Computer Information Sciences & Engineering Directorate
Computer Networks & Systems Division

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2013 Directors Meeting
Current Status of CISE I/UCRC Program

- 18 centers with 54 sites +
  - 11 sites in Planning Phase +
  - 3 sites in process for Planning
- 1 center will phase out in FY 13
- 4 centers in process to be added with 10 Sites
- 2 centers in Planning Phase with 5 Sites
- 1 center in process for Planning with 4 Sites

Robotic Surgery
New I/UCRCs

Unmanned Aircrafts
- BYU, UC-Boulder, Drexel (planning)
- Tim McLain, Eric Frew

Visual and Decision Informatics
- UL-Lafayette, Drexel
- Vijay Raghavan, Tony Hu

Innovation through Partnerships
RAPID Response Research Grants
Gulf Oil Spill

- **Assess Impact of Oil Spills on Marshlands using Swarms of Robotic Aquapods** *(Papanikolopoulos, Hondzo, Morellas, Anaraki, Voyles; U Minn)*

- **Improve Model Predictions of the Dispersion from the Deepwater Horizon Gulf Oil Spill with and Interactive "Human Sensor Situation Network"** *(Halem, Brown, Conte, Yesha; UMBC)*

- **Correlate Gulf Oil Spill Related Geospatial Data using Database Appliance Module for Multi-temporal Analysis** *(Rishe; FIU)*
RAPID Response Research Grants
CRISIS Mapping

- **Build Robotic Systems for Disaster Assessment and Disaster Relief** *(Papanikolopoulos, U Minn)*
- **Explore and Map with Aerial Robots in Rapid Response Situation: Remote Autonomous Exploration and Mapping** *(Kumar, Michael; U Penn)*
- **Present Assessment of Japanese Earthquake Eusing Visualization Technologies** *(Rishe; FIU)*
- **Use Land, Sea, and Aerial Unmanned Systems for Sendai Earthquake and Tsunami- Remote Assessment** *(Murphy, TAMU)*
RAPIDS: Crisis Mapping (Cont.)

- Economic and Rapid Removal of Trace Radioactive Substances from Waste Water Using Colloidal Separation Techniques Following the Earthquake and Tsunami (Somasundaran; Columbia)

- Automating Emergency Data and Metadata Management to Support Effective Short and Long Term Disaster Recovery Efforts (Pu; GaTech)

- CRAWLER Robot with Dual-Use Limbed Locomotion and Manipulation for Void Inspection (Andrews, Mahor; U Denver)

- Population Protection and Monitoring in Response to Radiological Incidents (Lee; GaTech)
RAPIDS: Crisis Mapping (Cont.)

- Collaborative Research (use facilities) between NSF/IUCRC CFSP (Friction Stir Processing) and Tohoku University (Nelson; BYU)
- IT Virtualization for Disaster Mitigation and Recovery (Tsugawa, Figuereido, Fortes; UFL)
- Deployment Technologies for Search and Rescue Snake Robots in Japan (Choset; CMU)
- Enabling Continued operation of IT services and Infrastructures during Floods and Other Disasters (Matsunaga, Fortes: UFL & Thamasat U & others: Thailand)
CISE I/UCRC Budget 2013
$ 6,984,997 Million
Includes New awards, Continuing awards, Supplements and Fundamentals

$ 9,094,853 Million
MRI’s awarded to IUCRC Sites

120 % of I/UCRC Budget
Planning grants Awarded (FY2012)

- Cyber-Physical Systems for Hospital Operating Rm
  - University of Florida & University of Houston

- Socio-Technical Ecosystems
  - Carnegie Mellon & University of Michigan

- Safety, Security, Rescue Research Center
  - UNC Charlotte (joining an existing center)
CISE & ENG Partnership: Collected from NCSU Data Base in 2011

*2010-2011 NSF-I/UCRC Center Structure Database Survey.
IUCRC Student Totals: CISE/ENG

FY2011-12 NSF-I/UCRC Center Structure Database
IUCRC Student Averages: CISE/ENG

FY2011-12 NSF-I/UCRC Center Structure Database

Innovation through Partnerships
Comparison: ENG/CISE

% of Centers

- CISE: 28.57%
- ENG: 71.43%

% of Budget

- CISE: 35.58%
- ENG: 64.42%

NSF-I/UCRC Center Structure Database
CISE Industrial Memberships

Total Number of Memberships

Average Number of New Members / Center

Fiscal Year

- Members Added this FY
- Members Left this FY
# CISE Supplementary Funding in 2011

