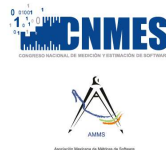


Cost & Risk Analysis of Managing Modernization Projects With Cloud and Open Source Considerations

Dan Galorath, Galorath Inc.





Key Points

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



Open Source Software is not FREE

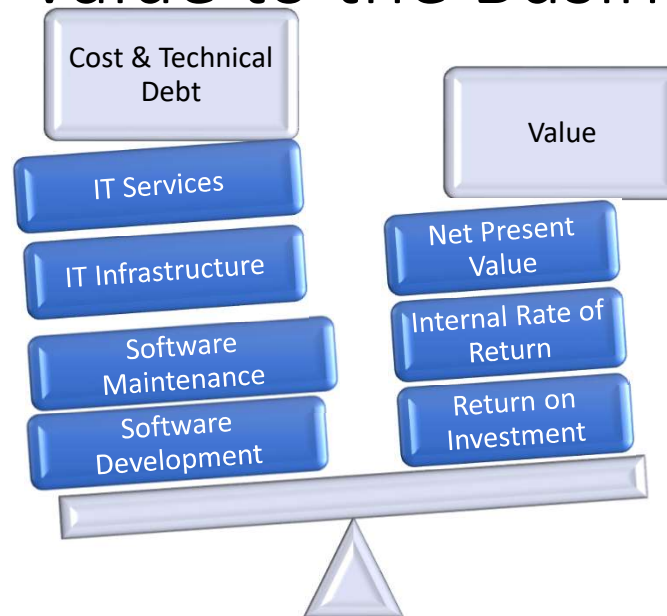


Open source, Agile, Cloud & other technologies can help... But they are not FREE





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 | <ul style="list-style-type: none">• Decommission if legacy app providing little value• Possibly roll some legacy functionality into consolidated modern application |
| Refactor | <ul style="list-style-type: none">• Preserve behavior by improving existing code• Possibly execute on new infrastructure (PaaS) |
| Replace | <ul style="list-style-type: none">• If legacy app providing value but commercial alternative can be better |
| Retain & Wrap | <ul style="list-style-type: none">• RETAIN if inexpensive or impractical to modernize• WRAP: modern wrapper around app - additional value & benefits e.g C# Java wrapper around COBOL app |
| Rehost | <ul style="list-style-type: none">• Viable functionality but Expensive to run• Move VM from on-premises to new environment E.g IaaS |
| Redevelop | <ul style="list-style-type: none">• Application providing value but legacy language, environment• Rewrite a new application that meets the current and upcoming requirements |

