Model Driven Solutions

Where Business Meets Technology

The NIEM-UML Approach to Model Driven Information Sharing

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Object Management Group: BoD, Gov-DTF Co-Chair

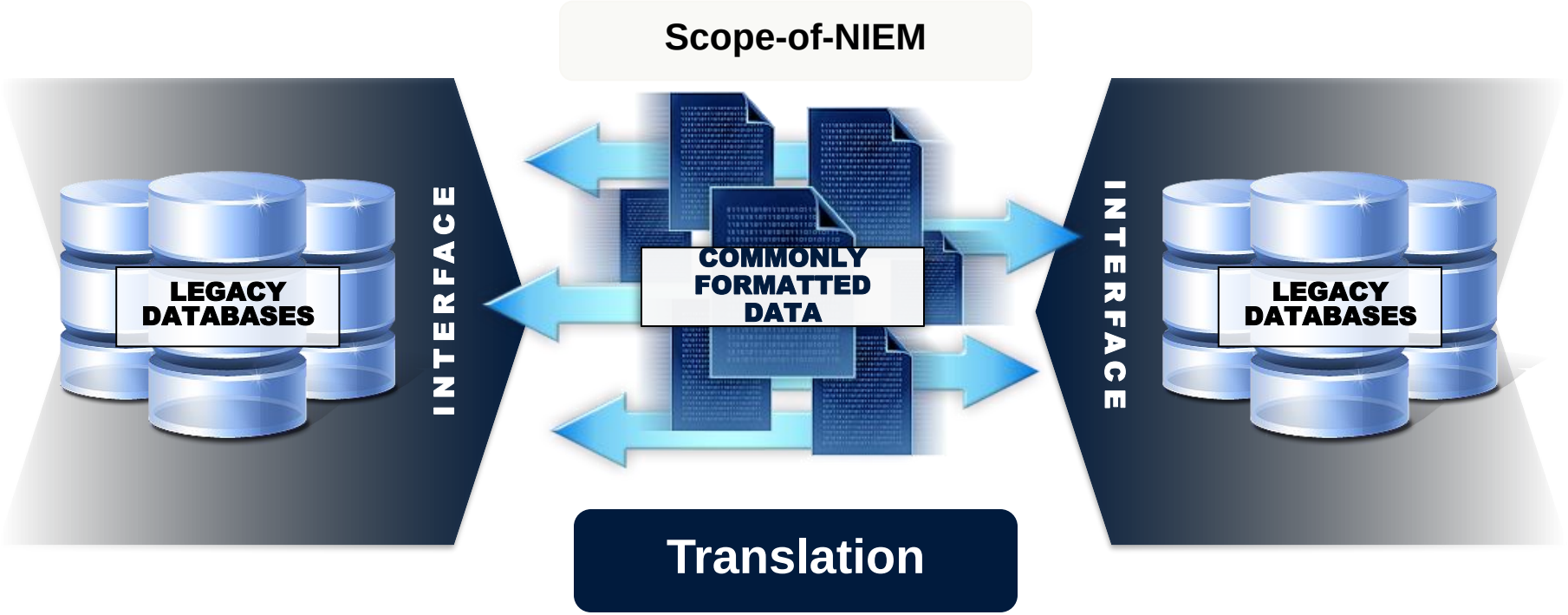
From 2012

OBJECT MANAGEMENT GROUP

NIEM

NATIONAL INFORMATION EXCHANGE MODEL

NIEM: Standardizing Data Moving Across Systems



NIEM intentionally does not address standardizing data inside legacy systems. NIEM serves as a translation layer (providing a common understanding) between and across disparate systems.

The NIEM-UML Specification

*

NATIONAL INFORMATION EXCHANGE MODEL

*This is not an official NIEM-UML logo, one is in the works.

NIEM-UML Goals

- Represent the **terms** and **semantics** of NIEM while being **agnostic** of its **structural representation**
- To **leverage standards** and standards based tools
- To **reduce complexity** and lower the barrier for entry
- To **facilitate reuse** of NIEM models and as a result schemas
- To embrace accepted **UML modeling** styles and constructs
- To enable use of NIEM-PIM models for use with **other standards, technologies** and layers
- To support **deterministic mapping** to and from the NIEM technology layers based on NIEM rules

Clarity: Ensure that a UML representation of a NIEM model produced by one developer can be interpreted as expected by another.

Simplicity: Make developing NIEM packages simple and business focused

Completeness: Ensure that a developer can produce a UML representation of any NIEM concept, including semantics, XML Schema structure, and metadata.

Practicality: With minimal effort, a developer can employ the profile in current UML modeling and MDA tools to develop a NIEM model.

NIEM-UML Layers (High Level)

Users & Architects

Platform Independent Model
Logical Information Models

Platform Specific Model
Model of XSD Artifacts

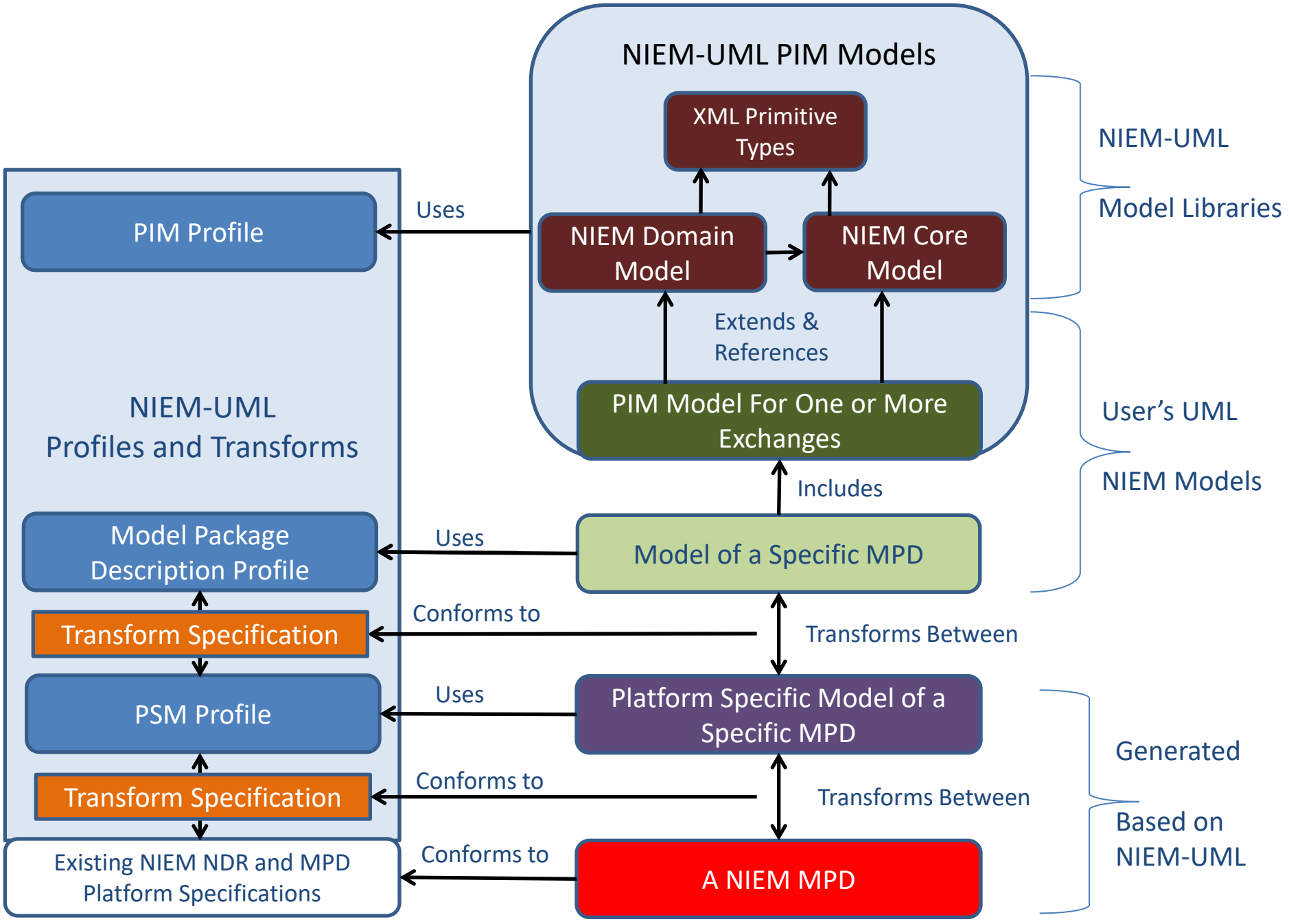
Transforms

Tools

Developers

NIEM-XSD Artifacts

(Based on extensive NIEM naming, design and packaging rules)


NIEM-UML PIM Models
XML Primitive Types
NIEM Domain Model
NIEM Core Model
Extends & References
PIM Model For One or More Exchanges
NIEM-UML
Model Libraries
User's UML
NIEM Models
Generated
Based on NIEM-UML
PIM Profile
Uses
NIEM-UML Profiles and Transforms
Model Package Description Profile
Uses
Model of a Specific MPD
Includes
Transform Specification
Conforms to
Transforms Between
PSM Profile
Uses
Platform Specific Model of a Specific MPD
Transform Specification
Conforms to
Transforms Between
Existing NIEM NDR and MPD Platform Specifications
Conforms to
A NIEM MPD

What is the NIEM PIM Profile?

