Situational Awareness for Cybersecurity

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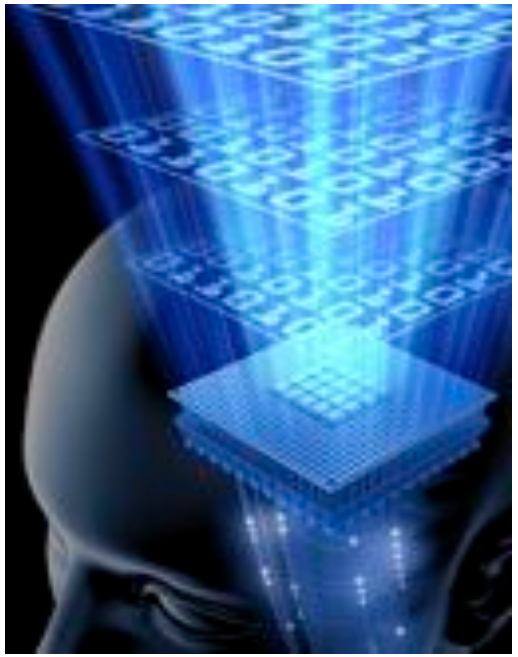
21 October 2011

http://ebiq.org/r/327

Situational Awareness



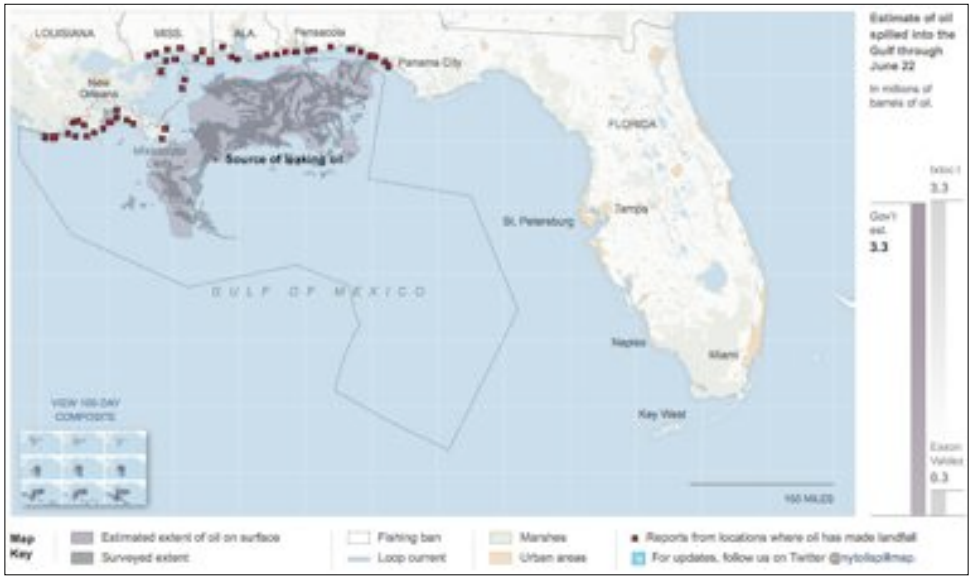
- Awareness of what's happening around you to understand how information, events, and actions will impact your goals & objectives, now and in future
- A common theme in as we become more *instrumented* and *interconnected*

  Cybersecurity, cyber-physical systems, hot conflicts, homeland security, disaster relief, health-care, IT services, network operations & management …
- Applies to people, smart interfaces, sensors, AI, wireless networks, embedded systems, streaming data, image processing, SIGINT, HUMINT, smartphones, etc.
- Challenges for distributed, dynamic & interconnected systems

