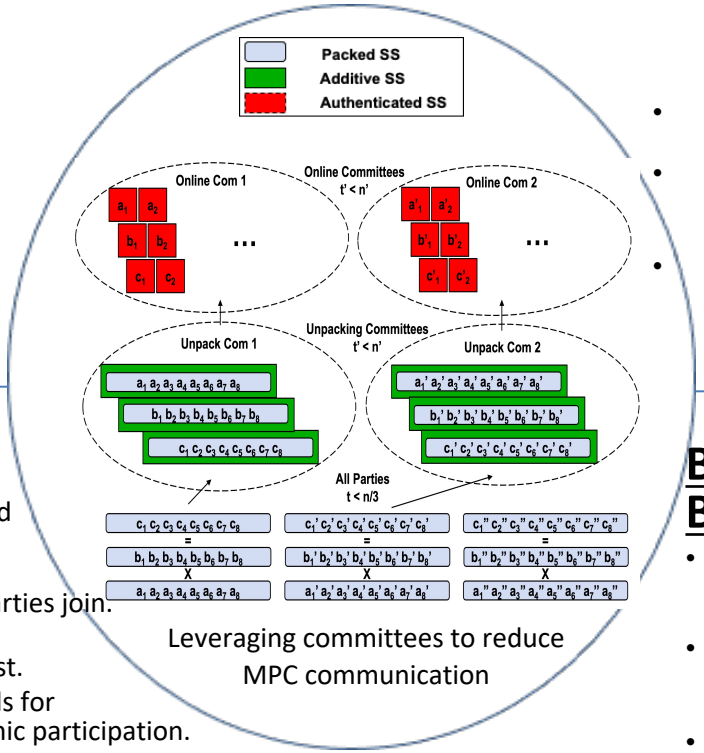
New Approaches for Large Scale Secure Computation

Challenge:

To develop new tools and protocols for facilitating large-scale, distributed, secure computation.

- Millions of parties,
- With varying resources,
- With realistic network constraints.



Leveraging committees to reduce MPC communication

Solution:

- New MPC protocols with improved asymptotic costs.
  - Honest-majority MPC with decreasing cost as more parties join.
  - Malicious-majority MPC with constant per-party cost.
- New security models and protocols for handling failed parties, and dynamic participation.
- Improved protocols for specific computations: multi-party set intersection, and distributed data shuffling.
- Oblivious data-structures for privacy-preserving fake news detection in encrypted messaging systems

Scientific Impact:

- Improved large-scale MPC will enable citizens to collaboratively leverage their data, while protecting individuals from third party observation.
- General approaches for large-scale MPC will lead to new applications
- Asymptotic improvements help identify what resources are necessary for achieving large-scale secure computation.
- Relaxed models supporting real computing environments help researchers explore new tradeoffs between privacy and efficiency.

Broader Impact and Broader Participation:

- Citizens, corporations and governments are becoming increasingly concerned with data privacy.
- Fighting fake news in encrypted messaging will help stem the flow of fake news in such platforms.
- We are training graduate students and postdocs in how to perform research in secure computation.
- Teaching MPC protocol development to undergraduate and graduate students.
- Leading outreach on MPC to community college instructors

1955620 -- Arkady Yerukhimovich, George Washington University, arkady@gwu.edu
1955264 -- S. Dov Gordon, George Mason University, gordon@gmu.edu
1955319 – Seung Geol Choi, U.S. Naval Academy, choi@usna.edu