Ownership Cost of Cybersecurity in Cloud Based IT Systems

Richard Mabe, Solutions Consultant
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Foreword

Life cycle cybersecurity protection of information technology (IT) systems has become a critical issue

- Internet of Things
- Aggressive nature of Cyber attacks

Users need to evaluate and compare most effective approach for cybersecurity protection with the life cycle cost (TOC) to host and operate IT systems

- Cloud
- User owned data center

This paper presents a business case framework to evaluate TOC and cybersecurity trade-offs

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- Davis Cass; VP Cloud Global Security Services; IBM
Overview

Scope and Definition of IT
Cloud Based Services/Support
Cloud Cybersecurity Concerns
Cybersecurity Total Ownership Costs
Evaluating Cost Trade-offs
Scope and Definition of IT
Assess for DOD System Integration

IT Products and Services (IOT)

Integrated
To Be

Platform IT

Information Systems and Enclaves
IT System Cybersecurity Functions

Cybersecurity capability within a system: Products, Services (HW and SW)

Cybersecurity as the primary mission function of an IT system:
  • Offensive/Defensive
  • Test and Evaluation
  • Vulnerability Assessment/Hunter
  • Cyber Command and Control
Cloud Based Services and Support
Cloud is a means to an end, enabling many benefits ...

- Faster to market
- Higher Quality
- ↓ Cost ↑ Flexibility
- Repeatable & Scalable
- Secure & Compliant

... that require organizations to transform, and re-think –

- How to deliver IT capabilities while improving quality
- How to interact and react with clients
- How to resolve technical debt
- How to meet cybersecurity requirements and mitigate cybersecurity threats
Cloud Business value is driven by Workload -

- Best Fit: Info Mgmt, Data Mgmt, C4I Apps
Service Delivery Models

Integration of Roles, Processes, Information, and Technology requires additional cloud service management

Additional Service Management Needed

Provided by Cloud Provider
Cloud Cybersecurity Concerns
Management Concerns

Can we hire the right skills?
- Skills shortage

Can we adapt?
- Adapting Platforms
- Innovation to lead

Are we communicating risk to our customers?
- Evolving techniques and technology

Are we protected?
- Ever-changing threat landscape

Have we protected our most crucial data?

Are we maximizing the value of our security investments?
What Holds us Back

Privacy and Compliance Issues
• Adapting to a risk-based approach (RMF)

Insider Threats
• Cloud host employees, contractors, partners

Cloud Host Skills Gap
• 209,000 cybersecurity jobs in the U.S. are unfilled
• Postings are up 74% over the past five years

Innovation
• CISCO estimates that by 2020 there’ll be 50 billion devices connected to the IOT

Advanced Attacks
• More than 80% involve cyber gangs, a global business that accounts for $400B+ a year
The Solution: A Well Planned Transition

As Is System
(User Data Cntr)
- Operate
- Sustain

Plan for Transition:
- Business Case
- Change Mgmt
- Svc Level Agreement

What
When
Where To
Security
Access

Transition:
- Software
- Data
- Interfaces

Execute Plan:
- SW Porting
- Data Migration
- User Training

Migrate
Instantiate
Test/Verify
Parallel Ops
Changeover
Go Live

Recurring Costs:
- Labor
- Materials
- Overhead
- ODCs
- Facilities
- PM/SE

Non-Recurring Costs:
- Modify/Refactor SW apps
- Prep data for migration
- Develop new middleware Interfaces
- Adapt to Cloud OS and Middleware Services
- PM/SE

To Be System
(Cloud Host)
- IaaS
- PaaS
- SaaS

Recurring Costs:
- Fees
- Licenses
- Subscriptions
For:
- Infrastructure
- Run Time Env
- SW Services
- Access
- Cybersecurity
- PM/SE
Cybersecurity Planning

Phase 1: Project Initiation:
• Collect and review data; prepare transition team and assets

Phase 2: Assess the As Is Security Posture
• Catalog current cloud use; prepare assessment report for the client

Phase 3: Define the “target” To Be state
• Analyze Requirements for the To Be Domain (Gap Analysis); present cloud security maturity framework

Phase 4: Recommend a Cloud Solution Roadmap
• And (potentially) a Business Case for the level of Cloud service
Cybersecurity Approach

Cloud Security & Regulatory Compliance Accelerators:

- Assess the maturity and effectiveness of the current security program in-place at the client’s organization
- Manage and govern information security more effectively and efficiently at all levels of the Cloud stack
- Identify and effectively manage security and regulatory compliance requirements while driving growth of programs
- Build a more risk aware culture through education and awareness
- Improve operational security for critical infrastructure
Cybersecurity Policies

