



A Comparison of IEEE/EIA 12207, ISO/IEC 12207, J-STD-016, and MIL-STD-498 for Acquirers and Developers

Lewis Gray, Ph.D.

Abelia Corporation

12224 Grassy Hill Court

Fairfax, Virginia 22033-2819 USA

(T) 703.591.5247 (F) 703.591.5005

lewis@abelia.com <http://www.abelia.com>



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For Further Information

Lewis Gray
Abelia Corporation
12224 Grassy Hill Court
Fairfax, VA 22033-2819 USA
703-591-5247 (F) 703-591-5005
lewis@abelia.com
www.abelia.com



Topics

- ◆ **Significant similarities and differences between the requirements in**
 - IEEE/EIA 12207 (adopted by the DoD on 27 May 98)
 - ISO/IEC 12207
 - J-STD-016, and
 - MIL-STD-498 (canceled by the DoD on 27 May 98)

- ◆ **Acquirer - developer relations as described in MIL-STD-498 / J-STD-016 and IEEE/EIA 12207.**

Background: The Pedigree of IEEE/EIA 12207

DOD-STD-2167A
"Defense System
Software
Development,"
Feb '88

ISO 12207

ISO/IEC 12207
"Software Life
Cycle Processes,"
Aug '95

IEEE Std

2167A

7935A

DOD-STD-7935A
"DoD Automated
Information
Systems (AIS)
Documentation
Standards," Oct '88

498

MIL-STD-498
"Software
Development and
Documentation,"
Dec '94

016

J-STD-016-1995
(Trial Use Std.)
"Software Life
Cycle Processes,
Software
Development"
Sep '95

12207

IEEE/EIA 12207.0-1996
"Software Life Cycle
Processes"
Mar '98
(Guides)
IEEE/EIA 12207.1-1997
IEEE/EIA 12207.2-1997
Apr '98

Background: Traditions of Major Influences

◆ U.S. Military Standards

- created by organizations within the U.S. Department of Defense
- authored by industry contractors
- authors guided by advisory committees consisting both of individuals and of representatives of military and industry organizations
- reviewed by military and industry personnel
- legally enforced on military software contractors
- used to compensate for shortage of technically-trained government software buyers.



◆ ISO Standards

- created by committees of national representatives
- inspire national implementations
- used voluntarily
- used by businesses
- used to simplify trade.

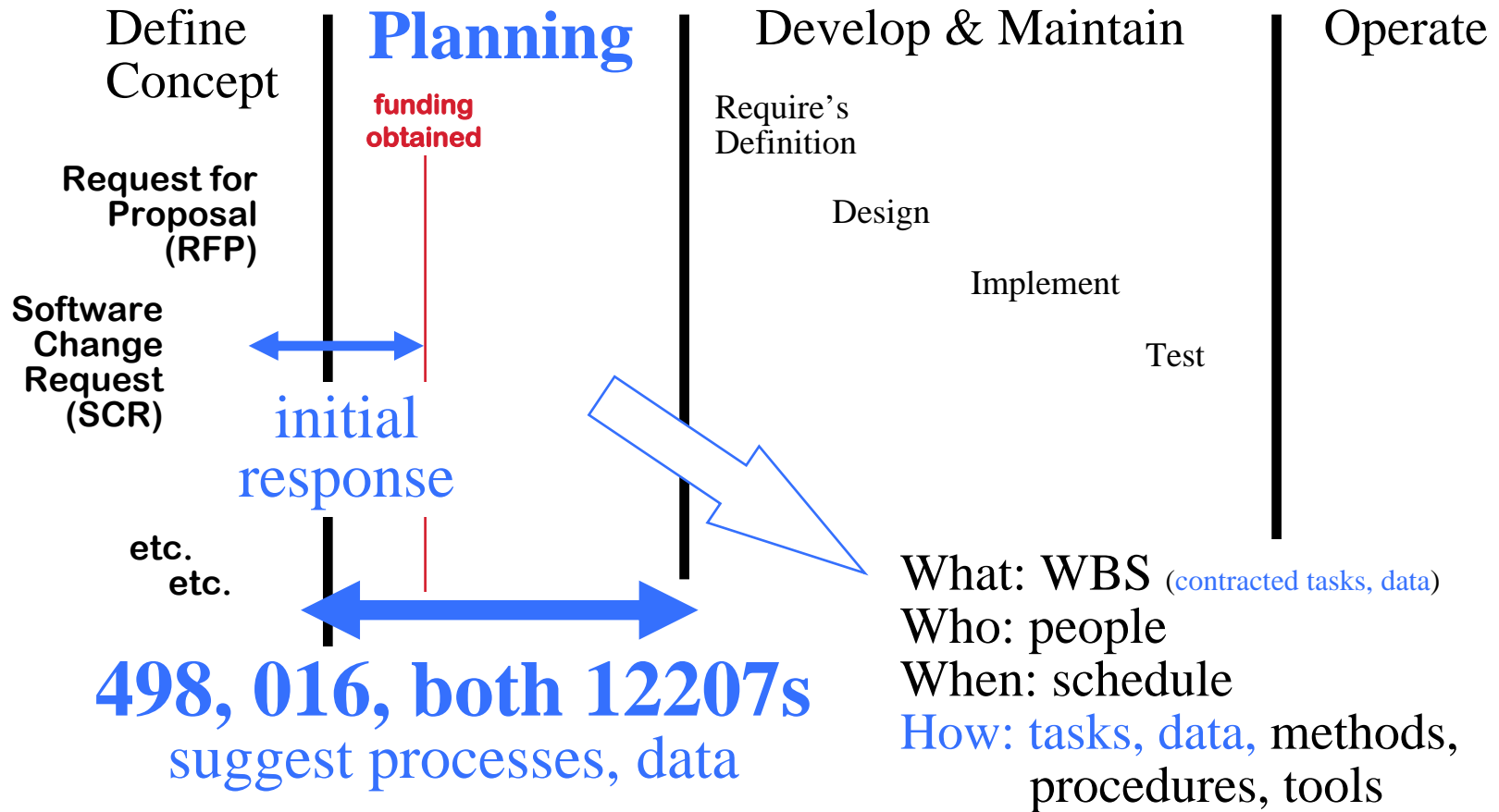


◆ IEEE Software Standards

- created by committees of professional individuals
- used voluntarily
- used by businesses and individuals
- used for self-improvement.



Background: All Four Standards are Most Useful...



Background: Similar Leadership Influences

The Chair of the DoD Harmonization Working Group (HWG) that developed **MIL-STD-498**,

the Editor of **ISO/IEC 12207** during its development,

the IEEE Co-Chair of the Joint Industry Working Group on Software Development that developed **J-STD-016-1995**, and

the IEEE Co-Chair of the Joint Industrial Standard Working Group (JISWG) that developed **IEEE/EIA 12207.0-1996**

all were the same person, Dr. Raghu Singh (SPAWAR), who is now with the U.S. Federal Aviation Admin. in Washington, DC.



