SOFTWARE ASSURANCE FORUM

BUILDING SECURITY IN

Software Assurance (SwA) Checklist for Software Supply Chain Risk Management

Software Assurance Forum

Processes and Practices Working Group

Agenda

- Problem
- Maturity Model Crosswalk
- Mapped Maturity Models
- SwA Checklist
  - Design
  - Establishing a Baseline
  - Challenges
- Questions

Problem

- Acquiring or developing secure software requires a robust set of processes throughout the lifecycle.
- How does an organization know it is:
  - Working with suppliers supporting similar assurance goals?
  - Implementing practices that address assurance goals?
    - Who is doing them?
    - How frequently?
    - Are they done well?
    - Are the practices reducing risk?
  - Improving its assurance capabilities?

Global Software Supply Chain Risks

- Software must be able to withstand use, abuse, and attack.
- Software will probably be used longer than intended in ways for which it was not designed.
- Risks can stem from actions by suppliers and their respective supply chains.
- Mitigating risks requires understanding and management of suppliers' capabilities, products, and services.

"Fit for Purpose" Testing

- Developers assume the role of an acquirer when they:
  - Reuse their own code
  - Reuse legacy code or code from other projects
  - Draw upon open source libraries
- Reused code may re-introduce old bugs and add new ones
- Code must be tested to determine it is "fit for purpose" in new projects

Taking a Comprehensive SwA Approach

- Don’t wait for a SwA mandate.
- Organizations must:
  - Manage and execute a risk-driven, yet rugged, robust, and thorough software lifecycle process
    - Focus on implementing the practices that address their assurance goals based upon their risk appetite
  - Add security “gates” throughout the software lifecycle
    - Not all gates need to be pass/fail, some can just measure
  - Ensure the entire organization is aware and on board (including CXOs, acquisitions, developers, managers, quality testers, etc.)
  - Perform necessary due diligence appropriate to the desired assurance level

Challenges

- Organizations that are ready to improve their assurance capabilities may not be aware of how to begin an organized security initiative.
- Several maturity models are freely available
  - Learning curves may inhibit adoption
  - Finding the right model(s) can be time consuming
  - Selecting model components can be difficult
  - Each model has a different approach and level of granularity

Maturity Model Crosswalk

- Performed a model-agnostic analysis of several freely available maturity models
- Identified agreements and differences among the models
- Provided a consolidated view of how the models address similar assurance goals and practices

Mapped Maturity Models

- The maturity models mapped within the crosswalk include:
  - Building Security In Maturity Model (BSIMM)
  - Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI) for Acquisitions
  - OWASP Open Software Assurance Maturity Model (SAMM)
  - SwA Forum Processes and Practices Working Group Assurance Process Reference Model (PRM)
  - CERT Resilience Management Model (RMM)

BSIMM

- Scientific observation-based descriptive model
- Uniquely qualified to be used as a measuring stick for software security

BSIMM

- Based upon analysis of the software security initiatives of 30+ organizations including:

Adobe	AON	Bank of America	The Depository Trust & Clearing Corporation (DTCC)
EMC	Google	Intel	Microsoft
Nokia	QUALCOMM	Sallie Mae	SWIFT
Symantec	Telecom Italia	VMware	Wells Fargo

http://www.bsimm.com

CMMI for Acquisitions

- CMMI-ACQ provides guidance to acquisition organizations for initiating and managing the acquisition of products and services
- Used to guide process improvement initiatives across a project, a division, or an entire organization.

