Carnegie Mellon
Software Engineering Institute

OMG
OBJECT MANAGEMENT GROUP

CISQ

CISQ Executive Forums

Meeting Minutes

And Next Steps

Combined report

Frankfurt, Germany 12NOV09

Arlington, VA, USA 14DEC09

CONSORTIUM FOR IT SOFTWARE QUALITY

Executive Summary

The meeting—Initial CISQ Executive Forums were held in Frankfurt, Germany on November 12, 2009 and Arlington, Virginia on December 12, 2009. A broad range of organizations participated in each forum with many being from Fortune 200 companies. Morning presentations described the Software Engineering Institute at Carnegie Mellon University, the Object Management Group, CISQ's objectives, and the existing software standards related to CISQ's objectives. The afternoon was devoted to open discussion of the most valuable quality issues CISQ could address for its members.

The discussion—The quality needs raised by forum participants were grouped into four categories; 1) specific quality attributes to be defined as quality measures in the CISQ standard, 2) infrastructure required to support these quality measures, 3) methods for integrating quality measures into life cycle and acquisition processes, and 4) primary uses for quality attribute measures. Participants wanted to prioritize the focus on application software, but did not want to artificially exclude system or embedded software. Votes tabulated across both meetings prioritized **five software attributes for CISQ focus: maintainability, reliability, efficiency/performance, security, and functional size**. Primary uses for these measures included controlling internal development, managing the quality of externally supplied software, estimating maintenance effort/costs, managing application portfolios, and assessing business disruption risk.

Next steps—Meeting participants that have not joined CISQ, but wish to participate in its activities, should sign up to join CISQ on its Website (www.it-cisq-org). CISQ will form five working groups during the first quarter of 2010. Four of these groups will focus on defining measures for the prioritized software attributes, and the fifth will focus on developing methods for using these measures. CISQ members have the option to assign delegates to any or all of the CISQ Technical Working Groups. Much of the work will be conducted virtually and coordinated by a Working Group Leader, but occasional working group meetings will be convened to initiate or finalize work products. *The immediate next steps for organizations wanting to participate in CISQ are to 1) complete the process of joining CISQ, 2) assign an Executive contact for CISQ, and 3) assign delegates to technical working groups in which they wish to participate*. Additional working group information will be sent in early January 2010.

1. Initial CISQ Executive Forums

1.1 Forum Participants and Agenda

The Consortium for IT Software Quality (CISQ) is sponsored by a partnership between the Software Engineering Institute at Carnegie Mellon University (SEI) and the Object Management Group (OMG). Both SEI and OMG have achieved global leadership in improving the practice of software engineering and application development. CISQ was created to engage executive leadership in global IT organizations in addressing the growing challenge of quality in IT business applications. The initial CISQ Executive Forums were held at SEI's offices in Frankfurt, Germany on November 12, 2009 and in Arlington, Virginia on December 14, 2009.

Participating Organizations—Both meetings attracted approximately 20 organizations as displayed in Table 1. Participants included large corporate and government IT departments, outsourcers and system integrators, and software package vendors. Participants were not required to be CISQ members to attend. However, future executive forums will be exclusively for executives from CISQ member organizations.

Table 1—Participating Organizations

Frankfurt, Germany	Arlington, Virginia, USA
Amadeus	AXA
AXA	Benchmark Consulting
BNP Paribas	Booz Allen Hamilton
Capgemini	CAST
CAST	Capers Jones Consulting
CIGREF	David Consulting Group
Daimler	Dept. of Health & Human Services
Deutsche Bundesbank	Dept. of Homeland Security
DNV-ITGS	Fannie Mae
First Data	FedEx
France Telecom--Orange	General Motors
Fraunhofer IESE	IBM
Intellinova	McKesson
Itestra	Morgan Stanley
Johannes Kepler University	U.S. Air Force
Kugler Maag	University of Memphis
Siemens	Tata Consultancy Services
SIGS Datacom	
Société Générale	*This column includes organizations*
T-Systems	*whose delegates were delayed or*
Technical University Munich	*forced to cancel because of weather*

The agenda was identical for both meetings and is displayed in Table 2. The SEI's overview of quality standards was presented by Dave Zubrow in Frankfurt and by Len Bass in Arlington. Also, in Arlington Bob Martin of MITRE made a lunch presentation on the efforts of the software assurance community to measure software security. The afternoon was devoted to gathering inputs from forum participants, which are presented in the next section.

