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***alertSmarts*<sup>™</sup> for the HERE Network –  
An EPA Demonstration Application**

**Jeff Ehman, Ph.D.**

201 Loudoun Street SW  
Leesburg, VA 20175  
[www.imagemattersllc.com](http://www.imagemattersllc.com)

# Vision

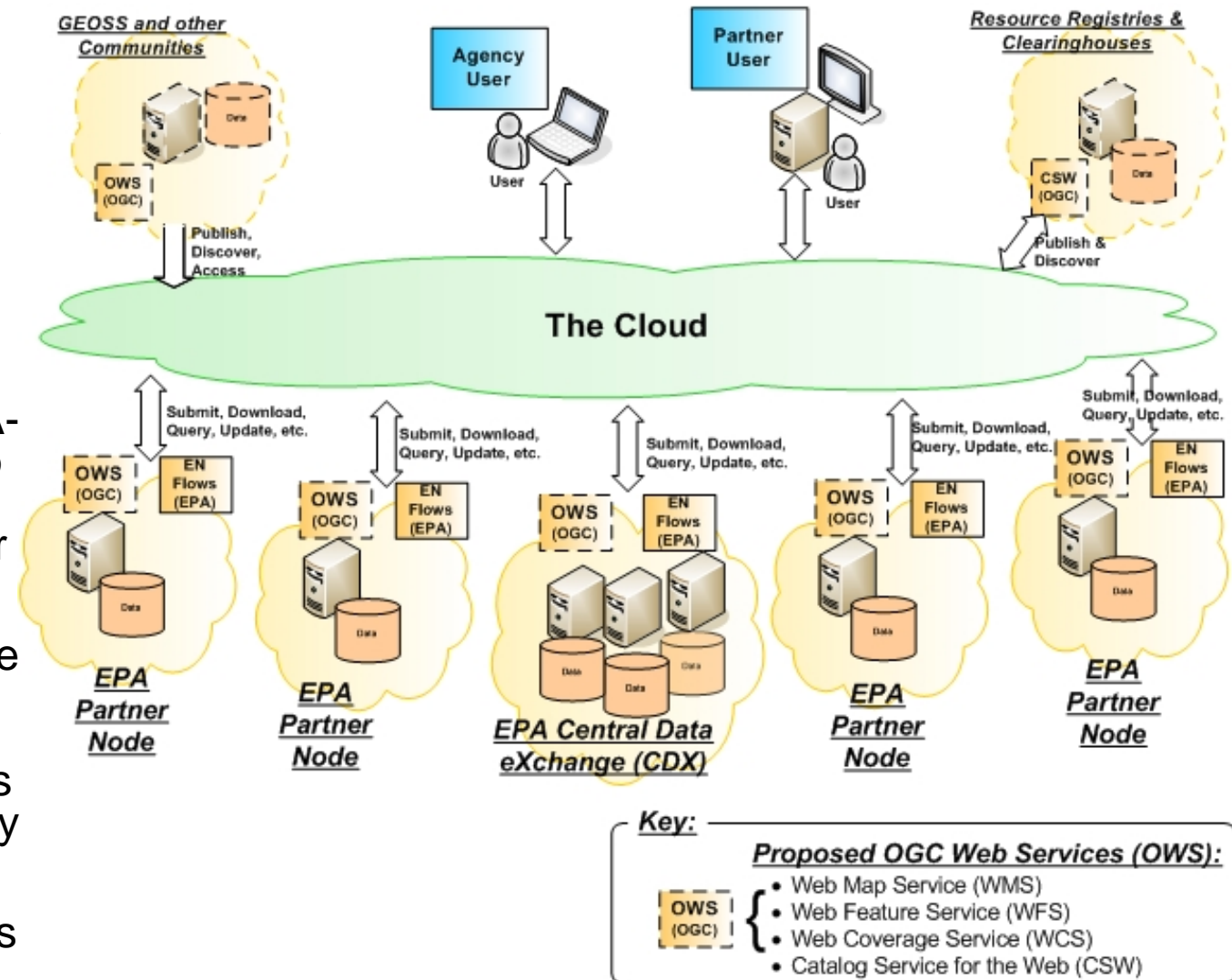
- Any software on any device (e.g., pc, laptop, handheld, cell phone) should be able to query and access portions of EN flows through standard protocols and representations.
  - Leverage resources from external communities, agencies and initiatives (e.g., GEOSS, COE/USACE, FEMA, NOAA)
  - Enable multi-jurisdictional, multi-level data sharing
    - Sharing EN resources with those other external communities, agencies and initiatives (e.g., National/Regional/Multi-jurisdictional Emergency preparedness, response and recovery)
  - Enable multiple modes of access to EN resources
    - Leverage EN resources using multiple interoperable applications from multiple vendors (e.g., Google Earth, Virtual Earth, ESRI, Intergraph, etc)
  - Getting just the right data at the right time to the right people.

