The Open Checklist Interactive Language (OCIL)

Version 1.1

Maria Casipe, Charles Schmidt
{mcasipe, cmschmidt}@mitre.org

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1 Introduction

The Open Checklist Interactive Language (OCIL) defines a framework for expressing a set of questions to be presented to a user and procedures to interpret responses to these questions for the purpose of developing security checklists. Although its intended domain of use is IT security, its generic nature allows for other applications. For instance, it could be used for authoring research surveys, academic course exams, and instructional walkthroughs.

All organizations must set up their own policies to describe the information to secure, the level of security it needs, and the required state for it to be considered secured. Enforcing and checking compliance with these policies on every system in the organization can be a very daunting task for IT security administrators. For this, they may choose to employ tools designed to automate security compliance checks. Existing automation tools, however, may not be able to completely handle all aspects of these checks. In these situations, IT security administrators face the challenge of manually checking for security policy compliance.

This document describes a standard data model and processing procedure for supporting manual security compliance checks. The data model is designed to encourage portability and reusability of objects. An XML schema of the data model is presented in Section 4.

1.1 Background

There have been a number of initiatives to provide standards for automating security checks. Some of these initiatives include:

- XCCDF (eXtensible Configuration Checklist Description Format): “A specification language for writing security checklists, benchmarks, and related kinds of documents.”

- OVAL (Open Vulnerability and Assessment Language): “OVAL includes a language used to encode system details, and an assortment of content repositories held throughout the community.”

However, none of the existing standards provide language for expressing compliance checks that require manual user interaction. A standard language for expressing manual checks and their results would provide the following benefits:

- Ensure that every manual check is done in the same manner (uniformity) and the required steps are followed, regardless of who performs the check.

- Ensure that manual checks can be tracked for auditing purposes.

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1 Source: http://nvd.nist.gov/xccdf.cfm
2 Source: http://oval.mitre.org
- Foster development of and interoperability among tools for creating, evaluating, and supporting manual checks.

- Foster collaboration among security-related communities in composing manual checks.

- Enhance manageability of manual checks.

This document describes a data model and processing procedure that provides an extensible, interoperable language for expressing compliance checks that require user feedback.

1.2 Vision for Use

OCIL is designed to enable authors to describe security compliance checks that require user feedback and record their results in an XML document. The end result allows organizations to utilize commercial tools that support manual checks and integrate with existing tools to aid IT security administrators in their tasks. The following scenarios illustrate some of the uses that OCIL will foster.

Scenario 1 –
A security compliance check author writes an IS document that describes a check that requires all labs in a particular building to be secured. This document is made accessible through a web form on the company intranet site. Each security officer accesses this form, which serves as the front-end to an IS interpreter. S/he is asked a series of questions starting with her/his area of responsibility (e.g. what building? what part of the building? etc.). If s/he is responsible for that particular building, then the interpreter asks the next appropriate questions until it produces a result. Otherwise, the evaluation stops. Results are submitted to a repository for further analysis.

Scenario 2 –
A security compliance check author writes an XCCDF document containing checks that needs to be performed for a particular system. However, some of the checks require a complex evaluation that currently cannot be automated. Within the document, s/he includes a reference to an IS document containing a manual check. When an IT security administrator checks for compliance using the XCCDF document, s/he loads it onto an XCCDF interpreter. Upon reaching a manual check, the XCCDF interpreter loads the IS document into the IS interpreter (either within the XCCDF interpreter or an external IS interpreter), which asks the administrator a series of questions. The user's response is collected and interpreted and the result is returned to the XCCDF interpreter which then continues with the remaining checks. The results from both the automated and manual checks are combined into a single report by the XCCDF interpreter.

Scenario 3 –
A company security officer would like to review all compliance checks including those done manually, and produce a report. S/he takes in an IS document that contains the results from the most recent assessment and transforms it into html with an XSL stylesheet.
2 Data model

The data model for OCIL consists of the following high-level object data types:

1. `<ocil>` An OCIL document holds exactly one ocil element. An ocil element is a container for all other elements in the document such as questionnaires, questions, test actions, and results. It also holds metadata describing the document and its creation.

2. `<questionnaire>` A questionnaire represents a series of questions to ask a user that will be evaluated to a single response. Questionnaires are intended to represent a single, discrete check similar to an OVAL definition. Questionnaires can reference one or more test actions or other questionnaires. Questionnaires themselves are referenced through a unique identifier. It also contains descriptive information about the check that is performed by this questionnaire and a property to specify whether it should be treated as a low- or high- priority concept.

3. `<test_action>` A test action defines a test (e.g. question) that needs to be evaluated and the action (i.e. either produce a result or evaluate another test action) to take based on user response. This element is abstract but it has four derived classes which could be used in a document: `<boolean_question_test_action>`, `<choice_question_test_action>`, `<numeric_question_test_action>`, and `<string_question_test_action>` each expecting a particular data-type for the user's response. The derived types are referenced through a unique identifier.

4. `<question>` A question is an abstract concept with a descriptive text that describes what needs to be answered and a set of instructions on how the user should come to their answer. Question elements are referenced through a unique identifier. There are four derived classes: `<boolean_question>`, `<choice_question>`, `<numeric_question>`, and `<string_question>` depending on the expected data-type of the user's response.

5. `<results>` The results element holds result information for every questionnaire, test action, and question recorded during a single evaluation of the OCIL document. It also includes metadata about when the evaluation started and ended, descriptive text about the results, and the target system.
2.1 Element Content Details

The tables below show the properties that make up the main element types of the IS data model.

### 2.1.1 oci1

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>scope</td>
<td>FULL or SHORT</td>
<td>0-1</td>
<td>The scope attribute describes how to process evaluation. A value of FULL specifies that evaluation should continue regardless on the status of whether a result can be produced. A value of SHORT indicates</td>
</tr>
</tbody>
</table>
that evaluation should stop when a result can be computed. (By default: FULL).

generator GeneratorType 1 A generator describes any information about the creator of the document. Specifically, it includes information about the tool used to generate the document as well as the schema version used and time of creation.

document DocumentType 0-1 A document includes document-level information that may be presented to a user. Specifically, it includes a title, descriptive information, and notices.

questionnaire questionnaire 1-n A questionnaire describes a sequence of questions that must be posed to the user in order to determine a state or condition, including processing instructions.

test_action test_action 1-n A test_action describes a state or condition that must be checked for, including processing instructions.

question question 1-n A question describes what needs to be posed to a user in order to check for a particular state or condition.

choice_group special 0-n A choice_group represents a reusable set of choices for a choice_question. Choice_question elements can explicitly specify each of their allowed choices, but this can become tedious if multiple choice questions have overlapping sets of choices. This structure allows a set of choices to be defined once and then reused repeatedly.

results results 0-1 Information about the results on evaluating a questionnaire or test_action.

The ocil element is the root element of an OCIL document. Conceptually, it contains all the questionnaires, test_actions, and questions, and may also contain a results section to store the results of an interaction with the user.

