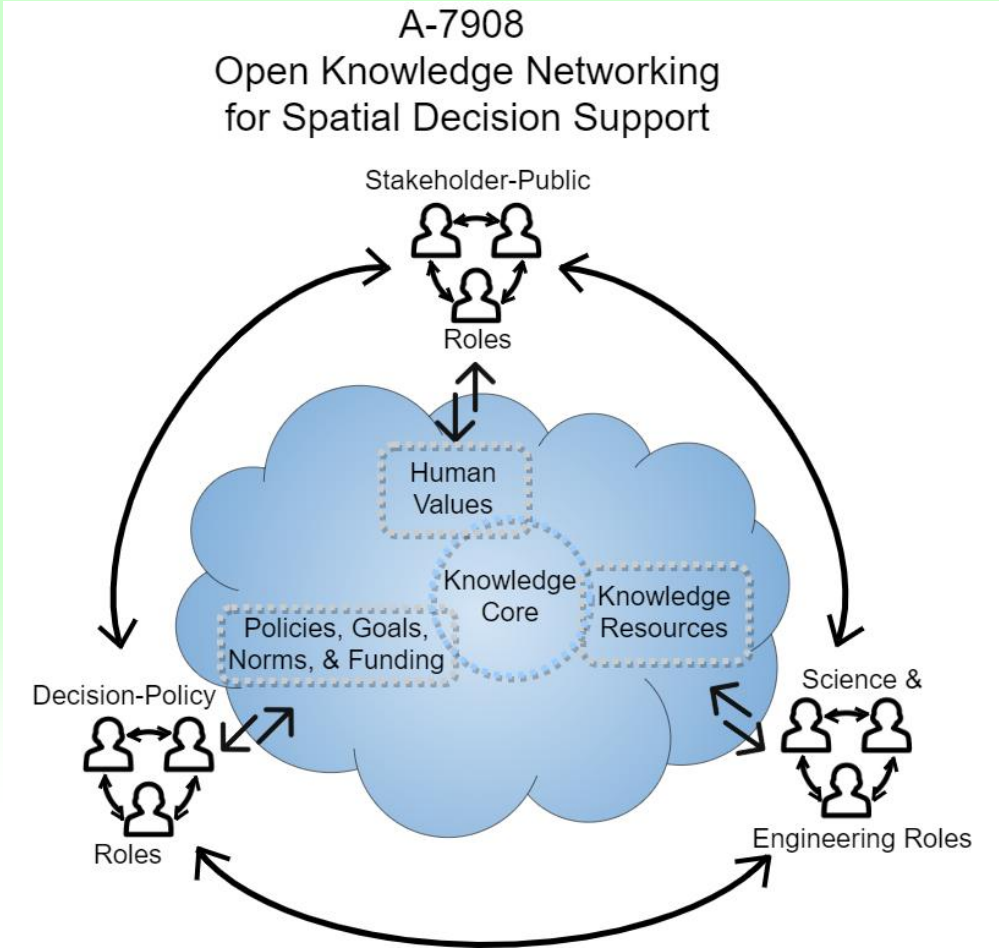
