



# Software Licenses: A Bill You Can't Pay?

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Joint IT and Software Cost Forum  
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# Problem Statement

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- 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

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- Objectives
- Software License Analysis
  - Data collection
  - Challenges
  - Demographics
  - Results
- DevSecOps Implications
- Conclusions



# Objectives

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# 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

## 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)

## 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

## Software Licenses

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

## Release Level IAVAs

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

Definitions of data elements available in data collection questionnaire



# Initiative Phases

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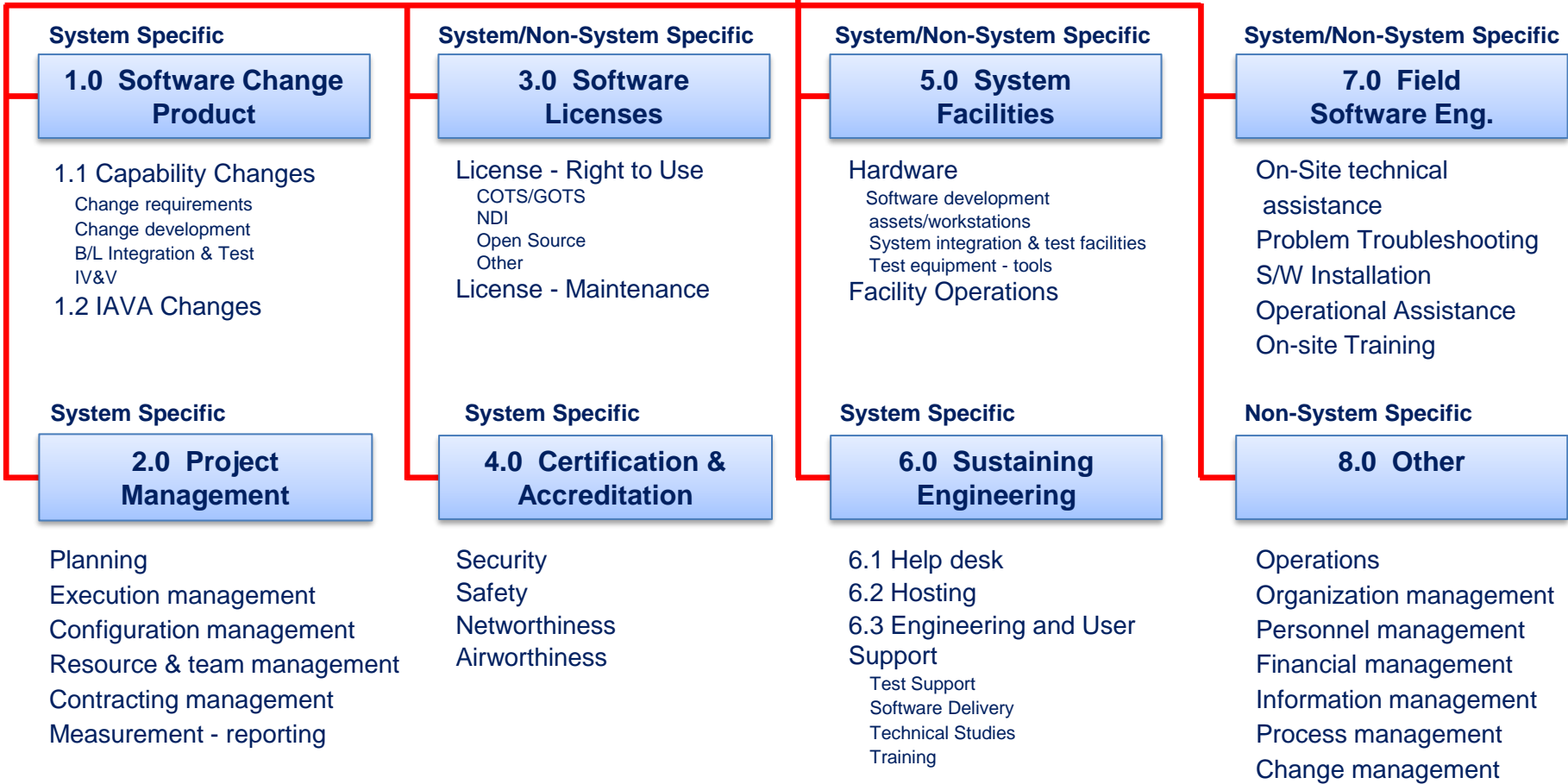
- Phase 0 - 1 year of data
  - Selected data from volunteer systems
  - 33 systems (updated in later collection phases)
- Phase 1 - 3 years of data
  - SES level coordination with G-4, ASAALT, G-6, G-8 and DASA-CE
  - 5 systems from each LCMC and PEO
  - 41 systems
- Phase 2 - 3 years of data
  - SES 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



