SPDX 3.0 - a migration journey

Gary O’Neall, co-lead SPDX tech, maintainer SPDX Java libs

Agenda

SPDX 2 to SPDX 3

- Why SPDX 3?
- The approach to creating the spec
- Overview of the changes

Impact on the Java Libraries

- Current (soon to be previous) Java Library architecture
- Breaking changes in the model causing breaking changes in the library
- Reducing the impact of the breakage
- Reducing errors translating from the spec

Why SPDX 3.0?

Simplify - profiles

Flexibility - relationship structure

Interest in SPDX for non-licensing scenarios

- supporting **security** and **safety critical** application compliance requirements.
- **AI/ML** and **datasets** increasing need for transparency

Consolidate efforts between the SPDX community & OMG/CISQ efforts

Timeline of SPDX Evolution - Use Case by Use Case

2010 SPDX begins

Standardized Single Package Information: Machine and human readable formats

2011 SPDX 1.0

Compliance Use Cases: Additional Project and License Information

2013 SPDX 1.2

Package Relations: 30+ additional use cases supported for complex packaging relationships and distribution scenarios

2015 SPDX 2.0

Security use cases: External references for vulnerabilities and product identification

2018 2.1 to ISO

2019

2020

SPDX & 3T-SBOM efforts merge: SPDX revises charter as an SDO

2021 SPDX 2.3

Free ISO Standard: ISO/IEC 5962 SPDX available

2022

Format Interoperability

CDx SPDX

2023 SPDX 3rc1

Profiles: New areas of use cases:
- Build
- Data
- Security
- AI
- Lite

2024+ SPDX 3.0

Profiles: New areas of use cases:
- Services
- Hardware
- Safety

I AM THE Cavalry

Legislation: proposed software transparency, updatability & bill of material as reqts in safety critical sectors (automotive & healthcare)

