USA – OGC standards play a key role in the US Federal Enterprise Architecture Geospatial Profile. The Federal Geographic Data Committee has implemented OGC standards in its spatial data clearinghouse (www.fgdc.gov), and the Geodata.gov (http://geodata.gov) website enables WMS and other OGC standards-based servers to publish their data to this "One Stop" portal implementation. http://www.hazardmaps.gov is a Federal Emergency Management Agency (FEMA) implementation of WMS capabilities for hazard map generation from multiple sources of geodata. The US Census lists TigerGML as a future Census Bureau product. The National Climate Data Center Portal (NCDC), the world's largest active archive of weather data, uses WMS and WFS interfaces to provide access to numerous climatological and meteorological resources. The National Oceanographic and Atmospheric Administration's (NOAA) Integrated Ocean Observation System (IOOS) (http://www.openioos.org) links together a wealth of ocean observation data from a wide variety of federal and non-federal sources through the use of OGC standards. A growing number of US states – Arkansas, Massachusetts, North Carolina, Pennsylvania and others – have built or are building Web-centric SDIs that rely on OGC standards.

SDI best practices – Enabling communities of interest

SDI's built on open standards "work together," enabling information networks that benefit multiple communities of interest. Examples include the Global Earth Observation System of Systems (GEOSS), the interoperating systems of the world's Oceans Observing community, the OneGeology digital geological map of the world, and the AEC/Geospatial convergence in Building Information Models. Through international standards, local, enterprise, regional and national SDIs become part of the Global Spatial Data Infrastructure.

Selected SDI-enabling standards

Find these at http://www.opengeospatial.org/standards/

- **CSW:** Catalog Services for the Web
- **GML:** Geography Markup Language
- **WFS:** Web Feature Service
- **WMS:** Web Map Service

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OGC® Standards Support SDI Development

The Global Spatial Data Infrastructure Association's Spatial Data Infrastructure (SDI) Cookbook (www.gsdi.org) defines SDI as the "… collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data."

OGC standards and complementary ISO standards have become part of SDI "best practices" around the world, as described below.

Australia – The Australian SDI consists of a wide variety of OGC standards-based enterprise implementations, including Western Australia's Landgate-developed Shared Land Information Platform (SLIP), which forms the foundation of an information connection service that serves 19 government agencies; the New South Wales Natural Resources Atlas (http://atlas.canri.nsw.gov.au/) and Australia's Internet Framework Technical Architecture (www.anzlic.org.au/get/237501586).

Bahrain – Standards of the Bahrain SDI are officially mandated, and they include the standards of international organizations like ISO and Open Geospatial Consortium (OGC), Inc.

Canada – The Canadian Geospatial Data Infrastructure (CGDI) has been developed by the Canadian government in partnership with the provinces, territories and the private sector. In 2007, a CGDI Interoperability Pilot, organized through OGC, tested and demonstrated the feasibility of using open-standards-based technology to improve the management and dissemination of CGDI data. GeoConnections Canada has a number of resources available publicly through OGC standards. The Canadian Geospatial Data Infrastructure Road Network File 2006 is encoded using the OGC Geography Markup Language Encoding Standard (GML).

China – The China Ministry of Land and Resources is using applications based on OGC Standards to build a country-level and province-level data exchange system that satisfies update requirements for land use data. China attaches great importance to sustainable development and the rational utilization of natural resources, and has made sustainable development a national strategy.

Denmark – Denmark's National Survey & Cadastre uses OGC Web Map Service Interface Standard to display maps from various databases.

Europe – The European Union INSPIRE (Infrastructure for Spatial Information in Europe) Directive leverages a standards-based architecture to promote geospatial interoperability across the EU. InterRisk is a European project (FP6-IST) addressing interoperable GMES (Global Monitoring for the Environment and Security) services for environmental risk management in marine and coastal areas of Europe. “Change on Borders” is a Regional Framework Operation (RFO) approved within the EU-program INTERREG IIIC. The EUROSION Project promotes better management of the coastal zones. SANY (Sensor Systems Anywhere) is a leading implementation of OGC Sensor Web standards. The EMSA (European Maritime Security Agency) CleanSeaNet service runs a satellite-based, near-real-time (30-min maximum delay), oil-spill detection service, whose contents are published through OGC CSW, WMS, WFS services. Data is encoded in OGC’s Geography Markup Language (GML) 3.1.1 standard.

