National Congress of Measurement and Software Estimation

Booklets

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Title: Cost & Risk Analysis of Managing Modernization Projects With Cloud and Open Source Considerations

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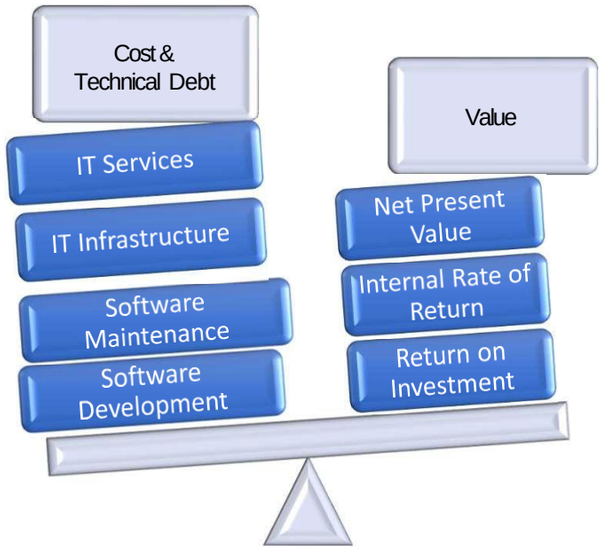
Key Points

Modernization can be costly but isoften worth it versus starting over

Open source, Software is not FREE

Open source, Agile, Cloud & other technologies can help… But they are not FREE

Best Analysis of Modernization Approach Looks at Value & Time To Value to the Business



It shouldn't be just how long and how much…
Should include Business Case "WHY"

Cost & Technical R's of modernization

(Adapted from Microsoft& Gartner)

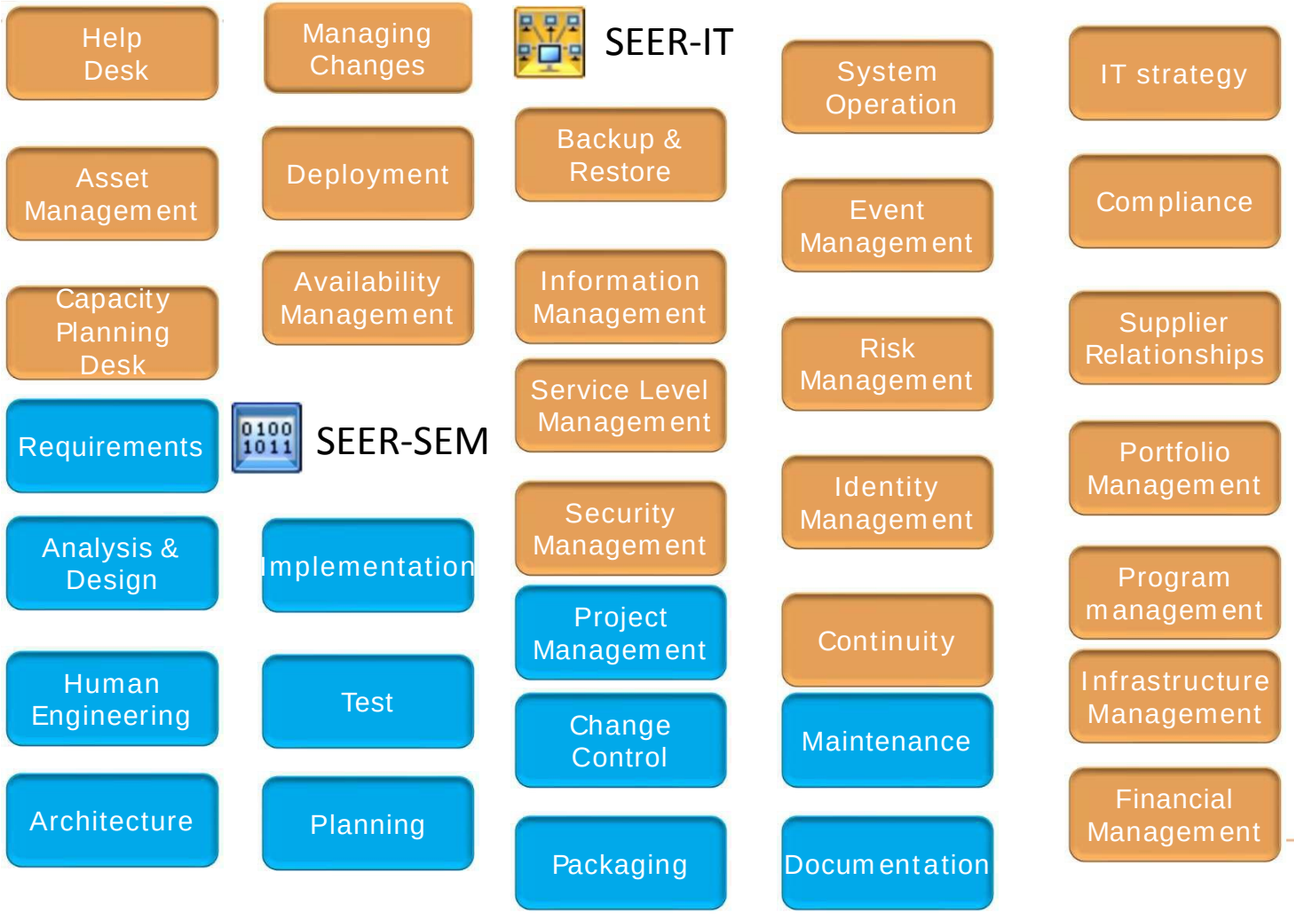
Retire	• Decommission if legacy app providing little value • Possibly roll some legacy functionality into consolidated modern application
Refactor	• Preserve behavior by improving existing code • Possibly execute on new infrastructure (PaaS)
Replace	• If legacy app providing value but commercial alternative can be better
Retain & Wrap	• RETAIN if inexpensive or impractical to modernize • WRAP: modern wrapper around app - additional value & benefits e.g C# Java wrapper around COBOL app
Rehost	• Viable functionality but Expensive to run • Move VM from on-premises to new environment E.g IaaS
Redevelop	• Application providing value but legacy language, environment • Rewrite a new application that meets the current and upcoming requirements

