Apples and Oranges

An experience in using cloud Cost Calculators and Rate Cards

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Outline

- Motivation and Approach
- Our Application Questionnaire
- Calculators and Tools Considered
- Cost Estimate Comparison
- Comparing Apples and Oranges
- Lessons Learned
- Next Steps

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Motivation and Approach

- **Team tasked with achieving DoD sponsor's objectives:**
  - Instantiate an on-premises, contractor-owned, contractor-operated (COCO) cloud pilot
  - Better understand cloud cost, schedule, and performance implications
- **Assessed reasonableness of sponsor Independent Government Cost Estimate (IGCE) by comparing to available cost estimate benchmarks**
  - Team input candidate systems' data into over a dozen calculators and rate cards for estimating storage and hosting costs for cloud applications
- **Evaluated relationship between application complexity and cloud cost**
  - Developed an Application Complexity Plotter to visualize complexity
- **Began developing a parameterized cloud cost model that could support Total Ownership Cost (TOC) assessment, Return-on-Investment (ROI) analysis, and "what if" scenario-building**

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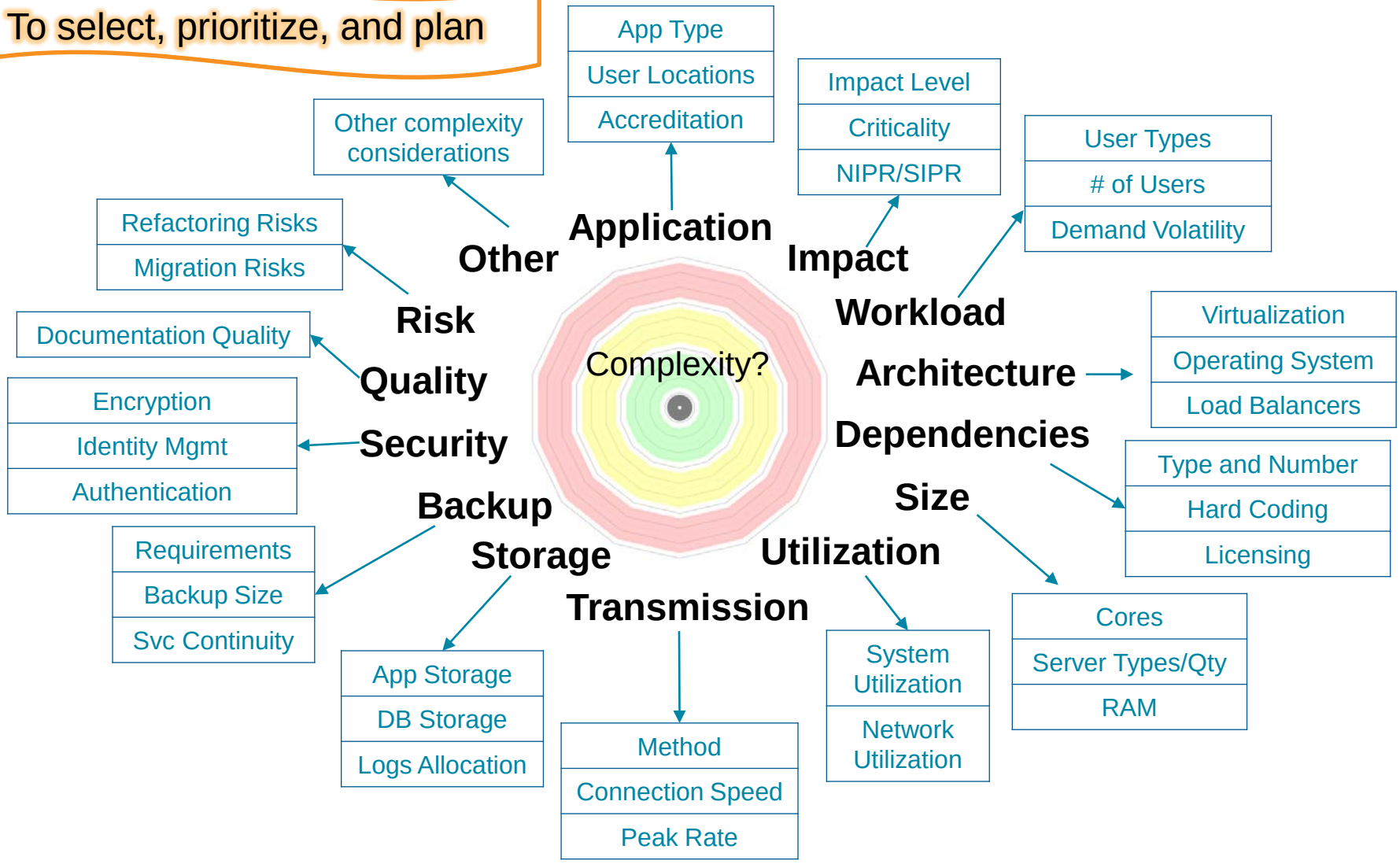
Our Application Questionnaire

To select, prioritize, and plan



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Candidate Application Data

- Received a wide variety of data on ~30 systems from multiple commands and CONUS geographies, complexities (low-high)
- Key usable inputs across the various calculators were number of cores*, required memory/RAM, and required storage

App Name	# cores: Web/ App	# cores: DB	TOTAL # cores	Req. RAM: Web/App	Req. RAM: DB	TOTAL Req. RAM	Storage: Web/ App	Storage: DB	TOTAL storage GB
System 1	10	6	16	40 GB	48 GB	88 GB	2500 GB	2500 GB	5000 GB
System 2	2	4	6	8 GB	16 GB	24 GB	180 GB	2507 GB	2687 GB
System 3	272	0	272	1072 GB	0	1072 GB	31758 GB	0 GB	31758 GB
System 4	18	6	24	61 GB	29 GB	90 GB	1160 GB	3000 GB	4160 GB
System 5	128	40	168	264 GB	224 GB	488 GB	11202 GB	17000 GB	28202 GB
System 6	2	0	2	4 GB	0	4 GB	730 GB	0	730 GB

A core is the central processing unit (CPU) that executes sequential instructions. A single silicon chip can have as many as 22 cores. A core is the basic computation unit of the CPU.

