

COM.Geo 2011

2nd International Conference and Exhibition on
Computing for Geospatial Research & Applications

May 23-25, 2011

Washington, DC

PROGRAM



Spotlight: Digital Earth in Mobile Phones and iPads

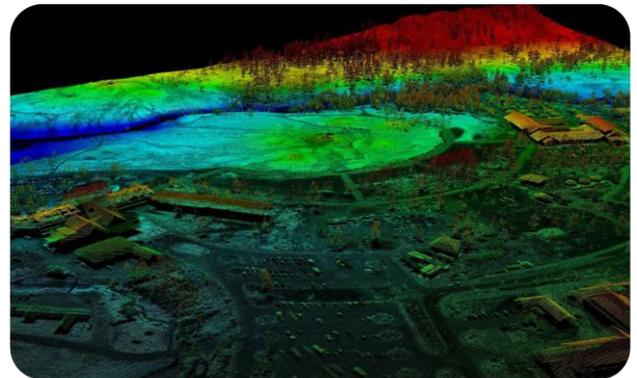
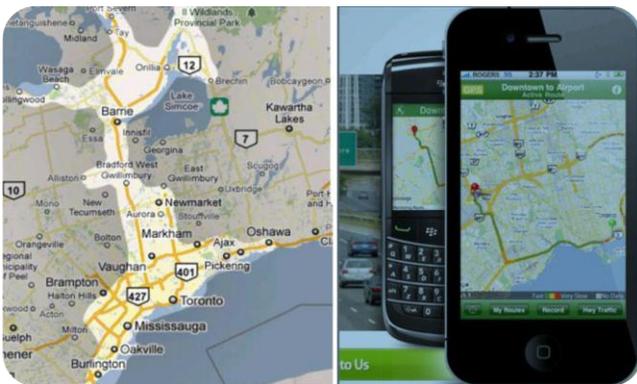


Image courtesy of the authors and partners

Program at a Glance

Monday, May 23	7:30 AM - 4:30 PM	Registration (Registration Room in front of the Grand Ballroom)		
	8:40 AM - 9:50 AM	Full Papers I Grand Ballroom	Short Papers I Meeting Room 307	Tech Talks/Demo Talks I Meeting Room 308
	9:50 AM - 10:00 AM	Coffee Break, Video Shows (Grand Ballroom)		
	10:00 AM - 11:30 AM	Grand Ballroom	10:00 am - 10:45 am 10:45 am - 11:30 am	Keynote 1: U.S. FCC Keynote 2: NASA
	11:30 AM - 1:00 PM	Welcome Reception (Continental Ballroom)		Video Shows (Grand Ballroom)
	1:00 PM - 2:25 PM	OGC Workshop Grand Ballroom	Full Papers II Meeting Room 307	Course I: AGI Meeting Room 308
	2:25 PM - 2:40 PM	Coffee Break		
	2:40 PM - 4:40 PM	OGC Workshop Grand Ballroom	Short Papers II Meeting Room 307	2:40pm-3:30pm: Course I: AGI 3:40pm-4:40pm: Panel III: NGS...
	1:00 PM – 5:00 PM	Posters, Exhibition (Continental Ballroom)		
Tuesday, May 24	8:00 AM - 4:30 PM	Registration (Registration Room in front of the Grand Ballroom)		
	8:30 AM - 9:30 AM	Full Papers III Grand Ballroom	Short Papers III Meeting Room 302	Short Papers IV Meeting Room 301
	9:30 AM - 9:45 AM	Coffee Break, Video Shows (Grand Ballroom)		
	9:45 AM - 12:00 PM	Grand Ballroom	9:45 am - 10:30 am 10:30 am - 11:15 am 11:15 am - 12:00 pm	Keynote 3: Microsoft Keynote 4: OGC Keynote 5: DHS - FEMA
	12:00 PM - 1:00 PM	Lunch Break, Video Shows (Grand Ballroom)		
	1:00 PM - 2:20PM	OGC Workshop Grand Ballroom	Full Papers IV Meeting Room 302	Course II: Microsoft Meeting Room 301
	2:20 PM - 2:30 PM	Coffee Break		
	2:30 PM - 4:30 PM	OGC Workshop Grand Ballroom	Tech/Demo Talks II Meeting Room 302	Course II: Microsoft Meeting Room 301
	8:30 AM – 4:30 PM	Posters, Exhibition (Continental Ballroom)		
Wednesday, May 25	8:00 AM - 10:00 AM	Registration (Registration Room in front of the Grand Ballroom)		
	9:00 AM - 10:30 AM	Panel I: NASA Meeting Room 302	Panel II: OGC Meeting Room 301	Tech Talks/Demo Talks III Meeting Room 307
	10:45 AM	First Pick-up to Cruise Deck: Shuttle boarding at the gate of Conference Center		
	11:20 AM	Second Pick-up to Cruise Deck: boarding at the gate of Conference Center		
	11:00 AM - 12:00 PM	Cruise Boarding		
	12:00 PM - 2:00 PM	Cruise Banquet		
	2:00 PM	First Pick-up: Shuttle back to the conference venue - Cafritz Conference Center		
	2:30 PM	Second Pick-up: Shuttle back to the conference venue - Cafritz Conference Center		



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General Information

About COM.Geo Conference

COM.Geo Conference is a leading-edge conference on computer science and technology for geospatial information research and applications. It focuses on the latest computer and information technologies for multidisciplinary research and development that enables the exploration in geospatial areas.

Innovative computing for geospatial research and application technologies are the spotlights at COM.Geo conference. "Turn innovative ideas into reality" is the highlight of COM.Geo conference. COM.Geo is playing a guiding role to advancing the technologies in computing for geospatial fields.

COM.Geo Conference is an exclusive event that bridges the gap between computing and geospatial areas, and connects professionals from academia, government, and industry in all related fields. COM.Geo Conference provides a forum for researchers, decision-makers, developers, and application users to present and discuss the most recent innovations, trends, experiences and concerns in both fields of computer science and geospatial information. The conference features the presentation of research papers, application case studies, technical briefings, workshops, courses, panels, demonstrations, and updates on use of advanced computing for geospatial techniques in industry.

COM.Geo 2011 is the 2nd International Conference and Exhibition on Computing for Geospatial Research and Applications on May 23-25, 2011 in Washington DC. The brightest spotlight of COM.Geo 2011 is Mobile Geospatial - Digital Earth in Mobile Phones and iPads.

The COM.Geo 2011 Proceedings are published by ACM (ISBN: 978-1-4503-0681-2) and available at ACM Digital Library for world distribution.

Alcohol

The COM.Geo conference expects all attendees to act responsibly when consuming alcoholic beverages. Consumption of alcohol by those under the age of 21 is prohibited.

Bags/Packages

For security reasons, the COM.Geo conference is unable to hold attendees' bags, packages, briefcases, coats, laptops or other personal items at registration. Be sure to keep your own safety and the security of your belongings.

Internet Access

The internet access connections are limited. Speakers can access internet through wired connections on the podium.

Non-Smoking Policy

The COM.Geo conference maintains a non-smoking policy in all meeting rooms, the exhibit room, and the registration room. Smoking is allowed only in designated smoking areas of the hotel.

Photography and Videography in Sessions

Photos and videos can be taken during presentations with the permission of the presenters.

Presentation Content

The COM.Geo conference is an open forum for sharing the results of research and application in computing for geospatial and related specialties. The contents of presentations by individuals or groups at the COM.Geo conference are their alone. The COM.Geo conference neither endorses nor disclaims the conclusions, interpretations, or opinions expressed by speakers at the conference.

Professional Conduct

Professional ideas and information are exchanged most effectively at the COM.Geo conference in an atmosphere free of abuse or harassment and characterized by courtesy and respect. To that end, the COM.Geo conference expects all individuals who attend to conduct themselves in a manner that establishes an atmosphere free from discriminatory practices.

Registration

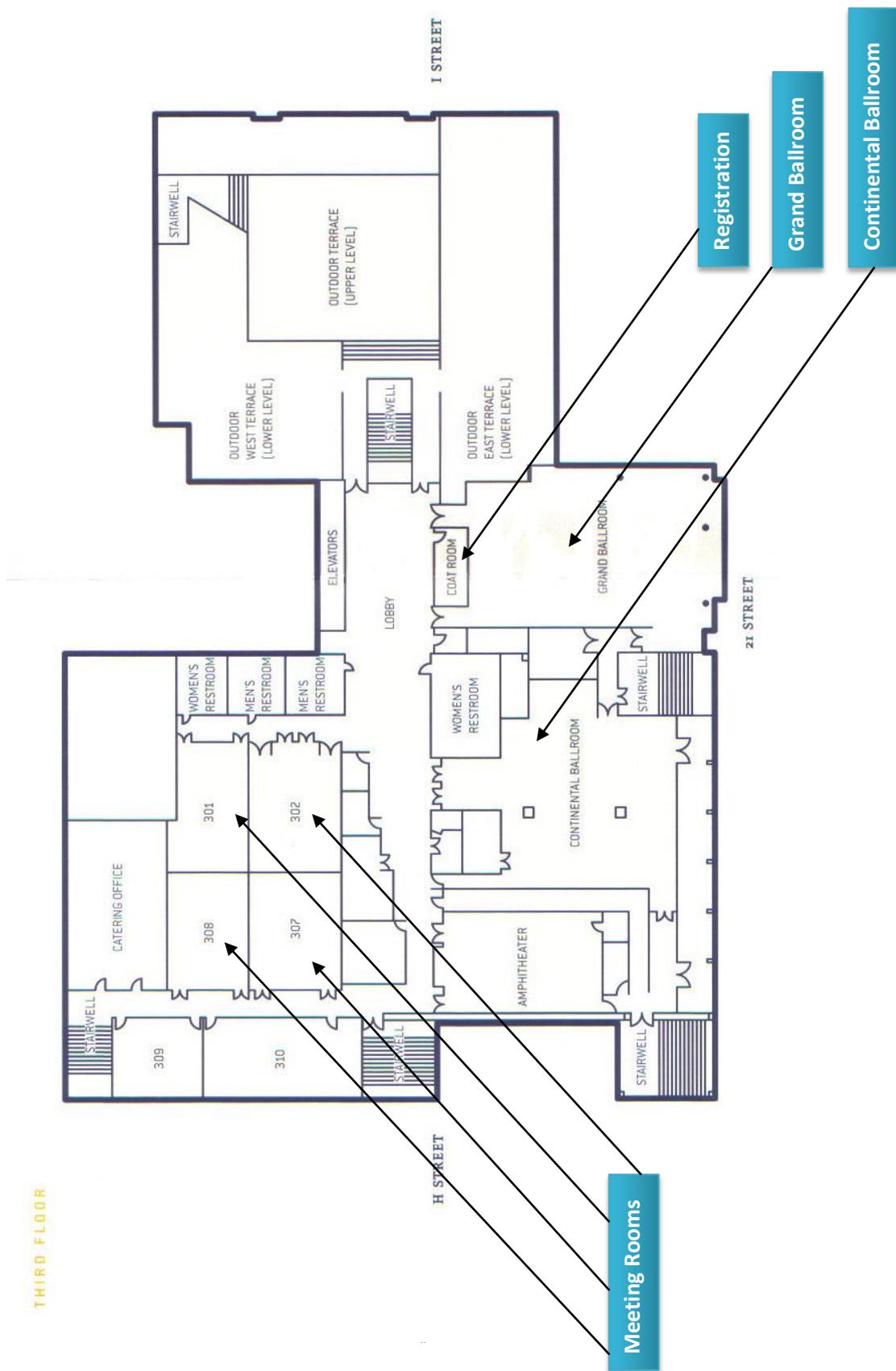
The COM.Geo conference Registration Desk will be located in front of the Grand Ballroom on the third level of the Cafritz Conference Center. Registration will be open during the following hours:

Monday, May 23	7:30 a.m. – 4:30 p.m.
Tuesday, May 24	8:00 a.m. – 4:30 p.m.
Wednesday, May 25	8:00 a.m. – 10:00 p.m.

Dress Code for Cruise Banquet

Dress Code for Cruise Banquet is **business-casual or dressy-casual attire**, such as nice slacks and collared shirts. We prefer NO jeans, shorts, tank tops, halter-tops, athletic shoes or flip-flops be worn on the cruise.

Location of Meeting Rooms



Plenary Sessions Grand Ballroom

Monday, May 23 10:00 AM – 11:30 AM

Keynotes Chair:

Prof. Simon Y. Berkovich

George Washington University

Keynote 1 10:00 AM - 10:45 AM



Michael Byrne

GIO

*U.S. Federal Communications
Commission (U.S. FCC)*

Michael Byrne is the Geographic Information Officer (GIO) for the Federal Communications Commission. He is the former GIO for the State of California and an expert

in the design, development, implementation, and use of GIS for research and policy. He has served as chair of the California GIS Council, a member of the National Geospatial Advisory Committee, and on the board of directors for both GreenInfo Networks and the National States GIS Council. Byrne holds a masters in geography from the University of California at Davis and is a certified GIS professional.

National Broadband Map

Broadband access and availability to every American is a key pillar of this administration. Congress authorized the development and maintenance of the National Broadband Map to provide the first ever searchable and interactive map of broadband availability. Transparency in broadband availability had never before been fully realized to both consumers and policy decision makers alike. The collection, integration and publication of this data charts a new course in broadband information access and will add significantly to the policy discussion about increasing American's access to high-speed internet.

Keynote 2 10:45AM - 11:30 AM



Patrick Hogan

*Program Manager
NASA World Wind*

Patrick Hogan currently manages the NASA World Wind development team, a group of world class engineers producing open source software that has received National awards and NASA Software of the Year for 2009/2010. During his 20

years with NASA, Patrick managed environmental programs and more recently the NASA Learning Technologies (NLT) program. NLT was an incubation 'tank' for technologies to move NASA content into education. NLT is where World Wind was born. Patrick, a former pilot, deep sea diver and high

school science teacher, has a Master's in Earth Science and is a Registered Geologist in the State of California.

NASA World Wind: Infrastructure for Spatial Data

The world has great need for analysis of Earth observation data, be it climate change, carbon monitoring, disaster response, national defense or simply local resource management. To best provide for spatial and time-dependent information analysis, the world benefits from an open standards and open source infrastructure for spatial data. In the spirit of NASA's motto "for the benefit of all" NASA invites the world community to collaboratively advance this core technology. The World Wind infrastructure for spatial data both unites and challenges the world for innovative solutions analyzing spatial data while also allowing absolute command and control over any respective information exchange medium.

Tuesday, May 24 9:45 AM – 12:00 PM

Keynotes Chair:

Prof. Simon Y. Berkovich

George Washington University

Keynote 3 9:45 AM - 10:30 AM



Dan Kasun

*Senior Director of Developer and
Platform Evangelism for U.S. Public
Sector at Microsoft*

Dan Kasun is the Senior Director of Developer and Platform Evangelism for U.S. Public Sector at Microsoft. Dan and his teams are responsible for evangelizing how new technologies can

be applied in the government and education industries, providing readiness and guidance to developers, and working directly with agencies, organizations and partners to help ensure success for solutions built on the Microsoft platform. In addition, Dan's organization works with schools, faculty, and students to build enthusiasm and competency for Computer Science education and technical career development.

Dan has been with Microsoft for over 15 years, and joined the Microsoft Public Sector business in 2009. During his tenure, he has worked with customers of all sizes - from small developer organizations to large enterprises in a variety of industries (Financial Services, Healthcare, Government, and Education). He is a frequent speaker at Microsoft and industry events - specializing in all areas of application development and technical architecture.

