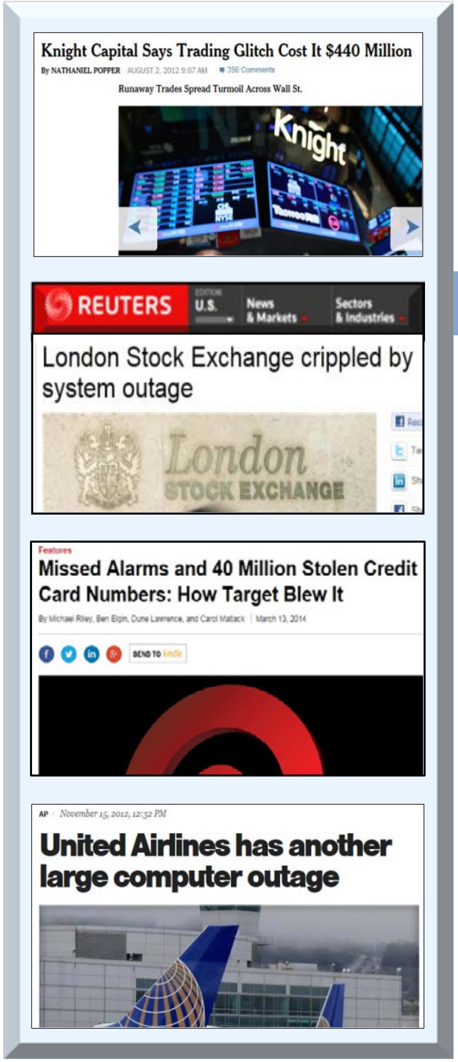
Advances in Measuring the Security and Architectural Integrity of Mission-Critical Systems

Dr. Bill Curtis
Executive Director
CISQ
Consortium for IT Software Quality

Why Measure IT Applications?

Six Digit Defects



Knight Capital Says Trading Glitch Cost It $440 Million

By NATHANIEL POPPER AUGUST 2, 2012 9:07 AM 356 Comments

Runaway Trades Spread Turmoil Across Wall St.

REUTERS EDITION U.S. News & Markets Sectors & Industries

London Stock Exchange crippled by system outage

Features

Missed Alarms and 40 Million Stolen Credit Card Numbers: How Target Blew It

By Michael Riley, Ben Elgin, Dune Lawrence, and Carol Matlack | March 13, 2014

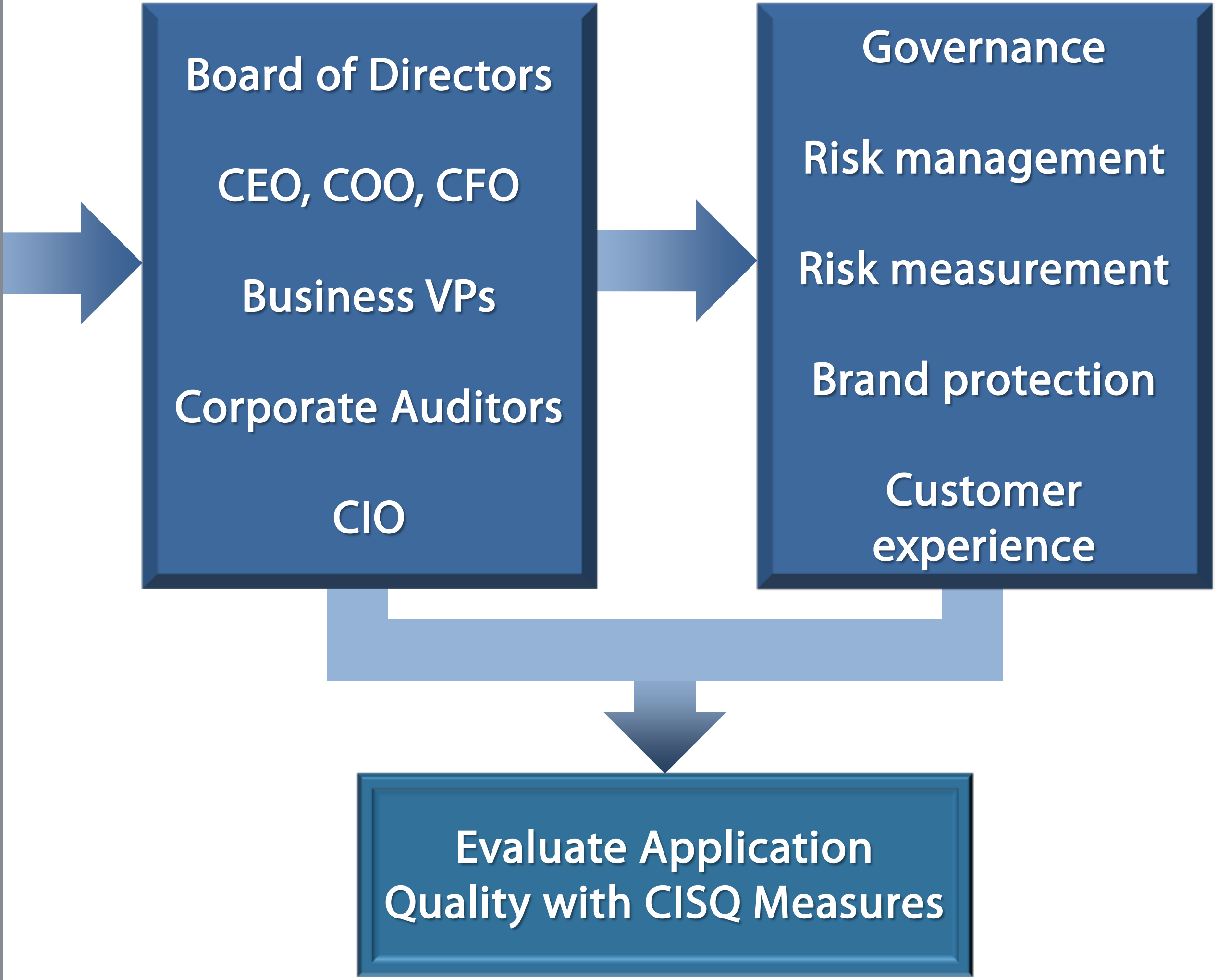
SEND TO kindle

AP / November 15, 2012, 12:32 PM

United Airlines has another large computer outage

now affect

accountable for



Board of Directors

CEO, COO, CFO

Business VPs

Corporate Auditors

CIO

Governance

Risk management

Risk measurement

Brand protection

Customer experience

Evaluate Application Quality with CISQ Measures

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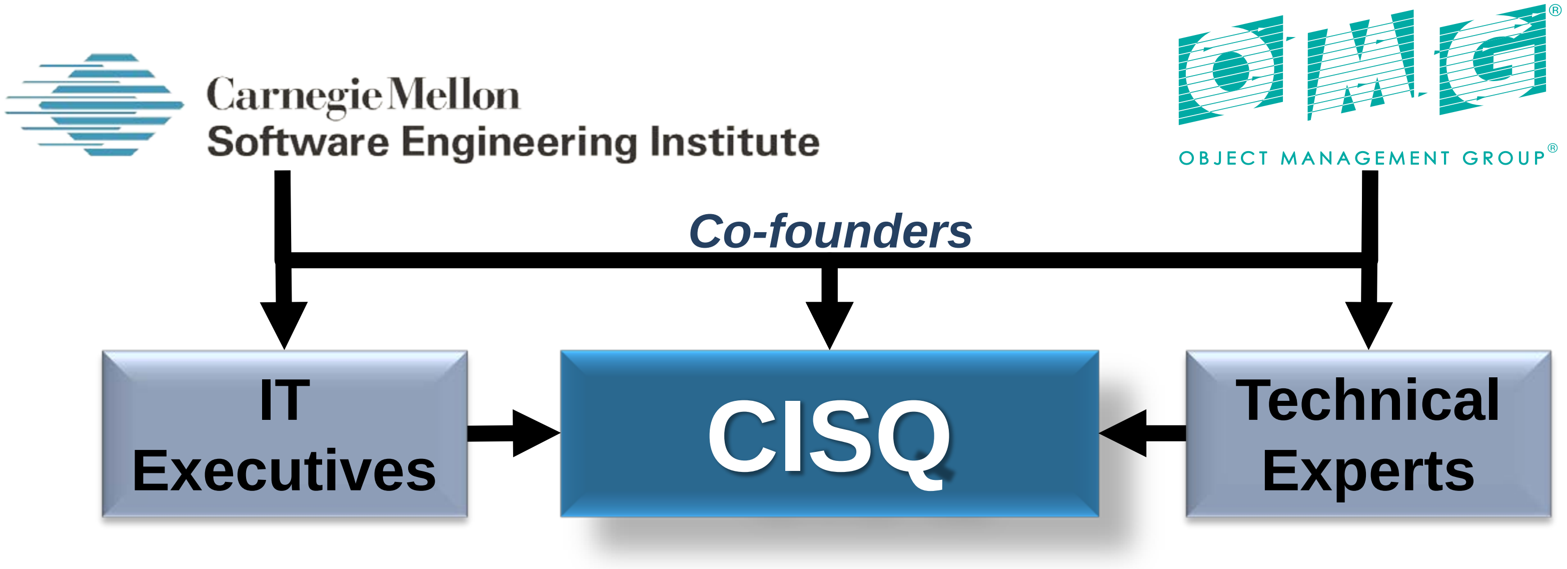
What is CISQ?


