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Customer Success Is Our Mission

AWIPS Continuous Technology Refresh (CTR)

AWIPS Software CTR

TO6: Outbrief and RRD

June 13, 2007

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T06 Out Brief Topics
Theme of T06: ADE Hardening and Refinement

- Architecture Changes
- Enhancements
  - Localization Pattern (CAVE and EDEX)
  - CAVE menu extensibility pattern
  - Plug In Extensibility
  - uEngine Refractor
  - Repository Refinement
- Deployment Simplification
  - Server Install with GUI driven installer
  - Workstation Install
- Hardening and Tuning
  - Server and Cluster Performance
  - Memory Leaks, Cluster State and locking, Dead Locks
  - JPROBE and JMX tools

Architecture Migration Roadmap: ADE Development

T06 Hardens the ADE, ready for Application Migration

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Architecture Changes

1/1/06 | 6/15/07 | 6/15/06 | 1/4/07 | 6/15/07

Raytheon IRAD | **TO 3** | **TO 4** | **TO 5** | **TO 6**

Tech. Reference Arch.
- SOA service framework
- Plug-in framework
- Micro Engine
- Core Base of Services
- Core Patterns
- Initial Open Source Project Integration

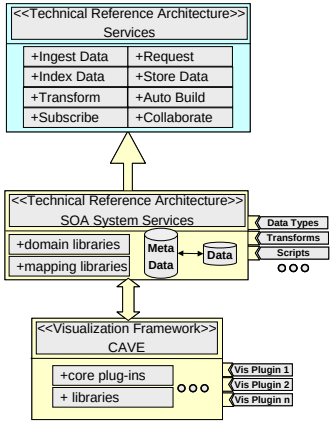
Release 0.0
1rst Delivered Code
- CM / Deploy Pattern
- SOA Templates
- Data Plug-ins
- Sub / notification
- mEngine Scripting
- CAVE

Release 0.1
- Regression Test Environ.
- CAVE +
- mEngine +
- Remote Data Access (XML)
- Dissemination

Release 0.2
- Server Execution Structure
- Remote Admin
- Legacy Adapters
- Alerting Pattern
- SOA Services +
- CAVE++

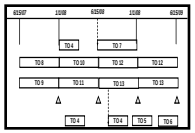
Release 1.0
- Localization Pattern
  - Server
  - CAVE
- Stress Testing
- Code hardening
- Installation Simplification

App Migration



All execution on workstation

Add Server Execution



TO 7

Detailed Application Migration Planning

ADE Lines of Code Count T03-T06
30K written in the last year

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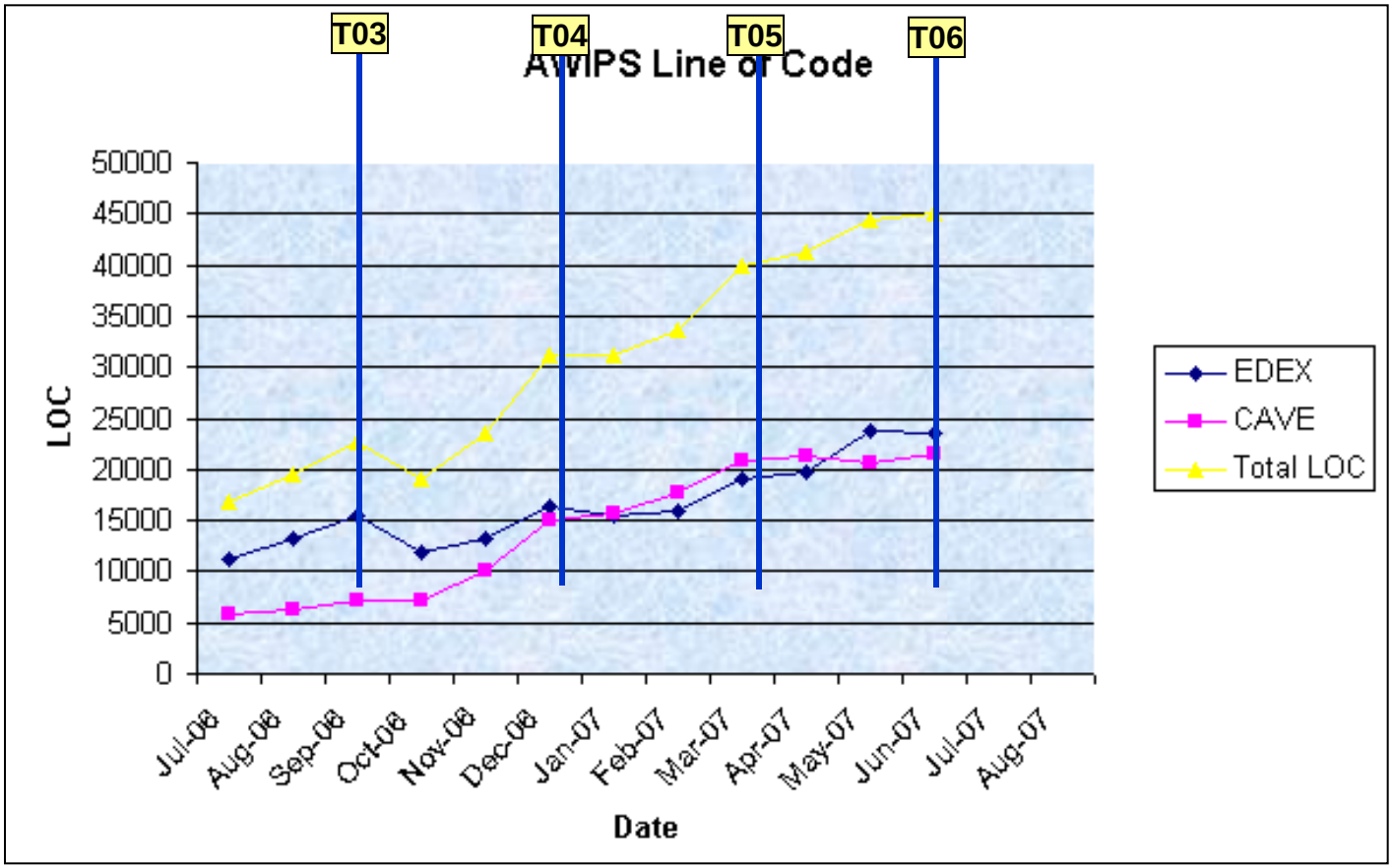
Architecture Changes

- Includes numerous refactorings to improve code base



SOA Architecture – Logical Layered View
Layers Separated By Simple APIs

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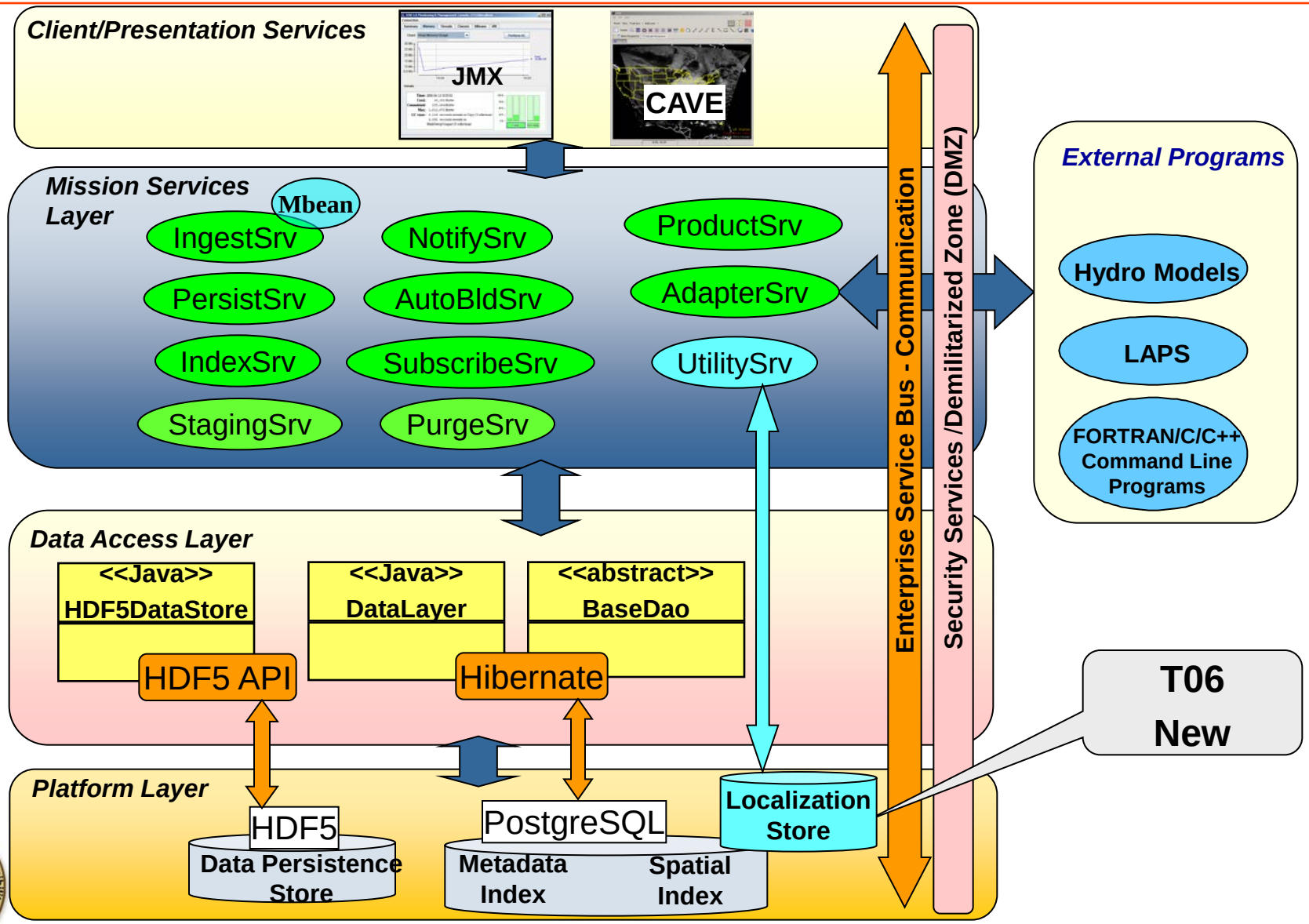
Architecture Changes



