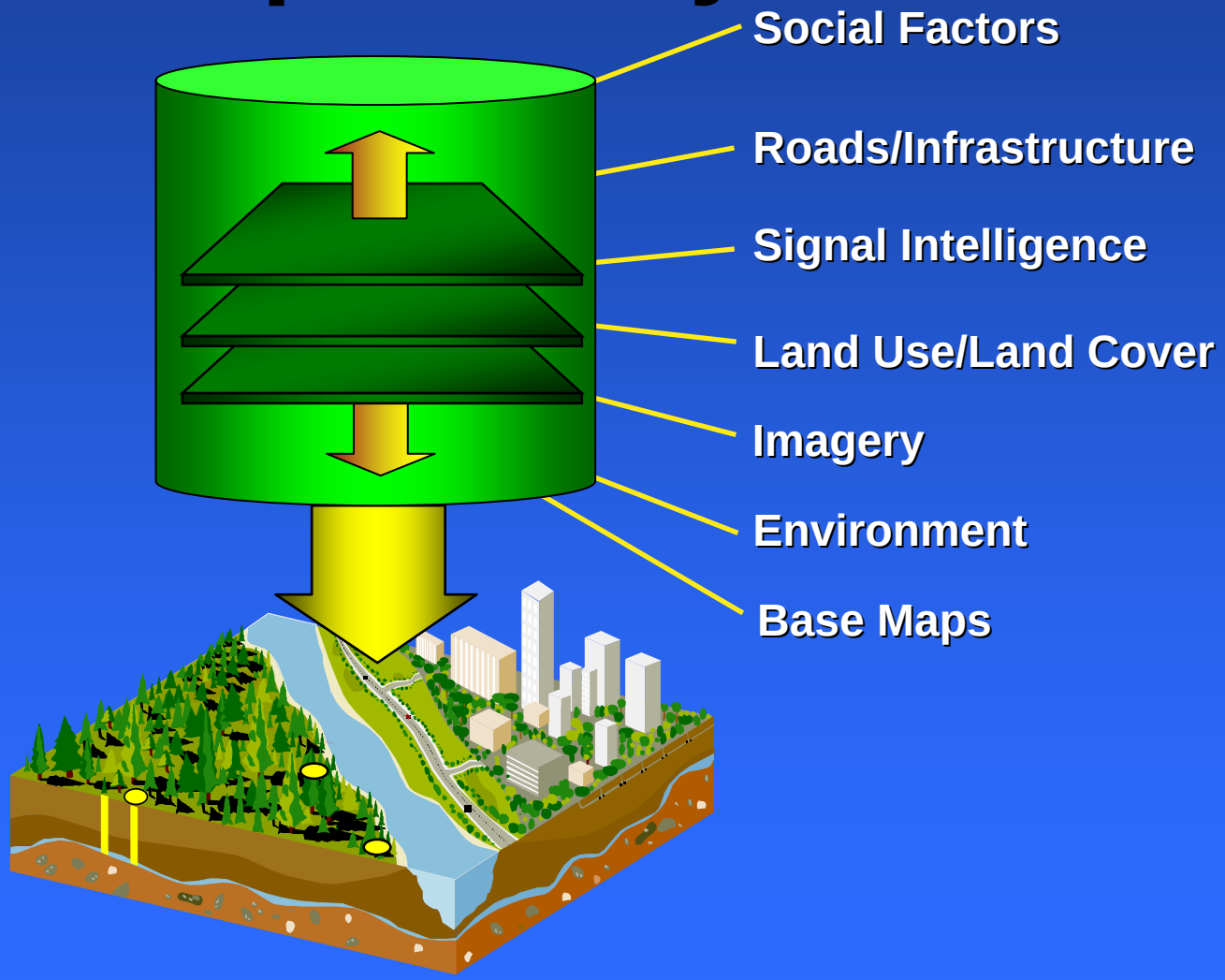
ESRI
& Interoperability

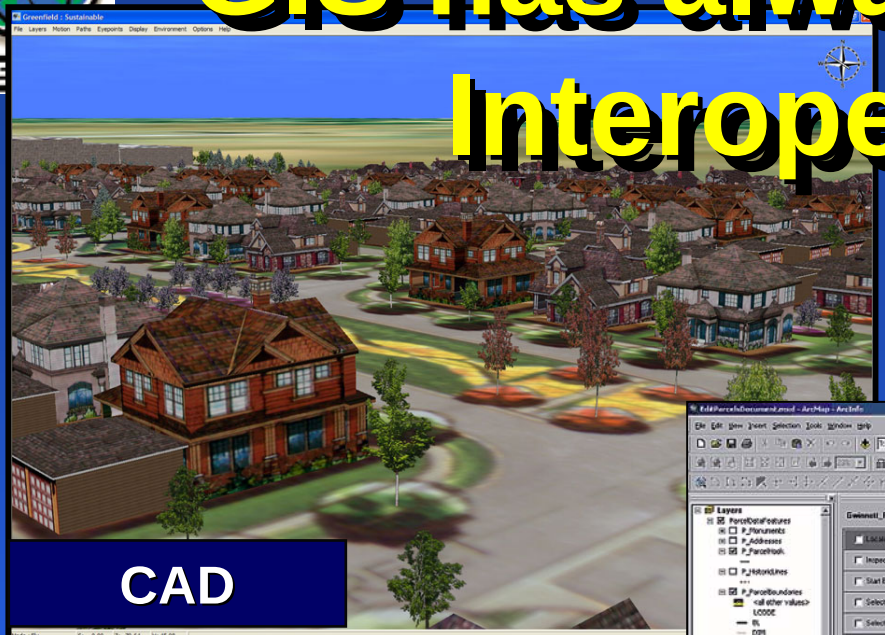
David Danko
ISO TC 211 Metadata Project Leader
OGC Metadata WG Chair
ESRI Senior Consultant – GIS Standards
ddanko@esri.com