# DASA-CE SWS WBS

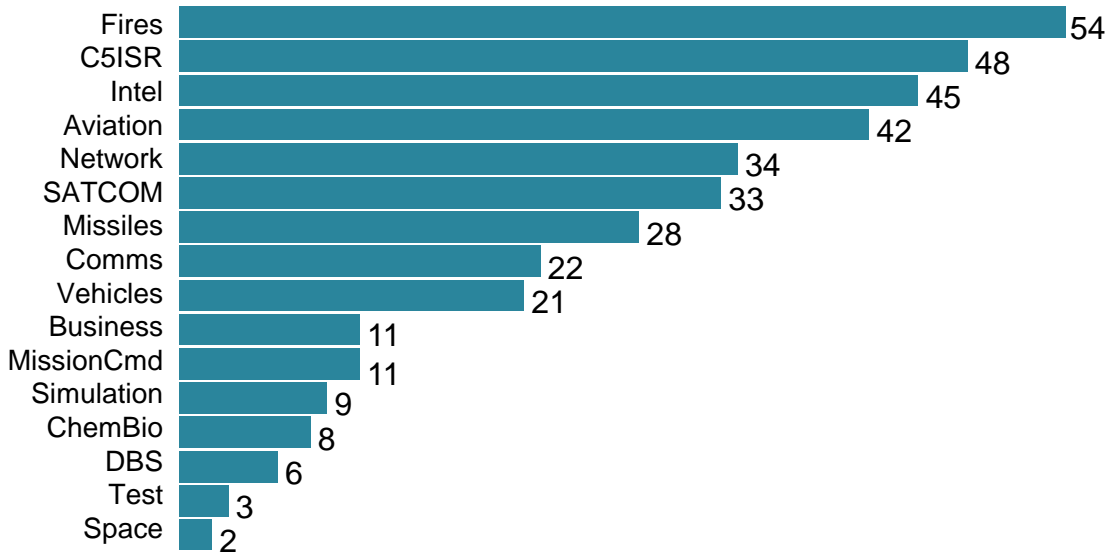
## Software Sustainment





# System Demographics

Number of Systems by Commodity



**377**

Unique Systems

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

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

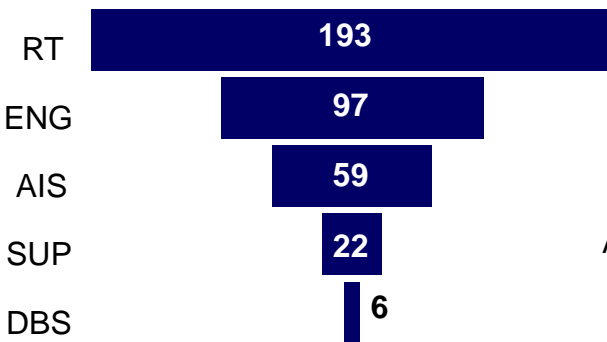
**115: PDSS-10; PPSS-105**  
Phase 3 Systems

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

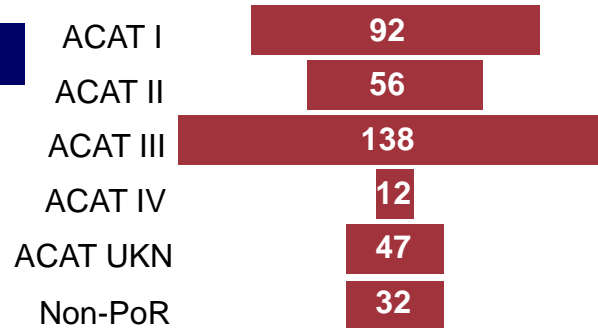
**3,835**

Data Fields

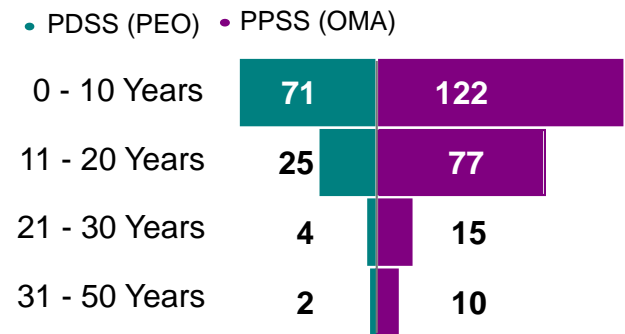
Systems by Super Domain



Systems by ACAT Level



Distribution of System Age



\*51 systems do not have age data



# Software License Analysis

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# Information Needs

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- 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\*

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- 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

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- 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