Current work at UMBC

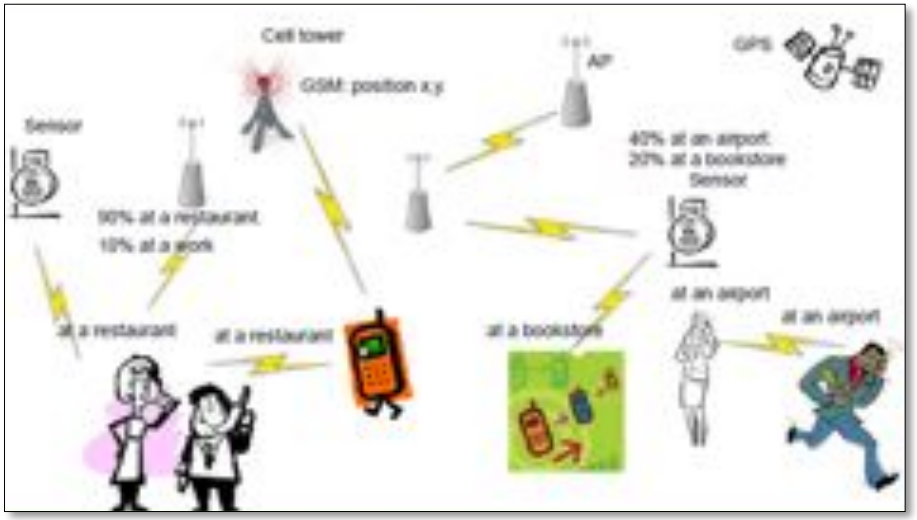
- We're exploring building situationally aware systems at UMBC
- I'll briefly touch on examples for social media and mobile computing
- Then describe some ongoing work for cybersecurity supported by Northrop Grumman

E.g.: Response System for Gulf Oil Spill (NSF)

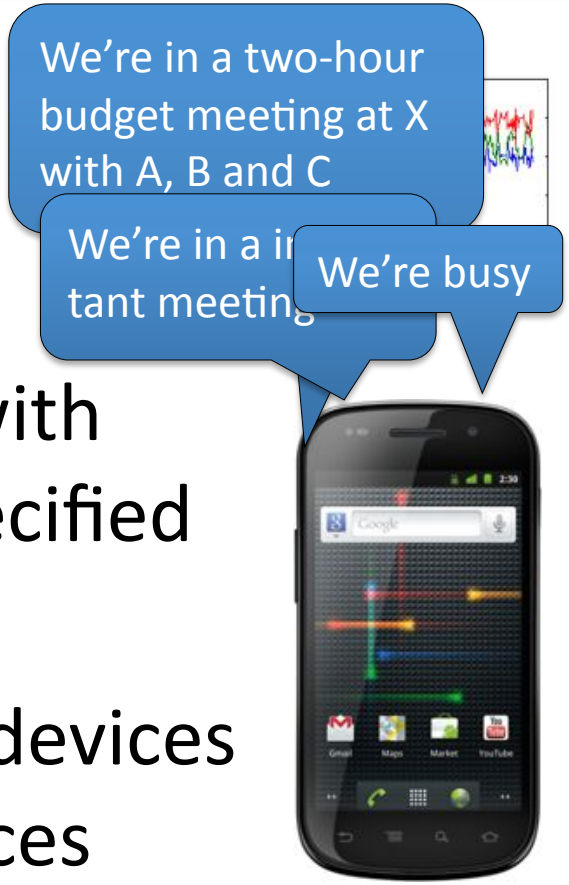


- Mine data from *social media* to improve oil spill trajectory model used by NOAA Emergency Response Division
- Used surface winds, currents, oil spill rates, boundary locations, oil dispersion, type of oil, diffusion coefficients, drift velocities, etc.
- Coupled with atmospheric, hydrologic and storm surge models
- Performed regressions, fishery impacts, animations

E.g.: Smartphones sharing context



- Platys is an $1.8M NSF project with Duke & NCSU
- Sensor-rich android phones learn to recognize their user's context: what, who, where, when, how …
- Information is shared securely and with appropriate detail following user specified privacy policies and context
- The shared information helps other devices learn faster and provide better services



