



IEEE WORKSHOP ON UTILITY BIG DATA

An event co-hosted by IEEE Smart Grid in partnership with the IEEE Power & Energy Society, IEEE Communications Society, IEEE Computer Society, IEEE Signal Processing Society, and the IEEE Big Data Initiative,

and co-located with the 19th International Conference on Intelligent Applications to Power Systems, ISAP 2017

Workshop Co-chairs

Jeffrey S. Katz, IBM
Le Xie, Texas A&M University

Organizing Committee

Phyllis Caputo, IEEE
Kathy Grise, IEEE
Dagmar Niebur, Drexel University

San Antonio, TX, September 18, 2017

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WORKSHOP SCHEDULE - Monday, September 18, 2017

Location : Navarro A

7:00 – 12:00	Registration – <i>Location: Navarro Foyer</i>
7:30 – 8:15	Breakfast – <i>Location: Navarro A</i>
8:15 – 8:45	Welcome – Local Organizing Committees and Dr. Chris Eugster, Chief Operating Officer, CPS Energy
8:45 – 10:15	Panel Session 1: Big Data Challenges and Opportunities (Utility Perspective) Moderator: Le Xie – Texas A&M University <ul style="list-style-type: none">▪ Valentine Emesih – Center Point▪ Tony Bruton – Oncor Electric Delivery▪ Diran Obadina – ERCOT▪ John Trowbridge – Austin Energy▪ Rolando Vega – CPS Energy
10:15 – 10:30	Coffee Break
10:30 – 12:00	Panel Session 2: Big Data Platforms and Warehouses (Vendors and Service Providers) Moderator: Jeff Katz – IBM <ul style="list-style-type: none">▪ Charles Vincent – IBM▪ Mirrasoul J. Mousavi – ABB▪ Brewster Mccracken – Pecan Street▪ Tom Overbye – PowerWorld/Texas A&M University (TAMU)
12:00 – 1:30	Networking Luncheon – <i>Location: Navarro B</i> ISAP Board of Directors Meeting – <i>Location: La Babia</i>
1:30 – 3:00	Panel Session 3: Big Data Research Moderator: Dagmar Niebur – Drexel University <ul style="list-style-type: none">▪ Le Xie – Texas A&M University▪ Tony Kuh – National Science Foundation▪ Emma Mary Stewart – Lawrence Livermore National Lab▪ Maurice Martin – National Renewable Energy Lab (tentative)
3:00 – 3:15	Coffee Break
3:15 – 4:30	Panel Session 4: Big Data Case Studies and Demos; Utilities and Beyond Moderator: Kathy Grise – IEEE <ul style="list-style-type: none">▪ Joe Sullivan – The Weather Company/IBM▪ David Belanger – Stevens Institute of Technology▪ Zita Vale – Polytechnic of Porto, Portugal
4:30 – 5:15	Wrap Up, Next Steps, and Input to White Paper
5:15	Workshop Adjourns

SPEAKERS AND MODERATORS

David Belanger



Senior Research Fellow at Stevens Institute of Technology
Leader, IEEE Big Data Initiative
Hoboken, NJ

Issues in Deployment of Big Data Systems

One of the biggest challenges facing production users of big data as the volume and velocity of available data explodes, for example as IoT, SDN, and 5G mature, is the complexity of the systems environment in which these capabilities will be deployed. There has been a huge amount of progress in the core big data areas such as the data base/stream management, data analysis, machine learning, and visualization over the past decade. However, most production big data capabilities will be deployed as pieces of much larger systems, for example, large networks such as power grids and beyond, that include a complex data lifecycle, critical dependence on interfaces with other systems, often in real time, and the engineering of upstream and downstream systems. This involves not only the design and architecture of the overall systems, connections and API's, but the assurance of security, operations, administration, and maintenance of the entire system. This talk takes a look at the issues and applications that will drive more routine production use of big data over the next several years.

Biography

David Belanger, Ph.D., is currently a Senior Research Fellow at Stevens Institute of Technology. In this role he continues his work in Big Data Technology, Applications, and Governance. He teaches and is a leader in the Business Intelligence & Analysis Master's Degree program. In addition, he is involved in consulting related to Big Data in areas such as Telecommunications Services, Health Care, Security, and Networking. He is the leader of the IEEE Big Data Initiative (bigdata.ieee.org) and on the steering committee of the New Jersey Big Data Alliance (njbldata.org).

Prior to this role, Dr. Belanger was Chief Scientist of AT&T Labs, and Vice President of Information, Software, & Systems Research at AT&T Shannon Labs in Florham Park, NJ. The Information, Software & Systems Research Lab conducted research in: large scale and real time information mining related to operations of a (communications) service business; interactive, information visualization; scalable, dependable software systems; and new, information based, communications services. It was also responsible for delivery and operations of very large scale (e.g. petabyte), near real time service management capabilities to AT&T, and its customers, as well as a wide variety of analytic and information mining services. He was the creator of the AT&T InfoLab, an organization aimed at optimizing the value gained from data for AT&T. InfoLab was a very early participant in "Big Data" research and practice. It performed data oriented projects across the spectrum of telecommunications services including networking, mobility, operations, customer interactions, services, and fraud/security.

