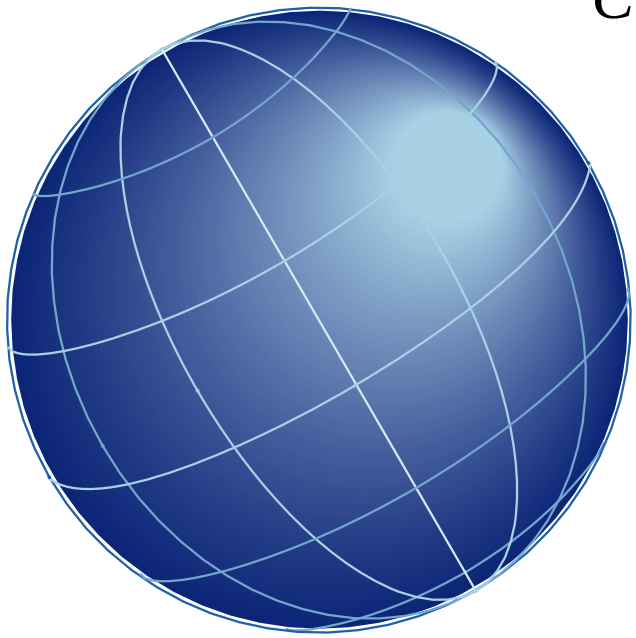
IDEF Methods for BPR to Support CALS

Comprehensive Solutions for a Complex World



IDEF and CALS

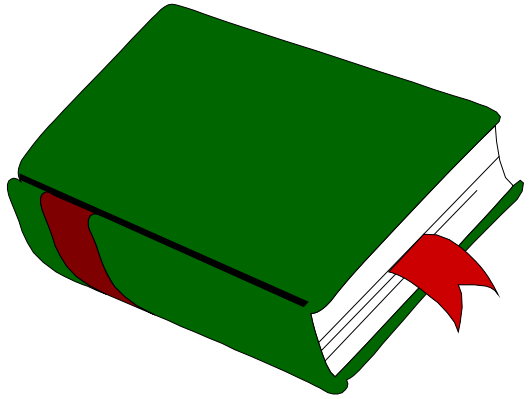
- CALS technologies enable *paperless environments* or the electronic flow of information.
- The implementation of CALS technologies require a re-engineering of enterprises.

IDEF and BPR

- Business Process Reengineering (BPR) assists in re-engineering the enterprises and the successful implementation of CALS.
- IDEF Methods support BPR activities (e.g., *knowledge acquisition, As-Is analysis, To-Be design, project planning, and implementation).*

What are Methods?

- **Methods:** A structured approach to capturing knowledge that maximizes accuracy but is also flexible enough to capture the real-world characteristics of that knowledge.

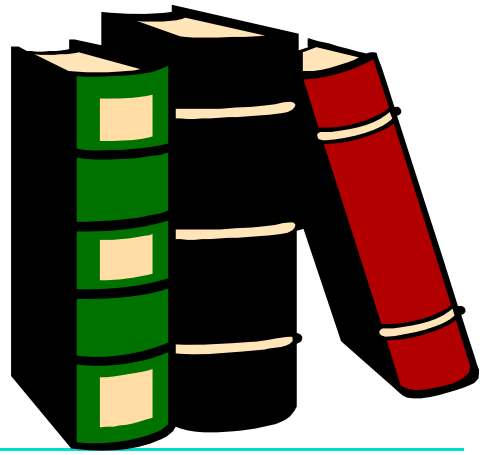


What are IDEF Methods?

- Integration DEFinition methods
- Knowledge Acquisition, Analysis, and Design tools
- Languages that include both graphics (diagrams) and text
- Formal procedures for constructing models or descriptions of a particular aspect of an organization

Why IDEF?

- **IDEF:** The IDEF Family of Methods was co-developed by industry and government. Their purpose is to provide a comprehensive yet flexible framework for describing, analyzing, and evaluating business practices. They are not proprietary and are supported by international standards.

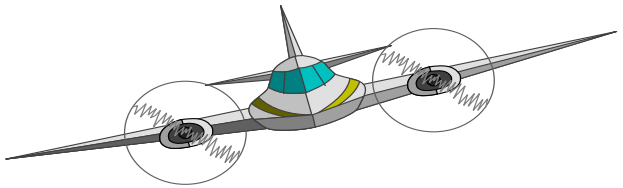


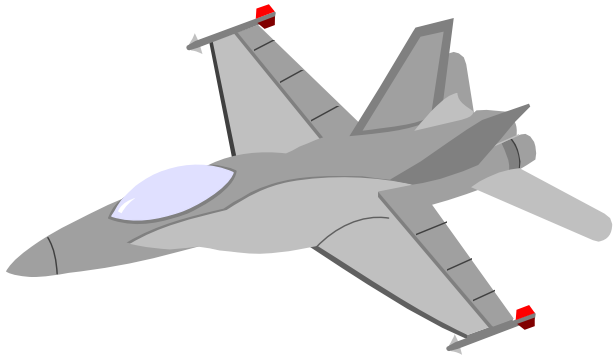
Characteristics of an IDEF Method

- Designed to address specific aspects of a problem, or provide different perspectives of the same problem
- Provide an explicit mechanism for integrating the results of the application of one IDEF with another
- Embody the knowledge of *good* practice for the targeted fact collection, analysis, design, or fabrication activity
- Designed to raise the performance of a novice practitioner to that of a more experienced practitioner
- Enforce formal techniques to ensure understandable communication

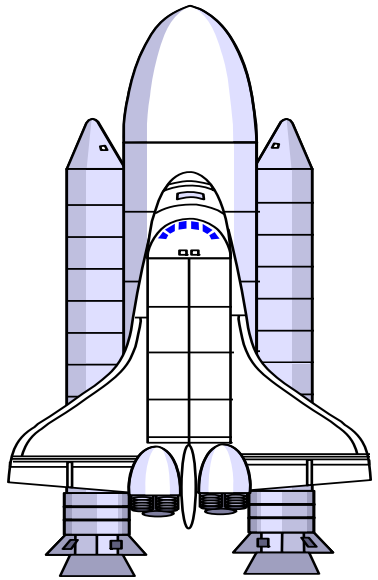
Continuing Evolution of IDEF

IDEFØ Function Modeling
IDEF1 Information Modeling





IDEF1X Data Modeling



IDEF3 Process Modeling
IDEF4 Object-oriented Design/Analysis
IDEF5 Ontology Description
IDEF9 Business Constraint Discovery

Original IDEF Methods

- Original plan was for the creation of several Integrated IDEFs from the ICAM Project
- The initial step was the development of the first 3 methods:
  - *Function/Activity Modeling (IDEFØ)*
  - *Information Modeling (IDEF1)*
  - *Dynamic Modeling (IDEF2)*

Where to use IDEF

- CALS Implementations--transitioning from paper to electronic systems
- Business Process Reengineering / Improvement
- Business / Manufacturing System Documentation/ISO 9000 Compliance
- Software/Information System Development
- Manufacturing Systems Analysis and Design

In The Beginning. . .

- IDEF0 - *Activity Modeling*
- IDEF1 - *Information Modeling*
- IDEF1X - *Logical Data Modeling*

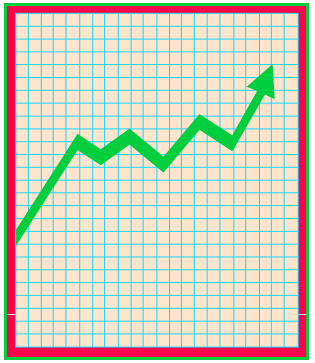
The Next Generation

- IDEF3 - *Process Modeling*
- IDEF4 - *Object-Oriented Design and Analysis*
- IDEF5 - *Ontology Description*
- IDEF9 - *Business Constraint Description*

Support for Systems Development

- IDEFØ is used to document what the enterprise does.
- IDEF3 models how the enterprise does what it does.
- IDEF1/1X capture how information is used to support what the enterprise does and how it does it.

With IDEF, systems development is based on real-world knowledge, not unrealistic goals.



