CYBER SECURITY DIVISION

2013 PRINCIPAL INVESTIGATORS'

Monitoring Database Management System (DBMS) Activity for Detecting Data Exfiltration by Insiders

Northrop Grumman Information Systems
Donald Steiner, PhD

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Homeland Security
Science and Technology

Team Profile

- **Northrop Grumman**: (Virginia) 68,000 employees, 50 States
  - Information Systems Sector → Cyber Solutions Division → Civil Systems Business Unit
    - Focus on Cyber Security, Emergency Management
    - Treasury/IRS, Dept. of State, Dept. of Homeland Security, Dept. of Justice, Health & Human Services, Texas, UK, New York City, London, Los Angeles, …
  - Dr. Donald Steiner, Principal Technologist and Technical Fellow
    - PhD Mathematics, Iowa State University
    - Data Management & Analytics, Cybersecurity, Cloud Computing
    - Manager Northrop Grumman Cybersecurity Research Consortium
    - 20 years applied research & development in Artificial Intelligence, Multi-Agent Systems
- **Purdue University**: (Indiana) 3,000 staff, 39,000 Students
  - Center for Education and Research in Information Assurance and Security (CERIAS): 81 faculty led by Dr. Eugene Spafford
  - Prof. Elisa Bertino, Director of Research at CERIAS
    - Fellow of the IEEE and Fellow of ACM
    - Distinguished awards for contributions to database systems, database security, advanced data management systems, and secure distributed systems.
    - Relevant publications
      - Bilal Shebaro, Asmaa Sallam, Ashish Kamra, Elisa Bertino: *PostgreSQL anomalous query detector*. EDBT 2013: 741-744
      - Elisa Bertino: *Data Protection from Insider Threats*. Synthesis Lectures on Data Management, Morgan & Claypool Publishers 2012

Customer Need

- DBMS = ?
  - Database Management System OR …
  - Detect Behavior by Manning and Snowden
- Data Exfiltration = Unauthorized removal of data from the enterprise
  - Lots of ways this can happen (humans and software)
- Goal: Detect and alert on data exfiltration attempts as early as possible
  - Before the horse leaves the barn

Approach

- Monitor user interaction with database systems for anomalous behavior
  - Most data on databases, file systems, etc.
  - Equally applicable to other data storage systems (Hadoop, …) and applications accessing such systems
  - Not local applications (Excel, Access, …)
- Project Flow (over 3 years)
  - Core research at Purdue University → Proof of Concepts
  - Transition at Northrop Grumman → Prototypes, Evaluation
    - Evaluation & Testing through Red-Team/Blue-Team
  - Operational Pilot at TBD

Benefits

- Detection and alerting in real-time
  - Immediate intervention if necessary
- Low-cost integration with existing infrastructure

Competition (optional)

- Improvement to:
  - Existing database monitoring systems
  - User monitoring systems
  - Network monitoring systems
  - Computer monitoring systems

Current Status

- Just started (5 business days ago)
  - Getting project up and running

Next Steps

- Requirements
  - Conceptual / Research
  - Development / Deployment
  - Testing
- Research
  - Assumption: Exfiltration causes an anomalous state that can be distinguished from the legitimate actions executed in a DBMS system.
  - Identify the events that represent signs of cyber-insider actions:
    - *"How do we define and identify user queries that are anomalous?"*
    - *"Which data sources does an insider target?"*
    - *"What information should be collected to detect such actions?"*
  - Build accurate DBMS access profiles
    - Use Role Based Access Control (RBAC) model
  - Detect Anomalous User Behavior
  - Detect Anomalous Events
    - Build repository of relevant DBMS log & SQL events
    - Analyze the events and detect anomalous events that raise alarm flags

Contact Information

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