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# ***National Spatial Data Infrastructures (NSDIs): North American Experience***

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**Henry Tom**

**International Symposium on NSDI (National Spatial Data Infrastructure)**

**Center for Spatial Information Science**

**University of Tokyo**

**June 8, 2009**

**Tokyo, Japan**

# *Agenda*

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*Spatial Data Infrastructures*

*North American Experience:*

*United States of America*

*Canada*

*Industry and International Trends*

*Recommendations*



# *Spatial Data Infrastructures*

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Definitions:

***Infrastructure***



***of natural and cultural features***



***information / data about this infrastructure***



***organizing this information by location***

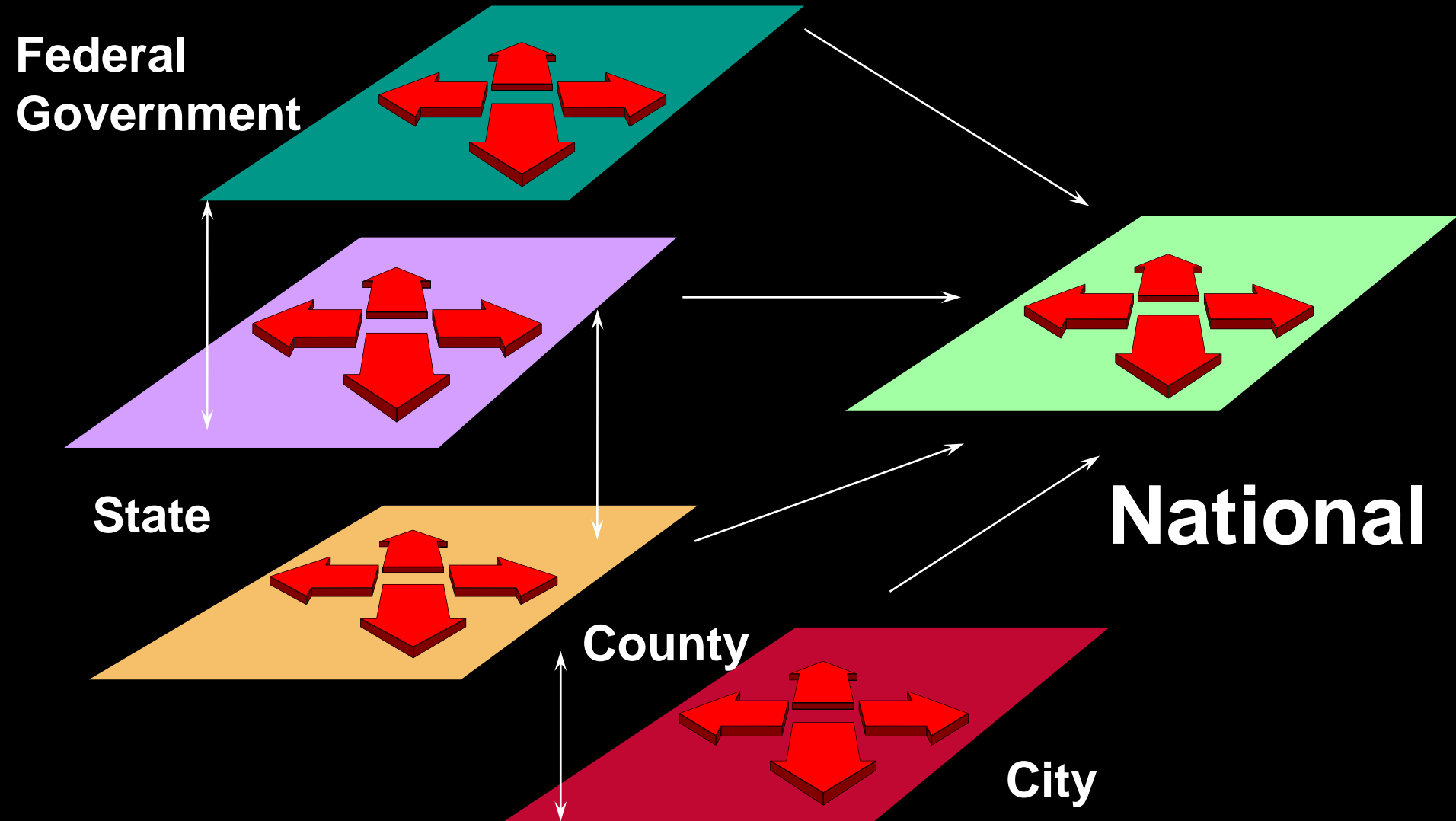


***spatial data infrastructure***

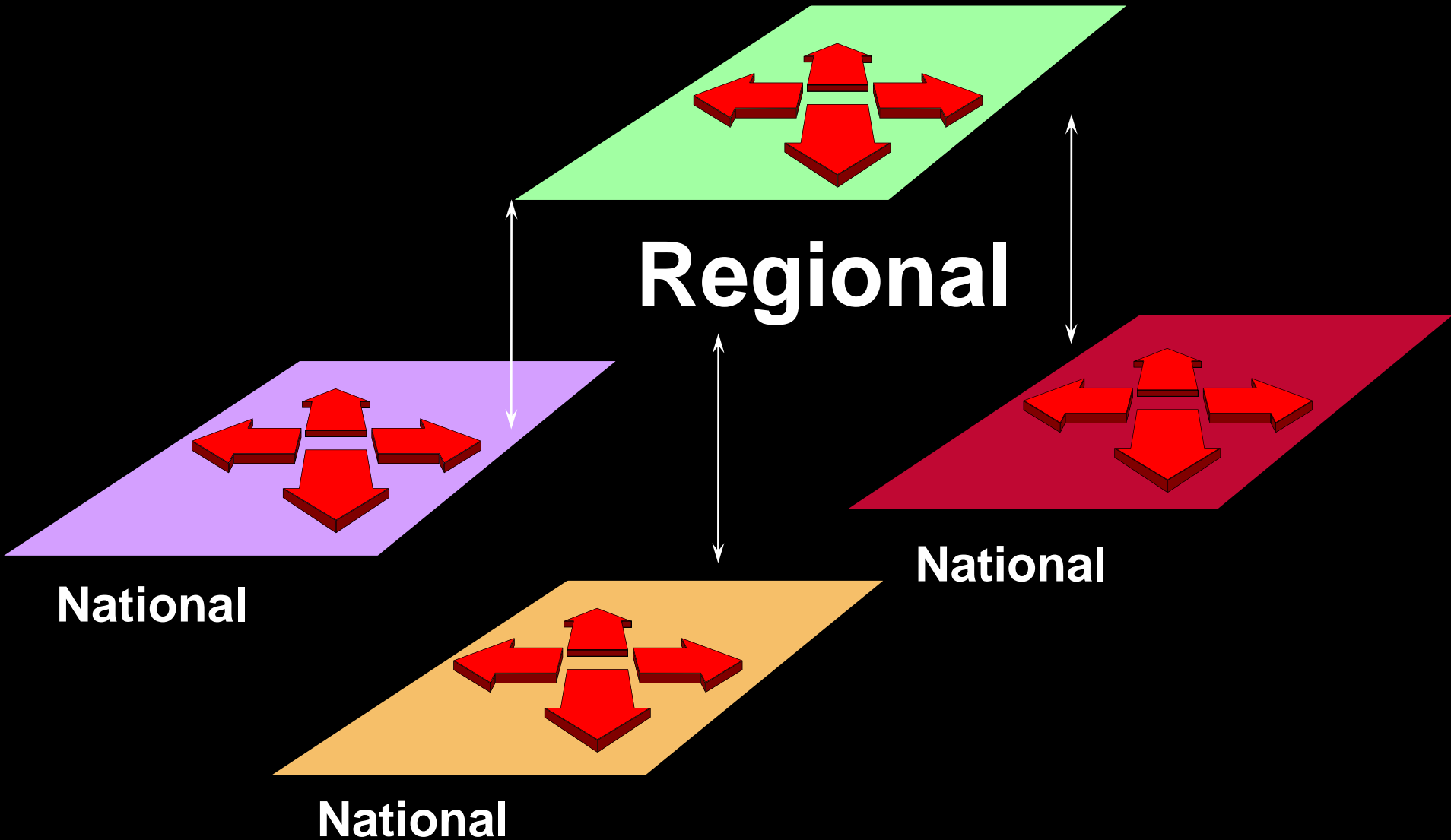


***Spatial data – Technology – Standards – Policies - People  
product and process***

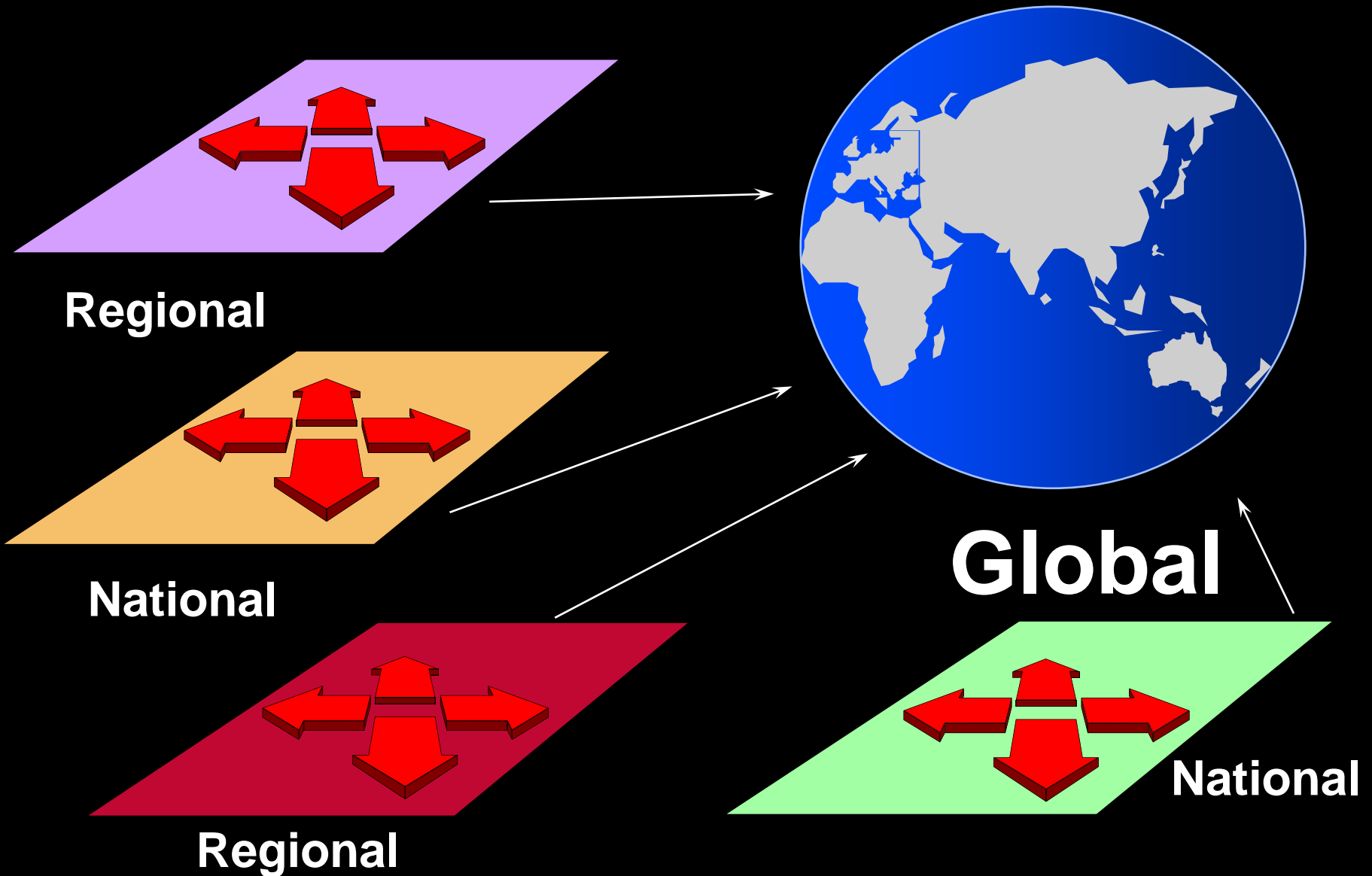
# *Spatial Data Infrastructures*



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# *Spatial Data Infrastructures*



# *North American Experience*

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## **US NSDI:**