Support for BPR Efforts

IDEFØ: Capture Activities and Their Relationships; Identify Core Activities; Identify Activities for Reengineering

IDEF3: Describe Business Processes; Redesign Processes for Improvement; Use Process Descriptions for Simulation

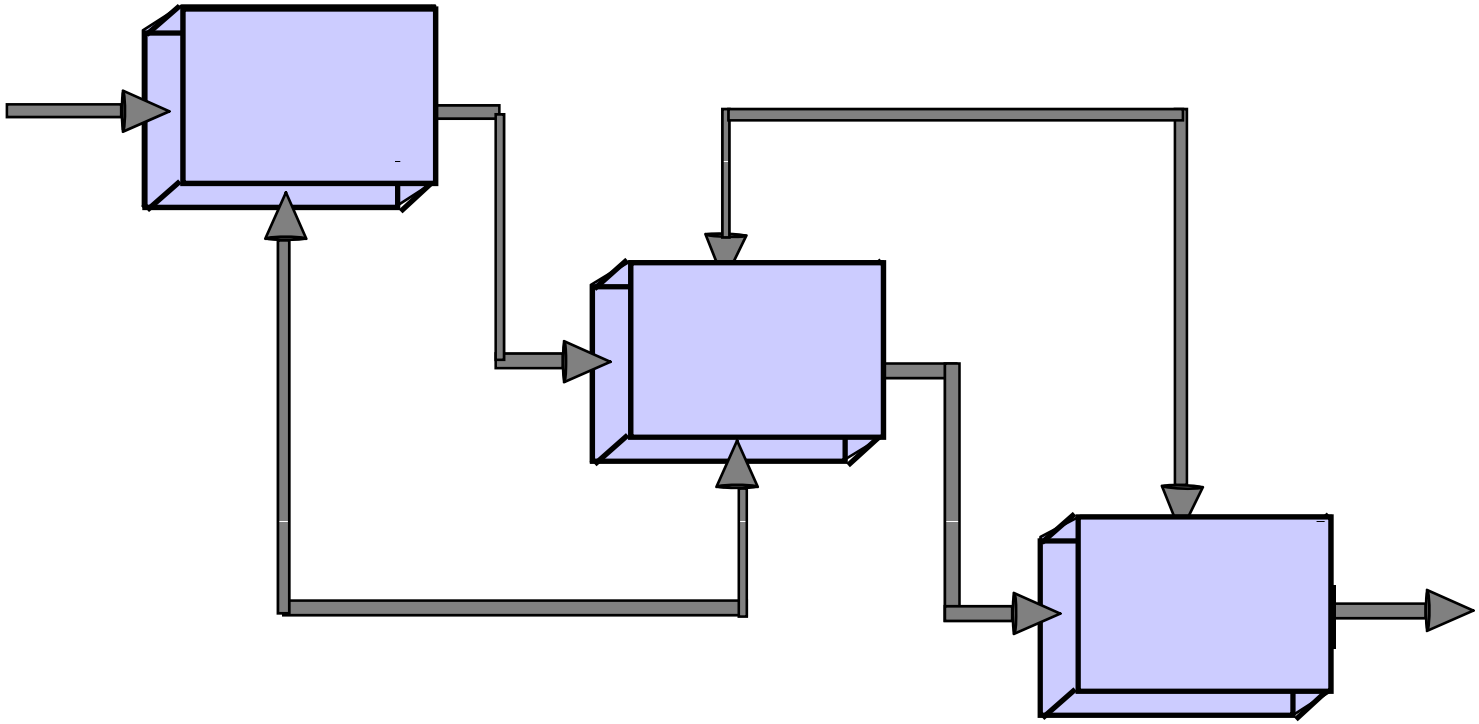
IDEF1/1X: Capture How Data and Information Are Used to Support Business Processes

Next Generation of IDEF Methods

Currently Envisioned Methods

- IDEF6 - Design Rationale Capture
- IDEF7 - Information System Audit Method
- IDEF8 - Human-System Interaction Modeling
- IDEF9 - Business-Constraint Discovery Method
- IDEF10 - Implementation Architecture Modeling
- IDEF11 - Information Artifact Modeling
- IDEF12 - Organizational Design Method
- IDEF13 - 3-Schema Architecture Design Method
- IDEF14 - Network / Distribution Design Method

IDEFØ Captures What an Enterprise Does



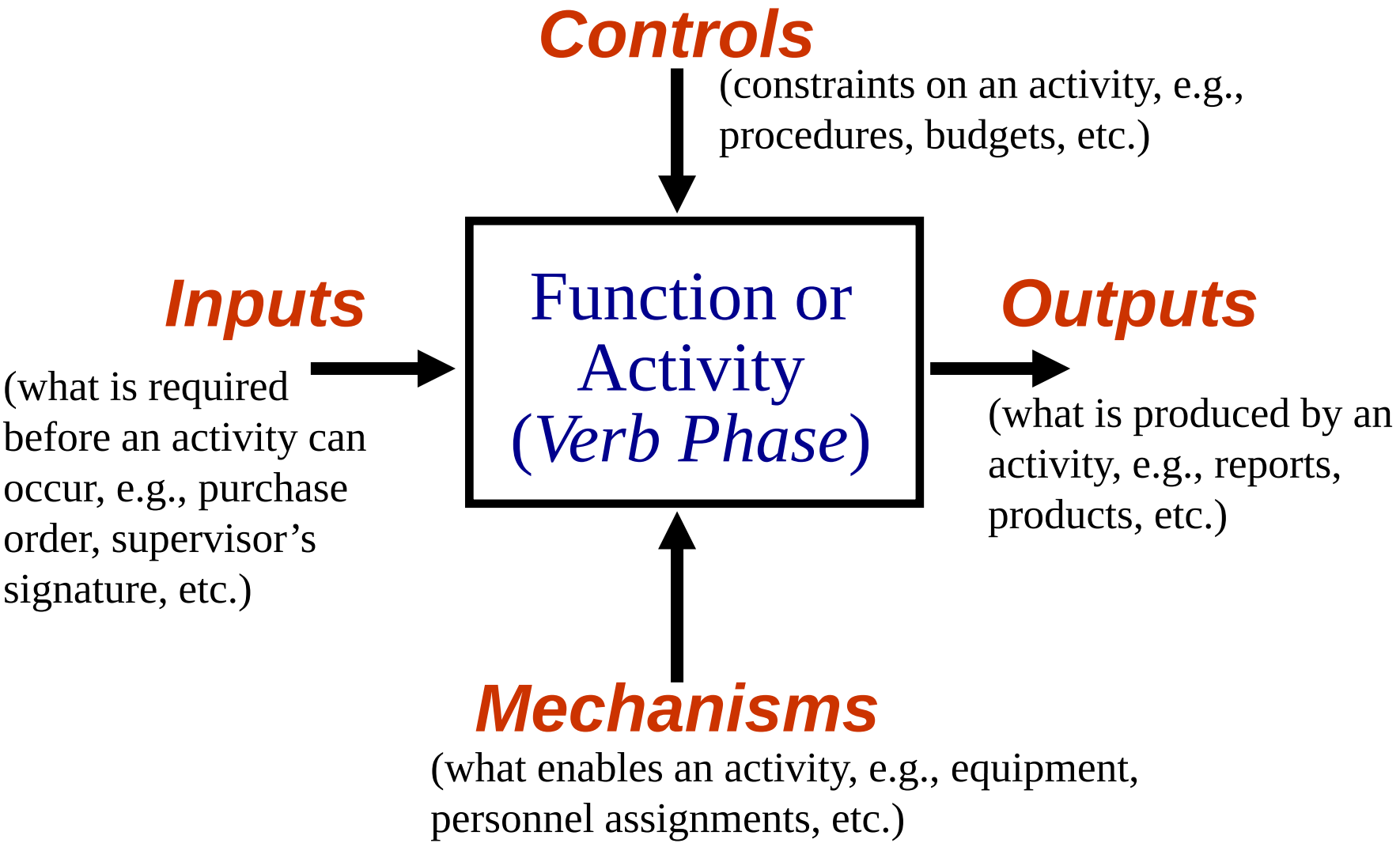
Why Develop An IDEFØ Activity Model?

- To identify, document, and communicate an enterprise's core activities.
- To understand how activities relate to one another.
- To identify value-added and non-value-added activities.
- To identify activities that need to be improved.

Benefits of Activity Modeling

- Documents current activities.
- Reduces the learning curve for new activity users.
- Captures and analyzes As-Is activities.
- Facilitates the design/redesign of activities for To-Be scenarios.

An IDEFØ Activity Box

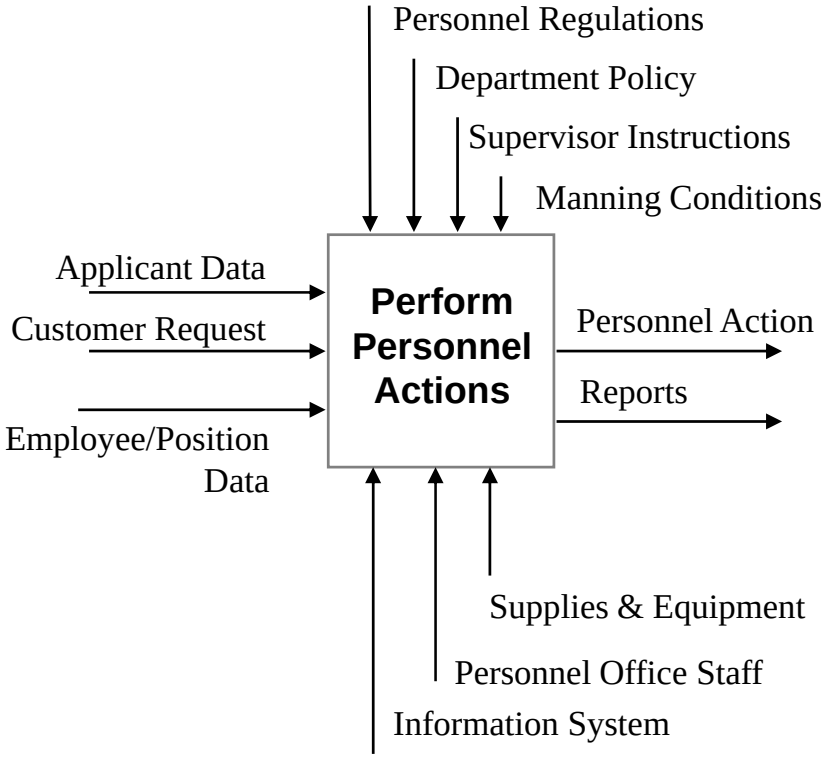


Context, Purpose, and Viewpoint:

The context defines the boundaries of your model—i.e., what will be included in the model.

