

An Open Source Graphical User Interface Surrogate C2 System for Battle Management Language Experimentation

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Presentation Overview

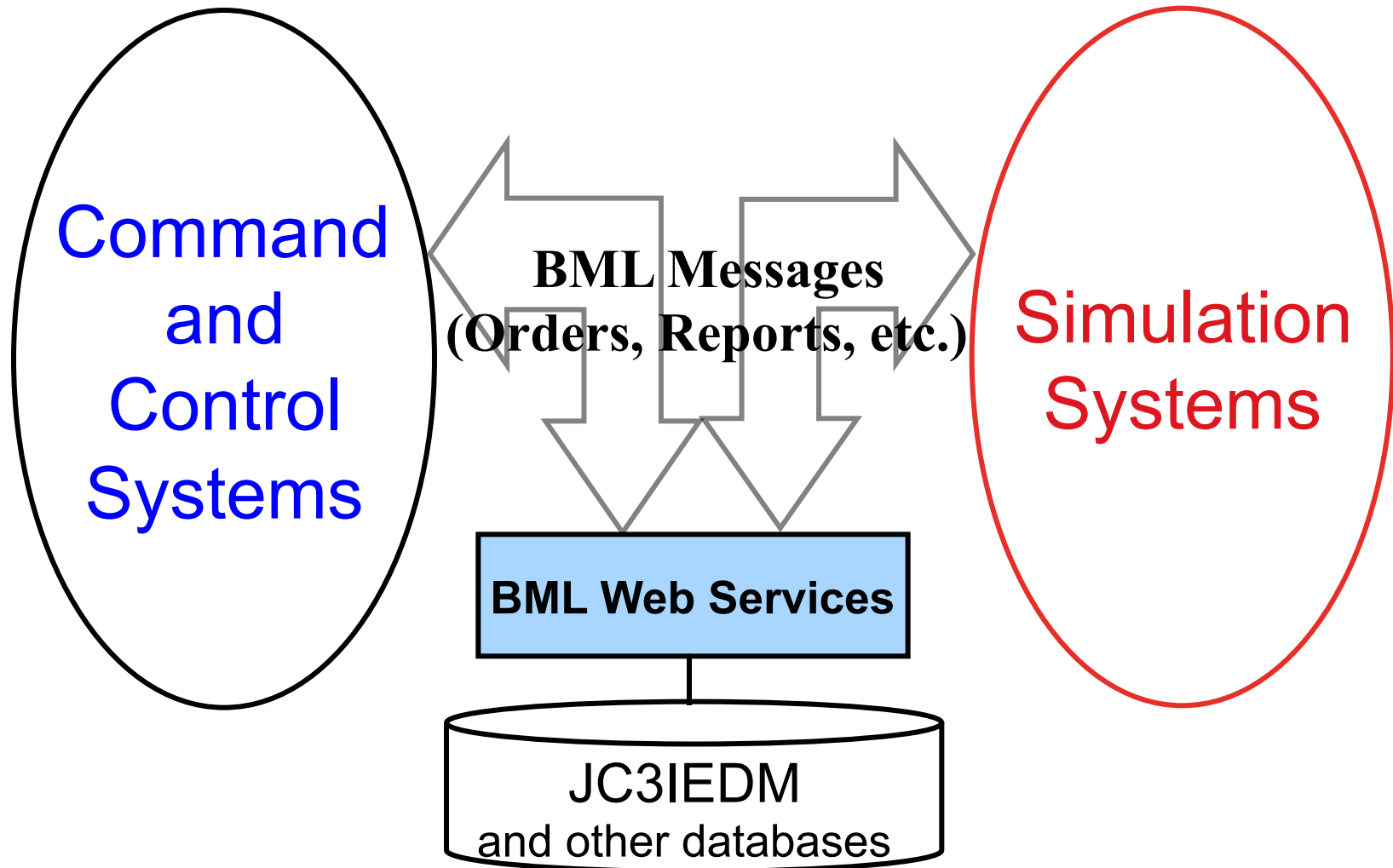
- BML and BML experiments
- GMU open-source BML software
- BML C2 GUI requirements
- Open-source development
- Functionality
- Use as surrogate C2 system
- Conclusions

BML Overview

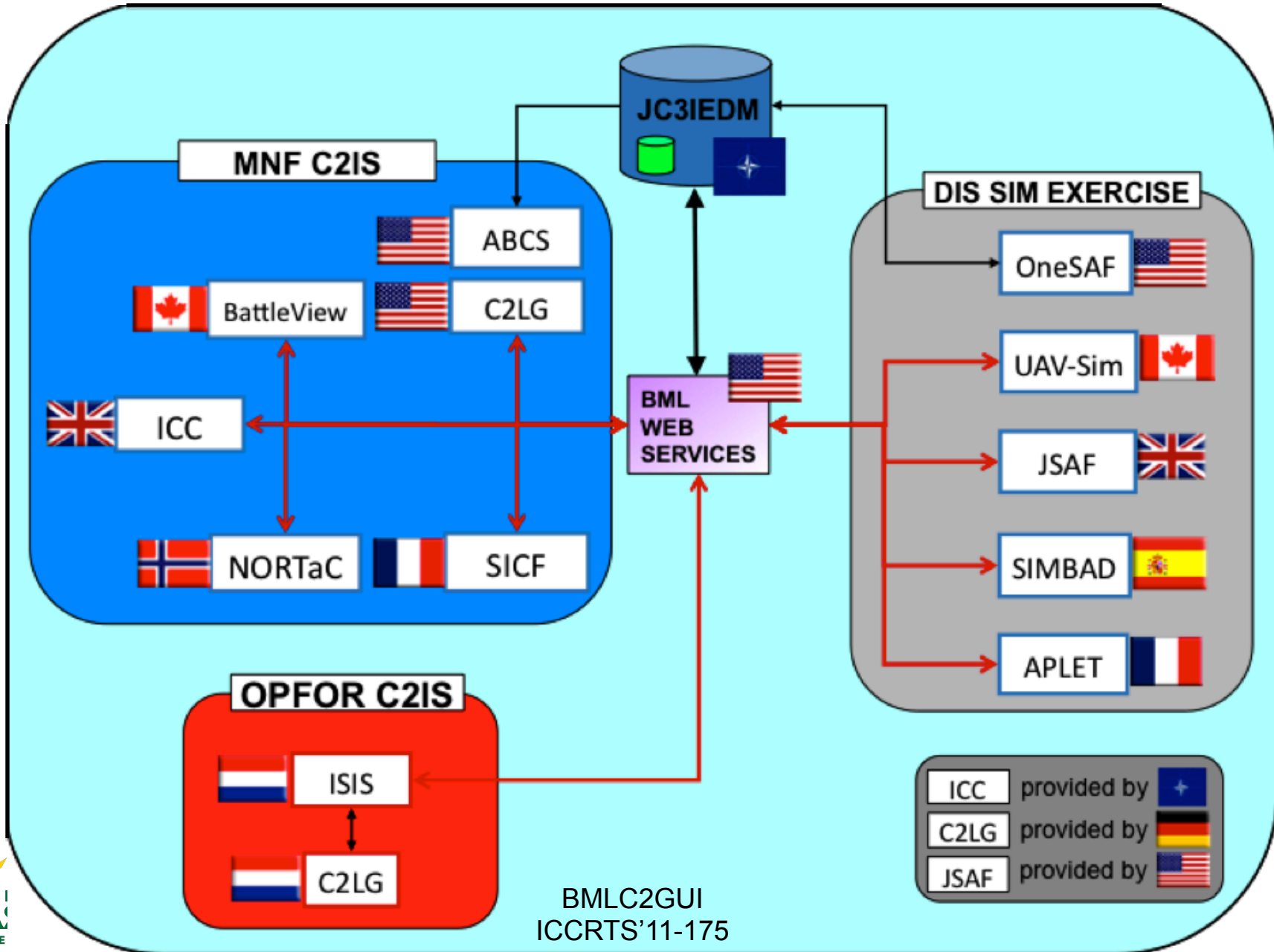
Background - BML

- Facilitates C2-Simulation interoperability
 - Exchange of Orders and reports in standard format
- Current architecture uses a repository service to hold state submitted by client C2 and Simulation systems
 - Web service with XML input – Network Centric
 - Data stored in JC3IEDM and can be replicated

