# Cloud Estimating in the 21st Century – Okay, Well in 2024!
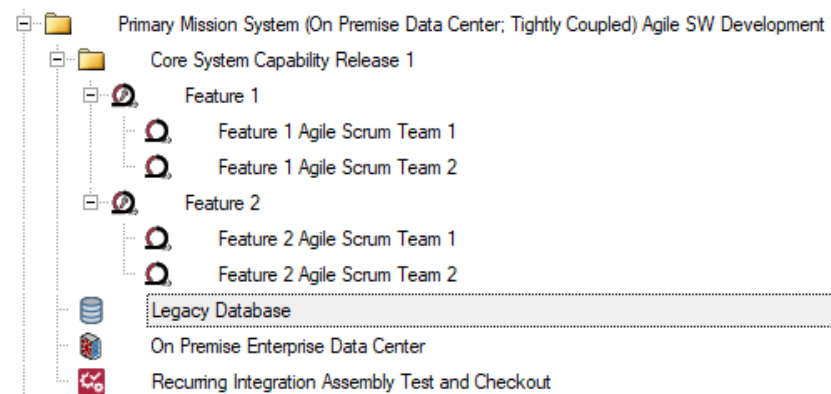
Chris Price

Cloud Overview

- Over the past decade, Cloud developments have started to become common place
  - Based on observations at Unison Cost Engineering, even faster over the past few years

- Rather than companies setting up and managing their own server farms, commercial providers like AWS now offer Cloud services for deploying large-scale business applications on public servers, which saves money, as shown here.

- With the incorporation of cybersecurity techniques, even the most sensitive, i.e., DoD and some other applications can be safely deployed 'in the Cloud'.

- To estimate cloud deployment accurately, must consider software development and performance, including storage utilizing Containers, Kubernetes Orchestrators, IaaS, and PaaS.

- This presentation is intended to provide an overview of a basic process to estimate a Cloud Development / Transition
  - Disclaimer: For convenience, throughout this presentation I will be using examples from the TruePlanning Software, recognizing however that other estimating models may have similar capabilities
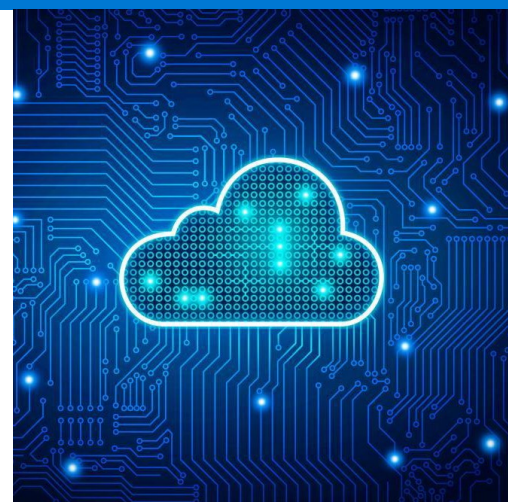
Cloud Software Development

- Cloud development begins with Software Development to provide core capability, similar to development for any environment

- This development may use any accepted Process: Waterfall, Agile, etc.

- If developing a new application to run exclusively in the Cloud, you may desire to develop it directly in a Cloud-based language, i.e., Linux, but there are options for deploying applications developed in other languages to the Cloud

- Note: Must consider both Applications & Storage

- Frequently, applications already developed in legacy languages and in-house operating environments are moved to the cloud

Primary Mission System (On Premise Data Center; Tightly Coupled) Agile SW Development
  Core System Capability Release 1
    Feature 1
      Feature 1 Agile Scrum Team 1
      Feature 1 Agile Scrum Team 2
    Feature 2
      Feature 2 Agile Scrum Team 1
      Feature 2 Agile Scrum Team 2
  Legacy Database
  On Premise Enterprise Data Center
  Recurring Integration Assembly Test and Checkout