NTIA: Software Transparency begins

3T-SBOM: OMG/CISQ begins w/ CONOPs for Tool-to-Tool SBOM

SPDX 3.0 initial draft

3T-SBOM initial draft

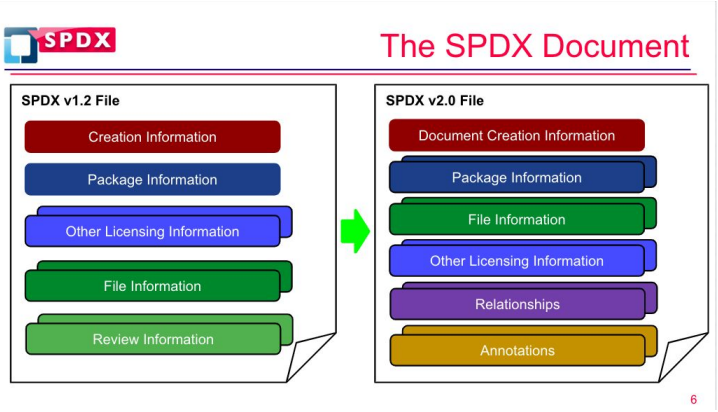
Transition of SBOM work to DHS

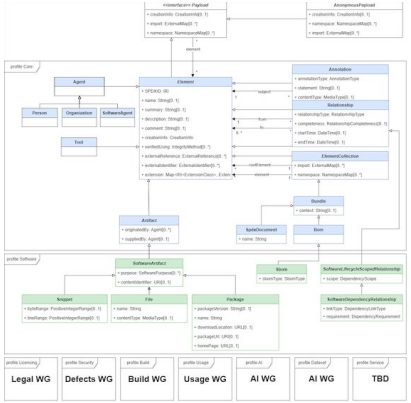
Executive Order 14028

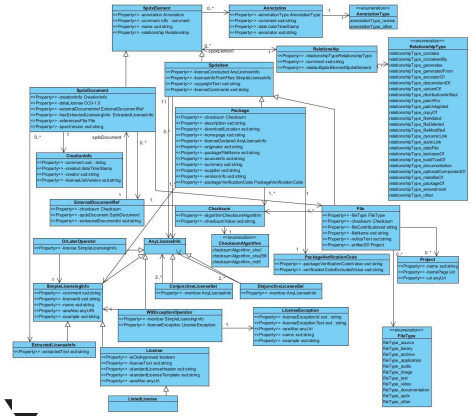
EU Cyber Resilience Act

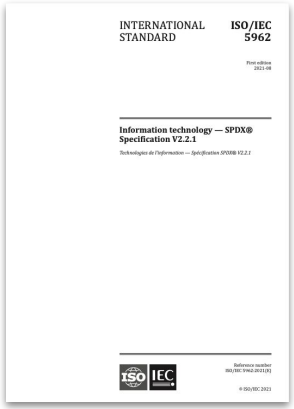
MITRE

Specification Evolution









Serialization into common formats
.json/.json-ld/.yaml/.xml/.rdf/.spdx/.xls

Online Specification

PAS ISO Submission

SPDX 3.0 Specification Infrastructure

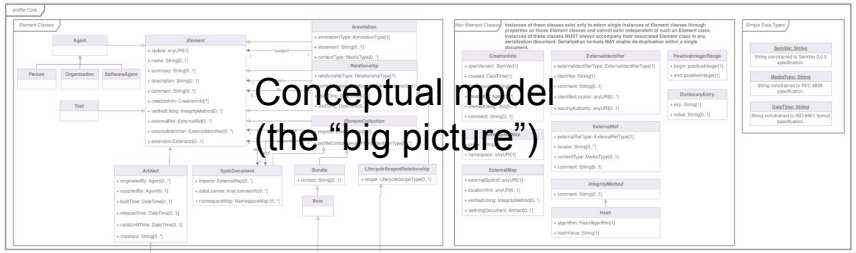
Specification is being transformed into markdown describing

- Classes, Properties, Enumerations
- Metadata (type & cardinality) and description for each element.
- Will be able to automatically generate schema from this version (for JSON, YAML, RDF, XML, tag-value, etc.) and reduce errors.

Profiles can add their own Classes and Properties and may also restrict other profiles (e.g. values, cardinalities, ...)

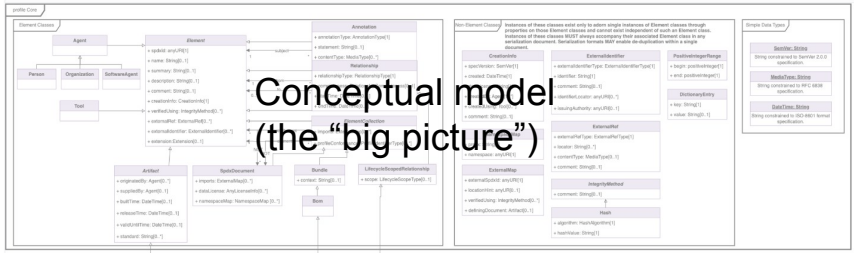
See: https://github.com/spdx/spdx-3-model

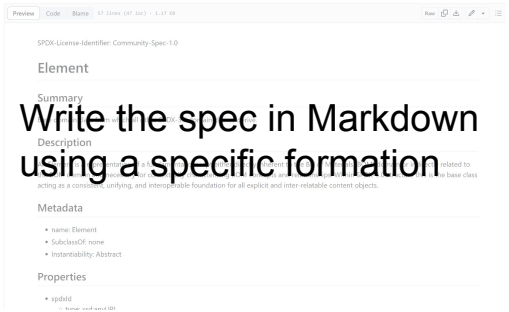
Approach to Creating the Spec



SPDX

Approach to Creating the Spec





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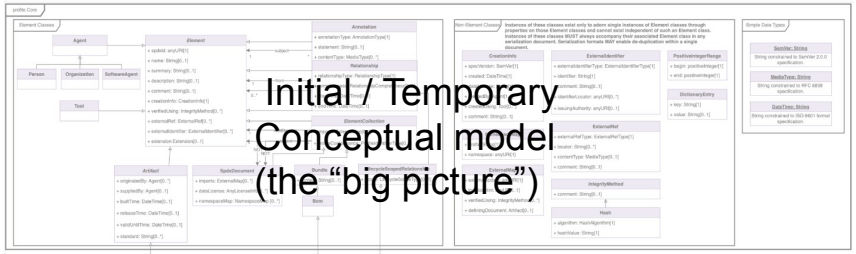
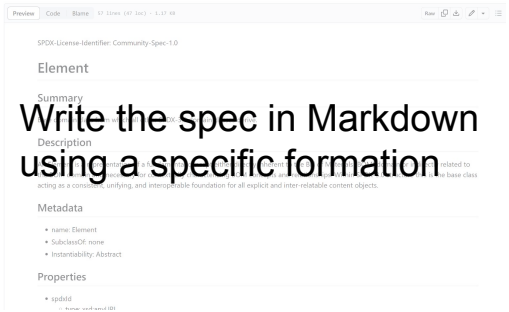
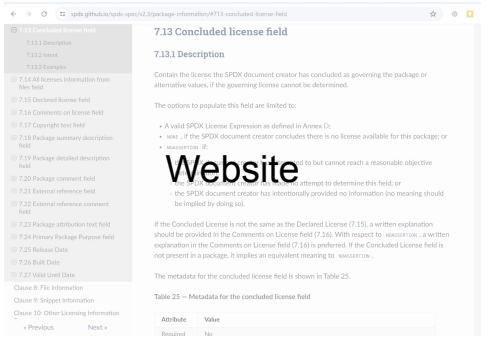