Cooperative effort (user/host)
- Identify, evaluate, implement and enforce security policies aligned to the delivery model: IaaS, PaaS, SaaS

Cloud service consumers and cloud service providers
- Establish and follow their respective cloud security policies

User’s cloud-specific security policies
- Likely reflect their corporate security policies
Cybersecurity Total Ownership Costs
TOC Scope for Cloud Apps

Measures all costs over the system’s life cycle

TCO = Capital Expenses + Operational Expenses + IT Governance/ Sys Mgmt
(Direct) + (Direct + Indirect) + (Overhead/Admin)
(Infrastructure) + (Services) + (PM, FM, SE, Cyber Mgmt)

Budget focus
• Changes from CAPEx to OPEx during and after transition

Cost Impacts for the System Owner:
• Changes the acquisition model: infrastructure not procured
• Changes the compliance / security model: Cloud security svcs
• Changes the management model: Cloud provider systems mgmt
Cost Elements for Cybersecurity

**Cost Elements**
Mil-Std-881D
Cybersecurity Focus

### Business System - Cyber Specific LLC

#### Capital Expenses
- Cybersecurity Integration - Governance and Org
- Custom Workload
- Cybersecurity Services (SW)
- Cyber End User Device (HW)
- Cyber Data
- System Level Technology
- Dedicated Cyber Comm
- Infrastructure Services
- Systems Engineering (RMF)
- Cyber Test and Evaluation

#### Operations Expenses
- Cybersecurity Services - Governance and Org
- System/Services Operations
- Cybersecurity Services
- Cyber Data Services
- End User Device Support Services
- Training Services Operations
- System/Services Mgmt
- Communications Services
- Infrastructure Services
- Cyber SW Maintenance/Modification
- Managed Services Operations
- Systems Engineering (RMF)
- Recurring Cyber Tests

- **Organized with Mil-Std-881D WBS, App J**
  - Highlights Cybersecurity costs for trade-off analysis
  - Includes Operating and Support costs

- **Cybersecurity costs do not all carry equal weight**

- **Drivers include:**
  - Systems Engineering Labor (Initial RMF)
  - Support Engineering Labor (Recurring RMF)
  - Initial and Recurring Cybersecurity Tests
  - Life Cycle Risk Management
    - *High replacement rate for vulnerable SW/HW*
    - *Continuous monitoring and threat analysis*
    - *Continuous validation of controls related to confidentiality, availability and integrity requirements*
## Map to Complete WBS - Development

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<tr>
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<th>11.1 Development/Procurement</th>
<th>11.1.1 Custom Application Development</th>
<th>11.1.4 System Level Hardware</th>
<th>11.1.2 System Level Integration</th>
<th>11.3 Systems Engineering</th>
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## Map to Complete WBS - Sustainment

### Cost WBS (Mil-Std-881D, App J)

![Diagram showing Cost WBS and Cybersecurity CES](Image)

### Operations Expenses

| Category                              | 1.2 Recurring Annual Business System Sustainment | 1.2.1 Program Management | 1.2.2 Systems/Sustainment Engineering | 1.2.3 Change Management | 1.2.4 Help Desk | 1.2.5 Data Cleaning/Data Mgmt | 1.2.6 System Data Base Admin | 1.2.7 IT Infrastructure/Network Maintenance | 1.2.7.3 Management | 1.2.8 HW Tech Refresh | 1.2.9 SW Licenses Refresh/Update | 1.2.9.1 Cybersecurity Equipment | 1.2.9.2 SW License | 1.2.10 Cybersecurity Maintenance Management | 1.2.10.1 Compliance Operations and Tracking (RMF) | 1.2.10.2 FOTE | 1.2.10.3 Certification/Validation | 1.2.10.4 Follow On User Training | 1.2.13.2 Software (Includes Cybersecurity and JAVA) |
|---------------------------------------|-----------------------------------------------|--------------------------|--------------------------------------|-------------------------|----------------|-------------------------------|---------------------------------|------------------------------------------|------------------|----------------------|------------------------------|---------------------------------|-----------------|-----------------------------------|------------------------|-----------------|-------------------------|-------------------------------|
| Cybersecurity Services - Governance and Org | X                                             | X                        | X                                    |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| System/Services Operations            | X                                             | X                        | X                                    |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Cybersecurity Services                | X                                             |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Cyber Data Services                   | X                                             |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| End User Device Support Services      |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Training Services Operations          |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| System/Services Mgmt                  |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Communications Services               |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Infrastructure Services               |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Cyber SW Maintenance/Modification     |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Managed Services Operations           |                                               |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Systems Engineering (RMF)             | X                                             |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |
| Recurring Cyber Tests                 | X                                             |                          |                                       |                         |                |                               |                                 |                                          |                  |          |                               |                                  |                 |                                   |                         |                |                           |