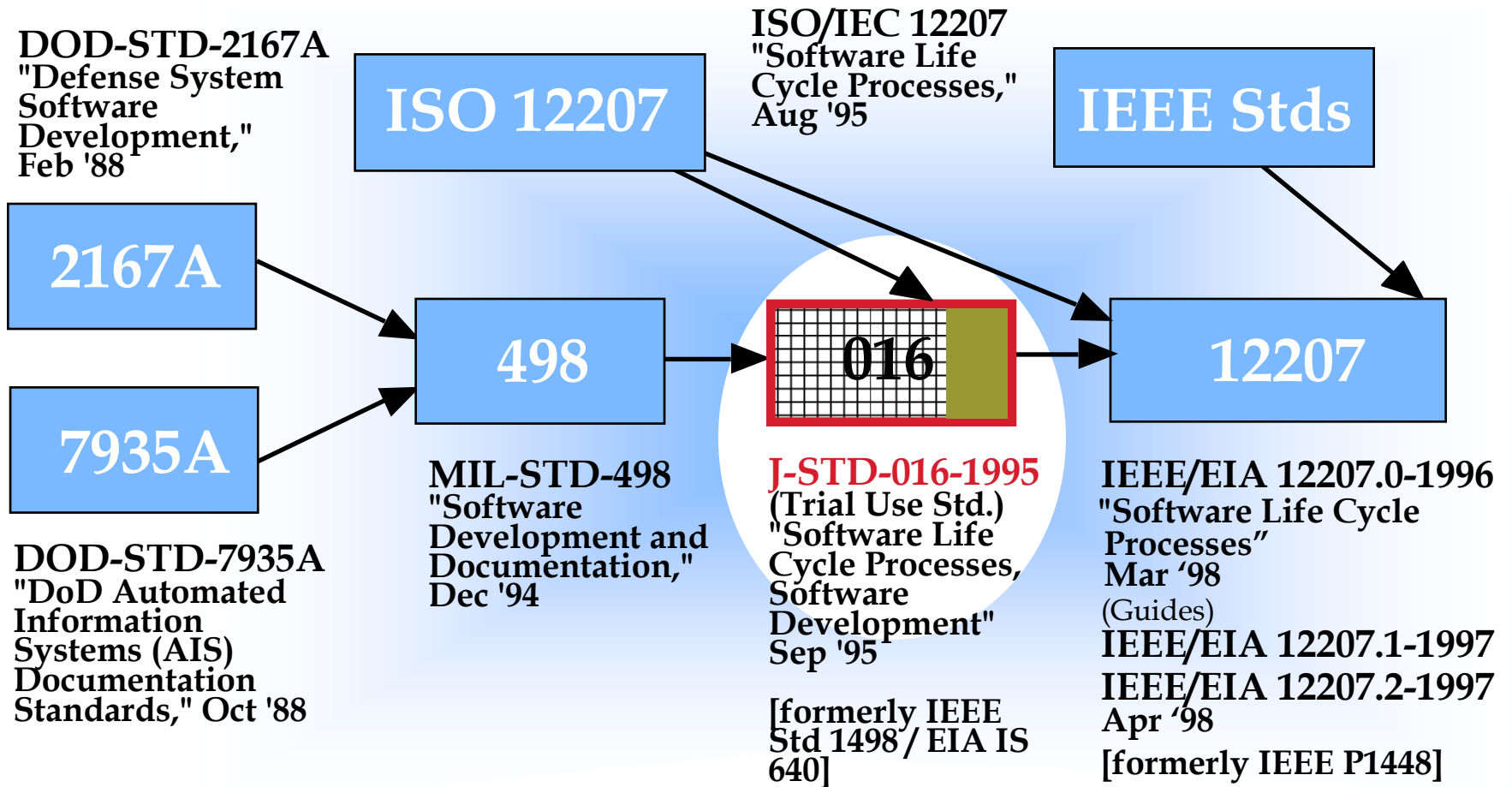
Topics

Significant similarities and differences between the requirements in

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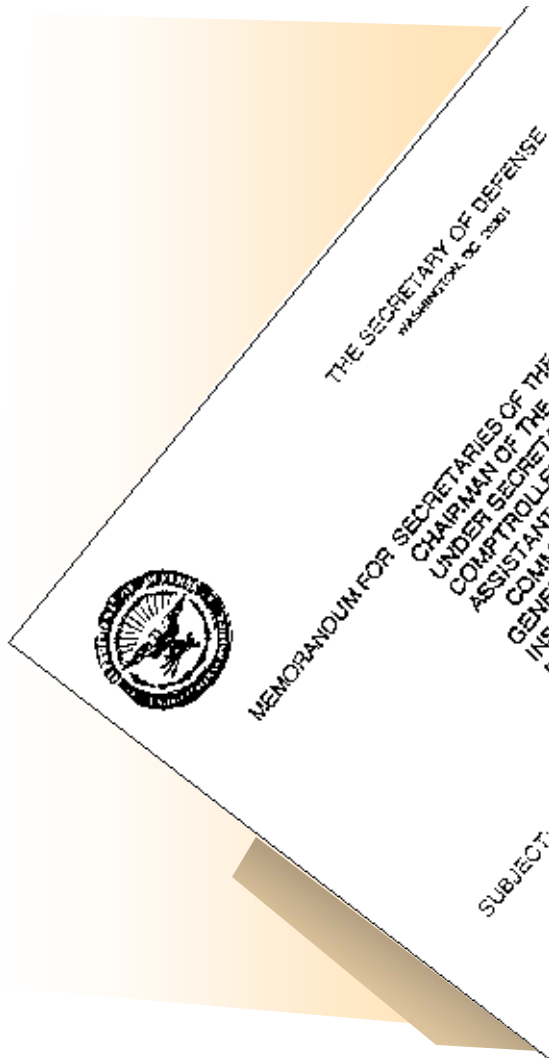
◆ Acquirer - developer relations as described in MIL-STD-498 / J-STD-016 and IEEE/EIA 12207.

The U.S. Military Tradition: MIL-STD-498 to J-STD-016



Why is There J-STD-016-1995?

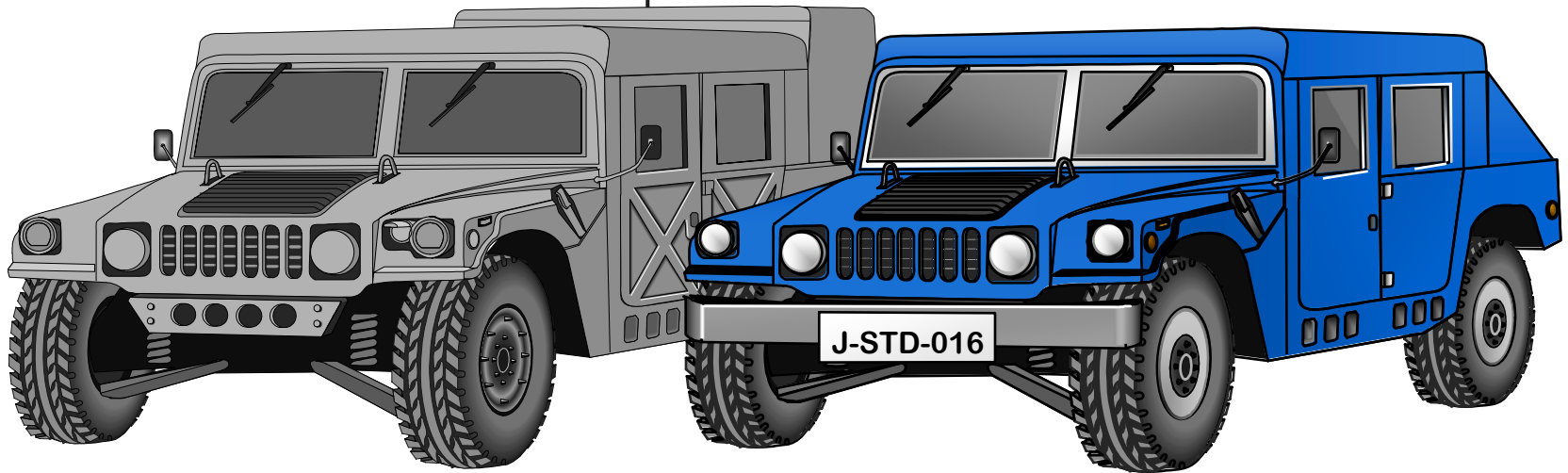
- ◆ **To bring MIL-STD-498's deliberately limited (2-year) life to a close.**
- ◆ **SecDef Perry's memo of 29 Jun 94 began the retirement of military software development standards.**
- ◆ **Despite the memo, MIL-STD-498 was adopted on 5 Dec 94 to provide a bridge to a suitable non-governmental software life cycle processes standard yet to be developed.**
- ◆ **That replacement standard is now called IEEE/EIA 12207. J-STD-016-1995 was the first step toward it.**



Only Cosmetic Differences

**If this is
MIL-STD-498...**

...this is J-STD-016-1995



MIL-STD-498 vs. J-STD-016-1995 “Bottom Line”

- ◆ **J-STD-016 is a “demilitarized” MIL-STD-498.**
- ◆ **J-STD-016-1995 adds a general requirement for traceability similar to the traceability elements in MIL-STD-498 DIDs.**
- ◆ **For each detailed requirement in MIL-STD-498 there is one in J-STD-016-1995 with the same technical content.**
- ◆ **Two additional activities in J-STD-016-1995 update system and software requirements to match the “as-built” software.**
- ◆ **For each MIL-STD-498 DID there is a product description in J-STD-016-1995 with the same content.**
- ◆ **Every data item in J-STD-016-1995 is also in MIL-STD-498.**

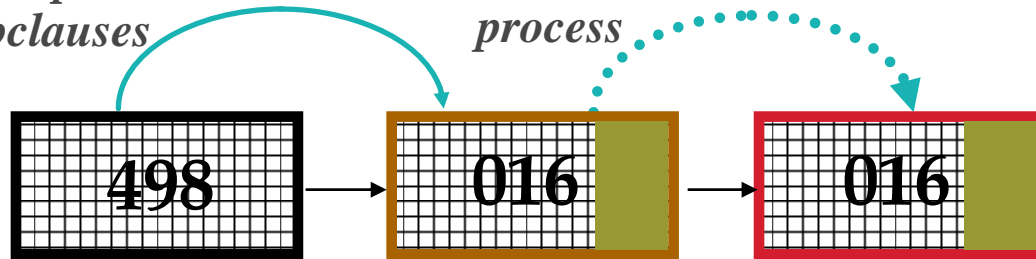
The Development of J-STD-016

- ◆ *Dropped military references*
- ◆ *Adopted ISO-style clauses*
- ◆ *Packaged data descriptions as subclauses*

Ballot in June '98 -

2nd ballot in Summer '99

- ◆ *Backed away from contractual use*
- ◆ *Redefined Tailoring*
- ◆ *Assumed defined organizational software process*



MIL-STD-498
"Software Development and Documentation,"
Dec '94

J-STD-016-1995
(Trial Use Std.)
Sep '95

J-STD-016-1998
"Software Life Cycle Processes:
Software Development"

Two Trends

- **Compatibility with ISO standards**
- **Influence of software process improvement goals**

Should (and Will) J-STD-016 Survive?