Accomplishments ranged from revolutionizing the corporate fraud systems and systems for measuring customer experience for each customer in the Mobility Business, to winning the Netflix Prize in 2009. They also included the development of world class tools used in Big Data. As Chief Scientist, he interacted with customers, suppliers, and government to articulate the company's technological directions.

Dr. Belanger received his B. S. from Union College (NY) in Mathematics, and an M. S. & Ph.D., in Mathematics, from Case Western Reserve University.

Tony Bruton



Director of T&D Services
Oncor Electric Delivery
Dallas, TX

Big Data Application at Oncor Electric Delivery

Oncor began implementing analytics on large data sets following its deployment of Advanced Meters. Analytic techniques have been expanded from the detection of non-technical losses to identifying previously unseen equipment errors such as transducer calibration. More recent analytics focus on improving Operator productivity in the control room. Operator productivity includes developing an accurate load forecast and improving the connected operating model. The analytics platform has evolved to include data sets from many different and previously disconnected sources and will continue to grow at Oncor.

Biography

Tony. Bruton graduated from Texas Tech University with a Bachelors in Electrical Engineering. He has been a member of IEEE since 1997. He joined Oncor in 2000. He has held a variety of positions within the company. He designed substations for three years before entering management. He was a District Manager for Oncor's east Texas area in the Transmission Business Unit. He also managed line the Transmission Line Design Group for many years. He set up the Program Management Organization for CREZ then managed the right of way acquisition for CREZ which included purchasing easements from 1500 land owners in three years. The ROW acquisition included assisting with transmission line routing and managing the eminent domain process. As CREZ ROW acquisition was completed he managed the line design for several hundred miles of the CREZ project.

Mr. Bruton's current role as Director of T&D Services involves the computer systems that monitor and control Oncor's Transmission and Distribution Grid. The systems include the Siemen's Control Room software, Transmission & Distribution SCADA communication front ends and the Outage Management System. He is also responsible for the development and management of the Transmission Grid Controller's training program.

Valentine Emesih



Vice President, Grid and Market Operations
CenterPoint Energy
Houston, TX

Advanced Analytics at Centerpoint Energy

Centerpoint Energy fully deployed advanced meters, and partially deployed intelligent grid switching devices in its Houston Electric service footprint. The digitalization of metering services, and distribution grid operation has created a sizeable data asset. I will share stories and examples of Centerpoint Energy's journey in utilizing its data assets to improve customer outcomes, asset management & utilization, and operational efficiency.

Biography

Valentine Emesih is currently Vice President of Grid and Market Operations at Centerpoint Energy. He is accountable for Centerpoint Energy's electric grid control centers, competitive retail market relations, and implementation/deployment of control center operational technologies – Advanced Metering System (AMS), Transmission Management System, and Advanced Distribution Management System (ADMS.)

He has worked in utility and utility automation business for 29 years.

Mr. Emesih, who is licensed Professional Engineer has worked for Centerpoint Energy since 1997. Prior to joining Centerpoint Energy, he held engineering, system development and project management positions at electric utility automation systems vendors – Ferranti International Controls in Sugar Land, Texas (currently ABB Enterprise Software); and Johnson Yokogawa Controls/Syseca Inc., in Carrollton, Texas (currently ARINC, Inc.).

He earned a Bachelor's and a Master's degree in electrical engineering from The University of Texas at Austin, and Auburn University respectively.

Cris Eugster



Chief Operating Officer
CPS Energy
San Antonio, TX

Workshop Welcome and Opening Remarks

Biography

Cris Eugster, Ph.D., has more than 25 years of leadership experience in the energy and technology sectors. Cris currently serves as Chief Operating Officer of CPS Energy, one of the nation's largest municipally-owned utilities with over 730,000 electric customers and 325,000 gas customers. CPS Energy is vertically integrated and includes generation, transmission and distribution, and retail services with annual revenues of over \$2.5 billion and total assets of over \$10.5 billion.

As Chief Operating Officer, Cris leads the Operations of CPS Energy and its approximately 2000 team members. Cris also leads overall corporate strategy, integrated resource planning, new products and services, research & development, and environmental oversight, driving the transformation of CPS Energy into a strong, innovative 21st century power provider. The strategy has led to significant investments in low carbon capabilities such as combined cycle natural gas, wind, and solar, in addition to large scale demand response programs and innovative smart grid solutions. CPS Energy is nationally recognized for its efforts in the New Energy Economy and has won numerous awards.

Cris sits on a number of Boards including Smart Electric Power Association (SEPA), Association of Edison Illuminating Companies (AEIC), Texas A&M Smart Grid Center Advisory Board (SGC), EPICenter and Trinity University Business Advisory Council. Past Boards have included Build SA Green, Solar San Antonio, Mission Verde Alliance, Texas Renewable Energy Industry Association (TREIA), DOE State Energy Advisory Board, Houston Chapter of the American Institute of Architects (AIA), and the United Way of San Antonio and Bexar County.

