Systems Integration

Social Systems

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Source: A significant part is from Mark W. Maier and Eberhardt Rechtin's *The Art of Systems Engineering 3rd Ed*

Introduction

Definition

- Technical work involving the participation of groups of people
  - Affect architecture
  - Affect design
- Classical examples: cathedrals, dams, roadways...
- Modern examples: air travel, information networks, health delivery...

Key characteristics

- Can not be conceived and built without social participation (planned or not)
- Heuristics: the four who's, economic value, perceptions and facts

Public Participation

- Members of public use the system's facilities
- Individuals are the end users. Not the utilities! (organizations maintaining the infrastructure and providing service)
- Examples: highways, aviation traffic control, power networks...
- Public cooperation and personal responsibility required (follow rules of the road...)
- Indviduals own a fraction of the structure (cars, computers, phones...). The rest of the facilites are rented
- Public speaks through specialized groups (automobile clubs...)
- Public initiates architectural changes (shift from fossil fuels to alternative energy sources)

- Social systems used by the government (NASA, police systems...)
- Public pays indirectly, influences indirectly (politics)

Foundations of Sociotechnical Systems Architecting

Common to any systems

- Systems approach, purpose orientation, modeling, certification, insight

Ultraquality?

- Nuclear power generation
- Manned space flight

- Public health
- Pollution control

Response to public's needs and perceptions

- Public's interests diverse and incompatible
- Interests change with time (e.g. due to accidents)

Client and User

- The client (who buys) is not the user: technical and ethical problem for the architect
- Standards help in this conflict (buildings, bridges, information systems(?)...)
- Getting (or not) a license makes sure that public interest comes first

- Which is the best degree of traffic control (ITS)?
- Which is the best degree of governmental regulation of the internet?
- Economics may help: economics studies social constructs

Socioeconomic Insights

- The four who's
  - Who benefits?
  - Who pays?
  - Who provides?
  - Who loses?
- Telephone system
  - 1: caller and receiver 2:caller 3:monopoly 4:services not offered, equipment not authorized
- Public health system
  - ?
- To have public services, the questions have to be answered
- Who makes and answers the questions?
- How is public interest expressed?

Socioeconomic Insights /2

- In any resource-limited situation, the true value of a given service or product is determined by what a buyer is willing to give up to obtain it (value, *not* cost)

Examples

- Public telephone network. Cost may be computed (time, distance, routing, bandwidth, depreciation...)
- Value?
- How to allocate costs among all users?

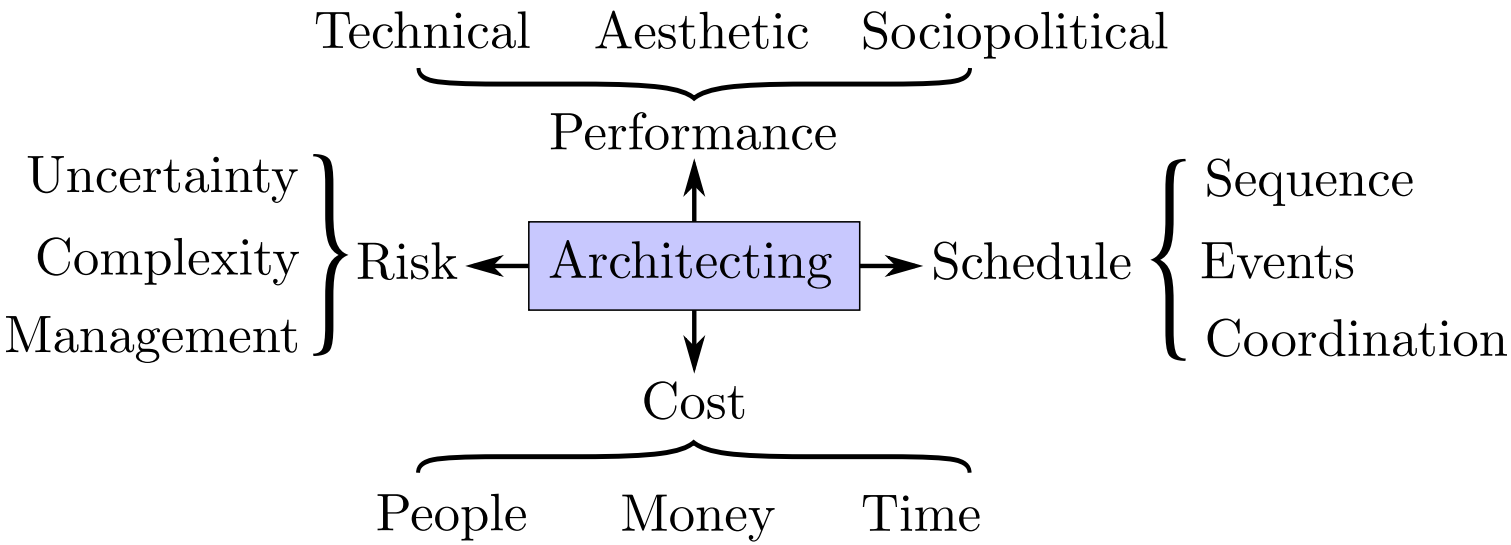
- TV
- Should home TV be pay-per-view for everyone?
- Who should decide on the answers?