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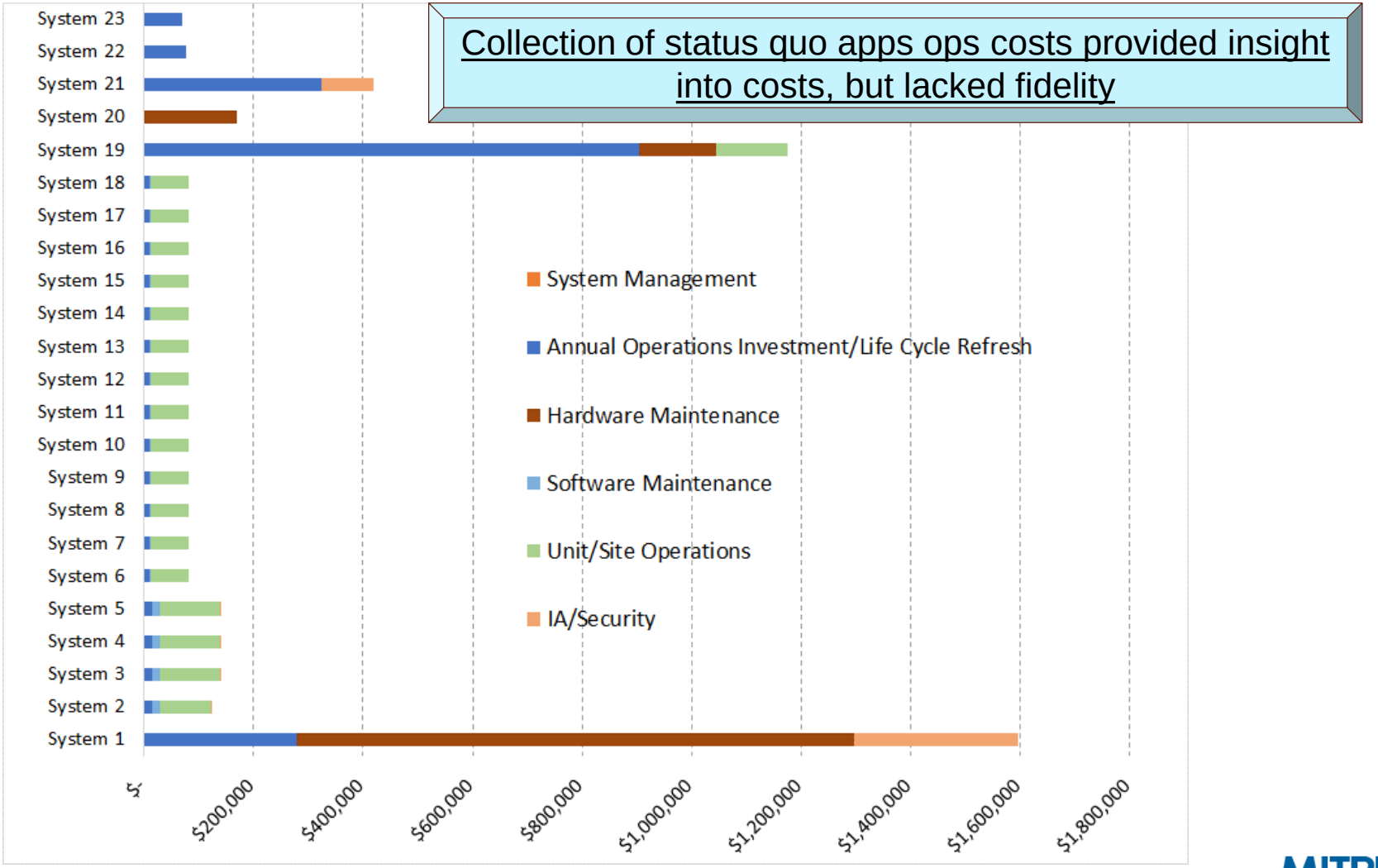
Status Quo O&S Cost for Some Apps

