

Software Engineering: A Practitioner's Approach, 6/e

Chapter 6

System Engineering

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System ... Wazzat?

- A set or arrangement of things related to form a unity or organic whole
- A set of facts, rules, principles, etc... classified and arranged to show a logical plan linking the various parts
- A method or plan of classification or arrangement
- An established method of doing something; method; procedure

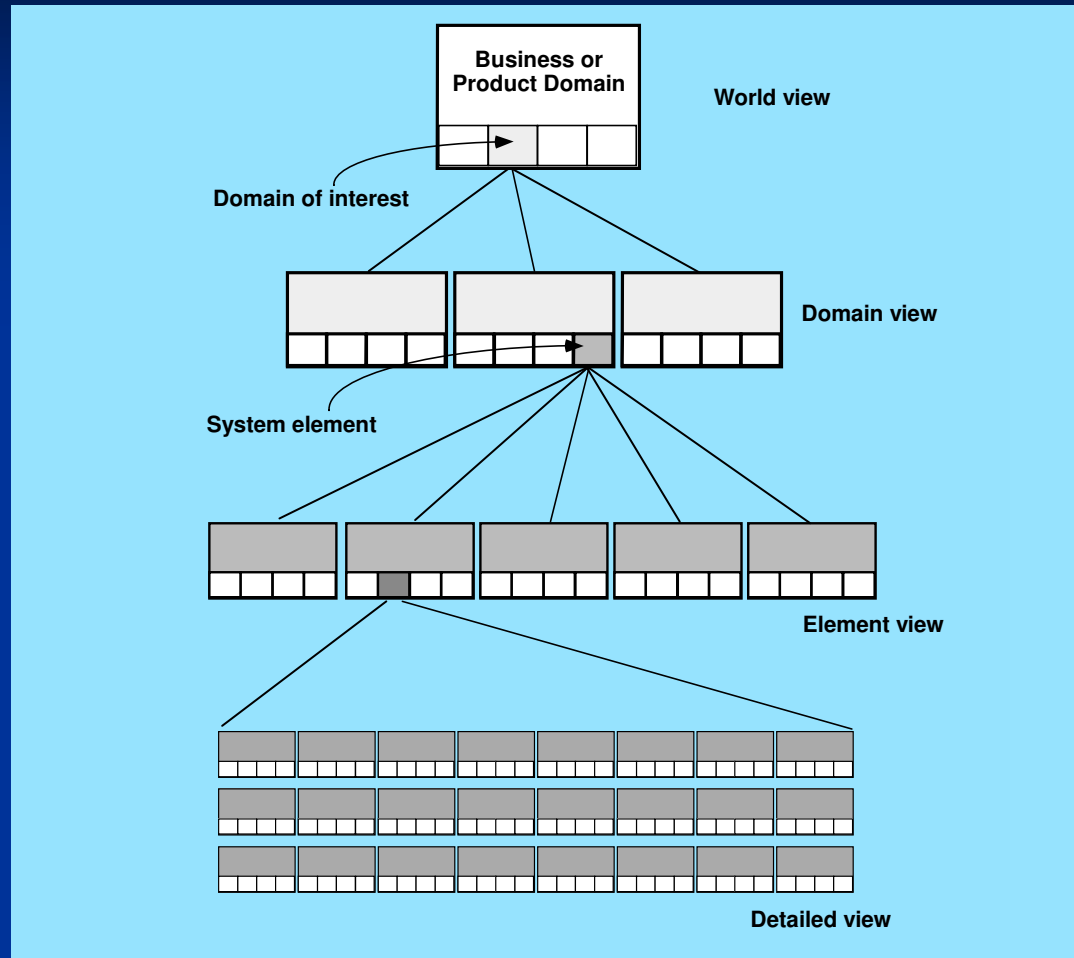
Computer-Based System

- A set or arrangement of elements organized in order to accomplish some predefined goal by processing information

System Engineering

- Elements of a computer-based system
 - Software
 - Hardware
 - People
 - Database
 - Documentation
 - Procedures
- Systems
 - A hierarchy of macro-elements

The Hierarchy



System Modeling

- Define the processes that serve the needs of the view under consideration.
- Represent the behavior of the processes and the assumptions on which the behavior is based.
- Explicitly define both exogenous and endogenous input to the model.
 - Exogenous inputs link one constituent of a given view with other constituents at the same level of other levels; endogenous input links individual components of a constituent at a particular view.
- Represent all linkages (including output) that will enable the engineer to better understand the view.