Modernization Requires "As Is" Model Discovery Costs

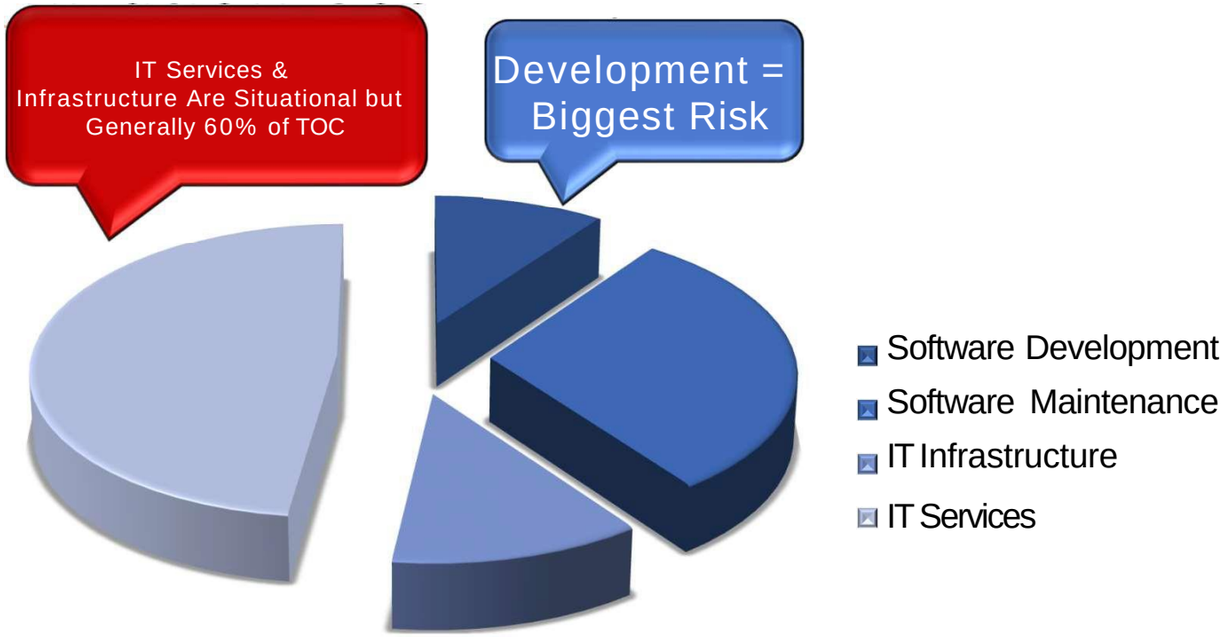
- "As Is" usually requires discovery (Systems Engineering) to mine knowledge
  - Business processes
  - Business rules & vocabulary
  - Logical data model models
  - Application logic
  - Physical data model
  - Program logic

Trying to change the organization processes just because of new software can be disaster

Software & IT Should Both Be Estimated (Adapted from IBM)

