A présentation on

Maintenance

Definitions

The act of keeping, or the expenditure required to keep, an asset in condition to perform efficiently the service for which it is used.

- The modification of a product, after delivery,
  - to correct faults,
  - to improve performance or other attributes,
  - or to adapt the product to a changed environment.

The 6 Purposes of Maintenance

The job of maintenance is to provide reliable plant for least operating cost

Types of Maintenance

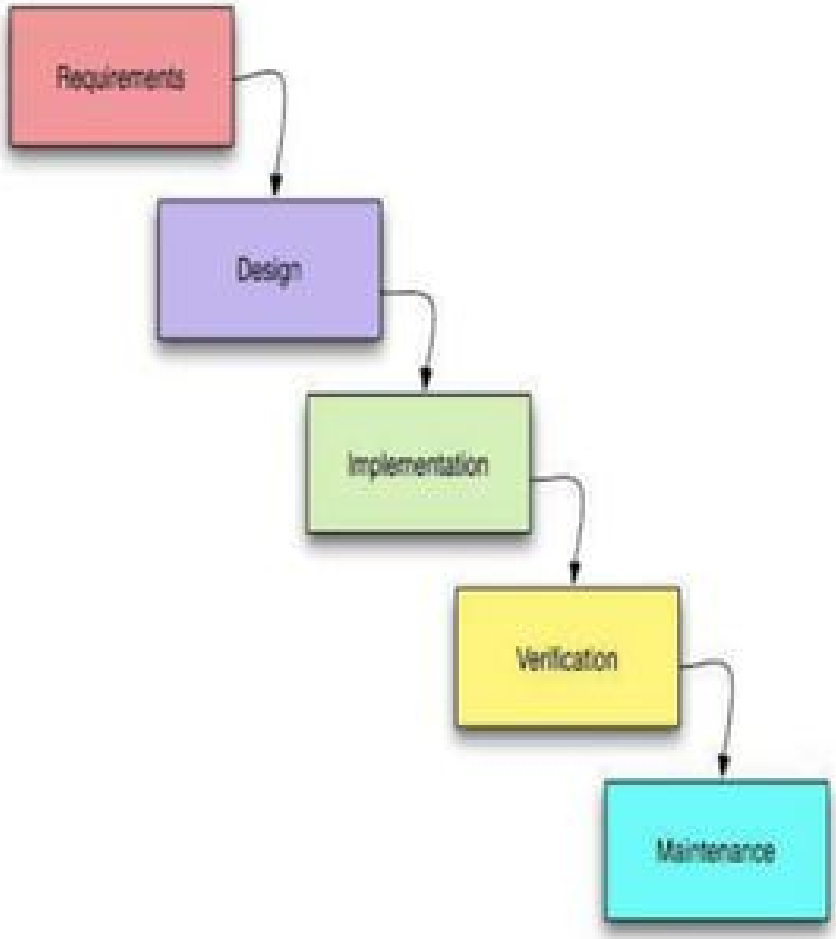
All maintenance activities have been grouped under four classes. They are-

1.Corrective maintenance:

2.Adaptive maintenance

3.Preventive maintenance

4.Perfective maintenance



Corrective maintenance: Reactive modification of a software product performed after delivery to correct discovered problems.

- system: response to equipment malfunctions
- characteristics:
  - *- inefficient maintenance department*
  - *- unpredictable equipment operation*
  - *- all maintenance work unplanned*
- example: *light bulb replacement*
- results: *steady degradation of equipment performance*
- maintenance department responsibility:
  - *- respond to emergencies*
  - *- get production back on line*

- **Adaptive maintenance**: Modification of a software product performed after delivery to keep a software product usable in a changed or changing environment.

