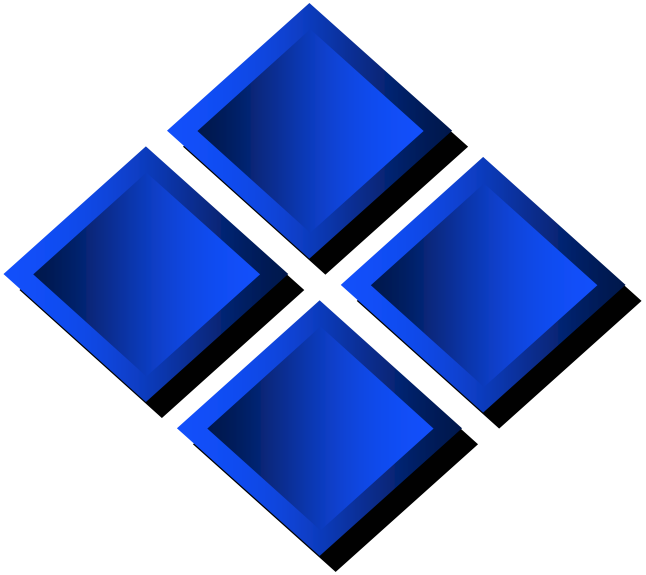

Achieving System and Software Assurance Through CMMI®-Compliant Processes

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Convener, ISO/IEC JTC1/SC7 WG9, System and Software Integrity

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Topics

- The Scope of System and Software Assurance
- Achieving System and Software Assurance Through CMMI®-Compliant Processes
- The CMMI® and Assurance
- Assurance in the Context of the Life Cycle
- Standards Supporting System and Software Assurance
- Implementing Assurance Processes

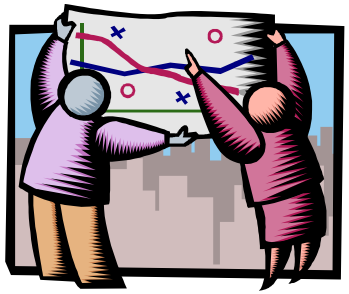
The Scope of System and Software Assurance

System and software assurance focuses on the management of risk and assurance of safety, security, and dependability within the context of system and software life cycles.

Terms of Reference: ISO/IEC JTC1/SC7 WG9, System and Software Integrity

Achieving System and Software Assurance Through CMMI®-Compliant Processes

1. Understand Your Business Requirements for Assurance



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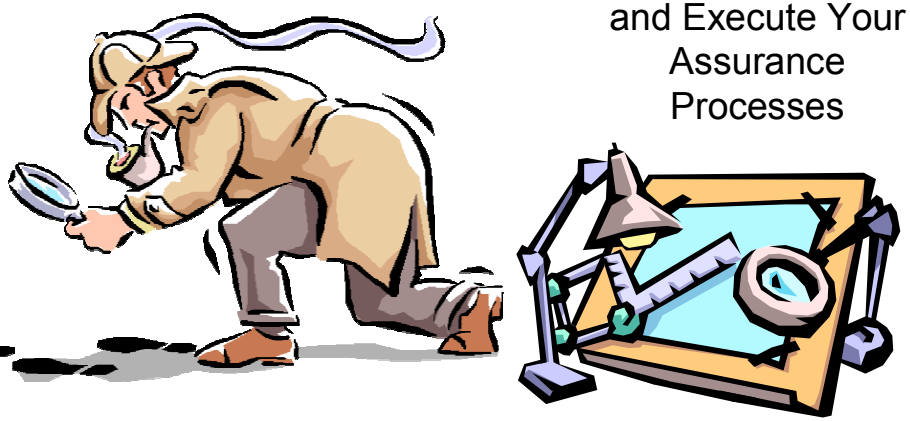
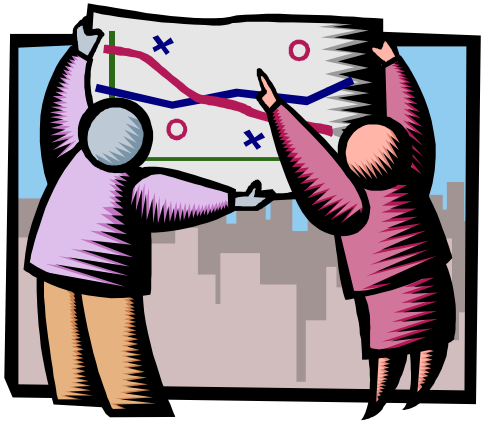


Business Requirements for Assurance

What are your business requirements for System and Software Assurance?

