

Software Metrics Initiative Update



2003 Business Managers' Conference Changes and Challenges

*14-15 May 2003
Defense Acquisition University
Ft. Belvoir, Virginia*

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A collage of various military and defense-related images, including a satellite, a fighter jet, a rocket launch, a helicopter, a tank, and a submarine. The collage is overlaid with text boxes.

**The On-line
DoD Cost
Research
Library**

Enhancing DoD Cost Analysis

The Defense Cost and Resource Center
1111 Jefferson Davis Hwy; Suite 500
Arlington, Virginia 22202
Phone: 703.602.3301 Fax: 703.602.8944
<http://crs.pae.osd.mil>

Background

- ◆ Software is a cost driver on many systems and the DoD has little historical data upon which to base future estimates
 - There are no data to compare estimated software cost and size with actual program results; no records of software metrics
 - Tried and failed to match CARDS with CCDR data
 - Software data routinely reported as “red” at annual DoD Cost Analysis Symposium
- ◆ Service Cost Centers requested CAIG research how community can obtain better data to estimate software systems
- ◆ Goal is to capture a common, small software data set from large MIS and weapon systems developments



History of Institutionalization

- ◆ Established a Software Metrics Working Group (SMWG) that included representatives from:
 - Service Cost Centers
 - Industry (Lockheed-Martin, Boeing, Raytheon, Northrup-Grumman)
 - PA&E (CAIG and MAIS representatives)
- ◆ Researched core metrics and potential data sources
- ◆ Held many meetings with SMWG (January 1999 to present)
 - Developed a “Sample Product Development Report” -- no DD Form
 - Developed a planning and collection process (requires tailoring)
 - Developed detail proposal and implementing documentation
- ◆ Established goal of minimal industry burden
 - Only consider data that is already collected by mature developers

History of Institutionalization (Concluded)

- ◆ Conducted limited pilot tests and revised proposal
- ◆ Crafted procurement documents with help of OSD Defense Procurement Specialist
- ◆ Coordinated with OSD/C3I software metrics initiative
- ◆ Obtained SMWG approval to seek DoD approval
- ◆ Requested formal comments from National Defense Industrial Association (NDIA) and Practical Software Measurement (PSM)



Software Metric Proposal Overview

- ◆ Objective: Collect key software metrics on DoD elements to improve cost estimating of future software intensive systems
- ◆ Proposed software metric data
 - Two pages--**Tailored for Program**--not a DD Form
 - Based on core metrics recommended by Software Engineering Institute (SEI)
 - **Size**
 - **Effort**
 - **Schedule**
 - **Quality (optional by program)**



Software Metric Proposal Overview (Concluded)

- ◆ Scope
 - ACAT IA, IC, and ID (MIS and weapons systems)
 - WBS elements determined by Working Integrated Product Team
 - For each software release
 - Commercial developers and Central Design Activities (CDAs) submit to PM and the Defense Cost and Resource Center--a subordinate organization with PA&E
- ◆ Frequency
 - With Cost Analysis Requirement Description (CARD) submission
 - 60 days after contract or Memorandum of Understanding (MOU)
 - When final products are delivered to the government
 - If delivery is in multiple builds or releases, a separate initial and final report is expected for each delivery



The Software Resource Data Report

- ◆ The SRDR will supply the DOD with software size, effort, and schedule data
 - For weapon and information system software developments
 - Data is needed for better estimates of future systems
 - Supported by CAIG, Service cost centers, and industry reps
- ◆ No centralized knowledge of DOD software cost or size currently exists
 - Data on embedded software is rarely made visible or retained
 - After-the-fact data calls have not proven useful
 - Some domain-specific data exists at lower levels (SMC)
 - Some cost centers have spent millions dredging up data (Navy)
 - SRDR process is designed to avoid the pitfalls of prior DOD-wide software data collection efforts



Who, What and When

- ◆ Programs Affected
 - SRDR's are required for all contracts within Acquisition Category (ACAT) IA, IC and ID with software content that is expected to exceed \$25 million (FY02\$)
- ◆ The Reported Data
 - Size, effort, schedule, and other descriptive development data
 - Submitted to Defense Cost and Resource Center (DCARC) for use by the DoD Cost Analysis Community
- ◆ Report frequency
 - 180 days prior to contract award by government PM (**estimates**)
 - 60 days after contract award or Memorandum of Understanding (MOU) by developing organization (**estimates**)
 - 60 days after start of subsequent software releases (**estimates**)
Within 60 days after any software release or final delivery by developing organization (**actual data about as-delivered product**)