Carnegie Mellon Software Engineering Institute

OMG OBJECT MANAGEMENT GROUP®

Co-founders

IT Executives

CISQ

Technical Experts

OMG Special Interest Group

CISQ is chartered to define automatable measures of software size and quality that can be measured in the source code, and promote them to become Approved Specifications of the OMG®

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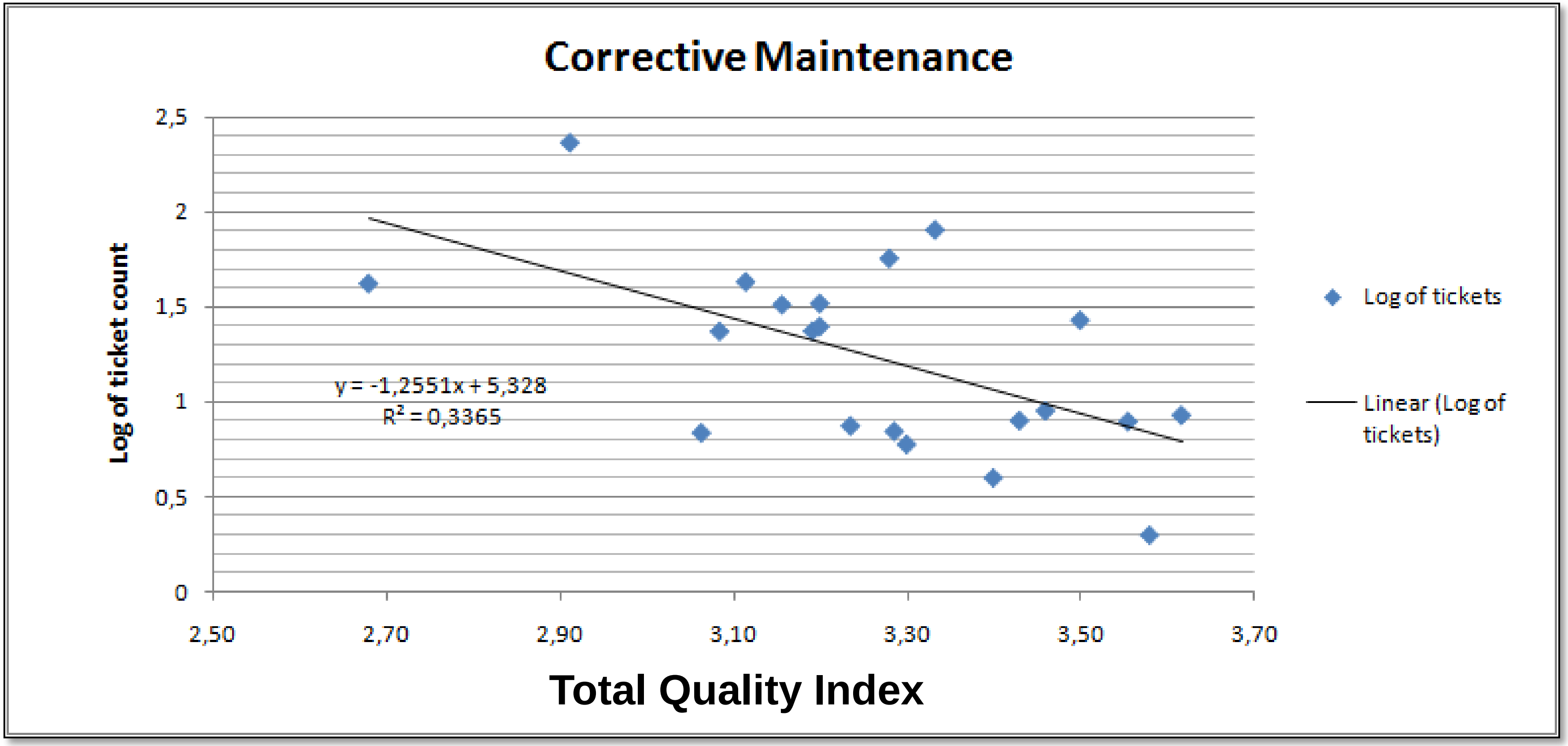
HUAWEI

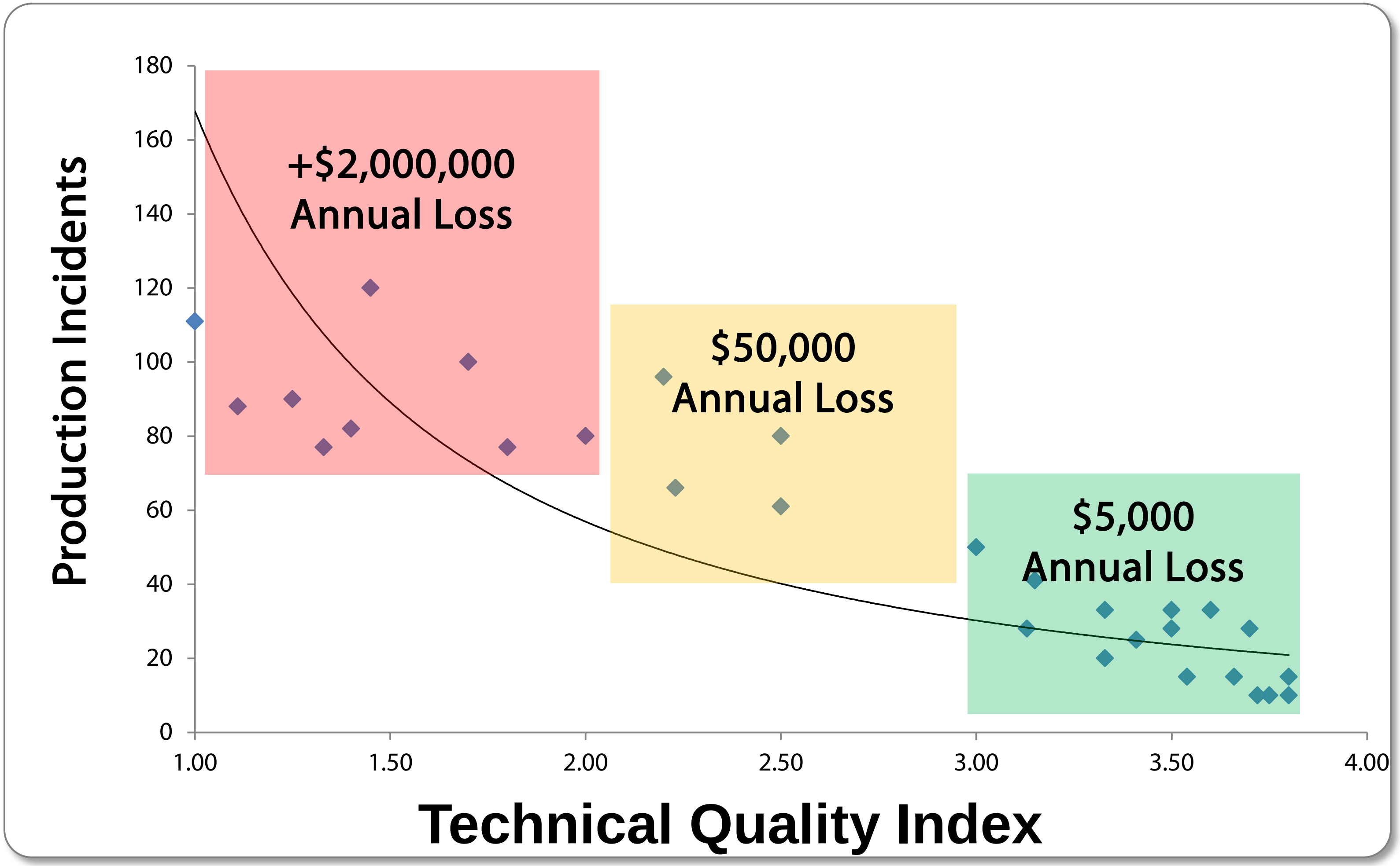
Reducing Operational Incidents & Costs

Study of structural quality measures and maintenance effort across 20 customers in a large global system integrator



