Software Licenses: A Bill You Can't Pay?

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Abstract

For the past 20 years the DoD has emphasized the purchase and use of commercial software licenses as an approach to cut overall software development costs. Has this approach achieved its desired effect? How can one tell? This presentation will show the challenges and results of analyzing over 3,800 license records collected for the Army Software Sustainment Initiative. Implications to DoD's future maintenance costs will be discussed.

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1 Executive Summary - Purpose and summary results

Non-developed software products are increasingly being used to develop and maintain software system applications. Non-developed software includes Commercial Off The Shelf (COTS), Government Off The Shelf (GOTS), Open-Source Software (OSS), Software-as-a-Service (SaaS), Army Gold Master (AGM), and Non-Commercial Proprietary product (NCP). The term "COTS" will be used in this paper to refer to all the different types of non-developed software.

Licenses for these products range from single- to enterprise-wide use. COTS products are used in development/maintenance and in operations. Licenses are used for end-user authorization, technical support, and product modification.

Army budget leadership has been looking at project budget requests for licenses for software maintenance. The cost for licenses for software maintenance is increasing. It is becoming an ever-increasing percentage of the Army operational budget.

Costs cannot be controlled until there is a good understanding of total owner costs for software COTS product licenses. The Army is considering different approaches to gain more insight into these costs. The Army wants better management of software licenses, an understanding of shared license costs for each program, and reduction in the growth of license costs.

This report presents preliminary analysis on COTS product license data drawn from the Army Software Maintenance Repository. COTS data is challenging to track across license names, vendor identities, product versions, license coverage, license usage, license type, and, surprisingly, license cost. The analysis results discussed are from Post-Deployment Software Systems (PDSS) and Post-Production Software Systems (PPSS), some of which have been in operation for 35 years.

Based on the analysis in this paper, a factor of +5% per year should be used (above inflation). Based on the lessons learned from this analysis, the knowledge exists on how to collect and normalize license data. We need broad executive-level sponsorship to require programs and organizations to regularly collect this data in a consistent manner, to provide leadership with the data to make objective fact-based decision in software development and sustainment. This is the only path to gaining the level of visibility, control, and efficiency needed for sustainment.

2 Software Sustainment Initiative

The objectives of the Army Software Sustainment Initiative are to effectively estimate and justify software system life cycle costs. The Initiative has collected and evaluated sustainment cost and technical data from Army operational systems. The data was collected in four phases spanning ten years. The data was used to generate and validate Cost Estimating Relationships (CERs). The CERs and statistics characterizing the sustainment data are used to improve Army sustainment policy, business, and technical requirements. Effective software sustainment cost estimation is the basis for Army system software life cycle cost management.

Software sustainment (SWS) includes all software change activities and products associated with modifying a software system after a software release has been provided to an external party. The release, a composite of one or more changes, is the primary SWS change product. A release can be either a formal release or an engineering release. SWS may include software enhancements, software maintenance, and/or cybersecurity updates.

Software maintenance (SWM) includes defect repair, rehosting, adaptations, updates, and reconfiguration of the software. SWM is a type of change performed on the software. SWS may be funded by multiple funding sources. Costs include both fixed and variable costs accrued at both the system and organizational levels for both organic (government) and contractor resources.

The Initiative started with data collection. Fundamental to data collection is a work breakdown structure (WBS) that identifies costs and groups them into common elements. The Initiative, through collaboration with Sustainment Organizations, created an Army Software Sustainment Work Breakdown Structure, Figure 1. The cost elements in the WBS were used to collect sustainment data.

The purpose of collecting data is to establish a robust foundation for software sustainment fact-based decisions. Sustainment costs are broken out by WBS element providing insight into expenditures. This allows for the examination of large cost centers and inefficiencies. The data in each WBS element can be segmented by sustainment organization, commodity, super domain, ACAT level, and life cycle phase for a more in-depth understanding cost.

The analysis presented in this report focuses on WBS elements 3.0, Software Licenses. The analysis examines license cost for systems in the production and O&S phases.