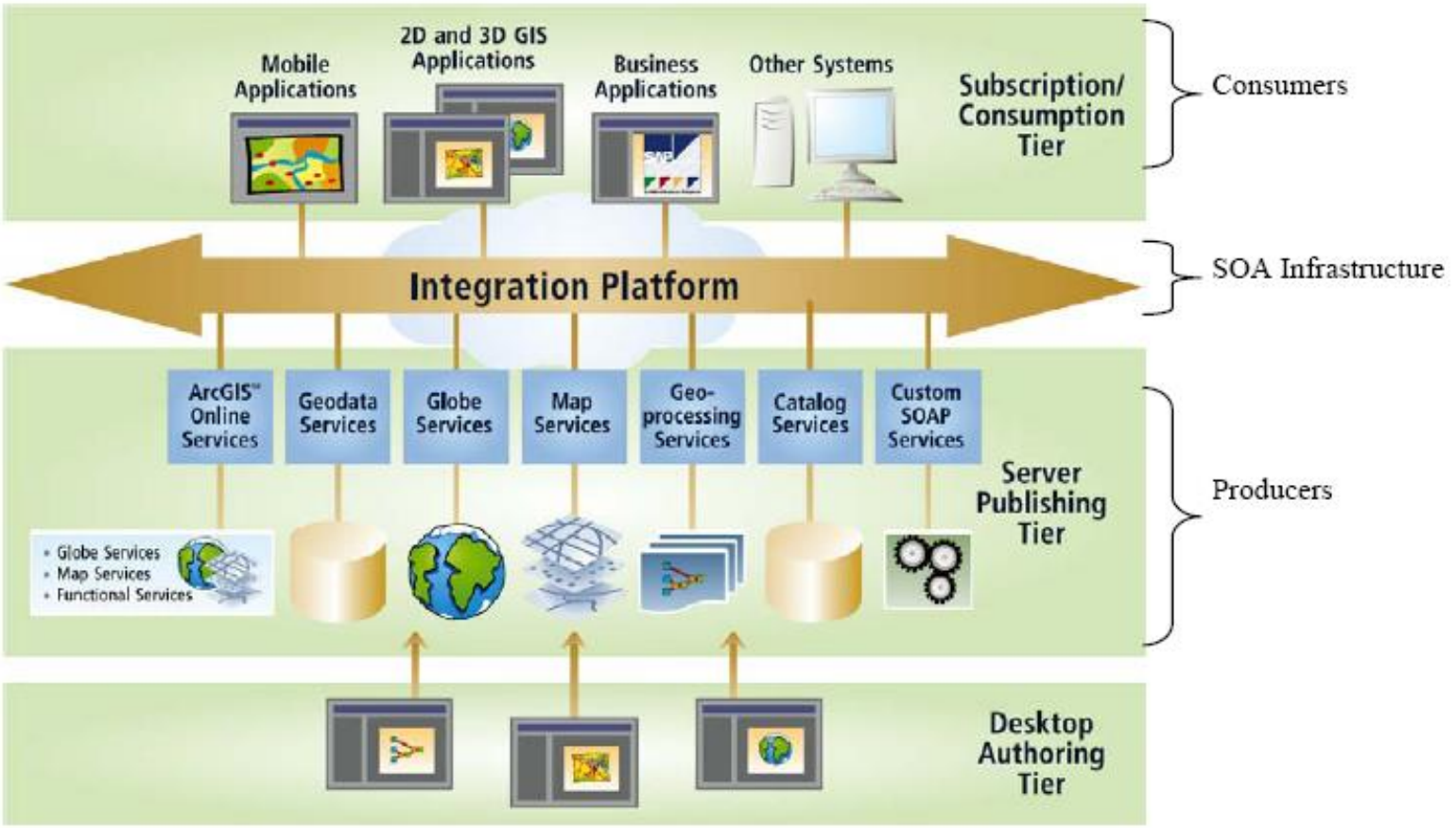


