SEDRIS visualization using X3D, and Language Bindings

ISO/IEC JTC 1/SC 24 Plenary & WG Meetings
Toulouse, France

August 6-10, 2018

Myeong Won Lee (U. of Suwon) and
Youngsoo Kwon (Intelli Korea Inc.)

Contents

- ***General concepts***
- ***STF development process***
- ***SEDRIS visualization using X3D***
- ***SEDRIS to X3D conversion***
- ***SEDRIS language bindings***
- ***Using the SEDRIS Components***
- ***Technology Components of SEDRIS***
- ***Application Data Models***

Technology Components of SEDRIS

- Spatial Reference Model (SRM): Unified and robust description of the coordinate systems, along with an accurate, efficient, and fast software implementation

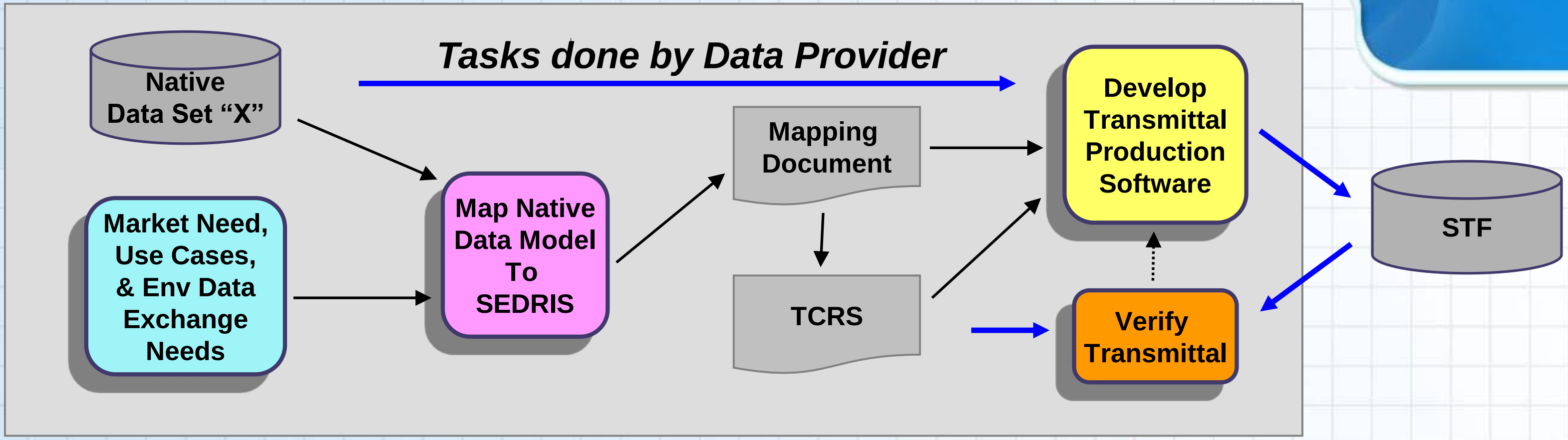
- Environmental Data Coding Specification (EDCS): Provides "thing" level semantics (the "dictionary" of the language) (classify/attribute scheme)

- Data Representation Model (DRM): Provides syntax and structural semantics for representing environmental data and databases (the "grammar" of the "language")

- SEDRIS Application Program Interface(API):
  – Allows ease of access
  – Lowers the barrier-to-entry in software development
  – Provides read, write, and modify capabilities

- SEDRIS Transmittal Format (STF): Platform independent storage and transmission of data

STF Development Steps


Tasks done by Data Provider
Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
TCRS
Develop Transmittal Production Software
Verify Transmittal
STF

Step 1: Native Requirements & Data Analysis: Define use or application plus data exchange requirements

Step 2: Develop Mapping Document: Use DRM, EDCS and SRM

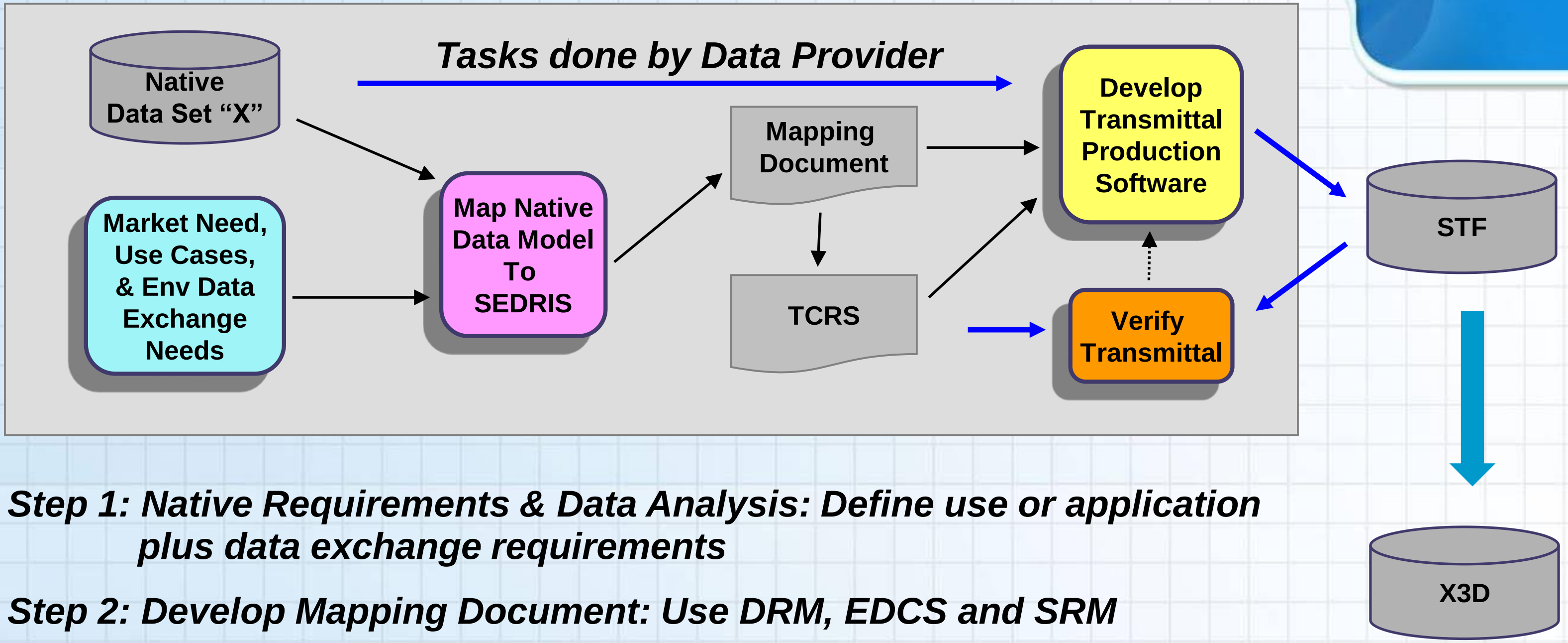
Step 3: Develop Validation Criteria -- TCRS

