COM. Conference and Summits 2014

COM.Geo 2014
COM.BigData 2014
COM.DriverlessCar 2014

August 4-6, 2014, Washington DC

PROGRAM

www.comstar-tech.org

Program at a Glance

Monday, August 4 *Ballroom at Marvin Center*

8:30 - 16:30	**Registration**
9:00 - 9:15	**Plenary Tech Show & Opening Remarks**
9:15 - 10:05	**Northrop Grumman Keynote** : **Big Data – A System Integrator's Perspective**
10:05 - 10:15	**Coffee Break** *(Ballroom)* & **Tech Show**
10:15 - 11:05	**FBDWG Keynote: The Federal Big Data Initiative: Where it has been and where it is going**
11:05 – 12:00	**Oracle Keynote**: **Making Sense of Big Data: The Role of Location**
12:00 - 13:00	**Welcome Lunch** *(Ballroom)*
13:00 - 14:30	**FBDWG Panel+: Federal Big Data Working Group**
14:30 - 14:40	**Coffee Break** *(Ballroom)* & **Tech Show**
14:40 - 16:30	**Plenary Panel+**: **Challenge and Solutions for Big Data in the Cloud**
8:30 - 16:30	**Posters, Brainstorm Corners, Exhibits, Social Networking**

Tuesday, August 5 *Meeting Rooms at Marvin Center*

	Meeting Room 302	*Meeting Room 301*	*Meeting Room 308*
8:30 - 16:30	**Registration**		
9:00 - 10:30	**Breakout Session I:** **Big Geo Data, Geo Cloud, Geofencing**	**Breakout Session II:** **Geospatial Computing and Application**	**SAML Workshop:** **SAML for OGV, OpenLayers, Google Earth**
10:30 - 10:40	**Coffee Break**		
10:40 - 12:00	**Panel+: Big Data and Geospatial Computing**		**SAML Workshop** *Cont.)*
12:00 - 13:00	**Lunch Break** *(by your own)*		
13:00 - 15:00	**Oracle Workshop:** **Learn to Build an Analytics Solution with Oracle's Spatial Tools and Platform**	**Big Data Workshop /Breakout Session III:** **Big Data Organizing, Searching, Storing, Analytics**	**OGC & ISO Workshop:** **Big Geo Data: Standards and Best Practices**
15:00 - 15:20	**Coffee Break**		
15:20 - 17:00	**Breakout Session IV:** **Transportation, UAV, Geo, LiDAR**	**Big Data Workshop /Breakout Session III** *(Cont.)* **Brainstorm Corners**	**OGC & ISO Workshop:** **Big Geo Data: Standards and Best Practices**
8:30 - 17:00	**Posters, Brainstorm Corners, Exhibits, Social Networking**		

Wednesday, August 6 *Jack Morton Auditorium (JMA) in DC & FHWA-TFHRC in McLean, VA*

8:30 - 12:00	**Registration**
9:00 - 9:15	**MIT Driverless Car Tech Show**
9:15 - 10:05	**U.S. DOT Keynote** : **How Talking Cars Will Transform the Way We Travel**
10:05 - 10:15	**Break & Tech Show**
10:15 - 11:05	**NVIDIA Keynote** : **The Future Car – Horsepower Replaced by Computing Power**
11:05 - 12:00	**U.S. DOE Keynote**: **Extreme Computing and Data Challenge**
12:00 - 12:30	**Packed Lunch**
12:30 - 13:30	**Transport to FHWA-TFHRC, Visitor Security Check**
13:30 - 16:30	**FHWA Welcome Remarks** **FHWA Tech Presentations, Demo Shows** **FHWA Four Lab Tours, Test Drives** **FHWA Closing Remarks, Visitor Security Sign Out**
16:30 - 17:00	**Transport back to Marvin Center/JMA in Washington DC**

Message from General Chair

It is our great pleasure to welcome you to the COM.* Conferences and Summits 2014; in short form, COM.* 2014, which takes place in Washington DC, U.S.A. on August 4-6, 2014 as well as the online COM.* Virtual Conference (COM.* VC).

The COM.* 2014 includes COM.Geo 2014, 5th International Conference on Computing for Geospatial Research and Application, COM.BigData 2014, The International Summit on Big Data Computing, and COM.DriverlessCar 2014, The International Summit on Driverless Car Computing.

The COM.* 2014 is an exclusive cross-disciplinary and inter-disciplinary event. COM.* starts with a focus on COM.Geo 5 years ago. COM.Geo has been playing a guiding role in geospatial computing since 2010.

This year, it has expanded to COM.BigData, COM.DriverlessCar, COM.Geo, and online VC. Innovative research and technologies are the brightest spotlights at the event. There are more innovative programs and world-wide people to attend the event physically or virtually. Besides government agencies and top industries, many other institutions not only show their latest technologies but also explore tech and market potentials at the event. COM.* 2014 is a much more exciting 3-in-1 event for Big Data, Driverless Cars, and geospatial computing research and technologies!

COM.* 2014 has exciting and high quality technical program sessions including brainstorm plenary keynotes, emerging tech panels, tech shows, workshops, research papers, practice papers, tech talks, posters, hot short talks, and onsite and online exhibits. It provides diverse opportunities for all decision-makers, engineers, researchers, developers, and users, across industrial companies, government agencies, and academic institutions, to present or demonstrate their latest work or share their latest visions and ideas at the event.

Furthermore, keynote speakers from U.S. DOT, U.S. DOE, Oracle, NVIDIA, Northrop Grumman, COMStar, Federal Big Data Working Group, etc. will not only give the key insights for future impacts and challenges, new perspectives, further innovation, trends for Big Data, driverless cars, and geospatial computing, but also reveal the interrelations between these technologies.

COM.Geo 2014

COM.Geo conference is a leading-edge conference with a focus on the latest computing technologies for multidisciplinary research and development that enables the exploration in geospatial areas. It is an exclusive event that builds a bridge between computing and geospatial fields. It connects decision makers, researchers, developers, scientists, and application users from government, academia, and industry in all related fields. The attendees were from more than 50 countries all over the world. COM.Geo publications by IEEE and ACM, read and cited worldwide, have broad impact on the development of theory, method and practice in geospatial computing.

COM.Geo 2014 is the 5th International Conference on Computing for Geospatial Research and Application. The conference topics include all the geospatial research and application technologies. The conference of this year highlights Big Data Computing, Cloud Computing, and Mobile Computing in geospatial fields.

COM.BigData 2014

Big Data is now invading in every aspect of our daily life and promise to revolutionize our existence. It is “the next frontier for innovation, competition and productivity” as said McKinsey Global Institute.

Big data provides an opportunity to find insight in new and emerging types of information constructions. How will you take advantage of this opportunity? Big Data definitely presents a number of challenges related to its complexity, heterogeneity, and immensity. Many of these novel challenges necessitate rethinking various aspects of information processing philosophy, data management platforms, and computing methodologies in science, engineering, medicine, and business.

We believe that appropriate investment in Big Data will not only lead to a new wave of fundamental technological advances that will be embodied in the next generations of Big Data management platforms, systems, and products, but also has the potential to create huge economic value in the world economy for years to come.

Message from General Chair

COM.BigData 2014 is the International Summit on Big Data Computing. The summit offers a timely venue for researchers, government decision-makers, and industry partners to present and discuss their latest insights, challenges, and results in big data computing.

COM.DriverlessCar 2014

Driverless cars, also called self-driving cars or robot cars, are one of the great technological advances for the future transportation. With the investments by the U.S. government and innovative companies in recent years, several companies and research institutions working in the field have fully demonstrated that self-driving vehicles are technically viable nowadays. Moreover, the last decade has shown a great leap in public interest in driverless car technologies. There is a common goal of making driverless cars a reality by 2020's.

Although driverless car technology has become more and more viable recently, we still have a long way to go for self-driving in public. No matter how smart self-driving cars are, safety is the most important thing. Driverless cars do have the potential to positively benefits humanity. Car manufactures have continually added automation features to improve vehicle safety since many decades ago. A full 90 percent of accidents are caused by human errors, such as loss of focus, sleepiness, etc. But robot cars have great technology strengths on safety over human weaknesses. They can react in milliseconds to avoid accidents. This is why the first thing every advocate of driverless cars brings up is the technology's safety benefits.

Additionally, a variety of non-technical issues, such as legal, liability, regulatory, culture, privacy concerns, need to be addressed. These will help consumers trust the capability of driverless cars to give up control and embrace many potential benefits that driverless cars present.

Both tech and non-tech issues will impact driverless vehicle integration into tomorrow's roadway, in particular, the ecological problems because self-driving cars would be mostly propelled by electricity. Of especial importance would be the humanitarian aspect of this technology since driverless cars could significantly improve the quality of life of handicapped people.

Making a strategic decision for automotive innovation is top priority. Both federal governmental policy-makers and technology leaders may need to work together for these. So this is why we advocated the COM.DriverlessCar summit to build a bridge between two sides.

COM.DriverlessCar 2014 is the premier forum featuring with a mixture of inspiring presentations and interactive discussions on driverless car technology and non-technical challenges. Researchers, practitioners, Policy-makers, decision-makers, and managers from government agencies, industry, and academia are invited to discuss the latest trends, strategies, challenges, research and applications as well as policies and business potentials for driverless cars.

Special thanks to Keynote Speakers, Mr. Tim Schmidt, Dr. Brand Niemann, Dr. Xavier Lopez, Mr. Danny Shapiro, Dr. Ray Renner, and Dr. Robinson Pino for their insightful vision to be delivered to our attendees. We appreciate the generosity of sponsors and partners: COMStar Computing Technology Institute, U.S. DOT, U.S. DOE, Oracle, NVIDIA, Northrop Grumman, Federal Big Data Working Group, MIT, George Washington University, and IEEE & CPS. We also would like to acknowledge the invaluable efforts and contributions of COM.* presenters, attendees, and volunteers.

We look forward to an exciting week of sharing technical ideas and visions with colleagues from around the world. We thank you for attending the onsite & online conferences and being a part of this very important event.

Lindi Liao, Ph.D.

General Chair and Program Chair
COM. Conferences and Summits 2014*
President & CEO
COMStar Computing Technology Institute
Washington DC, U.S.A.

Table of Contents

1 Program at a Glance

2 Message from General Chair

5 General Information

6 Location of Meeting Rooms

I - Marvin Center *(Washington DC)*

II - Jack Morton Auditorium *(Washington DC)*

III - U.S. DOT FHWA Turner-Fairbank Highway Research Center *(McLean, VA)*

9 Plenary Sessions

Monday Keynote I – **Northrop Grumman**: Big Data - A System Integrator's Perspective

Monday Keynote II – **Federal Big Data Working Group**: The Federal Big Data Initiative: Where it has been and where it is going.

Monday Keynote III – **Oracle:** Making Sense of Big Data: The Role of Location

Wednesday Keynote I – **U.S. DOT**: How Talking Cars Will Transform the Way We Travel

Wednesday Keynote II – **NVIDIA:** The Future Car - Horsepower Replaced by Computing Power

Wednesday Keynote III – **U.S. DOE**: Extreme Computing and Data Challenges

Wednesday Plenary Tech Show Talk – **MIT**: The Intelligent Co-Pilot: a Path toward Fully Autonomous Vehicles

13 Emerging Tech Panels+

Panel+ I - Federal Big Data Working Group

Panel+ II - Challenges and Solutions for Big Data in the Cloud

Panel+ III - Big Data and Geospatial Computing

18 Workshops

I - Oracle Workshop: Learn to Build an Analytics Solution with Oracle's Spatial Tools and Platform

II - Big Geo Data: Standards and Best Practices

III - SAML Best Practices Workshop

20 Breakout Sessions

I - Big Geo Data, Geo Cloud, Geofencing

II - Geospatial Computing and Application

III - Big Data Organizing, Searching, Storing, Analytics

IV - Transportation, UAV, Geo, LiDAR

26 Posters

28 U.S. DOT FHWA-TFHRC Tech Show, Lab Tours, Test Drives

29 Sponsors and Partners

30 Leading-Edge Tech Shows

I - U.S. DOT-FHWA Tech Show, Lab Tours, and Test Drives *(Half a Day in FHWA's Research Center)*

II – COMStar OfficeMap: Achieve the Best Map Results for MS Office

III - MIT Driverless Vehicle Tech Show

General Information

About COM.* Conference

The COM.* 2014 includes COM.Geo 2014, 5th International Conference on Computing for Geospatial Research and Application, COM.BigData 2014, The International Summit on Big Data Computing, and COM.DriverlessCar 2014, The International Summit on Driverless Car Computing.

The COM.* 2014 is an exclusive cross-disciplinary and inter-disciplinary event. COM.* starts with a focus on COM.Geo 5 years ago. COM.Geo has been playing a guiding role in geospatial computing since 2010.

The COM.* 2014 Proceedings are published by IEEE and available at IEEE Digital Library for world distribution.

Alcohol

The COM.* 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.* 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.* 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 venue.

