INTRODUCTION TO NSF CYBERSECURITY TRANSITION TO PRACTICE

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Introduction to NSF Cybersecurity Transition to Practice Acceleration EAGER

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- Project Plan
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NSF Strategic Priorities in Cybersecurity

From the 2016 Federal Strategy for Cybersecurity R&D:

- …long-term investments in a wide area of ***scientific fields***, and …ensuring the **adoption and implementation of new technologies** that emerge from research
- …basis for designing, building, and operating a cyber-infrastructure with **improved resistance and improved resilience to attack** that can be tailored to … technical and policy requirements, including ...**privacy and accountability**

Federal Cybersecurity Research and Development Strategic Plan:
https://www.whitehouse.gov/sites/whitehouse.gov/files/documents/2016_Federal_Cybersecurity_Research_and_Development_Stratgeic_Plan.pdf

NSF Cybersecurity TTP EAGER Goal and Approach

Goal: accelerate Transition To Practice (TTP) of NSF funded later stage cybersecurity research into operational environments by prototyping and experimental deployments

Approach

- Develop inventory of NSF cybersecurity research awards and PI's in SaTC, CICI, CPS programs
- Determine potential for research projects for applied usage in a Research & Education environment
- Serve as a matchmaker to encourage adoption of security capabilities by operational users
- Identify security infrastructure needs/gaps with current tools, success stories, best practices, learnings, potential synergies, collaboration opportunities
- Design and develop materials, events, TTP showcase webinars, matchmaking, & researcher TTP enablement
- Explore the opportunity to develop an end-to-end innovation pipeline
- Engage the extended R&E pipeline
- Design, develop, and begin to execute the pilot program

NSF Cybersecurity Transition to Practice (TTP) Success: Bro

- Bro provides a flexible, open network monitoring platform.
  - Developed since 1995, now at ICSI & NCSA.
  - Open-source with a BSD license.
  - Fundamentally different from a traditional IDS.
- Bridges gap between academia and operations.
  - Has helped transition research into practice for almost two decades.
  - Deployed operationally by universities, research labs, Fortune 20.

Project Plan

Step	Project Activities	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q
1	Project team in place								
2	Develop NSF Research Asset Inventory								
3	Interview NSF, researchers, practitioners, universities, industry, labs, DHS, other agencies								
4	Develop researcher/practitioner match-making showcase -online, events								
5	Develop TTP R&D showcase and technical workshops								
6	Deploy workshops				#1	#2	#3	#4	
7	Design, develop NSF TTP Portal								
8	Develop materials for NSF TTP Portal								
9	Deploy NSF TTP Portal								
10	Assess TTP program and develop recommendations								

Project Activity #1: Project team in place

- Florence Hudson, Chief Innovation Officer, Internet2
- Emily Nichols, Innovation Program Manager, Internet2
- Giselle Trent, Executive Assistant to Chief Innovation Officer, Internet2

