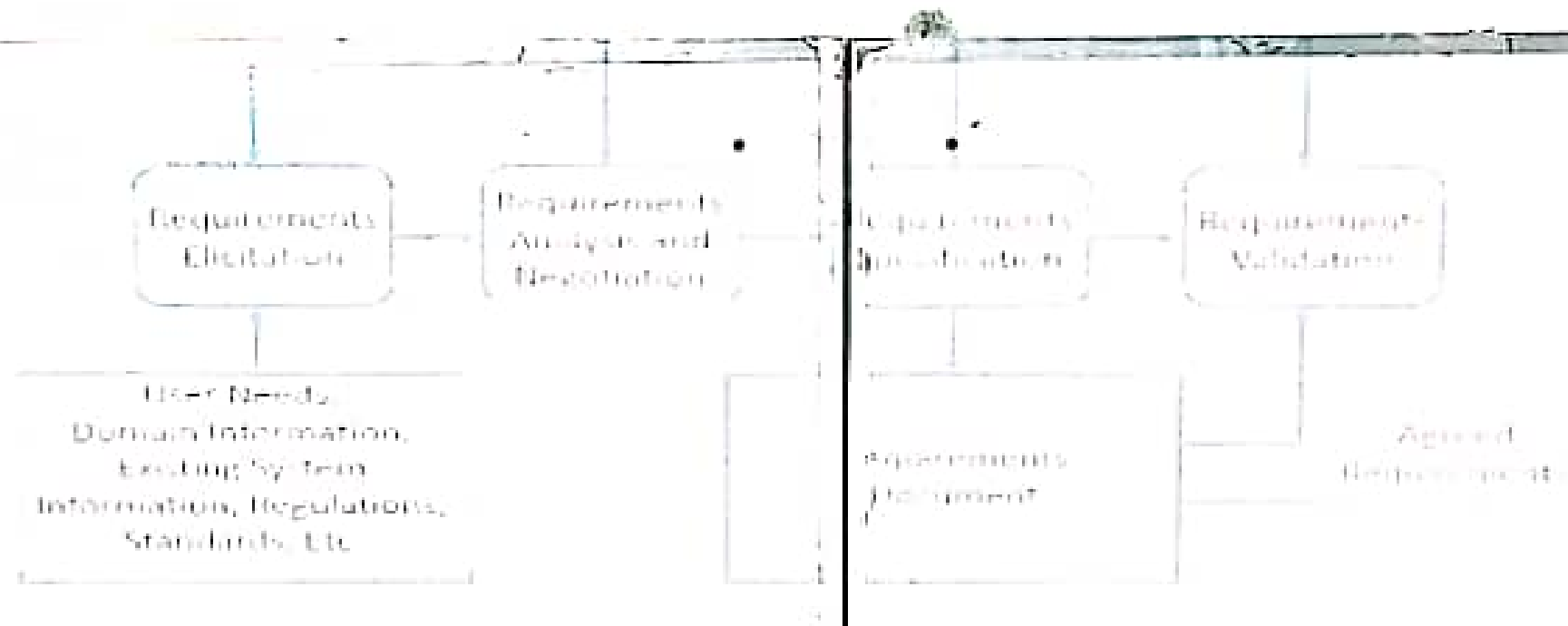




Requirements Engineering Process





Requirements Management

The process of managing changes to the requirements for a system

In this lecture, we'll talk about the reasons for changes in requirements and how to manage them

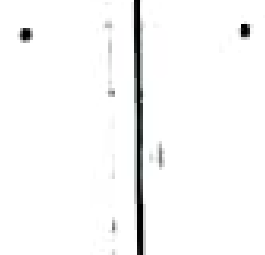
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Requirements Management

- The process of managing changes to the requirements for a system
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Requirements Management and Traceability

- Requirements cannot be managed effectively without requirements traceability
 - A requirement is traceable if you can discover who suggested the requirement, why the requirement exists, what requirements are related to it and how that requirement relates to other information such as systems designs, implementations and user documentation



Change - A Constant

- There is nothing permanent except change
 - Heraclitus (500 B.C.)
- No matter where you are in the system life cycle, the system will change, and the desire to change it will persist throughout the life cycle
- Software is like a sponge due to its susceptibility to change