Pre-facto threat/vulnerability detection and monitoring

IT Security & Network Security News

Duqu May Have Targeted Certificate Authorities for Encryption Keys

Script Kiddies Strike Again: USA Today Twitter Account Hacked

By Chloe Albanesius | September 26, 2011 12:55pm EST | 0 Comments | Email | Print

2 | Share 5 | Tweet 29 | Share 6 | Digg | Submit

Sponsored by DHS National Cyber Security Division/US-CERT

NIST National Institute of Standards and Technology

National Vulnerability Database

automating vulnerability management, security measurement, and compliance checking

Fox News Politics Twitter Account Hacked, Disturbing Tweets Appear

First Posted: 07/ 4/11 12:15 AM ET | Updated: 07/ 4/11 03:23 PM ET

SHADOWS IN THE CLOUD:

Investigating Cyber Espionage 2.0

Tracking *GhostNet*:

TODAY @ PCWORLD

Sony Makes it Official: PlayStation Network Hacked

by Keir Thomas, PCWorld Apr 23, 2011 7:35 AM

SA Time: Thu Oct 20 2011 18:22:29 GMT-0400 (EDT)

Stuxnet successor on the loose?

October 19 2011 at 09:09pm

Computer virus hits US Predator and Reaper drone fleet

By Noah Shachtman, wired.com | Published 12 days ago

Our Approach

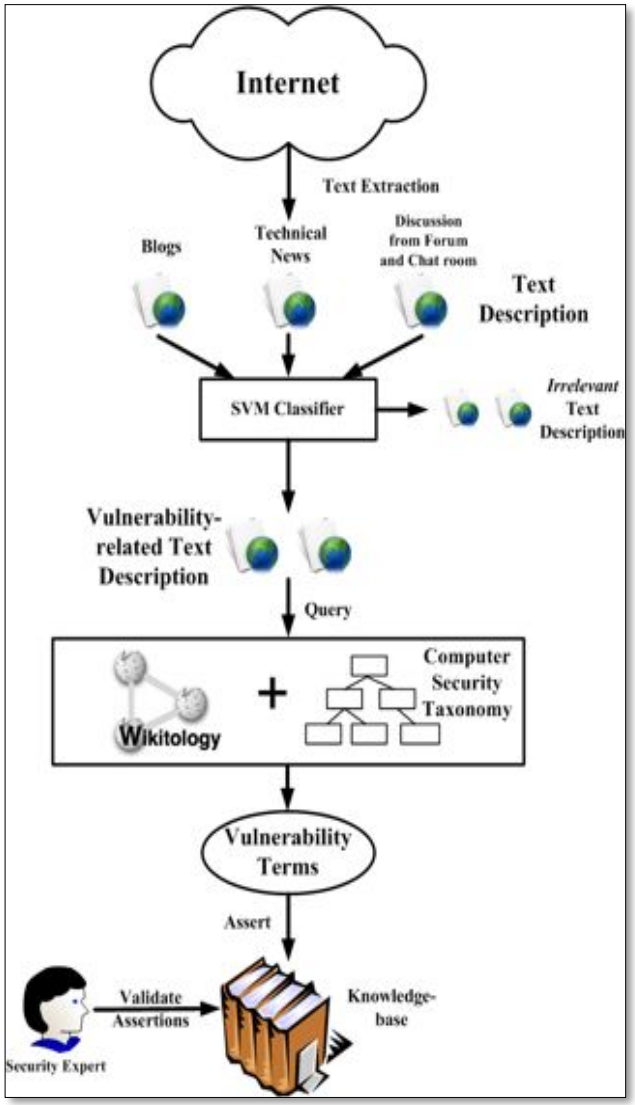
1. Detect *potential* new vulnerabilities from Web descriptions and discussions, extract information and map to IDS KB [ebiq.org/p/540]