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
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<tbody>
<tr>
<td>Fundamental (FRP)</td>
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<tr>
<td>REU: Research Exp for Undergrad</td>
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<tr>
<td>RET: Research Exp for Teachers</td>
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<tr>
<td>REV: Research Exp for Veterans</td>
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<tr>
<td>GOALI:</td>
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<tr>
<td>SBIR:</td>
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<tr>
<td>RAPID:</td>
<td>16</td>
</tr>
<tr>
<td>Other NSF: includes MRI’s</td>
<td>$10.5 Million</td>
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</tbody>
</table>

(\sim34\% \text{ of Total I/UCRC activity})
CISE I/UCRC Students in 2011

- **Supported:**
  - BS = 137
  - MS = 235
  - PhD = 430

- **Graduating:**
  - BS = 41
  - MS = 125
  - PhD = 103

- **Hired by Members:**
  - BS = 6
  - MS = 37
  - PhD = 21
CISE I/UCRCs

Advanced Knowledge Enablement
Autonomic Computing
Dynamic Data Analysis
e-Design
Embedded Systems
Experimental Computer Systems
Hybrid Multicore Productivity
Identification Technology
Intelligent Maintenance
Intelligent Storage
Net-Centrics Systems
Reconfigurable Computers
Search & Rescue Robots
Security & Software Engineering Rsch
Surveillance Theory
Wireless Internet
Unmanned Aircrafts
Visual and Decision Informatics
Significant Accomplishments

Many noted from CISE

- 4 International Site at IMS
- 1 International Site at CAKE
- 3 of Worlds Fastest and Most Energy Efficient Supercomputers at CHREC
- Several International awards
- 15 MRI awards

Other awards obtained as a result of the I/UCRC
CAKE: Center for Knowledge Advancement
CAKE: Center for Advanced Knowledge Enablement (Naphtali Rishe, FIU)

- FIU researchers have leveraged TerraFly to help IBM in their CARMEL project of monitoring airborne cameras.

*IBM CARMEL-TerraFly user interface (over Port of Miami).* Solid trapezoids are current projections of cameras’ view, The dotted trapezoid is synchronized with the playback of the selected camera.
CAKE: Center for Knowledge Advancement

GIS Analytics
GIS & Data for South America
Moving Objects, Modeling Data Transmission
GIS & Data
Predictive Spatial Modeling for Diseases
Moving Video Streaming
Aerial Imaging from Balloons
Transmission
NSF CAKE
National Science Foundation Industry-University Cooperative Research Center for Advance Knowledge Enablement
IBM S.T.E.M.
CAKE: Center for Knowledge Advancement (Borko Fuhrt, FAU)

- Unauthorized use cell Phones can put people’s safety at risk
- Cost-effective solutions for selective blocking of cell communication (voice and data) should occur where only authorized users can send or receive voice and data  
  (Researcher: Imad Mahgoub, FAU)
CAKE: Center for Knowledge Advancement  (FAU: Borko Fuhrt Researcher: Imad Mahgoub)

- Data dissemination in Vehicular Ad hoc NETworks (VANETs): Key research area with applications that range from safety to traffic flow information to weather reports and related information.
- Focus: Data dissemination protocols to deliver data with maximum efficiency and accuracy to a wide area
- Mutually exclusive categories of data propagation methods for the ad-hoc networks
  - Store-and-forward: less bandwidth, slow information
  - Multi-hop broadcasts

Goal: Develop efficient solutions to the data dissemination problem that are broader in scope than previous works and are able to handle all types of data, both critical and non-critical.
CAKE (FAU: Mahgoup)
CAC: Center for Autonomic Computing (Fortes, UFL)
Center for Autonomic Computing

CAC Systems used to manage and control systems and applications:

- **AVIRTEK**
  - Company startup from center
  - Now commercializing some of the cyber security technologies developed at the Center.
- Collaboration with CChIPS resulted in AIR Award

B2-LEO studies hydrological cycles, and its interactions with chemical and biological processes
CAC: Center for Autonomic Computing
Pompili; Lee, Viswanathan; Rutgers

- Observations:
  - Clouds - federated & virtualized datacenters - are a growing component of society’s IT infrastructure
  - Are being increasingly considered for HPC applications
  - Causes for concern - energy consumption & environmental impact
  - 237 billion kWh/year worldwide and 76 billion kWh/year

