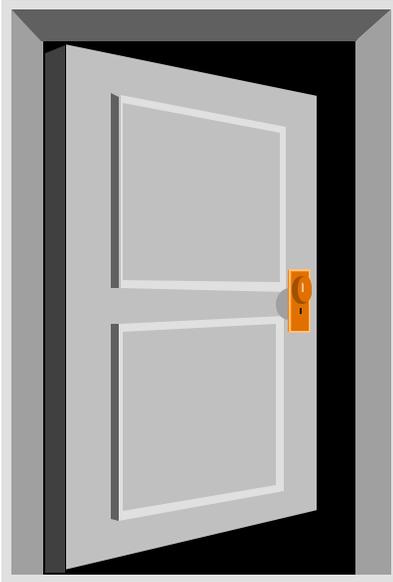
- **Brief overview of object technology**
 - **Initiatives to Develop Objects for A/E/C CADD & FM**
 - **Initiatives to Develop Object for GIS**
 - **Consolidated approach to standards development between the CADD, AEC, GIS, and FM domains.**
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User Oriented Object Definition

OBJECTS -

an abstraction of “things” in the real world (problem domain)

reflecting the capabilities of a system to keep info about it (state, behavior, ID), interact with it or both



Cost Estimate

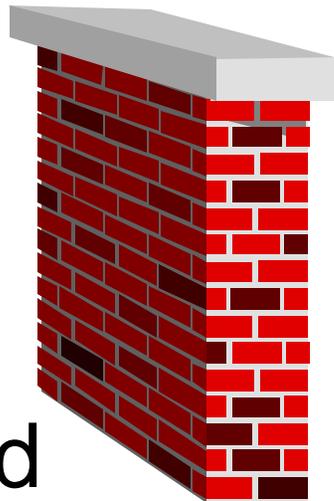
Work Order

Sidewalk Basin

Gate Runway

Floor Switch

Chair Road

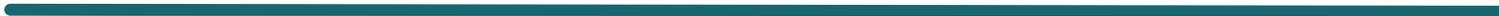
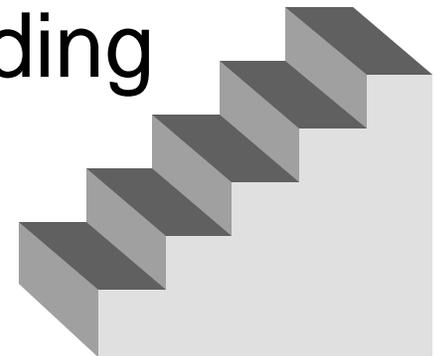


Fan Building

Thermostat

Pipe Duct

Fence Valve



Definition

- **An Object is characterized by:**
 - **State (What it knows) -**
 - ◆ state is hidden from user I.e., Encapsulation
 - ◆ ability to maintain state differentiates objects from set of functions (piece of software code.)
 - ◆ **example: door - locked/unlocked; waterline - functioning/broken**
 - **Behavior (What it can do)**
 - ◆ set of things you can ask it to do
 - ◆ user/client of object can ask it to perform some behavior(s)
 - ◆ **example: door - swings open/closed; waterline - transports water**
 - **Identity (Which object is it)**
 - ◆ reference & address a specific object
 - ◆ **example: door - ID#221; waterline - key#55342**
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What is Object Technology

Object technology is:

The set of otherwise diverse programming languages, techniques, tools, environments and methodologies that derive their value from the use of objects.

O-O Programming Languages

Software Developers
(e.g., C++, Java)

O-O & O-R Databases

Database Developers (e.g., Oracle 8i, O²)