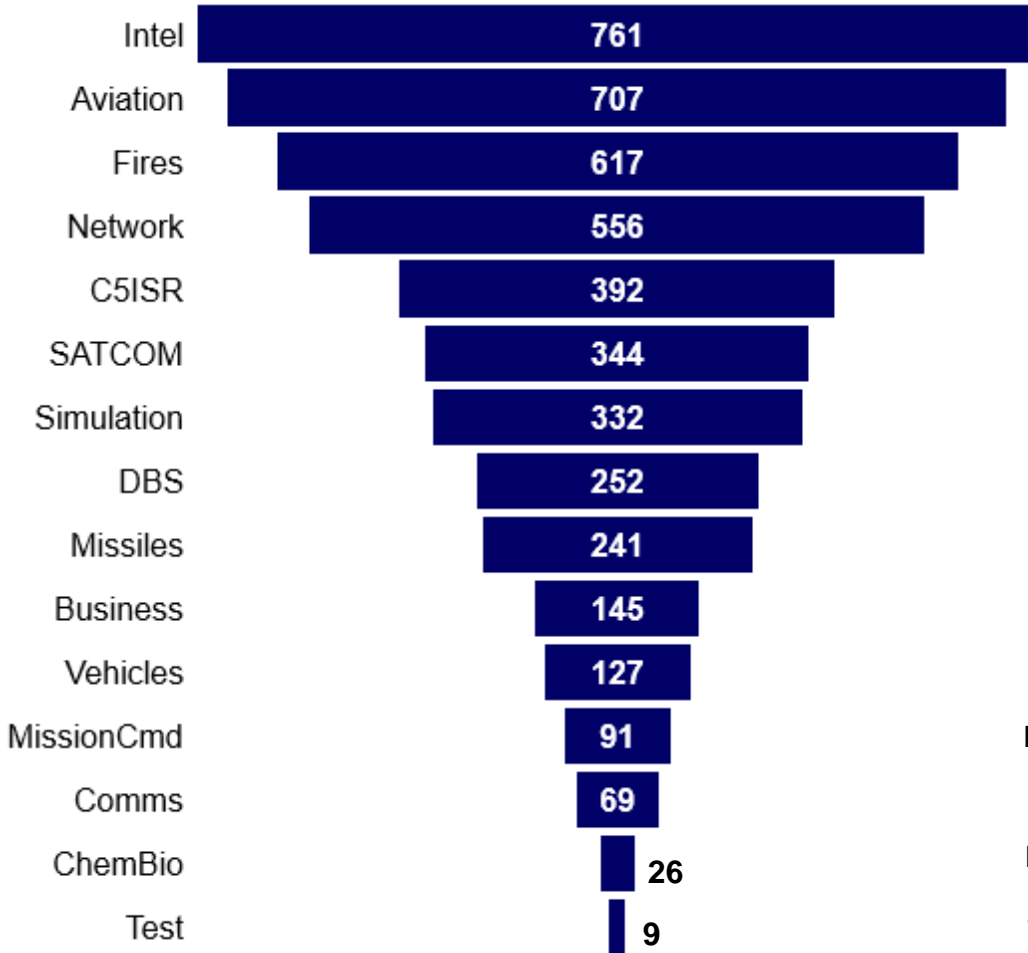
		Users / Seats / Computers / Processors			
		1	~2+	~20+	~100+
Features	Standard	\$	\$\$	\$\$\$	\$\$\$\$
	Professional	\$\$	\$\$\$	\$\$\$\$	\$\$\$\$\$
	Premier	\$\$\$	\$\$\$\$	\$\$\$\$\$	\$\$\$\$\$\$
	Enterprise	\$\$\$\$	\$\$\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$\$