Project Activity #2: NSF Research Asset Inventory – 914 Active SaTC Awards

Title	PI	Organization	Award Amt
TWC: TTP Option: Frontier: Collaborative: MACS: A Modular Approach to Cloud Security	Ran Canetti	Trustees of Boston University	$1,609,797
Collaborative Research: SI2-SSI: Empowering the Scientific Community with Streaming Data Middleware: Software Integration into Complex Science Environments	Tony Fountain	University of California-San Diego	$1,455,429
TWC: Medium: Micro-Policies: A Framework for Tag-Based Security Monitors	Benjamin Pierce	University of Pennsylvania	$1,200,000
TWC: TTP Option: Frontier: Collaborative: MACS: A Modular Approach to Cloud Security	Srini Devadas	Massachusetts Institute of Technology	$1,176,449
TWC: Medium: Hardware Trojans in Wireless Networks - Risks and Remedies	Yiorgos Makris	University of Texas at Dallas	$1,129,437
CPS: TTP Option: Synergy: Safe and Secure Open-Access Multi-Robot Systems	Magnus Egerstedt	Georgia Tech Research Corporation	$999,999
TWC: Medium: Collaborative: Towards Securing Coupled Financial and Power Systems in the Next Gen Smart Grid	Karl Levitt	University of California-Davis	$839,997
CPS:Synergy:Security of Distributed Cyber-Physical Systems with Connected Vehicle Applications	Pierluigi Pisu	Clemson University	$800,000
TWC: Medium: Collaborative: Towards a Binary-Centric Framework for Cyber Forensics in Enterprise Environments	Dongyan Xu	Purdue University	$800,000
TWC SBE TTP: Medium: Bringing Anthropology into Cybersecurity	Xinming Ou	Kansas State University	$715,845
TWC SBE: Option: Small: Building Public Cyber Health - Designing and Testing the Efficacy of a School-Focused, Gamification Approach to Create a Secure Computing Environment	Noel Greis	University of North Carolina at Chapel Hill	$653,975
SBES TWC: Phase: Small: Protecting the Bazaar: The Ecology of Cybersecurity in Weakly Fortified Networks	David Maimon	University of Maryland College Park	$647,804
TWC: TTP Option: Small: Differential Introspective Side Channels --- Discovery, Analysis, and Defense	Zhuoqing Mao	University of Michigan Ann Arbor	$605,282
CPS: TTP Option: Synergy: Collaborative Research: Hardening Network Infrastructures for Fast, Resilient and Cost-Optimal Wide-Area Control of Power Systems	Aranya Chakrabortty	North Carolina State University	$600,000
SBE: Medium: Collaborative: Understanding and Exploiting Visceral Roots of Privacy and Security Concerns	Alessandro Acquisti	Carnegie-Mellon University	$595,197
RET Site: Cyber Security Initiative for Nevada Teachers (CSINT)	Shamik Sengupta	Board of Regents, NSHE, obo University of Nevada, Reno	$540,000
TWC: Small: Understanding Anti-Analysis Defenses in Malicious Code	Saumya Debray	University of Arizona	$514,796
TWC: Medium: Collaborative: Towards a Binary-Centric Framework for Cyber Forensics in Enterprise Environments	Golden Richard	University of New Orleans	$511,193
TWC: Small: Quantitative Analysis and Reporting of Electromagnetic Covert and Side Channel Vulnerabilities	Alenka Zajic	Georgia Tech Research Corporation	$500,535
CICI: Data Provenance: Provenance-Based Trust Management for Collaborative Data Curation	Zachary Ives	University of Pennsylvania	$500,000
CPS: Breakthrough: Secure Telerobotics	Howard Chizeck	University of Washington	$500,000
TWC: Small: Addressing the challenges of cryptocurrencies: Security, anonymity, stability	Arvind Narayanan	Princeton University	$500,000
TWC: Small: Behavior-Based Zero-Day Intrusion Detection for Real-Time Cyber-Physical Systems	Sibin Mohan	University of Illinois at Urbana-Champaign	$500,000

Project Activity #2: Campus Pilot Projects

- **Zeropoint** – **Document Detection and Analytics**. UNC-Chapel Hill, PI – Fabian Monrose
  - Analyzes email, web content and server traffic for hazardous content. End-user will not need to guess whether a document is infected with malicious code, but is notified before data is lost.
- **Amico – Detection of Malware Downloads**. University of Georgia, PI – Roberto Perdisci
  - Automatically distinguishes between malware and benign software downloads.
- **CipherLocker – A Fully-Private Cloud Storage, Search, and Collaboration Portal for Education**: A Campus Pilot. State University of New York-Stony Brook, PI – Radu Sion
  - Functionality similar to Box and Dropbox, with additional feature of Search on Encrypted Data (SED) that makes stored files safely searchable while remaining encrypted.
- **A Kit for Exploring Databases Under the Hood for Security, Forensics and Data**. DePaul University, PI – Alexander Rasin
  - Open source tools to provide visibility into the storage of several database systems, illustrating exactly what is happening inside.
- **Named Data Networking**: Colorado State University, PI – Christos Papadapolous

Zeropoint:

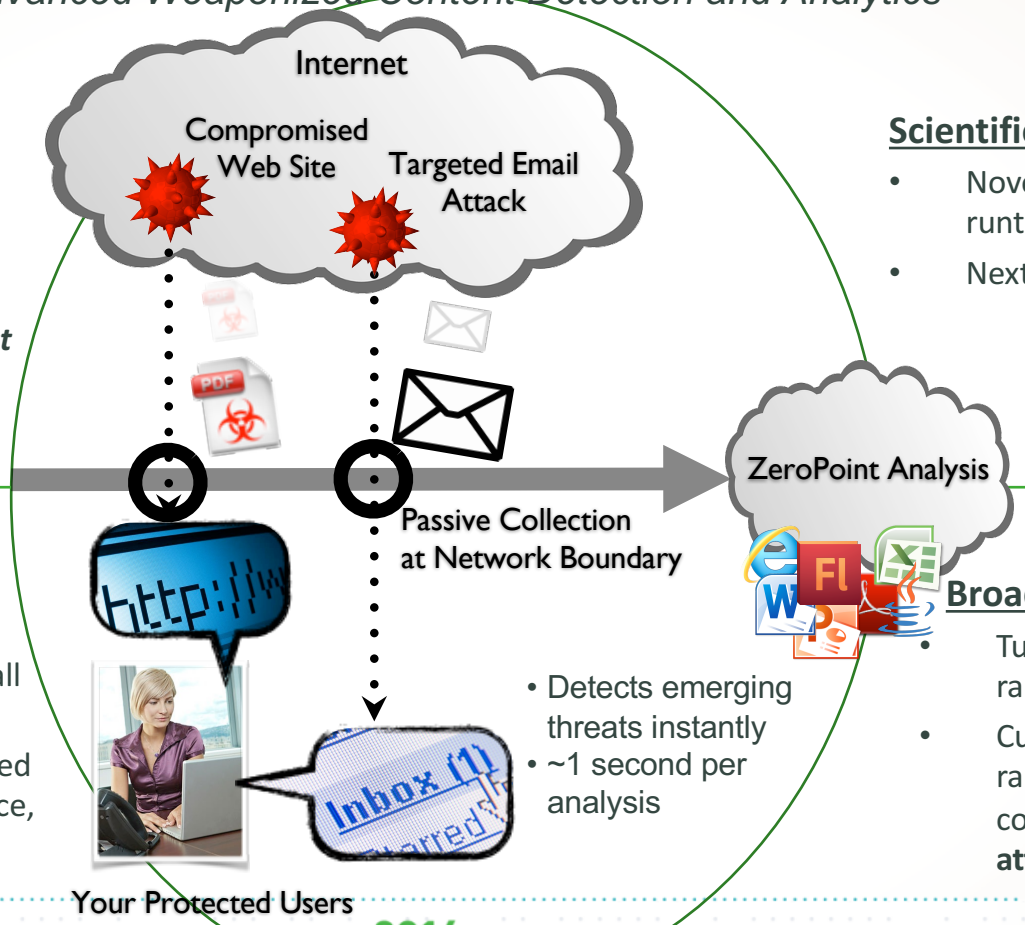
Advanced Weaponized Content Detection and Analytics

Challenge:

- **Weaponized documents** are pervasive and automatically and uniquely generated per-incident.
- Attacks take ***seconds to compromise, but months to detect*** with commodity technologies.

Solution:

- Patented ***Execution-of-Data*** technology examines data as potential code, executes it from all angles
- Malicious code, if present, is forced to run instantly in our secure space, providing operators with **concise forensic traces**.



- Detects emerging threats instantly
- ~1 second per analysis

Scientific Impact:

- Novel application of dynamic runtime analysis at scale
- Next-generation cyber defense

Broader Impact:

- Turns the tide by significantly raising the bar for the attacker
- Cuts through all the layers of randomized and obfuscated content, **illuminates intent of attacks**

Zeropoint Dynamics, LLC
http://www.zeropointdynamics.com
Contact: Kevin Z. Snow (kevin@zeropointdynamics.com)