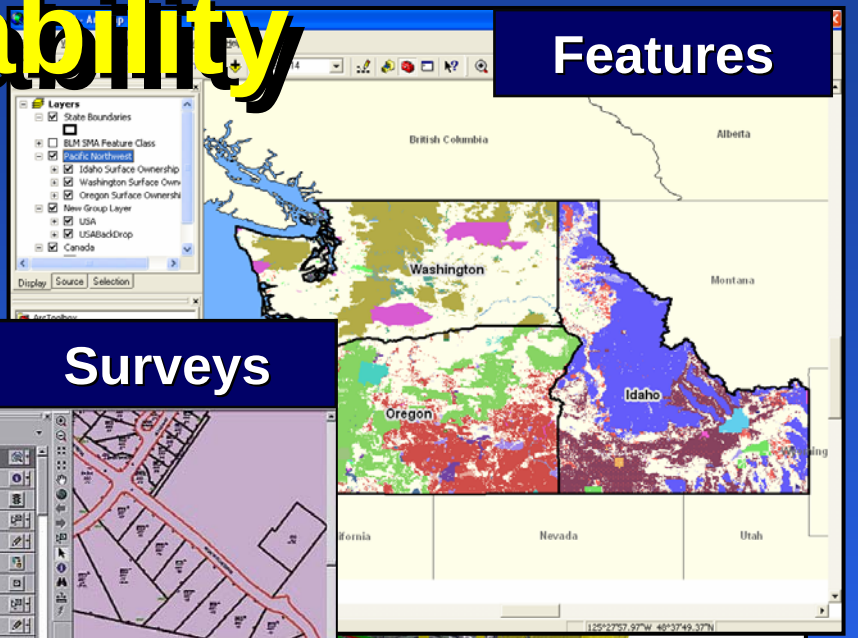
GIS has always required Interoperability

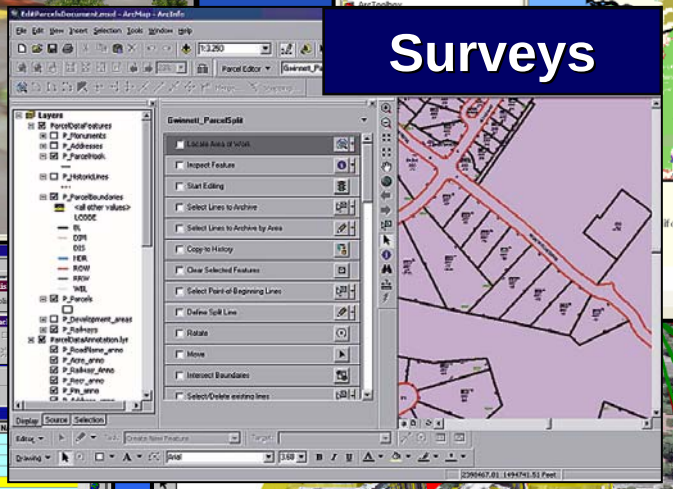


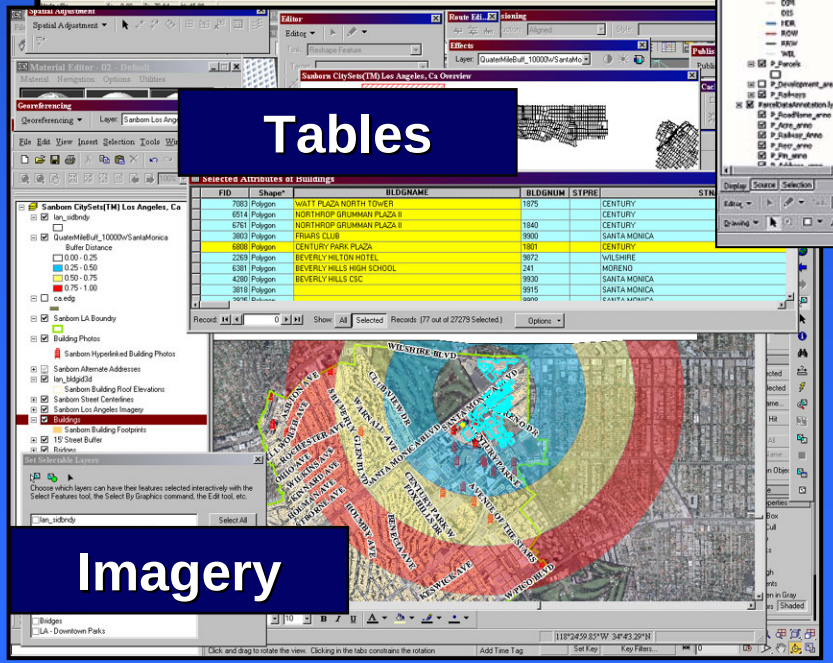
Geography is a “Key” an integrating technology