Initial / Temporary
Conceptual model
(the “big picture”)



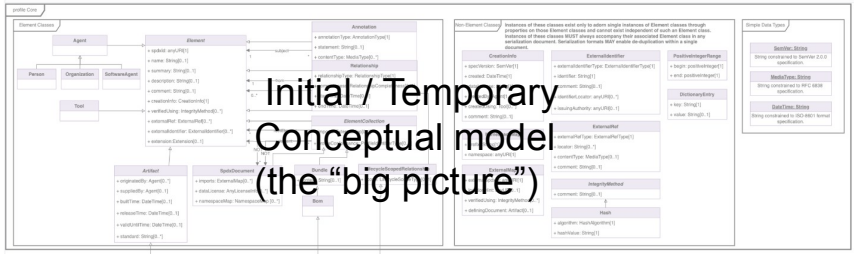
Write the spec in Markdown
using a specific formation

Tools /
Generators



Website

Approach to Creating the Spec



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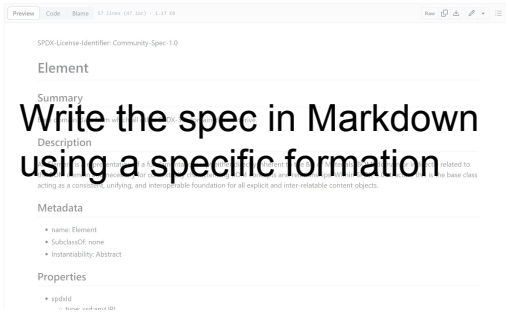

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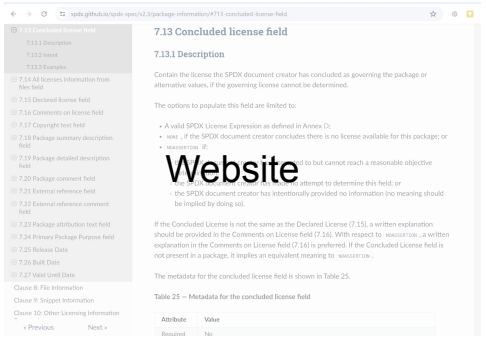

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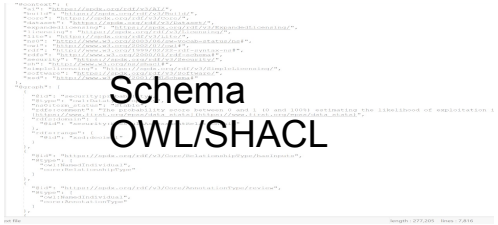
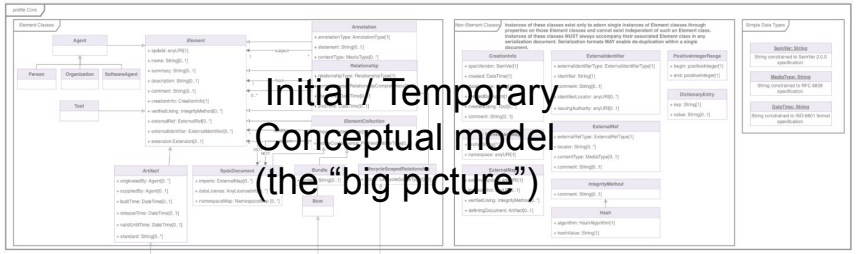


