Monday October 23

UT–M–A: COMMERCIAL WIRELESS NETWORKING: CREATING A TACTICAL INTERNET WITH COMMERCIAL TECHNOLOGY

This tutorial provides an overview of commercial wireless internetworking technologies within the context of the commercial domain and the potential roles of these technologies in the evolving network-centric warfighting force. Commercial wireless networking technologies have become increasingly popular over the past few years, and continue to impact the world socially and economically as the wireless Internet becomes more pervasive with rapidly increasing deployments across the world. This wireless outgrowth of the Internet has been fueled by the development of wireless technologies such as the nearly-ubiquitous IEEE 802.11 wireless local area network (WLAN) family of standards (also known as WiFi), broadband wireless access technologies such as the IEEE 802.16 standards family (also known as WiMax), and wireless personal area network (WPAN) technologies such as the IEEE 802.15 standards family (e.g. Bluetooth). Evolving cellular technologies (2.5G, 3G) provide an increasing capability support not only voice applications but also offer high-bandwidth data services and growing Internet accessibility across wide geographic areas. Furthermore, there has been an enormous amount of activity in the development of network- and higher-layer technologies to support mobility and wireless connectivity, such as Mobile Internet Protocol (MIP), and the continuing development of mobile ad-hoc network (MANET) routing protocols. With the development and envisioned deployment of IP Version 6 and its increased address space, along with the continually increasing capability of wireless networks, the envisioned proliferation of wireless network-capable devices is expected to be significant. Such proliferation will continue to push networking technologies that are highly capable, flexible, and scalable.

Concurrently, the military is undergoing a "transformation" to a network-centric warfare (NCW) paradigm. In the NCW paradigm, more importance is placed on the collection of, dissemination of, synthesis of, and action on information by lightweight, highly mobile, highly-lethal forces. This represents a fundamental trade of armor for network connectivity, placing unprecedented importance on the network(s) supporting the force structure. This warfighting paradigm is predicated upon the presence of a robust, highly capable, highly-interoperable, readily deployable and manageable, and secure networking capability to provide ubiquitous “anytime, anywhere, to anyone” communications. The composite of these networks will constitute the emerging Global Information Grid (GIG), a world-wide IP-based DoD network that is intended to remove communications as a constraint to the warfighter and his warfighting tactics.

There is a growing interest within the DoD community to leverage commercial Internet and wireless networking technologies in order to achieve this desired network-centric capability. This is understandable given the commercial Internet possesses many of the characteristics desired in the military counterpart. Subsequently, there continues to be an increasing number of military networks that are at least partly-based upon commercial wireless technologies and practices. However, these commercial technologies were not designed to meet military requirements, and as a result they may not perform well for all applications. If improperly applied within the military domain, they

could represent a regression of capability. In fact, commercial technologies are often defined to meet rigidly-defined performance goals and a narrow set of use cases. These constraints often result in poor performance when the network technologies are applied outside of the original scope, even within the commercial domain. Thus, it is important that the military communications community understand these technologies from a variety of perspectives. This includes becoming familiar with the technologies themselves, knowledge of what they are and are not designed for, how they are used within the commercial domain, and the relationships between these various technologies. Such an understanding enables the military community to identify gaps between technology and military needs, identify potential shortcomings that may induce operational constraints, and work to design military-specific augmentations as necessary to bridge these gaps and maintain a technological edge against potential adversaries who also have access to these same commercial technologies. Conversely, it is also important for the military community to have intimate familiarity with these technologies because those are the technologies adversaries are likely to possess. The goal of this tutorial is to provide an introduction to many of the wireless network technologies that are used within the commercial domain. This tutorial would provide attendees technical knowledge on pervasive wireless networking techniques and issues unique to the wireless domain. This tutorial will focus upon standardized commercial technologies, while refraining from presenting academic proposals from literature (there are too many technology proposals within the literature to realistically cover, even at a high-level, in a single tutorial session). Introductory material would be provided to identify key differences between wired and wireless domains, and highlight the key problematic areas in wireless internetworking. Introductory topics of the tutorial include: Introduction and motivation Why do we need to be concerned, from a military point of view, about commercial wireless technologies? Facts, figures, and trends of wireless networking technologies. Key functional attributes of pervasive commercial wireless technologies Examples of commercial deployments that highlight key desired capabilities, such as bandwidth, scale, security, and range Background. What is a wireless network? What does network mobility (NEMO) mean? What is mobile ad-hoc networking (and how is it different than NEMO)? Key differences between wired and wireless networks. What makes the wireless channel different from the wired channel? Wireless channel characteristics and key statistical models. What makes the wireless network different from a wired network? Mobility Temporal network topology and membership. Management Nodal configuration in the potentially rapidly changing network Security Increased accessibility and the shortcomings of traditional security models in this paradigm. Performance Examples will be provided of how applications flowing across a wireless IP network can experience degradation (e.g. a description of the 'TCP-over-wireless' problem will be provided).

The proposed tutorial then continues on to provide an overview of key pervasive commercial network technologies including:
• Current IEEE 802.11 WLAN technologies (a, b, g, i)
• Upcoming IEEE 802.11 WLAN technologies (e s r t)
• WPAN technologies (Bluetooth, 802.15 (.1/.2/.3/.4))
• Wireless broadband access technologies (802.16 (a, d, e), 802.20)
• Cellular coG??→2/p>

Each technology discussion will consist of the following sub-topics: 1) a description of the historical lineage of each technology, 2) the key design goals and usage cases for each technology, 3) some typical deployment models of the technology, 4) an overview

of the technology itself at the physical layer, medium access control (MAC) layer, and at the system-view, 5) a survey of the current equipment market (typical off-the-shelf product capabilities and profile (size, weight, power, etc.)), 6) on-going standardization efforts, and 7) on-going and envisioned deployment activities. Presentation of the different technologies aims to remain neutral to preclude any bias towards one technology as a more suitable candidate to another for any particular application. Finally, a commercial'big picture' will be provided, showing how each of these technologies serves a particular role within the commercial domain and how all these technologies together form the emerging wireless Internet.

The tutorial will then continue on to describe key technologies at the network-layer and above that are typically associated with wireless networking. This will include an overview of IP mobility support (both MIPv4 and MIPv6 models will be described).