Changing Requirements

- All stakeholders want to change requirements, due to different reasons
- Studies have shown that very significant percentage of delivered defects can be traced to changing user requirements
- A major issue in requirements engineering is the rate at which requirements change once the requirements phase has "officially" ended
- This rate is on average 3% per month in the subsequent design phase, and should go down after that
- This rate should come down to 1% per month during coding
- Ideally, this should come down to no changes in testing, however, this is very rare



Sources of Change

- New business or market conditions dictate changes in product requirements or business rules
- New customer needs demand modification of data produced by information systems, functionality delivered by products, or services delivered by computer-based system
- Reorganization or business growth/downsizing causes changes in project priorities or software engineering team structure
- Budgetary or scheduling constraints cause a redefinition of the system or product



Why All This Modification?

- As time passes, all constituencies know more
 - About what they need
 - Which approach would be best
 - How to get it done and still make money
- Statement of the fact: most changes are justified!



Managing Changing Requirements ???

- Following quality assurance mechanisms can limit the damage done by changing requirements

- State-of-the-art configuration control tools
- Requirements reviews

change.



Main Concerns in Requirements Management

- Managing changes to agreed requirements
- Managing the relationships between requirements
- Managing the dependencies between the requirements document and other documents produced in the systems engineering process



CASE Tools for Requirements Management

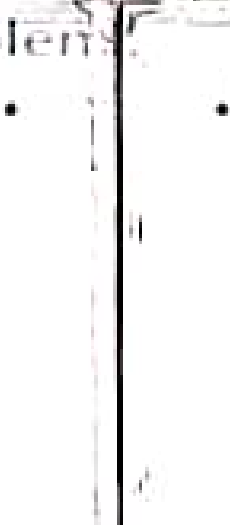
- Requirements management involves the collection, storage and maintenance of large amounts of information
- There are now a number of CASE tools available which are specifically designed to support requirements management
- Configuration management tools may be adapted for requirements engineering

Stable and Volatile Requirements

- Requirements changes occur while the requirements are being elicited, analyzed and validated and after the system has gone into service
- Some requirements are more stable, while others may be more subject to change than others
- Stable requirements are concerned with the essence of a system and its application domain. They change more slowly than volatile requirements
- Volatile requirements are specific to the instantiation of the system in a particular environment and for a particular customer



Requirements Change Factors

- Requirements errors, conflicts and inconsistencies
 - Evolving customer/end-user knowledge of the system
 - Technical, schedule or cost problems
- 



Requirements Change Factors - 2

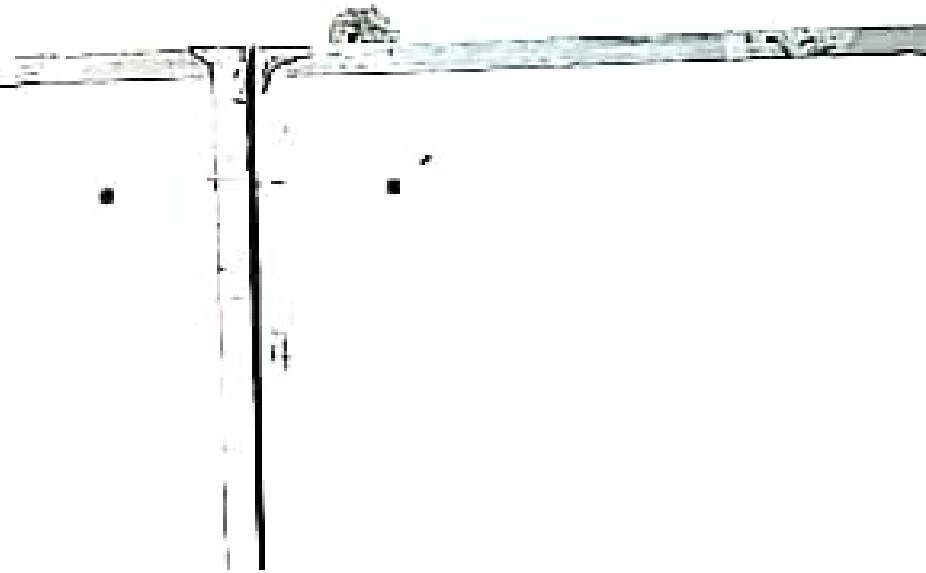
- Changing customer priorities
- Environmental changes
- Organizational changes





Types of Volatile Requirements

- Mutable requirements
- Emergent requirements
- Consequential requirements
- Compatibility requirements





Mutable Requirements

- These are requirements which change because of changes to the environment in which the system is operating



Emergent Requirements

- These are requirements which cannot be completely defined when the system is specified but which emerge as the system is designed and implemented.