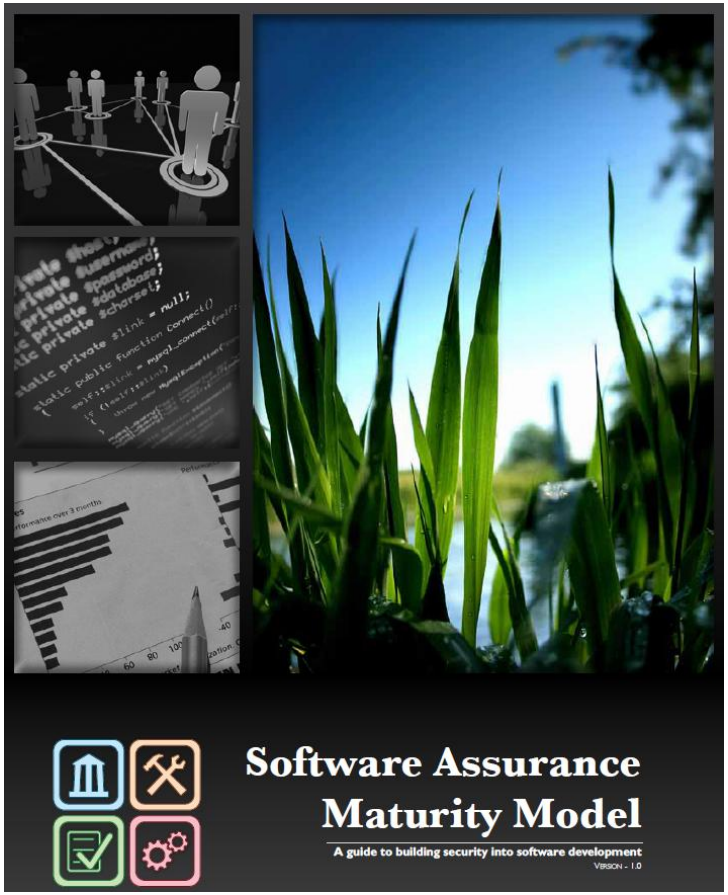
www.sei.cmu.edu/cmmi/

CMMI for Acquisitions

- Helps to:
  - Integrate traditionally separate organizational functions
  - Set process improvement goals and priorities
  - Provide guidance for quality processes
  - Provide a point of reference for appraising current processes
- Designed to support the future integration of other disciplines.

www.sei.cmu.edu/cmmi/

OpenSAMM



- Open framework to help organizations formulate and implement a strategy for software security that is tailored to the specific risks facing the organization.

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OpenSAMM

- OpenSAMM can be utilized by small, medium, and large organizations using any style of development.

OWASP

The Open Web Application Security Project

http://www.owasp.org

- Can be applied organization-wide, for a single line-of-business, or individual projects.

www.opensamm.org

Assurance PRM

- The Assurance PRM contains a set of assurance goals and supporting practices.
- SwA Forum Processes & Practices Working Group synthesized from the contributions of leading government and industry experts.

Assurance PRM

- Assurance for CMMI® defines the Assurance Thread for Implementation and Improvement of Assurance Practices that are assumed when using the CMMI-DEV.
- Understanding gaps helps suppliers and acquirers prioritize organizational efforts and funding to implement improvement actions.

https://buildsecurityin.us-cert.gov/swa/proself_assm.html

Assurance PRM Tool

- The SwA Self-Assessment incorporates the Assurance PRM goals and practices
- Provides an assessment framework of the implementation of assurance practices
- Contains mappings to other freely available maturity models

https://buildsecurityin.us-cert.gov/swa/proself_assm.html

CERT RMM

- Process improvement model
- Addresses the convergence of security, business continuity, and IT operations to manage operational risk and establish operational resilience
- Supplies a process improvement approach through the definition and application of a capability level scale that expresses increasing levels of process improvement

CERT
www.cert.org

CERT RMM

- Based upon the Resiliency Engineering Framework (REF)
- The REF described the range of processes that characterize the organizational capabilities necessary to actively direct, control, and manage operational resilience.
- The REF has been used by Financial Services Technology Consortium organizations to:
  - Benchmark their performance against the framework to characterize industry performance
  - Validate the framework
  - Begin process improvement efforts
- CERT created the RMM CAM (capability appraisal method) based on the SCAMPI appraisal method