Prior to Microsoft, Dan was an application developer and architect in the Financial Services Industry. He holds a bachelor's of science degree in computer engineering from Lehigh University

Plenary Sessions Grand Ballroom

Technology Trends and Industry Innovation

The current state of technology and its prevalence in all societies has created an era of amazing innovation and opportunity across the world. Specifically, three key transformational trends are coming together in a way that will significantly change our perspective of computing and how technology can be integrated into our lives. These trends are 1) the low-cost availability of near limitless resources, 2) ubiquitous availability of networks, devices, and I/O mechanisms, and 3) Natural "human" interfaces and experiences. This transformative combination will enable innovators to develop highly advanced solutions with very little investment, and will change the landscape of business and industry in ways that have never been predicted - much sooner than expected. This discussion will look into how these trends are progressing and how they are impacting key industries today.

Keynote 4 10:30 AM - 11:15 AM



George Percivall

Chief Architect and Executive Director - Interoperability Program, OGC

George Percivall is an accomplished leader in the development of information systems and international standards for geospatial information.

As OGC's Chief Architect, he is responsible for the overall vision for the OGC baseline and its evolution through developments by OGC members. As Executive Director of OGC's Interoperability Program, he is responsible for managing OGC's Interoperability Program, which involves planning and executing testbeds, pilot projects, interoperability experiments etc., and for running OGC's compliance testing program.

Prior to joining OGC, Mr. Percivall had leadership roles on several NASA projects. He was Chief Engineer of the Earth Observing System Data and Information System (EOSDIS) for the Landsat/Terra release; Principal engineer for NASA's Geospatial Interoperability Office; and, represented NASA in OGC, ISO TC211, and CEOS. He was the Director of the Geospatial Interoperability Group of GST, Inc. Previously, he led developments in Intelligent Transportation Systems with the US Automated Highway Consortium and General Motors Systems Engineering. He holds a BS in Physics and an MS in Electrical Engineering from the University of Illinois - Urbana.

GeoWeb on Mobile Internet

Geospatial data accessible on the web has become common place and transformative. The GeoWeb allows us to view geographic information about any location on the planet and to make plans based on this. Planning routes for travel using the GeoWeb has become highly advanced enabled by open standards. Using the GeoWeb for environmental studies is advancing but requires additional standards regarding

semantics of the features of the world. The GeoWeb is now moving to mobile internet platforms. Soon, if not already, mobile devices will be the predominant method to access the Internet. This is enabled by dramatic advances in technologies and business models for electronic communications and hand held devices. Smartphones have led the way enabling access on mobile devices similar to fixed internet locations. The initial generation of Location Based Services were defined based on walled gardens. Now we are extending the GeoWeb to the mobile internet and enhancing it based on location context and by access to an Internet of things including sensors. Using mobile GeoWeb devices embedded in the world enables an augmented understanding of our geospatial reality.

Keynote 5 11:15 AM - 12:00 PM



Eric Berman

HAZUS Program Manager, DHS - FEMA

Mr. Eric Berman is the current Hazus Program Manager for the Federal Emergency Management Agency (FEMA). He has approximately 20 years of hazard identification studies and mapping experience with an emphasis on GIS. Mr. Berman was recently among the recipients of Federal Computer Week magazine's 22nd Annual "Federal 100 Awards" in Washington, DC, for his outstanding leadership and work on the FEMA Hazus Program. He holds a Bachelor's Degree in Civil Engineering from Tennessee Technological University and represents the Department of Homeland Security on the U.S. Board on Geographic Names.

The Current State of Geospatial Modeling

Geospatial modeling has evolved since it was first introduced in the early 80s. In the past few years, the geospatial environment has exploded, providing previously unattainable high-resolution statistical data. Gone are the days of archaic topographic two-dimensional maps, and introduced are highly developed systems displaying ubiquitous geospatial data. Time and money are being saved as crews of experts are no longer data-collecting in the field. This increased currency and precision created through technological changes is directly impacting the decisions planners are making day-to-day. Desktop-based software is making way for cloud computing, allowing increased user base and data sharing across the globe. Mr. Berman will discuss the evolution of geospatial modeling, how we got here, and future advancements. What are the benefits of this new geospatial environment? How can we leverage these new tools to more accurately analyze data sets, and what environmental benefits will this create?

Full Paper Sessions

Full Paper Session I

Monday, May 23 8:40 AM – 9:50 AM

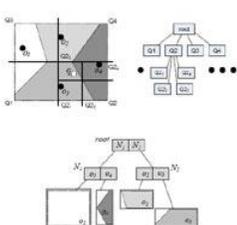
Grand Ballroom

Session Chair:

Prof. Dr. Ken Lee, University of Massachusetts - Dartmouth

Efficient Evaluation of Location-Dependent Skyline Queries Using Non-Dominance Scopes

Ken Lee



With respect to a given query point, a location-dependent skyline query (LDSQ) finds all objects that are not spatially dominated by any other in a specified set of objects. An object o is considered to spatially dominate another o' if o is not worse than o' for all search criteria and strictly better than o' for at

least one of the search criteria. Here, the search criteria include the objects' nearness to q and their non-spatial attributes. LDSQs have many valuable applications that need to find the best and nearest objects. Nevertheless, efficient evaluation of LDSQs faces challenges due to exhaustive comparisons among objects in determining their spatial dominance relationships which in turn depend on query points at the run time. In this paper, we introduce a notion of non-dominance scopes. For each object, a non-dominance scope is an area in which query points find the object not spatially dominated by other objects. With non-dominance scopes, LDSQs are simplified as searches for objects whose non-dominance scopes enclose query points. We develop algorithms to compute non-dominance scopes and evaluate LDSQs using indexed non-dominance scopes. We also evaluate our proposed approach. The experiment results show the outstanding performance of our proposed approach.

Keywords: Location-Based Services, Location-Dependent Skyline Query, Spatial Dominance, Non-Dominance Scope, Algorithm and Performance

Summarizing Textual Information about Locations

Congxing Cai, Eduard Hovy



This paper describes the summarization of textual material about locations in the context of a geo-spatial information display system. Both structured data and unstructured web pages are linked to maps. When the amount of

associated textual data is large, it is organized and summarized before display. A hierarchical summarization framework, conditioned on the small space available for display, has been fully implemented. A case study is conducted on a fully implemented system to show how users

interact with text in an integration context. Eye-tracking results are presented to illustrate and verify the observations in case study.

Keywords: Hierarchical text summarization, geo-spatial information system, geographical search, eye-tracking experiment

Service-Oriented Interactive 3D Visualization of Massive 3D City Models on Thin Clients

Dieter Hildebrandt, Jan Klimke, Benjamin Hagedorn, Jurgen Döllner



Virtual 3D city models serve as integration platforms for complex geospatial and georeferenced information and as medium for effective communication of spatial information. In this paper, we present a system architecture for service-oriented, interactive 3D visualization of massive 3D city models on thin clients such as mobile phones and tablets. It is based on high performance, server-side 3D rendering of extended cube maps, which are interactively visualized by corresponding 3D thin clients. As key property, the complexity of the cube map data transmitted between server and client does not depend on the model's complexity. In addition, the system allows the integration of thematic raster and vector geodata into the visualization process. Users have extensive control over the contents and styling of the visual representations. The approach provides a solution for safely, robustly distributing and interactively presenting massive 3D city models. A case study related to city marketing based on our prototype implementation shows the potentials of both server-side 3D rendering and fully interactive 3D thin clients on mobile phones.

Keywords: Service-oriented architecture, mobile device, distributed geo-visualization, 3D geovirtual environment, virtual 3D city model, 3D computer graphics

Full Paper Session II

Monday, May 23 1:00 PM – 2:25 PM

Meeting Room 307

Session Chair:

Dr. Sriram Krishnan, San Diego Supercomputer Center at UC San Diego (SDSC UCSD)

Enabling the "Internet of Places": a Virtual Structure of Space-Time-Tasks to find and Use Internet Resources

Giuseppe Conti, Paul Watson, Nic Shape, Raffaele De Amicis, Federico Prandi

Full Paper Sessions



The growing success of 3D spinning globes, navigation systems, and Location-Based Services (LBS) is promoting a profound paradigm shift, as people are becoming increasingly accustomed to accessing

heterogeneous digital content in relation to real world locations - be this place referred to within a tweet, the location of an incident as described by a news report, the various places where a video was filmed etc.

In response to this, an increasing number of Web 2.0 mash-ups are available from the web offering specialized web-based solutions to access various types of information based on the position of events in the real world. Nevertheless, the lack of native spatial support at the web level precludes geographical or location based contextualization of most digital resources available through the Internet.

This paradigm shift has created the preconditions at societal level for spatio-temporal enablement of the Internet which should evolve from a paradigm based on the "Internet of Objects" to a new, spatio-temporally capable, "Internet of Places", made of natively spatio-temporally contextualized web-services. This paper presents a vision for the next generation of intelligent web-based applications capable of delivering context-aware and real-time access to large-data repositories, by providing overarching technology to organize, filter and explore Web content from every domain using the same intuitive user-driven and spatio-temporal metaphor.

This paper tries to define a blueprint proposing protocols and data structures that could be used to reorient the web to change the key dimension for accessing and organizing resources, from the structure of Internet addresses to a more natural structure of space and time. According to this approach it would not matter where a resource is physically stored, but only whether it is relevant to a given user's task with respect to place and time.

This is what we have called the "Internet of Places".

Keywords: "Internet of Places", geospatial web, Future Internet, content creation, content indexing, information model.

An Open Geospatial Consortium Standards-based Arctic Climatology Sensor Network Prototype

Andrew John Rettig, Richard Allan Beck, Timothy John Rettig

In recent years, the standards of OGC's Sensor Web Enablement (SWE) initiative have been applied in a multitude of projects to encapsulate heterogeneous geosensors for web-based discovery, tasking and access. Currently, SWE services and the different types of geosensors are integrated manually due to a conceptual gap between these two layers. Pair-wise adapters are created to connect an implementation of a particular SWE service with a particular type of geosensor. We have constructed a prototype Open Geospatial Consortium (OGC) standards-based Arctic Climatology Sensor



Network Prototype (ACSNP) in response to recent developments in sensor technology and Internet Protocol Suite (TCP/IP) wireless communications in Barrow, Alaska for the National Science Foundation (NSF). The OGC

standards enable increased, interoperability, scalability, and extensibility for geospatial information at reduced cost. Our approach for the prototype is to integrate established technologies to create near-real-time geographic information networks (GINs). We linked a variety of meteorological and image sensors to a wide area wireless network in Barrow, Alaska. The network is a TCP/IP-based 700 Mhz WipLL network consisting of a 16 kilometer diameter local cloud as well as more distant fixed and mobile Iridium Open Port Units, that allow for global connectivity, at other remote research stations and on polar class ice breakers. Sensors linked to these wireless networks transfer their data to the Department of Energy (DOE) building in Barrow. The building houses two automatically populated mirrored File Transfer Protocol (FTP) servers running Microsoft Server 2003 within a virtualized environment. The data are automatically harvested from the remote site over redundant 4 X T-1 satellite links to the central data center in Cincinnati, Ohio where it is formatted to comply with the OGC database initiatives to create an OGC-compliant geodatabase within Microsoft SQL Server 2008. The final web publication is the result of a three part system; geodatabases, web services and web applications. We use ESRI's ArcGIS Server technology for retrieval and publication utilizing ESRI's compliance with OGC web services. These web services may then be embedded within OGC compliant clients, such as ESRI's ArcGIS Desktop and Google Earth for analysis and web applications. The Arctic Climatology Sensor Network Prototype is accessible at OpenSensorMap.com.

Keywords: Spatial Data Infrastructure, Geographic Information Network, GIN, Sensor Network, Sensor Web, Open Geospatial Consortium, OGC, Climatology, Arctic, Common Operational Platform, COP.

Analysing Complexity of XML Schemas in Geospatial Web Services

Alain Tamayo, Carlos Granell, Joaquin Huerta

XML Schema is the language used to define the structure of messages exchanged between OGC-based web service clients and providers. The size of these schemas has been growing with time, reaching a state that makes its understanding and effective application a hard task. A first step to cope with this situation is to provide different ways to measure the complexity of the schemas. In this regard, we present in this paper an analysis of the complexity of XML schemas in OGC web services. We use a group of metrics found in the literature and introduce new metrics to measure size and/or complexity of these schemas. The use of adequate metrics allows us to quantify the complexity, quality and other properties of the schemas, which can be very useful in different scenarios.

Full Paper Sessions

Keywords: XML Schema, Web Services, Geospatial Information, Complexity Analysis, Software Metrics

Full Paper Session III

Tuesday, May 24 8:30 AM - 9:30 AM

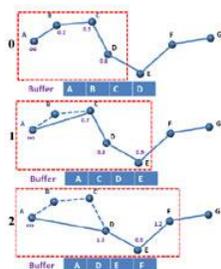
Grand Ballroom

Session Chair:

Dr. Giuseppe Conti, *Fondazione Graphitech*

SQUISH: An Online Approach for GPS Trajectory Compression

Jonathan Muckell, Vikram Patil, Fan Ping, Catherine T Lawson, Jeong-Hyon Hwang, S. S. Ravi



GPS-equipped mobile devices such as smart phones and in-car navigation units are collecting enormous amounts spatial and temporal information that traces a moving object's path. The popularity of these devices has led to an exponential increase in the amount of GPS trajectory data generated. The size of this data

makes it difficult to transmit it over a mobile network and to analyze it to extract useful patterns. Numerous compression algorithms have been proposed to reduce the size of trajectory data sets; however these methods often lose important information essential to location-based applications such as object's position, time and speed. This paper describes the Spatial QAllytY Simplification Heuristic (SQUISH) method that demonstrates improved performance when compressing up to roughly 10% of the original data size, and preserves speed information at a much higher accuracy under aggressive compression. Performance is evaluated by comparison with three competing trajectory compression algorithms: Uniform Sampling, Douglas-Peucker and Dead Reckoning.

Keywords: GPS, Trajectories, Compression

Ontological Analysis of Terrain Data

Susanne Riehemann, Daniel Elenius



Geographic applications require increasingly accurate data, for example to support high fidelity visual simulations. However, information about data accuracy is typically not directly available, and must instead be inferred from the

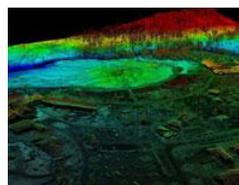
manner in which the data was acquired and processed. Some inaccuracies arise as subtle side-effects of processing steps, such as transformation errors due to implicit epochs or unintentional downsampling due to pixel overlap, which are known to only a small number of experts. To address this problem, we formalize the properties of each piece of data

and its processing history in a geographic ontology, and use declarative Semantic Web Rule Language (SWRL) rules to calculate the errors relative to the real world or to other data. Since the impact of these errors depends on the purpose for which the data is to be used, purpose-dependent requirements are described using an additional task ontology and evaluated by our task analyzer software. The geographic ontology combines knowledge from different areas of expertise, and our formal implementation makes it available for the community to use, critique, and augment.

Keywords: Terrain ontology, terrain accuracy, metadata

OpenTopography: A Services Oriented Architecture for Community Access to LIDAR Topography

Sriram Krishnan, Christopher Crosby, Viswanath Nandigam, Minh Phan, Charles Cowart, Chaitanya Baru, Ramon Arrowsmith



High-resolution topography data acquired with LIDAR (Light Detection and Ranging) remote sensing technology have emerged as a fundamental tool for Earth science research. Because these acquisitions are often undertaken

with federal and state funds at significant cost, it is important to maximize the impact if these geospatial data by providing online access to a range of potential users. The National Science Foundation-funded OpenTopography Facility hosted at the San Diego Supercomputer Center, has developed a Geospatial Cyberinfrastructure (GCI) to enable online access to Earth science-oriented high-resolution LIDAR topography data, online processing tools, and derivative products. Leveraging high performance computational and data storage resources available at SDSC, OpenTopography provides access to terabytes of point cloud data, standard digital elevation models, and Google Earth image data, all co-located with computational resources for higherlevel data processing. This paper describes the motivation, goals, and the technical details of the Services Oriented Architecture (SOA) and underlying cyberinfrastructure platform implemented by OpenTopography. The use of an SOA, and the co-location of processing and data resources are unique to the field of LIDAR topography data processing, and lays a foundation for providing an open system for hosting and providing access to data and computational tools for these important scientific data, and is an exemplar for similar large geospatial data and processing communityoriented cyberinfrastructure systems.