NEMO activities within the IETF will also be described. MANET routing protocols will be described (e.g. Ad-hoc On-Demand Distance Vector (AODV) and Optimized Link State Routing (OLSR)), as well as research associated with transport layer and application layer techniques to mitigate the effects of the wireless network. The performance of and technical issues associated with each technology will be discussed, and on-going development efforts within standards organizations and emerging technologies will also be discussed. The tutorial will next discuss the issues of technology standardization, vendor selection, interoperability, and the need for military-specific enhancements. For example, the tutorial will illustrate how a technology standard does not guarantee that different vendor equipment that conforms to that standard necessarily interoperates across vendors. Furthermore, performance and feature sets across different vendor equipment can vary dramatically, even if all are based upon the same standardized technology. It should be noted this discussion will be conducted without identification of vendors. The tutorial will then identify some of the key shortcomings of the existing and emerging commercial wireless technologies previously discussed within the military domain. The tutorial will discuss the need for advocating military requirements within standards bodies while maintaining chosen technology gaps. Such gaps would be bridged with military-specific augmentations to maintain a technological edge.

Mr. Jack L. Burbank — The Johns Hopkins University Applied Physics Laboratory (JHU/APL)
8:00am — 11:45am

The proposed tutorial will be conducted by Mr. Jack L. Burbank of The Johns Hopkins University Applied Physics Laboratory (JHU/APL). Mr. Burbank leads the Wireless Networking section within the Communications and Network Technologies group of JHU/APL. Mr. Burbank is an expert in the area of wireless networking, and has been focused on the application of commercial wireless networking technologies to the military context. Mr. Burbank's background is in communications theory, wireless networking, IP internetworking, satellite communications, communications vulnerability analysis, and computer simulation of communications systems. Mr. Burbank leads a team of network engineers at JHU/APL that regularly attends and participates within the Internet Engineering Task Force (IETF) and also closely follows activities within the IEEE 802 standards organization. Mr. Burbank's research interests include mobile ad-hoc networking, wireless MAC design, and cross-layer design. Mr. Burbank's current work projects include research into adaptive augmentation of the 802.11 MAC to improve

scalability and efficiency while maintaining backwards compatibility, analysis and development of concepts for Naval MANET sensor networks, DoD analysis of commercial MANET routing protocols, and the application of commercial wireless broadband technology in the design of a United States coastal area network capability. Mr. Burbank has published numerous technical papers and reports on topics of wireless networking (both terrestrial-based and space-based) (see reference list for a partial list), led commercial wireless network tutorial at the 2005 IEEE MILCOM conference, and holds a provisional patent for a novel commercial WLAN testbed concept developed while studying the inclusion of very high-speed mobile stations (in excess of Mach 4) within an 802.11-based WLAN. Mr. Burbank is a professor of networking and telecommunications in The Johns Hopkins University Part-Time Engineering Program

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UT–M–C: WIRELESS TACTICAL UNDERWATER SURVEILLANCE NETWORKS

A sensor network is deployed either inside the phenomenon or very close to it. Unlike some existing sensing techniques, the position of sensor network nodes need not be engineered or pre-determined. This allows random deployment in inaccessible regions. On the other hand, this also means that sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Sensor network nodes are fitted with an on-board processor. Instead of sending the raw data to the nodes responsible for the fusion, sensor network nodes use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data.

Sensor networks have wide-range of applications especially in a battlefield because of their flexible, low cost, and self-organizing features. Some feasible military applications are: monitoring friendly forces, equipment and ammunition; battle-field surveillance; reconnaissance of opposing forces and terrain; targeting; battle damage assessment; and nuclear, biological and chemical (NBC) attack detection and reconnaissance. We envision that, in future, wireless sensor networks will be an integral part of C4ISR systems.

Among the tactical sensor network applications, underwater surveillance is very attractive because being close to the target makes underwater detection and classification an easier challenge that can be tackled by more cost effective micro sensors. Moreover, the accuracy, sustainability, robustness and resilience of underwater surveillance systems based on ad hoc sensor networks is much higher comparing to the conventional underwater sensing systems. However, realization of wireless tactical underwater surveillance (WTUS) networks requires new underwater and near sea surface ad hoc networking techniques. Although many protocols and algorithms have been proposed for traditional wireless ad hoc networks, they are not well suited for the unique features and application requirements of WTUS networks. To illustrate this point, the differences between WTUS networks and a close peer ad-hoc networks are outlined below:

- Number of sensor nodes in a WTUS network can be several orders of magnitude higher than nodes in an ad hoc network.
- Sensor nodes are densely deployed.
- Sensor nodes are prone to failures.

- The topology of a WTUS network changes very frequently.
- Sensor nodes mainly use broadcast communication paradigm whereas most ad hoc networks are based on point-to-point communications.
- Sensor nodes are limited in power, computational capacities, and memory.
- Underwater and near sea surface have more challenging medium characteristics.

Many researchers are currently engaged in developing schemes that fulfill the requirements for wireless sensor networks. In this tutorial, we present a survey of protocols and algorithms proposed thus far for wireless sensor networks and applicable for WTUS networks. Our aim is to provide a better understanding of the current research issues in this field. We also attempt an investigation into pertaining design constraints and outline the use of certain tools to meet the design objectives.

Our tutorial is organized as follows: After introduction, we present potential application areas for WTUS networks. Then, we discuss the factors that influence the WTUS network design, and provide a detailed investigation of current proposals in this area. In conclusion, we identify the open research issues and summarize some current research projects.

Mr. Erdal Cayirci — NATO Joint Warfare Center
8:00am — 11:45am

Erdal Cayirci graduated from Turkish Army Academy in 1986, and from Royal Military Academy Sandhurst in 1989. He received his MS degree from Middle East Technical University, and the PhD degree from Bogazici University in computer engineering in 1995 and 2000, respectively. He retired from the Turkish Army when he was a colonel in 2005. He was an associated professor in Istanbul Technical University, Yeditepe University and Naval Sciences and Engineering Institute between 2001 and 2005. He was a visiting researcher with Broadband and Wireless Networking Laboratory and a visiting lecturer with the School of Electrical and Computer Engineering at Georgia Institute of Technology in 2001. He is currently Chief, CAX Support Branch in NATO Joint Warfare Center in Stavanger, Norway. His research interests include sensor networks, mobile communications, tactical communications, and military constructive simulation. He was an editor for IEEE Transactions on Mobile Computing, AdHoc Networks (Elsevier Science) and ACM/Kluwer Wireless Networks journals, and guest edited four special issues for Computer Networks (Elsevier Science), AdHoc Networks (Elsevier Science) and Kluwer Journal on Special Topics in Mobile Networking and Applications (MONET). He was the general chair of European Workshop on Sensor Networks 2005, general co-chair of Mediterranean Workshop on Ad Hoc Networks 2004, and program co-chairs of the First and Second IEEE Sensor Network Protocols and Applications Workshops in 2003 and 2004. He received “2002 IEEE Communications Society Best Tutorial Paper” Award for his paper titled “A Survey on Sensor Networks” published in the IEEE Communications Magazine in August 2002, “Fikri Gayret” Award from Turkish Chief of General Staff in 2003, “Innovation of the Year” Award from Turkish Navy in 2005.

