Geospatial Interoperability Office

Interoperability in Geospatial Web Services

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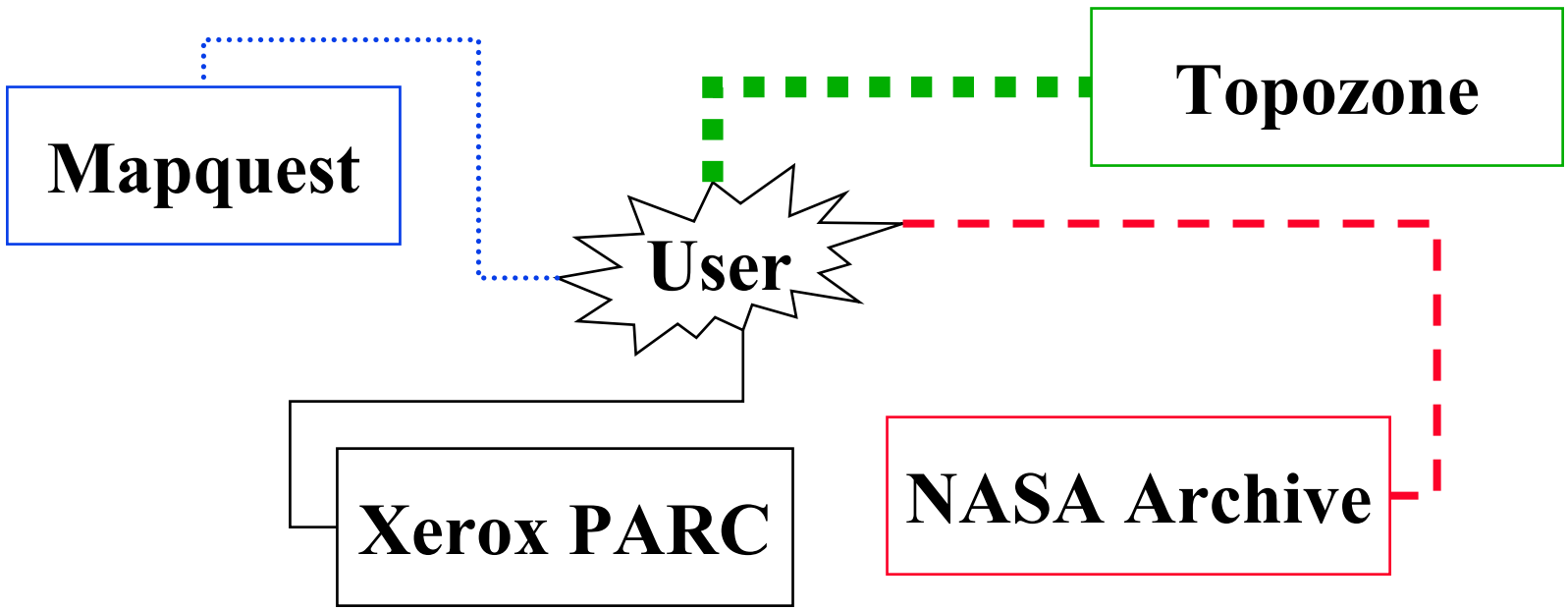
The Problem

- **Most existing internet map & data servers are not "interoperable"**
  - each has vendor-specific access method
  - access often requires human operator
  - service metadata is not standardized



