Open Security Controls Assessment Language

The Anatomy of OSCAL Models?

OSCAL 101 Series - Lecture #2

Presenters:

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NIST
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STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

THE PRESENTATION IS BEEING RECORDED!

□ NIST is hosting a series of monthly educational workshops, on the third Tuesday of each month, 11:00-12:00 EST.

□ **Purpose**: improve OSCAL adoption by expanding the OSCAL community of interest (COI) through the onboarding of members who have no previous knowledge of OSCAL.

□ Schedule and info: https://csrc.nist.gov/Projects/open-security-controls-assessment-language/oscal-education-workshops

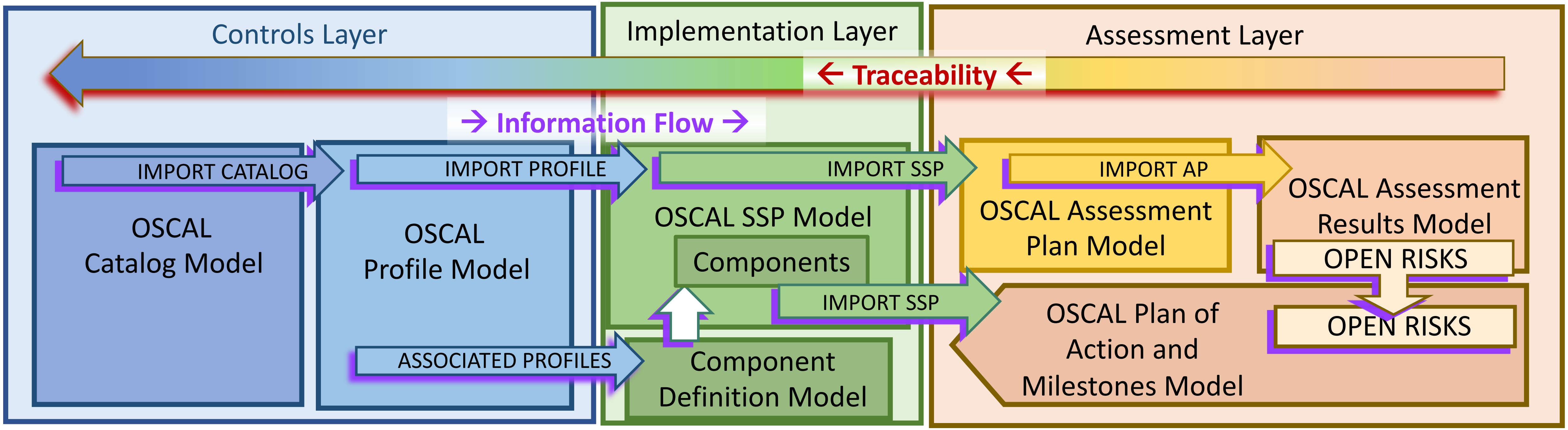
Welcome to the Lecture #2

Agenda

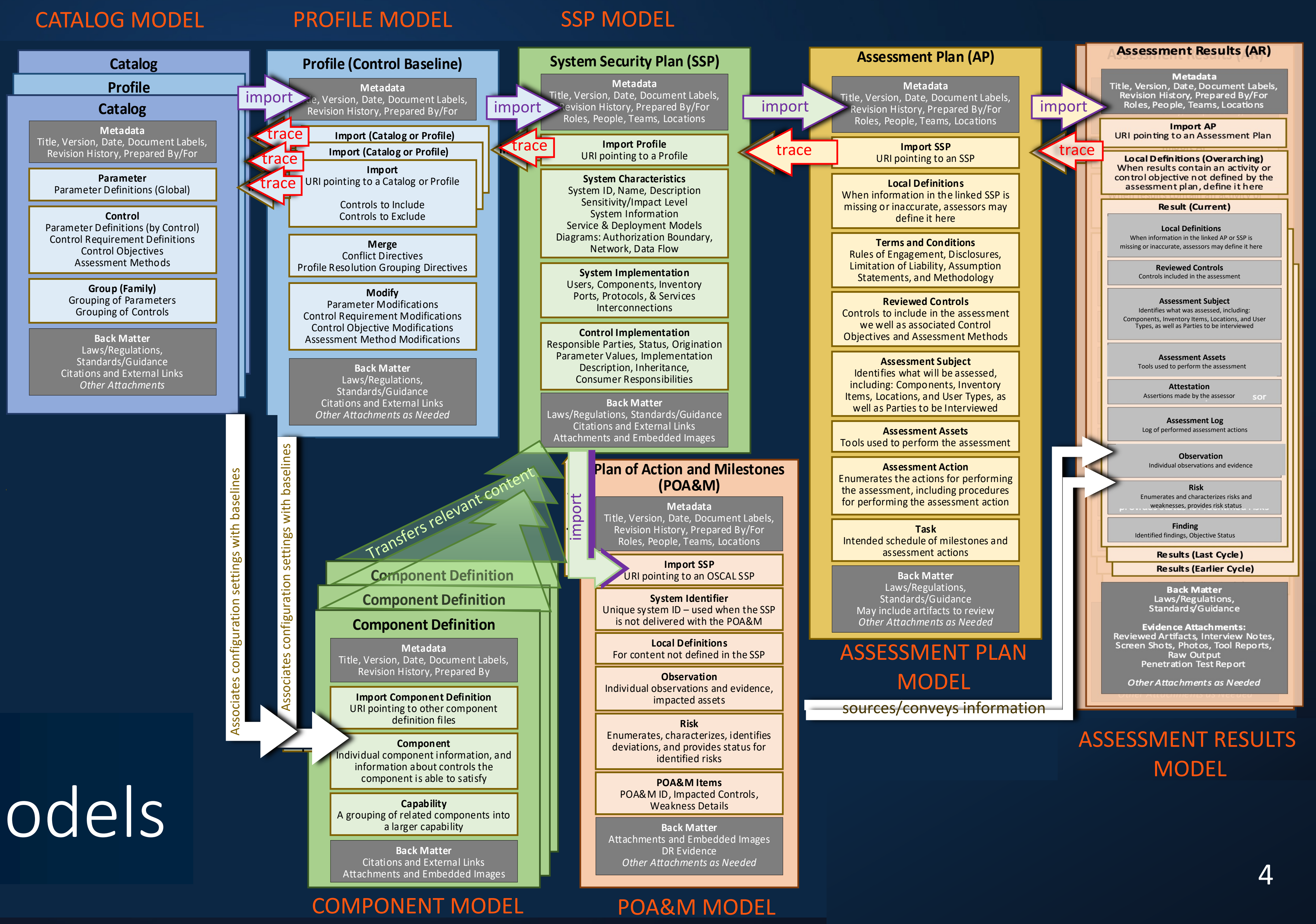
- ➢ Brief Review of OSCAL
- ➢ The Anatomy of OSCAL models
  - ➢ Catalog and Profile Models
  - ➢ Rob’s Yellow Bricks Road to the FPKI OSCAL Catalog

What is OSCAL?

- ❑OSCAL is a standardized, flexible, open-source language designed to express security controls and their associated implementations and assessment methods in machine-readable formats (XML, JSON, and YAML). OSCAL content can be easily transformed into human-friendly formats.
- ❑OSCAL:
  - ➢ Enables automated traceability
  - ➢ Provides a standards-based foundation for the next generation GRCs
  - ➢ Helps improve the risk management posture, consistency, and interoperability.



OSCAL Models



CATALOG MODEL

Catalog

Profile

Catalog

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By/For

Parameter
Parameter Definitions (Global)

Control
Parameter Definitions (by Control)
Control Requirement Definitions
Control Objectives
Assessment Methods

Group (Family)
Grouping of Parameters
Grouping of Controls

Back Matter
Laws/Regulations, Standards/Guidance
Citations and External Links
Other Attachments

PROFILE MODEL

Profile (Control Baseline)

Metadata
e, Version, Date, Document Labels, Revision History, Prepared By/For

Import (Catalog or Profile)

Import (Catalog or Profile)

Import
URI pointing to a Catalog or Profile

Controls to Include
Controls to Exclude

Merge
Conflict Directives
Profile Resolution Grouping Directives

Modify
Parameter Modifications
Control Requirement Modifications
Control Objective Modifications
Assessment Method Modifications

Back Matter
Laws/Regulations, Standards/Guidance
Citations and External Links
Other Attachments as Needed

SSP MODEL

System Security Plan (SSP)

Metadata
Title, Version, Date, Document Labels, evision History, Prepared By/For
Roles, People, Teams, Locations

Import Profile
URI pointing to a Profile

System Characteristics
System ID, Name, Description
Sensitivity/Impact Level
System Information
Service & Deployment Models
Diagrams: Authorization Boundary, Network, Data Flow

System Implementation
Users, Components, Inventory
Ports, Protocols, & Services
Interconnections

Control Implementation
Responsible Parties, Status, Origination
Parameter Values, Implementation Description, Inheritance, Consumer Responsibilities

Back Matter
Laws/Regulations, Standards/Guidance
Citations and External Links
Attachments and Embedded Images

Assessment Plan (AP)

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By/For
Roles, People, Teams, Locations

Import SSP
URI pointing to an SSP

Local Definitions
When information in the linked SSP is missing or inaccurate, assessors may define it here

Terms and Conditions
Rules of Engagement, Disclosures, Limitation of Liability, Assumption Statements, and Methodology

Reviewed Controls
Controls to include in the assessment we well as associated Control Objectives and Assessment Methods

Assessment Subject
Identifies what will be assessed, including: Components, Inventory Items, Locations, and User Types, as well as Parties to be Interviewed

Assessment Assets
Tools used to perform the assessment

Assessment Action
Enumerates the actions for performing the assessment, including procedures for performing the assessment action

Task
Intended schedule of milestones and assessment actions

Back Matter
Laws/Regulations, Standards/Guidance
May include artifacts to review
Other Attachments as Needed

ASSESSMENT PLAN MODEL

Assessment Results (AR)

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By/For
Roles, People, Teams, Locations

Import AP
URI pointing to an Assessment Plan

Local Definitions (Overarching)
When results contain an activity or control objective not defined by the assessment plan, define it here

Result (Current)

Local Definitions
When information in the linked AP or SSP is missing or inaccurate, assessors may define it here

Reviewed Controls
Controls included in the assessment

Assessment Subject
Identifies what was assessed, including:
Components, Inventory Items, Locations, and User Types, as well as Parties to be interviewed

Assessment Assets
Tools used to perform the assessment

Attestation
Assertions made by the assessor

Assessment Log
Log of performed assessment actions

Observation
Individual observations and evidence

Risk
Enumerates and characterizes risks and weaknesses, provides risk status

Finding
Identified findings, Objective Status

Results (Last Cycle)

Results (Earlier Cycle)

Back Matter
Laws/Regulations, Standards/Guidance

Evidence Attachments:
Reviewed Artifacts, Interview Notes, Screen Shots, Photos, Tool Reports, Raw Output
Penetration Test Report