BML Architecture



MSG-048 2009 Architecture

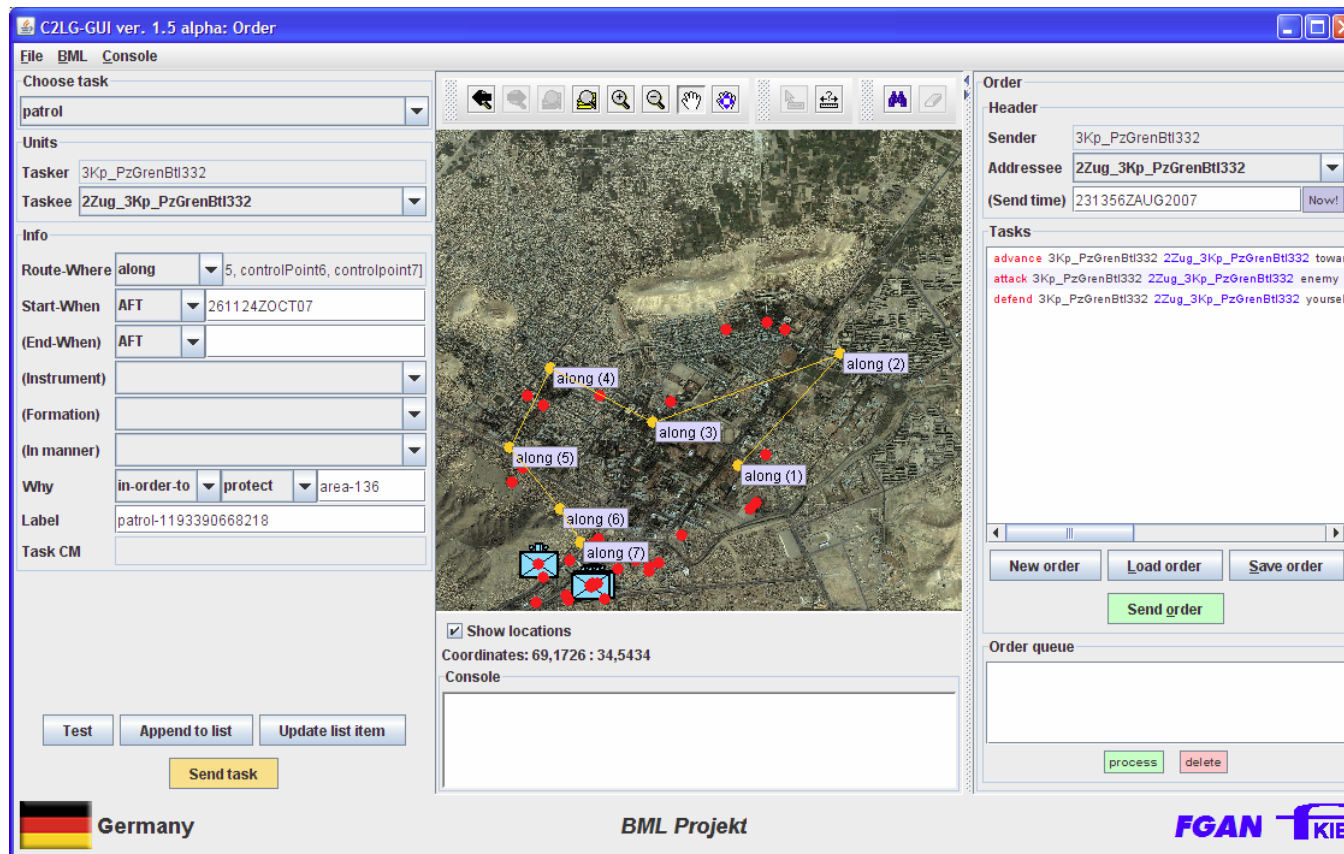


C2LG GUI

- Command & Control Lexical Grammer (C2LG) Graphical User Interface (GUI) was constructed by the German research center FGAN.
- The C2LG GUI was created to generate “pure” BML statements that were valid grammar statements.
- In many BML activities, the C2LG GUI was used as an “integration hub” to take the input from C2 systems and construct a “valid” JBML Order that could be sent and ingested by different nation’ s simulations.
- FGAN operates under rules that would not allow them to release the C2LG GUI to the whole BML community.

C2LG GUI

- Screen Shot

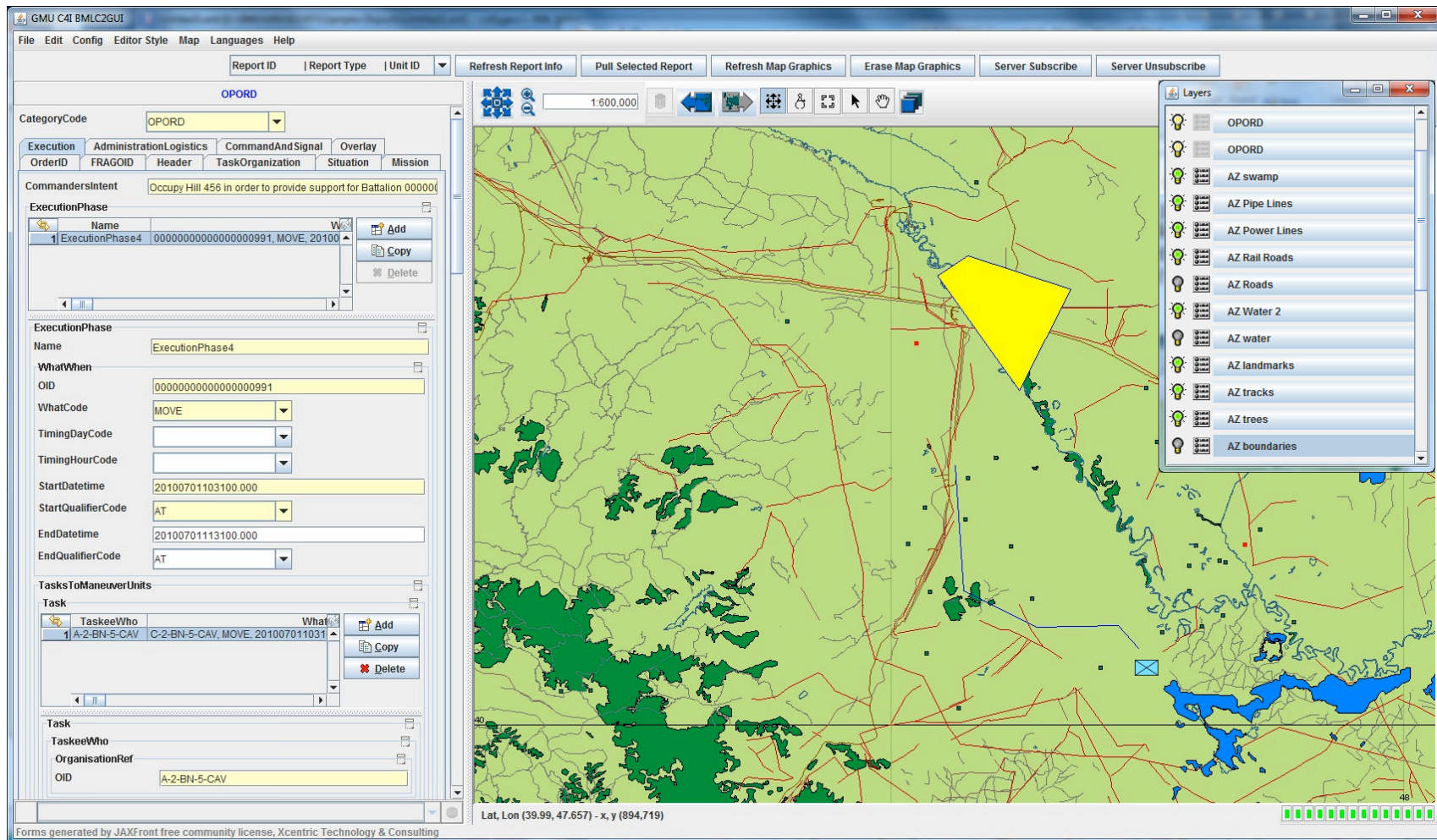


BML C2 GUI

BML C2 GUI

- Patterned after Fraunhofer-FKIE C2LG GUI
 - Usable as editor or monitor
 - Reads/writes Orders and Reports
 - Auto-configures to any BML schema
 - View and modify a BML-XML file
 - Map/image display shows 2525B icons from XML
 - Future version will enter geolocation data in BML-XML file
 - Open source at <http://c4i.gmu.edu/BML>

BML C2 GUI



BML C2 GUI : ORDER

Task TaskerWho TaskOrganization ControlMeasures

Task			
1	GroundTask, UnitID, 2TF A TEAM, SEIZE, HADES 3, AtWhere, JBMLAtWhere, HADES 3, AREAOFINTEREST, AREA, WhereLocat...		
2	GroundTask, UnitID, 2TF B TEAM, SEIZE, HADES 3, AtWhere, JBMLAtWhere, HADES 3, AREAOFINTEREST, AREA, WhereLocat...		