- **Received one year of status quo operations cost for 23 systems**



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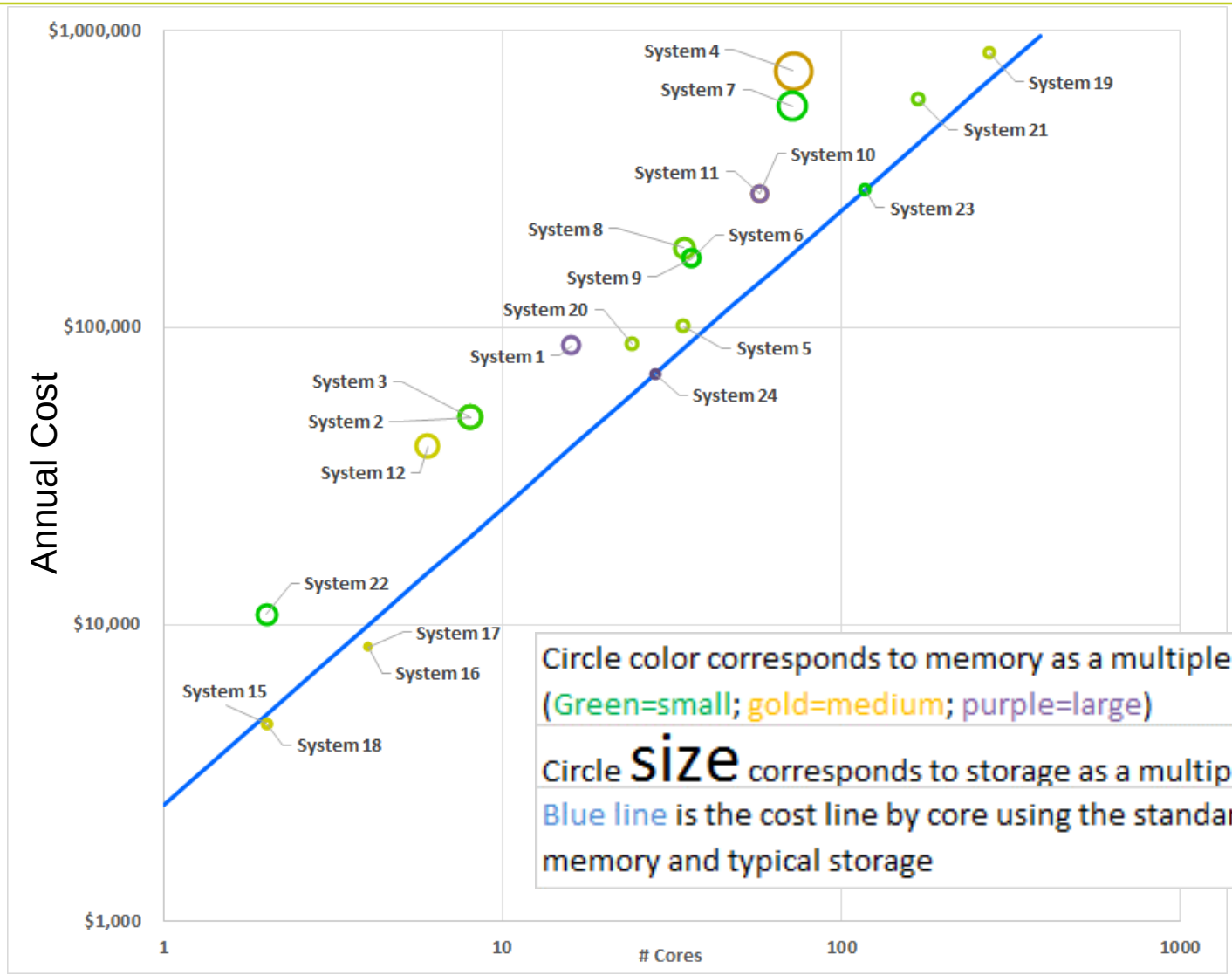
Early Analysis: Number of Cores as a Predictor of Memory & Storage Cost



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Calculators and Tools Considered

- **Online calculators:**
  - FEDRAMP GovCloud Shopper
  - Cloud.gov
  - Microsoft Azure online calculator
  - Amazon Web services online calculator
  - Google Web services calculator
  - Cloudorado

- **Rate cards/Spreadsheet calculators :**
  - DISA MilCloud Rate Card
  - DOD Rate Card Estimator (draft)
  - Navy Cloud Store (AWS)
  - LOGSA Rate Card
  - GSA IAAS Estimator
  - Cloud Cost Lite-MITRE developed tool
  - Technology Insertion Model (MITRE-developed tool with migration component)
  - DOD CIO Cloud Calculator (in development)
- **Individual vendor rates**
- **Commercial Parametric Models**

DEFENSE INFORMATION SYSTEMS AGENCY
The IT Combat Support Agency

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Rate Cards…User Beware!

- Rate cards should be taken with a grain of the proverbial salt

- IT Shops sometimes provide "rate cards" or catalogs that provide costs for various services.
- Unfortunately, frequently little to no context is provided, And there may be little insight as to how inputs are applied ("blackbox"). Excel-based calculators were more transparent, but insight was still lacking.
- For example, the DISA Rate Card is a single pdf spreadsheet listing prices for various services, with very little explanation

2016 DISA Rate card

STANDARD HOSTING RATES	
IBM Mainframe Rates	**RATE**
CPU Hours (Hour/Month)	$423.8944
IBM LINUX (Hour/Month)	$29.1112
IBM ZIIP CPU (Hour/Month)	$389.7015
Unisys Mainframe Rates	**RATE**
SUPS (Hour/Month)	$14.5389
Unisys Storage (MB/Day)	$0.0175
Storage Rates	**RATE**
IBM Storage (MB/Day)	$0.0003
IBM Long Term Storage (MB/Day)	$0.0002
Server Basic Local Service (GB/Month)	$0.9660
Server Basic Remote Service (GB/Month)	$0.4775
Server Operational Local (GB/Month)	$0.5074
Server Operational Remote (GB/Month)	$1.2025
Server Tier 2 Basic Local Service (GB/Month)	$0.6456

- Some sort of estimating methodology has to be assumed/created, as well as a discussion with the maker of the rate card to get context

