CYBER SECURITY DIVISION

2013 PRINCIPAL INVESTIGATORS’

Human and Technical Security (HATS)

Indiana University

Jean Camp

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Homeland Security

Science and Technology

Team Profile

- **Indiana University**
  - – Principal Investigator: Jean Camp
  - – Doctoral Researchers: Zheng Dong, Greg Norcie, Vaibhav Garg
  - – Research Programmer: Constantine Murenin

- **USC Information Sciences Institute**
  - – Principal Investigators: John Wroclawski and Jim Blythe
  - – Doctoral intern: Shirin Nilizadeh

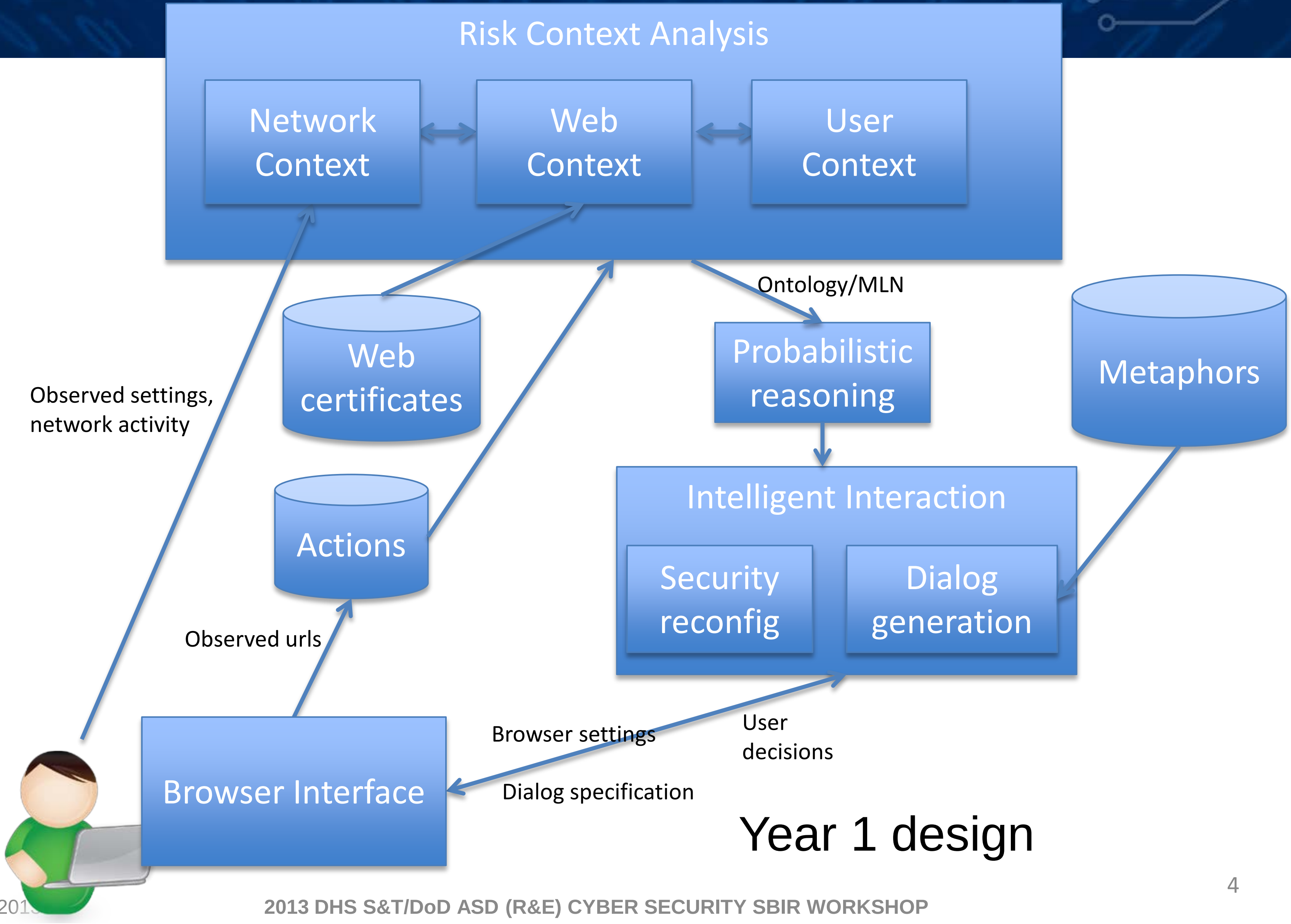
Customer Need

- Non-expert human decisions play a role in many cases of security failures.
- Improving communication, decision-making, and tool usability will have a large impact on security.
- People need security that fits: personalized, customized, and appropriate for the context.
  - Contexts: banking, work, high risk
  - Mental models: violent crime, mischievous vandals, bad neighborhoods, organized crime.