Task

TaskerWho	What	Where
1 UnitID, 2TF A TEAM	SEIZE	HADES 3, AtWhere, JBMLAtWhere, HADES 3, AREAOFINTEREST, AREA, WhereLocation, GDC, 4...

GroundTask

TaskerWho

UnitID

What

Where

WhereID

UNNAMED1

AtWhere

WhereLabel

WhereCategory

WhereClass

WhereValue

WhereLocation

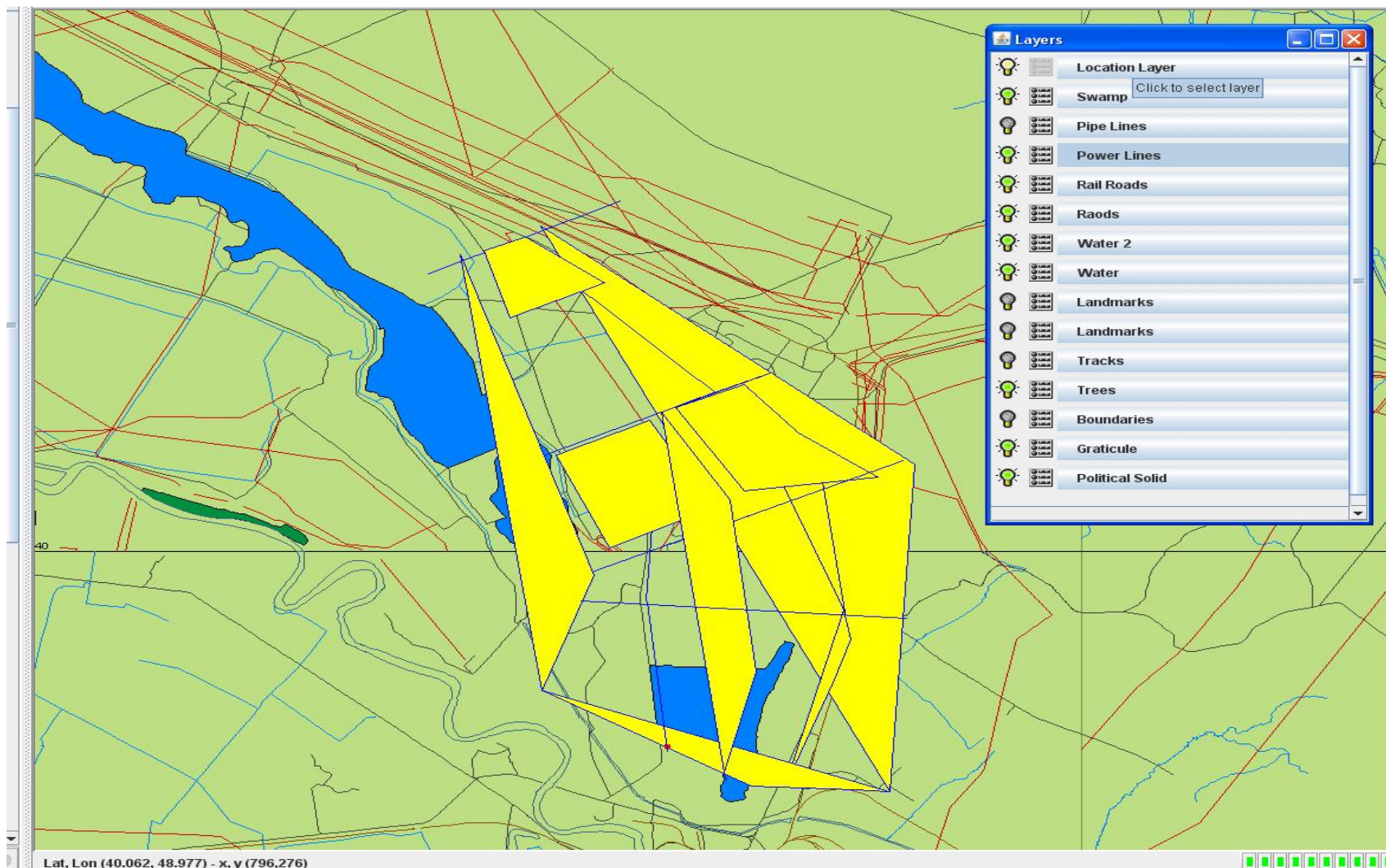
1 GDC, 40.0646754, 48.8700762, 0.0

Add Copy Delete

Add Copy Delete

Add

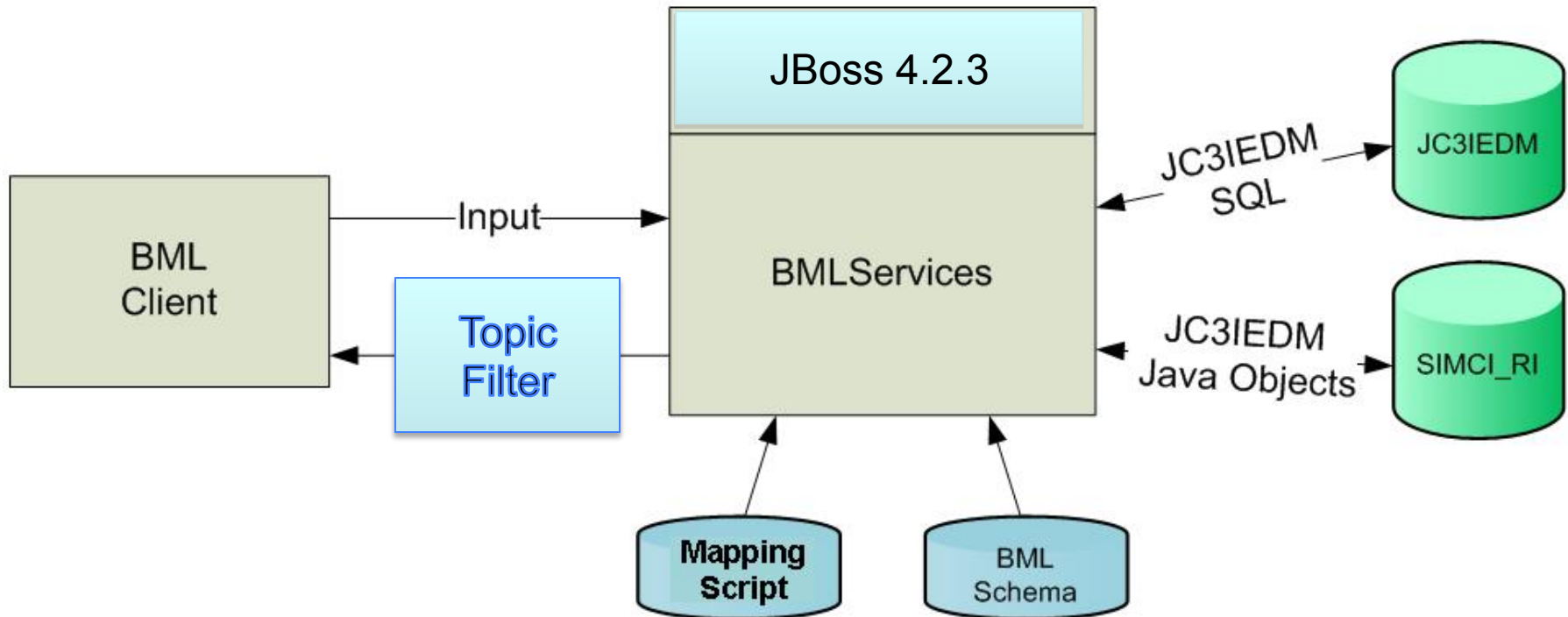
BML C2 GUI : CONTROL FEATURES



Scripted BML Server

- Middleware functions don't change
 - Mapping BML to JC3IEDM and push/pull to database
 - Program these once and get them right
- Interpreted WS offers flexibility
 - Rapid implementation of new BML constructs
 - Easy to modify underlying data model
 - JC3IEDM also continues to change
 - Reduces time and cost for prototyping
 - Scripting language provides a concise definition of BML-to-data model mappings
 - Although bugs still happen, the number of possible mistakes is far smaller
- Scripted operation may, however, be slower
 - We've multithreaded the server
 - 8 processors achieved over 10 Reports/sec
 - Believe it will scale at least to 16 processors (20 Reports/sec)

