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An American National Standard

Standard Guide for Rapid Prototyping of Computerized Systems¹

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1. Scope

1.1 This guide covers a rapid prototyping method for developing computerized systems. Intended readers of this guide are people who develop computerized systems, and students and teachers of system development methods.

1.2 Rapid prototyping is an approach to developing computerized systems which produces a working model more quickly than conventional approaches. Where conventional methods concentrate on preparing functional requirements and functional design documents that describe the needed system, rapid prototyping methods concentrate on preparing a working prototype. Users and developers learn the functional requirements and an appropriate system design by interacting with a series of prototypes, each of which is rapidly produced from a starting framework or from an earlier version. A prototype can evolve into an operational system, it can serve as an exact behavioral specification of an operational system, or it can be used to explore the feasibility of a new idea or design which can be incorporated in a larger system. The method is rapid in preparing each version of the prototype, but the overall time required for system development may be more or less than the time required with conventional methods.

1.3 Rapid prototyping is most appropriate when the functional requirements or functional design for a system are not well understood, or when experimentation is required to explore some aspect of system behavior. It is not appropriate in hazardous settings, or when the requirements are well understood.

1.4 The guide recommends use of prototyping tools, but it is not a standard for the tools themselves. It does not cover executable specification tools. Transforming a prototype that is used to clarify requirements into an operational system is discussed briefly in Section 8 and in detail in other referenced standards (see 2.1).

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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2. Referenced Documents

2.1 ASTM Standards:

- E 622 Guide for Developing Computerized Systems²
- E 625 Guide for Training Users of Computerized Systems²
- E 627 Guide for Documenting Computerized Systems²
- E 731 Guide for the Selection and Acquisition of Commercially Available Computerized Systems²
- E 919 Specification for Software Documentation for a Computerized System²
- E 1013 Terminology Relating to Computerized Systems²
- E 1029 Guide for Documentation of Clinical Laboratory Computer Systems²

2.2 ANSI Standards:

- ANSI/MIL-STD-1815A Ada Programming Language³
- ANSI/X3.9 Programming Language FORTRAN³
- ANSI/X3.159 Programming Language C³
- ANSI/X11.1 MUMPS Programming Language³
- ANSI/IEEE 729 Glossary of Software Engineering Terminology³
- ANSI/IEEE 770 X3.97 Pascal Programming Language³
- ANSI/IEEE 1063 User Documentation for Computer Software⁴

3. Terminology

3.1 *Definitions*—For definitions of terms relating to computerized systems, refer to Terminology E 1013, IEEE 729, and ANDIP.⁵

3.1.1 *fourth generation language, n*—a high-level computer language that incorporates data structures and procedures for a specific problem domain.

3.1.2 *prototype, n*—an original or model from which a system is copied.

3.1.3 *prototype, v*—to create an original or model.

² Annual Book of ASTM Standards, Vol 14.01.

³ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁴ Available from the Institute of Electrical and Electronics Engineers, Inc., 345 E. 47th Street, New York, NY 10017.

⁵ American National Dictionary for Information Processing Systems, Information Processing Systems Technical Report X3/TR-1-82, Dow Jones-Irwin, Homewood, IL.

3.1.4 *prototyping, n*—the activities that create an original or model.

3.1.5 *rapid prototyping, n*—an iterative method for developing prototypes of components, subsystems, or complete computerized systems, in which the time between successive versions of the prototype is short.

3.1.6 *RP, n*—rapid prototyping.

3.1.7 *third generation language, n*—a procedural high-level computer language, such as COBOL, FORTRAN, or Pascal.

4. Significance and Use

4.1 Rapid Prototyping (RP) is a way to develop a computerized system which produces a working model of the system very quickly. The RP process shown in Fig. 1 has many similarities, and some differences from the conventional system development process shown in Fig. 2. RP replaces the functional requirements and functional design phases of the conventional method with an iterative process of prototype refinement. Where the phases of the conventional method produce a set of documents that describe the system, RP produces a prototype. The prototype is tested and refined through several iterations, with intense interaction between system users and developers. RP is an experimental approach to system development which provides a learning device, the prototype, for users and developers. A prototype can be used as

a tool for clarifying functional requirements for the operational system, as a means of evaluating a design approach, or as a developing series of versions of the operational system. A prototype is sometimes used as an exact behavioral specification for an operational system which replaces it. Quality characteristics are often sacrificed during RP for the sake of rapid development and low cost; robustness, efficiency, generality, portability, and maintainability are commonly ignored. However, documentation needed to use the system cannot be ignored.