SOA – Technical Reference View
Technical Reference Architecture Extends

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Architecture Changes

Core Base of Services
- Micro Engine
- Plug-in Framework
- Extensible XML model
- Core SOA Services

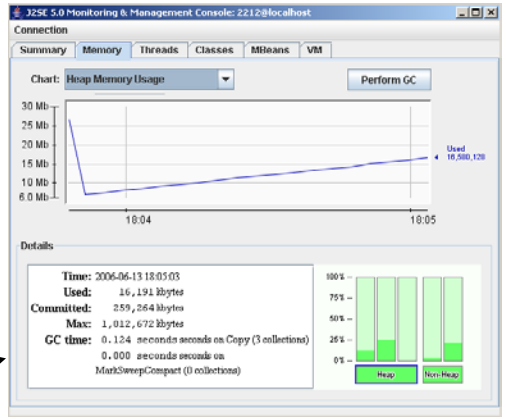
Extend to a specific domain
- Plug in specific libraries
- Plug in data types, transforms

Service Interface To Data
- Clean separation between data and visualization
- Canonical XML data model
- Scriptable Interface

<Technical Reference Architecture> Services

+Ingest Data	+Request
+Index Data	+Store Data
+Adapt	+Auto Build
+Subscribe	+Collaborate

Remote Management (JMX)



Satellite Feed 4.5Mps

Local Data

<Technical Reference Architecture> SOA System Services (EDEX)

+domain libraries	Meta Data ↔ Data
+mapping libraries	

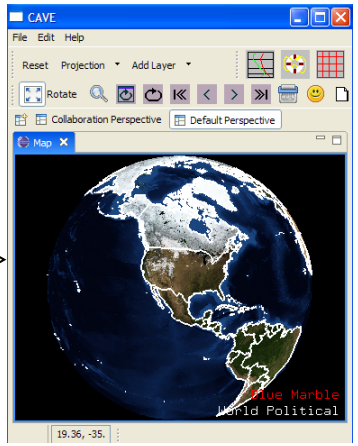
Data Types
Transforms
Scripts
○○○

<Visualization Framework> CAVE

2D/3D GIS	Drawing
Raster Render	Collaboration
Vector Render	XY Render
Auto Animate	Localization

Vis Plugin 1
Vis Plugin 2
Vis Plugin n

T06 New



AWIPS-II ADE High Level System Services
SOA Services Running in an ESB Container

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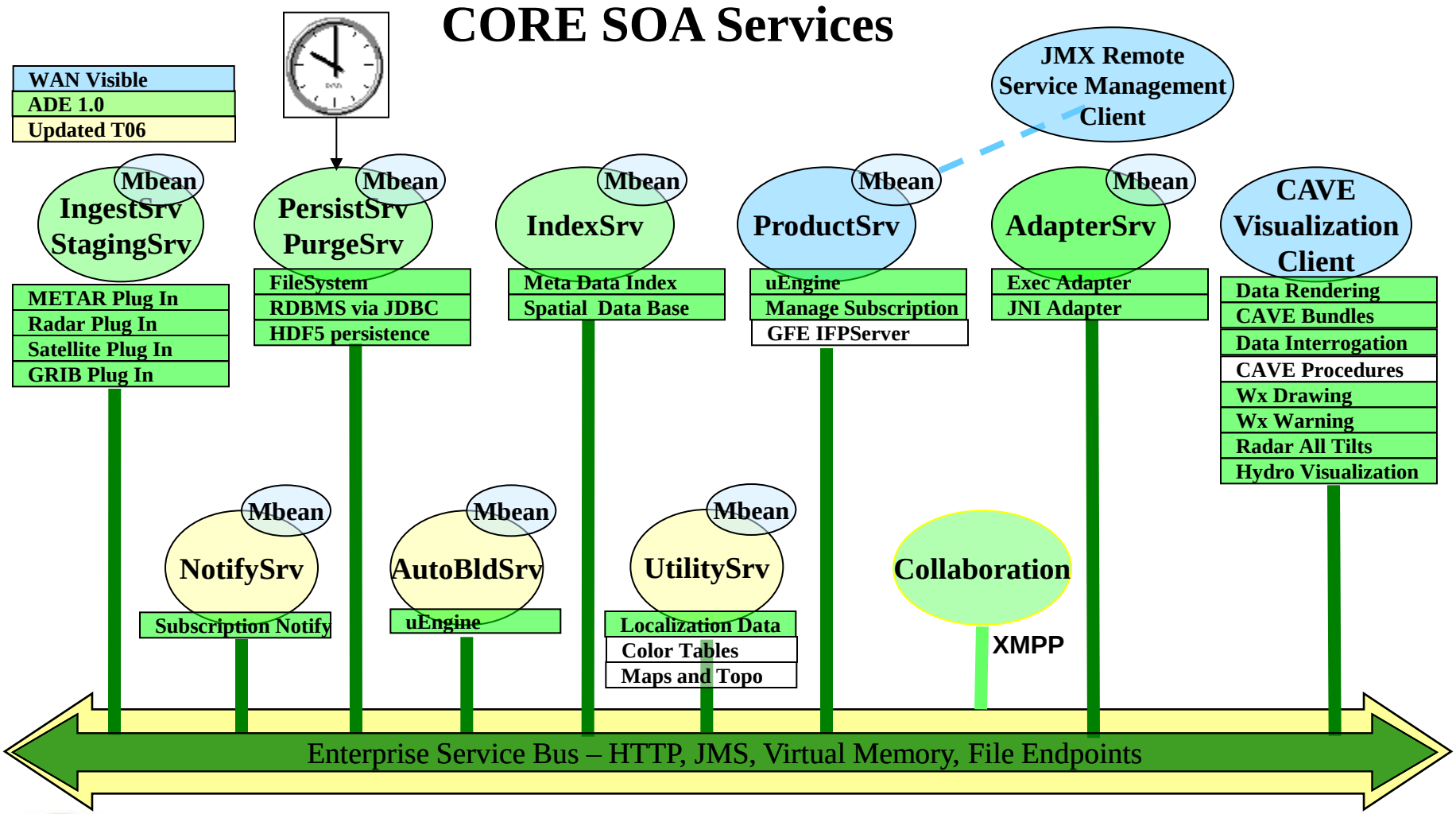
Architecture Changes



Services Independent of End Points

Localization Pattern
Centralizes Local Configuration …

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T06 Enhancements

- Localization procedure occurs at startup
  - CAVE localization is controlled through Eclipse Preferences
  - Extended Eclipse Preferences to use a XML data store
- Different approach to data since CAVE can work with large data sets less subsetting is required (ie Shape Files, topo)
- Localization is provided through two simple, unified interfaces
  - Configuration for the server
  - Localization for the client, with server synchronization capability
- Localization provides a multi-tiered configuration
  - **Base** (standard national configuration values), **Site** for Server (any values the site chooses to override)
  - **Base**, **Site** and **User** for Client (values that the user overrides)

Localization Pattern
Uses New SOA service UtilitySrv

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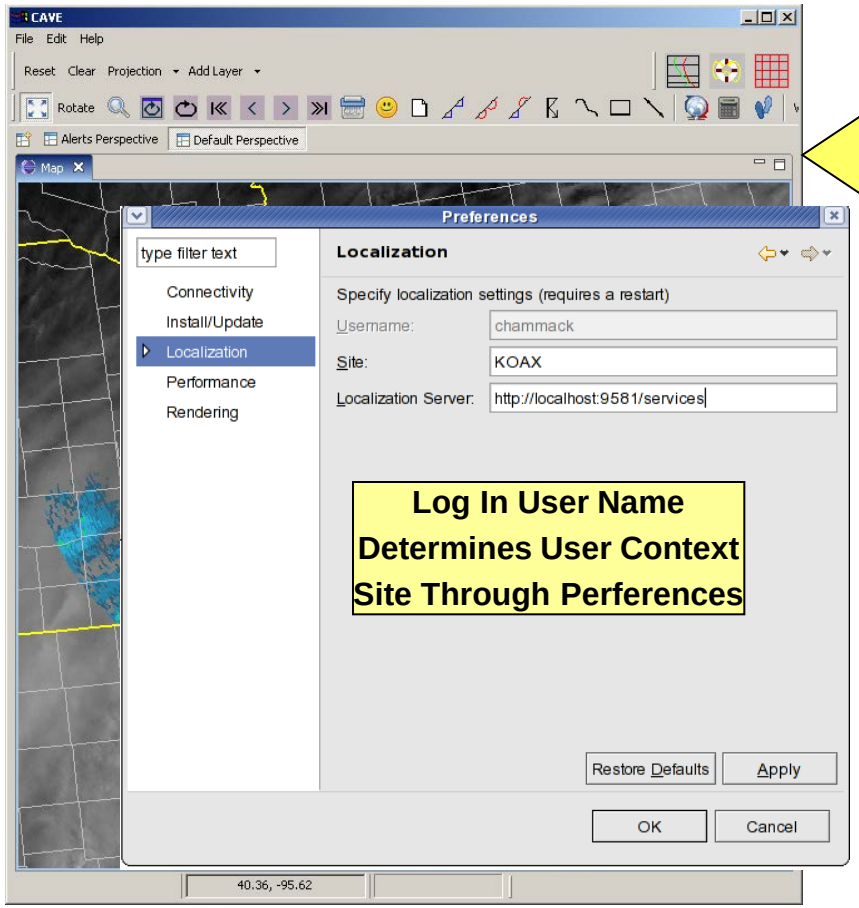
T06 Enhancements



