Status Update:

Research Exploring Malware in Energy Delivery Systems (REMEDYS)

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Agenda

Status Report

- Orientation to REMEDYS
- Approach and Gap Analysis
- MIT's Core Contributions to REMEDYS
  - Foundational Trust Modeling
  - Organizational Design Criteria
  - Evaluation Tool
  - Model Description for Stakeholder Engagement

Next Steps

- Transition
- Research Approach
- Tool for the EDS Ecosystem

First, let me set the stage… Malware Attack on the Electricity Sector

- Extreme cold front descends on Northeast and Midwest United States, expected to last 3-4 days.
- Power goes out on day one. Over 100 million are left without heat.
- Nearly 200 utilities scramble to recover.
- Utilities identify **malware** as the culprit and initiate emergency response plans.

What Can the EDS Do to Prevent or Mitigate a Cyber Event?

Now Imagine…
EDS Cyber Event Response Organization

- Collaborative organization led by EDS stakeholders
- Reliable, possibly dedicated staff
- Collectively have the latest information and intelligence
- Ability to create and propagate a mitigation quickly
- Covers gaps between individual response plans
- Ability to coordinate EDS stakeholders response

REMEDYS: An Organizational Structure for Coordinated Cyber Event Response

REMEDYS's objective is to develop, evaluate, and refine **organizational structures** that could be used to **coordinate the nation's multiple energy sector stakeholders** in the rapid research, development, and distribution of mitigations to **reduce the risk of an imminent or emerging cyber-attack** that might otherwise disrupt energy delivery.

- Initiated by DoE in 2017
- Focused on electricity sub-sector but applicable to all EDS sub-sectors
- REMEDYS team included MIT, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory

The team created 5 candidate organizational structures to test with stakeholders

We are at a decision point about how to proceed

Today, we will summarize some of the work done to date and our proposal about next steps

REMEDYS Approach

- Evaluate current **cyber threat landscape**
- Profile **EDS stakeholders** and define potential roles in organization
- Analyze existing and forthcoming **solutions to cyber threats** in EDS ecosystem
- Explore sector-wide and other sector **CIP best practices**
- Identify **relationships** that can be leveraged to achieve sector-wide participation
- Define **organizational requirements** and test hypotheses


Utility companies, owners, & operators


Vendors & Manufacturers

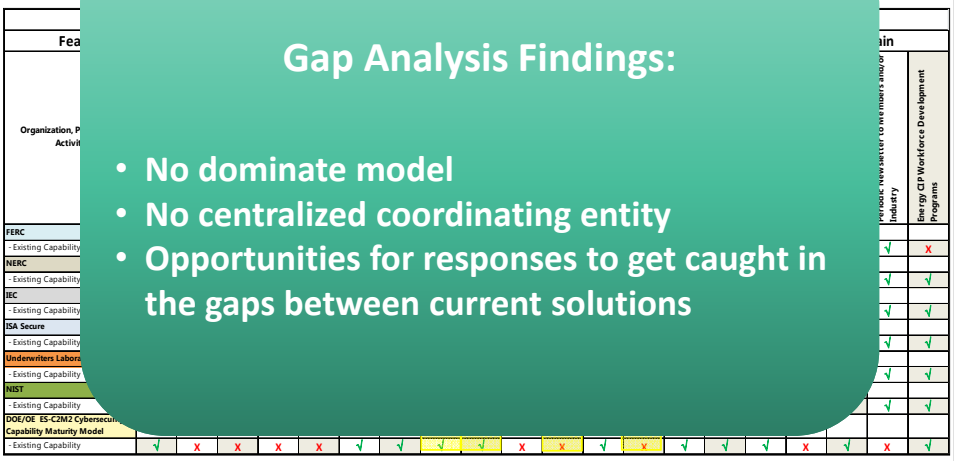

Cybersecurity Companies


Universities


Research Labs

Gap Analysis Findings:

- **No dominate model**
- **No centralized coordinating entity**
- **Opportunities for responses to get caught in the gaps between current solutions**