Other Attachments as Needed

ASSESSMENT RESULTS MODEL

Component Definition

Component Definition

Component Definition

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By

Import Component Definition
URI pointing to other component definition files

Component
Individual component information, and information about controls the component is able to satisfy

Capability
A grouping of related components into a larger capability

Back Matter
Citations and External Links
Attachments and Embedded Images

COMPONENT MODEL

Plan of Action and Milestones (POA&M)

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By/For
Roles, People, Teams, Locations

Import SSP
URI pointing to an OSCAL SSP

System Identifier
Unique system ID – used when the SSP is not delivered with the POA&M

Local Definitions
For content not defined in the SSP

Observation
Individual observations and evidence, impacted assets

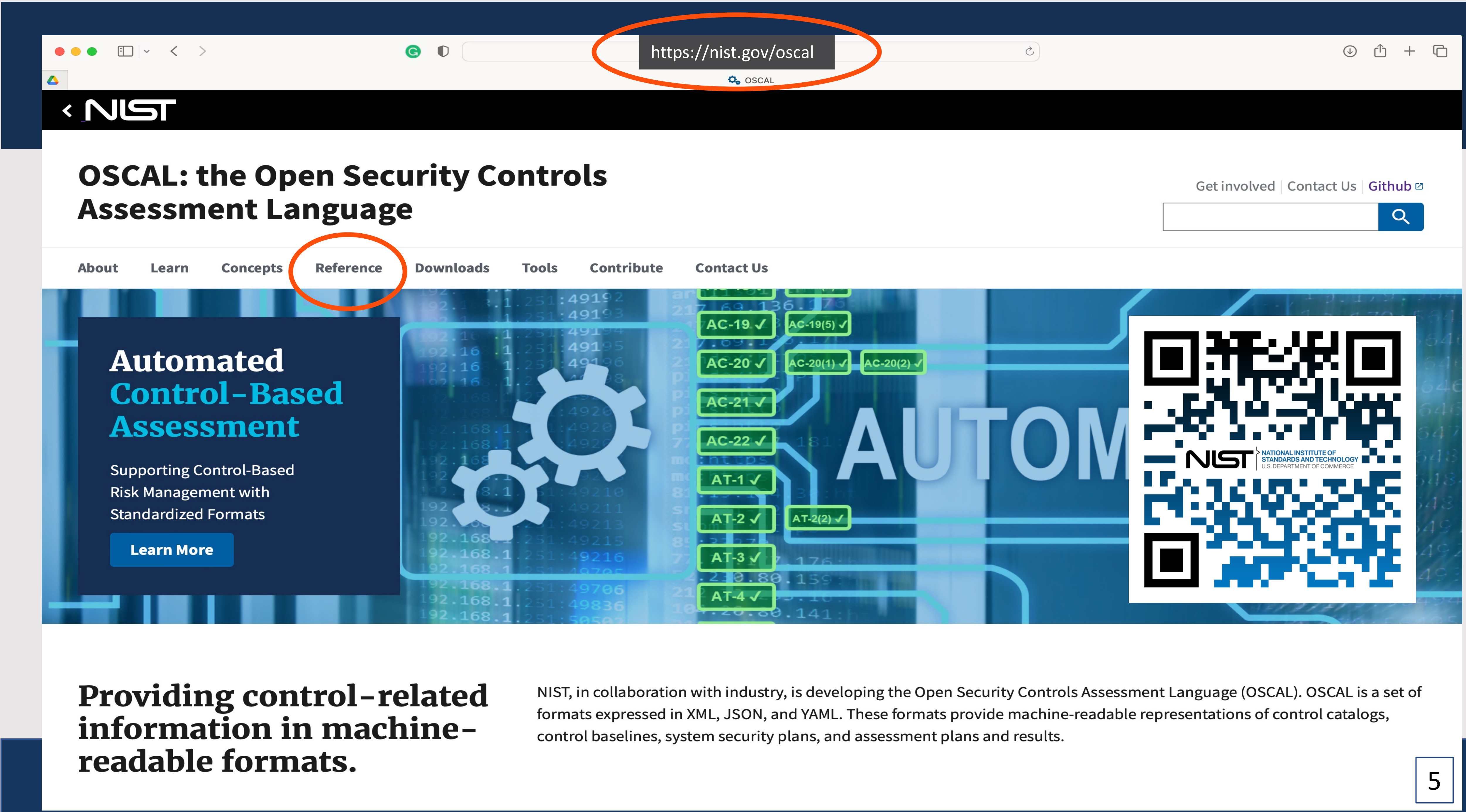
Risk
Enumerates, characterizes, identifies deviations, and provides status for identified risks

POA&M Items
POA&M ID, Impacted Controls, Weakness Details

Back Matter
Attachments and Embedded Images
DR Evidence
Other Attachments as Needed

POA&M MODEL

import
trace
trace
trace
import
trace
import
trace
import
trace
Associates configuration settings with baselines
Associates configuration settings with baselines
Transfers relevant content
import
sources/conveys information



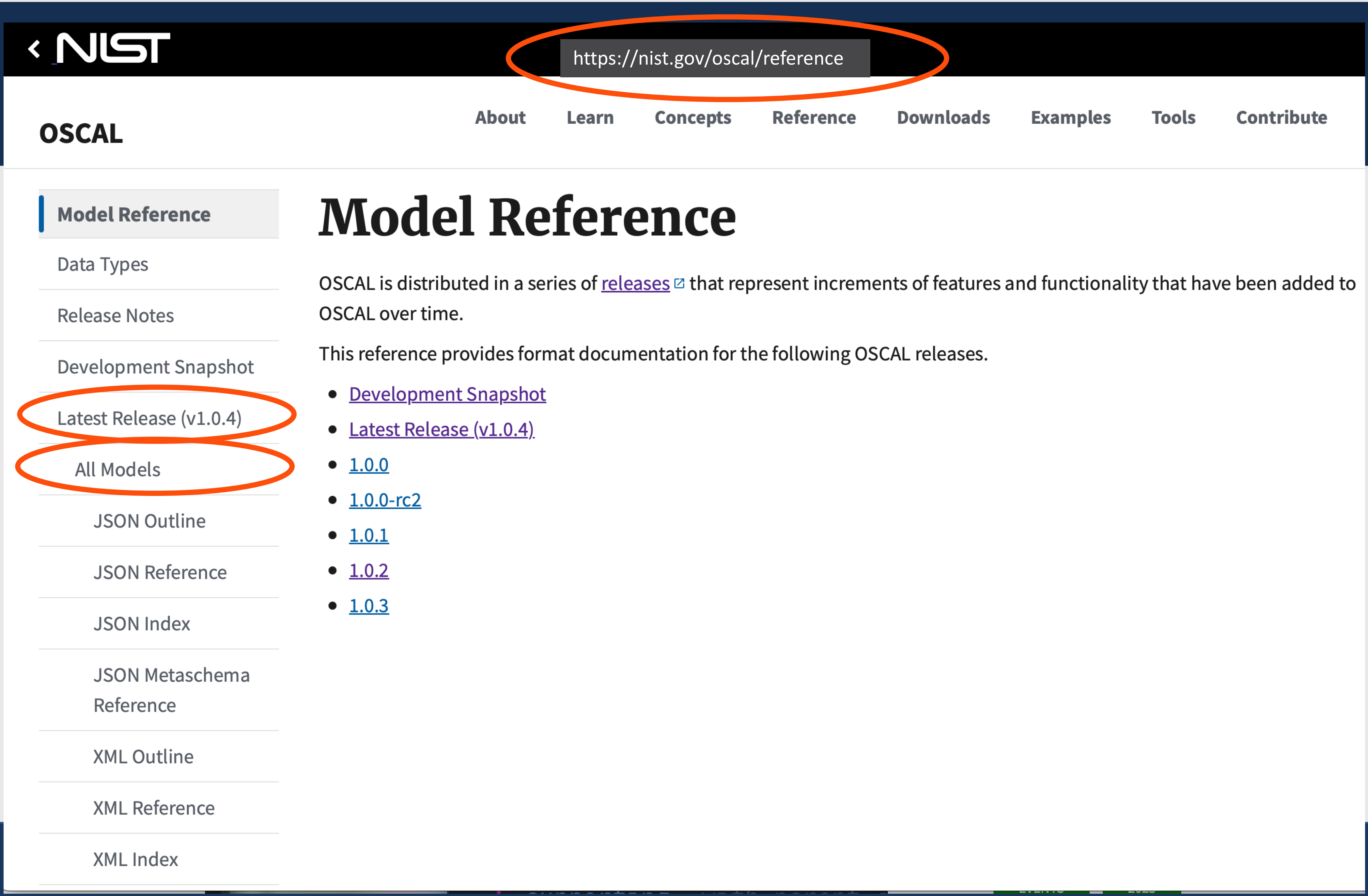
OSCAL: the Open Security Controls Assessment Language

Automated Control-Based Assessment

Supporting Control-Based Risk Management with Standardized Formats

Providing control-related information in machine-readable formats.

NIST, in collaboration with industry, is developing the Open Security Controls Assessment Language (OSCAL). OSCAL is a set of formats expressed in XML, JSON, and YAML. These formats provide machine-readable representations of control catalogs, control baselines, system security plans, and assessment plans and results.



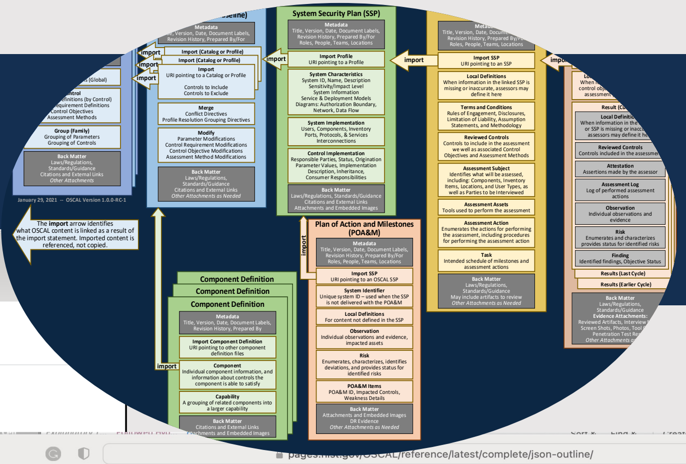
Model Reference

OSCAL is distributed in a series of releases that represent increments of features and functionality that have been added to OSCAL over time.