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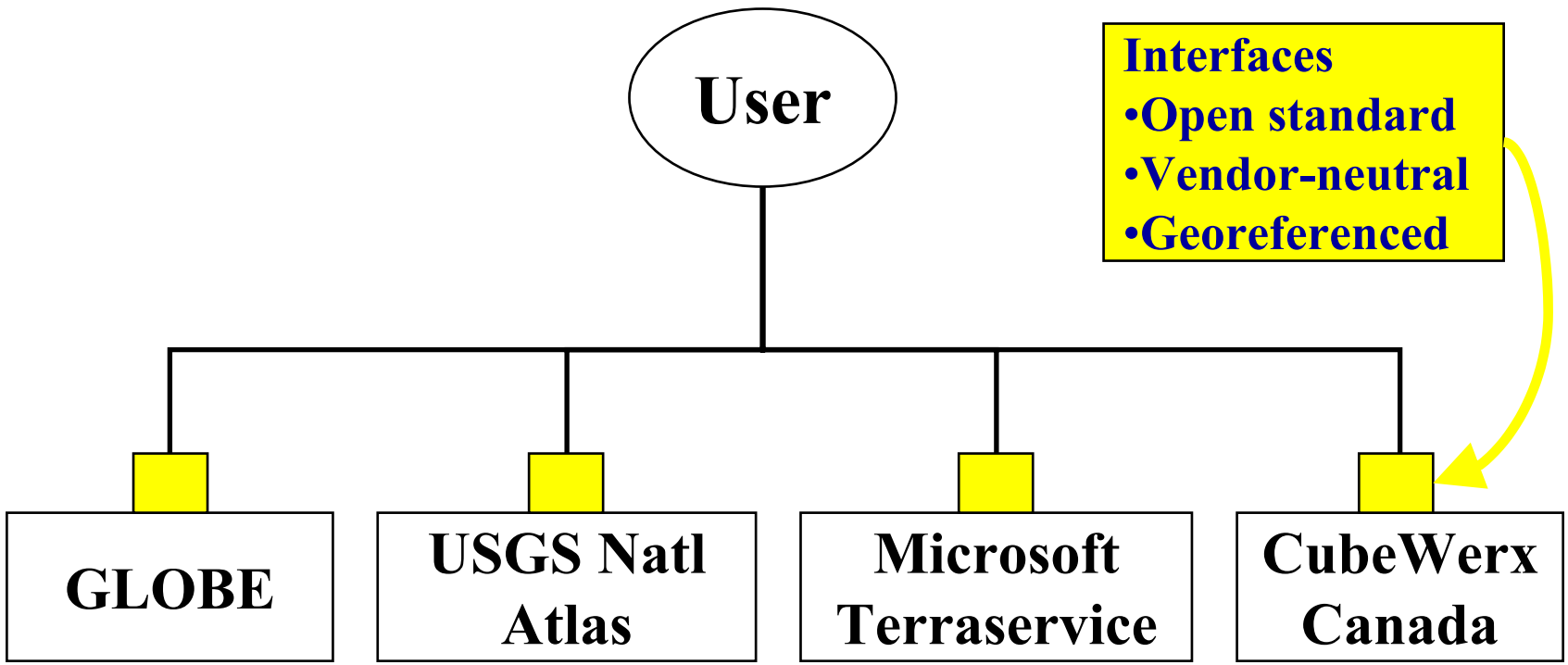
The Solution

- Standardized protocols for requesting geospatial information & services via HTTP
- Well-defined schema for service metadata



Open GIS Consortium (OGC)

GIS = Geographic Information System

- **OGC Members:**
  - 220+ institutions worldwide
  - software vendors, government, universities
- **Consensus development of open standards for interoperability**
- **Current focus on geospatial web services**
  - Building on HTTP, XML, etc
  - Experimenting with WSDL, SOAP, UDDI

www.opengis.org

WSDL = Web Services Description Language
SOAP = Simple Object Access Protocol
UDDI = Universal Description & Discovery Interface

OGC Testbeds

- Sponsorship by government agencies (or corporations)
- Cost sharing funds to vendors & academia
- Collaborative development of specifications
- Iterative prototyping
- Proven interoperability through working software

Web Map Service

- **WMS 1.0: 2000-04, WMS 1.1.1: 2002-04**
- **Scope: geographic data rendered as an image (a "map"), not actual data values**
- **Operations:**
  - GetCapabilities - send service metadata
  - GetMap - produce map of desired area
  - GetFeatureInfo (opt.) - describe feature at point