**1960s** Cold War – e.g., Cuban missile crisis 1962  
need for survivable communications & computer network  
US DoD Advanced Research Agency ( DARPA ) – ARPANET

**1975 – 1990** digital cartography – GIS, FICCDC - FGDC

**1990s** commercial Internet and Internet Service Providers (ISPs)

**1993** National Information Infrastructure Act ( NII )

**1994** Executive Order 12906 - US NSDI

**1994** Permanent Committee on GIS Infrastructure for  
Asia and the Pacific ( PCGIAP ) - RSDI

**1996** Global Spatial Data Infrastructure ( GSDI )

# *North American Experience*



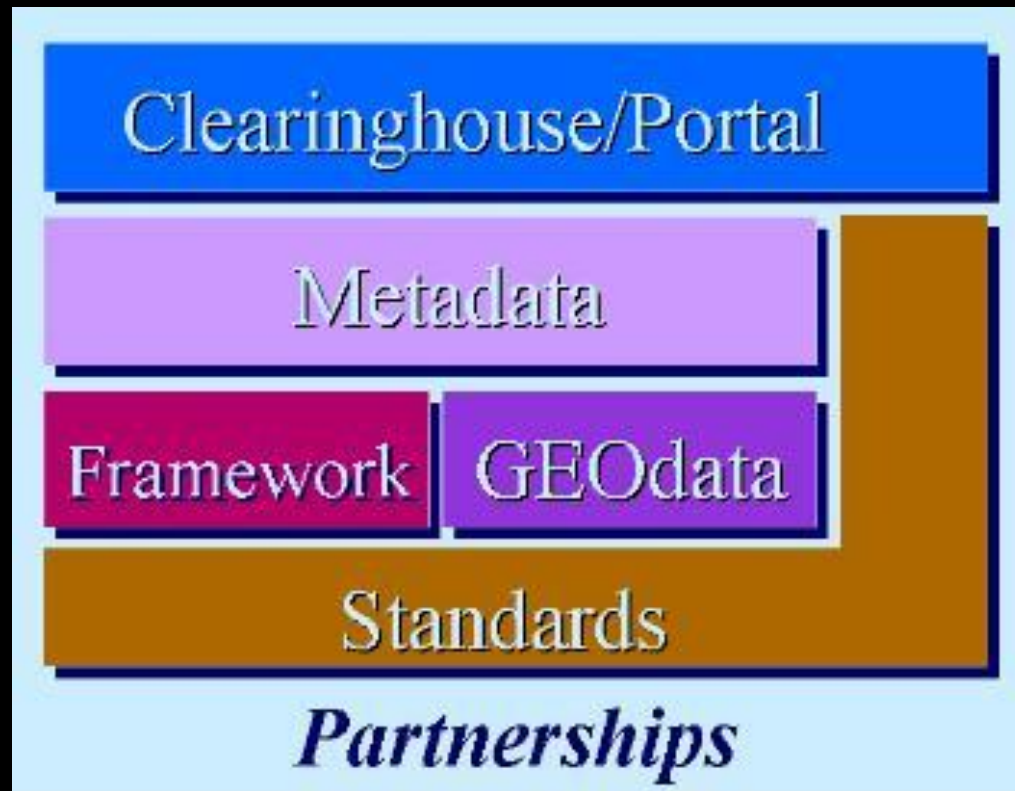
***“technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data”***