Prior to coming to San Antonio, Cris was the first Chief Officer for Sustainable Growth for the City of Houston as part of Mayor Bill White's team. Prior to that Cris was Partner with McKinsey & Company, an international management consulting firm, serving F100 companies in the Technology, Energy, and Diversified Services markets. He received his PhD and MS in Electrical Engineering from MIT focused on quantum transport research in nanostructures. He received his Bachelor of Science in Electrical Engineering from Texas A&M University with Magna Cum Laude honors.

Cris is married and has two sons.

Kathy Grise



Senior Program Director, IEEE Future Directions
Program Director, IEEE Big Data Initiative
Piscataway, NJ

Big Data Case Studies and Demos (Both in Power and Other Domains)

Big data is much more than just data bits and bytes on one side and processing on the other. It entails collecting, storing, processing, and analyzing immense quantities of data that is diverse in structure in order to produce insights that are actionable and value-added. Vast amounts of data of various types are being generated at increasing rates. Determining how to utilize this data strategically and efficiently from a practical application perspective is the focus of this discussion.

Merely collecting and storing data is not the sole objective of Big Data; rather, enhancement of businesses or societies drives the technologies of Big Data. For example, successful big data solutions can provide targeted marketing, identify new markets, or improve customer service through analysis of customer data, social media, or search engine data. Examination of industrial sensor data or business process data can enhance production, aid in proactive improvements to processes, or optimize supply chain systems. As a final example, society can benefit from big data analytics through intelligent healthcare monitoring, cybersecurity efforts, and smart cities data manipulation. Each panelist will share their thoughts on how (big) data is used from a practical perspective. Use cases, examples, scenarios, etc. will be referenced.

Biography

Kathy Grise is a Senior Program Director - IEEE Future Directions. Kathy supports new technology initiatives, and is the IEEE staff program director for the Big Data Initiative, Smart Materials Initiative, the IEEE Technology Navigator, Future Directions and Industry Advisory Board Committees, manages the digital presence team for Future Directions, and serves as the Technical Program Chair of COMPSAC 2018 Symposium - Data Sciences, Analytics, & Technologies (DSAT).

Prior to joining the IEEE staff, Ms. Grise held numerous positions at IBM, and most recently was a Senior Engineering Manager for Process Design Kit Enablement in the IBM Semiconductor Research and Development Center. Ms. Grise led the overall IT infrastructure implementation, and software development in support of semiconductor device modeling verification, packaging, and delivery, device measurement and characterization data collection and management, and automation for device modeling engineers. Ms. Grise is a graduate of Washington and Jefferson College, and an IEEE Senior member.

Check out ieee.org/futuredirections and bigdata.ieee.org.

Jeffrey S. Katz



Chief Technology Officer
Energy and Utilities industry
IBM Corporation
Hartford, CT

Big Data for Utilities Innovation

Utilities have been involved with Big Data and Analytics since SCADA systems became popular. Today's innovations evolved from faster communication of the data, larger computer memory and processing power to analyze the data, and visualization techniques to support discoveries within the data. In fact, some earlier "Smart Grid Zero" projects applied Big Data and Analytics without adding any new sensors, demonstrating the power of knowing more about what you already knew. Some early adopters of Big Data and Analytics in utilities made their first priority to expand the storage associated with SCADA systems. This came from knowing that data discarded while the process of developing an analytics strategy, including predictive maintenance, occurred would be valuable as the design phase began.

Analytics has moved from replicating alarm limits already available in the DCS, to on-line FFTs, cognitive computing, as well as numerical and algorithmic methodologies. Utilities are being encouraged to adopt some agile software methods, such as a period of data exploration to see the art of the possible, rather than limiting analytics to already conceived ideas of what needed to be examined in the data.

In the current world of computer science, more data accumulated by the equipment owner also becomes more concentrated data for cyber security offender activity. This requires thinking of security measures in newer protocols, the choice of communication medium, use of appropriate use of ubiquitous cloud computing. Physical security to protect interception, planting false data generators in remote locations, and image processing on surveillance cameras are also generating big data for operational support.

Renewable energy imposes variability on the grid that needs data driven optimization to keep the system safe, in balance, and meet environmentally friendly intentions. This newer equipment, which may not all be utility owned, controlled, or even monitored, due to its more recent manufacture, contains more embedded computing and sensors. Much of this generating source data has to be processed to assist in learning new maintenance patterns, feed weather simulations of solar flux and cloud cover, manage power quality from inverters, and ensure safe wind turbine operation. The utility driven and temporal variations in the optimization goals of balancing demand, conventional generation, renewable power production, and storage systems will be possible only with the considered application of big data.

Biography

Jeffrey S. Katz is the Chief Technology Officer of the Energy and Utilities industry at IBM. He is a Senior Member of the Institute of Electrical and Electronics Engineers. He is a member of the IBM Academy of Technology. He is a co-

chair of the Industrial Internet Consortium's Energy group, and is a member of the Internet2 working group on the Internet of Things.