A Case Study

- A C2 (Decision Support System) with 256,000 Lines of Code, and associated Database requirements
- We will look at different options to transition this application to the Cloud
- Intent is to define scope, identify key things to consider, and show cost savings over in-house deployments
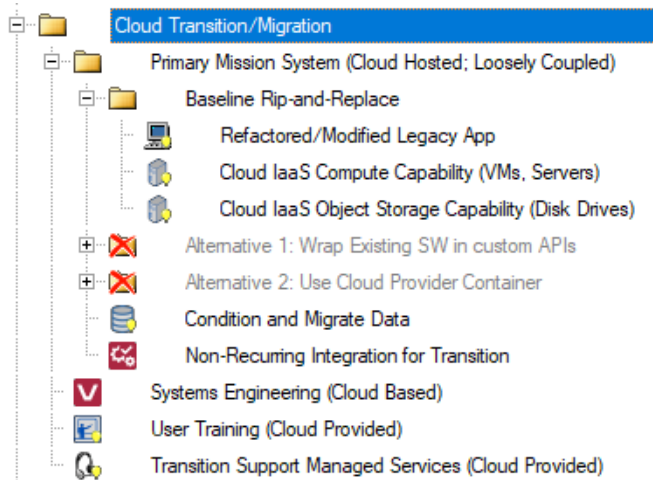
ReFactor Transition

- **Refactor (Rip-and-Replace): $~3.2M Total**

    If you have an existing application developed in a different language i.e., C, Ada, etc. then you may completely rewrite that application in the Cloud based environment

    Costly approach but optimal result

	Refactored/Modified Legacy App		Detailed Estimate
Cost:	$1,611,008.36	3.05% Labor Requirement:	10,505.07 hours
Project Cost:	$52,827,518.80	Project Labor Requirement:	456,634.89 hours
Phase Set:	A <Inherited>	Worksheet Set: A <Inherited>	

		Value	Units	Spread	Notes	Analyzer
1	Start Date					
2	**Application Details**					
3	Development Application Type	**Decision Support System**				
4	Functional Complexity	4.15				
5	Operating Specification	1.000				
6	Organizational Productivity	1.000				
7	Development Team Assessment	3.00				
8	**Contract Service Options**					
9	Development Service Options	In-House				
10	**Software Size**					
11	Size Units	Source Lines of Code (SLOC)				
12	New Size	15,000				
13	New Size Non-executable	0.00%	%			
14	Adapted Size	42,657				
15	Adapted Size Non-executable	0.00%	%			
16	Percent of Design Adapted	5.00%	%			
17	Percent of Code Adapted	10.00%	%			
18	Percent of Test Adapted	25.00%	%			
19	Design Repeat	60.00%	%			
20	Reused Size	213,343				

RePurchase Transition

- **Repurchase (Drop-and-Shop)**

    Some basic applications have equivalent applications already existing in the Cloud

    In this case you simply replace your current application(s) with those in the Cloud

    This is generally referred to as Platform-as-a-Service (PaaS)

    Common examples include Email, Calendar / Scheduling, other basic business process applications

    Minimal non-recurring transition costs / higher Cloud fees / user training for new apps

RePlatform Transition

- Re-Platform (Lift-and-Optimize)

- Optimize existing application to run in the Cloud

  - Incorporate Cloud Infrastructure and Platforms to some extent (IaaS, PaaS)

  - Use Cloud Provider's Applications / Tools to the maximum extent possible

- A variation on Drop & Shop (mentioned previously), but some combination of converting an existing application with utilizing capabilities already existing in the cloud

- Maybe just move storage but keep applications local

ReHost Transition

- Rehost (Lift-and-Shift): ~$1.0M Total

  - Migrate an existing application from an 'in-house' server to a public Cloud (IaaS)

  - Assumes no functional modification – application runs the same in the Cloud environment

  - Common approach

  - Make use of Containers and Kubernetes Orchestrators to run current software in Cloud environment

