# SaTC: CORE: Medium: An Optimization Framework for Identifying Dynamic Risk Management Practices

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Research objective: This project explores how an optimization modeling framework can be used to prescribe innovative, dynamic risk management policies that protect IT systems, support trustworthy computing in decentralized organizations, and efficiently use limited cyber-security resources.
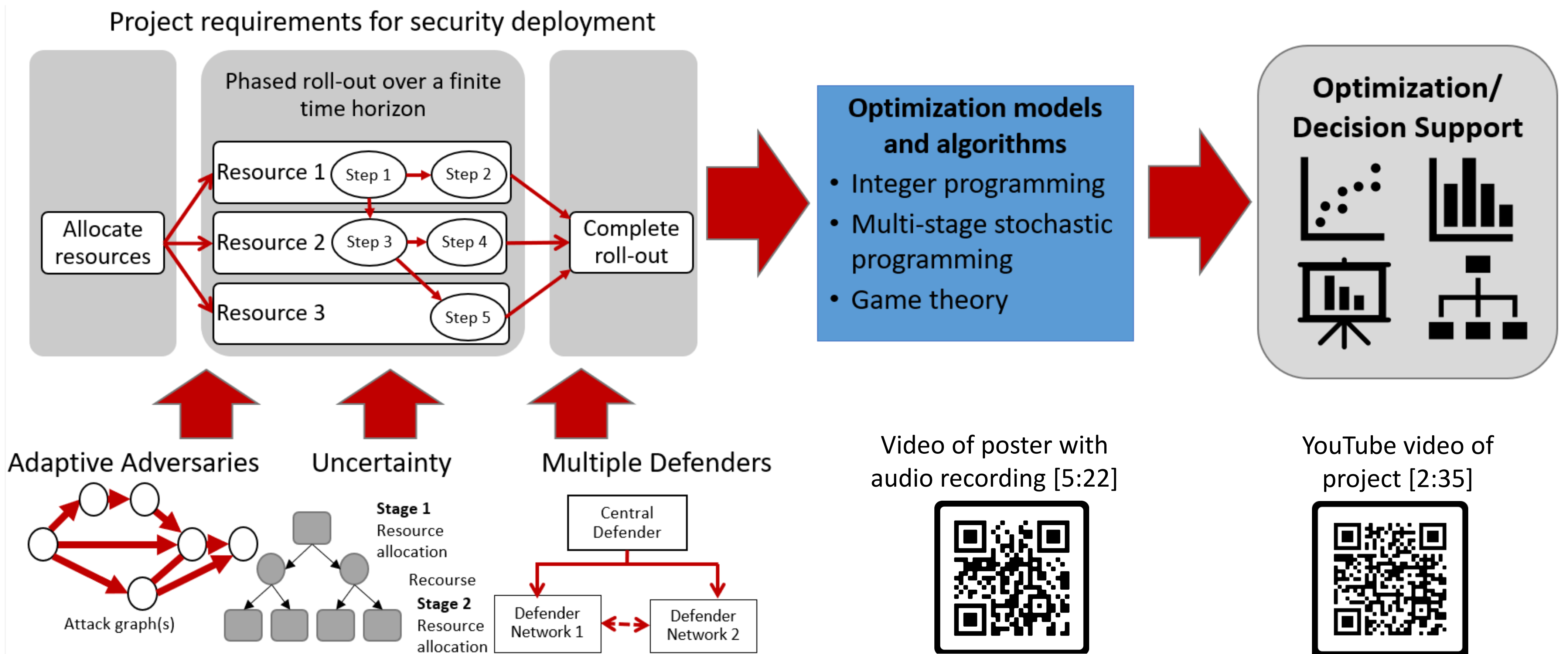
Video of poster with audio recording [5:22]
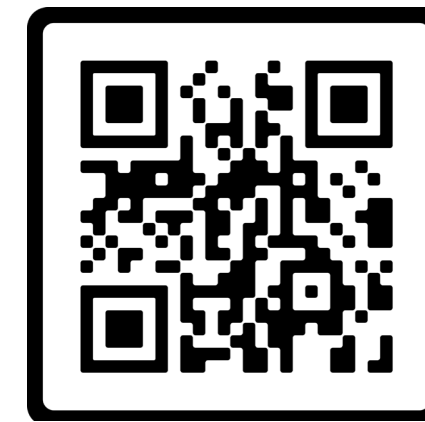
YouTube video of project [2:35]

Central challenge

- Protecting IT systems requires deploying security mitigations under uncertainty in a resource-constrained environment.
- Technical challenge: how to roll out security mitigations at the right time using the right resources, e.g., by assigning workers to tasks.
- Decisions of which mitigations to deploy and when are interrelated due co-coverage of vulnerabilities, use of shared resources, and precedence relations.
- Effectiveness of mitigations is uncertain and may depend on decisions of adaptive adversaries

Solution/Technical approach

- Approach: formulate and solve new optimization models to study how to make interdependent planning and resource allocation decisions.

Scientific impact

- Project advances our understanding of how to cost-effectively reduce risk by allocating scarce security resources.
- Project supports dynamic defensive strategies with the potential to achieve high levels of security without a corresponding increase in cost.
- New algorithmic techniques will identify optimal and near-optimal solutions to practical-sized problem instances quickly.
- Approach addresses multi-stage uncertainty, adaptive adversaries, and coordination between defenders.
- Models can provide insight into other applications, e.g., election security planning

Broadening participation in computing

- Doctoral development seminar to retain female and underrepresented minority (URM) graduate students

Broader impact to society

- Securing IT systems is becoming increasingly expensive.
- This project will provide a suite of tools to reduce risk in cost-effective manner to "bend the cost curve"

Education and outreach

- Mentoring graduate and undergraduate students
- "Lab open house" event for undergraduates interested in research (March 2021)
- Outreach talks to the public and YouTube videos planned
- Science blogging

Survey results given to students before and after semester (selected questions)	Fall 2021	
	BEFORE	AFTER
Survey question	% Agree or strongly agree	% Agree or strongly agree
My degree requirements are clear.	67%	86%
I understand university and program policies affecting graduate assistants.	78%	100%
I understand how to get started on research.	33%	100%
I know where to go to learn more about professional development.	56%	100%
I am confident I can balance course work, research, and personal obligations.	56%	86%
Number who filled out survey	*9*	*7*

The 5th NSF Secure and Trustworthy Cyberspace Principal Investigator Meeting (2022 SaTC PI Meeting)
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