



U.S. ELECTION ASSISTANCE COMMISSION

633 3rd St. NW, Suite 200

Washington, DC 20001

EAC Decision on Request for Interpretation

2023-06 Common Data Format (CDF) Extensions

Extensions to the VVSG 2.0

Extensions are additional functions, features, or capabilities included in a voting system that are not defined in the requirements. Extensions are permitted to accommodate the needs of states that may impose additional requirements and to accommodate changes in technology.

However, an extension is not allowed to contradict or relax requirements that would otherwise apply to the system and its devices.

Sections of Standards or Guidelines:

3.3-B – Specification of common data format usage

Manufacturers must provide publicly available documentation describing how the manufacturer has implemented a CDF specification for a particular device or function. This includes such items as:

1. descriptions of how elements and attributes are used;
2. constraints on data elements; and
3. extensions as well as any constraints.

4.1-F – Specification of common format usage

Manufacturers must include a specification describing how the manufacturer has implemented a CDF specification for a particular device or function. This includes such items as descriptions of how elements and attributes are used, as well as any constraints or extensions.

Date:

November 3, 2023

Question(s):

1. Does VVSG 2.0 requirement 3.3-B prohibit the use of extensions in CDF implementation?
2. VVSG 2.0 Appendix C calls out specific CDF publications, however, some have been revised since VVSG 2.0 was adopted. Which version of the CDF publications are required for implementation?



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Discussion:

The goal of the Common Data Formats (CDFs) in the VVSG 2.0 is to maximize interoperability without restricting creativity, growth, and development. When considering extensions, there needs to be a thorough understanding of how they impact interoperability and the ability to effectively test implementations.

CDF Native Support for Extensions

The Common Data Formats consists of two parts: a high-level data model constructed using Unified Modeling Languages (UML) class models and machine-readable schemas, representing skeletal structures for the use of concrete data representations (e.g., JSON, XML). NIST developed the CDFs to allow for the describing of values that did not exist at the time of drafting or were too context specific to warrant standardization. If no predefined enumeration literal (value) exists to describe an enumeration property, another value can be provided.

An example would be an enumeration called *HashType*. Four defined literals exist within the specification: *md5*, *sha-256*, *sha-512*, and *other*. A manufacturer may use another literal, e.g. *sha-244*, by first setting *Hash::Type* to *other*, and *Hash::OtherType* to *sha-244*. This “Other” structure is used as a predefined extension points. VVSG 2.0 requirements 3.3-B and 4.1-F refer to documenting these extension enumeration literals.

General Extensions

General extensions are defined here as the creation of new UML Properties which may become tags or attributes in XML, or properties in JSON. Both the XML and JSON schemas disallow extending the CDFs with new properties.

Specifically, XML Schema Definitions (XSD) use a closed data model unless explicitly opted-in, which the CDFs have not. JSON Schemas use an open data model by default, unless *additionalProperties* are set to false. In The NIST CDF JSON Schemas, all objects are defined with *additionalProperties* set to false. Referring to the statement on extensions on VVSG 2.0, pg. 20:

[...] However, an extension is not allowed to contradict or relax requirements that would otherwise apply to the system and its devices.

Such general extensions would contradict the requirements of the common data formats, as incorporated by reference into the VVSG 2.0.

Risks in Allowing General Extensions

It is impossible to predict how general extensions could be used. Ideally, they would only be used for manufacturer-specific details that would not normally be subject to standardization anyway. However, general extensions may be developed to make up for gaps in CDF functionality. Such gaps should be standardized so that those use-cases can be interoperable as well, but allowing general extensions discourages this.



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General extensions are, by nature, adding aspects to a standard. This risks compartmentalization of the CDF ecosystem, where systems may begin to support a “flavor” of CDF over its standardized form. This may lead to poor interoperability outcomes, with systems needing to support various flavors and confusing election officials as to the actual capabilities of CDFs.

While general extensions are problematic, it is possible to create a manufacturer data format under VVSG 2.0 requirement 4.2-B. These data formats can expand beyond the use cases outlined for the CDFs. A manufacturer must still be able to produce a CDF where required. All additional formats must be publicly defined.

Update of Common Data Formats to Support Discovered VVSG Gaps

In reference to VVSG 2.0 requirements 1.1.9-C.2 and 1.1.5-D.4, we have confirmed that they are not mapped to corresponding properties in the NIST CVR CDF. From an implementation standpoint the NIST CVR CDF Version 1 Revision 2 and prior cannot be used to meet these requirements. NIST plans a revision to the NIST CVR CDF to map these requirements. Practically, there are two options for implementation:

1. Wait until the revision is published by NIST and incorporate the revision into your system, or
2. Produce and document a manufacturer data format per 4.2-B that maps these requirements.

Revisions to CDF Publications

Manufacturers should declare the version of each CDF implemented in their system.

Future developments of common data formats will be mediated through a community discussion and development process (see <https://github.com/usnistgov/Voting>). Through such processes real world use of common and manufacturer data formats will provide pathways by which CDFs can evolve. A forthcoming lifecycle policy will provide additional guidance.

Conclusion:

Built-in extensions are incorporated into the common data formats to help address properties where a predefined literal does not exist within the standards. However, general extensions are disallowed from use in systems under the VVSG 2.0 due to complications in testing and negative impacts on interoperability. As manufacturers implement the CDFs, it will become clear if changes should be made to accommodate common practices or if additional extension points should be considered and incorporated into the CDFs. Manufacturers are encouraged to



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work with NIST to develop data points they feel are necessary so they can be standardized into the CDFs.

While it is required for manufacturers to implement the CDF specifications referenced by the VVSG, it is not required that all data exchange occur within the published CDFs. When it is necessary to exchange data not built into the CDFs, alternative methods may be used to achieve this.

Effective Date:

As of the date this document is published.