The Digital National Framework in Great Britain
Working together to develop and document the technical architecture

Presentation to EuroSDR/EuroGeographics Workshop on ‘Feature/Object Models’
Munich, 24-25th April, 2006

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V1.0b www.dnf.org
Overview

• Background and context
• Towards a technical definition of DNF
• Technical architecture
  – Reference model
  – Data model
• How the work is evolving
• Documenting the technical architecture
• Current work
  – Unique identifiers
  – Data association
• Conclusions
Background and context
Definition

“DNF is an industry standard for integrating and sharing business and geographic information from multiple sources.”
A common framework for all

Users define their own “views” & unique identifiers link the views together

“DNF is primarily concerned with geospatial information and its relationship to other data and information”
DNF Information Model

0. Coordinate Systems and Transformations

1. Base Reference Information
   Topographic & Marine objects

2. Associated Reference Information
   Real world objects: Roads networks, River networks, Property parcels, Addresses, Geology, Boundary, Imagery, DTMs

3. Application Information
   Patients, diseases, births/deaths, traffic flows, accidents, animals, subsidies, diseases, client records, land register, ownership, occupancy, crimes, asset information, insurance policies

Consistent Models and Methods

Consistent Methods for Publication & Derived Outputs
DNF Reference Base

- Ordnance Survey MasterMap – Topography Layer
- Derived originally from detailed topographic mapping at 1:1250 or 1:2500 scales
- Database contains over 400 million objects in Great Britain
- Objects abstractions from real-world represented by points, lines and polygons
- Positioned on the British National Grid
- Each object carries a unique identifier (TOID) kept throughout its life
- Each object has a defined life-cycle and is versioned
- Objects in nine themes: e.g. roads, tracks and paths; land; buildings
- Each object classified into one or more of 21 descriptive groups
- Available as a seamless base (not tiled)
- Update available as change-only
A common foundation
– Great Britain coastal waters

SeaZone is creating Base & Associated Reference Information offshore

Marine feature types complement those on land within extended catalogue

Differences and replication of objects along coast are being addressed

Base Reference Topography is inter-operable with OS MasterMap

Vertical datum issues are being addressed to create single 3-D surface from land to sea
Associating to the Reference Base
Towards a technical definition of DNF
How DNF is being defined and made operational

1. DNF Model
   Incorporating:
   1.1 Basic DNF principles
   1.2 Reference Model
   1.3 Spatial temporal reference Model & Transformations
   1.4 Object Model
   1.5 Data Association Models

2. DNF Registry – Operational
   Incorporating:
   2.1 Identifier management
   2.2 Feature/Object catalogue and Taxonomy
   2.3 Terminology
   2.4 Measuring conformance (of a dataset against the model)

3. Supporting Guidelines
   To include:
   3.1 Metadata
   3.2 Information Quality

3.3 Information Exchange
3.4 Maintenance
   • Other Guidelines as required
Defining the Framework

DNF
- DNF Assoc Object
- DNF Assoc Refer Layer
- Feature Catalogue
- DNF Reference Framework
- DNF Reference Base
- DNF Reference Object
- DNF Positioning System
- Metadata
- Data Quality

Application Information

Associated Reference Info.

Base Reference Information &

Geodetic Reference System- RTK GPS
Approach

1. Create a technical architecture
2. Express the architecture as a reference model
3. Develop object and association models
4. Move from the theoretical to the practical
   - use industry experience, build on actual cases
5. Evolve and document a DNF “standard”
   - specifications
   - codes of practice, guides
   - terminology
6. Develop procedures and registry services to support DNF
   - identifier management
   - feature catalogue
Technical architecture
Formal expression of architecture as a reference model

• Give a clear scope and context for DNF
• Guide the overall requirements for development
• Show relationship between DNF components
• Aid the understanding of DNF concepts
• Common basis for communication
• Expressed at the information level – logical view
Simple high-level model of DNF

DigitalNationalFramework

Specifications

content of

used by

DNF CrossReference

DNFReferenceObject

1..*

1..*

1..*

DNF AssociatedObject

0..*

Cross-reference to

ApplicationDataItem

0..*

0..*

Referenced by

Referenced by

Definition Level

Data Level
DNF Reference Model
DNF Reference Model – Data Level

DNF Reference Model – Data Level
Version 0.7 (Work in progress)
17-04-06
LJR

DigitalNationalFramework

DNF CrossReference

DNF Reference Object

DNF Associated Object

ApplicationDataItem

Information Service

Specifies content of

Specifies the DNF referencing used by

Is operated on by

Operates on

Cross-referenced to

Operates on
DNF Reference Base – OS MasterMap - Topography

Note: complex attributes not completely modelled

OS MasterMap Topography
Class Diagram
Version 1.0b
LRJ 17-04-06
Derived from OS MasterMap User Guides