Challenges in Current EDS Cyber Event Response

- High Barriers to Establish Trust Among Stakeholders
  - Cyber domain characterized by high barriers to trust between stakeholders
  - Difficult to determine sufficiency of measures and mitigations
  - High information saturation and relevancy unclear
- Complicated Communication and Coordination
  - Lack of well-defined approach to alerting and reporting
  - Difficulty communicating with vendors
  - Lack of coordination and prioritization of large-scale response efforts
  - Lag time between malware identification and mitigations
- Limited In-House Expertise and Resources
  - Limited in-house ability for utilities to identify malware vulnerabilities and attacks
  - Limited in-house ability to apply mitigations
- Complex Regulatory and Legal Barriers
  - Reporting could trigger regulatory punitive measures
  - Valuable information is classified

MIT's Core Contributions to REMEDYS Organization Research

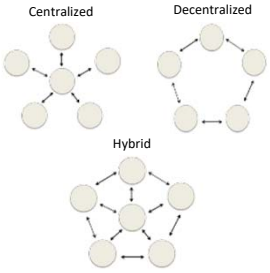
1. Created a trust model to inform organizational design
2. Used organizational design literature to study existing cyber resilience organizations
3. Developed criteria for designing REMEDYS organizational models
4. Developed tool to evaluate the models
5. Refined organization structure descriptions for stakeholder engagement

"The 4 Requirements of Trust" Review of Trust Model Literature

Requirements of Trust
Clarity and agreement of objectives
Clarity about assignments and roles
Appropriate and clear safeguards
Appropriate confidentiality

Criteria for Organizational Design

- Incorporated organizational theory to establish baseline requirements for effective REMEDYS organization
- Integrated fundamental organizational theory concepts from literature on structural options and building blocks (criteria)



Criteria	Definition	Organizations of Organizations
Chain of Command	Lines of authority for decision making, reporting and information flow	Who reports to whom between entities and how information will flow
Span of Control	Number of subordinates a superior can effectively manage	Number of entities 'reporting into' each other
Decision Authority	Decision-making process or authority	Where decisions are made in the structure (centralized, decentralized)
Specialization	Division of labor or how activities in an organization are broken down and divided between entities	How activities are broken down between entitles-defining the work each will do
Departmentalization	Grouping activities in order to coordinate common activities	Groups of entities to coordinate common activities to be done
Formalization	Amount of rules, procedures and other mechanisms that govern how activities are done	Rules, procedures and other mechanisms that govern how entities work together.
Culture	The unwritten rules of the organization	The unwritten rules necessary for the entities to work together (Trust, etc)

Studied Existing Cyber Resilience Organizations

- No organization is dedicated to coordinating EDS ecosystem malware response
- More criteria required to design REMEDYS organizational structures

Existing Organization
ISA Security Compliance Institute (ISCI)
Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks (UT CURENT)
Edison Electric Institute Cyber Mutual Assistance (EEI CMA)
US Nuclear Energy Community
SPAREConnect
Advanced Cyber Security Center (ASCS)
Financial Systemic Analysis and Resilience Center (FSARC)
Electricity Information Sharing and Analysis Center (EISAC)
Wireless Industrial Networking Alliance (WINA)

Refined Criteria for Designing/Describing REMEDYS Organization Models (14 Criteria)

Criteria	Definition/explanation
Goal	Overall goal of the organization. High level objective that all participants can agree on.
Members	Participating organizations, companies and/or groups. Characterization of the participants or groups of participants.
Structure	The formal reporting relationships of the organization such as committees, leadership positions, etc. Often depicted as an org chart.
Decision Processes	Steps and entities involved in making a decision.
Operational Processes	The day-to-day work to be done and how it's done (steps necessary for the work to get done)
Roles & Responsibilities	Key roles for each of the entities in the organization
Flow of Information & Mitigation	The way information will reach the appropriate participants in the organization.
Governance	The activities, decisions, and control systems that support the organization and enable it to work.
Basis of Trust	Activities/ org components specifically designed to provide a foundation for sharing and working together (objectives alignment, activities expectations, clear safeguards, appropriate confidentiality)
Key areas for Legal Arrangements	Areas necessary to include in the participation agreement to protect participants and provide guidance on actions and activities.
Funding	Resources necessary to cover costs of key activities that enable the organization to achieve objectives.
Culture	The unwritten rules; the values, attitudes and beliefs that drive behaviors in the organization.
Data Management & Protection	The plan for people, process and technologies needed to create and protect data generated or collected in the organization.
Risk Management	Identification of critical assets of the organization and the plan to recover should those assets be compromised, damaged or stolen.