Table 2—Forum Agenda		
9:00- 9:15	Welcome and Introductions	Dr. Paul Nielsen, CEO-SEI
9:15- 9:45	Introduction to the SEI	Dr. Paul Nielsen
9:45-10:30	Introduction to CISQ	Dr. Bill Curtis, Director-CISQ
10:45-11:15	Introduction to OMG	Dr. Richard Soley, CEO-OMG
11:15-12:00	Overview of Quality Standards	Dr. Dave Zubrow or Len Bass, SEI
1:00- 2:30	Group Discussion—Quality Needs	Open discussion
2:45- 4:00	Group Discussion—CISQ Objectives	Open discussion
4:00- 4:30	Summary and Adjourn	Drs. Paul Nielsen & Richard Soley

1.2 Sponsoring Organizations

Software Engineering Institute—Dr. Paul Nielsen presented an overview of the SEI, stating that SEI supports CISQ because one of its primary objectives is to partner with industry and government to enable measureable improvement in software engineering and management practices. Each of the SEI's four primary technical programs touch on the objectives of CISQ. SEI's lead technical contact for CISQ, Len Bass, has developed methods for characterizing quality attributes of software architectures in the Research, Technology, and Systems Solutions Program. An additional technical contact for CISQ, Dr. David Zubrow, leads work on software measurement in the Software Engineering Process Management Program. Work in SEI's Acquisition Support Program relates to the use of measures in software acquisition. Finally, SEI's Networked System Survivability Program supports efforts to better quantify the security aspects of software.

Object Management Group—Dr. Richard Soley presented an overview of OMG stating that its primary mission was to reduce the cost of adaptation among heterogeneous standards and systems. OMG will only support the development of standards when there are companies committing to implement them in technology within one year of approval. CISQ will submit its work products for standardization through two of OMG's Task Forces, Architecture-Driven Modernization and Software Assurance. These task forces have produced existing standards that provide a foundation for CISQ work products. Over the past 20 years OMG has developed an efficient process to accelerate the approval and deployment of standards into commercial use. OMG has also developed a fast track process for submitting these standards to ISO.

1.3 CISQ

CISQ Objectives—Dr. Bill Curtis presented an overview of CISQ and its objectives. CISQ exists to address a significant challenge: the lack of visibility IT executives have into the quality and risk of their critical business applications. A fundamental assumption underlying CISQ is that global standards for measuring the attributes of software, especially at the source code level, are fundamental to meeting this challenge. The IT industry needs standard measures to support the use of quality attributes in benchmarking and controlling software acquisition. Currently software measures are too often manual, expensive, and based on inconsistent or even subjective definitions. In order to improve the discipline of application development CISQ established the initial four objectives presented in Table 3.

Table 3—CISQ Objectives	
1	Raise international awareness of the critical challenge of IT software quality
2	Develop standard, automatable measures and anti-patterns for evaluating IT software quality
3	Promote global acceptance of the standard in acquiring IT software and services
4	Develop an infrastructure of authorized assessors and products using the standard

CISQ Products—To pursue its second objective, CISQ will form technical working groups for each of the high priority software attributes decided by the membership. CISQ technical working groups will define standard quality measures and software anti-patterns characterizing the software attributes of highest priority to CISQ members. Software anti-patterns represent vulnerabilities, weaknesses, and violations of good coding and architectural practice related to these high priority attributes. These working groups will produce four products that will be submitted to the OMG standards process.

Table 4—CISQ Work Products

Product	Description	Availability
Software measures	Standard definitions at the source code level with tailoring guidelines for application to different languages and technologies	Repository
Software anti-patterns	Anti-patterns defined to a level that can be recognized in source code	Repository
Manipulation rules	Rules for aggregating software measures from the component to the application level and other guidelines as necessary for manipulating measures of software attributes	Document
Usage guidelines	Methods for adopting and using software attribute measures and anti-patterns in developing, acquiring, or benchmarking applications	Document

We anticipate that approved definitions of measures and anti-patterns will be stored in repositories that are maintained under configuration management by OMG. These measures and anti-patterns will be associated with rules and guidelines for adapting them to different languages, platforms, technologies, and uses. CISQ will also develop rules and guidelines for aggregated measures from the component to the application level which OMG will support as approved specifications.