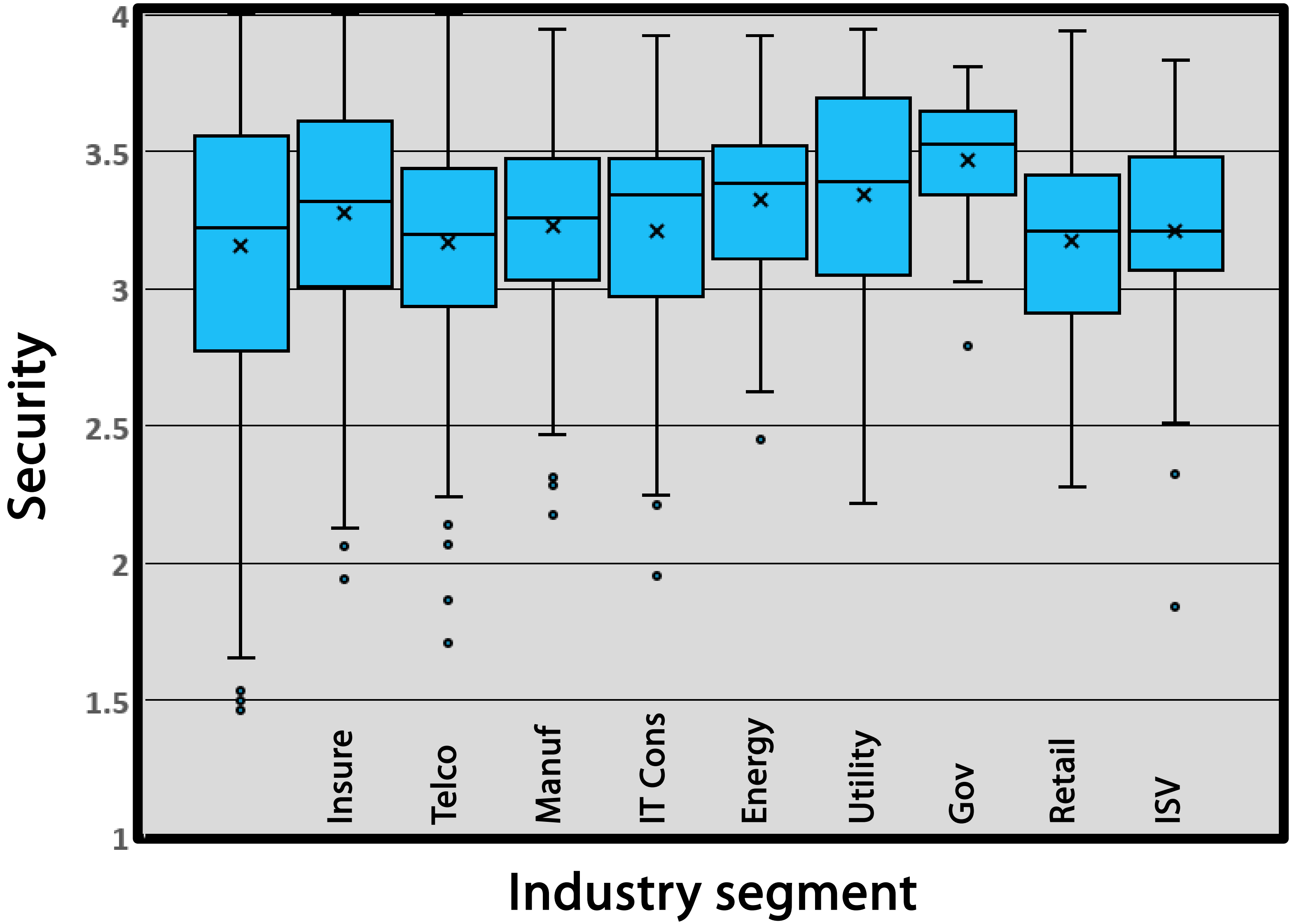
TQI increase of .24 decreased corrective maintenance effort by 50%

Reducing Operational Losses



Large international investment bank
Business critical applications

Too many Insecure Apps



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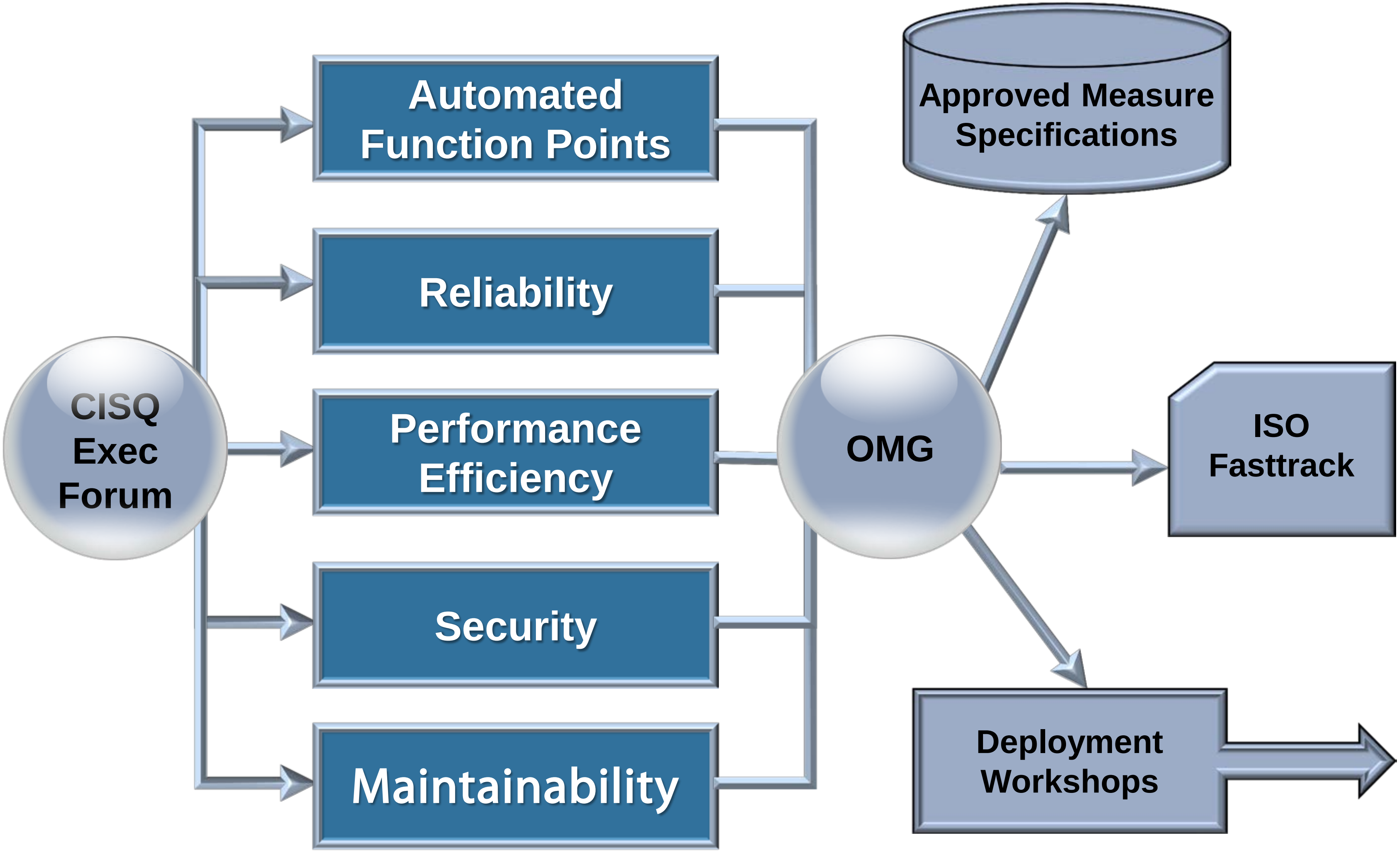
CISQ/OMG Standards Process