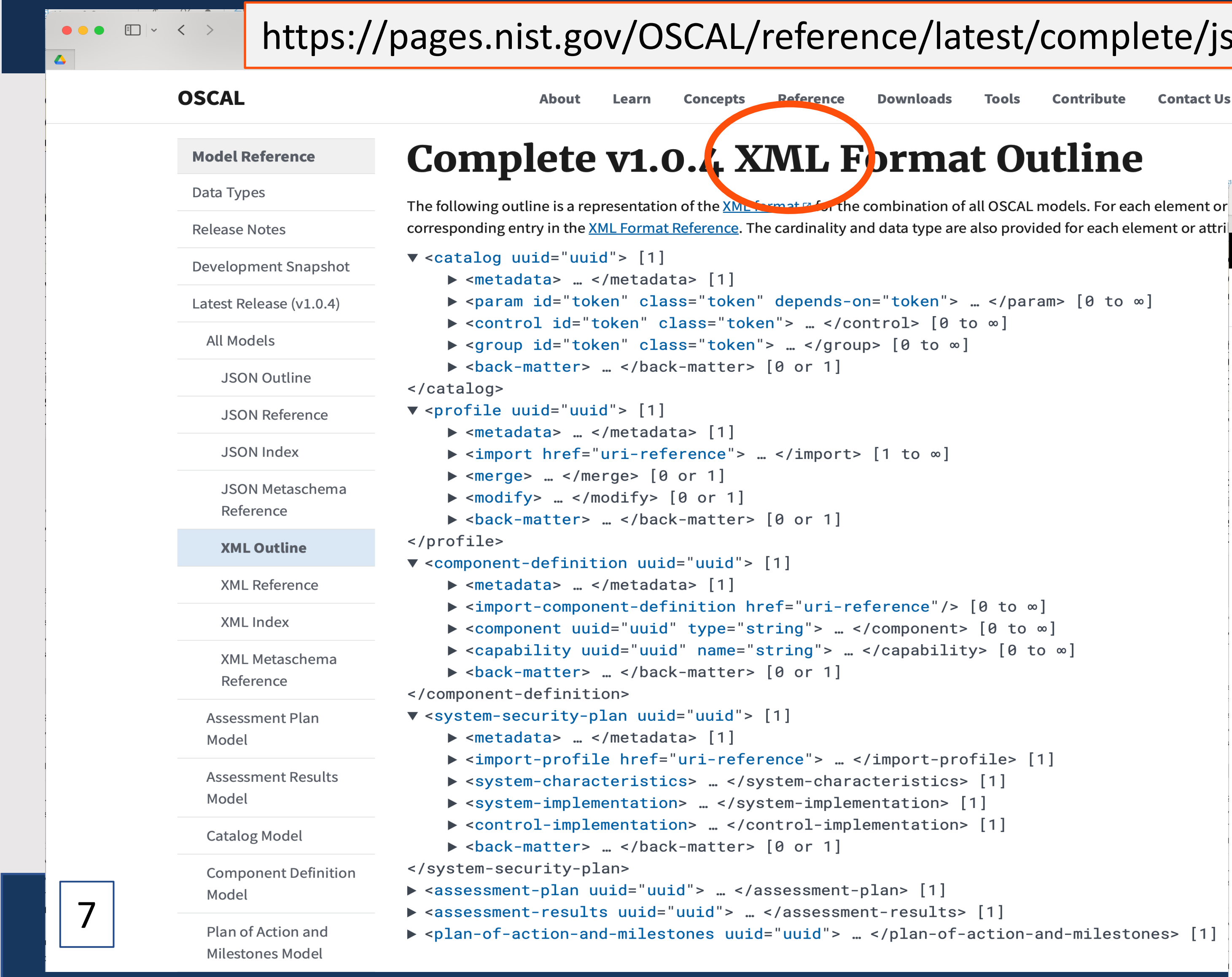
This reference provides format documentation for the following OSCAL releases.

- Development Snapshot
- Latest Release (v1.0.4)
- 1.0.0
- 1.0.0-rc2
- 1.0.1
- 1.0.2
- 1.0.3

OSCAL Models’ Outline


System Security Plan (SSP)
import
Component Definition
Plan of Action and Milestones (POA&M)
The import arrow identifies what OSCAL content is linked as a result of the import statement. Imported content is referenced, not copied.

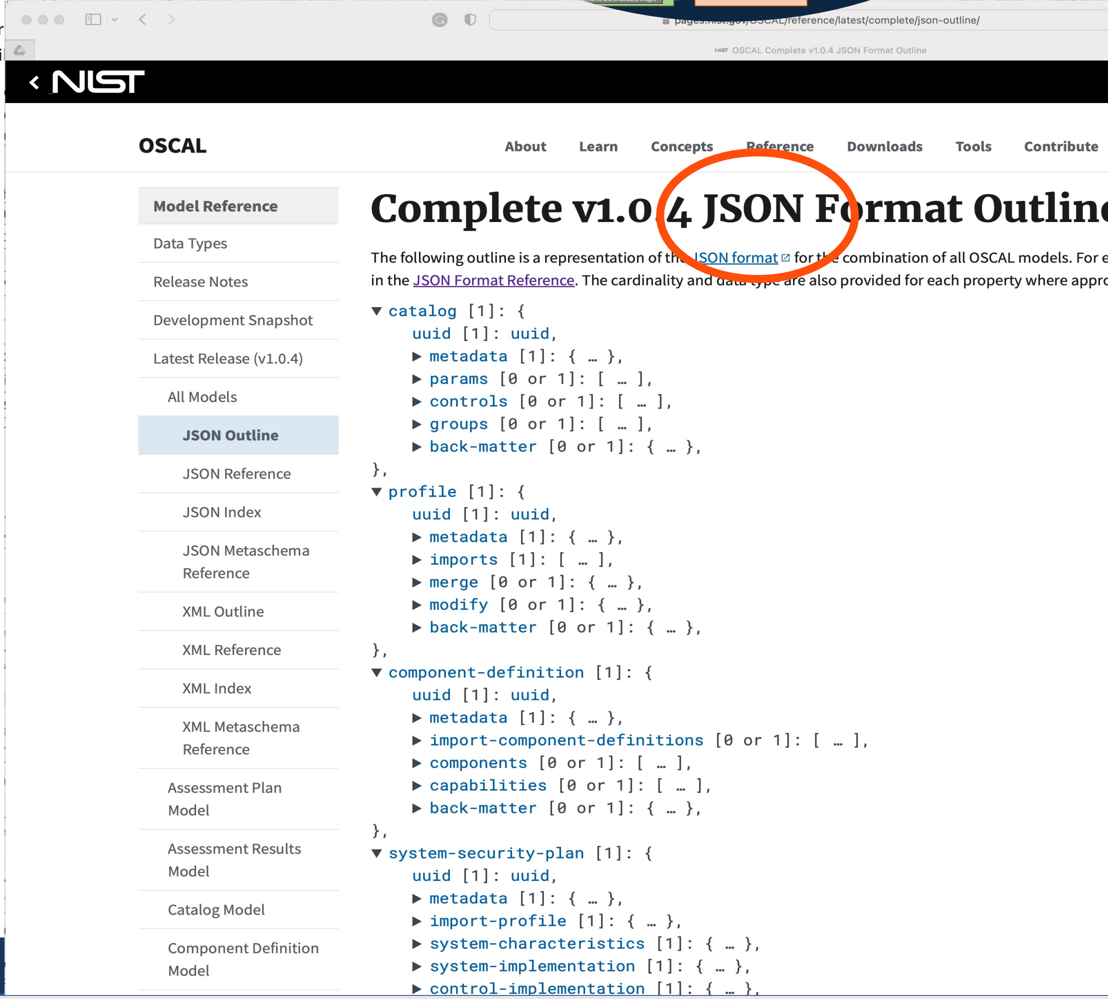
https://pages.nist.gov/OSCAL/reference/latest/complete/json-outline/



Complete v1.0.4 XML Format Outline

The following outline is a representation of the XML format for the combination of all OSCAL models. For each element or corresponding entry in the XML Format Reference. The cardinality and data type are also provided for each element or attri

```
▼ <catalog uuid="uuid"> [1]
    ▶ <metadata> … </metadata> [1]
    ▶ <param id="token" class="token" depends-on="token"> … </param> [0 to ∞]
    ▶ <control id="token" class="token"> … </control> [0 to ∞]
    ▶ <group id="token" class="token"> … </group> [0 to ∞]
    ▶ <back-matter> … </back-matter> [0 or 1]
</catalog>
▼ <profile uuid="uuid"> [1]
    ▶ <metadata> … </metadata> [1]
    ▶ <import href="uri-reference"> … </import> [1 to ∞]
    ▶ <merge> … </merge> [0 or 1]
    ▶ <modify> … </modify> [0 or 1]
    ▶ <back-matter> … </back-matter> [0 or 1]
</profile>
▼ <component-definition uuid="uuid"> [1]
    ▶ <metadata> … </metadata> [1]
    ▶ <import-component-definition href="uri-reference"/> [0 to ∞]
    ▶ <component uuid="uuid" type="string"> … </component> [0 to ∞]
    ▶ <capability uuid="uuid" name="string"> … </capability> [0 to ∞]
    ▶ <back-matter> … </back-matter> [0 or 1]
</component-definition>
▼ <system-security-plan uuid="uuid"> [1]
    ▶ <metadata> … </metadata> [1]
    ▶ <import-profile href="uri-reference"> … </import-profile> [1]
    ▶ <system-characteristics> … </system-characteristics> [1]
    ▶ <system-implementation> … </system-implementation> [1]
    ▶ <control-implementation> … </control-implementation> [1]
    ▶ <back-matter> … </back-matter> [0 or 1]
</system-security-plan>
▶ <assessment-plan uuid="uuid"> … </assessment-plan> [1]
▶ <assessment-results uuid="uuid"> … </assessment-results> [1]
▶ <plan-of-action-and-milestones uuid="uuid"> … </plan-of-action-and-milestones> [1]
```