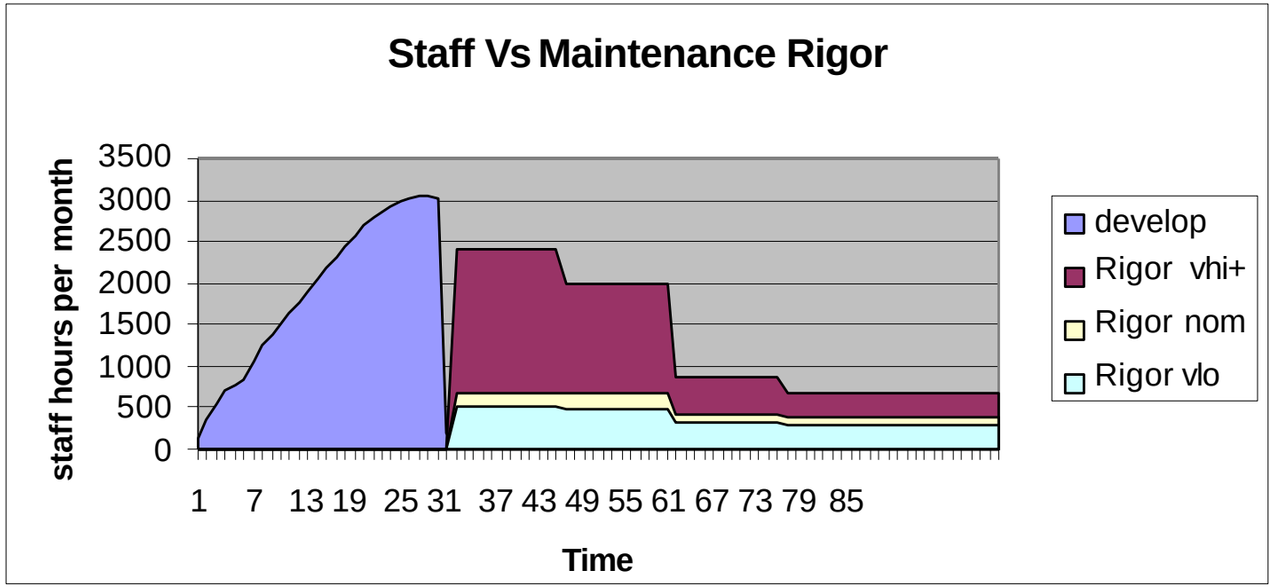


Modernization Cost Impact Total Ownership Cost



Software Development is about 6-10% of total ownership cost…
But much more of the risk
Assume $10m development could be over $100m total ownership

Legacy Systems Have Substantial Costs That Modernization May Offset



Open Source

Open Source Software (OSS)

https://www.slideshare.net/opensourceacademy/power-point-presentation-on-open-source-software

Computer **software** that is available in **source** code form:

Source code and certain other rights normally reserved for copyright holders are provided under a license

that permits users to study, change, improve and at times also to distribute the **software**.

- Term (OSS) now MISused for many license types
- Open Use
- Black Box Use
- Black Box from Vendor
- Open Use developmental

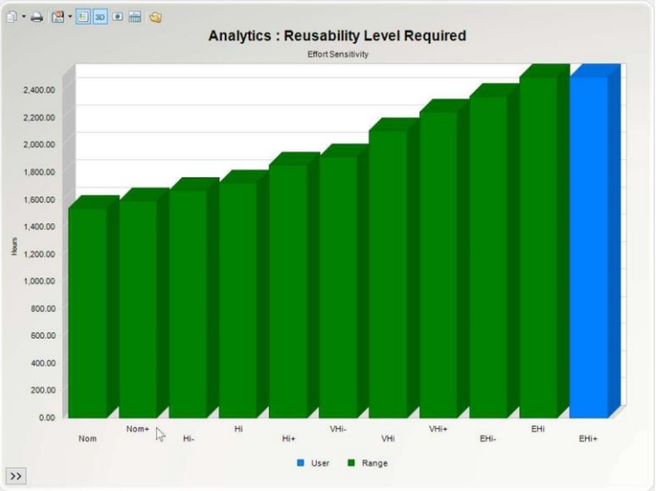
US Law Considers Open Source Software Commercial But Licensing Varies

Public Domain	• Anyone can do anything • Doesn't mean it is safe
Permissive	• Minimal requirements on software modification or redistribution • AKA: Apache Style or BSD Style or MIT license
Lesser General Public License	• Any user must be given the right to modify • Your developed code might have to be exposed
Copyleft	• When redistributing the program, you cannot add restrictions to deny other people the central freedoms of free software
Proprietary	• All rights reserved • Software may not be modified or redistributed

