TOPICS

The Nature and History of Software Development

Problems with Software Development

**Software Engineering Paradigms and Technology**

THE NATURE OF SOFTWARE

- **Characteristics of Software**

- **Failure Curves for Hardware and Software**

- **Software Components**

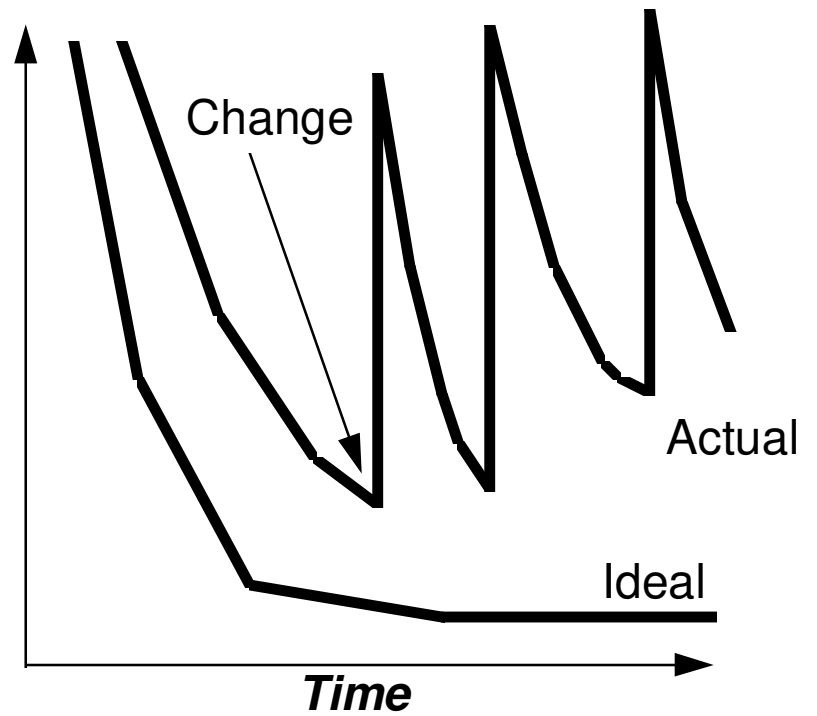- **Software Configuration**

- **Software Application Areas**

Characteristics of Software

- Software is *programs*, *documents*, and *data*.

- Software is developed or engineered; it is not manufactured like hardware.

- Software does not wear out, but it does *deteriorate*.

- Most software is custom-built, rather than being assembled from existing components.

- Software is a *business opportunity*.

Failure Curves for Hardware and Software

Failure Rate

"Infant Mortality"

"Wear Out"

Time
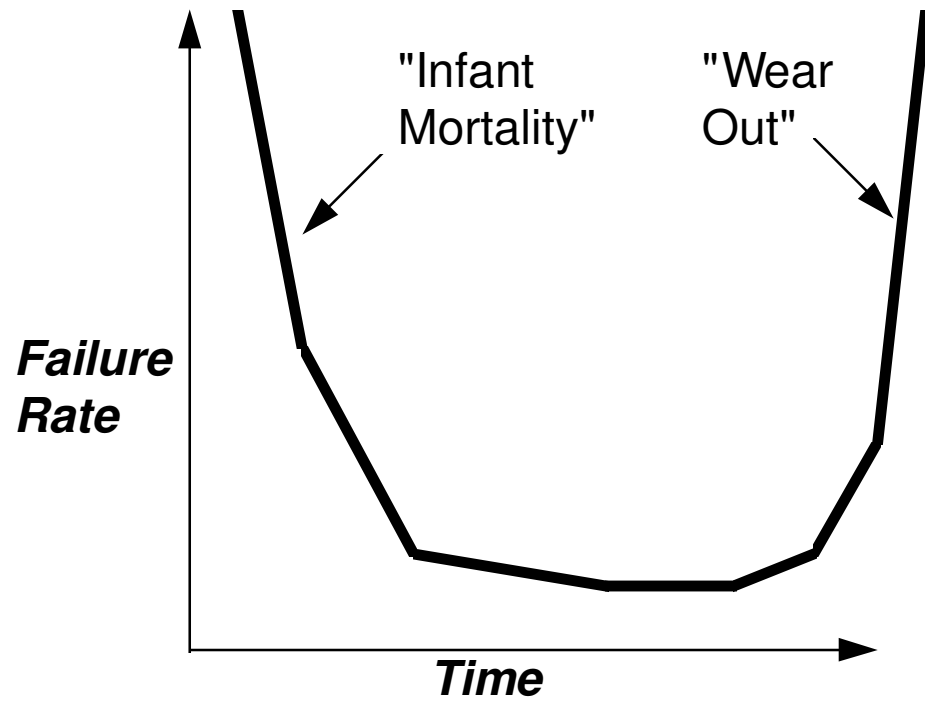
FAILURE CURVE FOR HARDWARE
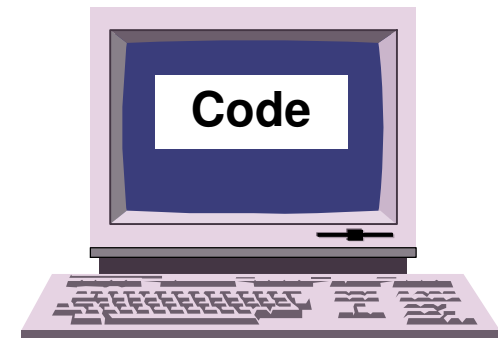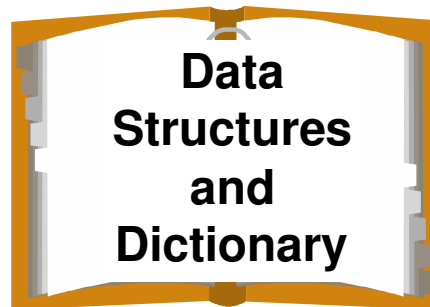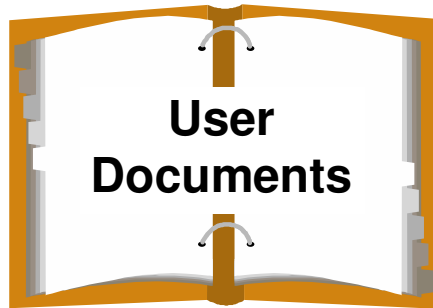
Change