- Business process requirements
- Legal and regulatory requirements
- Marketplace requirements
- Customer-specific requirements
- Product-specific requirements

1. Understand Your Business Requirements for Assurance



The CMMI® and Assurance

How does the CMMI® support System and Software Assurance?

2. Look to the CMMI® for Assurance-Related Process Capability Expectations

CMMI® Assurance Shortfalls

- Inconsistent treatment of safety and security concerns
- Insufficient assurance detail in required and expected components
  - Specific goals
  - Specific practices
- Insufficient traceability to assurance source standards

CMMI® – Process Areas and Assurance

Process Area	Explicit	Implicit	Supporting
Process Management			
OPF			✓
OPD			✓
OT			✓
OPP			✓
OID			✓
Project Management			
PP	✓		
PMC	✓		
SAM	✓		
IPM			✓
RSKM	✓		
IT			✓
ISM			✓
QPM			✓
Engineering			
REQM	✓		
RD	✓		
TS	✓		
PI	✓		
VER		✓	
VAL		✓	
Support			
CM	✓		
PPQA		✓	
MA		✓	
DAR	✓		
OEI	✓		
CAR	✓		

CMMI® – Project Management Process Areas and Assurance

- Project Planning (PP)
- Project Monitoring and Control (PMC)
- Supplier Agreement Management (SAM)
- Risk Management (RSKM)

CMMI® – Project Management Assurance Objectives - PP

Project Planning

- Determine the ***technical approach*** for the project, including the ***functionality*** expected in the final products, such as ***safety and security***
- Estimate ***effort and cost*** using models and/or historical data including **inputs related to level of security required** for tasks, work products, hardware, software, personnel, and work environment.
- ***Plan for the management of project data*** including ***data supporting safety*.**
- ***Establish requirements and procedures*** to ensure privacy and ***security of the data*.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Project Management Assurance Objectives - PMC

Project Monitoring and Control

- ***Monitor resources provided and used*, including the *security environment***
- ***Collect and analyze issues*** and ***determine the corrective actions*** necessary to address the issues, ***including security issues*.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Project Management Assurance Objectives - SAM

Supplier Agreement Management

- ***Evaluate the impact of candidate COTS products*** on the project's ***plans and commitments, including security requirements***

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Project Management Assurance Objectives - RSKM

Risk Management

- ***Identify the risks*** associated with cost, schedule, and performance in all appropriate product life-cycle phases, ***including risks associated with maintaining safety and security performance*.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Engineering Process Areas and Assurance

- Requirements Development (RD)
- Technical Solution (TS)
- Product Integration (PI)
- Verification* (VER)
- Validation* (VAL)

******Implicit*

CMMI® – Engineering Assurance Objectives - RD

Requirements Development

- ***Analyze needs and requirements for each product life-cycle phase*****,** including factors that reflect overall customer and end-user expectations and satisfaction, ***such as safety, security*****,** and affordability.
- Ensure that the ***design adheres to applicable design standards and criteria***, including ***safety standards*****.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Engineering Assurance Objectives - TS

Technical Solution

- ***Design comprehensive product-component interfaces*** in terms of ***established and maintained criteria*****,** including ***safety and security*****.**
- ***Adhere to applicable standards and criteria*****,** including ***safety standards*****.**
- ***Train the people performing or supporting the technical solution process*** as needed, including ***safety standards*****.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Engineering Assurance Objectives - PI

Product Integration

- ***Satisfy the applicable requirements and standards for packaging and delivering the product*, including** those for ***safety and security*.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Engineering Assurance Objectives - VER

Verification*

- ***Establish and maintain the environment*** needed to support verification. For example, a product test may require simulators, emulators, scenario generators, data reduction tools, environmental controls, and interfaces with other systems.
- ***Establish and maintain verification procedures and criteria*** for the selected work products.

