The Software Assurance Ecosystem:

OMG's Approach to Systems & Software Assurance

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Chairman and CEO

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With thanks to the OMG Systems Assurance Domain Task Force, especially Dr. Ben Calloni

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OMG's Mission

- Develop an architecture, using appropriate technology, for modeling & distributed application integration, guaranteeing:
  - reusability of components
  - interoperability & portability
  - basis in commercially available software
- Specifications *freely available*
- Implementations exist
- Member-controlled not-for-profit

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Who Are OMG?

- Adaptive
- Atego
- Boeing
- Business Rules Group
- CA Technologies
- Citigroup
- CSC
- EADS
- EDS
- Energistics
- Fair, Isaac
- Firestar Software
- Fujitsu
- HCL
- Hewlett Packard
- Hitachi
- HSBC
- IBM
- Lockheed Martin
- MEGA International
- Microsoft
- MITRE
- Model Driven Solutions
- National Archives
- NEC
- NIST
- No Magic
- NTT DoCoMo
- Northrop Grumman
- OASIS
- OIS
- Oracle
- PrismTech
- Real-Time Innov.
- SAP
- TCS
- Tether's End
- THALES
- Unisys
- W3C

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OMG & Modeling

- Best known for key standards in modeling languages:
  - UML (broad software & systems)
  - SysML (systems engineering)
  - SoaML (service-oriented architectures)
  - BPMN (business processes)
  - CWM (data warehouses)
  - MOF (modeling languages)

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OMG's Focus

- Three key "infrastructure" standards foci:
  - Modeling
  - Middleware
  - Real-time & other specialized systems
- More than 20 "vertical market" foci:
  - Healthcare
  - Financial services
  - Robotics
  - Etc.

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OMG Systems Assurance Task Force

- The Task Force (SysA TF) is focusing across all OMG vertical applications domains
  - Existing: healthcare, finance, military, manufacturing, telecommunications, etc.
  - New: smart energy grid, automotive
- Three co-chairs
  - Ms. Djenana Campara, KDM Analytics
  - Dr. Ben Calloni, Lockheed Martin
  - Mr. Paul Work, Raytheon

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SysA TF Strategy & Focus

- Strategy
  - Establish a common framework for analysis and exchange of information related to systems assurance and trustworthiness. This trustworthiness will assist in facilitating systems that better support Security, Safety, Software and Information Assurance

- Immediate focus of SysA TF is to complete work related to
  - Software Assurance (SwA) Ecosystem - **common framework for presenting and analyzing properties of system trustworthiness** that
    - leverages and connects existing OMG specifications and identifies new specifications that need to be developed to complete the framework
    - provides integrated tooling environments for different tool types
    - Is architected to improve software system analysis and achieve higher automation of risk analysis

Delivering System Assurance:

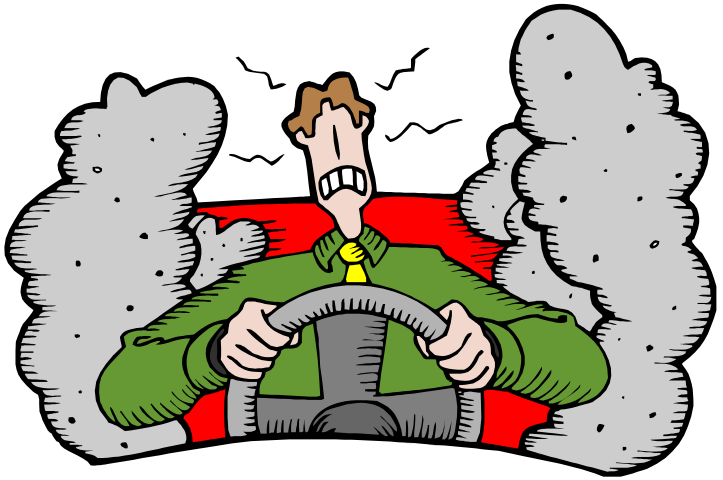
Delivering System Predictability and Reducing Uncertainty

- Software Assurance (SwA) is 3 step process
  1. **Specify Assurance Case**
     - Enable supplier to make **bounded assurance claims** about safety, security and/or dependability of systems, product or services
  2. **Obtain Evidence for Assurance Case**
     - Perform software assurance assessment to justify claims of meeting a set of requirements through a structure of sub-claims, arguments, and supporting evidence
     - Collecting Evidence and verifying claims' compliance is complex and costly process
  3. **Use Assurance Case to calculate and mitigate risk**
     - Exam non compliant claims and their evidence to calculate risk and identify course of actions to mitigate it
- Each stakeholder will have their own risk assessment – e.g. security, liability, performance, compliance

Currently, SwA 3 step process is informal, subjective & manual

Limitations of Current Assessment Approaches

- There is currently a lack of formalized methodology between high level policy claims and evidence means a laborious, unrepeatable (I.e., subjective), lengthy and costly certification process
- Current assessment approaches resist automation



