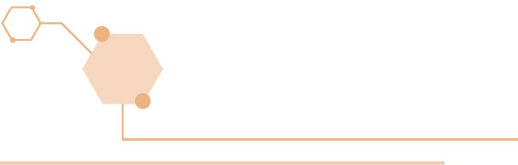


# Cost & Risk Analysis of Managing Modernization Projects With Cloud and Open Source Considerations

Dan Galorath, Galorath Inc.





# Key Points

Modernization can be costly but is often worth it versus starting over



Open Source Software is not FREE

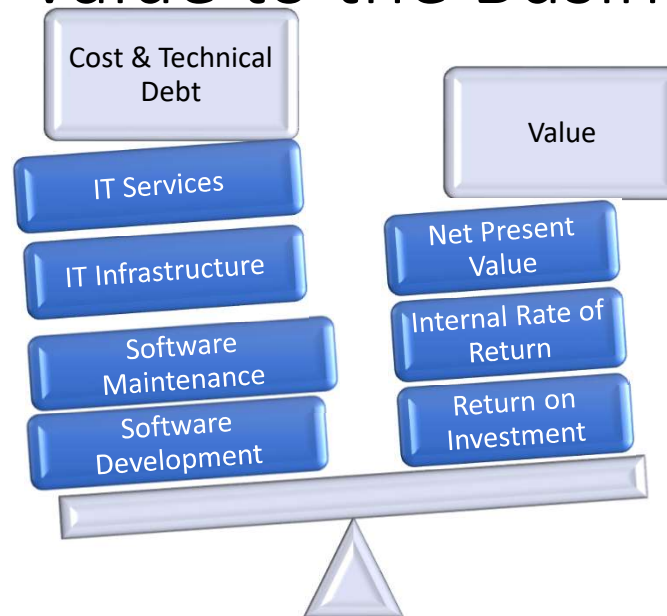


Open source, Agile, Cloud & other technologies can help... But they are not FREE





# 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

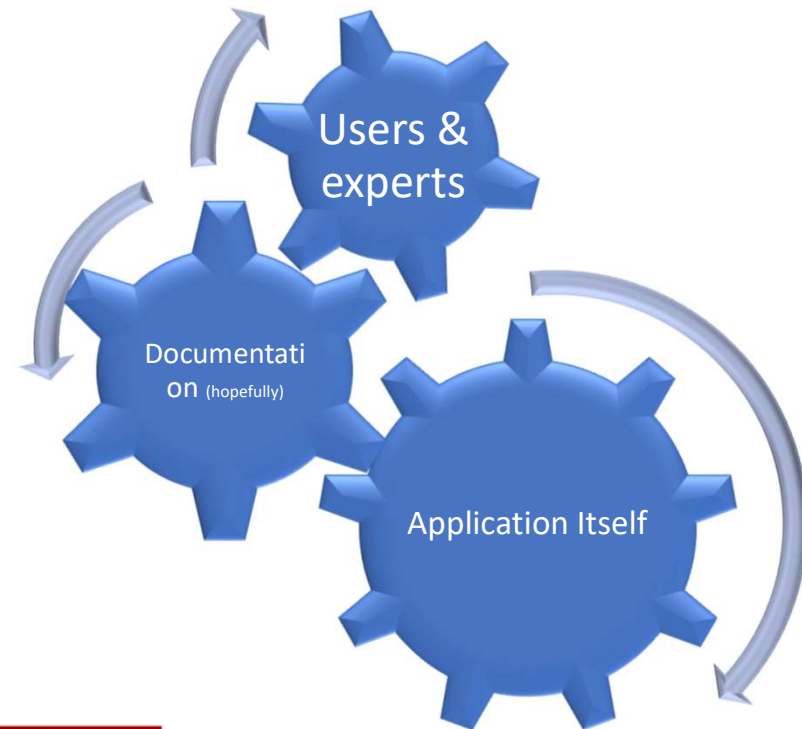
- Application providing value but legacy language, environment
- Rewrite a new application that meets the current and upcoming requirements



