Requirements Analysis

Session 12

INFM 603

The System Life Cycle

- Systems analysis
  - How do we know what kind of system to build?
- User-centered design
  - How do we discern and satisfy user needs?
- Implementation
  - How do we build it?
- Management
  - How do we use it?

Systems Analysis

- First steps:
  - Understand the task
    - Limitations of existing approaches
  - Understand the environment
    - Structure of the industry, feasibility study
- Then identify the information flows
  - e.g., Serials use impacts cancellation policy
- Then design a solution
  - And test it against the real need

What are Requirements?

- Attributes
  - Appearance
  - Concepts (represented by data)
- Behavior
  - What it does
  - How you control it
  - How you observe the results

Types of Requirements

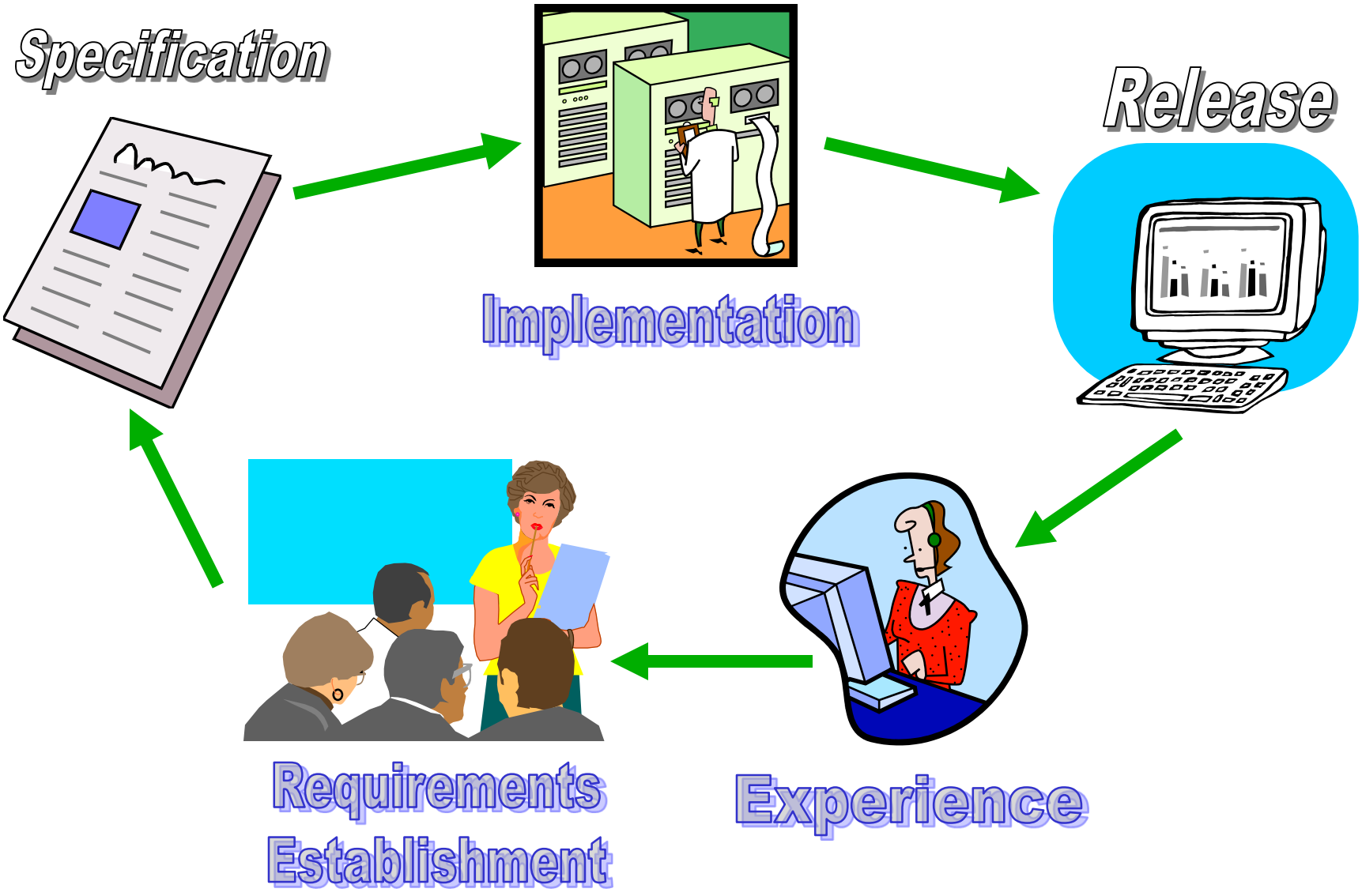
- User-centered
  - Functionality
- System-centered
  - Availability
    - Mean Time Between Failures (MTBF)
    - Mean Time To Repair (MTTR)
  - Capacity
    - Number of users for each application
    - Response time
  - Flexibility
    - Upgrade path

Who Sets the Requirements?

