Software Licenses:
A Bill You Can't Pay?

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Problem Statement

- The Army budget decision makers have been reviewing the projected budget requests for licenses for software maintenance

- The budget for license costs for software maintenance is increasing exponentially - it is becoming an ever increasing percentage of the Army operational budget
  - We do not have solid data today to defend budgets

- The Army is considering different approaches to:
  - Better manage software licenses
  - Share the responsibility for these costs, and
  - Reduce the growth in these costs

Topics

- Objectives, Strategy, and Analysis Approach

- Software License Analysis
  - Data collection
  - Challenges
  - Demographics
  - Results
  - Observations

- Conclusions

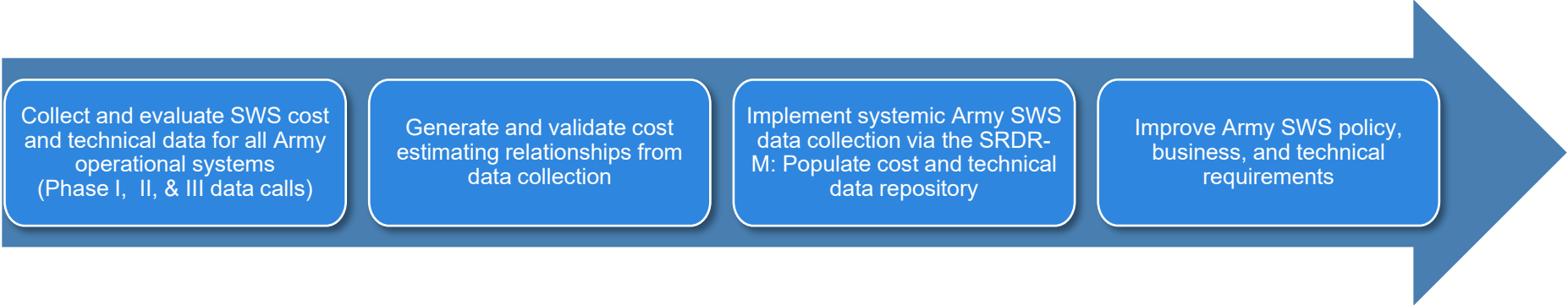# Objectives, Strategy, and Analysis Approach

SWS Initiative Objective and Strategy

Accurately estimate Army system Software Sustainment (SWS) costs to:

- Effectively estimate and justify software and system life cycle costs

- Objectively evaluate Army system software sustainment execution costs

- Inform and optimize the allocation of available sustainment resources across the Army

| Collect and evaluate SWS cost and technical data for all Army operational systems (Phase I, II, & III data calls) | Generate and validate cost estimating relationships from data collection | Implement systemic Army SWS data collection via the SRDR-M: Populate cost and technical data repository | Improve Army SWS policy, business, and technical requirements |

Effective software sustainment cost estimation is the basis for Army system software life cycle cost management

Data Collected During Initiative

System Context

- System name and description
- Services involved
- ACAT level
- Current phase/milestone
- MS C date
- Number of software baselines
- Number of hardware platforms/number of users
- C&A types and frequency
- Release and IAVA rhythm
- Data rights
- Pertinent WBS elements
- Analogous systems
- Sustainment organization

Definitions of data elements available in data collection questionnaire

Annual Funding

- Annual effort/cost data (total annual plus by WBS elements) broken out by government and contractor
- Labor rates
- Hourly basis for FTEs
- Total cost for software licenses

- For phase 3, LCMC programs requested to provide funding from all sources (not just OMA)

Software Licenses

- License name and version
- License class
- Company
- Usage
- Quantity
- IAVAs
- Coverage
- Cost (if program funded)
- Type
- Duration of license

Release Level Capabilities

- Release context information
- Application domain
- Operating environment
- Schedule - start and end dates
- Release effort / cost
- Size data (those that apply)
  - Software requirements
  - External requirements
  - Source Lines of Code (SLOC)
  - Non-SLOC based size (e.g. RICE-FW, use cases, story points)
  - Software changes counts by priority (e.g. change requests, problem reports, defects)
  - IAVAs

Release Level IAVAs

- Release context information
- Application domain
- Operating environment
- Schedule - start and end dates
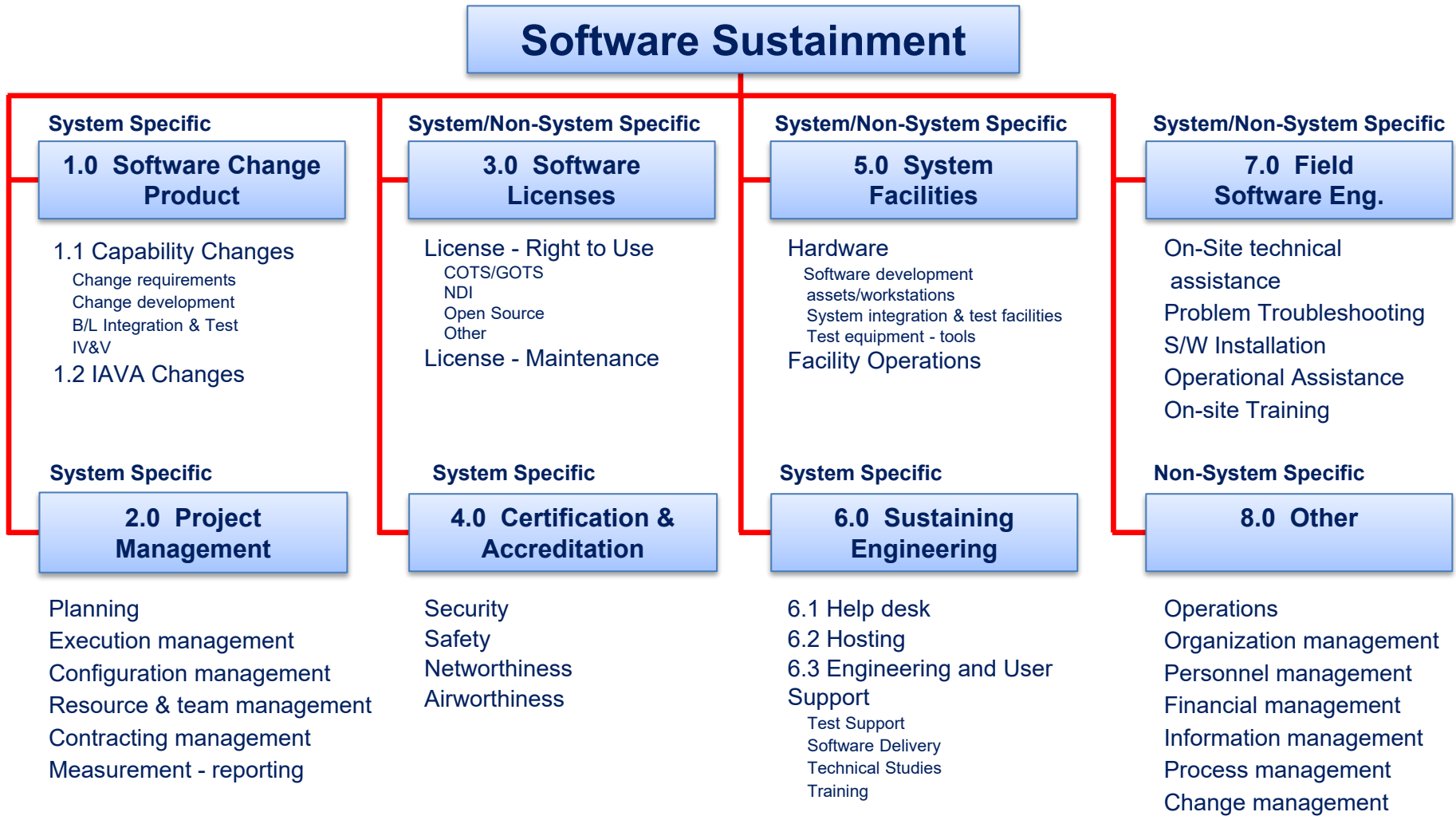- Release effort / cost
- Size - IAVAs

