Wireless Protocol Testbeds to develop Hierarchical Cloud-Fog Platforms for Communication in Disaster Incident Coordination

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Biography:
Prasad Calyam is an Assistant Professor in the Department of Computer Science at University of Missouri-Columbia, and a Core Faculty in the University of Missouri Informatics Institute (MUII). Before coming to the university in 2013, he was a Research Director at Ohio Supercomputer Center/OARnet, The Ohio State University. His research and development areas of interest include: Networked-Multimedia Applications, Distributed and Cloud Computing, Computer Networking, and Cyber Security. His research sponsors include: NSF, DOE, VMware, Cisco, Dell, Verizon, IBM, Huawei, Internet2, Coulter Foundation and others. He has developed several application testbeds involving city-level (within Dublin, OH Metro Fiberhoods, and Kansas City MO/KS Google Fiberhoods), state-level (within Ohio and Missouri) and has contributed to national level testbeds (NSF GENI/CloudLab, DOE ANI Testbed, iPlant/Cyverse).

Relevant Experience and Meeting Contribution: We are developing a city-scale hybrid cloud/fog computing testbed to support computer vision application algorithms related to the field of geography-based imaging during natural or man-made disaster incidents.

During disaster incidents, communication in a mass casualty disaster scene is limited and difficult in the absence of necessary wireless communication infrastructure at the edge networks, and high-speed networks with software-defined network technologies that interface with a core cloud. Lack of necessary on-demand infrastructure leads to misdirected and delayed triage of scene-wide critically injured patients. Today, there is lack of an integrated technology platform that allows a medical director or incident commander(s) to sense the scene status events collaboratively, and strategically delegate triage responsibility to the first responders, directing them remotely using audiovisual communication. Further, incident commander needs to use mobile cloud and network diversity involving wireless/wired networks available to connect to external databases (e.g., blood bank, patient data, medical resource pools that update availability of beds, ambulances, expert opinion, and so on).

Our research efforts address the problem of - data sources at the network-edges close to the collection/consumption sites need to be coupled with cloud offloading to a core computation cloud. Computation needs to be supported at the network-edges through ‘fogs’ that are capable of handling small instance video processing functions, and be integrated with a core public cloud infrastructure for handling large instance video processing functions, utilizing software-defined networking (SDN). As part of our project activities, we have setup a realistic virtual environment testbed and are developing custom templates as well as an SDN controller application to evaluate our hybrid cloud-fog architecture and resource placement algorithms. Our preliminary experiments have demonstrated the need for sustained throughput at the edge networks, and use of novel geographical wireless routing protocols to enhance remote responder/commander Quality of Experience (QoE) who are responding to disaster scenarios.

At the workshop, we will share how we are building upon these research results on performance engineering of public safety application testbeds, and how we are working towards setting up a city-scale testbed with city collaborator sites and first responder agencies. We also seek to contribute our experiences on best-practices to develop and maintain large infrastructure projects through collaborations with various stakeholders.