CISQ Exec Forum

Automated Function Points

Reliability

Performance Efficiency

Security

Maintainability

OMG

Approved Measure Specifications

ISO Fasttrack

Deployment Workshops

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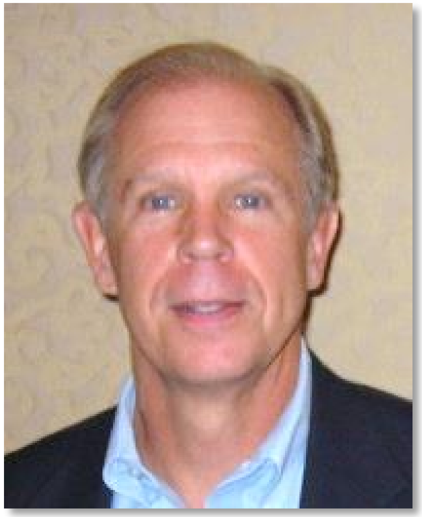
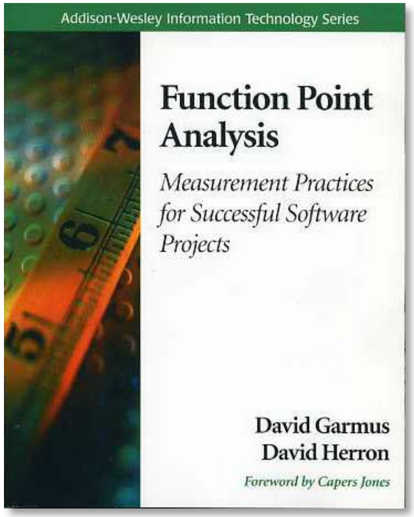
Automated Function Points

- OMG Supported Specification for Automated Function Points
- Mirrors IFPUG counting guidelines, but automatable
- Specification developed by international team led by David Herron of David Consulting Group





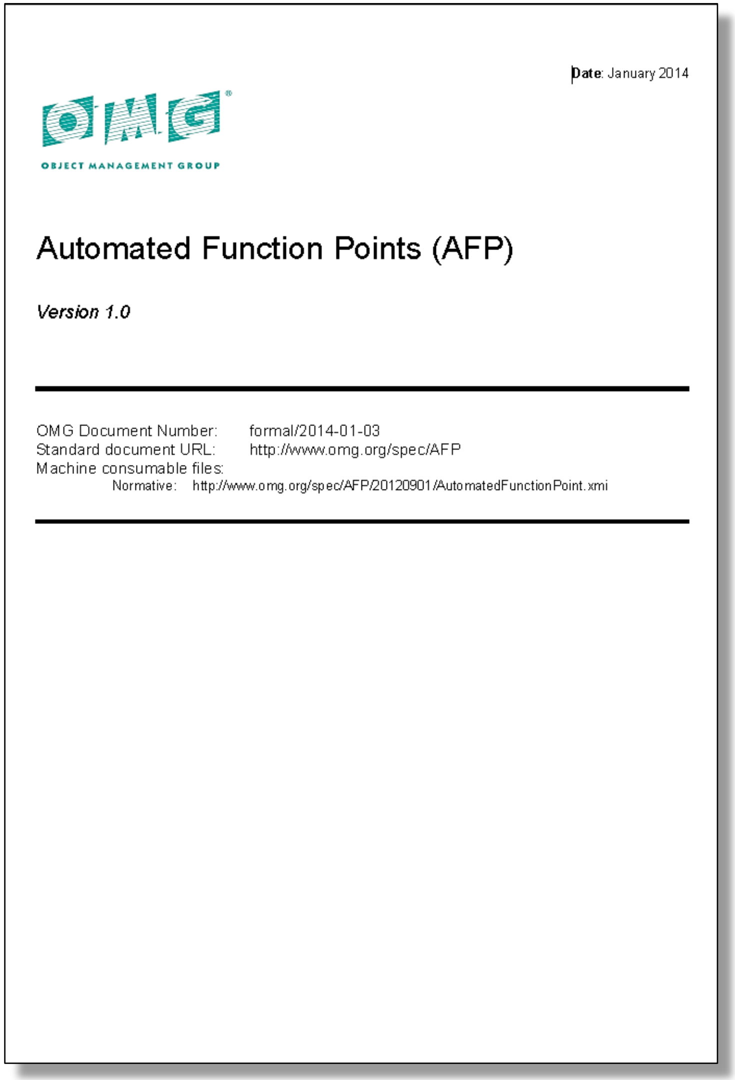
Addison-Wesley Information Technology Series

Function Point Analysis

Measurement Practices for Successful Software Projects

David Garmus
David Herron

Foreword by Capers Jones



Date: January 2014

OBJECT MANAGEMENT GROUP

Automated Function Points (AFP)

Version 1.0

OMG Document Number: formal/2014-01-03
Standard document URL: http://www.omg.org/spec/AFP
Machine consumable files:
Normative: http://www.omg.org/spec/AFP/20120901/AutomatedFunctionPoint.xmi

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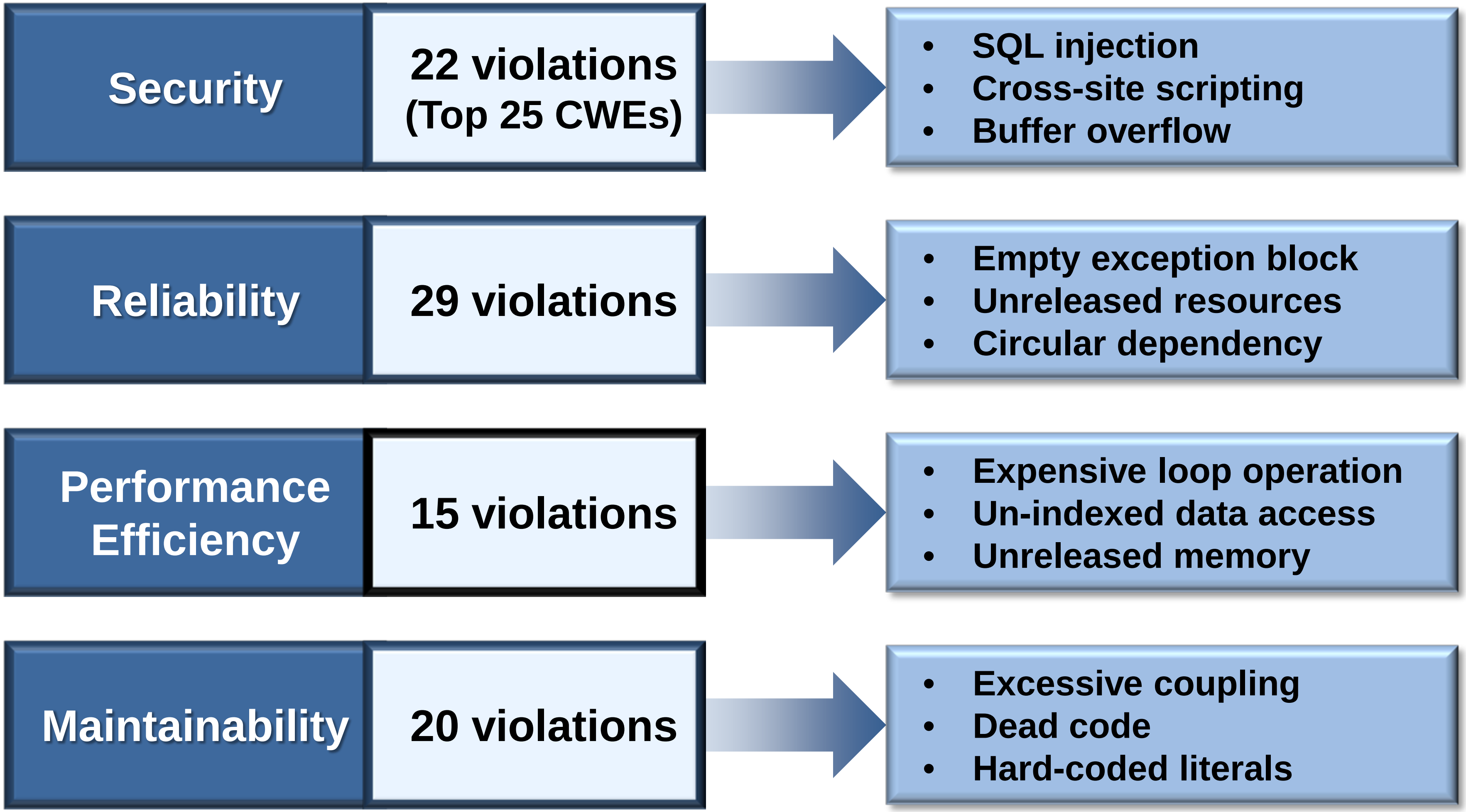
CISQ Structural Quality Measures