Keywords: LIDAR, SOA, Cyberinfrastructure

Full Paper Session IV

Tuesday, May 23 1:00 PM - 2:20 PM

Meeting Room 302

Session Chair:

Patrick Cozzi, *AGI, University of Pennsylvania*

Full Paper Sessions

Machine Learning Approaches for High-resolution Urban Land Cover Classification

Ranga Raju Vatsavai, Varun Chandola, Anil Cheriyyadat, Eddie Bright, Bhaduri Budhendra, Jordan Grasser



Proliferation of several machine learning approaches makes it hard to identify a suitable classification technique for analyzing high-resolution remote sensing images. In this study, we compared ten classification techniques from five broad machine learning categories. Surprisingly, the performance of simple statistical classification schemes like maximum likelihood and Logistic regression versus more complex and recent techniques is very close. Given that these two classifiers require little input from the user, they should still be considered for most classification tasks. Multiple classifier systems is a good choice if the resources permit.

Keywords: Bayesian Classification, Trees, Neural Networks, MCS

Dealing with Large Schema Sets in Mobile SOS-Based Applications

Alain Tamayo, Carlos Granell, Joaquin Huerta

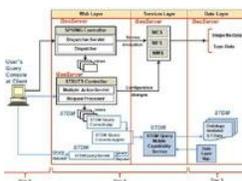


Although the adoption of OGC Web Services for server, desktop and web applications has been successful, its penetration in mobile devices has been slow. One of the main reasons is the performance problems associated with XML processing as it consumes a lot of memory and processing time, which are scarce resources in a mobile device. In this paper we propose an algorithm to generate efficient code for XML data binding for mobile SOS-based applications. The algorithm takes advantage of the fact that individual implementations use only some portions of the standards' schemas, which allows the simplification of large XML schema sets in an application-specific manner by using a subset of XML instance files conforming to these schemas.

Keywords: XML Schema, Web Services, Geospatial Information, XML Data Binding, Sensor Observation Services.

An Ontology-based Spatio-temporal Data Model and Query Language for Use in GIS-type Applications

Margaret Lyell, D. Voyadgis, M. Song, P. Ketha, P. Dibner



In this paper, we present a Web Ontology language (OWL) -based spatio-temporal data model that introduces the "spatio-temporal coordinate" concept and makes use of "temporal lifting". The ontology-based data model

captures application data features. A process for application data model development that incorporates spatio-temporal dependencies is presented. Standardized spatial concepts can be utilized. Spatio-temporal querying is supported; it makes use of the full data model. These concepts have been utilized in a prototype effort. The prototype was architected as a three-tier distributed, Web-based system. The middle tier, a query-answering layer, is incorporated into a Web-based Geographic Information System, GeoServer, while maintaining GeoServer's capabilities. The user's Query Console, architected as a Java applet, presents the ontology-based application data model to the user to support query formulation. The back-end data tier is extended by Managers that work with the ontology instance data to support faster access and query answering performance.

Keywords: Ontology, Spatio-temporal, Data Model, Query Language, GIS.

Short Paper Sessions

Short Paper Session I

Monday, May 23 8:40 AM - 9:50 AM

Meeting Room 307

Session Chair:

Dr. J.D. Blower, University of Reading, UK

Analyzing Tropical Cyclone Tracks of North Indian Ocean

Mukta Paliwal, Anand Patwardhan, N.L. Sarda



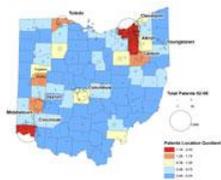
Cyclones are regarded as one of the most dangerous meteorological phenomena of the tropical region. The probability of landfall of a tropical cyclone depends on its movement (trajectory). Analysis of

trajectories of tropical cyclones could be useful for identifying potentially predictable characteristics. In this study, tropical cyclone tracks over the North Indian Ocean basin have been analyzed and grouped into clusters based on their spatial characteristics. For the identified clusters we have also examined characteristics such as life span, maximum sustained wind speed, landfall, seasonality. The resultant clusters are forming clear groupings on some of these characteristics. The cyclones with higher maximum wind speed and longest life span are grouped in to one cluster. Another cluster includes short duration cyclonic events that are mostly deep depressions and significant for rainfall over Eastern and Central India. The clustering approach is likely to prove useful for analysis of events of significance with regard to impacts.

Keywords: Cluster analysis, landfall, north Indian Ocean, trajectories, tropical cyclones

GIS Analysis of U.S. Patent Data: Examining Local Innovation Patterns

Jon Moore, Qian Cui



Current patent data in the United States provides limited spatial analysis capabilities within GIS applications. Most U.S. government data sources assign Federal Information Processing System (FIPS) codes or postal zip

codes which facilitate GIS data input. However, neither the U.S. Patent and Trademark Office nor the National Bureau of Economic Research assign location codes, or geocodes, in patent records or patent applicant data. Instead, patent records contain postal town or city place-names provided along with U.S. state locations. Place-names may not be unique within certain states and data from large cities can only be attributed over a wide area. This has resulted in most patent research to be analyzed only at the state scale of analysis. This paper presents a method for data structures

and geocoding that allows for geographical analysis of patents at the local (town, city and/or county) scale. This method is applied for data in Ohio from 2002 to 2006—the five most recent years of available data. The results show significant variability of data at the local scale. This variability is shown in terms of total patents, patenting by economic sector and for patent data standardized for the per capita labor force. The results also show the predominance of general manufacturing patents across the state, by comparison to specialized sectors. The results also illustrate two distinct innovation regions, along the I-75 corridor and in Northeast Ohio.

Keywords: Patents, business intelligence, GIS, innovation, Ohio

Query Rewriting in Spatial Database for Access Control

Zhen chen, Rongguo Chen, Jiong Xie, Mingbo Zhang, Changxiu Cheng, Yingdong Chen



Current database with numerous users requires access control. It is also needed in spatial database systems that keep both spatial attribute and non-spatial attribute safe. The query rewriting technology in spatial database is discussed in this paper. First the operations for merging authorization policies are discussed. By classifying the subjects and permit flag of the authorization policies, two operations, both intersection and union, are discussed with different purpose. And an algorithm for merging user's authorization policies is prompted. Then a view based query rewriting method is set up by replacing the all relations in the query with the corresponding view. That makes sure the fine-grained access control for the spatial database and spatial objects. Finally, a spatial database as an application is given to validate the effectiveness of query rewriting technology in spatial database.

Keywords: Fine-grained, access control, spatial database, query rewriting.

iGlobe: An Interactive Visualization and Analysis Framework for Geospatial Data

Varun Chandola, Ranga Raju Vatsavai, Budhendra Bhaduri



We demonstrate an interactive visualization and analysis system for integrating climate data with other geospatial data sets, such as environmental and demographic data. The iGlobe system is a desktop-based visualization and analysis environment which allows seamless integration of multiple geospatial data sets from varied sources and provides an interface to interactively analyze the different data sets and apply sophisticated data analysis and mining

Short Paper Sessions

algorithms in a near real time fashion. The framework is highly desirable in domains such as earth and climate sciences where great emphasis is placed on simultaneous analysis of different data sets such as remote sensing images, climate model simulation outputs, and other environmental and demographic databases, to understand weather and climate systems and the impact of climate change on nature and people.

Keywords: Visualization, Analysis, Geospatial, Spatiotemporal

Short Paper Session II

Monday, May 23 2:40 PM - 4:40 PM

Meeting Room 307

Session Chair:

Prof. Dr. Ge Jin, Purdue University Calumet

Road Extraction Using Smart Phones GPS

Zheng Niu, Songnian Li, Neda Poursaeid



GPS data crowd-sourced through smart phones is an emerging source of inexpensive data that can be used to provide real-time traffic information, identify traffic patterns, and predict traffic congestions. The same type of data can be very useful for cost-effective, fast updating of road network databases due to its rich spatial and temporal coverage and high data volume. This paper presents results of a study that extracts road geometry data using GPS data received from smart phones through a mobile traffic alert application. The focus is on the method for road centerlines and the study presents some promising results. It is expected the method can supplement, if not replace, the current practices of acquiring road network data using either traditional expensive and time consuming survey or remote sensing approaches.

Keywords: GPS data, road central line, algorithm, database

Service Chaining for Accessing Geospatial Information in Mobile Devices

Arindam Dasgupta, S.K. Ghosh



Technological advances in mobile devices as well as wireless networking are leading us towards a vision where mobile devices are utilized to access an array of geospatial web services in context of user specific geospatial information. Web Services enables pervasive accessibility of geospatial information in the mobile device and overcomes the physical location constraints of conventional computing. This technology is the perfect candidate, since a strong interoperable capability is the key requirement for sharing of geospatial data. The geospatial data can be useful

for decision making but the required information may not be always available only through the geospatial data services. The geospatial data essentially are required to turn into value added information. Thus, need of a geospatial data processing service is required which will be able to process geospatial data on-the-fly to resolve need of the mobile users. In this paper a framework has been proposed to provide value added geospatial information to the mobile users.

Keywords: Geospatial database, GIS, Spatial web services, Service Chaining

Routing-based Map Matching for Extracting Routes from GPS Trajectories

Terry Griffin, Yan Huang, Shawn Seals

This paper introduces a novel offline map matching approach.



We develop a routing-based map matching approach for standardizing identified routes in a collected GPS trajectories. Our approach first identifies key waypoints in a user's GPS trajectory using a modified Peucker curve reduction algorithm. Subsequently, it sends the key waypoints to a blackbox driving directions service which returns a route utilizing each of the key waypoints. The returned route is a standardized representation of the original GPS trajectory constructed using the minimum necessary set of points. A filter-and-rene approach is used to identify the incorrect portion of the returned route and a rene step is carried out by eliminating the waypoints which lead to the incorrect matching. Experiments results showed that the proposed approach works well for a dataset of 10 volunteers each collecting data an average of 34.3 days.

Keywords: Map-Matching, GPS, Web-based Services

Mining Social Media to Create Personalized Recommendations for Tourist Visits

Adrian Popescu, Gregory Grefenstette

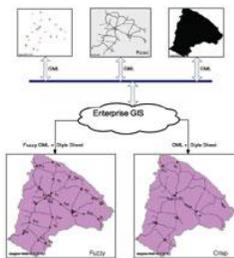
Photo sharing platforms users often annotate their trip photos with landmark names. These annotations can be aggregated in order to recommend lists of popular visitor attractions similar to those found in classical tourist guides. However, individual tourist preferences can vary significantly so good recommendations should be tailored to individual tastes. Here we pose this visit personalization as a collaborative filtering problem. We mine the record of visited landmarks exposed in online user data to build a user-user similarity matrix. When a user wants to visit a new destination, a list of potentially interesting visitor attractions is produced based on the experience of like-minded users who already visited that destination. We compare our recommender to a baseline which simulates classical tourist guides on a large sample of Flickr users.

Keywords: Collaborative filtering, tourist photographs, photo collections, Flickr, personalization, landmarks, recommendation

Short Paper Sessions

Formalizing Fuzzy Spatial Data Model for Integrating Heterogeneous Spatial Data

S.K. Ghosh, Indira Mukherjee



The geospatial information is becoming a major input for various decision making processes. The heterogeneity in the spatial data sets, usually collected and maintained by diverse organizations in their proprietary formats, poses a serious challenge for the integration process. Thus, the first step in this integration process is to develop a standardize geospatial data model from the individual data models. Then the model needs to be encoded in standard schema (GML) and the spatial web services need to be instantiated. Typically, an Enterprise-GIS (E-GIS) framework incorporates the OGC compliant geospatial web services for integration of heterogeneous spatial data sets. Further, the fuzziness exists in the properties of the geospatial objects and their relationships. Thus, there is a need to incorporate the fuzzy characteristics in the data model (application schema) of the E-GIS framework. The present work proposes a fuzzy geospatial data modeling technique for generation of fuzzy application schema. An approach for formalizing the fuzzy model using description logic has also been attempted. The formalization facilitate automated schema mapping required for the integration process. The efficacy of the proposed methodology has been demonstrated with help of an example.

Keywords: Spatial Data Model, Fuzzy Data Model, Enterprise GIS

Workflow Technology for Geo-Processing: The Missing Link

S. Migliorini, M. Gambini, A. Belussi, M. Negri, G. Pelagatti

Nowadays GIS users have at their disposal an unprecedented amount of spatial information, thanks to the growing acquisition capacity of the applied survey techniques and instruments, and to the development of Spatial Data Infrastructures and OGC Standards for sharing distributed spatial data. In this context there is the need for new GIS applications that cross the boundary of a single organization and are flexible enough to adapt to the environmental changes. This paper evaluates the applicability of the emerging workflow technology for developing new GIS distributed applications that combine automatic services and human interactions, and are able to deal with large amount of spatial data during long-running processing tasks. Moreover, the limits of this technology when applied to the geographical context are highlighted and some possible solutions to these limitations are proposed.

Keywords: Geo-processing workflow, Spatial Data Infrastructure, collaborative processes

Citizenship Through Data Sharing in the Amazon Region

Jorge Xavier da Silva, Tiago Badre Marino

Efforts to promote digital, social and environmental inclusions the Central Amazon Region are being made. The Federal Government and some universities plan to mobilize over forty thousands high school teachers and their students to grow as citizens, portraying through their own and unbiased perception the environment from which they emerged. The Rio de Janeiro Federal University (UFRJ) developed a web based system through which high school students are able to upload to



Internet, after screening procedures, all kinds of data (textual, pictures, videos, files) of their choice, using low cost equipments (GPS, digital cameras and notebooks) and simple system interfaces. During 2010, a pilot project has been applied to 48 high schools of the Santarem Municipality, Pará State, in the Central Amazon Region. The basic structure, procedures and some already obtained results are made available in the present paper, documenting one more example of data processing technology promoting citizenship in an emblematic region of Brazil.

Keywords: Amazon Region, data sharing, citizenship, geoprocessing, geographic information system, education, government, census

Distributed Image Processing and Classification for GIS Based Disaster Management and Communication System

Ge Jin, Babara Nicolai, Keyuan Jiang, Charles Winer



Natural disasters, such as hurricanes, tsunamis and earthquakes cause huge loss of life, enormous amounts of property damage, and lengthy recovery times. Although it is impossible to avoid the costs of disasters, human sufferings can be minimized through effective disaster management and decision support system that can facilitate and expedite the resource distribution process more efficiently and effectively. In this paper, we utilized the high performance computing resources at Purdue University Calumet (PUC) to develop a disaster data management, visualization and decision supporting system that focuses on North West Indiana region. This paper focuses on three research objectives: 1) development of web-based disaster data management and communication system, 2) fast distributed computation of disaster related damage assessment and resource distribution strategy utilizing Miner Cluster, 3) interactive visualization of disaster affected populations, resource centers, as well as the resource distribution strategy. This research provides an efficient way for the local government agencies to process and manage

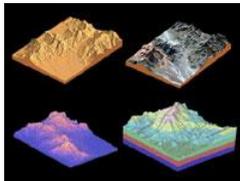
Short Paper Sessions

disaster related information under adverse disaster conditions.