- People who need the task done (customers)
- People that will operate the system (users)
- People who use the system's outputs
- People who provide the system's inputs
- Whoever pays for it (sponsor)

The Waterfall Model

Agile Methods



The Requirements Interview

- Focus the discussion on the task
  - Look for objects that are mentioned
- Discuss the system's most important effects
  - Displays, reports, data storage, device control, …
- Learn where the system's inputs come from
  - People, stored data, devices, …
- Note any data that is mentioned
  - Try to understand the structure of the data
- Shoot for the big picture, not every detail

Analyze the Information Flows

- Where does information originate?
  - Might come from multiple sources
  - Feedback loops may have no identifiable source
- Which parts should be automated?
  - Some things are easier to do without computers
- Which automated parts should be integrated?
- What existing systems are involved?
  - What information do they contain?
  - Which systems should be retained?
  - What data will require “retrospective conversion”?

Interaction Modality Choices

- Interactive ("timesharing")
  - Usually multiple processes on one machine
  - Possibly supporting different users
- Batch processing (e.g., recall notices)
  - Save it up and do it all at once

Management Issues

- Policy
  - Privacy, access control, appropriate use, …
- Training
  - System staff, organization staff, “end users”
- Operations
  - Fault detection and response
  - Backup and disaster recovery
  - Audit
  - Cost control (system staff, periodic upgrades, …)
- Planning
  - Capacity assessment, predictive reliability, …

Total Cost of Ownership

- Planning
- Installation
  - Facilities, hardware, software, integration, migration, disruption
- Training
  - System staff, operations staff, end users
- Operations
  - System staff, support contracts, outages, recovery, …

Strategic Choices

- Acquisition strategy
  - Off-the-shelf (“COTS”)
  - Open source
  - Custom-developed
- Implementation strategy
  - “Best-of-breed”
  - Integrated system

Open Source “Pros”

- More eyes ⇒ fewer bugs
- Iterative releases ⇒ rapid bug fixes
- Rich community ⇒ more ideas
  - Coders, testers, debuggers, users
- Distributed by developers ⇒ truth in advertising
- Open data formats ⇒ Easier integration
- Standardized licenses

Open Source “Cons”

- Communities require incentives
  - Much open source development is underwritten
- Developers are calling the shots
  - Can result in feature explosion
- Proliferation of “orphans”
- Diffused accountability
  - Who would you sue?
- Fragmentation
  - “Forking” may lead to competing versions
- Little control over schedule

Open Source Business Models

- Support Sellers

  Sell distribution, branding, and after-sale services.

- Loss Leader

  Give away the software to make a market for proprietary software.

