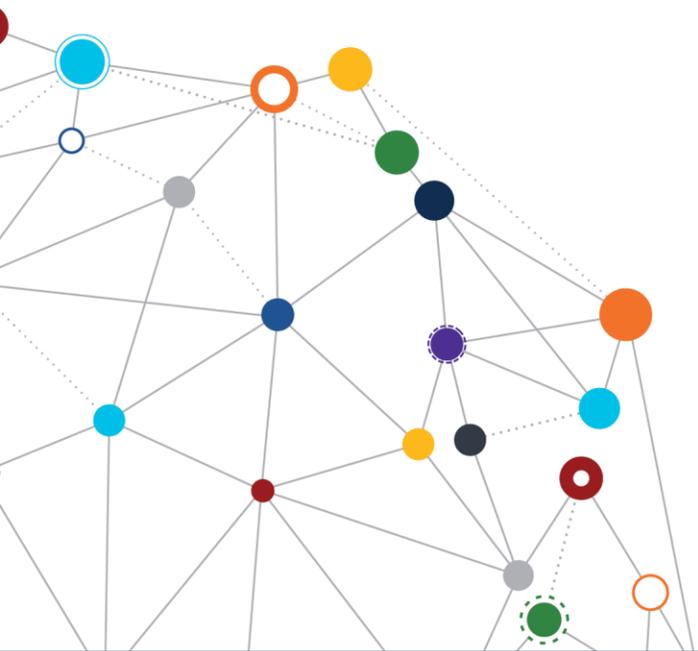


OFFICE OF
INFORMATION
AND TECHNOLOGY

Infrastructure-as-a-Service (IaaS) Enterprise Design Pattern

IaaS Flowchart

August 2018 | Demand Management Division



VA



U.S. Department of Veterans Affairs
Office of Information and Technology



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Table 1: Change Matrix

Version	Date	Description of Updates
1.0	08/03/2018	IaaS EDP Segment 2 document approved



1 Context

The move to an Infrastructure-as-a-Service (IaaS) model enables the Department of Veterans Affairs (VA) to achieve economies of scale, greater elasticity, greater resource efficiency, and better ability to maintain systems. IaaS breaks down data center silos, for example, by moving systems to the cloud. When management groups do not share information, goals, tools, priorities, and processes with each other, duplication and redundancy are at risk.

2 Problem

Project teams at VA would benefit from a standardized process for working with and towards IaaS solutions. Through the presentation of several flowcharts, the *IaaS* Enterprise Design Pattern (EDP) provides VA projects teams with a logical sequence for starting and finishing IaaS-based projects. This EDP also leverages industry best practices, internal VA resources and references, applicable guidance from previous EDPs, and the resources and guidance of the VA Enterprise Cloud (VAEC).¹ The Enterprise Cloud Solution Office (ECSO) Team works with project managers and business owners to determine an application's suitability for the VAEC.

3 Approach

The VAEC offers on-demand self-service, broad network access, resource pooling, elasticity, and a measured service. Currently, the VAEC provides private VA cloud environments in the Amazon Web Services (AWS) Government Cloud and the Microsoft Azure Government Cloud (MAG). VA is also planning an on-premise VA Private Cloud.

3.1 Implementation Tasks

In providing IaaS capabilities through the VAEC, project teams must recognize and implement standards for IaaS utilization. These standards are captured in cloud migration planning, service model selection, and utilization of the VAEC.

4 Application

The following flowchart depicts standards for IaaS utilization, as mapped to the Design, Engineering, and Architecture (DEA) user stories. More specific tasks are represented by additional flowcharts that follow.

¹ Reference the Cloud First Policy, articulated within VA Directive 6517, *Cloud Computing Services*, at http://www.va.gov/vapubs/viewPublication.asp?Pub_ID=852&FType=2.

