

Assessing Internet Resilience at a Key Node

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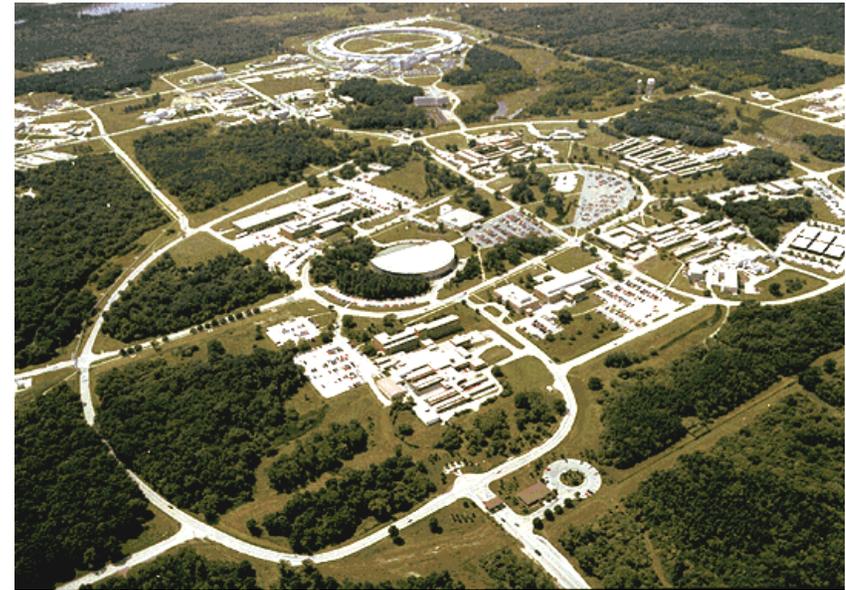
Argonne National Laboratory

Overview

- Managed by the University of Chicago under UChicago Argonne LLC
- More than 3,400 employees and 5,000 facility users
- Annual budget about \$800 million
- 1,500 acre site in DuPage County, 25 miles southwest of Chicago

Core Capabilities

- Photon Sciences
- Energy Systems Analysis
- Leadership Computing
- Transportation Research and Computing
- Environmental Sciences
- Global Security Sciences



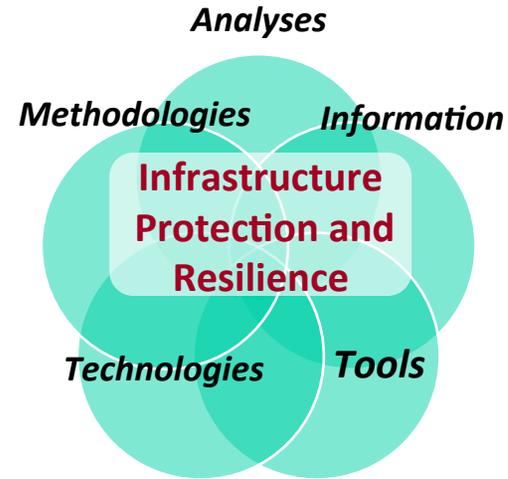
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| <ul style="list-style-type: none">▪ Engineers▪ Computer scientists▪ Information and cyber security specialists▪ Geospatial analysts▪ Economists▪ Social scientists | <ul style="list-style-type: none">▪ Lawyers▪ Regulatory analysts and public policy experts▪ Risk management professionals▪ Decision analysts▪ Educators |
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Risk and Infrastructure Science Center (RISC)

- Goal is to provide methodologies, information, analyses, tools, and technologies to inform decisions about infrastructure protection and resilience
- Capabilities built on 20+ years of critical infrastructure protection support to DOE, DoD, President's Commission on Critical Infrastructure Protection (PCCIP), DHS, and other organizations
- Large interdisciplinary staff to support infrastructure assurance work



RISC Core Capabilities

- Risk and resilience methodology development and assessment
- Metrics development and analysis
- Infrastructure and interdependencies modeling and analysis
- GIS/visualization tools
- Decision support systems
- Training (e.g., risk analysis)
- Cyber/Physical Infrastructure Analysis



Regional Resiliency Assessment Program

Argonne is supporting the U.S. Department of Homeland Security's Regional Resiliency Assessment Program (RRAP) in exploring the resilience of the Ashburn Data Center Cluster

In looking at a problem of this scope, we found two central questions that bear a closer examination for Internet resilience:

- What downstream consequences to the lifeline sectors and the national economy would a regional datacenter outage have?
- At what point would a regional, physical outage begin to affect the larger resilience of the Internet?