GEOG DL582 : GIS Data Management

Lesson 16: Technology Trends and Research



http://www.esri.com/library/whitepapers/pdfs/integrated-geoenabled-soa.pdf

Lesson: GIS Cloud Technology is here

Overview

Learning Objective Questions:

1. Why is integration of information technology an important trend?
2. What has driven mainstream and geospatial technology integration?
3. What is the nature of mobile computing and technology integration?
4. What are some mobile software products?
5. Why consider spatial data usability?
6. What are some geospatial technology trends?
7. What are some research frontiers?

Lesson Preview

Learning objective questions act as the lesson outline.

Questions beg answers.

Technology and Research Trends

1. Why is integration of information technology an important trend?

Geospatial technology is an important part of everyday activity.

...from everyday activity in peoples' lives

...to everyday activity in large organization existence.

Remembering...

- data management is at the core of GIS,
- map visualization and spatial analysis technologies are also in GIS,
- all three when tightly integrated compose fundamentals of GIS

Remembering... the knowledge ramp from lesson 2

...data, information, evidence, knowledge...understanding, wisdom

What do people need or want to know?

GIS has been a data integration engine, is becoming an information integration engine, and perhaps in the future will become an evidence and knowledge integration engine, but it takes your efforts on the job.

Key Terms

Technology integration
Data
Information
Evidence
Knowledge

- You and others propose what to improve. . .
- Use-inspired applications are ‘key’. . .
- Value-focused database design turns the key to open use-inspired applications

Convergence of mainstream information technology with geospatial information technologies continues.

- Mainstream IT being used as a base continues to become more functional with geospatial information technology

- All major database vendors offer geospatial data functions in their software

- Enabling people with geospatial information in a time setting, enables their situation awareness about the world on any given day; but situation awareness is not the only need.

- More synthesis from analysis is needed over a longer term than a day, for example for a week, month, year, or even decade.

- **Synthesis is the new integration; synthesis (fusion) creates information, evidence and knowledge from big data(bases)**.

Key terms
Mainstream

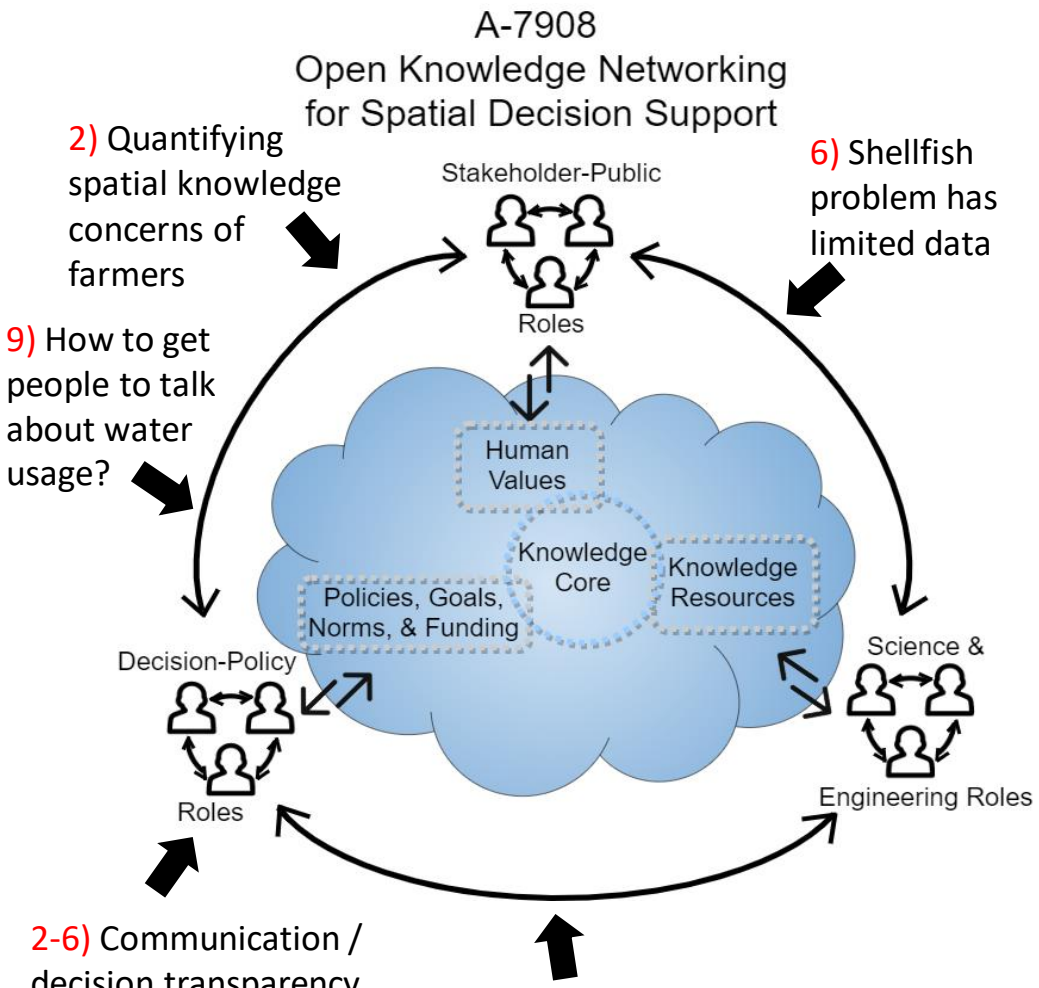


Diagram depicts information pain points during peoples' interactions about use-inspired and value-focused concerns regarding water resource knowledge.

