

Software Engineering

- Software engineering is concerned with the production of large scale software artifacts by teams of individuals
- *Software engineering is the application of science and mathematics by which the capabilities of computer equipment are made useful to man via computer programs, procedures, and associated documentation* -- B. Boehm
- *Software engineering ... is the part of computer science that is too difficult for the computer scientists* -- F. L. Bauer

Software Process

- *The related set of activities and processes that are involved in developing and evolving a software system* -- Sommerville
- Assessment
 - ISO 9000
 - Capability Maturity Model (CMM)
- Software process improvement
 - Software Process Improvement Networks (SPIN)

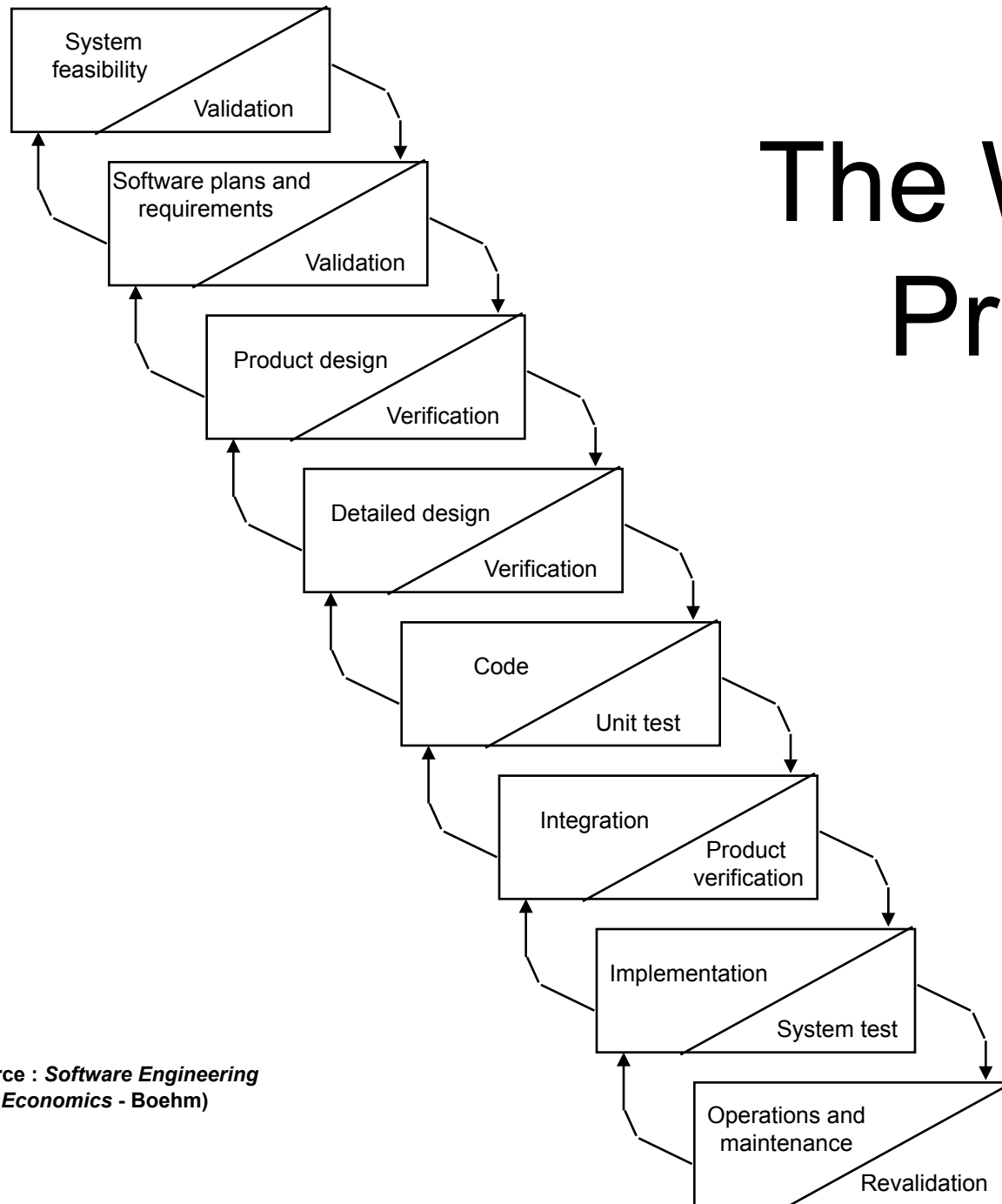
Popular Processes

- Waterfall
- Personal Software Process (PSP) /
Team Software Process (TSP)
- Unified Software Process (USP) /
Rational Unified Process (RUP)
- Cleanroom Software Engineering
- Extreme Programming (XP) / Agile
Methods

Real World Software Process

1. Order the T-shirts for the development team
2. Announce product availability
3. Write the code
4. Write the manual
5. Hire a product manager
6. Spec the software (writing the specs after the code helps to ensure that the software meets the specifications)
7. Ship
8. Test (the customers are a big help here)
9. Identify bugs as potential enhancements
10. Announce the upgrade program

The Waterfall Process



(Source : *Software Engineering Economics* - Boehm)

Time Spent in Various Phases of the Waterfall Process

Requirements analysis & design	30 - 40%
Implementation & unit test	15 - 20%
System (integration) test	30 - 50%
Operation & maintenance	yet another 100 - 300%