System Modeling

- Restraining factors:
 - **ASSUMPTIONS** reduce the number of possible permutations or variations
 - **SIMPLIFICATIONS** enable to create a model in a timely fashion
 - **LIMITATIONS** help to bound the system
 - **CONSTRAINTS** guide the manners in which a model is created and approaches taken when implementing the model
 - **PREFERENCES** indicate preferred architecture for all data, functions and technology. May clash with other restraining factors

System Simulation

- Used to verify and validate models before implementing them
- Helps eliminating surprises during implementation
- Allows system engineers to “test drive” the specifications of a system

System Engineering

- Two variants exist:
 - Business Process Engineering
 - Product Engineering

Business Process Engineering

- Uses an integrated set of procedures, methods, and tools to identify how information systems can best meet the strategic goals of an enterprise
- Focuses first on the enterprise and then on the business area
- Creates enterprise models, data models and process models
- Creates a framework for better information management distribution, and control

System Architectures

- Three different architectures must be analyzed and designed within the context of business objectives and goals:
- **Data architecture** provides a framework for the information needs of a business or business function
- **Application architecture** encompasses those elements of a system that transform objects within the data architecture for some business purpose
- **Technology infrastructure** provides the foundation for the data and application architectures

The BPE Hierarchy

- **Information strategy planning (ISP)**
 - strategic goals defined
 - success factors/business rules identified
 - enterprise model created
- **Business area analysis (BAA)**
 - processes/services modeled
 - interrelationships of processes and data
- **Application Engineering**
 - a.k.a ... software engineering
 - modeling applications/procedures that address (BAA) and constraints of ISP
- **Construction and delivery**
 - using CASE and 4GTs, testing

Information Strategy Planning

- Management issues
 - Define strategic business goals/objectives
 - Isolate critical success factors
 - Conduct analysis of technology impact
 - Perform analysis of strategic systems

- Technical issues
 - Create a top-level data model
 - Cluster by business/organizational area
 - Refine model and clustering

