
Recommendations of the National Institute of Standards and Technology

Stephen Quinn
David Waltermire
Christopher Johnson
Karen Scarfone
John Banghart

Recommendations of the National Institute of Standards and Technology

Stephen Quinn
David Waltermire
Christopher Johnson
Karen Scarfone
John Banghart

COMPUTER SECURITY

Computer Security Division
Information Technology Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899-8930

November 2009

U.S. Department of Commerce
Gary Locke, Secretary
National Institute of Standards and Technology
Patrick D. Gallagher, Deputy Director
Reports on Computer Systems Technology

The Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST) promotes the U.S. economy and public welfare by providing technical leadership for the nation’s measurement and standards infrastructure. ITL develops tests, test methods, reference data, proof of concept implementations, and technical analysis to advance the development and productive use of information technology. ITL’s responsibilities include the development of technical, physical, administrative, and management standards and guidelines for the cost-effective security and privacy of sensitive unclassified information in Federal computer systems. This Special Publication 800-series reports on ITL’s research, guidance, and outreach efforts in computer security and its collaborative activities with industry, government, and academic organizations.

National Institute of Standards and Technology Special Publication 800-126

Certain commercial entities, equipment, or materials may be identified in this document in order to describe an experimental procedure or concept adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the entities, materials, or equipment are necessarily the best available for the purpose.
**Acknowledgments**

The authors, Stephen Quinn, David Waltermire, Christopher Johnson, Karen Scarfone, and John Banghart of the National Institute of Standards and Technology (NIST), wish to thank their colleagues who reviewed drafts of this document and contributed to its technical content. The authors would like to acknowledge Paul Bartock of the National Security Agency (NSA); David Niemoller, Shane Shaffer, Matt Kerr, and Greg Witte of G2; Andy Bove of SecureAcuity; Jim Ronayne of Cobham; Paul Cichonski, Angela Orebaugh, and Victoria Thompson of Booz Allen Hamilton; and Jon Baker and Drew Buttner of the MITRE Corporation for their keen and insightful assistance throughout the development of the document. The authors also give a special acknowledgment to Matt Barrett of G2 for his outstanding contributions to the early drafts of the publication.

**Trademark Information**

OVAL and CVE are registered trademarks, and CCE and CPE are trademarks, of The MITRE Corporation.

XCCDF and SCAP are trademarks of the National Institute of Standards and Technology (NIST).

Windows XP, Windows Vista, and Windows Server 2003 are registered trademarks of Microsoft Corporation.

All other registered trademarks or trademarks belong to their respective organizations.

Table of Contents

Executive Summary ........................................................................................................................................... ES-1

1. Introduction ................................................................................................................................................. 1-1
   1.1 Authority .............................................................................................................................................. 1-1
   1.2 Purpose and Scope ............................................................................................................................... 1-1
   1.3 Audience ............................................................................................................................................. 1-1
   1.4 Document Structure ............................................................................................................................ 1-1
   1.5 Document Conventions ....................................................................................................................... 1-2

2. Overview of SCAP 1.0 ................................................................................................................................. 2-1

3. Basics of SCAP Components .................................................................................................................. 3-1
   3.1 Languages ........................................................................................................................................... 3-1
      3.1.1 Extensible Configuration Checklist Description Format (XCCDF) 1.1.4 ........................................... 3-1
      3.1.2 Open Vulnerability and Assessment Language (OVAL) 5.3 and 5.4 ........................................... 3-3
   3.2 Enumerations ....................................................................................................................................... 3-5
      3.2.1 Common Platform Enumeration (CPE) 2.2 ................................................................................. 3-5
      3.2.2 Common Configuration Enumeration (CCE) 5 ......................................................................... 3-6
      3.2.3 Common Vulnerabilities and Exposures (CVE) ........................................................................ 3-6
   3.3 Common Vulnerability Scoring System (CVSS) 2.0 .......................................................................... 3-7

4. SCAP General Requirements and Conventions ................................................................................... 4-1
   4.1 XCCDF Conventions and Requirements .......................................................................................... 4-1
      4.1.1 Metadata ..................................................................................................................................... 4-1
      4.1.2 XCCDF and CPE Dependencies .................................................................................................. 4-2
      4.1.3 <Rule> Element ............................................................................................................................ 4-3
      4.1.4 Embedded CCE References ........................................................................................................ 4-3
      4.1.5 Embedded CVE References ......................................................................................................... 4-4
      4.1.6 Allowed Check System Usage .................................................................................................... 4-4
      4.1.7 Use of the OVAL as a Check System ......................................................................................... 4-5
      4.1.8 <xccdf:Value> and OVAL Variable Dependencies ...................................................................... 4-6
      4.1.9 XCCDF Test Results .................................................................................................................... 4-6
      4.1.10 Assigning CVE Identifiers to Rule Results ................................................................................ 4-7
      4.1.11 Assigning CCE Identifiers to Rule Results ................................................................................. 4-8
      4.1.12 Mapping OVAL Results to XCCDF Results ............................................................................. 4-8
   4.2 OVAL Conventions and Requirements ............................................................................................... 4-9
      4.2.1 OVAL Schema Specification ....................................................................................................... 4-9
      4.2.2 OVAL Definitions and Affected Platforms .................................................................................. 4-9
      4.2.3 OVAL Definitions and Compliance Validation ............................................................................. 4-10
      4.2.4 OVAL Definitions and Vulnerability Assessment ....................................................................... 4-11
      4.2.5 OVAL Definitions and Patch Assessment .................................................................................... 4-11
      4.2.6 OVAL Inventories ........................................................................................................................ 4-11
      4.2.7 OVAL Results ............................................................................................................................... 4-11
   4.3 CPE Conventions ................................................................................................................................ 4-12
   4.4 CCE Conventions ............................................................................................................................... 4-12
   4.5 CVE Conventions ................................................................................................................................ 4-13
   4.6 CVSS Conventions ............................................................................................................................. 4-13

5. SCAP Use Case Requirements ............................................................................................................. 5-1
5.1 SCAP Configuration Verification with XCCDF and OVAL ............................................. 5-1
5.2 SCAP Vulnerability Assessment ................................................................................. 5-2
  5.2.1 SCAP Vulnerability Assessment Using XCCDF and OVAL .......................... 5-3
  5.2.2 SCAP Vulnerability Assessment Using Standalone OVAL .................. 5-3
5.3 Inventory Collection ................................................................................................. 5-4

Appendix A— Acronyms and Abbreviations ................................................................. A-1
Appendix B— References and other Resources .................................................................. B-1
Appendix C— SCAP Extensions to the XCCDF Specification ........................................ C-1
  C.1 Rule and Group Selection ..................................................................................... C-1
  C.2 Selection by Association ..................................................................................... C-1

Appendix D— SCAP Compliance Verification Data Stream Example ................................. D-1
  D.1 XCCDF Benchmark ............................................................................................ D-1
  D.2 OVAL Compliance ............................................................................................... D-5
  D.3 OVAL Patch ........................................................................................................ D-11
  D.4 CPE Dictionary ................................................................................................... D-19
  D.5 CPE Inventory .................................................................................................... D-20

List of Tables

Table 1-1. Conventional XML Mappings ........................................................................ 1-3
Table 3-1. XCCDF Rule Sample Data ............................................................................. 3-2
Table 3-2. XCCDF Value Statement Sample Data ......................................................... 3-3
Table 3-3. OVAL Definition Sample Data ...................................................................... 3-4
Table 4-1. XCCDF-OVAL Data Export Matching Constraints ........................................ 4-6
Table 4-2. Deriving XCCDF Rule Results from OVAL Definition Results ..................... 4-8
Table 4-3. Association of Family to Component Schemas ............................................. 4-10
Table 5-1. SCAP Configuration Verification Data Sources ............................................. 5-1
Table 5-2. SCAP Vulnerability Assessment Data Sources ............................................ 5-3
Table 5-3. SCAP Inventory Collection ......................................................................... 5-4

List of Figures

Figure 3-1. Example CCE Entry .................................................................................... 3-6
Figure D-1. example-winxp-xccdf.xml ........................................................................ D-1
Figure D-2. example-winxp-oval.xml .......................................................................... D-5
Figure D-3. example-winxp-patches.xml ................................................................. D-11
Figure D-4. example-winxp-cpe-dictionary.xml ....................................................... D-19
Figure D-5. example-winxp-cpe-oval.xml ............................................................... D-20
Executive Summary

The Security Content Automation Protocol (SCAP) is a suite of specifications that standardize the format and nomenclature by which security software products communicate software flaw and security configuration information. SCAP is a multi-purpose protocol that supports automated vulnerability checking, technical control compliance activities, and security measurement. Goals for the development of SCAP include standardizing system security management, promoting interoperability of security products, and fostering the use of standard expressions of security content.

This document defines the technical composition of SCAP Version 1.0 as comprised of six specifications—eXtensible Configuration Checklist Description Format (XCCDF), Open Vulnerability and Assessment Language (OVAL®), Common Platform Enumeration (CPE™), Common Configuration Enumeration (CCE™), Common Vulnerabilities and Exposures (CVE™), and Common Vulnerability Scoring System (CVSS)—and their interrelationships. These specifications are grouped into the following three categories:

- **Languages.** The SCAP languages provide standard vocabularies and conventions for expressing security policy, technical check mechanisms, and assessment results.

- **Enumerations.** Each SCAP enumeration defines a standard nomenclature (naming format) and an official dictionary or list of items expressed using that nomenclature. For example, CVE provides a dictionary of publicly known information security vulnerabilities and exposures.¹

- **Vulnerability measurement and scoring systems.** In SCAP, this refers to evaluating specific characteristics of a vulnerability and, based on those characteristics, generating a score that reflects the vulnerability’s severity.

SCAP utilizes software flaw and security configuration standard reference data, also known as SCAP content. This reference data is provided by the National Vulnerability Database (NVD),² which is managed by NIST and sponsored by the Department of Homeland Security (DHS).

This publication defines SCAP Version 1.0 in terms of both its component specifications and the requirements for SCAP content, and also describes the details of how the elements of SCAP interoperate. The technical specification describes the requirements and conventions that are to be employed to ensure the consistent and accurate exchange of SCAP content and the ability to reliably use the content with SCAP validated tools.

The U.S. Federal Government, in cooperation with academia and private industry, is adopting SCAP and encourages its use in support of security automation activities and initiatives.³ SCAP is achieving widespread adoption by major software and hardware manufacturers and has become a significant component of large information security management and governance programs. The protocol is expected to evolve and expand in support of the growing needs to define and measure effective security controls, assess and monitor ongoing aspects of that information security, and successfully manage systems in accordance with risk management frameworks such as NIST Special Publication 800-53, Department of Defense (DoD) Instruction 8500.2, and the Payment Card Industry (PCI) framework.

¹ [http://cve.mitre.org/](http://cve.mitre.org/)
² The National Vulnerability Database can be found at [http://nvd.nist.gov/](http://nvd.nist.gov/).
By detailing the specific and appropriate usage of the SCAP 1.0 components and their interoperability, NIST encourages the creation of reliable and pervasive SCAP content and the development of a wide array of tools that leverage SCAP capabilities. The use cases described in this document do not represent an exhaustive list of all possible applications of SCAP.

Organizations that use SCAP 1.0 or develop SCAP 1.0-based content or tools should implement the following recommendations:

**Follow the requirements listed in this document and in the associated component specifications.**

Organizations should ensure that their use of SCAP 1.0 is compliant with the requirements detailed in each component specification and the information presented in this document. If requirements are in conflict between component specifications, this document will provide clarification. If a component specification is in conflict with this document, the requirements in this document take precedence.

**When creating SCAP content, adhere to the conventions specified in this document.**

Security products and checklist authors assemble content from SCAP data repositories to create viable SCAP-expressed security guidance. A security configuration checklist that documents desired security configuration settings, installed patches, and other system security elements using SCAP in a standardized format is known as an SCAP-expressed checklist. Such a checklist would use XCCDF to describe the checklist, CCE to identify security configuration settings to be addressed or assessed, and CPE to identify platforms for which the checklist is valid. The use of CCE and CPE entries within XCCDF checklists is an example of an SCAP convention—a requirement for valid SCAP usage. These conventions are considered part of the definition of SCAP 1.0. Organizations producing SCAP content should adhere to these conventions to ensure the highest degree of interoperability.
1. **Introduction**

1.1 **Authority**

The National Institute of Standards and Technology (NIST) developed this document in furtherance of its statutory responsibilities under the Federal Information Security Management Act (FISMA) of 2002, Public Law 107-347.

NIST is responsible for developing standards and guidelines, including minimum requirements, for providing adequate information security for all agency operations and assets; but such standards and guidelines shall not apply to national security systems. This guideline is consistent with the requirements of the Office of Management and Budget (OMB) Circular A-130, Section 8b(3), “Securing Agency Information Systems,” as analyzed in A-130, Appendix IV: Analysis of Key Sections. Supplemental information is provided in A-130, Appendix III.

This guideline has been prepared for use by Federal agencies. It may be used by nongovernmental organizations on a voluntary basis and is not subject to copyright, though attribution is desired.

Nothing in this document should be taken to contradict standards and guidelines made mandatory and binding on Federal agencies by the Secretary of Commerce under statutory authority, nor should these guidelines be interpreted as altering or superseding the existing authorities of the Secretary of Commerce, Director of the OMB, or any other Federal official.

1.2 **Purpose and Scope**

This document provides the definitive technical specification for Version 1.0 of the Security Content Automation Protocol (SCAP). SCAP (pronounced S-CAP) consists of a suite of specifications for standardizing the format and nomenclature by which security software communicates information about software flaws and security configurations. This document describes the basics of the SCAP component specifications and their interrelationships, the characteristics of SCAP content, as well as SCAP requirements not defined in the individual component specifications.

The scope of this document is limited to SCAP Version 1.0. Other versions of SCAP and the component specifications, including emerging specifications and future versions of SCAP, are not addressed here. Future versions of SCAP will be defined in distinct revisions of this document, each clearly labeled with a document revision number and the appropriate SCAP version number.

1.3 **Audience**

This document is intended for three primary audiences:

- Content authors and editors seeking guidance to ensure that the SCAP content they produce operates correctly, consistently, and reliably in SCAP tools.

- Software developers and system integrators seeking to create, use, or exchange SCAP content in their products or service offerings.

- Content and/or tool developers preparing for SCAP validation at an accredited independent testing laboratory.

1.4 **Document Structure**

The remainder of this document is organized into the following four major sections:
Section 2 defines SCAP 1.0 and explains the purpose of SCAP.

Section 3 presents basic information on the specifications comprising SCAP 1.0.

Section 4 defines conventions and requirements for using SCAP to achieve interoperability of content and tools.

Section 5 presents use cases that demonstrate effective and compliant implementations of SCAP.

The document also contains appendices with supporting material:

- Appendix A contains an acronym and abbreviation list.
- Appendix B lists references and other resources related to SCAP 1.0 and its component specifications.
- Appendix C documents several SCAP extensions to the XCCDF component.
- Appendix D provides an example of an SCAP data stream.

