ISO 19119 and OGC Geographic Information Service Architecture

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Geographic Information Service Architecture

- **Service architecture standard developed jointly:**
  - ISO TC211
    - standardization in the field of digital geographic information
      - [http://www.isotc211.org](http://www.isotc211.org).
  - OpenGIS Consortium (OGC)
    - international consortium of companies, government agencies and universities
      - [http://www.opengis.org](http://www.opengis.org)
    - OGC Interoperability Program Testbed
      - TC 211 and OGC Cooperative Agreement

- **NASA’s Geographic Interoperability Office**
Geographic Information Service Architecture

- **Goals of Service Architecture**
- **Geographic Service Architecture**
  - A set of viewpoints
- **Implementations**
Goals of geographic service architecture

- Geographic Information in a period of radical integration.
  - “monolithic” image processing and GIS packages moving to the Internet.
- ISO 19119: framework for software development across variety of open information technologies
  - interoperable services through interface standardization
  - development of a service catalog through the definition of service metadata
  - separation of data instances & service instances,
  - one provider's service on another provider's data
Geospatial Service Architecture

Reference Model of Open Distributed Processing
- RM-ODP [ISO/IEC 10746]

- **Computational viewpoint:**
  - interaction patterns between services

- **Information viewpoint:**
  - semantics of information processing

- **Engineering viewpoint:**
  - design of distribution-oriented aspects

- **Technology viewpoint:**
  - implementation specifics, e.g., Web Services.
Viewpoints defined in “Reference Model - Open Distributed Processing,” ISO/IEC 10746
Geographic Service Architecture Viewpoints

- **Computational viewpoint:**
  - interaction patterns between services

Abstract

Implementation/Development
Computational viewpoint: *a basis for service chaining*

- Defining Services with reusable interfaces
- Service Metadata
- Service/Data coupling
- Service Chaining
Service, Interface, Operation

- **Service**
  - distinct part of the functionality that is provided by an entity through interfaces
- **Interface**
  - named set of operations that characterize the behavior of an entity
- **Operation**
  - specification of a transformation or query that an object may be called to execute.

*Definitions driven by WSDL, OSE, UML*
Service Metadata

- To evaluate fitness for use of a service
- Describes operations for accessing service
- Service metadata in service catalogs
- Service/Data coupling:
  - Tight-coupling to specific data set
    - Service metadata linked to geographic dataset metadata (ISO 19115)
  - Loose-coupling: service un-associated with specific data
    - Association with data types
Geographic Interoperability Office

Service Metadata

**Service description**

- Service characteristics (e.g. provenance, algorithm, QoS)
  - 1

- Interface characteristics (operations, bindings\(^\text{7}\)WSDL)
  - 1+

- Associated data sets/Content (described with ISO 19115 - Metadata)
  - 0+

*Used in getCapabilities response and Service Registries*
Service Chaining

- “Combining services in a dependent series to achieve larger tasks”
  - Basis for decision support
- Patterns for chaining
  - Transparent: user sees all of the services
  - Translucent: workflow aids the user
  - Opaque: aggregate service hides services
- Chaining validity
  - Services that work together to produce valid results
    - Services Organizer Folder (SOF)
  - Need for process semantics
  - Common service definitions
OGC “publish-find-bind” Pattern

Needed as amendment to ISO 19119

Requestors locate specific services

providers advertise data and services to registry

*Find*

Requestor

*Publish*

Provider

*Bind*

Requestor invokes services of the provider.
Geographic Service Architecture Viewpoints

- **Information viewpoint:**
  - semantics of information processing

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**Abstract**

**Implementation/Development**

**Engineering Viewpoint**

**Information Viewpoint**

**Computational Viewpoint**

**Technology Viewpoint**
Information viewpoint: 
*a basis for semantic interoperability*

- **Geographic Service Taxonomy**
  - Structured listing of service types
  - Built from survey of existing tools
- **Top level organization**
  - Open System Environment (OSE)
    - ISO/IEC TR 14252
- **Geographic specific expansion**
  - ISO 19109 General Feature Model
ISO 19119: Geographic Services Taxonomy

- **Human interaction services**
  - viewers and editors
- **Model/Information Management Services**
  - management and access to data: features, coverages, etc.
- **Workflow/Task Services**
  - chain definition and enactment
- **Processing services**
  - processing services – spatial
  - processing services – thematic
  - processing services – temporal
  - processing services – metadata
- **Communication services**
  - encoding and infrastructure
- **System management services**
Processing services – spatial

*Example Services*

- Coordinate conversion service
- Coordinate transformation service
- Orthorectification service
- Spatial subsetting service
- Feature matching service
- Route determination service
# RDF Implementation of ISO 19119 Service Taxonomy by OGC

<table>
<thead>
<tr>
<th>OGC code</th>
<th>Service class</th>
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<tr>
<td>0000</td>
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<td>Feature access</td>
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</tbody>
</table>

“OGC Web Services — Service Registry,” Version: 0.2, OpenGIS Project Document OGC 01-082, Date: 2001-12-21
• **Engineering viewpoint:** design of distribution-oriented aspects
Engineering Viewpoint: Distributing Services across networks

- **Service Taxonomy Categories**
- **Arranged with Networks in Mind**
- **Split processing services in two**

- Human Interaction services
  - User processing services
  - Shared processing services
    - Model/Information Management services
Engineering Viewpoint:
Distributing Services across networks

- Human Interaction services
  - User processing services
    - Shared processing services
      - Model/Information Management services
Engineering View: OGC Web Services

Human Interaction services

Server Side Human Interaction Services

Human Interaction services

Web Browser

“Thick” Client

Client Generator

Coverage Portrayal Service

Sensor Collection Service

Coord. Transf. Service

Map Server

Feature Server

Coverage Server

Catalog/Registry

Model/Information Management Services

Processing Services

= Interface

= Internet
Geographic Service Architecture Viewpoints

- Technology viewpoint:
  - implementation specifics, e.g., Web Services.
Technology viewpoint: a basis for cross platform interoperability

- Distributed Computing Platform (DCP)
  - Goal: interoperability within DCP and across DCPs
- Service Specifications:
  - *Platform-Neutral* service specifications
  - Multiple *Platform-Specific* service specifications
  - Development
    - from platform-specific to platform-neutral or
    - from platform-neutral to platform-specific.
  - Both platform-neutral and platform-specific needed for complete specification
- DCP: OGC Web Services
Geospatial service architecture implementation

- **OGC Web Mapping Testbeds 1 and 2**
  - Much of ISO 19119 emerged from WMT1
  - ISO 19119 basis of requirements for WMT2, output of WMT2 incorporated in 19119

- **OGC Web Services Testbed**
  - implementing, refining, and extending the concepts of ISO 19119.

- **Other implementations and ISO 19119**
  - GeoConnections, Canada,
  - CNES, France
  - EOSDIS ClearingHOuse (ECHO), NASA
ISO 19119 - Geographic Service Architecture

GIS moving to the Internet
• Service chaining
  – Reusable interfaces
  – Service metadata
• Semantic interoperability
  – Service Taxonomy
• Layered Model for Distribution
  – Thick/thin clients
• Service specifications
  – Platform-Neutral
  – Platform-Specific

Questions?