Collaboration between CNECT and US NSF on fundamental research

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CNS Programs in CISE Context



Next Generation Systems

- People expect networking/IoT as a utility similar to roads, water and electricity
- Emerging applications such as AR/VR, Tactile Internet, Robo-taxis, Passenger Drones will require enhance QoS
- Pervasive, continuous sensing driven by billions of IoT devices
- Requirements:
 - Trusted service
 - Available at any time and from any location, without disruption
 - Quality of service and experience
- Approach:
 - Fundamental research, clean-slate design
 - Abstractions, methodologies, self-adaptive
 - Testbeds
 - Datasets
 - Partnerships









Resilient & Intelligent NextG Systems (RINGS) program

- \$40M effort in Phase 1
- Target advances in both resilience & communication networks/systems
- Resilience-motivated designs
- Diverse partnerships



NextG research framework @ nsf

Resilient Systems



Hardware (RF and Mixed Signal Circuits, Antennas and Components)

Algorithms (Spectrum sharing, management, resource optimization)

Scalable Device-to-Edge-to-Cloud continuum

Merging of digital/physical/virtual worlds

Networking Technology and Systems (NeTS)



Extremely Low Very Low Infrared Visible **Radio Waves** Microwaves Frequency (ELF) Frequency (VLF) Radiation Light Wavelength Frequency 10 10² 104 10⁶ 10⁸ 1010 10¹² 1014 4-14 MHz \$ 2.4 GHz 900 MHz

research

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Source: Cisco, 2014

Networking Technology and Systems

- NeTS seeks to advance fundamental scientific and technological advances leading to the development of future generation networks.
- The program includes both 'wired' and 'wireless' network systems, from on-chip to Internet-scale, IoT and other network systems
 - Application-aware networking (e.g. AR/VR)
 - Future Internet architectures
 - Data center networks
 - In-network computing and storage
 - AI/ML for networking
 - Network resilience
 - Network security
 - Optical networks
 - Programmable networks

- 5G and beyond wireless networks
- MIMO networks
- WAN, MAN, backhaul and access networks
- Networking for serverless computing
- Network management: monitoring, measurement, traffic engineering, etc
- Network performance (latency, QoS)
- Network verification
- Quantum Networking



Research Programs:

- RINGS
- Networking Technology and Systems
- Computer Systems Research
- Research Infrastructure

Platforms for Advanced Wireless Research (PAWR): Enabling At-scale Experimentation



POWDER

Salt Lake City, UT Software defined networks and massive MIMO



COSMOS West Harlem, NY Millimeter wave and backhaul research



AERPAW Raleigh, NC Unmanned aerial vehicles and mobility



ARA Ames, IA Rural broadband

\$100M public-private partnership with DOD, USDA NIFA, and >35 companies accelerating beyond-5G wireless research

Collaborations

- NSF has stood up an array of programs and testbeds to support computer/network systems research
- NSF is looking at international partnerships
- Healthy collaborations in the past and opportunities for more
- Approaches:
 - Identify collaborations and synergies
 - Align ongoing projects
 - New joint projects
- Shared resources: testbeds, datasets,...