Implementation

of



Consequential Requirements

- These are requirements which are based on assumptions about how the system will be used. When the system is put into use, some of these assumptions will be wrong.

assumptions



Summary

- Requirements change is inevitable as customers develop a better understanding of their real needs and as the political, organizational and technical environment in which a system is developed changes.
- There are Stable and volatile requirements
- Types of volatile requirement include mutable requirements, emergent requirements, consequential requirements and compatibility requirements



Requirements Identification

- It is essential for requirements management that every requirement should have a unique identification
- The most common approach is ~~requirements numbering~~ chapter/section in the requirements document
- Problems with this are:
 - Numbers cannot be unambiguously assigned until the document is complete
 - Assigning chapter/section numbers is an implicit classification of the requirement. This can mislead readers of the document into thinking that the most important relationships are with the requirements in the same section

cancel



Requirements Identification Techniques

- Dynamic renumbering
- Database record identification
- Symbolic identification

Database Record Identification

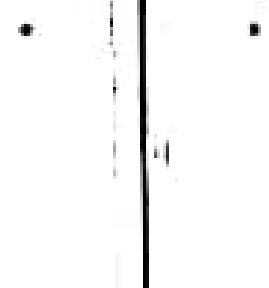
- When a requirement is identified it is entered in a requirements database and a database record identifier is assigned. This database identifier is used in all subsequent references to the requirement.

Identifying
is used



Storing Requirements

- Requirements have to be stored in such a way that they can be accessed easily and related to other system requirements





Requirements Storage Techniques

- In one or more word processor files
- In a specially designed requirements database



Word Processor Documents: Advantages

- Requirements are all stored in the same place
- Requirements may be accessed by anyone with the right word processor
- It is easy to produce the final requirements document



Word Processor Documents: Disadvantages -

- Requirements dependencies must be externally maintained
- Search facilities are limited
- Not possible to link requirements with proposed requirements changes
- Not possible to have version control on individual requirements
- No automated navigation from one requirement to another



Requirements Database Choice Factors - 1

- The statement of requirements
- The number of requirements
- Teamwork, team distribution and computer support
- CASE tool use
- Existing database usage