- Normalization is very time-consuming

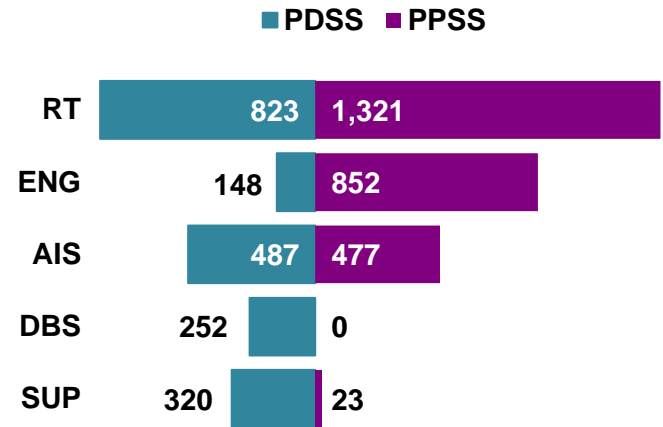


# Software License Demographics

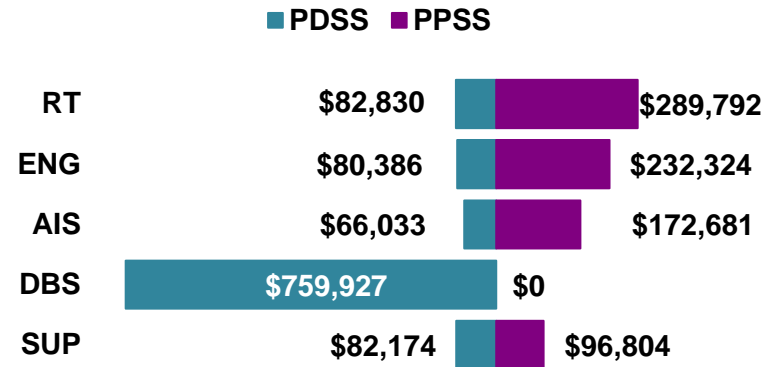
Licenses by Commodity



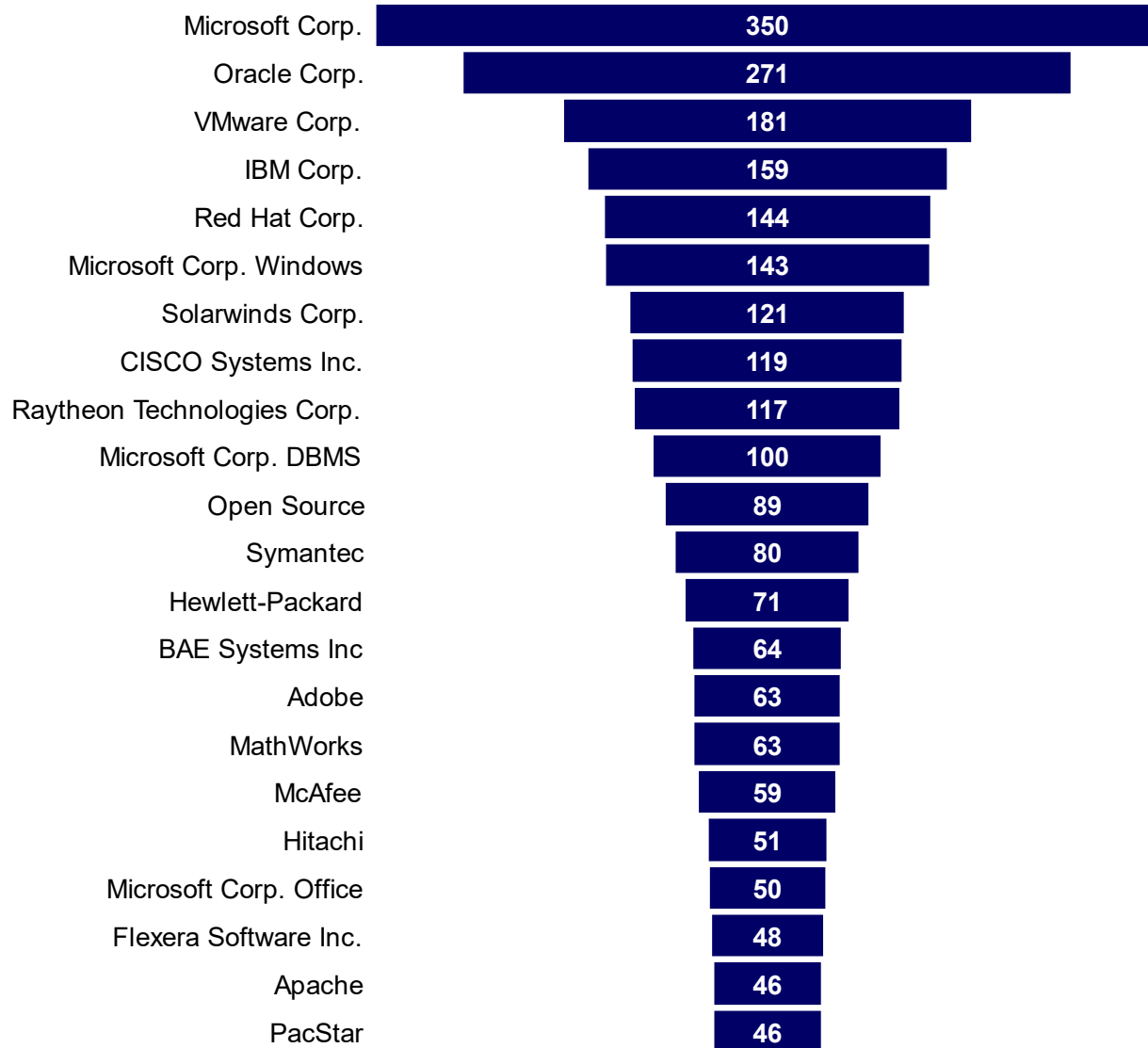
Number of Licenses by Super Domain



Average License Cost by Super Domain

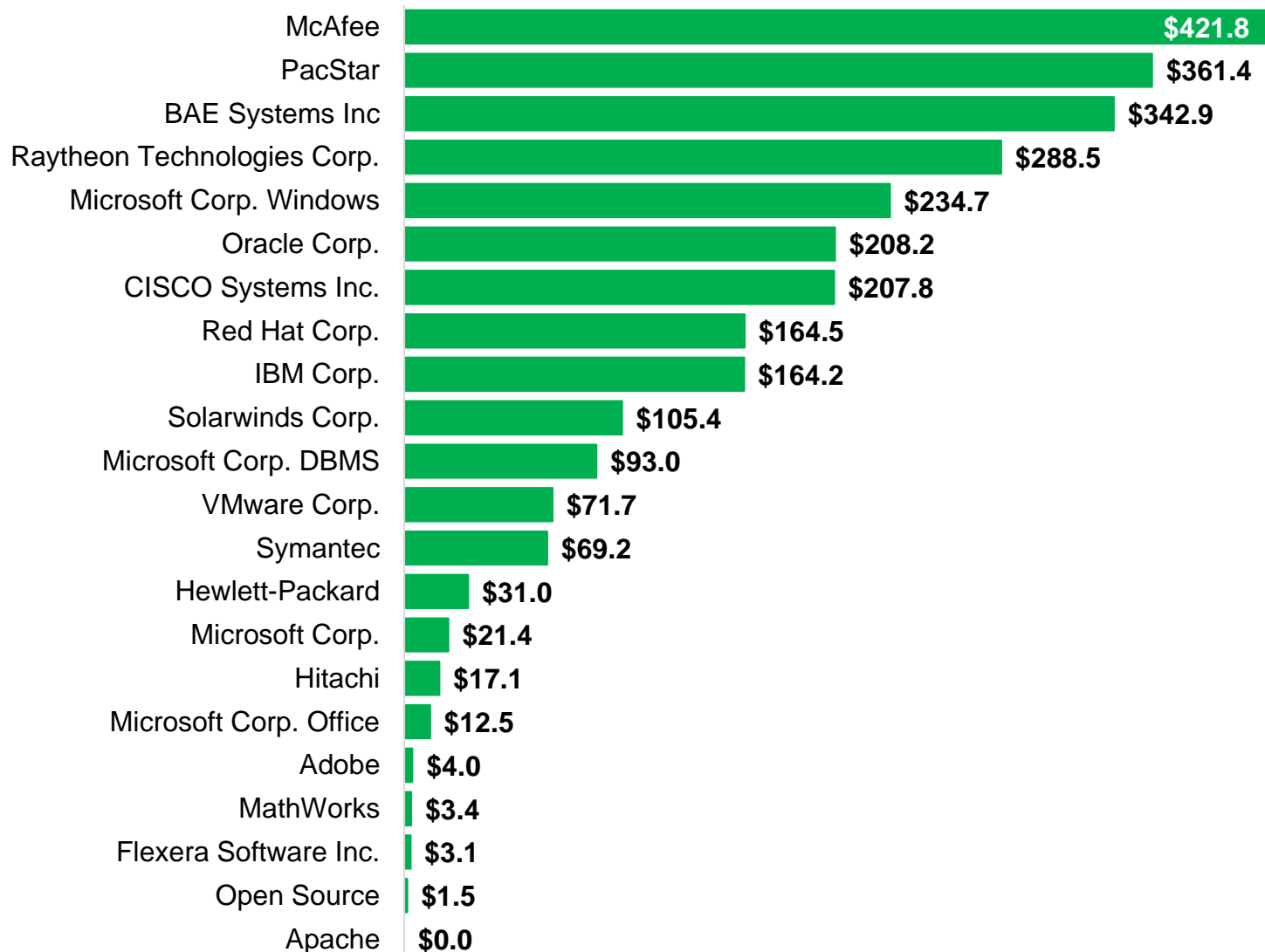


# License Quantity for Top 22 License Vendors

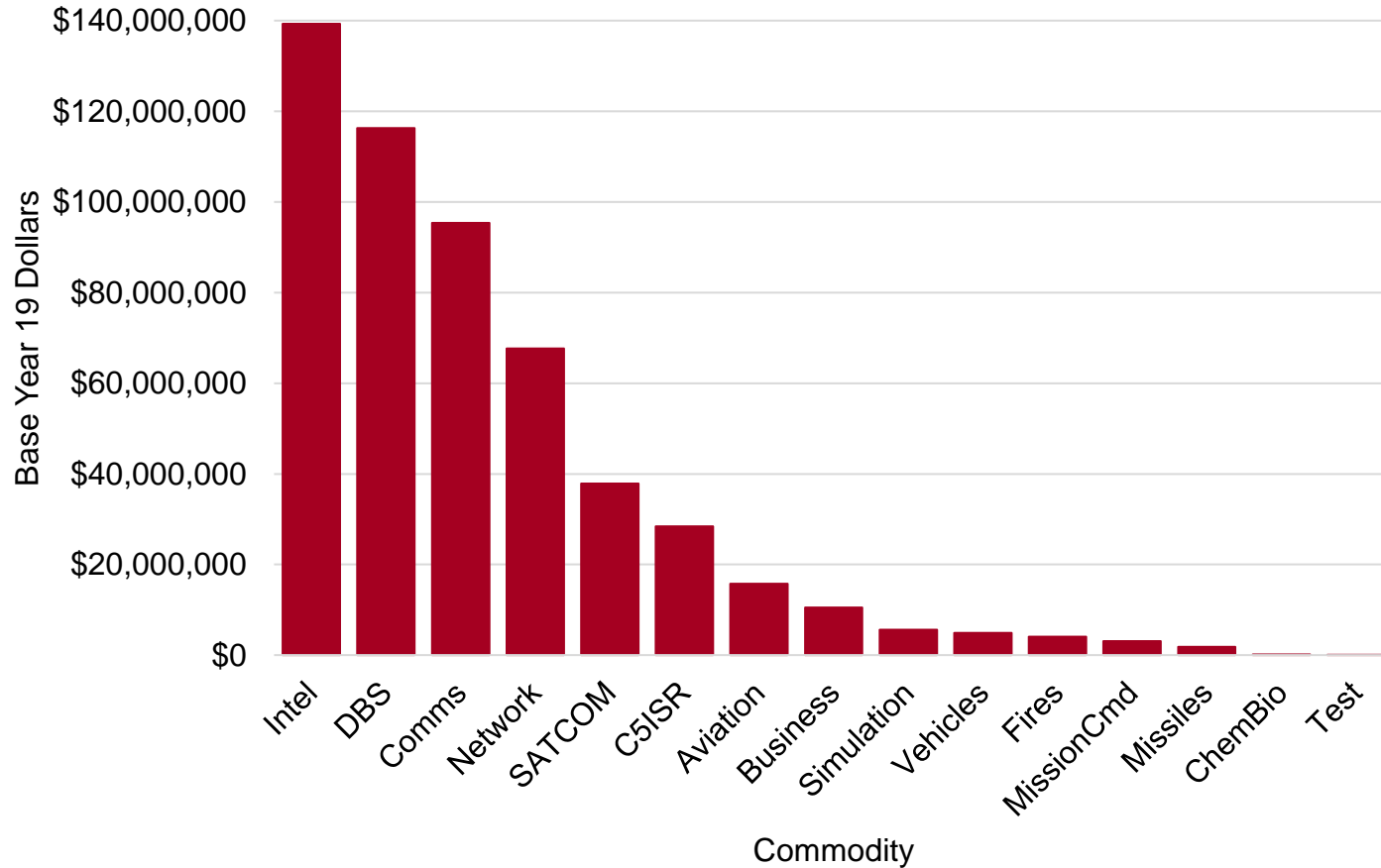




# Avg License Costs for Top 22 Vendors (\$K)



# License Total Costs by Commodity



# License Cost Analysis Approach

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- All costs were normalized to Base Year 2019 (BY19), effects of inflation were removed