# Some basic terms

- **Atom:** the *Atom Syndication Format* is an [XML](#) language used for [web feeds](#),
- **AtomPub:** *Atom Publishing Protocol* (*AtomPub* or *APP*) is a simple [HTTP](#)-based protocol for creating and updating web resources.
- **GeoRSS:** a standard for encoding location as part of an RSS feed; supports simple point, line and polygon geometries
- **OGC:** Open Geospatial Consortium - industry, government and academic organizations developing open interoperability standards
- **GML:** OGC's Geography Markup Language, an XML-based language for representing geographic features and their properties
- **WFS:** OGC's Web Feature Service specification for query and return of geographic features encoded using GML

# A Vision for an Open Exchange Network (EN): Distributed Data Centers & Regional Partners

- A secure Internet- and standards-based approach for exchanging environmental data and improving environmental decisions.
- Currently uses EPA-defined SOAP Web Services and XML Schema for transfer of data.
- Vision: Any software on any device is able to easily query and access portions of EN flows securely
- Realization through open web standards



# GeoTF Interoperability Pilot Project: Objectives

- Demonstrate useful exploitation of EPA EN flows enabled by open industry standards from EPA-EN, OGC, GeoRSS, etc.
- Demonstrate use of open industry standards to enable capabilities not currently available:
  - Dynamically find and access new/unanticipated resources
  - Aggregate and “fuse” spatial and tabular data from different resources for analysis, multi-modal views, and reports
- Provide a *reference implementation* of target capabilities
- Allow technically curious users to dynamically view the raw XML Web service requests and responses
- Demonstrate the GeoTF “best practices” for standards-compliant geographic encoding of EN data flows (“GeoRSS GML”)

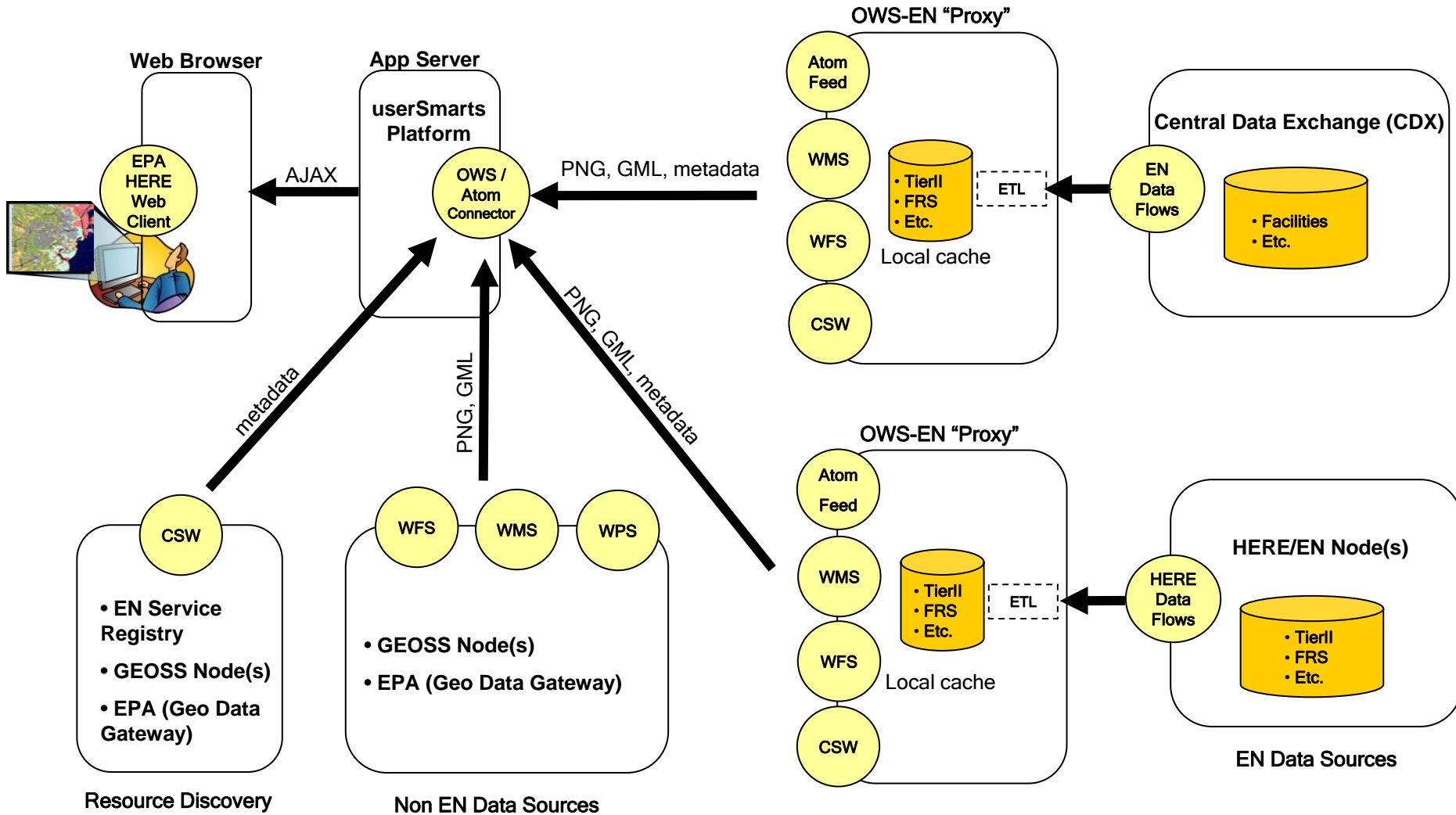
# GeoTF Interoperability Pilot Project: Core Functions