Photography and Videography in Sessions

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

Presentation Content

The COM.* 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.* conference are their alone. The COM.* 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.* conference in an atmosphere free of abuse or harassment and characterized by courtesy and respect. To that end, the COM.* conference expects all individuals who attend to conduct themselves in a manner that establishes an atmosphere free from discriminatory practices.

JMA Food Policy

No food or beverages are allowed within the Jack Morton Auditorium (JMA).

Registration

The COM.* conference Registration Desk will be located in front of the Grand Ballroom on the third floor of the Marvin Center on Monday August 4th, August 5th; first floor of the Jack Morton Auditorium, George Washington University, Washington, DC. Registration will be open during the following hours:

Monday	August 4	8:30 a.m. – 4:30 p.m.
Tuesday	August 5	8:30 a.m. – 4:30 p.m.
Wednesday	August 6	8:30 a.m. – 12:00 p.m.

Tour Bus Schedule

Only a limited number of attendees are available for the U.S. DOT FHWA TFHRC tour.

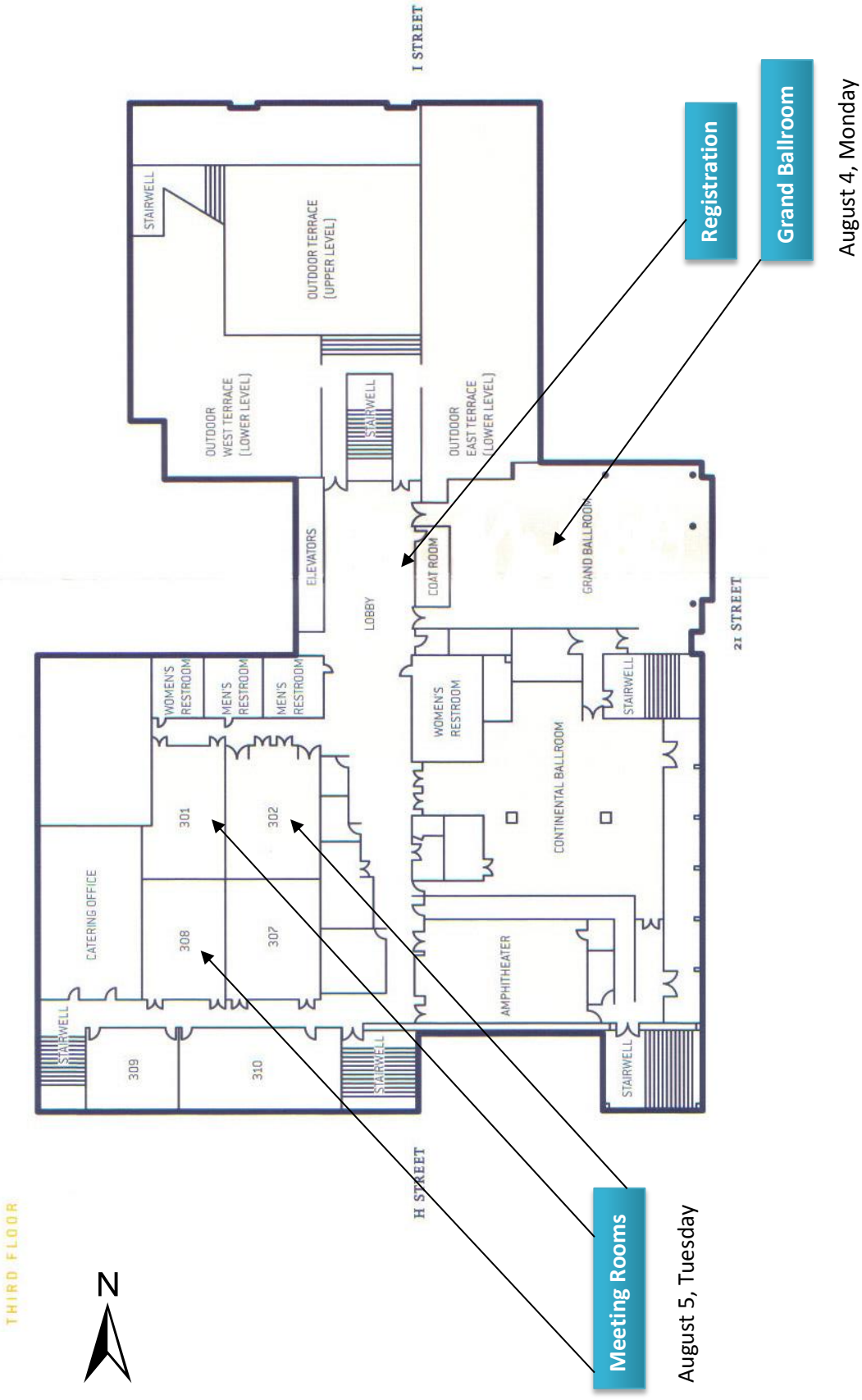
August 6th, Wednesday,
12:30 p.m. Bus leaves from the street corner of Marvin Center to FHWA campus in Mclean, VA
4:30 p.m. Bus leaves FHWA campus to GWU Marvin Center

Venue Information

Cafritz Conference Center (Marvin Center)
& Jack Morton Auditorium
800 21st St NW
Washington, DC 20052
USA

U.S.DOT-FHWA
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 221010
USA

Location of Meeting Rooms

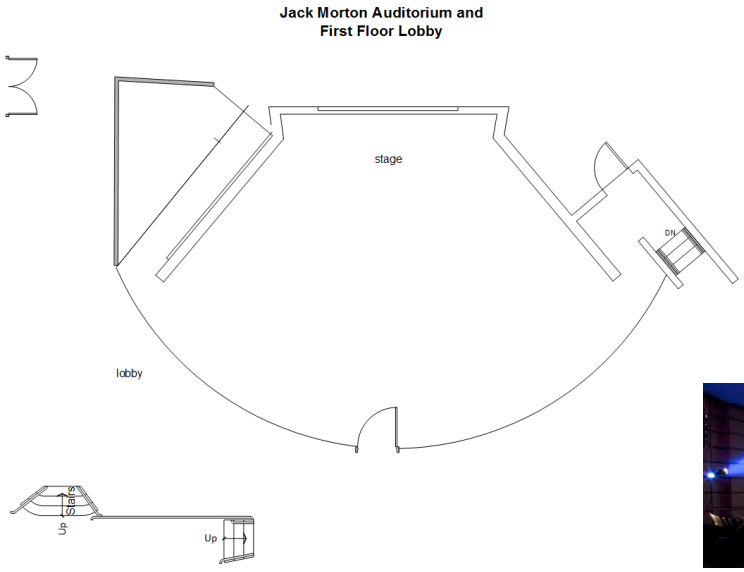


3rd Floor Plan of Marvin Center

800 21st St NW

Washington, DC 20052

Location of Meeting Rooms



Jack Morton Auditorium (JMA)

Media and Public Affairs (MPA) Building

805 21st Street NW

Washington DC, 20052

August 6, Wednesday Morning

(Food and drink are not allowed for audience in JMA and the lobby)

Location of Meeting Rooms

U.S. Department of Transportation (U.S. DOT)

Federal Highway Administration (FHWA)

Turner-Fairbank Highway Research Center (TFHRC)

6300 Georgetown Pike, McLean, VA 22101

August 6, Wednesday Afternoon

Security Requirements

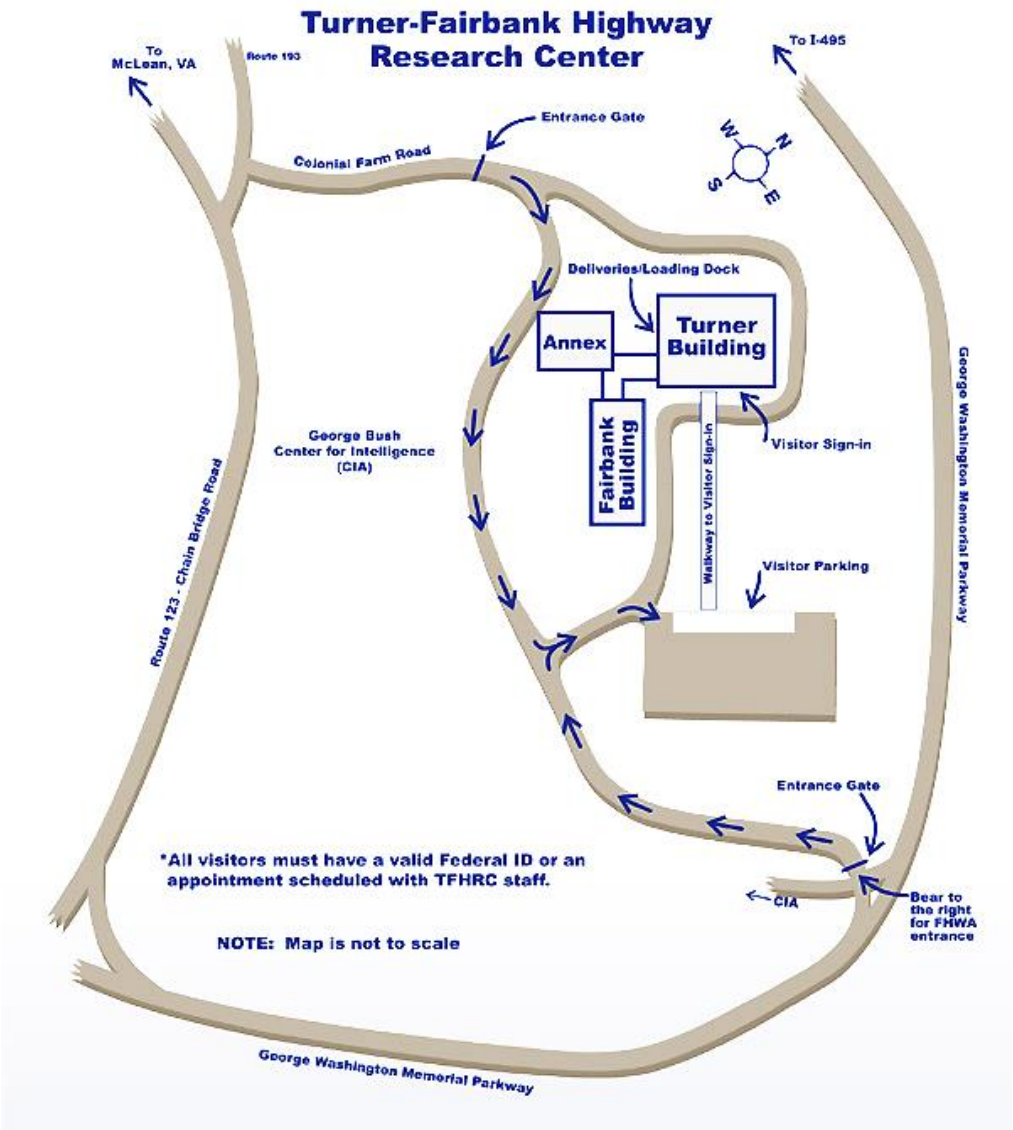
Only a limited number of attendees are invited to visit the FHWA labs. Each visitor need **a government issued pictured identification card** to gain access to the facility.
There will be a lot of walking and standing; comfortable clothes and shoes are recommended.

FHWA Tech Talks, Demo Shows & Lab Tours

Please see Page 28 for more details.

Schedules

12:30 PM Bus leaves from the street corner of Marvin Center
1:00 – 1:30 PM Visitor Security Check *(TFHRC Lobby)*
1:30 – 4:30 PM **FHWA Welcome Remarks** *(Conference Room)*
FHWA Tech Presentations *(Conference Room)*
FHWA Demo Shows *(Conference Room & Labs)*
FHWA Four Lab Tours *(Four Labs)*
FHWA Closing Remarks *(Conference Room)*
Visitor Security Sign Out *(TFHRC Lobby)*
4:30 PM Bus leaves from TFHRC, back to Marvin Center



Keynotes

Monday, August 4
Ballroom, Marvin Center

Keynote Chair:
Lindi Liao
COMStar Computing Technology Institute

Opening Remarks August 4 9:00 AM - 9:15 AM

Monday Keynote I: Northrop Grumman
August 4 9:15 AM - 10:05 AM

Dr. Ray Renner
Technical Fellow, Northrop Grumman Corp.

Big Data - A System Integrator's Perspective

Big data/data science/advanced geospatial analytic technologies and tools are advancing and proliferating rapidly, adding to the complexity and challenges of effectively bringing together COTS, OSS, GOTS in ways that are adaptive to the latest innovations in the field and effective for our missions. System integrators need to find the right balance between applying latest technologies and the discipline/domain expertise to address mission needs. Big Data has the potential to revolutionize the way that our customers collect, consume, analyze and visualize data. As these capabilities move out of Research and Development and into large development and integration projects, system integrators are faced with challenges and concerns with successfully realizing the potential and impact of big data for our customers. These challenges include what does big data mean for specific customers, good test data, open source software licensing and others. We will discuss these challenges, concerns and some approaches to them.

