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

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Abelia Corporation offers Lewis Gray's authoritative, on-site courses
on the standards that are mentioned in this presentation.
For detailed information about our courses, contact lewis@abelia.com.

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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.**

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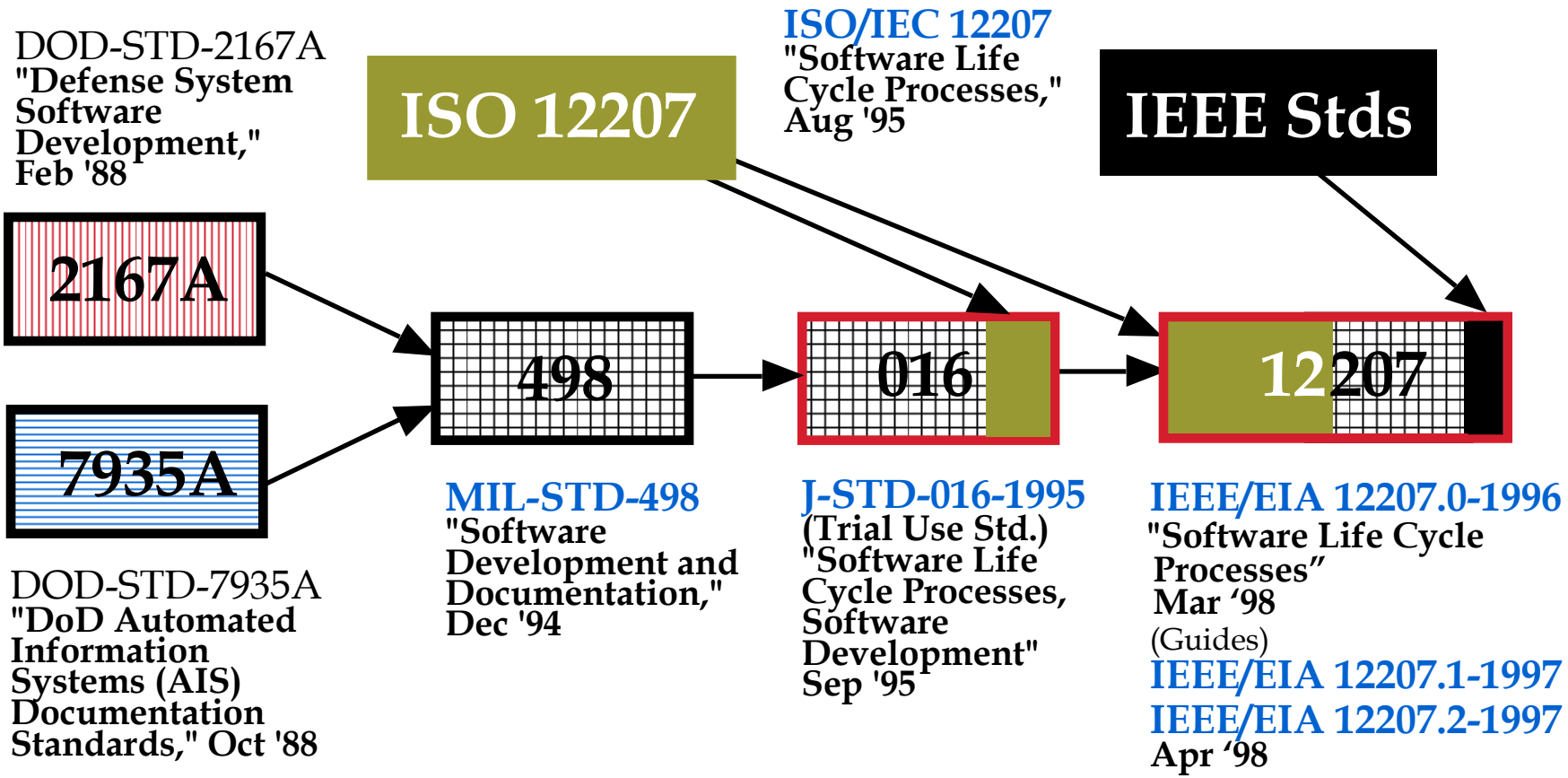
Background: The Pedigree of IEEE/EIA 12207



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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.

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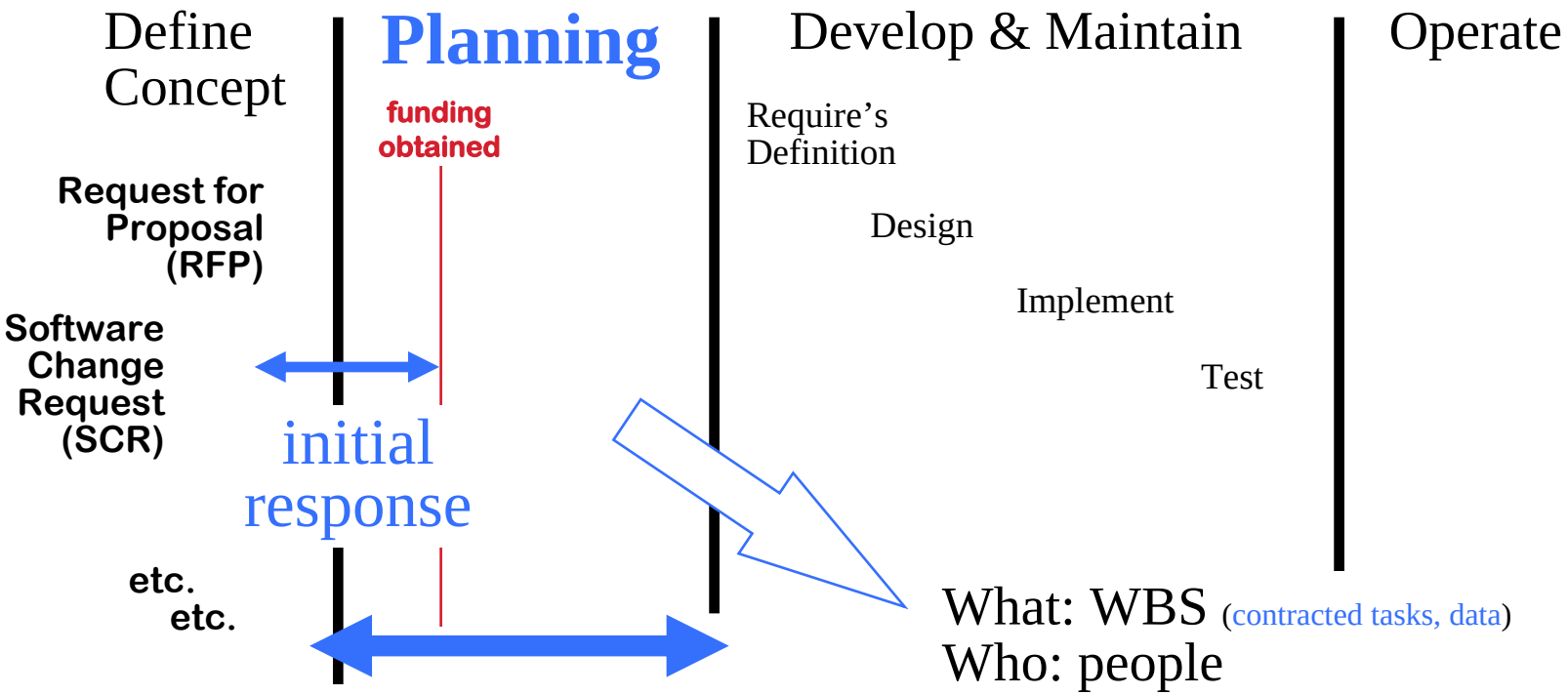
Background:
All Four Standards are Most Useful...



