We hit "glass ceiling(s)" years ago! Blackhats are winning unless we change!

Dr. Ulrich Lang, CEO
ulrich-lp@objectsecurity.com
650-515-3391
ObjectSecurity LLC

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Clarifications

- "Glass ceiling(s)" (in this talk): Invisible difficult barriers some stakeholders put in place that prevent others from progressing
- Controversial! Don't like it? – that's ok!
  - *Disclaimer: Much of this is a high-level discussion of the speaker's personal views, not a technical presentation with immediate "take-home" tools*

Presentation Outline

- Problem: Cyber security & privacy progress is too slow
- Case study: ObjectSecurity OpenPMF
- Who's "fault" is it?
- What "solutions" do we have?

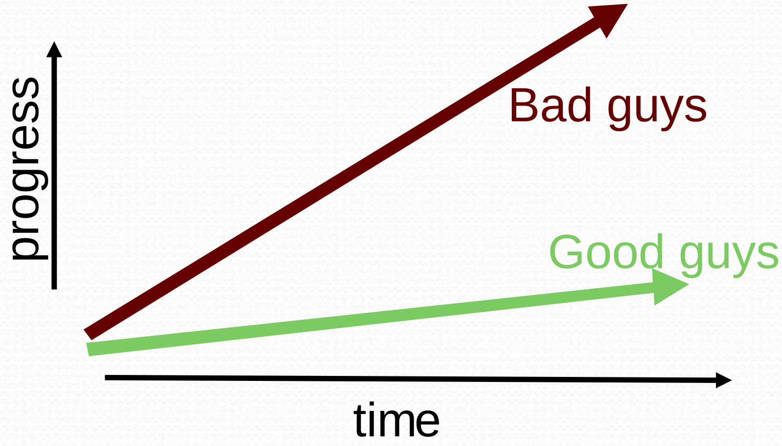
Dr. Ulrich Lang
CEO & Co-founder, ObjectSecurity
InfoSec PhD (Cambridge), & Master's (RHUL London)
CSA SV chapter board member, blogger, 5 patents,
>150 publications/presentations, book author, expert witness, …

Problem

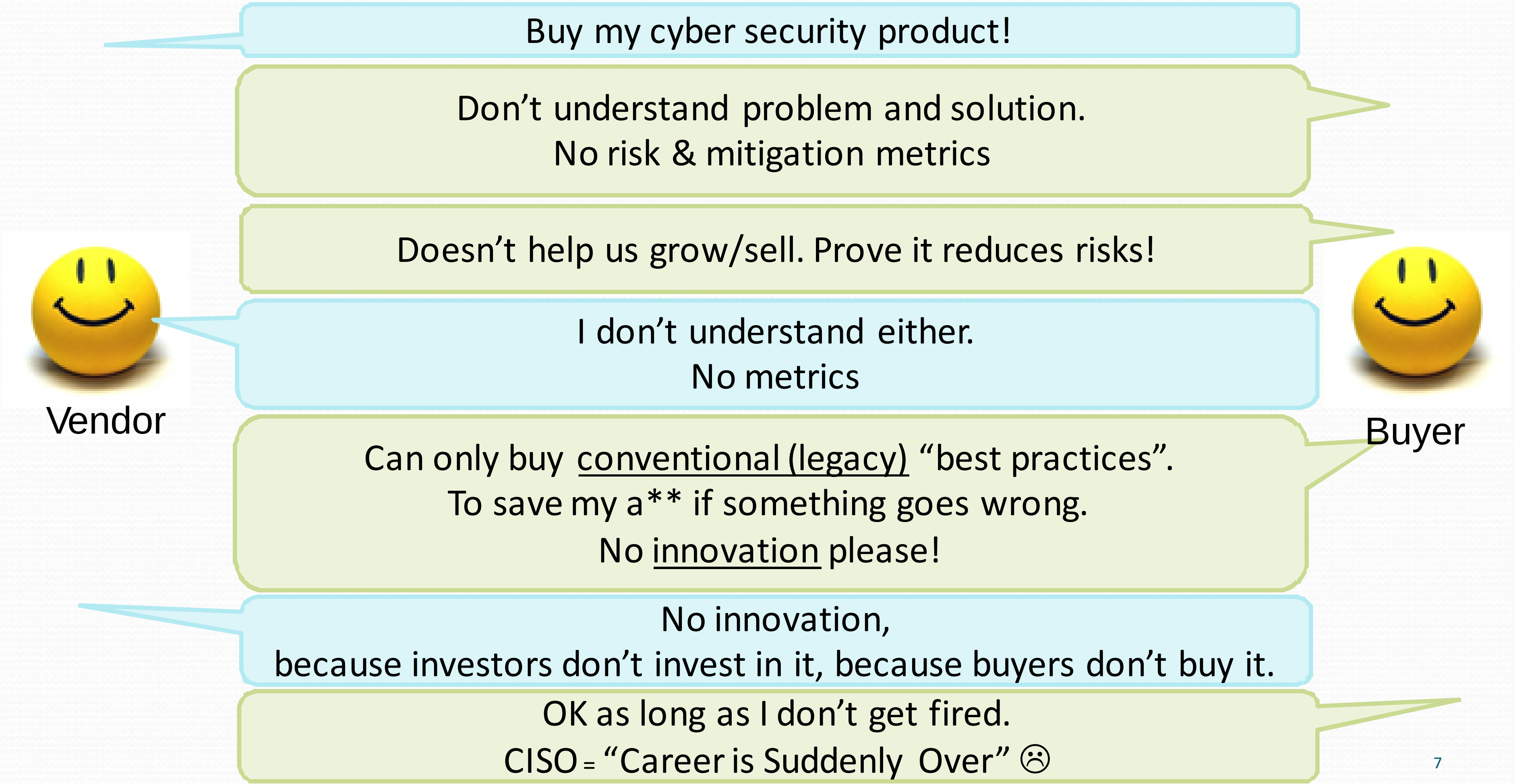
Cyber security & privacy progress is too slow
to keep up with the attackers

Let’s define the problem

- cyber security ecosystem is progressing too slowly
- few game-changers find adoption:
  - e.g. ABAC?, micro kernels?, privacy avatars? “good guys”: severe constraints (economic and otherwise)
- “bad guys”: better working ecosystem, and smaller problem to solve)
- how to break through the vicious cycle?



A cynic’s guide to cyber security selling (excerpt)



Buy my cyber security product!

Don’t understand problem and solution.
No risk & mitigation metrics

Doesn’t help us grow/sell. Prove it reduces risks!

Vendor

I don’t understand either.
No metrics

Buyer

Can only buy conventional (legacy) “best practices”.
To save my a** if something goes wrong.
No innovation please!

No innovation,
because investors don’t invest in it, because buyers don’t buy it.

OK as long as I don’t get fired.
CISO = “Career is Suddenly Over” ☹

“Market failure” defined

- definition:
  - inefficient allocation of goods/services
  - based on pure self-interest
  - can be improved from a societal point of view
- causes:
  - time-inconsistent preferences, information asymmetries, non-competitive markets (market power), principal–agent problems, externalities, or public goods
- Interventions:
  - self-regulatory organizations, governments or supra-national institutions

(roughly based on w ikipedia definition)

Market failure: cyber security

- Intractable: can’t quantify the problem or the solution
  - problems: attack vectors? risk/impact metrics?
  - solutions: reliable success metrics?
- Incomprehensible:
  - problems: do buyers understand? Do they want to know?
  - solutions: Can vendors make buyers understand the solutions? Do vendors know 100%?
- Information asymmetry seller-buyer

Market failure: cyber security

- Hard-to-quantify value: “negative sell”, unclear effectiveness
- Lack of accountability: product disclaimers etc.
- Externalities: Buyer often not the affected stakeholder
- Fewgood damage metrics:
  - e.g. cost of data breach from Verizon and Ponemon
  - Do you still shop at Target, Home Depot etc.?
- Security trade-off: Security often slows down systems, decreases usability, etc.