UT–M–B: NETWORK SECURITY: TRAFFIC ANALYSIS FOR DETECTING COMPUTER INTRUSIONS AND VIRUSES/WORMS

This half-day tutorial will give an overview of how traffic data is collected and analyzed to detect attacks directed against specific computer targets and large-scale virus/worm attacks (against the general Internet population). The tutorial is organized into two major parts.

The first part deals with directed attacks that aim to compromise the security of specific computer targets. We describe the two basic steps in directed attacks: scanning for vulnerabilities and exploit attack. This is essential background to understand how attack traffic is different from normal traffic. Next, we describe how traffic data is monitored and collected from various points in the network, including sniffers, routers, firewalls, honeypots, and intrusion detection systems. We review methods to analyze the traffic data to detect signs of computer intrusions. The two basic approaches of misuse detection and anomaly detection are explained.

The second part of the tutorial deals with virus and worm attacks which are not directed at specific targets. They are undirected large-scale attacks with the goal of compromising as many computers as quickly as possible. Their self-replicating behavior and ability to carry malicious payloads make them a major threat to the entire Internet. We give an overview of how virus and worm programs work to replicate and spread themselves through a network. The limitations of current defenses (antivirus software, firewalls, intrusion detection systems, access control lists) are explained. Finally, we describe methods designed for early worm detection and warning.

Mr. Thomas M. Chen — SMU, Dept of Electrical Engineering
1:45pm — 5:30pm

UT–M–D: POLICY CONFLICT RESOLUTION FOR NETWORK MANAGEMENT SYSTEMS

The subject of policy-based network management has received a great deal of attention in the recent past. Today's military networks are highly dynamic and pose stringent requirements for security, reliability, and above all, operations automation. Policy-based network management promises to deliver a high degree of automation for military network management. A policy-based network management system provides the capability to express networking requirements at a high level and have them automatically realized in the network, without requiring further manual updates. Network operators define policies that are used to drive the operation of the network management system. This approach provides the operator with the capability to specify high-level policies that specify long-term, network-wide configuration objectives. It also provides an automated feedback loop so that information reported by via network monitoring can be used to automatically trigger reconfiguration of the network based on policies. Once policies for network management are defined, they are automatically enforced by the policy management system. These capabilities can provide military personnel as well as commercial network operators with very powerful tools to configure and control their network, and to re-configure their network in response to network conditions, with the highest possible level of automation.

It has been widely recognized that the use of policies for network management is an essential step towards increasing automation, and many large DoD programs that are currently in progress (e.g. FCS, TMOS) mandate the use of policies for network management. However, as with every technology, these benefits come at the expense of certain obvious risks that need to be addressed. The biggest risk associated with policy-based management is that the policies themselves can interact in undesirable ways. They can also cause or attempt to cause conflicting actions to be taken by the management system. Thus it is essential that policies be analyzed for conflicts, and that some mechanisms be put in place for determining how to resolve these conflicts. There are many promising approaches for solving this problem that have been suggested in recent years; these approaches range from complex formal logic-based methods to simple strategies such as policy action prioritization. This tutorial will provide an overview of multiple policy conflict detection and resolution approaches, and will present practical applications of how conflicts can be detected and resolved. The focus will be on detecting and resolving policy conflicts for policy-based network management applications, and relevant network management examples will be used in the case studies. The tutorial will cover the following topics:

Introduction to Policy-Based Management: This section will provide an introduction to policy-based management and how policy-based management can be used for managing IP networks. The complexities of managing a large IP network pose some unique problems which can be addressed by the appropriate use of policies to describe high-level mission goals. These high-level policies are then automatically translated into the appropriate configuration commands that implement the required mission goals in the network.

Taxonomy of Policy Conflicts: This section will describe different types of policy conflicts hat can arise in policy-based network management systems. Policy conflicts can be characterized in several ways, and different conflict resolution strategies are applicable for resolving different types of policy conflicts. Thus it is necessary to categorize policies into different types so that the appropriate conflict resolution strategies can be applied.

Mechanisms for Policy Conflict Resolution: This section will delve into details of different mechanisms for policy conflict resolution. Some of the promising strategies include the use of logic programming, event calculus, and other formal techniques for analyzing sets of policies and detecting conflicts among them. Some techniques are appropriate for static policy analysis (prior to deployment), whereas others are suitable for run-time policy conflict detection. Resolution strategies also vary depending on the types of policies and policy conflicts. This section will provide an in-depth overview and analysis of the most promising policy conflict detection and resolution methods, and will compare their effectiveness.

Case studies: This section will present case studies that describe realistic policy conflict scenarios, and will compare the use of different mechanisms for detecting and resolving these conflicts. The case studies will use scenarios that are applicable to military networks managed by policy-based network management systems, and will include a number of scenarios that describe practical examples of policy conflicts that can arise in policy-based network management applications. The case studies will show how these

conflicts can be detected and resolved by the use of the policy conflict resolution strategies introduced earlier in this tutorial.

Recent Related Tutorials

R. Chadha, “Policy-Based Network Management”, Tutorial presentation, IEEE Tutorials Now, available at http://www.comsoc.org/livepubs/tutorials/Chadha/index.html.

R. Chadha, “Policy-Based Network Management”, Tutorial presentation, IEEE MILCOM 2005, Atlantic City, NJ, October 2005.

R. Chadha, “Managing Mobile Ad Hoc Networks”, Tutorial presentation, IEEE/IFIP Network Operations and Management Symposium (NOMS 2004), Seoul, South Korea, April 19-23 2004.

R. Chadha, "Using Policy-Based Management for MPLS Traffic Engineering", Tutorial presentation, IEEE/IFIP Network Operations and Management Symposium (NOMS 2002), Florence, Italy, April 2002.

R. Chadha, “Directory Enabled Networks (DEN): A Tutorial”, Tutorial presentation, IEEE/IFIP Network Operations and Management Symposium (NOMS 2000), Honolulu HI, April 2000.

Dr. Ritu Chadha — Telcordia Technologies
1:45pm — 5:30pm

Dr. Ritu Chadha is Chief Scientist and Director of the Policy Management research group in Applied Research at Telcordia Technologies, where she has been working since 1992. She is the Chief Engineer for Telcordia's Future Combat Systems (FCS) Network Management System subcontract with Northrop Grumman. She was the program manager for the CERDEC DRAMA (Dynamic Re-Addressing and Management for the Army) project, a 5-year Science and Technology Objective (STO) focused on the design, prototyping, and field demonstration of a policy-based network management system for mobile ad hoc networks. Dr. Chadha is an active participant in standards bodies such as the IETF. She has presented tutorials and invited speeches at several industry conferences and has published over 50-refereed papers in journals and conferences. She has presented tutorials and invited speeches at several industry conferences. Dr. Chadha received her Ph.D. in Computer Science from the University of North Carolina at Chapel Hill in 1991. Her research interests include policy-based management, network and service management for IP-based networks, ad hoc networking, and automated reasoning.