******Implicit*

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Engineering Assurance Objectives - VAL

Validation*

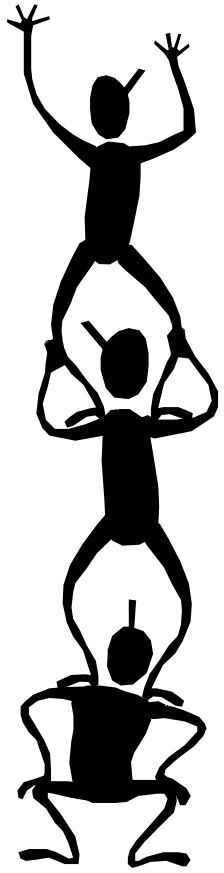
- ***Establish and maintain the environment*** needed to support validation.
- ***Establish and maintain procedures and criteria for validation*** to ensure that the product or product component will fulfill its intended use when placed in its intended environment.

****Implicit***

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Support Process Areas and Assurance

- Configuration Management (CM)
- Product and Process Quality Assurance* (PPQA)
- Measurement and Analysis* (MA)
- Decision Analysis and Resolution (DAR)
- Organization Environment for Integration (OEI)
- Causal Analysis and Resolution (CAR)



Implicit

CMMI® – Support Assurance Objectives - CM

Configuration Management

- ***Perform reviews*** to ***ensure that changes have not compromised the safety and/or security of the system*.**

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Support Assurance Objectives - PPQA

Product and Process Quality Assurance*

- ***Objectively evaluate the designated work products*** and services against the applicable process descriptions, standards, and procedures.

****Implicit***

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Support Assurance Objectives - MA

Measurement and Analysis*

- ***Establish and maintain measurement objectives*** that are derived from identified information needs and objectives. The sources for measurement objectives may be management, technical, project, product, or process implementation needs.
- ***Specify measures*** to address the measurement objectives. Measurement objectives are refined into precise, quantifiable measures.

****Implicit***

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Support Assurance Objectives - DAR

Decision Analysis and Resolution

- ***Establish and maintain guidelines*** to determine which issues are subject to a ***formal evaluation process***. For example, on design-implementation decisions when ***technical performance failure*** may cause a catastrophic failure (e.g., ***safety of flight item***).

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

CMMI® – Support Assurance Objectives - OEI

Organizational Environment for Integration

- ***Plan, design, and implement an integrated work environment***, including tradeoff of ***safety and security costs and benefits***.

Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

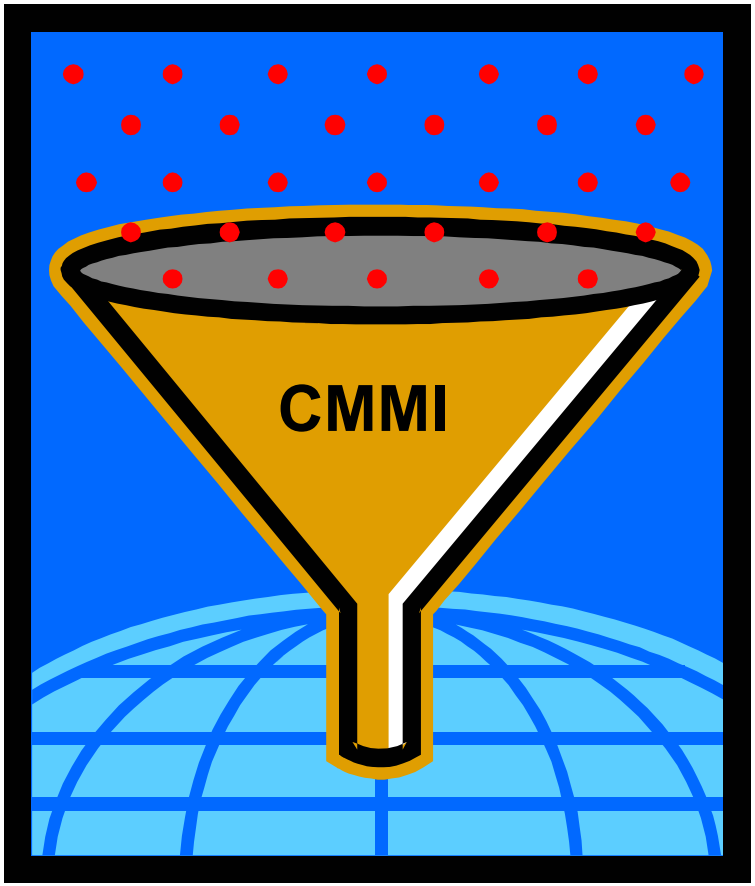
CMMI® – Support Assurance Objectives - CAR

Causal Analysis and Resolution

- ***Determine which defects and other problems will be analyzed further***, including ***safety impact considerations***.