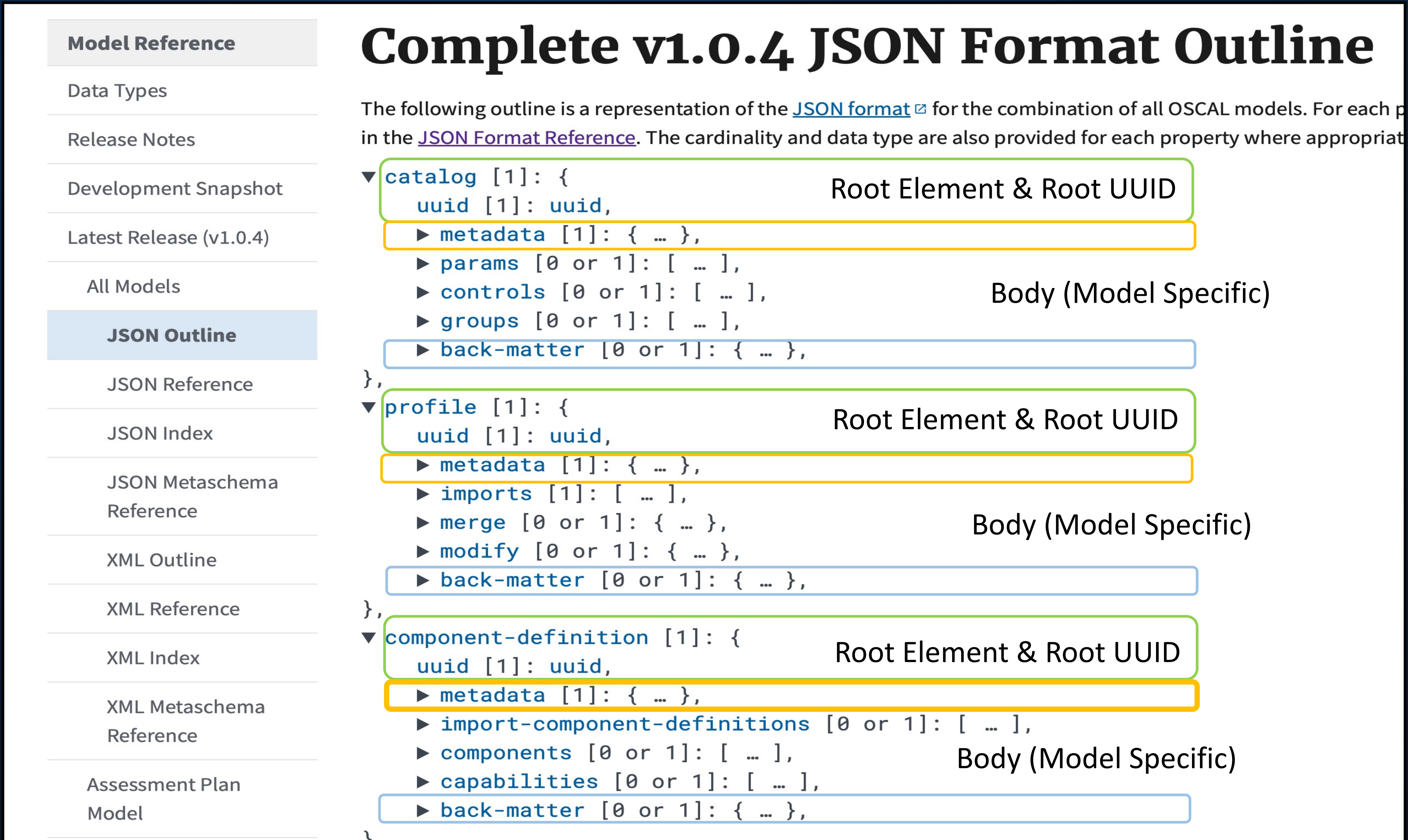


Complete v1.0.4 JSON Format Outline

The following outline is a representation of the JSON format for the combination of all OSCAL models. For e in the JSON Format Reference. The cardinality and data type are also provided for each property where appro

```
▼ catalog [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ params [0 or 1]: [ … ],
  ▶ controls [0 or 1]: [ … ],
  ▶ groups [0 or 1]: [ … ],
  ▶ back-matter [0 or 1]: { … },
},
▼ profile [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ imports [1]: [ … ],
  ▶ merge [0 or 1]: { … },
  ▶ modify [0 or 1]: { … },
  ▶ back-matter [0 or 1]: { … },
},
▼ component-definition [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ import-component-definitions [0 or 1]: [ … ],
  ▶ components [0 or 1]: [ … ],
  ▶ capabilities [0 or 1]: [ … ],
  ▶ back-matter [0 or 1]: { … },
},
▼ system-security-plan [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ import-profile [1]: { … },
  ▶ system-characteristics [1]: { … },
  ▶ system-implementation [1]: { … },
  ▶ control-implementation [1]: { … },
```

Common OSCAL Structure



Complete v1.0.4 JSON Format Outline

The following outline is a representation of the JSON format for the combination of all OSCAL models. For each p in the JSON Format Reference. The cardinality and data type are also provided for each property where appropriat

```
▼ catalog [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ params [0 or 1]: [ … ],
  ▶ controls [0 or 1]: [ … ],
  ▶ groups [0 or 1]: [ … ],
  ▶ back-matter [0 or 1]: { … },
},
▼ profile [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ imports [1]: [ … ],
  ▶ merge [0 or 1]: { … },
  ▶ modify [0 or 1]: { … },
  ▶ back-matter [0 or 1]: { … },
},
▼ component-definition [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ import-component-definitions [0 or 1]: [ … ],
  ▶ components [0 or 1]: [ … ],
  ▶ capabilities [0 or 1]: [ … ],
  ▶ back-matter [0 or 1]: { … },
}
```

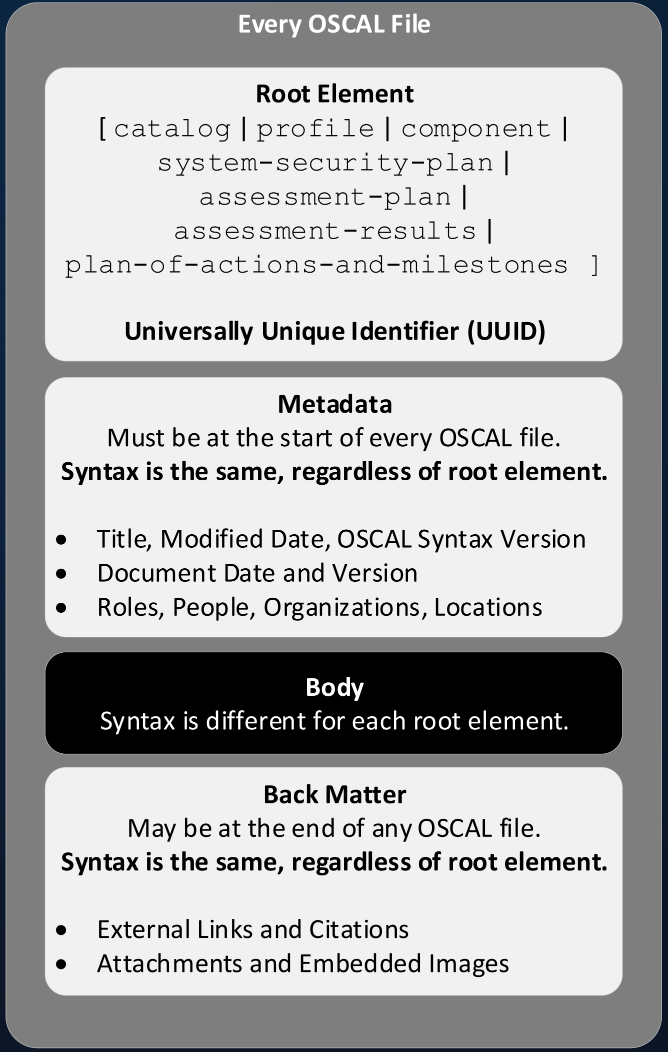
Common OSCAL Structure

- **Root Element:** The root element of the document indicates the type of content within the body of the file. The name of this element is unique to the specific model.
- **Root UUID:** A RFC 4122 Version 4 Universally Unique Identifier (UUID) that identifies the specific document instance. Changed when the document is modified.

- **Metadata:** Information about the document (i.e., title, last-modified timestamp, OSCAL version). Also used to define roles, parties (people, teams and organizations), and locations referenced in the document.

- **Model-specific Body:** The body is specific to each model.

- **Back Matter:** Used to link to and attach resources, which may contain citations. Used to associate graphics, supporting documentation, etc. with the OSCAL document. A reference entry here can be referenced from within the body of an OSCAL document.



Every OSCAL File

Root Element

[`catalog` | `profile` | `component` | `system-security-plan` | `assessment-plan` | `assessment-results` | `plan-of-actions-and-milestones`]

Universally Unique Identifier (UUID)

Metadata

Must be at the start of every OSCAL file.

Syntax is the same, regardless of root element.

- Title, Modified Date, OSCAL Syntax Version
- Document Date and Version
- Roles, People, Organizations, Locations

Body

Syntax is different for each root element.

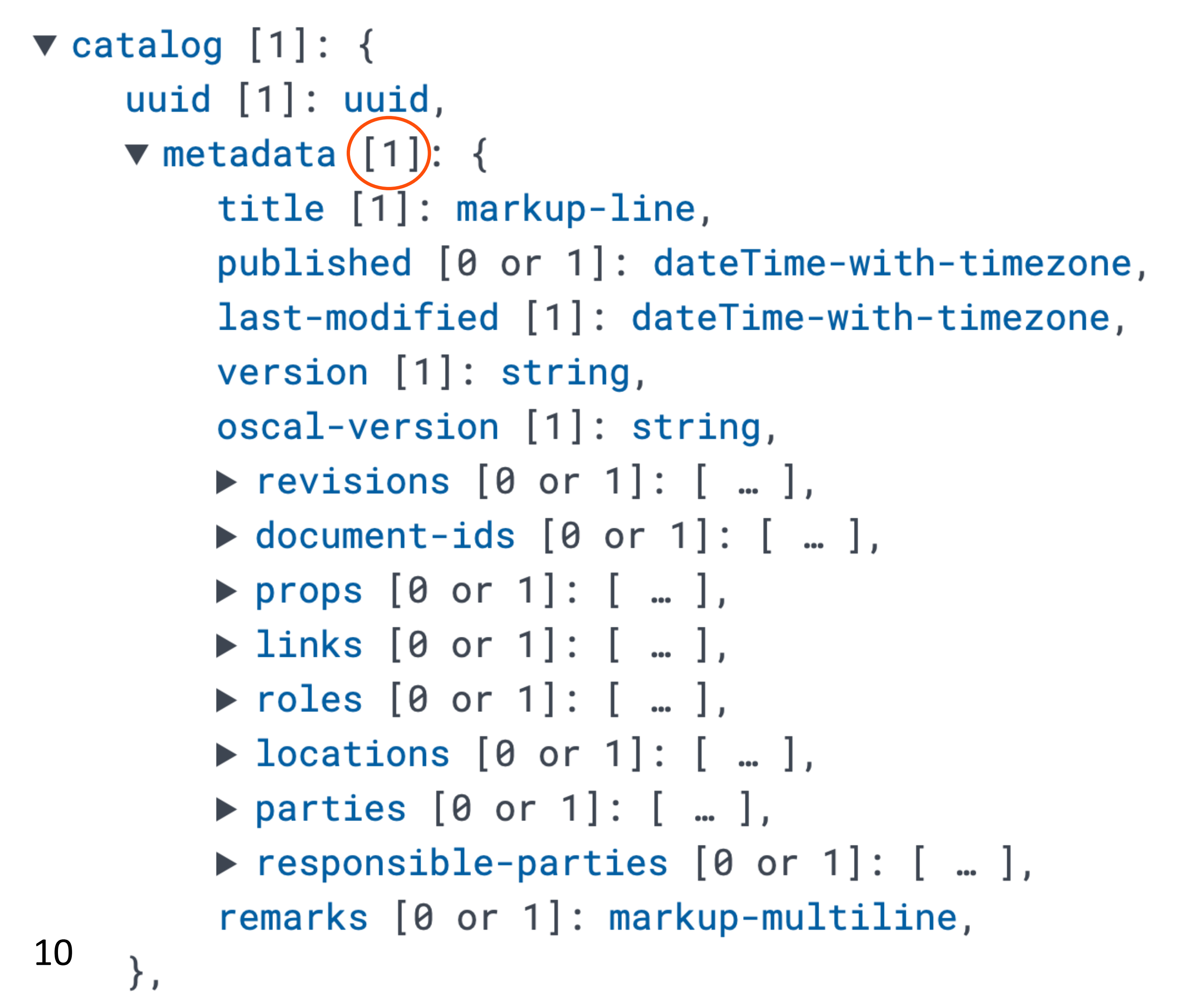
Back Matter

May be at the end of any OSCAL file.