Step 4: Develop Production software: Add in API and STF

Step 5: Validate Transmittal: Add in tools and applications

- ***STF development steps are easier to follow than early development steps.***
  - ☑ ***Engineer want to find integrated examples with fragmentary examples***
- ***Commercial approach usually use partial functions instead of SEDRIS full functions***
  - ☑ ***Engineer want to specialize particular function for their technical area***

SEDRIS Visualization Using X3D



Tasks done by Data Provider
Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
TCRS
Develop Transmittal Production Software
Verify Transmittal
STF
X3D

Step 1: Native Requirements & Data Analysis: Define use or application plus data exchange requirements

Step 2: Develop Mapping Document: Use DRM, EDCS and SRM

Step 3: Develop Validation Criteria -- TCRS

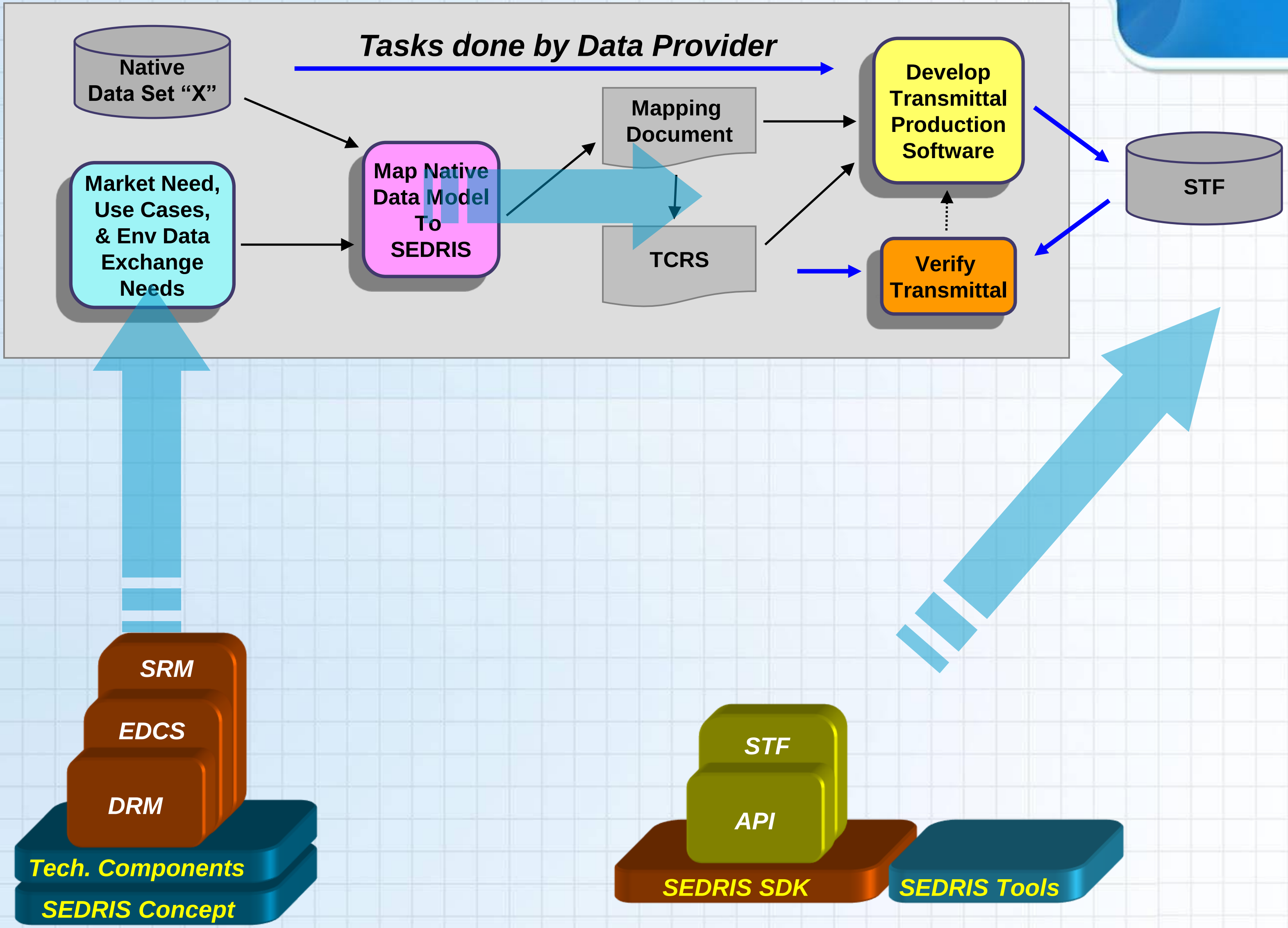
Step 4: Develop Production software: Add in API and STF