General Description of Data

- ◆ Size
 - Sample form recommends lines of code
 - New, modified, and reused (unmodified)*
 - Alternatives allowed (function points, objects points, etc.)*
 - Number of requirements (functional and interface)
 - COTS/GOTS products incorporated
- ◆ Schedule
 - Depends on process
 - Spiral: Iteration schedule*
 - Waterfall: Phase schedule*
- ◆ Effort
 - Direct hours by relevant activity or phase
 - Indirect hours as defined by organization



Collaborators in Design of SRDR

- ◆ DOD Cost Analysis Community
 - Service Cost Centers
 - Air Force Cost Analysis Agency*
 - Army's Cost and Economic Analysis Center*
 - Naval Center for Cost Analysis*
 - OSD's Cost Analysis Improvement Group (CAIG)
 - Cost analysts supporting government PM's
- ◆ Industry representatives
 - Focus group met 7 times between mid 1999 and the present
 - Format and data items mostly stabilized by late 2001
 - Continued to work process and coordination
- ◆ Academic insights incorporated
 - PSM
 - IDA



Salient Features

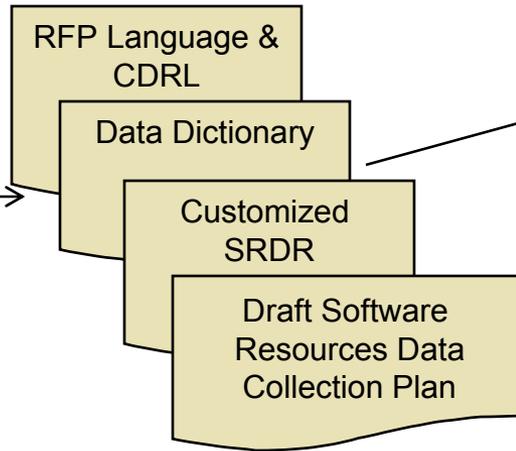
- ◆ Requesting data that developers normally use to manage software efforts
- ◆ Government suggests data elements
 - Must reflect size, effort, and schedule
 - Quality (defect) reporting only if directed by PM
- ◆ Developers have opportunity to comment on RFP
- ◆ Developers must propose how to meet intent
- ◆ Government-developer team customizes data items
 - Both the units and the definitions must be determined
- ◆ Delivery mechanism is flexible
 - Spreadsheet files preferred
 - Burden is on users to interpret and analyze

Objective: Maximum value at minimum cost

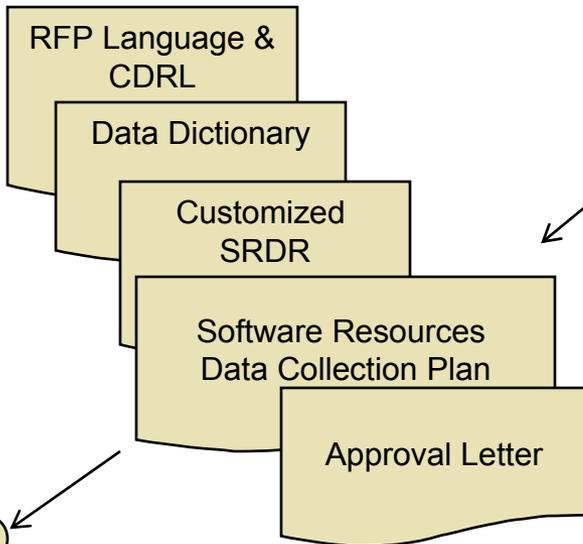
Software Resources Data Collection Planning Process



Cost Working Integrated Product Team (CWIPT) identifies software data needs, develops software resources data collection plan, customized SRDR, data dictionary, RFP language, and CDRL