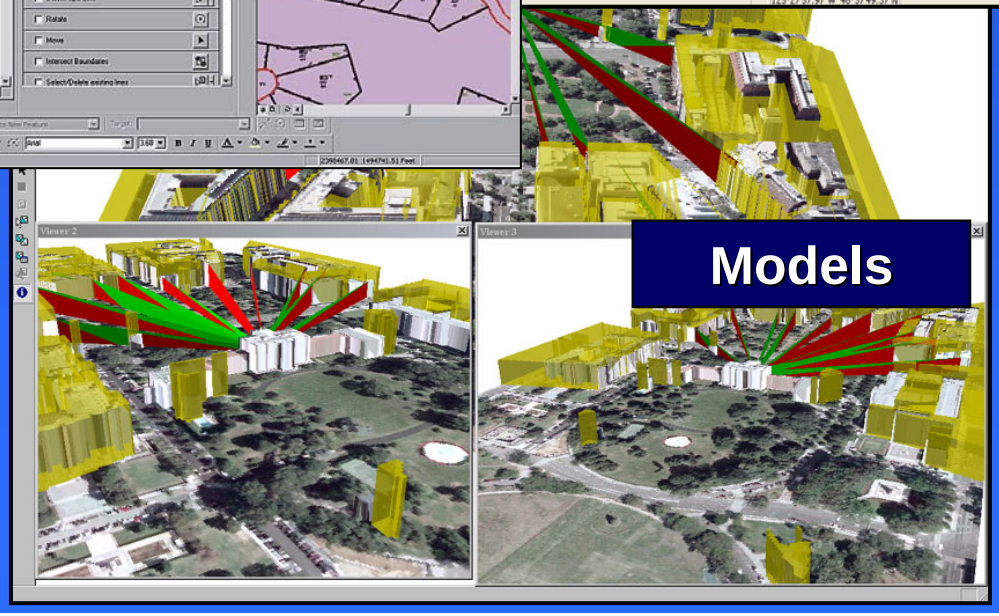
GIS has always required Interoperability









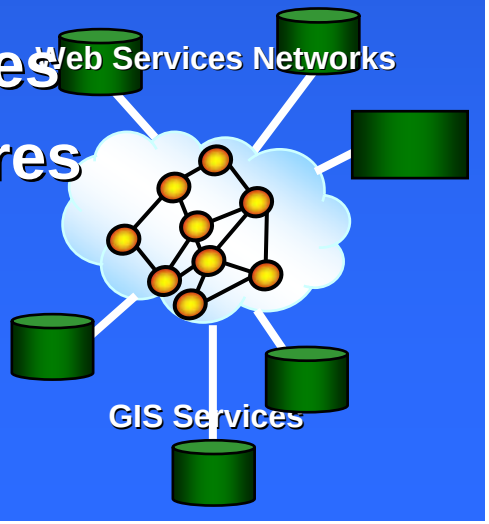


GIS has always required Interoperability

- Geographic analysis
  - Multiple sources, multiple organizations
  - Distributed within a community
  - Merging diverse information types

and continues to…

- Enterprise GIS
  - GIS evolving beyond isolated communities
  - GIS merging with broader IT infrastructures
- GIS Web Services
  - Enabled by distributed networks
  - Loosely coupled



Varieties of Interoperability

- Technical
- Semantic
  - Inter-disciplinary
- Political/Human
  - Legal

Interoperability Enablers

- Infrastructure
  - Compatible Technology
- Authorization
- Copyright
- Business Agreements
  - MOUs
- Business Model
  - Pricing/commerce
- Metadata
- Security
  - Privacy
- Information Assurance
  - Certification
  - Quality
- **Standards**

