

Discussion for Proposal

Sifat Ferdousi

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Smart and Connected Communities (S&CC)

- Communities in the US and around the world are entering a new era of transformation in which residents and their surrounding environments are increasingly connected through rapidly-changing intelligent technologies. This transformation offers great promise for improved wellbeing and prosperity but poses significant challenges at the complex intersection of technology and society.
- Concurrently, communities are unique and constantly evolving. Shifts in population size, demographics, economic opportunity, technology, built and natural environments, and available services all impact overall community culture, needs, and opportunities. A fundamental understanding of the complex, dynamic interactions between technology and society is essential for unlocking the potential benefits of smart and connected communities.
- A “smart and connected community” is, in turn, defined as a community that synergistically integrates intelligent technologies with the natural and built environments, including infrastructure, to improve the social, economic, and environmental well-being of those who live, work, or travel within it.

The goal of this solicitation is to accelerate the creation of the scientific and engineering foundations that will enable smart and connected communities to bring about new levels of economic opportunity and growth, safety and security, health and wellness, and overall quality of life.

- Topic: fundamental to smart and connected community solutions.
 - Specific areas include, but are not limited to, disaster response and emergency management, precision agriculture, cybersecurity of the electric grid and Internet-of-Things devices, and wired and wireless networking.

Disaster related, IoT, and Networking

Topic 1: Emergency Content Caching/Replication

- Contents are replicated among DCs for fast data access - moving more towards the edge (edge caching)
- In case of emergency, DCs or several servers can be affected leading to data loss or limited user access to data
- What data to replicate and how much (considering resource constraint)?
- Need to evacuate data in response to an upcoming threat? - only important data
 - But how do you define important?

- Identify different services (slicing)
- Content connectivity / data evacuation with service differentiation.
- Internet of Things (IoT) traffic will become increasingly heterogeneous not only in terms of traditional metrics as required bandwidth and maximum latency, but also in terms of functional requirements such as compute power and temporary storage.

Privacy

- Placing contents in metro networks – privacy plays a big role
- ISP and content providers
- ISP has user locations and content provider has information on user's content type/usage
 - But they don't share information due to privacy issues
- In case of emergency, these information can be very crucial for content placement
 - Need to replicate data but also need to preserve privacy

Type of Disaster/Attack

- So far we consider physical attack or disasters causing physical damages - consider also cyberattack
- Combined coordinated attacks

- Leverage our existing works on content connectivity / data evacuation / resource provisioning for IoT, etc.
- Scope for ML/AI:
 - Traffic flow classification/service differentiation
 - traffic forecast
 - Estimate user location and content usage info in case of emergencies based on limited information from ISPs preserving privacy

Topic 2: Network Monitoring

- Topic 2: Network monitoring / Failure management
- In case of disasters, some network nodes along with monitoring functions/sensors may get damaged
 - Utilize information from the remaining monitoring devices and previous data to estimate the failure extent

- F. Musumeci, C. Rottondi, G. Corani, S. Shahkarami, F. Cugini and M. Tornatore, "A Tutorial on Machine Learning for Failure Management in Optical Networks," in *Journal of Lightwave Technology*, vol. 37, no. 16, pp. 4125-4139, 15 Aug.15, 2019.