- A simplified subset of the Unified Modeling Language (UML)
- A set of UML constructs and stereotypes
  - Extends UML to represent NIEM **business information concepts**
  - Business information concepts are augmented with NIEM-Platform mapping information
  - Enforces NIEM rules (of which there are over 300) by leveraging OCL – *a valid NIEM-UML model will produce a valid MPD model*
- Representations correspond to commonly used UML patterns with a well defined mapping to NIEM platform
- Provides a generalized information modeling environment not specific to NIEM schema
- Supports mapping to and from the NIEM platform, supporting and enforcing the NDR and MPD
  - E.g. name prefix and suffixes are added as specified by NIEM rules

NIEM-UML Platform Independent Model (PIM) By Example

This presentation focuses primarily on the platform independent (business information model) layer of NIEM-UML

Pet Adoption Example

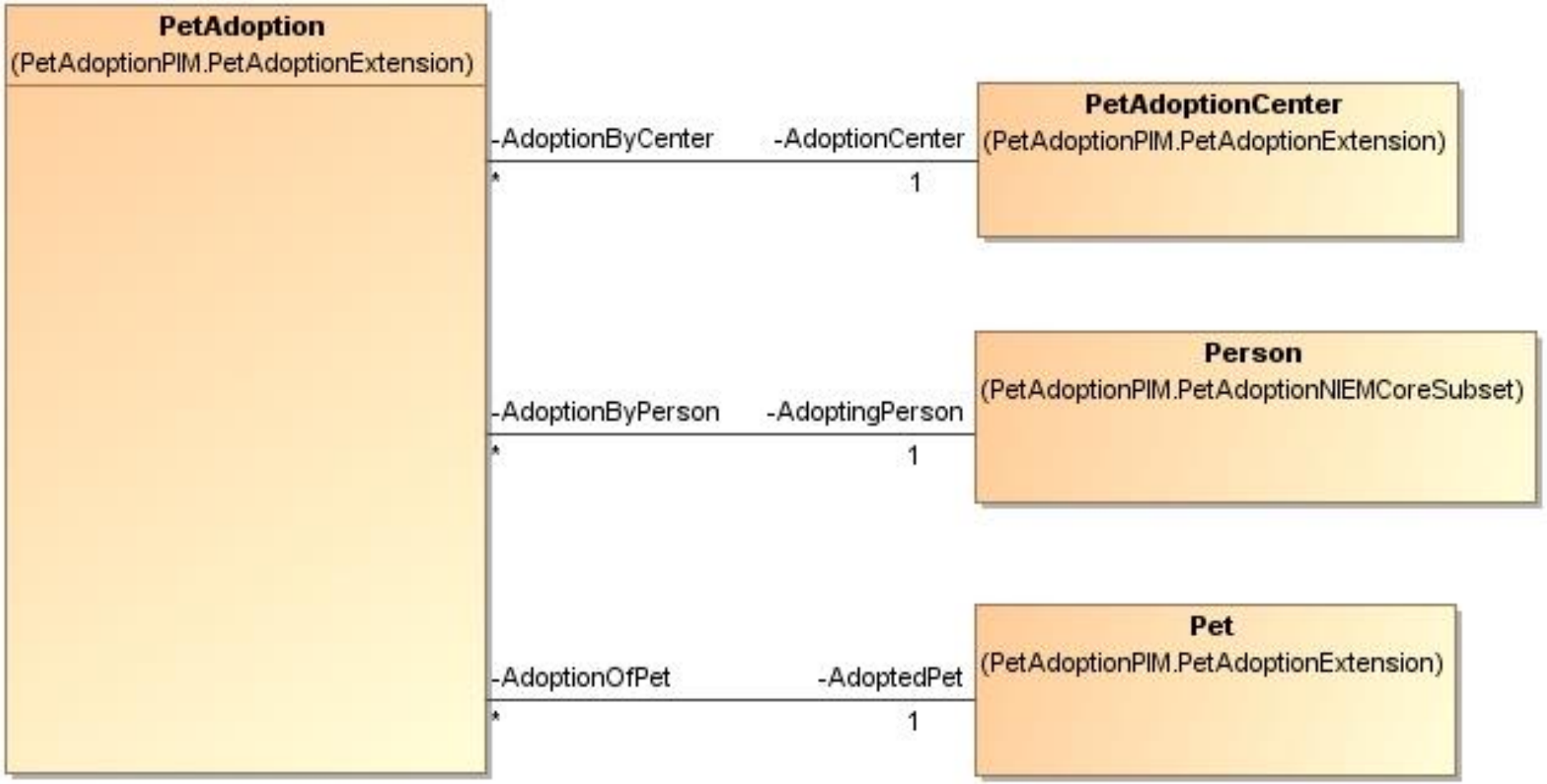
Data Exchange of adoptions by pet rescue centers

This is a very high-level example, intended to provide a general idea of what a PIM looks like and what it provides, it does not cover all NIEM-UML concepts.

Information to Exchange

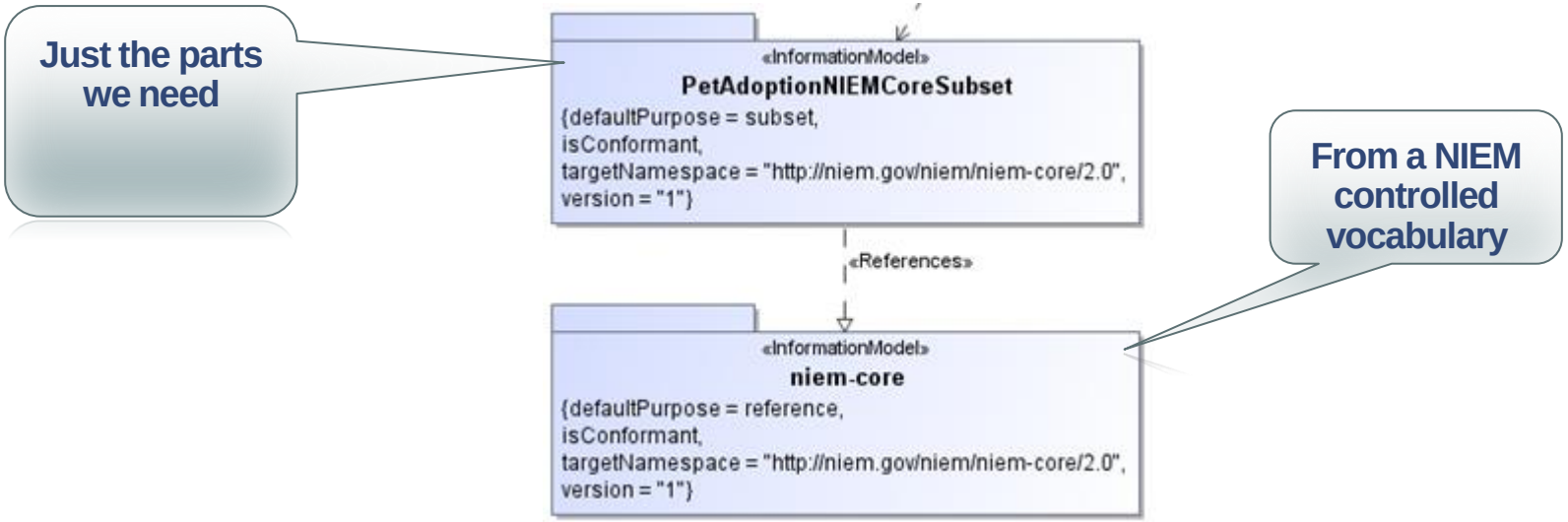
- Pet Adoptions
- Pets (Being adopted)
- People (Adopting)
- Pet Adoption Centers (Facilitating Adoptions)
- Addresses (Of people and adoption centers)
- Contact information (For people and adoption centers)
- Associations for contact information related to people