Tuesday October 24

UT–T–A: NEXT GENERATION WIRELESS TECHNOLOGIES: HIGH THROUGHPUT WIFI, WIMAX, AND UWB

This course on latest advances in wireless data networking is designed for engineers and managers involved in design and deployments of wireless equipment. In addition to providing an overview of technology, issues, standards it also covers the technical details. After a brief introduction to WiFi (IEEE 802.11) technology, we discuss the technological developments that enable high-speed IEEE 802.11n LANs. We present and compare different proposals. The second part of the course is on broadband wireless access using WiMAX. Technical developments that allow WiMAX to provide high-speed over a long distance are explained. The key features of various versions of IEEE 802.16 (802.16, 802.16a, 802.16d) are presented. The mobile broadband access 802.16e is also described. Again technology, industry status, and products are discussed. Ultra wide-band (UWB) technology for high-speed personal area networks is covered.

Wireless Networking: Issues and Trends
Top 10 Recent Networking Developments
Wireless: History
Life Cycles of Technologies
Wireless Industry Trends
Wireless Research Trends

Recent Developments in Wireless Physical Layer:
Spread Spectrum, Code Division Multiple Access
Orthogonal Frequency Division Multiplexing (OFDM)
Turbo Codes
Software Radio
Smart Antenna
Space-Time Block Codes
Ultra-Wideband

Wireless Local Area Networks (WLANs):
IEEE 802.11 Features
802.11 MAC
Current Activities in IEEE 802.11
Next Generation: 802.11n
Enhanced Quality of Service: 802.11e

IEEE 802.16 (WiMAX)
Key Features
QoS Classes
Scheduling and Link Adaptation
IEEE 802.16 Standards Activities
IEEE 802.11 vs 802.16
WiBro

Dr. Raj Jain — Washington University in St. Louis, MO
8:00am — 11:45am

Raj Jain is a Professor of Computer Science and Engineering at Washington University, St. Louis, MO. He is also Co-founder and Chief Technology Officer of Nayna Networks, Inc - a next generation broadband access equipment company in San Jose, CA. Until

August 2002, he was a Professor of Computer and Information Sciences at Ohio State University in Columbus, Ohio. Dr. Jain is a Fellow of IEEE, a Fellow of ACM. He has served on the Board of Technical Advisors to several companies including Nexabit Networks, Westborough, MA acquired by Lucent Corporation. (March 1997-1999), Amber Networks, Fremont, CA acquired by Nokia (1999-2001). He is the author of ``Art of Computer Systems Performance Analysis,'' which won the 1991 ``Best-Advanced How-to Book, Systems'' award from Computer Press Association. His fourth book entitled " High-Performance TCP/IP: Concepts, Issues, and Solutions," was published by Prentice Hall in November 2003. Based on his active participation in the computer industry, Dr. Jain was awarded 1999 siliconindia Leadership Awards for Excellence and Promise in Business and Technology.

UT–T–C: SATELLITE-BASED IP NETWORKS FOR MISSION CRITICAL APPLICATIONS

SUMMARY

Satellites provide a convenient way to create communication networks for hard-to-reach regions of the world. Satellites are particularly useful for military missions, in which Internet Protocols (IP) provide the basis for integrating voice, video and data into a single, cost-effective network. However there are issues. Satellite delay and bit errors can impact performance; there are choices regarding earth stations; satellite links must be integrated with terrestrial networks; space segment is expensive; security is a concern; quality of service must be provided. This three-hour tutorial will help participants understand the technology needed to resolve these issues.

COURSE OUTLINE

Hybrid Satellite and Terrestrial networks: Overview of end to end networks incorporating satellites, wide area networks (WAN) such as the GIG, local area networks (LAN), and mobile networks. Introduction to:

Communication Satellite Technology: LEOs, MEOs and GEOs. Converting bandwidth (Megahertz) to data channels (bits per second). Satellite coverage area, frequency bands, impact of rain.

Packet-Based Data Networking: Seven-Layer Model (ISO). Layer 2 networks such as Frame Relay, ATM, Aloha, Digital Video Broadcasting (DVB), and Ethernet.

The Internet and its Protocols: Higher layer networks using IP protocols. Routing between and within networks. Use of the Transmission Control Protocol (TCP) for reliable file transfer. Impact of bit errors and propagation delay on TCP-based applications. User Datagram Protocol (UDP) for IP multicasting, voice transmission (VOIP) and video streams. Introduction to Intranets, which are private networks that use IP protocols.

Satellite Data Networking Architectures: Ground station architectures for data networking. Shared outbound carriers incorporating Frame Relay, DVB. Dynamically

shared return channels: SCPC DAMA, TDMA/DAMA. Full mesh network technology, impact of mobile terminals.

Quality of Service (QoS) Issues in Intranets: Definition of quality factors for streams and files. Performance of voice and video in IP networks. Methods for improving QoS in Intranets, including differentiated services, caching and TCP protocol enhancement. Security issues and their impact on QoS.

Examples of Mission-Critical Systems: Short case histories of several types of mission-critical systems

A View of the Future: Next generation military and commercial satellites. Impact of on-board processing. What's ahead in low -cost ground station technology.

Mr. Burt H. Liebowitz — The MITRE Corporation
8:00am — 11:45am

Burt H. Liebowitz is Principal Network Engineer at the MITRE Corporation, McLean, Virginia, specializing in the analysis of satellite services. He has more than 30 years experience in computer networking, the last seven of which have focused on Internet-over-satellite services. He was President of NetSat Express Inc., a leading provider of such services and before that was CTO for Loral Orion, responsible for Internet-over-satellite access products. Mr. Liebowitz has authored two books on distributed processing and numerous articles on computing and communications systems and has lectured extensively on satellite networking. He holds three patents for a satellite-based data networking systems. Mr. Liebowitz has B.E.E. and M.S. in Mathematics degrees from Rensselaer Polytechnic Institute, and an M.S.E.E. from Polytechnic Institute of Brooklyn.

UT–T–B: NEXT GENERATION INFORMATION ACCESS: STATE OF THE ART TOOLS AND METHODS

Today most users need to manually perform data searches, extract information from retrieved data, summarize and interpret the results, and form conclusions based on the results. In contrast, intelligent information access tools can facilitate these activities for the analyst and operator throughout the process, decreasing task time and increasing comprehensiveness and accuracy of search if tools are appropriately chosen and applied. The purpose of this presentation is to provide an overview and demonstrations of five intelligent information access technologies: information retrieval, summarization, information extraction, text clustering, and question answering.