Approach

- HATS models the user and context to tailor communication
  - Tracks risk context to help identify problems and guide communication
  - Decision-theoretic reasoning about when and what to communicate
  - Tailors risk communication with mental models
  - Coordinates response through automation

Architecture of Approach



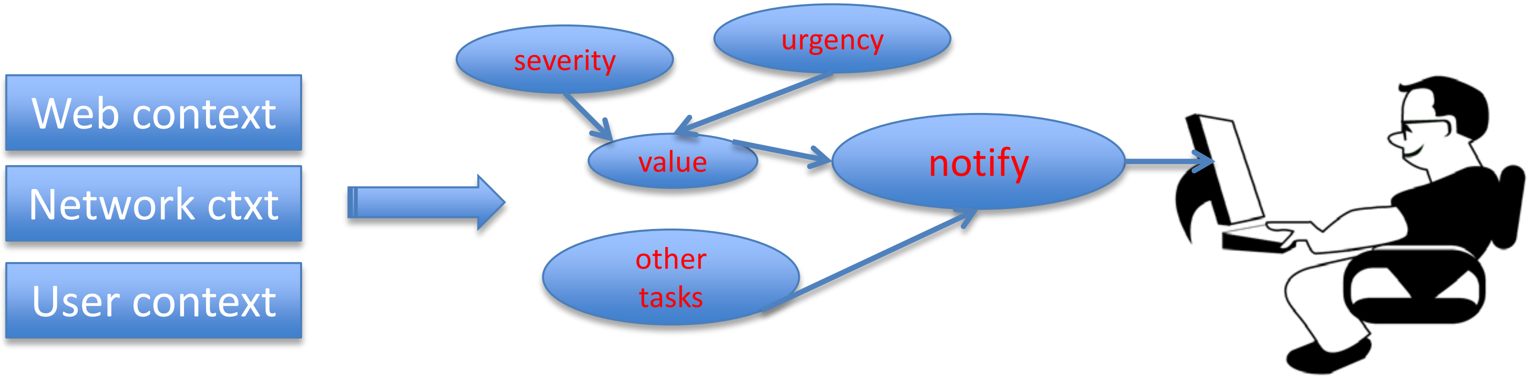
Year 1 design

Approach: Web Context

- Built learned models of web certificates, applied in real time for web context
  - Complements red/green lists approach
  - Sorting into banks, 6 large banks, phishing, rogue, other
  - Can classify and identify uncertainty in classification
  - URL history reputation system

Approach: Probabilistic Fusion

- Overall risk picture combines uncertain data from network, web and user contexts
- Use decision theory to decide when and how best to act and how to involve the user
- Markov logic network: uses human-readable rules, but compiles to a fast, optimal Bayesian network



Web context

Network ctxt

User context

severity

urgency

value

notify

other tasks

Approach: Mental Models

Your Actions are Risky

Stop download

Your Property Is At Risk

Do Not Put Information Into This Site

Mischievous Vandals Here

Wait While We Protect Your Machine

Physical Threat – High Risk!

Do Not Connect

Benefits

- Involve the user in decision making when appropriate and with understandable information
  - Risk illustration, action, risk escalated or resolved
- High security defaults, simple to override, personalized to individual and context.
- Machine learning approach allows updating responses to emerging threats
- Off-the-shelf tools can be coordinated through the mental model

Competition

- Products
  - – Everbank password reuse prevention
  - – Custom security configuration and audit
- Research
  - – Other usable security research groups
- Open source
  - – Certificate pinning
  - – No script

Current Status

- Key components of HATS prototype developed
  - Built learned models of web certificates, applied in real time for web context
  - Mental models identified, warnings designed
  - Implemented ontology and probabilistic reasoner for context fusion and interaction

Next Steps

- User testing will quantify benefits and data will fine-tune mental models approach
- Build out risk context: *e.g.* update user context from responses and integrate resources from related projects
- Web certificate next steps
- Porting to easily deployable real-time tool

Technology Transfer Activities

- Off the record all-day meeting at Indiana University
  - Potential users/tech transfer targets represented
    - Microsoft, Mozilla, Apple, Goldman Sachs
  - others represented
    - Tor, ISOC, CAIDA

- Industrial outreach
  - Microsoft Research – ongoing certificate analysis discussions, project intern, speaking invitation
  - Google via integration with Mozilla
  - Tor: https everywhere, certificate sharing

- Placed doctoral students in industry
  - PARC
  - Microsoft
  - Big Switch

Contact Information

http:// UsableSecurity.net

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