Initiative Phases

- ## Phase 0 - 1 year of data
  - Selected data from volunteer systems
  - 33 systems (updated in later collection phases)
- ## Phase 1 - 3 years of data
  - SES level coordination with G-4, ASAALT, G-6, G-8 and DASA-CE
  - 5 systems from each LCMC and PEO
  - 41 systems
- ## Phase 2 - 3 years of data
  - SES level coordination with G-4, ASAALT, G-6, G-8 and DASA-CE
  - Remaining systems from each LCMC and PEO
  - 151 systems
- ## Phase 3 - FY18 data - 1 year of data
  - 115 systems
- ## Phase 4 - FY21 data
  - License data from ASA/ALT (PEO) programs
  - 70 systems

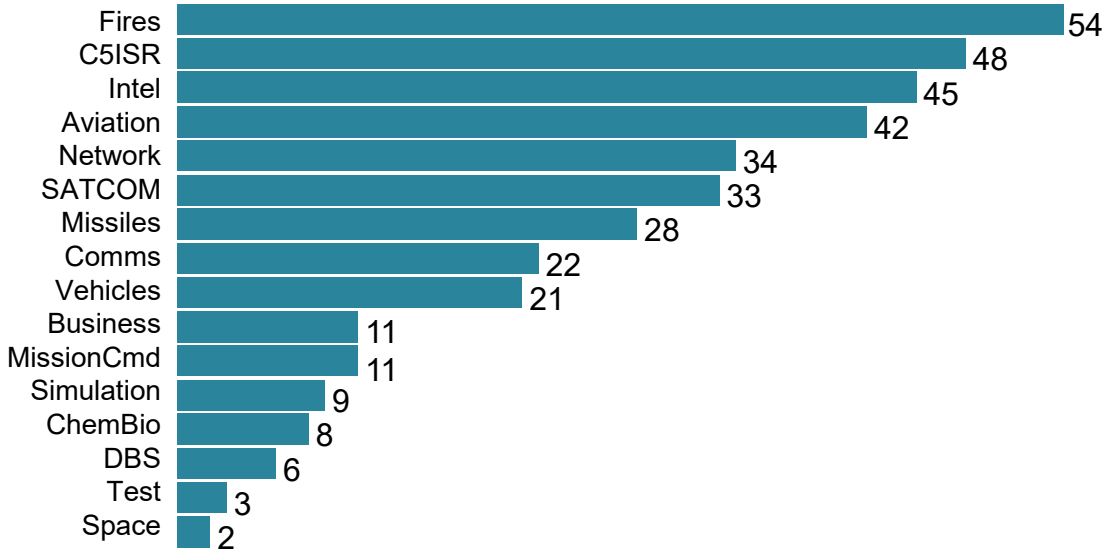Some systems provided updated data in later phases

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DASA-CE SWS WBS

Software Sustainment

System Specific

1.0 Software Change Product

1.1 Capability Changes
 Change requirements
 Change development
 B/L Integration & Test
 IV&V
1.2 IAVA Changes

System/Non-System Specific

3.0 Software Licenses

License - Right to Use
 COTS/GOTS
 NDI
 Open Source
 Other
License - Maintenance

System/Non-System Specific

5.0 System Facilities

Hardware
 Software development assets/workstations
 System integration & test facilities
 Test equipment - tools
Facility Operations

System/Non-System Specific

7.0 Field Software Eng.

On-Site technical assistance
Problem Troubleshooting
S/W Installation
Operational Assistance
On-site Training

System Specific

2.0 Project Management

Planning
Execution management
Configuration management
Resource & team management
Contracting management
Measurement - reporting

System Specific

4.0 Certification & Accreditation

Security
Safety
Networthiness
Airworthiness

System Specific

6.0 Sustaining Engineering

6.1 Help desk
6.2 Hosting
6.3 Engineering and User Support
 Test Support
 Software Delivery
 Technical Studies
 Training

Non-System Specific

8.0 Other

Operations
Organization management
Personnel management
Financial management
Information management
Process management
Change management

Version 5.0

System Demographics

Number of Systems by Commodity

Commodity	Count
Fires	54
C5ISR	48
Intel	45
Aviation	42
Network	34
SATCOM	33
Missiles	28
Comms	22
Vehicles	21
Business	11
MissionCmd	11
Simulation	9
ChemBio	8
DBS	6
Test	3
Space	2