1.5 Document Conventions

Some of the requirements and conventions used in this document reference XML content. These references come in two forms, inline and indented. An example of an inline reference is

“A `<cpe_dict:cpe-item>` may contain `<cpe_dict:check>` elements that reference OVAL definitions”.

In this example the notation `<cpe_dict:cpe-item>` can be replaced by the more verbose equivalent “the XML element whose qualified name is `cpe_dict:cpe-item`”. An even more verbose equivalent is “the XML element in the namespace ‘http://cpe.mitre.org/dictionary/2.0’ whose local name is `cpe-item`”.

An example of an indented reference is:

“References to OVAL definitions are expressed using the following format:

```xml
<cpe_dict:check system="http://oval.mitre.org/XMLSchema/oval-definitions-5"
  href="Oval_URL">[Oval_inventory_definition_id]</cpe_dict:check>”.
```

Indented references are intended to represent the form of actual XML content. Indented references represent literal content by the use of a fixed-length font, and parametric (freely replaceable) content by the use of an italic font. Square brackets ‘[]’ are used to designate optional content. Thus “[Oval_inventory_definition_id]” designates optional parametric content.

Both inline and indented forms use qualified names to refer to specific XML elements. A qualified name associates a named element with a namespace. The namespace identifies the specific XML schema that defines (and consequently may be used to validate) the syntax of the element instance. A qualified name declares this schema to element association using the format ‘prefix:element-name’. The association of prefix to namespace is defined in the metadata of an XML document and generally will vary from document to document. In this specification, the conventional mappings listed in Table 1-1 are used.
Table 1-1. Conventional XML Mappings

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Namespace URI</th>
<th>Schema</th>
</tr>
</thead>
<tbody>
<tr>
<td>cpe_dict</td>
<td><a href="http://cpe.mitre.org/dictionary/2.0">http://cpe.mitre.org/dictionary/2.0</a></td>
<td>CPE Dictionaries</td>
</tr>
<tr>
<td>cpe</td>
<td><a href="http://cpe.mitre.org/language/2.0">http://cpe.mitre.org/language/2.0</a></td>
<td>Embedded CPE references</td>
</tr>
<tr>
<td>nvd</td>
<td><a href="http://scap.nist.gov/schema/feed/vulnerability/2.0">http://scap.nist.gov/schema/feed/vulnerability/2.0</a></td>
<td>Base schema for NVD data feeds</td>
</tr>
<tr>
<td>cve</td>
<td><a href="http://scap.nist.gov/schema/vulnerability/0.4">http://scap.nist.gov/schema/vulnerability/0.4</a></td>
<td>NVD/CVE data feed elements and attributes</td>
</tr>
<tr>
<td>cvss</td>
<td><a href="http://scap.nist.gov/schema/cvss-v2/0.2">http://scap.nist.gov/schema/cvss-v2/0.2</a></td>
<td>NVD/CVSS data feed elements and attributes</td>
</tr>
<tr>
<td>dc</td>
<td><a href="http://purl.org/dc/elements/1.1/">http://purl.org/dc/elements/1.1/</a></td>
<td>Simple Dublin Core elements</td>
</tr>
<tr>
<td>xccdf</td>
<td><a href="http://checklists.nist.gov/xccdf/1.1">http://checklists.nist.gov/xccdf/1.1</a></td>
<td>XCCDF policy documents</td>
</tr>
<tr>
<td>oval</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-common-5">http://oval.mitre.org/XMLSchema/oval-common-5</a></td>
<td>Common OVAL elements and attributes</td>
</tr>
<tr>
<td>oval-def</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-definitions-5">http://oval.mitre.org/XMLSchema/oval-definitions-5</a></td>
<td>OVAL definitions</td>
</tr>
<tr>
<td>xxxx-def</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-definitions-5#xxxx">http://oval.mitre.org/XMLSchema/oval-definitions-5#xxxx</a></td>
<td>OVAL elements and attributes specific to an OS, Hardware or Application type xxxx</td>
</tr>
<tr>
<td>oval-res</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-results-5">http://oval.mitre.org/XMLSchema/oval-results-5</a></td>
<td>OVAL results</td>
</tr>
<tr>
<td>oval-sc</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-system-characteristics-5">http://oval.mitre.org/XMLSchema/oval-system-characteristics-5</a></td>
<td>OVAL system characteristics</td>
</tr>
<tr>
<td>xxxx-sc</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-system-characteristics-5#xxxx">http://oval.mitre.org/XMLSchema/oval-system-characteristics-5#xxxx</a></td>
<td>OVAL system characteristic elements and attributes specific to an OS, Hardware or Application type xxxx</td>
</tr>
<tr>
<td>oval-var</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-variables-5">http://oval.mitre.org/XMLSchema/oval-variables-5</a></td>
<td>The elements, types, and attributes that compose the core schema for encoding OVAL Variables. This schema is provided to give structure to any external variables and their values that an OVAL definition is expecting.</td>
</tr>
<tr>
<td>sch</td>
<td><a href="http://purl.oclc.org/dsdl/schematron">http://purl.oclc.org/dsdl/schematron</a></td>
<td>Schematron validation scripts</td>
</tr>
<tr>
<td>ds</td>
<td><a href="http://www.w3.org/2000/09/xmldsig#">http://www.w3.org/2000/09/xmldsig#</a></td>
<td>Interoperable XML digital signatures</td>
</tr>
</tbody>
</table>

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in Request for Comments (RFC) 2119.6

---

5 The types supported by OVAL 5.3 include the AIX, CATOS, ESX, FREE BSD, HP-UX, IOS, LINUX, PIXOS, SOLARIS, UNIX, WINDOWS, INDEPENDENT (common) operating systems, and APACHE application.

6 RFC 2119, “Key words for use in RFCs to Indicate Requirement Levels”, is available at http://www.ietf.org/rfc/rfc2119.txt.
2. Overview of SCAP 1.0

NIST Special Publication (SP) 800-117, Guide to Adopting and Using the Security Content Automation Protocol,\(^7\) defines the SCAP as being comprised of two major elements. [BAR09] First, SCAP is a protocol—a suite of six specifications that standardize the format and nomenclature by which security software communicates information about publicly known software flaws and security configurations annotated with common identifiers and embedded in XML. Second, SCAP also utilizes software flaw and security configuration standard reference data, also known as SCAP content. This reference data is provided by the National Vulnerability Database (NVD),\(^8\) which is managed by NIST and sponsored by the Department of Homeland Security (DHS). SCAP can be used for several purposes, including automating vulnerability checking, technical control compliance activities, and security measurement. The U.S. Federal Government, in cooperation with academia and private industry, is adopting SCAP and is encouraging widespread support of it.

This document defines Version 1.0 of SCAP in terms of both its component specifications and the requirements for SCAP content. As stated in the Executive Summary, organizations that use SCAP 1.0 should ensure that their use of it is compliant with the requirements detailed in each component specification and the information presented in this document. If requirements are in conflict between component specifications, this document will provide clarification. If a component specification is in conflict with this document, the requirements in this document take precedence.

SCAP 1.0 uses the following specifications:

- Extensible Configuration Checklist Description Format (XCCDF) 1.1.4, a language for authoring security checklists/benchmarks and for reporting results of checklist evaluation [QUI08]
- Open Vulnerability and Assessment Language (OVAL) 5.3 and 5.4, a language for representing system configuration information, assessing machine state, and reporting assessment results
- Common Platform Enumeration (CPE) 2.2, a nomenclature and dictionary of hardware, operating systems, and applications [BUT09]
- Common Configuration Enumeration (CCE) 5, a nomenclature and dictionary of security software configurations
- Common Vulnerabilities and Exposures (CVE), a nomenclature and dictionary of security-related software flaws\(^9\)
- Common Vulnerability Scoring System (CVSS) 2.0, an open specification for measuring the relative severity of software flaw vulnerabilities [MEL07].

Section 3 presents detailed information on each of these specifications and provides examples of how these components are used in context.

Security products and checklist authors assemble content from SCAP data repositories to create viable SCAP-expressed security guidance. As stated in the Executive Summary, a security configuration checklist that documents desired security configuration settings, installed patches, and other system security elements using SCAP in a standardized format is known as an SCAP-expressed checklist. Such a checklist would use XCCDF to describe the checklist, CCE to identify security configuration settings to

---

\(^7\) NIST SP 800-117 is available at http://csrc.nist.gov/publications/PubsSPs.html.

\(^8\) http://nvd.nist.gov/

\(^9\) CVE does not have a version number.
be addressed or assessed, and CPE to identify platforms for which the checklist is valid. The use of CCE and CPE entries within XCCDF checklists is an example of an SCAP convention—a requirement for valid SCAP usage. These conventions are considered part of the definition of SCAP 1.0 and are described in Sections 3, 4 and 5 of this document. Organizations producing SCAP content should adhere to these conventions to ensure the highest degree of interoperability.

SCAP revisions are managed through a coordinated process defined within the SCAP Release Cycle.\textsuperscript{10} The release cycle workflow manages changes related to SCAP specifications and validation processes including the addition of new specifications or updates to existing specifications. This process encourages community involvement, promotes transparency and awareness regarding proposed changes, and affords ample lead-time to prepare for pending changes.

\textsuperscript{10} SCAP Release Cycle, http://scap.nist.gov/timeline.html
3. Basics of SCAP Components

SCAP 1.0 is comprised of the six specifications referenced in Section 2: XCCDF, OVAL, CPE, CCE, CVE, and CVSS. These specifications are grouped into the following three categories:

- **Languages.** SCAP languages provide a standardized means for identifying what is to be evaluated and for expressing how to check system state.

- **Enumerations.** SCAP enumerations provide a standardized nomenclature (naming format) and an associated dictionary of items expressed using that nomenclature. For example, CVE provides a dictionary of publicly known information security vulnerabilities and exposures.\(^{11}\)

- **Vulnerability measurement and scoring systems.** SCAP vulnerability measurement and scoring systems provide the ability within SCAP to measure and evaluate specific vulnerability characteristics to derive a vulnerability severity score.

This section provides an introduction to the SCAP component specifications in each of these categories.

3.1 Languages

This section describes the two language specifications in SCAP 1.0: XCCDF 1.1.4 and OVAL 5.3 and 5.4. For each specification, the section describes its purpose and primary logical concepts, and provides examples.

3.1.1 Extensible Configuration Checklist Description Format (XCCDF) 1.1.4

XCCDF 1.1.4 is a specification language for expressing security configuration checklists, vulnerability alerts, and other related documents. The specification is designed to support information interchange, document generation, organizational and situational tailoring, automated compliance testing, and compliance scoring. An XCCDF document represents a structured collection of system review capabilities for some set of target systems. The specification also defines a data model and format for storing results of benchmark compliance testing. The intent of XCCDF is to provide a uniform means of expressing security checklists and the results of checklist evaluation.

An XCCDF document is composed of one or more XCCDF rules. An XCCDF rule is a high-level definition of a technical check on a system. A rule does not directly specify how a check should be performed, but instead points to other XML documents (such as OVAL Definition files) that contain the actual instructions for performing the check. Table 3-1 shows sample values from an XCCDF rule. This particular rule is for ensuring that the minimum password length is set to at least eight characters. The System Check section of the rule specifies the OVAL Definition example presented in Table 3-3.

\(^{11}\) [http://cve.mitre.org/]
Table 3-1. XCCDF Rule Sample Data

<table>
<thead>
<tr>
<th>Rule Field</th>
<th>Explanation</th>
<th>Sample Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule ID</td>
<td>The identifier for this rule</td>
<td>MinimumPasswordLength-8</td>
</tr>
<tr>
<td>Title</td>
<td>The title for the rule</td>
<td>Minimum Password Length = 8</td>
</tr>
<tr>
<td>Description</td>
<td>The description of the rule</td>
<td>This setting specifies the minimum length of a password in characters. The rationale behind this setting is that longer passwords are more difficult to guess and crack than shorter passwords. The downside is that longer passwords are often more difficult for users to remember.</td>
</tr>
<tr>
<td>References</td>
<td>References to checklists and other documents that contain requirements to which this rule maps—in this case, the IA-5 (Authenticator Management) control from NIST SP 800-53</td>
<td>IA-5 (<a href="http://csrc.nist.gov/publications/nistpubs/800-53-Rev3/sp800-53-rev3-final-errata.pdf">http://csrc.nist.gov/publications/nistpubs/800-53-Rev3/sp800-53-rev3-final-errata.pdf</a>)</td>
</tr>
<tr>
<td>Requires</td>
<td>The id of another Group or Rule in the Benchmark that should be selected for this Rule to be applied and scored properly. In this case, the IA-5 group</td>
<td>IA-5</td>
</tr>
<tr>
<td>Schema</td>
<td>The XML check system schema to use during rule evaluation (usually the OVAL schema)</td>
<td><a href="http://oval.mitre.org/XMLSchema/oval-definitions-5">http://oval.mitre.org/XMLSchema/oval-definitions-5</a></td>
</tr>
<tr>
<td>OVAL Definition File Reference</td>
<td>Name of the OVAL Definition file</td>
<td>WindowsXP-SP800-68.xml</td>
</tr>
<tr>
<td>OVAL Definition ID</td>
<td>The identifier of the OVAL Definition to be used</td>
<td>oval:gov.nist.1:def:20</td>
</tr>
</tbody>
</table>

The number of rules appearing in a typical XCCDF document will vary depending upon the intended use case. The rules appearing in an XCCDF document may also be organized into multiple XCCDF profiles that specify collections of rules to be evaluated on particular types of systems. Profiles can be used to express multiple policies within a single benchmark document; allowing the benchmark author to publish technical security control settings tailored to the type of system or the environment in which the system is deployed. By creating a policy that corresponds to a particular set of requirements, such as those of the FISMA, the Defense Information Systems Agency’s (DISA) Security Technical Implementation Guides (STIG), or the Health Insurance Portability and Accountability Act (HIPAA), the policy can be used to map those high-level requirements to the corresponding OVAL Definitions.

An XCCDF document can be further organized into one or more XCCDF groups. A group can contain one or more related rules or groups. Groups allow multiple rules to be enabled or disabled collectively instead of individually.

Another option involving XCCDF rules is to have user-definable values for certain rules, known as XCCDF values. Table 3-2 shows sample data from an XCCDF value statement. This particular value statement defines the duration of the account lockout (in minutes) that occurs after consecutive failed login attempts have exceeded a specific threshold. In this case, the value has been set to 15 minutes and the operator field specifies that the system setting for lockout duration is greater than or equal to this value. A checklist user may choose to alter or override this value in the profile(s) that reference this value to account for specific organizational policies.