System: *equipment design is based on minimal maintenance requirements.*

Characteristics- *close relationship with equipment suppliers.*

example: *roadways ,websites etc*

results*: continually improving equipment*

maintenance department responsibility:

- *input to equipment design*
- *minimize & eliminate maintenance requirements*

Preventive maintenance: Modification of a software product after delivery to detect and correct latent faults in the software product before they become effective faults.

system:

- *periodic adjustments & checks*
- *periodic replacement of worn parts*
- *periodic overhaul*

characteristics:

- *more predictable*
- *more efficient*

example: *changing oil & filters*

results: *maintain level of equipment*

maintenance department responsibility:

- *checking, replacing & overhauling*
- *perform checks during maintenance*

Perfective maintenance: Modification of a software product after delivery to improve performance or maintainability.

system: *periodic measurement & trending of equipment process*

characteristics:

- *predictable maintenance requirements*
- *planned & scheduled equipment repairs*

example: *software updates and service packs.*

results: *maintain equipment performance with minimal disruption to production*

maintenance department responsibility:

- *log equipment repairs*
- *trend data*
- *predict equipment repair cycles*

maintenance processes

There are six software maintenance processes which are as follows:

1) **The implementation processes** contains software preparation and transition activities, such as the conception and creation of the maintenance plan, the preparation for handling problems identified during development, and the follow-up on product configuration management.

2) The problem and modification analysis process, which is executed once the application has become the responsibility of the maintenance group. The maintenance programmer must analyze each request, confirm it (by reproducing the situation) and check its validity, investigate it and propose a solution, document the request and the solution proposal, and, finally, obtain all the required authorizations to apply the modifications.

Week commencing:		04-Jul-05	11-Jul-05	18-Jul-05	25-Jul-05
Operating unit	Craft	week 1	week 2	week 3	week 4
Area 1	Mech	8 M	7 M	6 M	5.5 M
	Elec	4.5 E	5 E	3 E	4 E
	Inst	1.5 I	2 I	0	3 I
Area 2	Mech	10 M	9 M	12 M	7 M
	Elec	5.5 E	3.5 E	7 E	4 E
	Inst	3 I	3 I	3 I	2.5 I
Area 3	Mech	0	1.5 M	0	1 M
	Elec	0	0.5 E	0	1 E
	Inst	0	0.5 I	0	0
Area 4	Mech	7 M	8.5 M	7 M	10 M
	Elec	4.5 E	5 E	5 E	5 E
	Inst	2.5 I	2 I	2 I	1.5 I
etc					
Weekly totals	Mech	25.0 M	26.0 M	25.0 M	23.5 M
	Elec	14.5 E	14.0 E	15.0 E	14.0 E
	Inst	7.0 I	7.5 I	5.0 I	7.0 I
Monthly totals	Mech	99.5 Mechanical			
	Elec	57.5 Electrical			
	Inst	26.5 Instrumentation			

3. The process considering the **implementation of the modification** itself.
4. The process **acceptance of the modification**, by confirming the modified work with the individual who submitted the request in order to make sure the modification provided a solution.

5. **The migration process** is exceptional, and is not part of daily maintenance tasks. If the software must be ported to another platform without any change in functionality, this process will be used and a maintenance project team is likely to be assigned to this task.
6. Finally, the last maintenance process, also an event which does not occur on a daily basis, is the **retirement of a piece of software.**

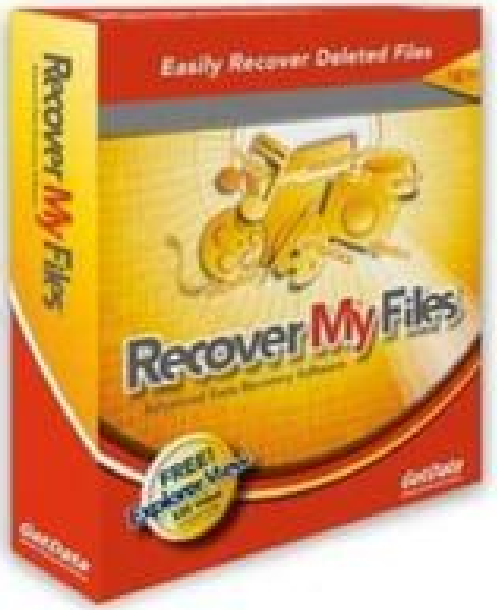
Software maintenance

Software maintenance is the process of changing a system after it has been delivered.