# Modernization Requires “As Is” Model

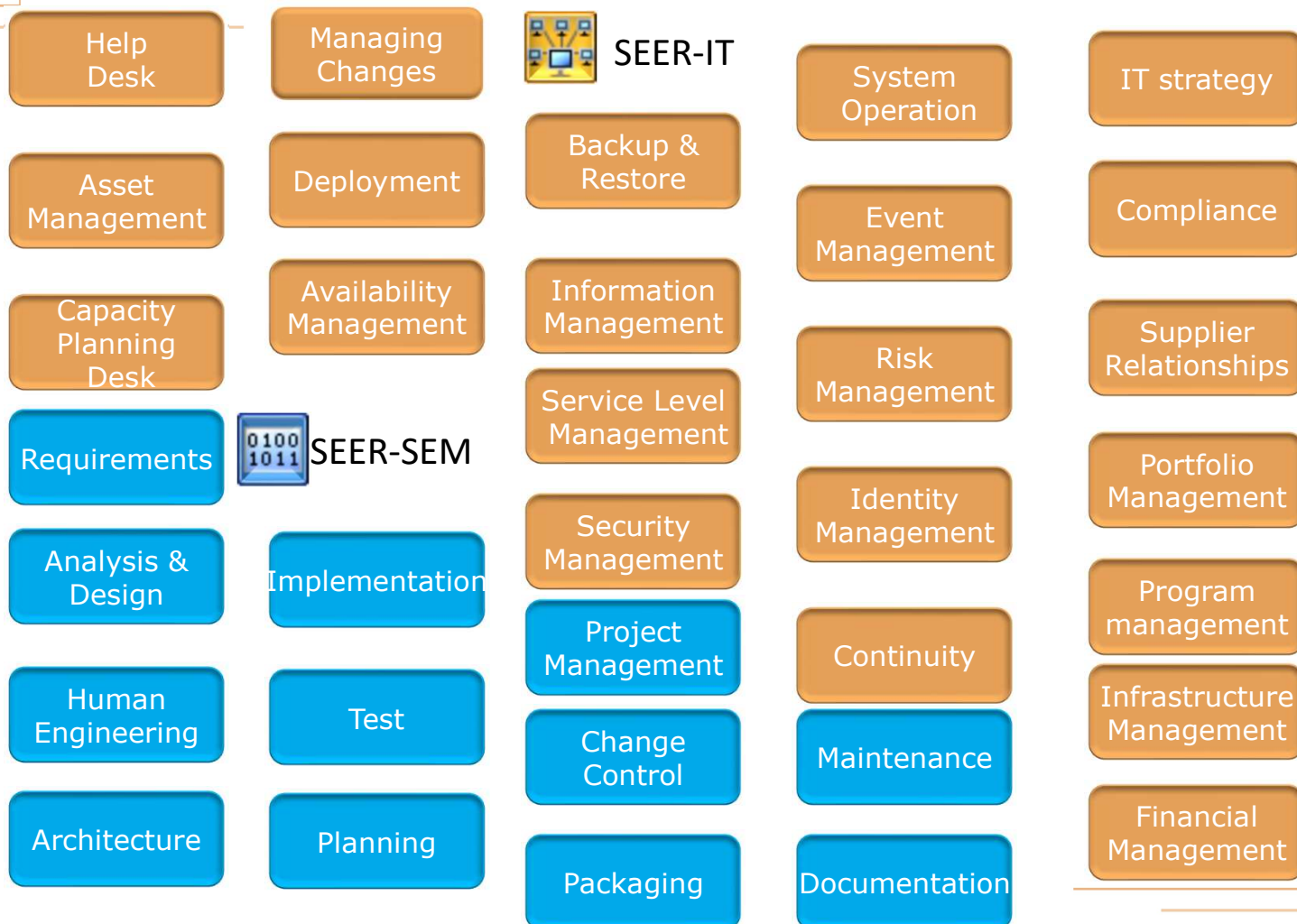
## Discovery Costs

- “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

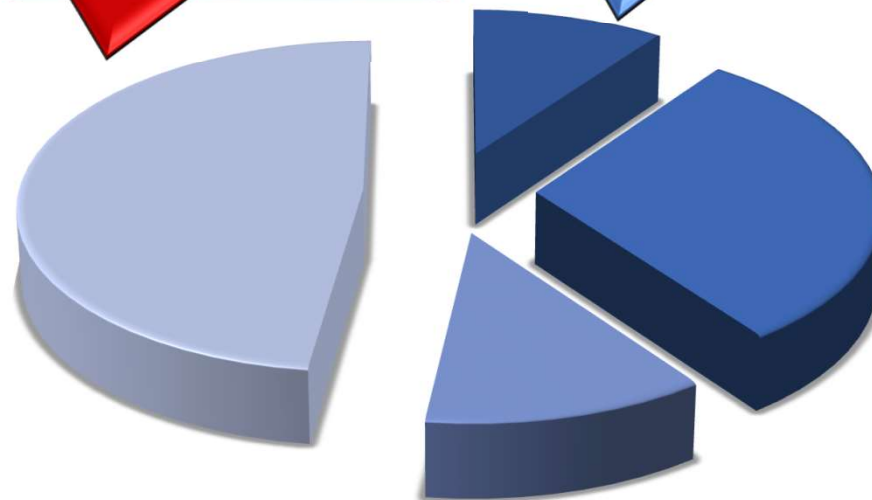
# Software & IT Should Both Be Estimated (Adapted from IBM)



