Volume II, Section 3
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3 Functionality Testing

3.1 Scope

This section contains a description of the testing to be performed by the ITAs to confirm the functional capabilities of a voting system submitted for qualification. It describes the scope and basis for functionality testing, outlines the general sequence of tests within the overall test process, and provides guidance on testing for accessibility.

3.2 Breadth of Functionality Testing

In order to best compliment the diversity of the voting systems industry, the qualification testing process is not rigidly defined. Although there are basic functionality testing requirements, additions or variations in testing are appropriate in order to compliment the system's use of specific technologies and configurations, the system capabilities, and the outcomes of previous testing.

3.2.1 Basic Functionality Testing Requirements

ITAs shall design and perform procedures to test a voting system against the functional requirements outlined in Volume I, Section 2. Tests procedures shall be designed and performed by the ITA that address:

    a.   Overall system capabilities;

    b.   Pre-voting functions;

    c.   Voting functions;

    d.   Post-voting functions;

    e.   System maintenance; and

f. Transportation and storage.

The specific procedures to be used shall be identified in the Qualification Test Plan prepared by the ITA. These procedures may replicate testing performed by the vendor and documented in the vendor's TDP, but shall not rely on vendor testing as a substitute for functionality testing performed by the ITA.

Recognizing variations in system design and the technologies employed by different vendors, the ITAs shall design test procedures that account for such variations and reflect the system-specific functional capabilities in Volume I, Section 2.

3.2.2   Variation of System Functionality Testing to Reflect Voting System Technologies and Configurations

Voting systems are not designed according to a standard design template. Instead, system design reflects the vendor's selections from a variety of technologies and design configurations. Such variation is recognized in the definitions of voting systems in Volume I, Section 1, and serves as the basis for delineating various functional capability requirements.

Functional capabilities will vary according to the relative complexity of a system and the manner in which the system integrates various technologies. Therefore, the testing procedure designed and performed by the ITA for a particular system shall reflect the specific technologies and design configurations used by that system.

3.2.3   Variation of System Functionality Testing to Reflect Additional Voting System Capabilities

The requirements for voting system functionality provided by Volume I, Section 2 reflect a minimum set of capabilities. Vendors may, and often do, provide additional capabilities in systems that are submitted for qualification testing in order to respond to the requirements of individual states. These additional capabilities shall be identified by the vendor within the TDP as described in Volume II, Section 2. Based on this information, ITAs shall design and perform system functionality testing for additional functional capabilities as well as the capabilities required by Volume I, Section 2 of the Standards.

3.2.4 Variation of System Functionality Testing to Reflect Voting Systems that Incorporate Previously Tested Functionality

The required functional capabilities of voting systems defined in Volume I, Section 2 reflect a broad range of system functionality needed to support the full life cycle of an election, including post election activities. Many systems submitted for qualification testing are designed to address this scope, and are tested accordingly.

However, some new systems seek qualification using a combination of new subsystems or system components interfaced with the components of an previously qualified system. For example, a vendor can submit a voting system for qualification testing that has a new DRE voting device, but that integrates the election management component from a previously qualified system.

In this situation, the vendor is strongly encouraged to identify in its TDP the functional capabilities supported by new subsystems/components and those supported by subsystems/components taken from a previously qualified system. The vendor is also encouraged to indicate in its system design documentation and configuration management records the scope and nature of any modifications made to the reused subsystems or components. Following these suggestions will assist the ITA in developing efficient test procedures that rely in part on the results of testing of the previously qualified subsystems or components.

In this situation the ITA may design and perform a test procedure that draws on the results of testing performed previously on reused subsystems or components. However, the scope of testing shall include, irrespective of previous testing, certain functionality tests:

  a.   All functionality performed by new subsystems/modules;

  b.   All functionality performed by modified subsystems/modules;

  c.   Functionality that is accomplished using any interfaces to new modules, or that shares inputs or outputs from new modules;

  d.   All functionality related to vote tabulation and election results reporting; and

  e.   All functionality related to audit trail maintenance.