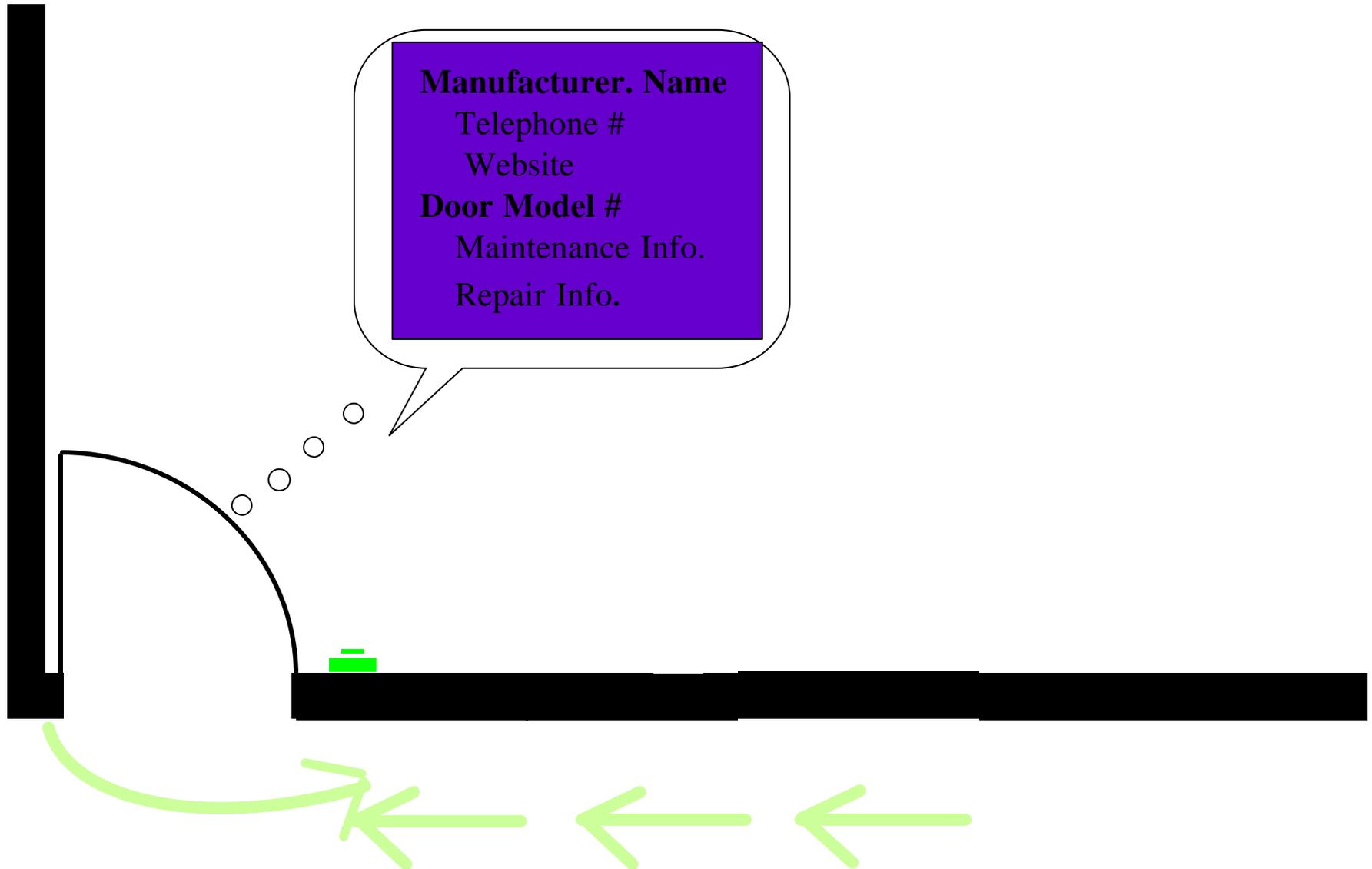
Object Methodologies -
describing/modeling domain “things”
& their characteristics using formal notation
which can be translated directly into software
components

Data Modelers and Domain Experts
(e.g., CASE Tools for UML, Express)

Object Components -
object classes, software components

Users
e.g. ESRI ArcInfo 8, Laserscan Gothic,
Smallworld, Graphisoft ArchiCAD,
Autodesk Architectural Desktop 2.0

Intelligent CADD Objects



Interoperability of a Door Object

- **Architectural** - the door is created with operating characteristics and associations to other structural members
 - **Design** – the door is specified using industry standards
 - **Codes and Standards** – the door is tested for compliance to building codes
 - **Simulation** – the door operates in a virtual walkthrough for client validation
 - **Costing** – the door contributes cost to the project
 - **Advertisement** – the door is part of the project specifications
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Interoperability of a Door Object