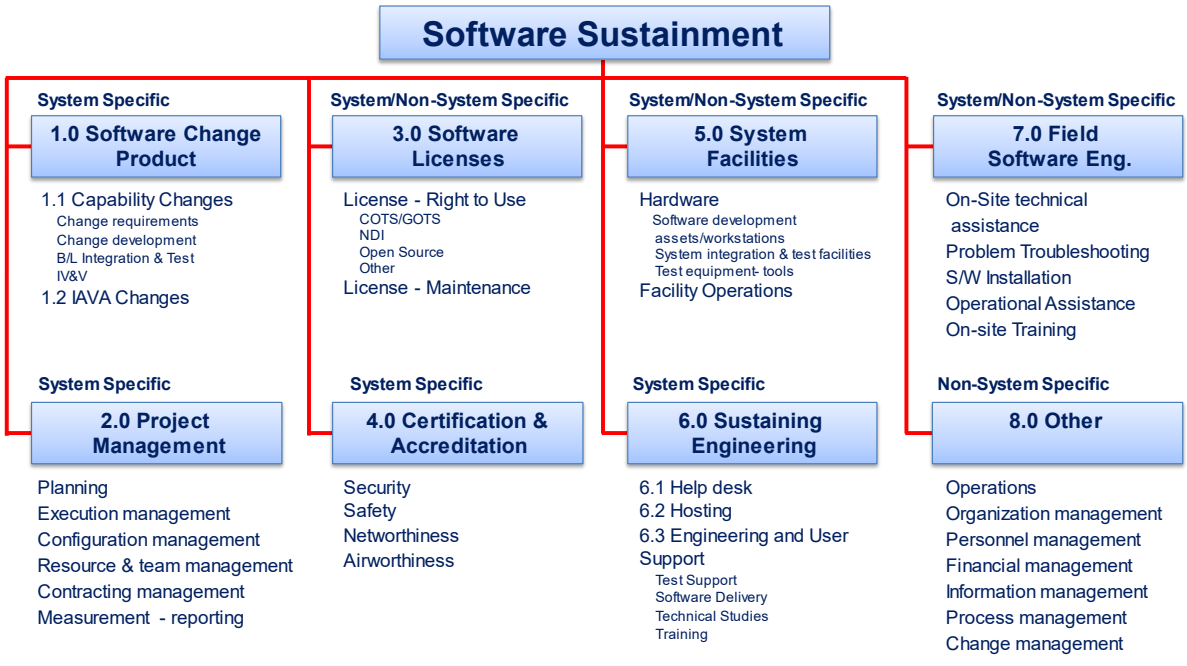

Figure 1. Army Software Sustainment WBS

3 Collecting COTS Software License Data

In assessing the licensing costs for developing and maintaining a software application, data collected for COTS licenses depend on what information is needed with anticipated information details. For instance, the question might be how much is spent annually on licenses. The needed data would include each license cost, the duration of the license, the year the license was

purchased or renewed, and whether the license was free, commercially available (e.g., Microsoft), non-commercial proprietary (NCP - custom software supplied by one vendor) or covered by the supplier, or contractor, of the software application. The last data item is an anticipated detail that may provide insight on which licenses cost the most annually.

In addition to annual license cost, the increase in license cost may be of interest. Data was collected on the cost of each license over time and that data provides the average overall cost growth by year. The data includes the COTS vendor so the number of licenses, total cost, and cost growth can be assessed for each vendor.

The question is why licenses cost so much. This depends on whether:

- The license is commercially available or proprietary
- The type of software product (e.g., productivity tools, databases, operating systems)
- The license use (e.g., permission to operate the software, technical support for the software, or modifications to the software)
- The license coverage: single seat, single-computer, or single-processor, site-wide, or enterprise-wide.
- Systems with the most licenses or highest license total cost
- The number and cost of licenses by domain or commodity
- The number and cost of licenses used in development activities versus licenses used by the software application end-user.

For the past eight years, the Army Software Sustainment Initiative has collected licensing data by Army systems. The license data was collected along with system development and annual cost data. The data was collected using an Excel spreadsheet that had data fields and definitions for each data field. The license data used in the analysis presented in this paper consisted of the following:

- System Context: This group of data fields captured information about the system that had software licenses. The data fields were Organization name (responsible for the system), System Name, System Description, system Super Domain, system Commodity, system ACAT Level, system Operating System, number of system users, number of software baselines, system phase (either development or maintenance), and the number of years in phase. The system context provides added detail to the license data and helps segment the data during analysis.
- License Name: This is the name of the software product that constitutes part of the final delivered application or part of a system being supported.
- License Version: The version of the license product being reported, e.g., Windows 10, Oracle 11g.
- License Replacement Field: This identifies a license that is being replaced by the reported product license for the situation when a vendor discontinues, changes, or merges their product.
- License Class: This identifies the license as either a Commercial Off The Shelf (COTS), Government Off The Shelf (GOTS), Open-Source Software (OSS), Software-as-a-Service (SaaS), Army Gold Master (AGM), or Non-Commercial Proprietary product (NCP).
- License Company Name: This identifies the vendor that created the software product versus the company that sold the product if not the same.
- License Usage: Some licenses are only used in the maintenance environment/facility to

develop/maintain the software. Some are only used in the operational environment. And some are used in both.

- License Coverage: The license coverage is either single (e.g., number of processors, processor cores, "seats" or computers), site-wide, or enterprise-wide.
- License Quantity: This provides the number of licenses for each license reported. If the coverage is single, provide the number of singles licenses. If the license is site-wide, enter 999 and if it is enterprise-wide, enter 9999.
- License Total Cost: This is the total cost for all licenses under this license name: single, site-wide, and enterprise-wide. If the cost is unknown, leave blank and identify who pays for this license in the Purchaser of License field.
- License Purchaser: This is the name of the organization that purchased the license, e.g., program name, maintenance center name, Program Executive Office name, Army Chief Information Office, Supplier name, etc.
- License Type: This captures the different cost structures vendors use to charge for COTS products and services: stand-alone license, subscription license, vendor services (e.g., help desk, tech support, on-site support) or vendor modification to their product.
- License Duration: This is the duration of the license as either annual, some other timeframe, or indefinite.
- License Award Date: The data the license was purchased.
- Systems Covered: If this license is a site license or enterprise license, this identifies systems in development or maintenance that are supported by this license.
- License Comments: This is any additional information that would better explain the provided license data

In additional to cost, the additional data fields provide information on differences in costs, cost sources, vendor dependence, and changing license costs.