Market failure: cyber security

- Attacker-defender asymmetry: Attacker only needs to win once, defender every time
- Doomsday narrative & industry direction:
  - Former Plan B (detection/remediation of sh** already going down) now often Plan A (i.e. first line of defense) ☹
    - “Prevention doesn’t work”, “remediation is the new prevention”, “continuous monitoring is the best defense”, “response and recovery”…
  - Compliance instead of security: paper-shuffling with % cooked up

Stopping here, but there is more…

Attackers

- Profit-driven cyber criminals
- Nation-states
- Malicious or accidental insiders
- Hacktivists
- …

Who’s “fault” is it?

Which stakeholders do what, and what is the effect?

the user’s fault?

- often the damaged stakeholder
- often not the buyer
- will usually not “vote with their feet”
  - can’t determine security quality, security need, vendor lock-in

The buyer’s fault?

- often don’t care
  - because unclear ROI, benefits, metrics, no interest/time
- often do minimum required to meet compliance
  - because of (perceived) unclear ROI
- often cannot adopt innovative security due to constraints
  - technical, financial, organizational, operational, cultural, educational, risk appetite (ironically!), personal risk

The vendor's fault?

- cannot commercialize disruptive cybersecurity -> won't sell
- incumbent security vendors/primes/integrators can reduce/defer their own cost and risk by blocking innovation
- changing buyer mindset to embrace something new takes a long time (sometimes 10-30 years)
- hi-tech entrepreneurs usually don't care much about security unless it's needed to make the business run
  - business failure risk much higher than security failure risk
  - time-to-market, cost savings, user experience etc. all count more
  - if users don't care/know, why invest in security?

The investor’s fault?

- business of making money, not to change/improve the world
  - If dogsh** sells now, invest in dogsh** ☺
- won’t invest in true security innovation because it won’t sell quickly:
  - educating market is expensive, time-consuming, risky, against “herd”
- to minimize risks:
  - only invest in minor, incremental improvement to reduce risk and time-to-exit (“timing is everything”)
  - only invest in “tried & tested” teams and technologies

The academic researcher's fault?

- In theory: fundamental cybersecurity research to come up with new solutions (15-30 year timeframe to mainstream)
- In practice, most of the research won't change the world
  - Nobody can predict IT that far out
  - Irreconcilable: teaching vs. research
  - Often don't know anything about the real world
  - Most researchers' own goals more important (e.g. publishing)

The government's fault?

- Government intervention #1 measure to fix market failures
- Gov. used to take the lead in IT and cybersecurity innovation
  - Now "looking to industry", but limited funds, inefficiencies, earmarks, sequester, bureaucracy, …
- However: Our physical security (military, police etc.) is run by government for good reasons. Why is cybersecurity different?
- Mandate cyber security through regulation (e.g. HIPAA)
- Unfortunately often no "teeth":
  - take calculated risks; non-mandatory; self-regulation etc.

The educator’s fault?

- Should educate the public about security and privacy
  - Societal understanding would maybe create a market
  - Users would maybe “vote with their feet” if they understood risks and solutions
  - Should be taught in school and at university
- Reality (see “Users” earlier):
  - Most people don’t care, don’t understand, falsely trust the provider/vendor

Stopping here, but there is more…

So whose fault is it?

- Everyone's!
- In particular:
  - Customers: A "free market" (if it worked) is ultimately driven by customers.
  - Government: Intervene to adjust market failures, esp. externalities, antitrust etc.
  - Vendors & Investors: Stuck in the middle

Case Study: Cybersecurity innovation from the “trenches”

Theoretical discussion? Or are these problems real?

Or is the lack of progress the innovators’ fault?

ObjectSecurity® OpenPMF™

Model-Driven Security Policy Automation

Founded July 2000…model-driven security invention since 2003…now it's 2015!!!

The Security Policy Automation Experts

information security specialists: innovative technologies + consulting, R&D

CUSTOMERS

ITS, ATC, Defense & Aerospace, Manufacturing, ICT, Smart Cities

QinetiQ | UK MoD

BAA | UK TSB | Artechhouse

Cyber Security KTN | Intel | ESG | SAP

Royal Bank of Scotland | Twinsoft/HP | BMVIT

European Commission | Deutsche Telekom

European Space Agency | Lufthansa Systems

Eurocontrol | Hornbach | UL VS

US Naval Research Laboratory

Promia (US Navy)

Agilent

Smartronix

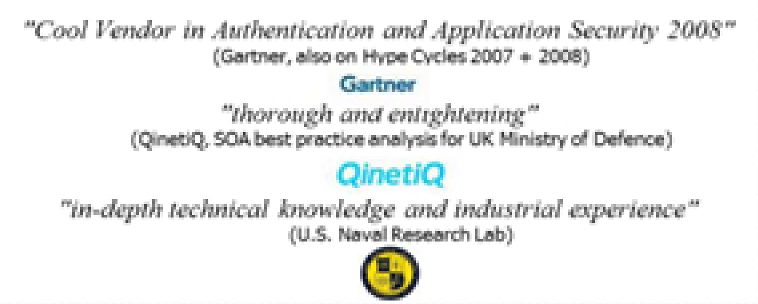
IBM

CHI

RTI (US Navy+ Air Force)

FutureTek (Boeing)

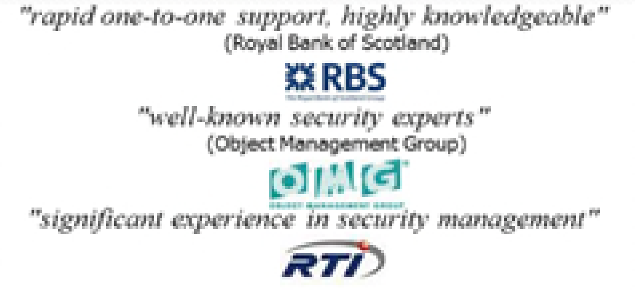
General Electric



"Cool Vendor in Authentication and Application Security 2008"
(Gartner, also on Hype Cycles 2007 + 2008)
Gartner

"thorough and enlightening"
(QinetiQ, SOA best practice analysis for UK Ministry of Defence)
QinetiQ

"in-depth technical knowledge and industrial experience"
(U.S. Naval Research Lab)



