Socio-technical system

Unit II

Socio-technical system

- **Socio-technical system:** Essential characteristics of socio technical systems, Emergent System Properties, Systems Engineering, Components of system such as organization, people and computers, Dealing Legacy Systems.

- **Critical system:** Types of critical system, A simple safety critical system, Dependability of a system, Availability and Reliability, Safety and Security of Software systems.

- **Requirements Engineering Processes:** Feasibility study, Requirements elicitation and analysis, Requirements Validations, Requirements Management.

- **System Models:** Models and its types, Context Models, Behavioural Models, Data Models, Object Models, Structured Methods.

Socio-Technical System

Socio-technical system

- Include one or more technical systems, but crucially also include knowledge of how the system should be used to achieve some broader objective.

- These systems have defined operational processes, include people as inherent parts of the system, governed by organizational policies and rules and may be affected by external constraints such as national laws and regulatory policies.

Essential characteristics of socio-technical system

- They have **Emergent properties** (Properties of a system as a whole). These properties depend on both system components and the relationships between them and hence they can be evaluated only when the system has been assembled

- They are often **Nondeterministic** that is when presented with the specific input they may not always produce the same output. Use of the system may create new relationships between the system components and hence change its emergent behavior.

- The extent to which the system supports organizational objectives does not depend on the system but also on the stability of these objectives and the relationships and conflicts between these objectives

Emergent System Properties

Emergent properties are properties of **the system as a whole** rather than properties that can be derived from the properties of components of a system.

They are the consequence of **the relationships between system components**, therefore they can only be assessed and measured once the components have been integrated into a system.

Examples Of Emergent Properties

Property	Description
Volume	Varies depending on how the component assemblies are arranged and connected
Reliability	Depends on component reliability but unexpected interactions can cause new types of failure and therefore affect the reliability of the system
Security	The security of the system is a complex property that cannot be easily measured. Attacks may be devised that were not anticipated by the system designers and so may defeat built in safeguards
Repair ability	This property reflects how easy it is to fix a problem with the system once it has been discovered. It depends on being able to diagnose the problem, access the components that are faulty and modify or replace these components
Usability	This property reflects how easy it is to use the system. It depends on the technical system components, its operators and its operating environment

Types Of Emergent Properties

- **Functional emergent properties –**

1. Appear when all parts of a system work together to achieve some objective.
2. For example, A bicycle has functional property of being a transportation device once it has been assembled from its components.

- **Non-functional emergent properties –**

1. Relate to behaviour of the system in its operational environment These are often critical for computer-based systems as failure to achieve some minimal defined level in these properties may make the system unusable.
2. Examples are reliability, performance, safety and security.

Reliability as an Emergent Property

- Because of component inter-dependencies, faults can propagate through the system.
- System failures often occur because of unforeseen inter-relationships between components.
- It is practically impossible to anticipate all possible component relationships. Software reliability measures may give a false picture of the overall system reliability.

Failures are not independent and they propagate from one level to another. Reliability is influenced by the following:

- **Hardware Reliability :** what is the probability of a hardware component failing and how long does it take to repair that component?
- **Software Reliability :** how likely is it that a software component will produce an incorrect output (software failure is lly distinct from hardware failure in that software does not wear out)?
- **Operator Reliability:** how likely is it that the operator of a system will make an error?