Lecture 3:
What is a System

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- WHAT a system is;
- WHO its users and stakeholders are;
- WHY it exists and HOW it benefits its users and stakeholders;
- HOW it is structured; and HOW it operates, is supported, and disposed.

What is a System ?

- a system is a dynamic and complex whole, interacting as a structured functional unit;
- energy, material and information flow among the different elements that compose the system;
- a system is a community situated within an environment;
- energy, material and information flow from and to the surrounding environment via semi-permeable membranes or boundaries;
- systems are often composed of entities seeking equilibrium but can exhibit oscillating, chaotic, or exponential behavior.
- A holistic system is any set (group) of interdependent or temporally interacting parts. *Parts* are generally systems themselves and are composed of other parts, just as systems are generally parts or *holons* of other systems.

What is a System?

- An <u>integrated</u> set of interoperable <u>elements</u>, each with explicitly <u>specified and bounded capabilities</u>, working <u>synergistically</u> to perform value-added processing to enable a User to satisfy <u>mission-oriented operational needs</u> in a prescribed <u>operating environment</u> with a specified outcome and probability of success.

Examples of Systems

- Economic systems
- Educational systems
- Financial systems
- Environmental systems
- Medical systems
- Corporate systems
- Insurance systems
- Religious systems
- Social systems
- Psychological systems
- Cultural systems
- Food distribution systems
- Transportation systems

- Communications systems
- Entertainment systems
- Government systems
    - Legislative systems
    - Judicial systems
    - Revenue systems
    - Taxation systems
    - Licensing systems
    - Military systems
    - Welfare systems
    - Public safety systems
    - Parks and recreation systems
    - Environmental systems

- System
    - A combination of human, products and tools
- Product
    - is typically a physical device or entity that has a <u>specific capability</u>—*form*, *fit*, and *function*—with a specified level of <u>performance</u>.
    - *Products* generally lack the ability (*intelligence*)
    - Contextually, however, a product may actually be a vendor's "system" that is integrated into a User's higher-level system. Effectively, you create a system of systems (SoS).
- Tools
    - a supporting product that enables a user or *system* to leverage its own capabilities and performance to more effectively or efficiently achieve mission objectives that exceed the individual capabilities of the User or system.
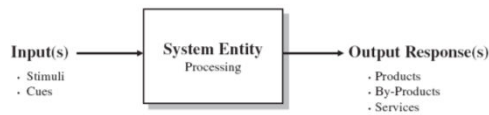
Representation of a System

Input(s)
· Stimuli
· Cues

→ **System Entity**
Processing →

Output Response(s)
· Products
· By-Products
· Services

Figure 3.1 Basic System Entity Construct

An Analytical view

Stakeholders   *Roles, Missions, & Objectives*   *Resources*   *Controls*

Acceptable Inputs →
Unacceptable Inputs →

System Entity
(Any Level of Abstraction)
• Attributes   • Products
• Capabilities   • By-Products
• Performance   • Services

→ *Acceptable Outputs*
⇢ *Unacceptable Outputs*
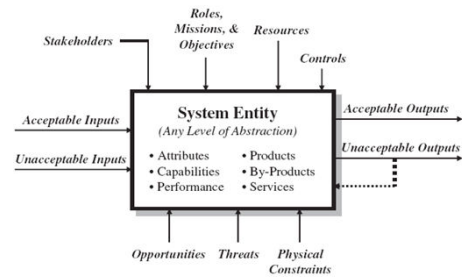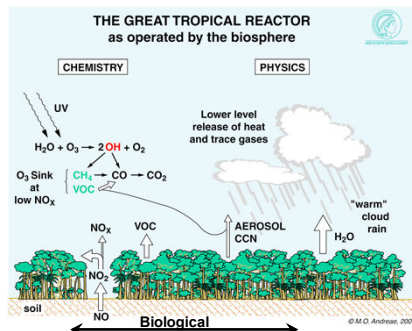
Opportunities   *Threats*   *Physical Constraints*

Figure 3.2 Analytical System Entity Construct

ILEAPS

Focus 2: Feedbacks between land biota, aerosols, atmospheric composition and climate

THE GREAT TROPICAL REACTOR
as operated by the biosphere

ILEAPS

Focus 2: Perturbations by human activities

THE GREAT TROPICAL REACTOR
as perturbed by deforestation and pollution
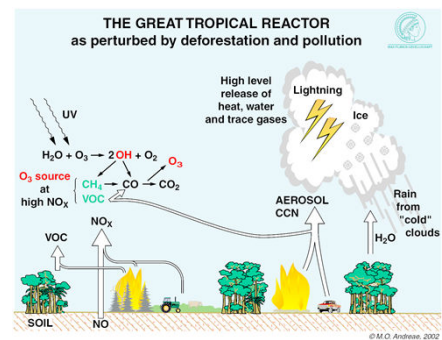
- Workflow based Systems
  - Schools, hospitals, banking, manufacturing, etc
- Complex, Multi level systems
  - Analyze
  - Design
  - Develop
- *Application of analytical*, *mathematical*, and *scientific* principles are needed