### 2.1.2 questionnaire

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>questionnaire identifier</td>
<td>1</td>
<td>Unique identifier for a questionnaire element.</td>
</tr>
<tr>
<td>priority</td>
<td>PriorityType</td>
<td>0-1</td>
<td>Specifies the priority level of a questionnaire. (By default: LOW).</td>
</tr>
<tr>
<td>child_only</td>
<td>boolean</td>
<td>0-1</td>
<td>Specifies whether the questionnaire should be treated as a top-level (=false) or only child-level (=true) questionnaire. (By default: false).</td>
</tr>
<tr>
<td>title</td>
<td>TextType</td>
<td>0-1</td>
<td>Descriptive heading or caption that describes the questionnaire.</td>
</tr>
<tr>
<td>description</td>
<td>TextType</td>
<td>0-1</td>
<td>Descriptive text that describes the questionnaire in more detail than a title.</td>
</tr>
</tbody>
</table>
| reference  | ReferenceType         | 0-n   | The reference element contains information about any external references related to this step. Examples could include references to other
The questionnaire element is the basic unit of an OCIL check. Each questionnaire would correspond to one recommendation or requirement in a security guide. After processing (which includes receiving the necessary responses from a user) a questionnaire will evaluate to one result type (see section 3.1 for a list of result values and their meanings).

The child_only attribute is used to distinguish between a "top-level" and a "low-level" questionnaire. A top-level questionnaire (the default) represents a questionnaire that would be posed to a user directly. Interpreter tools might chose to display a list of all the top-level questionnaires in an OCIL document to a user and allow the user to work through this list. By contrast, a low-level questionnaire is one that was designed to be part of another questionnaire. Specifically, it would be processed and its questions presented to the user as a part of another questionnaire, but would not be displayed independently. An interpreter tool would not wish to display this questionnaire in a list of top-level questionnaires since it represents a sub-section of other questionnaires.

A questionnaire would contain references to one or more test_actions along with an operator used to combine them and an optional negate attribute which could be used to negate the final result. All of this information appears within the questionnaire's <actions> element. Conceptually, this permits an author to pose multiple questions to a user and then aggregate them into a single response. While a single questionnaire may only use a single operator (plus the optional negate) to combine the results of its referenced test_actions, the fact that test_actions can refer to other questionnaires, which can themselves reference multiple test_actions and aggregate them with their own operator allows for arbitrarily complex logical combinations of responses.

2.1.3 test_action
The test_action element is a simple abstract element that serves as the base for a number of child elements. Conceptually, a test_action, as used in an OCIL document to identify a specific question to pose to the user and then handle the user's response. Handling the user response can involve picking a specific result value for this test_action or calling another test_action or questionnaire. (The ResultsChoiceType structure is used to specify this information.) The former case represents a situation where the user's response is conclusive while the latter would be used if the user's response required further follow-up questions in order to reach a final result. The handlers are used to convert a user response (e.g. a number or string) into a result value (e.g. PASS or FAIL). If there is no handler for the given user response, a result value of ERROR is generated.

As noted, the test_action element itself is abstract and would not appear within an OCIL document. It is extended by the question_test_action element, which is also abstract. The question_test_action is then extended by four different child elements, each of which corresponds to a different data-type for the user response. It is these latter elements that would actually be used. The relevant types are described below:

<table>
<thead>
<tr>
<th>actions</th>
<th>OperationType</th>
<th>1</th>
<th>A set of test_action that must be evaluated for this questionnaire.</th>
</tr>
</thead>
<tbody>
<tr>
<td>notes</td>
<td>string</td>
<td>0-n</td>
<td>Any information related to the questionnaire.</td>
</tr>
</tbody>
</table>
### test_action

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>notes</td>
<td>string</td>
<td>0-n</td>
<td>Used to record information related to the test_action.</td>
</tr>
</tbody>
</table>

### question_test_action

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>test_action identifier</td>
<td>1</td>
<td>Unique identifier for a question_test_action.</td>
</tr>
<tr>
<td>question_ref</td>
<td>question identifier</td>
<td>1</td>
<td>Identifies a question using its id.</td>
</tr>
<tr>
<td>title</td>
<td>TextType</td>
<td>0-1</td>
<td>Descriptive heading or caption that describes the question_test_action.</td>
</tr>
<tr>
<td>when_unknown</td>
<td>ResultChoiceType</td>
<td>0-1</td>
<td>Processing instruction for when an UNKNOWN value is received.</td>
</tr>
<tr>
<td>when_not_tested</td>
<td>ResultChoiceType</td>
<td>0-1</td>
<td>Processing instruction for when a NOT_TESTED value is received.</td>
</tr>
<tr>
<td>when_not_applicable</td>
<td>ResultChoiceType</td>
<td>0-1</td>
<td>Processing instruction for when a NOT_APPLICABLE value is received.</td>
</tr>
<tr>
<td>when_error</td>
<td>ResultChoiceType</td>
<td>0-1</td>
<td>Processing instruction for when an ERROR value is received.</td>
</tr>
</tbody>
</table>

The question_test_action expands on the test_action element, adding a unique id, a reference to a question, a title, and handler elements for four types of responses to the referenced question.

The four child elements of question_test_action are listed below. In addition to inheriting all the handlers of their parents, they define additional handlers to contain processing instructions for the expected type of user input.

### boolean_question_test_action

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>when_true</td>
<td>ResultChoiceType</td>
<td>1</td>
<td>Processing instruction for when the user responds with TRUE or YES.</td>
</tr>
<tr>
<td>when_false</td>
<td>ResultChoiceType</td>
<td>1</td>
<td>Processing instruction for when the user responds with FALSE or NO.</td>
</tr>
</tbody>
</table>

### numeric_question_test_action

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>when.equals</td>
<td>extends ResultChoiceType</td>
<td>0-n</td>
<td>Processing instruction for when the user responds with a specific numeric value. The extension to ResultsChoiceType allows the author to specify this value.</td>
</tr>
<tr>
<td>when_range</td>
<td>extends</td>
<td>0-n</td>
<td>Processing instruction for when the user response</td>
</tr>
</tbody>
</table>
ResultChoiceType falls within a specified range of values. The extension to ResultChoiceType allows the author to specify this range.

Note that, despite the fact that either handler may be omitted, at least one handler must appear within the body of a numeric_question_test_action. If multiple handlers could potentially match a particular user response (for example, if there were overlapping ranges) then the first matching handler is used. Since when_equals handlers always come before when_range handlers, this gives when_equals handlers precedence.

**string_question_test_action**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>when_pattern</td>
<td>ResultChoiceType</td>
<td>1-n</td>
<td>Processing instruction for when the user responds with a string that matches a specified regular expression. The extension to ResultChoiceType allows the author to specify this regular expression.</td>
</tr>
</tbody>
</table>

If the user's response could match multiple patterns, the handler with the first matching pattern is used.

**choice_question_test_action**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>when_choice</td>
<td>ResultChoiceType</td>
<td>1-n</td>
<td>Processing instruction for when the user responds with one of a specified list of choices. The extension to ResultChoiceType allows the author to specify multiple choices.</td>
</tr>
</tbody>
</table>

Choice questions present the user with a list of possible responses and the user selects one of them. The author should create handlers to cover all of the possible choices a user might select.