- Approach: Cross-layer thermal-aware management

- Contributions:
  - Heat-imbalance model (predict future temperature)
  - VMAP: proactive thermal-aware virtual machine consolidation

- Threefold positive effect:
  - Better computing resource utilization
  - Improved cooling system performance
  - Minimize server system failures (due to overheating)

- Experiments: VMAP vs. 6 competing algorithms
CAC (UFL; Fortes)
Thailand Flood 2011

Collection and analysis of data related to damaged IT assessing requirements of time frame and scale of data movement needed during and after disaster based on classes of services.

Design and conduct wide-area IT infrastructure migration experiments

- Evaluate trade-off between maintaining high-availability of underlying services and ability to transfer an increased number of services with little downtime.
- Explore dynamic priority assignment to properly schedule efficient VM image transfer.
Design recommendation for an IDC-based resilient middleware for disaster recovery.

After the incident, countermeasures were sought and/or implemented to reduce risks from similar loss (e.g., installation of UPS, design of flood-resilient building) and to improve IT infrastructures (e.g., Gigabit optical fiber installation, interest in using virtualized servers).

All of the above changes show the possibility of leveraging IDCs as disaster recovery sites.
Enabling continued operation of IT services and infrastructures during floods and other disasters

PIs: Andréa Matsunaga; José Fortes
University of Florida

Thammasat University (TU) Rangsit Campus. The flood level was approximately 2.23m high for 48 days. IT equipment (e.g., PCs, servers, telephone infrastructure) suffered severe damage, & all IT & educational services were disrupted for entire period.

Other universities and industry affected
IT Virtualization for Disaster Mitigation and Recovery

Maurício Tsugawa, Renato Figueiredo, José Fortes
Takahiro Hirofuchi, Hidemoto Nakada, Ryousei Takano
DDA: Dynamic Data Analytics

- Dynamic Data Analysis
- SUNY at Stony Brook
- Rutgers University
Hybrid Multicore Productivity Research

A member company has used the centers research results on extremely data intensive computations to utilize GPU units in its production.
Center for Hybrid Multicore Productivity Research (CHMPR)

Japan Tsunami Marine Debris: Confirmed Sightings

Since the tsunami, NOAA has received over 1,000 reports of debris from the general public and partners at sea and on shore. While many of these debris objects may fit the profile of tsunami debris, only a few can be traced back to the disaster with 100 percent certainty based on a clear “fingerprint,” such as a government registration or personal information. The items mapped below are the debris NOAA has “confirmed,” through partners or Japan consulates, to be tsunami debris. Click on the icons for more information. *Note: You may need to zoom in to see multiple icons.
CHPRA

A small boat lost during the tsunami sits on a beach in Cape Disappointment, WA. Credit: WA State Department of Ecology
The Complexity Management Tool
- Links the identified indicators to compute cost impact for different sources of product complexity in product design, development, manufacturing, assembly and supply chain.
- (CMT) has been tested on three product lines at The Goodyear Tire & Rubber Company (Goodyear).

The analysis should help reduce production costs for two critical components by approximately 10% and 40%.

Goodyear has started the process of acquiring IP rights from the university so the technology can be licensed in collaboration with the Center for e-Design.
Center for e-Design: Iowa State

- Goodyear is implementing research results from e-Design
- Work appears to be having significant impact on production cost reduction
Center for e-Design

BYU’s v-CAx Site Goal:

To accelerate industry productivity by developing and testing new collaborative multi-user computer-aided engineering tools that leverage highly collaborative gaming paradigms.
e-Design: BYU (Gerg Jensen)

Multi-user CAD Collaboration Prototypes: How We Are Different!