High-level information Model

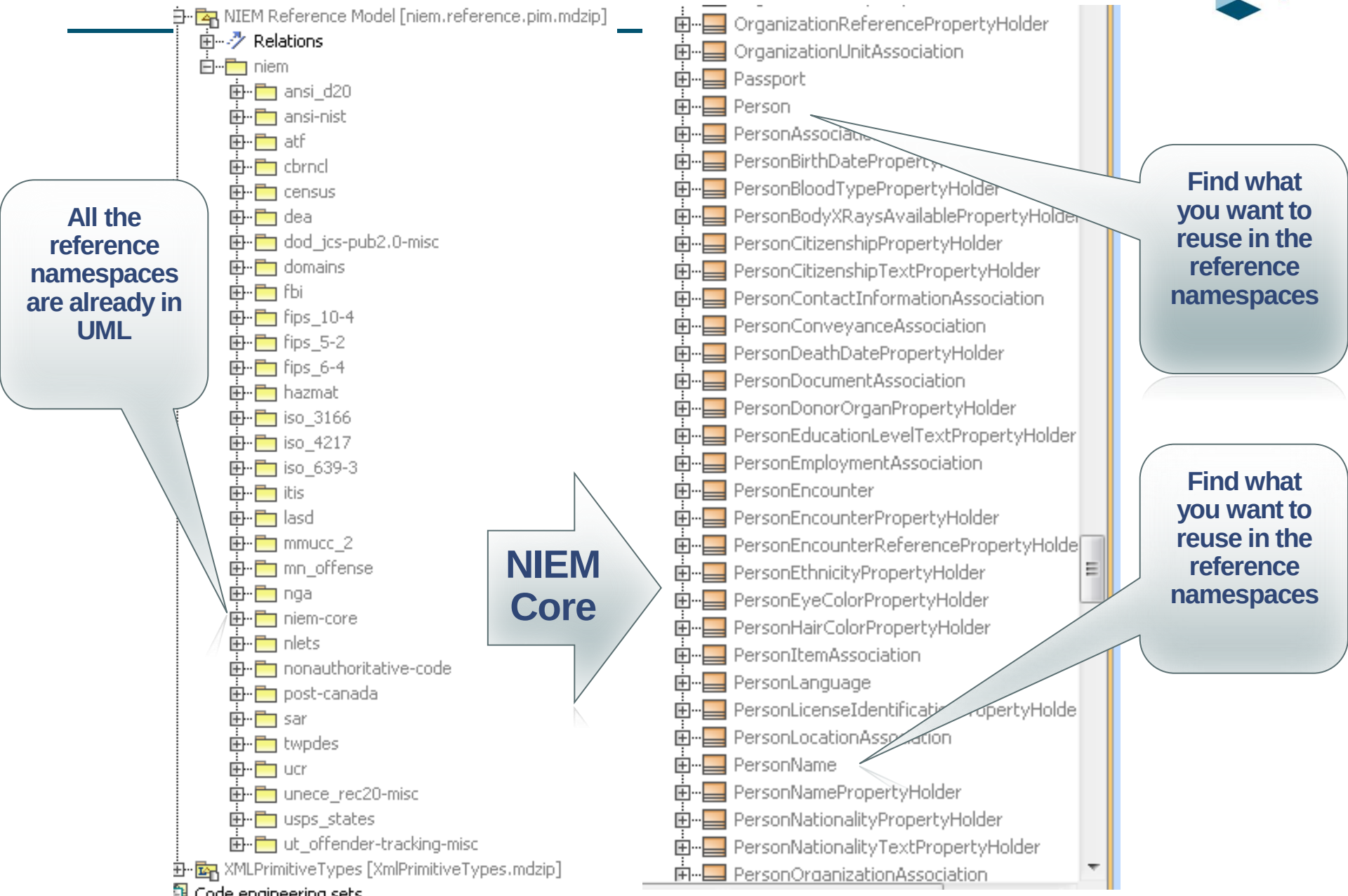


Reusing Reference Namespaces

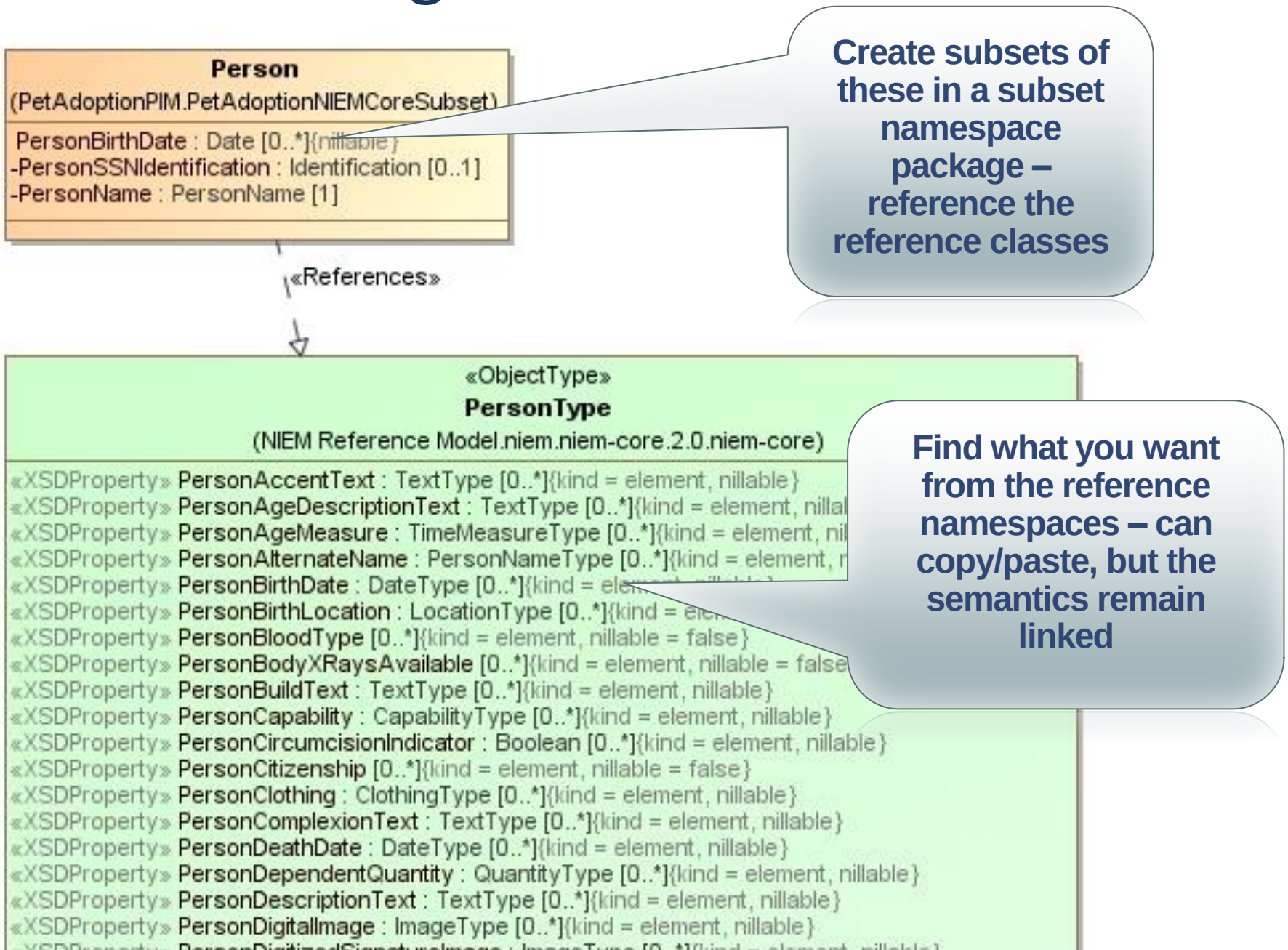
- Central to NIEM is the reuse of concepts defined in “reference namespaces”, controlled business vocabularies of data exchange elements
- “NIEM Core” is the central reference vocabulary, extended with multiple domain specific vocabularies