"rapid one-to-one support, highly knowledgeable"
(Royal Bank of Scotland)
RBS

"well-known security experts"
(Object Management Group)
OMG

"significant experience in security management"
RTI

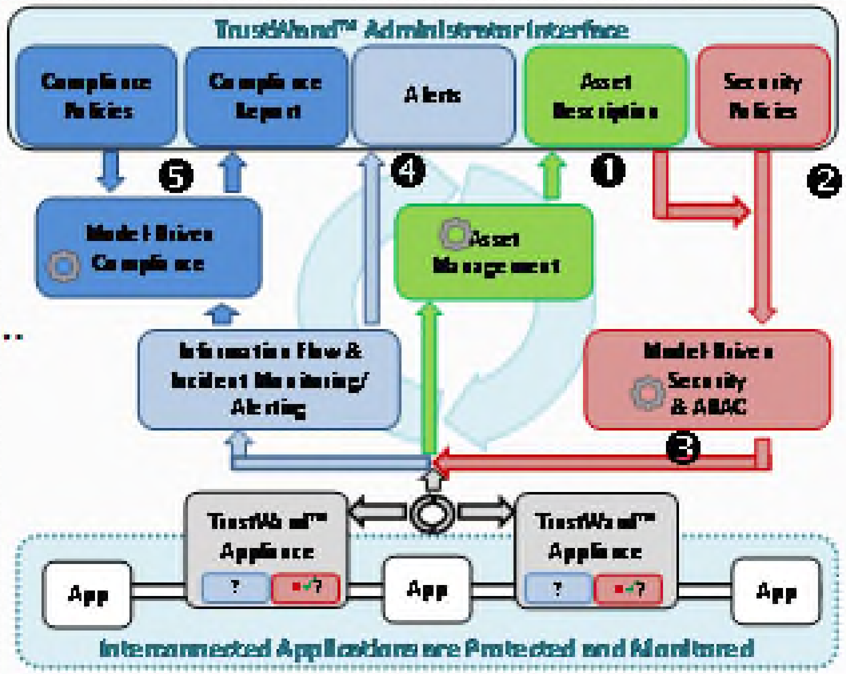
Glass ceiling - white hats are wasting time!!!

- 2000-2014 University R&D since 1997, startup since 2000…now 2015!
  - Industry "group-think" was blacklisting, compliance-based "security", monitoring/remediation as "Plan A"
    - Preventive white-listing, with end-point agents, and "doing policy right" not "group-think"
  - Market tanked at critical times:
    - Dot-com burst prevented high-growth at the beginning
    - Great recession just after brief high-visibility phase (e.g. 2008 Gartner "Cool Vendor")
  - Large vendors/integrators ignored/blocked this innovation
  - Customers often did not care (more concrete interest since about 2012)
  - "Staleness" (VC speak)

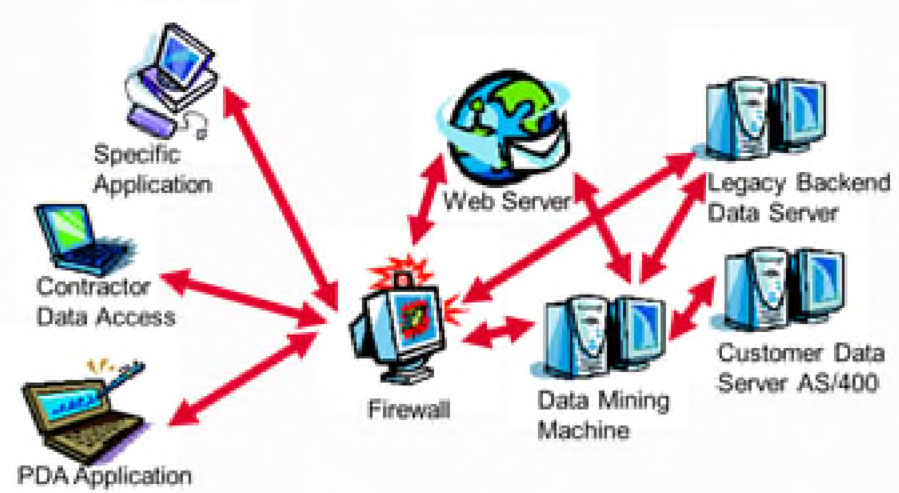
Glass ceiling - white hats are wasting time!!!

- 2014/2015: Strong IT investment market,
  - closing joint venture deal with partner Promia for TrustWand (incl. OpenPMF).
  - Investment for: Incremental improvement over current state, over a decade later…

University R&D since 1997,
startup since 2000…now 2015!



2000 …Middleware Security

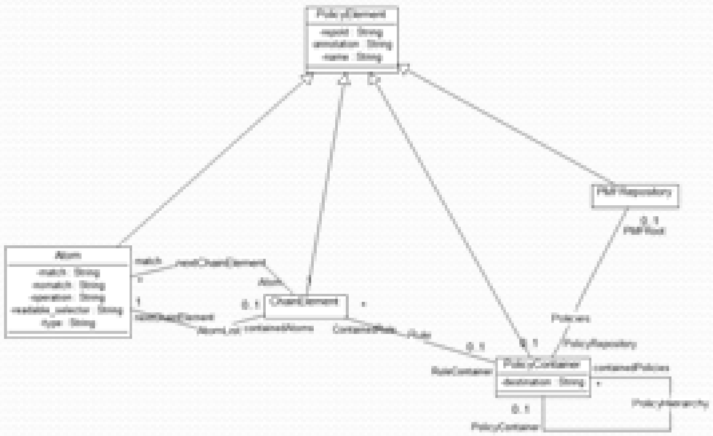


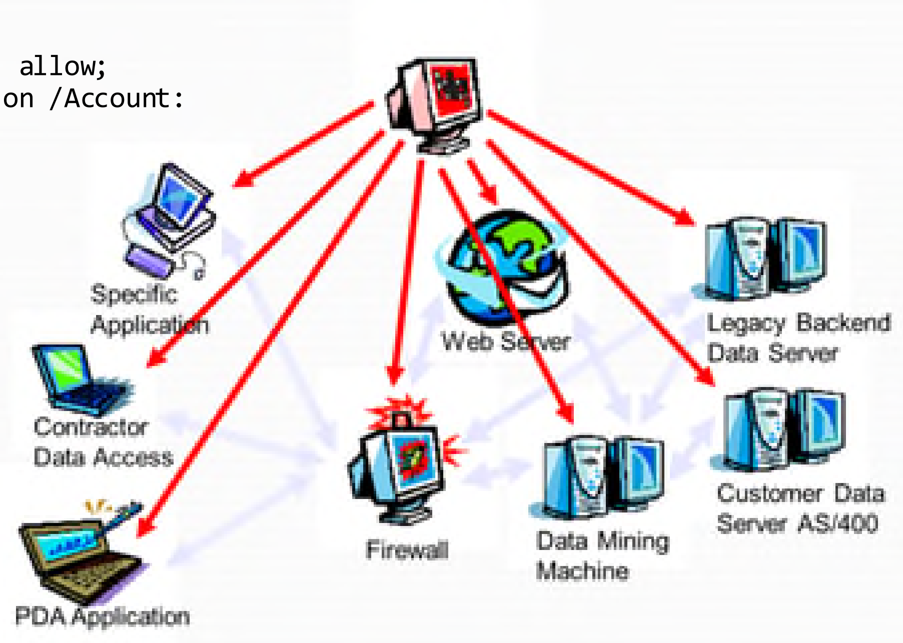
Implementing policies too difficult:

- Too many rules (whitelisting) in too many places
- Too many dynamic changes (agility)
- Policy support not expressive enough
- No assurance
- …

2002 …OpenPMF v1 (ABAC)

```
policy /OS {
   /OS/alice invokes {create, open} on /OS/Bank: allow;
   /OS/alice speaksfor /OS/bob invokes withdraw on /Account:
{allow, log}, {deny,log};
   * in /OS/staff uses /OS/server: allow
  };
```