4 Software License Data Demographics

The Software Maintenance Data Repository covers five super-domains (SD) and 16 commodities across 20 organizations. The super domains are defined as:

- Real-Time (RT): These are specific solutions limited by system characteristics such as memory size, performance, or battery life. These projects take the most time and effort due to constraints.
- Engineering (ENG): Engineering software operates under less severe constraints than real-time software. This software may take the outputs of real-time software and further process them to provide human consumable information or automated control of devices, or the software may perform transformation and aggregation / distribution of data. These projects take more time and effort due to multiple factors.
- Automated Information Systems (AIS): Automated information system software provides information processing services to humans or software applications. These applications allow the designated authority to exercise control and have access to typical business / intelligence processes and other types of information access. These systems also include software that facilitates the interface and control among multiple Commercial Off The Shelf (COTS) and Government Off The Shelf (GOTS) software applications. This software has few constraints.

- Defense Business Systems (DBS): Defense Business Systems are a subset of AIS software that are very large and expensive systems financial and business systems. They are broken out in the data because of their outlier costs. DBS are also considered a commodity.
- Support (SUP): Support software assists with operator training and software testing. This software has few constraints.

The repository data is also characterized by 16 commodities, as shown in Table 1. These commodities are defined by DASA-CE to group similar Army systems for cost estimating purposes.

Table 1. System Commodities

Aviation	Business
C5ISR	ChemBio
Comms	DBS
Fires	Intel
Missiles	Mission CMD
Network	SATCOM
Simulation	Space
Test	Vehicles

The data in the repository is from systems that are in either Post Deployment Software Support (PDSS) or Post-Production Software Support (PPSS).

PDSS includes program office managed systems from MS-C through Low-Rate Production (LRP) and Full-Rate Production (FRP). It is funded by RDT&E, production, or other funding. It often includes enhancements and technical changes. The programs are controlled by a Program Executive Office (PEO).

PPSS are Life Cycle Management Center controlled systems in the Operations and Sustainment (O&S) phase. The focus is on repairs and smaller changes to existing functionality. It is funded by Operational Maintenance Army (OMA).

4.1 System-level Data

The software maintenance data repository contains 377 systems spanning 16 commodities collected over four data collection phases, as shown in Table 2.

Table 2. Repository Size

Phase	# of Systems	Notes
1	41	
2	151	Some repeats
3	115	O&S systems only
4	70	License data only

System-level data contains context data about a system including system name, DoD Services that use the system, ACAT level, acquisition phase with phase start date, number of software baselines, number of platforms, number of users, operational use, data rights, funding sources, and contact information.

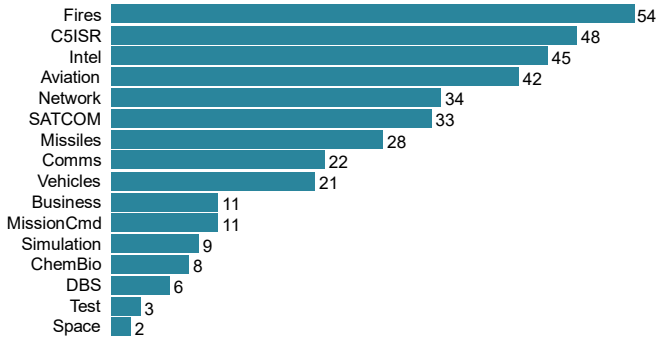

Figure 2. Number of Systems by Commodity

The commodities represented in the repository are shown in Figure 2. The top five commodities, which account for almost 60% of the data, are Fires (direct fire weapons), C5ISR (Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance), Intel, Aviation, and Network.

Figure 3 shows the data segmented into three groups: super domains, ACAT level, and system age. The RT domain in the left graphic represents 51% of the data followed by ENG, AIS, SUP, and DBS. The RT domain is mostly comprised of Army weapon systems. In the middle graphic, the largest ACAT level group is ACAT level III and includes a mix of the commodities.

The graphic on the right in Figure 3 shows the system age defined as time in PDSS or PPSS. It is noteworthy that 20 years after development, there are still six systems in PDSS. As would be expected, most of the systems in the repository are in PPSS.

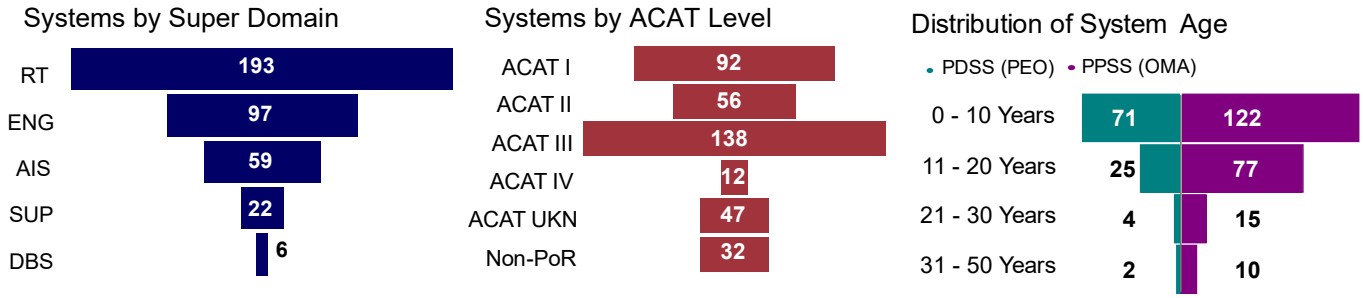

Figure 3. Super Domains, ACAT Levels, and System Age

4.2 Software License Data

Many software systems contain COTS software used in the development and in the deployed systems[1]. The software maintenance repository contains over 3,800 license records with data on license name, vendor, version, quantity, type, coverage, and cost

The number of COTS software by super-domain are shown in Figure 4. RT systems have the largest number of COTS products overall. The number of COTS in PPSS is much larger than PDSS.