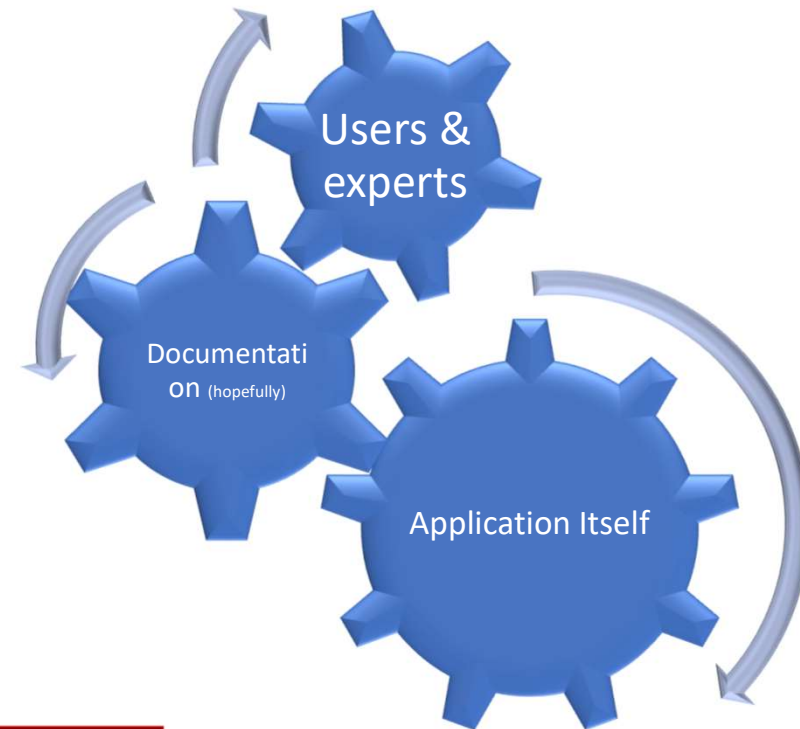




Modernization Requires “As Is” Model

Discovery Costs

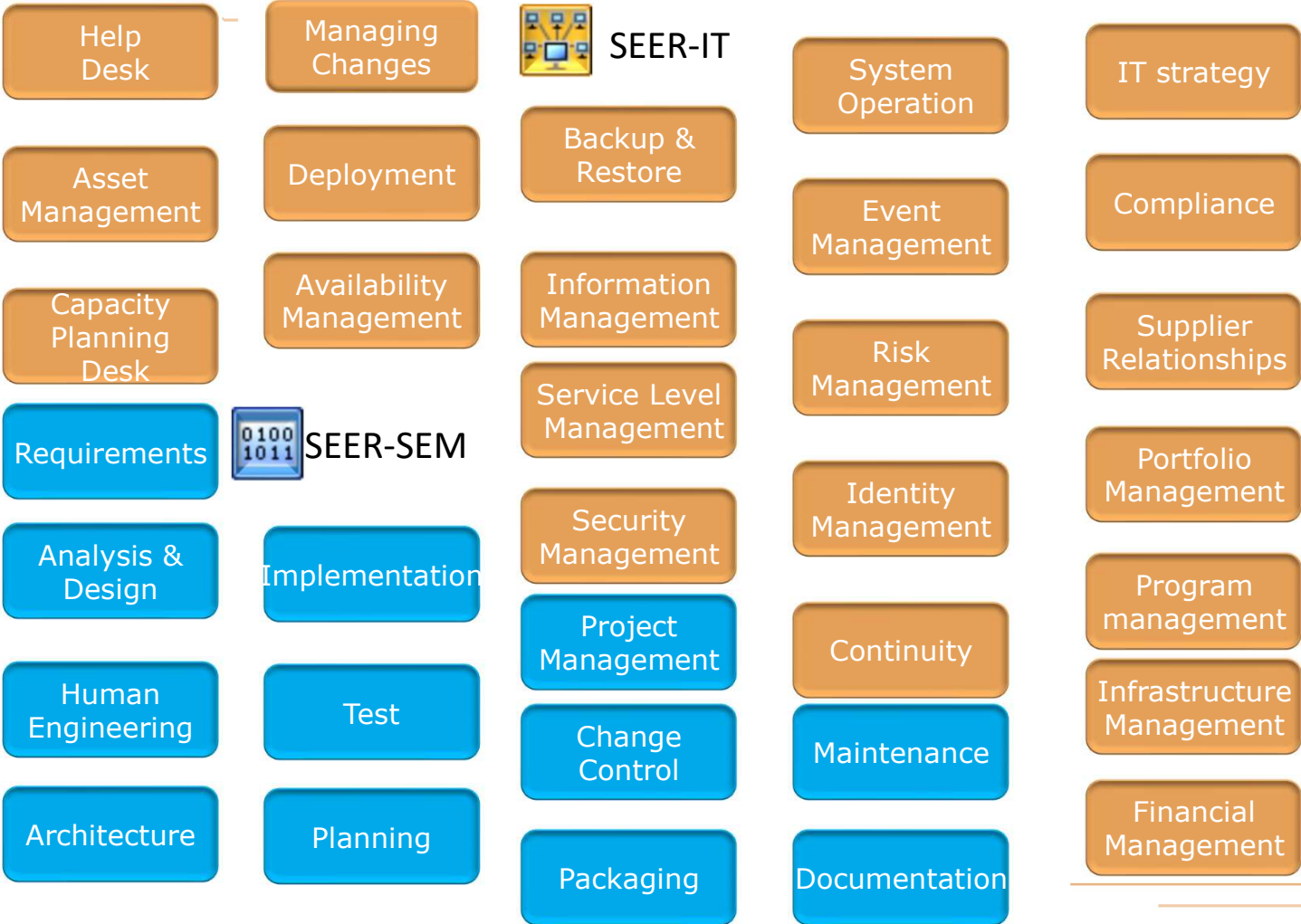
- “As Is” usually requires discovery (Systems Engineering) to mine knowledge
 - Business processes
 - Business rules & vocabulary
 - Logical data model models
 - Application logic
 - Physical data model
 - Program logic