Log In User Name
Determines User Context
Site Through Perferences

ESB Sync Protocal

At CAVE
Start Up

<<SOA Service>>
UtilitySrv

<<Java>>
UtilityManager

+putFile()
+getFile()
+listFiles()

User

Site

Base

Localization Pattern
Defines the default screen, menus, configuration

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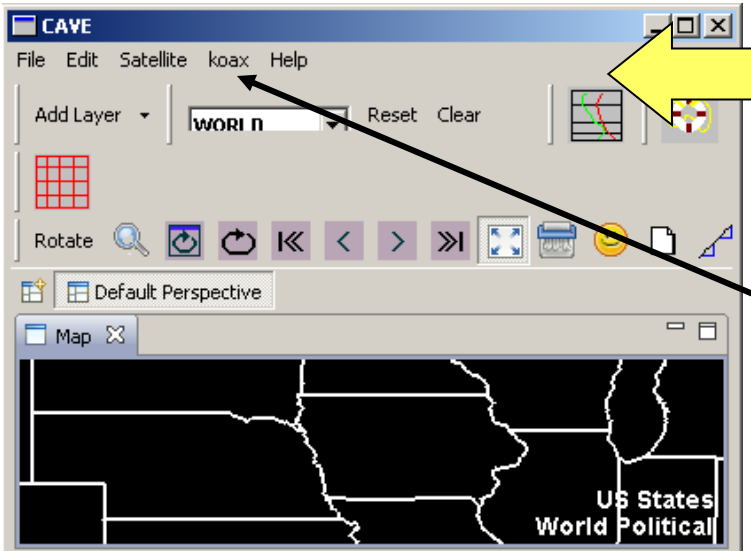
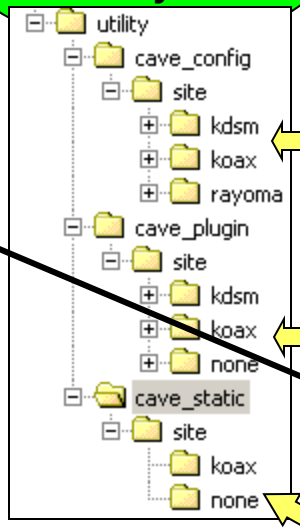
T06 Enhancements



<<SOA Service>>
UtilitySrv



Configration Preferences

config.xml

```
<configuration>
  <siteName>KOAX</siteName>
  <siteFullName>Omaha</siteFullName>
  <siteType>WFO</siteType>
</configuration>
```

Menus

plugin.xml

```
<plugin>
- <extension point="org.eclipse.ui.me
  - <menuContribution locationURI="m
    - <menu label="koax">
```

default-bundle.xml

Default screen

Optional
uEngine Script

Localization Data –
Hierarchical Preferences, Menus, Data …

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T06 Enhancements

Base:

```
<configuration>
   <textureCardPreference>128</textureCardPreference>
   <textureMemoryPreference>384</textureMemoryPreference>
   <framesPerSecondPreference>25</framesPerSecondPreference>
   <tileBoundaries>false</tileBoundaries>
   <connectionMethod>jms</connectionMethod>
   <jmsServerAddress>tcp://localhost:61616</jmsServerAddress>
   <dataDirectory>/awips/opt/data/hdf5</dataDirectory>
   <fontMagnification>1.0</fontMagnification>
</configuration>
```

Site:

```
<configuration>
   <siteName>KOAX</siteName>
   <siteFullName>Omaha</siteFullName>
   <siteType>WFO</siteType>
   <dataDirectory>/oax-awips/opt/data/hdf5</dataDirectory>
</configuration>
```

User:

```
<configuration>
   <fontMagnification>1.25</fontMagnification>
</configuration>
```

CAVE Menu Extensibility – Eclipse 3.3
Configuration Preferences, Menus, Data …

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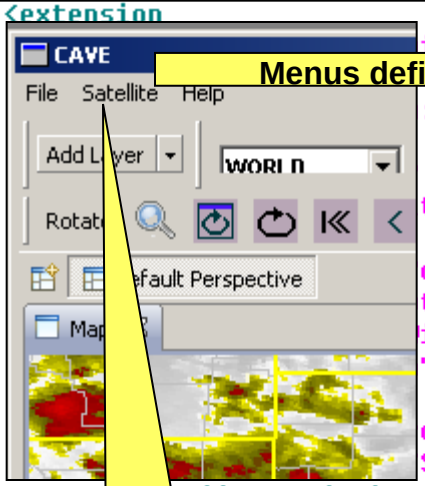
T06 Enhancements



plugin.xml

Menus defined in plug in xml

CAVE satellite

plug In

```
<extension
                i.menus">
                :org.eclipse.ui.main.me

                te">

                com.raytheon.viz.ui.loadBundle"
                theon.viz.sat.irWindow"
                indow"
                ">

                oductURI"
                Satellite/Images/GOES/East_CO
        </parameter>
        <parameter
              name="productName"
              value="IR Window">
        </parameter>
        <parameter
              name="bundleLocation"
              value="etc/bundles/IRWindow.xml">
        /parameter>
        mand>
```

bundle.xml

```
<mapDescriptor>
 <resource class="com.raytheon.viz.sat
  <properties>
   <value field="colorMap">COLORMAP { ir_default }</value>
   <value field="colorMapMin">0.0</value>
   <value field="colorMapMax">255.0</value>
   <value field="contrast">1.0</value>
   <value field="brightness">1.0</value>
   <value field="interpolationState">false</value>
   <value field="requestScript">include("SatelliteRequest.js");
var dataRequest = new SatelliteRequest();
dataRequest.setCount(8);
dataRequest.addParameter("satellite","GOES");
dataRequest.addParameter("parameter","Imager 11 micron IR");
dataRequest.setSortValue("valid_time");
dataRequest.addParameter("area_subtype","East CONUS");
dataRequest.execute();</value>
  </properties>
  <resourceProperties>
   <isVisible>true</isVisible>
   <opacity>1.0</opacity>
   <isLabeled>true</isLabeled>
   <isHoverOn>false</isHoverOn>
  </resourceProperties>
```

references bundle

Menu fields update

Automatically through the AlertManagerJob as data is ingested

Embedded uEngine Script

Retreives and transforms data for display

CAVE Menu Extensibility Pattern
Leverages Capability in Eclipse 3.3

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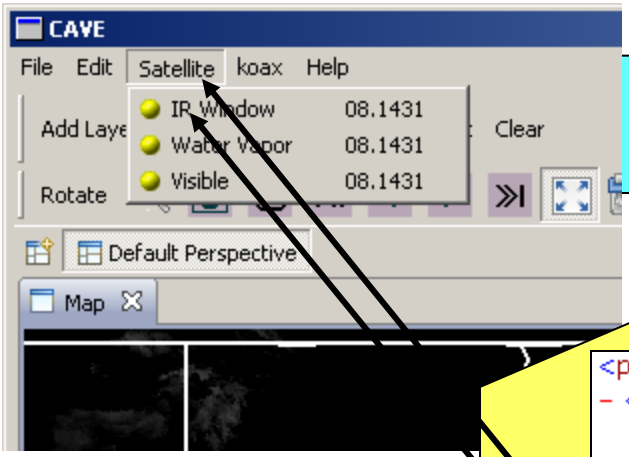
T06 Enhancements



CAVE satellite Plug In

plugin.xml

```
<plugin>
- <extension point="com.raytheon.viz.core.resource">
    <resource class="com.raytheon.viz.satellite.rsc.SatResource"
      factoryClass="com.raytheon.viz.satellite.rsc.SatResourceFactoryAdapter" nam
      recordClass="com.raytheon.edex.plugin.satellite.SatelliteRecord" />
  </extension>
- <extension point="org.eclipse.ui.menus">
  - <menuContribution locationURI="menu:org.eclipse.ui.main.menu?after=edit">
    - <menu id="satellite" label="Satellite">
      - <command commandId="com.raytheon.viz.ui.loadBundle" id="com.raytheon.v
          <parameter name="productURI" value="/Satellite/Images/GOES/East_CONI
          <parameter name="productName" value="IR Window" />
          <parameter name="bundleLocation" value="etc/bundles/IRWindow.xml" />
        </command>
```

Bundle IRWindow.xml

uEngine Script to Retreive loop of data

CAVE Menu Extensibility Pattern
Auto updating menu data time indicators

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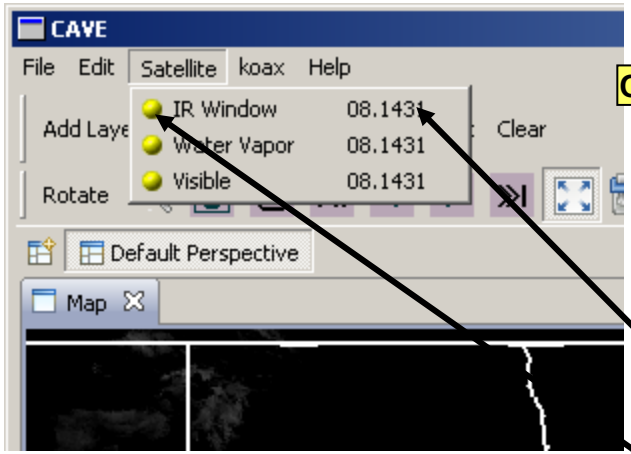
T06 Enhancements



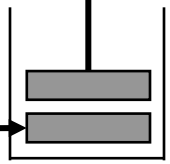
CAVE Start Up

Build List of DataURIs from Menus

Perform Initial Catalog Queries To Populate CAVE Menus

<<Eclipse Job>>
MenuManagerJob
+run() {Every 2 Sec.}

IngestSrv



Alerts
JMS Topic

Plug In Refinement
T06 Reorganization of Eclipse Plug Ins

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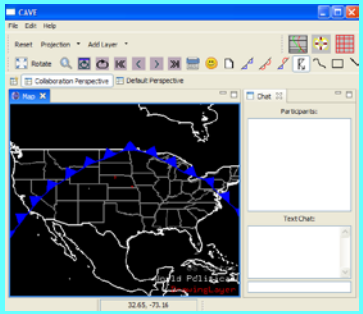
T06 Enhancements