He was chair of the Smart Grid Session of the Yale Alumni in Energy conference in 2012, and was a co-chair of the IEEE 2030 Standard on Smart Grid Interoperability Guidelines IT Task Force. He was on the External Advisory Board of the Trustworthy Cyber Infrastructure for the Power Grid, and is on the Advisory Board of the Advanced Energy Research and Technology Center. He was on the "Networked Grid 100: The Movers and Shakers of the Smart Grid in 2012" list from Green Tech Media. He was appointed to the IEEE Standards Association Standards Board for 2014. He is an Open Group Distinguished IT Specialist.

Prior to IBM he was the Manager of the Computer Science department at the U.S. Corporate Research Center of ABB, and then of ALSTOM.

He is an author on six patents, in tele-medicine, robotics and computer vision, and intelligent electric power distribution, with others pending. He has a Commercial General Radiotelephone license from the U.S. Federal Communications Commission, and belongs to Sigma Xi.

Jeff has organized or taught several volunteer activities around robotics for education, including FIRST, FIRST Lego League, and VEX Robotics. Jeff is also a long time amateur (ham) radio operator. He was a Region 1 finalist in the Johns Hopkins National Search for Computing Applications to Assist Persons with Disabilities. He is the Connecticut District vice president of the Yale Science and Engineering Association.

He can be reached at jskatz@us.ibm.com.

Anthony Kuh



Program Director for Energy, Power, Control, and Network (EPCN)
National Science Foundation
Arlington, VA

NSF Perspectives on Power and Energy Systems, Data, and Convergence

We present NSF programs in power and data area with a focus on the Energy, Power, Control and Networks (EPCN) area of the Electrical, Communications, and Cyber Systems (ECCS) Division. This includes core programs and also special solicitations (e.g. Smart and Connected Communities, Cyber Physical Systems). NSF has also listed ten big ideas and we discuss how two of the ideas "Harnessing Data for 21st Century Science and Engineering" and "Growing Convergent Research at NSF" fit well into this workshop on Utility Big Data.

Biography

Anthony Kuh, Ph.D., received his B.S. in Electrical Engineering and Computer Science at the University of California, Berkeley in 1979, an M.S. in Electrical Engineering from Stanford University in 1980, and a Ph.D. in Electrical Engineering from Princeton University in 1987. Dr. Kuh previously worked at AT&T Bell Laboratories and has been

on the faculty in Electrical Engineering at the University of Hawai'i since 1986. He is currently a Professor in the Department, serving as director of the interdisciplinary renewable energy and island sustainability (REIS) group, and is also serving as a program director for the National Science Foundation (NSF). Previously, he served as Department Chair of Electrical Engineering. Dr. Kuh's research is in the area of neural networks and machine learning, adaptive signal processing, sensor networks, communication networks, and renewable energy and smart grid applications.

Dr. Kuh won a National Science Foundation Presidential Young Investigator Award and is an IEEE Fellow. He was also a recipient of the Boeing A. D. Welliver Fellowship and received a Distinguished Fulbright Scholar's Award working at Imperial College in London. Dr. Kuh was an Associate Editor for the IEEE Transactions on Circuits and Systems, served on the IEEE Neural Networks Administrative Committee, served on the IEEE Neural Networks for Signal Processing Committee, and was a Distinguished Lecturer for the IEEE Circuits and Systems Society. Dr. Kuh co-chaired the 1993 International Symposium on Nonlinear Theory and its Applications (NOLTA) and served as the technical co-chair for the 2007 IEEE ICASSP both held in Honolulu. He served as the IEEE Signal Processing Society Regions 1-6 Director at Large and was a senior editor of the IEEE Journal of Selected Topics in Signal Processing. He currently serves on the Board of Governors of the Asia Pacific Signal and Information Processing Association as Vice President of Technical Activities.

In January, 2017 he started service as a program director for NSF. He is in the Electrical, Communications, and Cyber Systems (ECCS) division working in the Energy, Power, Control, and Network (EPCN) group.

Maurice Martin



Senior Technology Leader
Cyber-Physical Systems Security & Resilience Center
National Renewable Energy Laboratory
Golden, CO

Hierarchical Scoring and Improved Utilization of Cyber Threat Intelligence (HiScore)

Research at NREL seeks to improve the effectiveness and usefulness of Cyber Threat Intelligence (CTI) alerts received by utilities. One technique is to combine CTI data from outside sources with local data produced and stored by the utility. This enables the utility to determine the relevance of the alerts based on data from utility's asset management system, SIEM(s) and other systems. Doing so will reduce the current flood of CTI data to a more manageable stream, and enable utilities to follow up on the alerts that are likely to represent the largest threats.

Biography

Maurice Martin serves as Senior Technology Leader for the Cyber-Physical Systems Security & Resilience Center at NREL. Martin provides program management and system-level analysis for cyber security initiatives in the utility space, and engages large and diverse groups of stakeholders on efforts to improve technology, security, and resilience. He serves as liaison to utility industry associations and the electric cooperative community. He is an experienced instructor and writer.