- Define Threat Areas
  - Designate region in which facilities and their stored chemicals may potentially be affected by a threat
- Discover Resources
  - HERE/EN resources (nodes and services)
  - Discover 3<sup>rd</sup>-party resources (Web services and data)
- Access HERE data, view and report
  - Access and view HERE flows:
    - Facilities (FRS) via WFS & AtomPub/GeoRSS feed
    - Chemical Inventory (Tier II) via AtomPub/GeoRSS feed
  - Access and integrate 3<sup>rd</sup>-party Web services and data
- Show service request/response log

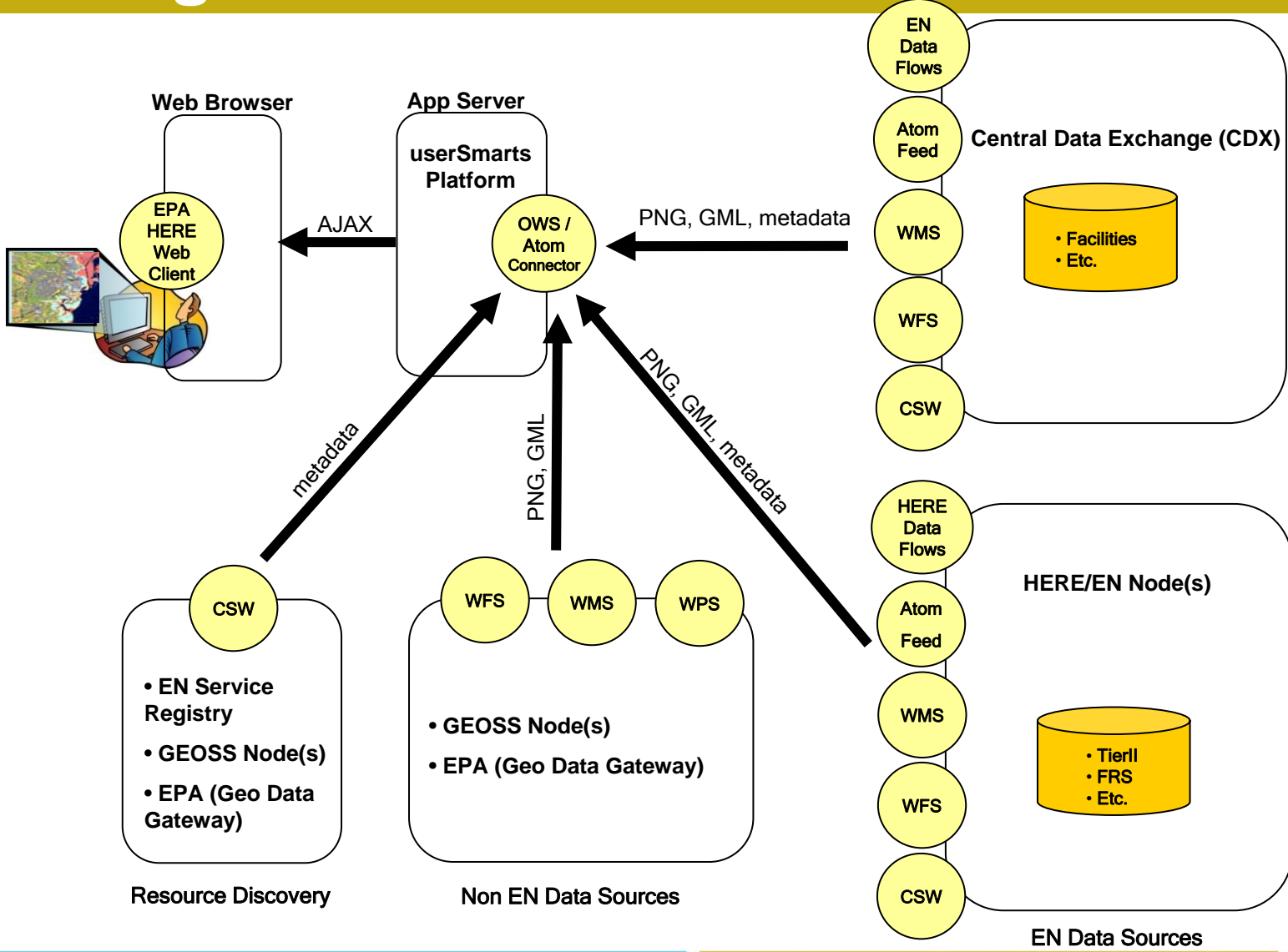
# FRS and TierII Chemical Queries

1. Find facilities within geographic area
  - *Where FRS.Where.Point within GML.Geometry*
2. Find facilities by Facility ID
  - *Where FacilityRegistryIdentifier=15830*
3. Find facilities by Name/City/Zip/State/HUC Code/SIC Code/ etc
  - *Where FacilitySiteAllDetails/LocationAddress/LocalityName="York"*
4. Find facilities storing a chemical
  - *Where TierII.EPAChemicalRegistryName= "aceto\*"*
5. Find facilities within geographic area and storing a chemical
  - *Where TierII.EPAChemicalRegistryName="aceto\*" AND FRS.Where.Point within GML.Geometry*
6. List chemicals by name
  - *Where TierII.EPAChemicalRegistryName= "aceto\*"*