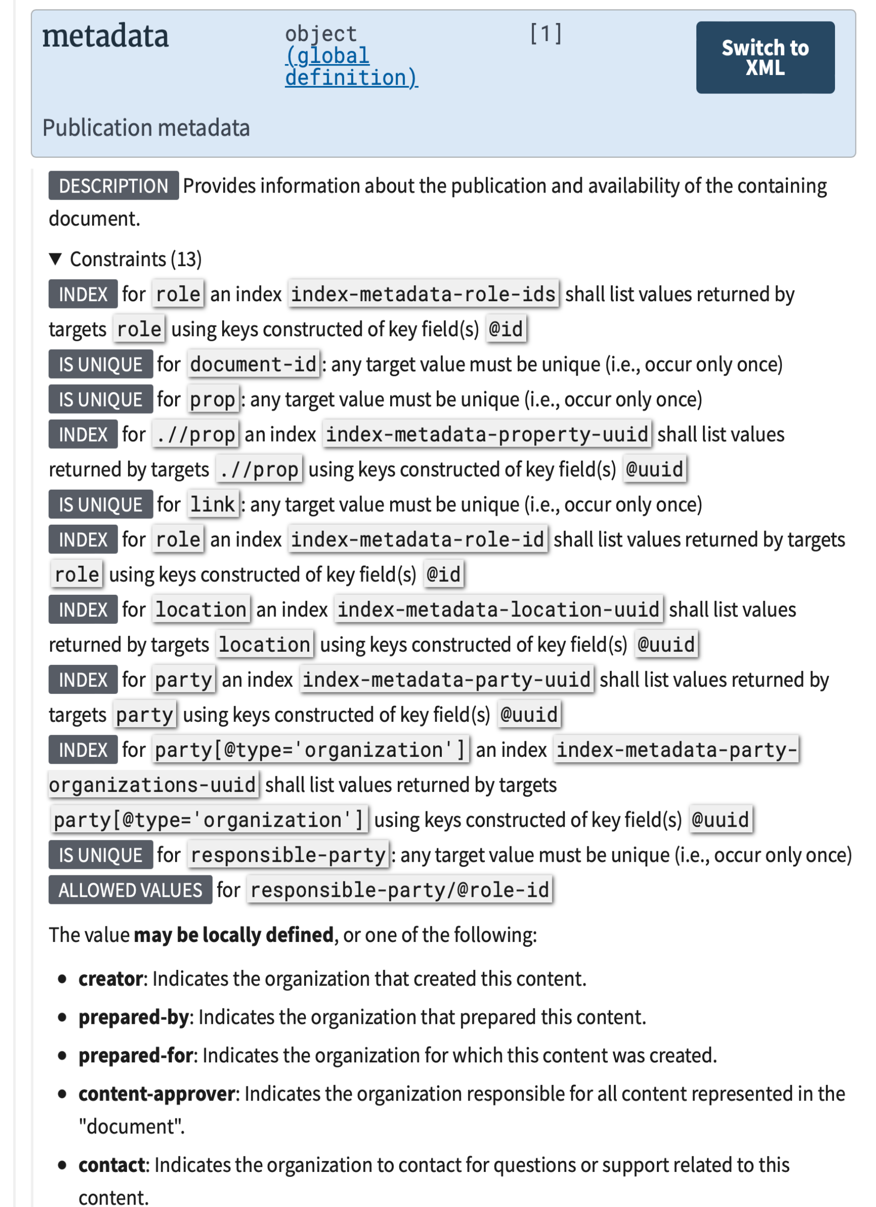
Syntax is the same, regardless of root element.

- External Links and Citations
- Attachments and Embedded Images

The Metadata Element – Cardinality and Data Type



```
▼ catalog [1]: {
    uuid [1]: uuid,
  ▼ metadata [1]: {
      title [1]: markup-line,
      published [0 or 1]: dateTime-with-timezone,
      last-modified [1]: dateTime-with-timezone,
      version [1]: string,
      oscal-version [1]: string,
    ▶ revisions [0 or 1]: [ … ],
    ▶ document-ids [0 or 1]: [ … ],
    ▶ props [0 or 1]: [ … ],
    ▶ links [0 or 1]: [ … ],
    ▶ roles [0 or 1]: [ … ],
    ▶ locations [0 or 1]: [ … ],
    ▶ parties [0 or 1]: [ … ],
    ▶ responsible-parties [0 or 1]: [ … ],
      remarks [0 or 1]: markup-multiline,
  },
```



metadata object (global definition) [1]

Publication metadata

DESCRIPTION Provides information about the publication and availability of the containing document.

▼ Constraints (13)

INDEX for `role` an index `index-metadata-role-ids` shall list values returned by targets `role` using keys constructed of key field(s) `@id`

IS UNIQUE for `document-id`: any target value must be unique (i.e., occur only once)

IS UNIQUE for `prop`: any target value must be unique (i.e., occur only once)

INDEX for `.//prop` an index `index-metadata-property-uuid` shall list values returned by targets `.//prop` using keys constructed of key field(s) `@uuid`

IS UNIQUE for `link`: any target value must be unique (i.e., occur only once)

INDEX for `role` an index `index-metadata-role-id` shall list values returned by targets `role` using keys constructed of key field(s) `@id`

INDEX for `location` an index `index-metadata-location-uuid` shall list values returned by targets `location` using keys constructed of key field(s) `@uuid`

INDEX for `party` an index `index-metadata-party-uuid` shall list values returned by targets `party` using keys constructed of key field(s) `@uuid`

INDEX for `party[@type='organization']` an index `index-metadata-party-organizations-uuid` shall list values returned by targets `party[@type='organization']` using keys constructed of key field(s) `@uuid`

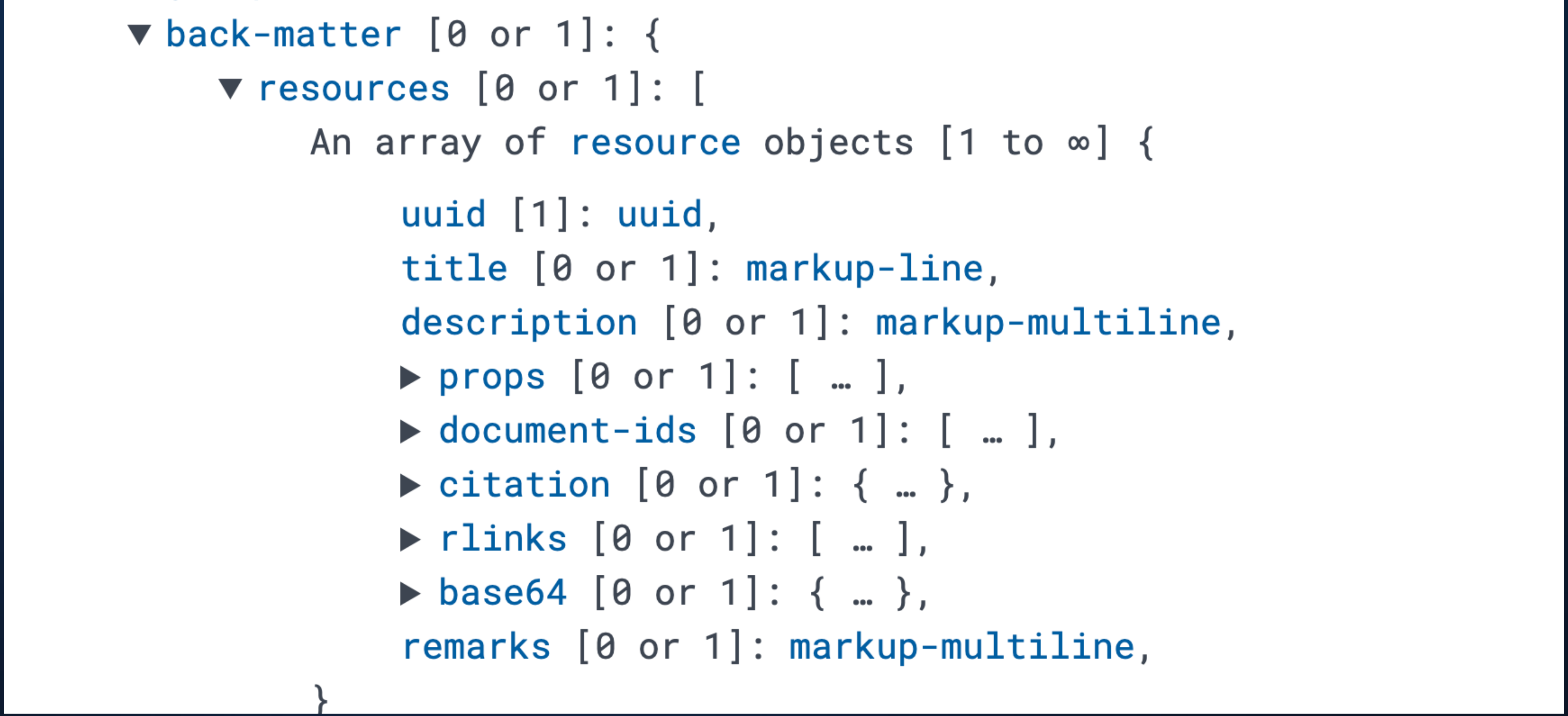
IS UNIQUE for `responsible-party`: any target value must be unique (i.e., occur only once)

ALLOWED VALUES for `responsible-party/@role-id`

The value **may be locally defined**, or one of the following:

- **creator**: Indicates the organization that created this content.
- **prepared-by**: Indicates the organization that prepared this content.
- **prepared-for**: Indicates the organization for which this content was created.
- **content-approver**: Indicates the organization responsible for all content represented in the "document".
- **contact**: Indicates the organization to contact for questions or support related to this content.