Martin’s experience includes leading the cyber security work group at the National Rural Electric Cooperative Association (NRECA, the service organization for electric co-ops in the U.S.), where he managed a portfolio of member-funded research projects and provided outreach and engagement for DOE-funded research projects. He participated in the development of DOE’s Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2) and contributed to EPRIs comparative analysis of cyber security guidance documents. He holds a M.S. in Systems Science and a B.S. in Electrical Engineering, both from Louisiana State University.

Brewster Mccracken



CEO of Pecan Street
Austin, TX

Data-driven Insights on Residential Use of Electricity and Gas

Drawing from Pecan Street’s data-intensive multi-year field research on customer end uses of electricity, gas and water, Brewster McCracken will show how high-resolution, highly-granular data can provide more precise, actionable information on the impacts of new technologies, demand management tools and fault detection.

Biography

Brewster McCracken is CEO of Pecan Street Inc., the nonprofit research institute founded by the Cockrell School of Engineering at The University of Texas. Pecan Street provides data-intensive research support for university-industry applied research by carrying out behavioral and technology interventions and by operating Dataport, the largest research database on customer energy and water use. Most of Dataport’s water data comes from measurement instruments that Pecan Street designs, manufactures and installs.

Smart Grid Today has named him one of the nation’s “50 Smart Grid Pioneers”, and GreenBiz.com named him to its VERGE 25 list of 25 U.S. smart grid leaders.

Mirrasoul (“Mir”) Mousavi



Senior Principal Scientist
ABB Corporate Research
Raleigh, NC

Distribution Analytics: Use Cases, Lessons Learned, and Next Steps

In this talk, I will share gained experiences over a decade of developing, demonstrating, and deploying energy analytics to improve utility operations, outage management, and asset management. I will also cover lessons learned and big hurdles that must be overcome to initiate and sustain analytics projects for maximum impact.

Biography

Mirrasoul (“Mir”) Mousavi, Ph.D., is a Senior Principal Scientist for ABB Corporate Research out of Raleigh, NC. As a senior global technologist, he spearheads strategic initiatives and technology development projects in the energy and automation domain focusing on intelligent monitoring, protection, and control applications. In addition to his technical responsibilities, he oversees University Relations and Internships programs for the center. Mirrasoul is ABB’s liaison to Power Systems Engineering Research Center, having served as chair and vice-chair of the Industry Advisory Board. He holds a PhD degree in electrical engineering from Texas A&M University. Dr. Mousavi holds 11 US and international patents and has published over 35 articles and book chapters related to his research. His current professional interests are related to power systems automation, energy analytics applications, and renewables integration.

Dagmar Niebur



Associate Professor
Drexel University
Philadelphia, Pa

Moderator of Panel Session 3 on Big Data Research

Biography

Dagmar Niebur, Ph.D., received a Diploma in Mathematics and Physics from the technical University of Dortmund, Germany in 1984, a Diploma in Computer Science in 1987 and a Ph.D. in Electrical Engineering from the Swiss Federal Institute of Technology, Lausanne, Switzerland in 1994. Dr. Niebur joined Drexel University in March 1996, where she is now an associate professor. She served as the Program Director for Power, Control and Adaptive Networks at the National Science Foundation from 2007 to 2009.

Before joining Drexel, she held research positions at the Jet Propulsion Laboratory, Pasadena, CA, and the Swiss Federal Institute of Technology as well as a computer engineering position at the University of Lausanne and a summer visiting professor appointment at CEPTEL, Brazil.

Dr. Niebur’s research has been funded by the National Science Foundation, the US Department of Energy, the Office of Naval Research, the Electric Power Research Institute and others. She is a recipient of the NSF CAREER award.

Recent professional service includes chairing of the IEEE-PES Technical Committee on Power System Analysis, Computing and Economics, founding member of the IEEE PES Pus Scholarship Initiative, Editor for the IEEE Transactions on Power Systems, Associate Editor for the American Control Conference, member of the Editorial Advisory Board of the International Journal of Engineering Intelligent Systems for Electrical Engineering and Communications, technical committee membership of the Power System Computation Conference, technical vice-chair and proceedings editor of the International Conference on Intelligent Systems for Power Systems (ISAP) 2005 and 2007, member of ISAP's Board of Directors since 2007.

Diran Obadina



Principal Engineer
Electric Reliability Council of Texas (ERCOT)
Austin, TX

Network Model Data Management System and Process at ERCOT

Network models of high fidelity are critical in the reliability and energy market operations of the electric system. In this talk, we will present the infrastructure and procedure around a temporal CIM-based network model management system used to securely submit, validate, track, test, notify and build high fidelity network models for reliability, real-time and forward energy markets operations at ERCOT.