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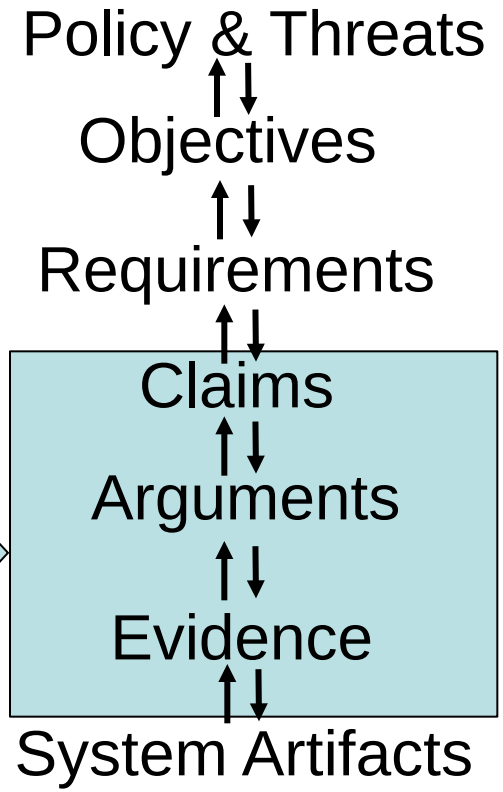
The SwA Process

Claim:
"It rained last night!"

Methodology Gap



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Improving System Assessments:
Systematic, Objective and Automated

Key Requirements:

1. Specified assurance compliance points through formal specification
2. Transparency of software process & systems
3. End-to-end Traceability: *from code to models to evidence to arguments to security requirements to policy*
4. Standards based Integrated tooling environment

Together, these requirements enable the management of system knowledge and knowledge about properties, providing a high degree of transparency, traceability and automation

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The Software Assurance Ecosystem: Turning Challenge into Solution

- The SwA Ecosystem is a formal framework for analysis and exchange of information related to software security and trustworthiness
- The SwA Ecosystem provides a technical environment in which formalized claims, arguments and evidence can be brought together with formalized and abstracted software system representations to support high automation and high fidelity analysis.
- The SwA Ecosystem is based entirely on ISO/OMG Open Standards:
  - Semantics of Business Vocabulary and Rules (SBVR)
  - Knowledge Discovery Metamodel (KDM)
  - Structure Metrics Metamodel (SMM)
  - Structured Assurance Case Metamodel (SACM) (Adopted June 2010)
    - Software Assurance Evidence Metamodel (SAEM)
    - Argumentation Metamodel (ARM)
- The SwA Ecosystem is architected with a focus on providing fundamental improvements in analysis

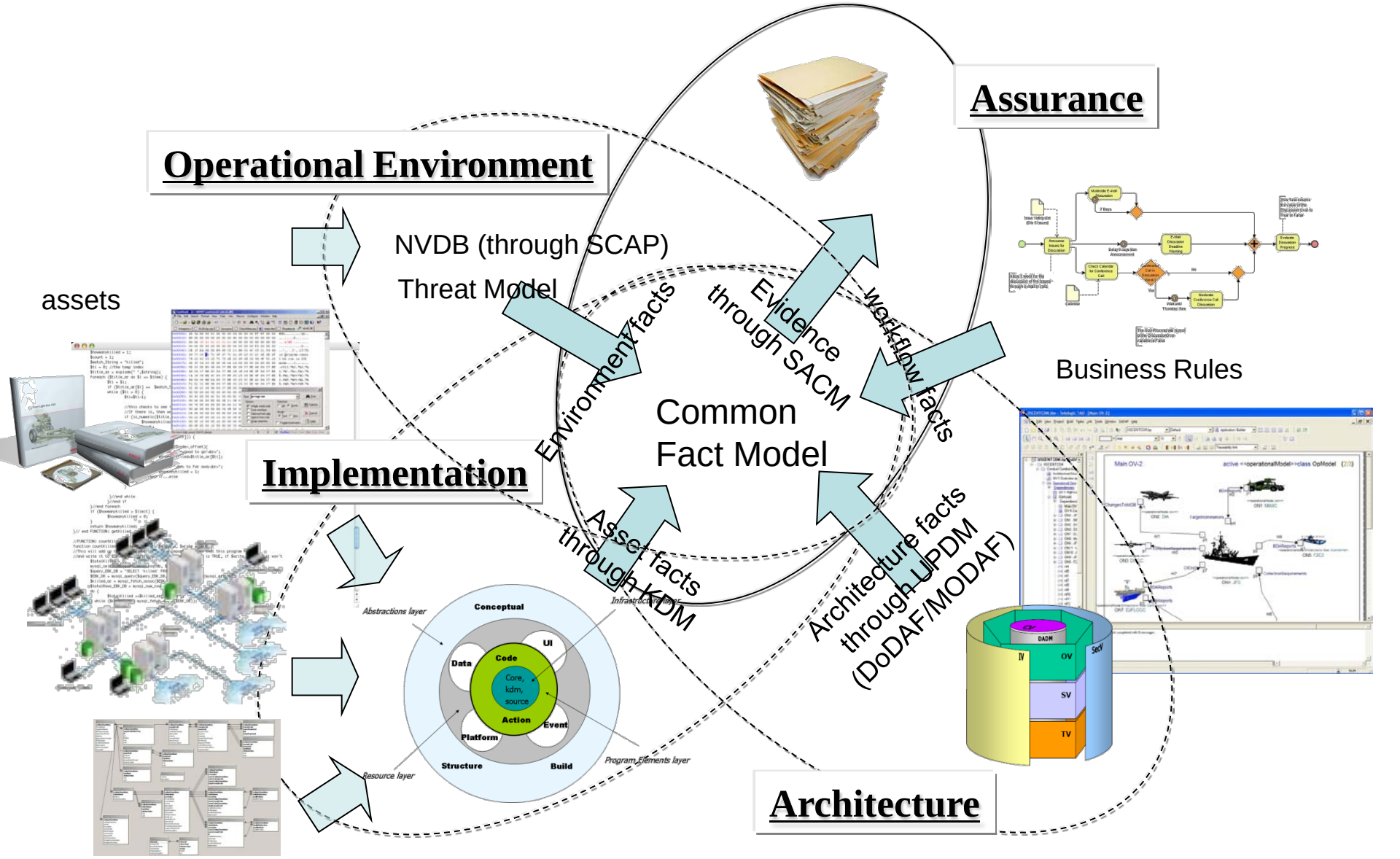
Leveraging what we already have through SwA Ecosystem