377
Unique Systems

41: PDSS-26; PPSS-15
Phase 1 Systems

151: PDSS-56; PPSS-95
Phase 2 Systems

115: PDSS-10; PPSS-105
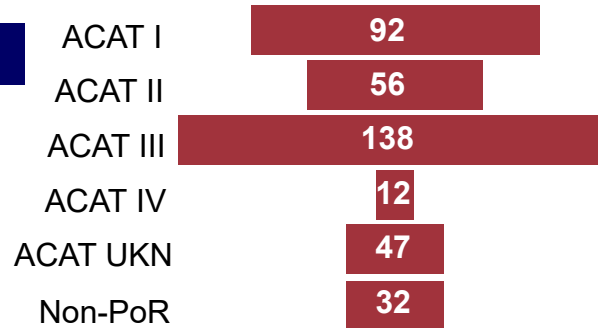Phase 3 Systems

70: PDSS-27; PPSS-43
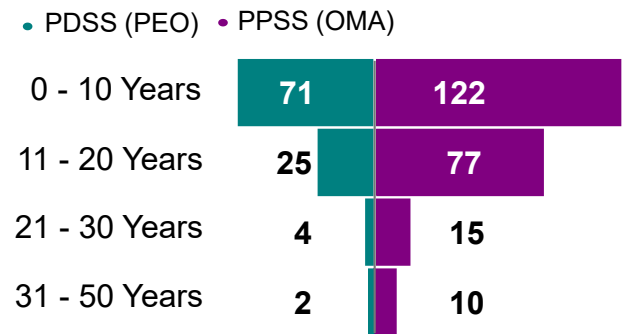Phase 4 Systems

3,835
Data Fields

Systems by Super Domain

Domain	Count
RT	193
ENG	97
AIS	59
SUP	22
DBS	6

Systems by ACAT Level

ACAT Level	Count
ACAT I	92
ACAT II	56
ACAT III	138
ACAT IV	12
ACAT UKN	47
Non-PoR	32
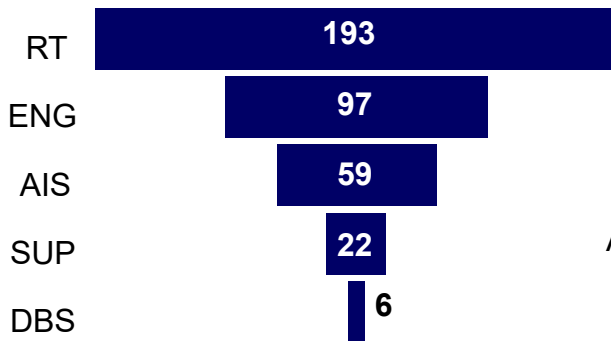
Distribution of System Age

• PDSS (PEO) • PPSS (OMA)

Age	PDSS (PEO)	PPSS (OMA)
0 - 10 Years	71	122
11 - 20 Years	25	77
21 - 30 Years	4	15
31 - 50 Years	2	10

*51 systems do not have age data

Software License Analysis

Information Needs

- ## License data collection provides:

  - Annual license cost expenditures

  - Change in license costs (with multi-year data)

  - Factors influencing the change in license costs, e.g., license coverage & type

  - Sources of license costs, e.g., vendors

- ## Context data for drill-down, e.g.,

  - License cost by system

  - License cost by super-domain

  - License cost by commodity

  - 'Development' versus 'End-User' license cost

License Data Fields*

- Maintenance Organization
- System Name (if only one)
- Commodity
- Super Domain
- PDSS/PPSS Phase
- License Name
- Class (COTS, OSS, etc)
- Version
- Vendor Company
- Usage (Dev., Ops., Both)

- Quantity
- IAVAs
- Coverage (Single, Site-Wide)
- Total Cost
- Cost per License
- Type (End-User, Tech Support)
- Duration
- License Purchaser
- Purchase Date
- Purchase FY
- Comments

*First five data fields provide contextual data for drill-down analysis

License Data Challenges - Government

- Programs do not always track purchases, support, and service costs
  - About half of the license data had associated cost data
- Variety of license strategies: enterprise, site, program, supplier purchases
  - Many licenses do not have system costs if they are enterprise or site licenses, or if they are purchased by the supplier
- Inconsistent information on license purchase approaches
  - The word "Maintenance" could mean maintenance, support, or services
  - Inconsistent knowledge of whether a license is single-use, site-use, or enterprise-use
  - A license that is purchased annually may or may-not be a subscription
- Inconsistent data / data requires normalization
  - License and Vendor names are reported differently for the same license
  - Use (Development Environment, Operations, Both) not identified
  - Need data for both maintenance environment/facilities (including software factory) and operations
  - Quantity not always known
  - Coverage (Single, Enterprise) not always identified
  - Cost and date formats vary
  - Sometimes people write explanations in the data fields

License Data Challenges - Vendor

- License vendors change sales strategies and costs over time that dramatically increases license costs (purchases to annual subscriptions)
  - Hard to change vendors once committed
- License vendors update and sunset licenses frequently, driving changes to operational software
  - New products, merge products, repackage products
- License data changes frequently:
  - Company names (as companies are sold or merged)
  - License names and versions (variations reported and replacement names)
- Inconsistent data – data requires normalization
- The word "Enterprise" in a license name is misleading as it could refer to the number of features in a product and not the license coverage
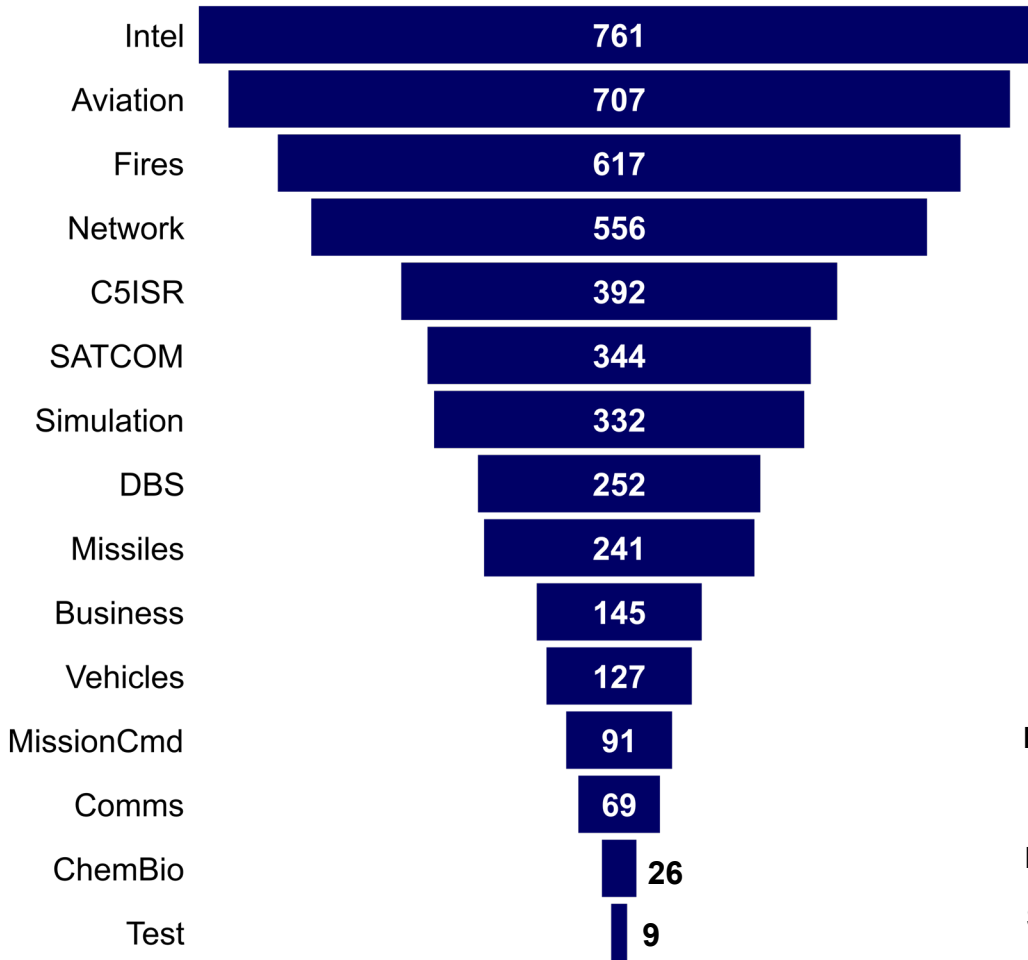
	Users / Seats / Computers / Processors			
	1	~2+	~20+	~100+
Standard	$	$$	$$$	$,$$$
Professional	$$	$$$	$,$$$	$$,$$$
Premier	$$$	$$$$	$$,$$$	$$$,$$$
Enterprise	$,$$$	$$,$$$	$$$,$$$	$,$$$,$$$