- 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 ratio of the unit cost for one year to the unit cost of the next year
- Analysis depended on *normalization* of License names - provided data grouping
- After roll-up of same year data, 210 records yielded 81 annual unit cost pairs



# Pivot Table Example

Systems	2012	2013	2014	2015	2016	2017
<b>LIC_NAME_n</b>		<b>18,678,689</b>	<b>20,394,098</b>	<b>7,688,189</b>	<b>18,899,175</b>	
[ESRI] ESRI Unlimited		9,088,193	8,609,505			
[ISD] Appraisal Wizard		2,585				
Adobe Acrobat Professional					0	
Adobe LiveCycle Designer					0	
AdobeCLPG 5.x RoboHelp Office MP Rnw 1yr-Lvl 2(EU)		1,166				
Advanced Security			214,351			
Agent Logic 2015				82,130		
Agent Logic RulePoint Base					565	
Agent Logic RulePoint Base Maint		311	540			
Agent Logic RulePoint Cores for Production Use					72	
Agent Logic RulePoint Cores Maint		78	69			
Agent Logic RulePoint Development Kit Maint		310,605	875			
Agent Logic RulePoint SDK					92	
Agent Logic RulePoint Seats for Production					21	
Agent Logic RulePoint Seats Maintenance		78	20			
AgileGraph					158,868	
AgileGraph 2015				160,775		
AgileGraph Software Maintenance Support		164,981	162,543			

- 19 systems had multi-year license data
- 81 record pairs of two-year data

Note: did not have data for all years for most licenses



# Same COTS Product Comparison

- Example: InstallShield
- Cost per single license varies across systems and Maintenance Organizations