Interview conversations 1-9 associate interviewees and pain points.

1) Senior Ecologist, WA Ecology, Watershed Characterization
2) Director, County Rural Resources, River Corridors
3) Manager, WA Ecology, Stormwater Management
4) Restoration Ecologist, NOAA, Water Quality Degradation
5) Manager, WA Dept Fish & Wildlife, Nearshore Restoration
6) Shellfish Biologist, Suquamish Tribe, Shellfish Bed Management
7, 8) Senior Modelers, WA Ecology, Puget Sound Water Quality
9) Senior Policy Analyst, Skokomish Indian Tribe, Natural Resources

Open Knowledge Networking, often oriented towards data, information, evidence, and knowledge resources, will continue to include human resources (e.g., people, projects, organizations, decisions) based on team's participatory use-inspired research approach.

2. What has driven mainstream and geospatial technology integration?

- Advances in computer hardware, software, and standards.
  - Large datasets (data management)
  - High performance processing (spatial analysis)
  - Computer graphics and entertainment (geovisualization)

- Advent of the Internet, networked computing, standardization, interoperability, usability

- Growing demand for novel and sophisticated applications
  - Reflect on the knowledge ramp about anything, anywhere, anytime within the context of your favorite domain.

- Recognition that spatial information has value for modern society (reducing the 'friction' of distance is valuable…save time). What might be more valuable than information? …perhaps evidence and knowledge packaged appropriately