# Modernization Costs Impact Total Ownership Cost

IT Services & Infrastructure Are Situational but Generally 60% of TOC

Development = Biggest Risk

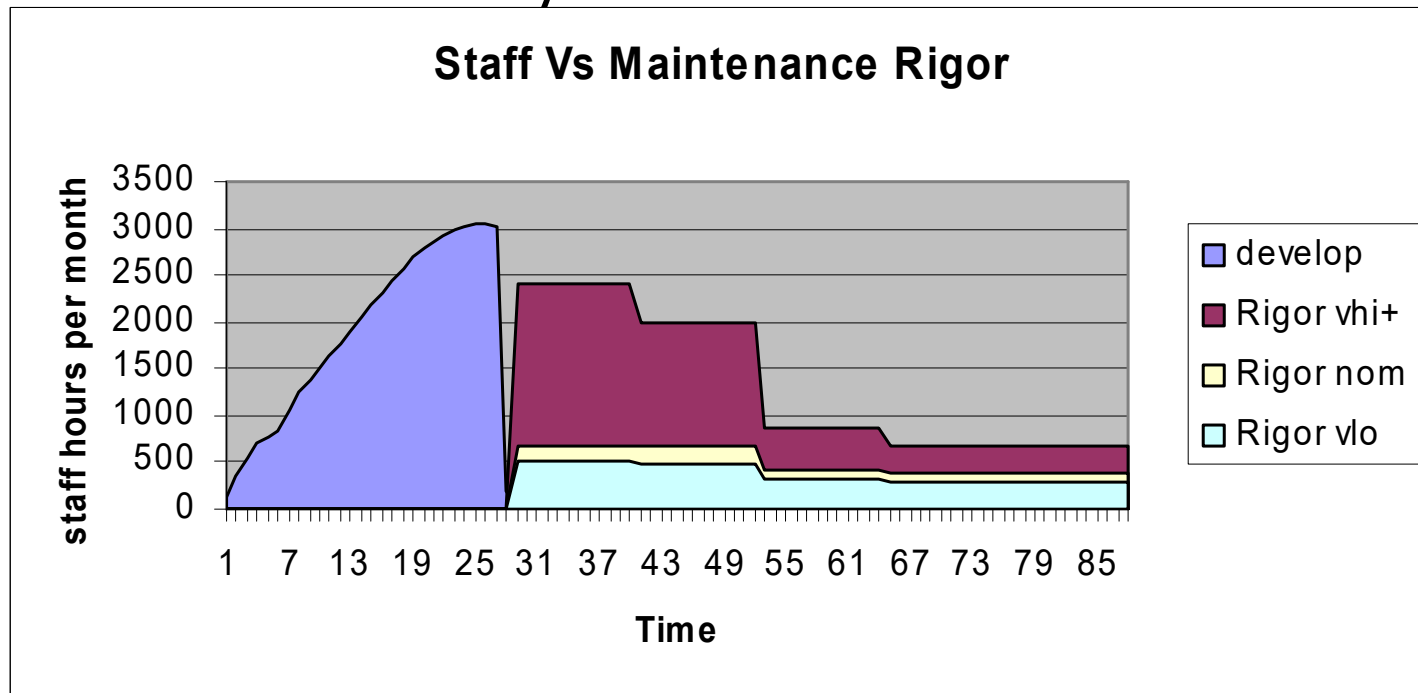


- Software Development
- Software Maintenance
- IT Infrastructure
- IT Services

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

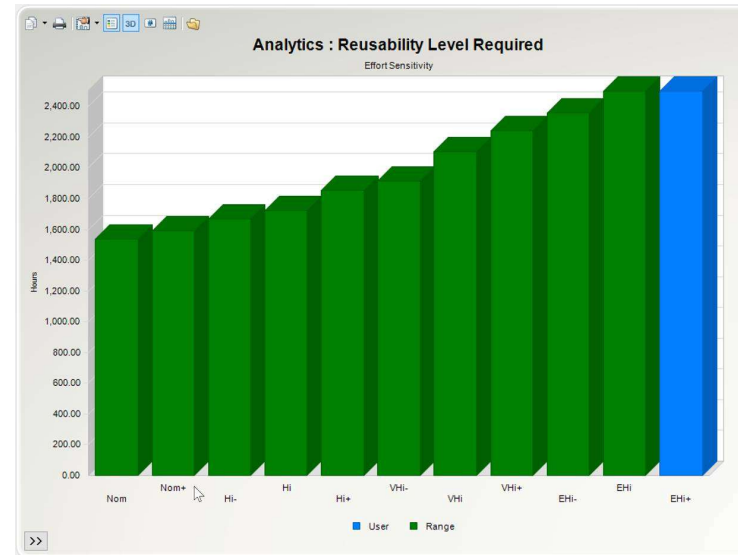
## Proprietary

- All rights reserved
- Software may not be modified or redistributed



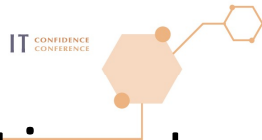
# US OMB M-16-21 Promote Reuse & Open Source.. But

- [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