- The Software Assurance Ecosystem enables industry and government agencies to **leverage** and **connect** existing policies, practices, processes and tools, in an affordable and efficient manner

- The key enabler is the Software Assurance (SwA) Ecosystem **Infrastructure**
  - an open standards-based integrated tooling environment that dramatically reduces the cost of software assurance activities
    - Integrates different communities: Formal Methods, Assurance Case, Reverse Engineering and Static Analysis, and Dynamic Analysis for a System Assurance solution
    - Enables different tools to interoperate
    - Introduces many new vendors to ecosystem because they each leverage parts of the tool chain

Where We are Going: Expanding the SwA Ecosystem

Common Fact Model



Software Assurance Ecosystem: *The Formal Framework for System Assessments with Focus on Automation*

Tools Interoperability and Unified Reporting Environment

Process Docs & Artifacts

Requirements/Design Docs & Artifacts

Reports, Risk Analysis, etc

Process, People & Documentation Evaluation Environment

- Some point tools to assist evaluators but mainly manual work
- Claims in Formal SBVR vocabulary
- Evidence in Formal SBVR vocabulary
- Large scope requires large effort
- **Supported by The Open Group's UDEF***

Process, People, documentation Evidence

Formalized Specifications

Assurance Case Repository

- Formalized in SBVR vocabulary
- Automated verification of claims against evidence
- Highly automated and sophisticated risk assessments using transitive inter-evidence point relationships

Supported by the following standards:
- ISO/IEC 15026
- ISO/TC 37 / OMG SBVR
- OMG ARM
- OMG SAEM
- Software Fault Patterns (Target late 2011)
- UML Security Policy Extensions (planned)

Software System / Architecture Evaluation

- Many integrated & highly automated tools to assist evaluators
- Claims and Evidence in Formal vocabulary
- **Combination of tools and ISO/OMG standards**
- Standardized SW System Representation In KDM
- Large scope capable (system of systems)
- Iterative extraction and analysis for rules

Supported by ISO/IEC 19506

Software system Technical Evidence

Executable Specifications

SFP(CWE)

IA Controls

Protection Profiles

Hardware Environment

Software System Artifacts

Data Structures

Summary of the SwA Ecosystem Approach

- Normalized uniform common fact model
  - Separation of data feeds from reasoning
  - Standards-based
- Assurance case and SBVR
  - Representation of substantive reasoning
  - Natural language
- End-to-end multi-segment Traceability models
  - Code to state diagrams
  - Code to architecture
  - Code to conceptual model
  - Code to evidence determined by arguments
  - Evidence to arguments
  - Arguments to policy
- Focus on polynomial path-based properties
  - Instead of exponential state-based properties
- Arguments are “executable” queries to the fact model

Key Value of the SwA

The Key Value of the SwA Ecosystem Approach is End-to-end Traceability:

from code
to models
to evidence
to arguments
to security requirements to policy

For More Information

- OMG Systems Assurance Domain Task Force: http://sysa.omg.org/
- OMG General Information: http://www.omg.org/
- Richard Soley: soley@omg.org