***“ US NSDI requires and will facilitate cooperation and interaction among various levels of government, the private sector, and academia”***



# *North American Experience*

## **US NSDI: Components**



# *North American Experience*

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**National Geospatial Program, US Geological Survey (USGS)**

**US Federal Geographic Data Committee ( FGDC )**

**focuses on policy, standards, and advocacy**

**The National Map – Framework Data**

**focuses on integrated, certified base mapping content**

**GeoSpatial One-Stop ( GOS ) - Portal**

**focuses on discovery and access of geographic data**

# *North American Experience*

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## **US NSDI**

### **US Federal Geographic Data Committee ( FGDC )**

**focuses on policy, standards, and advocacy**

**Chair: Secretary of Interior**

**Vice Chair: Deputy Director, Office of Management and Budget (OMB)**

**19 US Federal agencies**

**FGDC Coordination Committee**

**National Geospatial Advisory Committee ( NGAC )**

**Numerous stakeholder organizations participate in FGDC activities: state and local government, industry, and professional organizations.**

**Cooperative Agreement Grants (CAP) seed NSDI implementations**

# *North American Experience*

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## **US NSDI**

### **The National Map – Framework Data**

**focuses on integrated, certified base mapping content**

**Collaborative efforts among USGS and other federal, State, and local partners to improve and deliver topographic information for the Nation.**

**Framework Data** – basic data from which other geographic information can be derived, e.g., boundaries, transportation, land cover, elevation, hydrography, geographic names, etc.

# *North American Experience*

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## **US NSDI**

### **GeoSpatial One-Stop ( GOS ) – Portal**

**focuses on discovery and access of geographic data**

**Your **One-Stop** for finding and using Federal, State, and local geographic data**

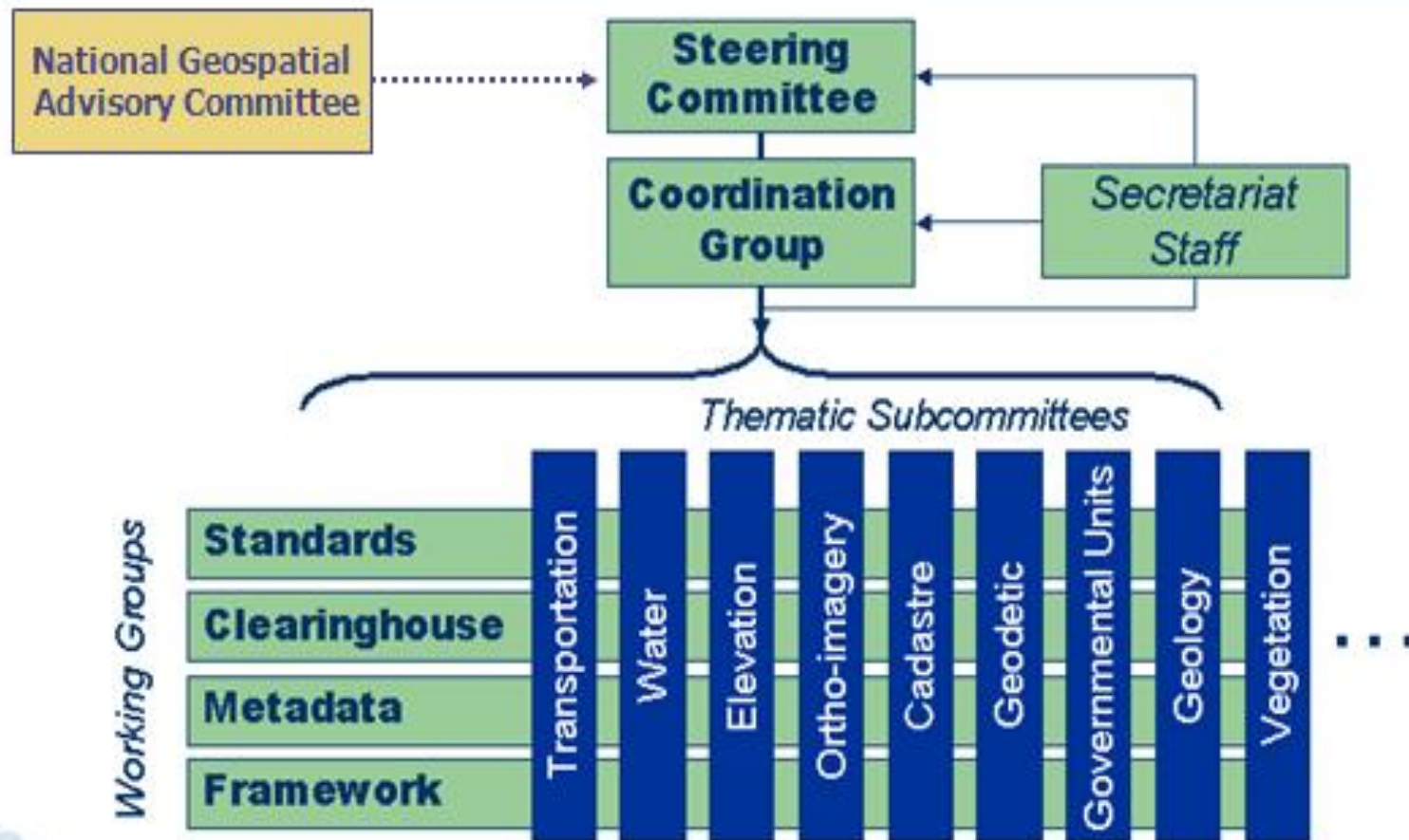
<http://gos2.geodata.gov/wps/portal/gos>