Dr. Ray Renner is a Technical Fellow at Northrop Grumman and an adjunct professor at The George Washington University. Northrop Grumman is a leading system integration company providing innovative systems, products and solutions in unmanned systems, cyber, C4ISR, and logistics and modernization to government and commercial customers worldwide with over 65,000 employees across 25 countries. Ray is the Chief Engineer on a big data productization effort at Northrop Grumman and the Chairperson for the Northrop Grumman Information System Software Engineering Center of Excellence. He has 25 years of experience in software and systems development and software R&D. His research interests include geospatial analysis and visualization, big data analysis and visualization, software engineering and Agile software development.

Monday Keynote II: Federal Big Data Working Group Meetup, Semantic Community
August 4 10:15 AM - 11:05 AM

Dr. Brand Niemann
Former Senior Enterprise Architect & Data Scientist, U.S. EPA
Co-organizer, Federal Big Data Working Group Meetup
Director and Senior Data Scientist, Semantic Community

The Federal Big Data Initiative: Where it has been and where it is going

Since the White House announced the Big Data Initiative in 2010, there have been a series of activities for government agencies, academia, and industry to participate in to develop data scientists, perform research, and to develop applications, which this presentation will summarize. The work of the Federal Big Data Senior Steering Work Group, the NSF Big Data Funding Opportunities, and the Federal Big Data Working Group Meetup will be described and specific examples will be shown.

The roles of the Presidential Digital Government Strategy and Open Data / Open Government Policy, the new Congressional Data Act, and the Open Research Data Policy will be described and specific examples of their implementation will be given. Attendees should be able to see where they might participate in the Federal Big Data Initiative as a result of attending this presentation.

Dr. Brand Niemann, former Senior Enterprise Architect & Data Scientist with the US Environmental Protection Agency, works as a data scientist, produces data science products, and publishes data stories for Semantic Community, AOL Government, & Data Science & Data Visualization DC. He is the co-organizer of the Federal Big Data Working Group Meetup and the Director and Senior Data Scientist for Semantic Community.

Keynotes

Monday Keynote III: Oracle
August 4 11:05 AM - 12:00 AM

Dr. Xavier Lopez
Senior Director of Product Management for Oracle Spatial Oracle

Making Sense of Big Data: The Role of Location

Today's business and government organizations are challenged when trying to manage and analyze information from enterprise databases, streaming servers, social media and open source. This is compounded by the complexity of integrating diverse data types (relational, text, spatial, images, spreadsheets) and the entities they represent (customers, products, suppliers, events, and locations) - all of which need to be understood and re-purposed in different contexts. Identifying meaningful patterns across these different information sources is non-trivial. Moreover, conventional IT tools, such as GIS, data warehousing and business intelligence alone, are insufficient at handling the volumes, velocity and variety of content at hand. A new framework and associated tools are needed. Dr. Lopez outlines how developers are applying "linked data" concepts to make sense of these Big Data sources. He will describe new approaches oriented toward search, discovery, linking, and analyzing information on the Web, and throughout the enterprise. The key take away is use of spatial and linked open data concepts to enhance content alignment, interoperability, discovery and analysis of Big Data.

Dr. Xavier Lopez is Senior Director of Product Management for Oracle's Spatial products group. For the past sixteen years, he has led Oracle's efforts to incorporate spatial technologies across Oracle's database, application server, and application business.

He has over twenty years of experience in the area of GIS and spatial databases. He is currently focusing on high performance spatial computing and linked open data. He holds advanced degrees in engineering and planning from the University of Maine, MIT, and the University of California, Davis. He is currently a member of the US National Geospatial Advisory Committee (NGAC). Xavier is a past member of the Mapping Science Committee of the National Academy of Science, which advises the nation on mapping activities.

Wednesday, August 6
Jack Morton Auditorium, Media and Public Affairs Building

Keynotes Chair:
Dr. Lindi Liao
COMStar Computing Technology Institute

Wednesday Keynote I: U.S. DOT
August 6 9:15 AM - 10:05 AM

Mr. Tim Schmidt
Senior Technology Advisor
Turner-Fairbank Highway Research Center
Federal Highway Administration (FHWA)
U.S. Department of Transportation (U.S. DOT)

How Talking Cars Will Transform the Way We Travel

Imagine a transportation system where cars can see things that you can't. Such cars could warn of a potential crash or icy roads ahead, advise of a traffic jam ahead, or help find a parking space. Imagine if buses could tell if you will make your next connection, mapping software could indicate the greenest travel route, and cell phones could communicate with traffic signals so disabled pedestrians can safely cross an intersection. These developments are closer than you think through the U.S. Department Transportation (USDOT) connected vehicle research. Connected vehicles combine leading-edge technologies (GPS, Wi-Fi, wireless sensors, and dedicated short-range communications) to enable high-speed, real-time communications among vehicles, roadside infrastructure, and mobile devices. The USDOT is investing in connected vehicles because of their promise to save lives, as well as improve traffic flow, reduce environmental impacts, and make our communities safer and more livable.

Mr. Tim Schmidt, has served the U.S. Department of Transportation in multiple senior executive capacities involving technology advocacy, strategic planning and thought leadership, and has been involved with various aspects of connected and automated vehicle activities. His keynote will outline various aspects of the federal government's vision and future roadmap for self-driving cars. Mr. Schmidt is currently the Senior Technology Advisor at FHWA's Turner-Fairbank Highway Research Center. He was formerly the U.S. DOT's Deputy Chief Information Officer (CIO) and Chief Technology Officer (CTO). He has also held technology and corporate leadership positions at the FAA, IRS, White House and multiple private sector corporations. Mr. Schmidt is a retired Army

Keynotes

officer having served over 20 years within the U.S. Department of Defense.

Wednesday Keynote II: NVIDIA

August 6 10:15 AM - 11:05 PM

Mr. Danny Shapiro
Senior Director of Automotive
NVIDIA

The Future Car - Horsepower Replaced by Computing Power

The art and science of computing has been dramatically transformed by the invention of the graphics processing unit or GPU over a decade ago. Not only are GPUs used extensively in industries such as video games, movie production, product design, medical diagnosis, scientific research, and energy exploration, but they play a vital role in the automotive industry. From concept styling and design, to engineering and simulation, to advertising and point of sale marketing, the GPU helps designers and engineers make better, safer, more energy efficient and more affordable cars.

However while these applications of graphics and parallel processing have focused on the creation of cars, we are now seeing the need to increase the computing power inside the vehicle as well. Many cars today have numerous microcontrollers and run millions of lines of code, however tomorrow, your car will be the most powerful computer you will ever own. High-performance mobile computing and innovative sensing technology has both automakers and Silicon Valley re-thinking what the promise of a car means to consumers.

Developments in computer vision, image processing, machine learning and augmented reality - all fields that rely heavily on the GPU -- will help define the automotive experience of the future and pave the road to the self driving car. In vehicle supercomputing and connections to the cloud will forever change owning, driving and riding in a car.

Mr. Danny Shapiro is NVIDIA's Sr. Director of Automotive, focusing on solutions that enable faster and better design of automobiles, as well as in-vehicle solutions for infotainment, navigation and driver assistance.

He is a 25-year veteran of the computer graphics and semiconductor industries, and has been with NVIDIA since 2009. Prior to NVIDIA, Danny served in marketing, business development and engineering roles at ATI, 3Dlabs, Silicon Graphics and Digital Equipment. Danny holds a BSE in Electrical Engineering and Computer Science from Princeton University and an MBA from the Hass School of Business at UC Berkeley. He lives in Northern California where his home solar panel system charges his electric car.

Wednesday Keynote III: U.S. DOE

August 6 11:05 AM - 12:00 PM

Dr. Robinson E. Pino
Computer Scientist and Program Manager
Advanced Scientific Computing Research, Office of Science
U.S. Department of Energy (U.S. DOE)

Extreme Computing and Data Challenges

The Office of Science Advanced Scientific Computing Research Program underpins DOE's world leadership in scientific computation by supporting research in applied mathematics, computer science, high-performance networks, computational partnerships and educational programs. In particular, our Computer Science research portfolio fills a critical gap in scientific computing. The computing resources required to fulfill the Office of Science mission exceed the state-of-the-art by a significant margin. Furthermore, the software tools, libraries and the distributed software environments needed to accelerate scientific discovery through modeling and simulation are beyond the realm of commercial interest. Yet, the computing resources and the applications that run on them are vital to maintaining the United States' competitiveness in the world economy. Our Computer Science research program supports research that enables computing at extreme scales and the understanding of extreme scale data from both simulations and experiments. It aims to make scientific computers as easy and effective to use as possible. This talk will focus on challenges for computing and data.

Dr. Robinson E. Pino is a Computer Scientist and Program Manager for the Advanced Scientific Computing Research

Keynotes

(ASCR) program office in the Department of Energy's (DOE) Office of Science. In his portfolio, Dr. Pino focuses on revolutionary basic research and development efforts for high performance computing and applications that will enable our continued leadership through exascale and beyond computing and energy efficient technologies. Dr. Pino has expertise within technology development, program management, government, industry, and academia. He previously worked as Director of Cyber Research at ICF International advancing the state of the art in cybersecurity by applying autonomous concepts from computational intelligence and neuromorphic computing for the U.S. Department of Defense (DoD) Army Research Laboratory (ARL) and various DoD and U.S. Department of Energy (DoE) collaborators, industry and academia. Dr. Pino's research and development program focused on the development of intelligent, autonomous, and cognitive applications toward network, host, and mobile security solutions. In addition, Dr. Pino was a Senior Electronics Engineer at the U.S. Air Force Research Laboratory (AFRL) where he was a program manager and principle scientist for the computational intelligence and neuromorphic computing research efforts. He also worked at IBM as an advisory scientist/engineer development enabling advanced CMOS technologies and as a business analyst within IBM's photomask business unit. Dr. Pino served as an adjunct professor at the University of Vermont where he taught electrical engineering courses. Dr. Pino has a Ph.D. and M.Sc. degrees in Electrical Engineering with honors from Rensselaer Polytechnic Institute and a B.E. in Electrical Engineering with honors from the City University of New York, City College. He is the recipient of numerous awards and professional distinctions; has published over 50 technical papers, including three books; and holds six patents, three pending.

Plenary Tech Show Talk: MIT

August 6 9:00 AM - 9:15 AM

Dr. Karl Iagnemma

Director of Robotic Mobility Group, MIT

The Intelligent Co-Pilot: a Path toward Fully Autonomous Vehicles

Dr. Karl Iagnemma is a principal research scientist in the Mechanical Engineering department at the Massachusetts Institute of Technology. He holds a B.S. from the University of Michigan, and an M.S. and Ph.D. from MIT, where he was a National Science Foundation Graduate Fellow. He has performed postdoctoral research at MIT, and has been a visiting researcher at the NASA Jet Propulsion Laboratory and the National Technical University of Athens (Greece). He currently serves on the editorial board of the IEEE Transactions on Robotics and the Journal of Field Robotics. Dr. Iagnemma's primary research interests are in the areas of design, sensing, motion planning, and control of mobile robots in outdoor terrain, including modeling and analysis of robot-terrain interaction. He is author of the monograph Mobile Robots in Rough Terrain: Estimation, Planning and Control with Application to Planetary Rovers (Springer, 2004). He has recently led research programs for agencies including the U.S. Army Tank-Automotive and Armaments Command, the Army Research Office, DARPA, the NASA Mars Program Office, Ford Motor Company, and the NASA Institute for Advanced Concepts, among others. He has authored or co-authored many conference and journal papers on a wide range of robotic topics, and has consulted for various private companies and government agencies. Dr. Iagnemma was chosen as one of 16 people who redefined science in 2003 by SEED magazine. He was a 2005 nominee for a MacArthur Foundation fellowship.