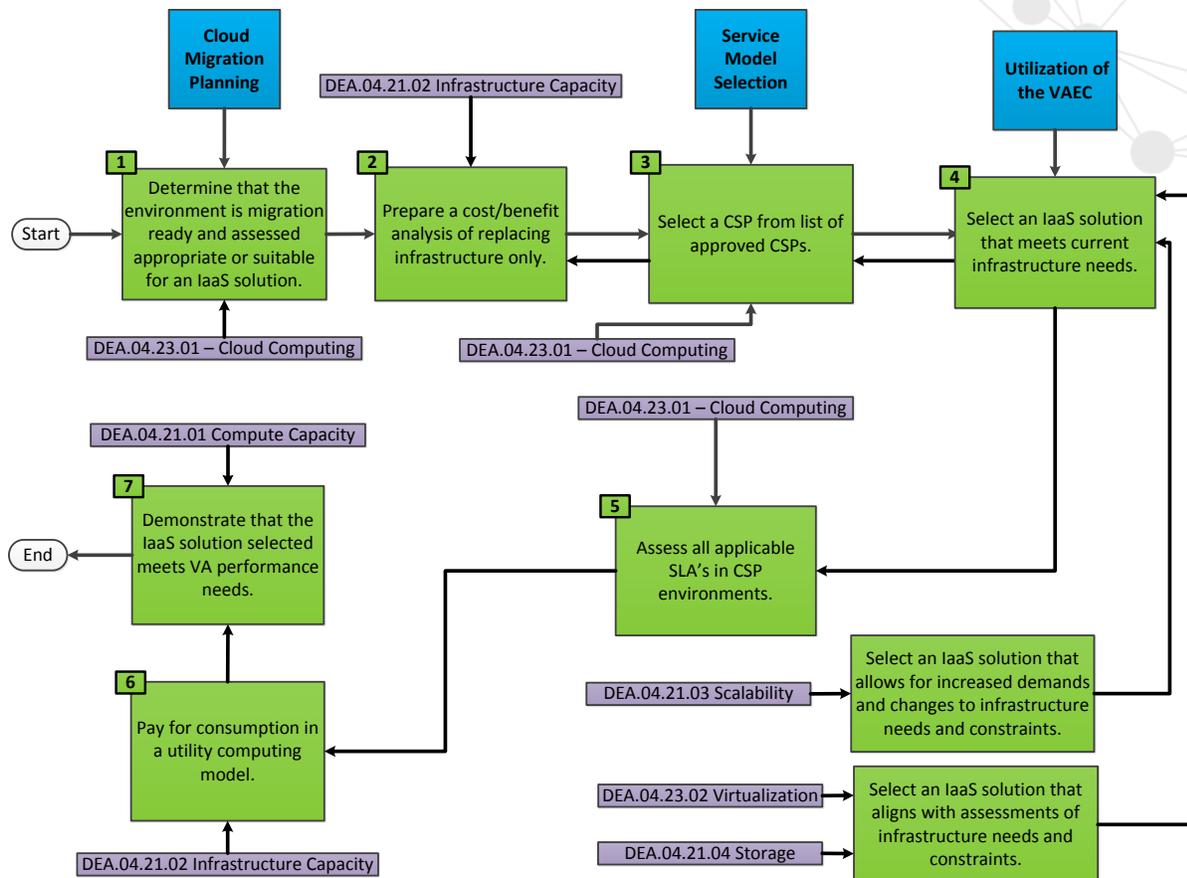


Figure 1: IaaS Task Flowchart

As shown in Figure 1, cloud migration planning is the key driver to assessing the readiness and suitability of an environment for an IaaS solution in step 1. A project team can determine if their environment is appropriate for an IaaS solution by successfully completing the seven steps for cloud migration planning. The specific tasks necessary for cloud migration planning are shown in the flowchart in Figure 2.

When performing a cost benefit analysis in step 2 (for attributes not handled by the CSP),² a project should consider the following costs.

- The cost of the define, design, and build system phases
- The costs for the IaaS environment, development, installation, operations, and maintenance
- The non-recurring costs associated with the design, development, installation, operation, maintenance, disposal, and consumables for the new IaaS environment

² Reference the Department of Veterans Affairs Cost Benefit Analysis Template at https://www.va.gov/PROCESS/artifacts/cost_benefit_analysis_template.docx.

- The recurring costs of operating and maintaining each alternative over the lifecycle of the IaaS environment

In step 7, a project team demonstrates that the IaaS solution meets VA needs by performing acceptance testing and validating the testing results. Project teams can work with the selected CSP to ensure that the target IaaS solution aligns with the criteria associated with the DEA user stories.