Step 5: Validate Transmittal: Add in tools and applications

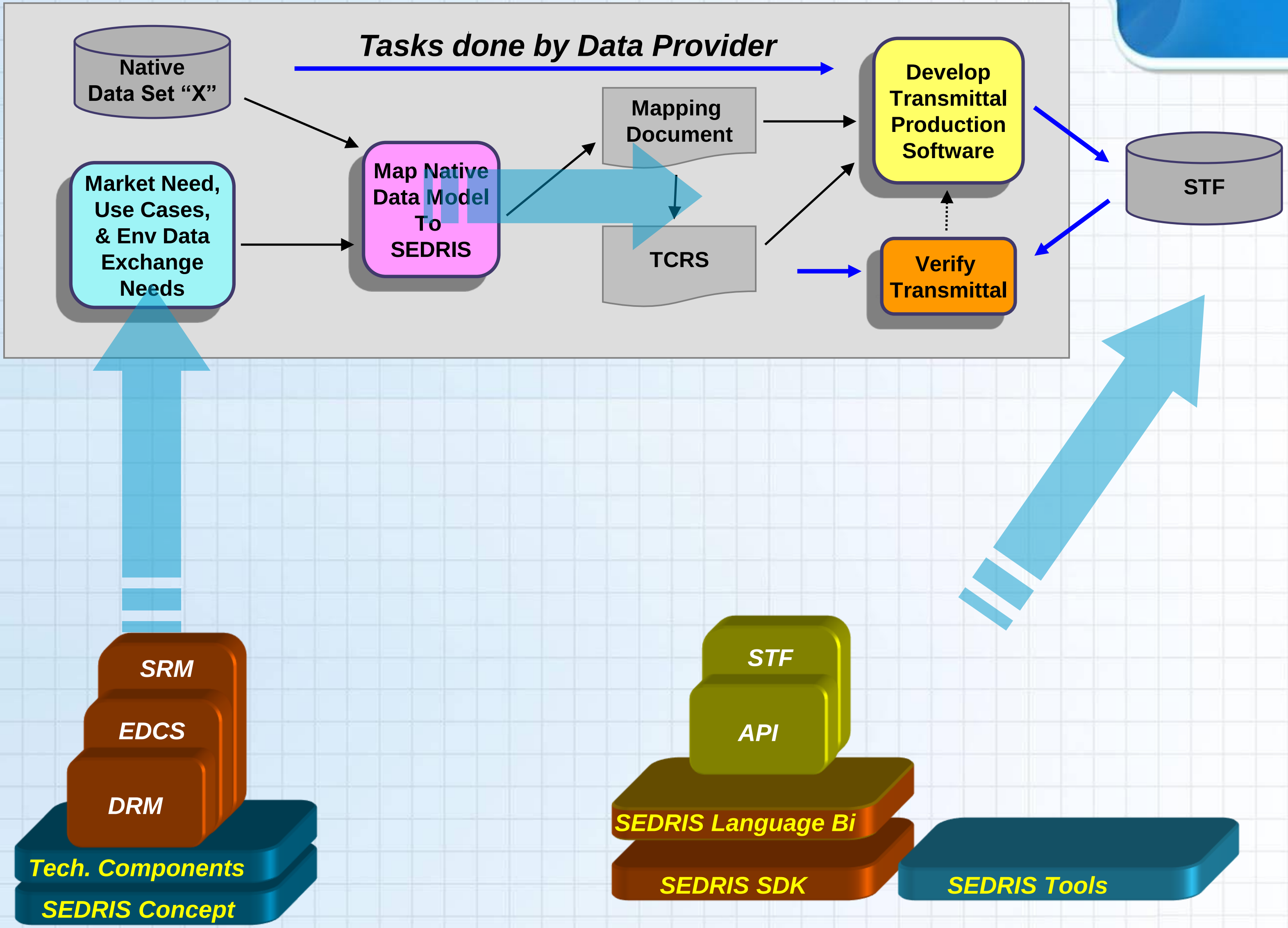
Step 6: Visualize SEDRIS data

- ***STF development steps are easier to follow than early development steps.***
  - ☑ ***Engineer want to find integrated examples with fragmentary examples***
- ***Commercial approach usually use partial functions instead of SEDRIS full functions***
  - ☑ ***Engineer want to specialize particular function for their technical area***

SEDRIS Components and STF

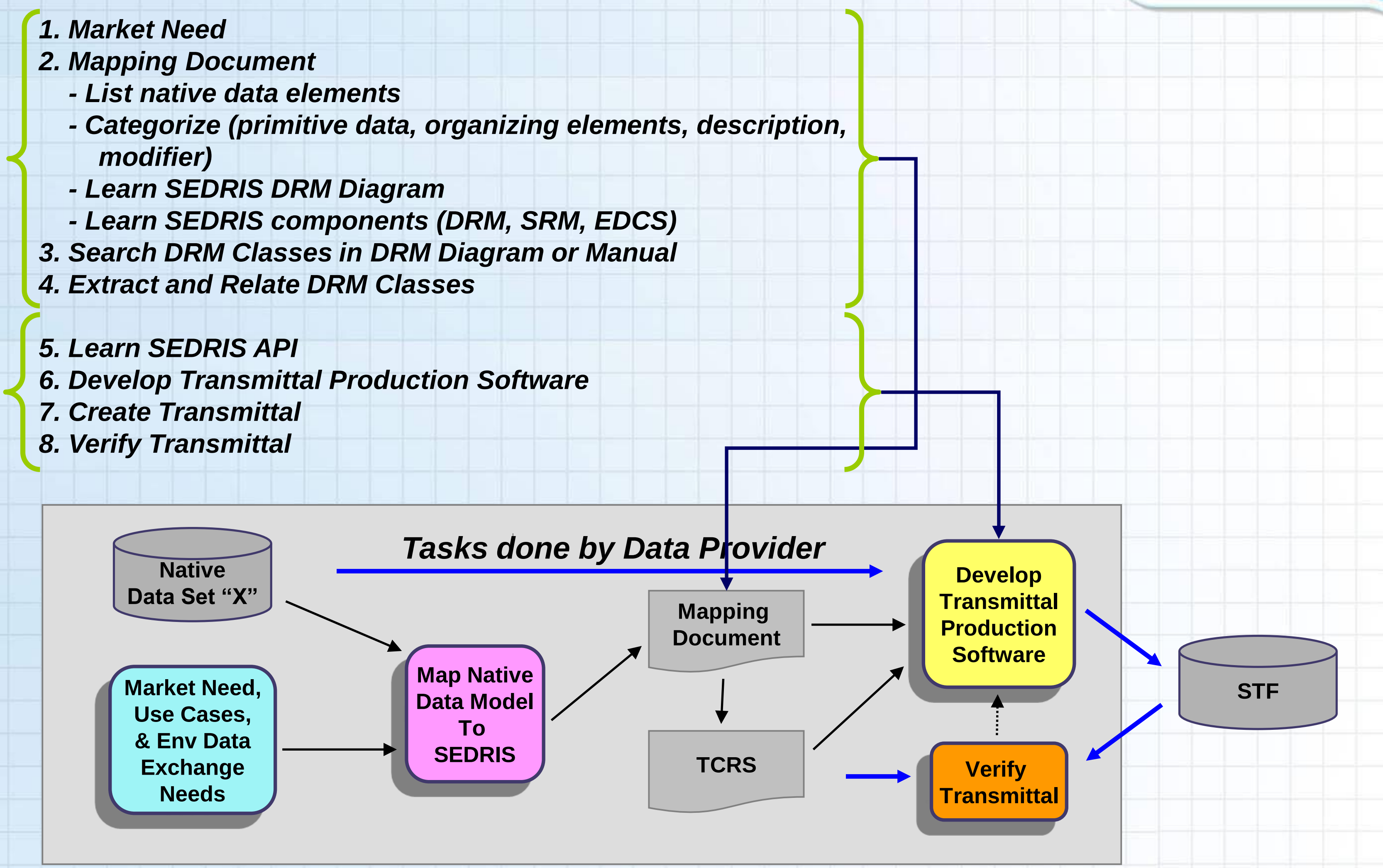

Tasks done by Data Provider
Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
TCRS
Develop Transmittal Production Software
Verify Transmittal
STF
SRM
EDCS
DRM
Tech. Components
SEDRIS Concept
STF
API
SEDRIS SDK
SEDRIS Tools