Schema
OWL/SHACL

SPDX

Approach to Creating the Spec



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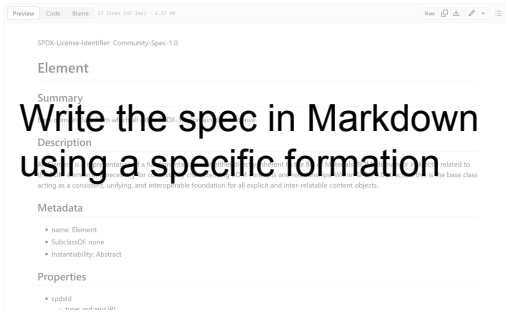

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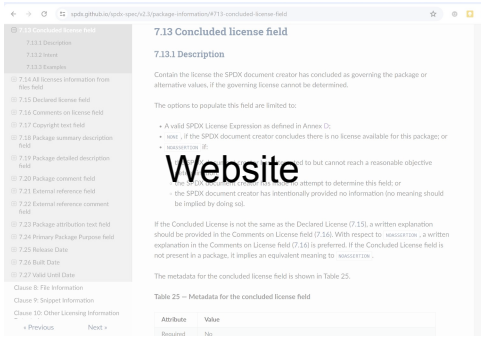

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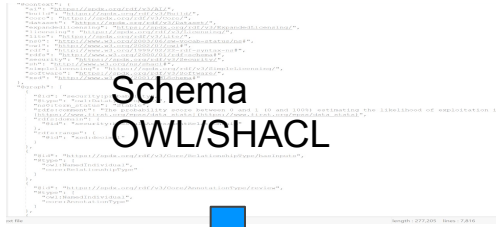

Schema
OWL/SHACL

Serialization
Schemas

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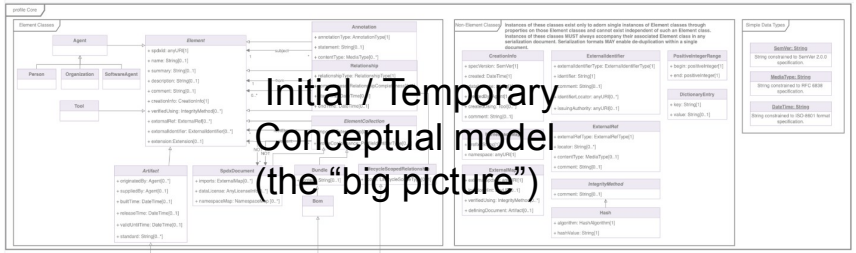
Approach to Creating the Spec



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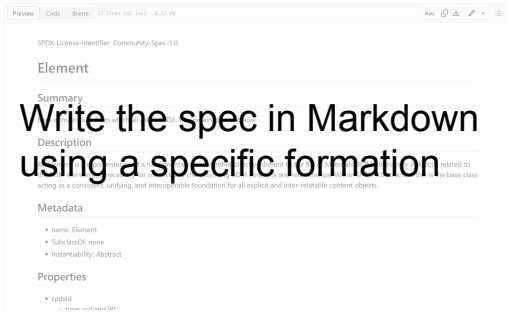

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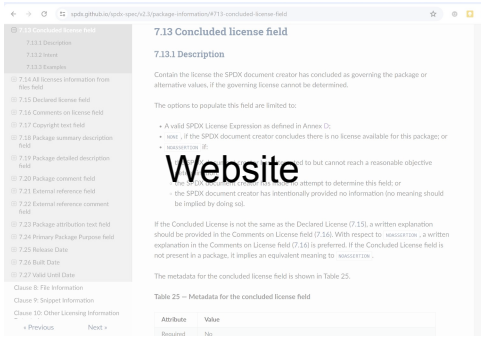

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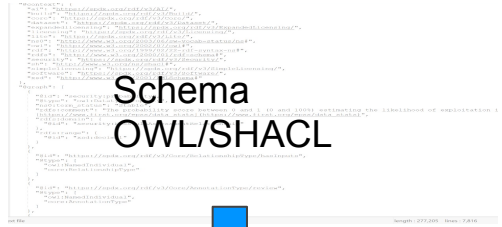

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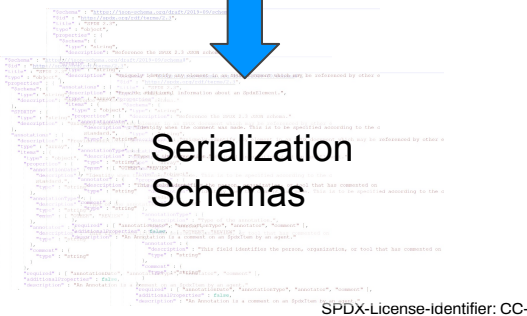

Serialization
Schemas

Ensures Consistency

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Why SHACL / OWL?