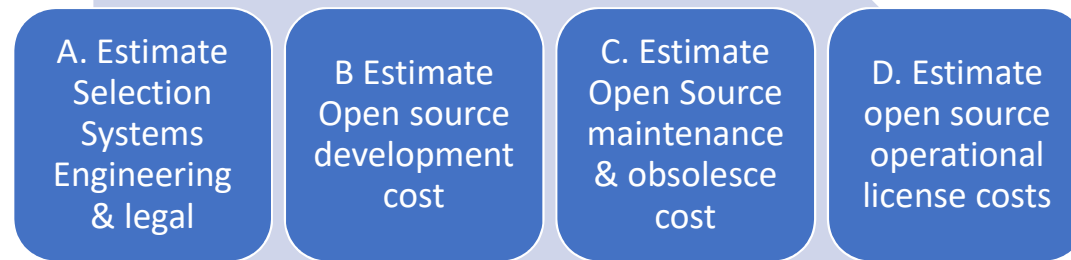


- Problem: Up to 63% increase in initial development effort to make software reusable in the first place





# 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.

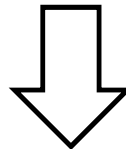


# Coverity and Open Source Projects

- 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

Result Redesign Percentage

Weight	Redesign Component
0.22	Architectural Design Change
0.78	Detailed Design Change
0.5	Reverse Engineering Required
0.225	Redocumentation Required
0.075	Revalidation Required