Scripted BML WS Configuration

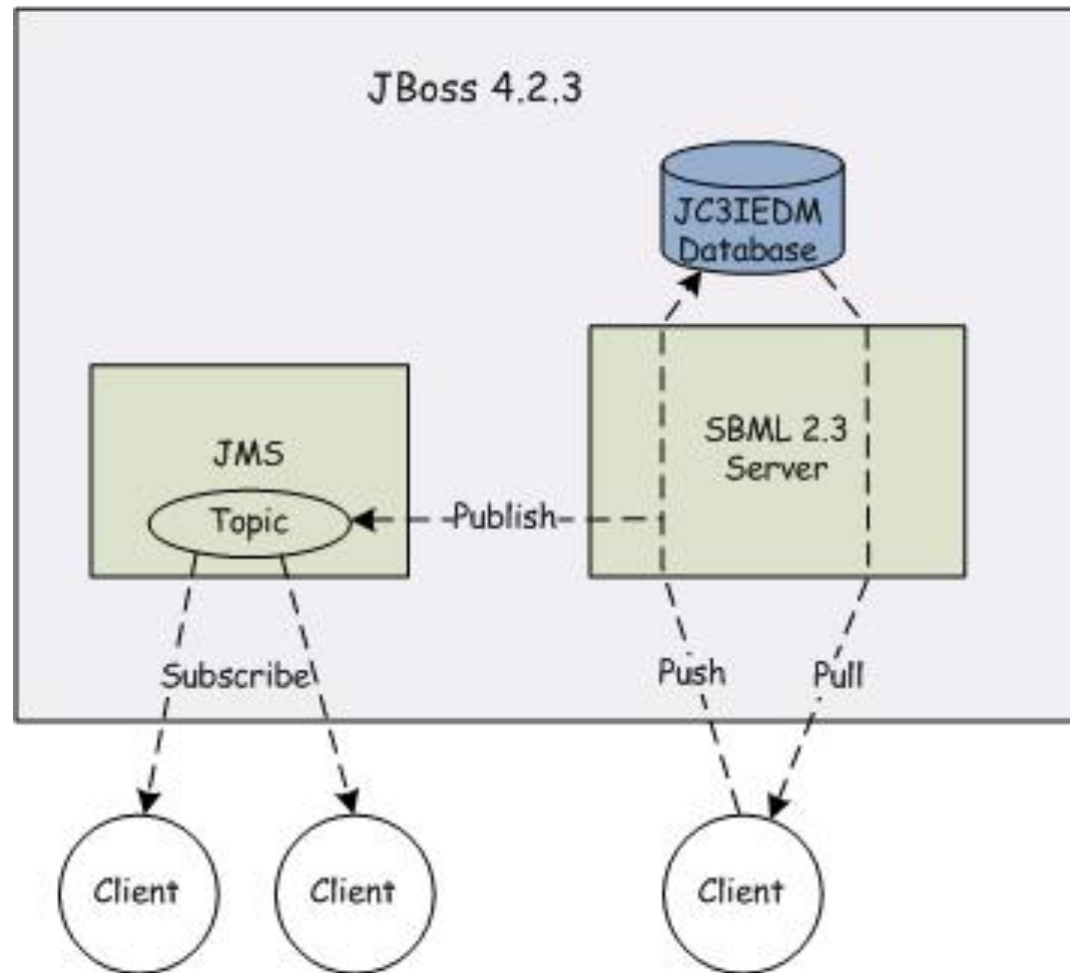


Two implementations: MySQL and SIMCI RI

Polling vs Publish/Subscribe

- “Pure” Web Service is always accessed by *push* or *pull* transaction from client
 - No provision for server to initiate action
- For clients to stay up to date they must pull latest status from server at rate determined by their need for up-to-date information (called *polling*)
 - Result: MSG-048 server in 2008 spent most of its time responding to status pulls
- Publish/subscribe gets around this by letting clients identify the categories of information they need – they *subscribe* to *Topics*
 - Server sends them a copy of every update associated with each subscribe Topic
 - More timely updates and a dramatic reduction in overhead

Publish/Subscribe Architecture



SBML in NATO MSG-048

- Paper 10S-SIW-049 describes a significant NATO Technical Activity that used SBML
- Six national C2 systems and five national simulations interoperating
- Six months of preparation culminated in a week of experimentation at Manassas, VA
- Publish/subscribe essential to meet performance needs
- See companion paper for more information

SBML Services in the BML C2 GUI

- The BMLC2GUI uses the Web Services maintained by SBMLServer through the SBMLClient application.
 - CallListWho: is used by the GUI to bring up all the necessary information about a unit given its UnitID in order to compose the MILSTD2525b key (String characters) that enables the tool to draw the correct unit symbol in its desired position.

```
<callListWho>  
<UnitID>3</UnitID>  
</callListWho>
```

- The BMLC2GUI is open source - could be modified to use other source of Unit information

SBML Services in the BML C2 GUI

- The BMLC2GUI uses the following Web Services maintained by SBMLServer through the SBMLClient application.
 - GetLatestReportIDs: is used by the GUI to build a list of report information:

```
<GetLatestReportIDs>  
</GetLatestReportIDs>
```

- ReportPull: is used by the GUI to pull a report from the SBML Web Service so that it can be viewed or edited and its geospatial information be extracted and illustrated on the map.

```
<ReportPull>  
<ReportID>410</ReportID>  
</ReportPull>
```

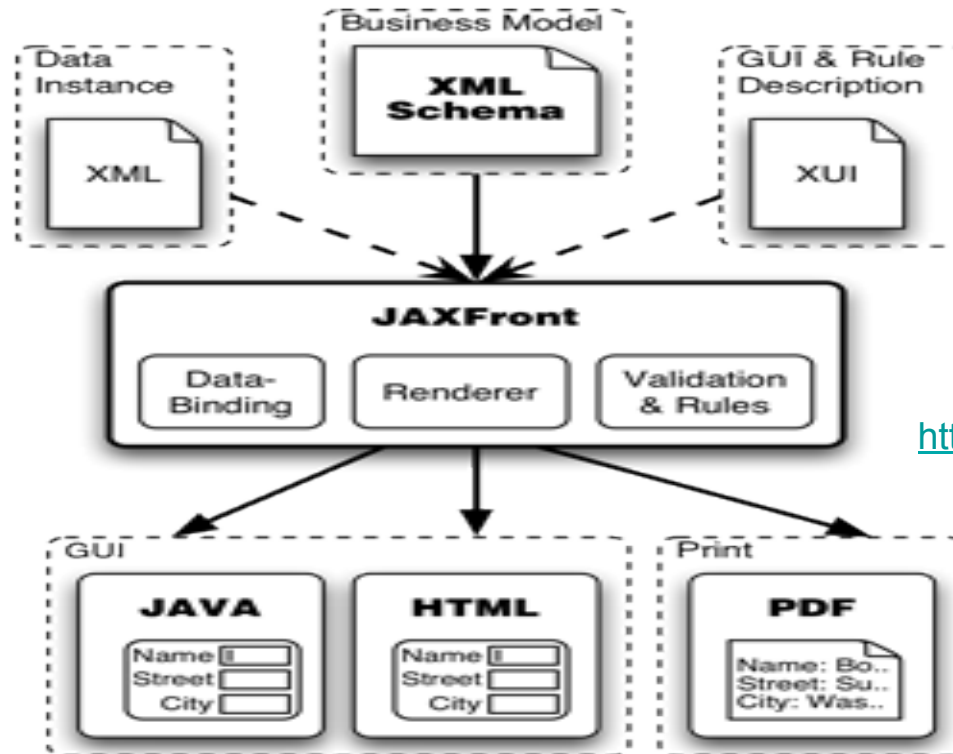
BML C2 GUI Requirements

JaxFront – Open Source XML Java Editing

- JaxFront is a technology developed by Switzerland's Xcentric Technology & Consulting GmbH.
- It is “a technology to generate graphical user interfaces on multiple channels (Java Swing, HTML, PDF) on the basis of an XML schema”.
- Web site <http://www.jaxfront.org>
- The BML C2 GUI uses the Free Community version (Open-Source) of JaxFront as a major component for editing BML documents.
- The user can dynamically generate GUIs that allow the user to edit XML data without being exposed to the underlying XML technology.