- $\frac{1}{N}$th the time

<table>
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<th>Front Frame Modeling Times</th>
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<tr>
<td>NX Connect</td>
<td>3</td>
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<tr>
<td>CATIA V5</td>
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<td>CATIA Connect</td>
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<tr>
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<tr>
<td>Inventor Connect</td>
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<td>6</td>
</tr>
</tbody>
</table>

[Diagram of front frame model]
e-Design: BYU

Other Examples of Multi-user CAD Prototypes

- $1/N^{th}$ the time

<table>
<thead>
<tr>
<th>Wing Modeling Times</th>
<th># of Modelers</th>
<th>Time in Minutes</th>
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<tr>
<td>NX Connect</td>
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<tr>
<td>NX Connect</td>
<td>4</td>
<td>18</td>
</tr>
</tbody>
</table>
e-Design: BYU

Current Multi-User Projects

Boeing 777-ER

NASA CRM
e-Design: U Buffalo

- Effectiveness of simulators
- Aims for the widespread deployment of simulators for training programs, across the nation
- Corporate partner: Moog, Inc.
E-Design: VaTech

- Hosted RET Group to infuse 3D design tools and eng education methods into curriculum
- Topics: spatial visualization assessment and remediation, product dissection, rapid-prototyping and 3D Printing, and Web3D course content delivery.
- Many teachers will adopt the spatial visualization methods.
CERCS: Experimental Computer Systems

Karsten Schwan, Calton Pu: GaTech

- Created SAVI: Global Research on Applying Information Technology to Disaster Management (GRAIT-DM).

- SAVI: a collaboration between USA (CERCS at Georgia Tech) and Japan (Univ. Tokyo) to collect and apply Big Data techniques to aid and innovate disaster management in 3 main phases: preparedness, response, and recovery.

ECS: Experimental Computer Systems
Karsten Schwan, GaTech
ECS: Experimental Computer Systems
A JTAG-Based Device Security Architecture for Embedded Systems
Eye vein biometrics is a revolutionary new ocular biometric modality (US Patent number 7,327,860, issued Feb 5, 2008) that was conceived and developed by Dr. Reza Derakhshani, University of Missouri-Kansas City (UMKC) and Dr. Arun Ross, West Virginia University (WVU) in 2005 through a seed grant from Center for Identification Technology Research (CITEr), an NSF I/UCRC.

This technology was further developed with support from CITEr, UM Fast Track IP Initiative program, Leonard Wood Institute, and most recently by research contracts from EyeVeify, LLC (total funding to date: $404,127).

In contrast to other existing biometric modalities, eye vein biometrics utilizes the only exposed and easily seen vasculature in our bodies: the veins in the white of the eye.
CITER

- In contrast to retinal and hand vein scans, vasculature seen on the white of the eye do not need specialized scanning devices for imaging the back of the eye or under the skin.

- In fact, they can be easily imaged with cell phone cameras. Thus, this vascular-class and highly accurate biometric has an instant global impact given the historically unprecedented availability of camera phones across the world.

- Furthermore, eye vein biometrics has distinct advantages over iris recognition for homeland security applications (given its ability to identify subjects from longer distances using natural lighting, or when subjects are looking away from the camera or are wearing cosmetic lenses.)
CITER

This biometric technology is currently being commercialized by EyeVerify (www.eyeverify.com), a Kansas City-based startup founded by local entrepreneur and EyeVerify's CEO Toby Rush in January 2012, through an exclusive licensing agreement with WVU and UMKC.
CITER

- In contrast to other existing biometric modalities, eye vein biometrics utilizes the only exposed and easily seen vasculature in our bodies: the veins in the white of the eye.
- In contrast to retinal and hand vein scans, vasculature seen on the white of the eye do not need specialized scanning devices for imaging the back of the eye or under the skin.
- Can be easily imaged with cell phone cameras. This vascular-class and highly accurate biometric has an instant global impact given the historically unprecedented availability of camera phones across the world.
- Given its ability to identify subjects from longer distances using natural lighting, or when subjects are looking away from the camera or are wearing cosmetic lenses, eye vein biometrics has distinct advantages over iris recognition for homeland security applications.

- This biometric technology is currently being commercialized by EyeVerify (www.eyeverify.com), a Kansas City-based startup founded by local entrepreneur and EyeVerify's CEO Toby Rush in January 2012, through an exclusive licensing agreement with WVU and UMKC.
The Twyman, Elkins & Burgoon project, "Automated Rigidity Analysis for Automated Screening."

- Not only confirmed that a force platform could unobtrusively detect rigidity and predict innocent versus guilty respondents at a rate equal to or better than professional interviewers (ROC = .77).
- Also demonstrated that rigidity could be detected with the Kinect and successfully discriminate truth from deception.
- Additionally, the project resulted in construction of a new testbed, the ASK (Automated Screening Kiosk), that could be equipped with a variety of sensors for noncontact screening.
A CITE R spin-out company, NexID Biometrics, LLC, has licensed technology based on two patents from Clarkson and West Virginia.