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



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



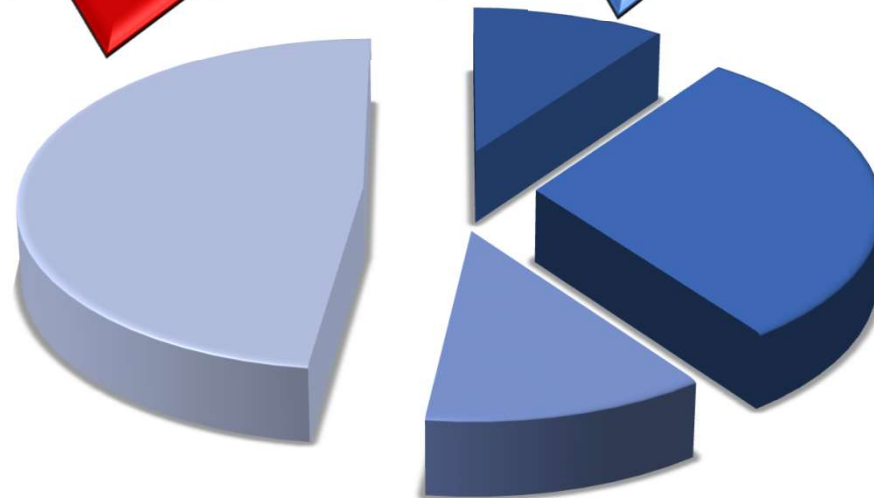


Modernization Costs Impact Total Ownership

Cost

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

Development = Biggest Risk



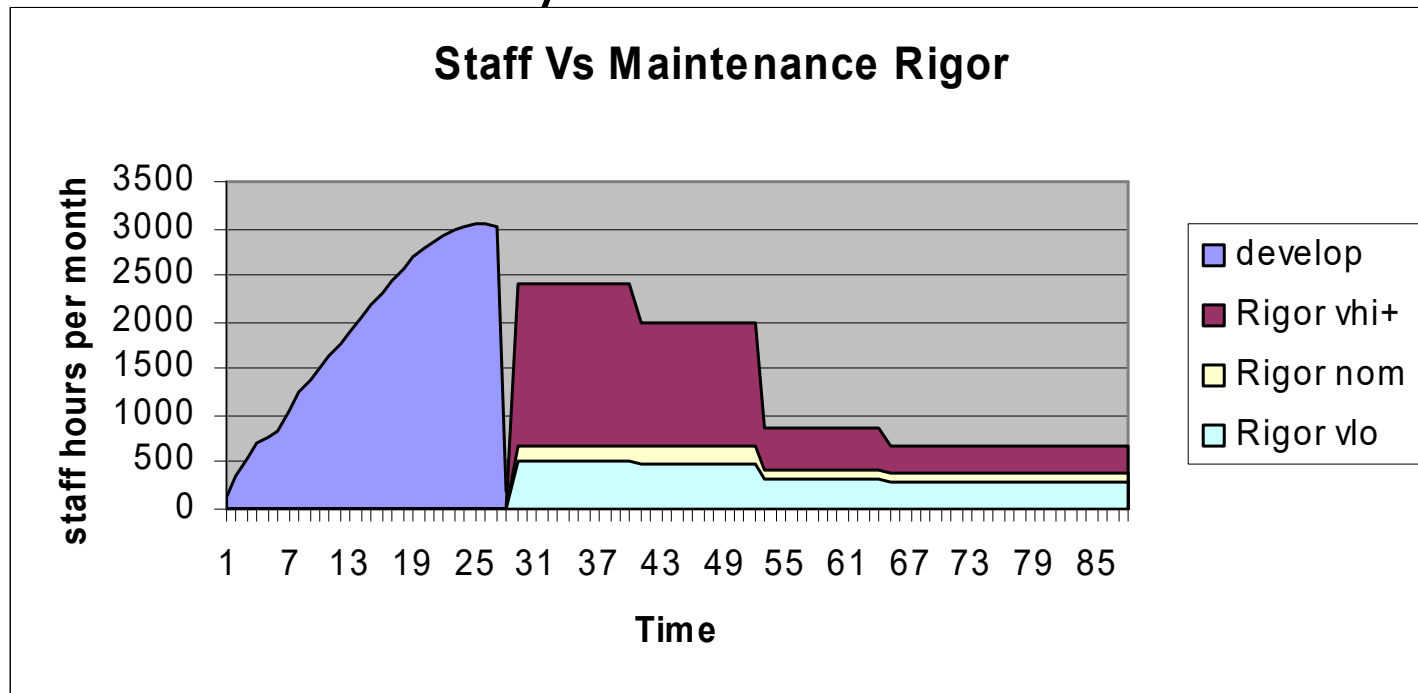
- Software Development
- Software Maintenance
- IT Infrastructure
- IT Services

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

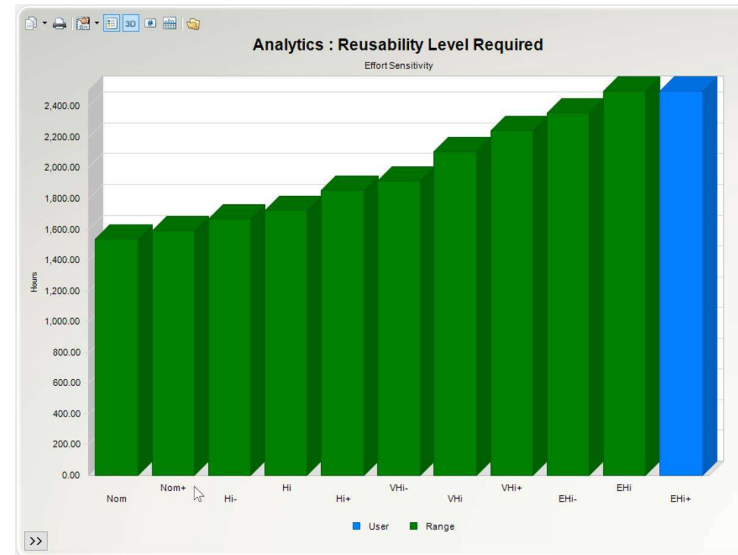