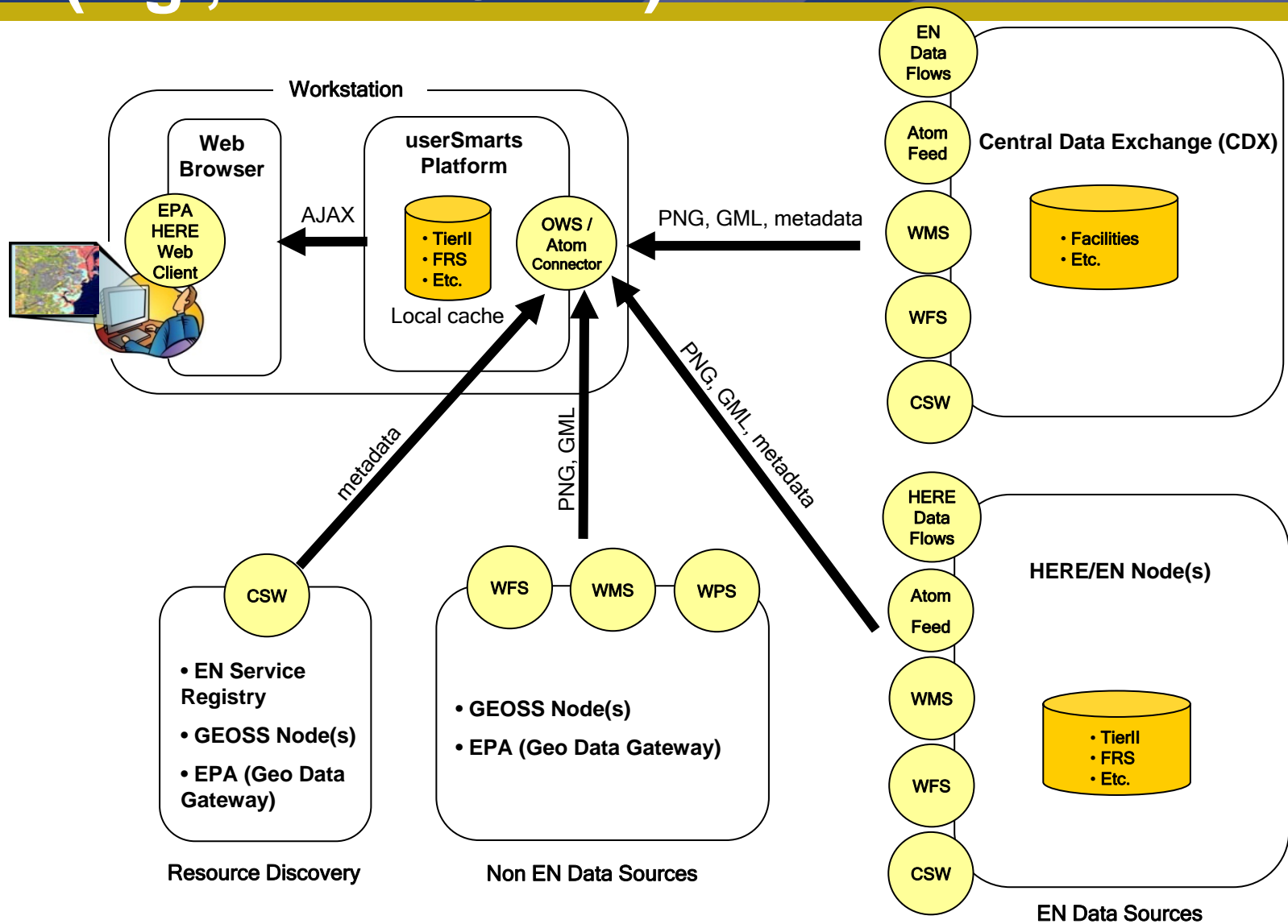
# OWS/EN Architecture: As-Built



# OWS/EN Architecture: Recommended Target



# OWS/EN Architecture: Detached Mode (e.g., HERE Client)



# Application design & development

- Design guided by:
  - Vision of an Open EN
  - GeoRSS / GML best practices paper from the EN Geo Task Force
  - To-be architecture of node infrastructure for supporting access to flows: OWS atop EN nodes
  - Interface specifications and data encoding standards required for interoperability
  - Lessons learned from Phase I
- *alertSmarts* applied to HERE use case
  - Easy to use, powerful application for narrowing search of large amounts of related information – built on *userSmarts*<sup>TM</sup> middleware
  - Context-sensitive Resource Discovery – rapid filter and display of relevant feeds.
  - Data from disparate distributed feeds are collected, cached, and indexed for fast and seamless user interaction in browser
  - Much faster and more intuitive than traditional drilldown UIs.
  - View linked lists, features on map, and drill down to detail. All updated simultaneously.
  - Utilizes GML and GeoRSS and for encoding and sharing geoenabled information from HERE flows - constrainable queries available to any application!

# Cut to Demonstration

# Status of “alertSmarts for HERE”

- Runs in Web browsers
- 100% Java (and JavaScript) application, middleware and database: open, lightweight, free, industry best-practice
- Services and applications deployed using Apache “Tomcat” application server: open, lightweight, free, industry best-practice
- This version does not directly access HERE network nodes
  - Data extracted from the HERE Client’s MS SQL database and loaded as-is to H2DB (a free, fast, embedded DB), accessed via Hibernate (for SQL->Java bindings) and deployed on application server
  - H2DB image of HERE Client data is currently \*not\* optimized for queries
  - Many opportunities to improve database query performance!
- Permission for accessing only one HERE network node was granted; cannot yet demonstrate seamless cross-jurisdictional (node) searches
- This version of the alertSmarts™ client does not (currently) support shared maps, reports, and alerts.

# Next steps

## alertSmarts for HERE application

- Optimize database performance and refresh for cached data
- Support additional EN Flows
- Add client functionality

## GeoTF, and EN

- Make “alertSmarts for HERE” application and documentation available to EN participants interested in open geo standards
- Identify an EN exchange which requires access through open web services (OWS); implement and document experiences