CISQ Quality Characteristic Measures		Example architectural and coding violations composing the CISQ measures
Security	22 violations (Top 25 CWEs)	• SQL injection • Cross-site scripting • Buffer overflow
Reliability	29 violations	• Empty exception block • Unreleased resources • Circular dependency
Performance Efficiency	15 violations	• Expensive loop operation • Un-indexed data access • Unreleased memory
Maintainability	20 violations	• Excessive coupling • Dead code • Hard-coded literals

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The 22 CWEs in the Security Measure

CWE-22	Path Traversal Improper Input Neutralization
CWE-78	OS Command Injection Improper Input Neutralization
CWE-79	Cross-site Scripting Improper Input Neutralization
CWE-89	SQL Injection Improper Input Neutralization
CWE-120	Buffer Copy without Checking Size of Input
CWE-129	Array Index Improper Input Neutralization
CWE-134	Format String Improper Input Neutralization
CWE-252	Unchecked Return Parameter of Control Element Accessing Resource
CWE-327	Broken or Risky Cryptographic Algorithm Usage
CWE-396	Declaration of Catch for Generic Exception
CWE-397	Declaration of Throws for Generic Exception
CWE-434	File Upload Improper Input Neutralization
CWE-456	Storable and Member Data Element Missing Initialization
CWE-606	Unchecked Input for Loop Condition
CWE-667	Shared Resource Improper Locking
CWE-672	Expired or Released Resource Usage
CWE-681	Numeric Types Incorrect Conversion
CWE-706	Name or Reference Resolution Improper Input Neutralization
CWE-772	Missing Release of Resource after Effective Lifetime
CWE-789	Uncontrolled Memory Allocation
CWE-798	Hard-Coded Credentials Usage for Remote Authentication
CWE-835	Loop with Unreachable Exit Condition ('Infinite Loop')

Robert Martin
MITRE

CWE™

Common
Weakness
Enumeration
cwe.mitre.org

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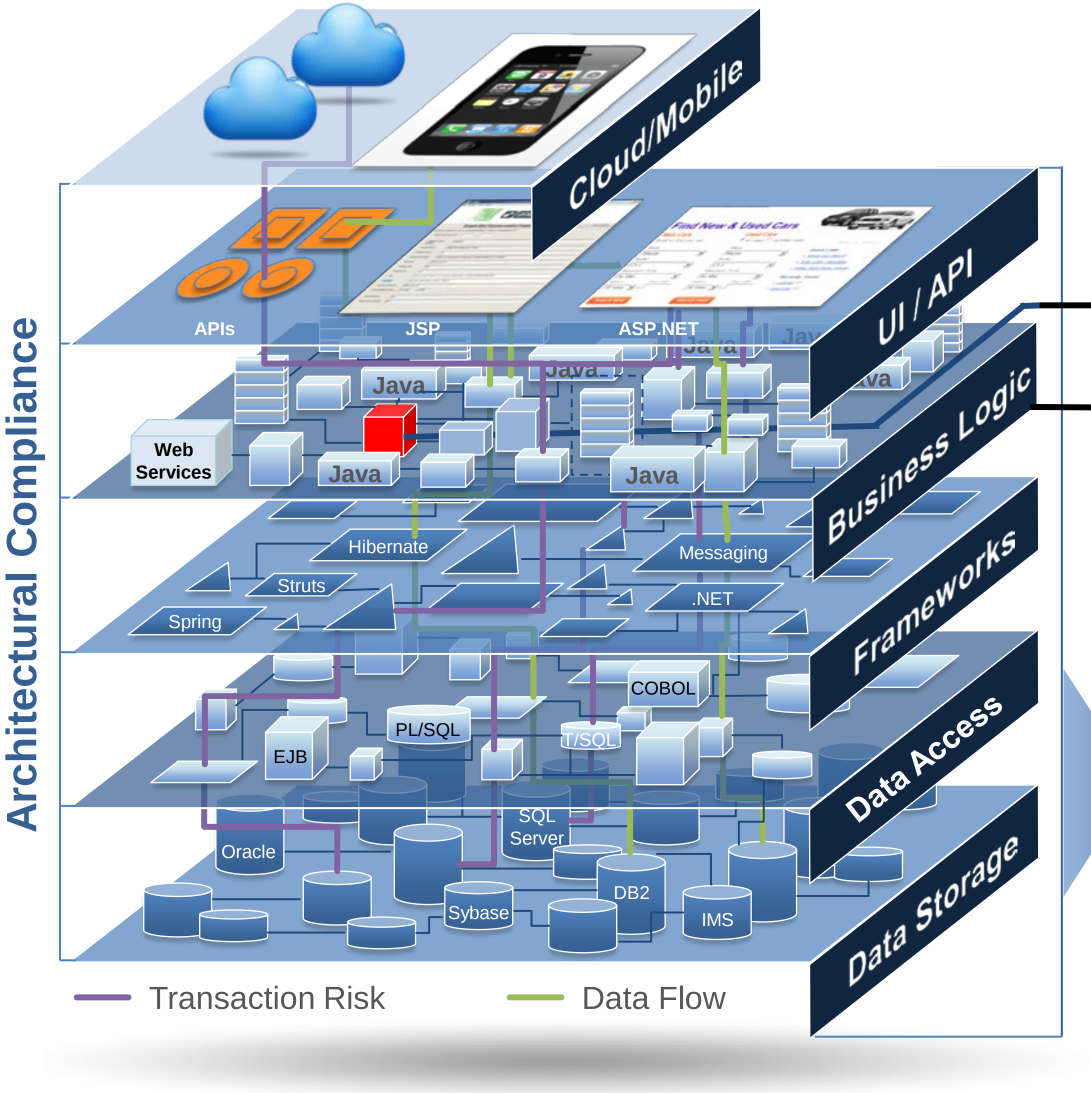
Modern Apps Are a Technology Stack



1 Unit Level

- Code style & layout
- Expression complexity
- Code documentation
- Class or program design
- Basic coding standards
- Developer level

