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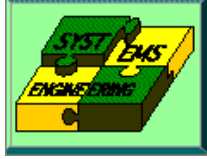


SYST 101: Intro to Systems

Lecture 16

Mar 18, 2004

C. Wells, SEOR Dept.

Announcements

- None

Agenda

- Dr. Kathy Laskey (SEOR) on the department curriculum
- Systems & Events
- System Architecture Descriptions

Why Systems?

- The universe is too big and too complicated
  - Too much to do or understand
  - Divide and conquer
    - Artificial non-unique partitions
    - Every system is someone else's subsystem
    - It's the structure and interaction
- Combine and simplify for the system view
  - The big picture at the expense of detail
  - Relationships between parts is the focus

Events vs Systems

- So far, we've discussed systems
  - Implied that they interact with each other
  - Implied that they do things themselves
- Brings us to how systems interconnect, and the topic of events
  - The structure and interaction

System Interfaces

- Systems connect to each other through interfaces
- In man-made systems, the interfaces are pretty easy to see...

Interfaces on Common Systems

- The components of a PC have interfaces to each other

- and some of them have interfaces to you.

Events

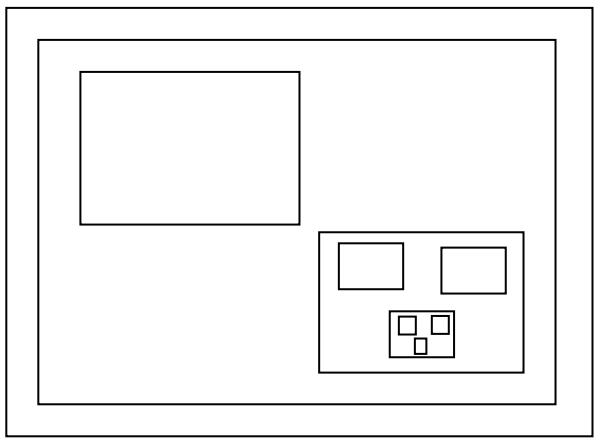
- Events are things that happen in or to your system
- Events usually have relatively short time durations.
  - Functions, on the other hand, can take a long time to perform

Example Events & Systems

- System: Road Traffic System
  - Events: Accident, Repair Activity starts
- System: PC
  - Event: Type on keyboard, move & click mouse
- System: Human Being
  - Event: Burns hand on stove, sees pretty picture, gets hungry

Internal vs External Events

- Systems are made up of sub-systems.
  - And often a system can be viewed as a sub-system to some larger system



Systems inside systems inside systems ...

Every system is somebody else's subsystem

Internal vs External Events

- A system can experience events that come from external systems, or can experience events that come from one of its internal systems
  - When you get hungry, your brain sub-system is responding to low-sugar signals from your endocrine system.

Events vs Functions

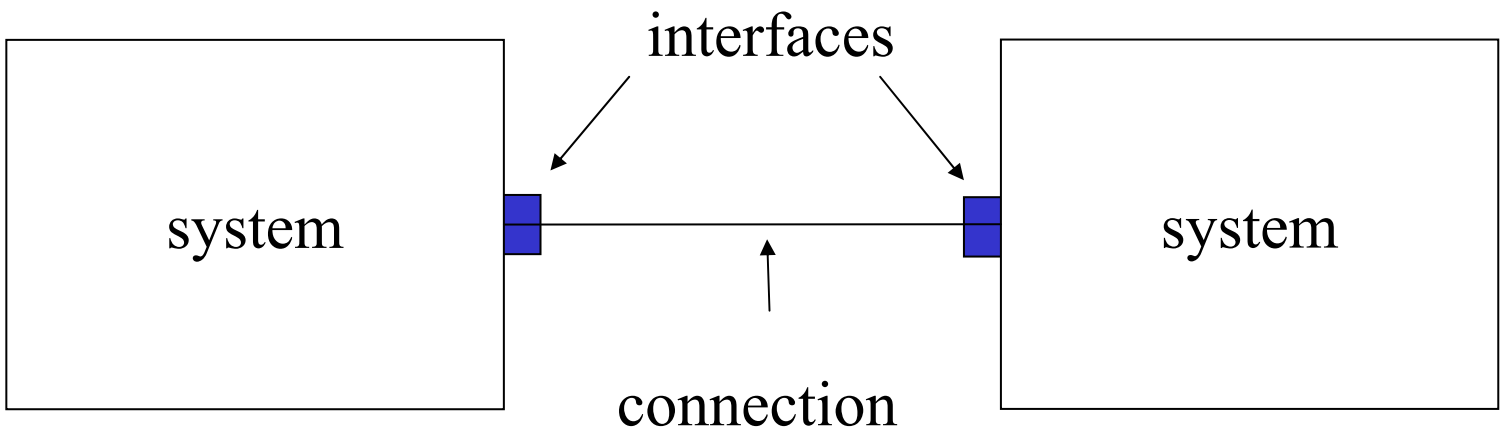
- A common modeling technique:
- Envision systems as responding to events by performing a function.
- Events “trigger” functions
- Biology: Stimulus-response

Events & Interfaces

- Systems relate to each other through their interfaces
  - Events are often “transmitted” through some sort of interface.
  - Interfaces are much easier to see in man-made systems
  - Sometimes not so easy to see in natural systems.
    - That’s what makes medicine so hard...

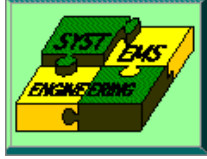
Events, Interfaces & Functions

- Basic modeling concept:



Stimulus-Response

- Basic general form: “When event {a} comes in over interface {i}, then do function xyz.”
  - Optional: “and send event {b} out over interface {k}.”



Example

- When I burn my hand, I jerk my arm.
- When event {my hand feels pain} comes in over interface {nerve endings in hand}, do function {react} and send event {move arm} to interface {muscle nerves in arm}.

Note!

- A System's interfaces will exist whether or not they are connected to anything!!
- A system's interfaces and what information they carry to and from the system are a key part of system design, and a key element in understanding natural systems.

Interfaces and Good Design

- A good design has stable interfaces that do not need to be changed over many generations of the system design.
- Best example: Stereo System

Input/Output jacks on back

Stereo Input/Output Jacks

- Although the technology of stereo equipment has changed significantly over the last 60 years....
  - Then: Vaccuum tubes, phonograph players, open reel tape decks
  - Now: All solid state circuitry, CPUs instead of analog amplifiers, CD players
  - The interfaces have remained the same!
  - Physical nature of the plugs & jacks, and the standards for the audio signals.

Not so good design

- Cars
  - There is no such thing as a generic alternator or radiator for cars.
    - You have to get exactly the right radiator
      - "'75 Chevy Impala with the 250cc 6-cylinder engine...."
  - Some standardized man-machine interfaces
- Every redesign of the system (car) leads to redesign of every sub-system.
  - Increased designing costs, increased supportability and maintenance costs, increased maintenance training costs
  - Increased frustration in the consumer as well

Assignments

- Reading
  - Petroski, IBD, Chapters 6 & 7.
    - Facsimiles and Networks
    - Airplanes and Computers
- Homework. Consider GMU as a system
  - a) Break it up into subsystems (at least 4)
  - b) Define its external interfaces (at least 4)
  - c) Define its internal interfaces (at least 5)
  - d) For each interface:
    - Define what input and output events are carried (transmitted)
    - Define what functions in the system are triggered by the input events, and define which functions produce output events.