- Captures semantic constraints as well as syntax constraints
- A superset of serialization schema functionality
  - Can be used to generate any of the schemas we've identified
- Tools exist in most language ecosystems to validate

Structural Changes

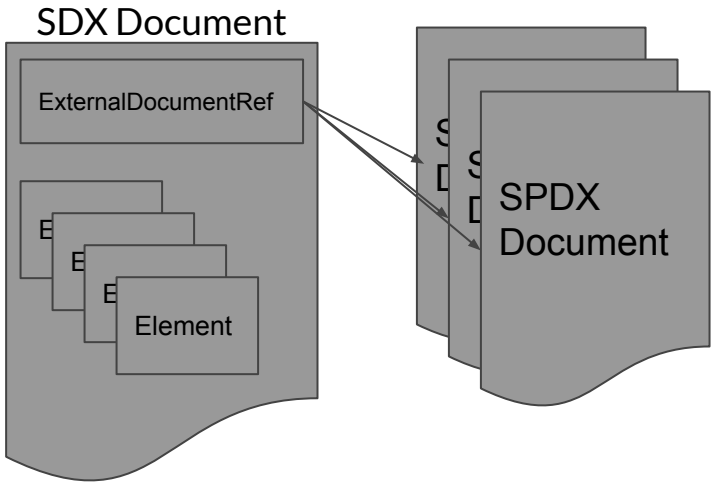
Profiles

- Conformance Requirements
  - Additional restrictions on properties (e.g. required license information in the licensing profile
- Namespace
  - Organizes the vocabulary into more logical digestible units (e.g. you don't have to know all the licensing terms if you're only interested in security)
- Organization
  - SPDX work groups are organized around profiles

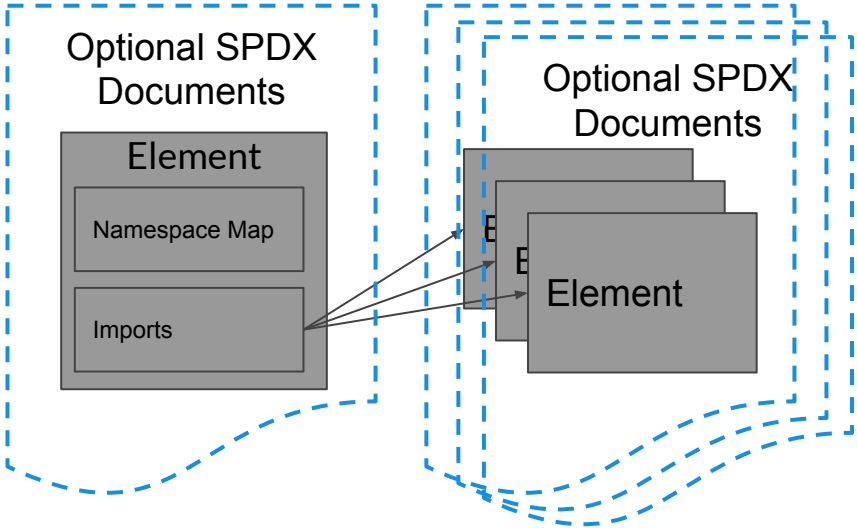
Structural Changes

External Document References

SPDX 2.3



SPDX 3.0



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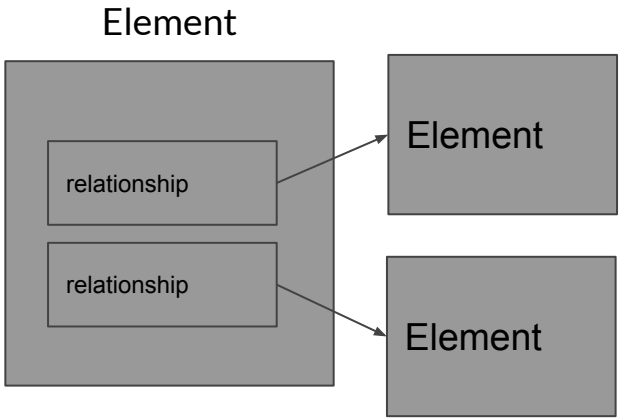
Structural Changes