JaxFront – Open Source XML Java Editing

- JAXFront architecture



Source:
<http://www.jaxfront.org>.

- JAXFront also provides XML User Interface (XUI) Editor to customize its forms

BML C2 GUI Development Goals

- Core functions like C2LG GUI
- Differences from C2LG GUI:
 - Open resource
 - Quick response to changes
 - Ease of use
 - Low development cost

Open-Source Development

BML C2 GUI Development

- The core of the BMLC2GUI is the use of JAXFront's libraries to build a new and a customized type of XML Document Object Module (DOM) that can be rendered as Java Swing objects.
- The JaxFront's DOM Builder takes the following parameters to generate a JAXFront document:
 - The XML document.
 - The Schema.
 - The XUI (optional): XML User Interface file used to customized the view of the XML document. The default is a tree view.
 - The XML root node

BML C2 GUI Development

- JaxFront's EditorPanel renders the generated DOM using Java Swing components with the help of the XUI file.

```
currentDom = DOMBuilder.getInstance(). build  
("default-context", xsdUrl, xmlUrl, xuiUrl, root);
```

BML C2 GUI Development

- After the successful rendering of the XML document, we start extracting the geospatial information (Latitude, Longitude coordinates representing positions or dimensions of objects) on the map.
- We parse the document and pass the elements and values to OpenMap's MapHandler
- The MapHandler draws and controls the following types of layers:
 - Country or area of interest geospatial data layers. In our case (ESRI shape files).
 - BML objects and geospatial information: unit, minefield, bridge, spot, track.
 - MIL-STD-2525b symbols

Open Map

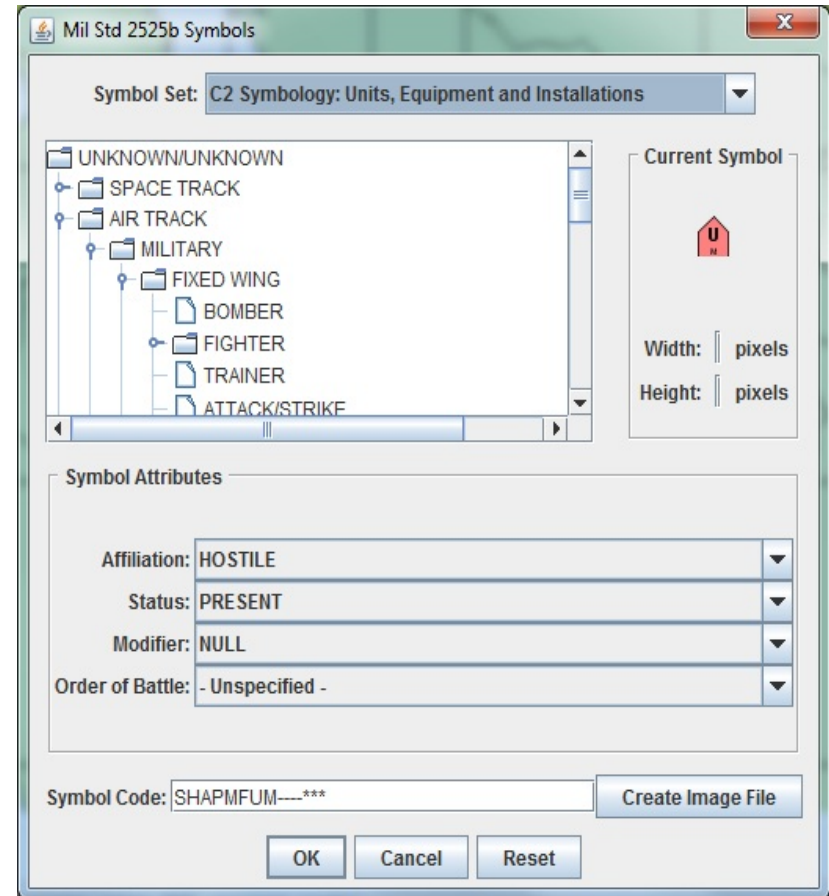
- Open Source JavaBeans based Geospatial development tool.
- From BBN Technologies, now part of Raytheon.
<http://openmap.bbn.com>
- BMLC2GUI is using the latest version of OpenMap 4.6.5, released March 5, 2009.
- It provides various capabilities to allow users to see and manipulate geospatial information.
- OpenMap supports various map data file formats.

Open Map

- This release of the BMLC2GUI is using ESRI shape files.
- The BMLC2GUI uses OpenMap to display the different data layers on the map in addition to drawing BML objects, units and control measures at their corresponding locations.

Open Map - MIL-STD-2525B

- The BMLC2GUI makes use of the OpenMap's implementation of MIL-STD-2525B symbols
- The unit/object symbol is constructed from the UnitID / objectType during the geospatial information extraction.
- The corresponding unit/object symbol is drawn at the Lat-Lon coordinates
- Objects can be minefield, bridge, spot,...



BML C2 GUI

Capabilities & Functionality

BML C2 GUI - Functions

- Editing a BML Document
- Serialization of a BML Document
- Validation of a BML Document
- Pulling a BML Document
- Pushing a BML Document
- Retrieving Latest Reports
- C2 Capability

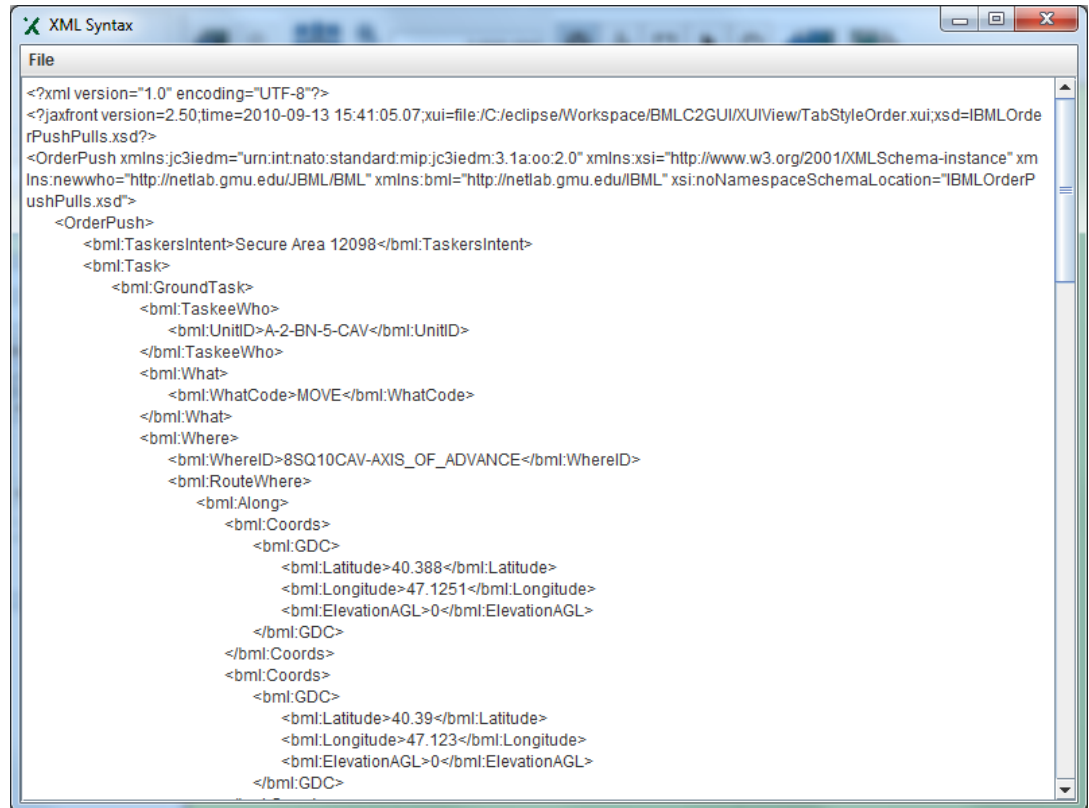
BML C2 GUI - Functionality

- Editing a BML Document
 - The BML C2 GUI can edit any type of BML documents.
 - The user has the capability to create a new order or a report in the GUI or open an existing document from the file system.
 - The user has the flexibility of modifying, validating, serializing the document