**question**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>question identifier</td>
<td>0-1</td>
<td>Unique identifier for a question.</td>
</tr>
<tr>
<td>question_text</td>
<td>string</td>
<td>1-n</td>
<td>Descriptive text to be posed to the user as a question.</td>
</tr>
<tr>
<td>instructions</td>
<td>special</td>
<td>0-1</td>
<td>A sequence of steps intended to guide the user in determining an answer to a question.</td>
</tr>
<tr>
<td>notes</td>
<td>string</td>
<td>0-n</td>
<td>Any information related to the question.</td>
</tr>
</tbody>
</table>

A question element represents a question to pose to the user and an optional set of instructions for the user to follow in order to arrive at their answer. The question element itself is abstract and does not appear in OCIL documents. Instead, the four child elements, one for each data type of user response are used.

The child elements all inherit the constructs of their parent element. In addition, all four may contain an optional attribute to designate a default value. Two child element types contain
2.1.5 results

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Count</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>start_time</td>
<td>dateTime</td>
<td>0-1</td>
<td>Specifies when the evaluation of the OCIL document started.</td>
</tr>
<tr>
<td>end_time</td>
<td>dateTime</td>
<td>0-1</td>
<td>Specifies when the evaluation of the OCIL document completed.</td>
</tr>
<tr>
<td>title</td>
<td>TextType</td>
<td>0-1</td>
<td>A descriptive heading or caption that describes the result set.</td>
</tr>
<tr>
<td>target</td>
<td>string</td>
<td>0-n</td>
<td>Host name of the system(s) being checked.</td>
</tr>
<tr>
<td>target_address</td>
<td>string</td>
<td>0-n</td>
<td>Address(es) of the system(s) being checked.</td>
</tr>
<tr>
<td>questionnaire_result</td>
<td>special</td>
<td>0-n</td>
<td>Describes the result of evaluating a questionnaire.</td>
</tr>
<tr>
<td>question_result</td>
<td>special</td>
<td>0-n</td>
<td>Describes the result of evaluating a question.</td>
</tr>
<tr>
<td>test_action_result</td>
<td>special</td>
<td>0-n</td>
<td>Describes the result of evaluating a test_action.</td>
</tr>
</tbody>
</table>

The results element is used to store the results from processing the document. These results include not only the evaluated results of each questionnaire, but a breakdown of the results for each test_action and the user's response to each question.

3 Requirements

This section describes the processing requirements that an interpreter must follow in order to correctly process an OCIL file.

3.1 Types of Results

The result value of a questionnaire or a test action can be any one of the following:

1. **PASS**. The state or condition being tested is achieved or satisfied.
2. **FAIL**. The state or condition being tested is not achieved or satisfied.
3. **UNKNOWN**. The state or condition being tested could not be determined.
4. **ERROR**. The user answered with an unacceptable or unhandled value; OR the interpreter encountered an unhandled situation or system error.
5. **NOT_APPLICABLE.** The questionnaire or test action does not apply to the goal as determined by user response(s).

6. **NOT_TESTED.** The questionnaire or test action has not been inspected by the user for the following reasons: (a) the user marked a question referenced by a test action as not tested, or (b) the questionnaire or question referenced by a test action has not been presented to the user yet.

### 3.2 Scope of Evaluation

Evaluation can be controlled through the @scope attribute of the `<ocil>` element. It can either have a value of SHORT or FULL. By default, it is set to FULL.

Setting the value of the @scope attribute to SHORT forces the evaluation of any questionnaire to stop when sufficient information has been gathered to produce a final result. For example, suppose there are 10 test actions in a questionnaire and based on the user’s response on the 5th test action, the result of the questionnaire can be computed. At this point, the evaluation will stop if @scope is set to SHORT.

Setting the value of the @scope attribute to FULL forces questionnaires to evaluate all test actions even if the final result will be unaffected by the subsequent questions. In the example above, if the @scope was set to FULL, evaluation would finish when the 10th question has been answered even though the final result was known after the evaluation of the 5th test action.

### 3.3 Evaluating Test Actions

The IS defines a structure called test action. A test action defines what needs to be tested (e.g. a question), and what action to take based on user response. An action can either be an event that triggers the next test action to be evaluated or it can simply produce a result. If the action is to produce a result, then the result is propagated up to its calling test action.

A questionnaire may contain multiple references to other test actions. To evaluate a questionnaire, each referenced test action must be evaluated, modified by the @scope attribute in the `<ocil>` element as described in section 2.1. The results of the referenced test actions are combined to produce the final result of the questionnaire. The following steps describe how the results are combined (in order):

1. The value of the @operation attribute in the `<actions>` element is applied. This attribute can either have an AND or OR value. By default, its value is set to AND. The truth table below (see Table 1) defines how to combine results.

2. The value of the @negate attribute in the `<actions>` element is applied. This attribute can either have a true or false value. By default, its value is set to false. When set to true, the result returned by the questionnaire is changed in the following way: FAIL becomes PASS, PASS becomes FAIL, and all other results are unchanged.
### Table 1. Truth Table for Combining Test Action Individual Results

<table>
<thead>
<tr>
<th>Operator</th>
<th>Number of Individual Results</th>
<th>Final Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS</td>
<td>FAIL</td>
<td>ERROR</td>
</tr>
<tr>
<td>AND</td>
<td>1+</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0+</td>
<td>1+</td>
</tr>
<tr>
<td></td>
<td>0+</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0+</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>OR</td>
<td>1+</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 3.4 Test Actions and Error Processing

As mentioned in Section 2.2, a test action defines what needs to be tested (e.g. a question), and what action to take based on user response. Every test action that references a question may contain any or all of the following elements: `<when_error>`, `<when_unknown>`, `<when_not_tested>`, and `<when_not_applicable>`. The names suggest the condition when the action defined within the element is to be applied:

- `<when_error>` defines the action to take when an error occurs.
- `<when_unknown>` defines the action to take when the user marks a question as having an unknown answer.
- `<when_not_tested>` defines the action to take when the user decides not to evaluate a test.
- `<when_not_applicable>` defines the action to take when the user marks a question as not applicable.

The above elements are optional, i.e., some or all of them may not exist for a particular test action.

The IS contains structures for different question types depending on the expected data-type of the user's response. For each type of question, there is an associated variant of the test action element that contains additional handlers to process the anticipated user response. For instance,
for a `<boolean_test_action>`, a `<when_true>` and `<when_false>` are added to define what actions to take when a test evaluates to a true (or yes) or false (or no), respectively.

When a test evaluates to a value with no defined action, the result is an ERROR. For example, if a user marks a test as NOT_APPLICABLE, but there is no `<when_not_applicable>` handler, the `<test_action>` will evaluate to ERROR. Likewise, if a user provides a normal answer (boolean, number, string, etc.), but there is no handler for that answer this will also evaluate to ERROR. For example, if the user returns 9 but there is no `<when_equals>` or `<when_range>` handlers that match a value of 9 then an ERROR is returned. This means that, apart from an ERROR result, the only time any other result values are returned by a test action would be if the handler explicitly provided a return value.