Biography

Diran Obadina is Principal Engineer at ERCOT, with responsibility for strategic development of applications and systems required for reliability and energy markets operations. Before joining ERCOT in 2003 as Manager of Development of Energy and Market Management Systems, he was a Senior Staff Engineer at Siemens Energy and Automation, involved with the development and delivery of EMS and MMS. He received the BSc from the University of Ife, Nigeria, the MScE from the University of New Brunswick, Canada, and the PhD degrees from the University of Calgary, Canada, all in Electrical Engineering

Thomas J. Overbye



TEES Distinguished Research Professor
Electrical and Computer Engineering
Texas A&M University
College Station, TX

Big Data and Synthetic Electric Grid Systems

Test cases are widely used in the power systems for research and education. Even though several small-scale test cases are available to the public, access to actual large-scale power system models is much more limited. This talk explains how large-scale synthetic electric systems can help to bridge this gap, and explains some of the big data issues associated with the use of such systems.

Biography

Thomas J. Overbye, Ph.D., is a TEES Distinguished Research Professor in Electrical and Computer Engineering at Texas A&M University (TAMU). Prior to joining TAMU in January 2017 he was the Fox Family Professor of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign (UIUC). He received his BS, MS, and Ph.D. degrees in Electrical Engineering from the University of Wisconsin-Madison.

Emma Stewart



Deputy Associate Program Leader
Cyber & Infrastructure Resilience Program at
Lawrence Livermore National Laboratory
Livermore, CA

Integrated Multi-Scale Data Analytics and Machine Learning for the Distribution Grid

A vision of the future distribution grid and its interface to buildings is one of cohesion, an interactive reliable environment where there are consumer benefits and motivations to leverage customer owned behind-the-meter assets to provide services to the grid, energy markets, other entities within the distribution feeder, and ultimately to the larger society as a whole. This future distribution grid may be a reliable, safe, and resilient energy transport platform that supports high penetration of Distributed Energy Resources (DER). The growth of communicative DER and connected behind-the-meter power electronic devices may introduce fluctuations and uncertainty not previously seen on the distribution grid if the resources operate independently, or are driven by independent communications and controls. However, these new data generating and communicative features may also offer a vast opportunity to increase the operational efficiency of both the grid and the buildings connected to it, but only if the data collected at all the various nodes can be easily transformed into intelligible, actionable information.

This presentation will discuss an approach and set of work being developed by a multi-national laboratory team, funded through the DOE Grid Modernization Initiative which will evaluate these challenges to develop data driven solutions leveraging multi-scale machine learning based analytics. The work utilizes various data sets across the nodes within the end to end power system (e.g. generation to end use) to automatically produce accurate actionable information for the various parties and actors encompassing the power system. At the heart of the work, applied analytics are required to turn these raw data into actionable information.

Biography

Emma Stewart (M08-SM14) received her under-graduate degree in Electrical and Mechanical Engineering at the University of Strathclyde in 2004 and her PhD in Electrical Engineering in 2009. She is currently a Deputy Associate Program Leader in the Cyber & Infrastructure Resilience Program at Lawrence Livermore National Lab. Her research focuses on the distribution grid and analytics associated with high penetration of distributed resources. She was Deputy Group Leader at Lawrence Berkeley National Lab until 2017.

Joe Sullivan



Utility Solution Sales Executive
The Weather Company an IBM Business

High Resolution Weather Applied to Utility Operation

Applications of weather observation and forecasts for utilities usually involve data from the nearest reporting location, e.g. an airport location many miles away. Advancements in weather technology and data collection now allow utilities to get a very specific look at weather conditions at asset locations or other locations of interest. The internet of things and crowd sourced weather information are quickly advancing the weather industry in ways that most utilities would think impossible just a few years ago.

In my presentation I will present information regarding the latest use of crowd sourced weather data, its impact on the resolution and accuracy of weather information and how it is transforming the way weather is applied in the energy and utility sector. Relevant use cases of weather will be presented to demonstrate the high resolution capability of the latest generation of weather data.

Biography

Joe Sullivan has been connecting weather with smart decisions for nearly 2 decades. He spent the last 10 years working for renewable energy, utility and weather companies coupling the weather with electric generation and demand, customer impact and storm outages. Joe has held roles as a Product Manager, Research Project Manager, Executive Director, Account Manager and Television Broadcaster.

At The Weather Company, Joe works with utilities, smart energy companies, energy service providers, energy retailers and analytics companies providing customized weather output for analyzing weather's impact to a customer's business. Joe has been with The Weather Company since 2012.

Prior to TWC, Joe was Director of Operating Services at WindLogics, an indirect, wholly owned subsidiary of NextEra Energy. Joe's team of consultants and researchers provided renewable energy and electric demand forecasts for utility clientele.

Joe holds a Bachelor of Science degree in Meteorology from St. Cloud State University in St. Cloud, Minnesota. He lives in Eden Prairie, MN with his wife and three children. He enjoys everything outdoors and all kinds of weather.

John Trowbridge



Manager, Data Analytics
Austin Energy
Austin, TX

Big Data Application on the Other Side of the Meter

Customer Energy Solutions at Austin Energy is looking to leverage third party public and vendor data to create a comprehensive understanding of the electric customer. Use of appraisal district information combined with psychographic data has provided a means to focus customer outreach for conservation and alternative generation sales thus saving money over a blanket, indiscriminate marketing coverage. This data is also used to target both conservation and demand response to customers that have a higher potential to realize savings.