Features (row label for the table)

- Normalization is very time-consuming

Software License Demographics

Licenses by Commodity

Commodity	Count
Intel	761
Aviation	707
Fires	617
Network	556
C5ISR	392
SATCOM	344
Simulation	332
DBS	252
Missiles	241
Business	145
Vehicles	127
MissionCmd	91
Comms	69
ChemBio	26
Test	9

Number of Licenses by Super Domain

■ PDSS ■ PPSS

Super Domain	PDSS	PPSS
RT	823	1,321
ENG	148	852
AIS	487	477
DBS	252	0
SUP	320	23
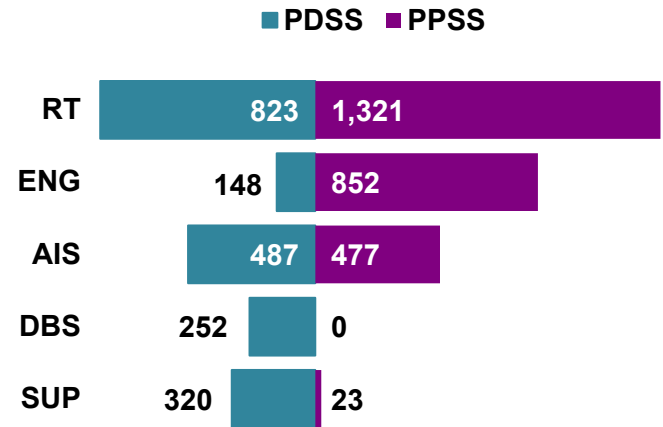
Average License Cost by Super Domain