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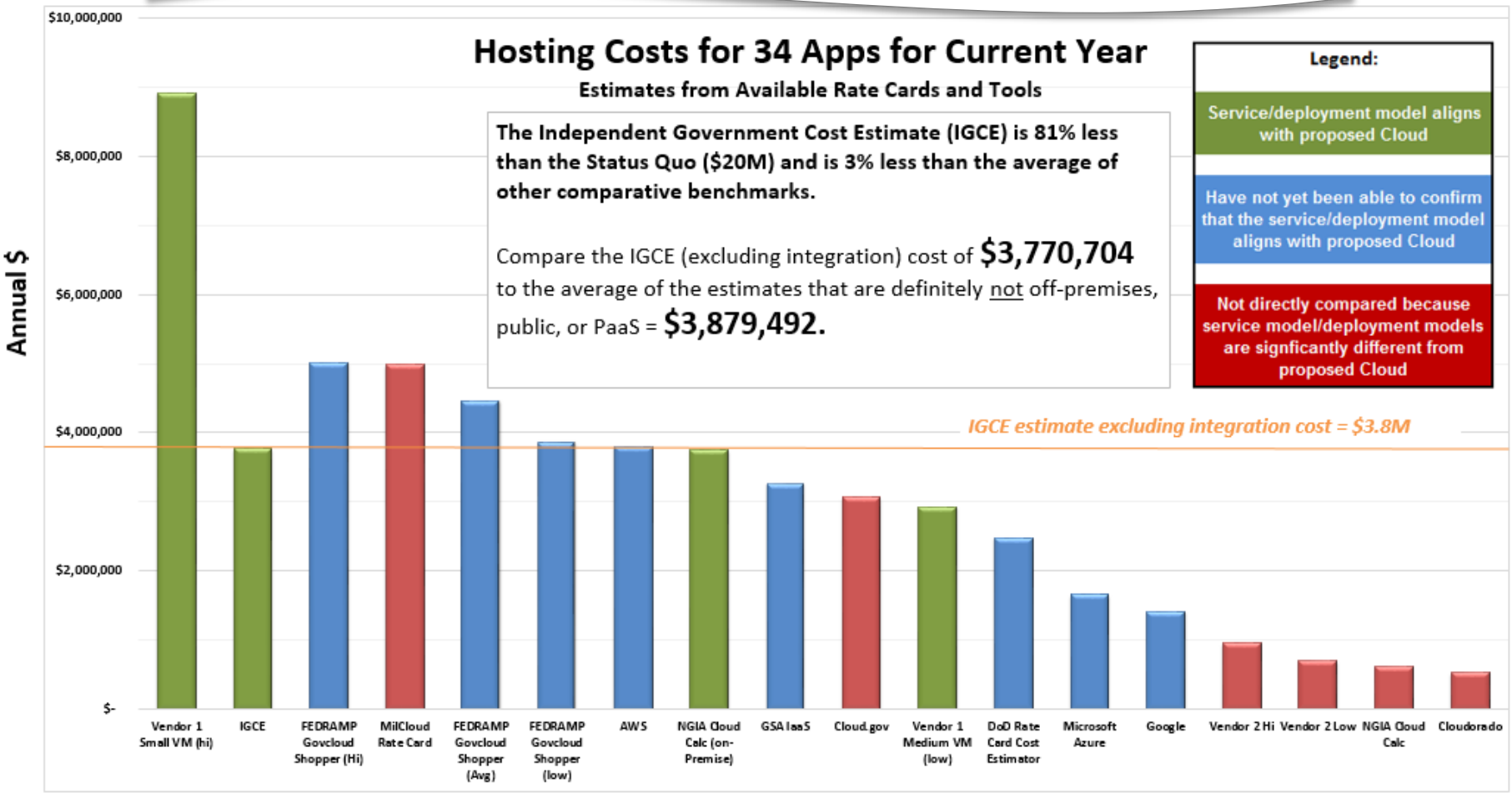
Cost Estimate Comparison

We compared the sponsor's IGCE to 17 calculator estimates



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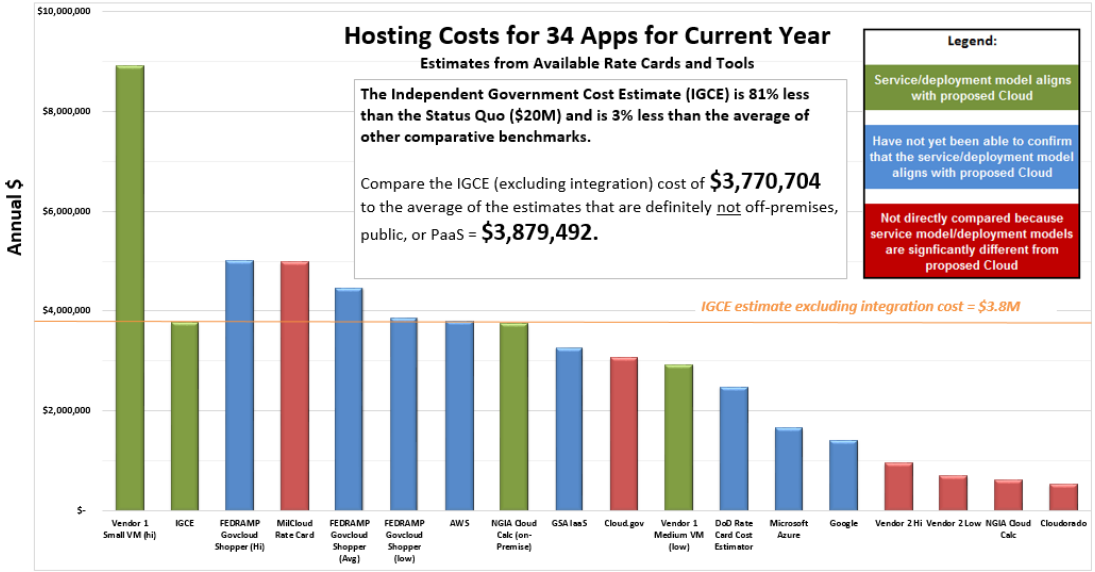
Cost Estimate Comparison



- To assess the reasonableness of an IGCE, developed ROM estimates using available tools, calculators, and rate cards from Government, DoD, and commercial industry.
- The current legacy status quo estimate is approximately $20M/year for 34 apps. In a Cloud environment, all comparison benchmarks are less than $10M/year, representing more than a 50% reduction in expected cost.
- The second stacked bar from the left represents the IGCE. $3.8M per year to host 34 apps compares reasonably with other benchmarks.

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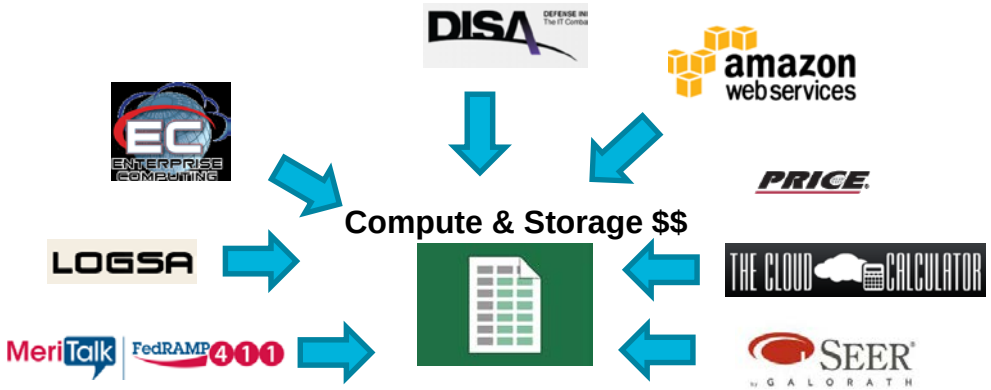
Comparing Apples and Oranges