- Encourage node software producers to build-in a OWS layer.
- Continue GeoTF work in determining best practices for publishing and accessing geospatial information through the EN
- See the GeoTF’s *Future Paths for Geo on the EN* (discussion outline) for more information.



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**Thank you!**





**Jeff Ehman**

**[jeffe@imagemattersllc.com](mailto:jeffe@imagemattersllc.com)**

**812-325-7937**

# Backup Slides

# Steps to Implementing OWS/Atom Services

- 
1. Determine what information needs to be published (i.e., brief, summary, full?)
  2. Determine the performance / reliability / security requirements & budget / staff constraints
  3. Define target XML representations (XML Schema) for WFS (gml:\_Feature) and AtomFeed (atom:content)
  4. Develop mappings from the database to the target XML representations
  5. Develop, test and optimize queries
  6. Implement the WFS and Atom services (Build or Buy?)
  7. Deploy on host server (In-house or Out-source?)

# Open Data Feeds

- Facilities WFS:
  - FRS: <http://beta.usersmarts.com/en-node/api/services/1/wfs>
  - GEODATA: <http://beta.usersmarts.com/es/api/wfs>
- Facilities Atom Feed:
  - FRS: <http://beta.usersmarts.com/en-node/api/services/1/2/atom>
  - GEODATA:  
<http://live.usersmarts.com/es/api/facilities?format=text/xml>
- TierII Chemical Inventory Atom Feed
  - <http://beta.usersmarts.com/en-node/api/services/10/11/atom>
- Emission Reports Atom Feed:
  - <http://live.usersmarts.com/es/api/emissions?facilityId=97303PRDCT3049I&format=text/xml>
- Station Measurements Atom Feed:
  - <http://live.usersmarts.com/es/api/stationReports/10637>
- Resource Catalog (CSW):
  - <http://beta.usersmarts.com/csw-epa/csw?REQUEST=GetCapabilities>

# Example GML Schema: WfsFacilityBriefWithChemicals

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:gml="http://www.opengis.net/gml" xmlns:facid="http://www.epa.gov/xml"
  xmlns:t2="http://www.exchangegenetwork.net/schema/TierII/1/0" targetNamespace="http://www.epa.gov/xml" elementFormDefault="qualified"
  version="1.0">
  <xs:import namespace="http://www.opengis.net/gml" schemaLocation="http://schemas.opengis.net/gml/3.1.1/base/gml.xsd"/>
  <xs:import namespace="http://www.exchangegenetwork.net/schema/TierII/1/0"
    schemaLocation="http://www.exchangegenetwork.net/schema/TierII/1/0/TierII_ChemicalInventory_v1.0.xsd"/>
  <xs:include schemaLocation="http://www.exchangegenetwork.net/schema/FRS/2/3/FACID_FacilitySiteAll_v2.3.xsd"/>
```

Import & include FRS  
and TierII Schema

...

