

Socio-Technical Systems

Sommerville, Chapter 2

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*"As a computer, I find your faith
in technology amusing."*

-- unknown PC

What is a System?

- **System** = purposeful collection of inter-related components working together to achieve some common objective.
- (IT) system may include **software**, mechanical, electrical & electronic **hardware** and be operated by **people**
- System components dependent on other system components

System Categories

■ Technical computer-based systems

- includes hardware & software, but where operators and operational processes are not normally considered to be part of the system
- not self-aware

■ Socio-technical systems

- technical systems + operational processes & people who use & interact with t.s.
- governed by organisational policies and rules
- *If you do not understand the organisational environment where a system is used, the system is less likely to meet the real needs of the business and its users*

Software industry almost always tasked with socio-technical systems

Make it habit to think of a system as being socio-technical

Socio-technical System Characteristics

- Emergent properties
 - Properties of the system as a whole depend on components and their relationships ↘
- Non-deterministic
 - do not always produce same output when presented with same input
 - systems's behaviour partially dependent on human operators + a time-varying environment
- Complex relationships with organisational objectives
 - extent to which system supports organisational objectives does not just depend on system itself

What roles in an IT company do you know of?

Emergent Properties

- Properties of the **system as a whole** rather than properties that can be derived from the components properties
- **consequence of the relationships** between system components
- They can therefore only be assessed and measured once the components have been integrated into a system

In plain words:

expect surprises once your carefully crafted code becomes part of a larger context (sw/hw/people)!

Examples of Emergent Properties & Possible Surprises

Property	Description
Volume	Total space occupied depends on how component assemblies are arranged & connected.
Reliability	System reliability depends on component reliability but unexpected interactions can cause new types of failure.
Security	The system's ability to resist attack is a complex property that cannot be easily measured. Attacks not anticipated by system designers may defeat built-in safeguards.
Repairability	How easy is it to fix a problem once it has been discovered? Depends on being able to diagnose the problem, access the components that are faulty, and modify/replace them.
Usability	How easy is it to use the system? Depends on the technical system components, its operators and its operating environment.

log files

m vs inch

buffers

hot repair

il8n
msg sizes
scrn / mem

- 1983: Boeing 767 went into **four-minute powerless glide**
 - **overheating** → pilot had to shut down both engines

engine management system:
run engines at slow speed
to **optimize fuel efficiency**

particular atmospheric circumstances:
ice on engine surfaces
→ reduced flow of air
→ engines **work harder and overheat**

- FAA: "The problem is that the designer *didn't anticipate all the possible demands the software would face. The computer will always do something. But it will only do the correct thing if it has been programmed for that situation.*"

Side Note: Will They Love You?

- So you're a diligent software engineer...
 - Careful design & implementation
 - Comprehensive testing
- Will they love you?
 - Project manager: "you take too long", "you are wasting time"
 - Customer: "the project is too expensive"
 - *...and your program keeps silent – no errors!*
- Will they love you???

Dream on!