Relationships

SPDX 2.3



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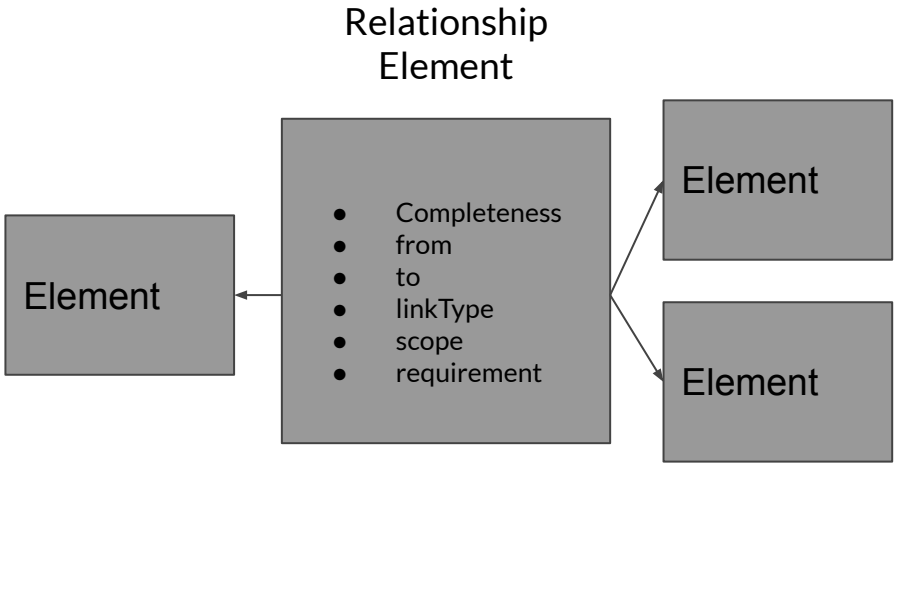

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Other SPDX 3.0 changes

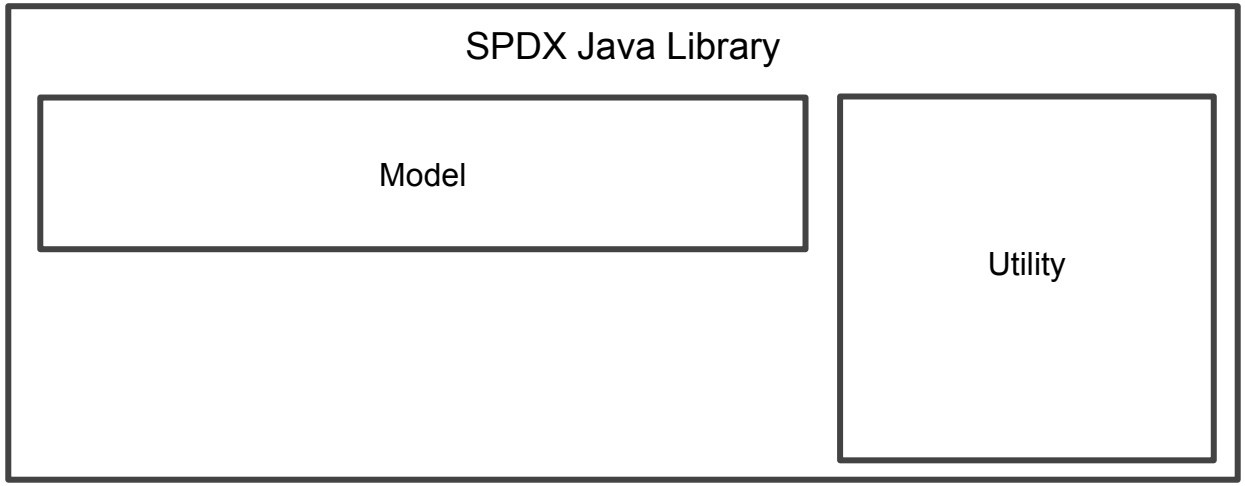
- Better model for “Entities” (person, organization, tools)
- Renamed or removed confusing properties (e.g. filesAnalyzed)
- Added some useful classes and properties (e.g. Artifact, packageUrl)
- Profile specific classes and properties
- Details: https://docs.google.com/document/d/1-olHRnX1CssUS67Psv_sAq9Vd-pc81HF8MM0hA7M0hg