Consider the following example:
(Source: ISO IEC 27002 2005 Information Security Audit Tool)

8.1 Question 1. Have you reduced the risk of theft, fraud, or misuse of facilities by making sure that all prospective employees understand their responsibilities before you hire them? YES NO N/A

The above question requires an answer of YES, NO, or N/A (Not Applicable). It is best modeled with a `<boolean_question>` element. For instance,

```xml
<boolean_question id="inter:mitre.org:question:1" model="MODEL_YES_NO">
  <question_text>
    Have you reduced the risk of theft, fraud, or misuse of facilities by making sure that all prospective employees understand their responsibilities before you hire them?
  </question_text>
</boolean_question>
```

To describe what happens when a user responds to this type of question, a `<boolean_question_test_action>` can be defined in the following manner:

```xml
<boolean_question_test_action id="inter:mitre.org:testaction:1" question_ref="inter:mitre.org:question:1">
  <when_true>
    <result>PASS</result>
  </when_true>
  <when_false>
    <test_action_ref>inter:mitre.org:testaction:2</test_action_ref>
  </when_false>
  <when_not_applicable>
    <test_action_ref>inter:mitre.org:testaction:3</test_action_ref>
  </when_not_applicable>
</boolean_question_test_action>
```

An interpreter would present the referenced question to the user. Based on the user's response to the question, the test action would perform different actions. Specifically, if the user responds:

<table>
<thead>
<tr>
<th>Response</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>The <code>&lt;when_true&gt;</code> handler is invoked, which sets the result of this test action to PASS.</td>
</tr>
<tr>
<td>NO</td>
<td>The <code>&lt;when_false&gt;</code> handler is invoked. This causes the interpreter to evaluate the test action with id <code>inter:mitre.org:testaction:2</code>. Whatever that test action evaluates to becomes the result of this test action.</td>
</tr>
</tbody>
</table>
The <when_not_applicable> handler is invoked. This causes the interpreter to evaluate the test action with id `inter:mitre.org:testaction:3` Whatever that test action evaluates to becomes the result of this test action.

There is no handler for any other responses so other responses set the result of this test action to `ERROR`.

Note that for simplicity purposes, ‘yes’ and ‘true’ responses are mapped to a <when_true> element. Similarly, ‘no’ and ‘false’ responses are mapped to a <when_false> element.

A <numeric_test_action> is a test action that references a <numeric_question>. It contains a set of <when_equals> and/or <when_range> element. A <when_equals> element defines what action to take when a particular value matches the response of the user. Similarly, a <when_range> element defines what action to take when the user’s response is within a specified range of values, for example [29,100], [101,132), or (131, 249]. If the value given by the user matches multiple conditions, then the first matching handler is applied. Since <when_equals> handlers always come before <when_range> preference is given to exact matches.

A <string_test_action> is a test action that references a <string_question>. It contains a set of <when_pattern> element. A <when_pattern> element defines what action to take when the user’s response matches a particular regular expression. Similar to <numeric_test_action>, if the value given by the user matches multiple conditions, then the first <when_pattern> matched is applied.

A <choice_test_action> is a test action that references a <choice_question>. It contains a set of <when_choice> element. A <when_choice> element defines what action to take when the user's responds matches one of a list of choices. The schema prevents multiple <when_choice> elements from containing references to the same choice within a single <choice_test_action>.