  - Consideration for both Applications and Data / Storage
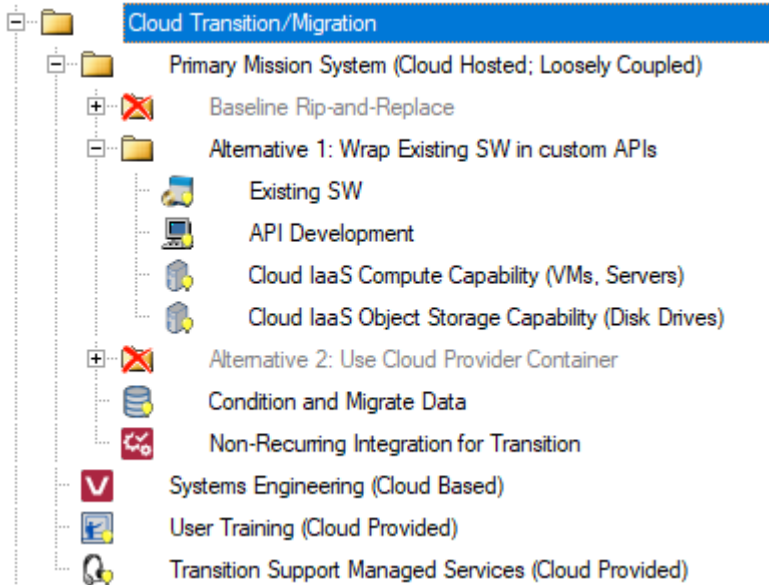
  - Cost effective approach
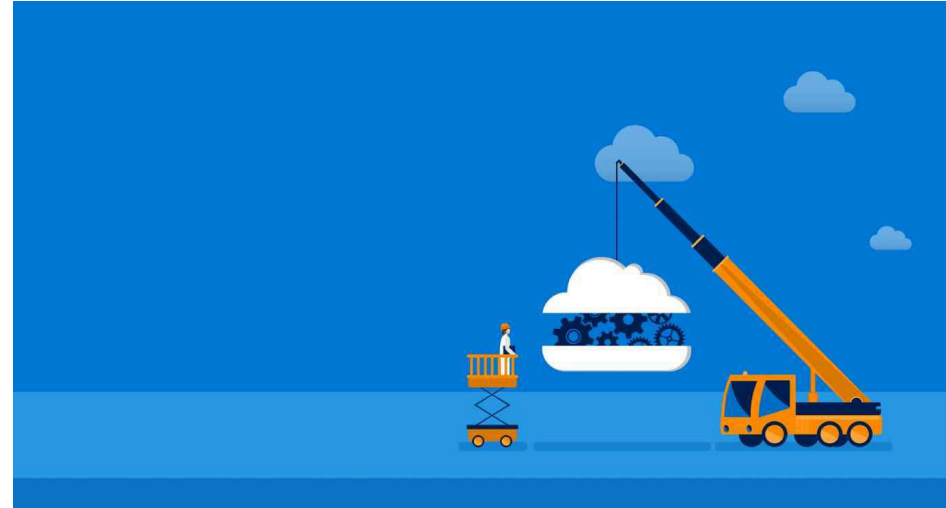
ReHost Transition Options

- **Custom API: $1.2M Total**

  Write custom API to interface legacy software to Cloud Host environment, using Cloud VMs, Servers

Cloud Transition/Migration
- Primary Mission System (Cloud Hosted; Loosely Coupled)
  - Baseline Rip-and-Replace
  - Alternative 1: Wrap Existing SW in custom APIs
    - Existing SW
    - API Development
    - Cloud IaaS Compute Capability (VMs, Servers)
    - Cloud IaaS Object Storage Capability (Disk Drives)
  - Alternative 2: Use Cloud Provider Container
  - Condition and Migrate Data
  - Non-Recurring Integration for Transition
- Systems Engineering (Cloud Based)
- User Training (Cloud Provided)
- Transition Support Managed Services (Cloud Provided)

Alternative 1: Wrap Existing SW in custom APIs   <custom>

| Cost: | $618,904.52 | 52.46% | Labor Requirement: | 2,784.02 hours |
| Project Cost: | $1,179,702.49 | | Project Labor Requirement: | 6,907.75 hours |

Phase Set: A <Inherited>   Worksheet Set: A <Inherited>

	Costs (No Roll-Up Included) : Alternative 1: Wrap Existing SW in custom APIs - [Folder] Currency in USD ($) (in October, 2021)		**Total**	Development
1	Existing SW			
2		Business Requirements Analysis	2,791	2,791
3		Solution Design	2,930	2,930
4		Installation and Configuration	9,007	9,007
5		Integration and Test	30,617	30,617
6		**Subtotal**	45,345	45,345
7	API Development			
8		Software Requirements Analysis	30,116	30,116
9		Software Design	154,676	154,676
10		Code and Unit Test	71,827	71,827
11		Software Integration and Test	33,910	33,910
12		Software Qualification Test	41,813	41,813
13		Software Installation Support	27,974	27,974
14		**Subtotal**	360,316	360,316
15	Cloud IaaS Compute Capability (VMs, Servers)			
16		Monthly Service Cost	174,069	174,069
17		**Subtotal**	174,069	174,069
18	Cloud IaaS Object Storage Capability (Disk Drives)			
19		Monthly Service Cost	39,175	39,175
20		**Subtotal**	39,175	39,175
21	**Total**		618,905	618,905