YES, because...

- ◆ **J-STD-016 product descriptions have been cited by IEEE/EIA 12207.1 but not included in whole.**
- ◆ **Projects that use (or prefer to adopt) MIL-STD-498 language for contracts, or have process descriptions based on it, need J-STD-016.**

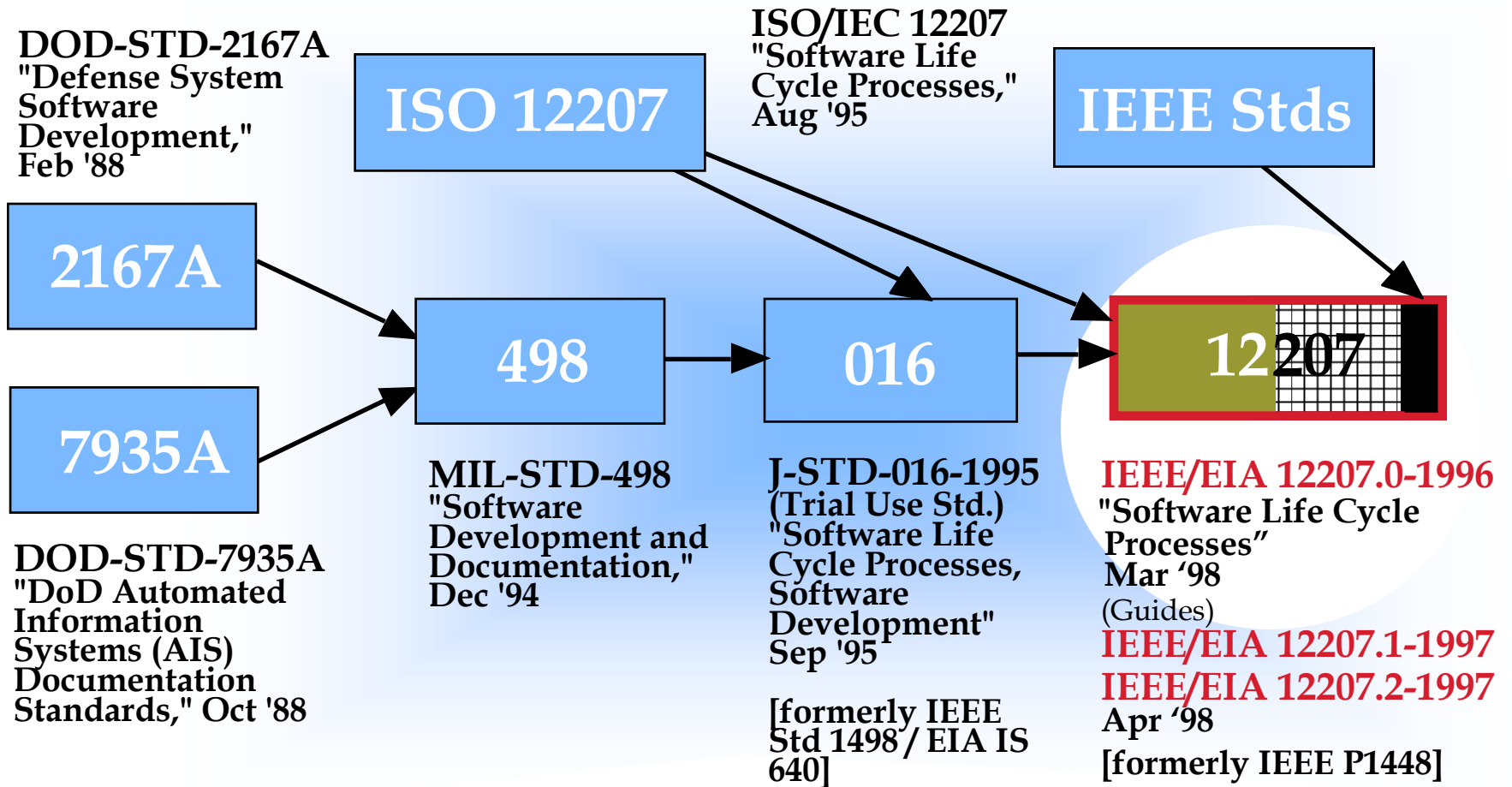
NO, because...

- ◆ **Most of the J-STD-016 engineering requirements are already in IEEE/EIA 12207.2, and the content of J-STD-016 product descriptions could be added to IEEE/EIA 12207.1.**
- ◆ **IEEE/EIA 12207 is compatible with a software process description written in language from MIL-STD-498.**
- ◆ **Most topics in J-STD-016 are covered by other IEEE or ISO standards.**

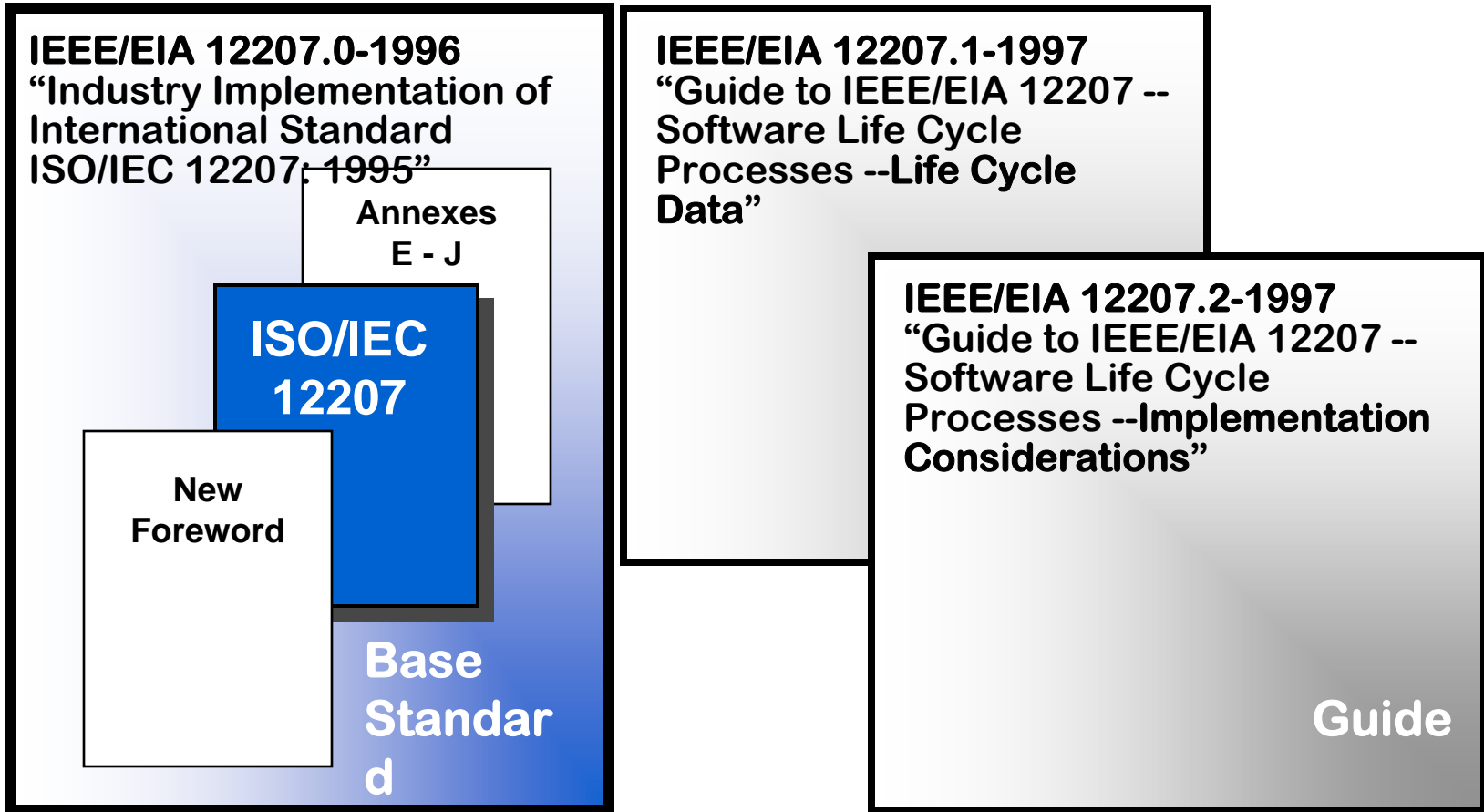
FACT...