LEARNING OBJECTIVES
Participants who attend the presentation will:
Learn the current state of the art in information retrieval, summarization, information extraction, text clustering, and question answering
Understand the applicability of tools for specific analytic tasks
See live demonstrations of several of the technologies if internet connectivity is available

While the presentation will not make specific tool recommendations, it will provide participants with a list of internet or commercially available tools in each of these categories.

Keywords
Information access, information retrieval, document summarization, information extraction, text clustering, and question answering

Target Audience
This presentation is intended for analysts, tool builders and program managers who want to get a solid understanding of the range of capabilities available to intelligently access information. The presentation will be useful to researchers and practitioners interested in using or designing intelligent information access systems. There is no prerequisite knowledge required, although general knowledge of information technology will enhance the value of this course for participants.

INFORMATION RETRIEVAL
The state of the art in information retrieval will be summarized to show how ranked lists of documents can be obtained from queries. Information retrieval methods such as indexing and query transformation will be discussed along with how one evaluates the results. Today, systems can return documents across languages relevant to a particular subject with around 80% precision but low recall (or vice versa). Advances in automated query expansion and relevancy feedback have achieved near human retrieval performance. We summarize results from NIST's annual Text Retrieval Conference (TREC). We describe how search engines exploit statistics (e.g., Term-frequency-inverse document-frequency (TFIDF) and co-occurrence, structure (e.g., Google's use of link analysis) and format to enhance retrieval. Emerging systems exist that provide content based retrieval of speech, imagery, and video. We contrast search engines, directories, metacrawlers, and content providers. We summarize how the role of the semantic web in enhancing retrieval.

SUMMARIZATION
Summarization is the technology process that distills the most important information from a source (or sources), and produces an abridged version of the information as either an abstract or an extract. With newspaper text, analyst can summarize documents to 20% of their source size without information loss, saving themselves 50% of task time (Mani and Maybury, 1999). We outline summarization evaluations conferences such as SUMMAC, the Japanese Text Summarization Challenge, and the Document Understanding Conference summarization evaluation (http://duc.nist.gov).

INFORMATION EXTRACTION
Delving deeper, information extraction is used to identify semantic elements within a body of text, for example, entities such as people places or things, properties such as characteristics of entities, or relationships. Current systems are able to extract named entities in news with over 90% accuracy and relations among entities at 70-80%accuracy

TEXT CLUSTERING
Text clustering is the process of detecting topics within a document collection, creating a taxonomy of these topics, assigning documents to the topics, and then labeling these

topic clusters so they can more easily be used by various tools. A number of commercial tools are available on line (e.g., vivismo.com) and they may include visualization of search results such as link node diagrams (e.g., www.kartoo.com).

QUESTION ANSWERING
Question answering uses several of the previously discussed technologies. In question answering, questions are analyzed and augmented by the system, documents are retrieved using this augmented question, answers are extracted from these candidate documents, and a ranked set of possible answers is provided to the user. Using the best performing question answering system, an analyst can retrieve answers to simple factual questions from relevant documents at 75% accuracy (Maybury. 2004). On line question answering systems include AskJeeves www.ask.com and Language Computer Corp www.languagecomputer.com.

SUMMARY
Effectively exploited, intelligent information access systems promise many benefits. These include:
More strategic management of intellectual resources – unlocking the full enterprise potential.
More efficient knowledge discovery -- enabling more rapid knowledge discovery with less work.
More effective knowledge application -- tailoring information access to individual needs.

Dr. Mark T. Maybury — The MITRE Corporation
1:45pm — 5:30pm

As Executive Director of MITRE's Information Technology Division, Dr. Mark Maybury is responsible for the direction of MITRE advanced research and development for intelligence and defense systems. Mark has organised international conferences, given tutorials, and published over fifty articles in the area of language generation, multimedia presentation, text summarization, intelligent information retrieval and analysis. Mark is editor of Intelligent Multimedia Interfaces (AAAI/MIT Press, 1993), Intelligent Multimedia Information Retrieval (AAAI/MIT Press, 1997),. New Directions in Question Answering (AAAI/MIT Press, 2004), co-editor of Readings on Intelligent User Interfaces (Morgan Kaufmann Press, 1998), Advances in Text Summarization (MIT Press, 1999) and Advances in Knowledge Management: Classic and Contemporary Works (MIT Press, 2001) and co-author of Information Storage and Retrieval: Theory and Implementation. 2nd Edition (Kluwer Academic, 2000) and co-editor of Knowledge Management (MIT Press 2000). Mark serves on the Board of the Object Management Group, Treasurer of ACM SIGART, and member of the Steering Committee for ACM IUI. Mark received his M.Phil. in Computer Speech and Language Processing (1987), an MBA from RPI (1989), and his Ph.D. in Artificial Intelligence (1991) at Cambridge University, UK. Prior to joining MITRE, Dr. Maybury served as a US Air Force Officer at Rome Air Development Center.

UT–T–D: IMPROVING TACTICAL COMMUNICATION IN IP NETWORKS WITH ROUTE ANALYTICAL TECHNOLOGY

Traditional network management, carried out using SNMP polling and often augmented by codebook-based correlation, fails to pass muster in the IP networks central to many agencies' tactical operations. Routing dynamics often lead to unpredictable and intermittent network behaviors that leave NOC (Network Operations Center) staff unable to explain what caused such behaviors, and at a loss as to how to keep them from recurring.

This tutorial introduces the concept of route analytics, which uses information contained in IP routers' protocol "conversations" to record and visualize the complex and dynamic layer 3 issues that cause undesirable network behavior. NOC staffers can then take corrective action to increase service predictability and availability.

Route analytics devices listen and participate in routing protocol exchanges. They record every message received and at times probe the network for additional information. Failure and recovery of IP connectivity between routers triggers routing message exchanges. By receiving these triggered routing messages, route analytics devices are able to monitor and alert network reachability problems as fast as they are identified by the routers in the network. They then provide a real time network map showing failed or flapping components.

Stored historical data allows forensics analysis of reachability problems. For example, a short lived outage can cause significant reachability damage perhaps due to a suboptimal network or address assignment design. The outage may self correct in time for an operator to intervene and understand why such a damage was caused. Route analytics devices allow viewing the state of the network at any point in the past and allow stepping through the routing messages one by one allowing the operator to see the affect of each message until the cause of the problem is discovered.

Route analytics devices also automatically analyze this stored data for patterns and root causes, yielding failed or about to fail components that should be replaced. They allow modeling and simulating “what-if” scenarios for network planning, change management, and disaster recovery planning.

The centerpiece of the tutorial will be the use of route analytics by the U.S. Navy's Pacific Region Network Operations Center (PRNOC), in Wahiawa, Hawaii, to maintain an effective communications infrastructure for ships based in the Pacific Ocean. In this tutorial, we will present case studies from both this network and other service provider and enterprise networks.