Standardized Service Metadata

- **Each OGC Web Service (OWS) is self-describing**
- **GetCapabilities operation - predefined URL syntax to request service description**
- **Response is "Capabilities XML" document**
  (XML = Extensible Markup Language)
- **Standard format & vocabulary**
  - automatically parsed by Clients
  - harvested by Catalogs
  - legible to humans if necessary

semantic interoperability

WMS Metadata

- **Title of server and general information**
- **Base URL for each operation**
- **List of map layers available**
- **For each map layer, possible metadata include:**
  - Name, Title, Abstract, Keywords
  - Coordinate systems & bounding boxes
  - Available rendering styles
  - Dimensional parameters (e.g., time)
  - URL of dataset metadata (FGDC/ISO 19115)

Standardized Request Messages

- **HTTP GET: parameters appended to base URL**
  - SERVICE=WMS&REQUEST=GetCapabilities
  - SERVICE=WMS&REQUEST=GetMap&
    LAYERS=layers&
    STYLES=styles&
    FORMAT=format&
    SRS=coordinate_system&
    BBOX=bounding_box&
    WIDTH=width&
    HEIGHT=height

technical interoperability

map size & location

⇒ Map "Client" can simply be a web page!

- **HTTP POST: Request is encoded as XML document**

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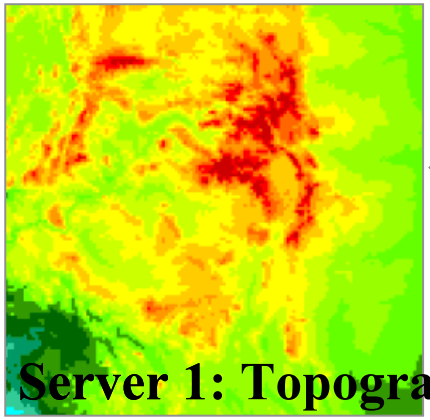
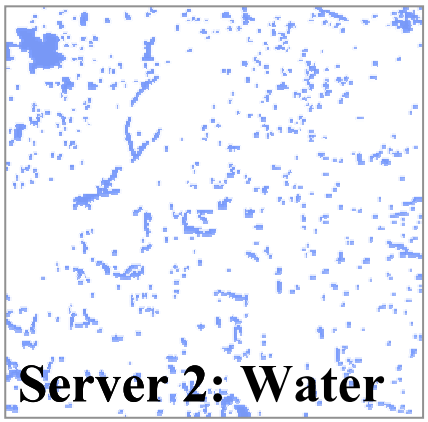
Interoperable Web Mapping