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

0.00% 0.00% 0.00%

Least	Likely	Most	Percentage of the existing software that...
0%	0%	0%	... requires architectural design change
0%	0%	0%	... requires detailed design change
0%	0%	0%	... requires reverse engineering
0%	0%	0%	... requires redocumentation
0%	0%	0%	... requires revalidation with the new design

## Step 2: Set Reimplementation Factors

### Reimplementation Breakdown

Formula

Result Reimplementation Percentage

Weight	Inputs
0.37	Recoding Required
0.11	Code Review Required
0.52	Unit Testing Required

$$.37*A + .11*B + .52*C$$

0.00% 0.00% 0.00%

Least	Likely	Most	Percentage of the existing software that...
0%	0%	0%	... requires actual code changes
0%	0%	0%	... requires code reviews
0%	0%	0%	... requires unit testing

## Step 3: Set Retest Factors

### Retest Breakdown

Formula

Result Retest Percentage

Weight	Inputs
0.1	Test Plans Required
0.04	Test Procedures Required
0.13	Test Reports Required
0.25	Test Drivers Required
0.36	Integration Testing
0.12	Formal Testing

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

0.00% 0.00% 0.00%

Least	Likely	Most	Percentage of the existing software that...
0%	0%	0%	... requires test plans to be rewritten
0%	0%	0%	... requires test procedures to be identified and written
0%	0%	0%	... requires documented test reports
0%	0%	0%	... requires test drivers and simulators to be rewritten
0%	0%	0%	... requires integration 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” PC World  
<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