Emerging Tech Panels+

Monday, August 4
Ballroom, Marvin Center

Panel+ I: Federal Big Data Working Group
Aug 4 1:00 PM - 2:30 PM

Moderator:

Dr. Katherine Goodier
Xcelerate Solutions

Panelists:

Dr. Kirk Borne
Professor of Astrophysics and Computational Science, George Mason University

Dr. Chuck Rehberg
CTO, Trigent and Semantic Insights

Dr. Joan Aron
Independent Consultant Climate Data, Aron Environmental Consulting

Dr. Tom Rindflesch
Information Research Specialist at Cognitive Science Branch, National Institutes for Health (NIH)

Ms. Mary Galvin
Managing Principal, AIC & Semantic Community

The Federal Big Data Working Group Panel will feature these members who will discuss their involvement in the working group, research applications, use cases, publications, solutions, and technologies:

Federating Uses Cases
- Data Science: Brand Niemann
- Privacy and Security: Katherine Goodier
- Environmental and Earth Science: Joan Aron
- Astronomy: Kirk Borne

Federating Data Publications
- Structured Scientific Content: Papers, journals, books, reports, etc.
- Data FAIRports: Findable, Accessible, Interoperable, and Reusable
- Data Stories That Persuade: Claims and Evidence

Federating Solutions & Technologies
- Semantic MedLine: Tom Rindflesch
- Reading and Reasoning: Katherine Goodier and Chuck Rehberg, Semantic Insights on Elsevier Content Text Mining
- Social Media and NodeXL: Marc Smith
- Hand-Crafted by Individuals and Teams: Mary Galvin, STEM
- Data Mining Standards and Products: Brand Niemann, Data Publications in Data Browsers
- Machine Processing: Fredrik Salvesen, Semantic Data Publications on Yarc Data Graph Appliance
- Data Curation at Scale: Michael Stonebraker, Tamr on 1000s of Spreadsheets

Panel+ II: Challenges and Solutions for Big Data in the Cloud
Aug 4 2:40 PM - 4:30 PM

Moderator:

Dr. Shyam Parhi
Computer Scientist, Airport Engineering Division, Federal Aviation Administration (FAA)

Panelists:

Mr . Tim Schmidt
Senior Technology Director at FHWA-TFHRC, U.S. DOT

Dr. Xavier Lopez
Senior Director of Product Management for Oracle Spatial, Oracle

Dr. Simon Berkovich
Professor of Computer Science, George Washington Univeristy

Dr. Robinson E. Pino
Computer Scientist and Program Manager, U.S. Department of Energy (U.S. DOE)

Dr. Shawana P. Johnson
President, Global Marketing Insights, Inc.

Mr. Joseph Obernberger
Principal investigator, Northrop Grumman Corp.

Dr. Chaowei Yang
Professor of GISicence, George Mason University

Dr. Durmus Cesur
Program Manager, DCHC MPO

10-Minute Tech Talks

Hosting legacy Airport Layout Plans and airport imageries in Cloud
Dr. Shyam Parhi

Airports GIS is a web portal which hosts a few application modules. It allows authorized Airports GIS users to submit changes to airport data. One of these modules in Airports GIS is electronic Airport Layout Plan (eALP). This application helps airports create their digital Airport Layout Plans. The layout view capability in this module is provided by ESRI's ArcGIS server. The initial phase of testing a few eALPs across the nation as a pilot program initiative is over and valuable lessons are learned from this activity. We expect this application will go to production sometimes next year. It will take several years before most or all airports in USA have their digital Airport Layout Plans. During this transition period we are storing legacy Airport Layout Plans in Cloud. These Layout

Plans are basically in pdf form. Plans to catalogue these Layout Plans and provide access to users are being implemented.

Airports GIS also hosts another Survey module. As part of this module requirement, we collect airport imagery for almost every submitted airport project to Airports GIS. We have already archived some of these ortho images in Cloud. This gives the ability to users to take advantage of ESRI's ArcGIS viewer to analyze and manage these imageries. These ortho images are large in size. In future, we will receive a lot more ortho images because the number of airports who submit this data is growing and the size of each ortho image is also growing. Hence, it needs special care to organize and access these imageries. Once completed, this will have significant impact on airport planning and budgeting.

Intelligent Software Defined Storage
Dr. Simon Berkovich

The Big Data situation requires a qualitatively different type of information processing. This problem brings in a new type of a computational model that explicitly works only with a relatively small portion of the available data, while the rest of the data just implicitly affects selection of the given working portion [1]. The unavoidable restrictions on the operations with overabundant data translate into the design of the brain in accordance with the fundamental Freud's idea of unconsciousness. This design is contemplated in our paper [2]. Diversified information in overwhelming amounts appears ambiguous, volatile, and unreliable. So, the contents of Big Data systems cannot be treated with confidence as in traditional searching and data mining. Instead, Big Data should be utilized essentially through what can be seen as "knowledge formation". In other words, processing of Big Data must be performed by what can be considered as "scientific method". Namely, besides simple extraction of references as from regular information systems the full exploitation of Big Data necessitates formulating testable hypotheses and creating prediction models. A classical illustration presents usage of the observational data of Tycho Brahe through transformation of Kepler's laws into Newton's model of "Universal Gravitation". Thus, employing Big Data falls into the realm of Artificial Intelligence. As a matter of fact, the intelligence facilities of the brain can be considered as a necessary condition to deal with the Big Data challenge. A special type of holographic memory is a pivot point in the realization of these facilities [2]. To implement such kind of Big Data processing facilities in practice we introduce a particular construction of Software Defined Storage. This construction emulates the basic features of the suggested memory organization of the brain: multi-attribute cortical map, content-addressable access, and stream resolution of multiple responses. The envisioned Software Defined Storage incorporates two developments: memory device for multi-atribute items that can be accessed by any combinations of attributes using Fuzzyfind procedures [3] and massive distributed streaming for resolution of multiple responses [4].

Dr. Shawana P. Johnson's Talk Abstract
Dr. Shawana P. Johnson

Will provide a brief overview of Enablers and Challenges to Big Data in the Cloud which will touch on the following key topics:

- Connectivity
- Signaling
- Device Detection
- Data Ownership
- Standards
- Security
- Bandwidth
- Battery Life
- Collaboration
- Government Role

Big data leads to "big topics for discussion and action geospatially" which are being thoughtfully addressed.

Panelists' Bios

Mr. Tim Schmidt has served the U.S. Department of Transportation in multiple senior executive capacities involving technology advocacy, strategic planning and thought leadership, and has been involved with various aspects of connected and automated vehicle activities. His keynote will outline various aspects of the federal government's vision and future roadmap for self-driving cars. Mr. Schmidt is currently the Senior Technology Advisor at FHWA's Turner-Fairbank Highway Research Center. He was formerly the U.S. DOT's Deputy Chief Information Officer (CIO) and Chief Technology Officer (CTO). He has also held technology and corporate leadership positions at the FAA, IRS, White House and multiple private sector corporations. Mr. Schmidt is a retired Army officer having served over 20 years within the U.S. Department of Defense.

Dr. Xavier Lopez is Senior Director of Product Management for Oracle's Spatial products group. For the past sixteen years, he has led Oracle's efforts to incorporate spatial technologies across Oracle's database, application server, and application business. He has over twenty years of experience in the area of GIS and spatial databases. He is currently focusing on high performance spatial computing and linked open data. He holds advanced degrees in engineering and planning from the University of Maine, MIT, and the University of California, Davis. He is currently a member of the US National Geospatial Advisory Committee (NGAC). Xavier is a past member of the Mapping Science Committee of the National Academy of Science, which advises the nation on mapping activities.

Prof. Simon Berkovich received MS in Applied Physics from Moscow Physical-Technical Institute (1960) and PhD in Computer Science from the Institute of Precision Mechanics and Computer Technology of the USSR Academy of Sciences (1964). He played a leading role in a number of projects on the design of advanced hardware and software systems. He has several hundred professional publications in various areas of physics, electronics, computer science, and biology. In 2002,

Professor Simon Berkovich was elected a member of the European Academy of Sciences "for an outstanding contribution to computer science and the development of fundamental computational algorithms".

Dr. Robinson E. Pino is a Computer Scientist and Program Manager for the Advanced Scientific Computing Research (ASCR) program office in the Department of Energy's (DOE) Office of Science. In his portfolio, Dr. Pino focuses on revolutionary basic research and development efforts for high performance computing and applications that will enable our continued leadership through exascale and beyond computing and energy efficient technologies. Dr. Pino has expertise within technology development, program management, government, industry, and academia. He previously worked as Director of Cyber Research at ICF International advancing the state of the art in cybersecurity by applying autonomous concepts from computational intelligence and neuromorphic computing for the U.S. Department of Defense (DoD) Army Research Laboratory (ARL) and various DoD and U.S. Department of Energy (DoE) collaborators, industry and academia. Dr. Pino's research and development program focused on the development of intelligent, autonomous, and cognitive applications toward network, host, and mobile security solutions. In addition, Dr. Pino was a Senior Electronics Engineer at the U.S. Air Force Research Laboratory (AFRL) where he was a program manager and principle scientist for the computational intelligence and neuromorphic computing research efforts. He also worked at IBM as an advisory scientist/engineer development enabling advanced CMOS technologies and as a business analyst within IBM's photomask business unit. Dr. Pino served as an adjunct professor at the University of Vermont where he taught electrical engineering courses. Dr. Pino has a Ph.D. and M.Sc. degrees in Electrical Engineering with honors from Rensselaer Polytechnic Institute and a B.E. in Electrical Engineering with honors from the City University of New York, City College. He is the recipient of numerous awards and professional distinctions; has published over 50 technical papers, including three books; and holds six patents, three pending.

Dr. Shawana P. Johnson, President, Global Marketing Insights, Inc. (GMI) is an expert in the usage and application of Global Commercial Geospatial Imagery and associated technologies. Her organization is the largest provider of highly customized product and techical market research in the world with sole source access to a database developed under contracts with NOAA and the USGS. GMI is also a leading technology transfer specialist assisting the US government with access to geospatial technology platforms and tools as well as providing commercial geospatial organizations knowledge concerning global buying habits and technology trends. She speaks regularly on the topics of Big Data and how to move Geospatial Imagery in the cloud and on sophisticated platforms and has recently spoken at MIT on the Internet of Things and at an LES Summit- to Intellectual Property and Licensing Executives focused on Big Data and Geospatial Computing and the Challenges faced with new Business Models (per use basis in the cloud) and Licensing and Standards.

Mr. Joseph Obernberger is Principal investigator on R&D projects at Northrop Grumman involving big data processing and analytics. Involved in software development and architecture design for a system that ingests and performs analytics on large amounts of unstructured text, video and audio data using a combination of COTS and open source software.

Prof. Chaowei Phil Yang is a Professor at George Mason University, where he founded and directs the center for intelligent spatial computing and NSF spatiotemporal innovation center. His research focuses on utilizing spatiotemporal principles to optimize computing infrastructure to support science discoveries and engineering development. He proposed and consolidated as a leader several geocomputing research directions including distributed geographic information processing, geospatial cyberinfrstructure, spatial computing, and spatial cloud computing. Exemplified by $25M research funding and 100+ articles, his activities are widely recognized through awards from the White House, NASA, Nobel Intent Blog, MOST, CPGIS, and many others. His latest endeavor is to lead the building of the national and international spatiotemporal infrastructure to advance a) human intelligence through spatiotemporal thinking, b) computer software and tools through spatiotemporal computing, and c) human capability of responding to deep scientific questions and grand engineering challenges through spatiotemporal applications.

Dr. Durmus Cesur has more than 20 years of experience in Engineering, Information Technology, and Project/Program/Strategic Management fields. He has been working as GIS/Database/Web Administrator (Program Manager) at DCHC MPO currently. He has worked in private, public and academic sectors nationally and internationally at various roles and capacities including analyst, program manager, adjunct professor, consultant and Sr. Consultant. He worked at Space Imaging, Intera Inc., Natural Resource Ecology Lab, and National Park service, Colorado State University, Front Range Community College and KMaras University (International, Turkey). He has been licensed as Professional Engineering (PE) in the State of Texas, and have project management professional (PMP), Certified Floodplain Management, Geographic Information Systems Professional, and ESRI Authorized and Certified Instructor, ESRI Enterprise Associate and ArcGIS Desktop Associate and Professional and CompTIA - Certified Technical Trainer Certifications (CTT+) certifications. He is a reviewer in Several Journals, and Committee Member and Advisor in GIS/IT/Water related national/international organizations such as Journal of American Water Resources AWRA, Air and Waste Management Journal, GITA, HarmonIT, Floodsite etc. He is being awarded various awards in GIS including Special Achievement in GIS in 2004 and being listed in Who's Who in America List since 2009. Dr. Cesur holds a Ph.D. Civil/Environmental Engineering, a M.S. in Computer Information Systems & Civil Engineering, and a B.S. Civil Engineering.

Emerging Tech Panels+

Tuesday, August 5
Room 302, Marvin Center

Panel+ III: Big Data and Geospatial Computing
10:40 AM - 12:00 PM

Moderator

Dr. Ray Renner
Technical Fellow, Northrop Grumman Corp.

Panelists

Dr. Xavier Lopez
Senior Director of Product Management for Oracle Spatial, Oracle Corp.

Dr. Shawana P. Johnson
President, Global Marketing Insights, Inc.

Dr. Peter Baumann
Professor of Computer Science, Jacobs University

Dr. Chaowei Yang
Professor of GISicence, George Mason University

Dr. Durmus Cesur
Program Manager, DCHC MPO

Dr. Shawana P. Johnson's Talk Abstract
Dr. Shawana P. Johnson, GISP

Big Data and Geospatial computing – The Internet of Things (IoT) is impacting geospatial computing. The IoT is not really about just a collection of personal connected devices but the ability of my devices to communicate with the sensors in everything that I want to connect with or know about in other words connecting to (more) intelligent or "smart" devices. This requires complex networking as well as location based intelligence in order for each device to understand my location and the location of other devices as well. Location data is many times geographic in nature and requires a great deal more bandwidth and compute ability to move and connect the information. Currently we have about three connected devices to each person and this is expected to double by 2018 and cloud computing provides real-time communication network connections to many computers and the Internet which allows many users to avoid expensive hardware that can only hold small amounts of imagery and focus more on the ability to manage imagery. Being able to manipulate and process imagery in the cloud allows you to grab that imagery from any location whenever necessary as simple as email. Currently, the cloud is a major key to the use and Big Data as it relates to Geospatial Computing.