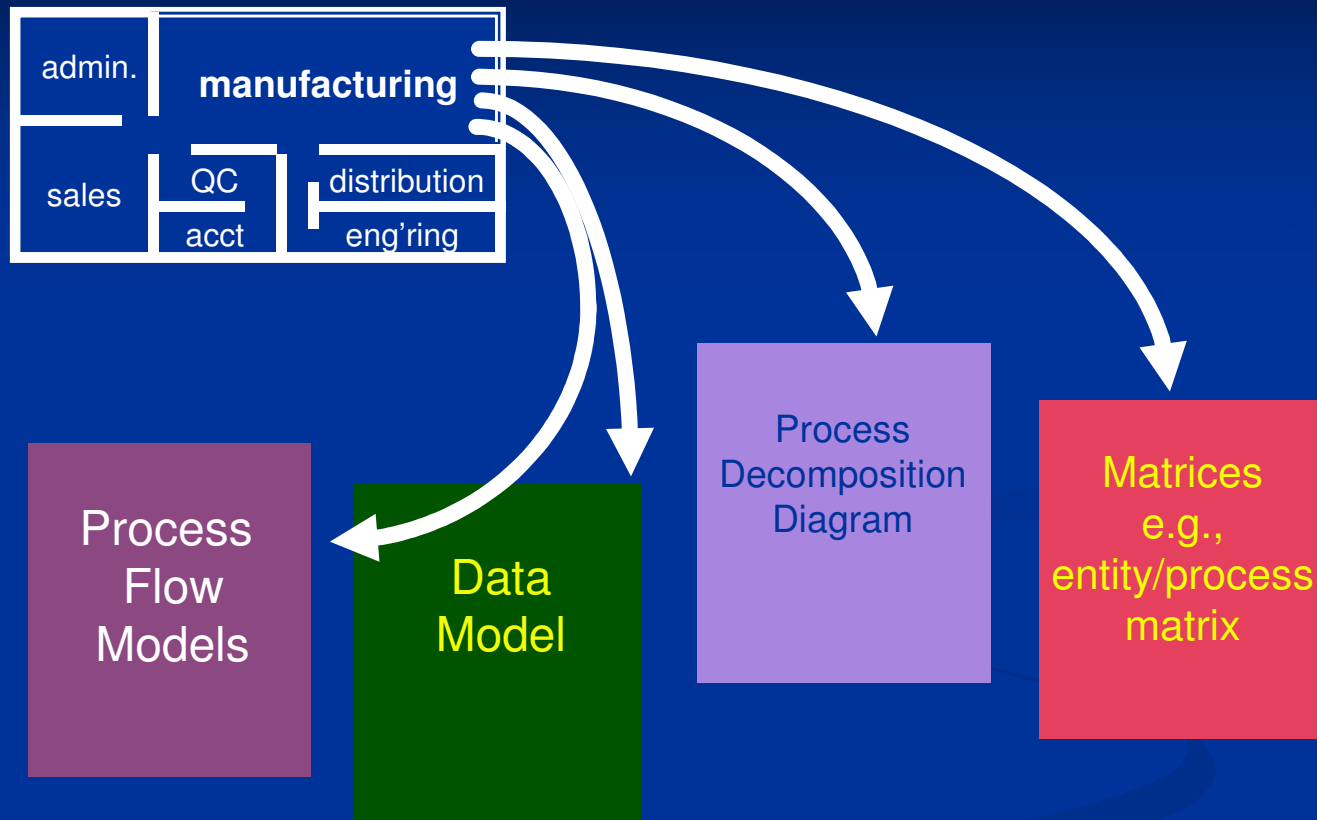
Defining Objectives and Goals

- **Objective**—general statement of direction
- **Goal**—defines measurable objective: “reduce manufactured cost of our product”
 - **Subgoals:**
 - ↓ decrease reject rate by 20% in first 6 months
 - ↓ gain 10% price concessions from suppliers
 - ↓ re-engineer 30% of components for ease of manufacture during first year
- Objectives tend to be strategic while goals tend to be tactical