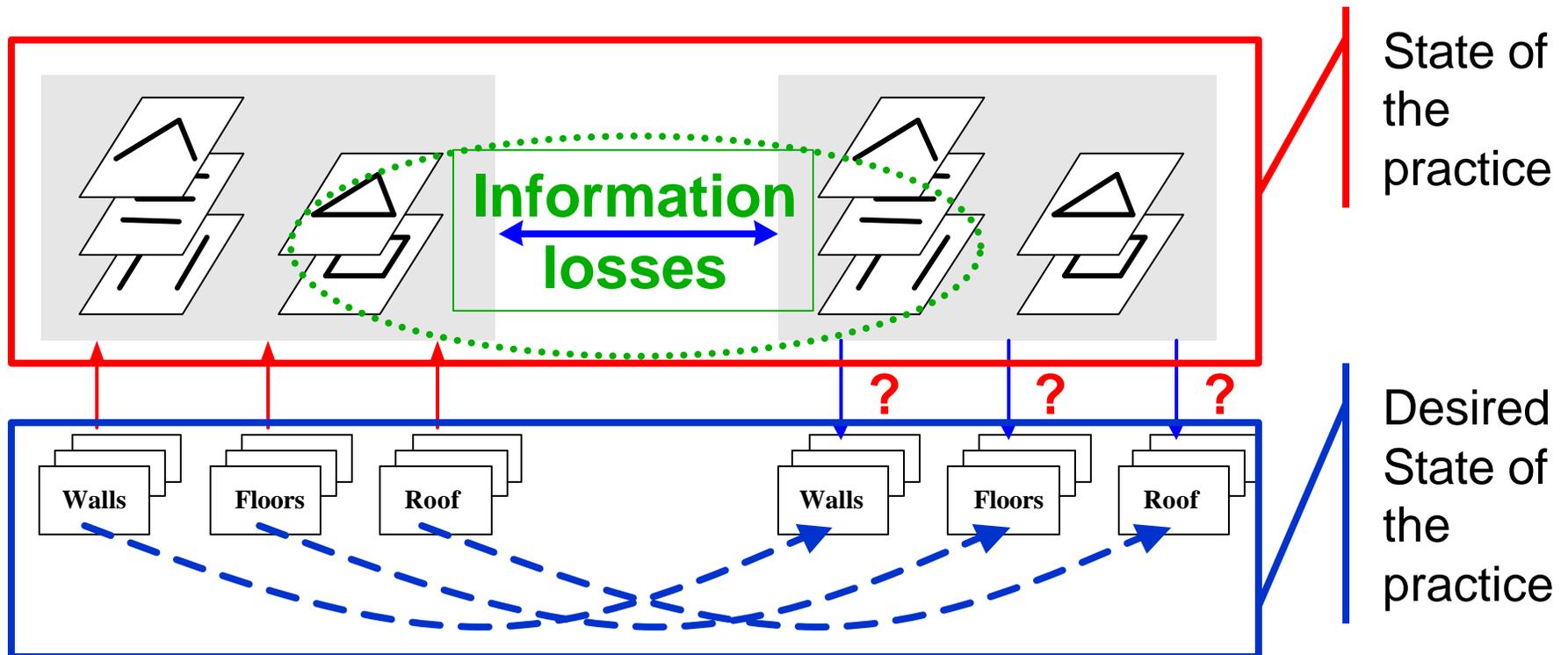
- **Bid** – the door is bid by the contractor; alternatives can be recommended and replaced in negotiations
 - **Construction** – the door is ordered, warehoused, and installed creating actual cost for the contractor
 - **Inspection** – the door is verified to comply with the final negotiated contract
 - **Maintenance** – the door is repaired and maintained
 - **Renovation** – the door is replaced, removed, or remains in service
 - **Information Services** – the door is spatially located as part of a building for visitor routing or other customer service
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Results of Interoperability

- **The door object and its attributes are used and reused throughout the process.**
 - **Software written to use the door object (including its attributes) work together to eliminate data reentry.**
 - **Data integrity is maintained through the reuse of single door object used by multiple applications.**
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Knowledge Sharing

- When we exchange only graphics data, we lose knowledge e.g. Architect/Designer/Engineer, ...
- With Objects you begin to include some of this knowledge into the data.