Panelists' Bios

Dr. Ray Renner is a Technical Fellow at Northrop Grumman and an adjunct professor at The George Washington University. Northrop Grumman is a leading system integration company providing innovative systems, products and solutions in unmanned systems, cyber, C4ISR, and logistics and modernization to government and commercial customers worldwide with over 65,000 employees across 25 countries. Ray is the Chief Engineer on a big data productization effort at Northrop Grumman and the Chairperson for the Northrop Grumman Information System Software Engineering Center of Excellence. He has 25 years of experience in software and systems development and software R&D. His research interests include geospatial analysis and visualization, big data analysis and visualization, software engineering and Agile software development.

Dr. Xavier Lopez is Senior Director of Product Management for Oracle's Spatial products group. For the past sixteen years, he has led Oracle's efforts to incorporate spatial technologies across Oracle's database, application server, and application business. He has over twenty years of experience in the area of GIS and spatial databases. He is currently focusing on high performance spatial computing and linked open data. He holds advanced degrees in engineering and planning from the University of Maine, MIT, and the University of California, Davis. He is currently a member of the US National Geospatial Advisory Committee (NGAC). Xavier is a past member of the Mapping Science Committee of the National Academy of Science, which advises the nation on mapping activities.

Dr. Shawana P. Johnson, President, Global Marketing Insights, Inc. (GMI) is an expert in the usage and application of Global Commercial Geospatial Imagery and associated technologies. Her organization is the largest provider of highly customized product and technical market research in the world with sole source access to a database developed under contracts with NOAA and the USGS. GMI is also a leading technology transfer specialist assisting the US government with access to geospatial technology platforms and tools as well as providing commercial geospatial organizations knowledge concerning global buying habits and technology trends. She speaks regularly on the topics of Big Data and how to move Geospatial Imagery in the cloud and on sophisticated platforms and has recently spoken at MIT on the Internet of Things and at an LES Summit- to Intellectual Property and Licensing Executives focused on Big Data and Geospatial Computing and the Challenges faced with new Business Models (per use basis in the cloud) and Licensing and Standards.

Dr. Peter Baumann is Professor of Computer Science at Jacobs University, Bremen, Germany. He researches on scalable multi-dimensional array databases and their application in earth, space, and life sciences. Peter Baumann has pioneered Array Databases. He has authored and co-authored 100+ books, chapters, and papers on array databases and related fields. He has architected the rasdaman system which is today's only fully implemented and operationally used raster database worldwide. For the commercial support of rasdaman, he has launched and is CEO of a dedicated spinoff company. He holds international patents on array databases and has received a series of national and international innovation awards for his work. In the Open Geospatial Consortium (OGC) standardization body he is chairing the "Big Geo Data" working groups and editor of 12 standards. In ISO, he is working on the

forthcoming SQL/MDA, an SQL extension for multi-dimensional arrays and is member of the SC32 Study Group on Big Data. In RDA, he co-chairs the Big Data Analytics Interest Group and the Geospatial Interest Group.

Prof. Chaowei Phil Yang is a Professor at George Mason University, where he founded and directs the center for intelligent spatial computing and NSF spatiotemporal innovation center. His research focuses on utilizing spatiotemporal principles to optimize computing infrastructure to support science discoveries and engineering development. He proposed and consolidated as a leader several geocomputing research directions including distributed geographic information processing, geospatial cyberinfrstructure, spatial computing, and spatial cloud computing. Exemplified by $25M research funding and 100+ articles, his activities are widely recognized through awards from the White House, NASA, Nobel Intent Blog, MOST, CPGIS, and many others. His latest endeavor is to lead the building of the national and international spatiotemporal infrastructure to advance a) human intelligence through spatiotemporal thinking, b) computer software and tools through spatiotemporal computing, and c) human capability of responding to deep scientific questions and grand engineering challenges through spatiotemporal applications.

Dr. Durmus Cesur has more than 20 years of experience in Engineering, Information Technology, and Project/Program/Strategic Management fields. He has been working as GIS/Database/Web Administrator (Program Manager) at DCHC MPO currently. He has worked in private, public and academic sectors nationally and internationally at various roles and capacities including analyst, program manager, adjunct professor, consultant and Sr. Consultant. He worked at Space Imaging, Intera Inc., Natural Resource Ecology Lab, and National Park service, Colorado State University, Front Range Community College and KMaras University (International, Turkey). He has been licensed as Professional Engineering (PE) in the State of Texas, and has project management professional (PMP), Certified Floodplain Management, Geographic Information Systems Professional, and ESRI Authorized and Certified Instructor, ESRI Enterprise Associate and ArcGIS Desktop Associate and Professional and CompTIA - Certified Technical Trainer Certifications (CTT+) certifications. He is a reviewer in Several Journals, and Committee Member and Advisor in GIS/IT/Water related national/international organizations such as Journal of American Water Resources AWRA, Air and Waste Management Journal, GITA, HarmonIT, Floodsite etc. He is being awarded various awards in GIS including Special Achievement in GIS in 2004 and being listed in Who's Who in America List since 2009. Dr. Cesur holds a Ph.D. Civil/Environmental Engineering, a M.S. in Computer Information Systems & Civil Engineering, and a B.S. Civil Engineering.

Workshops

Tuesday, August 5
Room 302, Marvin Center

Oracle Workshop

Learn to Build an Analytics Solution with Oracle's Spatial Tools and Platform

1:00 PM - 3:00 PM

Presenter
Daniel Geringer
Senior Manager, Software Development, Oracle

Whether it's marketing analysis to send customers mailers from their closest store, or to find the closest repair depots to a portion of rail that needs to be serviced, very often the result is based on drive time analysis, not as the crow flies analysis. Learn how to optimize strategies and solve these network based requirements, without computing every possible point to point drive time calculation. This hands-on workshop will walk you through building an end to end application that maximizes performance, and optimizes hardware resources to solve massive drive time analysis requirements. The application will be based on Oracle Spatial and Graph's geocoder, router, and network graph technologies, and on Oracle Fusion Middleware MapViewer.

Attendees will be expected to provide their own laptops; the virtual machine will be available for download in advance of the workshop.

Prerequisites:

Attendees should have some knowledge of Java, SQL and PL/SQL. The workshop will use an Oracle Virtual Box Linux based image pre-configured with the required Oracle software and HERE sample data for San Francisco. The image will be available for download by attendees prior to the workshop. It uses Oracle Enterprise Linux so some experience with invoking scripts and using text editors on Linux (vi or gedit) will be beneficial.

Hardware and software requirements:
* Laptop (quad-core preferred)
* Virtual Box 4.2 or later (https://www.virtualbox.org/)
* Minimum 8Gb RAM (16Gb preferred): The VM requires 6GB and two processors to run.
* Minimum 100Gb free disk space (the image is approximately a 17Gb download that requires an additional 60 Gb of disk during import)

Tuesday, August 5
Room 308, Marvin Center

SAML Best Practices Workshop

How to build an Access Management Federation for geospatial Services

9:00 AM - 12:00 PM

Presenter
Dr. Andreas Matheus
Senior Research Scientist
Department of Computer Science
University of the Bundeswehr, Germany

A geospatial Access Management Federation is a network of trusted partners that allow sharing of protected geospatial services and data among each other. In order to enable access to a protected resource, a user must proof that she belongs to a trusted partner. It is therefore essential to have secure and interoperable authentication in place. One standards based approach is leveraging the OASIS Security Assertion Markup Language (SAML).

The standard defines a framework to securely exchange assertions about users. The resulting challenge is to use the best combination of the different profiles and bindings to suit best a particular need. It is in particular important to know the best practice that fits best the computing environment and the services provided.

When making OGC Web Services available in an Access Management Federation, it is important to understand the requirements that are introduced by the geospatial domain; for example by the client and the data format exchanged.

This workshop introduces the OASIS SAML standard and introduces a best practices, which combination of profiles and bindings fits best the use of OGC Web Services and OpenLayers based web-- ‐ mapping applications as well as Google Earth and other desktop applications.

Workshop Outline
This ½ day workshop aims to cover the following topics:

Workshops

09:00 – 10:00	**Motivation of an Access Management Federation for geospatial services**
	What are the typical motivations and requirements to establish an Access Management Federation? What are the organizational and stakeholder needs?
10:00 – 11:00	**Introduction to SAML (Security Assertion Markup Language)**
	What are SAML Profiles and Bindings all about? What are pros and Cons of the different important profiles in different computing environments (Intranet, Internet and Mobile Network)?
11:00 – 11:30	**The Discovery and the Single--Sign--On (SSO) Challenge**
	How can a user find the one organization of the federation to login? What is required to support (automatic) SSO to support clients like OpenLayers?
11:30 – 12:00	**Best Practices and demonstration of an Access Management Federation providing OGC Web Services**
	What are the SAML profiles and bindings that fit the purpose best? What challenges must be determined and how can they be solved when planning to use OpenLayers based web---mapping applications?
12:00 – 13:00	**Conclusions and Discussion**
	What is the feedback from the audience? What are the remaining questions of the audience? The conclusions.

Tuesday, August 5

Room 308, Marvin Center

OGC & ISO Workshop

Big Geo Data: Standards and Best Practices

An Introduction to OGC and ISO Big Data standards - and why you should know

1:00 PM - 5:00 PM

Presenter

Dr. Peter Baumann

Professor, Computer Science at Jacobs University, Germany

Co-Chair/Founder, OGC Domain Working Groups (BigData, WCS, (Coverages, Temporal)

Leading Member, ISO Arrays SQL

Charter Member, OSGeo

Big Data pose special challenges on geo data, touching upon all the V keywords, like Volume, Velocity, Variety, and Veracity. Simultaneously, demands are massively increasing, from the traditional file download to allowing customers to build their own spatio-temporal product on the fly.

This seminar introduces to the key Big Geo Data standards of OGC and ISO. It explains their mechanics, use, and scalability capabilities by way of many illustrations as well as hands-on test services. An outlook will be given to current discussions and future directions in several relevant standardization bodies.

The seminar is suitable for both beginners with some background in geo Web services, as well as for experts and implementers.

Breakout Sessions

★★★ Full Paper
★★ Short Paper
★ Briefing Paper
❋ Tech Talks
▶ Video Presentation

Big Geo Data, Geo Cloud, Geofencing

Tuesday, August 5 9:00 AM - 10:30 AM
Room 302, Marvin Center

Session Chair:
Dr. Tobias Jacobs , NEC Laboratories Europe

▶ ★★ A Hybrid Cloud Computing Approach for Managing Spatial Data: A Case Study for Water Resources in Greece

Dimitrios Kallergis, Chrysoula Papacharalampou, Konstantinos Chimos, Thomas Chavakis, Christos Douligeris

Global challenges and technology advancements have driven researchers and professionals to demand new tools for solving complex problems in terms of massive data exploitation. This paper describes a system that offers 3D visualisation of data with spatial interest regarding the management of water resources. The Software as a Service (SaaS) delivery is instrumented by a hybrid cloud implementation. A public cloud is used for a web service that accommodates the database system and the network traffic load provisioning, whilst a private cloud serves the rest of the web service, along with a custom metering service regarding the hybrid cloud's overall performance. In the context of this work, the geospatial data are exploited similarly to those which will be offered by governmental authorities in Greece conforming to European and National Laws and provide Web Mapping Services through open-access data repositories. Since these data storage solutions are still in an on-going progress, this paper works with private data gathered from professionals in the field of Earth Sciences. The resulted service provides seamless access to the geospatial data which are presented in a 3D web platform.

★★★ GLOBE: Analytics for Assessing Global Representativeness

Matthew D. Schmill, Tim Oates, Nicholas R. Magliocca, Erle C. Ellis

The goal of meta-analysis is to synthesize results from a collection of studies in order to identify patterns that have broader applicability. In the earth sciences, these synthesis studies attempt to bring together results of local case studies to make claims about global patterns. In order to substantiate claims of generality, it is crucial to establish that the collected case studies are representative of the regions they claim to characterize. Said differently, a meta-analyst must demonstrate that their choice of studies was not biased in a way that would undermine her claims. The GLOBE project aims to shorten the gap between local and global researchers by, among other things, providing analytics that help assess the representativeness of a collection of study sites and assist in correcting any bias found. In this paper we present the methods used by GLOBE to formalize the concept of representativeness, to analyze and visualize it, to remediate sampling bias, and present a use case in the domain of land change science.