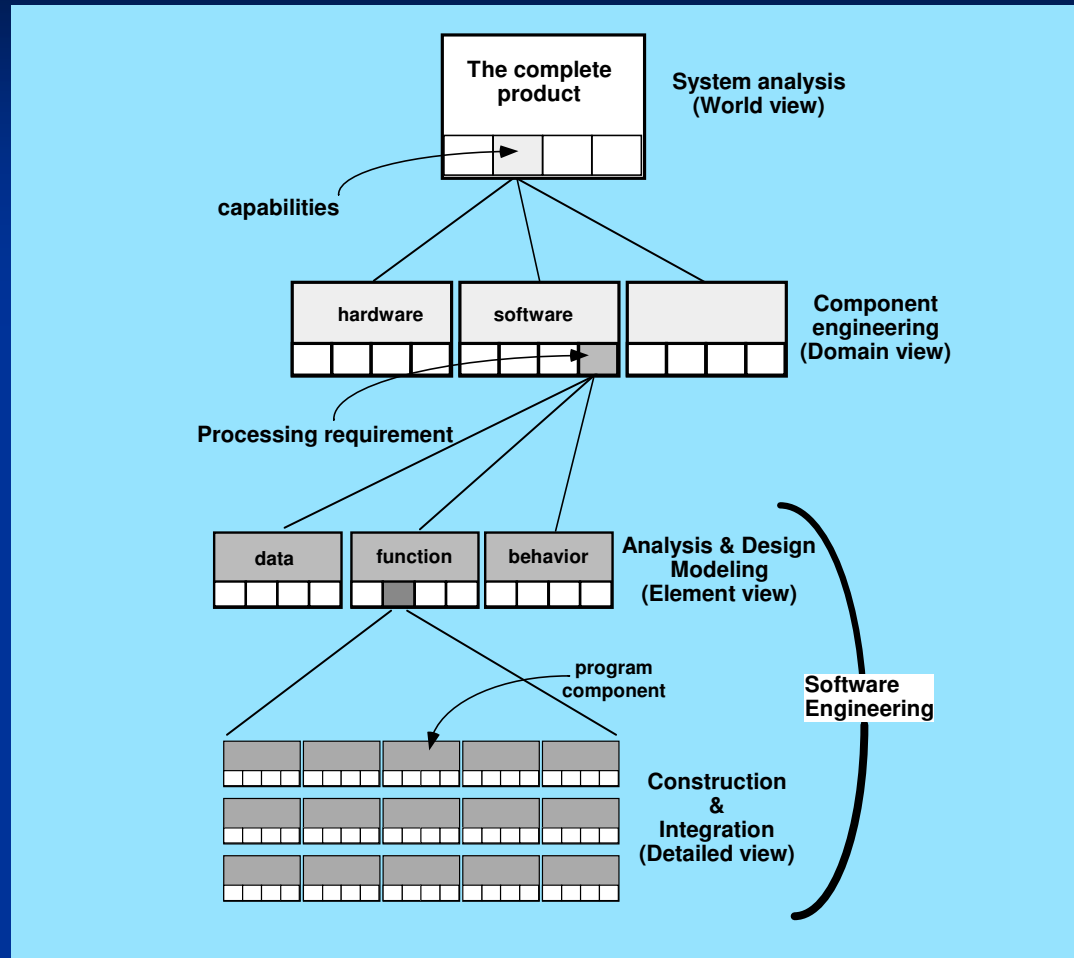
Business Area Analysis

- Define “naturally cohesive groupings of business functions and data” (Martin)
- Perform many of the same activities as ISP, but narrow scope to individual business area
- Identify existing (old) information systems / determine compatibility with new ISP model
 - Define systems that are problematic
 - Defining systems that are incompatible with new information model
 - Begin to establish re-engineering priorities