- ◆ **There is significant DoD interest in adopting J-STD-016.**

The Business Tradition: IEEE/EIA 12207

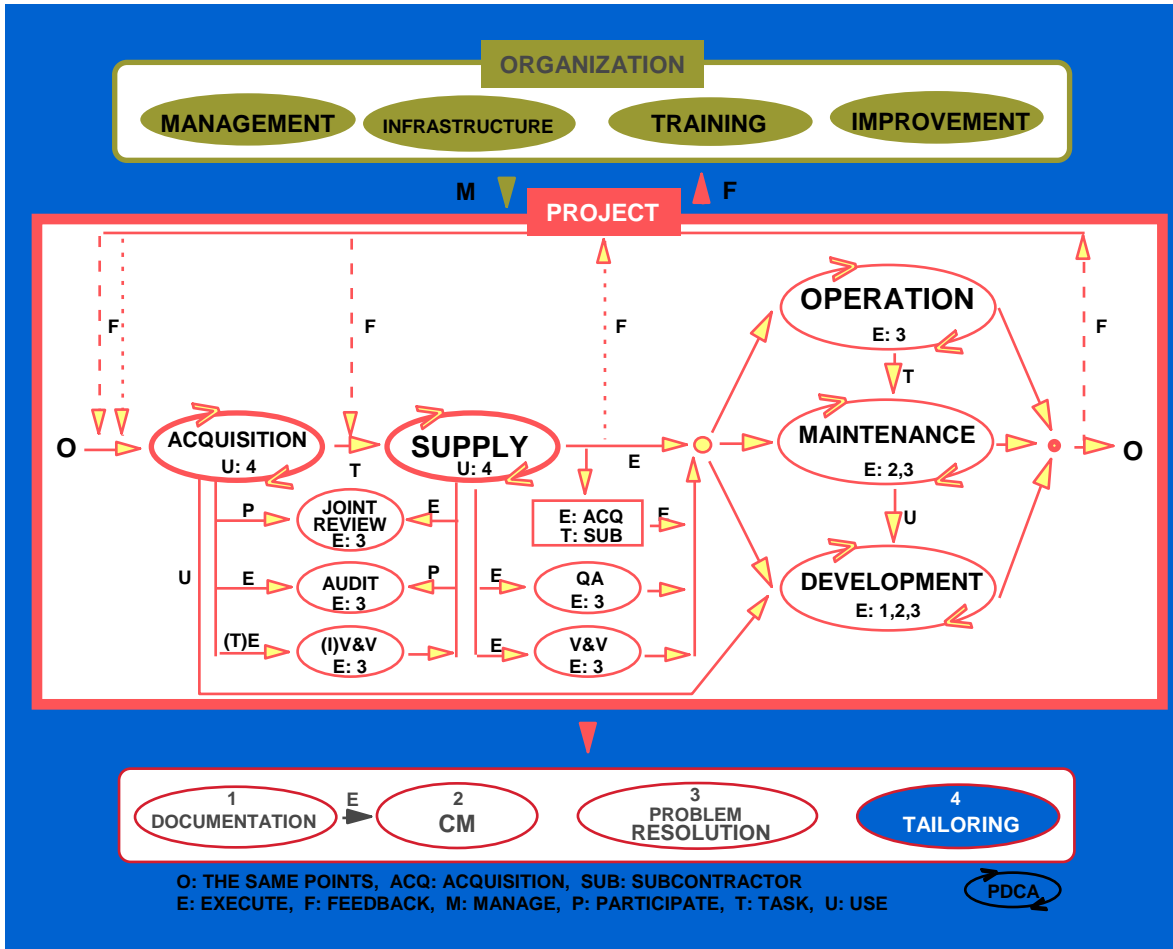


IEEE/EIA 12207 Structure at a Glance



ISO/IEC 12207 & IEEE/EIA 12207 Share a Life Cycle Processes Model

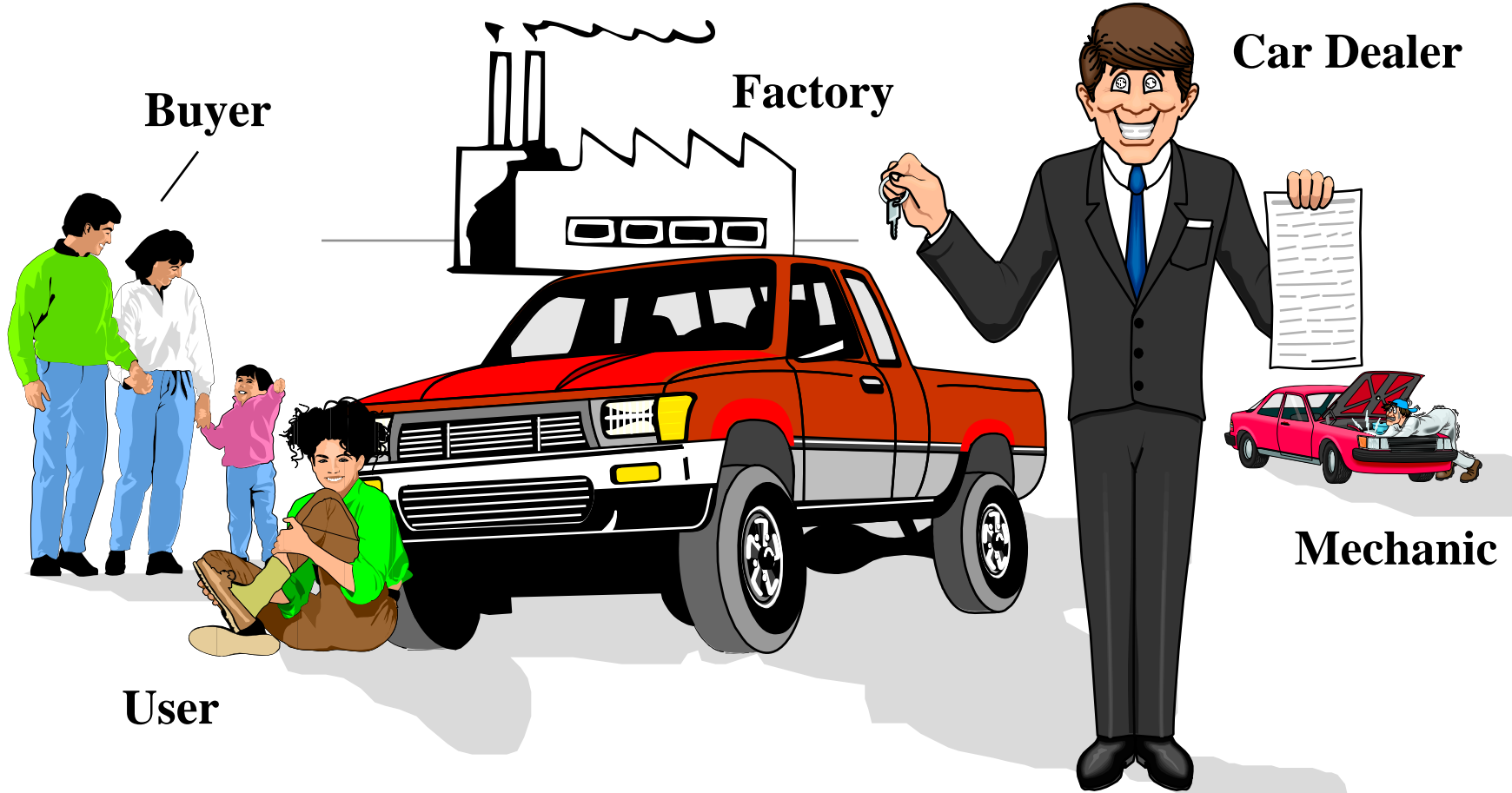
Key



- 0 - the same points
- CM - Configuration Management process
- E - execute
- E:n - execute supporting process n
- E:ACQ - execute the Acquisition process
- F - feed back (*verb*)
- (I)V&V - (independent) Verification & Validation processes
- M - manage
- P - participate in
- QA - Quality Assurance process
- T - task (*verb*)
- T:SUB - task a subcontractor
- (T)E - task the processes if they are independent, or execute them otherwise
- U - use
- U:n - use supporting process n
-
- PDCA - Plan, Do, Check, Act

The life cycle processes of ISO/IEC 12207...