Keywords: Disaster Management and Communication, GIS, Grid Computing, Visualization

GPU-Based Fast Volumetric Terrain Modeling for Volumetric GIS

D. Liao



The ability to integrate and process volumetric information has recently become increasingly desirable in traditional GIS. Volumetric GIS (VGIS) is a new, challenging, and promising field. However, due to the lack of the

volumetric data source, many research activities in volumetric GIS have not been further carried out deeply. This paper proposes a GPU-based fast volumetric terrain modeling technique using standard graphics hardware. Using this technique can generate the volumetric terrain data from traditional geometric terrain data, such as Triangulated Irregular Network (TIN) or Digital Elevation Model (DEM), at interactive time or even in real time. To achieve fast volumetric terrain modeling, this algorithm makes use of standard OpenGL features to apply GPU acceleration to solid terrain slicing and other graphics operations. Some experimental volumetric terrain results based on USGS DEM data are shown in the paper. The conclusions and further works are described in the end.

Short Paper Session III

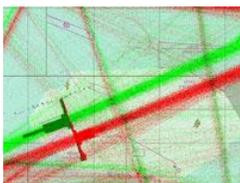
Tuesday, May 24 8:30 AM - 9:30 AM

Meeting Room 302

Session Chair:

Prof. S. K. Ghosh, Indian Institute of Technology, Kharagpur, India

Hazard Identification by geo-referenced Tracking of seagoing Vehicles



Reinhard Mueller, Petro Braverman, Michaela Demuth

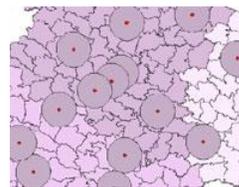
Tracking and tracing are well established methods used in various applications for pure observing, process prediction or automation. RADAR (Radio Detection and Ranging) was the very first technology in target detection and target tracking – launched by the maritime industry. The next milestone was reached by the transponder technology decades later. Today both technologies operate side by side or in a complementary manner. This paper will introduce a method for vessel traffic tracking in special navigational sea areas with recommended traffic rules based on the transponder technology AIS

(Automatic Identification System). The goal of this application is the appropriate supporting of ship masters in cases of a detected hazard potential during high traffic density passages. The paper will also discuss the results of a realized case study executed in the Baltic Sea.

Keywords: AIS, electronic sea chart, hazard identification, rule violation, radio communication, self-controlling monitoring, vessel traffic

A Geospatial Framework for Mapping of Electromagnetic Radiations

Saswati Ghosh, Arindam Dasgupta, S. K. Ghosh



The electromagnetic radiations from the various electronic equipments, such as transmitters for broadcasting of radio/TV and mobile communication, are the major sources of electromagnetic pollution. This is creating a potential hazard for public health. This work aims at mapping the electromagnetic field over population map through open geospatial standards. This may facilitate proper management of man-made electromagnetic radiations and monitoring of public health.

Keywords: Electromagnetic field, GIS mapping

A Service Visualization Tool for Spatial Web Portal

Chen Xu, Chaowei Yang, Jing Li, Jizhe Xia, Xin Qu, Myra Bambang, Yan Xu, Dan Fay



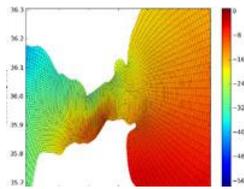
This paper introduces the design and development of a client-side graphical user interface (GUI) for the NASA Spatial Web Portal. A spatial web portal is an entry point to spatial data and services within spatial platforms. The usability and efficiency of the entry point will decide the success of the entire system. This paper describes visualization and GUI designs and implementation for improving client performance. Abundant information about web service is tightly grouped into different floating windows for better information display. Asynchronous JavaScript and XML (AJAX) technology is implemented to enhance visualization performance. The mirror world tools such as Google Maps, Bing Maps, and NASA World Wind provide new mechanism for spatial data discovery and visualization. We test how the methods utilized along with Bing Maps improve the performance of the NASA Spatial Web Portal.

Keywords: Geospatial web portal, spatial web service, visualization, GUI

Fast Regridding of Large, Complex Geospatial Datasets

J.D. Blower, A. Clegg

Short Paper Sessions



In the earth sciences, data are commonly cast on complex grids in order to model irregular domains such as coastlines, or to evenly distribute grid points over the globe. It is common for a scientist to wish to re-cast such data onto a grid that is more amenable to manipulation, visualization, or comparison with other data sources. The complexity of the grids presents a significant technical difficulty to the regridding process. In particular, the regridding of complex grids may suffer from severe performance issues, in the worst case scaling with the product of the sizes of the source and destination grids. We present here a mechanism for the fast regridding of such datasets, based upon the construction of a spatial index that allows fast searching of the source grid. We discover that the most efficient spatial index under test (in terms of memory usage and query time) is a simple look-up table. A kd-tree implementation was found to be faster to build and to give similar query performance at the expense of a larger memory footprint. Using our approach, we demonstrate that regridding of complex data may proceed at speeds sufficient to permit regridding on-the-fly in an interactive visualization application. For large datasets with complex grids, the new mechanism is shown to greatly outperform algorithms used in many scientific visualization packages.

Keywords: Regridding, GIS, Web Map Service, visualization, curvilinear grids, spatial index

Short Paper Session IV

Tuesday, May 24 8:30 AM - 9:30 AM

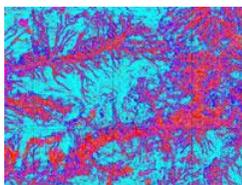
Meeting Room 301

Session Chair:

Prof. Dr. Ge Jin, Purdue University Calumet

Landslide Hazard Mapping Using Geospatial Models

Saro Lee, Chandra Prakash Poudyal



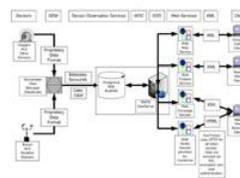
The purpose of this study is to map landslide hazard in Panchthar area, Nepal. The landslide hazard map was made and validated using frequency ratio, logistic regression and artificial neural network models with a geographic information system (GIS). The landslide locations were identified in the study area from interpretation of aerial photographs and checked by field survey. A spatial database of the topography, geology and land use was constructed and the 10 landslide-related factors were extracted. Using these factors, the hazard to landslides was analyzed using the 3 models. The validation result showed that the frequency ratio, logistic regression and artificial neural network models had 82.2%, 81.6% and 78.3% accuracies, respectively, representing an overall satisfactory agreement, with the

frequency ratio model giving the best result. The generated maps could be used to estimate the hazard to population, property and existing infrastructure such as the transportation network.

Keywords: Landslide hazard, Aerial Photograph, Frequency ratio, Logistic regression, Artificial neural network, GIS

GeoTempo: A Modular, End-to-End OGC Sensor Web

Richard Beck, Kevin Kriegel, Mariusz Stanis, Douglas Miller, Dan Gray, Robert Frohn, Joseph Brunner, John Dobbins, Phil Ardire, James Lein, Robert South, James McLaughlin, Charles Lambert, Lake Erie



Environmental information is valuable for monitoring and remediation efforts only if the location and time of acquisition are recorded in parallel with other parameters such as temperature, pH, pCO₂ etc. Similarly, environmental information must be searchable and retrievable on the basis of geolocation and time of acquisition as well as other parameters such as sensor type, measurement type, measurement value, units of measure and keyword among others. Here we describe one specific and successful strategy for the implementation of geospatially and temporally-enabled cyber-infrastructure focused on open source geospatial standards (Open Geospatial Consortium or OGC), network protocols, operating systems, database software and geospatial extensions. This paper describes a real-world OGC-compliant sensor web for environmental monitoring and mapping of terrestrial and aquatic invasive species with geospatial and temporal query capabilities called GeoTempo as demonstrated in the Great Lakes region of the United States and Canada.

Keywords: Sensors, Sensor Web, Standardization, Interoperability.

An Improved MTF Compensation Restoration Algorithm for Remote Sensing Image

Yaqiong Chai, Zhongkui Feng, Dongkai Qi, Qing Guo



This paper proposes an improved modulation transfer function compensation restoration algorithm for remote sensing image based on inverse filtering, a traditional image restoration method. The improved algorithm is accomplished by optimizing the compensating curve shape and the compensating factor. The quality of resultant image is better than before and the quantitative results are satisfying. Moreover, the optimal algorithm is adaptive to various remote sensing images and it overcomes the limited adaptability of former work.

Short Paper Sessions

Keywords: MTFC; Remote sensing image; Algorithm; Image Restoration

Demo Talk:

Surf the World from Your Lap - Intelesense Demonstrates IVJ-Mobile on iPad

Kevin Montgomery



IVJ-Mobile from Intelesense Technologies is now running on the Apple iPad (as well as iPhone and Android devices), and provides access to over 1M layers of geospatial data at your fingertips from anywhere. Inteleview is built

on top of the NASA WorldWind core engine, but extends its capabilities via the Intelesense Data Exchange- a massive data integration platform with collaboration portals to empower people to connect, share, and work together.

Tech Talks & Demo Talks

Session I

Monday, May 23 8:40 AM - 9:50 AM

Meeting Room 308

Session Chair:

Dr. Frank Hardisty, Pennsylvania State University

Coastal Resilience: An Ecosystem-Based Coastal and Marine Spatial Planning Framework

George Thomas Raber, Zach Fredana

Coastal Resilience is an ecosystem-based coastal and marine spatial planning framework that utilizes sea level rise, storm surge, ecological, and socioeconomic spatial information to identify and implement ecosystem-based adaptation strategies (<http://coastalresilience.org>). Starting in Long Island in NY, the Coastal Resilience team has worked with local communities to map sea level rise and other coastal hazards alongside natural resources and human communities at risk. Communities are able to visualize this information via a web-based spatial decision support tool and identify potential impacts and adaptation options that can be implemented within their existing planning and regulatory frameworks. The Coastal Resilience project has expanded to multiple sites around the United States, including in the Gulf of Mexico, where it is now being used in the Gulf Restoration Decision Support tool (<http://GulfRestorationDS.org>) to help identify coastal habitat restoration sites (i.e. oyster reefs, salt marshes) that best benefit human communities. To date, three related but distinct web applications have been developed with similar goals, interface and architecture that all share a common code base. The individual sites are hosted on the Amazon cloud and utilize Esri's ArcGIS server technology. The client interface relies on the ArcGIS Javascript API, and has been developed in a modular, data driven approach. For example, in those Coastal Resilience applications that contain future sea-level rise and/or storm surge data, tools for analyzing and visualizing this data are automatically added to the web application via the application code base, relying on the data and services by utilizing a specific data model. When additions or modifications are made to the data the changes are posted to the site without modifying the code base. This is true for a number of other tools including a restoration analysis dashboard. The technical talk will focus on the architecture, data model and the project background.

Balancing Need with Numbers: Assessing Need by Downscaling and Weighting Vulnerability Data with Population Density

John J. Boos

Hurricane Katrina showed Americans and the world that disasters can happen wherever there are people and clearly illustrated that being poor, old (or young), a minority, or a female puts one at greater risk to suffer negative short- and long-term impacts, with people with more than one of these characteristics having even a higher risk (Laska and Morrow 2006). In other words, belonging to these groups makes one



more vulnerable. Hurricane Katrina also illustrated how actionable information on the degree of vulnerability must be balanced with the numbers of people affected. In other words, in order to maximize the

effectiveness of public resources, it may sometimes be necessary to focus on more densely populated areas with lower rates of social vulnerability because, due to the sheer number of people, there are actually more vulnerable people located in these areas than in areas with high rates of vulnerability and lower population densities. This research mathematically weights vulnerability data with 90 meter residential gridded population data from LandScan USA (Bhaduri et al. 2007) to create a dataset that provides more actionable information to local authorities who need to balance rates of need with the number of individuals affected to ensure an efficient use of limited resources. The methods explored by this research successfully integrate vulnerability data with high resolution gridded population data. Based on the analyses it can be stated that the resulting population-weighted vulnerability data is significantly different from the unweighted vulnerability data and selectively different from the population data depending upon population density. More importantly, the method explored by this research allows for the combination of vulnerability and population density (two factors that are often examined separately) to create a surface with very high spatial resolution (90m) that shows where the greatest need is based both upon the levels of vulnerability and the number of people who are affected.

Interior Space GIS: A Foundation for Campus-wide Planning and Management

Peter Sforza, Thomas Dickerson, Jason Shelton



Virginia Tech is in the process of integrating building floor plans into an enterprise GIS to improve campus planning and management. Although Virginia Tech has maintained separate

mapping of interior and exterior features for many years, the completion of this project will mark the first time the campus has combined these in a unified viewing environment. By updating the format of the interior space mapping and placing it in a geospatial context, new modes of interaction, analysis, and visualization will be possible. Examples of ways the interior space GIS may be used include: space accounting and management, fixed asset and hazardous substance mapping, precise E-911 response and situational awareness, way finding and evacuation routing, visualization of campus populations by day and time, and links to other documentation stored in the digital plans library or work order management system. The interior space GIS will be a generalized depiction of interior spaces based on existing floor plans. As Building Information Model (BIM) files become available for newly constructed buildings, and interior space surveys improve the mapping of existing buildings, the accuracy of interior space GIS will improve.

Tech Talks & Demo Talks

Onigokko: A Pervasive Tag Game for Spatial Thinking

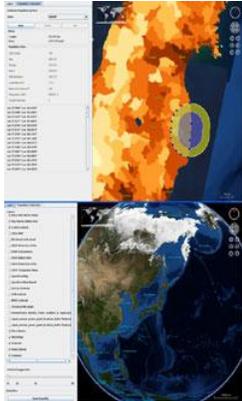
Wanglin YAN, Tatsuya Maeda, Akihiro Oba, Chisho Ueda



This article considers the development of a traditional Japanese tag game, Onigokko in terms of critical spatial thinking. Camera-embedded GPS mobile phones are used as a tool for positioning, touching, and communicating. A web server is used for planning games, monitoring the movements of teams and sharing information among players. Using city streets or country villages as playgrounds, team members collect points by visiting checkpoints and touching (i.e. taking photographs) enemy teams. Real-time communications by mobile phones enable players to think spatially and move strategically. The experiment demonstrates that the system functions well. The game is perceived as thrilling and is therefore able to foster a remarkable improvement in critical spatial thinking.

Global Climate Change and Human Health Impacts: Investigation and Analysis in the Classroom Using Innovative Technologies

Sneha Rao, Mark Becker, Amy Work



The objective of the NASA Global Climate Change Education (GCCE) project is to provide educators at the elementary, secondary, and undergraduate levels the tools and resources to access NASA climate information and related Earth system information, in order to engage students in critical thinking about global climate change and the potential impacts on human health across the planet.

This project incorporates NASA climate change information and other Earth system information related to human health into NASA World Wind, an open source 3-D visualization tool. World Wind uses OGC-compliant Web Coverage Services (WCS) and Web Map Services (WMS) that allow zooming in from satellite altitude to any location on the Earth's surface. Student lessons will use climate data made available through the enhanced NASA World Wind interface to explore potential impacts on human health in areas of food security, water security, and infectious disease. Two existing Web-based resources, the Climate Mapper tool from IAGT and the Population Estimation Service from SEDAC, will be merged and made available through a customized NASA World Wind interface that will launch from the Web.

This merger of two NASA-supported tools will allow the technical component and parametric statistics to be applied

to additional climate- and human health-related data sets from CIESIN, such as world population grids, malnutrition levels related to changes in temperature and precipitation that would impact staple food production, population displacement related to rising sea levels, and spatial epidemiology of vector-borne diseases and population access to a public health infrastructure.

Demo Talk:

The Geospatial Revolution Project

Penn State Public Broadcasting, Frank A. Hardisty



Penn State Public Broadcasting has produced the Geospatial Revolution Project, an integrated public media and outreach initiative about the world of digital mapping and how it is changing the way we think, behave and interact. With the goal of increasing public awareness of geospatial technologies, the project offers four 15-minute online mini-documentary episodes, 3-minute shorter chapters, as well as K-16 educational materials. The episodes share compelling human stories that clarify the complex and decode the mysterious, explain the virtues and explore the potential dangers of these emerging technologies. The Geospatial Revolution Project explores the seamless layers of satellites, surveillance, and location-based technologies creating a worldwide geographic knowledge base vital to solving myriad social and environmental problems in the interconnected global community.