Interaction Between Public and Private Sectors

- Sectors comparable in size, capability and influence
- The answers to the questions are different in both sectors
- Rules: Public sector follows them. Private sector sees them as deterrents to efficiency
- Private sector: good at providing well-specified things at specified times
- Public sector: good at providing services with the available resources
- Public sector: looks for agreement (absence of a large number of losers)
- Private sector: looks for specific segments of users

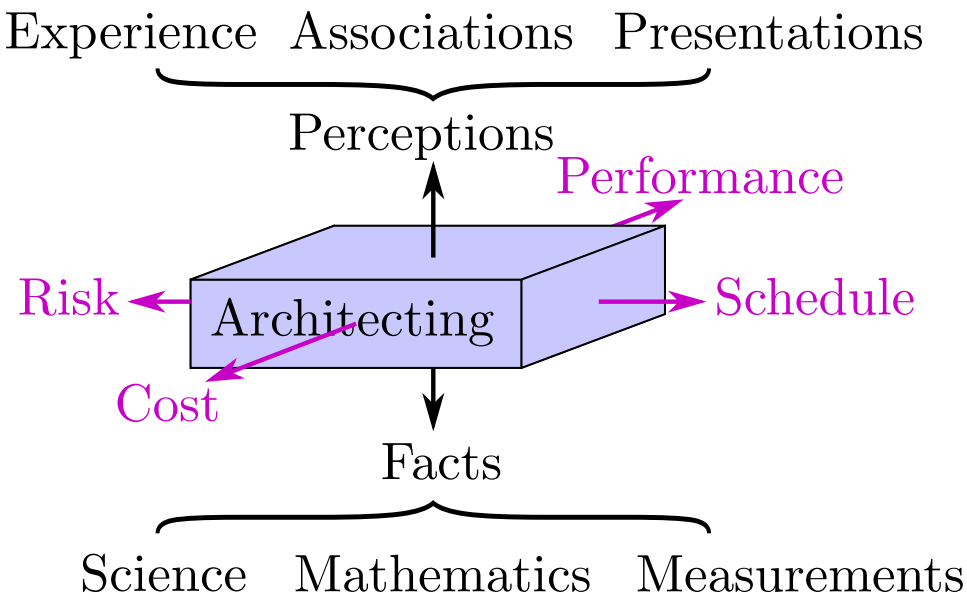
Facts versus Perceptions

- Architects: trade-offs between Performance, Schedule, Cost and Risk



Facts versus Perceptions /2

- Add: Facts and Perceptions



- Nuclear plants: *Design with transparent safety*
- Airline travel: Airliner capacity. Accident?
- Health care: Is perceived as *free* and becomes expensive
- Apollo: Picture of earth from moon (next slide)

The Earth seen from the Moon

Facts versus Perceptions /3

- Perceptions are as real as facts
- *The phrase "I hate it" is direction (directions∼instructions)*
- Learn to alleviate the tension between facts and perceptions
  - Communicate effectively
  - Understand the audience

Heuristics for Social Systems

- Success is in the eye of the beholder
- Do not assume that the original statement of the problem is necessarily the best, or even the right one
- Be sure there are mutually consistent answers to the Four Who's: Benefits? Pays? Provides? Loses?
- In any resource-limited situation, the true value of a given service or product is determined by what one is willing to give up to obtain it
- The choice between the architectures may well depend upon which set of drawbacks the stakeholders can handle best

Heuristics for Social Systems /2

- It is not the facts but the perceptions that count
- The phrase “I hate it” is direction
- In social systems, how you do something may be more important than what you do
- When implementing a change, keep some elements constants as an anchor point for people to cling to
- It is easier to change the technical elements of a social system than the human ones