CISQ-Related Standards—Dr. Dave Zubrow and Len Bass presented an overview of standards related to quality and architectural integrity of application software. The most relevant existing standard is ISO 9126 which describes a model of quality attributes. ISO 9126 is being replaced by the ISO 25000 series and Dr. Zubrow leads the American team contributing to this standard. CISQ will be able to contribute to the ISO 25000 series both through national representatives such as Dr. Zubrow and through OMG's fast track process for submitting their standards to ISO.

OMG supports several standards that CISQ will use to accelerate the development of standard measures of software attributes. These include the Knowledge Discovery Meta-Model (describes the output produced by static analysis that provides the countable elements for quality attribute metrics) and the Structured Metrics Meta-model (a standard format for representing metrics). OMG is currently working on a standard for representing anti-patterns, vulnerabilities, weaknesses, and violations of good coding practice. CISQ will support the development and evolution of this and related standards since they provide a foundation for CISQ work products.

CISQ timetable—CISQ will initiate technical working groups in the first quarter of 2010 to begin work on measures for high priority software attributes. OMG will release a Request for Proposal for code-level software quality attributes at its June technical meeting in Minneapolis, MN. CISQ will provide an initial response to this proposal either at the September meeting in Cambridge, MA or the December meeting in Santa Clara, CA. Initial measures will be available to CISQ members by the end of 2010 and it is anticipated that these measures will be approved via the OMG standards process during 2011. The schedule for establishing a repository of standard anti-patterns will follow the schedule for measures by two or more quarters since it will depend on the creation of a standard for representing anti-patterns. A more detailed plan for CISQ activities will be provided in a separate document.

2. Summary of Participant Discussions

The afternoon sessions were devoted to obtaining feedback from forum participants on their software quality needs and how CISQ objectives might best address them. The open discussions were moderated by Bill Curtis, Dave Zubrow, and Len Bass, and all participants were encouraged to contribute. The results of these sessions are summarized in the following tables, and their translation into next steps for CISQ is presented in the next section.

2.1 Software Quality Needs

Survey of Quality Needs—Participants were first asked to list key improvements in software quality measurement that would benefit their organization, especially those related to the objectives of CISQ. The responses could be grouped into the four broad categories heading the columns in Table 5. This is not an exhaustive list, since similar items were grouped into one response.

Table 5—Participant Needs for Software Quality Measurement

Target	Support	Process	Uses
• Measures of design quality (complexity, coupling, cohesion, etc.) • Clear definition of maintainability • Measures that relate to cost of ownership • Measures of change (Δ's) in quality characteristics over time • Measures related to coding standards • Measures to be used in decisions about an application • Measures of non-code artifacts (requirements, designs, UML, etc.) • Weaknesses related to emergency releases • Measures of defects and defect-related factors • Quality measures from dynamic analysis • Measures of quality related to small changes • Scalable metrics for use with software varying in size, languages, or platform	• Prescriptive quality framework • Model relating code characteristics to quality characteristics and outcomes • Rules for aggregating metrics from code to application level • Guidelines for setting metric thresholds that trigger remedial action • Validation of ability to predict outcomes and system user satisfaction • Common vocabulary for communicating about quality • Standard reporting format for measures • Priorities for use of metrics with designs, requirements, code, etc. across life cycle	• Methods for integrating metrics into life cycle practices • Techniques for reducing developer resistance • Coordination of quality objectives across distributed development • Scalable quality practices for projects varying in size and duration • Integration of measures into test planning and design for testability • Practices for using metrics in quality gates for externally supplied software • Methods for using historical results to manage applications	• Service Level Agreement parameters with suppliers/vendors • Quality control gates for accepting externally supplied software • Translation from quality metrics to indicators of technical and business risk • Establishing the link between development actions and business outcomes • Measure risk factors in software supply chain • Estimating the cost of maintaining and application • Decisions regarding investments in or retirement of an application • Governance of an application portfolio

Category 1: Target—The first category concerns the target for quality attribute measures. Measurement needs were typically not stated as specific attributes, but rather as outcomes the measures could describe or predict such as change in quality over time, cost of ownership, adherence to coding standards, or design quality. The definitions of these measures needs to be flexible enough to characterize software attributes of small changes as well as applications reaching into the millions of lines of code. Although they agreed the initial focus should be on measures taken from source code, participants requested that CISQ expand its coverage over time to include non-code artifacts such as requirements, design documentation, and test related materials.