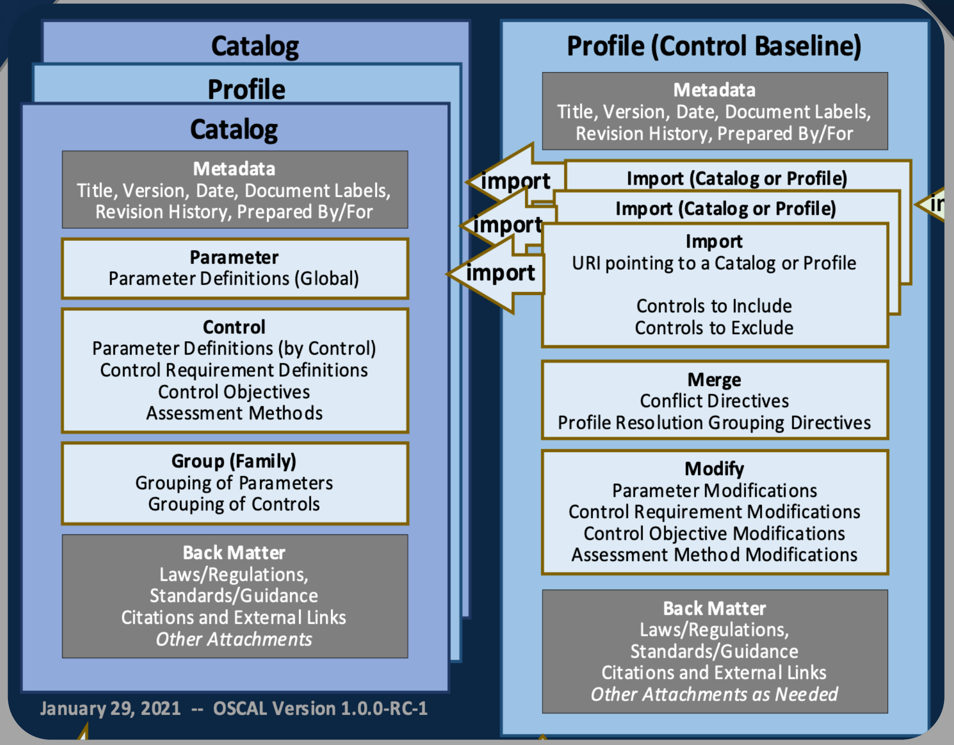
The Back-matter Element – Cardinality and Data Type



```
▼ back-matter [0 or 1]: {
    ▼ resources [0 or 1]: [
        An array of resource objects [1 to ∞] {

            uuid [1]: uuid,
            title [0 or 1]: markup-line,
            description [0 or 1]: markup-multiline,
            ▶ props [0 or 1]: [ … ],
            ▶ document-ids [0 or 1]: [ … ],
            ▶ citation [0 or 1]: { … },
            ▶ rlinks [0 or 1]: [ … ],
            ▶ base64 [0 or 1]: { … },
            remarks [0 or 1]: markup-multiline,
        }
```

OSCAL Controls Layer



Catalog

Profile

Catalog

Metadata
Title, Version, Date, Document Labels,
Revision History, Prepared By/For

Parameter
Parameter Definitions (Global)

Control
Parameter Definitions (by Control)
Control Requirement Definitions
Control Objectives
Assessment Methods

Group (Family)
Grouping of Parameters
Grouping of Controls

Back Matter
Laws/Regulations,
Standards/Guidance
Citations and External Links
Other Attachments

import

import

import

Profile (Control Baseline)

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Import (Catalog or Profile)

Import (Catalog or Profile)

Import
URI pointing to a Catalog or Profile

Controls to Include
Controls to Exclude

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Profile Resolution Grouping Directives

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January 29, 2021 -- OSCAL Version 1.0.0-RC-1

OSCAL Catalog Model

Represents a collection of security and privacy controls, which may be used as part of a risk management program.

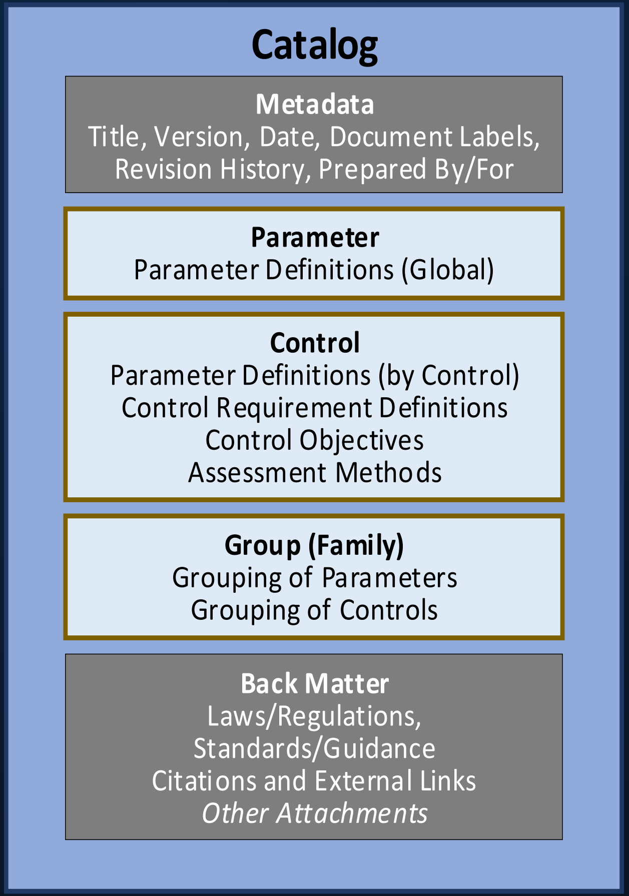
- **Metadata:** Same for each OSCAL model

- **Parameter:** Provides a global policy variable used by one or more control

- **Control:** An individual control in the catalog.
  - May contain control-specific parameters, control requirement statements, control objectives, assessment methods, references
  - Controls can have child controls.

- **Group:** Related controls may be grouped. Parameters related to this group may be defined here.

- **Back Matter:** Same for each OSCAL model



Catalog

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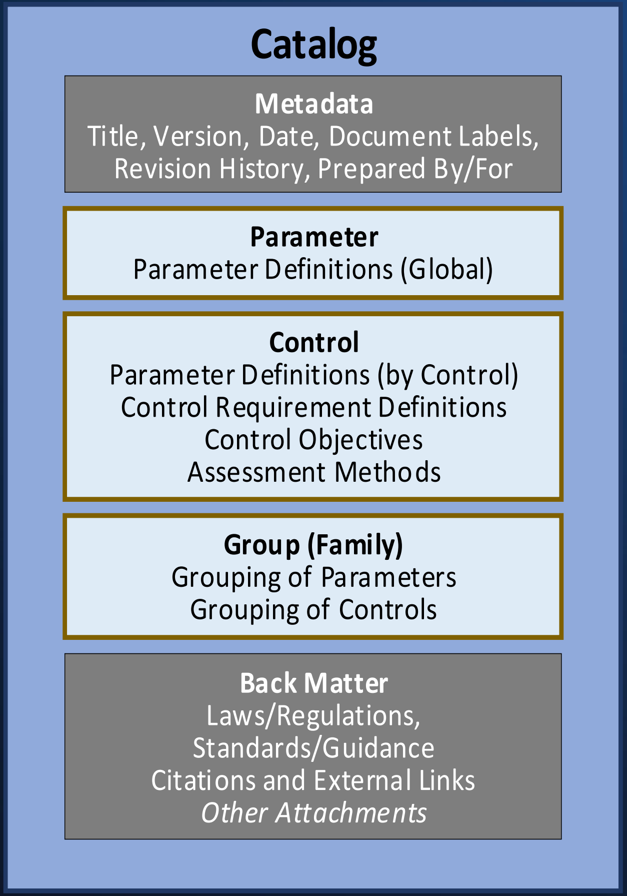
OSCAL Catalog Model



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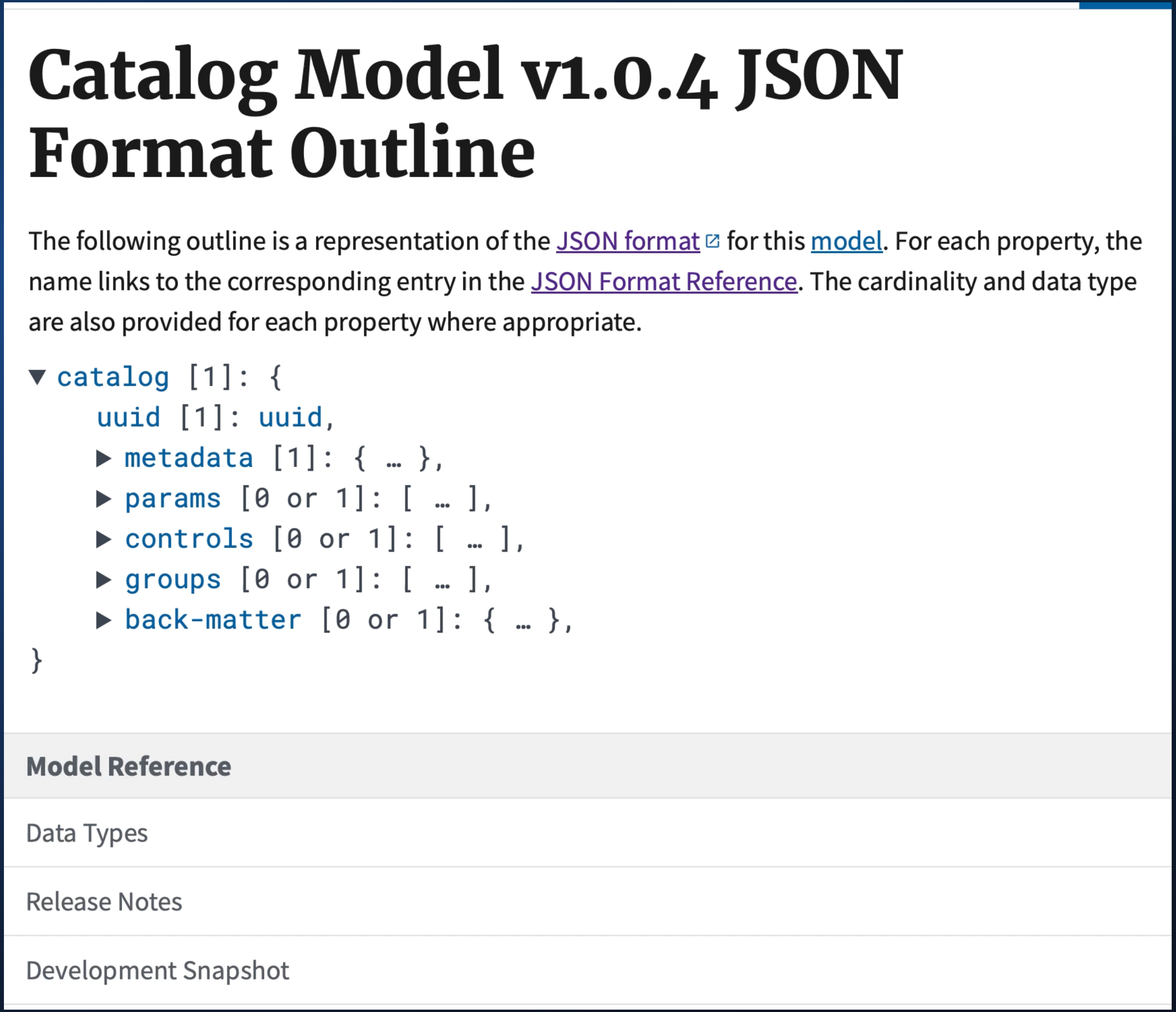


Catalog Model v1.0.4 JSON Format Outline

The following outline is a representation of the JSON format for this model. For each property, the name links to the corresponding entry in the JSON Format Reference. The cardinality and data type are also provided for each property where appropriate.

```
▼ catalog [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ params [0 or 1]: [ … ],
  ▶ controls [0 or 1]: [ … ],
  ▶ groups [0 or 1]: [ … ],
  ▶ back-matter [0 or 1]: { … },
}
```

Model Reference

Data Types

Release Notes

Development Snapshot

OSCAL Profile Model

Used to establish a baseline of controls to be implemented with a system.