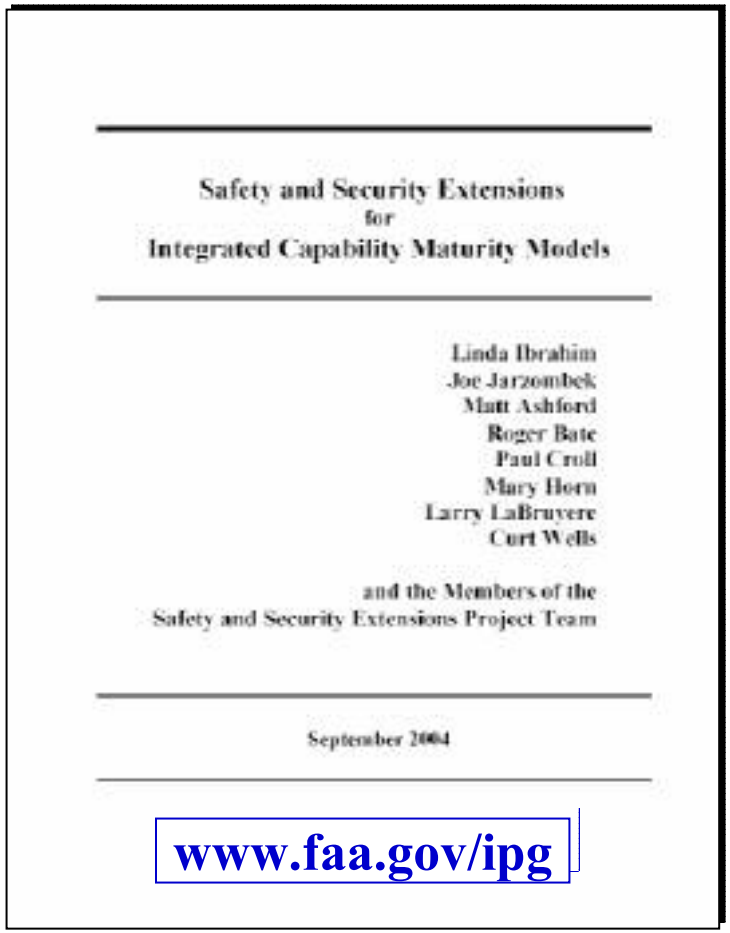
Source: CMMI® -SE/SW/IPPD/SS, V1.1, Continuous Representation, © CMU SEI,2002.

Beyond The CMMI®



Safety and Security Extensions for Integrated Capability Maturity Models

1. Ensure Safety and Security Competency
2. Establish Qualified Work Environment
3. Ensure Integrity of Safety and Security Information
4. Monitor Operations and Report Incidents
5. Ensure Business Continuity
6. Identify Safety and Security Risks
7. Analyze and Prioritize Risks
8. Determine, Implement, and Monitor Risk Mitigation Plan
9. Determine Regulatory Requirements, Laws, and Standards
10. Develop and Deploy Safe and Secure Products and Services
11. Objectively Evaluate Products
12. Establish Safety and Security Assurance Arguments
13. Establish Independent Safety and Security Reporting
14. Establish a Safety and Security Plan
15. Select and Manage Suppliers, Products, and Services
16. Monitor and Control Activities and Products