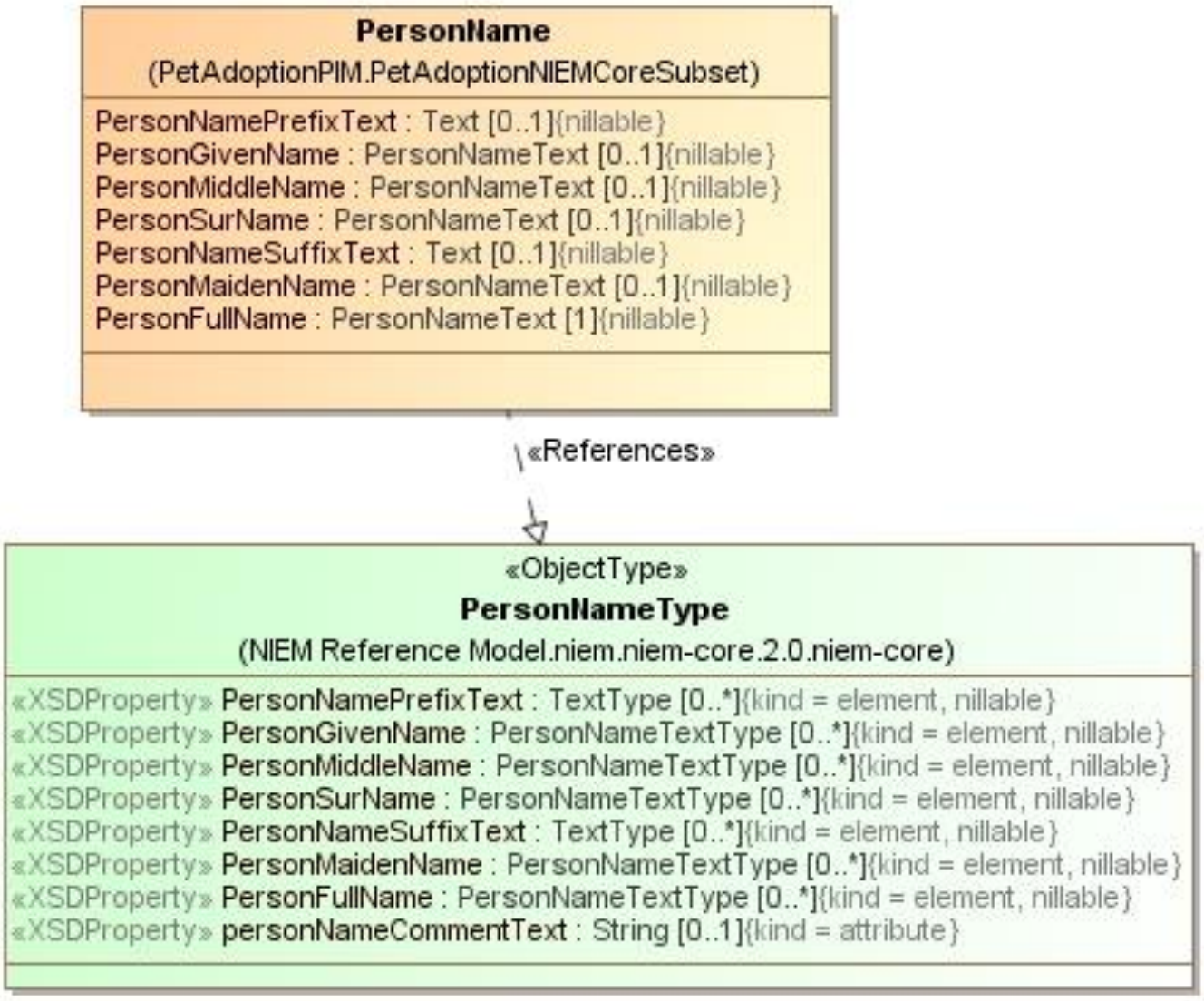
Reusing NIEM Core



Modeling reuse of NIEM Core

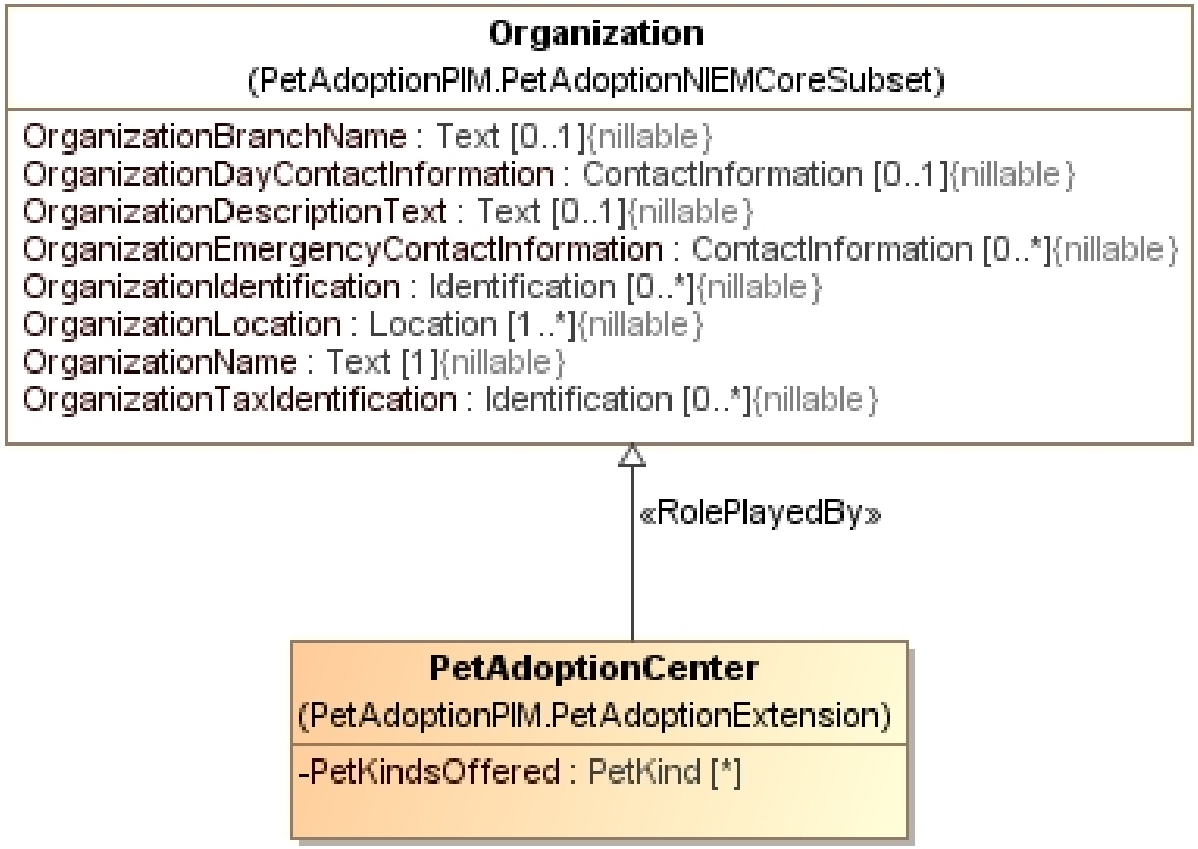


Repeat as required



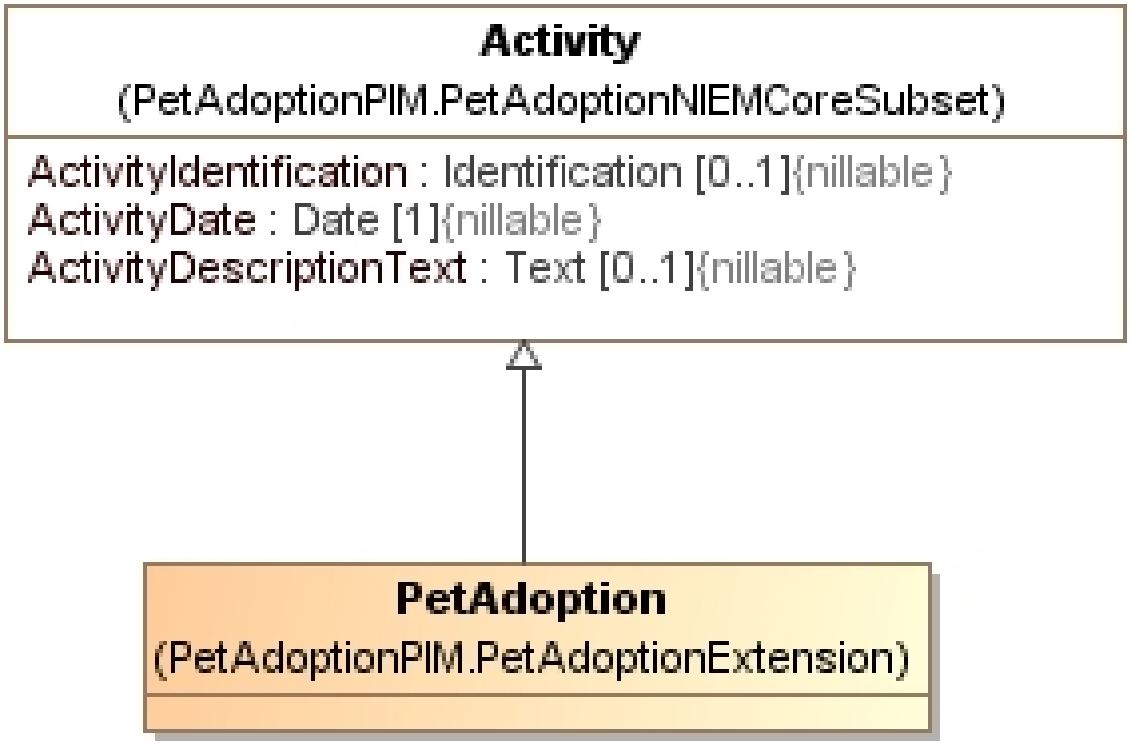
Roles of organizations

- What is an “Adoption Center”?
- It is a kind of organization
- But perhaps more properly a “role” an organization plays, as they could play other roles as well
- This is one representation of NIEM roles