SEDRIS Language Binding


Tasks done by Data Provider
Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
TCRS
Develop Transmittal Production Software
Verify Transmittal
STF
SRM
EDCS
DRM
Tech. Components
SEDRIS Concept
STF
API
SEDRIS Language Bi
SEDRIS SDK
SEDRIS Tools

The Current Working Step

Current Working Process



1. Market Need

2. Mapping Document

- List native data elements

- Categorize (primitive data, organizing elements, description, modifier)

- Learn SEDRIS DRM Diagram

- Learn SEDRIS components (DRM, SRM, EDCS)

3. Search DRM Classes in DRM Diagram or Manual

4. Extract and Relate DRM Classes

5. Learn SEDRIS API

6. Develop Transmittal Production Software

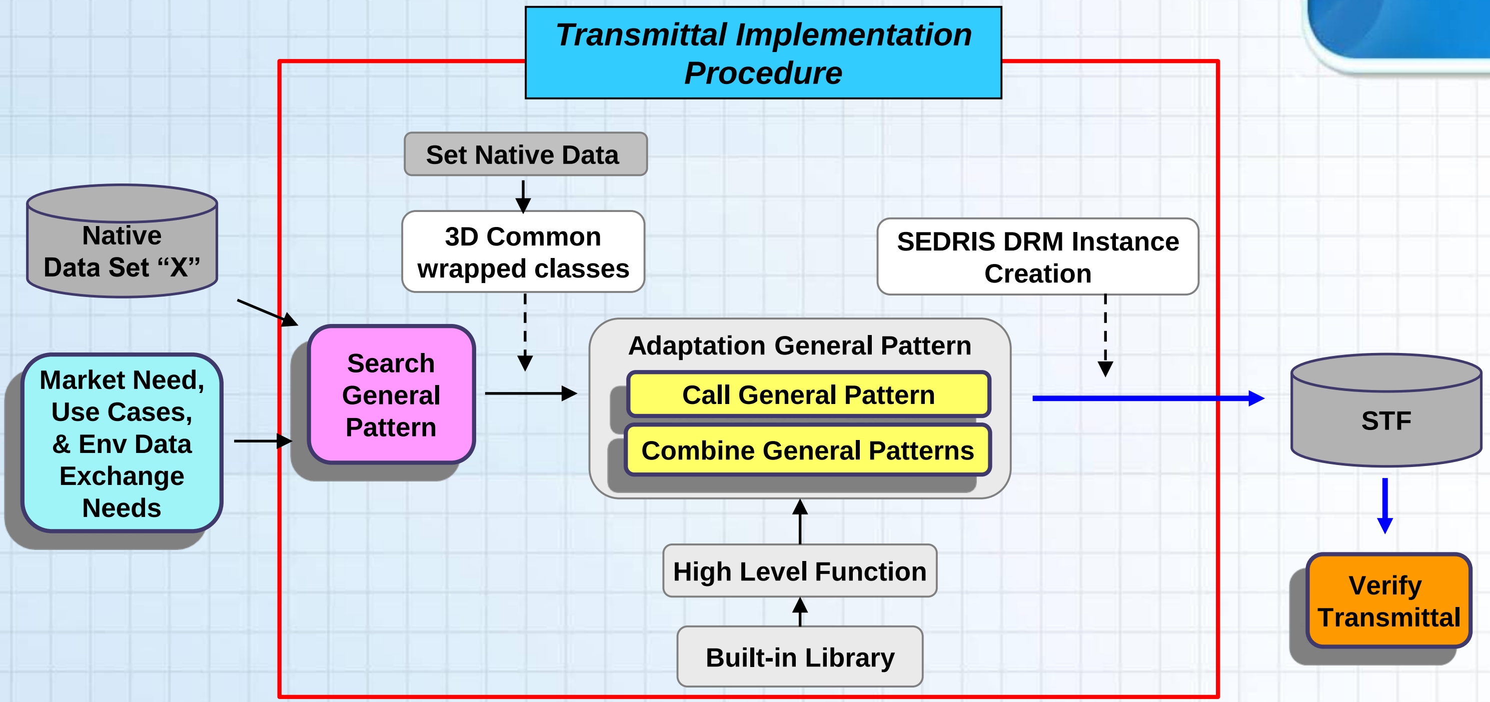
7. Create Transmittal

8. Verify Transmittal

Tasks done by Data Provider

Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
TCRS
Develop Transmittal Production Software
Verify Transmittal
STF

The Working Step with Mapping Method



Transmittal Implementation Procedure

Native Data Set "X"

Market Need, Use Cases, & Env Data Exchange Needs

Search General Pattern

Set Native Data

3D Common wrapped classes

SEDRIS DRM Instance Creation

Adaptation General Pattern

Call General Pattern

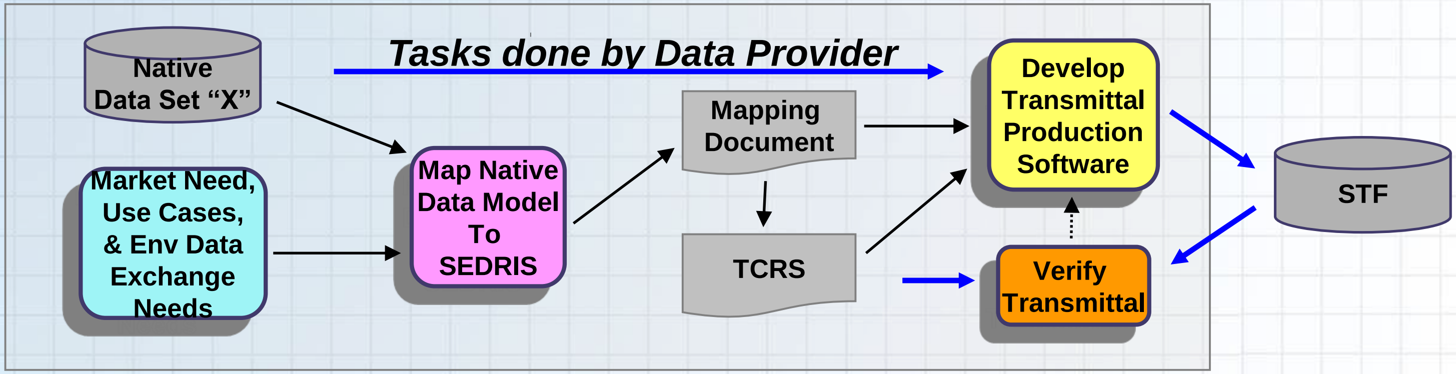
Combine General Patterns

High Level Function

Built-in Library

STF

Verify Transmittal



Tasks done by Data Provider

Native Data Set "X"