2 Technology Level

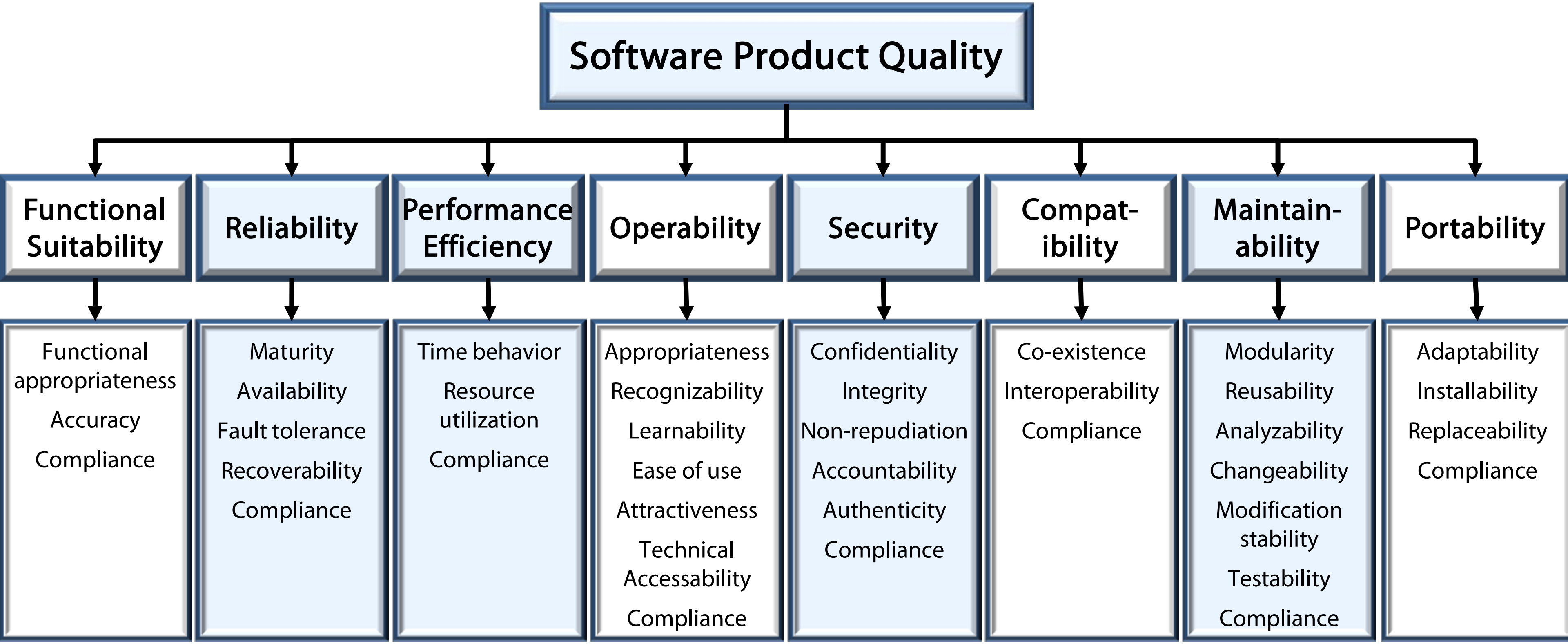
- Single language/technology layer
- Intra-technology architecture
- Intra-layer dependencies
- Inter-program invocation
- Security vulnerabilities
- Development team level

3 System Level

- Integration quality
- Architectural compliance
- Risk propagation
- Application security
- Resiliency checks
- Transaction integrity
- Function point
- Effort estimation
- Data access control
- SDK versioning
- Calibration across technologies
- IT organization level

How Do CISQ Measures Relate to ISO?

- ISO 25000 series replaces ISO/IEC 9126 (Parts 1-4)
- ISO 25010 defines quality characteristics and sub-characteristics
- CISQ conforms to ISO 25010 quality characteristic definitions
- ISO 25023 defines measures, but not at the source code level
- CISQ supplements ISO 25023 with source code level measures



Software Product Quality

Functional Suitability	Reliability	Performance Efficiency	Operability	Security	Compatibility	Maintainability	Portability
Functional appropriateness	Maturity	Time behavior	Appropriateness	Confidentiality	Co-existence	Modularity	Adaptability
Accuracy	Availability	Resource utilization	Recognizability	Integrity	Interoperability	Reusability	Installability
Compliance	Fault tolerance	Compliance	Learnability	Non-repudiation	Compliance	Analyzability	Replaceability
	Recoverability		Ease of use	Accountability		Changeability	Compliance
	Compliance		Attractiveness	Authenticity		Modification stability	
			Technical Accessability	Compliance		Testability	
			Compliance			Compliance	

CISQ automated quality characteristic measures highlighted in blue

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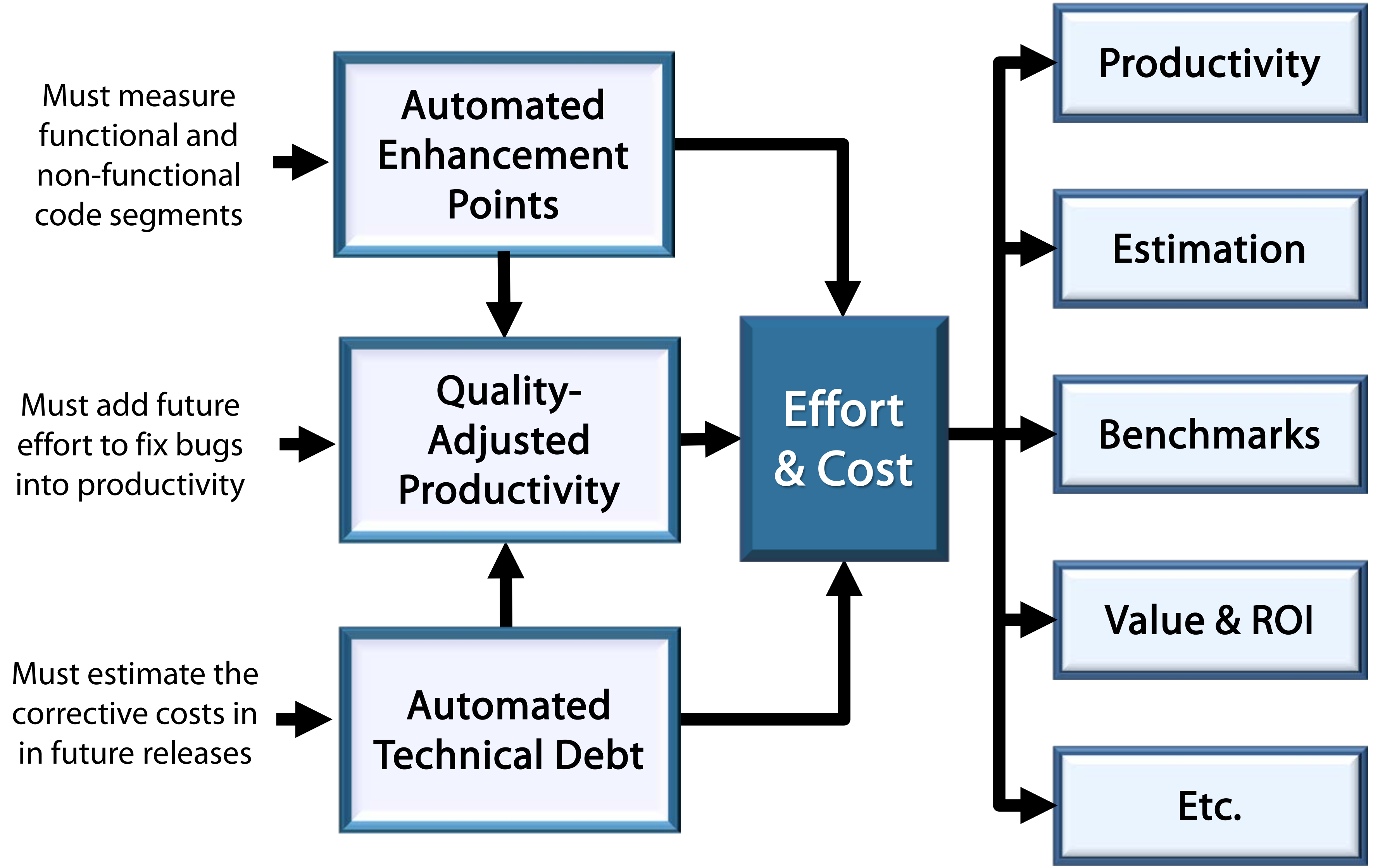
Emerging CISQ Measures


Must measure functional and non-functional code segments

Automated Enhancement Points

Must add future effort to fix bugs into productivity

Quality-Adjusted Productivity

Must estimate the corrective costs in in future releases

Automated Technical Debt

Effort & Cost

Productivity

Estimation

Benchmarks

Value & ROI

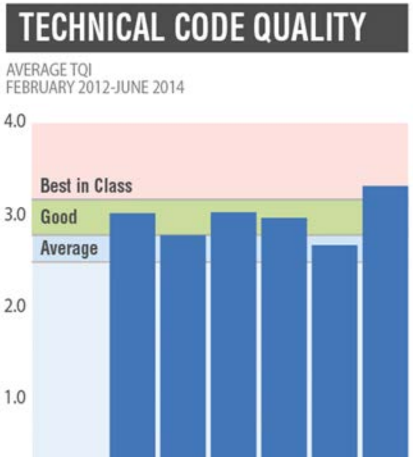
Etc.