The screenshot displays the BML C2 GUI interface. At the top, the title bar reads "GMU C4I BMLC2GUI". The menu bar includes "File", "Edit", "Config", "Editor Style", "Map", "Languages", and "Help". The main window shows a form for "OrderPush" with fields for "OrderPush", "TaskersIntent" (Secure Area 12098), "OrderIssuedWhen" (20080808080808.000), "OrderID" (225), "ReferenceOrderID", and "Context". Below the form are tabs for "Task", "TaskerWho", "TaskOrganization", and "ControlMeasures". The "Task" tab is active, showing a table with one row: "1 GroundTask, UnitID, 110BCT, MOVE, 8SQ10CAV-AXIS_OF_ADVANCE, RouteW...". To the right of the table are "Add", "Copy", and "Delete" buttons. Below the table is another "Task" section with fields for "TaskerWho", "UnitID" (110BCT), "What" (MOVE), "Where" (8SQ10CAV-AXIS_OF_ADVANCE), "UNNAMED1" (RouteWhere), "RouteWhere" (Along), and "Along" (Coords). At the bottom, there is a "Coords" table with four rows of coordinates: "1 GDC, 40.388, 47.1251, 0", "2 GDC, 40.2007, 47.1415, 0", "3 GDC, 40.1472, 47.2843, 0", and "4 GDC, 40.1486, 47.4435, 0". The bottom of the window displays "Forms generated by JAXFront free community license, Xcentric Technology & Consulting".

BML C2 GUI - Functionality

- Serialization of a BML Document
 - The BML C2 GUI provides the user with the capability to see the XML source of any document he is editing.
 - This feature is very useful, especially to the experienced and advanced users.



```
<?xml version="1.0" encoding="UTF-8"?>
<?jxfront version=2.50,time=2010-09-13 15:41:05.07;xui=file:/C:/eclipse/Workspace/BMLC2GUI/XUIView/TabStyleOrder.xui;xsd=IBMLOrderPushPulls.xsd?>
<OrderPush xmlns:jc3iedm="urn:int.nato.standard:mip:jc3iedm:3.1a:oo:2.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:newwho="http://netlab.gmu.edu/IBML/BML" xmlns:bml="http://netlab.gmu.edu/IBML" xsi:noNamespaceSchemaLocation="IBMLOrderPushPulls.xsd">
  <OrderPush>
    <bml:TaskersIntent>Secure Area 12098</bml:TaskersIntent>
    <bml:Task>
      <bml:GroundTask>
        <bml:TaskeeWho>
          <bml:UnitID>A-2-BN-5-CAV</bml:UnitID>
        </bml:TaskeeWho>
        <bml:What>
          <bml:WhatCode>MOVE</bml:WhatCode>
        </bml:What>
        <bml:Where>
          <bml:WhereID>8SQ10CAV-AXIS_OF_ADVANCE</bml:WhereID>
          <bml:RouteWhere>
            <bml:Along>
              <bml:Coords>
                <bml:GDC>
                  <bml:Latitude>40.388</bml:Latitude>
                  <bml:Longitude>47.1251</bml:Longitude>
                  <bml:ElevationAGL>0</bml:ElevationAGL>
                </bml:GDC>
              </bml:Coords>
            </bml:Along>
          </bml:RouteWhere>
        </bml:Where>
      </bml:GroundTask>
    </bml:Task>
  </OrderPush>
</OrderPush>
```

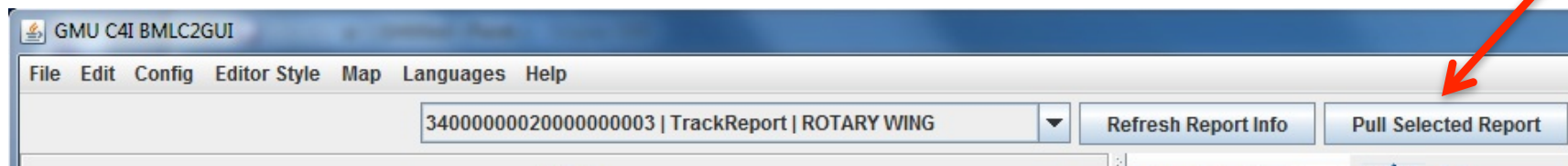
BML C2 GUI - Functionality

- Validation of a BML Document
 - The BML C2 GUI provides the user with the capability to validate the BML document against its schema.
 - This serves as a validation option **before** sending the document to any web service in order to guarantee well conformance with the schema.
 - When the validation option is selected, all the possible validation problems can be displayed in the GUI's status bar and also a red box can be drawn around the text area having the problem.

The screenshot displays the BMLC2GUI application window. The title bar reads "GMU C4I BMLC2GUI". The menu bar includes "File", "Edit", "Config", "Editor Style", "Map", "Languages", and "Help". Below the menu bar, there are input fields for "Report ID", "Report Type", and "Unit ID", along with a "Refresh" button. The main content area is titled "Order" and contains a form for "OrderPush". The form fields include "TaskersIntent" (Secure Area 12098), "OrderIssuedWhen" (20080808080808.000), "OrderID" (600), and "ReferenceOrderID". Below these fields are tabs for "Task", "TaskerWho", "TaskOrganization", and "ControlMeasures". The "TaskerWho" tab is active, showing a table with columns "UnitID" and "UnitID", and a row with the value "A-2-BN-5-CAV". At the bottom of the window, a status bar displays the message "The field (UnitID) is mandatory." in blue text, which is circled in red. The footer of the window reads "Forms generated by JAXFront free community license, Xcentric Technology".

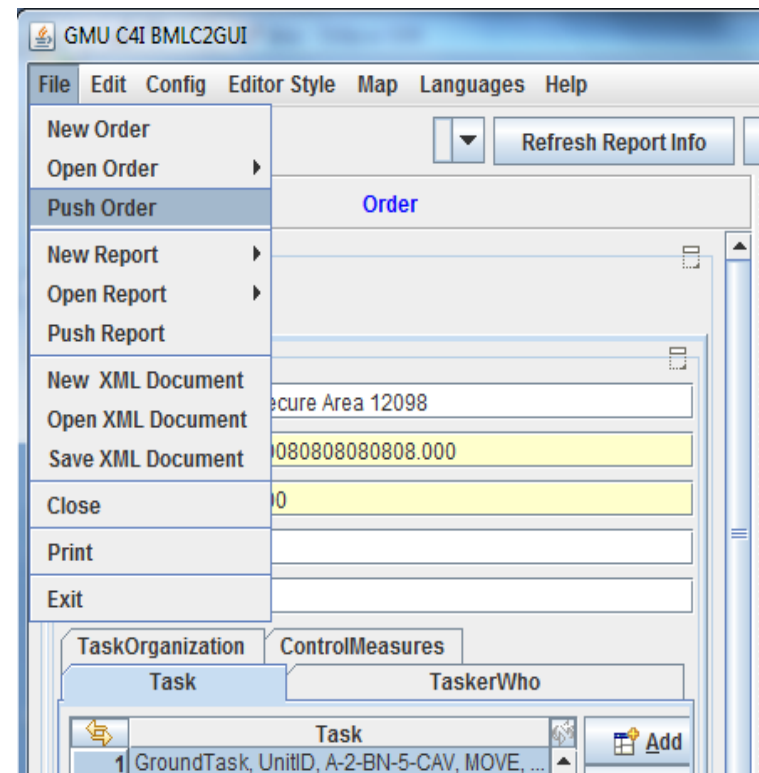
BML C2 GUI - Functionality

- Pulling a BML Document
 - The BML C2 GUI provides the user with the capability to pull reports from the SBMLServer through two paths:
 - Subscriber: By activating the “SBMLSubscriber” listener application, which listens to any coming new report and automatically detects its type and displays it in the editor area. It will also extract any geospatial data from the report and display it on the map.
 - Manually: By selecting the desired report from a Report Information list of the latest reports added from the web service.