Table 3-2. XCCDF Value Statement Sample Data

<table>
<thead>
<tr>
<th>Rule Field</th>
<th>Explanation</th>
<th>Sample Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value ID</td>
<td>The identifier for this value</td>
<td>AccountLockoutDurationTime</td>
</tr>
<tr>
<td>Type</td>
<td>The type of the value (e.g., string, number)</td>
<td>Number</td>
</tr>
<tr>
<td>Operator</td>
<td>The comparison operator (in this case, the system’s value for account lockout duration time must be greater than or equal to the specified value)</td>
<td>greater than or equal</td>
</tr>
<tr>
<td>Title</td>
<td>The title for the value</td>
<td>Account Lockout Duration Time</td>
</tr>
<tr>
<td>Description</td>
<td>The description of the value</td>
<td>This value specifies how long the user account should be locked out. This is often set to a low but substantial value (e.g., 15 minutes).</td>
</tr>
<tr>
<td>Question</td>
<td>Explanatory text that can be presented to the user when customizing the checklist</td>
<td>Account lockout duration time (in minutes)</td>
</tr>
<tr>
<td>Value</td>
<td>The value assigned to the AccountLockoutDurationTime value</td>
<td>15</td>
</tr>
<tr>
<td>Default</td>
<td>A suggested default value number for checklist users’ reference; not actually used when performing checks or applying configuration settings</td>
<td>15</td>
</tr>
</tbody>
</table>

3.1.2 Open Vulnerability and Assessment Language (OVAL) 5.3 and 5.4

OVAL is used to express standardized, machine-readable rules that can be used to assess the state of a system. Under SCAP, OVAL is commonly used to determine the presence of vulnerabilities and insecure configurations. A set of instructions used to check for a security problem, such as an incorrect minimum password length setting, is known as an OVAL Definition. A file containing one or more OVAL Definitions (often hundreds or even thousands) is known as an OVAL Definition file.

There are four types of OVAL Definitions:12

- Vulnerability definitions, which define “the conditions that must exist on a computer for a specific vulnerability to be present”
- Patch definitions, which define “the conditions on a computer that determine whether a particular patch is appropriate for a system”
- Inventory definitions, which define “the conditions on a computer that determine whether a specific piece of software is installed on the system”
- Compliance definitions, which define “the conditions on a computer that determine compliance with a specific policy or configuration statement”.

Table 3-3 shows sample values that have been extracted from an actual OVAL compliance definition. Explanations of each value have also been provided. The definition ID, version, and class are standard fields that are part of every OVAL Definition. The exact types of information contained in the metadata vary among definitions, but at a high level they explain the intent of the definition. The criteria provide

---

12 These definitions are taken from the OVAL Web site’s “Structure of the Language” page, located at http://oval.mitre.org/language/about/structure.html.
the technical details of how the system will be checked for the items of interest, such as the presence of a vulnerability or the value of a configuration setting. Each OVAL Definition has a single top-level criterion that can contain one or more sub-criteria. The operator associated with each criterion specifies how the results produced by the sub-criteria are combined (e.g., AND, OR).\(^\text{13}\)

The example in Table 3-3 has two criteria. One of the criteria is an OVAL Test, which is a specific system check—in this case, that the system is configured to require a minimum password length of at least eight characters. The other criterion is actually another definition—in this case, an inventory definition that confirms that the target system is running Windows XP SP2 on a 32-bit architecture.

<table>
<thead>
<tr>
<th>Table 3-3. OVAL Definition Sample Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition Field</strong></td>
</tr>
<tr>
<td>ID</td>
</tr>
<tr>
<td>Version</td>
</tr>
<tr>
<td>Class</td>
</tr>
</tbody>
</table>

**Metadata**

| Title | Short description for the definition | Minimum Password Length of 8 Characters |
|Affected product | The operating system or application version(s) to which this definition is applicable | Microsoft Windows XP, SP2, 32 bit |
|References | References to checklists and other documents that contain requirements to which this definition maps | NIST SP800-68 Appendix A, 1.4b, http://csrc.nist.gov/itsec/download_WinXP.html DISA FSO Checklist, 5.4.1.3 DISA VMS 6XID V0001106 DISA PDI ID 1740 |
|Description | Description for the definition | The minimum allowable password length is 8 characters |

**Criteria**

| Definition reference | The identifier of another OVAL Definition, OVAL definition references another OVAL definition (extended definition) | oval:gov.nist.1:def:9 |
|Definition comment | A brief explanation of what the definition addresses; in this case, it is used to determine if the target system is running Windows XP SP2 on a 32-bit architecture | Precondition 9: Windows family, Windows XP, SP2, 32 bit |
|Test reference | An identifier for an OVAL Test that is run when evaluating the OVAL definition. | oval:gov.nist.1:tst:16 |
|Test comment | A brief explanation of what the test addresses; in this case, it is used to determine if the target system requires a minimum password length of 8 characters | Minimum password length is 8 characters |

\(^{13}\) In the context of this publication, the words ‘criterion’ and ‘criteria’ are used properly; however, the reader should note that the actual OVAL element names are expressed using ‘criteria’ where this document expresses the term ‘criterion’ and ‘criterion’ where this document expresses the term ‘criteria’.

3-4
As the example in Table 3-3 shows, definitions often reference one or more tests. The instructions that comprise each test are also included in the OVAL Definition file. A test does not directly contain the technical details of checking the system but instead references other OVAL constructs. Typically, a test references an OVAL Object, which is a logical construct for a portion of the target system (e.g., password policy, file, Windows registry key), and an OVAL State, which is a particular check of the specified OVAL object (e.g., verifying that the password policy requires a minimum password length of at least eight characters, verifying the existence of a file). An OVAL State can also reference one or more OVAL Variables, which are user-definable values (e.g., minimum password length value of eight). This modular approach introduces additional complexity but fosters reuse and allows OVAL Definitions to be used without requiring the details of test construction to be exposed. Individuals seeking detailed information can refer to the OVAL Definition file for the definition, Test, Object, and State ID numbers, and instructions associated with each entity. More technical details on OVAL Definition files, including examples of the XML code for OVAL Definitions, are presented in Section 4. An OVAL Definition tutorial is also available from the OVAL Web site at http://oval.mitre.org/language/about/definition.html.

3.2 Enumerations

This section describes the three enumeration specifications in SCAP 1.0: CPE 2.2, CCE 5, and CVE. SCAP enumerations typically consist of an identifier, an associated description or definition, and a list of supporting references. For each specification, the section describes its purpose and provides examples of entries. The section also explains the interdependencies between these specifications and other SCAP component specifications.

3.2.1 Common Platform Enumeration (CPE) 2.2

CPE 2.2 is a standard naming convention for operating systems, hardware, and applications. The purpose of CPE is to provide consistent names that can be shared by multiple parties and solutions to refer to the same specific platform type.

The syntax of an individual CPE Name, as defined in Section 5 of the CPE 2.2 Specification, is as follows:

cpe:/{part}:{vendor}:{product}:{version}:{update}:{edition}:{language}

For example, “cpe:/o:redhat:enterprise_linux:2.1::es” refers to Red Hat Enterprise Server 2.1. The “o” indicates that this CPE describes an operating system. In this example, the edition field is blank, indicating that this CPE refers to all editions of Red Hat Enterprise Server 2.1.

CPE Names are used in conjunction with many of the SCAP specifications to provide an association to asset-related information. CPE is used by SCAP in the following ways:

- **XCCDF** – In an XCCDF checklist, CPE Names can be used to identify the hardware or software platform to which an XCCDF object (e.g., benchmark, profile, group, rule) applies.
- **CCE** – CPE Names can be associated with configuration vulnerabilities to identify platforms covered by CCE technical mechanisms.

---

• CVE – CVEs are related to one or more product platforms expressed as CPEs. The mapping of CPEs to CVEs is performed by NVD analysts and is published in the NVD vulnerability data feed.

3.2.2 Common Configuration Enumeration (CCE) 5

The CCE 5 naming scheme is a dictionary of names for security configuration settings for deployed software. Each type of security-related configuration issue is assigned a unique identifier to facilitate fast and accurate correlation of configuration data across multiple information sources and tools. The MITRE Corporation publishes the CCE list.  

There are five attributes in a CCE entry: a unique identifier number, a description of the configuration issue, logical parameters of the CCE, the associated technical mechanisms related to the CCE, and references to additional sources of information. Figure 3-1 provides an example of these attributes for a CCE 5 entry for Windows XP:

![Figure 3-1. Example CCE Entry](http://cce.mitre.org/lists/cce_list.html)

References to CCEs are used by some of the other SCAP specifications to provide an association to particular security configuration settings. In an XCCDF checklist, CCEs can be used to specify which security configuration settings are of interest (i.e., which settings should be checked). Similarly, OVAL uses CCE entries for the same purpose.

3.2.3 Common Vulnerabilities and Exposures (CVE)

CVE is a dictionary of unique, common names for publicly known software flaws. This common naming convention allows sharing of data within and among organizations and enables effective integration of services and tools. For example, a remediation tool may use CVE information from several scanning tools and monitoring sensors, enabling an integrated risk mitigation solution. CVE provides the following:

• A comprehensive list of publicly known software flaws
• A globally unique name to identify each vulnerability
• A basis for discussing priorities and risks of vulnerabilities
• A way for a user of disparate tools and services to integrate vulnerability information


CVE issuance is managed by The MITRE Corporation and is sponsored by the DHS National Cyber Security Division (NCSD). General CVE information is available at [http://cve.mitre.org/](http://cve.mitre.org/).
A CVE vulnerability entry consists of a unique name (e.g., CVE-2000-0001), a short description (e.g., “RealMedia server allows remote attackers to cause a denial of service via a long ramgen request.”), and references to public advisories on the vulnerability.

CVE is used in conjunction with other SCAP specifications to satisfy the following use cases:

- **XCCDF.** In an XCCDF checklist, CVEs are used to uniquely identify which software flaw vulnerabilities are of interest (i.e., flaws that are to be checked during the evaluation of the checklist).
- **CVSS.** CVSS scores are associated with CVE entries to uniformly express the fundamental characteristics of the software flaw and to provide a severity score based on these characteristics.
- **OVAL.** Including the specific CVE entry in the OVAL metadata enables a reviewer to accurately understand the basis for a given OVAL definition such as a Vulnerability or Patch test.

Working with researchers, The MITRE Corporation assigns CVE IDs to publicly known vulnerabilities in commercial and open source software.

### 3.3 Common Vulnerability Scoring System (CVSS) 2.0

CVSS 2.0 provides a repeatable method for consistently evaluating and expressing the risk associated with a given software flaw (e.g., CVE). The use of this shared scoring model allows meaningful comparisons of vulnerability severity scores. CVSS provides three metric groups that can be used to derive a vulnerability score:

- **Base,** which uses the intrinsic characteristics of the vulnerability to provide a generic score
- **Temporal,** which captures external factors that may change over time (e.g., availability of exploit code). The base score is adjusted to render a temporal score that accounts for the temporal factors
- **Environmental,** which characterizes the severity of a vulnerability in the context of an organization’s operating environment

The purpose of performing CVSS scoring is to help organizations understand the relative importance of various vulnerabilities so that they can effectively assess, prioritize and mitigate vulnerabilities. Because hundreds of vulnerabilities are publicly announced every week, it is important for organizations to have an easy way to identify those vulnerabilities that have the greatest operational impact. NVD analysts compute and publish CVSS base scores for all CVEs, but organizations are encouraged to further tailor these scores by employing the temporal and environmental metrics to more precisely measure the risk a vulnerability represents within their specific organization.

Complete examples of CVSS measures and scores are available in the official CVSS 2.0 specification [MEL07]. A brief example of base measures, extracted from [MEL07], is [AV:N/AC:L/Au:N/C:C/I:C/A:C], with a base score of 10.0. The bracketed notation for the base measures is known as a vector. The first half of the notation indicates that the Access Vector is Network, the Access Complexity is Low, and the Authentication requirement is None. The second half of the notation indicates that the potential impact to Confidentiality, Integrity, and Availability is Complete.

---

17 The CVE repository maintained by NIST contains all CVEs issued by The MITRE Corporation as well as supplemental data such as CVSS base scores, vendor statements, and Spanish language translations. NVD provides fine-grained searching and statistical analysis capabilities as well. CVEs and associated NIST-provided metadata can be viewed at [http://nvd.nist.gov/nvd.cfm](http://nvd.nist.gov/nvd.cfm).
The scoring scale is 0 to 10, with 10 being the most severe, so a score of 10.0 indicates the highest severity possible.

The CVSS Special Interest Group from the Forum of Incident Response and Security Teams (FIRST) developed CVSS 2.0. More information on CVSS can be found at http://www.first.org/cvss.
4. SCAP General Requirements and Conventions

As described in NIST Special Publication 800-117, Guide to Adopting and Using the Security Content Automation Protocol,\(^\text{18}\) the motivation for creating SCAP was to provide a standardized approach to maintaining the security of enterprise systems, enhance interoperability of security products, and enable consistent security assessments. The following conventions and requirements were established to help satisfy these goals by ensuring that validated tools and content interoperate as designed and provide the expected results.

4.1 XCCDF Conventions and Requirements

An SCAP XCCDF document is a machine-readable XML document that defines the policies and test conditions to be evaluated or applied. Types of XCCDF documents include Definition documents that express policy statements and Result documents that contain both policy statements and actual test results.

An SCAP Benchmark document validates against the XCCDF schema (http://scap.nist.gov/specifications/xccdf/) and conforms to all relevant content requirements as outlined in the XCCDF Specification [QUI08].

In cases where localized text is used, US English is the default language. If a @lang attribute is omitted, the @lang attribute of the nearest ancestor `<xccdf:Benchmark>`, `<xccdf:Value>`, `<xccdf:Group>` and `<xccdf:Rule>` element should be consulted. If this value is omitted, then a value of lang="en-US" SHALL be used by default.

4.1.1 Metadata

XCCDF metadata provides descriptive information about the security benchmark. The metadata is used by SCAP tools to assist in the selection of the appropriate benchmark, ensure that the most recent or correct version of a benchmark is used, and to provide additional information about the benchmark.

The following requirements and conventions apply to the `<xccdf:Benchmark>` element:

- The REQUIRED `@id` attribute SHALL be used to uniquely identify all revisions of a benchmark globally.

- The `@style` attribute, if provided, SHALL have the value “SCAP_1.0”. If not provided, its value SHALL be assumed to be “SCAP_1.0”. **This will be a REQUIRED attribute in SCAP 1.1.**

- The `<xccdf:status>` element indicates the current status of the benchmark document. The associated text value MUST be “draft” for documents released in public draft state and “accepted” for documents that have been officially released by an organization. It is RECOMMENDED that the `date` attribute be populated with the date of the status change. Additional `<xccdf:status>` elements MAY be included to indicate historic status transitions.

- The `<xccdf:version>` element SHALL uniquely identify the particular revision of the benchmark.

---

\(^\text{18}\) NIST SP 800-117 is available at [http://csrc.nist.gov/publications/PubsSPs.html](http://csrc.nist.gov/publications/PubsSPs.html).
One or more instances of the `<xccdf:notice>` element MAY be provided indicating clarifications, suggestions, or warnings regarding the use of the benchmark, including but not limited to terms of use, legal notices or copyright statements.

The `<xccdf:metadata>` element MAY be provided. It is RECOMMENDED that this element contains the following Dublin Core terms: `<dc:creator>`, `<dc:publisher>` and `<dc:contributor>`. This metadata will be REQUIRED in SCAP 1.1.