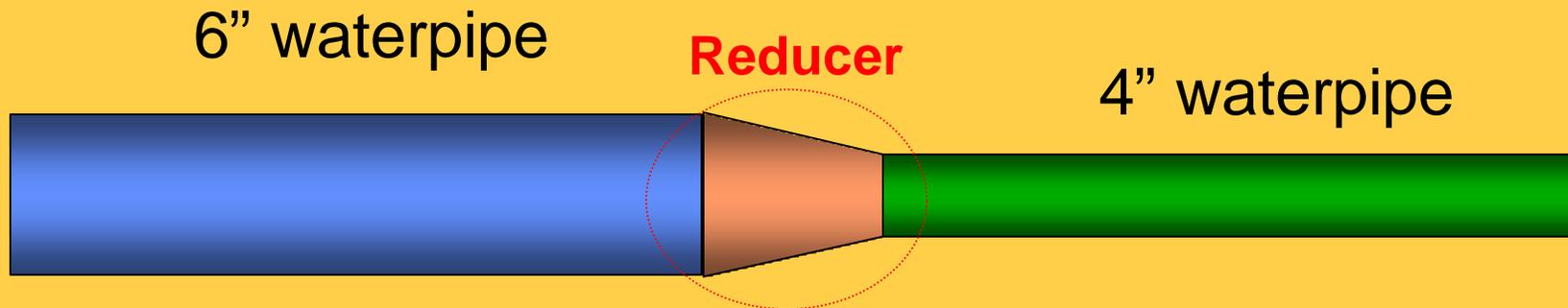


GIS Objects

- **GIS application of object technology primarily used today by Utility Co. and other network applications to model facilities** (*e.g. gas, water, electric, communications, road networks.*)
- **Also see some OO-base GIS use by large national charting agencies for data support feature data capture, update, & maintenance.**
- **Considerable Object-Based GIS experimentation going on NIMA, TEC, USGS, and elsewhere.**
- **Benefits of OO-based GIS:**
 - ◆ **easier to capture unique data types & systems/facilities.**
 - ◆ **ability to model real world phenomena as an object with various graphic representations and accompanying attributes** (*e.g. various scale topo maps/hydro charts.*)
 - ◆ **ability to add behaviors to ensure data integrity.**

Intelligent GIS Object Example

Waterpipe --includes behavior(s) that specifies what it can connect with (e.g., 6" main can connect to another 6" main or needs a reducer to connect to 4" waterpipe.)



GIS representation

Standards Initiatives For Objects

- **IAI - International Alliance for Interoperability**

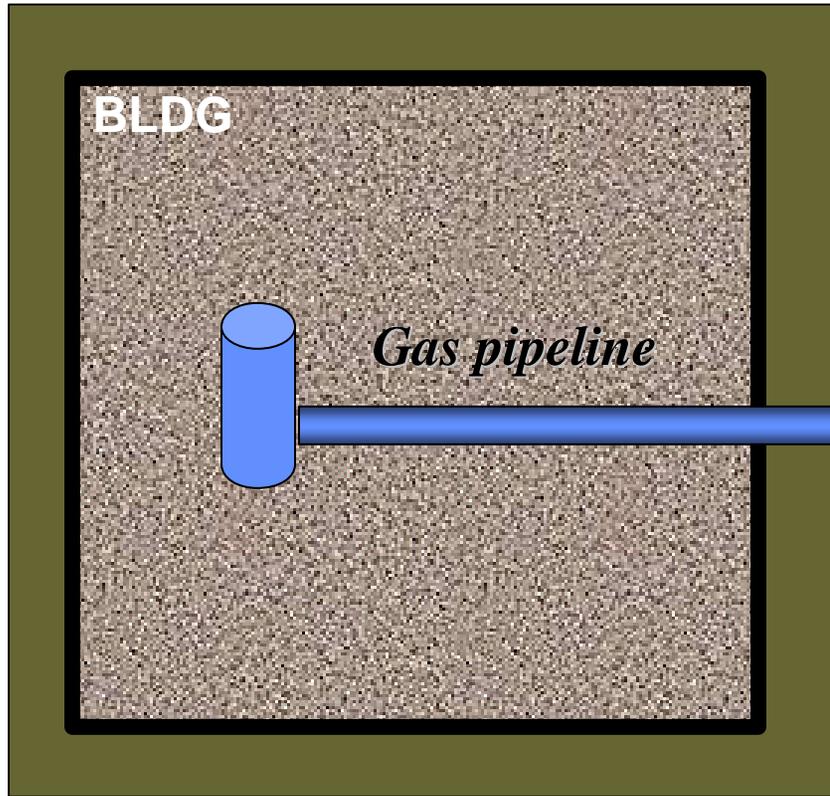
- ◆ AEC Project information sharing through the project life cycle
- ◆ IFC - Industry Foundation Classes
 - IFC is to “objects” what DXF is to graphic entities
- ◆ *Center personnel lead 3 major activities within IAI*