  www.cert.org/resilience/rmm.html

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	Governance			Knowledge			Verification			Deployment			Supplier Management		
	Strategy & Metrics	Policy & Compliance	Training & Guidance	Threat Assessment	Security Requirements	Secure Design	Architecture Analysis	Code Analysis	Risk-Based Security Testing	Penetration Testing	Vulnerability Management	Environment Hardening	Agreement Requirements	Evaluation & Selection	Agreement Management
Practices:	Establishes Security Plan; communicates and provides training for the plan	Identifies and monitors relevant compliance drivers	Conducts security awareness training regularly	Builds and maintains list of application-specific attack models	Documents, analyzes, and manages functional security requirements	Develops list of preferred frameworks and security features; explicitly applies security principles to design	Reviews design against security requirements	Develops list of top bugs and creates review checklists from security requirements	Performs edge / boundary value condition testing in QA process	Performs external penetration testing on production software with latest techniques and mitigates	Identifies point of contact for incident response; creates incident response team	Maintains operational environment specification	Identifies and prioritizes supplier dependencies; identifies, assesses, and mitigates risks associated with supplier dependencies	Establishes, reviews, and distributes solicitation package	Formalizes supplier relationships and executes supplier agreement
BSIMM	SM1.1	CP1.1	T1.1	AM1.1	SR1.1	SFD1.1	AA1.1 - AA1.3	CR1.1	ST1.1 - ST1.2	PT1.1 - PT1.2	CMVM2.1	SE1.1	SR3.1	-	-
	-	CP1.2	T3.4	AM1.4	-	SFD1.2	SFD3.1	-	-	-	-	SE1.2	-	-	-
CMMI-ACQ	PP SG2 - SG3	OPF SG1	OT SG2	RSKM SG1 - SG2	ARD SG1, SG3	ATM SG2	ATM SG1	AVER SG3	AVER SG3	AVER SG3	CAR SG1	CM SG2 - SG3	RSKM SG2-SG3	SSAD SG1	AM SG1
	-	-	-	-	REQM SG1	AVAL SG2	AVAL SG1 - SG2	-	-	CAR SG1 - SG2	OPD SG1	-	PP SG1	-	SSAD SG3
OSAMM	SM1B	PC1A	EG1A	TA1A	SR1A	SA1A	DR1B	CR1A	ST2B	ST1B	VM1A	EH1A	-	-	-
	-	PC1B	-	-	SR2B	SA1B	-	-	-	-	VM1B	-	-	-	-
PRM	SG 2.1	SG 3.1	SG 1.3	SG 3.2	SG 3.1	SG 3.2	SG 3.4	SG 3.4	SG 3.4	SG 3.4	SG 4.3	SG 4.3	SG 2.3	SG 2.3	SG 2.3
	SG 1.3	-		-	-	-	-	-	-	-	-	-	SG 3.1	-	-
RMM	RTSE:SG2 - SG3	COMP:SG2	OTA:SG1 - SG2	RISK:SG1 - SG4	RRD:SG1 - SG3	RTSE:SG1 - SG2	-	VAR:SG2	RTSE:SG3	RTSE:SG3	VAR:SG1	ADM:SG3	EXD:SG1 - SG2	EXD:SG3	EXD:SG3
	MON:SG1	MON:SG1 - SG2	-	KIM:SG6	RRM:SG1	KIM:SG2, SG6	-	KIM:SG6	-	-	MON:SG1	KIM:SG5	RISK:SG3 - SG6	-	-
Practices:	Collects and tracks security plan metrics based upon risk	Establishes policies and procedures for compliance with security plan and other compliance requirements	Conducts role-based advanced application security training	Identifies potential attacker profiles	Documents, analyzes, and manages non-functional security requirements	Builds secure frameworks, security services, and security design patterns	Makes design reviews available for projects	Uses automated code analysis tools; requires code analysis as part of development	Integrates black box security testing tools into QA of software releases	Performs periodic internal white box pen testing	Develops consistent incident response process	Monitors baseline environment configuration changes	Establishes enterprise and assurance requirements for supplier agreement	Evaluates solicitation responses	Monitors and corrects supplier processes and performance