4 Example

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ocil xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.mitre.org/ocil/1.1 ocil.xsd"
    xmlns="http://www.mitre.org/ocil/1.1">
  <!--Generator -->
  <generator>
    <schema_version>1.1</schema_version>
    <timestamp>2009-5-20T00:00:00</timestamp>
  </generator>
  <!--Questionnaires -->
  <questionnaire id="ocil:mitre.org:questionnaire:1" priority="LOW">
    <title>Physical security Requirements</title>
    <description>Inadequate physical protection can undermine all other security precautions utilized to protect the system. This can jeopardize the confidentiality, availability, and integrity of the system. Physical security of the AIS is the first line protection of any system. Note: Critical servers should be located in rooms, or locked cabinets, that are accessible only to authorized systems personnel. User workstations containing sensitive data should be in access controlled areas.</description>
    <actions priority="LOW">
      <test_action_ref priority="LOW">ocil:mitre.org:testaction:11</test_action_ref>
    </actions>
  </questionnaire>
</ocil>
```
<questionnaire id="ocil:mitre.org:questionnaire:2" priority="LOW">
  <title>Users with Administrative Privileges</title>
  <description>Using a privileged account to perform routine functions makes the computer vulnerable to attack by any virus or Trojan Horse inadvertently introduced during a session that has been granted full privileges. The rule of least privilege should always be enforced.</description>
  <actions priority="LOW" operation="OR">
    <test_action_ref priority="LOW">ocil:mitre.org:testaction:2</test_action_ref>
    <test_action_ref priority="LOW">ocil:mitre.org:testaction:22</test_action_ref>
  </actions>
</questionnaire>

<questionnaire id="ocil:mitre.org:questionnaire:3" priority="LOW">
  <title>Backup Administrator Account</title>
  <description>Backup Operators are able to read and write to any file in the system, regardless of the rights assigned to it. Backup and restore rights permit users to circumvent the file access restrictions present on NTFS disk drives for the purpose of backup and restore. Members of the Backup Operators group should have special logon accounts for performing their backup duties.</description>
  <actions priority="LOW" operation="AND">
    <test_action_ref priority="LOW">ocil:mitre.org:testaction:31</test_action_ref>
    <test_action_ref priority="LOW">ocil:mitre.org:testaction:32</test_action_ref>
  </actions>
</questionnaire>

<!-- Test Actions -->
<boolean_question_test_action id="ocil:mitre.org:testaction:11" question_ref="ocil:mitre.org:question:11">
  <when_true>
    <result>PASS</result>
  </when_true>
  <when_false>
    <result>FAIL</result>
  </when_false>
</boolean_question_test_action>

  <when_choice>
    <choice_ref>ocil:mitre.org:choice:211</choice_ref>
    <result>PASS</result>
  </when_choice>
  <when_choice>
    <choice_ref>ocil:mitre.org:choice:212</choice_ref>
    <result>FAIL</result>
  </when_choice>
</choice_question_test_action>

  <when_choice>
    <choice_ref>ocil:mitre.org:choice:221</choice_ref>
    <result>FAIL</result>
  </when_choice>
  <when_choice>
    <choice_ref>ocil:mitre.org:choice:222</choice_ref>
    <result>PASS</result>
  </when_choice>
</choice_question_test_action>

<numeric_question_test_action question_ref="ocil:mitre.org:question:31" id="ocil:mitre.org:testaction:31">
  <when_range>
    <result>FAIL</result>
    <range>
      <min>0</min>
      <max>10</max>
    </range>
  </when_range>
  <when_range>
    <result>PASS</result>
  </when_range>
</numeric_question_test_action>
<min>11</min> <max>100</max>
</range>
</when_range>
</numeric_question_test_action>

<string_question_test_action question_ref="ocil:mitre.org:question:32"
 id="ocil:mitre.org:testaction:32">
 <when_pattern>
 <result>PASS</result>
 <pattern>secured</pattern>
 </when_pattern>
 <when_pattern>
 <result>FAIL</result>
 <pattern>unsecured</pattern>
 </when_pattern>
</string_question_test_action>

<false_question id="ocil:mitre.org:question:11" model="MODEL_YES_NO">
 <question_text>Has equipment been relocated to a controlled access area?</question_text>
</false_question>

<choice_question default_answer_ref="ocil:mitre.org:choice:211" id="ocil:mitre.org:question:21">
 <question_text>Which one of the following is true?</question_text>
 <choice id="ocil:mitre.org:choice:211"> All administrators have a separate account for normal user tasks. </choice>
 <choice id="ocil:mitre.org:choice:212"> Not all administrators have separate account for normal user tasks. </choice>
</choice_question>

<choice_question default_answer_ref="ocil:mitre.org:choice:221" id="ocil:mitre.org:question:22">
 <question_text>Which one are you using for system administration?</question_text>
 <choice id="ocil:mitre.org:choice:221"> I'm using my normal user account. </choice>
 <choice id="ocil:mitre.org:choice:222"> I'm using the built-in system administrator account. </choice>
</choice_question>

<numeric_question id="ocil:mitre.org:question:31">
 <question_text>How many user ids do each Backup Operator have for performing backup duties?</question_text>
</numeric_question>

<string_question id="ocil:mitre.org:question:32">
 <question_text>IAO stored details about the backup administrator account in a ____ location. </question_text>
</string_question>

</ocil>

5 Schema

<?xml version="1.0" encoding="UTF-8"?>
<!--
DOCUMENT: ocil.xsd
CREATED ON: 7 February 2005 (Interactive Schema)
LAST UPDATED ON: May 20, 2009 (OCIL)
AUTHORS: David Waltermire, Jon Baker, Maria Casipe, Charles Schmidt
VERSION: 1.1
DESCRIPTION: XML Schema for defining interactive questions to be used as external checks
-->
The Open Checklist Interactive Language (OCIL) is a language to express a set of questions to be presented to a user and procedures to interpret responses to these questions for the purpose of developing security checklists. Although its intended domain of use is IT security, its generic nature allows for other applications. For instance, it could be used for authoring research surveys, academic course exams, and instructional walkthroughs.

This document was originally developed by David Waltermire (The Center for Internet Security) and has been revised by The MITRE Corp with input from the security benchmark community. It is intended for developers and assumes familiarity with XML.
numeric_question, or string_question. </xsd:documentation>
</xsd:element>
</xsd:element>
<xsd:element ref="inter:choice_group" minOccurs="0" maxOccurs="unbounded">
  <xsd:documentation>Holds choice groups which represent possible sets of choices for choice_questions. Choice_groups may be reused across multiple choice_questions. </xsd:documentation>
</xsd:element>
</xsd:element>
<xsd:element ref="inter:results" minOccurs="0" maxOccurs="1">
  <xsd:documentation>The results element contains the results of an evaluation of the OCIL file. This includes records of all questionnaire results, question results, and test_action results.</xsd:documentation>
</xsd:element>
</xsd:sequence>
<xsd:attribute name="scope" use="optional" default="FULL" type="inter:ScopeType">
  <xsd:documentation>This specifies the test_actions referenced by the questionnaires in this document should be evaluated. If a value of FULL is provided, then all test_actions in a questionnaire will be evaluated regardless of whether the result can be known ahead of time. If a value of SHORT is provided a questionnaire will stop evaluating test_actions as soon as the final result has been determined. (For example, if one test_action evaluates to FAIL and the test_actions of a questionnaire are being ANDed together, the result is immediately known to be FAIL regardless of the results of other test_actions. If the scope is FULL, even though it is known that the questionnaire will return FAIL, the other test_actions will still be evaluated. If the scope is SHORT, no further test_actions would be evaluated since the final result had been determined.)</xsd:documentation>
</xsd:attribute>
</xsd:complexType>
<!-- **************************** ************** ******************** ************************************** -->
<!--  Questionnaire references * -->
<!-- **************************** ************** ******************** ************************************** -->
<xsd:key name="questionnaireIdKey">
  <xsd:selector xpath="inter:questionnaire"/>
  <xsd:field xpath="@id"/>
</xsd:key>
<xsd:keyref refer="inter:questionnaireIdKey" name="questionnaireKeyRef">
  <xsd:selector xpath=".//inter:questionnaire_result"/>
  <xsd:field xpath="@questionnaire_ref"/>
</xsd:keyref>
<!-- **************************** ************** ******************** ************************************** -->
<!--  Test Action references * -->
<!-- **************************** ************** ******************** ************************************** -->
<xsd:key name="testActionIdKey">
  <xsd:annotation>
    <xsd:documentation>test_actions include question_test_action and compound_test_action {questionnaires are CompoundTestAction}</xsd:documentation>
  </xsd:annotation>
  <xsd:selector xpath="inter:boolean_question_test_action|inter:choice_question_test_action|inter:numeric_question_test_action|inter:string_question_test_action|inter:questionnaire"/>
  <xsd:field xpath="@id"/>
</xsd:key>
<xsd:keyref refer="inter:testActionIdKey" name="testActionKeyRef">
  <xsd:selector xpath=".//inter:test_action_ref"/>
  <xsd:field xpath="@test_action_ref"/>
</xsd:keyref>
<xsd:keyref refer="inter:testActionIdKey" name="testActionResultKeyRef">
  <xsd:selector xpath=".//inter:test_action_result"/>
  <xsd:field xpath="@test_action_ref"/>
</xsd:keyref>
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="questionnaire">
    <xs:complexType>
      <xs:annotation>
        <xs:documentation>A questionnaire represents specific question or set of questions that evaluate to a single result. A questionnaire may contain multiple test actions. Test actions may be nested and aggregated thru some acceptable operation to produce the result of a check. </xs:documentation>
      </xs:annotation>
    </xs:complexType>
  </xs:element>
</xs:schema>
Each questionnaire is required to have a unique identifier that conforms to the definition of NCName in the Recommendation "Namespaces in XML 1.0", i.e., all XML 1.0 names that does not contain colons. 

Priority is an optional attribute that can either be HIGH, MEDIUM or LOW. It specifies the importance of a particular test action reference.

This attribute specifies whether or not this questionnaire should only appear as a child of another questionnaire. All questionnaires must be defined within the body of the ocil element and, by default, interpreters might simply grab all questionnaires and present them to a user. However, questionnaires can reference other questionnaires through a test_action_ref. If an author references a questionnaire in this way they may not wish that the questionnaire be presented to a user except as a child of another questionnaire. By setting the child_only attribute to true, the author is indicating that the given questionnaire should not be a "top-level" questionnaire but should instead only be presented as the child of another questionnaire.

A question elements contains information one question that needs to be answered by a user. It can be a boolean_question, choice_question, numeric_question, or string_question depending on the set of acceptable answers.

A boolean_question is a type of question with valid responses of either TRUE, FALSE or YES, NO.