- Modifying a program after it has been put into use.
- Maintenance does not normally involve major changes to the system's architecture.
- Changes are implemented by modifying existing components and adding new components to the system.

Software Breakdown Causes

- basic conditions neglected
- inadequate skills
- operating standards not followed
- deterioration unchecked
- inherent design weakness



Need for software maintenance

- Maintenance to repair software faults
  - Changing a system to correct deficiencies in the way meets its requirements.
- Maintenance to adapt software to a different operating environment
  - Changing a system so that it operates in a different environment (computer, OS, etc.) from its initial implementation.
- Maintenance to add to or modify the system's functionality
  - Modifying the system to satisfy new requirements.

Optimal maintenance

Its the discipline which is concerned with maintaining a system in a manner that maximizes profit or minimizes cost.

- Cost functions depending on the reliability and maintainability characteristics of the system determine the parameters of interest to minimize.
- Parameters often considered are
  - the cost of failure,
  - the cost per time unit of "downtime",
  - the cost (per time unit) of corrective maintenance,
  - the cost per time unit of preventive maintenance an
  - the cost of repairable system replacement

Maintenance costs

Maintenance costs are usually greater than development costs by a factor of 2 to 100.

- The costs arise from both technical and nontechnical factors.
  - A deployed system is expensive to change .
  - High cost of breaking an already working system.
  - Maintenance costs increase over time and as the system evolves.

Reasons:

Maintenance changes ,degrades the original system structure.

Aging software results in high support costs.

Maintenance cost factors

Team stability

Maintenance costs are reduced if the same staff are involved with them for some time.

Contractual responsibility

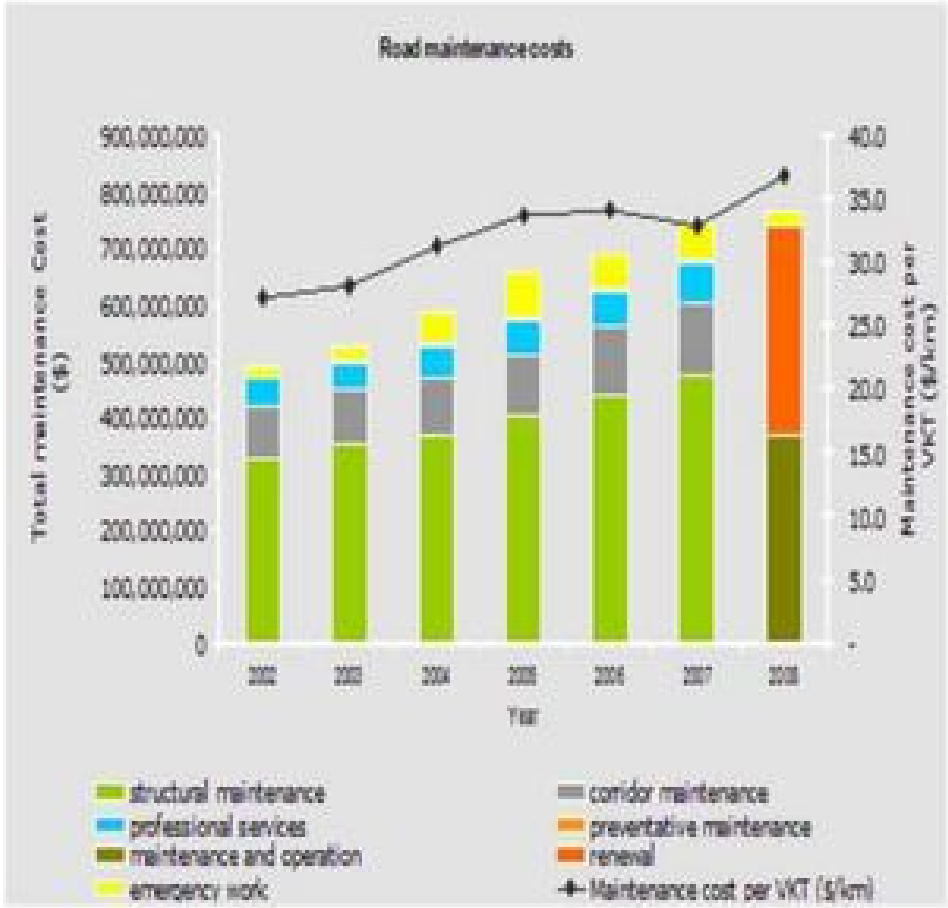
The developers of a system may have no contractual responsibility for maintenance so there is no incentive to design for future change.