The following requirements and conventions apply to the `<xccdf:Benchmark>`, `<xccdf:Profile>`, `<xccdf:Value>`, `<xccdf:Group>` and `<xccdf:Rule>` elements:

One or more instances of the `<xccdf:title>` element SHALL be provided. Each instance MUST contain text values that indicate the purpose of the benchmark delimited by an OPTIONAL `language` attribute. If more than one `<xccdf:title>` element is provided then the language attribute SHALL be provided. An `<xccdf:title>` element SHALL be provided that represents an “en-US” title.

One or more instances of the `<xccdf:description>` element SHALL be provided. Each instance MUST contain text values that represent the purpose and intended audience of the benchmark delimited by an OPTIONAL `language` attribute. If more than one `<xccdf:description>` element is provided then the language attribute SHALL be provided. An `<xccdf:description>` element SHALL be provided that represents an “en-US” description.

One or more instances of the `<xccdf:reference>` element MAY be included. These elements SHALL provide a cross reference to additional information, preferably including a URL, to obtain additional information regarding the benchmark.

All remaining OPTIONAL elements in the XCCDF schema MAY be included at the author’s discretion unless otherwise noted in this document.

For an example, refer to the appendix section D.1 lines 31-35.

### 4.1.2 XCCDF and CPE Dependencies

For all SCAP content, the applicability of XCCDF `<xccdf:Benchmark>` elements to specific IT platforms SHALL be specified using Common Platform Enumeration (CPE) Names.

CPE Names used within an XCCDF benchmark SHALL match the names of existing Official CPE Dictionary entries where possible. If multiple matches are found within the dictionary (e.g., deprecated and current CPE Names), the most current CPE Name SHOULD be used.

Each `<xccdf:Benchmark>` bound to a CPE Name SHALL be declared in the required CPE dictionary stream and each OVAL inventory class definition referenced from the dictionary stream SHALL be specified in the required CPE inventory stream.

Use of CPEs bound to `<xccdf:Profile>`, `<xccdf:Group>`, and `<xccdf:Rule>` elements SHALL NOT be allowed.

---

4.1.3  <Rule> Element

The following requirements and conventions apply to the <xccdf:Rule> element:

When defining the @id attribute it is important to take into consideration the long-term use of the Rule. As most Rule identifiers are generated by humans today, there is a tendency to encode meaning in the identifier. This can create contradictions within the @id attribute relative to the containing document or policy as content is re-used and re-purposed. It is RECOMMENDED that information is omitted in the identifier that references: the target platform, assessed values, and/or security guide context.

The @weight attribute SHALL be provided on <xccdf:Rule> elements. The value for this element SHALL be defined as “10.0” as a placeholder for Common Configuration Scoring System (CCSS) scores to indicate the highest possible weight. Once the CCSS is adopted into a future version of SCAP and CCSS scores are available, these values will be replaced with appropriate CCSS scores.

If the XCCDF document represents software flaws, then the CVSS metric SHALL be defined in the @weight attribute on the <xccdf:Rule> elements.

4.1.4 Embedded CCE References

XCCDF <xccdf:Rule> elements MAY be used to define a policy requiring compliance with a specific configuration setting. When a configuration setting having one or more associated CCE Identifiers from the CCE List is expressed as an XCCDF rule, an <xccdf:ident> element\(^\text{21}\) reference SHALL be provided within the <Rule> element. The <xccdf:ident> element provides a globally unique identifier for a specific configuration setting.

The <xccdf:ident> element syntax SHALL be used as follows:

1. The system attribute for the <xccdf:ident> element SHALL be defined using the CCE Version 5 system identifier “http://cce.mitre.org”.
2. The CCE Identifier SHALL be used for the <xccdf:ident> element content.

For example:

```xml
<Rule id="AuditAccountLogonEvents">
  <title>Audit Account Logon Events</title>
  ...
  <ident system="http://cce.mitre.org">CCE-3867-0</ident>
  <ident system="http://cce.mitre.org">CCE-3008-0</ident>
  ...
</Rule>
```

A rule result of “pass” indicates that the target platform complies with the configuration setting guidance expressed in the XCCDF rule.

---

4.1.5 Embedded CVE References

XCCDF `<xccdf:Rule>` elements MAY be used to assess security related software flaws. When this assessment is associated with one or more associated CVE Identifiers from the CVE vulnerability feeds, an `<xccdf:ident>` element reference within the `<xccdf:Rule>` element SHALL be provided.

The `<xccdf:ident>` element syntax SHALL be used as follows:
1. The system attribute for the `<xccdf:ident>` element SHALL be defined using the CVE system identifier “http://cve.mitre.org”.
2. The CVE Identifier SHALL be used for the `<xccdf:ident>` element content.

For example:

```xml
<Rule id="SQLInjectionVulnerability"
     title="SQL Injection Vulnerability">
    ...
    <ident system="http://cve.mitre.org">CVE-2008-6865</ident>
    <ident system="http://cve.mitre.org">CVE-2008-6866</ident>
    ...
</Rule>
```

A rule result of “pass” indicates that the target platform satisfies all the conditions of the XCCDF rule and is unaffected by the vulnerability or exposure referenced by the CVE.

4.1.6 Allowed Check System Usage

The following requirements and conventions apply to the use of the `<xccdf:check>` element and check systems in general.

The `<xccdf:complex-check>` element SHALL NOT be used.

The `<xccdf:check-content>` element SHALL NOT be used to embed check content directly into XCCDF content.

If multiple `<xccdf:check-content-ref>` elements are provided, then processing SHALL:
1. Evaluate each `<xccdf:check-content-ref>` element in the order that it appears in the `<xccdf:check>` element. The first resolvable `<xccdf:check-content-ref>` element SHALL be used to determine the `<xccdf:Rule>` status.
2. For each `<xccdf:check-content-ref>` element, a tool will attempt to retrieve the document referenced by the `@href` attribute. If not resolvable, the next available `<xccdf:check-content-ref>` element SHALL be evaluated. If none of the `<xccdf:check-content-ref>` elements are resolvable, then the result of the rule evaluation SHALL be the XCCDF “error” status and processing of the `<xccdf:Rule>` SHALL end. Please note that it is acceptable to map a remote URL to a local copy of the file in cases where remote access is not available, not allowed or not practical.
3. Once a resolvable `<xccdf:check-content-ref>` element is found, then check system processing SHALL proceed.

For example, refer to the appendix section D.1 lines 223-226.

---

4.1.7 Use of the OVAL as a Check System

A rule MAY refer to one or more OVAL Definitions to implement the technical tests necessary to
determine the pass/fail status of the rule. Embedded OVAL Definitions are not supported by SCAP
XCCDF. References from SCAP compliant XCCDF to OVAL Definitions SHALL use the form:

<check-content-ref href="OVAL_Source_URI" [name="OVAL_Definition_Id"]/>

The href attribute identifies the OVAL Definition XML stream. When present, the optional name
attribute refers to a specific OVAL definition in the designated content stream. When an XCCDF rule
references a specific OVAL Definition, an OVAL Definitions source SHALL be available to resolve the
reference.

SCAP stylistic conventions specify that the optional name attribute be omitted if the rule is designed to
evaluate the current patch level of the target platform. The following rule specification is an example of
this convention:

Rule id="SecurityPatchesUpToDate" selected="false" weight="10.0">
  <title>Security Patches Up-To-Date</title>
  <description>Keep systems up to current patch levels</description>
  <check system="http://oval.mitre.org/XMLSchema/oval-definitions-5">
    <check-content-ref href="scap-win2000-patches.xml"/>
  </check>
</Rule>

In the previous example, the <xccdf:check-content-ref> element’s href attribute refers to an
OVAL Definitions stream containing one or more OVAL patch definitions. This check-content-
ref is equivalent to referencing a virtual OVAL Definition of the form:

<oval definitions xmlns:oval-def="http://oval.mitre.org/XMLSchema/oval-definitions-5">
  <definitions>
    <definition id="identifier of patch definition" version="0" class="patch">
      ...
      <criteria>
        <extend_definition definition_ref="identifier of patch definition 1"/>
        ...
        <extend_definition definition_ref="identifier of patch definition N"/>
      </criteria>
    </definition>
  </definitions>
</oval_definitions>

where the extended definitions are the individual patch definitions defined in the OVAL content stream.23

If any <xccdf:Rule> references an OVAL patch definition, a patch scan source SHALL be used to
resolve the reference.

---

23 The Inventory definition results are not to be considered in the overall patch results. The intent is to logically combine the
result of each definition with a class of ‘patch’ using the AND operation. The patch definition file may contain a mix of
patch and inventory definitions and the overall patch checking result should be the AND of just the patch definition results
values.
4.1.8 <xccdf:Value> and OVAL Variable Dependencies

Content authors SHOULD refrain from hard coding assessment values into the OVAL Definitions to maximize the flexibility and reuse of OVAL modules. The recommended approach is to define these values as XCCDF value parameters. An acceptable alternative is to represent these values as discrete OVAL Variables or within an OVAL Variables file.

When the OVAL Definition(s) referenced from a rule require one or more external variable bindings, the check-export element(s) that define the binding of XCCDF values to OVAL variables SHALL precede the check-content-ref element. The format of these elements is:

```xml
<check-export xmlns=http://checklists.nist.gov/xccdf/1.1
    value-id="XCCDF_Value_id" export-name="OVAL_External_Variable_id"/>
```

The following check element example demonstrates the use of this convention:

```xml
<check system="http://oval.mitre.org/XMLSchema/oval-definitions-5">
    <check-export export-name="oval:gov.nist.fdcc.xp:var:66711" value-id="NoSlowLink_var"/>
    <check-export export-name="oval:gov.nist.fdcc.xp:var:66712" value-id="NoBackgroundPolicy_var"/>
    <check-export export-name="oval:gov.nist.fdcc.xp:var:66713" value-id="NoGPOListChanges_var"/>
    <check-content-ref href="fdcc-winxp-oval.xml" name="oval:gov.nist.fdcc.xp:def:6671"/>
</check>
```

The type and value binding of the specified XCCDF Value is constrained to match that lexical representation of the indicated OVAL Variable Data Type. Table 4-1 summarizes the constraints regarding data type usage. Additional information regarding OVAL and XCCDF data types can be found in the OVAL Common Schema documentation\(^\text{24}\) and the XCCDF specification\(^\text{25}\).

<table>
<thead>
<tr>
<th>OVAL Data Type</th>
<th>Matching XCCDF Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int</td>
<td>number</td>
</tr>
<tr>
<td>Float</td>
<td>number</td>
</tr>
<tr>
<td>Boolean</td>
<td>boolean</td>
</tr>
<tr>
<td>string, evr_string, version, ios_version, filesset_revision, binary</td>
<td>string</td>
</tr>
</tbody>
</table>

4.1.9 XCCDF Test Results

XCCDF test results are documented as the contents of an <xccdf:TestResult> element that either stands alone as the root of an XML document or is embedded as a child-element of an <xccdf:Benchmark> root element. In the latter case, the associated benchmark is the embedding benchmark; in the former, the <xccdf:TestResults> document requires an embedded

---


<xccdf:Benchmark> element that identifies the associated benchmark. <xccdf:Benchmark> elements are ignored in <xccdf:TestResult> elements that are embedded in their associated benchmark.

To be considered valid SCAP content, the following conditions SHALL be met:

- When using a profile during the processing of XCCDF content, the test results SHALL embed an <xccdf:Profile> element that identifies the non-abstract profile in the associated benchmark whose evaluation results are reported by the test results.
- Reported rule results SHALL include all selected rules within the specified Profile.
- Reported value-settings SHALL include all those values that are exported by the reported rules. The specific settings are those determined by the reported Profile.
- The <identity> tag identifies the security principal used to access rule evaluation on the target(s).
- The <rule-result> elements SHALL report the result of the application of each selected rule against all specified targets. The rule_idref attribute of the <xccdf:rule-result> SHALL identify the selected rule and each <xccdf:instance> element SHALL identify the corresponding <xccdf:target> element.

4.1.10 Assigning CVE Identifiers to Rule Results

The XCCDF <xccdf:rule-result> element provides data indicating the result of assessing a system using the identified XCCDF <xccdf:Rule> element. If the target XCCDF <xccdf:Rule> identified by the <xccdf:rule-result idref=""/> attribute has one or more <ident> elements with the “http://cve.mitre.org” system identifier, then each <xccdf:ident> element SHOULD also appear within the <xccdf:rule-result> element.

For example:

```xml
<rule-result idref="minimum_password_length"
    xmlns="http://checklists.nist.gov/xccdf/1.1">
    ...
    <cdf:Rule id="java-upgrade-278" selected="1" weight="0.5">
        <cdf:title>Java Bug Fix Upgrade Installed</cdf:title>
        <cdf:ident system="http://cve.mitre.org/">CVE-2006-0614</cdf:ident>
    ...
</rule-result>
```

---

<sup>26</sup> See NIST IR 7275r3, The XCCDF Specification version 1.1.4, p.30 table and p.59 section “<ident>“. 
4.1.11 Assigning CCE Identifiers to Rule Results

The XCCDF <xccdf:rule-result> element provides data indicating the result of assessing a system using the identified XCCDF <xccdf:Rule> element. If the target XCCDF <xccdf:Rule> identified by the <xccdf:rule-result idref=""/> attribute has one or more <xccdf:ident> elements with the “http://cce.mitre.org” system identifier, then each <xccdf:ident> element SHOULD also appear within the <rule-result> element. For example:

```xml
<rule-result idref="minimum_password_length"
    xmlns="http://checklists.nist.gov/xccdf/1.1">
    ...
    <ident system="http://cce.mitre.org">CCE-2981-9</ident>
    ...
</rule-result>
```

4.1.12 Mapping OVAL Results to XCCDF Results

When an <xccdf:Rule> element references an OVAL Definition, the <xccdf:rule-result> that results from the application of that rule specifies an XCCDF rule result that is mapped from the OVAL Definition Result. This result is calculated by applying the referenced OVAL Definition to a target platform.

In some cases the derived results may seem counterintuitive, but when viewed in the appropriate context the underlying logic is evident. For example, if an OVAL Definition of class “compliance” is processed and the XCCDF returns a result of “True”, the tool is conveying the fact that the system was found to be compliant with that check and therefore returns a “Pass” result. A similar definition for a vulnerable condition will return results of “False” if that vulnerability was not found on the examined devices, resulting in a “Pass” from the XCCDF rule. SCAP compliant processors that generate XCCDF rule results SHALL apply the mapping illustrated in Table 4-2 when deriving XCCDF rule results from OVAL definition results.

SCAP users may reference several classes of OVAL Definitions from a single XCCDF document (e.g., a single SCAP-expressed checklist that performs configuration verification AND patch compliance checks.) Users of multiple OVAL Definition classes must consider the effect of the definition class when interpreting definition results and ensure that rule evaluation produces the correct results.