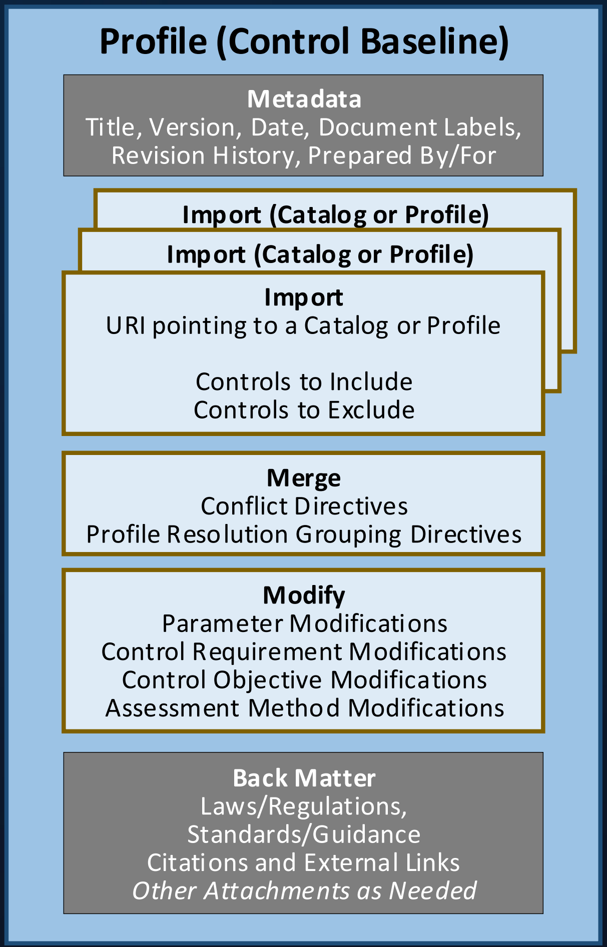
- **Metadata:** Same for each OSCAL model

- **Import:** Identifies an OSCAL catalog or other profile to import controls from
  - A control must be imported to be included in a baseline.
  - All parameters and back-matter resources cited by an imported control are also imported.

- **Merge:** Provides directives used to organize controls and to resolve conflicts when the same control is imported multiple times

- **Modify:** Allows tailoring of imported controls, including their parameters, control requirement definitions, references, control objectives, and assessment actions.

- **Back Matter:** Same for each OSCAL model



Profile (Control Baseline)

Metadata
Title, Version, Date, Document Labels, Revision History, Prepared By/For

Import (Catalog or Profile)

Import (Catalog or Profile)

Import
URI pointing to a Catalog or Profile

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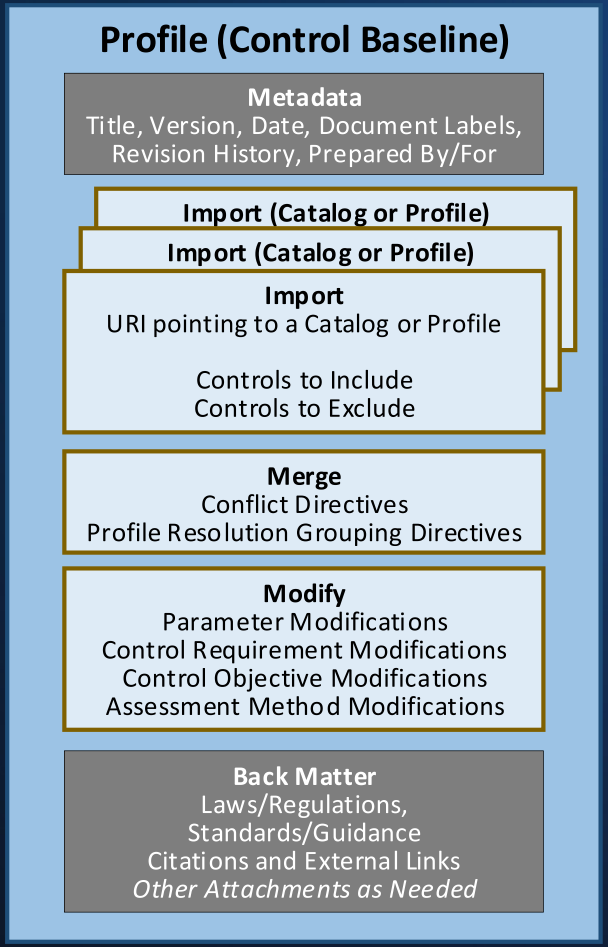
OSCAL Profile Model



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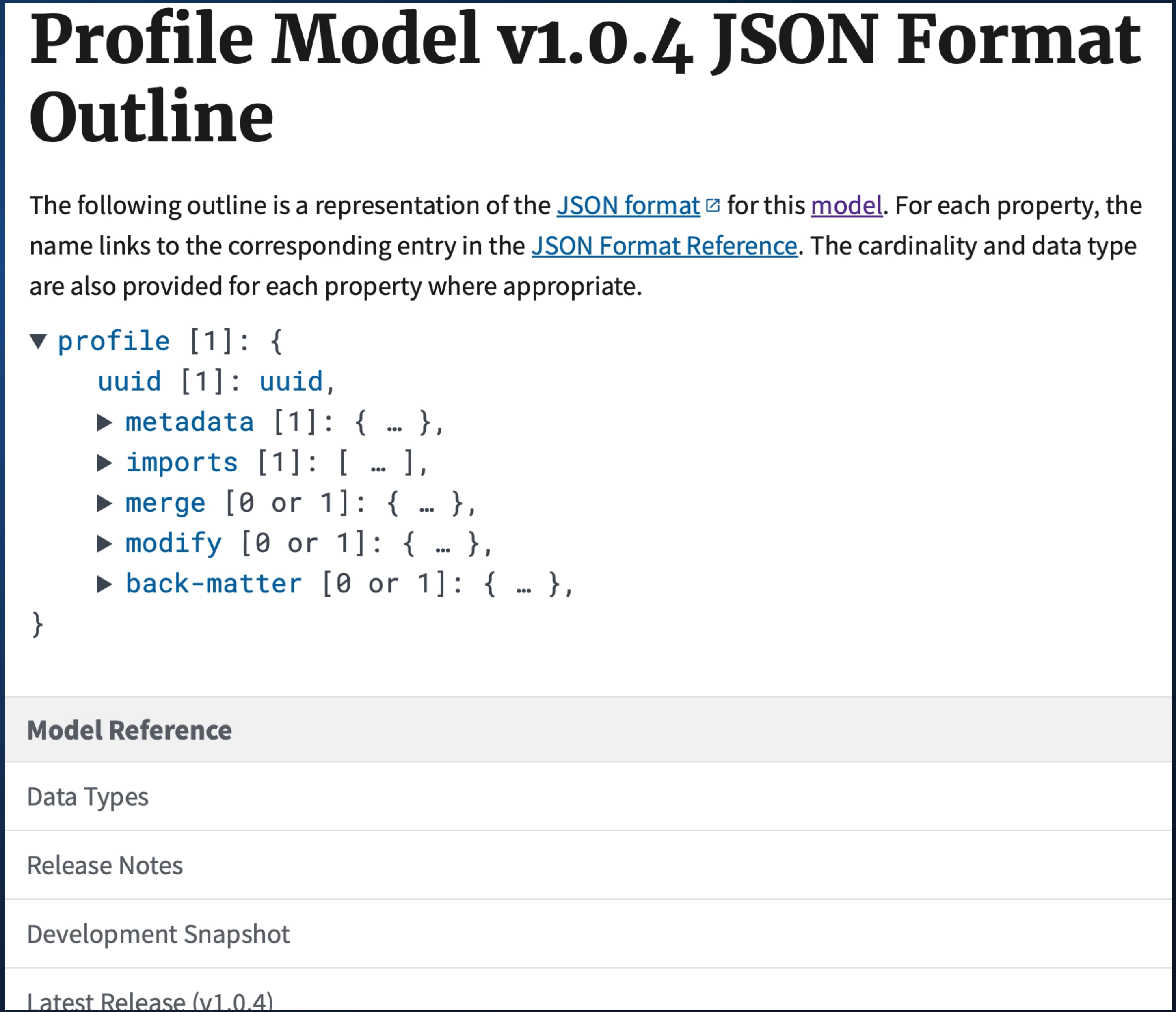
Modify
Parameter Modifications
Control Requirement Modifications
Control Objective Modifications
Assessment Method Modifications

Back Matter
Laws/Regulations,
Standards/Guidance
Citations and External Links
Other Attachments as Needed



Profile Model v1.0.4 JSON Format Outline

The following outline is a representation of the JSON format for this model. For each property, the name links to the corresponding entry in the JSON Format Reference. The cardinality and data type are also provided for each property where appropriate.

```
▼ profile [1]: {
    uuid [1]: uuid,
  ▶ metadata [1]: { … },
  ▶ imports [1]: [ … ],
  ▶ merge [0 or 1]: { … },
  ▶ modify [0 or 1]: { … },
  ▶ back-matter [0 or 1]: { … },
}
```

Model Reference

Data Types

Release Notes

Development Snapshot

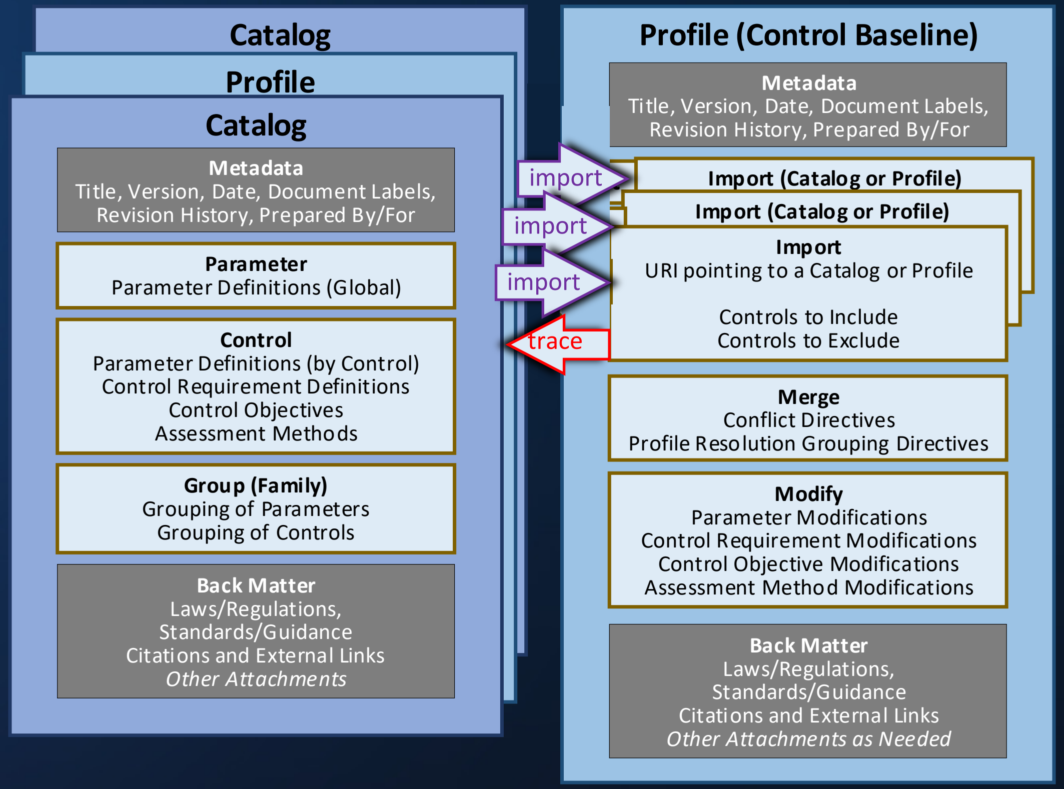
Latest Release (v1.0.4)

OSCAL Profile Model - Inheritance

A profile can import controls from:

- A catalog or multiple catalogs
- Another profile or multiple profiles

This allows a baseline to be established by customizing another baseline.