The Waterfall Process

- Entrance/advancement criteria for each phase
- Document driven \Rightarrow heavyweight
- **Non-overlapping phases**
- Product visibility only at end of process \Rightarrow lack of user feedback
- Brittle in the face of requirements change

Waterfall Activity Definitions - 1

- **Requirements Analysis:** determination, specification, review and update of software functional, performance, interface, and verification requirements
- **Product Design:** determination, specification, review and update of hardware-software architecture, program design, and data base design
- **Programming:** detailed design, code, unit test, and integration of individual computer program components. Includes programming personnel planning, tool acquisition, data base development, component level documentation, and intermediate level programming management

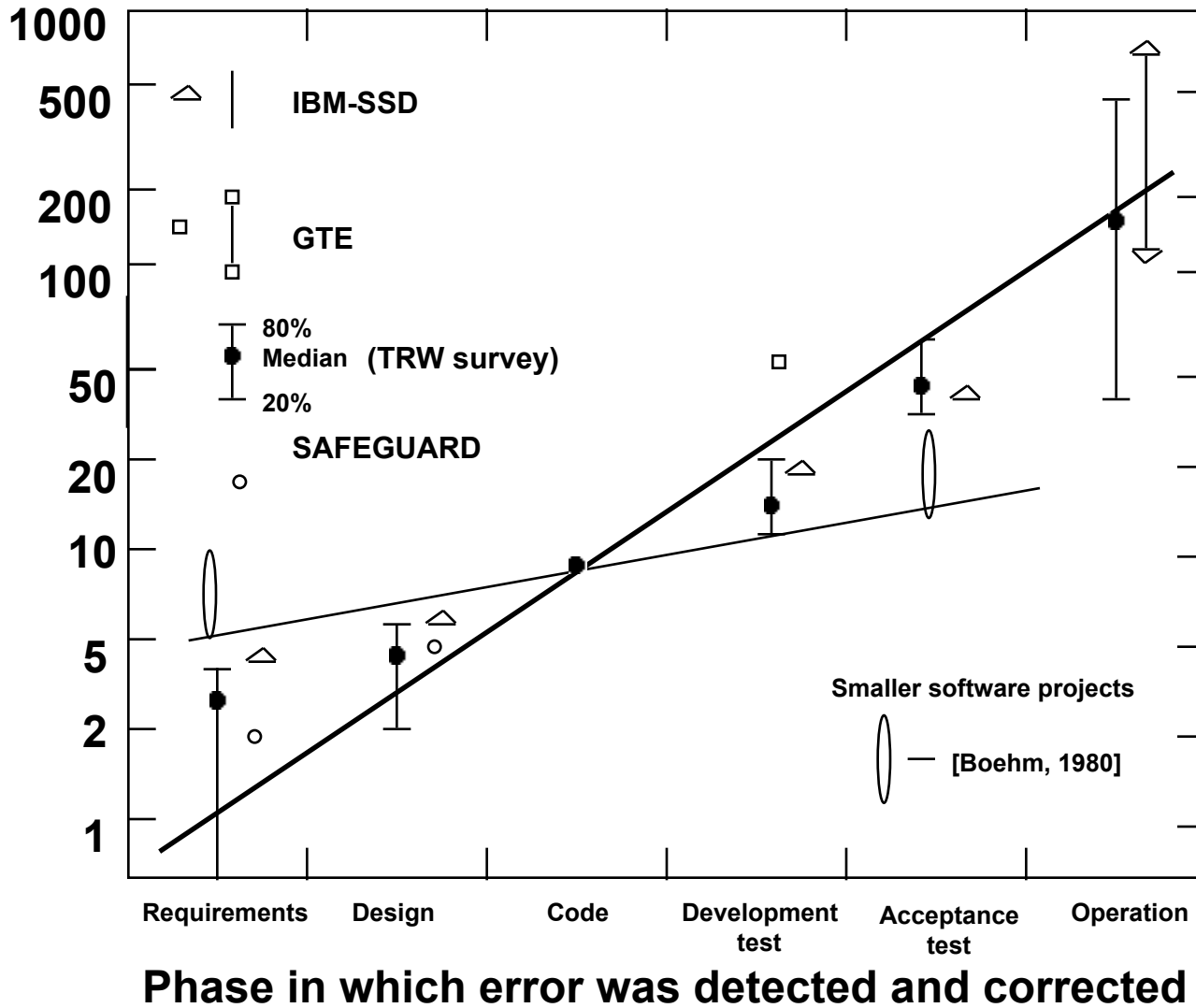
Waterfall Activity Definitions - 2

- **Test Planning:** Specification, review, and update of product test and acceptance test plans. Acquisition of associated test drivers, test tools, and test data
- **Verification and Validation:** Performance of independent requirements validation, design V & V, product test, and acceptance test. Acquisition of requirements and design V & V tools
- **Project Office Functions:** Project level management functions. Includes project level planning and control, contract and subcontract management, and customer interface

Waterfall Activity Definitions - 3

- **Configuration Management:** configuration management includes product identification, change control, status accounting, operation of program support library, development and monitoring of end item acceptance plan
- **Quality Assurance:** Quality assurance includes development and monitoring of project standards, and technical audits of software products and processes
- **Manuals:** Development and update of users' manuals, operators manuals, and maintenance manuals

Increase in Cost-to-Fix or Change Software throughout the Life Cycle



(Source : Software Engineering Economics - Boehm)