Key terms
Technology integration

Technology Integration

Integrative technologies include…

- universal servers
- web servers
- data warehouses
- mobile computing

All encourage development of **Enterprise GIS**

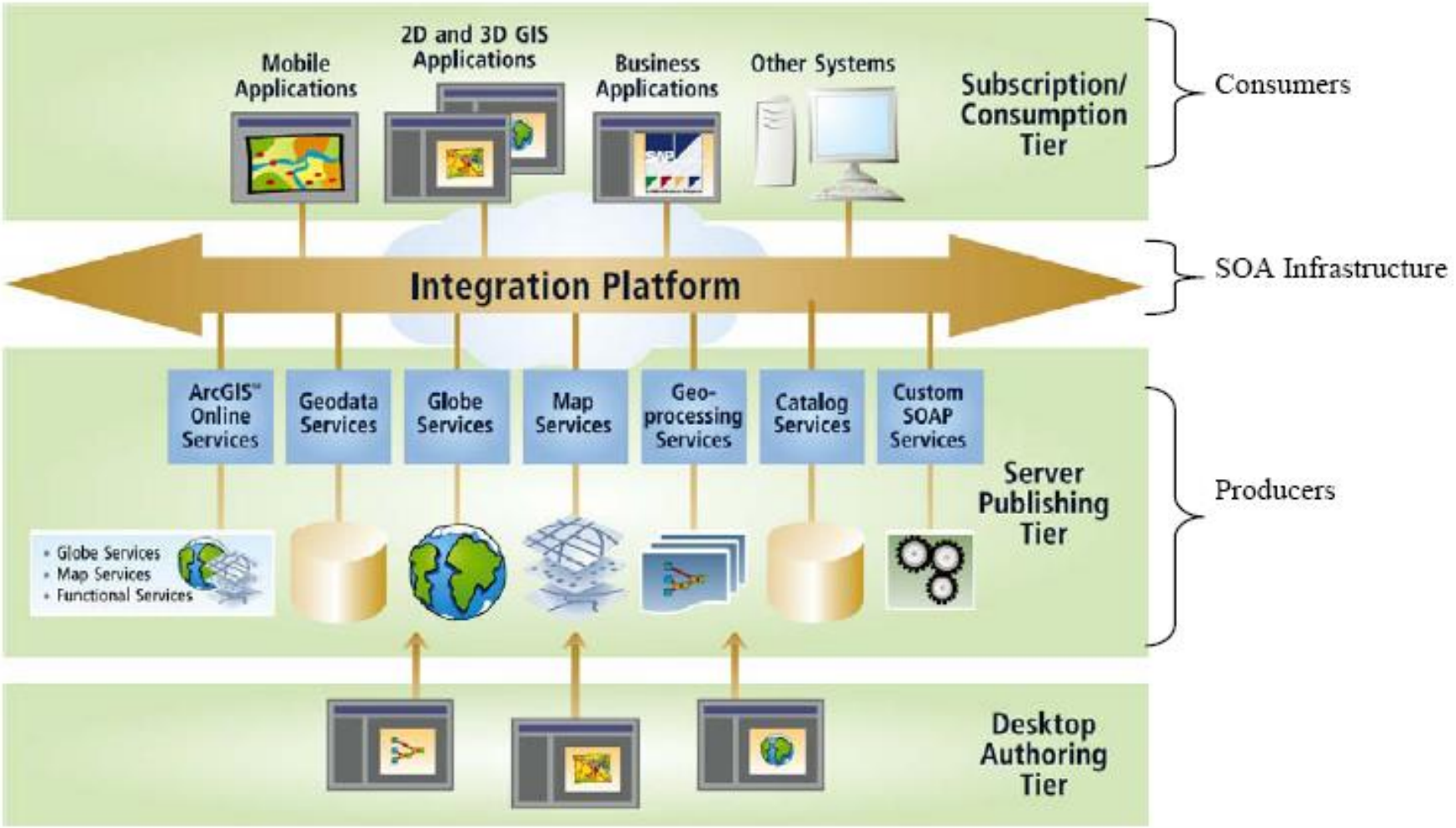
Seamless IT resources are needed to satisfy many users

An integration platform (using SOA on next slide) speaks to the idea of seamlessness. The right amount of information at the right place at the right time…anything (everything), anywhere, anytime