Session II

Tuesday, May 24 2:30 PM - 4:30 PM

Meeting Room 302

Session Chair:

Dr. Ray Renner, Northrop Grumman Corp.

Hazus Risk Assessment Software Has Integrated into Federal Geospatial Planning

Eric Berman

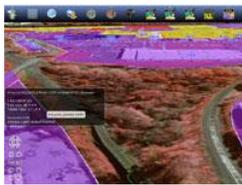
Hazus-MH is FEMA's powerful regional loss estimation methodology and software application that enables users to quantify losses from earthquakes, hurricanes, and floods. In Hazus, current scientific and engineering knowledge is coupled with the latest GIS technology to produce estimates of potential loss of life and property (i.e. critical facilities, economic loss, and displaced households). Hazus has evolved from a "community-centric" tool that has been used for state and local risk assessments and mitigation planning to a geospatial tool that has been widely integrated into the mainstream of federal geospatial planning and consequence assessments. Hazus program manager, Mr. Berman will discuss the recent advances made in Hazus technology, including the development of the Comprehensive Data Management System (CDMS) geospatial web portal to

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support integration of mapping statewide data. Mr. Berman will also discuss how Hazus has been utilized by other federal agencies, including the U.S. Geological Survey, in an ongoing effort to develop a robust, scientifically-based model with inventories that are mission critical to federal and state users. Hazus is also major component of the DHS Geospatial Concept of Operations (GeoCONOPS), a multi-year initiative to promote the application of geospatial technologies to support federal response and recovery under the National Response Framework.

Spatial Data Infrastructure-Northwest

Brandt Melick



Innovators across the Northwest seek to engage Com-Geo attendees in dialog on groundwork underway in Oregon to leverage Open Source Solutions (OSS) and advance National Spatial Data Infrastructure (NSDI) with a new initiative called SDI-Now (Spatial Data Infrastructure - Northwest). Agencies across Oregon have begun evaluating and testing NASA World Wind (WW) JAVA SDK as enabling technology for vertical and horizontal data sharing at the local level (complex public works infrastructure with private engineering firms), data sharing at the regional level (county-wide address information, cadastral information, land use information, and political boundaries), data sharing at the state level (state-wide elevation information and hydro systems) and data sharing with federal agencies.

Specific business areas include managing local electronic assets (facilities inventories), coordinating data flows between regional consortia that manage the regional land information systems, and serving large dynamic remote sensing data sets such as climate, imagery and elevation (LiDAR). The State's Elevation Framework Implementation Team, the Pacific Northwest Hydro Community, the City of Springfield and many others from government, education, federated tribes and the private sector are evaluating new methods to overcome age-old problems regarding NSDI implementation. The presentation will focus on challenges, user needs and key advances under investigation with empowering OSS such as WW. In short, this talk will be needs based and WW centric – rich with the nuances of local SDI.

Demo Talk: Rolling Thunder Demo using WorldWind for Java

Anthony Dale Anecito

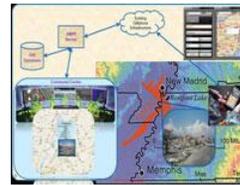


Rolling Thunder is a Service Oriented Architecture based Information System that uses Java technology. The Service features include but not limited to 3D mapping, Video, Testing, Internet search and browsing. The development started over 10 years ago and continues to evolve today. Special focus was given to 3D mapping using NASA WorldWind for Java library and is downloaded daily by Universities, Government agencies,

Companies and individuals from all over the world. Unique capabilities were added such as being able to run a filter against the 3D map and making a layer semi-transparent to name a few. Web Service support for mapping meta-data and lists were added several years ago and are evolving monthly. With the current features such as support for over 13 video formats including web cams and built-in browser support expect to see unique and highly valued combination of information for 3D mapping to be available soon for Demos.

Situation and Incident Reporting System (SIRes)

Ray Renner, Zohra Hemani, Harold S. Pio, Matt Moran, Ellins Thomas, Alejandro Vargas



Smart phones have been used informally in several large disaster responses in recent history. The Situation and Incident Reporting System (SIRes) is an experimental system designed to build formal GIS tools for collecting and reporting disaster response information in real-time. SIRes quickly clarifies the ground situation utilizing smart phone technology and database tools allowing for rapid situational awareness and response from the scene of the disaster. SIRes allows real-time reporting from on-site personnel to automatically populate command center databases with information. This information is shared with other on-site personnel and displayed/analyzed at the command center using software tools for information analysis. The SIRes mobile apps provide an inexpensive way to provide a large scale disaster response system across a large variety of organizations and personnel.

A Comparison of Mobile GIS Development Options on Smart Phone Platforms

Ray Renner, Zohra Hemani, Harold S. Pio, Matt Moran, Ellins Thomas, Alejandro Vargas



The availability of smart phones and the wide spread use of GIS consumer products on smart phones has given rise to a substantial expectation of GIS applications on mobile platforms. This talk examines three of the mobile operating systems (OS) and the GIS development options for those OSs. This talk details our experience with using Google's Android, Microsoft's Phone 7, and Apple's iOS for pervasive and mobile GIS application development. The comparisons of the development environment for the three main smart phone platforms is done by developing similar GIS visualization, data collection, and real-time reporting applications. The talk discusses the development choices for each platform, our choice of the development options for the applications, and the lessons learned from the application development. The talk outlines the pros and cons that were discovered for three mobile platforms for the applications that we developed and discusses the conclusions of the comparison.

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Development of an ESRI ArcToolBox for Semi-Automated Building Modeling from MultiPatch Features

Marvin D. Watts, Elizah S. Dasari, Shahrouz K. Aliabadi



This paper briefly describes the development of an ESRI ArcToolBox that leverages commercial-off-the-shelf (COTS) software for the semi-automated generation of Open Geospatial Consortium (OGC) CityGML standard level of detail one (LoD1) and two (LoD2) building models from high resolution imagery and digital elevation models (DEM) for use in blast analysis applications. The ArcToolBox consists of Overwatch Systems Feature Analyst (v4.2), ESRI ArcGIS (v9.2) ModelBuilder, and the Safe Software Feature Manipulation Engine (v2010). This work is part of an on-going project to improve the blast damage predictions and calculation of evacuation distances for explosions in urban environments through development of a fast-running, easy-to-use desktop tool that would combine updated correlation modeling for urban blast and fragmentation with improved semiautomated geometry modeling techniques.

3D City Site Model Extraction through Point Cloud Generated from Stereo Images

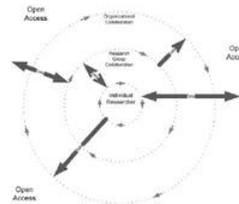
Bingcai Zhang, William Smith



It is a grand challenge to automatically extract 3D city site models from imagery. In the past three decades, researchers have used radiometric and spectral properties of 3D buildings and houses to extract them in digital imagery with limited success. This is because their radiometric and spectral properties vary considerably from image to image, from sensor to sensor, and from time to time. The locations and shapes of 3D buildings and houses are invariant and painfully obvious in a terrain-shaded relief image generated from a point cloud. Based on this observation, we have developed AFE (Automatic Feature Extraction) that can automatically extract 3D city site models from a point cloud which is automatically generated from stereo images. Point cloud generation from stereo imagery is a key technology which has been used in the geospatial industry for more than two decades. We have developed NGATE (Next Generation Automatic Terrain Extraction) that matches every pixel across all selected stereo image pairs. For each XY location, an array of Z coordinates are computed from a number of different stereo image pairs using a voxel 3D grid. The voxel 3D grid is statistically filtered for outliers and weighted averaging is used to generate a very dense and accurate point cloud. The AFE algorithms consists of the following components: identify and group 3D building and house points into regions; separate buildings and houses from trees; trace region boundaries; regularize and simplify boundary polygons; construct complex roofs.

WorldMap: A Strategy to Allow Researchers to Scratch Their Itches Online Thereby Improving Data Access for All

Benjamin Lewis



The Center for Geographic Analysis is building WorldMap, an open source, cloud-based platform to promote collaboration around geospatial information (<http://worldmap.harvard.edu/alpha>). Despite the plethora of ways in which research materials can now be shared on the web, geospatial information lags despite enormous potential for creating new knowledge through its unique ability to cut across disciplines.

The reasons for the lag are many and interconnected: 1) lack of a platform which supports even basic real time geospatial collaboration, 2) lack of a platform that is easy to obtain and install, 3) the sparse implementation of standards for geospatial interoperability, 4) the size and complexity of geospatial datasets, 5) the lack of an incentive for researchers to upload geospatial datasets to a system that supports eventual sharing.

Taken together these factors are recipe for stagnation despite the arrival 6 years ago of the Google Maps API and KML. Where is the Apache of the spatial world to spur a grassroots geoweb and bring it to the broad range of public, private and non-profit organizations that need it, and to non-GIS trained researchers wherever they may be?

WorldMap is an attempt to nudge the ball forward in theory and practice. The concept is to allow anyone to upload and publish data to the web, control how data is represented, and to control access to one's data. Users will also have a range of data exploration tools and eventually online annotation, editing, and analysis. By letting researchers use the system to "scratch their own itch" we hope to take a page from successful attempts to crowdsource the development of other complex public goods such as collections, software, and encyclopedias. The reason so much valuable geodata resides on personal hard drives is not people don't want to share, it is because because doing so does not appear to be useful, easy, or fun.

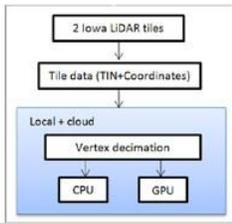
This talk will demonstrate the functionality of the current version of WorldMap as a potential collaboration platform, then will talk about ideas for future enhancements, and solicit feedback on the platform and how it could be improved.

GPU-based Cloud Performance for LiDAR Data Processing

Ramanathan Sugumaran, Dossay Oryspayev, Paul Gray

Goal of this paper is to compare the timing/performance results of CPU and GPU on local and Cloud platform for processing massive Light Detecting and Ranging (LiDAR) topographic data. We have used locally various multi-core

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CPU technologies as well as GPU implementations on various graphics cards of nVidia which support CUDA, where as a cloud computing infrastructure utilized various components of the Amazon Web Services (AWS). In order to study the performance,

we have developed and implemented vertex declimation algorithm for data reduction of LiDAR point cloud. Our presentation will demonstrate the preliminary results by comparing the multi-core CPU and GPU based implementations of the code, as well as the comparison with cloud performance.

Demo Talk: A Multi-Tenant Cloud-based Full-function GIS

Eamon Walsh

Cloud computing in itself is not sufficient be provided GIS as an on-line service at low cost to organizations ranging from individuals to thousands of users. "Multi-tenancy" is a technology that allows cloud computing resources to be shared amongst multiple organizations so as to offer full-function GIS on-line at low cost to organizations ranging from individuals to thousands of users. This presentation will cover:

1. How multi-tenancy works, and how it differs from hosting existing web / server GIS in the cloud. How it makes it possible to (1) Provide at a low cost GIS functionality equivalent to desktop GIS to organizations of scales ranging from individuals to thousands of people; and (2) Make GIS solutions instantly available "on demand" to new adopters.
2. This will have a critical business impact of this technology on GIS by dramatically lowering cost, reducing start-up time, and increasing flexibility compared with traditional GIS and with simpler cloud hosting approaches.
3. A working multi-tenant cloud-based GIS can be demonstrated, from creation of a service for a new organization, through loading data and adding users, to GIS use. Experience of deploying this technology shows new types of users starting with GIS as a Service, with high expectations of ease of use and of an instantly availability.

Processing LiDAR Data to Visualize Soil Erosion and Analyze Slope Stability

Ashraf Ghaly

LiDAR data can be used in many engineering applications. These applications include, but are not limited to, highway engineering, land development, pipeline mapping and leak detection, power line mapping, cell tower mapping, forestry, mining, flood study, coast erosion, etc. The State of New York (NYS) has collected LiDAR data that cover significant area of the state. This data is made available for educational and research purposes. Data that covers the Mohawk River spans a number of counties and involves areas of the river where there has been significant meander migration and bank erosion. Due to the unstable nature of the soil forming the riverbanks and the considerable steepness of slopes at many

locations, displacement, settlement, yielding, and even failure, of the foundations of some structures have been recorded. The goal of the present study was to use the LiDAR data provided by NYS to map the slopes along the banks of the Mohawk River and to detect areas where steep slopes could critical indicators of imminent failure. The data was also used to identify sections of the river where, due to sharp bents, erosion may be accelerating resulting in faster meander migration. Detecting these phenomena at early stage is key toward the prevention of catastrophic failure that can result in loss of life and property.

Performance vs. Productivity in the Context of ArcGIS Server 10

Brendan Collins

While many programming languages excel in their ability to execute commands quickly, other embody a greater focus on programmer productivity and clear syntax. In ESRI's GIS software package is written in C#, Visual Basic, Java, or C++, all more difficult languages to learn than Python, but also much faster. In modern web programming, ArcGIS Python scripts are now making their way into the server, sometimes at the expense of application performance and stability. I have explored the idea of code performance vs. programmer productivity in the context of ArcGIS Server by writing several web-based geoprocessing services in both Python and C# ArcObjects. The goal was to identify the class of tools which are best developed using one technology or the other, either based on performance or ease of development. From the outset, I made the assumption that under equal circumstances, it is easier to develop a service in Python, but that C# will always execute faster. The different geoprocessing services were divided into three categories: raster-based, and server utilities. The services had different inputs and outputs ranging from text to polygons to zip files. Multi-Mechanize web performance and load testing framework was used to automate requests, logging responses, and compiling statistics. Using this framework, I was able to make an assessment of the exact types of geoprocessing services which should be built using python, and which should be avoided.

Session III

Wednesday, May 25 9:00 AM - 10:30 AM

Meeting Room 307

Session Chair:

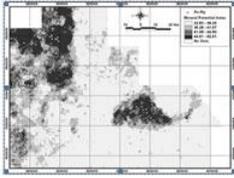
Dr. Frank Hardisty, Pennsylvania State University

Integration of Mineral Potential Maps from Various Geospatial Models

Saro Lee

The purpose of this study is to map mineral potential in Gangreung area, Korea. The mineral potential map was made and validated using likelihood ratio, logistic regression and artificial neural network models with a geographic information system (GIS). Moreover integration of the models

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has applied to get the better accuracy than each model. For this, the factors related to Au-Ag mineral occurrence were compiled in the GIS database. The factors are the geological data of lithology and fault structure, geochemical data. Using these factors, the potential of mineral were analysed using the 3 models. The validation result showed that the likelihood ratio, logistic regression and artificial neural network models had 83.70%, 81.91% and 77.37% accuracies. But the integrated mineral potential map, prediction accuracy was 92.94%. The generated maps could be used to not only predict known areas of Au-Ag occurrence, but also identify areas of potential mineralization where no known deposit occurs.

Natural Resources Data Management System (NRDMS) – A Suite of Web-Accessible Geo-Spatial Data Processing Tools for E-Governance in India

P.S. Acharya, S.K. Ghosh, S.C. De Sarkar

The National e-Governance Plan (NeGP) of India aims at making all government services accessible to the citizens through common service delivery outlets. It also seeks to ensure efficiency, transparency, and reliability of such services at affordable costs. A huge nationwide ICT infrastructure comprising of more than one lakh Common Service Centres (CSCs) for approximately six lakh villages, Statewide Area Networks (SWAN) for network connectivity to the lowest administrative levels, and State Data Centres (SDCs) for hosting state level e-Governance applications and data are thus being set up. Government departments, like, Land Records, Police, Property Registration, Agriculture, Employment, Watershed Management, Disaster Management, and local level elected bodies like Panchayats (village clusters) and Municipalities etc. involving geographic information, geo-spatial data and processing tools assume significance.