- **The cloud achieves efficiencies through standardization, shared resources and commoditization.**

Items may be bundled differently by vendor and by model



Each vendor has their own "secret sauce"

- **Many vendors include or leave out items that do not vary in their standard offerings**

Security Level

Connectivity

Utilization Allowance
(elastic, reserved)

IaaS, PaaS, SaaS

- **Most vendors will offer a custom quote for non-standard items**
- **Apples and Oranges can still be compared. They must first be normalized as much as possible.**

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Calculator/Tool Inputs

Partial Universe of Cost Calculator/Rate Card Inputs

1	# of User Accounts	10	Req. RAM: DB	19	vCPUs per instance	28	PUT requests
2	# Concurrent Users	11	# cores: Web/ App	20	Cores per instance	29	OS
3	Types of Servers	12	# cores: DB	21	RAM per instance	30	# additional elastic IPs
4	# of each type of server	13	Req. RAM: Web/App	22	Storage per instance	31	Elastic Block Store (EBS) Opt
5	Data size in GB	14	Hard Drive Space Needed	23	DB Storage	32	# Elastic Load Balancers
6	Logs allocation	15	CPU Power	24	Web Storage	33	total hrs per month
7	Current system utilization rate	16	Web app instances	25	Transfer in-GB	34	VM class
8	Current network utilization	17	DB instances	26	Transfer out-GB	35	Data processed by Elastic Load Balancers
9	WAN bandwidth for currently traversed circuits	18	Instance Type	27	GET requests	36	Available local Solid State Drive (SSD) space

Of these, here are the inputs that appear to matter the most

Almost *all* models ask about:

- Compute
- Memory
- Storage

The *majority* of models ask about:

- Transmission
- Labor inducing factors (like # of VMs, PaaS)
- Utilization
- Operating System (i.e. Windows, Linux)

***Occasionally* models/rate cards prompt questions on:**

- Software & Server Types
- Value added offerings e.g.,
  - Architecture
  - Monitoring
  - Security

Inputs that Typically Drive Costs are shown by red ovals

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Lessons Learned about Calculators, Rate cards, and Cloud Cost Tools

- **Most models only calculate annual recurring costs,** with no allowance for storage and compute growth year-over-year
- **Models do not estimate other major cost elements** such as: system engineering and program management; integration and test; security-related costs; professional/managed services, migration costs
- Some tools include an option to estimate **Disaster Recovery, COOP**, and some **additional professional services**
- **On versus off-premise considerations** were not inputs to most calculators
- **Private vs. public considerations** were not inputs to most calculators
- Few tools include cost for **uncertainty/risk**
- Some models do not use *cloud impact level* (DOD-specific term) but instead use Federal Information Security Management Act (FISMA); others had no **security** variable

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Next Steps: Parameterized Lifecycle Model for Cloud

MODEL INPUT

Cloud Hosting Options

Deployment Models:
- IaaS
- PaaS
- SaaS

Service Models:
- Private
- Community
- Public

Hosting Requirements

Current Cost

Basis of Estimate

GR&A

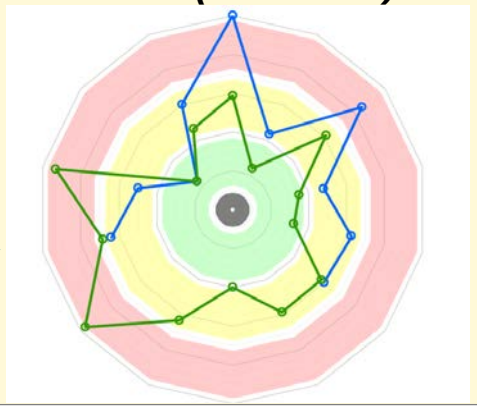
Functional Drivers of Cloud Cost

Objective

Subjective

MODEL TRANSFORM

Application Complexity Plotter (Next slide)



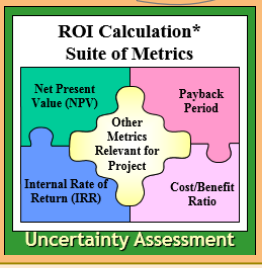
MODEL OUTPUT

Insourced vs Outsourced:

Storage $
Compute $
Transmit $
Managed Service $
Other – Optional

Reporting

CBA
BCA



LCCE

IGCE

Pay per Use

What-If Calculator

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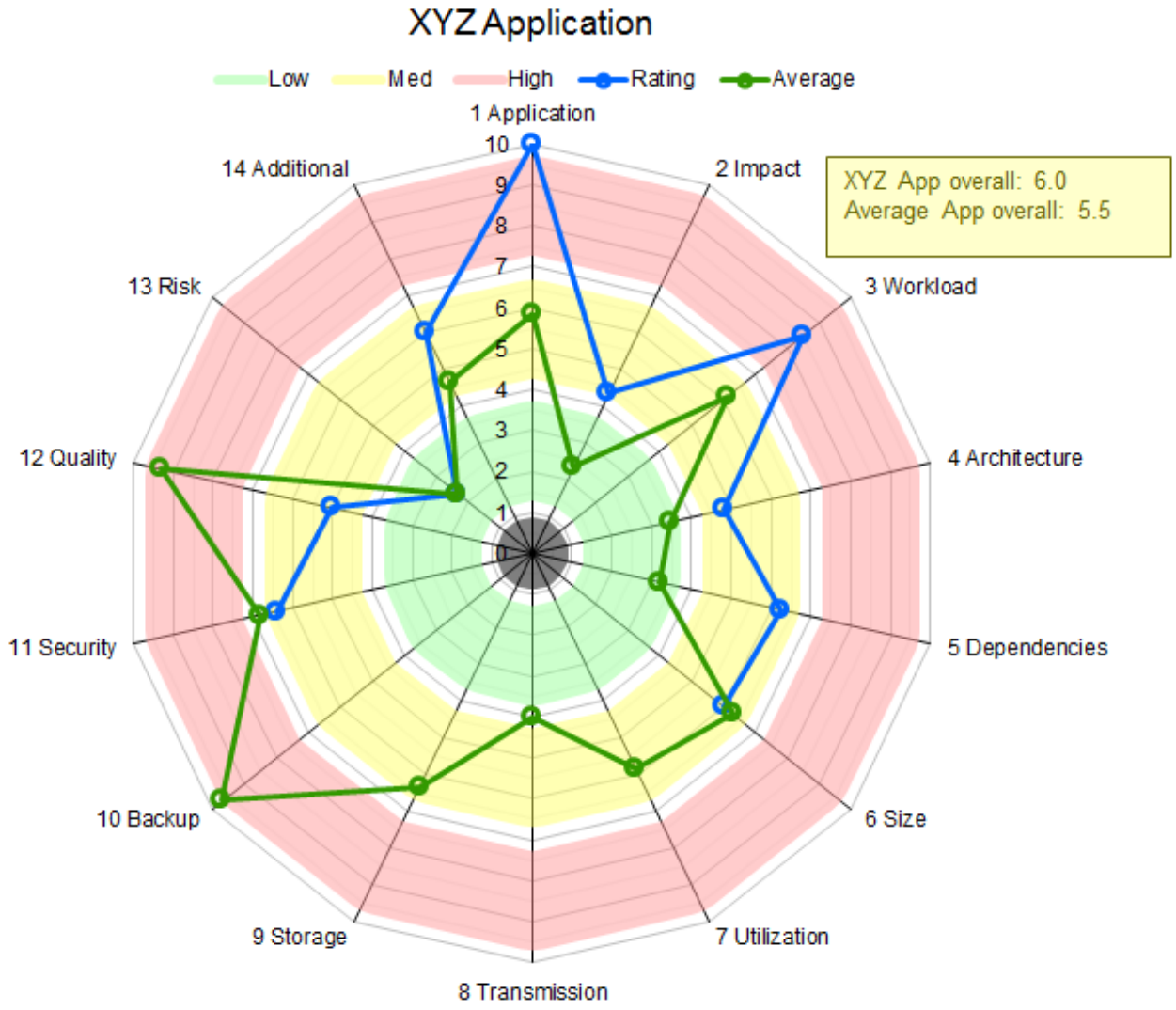
Next Steps: Application Complexity as an Indicator of Cloud Cost Impact



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Backup

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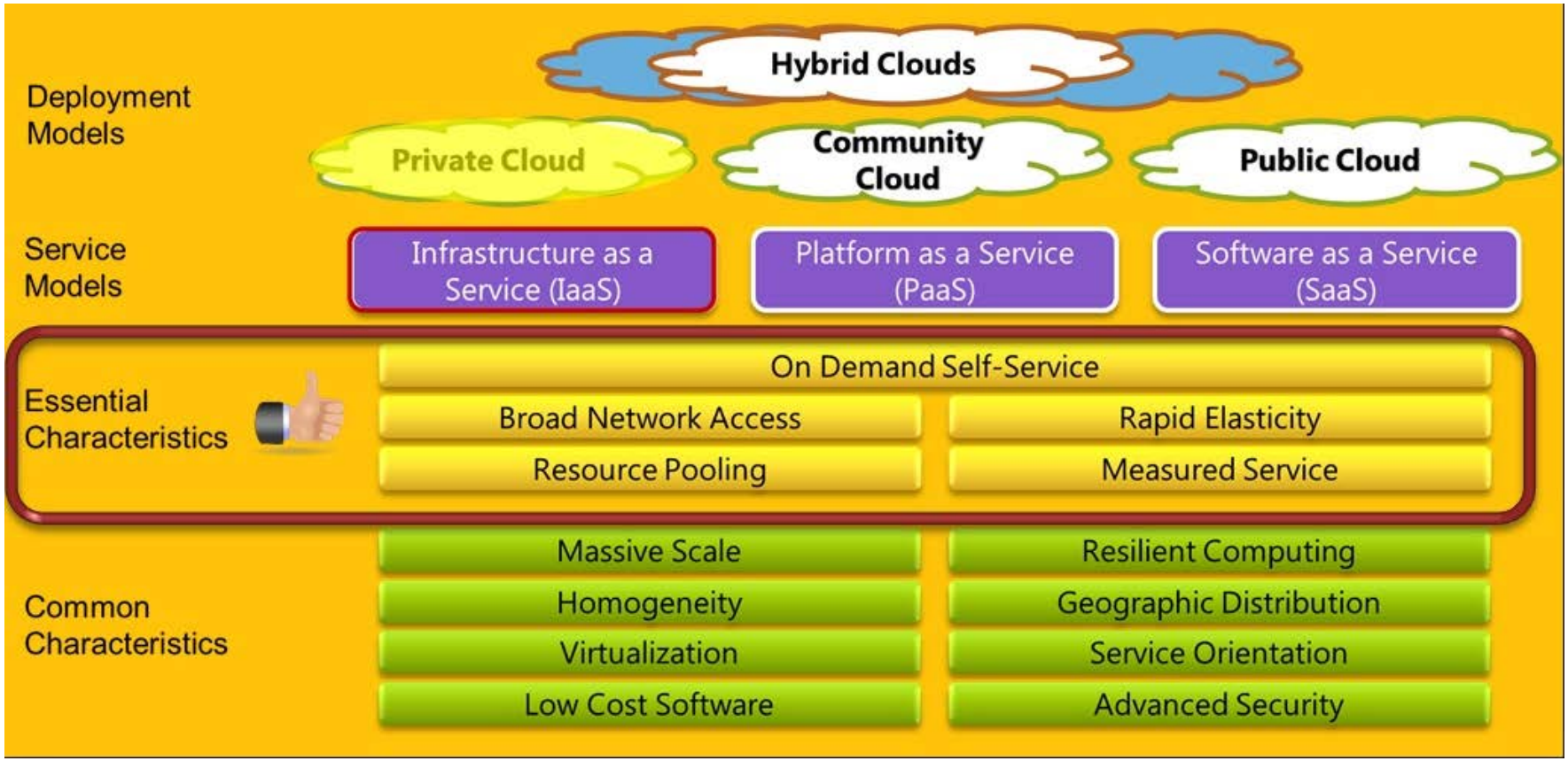
NIST Cloud Definition



