Appendix B: Scenario Narrative to Demonstrate Functionality to be Developed and Demoed in OWS-2

Context

This narrative is simply to provide context to demonstrate the functionality developed in the OGC Interoperability Program (IP) Initiative, the Open Web Services, Phase 2 (OWS-2). NIMA has supported this OGC IP Initiative in attempting to help NIMA/GeoScout mission to transform the NIMA Information Technology Infrastructure over the next 5 to 10 years.

The scenario listed here is entirely fictitious and has been generated to help demonstrate the interfaces and encodings that have been developed in OWS-2.

February 2004:

NIMA/P Customer Support lead has received a request from various US Government Agencies and Armed Forces to support the reconstruction of the Iraq Infrastructure after Operation Iraq Freedom.

Customer Support requests more details about the specific area of interest and requirements. A message is received back that the Agencies/Services involved would like to start with the city of Baghdad. Additional guidance is received stating that reconstruction efforts will start with getting basic services up to operational status. Analysts are asked to identify the location of all schools, hospitals, water and electrical facilities and police and fire stations and provide analysis of currency and completeness for these infrastructure features. Also required will be a detailed transportation and hydrography network.

After receiving the necessary information, two analysts of the NIMA Iraq Branch start to check the consolidated data store for data over Baghdad. Analysts determine the data holding content from the existing geospatial database consists of 4 Arc 2D Shapefiles covering the city of Baghdad. These shapefiles are converted to GML 2.1 using the NIMA Base Profile Application Schema, Zipped and transferred to field analysts.

Field analysts realize that some of the infrastructure information is incomplete and not current. Analysts start determining how to get the appropriate source material to compile current and complete infrastructure information. They search the CSIL - Commercial Satellite Imagery Library and find Spot 5 multi-spectral imagery (with 10 meter spatial resolution) has been collected and purchased during the late fall of 2003 for the geographical area of North-central Iraq. They request and receive the imagery one week after their initial querying of the CSIL. Using imagery and additional sources analysts determine the physical condition of such features and begin updating the data as required.

Analysts are asked to make assessments and identify areas where such services/facilities are in high demand based on field inspections and observations. A needs assessment is made to determine requirements to get each facility in working condition or suitable alternative sites if the damage is too severe. It is determined that many reconstruction materials will be delivered at the local airport and transported to the appropriate site. Analysts are asked to determine optimal routes for the transfer of such materials considering road widths, road conditions/restrictions. Analysts are also asked to consider hostile activity when determining the recommended routing. Several days into the exercise weather conditions change and water levels of the Tigris River in Baghdad are rising to flood levels. Analysts are asked to provide weather information integrated with their daily report and determine if rising waters will affect potential travel routes and/or facility locations.

Analysts determine that the data encoded in GML 2.1 is insufficient to meet these new requirements. Due to the rising water levels on the Tigris River and the need to determine flood levels 2 1/2D geometry is required. Data with full topology is required for accurate route analysis. Data with Xlinks to the NIMA Gazetteer database will ensure correct identification of facilities. To support multiple uses at the airport location analysts collect and encode the airport with multiple geometric representations. Each geometric representation (point, line, area) will contain more details than the previous with the area representation containing the most detailed information. Accurate reporting of progress of infrastructure work will require that each building under repair be tracked and reported based on time and changes in operational status. Additionally, agencies working the repair operations request that the Tigris River be updated on a daily basis to show current flood conditions. Analysts collect the Tigris River as a single feature with multiple geometries based on time. All data needs to be based on WGS-84 datum.

A determination is made to convert to a GML 3.1 encoding to enable adding z-values, topology and utilize additional GML 3 capabilities such as Xlinks, dynamic features, observations, roadway restrictions, multiple geometries (Airport Facility) and a temporal element. A NIMA Profile Base Application Schema for GML 3.0 must be created. Analysts determine the base schema should contain wherever possible any GML capability that is required throughout the data instance. The base application schema will be designed to contain the following:

1) The Coordinate Reference System to be used for all features and geometries in both the base and secondary application schema.
2) The original set of 49 Features and their attributes.
3) Geometry schemas in use with the 49 features.
4) Topology schemas in use with the 49 features.

Additionally analysts have determined that the base schema must be appended with a secondary application schema. The secondary schema will contain any unique GML functionality and be able to override the base schema for specific instances. The secondary schema will be designed to contain the following:

1) Incorporate additional features/attributes as required to complete the mission
2) Expanded use of GML 3 capabilities as required by the additional features.

A decision is made to combine the 4 quadrants of data of transportation coverage in order to create topology for that specific layer of data. Further a decision is made to track the rise of the Tigris River using a temporal topology schema. Analysts extract both the hydro and transportation features into separate coverages. Topology is built for the transportation coverage to ensure integrity of route analysis while temporal topology is applied to the Tigris River to better track the river flow and make predictions based on weather reports.