### **FGDC Clearinghouse Registry –**

**A database of all clearinghouse nodes participating in the clearinghouse activity:**

[http://registry.gsdi.org/index\\_reg.php](http://registry.gsdi.org/index_reg.php)

# North American Experience



**FGDC Organization**

# North American Experience

## Online Training Initiative

<i>The National Spatial Data Infrastructure (NSDI)</i>		
Geospatial Data Discovery and Access	Geospatial Data Integration	Geospatial Partnerships, Policy and Planning
<i>Geospatial One-Stop Portal</i>	<i>NSDI Standards</i>	<i>NSDI Policies and Practices</i>
<i>Geospatial Metadata</i>	<i>NSDI Data Themes</i>	<i>NSDI Partnership Opportunities</i>
<i>Geospatial Web Services</i>	<i>The National Map</i>	<i>Geospatial Business Planning</i>

<http://www.fgdc.gov/training/nsdi-training-program/online-lessons>

# *North American Experience*

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## **Canadian Geospatial Data Infrastructure ( CGDI )**

### **GeoConnections Program:**

*National partnership program led by Natural Resources Canada that collaborates and partners with all levels of government, private sector, non-government organizations, academia and international organizations in order to build and evolve the Canadian Geospatial Data Infrastructure.*

### **CGDI: GeoConnections Secretariat**

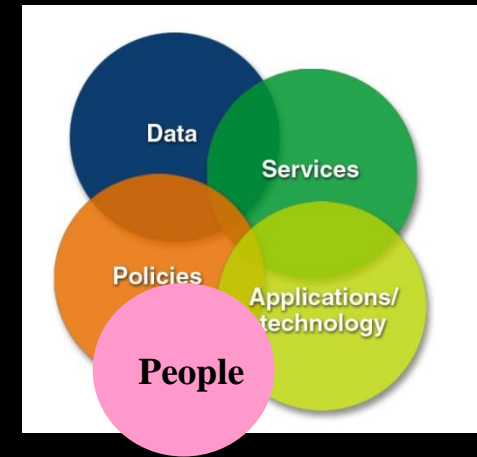
- *Program Delivery Teams: User Capacity, Data Content, Technology and Architecture, Policy, Communications, Value Management Office*



# North American Experience

## Canada - Defining Spatial Data Infrastructure

- Collaborations of suppliers (supply) that enable users (demand) to access geospatial data and tools;
- Autonomous, but interdependent;
- A network of networks:
  - Data, Metadata;
  - search and access services;
  - applications/technology;
  - Policies;
  - People.
- For better business and policy decision-making, and value-added commercial activities.