498, 016, both 12207s
suggest processes, data

What: WBS (contracted tasks, data)
Who: people
When: schedule
How: tasks, data, methods, procedures, tools

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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.

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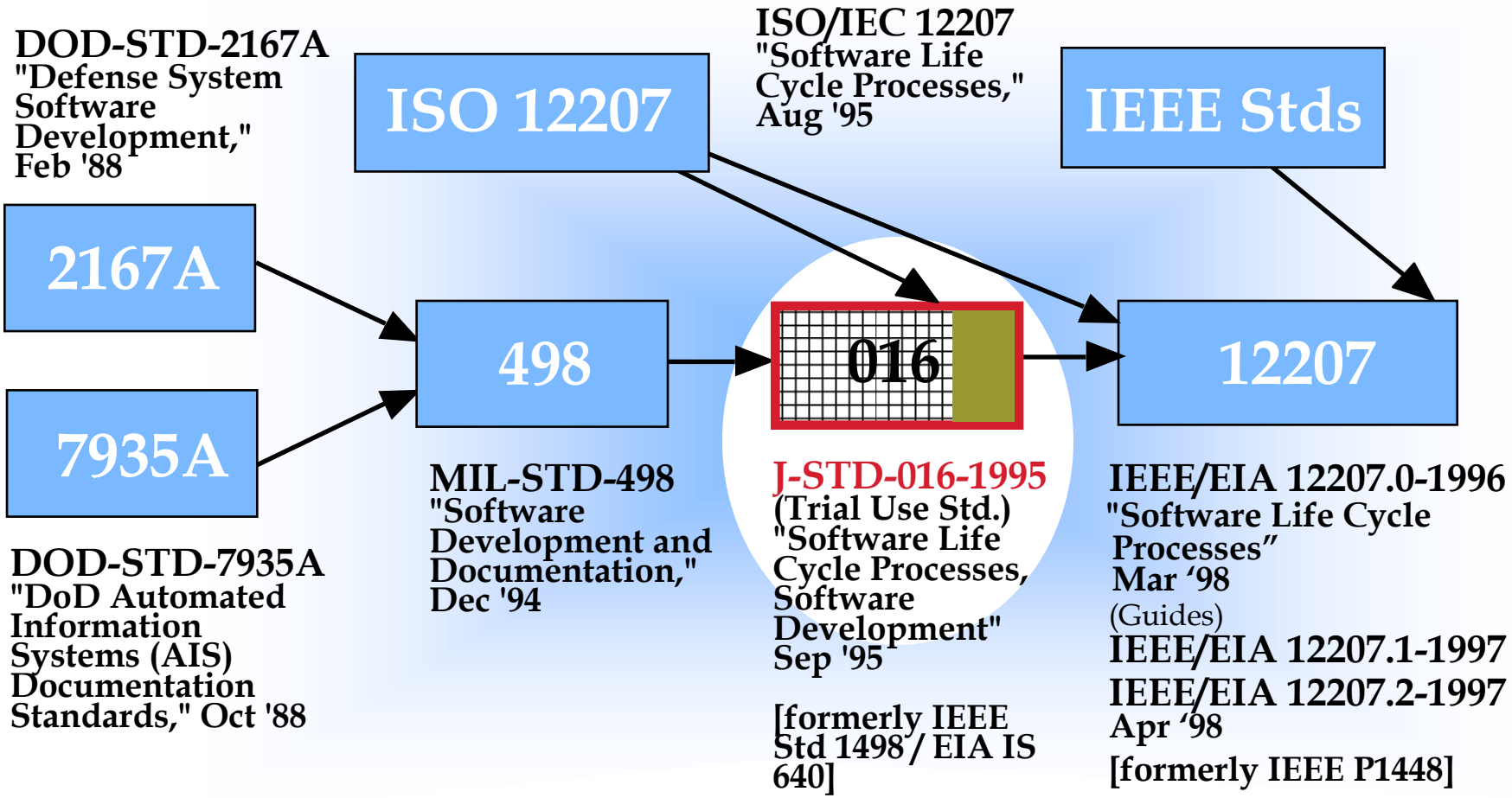
The U.S. Military Tradition: MIL-STD-498 to J-STD-016



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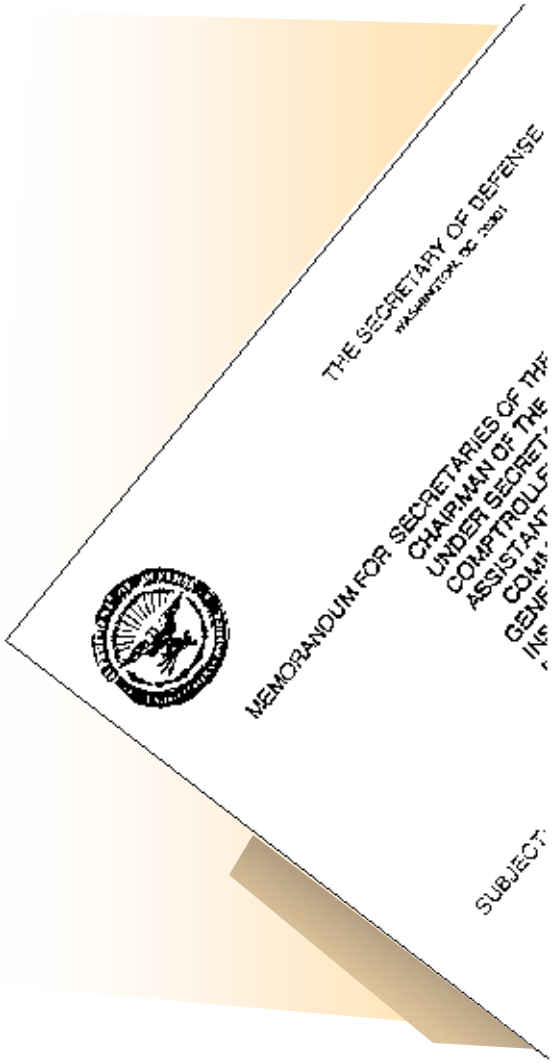
Why is There J-STD-016-1995?



- 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.