Developer analyzes and comments on SW resources data requirements

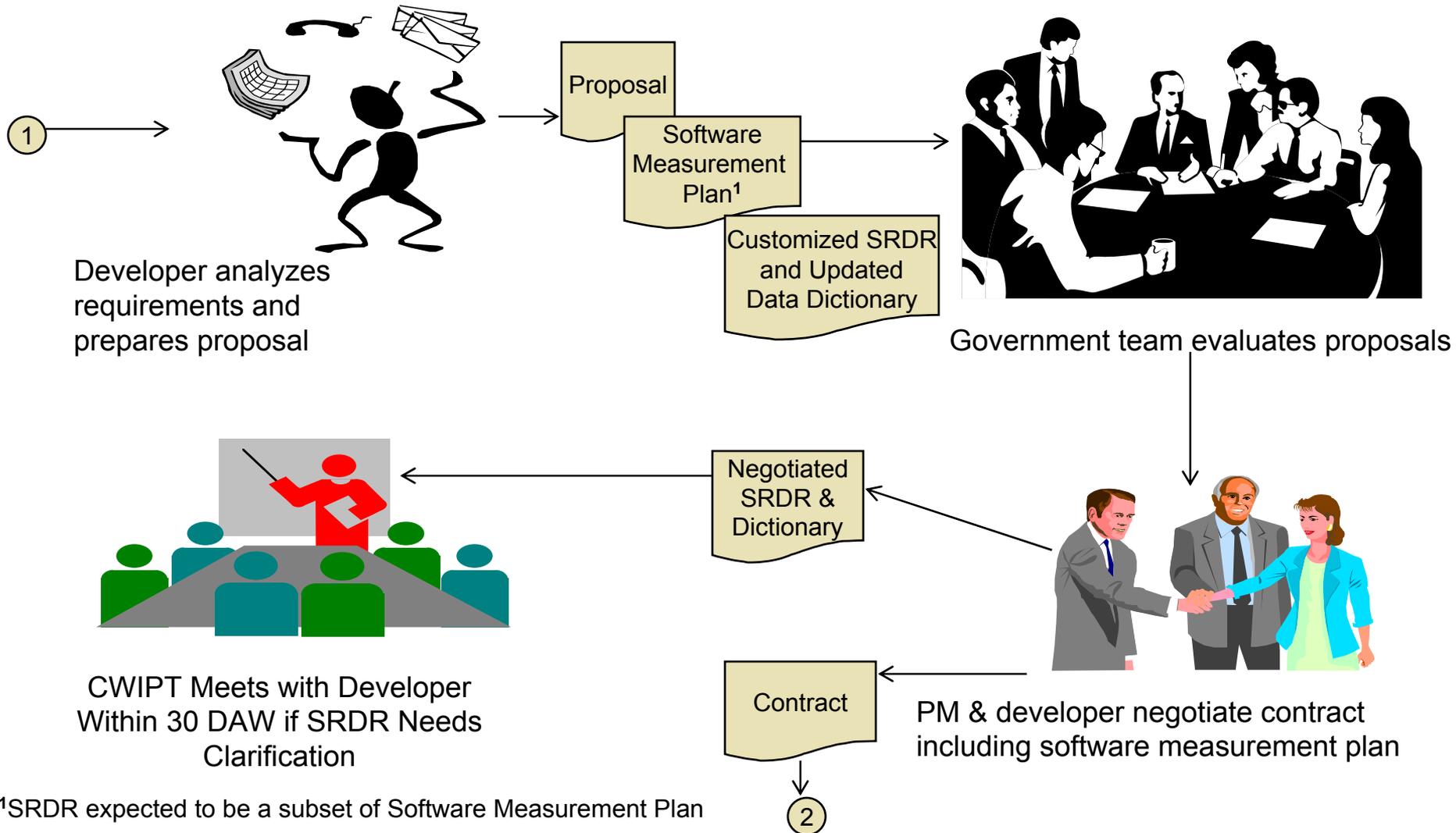


CAIG Chair approves Software Resource Data Collection Plan



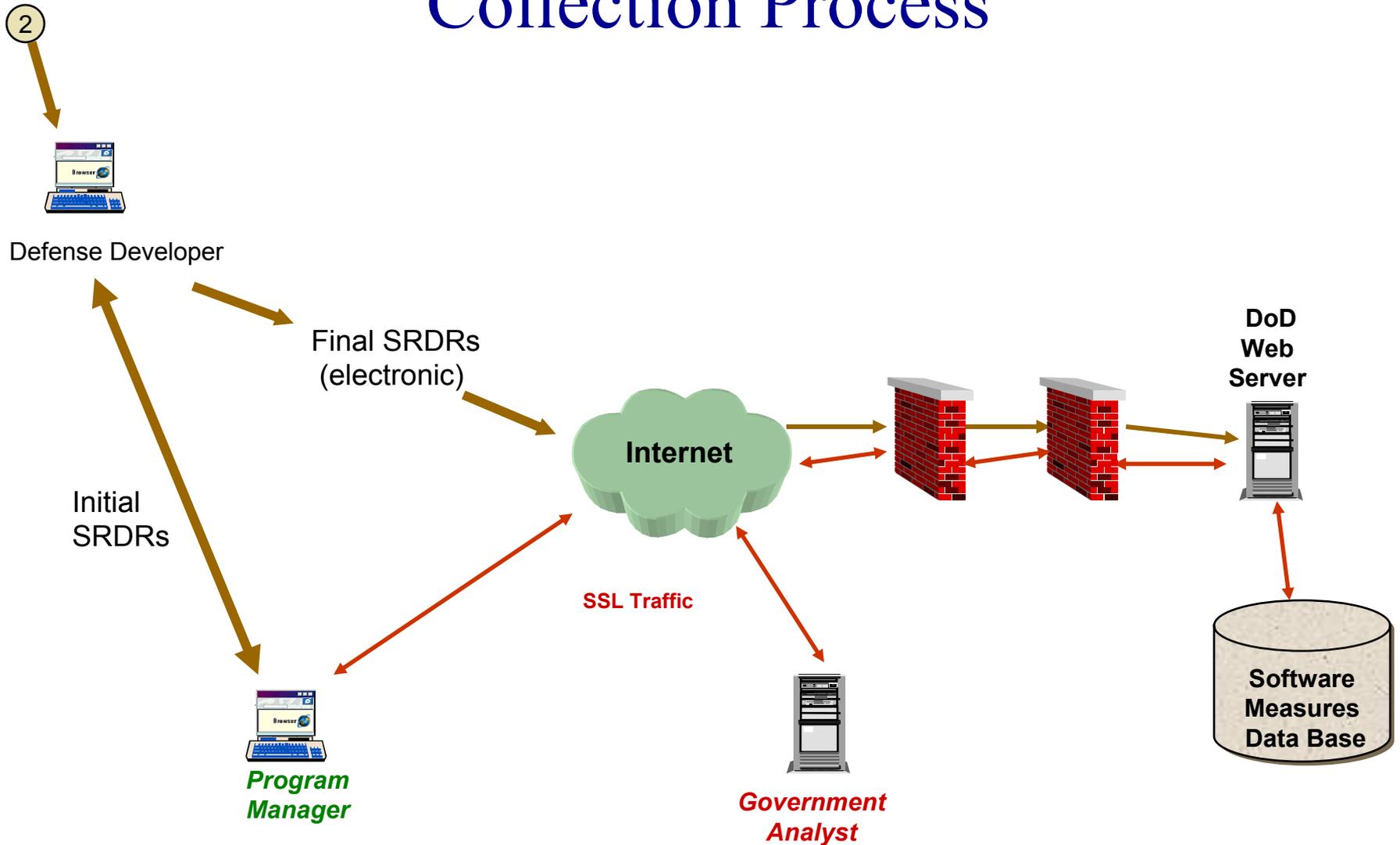
(CWIPT) evaluates comments, revises SRDR, data dictionary, RFP language, and CDRL. Updates Software Resources Data Collection Plan for CAIG approval.

Software Resources Data Collection Planning Process (Concluded)



¹SRDR expected to be a subset of Software Measurement Plan

Software Resources Data Report Collection Process



Stakeholder Feedback

- ◆ Developers are willing to do it provided:
 - Can use existing data (minimal effort ≤ 100 hours per report)
 - Minimal frequency
 - Be permitted to explain data
 - Get paid for it (must be a CDRL item with a Data Item Description)
- ◆ Best Practices Community (PSM)
 - Recommended and strongly support “issue-driven” approach, i.e., customization
- ◆ C3I and AT&L’s Software Intensive System Group
 - Provided recommendations for process



Development Challenges

- ◆ Recordation or oversight?
 - Established goal of recordation to help future estimates not oversight of ongoing programs
 - Pared down to early estimates and as-delivered actuals
 - This helped minimize cost and intrusiveness
- ◆ Eliminated dollar cost values
 - We only needed engineering data, not dollars
 - This eliminates need for contractors to route submissions through their accounting and legal departments
- ◆ Ensuring acceptability to industry
 - Included opportunity for comments and explanations
 - No quality reporting unless required by government PM