<table>
<thead>
<tr>
<th>OVAL Definition Result</th>
<th>XCCDF Rule Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>Error</td>
</tr>
<tr>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Not applicable</td>
<td>Notapplicable</td>
</tr>
<tr>
<td>Not evaluated</td>
<td>Notchecked</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Definition Class</th>
<th>Definition Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance</td>
<td>True</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>False</td>
</tr>
<tr>
<td>Inventory</td>
<td>True</td>
</tr>
<tr>
<td>Patch</td>
<td>False</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Definition Class</th>
<th>Definition Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance</td>
<td></td>
</tr>
<tr>
<td>Vulnerability</td>
<td></td>
</tr>
<tr>
<td>Inventory</td>
<td></td>
</tr>
<tr>
<td>Patch</td>
<td></td>
</tr>
</tbody>
</table>

Table 4-2. Deriving XCCDF Rule Results from OVAL Definition Results
4.2 OVAL Conventions and Requirements

When used for SCAP purposes, OVAL content SHALL comply with one of the following document schema:

- `<oval-def:oval_definitions>` document – A specification of OVAL Definitions, Tests, Objects, States and Variables. This document may optionally be used as a component of an SCAP data source.
- `<oval-var:oval_variables>` document – A specification of external OVAL Variable bindings. This document may optionally be used as a component of an SCAP data source.
- `<oval-sc:oval_system_characteristics>` document – A specification of target system characteristics, that is, the specification of OVAL Object values queried from a target system
- `<oval-res:oval_results>` document – The evaluation results of specified definitions and tests, as well as a copy of the OVAL System Characteristics from which the results can be derived.

4.2.1 OVAL Schema Specification

All of the OVAL content MUST contain an `<oval:generator>` element. The bundle version of any particular document instance SHALL be specified using the `<oval:schema_version>` content element of the `<oval:generator>` as in this example:

```
<oval:generator>
  <oval:product_name>The OVAL Repository</oval:product_name>
  <oval:schema_version>5.3</oval:schema_version>
</oval:generator>
```

The bundle version of an `<oval-def:oval_definitions>` document SHOULD be chosen based on the version provided in the `<oval:generator>/<oval:schema_version>` element’s value.

The bundle version of an `<oval-var:oval_variables>` document SHALL be the same as that of the `<ovaldef:oval_definitions>` document whose external variables are bound by the variables document.

Production of `<oval-sc:oval_system_characteristics>` or `<oval-res:oval_results>` is OPTIONAL. If an `<oval-sc:oval_system_characteristics>` or `<oval-res:oval_results>` document is generated as a consequence of the application of a `<oval-def:oval_definitions>` document, then the bundle version of the generated document SHALL be the same as that of the `<oval-def:oval_definitions>` document.

4.2.2 OVAL Definitions and Affected Platforms

The `<oval-def:metadata>` element of an `<oval-def:definition>` optionally identifies platforms affected by including `<oval-def:affected>` elements. One or more of these elements SHALL be present whenever the class of the `<oval-def:definition>` is “vulnerability”,
“compliance”, “patch”, or “inventory”.\textsuperscript{27} \texttt{<oval-def:affected>} elements MAY be used when the definition class is “miscellaneous”. If more than one \texttt{<oval-def:affected>} element is included in definition metadata, then the family attribute of each of the \texttt{<oval-def:affected>} elements SHALL be bound to the same value\textsuperscript{28}. Thus each \texttt{<oval-def:definition>} is either associated with a single family, or the family association of the definition is undefined (only allowed for OVAL definitions whose class is “miscellaneous”).

If the family association of an OVAL Definition is undefined, any definitions extended by that definition SHALL also have undefined family associations. If the family association of an OVAL Definition is specified, then any definitions extended by that definition SHALL be the same as that of the extending definition or SHALL have an undefined family association.

For the purposes of SCAP, an OVAL Definition’s family association also determines the kinds of tests that it can reference as \texttt{<oval-def:criterion>}. Table 4-3 maps the family associations to the test component schema\textsuperscript{29} allowed for the family. Each component namespace is designated by its fractional part; for example, #windows refers to the component namespace URI http://oval.mitre.org/XMLSchema/oval-definitions-5#windows.

<table>
<thead>
<tr>
<th>Family</th>
<th>Allowed Subschemas</th>
</tr>
</thead>
<tbody>
<tr>
<td>undefined</td>
<td>#independent</td>
</tr>
<tr>
<td>ios</td>
<td>#independent #ios</td>
</tr>
<tr>
<td>macos</td>
<td>#independent #macos</td>
</tr>
<tr>
<td>unix</td>
<td>#independent #hpux #linux #solaris #unix</td>
</tr>
<tr>
<td>windows</td>
<td>#independent #windows</td>
</tr>
</tbody>
</table>

### 4.2.3 OVAL Definitions and Compliance Validation

An OVAL compliance Definition is an \texttt{<oval-def:oval_definitions>} document that specifies definitions for validating the compliance status of target platforms. An OVAL compliance definition SHALL specify at least one definition of class “compliance.” An OVAL compliance definition may also reference definitions of class “inventory” that are extended (transitive) by the “compliance” class definitions.


\textsuperscript{28} The OVAL 5.3 test subschema namespaces are:

- http://oval.mitre.org/XMLSchema/oval-definitions-5#independent Supports any OS
- http://oval.mitre.org/XMLSchema/oval-definitions-5#ios Supports Cisco IOS
- http://oval.mitre.org/XMLSchema/oval-definitions-5#hpux Supports HP-UX
- http://oval.mitre.org/XMLSchema/oval-definitions-5#unix Supports Unix dialects
- http://oval.mitre.org/XMLSchema/oval-definitions-5#macos Supports Apple Macintosh
- http://oval.mitre.org/XMLSchema/oval-definitions-5#solaris Supports Sun Solaris
- http://oval.mitre.org/XMLSchema/oval-definitions-5#windows Supports Microsoft Windows
- http://oval.mitre.org/XMLSchema/oval-definitions-5#freebsd Supports FreeBSD
- http://oval.mitre.org/XMLSchema/oval-definitions-5#apache Supports Apache applications

If an OVAL “compliance” class definition maps to one or more CCE identifiers, the definition SHOULD include `<oval-def:reference>` elements that reference those identifiers using the following format:

```xml
<oval-def:reference source="CCE" ref_id="CCE_identifier"/>
```

### 4.2.4 OVAL Definitions and Vulnerability Assessment

An OVAL vulnerability definition is an `<oval-def:oval_definitions>` document that specifies definitions for assessing the vulnerability status of target platforms. An OVAL vulnerability definition SHALL specify at least one definition of class “vulnerability” or “patch”. An OVAL vulnerability definition may also reference definitions of class “inventory” or “compliance” that are extended (transitive) by the “vulnerability” class definitions.

If an OVAL “patch” or “vulnerability” class definition maps to one or more CVE identifiers, the definition SHOULD include `<oval-def:reference>` elements that reference those identifiers using the following format:

```xml
<oval-def:reference source="CVE" ref_id="CVE_identifier"/>
```

OVAL “patch” class definitions SHOULD also reference source patch identifiers, if they exist.

### 4.2.5 OVAL Definitions and Patch Assessment

An OVAL patch definition is an `<oval-def:oval_definitions>` document that specifies definitions for assessing the patch status of target platforms. An OVAL patch definition SHALL specify at least one definition of class “patch”. An OVAL patch definition may also include definitions of class “inventory” that are extended (transitive) by the “patch” class definitions.

If an OVAL “patch” class definition is associated with a source specific identifier (for example, KB numbers for Microsoft patches), these identifiers SHOULD be included in `<oval-def:reference>` elements contained by the definition. For example:

```xml
<oval-def:reference source="www.microsoft.com/Patch" ref_id="KB912919"/>
```

If an OVAL “patch” class definition maps to one or more CVE identifiers, the definition MAY include `<oval-def:reference>` elements that reference those identifiers using the following format:

```xml
<oval-def:reference source="CVE" ref_id="CVE_identifier"/>
```

### 4.2.6 OVAL Inventories

An OVAL Inventory component is an `<oval-def:oval_definitions>` document that specifies only “inventory” class definitions for verifying CPE match conditions.

### 4.2.7 OVAL Results

While the OVAL specification permits limited result status reporting, SCAP-compliant content includes full status reporting including Error, Unknown, Not Applicable, Not Evaluated, True, and False. Section 4.1.12 provides additional detail about OVAL results.
Results returned SHALL be compliant with the OVAL results schema.\textsuperscript{30} In order to support SCAP instances where OVAL thin content (only the ID of the definition and the results) is preferred, SCAP content SHALL support all valid values for the ContentEnumeration directives controlling the expected content of the results file. Specific product requirements may be implemented through the Derived Test Requirements.

### 4.3 CPE Conventions

CPE Names supported by the Official CPE Dictionary data feed or the custodial list supported by The MITRE Corporation\textsuperscript{31} may be used by SCAP components to reference CPE Names. The process for assigning new CPE Names is supported by The MITRE Corporation.\textsuperscript{32} Local enumerations are permitted, but if a CPE Name for a product or platform exists in the Official CPE Dictionary, the tool SHALL use that official identifier.

Section 8 of CPE Specification 2.2 provides the defining structure of the Official CPE Dictionary. For certain names, a \texttt{<cpe\_dict:cpe\_item>} MAY contain one or more \texttt{<check>} elements that reference OVAL system inventory definitions using the following format:

\begin{verbatim}
<cpe\_dict:check system="http://oval.mitre.org/XMLSchema/oval-definitions-5"
    href="Oval\_URL">Oval\_inventory\_definition\_id</cpe\_dict:check>
\end{verbatim}

For example:

\begin{verbatim}
<cpe-list xmlns="http://cpe.mitre.org/dictionary/2.0"
    xmlns:cpe\_dict="http://cpe.mitre.org/dictionary/2.0">
    <cpe-item name="cpe:o:microsoft:windows_2003">
        <title>Microsoft Windows Server 2003</title>
        <check system="http://oval.mitre.org/XMLSchema/oval-definitions-5">
            oval:org.mitre.oval:def:128
        </check>
    </cpe-item>
</cpe-list>
\end{verbatim}

The referenced OVAL inventory definition specifies the technical procedure for determining whether or not a specific target asset is an instance of the CPE Name specified by the \texttt{<cpe\_dict:cpe\_item>} element. This usage is encouraged for CPE dictionary components of SCAP expressed data streams.

If a \texttt{<cpe\_dict:cpe\_item>} contained in a CPE dictionary component of an SCAP data stream references an OVAL “inventory” definition, then that definition SHALL be resolved by a CPE Inventory component in the same data stream.\textsuperscript{33} Furthermore, the title of the \texttt{<cpe\_dict:cpe\_item>} SHALL match the title of an affected platform bound to the referenced definition.\textsuperscript{34}

### 4.4 CCE Conventions

CCE identifiers are used by SCAP components to reference Common Configuration Enumerations. CCE identifiers for new configuration settings are assigned by the CCE Content Team.\textsuperscript{35} To maintain

\textsuperscript{30} The OVAL schemas are described in detail at [http://oval.mitre.org/language/about](http://oval.mitre.org/language/about).
\textsuperscript{31} The Official CPE Dictionary is located at [http://nvd.nist.gov/cpe.cfm](http://nvd.nist.gov/cpe.cfm).
\textsuperscript{32} Ibid.
\textsuperscript{33} More information is provided in Section 4.7.
\textsuperscript{34} Section 4.2.2 explains more detail about OVAL definitions.
\textsuperscript{35} [http://cce.mitre.org/lists/creation_process.html](http://cce.mitre.org/lists/creation_process.html) documents the CCE Creation Process.
consistency and accuracy among the SCAP validated tools, if a CCE entry for a particular configuration setting exists in the Official CCE Dictionary, the security products SHALL use the official CCE identifier. If no CCE exists for the configuration setting of interest, an alternate identifier MAY be used, but the user SHOULD seek to have a CCE identifier issued for the vulnerability.

The MITRE Corporation maintains the current official CCE list at [http://cce.mitre.org/lists/cce_list.html](http://cce.mitre.org/lists/cce_list.html) and new CCEs can be requested from The MITRE Corporation at [http://cce.mitre.org/lists/creation_process.html](http://cce.mitre.org/lists/creation_process.html).

### 4.5 CVE Conventions

CVE identifiers are used by SCAP components to reference publicly known software flaws. CVE references in SCAP content MAY include both “candidate” and “entry” status identifiers. If a CVE identifier exists for a particular vulnerability, security products SHALL use the official CVE identifier. If no CVE exists for the software flaw, an alternate identifier MAY be used, but the user SHOULD seek to have a CVE identifier issued for the vulnerability. The process for submitting unpublished vulnerabilities and obtain CVE identifiers is available from The MITRE Corporation via [http://cve.mitre.org/cve/obtain_id.html](http://cve.mitre.org/cve/obtain_id.html).

It should be noted that not all CVE entries identify an associated patch or remediation; in fact, the ability to determine the availability of a patch or remediation is a valuable feature of the CVE component. Vendors SHOULD reference CVE entries in notifications (e.g., security patch bulletins) to support the use of automated tools and to ensure clarity when referencing a given vulnerability. Similarly, CVE authors SHOULD reference applicable vendor patch identification whenever possible.

NIST provides a CVE data feed to support dynamic and current vulnerability information and associated metadata (e.g., CVSS values). The current schema is available at [http://nvd.nist.gov/download.cfm](http://nvd.nist.gov/download.cfm).

### 4.6 CVSS Conventions

The CVSS specification (described at [http://www.first.org/cvss/cvss-guide.html](http://www.first.org/cvss/cvss-guide.html)) defines Base score metrics that characterize the severity of the vulnerability using the intrinsic characteristics of the vulnerability. The CVSS framework also allows further refinement of the base score using Temporal Metrics, which may change over time (e.g., Exploitability, Report Confidence) and Environmental Metrics, which are unique to a particular environment (e.g., Collateral Damage Potential, Target Distribution).

If an accompanying CVSS score exists for a CVE, products SHOULD use it. CVSS base scores are provided for all CVE identifiers contained in the NVD CVE data feed. If a CVSS Base Metric is provided, it SHALL reflect the current Base score as reflected in the official source. SCAP users MAY leverage the flexibility provided within the CVSS component specification by deriving and using the Temporal and Environmental metrics as needed.

---

36 NIST provides the NVD CVE data feed at [http://nvd.nist.gov/download.cfm#CVE_FEED](http://nvd.nist.gov/download.cfm#CVE_FEED).
5. SCAP Use Case Requirements

To facilitate implementation of the SCAP requirements specified in Section 4, this section describes specific uses that demonstrate effective use of the protocol. The content of this section identifies the input data source conventions identified with the SCAP components and associates these with the following use case examples:

- Configuration Verification
- Vulnerability Assessment
- Patch Validation
- Inventory Collection

These examples are not intended to limit SCAP but provide a framework for future use cases and document the specifics of the data streams described. SCAP enables many types of automated assessment, each with discrete benefits and each considered separate content. For example, vulnerability assessment (i.e., quantitative and repeatable measurement and scoring of software flaw vulnerabilities across systems) is related to but separate from configuration verification.