NATO - The NATO C3 Technical Architecture (ISSC NATO Open Systems Working Group 2005) and a host of NSDI programs in Europe call for use of OGC and ISO standards as a best practice.

Germany – The German state North-Rhine Westphalia established its spatial data infrastructure, GDI.NRW, as a joint initiative of 140 state agencies, municipalities, private companies and scientific institutes. The North-Rhine Westphalia Sig3D organization was the originator of CityGML, a globally important OGC standard for sharing urban models and integrating design drawings with spatial data.

The Netherlands – Dutch Geo-Information and ICT Department of the Ministry of Transport, Public Works and Water Management has a Spatial Data Infrastructure (SDI) based on open standards. The Ministry's responsibilities include traffic via roads, waterways, railways, and by air, and they are also responsible for clean water in the rivers, lakes, sea, and water tables. The Dutch National Mapping Agency Kadaster uses a GML-based application schema for data sharing. The Dutch Kadaster Topographical Service (http://www.tdn.nl) has demonstrated interoperability involving their TOP 10 GML schemas (also known as TOP10NL) and a number of commercial products.

Hong Kong – GML is specified in electronic-Government Interoperability Framework (e-GIF) best practices.

India – In addition to benefiting directly from open geospatial architectures for government, countries that embrace open standards benefit from trade as their service providers learn to serve global customers. In a short time, Indian companies have come to be major players in software development, customer support, and geospatial service provision. Information technology – including geospatial technology – has also provided a platform for research and development leading to expansion in other IT sectors.

Norway – The ByggSøk project managed by the Norway National Office of Building Technology and Administration has advanced an interoperable, standards-based system to improve accuracy, lower costs, and enable greater transparency of the building zoning and permitting process. The national spatial data infrastructure, "Norge Digitalt," makes use of OGC standards, and the ministry of education, through Norge Digitalt, gives universities, colleges and schools in Norway access to the high quality data that is available for all of Norway.

Romania – The Romanian national mapping agency recently worked with the Dutch Cadastre to design a service oriented NSDI architecture based on OGC standards.

Spain – IDEC, the Geoportal of the Catalonia SDI, a project of the government of the autonomous region of Catalonia (Spain), offers several services, including the multilingual Catalog Server describing data available from over 80 providers. The Viewer, a client that implements the OGC Web Map Server (WMS) Specification, allows the user to access more than a dozen WMS servers from different providers who together provide about 200 layers of geodata. A 2007 study by the Centre of Land Policy and Valuations of the Universitat Politècnica de Catalunya showed that the initial investment to set up the IDEC SDI was recovered in just 4 months, or 6 months if the operating costs for 2004-05 are also included. Other programs based on OGC standards include UNIVERS, a regional initiative to connect map servers of the university Departments in Catalonia; and LOCAL, a project to integrate municipalities’ systems in the Catalonia Regional SDI.

Britain – Through the Digital National Framework (DNF), now in GML, the Ordnance Survey, Britain’s national mapping agency, has transformed the way it operates in order to realize its new vision. The restructured DNF data greatly enhances the versatility and usability of large scale topographic data, turning it from merely a “representation of a line map” into a GIS-friendly model of the real world. Using GML for data supply makes it accessible to more software systems, and hence to more users, than would be possible using any other format.

United Nations – The UN is progressing towards the build-out of an UN-wide SDI. The UN's geospatial vision, implementation strategy and standards-based reference architecture are outlined in the “UNSDI Compendium”. Also, The United Nations initiative on Global Geospatial Information Management (UN-GGIM) plays a leading role in setting the agenda for the development of global geospatial information and to promote its use to address key global challenges. The UN assists countries in developing national policies and practices that formalize the ways in which their geospatial data can be shared, used, and disseminated. Open standards are a key enabler for data sharing within the UN and among the countries it serves.