Finding the Farm: Postal Address-Based Building Clustering

Christopher Eby, Alice Armstrong



Geocoding, the act of mapping place names and addresses to locations on digital maps, is an important feature of many geographical information systems. Yet, traditional geocoding algorithms can be very inaccurate, especially in rural areas. Land plot maps maintained by local governments can be used to increase accuracy but are not always available. A constraint satisfaction method proposed by Michalowski and Knoblock has the potential to greatly increase accuracy by exploiting two widely available datasets, phone book addresses and building locations derived from aerial photographs, but it may still be inaccurate when the number of buildings does not correspond to the number of addresses.

Therefore, this research investigates the accuracy of a method of taking addresses and building locations and grouping the buildings into clusters where each cluster contains the buildings present at a single address. The k-means, complete-link, and a minimum spanning tree-based clustering algorithm are all tested on building locations gathered from aerial photographs of predominantly rural Fulton County, PA, to determine which method creates the most accurate clusters. A secondary hypothesis is tested to find whether geolocating to a cluster centroid or to the building within the cluster that is closest to the road produces locations closer to the address locations provided by Fulton County. If the results of these two experiments yield accurate results, they can be used as an important preprocessing step in a geocoding system based on Michalowski and Knoblock's method.

Biodiversity Conservation GIS: Using Geographic Information Systems to Support Conservation Management Decisions

Samira MOBAIED, Nathalie MACHON, Bernard RIERA

Global changes threaten natural ecosystems that are collapsing and even completely disappearing. Their conservation is a priority to halt the biodiversity loss, and is currently assured by conventions and programmes that aim at maintaining and restoring natural habitats. Different management methods have to be used to keep them in a favourable state of conservation, like the control of the natural succession and of the physical structure of the vegetation. The European heathland habitat is a typical example of such an active management. We present here the results of three studies that have been developed using GIS to support and improve heathland conservation management.

GPS-Tagged Images Define the Trail of an Interdisciplinary Miniterm in Egypt

Ashraf Ghaly



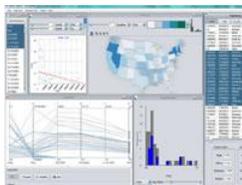
Egypt has one of the oldest civilizations of the world. Its history is rich with events and its land still hides a lot of mystery. With the Mediterranean Sea to the north and the Red Sea to the east, Egypt enjoys a strategic location on the map of the world. Furthermore, for its beautiful nature, mild weather, endless beaches, and rich history, Egypt is a major tourist attraction. A three weeks miniterm has been developed to introduce students to many of the major features of ancient and modern Egyptian civilization. Visits to many ancient and modern places including temples and monuments all over Egypt introduced the students to places of historical significance. Using a GPS-enabled camera made it possible to link visited locations with points on the map of the

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world. This approach added to students' excitement as it was noticed that students developed greater sense of appreciation of the visited places as they become part of a photo taken at a given place. Such a map-linked photo personalizes students' relationship with the visited location. The major goal of the miniterm was to help the students appreciate history/culture, as well as engineering/architecture of various noteworthy monuments. Students' interest in, and enthusiasm for this type of study were remarkable.

Methods for Ad-hoc Delineation and Analysis of Categories of Spatio-Temporal Events

Frank Hardisty, Donna Peuquet, Sen Xu, Anthony C Robinson



Analysts are faced with increasing volume and complexity of spatially and spatio-temporally referenced events to analyze. One means of taming this volume and complexity is to develop methods and tools that can identify

patterns, including spatio-temporal structure like clusters, in event data. To understand these methods and tools, we first present some of the motivation for the work, and then we detail the software architecture that we will use to support categorical analysis of spatio-temporal events. Methods for analyzing spatial events, and spatio-temporal events, have experienced a recent renaissance. This upsurge in interest has occurred in part because of novel high-quality event sources which can provide complex data with geographic and temporal referents.

Examples of such event sources include geographically located Twitter postings linked to documents, or photographs and video taken with GPS-enabled mobile phones. The products of these event sources are a vast stream of events that are linked with heterogeneous and voluminous data, including textual, imagery data as well as numerical data. One of the ways of making numerical sense of such heterogeneous data is to consider the text or media as a set of tagged categories. We can then apply methods for detecting structure in spatio-temporal events, including recently developed methods for disease outbreak detection, to these categories. We are developing methods and associated software that will allow users to tag or label events, analyze them, and interact with visual representations of the event structure detected by the analysis. An integrated software system, called STempo, will provide the user with a fixed set of analysis tools and coordination topology to work from. The category tagging and structure detection tools will also be worked into the larger set of tools available in the GeoViz Toolkit, an interactive system for geographic visualization and analysis.

Ceiling Vision based Localizer for Mobile robot

Seung-Hun Kim, Changwoo Park, Sewoong Jun

When mobile robots perform their missions, the self-localization needs basically. Several past researches

established how to obtain their location information from the environment by using a distance sensor or a camera. However, these methods have map-making problem when the environment changes and localization problem while the robot moves from sensing features has typical affine and occlusion characteristics. This paper presents a localizer for mobile robot that travels around indoor environments. Our module uses the only one sensor, a single camera looking up the ceiling. There is no efficient enough SLAM algorithm working on embedded system. The initial difficulty of vision based SLAM is computational complexity to acquire reliable feature on their algorithm. To reduce the computational complexity, we use the ceiling segmentation to extract line features of ceiling area. Line features are extracted from the boundaries between the ceiling and walls. The line features have advantages over point features for its robustness to environmental variation and structural information helpful to data association. Extended Kalman Filter is used to estimate the pose of a robot and build the ceiling map with line features. The experiment is practiced in our indoor test bed and the proposed algorithm is proved by the experimental results.

Demo Talk: GIS Kit Demonstration of Field Data Collection and Large Dataset Visualization on the iPad2

Jonathan Lund – CEO, Garafa

GIS Kit is a new product for the iPhone and iPad that aims to provide the key components of GIS to a mobile professional. It is under development by the creators of GPS Kit, a popular iPhone/iPad app for handheld GPS. GPS Kit received a strong response from the GIS community and Garafa attributed this to their aim to make GPS Kit the highest quality and fastest performing app of its kind. As a result of the requests of these users, Garafa has teamed up with several GIS professionals and firms to define the ultimate tool for field use. Although scheduled for release this summer, many of the core technologies are in place and Garafa would like to demonstrate a prototype as well as gather feedback from end users. Some notable features to be demonstrated include: KML support, custom types and attributes, data collection, and some benchmarks of performance on very large datasets.

Demo Talk: HP Launches ePrint & Share for hp Large Format Printers

Judy Manesh - President, MEI Computer and Graphics

Hp Large Format printers have been a valuable communication tool in the Geo Spatial world. There is a need to get "the Big Picture" to communicate and share ideas for collaboration as well as presentation. Now those users are working mobile and from remote work sites, hp has adapted the printing environment. HP's ePrint & Share site allows collaboration and access to print files from your PC, directly from the printer or from a mobile device. Hp's newest line of Designjet ePrinters allows driverless printing from a web browser, or a USB connected device from the touch screen front panel.

Workshop - Expanding GeoWeb to an Internet of Things

Session 1 - Scope and Vision

Monday May 23 1:00PM - 2:25PM

Grand Ballroom

Session Chair:

George Percivall, OGC

Expanding GeoWeb to an Internet of Things

George Percivall, Nadine Alameh

OGC

Connecting our world with accessible networks is scaling to trillions of everyday objects. The Internet of Things, Pervasive Computing, Sensor Web are research names for this development. Planetary Skin, Smarter Planet and CeNSE are several corporate names. The Internet will be augmented with mobile machine-to-machine communications and ad-hoc local network technologies. At the network nodes, information about objects will come from barcodes, RFIDs, and sensors. The location of all objects will be known. This workshop seeks to explore the role of location in expanding GeoWeb to an Internet of Things.

The workshop seeks presentations on functions enabled by geographic location and to location relative to surrounding objects. Most of the objects will be indoor in a 3D setting. The workshop also seeks presentations on relevant technologies such as location determination, geocoding, schemas for points of interest, ad-hoc network formation based on location, processing of information of the objects to detect phenomena of interest and location based services. Technology standards will be important for interoperability at this scale, e.g., OpenLS, CityGML, and Sensor Web Enablement standards from the OGC.

Planetary Skin Institute ALERTS -Automated Landchange Evaluation, Reporting and Tracking System

J.D. Stanley

Chief Technology Officer, Planetary Skin Institute

In December of 2010 the Planetary Skin Institute announced the beta release of ALERTS – Automated Land change Evaluation, Reporting and Tracking System.

ALERTS is a decision support Evaluation, Reporting and Tracking system for near real-time global land use, land cover change, and disturbance detection and analysis. It provides global coverage of deforestation or other land change events and offers users a number of useful tools for identifying, characterizing and responding to disturbances.

This public beta release of ALERTS was a direct result of the Planetary Skin Institutes' community swarming efforts with NASA, INPE, MINAM, Cisco, University of Minnesota, and Terrestrial Carbon Group. The team spent 12 months designing an immersive decision support environment to facilitate Planetary Skin Institute's mission for pioneering

emerging R&D initiatives across sectors and disciplines for the monitoring and managing of scarce resources.

Further by incorporating over 200 layers that span spatial and temporal land related themes ALERTS empowers the users to go beyond disturbance detections and assess and analyze projected transitional risk scenarios.

Keywords: Land change detection, planetary skin, carbon stocks, transitional risk

Physical World as an Internet of Things

Prof. Dr. Simon Berkovich

George Washington University

A concept of the physical Universe that does not address the issue of the difference in the behavior of dead and living matter is not just incomplete, it simply cannot be correct. We have developed a cellular automaton model of the Universe where the appearing material configurations share the information control under global content-addressable holographic memory. As a result, biological information processing is organized as Cloud Computing [1]. With the rise of the Internet there is no doubt that such an organization is much more efficient; other control arrangements for material things may be simply not workable.

The Internet construction of the physical world is a sort of realization of quantum computing. The viability of this construction is most dramatically revealed by the phenomenon of quantum nonlocality - instantaneous non-signaling correlation of distant events. Nonlocality is intrinsic to the sliced processing of holography, which brings in instantaneous interactions through common memory rather than performs gradual signaling through message passing. Traditional thinking cannot accommodate nonlocality into the paradigm of the physical world. At the moment, the given construction presents the one and only available operational explanation of this inconceivable phenomenon.

The holographic Internet milieu sets up different control patterns for molecular structures depending on their size. Small particles get immediate holographic feedbacks by returning beam establishing an interactive holography environment for quantum mechanics behavior [2]. The feedbacks for macromolecules ("aperiodic crystals" [3]) are richer as their highly developed conformational oscillations furnish access keys to the holographic storage; so, in contrast to small particles, the behavior of macromolecules is governed additionally by signals from the bulk of the holographic memory. Drastic distinctions in the behavior of dead and living objects are due to different feedbacks for small and large molecules produced by the Internet infrastructure of the material world.

Functioning of complex systems ordinarily requires inflows of two types of entities: information signals and actuation impetuses. The latter aspect in relation to the motility of macromolecules has been considered in [4]. According to [3], the purpose of feeding is not the acquisition of energy but

Workshop - Expanding GeoWeb to an Internet of Things

intake of "negative entropy". The essential point in metabolism is freeing from all the entropy that an organism cannot help producing while alive. The primary hypothesis about the acquisition of energy by living organisms is that the inside burning of the sugar in one way or another provides the motive power to the muscle. Yet the amount of energy obtained with the food does not seem enough for the work the organisms perform; for example, some beetles would need daily intake of food twice their own mass. Furthermore, it is not known how exactly the energy-providing reactions are coupled to the mechanical precision and how the control signals arriving at macromolecules are transformed into purposeful actions.

The total amount of power required by all the living organisms on Earth can be commensurable (within some orders of magnitude) to the total amount of power used by modern human civilization. In corresponding terms, it can be said that living organisms consume the ultimate source of energy - solar radiation in the form of "biomass". This common view is confronted considering a new source of energy for biochemical motions by relating it to the external clock of the physical Internet. This kind of energy can be extracted from the pushing pulses of this clocking mechanism, the so-called "hot-clocking" effect [6], and concentrated by the mode of the parametric resonance [4]. This kind of surmised powering for the biochemical activities effectively intermingles information and energy processes. Figuratively speaking, the proposed machinery can be seen as USB port functionality incorporated in the quantum computer of the Universe.

For the Internet of the physical world the considered clocking mechanism introduces an unexpected triggering condition at its working frequency of 1011 Hz. Actually, it has been noticed that electromagnetic waves in the corresponding millimeter range produce various harmless, but otherwise unexplainable, biological effects that cannot be understood either in terms of heating or through direct action of electric fields; "it follows that the electromagnetic wave acts as a trigger to events for which the biological system is already prepared"[7]. Since biological objects operate under 1011 Hz clock cycle they might be affected by a novel environmental factor - gigahertz radiation from the vast spread of cellular phones. Conventional physics does not foresee how this radiation can influence biological objects, while the massive epidemiological studies would take decades [8]. In the meantime, it is important to keep in mind that HF electromagnetic radiation could interfere with biological processes as long as they are driven by 1011 Hz clock of Cloud Computing.

Keywords: Cyber-physics, Internet of Things, Quantum Computing, Cloud Computing, Bioinformatics.

Future Work on the Ushahidi Platform to Use QR Codes to Tag Buildings and Places with Application to Crisis Scenarios

Jon Gosier

SwiftRiver/Ushahidi

What to Do with 500M Location Requests a Day?

Kipp Jones, Richard Sutton

Skyhook Wireless

Skyhook Wireless provides hybrid positioning to millions of mobile devices around the world. Using an approach that integrates cell, WiFi, and GPS signals, the system services over 500 million location requests daily. This results in a massive and perpetually growing artifact of device locations anchored in time and place. Using this time-stamped location data, we are able to measure aggregated mobile device activity with extreme local accuracy, to any required resolution, across thousands of cities worldwide.

Providing location services to such a large population of devices allows Skyhook to continuously improve positioning quality by reconciling signal maps returned from adjacent requests. It also provides an unparalleled tool for quantifying social behavior in space and time. We describe one analytical output of these data - SpotRank - which presents a normalized week of discrete, measured hours across the entire global Skyhook service area.

SpotRank provides a method to compare and analyze locations aggregated to .001 decimal degree tiles (approximately 1 hectare at mid latitudes) in 1-hour increments. The SpotRank "canonical week" provides an averaged measure of activity for each tile-hour: 168 hours across more than 10 million tiles. This architecture permits many creative comparisons, such as how a typical activity level varies between Monday at 9AM and Friday at 9AM for any tile in our coverage area. These normalized data may also be compared using tiles in disparate cities or countries. With these data as the baseline, many predictive and anomalous behavior analyses are possible, using SpotRank standalone metric or in concert with local data sources.

Keywords: Hybrid positioning system, SpotRank, Skyhook, mobile activity.

Session 1 - Scope and Vision (Cont.)

Session 2 - Enabling Technology

Session 2a - Object location, identity and function

Monday May 23 2:40PM - 4:40PM

Grand Ballroom

Session Chair:

Richard Barnes, BBN

National Broadband Map to facilitate IOT/M2M Deployment

Michael Byrne

US FCC

Workshop - Expanding GeoWeb to an Internet of Things

Overview/Survey Presentation

Richard Barnes
BBN

Geo-Locating Things on the Internet

Miten Sampat
VP of Product Strategy, Quova Inc.