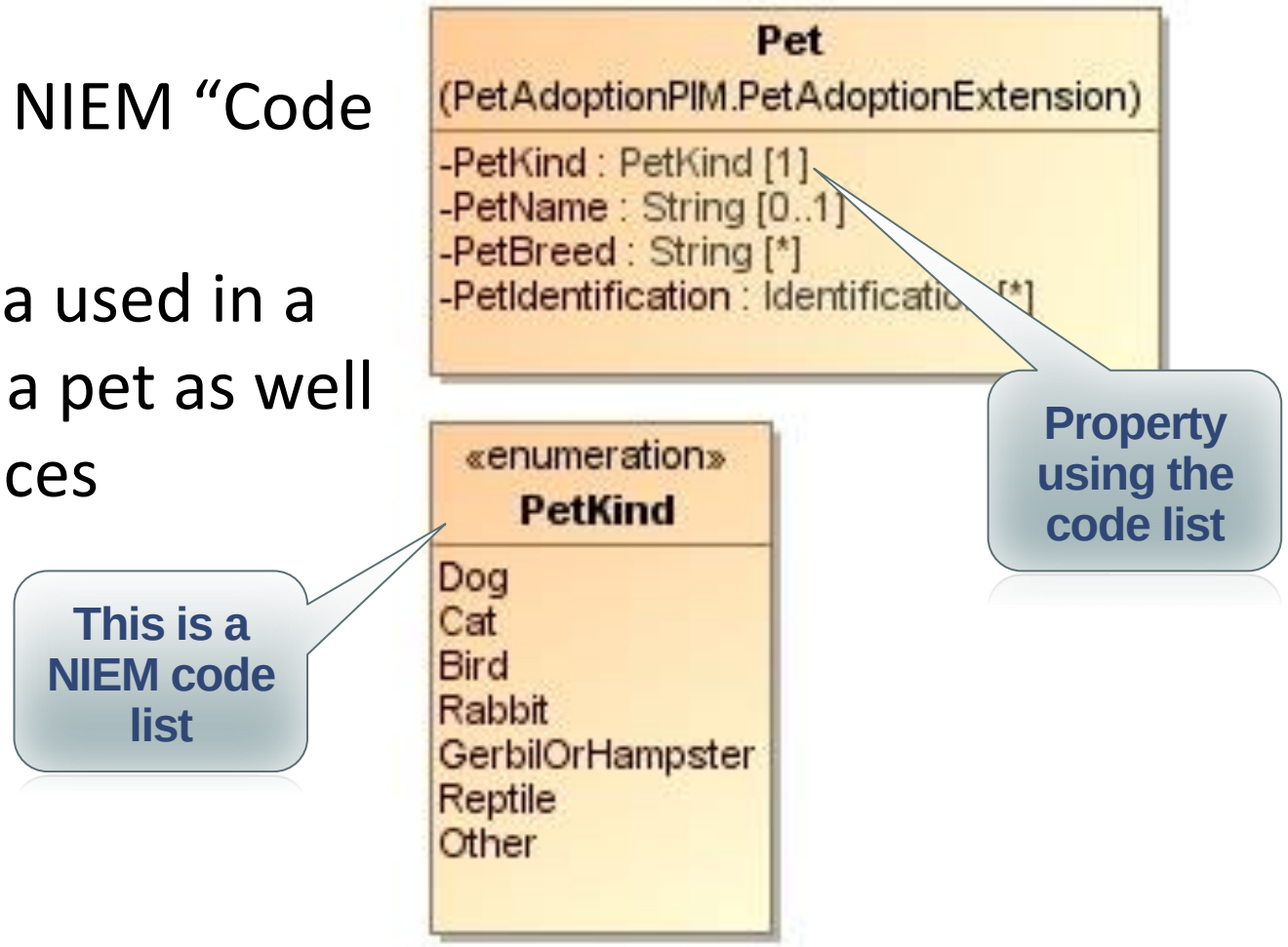
What is an Adoption?

- An adoption is a kind of activity
- We can reuse this from NIEM-Core as well

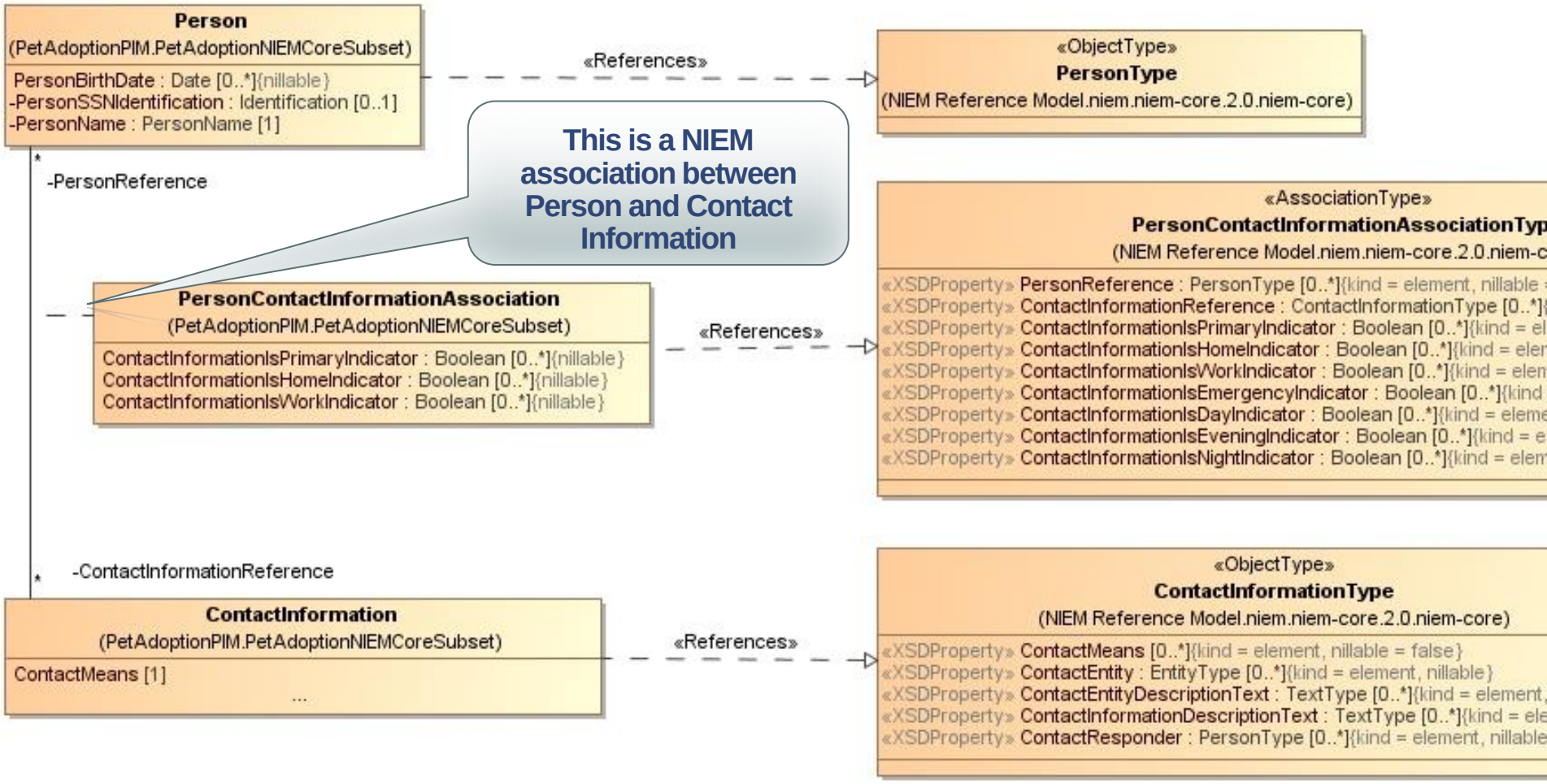


What Kinds Of Pets Are Adopted?

- PetKind is a NIEM “Code List”
- This can be a used in a property of a pet as well as other places