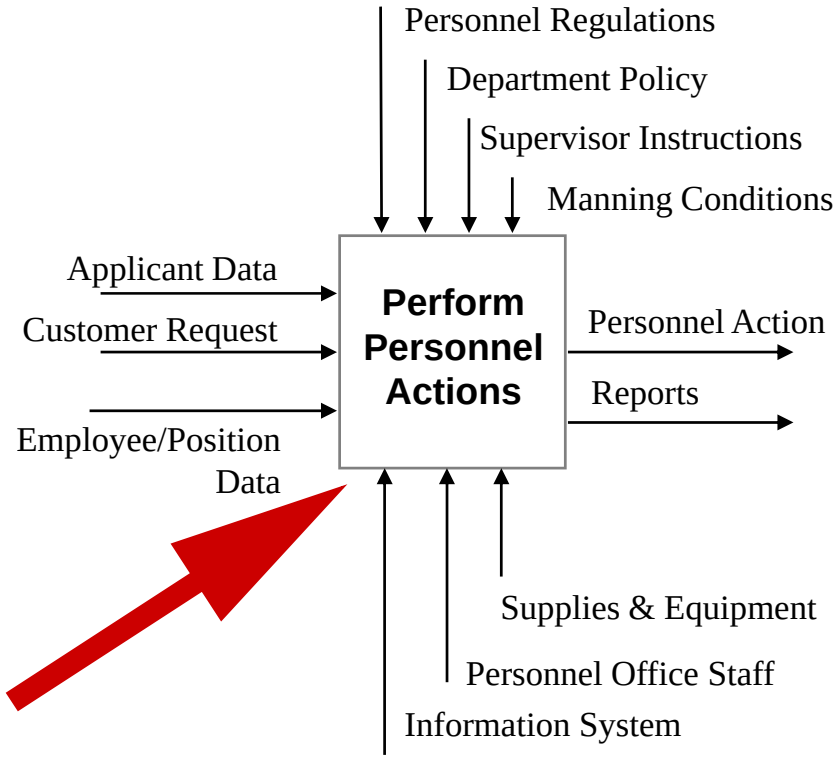
For example, Employee/Position Data comes from outside the model.

CONTEXT



Context, Purpose, and Viewpoint:

PURPOSE



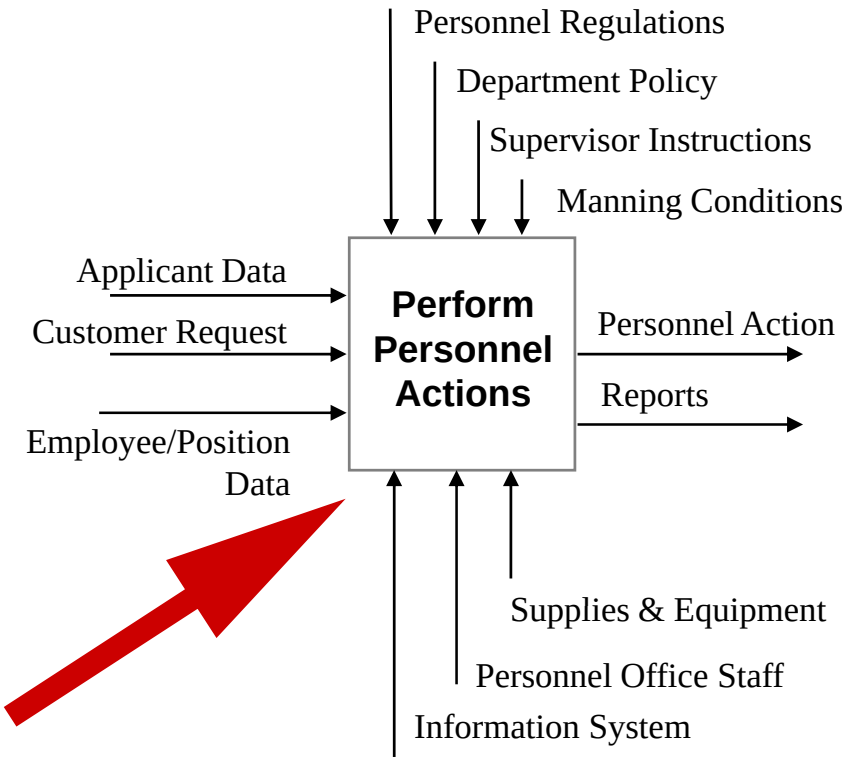
We define purpose as the reason to develop this particular activity model.

Purpose: To document the activities associated with managing Personnel Actions and identify non-value-added activities that might be eliminated.

Context, Purpose, and Viewpoint:

VIEWPOINT

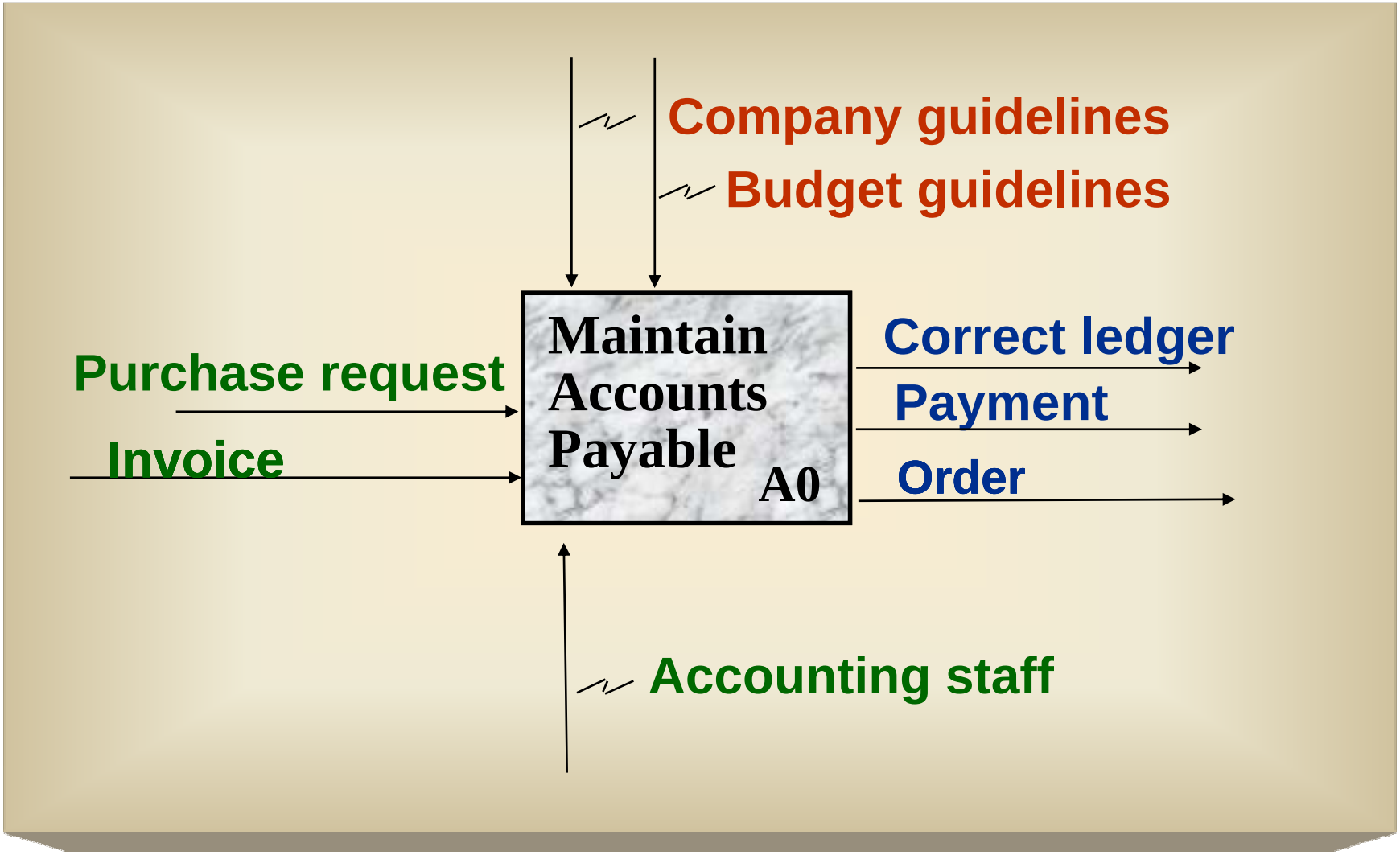
Viewpoint can be thought of as the perspective of the person/group developing the model.