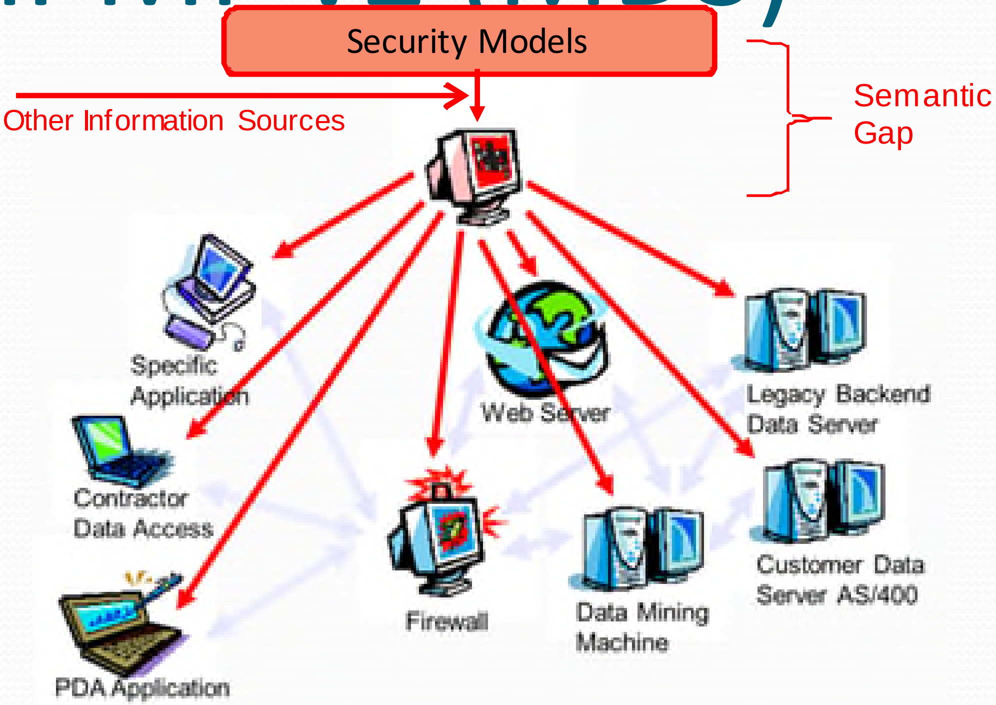




<u>Implementing policies too difficult:</u>

- Still too many rules, now in one place
- Too many dynamic changes (agility)
- Policy support not expressive enough
- Little assurance
- …

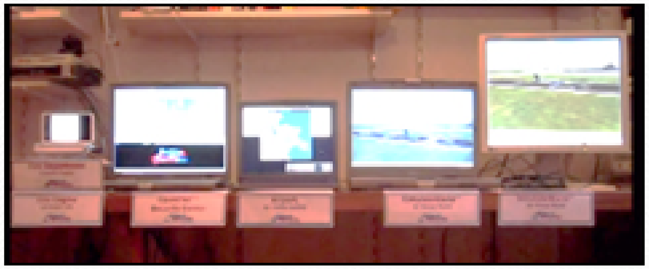
2004 …OpenPMF v2 (MDS)



Security Models

Other Information Sources

Semantic Gap

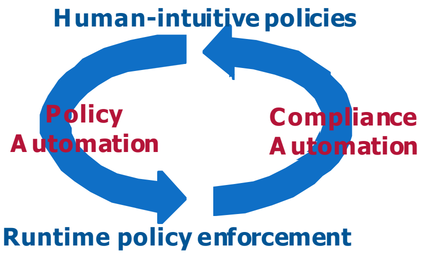


2007 started patenting, 2014 first patent granted, 2015 2nd patent. Now 8 years after filing 15 years after founding.

OpenPMF

Model-Driven Security:

- ✓ cheaper
- ✓ more secure
- ✓ faster accreditation/compliance
- ✓ for agile, complex IT landscapes
- ✓ standards



Human-intuitive policies

Policy Automation

Compliance Automation

Runtime policy enforcement

Challenges are growing & converging!

- IT environment
  - agile, complex, interconnected “System of Systems”
- Policies
  - numerous, complex, meaningful/feature-rich (e.g. privacy), fine-grained, contextual/dynamic
- Status quo fails
  - blacklisting; anomaly/behavior/incident-based; manual policy implementation…
- Need better policy tools
  - meaningful, preventive (whitelisting), manageable, supports IT agility, information flow based, repeatable/traceable/verifiable

Business problem has existed for >15 years, but the IT industry today still acts as if it is a new/future problem

Model-Driven Security

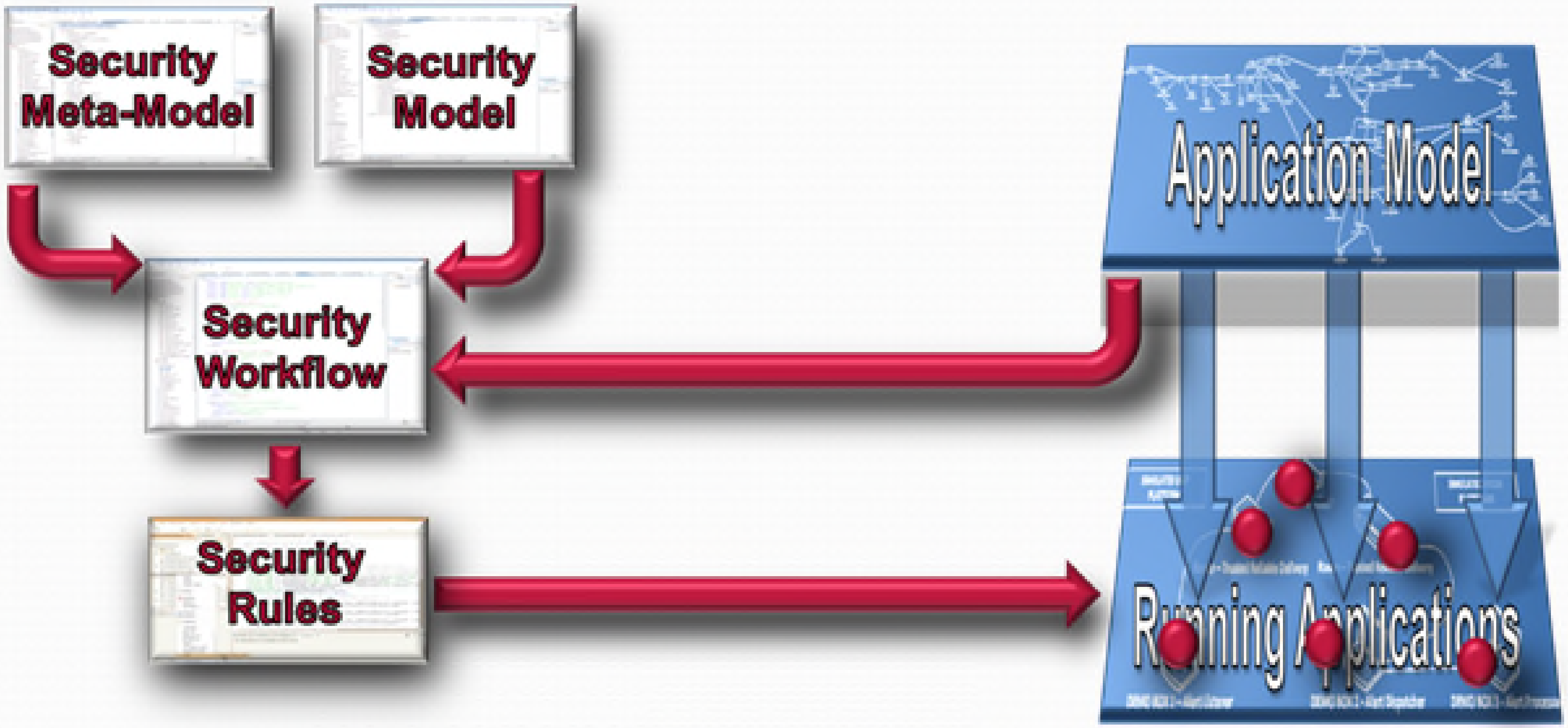
University research since late 90's, our invention since ca. 2003…now it's 2015!