BSIMM	SM1.5	CP1.3	T2.1	AM1.3	SR1.3	SFD2.1	AA2.1	CR1.4	ST2.1	PT2.1 - PT2.3	CMVM1.1	SE1.1	SR2.1, SR2.5	-	-
	SM2.1	CP3.2	-	-	-	SFD2.3	AA2.3	CR2.3	-	-	-	-	-	-	-
CMMI-ACQ	MA SG1 - SG2	OPF SG2 - SG3	OT SG2	RSKM SG1 - SG2	ARD SG1, SG3	ATM SG2	AVAL SG1	AVER SG3	AVER SG3	AVER SG3	CAR SG1	CM SG2 - SG3	REQM SG1	SSAD SG2	AM SG1
	PMC SG1	-	-	-	REQM SG1	AVAL SG2	PMC SG1 - SG2	-	-	-	OPD SG1	-	ARD SG2	-	REQM SG1
OSAMM	SM1B	PC2A	EG2A	TA1B	SR1B	SA2A	DR2A	CR2A	ST1B	ST1A	VM2A	EH2B	SR3A	-	-
	-	-	EG3B	-	-	SA2B	DR2B	CR2B	-	ST1B	-	-	-	-	-
PRM	SG 1.1	SG 1.2	SG 1.3	SG 3.2	SG 3.1	SG 3.2	SG 3.4	SG 3.4	SG 3.4	SG 3.4	SG 4.3	SG 4.3	SG 3.1	SG 2.3	SG 2.3
	SG 2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	SG 3.5
RMM	MA:SG2	RTSE:SG2	OTA:SG3 - SG4	RISK:SG1 - SG4	COMP:SG2	RTSE:SG3	-	RTSE:SG3	RTSE:SG3	RTSE:SG3	VAR:SG1	ADM:SG3	EXD:SG3	EXD:SG3	EXD:SG4
	MON:SG2	COMP:SG1	-	KIM:SG6	RRM:SG1	-	-	-	-	-	MON:SG1	KIM:SG5	RRD:SG2 - SG3	-	RRM:SG1
Practices:	Drives budgets based upon analysis from metrics collections	Measures project compliance at specific checkpoints	Provides security resources for coaching / learning	Builds and maintains abuse cases and attack patterns	Builds repository of well written testable and reusable security requirements	Requires use of approved security platforms and architectures	Builds standard architectural patterns from lessons learned	Tailors code analysis for application-specific concerns	Employs risk-driven automated security and regression testing in QA process	Performs extensive penetration testing customized with organizational knowledge	Conducts root cause analysis for incidents, fixes all occurrences of bugs	Identifies and deploys relevant operations and protection tools; performs code signing	Establishes supplier agreement	Negotiates and selects supplier	Evaluates and accepts supplier work products
BSIMM	SM1.5	CP2.3	T1.3 - T1.4	AM2.1	SR1.2	SFD3.2	AA3.2	CR3.1	ST3.1	PT3.1 - PT3.2	CMVM3.1 - 3.2	SE2.3	CP2.4	-	-
	-	CP3.3	T2.4 - T2.5	AM 2.2	SR2.3	-	-	-	-	-	-	-	CP3.2	-	-
CMMI-ACQ	PMC SG2	OPP SG1	OT SG2	RSKM SG2	-	CM SG1	AVAL SG2	AVER SG3	AVER SG3	AVER SG3	CAR SG1 - SG2	OID SG1 - SG2	SSAD SG3	SSAD SG2	AM SG1
	-	-	-	-	-	-	-	-	-	-	-		-		PPQA SG1
OSAMM	SM3A	PC3A	EG1B - EG2B	TA2A	SR2A	SA3A	DR3A	CR3A	ST1A	ST1B	VM3A	EH3A	-	-	-
	SM3B	-	EG3A	-	-	SA3B	-	-	ST2A	-	-	OE3B	-	-	-
PRM	SG 3.1	SG 4.1	SG 1.3	SG 3.1	-	SG 3.2	SG 3.4	SG 3.4	SG 3.4	SG 3.4	SG 4.2	SG 4.3	SG 2.3	SG 2.3	SG 2.3
	-	-	-	-	-	-	-	-	-	-	SG 3.5	-	-	-	-
RMM	RTSE:SG3.SP1	RTSE:SG2	OTA:SG2	RISK:SG1 - SG4	KIM:SG6	KIM:SG2	KIM:SG6	RTSE:SG2	RTSE:SG3	RTSE:SG3	VAR:SG2 - SG4	RISK:SG5	EXD:SG3	EXD:SG3	EXD:SG4
	MON:SG2	COMP:SG3 - SG4	OTA:SG4	KIM:SG6	-	-	-	RTSE:SG3	-	-	MON:SG2	-	-	-	RRM:SG1