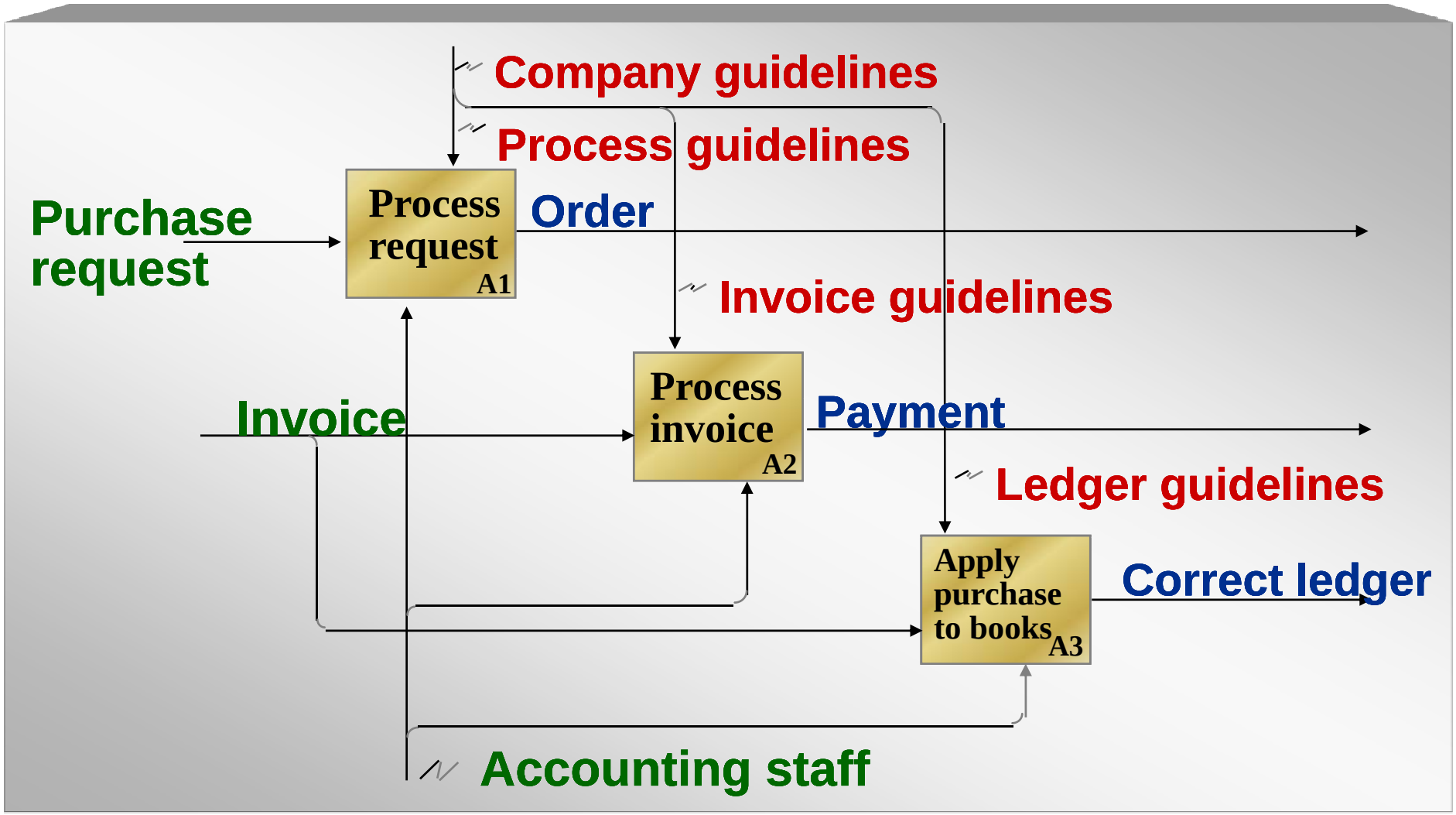
Viewpoint:

Personnel Officer

Decomposition: An Example



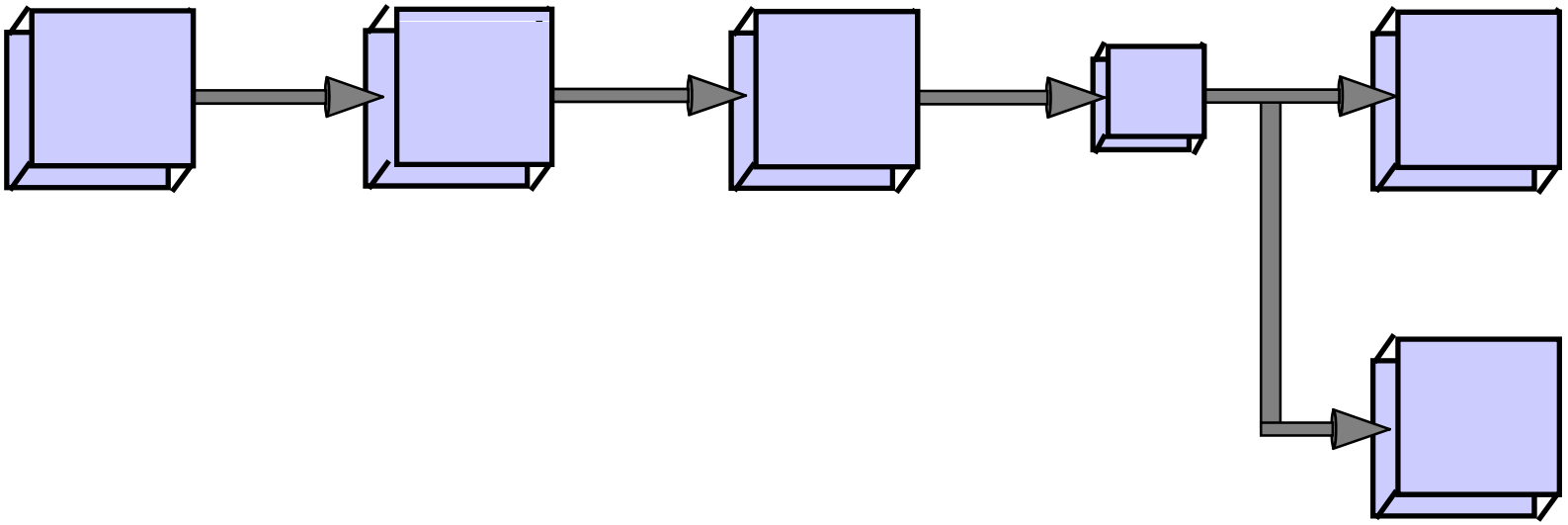
Decomposition: An Example



IDEFØ As a Standard

- Federal Information Processing Standards Publication (FIPS PUB) 183-Integrated Definition for Function Modeling (IDEFØ)
  - Published December 1993
- DoD 8020.1-M established that “IDEFØ is the DoD standard methodology used for activity modeling”
- Currently, ANSI Standard Being Developed

IDEF3 Captures How an Enterprise Does What It Does



Why Develop An IDEF3 Process Model?

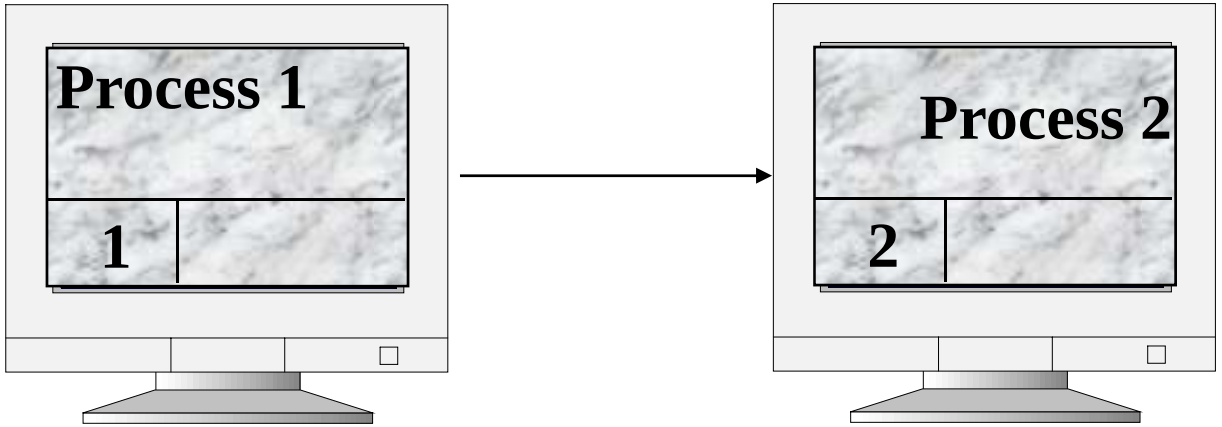
- To describe the process view of a process.
- To describe the OSTN view of a process.
- To capture timing and decision logic of processes.
- To support descriptions at any desired level of detail through *Decompositions*.
- To employ the concepts of *Scenarios* to simplify the structure of complex process flow descriptions.
- To support the capture of multiple viewpoints.

Benefits of Process Modeling

- Document current processes for standardization.
- Provide guidelines for new process members to reduce the learning curve.
- Capture and analyze As-Is processes.
- Design/redesign process for To-Be scenarios.
- Test the design of a new process before embarking on an expensive development project.