Proprietary

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



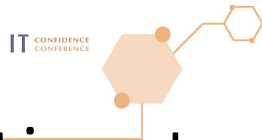
US OMB M-16-21 Promote Reuse & Open Source.. But

- [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

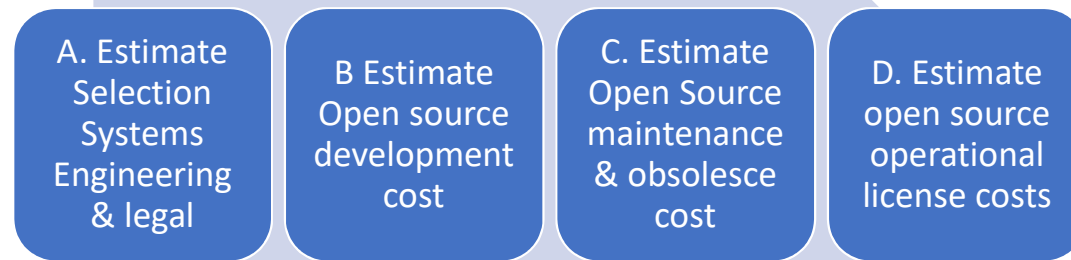


• Problem: Up to 63% increase in initial development effort to make software reusable in the first place





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 AAFP 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).