The specific tasks necessary for cloud migration planning are outlined in Figure 2 and based on guidance from previous EDPs, including *Transition to Cloud*, *Cloud Security*, and *Enterprise Cloud Service Management*.³ The following steps provide an example of how a project team could complete a cloud migration successfully.⁴

1. Perform an analysis of the current IT architecture to identify elements that can be placed in the cloud.
2. Analyze the business functions that the current systems provide to prioritize criticality, such as performing a Business Impact Analysis (BIA).
3. Break down the system into its components through a balanced approach.⁵
 - Over-analyzing the system decomposition may result in constant refactoring that could impede high level migration objectives and schedule.
 - Insufficient decomposition may miss the opportunity to leverage beneficial cloud-native applications.
4. Migrate data and applications to the cloud for the component in question.
5. The process continues until all the components are migrated (return to step 1 if needed).

³ Reference *Transition to Cloud* EDP at https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf; and the *Cloud Security* EDP at https://www.oit.va.gov/library/programs/ts/edp/privacy/CloudSecurity_V1.pdf; and the *Enterprise Cloud Service Management* EDP at

https://www.oit.va.gov/library/programs/ts/edp/cloud/EnterpriseCloudServiceManagement_v2.pdf.

⁴ Reference *Transition to Cloud* EDP at

https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf.

⁵ Source: *3 strategies for migrating applications to the cloud* at <https://www.accenture.com/us-en/blogs/blogs-amod-bavare-keys-to-refactoring-cloud-migration>.

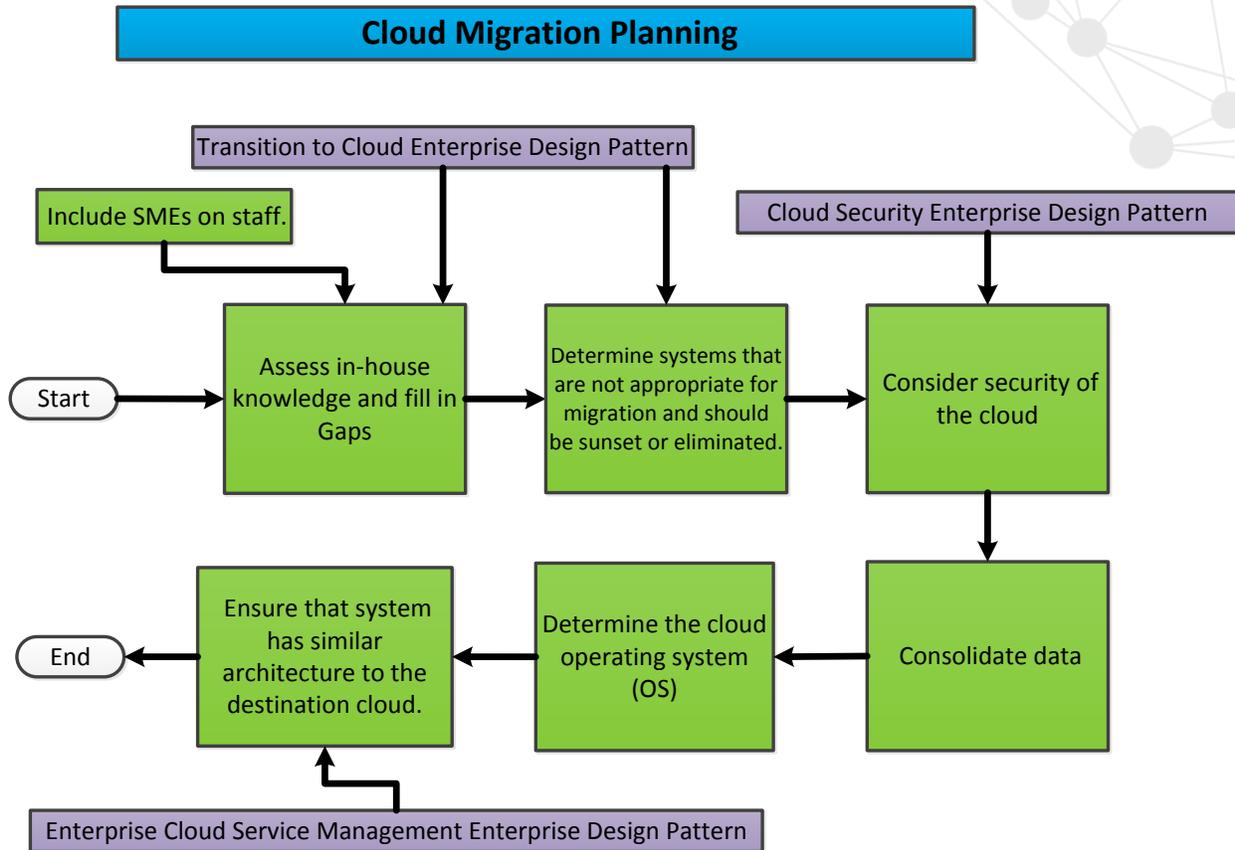


Figure 2: IaaS Cloud Migration Planning Flowchart

Following cloud migration planning, service model selection must be implemented. The specific tasks necessary for service model selection are shown in the flowchart in Figure 3.