■ PDSS ■ PPSS

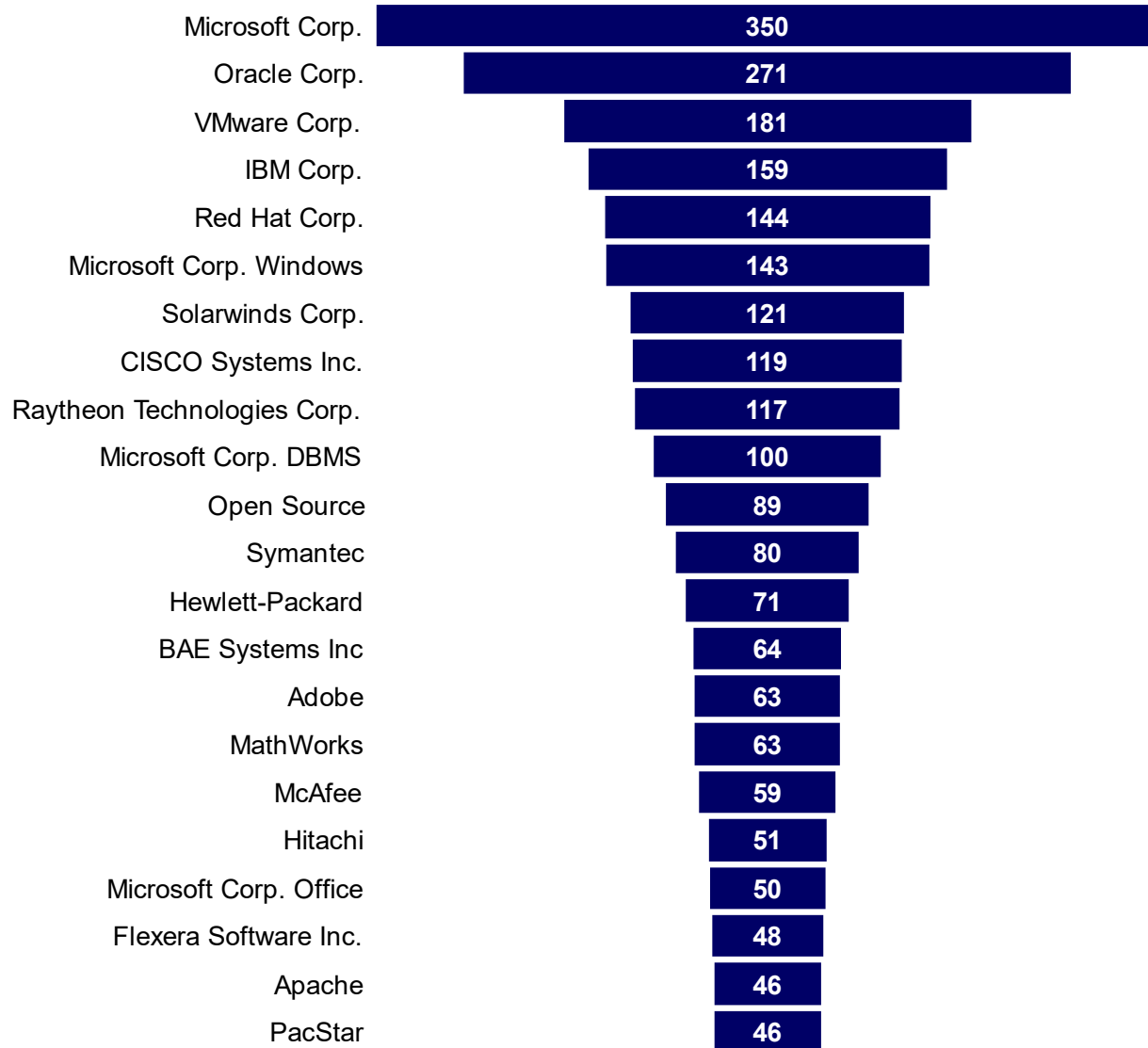| Super Domain	PDSS	PPSS
RT	$82,830	$289,792
ENG	$80,386	$232,324
AIS	$66,033	$172,681
DBS	$759,927	$0
SUP	$82,174	$96,804
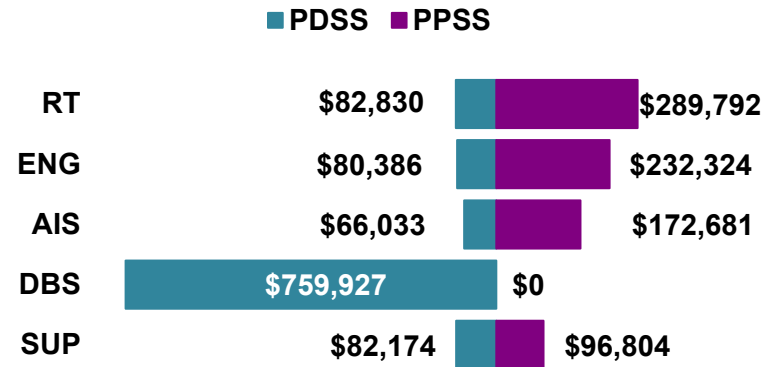
Annual License Costs
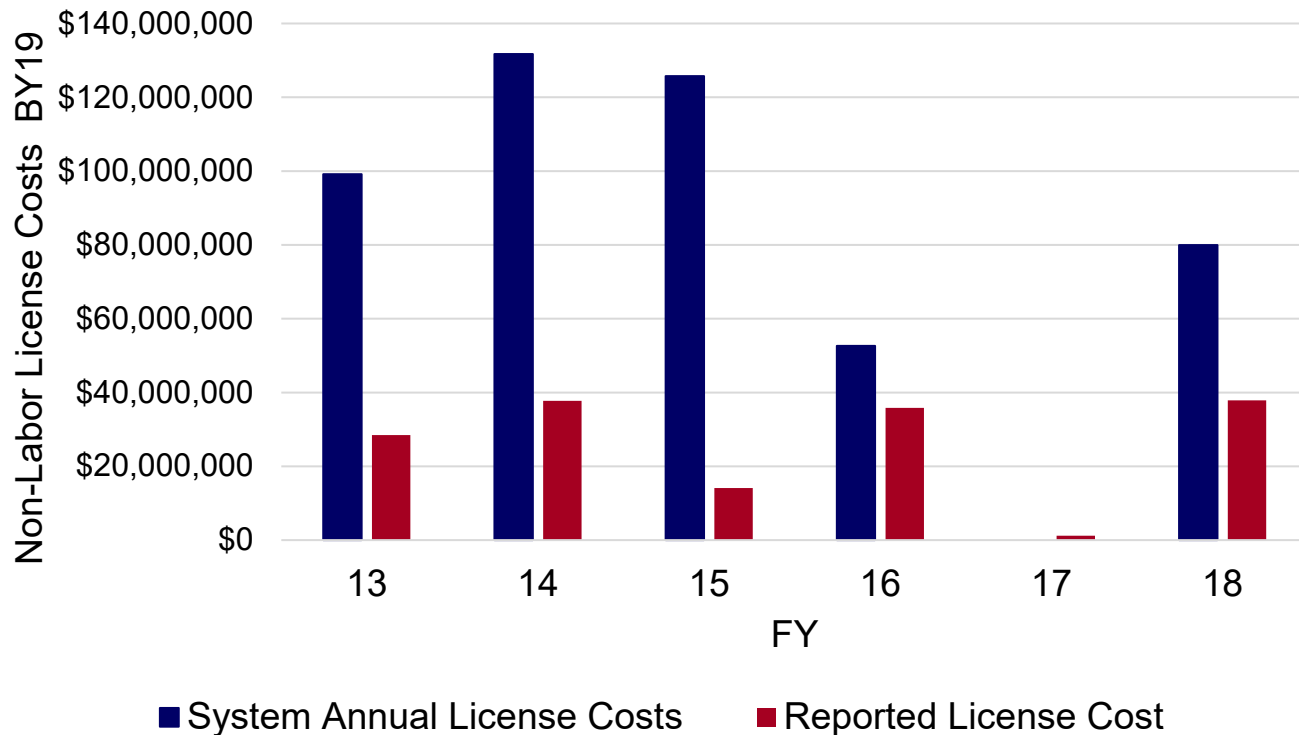
- System Annual License Costs are the total cost for licenses in a year