Key terms

universal servers
web serves
data warehouses
data marts and
mobile computing

Technology Integration – ArcGIS way…



http://www.esri.com/library/whitepapers/pdfs/integrated-geoenabled-soa.pdf

Spatial Database development framework

Y&H p. 481 provides a three-layer framework

Spatial Database Applications

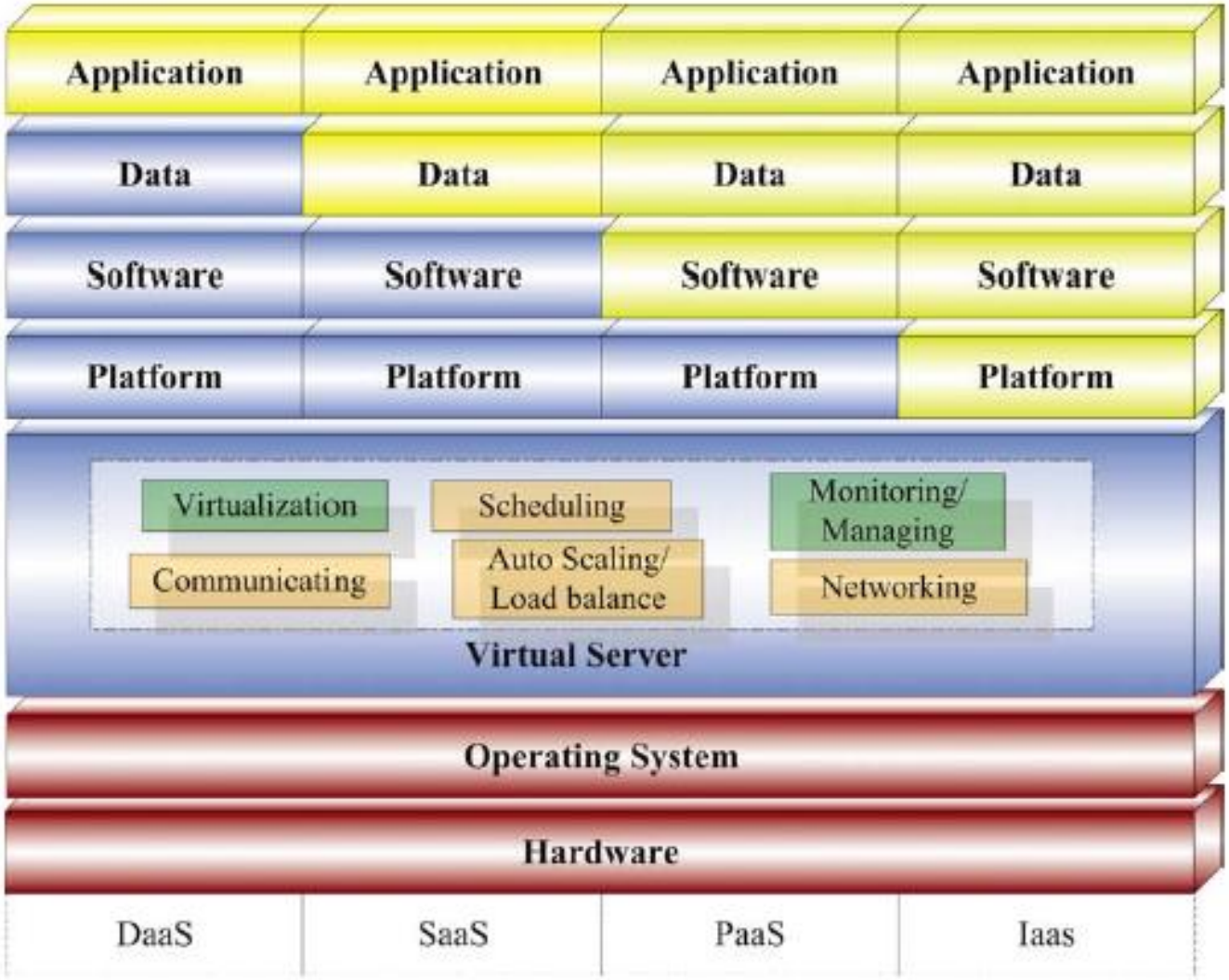
Spatially-enabled Information Infrastructure

Spatial Data Sources

Key terms

A mix of data, software, hardware, institutional arrangements, procedures to support an appropriate timing of applications; but let's extend that idea to cloud computing framework (next slide)

Spatial cloud computing is now and the future



Key terms

Spatial Cloud Services Architectures

Web services
- OGC standards

RESTful services
- APIs are faster

Yang, Chaowei , Goodchild, Michael , Huang, Qunying , Nebert, Doug , Raskin, Robert, Xu, Yan, Bambacus, Myra and Fay, Daniel (2011) 'Spatial cloud computing: how can the geospatial sciences use and help shape cloud computing?', International Journal of Digital Earth, 4: 4, 305 — 329

3. What is the nature of mobile computing and technology integration?

Y&H p. 476 Table 12-1 provides types and characteristics of mobile computers…but here is an extension

Laptop computers

Display screens and processors are now high performance

Personal digital assistant

Integrated with desktop and laptop applications

Hand-held computers

Functional field mapping capabilities

Tablet computers

Handscript recognition is now very good, as is voice recognition

Smart Phones

anything, anywhere, anytime

Key terms
Mobile computing
PDA
Hand-helds
Tablets

4. What are some mobile software products?

Y&H p. 478 Table 12-2 provides some mobile software products

Vendor	Product	Description
Autodesk	OnSite Enterprise	GIS design app
Esri	ArcPad	ArcIMS shapefile displays
Esri	ArcPad App Build	Customizing mobile apps
Esri	Mobile ArcGIS	Analysis and decision apps
MapInfo	MapX Mobile	Map-based applications
MapInfo	MapXtend	Wireless apps in J2EE
Hexagon Geospatial	Mobile MapWorks	Tablet/Phone GIS