24-25th April 2006
EuroSDR/EuroGeographics Workshop
OS MasterMap Topography in DNF context

DNFReferenceObject

TopographicPoint

CartographicSymbol

CartographicText

BoundaryLine

TopographicLine

TopographicArea

Point

Polyline

Polygon

Ring

Outer boundary

Inner boundary

0..*

+point

anchorPoint

+polyline

+polygon
Main characteristics of DNF Reference (OS MasterMap Topography) Objects

- Abstracted from real world as “feature types”:
  - TopographicArea
  - TopographicLine
  - BoundaryLine
  - TopographicPoint
  - CartographicSymbol
  - CartographicText
- Represented geometrically by:
  - Points
  - Polyline
  - Ring/Polygon
- Full attribution of feature types

Overhead, underground and landform features structured separately

Independent polygon - each ring points to a list of coordinated points
OSMasterMap Attribution

- **TOID** – unique and maintained identifier on all feature instances
- **Version** – of feature instance
- **Version Date**
- **Theme** – nine themes - feature can be in multiple themes
- **Feature Code** – coding of Desc Group - Feature Type - Desc Term
- **Change History**
- **Descriptive Group** – primary classification-one/more of 21 groups
- **Descriptive Term** – further classification of group
- **Physical Level** - underground, obscured, normal level, or overhead
- **Physical Presence** – real-world presence e.g. obstructing, edge
- **Geometry** - Point, Polyline, Polygon
- Other attributes specific to types + metadata
Topographic Identifiers - TOIDs

- **Purpose:**
  - Promote data association
  - Cross-referencing within OS MasterMap
  - Identify modified and departed features in change-only data
  - Provide for continuity of cross-referencing over time
  - Group features into more complex features

- **Unique in whole of Great Britain**
- **Maximum of 16 digits - prefixed by “osgb”**.
- **Given to all feature types**
- **Persist throughout the life of the object**
- **Unique reference to a feature instance at a particular point in time requires:**
  - TOID
  - Version number
Life-cycle rules for TopographicArea

- New real world object: Create new feature, Version 1
- Changed real-world object: Retain feature, Update version number
- Modified feature correcting error: Delete feature, Create new feature, Version 1
- Removed real world object: Delete feature

TopographicLine less persistent because of splitting at update
TopographicPoint simpler life-cycle
Change History

- **New** - new feature in the database.
- **Position** - feature changed geometry through accuracy improvement.
- **Modified** - feature has been edited by an operator e.g.
  - Geometry of a topographic feature changed after real-world change.
- **Software** - feature has been adjusted by an automatic software process.
- **Reclassified** - descriptive attributes of a feature have changed.
- **TextChange** - text string of text feature has changed.
- **Restructured** - new line feature(s) created from existing feature(s) where:
  - The feature is split into two or more features.
  - Two or more features are joined together.
- **Attributes** - applied to features with non-geometric attribute change
- **Incomplete** – area or line feature is incomplete e.g. during revision process

Not all changes reflect real-world changes
Types of association

Point

Line

Area

School Object
⇒ Name
⇒ Address

<School Id> ~
<User Defined Object -Id>

References:
TOID of OS MM object
TOID of OS MM object
TOID of OS MM object
TOID of OS MM object
TOID of OS MM object
TOID of OS MM object
...
OS MasterMap layers

- Integrated Transport Network
- Address Layer
- Topography
- Imagery
Associated DNF Objects in OS MasterMap

Class Diagram
Version 1.0b
LJR 21-04-06

DNF Reference Base

DNF Associated Reference Layer (Integrated Transport Network (ITN))

DNF Associated Reference Layer (Address Layer)