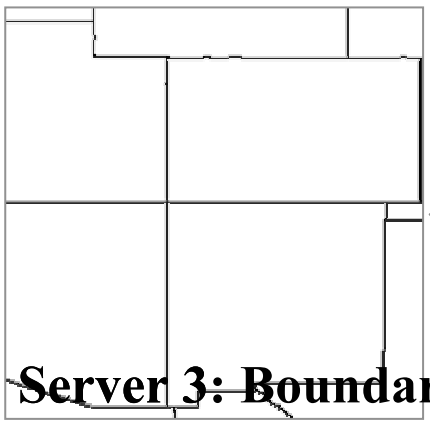


Server 1: Topography

GetMap

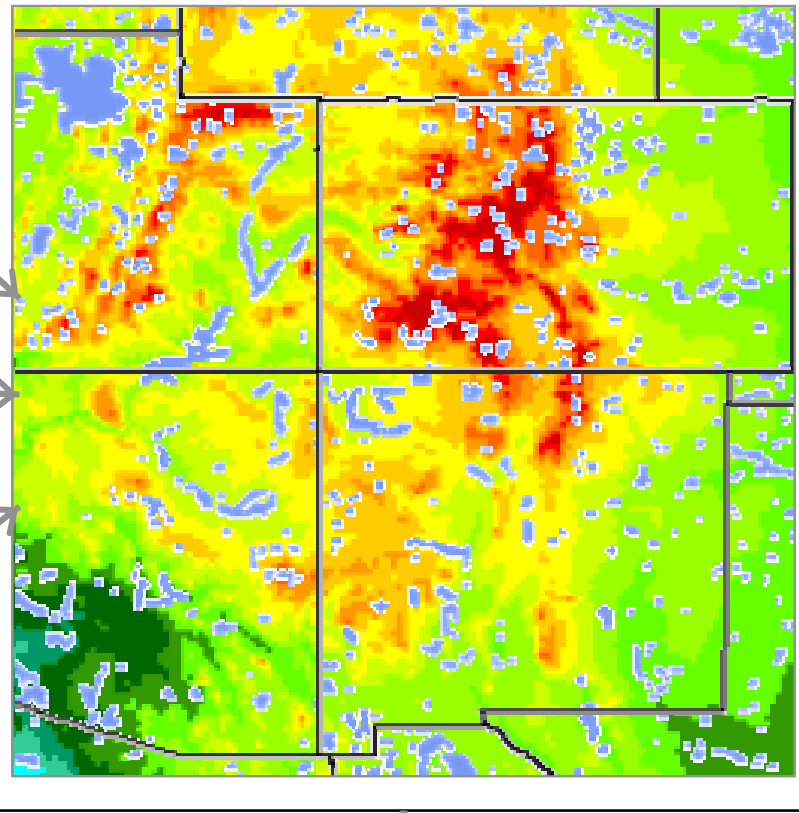


Server 2: Water



Server 3: Boundaries

Viewer Client: Combined Map



Catalog Service

Broader Adoption of WMS

- **ISO 19128 Committee Draft issued 2002-09**
  - Vote for adoption as Draft Intl Std 2002-12
- **Commercial vendor products**
- **Growing number of servers world-wide**
- **Core standard of GeoConnections Canada**
- **Core standard of US Geospatial One-Stop**

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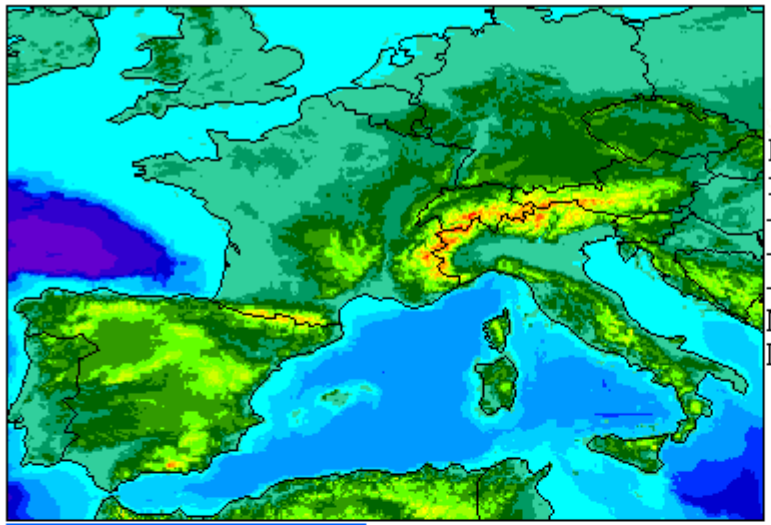


NASA Web Map Viewer

>Viewer
-Help
-Technology
-Software

NASA Geographic Interoperability Office

Click on map above to:

Zoom In Out x 2

Recenter

More Controls

Map area: 28.667 x 19.449 deg

Go To: List of Countries

viewer.digitalearth.gov

Theme: World Topography View

Current theme: 1017322050125335882.xml (bookmarkable link)

Map Size (currently 377x256)