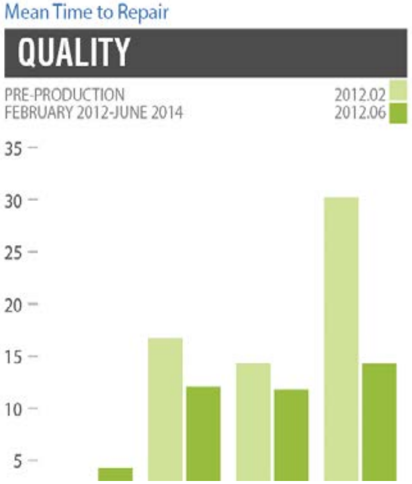
CISQ in Service Level Agreements

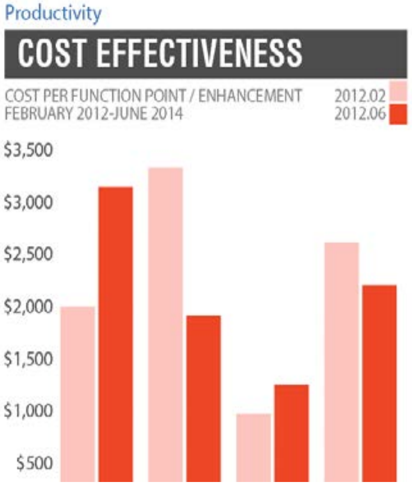
Evaluate Product Quality against Targets in Quality Level Agreements

Outsourcer	Automated Function Points	Reliability	Performance Efficiency	Security	Maintainability
VENDOR 1	245	3.16	2.34	3.01	1.99
VENDOR 2	628	2.78	2.78	3.12	2.34
VENDOR 3	931	1.67	3.54	2.98	1.76
VENDOR 4	659	3.12	3.11	2.79	3.11
VENDOR 5	86	2.56	2.88	3.03	2.56
VENDOR 6	1047	3.76	2.89	2.97	2.55

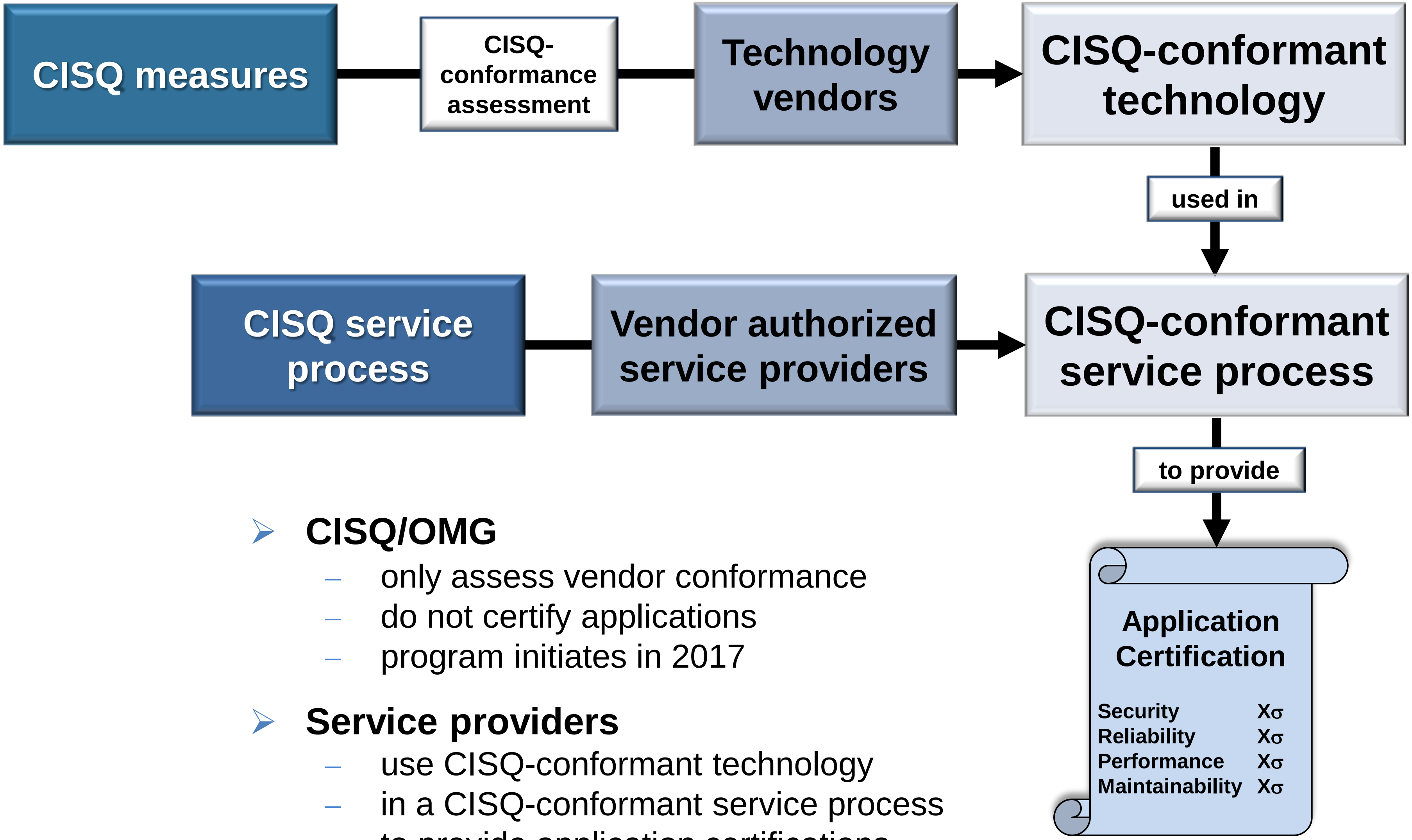
Monitor and Manage Service Provider Performance







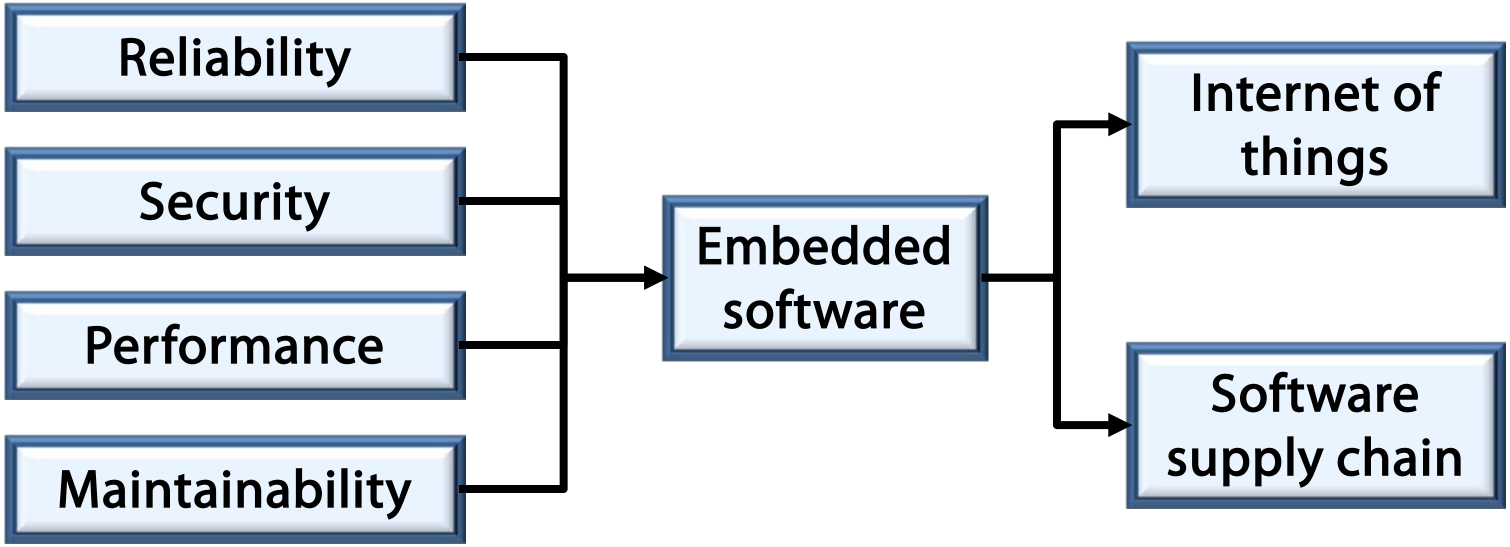
App Certification Using CISQ


CISQ measures
CISQ-conformance assessment
Technology vendors
CISQ-conformant technology
used in
CISQ service process
Vendor authorized service providers
CISQ-conformant service process
to provide
Application Certification
Security Xσ
Reliability Xσ
Performance Xσ
Maintainability Xσ