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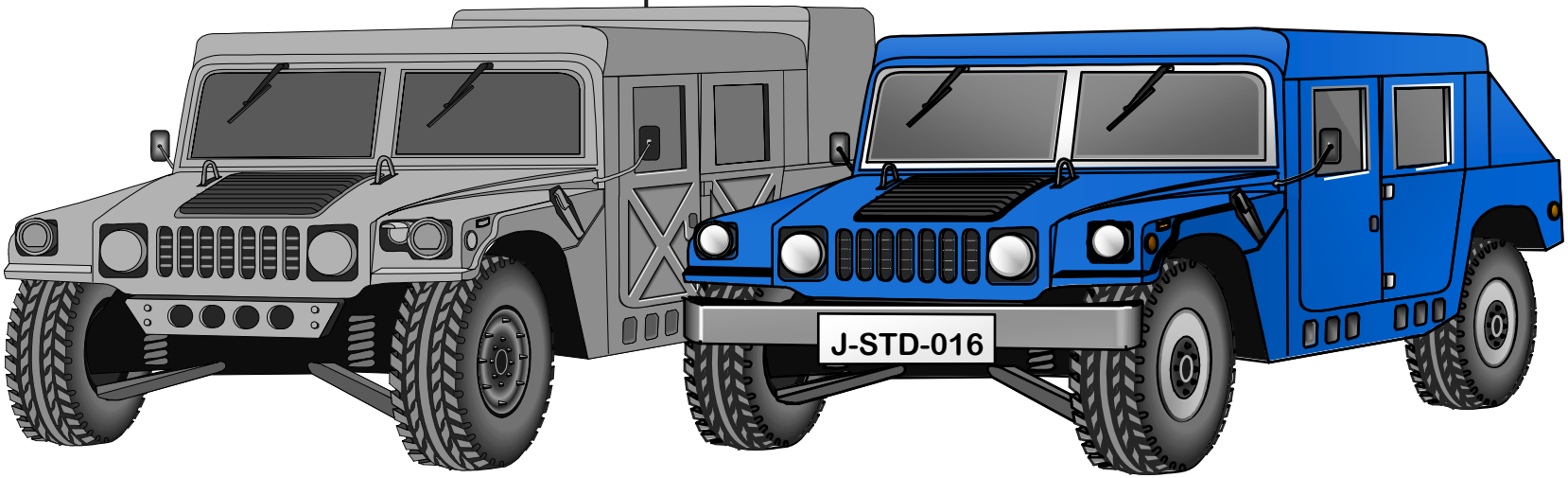
Only Cosmetic Differences

If this is MIL-STD-498...

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



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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.**

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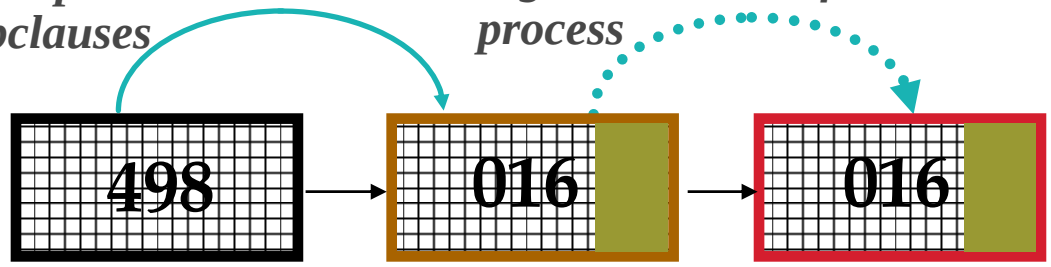
The Development of J-STD-016

- *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**

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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.

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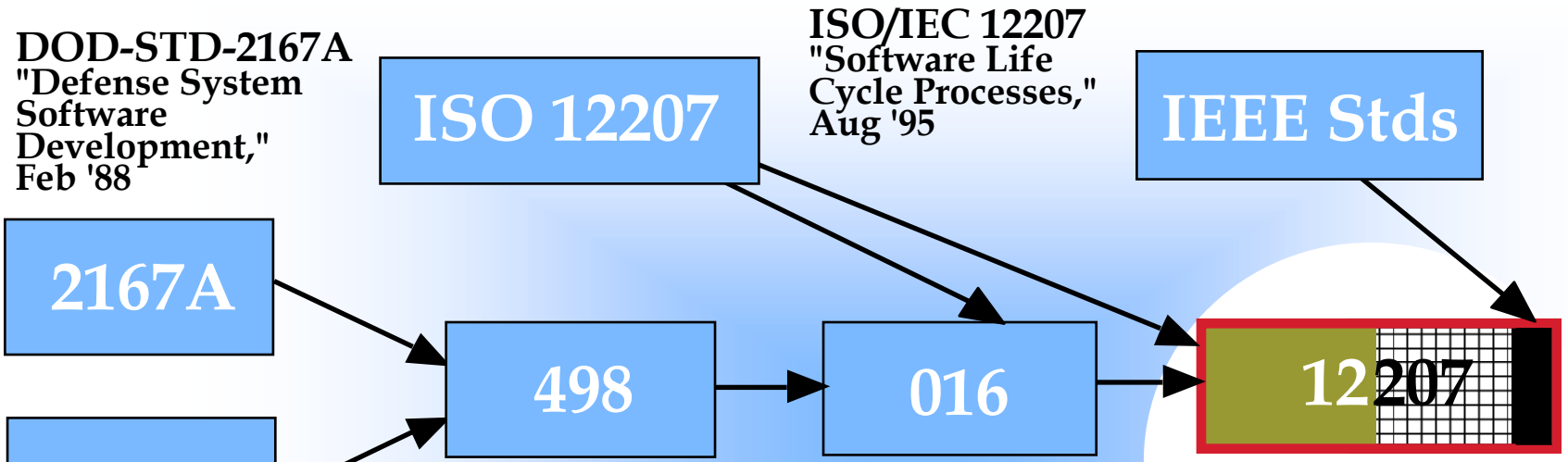
The Business Tradition: IEEE/EIA 12207