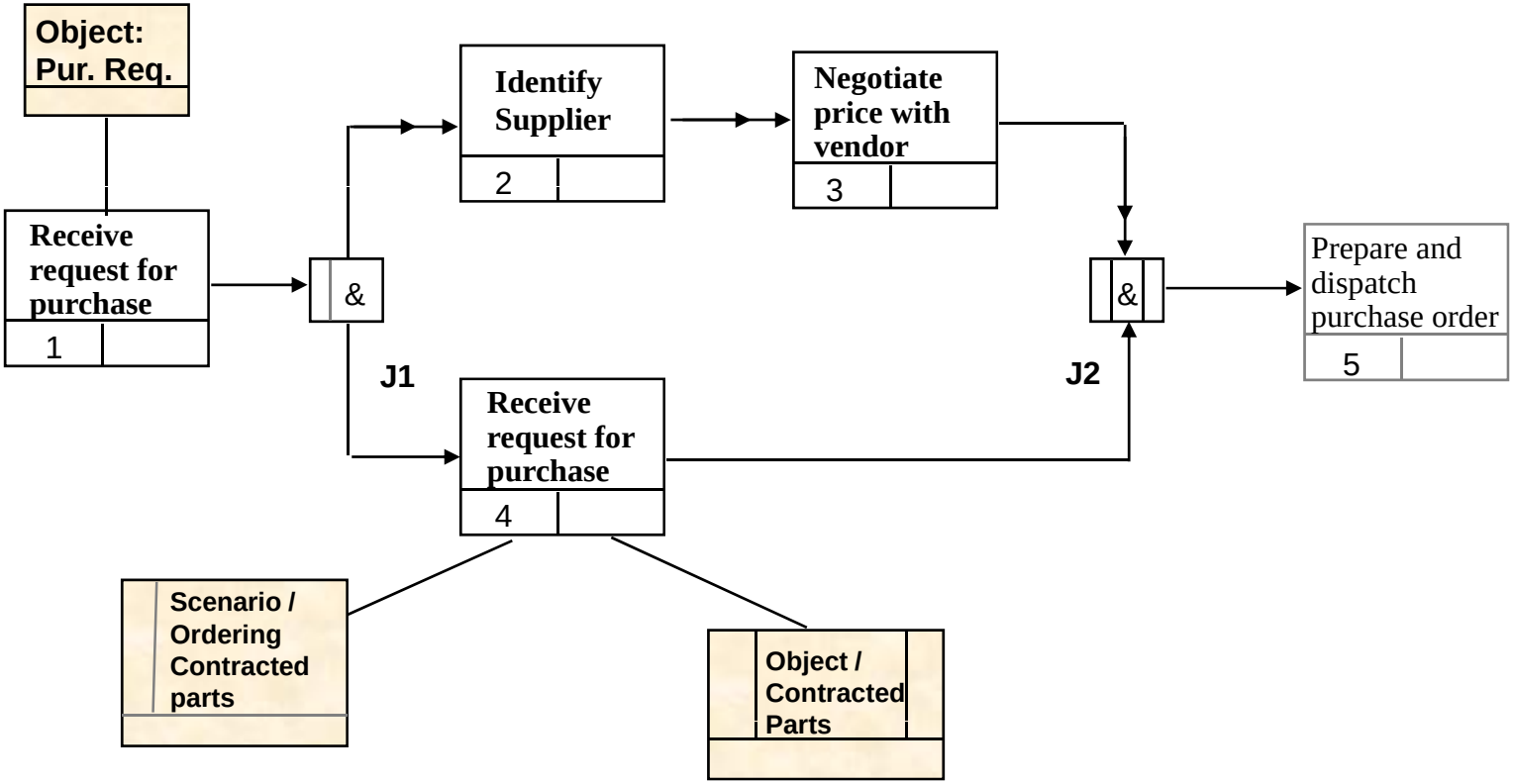
Precedence Link

Process 1 will need to be finished before you can do Process 2.



Referents

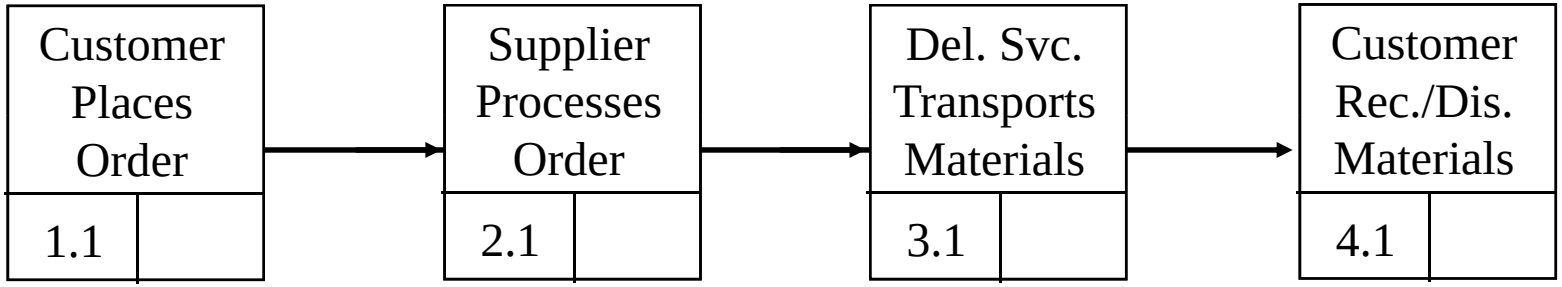
. . . simply point the reader to some other aspect of the model that needs to be considered.



Establish Scenario Objectives: (Viewpoint, Purpose, and Context)

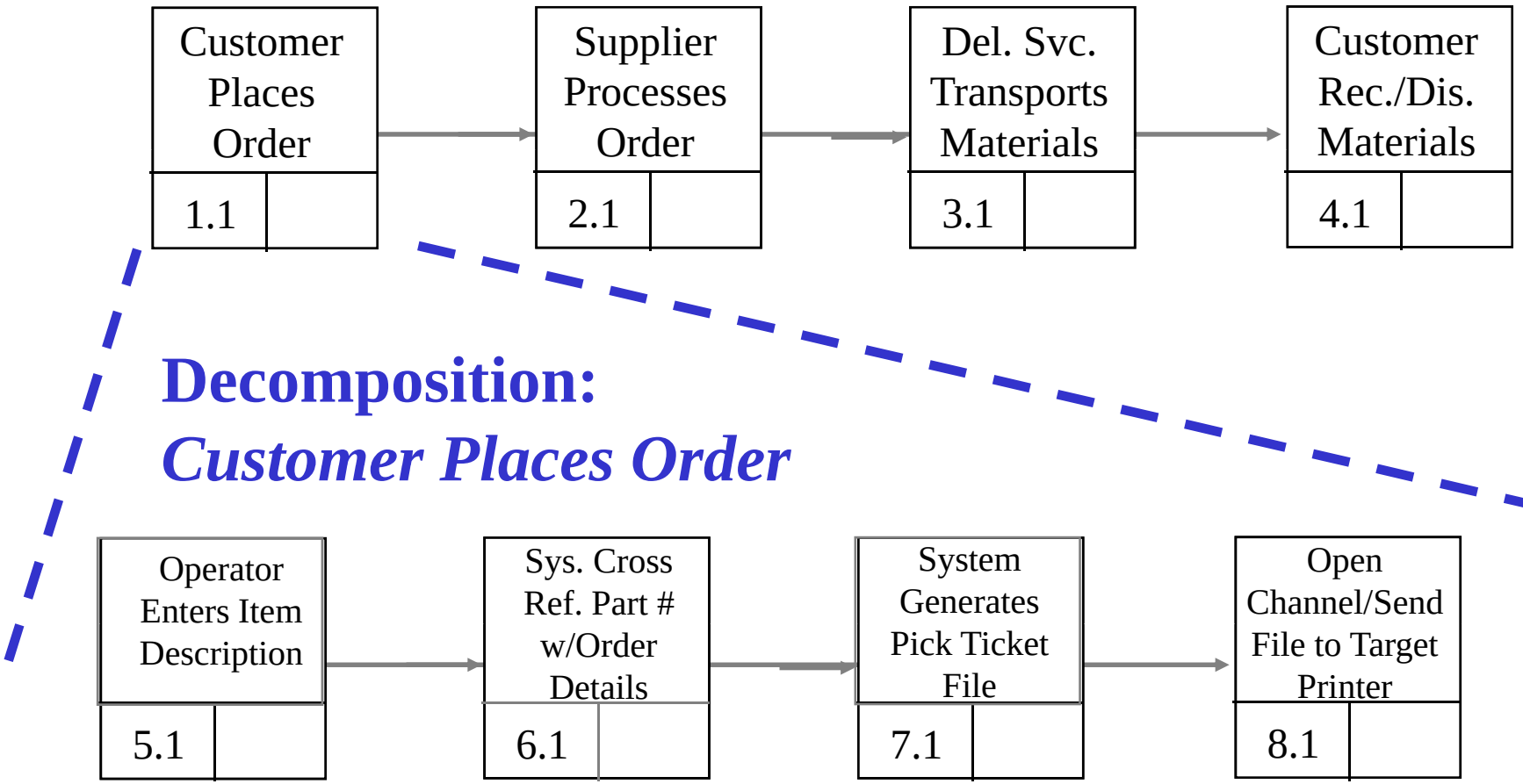
- *Viewpoint*
  - Determines what can be *seen* and from what *perspective.*
- *Purpose*
  - Establishes the goal of the communication intended by the description.
  - Defines why the description is being developed, and specifies how it will be used.
- *Context*
  - Establishes the subject of a description.
  - Establishes the subject as a part of a larger whole.
  - Creates a boundary within the environment.