LIC_NAME	LIC_NAME_n	Qty_n	Cover_n	LIC_Cost_Per_BY19	FY_n
Installshield	InstallShield	2	Single	\$825	2013
InstallShield	InstallShield	3	Single	\$2,316	2014
InstallShield-Anywhere (Renewal)	InstallShield-Pro	5	Single	\$942	2014
InstallShield	InstallShield	3	Single	\$2,736	2015
InstallShield-Anywhere	InstallShield-Pro	8	Single	\$789	2015
InstallShield Professional	InstallShield-Pro	4	Single	\$719	2016
Installshield	Installshield	2	Single	\$1,041	2017
InstallShield	InstallShield	3	Single	\$2,601	2018
InstallShield Professional	InstallShield-Pro	4	Single	\$650	2018

- Shows Opportunity Costs: differences in costs represents money not saved
- Shows where to negotiate a single product license cost



# Price Ratio License Analysis Results

- This approach is based on the Chained Consumer Price Index without the “weighted” price ratio, i.e., all price ratios are treated as equal
- Two successive time periods were analyzed, p<sup>1</sup> and p<sup>2</sup>

$$Index_{[1:2]}^{Price\ Ratio} = \prod_i \left( \frac{p_i^2}{p_i^1} \right) \text{ where } i = License$$

## Example

p <sup>1</sup> FY	p <sup>2</sup> FY	License	P <sup>1</sup>	P <sup>2</sup>	p <sup>2</sup> /p <sup>1</sup>
15	16	AgileGraph	\$160,775	\$158,868	0.99
15	16	Viper	\$356,920	\$385,391	1.08
15	16	Red Hat LINUX Desktop, Basic Support	\$2,355	\$2,314	0.98
<b>15</b>	<b>16</b>	<b>p<sup>2</sup>/p<sup>1</sup> Mean</b>			<b>1.02</b>

- A Price Ratio less than 1.0 means the price was reduced
- All prices and costs are in Base Year 2019 amounts



# License Cost Change Reasons

## Reasons for Major Cost Decreases

- Initial purchase 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

## 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



# Price Ratio License Results

- The mean price ratio across all year groups was 1.01
  - There was a lower degree of variation
- Ignoring year groups with less than 5 records, the mean price ratio was 1.08
  - But there are only two selected year groups: FY 13-14 and FY 21-22
- Across all year groups, the mean price ratio was 1.05

Year	Count	p <sup>2</sup> /p <sup>1</sup>
12-13	2	1.01
13-14	9	1.08
14-15	2	1.01
15-16	3	1.02
16-17	0	
17-18	0	
18-19	1	0.83
19-20	0	
20-21	3	1.05
21-22	14	1.08
Mean		1.01
Selected Mean		1.08

Year	Count	Overall Mean for p <sup>2</sup> /p <sup>1</sup>
FY 12 -22	34	1.05





# Interpolated Data

- There were 36 licenses that had multi-year data, e.g., FY16 & FY18 but no FY17
- Data was linearly interpolated for the missing years

## Example

p <sup>1</sup> FY	p <sup>2</sup> FY	License	P <sup>1</sup>	P <sup>2</sup>	p <sup>2</sup> /p <sup>1</sup>
15	16	AgileGraph	\$160,775	\$158,868	0.99
15	16	Viper	\$356,920	\$385,391	1.08
15	16	Red Hat LINUX Desktop, Basic Support	\$2,355	\$2,314	0.98
15	16	Microsoft VS Enterprise with MSDN (VL)	\$1,210	\$1,254	1.04
15	16	VBS IG	\$459	\$583	1.27
15	16	GeoRover Tools for ArcGIS	\$1,892,060	\$1,870,427	0.99
15	16	TestComplete Enterprise Floating License	\$931	\$912	0.98
15	16	LiDAR Analyst	\$1,081	\$864	0.80
15	16	SOCET GXP GeoAnalysis (4004-UE)	\$2,278	\$2,118	0.93
15	16	Beyond Compare	\$34	\$91	2.67
15	16	Memory Validator	\$229	\$347	1.51
15	16	MSDN	\$1,072	\$969	0.90
15	16	Installshield	\$933	\$987	1.06
15	16	GEM X Encryptor Manager	\$2,145	\$2,109	0.98
15	16	SNMPc Enterprise Maintenance	\$745	\$733	0.98
15	16	SNMPc Workgroup Maintenance	\$291	\$287	0.98
<b>15</b>	<b>16</b>	<b>p<sup>2</sup>/p<sup>1</sup> Mean</b>			<b>1.13</b>

# Interpolation Results

- The number of records in each year group increased for most groups
- Ignoring year groups with less than 5 records, the mean price ratio was 1.03
- Across all year groups, the mean price ratio was X1.03