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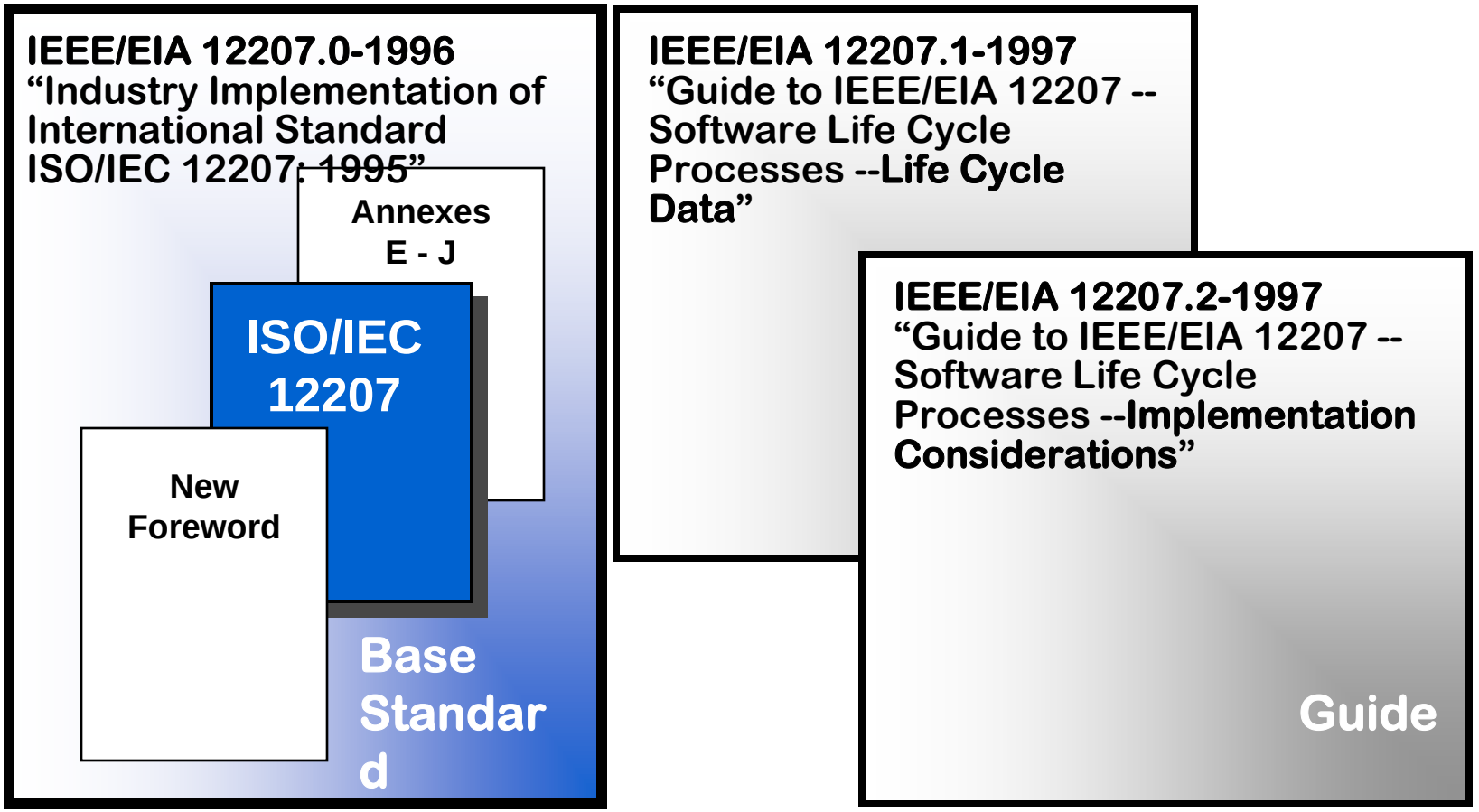
IEEE/EIA 12207 Structure at a Glance



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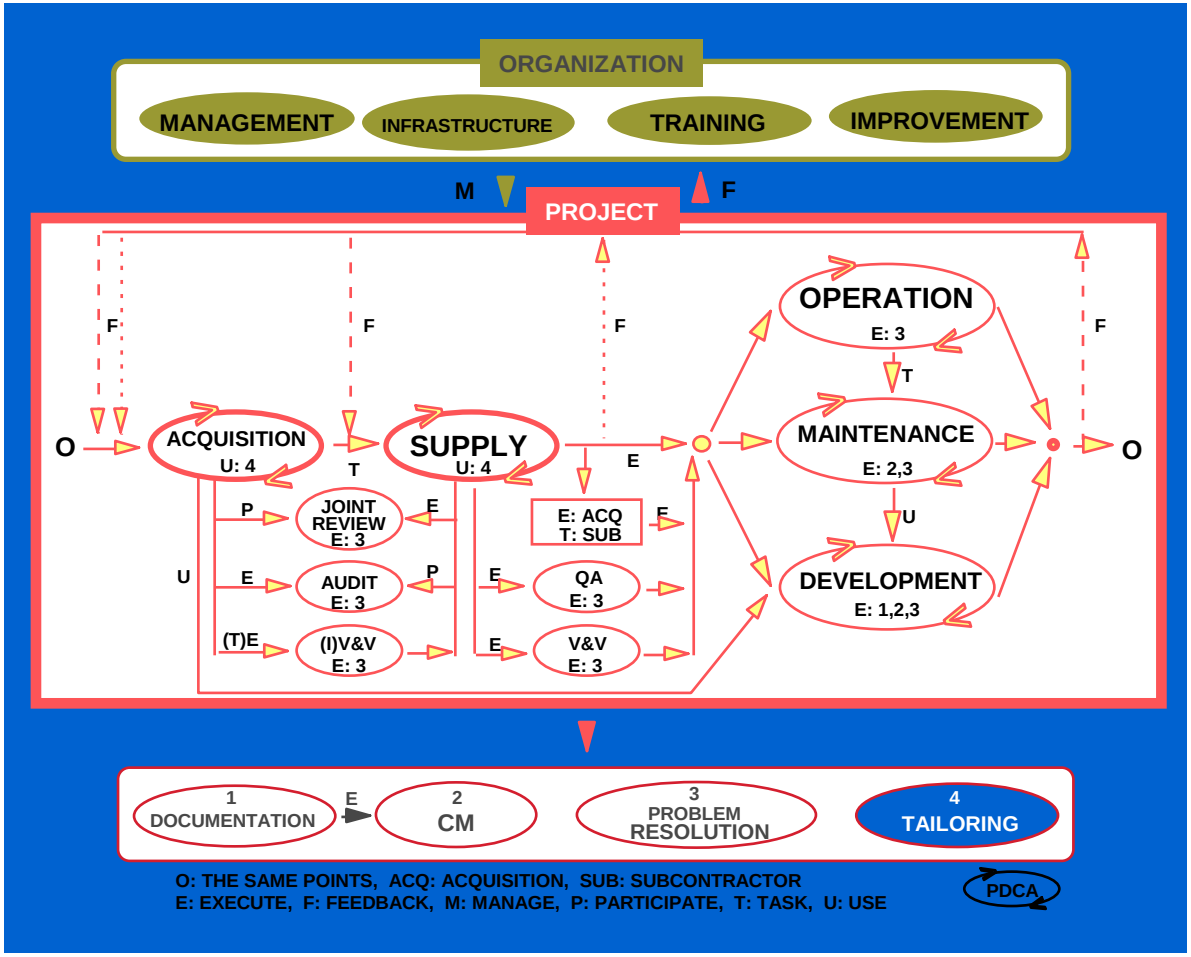
ISO/IEC 12207 & IEEE/EIA 12207
Share a Life Cycle Processes Model