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Evaluating Cost Trade-offs
## Trade-Offs for IaaS:

### Cost Elements

- **Mil-Std-881D Cybersecurity Focus**

### As Is: Data Center
- **User Owned Vertical Integration**

### To Be: IaaS
- **Fee for Svc Virtual Domain**

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## Trade-Offs for PaaS:

### Cost Elements

**Mil-Std-881D Cybersecurity Focus**

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<th>Business System - Cyber Specific LCC</th>
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<th>To Be: PaaS Fee for Svc Virtual Domain</th>
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### Trade-Offs for SaaS:

#### Cost Elements

- **Mil-Std-881D Cybersecurity Focus**

#### As Is: Data Center
- User Owned
- Vertical Integration

#### To Be: SaaS
- Fee for Svc
- Virtual Domain

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<td>Cybersecurity Services - Governance and Org</td>
<td>User Funded Program Mgmt (Governance)</td>
<td>Cloud Provided Program Mgmt (Governance)</td>
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<td>System/Services Operations</td>
<td>Workload Management and Operations</td>
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<td>Cybersecurity Services</td>
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<td>Fee-License for Recurring Cloud HW/SW Cyber Services</td>
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<td>Fee for Recurring Cloud Data Storage/Management</td>
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<td>Fee-License for Recurring Cloud Platform Mgmt and Ops</td>
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<td>Technology Management and Operations</td>
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<td>Data Center/Corporate Staff</td>
<td>Fee-License for Recurring Cloud Provided/Managed Comm Svcs</td>
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<td>Infrastructure Services</td>
<td>Data Center/Corporate Staff</td>
<td>Fees for Recurring Cloud Provided/Managed Infr Services</td>
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<td>Cyber SW Maintenance/Modification</td>
<td>SW Maintenance and Modifications</td>
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<td>Managed Services Operations</td>
<td>User Owned/Managed SW Services</td>
<td>Fee-License for Recurring Cloud Managed Help Desk/User Svcs</td>
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<td>Systems Engineering (RMF)</td>
<td>User Funded Systems Engineering</td>
<td>Fee-License for Recurring Cloud Provided Platform Service</td>
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<td>Recurring Cyber Tests</td>
<td>User Funded Systems Test/Eval</td>
<td>Fee-License for Recurring Cloud Provided Platform Service</td>
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</table>
Evaluating Trade-offs

Measure cloud performance in context of workload

• Not just price, but Price-Performance that matters (band for buck)

What to consider:

• **Real requirements** (capabilities) for Apps, Workload, Security, Service
  
  Can the provider meet requirements for Confidentiality, Availability and Integrity?

• **Performance in the cloud**; including: flexibility to position workload; access to emerging technology; scalability
  
  Are secure, high speed choices available for sensitive workloads?

• **Economics**; including: choice of technologies; visibility and control of user resources; ability to optimize ROI
  
  What is the current and future cost of Security-Performance? Are there hidden costs?

*Cloud IT Economics, What you don’t know about TCO can hurt you. IBM Corp., 2018*
Compare Meaningful Measures

Measures to consider for Cloud applications:

- **Web response**: bandwidth/process speeds; ability to expand quickly
  Can the provider meet requirements for cybersecurity controls?

- **Data storage/retrieval**: I/O queries per hour; unit cost of storage
  Is secure storage readily available and accessible at an affordable rate?

- **Inter-networking capability**: cloud-to-cloud; cloud-to-data center; data center-to-data center (edge computing)
  What is the cost of security for a messaging intensive workload?