Actual

Ideal

Time

FAILURE CURVE FOR SOFTWARE

Software Components

- **Software programs, or software systems, consist of *components*.**

- **A set of components which comprise a logical unit of software is called a *software configuration item*.**

- **Reuse and development of reliable, trusted software components improves software *quality* and *productivity*.**

- **Computer language forms:**

  - ○ **Machine level (microcode, digital signal generators)**

  - ○ **Assembly language (PC assembler, controllers)**

  - ○ **High-order languages (FORTRAN, Pascal, C, Ada, ...)**

  - ○ **Specialized languages (LISP, OPS5, Prolog, ...)**

  - ○ **Fourth generation languages (databases, windows apps)**

Software Configuration

Software Project Plan

Software Requirements Specification

Software Design

User Documents

Software Test Plan and Procedures

Data Structures and Dictionary

Code

Software Development Activities

- **Planning Activity**

  - Software Project Plan

- **Requirements Definition Activity**

  - Software Requirements Specification

  - Software Test Plan and Procedures

  - Data Structures and Dictionary

  - User Documents

- **Design Activity**

  - Software Design Documents

  - Software Test Plan and Procedures

  - Data Structures and Dictionary

- **Coding and Testing Activity**

  - Code

  - Software Test Plan and Procedures

- **Delivery and Maintenance Activity**

  - User Documents

  - Others as needed

Software Application Domains

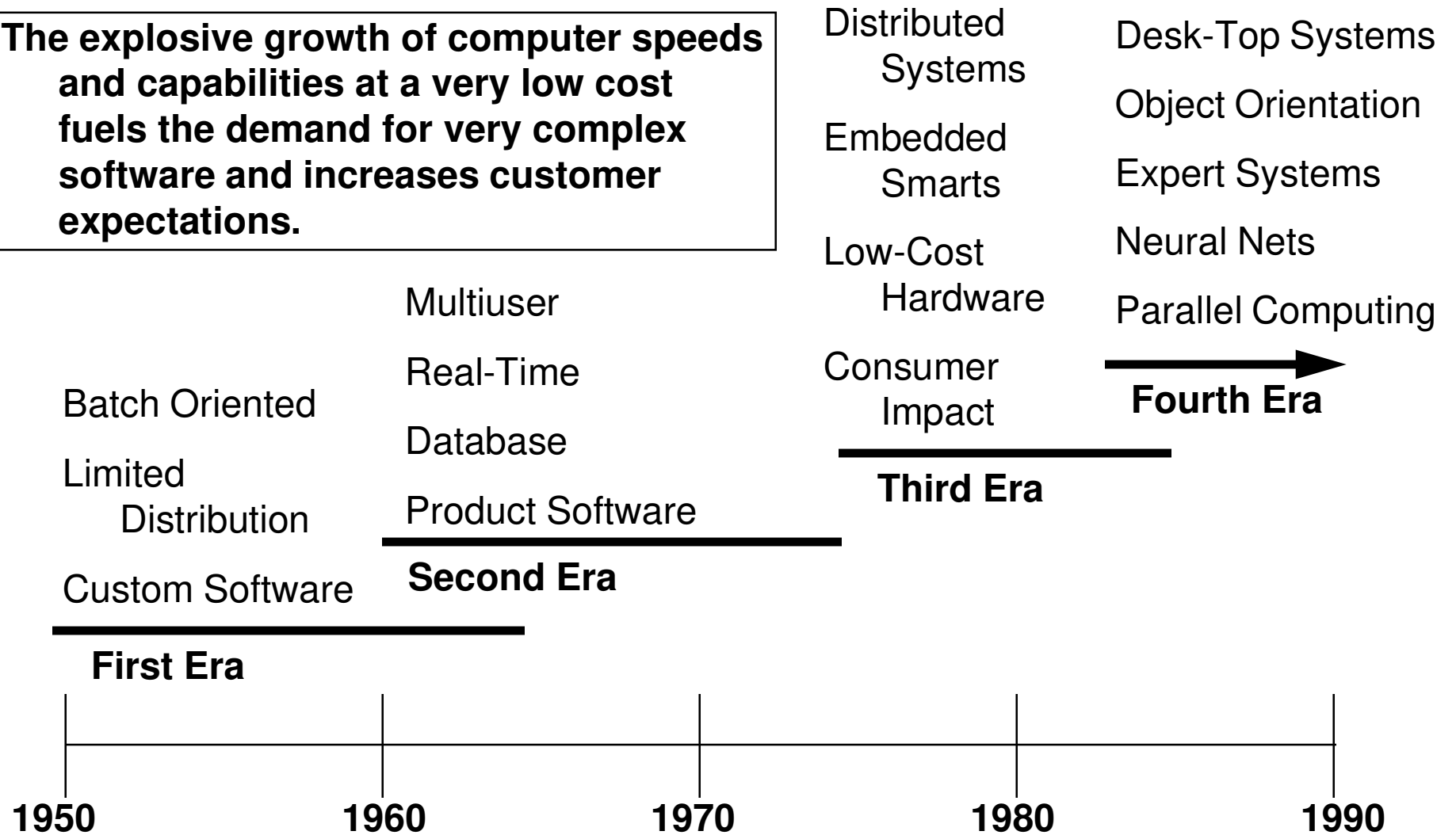- **System**
  - ○ **compilers**
  - ○ **editors**
  - ○ **Operating Systems**
- **Real Time**
  - ○ **machine control**
  - ○ **auto controls**
- **Business**
  - ○ **databases**
  - ○ **stock management**
- **Personal Computer**
  - ○ **all non-realtime above**