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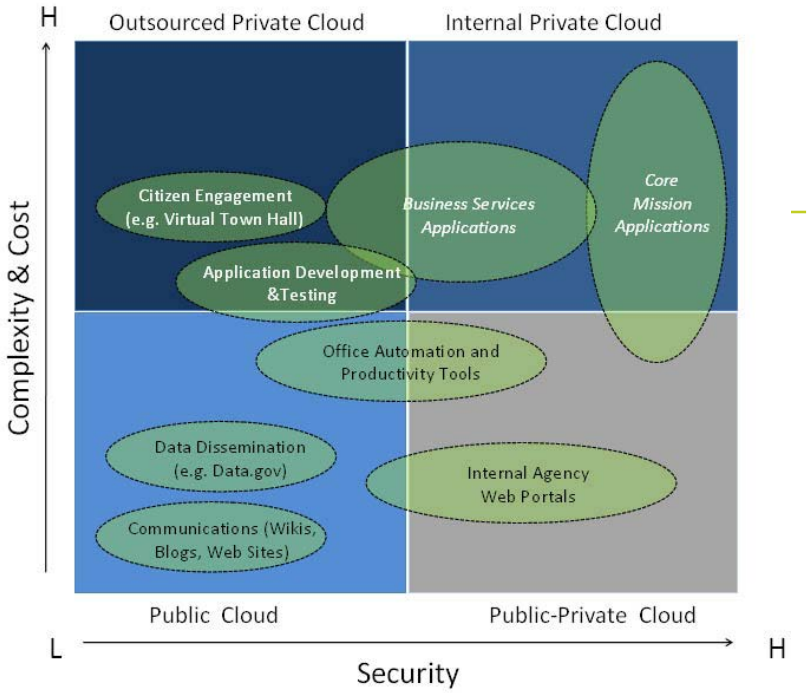
NIST Cloud Services



Public Sector Management of XaaS Platforms

Traditional IT	Infrastructure (as a Service)	Platform (as a Service)	Software (as a Service)
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
Operating System	Operating System	Operating System	Operating System
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

You manage Delivered as a service

Source: Adapted from IDC Government Insights

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Lessons Learned about our Analysis

- **It's a pilot-we will learn from it!**
  For this project, we had to remind ourselves that the reason our customer was conducting a pilot in the first place was because we did not have all the answers-including what it would cost.

- **Inform the customer to manage expectations.**

  In our customer's case, they were going to a private, on-premises cloud; much of the cost savings associated with the public cloud (due to amortized costs over multiple customers) would not be realized.

  – Note cost differences (e.g., high upfront costs, less realized savings) as well as benefits (e.g., higher security)

- **No formal survey existed that we could find comparing multiple calculators, though several had examined AWS & DISA.**
- **Use an RFI as a tool to gather information directly from vendors**
- **Access to cloud subject matter experts key**

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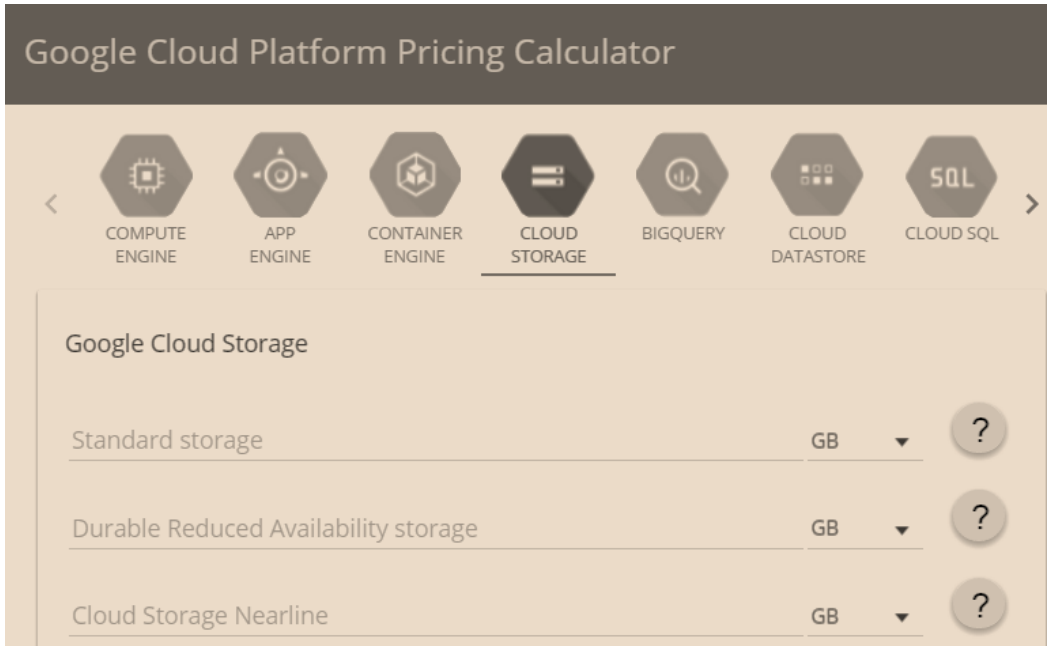
Google Cloud Calculator