With an ever-increasing dominance of the Internet as the conduit for social, commercial, governance, and research activity; determining the physical location of end points is critical. Physical location is an essential piece of context that informs decision-systems of numerous geo-derived dimensions. For example, the location of a user performing an e-commerce transaction enables the merchant to calculate applicable federal and state level taxes. From casual applications such as content localization to critical applications such as E-911 and cyber defense; geo-locating end-points is vital for the design, delivery, and optimization of services on the Internet.

However, the Internet infrastructure was developed in an organic fashion without a master plan or design that foresaw the importance of geography. Every transaction conducted over the Internet requires a source and destination IP address, which make it a pervasive classifier. IP addresses are to the Internet as Street addresses or Postal Codes are to the real world; and can therefore serve as the basis of a co-ordinate system to the neo-geography of the Internet. Search engines, content delivery networks, content providers, e-commerce intermediaries, advertising networks, fraud prevention systems, and web analytics providers rely on IP-geolocation solutions to enhance their services today. Through this tech talk, the author will provide an overview of technical methods that form the basis of geo-locating things using IP addresses, and outline pros and cons of the state of the art. The talk will also outline emerging technologies that point the way forward to enhance the precision and accuracy of current methods.

Miten Sampat is currently VP of Product Strategy at Quova, enabling some of the largest web companies understand "where" their users come from. Before Quova, Miten was Chief Architect & CTO at Feeva where he developed technology to enable ISP's to provide metadata for targeted online advertising in a privacy friendly manner. Prior to Feeva, Miten co-founded & led the SeeVT project at the Center for HCI at Virginia Tech that conducted R&D on handheld location based systems, and developed one of the early implementations of Wifi(R) location sensing. Miten also worked at Reliance Communications in India to design, develop, and introduce value-added local services to mobile consumers in India. He has a BS & MS in Computer Science from Virginia Tech, where he was awarded the Outstanding Graduate Student of the Year.

Keywords: IP geo-location, location-based.

Session 2 - Enabling Technology

Session 2b - Spatial models: indoor

Tuesday May 24 1:00PM - 2:20PM

Grand Ballroom

Session Chair:

Steve Smyth, MobileGIS

Site and Building Directories and Navigation

Carl Stephen Smyth
Director, MobileGIS Ltd

Many of us have an intuition that we should be able to extend the technical and commercial success of road navigation in large geographic spaces to smaller spaces such as parks, shopping malls, business estates, airports, train stations, crime scenes, disaster sites, and individual buildings. Designing real applications leads to three key technical and business questions:

* "What are the requirements?" There are clear differences in comparison with road navigation. Smaller spaces have a human-scale level structure embedded in 3-dimensional space. Visualization and analysis can be as important as navigation itself. Does the turn-by-turn guidance model still make sense?

* "Where do models come from?" Smaller spaces have complex structure that are complex and can change frequently. Multiple sources inevitably have semantic and quantitative inconsistencies. How do you find content? How do you integrate content? How do you update content?

* "How do you locate a mobile device in smaller spaces?" Compared to road navigation, the precision requirements are tighter, the difficulties in radio propagation are extreme, and level information within structures is essential.

Consideration of these questions in a practical application at the Italian fire training centre at Montelibretti provides some answers.

Keywords: Indoor navigation, building directories, indoor location

Navigation-to-Thing and Highly-Context-Focused 'Around Me' Use Cases

Paul Bouzide
NAVTEQ

The models for representing, maintaining and using "navigable" geographic features are evolving from a 2D centerline roadway model, through a highly detailed 3D pedestrian, indoor and multimodal model and into a Internet of (Locatable) Things. As this evolution proceeds, the volume of data that can be processed and delivered to end user applications could reach an untenable torrent, both from a human cognition as well as a machine resource perspective.

The key as always is information, not just data. Contextualized interpretation, not just a collection of undifferentiated ground truth facts. What's needed at the

Workshop - Expanding GeoWeb to an Internet of Things

edges of the GeoWeb - particularly for relatively network and processing challenged mobile devices - is the notion of "byte-sized" (pun intended) content that's "right-sized" for each individual actor based on highly dynamic personal or organizational usage contexts.

It's clear that edge applications will continue to play a role in providing such a contextual filter. Less obvious is how other GeoWeb participants will also provide contextual value. The application developer interface to a geodata provider is a pathway for application development time, product creation time and run time information exchange. This exchange will inform the processes and business rules that a data provider uses to prioritize the gathering, processing and correlation of observations, the mediation of geodata product quality level guarantees, and the delivery models for the application-ready features themselves. The effectiveness of this pathway will depend on low processing latencies, not only between observation detection and feature change availability, but also between an end user's context and what features are provided at what levels of detail.

There is ample precedent in the current vehicle navigation ecosystem for leveraging this pathway to make the resulting user experience compelling and economically viable. Moving to an integrated 3D model of the built and natural world as a framework for an Internet of Things will require enriching and formalizing this interface in order to build contextual value into the GeoWeb.

Keywords: Geoweb; navigation; context; latency

Building Information Modeling

Geoff Zeiss

Director, Utility Industry Program, Autodesk

Using digital design models has been a common practice in the manufacturing industry for decades. Project teams at companies such as Boeing and Toyota have placed digital models at the core of their collaborative, concurrent engineering processes. The same approach, called building information modeling (BIM), is increasingly being adopted by architecture, engineering, and construction (AEC) service providers for building and infrastructure projects. Unlike CAD, which uses software tools to generate digital 2D and/or 3D drawings, BIM facilitates a new way of working: creating designs with intelligent objects that enables cross-functional project teams in the building and infrastructure industries to collaborate in a way that gives all stakeholders a clearer vision of the project. Models created using software for BIM are intelligent because of the relationships and information that are automatically built into the model. Components within the model know how to act and interact with one another. BIM not only enables engineers architects and construction firms to work more efficiently, but creates a foundation for sustainable design, enabling designers to optimize the environmental footprint of a structure during the design phase. Convergence is breaking down the barriers between technical disciplines. The integration of BIM,

geospatial, physical modeling and 3D visualization provides a framework of interoperability that enables an intelligent synthetic model of entire urban environments.

Geoff Zeiss has more than 20 years' experience in the geospatial software industry and 15 years' experience developing enterprise geospatial solutions for utilities, communications, and government. His interests include streamlining infrastructure management workflow, open source geospatial, and converged BIM/CAD/GIS/3D simulation solutions. Geoff was Director of Product Development at MCI VISION* Solutions which pioneered RDBMS-based spatial data management, CAD/GIS integration, and data versioning. He has been directly involved in some of the largest successful implementations of geospatial network documentation/records management systems in the utility and telecommunications sectors. Geoff is a frequent speaker at geospatial events around the world including Where 2.0, GITA (US, Australia, Japan), FOSS4G, GeoBrazil, Map Middle East, URISA, Location Intelligence, and Map World Forum and received a Speaker Excellence Award at GITA in 2009.

Keywords: BIM, convergence

Building 3D Models from Images

Eyal Ofek

Microsoft

Session 2 - Enabling Technology

Session 2c - User applications

Session 3 - From R&D to

persistence/commercialization

Tuesday May 24 2:30PM - 4:30PM

Grand Ballroom

Session Chair:

George Percivall, Nadine Alameh, OGC

Integrating 3D Data in Service-based Visualization Systems

Jan Klimke, Dieter Hildebrandt, Benjamin Hagedorn,

Jurgen Döllner

Hasso-Plattner-Institute

Georeferenced data is available from a wide range of sources, e.g., Directory Services, Sensor Observation Services, Web Feature Services or even proprietary interfaces. Many of the data originating from an Internet of Things will be three-dimensional representing outdoor as well as indoor geographic features and their properties. Based on this data, its integration, and its visualization totally new applications and systems could be designed and implemented supporting various applications domains. Recent work in the area of service-based 3D visualization enables high-quality visualization of complex 3D geodata, e.g., 3D city models and

Workshop - Expanding GeoWeb to an Internet of Things

3D indoor building models, on thin clients as well as mobile devices such as smartphones and tablets. This work uses a service-based, image-based visualization approach that decouples the server-side resource-intensive management and rendering of complex, massive 3D geodata from client-side display functionalities: A Web View Service provides image representations of a 3D scene; these images, which can contain different types of information per pixel, are transmitted to a client application that can reconstruct a 3D representation of this scene.

In this talk, we will describe how to combine 3D geodata originating from the Internet of Things with this service-based approach in a way that allows for the interactive exploration of and interaction with 3D worlds and objects of interest. In detail, this 3D geodata can be integrated into the visualization process a) at the rendering stage of a portrayal service, b) through an image post processing step or c) in the client application itself. Moreover, this data can be visually represented directly by modifying the appearance of existing features, e.g., for visualizing measurements, or indirectly by introducing additional objects, e.g., icons, into the 3D scene. We will discuss advantages and disadvantages of these different approaches for implementing visualization applications using live geodata sources.

Keywords: Geovisualization, service-based visualization, geodata integration

An Internet of Places: Navigating the Web in Space-Time

*Paul Watson, Giuseppe Conti, Federico Prandi
1Spatial Group Limited, Fondazione Graphitech*

We are becoming increasingly accustomed to accessing content in relation to real-world locations via specialized geobrowsers, mobile apps and Web 2.0 mash-ups. The variety of content and distribution channels increases daily public web services, sensor networks and social networking sites. However, each of today's applications is hard-wired to specific data and requirements, severely limiting its potential for reuse. Moreover, the linking of these applications to and from other relevant digital resources in an integrated way is not possible; the lack of native spatiotemporal support at the Web level precludes geographical or location-based contextualisation of most digital resources available via the Internet. This paper presents a vision for the next generation of intelligent, web-based applications, capable of delivering context-aware, real-time access to large data repositories by providing technology to organize, filter and explore Web content from every domain using the same intuitive, user-driven and spatiotemporal metaphor. Association of spatiotemporal context to, or inference of it from, Web resources, allowing others to discover them and combining them in new ways requires not only generic, Web native, spatiotemporal data models, flexible data encoding, query and transmission mechanisms, but novel data crawling and indexing methods. It also mandates a new user search and

service delivery paradigm which embeds both existing and new digital resources in a virtual and semantic fabric of space-time which can be searched and explored simply by looking into the virtual world using geobrowsers and augmented reality devices. Together, these facilities give rise to a new class of application which continuously offers new data and services relevant to the user's location, time and task as they browse this is what we call the Internet of Places

Sensor Web Standards and the Internet of Things

*Scott Fairgrieve, Stefan Falke
Northrop Grumman*

Sensors are a key enabler in the realization of an Internet of Things; they empower us to better understand the state of the world around us and to discover and glean information about objects and actions that drive that world. Many of the objects we associate with the Internet of Things are sensor-based systems, contain sensors as key components (e.g. buildings, vehicles, appliances, etc.), or require sensors in order to be discovered and located. The measurements and information from those sensors are what provide much of the Internet of Things with

meaningful data. RFID chips, QR codes, and other technologies facilitate tagging, identifying, and locating objects, but making the presence of these tagged objects and their associated information known to the broader world ultimately requires sensors such as RFID readers and mobile device cameras and standard mechanisms for describing and disseminating that information. Keeping the importance of sensors in mind, this presentation explores the applicability of the Open Geospatial Consortium (OGC) Sensor Web Enablement (SWE) standards

to help build and drive the Internet of Things by standardizing the way in which sensors and sensor data are described, discovered, accessed, and controlled. SWE provides extensive support for describing the location of sensors and their observations, and this location information is a key aspect of data within the Internet of Things,

allowing both human users and intelligent objects to know where they are, what they do, and what objects and data are available around them. This presentation describes how SWE-based sensor description and location information and the spatial relationships derived from that information can be applied in a variety of novel applications to facilitate an Internet of Things.

Keywords: Sensor web, Internet of Things (IoT), OGC, SWE, standards.

Let's Move E911 Indoors

*Michael J Loushine
Senior Scientist, Wireless Systems & Networks
Clifford A Behrens
Senior Scientist & Director, Information Analysis*

There has been much recent activity within communications networking standards groups to define ways of discovering,

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representing and conveying outdoor locations of objects and people. Much of the motivation for this activity has come from the need to comply with FCC E911 mandates. Over the last couple of years, Telcordia has assembled a test bed to demonstrate the application of some of these standards in network communications infrastructure that enables recruitment and deployment of rapid emergency response teams. For example, this infrastructure provides situational awareness by integrating 3GPP IMS to provide a SIP/IP core network infrastructure and route 911 calls, OMA LOCSIP to convey terminal locations, OMA Presence SIMPLE to publish status notifications, IETF LoST to select a PSAP to answer 911 calls, GSMA RCS to publish locations/presence and perform user-based position determination of terminals, IETF HELD to perform network-based position determination of terminals, and WiMAX to transmit and receive voice, video, and other data. To date, our technology demonstration has considered only outdoors emergency scenarios; we now plan to extend our testbed by moving the emergency scenario indoors. An indoors extension of our scenario will require the adoption and integration of other location-based standards. Consequently, we are currently planning enhancements to our infrastructure that makes use of IETF PIDF-LO, OMA SUPL and OGC CityGML, i.e., new standards for representing and conveying indoor locations and their context. Our objective is to demonstrate the value these standards offer to network communications for managing indoor emergencies, to provide feedback to standards forums based on experiences from our demonstrations, and to expose opportunities to enhance and integrate them in ways critical for meeting the needs of decision-makers and emergency response teams.

Keywords: Emergency response, indoors location, location-based service

Beyond the Check-In - Fragmentation and Consolidation in the Emerging Geoweb Industry

*Peter Verkooijen
Founder, Geoweb Forum*

Until the introduction of the iPhone in 2007, GIS and the geospatial web were the exclusive domain of academics and technologists in large organizations and governments. GPS-enabled smartphones, combined with services like Google Maps, opened up the field to existing communities of web entrepreneurs. They did with the new capabilities what they knew best and created free mobile location-based services to gather the large user bases required to generate advertising revenue.

New York-based Foursquare led this new wave in consumer LBS apps. The Geoweb Forum project was started in 2008 to put the trend into a broader context and connect the traditional New York media, advertising and retail industries with the geospatial world. The project defines the geoweb as the next phase of web after the much hyped web 2.0. Connecting the digital realm to physical location promises to

have a much more tangible business impact than social media ever had.

With location check-in now ubiquitous, attention is shifting to platform builders like Xtify, Placecast, Retailgenie, LOC-AID and SimpleGeo, companies that focus on solving practical business problems for marketers and retailers as well as application developers. Foursquare launched its own platform initiatives, as did Apple, Google and Microsoft. Managing the fragmentation in handsets, operating systems and carriers and making sense of location data streams is now front and center.

This session will present and discuss insights from panels at the Geoworld Summit, happening May 12th in New York, on fragmentation, consolidation and standardization in the emerging geoweb industry. Peter Verkooijen is organizer of the Geoweb Forum project and a veteran journalist for leading Dutch trade publications in IT, retail, advertising, supply chain, industrial management and healthcare.

Peter Verkooijen is organizer of the Geoweb Forum project and a veteran journalist for leading Dutch trade publications in IT, retail, advertising, supply chain, industrial management and healthcare.

Keywords: Geoweb, internet of things, commercialization, fragmentation, consolidation, check-in

Collaborative Development of Open Standards for Expanding GeoWeb to the Internet of Things

*George Percivall
Chief Architect and Executive Director, Interoperability Program, OGC*

In a multi-vendor environment, development of the Internet of Things (IoT) will be limited without the emergence of open, consensus standards that enable collaboration. Such standards will define an infrastructure that raises the level of services and quality of information for the marketplace thereby providing more opportunities, particularly for the vendors that collaborate to define the standards. Collaborative development is key to consensus adoption and wide use of information technology standards.