★★★ HydroCloud: A Cloud-Based System for Hydrologic Data Integration and Analysis

Michael P McGuire, Martin C. Roberge, Jie Lian

The analysis of rainfall and runoff to characterize watershed response to storm events is a critical area of hydrologic research. A wealth of data exists to perform this analysis, but it is not easily accessible in a central location. The United States Geological Survey currently collects stream flow data for approximately 12,000 watersheds in the United States. The National Oceanic and Atmospheric Administration produces the spatially-distributed NEXRAD precipitation data, which can be used to estimate rainfall over an entire watershed. While the data is plentiful, it has yet to be integrated in a single system where hydrologists can easily explore the pattern of rainfall and runoff to assess watershed response. In this paper, we present the HydroCloud system, a novel system which uses cloud-based technology for integrating, storing, and exploring hydrologic data and demonstrate its utility in the analysis of watersheds.

★★★ A Spatiotemporal Interpolation Method Using Radial Basis Functions for Geospatiotemporal Big Data

Travis Losser, Lixin Li, Reinhard Piltner

Epidemiological studies have highlighted the public concerns about health effects of particulate air pollution. Modeling fine particulate matter PM2:5 exposure risk and monitoring day-to-day changes in PM2:5 concentration is a critical step for understanding the pollution problem and embarking on the necessary remedy. This research designs and implements the Radial Basis Function (RBF) spatiotemporal interpolation method to assess the trend of daily PM2:5 concentration for the contiguous United States over the year of 2009, at both the census block group level and county level. This research also compares the performance of the RBF spatiotemporal interpolation with the Inverse Distance Weighting (IDW) spatiotemporal interpolation. Traditionally, when handling spatiotemporal interpolation, researchers tend to treat space and time separately and reduce the spatiotemporal interpolation problems to a sequence of snapshots of spatial interpolations. In this paper, PM2:5 data interpolation is conducted in the continuous space-time domain by integrating space and time simultaneously. Time values are calculated with the help of a factor under the assumption that spatial and temporal dimensions are equally important when interpolating a continuous changing phenomenon in the spacetime domain. Various RBF-based spatiotemporal interpolation methods are evaluated by leave-one-out cross validation. More importantly, this study explores computational issues (computer processing speed) faced during implementation of spatiotemporal interpolation for huge data sets. Parallel programming techniques and an advanced data structure named k-d tree are adapted in this paper to address the computational challenges.

★★★ **Large Scale Indexing of Geofences**
Tobias Jacobs, Flavio Cirillo, Miquel Martin, Piotr Szczytowski

The modern smart phone and car concepts provide a fertile ground for new location-aware applications, ranging from traffic management to social services. While the functionality is partly implemented at the mobile terminal, there is a rising need for efficient backend processing of high-volume, high update rate location streams. It is in this environment that geofencing, the detection of objects traversing virtual fences, is becoming a universal primitive required by an ever-growing number of applications. To satisfy the functionality and performance requirements of large-scale geofencing applications, we present in this work a backend system for indexing massive quantities of mobile objects and geofences. Our system runs on a cluster of servers, achieving a throughput of location updates that scales linearly with number of machines. The key ingredients to achieve a high performance are a specialized spatial index, a dynamic caching mechanism, and a load-sharing principle that reduces communication overhead to a minimum and enables a shared-nothing architecture. The throughput of the spatial index as well as the performance of the overall system are demonstrated by experiments using simulations of large-scale geofencing applications.

Geospatial Computing and Application

Tuesday, August 5 9:00 AM - 10:30 AM
Room 301, Marvin Center

Session Chair:
Dr. Chun-Kit (Ben) Ngan, Penn State University

★★★ **An Ontology-based Approach to Represent Trajectory Characteristics**
Tales Paiva Nogueira, Reinaldo Bezerra Braga, Herve Martin

The behavior of moving objects has been a relevant source of information to intelligent mobile systems. However, most of existing works on trajectory representation deal only with basic characteristics of trajectories, such as space and time, while these attributes may be not enough to provide the required information to intelligent systems. We observe that the analysis of other characteristics (e.g. speed and acceleration) of mobile objects enriches the trajectory description as well as open opportunities to novel applications. However, the dynamic nature of these characteristics brings several challenges related to the preprocessing and analysis of raw data. In this paper, we show how these additional characteristics may be integrated in trajectory modeling. We address the problem of representing trajectories with qualitative descriptions of movement modeled as an ontology. We validate our approach with real data from a sport tracking application.

★ **Geo-Data Fusion Integrator for Object-Oriented Spatiotemporal OLAP Cubes**
Chun-Kit Ngan

We first propose a Geo-Data Fusion Integrator. Specifically, we design a sequential-parallel-modularized (SPM) approach to integrate different datasets into a geo-data object, i.e., a multidimensional unified-OLAP cube, archived in a geo-data warehouse for decision-making analysis. Different datasets of geo-data objects are processed in parallel across multi-stages in sequence, and then integrated into a well-defined OLAP cube. Each SPM component is a self-contained, modularized unit that processes the data. The technical merits of this SPM approach include fast manipulations, error minimization, and easy maintenance. Second, to create a unified geo-data object, we extend the object-oriented spatial-temporal data model as a multidimensional OLAP cube, i.e., a Star-based Geo-Object-Oriented SpatiotEmporal (S-GOOSE) data model, which combines the advantages of both OLTP and OLAP approaches. This S-GOOSE data model is an object-relational-based cube that enables military operators to analyze unified geo-data objects from multiple dimensions, such as time, space, and location, to help them make a better decision on paths.

★ **The Implementation of Geo-Cloud SaaS System for Supporting the Civil Engineering Design Using BRMS Open Software**
Sang-Yong Kang, Young-Hoon Lee

This project developed the civil computational design supporting platform and mobile application software which will be used in civil engineering area. This system was developed based on geographic information system (GIS), global position system technology, OGC software technology and expert software system. These kinds of software will be uploaded to private cloud system. This system, called CEDP (Civil Engineering Design support SaaS cloud Platform), can be used in the design phase of civil engineering where either a 3G or a LTE telecommunication are available. CEDP can identify the geographic position of the land, survey the position of land correctly and calculate the surveying result especially in civil construction area. Territory development plan of specific area will be surveyed and obtained by CEDP also. To implement the self design rule selection, BRMS (Business Rule Management System) is used. This software will be helpful to automate the numerous repetitive works when we design civil engineering products. In this paper, the software architecture of CEDP and its output examples are presented.

★ **Digital Earth In A User-Centric Perspective**
Bruno Simoes, Raffaele De Amicis

At the present, we are in the midst of another major societal shift that is leading to a hyper-connected society. In this hyper-connected society, the convergence of mobile technology, online access and global media is connecting masses of people without precedents, with resulting impacts on communication, content creation and social engagement. In this manuscript, we propose a conceptual framework that leverages the trend of sharing videos recorded with mobile devices, to turn the real-

space surrounding us into a "virtual stage" for ubiquitous media-sharing. Automatic 3D reconstruction of events and places will follow from user-generated content, to foster new forms of spatial-temporal augmented content-a Digital Earth. Three strategies essential to this framework are presented and discussed: the convergence of Big Data and Crowdsourcing, proactive policies, and Big Data capability through user engagement.

★★ An Efficient Architecture for Automatic Shaders Management on Virtual Globes
Agustin Trujillo, Jose P. Suarez, Jose M. Santana, Manuel de la Calle, Diego Gomez-Deck

This paper presents the last advances in Glob3 Mobile, a multi-platform graphics engine for Virtual Globes oriented to any kind of user. More specifically, the document focuses on the possibilities that programmable graphic pipelines have to offer regarding the rendering of many kinds of geospatial symbology. This paper explains a few key aspects about what shading programs are, and their benefits compared to the fixed rendering pipeline paradigm. It is also discussed how to manage the programs running on GPU in an user-friendly way, and the architecture that allows to perform this management keeping a high performance during the rendering.

★★ Reproducible, Automated and Objective Stream Threshold Selection and Upstream Riparian Corridor Delineation from Digital Elevation Models in Open Source Software
Avit Kumar Bhowmik, Markus Metz, Ralf B. Schafer

Selection of accumulation thresholds for automated stream network extraction from digital elevation models (DEM) and delineation of upstream riparian corridors for given stream sampling points are important in water resources research. Accumulation threshold selection is often done by subjective comparison to a surveyed stream network and upstream riparian corridors are delineated manually. In this paper, we present "ATRIC", a combination of two algorithms developed by integrating the open source software packages R and GRASS GIS. ATRIC extracts DEM stream sources based on lateral displacements from surveyed stream network. The lateral displacement is selected by optimizing the number of DEM streams compared to the number of surveyed streams. Then an accumulation threshold is selected by optimizing the percentage of overlapped DEM stream cells with surveyed stream cells buffered with the selected lateral displacement. ATRIC extracts upstream riparian corridors from upstream catchments delineated by snapping stream sampling points to DEM extracted stream network. ATRIC showed better goodness of fit when compared to available algorithms and thus will improve topographic mapping and hydrological information extraction.

❋ rasdaman: Array Databases Boost Spatio-Temporal Analytics
Peter baumann

Rasdaman ("raster data manager") is the pioneer in Array Database Systems, the next generation in scalable scientific data services: it provides agile analytics on massive multidimensional raster data ("arrays"), such as regular and irregular spatio-temporal grids. An SQL-style query language allows users to flexibly build their own product in a "mix and match" style. The underlying engine boosts performance through strong optimizations, large-scale parallelization, and use of new hardware.

Big Data Organizing, Searching, Storing, Analytics

Tuesday August 5 13:00 PM - 15:00 PM
Room 301, Marvin Center

Session Chair:
Prof. Simon Berkovich, Dr. Nima Bari, George Washington Unversity

★ Organization of the Brain in Light of the Big Data Philosophy
Simon Berkovich

The paper presents a computational scheme for the brain using Cloud Computing in the Holographic Universe. The surmised construction captures all the basic operational characteristics of the brain in health and disease.

★★ Dynamic Protection for Critical Health Care Systems using Cisco CWS: Unleashing the power of Big Data Analytics
Rajesh Vargheese

Critical Care IT systems such as critical care monitoring systems, support devices, information systems that provide point of care guidance to care teams are a key component of a lifesaving effort. The mega trends of mobility, cloud combined with wide spread increase and sophistication of malware, has created new challenges. The point in time detection methods at the hospitals are not effective and pose a big threat to the critical care systems. To maintain the availability and integrity of these critical care systems, new adaptive, learning security defense systems are required that not only learns from the traffic entering the hospital, but also from the traffic worldwide. Cisco's Cloud web security (CWS) provides industry-leading security and control for the distributed enterprise by protecting users everywhere, anytime through Cisco worldwide threat intelligence, advanced threat defense capabilities, and roaming user protection. It leverages the big data to perform behavioral analysis, anomaly detection, evasion resistance, rapid Detection services using flow based, signature based, behavior based and full packet capture models to identify threats. It provides comprehensive malware defeating capabilities, by performing file Reputation, file Sandboxing, and file Retrospection to detect, block and mitigate threats against critical assets.

★★ An Efficient Technique for Searching Very Large Files with Fuzzy Criteria Using the Pigeonhole Principle

Maryam Yammahi, Kamran kowsari, Chen Shen, Simon Berkovich

Big Data is the new term of the exponential growth of data in the Internet. The importance of Big Data is not about how large it is, but about what information you can get from analyzing these data. Such analysis would help many businesses on making smarter decisions, and provide time and cost reduction. Therefore, to make such analysis, you will definitely need to search the large files on Big Data. Big Data is such a construction where sequential search is prohibitively inefficient, in terms of time and energy. Therefore, any new technique that allows very efficient search in very large files is highly demanded. The paper presents an innovative approach for efficient searching with fuzzy criteria in very large information systems (Big Data). Organization of efficient access to a large amount of information by an "approximate" or "fuzzy" indication is a rather complicated Computer Science problem. Usually, the solution of this problem relies on a brute force approach, which results in sequential look-up of the file. In many cases, this substantially undermines system performance. The suggested technique in this paper uses different approach based on the Pigeonhole Principle. It searches binary strings that match the given request approximately. It substantially reduces the sequential search operations and works extremely efficiently from several orders of magnitude including speed, cost and energy. This paper presents a complex developed scheme for the suggested approach using a new data structure, called FuzzyFind Dictionary. The developed scheme provides more accuracy than the basic utilization of the suggested method. It also, works much faster than the sequential search.

★★★ On the Organization of Cluster Voting with Massive Distributed Streams

Adi Alhudhaif, Tong Yan, Simon Berkovich

Data processing is one of the important challenges on Big Data. In this paper we investigate optimal processing algorithm for massive data streams, propose a new processing algorithm called multi-buffer based majority algorithm. The algorithm maintains time complexity of O(n) and selects prevalent elements of frequencies as low as 1%. Our experiments indicate that multi-buffer based majority algorithm has improvements on both accuracy and efficiency. Moreover, we use multibuffer based algorithm to process data streams on single system and distributed system. These experiments indicate that using multi-buffer based algorithm can have better performance on distributed system. Moreover, we give explanations of the experiments' result and indicate several major factors which influence the result accuracy: stream size, element range in the stream, frequency of predominant elements and our buffer sets.

