Cisco Multicloud Portfolio:

Cloud Consume

Cisco CloudCenter:
Secure and Seamless Migration of Applications to Cloud

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Executive summary

Cloud computing is changing rapidly. To get the best technological and business advantage, you need an evolving cloud strategy to put the right workload in the right environment. You have many choices, and there are good business reasons to use different on-premises or cloud environments: agility, efficiency, security, control, compliance, and performance, to name a few. As a result, a growing mix of applications is available across multiple environments. These applications need to be managed to deliver the promised benefits of cloud.

If they are not managed effectively, the complexity of managing a hybrid service portfolio can undermine the promised cost and agility values of cloud computing. The ability to seamlessly migrate applications becomes crucial with hybrid clouds. You need to deal not only with migration of applications but also with their ongoing management and performance monitoring.

With the obvious benefits of public clouds like elasticity, reduced operational overheads, and on-demand provisioning, businesses are architecting their new applications with public cloud in mind. This works well for greenfield deployments, and to get the benefits of public cloud for brownfield applications, organizations are looking for ways to migrate their existing applications to cloud.

This guide documents how the Cisco CloudCenter™ solution, working with AppDynamics®, iQuate, and CloudEndure, can help you seamlessly migrate and monitor applications to meet changing business and user needs. The audience for this guide includes, but is not limited to, infrastructure administrators and application developers.

Cisco Multicloud Portfolio: Overview

In a multicloud world, growing complexity is driving a cloud gap between what your customers require and what your people, processes, and tools can support. With Cisco® Multicloud Portfolio, we make it simple: simple to connect, simple to protect, and simple to consume.

The Cisco Multicloud Portfolio is a set of essential products, software, and services supported with simplified ordering and design deployment guides to help you when it comes to multicloud adoption. Cisco Multicloud Portfolio consists of four component portfolios (Figure 1):

- **Cloud Advisory**: Helps you design, plan, accelerate, and reduce risk during your multicloud migration.
- **Cloud Connect**: Securely extends your private networks into public clouds and ensures the appropriate application experience.
- **Cloud Protect**: Protects your multicloud identities, direct-to-cloud connectivity, data, and applications, including Software as a Service (SaaS) and detects infrastructure and application threats on-premises and in public clouds.
- **Cloud Consume**: Helps you deploy, monitor, and optimize applications in multicloud and container environments.
Cloud Consume overview

Cloud Consume consists of essential products to help you deploy, monitor, and optimize applications in multicloud environments:

- AppDynamics
- Cisco CloudCenter
- Cisco Container Platform

For detailed use cases, see the section about Cloud Consume on the portfolio’s solution page at https://www.cisco.com/go/multicloud.

Cloud Consume use cases

Cloud Consume allows you to scale applications, gain visibility into application performance, control cloud spend, and manage the full application lifecycle. Cloud Consume delivers value in the following use cases:

- Optimize resources by scaling applications based on end user performance and business metrics (such as conversion rate, page loading time) to align with your organization’s needs.
- Apply governance and control of who deploys what and where to ensure security and compliance while controlling resource usage and cloud costs.
- Optimize service quality by identifying and responding to emerging issues before they impact your business.
- Seamless deployment and monitoring using automated provisioning of fully configured application stacks with monitoring agents into any environment.
- Optimize code by identifying code-level performance issues.
- Migrate with comparison by first identifying services to migrate and then getting an accurate view of applications’ technical and business metrics before and after to prove migration success.
- Simplify deployment and management of Kubernetes containers through automation and end to end lifecycle management of container clusters.
- Optimize containers for multicloud environments on-premises and in public clouds (e.g. GCP etc.).
Could Consume benefits
Cloud Consume benefits include:

- Seamless deployment and monitor of applications across multicloud
- Identification of performance trends to right-size IT resources and control cloud spend
- Identification of application dependencies to prioritize migration candidates
- Analysis of user, app, and business performance before and after migration
- 20-30 times faster application deployment time
- 10-20 percent lower overall TCO
- Faster application turnaround cycles (develop-test-stage-run)
- Assurance of multicloud performance
- Collection of business metrics (such as conversion rates, costs) to drive cloud consumption decisions
- Reduced complexity with fully curated, open container management for production-grade Kubernetes

Technology overview
The rapid pace of innovation puts tremendous pressure on your organization to accelerate its ability to deploy applications. By being able to deploy applications quickly, rather than in days or weeks, the cloud provides tremendous value. It is not surprising then, that today, over 73 percent of organizations have adopted or are adopting a hybrid cloud strategy.

Hybrid cloud strategies are continuously evolving to make sure that the right workloads are in the right environment to result in the best technological and business advantages. You have many choices available to you, and there are compelling business reasons to utilize different environments, such as agility, efficiency, security, control, compliance, and performance.

However, along with the different groups of users utilizing a growing diversity of applications across multiple environments and clouds, comes increasing complexity. If not managed effectively, the complexity of a hybrid service portfolio can completely undermine the value, agility, and cost savings associated with cloud computing.

Experts agree that we need a new approach with good planning, tools, and implementation that supports seamless application migration across multicloud environments.

Cisco CloudCenter
The Cisco CloudCenter solution is a hybrid cloud management platform that securely provisions infrastructure resources in data center, private, and public clouds so that you can quickly and easily model, deploy, and manage applications and data in any environment. Whether you are deploying simple or complex workloads to one or many environments, Cisco CloudCenter enables users to serve themselves without having to understand the nuances of the underlying automation mechanisms or cloud environments.

The solution supports a wide range of uses in enterprise IT organizations, including application migration, DevOps automation across various cloud environments, and dynamic capacity augmentation within or between clouds. It also can serve as the foundation for a comprehensive hybrid IT-as-a-Service (ITaaS) delivery strategy.
Each cloud, whether private or public, uses a different approach when it comes to compute, network, security, and storage. Cisco CloudCenter abstracts these differences for the end user, providing a single-pane-of-glass approach that makes deployment of applications seamless across all clouds without the need for cloud-specific scripting. In addition to eliminating cloud lock-in, it also simplifies cost control, security, governance, and portability.

Cisco CloudCenter begins with a cloud-independent portable object model called an “application profile” that combines infrastructure-automation and application automation layers in a single deployable blueprint. Application profiles define each application’s deployment and management requirements and outline the relationship between users, deployment environments, and deployable blueprints. Cisco CloudCenter also abstracts Infrastructure-as-a-Service (IaaS) APIs that are different in each environment, and it uses a unique, patented architecture to allow a single deployable blueprint to be in a user’s choice of target environments. These cloud-specific orchestrators abstract applications from the cloud, interpret the needs of applications, and translate these needs to cloud-specific services and APIs.

The Actions Library is a framework that extends the CloudCenter platform capabilities. It enables you to create, manage, and execute actions for virtual machine management. This framework also allows the administrators to define actions and execute them on different CloudCenter resources such as virtual machines, deployments, and application profiles. The association criteria defined as part of an action dictate which action is available for execution against which specific resource.

**AppDynamics Application Performance Management**

AppDynamics Application Performance Monitoring (APM), a component of the AppDynamics App IQ platform, gives you end-to-end visibility into the performance of your applications. AppDynamics works with popular programming languages such as Java, .NET, Node.js, PHP, Python, C/C++, and more, enabling you to:

- Troubleshoot problems such as slow response times and application errors
- Automatically discover application topology and how components in the application environment work together to fulfill key business transactions for users
- Measure end-to-end business transaction performance, along with the health of individual application and infrastructure nodes
- Receive alerts based on custom or built-in health rules, including rules against dynamic performance baselines that alert you to issues in the context of business transactions
- Analyze your applications at the code-execution level using snapshots

**CloudEndure Live Migration**

The CloudEndure Live Migration service helps migrating workloads to the cloud and back. It utilizes block-level continuous replication, application stack orchestration, and automated machine conversion to ensure 100 percent data integrity. Whether you are migrating to, across, or within clouds, CloudEndure Live Migration gives you the flexibility and security you need to succeed in today’s fast-paced digital ecosystem.
iQuate iQCloud

iQCloud is the most advanced automated discovery and service-mapping solution available. It brings an unprecedented clarity to complex, hybrid, and multicloud IT estates. iQCloud maps your business services and interdependencies across legacy, private, and public cloud environments.