Dr. Cengiz Alaettinoglu — Packet Design, Inc.
1:45pm — 5:30pm

Cengiz Alaettinoglu is a fellow at Packet Design, Inc. Currently he is working on scaling and convergence properties of both inter-domain and intra-domain routing protocols. He was previously at the USC Information Sciences Institute, where he worked on the Routing Arbiter project. He co-chaired the IETF Routing Policy System Working Group to define the Routing Policy Specification Language and the protocols to enable a distributed, secure routing policy system.

Alaettinoglu received a B.S. degree in computer engineering in 1988 from the Middle East Technical University, Ankara, Turkey; and M.S. and Ph.D. degrees in computer science in 1991 and 1994 from the University of Maryland at College Park. He was a Research Assistant Professor at the University of Southern California, where he taught graduate and undergraduate classes on operating systems and networking from 1994 to 2000. He has given numerous talks at NANOG, IETF, RIPE and APNIC meetings, as well as at ACM and IEEE conferences and workshops.

Wednesday October 25

UT–W–A: WiMAX (IEEE 802.16-2004, IEEE 802.16e)

Fujitsu is a leader in the WiMAX industry. As a Founding Member and Board Member in good standing of the WiMAX Forum and as a provider of a full portfolio of WiMAX products from silicon to full systems and infrastructure support, we present the following abstract and outline for a WiMAX tutorial session. Mr. James Orr – Principal Network Architect is the subject matter expert that will be presenting the tutorial. Mr. Orr has been involved in the Fujitsu WiMAX effort since 2002, is a voting member of the WiMAX Forum and has spoken at numerous WiMAX events including, but not limited to, CTIA, SuperComm, WiMAX World, Jefferies, UBS, SCTE and WCA. He currently runs the North American market development program for Broadband Wireless. The WiMAX topic covers several areas. We have found that breaking it down into three core parts works best. Part I – WiMAX Overview This segment will present the history of WiMAX up to the time of the publication of the tutorial later this year. The intent of this section is to describe how 802.16 has developed from the original intent of the standard to the versions passed by IEEE. We will discuss the evolution of the WiMAX Forum and its operations and goals. Part II – WiMAX Applications, Commercial and Direct Translation to the Military. This segment will describe the real and targeted applications for WiMAX. This includes the varieties of Broadband Wireless Access (BWA) for residential and business use and the translation to Military applications. The significant benefits to using WiMAX as the BWA technology for Military applications – security, large scale market volume, global acceptance, native IP, etc. will be discussed. Part III – Theory of Operation In this more in-depth section, we will describe the actual operation of the WiMAX product set to back up the supposition in the prior section. We will describe the operational characteristics of the technology and why this supports the movement to an All-IP operational model. Part IV – Key Technology Assessment – There are many technologies that make up the operational structure of a WiMAX system. We will describe the various technologies and the trade-offs inherent to each technology. The impact to performance and service implementation will be discussed.

Mr. James Orr — Fujitsu Network Communications
8:00am — 11:30am

Jim Orr, principal network architect in the wireless market development group at Fujitsu, has worked in the telecommunications industry for nearly 16 years, serving in various

engineering, network planning, network architecture and marketing roles in both the vendor and the carrier community. Before joining Fujitsu in November 2001, Jim increased his industry experience through progressively expanding responsibilities in network architecture and implementation with Latus Lightworks, McLeod Communications, Caprock Communications, GST Telecom and Electric Lightwave. He began his career with Northern Telecom in systems and sales engineering roles. Jim holds a bachelor of science degree in electrical engineering from Texas A & M University and a master's degree in business administration from Washington State University.

UT–W–C: JTRS SCA FOUNDATIONAL OVERVIEW

As well as being the core standard for all Department of Defense (DoD) software-based communications programs involved with Network Centric Operations (NCO) and Network Centric Warfare (NCW) such as the JTRS Ground Mobile Radios (GMR), Airborne Maritime Fixed-station (AMF), Family of Advanced Beyond-line-of-sight Terminals (FAB-T), and Future Combat Systems (FCS), the SCA specification forms the corner-stone basis that inspires many of today's emerging commercial international standards such as the Object Management Group (OMG) specification for developing SCA-based Software Defined Radio (SDR) components, host environments, and waveforms known as the Platform-Independent Model and *Platform-Specific Model for Software Radio Components.*

This overview is of most interest to SCA Core Framework (CF) providers, developers and testers of applications (e.g. waveforms) and components (e.g. service, device, and application component, etc.), Domain Profile tool providers, and authors of international software radio standards inspired by and based on the SCA specification, such as the Object Management Group (OMG) *PIM & PSM for Software Radio Components Specification.* In addition to discussing each topic in detail, this overview provides insight to related information not covered in the SCA specification and often left open to interpretation. Additional discussions include topics such as bridging of the gap between the *JTRS SCA Specification* and the *JTRS SCA Security Supplement*, as well as the challenges of passing SCA compliancy tests for CFs.

The **CORBA Naming Service** sub-topic covers the Naming Service-related roles and responsibilities for the SCA CF DeviceManager and Domain Management interfaces and components instantiated and torn down by these interfaces.

The **CORBA Event Service** sub-topic covers the responsibilities of the Domain Management interfaces for creation and destruction of the CF domain event channels, connecting and disconnecting components to/from these event channels, and responsibilities of components that act as suppliers or consumers for these event channels.

Finally, the **Connections** sub-topic covers the architecture of the SCA Domain Profile XML files for expressing connections between components, responsibilities of the CF providers with respect to establishing these connections, and responsibilities of component implementations that play the user or provider role in a connection.

SCA ADVANCED TOPICS OBJECTIVES
Provide a brief overview of the OMG Naming and Event Services, along with an in-depth look into the SCA-mandated subsets, related CF and component developer responsibilities, pertinent Domain Profile XML elements, Security Supplement restrictions and conflicts with the main SCA specification, and suggested approaches for resolving such conflicts for specific implementation architectures.
Provide an overview of the Domain Profile XML elements for expressing connections between components, responsibilities of the CF providers with respect to establishing these connections, and responsibilities of component implementations that play the user or provider role in a connection.

Miss Neli Hayes — The Boeing Company
8:00am — 11:30am

As an Associate Technical Fellow of The Boeing Company with over 17 years of software engineering experience and extensive software engineering hands-on, formal education, and teaching experience in development of distributed, real-time embedded and object-oriented systems, Miss Neli Hayes is a lead Principal Software Architect, Software Technical Specialist, and Business Development Technical Marketing Assist for Boeing's Joint Tactical Radio System (JTRS) military contracts and Software Defined Radio (SDR) Integrated Research and Development (IR & D) Center of Excellence (COE) based in Southern California.