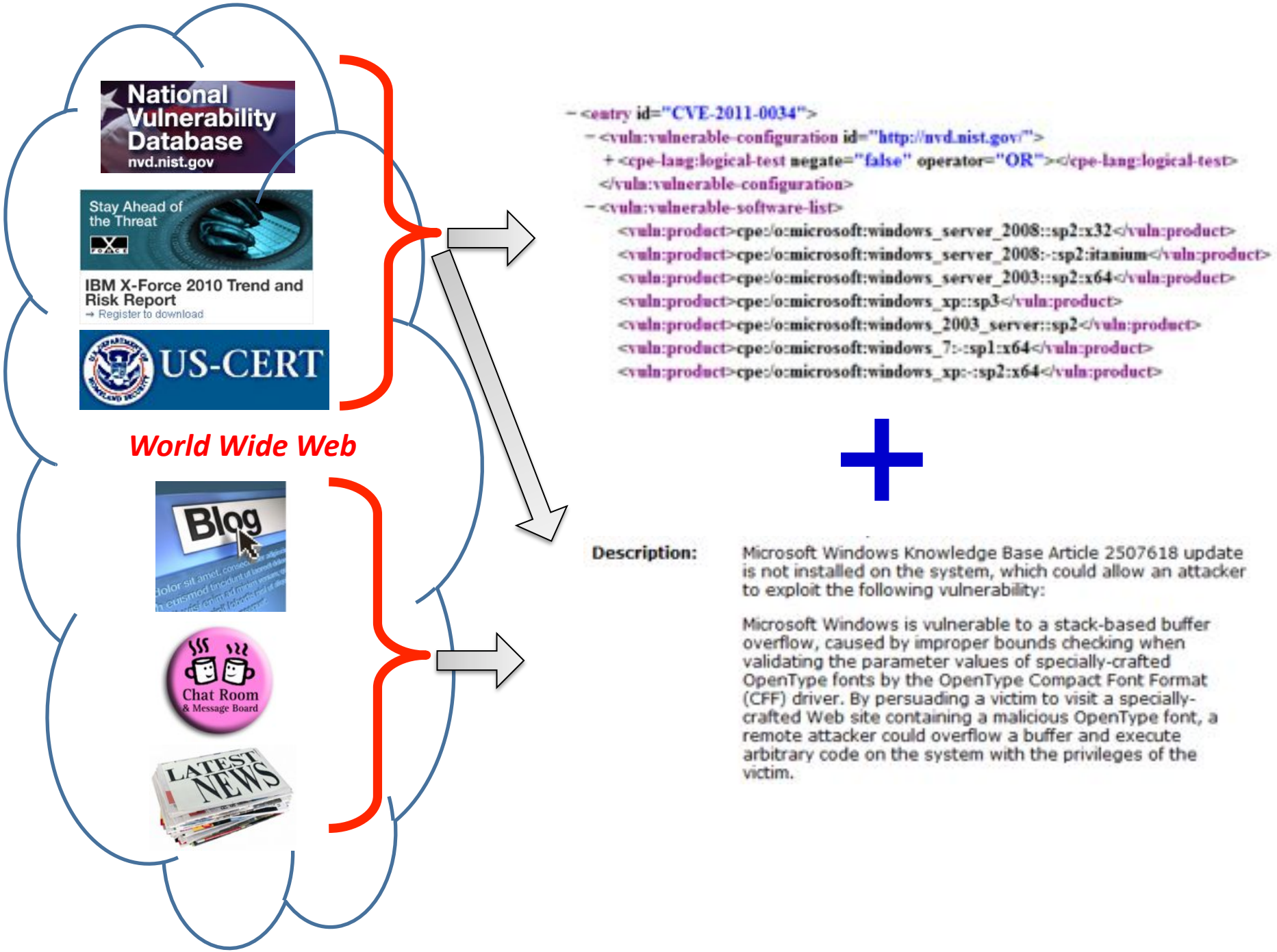
2. Recognize *potential* attacks and intrusions in data from low level intrusion detection systems and map to IDS KB [ebiq.org/p/63]