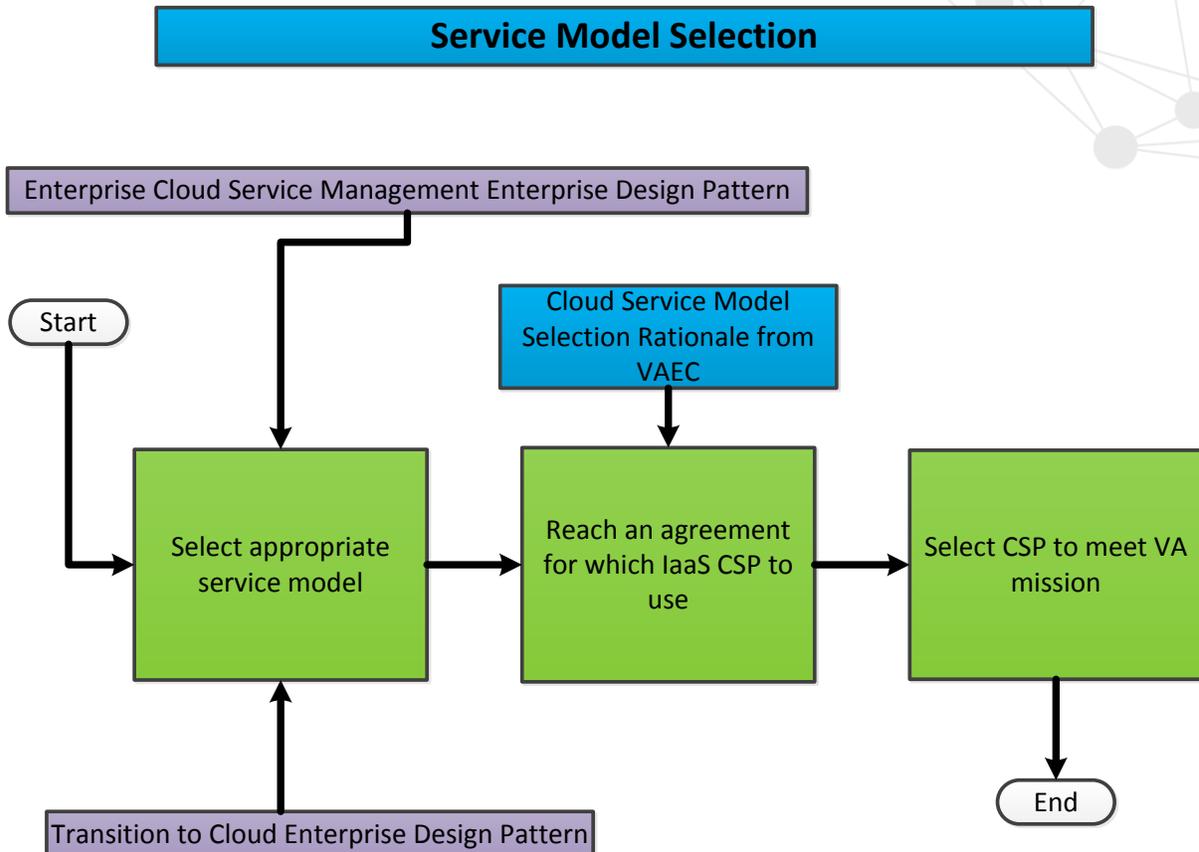


Figure 3: Service Model Selection

The reference to the Cloud Service Model Selection Rationale from the VAEC can be found in Figure 1 *IaaS Draft Decision Tree CSP from ECSO* of IaaS Service Provider Selection EDP. The following steps provide an example of how a project team could complete a successful cloud computing service model selection.⁶

1. Refer to the VAEC Self-Service Catalog for offerings for established IaaS CSPs and resources. If there is a need to add an alternative solution, contact the ECSO to work through the needs of the target environment.
2. Evaluate the requirements for IaaS options. IaaS is minimally managed by the CSP and mostly managed by the consumer. The applications, data, runtime, middleware, and O/S are managed by the consumer, but the virtualization, servers, storage, and networking are managed by the provider.
3. If consideration is given to an external candidate CSP (outside existing vendor-VAEC partnerships), project teams will need to ensure alignment with the infrastructure

⁶ Reference *Transition to Cloud EDP* at https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf.

requirements of the target environment, the forecasted skills of the staff, and the results of the cost benefit analysis.