- <http://www.geoconnections.org/en/index.html>

# *North American Experience*

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## **Canadian Geospatial Data Infrastructure**

### **Geoconnections' Guiding Principles:**

- *Shared leadership, open to any interested stakeholder.*
- *National partnership.*
- *Cost-shared projects.*
- *Contribute / Leverage national, regional and international standards.*
- *Data sharing: collected once, closest to source, seamless (where possible).*

# *North American Experience*

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## **CGDI Essentials**

*Combining current, standards –based data from its source makes the CGI a potent decision-making ally*

*Layering different CGDI data sets expands insights*

*Sharing data from its sources reduces costs and improves decision making*

*Developers and suppliers also benefit from the CGDI*

## **Four priority areas & audiences:**

*Public safety decision-makers*

*Public health community*

*Aboriginal community decision-makers*

*Environment and sustainable development decision-makers*

# *North American Experience*

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## **Canadian Geospatial Data Infrastructure ( CGDI )**

- **GeoConnections Phase 1: 1999– 2005: Building the CGDI**
  - Launched to make Canada's geographic information accessible online by building the CGDI. Focused on building the infrastructure, liberating information and cultivating demand for applications
- **Renewed Government of Canada Program - \$60M over 5 years (2005-2010)**
- **Purpose: To improve Canadians' quality of life by helping make geospatial data and technologies available to enhance decision-making in four priority user communities:**
  - Public Health;
  - Public Safety & Security;
  - Environment & Sustainable Development;
  - Matters of Importance to Aboriginals.

# *North American Experience*

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## **GeoConnections Program Advisory Committees**

- **Architecture Advisory Committee**

*guidance and responsibility for geospatial standards and specifications along with related tools and technologies to address users' needs and expand the use of the CGDI*

- **Policy Advisory Committee**

*provide guidance on policy issues to the broad geomatics community*

*to identify and resolve policy issues in support of objectives of the GeoConnections Management Board*

- **Application-area committees:**

*Aboriginal Matters, Environment & Sustainable Development, Public Health, Public Safety*

# North American Experience

## GeoConnections Discovery Portal - Metadata Access

### Developer's Corner

API Guide

Free Tools

CGDI Technical Guide

Web Mapping Tool

Resources

Help

CDGI Documents

Online Training

<http://geodiscover.cgdi.ca/gdp/index.jsp?language=en>

The screenshot shows the GeoConnections Discovery Portal website. The header includes the logo and navigation links: Home, About Us, Contact Us, Français, and Canadian Geospatial Data Infrastructure. Below the header is a search bar with options: Search Geospatial Data, Search Organizations, Search Services, Update Your Content, and Help. The main content area is divided into several sections: Quick Links (Geobase, GeoGratis, Quicklook Swath Browser, Atlas of Canada, Toporama, NAPL Online, CEOCat), Resources (Help, CGDI Documents, Online Training), and a central search area with a 'QUICK DATA SEARCH' input field and 'SEARCH', 'BASIC DATA SEARCH', and 'ADVANCED DATA SEARCH' buttons. There are also sections for 'BROWSE POPULAR DATASETS' (Satellite Imagery, Topographic Data, Aerial Photography) and 'Developer's Corner' (API Guide, Free Tools, CGDI Technical Guide, Web Mapping Tool (beta version)). A 'News' section mentions 'November 2006 New Version Installed'. The footer contains 'Important Notices', 'Acknowledgements', and the Canada logo.

# *Industry and International Trends*

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## *Recent Trends in Web Mapping*

*June 2006 – Google Earth software  
downloaded by over 100 million people*

*Google API – probably a very large number*

*May 2006: Map directions*

*Google - 26 million US visitors*

*Yahoo – 26.1 million visitors*

*Mapquest – 43.5 million visitors*

*February 2009: Map directions*

*Google                    36% US visitors*

*Mapquest                40 % US visitors*

# *Industry and International Trends*



*Google, Microsoft, and Yahoo are highly successful  
- provide maps, imagery and directions.  
They demonstrated that there is a market for  
location based services*

*July 2007 Tele Atlas 2.8 billion USD by Tom Tom (PND)*

*2006 17 million Personal Navigation Device (PND)*

*2007 35 million PND*

*2010 83 million PND*

*October 2007 Navteq 8.1 billion USD by Nokia*

*Nokia has 36 % world market share mobile handsets*

*2006 – 346 million phone / mobile devices*



# *Industry and International Trends*

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*Major players such as Google, Microsoft, Yahoo, Tom Tom and Nokia have done what the geo-spatial community has not done:*

*– they have answered the question of **where** - for the **masses** on the **Internet** & for **mobile** devices such as PND and GPS enabled telephones and now providing services based upon location*

***Paradigm Shift** – these major technology giants and mobile telephone companies have validated the **demand** and **determined** that the “**map**” can be the **next new exciting user interface to computing** - an integrating interface that serves as the “**basemap**” for much of the activities of society, organizations, governments, and the world at large.*

***Integrating Web mapping interfaces and new data & technology:**  
Geo-spatial community can greatly minimize their expenditures and extend their own data and applications domestically and internationally by accessing and utilizing “new “ data, technology and applications.*

# National Spatial Data Infrastructure ( NSDI )

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*My recommendations are .....*

# *National & International Interoperability*

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## **ISO/TC 211 Advisory Group on Outreach**

*Promote the awareness, adoption, and advocacy of ISO/TC 211 standards in user communities.*