An SCAP data stream is the expression of a security use case using one or more SCAP components that can be processed by an SCAP-validated product. The required XML content composing an SCAP data stream depends on the use case and is designed to satisfy specific policy or situational awareness objectives. Every SCAP data stream bundle SHALL use a common locator prefix that is part of a relative URL whose base is the URL of the deployed data source. The notation ‘xxxx’ designates a locator prefix that SHALL be associated with a use case specific data source component stream.

For example:

```
file:///c:/content/example-winxp-xccdf.xml
```

The URL base is: file:///c:/content/
The locator prefix is: example-winxp
The component stream is: xccdf.xml

5.1 SCAP Configuration Verification with XCCDF and OVAL

SCAP enables automated processes to compare system characteristics and settings against an SCAP-expressed checklist. Using such a process, such as that referenced in NIST SP 800-68, *Guide to Securing Microsoft Windows XP Systems for IT Professionals*, a user may confirm compliance and identify deviations from checklists appropriate for relevant operating systems and/or applications.

The following data sources are necessary to support SCAP-compliant configuration verification use cases:

<table>
<thead>
<tr>
<th>Component</th>
<th>Stream Locator</th>
<th>Required/Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>XCCDF Benchmark</td>
<td>xccdf.xml</td>
<td>Required</td>
</tr>
<tr>
<td>OVAL Compliance</td>
<td>oval.xml</td>
<td>Required</td>
</tr>
<tr>
<td>OVAL Patch</td>
<td>patches.xml</td>
<td>Optional</td>
</tr>
<tr>
<td>CPE Dictionary</td>
<td>cpe-dictionary.xml</td>
<td>Required</td>
</tr>
<tr>
<td>CPE Inventory</td>
<td>cpe-oval.xml</td>
<td>Required</td>
</tr>
</tbody>
</table>

Table 5-1. SCAP Configuration Verification Data Sources
For an SCAP configuration verification data source to be processed by the appropriate SCAP-validated product:

- Each Rule specified in the XCCDF benchmark SHALL include an `<ident>` element containing a CCE reference, where an appropriate reference exists.

- If an `<ident>` is specified in an XCCDF benchmark Rule, then that reference SHALL match the CCE reference found in the associated OVAL definition(s).

- The XCCDF `<xccdf: Benchmark>` element SHALL contain references to one or more CPEs.

- A rule bound to a specific CCE may be associated with one or more of the controls described in NIST SP 800-53. The mapping to these controls may be represented in the XCCDF benchmark by applying the following conventions:
  - Use of an official, dynamic data feed is preferred to static coding of values in SCAP data sources. The NVD provides a data feed\(^{37}\) that correlates CCE identifiers with the control identifiers described in SP 800-53.
  - The SP 800-53 controls referenced within an XCCDF benchmark are represented by `<xccdf: Group>` elements. Note that the XCCDF control group identifiers correspond to the control identifiers found in Appendix F of SP 800-53.
  - Each `<xccdf: Rule>` SHALL be associated with one or more SP 800-53 controls by capturing the ID of the each associated control in an `<xccdf: requires>` element within the rule. This association allows rules to be enabled/disabled at the profile level through the selection/deselection of the associated control groups.
  - The chosen convention for mapping XCCDF rules to SP 800-53 controls within a benchmark SHOULD be uniformly applied to all rules having SP 800-53 mappings.

- XCCDF configuration scanning processes SHALL produce XCCDF Results and OVAL Results that comply with the XCCDF and OVAL Results schema.

- XCCDF Results documents SHALL include a result for each rule that was evaluated during the scan. OVAL Results documents SHALL include the results of every OVAL definition used to generate the reported rule results.

- If an XCCDF rule references a specific OVAL definition, the definition MUST be a compliance class definition.

- An XCCDF benchmark MAY include a “patches up-to-date” rule that references an OVAL patch component stream. If such a rule is used, the OVAL patch component MUST be included in the OVAL compliance data source.

- An XCCDF benchmark MAY enumerate one patch per rule. If this approach is used, a specific OVAL definition of class “patch” MUST be referenced in the OVAL Patch component stream.

### 5.2 SCAP Vulnerability Assessment

In the context of SCAP, a vulnerability is defined as a software flaw, bug, or defect that introduces a security exposure. SCAP enables interoperability among vulnerability scanners and reporting tools to provide consistent detection and reporting of these flaws and supports comprehensive remediation tool

capabilities. Section 4.1.12 documents the reasons that vulnerability assessment and configuration verification are significantly different use cases, and shows how SCAP results are interpreted under these two use cases.

5.2.1 SCAP Vulnerability Assessment Using XCCDF and OVAL

Effective vulnerability assessment using a combination of SCAP components requires the following data sources:

<table>
<thead>
<tr>
<th>Component</th>
<th>Stream Locator</th>
<th>Required/Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>XCCDF Benchmark</td>
<td>xxxxxxxccdf.xml</td>
<td>Required</td>
</tr>
<tr>
<td>OVAL Vulnerability</td>
<td>xxxxxxxoval.xml</td>
<td>Required</td>
</tr>
<tr>
<td>OVAL Patch</td>
<td>xxxxxxxpatches.xml</td>
<td>Optional</td>
</tr>
<tr>
<td>CPE Dictionary</td>
<td>xxxxxxxcpe-dictionary.xml</td>
<td>Required</td>
</tr>
<tr>
<td>CPE Inventory</td>
<td>xxxxxxxcpe-oval.xml</td>
<td>Required</td>
</tr>
</tbody>
</table>

For an SCAP Vulnerability Assessment to be performed by the appropriate SCAP-validated product, the following conditions SHALL be met:

- The XCCDF <xccdf:Benchmark> element SHALL contain references to one or more CPEs.
- XCCDF Vulnerability Scanning SHALL generate an XCCDF Results file. The XCCDF Results document SHALL include a result for each rule that was evaluated during the scan.
- Each Rule specified in an XCCDF benchmark SHALL include an <ident> element containing a CVE reference, where an appropriate reference exists.
- Each Rule specified in an XCCDF benchmark SHALL reference a specific OVAL vulnerability, patch, or inventory definition; except in cases where no automated mechanism exists to express a check in OVAL.
- If OVAL Results are generated:
  - OVAL Results SHALL be expressed in compliance with the OVAL Results schema, and
  - OVAL Results documents SHALL include the results of every OVAL definition used to generate the reported rule results.
- If a CVE reference is specified in an XCCDF benchmark rule, then that reference SHALL match the CVE reference found in the associated OVAL definition(s).

5.2.2 SCAP Vulnerability Assessment Using Standalone OVAL

For an OVAL-only vulnerability assessment to be processed by the appropriate SCAP-validated product, the following SHALL be present:

- A Standalone OVAL Vulnerability Data Stream SHALL include an OVAL Vulnerability XML stream component that defines the applied OVAL vulnerability class definitions.
- OVAL Definitions SHALL include CVE references, if such exist.
■ OVAL vulnerability data scanning SHALL generate an OVAL Results document that complies with the OVAL Results schema and includes the results of every OVAL definition used to generate the reported rule results.

■ The OVAL Results document SHALL include a definition result with supporting system-characteristics data for every definition in the vulnerability data source.

5.3 Inventory Collection
Organizations require a consistent protocol for integrating inventory information from among a broad range of products, and SCAP provides excellent methods for collecting this data. For example, SCAP inventory data is an important input to the Risk Management Framework,\footnote{The Risk Management Framework is explained in NIST SP 800-53 Revision 3 at \url{http://csrc.nist.gov/publications/PubsSPs.html}.} establishing an effective foundation for system categorization and baseline security controls. For SCAP tools to collect this inventory information, the following data sources are required:

<table>
<thead>
<tr>
<th>Component</th>
<th>Stream Locator</th>
<th>Required/Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>XCCDF Benchmark</td>
<td>xxcxxccdf.xml</td>
<td>Optional</td>
</tr>
<tr>
<td>CPE Dictionary</td>
<td>xxcxxcpe-dictionary.xml</td>
<td>Required</td>
</tr>
<tr>
<td>CPE Inventory</td>
<td>xxcxxcpe-oval.xml</td>
<td>Required</td>
</tr>
</tbody>
</table>

In order for an Inventory scan to be processed by the appropriate SCAP-validated product:

■ The inventory data source SHALL include an OVAL Inventory component that defines the applied OVAL inventory class definitions.

■ OVAL vulnerability data scanning SHALL generate an OVAL Results document that complies with the OVAL Results schema and includes the results of every OVAL definition used to generate the reported rule results.

■ The results document SHALL include a definition result with supporting system-characteristics data for every definition in the Inventory component.
## Appendix A—Acronyms and Abbreviations

Appendix A defines selected acronyms and abbreviations used in the document.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCE</td>
<td>Common Configuration Enumeration</td>
</tr>
<tr>
<td>CPE</td>
<td>Common Platform Enumeration</td>
</tr>
<tr>
<td>CVE</td>
<td>Common Vulnerabilities and Exposures</td>
</tr>
<tr>
<td>CVSS</td>
<td>Common Vulnerability Scoring System</td>
</tr>
<tr>
<td>DHS</td>
<td>Department of Homeland Security</td>
</tr>
<tr>
<td>DISA</td>
<td>Defense Information Systems Agency</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>FDCC</td>
<td>Federal Desktop Core Configuration</td>
</tr>
<tr>
<td>FIRST</td>
<td>Forum of Incident Response and Security Teams</td>
</tr>
<tr>
<td>FISMA</td>
<td>Federal Information Security Management Act</td>
</tr>
<tr>
<td>FSO</td>
<td>DISA Field Security Operations</td>
</tr>
<tr>
<td>GPO</td>
<td>Group Policy Object</td>
</tr>
<tr>
<td>HIPAA</td>
<td>Health Insurance Portability and Accountability Act</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>ITL</td>
<td>Information Technology Laboratory</td>
</tr>
<tr>
<td>NCSD</td>
<td>National Cyber Security Division</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>NISTIR</td>
<td>National Institute of Standards and Technology Interagency Report</td>
</tr>
<tr>
<td>NSA</td>
<td>National Security Agency</td>
</tr>
<tr>
<td>NVD</td>
<td>National Vulnerability Database</td>
</tr>
<tr>
<td>OMB</td>
<td>Office of Management and Budget</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>OVAL</td>
<td>Open Vulnerability and Assessment Language</td>
</tr>
<tr>
<td>PCI</td>
<td>Payment Card Industry</td>
</tr>
<tr>
<td>PDI</td>
<td>DISA Potential Discrepancy Item</td>
</tr>
<tr>
<td>RFC</td>
<td>Request for Comments</td>
</tr>
<tr>
<td>SCAP</td>
<td>Security Content Automation Protocol</td>
</tr>
<tr>
<td>SP</td>
<td>Service Pack</td>
</tr>
<tr>
<td>SP</td>
<td>Special Publication</td>
</tr>
<tr>
<td>STIG</td>
<td>Security Technical Implementation Guide</td>
</tr>
<tr>
<td>URI</td>
<td>Uniform Resource Identifier</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>VMS</td>
<td>DISA Vulnerability Management System</td>
</tr>
<tr>
<td>XCCDF</td>
<td>eXtensible Configuration Checklist Description Format</td>
</tr>
<tr>
<td>XML</td>
<td>eXtensible Markup Language</td>
</tr>
</tbody>
</table>
Appendix B—References and other Resources

Appendix B lists references and other resources related to SCAP 1.0 and its component specifications.


The resources below may be retrieved from the NIST SCAP web site:

[1] CVE specification and description (http://scap.nist.gov/revision/1.0/index.html#cve)
[2] CCE specification and description (http://scap.nist.gov/revision/1.0/index.html#cce)
[3] CPE specification and description (http://scap.nist.gov/revision/1.0/index.html#cpe)
[4] CVSS specification and description (http://scap.nist.gov/revision/1.0/index.html#cvss)
[5] XCCDF specification and description (http://scap.nist.gov/revision/1.0/index.html#xccdf)
Appendix C—SCAP Extensions to the XCCDF Specification

C.1 Rule and Group Selection

Rules and Groups may be selected for application in the context of either a Benchmark or a Profile contained by a Benchmark. This extension expands on the semantics of rule and group Selection.

C.1.1. A group or rule is selected in a Benchmark if and only if at least one of the following is true:

a. The group or rule is immediately contained by the Benchmark and the ‘selected’ attribute of the group or rule is bound to true.

b. The group or rule is immediately contained by a group that is selected in the Benchmark and the ‘selected’ attribute of the subject group or rule is bound to true.

c. The group or rule is selected by association relative\(^{39}\) to the Benchmark.

C.1.2. A group or rule will be selected in a Profile only if it is either explicitly or implicitly selected in the Profile.

C.1.3. A group or rule is explicitly selected in a Profile only if there exists a \(<select>\) contained by the Profile whose ‘idref’ attribute is bound to the id of the group or rule and whose ‘selected’ attribute is set to true. A group or rule is explicitly deselected in a Profile only if there exists a \(<select>\) contained by the Profile whose ‘idref’ attribute is bound to the id of the group or rule and whose ‘selected’ attribute is set to false.

C.1.4. A group or rule is implicitly selected in a Profile if and only if it is not explicitly selected or deselected in the Profile and at least one of the following is true:

a. The group or rule is selected in the Benchmark.

b. The group or rule is selected in the Profile extended by the subject Profile.

c. The group or rule is selected by association relative to the Profile.

C.2 Selection by Association

The sequence of \(<requires>\) and \(<conflicts>\) optionally bound to a group or rule creates a set of directed associations rooted on the subject group or rule and terminating on other Groups or Rules. The resulting directed graphs are valid only if they are acyclic. The associations rooted on a group or rule may be used to determine an associative selection predicate on the subject group or rule. The selection predicate is evaluated as follows

C.2.1. The selection value of a \(<requires>\) relative to the Benchmark is true only if all of the Groups or Rules referenced by the element are selected by the Benchmark, likewise the selection value relative to a Profile is true only if all of the Groups or Rules referenced by the element are selected in the Profile.

C.2.2. The selection value of a \(<conflicts>\) relative to the Benchmark is true only if at least one of the Groups or Rules referenced by the element are deselected by the Benchmark, likewise the

\(^{39}\) Selection by association is discussed in C.2.
selection value relative to a Profile is true only if at least one of the Groups or Rules referenced by the element are deselected in the Profile.

C.2.3. The selection value of a sequence of <requires> and <conflicts> is true relative to the Benchmark only if at least one of the elements in the sequence evaluates to true relative to the Benchmark, likewise the value of the sequence relative to a Profile is true only if at least one of the elements in the sequence evaluates to true relative to the Profile.
Appendix D—SCAP Compliance Verification Data Stream Example

The content in this XML example section has been derived from the NIST SP 800-68 configuration guidance for Windows XP operating systems. This example content is referenced throughout this document as an illustration of how a potential SCAP data stream may be represented. Please note that much of the content from the original source has been removed or changed. The complete, original data stream can be downloaded at http://web.nvd.nist.gov/view/ncp/repository/checklistDetail?id=76.