100% Create New Map

WMS Context XML

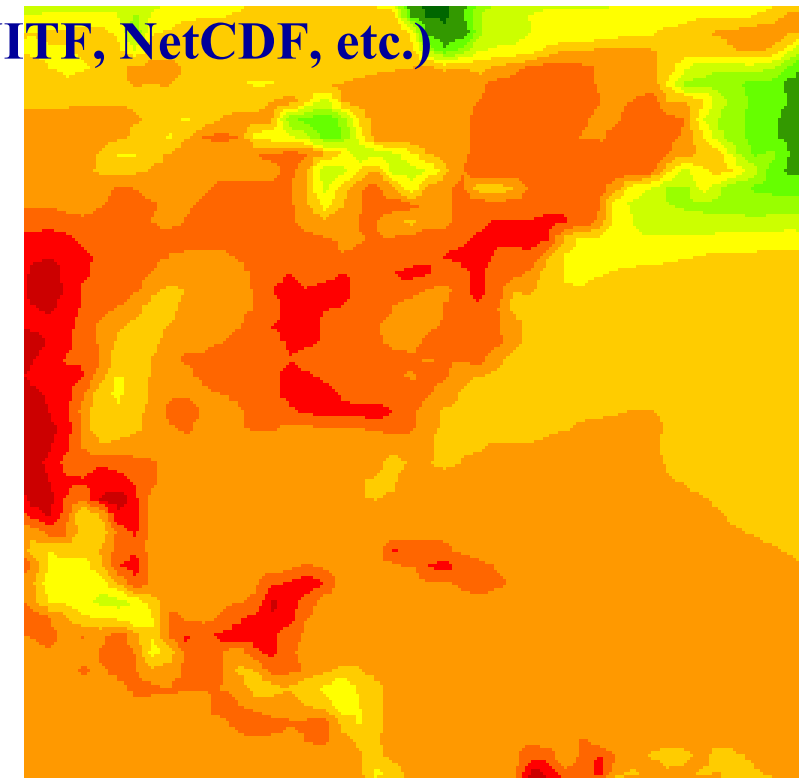
- **Draft v0.1.4 released 2002-08**
- **Scope: Description of a composite map (from multiple WMS servers)**
  - save state of Client application
  - reproduce view in another Client
- **XML document enumerating:**
  - map(s) provided by each WMS
  - overall bounding box
  - other useful info

Web Feature Service (WFS)

- **WFS 1.0: 2002-09**
- **Scope: storage & retrieval of geographic vector feature data (point/line/polygon)**
- **XML data encoding format: Geography Markup Language (GML)**
- **Filter Specification: Restrict WFS output based on user criteria**
- **Operations:**
  - GetCapabilities
  - DescribeFeatureType
  - GetFeature
  - Transaction *(optional)*
  - LockFeature *(optional)*

Web Coverage Service (WCS)

- **Draft v0.7 released 2002-04**
- **Scope: Retrieval of gridded, swath, TIN or other "coverage" data in binary or other formats (HDF, GeoTIFF, NITF, NetCDF, etc.)**
- **Operations:**
  - GetCapabilities
  - GetCoverage



Portrayal Services

- **Client submits GetMap request to portrayal service**
- **"Enhanced" request includes:**
  - URL of 3rd-party WFS or WCS from which to get data
  - URL of Styled Layer Descriptor (SLD) document describing how data are to be represented
- **Response is map image for display by simple client (e.g., web browser)**

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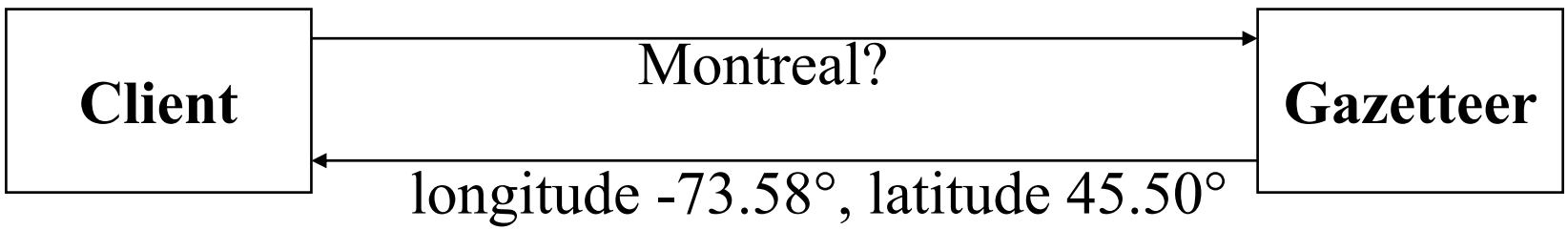
Web Terrain Service

- **Draft v0.3.2 released 2001-08**
- **Scope: Perspective views of terrain, possibly with additional data overlaid**
- **A generalization of Web Map Service to views that are not "straight down"**
- **Operations:**
  - GetCapabilities
  - GetView

Gazetteer

- **Draft v0.9 issued 2002-09**
- **A specialization of WFS**
- **Scope: Given a place name (or other identifier), return geometry and attributes as a GML Feature**