For more information on the Regional Resiliency Assessment Program contact: resilience@dhs.gov or on the Ashburn RRAP: kelly.wilson@hq.dhs.gov

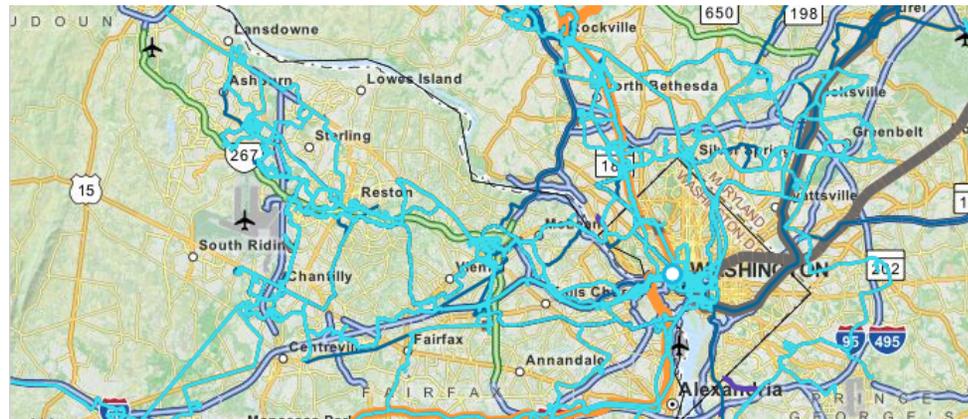


Ashburn, VA, Data Center Cluster RRAP

Why Ashburn?

Beyond Ashburn's history as an interconnection point, there remain several factors that spur its current and continued growth:

- Abundant low cost energy
- Abundant water
- Abundant land
- Favorable tax incentives
- Proximity to Washington, D.C. and Transatlantic Fiber



Ashburn / Washington Fiber (Zayo.com)



Ashburn, VA, Data Center Cluster RRAP Objectives

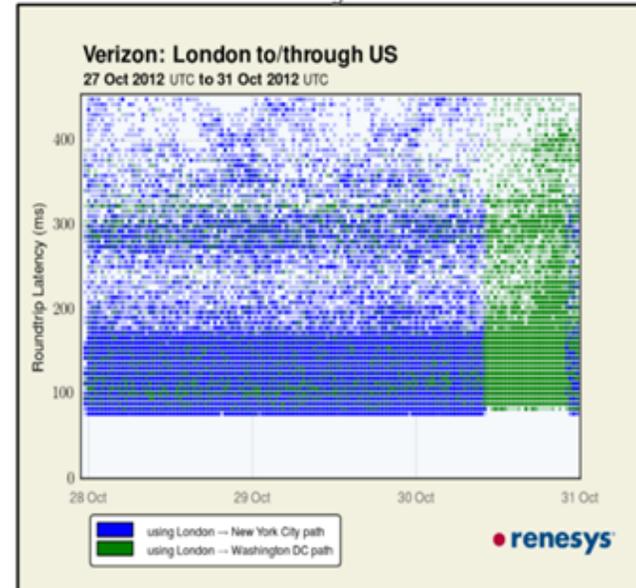
- Underscore the importance of public private partnerships to identify vulnerabilities and mitigate threats to the Nation from cyber-attacks, physical attacks, and natural disasters
- Assess the resilience and vulnerabilities of the lifeline infrastructures supporting data center operations and their collective dependencies.
- Assess and model the downstream effects on lifeline sectors as a result of short-term or long-term loss or degraded capabilities of the cluster's data centers.
- Evaluate State and county prioritization plans for restoring electric and emergency generator fuel supplies.
- Model consequences of critical node outages to Internet resilience.



Modeling Resilience of the Ashburn Data Center Cluster

- For historical reasons (MAE-East), Ashburn has become a critical node in the fabric of the internet.
- During Hurricane Sandy, the data offload from New York to Ashburn was successful. Would the reverse offload be equally successful?
- At what point would slowdowns of Internet traffic due to an outage of Ashburn nodes begin to impact critical services?

Hurricane Sandy Data Offload



Once generators failed, NY data centers shed their load using a London to DC path,. Note the drastic and abrupt change when NY data centers shut down and the entire internet load shifted to Ashburn, creating a potential single point of failure.

