

## Software Evolution



It is impossible to produce a system of any size which does not need to be changed.

Parts of the software may have to be modified to correct the errors that are found in operation, or to improve its performance or other non-functional characteristics.

After delivery, software systems always evolve in response to demand for change.

## Software Evolution Approaches



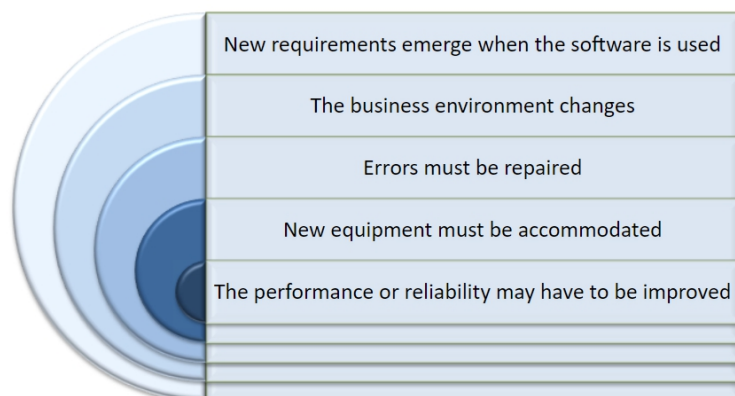
Software maintenance

Architectural transformation

Software re-engineering.



## Software Change



## Software change strategies



### Software Maintenance

- Changes are made in response to changed requirements but the fundamental software structure is stable

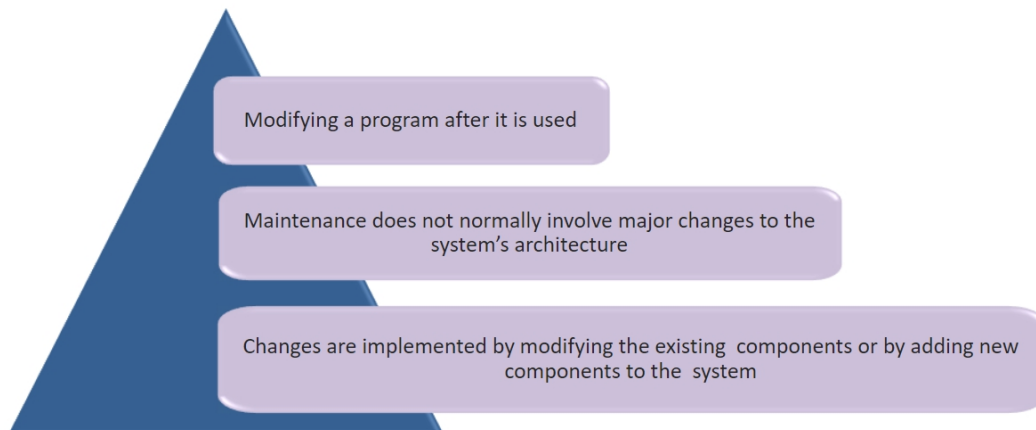
### Architectural Transformation

- The architecture of the system is modified
- Generally from a centralized to a distributed architecture

### Software Re-engineering

- New functionality is not added to the system but it is restructured and reorganized to facilitate future changes

## Software Maintenance



## Types of maintenance



Corrective

Adaptive

Perfective

Preventive

## Types of maintenance

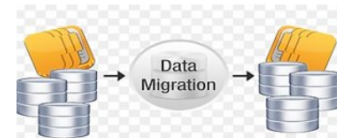
### Corrective maintenance

- Maintenance that includes the repair of defects in an existing system
- Defects can stem from
  - Requirements specification errors
  - Design errors
  - About 80% of all problems stem from requirements and design
  - Coding errors



### Adaptive maintenance

- Maintenance to adapt software to changes in the working environment
- Invoked by:
  - Internal needs
  - External requirements e.g. changes in law



## Types of maintenance

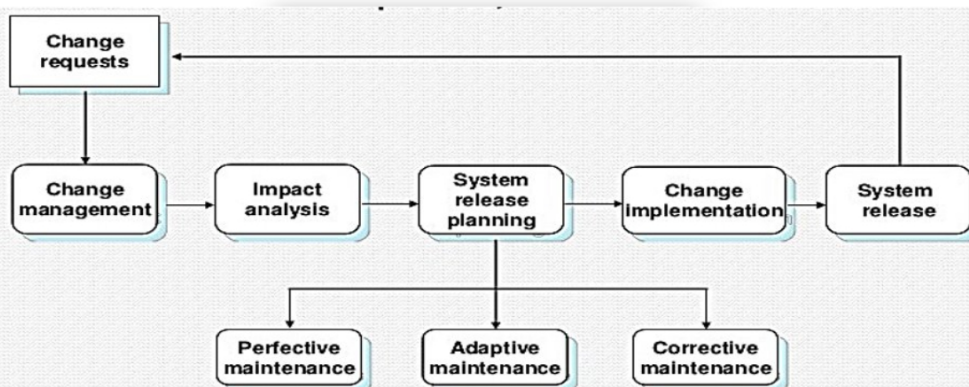
### Perfective maintenance

- Includes all efforts to polish or refine the quality of the software or the documentation
- Important that the improvement reduces the system maintenance costs