In the vertical specialized domains, Miss Hayes' specialty is the development of Software Communications Architecture (SCA)-compliant Operating Environments (OEs) for Boeing's JTRS software radios. She is the chief software architect and designer for the JTRS Ground Mobile Radios (GMR) program SCA Core Framework (CF) product and serves as one of the program's technical specialists, providing guidance and technical counsel to other software radio contracts such as Airborne Maritime Fixed-station (AMF), Family of Advanced Beyond-line-of-sight Terminals (FAB-T), and Future Combat Systems (FCS). She has been involved with the development of SCA-compliant software radios since the beginning of the JTRS Step 2B program, where as a part of an elite group of software engineers, she has designed and developed SCA-compliant CFs and OEs based on multiple versions of the SCA, submitted numerous change proposals for the improvement of the SCA, served as an architect on the JTRS Joint Program Office (JPO) SCA Technical Architecture Group (TAG), and co-authored SCA white papers presented nationally and internationally at the SDR Forum. She has taught the very first and evolving in-depth half-day tutorials of the SCA at 7 national Object Management Group (OMG) conferences as well as MILCOM 2005 since July of 2003 and receives continuous invitations for teaching these tutorials and related papers at other renowned national and international conferences such as the Military Radios Conference. Within Boeing she has been a specialist in developing real-time, distributed, and object-oriented software using C++, CORBA and UML, has taught related in-depth university level courses for Boeing JTRS software engineers on these subject matters, and has coordinated on-sight teaching of these and other related SDR courses for Boeing engineers from local universities such as the University of California Los Angeles (UCLA), and University of California Irvine (UCI).

At the OMG Miss Hayes co-chairs the task force for the commercial international version of the SCA specification for software radios, and serves as a contributing software

architect for the improvement of this specification since 2004. She additionally serves on the OMG Board of Directors as well as Business Committee, overseeing the acceptance of the SCA-based Software Radio specification, as well as other OMG formal specifications, after these specifications get approved by the OMG Architecture Board. Miss Hayes has been the driving force for Boeing's sponsorship of the OMG Software Based Communications (SBC) Workshops and other key OMG Technical Meetings since 2004. She has served for two consecutive years on the SBC workshop's program committee, reviewing and accepting SCA-based SDR papers and tutorials and soliciting related papers and tutorials for this international workshop not only from within Boeing, but also from across the U.S. and Europe from Boeing's teammates and fellow industry architects on the JTRS GMR and related programs and standardization efforts.

Miss Hayes holds B.S. degrees in Computer Science and Mathematics and an M.S. degree in Computer Science from the California State University, Fullerton (CSUF).

UT–W–B: ROUTING IN DELAY TOLERANT MOBILE TACTICAL AD HOC NETWORKS: OVERVIEW AND CHALLENGES

In mobile tactical ad hoc networks, nodes are constantly in motion and/or operate on limited power. When nodes are in motion, links can be obstructed by intervening objects. When nodes must conserve power, links are shut down. These result in intermittent connectivity. When no path exists between source and destination, network partition occurs. Examples of an intermittently connected network (ICN) are: a). An inter-planet satellite communication network where satellites and ground nodes may only communicate with each other several times a day, b). A sensor network where sensors are not powerful enough to send data to a collecting server or are scheduled to be wake/sleep periodically, c). A military ad hoc network where nodes (e.g. tanks, airplanes, soldiers) may move randomly and are subject to being destroyed. Applications in ICNs must tolerate delays beyond conventional IP forwarding delays and these networks are referred to as delay/disruption tolerant networks (DTN). New protocols specifically for DTNs must be developed as existing protocols designed for the Internet do not work properly. Applications in DTNs include

- JPL's Inter-planet network,
- US Navy Seaweb Initiative: Enabling Undersea FORCEnet for cross-system, crossplatform, cross-mission, cross-nation interoperability
- UMass DieselNet: A Disruption-Tolerant Network Testbed
- US Marine Corps CONDOR—Command and Control On-the-Move Network Digital Over-the-Horizon Relay.

Recently there has been much research activity in the emerging area of intermittently connected ad hoc networks and delay/disruption tolerant networks (DTN) (DARPA launched one in 2005). There are different types of DTNs depending on the nature of the network environment. Routing in DTNs is one of the key components in the DTN architecture proposed by the DTN research group. Therefore, researchers have proposed different routing protocols for different types of DTNs in the last few years. In this tutorial, we review the state of the art in DTN networks, especially routing protocols. We categorize these routing protocols based on information used. For deterministic time

evolving networks, three main approaches are discussed: the tree approach, the space and time approach, and the modified shortest path approach. For stochastic time evolving networks, the following approaches are reviewed: the epidemic or random forwarding approach, predication or history based approach (including per contact routing based on one-hop information only and per contact routing based on average end to end information), the model based routing approach as well as approaches which control the movement of certain special nodes. Recent developments in erasure coding and network coding applied to DTNs are also discussed.

As a case study, we will discuss how DTN technologies are applied to real DOD networks such as US Marine Corps CONDOR—Command and Control On-the-Move Network Digital Over-the-Horizon Relay. CONDOR is a short term bridging strategy to link existing tactical radio and data networks and to provide an over-the-horizon communications capability to link line-of-sight radio systems that have moved beyond line-of-sight or that precluded by terrain features or other obstacles. The tutorial also identifies open research issues and intends to motivate new research and development in this area.

E Outline

1) Introduction
 a) Reviewing wireless, mobile tactical ad hoc networks
  i) Military Style Ad-hoc networks
  ii) Deep Space Networks
  iii) Sensor Networks
 b) Characteristics of MANET
 c) DTN Research group's architecture
 d) DTN Applications (BBN DARPA DTN Project, JPL Inter-planet network, US Marine Corps CONDOR, US NAVY Seaweb, ZebraNet, DataMule, etc)
2) Routing protocols
 a) Deterministic routing
  i) Tree approach
  ii) Space and time graph approach
  iii) Modified shortest path approach
 b) Stochastic approaches
  i) Epidemic routing
  ii) Link forwarding probability estimation based approaches
   (1) per contact routing based on next hop information
   (2) per contact routing based on end to end information
  iii) Model based forwarding
  iv) Controlling the movements of the nodes
 c) Coding based approaches
  i) Erasure coding based approaches
  ii) Network coding based approaches
3) Case Study: Applying DTN technology to US Marine Corps—CONDOR
 a) Overview of CONDOR
 b) DTN for CONDOR
 c) DTN application development
4) DTN Open issues/research areas

F Intended Audience The tutorial is designed for researchers, system engineers, network architects, and protocol implementers from government, academia or industry interested in intermittently connected ad hoc networks and delay tolerance networks.