 - Eliminated paths for data to be used against providers
- ◆ Convincing government policymakers of need
 - Low cost and low intrusion were keys to DAPWG approval

Implementation Challenges

- ◆ Industry “pilot tests”
 - Spent several months visiting contractors to fine-tune data and processes
 - Allowed increased government effort if industry benefits
- ◆ Process is highly manual by necessity
 - Negotiations with contractors are needed
 - Customization of data and definitions required
 - Users required to understand definitions, interpret data
 - No “standard definitions” imposed on programs*
 - Previous attempts to centralize standardized data reporting have not been sustainable (this is not endemic to DOD)*
- ◆ Coordination of reporting formats within DOD
 - By design, no standard format
 - DOD approval of meta-data is novel



Status

- ◆ DODI 5000 is considered “Interim Guidance”
- ◆ SRDR process is included in instructions
- ◆ Expect SRDR process to be retained in finalized DODI 5000
- ◆ Currently working with several major programs to tailor reporting
- ◆ Have received initial data (estimates) from several major programs
 - JSF, WIN-T, JTRS, C-130 AMP, CEC
 - FCS expected soon



More Information and Points of Contact

- ◆ Manual, sample forms, SOW, CDRL's and proposed DID's are available from Defense Cost and Resource Center
 - <http://dcarc.pae.osd.mil/>
 - Under *Software Metrics* tab
- ◆ POC's:
 - Ron Lile, DCARC
 - (703) 602-3301
 - ronald.lile@osd.mil
 - John Bailey, IDA
 - (703) 845-2534
 - jbailey@ida.org

