Socio-Technical Systems

Sommerville, Chapter 2

Instructor: Peter Baumann

email: pbaumann@constructor.university
tel: -3178
office: room 88, Research 1

"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.	log files
Reliability	System reliability depends on component reliability but unexpected interactions can cause new types of failure.	m vs inch
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.	buffers
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.	hot repair
Usability	How easy is it to use the system? Depends on the technical system components, its operators and its operating environment.	i18n msg sizes scrn / mem

http://catless.ncl.ac.uk/Risks

- 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 some-thing. But it will only do the correct thing if it has been programmed for that situation.*"

see also: http://en.wikipedia.org/wiki/Gimli_Glider

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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!