SCC: Integrating heterogeneous wireless networks and advanced data science to bridge the digital divide in rural emergency preparedness and response, NSF Award #1831547

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Project Overview

Community-identified problem: Emergency preparedness and response in mountainous rural areas without commercial mobile broadband is a critical societal issue.

- Systems and protocols for heterogeneous wide-area networks with infrastructure mobility.
- Framework for emergency information integration, presentation and exchange.
- Algorithms for improved information exchange in rural socio-physical networks.
- Investigating co-design, adoption and use of information technologies for rural emergency preparedness and response.

Intellectual merit: The project integrates new technologies, including the **E!App** and the **Data Mule Unit** with **existing communications infrastructure** to improve the **safety and social well-being** of those who live, work and travel in rural communities. Application domains that may benefit from the research outcomes include remote healthcare, environmental monitoring and others.
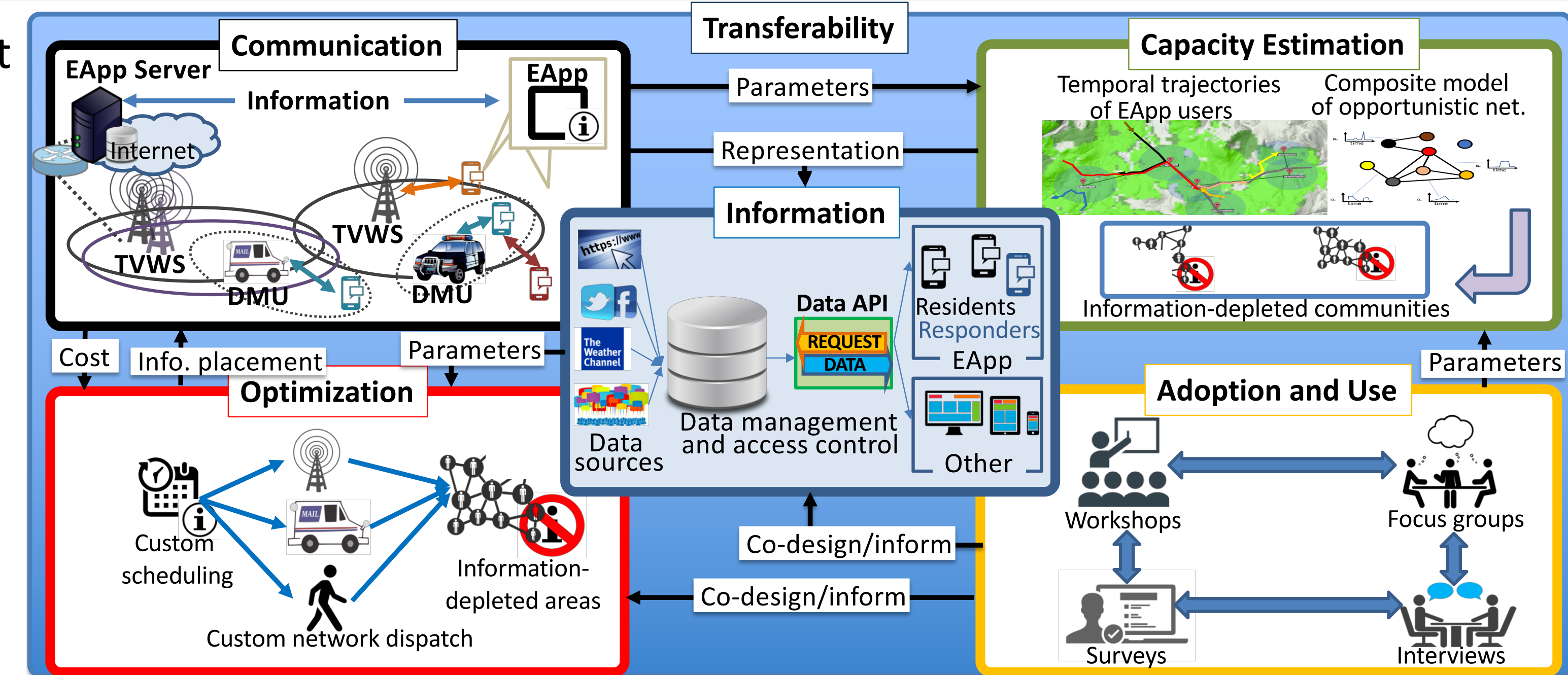
Community-informed project activities

- **E!App** transferability deployment in Johnsburg, NY.
  - Deployed to 44 users in partner communities
  - Effects of co-creation on rural emergency ICT adoption *[DG.O'23]*
  - Understanding the applicability of P2P rural information delivery
- **Fundamental data science for mobility and information dissemination.**
  - Adaptive temporal scale estimation *[SDM'23], [TMLR'22]*
  - Network inference from temporal behavior *[SDM'23a]*
  - Instance and subnetwork selection for learning on graphs *[DSAA'22]*
- **Human-centric design** in applications for rural EPR.