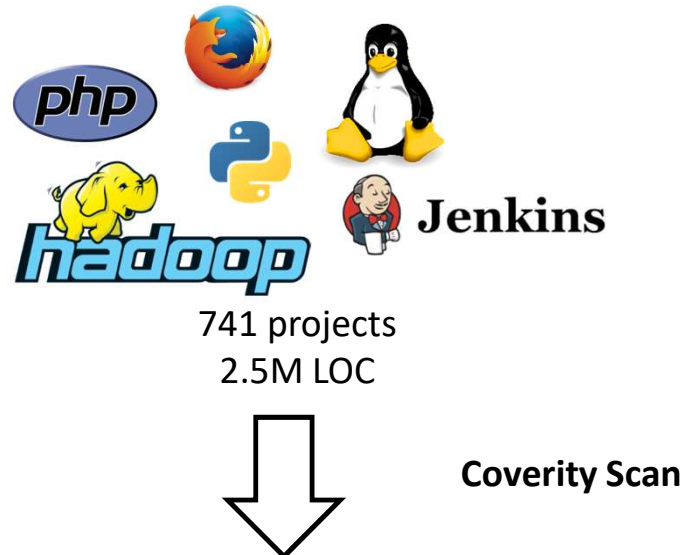
- **SLA or KPI:** All metrics quality, quality or complexity can be reuse in some contract focus on the evolution.





Coverity and Open Source Projects

- Coverity is providing a free service for open source projects



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 |
|--------|------------------------------|
| 0.22 | Architectural Design Change |
| 0.78 | Detailed Design Change |
| 0.5 | Reverse Engineering Required |
| 0.225 | Redocumentation Required |
| 0.075 | Revalidation Required |