```
<!-- A brief representation of TierII:ChemicalInventory element -->
<xs:element name="ChemicalInfo" type="facid:ChemicalInfoType"/>
<xs:complexType name="ChemicalInfoType">
```

```
<xs:sequence>
```

```
<xs:element ref="t2:EHSIndicator" minOccurs="0"/>
<xs:element ref="t2:HealthEffects" minOccurs="0" maxOccurs="unbounded"/>
<xs:element ref="t2:HazardType" minOccurs="0" maxOccurs="unbounded"/>
<xs:element ref="t2:TradeSecretIndicator" minOccurs="0"/>
<xs:element ref="t2:NumberOfDaysOnsite" minOccurs="0" maxOccurs="unbounded"/>
<xs:element ref="t2:StorageLocationDescription" minOccurs="0" maxOccurs="unbounded"/>
<xs:element ref="t2:ChemicalIdentification" minOccurs="0"/>
```

Select TierII  
ChemicalInventory  
elements to use in new  
object called  
"ChemicalInfo"

```
</xs:sequence>
```

```
</xs:complexType>
```

```
<!-- === facid:WfsFacilitySummary===== -->
```

```
<xs:element name="WfsFacilitySummary" type="facid:WfsFacilitySummaryType" substitutionGroup="gml:_Feature"/>
<xs:element name="WfsFacilityBriefWithChemicals" type="facid:WfsFacilitySummaryType" substitutionGroup="gml:_Feature"/>
<xs:complexType name="WfsFacilitySummaryType">
```

```
<xs:complexContent>
```

```
<xs:extension base="gml:AbstractFeatureType">
```

```
<xs:sequence>
```

```
<xs:element name="where" type="gml:PointPropertyType"/>
<xs:element ref="facid:FacilityRegistryIdentifier"/>
<xs:element ref="facid:FacilitySiteName"/>
<xs:element ref="facid:FacilitySiteTypeName" minOccurs="0"/>
<xs:element ref="facid:LocationAddressText"/>
<xs:element ref="facid:LocalityName"/>
<xs:element ref="facid:CountyName"/>
<xs:element ref="facid:StateUSPSCCode"/>
<xs:element ref="facid:LocationZIPCode"/>
<xs:element ref="facid:SICCode" minOccurs="0" maxOccurs="unbounded"/>
<xs:element ref="facid:ChemicalInfo" minOccurs="0"
```

Define GML Feature  
type and selected  
properties from FRS and  
TierII schema... allows  
join queries with  
combined results

```
maxOccurs="unbounded"/>
```

```
</xs:sequence>
```

```
</xs:extension>
```

```
</xs:complexContent>
```

```
</xs:complexType>
```

# WFS Query: WfsFacilityBriefWithChemicals

```
<?xml version="1.0" encoding="UTF-8"?>
<GetFeature xmlns="http://www.opengis.net/wfs" xmlns:facid="http://www.epa.gov/xml"
  xmlns:t2="http://www.exchangenetwork.net/schema/TierII/1/0" startPosition="0" maxFeatures="10">
  <Query typeName="facid:WfsFacilityBriefWithChemicals">
    <ogc:Filter xmlns:ogc="http://www.opengis.net/ogc">
      <ogc:And>
        <ogc:PropertyIsLike wildCard="*" singleChar="#" escapeChar="!">
          <ogc:PropertyName>t2:ChemicalInventory/t2:ChemicalIdentification/sc:EPACChemicalRegistryName</ogc:PropertyName>
          <ogc:Literal>acetone</ogc:Literal>
        </ogc:PropertyIsLike>
        <ogc:Intersect>
          <ogc:PropertyName>where</ogc:PropertyName>
          <gml:Polygon xmlns:gml="http://www.opengis.net/gml">
            <gml:outerBoundaryIs>
              <gml:LinearRing>
                <gml:coordinates>
          96.12144512991861,41.168536685440436 -96.1237053565119,41.16802844552299 -96.12602130617414,41.16797091962696 -
          96.12830397825859,41.16836631844027 -96.13046565095719,41.16919944700826 -96.13242325240041,41.1704382886673 -
          96.13410155306265,41.17203523542717 -96.13543605679062,41.17392891751947 -96.13637547935448,41.17604656180339 -
          96.13688371927194,41.178306788396675 -96.13694124516796,41.18062273805891 -96.13654584635465,41.182905410143356 -
          96.13571271778666,41.18506708284196 -96.13447387612763,41.187024684285184 -96.13287692936775,41.18870298494741 -
          96.13098324727545,41.190037488675394 -96.12886560299154,41.190976911239254 -95.87034356930013,41.27646427696191 -
          95.86808334270684,41.276972516879354 -95.8657673930446,41.27703004277539 -95.86348472096016,41.276634643962076 -
          95.86132304826155,41.275801515394086 -95.85936544681833,41.27456267373505 -95.8576871461561,41.27296572697518 -
          95.85635264242812,41.27107204488288 -95.85541321986426,41.26895440059896 -95.85490497994681,41.26669417400567 -
          95.85484745405078,41.26437822434344 -95.8552428528641,41.26209555225899 -95.85607598143208,41.259933879560386 -
          95.85731482309112,41.25797627811716 -95.85891176985099,41.256297977454935 -95.86080545194329,41.25496347372695 -
          95.8629230962272,41.25402405116309 -96.12144512991861,41.168536685440436</gml:coordinates>
              </gml:LinearRing>
            </gml:outerBoundaryIs>
          </gml:Polygon>
        </ogc:Intersect>
      </ogc:And>
    </ogc:Filter>
  </Query>
</GetFeature>
```

# WFS Query Results: WfsFacilityBriefWithChemicals