Staff skills

Maintenance staff are often inexperienced and have limited domain knowledge.

Program age and structure

As programs age, their structure is degraded and they become harder to understand and change.



Strategies to reduce maintenance costs:

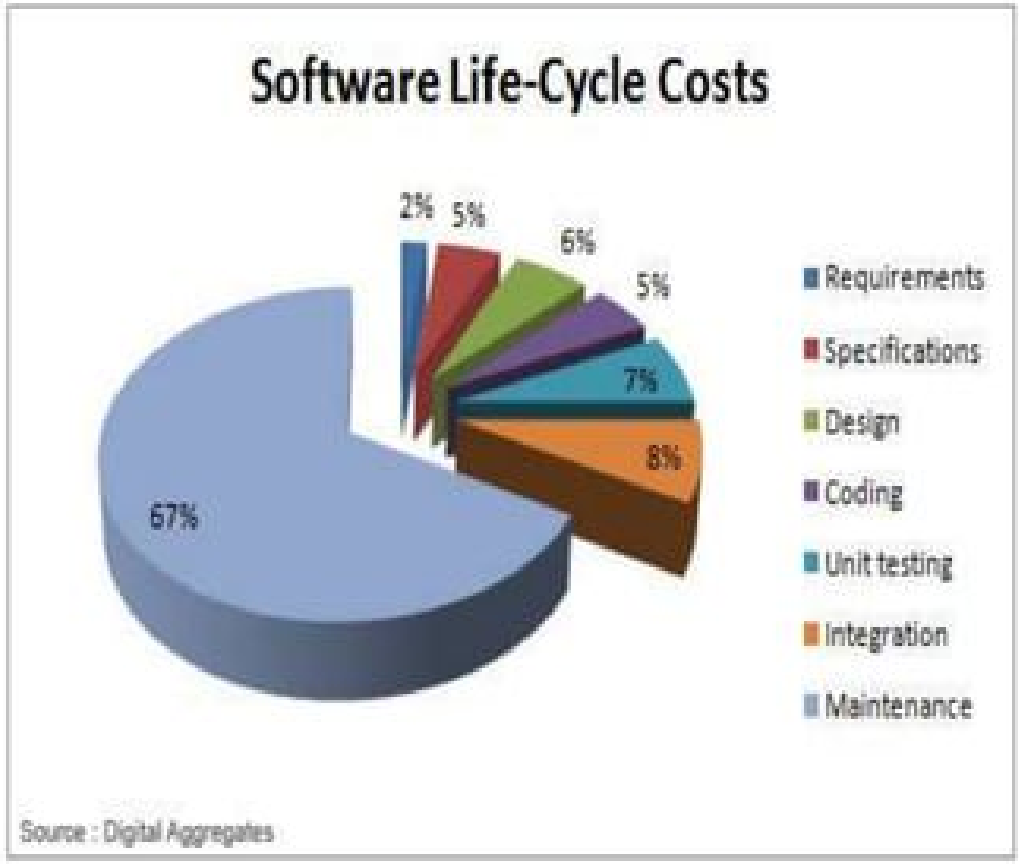
-Correct slight defects in parts and jigs.