3. Integrate and reason over results of (1) and (2) to identify *actual* attacks [ongoing]

1 Tracking Security Vulnerability Info

- Working with Northrop Grumman on system to discover new software vulnerabilities and track their spread and evolution
- Use human language technology, machine learning and cybersecurity knowledge bases to extract, evaluate and fuse structured information from Web, chat rooms, and social media
- Prototype automatically adds to, updates and maintains a structured knowledge base




National Vulnerability Database
nvd.nist.gov
Stay Ahead of the Threat
IBM X-Force 2010 Trend and Risk Report
→ Register to download
US-CERT
World Wide Web
Blog
Chat Room
& Message Board
LATEST NEWS
- <entry id="CVE-2011-0034">
- <vuln:vulnerable-configuration id="http://nvd.nist.gov/">
+ <cpe-lang:logical-test negate="false" operator="OR"></cpe-lang:logical-test>
</vuln:vulnerable-configuration>
- <vuln:vulnerable-software-list>
<vuln:product>cpe:/o:microsoft:windows_server_2008::sp2:x32</vuln:product>
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<vuln:product>cpe:/o:microsoft:windows_server_2003::sp2:x64</vuln:product>
<vuln:product>cpe:/o:microsoft:windows_xp::sp3</vuln:product>
<vuln:product>cpe:/o:microsoft:windows_2003_server::sp2</vuln:product>
<vuln:product>cpe:/o:microsoft:windows_7:-:sp1:x64</vuln:product>
<vuln:product>cpe:/o:microsoft:windows_xp:-:sp2:x64</vuln:product>
Description:
Microsoft Windows Knowledge Base Article 2507618 update is not installed on the system, which could allow an attacker to exploit the following vulnerability:
Microsoft Windows is vulnerable to a stack-based buffer overflow, caused by improper bounds checking when validating the parameter values of specially-crafted OpenType fonts by the OpenType Compact Font Format (CFF) driver. By persuading a victim to visit a specially-crafted Web site containing a malicious OpenType font, a remote attacker could overflow a buffer and execute arbitrary code on the system with the privileges of the victim.

Ex: input and extracted knowledge

http://en.wikipedia.org/wiki/Buffer_overflow

Manufacturer + Product + Version

Buffer overflow in Fax4Decode in LibTIFF 3.9.4 and possibly other versions, as used in ImageIO in Apple iTunes before 10.2 on Windows and other products, allows remote attackers to execute arbitrary code or cause a denial of service (application crash) via a crafted TIFF Internet Fax image file that has been compressed using CCITT Group 4 encoding, related to the EXPAND2D macro in libtiff/tif_fax3.h.