The technology is a software algorithm which recognizes when a fingerprint scanner is being faked by an artificial finger.

NexID Biometrics, LLC, based in Potsdam, NY, generates revenue, and has 3 full time employees.
Fingerprint liveness (or anti-spoofing) algorithms for prevention of fingerprint spoofing or obfuscation.

Two patents, Clarkson and WVU.

NexID Biometrics

- Commercial implementation in over 1 million laptops.
- Technology license to a major international security company in 2012.
Conceived and developed by Dr. Reza Derakhshani, (UMKC) and Dr. Arun Ross, (WVU) in 2005 through a CITeR project.

Vein biometrics utilizes the veins in the white of the eye.


EyeVerify created in 2012.
Center for Intelligent Maintenance Systems

- Estimated impacts as of 2011: $846,738,946 (As assessed by IMS Center Members)
  - One Center Member is deploying IMS-based technology throughout its global network of manufacturing facilities, which resulted in improvements in predictive maintenance and machine performance.
  - Produces estimated $500 Million in plant savings ANNUALLY

The Watchdog Agent®
- Center’s tools for prognostics & health management,
- Deployed in numerous projects
- Brought real impacts and cost savings to the Center’s members.

Reconfigurable Thresholds And Real Time Analysis
IMS: Intelligence Maintenance Systems

2012 LabVIEW Tools Network Awards
Most Innovative Product - Prognostics

Presented to
Center for Intelligent Maintenance Systems
Watchdog Agent

LabVIEW
CRIS: Center for Research in Intelligent Storage
(David Du, U Minn)

- Developed and investigated efficient solutions for designing new storage devices like solid state drives (flash memory based), PCM (Phase Change Memory), and Shingled Write Disks.
- Provided innovative ways of integrating and using the new memory and storage hierarchies including these emerging memory/storage devices.
- Designed new techniques for modeling I/O workloads for various applications.
- Some of these results are currently used by our sponsor companies.

Solid State Storage - Design and Applications:
CHREC: Center for High-Performance Reconfigurable Computing

- Growth in first 5 years (Phase-I)
  - Grown to 4 university sites and 42 memberships
    - U FL: Alan George; GWU: Tarek El-Ghazawa;
    - BYU: Brent Nelson; VaTech: Peter Athanas
- World-class facilities developed in-house
  - Novo-G: world’s top reconfigurable computer
  - HokieSpeed: GPU-centric supercomputer
    - Debuted at the end of 2011 as most energy-efficient (i.e., greenest) commodity supercomputer in U.S. on the Green500
  - Pyramid: CPU-centric supercomputer
- Air Force Research Labs
  - Using CHREC Tools in deployment of UAV
  - Employees using “CHREC Ed” as
CHREC: Center for High Performance Reconfigurable Computing

- U FL: Alan George; GWU: Tarek El-Ghazawa;
- BYU: Brent Nelson; VaTech: Peter Athanas

Recent Workshop included
- 212 projects
- 105 people (90 in place + 115 via webEX)
- > 25 companies, labs, and agencies
- > $10 M in revenue so far
Safety, Security, Rescue

- Parts of this Technology were licensed to ReconRobotics Inc.
- Innovative robots that roll, fly, & swim
- A start-up (ReconRobotics Inc.) has deployed more than 3,000 of these robots in 40 countries.
- 50 jobs have been created in MN.
Search and Rescue
U Minn
SSRC: Safety, Security Search & Rescue
Nikos Papanikolopoulos, U Minn
SSRC: Safety, Security Search & Rescue
Nikos Papanikolopoulos, U Minn
SSRC
Nikos Papanikolopoulos, U Minn
Center for Search and Rescue: Denver

- A radically new type of aerial drone for close interaction with structures & environment
- Hexrotor dexterous UAV is able to carefully direct its thrust in any direction

Dexterous UAV Developed for Agile Structural Inspection and Aerial Mobile Manipulation

- Partnered with U Tohoku, Japan, in aftermath of the Great East Japan Earthquake and Tsunami, to explore robotic response to such large-scale disasters.
Search and Rescue: Denver

Explosion-Proof Active Scope Camera for Hazardous Inspection

- Powered by water, “Camera on-a-Rope” is safe (no motors)

- Caused by earthquake, tornado or man-made event, collapsed structures can entomb survivors, making location of people in distress difficult, not to mention their extraction. Small “cameras-on-a-stick” are used to penetrate the rubble and look into voids to quickly search for humans. Even cameras on robotic snakes have been developed to speed the task. But a common problem with such scenarios is the likelihood of flammable or explosive gases and liquids that are often present.

