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Aristocracy, Democracy, and System Design

System Design

- Conceptual Integrity
- Achieving Conceptual Integrity
- Aristocracy and Democracy
- What Does the Implementor Do While Waiting?

Architectural conceptual integrity

- European cathedral building spanned generations
- Some builders "improved" on original design
- Resulted in contradictory designs
  - e.g., Norman transept contradicts Gothic nave
- Reims cathedrals achieved integrity

- Software conceptual disunity arises from separating design effort into multiple tasks

Conceptual integrity predominates

- The most important system design consideration

- How is it achieved?
- Does it imply elitism?
- How do we keep the architects realistic?
- How do we communicate the architecture to the from the designer to the implementers?

Achieving conceptual integrity

- Programming makes computers functional
  - i.e., useful for some task or function
- Adding function increases complexity
- The ratio of function to complexity is the ultimate measure of a system design
  - Function alone is not enough
  - Simplicity alone is not enough

Function versus simplicity

- Function implies generalization
  - e.g., food processor
- Simplicity implies specialization
  - e.g., can opener
- See "Hello World" program examples http://www2.latech.edu/~acm/helloworld/

Strategies for conceptual integrity

- Two strategies for conceptual integrity
  - Divide architecture from implementation
  - Organize in surgical teams
- Architecture specifies the end (user interface)
  - i.e., What the system does
- Implementation specifies the means
  - i.e., How the system achieves the end

Aristrocracy and Democracy

- Are architects elite?
  - Yes: Conceptual integrity requires someone to control the concepts
- Do the architects do all creative work?
  - No: Creativity is not limited to setting the specifications, but also applies to implementation
- Would better products come from joint effort?
  - Good ideas that don't integrate are best left out

OS/360 example multiple architects

- 10 persons in architecture group
  - Warned that following plan would result in three-month delay and lower quality
- 150 persons in control program group
  - Proposed using 150 to write specification under the architects' supervision
  - Argued that 150 wide be idle otherwise
- Architect was right

Objections to exclusive architects

- Specification will be impractical
  - See *The Second-System Effect*
- Architects get all of the creative fun
  - Creativity can be enhanced by constraints
- Implementers sit idle while waiting for architects
  - Defer hiring as long as possible
  - Proceed based on rough estimations