Friday, April 17th

Internet of Things

Morning:

Connectivity Options for IoT Applications

There are many options for implementing wireless connectivity for Internet of Things applications, and new options are being introduced every day. In this session the common system architectures will be described and connectivity options will be explored, with advantages and disadvantages for each option presented. The discussion will cover Bluetooth, 802.11, and cellular technologies. Why should you choose one over the other?

Steve Weeres manages the M2M business development function for Arrow's North Central region. He has over 30 years' experience in electronic product development and has brought connected solutions to market in the medical, industrial and aerospace verticals. His understanding of both the technical and business challenges involved with fielding system solutions makes him a trusted advisor for hundreds of Arrow customers. Prior to joining Arrow, Steve was the Director of Engineering at Spectrum Design Solutions, an industry leader in the development of wireless connectivity solutions. He has also had product development leadership positions at Braemar Inc., Cyber Optics, Honeywell and Emerson Electric. Steve holds a degree in Electrical Engineering from the University of Minnesota.

Challenges and Strategies for Cellular Integration and Approvals

What is happening to the global cellular market? Is 2G still an option? What does it take to integrate, validate, and approve a cellular product?

Kyle Sporre is the Manager of RF/Hardware Engineering for Etherios Wireless Design Solutions (a division of Digi International), a provider of custom embedded wireless technology solutions to clients around the world. With nearly 15 years of RF product development experience in implantable medical devices, wireless security systems, and Wi-Fi chip development, Kyle now focuses on wireless technology and RF for embedded system devices. Kyle has a BSEE from Purdue University and an MSEE from the University of Minnesota.

Ted Nesse is the Director of Engineering for Etherios Wireless Design Solutions (a division of Digi International), a provider of custom embedded wireless technology solutions to clients from around the world. With over 30 years of product development experience, Ted's career has focused on embedded systems, including electronic security, communication protocols and wireless communications. Ted has earned a BA in Biology from St. Olaf College, a BS in Electrical Engineering and a MS in Computer, Information and Control Engineering from the University of Michigan.

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Friday, April 17th

Internet of Things

Afternoon:

RF Basics and Systems Issues
Learn the basics of RF design, how to ensure your system is designed well, and that your prototypes work as intended. Topics include link budgets, public domain tools, best practices, review checklists, components, modulation, and regulatory issues.

Jake Salmi has been an analog applications engineer for Texas Instruments for over 10 years. His specialties range from low power, low cost RF circuits to high speed, low noise instrumentation. Jake earned the BSEE from Michigan Technological University in 1993 and has been a member of IEEE since 1991.

Curt McNamara, P.E. is a licensed design engineer in the state of Minnesota. He has over 30 years of design experience, with specialties in EMC, RF, low power, regulatory approvals, and modeling. Curt earned the B.S.E.E. degree (1988) from the University of Minnesota, and the Masters of Engineering in Systems Engineering from Portland State in 2010.

Modeling and Simulation: Analog and Mixed-Signal Integrated Circuit Verification - A Designer's Approach
Big-picture approach and philosophy for analog/mixed-signal (A/MS), and IC verification flows.

Kurt Kimber, Allegro MicroSystems
Adam Lipsey, Avago Technologies; **Tristan Simetkosky**, Packet Digital

Friday, April 17th

Power & Energy

Morning:

Introduction to Transmission System Planning
Transmission system planning is ever more important as new technologies get connected to the grid, equipment ages, and populations evolve. Through all of this we need to ensure there is a plan for delivering reliable and affordable electrical power. A thorough understanding of the fundamentals is vital to ensuring a sound plan for future developments to the electric grid. Transmission system planning ensures we can identify the drivers of transmission and generation expansions, and successfully apply new technologies. After reviewing the fundamentals of power flow and defining the planning function, a set of metrics will be described from which the grid can be evaluated. Finally, we will cover the variables and critical factors of transmission system planning such as thermal overload, voltage stability, dynamic stability, and real-time operation.