Biography

John. Trowbridge graduated from University of Arizona with a Bachelors degree in Aerospace Engineering and a Masters in Mechanical Engineering from the University of Texas. John began his career at Austin Energy evaluating energy conservation programs using building simulation programs but found that analysis of actual energy use is more effective, thus entering the arena of statistics and data analytics. He then sought to leverage third party data to develop a more comprehensive understanding of the diversity of customers in Austin Energy's service territory.

Zita Vale



Professor
Polytechnic of Porto
Porto, Portugal

Agent-based Energy Resource Management Supported by Local and Remote Data

Technology and business advancements are having a huge impact on power and energy systems operation, namely on the volume of the generated data. These data have relevant value for all involved entities, from producers, consumers and aggregators to retailers, market and system operators. New techniques are required to accommodate, analyze, interpret and manage all the relevant data so that the involved parties can improve their decision-making process and gain awareness on the environment in which they are operating.

Advances in data analytics and mining require researchers and other professionals to have access to adequate data sets, which is still very difficult and is proven to be a major bottleneck in the field. The Task Force on Open Data Sets, operating in the scope of the IEEE Power & Energy Society's Intelligent System Subcommittee of the Analytic Methods for Power Systems (AMPS) Technical Committee is supporting an initiative making public data sets permanently available in <http://sites.ieee.org/pes-iss/data-sets>.

This talk will share Zita Vale's experiences on real data use for improving energy resource management. It will be based on her experience on the design and implementation of a multi-agent based infrastructure for real-time operation and simulation of smart grids and micro grids and on its use from a practical perspective with real time data from multiple international sources.

Biography

Zita Vale, Ph.D., is a professor at the Polytechnic Institute of Porto and the director of the Research Group on Intelligent Engineering and Computing for Advanced Innovation and Development (GECAD). She received her diploma in Electrical Engineering in 1986 and her PhD in 1993, both from University of Porto.

Zita Vale works in the area of Power and Energy Systems, with special interest in the application of Artificial Intelligence techniques. She has been involved in more than 50 funded projects related to the development and use of Knowledge-Based systems, Multi-Agent systems, Genetic Algorithms, Neural networks, Particle Swarm Intelligence, Constraint Logic Programming and Data Mining. The main application fields of these projects comprise:

- Smart Grids, accommodating an intensive use of Renewable Energy Sources, Distributed Energy Resources (DER) and Distributed Generation (DG). She addresses the management of energy resources, the impact of DER on electrical networks, the negotiation of DER in electricity markets, demand response, storage, energy management in buildings, and electrical vehicles, including the ones with gridable capability (V2G);

- Electricity markets, addressing contracts, prices and tariffs, decision-support for market participants, aggregation, ancillary services, and wholesale and local market simulation;
- Control Center applications, namely intelligent alarm processing, intelligent interfaces and intelligent tutors.

Zita has published over 700 works, including more than 100 papers in international scientific journals, and more than 500 papers in international scientific conferences.

Rolando Vega



Manager of Analytics and Business Insight
Energy Supply and Market Operations
CPS Energy
San Antonio, TX

San Antonio's Electric Utility Making Big Data Analytics the Business of the People...for the People

Being part of a municipality-owned electric utility offers a unique opportunity to lead in the area of big data analytics. What moves the electric utility of the 7th largest city in the U.S.? The answer is, People. For years, CPS Energy has invested in development of local talent, local technology development, city growth, its employees and an asset infrastructure that is setting the stage for continued success. At CPS Energy, when such investments are topped by a data infrastructure and applications conducive to creation of business insights, we can justify and prioritize investments. For us, the biggest people-opportunities in big data analytics are around operations, customer and employee engagement, and safety. The presenter will provide examples and share how his views have evolved from those of a researcher, to global renewable energy consultant, to technology innovator, and more recently a "harvester of value" from within people, process and technology assets. Lastly, current and anticipated future states with regards to San Antonio's electric utility big data enablement platform will be presented.

Despite the diverse landscape of technology solutions in big data analytics, such as: (1) cloud-based distributed computing (driven by economies of scale and need for optimal response of Bulk Electric System and tailored customer service), and (2) machines interchanging information with other machines in the industrial Internet-of-Things (driven by exponential growth of devices in the communication network and desire for faster optimal controllability in the Distribution Management System), technology investment decisions in electric utilities are still made by and for people with a keen eye for creating value for its customers. In addition, driven by a turning point of open-source software in recent years, machine learning has matured passed the point of academic research and inflated expectations, and has enabled faster and more transparent technology deployment, even though machine learning was first conceived in the 1950s. Computer codes that use machine learning techniques could be easily trained and deployed centrally or on distributed infrastructure to predict more optimal solutions to business problems if data inputs behave within reasonable range and with normal variability. However, field sensors, actuators or communication networks of utility-scale environments, in seeking to meet economic and customer expectations, they end up being dynamic and heterogeneous in function, quality of service, time synchronization and location and there is still significant time spent in vetting security standards are met and performing input data completeness and accuracy checks. Since electric utilities serve a large group of customers in their territory the opportunities to create value for the customers far outweighs its challenges given the inequality in human resources to data intake ratio. But until new tested principles in cyber physical systems are developed it seems that we must

resort to traditional error handling processes in middleware workflows to account for known potential data inaccuracies and to close the gap between central and distributed computing resources.