CipherLocker

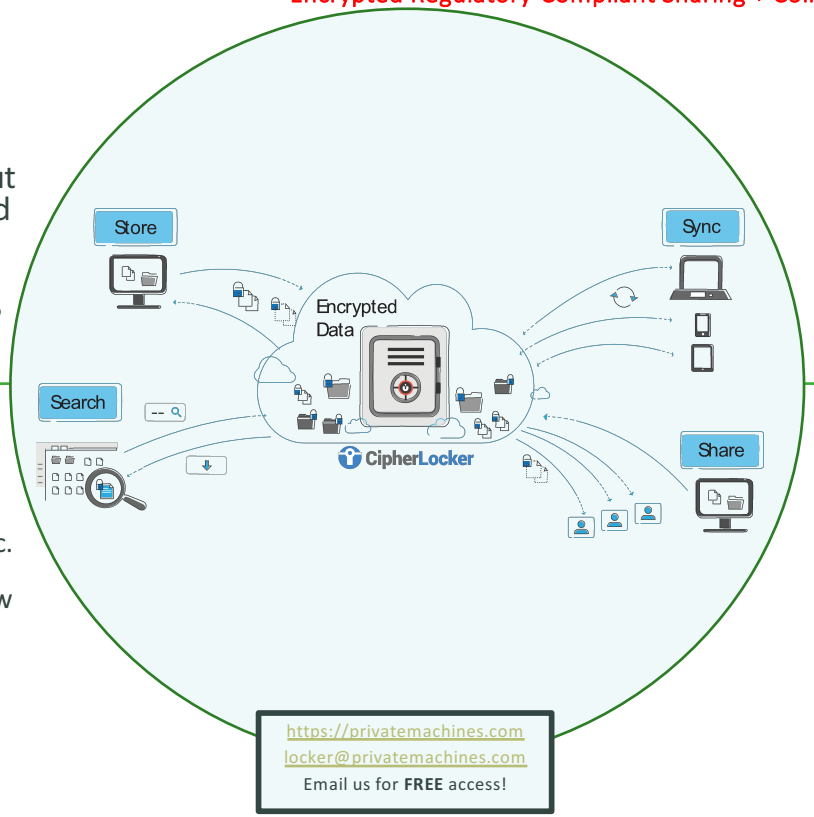
Encrypted Regulatory-Compliant Sharing + Collaboration

Challenge:

Sharing and collaborating without risk of data leaks and compromise. Regulatory compliant. NIST FIPS certified.

Solution:

Strong, transparent client-side encryption layer. Drag-and-drop share. Store. Share. Sync. Search. Everything encrypted on-prem. New innovative search on encrypted data technology.



https://privatemachines.com
locker@privatemachines.com
Email us for **FREE** access!

Scientific Impact:

Researchers and students participate and directly evaluate the platform in operation. Project sparks significant additional research into client-side driven security in cloud contexts.

Broader Impact:

Provide free secure storage to 24,500 students and 2,500 educators. Testbed for deploying secure protocols in a live environment. The project will train students and contribute to the creation of a skilled cyber-security domestic workforce available to fulfill our nation's needs.

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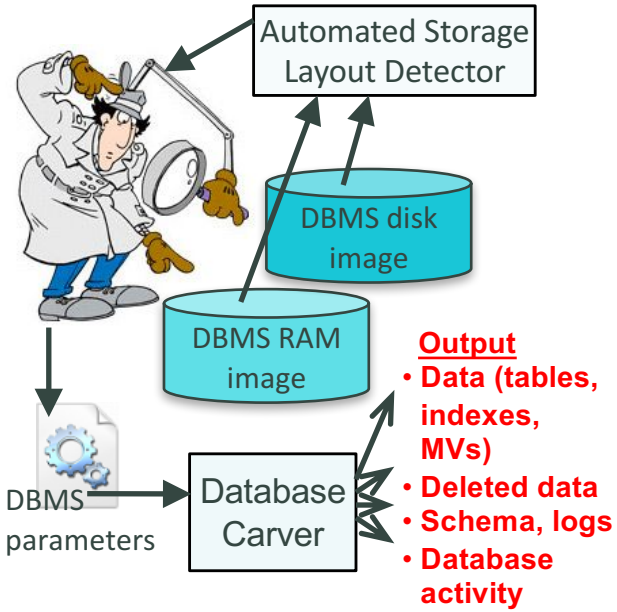
Database Reconstruction Kit: How to Capture all DBMS Data and Activity from any Disk or RAM Fragment