Jeff Norman is with the Midwest Regional Operator as a Senior Risk Assessment & Mitigation Engineer. He received a B.S. and M.S. in Electrical Engineering from the University of Minnesota. Jeff is a licensed PE with 12 years of experience in the electric utility industry. His expertise is in power system studies including power flow and voltage stability, auditing, and customer relations.

Introduction to Power Systems Protection using Relays
This presentation focuses on introducing concepts and terms associated with power system protection using relays. It starts with a simple electric network showing different equipment and methodically introduces terms and principles pertaining to protecting the network and isolating only those faulted elements in a network. The need for a redundant/back up protection, zones of protection, equipment failure protection will be discussed. Future trends are also discussed.

Pratap Mysore is with HDR, Minneapolis as Systems Protection Director. He has nearly forty years of experience in the field of substation controls and protection. He is actively involved in IEEE and is the Vice-Chair of Power Systems Relaying Committee under IEEE Power and Energy Society. He is an adjunct faculty at The University of Minnesota where he teaches a graduate level course on protection in the spring semester. He is a registered professional engineer in the state of Minnesota.

Afternoon:

Electricity Market Pricing: Marginal vs. Convex Hull Pricing
In the United States, most Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) use a method called locational marginal pricing (LMP) to establish the price of electricity bought and sold in electricity markets. Recently, some ISOs/RTOs have planned to implement an alternative to the LMP methodology based on a system called Convex Hull Pricing.

This presentation offers a tutorial on the fundamentals of Convex Hull Pricing. With the aid of several simple examples, the presentation will summarize what Convex Hull Pricing is, how it differs from LMP, and briefly discuss how some electricity markets are planning to implement modified versions.

Anthony Giacomoni is an Associate Market Analyst in the Internal Market Monitoring group at ISO New England in Holyoke, MA. His background includes power system optimization, communication, control, and economics.

Anthony earned a B.S. degree in electric power engineering and economics from Rensselaer Polytechnic Institute, Troy, NY in 2007; and the M.S. and Ph.D. degrees in electrical engineering with a concentration in electric power systems from the University of Minnesota in 2009 and 2011, respectively. Anthony's research interests include electricity markets, optimization, distribution automation, microgrids, and complex interactive networks.

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Saturday, April 18th

Cyber Security

Morning:

Applied Public key cryptography for the Internet of Things - Tom Markham, Honeywell.
Public key cryptography plays a critical role in securing many aspects of our lives including internet commerce, secure code/patch distribution, secure email and now the Internet of Things (IoT). The IoT will significantly increase the number of devices that must authenticate and the number of secure communications links that must be established. In this talk we provide an introduction to public key cryptographic systems. The target audience is computer scientists and engineers building systems, not mathematicians developing algorithms. Thus, the focus will be on key management, applying cryptographic primitives, protocols and building systems rather than on cryptanalysis.

Managing Safety and Security for Cyberphysical Systems - Ken Hoyme, Adventium Labs.
Cyber-physical systems (CPS) are those that control interactions with the physical world, with sensing, control and actuation subsystems needed to safety operate. CPS's are those that control airplanes, chemical plants, the power grid and medical devices, to name a few. These systems traditionally have dealt with real-time requirements in order to achieve safe operation. As these systems are becoming more connected, the need to operate them securely has risen in importance. In this talk we will address some of the tension between safety and security and some methods to reason about the balance between competing requirements.

High-Assurance Cyber Military Systems (HACMS) program - John Backes, Rockwell Collins.
DARPA has applied a clean-slate, formal methods-based approach to the construction of high-assurance cyber physical systems, including network-enabled military vehicles that provide the highest levels of dependability and are resistant to emerging cyber threats. The Rockwell Collins team, including Boeing, the University of Minnesota, NICTA, and Galois has focused on cyber threats to unmanned air vehicles (UAVs). In this presentation we provide an overview of the contributions of each team member and describe how we have used these contributions to develop prototype UAVs on an open research platform (quadcopter) and how we are demonstrating their practicality and effectiveness by transferring them to the Boeing Unmanned Littlebird helicopter.