Market Need, Use Cases, & Env Data Exchange Needs

Map Native Data Model To SEDRIS

Mapping Document

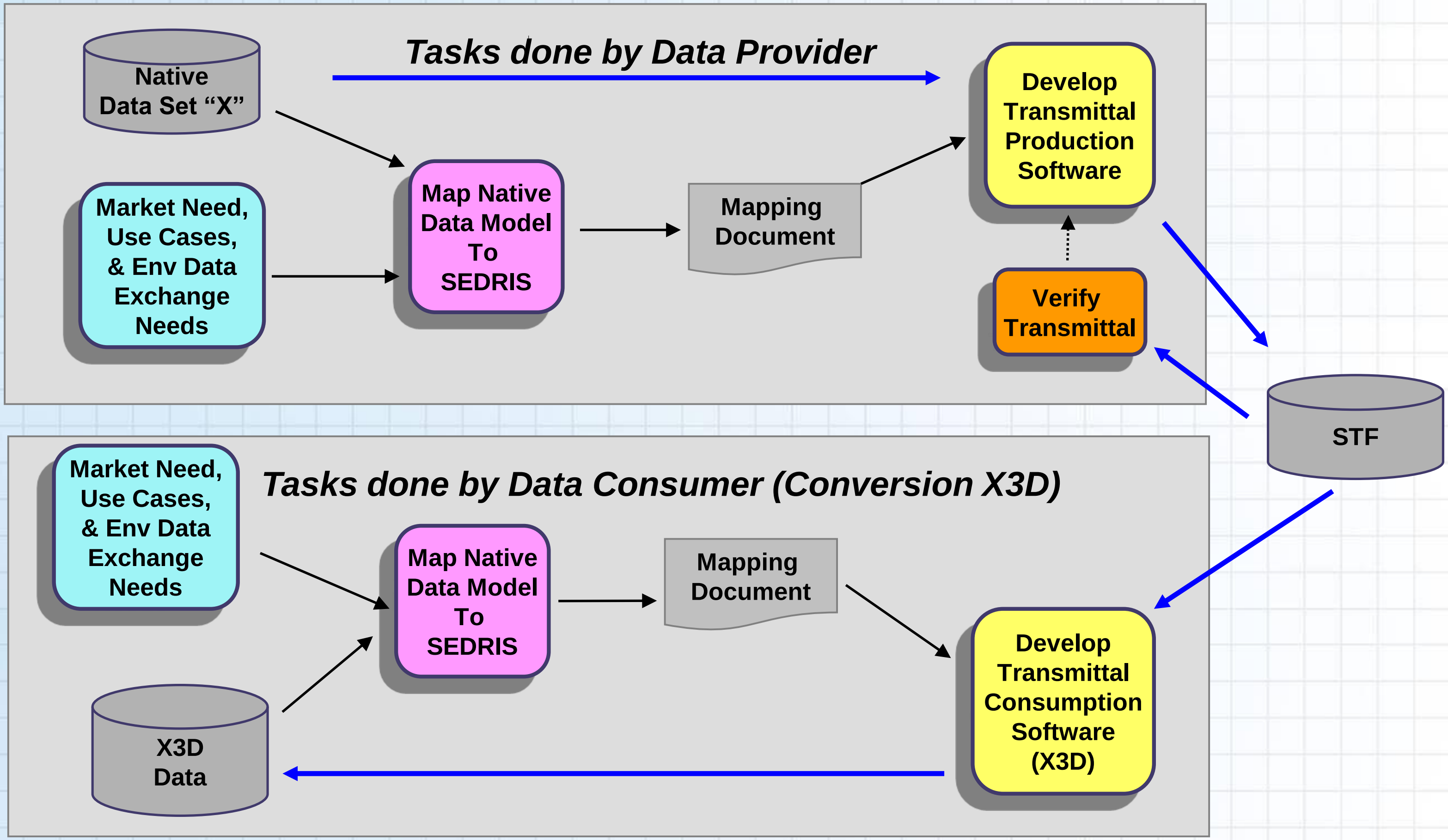
TCRS

Develop Transmittal Production Software

Verify Transmittal

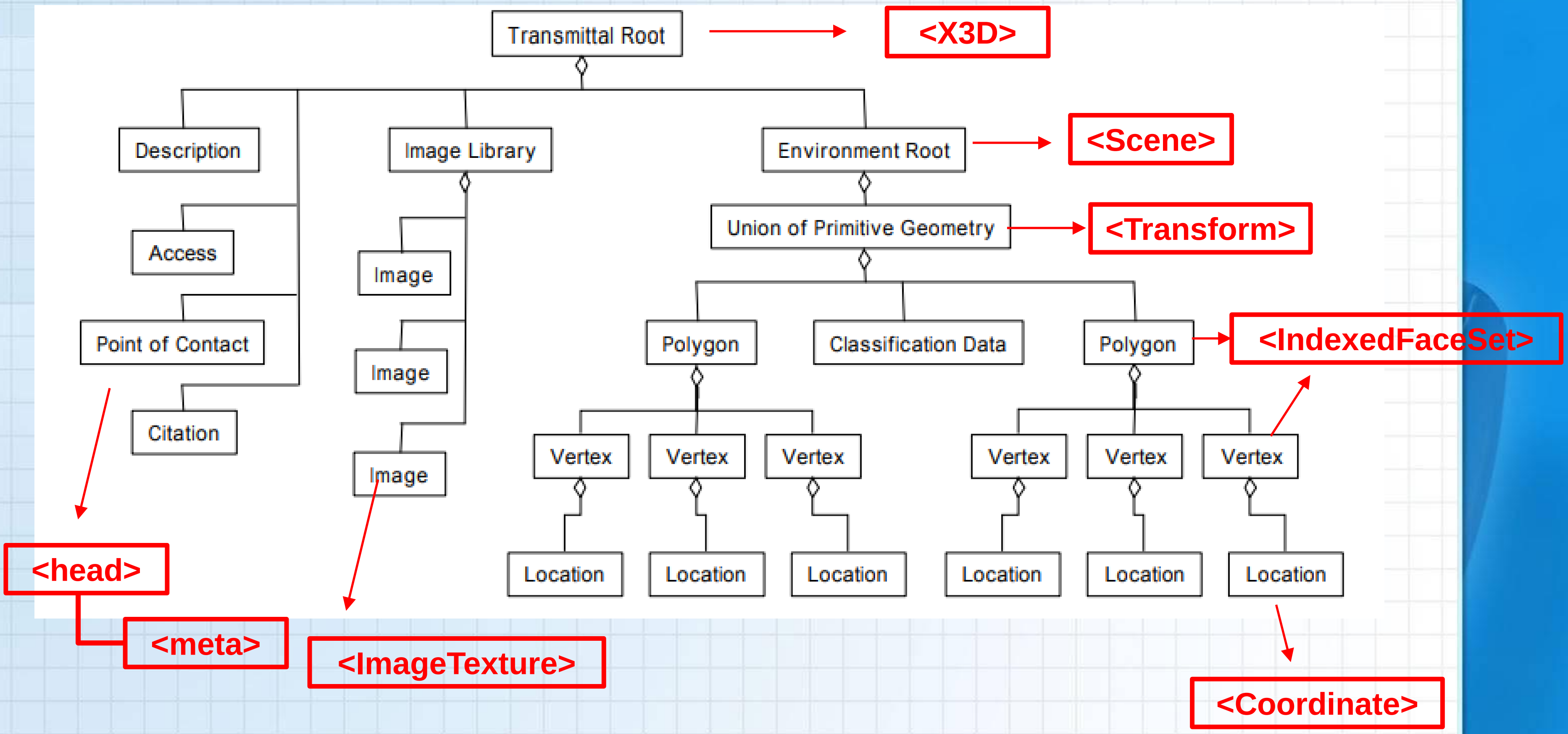
STF

The SEDRIS Production and Consumption Process (X3D)

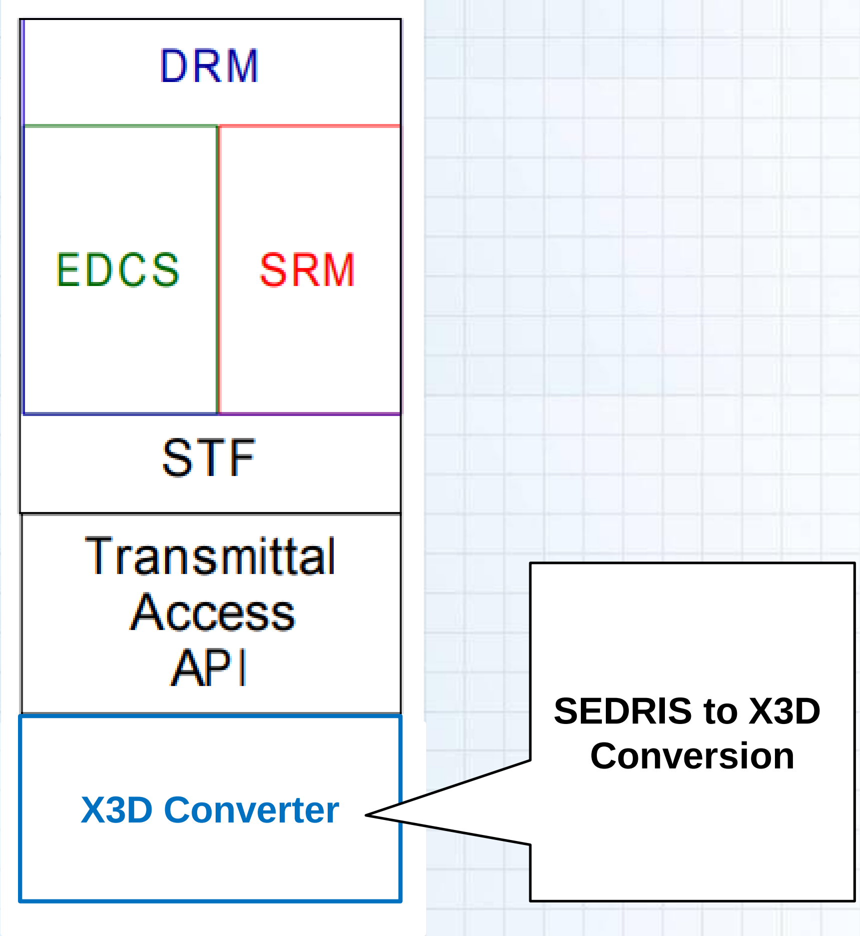


Tasks done by Data Provider
Native Data Set "X"
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
Develop Transmittal Production Software
Verify Transmittal
STF
Tasks done by Data Consumer (Conversion X3D)
Market Need, Use Cases, & Env Data Exchange Needs
Map Native Data Model To SEDRIS
Mapping Document
Develop Transmittal Consumption Software (X3D)
X3D Data