- Reported License Costs are the sum costs for each license some of which were missing cost data
- The disparity between System Annual Costs and Reported Costs is due to licenses being purchased by other Organizations.
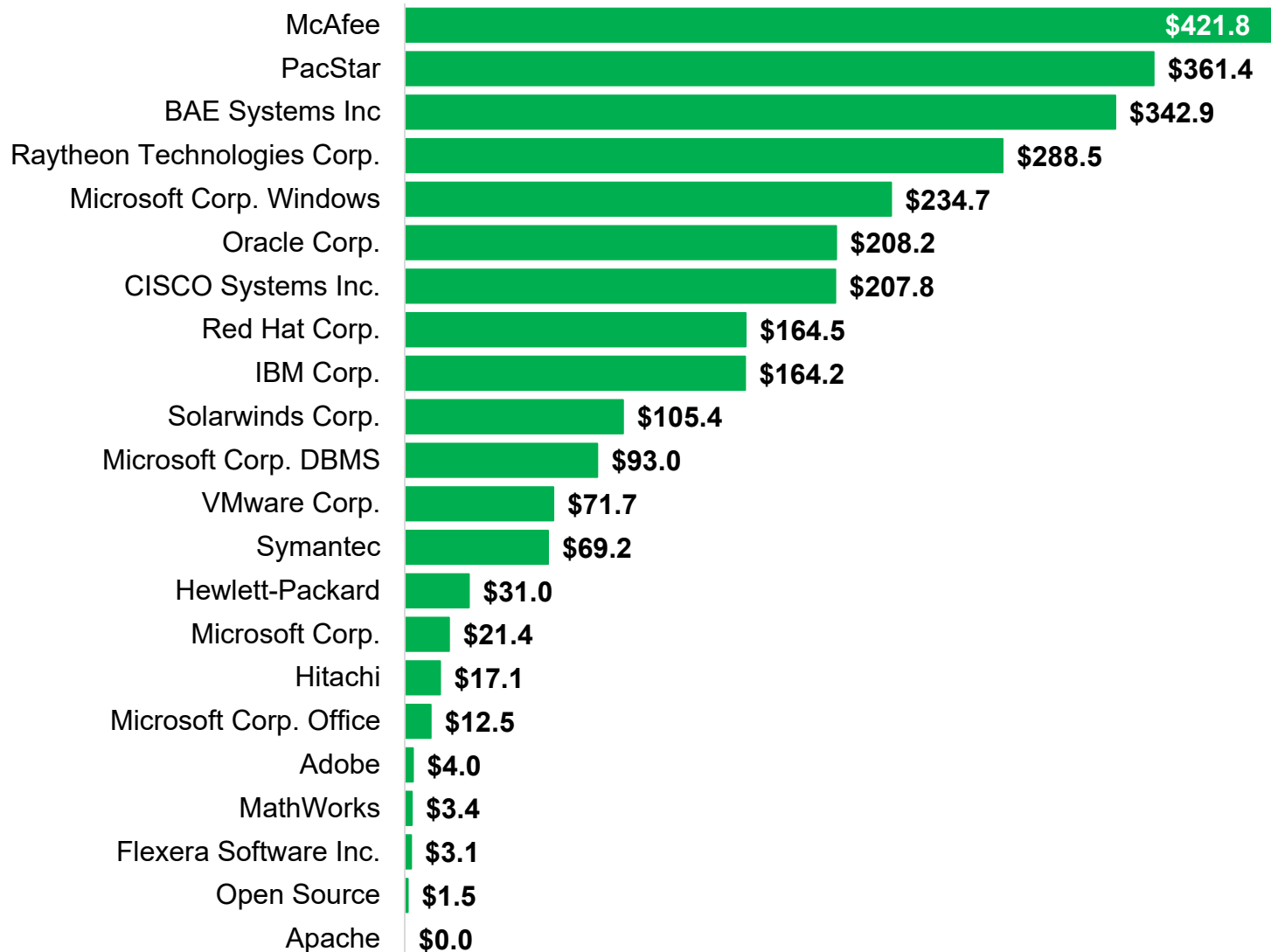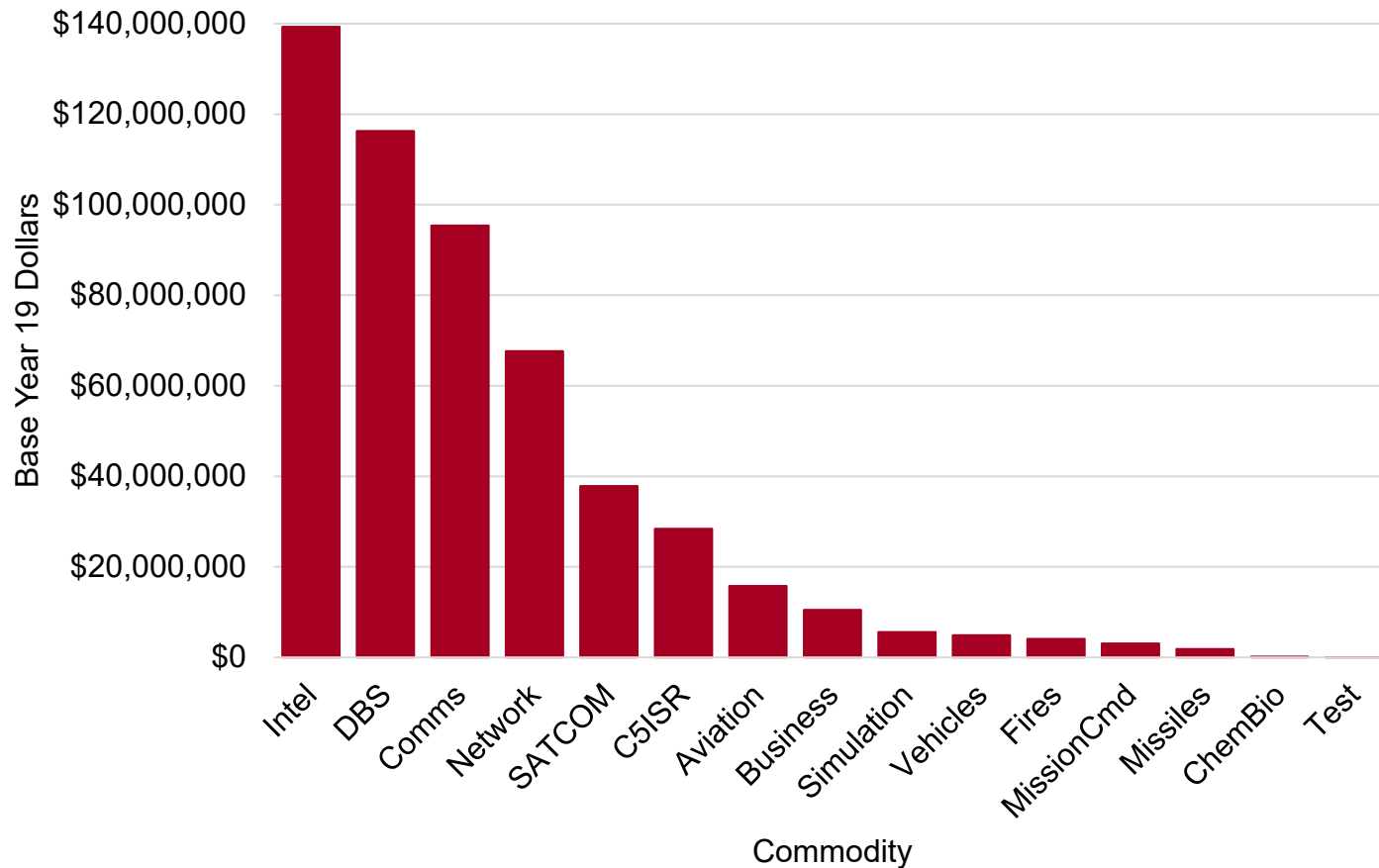- No System Annual License cost data was collected for FY17