⇒ User can navigate by place name rather than by coordinates

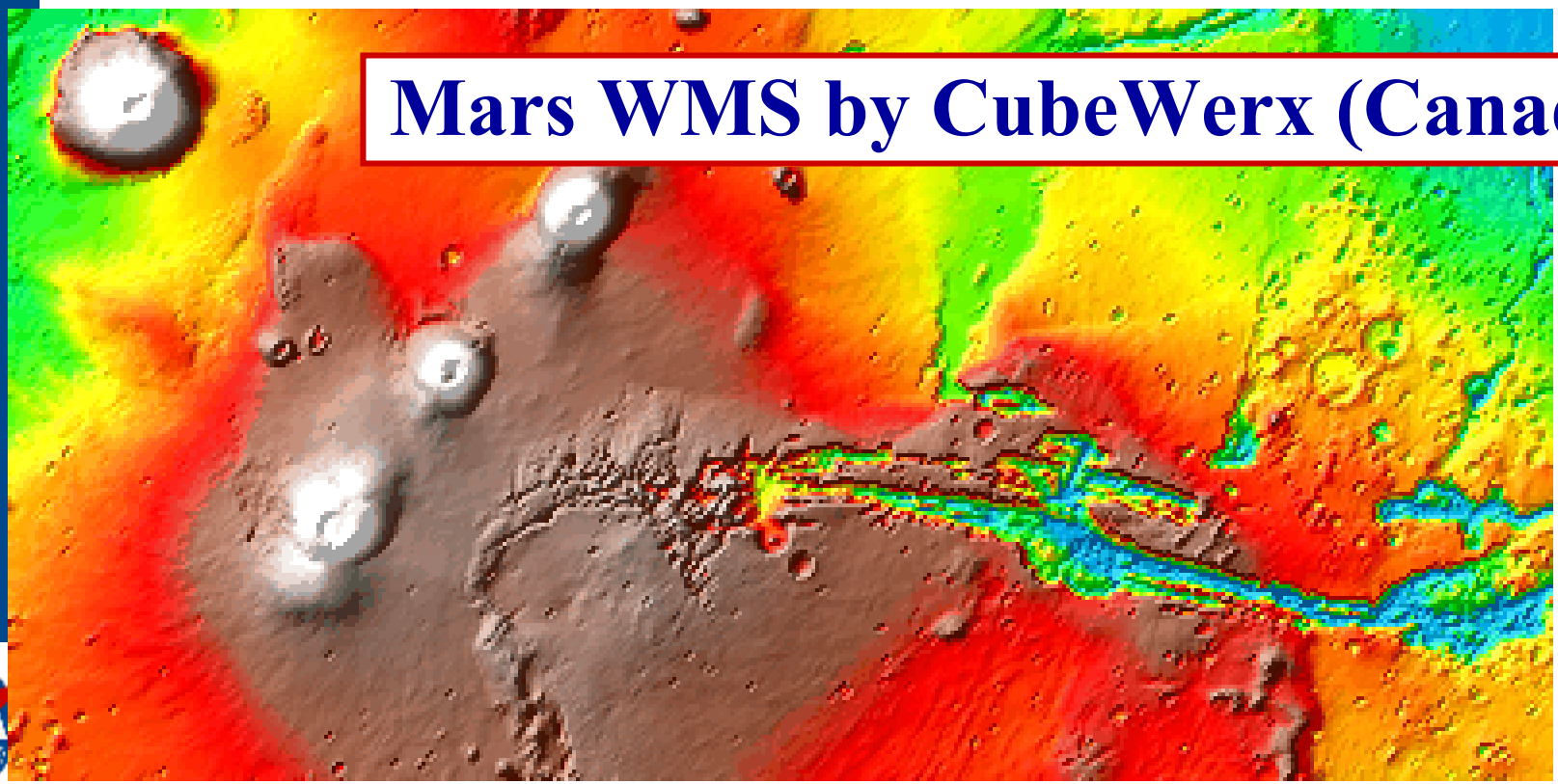


Web Registry Service

- **Draft v0.0.2 issued 2001-01**
  - "Stateless" HTTP version of session-oriented Catalog Service v1.0 (1999)
- **Scope: Searchable catalog of services and data**