Year	Count	p <sup>2</sup> /p <sup>1</sup> Mean
11-12	1	
12-13	4	1.00
13-14	18	1.04
14-15	16	0.90
15-16	16	1.13
16-17	27	1.04
17-18	26	1.01
18-19	1	
19-20	0	
20-21	3	1.05
21-22	14	1.08
Mean		1.03
Selected Mean		1.03

Year	Count	Overall Mean for p <sup>2</sup> /p <sup>1</sup>
FY 12 -22	126	1.03

- Price ratios showed lower variability with interpolated data
- Probably due to evenly spreading the price across missing year groups



# Recommendations

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- Short-term: what number to use, e.g., 1.01, 1.03, 1.05, 1.08
- Long-term: The collection of recent data from selected systems would validate a License Price Index
  - Select 12 Systems from different Programs or
  - Evaluate a database of multi-year license costs (if one can be accessed)
  - Collect complete data for FYs 20, 21, and 22 (price and cost)
  - Collect data for FY23 when available
  - The data should be from the same licenses across the FYs
- As with Consumer Price Index, a License Price Index would be a very useful budgeting tool



# DevSecOps Implications

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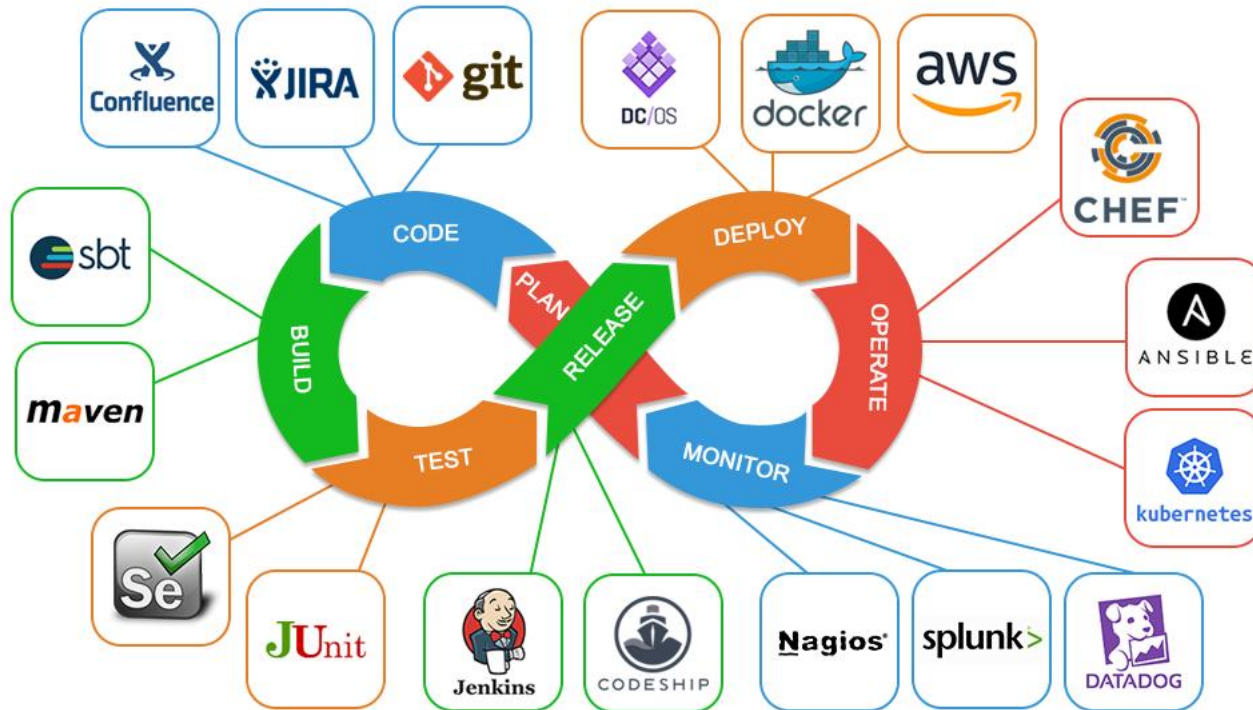
# DevSecOps Estimation Challenges

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- DevSecOps is based on the principle of Continuous Integration (CI) and Continuous Delivery (CD)
- Multiple development pipelines create, enhance, and maintain different software products independently and concurrently using a Software Factory construct
- This construct relies on **task automation for repeatable tasks** thus reducing workload (and cost), improving quality, and increasing the speed of delivery
- Automation is enabled with **software tools**
  - The cost of startup and buildout of a software factory is driven by effort and supporting tool costs
  - The cost will vary with the degree of implementation
- A Software Factory has an initial start-up and an ongoing cost



# Task Automation for Repeatable Tasks



# Conclusions

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# License Data Conclusions

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- 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





# Contributors

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