- **OGC - Open GIS Consortium, Inc.**

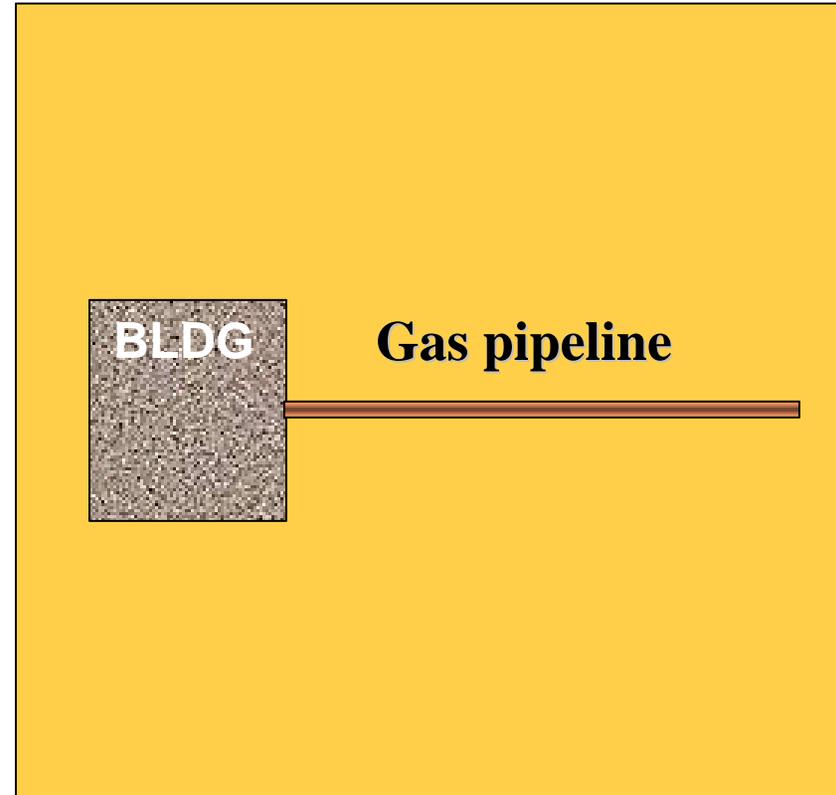
- ◆ GIS/geoprocessing technology object interfaces for data and services.
 - ◆ *Center plans to initiative a FY01 project in partnership with OGC to examine how to modify SDSFIE to encompass an object model (as well as current relational model.)*
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CADD & GIS Objects Interoperability