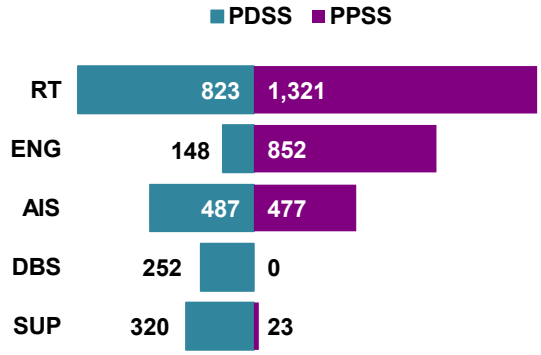

Figure 4. Number of COTS Software

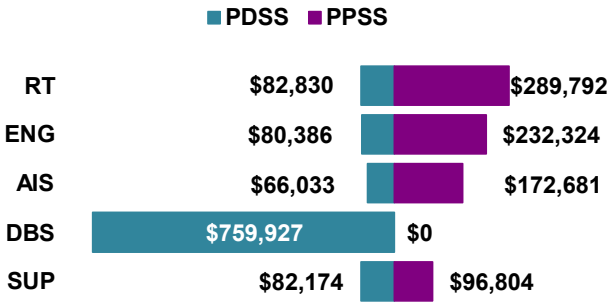

Figure 5. Avg. Cost of COTS Software

Figure 5 shows the average COTS cost by SD. In the PDSS phase, DBS has the highest cost by a factor of nine. While RT systems have the largest number of COTS products in PPSS, the average PPSS cost is not significantly higher than ENG and AIS systems. RT systems use a larger number of Government-supplied and Open-Source Software products thus saving on cost.

[1] COTS, as used in this report, includes Government supplied and Open-Source Software

5 License Cost Analysis

Analysis of license data is challenging. There are a variety of licenses strategies employed by COTS vendors: single, site-wide, and enterprise-wide, technical support, and COTS product modifications. Many programs do not have license costs if they are site- or enterprise-wide licenses. Programs developing or maintaining software do not always track purchases and support separately.

Another challenge is that the same license data changes. Company names change due to being sold or merged. License names and versions change due to closing out or merging products. License purchasing strategies are changing from periodic purchases to annual subscriptions (which include updates and, perhaps, technical support).

The license and vendor names are reported differently for the same license. Variations of vendor names are reported for the same vendor. The reported cost and date formats vary. Sometimes, people write explanations in the data fields. The data requires normalization. Normalization is very time consuming, but it is very important too.

5.1 Annual Costs

The data collection form has a section for entry of the data items discussed earlier in Section 3. Another part of the form requests annual cost data for other WBS elements, Figure 1, in addition to license costs.

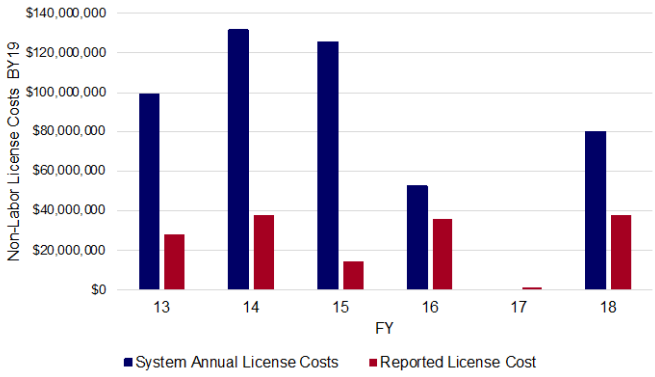

Figure 4. Reported Annual License Costs

Figure 6 shows the annual costs from the license data in blue (no data was collected for FY17). The reported license costs from the system annual cost data are shown in red. The disparity in costs is due to the mix of single, site-wide, and enterprise-wide cost data and the difficulty in tracking license costs when licenses are funded by higher-tier organizations. The figure illustrates how difficult it is to assess how much is being spent on licenses per year.

5.2 Commodity Costs

There are 16 commodities and Figure 7 shows the distribution of licenses by commodity. Intel has the largest number of COTS products, 761, followed by Aviation with 707. Comparing Figure 7 to Figure 8, the DBS commodity (it is also a Super Domain) is ranked eighth in number of COTS products but it has the second to highest total license cost due to the large number of users and the high cost of the COTS products utilized.