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

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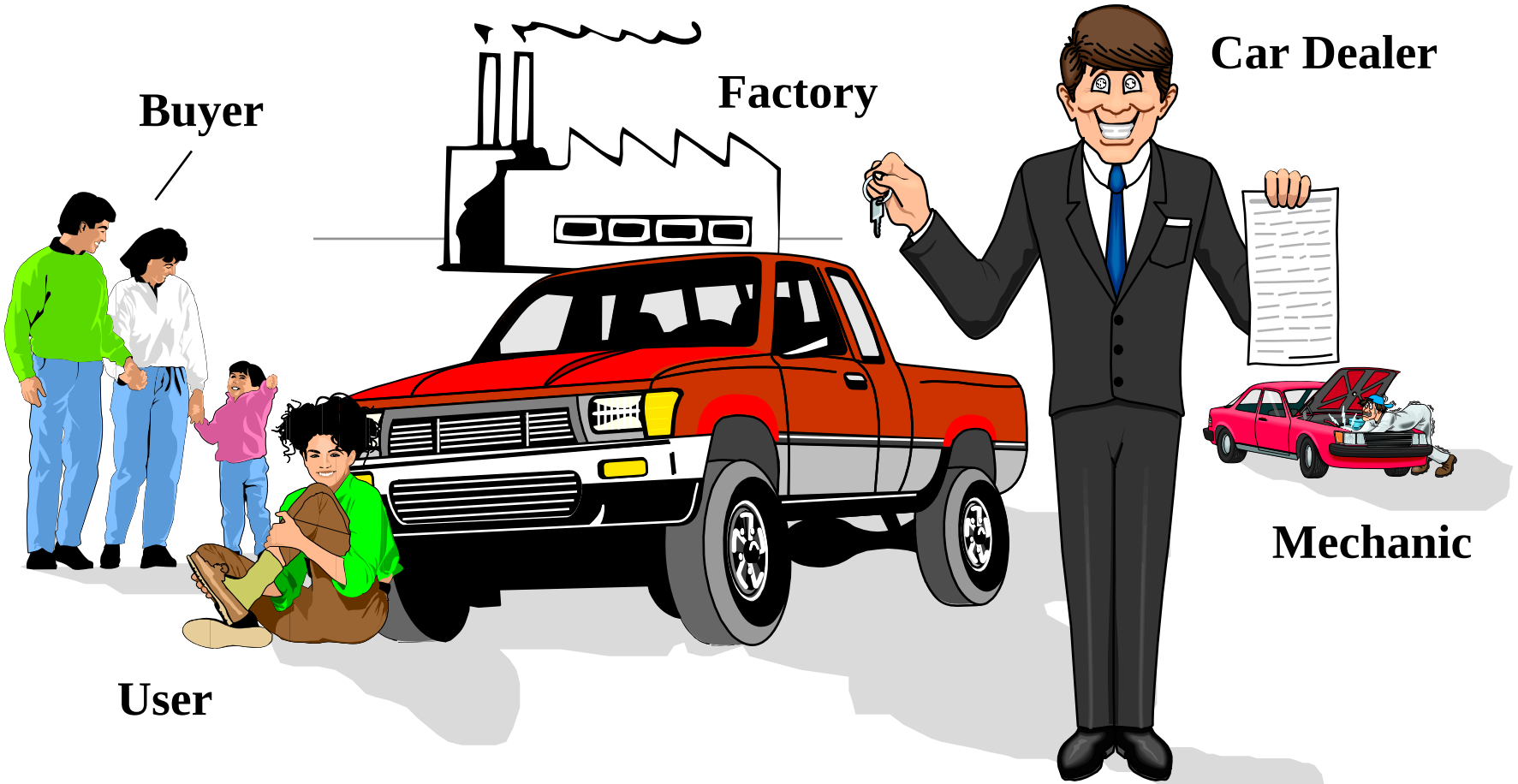
The life cycle processes of ISO/IEC 12207...
Retail Purchase Roles: A New Car



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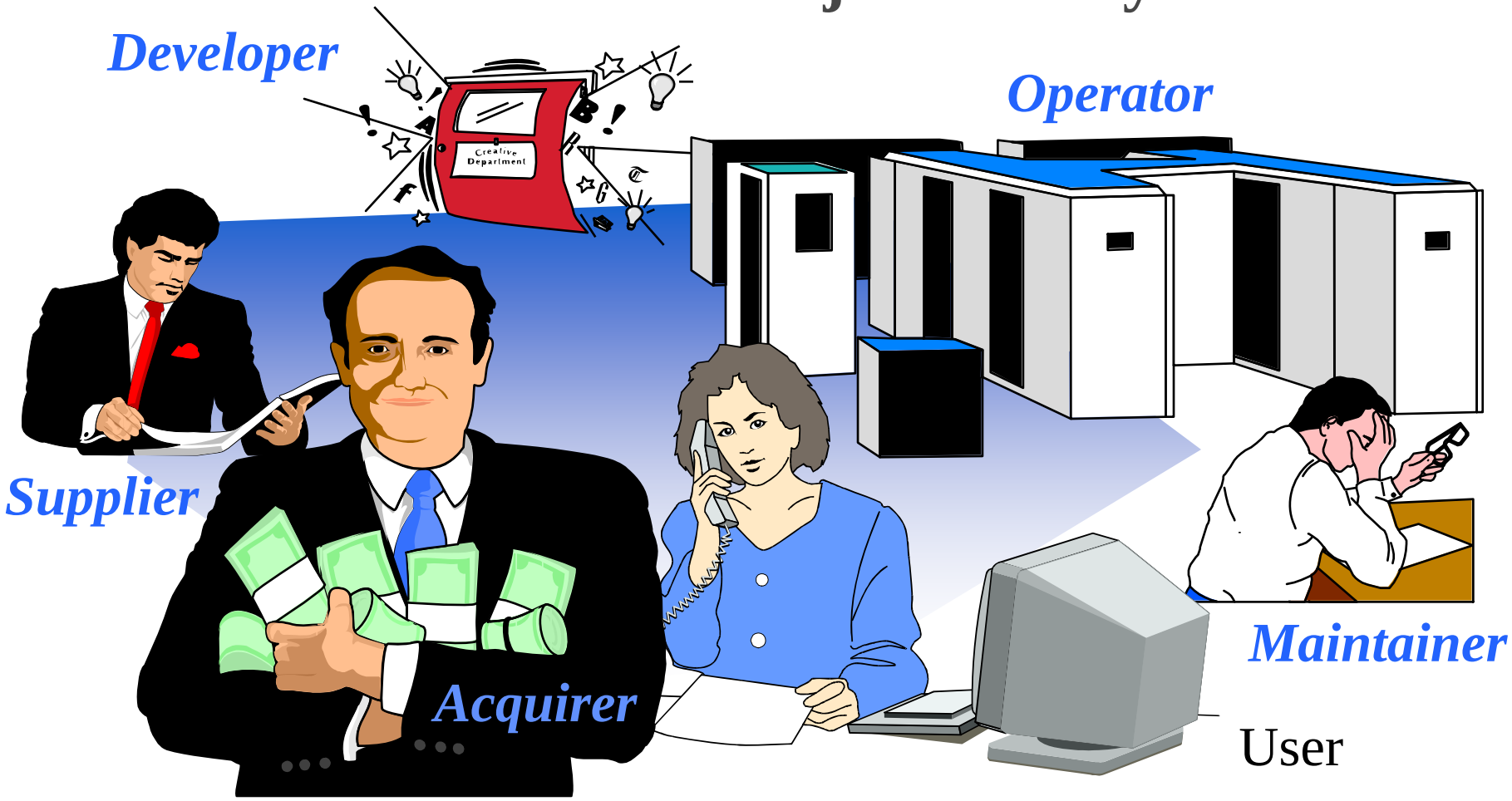
ISO/IEC 12207 & IEEE/EIA 12207...
Generalized Primary Parties in a Software Project Life Cycle



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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."

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

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

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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.**

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...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.**

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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**

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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.**

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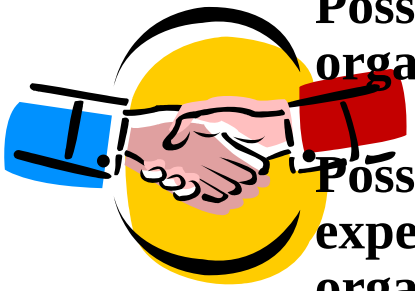
How are ISO/IEC 12207 and IEEE/EIA 12207 Used?

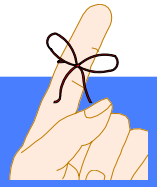


- **By two "parties" ---**

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!