USOMB M-16-21 Promote Reuse & Open Source.. But

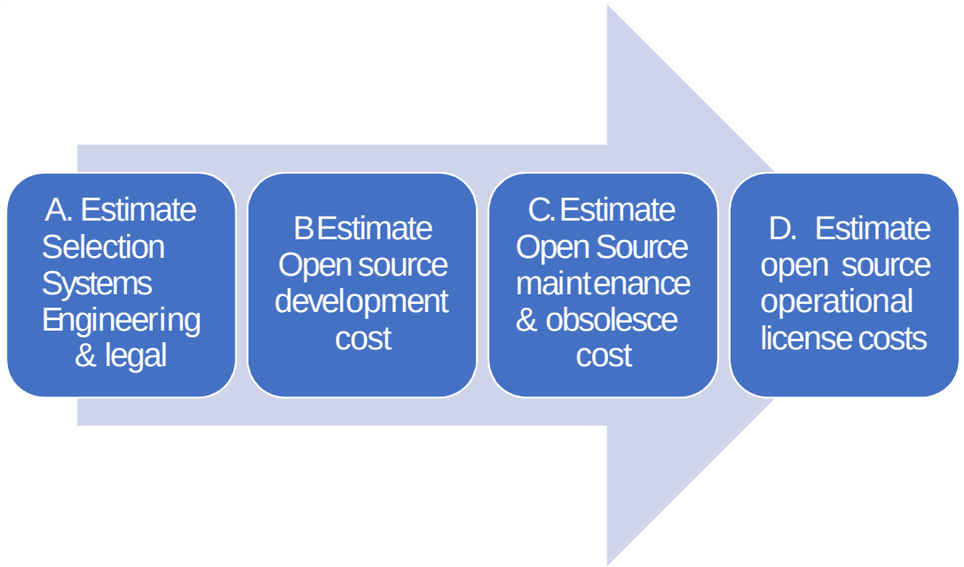
- M-16-21, OMB's Federal Source Code Policy: Achieving Efficiency, Transparency, and Innovation through Reusable and Open Source Software requirements

- (1) all custom-developed code must be available for reuse within the government subject to limited exceptions (e.g., national security) and
- (2) Pilot program, federal agencies must release at least 20 percent of their custom-developed code to the public as OSS
- Goal is to promote reuse as a cost saving measure to reduce redundant coding



- Problem: Up to 63% increase in initial development effort to make software reusable in the first place

Estimate Open Source Costs



- Sizing can be functional, SLOC, COTS Cognition
  - Depending on source
- One study estimated within 2% using functions in documentation table of contents

Open Source Summarized Costing Process

	X.1 Systems Engineering	X.2 Development	X.3 Maintenance	X.4 Additional Costs
Open Use	Compute Effective Size, Functionality or SLOC, or use Systems Engineering model	Use Effective Size	Cost Model with Use Total or Effective Size	Licensing Cost
Black Box Use	Compute Effective Size, Functionality or SLOC	Similar to Open Source Open Use	Same as Open Use	Licensing Cost
Black Box Use from Vendor	Compute Effective Size, Functionality or SLOC	Various, good approach is function points	Same as Open Use	Licensing Cost plus Support
Open Use Developmental	Compute Total, Effective, New Size	Estimate as Development	Same as Open Use	May have licensing cost

Static Code Analysis Can Help Quantify Open Source Quality (Source Cast Software)

- **Reliable measurement:** CISQ Software Sizing and Quality Standards.

- **Automated:** Sizing AFP and AEFP by a tool which remove subjectivity.

- **Consistent:** Same rules and assumption from version to version.

- **Business relevant:** Risk adjusted Productivity with normalization for trending.

- **Fact based measurement:** All metrics quality, quality or complexity should be accessible by both side (client and vendor).

- **SLA or KPI:** All metrics quality, quality or complexity can be reuse in some contract focus on the evolution.

Coverity and Open Source Projects

- Coverity is providing a free service for open source projects

741 projects
2.5M LOC

Coverity Scan

44,641 defects are fixed

(Only 10.2% of identified defects are false positives in 2013)

How To Compute Effective Size For Open Source

Step 1: Set Redesign Factors

Redesign Breakdown

Formula: 0.22*A+0.78*B+0.5*C+0.3*(1-(0.22*A+0.78*B))*(3*D+E)/4

Result Redesign Percentage: 0.00% 0.00% 0.00%

Weight	Redesign Component	Least	Likely	Most	Percentage of the existing software that...
0.22	Architectural Design Change	0%	0%	0%	... requires architectural design change
0.78	Detailed Design Change	0%	0%	0%	... requires detailed design change
0.5	Reverse Engineering Required	0%	0%	0%	... requires reverse engineering
0.225	Redocumentation Required	0%	0%	0%	... requires redocumentation
0.075	Revalidation Required	0%	0%	0%	... requires revalidation with the new design