Evaluation Tool: Compare Models

Criteria	Definition/explanation	Evaluation Question
Decision Processes (Operational)	Steps and entities involved in making a decision.	How difficult will it be in this structure to make and communicate operational decisions to those who need to know them?
Roles / Responsibilities	Key roles for each of the entities in the organization	How clear are the roles and responsibilities for each of the entities and the individuals in this structure (what are the key roles needed to fill in this model)?
Basis of Trust	Activities/ org components specifically designed to provide a foundation for sharing and working together	How well does this structure (separate from personalities/specific people) establish and institutionalize trust among the constitutes?
Data Management /Protection	The plan for people, process and technologies needed to create and protect data generated or collected in the organization.	How well does this structure manage data protection, ownership, distribution and security?
Flow of Information / Mitigation	The way information will reach the appropriate participants in the organization.	How well does this structure facilitate or block flow of information and mitigations to the participants?
Culture	The unwritten rules; the values, attitudes and beliefs that drive behaviors in the organization.	How well does this structure support or block the values, attitudes and beliefs that enable mitigation creation and sharing?
Decision Processes (Strategic)	Steps and entities involved in making a decision.	How well will strategic decisions be made within this structure?

Criteria	Definition/explanation	Evaluation Question
Goal / Strategic Intent	Overall goal of the organization. High level objective that all participants can agree on.	How well will this structure support the goal of REMEDYS to create and propagate mitigations? How well will this structure ensure that all participants are aligned and agree to this objective?
Membership	Participating organizations, companies and/or groups. Characterization of the participants or groups of participants.	How well does this structure make sure that appropriate constitutes are participating?
Governance	The activities, decisions, and control systems that support the organization and enable it to work.	How well does this structure ensure basic governance tasks and activities are conducted?
Organizational Structure	The formal reporting relationships of the organization such as committees, leadership positions, etc. Often depicted as an org chart.	How well defined are the structures , reporting relationships and lines of communiation in this model?
Key areas for Legal Arrangements	Areas necessary to include in the participation agreement to protect participants and provide guidance on actions and activities.	How well does this structure create, share, gain agreement, and enforce participation?
Risk Management	Identification of critical assets of the organization and the plan to recover should those assets be compromised, damaged or stolen.	How well does this structure identify critical assets? How well will this structure identify key risks to it's ability to be successful? How well will this structure provision for protection from these risks?
Funding	Resources necessary to cover costs of key activities that enable the organization to achieve objectives.	How well does this structure make sure that necessary funds to run and manage be available?

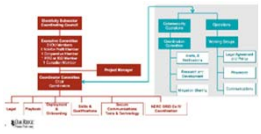
Develop 5 Candidate Models

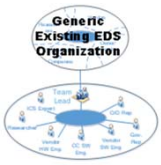
- ORNL and PNNL developed and refined hypothetical models to:

Malware Coordinating Council (MCC)

Dedicated Malware Task Team (DMTT)

CMA Malware Subcommittee (CMS)





Volunteer Malware Task Team (VMTT)

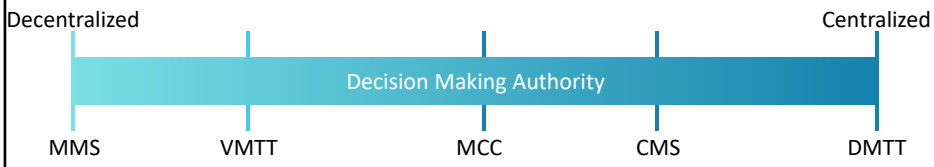
Malware Mitigation Society (MMS)

Key Differentiating Attributes

Of 14 descriptive criteria, 5 criteria are the key ways to describe the differences in the candidate models.