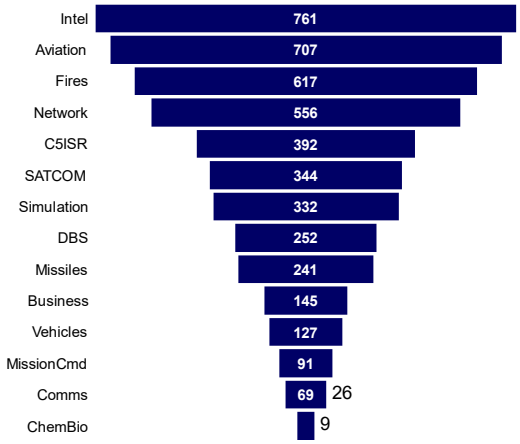

Figure 7. COTS Software by Commodity

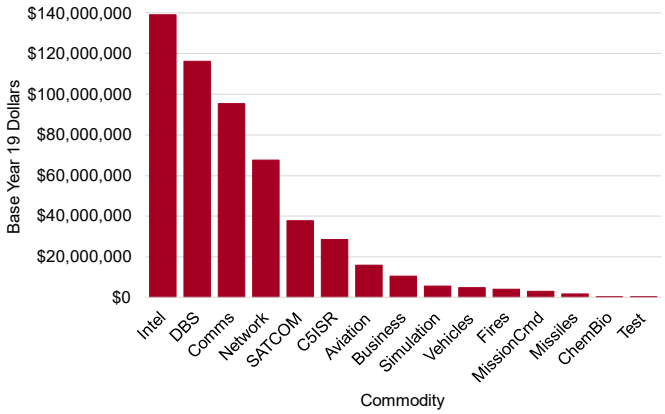

Figure 8. Total Cost by Commodity

Groups of commodities are an example of additional contextual information about software licenses. It is an example of deeper insight to identify sources of high COTS license costs.

5.3 Vendor Costs

Knowing the number of licenses used from each vendor, or license supplier, shows the dependence on that company, as shown in Figure 9. This vulnerability exists because companies merge with other businesses, merge product lines, add/drop product functionality, and change their pricing structure. For example, Microsoft Corp., Oracle, VMware, and IBM are the topped ranked number of licenses by company. This figure clearly shows the difficulty that would occur if a decision were made to switch to another vendor for business reasons.

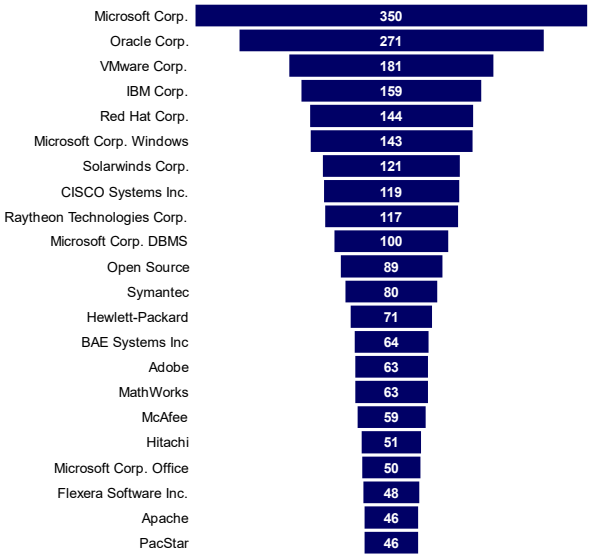

Figure 9. Top 22 Licenses by Company

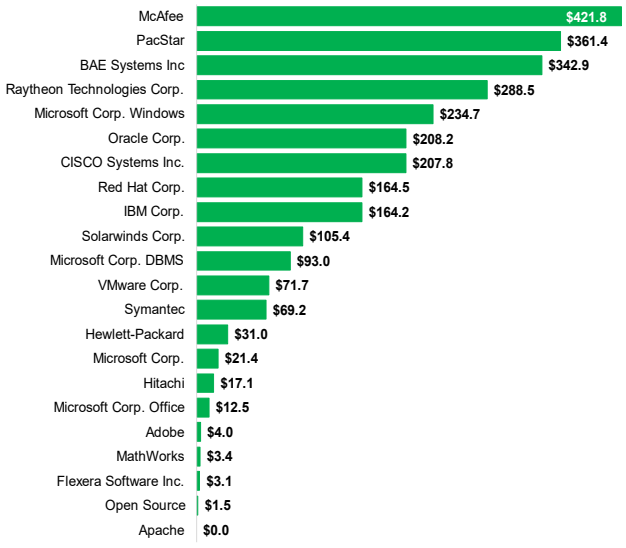

Figure 10. Top 22 Avg. License Costs by Company ($K)

Another source of cost is cost by vendor as shown in Figure 10. Understanding how much is being paid to each company presents an opportunity to negotiate enterprise-wide licenses thus reducing per license cost. The top ranked average cost in Figure 10 is not the same as the top number of licenses by company. As an example, Microsoft Corp. (Visual Studio, Exchange Server, .NET framework, Visio, and Developer Network) is lower in cost rankings, 15th, than in

numbers of licenses, 350. McAfee, PacStar, BAE Systems Inc., and Raytheon Technologies Corp. have the highest average license costs.

5.4 License Class

There are different classes of off-the-shelf product licenses: Commercial (COTS), Non-Commercial Proprietary (NCP), Government Off The Shelf (GOTS), Open-Source Software (OSS), Cloud computing, and Army Gold Master (AGM), which are Army-wide licenses.

A breakout for each license class is shown in Figure 11. The gray bars are the license total costs, and the blue line is the license quantity. Commercial COTS is by far the largest class in cost and quantity followed by NCP. These two classes along with Cloud and AGM are licenses that must be purchased. The free licenses, GOTS and OSS, are much less used.