The BAA Process

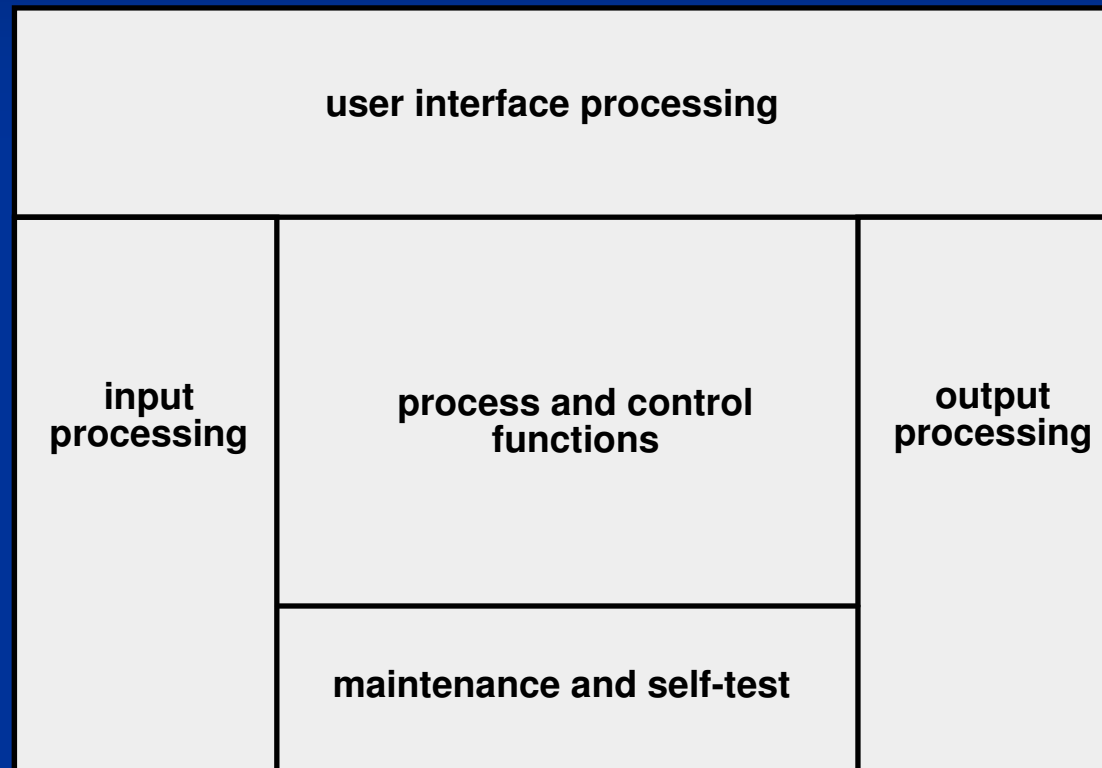


Product Engineering

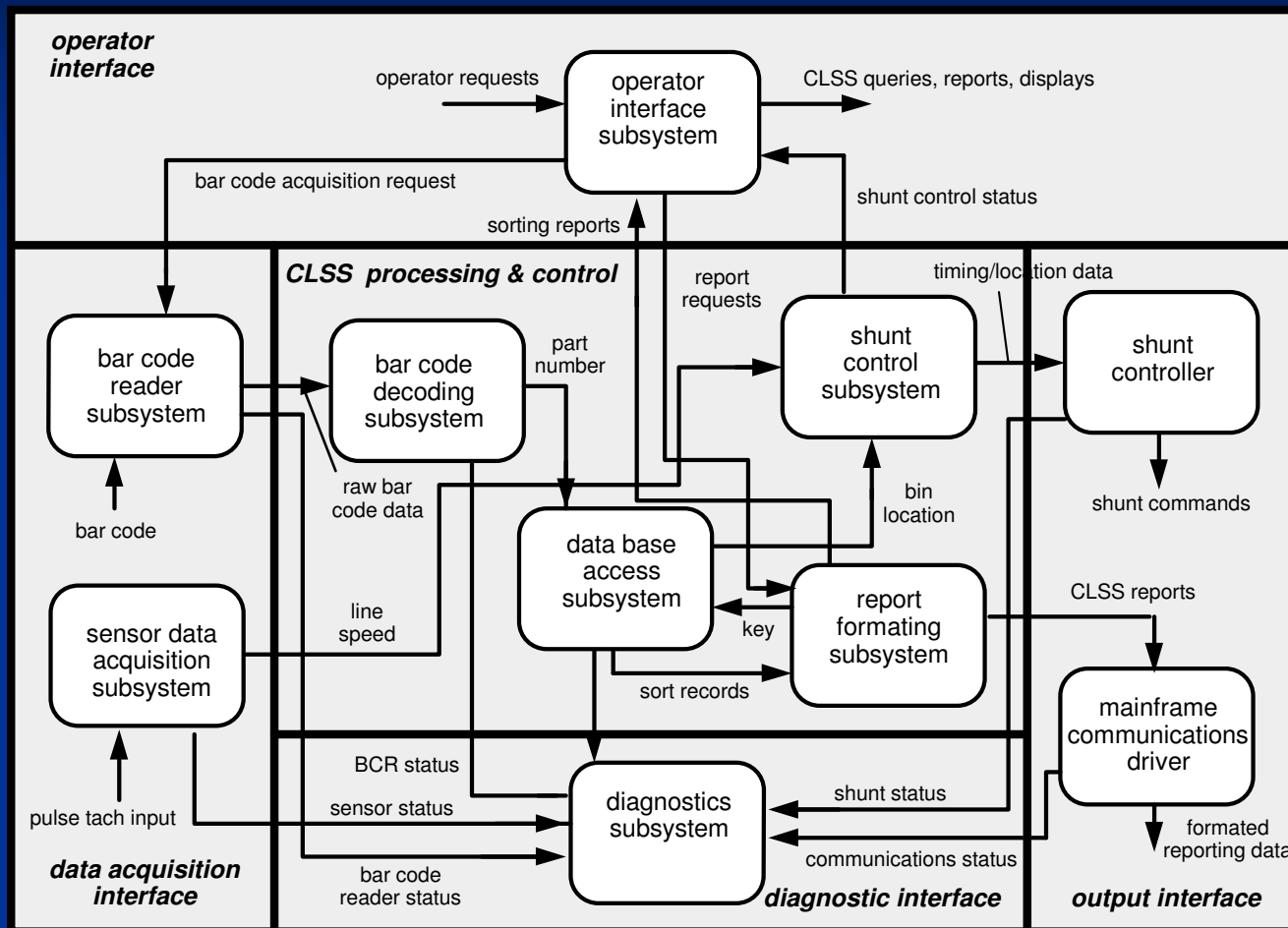


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Product