- The analysis became a framework depicting the agreement and differences among the models
- Provides a valuable reference for those wishing to improve their assurance capabilities
- Evolved into a more robust SwA tool
- The SwA Checklist serves as a model-agnostic harmonized view of current software assurance guidance.

Intended Use

- Useful to any organization that is currently or will soon be acquiring or developing software
- Organizations can use the SwA Checklist to:
  - Guide their own development
  - Evaluate vendor capabilities
- The checklist can facilitate an understanding of similar assurance goals and practices among the models
- Guide the selection of the most appropriate model components

Design of the SwA Checklist

- Currently implemented as a “hot linked” Microsoft Excel spreadsheet
- Provides a cross-reference of goals and practices with side-by-side mappings to several freely available maturity models
- Presents a list of consolidated goals and practices as well as additional detail illustrating where the maturity models agree and diverge
- The consolidated format simplifies identification of the model components best suited for use

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SwA Checklist Design

Software Assurance Checklist for Software Supply Chain Risk Management

Domains:	Governance			Knowledge			Verification			Deployment			Supplier Management		
Categories:	Strategy & Metrics	Policy & Compliance	Training & Guidance	Threat Assessment	Security Requirements	Secure Design	Architecture Analysis	Code Analysis	Risk-Based Security Testing	Penetration Testing	Vulnerability Management	Environment Hardening	Agreement Requirements	Evaluation & Selection	Agreement Management
Goals:	Establishes and executes plan for ensuring software is secured throughout the supply chain	Enforces and tracks compliance with security plan policies and other compliance requirements	Fosters training and awareness programs to ensure staff can properly maintain a secure software supply chain	Performs threat modeling and maintains knowledgebase of threats to secure software supply chain	Develops and enforces security requirements that will ensure a secure software supply chain	Builds security into the software design	Reviews software designs to ensure they meet the documented assurance requirements	Analyzes code to mitigate bugs before advancing to production	Performs automated testing as part of QA process to identify flaws	Conducts penetration testing to test software from a hacker's perspective	Establishes robust processes to identify, prioritize, and fix software vulnerabilities	Protects, monitors, and manages the software environment	Manages supplier risk and documents supplier security requirements	Reviews and selects supplier(s) demonstrating sufficient risk management controls and processes to meet security requirements	Enforces, monitors, manages, and analyzes supplier performance against documented supplier security requirements
Practices:	Establisher Security Plan; communicates and provides training for the plan	Identifies and monitors relevant compliance drivers	Conducts security awareness training regularly	Builds and maintains list of application-specific attack models	Documents, analyzes, and manages functional security requirements	Develops list of preferred frameworks and security features; explicitly applies security principles to design	Reviews design against security requirements	Develops list of top bugs and creates review checklists from security requirements	Performs edge/boundary value condition testing in QA process	Performs external penetration testing on production software with latest techniques and mitigates defects	Identifies point of contact for incident reporting; creates incident response team	Maintains operational environment specification	Identifies and prioritizes supplier dependencies; identifies, analyzes, and mitigates risks associated with	Establishes, reviews, and distributes solicitation package	Formalizes supplier relationships and executes supplier agreements
Status:															
Practices:	Collects and tracks Security Plan metrics based upon risk	Establishes policies and procedures for compliance with security plan and other compliance requirements	Conducts role-based advanced application security training	Identifies potential attacker profiles	Documents, analyzes, and manages non-functional security requirements	Builds secure framework, security services, and security design patterns	Makes design reviews available for projects	Uses automated code analysis tools; requires code analysis as part of development process	Integrates black box security testing tools into QA software release	Performs periodic internal white box testing	Develops consistent incident response process	Monitors baseline environment configuration changes	Establishes enterprise and assurance requirements for supplier agreements	Evaluates solicitation responses	Monitors and corrects supplier processes and performance
Status:															
Practices:	Drives budgets based upon analysis from metrics collection	Measures project compliance; specific checkpoints	Provides security resources for coaching / learning	Builds and maintains abuse cases and attack patterns	Builds knowledgebase of well-written reusable, testable security requirements	Requires use of approved security platforms and architectures	Builds standard architectural patterns from lessons learned	Tailors code analysis for application-specific concerns	Employs risk-driven automated security and reorganizes testing in QA process	Performs extensive penetration testing customized with organizational knowledge	Conducts root cause analysis for incidents, fixes all occurrences of bugs	Identifies and deploys relevant operational and protection tools; performs code scanning	Establishes supplier agreements	Negotiates and selects supplier	Evaluates and accepts supplier work products
Status:															

Intro | SwA Checklist | Sources | BSIMM | CMMI-ACQ | OSAMM | PRM | RMM

- All fields are hyperlinked to specifically related areas in other tabs in the spreadsheet
- This linking allows the user to read how different models address similar assurance goals and practices

Design of the SwA Checklist

- The SwA Checklist has five domains:
  - Governance
  - Knowledge
  - Verification
  - Deployment
  - Supplier Management
- There are three categories under each domain, each having their own goal statement.
- Each goal contains three practices.