CADD



GIS



Solution Approach

- **Define a strategy for consolidating standards initiatives using object technology for AEC, CADD, FM, and GIS.**
 - **Leverage federal investments participating in credible industry, et. al. standards organizations.**
 - **Establish contracting language to enforce standards use.**
 - **Identify tools that complement each other (toolkits) and satisfy requirements of process functions**
 - **Use interoperable COTS and GOTS tools conforming to standards.**
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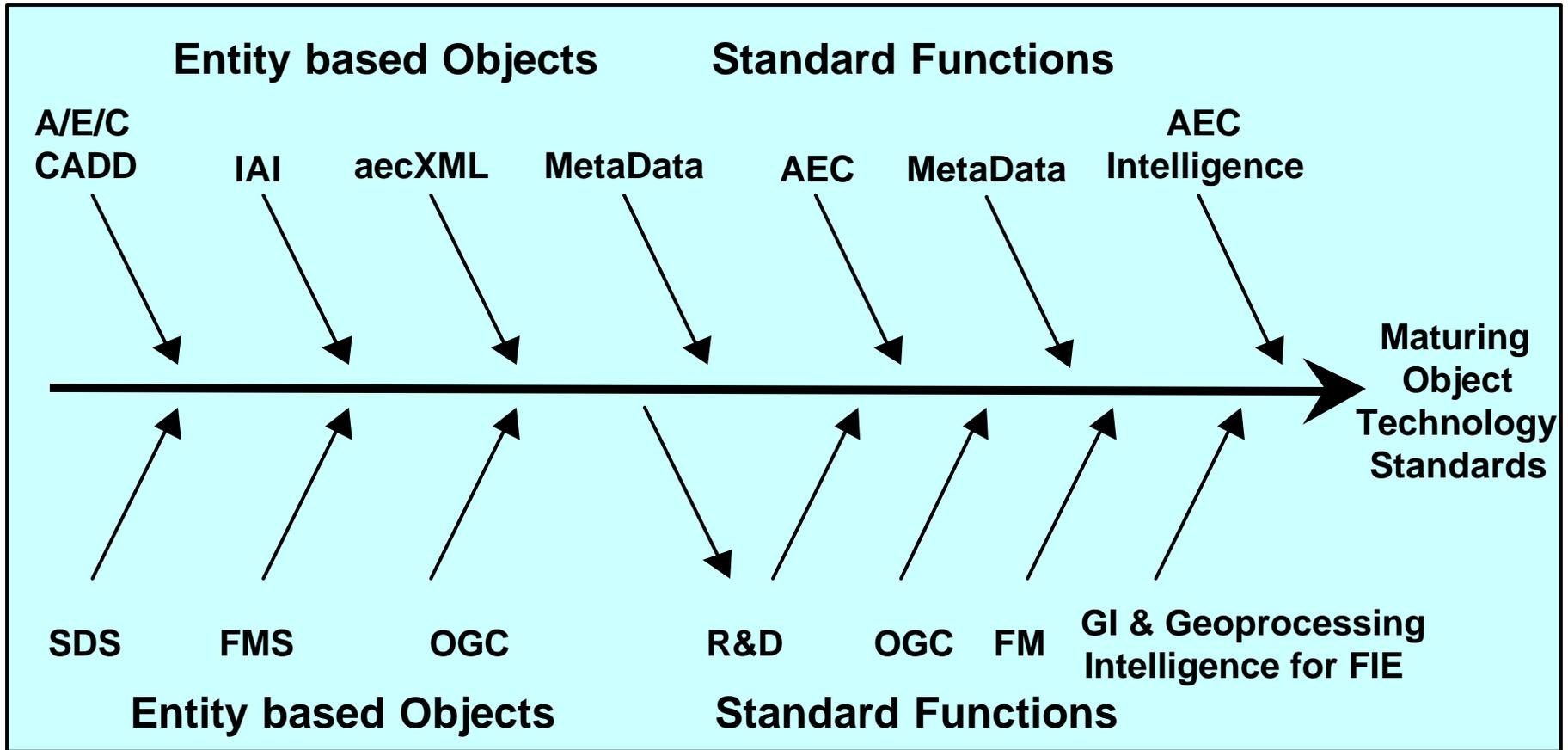
Project Approach