```
<?xml version="1.0" encoding="UTF-8"?>
<wfs:FeatureCollection xmlns:wfs="http://www.opengis.net/wfs" featuresMatched="1">
  <gml:featureMember xmlns:gml="http://www.opengis.net/gml">
    <facid:WfsFacilityBriefWithChemicals xmlns:facid="http://www.epa.gov/xml" fid="73584">
      <facid:where>
        <gml:Point>
          <gml:coordinates>-95.96961,41.221999</gml:coordinates>
        </gml:Point>
      </facid:where>
      <facid:FacilityRegistryIdentifier>73584</facid:FacilityRegistryIdentifier>
      <facid:FacilitySiteName>Brenntag Great Lakes LLC</facid:FacilitySiteName>
      <facid:LocalityName>Omaha</facid:LocalityName>
      <facid:CountyName>Douglas</facid:CountyName>
      <facid:StateUSPSCode>NE</facid:StateUSPSCode>
      <facid:LocationZIPCode>68107-1225</facid:LocationZIPCode>
      <facid:SICCode>5169</facid:SICCode>
      <facid:ChemicalInfo xmlns:t2="http://www.exchangene트워크.net/schema/TierII/1/0
TierII_ChemicalInventory_v1.0.xsd">
        <t2:EHSIndicator>N</t2:EHSIndicator>
        <t2:HealthEffects>Immediate/Acute</t2:HealthEffects>
        <t2:HazardType>Fire</t2:HazardType>
        <t2:TradeSecretIndicator>N</t2:TradeSecretIndicator>
        <t2:NumberOfDaysOnsite>365</t2:NumberOfDaysOnsite>
        <t2:StorageLocationDescription>WAREHOUSE</t2:StorageLocationDescription>
        <t2:ChemicalIdentification xmlns:sc="urn:us:net:exchangene트워크:sc:1:0">
          <sc:CASNumber>67641</sc:CASNumber>
        </t2:ChemicalIdentification>
      </facid:ChemicalInfo>
      <sc:ChemicalSubstanceSystematicName>ACETONE</sc:ChemicalSubstanceSystematicName>
      <sc:EPACChemicalRegistryName>ACETONE</sc:EPACChemicalRegistryName>
    </facid:WfsFacilityBriefWithChemicals>
  </gml:featureMember>
</wfs:FeatureCollection>
```

# AtomPub with OpenSearch

- Search FRS Facilities by Facility ID:
  - <http://beta.usersmarts.com/en-node/api/services/1/2/atom?FacilityRegistryIdentifier=10000>
- Search FRS Facilities by Facility Name:
  - [http://beta.usersmarts.com/en-node/api/services/1/2/atom?FacilitySiteName=\\*PLANT\\*](http://beta.usersmarts.com/en-node/api/services/1/2/atom?FacilitySiteName=*PLANT*)
- Search FRS facilities by TierII ChemicalInventory name:
  - [http://beta.usersmarts.com/en-node/api/services/1/2/atom?EPAChemicalRegistryName=aceto\\*](http://beta.usersmarts.com/en-node/api/services/1/2/atom?EPAChemicalRegistryName=aceto*)

# FRS query results: GeoRSSFacility

<http://beta.usersmarts.com/en-node/api/services/1/2/atom?FacilityRegistryIdentifier=10000>