Category 2: Support—The second category concerns the infrastructure needed to support the use of software attribute measures. This infrastructure includes a prescriptive framework to integrate different measures, a common vocabulary for describing them, and a model that relates them to outcomes. Rules or guidelines need to be established for aggregating measures from the component to the application level, setting thresholds for measures, how measures will be prioritized for use with different types of software artifacts, and standard formats for presenting results. They also requested that these frameworks and models be validated against actual outcomes and user satisfaction.

Category 3: Process—The third category concerns guidance on how to integrate software attribute measures into software life cycle processes. This guidance includes best practices for using measures with distributed teams, test planning, and quality gates for acquired software. Guidance is needed for adjusting practices to project processes of varying sizes and complexity. Participants also asked for methods to reduce resistance to the use of quality measures among developers.

Category 4: Uses—The fourth category concerns the ultimate uses for software attribute measures. These uses include using software attribute measures to assess the risks to which an application exposes the business, the risk inherent in the supply chain delivering an application to the business, and help in building business cases based on validating the link between application quality and business outcomes. Uses of these measures with software suppliers include inserting software attribute objectives as the equivalent of Service Level Agreements into outsourcing contracts and incorporating their measurement into quality gates for accepting the resulting software. Outsourcers are interested in using these measures to estimate the cost of managing an application over its life prior to making a bid. Participants were interested in using software attribute measures to better govern their application portfolio and make investment decisions regarding individual applications.

Priorities for Use—To better understand their priorities, participants in Frankfurt were asked to assign a vote to each of their three highest priority uses for software attribute measures. The results in Table 6 indicate that managing internal development and controlling outsourced development were their top priorities. Estimating the total cost of ownership and managing the application portfolio were also important uses.

Table 6—Uses for Measures

Category of use	# of votes
Managing internal development	22
Controlling outsourced work	19
Estimating effort and costs	9
Portfolio management	9
Risk management	5
Benchmarking	2
Innovation	1

The Arlington forum felt that all categories were priority uses, elevating the importance of risk and portfolio management. The Arlington group did not include innovation in their list of uses, but added the use of measures to evaluate software from package vendors, ratings for vendor products, guidance for testing, software asset evaluation.

Priorities for Measures—After discussing uses, in both forums participants were given 3 votes to distribute among a list of software attributes according to their priorities. The results are presented in Table 7. Functional suitability was included in Frankfurt but dropped from consideration in Arlington. The voting at both forums placed priorities on reliability and maintainability. Security received a higher priority in Arlington likely based on the luncheon presentation by Robert Martin of MITRE on software security and its measurement. Performance efficiency received a higher priority in Frankfurt than in Arlington. The differences in priority for size measurement resulted from an important development occurring after the Frankfurt forum.

Table 7—Measurement Priorities

Software attribute	# of votes	
	Frankfurt	Arlington
Functional suitability	5	
Reliability	15	14
Usability	3	2
Performance efficiency	13	3
Maintainability	19	15
Portability	0	1
Security	4	12
Compatibility/interoperability	0	1
Size	2	unanimous

Size Measurement—Participants in the Frankfurt forum were asked what they were using for measuring the size of their applications. The results are presented in Table 8. Although Function Points were used by some organizations, they were criticized for the cost of manual counting and inconsistent results across different counters.

Table 8—Current Size Measures

Size measure	# of companies
Source lines of code	6
Function points	3
Cyclomatic complexity	1
Effort	2
Number of instructions	1

Following the Frankfurt forum, CISQ interacted with leaders in the Function Point counting world who were committed to creating a definition of Function Points that can be counted at the source code level and were frustrated with difficulty of achieving this definition through the International Function Points User Group (IFPUG). Capers Jones and Mike Harris (CEO of the David Consulting Group), both leaders in the Function Point community, participated in the Arlington forum to determine the interest in the CISQ community for sponsoring a technical working group on Functional Measurement. Although size measures had received few votes in Frankfurt, this new opportunity with leaders in the Function Point community elevated the importance of size measurement in the Arlington forum to win unanimous support as a priority focus area.

2.2 Quality Benefits Model

In order to help justify investments in quality practices, participants need a model that demonstrates how code quality attributes relate to business outcomes. During the session a prototype model was developed to stimulate further discussion. An elaboration of this model based on the ensuring discussion is presented in Figure 1. Some

early members of CISQ have asked that CISQ elaborate such a model to help present the business case for improving the quality of applications. As CISQ moves forward, member organizations will have an opportunity to contribute data or case studies that demonstrate the business value of application quality.