JAVA JVM
SOA Service
Container

TAF
SHEF
RADAR
SATELLITE
GRIB
METAR
MESOWEST

JAVA JVM
Eclipse
RCP



T06 Minor
Refactor of Plug In Pattern

Signed	Provider	Plug-in Name
X	Raytheon	Catalog Plug-in
X	Raytheon	Volume Browser Plug-in
X	Raytheon	Warngen Plug-in
X	Raytheon	GIS Tools Plug-in
X	Raytheon	Geotiff Plug-in
X	Raytheon	Looping Plug-in
X	Raytheon	Alerts Plug-in
X	Raytheon	Grid Plug-in
X	Raytheon	Raytheon Visualization Toolkit
X	Raytheon	GlMap Plug-in
X	Raytheon	Map Tools Plug-in
X	Raytheon	Shapefile Plug-in
X	Raytheon	Satellite Plug-in
X	Raytheon	GFE Plug-in
X	Raytheon	Viz UI
X	Raytheon	Hydro Plug-in
X	Raytheon	Viz Core Capabilities
X	Raytheon	Pngtile Plug-in
X	Raytheon	AWIPS Personality Plug-in
X	Raytheon	OpenGL Rendering Plug-in
X	Raytheon	SkewT Plug-in
X	Raytheon	Nav Tools Plug-in
X	Raytheon	Radar Plug-in
X	Raytheon	EDEX Support Plug-in
X	Raytheon	Viz Drawing Capabilities
X	Raytheon	Graphing Plug-in
X	Raytheon	Pointdata Plug-in
X	Raytheo...	Batik Plug-in
X	Raytheo...	MuleClient Plug-in
X	Raytheo...	Rhino Plug-in
X	Raytheo...	Jibx Plug-in
X	Raytheo...	HdfS Plug-in
X	Raytheo...	OpenGL Plug-in
X	Raytheo...	Configuration Plug-in
X	Raytheo...	EHCache Plug-in
X	Raytheo...	Apache Commons Logging Plug-in
X	Raytheo...	Apache Commons Beanutils Plug-in
X	Raytheo...	Apache Commons Lang Plug-in
X	Raytheo...	Units Plug-in
X	Raytheo...	JOGL Win32 Specific Fragment
X	Raytheo...	Activemq Plug-in
X	Raytheo...	Apache Commons Collections Plug-in
X	Raytheo...	Vecmath Plug-in
X	Raytheo...	Geotools Plug-in
X	Raytheo...	Smack Plug-in
X	Raytheo...	JOGL Linux Specific Fragment

Incremental Upgrades Enabled Through Plug Ins

Plug In Enhancements
CAVE refactored, SOA new uEngine Scripting

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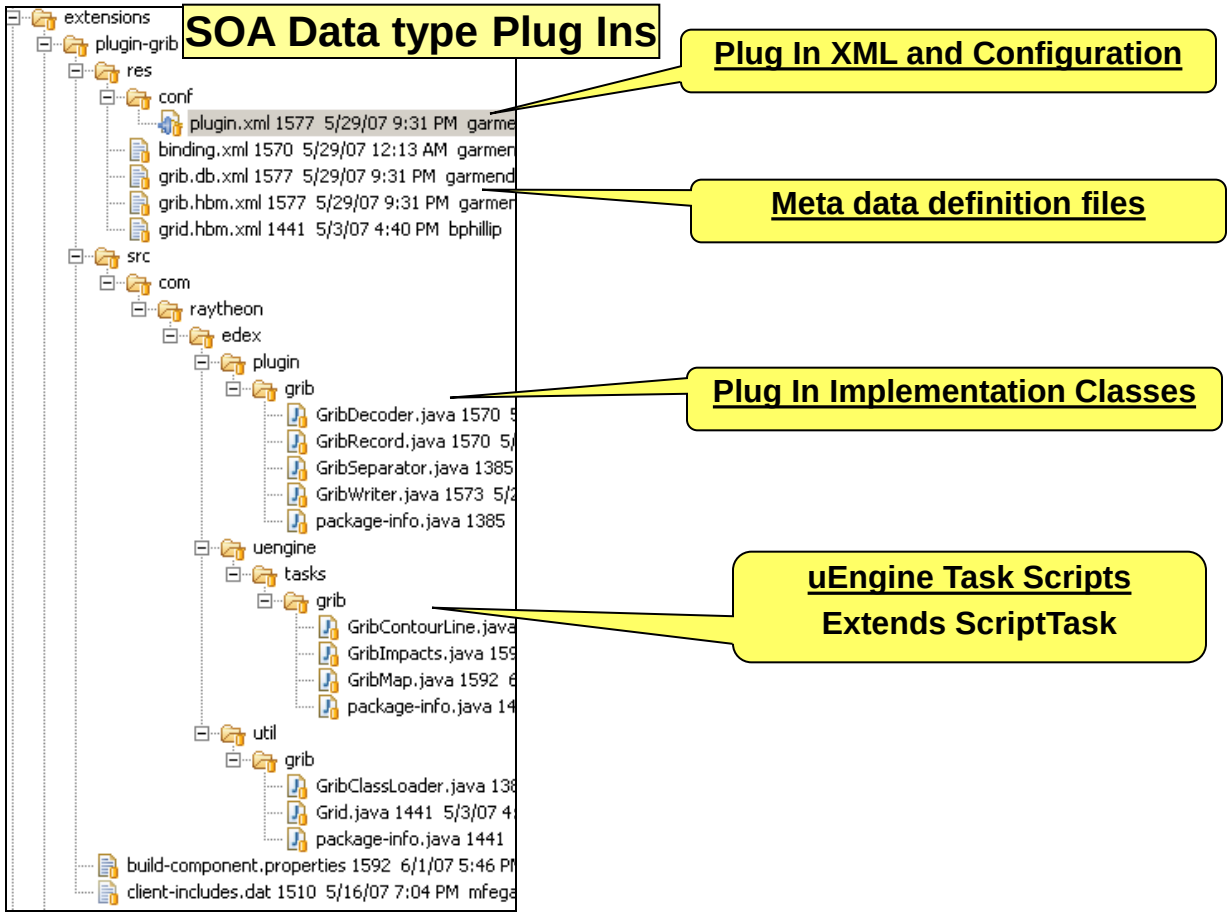
T06 Enhancements

- CAVE plug ins refactored in >30 separate plug ins following Eclipse best practices



T06 CAVE Eclipse RCP Plug In Tree
Dependency tree

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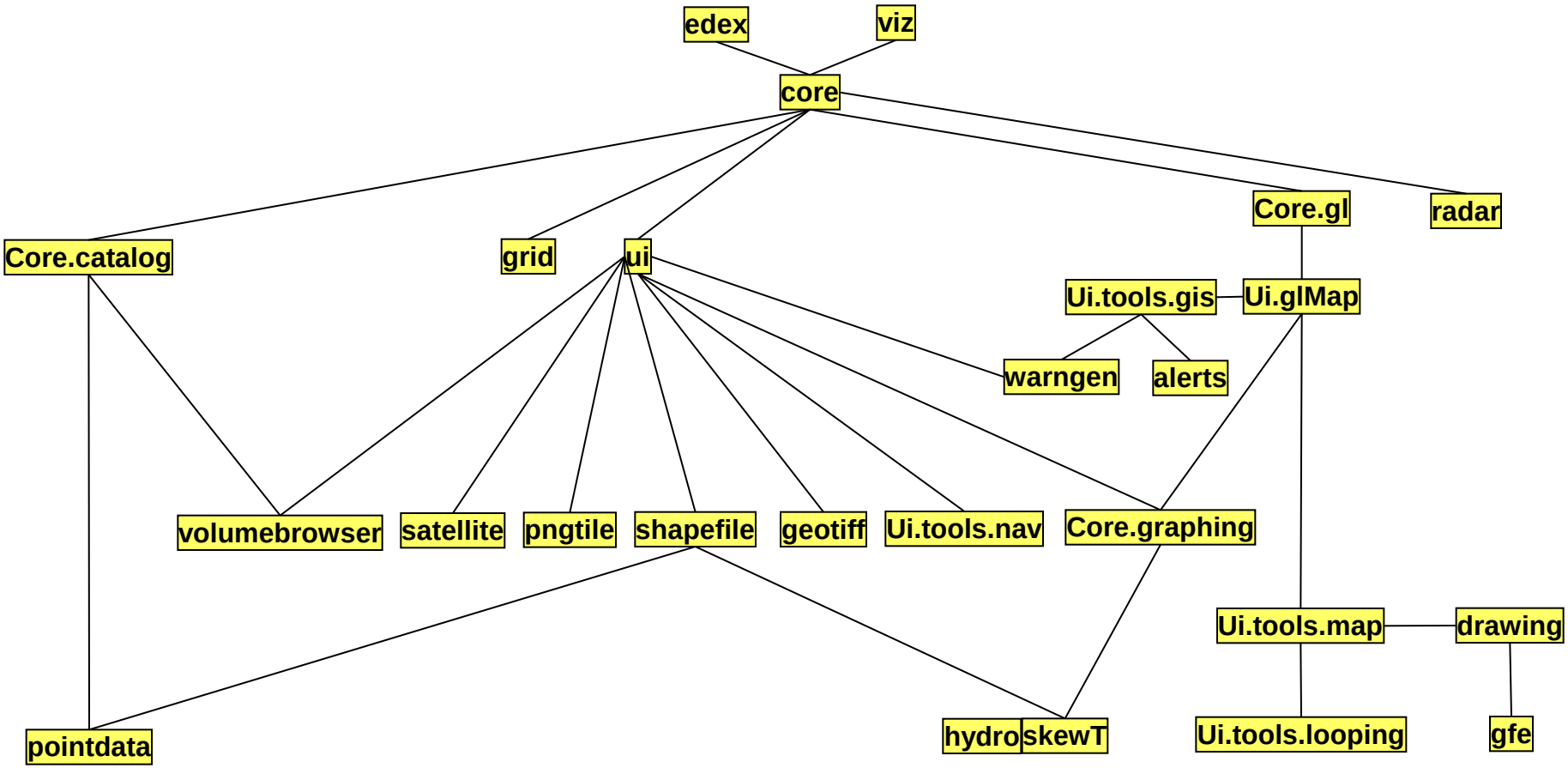
T06 Enhancements