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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.**

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

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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.**

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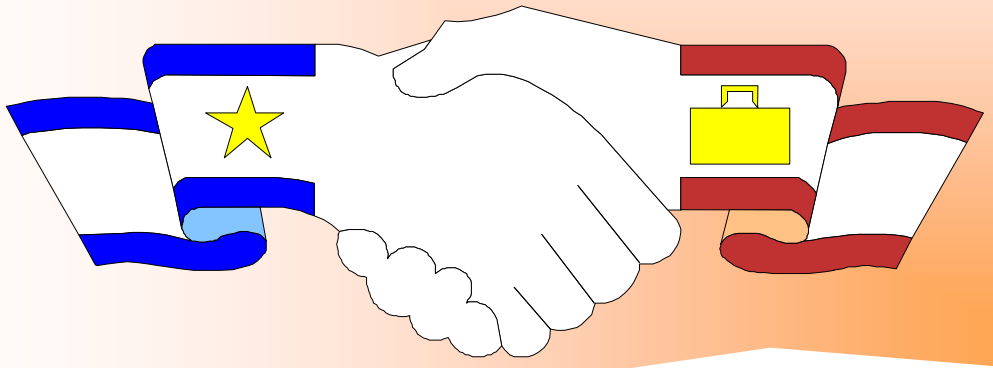
The Biggest Problems for Software Development Projects Occur Outside the Scope of J-STD-016

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



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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.**

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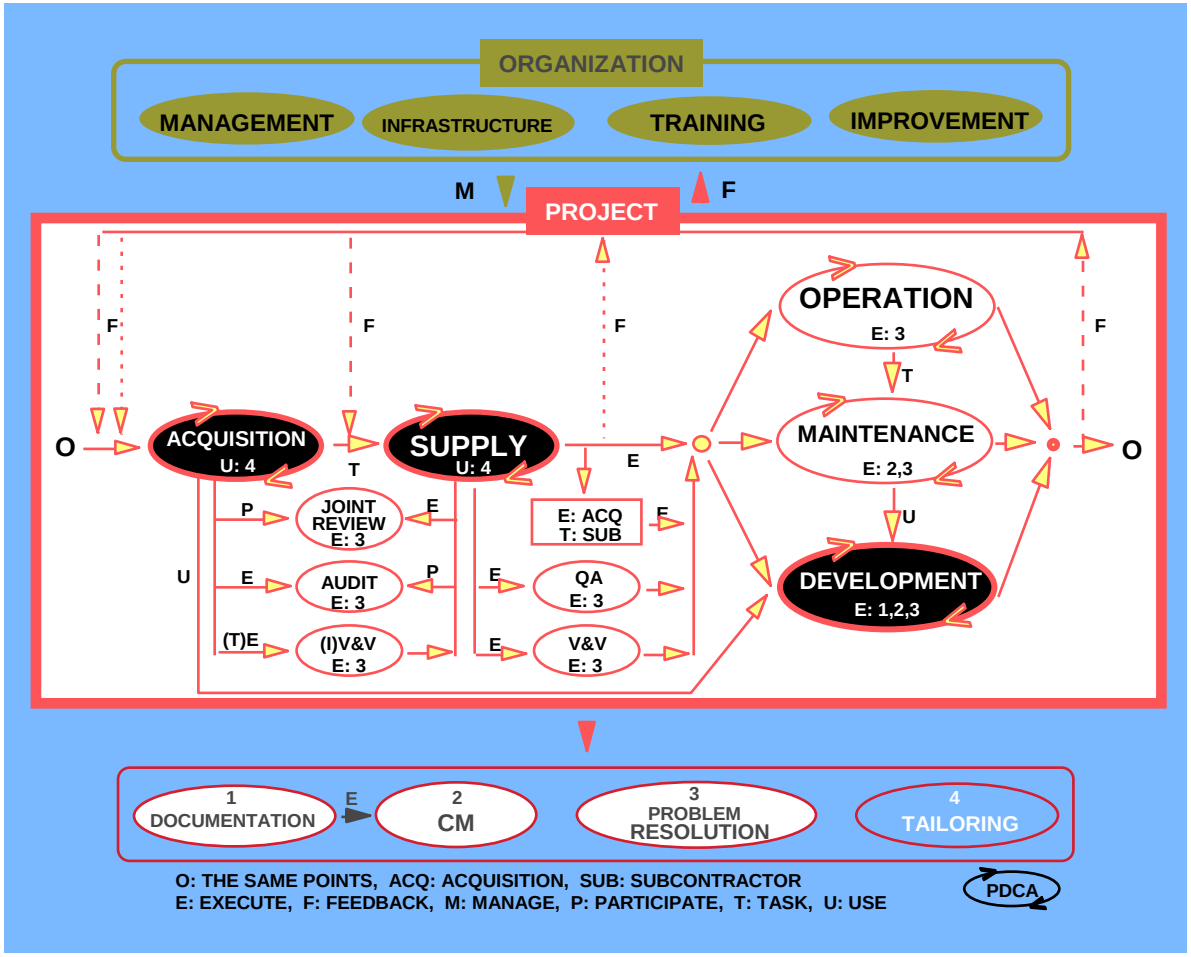
IEEE/EIA 12207
Life Cycle Processes Model



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PDCA	- Plan, Do, Check, Act

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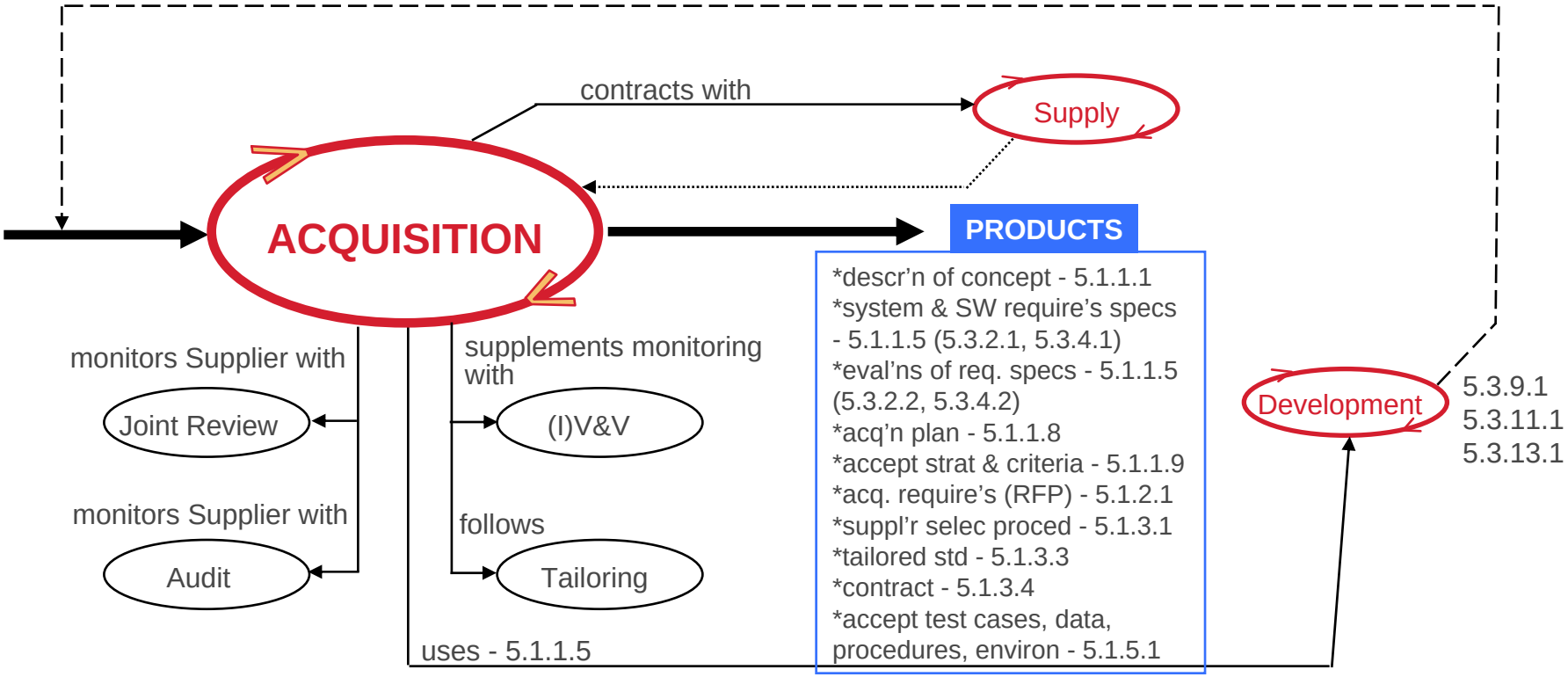
IEEE/EIA 12207 Acquisition Process