The default_answer attribute specifies the default value of the boolean_question. Its value may be set to true or false.
The model attribute specifies whether to the user should respond with True, False, or YES, NO. If the value of this attribute is not set, then it defaults to MODEL_YES_NO (i.e. response can either be YES or NO).

A choice_question is a type of question element with one or more acceptable answers specified by the author. The user will select one of these specified answers as their response. Acceptable answers are specified either explicitly using the choice element or implicitly using the choice_group_ref element to reference a choice_group element. Choices are presented in the order in which they are provided. All the choices in a choice_group are inserted in the order in which they appear within the choice_group.

Holds the information associated with one of the possible responses to this choice_question.

Holds a reference to a choice_group. The questions described in this choice group are used as possible responses for this choice_question.

The default_answer_ref specifies the choice id of the default answer to the question.

An optional default value may be specified as the answer.

A numeric_question is a type of question_element that requires a numeric answer. Acceptable values may be positive or negative and may include decimals.
<xsd:element name="string_question" substitutionGroup="inter:question">
  <xsd:annotation>
    <xsd:documentation>A string_question is a type of question element that requires a string answer. </xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:complexContent>
      <xsd:extension base="inter:QuestionType">
        <xsd:attribute name="default_answer" type="xsd:string" use="optional">
          <xsd:annotation>
            <xsd:documentation>An optional default value may be specified as the answer. </xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<!-- -------------------------------------------------------- -->
<!-- * TestAction Elements                                    -->
<!-- -------------------------------------------------------- -->
<xsd:element name="test_action" type="inter:ItemBaseType" abstract="true">
  <xsd:annotation>
    <xsd:documentation>This is a common base element for the question_test_action element. </xsd:documentation>
  </xsd:annotation>
</xsd:element>

<xsd:element name="question_test_action" type="inter:QuestionTestActionType" abstract="true" substitutionGroup="inter:test_action">
  <xsd:annotation>
    <xsd:documentation>The question_test_action element contains a reference to a single question along with a set of handlers that indicate how processing should proceed based on the answer provided by the user. This element is abstract and is implemented in a document as a boolean_test_action, choice_test_action, numeric_test_action, or string_test_action. The type of question_test_action must match the type of question referenced. (E.g. a boolean_test_action MUST reference a boolean_question, etc.) </xsd:documentation>
  </xsd:annotation>
</xsd:element>

<xsd:element name="boolean_question_test_action" substitutionGroup="inter:question_test_action">
  <xsd:annotation>
    <xsd:documentation>A boolean_question_test_action element references a boolean_question and includes handlers for TRUE (YES) or FALSE (NO) responses. </xsd:documentation>
  </xsd:annotation>
</xsd:element>

<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="inter:QuestionTestActionType">
      <xsd:sequence>
        <xsd:element name="when_true" type="inter:ResultChoiceType" minOccurs="1" maxOccurs="1">
          <xsd:annotation>
            <xsd:documentation>The element when_true specifies the action to do when the answer is true. </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element name="when_false" type="inter:ResultChoiceType" minOccurs="1" maxOccurs="1">
          <xsd:annotation>
            <xsd:documentation>The element when_false specifies the action to do when the answer is false. </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="choice_question_test_action"
A choice_question_test_action element references a choice_question and includes handlers for the various choices set out in the choice_question.

A numeric_question_test_action element references a numeric_question and includes handlers that indicate actions to perform based on whether the user's response matches a particular value or falls within a particular range.

This structure is used to ensure that any number of when_equals and when_range handlers may appear, but there must be at least one handler (of one type or the other) and any when_equals handlers must precede any when_range.

This element holds information on what to do when the answer matches the specified value.

This element holds information on what to do when the answer is within a specified range of values.
<xsd:element name="string_question_test_action"
    substitutionGroup="inter:question_test_action">
  <xsd:annotation>
    <xsd:documentation>
      A string_question_test_action element references a string_question and includes handlers that indicate actions to perform based on whether the user's response matches a given regular expression. </xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:complexContent>
      <xsd:extension base="inter:QuestionTestActionType">
        <xsd:sequence>
          <xsd:element ref="inter:when_pattern" minOccurs="1" maxOccurs="unbounded">
            <xsd:annotation>
              <xsd:documentation>
                This element holds information on what to do when the answer matches a specified regular expression pattern. </xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<!-- ***************************************************************************** -->
<!-- * Result Elements * -->
<!-- ***************************************************************************** -->
<xsd:element name="results">
  <xsd:annotation>
    <xsd:documentation>
      The results element stores information about the results of processing the questionnaires, test_actions, and questions in a document. </xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="title" type="inter:TextType" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>
            The title element contains a descriptive heading or caption describing the result set. </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="target" type="xsd:string" minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>
            The target element contains identifying information about the host that was targeted by the assessment. </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="target_address" type="xsd:string" minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>
            The target_address element contains address information about the host that was targeted by the assessment. </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="questionnaire_result" minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>
            The questionnaire_result element contains information about the result of a particular questionnaire. </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
    <xsd:attribute name="questionnaire_ref" type="inter:QuestionnaireIDPattern" use="required">
      <xsd:annotation>
        <xsd:documentation>
          The questionnaire_ref attribute identifies a particular questionnaire using its id. </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:complexType>
</xsd:element>
<xsd:attribute name="result" type="inter:ResultType" use="required">
    <xsd:documentation>The result attribute holds the result of evaluating the specified questionnaire.</xsd:documentation>
</xsd:attribute>
</xsd:complexType>
</xsd:element>
<xsd:element ref="inter:question_result" minOccurs="0" maxOccurs="unbounded">
    <xsd:documentation>A question_result element contains result information associated with a specific question. One of these elements (or rather, one of its derived elements) will appear for each question evaluated.</xsd:documentation>
</xsd:element>
<xsd:element name="test_action_result" minOccurs="0" maxOccurs="unbounded">
    <xsd:documentation>The test_action_result element contains the result of a test_action evaluation. One of these elements will appear for each test_action evaluated.</xsd:documentation>
</xsd:element>
<xsd:complexType>
    <xsd:attribute name="test_action_ref" type="inter:TestActionRefValuePattern" use="required">
        <xsd:documentation>The test_action_ref attribute identifies a specific test_action using its id.</xsd:documentation>
    </xsd:attribute>
    <xsd:attribute name="result" type="inter:ResultType" use="required">
        <xsd:documentation>The result attribute holds the result of evaluating the specified test_action specified.</xsd:documentation>
    </xsd:attribute>
</xsd:complexType>
</xsd:element>
<xsd:attribute name="start_time" type="xsd:dateTime" use="optional">
    <xsd:documentation>The start_time attribute is an optional attribute that specifies when the evaluation of this OCIL file started.</xsd:documentation>
</xsd:attribute>
<xsd:attribute name="end_time" type="xsd:dateTime" use="optional">
    <xsd:documentation>The end_time attribute is an optional attribute the specifies when the evaluation of this OCIL file ended.</xsd:documentation>
</xsd:attribute>
<xsd:element name="question_result" type="inter:QuestionResultType" abstract="true">
    <xsd:annotation>
        <xsd:documentation>A question_result element contains result information associated with a specific question. The specific type of question_result (boolean_question_result, choice_question_result, etc.) depends on the type of the associated question (boolean_question, choice_question, etc.).</xsd:documentation>
    </xsd:annotation>
</xsd:element>
<xsd:element name="boolean_question_result" substitutionGroup="inter:question_result">
    <xsd:annotation>
        <xsd:documentation>A boolean_question_result element contains a reference to a boolean_question, the user's response, and whether the question was successfully posed.</xsd:documentation>
    </xsd:annotation>
</xsd:complexType>
<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="inter:QuestionResultType">
      <xsd:sequence>
        <xsd:element name="answer" type="xsd:boolean" maxOccurs="1" nillable="true">
          <xsd:annotation>
            <xsd:documentation>The value of the answer to the boolean_question. It could either be TRUE or FALSE.</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="choice_question_result" substitutionGroup="inter:question_result">
  <xsd:annotation>
    <xsd:documentation>A choice_question_result element contains a reference to a choice_question, the user's response, and whether the question was successfully posed.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:complexContent>
      <xsd:extension base="inter:QuestionResultType">
        <xsd:sequence>
          <xsd:element name="answer" maxOccurs="1" nillable="true">
            <xsd:annotation>
              <xsd:documentation>The answer element contains a choice_ref attribute that identifies the choice selected by the user.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="numeric_question_result" substitutionGroup="inter:question_result">
  <xsd:annotation>
    <xsd:documentation>A numeric_question_result element contains a reference to a numeric_question, the result provided by the user, and whether the question was successfully posed.</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:complexContent>
      <xsd:extension base="inter:QuestionResultType">
        <xsd:sequence>