SOA Plug In Tool Added to ADE
Adding using the tool to a training module

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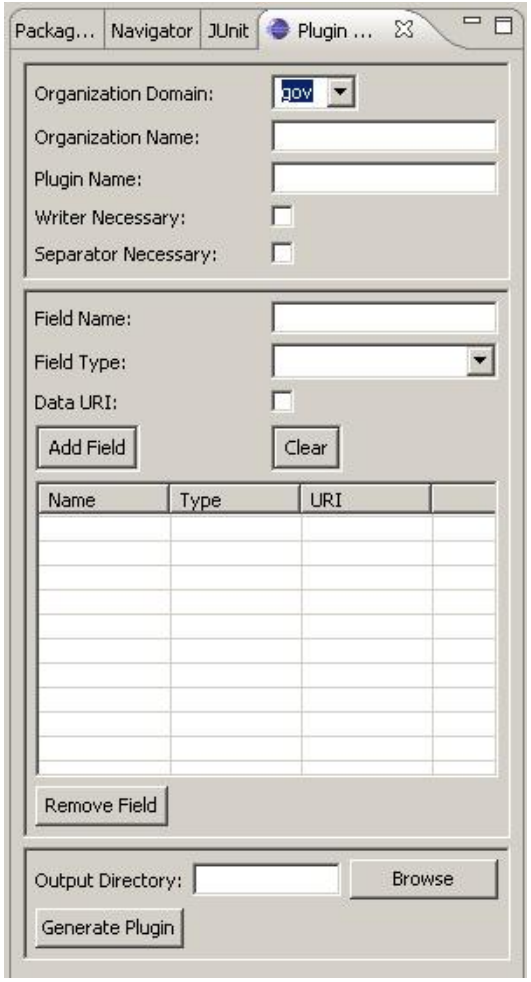
T06 Enhancements

- New with ADE 1.0: a Plug-in Creation tool.
  - The Plug-in Creation tool is implemented as an Eclipse plug-in.
  - Once installed, the Plug-in Creation tool may be used like any other element of the Eclipse IDE.
- The Plug-in Creation tool automates most of the work involved in generating the initial files for a data-type plug-in.
  - Automatically creates the required directory structure for the plug-in.
  - Generates class stubs for the required Java classes.
  - Generates initial configuration and build files.



uEngine Scripting Changed to JavaScript

- **Goal:** Simplify task writing and have control structures in language
- Uses Mozilla's freely available **Rhino**
  - Same JavaScript engine in JDK 1.6, except Mozilla version offers more features
  - Used in Eclipse
- UengineScript class, simply call setScriptText(String javaScriptCode) and run()
- Extend ScriptTask, Basic POJOs with an execute() method
- No digester rules, No chain data
- Tasks only operate on one object (loops at the script level)

Comparison of number of lines of code

- Current uEngine tasks
  - TermQueryIndex – 297
  - ASCIIToXML – 70
  - FileIn – 106
  - FileOut – 121
  - GribMap – 215
  - ColorMapImage – 110
  - ImageOut – 114
  - MakeResponseASCII – 37
  - MakeResponseURI – 97

- New uEngine tasks
  - TermQuery – 84
  - AsciiToXml – 24
  - FileIn – 40
  - FileOut – 112
  - GribMap – 187
  - ColorMapImage – 78
  - ImageOut – 77
  - MakeResponseAscii – 30
  - MakeResponseUri - 45

New uEngine Script Examples
Satellite and Grid uEngine examples

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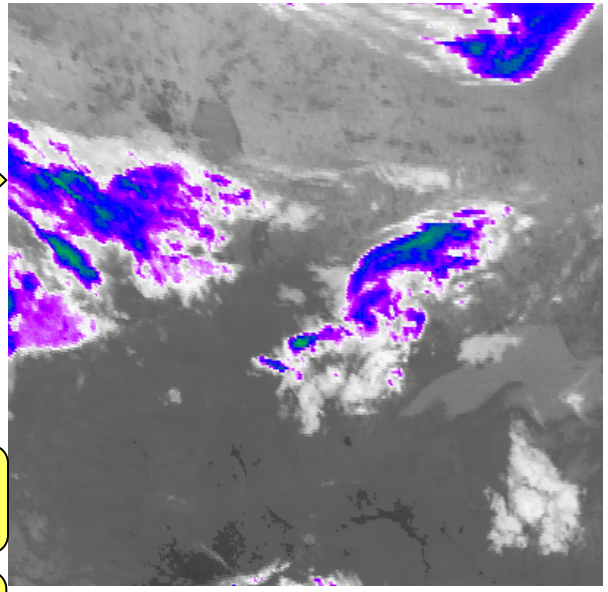
T06 Enhancements

```
include("SatelliteRequest.js");
var dataRequest = new SatelliteRequest();
dataRequest.requestImage(true);
dataRequest.setCount(1);
dataRequest.addParameter("parameter","Imager 11 micron IR");
dataRequest.addParameter("valid_time","2007-06-10 10:01:43.0");
dataRequest.addParameter("area_subtype","East CONUS");
dataRequest.setColormap("IREnhanced");
dataRequest.reprojectImage(false);
dataRequest.setFormat("png");
dataRequest.execute();
```

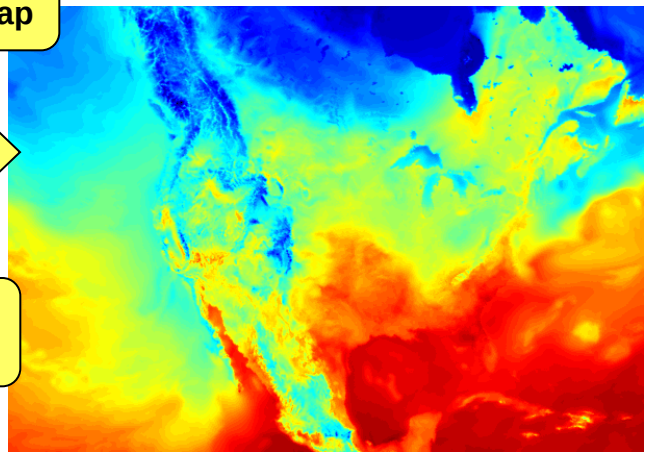


```
include("GridRequest.js");
var dataRequest = new GridRequest();
dataRequest.requestImage(true);
dataRequest.setCount(1);
dataRequest.addParameter("genprocess","84");
dataRequest.addParameter("paramid","Temperature");
dataRequest.addParameter("levelinfo","2.0_m");
dataRequest.addParameter("basetime","2007-06-10 12:00:00.0");
dataRequest.addParameter("forecasttime","0");
dataRequest.setColormap("GribRGB");
dataRequest.reprojectImage(false);
dataRequest.setFormat("png");
dataRequest.setScaleFactor(1.0);
dataRequest.execute();
```