- Information flow based SoS security (users & devices)
  - IoT/M2M often has system description & well-defined M2M interactions
- Access policies
  - Whitelisting; meaningful access policies; support IT agility
  - Advanced access control approaches (ABAC, PBAC, RAdAC, ZBAC, PHABAC…)
- Model-Driven Security (MDS)
  - Tool supported process
  - Model "undistorted" security requirements models at a high level of abstraction,
  - Using other information sources (produced by other stakeholders, expressed in DSL),
  - Transform models into enforceable security rules with little/no human intervention;
  - Run-time decisioning enforcement, dynamic policy updates, policy incident monitoring.

Model-Driven Security (MDS): Automatic generation of technical security rules for information flow enforcement
Use case: Access control, monitoring

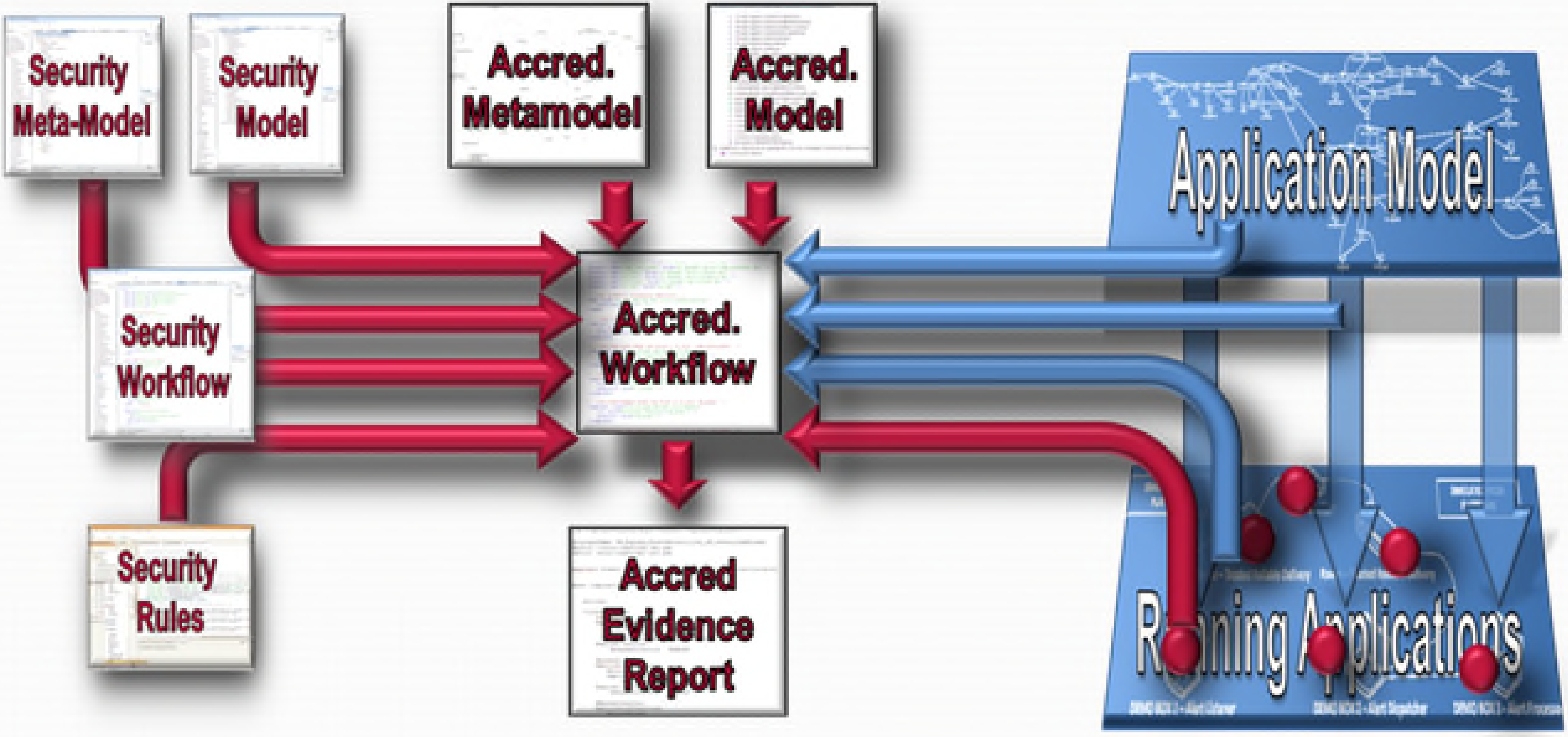
Model-Driven Security Accreditation (MDSA): Automatic generation and update of supporting evidence for info. assurance accreditation (-> *requires MDS)*
Use Case: for Common Criteria

OpenPMF MDS



http://www.youtube.com/watch?v=Eiy19v-n-1s

MDSA



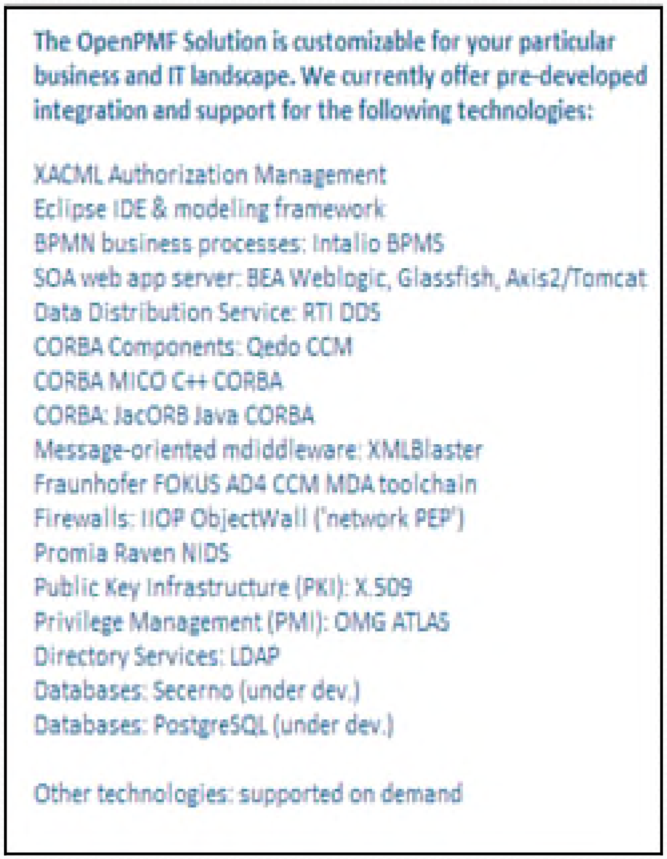
http://www.youtube.com/watch?v=Eiy19v-n-1s

OpenPMF™

OpenPMF is standards-based
(incl. Ecore/MOF, XMI, XACML, ABAC),
award-winning, and patented.