4.1.1 *Rapid* in RP means that the time between successive versions of the prototype is short. It should be short enough that (1) both users and developers can remember how each version relates to the previous one without written notes, (2) user requirements do not change significantly while a version is being developed, (3) the prototyping team will remain in the project through the RP phase, and (4) total time to develop the system is acceptable. (Expected project duration should be stated in the project definition agreement. See Section 6 and Guide E 622, Section 6.) A few days between versions is adequate and a few weeks may be acceptable. If the time needed to produce a new version is longer, then it may be necessary to produce that version using a conventional system development method (for example, Guide E 622) with full documentation of requirements and design (see Appendix X3).

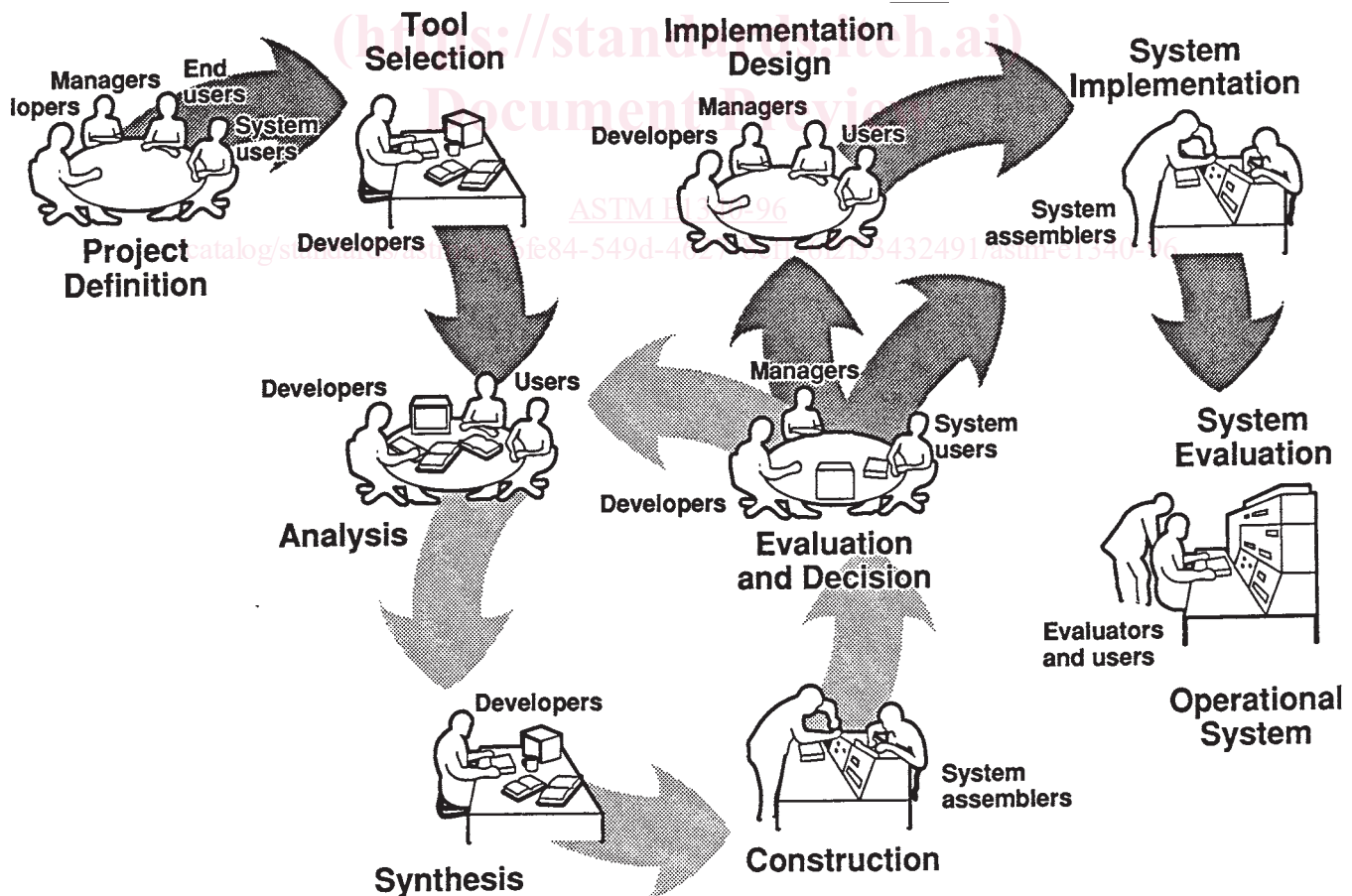


FIG. 1 Rapid Prototyping of a Computerized System