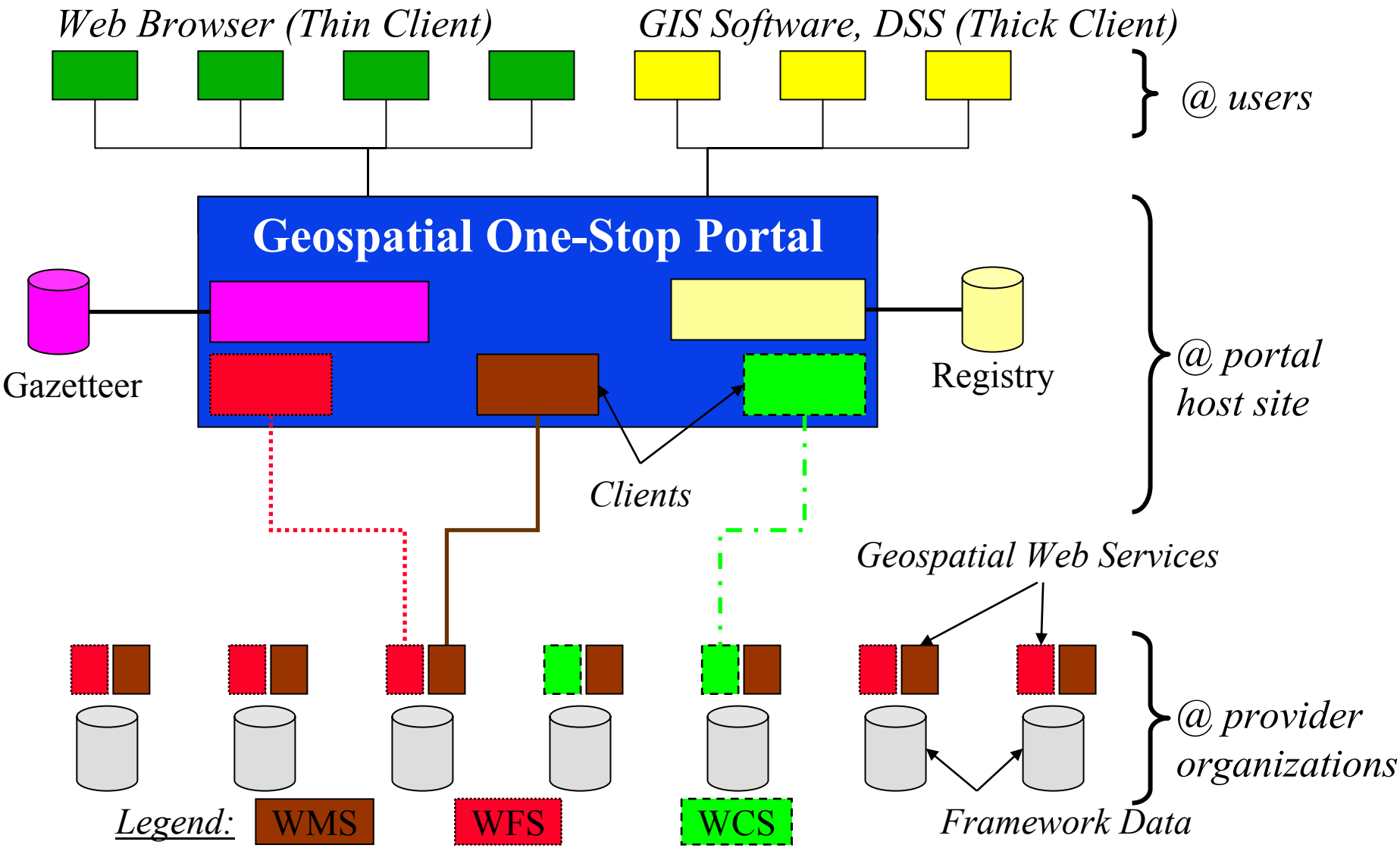
Other Planets!