Participation in Standards

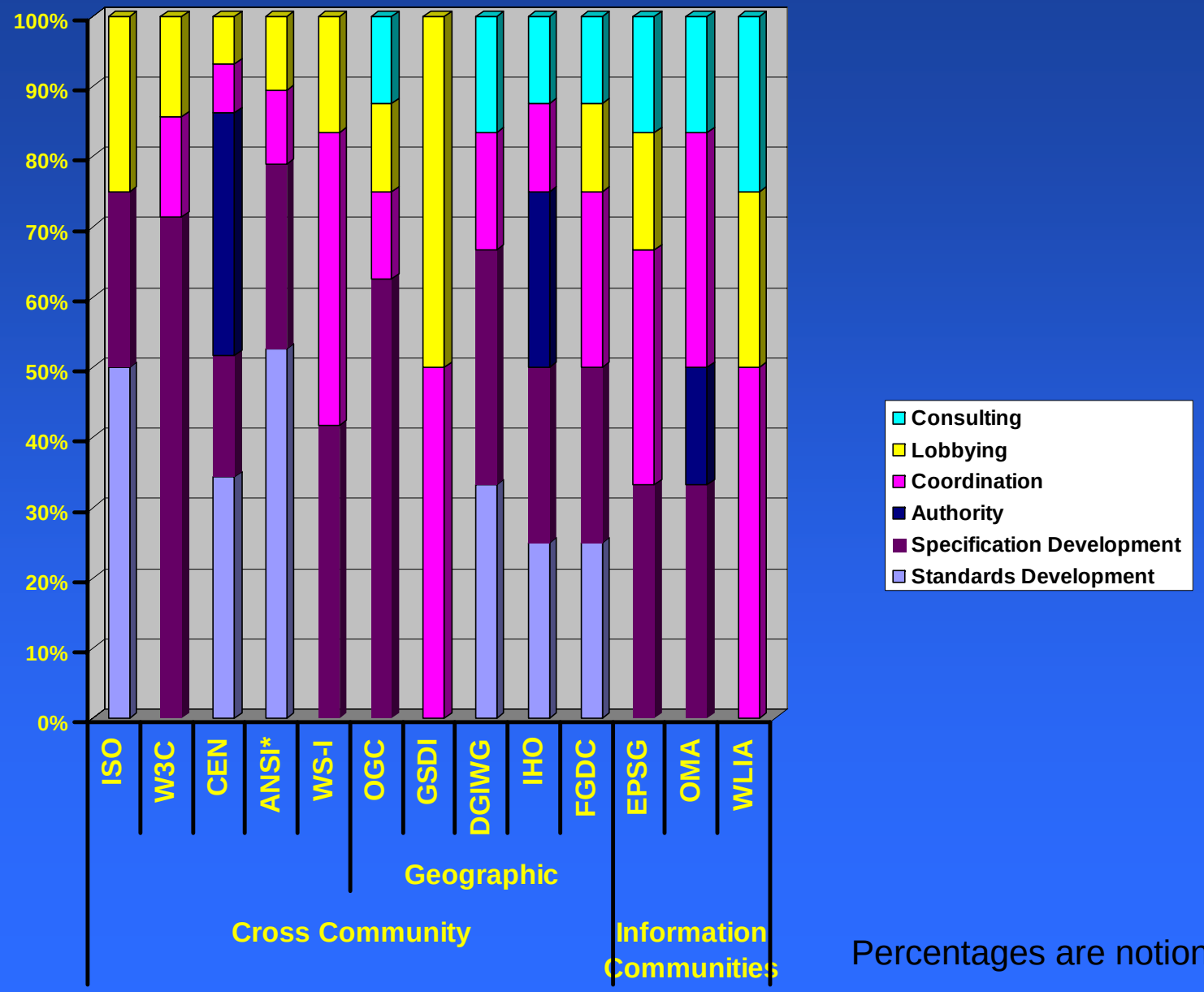
- **Implementing**
  - Platform
  - GIS standards
  - IT/industry standards

- **Development**
  - International Standards
  - Regional Standards
  - National Standards
  - Information Community Standards
    - NATO ICAO, IHO…

ESRI Actively Participates in Interoperability & Standards Organizations

- **ISO** – International Organization for Standardization
- **OGC** – Open GIS Consortium
- **ANSI/INCITS** – American National Standards Institute/International Committee for Information Technology Standards
- **OASIS** – Organization for the Advancement of Structured Information Standards
- **IHO** – International Hydrographic Organization
- **WS-I** – Web Services Interoperability Organization
- **OMA** – Open Mobile Alliance (formerly LIF)
- **WLIA** – Wireless Location Industry Association
- **FGDC** – Federal Geographic Data Committee
- **GSDI** – Global Spatial Data Infrastructure
- **CEN** – Committee for European Normalization
- **DGIWG** – Digital Geographic Information Working Group
- **EPSG** – European Petroleum Survey Group

Standards Organizations



Percentages are notional

ISO Participation

- ESRI provides leadership role in ISO TC 211 Standards Development:
  - ISO 19115: Metadata (Project Leader)
  - ISO 19115-2: Metadata – Imagery extension (Editor)
  - ISO 19125: Simple Feature Access (Editor)
    - Part 1 – Common Architecture
    - Part 2 – SQL Option
  - ISO 19139: Metadata – Implementation Specification (Project Leader – supported Editor/committee process)
- Provide technical experts on many WI project teams
- Harmonization with ISO JTC SC 32: ISO/IEC 13249-3: 1999
  - *SQL* Multimedia and Application Packages – Part 3: Spatial