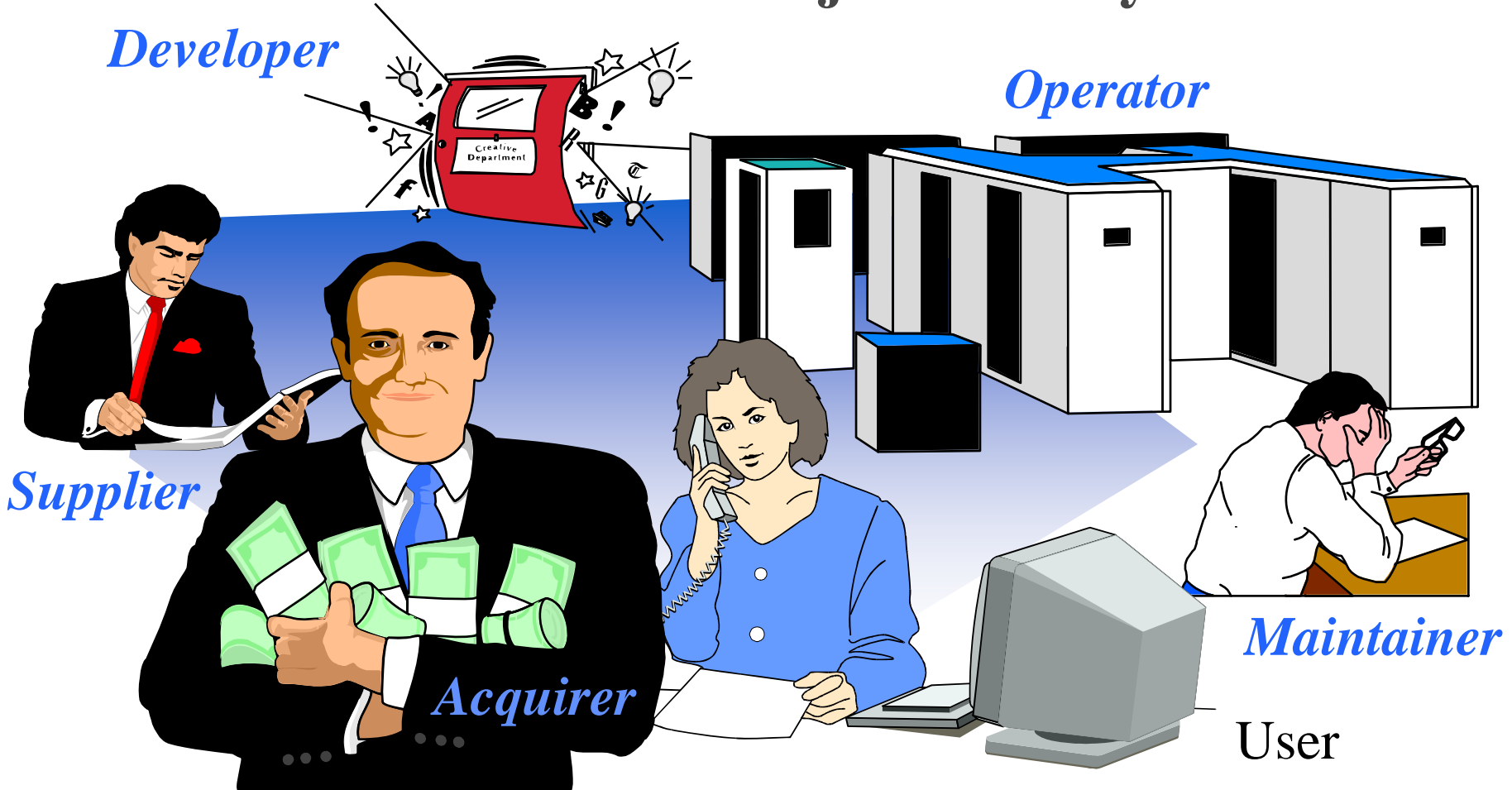
Retail Purchase Roles: A New Car





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ISO/IEC 12207 & IEEE/EIA 12207... Generalized Primary Parties in a Software Project Life Cycle



ISO/IEC 12207 & IEEE/EIA 12207...

Basic Relation Between Primary Parties: a Binding Agreement

Example contracts: acquirer - supplier (5.1.3.4 - 5.2.3.1), supplier - subcontractor (5.2.5.4)



“3.7 Contract: A binding agreement between two parties, especially enforceable by law, or a similar internal agreement wholly within an organization, for the supply of software service or for the supply, development, production, operation, or maintenance of a software product.”

ISO/IEC 12207 & IEEE/EIA 12207 are About the Software Life Cycle



**A “Carnot cycle” for software
development and operational use.**

In Contrast...

MIL-STD-498 and J-STD-016 are About What Developers Do...

- ◆ **Twenty five management and engineering activities: some of these must be chosen (via tailoring) and ordered into a software development process, and then carried out as planned.**
- ◆ **Twenty two descriptions of data items (DIDs / product descriptions) that represent records of the results of the chosen management and engineering activities: some of the data elements of the data items must be chosen (via tailoring) and the chosen data must be recorded during software development.**

...But, a Developer is Only One of Five Primary Parties in ISO/IEC 12207 & IEEE/EIA 12207

**ISO/IEC 12207 and IEEE/EIA 12207 contain
management, engineering, and data requirements for**

- Acquirers**
- Suppliers**
- Developers**
- Operators, and**
- Maintainers.**

How Does IEEE/EIA 12207 Differ From ISO/IEC 12207? “Bottom Line”

- ◆ **IEEE/EIA 12207.1 provides much more extensive guidance than ISO/IEC 12207 does on**
 - the possible content of key document types mentioned in ISO/IEC 12207 (for example ‘description’ and ‘plan’), and on different instances of each type (for example database design description and project management plan).
- ◆ **IEEE/EIA 12207.2 provides guidance on (i.e., intends to “summarize the best practices” for)**
 - implementing the primary, supporting, and organizational life cycle processes defined in clauses 5, 6, and 7 of ISO/IEC 12207.
- ◆ **Tailoring is defined differently in IEEE/EIA 12207**
- ◆ **Compliance is defined differently in IEEE/EIA 12207**

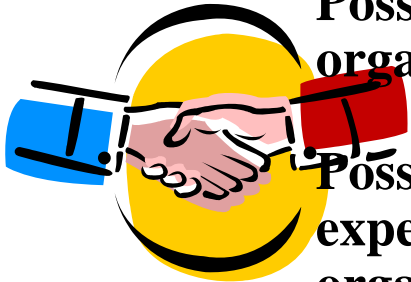
Pause...to Recap...

- ◆ **IEEE/EIA 12207 adds guidance on data and on implementing life cycle processes to the requirements in ISO/IEC 12207.**
- ◆ **The content of ISO/IEC 12207 is preserved nearly intact in IEEE/EIA 12207 (tailoring and compliance are the major exceptions).**
- ◆ **Because the guidance in IEEE/EIA 12207 is based on the requirements in MIL-STD-498 / J-STD-016-1995, it allows contractual language and software processes and data based on the earlier standards.**
- ◆ **So, you can keep successful, old software processes and data requirements when adopting IEEE/EIA 12207.**

How are ISO/IEC 12207 and IEEE/EIA 12207 Used?

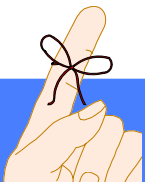
◆ **By two “parties” ---**

Possible Jointly: For legal, contractual language when one organization acquires software from another.



Possible Jointly: For “binding” guidance that establishes expectations between developers and their customers within an organization (for example, between two different projects, or between software programmers and software users).

Important Individually: As a checklist for evaluating the other party’s plans and performance.



◆ **By a single “party” ---**

Most important: As a planning checklist for the party’s role!

What is the Value of IEEE/EIA 12207?

- ◆ **Covers more of the software life cycle, more thoroughly, than any earlier software process standard.**
- ◆ **Defines relations between the primary parties in the software life cycle better than any other standard except ISO/IEC 12207.**

Topics

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Acquirer - developer relations as described in MIL-STD-498 / J-STD-016 and IEEE/EIA 12207.

Roles Directed by J-STD-016

◆ Acquirer



- Procures software products for itself or another organization
- Decides requirements for software products
- Tailors J-STD-016
- Confirms that software products satisfy requirements.

◆ Developer



- **Establishes software process**
- **Defines requirements and develops software products**
- **Suggests tailoring of J-STD-016**
- **Selects characteristics of software products to satisfy requirements**
- **Performs other activities in J-STD-016 (that are not tailored out), develops and records data in J-STD-016 product descriptions (that are not tailored out).**

◆ Maintenance Organization



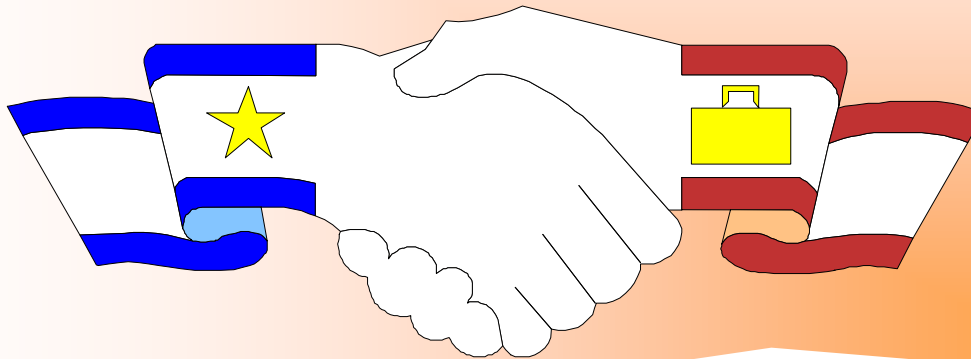
- Performs the activities that ensure that software installed for operational use continues to perform as intended and fulfill its intended role in system operation.