OS MasterMap Associated Layers

TopographicArea

DNFReferenceObject

RoadLink

RoadNode

Road

AddressPoint

To be implemented in Address Layer 2

0..* 0..* 0..*

1

1

2

1..*

0..* 0..*

1

1..*

205x526

AddressPoint

OS MasterMap Associated Layers

Class Diagram
Version 1.0b
LJR 21-04-06

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0..* 0..* 0..*

1

1

2

1..*

0..* 0..*

1

1..*
Simple Reference Model

DigitalNationalFramework

DNF High-Level Reference Model
Version 1.1
LJR 17-04-06

Specifies content of

Specifies the DNF referencing used by

Definition Level
Data Level

DNFReferenceObject

DNFCrossReference

1..*

DNFReferenceObject

DNFAssociatedObject

0..*

ApplicationDataItem

24-25th April 2006
EuroSDR/EuroGeographics Workshop
DNF Reference Model – Definition Level – simplified view

- DNF Simple Definition Model
- DNFReferenceObject
- DNFAssociatedObject
- DNFPositioningSystem
- MetadataSchema
- DNFReferenceFramework
- DNFFeatureCatalogue
- DataQualitySchema
- DigitalNationalFramework
- DNFReferenceBase
- DNFAssociatedReferenceLayer
- DNFReferenceObject
- DNFReferenceObject
- DNFReferenceObject

Specifies the DNF referencing used by DNF Definition Level Data Level
DNF Reference Model – Definition Level

- DigitalNationalFramework
- MetadataSchema
- DNFPositioningSystem
- DNFAssociatedObject
- DNFReferenceObject
- TemporalReferenceSystem
- SpatialReferencingSystemUsingCoordinates
- Taxonomy
- DNFAssociatedObject
- DNFReferenceFramework
- DNFAssociatedLayer
- DNFTopographicIdentificationSchema
- IdentificationScheme
- GeometryType
- DataQualityElement
- FeatureType
- DataQualitySchema

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DNF Full Definition Model
Version 0.8 (Work in progress) 21-04-06 LJR
How the work is evolving
“DNF is an industry standard for integrating and sharing business and geographic information from multiple sources”
The organisation

Events

Website

Documents

DNF Event

digital national framework

Case Studies

Technical Guides

Events Website

Documents

Expert Gp

2-3 times a year

Communications Gp

when required

Technical Group

when required

Technical Wkg Group

Technical Wkg Group
A “standard” for DNF

- For common and repeated use
- Aimed at achievement of a degree of order in a DNF context
- A successful DNF “standard” must be:
  - accessible and usable
  - beneficial and impartial
- Needs to have wide application
- Predominantly contain:
  - codes of practice, guides
  - glossaries, vocabularies, terminology
- A minimum of mandatory requirements
  - enough to be able to measure conformance
- Build on existing national and international standards
Specifies content of
DigitalNationalFramework

DNFReferenceObject

DNFCrossReference

DNFAssociatedObject

ApplicationDataItem

Cross-reference by point, by area or linear

Cross-referencing using identifiers

Coordinate referencing systems for positioning

Use of identifier prefix indicating originator

Maintenance of cross-references

Classification of features/objects

Metadata (based on ISO 19115)

Quality (based on ISO 19113 & ISO 19114)

Data classification taxonomy

Data maintenance

Areas for "standardisation" or guidance

Coordinate referencing systems for positioning

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Data classification taxonomy

Data maintenance
Proposed documentation

- High-level documentation
  - introduction to DNF
  - reference model
- Models
- Technical Guides
  - express the main requirements
  - supported by examples
- Conformance Guidance
  - how to conform to DNF
- Guidelines and best practice
  - many based on existing standards
- Other supporting documentation
- Procedures
DNF Registry

Identities

This section of the registry allows organisations to register 4-character codes that are unique to them. On publication of non-compliant datasets, identifiers can be prefixed with these codes in order to guarantee uniqueness within the Digital National Framework.

The DNF Expert Group reserves the right to moderate registrations in order to preserve the integrity of the registry.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Code</th>
</tr>
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<tbody>
<tr>
<td>Assist Applications Limited</td>
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<td>bgen</td>
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<td>deuk</td>
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<td>duc1</td>
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<tr>
<td>Greenwich Council</td>
<td>gree</td>
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</table>
Conclusions
Conclusions

- Have a consistent topographic base in Great Britain:
  - Detailed
  - Based on feature types
  - Maintained
  - Unique identifiers
- Real opportunity to improve information sharing and data integrity
- Collaborative effort within the GI industry to arrive at a pragmatic approach
- Driven by industry not Ordnance Survey
- Based on an evolving technical architecture:
  - Reference model
  - Data model
- Documenting the technical architecture
- Prioritising:
  - Unique identifiers
  - Data association
- Need to progress data classification and feature cataloguing
Questions....