ReHost Transition Options

- **Cloud Service Container: $1.0M Total**

  Use Cloud Container Service / Orchestrator

  Least cost / most efficient method

Infrastructure as a Service (IaaS)

- All methods of Cloud transition involve utilizing the Cloud providers IaaS:

- Virtual Machines, Servers: $174K for 100 VMs / year

- Storage / Disk Drives: $39K / year for 50TB storage, 5TB data transfer, and 1M RW ops.

- Data Migration: $36K, plus Integration effort: $169K

- Systems Engineering: $33K

- Training: $133K (8 hrs.)

- Support Services: $85K for 500 Users

- Note: All IaaS Cloud Service prices used here are from AWS a/s July 2023 or August 2020

Cloud IaaS Compute Capability (VMs, Servers) — Simple Estimate

Cost:	$174,054.48	0.47% Labor Requirement:	0.00 hours
Project Cost:	$36,845,716.37	Project Labor Requirement:	268,746.13 hours

Phase Set: A <Inherited>   Worksheet Set: A <Inherited>

		Value	Units	Spread	Notes	Analyzer
1	Start Date					
2	**Device Information**					
3	Purchasing Model	Infrastructure as a Service				
4	Type of Cloud Service	Virtual Machine				
5	Number of Deployments	Custom - Yearly				
6	Monthly Price Per Virtual Machine (Linux)	150.72	$ in 20...			
7	Monthly Price Per Virtual Machine (Windows)	0.00	$			
8	Monthly Additional Disk Price	12.69	$ in 20...			
9	Secret or Top Secret Cloud Instance?	No				
10	Secret or Top Secret Multiplier - Virtual Machine	1.00				
11	Secret or Top Secret Multiplier - Storage	1.00				

Cloud IaaS Object Storage Capability (Disk Drives) — Simple Estimate

Cost:	$39,174.99	0.11% Labor Requirement:	0.00 hours
Project Cost:	$36,845,716.37	Project Labor Requirement:	268,746.13 hours

Phase Set: A <Inherited>   Worksheet Set: A <Inherited>

		Value	Units	Spread	Notes	Analyzer
1	Start Date					
2	**Device Information**					
3	Purchasing Model	Infrastructure as a Service				
4	Type of Cloud Service	Storage				
5	Time Period of Service (in Months)	12.00	Month(s)			
6	Monthly Object Storage Price	1,593.08	$			
7	Monthly File Storage Price	1,583.10	$ in 20...			
8	Secret or Top Secret Cloud Instance?	No				
9	Secret or Top Secret Multiplier - Storage	1.00				

Operations in the Cloud

- $13.2M for 10 years, including:
  - Data
  - User Training
    - Qty. 50 - 8 hr. courses
  - Managed Help Desk
    - 500 Users

Recurring Cloud Oerations and Support (Shared IT Functionality)
- Primary Mission System (Cloud Hosted; Loosely Coupled)
  - Application SW Maintenance
  - Recurring Database Services
  - Infrastructure Services Operations (Virtual Machines + Block Storage)
  - Infrastructure Services Operations (Object + File Storage + NW Bandwidth)
  - Integration Assembly Test and Checkout
- Systems Engineering (Cloud Based, Loosely Coupled)
- Recurring User Training
- Managed Services-Help Line, etc ....

Case Study Summary

10M Initial Development (SW Application + Database)

$25.9M to run on internal servers for 10 years

$1M to $3.2M to transition to the Cloud, depending on approach

Total $17.3M to transition and operate in the Cloud for 10 years (worst case, assuming Refactor)

Net savings of $8.6M - $10.8M over 10 years to move to Cloud!