| 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

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

Result Reimplementation Percentage

0.00% 0.00% 0.00%

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

| 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

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

Result Retest Percentage

0.00% 0.00% 0.00%

| 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 |

| 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

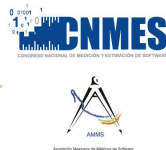




Cloud Costing

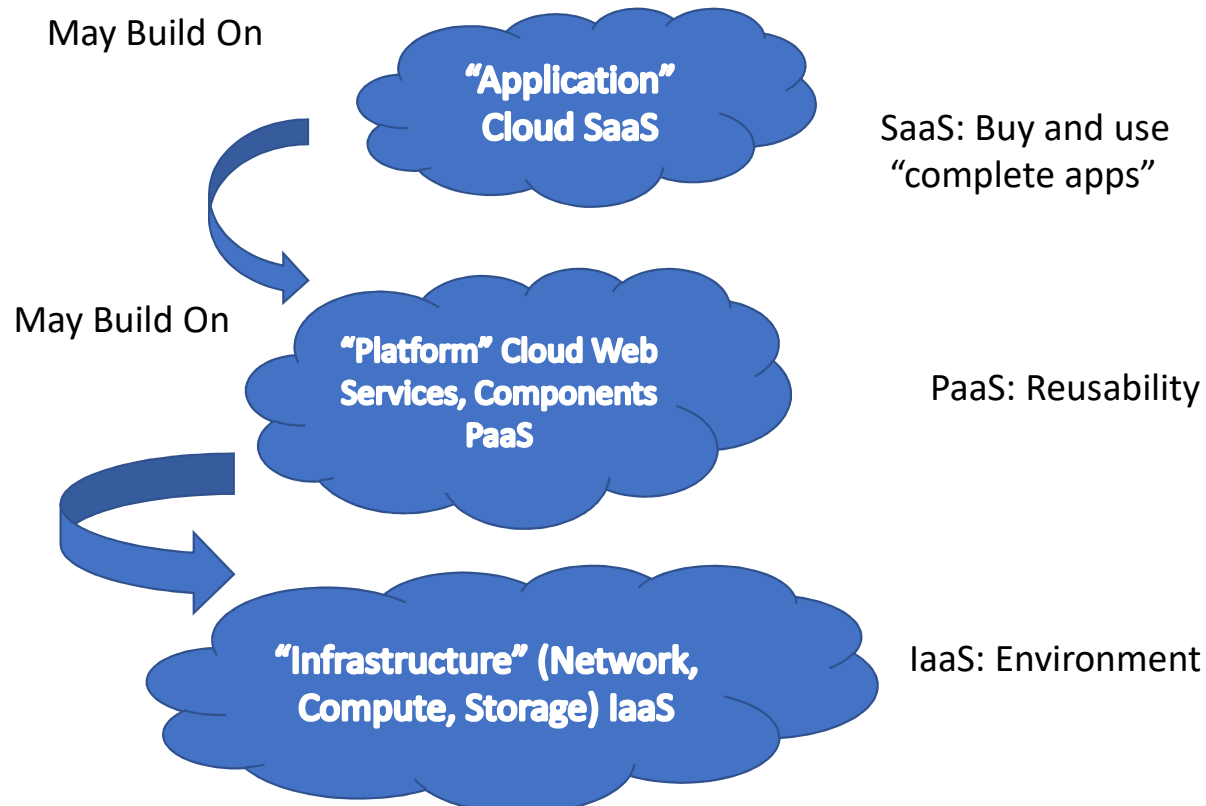


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NIST - Cloud Service Models



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)

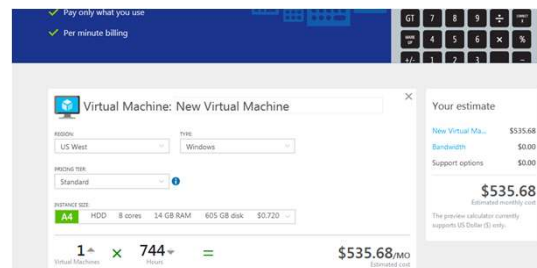
1. Symantec Back-up Exec: **\$2,822** (includes 2014 vr and 4 agents)

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



Your estimate

New Virtual Ma... \$535.68

Bandwidth \$0.00

Support options \$0.00

\$535.68 * 12

\$535.68

Estimated monthly cost

Note: Costs Here EXCLUDE IT Support Costs

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Cloud Solutions Still Have Major Organizational Responsibilities & Costs