          <xsd:element name="answer" type="xsd:decimal" maxOccurs="1" nillable="true">
            <xsd:annotation>
              <xsd:documentation>The decimal value of the answer to a numeric_question as provided by the user.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<xsd:element name="string_question_result" substitutionGroup="inter:question_result">
  <xsd:annotation>
    <xsd:documentation>A string_question_result element contains a reference to a string_question, the string provided by the user in response, and whether the question was successfully posed.</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="inter:QuestionResultType">
      <xsd:sequence>
        <xsd:element name="answer" type="xsd:string" maxOccurs="1" nillable="true">
          <xsd:annotation>
            <xsd:documentation>The string value of the answer to a string question provided by the user.</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<!-- ************************************************************************-->
<!-- * Global Types * -->
<!-- ************************************************************************-->
<xsd:simpleType name="ScopeType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="FULL">
      <xsd:annotation>
        <xsd:documentation>The FULL value indicates that all questions must be asked regardless of whether or not they are all needed to produce a result for a questionnaire.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="SHORT">
      <xsd:annotation>
        <xsd:documentation>The SHORT value indicates that once a result value can be computed for a questionnaire, then it is safe to stop asking questions.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="BooleanQuestionModelType">
  <xsd:annotation>
    <xsd:documentation>Provides the acceptable models (i.e. set of acceptable responses) for a boolean question.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="MODEL_YES_NO">
      <xsd:annotation>
        <xsd:documentation>MODEL_YES_NO represents a response set of YES, NO.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MODEL_TRUE_FALSE">
      <xsd:annotation>
        <xsd:documentation>MODEL_TRUE_FALSE represents a response set of TRUE, FALSE.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="OperatorType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="AND">
      <xsd:annotation>
        <xsd:documentation>The AND operator produces a true result if every argument is true. If one or more arguments are false, the result of the AND is false. See the truth table provided in the ResultType type for a complete list of how the various result types are combined by an AND operation.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="OR">
      <xsd:annotation>
        <xsd:documentation>The OR operator produces a true result if one or more
arguments is true. If every argument is false, the result of the OR is false. See the truth table provided in the ResultType type for a complete list of how the various result types are combined by an AND operation.

The CompoundTestActionType type describes the structures used to combine multiple test_action elements into a single result.

The title element contains a descriptive heading for this set of test_actions.

The description element contains a caption describing the set of test_actions.

The reference element contains information about any external references related to this step. Examples could include references to other standards such as CVE, CCE, or CPE.

The actions element holds one or more test_action elements along with the operators used to combine them into a single result.

The optional product_name specifies the name of the application used to generate the file.

The optional product_version specifies the version of the application used to generate the file.
<xsd:complexType name="DocumentType">
   <xsd:documentation>This type describes structures used to provide document-level information, including title, descriptions, and notices.</xsd:documentation>
   <xsd:sequence>
      <xsd:element name="title" type="xsd:string" minOccurs="1" maxOccurs="1">
         <xsd:annotation>
            <xsd:documentation>Used to provide a title for this document</xsd:documentation>
         </xsd:annotation>
      </xsd:element>
      <xsd:element name="description" type="xsd:string" minOccurs="0" maxOccurs="unbounded">
         <xsd:annotation>
            <xsd:documentation>Each description element contains part of an overall description for the entire document. (Note that questionnaires contain their own description for questionnaire specific descriptions.)</xsd:documentation>
         </xsd:annotation>
      </xsd:element>
      <xsd:element name="notice" type="xsd:string" minOccurs="0" maxOccurs="unbounded">
         <xsd:annotation>
            <xsd:documentation>Each notice contains a notice or warning to the user of this document.</xsd:documentation>
         </xsd:annotation>
      </xsd:element>
   </xsd:sequence>
   <xsd:complexType name="ItemBaseType">
      <xsd:annotation>
         <xsd:documentation>The ItemBaseType complex type defines structures allowing a set of notes to be included. This type is inherited by many of the elements in the OCIL language.</xsd:documentation>
      </xsd:annotation>
   </xsd:complexType>
</xsd:complexType>
The QuestionTestActionType type defines structures that are used to hold handlers for non-standard results (UNKNOWN, NOT_TESTED, NOT_APPLICABLE, and ERROR) received from a referenced question. All children of question_test_action extend this type.

The title element contains a descriptive heading for this set of handlers.

The when_unknown element contains processing instructions for when the received result is UNKNOWN.

The when_not_tested element contains processing instructions for when the received result is NOT_TESTED.

The when_not_applicable element contains processing instructions for when the received result is NOT_APPLICABLE.

The when_error element contains processing instructions for when the received result is ERROR.

Each item is required to have a unique identifier that conforms to the definition of NCName in the Recommendation "Namespaces in XML 1.0", i.e., all XML 1.0 names that does not contain colons.
The question_ref attribute contains the id of a question.

The response attribute classifies the user response. If the user provides a standard answer to the question the response is set to ANSWERED (the default). If, however, the user selects an exceptional answer (UNKNOWN, NOT_APPLICABLE, etc.) then this attribute will be set to the corresponding exceptional result.

The QuestionType complex type defines a structure to describe a question and any instructions to help in determining an answer.

The min element contains a minimum value.

The inclusive attribute specifies whether the minimum value should be in the specified range. The default is true, indicating it is included.
The max element contains a maximum value.

The inclusive attribute specifies whether the minimum value should be included in the range. The default is true, indicating it is included.

This element indicates that a final value (i.e. PASS, FAIL, ERROR, UNKNOWN, NOT_TESTED, NOT_APPLICABLE) should be returned if the encapsulating handler is invoked.

This element indicates that a new test_action should be processed if the encapsulating handler is invoked.

An UNKNOWN value indicates that the result of a test cannot be determined.

An ERROR value indicates that an error occurred while processing the check. Among other causes, this can indicate an unexpected response from the user.

A NOT_TESTED value indicates that the check has not been tested yet.
A NOT_APPLICABLE value indicates that the check is not relevant and can be skipped.

The ResultType simple type defines acceptable result values for questionnaires and test_actions.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>F</th>
<th>E</th>
<th>U</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1+</td>
<td>0</td>
<td>0</td>
<td>0+</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1+</td>
<td>0+</td>
<td>0+</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>1+</td>
<td>0+</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0+</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Pass**

**Fail**

**Error**

**Not Tested**

**Not Applicable**

A PASS value indicates that the check passed its test.

A FAIL value indicates that the check did not pass its test.

Indicates that the user responded by answering the question posed.

The TextType complex type defines an element that holds any information.
interpret the information. </xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:extension>
</xsd:complexType>
</xsd:simpleType>
<!-- additional content -->
<!--  ID Patterns  -->
<!--  ID Patterns  -->
<xsd:simpleType name="QuestionnaireIDPattern">
<xsd:annotation>
<xsd:documentation> ID values for questionnaires must match this pattern. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:questionnaire:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="QuestionIDPattern">
<xsd:annotation>
<xsd:documentation> ID values for questions must match this pattern. Each ID must be unique within an OCIL document. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:question:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="QuestionTestActionIDPattern">
<xsd:annotation>
<xsd:documentation> ID values for test_actions must match this pattern. Each ID must be unique within an OCIL document. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:testaction:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="TestActionRefValuePattern">
<xsd:annotation>
<xsd:documentation> A test_action_ref may refer to either a test_action or a questionnaire. This type represents the union of these two ID patterns. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:testaction:[1-9][0-9]*"/>
<xsd:pattern value="ocil:[A-Za-z0-9_]+:questionnaire:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="ChoiceIDPattern">
<xsd:annotation>
<xsd:documentation> ID values for choices in choice_questions must match this pattern. Each ID must be unique within an OCIL document. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:choice:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="ChoiceGroupIDPattern">
<xsd:annotation>
<xsd:documentation> ID values for choice_group references in choice_questions must match this pattern. Each ID must be unique within an OCIL document. </xsd:documentation>
</xsd:annotation>
<xsd:restriction base="xsd:string">
<xsd:pattern value="ocil:[A-Za-z0-9_]+:choicegroup:[1-9][0-9]*"/>
</xsd:restriction>
</xsd:simpleType>

</xsd:element>
</xsd:schema>
The test_action_ref element holds a reference (id) to a test_action or questionnaire.

The negate attribute can be used to specify whether to toggle the result from PASS to FAIL, and vice versa. A result other than PASS or FAIL (e.g. ERROR, NOT_TESTED, etc.) will be unchanged by a negate operation.

Priority is an optional attribute that can either be HIGH, MEDIUM or LOW. It specifies the importance of a priority test action reference.

The choice_ref element specifies the id of a choice.

All choices are tagged with a unique identifier that may be referenced by a choice_test_action referencing the encapsulating choice_question.

A choice_group defines a group of choices that may then be reused in
multiple choice_question elements. For example, a document may include multiple choice_questions with the options of "Good", "Fair", or "Poor". By defining these choices in a single choice_group, the author would not need to list them out explicitly in every choice_question.

