**STREAMS: Secure Transport and REsearch Architecture for Monitoring Stroke Recovery**

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The rehabilitation of stroke patients is a long but critical process for their long-term wellness. An advanced rehabilitation environment is being established at Chattanooga, Tennessee to provide real-time multi-modal sensor-based monitoring of patients (using webcams and wearable sensors) that can reduce the risk of events such as accidental falls and inappropriate dietary intake and support at-home rehabilitation. Sensor-generated live data streams about patient status and activities are processed at data centers for real-time analytics, helping healthcare professionals to respond to patients' needs quickly and effectively. As the data streams may contain electronic Protected Health Information (ePHI), they must be protected so that transmission and usage conform to security and privacy regulations, such as HIPAA/HITECH and applicable state laws. We plan to address the security challenges in this environment by developing a **S**ecure **T**ransport and **RE**search **A**rchitecture for **M**onitoring **S**troke Recovery (**STREAMS**), a technical proof-of-concept implementation, to secure end-to-end sensor data streams using security software defined networking (S2DN) technologies, and elastic compute and storage resources. The project team consists of healthcare professionals from Erlanger Southeast Regional Stroke Center, medical researchers from UMass Medical School, computer scientists at UMass Lowell, IT staff at the collaborating institutions, engineering staff from Internet2, Chameleon Cloud and CloudLab, as well as industrial partners (Corsa and Extreme Networks).



**Intellectual Merits**

The STREAMS project will contribute novel and generalizable solutions to security challenges in the fields of networking, data analytics, biomedical research, and healthcare/clinical practice. 1) It will be the very first prototype of a secure network architecture to provide advanced data analytics-based healthcare to stroke patients in a realistic clinical environment; 2) A Secure SDN controller (S2DN) will be designed to authenticate, identify, and direct encrypted data streams to ensure the data streaming over the network are HIPAA/HITECH compliant, provide guidance in provisioning of compute resources at the cloud, and apply the most appropriate decryption algorithms based on the role of users, priority, types and source of the sensor data stream, as well as network conditions; and 3) We will design a generalizable secure hardware and software architecture to collect, encrypt, decrypt, store, transport, analyze, and maintain the integrity and availability of the data from these multimodal sensors to enable them to be fused using analytics algorithms to learn about patient activities that are highly relevant to stroke recovery.

**Broader Impact**

The STREAMS project is anticipated to produce a number of important broader impacts: 1) it will significantly improve the healthcare outcomes of stroke patients by providing ubiquitous care to them, reducing healthcare costs by allowing patients to rehabilitate in their homes, helping healthcare providers reach a large number of patients in need, and predicting risky events and reducing response time; 2) it will promote teaching and broaden participation of underrepresented groups, including Hispanic and female students whom we will recruit for the project. It will also create research opportunities for both undergraduate and graduate students and extend knowledge through education and outreach; 3) it will generate new knowledge for the networking community at large and the proposed network infrastructure can also be used as a common platform for studying future network applications; and 4) The project will strengthen the ongoing partnership among the medical professionals, medical science researchers and computer scientists.