D.1 XCCDF Benchmark

The following example XCCDF XML instance represents a configuration checklist.

```
<xml version="1.0" encoding="UTF-8"?>
  <status date="2009-09-18" draft="true" id="example" idref="cpe:q:winxp-1.2.1.0" />
  <title>Windows XP Configuration Verification Example</title>
  <description>This checklist has been created to assist IT professionals with understanding the requirements and conventions defined in the NIST SP 800-126.</description>
  <notice id="terms-of-use" xml:lang="en">Do not attempt to implement any of the settings in this guide without first testing them in a non-operational environment. NIST assumes no responsibility whatsoever for its use by other parties, and makes no guarantees, expressed or implied, about its quality, reliability, or any other characteristic. NIST would appreciate acknowledgement if the document and template are used.</notice>
  <front-matter xml:lang="en">Example front matter</front-matter>
  <rear-matter xml:lang="en">Example rear matter</rear-matter>
  <platform idref="cpe:q:windows_xp"/>
  <version>v0.1</version>
  <metadata>
    <dc:creator>National Institute of Standards and Technology</dc:creator>
    <dc:publisher>National Institute of Standards and Technology</dc:publisher>
    <dc:contributor>John Doe</dc:contributor>
  </metadata>
  <!-- Scoring models supported by this checklist -->
  <model system="urn:xccdf:scoring:default"/>
  <profile id="example-profile-1"/>
  <description>Federal Desktop Core Configuration version 1.2.1.</description>
  <select idref="account_lockout_duration" selected="true"/>
  <select idref="minimum_password_length" selected="true"/>
  <select idref="regedit.exePermissions" selected="true"/>
</Benchmark>
```

Figure D.1. example-winxp-xccdf.xml

D-1

---

1. Introduction

This is an example SCAP data stream for the Configuration Verification use case. This data stream is based on the NIST SP 800-68. Please note that much of the content has been removed or changed. The complete, original data stream can be downloaded at: http://web.nvd.nist.gov/view/ncp/repository/checklistDetail?id=76.

2. Introduction

---

3. Security Settings

The following controls must be checked in order to verify compliance.

---

4. Account Policies Group

---

5. Account Lockout Policy Settings

---

6. Account Lockout Duration

The amount of time in seconds that an account is locked before it is automatically unlocked by the system. 15 minutes - 900 seconds A value of 0 means that an administrator must unlock the account.

---

7. Account Lockout Duration

The lockout duration specifies how long the user account should be locked out after too many bad logon attempts. This is often set to a low but substantial value (e.g., 15 minutes), for two reasons. First, a legitimate user that is accidentally locked out only has to wait 15 minutes to regain access, instead of asking an administrator to unlock the account. Second, an attacker who is guessing passwords using brute force methods will only be able to try a small number of passwords at a time, then wait 15 minutes before trying any more. This greatly reduces the chances that the brute force attack will be successful.

---

8. Reference

---
<dc:type>GPO</dc:type>
<dc:source>Computer Configuration\Windows Settings\Security Settings\Account Policies\Account Lockout Policy</dc:source>
</reference>
<ident system="http://cce.mitre.org">CCE-2928-0</ident>
<ident system="http://cce.mitre.org/version/4">CCE-980</ident>
<check system="http://oval.mitre.org/XMLSchema/oval-definitions-5">
<check-export value-id="account_lockout_duration_var" export-name="oval:gov.nist.fdcc.xp:var:15"/>
<check-content-ref href="example-winxp-oval.xml" name="oval:gov.nist.fdcc.xp:def:23"/>
</check>
</Rule>
</Group>
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<Group id="password_policy_settings">
<title>Password Policies</title>
<description>In addition to educating users regarding the selection and use of good passwords, it is also important to set password parameters so that passwords are sufficiently strong. This reduces the likelihood of an attacker guessing or cracking passwords to gain unauthorized access to the system. As described in Section 3.2.1, NIST recommends the use of NTLM v2 or Kerberos instead of LM or NTLM v1 for authentication. Windows XP offers the same password parameters as Windows 2000. The following parameters are specified in the NIST templates:</description>
<Value id="minimum_password_length_var" type="number" operator="greater than or equal">
<title>Minimum Password Length</title>
<description>The minimum number of characters required for a password</description>
:value selector="8_characters" />
:value selector="9_characters" />
:value selector="12_characters" />
</Value>
</Group>
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
</dc:type>GPO</dc:type>
<dc:source>Computer Configuration\Windows Settings\Security Settings\Account Policies\Password Policy</dc:source>
</reference>
<ident system="http://cce.mitre.org">CCE-2981-9</ident>
<ident system="http://cce.mitre.org/version/4">CCE-100</ident>
<check system="http://oval.mitre.org/XMLSchema/oval-definitions-5">
<check-export value-id="minimum_password_length_var" export-name="oval:gov.nist.fdcc.xp:var:12"/>
<check-content-ref href="example-winxp-oval.xml" name="oval:gov.nist.fdcc.xp:def:19"/>
</check>
</Rule>
</Group>
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<Group id="file_permissions_group">
<title>File Permissions Settings</title>
<description>This group checks the permissions of specified files.</description>
<Rule id="regedit.exePermissions" selected="false" weight="10.0">
<title>regedit.exe Permissions</title>
<description>Failure to properly configure ACL file and directory permissions, allows the possibility of unauthorized and anonymous modification to the operating system and installed applications.</description>
</Rule>
</Group>
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
<!-- ~~~~~~~~~~~~~~~~~~~~~~~~~~ -->
</dc:type>GPO</dc:type>
<dc:source>Computer Configuration\Windows Settings\Security Settings\File System</dc:source>

D-3
Securing a given computer has become increasingly important. As such, it is essential to keep a host up to current patch levels to eliminate known vulnerabilities and weaknesses. In conjunction with antivirus software and a personal firewall, patching goes a long way to securing a host against outside attacks and exploitation. Microsoft provides two mechanisms for distributing security updates: Automatic Updates and Microsoft Update. In smaller environments, either method may be sufficient for keeping systems current with patches. Other environments typically have a software change management control process or a patch management program that tests patches before deploying them; distribution may then occur through local Windows Update Services (WUS) or Windows Server Update Services (WSUS) servers, which provide approved security patches for use by the Automatic Updates feature.

Security Patches

Keep systems up to current patch levels to eliminate known vulnerabilities and weaknesses.

Security Patches Up-To-Date

Keep systems up to current patch levels to eliminate known vulnerabilities and weaknesses.
D.2 OVAL Compliance

The following OVAL XML instance represents compliance definitions used to evaluate the XCCDF checklist from the previous section.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<oval_definitions xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5"
  xmlns:win="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  <generator>
    <product_name>National Institute of Standards and Technology</product_name>
    <schema_version>5.3</schema_version>
    <timestamp>2009-04-08T15:04:22.000</timestamp>
  </generator>
  <!-- ------------------------------- DEFINITIONS ------------------------------- -->
  <!-- ------------------------------- DEFINITIONS ------------------------------- -->
  <definitions>
    <definition id="oval:gov.nist.fdcc.xp:def:23" version="1" class="compliance">
      <metadata>
        <title>Account Lockout Duration</title>
        <affected family="windows"/>
        <platform>Microsoft Windows XP</platform>
      </metadata>
      <criteria>
        <extend_definition comment="Microsoft Windows XP is installed">
          <definition_ref>oval:gov.nist.fdcc.xp:def:2</definition_ref>
        </extend_definition>
        <criterion operator="OR">
          <criterion comment="Account Lockout Duration is set to keep accounts locked for at least the defined number of minutes">
            <test_ref>oval:gov.nist.fdcc.xp:tst:19</test_ref>
          </criterion>
        </criterion>
      </criteria>
    </definition>
    <definition id="oval:gov.nist.fdcc.xp:def:19" version="1" class="compliance">
      <metadata>
        <title>Minimum Password Length</title>
        <affected family="windows"/>
        <platform>Microsoft Windows XP</platform>
      </metadata>
      <criteria>
        <criterion comment="Account Lockout Duration is set to keep accounts locked until an administrator unlocks them">
          <test_ref>oval:gov.nist.fdcc.xp:tst:1911</test_ref>
        </criterion>
      </criteria>
    </definition>
  </definitions>
</oval_definitions>
```
<definition id="oval:gov.nist.fdpcc.xp:def:2" version="1" class="compliance">
  <metadata>
    <title>Administrators and System User Have Full Access to the SYSTEMROOT/regedit.exe File</title>
    <affected family="windows">
      <platform>Microsoft Windows XP</platform>
    </affected>
    <reference source="http://cce.mitre.org" ref_id="CCE-2175-8"/>
    <reference source="http://cce.mitre.org/version/4" ref_id="CCE-795"/>
    <description>The Administrators group and the System user should have full access to the SYSTEMROOT/regedit.exe file and all other users should have no file access privileges.</description>
  </metadata>
  <criteria>
    <extend_definition comment="Microsoft Windows XP is installed">
      <criterion operator="AND">
        <criterion comment="The Administrators group is granted full access to the file regedit.exe">
          <test_ref>oval:gov.nist.fdpcc.xp:tst:248</test_ref>
        </criterion>
        <criterion comment="The System user is granted full access to the file regedit.exe">
          <test_ref>oval:gov.nist.fdpcc.xp:tst:249</test_ref>
        </criterion>
      </criterion>
      <criterion comment="There are no access privileges to file regedit.exe by users not part of the Administrators group or the System user">
        <test_ref>oval:gov.nist.fdpcc.xp:tst:250</test_ref>
      </criterion>
    </extend_definition>
  </criteria>
</definition>

<definition id="oval:gov.nist.fdpcc.xp:def:4" version="1" class="compliance">
  <metadata>
    <title>Microsoft Windows XP is installed</title>
    <affected family="windows">
      <platform>Microsoft Windows XP</platform>
    </affected>
    <reference source="http://cce.mitre.org" ref_id="CCE-2175-8"/>
    <reference source="http://cce.mitre.org/version/4" ref_id="CCE-795"/>
    <description>Microsoft Windows XP is installed.</description>
  </metadata>
  <criteria>
    <criterion comment="the installed operating system is part of the Microsoft Windows family">
    </criterion>
    <criterion comment="Microsoft Windows XP is installed">
      <test_ref>oval:gov.nist.fdpcc.xp:tst:7</test_ref>
    </criterion>
  </criteria>
</definition>

<tests>
  <family_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent" id="oval:gov.nist.fdpcc.xp:tst:6" version="1" comment="the installed operating system is part of the Microsoft Windows family">
    <check existence="at_least_one_exists">check="only_one">
      <object_ref>oval:gov.nist.fdpcc.xp:obj:3</object_ref>
    </check>
  </family_test>
  <state state_ref="oval:gov.nist.fdpcc.xp:state:14"/>
</tests>

<family_test>
<registry_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:7" version="1" comment="Microsoft Windows XP is installed"
    check_existence="at_least_one_exists" check="at_least_one">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:4"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:15"/>
</registry_test>

<passwordpolicy_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:19" version="1" comment="Minimum password length is profile defined" check_existence="at_least_one_exists" check="all">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:8"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:20"/>
</passwordpolicy_test>

<lockoutpolicy_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:1911" version="1" comment="Account Lockout Duration is set to keep accounts locked for at least the defined number of minutes" check_existence="at_least_one_exists" check="all">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:9"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:2511"/>
</lockoutpolicy_test>

<fileeffectiverights53_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:248" version="1" comment="The Administrators group is granted full access to the file regedit.exe" check_existence="any_exist" check="all">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:155"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:51"/>
</fileeffectiverights53_test>

<fileeffectiverights53_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:249" version="1" comment="The System user is granted full access to the file regedit.exe" check_existence="any_exist" check="all">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:156"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:51"/>
</fileeffectiverights53_test>

<fileeffectiverights53_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:ste:250" version="1" comment="There are no access privileges to file regedit.exe by users not part of the Administrators group or the System user" check_existence="any_exist" check="all">
    <object object_ref="oval:gov.nist.fdcc.xp:obj:157"/>
    <state state_ref="oval:gov.nist.fdcc.xp:ste:52"/>
</fileeffectiverights53_test>
</tests>

</objects>

<family_object xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent"
    id="oval:gov.nist.fdcc.xp:obj:3" version="1"/>

<registry_object xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:obj:4" version="1""
    hive>HKEY_LOCAL_MACHINE</hive>
    <key>SOFTWARE\Microsoft\Windows NT\CurrentVersion</key>
    <name>CurrentVersion</name>
</registry_object>

<passwordpolicy_object xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
    id="oval:gov.nist.fdcc.xp:obj:8" version="1"/>

<lockoutpolicy_object xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
D-8
<lockoutpolicy_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <lockout_duration datatype="int">1</lockout_duration>
</lockoutpolicy_state>

<registry_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <value datatype="string">5.1</value>
</registry_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>

<fileeffectiverights53_state xml:id="oval:gov.nist.fdcc.xp:ste:53" version="1">
  <file_read_attributes datatype="boolean">1</file_read_attributes>
  <file_read_ea datatype="boolean">1</file_read_ea>
  <file_read_data datatype="boolean">1</file_read_data>
  <file_write_attributes datatype="boolean">1</file_write_attributes>
</fileeffectiverights53_state>
<table>
<thead>
<tr>
<th>Line</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>346</td>
<td><code>&lt;/variables&gt;</code></td>
</tr>
<tr>
<td>347</td>
<td><code>&lt;![--</code></td>
</tr>
<tr>
<td>348</td>
<td><code>&lt;!--</code></td>
</tr>
<tr>
<td>349</td>
<td><code>&lt;!--</code></td>
</tr>
<tr>
<td>350</td>
<td><code>&lt;/oval_definitions&gt;</code></td>
</tr>
</tbody>
</table>
D.3 OVAL Patch

The following OVAL XML instance represents patch definitions used to assess the `<xccdf:Rule>` element from section D.1 lines 223-226.

