Software Problem Definition

System Engineering Hierarchy

System Modeling
System Process & Modeling

Architectures Involved

- data architecture - who & why
  - framework for the information needs - customer
- applications architecture - how - approach
  - framework for the transformation of the information
- technology infrastructure - using
  - the methodology to accomplish the transformation

Example

Goal - translate a customer's desires into a working product
  First step - into requirements and specifications for a working product
  Putting details into application arch & tech. infrastructure

Component Level - Program requirements and specs.

Requirements Engineering

Methodology - product level

- specify the system behavior without eluding of its implementation
- understand the customer
- functional requirements
  - the services the system should provide
    - e.g., the system provides a set of tools for drawing figures
- non-functional
  - the features the system should provide
    - e.g., the system should be reliable
  - the constraints on the system
    - e.g., run within 10 mbytes of memory
Requirements document - organization

It should specify behavior, constraints on implementation, any thoughts about life cycle (use), responses to events, etc.
Like other documents in engineering process, it should enable evolution.

Requirements document

Problem - use of natural language
  - lack of clarity
  - confusion between functional & non-functional requirements
  - lack of completeness, conflicts, etc.
Partial solution
  - Outline format with rationale
  - Numerics allow for significant referencing
Example
2.6 Drawing figures
2.6.1 The system shall provide a tools for drawing and editing figures. The tools are limited to lines, arcs, rectangles, and ovals.
Rationale: The components are those needed for ABC Design Tool

Requirements - approach

Interface with customer
  - Understanding
  - gather knowledge of system - understanding
  - Collection
  - understanding the system features needed
  - Classification
  - clustering features for further analysis
  - Conflict resolution
  - not all features may be compatible

Validation - make sure of the needs by revisiting.

Prioritization
  - which must be included
Requirements Development

Getting the requirements right

Difficulties:
- Customer doesn’t know what he wants - or cannot describe
- Difficult to translate into computer terminology
- Conflicting requirements (not obvious on surface)
- Organizational, economic, business factors may be involved.
- Political factors may be involved

Requirements - mechanisms

Method-based analysis - close to design
- Model the system using design-like procedures

Scenario analysis - viewpoint
- Consult, interact with all persons & environments involved
  - Note: this can be a difficult & time consuming task
- Brainstorm actions, operations, services, exceptions, etc.
- Scope of viewpoints
  - Data sources & sinks
  - Frameworks - organization & structure
  - Users of service
  - Environment

Scenario organization

Describe & organize all activities for the system
- Use of description templates
  - Service and viewpoint
  - Use data flow, event, hierarchy, etc. charts & diagrams
  - Pressman’s traceability tables & context diagrams

Example - Bank card account system

<table>
<thead>
<tr>
<th>Service operations</th>
<th>Service actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Holder Actions</td>
<td>Control Input</td>
</tr>
<tr>
<td>Withdraw cash</td>
<td>Start</td>
</tr>
<tr>
<td>Query Balance</td>
<td>Select service</td>
</tr>
<tr>
<td>Order materials</td>
<td>Cancel</td>
</tr>
<tr>
<td>Transfer funds</td>
<td>End</td>
</tr>
</tbody>
</table>

Data
- Card Info
- PIN
- Amount
- Message
Scenario organization - templates

Service template

- Reference: Withdraw cash
- Rationale: Improve customer relations & reduce paperwork
- Specs: Press CW button
- Users: Accnt. holder & foreign user
- Constraint: Complete within 1 minute.

Viewpoint template

- Reference: Accnt holder
- Attributes: Accnt name, no., PIN
- Events: Start trans., Select service, Cancel trans., Withdraw cash
- Services: Query Balance, Order materials, Transfer funds

System context

Consider the whole environment

People context

- Most difficult
- Get help - your author suggests sociologists
- Use prototyping with testing
- Use evolutionary development
- Succeed - profit by your mistakes