G Motivation Even though the research in routing in DTNs is in its early stage, there are already many architecture and routing protocols proposed. It is high time to organize all into different categories, to compare them in terms of resource used and network efficiency and identify open research issues in this area. Our intention is that, by reviewing these layer-agnostic protocols in details and categorizing them into different classes, efficient algorithms and new improvements can be developed.

H Objective By finishing this tutorial, the attendee should be able to describe what a DTN is, what the applications in DTN are, what the main research challenges in DTNs are, what kind of routing protocols have already been proposed and what the open research issues in DTNs are.

Dr. Zhensheng Zhang — San Diego Research Center
1:45pm — 5:30pm

Dr. Zhensheng Zhang received his Ph.D. in electrical engineering from the University of California, Los Angeles in 1989. Dr. Zhang has over fifteen years experience in design and analysis of network architecture, protocols and control algorithms, with very strong backgrounds in performance analysis, modeling and simulation of the communication networks. He is currently with San Diego Research Center (SDRC), Principal Investigator for several DOD projects. Before joining SDRC, he visited Microsoft Research in the summer of 2002 and worked at Sorrento Networks, Department of System Architecture, for 2 years, responsible for designing the next-generation optical metro networks using the GMPLS control framework. Prior to Sorrento Networks he was with Bell Laboratories, Lucent Technologies, focusing on research and development in wireless networks. Currently, Dr. Zhang is Editor of IEEE Transaction on Wireless Communications. He served the General Chair of Broadband Wireless Networking Symposium, October 2004. He has served as Guest Editor for the IEEE JSAC special issue on Overlay Networks, 2003 and the Journal of Wireless Networks issue on multimedia wireless networks, August 1996. Dr. Zhang served as Member at Large of the IEEE San Diego section 2004 and as Chair of IEEE Communication Society, San Diego section, 2004-2006. His research interests include wireless ad hoc networks, wireless sensor networks. He has given many invited talks and tutorials on wireless ad hoc networks at various conferences.

He has published more than 100 papers in ACM/IEEE Transactions on Networking, IEEE JSAC, IEEE Transactions on Communications, and key ACM/IEEE conferences. The following just lists 3 publications related to DTNs.

– Z. Zhang, *Routing in Delay Tolerant Networks: Overview and Challenges,* IEEE Communication Survey and Tutorials, Volume 8, No. 1, 1st Quarter, 2006.
– Y. Liao, K, Tan and Z. Zhang, *Estimation based Erasure coding Routing in Delay Tolerant Networks,* The 2006 International Wireless Communication and Mobile Computing Conference, Vancouver, Canada, July 3~6, 2006 (accepted)
– Y. Gong Q. Zhang and Z. Zhang, *Anycast Routing in Delay Tolerant Networks,* IEEE Globecom 2006 (submitted).

UT–W–D: INTRODUCTION TO COGNITIVE OPERATIONAL SITUATION MANAGEMENT

According to modern US defense doctrine, the future war is characterized by high mobility of troops and weapon systems, increasing operational tempo, and fast evolving operational situations. As a result of that the military commanders need comprehensive and effective methods of battlespace situation management. Situation Management (SM) is as a synergistic goal-directed process of monitoring, control, and prediction of situations in dynamic systems (operational spaces) so that desired goal situations are reached within pre-defined quality, resource and time constraints. The tasks of instrumentation of the dynamic system, modeling the system and the world situations, reasoning about the situations, action planning, situation prediction are essential technology ingredients of Situation Management. As a rule, the management of battlespace operational situations often involves a large number of dynamic objects that change their states in time and space, and engage each other into fairly complex spatio-temporal relations.

Our interest will be mostly on cognitive (intelligent) situation management, i.e. on SM, which is associated with the meaning of situations, the intelligent methods of reasoning about the situations, and actions planning. In order to exhibit such intelligent capabilities, the systems should possess fairly elaborated conceptual knowledge about the domain (domain ontology). Examples of situation management applications: real-time monitoring of networks and complex engineering systems; tactical and asymmetric battlespace operations management; post-disaster emergency, rescue and relief operations coordination, physical infrastructure and cyber security monitoring, and several others.

This tutorial gives a brief overview of the type of the dynamic networks and systems, their management requirements, and presents the technological solutions to support situation management This is an introductory tutorial, however several novel management models and technological solutions will be described in sufficient depth to lead the students to practical engineering methods and tools. The first section of the tutorial describes the domain of cognitive situation management, reviews the issues, and gives introductory notions of modeling complex dynamic systems and operational situation management. The second section introduces the basic elements of the formal framework of cognitive situation management, including entities, entity relations, dynamic systems, events, situations, situation awareness, decision awareness and ontology for situation management. The third section gives examples of situation management, including battlespace situation awareness and threat analysis, network surveillance and fault management, disaster situation management, and enterprise intrusion detection. The fourth section describes the core technologies of building situation management systems, including, situation modeling, real-time event correlation, case-based reasoning, ontology-based situation management, and system topology modeling. The fifth section presents a distributed architecture of a situation management system based on a multi-agent approach, describes the software system architecture based on component services, and refers to a several tools of building the situation management applications. The last section discuss some advanced topics of situation management and outline future research and development directions.

Dr. Gabriel Jakobson — Altusys Corporation
1:45pm — 5:30pm

Dr. Gabriel Jakobson is the Chief Scientist at Altusys Corp., a consulting firm specializing in the development of intelligent Situation Management technologies for defense, telecommunication, homeland security applications. During his more than 20 years tenure at Verizon (formerly GTE) he had increasing responsibilities of leading advanced information technology and telecommunication network operations support programs. Prior to that he was Senior Research Scientist at the Institute of Cybernetics, Tallinn, Estonia.

Dr. Jakobson has authored or co-authored more than 80 technical publications and has awarded 3 US patents on innovative real-time event correlation methods. He has given many invited presentations, seminars, and short courses He received his MS degrees in Electrical Engineering from the Tallinn Technical University, Estonia, and Ph.D. in Computer Science from the Institute of Cybernetics, Estonia.

As IEEE Senior Member Dr Jakobson has served in the organizing committees of numerous US and international conferences. He is the chair of the Workshop on Situation Management SIMA 2005 and 2006 held in-conjunction with MILCOM 2005/2006, Chair of the Special Session on Situation Management at International Conference of Information Fusion 2006 in Florence, Italy, General Chair of the International Conferences of Enterprise Networking and Services (EntNet) 2002-2006, and chair of the panel on Semantic Models of Cognitive Information Fusion and Situation Management at KIMAS 2005. He serves as a TPC member for several conferences including DSOM, NOMS, IM, LANOMS, and others. Dr. Jakobson is the current chair of the Enterprise Networking Technical Committee of IEEE Comsoc, IEEE ComSoc Membership Development Board Member, and ComSoc's ICC/Globecom Technical Committee Member.