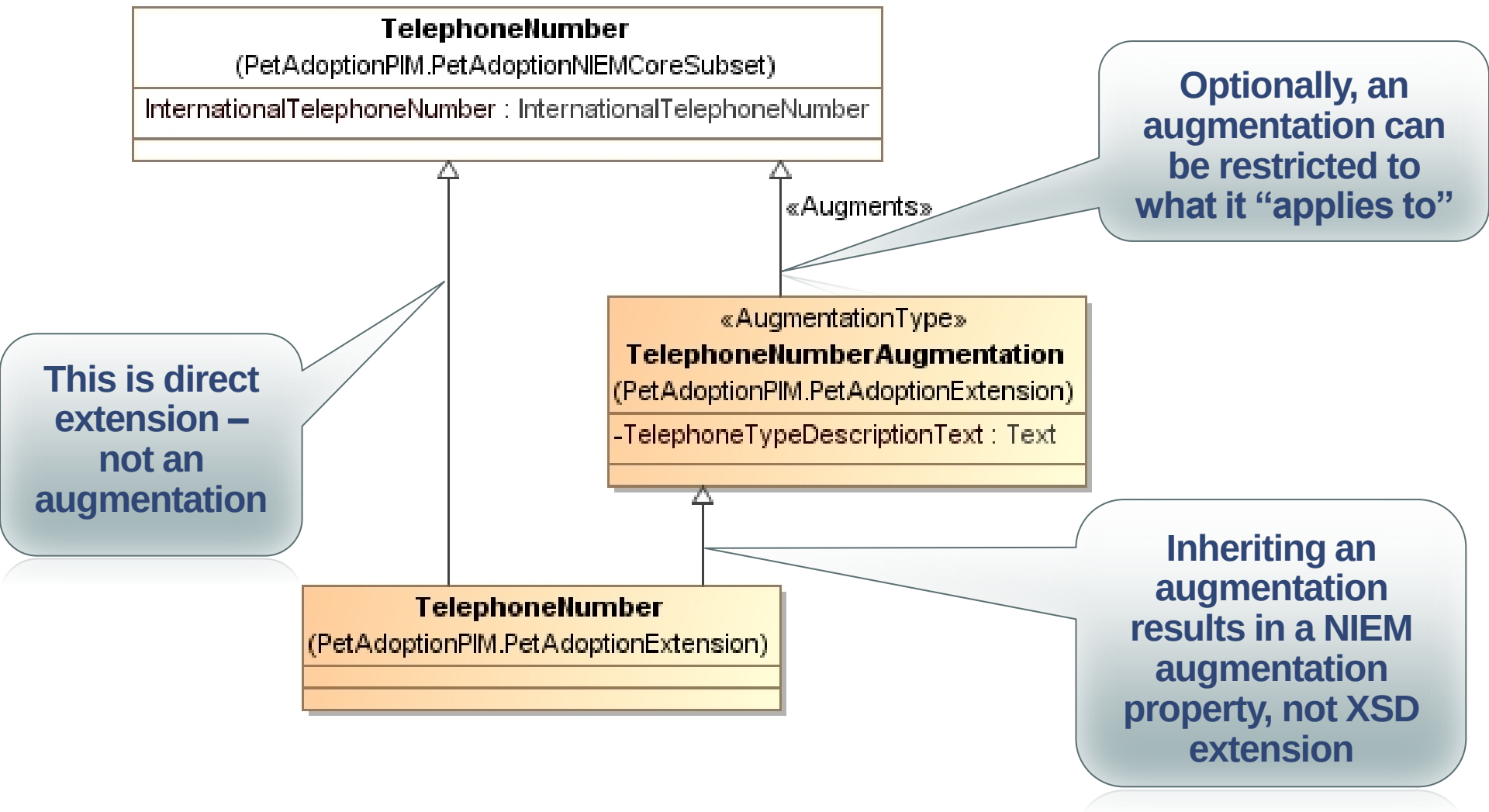


NIEM Associations

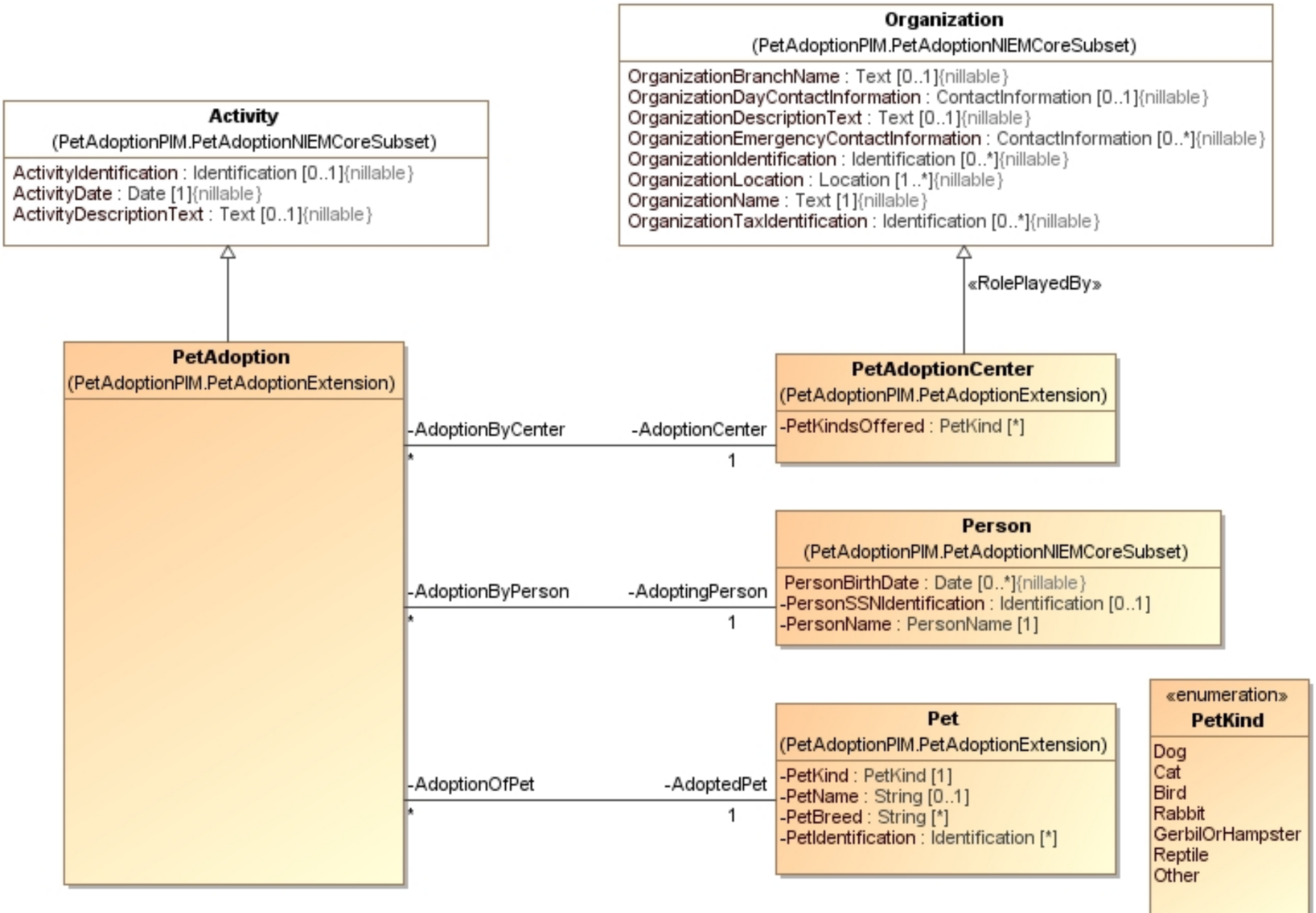


Associations Connect Objects – in this case people and contact information

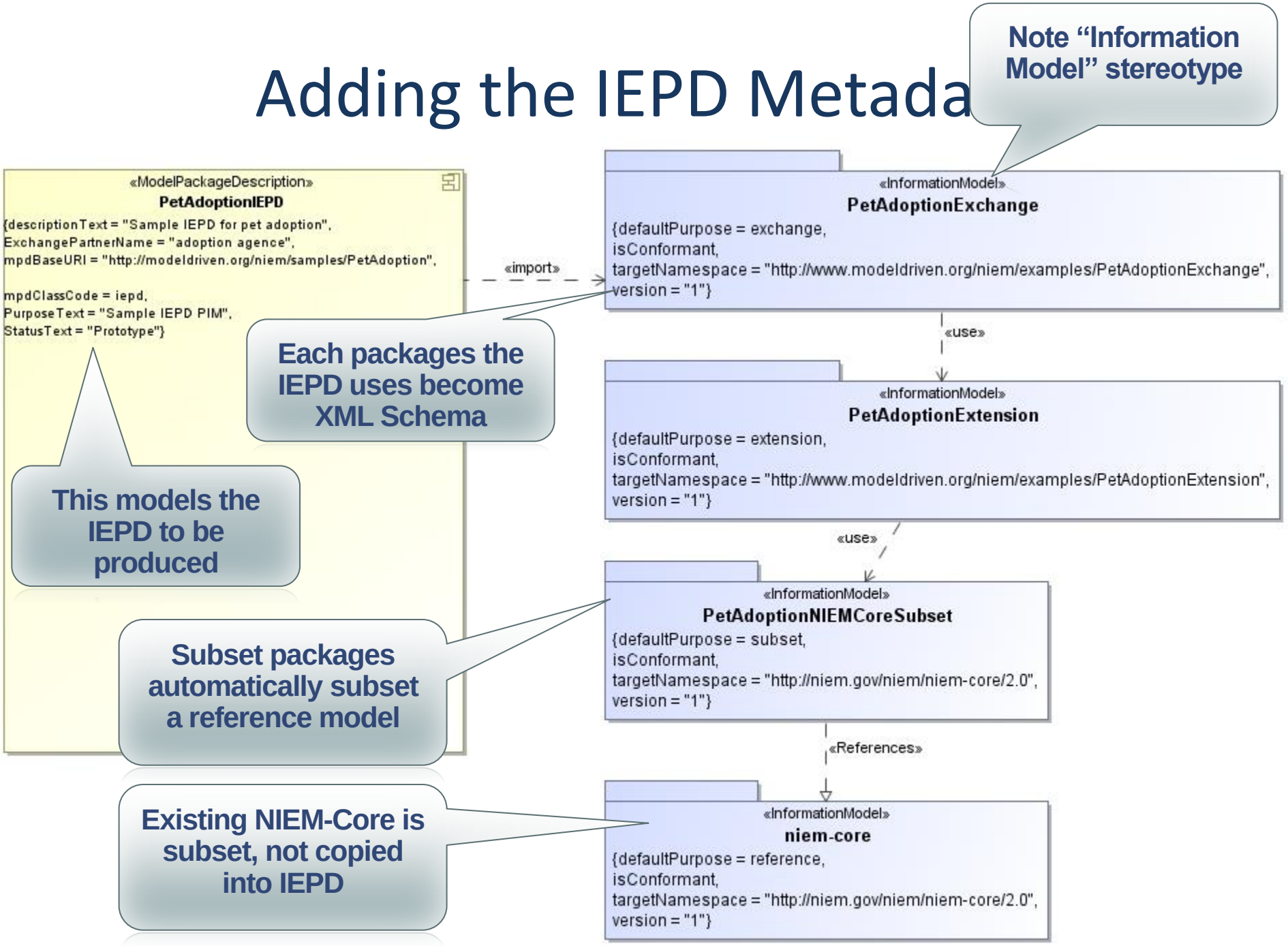
Augmentations – Phone Number ++



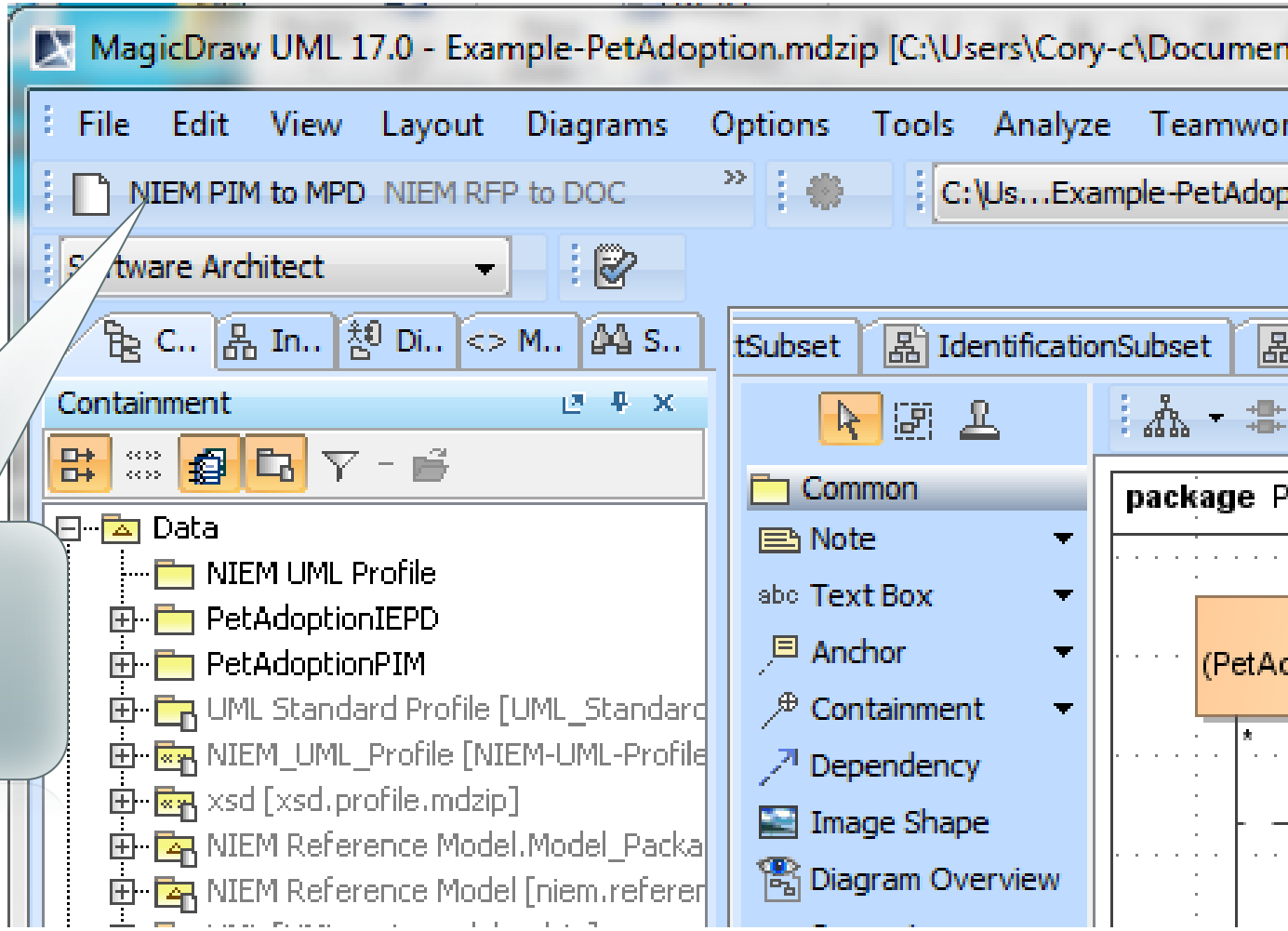
Completed High-Level Model



Adding the IEPD Metada