Retreives Loops

Sets Color Map

Image Format



T06 ProductSrv Changes
JavaScript uEngine Language & DB for Subscribe

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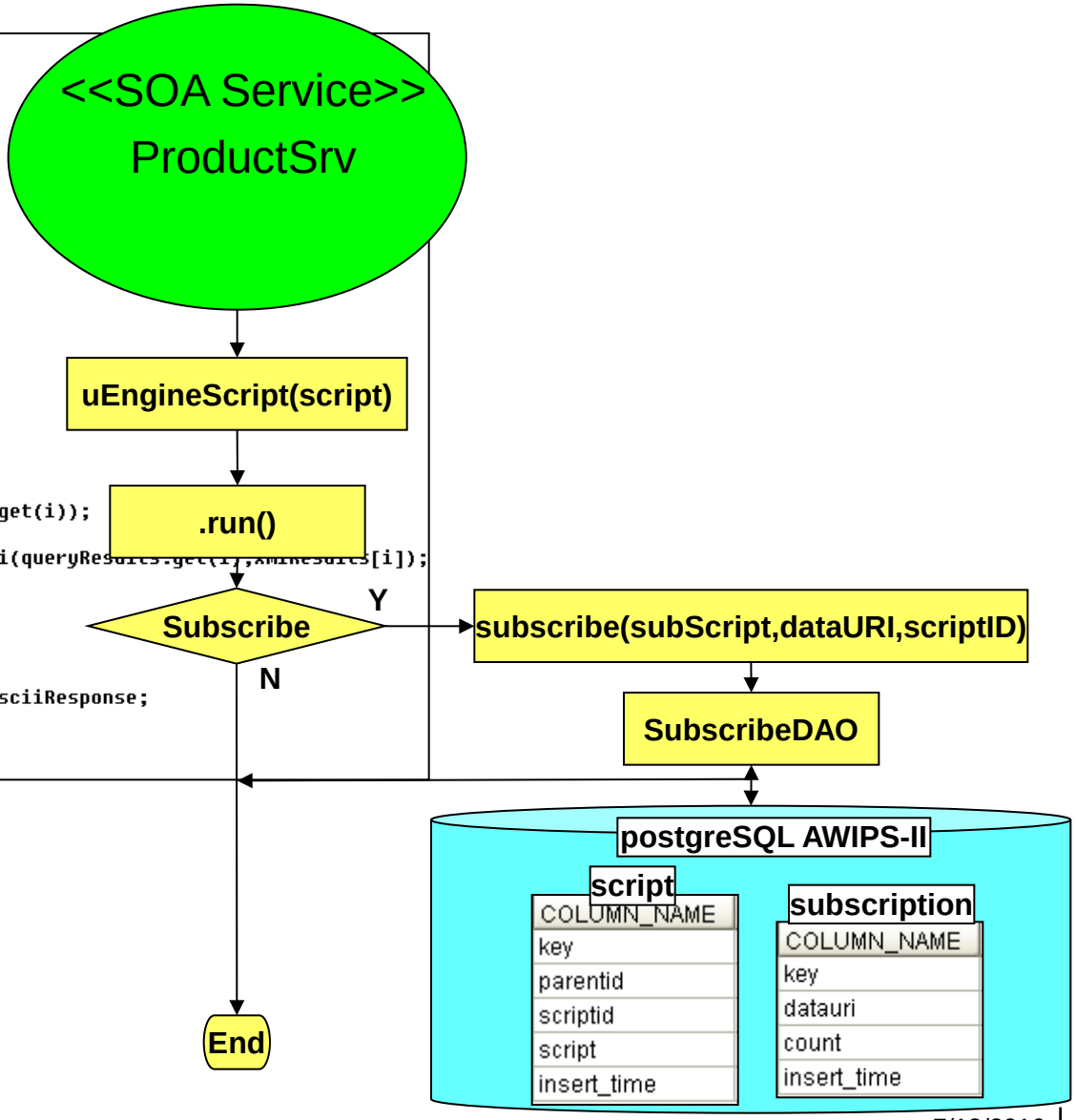
T06 Enhancements

```
function MetarRequest(){
   this.subscribe = true;
   this.subscription = new Subscription();
}
function metarQuery()
{
   var query = new TermQuery("metar");
   query.addParameter("reporttype", "METAR");
   query.addParameter("stationid","KDBN");
   query.setCount(3);
   this.subscription.setup(query);
   var queryResults = query.execute();
   return makeAsciiResponse(queryResults);
}
function makeAsciiResponse(queryResults)
{
   var xmlResults = new Array();
   var response = new Array();
   for(i=0; i < queryResults.size(); i++)
   {
         var toXml = new DataToXml(queryResults.get(i));
         xmlResults[i] = toXml.execute();
         var makeResponse = new MakeResponseAscii(queryResults.get(i),xmlResults[i]);
         response[i] = makeResponse.execute();
   }
   return response;
}
MetarRequest.prototype.metarQuery = metarQuery;
MetarRequest.prototype.makeAsciiResponse = makeAsciiResponse;

var dataRequest = new MetarRequest();
dataRequest.metarQuery();
```



T06 NotifySrv Changes
Scripts and Subscriptions are in RDBMS

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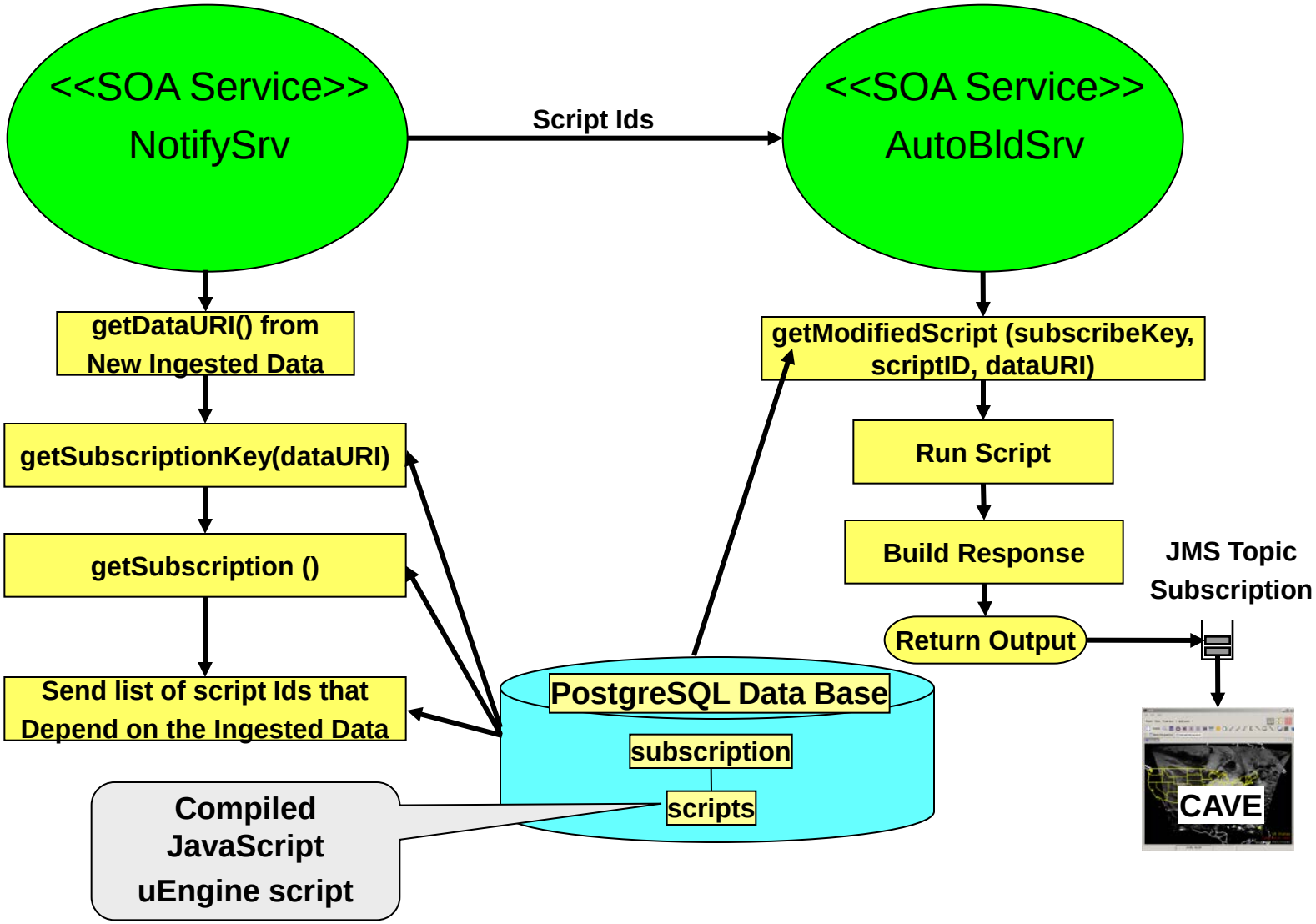
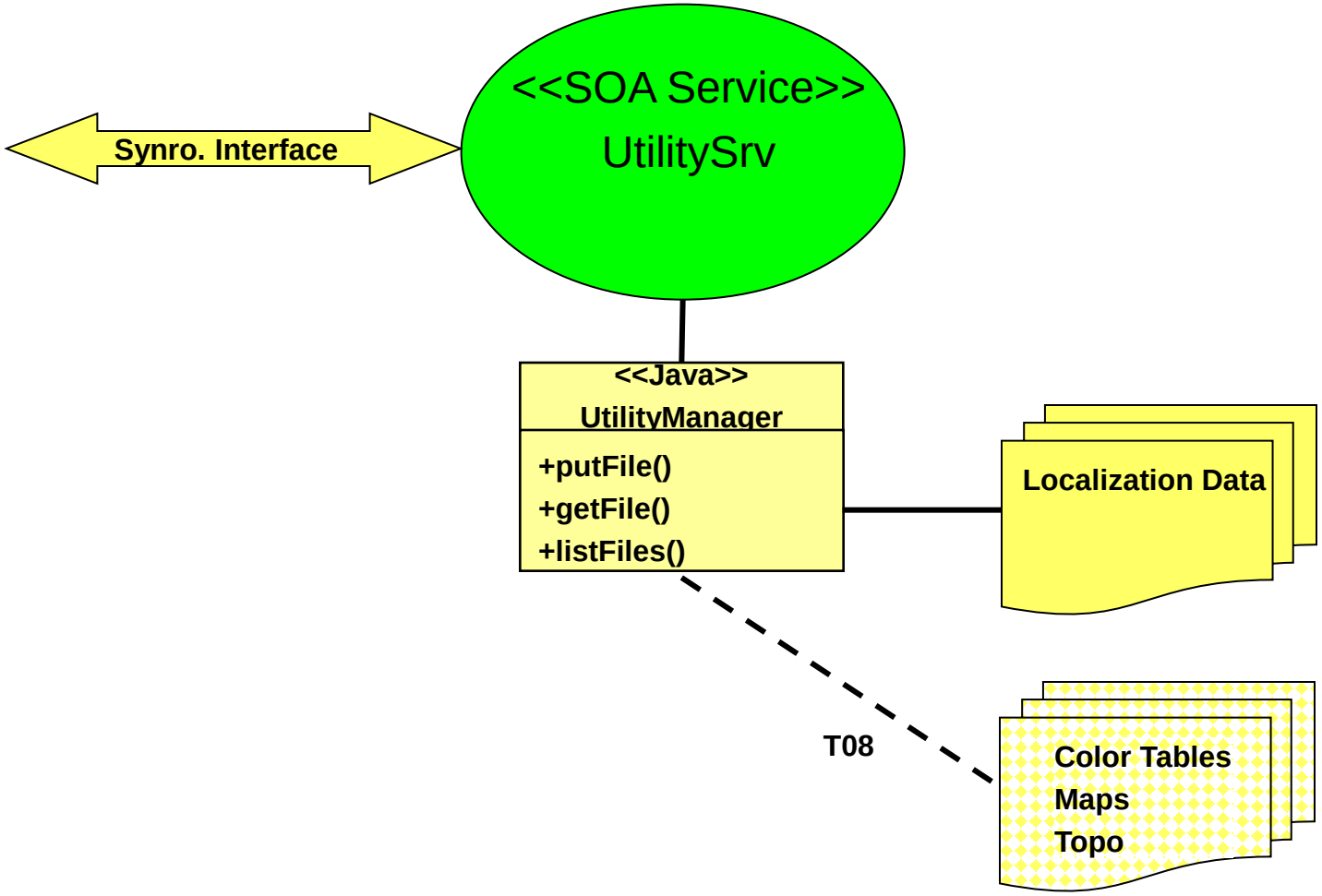
T06 Enhancements