Step 2: Set Reimplementation Factors

Reimplementation Breakdown

Formula: .37* A + .11*B + .52*C

Result Reimplementation Percentage: 0.00% 0.00% 0.00%

Weight	Inputs	Least	Likely	Most	Percentage of the existing software that...
0.37	Recoding Required	0%	0%	0%	... requires actual code changes
0.11	Code Review Required	0%	0%	0%	... requires code reviews
0.52	Unit Testing Required	0%	0%	0%	... requires unit testing

Step 3: Set Retest Factors

Retest Breakdown

Formula: .10*A + .04*B + .13*C + .25*D + .36*E + .12*F

Result Retest Percentage: 0.00% 0.00% 0.00%

Weight	Inputs	Least	Likely	Most	Percentage of the existing software that...
0.1	Test Plans Required	0%	0%	0%	... requires test plans to be rewritten
0.04	Test Procedures Required	0%	0%	0%	... requires test procedures to be identified and written
0.13	Test Reports Required	0%	0%	0%	... requires documented test reports
0.25	Test Drivers Required	0%	0%	0%	... requires test drivers and simulators to be rewritten
0.36	Integration Testing	0%	0%	0%	... requires integration testing
0.12	Formal Testing	0%	0%	0%	... requires formal demonstration testing

Open Source Obsolescence Is A Cost / Schedule Risk

- OpenOffice… Open Source Competitor to Microsoft Office
- Developers moved to LibreOffice
- Openoffice seeing little development and potentially drawing potential LibreOffice users to “a defunct piece of software” PCWorld
  http://www.pcworld.com/article/2977112/software-productivity/why-you-should-ditch-openoffice-and-use-the-free-libreoffice-suite.html
- A post on the Apache OpenOffice blog from back in April, 2015 pleads for more developers. “OpenOffice is currently in the need to expand the number of its developers,” it says. “We believe that seeing our release cycle slow down would damage the whole OpenOffice ecosystem.”

For Non-Mainstream Open Source Obsolescence risk is high and must be costed

Open Source Classification & Estimation Approach

Used as it, Non-Developmental Software (NDI)

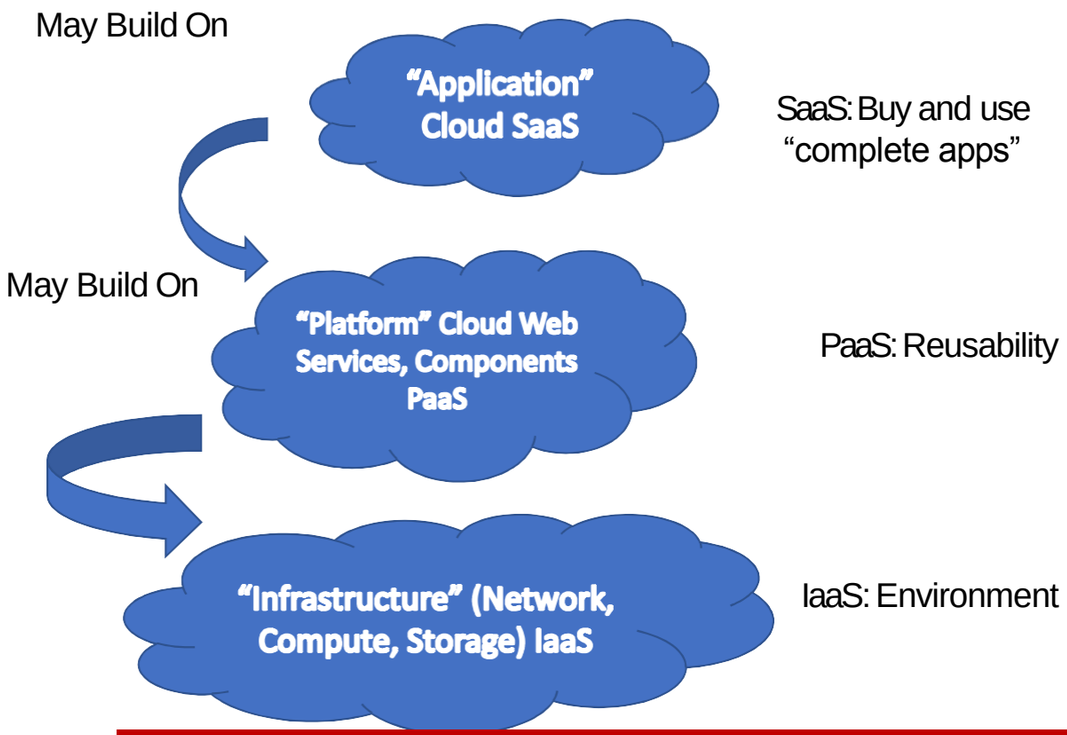
- Systems engineering / Selection
- **COTS Cognition**
- Integration & Test
- Maintenance
- Possible data migration cost