Development of effective open standards is a balancing act. The standards need to be agile and adaptive to the rapidly changing developments in the marketplace. The standards also need to have a sound engineering foundation and respect relevant aspects of the existing technology base. The use of open standards to connect components, applications, and content – allowing a "white box" view on the components' functionality and interfaces without revealing implementation details " fulfills the industry requirement for protection of intellectual property and the user requirement for transparency.

The COM.Geo Workshop on "Expanding GeoWeb to an Internet of Things" is an excellent opportunity to discuss how organizations can increase their business based on quality location information in the Internet of Things. Quality information in a multi-vendor environment can only be

Workshop - Expanding GeoWeb to an Internet of Things

obtained using standards. An industry-based consortium is needed to establish effective standards for information sharing about location in the Internet of Things. The Open Geospatial Consortium (OGC) has a proven process for industry-wide collaborative development of efficient standards for spatial and location information.

The mission of OGC is to serve as a global forum for the development and promotion of open standards and techniques in the area of geoprocessing and related information technologies. The OGC has 410+ members - geospatial technology software vendors, systems integrators, government agencies and universities -participating in the consensus standards development and maintenance process. Through its Specification Program, Interoperability Program, and Marketing and Communications Program, the OGC develops, releases and promotes open standards for spatial processing. Technology and content providers collaborate in the OGC because they recognize that lack of interoperability is a bottleneck that slows market expansion. They know that interoperability enabled by open standards positions them to both compete more effectively in the marketplace and to seek new market opportunities.

The OGC recommends the following steps for advancing the GeoWeb to an IoT-based marketplace:

- Definition of a standards-based "GeoWeb meets IoT" framework to spur coordinated application development.
- Coordination of standards for location in IoT with other relevant standards development organizations.
- Discussions of the framework in the OGC Specification Working Groups to identify if additional standards are needed.
- Conduct an Embedded Mobile Ecosystem Testbed using the OGC Interoperability Program approach.

Keywords: Geoweb; Internet of Things; collaborative development; standards; OGC

Panels

Monday May 23 3:40PM - 4:40PM

Meeting Room 308

Fugro EarthData
National Geodetic Survey
USGS

Modernization Program for the North American Datum and Reference Frame

Moderator:

Dr. Qassim A. Abdullah
Fugro EarthData

Panelists:

David Doyle
US National Geodetic Survey

Milo Robinson
Space Based Position, Navigation, & Timing, DOI

The North American Datum of 1983 (NAD 83) witnessed over the past few decades major transformation in order to satisfy users need in terms of accuracy and reliability. Such transformation evolved in multi-phase modernization program that left users anxious about tools and procedures that they needed to implement in order to catch up with such changes. Today, users of NAD83 have to deal with different versions of the datum such as NAD83/86, NAD83/HARN, NAD83/CORS(96), and the latest adjustment of NAD83/NSRS2007. The subsequent versions added confusion and discrepancies in the product delivered over the years. The North American Vertical Datum of 1988 (NAVD88) went through similar evolution each time a new geoid model is published. The panel addresses users concerns and shed the light on the latest efforts lead by the National Geodetic Survey (NGS) to modernize the datums to coincide with the more reliable and globally maintained, the International Terrestrial Reference System (ITRS) realized by a set of reference points coordinates denoted by the International Terrestrial Reference Frame (ITRF).

Wednesday May 25 9:00AM - 10:30AM

Meeting Room 302

NASA World Wind
NSDI: Tower of Babel Aspiring to Lingua Franca

Moderator:

Patrick Hogan
NASA World Wind Program Manager

Panelists:

Dr. Budhendra Bhaduri
ORNL

Brandt Melick
City of Springfield Oregon

Dr. Chaowei [Phil] Yang
George Mason University

Dr. Kevin Montgomery
Intelesense Technologies

Consistent means to share geographic data among all users could produce significant savings for data collection and use and enhance decision making. Executive Order 12906 calls for the establishment of the National Spatial Data Infrastructure (NSDI) defined as the technologies, policies, and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community.

The goal of this Infrastructure is to reduce duplication of effort among agencies, improve quality and reduce costs related to geographic information, make geographic data more accessible to the public, increase the benefits of using available data, and establish key partnerships with states, counties, cities, tribal nations, academia and the private sector to increase data availability.

A panel of state, federal, academia and industry experts in spatial data will lead a free-wheeling discussion regarding survival in the spatial age with "data, data everywhere and yet not enough to think."

1. Hundreds of thousands of KML/SHP/etc. spatial data files are out there. How do you find the ones you want?
2. Computation-heavy data analysis is needed just to see climate data, much more do research with. How do you spread that computation load around?
3. Each local government entity throughout each state and across the nation are in need of similar data management tools, as well as access to similar datasets. How do we route ourselves away from duplicative GIS solutions and happily harness the larger community?
4. Given that natural disasters are an inevitable part of life on Earth, be they earthquakes, forest fires or storm activity, how do we optimize access to the considerable datasets (i.e., NetCDF) essential for weather forecasting, climate research and disaster management?

Please join us in brainstorming smarter ways for a precious planet to do business.

Wednesday May 25 9:00AM - 10:30AM

Meeting Room 301

OGC
Leveraging Agile Development and Architecture Techniques in the Development of Geoinformatics Standards

Moderator:

Nadine Alameh, George Percivall
OGC

Panels

Panelists:

Nadine Alameh

Open Geospatial Consortium (OGC)

Perspective: OGC Interoperability Program's rapid prototyping role in advancing standards

Dr. Alameh is Director of Interoperability Programs at OGC, planning and managing multi-vendor software prototyping and pilot initiatives to advance geoinformatics-related requirements and specifications. Dr. Alameh is a leader in the field of geospatial interoperability with a proven track record in architecting and implementing geospatial technologies, standards and web services. Her current engagements include leading diverse international teams of participants and sponsors in applying OGC and other web standards for providing up-to-date aeronautical and weather information to pilot, aircrafts and other users of such on-demand real-time information.

Dr. Alameh is also leading Global Earth Observing System of Systems (GEOSS) Architecture Implementation Pilots (AIP) activities, focusing on supporting the earth observation community in developing and deploying new process and infrastructure components for the GEOSS Common Infrastructure. Dr. Alameh holds two MS. degrees and a Ph.D. from MIT in the field of Information Systems Engineering.

Gregory Black

National Geospatial Intelligence Agency (NGA)

Perspective: Involvement in various national and international standards development organizations

Mr. Black is currently the Director of the National Center for Geospatial Intelligence Standards (NCGIS), and the Deputy Director of the Enterprise Architecture and Standards office at NGA. In these roles, Mr. Black directly supports the NGA Chief Information Office in fulfilling his functional management responsibilities for GEOINT standards and architectures for the National System for Geospatial-Intelligence (NSG) community. Mr. Black represents the NSG community in standards development organizations world-wide, and leads key GEOINT standards governance forums across the NSG, to include the Geospatial Intelligence Standards Working Group (GWG). Mr. Black is focused on development, implementation and management of standards crucial to ensuring compatibility and interoperability of GEOINT data and systems that embody the NSGS enterprise architecture.

James Burke

Network Centric Operations Industry Consortium (NCOIC)

Perspective: Development of industry patterns in response to industry requirements for interoperability

James Burke is chair of NCOIC's Technical Council. He has been an NCOIC leader since 2004, most notably serving as chairman of its Building Blocks Functional Team for five consecutive years. NCOIC is an international not-for-profit corporation dedicated to forming an industry-wide technical infrastructure to enable network centric operations (NCO) and accelerate the delivery of NCO solutions to worldwide

customers. Burke works for Lockheed Martin Information Systems and Global Services where he leads information systems and network engineering teams. In addition, Jim oversees group research and development initiatives, as well as company-sponsored university research programs. His 20-year career with Lockheed Martin and other companies spans the defense, intelligence and commercial markets.

Ray Renner

Northrop Grumman Corporation (NGC)

Perspective: Use of standards and interoperability in industry

Dr. Ray Renner is a technical fellow at Northrop Grumman in the Geo-Enterprise Systems Operating Unit. He has been in the software development field for over 20 years and has been involved in the development of GIS systems for the last 15 years. His latest interests have been in the research and development of mobile GIS systems, geospatial social network analysis, and advanced GIS analysis techniques.

With the increasingly seamless integration of geospatial intelligence into mainstream IT solutions and the rise of the "Geospatial Web", the need for geoinformatics standards is ever more critical. Geoinformatics standards detail the engineering aspects (and rules) capturing common agreements for implementing an interface or encoding that applies to specific geospatial interoperability problems. Standards from organizations such as ISO and the Open Geospatial Consortium (OGC) enable users to more freely exchange and apply geospatial information, applications and services across networks, platforms and products.

This panel is about the emerging agile processes behind the development of such standards in the geoinformatics field, specifically complementing the traditional formal consensus processes as a way to keep up with rapid technology changes, and the immediate needs for these standards in a wide range of domains. Agile processes are based on iterative, incremental and collaborative development, and typically deliver increased value, higher adaptability and reduced risk levels in meeting customer requirements and project objectives.

As an example in the geospatial field, the OGC Interoperability Program organizes and manages Interoperability Initiatives based on a rapid engineering process to develop, test, demonstrate, and promote the use of OGC standards. Such initiatives typically provide the initial working prototypes that are positioned to be the next best standards. Complemented by a solid architecture framework, this process allows for the development of set of standards for adoption in mature products.

This panel hosts representatives from standards-development organizations and industry to provide their perspectives on the agile processes in geoinformatics standards development and their value to their members/customers in the era of ubiquitous geospatial informatics. Such agile processes contribute to achieving the guiding vision of a world in which everyone benefits from geographic information and services made available across any network, application, or platform.

Courses & Video Shows

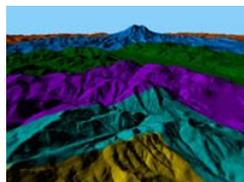
Courses

Monday May 23 1:00PM - 3:30PM

Meeting Room 308

AGI, University of Pennsylvania
Under the Hood of Virtual Globes

Patrick Cozzi, Kevin Ring



Virtual globes are a key tool for visualizing large geospatial datasets. This course goes under the hood of virtual globes and looks at their implementation techniques from the software developer's perspective. Our focus is not on one particular virtual globe, such as NASA World Wind or Google Earth; instead, we discuss common techniques used by many virtual globes, including coordinate transformations, globe representations, precision, multithreading, and terrain rendering. We also consider the differences between virtual globe 3D engines and game engines.

Attendees should have software development experience. A background in computer graphics is useful, but not required.

For more details about the course, please open the file:
http://www.com-geo.org/doc/prog/agi_course_pro.pdf

Tuesday May 24 1:00PM - 4:30PM

Meeting Room 301

Microsoft
Windows Phone 7 Workshop

Joel Reyes, Dr. Zhiming Xue



Are you interested to write an application or a game and make it available on Windows Phone 7 devices through Microsoft's Marketplace? At the workshop, we will demonstrate how you can build Windows Phone 7 applications or games, what tools are available, what public sector specific

applications have been created, how you can publish your applications, etc. We will answer any questions you may have about Windows Phone 7. So come on over and join us in this fun workshop. Bring your computer if you like. Or, you can play with our demo phones and pre-installed applications.

Video Shows

Monday, May 23 9:50 AM - 10:00 PM

Monday, May 23 12:00 PM - 1:00 PM

Grand Ballroom

Penn State Public Broadcasting
The Geospatial Revolution Project



Penn State Public Broadcasting has produced the Geospatial Revolution Project, an integrated public media and outreach initiative about the world of digital mapping and how it is changing the way we think, behave and interact.

With the goal of increasing public awareness of geospatial technologies, the project offers four 15-minute online mini-documentary episodes, 3-minute shorter chapters, as well as K-16 educational materials. The episodes share compelling human stories that clarify the complex and decode the mysterious, explain the virtues and explore the potential dangers of these emerging technologies. The Geospatial Revolution Project explores the seamless layers of satellites, surveillance, and location-based technologies creating a worldwide geographic knowledge base vital to solving myriad social and environmental problems in the interconnected global community.

Demo Talk: Monday May 23 9:40 AM - 9:50 AM

Tuesday, May 24 9:30 AM - 9:45 PM

Tuesday, May 24 12:00 PM - 1:00 PM

Grand Ballroom

Intelesense Technologies
Surf the World from Your Lap - Intelesense Demonstrates IVJ-Mobile on iPad



IVJ-Mobile from Intelesense Technologies is now running on the Apple iPad (as well as iPhone and Android devices), and provides access to over 1M layers of geospatial data at your fingertips from anywhere. Inteleview is built

on top of the NASA WorldWind core engine, but extends its' capabilities via the Intelesense Data Exchange- a massive data integration platform with collaboration portals to empower people to connect, share, and work together.

Demo Talk: Tuesday May 24 9:15 AM - 9:30 AM

Courses & Video Shows

Tuesday, May 24 12:00 PM - 1:00 PM

Grand Ballroom

MEI Computer and Graphics

HP Launches ePrint & Share for hp Large Format Printers

Hp Large Format printers have been a valuable communication tool in the Geo Spatial world. There is a need to get “the Big Picture” to communicate and share ideas for collaboration as well as presentation. Now those users are working mobile and from remote work sites, hp has adapted the printing environment. HP’s ePrint & Share site allows collaboration and access to print files from your PC, directly from the printer or from a mobile device. Hp’s newest line of Designjet ePrinters allows driverless printing from a web browser, or a USB connected device from the touch screen front panel.

Demo Talk: Wednesday May 25 10:20 AM - 10:30 AM

Posters

Posters

Coastal Resilience: An Ecosystem-Based Coastal and Marine Spatial Planning Framework

George Thomas Raber, Zach Fredana

Balancing Need with Numbers: Assessing Need by Downscaling and Weighting Vulnerability Data with Population Density

John J. Boos

Interior Space GIS: A Foundation for Campus-wide Planning and Management

Peter Sforza, Thomas Dickerson, Jason Shelton

Global Climate Change and Human Health Impacts: Investigation and Analysis in the Classroom Using Innovative Technologies

Sneha Rao, Mark Becker, Amy Work

Hazus Risk Assessment Software Has Integrated into Federal Geospatial Planning

Eric Berman

Rolling Thunder Demo using WorldWind for Java

Anthony Dale Anecito

Development of an ESRI ArcToolBox for Semi-Automated Building Modeling from MultiPatch Features

Marvin D. Watts, Elizah S. Dasari, Shahrouz K. Aliabadi

3D City Site Model Extraction through Point Cloud Generated from Stereo Images

Bingcai Zhang, William Smith

WorldMap: A Strategy to Allow Researchers to Scratch Their Itches Online Thereby Improving Data Access for All

Benjamin Lewis

A Multi-Tenant Cloud-based Full-function GIS

Eamon Walsh

Processing LiDAR Data to Visualize Soil Erosion and Analyze Slope Stability

Ashraf Ghaly

Natural Resources Data Management System (NRDMS) – A Suite of Web-Accessible Geo-Spatial Data Processing Tools for E-Governance in India

P.S. Acharya, S.K. Ghosh, S.C. De Sarkar

Finding the Farm: Postal Address-Based Building Clustering

Christopher Eby, Alice Armstrong

Biodiversity Conservation GIS: Using Geographic Information Systems To Support Conservation Management Decisions

Samira MOBAIED, Bernard RIERA, Nathalie MACHON

GPS-Tagged Images Define the Trail of an Interdisciplinary Miniterm in Egypt

Ashraf Ghaly

Ceiling Vision based Localizer for Mobile robot

Seung-Hun Kim, Changwoo Park, Sewoong Jun

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MEI Computer and Graphics

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MEI offers new and refurbished HP Designjet printers at competitive prices, while continuing to repair personal computers and laptops. We also offer on-site printing services. Our technical expertise has enabled MEI to become the leading HP Designjet printer repair center in the DC Metro area. We are an HP Authorized Support Partner.



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OGC

www.opengeospatial.org

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