3.3 General Test Sequence

There is no required sequence for performing the system qualification tests. For a system not previously qualified, the ITA may perform tests using generic test ballots, and schedule the tests in a convenient order, provided that prerequisite conditions for each test have been satisfied before the test is initiated.

Regardless of the sequence of testing used, the full qualification testing process shall include functionality testing for all system functions of a voting system, minus the exceptions noted in Section 3.2. Generally, in depth functionality testing will follow testing of the systems hardware and the source code review of the system's software. ITAs will usually conduct functionality testing as an integral element of system level integration testing described in Volume II, Section 6.

Some functionality tests for the voting functions defined in Volume I, Section 2.4 and 2.5 may be performed as an integral part of hardware testing, enabling a more efficient testing process. Ballots processed and counted during hardware operating tests for precinct count and central count systems may serve to satisfy part of the functionality testing provided that the ballots were cast using a test procedure that is equivalent to the procedures indicated below.

3.3.1 Functionality Testing in Parallel with Hardware Testing for Precinct Count Systems

For testing voting functions defined in Volume I, Sections 2.4 and 2.5, the following procedures shall be performed during the functionality tests of voting equipment and precinct counting equipment.

a. The procedure to prepare election programs shall:

1) Verify resident firmware, if any;

2) Prepare software (including firmware) to simulate all ballot format and logic options for which the system will be used;

3) Verify program memory device content; and

4) Obtain and design test ballots with formats and voting patterns sufficient to verify performance of the test election programs.

b. The procedures to program precinct ballot counters shall:

1) Install program and data memory devices, or verify presence if resident; and

2) Verify operational status of hardware as in Volume II, Section 4.

c. The procedures to simulate opening of the polls shall:

1) Perform procedures required to prepare hardware for election operations;

2) Obtain "zero" printout or other evidence that data memory has been cleared;

3) Verify audit record of pre-election operations; and

4) Perform procedure required to open the polling place and enable ballot counting.

      d.   The procedure to simulate counting ballots shall cast test ballots in a number sufficient to demonstrate proper processing, error handling, and generation of audit data as specified in Volume I, Sections 2 and 4.

      e.   The procedure to simulate closing of polls shall:

          1) Perform hardware operations required to disable ballot counting and close the polls;

          2) Obtain data reports and verify correctness; and

          3) Obtain audit log and verify correctness.

They need not be performed in the sequence listed, provided the necessary precondition of each procedure has been met.

3.3.2   Functionality Testing in Parallel with Hardware Testing for Central Count Systems

For testing voting functions defined in Volume I, Sections 2.4 and 2.5, the following procedures shall be performed during the functional tests.

      a.   The procedure to prepare election programs shall:

          1) Verify resident firmware, if any;

          2) Prepare software (including firmware) to simulate all ballot format and logic options for which the system will be used, and to enable simulation of counting ballots from at least 10 polling places or precincts;

          3) Verify program memory device content; and

          4) Procure test ballots with formats, voting patterns, and format identifications sufficient to verify performance of the test election programs;

      b.   The procedure to simulate counting ballots shall count test ballots in a number sufficient to demonstrate proper processing, error handling, and generation of audit data as specified in Volume I, Sections 2 and 4; and

      c.   The procedure to simulate election reports shall:

          1) Obtain reports at polling places or precinct level;

          2) Obtain consolidated reports;

          3) Provide query access, if this is a feature of the system;

          4) Verify correctness of all reports and queries; and

          5) Obtain audit log and verify correctness.

They need not be performed in the sequence listed, provided the necessary preconditions of each procedure have been met.

3.4   Functionality Testing for Accessibility

As indicated in Volume I, Section 2.2.7, voting systems shall provide accessibility to individuals with disabilities, meeting the specific requirements of this Section. ITAs shall design and perform test procedures that verify conformance with each of these requirements.

3.5   Functionality Testing for Systems that Operate on Personal Computers

For systems intended to use non-standard voting devices, such as a personal computer, provided by the local jurisdiction, ITAs shall conduct functionality tests using hardware provided by the vendor that meets the minimum configuration specifications defined by the vendor.

Volume II, Section 4, provides additional information on hardware to be used to conduct functionality testing of such voting devices, as well as hardware to be used to conduct security testing and other forms of testing.