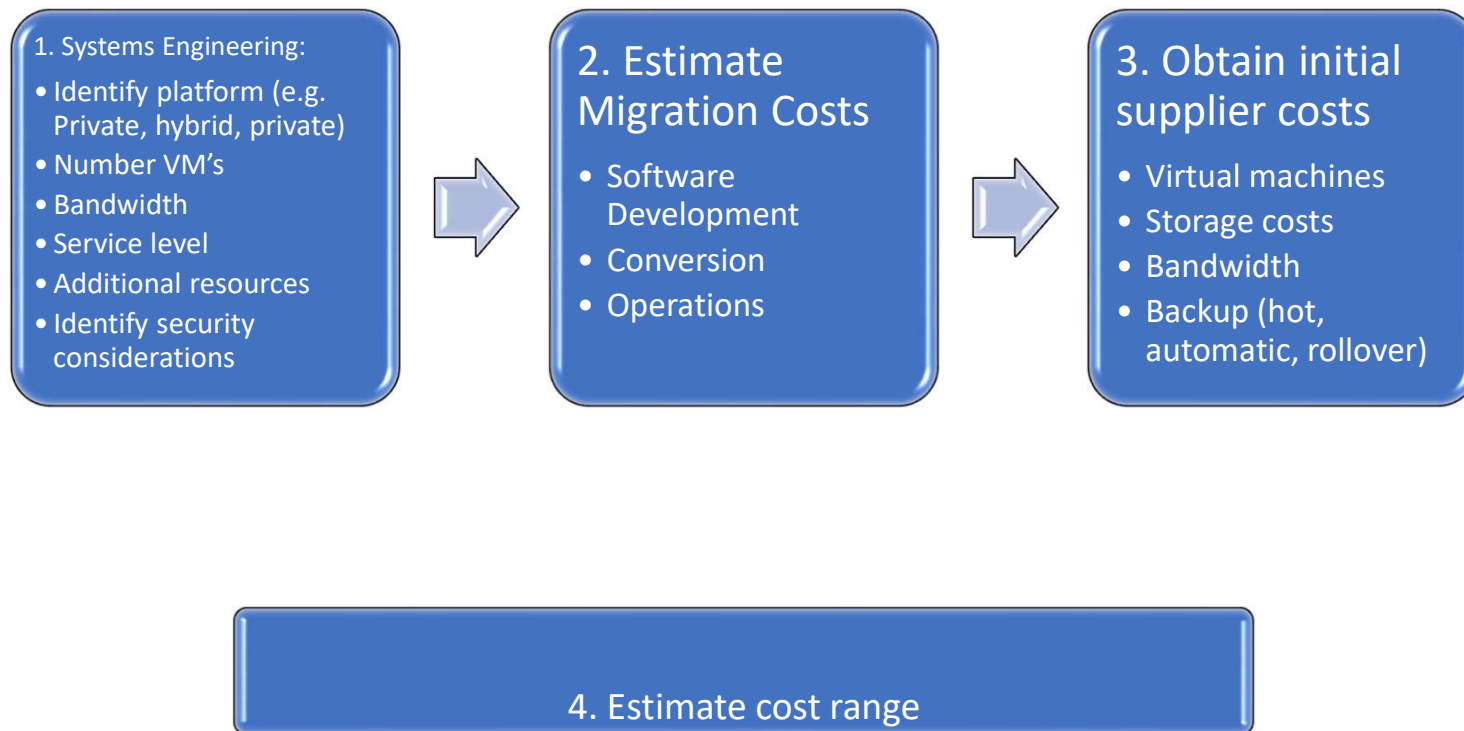
| | IaaS | PaaS | SaaS |
|---------------------------|-------------------------|-------------------------|-------------------------|
| Corporate Data | Organization | Organization | Organization |
| Archival Backups | Organization | Organization | Organization |
| Local user support | Organization | 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