Following service model selection, project teams should assess all applicable Service Level Agreements (SLAs) in CSP environments; followed by specific steps for utilization of the VAEC, as shown in the flowchart in Figure 4.

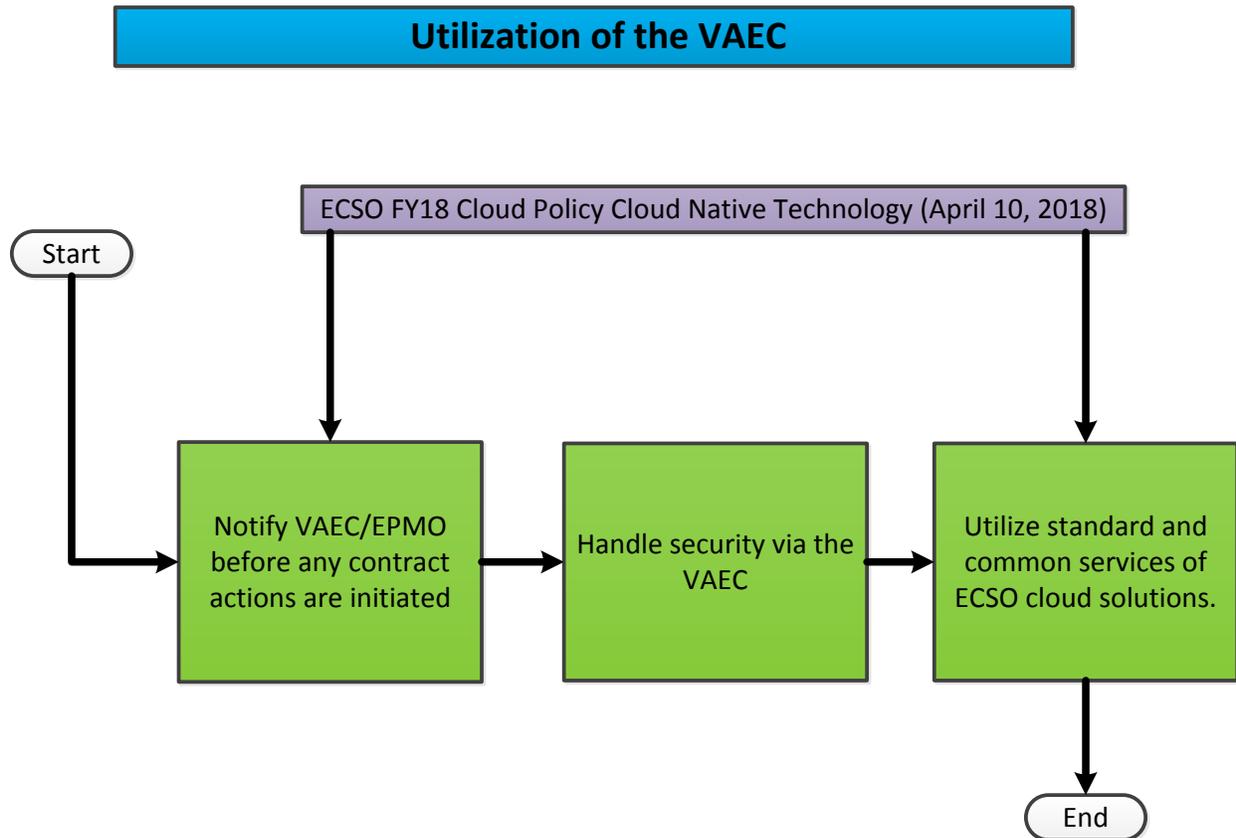


Figure 4: IaaS Utilization of the VAEC

The following steps provide an example of how project teams could utilize guidance from the VAEC:⁷

1. Fill out the ECSO Request Form and participate in an Intake Meeting with the Enterprise Cloud Solutions Office (ECSO) team. This will allow project teams to receive the ECSO Information Guide, discuss funding requirements, review acquisition options, receive guidance, and set up sandbox accounts.