Decompositions: Purchase Order Example

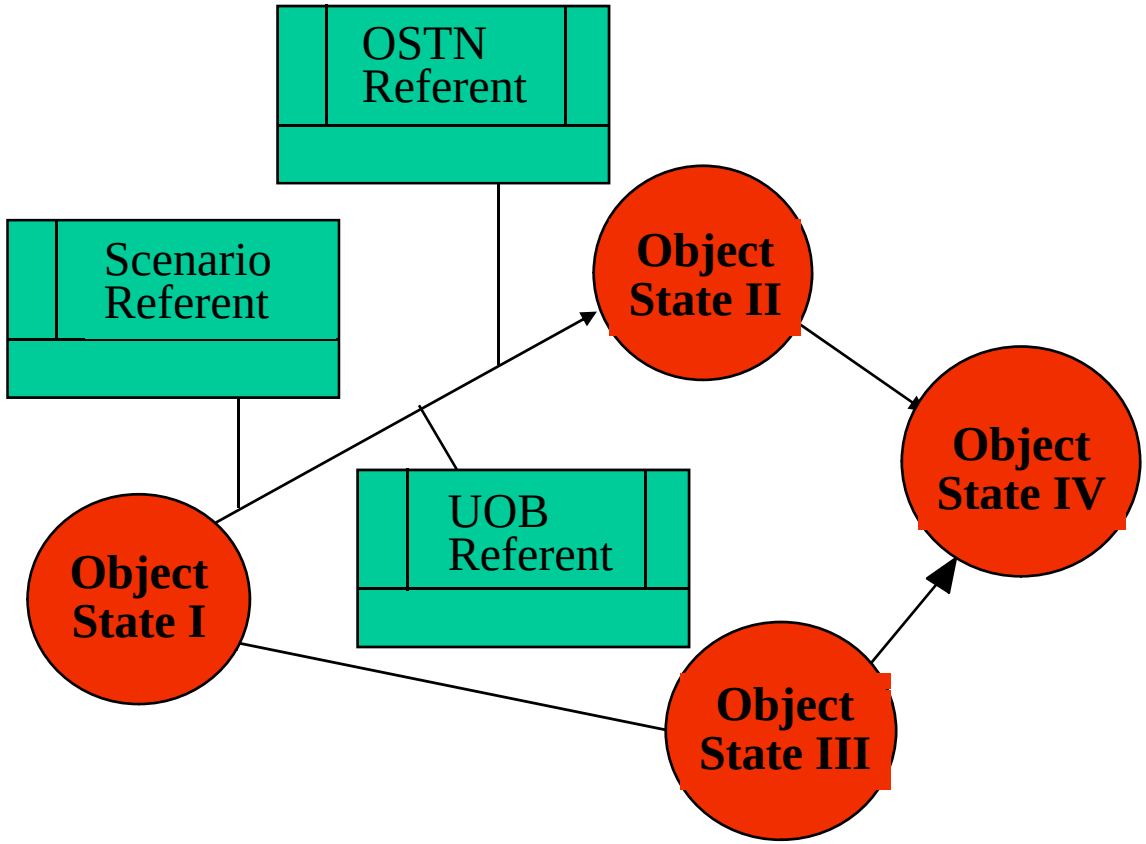


Top-level Scenario: *As-Is Order Process*

Decompositions: Purchase Order Example

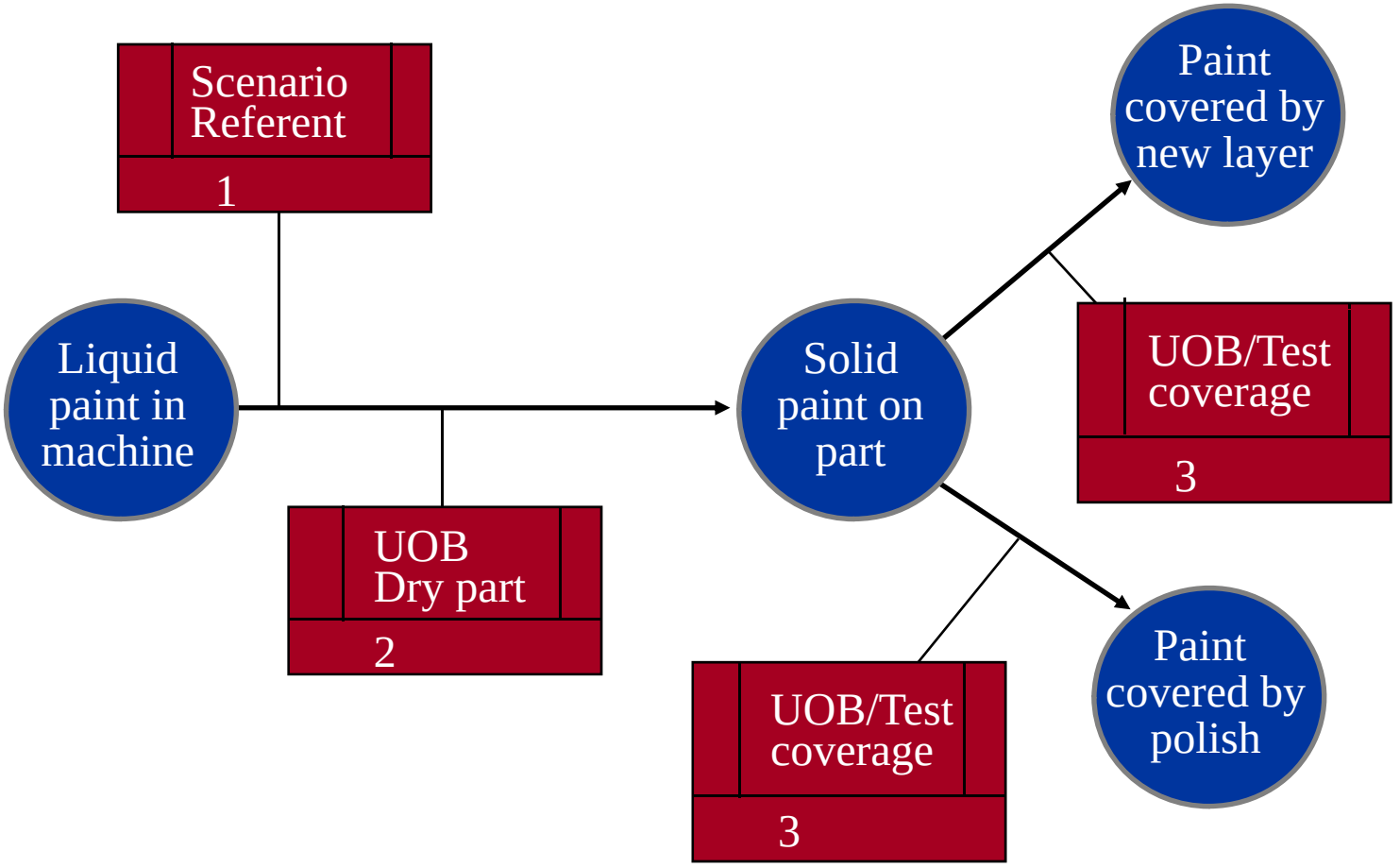


OSTN Diagram



- Allows construction of an object-centered view.
- Summarizes allowable transitions of an object in the domain.
- Document data life cycles.
- Cuts across the process flow diagrams.
- Characterizes dynamic behavior of objects.

Paint Shop OSTN: Focus Object: Paint



Comparing IDEFØ and IDEF3

IDEFØ Models

- What do I do?
- Single Viewpoint
- No timing or logic intended
- Target activities that require improvement

IDEF3 Models

- How do I do it?
- Multiple viewpoints
- Both time and cause-and-effect logic
- Improve specific processes