Architecture Template (after Hatley-Pirbhai)



Architecture Flow Diagram



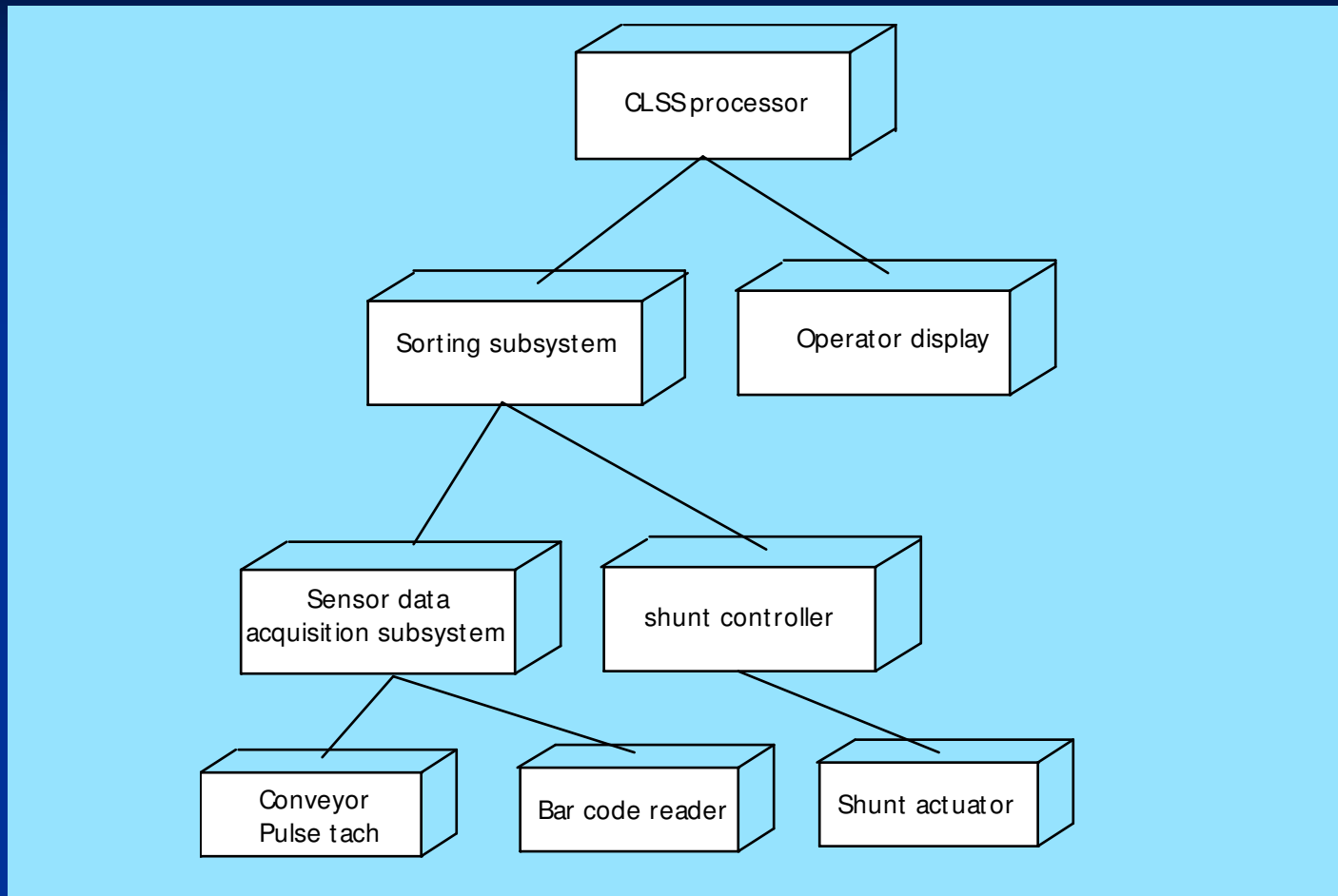
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System Modeling with UML