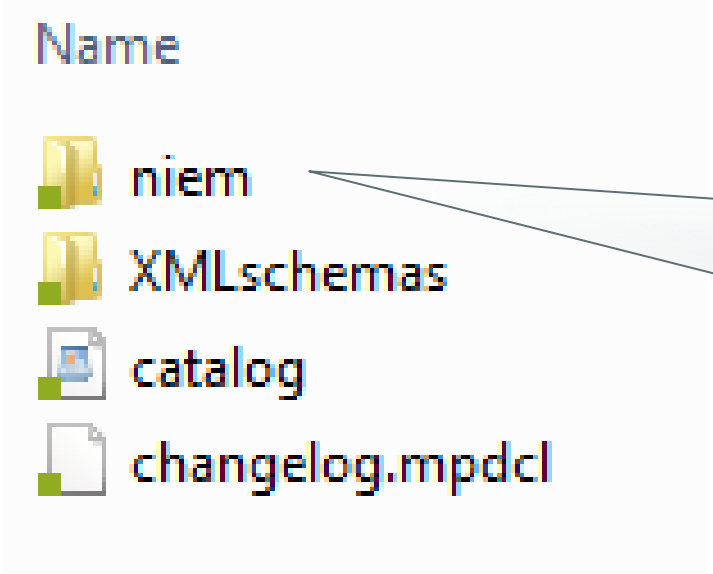


Create the IEPD from the model



You then tell your UML and/or MDA tool to make the IEPD

All the IEPD artifacts are then created by the MDA Automation

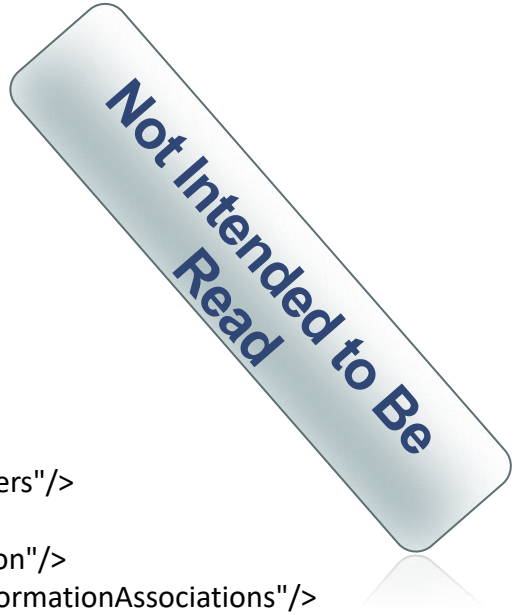


Given a model that satisfies the NIEM-UML profile a valid and complete IEPD is guaranteed to come out.

