

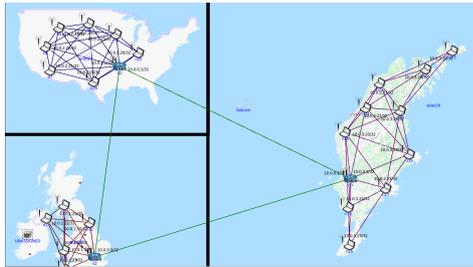
Demonstration of Game Theoretic Resource Allocation in a Coalition



Faheem Zafari (Imperial), Kin K Leung (Imperial), Don Towsley (Umass), Prithwish Basu (Raytheon BBN), Ananthram Swami (ARL), Jian Li (Umass), David Conway-Jones (IBM UK)

Objective

- To create a framework that can share and allocate resources in an efficient and effective way, while considering the objectives of various domains that results in a multi-objective optimization problem.



Technical Challenges

- Domains may have insufficient resources to satisfy all user requests.
- Allocating available resources optimally to different applications is also challenging.

Approach

- The demonstration shows how a game theoretic approach can be used to optimize the allocation of resources across a Coalition of Partners with varying objectives or utilities.
- Different coalition members with resource surpluses and deficits form a coalition where coalition members with resource surpluses share their free resources with coalition members that have a resource deficit.
- The information shared can be a commonly agreed representation of resource requirements, without being explicit, so as to allow likewise comparisons to be performed but without leaking details of the resources required.
- By varying the simulated tasks and network loads behind the coalition access point nodes, we can demonstrate how the algorithm allocates resources amongst the other Coalition Partners automatically.

Military & Coalition Relevance

- This scenario aligns well with current NATO Protected Core Network (PCN) potential laydown where country access points will be connected to the core in order to utilize the common network, but as yet no methodology for resource sharing and allocation has been proposed.

Results

- We have shown that the proposed framework provides Pareto optimal allocation and guarantees stability of coalition among different partners for non-negative increasing utility functions
- Resource sharing can help with allocating resources to domains with resource deficits resulting in an increased utility for service providers and user satisfaction



Results showing local allocations (blue), remote allocations (red), total capacity (grey)

Configuration screen to set loading of nodes

Summary & Future Work

- Currently working on extending the framework to consider communication costs and use matching based algorithms to better match domains with resource deficit to domains with resource surplus.

Publication

Zafari, F., Li, J., Leung, K. K., Towsley, D., & Swami, A. (2018, October). A Game-Theoretic Approach to Multi-Objective Resource Sharing and Allocation in Mobile Edge. In *Proceedings of the 2018 on Technologies for the Wireless Edge Workshop* (pp. 9-13). ACM.