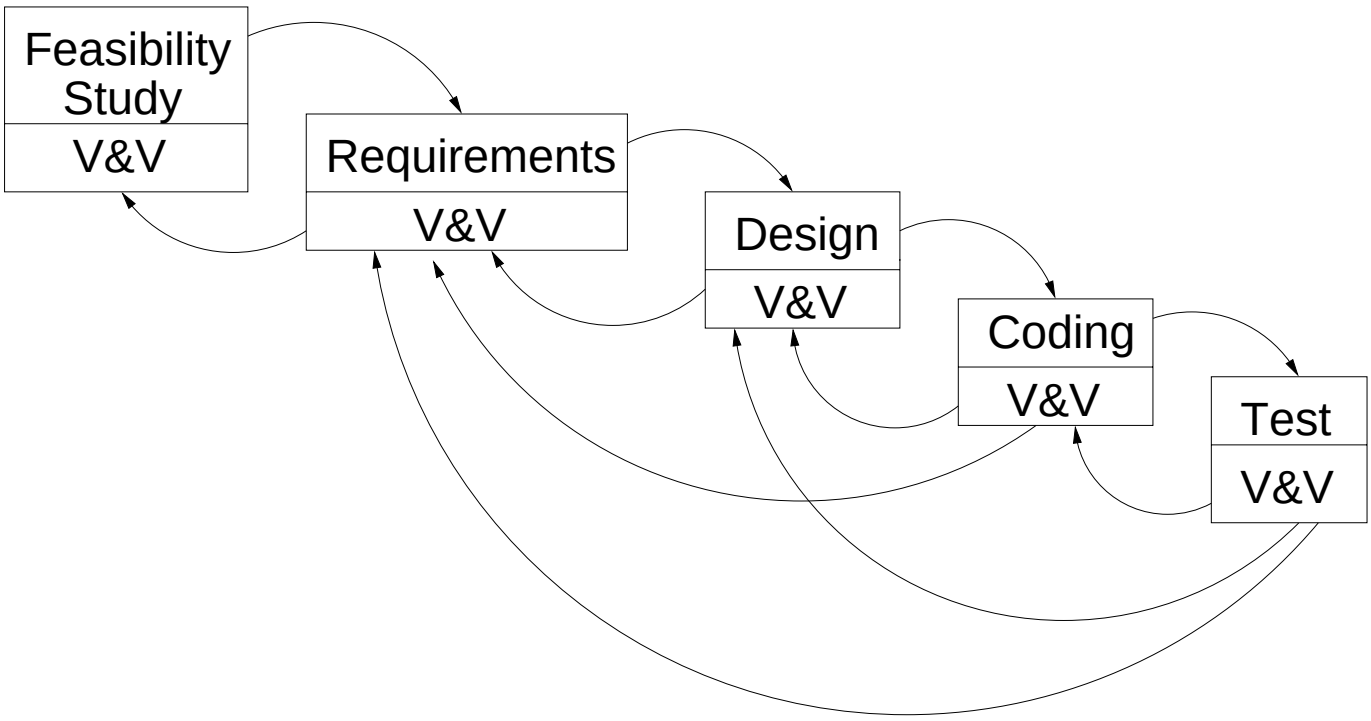
Waterfall Model



- Deliverables − baselines
- Document−driven process
- "Big Bang" testing, "stubs", daily build and smoke test
- "A Rational Design Process and How to Fake It"

Evolutionary Model

- Prototyping − "Do it twice"
  - to assess feasibility
  - to verify requirements
- May only be a front end or executable specification
  Or develop system with less functionality or quality attributes
- 3 approaches:
  1) Use prototyping as tool for requirements analysis.
     Need proper tools
  2) Use to accomodate design uncertainty.
     Prototype evolves into final product
     Documentation may be sacrificed
     May be less robust
     Quality defects may cause problems later
  3) Use to experiment with different proposed solutions before large investments made.

Evolutionary Models (2)

- Drawbacks:
  - Can be expensive to build
  - Can develop a life of its own − turns out to be product itself
  - Hard to change basic decisions made early
  - Can be an excuse for poor programming practices
- Experimental Evaluation:
  - Boehm: prototyping vs. waterfall
    Waterfall: addressed product and process control risks better
    Resulted in more robust product, easier to maintain
    Fewer problems in debugging and integration due to more thought−out design
    Prototyping: addressed user interfaces better
  - Alavi: prototyping vs. waterfall applied to an information system
    Prototyping: users more positive and more involved
    Waterfall: more robust and efficient data structures

Incremental Model

- Functionality produced and delivered in small increments.
- Focus attention first on essential features and add functionality only if and when needed
- Systems tend to be leaner −− fights overfunctionality syndrome
- May be hard to add features later
- Variant: Incremental implementation only
  - Follow waterfall down to implementation
  - During requirements analysis and system design
    - Define useful subsets that can be delivered
    - Define interfaces that allow adding later smoothly
  - Different parts implemented, tested, and delivered according to different priorities and at different times.

Spiral Model

- Includes every other model
- Risk driven (vs. document driven or increment driven)
- Radius of spiral represents cost accumulated so far

Do you need one uniform process over entire project?

- In requirements analysis, identify aspects that are uncertain

  e.g., library:

  checkout and checkin (inventory control) − relatively certain
  card catalogue, user search − relatively uncertain

then have separate processes for the different parts.

Software Factory

- Most software organizations strictly separated between initial development and later maintenance.
  - No incentive to produce a system that can be easily maintained.
  - No incentive to produce reusable components.
- Project management vs. product management
- Extend management responsibility to cover family of products rather than an individual product (product families)

Despite the rhetoric, CMM emphasizes control over flexibility and learning

- Control orientation seeks to maintain predictable operations, minimize variation, and avoid surprises.
- Learning orientation seeks to increase variation in order to explore opportunities.
- Formal bureaucratic control undermines intrinsic motivation needed for creative and flexible responses to uncertainty.
- Senge: humanistic values of caring and individual freedom are essential to building learning organizations.
- Carroll: "In too many TQM programs, it is the difficult−to−implement portions of the program that are being finessed or ignored and the rhetoric that is being retained."

Other CMM Problems

- Treats people as assembly line workers, i.e., replaceable, unreliable
  Humans are subordinated to defined processes
- Why five levels? Why a rigid order?
- Creates inflexible organizations and the illusion of control
- Places the focus on the wrong things