Key terms
Mobile products

Spatial Data Trends

5. Why consider spatial data usability?

Diverse spatial data providers

- Five sectors: government, academic, private industry, non-for-profit, and crowd-sourced (VGI)

Increasing complexity of spatial problems

- Data from different sources, since no single source provides all perspectives needed; for example, Puget Sound Partnership data assembly is a grand challenge – so many organizations and perspectives

Critical decisions

- Requires good knowledge of the context of use
- Decision situation assessment is needed to inform context
- Data available versus data ready for use

Legal liability

- Be vigilant of limitations of use

Key terms
Data providers

Real-time data

Real-time data processing
- Sensor web is adding considerable data

More and more applications are emerging for real-time data processing

Temporal attributes for geospatial data becoming more important

Location tracking is now a significant application in many endeavors
- such as package delivery tracking

On-site monitoring of changes at a particular location, e.g. water quality monitoring

Key terms
Real-time
Sensor web

Trends in spatial applications

- Spatial application service providers
  - e.g. Geocoding services are provided on a per address basis
- Cloud computing (server farm) rental space for major implementations
- Value chain – different vendors providing one-step in the chain of service (See Y&H p. 490 Figure 12-5 Service chain.)
- Spatio-temporal modeling is growing in significance since space and time awareness continues to become more important.

Key terms
server farm
value chain
spatio-temporal

Geospatial Data Continues to Diversify

Health Care

- Applications are now more widespread, data and analysis
- People everywhere

Law Enforcement and Public safety

- People report incidents from everywhere
- Monitoring and surveillance
- Law enforcement wants access everywhere

Business Intelligence Apps

- Business Intelligence – capture what might be knowledge
- Dashboard Apps – keep track of bottom-line

Participatory GIS

- Stakeholders are more casual users
- Online participation in analytic-deliberative decision-making

Key terms
Business intelligence
App

6. What are some geospatial technology trends?

- Spatial data acquisition, integration, and synthesis
- Sensor networks support real-time acquisition
- Distributed and mobile computing – access data from anywhere, anytime
- Geographic representation – spatial-temporal representations
- Interoperability of geographic information – pull from multiple sources
- Open formats and GML – coding schemas has become more flexible
- Spatial data infrastructures – make data more accessible through directories; make it easier to access technically and legally
- Spatial data and society – Make data more widely available to more people for more applications…the cloud solution
- Key on use-inspired as human-centered and value-focused data(base) design to support application design

Key terms
Sensor net
interoperability
GML
SDI

7. What are some data resource frontiers?

Large spatial databases online everywhere access – large archival data stores; data discovery more broadly implemented

Improved 3D and 4D space-time data, information, evidence, and knowledge resources used in management, analysis and display

Improved service-oriented architectures using web services; broaden and deepen coupling; service chains

Use of spatial cloud computing; designing high performance cloud computing for high performance collaboration

spatial-temporal principles (what is close to what in space and time) in spatial cloud computing

Synthesize technology support (all of the above) for improving spatial thinking, learning, and decision making; space-time connects all three

Key terms
Archival data store
Geovisualization
Service-oriented arch
Data standards
Cloud computing
Integrated systems

Geospatial Data Management Futures…

What are some of your favorite frontiers?

….Next quarter, next year, next career?

What have you heard about the futures of data technologies?

Key terms

BIG DATA and BIG MODELS = BIG DATA MODELS

Schemas at the individual elements level is called ontologic knowledge graph databases

Supercomputing – cloud versus grid – what is the integrated approach, or better yet synthesized approach for you and your GIS work of the future?

Summary

In this lesson, we addressed the current and future of…

1. Integration of information technology
2. Mainstream and geospatial technology integration
3. Mobile computing and technology integration
4. Some of mobile software products
5. Spatial data usability
6. Some of the geospatial technology trends
7. Some of the research frontiers

Contact me at nyerges@uw.edu if you have questions or comments about this lesson.

GEOG DL582: GIS Data Management

END Lesson 16: Technology Trends and Research