J-STD-016 Acquirer-Developer Relation

- ◆ **Begins after contract award**
- ◆ **Developer requirements analysts go to work to find out what the acquirer's conditions for acceptance will be.**
- ◆ **Developer performs the activities in J-STD-016 that were not tailored out by the acquirer, and develops and records the data in the J-STD-016 product descriptions that were not tailored out by the acquirer.**
- ◆ **Periodically, developer presents status of work to acquirer.**
- ◆ **After reviewing developer's qualification tests, acquirer decides whether to accept software products.**

The Biggest Problems for Software Development Projects Occur Outside the Scope of J-STD-016

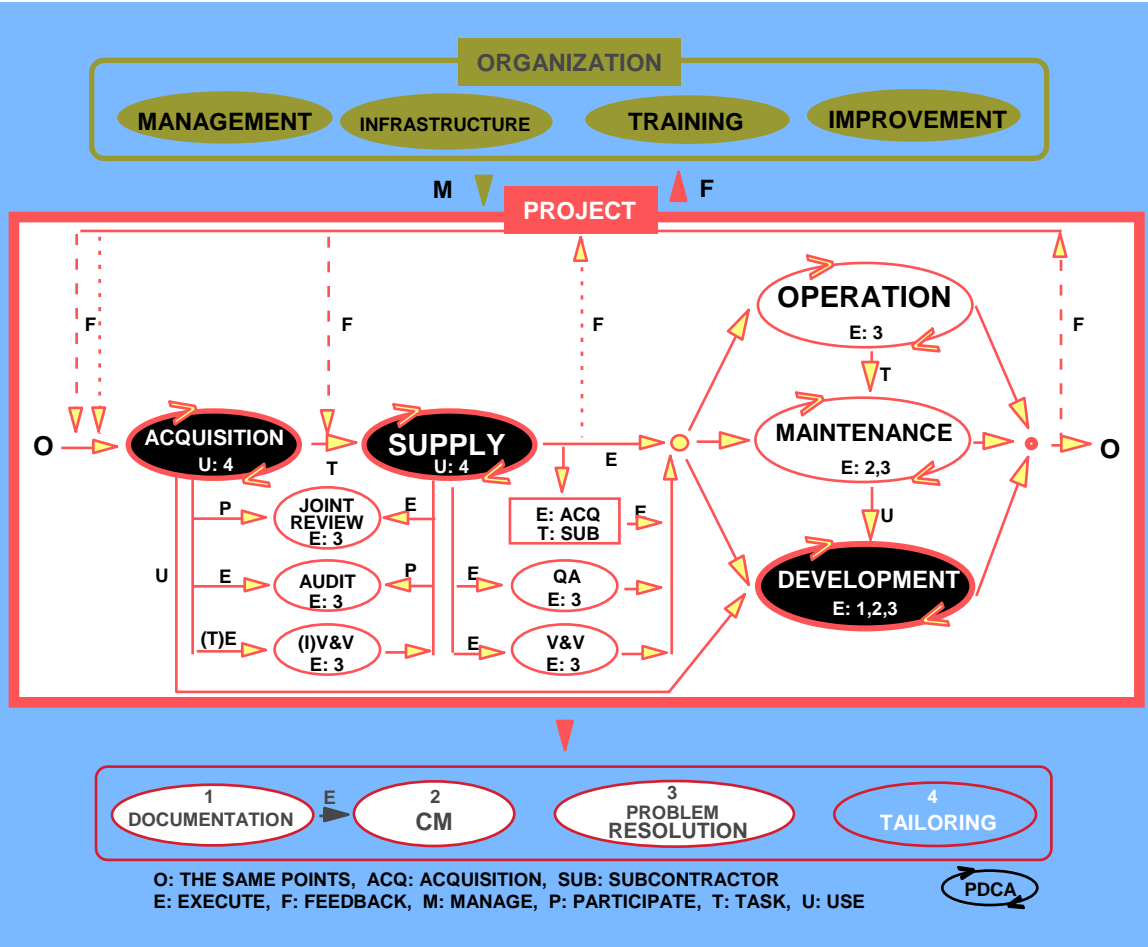
- ◆ **Contract terms (cost and schedule)**
- ◆ **Requirements**



IEEE/EIA 12207 Acquirer-Developer Relation

- ◆ **Begins before contract award**
- ◆ **Acquirer's requirements analysts decide what the requirements will be before a developer is hired.**
- ◆ **Developer performs the activities in IEEE/EIA 12207 that were not tailored out by the acquirer, and develops and records the data required by the standard that were not tailored out by the acquirer.**
- ◆ **Periodically, developer presents status of work to acquirer.**
- ◆ **After reviewing developer's qualification tests, acquirer decides whether to accept software products.**

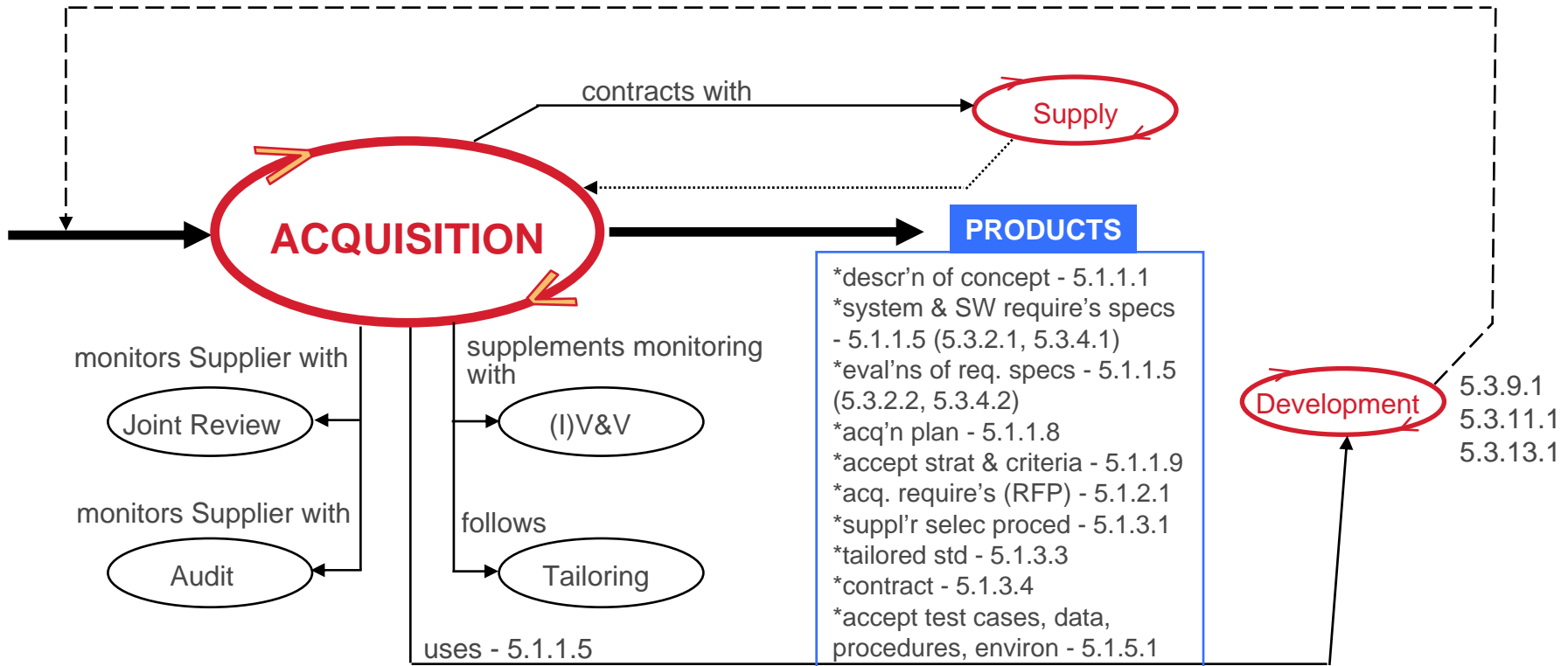
IEEE/EIA 12207 Life Cycle Processes Model



Key

- O** - the same points
- CM** - Configuration Management process
- E** - execute
- E:n** - execute supporting process n
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-
- PDCA** - Plan, Do, Check, Act