Afternoon:

Cybercrime Targets Medical: Why The Next BlackPOS Malware Could Be For Healthcare -
Dan Lyon, Cigital.
Medical device security is a system property that has traditionally not been designed into many medical device systems. Implementing security controls has meant not implementing something else that customers want, but as medical systems become more capable, abusing them becomes more attractive. Target's point of sale breach showed a level of sophistication which could serve as a blueprint for medical device attacks. At this talk attendees will learn the motivations behind cybercrime targeting medical systems, how malware might be extended to medical devices, and a methodology to address the threats.

Web application security: Getting and staying ahead of hackers - Christina Carlson, IBM.
In this session we cover the current state of web application security in the wild and demonstrates some of the most common web hacks that exploit security vulnerabilities. We then discuss the various security testing options and their advantages and drawbacks - and the reasons why you can't depend on only last-minute automated security testing to be sure your application is secure.

An Introduction to Virtual Machine Introspection - Mike Neilsen, Adventium Labs.
Virtual machine introspection provides access to low-level details of a running virtual machine to agents running outside the guest. This talk introduces virtual machine introspection and some of its challenges through a series of practical examples. We will provide a description of introspection, mechanisms for implementing introspection, and examples of how cyber defenders can use introspection to detect, analyze, and prevent malware.

Saturday, April 18th

Internet of Things II

Morning:

Sonnet Software Introductory Training
With high-speed designs continually pushing the envelope, it is growing more and more important to turn to full-wave electromagnetic solvers for verification of designs. Sonnet Software stands at the forefront of accuracy for such solvers, and enables incredible designs to be made. This talk is a 90 minute, hands-on tutorial session with Sonnet Lite, a free, feature-limited version of Sonnet. Attendees can bring their own laptop and Sonnet lite will be available for install and use.

Brian J. Rautio earned the B.S.E.E. degree (2009) from Rensselaer Polytechnic Institute in Troy, NY, the M.S.E.E degree (2011) and the Ph.D. degree in Electrical and Computer Engineering (2014) from Syracuse University in Syracuse, NY. He completed internships with Sonnet Software, North Syracuse, NY in 2005, 2007 and (part time) 2008, and with Advanced Micro Devices, Austin, TX, in 2006. He is now employed by Sonnet Software. He has been an IEEE member since 2006 and is an active volunteer on many IEEE activities, including membership in the MTT-s Technical Coordinating Committee.

Afternoon:

Building scalable systems for connected devices
Learn about how spark.io has created a new class of low cost connectivity solutions. After the talk the group will spend time exploring some devices and getting hands-on experience.

David Middlecamp is a Senior Software Engineer at Spark, and has been dreaming about beautiful massive systems for the better part of the last three decades. He graduated with a BA in Computer Science from St. Olaf College in 2005, and is currently busy building systems for connected devices at Spark.

Over the last ten years or so, David has built systems in the Health Care, Non-profit, GIS, and Spatial Analytics industries. He's contributed to and started a variety of open source projects, and is attempting to be a polyglot across a variety of languages and stack.

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Saturday, April 18th – Afternoon

Robotics

Robotics in Assistive Technologies
Robotics provides an efficient approach in the development of assistive devices, due to their enhanced functionality. One of the important goals of current research projects in robotics is to contribute to the quality of life of the elderly and individuals with disabilities and help them to maintain an independent lifestyle. The introduction of robotics and technology-supported environments play a huge role in allowing elderly and people with physical disabilities to keep living a self-determined, independent life in their familiar surroundings. Individuals who are elderly or have a disability require novel approaches for communicating efficiently with robotic-assisted services in their living environments and even unstructured environment with safety and reliability. The development of such systems should be focused on cost effectiveness, ease of control, and safe operation, in order to enhance the autonomy and independence of such individuals, minimizing at the same time the necessity for a caregiver. In addition to providing assistance to elderly, it can further be envisaged that such robotic appliances will be of general utility to humans both at the workplace and in their homes.