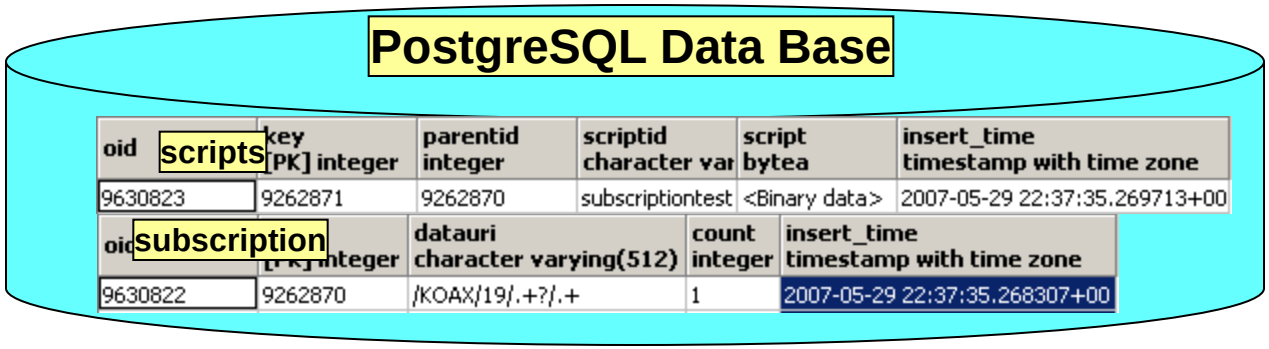


T06 New service: UtilitySrv
Supports Serving Out Localization Data



Repository Refinement

- Subscription added to PostgreSQL data base
  - Server state data simplifies clustering
- Configurable Purge Retention Period
- Performance enhancements with indexes on metadata



Spatial Table Refactor – Geo Spatial
Postgis extension to PostgreSQL

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T06 Enhancements

- Geo Spatial Enabling Data
  - Chosen Approach: Create Static Spatial Tables in PostgreSQL
    - PostGIS extension: Free, simple, high performance

  Input / Output:
    - All ingested data is spatially indexed and can be spatially queried
    - Can create Shape and GeoTiff output

PostgreSQL Data Base

radar_spatial

gid [PK] serial	rda_id character varying(4)	rpg_id_des ch	immutablex	wfo_id character varying(4)	eqp_elv numeric	name character varying(36)	lon double	lat double	elevmeter double pre	the_geom geometry
1	TADW	300		LWX	346.1500	Andrews AFB, MD	-76.845	38.695	105.50652	0101000000A

spatial_grids

grid [PK] integer	description character varyin	nx in	ny	dx	dy double pre	crs character varying(2047)	coverage geometry
87	U.S. Area; used in f	81			68.153	PROJCS["Polar Stereographic	0103000000010

spatial_obs_stations

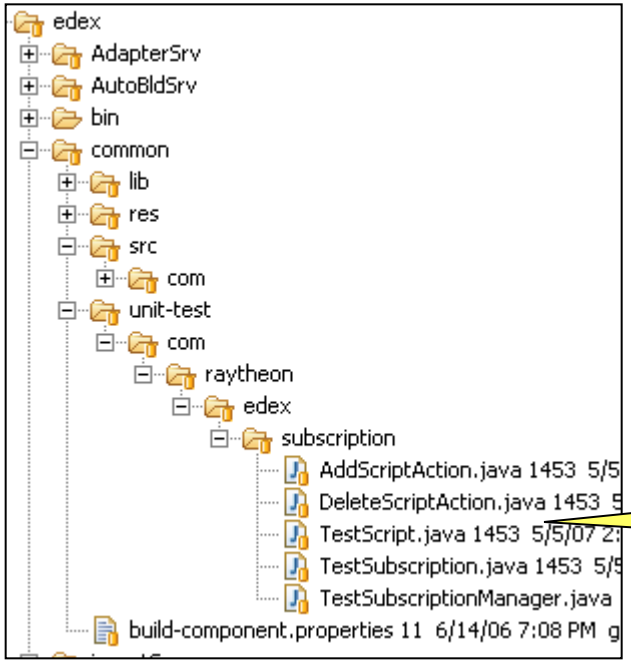
gid [PK] serial	icao character var	wmoindex integer	name	country	state	wmoregion integer	elevation integer	upperaireleva integer	rbsnindicator character var	stationgeom geometry	upperairgeom geometry
1	AGGH	91520				5	8	9	P	01010000009A9	

spatial_satellite

id [PK] ch	description character varying(255)	type	px	py	crs character varying(20	coverage geometry
TICF01	Multi-Satellite Composite	visible	1024	1024	PROJCS["Polar Stereogra	0103000000010

Unit Testing Framework Added

CM Code Repository



ANT Build Control Files

Build.xml

Test.xml
<target test

Junit test Source Files Supported by Eclipse IDE

Cruise Control Automatic Build

- **Unit tests will be used to verify meteo lib functions**
- **Unit tests will be used for automatic regression testing of common packages**
- **Unit test can test lower level component parts of applications**

Deployment Simplification
Based on IzPack (Open Source Install Shield)

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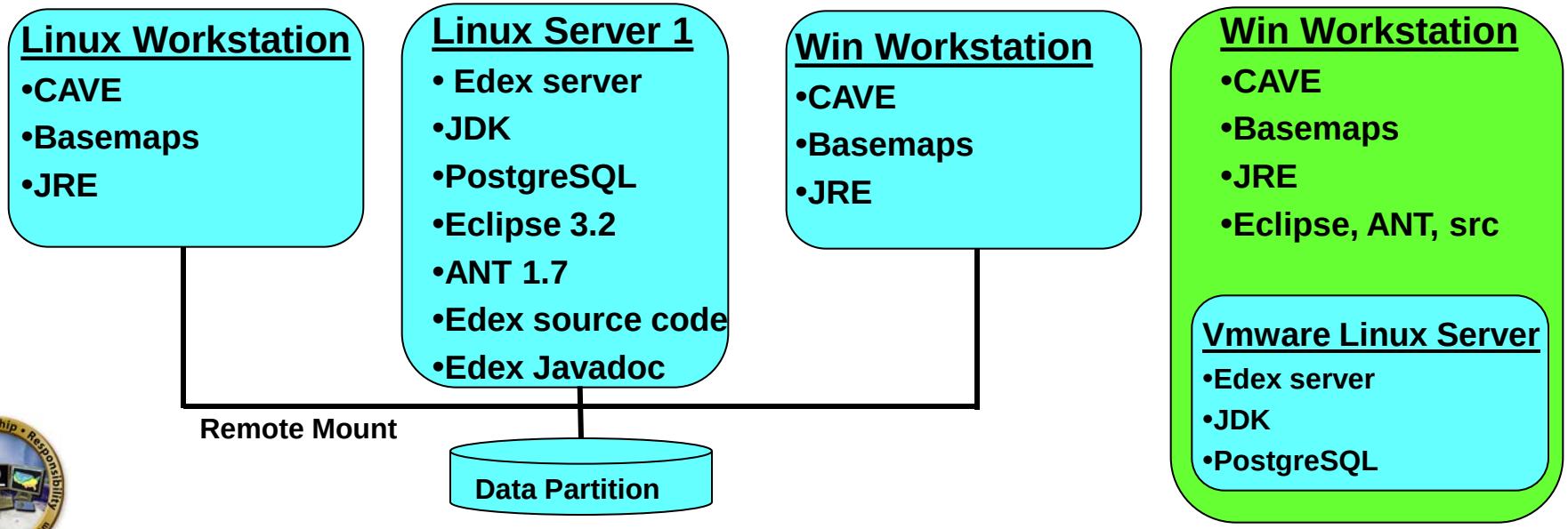
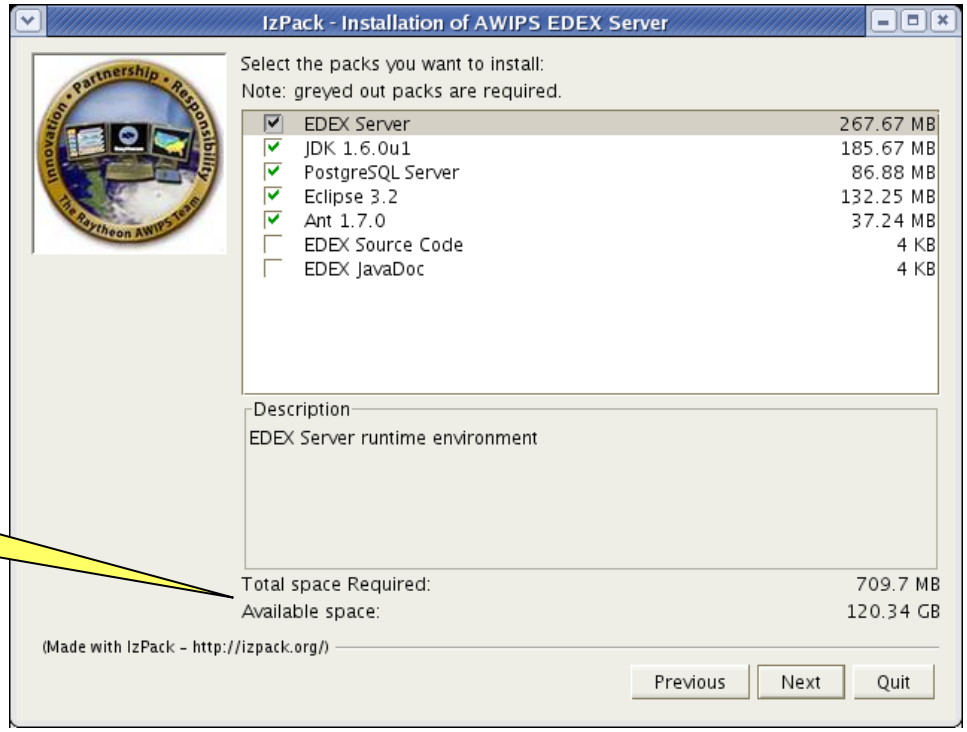
Deployment