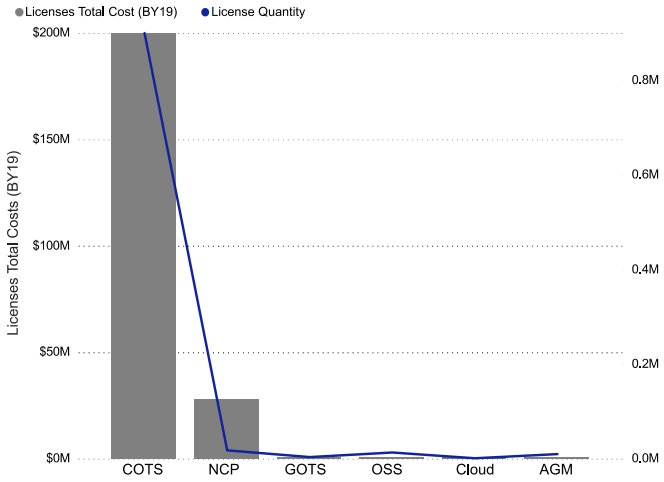

Figure 11. License Cost by Quantity

5.5 License Coverage

Generally, the most inexpensive licenses per user are free and unlimited, followed by enterprise-wide, site-wide, then single. Figure 12 shows the total cost for each license coverage type by phase, PDSS and PPSS.

During the PDSS phase (Low-Rate Production and Full-Rate Production), total cost for single coverage licenses predominates. This changes in PPSS (post-production) to enterprise-wide coverage driving the license cost per user down.

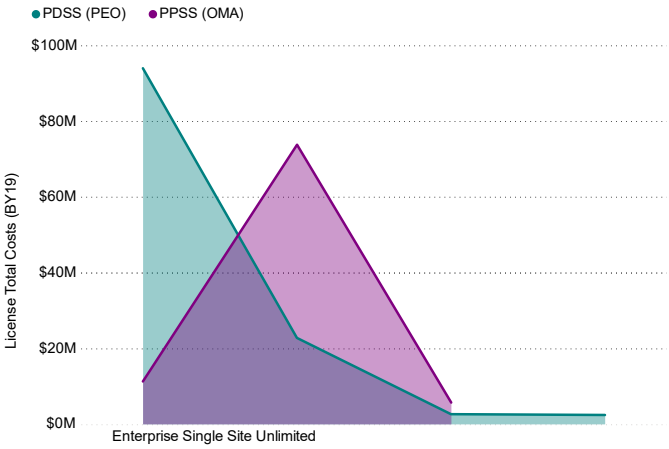

Figure 12. Total Costs by Coverage

5.6 Changes in License Cost

Licenses for each system that had multi-year cost data and the quantity of licenses were selected for analysis. All license costs were normalized to Base Year 2019 (BY19). The annual license cost data was divided by the license quantity to derive license cost per year for a single quantity: annual unit cost. The annual unit cost change was determined by comparing the unit cost from one year to the unit cost of the next year to derive a percentage change.

This analysis depended on normalization of license names. Different versions of the same product were given a common name. This provided the ability to group similar product data together. However, the full license name reveled differences within a license group, e.g., Comm Manager versus Comm Manager 2nd Generation, enabling exact unit cost comparisons within the

group. Both the normalized and the full license name were needed for analysis.

There were cases where the same license was purchased more than once in the same year. This required roll-up of same-year data by summing the costs and quantities for that year.

Figure 13 shows the percentage unit cost change per year based on 81 pairs of cost data. A negative cost change means the price went down from one year to the next. The lowest price drop was -91% and the highest price increase was 222%. Using the mean of the change (2.2%) and the standard deviation (39.9%), the ±1 standard deviation ranges from -37.6% to 42.1%.

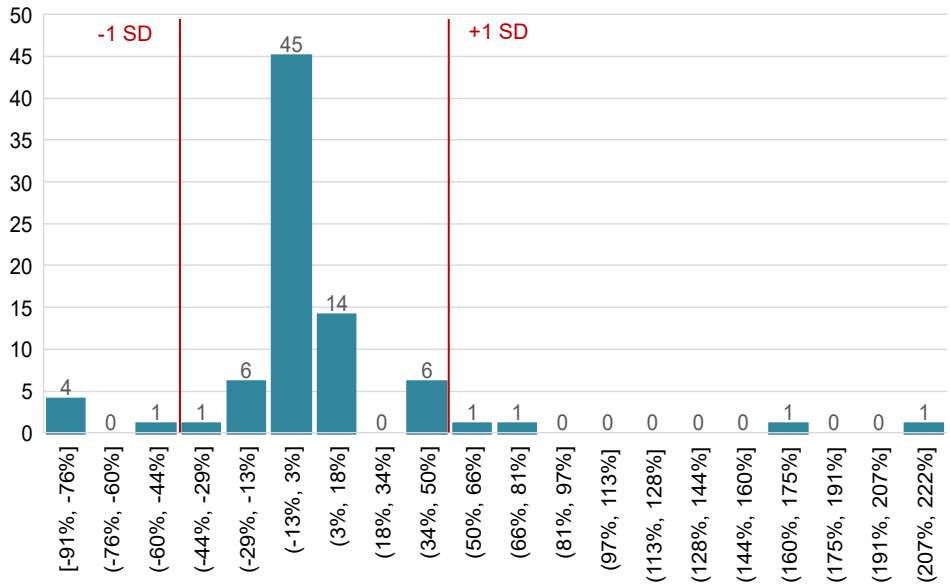

Figure 13. Percent Unit Cost Change per Year

The data within the ±1 standard deviation range represents most of the data (71 pairs) as can be seen in the figure. There was a need for a deeper understanding of the price changes within this range. Figure 14 shows the distribution of data within the ±1 standard deviation range.