- **Changed (Developmental software)**
- Systems engineering / Selection
- **Reuse / Mods**
- Integration & test
- Maintenance
- Possible data migration cost

Availability does not guarantee suitability, reliability, or information assurance

Cloud Costing

NIST - Cloud Service Models



Service Models Have Blurred Together and are no longer a valuable cost driver

We Know How To Estimate Cloud Costs and ROI

- Cloud isn't so different
  - Alternate approaches to cost, ROI or business case NOT needed
- BUT.. Systems engineering costs can skyrocket
- Many jobs change, don't dissapear
- Important to identify costs that will increase as well as decrease.. E.g. bandwidth
- Risk must be factored in
  - E.g. data inaccessibility
- SaaS and on-premises setup costs could be similar..
- BEWARE the shopping list on cloud sites

When cloud computing is perceived as a panacea, with assumed savings, it's buyer beware

On Premises Often Cheaper (IaaS Example)

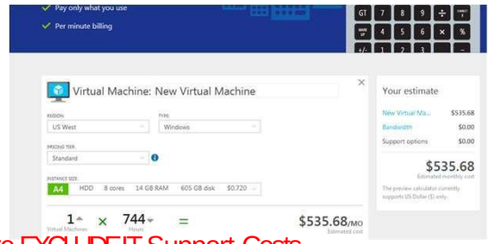
In-house(Buy) $8,873 total 5 years

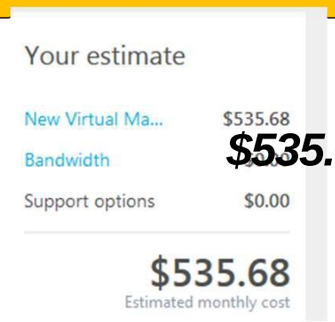
Replacement Server: Dell PowerEdge T430 - **$3,943**
Back-up Software License and agents (2 options)
1. Symantec Back-up Exec: **$2,822** (includes 2014 vr and 4 agents)
2. Dell NetVault - **$2,108** (includes 1 TB capacity)

Note: Costs Here EXCLUDE IT Support Costs

$8,873

Cloud $32,115 Total $6,423 Annual





$535.68 * 12

Note: Costs Here EXCLUDE IT Support Costs

Cloud Solutions Still Have Major Organizational Responsibilities & Costs

	IaaS	PaaS	SaaS
Corporate Data	Organization	Organization	Organization
Archival Backups	Organization	Organization	Organization
Local user support	Organization	Organization	Organization
Source Code	Organization	Organization	Vendor
Application Configuration	Organization	Organization	Maybe
Programming Languages	Organization	Vendor	Vendor
Frameworks	Organization	Vendor	Vendor
Containers	Organization	Vendor	Vendor
Operating System	Vendor	Vendor	Vendor
Hardware	Vendor	Vendor	Vendor
Service level agreements	Difficult or impossible	Difficult or impossible	Difficult or impossible

Note The Line between IaaS and PaaSis blurring to the point that is generally NOT a cost driver

Cloud Selection & Costing Process

1. Systems Engineering:

- Identify platform (e.g. Private, hybrid, private)
- Number VM's
- Bandwidth
- Service level
- Additional resources
- Identify security considerations

2. Estimate Migration Costs

- Software Development
- Conversion
- Operations

3. Obtain initial supplier costs

- Virtual machines
- Storage costs
- Bandwidth
- Backup (hot, automatic, rollover)