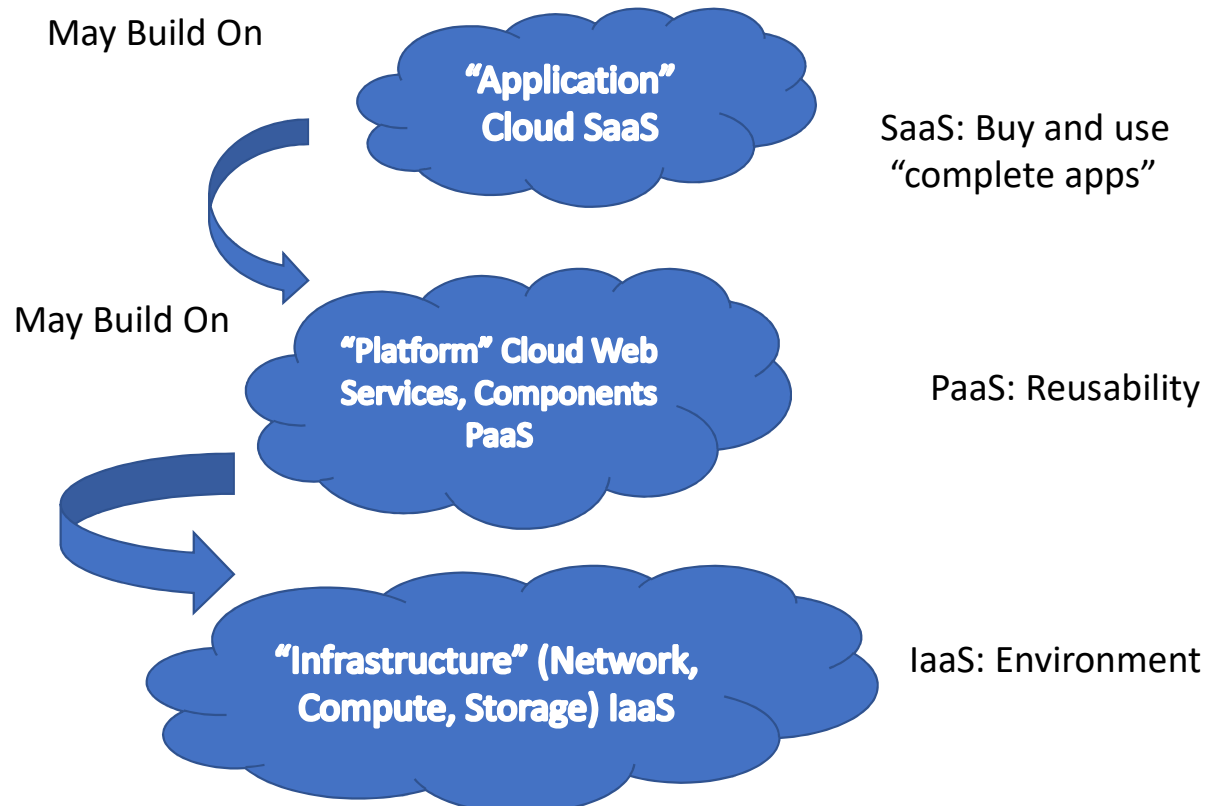
# Cloud Costing

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# 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 disappear
- 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)

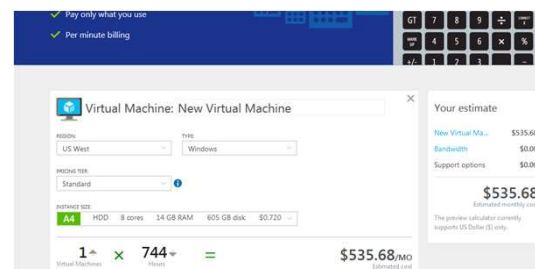
1. Symantec Back-up Exec: **\$2,822** (includes 2014 vr and 4 agents)

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**



Note: Costs Here EXCLUDE IT Support Costs

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Your estimate

New Virtual Ma... \$535.68

Bandwidth \$0.00

Support options \$0.00