http://en.wikipedia.org/wiki/Denial-of-service_attack

```
@prefix dbpedia: <http://dbpedia.org/resource/> .
@prefix ids: <http://ebiquity.org/ontologies/cybersecurity/
ids/v2.0/ids♯ > .
[a ids:Vulnerability;
 ids:hasMeans dbpedia:Buffer_overflow;
 ids:hasConsequence dbpedia:Denial-of-service_attack].
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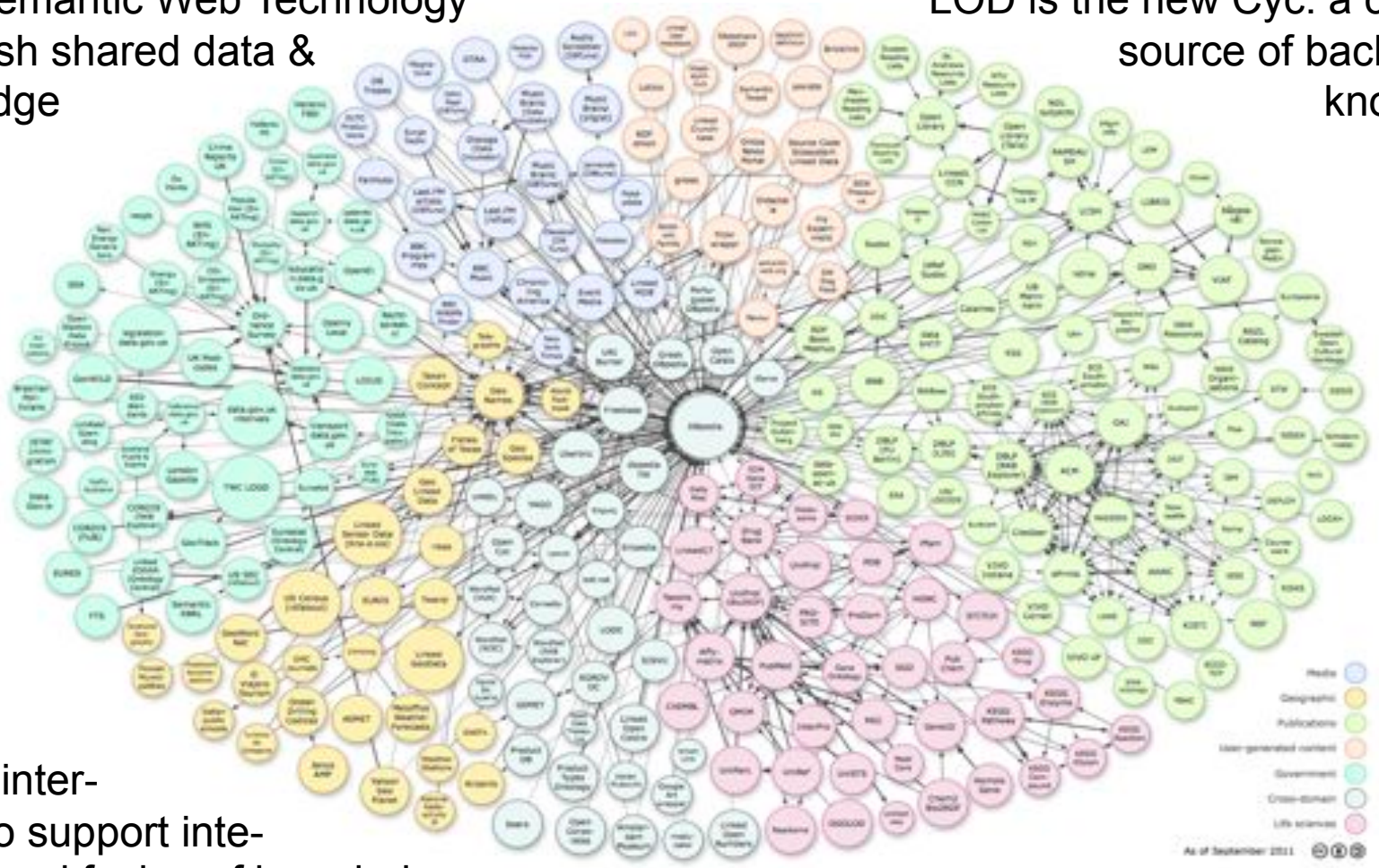
Knowledge represented as OWL semantic web data

Linked Open Data Cloud 2007-11

Uses Semantic Web Technology to publish shared data & knowledge