IEEE/EIA 12207 Acquisition Process



Related IEEE/EIA 12207.1 Acquisition References

- ◆ **Concept of operations description (5.1.1.1) [2 refs] - J-STD-016 F.2.1 “Operational Concept Description”**
- ◆ **System requirements description (5.1.1.2) [4 refs] - J-STD-016 F.2.2 “System/Subsystem Specification”**
- ◆ **Software requirements description (5.1.1.4) [4 refs] - J-STD-016 F.2.3, F.2.4 “Interface Requirements Specification,” and “Software Requirements Specification”**
- ◆ **Acquisition Plan (5.1.1.8) [3 refs] - ASTM E731 “Guide for Selection and Acquisition of Commercially Available Computerized Systems,” IEEE Std 1062 “IEEE Recommended Practice for Software Acquisition”**
- ◆ **Test or validation procedures (5.1.5.1) [3 refs] - IEEE Std 829 “IEEE Standard for Software Test Documentation,” J-STD-016 H.2.1 “Software Test Description”**



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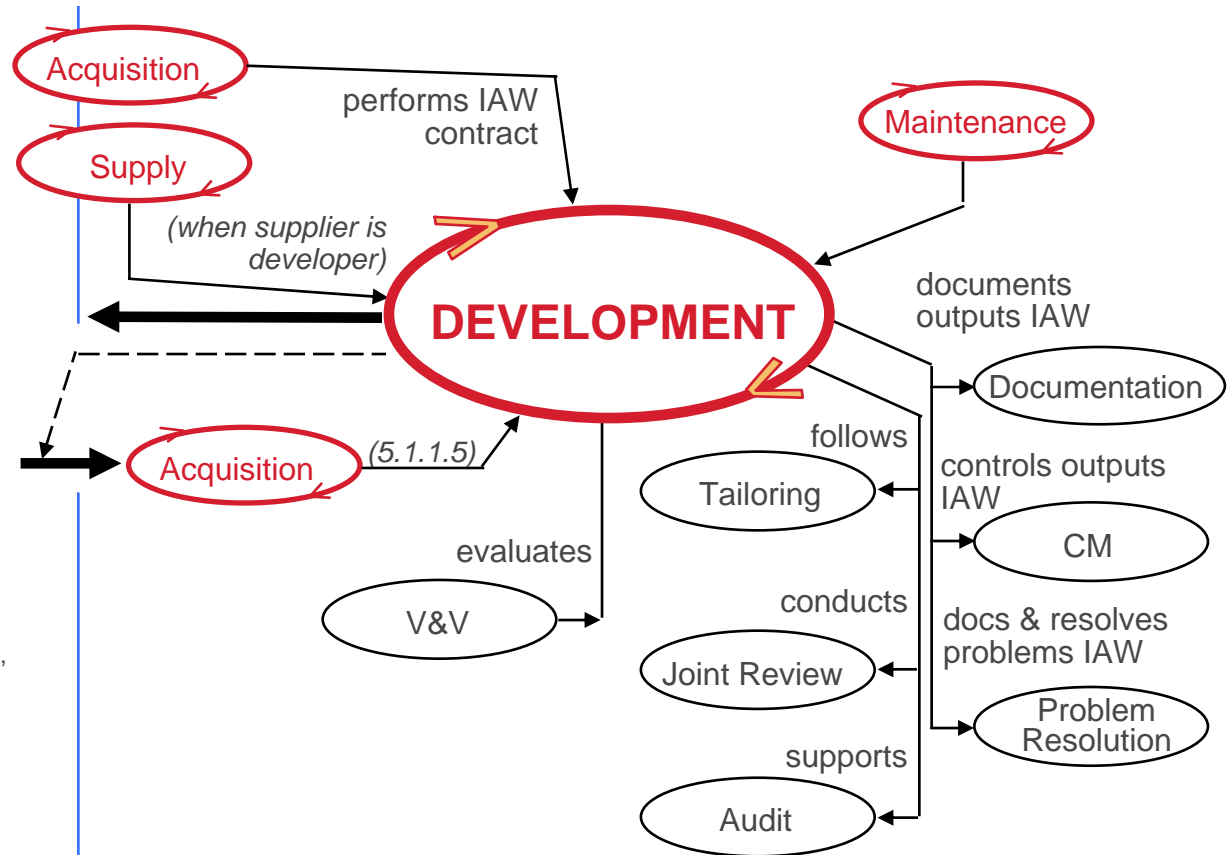
Other Acquisition Process Data

- ◆ **Request For Proposal (5.1.2.1)**
- ◆ **Contract (5.1.3.4)**

IEEE/EIA 12207 Development Process

- *SW life cycle model w/ active from Develop proc - 5.3.1.1
- *baselines for config items - 5.3.1.2 (Annex J)
- *tailored stds, methods, tools, langs - 5.3.1.3
- *plans for active of Develop proc - 5.3.1.4
- * (sys require's spec - 5.3.2.1, in Acq. process)
- *top-level sys architect - 5.3.3.1
- *SW require's spec - 5.3.4.1 (in Acq. process also)
- *architect of SW items - 5.3.5.1
- *top-level design for interfaces - 5.3.5.2
- *top-level design for databases - 5.3.5.3
- *prelim & updated versions of user docs - 5.3.5.4, 5.3.6.4, 5.3.7.3, 5.3.8.3
- *prelim & updated test require's and sched for SW integration - 5.3.5.5, 5.3.6.6, 5.3.7.4
- *detailed design of SW comp's - 5.3.6.1
- *detailed design of interfaces - 5.3.6.2
- *detailed design of databases - 5.3.6.3
- *require's & sched for testing SW units 5.3.6.5
- *SW units & databases - 5.3.7.1
- *SW unit test results - 5.3.7.2
- *integration plan - 5.3.8.1
- *sys & SW integ and test results - 5.3.8.2, 5.3.10.1
- *tests, test cases & procedures for SW & sys qual testing - 5.3.8.4, 5.3.10.2
- *SW & sys test results - 5.3.9.1, 5.3.11.1
- *audit results - 5.3.9.4, 5.11.3
- *evaln's of products - 5.3.2.2, 5.3.3.2, 5.3.4.2, 5.3.5.6, 5.3.6.7, 5.3.7.5, 5.3.8.5, 5.3.9.3, 5.3.10.3, 5.3.11.2
- *complete deliverable SW product - 5.3.11.4, 5.3.13.2
- *installation plan - 5.3.12.1
- *installation events & results - 5.3.12.2
- *acceptance review and testing results - 5.3.13.1