The red box in Figure 14 is of particular interest. Sometimes the cost of a product license did not change from one year to the next. But when the costs were normalized to BY19 dollars, the result was a small cost decrease due to the inflation adjustment. The range of this adjustment was from -1,11% to -1.97% depending on the year of the data. Of the 36 pairs of data highlighted in the box, 35 pairs fell into this category.

The mean of the data in Figure 14 is 1.3% and the standard deviation is 12.2%. Based on these statistics, any change below -10.8% was labeled as a *major cost decrease* and any change above 13.5% was labeled a *major cost increase*. The cost change between the major increase/decrease boundaries were labeled *minor*.

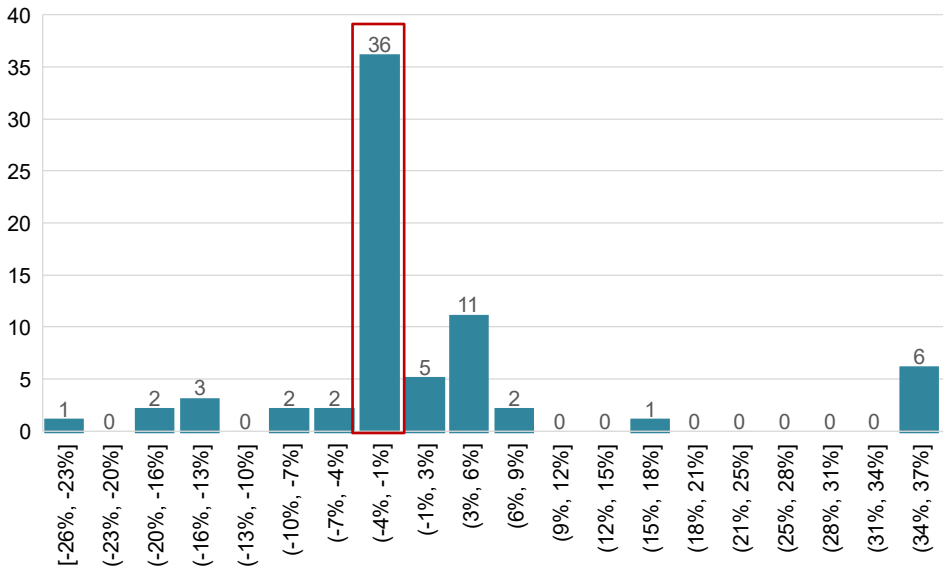

Figure 14. ±1Standard Deviation Unit Cost Change per Year

Table 3 shows the breakout of the cost change categories. The percent change boundaries are based on cost increments in the data and are consistent with the increase/decrease percentage cost change criteria discussed above. Grouping the data provides the opportunity of examining the reasons for major changes.

Table 3. License Cost Change Categories

Cost Change Category	% Change	Count	
Cost increase-major	Over 18.14%	11	29 pairs with a median **5%** increase
Cost increase-minor	0.77 to 7.8%	18	
Inflation adjustment	-1.11% to -1.97%	35	
Cost decrease-minor	-3.12% to -9.57%	5	17 pairs with a median 16% decrease
Cost decrease-major	Over -14.49%	12	

Major cost increases have several characteristics. Custom proprietary products had major increases in cost. Specialty products also had major cost increases, e.g., rule-based, logic, imaging, geo-mapping, data comparison, and computer memory analysis software products. In some cases, the vendor increased the license price unexplainably.

Major cost decreases provided interesting insights. With some licenses, there is an initial purchase of a perpetual license (large cost) followed each year by a maintenance license (low cost) for fixes and perhaps some help desk support. Some vendors moved their pricing strategy from perpetual to an annual subscription license fee for a lower cost but required to be renewed annually. In one instance, a vendor was purchased by another company and that company lowered the license price. There were a few cases where the vendor lowered the license price unexplainably.

For cost risk, a median **5% increase** in annual license cost should be assumed and does not include inflation. The 5% increase is per year, i.e., each year the cost increases 5% from the previous year. It should not be assumed that a license cost will decrease or any of the cost decrease-conditions described above will prevail.

The implications of an annual 5% increase can be illustrated using the statistics in Table 4.

Table 4. Users and Unit Cost Statistics

	Avg #Users	*License Unit Cost*
Mean	**951**	$34,787
Median	**14**	**$842**
Standard Deviation	3,140	$195,210
Minimum	1	$1
Maximum	24,000	$1,913,693
Count	81	209

If a product license is used in a development environment by 14 people (the mean number of uses in Table 4) and the cost is $842 per license (the median cost in Table 4), the total cost of licenses is $11,788. An annual increase of 5% means next year's cost is $12,377, roughly a $589 increase.

However, if a product license is used in an Army operational environment by 951 soldiers (with some systems the number of soldiers is in the thousands), a 5% annual increase means cost increases from $800,742 to $840,779, roughly a $40,000 increase the next year.

5.7 License Cost Observations

There are multiple license types for a single product, and it is important to keep track of the different types. Examples of license types are Professional versus Standard; Analysis versus eXtreme Analysis; Advanced Enterprise Linux versus Advanced Enterprise Windows; and Locked versus Floating licenses.