- Explore avenues to sustain project outcomes.
- **Wide-area heterogeneous networks with infrastructure mobility**
  - Reinforcement learning rate adaptation *[VTC'24]*
  - DMU demonstration *[VTC'24]*
  - Performance and adoption of rural TVWS

E!App deployment
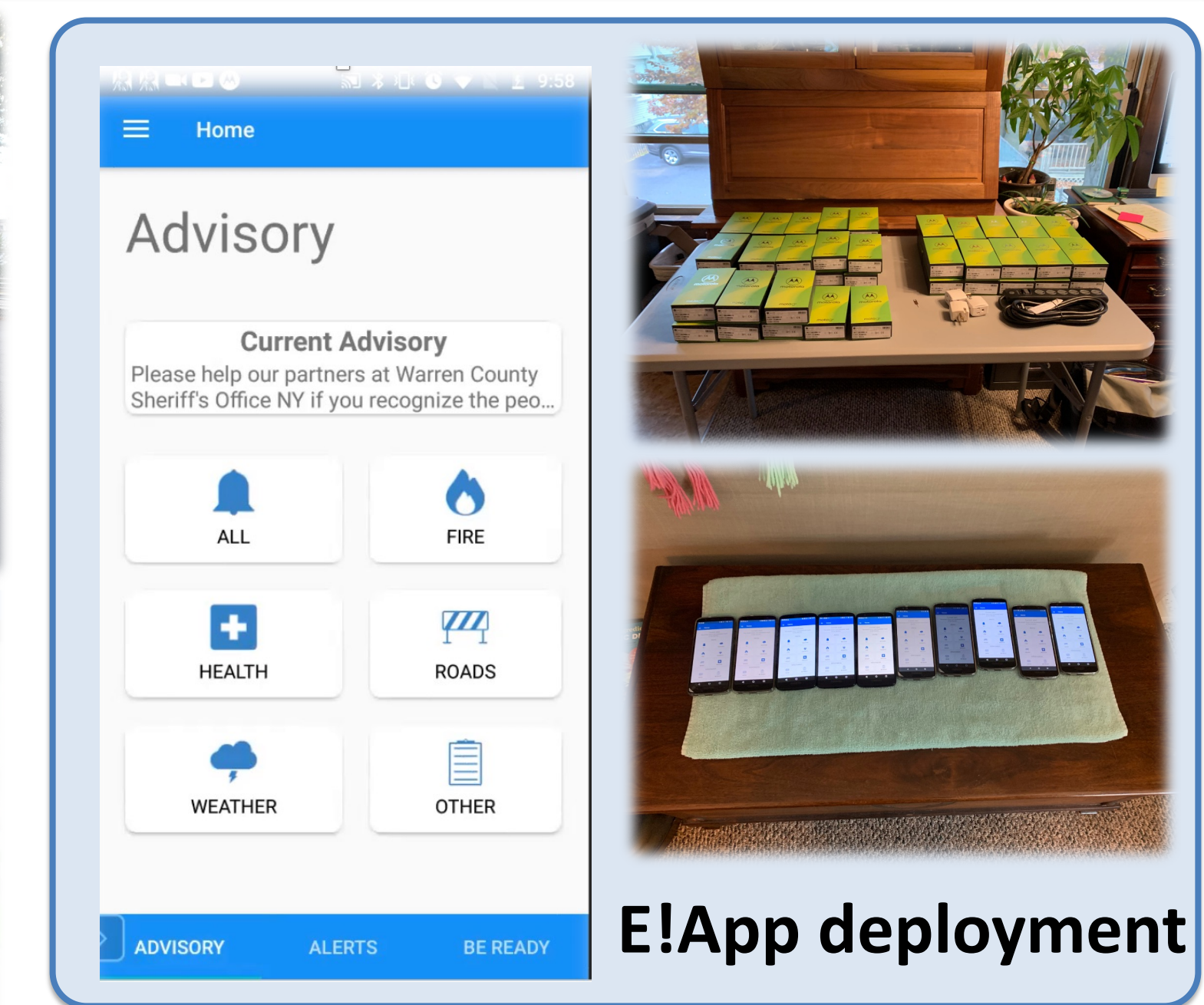
Broader impacts

Immediate impact
- Design and develop E!App and the DMU for better rural EPR information access.
- Study the adoption and applicability of socio-technical frameworks to rural residents and first responders.
- Engage and empower the community through direct participation in research activities.
- Train students from high school to doctoral level in cross-disciplinary fundamental research with real impact.

Long-term impact
- A novel framework for information distribution in rural areas through socio-physical networks with applicability beyond EPR.
- Algorithms for analysis and mining of spatio-temporal and dynamic graph data.
- Insights into the impact of socio-technological frameworks on the well-being of rural residents and first responders.

Next steps

Technological outcomes
- The E!App and the Data Mule Unit (DMU)

Exploring avenues to sustain the E!App
- *Generalizability* – making the E!App relevant to other communities
- *Transferability* – explore transfer to public/private organizations

Challenges in the transferability of rural-centric outcomes
- Under-resourced rural agencies unlikely to have resources
- The industry may not have a compelling enough business case
- State agencies use third-party commercial solutions, which are urban-centric

Interested in adopting our technology? Talk to us at the meeting!