- **Establish a Center Working Group**
 - ◆ Author consolidated strategy
 - ◆ Reviewers of the center's object efforts
 - ◆ Identify credible standards organizations
 - Review work of standards organizations
 - Build relations with credible organizations
 - ◆ Assess current state of object standards in industry
 - ◆ Advance standards that will be used in all tools (CADD, AEC, GIS, FM, and admin)
 - ◆ Working relationship with developers
 - ◆ Compliance testing program and logo
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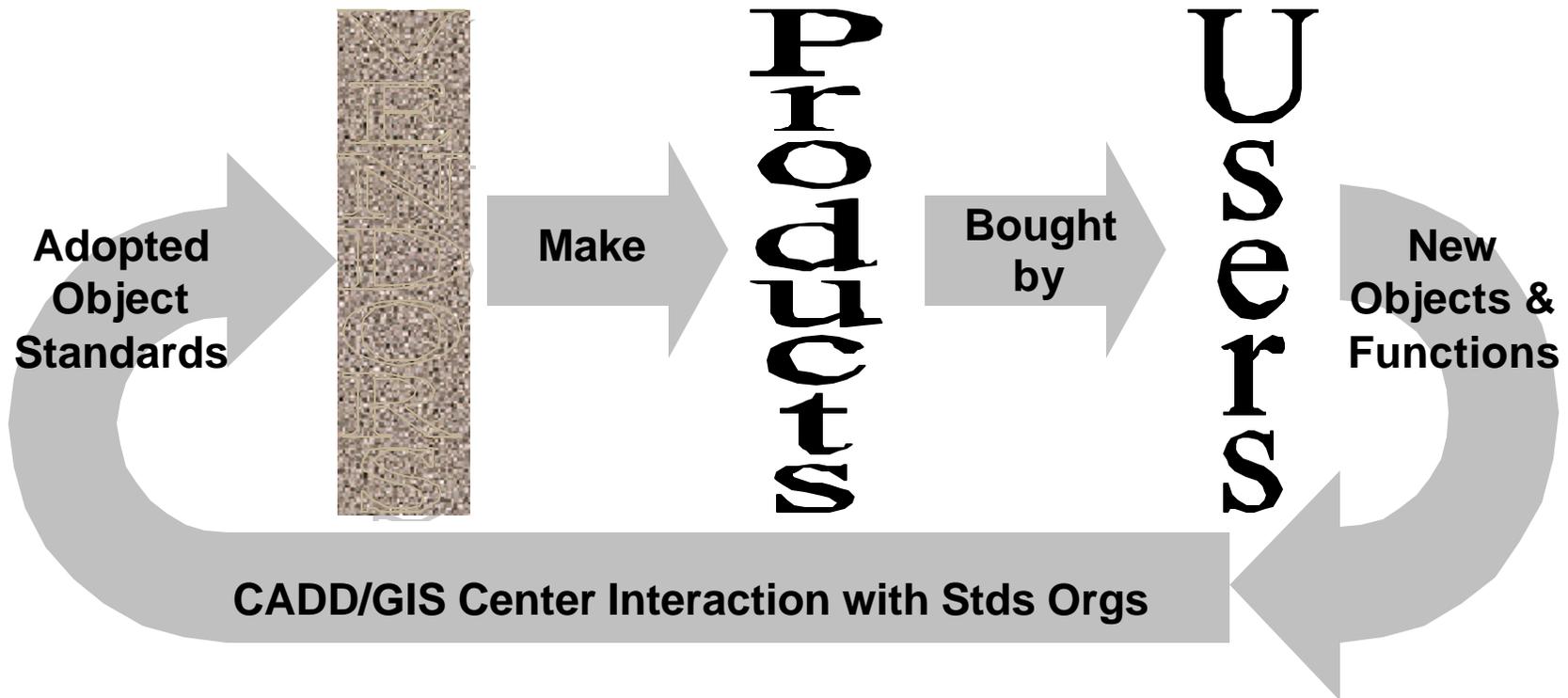
Project Approach

- **Identify Center work using Object technology**
 - **Develop Consolidated Object Strategy**
 - ◆ **Define parameters for Object identification**
 - ◆ **Identify necessary collaboration between Center projects and between standards organizations**
 - **Join Standards Organizations affecting Objects**
 - **Establish leadership in Standards Organizations**
 - **Attract field involvement**
 - ◆ **Corps of Engineer's Districts**
 - ◆ **Other uniformed services installations**
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Progressive Improvement