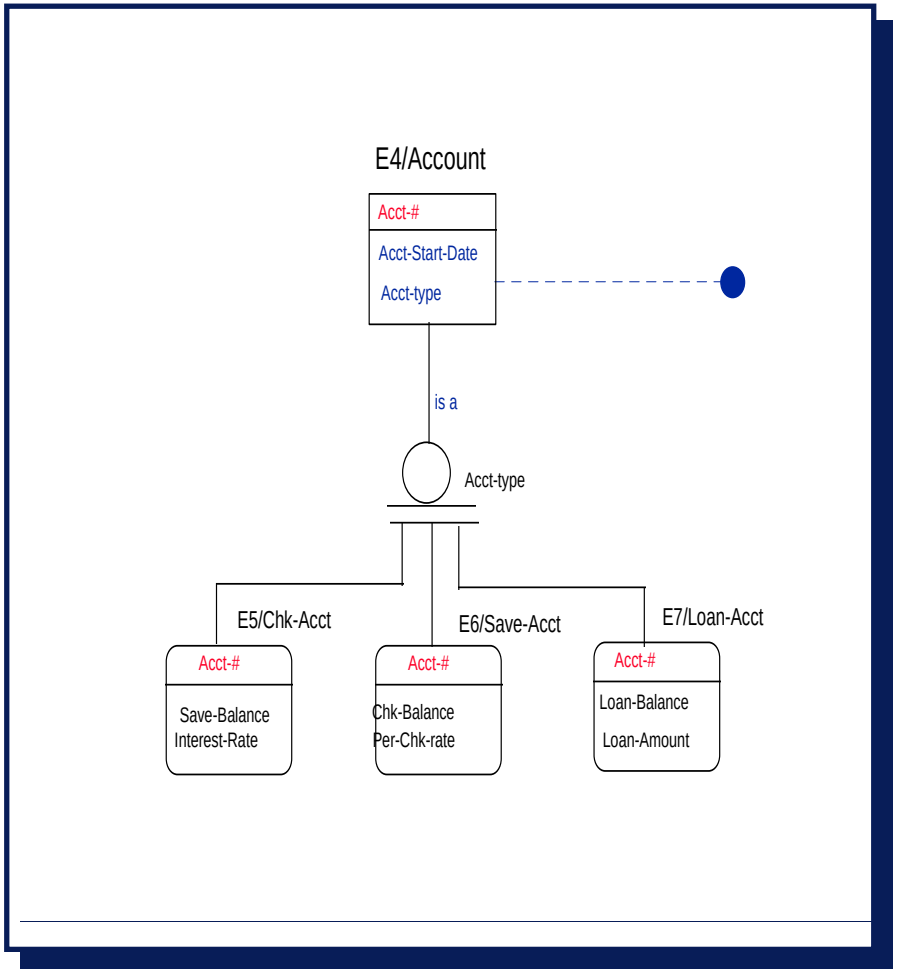
IDEF1X

Data Modeling

What is an IDEF1X Data Model

- **Graphical/Textual Depiction of the Data Relationships and Business Rules for an ADP System**

- **A Design of Logical Data Structures to be Implemented in a Relational Database**



What IDEF1X Is and Isn't

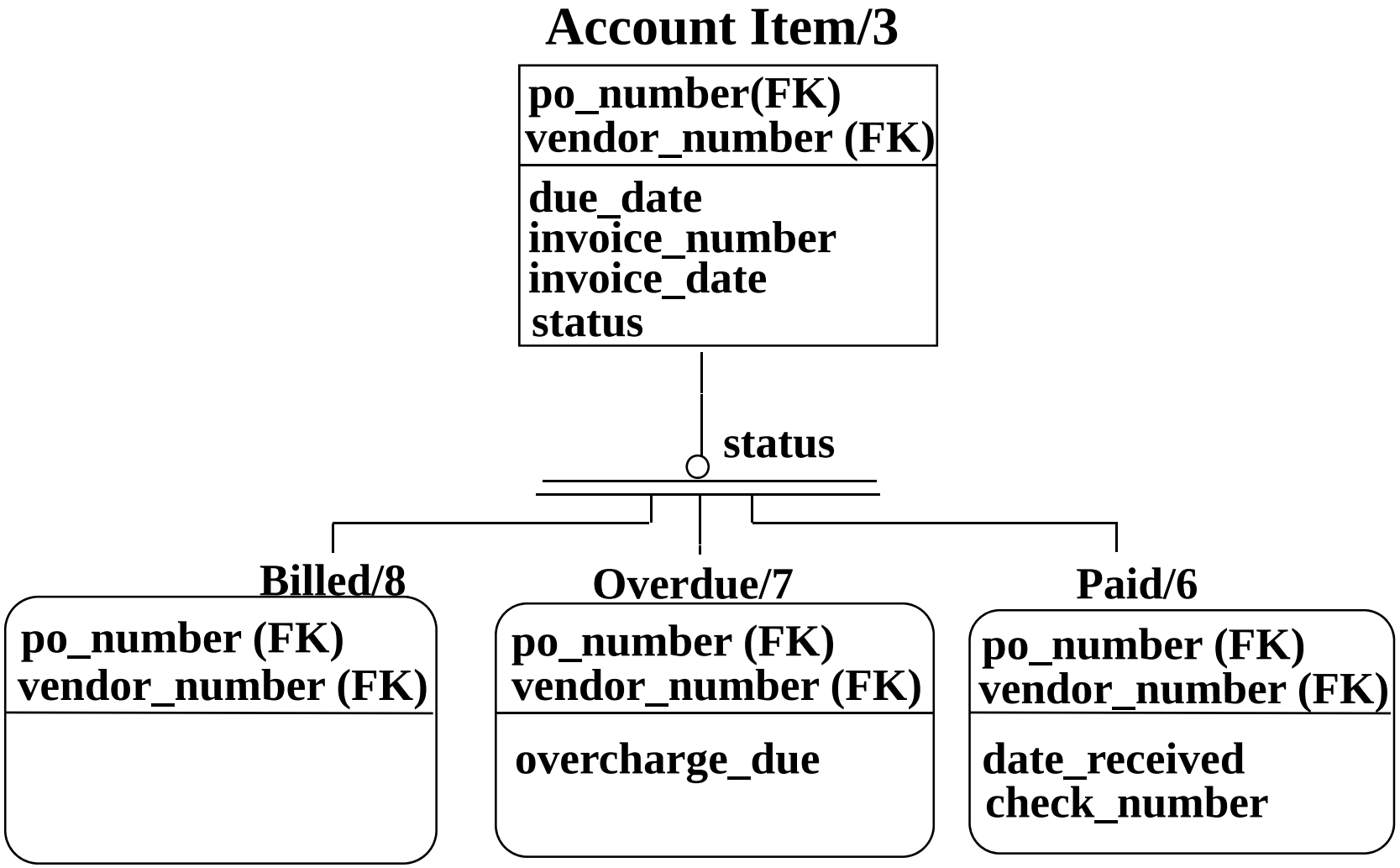
IDEF1X is:

- Data modeling
- For designing relational databases and systems
- For As-Is and To-Be data system analysis and modeling

IDEF1X isn't:

- For modeling real world things
- For designing Object-Oriented databases and systems

Categorization Migration Example



IDEF1X As a Standard

- Federal Information Processing Standards Publication (FIPS PUB) 184-Integrated Definition for Data Modeling (IDEF1X)
  - Published December 1994
- DoD 8020.1-M established that “IDEF1X is the DoD standard methodology used for data modeling”
- Currently, ANSI standard is being developed

Method Comparisons (IDEFØ, 1X, and IDEF3)

- **What you do**
- ***Functional dependencies***
- **Used to "target" activities that need improvement**
- **A modeling method**

- **What you need to know**
- ***Information Management or Database Design***
- **Information or Data Requirements**
- **Analysis method (1) /Design method (1X)**

- **How you do it**
- ***Precedence and Cause-&-Effect***
- **Reduce Cycle Time**
- **A description method**

Continuing the Development

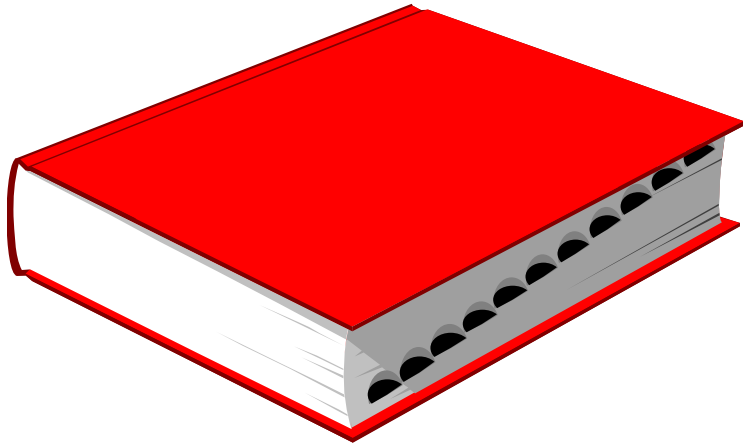
- IDEF4 Object-Oriented Design
- IDEF5 Ontology Description
- IDEF9 Business Constraint Description

IDEF4

Object-Oriented Design and Analysis

IDEF4: Object-Oriented Design Method

What Does "Object-Oriented" Mean?



By viewing a program from an object-oriented (OO) perspective, the developer can understand how the program behaves based on how its objects interact.

Why is IDEF4 Necessary?

- Reuse of legacy systems
- Improve the quality of OO code produced by novice OO programmers
- Structured design and relation design methods are not adequate for the design of object-oriented (OO) systems

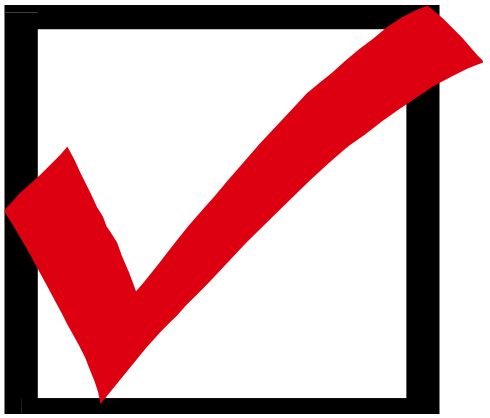
Motivation for IDEF4

- The need for a design tool that allows the use of commercial-off-the-shelf software and the reuse of existing systems
- The need for a design tool for those who will develop object-oriented databases and software
- To allow for the expression of domain knowledge in a more natural way (the object-oriented paradigm)

Features of IDEF4

- Views object-oriented design as part of a larger system development framework
- Emphasizes object-oriented design process over the graphical syntax, using graphical syntax and diagrams to communicate important design issues
- Provides support for “least commitment” strategies for assessing the design impact of the interaction between class inheritance, object composition, functional decomposition, and polymorphism

Benefits of IDEF 4



The intuitive nature of object-oriented programming makes it easier to produce code.