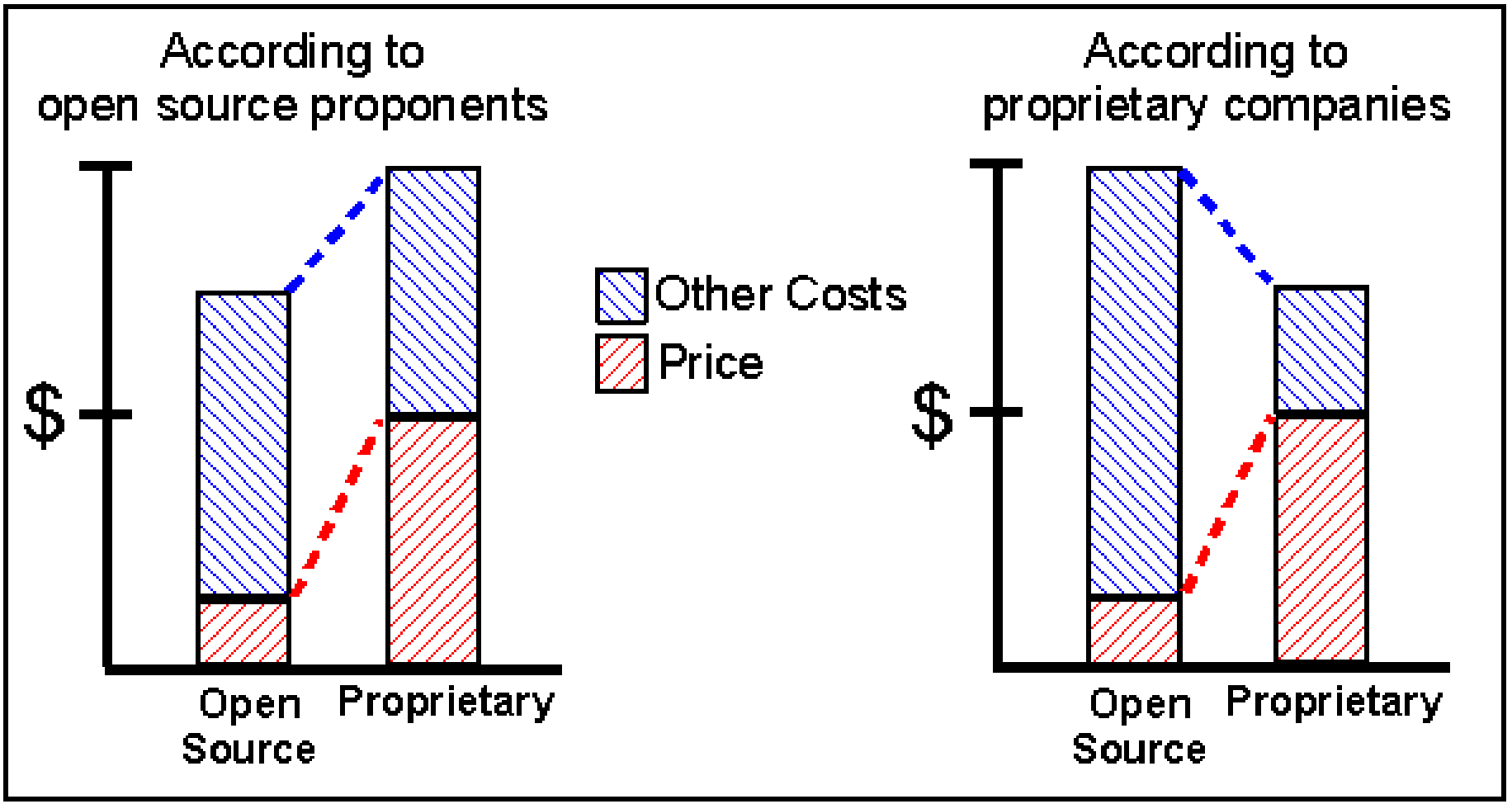
- Widget Frosting

  If you're in the hardware business, giving away software doesn't hurt.

- Accessorizing

  Sell accessories:
  books, compatible hardware, complete systems with pre-installed software

Total Cost of Ownership



Unified Modeling Language

- Systems can get more complex than people can comprehend all at once
- Key idea: Progressive refinement
  - Carve the problem into pieces
  - Carve each piece into smaller pieces
  - When the pieces are small enough, code them
- UML provides a formalism for doing this
  - But it does not provide the process

Specifying Structure

- Capturing the big picture
  - Use case diagram (interactions with the world)
  - Narrative
  - Scenarios (examples to provoke thinking)
- Designing the object structure
  - Class diagram (“entity-relationship” diagram)
  - Object diagram (used to show examples)

Specifying Behavior

- Represent a candidate workflow
  - Activity diagram (a “flowchart”)
- Represent object interactions for a scenario
  - Collaboration diagram (object-based depiction)
  - Sequence diagram (time-based depiction)
- Represent event-object interactions
  - Statechart diagram (a “finite state machine”)

Good Uses for UML

- Focusing your attention
  - Design from the outside in
- Representing partial understanding
  - Says what you know, silent otherwise
- Validate that understanding
  - Structuring communication with stakeholders

Avoiding UML Pitfalls

- Don’t sweat the notation too much
  - The key is to be clear about what you mean!
- Don’t try to make massive conceptual leaps
  - Leverage abstraction encapsulation
- Don’t get to attached to your first design
  - Goal is to find weaknesses in your understanding

Use Case Design

- Use Case Diagram
  - Input-output behavior
- Use Case Narrative
  - Explains each use case
- Use Case Scenario
  - Activity diagram shows how the use cases are used together (we'll save this one for 2 weeks)

Use Case Diagram

- External “actors”
  - Roles of people
  - Types of systems
- Use cases
  - Top-level functions (solid arrows to/from actors)
- Relationships among use cases
  - Always-depends-on (dashed <<include>>)
  - Sometimes-is-depended-on (dashed <<extend>>)
  - Inherits-from (solid triangle-arrow)

Summary

- Systems analysis
  - Required for complex multi-person tasks
- User-centered design
  - Multiple stakeholders complicate the process
- Implementation
  - Architecture, open standards, …
- Management
  - Typically the biggest cost driver