★★★ Organization of Knowledge Extraction from Big Data Systems

Ganapathy Mani, Nima Bari, D. Liao, Simon Berkovich

Even though some of the present-day technologies provide a number of solutions for handling large amounts of data, the increasing accumulation of data-also termed as Big Data-from the Internet such as emails, videos, images, and text as well as the digital data in medicine, genetics, and sensors and wireless devices is demanding efficient organizational and engineering designs. Many forms of digital data such as maps and climate informatics, geospatial attributes such as global positioning coordinates, location information, and directions are represented by text, images, or interactive graphics-videos. A single source may produce various types of data (e.g. a geospatial data source may produce both image- and text-type data). This vast and rich data requires a generic processing mechanism that can adapt to various data types and classify them accordingly. In this paper, we propose a technique to optimize the information processing for on-the-fly clusterization of disorganized and unclassified data from vast number of sources. The technique is based on the fuzzy logic using fault-tolerant indexing with error-correction Golay coding. We present an information processing model and an optimized technique for clustering continuous and complex data streams. We show that this mechanism can efficiently retrieve the sensible information from the underlying data clusters. The main objective of this paper is to introduce a tool for this demanding Big Data processing-on-the-fly clustering of amorphous data items in data stream mode. Finally, we introduce the parallels between computational models of Big Data processing as well as the information processing of human brain where the human brain can be considered as a Big Data machine.

★ Adaptive and Interactive Design based on Big Data Computational Model for Treating Autism

Ganapathy Mani, D. Liao, Simon Berkovich

We propose an affordable and adaptive computer interaction design to cure autism, where the progress monitoring can eliminate the danger of addiction the suggested plan is based on the concept of the Big Data computational model that selects only a small part of information to operate explicitly while the rest of information contributes to this selection just implicitly.

★★ Organization of Meta-knowledge in the Form of 23-bit Templates for Big Data Processing

Nima Bari, D. Liao, Simon Berkovich

We are living and facing an unprecedented growth of available large-scale structured and unstructured data both. From different broad range of online websites and applications, data is being collected at significantly exceptional rate. For instance, "Facebook reports about 6 billion new photos every month and 72 hours of video are uploaded to YouTube every minute". Researchers and developers are faced with this large amount of data that needs to be processed, analyzed, and clustered. Analysis of Big Data essentially drives every aspect of our daily life, including and not limited to, retail services, mobile services, financial services, manufacturing, and life sciences. The existing and conventional data processing techniques and clustering algorithms were not initially designed to handle this large amount of data and we face challenges to analyze Big Data. This research paper attempts to enhance these existing clustering algorithms to process Big Data. This research introduces an unprecedented big data processing technique

using a 23-bit question meta-knowledge template for Big Data clustering in a linear time complexity O(n).

★ Testing Scientific Research Grant Funding Fairness

Peter Z. Revesz

The fairness of scientific grant funding is receiving increased scrutiny. International granting agencies need to show that they award grants to the top researchers while at the same time avoid unwarranted regional or country specific bias. This paper shows a method for testing regional or country specific bias, even when the countries have different percentages of top researchers and universities. A case study of the international research grants of the Air Force Office of Scientific Research is used to illustrate the method, which shows that the Air Force Office of Scientific Research has favored, as expected, the higher ranked universities in all countries where it operates, with only a slight positive bias for Japanese and UK universities.

★★★ Organizing and Storing Method for Large-scale Unstructured Data Set with Complex Content

Dongqi Wei, Chaoling Li, Wumuti Naheman, Jianxin Wei, Junlu Yang

At the arrival of big data era, traditional geological industries are still using the traditional way to produce and collect data, and geosciences information is represented as unstructured data in various forms. These data is often categorized together according to a relatively simple way, thus forming a number of datasets with complex internal structure. However, this is not a good expression of rich geoscience information carried by unstructured data and it is also inconvenient to express complex relationships among the information, even against to find in-depth knowledge across datasets. Meanwhile, existence forms of such data also impeded the application of advanced technological methods. In an attempt to solve the problem, this paper proposes a multi-granularity content tree model and pay-as-you-go mode to support evolvement data modeling. These features help to split the data model,, position data content precisely and to expand the dimensions of the main features that described according to the data subject, and then gradually discover data contained information and relationships among the information. Considering the large size of the data features, this paper designs data persistence mode based on HBase, so as to achieve the purpose of data processing by using technologies within the Hadoop system. This article also presents data content extraction and content tree initial state algorithms under MapReduce framework, and dynamic loading and local caching algorithms of content tree, thus forming a basic extract-store-load process. An application example of the model about the geological industries is given at the end.

Transportation, UAV, Geo, LiDAR

Tuesday, August 5 3:20 PM - 5:00 PM
Room 302, Marvin Center

Session Chair:
Dr. Durmus Cesur , DCHC MPO

★★ How Single-Sign-On improves the usability of protected Services for geospatial Data

Andreas Matheus

The Internet is full of services and data providers which offer access to massive data holdings, in particular with geospatial content. But when it comes to build meaningful applications in domains such as disaster management, what is important then? Usually trusted data and services are required. So the main question is about open standards and technologies that allow the secure and trustworthy use of protected geospatial data and services. One prominent solution was practiced during the Group on Earth Observations Architecture Implementation Pilot (AIP) no. 6, were international organizations from the US and Europe participated in the creation of a federation of protected data and services. During the GEO-X plenary in Geneva Switzerland on January 2014, a life demonstration concluded with the feasibility of the approach taken. It was in particular the Single-Sign-On and the managed circle of trust that enabled the creation of meaningful client applications of which one combined NASA Ames and ESA data served via protected services of the federation. This paper reports about the resulting Access Management Federation that was implemented during AIP-6, the required standards and technologies as well as the technical approach taken. The paper concludes with findings and best practices important towards operational use.

❋ Unlimited Detail Technology: Render unlimited amounts of point cloud data in Real-Time

Josh Beck

Meandering waterways experience significant erosion and sedimentation especially during floods when the flow quantity considerably increases. Rivers and streams with sharp bents are regularly exposed to damages along their path as the speeding water flow erodes the concave side of the bent and deposits sedimentation on the convex side of the same. Surveying the pattern of sediment transport along lengthy water ways could require extensive effort especially if the waterway is long and/or has many twists and turns. A practical and technologically advanced way toward carrying out such a survey is to utilize LiDAR images taken along the waterway. This study was undertaken to analyze LiDAR tiles associated with sharply meandering sections along the Mohawk River in New York. The analysis was done by making a comparison at the examined sections before and after a major flooding event. The study used LiDAR rasters to model the terrain at the sections under consideration. Furthermore, digital elevation model (DEM) data was also employed to create models of the terrain prior to the major flooding event. The comparison also relied on contour maps, TINs, and LiDAR terrain simulation. It was concluded that the geometrical pattern of meandering sections is greatly impacted by major flooding events. Some of the changes that occur at a twisted section could result in a permanent irreversible damage to the waterway. A LiDAR survey could be an economical and efficient way to examine long waterways riddled with twists and turns. River sections that experience repeated erosion effects could become

unstable. Identifying such sections and providing them with the necessary protection should be of high priority to prevent a landslide or a similar disaster.

❋ A LiDAR Study of Erosion and Sedimentation of Meandering Waterways

Ashraf Ghaly

Meandering waterways experience significant erosion and sedimentation especially during floods when the flow quantity considerably increases. Rivers and streams with sharp bents are regularly exposed to damages along their path as the speeding water flow erodes the concave side of the bent and deposits sedimentation on the convex side of the same. Surveying the pattern of sediment transport along lengthy water ways could require extensive effort especially if the waterway is long and/or has many twists and turns. A practical and technologically advanced way toward carrying out such a survey is to utilize LiDAR images taken along the waterway. This study was undertaken to analyze LiDAR tiles associated with sharply meandering sections along the Mohawk River in New York. The analysis was done by making a comparison at the examined sections before and after a major flooding event. The study used LiDAR rasters to model the terrain at the sections under consideration. Furthermore, digital elevation model (DEM) data was also employed to create models of the terrain prior to the major flooding event. The comparison also relied on contour maps, TINs, and LiDAR terrain simulation. It was concluded that the geometrical pattern of meandering sections is greatly impacted by major flooding events. Some of the changes that occur at a twisted section could result in a permanent irreversible damage to the waterway. A LiDAR survey could be an economical and efficient way to examine long waterways riddled with twists and turns. River sections that experience repeated erosion effects could become unstable. Identifying such sections and providing them with the necessary protection should be of high priority to prevent a landslide or a similar disaster.

❋ Integrating Enterprise GIS with Cloud Computing for Transportation Planning and Modeling

Durmus Cesur, Rakesh Malhotra, Amanda Klepper, Andrew Henry, Kiran Ulak, Felix Nwoko

Today's enterprise information systems (EIS) are rapidly evolving both in terms of architecture and content. The various modern operating systems, applications, and databases that form todays EIS are made more usable and scalable by integration into the cloud, while also becoming more complicated. There is a critical need for organizations that house big data, such as the Durham Chapel Hill Carrboro Metropolitan Planning Organization (DCHC MPO), to leverage cloud computing as part of their EIS strategy to serve geospatial data and applications to external stakeholders. Integration with the cloud enables the use of online applications that are flexible, distributed, and scalable to achieve greater operational efficiency, backup/archival capabilities, and other benefits. The key to success in integration is the ability to deploy distributed cloud-based enterprise service bus (ESB) and service oriented architecture (SOA) processes to integrate value chains in a continually changing environment.

DCHC MPO has developed two applications that integrate enterprise GIS with cloud computing using Esri products. The first application is a regional travel demand model (Triangle Regional Model) which facilitates information sharing between state, regional, and municipal transportation modelers who find it easier to collaborate over the web rather than by email, FTP, or other means. The second application is a regional land use model (CommunityViz) in which planners from several dozen stakeholder agencies edit parcel attribute data using a selection of client tools. This paper will identify the foundational architecture required to enable the seamless integration of an enterprise system with a public cloud to achieve better collaboration and more streamlined organizational processes. It will also discuss the pros and cons of public cloud and integrated cloud architectures.

★★★ A Data Model for Guide Sign System and Its Application in Guide Sign Placement

Niu Zhong Ming, Huang Min, Li Er Da, Zhang Xu

Guide signs are recognized to be one of the most important elements in road facilities. The frequent changes of road network structure and traffic control strategies in urban area promote the need of updating guide sign dynamically and designing a placement solution rapidly. In order to accomplish those requirements, a data model is introduced to describe the guide sign system and the extracting data will be stored in the guide sign database. The data model composes of five core components: junction, road segment, guide sign location, guide sign panel, and guide sign item. A Point of Interest Oriented Placement Method (POIOPM) is proposed to accomplish the need of designing a placement solution for POI rapidly. Finally, the placement solution to the proposed data model is built on the platform of ArcGIS and C#. It has shown the solution matches the practical guide signs. This indicates the correctness and reliability of the proposed data model.

★ Steering Behavior during Overtaking on Freeways

Li Penghui, Hu Mengxia, Zhang Wenhui, Xu Xiaoqing, Li Yibing

The steering behavior of lane change during overtaking on the freeway is experimentally investigated based on a six DOF moving-based driving simulator. 12 experienced participants are involved and instructed to overtake leading vehicles in specially designed scenarios, and their first lane changing of the overtaking is analyzed. The influence of type and speed of leading vehicle on steering behavior are explored by parametric tests. Results show that type of leading vehicle has no impact on steering behavior, including steering wheel amplitudes and duration of each phase. Speed of leading vehicle has significant influence on the first steering wheel amplitude, the second steering wheel amplitude and duration of first phase. This finding may help construct the lane change steering model on freeways with leading vehicle taken into consideration, and promote the freeway driving safety.

Providing Overview of China Datasets Using Linked Micromaps

Yanjia Zhang, Daniel Carr

Showing statistical overviews of datasets is often helpful in providing context before drilling to details. Linked Micromaps have been primarily used so to show overviews based on US statistical summaries with many featuring environmental and health statistics. This poster features data from China. The example below shows the gender ratio for China provinces in 2000 and 2010. The imbalance is problematic. The design creates small perceptual groups of four or fewer provinces to focus attention and to limit the number of colors used to link province names to their locations. This is helpful for those not familiar with China's provinces. Sorting the 2010 ratios provides a ranking of provinces. Cumulative highlighting of provinces based their ranks provides spatial patterns that can be informative. Access to statistics from China's provinces and large cities will get easier over time. Concerns about air pollution have led to increased monitoring and reporting of statistics. The poster will include other available statistics related to house price for selected cities.