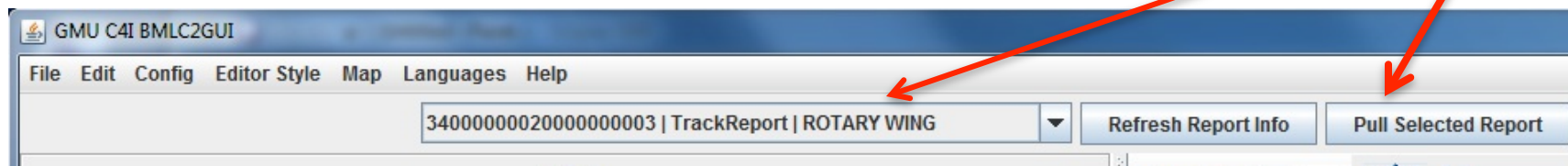
BML C2 GUI - Functionality

- Pushing a BML Document
 - The BMLC2GUI provides the capability to create, edit, validate (optional) and push any type of BML document
 - When a user decides that the order or report is ready to be pushed, the GUI provides him with a simple user interface to do so with a click of a button.
 - Off-course this interface is a shell to the call of the SBMLClient.



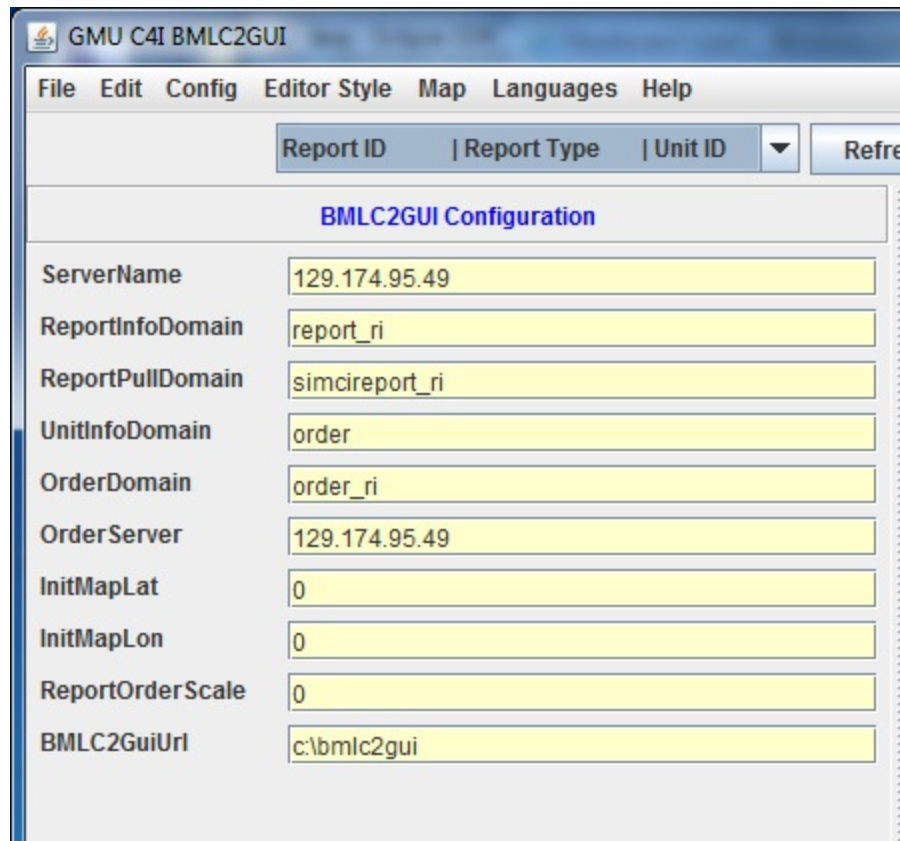
BML C2 GUI - Functionality

- Retrieving Latest Reports
 - The BMLC2GUI provides the user with the capability to see a list of reports consisting of the Report ID, Type and Object/Unit ID.
 - The user has the capability to refresh this list manually in addition to the automatic update while the subscriber is running.
 - The user can select any report from the list and get a view of that report: document view and geospatial information representation.



BML C2 GUI - Configuration

- The BMLC2GUI makes use of the same JAXFront editing capabilities to configure its environment variables



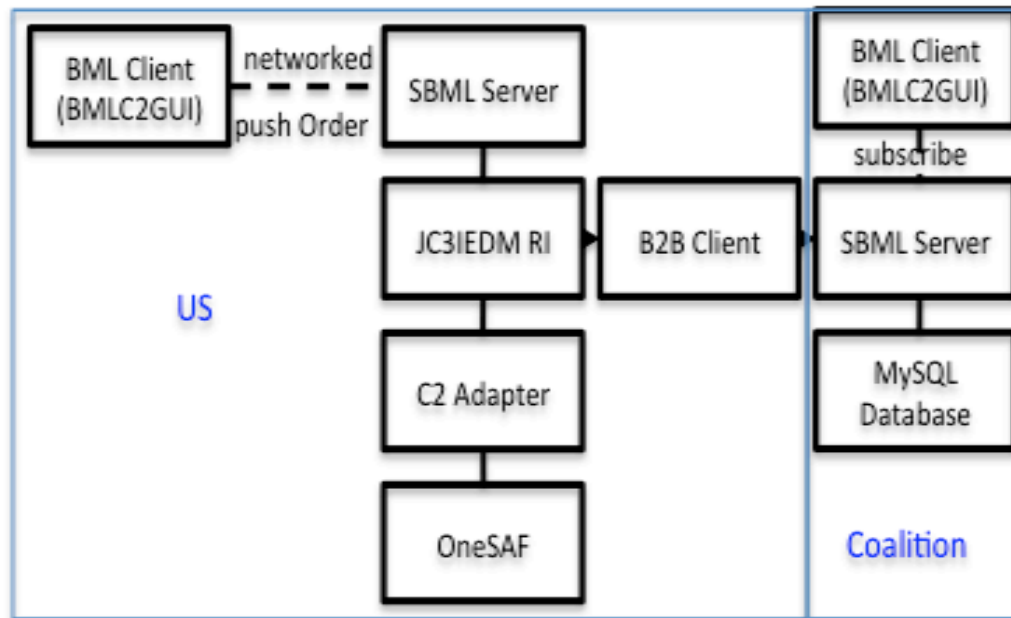
The screenshot shows a web-based configuration interface for the BMLC2GUI. The window title is "GMU C4I BMLC2GUI". The menu bar includes "File", "Edit", "Config", "Editor Style", "Map", "Languages", and "Help". Below the menu bar, there are three tabs: "Report ID", "Report Type", and "Unit ID", with a "Refre" button to the right. The main content area is titled "BMLC2GUI Configuration" and contains a list of configuration variables, each with a corresponding text input field:

Variable Name	Value
ServerName	129.174.95.49
ReportInfoDomain	report_ri
ReportPullDomain	simcireport_ri
UnitInfoDomain	order
OrderDomain	order_ri
OrderServer	129.174.95.49
InitMapLat	0
InitMapLon	0
ReportOrderScale	0
BMLC2GuiUrl	c:\bmlc2gui

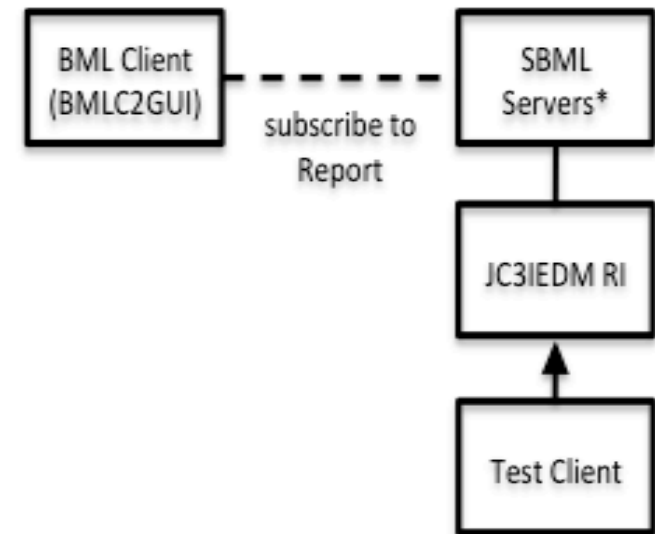
BML C2 GUI - Functionality

- C2 Capability
 - The BMLC2GUI implements the SBMLSubscriber Client application to connect to the subscription service of the SBMLServer.
 - This client connectivity enables the GUI to listen to any BML activity such as reports being generated.
 - The main usage of the Subscriber in the GUI is to pull new BML reports of any type and display them immediately on the screen in the editing/viewing panel in addition to extracting the geospatial information and display it in the map panel.
 - Some modifications to the code can make it a more advanced C2 system.
 - Examples to be shown in the coming integration demo slides