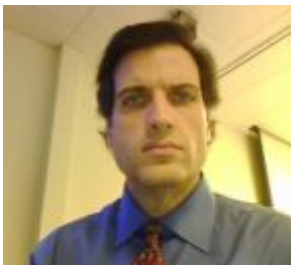
Biography

Rolando Vega, Ph.D., PE, has been a renewable energy consultant and researcher for the last 10-years. He currently leads a staff of engineers, analysts and data scientists to perform analysis and provide business insights and reporting on the energy market operations of CPS Energy in ERCOT. He is responsible for the analytical skills of the team, as well as the data and associated systems required to effectively provide solid analytics.

Before his current position he led the R&D and technical performance in the subjects of renewable energy forecasting, GIS LiDAR analytics, building load forecasting and grid integration at The University of Texas at San Antonio (UTSA). Dr. Vega has led the development of 3 patent pending in the area of distributed energy forecasting and led the development of technologies for distributed IoT traffic monitoring, cyber abnormality detection and prediction for the electric utility industry.

He started and was responsible for the Renewable Energy consulting business in US, Mexico, Brazil and China for a global 1700+ employee consulting company. Dr. Vega helped develop the company's consulting renewable energy annual revenues to about \$6M in 3-years. He drives teamwork, effectively draws from the strengths of his team and focuses in innovative ideas and great communication to provide solutions. Dr. Vega's former clients include top tier global owners, utilities and manufacturers of renewable energy assets and operations. Dr. Vega is a registered Professional Engineer and holds an active NCEES record for licensure in any U.S. state.

Charles Vincent



Chief Industry Architect and IBM Distinguished Engineer
IBM® Global Services
Dallas, TX

Big Data Analytics Program Scaling Challenges at Energy Utilities

As utility companies roll out Big Data analytics programs beyond initial pilots, there are common challenges being faced. Charles will discuss these challenges and how utilities are successfully navigating them.

Biography

Charles Vincent is a Distinguished Engineer working in IBM's Global Center of Competency for Energy and Utilities. He has almost thirty years of experience designing and delivering technical business solutions for Energy Utilities. He has hands on experience with most utility systems including Customer Information Systems, Complex Billing, AMR/AMI, Distribution Automation and Distributed Energy Resources. Charles is a founding member of IBM's Intelligent Utility Network Architecture Council, and has helped drive many of IBM's strategic initiatives in the Energy and Utilities space in particular, AMI, Smart Grid, Data Analytics, Mobility and Cloud. Charles has provided

architectural and implementation leadership on numerous Smart Grid projects working with utility companies and industry groups such as EPRI. He serves as an advisor on IBM's Distributed Generation Workgroup as part of IBM's IUN Coalition

Le Xie



Associate Professor and Eugene Webb Fellow
Department of Electrical and Computer Engineering
Texas A&M University
College Station, TX

Streaming Analytics of Dynamic Data in Power Systems: A Tale of Two Time Scales

How to conduct near real-time analytics of streaming data in the smart grid? This talk offers a dynamic systems approach to utilizing emerging data for improved monitoring of the grid. The first example of the talk presents how to leverage the underlying spatio-temporal correlations of synchrophasors for early anomaly (e.g., subsynchronous oscillations) detection and data quality outlier detection. The second example presents a dynamic systems approach to modeling price responsive demand in real-time markets. The underlying theme of the work suggests the importance of integrating data with dynamic physics-based analytics in the context of electric energy systems.

Biography

Le Xie, Ph.D., is an Associate Professor and Eugene Webb Faculty Fellow in the Department of Electrical and Computer Engineering at Texas A&M University. He received B.E. in Electrical Engineering from Tsinghua University in 2004, S.M. in Engineering Sciences from Harvard in 2005, and Ph.D. in Electrical and Computer Engineering from Carnegie Mellon in 2009. His industry experience includes ISO-New England and Edison Mission Energy Marketing and Trading. His research interest includes modeling and control in data-rich large-scale systems, grid integration of clean energy resources, and electricity markets.

Dr. Xie received the U.S. National Science Foundation *CAREER Award*, and DOE Oak Ridge Ralph E. Power Junior Faculty Enhancement Award. He was awarded the 2017 IEEE PES Outstanding Young Engineer Award. He was recipient of Texas A&M Dean of Engineering Excellence Award, ECE Outstanding Professor Award, and TEES Select Young Fellow. He is an Editor of *IEEE Transactions on Smart Grid*, and the founding chair of IEEE Power and Energy Society Subcommittee on Big Data & Analytics for Grid Operations. He and his students received the Best Paper awards at North American Power Symposium, IEEE SmartGridComm, ACM E-Energy, and the Texas Power and Energy Conference.