Catalog

Profile

Catalog

Metadata
Title, Version, Date, Document Labels,
Revision History, Prepared By/For

Parameter
Parameter Definitions (Global)

Control
Parameter Definitions (by Control)
Control Requirement Definitions
Control Objectives
Assessment Methods

Group (Family)
Grouping of Parameters
Grouping of Controls

Back Matter
Laws/Regulations,
Standards/Guidance
Citations and External Links
Other Attachments

Profile (Control Baseline)

Metadata
Title, Version, Date, Document Labels,
Revision History, Prepared By/For

Import (Catalog or Profile)

Import (Catalog or Profile)

Import
URI pointing to a Catalog or Profile

Controls to Include
Controls to Exclude

Merge
Conflict Directives
Profile Resolution Grouping Directives

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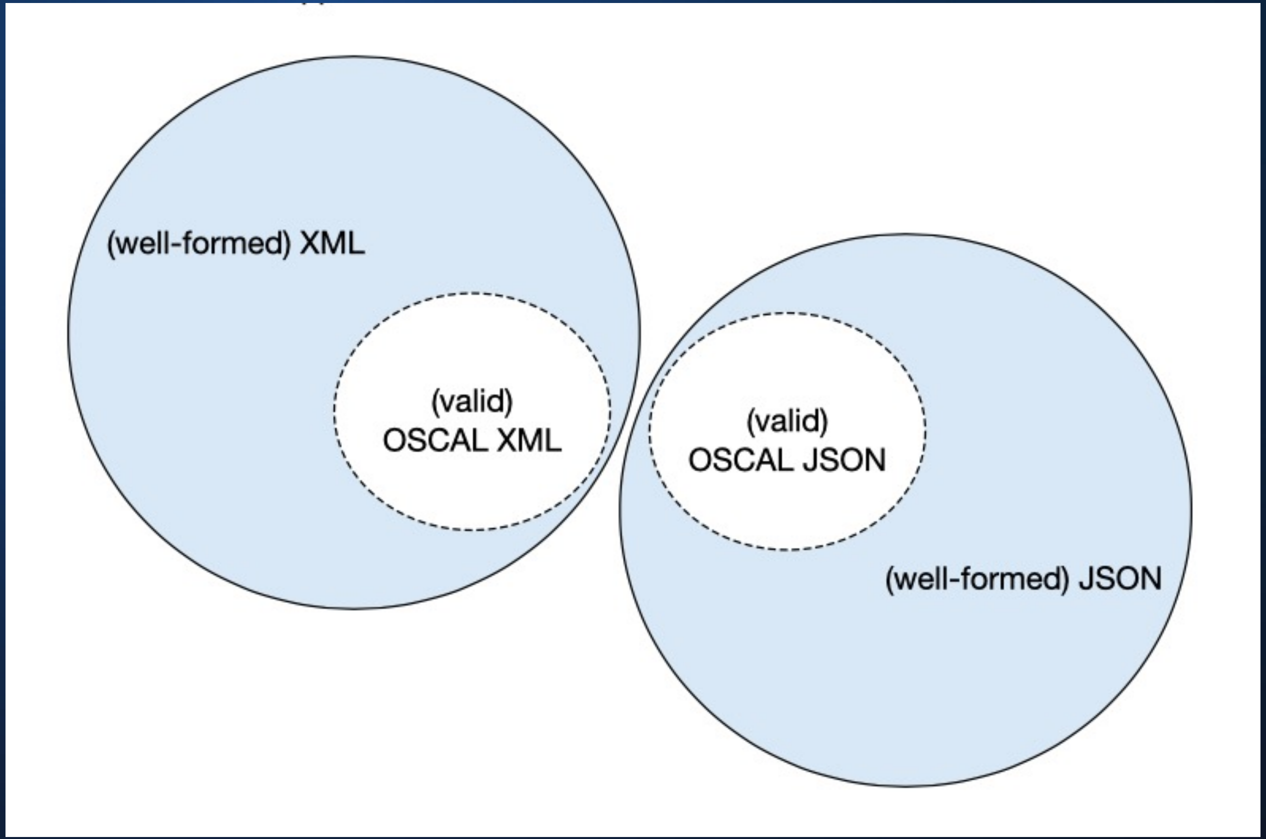
Other Attachments as Needed

OSCAL Content Validation

https://pages.nist.gov/OSCAL/concepts/validation/

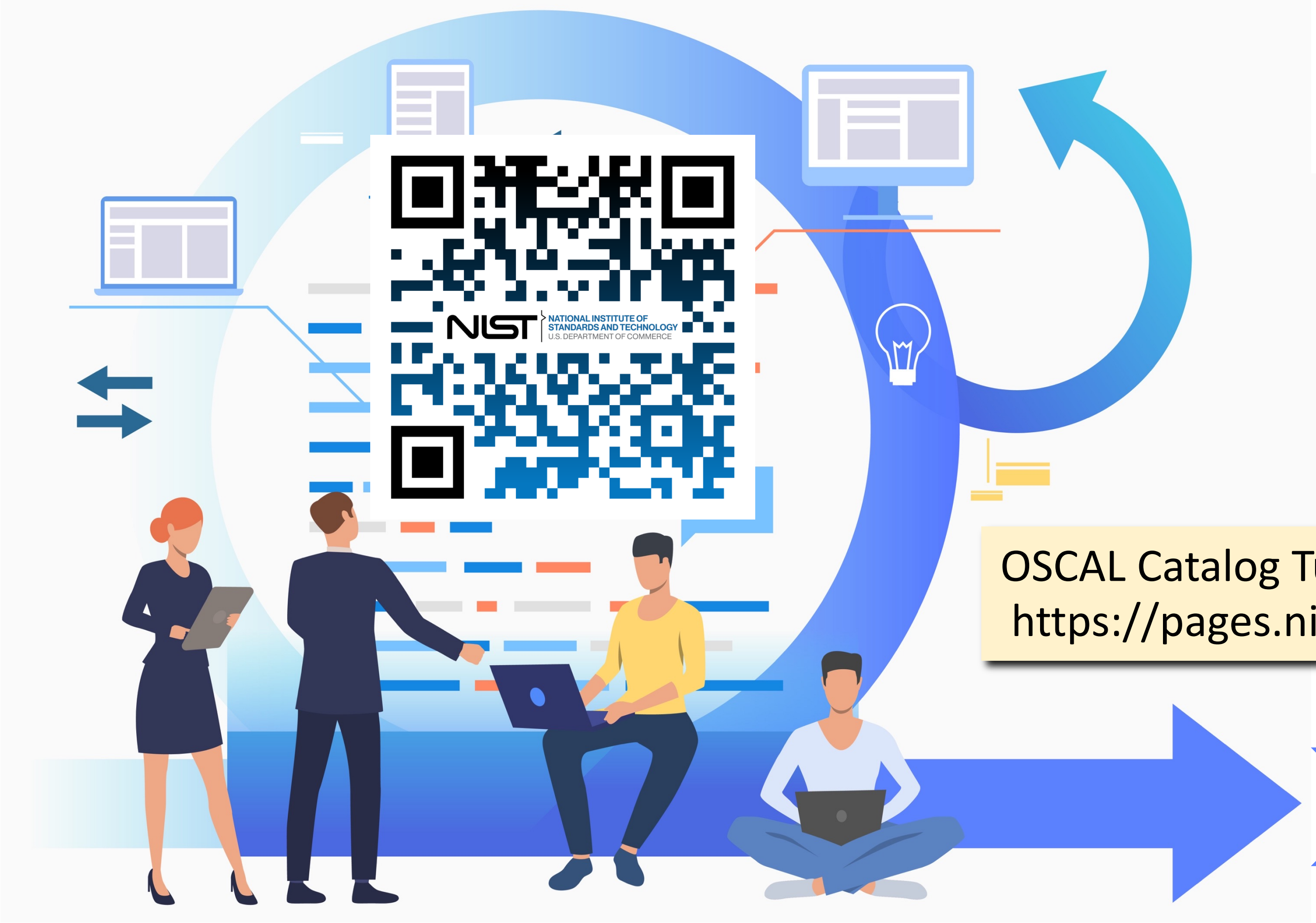
"well-formed" vs "valid” OSCAL content



XML Schema Validators:
https://www.w3.org/XML/Schema#Tools

JSON Schema Validators:
https://json-schema.org/implementations.html#validators

Rob’s Yellow Bricks Road to the FPKI OSCAL Catalog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Thank you!

OSCAL is a community-driven program!

Please join us!

OSCAL Catalog Tutorial:
https://pages.nist.gov/OSCAL/learn/tutorials/control/basic-catalog/

https://www.nist.gov/OSCAL

Contact us at: oscal@nist.gov

Subscribe to our mailing lists: oscal-dev@list.nist.gov or oscal-updates@list.nist.gov

Chat with us on Gitter: https://gitter.im/usnistgov-OSCAL/Lobby

Collaborate with us on GitHub: https://github.com/usnistgov/OSCAL

Join our COI meetings: https://pages.nist.gov/OSCAL/contribute/#community-meetings

Open Floor Discussion

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Ground Rules of Engagement

- Keep the discussion respectful by:
  - using welcoming and inclusive language
  - being respectful of differing viewpoints and experiences
  - gracefully accepting constructive criticism
  - wait for one speaker to finish before speaking
- Speak from your own experience instead of generalizing.
- Do not be afraid to respectfully challenge one another by asking questions focused on ideas not on the company or presenter.
- The final goal is not to always agree but rather gain a deeper understanding.