General Interoperability Requirements

DRAFT REQUIREMENTS for VVSG 2.0

02/07/18

These general requirements have been developed as a starting point for discussion of interoperability in voting devices to be required in the forthcoming VVSG 2.0. It is intended that these requirements will be discussed within the VVSG Interoperability Working Group and subsequently modified as appropriate.

The requirements in this section deal with making voting device interfaces and data formats transparent and interoperable. The advantages of transparency and interoperability include that systems and devices may work across different manufacturers and that data can be conveniently aggregated and analyzed across different platforms. The requirements address (a) integratability of hardware and (b) common public formats for data. The requirements in this section do not address or mandate true interoperability of interfaces, however they reduce the barriers to interoperability.

Integratability deals with the physical and technical aspects of connections between systems and devices, which include hardware and firmware, protocols, etc. Basic integratability of devices is achieved through use of common, standard hardware interfaces and interface protocols such as USB. Thus, a printer port must not be proprietary; it must use a common hardware interface and interface protocol, with the goal being that printers of similar type should be interchangeable.

Systems and devices that are integratable are designed such that components of systems may be compatible or can be made compatible with each other through some moderate amount of effort, for example, by writing "glue code." For example, an audit device may be designed to work with an EMS, but it may require adaptations to protocols for signaling or data exchange. Adapting the audit interface to the EMS may require some amount of software modification but should still be within reasonable bounds.

The barriers to interoperability are further reduced if all systems support the same commonly agreed upon, publicly-available data formats for ballot definition, records and reports. The advantages of using common data formats include:

- Common formats for specifying election programming data such as ballot definition files promotes greater accuracy and reduces duplication;

- Common exported data formats can assist in aggregating results and conducting analyses and audits across among manufacturer systems (e.g., auditing statewide contests in states whose counties use election systems from different vendors);
- Common formats for use in data reports can be mapped as necessary to locality-specific reports as opposed to requiring election systems to export reports in many different locality-specific formats; and
- Costs of testing and audit may be reduced when a uniform format for inputs and outputs is employed.

The requirements in this section concern the following:

- Common hardware interfaces;
- Non-restrictive, publicly available formats for data export and interchange; and
- Documentation for formats and for how each manufacturer has implemented them, including sample source code for reading different formats.

These requirements include support for the NIST SP 1500 Common Data Format (CDF) specifications developed by NIST and its public working groups on election data standards, including for exports and interchanges of:

- Election programming data
- Ballot definition data
- Cast vote records
- Voter registration-related data
- Election results data

Manufacturers may continue to use their own formats as they choose and could provide support for the NIST SP 1500 specifications via conversions or translations from any proprietary formats.

The requirements promote, but do not mandate true interoperability of all voting devices across different manufacturers.

The requirements support the following principle and associated guidelines:

4. The voting system is designed to support interoperability in its interfaces to external systems, its interfaces to internal components, its data, and its peripherals.

4.1 Voting system data thatis imported, exported, or otherwise reported, is in an interoperable format.

4.2 Standard, publicly-available formats for other types of data are used, where available.

4.3 Widely-used hardware interfaces and communications protocols are used.

1. General Interoperability Requirements

1-A Integratability of systems and devices

Systems MUST maximize integratability with other systems and/or devices of other systems.

Applies to: Voting system

> **Discussion**
> This is a goal-oriented requirement to promote interoperability of voting system devices among and across manufacturers. Manufacturers are urged to design and build voting devices such that they can interoperate with similar devices from other manufacturers or can be made to interoperate within reasonable bounds.

Status:	under review
Updated:	02/13/18
Gap	notes:New requirement

1-A.1 Standard device interfaces

Standard, common hardware interfaces and protocols MUST be used to connect devices.

Applies to: Voting system

> **Discussion**
> This refers to use of widespread, commonly used protocols and hardware interfaces when connecting to printers, disks, and other devices. A device that uses a proprietary hardware interface when a more standard interface is available, e.g., USB, would be non-conformant.

Status:	under review

| Updated: | 02/13/18 |
| Gap | notes:New requirement |

1-A.2 Standard protocols and algorithms

Standard, publicly-available and publicly-documented protocols MUST be used, where possible, for exchanging data or encoding data.

Applies to: Voting system

> **Discussion**
> This refers to the use of common protocols for wireless communications, e.g., Bluetooth, etc. It also refers to data encodings such as for bar and QR codes typically used by ballot marking devices to encode voter choices.