**\$535.68 \* 12**

**\$535.68**  
Estimated monthly cost

# Cloud Solutions Still Have Major Organizational Responsibilities & Costs

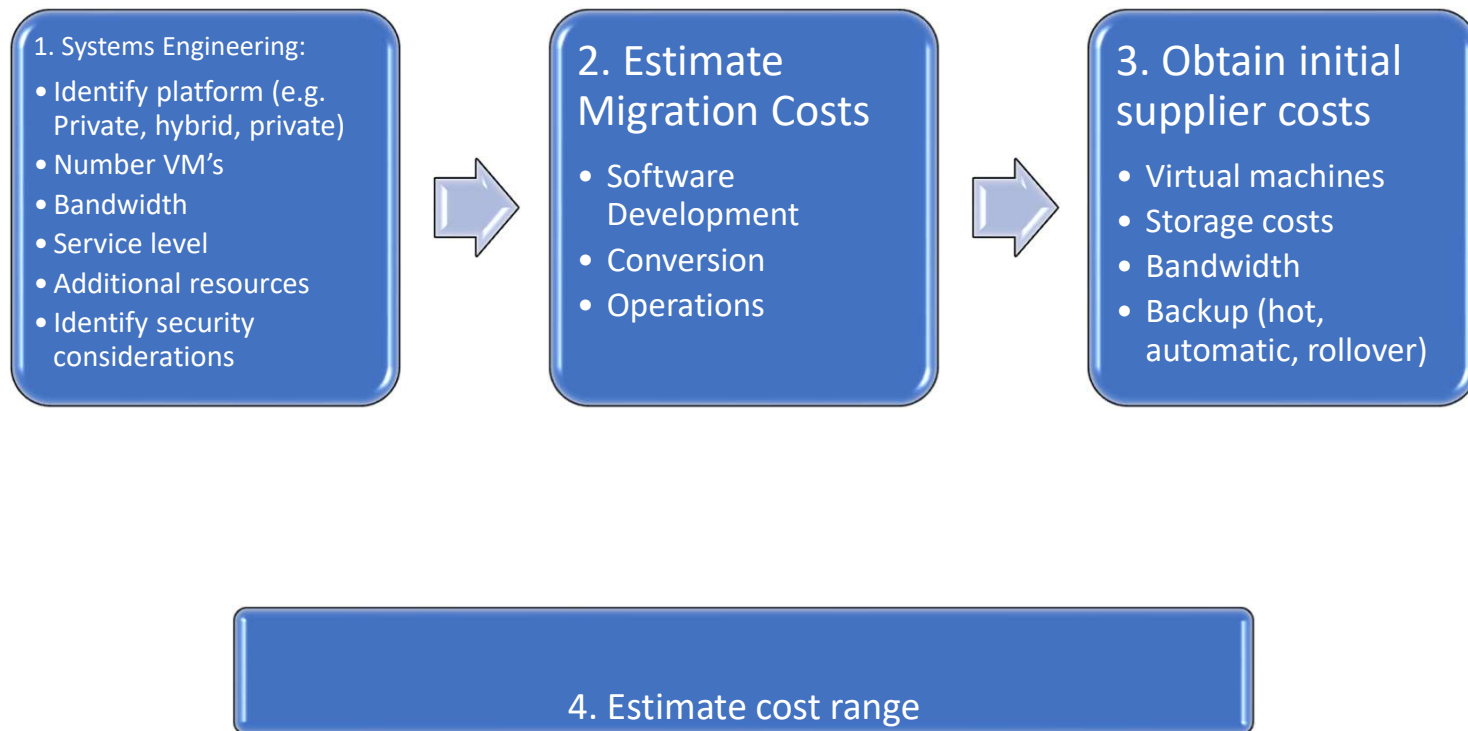
	IaaS	PaaS	SaaS
Corporate Data	Organization	Organization	Organization
Archival Backups	Organization	Organization	Organization
Local user support	Organization	Organization	Organization
Source Code	Organization	Organization	Vendor
Application Configuration	Organization	Organization	Maybe
Programming Languages	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 PaaS is blurring to the point that is generally NOT a cost driver