ISO TC 211- completed standards

Guiding ESRI Development

- ISO 19101:2002 - Reference model
- ISO 19105:2000 - Conformance and testing
- **ISO 19106:2004 - Profiles**
- **ISO 19107:2003 - Spatial schema**
- **ISO 19108:2003 - Temporal schema**
- **ISO 19110:2005 - Methodology for feature cataloguing**
- **ISO 19111:2003 - Spatial referencing by coordinates**
- **ISO 19112:2003 - Spatial referencing by geographic identifiers**
- **ISO 19113:2002 - Quality principles**
- **ISO 19114:2003 - Quality evaluation procedures**
- **ISO 19115:2003 - Metadata**
- ISO 19116:2004 - Positioning Services
- **ISO 19119:2005 - Services**
- **ISO 19125:2004 - Simple feature access – Part 1-2**
- **And several technical reports**

ISO TC 211- DIS stage

Guiding ESRI Development

- ISO/DIS 19104 - **Terminology**
- **ISO/FDIS 19109 - Rules for application schema**
- **ISO/DIS 19117 - Portrayal**
- **ISO/DIS 19118 - Encoding**
- **ISO/DIS 19123 - Schema for coverage geometry and functions**
- **ISO/DIS 19128 - Web Map server interface**
- ISO/DIS 19133 - **Location based services tracking and navigation**
- ISO/DIS 19135 - **Procedures for registration of items of geographic information**
- **ISO/DIS 19137 - Core profile of the spatial schema**
- **ISO/PDTS 19139 - Metadata – XML Schema implementation**

OGC Participation

- ESRI
  - Principle member
  - Actively participates:
    - Technical Committee
    - Planning Committee
    - Board of Directors
    - All three OGC programs
      - Interoperability program
      - Standards program
      - Community Outreach and Adoption program
  - Current chair
    - Metadata Working Group (WG)
    - Location Services WG
  - Sponsors
    - Open Location Services Initiative

OGC specifications and Interoperability

- Data Management
  - Simple Features
- Data Formats
  - GML
- Web Services
  - Web Services
  - Catalog Services

OGC "Specifications"

AOS 0.2.0 (DP)
AOS 0.5 (RFC)
AOS 0.5.0 (RP)
B-XML 0.0.8 (DP)
BSM 0.0.8 (DP)
CAT 1.0 (OIS)
CAT 1.1.1 (OIS)
CAT 2 (OIS)
CAT2 19115 0.9.2 (DP)
CAT2 ebRIM 0.9.1 (DP)
CICE:Compu 0.5.0 (DP)
CICE:Engin 0.7.1 (DP)
CICE:Enter 0.7.0 (DP)
CICE:Infor 0.3.1 (DP)
CPS 0.0.2 (IPR)
CPS 0.0.2 (IPR)
CT 1.0 (OIS)
CTO 1.0 (OIS)
DD CRS 1.1.0 (RP)
DS 5.0 (DIPR)
Filter 1.0.0 (OIS)
Gateway 1.0.1 (DIPR)
Gaz 0.0.9 (DP)
Gaz 0.8 (DP)
GC 1.0 (OIS)
GDAS 0.9.1 (DP)
GeoC 0.7.6 (DP)
GeoP 0.7.1 (DP)

GLS 0.9.1 (DP)
GLS 0.9.1 (DP)
GML 1.0 (RP)
GML 2.0 (OIS)
GML 2.1 (OIS)
GML 3.0 (OIS)
GML2.1 2.1.2 (OIS)
GML3.1 3.1 (RP)
HLG-CT 0.0.3 (DP)
IntClient 0.1.18 (DP)
IntEnc 1.1 (DIPR)
Level 0 0.0.10 (DP)
Location 5.2 (DIPR)
LOF 1.0 (DP)
MSSS (DROP)
O&M 0.86 (DP)
O&M 0.9.2 (RP)
OLS 0.0 (OIS)
OLS 1.0 (OIS)
OLS Core 1 (OIS)
OLS Nav 0 (RFC)
OLSIM (DIPR)
OLSref 1.3 (DIPR)
OMF 0.0.3 (DP)
OWS Common 0.1.0 (DP)
OWS Common 0.2.0 (RP)
OWS common 0.3.0 (RP)
Present 1.6 (DIPR)

RDS 6.0 (DIPR)
SensorCS 0.5.1 (IPR)
SensorML 0.4d (IPR)
SensorML 0.7 (DP)
SensorML 1.0.0 beta (RP)
SFC 1.1 (OIS)
SFO 1.1 (OIS)
SFS 1.1 (OIS)
SFS BG 1.1 (OIS)
SFS NG 1.1 (OIS)
SFS TF 1.1 (OIS)
SIM 0.3.0 (DP)
SLD 0.7.2 (OIS)
SLD 1.0 (OIS)
SMS 0.0.9 (DP)
SOAP 0.8 (DP)
St Cat 0.06 (DIPR)
UDDI 0.5 (DP)
UoM 0.6 (RP)
UoM 1 (RP)
WCS 0 (OIS)
WCS 0 (RP)
WCS 0.7 (DP)
WCS 1 (OIS)
WCTS 0.0.4 (DP)
WFS 0.0.13 (DIPR)
WFS 0.0.14 (RFC)
WFS 1.0 (OIS)