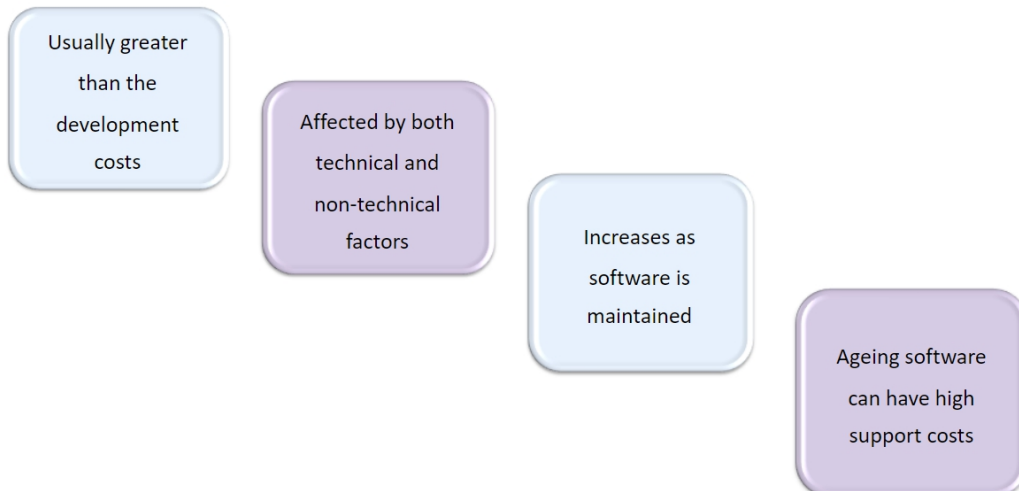
### Preventive maintenance

- Changes made to the system to avoid any software fault in the future

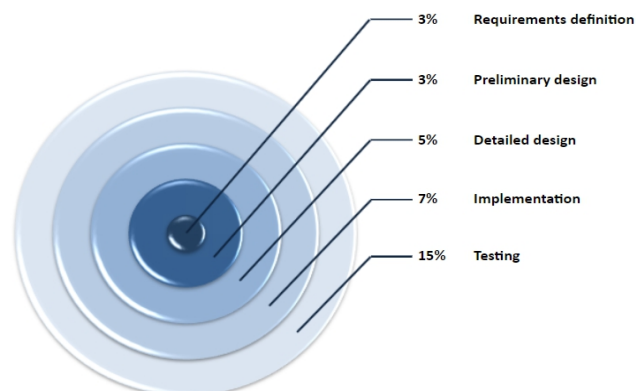
## Software Maintenance



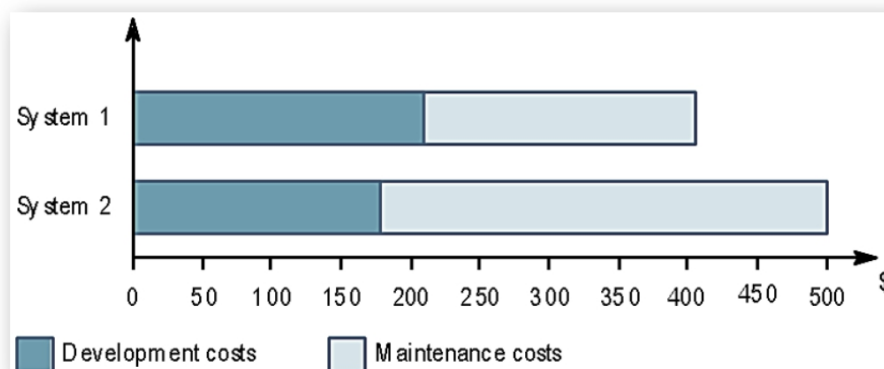
## Maintenance costs



## Relative Costs of Maintenance



## Development / Maintenance cost



## Maintenance Example



Anti-Virus Software

Operating System  
Patching

Y2K