Changes “Big Picture”

- More flexibility with profiles, new relationship structure, independent annotations, external map structure
- Simpler with profiles, simpler snippets, no more filesAnalyzed, clearer naming
- More use cases with profiles
- For the details - see the Migration Document:
  https://docs.google.com/document/d/1-olHRnX1CssUS67Psv_sAq9Vd-pc81HF8MM0hA7M0hg/edit?usp=sharing

Impact on Java Libraries

Current Java Library Architecture



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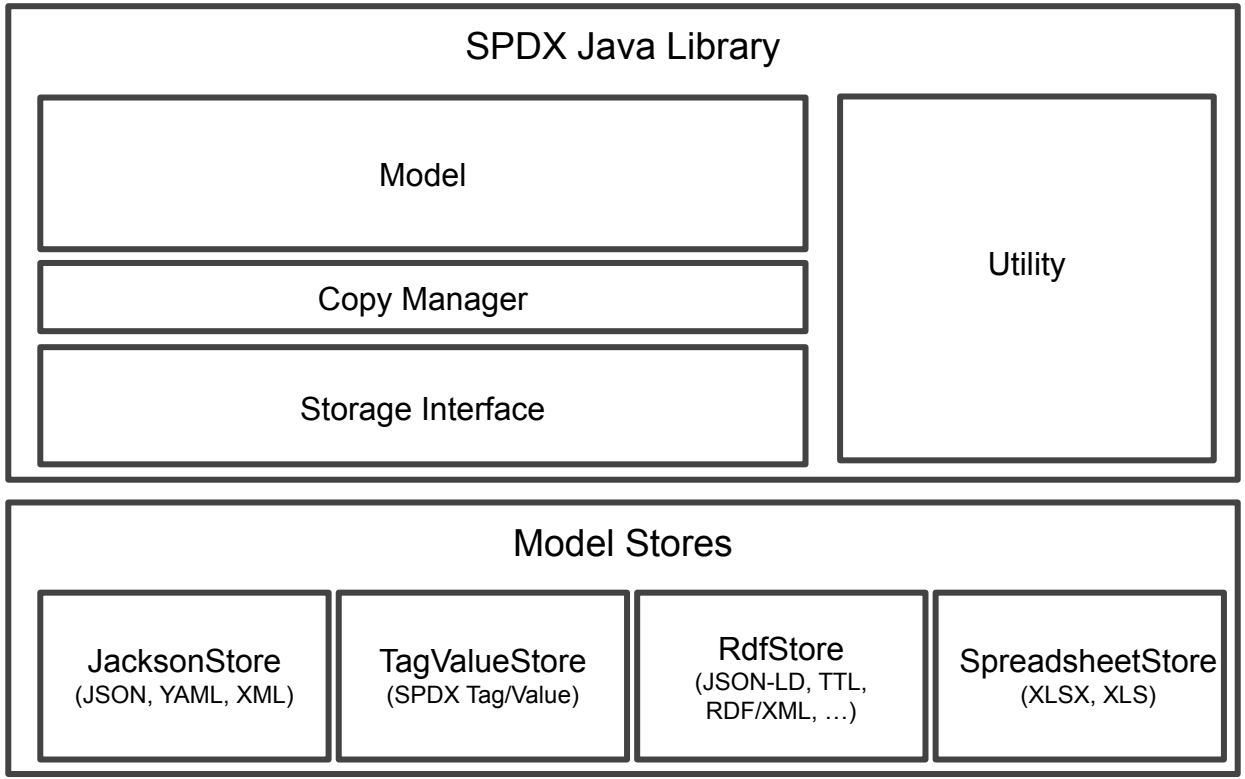
Current Java Library Architecture



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Breaking Changes in the Java Library

Storage Interface

- Expanded namespaces in profiles
  - Can no longer assume property names are unique
  - Added a “namespace” parameter in addition to the property name

public Optional<Object> getValue(String documentUri, String id, String propertyName)

public Optional<Object> getValue(String documentUri, String id, String namespace, String propertyName)

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Breaking Changes

Model

- Compatibility package if you're dealing with an SPDX 2.X document
- Relationships and Annotation structure - independent elements
- ExternalDocumentRef structure
- Replace Person/Organization strings with Agent
- Snippet simplifications
- Properties -> Relationships (e.g. packageFileName, concludedLicense)
- Plus a few other miscellaneous changes (see the migration document for details)