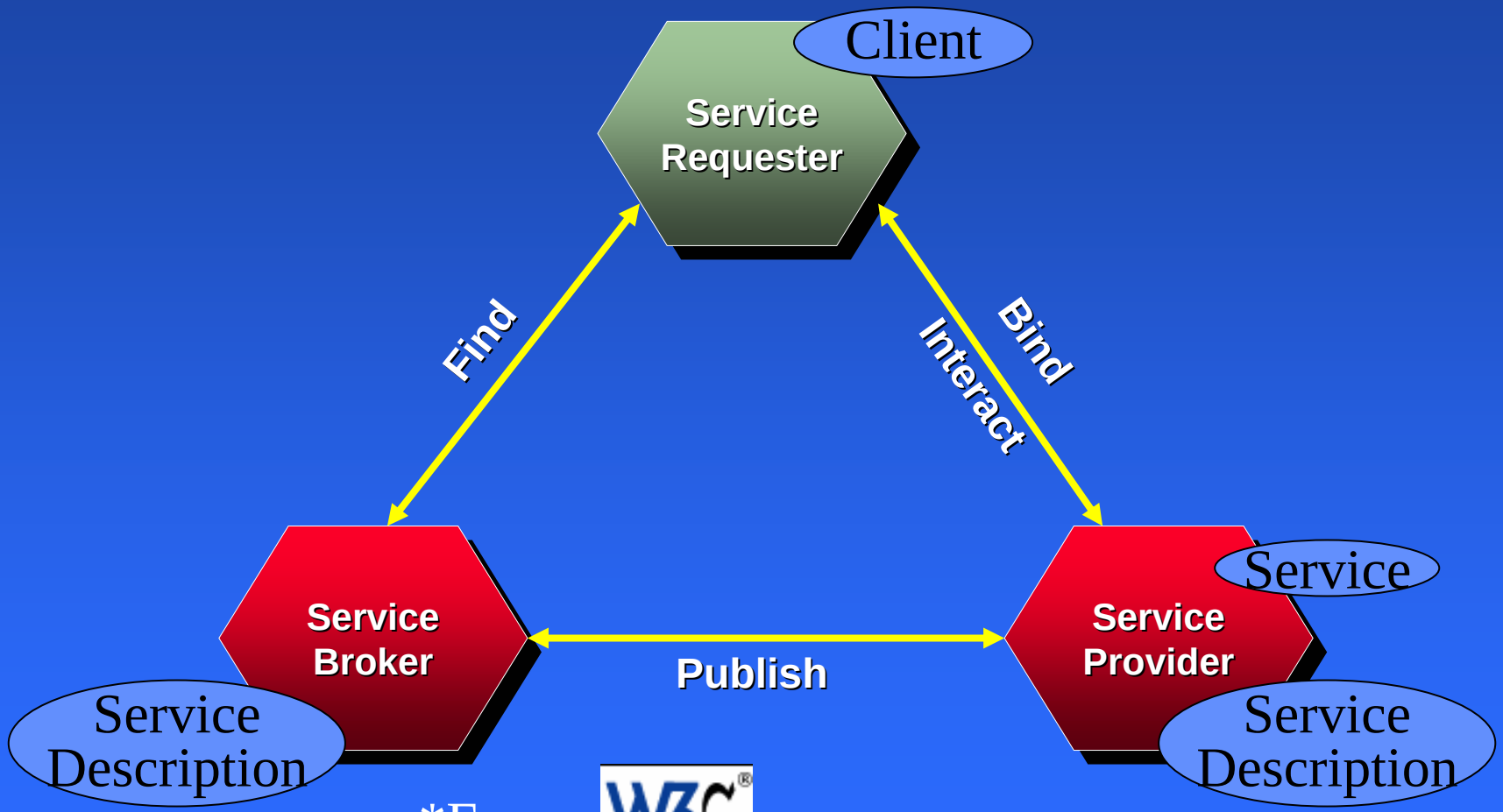
WFS 1.0.0 (OIS)
WFS(T) 0.0.14 (OIS)
WFS(T) 1.0 (OIS)
WMC 0 (RFC)
WMC 0.1.4 (DP)
WMC 0.1.7 (RFC)
WMC 1.0 (OIS)
WMS 1.0.0 (OIS)
WMS 1.1.0 (OIS)
WMS 1.1.1 (OIS)
WMS POST 0.0.3 (DP)
WMS1.3 1.3 (OIS)
WMS1.3.0 1.3.0 (RP)
WNS 0.1.0 (DP)
WOS 0.0.3 (DP)
WPOS 0.2 (DP)
WRS 0.0.2 (DP)
WSA 0.3 (DP)
WTS 0.3.2 (DP)
WTS 0.5 (RFC)
XIMA 0.4 (DP)
XLS 1.1 (DIPR)
XML for CR 2.0.0 (RP)
XML for CR 2.1.0 (RP)

Draft Interoperability Program Report
Interoperability Report
Discussion Paper
Recommendation Paper
Request For Comment
OGC Interoperability Specification