- Work with Japan developing an Explosion-Proof Active Scope Camera for safe exploration of disaster scenarios.
Center for Search and Rescue: U Penn

Ground and aerial -

- Collaborative Experiments established feasibility using a collab team w Tohuki U.
- Smallest quadroto w. cameras, laser range finder, and IMU
- Able to navigate unknown environments and
- Provide info in interior of collapsed buildings for disaster recovery
Center for Search and Rescue: U Penn

Ground and aerial -

Biggest quadrotor on Tohuku University mobile robot
Storage: UCSC

- Technology developed was incorporated into a product shipped by NetApp.
- NetApp used our algorithm, CRUSH, as the basis for the data distribution heuristics they used in their new product.
- Published papers in collaboration with four different industrial sponsors (Samsung, NetApp, IBM, EMC).
- This approach to collaborative is giving I/UCRC members both access to our research and a hand in doing it.
Unmanned Aircrafts Systems (FY2013)

- BYU
- UC-Boulder
- Drexel (planning)
Visual and Decision Informatics

- Visual and Decision Informatics
- UL-Lafayette, Drexel
WICAT: Wireless Internet Center for Advanced Technology
Transmission: Medical Data from Ambulance to Emergency Room

Sensor information available to Emergency Medical Technicians (EMTs) in the field is of critical value to the emergency room team that is preparing to treat the arriving patient.

ECG information is used to diagnose ST-Elevated Myocardial Infarction (STEMI), a severe type of heart attack, establishing the need for prompt treatment in a catheterization lab.

Figure 1. Proposed Pre-Hospital ECG Workflow
WICAT

- Critical Sensor information available to Emergency Medical Technicians (EMTs) in the field must be transmitted quickly to emergency room team preparing to treat the arriving patient.

- WICAT Center carried out a project with UVa hospital’s Emergency Room team to evaluate use of wirelessly transmitted sensor information from ambulance to hospital.

- Establishing transmission protocols constitutes a major issue for sending ECG information within the time requirements that emergency procedures demand, as well as,

- Determining whether quality of service in a rural area sufficiently supports timely decisions regarding special equipment and personnel needs.
Figure 2: STEMI App Image Capture and Transmission Workflow
WICAT

- Predicting Delay Bound Violations In Cellular Data Networks – ECG Imagery:
- Real-time assessment of wireless service quality, a challenge, especially for highly mobile hosts with transient service requirements.
- For some mission critical applications, such as telemetry of medical data for remote diagnosis and treatment, traditional measures of quality of service, especially those suited for persistent streaming applications, can be inadequate. in the Charlottesville operating area.
WICAT

QoS assessment often simply provide accurate, instantaneous prediction of whether the image upload will be successfully received and acknowledged within a given latency window based on the location and speed of ambulance.

Here explicit assessment of bandwidth is an unnecessary and potentially misleading approach to characterizing the available service.

A statistical framework is sought for building and evaluating application-specific predictors for mobile, delay-bound violations.

Figures 3 & 4 illustrate an empirically derived QoS assessment scheme for ECG images transmitted from the iPhone app above, along with results from preliminary field-testing.
Figure 3. Methodology for predicting violations of a 2-minute transmission delay bound for 20KB images.
Figure 4: Histogram of STEMI iPhone App performance in Charlottesville
Center for Wireless Internet Technology

Elza Erkip's research and papers on Cooperative Relays
- Have led to proposal of cooperative relays for 3G and 4G cellular systems, including the new LTE and LTE-A standards, and the IEEE 802.16/WiMAX system.
- Have influenced research and development activities at many companies as industry strives to provide reliable high data rate wireless access in so many challenging indoor and outdoor locations.
Center for Security & Software Engineering Research

- **The design metrics technology**
  - Used at ten $S^2$ERC affiliate sites,
  - Very successful in identifying fault-prone components during design

- **S2ERC software reconnaissance**
  - Used to cut maintenance activities and costs at Telcordia and Northrop Grumman

- **Visual Intrusion Detection Systems**
  - Used for fighting cybercrime, deployment being looked at by Army Research labs
CAREER & PECASE

