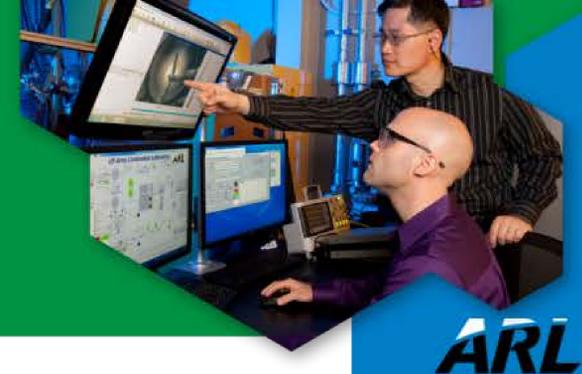


# The Resilience of the Internet to Colluding Country Induced Connectivity Disruptions

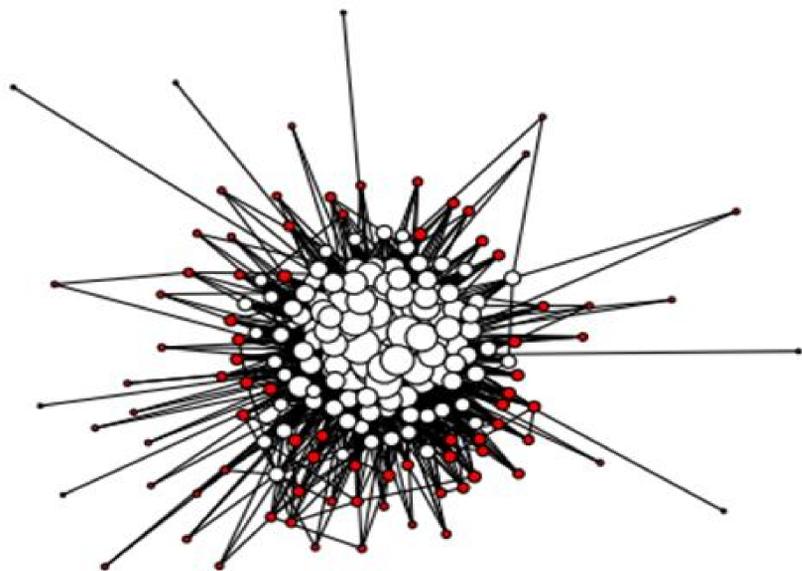


**S&T Campaign: Information Sciences**  
*Science of Cyber Security*

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## Research Objective

- Determine the risk to the functionality of the internet posed by various classes targeted attacks against the BGP routing infrastructure



Logical connectivity of the internet shows negative assortativity. Node sizes are proportional to their degree. The 84 red nodes have degree  $\leq 10$ . Only 0.41 % of edges connect two red nodes.

## Challenges

- VSP less well-studied than other graph cut problems; current published approximation do not scale to our problem
- Limited availability of topological data



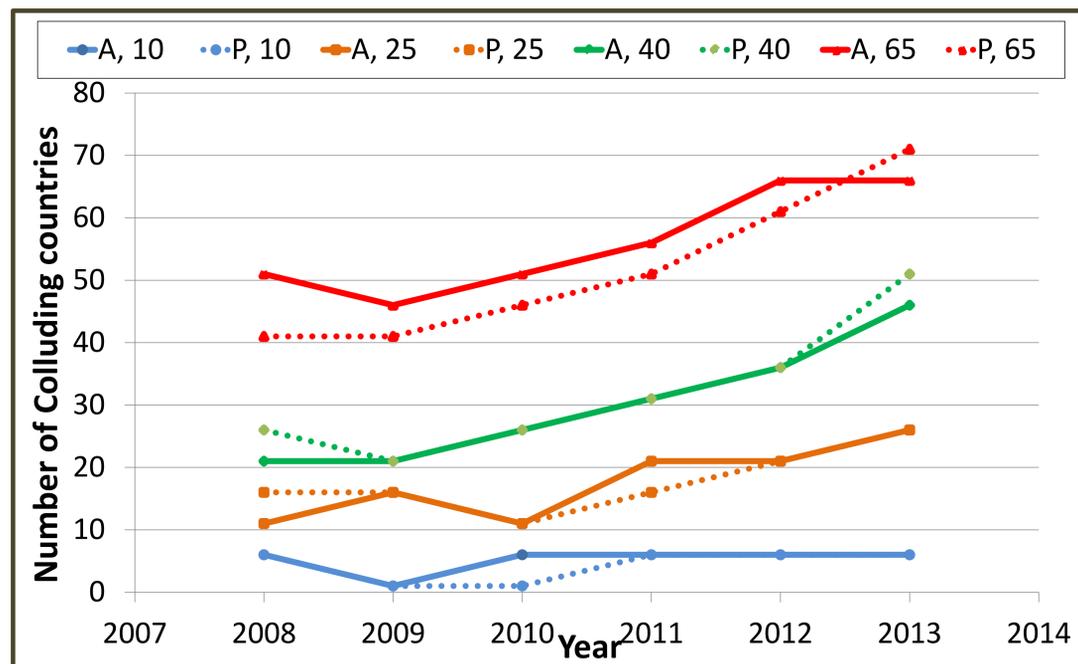
Year	Number of Countries	Number of Edges	Number of Monitors
2008	206	2235	33
2009	211	2343	42
2010	218	2644	54
2010	219	2925	59
2012	221	3138	65
2013	224	3452	89

## ARL Facilities and Capabilities Available to Support Collaborative Research

- ARL Cyber Lab
- Network Science Research Lab (Q3 FY15)
- DOD HPC supercomputing resource center

## Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expertise in or tools for vertex separator approximations for extremely large graphs (up to tens of millions of nodes)
- More complete sources of BGP routing data from more diverse perspectives, particularly geolocated data



- Non-Communicative Clusters:** Into how many non-communicative clusters can a group of colluding countries divide the Internet?
- Country Isolation:** What is the maximal number of countries that can be cut off from the Internet by a group of colluding countries?