OpenPMF Components

- A model-driven policy authoring tool,
- A model-driven rule generation tool,
- An attribute-based authorization policy server,
- Policy decision/enforcement points,
- A model-driven compliance/accreditation evidence generation tool



The OpenPMF Solution is customizable for your particular business and IT landscape. We currently offer pre-developed integration and support for the following technologies:

XACML Authorization Management
Eclipse IDE & modeling framework
BPMN business processes: Intalio BPMS
SOA web app server: BEA Weblogic, Glassfish, Axis2/Tomcat
Data Distribution Service: RTI DDS
CORBA Components: Qedo CCM
CORBA MICO C++ CORBA
CORBA: JacORB Java CORBA
Message-oriented mdiddleware: XMLBlaster
Fraunhofer FOKUS AD4 CCM MDA toolchain
Firewalls: IIOP ObjectWall ('network PEP')
Promia Raven NIDS
Public Key Infrastructure (PKI): X.509
Privilege Management (PMI): OMG ATLAS
Directory Services: LDAP
Databases: Secerno (under dev.)
Databases: PostgreSQL (under dev.)

Other technologies: supported on demand

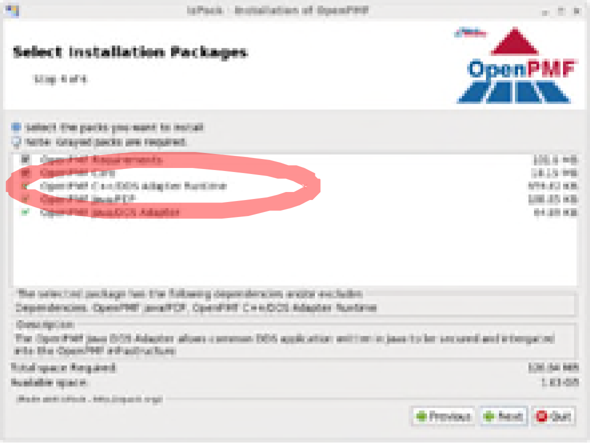
Advanced Access Control

- **Attribute-Based Access Control (ABAC):** Standardized since 2002 …. Now 2015! Adoption: low (?)
  - "attributes: subject, object, requested operations, environment conditions
  - policy, rules, or relationships: allowable operations for a given set of attributes." (NIST 800-162 draft)
- by 2020, 70% of all businesses will use ABAC as the dominant mechanism to protect critical assets, up from less than 5% today (Gartner)
- Example: OASIS XACML

- **Proximity-Based Access Control (PBAC)**
  - policies based on relative proximity/distance
  - between one or more proximity attributes associated with an accessor
  - and one or more proximity attribute associated with an accessed resource. (source: ObjectSecurity)
- Many PBAC dimensions: Geo-Location/Geospatial, Organizational, Operational, Temporal, Business Process, Security, Risk, Social Proximity, Information Proximity, …

- …

MDS & PBAC Example …



IzPack - Installation of OpenPMF

Select Installation Packages

Step 4 of 6

Select the packs you want to install

Note: Grayed packs are required.

☒ OpenPMF Requirements	101.6 MB
☒ OpenPMF Core	18.15 MB
✓ OpenPMF C++/DDS Adapter Runtime	974.42 KB
✓ OpenPMF JavaPDP	108.05 KB
✓ OpenPMF Java/DDS Adapter	64.69 KB

The selected package has the following dependencies and/or excludes:

Dependencies: OpenPMF JavaPDP, OpenPMF C++/DDS Adapter Runtime

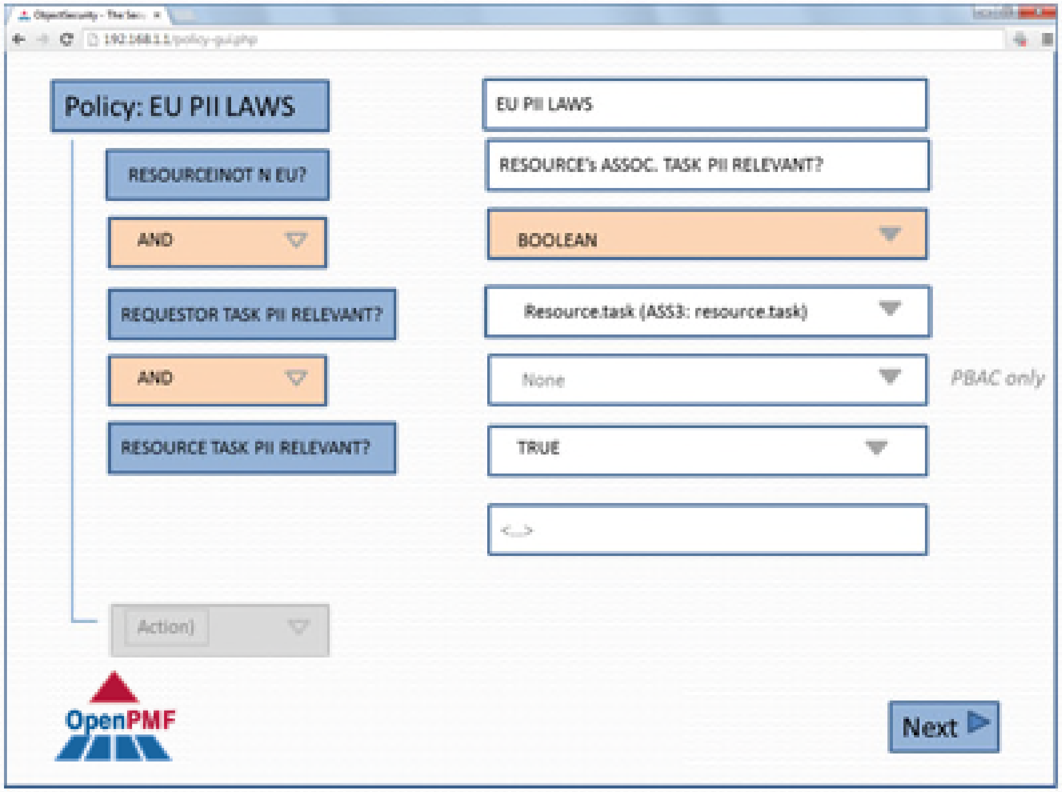
Description

The OpenPMF Java DDS Adapter allows common DDS application written in Java to be secured and integrated into the OpenPMF infrastructure

Total space Required: 120.54 MB

Available space: 1.83 GB

(Made with IzPack - http://izpack.org)