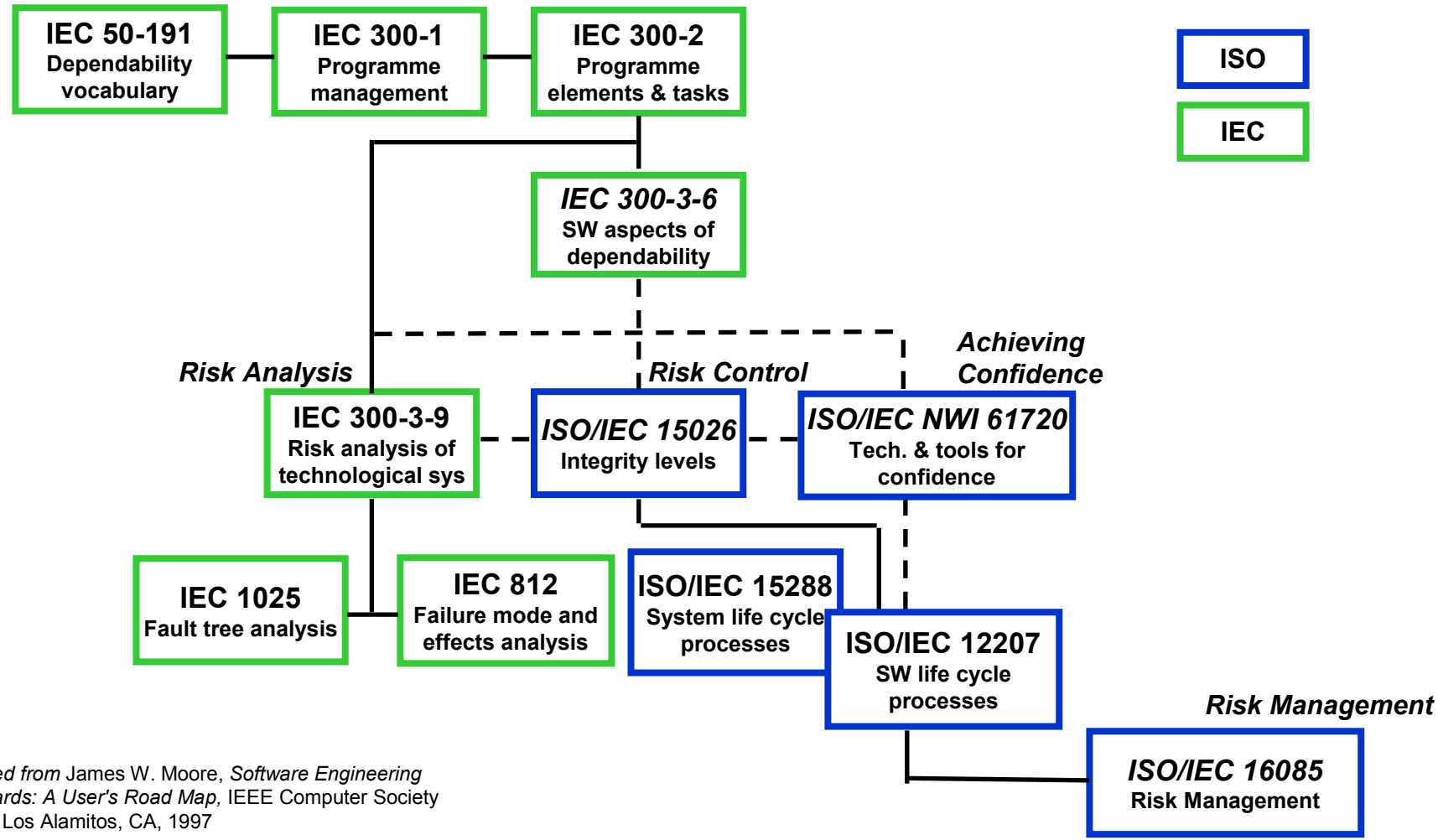
Source: United States Federal Aviation Administration, Safety and Security Extensions for Integrated Capability Maturity Models, September 2004

Standards Supporting System and Software Assurance

What Standards Support System and Software Assurance?

3. Look to Standards for Assurance Process Detail

Dependability Standards



Adapted from James W. Moore, *Software Engineering Standards: A User's Road Map,* IEEE Computer Society Press, Los Alamitos, CA, 1997

Safety and Security Standards

IEC 61508
Functional Safety

IEEE 1228
SW safety plans

Sector-Specific Standards

IEC 60880
SW in nuclear power safety systems

DO 178B
SW considerations in airborne equip certification

Military Standards

MIL-STD-882D
Standard Practice for System Safety

DEF STAN 00-56
Safety Management Requirements for Defence Systems

IEC

IEEE CS

Military

RTCA

Safety

Security

ISO/IEC 15408
Common Criteria for IT Security Evaluation

ISO/IEC 17799
Code of Practice for Information Security Management

ISO/IEC 10181
Security frameworks for open systems

IEEE P1619
Standard Architecture for Encrypted Shared Storage Media

ISO/IEC 9796
Digital Security Schemes

IEEE P1700
Security Architecture for Certification and Accreditation of Information