⁷ Reference VA Enterprise Cloud (VAEC) at <https://vawww.portal.va.gov/sites/ECS/Shared%20Documents/Cloud%20101/VA-EnterpriseCloud-Flyer.pdf>.

2. Sign up for training if needed (see the ECSO Portal Learning Page for a list of cloud-related courses available on TMS).⁸
3. Email the ECSO for other cloud questions.⁹

Table 2 provides additional details corresponding to the key recommendation areas.

Table 2 : Guiding Principles IaaS EDP

DEA User Story	Title	Guiding Principle	Resources and Supplemental Actions
DEA 04.23.01	Cloud Computing	<p>1. Determine that the environment is migration ready and assessed appropriately, or suitable for an IaaS solution.</p>	<p>1.1 Cloud Migration Planning</p> <ul style="list-style-type: none"> • <i>Transition to Cloud</i> EDP¹⁰: Section on Key Attributes of a Transition to Cloud Framework • <i>Cloud Security</i> EDP¹¹: Sections on Shared Responsibility Model and TIC compliance • <i>ECSM</i> EDP¹²: Sections on Technical and Architectural Principles and Security Considerations <p>1.2 Cloud migration assessment should be consistent with VAEC approved resources and procedures: Consult ECSO guidelines¹³ before moving forward.</p>

⁸ Reference VA Available Cloud Training at <https://vaww.portal.va.gov/sites/ECS/SitePages/Cloud-Training.aspx>.

⁹ Email the VAEC for other cloud questions to VAITECintakeMailbox@va.gov.

¹⁰ Reference *Transition to Cloud* EDP at https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf.

¹¹ Reference *Cloud Security* EDP at https://www.oit.va.gov/library/programs/ts/edp/privacy/CloudSecurity_V1.pdf.

¹² Reference *ECSM* EDP at https://www.oit.va.gov/library/programs/ts/edp/cloud/EnterpriseCloudServiceManagement_v2.pdf.

¹³ Reference ECSO Service Request at <https://vaww.portal.va.gov/sites/ECS/SitePages/ECS-Request-Form.aspx>.



DEA User Story	Title	Guiding Principle	Resources and Supplemental Actions
		<p>3. Select a CSP from approved list of CSPs.</p>	<p>3.1 Select service model:</p> <ul style="list-style-type: none"> • Transition to Cloud EDP¹⁴ – Section on Service Model Selection • ECSM EDP¹⁵ – Sections on Operational Vision and Business Principles <p>3.2 Move forward with Microsoft or AWS for IaaS services.</p>
		<p>5. Assess all applicable SLA's in CSP environments.</p>	<p>5.1 ECSM EDP - SLAs guidance-</p> <ul style="list-style-type: none"> • Future Capabilities • Business Principles • Operational Vision • Governance and Risk Management. <p>5.2 If SLA with IaaS CSP (step 3.1) meets enterprise guidance (step 5.1), move forward. If not, revise SLA or consider revisiting step 3 again.</p>
<p>DEA 04.21.02</p>	<p>Infrastructure Capacity</p>	<p>2. Prepare a cost/benefit analysis of replacing infrastructure only.</p>	<p>2.1 Estimate utilization costs based on demand forecasting.</p> <p>2.2 Estimate virtual server and storage costs.</p> <p>2.3 Assess pay-per-use vs. capital expenditures. If pay-</p>

¹⁴ Reference *Transition to Cloud* EDP at https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf.

¹⁵ Reference *ECSM* EDP at https://www.oit.va.gov/library/programs/ts/edp/cloud/EnterpriseCloudServiceManagement_v2.pdf.



DEA User Story	Title	Guiding Principle	Resources and Supplemental Actions
			per-use is more cost effective, move forward with an IaaS CSP.
		6. Pay for consumption in a utility computing model.	6.1 Pay in advance for ability to use IaaS CSP environment. 6.2 As usage is depleted, acquire more credits.
		7. Demonstrate that the IaaS solution that is selected meets VA performance needs	7.1 Perform acceptance testing. 7.2 Validate testing.
DEA 04.21.03	Scalability	4. Select an IaaS solution that meets current infrastructure needs.	4.1 Select an IaaS solution that enables increased demands and changes to infrastructure needs and constraints. 4.2 Select an IaaS solution that aligns with an assessment of infrastructure needs and constraints.
DEA 04.23.02	Virtualization	4. Select an IaaS solution that meets current infrastructure needs.	4.1 Select an IaaS solution that enables increased demands and changes to infrastructure needs and constraints. 4.2 Select an IaaS solution that aligns with an assessment of infrastructure needs and constraints.