Wei (Vivien) Shi received the B.S. degree in electrical engineering from Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2005, the M.S. degree in electrical engineering from Hebei University of Technology, Tianjin, China, in 2008, and the Ph.D. degree in electrical engineering from New Jersey Institute of Technology, Newark, NJ, in 2012. Since 2012, she has been with University of Wisconsin-Stout, Menomonie, as an Assistant Professor in the Department of Engineering and Technology. Her research interests include robotics, control systems, automation, intelligent systems, and biomedical applications.

Adaptive Manufacturing
The ever increasing use of composites for aircraft components presents opportunities for new ways to process these parts. There are myriad benefits for use of composites in achieving aircraft performance goals. However, composites come with unique challenges as well. Some of these challenges impact the ability to produce accurate parts. Traditionally, such parts have been trimmed only while clamped in dedicated rigid tools that secure the part in the nominal shape. This results in significant investment in tooling design, production, maintenance, storage, handling, etc. As an alternative, PaR has developed its Adaptive Manufacturing System that incorporates a Robotic Fixture and Precision Motion Machine with Integrated Process Head.. This presentation will further describe the challenges and technology implemented in the delivery of this system.

Jim Cunov, CTO – Automation Solutions, PaR Systems Inc. Shoreview, MN
A Mechanical Engineer by training, Jim's career so far at PaR Systems has encompassed various positions from Project Engineer, Project Manager, Engineering Manager, Program Manager, Business Segment Leader, Director of Business Development – Aerospace to his current role as CTO. This 29+ year career at PaR has supported many different industries including Nuclear and Aerospace, but always with the focus on ensuring the customer will be successful. In his current position, Jim is responsible for identifying the technology that our customers need, and ensuring that PaR has the technology or is developing it ahead of that customer need.

Tutorial: Artificial Heart - Progress and Challenges

The idea of an artificial heart has captivated our imagination for over a century. In spite of tremendous progress, this ambitious goal has eluded the scientists, doctors and the engineers so far. However, this quest has led to remarkable clinical inventions, including left ventricular assist devices (LVAD). An LVAD provides hemodynamic support to a failing left ventricle, a Total Artificial Heart (TAH) assumes the hemodynamic functions of both ventricles and a fully implantable TAH operates tether-free without a percutaneous access. This presentation will review the design, clinical performance and limitations of the seminal artificial hearts and LVADs, including the University of Utah/Jarvik/SynCardia, AbioCor and Carmat artificial hearts and TCI/HeartMate XVE, HeartMate II and HeartWare HVAD LVADs. Design of the subsystems, such as the energy converter and its controller, blood pump and valves, percutaneous and transcutaneous energy transfer, will be analyzed. System design under the competing priorities of hemocompatibility, durability, miniaturization, efficiency and, in case of artificial hearts, the unique requirement of unequal left and right ventricular outputs, will be reviewed.

Sourav Bhunia, Ph.D.

Saturday, April 18th – All Day

Career Assistance – Updates and Insights for Today's Job Market

Successful, rewarding careers do not just happen. They require effort and skill. In this interactive session, members of the IEEE-USA Employment and Careers Committee will present important updates and information about building a successful career in today's fast changing environment.

Managing Your Career as a Business - Morning Session I and II
- How to manage your career as a business, from planning, through collateral, managing performance, and promoting the business
- How to inventory the assets of your business: your skills, interests, and work values
- How to grow your business through continuous learning, building relationships, learning to lead, and stretching your current activities
- How to avoid career de-railers

Tactics for Getting the Work that You Want - Afternoon Session I and II
- How to get the most from networking
- Developing a resume that says what employers want to know
- Managing the interview rather than having it manage you
- What it really takes to have your own business.

Ron Jensen, Tarek Lahdhiri, Peggy Hutcheson, Mauro Togneri - IEEE-USA Employment and Career Services Committee