- **Nothing fundamentally "geo" about these geospatial services**
  - except variable coordinate reference system ID

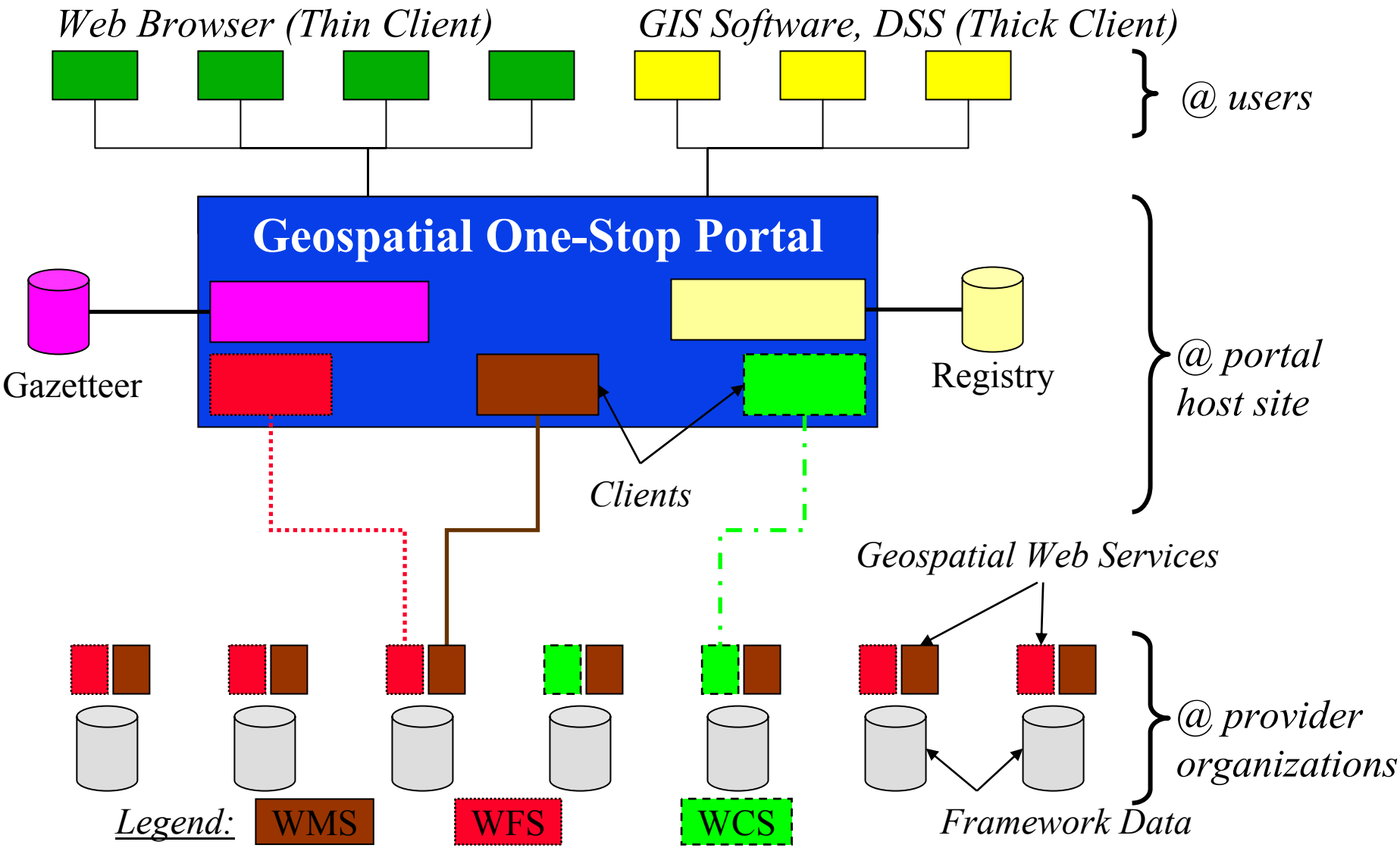


Mars WMS by CubeWerx (Canada)

Geospatial One-Stop Portal



Geospatial One-Stop Portal



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