- **Embedded**
  - ○ **appliance control**
  - ○ **FPGA programs**
  - ○ **auto controls**
- **Engineering and Scientific**
  - ○ **simulation**
  - ○ **computer-aided design**
  - ○ **"number crunching"**
- **Artificial Intelligence**
  - ○ **expert systems**
  - ○ **neural networks**

HISTORY OF
SOFTWARE DEVELOPMENT

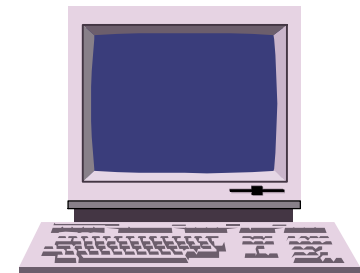- **Role of Software**

- **Industrial View**
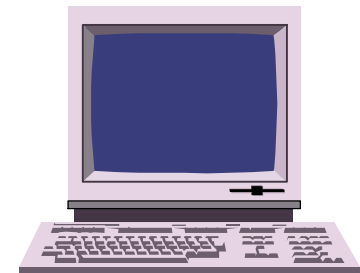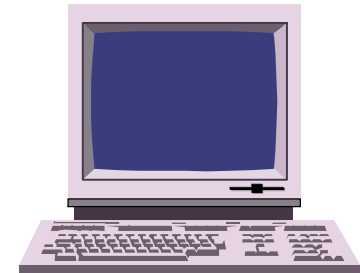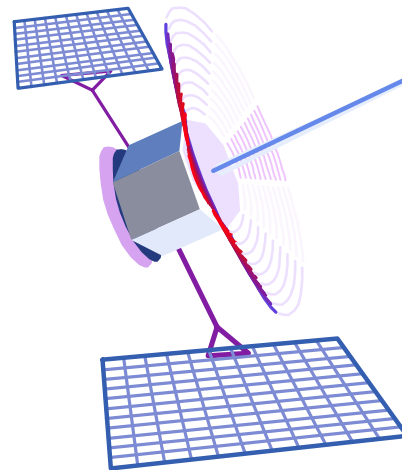
Role of Software

The explosive growth of computer speeds and capabilities at a very low cost fuels the demand for very complex software and increases customer expectations.

Distributed Systems

Desk-Top Systems

Object Orientation

Embedded Smarts

Expert Systems

Low-Cost Hardware

Neural Nets

Multiuser

Parallel Computing

Real-Time

Consumer Impact

Fourth Era

Batch Oriented

Database

Limited Distribution

Product Software

Third Era

Custom Software

Second Era

First Era

1950	1960	1970	1980	1990

Role of Software, Continued

Where Do We Go From Here?

- **Parallel computing to extend speed of computation**

- **Object-oriented methods of software design**

- **Software frameworks evolve to handle larger and multiprogram systems**

- **Heavy dependence on graphics interfaces**

- **Artificial intelligence and neural computing become useful**

- **National computing motivates huge software systems**

- **Advanced programming languages**

Industrial View

- **Why does it take so long to finish a working software system?**

- **Why are development costs so high?**

- **Why can't we find all software errors before software is delivered?**

- **How can we measure the progress of software development?**

- **How can we survive in the global economy?**