A Historical Perspective of Erosion and Sedimentation at Curved Sections Along the Mohawk River

Ashraf Ghaly

Erosion and sedimentation at curved sections along waterways constitute a major soil stability challenge. The Mohawk River in New York and its two major tributaries (the Schoharie Creek and West Canada Creek) are illustration of how severe this problem could be. The riverbanks are continuously exposed to erosion and sedimentation, which compromise its stability and the infrastructure in its vicinity. This problem is aggravated at times of floods where both the quantity of discharge and flow velocity increase. With the availability of historical images of various sections of the river, one can detect the pattern of erosion and sedimentation over time and see the effect of repeated flooding on the structural stability of the soil in the area. This study was undertaken to identify, along the Mohawk River length, the sections that have been seriously impacted by both erosion and sedimentation problems and to classify these sections according to its level of severity and the need for remediation. In absence of sufficient funds to address all river problems simultaneously, it is necessary to prioritize areas where hazardous conditions exist. The Mohawk River waterway was surveyed and sections where erosion and sedimentation were marked according to their coordinates. The angle and radius of curvature at each section were determined. Depending on aerial survey images of a given section, the damage that the section exhibited was identified, and the level of danger of a structural collapse was assessed. In light of these conditions, various solutions to remedy the hazardous conditions at these sections were suggested. These solutions varied between simple ones such as re-grading the earth slope to make it milder to more comprehensive ones such as the construction of sheet piles walls. This study resulted in an extensive database of numbered sections along the Mohawk River starting from its origin in the west throughout its entire length to where it discharges into the Hudson River. This database involves coordinates of all identified sections, historical images of the section under consideration at different times and the pattern of instability that the sections experience, and proposed solutions to address hazardous conditions at the locations of these sections. It is anticipated that this database would serve as a helpful tool to researchers, government agencies, and parties interested in making critical decisions regarding maintaining the waterway in good and stable condition.

Metaknowledge Templates for on-the-Fly Clustering of Big Data Streams

Nima Bari, Simon Y. Berkovich

This poster paper proposes a novel processing technique to optimize on-the-fly clusterization of disorganized and unclassified Big data from a vast number of sources. The technique is based on the fuzzy logic using fault-tolerant indexing with error-correction codes. This research aims to introduce a processing template for this demanding "Big Data" processing methodology-clustering of amorphous data items in data stream mode. Researchers investigate a novel approach for the development of meta-language templates in the form of 23-bit questions. The presented approach is based on the previously developed construction of FuzzyFind Dictionary utilizing the error-correcting Golay Code. Realization of this technique requires processing of intensive continuous data streams, which can be effectively implemented using multi-core pipelining with forced interrupts. The objective of this research is to bring forward a new novel simple and efficient tool for one of the most demanding operations of this "Big Data" clusterization of amorphous data from diverse sources.

Integrating Enterprise GIS with Cloud Computing for Transportation Planning and Modeling

Durmus Cesur, Rakesh Malhotra, Amanda Klepper, Andrew Henry, Kiran Ulak, Felix Nwoko

Today's enterprise information systems (EIS) are rapidly evolving both in terms of architecture and content. The various modern operating systems, applications, and databases that form todays EIS are made more usable and scalable by integration into the cloud, while also becoming more complicated. There is a critical need for organizations that house big data, such as the Durham Chapel Hill Carrboro Metropolitan Planning Organization (DCHC MPO), to leverage cloud computing as part of their EIS strategy to serve geospatial data and applications to external stakeholders. Integration with the cloud enables the use of online applications that are flexible, distributed, and scalable to achieve greater operational efficiency, backup/archival capabilities, and other benefits. The key to success in integration is the ability to deploy distributed cloud-based enterprise service bus (ESB) and service oriented architecture (SOA) processes to integrate value chains in a continually changing environment.

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state, regional, and municipal transportation modelers who find it easier to collaborate over the web rather than by email, FTP, or other means. The second application is a regional land use model (CommunityViz) in which planners from several dozen stakeholder agencies edit parcel attribute data using a selection of client tools. This paper will identify the foundational architecture required to enable the seamless integration of an enterprise system with a public cloud to achieve better collaboration and more streamlined organizational processes. It will also discuss the pros and cons of public cloud and integrated cloud architectures.

Adaptive and Interactive Design based on Big Data Computational Model for Treating Autism
Ganapathy Mani, D. Liao, Simon Berkovich

We propose an affordable and adaptive computer interaction design to cure autism, where the progress monitoring can eliminate the danger of addiction the suggested plan is based on the concept of the Big Data computational model that selects only a small part of information to operate explicitly while the rest of information contributes to this selection just implicitly.

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U.S.DOT-FHWA TFHRC Tech Show, Lab Tours

Wednesday, August 6 1:30PM-4:30PM
U.S. DOT-FHWA, Mclean, VA

Introduction

The Federal Highway Administration (FHWA) Turner-Fairbank Highway Research Center (TFHRC) is the Nation's premier federally owned and operated highway research and development facility. Located in McLean, VA as the research center for the FHWA, TFHRC coordinates and conducts an ambitious program of innovative highway research and development to address critical needs of the national highway system.

On July 15, 2014, U.S. President Obama visited FHWA-TFHRC and tested a self-driving car at a simulator of Highway Driving Simulator (HDS) Lab, then gave a speech on "the Importance of Our Nation's Infrastructure". The news was reported by the White House, U.S. Department Transportation, The Washington Post, and FHWA, respectively.

President Barack Obama delivers remarks on the economy at Turner-Fairbank Highway Research Center in McLean, Virginia, July 15, 2014. (Official White House Photo by Pete Souza)

President Barack Obama prepares to drive a Saturn SL1 vehicle simulator during a tour of the Turner-Fairbank Highway Research Center in McLean, Va., July 15, 2014. (Official White House Photo by Amanda Lucidon)

COM.* 2014 General Chair, Dr. Liao, drove the same vehicle simulator for developing the PC-clustered driving simulator system when she worked at HDS Lab as a key team member before. (Official FHWA Photo)

Tech Show, Lab Tours, and Test Drives

- FHWA Intelligent Transportation Systems
- Connected Vehicles / Vehicle-to-Infrastructure (V2I)
- Big Data Computing in Transportation
- Human Center Systems, Highway Driving Simulator (HDS)
- Transportation Safety, Geometric Design, Crash Analysis and Simulation
- Transportation GIS/GPS/LiDAR

TTFHRC Background

The Turner-Fairbank Highway Research Center (TFHRC) is the Nation's premier federally owned and operated highway research and development facility. Located in McLean, VA as the research center for the Federal Highway Administration (FHWA), TFHRC coordinates and conducts an ambitious program of innovative highway research and development to address critical needs of the national highway system. Through its three research and development (R&D) offices – Infrastructure, Safety, and Operations – along with the Exploratory Advanced Research Program, FHWA engineers, scientists, and psychologists conduct applied and exploratory advanced research in vehicle-highway interaction, nanotechnology, and a host of other types of transportation research in safety, pavements, highway structures and bridges, human-centered systems, operations and intelligent transportation systems, and materials. With more than 20 laboratories, the center provides a vital resource for advancing the body of knowledge that has been created and developed by our researchers.

TFHRC provides the world highway community with advanced and applied research and development related to new and existing highway technologies. The center reviews, tests, studies, researches, and finds solutions to complex technical problems through the development of more economical, environmentally sensitive designs; more efficient, quality controlled construction, operational, and safety practices; and more durable materials. The end result is a safer, longer-lasting, more reliable highway transportation system.

At times, when our expertise is requested, we also work with FHWA's Federal Lands Highway to test new solutions specifically for Federal lands and parks, to make transportation facilities, roads, or structures more aesthetically in tune with nature, yet still function with the same high standards of other highway structures and materials. We collaborate with other national laboratories and agencies to address the needs of the Nation and to keep American citizens safe in all parts of the world.

Please see Page 8 for more details of the location map and directions.

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Leading-Edge Tech Shows

U.S. DOT-FHWA Tech Show, Lab Tours, and Test Drives (Half a Day in FHWA's Research Center)
Please see Page 23 for details.

COMStar OfficeMap Tech Show (Ballroom/JMA)

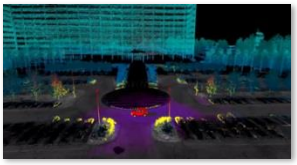
Achieve the Best Map Results with OfficeMap in MS Office!

COMStar OfficeMap is the latest Microsoft PowerPoint Add-in. It provides a fast and easy way to directly create various kinds of maps on PowerPoint slides. OfficeMap offers many map templates. The map templates for MS Office is an impressive collection of dozens of categorized maps with appropriate projections for PowerPoint slides.OfficeMap offers three different symbol collections for simple symbols, color ramp symbols, and point symbols (i.e., markers, icons, and fonts).

MIT Driverless Vehicle Tech Show (JMA)

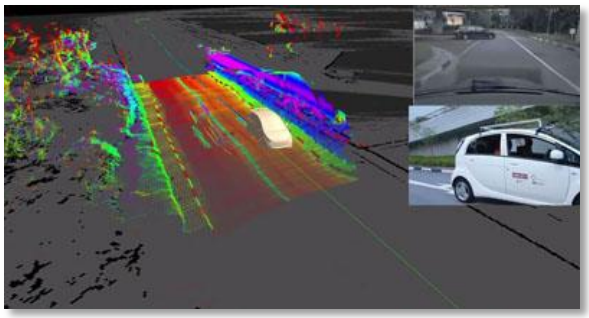
The Intelligent Co-Pilot: a Path toward Fully Autonomous Vehicles

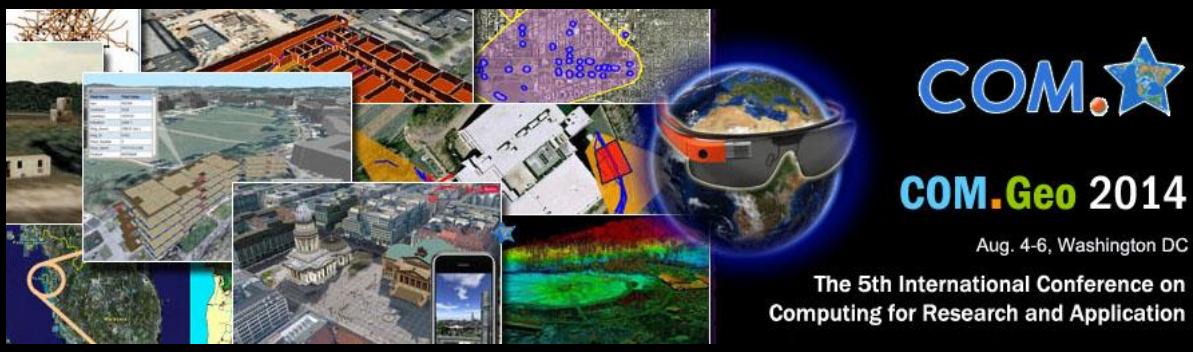
This tech show demonstrates the "Intelligent Co-Pilot," a practical, near-term pathway to autonomous vehicle development. In this framework, the human driver and the autonomous control system share control authority, with the autonomous system generally only assuming control when the threat of an accident is significant. The system could also be tuned, however, to provide a greater degree of assistance. Such a system represents an attempt to reap the safety benefits of full autonomy, while ensuring that the operator remains attentive and responsible for high level decisions.



The Future with Self-Driving Cars

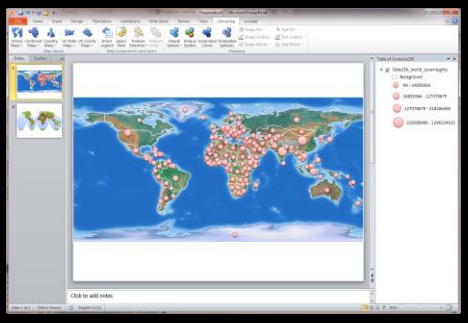
This work demonstrates work at SMART, the Singapore-MIT Alliance for Research and Technology, focused on development and testing of a new mobility-on-demand paradigm. This work, led by Professor Emilio Frazzoli of MIT, consists of a fleet of fully autonomous vehicles that can be summoned via smartphone by users to take them to a desired destination. The vehicles respond rapidly due to state-of-the-art backend software that positions the vehicles based on analysis of historical demand data. Analysis of transport data by the SMART researchers have shown that all of Singapore could be effectively served by such a mobility-on-demand paradigm, even while substantially reducing the overall number of vehicles on the road.

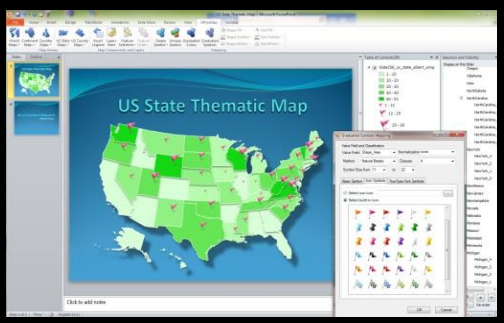




COM.OfficeMap Microsoft PowerPoint Add-in

A Map and GIS Tool in Microsoft Office





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