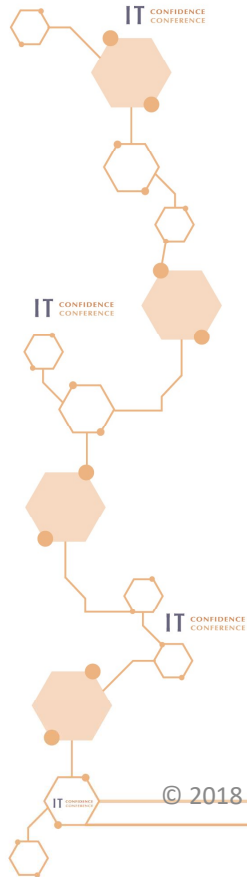
Some Gottchas in Cloud Costing

- 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

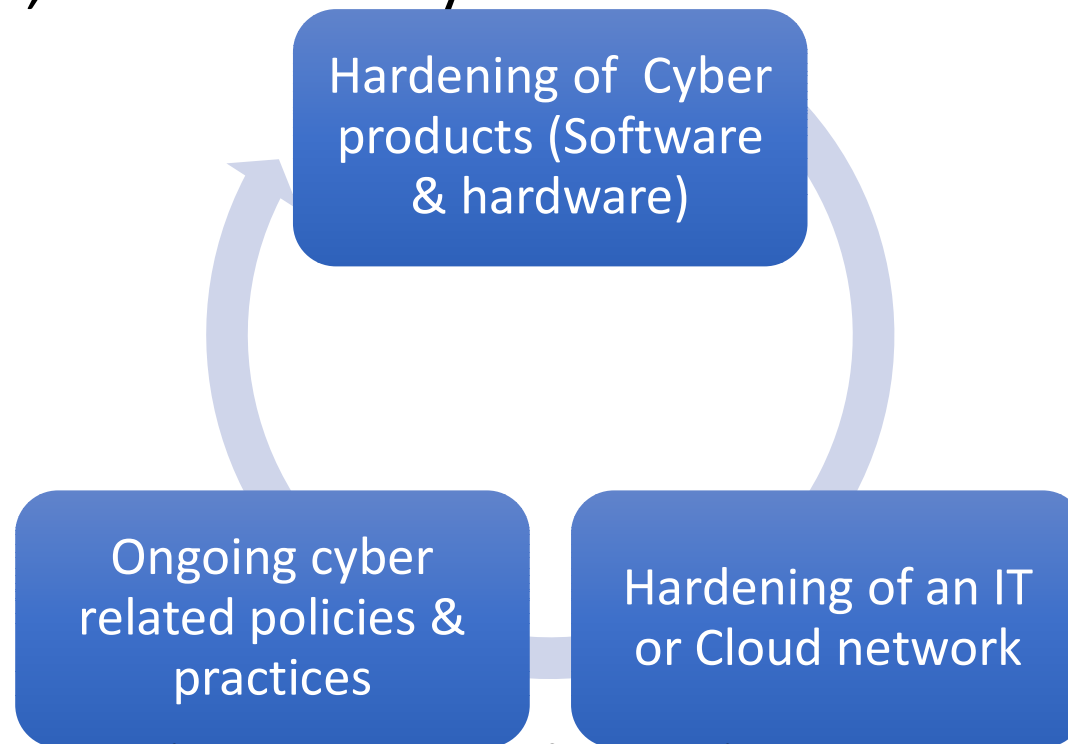


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Cybersecurity Costing Includes Software, Hardware, IT & Policy



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 | \$1,338.00 |
| 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 R | | 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 | N/A | 32 1 - 100 seats - 1001 seats | 952 64 1001 |

| Category | Sub Category | Application | Protected Systems | | | | | | | Threats Addressed | | | | | | |
|---------------------|---------------------------|-------------------------------------|-------------------|---------|-------|-------|--------|--------|----------|-------------------|---------|--------------|--------------|----------|---------|---|
| | | | Computer | Printer | Cloud | Phone | Tablet | Server | Embedded | 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 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| Email Security | Email Encryption | Integrated Data Protection | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| Email Security | Email Encryption | SaaS Delivery and Integrations | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Email Security | Email Encryption | Secure Email Gateway (SEG) | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| Endpoint Security | Application Control | Anti-Spam | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Endpoint Security | Biometric (Biological) | Iris | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Endpoint Security | Biometric (Biological) | Palm | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Endpoint Security | Endpoint Protection | EDR (Endpoint Detection and R | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Endpoint Security | Password Management | Password Control | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Identity Governance | Federated Identity | Single Sign on Service | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Identity Governance | LDAP repository | LDAP Proxies | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Identity Governance | LDAP repository | Meta-Directories | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Identity Governance | LDAP repository | Virtual-Directories | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Identity Proofing S | Endpoint-centric | Caller ID | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Identity Proofing S | Endpoint-centric | Device fingerprint | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Identity Proofing S | Endpoint-centric | Geolocation analysis | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Identity Proofing S | Endpoint-centric | Mobile location services | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Identity Proofing S | Endpoint-centric | Navigation | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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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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