ISO/IEC 21827
Systems Security Engineering CMM

IEEE P2200
Baseline Operating System Security

ISO

IEEE CS

FISMA Legislation

"Each Federal agency shall ***develop, document, and implement an agency-wide information security program*** to provide information security for the information and information systems that support the operations and assets of the agency, including those provided or managed by another agency, contractor, or other source…"

- Federal Information Security Management Act of 2002

Source: FISMA Implementation Project, Dr. Ron Ross, NIST, April 2004

NIST FISMA Implementation Project Standards and Guidelines

- FIPS Publication 199 (Security Categorization)
- NIST Special Publication 800-37 (Certification & Accreditation)
- NIST Special Publication 800-53 (Security Controls)
- NIST Special Publication 800-53A (Assessment)
- NIST Special Publication 800-59 (National Security)
- NIST Special Publication 800-60 (Category Mapping)
- FIPS Publication 200 (Minimum Security Controls)

Source: FISMA Implementation Project, Dr. Ron Ross, NIST, April 2004

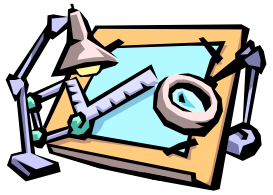
Use CMMI®-Compliant Processes to Achieve System and Software Assurance

Have you addressed the assurance implications of your CMMI®-compliant processes?

Do your assurance processes meet your business requirements?

- Business process requirements
- Legal and regulatory requirements
- Marketplace requirements
- Customer-specific requirements
- Product-specific requirements

4. Build or Refine and Execute Your Assurance Processes



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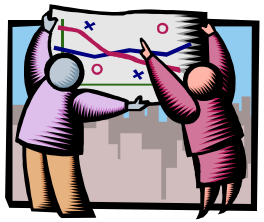

Achieving System and Software Assurance Through CMMI®-Compliant Processes

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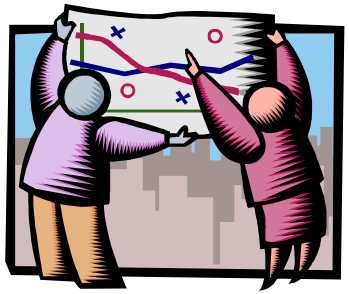

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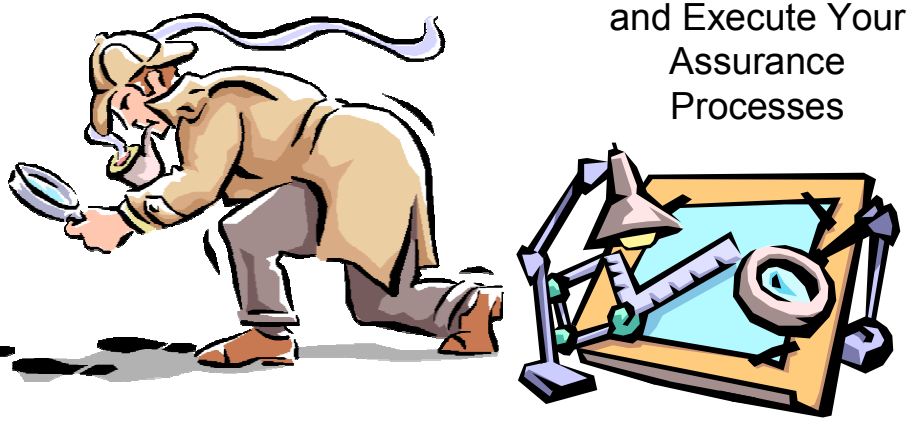

For More Information . . .

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For IEEE Standards:

http://computer.org/standards/sesc/
http://ieeeia.org/iasc/
http://computer.org/cspress/CATALOG/st01110.htm

For ISO/IEC Standards:

http://saturne.info.uqam.ca/Labo_Recherche/Lrgl/sc7/