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Protecting Communication Networks, Devices, and their Users: Technology and Psychology

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Outline

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1. “Security” WP (WP6) overview
2. Projects, challenges
3. Theoretical and practical results
4. One important outcome

Brief History

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- Cross-WP activity in FI 1st phase (FI-1)
  (led by Mikko Särelä of Ericsson, Sasu Tarkoma of TKK)
- WP with three activities in FI-2:
  - Unwanted Traffic
  - Anomaly Detection
  - Trust, Reputation and Management of Credentials
  (1.6.2009 – 31.12.2010, led by Mika Rautila of VTT)
- WP with three activities in FI-3:
  - Botnet Problem
  - Data Analysis for Information Security
  - Understanding and Designing Security Experience
  (1.4.2011 – 31.3.2012)

Partners

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- Stonesoft
- Aalto/HIIT, ICS, CSE
- VTT
- F-Secure
- NSN
- TUT
- Nokia
- UH
- Ericsson

WP6 in FI-2

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- High diversity in the plans:
  - Malware and targeted attacks detection and prevention
  - Security for Cloud Computing
  - Manipulation-resistant robust reputation systems
  - Trust between devices and entities in data networks
  - Data access authorization rules and key management
- Selected results and advances:
  - Detecting botnets through anomalous use of network services; identifying Command and Control traffic
  - Security anomaly visualization for a network intrusion detection system, feature selection
  - Call graph-based analysis of executable files
  - UI prototype for collecting feedback and presenting reputation information on widgets and their developers

Moving to FI-3

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- Due to smaller allocations, fewer directions and partners, narrower focus
- Greater effort to implementing and testing methods and algorithms:
  "Milestones" defined as prototypes and production system integrations
- Core areas are:
  - Data analysis for recognizing malicious objects and activities
  - Role of humans in security systems; visualizations
  - Security-related User Experience

WP6 Projects in FI-3

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- Botnet techniques and botnet characterization and detection approaches (Stonesoft, HIIT)
- Network-based intrusion detection, role of security officer (NSN)
- Classification and clustering for detecting malicious files by their static and dynamic features (Aalto/ICS, F-Secure)
- Study of user perception and experience of security (HIIT, F-Secure)
- Comparative evaluation of UX for security products (TUT, F-Secure)
- Security events visualization (Stonesoft)

Fighting Botnets

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- Analyzing botnet techniques and vulnerabilities used by botnet writers
- Fingerprints for identifying botnets
  - Based on communication:
    - between bots within a botnet
    - between bots and “Command and Control” (C&C)
    - from bot to drop zone
  - Based on popular exploits
- Botnet detection techniques
  - DPI of malicious payload or C&C communication
  - Port scanning detection
  - Detecting outgoing spam messages
  - Domain flux analysis (number of DNS requests, mostly failed)
  - Detecting HTTP requests in “click fraud” cases

Network-based Intrusion Detection TiViT

- High-level goals:
  - Select “right” features for monitoring and analysis
  - Keep false alarms level low
  - Make analysis results understandable for security officers
  - Ensure that analysis speed scales for high traffic volumes
- Several Master Thesis works towards the goals:
  - “Traffic analysis for intrusion detection in telecommunications networks” on feature selection for specified threat scenarios
  - “Graphical user interface for intrusion detection in telecommunication networks” on GUI concept and prototype for security anomaly visualization in telco networks
  - “Graph-based clustering for anomaly detection in IP networks” on NodeClustering, a fast and simple anomaly detection method
  - “Selective Flow Distribution for Network-based Intrusion Detection Clusters” on an NIDS cluster load balancing system

UX of Security Products

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- Comparative evaluation of user experience of several major Internet and mobile security products
  - Development and testing of a process for evaluating security software user experience
  - Usability and security experts were involved in discovering usability problems and suggesting solutions
  - Comparative results were used to find differentiating factors
- Examples of findings:
  - Warnings in risky situations require understandable words
  - Warning dialogs needed before dangerous changes are applied
  - All evaluated warning flyers diminish too quickly
  - Windows built-in warning appears at the same time

Security Experience

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- A user study on how end users perceive and experience security in connection with support calls dealing with security issues
  - Run in collaboration with a local teleoperator
  - Individual interviews with support call specialists
  - Focus group with a group of support call specialists
  - Analysis of randomly selected support calls on security
  - Pair interview with support call specialists to check the findings
- Examples of findings:
  - Security support calls have an essential part in how users try to manage their security
  - Security problems are often confused with device- or network-related ones - problems are often associated with security
  - Constant safety concerns are a major cause for security support calls