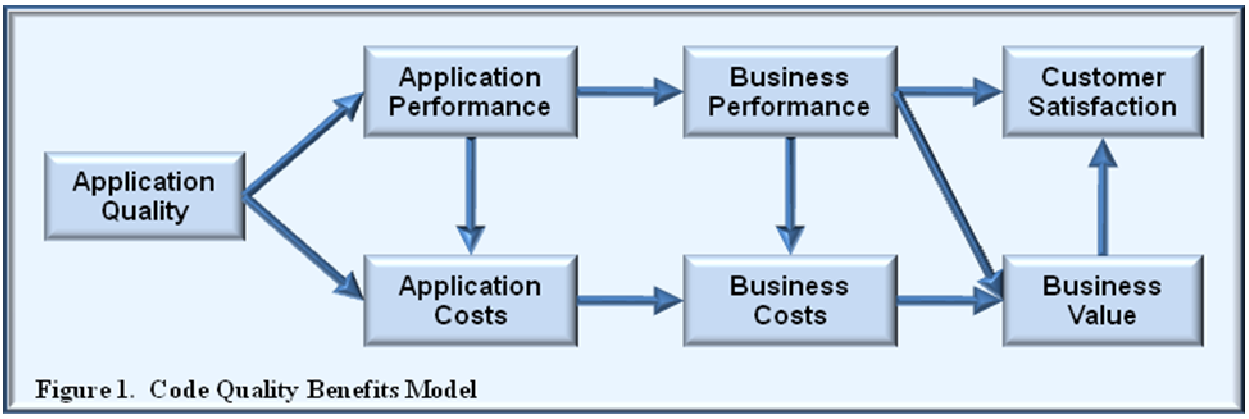

Figure 1. Code Quality Benefits Model

Scope—The original scope of CISQ objectives was focused on IT or business application software. The participants in both forums reaffirmed this priority, but half the attendees in Frankfurt and the majority in Arlington did not want to limit the scope artificially to just business applications. Participants expressed value in addressing embedded software and other categories of general software to the extent it did not dilute the focus on business applications. Real-time software was the only category that was considered out of scope.

Certifications—Participants discussed their interest in having certifications against CISQ-sponsored quality standards for four target areas; developers, appraisers, tools, and products. Table 9 summarizes the purposes for these certifications as well as some of the options for implementing them. Consideration of how to best address various certifications will begin after CISQ work products have started moving through the standards process.

Table 9—Certifications

Target	Purpose	Options
Developers	Certify that developers understand how to develop software possessing desirable quality attributes	OMG offers certifications for developers on many of their existing standards
Appraisers	Certify that appraisers are capable of using the standards effectively in providing professional diagnostic services	SEI has developed licensing services for appraisers in areas such as CMMI
Tools	Certify that tools which implement the defined measures and anti-patterns provide accurate results	Such certifications have proven difficult in the past, but options will be explored

3. Next Steps

Based on the results of the Frankfurt and Arlington forums, five technical working groups will be launched in 2010. Organizations interested in participating in these activities should take the following three steps summarized in Table 10 and described below.

Table 10—Next Steps for CISQ Participation	
1	Join CISQ (see the CISQ Membership tab at www.it-cisq.org
2	Identify the executive contact for CISQ and send the name to director@it-cisq.org
3	Nominate a delegate to your chosen technical working groups and send the names to director@it-cisq.org

First, participants in the two forums who have not joined CISQ and want to participate should join immediately. Go to the CISQ Website, www.it-cisq.org , and access the 'CISQ Membership' tab. Only CISQ members will be able to participate in future CISQ activities.

Second, identify the executive contact for CISQ and provide the name to director@it-cisq.org. This should be the person who would normally attend the CISQ Executive Forums, nominate delegates to the technical working groups, and represent the member organization in setting CISQ objectives.

Third, review the technical working groups for 2010 (Table 11 below), nominate a delegate to each working group in which your organization would like to participate, and provide their names to director@it-cisq.org. Member organizations can participate in as many or as few technical working groups as they choose.

Technical Working Groups—Five technical working groups will be formed to address four areas of measurement and the methods for using such measures. The working groups are summarized in Table 11. Each technical working group will have a technical leader selected from one of CISQ's member organizations. The Director of CISQ will act as a technical advisor and coordinator to maintain consistency among the work products produced by the various working groups. Working groups will launch their activities in an onsite meeting held during the first quarter of 2010. However, much of the work for each work group will be conducted virtually and coordinated by the working group leader. Thereafter onsite meetings will be held only as needed to complete and sign off work products.