- Ensure basic equipment conditions are maintained

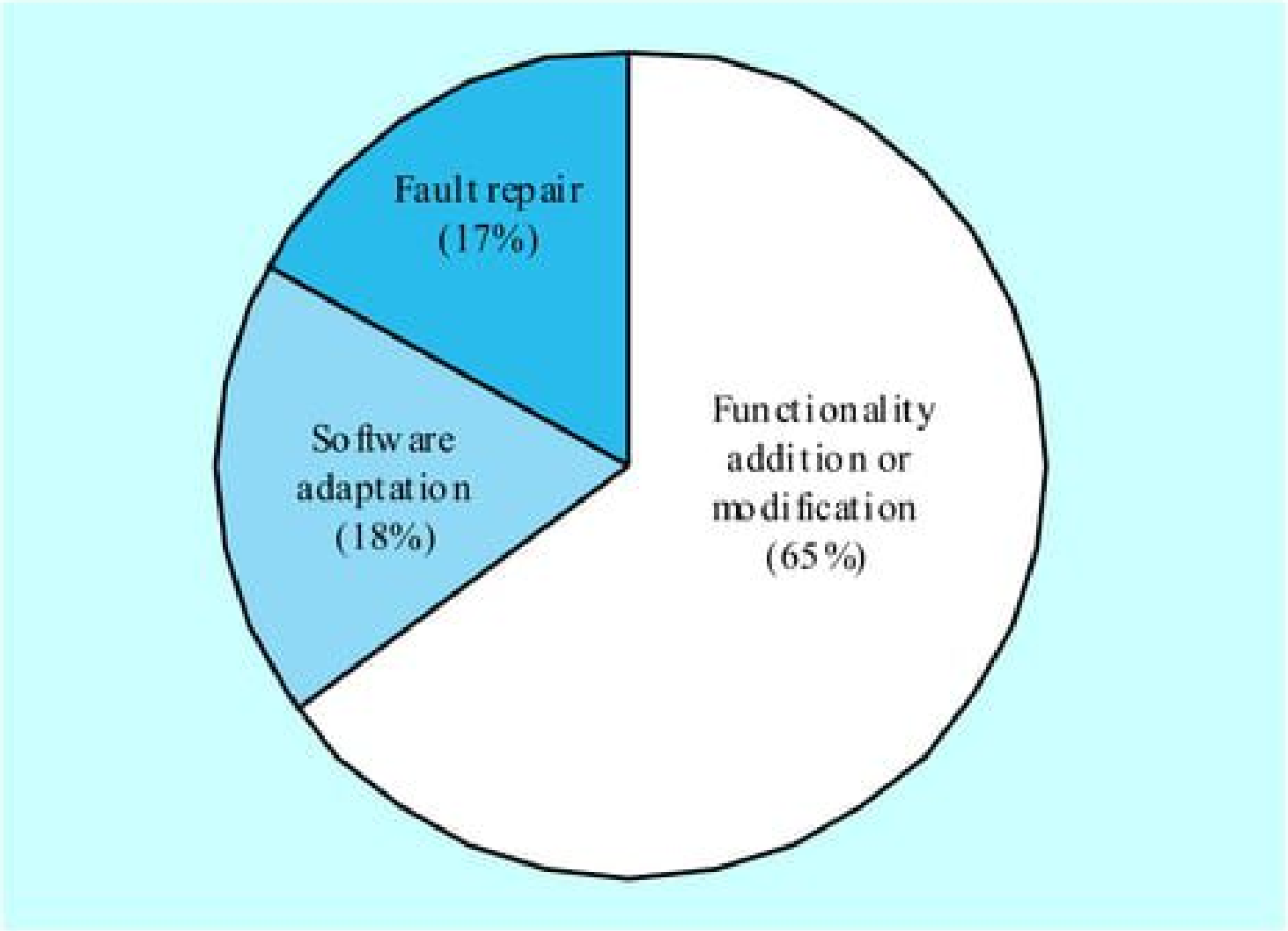
- Review basic operations

- Conduct physical analysis

- Adopt an analytical approach



Distribution of maintenance effort



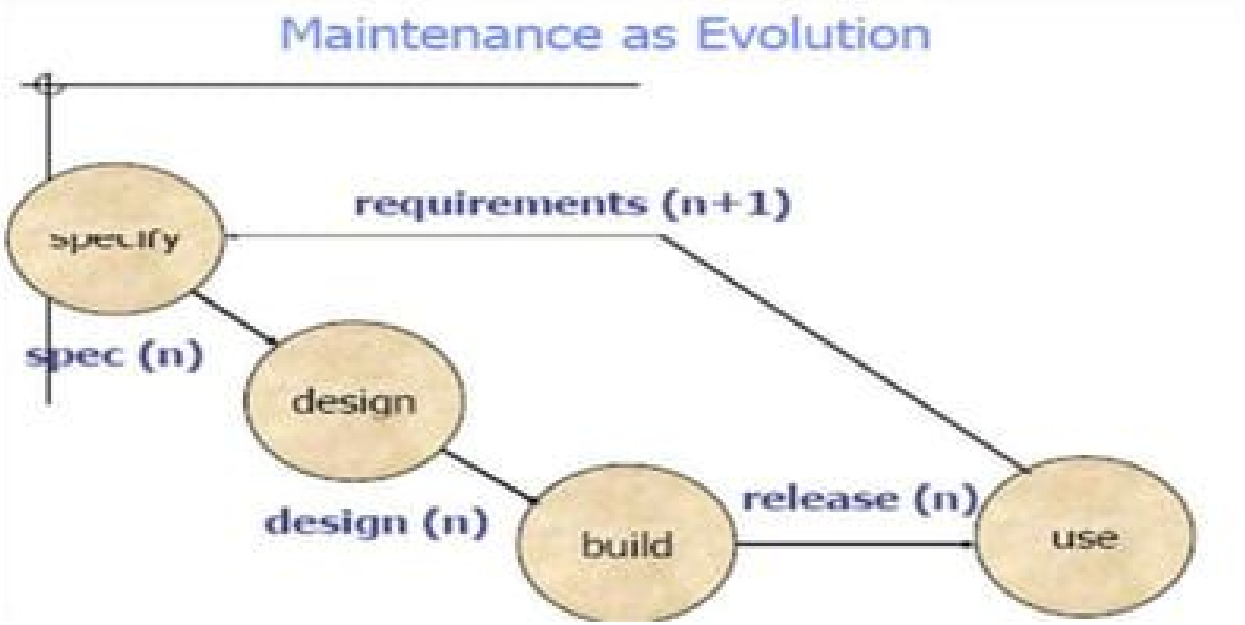
Source:www.wikipedia.com

Maintenance Problems

- Someone else's program.
- Developer not available.
- Proper documentation doesn't exist.
- Not designed for change.
- Maintenance activity not highly regarded.

Maintenance is inevitable

- The system requirements are likely to change while the system is being developed because the environment is changing. Therefore a delivered system won't meet its requirements.
- Systems are tightly coupled with their environment. When a system is installed in an environment it changes that environment and therefore changes the system requirements.
- Therefore systems MUST be maintained if they are to remain useful in an environment.



The Rewards of Maintenance

- Maintenance is a thankless task in every way:
- Maintainers deal with dissatisfied users.
- If the user were happy, the product would not need maintenance.
- The user's problems are often caused by the individuals who developed the product, not the maintainer.
- The code itself may be badly written.
- Post delivery maintenance is despised by many software developers.

- Unless good maintenance service is provided, the client will take future development business elsewhere.
- Post delivery maintenance is the most challenging aspect of software production —and the most thankless.
- The user frequently does not understand that maintenance can be difficult, or impossible for some requests.

Conclusion

- Maintenance is a major cost for software and must be planned for during the entire life cycle.

- Design workflow —use information-hiding techniques
- Implementation workflow — good coding style

- Documentation must be complete, correct, and current.

- During maintenance, maintainability must not be compromised.

- Maintenance is so critical and challenging that the best people should be put on the task and rewarded accordingly.