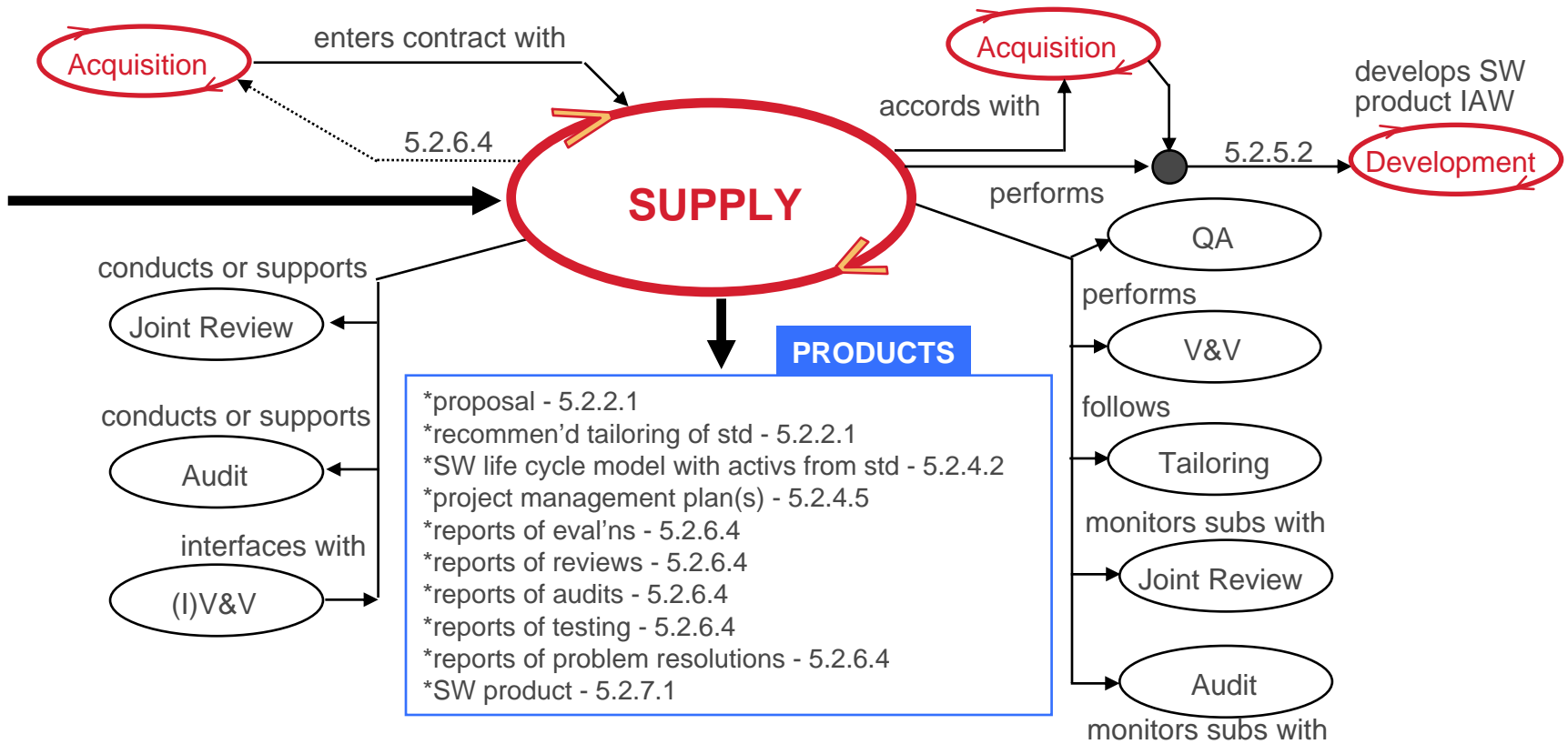
PRODUCTS



Related IEEE/EIA 12207.1 Development References

- ◆ **Software life cycle model description (5.3.1.1) [1 ref] - IEEE Std 1074 “IEEE Standard for Developing Software Life Cycle Processes”**
- ◆ **System requirements specification (5.3.2.1) [4 refs] - J-STD-016 F.2.2 “System/Subsystem Specification”**
- ◆ **System architecture and requirements allocation description (5.3.3.1) [4 refs] - J-STD-016 G.2.1 “System/Subsystem Design Description”**
- ◆ **Software requirements description (5.3.4.1) [4 refs] - J-STD-016 F.2.3, F.2.4 “Interface Requirements Specification,” and “Software Requirements Specification”**

IEEE/EIA 12207 Supply Process



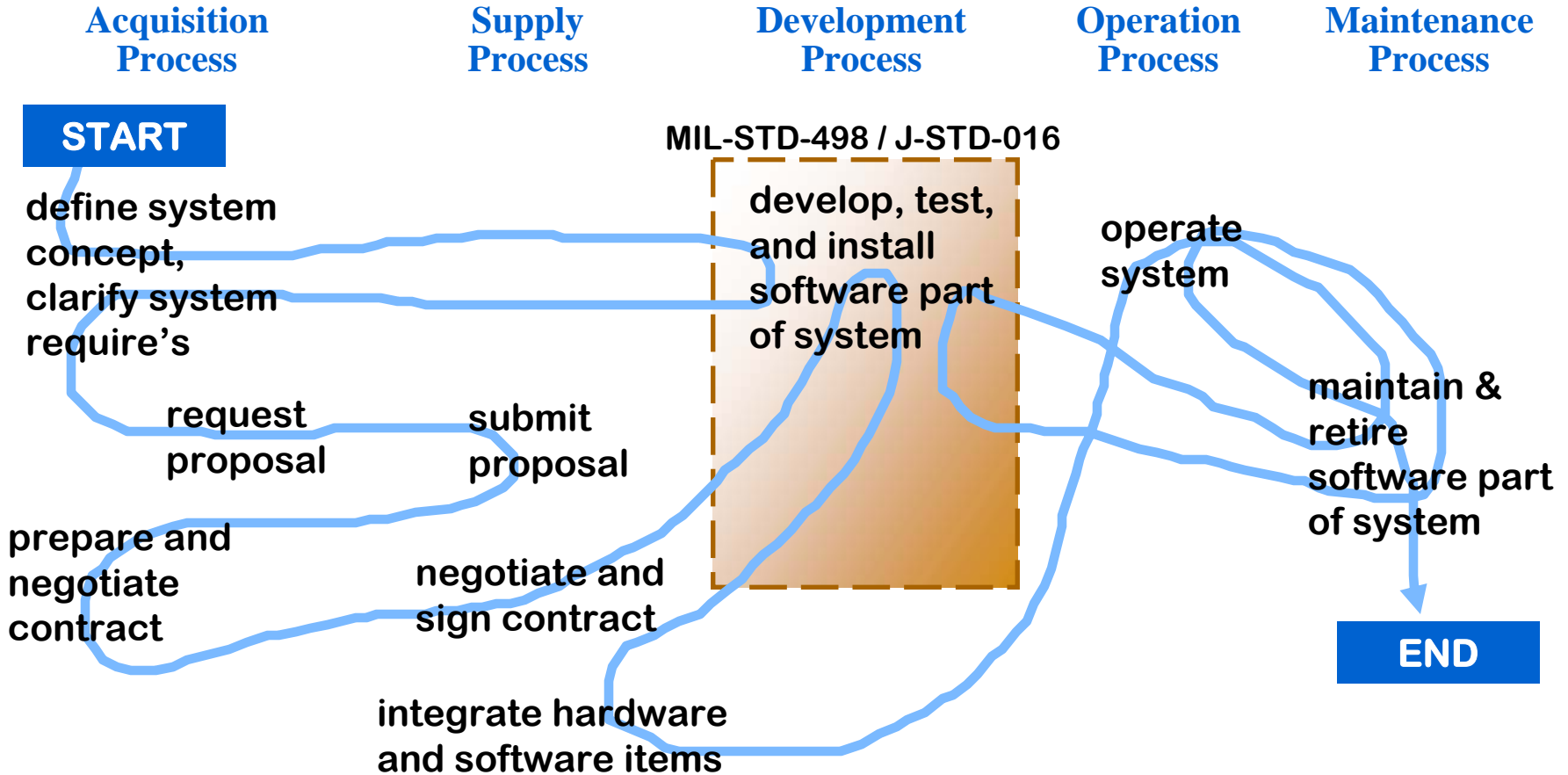


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Relevant Supply Process Data

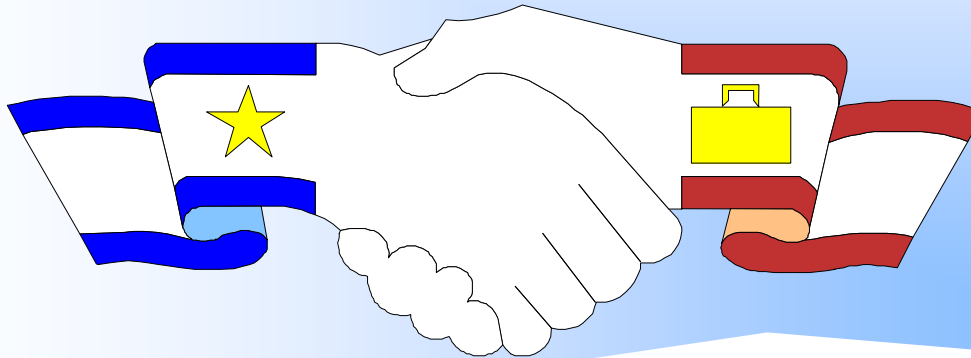
◆ Proposal (5.2.2.1)

ISO/IEC 12207 & IEEE/EIA 12207... Simple Life Cycle Activities Flow



Back to the Biggest Problems for Software Development Projects...

- ◆ **Contract terms (cost and schedule)**
- ◆ **Requirements**
- ◆ **They are within the scope of ISO/IEC 12207 and IEEE/EIA 12207.**



How to Get the Standards

◆ IEEE/EIA 12207

- Order from IEEE at 800-678-4333 (732-981-0060 outside the US and Canada) -- FAX: 908-981-9667 -- telex 833233
- **US DoD customers: Obtain IEEE/EIA 12207 through the (DODSSP) Standardization Order Desk, 700 Robbins Avenue, Building 4/D, Philadelphia, PA 19111-5094.**

◆ J-STD-016-1995

- Order from IEEE, or from Global Engineering Documents at 800-854-7179 (303-397-7956 outside the US) -- FAX: 303-397-2740.

◆ MIL-STD-498

- Download from Abelia Corporation at <http://www.abelia.com/pubsmain.htm>

Recommended Reading

- ◆ Reed Sorensen, “MIL-STD-498, J-STD-016, and the U.S. Commercial Standard,” in *CrossTalk*, June 1996, pages 13-14, 26.
- ◆ Lewis Gray, “ISO/IEC 12207 Software Life Cycle Processes,” in *CrossTalk*, August 1996, pages 14-18.
- ◆ Raghu Singh, “International Standard ISO/IEC 12207 Software Life Cycle Processes,” August 1996 at www.abelia.com/pubsmain.htm
- ◆ James W. Moore, Perry R. DeWeese, and Dennis Rilling, “U.S. Software Lifecycle Process Standards,” in *CrossTalk*, July 1997, pages 6-8.
- ◆ Raghu Singh, “ISO/IEC 12207 Tutorial,” June 1998 at www.abelia.com/pubsmain.htm