Table 11—Technical Working Groups	
Working group	**Initial technical focus**
Size	Develop a definition for automating Function Points
Maintainability	Measure factors affecting maintenance cost, effort, and duration
Reliability and Performance	Measure factors affecting availability and responsiveness to users
Security	Measure factors affecting vulnerability and leverage existing work in the assurance community
Best Practices	Define best practices for using code measures with internally and externally supplied software

Size Working Group—The Size Working Group will be led by Mike Harris from current CISQ member David Consulting Group. Mike is an internationally respected leader in the IFPUG community who has been calling for the development of a definition of Function Points that can automated and computed on source code to reduce the cost and subjectivity of functional measurement. The initial objective of this group will be to create a definition that is as close to the existing IFPUG standard as possible while resolving the issues necessary to support automation. Organizations participating in this working group will be encouraged to pilot the counting rules as they move through the standardization process. Possible future objectives for this group will be to define functional measures for areas in which Function Points may not adequately represent such as Web interfaces or heavily algorithmic software. This group will be supported by CISQ Special Advisor Capers Jones, a leading advocate of Function Point measurement.

Maintainability Working Group—This working group will develop a definition that is consistent with existing international standards, but sufficiently detailed to support the definition of automated measures. In addition to a single summary measure to characterize distinct factors that affect maintainability, this group may also produce a set of measures that provides better guidance for improving application quality. This working group will

define anti-patterns representing coding practices that make applications less maintainable. Finally this working group will develop rules for aggregating maintainability measures from the component to the application level.

Reliability and Performance Working Group—Since many common factors affect both reliability and performance, the measurement of these two quality attributes will be addressed in the same working group. This working group will be tasked with distinguishing which factors and anti-patterns affect both reliability and performance and which affect one but not the other. These results will be developed into measures for each characteristic. Organizations participating in this working group will be encouraged to calibrate these measures based on static analysis with measures taken from the operational behavior of applications such as mean time to failure and user response time.

Security Working Group—This working group will develop source code measures that predict the vulnerability of source code to external attack. It is anticipated that Robert Martin of MITRE will work closely with this group to coordinate its work products with developments in the software assurance community such as the Common Weakness Enumeration and Common Vulnerability Scoring System. This working group will leverage the existing work accomplished by the software assurance community and the Software Assurance Task Force of OMG. Participation in this working group will provide a conduit for transferring the best practices from the software assurance community into CISQ member organizations.

Best Practices Working Group—This working group will focus on defining best practices for integrating quality attribute measures into three types of processes; development and maintenance, acquisition of externally developed software, and application portfolio management. This group will define methods not only for using measures, but also for introducing, adopting, and supporting them. These best practices will supplement and extend guidelines in Practical Software Measurement and ISO 15939-Software Measurement Process for use with measures produced by static code analysis. Consequently the work products produced by this working group may be more appropriately released as guidebooks than as a standard. Organizations participating in this working group will be encouraged to pilot best practices as part of developing the guidelines.

Working Group Plans and Schedules—Each technical working group will produce its own plan of action and schedule. CISQ will move its work products toward standardization by submitting them as responses to RFPs issued by appropriate OMG Domain Task Forces. Consequently, working group milestones will be set to coincide with important dates in the OMG standardization process. CISQ intends to submit initial work products that respond to OMG RFPs by the end of 2010. These work products will be metric definitions that will be approved for incorporation into a size and quality attribute standards repository. At regular intervals additional work products containing additional measures will be submitted to the OMG process to be approved for inclusion into these repositories. In a separate document CISQ will produce a plan describing how different types of work products will enter and pass through relevant OMG standardization processes. Numerous OMG Task Forces are requesting processes for creating repositories rather than specification documents, and CISQ will contribute to establishing these processes.

CISQ 2010 Meetings—CISQ anticipates conducting Technical Working Group launch meetings toward the end of the first quarter in North America and in Europe. CISQ will provide each working group with electronic support for group activities and interactions. CISQ anticipates conducting its next Executive Forums during the early Fall of 2010. However, Executive Forums could be held earlier on targeted issues that CISQ executive contacts wish to address. CISQ will establish a mechanism for reporting progress to its members on a quarterly basis which may involve Webinars.