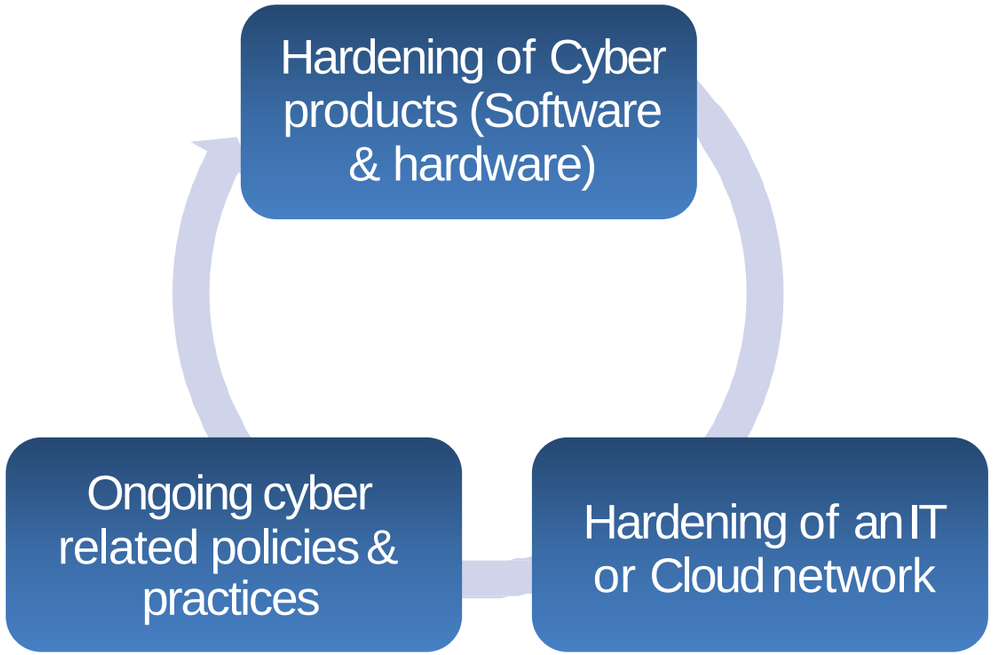
4. Estimate cost range

Some Gottchas in Cloud Costing

- Reliability requirements can double cloud resources needed
- Security
- Hot backup can double cloud resources
- Is backup in cloud sufficient
- Will timing work with application being modernized
- $6.19 per hour may sound like a bargain… but that can be $54k per year

Cyber Security

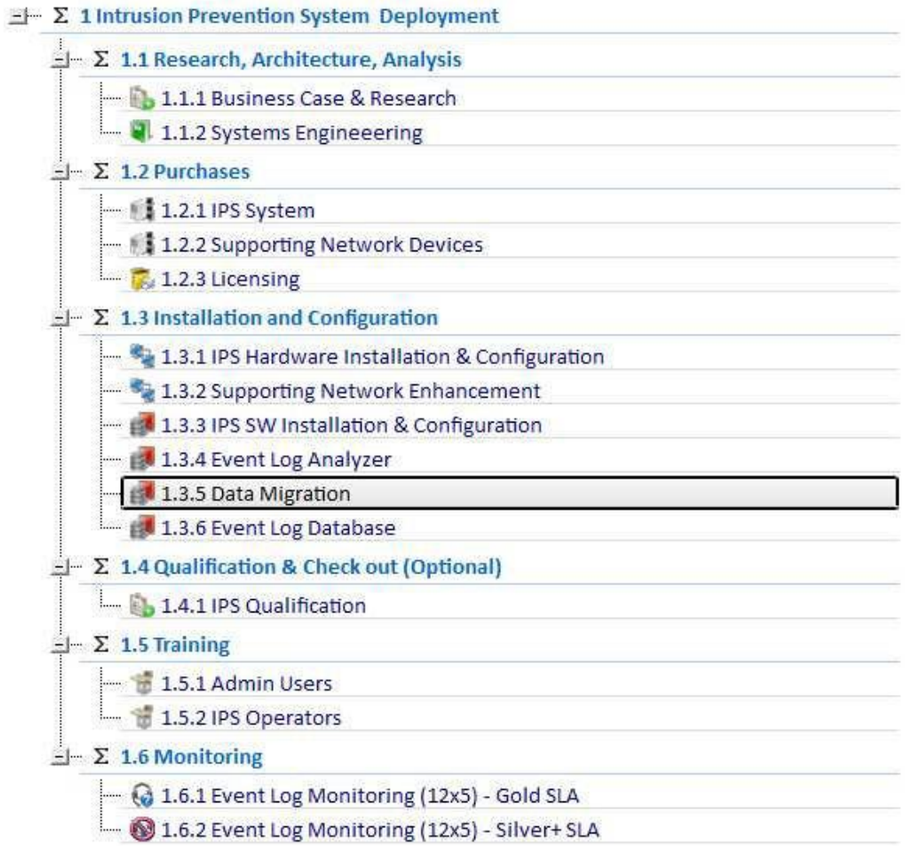
Cybersecurity Costing Includes Software, Hardware, IT & Policy



Above costs don't include cost impact of breaches (Galorath studying costing breach impact)

Cyber Example Cost Breakdown

(Deployment of an Intrusion Prevention System)