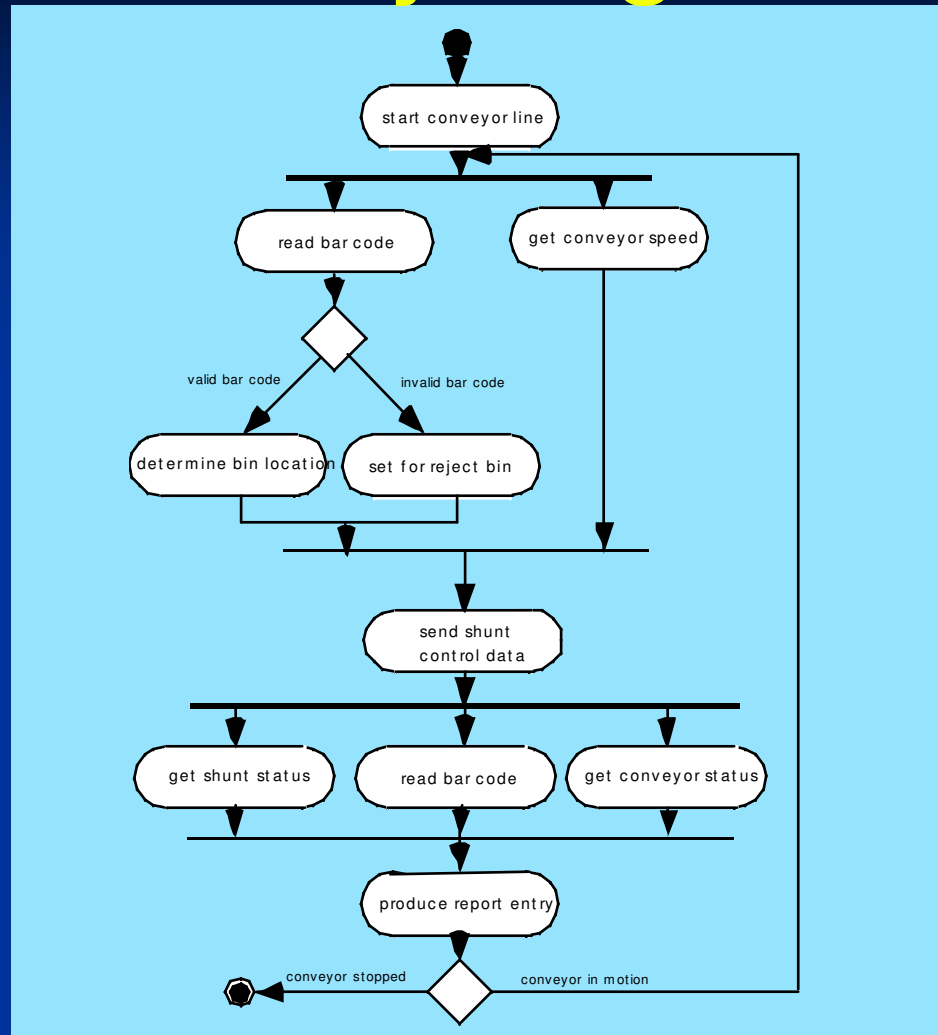
- **Deployment diagrams**
 - Each 3-D box depicts a hardware element that is part of the physical architecture of the system
- **Activity diagrams**
 - Represent procedural aspects of a system element
- **Class diagrams**
 - Represent system level elements in terms of the data that describe the element and the operations that manipulate the data

These and other UML models will be discussed later

Deployment Diagram



Activity Diagram



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Class Diagram