Adopted OGC Specifications
Implemented by ESRI

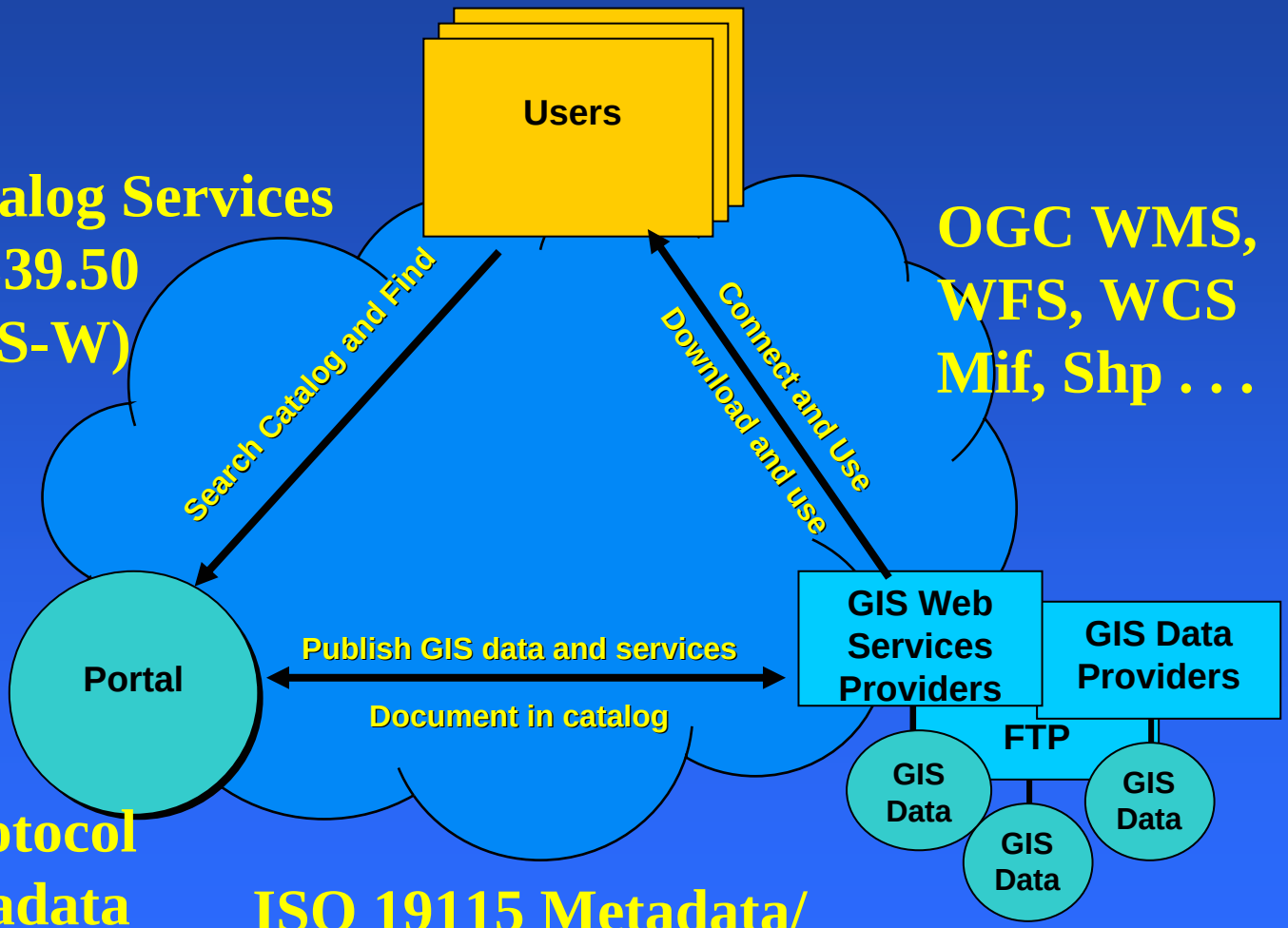
- Catalog Interface (CAT)
- Coordinate Transformation Services (CT)
- Filter Encoding (Filter)
- Geography Markup Language
- Grid Coverages (GC)
- Location Services (OpenLS)
- Simple Features – CORBA (SFC)
- Simple Features – SQL (SFS)
- Simple Features – OLE/COM (SFO)
- Styled Layer Descriptor (SLD)
- Web Coverage Service (WCS)
- Web Feature Service (WFS)
- Web Map Context Documents (WMC)
- Web Map Service (WMS)

W3C Service Oriented Architecture*



*From W3C Web Service Architecture, 14 Nov. 2002

ESRI's Standards Based Portal Architecture



OGC Catalog Services (Z39.50 CS-W)

OGC WMS, WFS, WCS Mif, Shp . . .