PECASE Nominees are selected from among the meritorious CAREER awardees

- PECASE:
  - George Pappas (2002), *U Penn*
    - Hierarchical Abstractions of Hybrid Systems

- CAREER (new FY2011):
  - Dario Pompili, *Rutgers*
    - Underwater Multimedia Communication
  - Greg Stitt, *U Florida*
    - Cloud Computing
Major Research Instrumentation

- State-of-the-Art Development and Acquisition of Instrumentation for Transformative Research
- Amount: $100K - $4M
- Due: Thursday February 23, 2013

- Teams of Miniature Mobile Robots
  - U of Minn, Berea College

- Energy Efficient Data Centers, UCSD
- Data Capacitor, U of Indiana
MRI: Major Research Instrumentation

- Hi Perf Computing Instrumentation Collab Data-Enabled Science: *Apon; Clemson*
- HPC Syst fr Data Driven Discovery in Sc & Eng: *Somani; Iowa St*
- CAREN Virtual Reality Syst fr Collab Rsch in Assistive & Rehab Technologies: *Dubey; USFL*
- Collab: Dev of Intelligent Autonomous Unmanned Mobile Sensor: *Valavanis; Denver & Boussalis; Cal St*
- Support Multi-Technology Vehicular Networking Syst Rsch: *Mahgoub, FAU*
- Cloud Car: Diverse Distributed Instr for Vehicles in the Cloud: *Dantu, UNT*
- Biplane Fluoroscopy System fr Dynamic Imaging In-Vivo Human Motion: *Rullkoetter, U Denver*
- Prototype: Next Generation Algorithms for Large-Scale Viz, Data Proc, & Arch: *Silva, Poly-NY*
MRI: Major Research Instrumentation

- Hybrid CPU/GPU Nodes for Interdisciplinary Hi Perf Computing Facility: Gobbert, UMBC
- Instr for Assured Cloud Computing: Khan, UT-Dallas
- Near Real Time Accuracy Muscoloskeletal Syst (SKELETALMI) Measurement and Analysis Instrum: Metaxas, Rutgers
- FLEX Reconfigurable Multi-user Immersive Vis Syst: Kurniawan, UCSC
- A Data Center Testbed for Security and Resilience: Chao, NY Poly
Science and Technology Centers
(Prior Competition)

- CENS: Center for Embedded Network Sensing, UCLA
- TRUST: Ubiquitous Secure Technology, UC-Berkeley
- BEACON: Evolution in Action, Michigan State U
- CEES: Energy Efficient Electronics Science, UC Berkeley
- EFSI: Science of Information, Purdue U
Special Projects

- Ask Alex
- Avatar
- Native American Dialogues

“Ethical Space of Engagement”

- Workshops
  - New ideas
  - New instruments
Special Projects (UCF: Gonzalez, Demara, UIC: Lee)
Orlando Science Center Exhibit
PLANS Continue

- Humanoid containing Avatar linked to Knowledge Base: Ask Alex

NEED FUNDS!
Look, Think, Imagine, Act!

“The future is already here – it’s just not very evenly distributed”

- From the *age of information* into the *age of convergence*
  - Challenge today’s assumptions
  - Think small and Think big – together!
  - Leverage emergent behaviors
  - Never forget the social context when
    - Sensors are everywhere, and data analytics includes everyone:
    - Avatars with Humanoids Interacting with Unmanned Systems
    - ... ... ...
Unleash the Power of our Imagination

- Communicating minds without speech or signs
- Implantable brain sensors
- Cells responsive to ... (sensors?) ...
- Bio implantable everything ...
- Flexible electronics to increase... (computing?) ...
- Radio guided micro robotics surgery
- High intensity focused ultrasound non-invasive surgery

- What else?

You can do this and more ...
Comments

“give our malleable genomes, imaginative minds, and clever hands the power to transform even the strongest forces in our environment...”

“Let the wind rise to a howl and raise a great sea; we need not stay home or become flotsam, for we can change tack, trim sail, and become what amounts to a different vessel...”

Restless Genes by David Dobbs

National Geographic

Jan 2013
A Few of the Many Roadmaps for the 21st Century

NSF K-12 STEM Education

NSF and the Chemical Industry
http://www.nsf.gov/crssprgm/nano/reports/nsfnnireports.jsp

NSF Cyberinfrastructure Framework for 21st Century

http://www.cc.gatech.edu/~pestei/roadmap/
Peter Pesti:

Where do you want to travel?