Compute Engine			
Region	US		
VM class	regular		
Instance type	n1-standard-2		
Cores per isnstance		2	units
RAM per instance		7.5	GB
Paid OS Cost (Windows)	$	32,236.80	
GCE Instance Cost	$	28,207.20	
total hrs per month		402,960	hrs/mo
price per instance	$	0.28	/hr
monthly price	$	208.00	/mo
Total available local SSD space	1x375		GB
Sustained use discount		30%	
effective hourly rate	$	0.26	/hr
Estimated monthly cost	$	105,777.00	/mo
Persistent Disk (Storage)			
storage		288,870	GB
Estimated monthly cost	$	11,554.80	
Load Balancing (global)			
Forwarding rules		68	
Network ingress/egress		3200	GB
Estimated monthly cost	$	503.75	
Network Bandwidth			
Egress to different zone in same region		100	GB
Egress to different region within the US		100	GB
Estimated monthly cost	$	2.00	
Total Estimated Monthly Cost	$	117,837.55	/mo
Total Estimated Annual Cost	**$**	**1,414,050.60**	**/yr**

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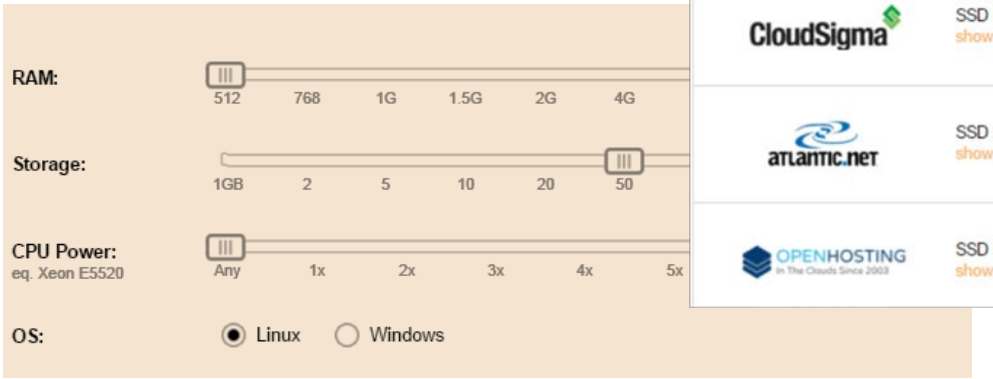
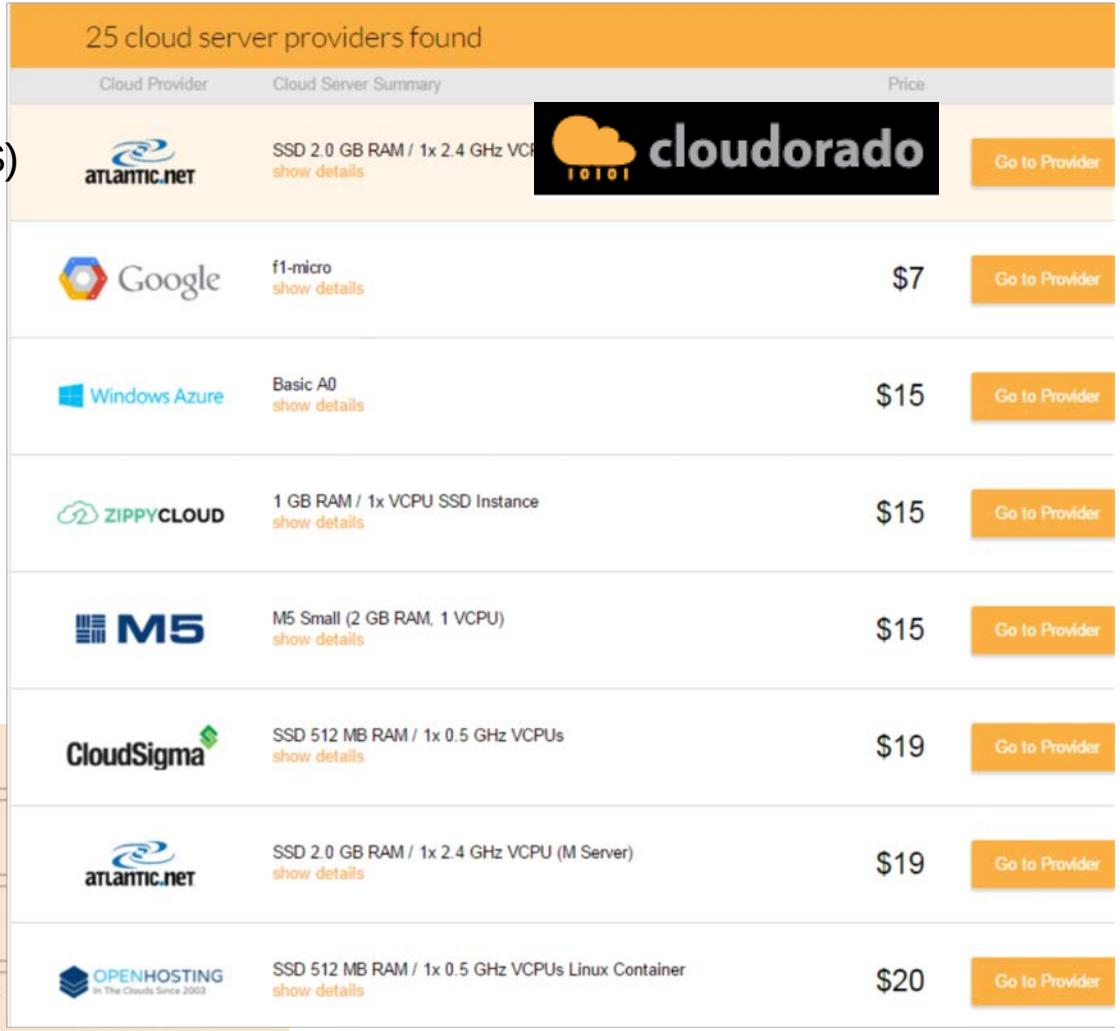
Clouderado Pricing Tool-the "Kelly Blue Book" of Clouds

- **Key Inputs:**
  - VM Size, Qty, Storage (Doubling storage doubles $)
- **FISMA low/moderate only.**
- **Backup/storage computed together.**
- **Provides low-average high range**
- **Also provides prices for utility cloud services**
- **Considers 19 vendors**





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