Some license costs "appear" to decrease in succeeding years due to inflation adjustments to BY19 dollars. The data shows the unadjusted costs were the same in succeeding years, it was the adjustment that made the price decrease. Succeeding year same-pricing represented a cost savings to the Army for those two years.

As discussed earlier, the first year of a license purchase (high cost) was followed in succeeding years with a maintenance cost (lower cost) giving the appearance of a price decrease.

In the data, it was found that some of the managers of the systems maintained a Procurement License Tracking System spreadsheet. This is a best practice and can help identify opportunity costs and possible savings.

6 License Data Challenges

There were many challenges with the software license data. Issues requiring attention were license cost, terminology, coverage, sales strategies, and data normalization. Some of the most challenging are discussed in this section.

Programs do not always track purchases, support, and service costs. Only about half of the license data in the repository had associated cost data. This is due to the purchase of licenses outside the system, i.e., organization licenses, enterprise-wide licenses, or supplier purchased licenses. Insight into outside-purchased costs was generally not available to the data submitter.

There was inconsistent information on license purchase approaches. The word "maintenance" could mean maintenance, support, or services in the data. There was inconsistent knowledge of whether a license was single-use, site-use, or enterprise-use. It was not often known if a license was purchased every year or if the license was a subscription.

The most time-consuming challenge was normalizing inconsistent data. Several data fields used free-form text to describe the data. License and vendor names were reported differently for the same license and some companies merged with other companies – a big task for normalization with over 3,800 licenses and over 500 vendors. People did not know if the license was used only in maintenance environment/facilities, only in operations, or both. To obtain a full accounting of licenses costs, data is needed for both maintenance environment/facilities (including software factories) and operations. People did not always know the number of single licenses purchased. License coverage (Single, Site, Enterprise) was not always identified. Cost and date formats varied. Sometimes, people wrote in free-form text explanations in numerical data fields.

License terminology would be misleading. For instance, the word "Enterprise" in a license name could refer to the number of features in a product and not the license coverage. Terms such as standard, professional, premier, and enterprise appeared in license names. The cost for each increasingly capable set of features depends on the number of licenses used as shown in Table 4.

Table 5. License Name Ambiguity

		Users / Seats / Computers / Processors			
		1	~2+	~20+	~100+
Features	Standard	$	$$	$$$	$,$$$
	Professional	$$	$$$	$,$$$	$$,$$$
	Premier	$$$	$$$$	$$,$$$	$$$,$$$
	Enterprise	$,$$$	$$,$$$	$$$,$$$	$,$$$,$$$

License vendors change sales strategies and costs over time which increase license costs. An example of this is going from an outright license purchase to an annual license subscription. The license purchase can be used for many years. The subscription strategy forces a purchase each year.

License vendors update and sunset licenses over time. They introduce new products, merge products, repackage products. This often represents a maintenance cost because changes to a COTS product often force a change the operational software.

7 Conclusions

Licenses for software COTS products are required for both the maintenance environment and facilities (including software factories) as well as operations. It is likely that every system that transitions to sustainment will come with a software license bill. Costs cannot be controlled until there is a good understanding of the total ownership costs (TOC) of licenses. Initial data shows software applications relying on COTS products will experience a rise in cost over the life of the system. Products will be merged or dropped thus forcing changes to the operational software and impacting TOC.

License costs need to be completely tracked, even if the cost is paid by the enterprise, another organization, or is provided by the supplier. License costs need to capture complete and standardized descriptive information. The Government needs a method to allocate the license costs down to individual systems to prepare and defend budgets, especially for those licenses paid for by other-than project funds.

Associated work in studies, integrated product reports, and working teams show that there is an interest in the Army for a cost factor by which to estimate and manage software license costs. Based on the analysis in this paper, a factor of +5% per year should be used (above inflation). Based on this analysis, the knowledge exists on how to collect and normalize license data. We need broad executive-level sponsorship to require programs and organizations to regularly collect this data in a consistent manner, to provide leadership with the data to make objective fact-based decision in software development and sustainment. This is the only path to gaining the level of visibility, control, and efficiency needed for sustainment.

Acronyms

ACAT	Acquisition Category
AGM	Army Gold Master
AIS	Automated Information Systems Super Domain
BY	Base Year
C5ISR	Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance
COTS	Commercial Off the Shelf (includes Government supplies and Open Source)
DASA-CE	Deputy Assistant Secretary of the Army for Cost and Economics
DevSecOps	Development, Security, and Operations
ENG	Engineering Super Domain
FRP	Full-Rate Production
GOTS	Government Off The Shelf
LRP	Low-Rate Production
MS-C	Acquisition Milestone C
MTA	Middle Tier Acquisition, Rapid Prototype
NCP	Non-Commercial Proprietary
NDI	Non-Developed Item
O&S	Operations and Sustainment
OMA	Operational Maintenance Army
OSS	Open-Source Software
PEO	Program Executive Office
POR	Program of Record
PDSS	Post-Deployment Software Support
PPSS	Post-Production Software Support (the phase after PDSS)
RDT&E	Research, Development, Test, and Evaluation
RT	Real-Time Super Domain
SaaS	Software as a Service
SD	Super Domain
SUP	Support Super Domain
SWM	Software Maintenance
TOC	Total Ownership Cost
WBS	Work Breakdown Structure