Galorath Cyber Security Cost Data Collection In 3rd Year

Category	Sub Category	Application	Human/Technical/Both (0/1/2)	Identify	Protect	Detect	Respond	Recover	Least	Likely	Most	Unit (cost per)	Least	Likely	Most
Data Security	Data Encryption	Portable Encrypting Hard Drive 10T	1	0	1	0	0	0	N/A	N/A	N/A	N/A	$818.00	$1,105.50	$1,39
Email Security	Email Encryption	DomainKeys Identified Mail (DKIM)	1	0	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Email Security	Email Encryption	Integrated Data Protection	1	0	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Email Security	Email Encryption	SaaS Delivery and Integrations	1	0	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Email Security	Email Encryption	Secure Email Gateway (SEG)	1	1	1	0	0	0	N/A	N/A	N/A	N/A	$35,869.02	-	$91,4
Endpoint Security	Application Control	Anti-Spam	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Application Control	Anti-Virus	1	1	1	1	1	0	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Biometric (Biological)	Fingerprint	2	0	1	1	0	0	$39.99	$637.50	$2,250.00	machine	N/A	N/A	N/A
Endpoint Security	Biometric (Biological)	Iris	2	0	1	1	0	0	$190.00	$1,259.67	$2,275.00	machine	N/A	N/A	
Endpoint Security	Biometric (Biological)	Palm	2	0	1	1	0	0	$369.99	$7,900.00	$13,770.35	machine	N/A	N/A	
Endpoint Security	Endpoint Protection P	EDR (Endpoint Detection and R	2	1	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Endpoint Protection P	Endpoint encryption	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Endpoint Protection P	Whitelist	2	1	1	1	0	0	N/A	N/A	N/A	N/A	$0.00	$3,500.00	$650,000.0
Endpoint Security	Host Intrusion Preven	HIPS PCU	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Host Intrusion Preven	HIPS server-side	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endpoint Security	Password Manageme	Access Management	2	1	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Endpoint Security	Password Manageme	Password Control	2	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	
Identity Governanc	Federated Identity	Single Sign on Service	1	1	1	1	0	0	N/A	N/A	N/A	N/A	32 1 - 100 seats	1001 seats	952.64 1001

			Protected Systems							Threats Addressed					
Category	Sub Category	Application	Computer	Printer	Cloud	Phone	Tablet	Server	Embedded	Virus	Malware	Trojan Horse	Password Att	Phishing	Hacking
Data Security	Data Encryption	Portable Encrypting Hard Drive 10T	1	0	0	0	0	0		0	0	0	0	0	
Email Security	Email Encryption	DomainKeys Identified Mail (DKIM)	1	0	1	0	0	1		1	1	1	0	0	1
Email Security	Email Encryption	Integrated Data Protection	1	0	1	1	1	1		1	1	1	0	0	1
Email Security	Email Encryption	SaaS Delivery and Integrations	0	0	1	0	0	1		1	1	1	0	0	0
Email Security	Email Encryption	Secure Email Gateway (SEG)	1	1	1	0	0	1		1	1	1	0	1	0
Endpoint Security	Application Control	Anti-Spam	1			1	1	0		1	1	1		1	0
Endpoint Security	Application Control	Anti-Virus	1	1		1	1	1		1	1	1		1	1
Endpoint Security	Biometric (Biological)	Fingerprint													
Endpoint Security	Biometric (Biological)	Iris													
Endpoint Security	Biometric (Biological)	Palm													
Endpoint Security	Endpoint Protection P	EDR (Endpoint Detection and R													
Endpoint Security	Endpoint Protection P	Endpoint encryption													
Endpoint Security	Endpoint Protection P	Whitelist	1	1	1	1	1	0		1	1	1	1	1	1
Endpoint Security	Host Intrusion Preven	HIPS PCU	1	0	0	0	0	0		1	1	1	1	1	1
Endpoint Security	Host Intrusion Preven	HIPS server-side	0	0	0	0	0	1							
Endpoint Security	Password Manageme	Access Management													
Endpoint Security	Password Manageme	Password Control													
Identity Governanc	Federated Identity	Single Sign on Service	1	1	1	1	1	1		0	0	0	1	0	1
Identity Governanc	LDAP repository	LDAP Proxies	1	0	1	0	1	1		0	0	0	1	0	1
Identity Governanc	LDAP repository	Meta-Directories	1	0	1	0	1	1		0	0	0	1	0	1
Identity Governanc	LDAP repository	Virtual-Directories	1	0	1	0	1	1		0	0	0	1	0	1
Identity Proofing S	Endpoint-centric	Caller ID	0	0	0	1	0	0		0	0	0	1	0	
Identity Proofing S	Endpoint-centric	Device fingerprint	1	0	1	1	1	1		1	1	1	1	0	
Identity Proofing S	Endpoint-centric	Geolocation analysis	1	0	1	0	1	1		1	1	1	1	0	1
Identity Proofing S	Endpoint-centric	Mobile location services	0	0	0	1	1	0		0	0	0	0	0	

Key Points

Modernization can be risky & substantially misestimated

Modernization approaches can reduce cost & risk

Open source, Agile, Cloud & other technologies can help… But they come at a cost (not free)

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