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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)

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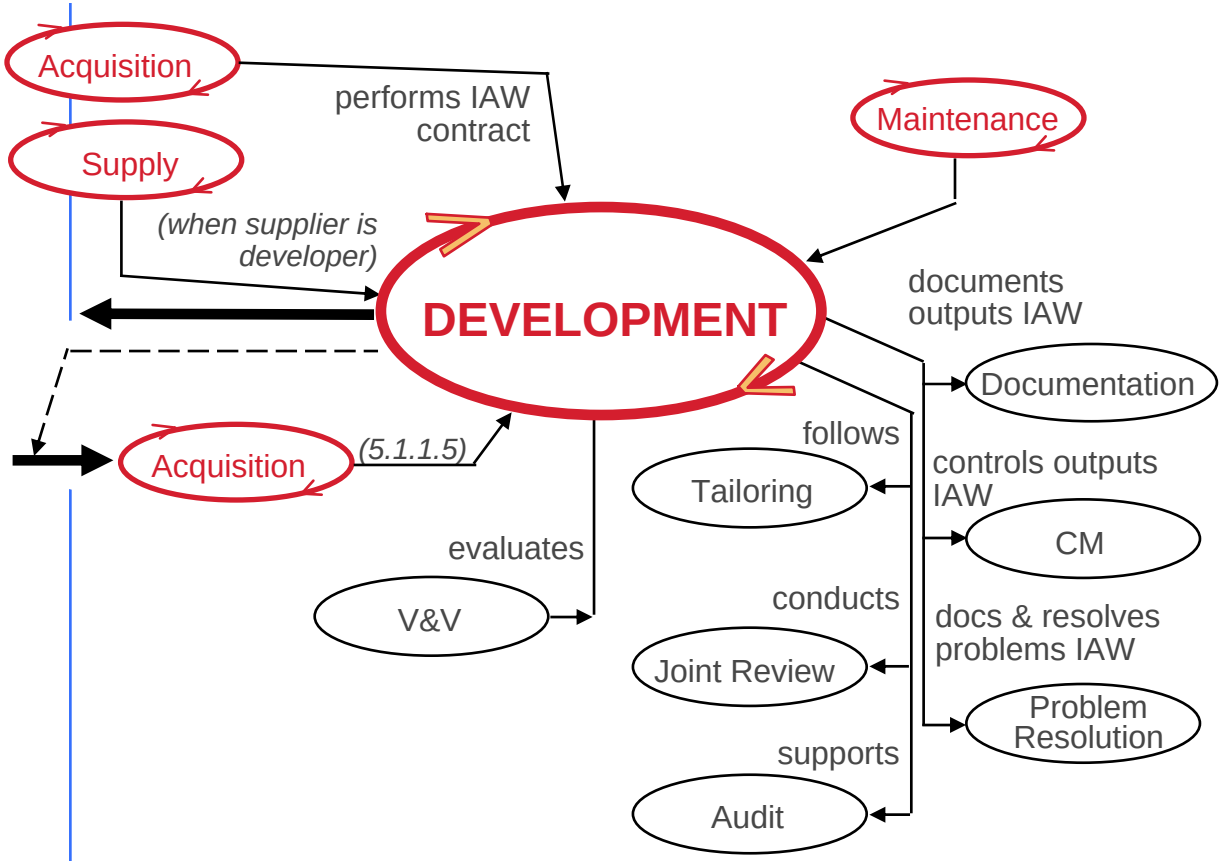
IEEE/EIA 12207 Development Process

*SW life cycle model w activs 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 activs of Develop proc - 5.3.1.4
*(sys require's spec - 5.3.2.1, in Acq. process)
*top-level sys architec - 5.3.3.1
*SW require's spec - 5.3.4.1 (in Acq. process also)
*architec 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



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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”**