OAI Protocol for Metadata Harvesting

ISO 19115 Metadata/
ISO 19139 Metadata
XML Schema Implementation

OGC Product Registry

ArcGIS	8.1	Client	SFO 1.1	Compliant
ArcSDE for Informix	8.1	Server and Client	SFS TF 1.1	Compliant
ArcSDE for DB2	8.1	Server and Client	SFS TF 1.1	Compliant
Spatial Database Engine for Oracle	3.0.2	Client	SFS NG 1.1	Compliant
Spatial Database Engine for DB2 Datajoiner	3.0.2	Client	SFS TF 1.1	Compliant
Spatial Database Engine for Informix	3.0.2	Client	SFS TF 1.1	Compliant
ArcIMS	3.0	Server	WMS 1.0.0	Implementing
ArcIMS	4.0	Server	WMS 1.0.0	Implementing
ArcIMS	4.0, 4.0.1	Server and Client	SLD 1.0	Implementing
ArcIMS	4.0,4.0.1	Server	Filter 1.0.0	Implementing
Arc Explorer	4.0.1	Client	WMS 1.1.0	Implementing
Arc Explorer	4.0.1	Client	WMS 1.0.0	Implementing
Arc Explorer	4.0.1	Client	WFS 1.0.0	Implementing
Arc Explorer	4.0.1	Client	GML 2.1	Implementing
Arc Explorer	4.0.1	Client	WMS 1.1.1	Implementing
ArcIMS Metadata Server	9.0	Server and Client	CAT 1.1.1	Implementing
ArcIMS Metadata server	4.0,4.0.1	Server and Client	CAT 1.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	CAT 1.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	CAT 1.1.1	Implementing
GIS Portal Tool Kit	2.0	Server and Client	CAT 2	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WCS 1	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WFS 1.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WMC 1.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WMS 1.0.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WMS 1.1.0	Implementing
GIS Portal Tool Kit	2.0	Server and Client	WMS 1.1.1	Implementing
ArcIMS	4.0,4.0.1	Server	GML 2.1	Implementing
ArcIMS	4.0,4.0.1	Server	GML2.1 2.1.2	Implementing
ArcIMS	4.0,4.0.1	Server	WFS 1.0.0	Implementing
ArcIMS	4.0, 4.0.1	Server and Client	WMS 1.1.0	Implementing
ArcIMS	4.0, 4.0.1	Server and Client	WMS 1.1.1	Implementing
ArcIMS Metadata Server	9.0	Server and Client	CAT 1.0	Implementing
ArcIMS Metadata server	4.0,4.0.1	Server and Client	CAT 1.1.1	Implementing
ArcIMS Metadata Server	9.0	Server and Client	CAT 2	Implementing
ArcIMS	9.0	Server	WMS 1.0.0	Implementing
ArcIMS	9.0	Server	WMS 1.1.0	Implementing
ArcIMS	9.0	Server	WMS 1.1.1	Implementing
ArcIMS	9.1	Server and Client	Filter 1.0.0	Implementing
ArcIMS	9.1	Server and Client	GML 2.1	Implementing
ArcIMS	9.1	Server and Client	GML 3.0	Implementing
ArcIMS	9.1	Server and Client	GML2.1 2.1.2	Implementing
ArcIMS	9.1	Server and Client	SLD 1.0	Implementing
ArcIMS	9.1	Server and Client	WFS 1.0.0	Implementing
ArcGIS Server	9.0	Server	WCS 1	Implementing
ArcGIS Interoperability Tool Bar Add-on	8.3	Client	GML 2.1	Implementing
ArcGIS Interoperability Tool Bar Add-on	8.3	Client	WFS 1.0.0	Implementing
ArcGIS Interoperability Tool Bar Add-on	8.3	Client	WMS 1.1.0	Implementing
ArcGIS	9.0	Client	WCS 1	Implementing
ArcGIS	9.0	Client	WMS 1.1.1	Implementing
ArcLocation Solutions		Server and Client	OLS 1.0	Implementing
ArcGIS Data Interoperability Extension	9.0	Client	GML 3.0	Implementing
ArcGIS Data Interoperability Extension	9.0	Client	GML2.1 2.1.2	Implementing
ArcGIS Data Interoperability Extension	9.0	Client	WFS 1.0.0	Implementing
ArcIMS Data Delivery Extension	9.0	Server	GML 3.0	Implementing
ArcIMS Data Delivery Extension	9.0	Server	GML2.1 2.1.2	Implementing
ArcIMS Data Delivery Extension	9.0	Server	WFS 1.0.0	Implementing
ArcExplorer Web		Client	WMC 1.0	Implementing
ArcExplorer Web		Client	WMS 1.0.0	Implementing
ArcExplorer Web		Client	WMS 1.1.0	Implementing
ArcExplorer Web		Client	WMS 1.1.1	Implementing
ArcSDE Oracle	9.0	Server	SFS BG 1.1	Implementing
ArcSDE SQL Server	9.0	Server	SFS BG 1.1	Implementing

http://www.opengeospatial.org/

Summary

- Interoperability has always been important to GIS
  - Many flavors of interoperability
  - Standards: one of the things that make interoperability happen
- ISO and OGC standards are maturing and moving into the market
- ESRI has a long history with interoperability
  - Involvement with standards development organizations
  - Implementing GI and IT standards, multi-platform, multi-DBMS
- ESRI will continue this commitment to interoperability
  - ESRI will implement all standards and specifications that contribute to interoperability and make business sense
- Participate with us – tell us what's important

Thank you

ddanko@esri.com