Create New	Governance of Organization	Use Existing Org. Governance
Decentralized	Decision Making Authority	Centralized
Volunteers	Resource Availability	Dedicated, Resourced Team
Affected Entity Plus Vendor	Development of Malware Mitigation	Affected Entity Plus Vendor & Others
Decentralized	Information Sharing and Flow	Centralized

Sample Key Attribute: Decision Making Authority

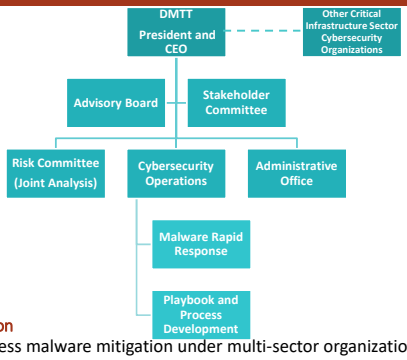


- **Continuum** – Captures where decision making authority lies
- **Centralized** – Authority lies in a single entity, often a board and/or a executive, which directs the organization. Participating entities are represented through delegates on the board or by choosing the executive
- **Decentralized** – Models are characterized by a high degree of voluntary participation. Decisions may require consensus of the entire organization or only affected members have decision authority

https://veritusgroup.com

Candidate Model Summary Slide Example 1

Dedicated Malware Task Team (DMTT)

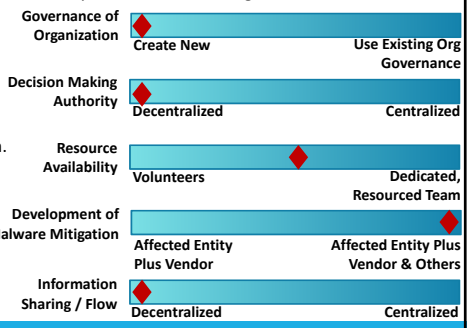


Description

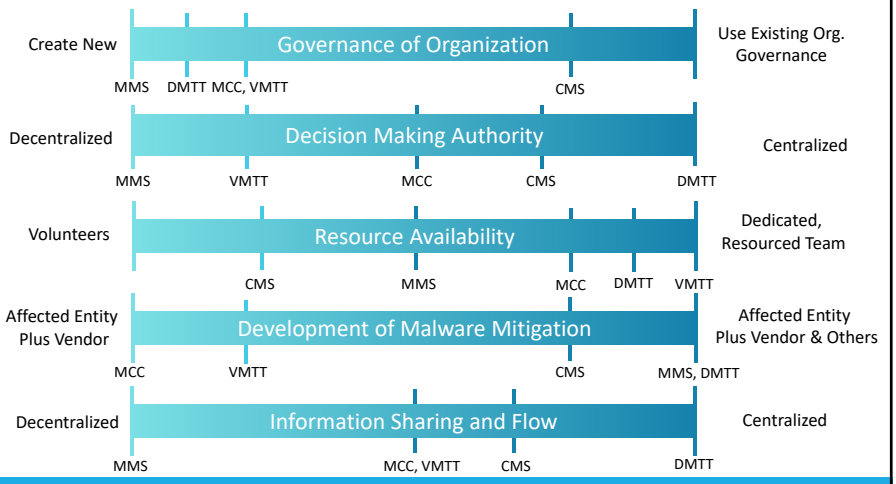
- Address malware mitigation under multi-sector organization.
- Fully staffed and funded
- Analyses are used to pre-emptively develop malware mitigations when possible and ensure resources, playbooks, and critical processes are disseminated to members
- Dedicated response teams rapidly respond to malware infections of its energy sector stakeholders and when asked by other industries for the purpose of mutual defense

Distinguishing Characteristics

- Dedicated center with formal relationships across electric and other sectors.
- Established coordination with government entities, i.e. DoD, FBI, and DHS
- Structure emphasizes collaboration across industry and private sector boundaries to perform better analysis and malware mitigation



Today: 5 Candidate Organization Structures



Transition

- Leadership changed in research arm of DoE
- REMEDYS moved off the list of currently funded projects
- Originally identified problem has not gone away
- Still have gaps sector-wide malware mitigation response

Next Steps – Research Approach

Proposed revised project objective

- Not continue with REMEDYS as previously laid out
- New objective: Identify the optimal **mechanism** to coordinate a sector-wide response to a malware attack

Stakeholder outreach and engagement

- Coordination directly with E-ISAC, CREDC members, and other stakeholders

Leverage expertise at MIT

- Trust modeling
- Governance theory
- Economic game theory

Next Steps: Tool for the EDS Ecosystem

1. Helps highlight the gap in sector-wide malware response
2. Builds consensus on how to close the gaps
3. Lays the foundation for a mechanism to rapidly respond to malware attack on the EDS ecosystem

Questions?

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