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1-A.3 Public documented manufacturer protocols

Where it is not currently possible to meet requirement A.2, manufacturers MUST use a publicly documented protocol.

Applies to: Voting system

> **Discussion**
> This refers to, for example, packing or compressing data before encoding in a QR code. If a manufacturer uses its own protocol or algorithm, it must document its implementation and usage and make this available publicly.

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1-B Data export and exchange format

Voting devices MUST provide support for the non-restrictive, publicly-available NIST SP Common Data Format specifications for data inputs and output:

a. Election programming data, NIST SP 1500-100

b. Ballot definition data, NIST SP 1500-104

c. Cast vote records, NIST SP 1500-103

d. Voter registration-related data, NIST SP 1500-102

e. Election results data, NIST SP 1500-100

f. Election event logging data, NIST SP 1500-101

Applies to: Voting system

Discussion

Manufacturers can continue use of any proprietary input/output data formats or internal data formats, however at the same time manufacturers must provide support for the NIST SP specifications. Implementations that do this via translations or conversions from a proprietary format would be considered conformant.

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Gap   notes:New requirement

1-B.1 Election definition devices, election programming data input and output

Election definition devices MUST include support for the NIST CDF specifications for data inputs and outputs, including for:

   a. Input or output of election programming data;

   b. Input or output of ballot programming data; and

   c. Pre-election reports.

Applies to: Election definition devices

Discussion

This requirement concerns input of pre-election data into an election definition device, such as for identification of political geography, contest, candidates, ballot data, and other pre-election information used to setup an election and produce ballots.   It also concerns reports of pre-election data from the election definition device. The NIST SP specifications, where applicable, can be supported via translations or conversions from manufacturer-proprietary formats.

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1-B.2 Tabulators, report data

Tabulators MUST include support for the NIST CDF specifications for election results reporting data.

Applies to: Tabulators

Discussion

This requirement deals with reporting of election results reporting data from tabulators such as an EMS. CCOS and PCOS generally do this via exports of cast vote records (see 1-B.3).

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1-B.3 Exchange of CVRs

Devices that export or import CVRs MUST support the NIST CDF specifications with respect to export and import of CVRs.

Applies to: Vote-capture devices, Tabulators

Discussion
Devices that export or import CVRs typically include the EMS, CCOS and PCOS, other vote-capture devices, and audit devices.

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1-B.4 Exchange of voting device election logs

Voting devices MUST support the export or import of election log data using the NIST SP 1500-101 specification.

Applies to: Voting system

Discussion
This requirement refers to election logs and not system logs provided by common operating systems such as Microsoft Windows or Apple IOS. This requirement does not mandate that manufacturers use the format for storing election log information; a manufacturer can meet this requirement by conversion or translation from a native format into the NIST SP 1500-101 format.

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1-B.5 Specification of common format usage

The voting device or election system manufacturer MUST provide a specification describing how the manufacturer has implemented a NIST SP 1500 CDF specification with respect to the manufacturer's specific voting devices and data, including such items as descriptions of elements, attributes, constraints, extensions, syntax and semantics of the format, and definitions for data fields and schemas.

Applies to: Voting system

> **Discussion**
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> Conformance to a common data format does not guarantee data interoperability. The manufacturer must document fully how it has interpreted and implemented a NIST CDF specification for its voting devices and the types of data exchanged/exported.

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Gap	notes:New requirement

1-B.6 Public specification of manufacturer native formats

Where a NIST SP 1500 CDF Specification or other interoperable interchange specification does not exist for a particular area of data interchange, the voting device manufacturer MUST provide a specification for its native format, describing how the manufacturer has implemented the native format with respect to the manufacturer's specific voting devices and data, including such items as descriptions of elements, attributes, constraints, extensions, syntax and semantics of the format, and definitions for data fields and schemas.

Applies to: Voting system

> **Discussion**
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> This requirement is essentially the same as requirement 1-B.5 but for the manufacturer's own native formats where a NIST CDF specification does not exist.

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1-B.7 Common format across manufacturers

The voting system manufacturer MUST support the NIST SP 1500 CDF specifications for export and interchange of data and reports across its major device categories.

Applies to: Voting system

> **Discussion**
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> Different equipment from the same manufacturer must be interoperable with the respect to data format. For example, a common ballot definition should apply to all manufacturer vote-capture devices and should not be specific to each device.   Export of data (e.g., reports and CVRs) must use a common format across all devices.

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