Even this simple example produces dozens of interdependent technology artifacts in the IEPD

MDA Automation Also creates Multiple NIEM Conformant XML Schema

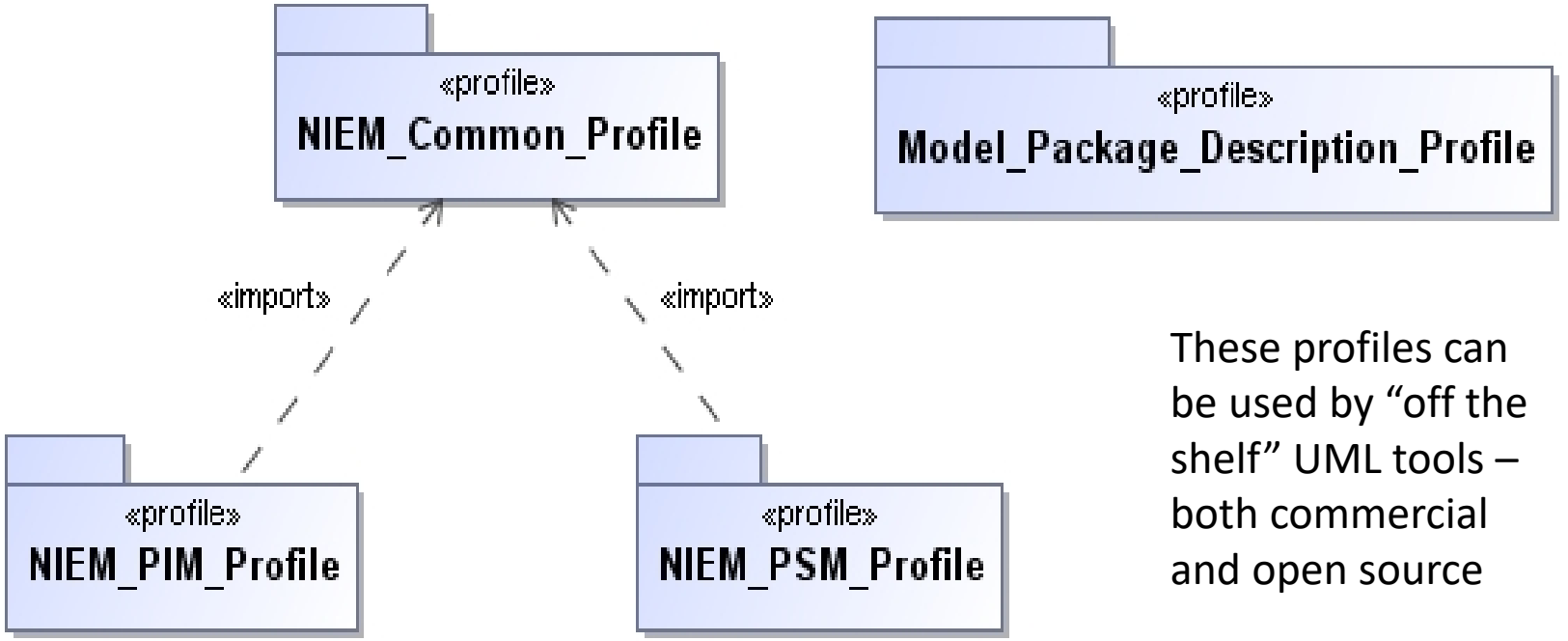
```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:Q1="http://www.modeldriven.org/niem/examples/PetAdoptionExtension" xmlns:i="http://niem.gov/niem/appinfo/2.0
 <xsd:import namespace="http://niem.gov/niem/appinfo/2.1" schemaLocation="../../../.././niem/appinfo/2.1/appinfo.xsd"/>
 <xsd:import namespace="http://niem.gov/niem/structures/2.0" schemaLocation="../../../.././niem/structures/2.0/structures.xsd"/>
 <xsd:import namespace="http://www.modeldriven.org/niem/examples/PetAdoptionExtension" schemaLocation="../../../.././XMLschemas
 <xsd:import namespace="http://www.modeldriven.org/niem/examples/PetAdoptionExchange" schemaLocation="../../../.././XMLschemas
 <xsd:import namespace="http://niem.gov/niem/appinfo/2.0" schemaLocation="../../../.././niem/appinfo/2.0/appinfo.xsd"/>
 <xsd:import namespace="http://niem.gov/niem/proxy/xsd/2.0" schemaLocation="../../../.././niem/proxy/xsd/2.0/xsd.xsd"/>
 <xsd:import namespace="http://niem.gov/niem/niem-core/2.0" schemaLocation="../../../.././XMLschemas/niem/niem-core/2.0/niem-cor
 <xsd:complexType abstract="false" name="PetAdoptionExchangeType">
  <xsd:annotation>
   <xsd:appinfo>
    <i:Base i:name="Object" i:namespace="http://niem.gov/niem/structures/2.0"/>
   </xsd:appinfo>
  </xsd:annotation>
  <xsd:complexContent>
   <xsd:extension base="s:ComplexObjectType">
    <xsd:sequence>
     <xsd:element maxOccurs="unbounded" minOccurs="1" ref="tns:People"/>
     <xsd:element maxOccurs="unbounded" minOccurs="1" ref="tns:Pets"/>
     <xsd:element maxOccurs="unbounded" minOccurs="1" ref="tns:PetAdoptions"/>
     <xsd:element maxOccurs="unbounded" minOccurs="1" ref="tns:PetAdoptionCenters"/>
     <xsd:element maxOccurs="unbounded" minOccurs="0" ref="tns:Addresses"/>
     <xsd:element maxOccurs="unbounded" minOccurs="0" ref="tns:ContactInformation"/>
     <xsd:element maxOccurs="unbounded" minOccurs="0" ref="tns:PersonContactInformationAssociations"/>
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>
 <xsd:element abstract="false" name="People" nillable="false" type="nc:PersonType"/>
 <xsd:element abstract="false" name="Pets" nillable="false" type="Q1:PetType"/>
 <xsd:element abstract="false" name="PetAdoptions" nillable="false" type="Q1:PetAdoptionType"/>
```



As part of this process

- The model is fully validated with “OCL Constraints” for NIEM Rules
- The produced PSM (NIEM Artifacts) are also validated
- Many NIEM rules are taken care of automatically in the transformation rules such as Naming and Global elements – there are over 300 NIEM rules!
- The resulting IEPD is either valid or any problems noted (how being tool dependent)
- There are still a few subjective NDR Rules that can’t be tested by the automation

NIEM-UML Profile Structure



These profiles can be used by “off the shelf” UML tools – both commercial and open source

NIEM Reference Vocabularies

Core (NIEM Core)

Reference (Combined)

ansi_d20
apco
atf
cbrncl
census
dea
dod_jcs-pub2.0-misc
edxl-cap
edxl-de
edxl-have
edxl
fbi
fips_10-4
fips_5-2
fips_6-4
geospatial
have-codes
hazmat
icism
iso_3166
iso_4217
iso_639-3
itis
lasd
mmucc_2
mn_offense
nga
nlets
nonauthoritative-code
post-canada
sar
twpdes
ucr
unece_rec20-misc
usps_states
ut_offender-tracking-misc
core
emergencyManagement
familyServices
infrastructureProtection
intelligence
jxdm
maritime
screening
external.cap
external.de
external.have
external.ogc

Who Is OMG?

Object Management Group (OMG):

- Founded in 1989
- More than 470 member companies
- The largest and longest standing not-for-profit, open-membership consortium which develops and maintains computer industry specifications.
- Continuously evolving to remain current while retaining a position of thought leadership.

Developing Standards

Standards are developed using OMG's mature, worldwide, open development process. With over 20 years of standards work, OMG's one-organization, one-vote policy ensures that every vendor and end-user, large and small, has an effective voice in the process.

Finance Healthcare Insurance Government







OMG's Best-Known Successes

Common Object Request Broker Architecture

- CORBA® remains the only language- and platform-neutral interoperability standard

Unified Modeling Language

- UML® remains the world's only standardized modeling language

Business Process Modeling Notation

- BPMN™ provides businesses with the capability of understanding their internal business procedures

Common Warehouse Metamodel

- CWM™, the integration of the last two data warehousing initiatives

Meta-Object Facility

- MOF™, the repository standard

XML Metadata Interchange

- XMI®, the XML-UML standard

SoaML

- Service Oriented Modeling Language

Nomagic Cameo NIEM-UML

- First “Out of the box” implementation of NIEM-UML
- NIEM-UML Plugin for MagicDraw Provides:
  - The NIEM plugin using UML makes NIEM easier to implement
  - Facilitates the transform generating NIEM compliant technology artifacts
  - Helps create the model, more than 50 NIEM reference models are included
  - Facilitates NIEM subsetting
  - Plugin helps you identify and create subsets
  - Templates included with the NIEM MagicDraw plugin: MPD model, empty models
  - Visual and automated way to create subset models
  - Extensive modeling features: easy and intuitive to create NIEM IEPD models
  - Facilitates modeling metadata
  - Makes it easy to find and reuse reference models
  - The plugin contains an extensive reference model with more than 50 reference models
  - The plugin contains more than 12 examples of IEPDs
  - Ideal for security modeling
  - Support for the full lifecycle of an enterprise’s applications

No Magic

http://www.nomagic.com/products/magicdraw-addons/cameo-niem-plugin.html

Model Driven Solutions

- Model Driven Solutions (MDS) is a small business headquartered in North Virginia. Our primary customers are government and large corporations.
- MDS provides a Model Driven approach to business and information systems solutions.

Providing

- Enterprise Architecture
- Business Architecture
- Information Architecture
- Services Architecture
- Systems Architecture
- Executable Systems
- Automated Federation
- Open Source Tooling

Using

- Semantic Technologies
- Unified Modeling Language
- Business Process Modeling Notation
- Service Oriented Architecture
- Model Driven Architecture
- Industry Standards
- Open Source & Commercial Products

Questions and Comments