This information is combined and reported out daily using WMS capabilities. Analysts determine feature styling on the WMS should be based on GEOSYM CGM symbology. Field teams attempting to access data directly via internet connection to the WMS discover that the data instance files are quite large and very time consuming to download. Analysts are asked to evaluate potential compression packages and/or binary encoding practices to speed delivery. NIMA analysts and base support teams will utilize WFS functionality to download the data to production workstations for continual maintenance and update. Analysts will upload daily updates (flood status, construction status, and hostile activity status) to the WFS which will in turn be accessed daily by the WMS to display the most current information.

GML 2.1 Schema requirements:

Topology – none.
Geometry – simple feature

Feature and attribute – original shapefile (49 features Profile)

GML 3 Schema Requirements:

Geometry –

GML Geometric Property Type	Defined in GML Schema File	Restrictions
gml:PointPropertyType	geometryBasic0d1d.xsd	none
gml:CurvePropertyType	geometryBasic0d1d.xsd	only LineString allowed as value
gml:SurfacePropertyType	geometryBasic2d.xsd	only Polygon allowed as value
gml:MultiCurvePropertyType	geometryAggregates.xsd	only MultiLineString allowed as value
gml:MultiSurfacePropertyType	geometryAggregates.xsd	MultiPolygon and MultiSurface allowed as value; MultiSurface can use only linear (sub)geometries
gml:LinearRingPropertyType	geometryBasic2d.xsd	this was missing in GML-2 and has justifiably been added to GML-3
gml:RingPropertyType	geometryPrimitives.xsd	only LinearRing or Ring with LineStrings can appear as value

Additional requirements for Geometry include:

- Handle simple geometric shapes 0-2.5 D. Don't need 3D solids
- Only LineString type curves (CurveSegments) must be supported.
- Allow a feature to have any number of geometric properties

Topology –

Temporal Topology

Primitive Topology Objects

Features and Attributes –

NIMA Base extraction list (49 Features and Attributes)

NIMA Enhanced extraction list:

Features - Buildings (school, hospital, police station, fire station)

Utilities (water & electric)

General Miscellaneous Feature (ZD019)

Geographic Information Point (ZD012)

Land Subject to Inundation (BH090)

Safety Fairway (FC170)

Attributes – Roads

Traffic Flow (TRF) = 000 (unknown)

Traffic Flow (TRF) = 003 (one way)

Traffic Flow (TRF) = 004 (two way)

Bridge

Bypass Condition Code (BCC) = 000 (unknown)

Bypass Condition Code (BCC) = 001 (easy)

Bypass Condition Code (BCC) = 002 (difficult)

Bypass Condition Code (BCC) = 003 (impossible)

Overhead Clearance Category (OCC) = 000 (unknown)

Overhead Clearance Category (OCC) = 001 (restricted)

Overhead Clearance Category (OCC) = 002 (unlimited)
Safe Horizontal Clearance (SHC)
Under Bridge Clearance with Greater Precision (UBD)

Buildings
Building Function Code = 006 (hospital)
Building Function Code = 012 (police station)
Building Function Code = 015 (school)
Building Function Code = 037 (fire station)
Existence = 000 (unknown)
Existence = 005 (under construction)
Existence = 006 (abandoned/disuse)
Existence = 007 (destroyed)
Existence = 028 (operational)
Name
Named Feature Identifier
Power Plant Category = 001 (hydro-electric)
Power Plant Category = 007 (internal combustion)
Product = 031 (electric)
Product = 116 (water)

General Miscellaneous Feature (ZD019)
Annotation Category Primary (ACP)
Extraction Timestamp (TMS)
Name (Nam)
Named Feature Identifier (NFI)
Name Identifier (NFN)
Text (TXT)

Geographic Information Point (ZD012)
Extraction Timestamp (TMS)
Text (TXT)

Land Subject to Inundation (BH090)
Area (ARE) Area with greater than 1 meter resolution
Existence (EXS) = 000 (unknown)
Existence (EXS) = 045 (natural)
Existence (EXS) = 048 (controlled)
Extraction Timestamp (TMS)
Hydrological Category (HYC) = 000 (unknown)
Hydrological Category (HYC) = 003 (dry)
Hydrological Category (HYC) = 006 (non perennial/ Intermittent/Fluctuating)
Hydrological Category (HYC) = 008 (Perennial/ Permanent)
Hydrological Category (HYC) = 999 (other)
Text (TXT)
Width (WGP) Width with greater than 1 meter resolution

Sources Provided:
4 quads of 2D Arc Shapefiles over Baghdad
4 quads of 3D Arc Shapefiles over Baghdad
1 full coverage Arc Coverage (hydro data)
1 full coverage Arc Coverage (transportation data)

Requirements:
1 Base Application Schema (49 features) GML 2.1
4 Quads Baghdad data encoded in GML 2.1

1 Base Application Schema (49 features) GML 3.0
1 Enhanced Application Schema (additional features/attributes identified above) GML 3.0
4 Quads Baghdad data encoded in GML 3.0
2 complete Baghdad data encoded in GML 3.0 (Hydro & Transportation)