```
<feed xmlns="http://www.w3.org/2005/Atom" xmlns:opensearch="http://a9.com/-/spec/opensearch/1.1/">
  <title>Facilities Feed</title>
  <opensearch:totalResults>1</opensearch:totalResults>
  <opensearch:itemsPerPage>1</opensearch:itemsPerPage>
  <entry>
    <id>10000</id>
    <title>Frontier Co-op Company</title>
    <summary>351 Cottonwood StNorth BendNE68649-8500</summary>
    <link href="http://beta.usersmarts.com:80/en-node/api/services/1/2/10000/atom" rel="alternate"/>
    <georss:point xmlns:georss="http://www.georss.org/georss"> 41.46036 -96.790243</georss:point>
    <content type="text/xml">
      <facid:GeoRssFacility xmlns:facid="http://www.epa.gov/xml">
        <facid:GeographicLocation>
          <georss:where xmlns:georss="http://www.georss.org/georss">
            <gml:Point xmlns:gml="http://www.opengis.net/gml">
              <gml:coordinates>-
                96.790243,41.46036</gml:coordinates>
            </gml:Point>
          </georss:where>
          <facid:AlternativeCRS>
            <gml:Point xmlns:gml="http://www.opengis.net/gml">
              <gml:coordinates>-
                96.790243,41.46036</gml:coordinates>
            </gml:Point>
          </facid:AlternativeCRS>
        </facid:GeographicLocation>
        <facid:FacilitySiteAllDetails>
          <facid:FacilitySite>
            <facid:FacilityRegistryIdentifier>10000</facid:FacilityRegistryIdentifier>
            <facid:FacilitySiteName>Frontier Co-op
            Company</facid:FacilitySiteName>
            <facid:CongressionalDistrictNumber>01</facid:CongressionalDistrictNumber>
            <facid:LegislativeDistrictNumber>15</facid:LegislativeDistrictNumber>
            </facid:FacilitySite>
          </facid:LocationAddress>
        </facid:FacilitySiteAllDetails>
      </facid:GeoRssFacility>
    </content>
  </entry>
</feed>
```

# AtomPub Feed (TierII ChemicalInventory)

[http://beta.usersmarts.com/en-node/api/services/10/11/atom?EPACChemicalRegistryName=aceto\\*](http://beta.usersmarts.com/en-node/api/services/10/11/atom?EPACChemicalRegistryName=aceto*)

```
<feed xmlns="http://www.w3.org/2005/Atom" xmlns:opensearch="http://a9.com/-/spec/opensearch/1.1/">
  <title>Chemical Feed</title>
  <opensearch:totalResults>795</opensearch:totalResults>
  <opensearch:itemsPerPage>10</opensearch:itemsPerPage>
  <entry>
    <id>CFCFEF5A-9809-4D14-9466-2CB9ADEB9D0C</id>
    <title>(POLY)AMIDE PA 46</title>
    <link href="http://beta.usersmarts.com:80/en-node/api/services/10/11/CFCFEF5A-9809-4D14-9466-2CB9ADEB9D0C/atom" rel="alternate"/>
    <content type="text/xml">
      <TierII:ChemicalInventory xmlns:TierII="http://www.exchangenetwork.net/schema/TierII/1/0
TierII_ChemicalInventory_v1.0.xsd">
        <TierII:ChemicalIdentification>
          <sc:CASNumber
xmlns:sc="urn:us:net:exchangenetwork:sc:1:0">50327770</sc:CASNumber>
          <sc:ChemicalSubstanceSystematicName
xmlns:sc="urn:us:net:exchangenetwork:sc:1:0">Plastic Pellets</sc:ChemicalSubstanceSystematicName>
          <sc:EPACChemicalRegistryName
xmlns:sc="urn:us:net:exchangenetwork:sc:1:0">(POLY)AMIDE PA 46</sc:EPACChemicalRegistryName>
        </TierII:ChemicalIdentification>
        <TierII:TradeSecretIndicator>N</TierII:TradeSecretIndicator>
        <TierII:ChemicalPhysicalState>Mix</TierII:ChemicalPhysicalState>
        <TierII:ChemicalPhysicalState>Solid</TierII:ChemicalPhysicalState>
        <TierII:ChemicalInventoryDetails>
          <TierII:AverageDailyAmount>0.0</TierII:AverageDailyAmount>
          <TierII:MaximumCode>04</TierII:MaximumCode>
          <TierII:NumberOfDaysOnsite>365</TierII:NumberOfDaysOnsite>
          <TierII:MaximumDailyAmount>0.0</TierII:MaximumDailyAmount>
          <TierII:AverageCode>03</TierII:AverageCode>
        </TierII:ChemicalInventoryDetails>
        <TierII:cid>CFCFEF5A-9809-4D14-9466-2CB9ADEB9D0C</TierII:cid>
        <TierII:EHSIndicator>N</TierII:EHSIndicator>
        <TierII:ChemicalStorageLocations>
          <TierII:MeasurementUnit/>
          <TierII:MaximumAmountAtLocation/>
          <TierII:StorageLocationTemperatureDescription/>
          <TierII:StorageTypeCode>K</TierII:StorageTypeCode>
          <TierII:ConfidentialLocationIndicator>N</TierII:ConfidentialLocationIndicator>
          <TierII:StorageLocationPressureDescription/>
          <TierII:StorageLocationPressureCode>1</TierII:StorageLocationPressureCode>
          <TierII:StorageTypeDescription/>
          <TierII:StorageLocationTemperatureCode>4
        </TierII:StorageLocationTemperatureCode>
          <TierII:StorageLocationDescription>Molding</TierII:StorageLocationDescription>
        </TierII:ChemicalStorageLocations>
      </TierII:ChemicalInventory>
    </content>
  </entry>
```