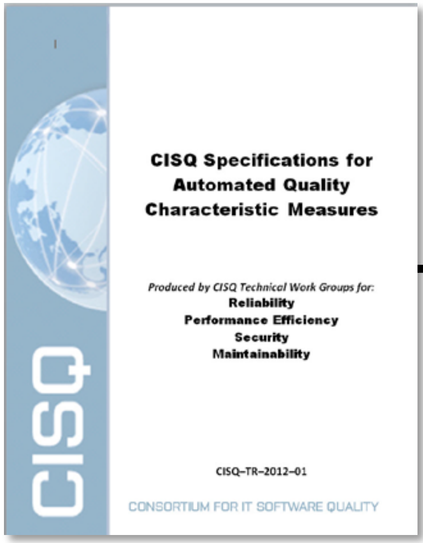
- **CISQ/OMG**
  - only assess vendor conformance
  - do not certify applications
  - program initiates in 2017
- **Service providers**
  - use CISQ-conformant technology
  - in a CISQ-conformant service process
  - to provide application certifications

CISQ's Current Work Agenda

Embedded software extensions



Deploy CISQ into policy



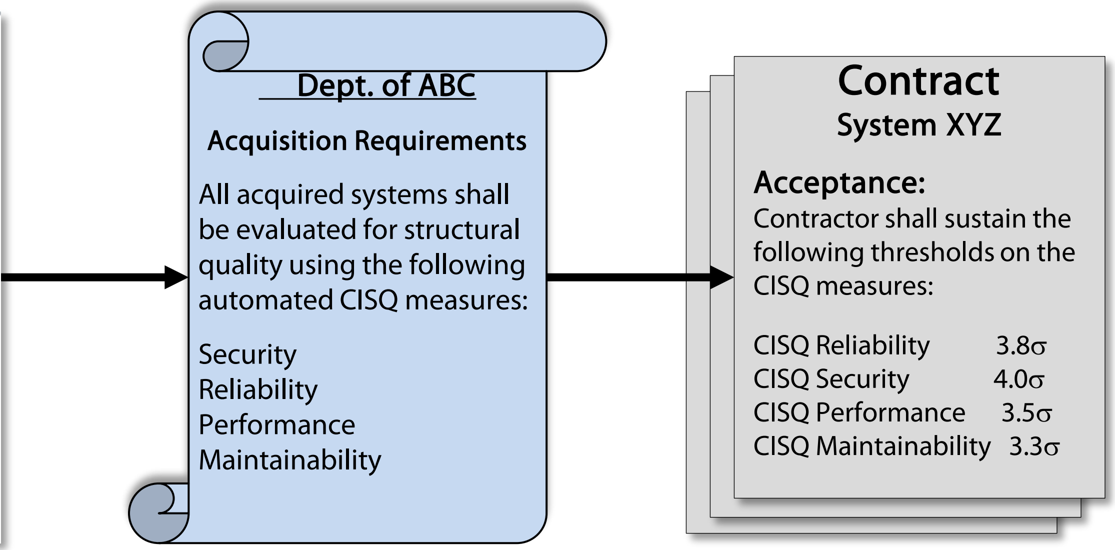
CISQ Specifications for Automated Quality Characteristic Measures

Produced by CISQ Technical Work Groups for:
Reliability
Performance Efficiency
Security
Maintainability

CISQ–TR–2012–01

CONSORTIUM FOR IT SOFTWARE QUALITY

CISQ



Dept. of ABC

Acquisition Requirements

All acquired systems shall be evaluated for structural quality using the following automated CISQ measures:

Security
Reliability
Performance
Maintainability

Contract

System XYZ

Acceptance:
Contractor shall sustain the following thresholds on the CISQ measures:

CISQ Reliability	3.8σ
CISQ Security	4.0σ
CISQ Performance	3.5σ
CISQ Maintainability	3.3σ

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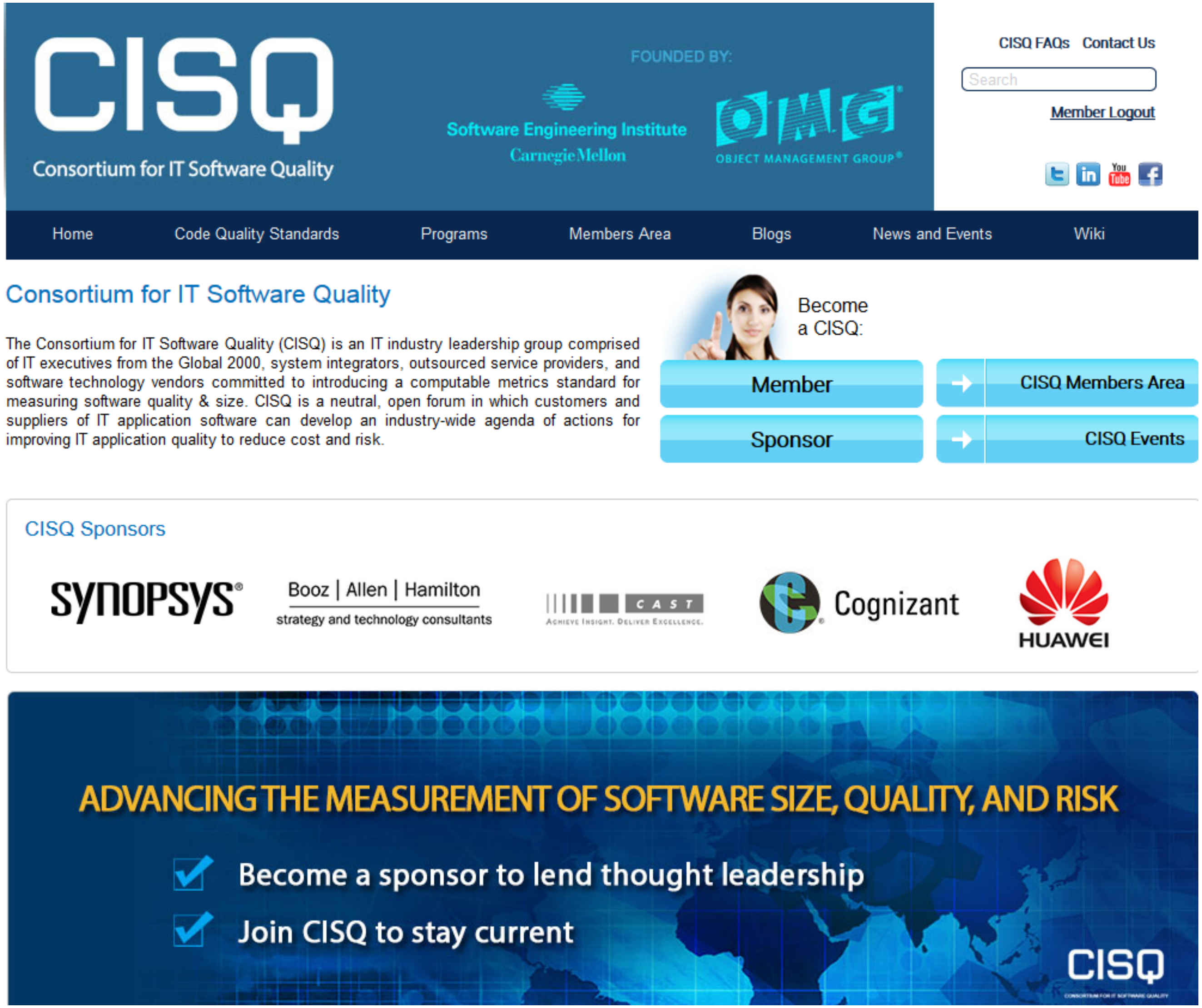

Consortium for IT Software Quality

The Consortium for IT Software Quality (CISQ) is an IT industry leadership group comprised of IT executives from the Global 2000, system integrators, outsourced service providers, and software technology vendors committed to introducing a computable metrics standard for measuring software quality & size. CISQ is a neutral, open forum in which customers and suppliers of IT application software can develop an industry-wide agenda of actions for improving IT application quality to reduce cost and risk.

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