```
<?xml version="1.0" encoding="UTF-8"?>
<oval_definitions xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5"
xmlns:oval="http://oval.mitre.org/XMLSchema/oval-common-5"
xmlns:win-def="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
<generator>
  <oval:product_name>National Institute of Standards and Technology</oval:product_name>
  <oval:schema_version>5.3</oval:schema_version>
  <oval:timestamp>2009-08-21T08:34:35.000-05:00</oval:timestamp>
</generator>

<definition id="oval:gov.nist.fdcc.patch:def:5" version="0" class="patch">
  <metadata>
    <title>Remote Code Execution (891781)</title>
    <affected family="windows">
      <platform>Microsoft Windows XP</platform>
    </product>Microsoft Internet Explorer</product>
  </affected>
  <reference source="Microsoft" ref_id="MS05-013"
  <reference source="Microsoft" ref_id="KB891781"
    ref_url="http://support.microsoft.com/kb/891781"/>
  <reference source="Bugtraq ID" ref_id="11950"
    ref_url="http://www.securityfocus.com/bid/11950"/>
  <reference source="CERT-VPN" ref_id="VU#356600"
    ref_url="http://www.kb.cert.org/vuls/id/356600"/>
  <reference source="CIAC" ref_id="p-126"
    ref_url="http://www.ciac.org/ciac/bulletins/p-126.shtml"/>
  <reference source="CVE" ref_id="CVE-2004-1319"
    ref_url="http://cve.mitre.org/cgi-bin/cvename.cgi?name=CVE-2004-1319"/>
  <reference source="OVAL" ref_id="oval:org.mitre.oval:definition:3851"/>
  <reference source="OVAL" ref_id="oval:org.mitre.oval:definition:1701"/>
  <reference source="OVAL" ref_id="oval:org.mitre.oval:definition:4758"/>
  <reference source="OVAL" ref_id="oval:org.mitre.oval:definition:1114"/>
  <reference source="OVAL" ref_id="oval:org.mitre.oval:definition:3464"/>
</definition>
```
Microsoft has released MS05-013 to address security issues in Microsoft Internet Explorer as documented by CVE-2004-1319. (938127)

Microsoft Windows XP (32-bit) SP2 is installed
Microsoft Windows Vista
Microsoft Internet Explorer

Microsoft has released MS07-050 to address security issues in the Vector Markup Language (VML) implementation in Windows as documented by CVE-2007-1749.

<definition id="oval:gov.nist.fdcc.patch:def:115275" version="0" class="inventory">
<metadata>
<title>Windows XP is installed</title>
<affected family="windows">
<platform>Microsoft Windows XP</platform>
</affected>
<br/>(AND)
<reference source="CPE" ref_id="cpe:/o:microsoft:windows_xp"/>
<description>The operating system installed on the system is Microsoft Windows XP.</description>
</metadata>
</definition>

<definition id="oval:gov.nist.fdcc.patch:def:115276" version="0" class="inventory">
<metadata>
<title>Windows XP (32-bit) SP2 is installed</title>
<affected family="windows">
<platform>Microsoft Windows XP</platform>
</affected>
<br/>(AND)
<reference source="CPE" ref_id="cpe:/o:microsoft:windows_xp::sp2:x86"/>
<description>A version of Microsoft Windows XP (32-bit) SP2 is installed.</description>
</metadata>
</definition>

<definition id="oval:gov.nist.fdcc.patch:def:115277" version="0" class="inventory">
<metadata>
<title>Windows XP (64-bit) SP2 is installed</title>
<affected family="windows">
<platform>Microsoft Windows XP</platform>
</affected>
<br/>(AND)
<reference source="CPE" ref_id="cpe:/o:microsoft:windows_xp::sp2:x64"/>
<description>A version of Microsoft Windows XP (64-bit) SP2 is installed.</description>
</metadata>
</definition>

<definition id="oval:org.mitre.oval:def:563" version="3" class="inventory">
<metadata>
<title>Internet Explorer 6 is installed</title>
<affected family="windows">
<platform>Microsoft Windows 2000</platform>
<platform>Microsoft Windows XP</platform>
<platform>Microsoft Windows Server 2003</platform>
</affected>
<br/>(AND)
<reference source="CPE" ref_id="cpe:/a:microsoft:ie:6"/>
<description>The application Microsoft Internet Explorer 6 is installed.</description>
</metadata>
</definition>

<oval_repository>
<submitted date="2006-08-11T12:53:40">
<contributor organization="ThreatGuard, Inc."">Robert L. Hollis</contributor>
</submitted>
<status_change date="2006-09-08T11:26:00.000-04:00">DRAFT</status_change>
<status_change date="2006-09-27T12:29:31.086-04:00">INTERIM</status_change>
<status_change date="2006-10-16T15:58:44.500-04:00">ACCEPTED</status_change>
<modified comment="Added an anchor to the regex used to check for Internet Explorer 6." date="2007-01-11T20:38:00.950-05:00">
<contributor organization="The MITRE Corporation">Matthew Wojcik</contributor>
</modified>
<status_change date="2007-01-11T20:49:17.329-05:00">INTERIM</status_change>
<status_change date="2007-02-20T13:40:46.580-05:00">ACCEPTED</status_change>
<modified comment="Added CPE reference." date="2007-04-30T07:48:00.756-04:00">
<contributor organization="The MITRE Corporation">Jonathan Baker</contributor>
</modified>
<status_change date="2007-04-30T07:54:07.779-04:00">INTERIM</status_change>
<status_change date="2007-05-23T15:05:48.577-04:00">ACCEPTED</status_change>
</dates>
<status>ACCEPTED</status>
</oval_repository>
</metadata>
<criteria>
<comment>Traits are not needed for this criterion.</comment>
<expression test="oval:org.mitre.oval:tst:2333"/>
</expression>
</criteria>
</definition>
<definition id="oval:org.mitre.oval:def:627" version="1" class="inventory">
<title>Microsoft Internet Explorer 7 is installed</title>
<metadata>
<affected family="windows">
<platform>Microsoft Windows XP</platform>
<platform>Microsoft Windows Server 2003</platform>
<platform>Microsoft Windows Vista</platform>
</affected>
<reference source="CPE" ref_id="cpe:/a:microsoft:ie:7"/>
<description>A version of Microsoft Internet Explorer 7 is installed.</description>
<oval_repository>
<dates>
<submitted date="2007-01-09T06:00:00">
<contributor organization="Secure Elements, Inc."">Sudhir Gandhe</contributor>
</submitted>
<status_change date="2007-01-11T15:30:00-04:00">DRAFT</status_change>
<status_change date="2007-02-20T13:40:49.320-05:00">INTERIM</status_change>
<modified comment="Added Microsoft Windows Vista to the list of affected platforms." date="2007-03-05T09:10:01.104-05:00">
<contributor organization="The MITRE Corporation">Andrew Buttner</contributor>
</modified>
<status_change date="2007-03-21T16:17:23.092-04:00">ACCEPTED</status_change>
</dates>
<status>ACCEPTED</status>
</oval_repository>
</metadata>
<criteria>
<comment>Internet Explorer 7 is installed</comment>
<expression test="oval:org.mitre.oval:tst:178"/>
</expression>
</criteria>
</definition>
</definitions>
<tests>
<test registry_test_url="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:gov.nist.fcc.patch:tst:57914" version="0" comment="Windows XP is installed">
<check_existence>at_least_one_exists</check_existence>
<check>at_least_one</check>
<object object_ref="oval:org.mitre.oval:obj:5590"/>
<state state_ref="oval:gov.nist.fcc.patch:state:53828"/>
</tests>
<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent"
  id="oval:org.mitre.oval:tst:99" version="1"
  comment="the installed operating system is part of the Microsoft Windows family"
  check_existence="at_least_one_exists" check="only one">
  <object object_ref="oval:org.mitre.oval:obj:99"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:178" version="1"
  comment="Internet Explorer 7 is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:247"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:1151" version="2"
  comment="the patch kb891781 is installed (Hotfix key)"
  check_existence="at_least_one_exists"
  check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:823"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:2333" version="2"
  comment="Internet Explorer 6 (any patch level) is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:247"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:115" version="1"
  comment="Win2K/XP/2003 service pack 2 is installed" check_existence="at_least_one_exists"
  check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:717"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3422" version="3"
  comment="the version of vgx.dll is less than 6.0.3790.4106"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:308"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3653" version="2"
  comment="a version of Windows for the x64 architecture is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:1576"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3823" version="1"
  comment="a version of Windows for the x86 architecture is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:1576"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3856" version="3"
  comment="the version of vgx.dll is less than 6.0.2900.3164"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:308"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:99" version="1"
  comment="the installed operating system is part of the Microsoft Windows family"
  check_existence="at_least_one_exists" check="only one">
  <object object_ref="oval:org.mitre.oval:obj:99"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent"
  id="oval:org.mitre.oval:tst:99" version="1"
  comment="the installed operating system is part of the Microsoft Windows family"
  check_existence="at_least_one_exists" check="only one">
  <object object_ref="oval:org.mitre.oval:obj:99"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:178" version="1"
  comment="Internet Explorer 7 is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:247"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3422" version="3"
  comment="the version of vgx.dll is less than 6.0.3790.4106"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:308"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3653" version="2"
  comment="a version of Windows for the x64 architecture is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:1576"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3823" version="1"
  comment="a version of Windows for the x86 architecture is installed"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:1576"/>
</file_test>

<file_test xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows"
  id="oval:org.mitre.oval:tst:3856" version="3"
  comment="the version of vgx.dll is less than 6.0.2900.3164"
  check_existence="at_least_one_exists" check="at least one">
  <object object_ref="oval:org.mitre.oval:obj:308"/>
</file_test>

D-16
<hive>\text{HKEY_LOCAL_MACHINE}</hive>
<key>SYSTEM\CurrentControlSet\Control\Session Manager\Environment</key>
</registry_object>

<registry_object xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:5590" version="1" comment="This registry key ProductName">
<hive>\text{HKEY_LOCAL_MACHINE}</hive>
<key>SOFTWARE\Microsoft\Windows NT\CurrentVersion</key>
</registry_object>

</object>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:gov.nist.fcccc.patch:ste:53828" version="0" comment="The registry key matches with XP">
<value operation="pattern match">.*(XPxp).*</value>
</registry_state>

</family>

</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:99" version="1" comment="Microsoft Windows family">
<family>\text{windows}</family>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:115" version="1" comment="The registry key has a value that matches 7.**">
<value operation="pattern match">7\.*$</value>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:1031" version="1">
<value operation="equals" datatype="int">1</value>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:2185" version="2" comment="The registry key has a value that matches 6.**">
<value operation="pattern match">6\.*</value>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:2827" version="1" comment="The registry key has a value of Service Pack 2">
<value>Service Pack 2</value>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:3180" version="2">
<value>amd64</value>
</registry_state>

<file_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:st:3185" version="2">
<version operation="less than" datatype="version">6.0.2900.3164</version>
</file_state>

<file_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:st:3412" version="2">
<version operation="less than" datatype="version">7.0.6000.20628</version>
</file_state>

<file_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:st:3490" version="2">
<version operation="less than" datatype="version">6.0.3790.4106</version>
</file_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:3649" version="1" comment="x86 architecture">
<value>x86</value>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:org.mitre.oval:obj:394" version="1">
<version datatype="version" operation="less than">6.1.0.9232</version>
</registry_state>

<registry_state xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows" id="oval:gov.nist.fcccc.patch:ste:115" version="0" comment="The registry key has a value of 5.1 or 5.2">
<value operation="pattern match">5\.(1|2)</value>
</registry_state>

<variables>
  <local_variable id="oval:org.mitre.oval:var:206" version="1"
      comment="Windows common files\microsoft shared\triedit directory" datatype="string">
    <concat>
      <object_component item_field="value" object_ref="oval:org.mitre.oval:obj:281"/>
      <literal_component>\microsoft shared\triedit</literal_component>
    </concat>
  </local_variable>
  <local_variable id="oval:org.mitre.oval:var:209" version="2"
      comment="Base path to vgx.dll, part of Vector Markup Language (VML) implementation." datatype="string">
    <concat>
      <object_component item_field="value" object_ref="oval:org.mitre.oval:obj:281"/>
      <literal_component>\Microsoft Shared\VGX</literal_component>
    </concat>
  </local_variable>
</variables>
D.4 CPE Dictionary

This minimal CPE dictionary XML instance contains CPE Names referenced in the XCCDF document presented in section D.1.

Figure D-4. example-winxp-cpe-dictionary.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<list xmlns="http://cpe.mitre.org/dictionary/2.0"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  <item name="cpe:/o:microsoft:windows_xp">
    <title>Microsoft Windows XP</title>
  </item>
</list>
```
D.5 CPE Inventory

The following OVAL XML instance contains OVAL definitions that SHOULD be used to evaluate the CPE Name defined in the previous section.

**Figure D-5. example-winxp-cpe-oval.xml**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<oval_definitions
 xmlns=http://oval.mitre.org/XMLSchema/oval-definitions-5
 xmlns:win-def=http://oval.mitre.org/XMLSchema/oval-definitions-5#windows
 xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
 xsi:schemaLocation=http://oval.mitre.org/XMLSchema/oval-definitions-5#windows
 http://oval.mitre.org/language/download/schema/version5.3/ovaldefinition/common/windows-
definitions-schema.xsd
 http://oval.mitre.org/language/download/schema/version5.3/ovaldefinition/common/ind-
definitions-schema.xsd
 http://oval.mitre.org/language/download/schema/version5.3/ovaldefinition/common/com-
definitions-schema.xsd
 http://oval.mitre.org/language/download/schema/version5.3/ovaldefinition/common/windows-
definitions-schema.xsd

<generator>
  <oval:product_name>National Institute of Standards and Technology</oval:product_name>
  <oval:schema_version>5.3</oval:schema_version>
  <oval:timestamp>2008-09-02T12:59:10.000-04:00</oval:timestamp>
</generator>

<!-- DEFINITIONS -->
<definition id=oval:gov.nist.fdcc.xp:def:2 version="1" class="inventory">
  <metadata>
    <title>Microsoft Windows XP is installed</title>
    <affected family="windows">
      <platform>Microsoft Windows XP</platform>
    </affected>
    <description>Microsoft Windows XP is installed</description>
  </metadata>
  <criteria>
    <criterion comment="the installed operating system is part of the Microsoft Windows family">
      <criterion comment="Microsoft Windows XP is installed">
        <test_ref>oval:gov.nist.fdcc.xp:tst:7</test_ref>
      </criterion>
    </criterion>
  </criteria>
</definition>

<!-- TESTS -->
<tests>
  <family_test id=oval:gov.nist.fdcc.xp:tst:6 version="1" comment="the installed operating system is part of the Microsoft Windows family">
    <check_existence="at_least_one_exists" check="only one" uri=http://oval.mitre.org/XMLSchema/oval-definitions-5#independent>
      <object object_ref=oval:gov.nist.fdcc.xp:obj:3/>
      <state state_ref=oval:gov.nist.fdcc.xp:ste:14/>
    </check_existence>
  </family_test>
  <registry_test id=oval:gov.nist.fdcc.xp:tst:7 version="1" comment="Microsoft Windows XP is installed">
    <check_existence="at_least_one_exists" check="at least one" uri=http://oval.mitre.org/XMLSchema/oval-definitions-5#windows>
      <object object_ref=oval:gov.nist.fdcc.xp:obj:4/>
      <state state_ref=oval:gov.nist.fdcc.xp:ste:15/>
    </check_existence>
  </registry_test>
</tests>
```

<objects>
  <family_object id="oval:gov.nist.fdcc.xp:obj:3" version="1">
    xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent"/>
  <registry_object id="oval:gov.nist.fdcc.xp:obj:4" version="1">
    xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows">
      <hive>HKEY_LOCAL_MACHINE</hive>
      <key>SOFTWARE\Microsoft\Windows NT\CurrentVersion</key>
      <name>CurrentVersion</name>
  </registry_object>
</objects>

<states>
  <family_state id="oval:gov.nist.fdcc.xp:ste:14" version="1">
    xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#independent">
    <family>windows</family>
  </family_state>
  <registry_state id="oval:gov.nist.fdcc.xp:ste:15" version="1">
    xmlns="http://oval.mitre.org/XMLSchema/oval-definitions-5#windows">
      <value>5.1</value>
  </registry_state>
</states>