Reducing the Breakage

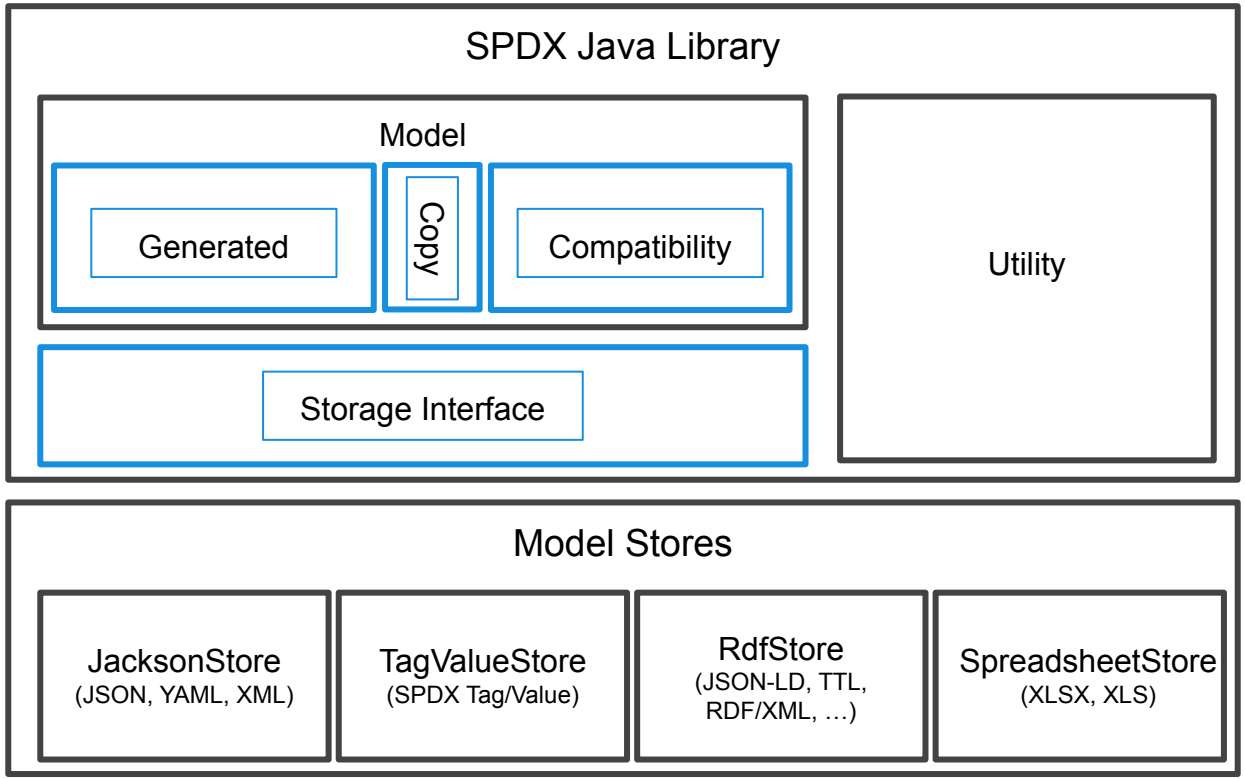
- Compatibility package with the version 2.X model
  - “CopyManager” handles upgrades from 2.X to 3.0
- SpdxModelFactory to direct you to the correct model based on SPDX spec version
  - getElements, getModelObject (by type), createModelObject (by type)
- “Relationship” list properties
  - Treats a relationship as a list property within a class
  - Can also access the relationships independently
  - Example: getConcludedLicense
- Compatible storage interface which looks up the namespace for property names

Reducing the Errors

Generating the Model Files

- Generated from the OWL/SHACL file
  - Currently implemented in Java using Mustache templates
  - Investigating switching to the Python generator written by Joshua Watt
  - Consistency from the spec markdown files all the way through the code
- Generate serialization specific schemas from the OWL/SHACL file
  - JSON Schema
  - XML Schema
- Generate verification code based on the OWL/SHACL schema
- For RDF serializations, verify directly against the OWL/SHACL schema
  - Not implemented with other serialization formats due to the “weight” of the RDF dependencies

SPDX 3.0 Java Library Architecture



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