Challenge:

- Given an **incomplete** or **corrupt** storage with **unknown** database(s)
  1. Reconstruct **all data**
  2. Determine **database activity**

Solution:

- **Universal**, parametric model of byte-level DBMS storage
- Automate learning new DBMS parameters
- Reconstruct any storage fragment (disk or RAM)



Scientific Impact:

- A **unified** database storage model
- **Automating** reverse-engineering of DBs
- **Generalized** approach to database forensics

Broader Impact:

- Reconstruct database from **partial** or **corrupt** disk fragments or RAM
- **Determine if an attacker stole or tampered with data**

CNS Award #1656268

Alexander Rasin, Jacob Furst, Karen Heart (DePaul University)

Jonathan Grier (Grier Forensics)

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Project Activity #3: Interview CI Experts (Network/Security Engineers, SysAdmins, DBAs, CISO, CIO) on Needs and Willingness to try Later Stage Research

1. Interview NSF TTP cybersecurity awardees & future PI's
   - Determine who is ready to enter an applied research phase
   - Identify which PI's need a campus pilot or partner to test out the concept
2. Identify & interview potential R&E Practitioners re: interest in testing/applying the research
   - Approach Internet2 member universities to determine interest
   - Roles: CIOs, CISOs, IT staff
   - Identify cybersecurity gaps and needs, interest in approach, considerations
3. Interview SMEs in the TTP process to identify best practices and learnings
   - Federal Agencies & Programs including NSF SATC/CICI/CPS, DHS, CRI, SBIR/STTR, ICORPS, IU/CRC
   - University Vice Presidents of Research and Tech Transfer Offices

Project Activity #4: Enable TTP Matchmaking

1. Develop matchmaking opportunity for ready researchers and institutions
   - Identify R&E institutions interested in participating in NSF funded cybersecurity research
   - Engage CIOs and CISOs in the potential practitioner institutions to validate interest
   - Develop plan for matchmaking events
2. Develop portfolio of cybersecurity research ready to be applied in practitioner institutions
   - Assess cybersecurity research readiness for applied research in practitioner institutions
   - Classify and present research by category: e.g., Named Data Networking, Network Security, IoT, Smart Grid, HCLS
3. Assess best practices and determine if and how to leverage them
   - From DHS TTP, SBIR/STTR, Tech Transfer programs, industry, successful TTPs

Project Activity #5 and 6: Develop and deploy TTP matchmaking showcase events, workshops, webinars

1. Kickoff and input from Internet2 membership
   - Internet2 TechEx, Miami, FL: Kickoff, September 27, 2016
2. Webinars or workshops to showcase TTP research assets with potential R&E users
   - Internet2 Collaborative Innovation Community call and Input – October 2016, perhaps ongoing TBD
   - Internet2 events: Global Summit - April 2017, May 2018; TechEx - Sept 2016, Oct 2017
   - Other calls/events, w/agencies, organizations, regionally, CIOs/CISOs, ITANA (IT Architects iN Academia)
3. Webinars and workshops to provide researcher coaching for TTP success
   - Knowing when you are ready to transition to an applied research environment for user input
   - Other potential topics: clarity of value proposition of research tool/asset
   - Identify who can do the coaching and how best to provide it

Discussion

- Are you involved in Cybersecurity TTP work – with NSF or another agency?
- Do you have cybersecurity research on campus you know of that might be interested in a TTP matchmaking opportunity in the Internet2 community?
- Would you be interested in being an applied research user?
- What would you need to make the decision to apply cybersecurity research?
- If you have been involved in applying cybersecurity or other NSF research before, what was the experience, and what can we learn from it?
- What do you think the opportunities, challenges, best practices, and critical success factors are for TTP?
- What acceleration techniques, partnership models, and other forms of enablement do you think would improve the TTP process?

Please let us know your input, interest and pilot opportunities

- **Tuesday, Sept 27 TechEx Afternoon session to continue the discussion, 3:50-4:40pm "NSF Cybersecurity Transition to Practice Acceleration EAGER – CONTINUED"**

- Email us:
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