# Cloud Selection & Costing Process



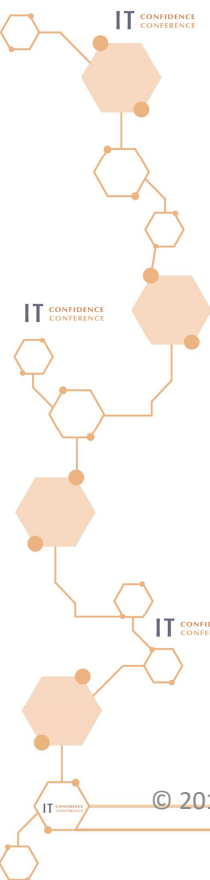


# Some Gottchas in Cloud Costing

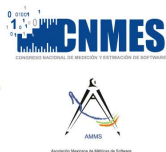
- Reliability requirements can double cloud resources needed
- Security
- Hot backup can double cloud resources
- Is backup in cloud sufficient
- Will timing work with application being modernized
- \$6.19 per hour may sound like a bargain... but that can be \$54k per year



# Cyber Security

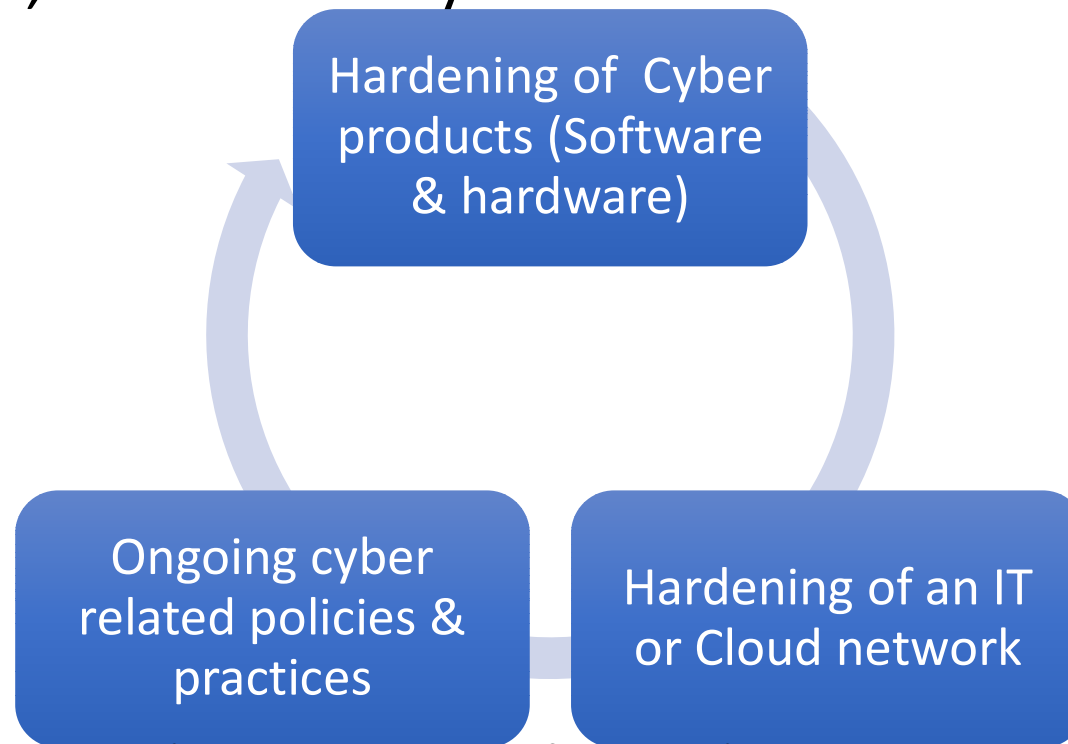


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# Cybersecurity Costing Includes Software, Hardware, IT & Policy



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



# Cyber Example Cost Breakdown (Deployment of an Intrusion Prevention System)

Σ	1 Intrusion Prevention System Deployment
Σ	1.1 Research, Architecture, Analysis
	1.1.1 Business Case & Research
	1.1.2 Systems Engineering
Σ	1.2 Purchases
	1.2.1 IPS System
	1.2.2 Supporting Network Devices
	1.2.3 Licensing
Σ	1.3 Installation and Configuration
	1.3.1 IPS Hardware Installation & Configuration
	1.3.2 Supporting Network Enhancement
	1.3.3 IPS SW Installation & Configuration
	1.3.4 Event Log Analyzer
	1.3.5 Data Migration
	1.3.6 Event Log Database
Σ	1.4 Qualification & Check out (Optional)
	1.4.1 IPS Qualification
Σ	1.5 Training
	1.5.1 Admin Users
	1.5.2 IPS Operators
Σ	1.6 Monitoring
	1.6.1 Event Log Monitoring (12x5) - Gold SLA
	1.6.2 Event Log Monitoring (12x5) - Silver+ SLA



# Galorath Cyber Security Cost Data Collection

In 3rd

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 10TB	1	0	1	0	0	0	N/A	N/A	N/A	N/A	\$818.00	\$1,105.50	\$1,330.00
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	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	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	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	-	\$91,400.00
Endpoint Security	Application Control	Anti-Spam	1	1	1	1	0	0	N/A	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	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	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	N/A
Endpoint Security	Endpoint Protection	EDR (Endpoint Detection and Response)	2	1	1	1	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endpoint Security	Endpoint Protection	Endpoint encryption	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endpoint Security	Endpoint Protection	Whitelist	2	1	1	1	0	0	N/A	N/A	N/A	N/A	\$0.00	\$3,500.00	\$650,000.00
Endpoint Security	Host Intrusion Prevention	HIPS PCU	1	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endpoint Security	Host Intrusion Prevention	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 Management	Access Management	2	1	1	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endpoint Security	Password Management	Password Control	2	1	1	1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Identity Governance	Federated Identity	Single Sign on Service	1	1	1	1	0	0	N/A	N/A	N/A	N/A	\$2.12	100 seats	952.64 1000 seats

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



# 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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