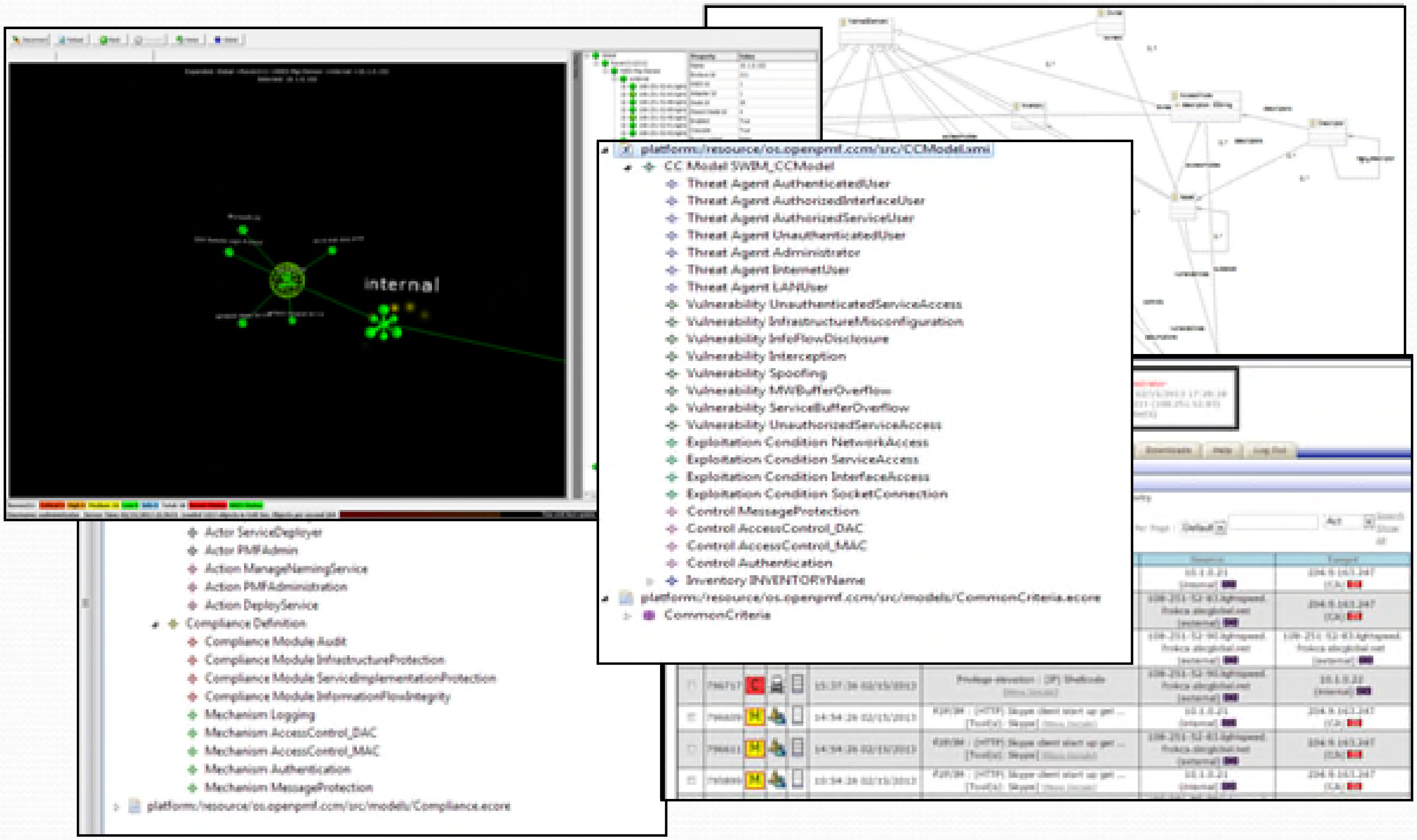


ObjectSecurity - The Sec...

192.168.1.1/policy-gui.php

Policy: EU PII LAWS	EU PII LAWS
RESOURCEINOT N EU?	RESOURCE's ASSOC. TASK PII RELEVANT?
AND	BOOLEAN
REQUESTOR TASK PII RELEVANT?	Resource.task (ASS3: resource.task)
AND	None (PBAC only)
RESOURCE TASK PII RELEVANT?	TRUE
	<...>

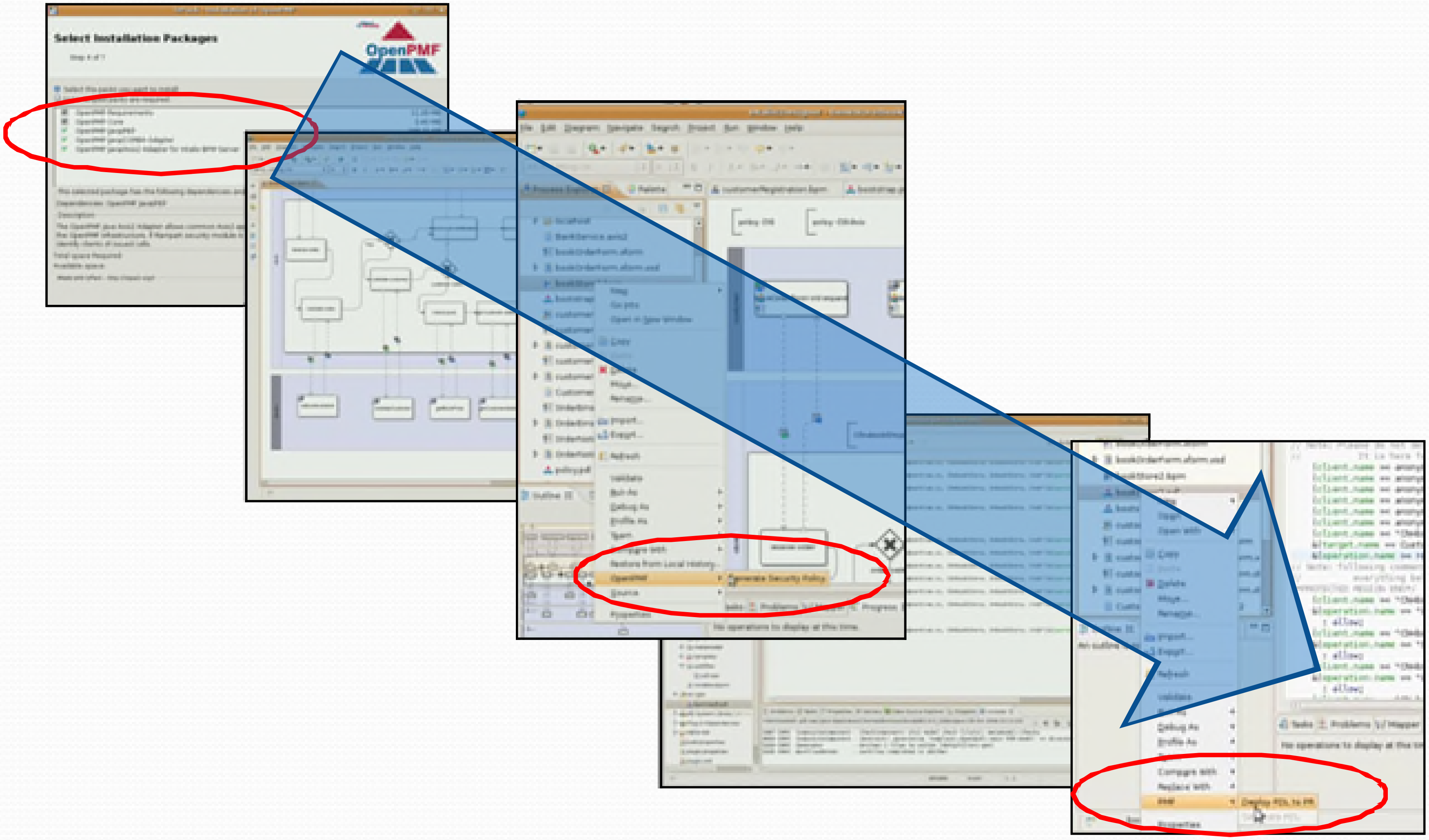
User Experience TrustWand



- platform:/resource/os.openpmf.com/src/CCModel.xmi
  - CC Model SWIM_CCModel
    - Threat Agent AuthenticatedUser
    - Threat Agent AuthorizedInterfaceUser
    - Threat Agent AuthorizedServiceUser
    - Threat Agent UnauthenticatedUser
    - Threat Agent Administrator
    - Threat Agent InternetUser
    - Threat Agent LANUser
    - Vulnerability UnauthenticatedServiceAccess
    - Vulnerability InfrastructureMisconfiguration
    - Vulnerability InfoFlowDisclosure
    - Vulnerability Interception
    - Vulnerability Spoofing
    - Vulnerability MWBufferOverflow
    - Vulnerability ServiceBufferOverflow
    - Vulnerability UnauthorizedServiceAccess
    - Exploitation Condition NetworkAccess
    - Exploitation Condition ServiceAccess
    - Exploitation Condition InterfaceAccess
    - Exploitation Condition SocketConnection
    - Control MessageProtection
    - Control AccessControl_DAC
    - Control AccessControl_MAC
    - Control Authentication
    - Inventory INVENTORYName
- platform:/resource/os.openpmf.com/src/models/CommonCriteria.ecore
  - CommonCriteria

- Actor ServiceDeployer
- Actor PMFAdmin
- Action ManageNamingService
- Action PMFAdministration
- Action DeployService
- Compliance Definition
  - Compliance Module Audit
  - Compliance Module InfrastructureProtection
  - Compliance Module ServiceImplementationProtection
  - Compliance Module InformationFlowIntegrity
  - Mechanism Logging
  - Mechanism AccessControl_DAC
  - Mechanism AccessControl_MAC
  - Mechanism Authentication
  - Mechanism MessageProtection
- platform:/resource/os.openpmf.com/src/models/Compliance.ecore

User Experience Push-Button Automation



Solutions

What “solutions” do we have?