DEA User Story	Title	Guiding Principle	Resources and Supplemental Actions
DEA 04.21.02	Storage	4. Select an IaaS solution that meets current infrastructure needs.	<p>4.1 Select an IaaS solution that enables increased demands and changes to infrastructure needs and constraints.</p> <p>4.2 Select an IaaS solution that aligns with an assessment of infrastructure needs and constraints.</p>
DEA 04.21.01	Compute Capacity	7. Demonstrate that the IaaS solution that is selected meets VA performance needs	<p>7.1 Perform acceptance testing.</p> <p>7.2 Validate testing.</p>

Future updates of this document will reflect updates to the DEA Compliance Criteria to reflect the guiding principles for IaaS release.

5 Impacts

If a move to the IaaS cloud is not implemented, the following are potential pitfalls:

- Higher capital expenditure costs (CapEx)
- Lower computing power
- Less scalability

Appendix: References

References:

- *3 strategies for migrating applications to the cloud*: <https://www.accenture.com/us-en/blogs/blogs-amod-bavare-keys-to-refactoring-cloud-migration>
- Application Performance Management EDP: https://www.oit.va.gov/library/programs/ts/edp/ea/ApplicationPerformanceManagement_v3.pdf
- Business Impact Analysis EDP: https://www.oit.va.gov/library/programs/ts/edp/itsm/BusinessImpactAnalysis_V1.pdf
- Cloud Computing Architecture EDP: https://www.oit.va.gov/library/programs/ts/edp/cloud/CloudComputingArchitecture_V1.pdf
- Cloud First Policy: http://www.va.gov/vapubs/viewPublication.asp?Pub_ID=852&FType=2
- Cloud Security EDP: https://www.oit.va.gov/library/programs/ts/edp/privacy/CloudSecurity_V1.pdf
- DEA User Stories: <https://vaww.portal2.va.gov/sites/asd/TechStrat/IPTS/SitePages/Home.aspx>
- Disaster Recovery as a Service EDP: https://www.oit.va.gov/library/programs/ts/edp/itsm/DisasterRecoveryAsAService_V1.pdf
- ECSM EDP: https://www.oit.va.gov/library/programs/ts/edp/cloud/EnterpriseCloudServiceManagement_v2.pdf
- ECSO Service Request: <https://vaww.portal.va.gov/sites/ECS/SitePages/ECS-Request-Form.aspx>
- FedRAMP: <https://www.fedramp.gov/>
- Handbook 6500: https://www.va.gov/vapubs/viewPublication.asp?Pub_ID=793&FType=2
- Transition to Cloud EDP: https://www.oit.va.gov/library/programs/ts/edp/cloud/TransitiontoCloud_V1.pdf
- TRM: <http://trm.oit.va.gov/>
- VA Available Cloud Training: <https://vaww.portal.va.gov/sites/ECS/SitePages/Cloud-Training.aspx>
- VA Cloud Security Handbook, VA Directive 6517: https://www.va.gov/vapubs/viewPublication.asp?Pub_ID=853&FType=2

- VA Cost Benefit Analysis Template: https://www.va.gov/PROCESS/artifacts/cost_benefit_analysis_template.docx
- VA Digital Modernization Strategy, April 11, 2018 VA Directive 6551: https://www.va.gov/vapubs/viewPublication.asp?Pub_ID=829&FType=2
- VA Enterprise Architecture: <https://www.ea.oit.va.gov/>
- VA MEFs: https://www.va.gov/vapubs/viewPublication.asp?Pub_ID=582&FType=2
- VAEC: <https://vaww.portal.va.gov/sites/ECS/SitePages/VA-Enterprise-Cloud-VAEC.aspx>
- VASI Dashboard: <http://vaausappdar401.aac.dva.va.gov/views/VAEATargetPortfolios/VATargetPortfolioDashboard?iid=1&isGuestRedirectFromVizportal=y&embed=y>
- VEAR: <https://vaausdarapp82.aac.dva.va.gov/ee/request/home>

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