SEDRIS To X3D Conversion



X3D Converter



DRM

EDCS

SRM

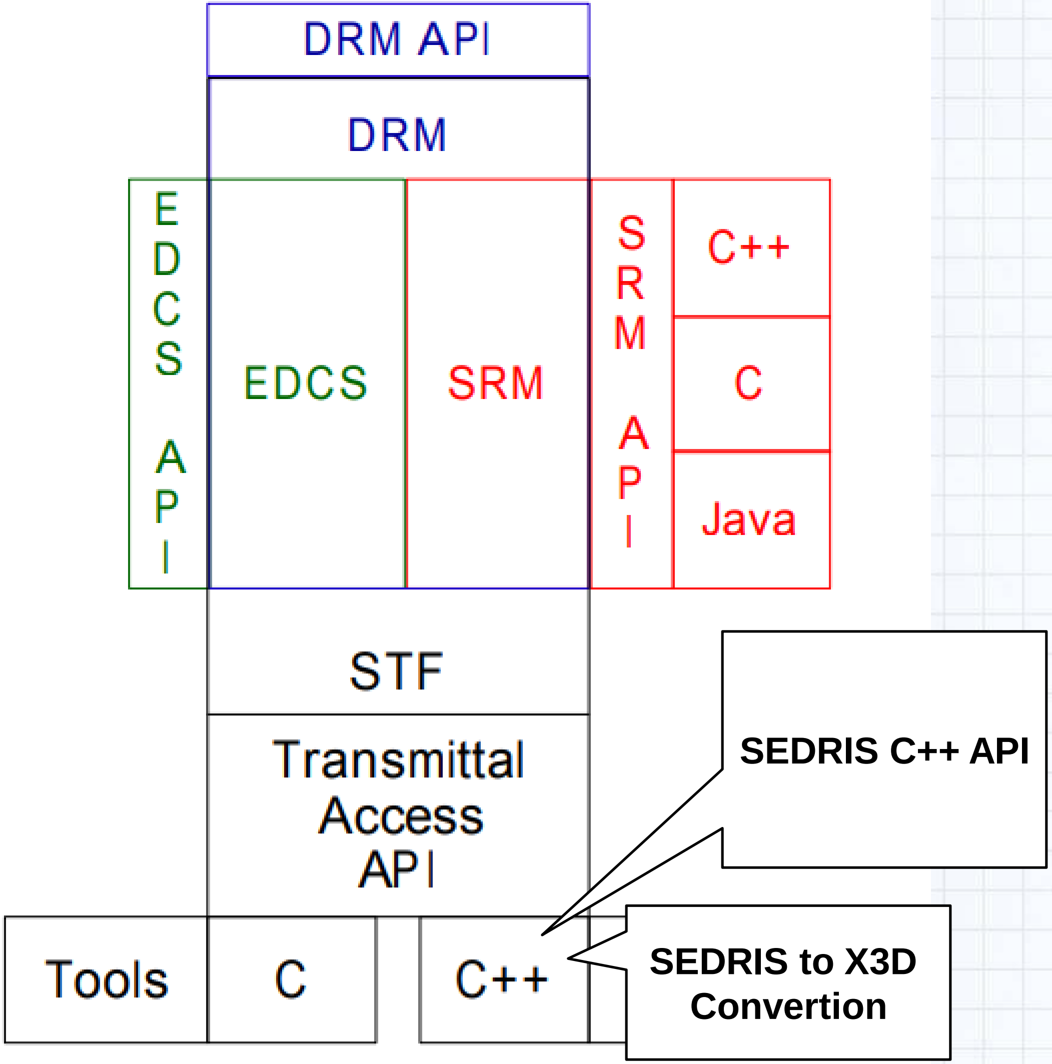
STF

Transmittal Access API

X3D Converter

SEDRIS to X3D Conversion

SEDRIS Components



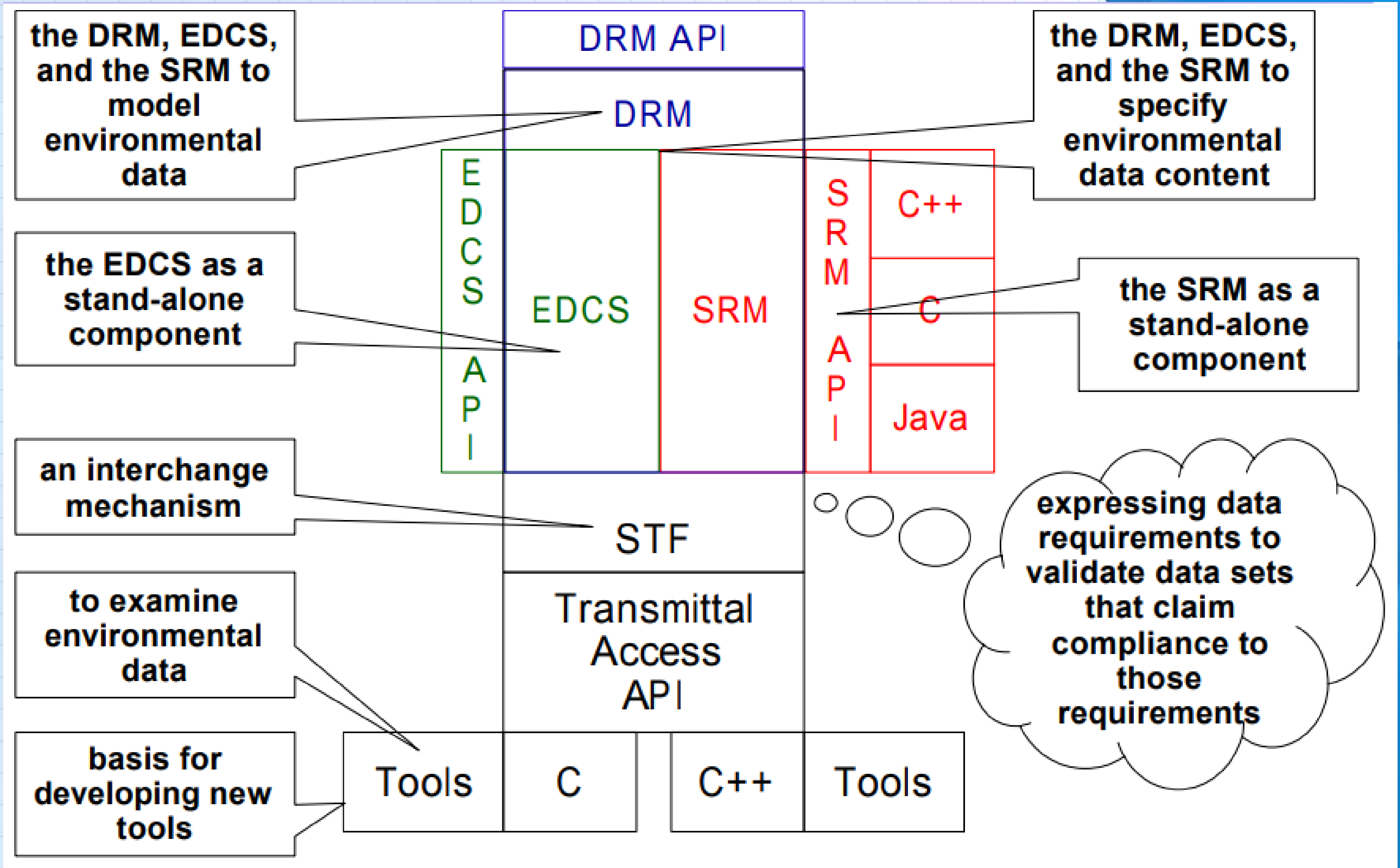
SEDRIS C++ API

SEDRIS to X3D Convertion

Using the SEDRIS Componets

- The SEDRIS API is an encapsulation of functionality which provides applications the ability to access DRM objects.
- The SEDRIS API is Transmittal Access API, DRM API, SRM API, EDCS API
- The Transmittal Access API implementation relies on the DRM, SRM, and EDCS APIs
- The Transmittal Access API deals with transmittals and objects within those transmittal
- Every object has a unique string within a transmittal, referred to as the “object id”