License Quantity for Top 22 License Vendors

Vendor	Quantity
Microsoft Corp.	350
Oracle Corp.	271
VMware Corp.	181
IBM Corp.	159
Red Hat Corp.	144
Microsoft Corp. Windows	143
Solarwinds Corp.	121
CISCO Systems Inc.	119
Raytheon Technologies Corp.	117
Microsoft Corp. DBMS	100
Open Source	89
Symantec	80
Hewlett-Packard	71
BAE Systems Inc	64
Adobe	63
MathWorks	63
McAfee	59
Hitachi	51
Microsoft Corp. Office	50
Flexera Software Inc.	48
Apache	46
PacStar	46

Avg License Costs for Top 22 Vendors ($K)

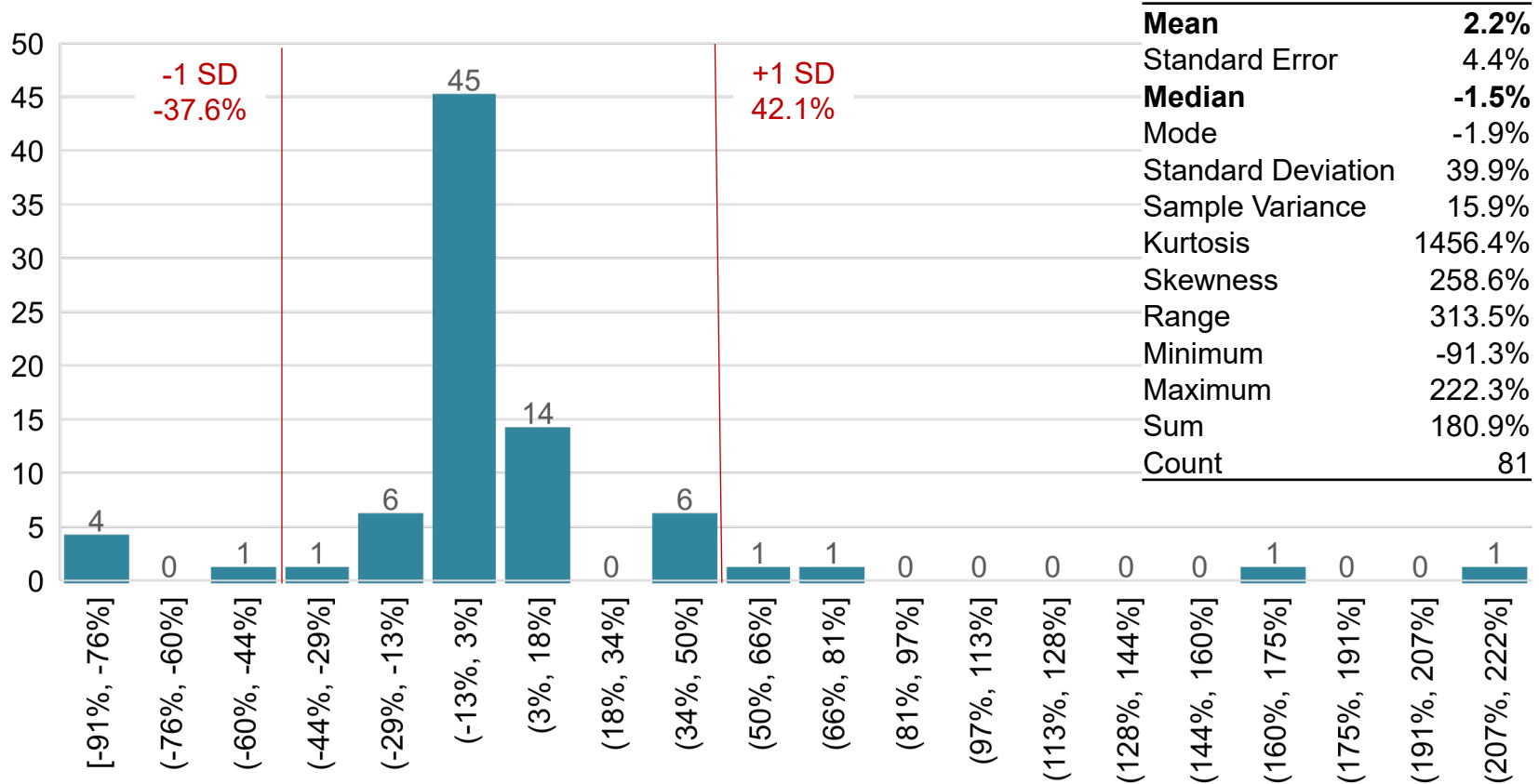| Vendor	Cost
McAfee	$421.8
PacStar	$361.4
BAE Systems Inc	$342.9
Raytheon Technologies Corp.	$288.5
Microsoft Corp. Windows	$234.7
Oracle Corp.	$208.2
CISCO Systems Inc.	$207.8
Red Hat Corp.	$164.5
IBM Corp.	$164.2
Solarwinds Corp.	$105.4
Microsoft Corp. DBMS	$93.0
VMware Corp.	$71.7
Symantec	$69.2
Hewlett-Packard	$31.0
Microsoft Corp.	$21.4
Hitachi	$17.1
Microsoft Corp. Office	$12.5
Adobe	$4.0
MathWorks	$3.4
Flexera Software Inc.	$3.1
Open Source	$1.5
Apache	$0.0

License Total Costs by Commodity

License Cost Analysis Approach

- All costs were normalized to Base Year 2019 (BY19)

- Only "Single" or "Site" license coverages that had LIC_Qty were analyzed (BY19 license cost per quantity per year: annual unit cost)

- Licenses were selected by System with more than 1-year of cost data for a single license

- License cost change was determined by comparing the unit cost for one year to the unit cost of the next year

- Analysis depended on *normalization* of License names – provided data grouping
  - However, full license name revealed differences in licenses and pricing, e.g. Comm Manager versus Comm Manager 2nd Generation
  - Both data fields are needed for analysis