```xml
<xsd:complexType>
  <xsd:sequence>
    <xsd:element ref="inter:choice" minOccurs="1" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>Holds the information associated with one of the possible responses for a choice_question. </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="id" type="inter:ChoiceGroupIDPattern" use="required">
    <xsd:annotation>
      <xsd:documentation>Holds the id of this choice group. This id is referenced within choice_question elements to include the choices contained in a group. </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>
```

The element when_equals specifies the action to take in a numeric_test_action when a particular value is given by a user in response to a numeric_question.

```
<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="inter:ResultChoiceType">
      <xsd:sequence>
        <xsd:element name="value" type="xsd:decimal" minOccurs="1" maxOccurs="unbounded">
          <xsd:annotation>
            <xsd:documentation>Each value holds what is to be matched. </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
</xsd:complexType>
```

The element when_range specifies the action to take in a numeric_test_action when a value given by a user in response to a numeric_question falls within the indicated range.

```
<xsd:complexType>
  <xsd:complexContent>
    <xsd:extension base="inter:ResultChoiceType">
      <xsd:sequence>
        <xsd:element name="range" type="inter:RangeType" minOccurs="1" maxOccurs="unbounded">
          <xsd:annotation>
            <xsd:documentation>Each range element holds a single numeric range. </xsd:documentation>
          </xsd:annotation>
        </xsd:element>
      </xsd:sequence>
    </xsd:extension>
</xsd:complexType>
```

The element when_pattern specifies the action to take in a string_test_action when a string given by a user in response to a string_question.
matches the given regular expression. </xsd:documentation>
</xsd:complexType>
</xsd:complexContent>
<xsd:extension base="inter:ResultChoiceType">
<xsd:sequence>
<xsd:element name="pattern" type="inter:PatternType" minOccurs="1" maxOccurs="unbounded">
<xsd:annotation>
<xsd:documentation> Each pattern element holds a regular expression against which the user's response string is to be compared. </xsd:documentation>
</xsd:annotation>
</xsd:element>
</xsd:sequence>
</xsd:extension>
</xsd:complexType>
</xsd:element>
</xsd:complexType>

<!-- **************************** -->
<!-- * Instructions Element and Supporting Types * -->
<!-- **************************** -->
<xsd:complexType name="ReferenceType" mixed="true">
<xsd:annotation>
<xsd:documentation> The ReferenceType complex type defines structures used to hold information about an external reference given its URI and description. </xsd:documentation>
</xsd:annotation>
<xsd:complexContent>
<xsd:extension base="inter:TextType">
<xsd:attribute name="href" type="xsd:anyURI">
<xsd:annotation>
<xsd:documentation> The href attribute holds the URI of an external reference. This may be the namespace associated with the information in the body or a web URL containing relevant information. </xsd:documentation>
</xsd:annotation>
</xsd:attribute>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
</xsd:complexType>
<xsd:complexType name="StepType">
<xsd:annotation>
<xsd:documentation> The StepType complex type defines structures that describe one step (out of possibly multiple steps) that a user should take in order to respond to a question. The steps would appear as parts of the question's instructions element. </xsd:documentation>
</xsd:annotation>
<xsd:sequence>
<xsd:element name="description" type="inter:TextType" minOccurs="0" maxOccurs="1">
<xsd:annotation>
<xsd:documentation> The description element contains some information about this step. </xsd:documentation>
</xsd:annotation>
</xsd:element>
<xsd:element name="reference" minOccurs="0" maxOccurs="unbounded" type="Inter:ReferenceType">
<xsd:annotation>
<xsd:documentation> The reference element contains information about any external references related to this step. </xsd:documentation>
</xsd:annotation>
</xsd:element>
<xsd:element ref="inter:step" minOccurs="0" maxOccurs="unbounded"/>
<xsd:complexType>
  <xsd:sequence>
    <xsd:element name="step" type="inter:StepType">
      <xsd:annotation>
        <xsd:documentation>The step element describes one step in the procedures a user should undertake in order to answer an encapsulating question.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="instructions">
      <xsd:annotation>
        <xsd:documentation>The instructions element contains a step by step procedure to guide the user in answering a question.</xsd:documentation>
      </xsd:annotation>
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element name="title" type="inter:TextType">
            <xsd:annotation>
              <xsd:documentation>The title element contains a descriptive heading for the instructions.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
          <xsd:element ref="inter:step" minOccurs="1" maxOccurs="unbounded">
            <xsd:annotation>
              <xsd:documentation>The step element contains information about one step of the instructions.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType>
  <xsd:sequence>
    <xsd:element name="instructions">
      <xsd:annotation>
        <xsd:documentation>The instructions element contains a step by step procedure to guide the user in answering a question.</xsd:documentation>
      </xsd:annotation>
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element name="title" type="inter:TextType">
            <xsd:annotation>
              <xsd:documentation>The title element contains a descriptive heading for the instructions.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
          <xsd:element ref="inter:step" minOccurs="1" maxOccurs="unbounded">
            <xsd:annotation>
              <xsd:documentation>The step element contains information about one step of the instructions.</xsd:documentation>
            </xsd:annotation>
          </xsd:element>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>