Using the SEDRIS Componets



the DRM, EDCS, and the SRM to model environmental data

the EDCS as a stand-alone component

an interchange mechanism

to examine environmental data

basis for developing new tools

the DRM, EDCS, and the SRM to specify environmental data content

the SRM as a stand-alone component

expressing data requirements to validate data sets that claim compliance to those requirements

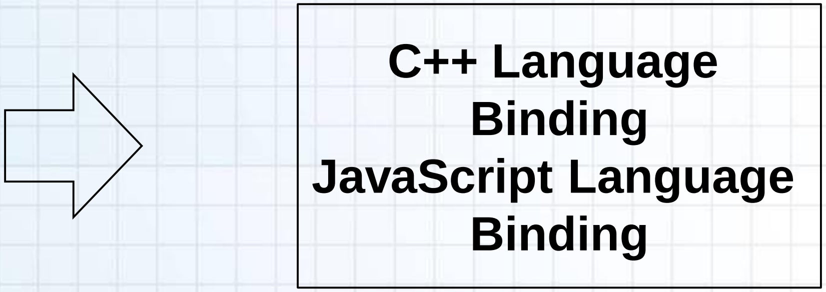
Transmittal Access API Functionality

- **Transmittal Functionality**
  - ✓ SE_OpenTransmittalByFile
  - ✓ SE_OpenTransmittalByName
  - ✓ SE_CloseTransmittal
  - ✓ SE_GetTransmittalFromObject
  - ✓ SE_FreeTransmittal
  - ✓ SE_GetTransmittalFile
  - ✓ SE_GetTransmittalName
  - ✓ SE_GetTransmittalVersionInformation
  - ✓ SE_GetUniqueTransmittalID
  - ✓ SE_SetTransmittalName
  - ✓ SE_TransmittalsAreSame

C++ Language Binding
JavaScript Language Binding

Transmittal Access API Functionality

- **Object instance functionality:**
  - ✓ SE_GetRootObject
  - ✓ SE_SetRootObject
  - ✓ SE_CreateObject
  - ✓ SE_CloneObject
  - ✓ SE_RemoveFromTransmittal
  - ✓ SE_FreeObject
  - ✓ SE_GetIDForObject
  - ✓ SE_GetObjectForID
  - ✓ SE_GetPackedHierarchy
  - ✓ SE_FreePackedHierarchy
  - ✓ SE_GetRemainingObjectsList
  - ✓ SE_FreeRemainingObjectsList
  - ✓ SE_GetRemainingPackedHierarchiesList
  - ✓ SE_FreeRemainingPackedHierarchiesList
  - ✓ SE_GetDRMClass
  - ✓ SE_GetFields
  - ✓ SE_PutFields
  - ✓ SE_ObjectsAreSame



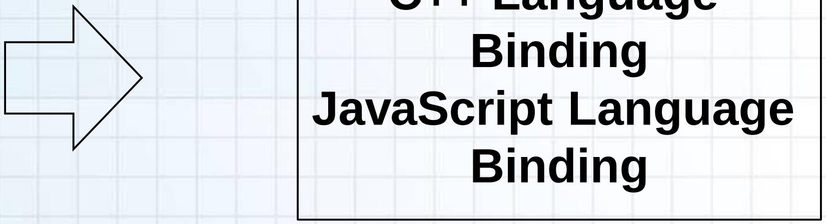
C++ Language Binding

JavaScript Language Binding

Transmittal Access API Functionality

- **Relationship Management:**
  - ✓ SE_AddAssociateRelationship
  - ✓ SE_AddComponentRelationship
  - ✓ SE_RemoveAssociateRelationship
  - ✓ SE_RemoveComponentRelationship
  - ✓ SE_GetObjectReferenceCount
  - ✓ SE_GetRelationCounts

- **Traversal/Extraction:**
  - ✓ SE_GetAggregate
  - ✓ SE_GetAssociate
  - ✓ SE_GetComponent
  - ✓ SE_InitializeAggregateIterator
  - ✓ SE_InitializeAssociateIterator
  - ✓ SE_InitializeComponentIterator
  - ✓ SE_GetIterationLengthRemaining
  - ✓ SE_GetNextObject
  - ✓ SE_FreeIterator



C++ Language Binding

JavaScript Language Binding

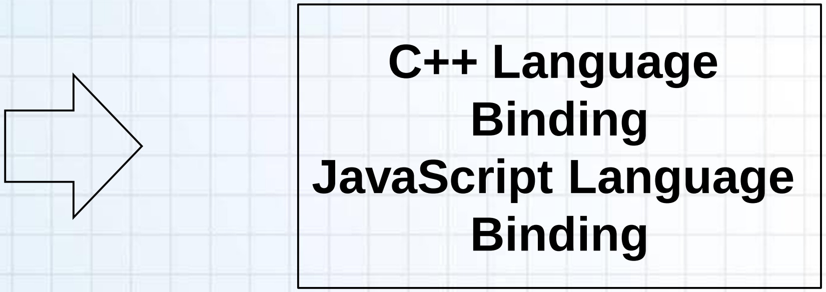
Transmittal Access API Functionality

- Search Criteria
  - ✓ SE_CreateSearchFilter
  - ✓ SE_FreeSearchFilter
  - ✓ SE_CreateSpatialSearchBoundary
  - ✓ SE_DetermineSpatialInclusion
  - ✓ SE_FreeSpatialSearchBoundary

- Data Tables
  - ✓ SE_GetDataTableData
  - ✓ SE_PutDataTableData

- Images
  - ✓ SE_GetImageData
  - ✓ SE_PutImageData

- Auto Conversion
  - ✓ SE_SetColourModel
  - ✓ SE_SetSRFParameters



C++ Language Binding
JavaScript Language Binding

Conclusions

- **SEDRIS visualization using X3D**
    - **X3D conversion**
    - **X3D viewers**

- **Language bindings for SEDRIS API**
    - **C++ language binding**
    - **Javascript language binding**

- **SEDRIS viewer development for testing language bindings**