Change Management Stages

problem

Problem analysis and
change specification

Change
initiating

Change
planning

Change
implementation

Change
evaluation



Change Management Stages

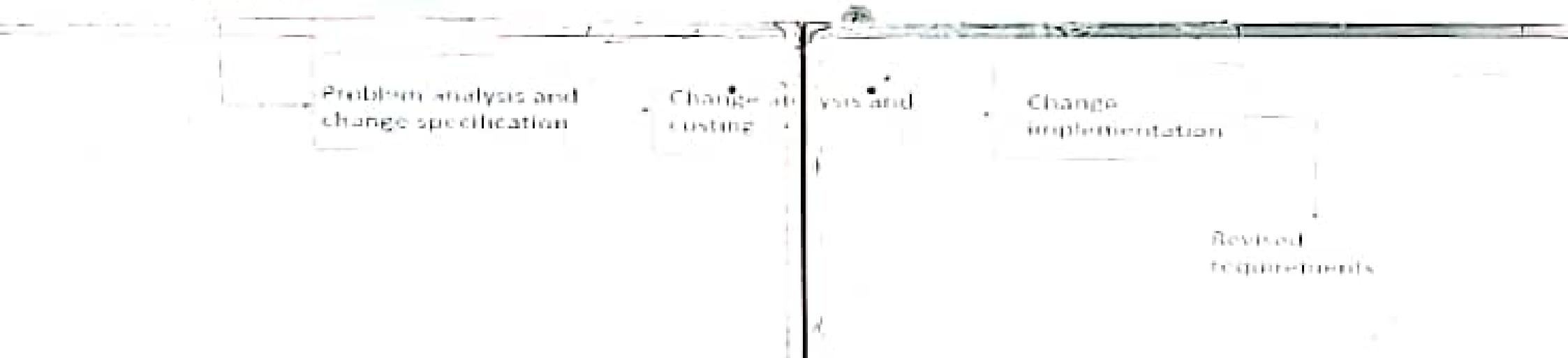
problem

Problem analysis and
change specification

Change analysis and
costing

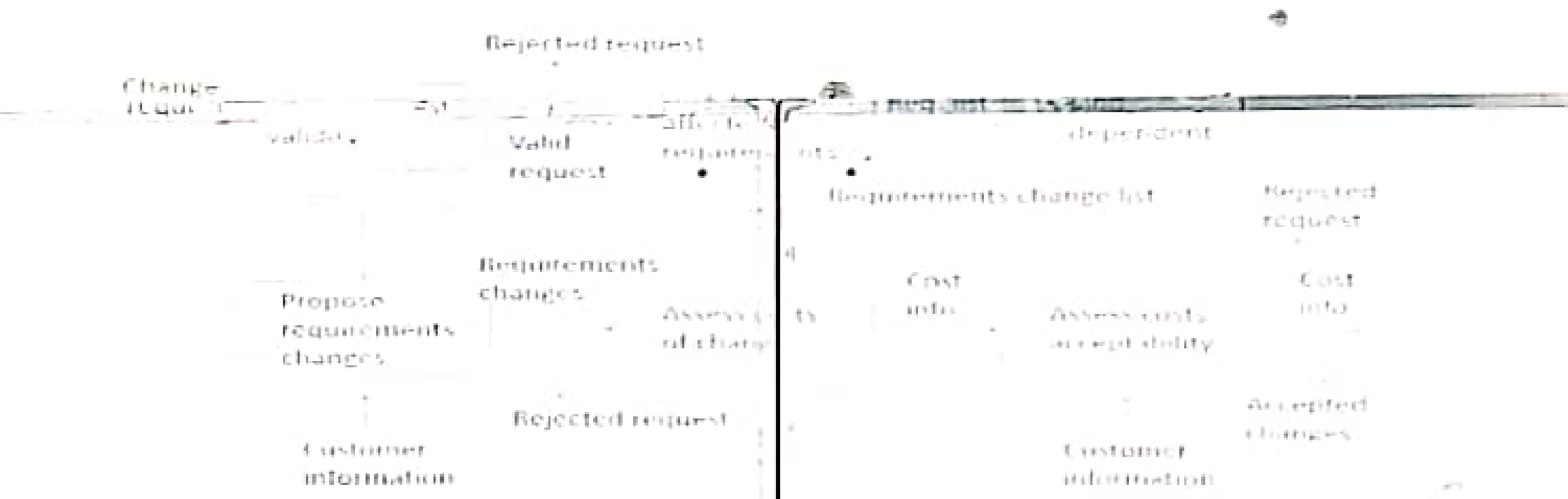
Change
implementation

Revised
requirements





Change Analysis and Costing Process





Software Requirement Engineering (SE-211)

Lecture 26: Requirements Traceability

Chapter 6: Requirement Engineering and Management

Chapter 9: Requirement Engineering a Good Practice Guide

Requirements Traceability

- Requirements tracing involves identifying the requirement in all the software artifacts including information artifacts and code artifacts.
- Refers to ability to describe and follow the life of a requirement, in both a forward and backwards direction
- That is from its origins, through its development and specification, to its subsequent deployment and use, and through all periods of on-going refinement and iteration in any of these phases

Tracing Requirements

- It is important to trace requirements both ways
 - Origin of a requirement
 - Requirements
- This is a continuous process

WIS
Requirement

FR - col - CR
FR - Col - CR
EF - CR



Classifications of Requirements Traceability

- Backward-from traceability
- Forward-from traceability
- Backward-to traceability
- Forward-to traceability





A Generic Traceability Table

| | A01 | A02 | A03 | Aii |
|-----|-----|-----|-----|-----|
| R02 | | | | |
| R03 | | | | |
| Rnn | | | | |