BML C2 GUI in the Integration Process



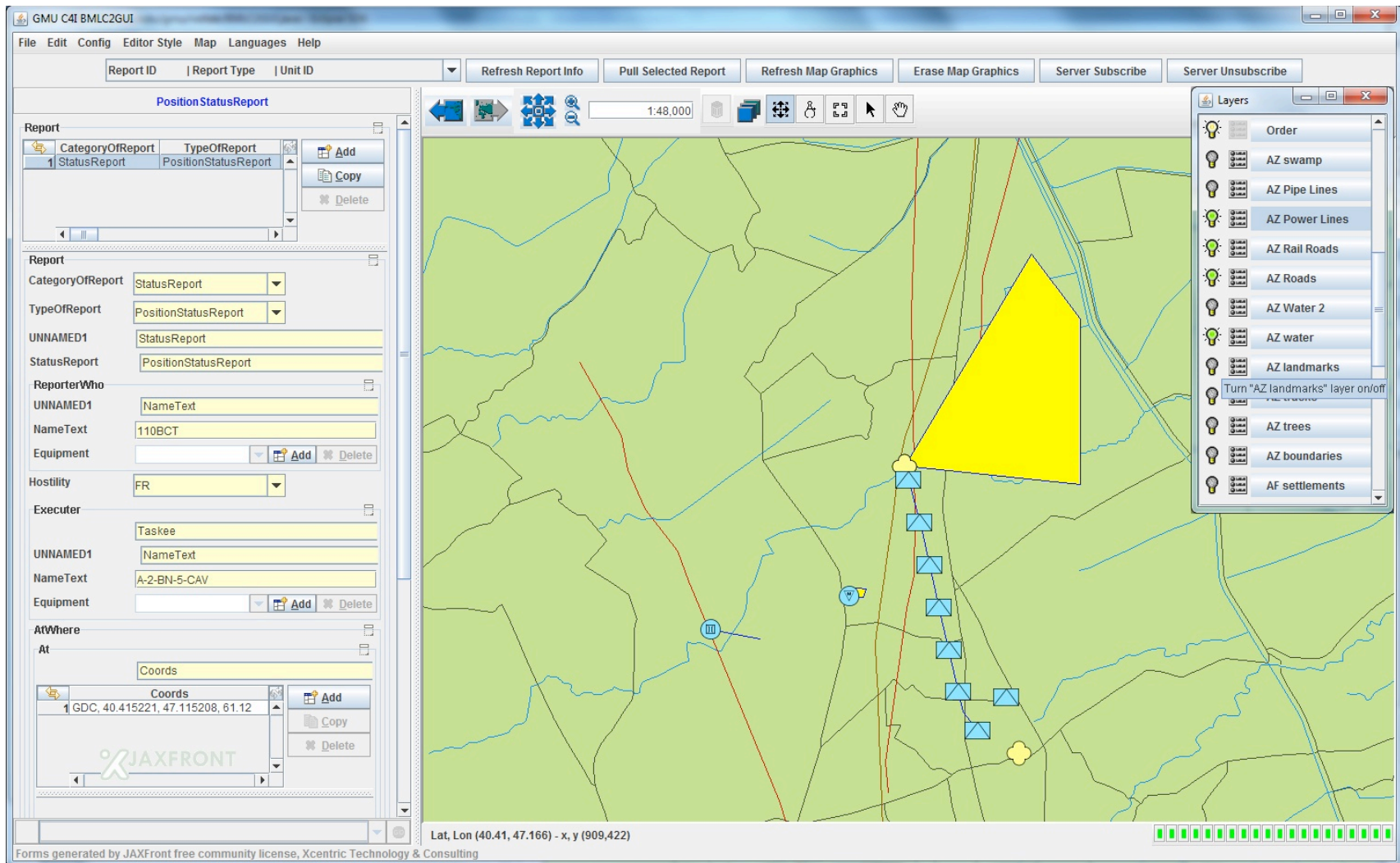
a. Orders



b. Reports

Use as Surrogate C2 System

Reports in BML C2 GUI



OPORD using SISO C-BML

The screenshot displays the GMU C4I BMLC2GUI interface. At the top, there is a menu bar with 'File', 'Edit', 'Config', 'Editor Style', 'Map', 'Languages', and 'Help'. Below the menu bar are buttons for 'Report ID', 'Report Type', 'Unit ID', 'Refresh Report Info', 'Pull Selected Report', and 'Refresh Map G'. The main content area is titled 'OPORD' and contains several sections:

- CategoryCode:** A dropdown menu set to 'OPORD'.
- CommandersIntent:** A text field containing 'Occupy Hill 456 in order to provide support for'.
- ExecutionPhase:** A table with columns 'Name' and 'WhatWhen'. The first row is 'ExecutionPhase4' with '00000000000000000991, MOVE, 20100701103100.000, AT, 20100701113100.000, AT'. To the right of the table are 'Add', 'Copy', and 'Delete' buttons.
- ExecutionPhase Details:** A form with fields for 'Name' (ExecutionPhase4), 'WhatWhen' (OID: 00000000000000000991), 'WhatCode' (MOVE), 'TimingDayCode', 'TimingHourCode', 'StartDatetime' (20100701103100.000), 'StartQualifierCode' (AT), 'EndDatetime' (20100701113100.000), and 'EndQualifierCode' (AT).
- TasksToManeuverUnits:** A table with columns 'Task', 'TaskeeWho', and 'WhatWhen'. The first row is 'A-2-BN-5-CAV' with 'C-2-BN-5-CAV, MOVE, 20100701103100.000, AT, 20100701113100.000, AT' and 'Route'. To the right are 'Add', 'Copy', and 'Delete' buttons.
- Task Details:** A form with fields for 'Task' and 'TaskeeWho'.

At the bottom of the window, it says 'Forms generated by JAXFront free community license, Xcentric Technology & Consulting'.

OPORD Mapping Capabilities

The screenshot displays the GMU C4I BMLC2GUI application interface. The window title is "GMU C4I BMLC2GUI". The menu bar includes "File", "Edit", "Config", "Editor Style", "Map", "Languages", and "Help". The toolbar contains buttons for "Report ID", "Report Type", "Unit ID", "Refresh Report Info", "Pull Selected Report", "Refresh Map Graphics", "Erase Map Graphics", "Server Subscribe", and "Server Unsubscribe".

On the left side, there is a data entry form for an OPORD report. The "CategoryCode" is set to "OPORD". The form includes tabs for "CommandAndSignal", "Overlay", "Situation", "Mission", "Execution", and "AdministrationLogistics". The "OrderID" field contains "00000000000000000604". The "TaskerWho" section includes "OrganisationRef" with "OID" set to "A-2-BN-5-CAV". The "UNNAMED1" section includes "OrderIssuedWhen" set to "20101010080808.000".

The central map area shows a geographical map with a yellow polygon highlighting a specific region. The map scale is indicated as "1:1,200,000". The "Layers" panel on the right lists various map layers, including "OPORD", "AZ swamp", "AZ Pipe Lines", "AZ Power Lines", "AZ Rail Roads", "AZ Roads", "AZ Water 2", "AZ water", "AZ landmarks", "AZ tracks", "AZ trees", "AZ boundaries", and "AF settlements".

The bottom of the interface features a status bar with the text "The field (Location[4] > OID) is mandatory." and "Forms generated by JAXFront free community license, Xcentric Technology & Consulting". The JAXFRONT logo is visible in the bottom left corner of the map area.

Conclusions

- The BMLC2GUI provides an easy-to-use, comprehensive tool for the BML developer and end user
- Platform-independent and command-line free BML editing and viewing
- Geospatial capabilities
- Validation and Serialization
- Being open-source makes it less expensive to own and operate
- Customization and enhancements possible by the BML community
- Open source at <http://c4i.gmu.edu/BML>