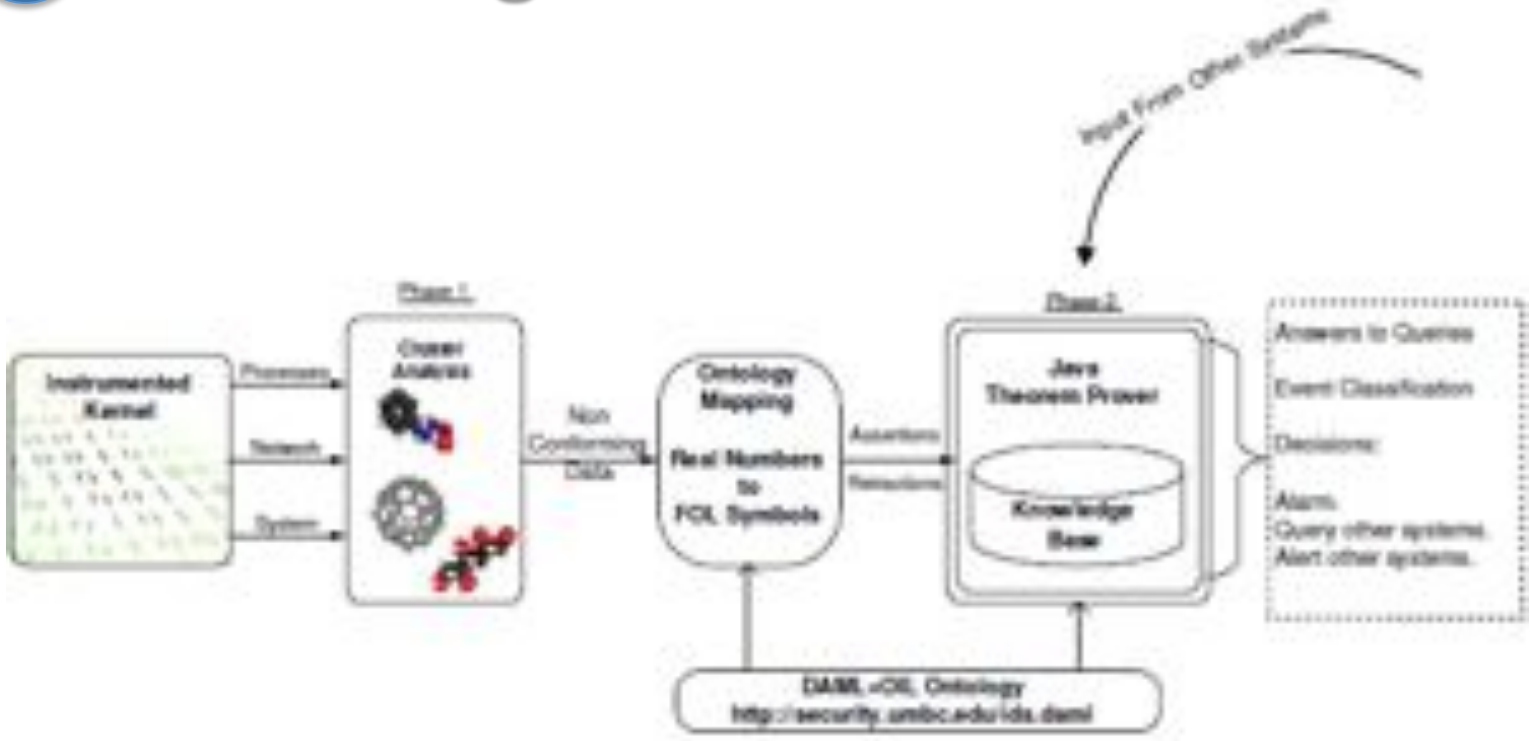
LOD is the new Cyc: a common source of background knowledge



Data is inter-linked to support inte-gration and fusion of knowledge

2011: 31B facts in 295 datasets interlinked by 504M assertions on ckan.net

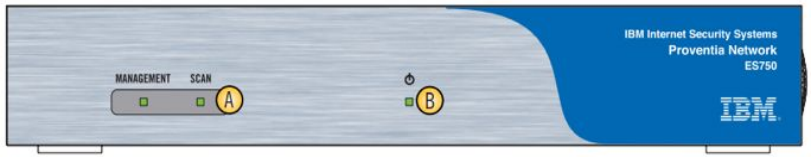
2 Knowledge-based intrusion detection

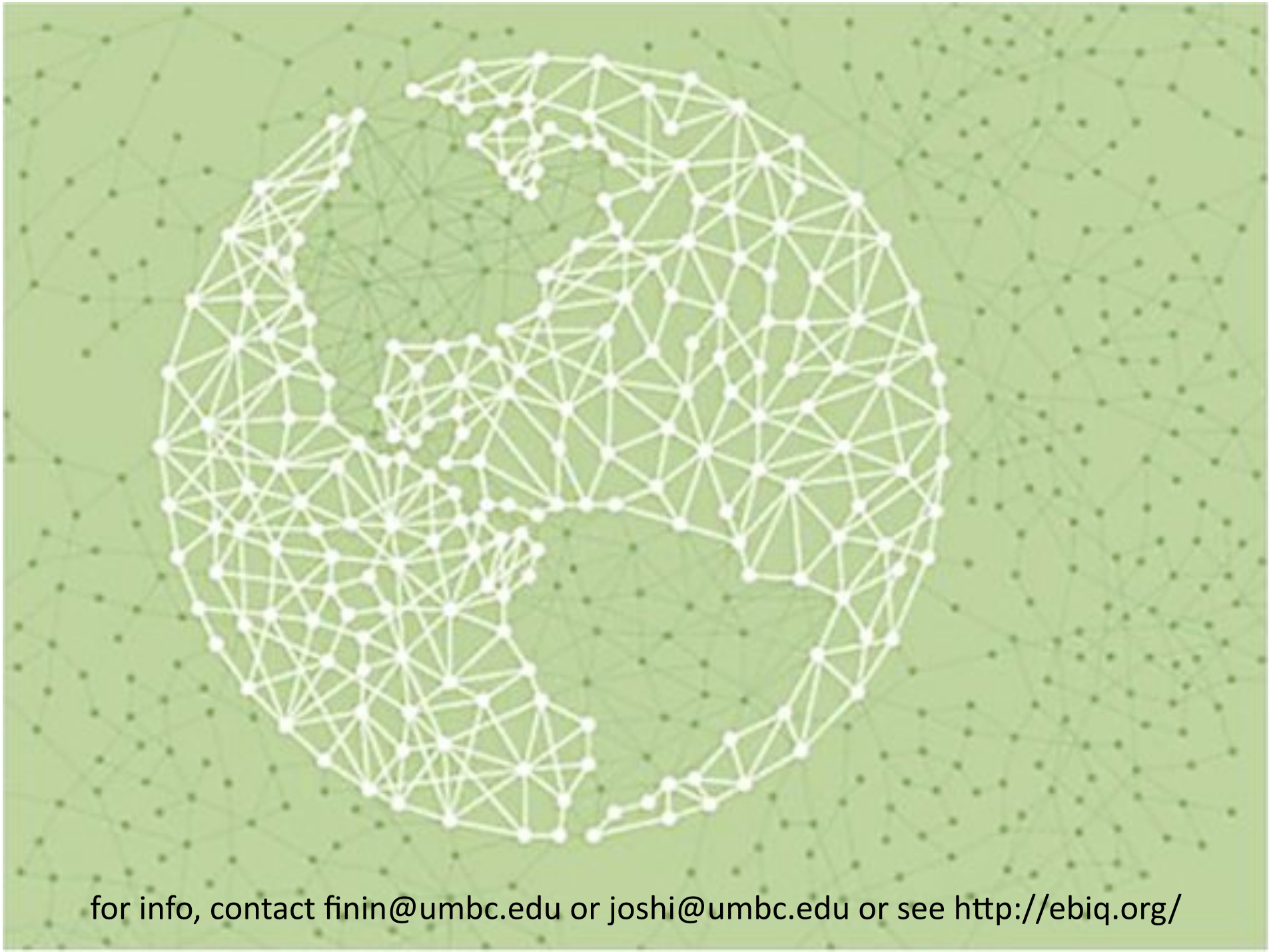


- Low level system data is compared to a model of the quiescent state
- Nonconforming data modeled in an *IDS ontology* and reasoned over to predict potential attack type
- Undercoffer, 2003, 2004

3 Integration, reasoning & prediction

- Update the IDS ontology & populate with data from NVD, CERT and NGC resources
- Improve and deploy cybersecurity information extraction prototype
- Integrate into the Linked Open Data cloud to exploit background knowledge
- Ingest low-level data from IBM Proventia Network Enterprise Scanner ES 750
- Evaluate in our UMBC lab environment to identify potential attacks

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