- Created a new GUI based installer
- Standard Linux Server Install for Server Side pieces
- Standard Linux Workstation Install for CAVE
- Windows Workstation for CAVE
- Windows Workstation Server Side Using VMWare
- Procedure for clustering (varies on Clustering Con-ops)



Deployment Simplification

- CAVE application and EDEX services installed using two separate installers
  - Each installer can install all files to the user's home directory.
  - EDEX can be run as a VMWare image with CAVE interface



Disk Space Check

Hardening – JPROBE dynamic code analysis

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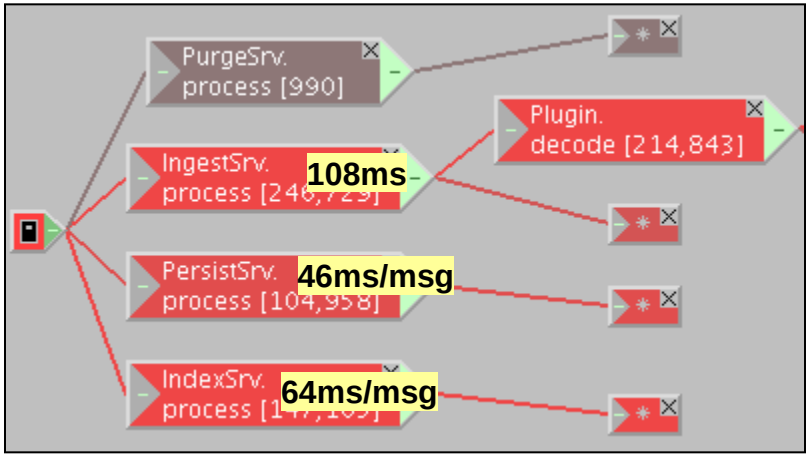
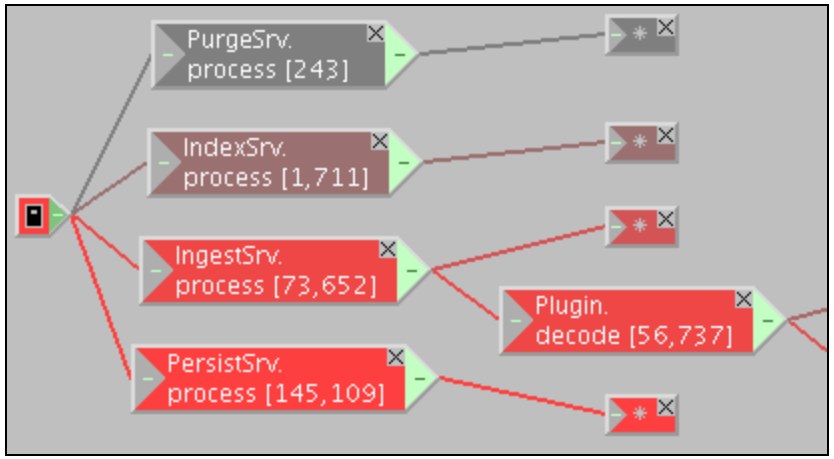
T06
Hardening

Jprobe Execution Time Breakout For Grib Ingest



Satellite Ingest



- CAVE memory leak when running loops overnight, fixed
- activeMQ dropping Mule connections (time outs), fixed
- Jgroups configuration for clustering when clustering Con-ops determined
- Message reference memory leak in AWIPS services fixed
- Message file caching for idle messages eviction policy added to prevent memory growth

Server Memory and CPU useage
JMX Jconsole Cluster Monitoring

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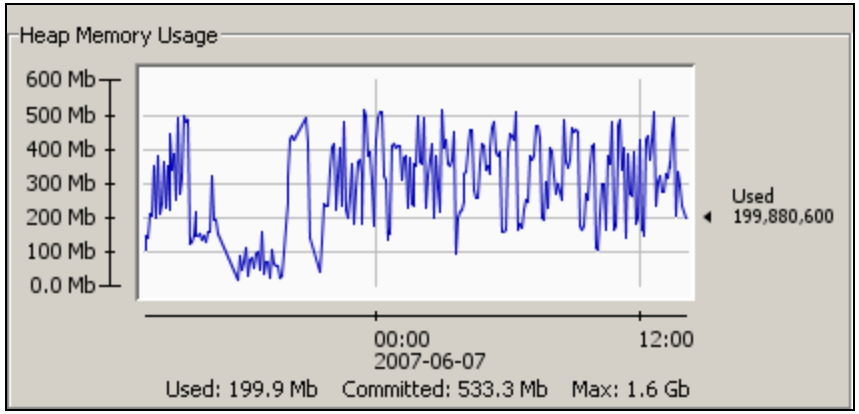
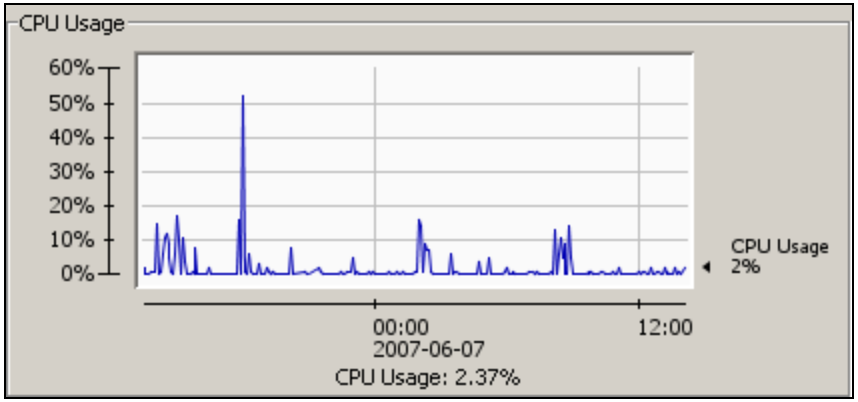
T06
Hardening

CP Processor

Dell 1850
2 Dual core/4G

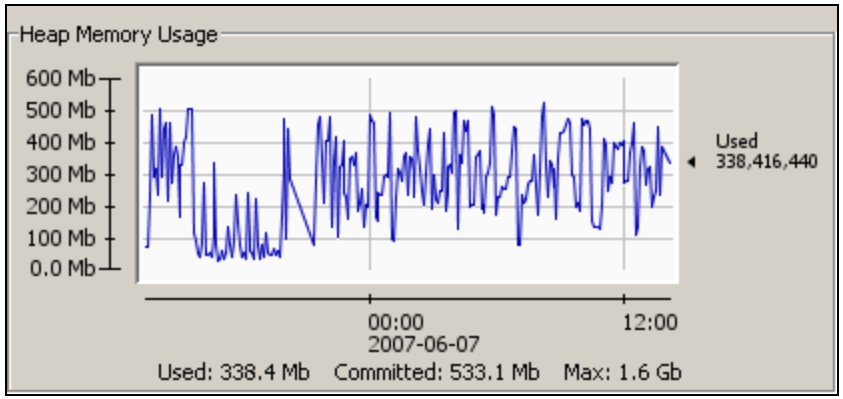
Clustered Server awips-int1

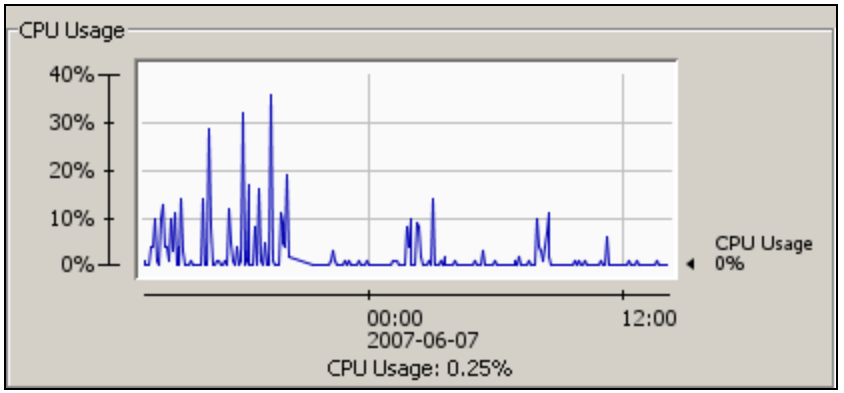




Dell 1850

Clustered Server awips-int2





ADE is Ready for Applications
Running out of ideas for refactoring

Raytheon

T06 Hardening

- Core ADE patterns are stable and perform well
- Visualization Performance is better than expected
- CAVE uses Eclipse RCP 3.3 which has added XML menu extensions (a 250 slide SWT GUI guide has been put together): Ready for application interface coding
- SBN data feed to Cluster has been active during the T06 and used to find memory and stability issues
- SOA Plug In pattern decouples development (the IFPServer is being ported entirely within a plug in)
- uEngine pattern is stable and turning out to be a very powerful enabler of adaptability
- Other groups within Raytheon are showing increasing interest

T06 RRD Scenario Steps

Raytheon

Demo Scenario

Scenario Step	Result
Bundles: Show saving and retrieving a bundle	Main display should return to the saved state.
Localization Cave: Set preferences to KOAX then KDSM	Menu, display, and preferences should all reflect the localization.
uEngine Scripts: Run All tilts script	All tilts works as before but with new JavaScript based uEngine script.
MetaData Schema: Run PGadmin	See metadata structure, and spatial tables.
Menus: Adding a menu item to localized menu	New menu item shows when CAVE is restarted