**SDIs ( NSDI, RSDI, GSDI )**

**Professional organizations**

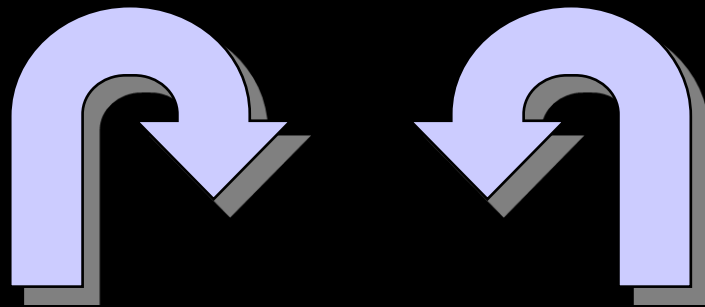
**United Nations**

**Non governmental organizations ( NGOs)**

***Institutionalization of standards***

# *Standards & Spatial Data Infrastructure*

**Standards  
Infrastructure**



**Spatial Data  
Infrastructures**

**Standards**

**Global**

**Standards**



**Regional**

**Technology**



**National**

**Data policy**

**Sub  
National**

**Institutional  
framework**

**Interoperability**

**Mutually inclusive**

# *GIS Standards Infrastructure*

<b>Standards Organization</b>	<b>Standards Scope</b>	<b>User / Industry Organizations</b>
<b>Federal Geographic Data Committee ( FGDC )</b>	<b>Government</b>	<b>US Government agencies</b>
<b>American National Standards Institute ( ANSI )</b>	<b>National</b>	<b>US Federal, state, county, city agencies, public, and industry</b>
<b>European Committee for Standardization ( CEN )</b>	<b>Regional</b>	<b>Digital Geographic Information Working Group ( DGIWG ) Infrastructure for Spatial Information in Europe ( INSPIRE ) Permanent Committee on GIS Infrastructure for Asia and the Pacific ( PCGIAP )</b>
<b>International Organization for Standardization ( ISO ) Open GIS Consortium ( OGC )</b>	<b>International</b>	<b>International Cartographic Assoc. ( ICA ) International Hydrographic Bureau ( IHB ) , etc.</b>

# *Standards for SDIs*

## *Deployment*



International geospatial  
community

All levels of  
Government

Industry

Professional  
organizations

UN agencies

IT community



**Spatial Data Infrastructures (SDIs)**

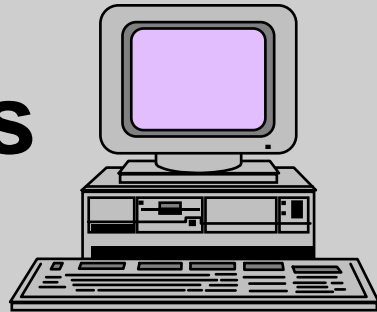
# *Standardization Process*

## Implementation

Frequent Revisions

Stable

**Software  
Interfaces**



**Spatial Data  
Standards**



**Industry**

**Data producers  
& users**

# ***Standardization Process***

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***De jure – formal structure and process***

***International Organization for  
Standardization ( ISO )***

***De facto – by default or dominance***

***standards from internet or power players like  
Google, Microsoft, Yahoo, MapQuest***

***Open Geospatial Organization (OGC)***

***geospatial industry consortium***



# ISO/TC 211 & OGC



1994

**ISO/TC 211 - de jure formal standards technical committee**

**OGC - de facto industry technical specifications**

**1999 - OGC - ISO/TC 211 Class A Liaison status**

**ISO/TC 211 & OGC Joint Advisory Group ( JAG )**

**ISO standardization of OGC specifications: Simple Features Access, Web Mapping Server Interface**

**Jointly develop the Imagery & gridded data Reference Model, Framework, and the OGC Sensor Markup Language Geography Markup Language ( GML )**

# ISO / TC 211 Website

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You will find updated information on ISO/TC 211 on the following World Wide Web-server :

***<http://www.isotc211.org>***

containing :



- Secretariat
- Organization
- Calendar
- About...
- Resolutions
- Document list
- Scope and work programme
- Mail to secretariat
- Newsletter and information
- Presentations (slides)

# *Open Geospatial Consortium ( OGC )*



<http://www.opengeospatial.org/>

## OGC Mission

Our core mission is to deliver interface specifications that are openly available for global use.