Unfortunately, the ease with which software is produced also makes it easier to create software of poor design, resulting in systems lacking re-usability, modularity, and maintainability. **The IDEF4 method is designed to assist in the correct application of this technology.**

IDEF5

Ontology Capture

IDEF5: Ontology Description Capture Method

The IDEF5 method was developed by KBSI to provide a method to assist in creating, modifying, and maintaining *ontologies*—a domain vocabulary complete with a set of precise definitions to enable consistent interpretation.

Motivation for IDEF5

- First step in CALS/CE/TQM is knowing what the other fellow is talking about.
- Lack of enabling technology for knowledge capture and sharing (the need for capturing alternative levels of abstractions)
- Lack of enabling technology for integrated systems (process as well as data integration services)
- Need to support collaborative decision making

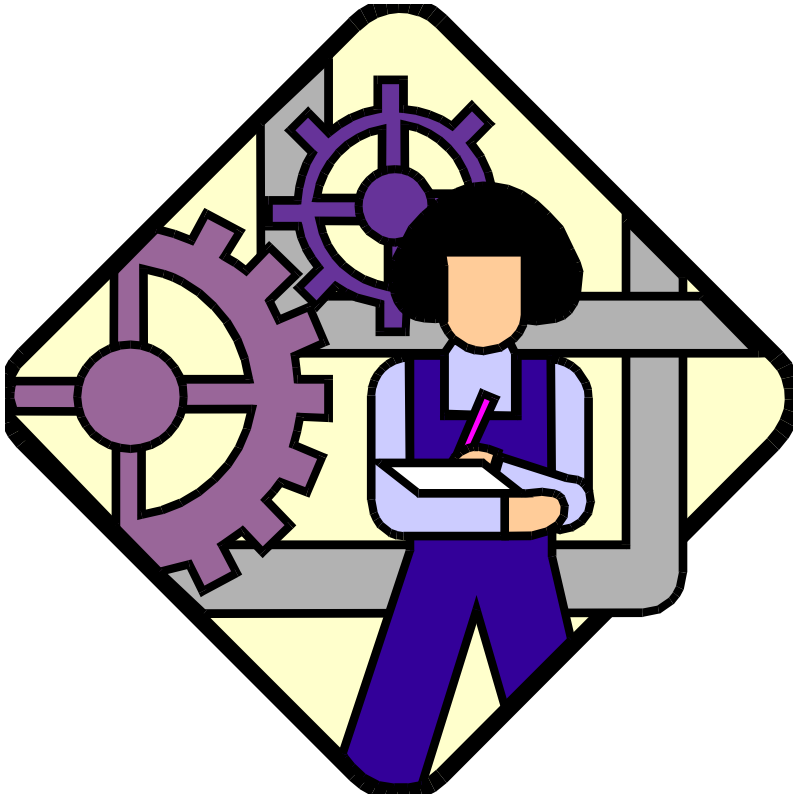
The Need for Ontologies

The nature of any domain is revealed through three aspects:

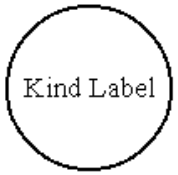
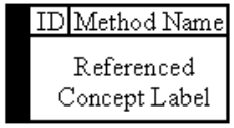
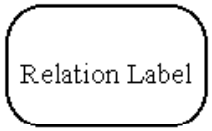
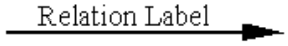
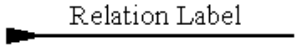
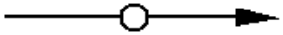
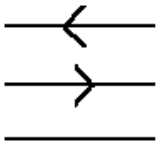
- *the vocabulary* used to discuss the characteristic objects and processes comprised in the domain
- *rigorous definitions* of the basic terms in that vocabulary
- characterization of the *logical connections* between those terms.

The Need for Ontologies

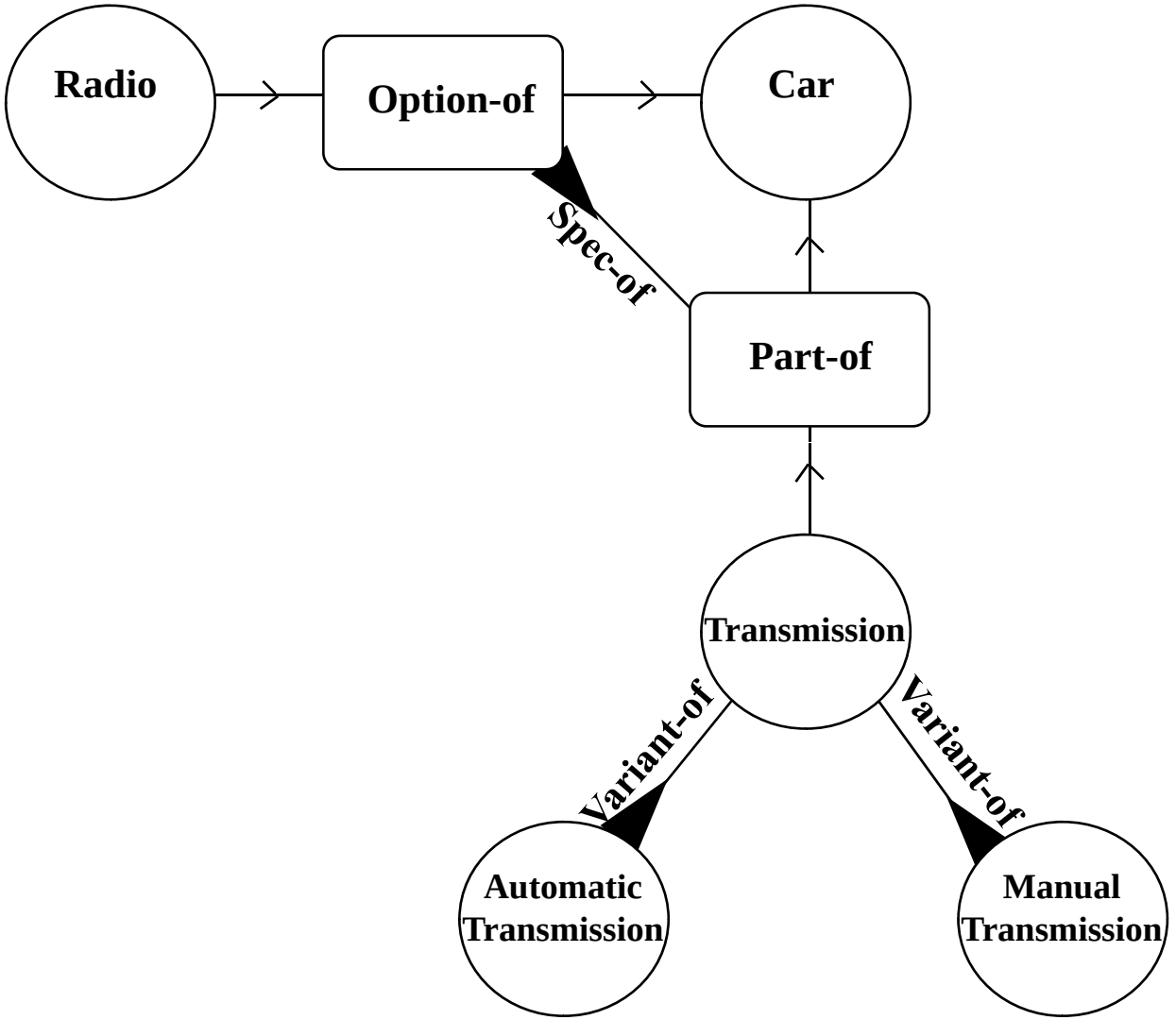
The IDEF5 method allows domain experts to construct ontologies that address these elements by capturing assertions about real-world objects, their properties, and their interrelationships.



IDEF5 Concepts: Schematic Language

Kind Symbols; Individual Symbols; Referents	**Relation Symbols; State Transition Symbols**	**Process Symbols; Connecting Symbols; Junctions**
Kind Symbols  Individual Symbols  Referents  	*n* -Place First-Order Relation Symbols  Alternative Two-Place First-order Relation Symbols  Two-Place Second-Order Relation Symbols  State Transition Symbols Weak Transition Arrow  Strong Transition Arrow  Instantaneous Transition Marker Δ	Process Symbols  Connecting Symbols  Junctions 

IDEF5 Complex Schematic



IDEF9: Business Constraint Discovery Method

Policies, rules, conventions, procedures, contracts, agreements, regulations, and societal and physical laws define an enterprise. These mechanisms forge relationships between people, information, material, and machines to make a system. We call these Business Constraints.

IDEF: The Next Generation

Released methods (published method reports)

- **IDEF3 - *Process Description Capture***
- **IDEF4 - *Object-Oriented (OO) Design***
- **IDEF4C++ - *OO Design using the C++ Language***
- **IDEF5 - *Ontology Description Capture***
- **IDEF6 - *Design Rationale Capture***
- **IDEF8 - *Human Systems Interaction Design***
- **IDEF9 - *Business-Constraint Discovery***
- **IDEF14 - *Network Design***