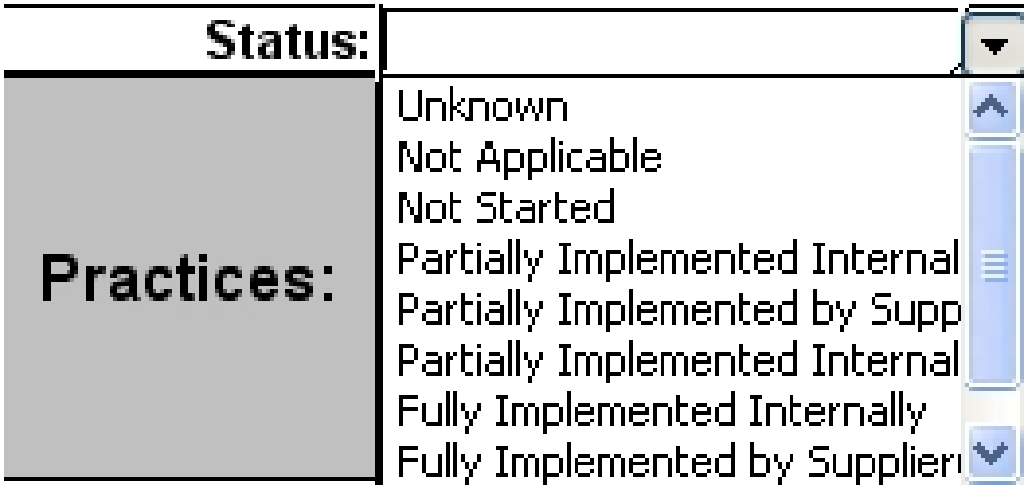
Domains:	Governance		
Categories:	Strategy & Metrics	Policy & Compliance	Training & Guidance
Goals:	Establishes and executes plan for ensuring software is secured throughout the supply chain	Enforces and tracks compliance with security plan policies and other compliance requirements	Fosters training and awareness programs to ensure staff can properly maintain a secure software supply chain
Practices:	Establishes Security Plan; communicates and provides training for the plan	Identifies and monitors relevant compliance drivers	Conducts security awareness training regularly
Status:			

Establishing a Baseline

- Organizations can establish an assurance baseline using the SwA Checklist
- Learn more about current software assurance best practices
- Become increasingly familiar with the referenced maturity models
- Select model components most applicable to specific needs or use the mappings as added value for the maturity model already in use

Establishing a Baseline

- There is a “Status” cell under each practice in which to select an implementation status.



- The aggregation of the status of each practice helps organizations understand their ability to execute on software assurance activities.

Implementation Status

- Implementation status options vary based upon:
  - The degree to which the practice is implemented (i.e., not started, partially implemented, or fully implemented) and
  - The party responsible for each practice (i.e., internally, by the supplier, or by both).
- Two other responses include “Unknown” and “Not Applicable.”
  - Follow up on these statuses
  - Unknown = increased risk
  - “Not Applicable” responses require justification
- Thoroughly investigate the status of each practice
- Users may discover:
  - Certain practices actually are applicable or
  - Practices are already being performed as part of other related practices

Baseline Summary

- After establishing a baseline, a summary displays at the bottom
- This system provides an easy-to-view dashboard for an organization's overall implementation of assurance practices

Summary:	
Not Applicable:	0
Unknown or Not Started:	9
Partially Implemented:	19
Fully Implemented:	17

Baseline Challenges

- “Stop light” colors can be misleading
- Do not focus solely on the “reds” and “yellows”
- “Green” does not necessarily satisfy the organization’s assurance goals or adequately mitigate risks
- A practice in green is one that is being performed, not necessarily one that is required
- Analyze the entire checklist to determine if the correct entity performs each practice correctly and to a sufficient extent, and if each practice is actually mitigating risks according to the organization’s assurance goals

Baseline Challenges

- Practices marked as “Fully Implemented” do not necessarily represent resources that are well allocated
- Select components from the source models to improve the implementation of practices specifically required to meet assurance goals, then ensure their satisfactory completion
- Measure not only the assurance activities, but also software lifecycle artifacts (e.g., code) to ensure both are improving
- Determine the model components that help accomplish a coherent and cohesive set of activities that meet organizational goals based upon business objectives and risk appetite

SwA Checklist Benefits

- Establishes an assurance baseline
- Facilitates understanding and selection of maturity models and model components
- Increases understanding of overall supply chain assurance and implementation of practices
- Enables more productive dialogue among all supply chain parties
- Fosters better understanding of where risk is introduced during acquisition or development of software
- Baseline provides an organized framework from which to discuss resource needs with senior leadership for assurance initiatives

Plans

- The SwA Checklist will be available on the DHS SwA Community Resources and Information Clearinghouse website.
- The SwA Forum Processes & Practices Working Group plans to add mappings to additional models and update the SwA Checklist as newer versions of mapped models are released.
- CrossTalk journal article

Contacts

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