*OGC is an international industry consortium of 360 companies, government agencies and universities participating in a consensus process to develop publicly available geoprocessing specifications.*

# *ISO Metadata Standard Profiles*

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*North America – Canada & USA*

*Europe – European Union ( 27 countries )*

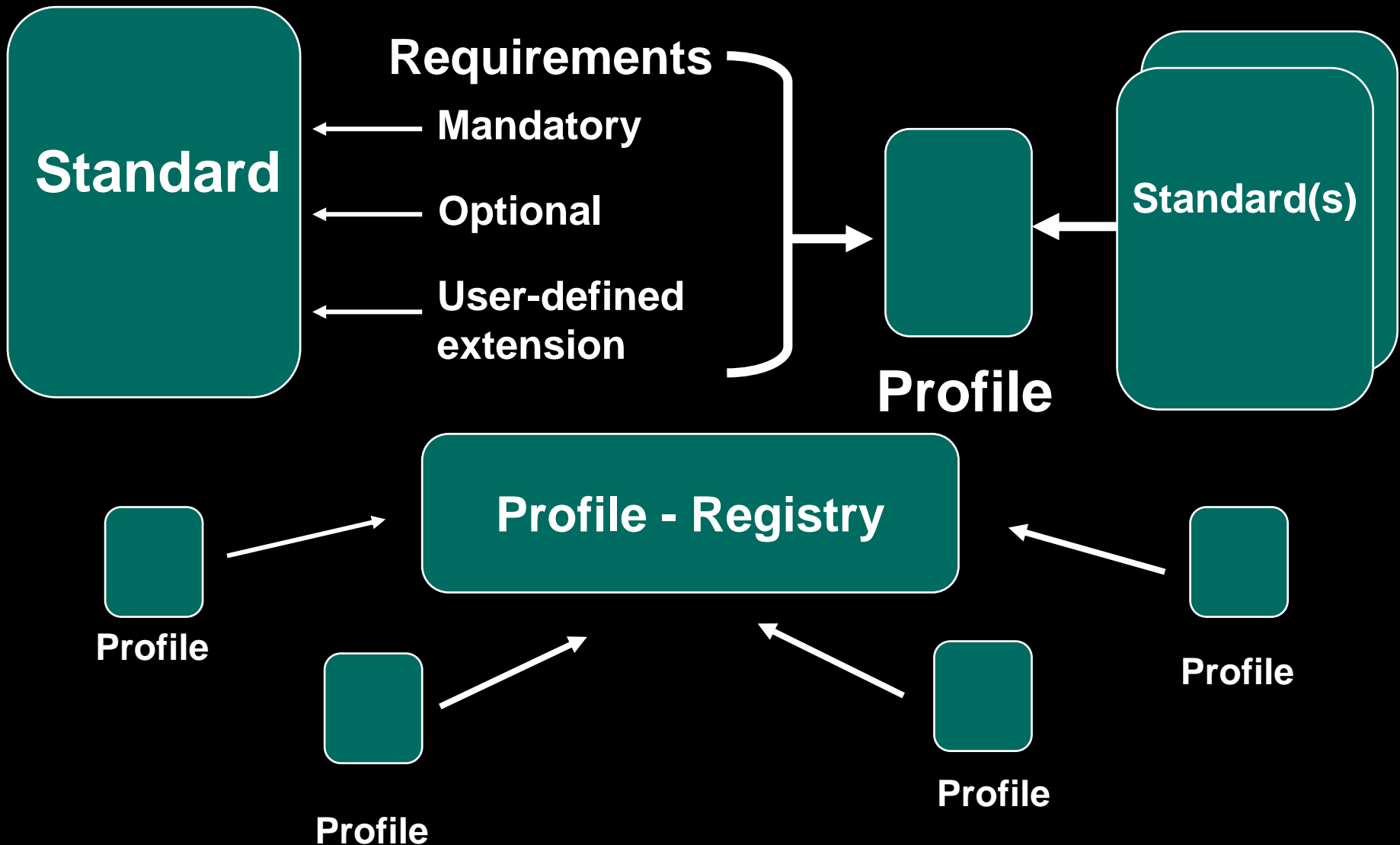
*Latin America ( 50 + countries)*

*Africa ( 50 + countries)*

*Asia & the Pacific ( 55 countries)*

*United Nations ( 33 agencies )*

# Profiles & Registry



# ISO Profile Registry

ISO Metadata Profile - Registry

bridge

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data element.....

data element.....

Asia Pacific ISO Metadata Profile

UNGIWG  
Profile

National Profiles

# *Summary of Recommendations*

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## **Major SDI Component - Geographic information standards**

*National ISO Metadata Profile*

*Regional Metadata Profile*

*Global ISO Metadata Registry*

## **Institutional**

*International Steering Committee for Global Map ( ISCGM )*

*Permanent Committee for GIS infrastructure for Asia and the Pacific ( PCGIAP )*

*United Nations Geographic Information Working Group ( UNGIWG )*

# *Summary of Recommendations*

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## **Open Source geospatial software**

*Open Source Geospatial Foundation* <http://www.osgeo.org/>

## **Industry**

*Monitor the power Internet “technology” companies like Google, Microsoft, Yahoo, but, do not ignore the growing number of geospatial startups – domestically & internationally*

*These “technology” companies have now become the digitizing agents for capturing information for the “map” interface to mobile computing & services – “doing the heavy lifting”*

*Watch TeleAtlas, Navteq, who capture much of the “traditional” geographic information and also the communications companies that produce much of the “mobile Internet innovations*

*Governments, organizations, and citizens can then harvest and harness the “new” data & technology and integrate these mechanism into a NSDI and related activities.*



***Thank you !***



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