Disclaimer: Not a simple take-home message

The buck stops with the user or buyer?

- inform/educate consumers about cyber-security
- education about security & privacy in schools & jobs to create customers who can discern good from bad
  - users could push buyers
  - buyers could push vendors
  - etc.
- If educated, could request security certifications as part of decision process
- Is this realistic???

The buck stops with the government?

- Education about security & privacy in schools & jobs to create customers who can discern good from bad
- Stick: More regulation (very controversial – but: cf. seatbelts)
  - vendor liability, mandatory breach reporting, best practices regulations, accounting regulations that include security etc.
- Carrot: Financial stimulus into innovation
  - Fund innovators R&D: sometimes good, but hard to get & low ROI
  - Fund adoption of innovation: e.g. smart grid, HITECH: often inefficient.
  - Fund academic research: impact unclear, expensive/inefficient

The buck stops with incumbent vendors?

- would need to play a critical role in innovation adoption.
- unlikely. Will only do the minimum needed
  - to not lose incumbent vendor position against competitors
- few vendors own the lion share of the market
  - Customers support consolidation into few vendors
    - Not conducive to innovation
- could provide security certifications as a marketplace differentiator?

The buck stops with infosec innovators?

- Mostly done today (& ObjectSecurity 2000-2012)
  - bang head against the wall long enough and the "market failure" fails once in a while, i.e. a occasionally small/new/disruptive innovator may make it (die-hard attitude, sweat equity, frustration, patience)
- But:
  - very inefficient, most good ideas evaporate, few rewards for innovative entrepreneurs
  - disgruntles the most valuable stakeholder in the innovation pipeline

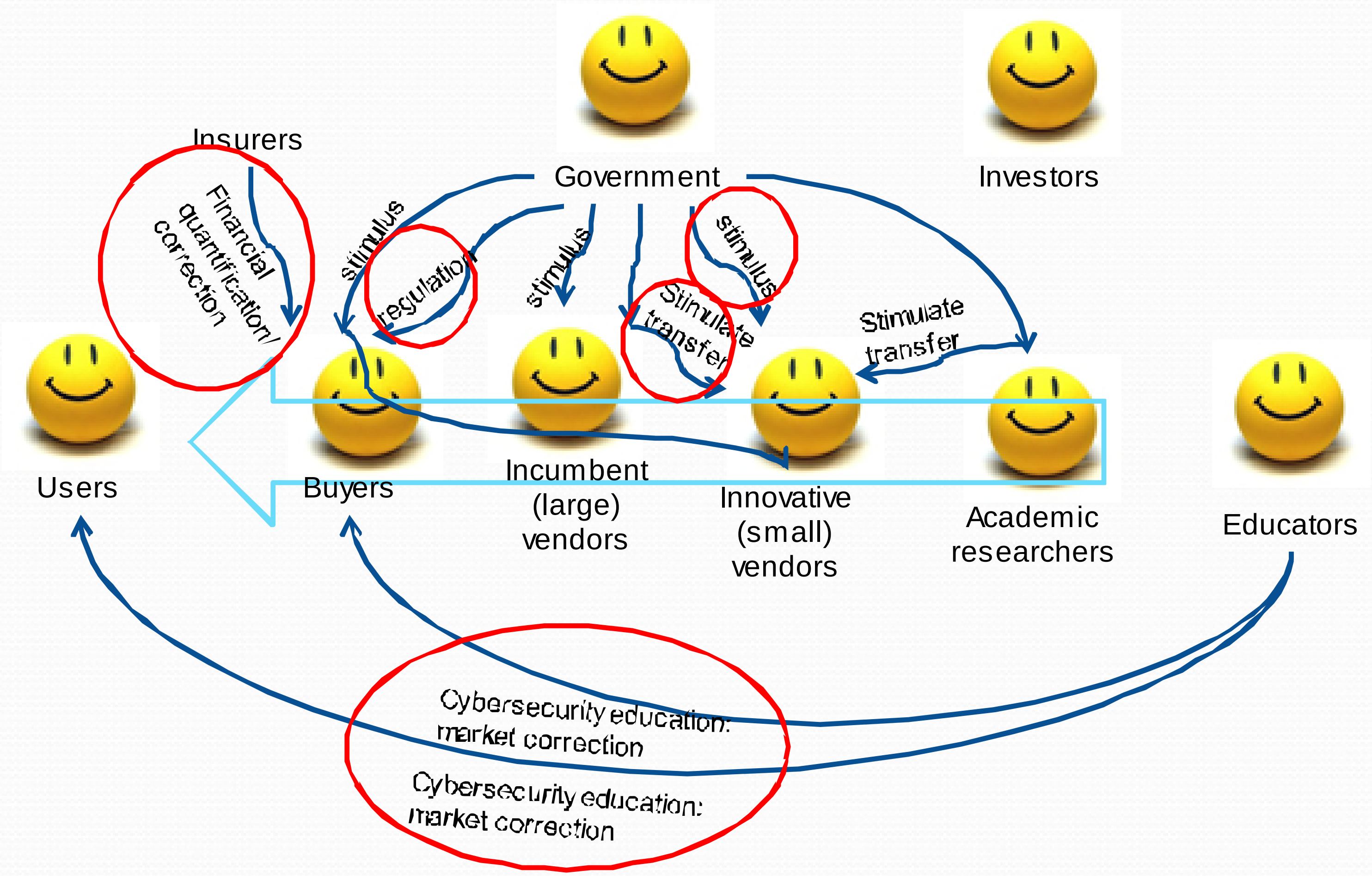
The buck stops with insurances?

- Cyber insurance as a carrot/stick mechanism
- associate a cost (premium) with not doing security well?
  - may mean many security mechanisms are not “worth it”
  - many externalities (e.g. societal damage) are not accounted for
- associate a premium savings with the cost of doing security
  - turns security implementation from cost into a cost-saving
- they don’t insure “stupid”

Or: Wait until it gets bad enough?

- Heard this almost 20 years ago – did not materialize yet
  - Much worse today than predicted back then…
- Maybe we are not that important after all?
  - Who stopped shopping at Target, Home Depot etc.?
- Wait until it's too late? Cyberwar? Massive losses etc.?

In conclusion – where to tune/fix? (just some thoughts)


Insurers
Financial quantification/ correction
Government
Investors
stimulus
regulation
stimulus
Stimulate transfer
stimulus
Stimulate transfer
Users
Buyers
Incumbent (large) vendors
Innovative (small) vendors
Academic researchers
Educators
Cybersecurity education: market correction
Cybersecurity education: market correction

Thank you

Dr. Ulrich Lang, CEO

ulrich-lp@objectsecurity.com

650-515-3391

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