Security Events Visualization

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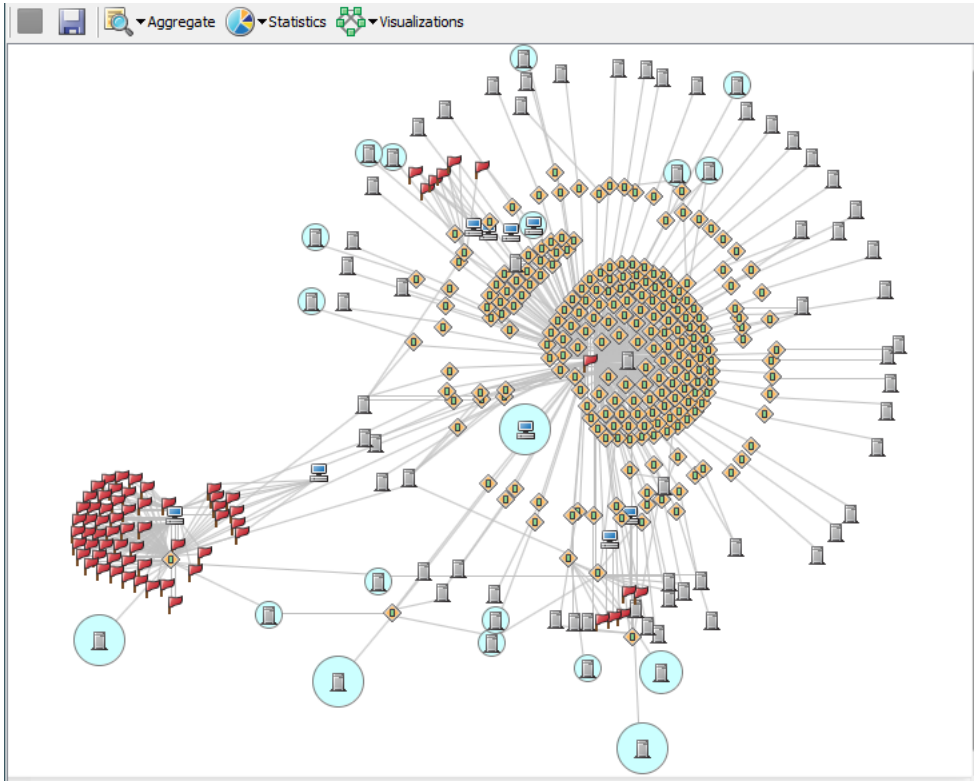
- Multiple views supported
- Non-deterministic layout algorithm (Kamada-Kawaii)
- Hoovering and zooming
- Drill-in features
- Event normalization
- Aggregation logic for better scalability
- Potential in security device configuring



Research results

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- As more time went to implementations, the number of publications was modest in WP6 FI-3:
  - Two conference papers published
  - One conference and one journal papers submitted
  - Five University theses (Aalto, TUT)
  - Two conference papers will be submitted in June

Implementations Presented

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- Classification and clustering methods for identifying malware run in F-Secure's Security Labs
  http://www.slideshare.net/tivit/tivit-interactive-10185532
- Security logs visualization functionality integrated with StoneGate SMC product
  http://www.slideshare.net/tivit/tivit-interactive-log-visualization

Observations and Thoughts

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- Investing in “strategic research” and long-term commitments are hard for many industrial partners
- Challenging to pursue both “breakthrough results” and “research to lead to new business”
- Most of work done as two- or even one-party projects
  Working out wider collaborations requires time and effort
- Relatively short funding periods make it tough to keep key personnel at academic partners

“Data to Security” Ecosystem

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- An idea of uniting network and device views:
  - Analyzing network traffic, files, scripts, …
  - Was discussed within the FI program, is becoming a reality now, as a “business pilot ecosystem”
- All the FI-3 WP6 industrial partners are involved: Stonesoft, NSN, F-Secure
- New partners: Elisa, EXFO NetHawk
- Protecting ISP and MNO networks by sharing information from network equipment, end-user devices, and backend analysis systems
  In particular, to deal with botnets

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Thank you

www.futureinternet.fi

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