- After roll-up of same year data, 210 records yielded 81 annual unit cost pairs
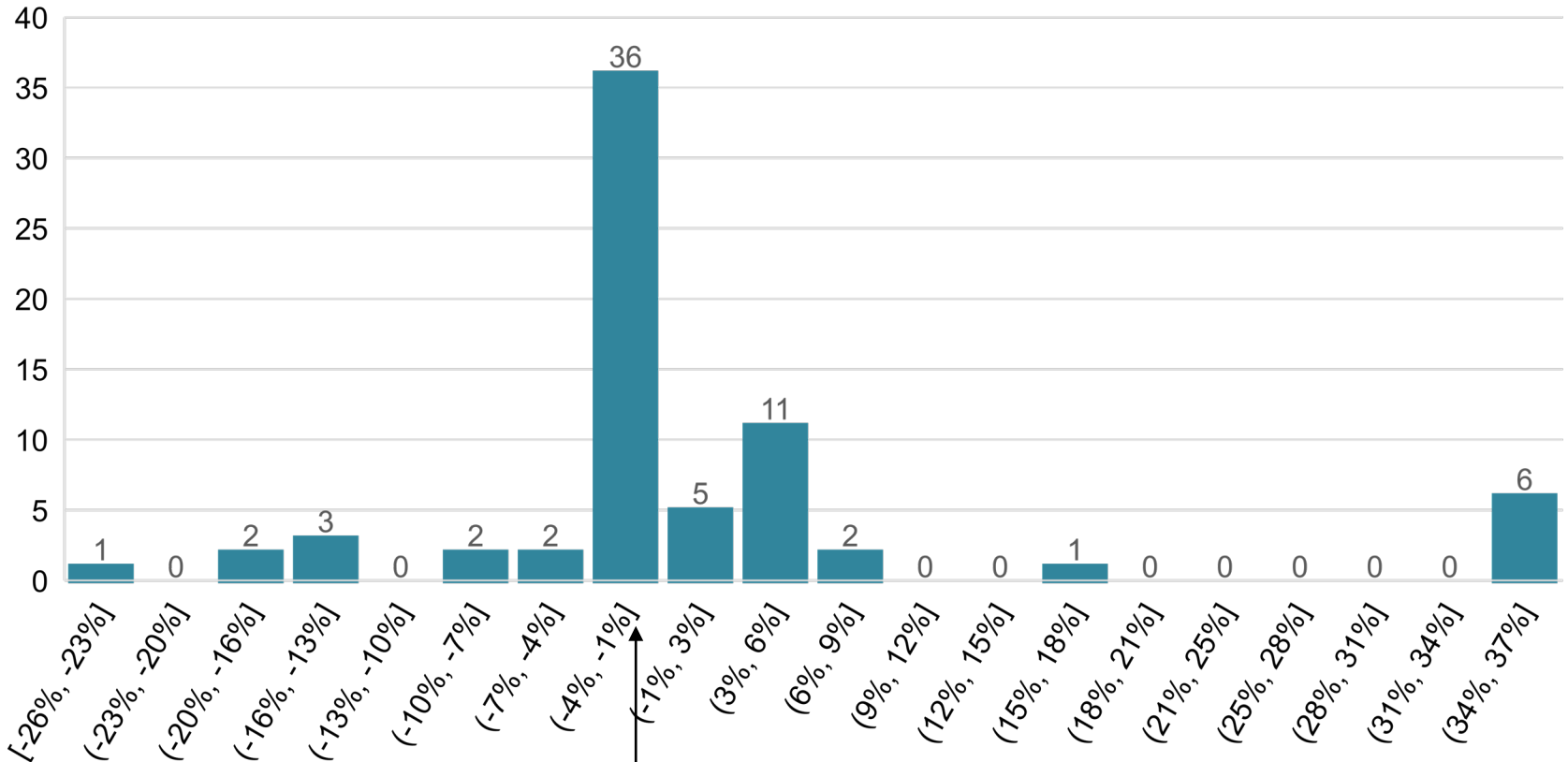
%Unit Cost Change per Year*

A negative cost change means the price went down from one year to the next

-1 SD
-37.6%

+1 SD
42.1%

Mean		**2.2%**
Standard Error		4.4%
Median		**-1.5%**
Mode		-1.9%
Standard Deviation		39.9%
Sample Variance		15.9%
Kurtosis		1456.4%
Skewness		258.6%
Range		313.5%
Minimum		-91.3%
Maximum		222.3%
Sum		180.9%
Count		81

*Cost changes in BY19 dollars are based on a single license change per year,
i.e. total cost / quantity / yr

±1 Std Dev Unit Cost Change per Year*

35 records had -1.11% to -1.97% cost change due to inflation adjustment to BY19 dollars when the product had the same price in succeeding years.

*Cost changes in BY19 dollars are based on a single license change per year, i.e. total cost / quantity / yr

License Cost Change Categories

Overall, license costs increase **annually**

Cost Change Category	% Change*	Count
Cost increase-major	Over 18.14%	11
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
Cost decrease-major	Over -14.49%	12

29 / Median increase **5%**

17 / Median decrease -16.6%

Reasons for Major Cost Increases
- Custom proprietary products
- Specialty products, e.g. rule-based logic, imaging, mapping, data comparison, computer memory analysis
- Vendor price increase

Reasons for Major Cost Decreases
- Initial purchase of a perpetual license w/maintenance followed by lower annual maintenance
- Change from perpetual to an annual subscription license
- License vendor purchased by another company
- Large license quantity increase
- Vendor price decrease

*Changes boundaries are based on increments in the data

Implications

Avg Number of Users	
Mean	**951**
Median	**14**
Standard Deviation	3,140
Minimum	1
Maximum	23,999
Count	81

License Unit Cost	
Mean	$34,787
Median	**$842**
Standard Deviation	$195,210
Minimum	$1
Maximum	$1,913,693
Count	209

- For cost risk, a median 5% increase in annual license cost should be assumed
  - It should not be assumed there will be a cost decrease even though there were cases of cost decreases in the data

- If a product license is used in a development environment by 14 people and the cost is $842 per license, the total cost for licenses is $11,788. A median 5% increase 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, a median 5% increase means cost increases from $800,742 to $840,779, roughly a $40,000 increase

Observations

- There are multiple license types for a single product and it is important to keep track of the different types, e.g.
    - Professional versus Standard
    - Analysis versus eXtreme Analysis
    - Advanced Enterprise Linux versus Advanced Enterprise Windows
    - Locked versus Floating license
- Some costs "appeared" to decreased in succeeding years due to inflation adjustment to BY19 dollars
    - The unadjusted costs were the same in succeeding years
    - Represents a savings to the Army
- Year 1 was the product purchase but succeeding years were a smaller maintenance fee (looked like a price drop)
- A Best Practice:
    - *Procurement License Tracking System (PLTS) Spreadsheet from the Software License Acquisition Branch* – evidence of tracking license cost
    - Identifies Opportunity Costs and possible savings

Conclusions

License Data Conclusions

- Costs cannot be controlled until there is a good understanding of the total ownership costs (TOC) of licenses
- Products will be merged or dropped thus forcing changes to the operational software and impacting TOC
- The Government needs a method to allocate the license costs down to individual systems to prepare and defend budgets
  - Especially for those paid for by other-than project funds
- Initial data shows software applications relying on COTS products will experience a rise in cost over the life of the system
- License costs need to capture complete and standardized descriptive information
- 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, e.g., +5% per year
- We need broad executive-level sponsorship to require programs and organizations to regularly collect this data in a consistent manner

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