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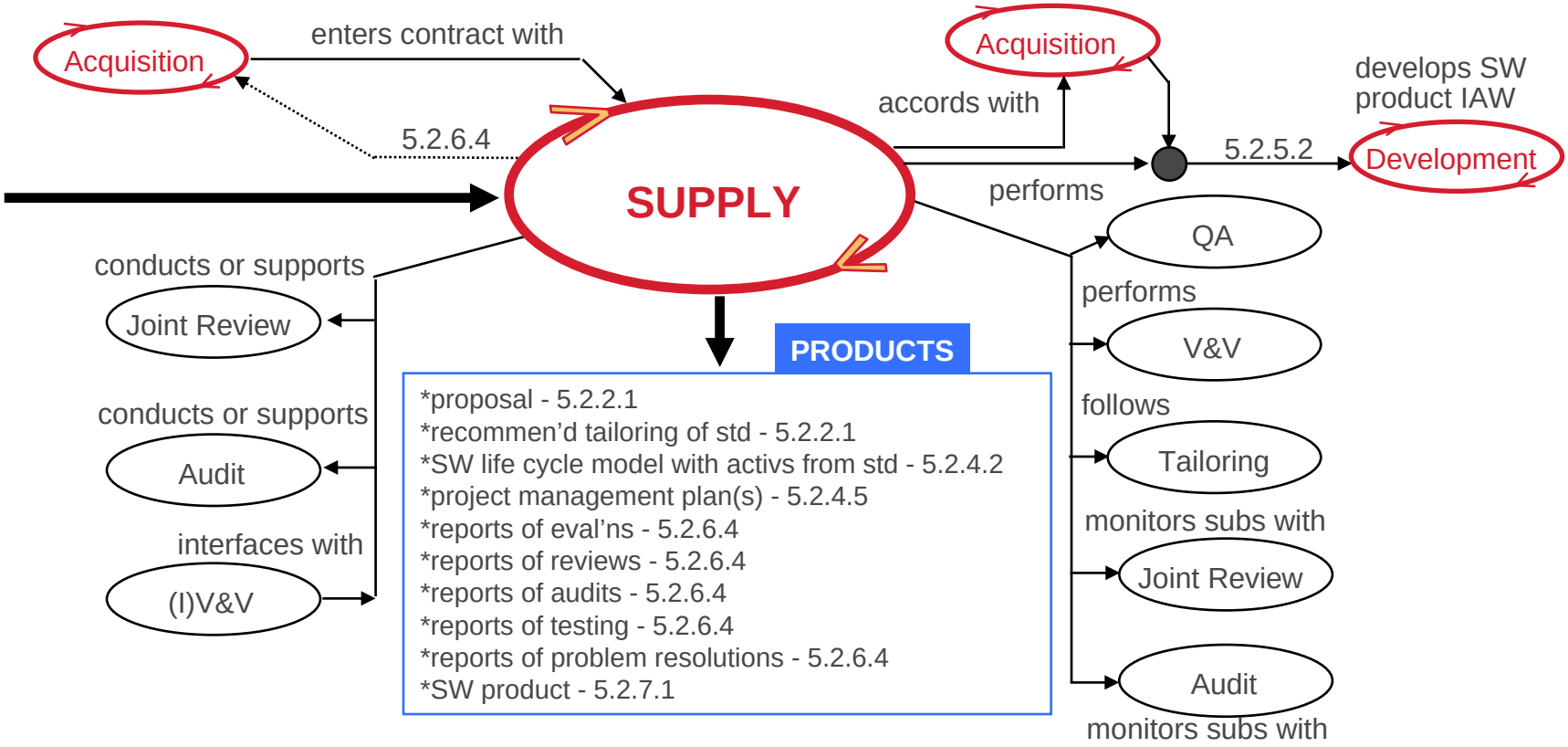
IEEE/EIA 12207 Supply Process



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Relevant Supply Process Data

- **Proposal (5.2.2.1)**

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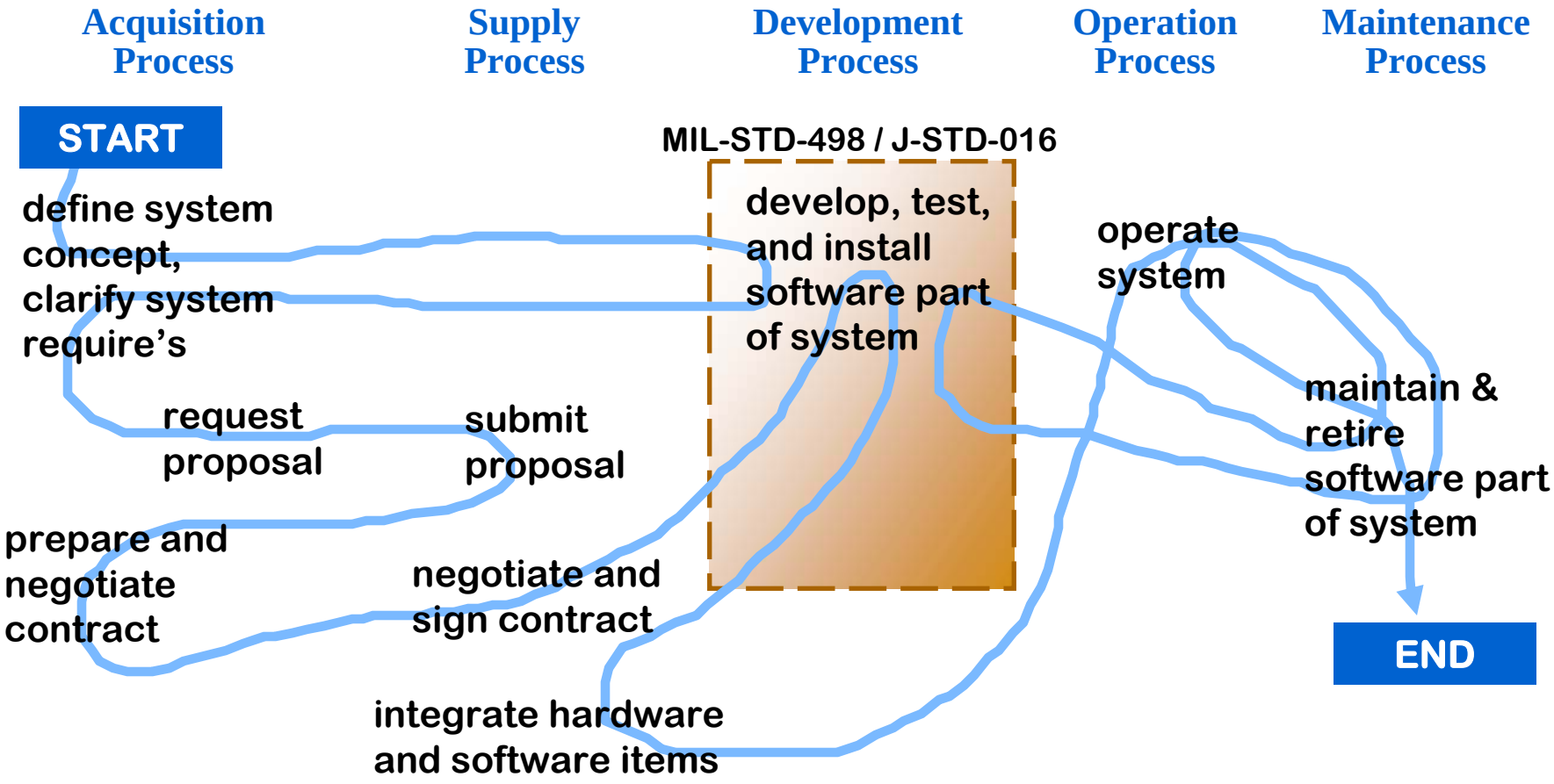
ISO/IEC 12207 & IEEE/EIA 12207...
Simple Life Cycle Activities Flow



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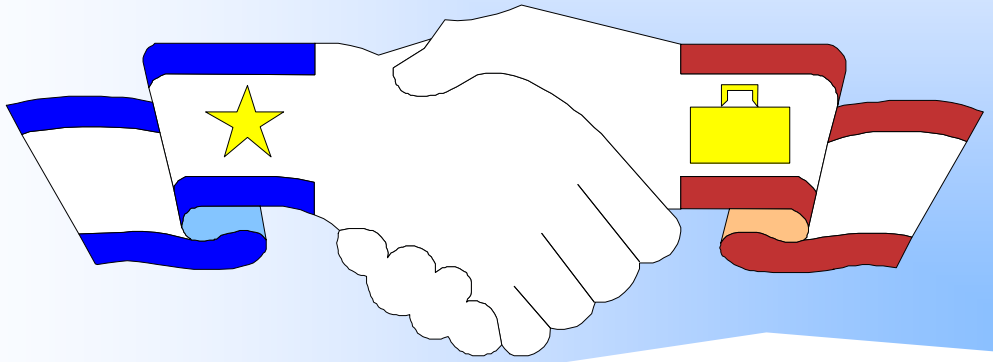
Back to the Biggest Problems for Software Development Projects...

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



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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

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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