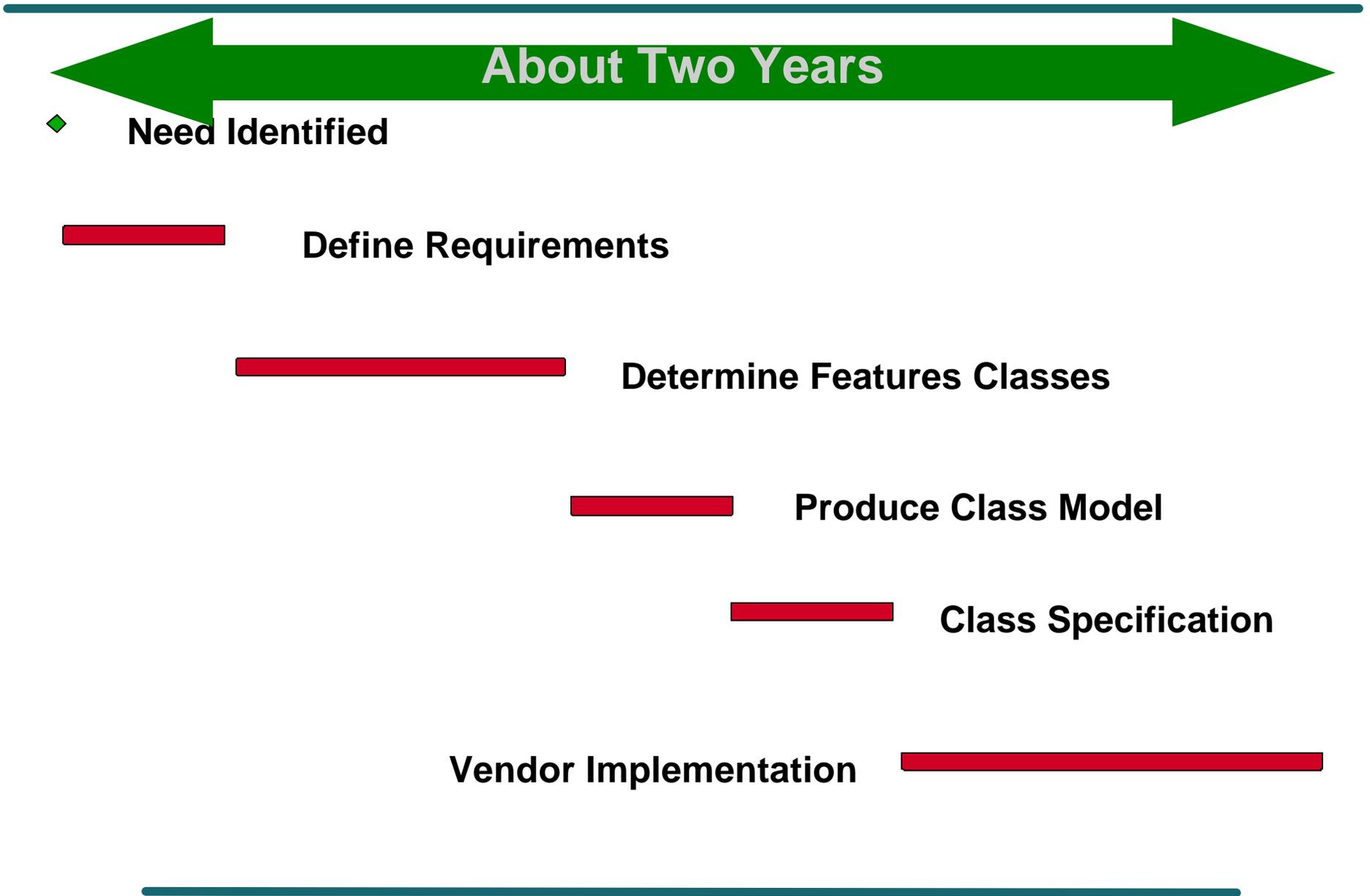


Evolutionary Cycle



Optimistically, it's a two year process from defining new standard for an object class (e.g., water system) to adoption by vendors.

Target Schedule per Needed Feature Set



Benefits of Objects

- **Objects can provide the architect and engineer with an intuitive human-computer interface**
 - *Objects can be shared by different software (Hopefully!)*
 - **Objects can be distributed on different machines for enterprise data sharing**
 - **Objects allow software developers to produce products quicker and cheaper by assembling software components**
 - **Mature well-designed Objects**
 - ◆ **will be reused**
 - ◆ **will be changed without a need for complete testing**
 - ◆ **increase independence between software functions**
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Liabilities of Objects

- **Objects require specialized training**
 - **Objects may not immediately produce cost savings**
 - ***Migrating from a procedural software approach to an object approach can cause significant effects to the organization***
 - **Objects require a different software development method**
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Conclusion

- **CADD industry is moving out with the development of object foundation classes for CADD and A/E/C & FM (inside bldg.)**
 - ◆ Center participating these object tech. stds. activities.
 - **GIS industry is focusing on object s/w interfaces to GI and services.**
 - ◆ the dominant GIS vendor has recently released an object-based GIS, i.e, ArcInfo 8.
 - ◆ Significant users looking at object technology to support robust GI production update & maintenance.
 - **Timing is good for Govt. Agencies interested in A/E/C & FM to steer (not row) these object technology standards activities toward interoperability.**
- ✦ Center's Consolidated Object Strategy Project should define a way forward to develop object standards for CADD/GIS & FM.*
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QUESTIONS AND DISCUSSION