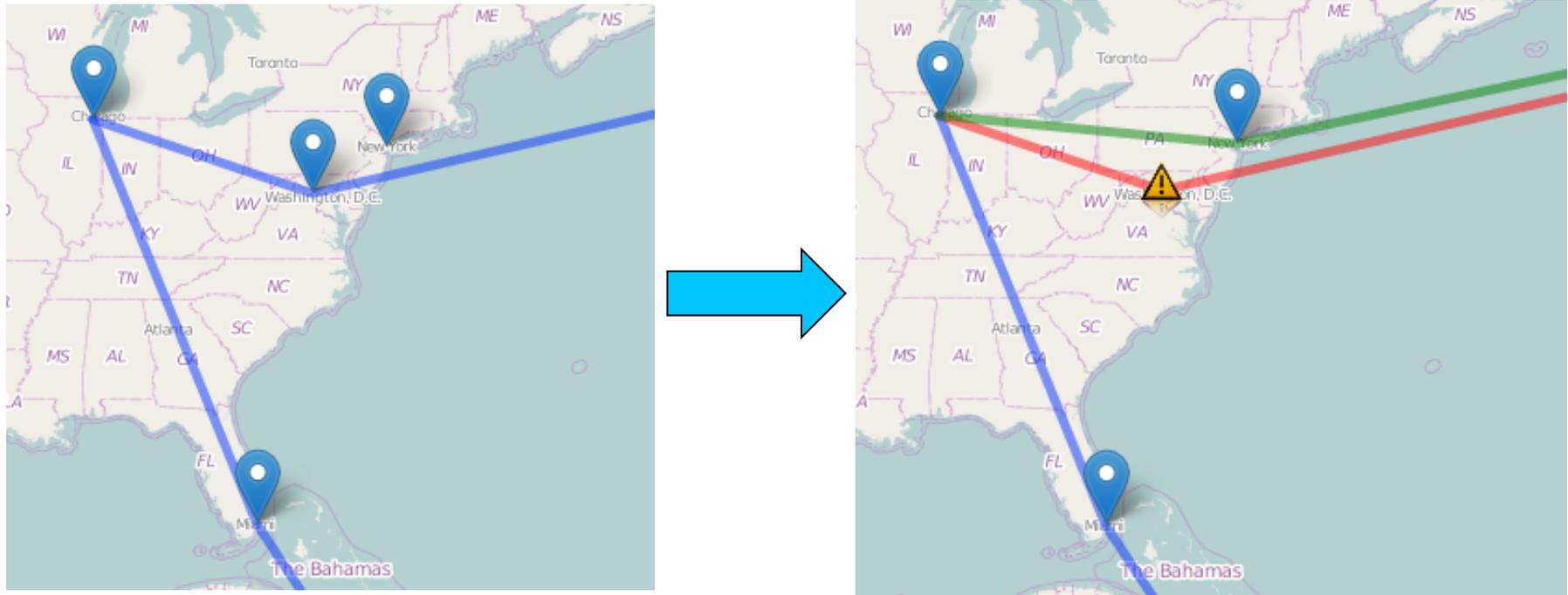


Value to Stakeholders

- Information on infrastructure dependencies that decision makers can use for response planning
- Understanding of the implications of interdependencies among infrastructure systems
- Identification of the cascading consequences of system operation, including impacts on public health and economic values
- Identification of mitigation strategies for specific contingencies
- Evaluation of impacts on future system operational constraints
- Characterization of the importance of interconnections with regard to regional system stability



Modeling Critical Nodes and Reroutes

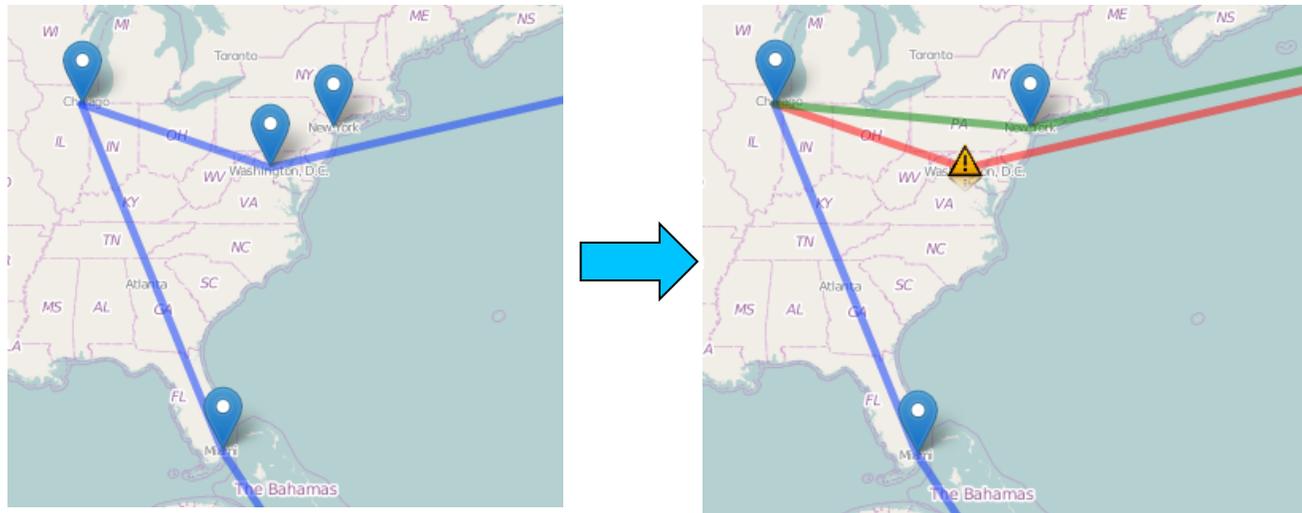


- How do we model a **regional** outage, particularly to a critical region such as Ashburn?
- During a slow down, at what point do things like VOIP become unusable, potentially impacting emergency services?
- What scale of outage or disaster would be serious enough to hamper or defeat TCP's built in resilience?



Data Collection Avenues

- Sustained traceroutes through critical node areas during slowdown events
- Studies of previous failures and outages
- Provider fiber mapping and failover plans
- Iowa State's ISEAGE and other internet modeling tools
- Telegeography and other curated datasets



Q & A

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