- **Cloud host**: speed and efficiency of SW porting and Data migrations to the cloud for highly secure applications
  How efficiently does the provider move data and workloads?
Trade-off Methodologies:

Example 1: The Cloud Price Index (cPCI)*

• Required Labor for VM Support vs VM Utilization and Capacity

• Derive average price of a cloud solution using “basket of goods” approach:
  
  Determine the total cost of a bundle of services (IaaS, PaaS, SaaS)
  
  Estimate the average “Cost for VM Hour” and “Price per GB month”

• Compare and evaluate options based on Labor Efficiency and VM Use:
  
  The more VMs a single administrator/system engineer can manage, the lower the unit “Cost per VM Hour”
  
  The more Capacity Use per VM, the lower the “Cost per GB Month”

* Total cost of ownership in private cloud: guidelines for buyers. O. Rogers and J. Atelsek, 451 Research, Sept 2017
Commodity Scale
(User Data Center Economies)

Standard Scale
(Cloud Economies)

VMs / Engineer

% Utilization
Trade-off Methodologies:

Example 2: Predictive Analytics

• Employ a wide variety of statistical techniques, such as modeling, machine learning, and data mining to rapidly analyze current and historical facts to predict future (unknown) events/outcomes

• Apply to Cloud Workloads; consider framework tools:
  - Consider control requirements, technical issues and business risks to minimize service interruptions / optimize continuous service
    (Tool: Control Objects for Information and Related Technology – CobIT)
  - Consider also IT System Governance and Business Investments to minimize life cycle cost and optimize budget performance
    (Tool: Value from IT Investments – VAL IT)

• Best practice: extend CAIV framework to cloud workloads (Objectives, Thresholds)
Evaluate Investment Performance and System Delivery Effectiveness:

CobiT DS4 Ensure Continuous Service
Ensure that IT service and infrastructure can resist and recover from failures…

The Optimized TCO provides the essential “best value” framework for the strategic decision process

Typical KPI
- Time to Market
- Patching (IAVA)
- SLA

*Control Objects for Information and Related Technologies
*Value from IT Investments

Val-IT
IM4 Perform Alternative Analysis
IM7 Identify Full Life Cycle Costs and Benefits
Wrap-up

Cybersecurity related costs are included in a number of places in a system TCO Cost Element Structure: HW, SW, Infrastructure, Governance, Operations / Sustainment / Modifications

Cost drivers are likely Labor costs for Systems Engineering labor and Test events supporting Risk Based Management of Cybersecurity requirements for the system’s life cycle

The optimal TCO solution is likely an affordable mix of user owned and managed applications that employ Cloud Infrastructure and Virtual Platforms

- The User maintains responsibility for the Application Cybersecurity Assessment
- The Cloud provider accepts responsibility and maintains authority for their Infrastructure and Virtual Domains/Platforms

Use of predictive analytics, combined with modeling approaches like CobiT, VAL-IT and pCPI provides a consistent framework to holistically and consistently calculate TCO on a lifecycle basis

The process is a life cycle team effort supported by the User and by the Cloud Provider
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Mr. Mabe has over 40 years of experience as an operations analyst, focusing on logistics analysis and cost estimating for the Air Force and other government programs. Prior to his current position with Price Systems, LLC, Mr. Mabe was a Business Area Manager for Quantech Systems, Inc. at Hanscom AFB, managing a team of 20 analysts developing cost estimating products for Air Force C4I, Cyber and Networking system programs. Prior to his work at Quantech, Mr. Mabe was the Technical Advisor for the IT and Electronics Systems Division of the Air Force Cost Analysis Agency (AFCAA), providing cost research, databases and tailored tools to support independent cost estimates of AF acquisition programs. Mr. Mabe also supported several AF and DOD working groups focused on methods to apply industry best practices for SW development, cybersecurity and C4I systems integration to DOD programs.

Prior to working for AFCAA, Mr. Mabe provided cost estimating and cost analysis support to multiple C4I, Cyber and Networking programs at Hanscom AFB, MA - for 2 years as a PEO level Cost Chief, and for 13 years as a Technical Expert for Tecolote Research, Inc. Many of these were Joint Service programs, sharing systems and equipment with Army and Navy C4I programs. Prior to working at Tecolote, Mr. Mabe spent 6 years with TASC in Reading, MA managing a team of systems engineers and logistics analysts developing readiness based supply and logistics models for the Air Force. Prior to TASC, Mr. Mabe was an Air Force supply and logistics officer, providing hands-on support to Air Force operations in the CONUS and in USAFE. He completed his active Air Force duties by serving as an Assistant Professor for Inventory Management at the Air Force Institute of Technology.

Mr. Mabe holds a BS Degree in Geology from Boise State University, and an MS in Logistics Management from AFIT. He received a Level 3 DAWIA certification in Business-Cost Estimating, and also a Level 3 DOD Financial Management certification in Cost. He is a recipient of the AF Outstanding Civilian Career Service Award.