Some of the key capabilities of iQCloud include:

- Captures and identifies business services, applications, infrastructure components
- Maps dependencies and communications across infrastructure and IT environments
- Provides hardware and software inventory details required to populate and update Configuration Management Databases (CMDBs), business service models, cloud orchestration, and IT transformation tools

Solution design

Requirements

Moving applications to the cloud can be overwhelming, and customers want to move to the cloud with near zero downtime. Users want to move applications, instead of individual virtual machines. However, typical moves to the cloud focus on moving individual virtual machines. Usually, the applications are a group of virtual machines (one or more). Moving one virtual machine in the application may break the application or create an orphaned state for an application. Thus, it is critical that the whole application move, which may involve moving more than one virtual machine.

It has been a challenge to find application components that interact for existing applications (also known as brownfield applications). With the help of application discovery tools, application dependency can be derived and the grouping of virtual machines can be done in an environment. Once the application discovery is done, you can plan the migration of the application.

The prerequisites for the design in this guide are:

- Basic knowledge of Cisco CloudCenter
- Cisco CloudCenter set up and running
- Multiple clouds integrated into CloudCenter using orchestrators
- Image mappings set up for the clouds in use
- AppDynamics SaaS or on-premises version up and running
- CloudEndure SaaS set up
- iQuate iQCloud SaaS set up

Design principles

Planning for a multiphase approach for migration is essential. This approach helps in the effective migration of applications by segregating the tasks according to their functional aspects. The Cisco CloudCenter solution simplifies the application migration process (Figure 2).
Figure 2. Application migration flow with Cisco CloudCenter

Application Discovery is the first step in identifying the application and its components. Collecting information about the applications in the existing environment is critical in understanding what and how the application should be migrated. Interdependencies in the application components need to be fully understood. This understanding gives confidence when planning the migration for the applications, as the goal is to migrate the whole application (instead of pieces) and avoid anything that would lead to an orphaned state for the application during after the migration.

One of the key drivers of the application migration is better performance in the public cloud. To make sure that the application performance is the same or better in the public cloud, you need to have established performance baselines while the application is running in the private cloud. Using AppDynamics, the performance baseline can be set up for the application, and that baseline helps you understand the application behavior with the current infrastructure. Building technical and business metrics for performance baseline keeps the focus on measuring the performance not only at the technical level but also at the business level (how users are interacting with the application, understanding business key performance indicators, etc.).

After application discovery and initial performance baselining, the application is migrated using lift-and-shift-type migration tools. The lift-and-shift migration lets you move the application without rearchitecting or redesigning it, making for less disruptive and quicker application migration.

Once migration is complete, it is essential to measure the application's performance and learn more about the application. Performance baselining is done again, this time with the application running in the public cloud, using the same technical and business metrics as for the on-premises performance baselining.

Using the pre-migration and post-migration phases' performance baselines, you can compare the application's technical and business metrics. Technical metrics can be used by DevOps and application owners to gain confidence. The business metrics help in understanding user behavior, application interaction, and the like.
Solution deployment

Cisco CloudCenter lets you navigate the different phases by interacting with various tools at various stages of the application migration cycle. Different tools are available for each of the stages, and with CloudCenter’s extensible architecture, you can plug in various tools based on your environment, management and application needs. AppDynamics, iQuate, and CloudEndure are among the tools you can use with Cisco CloudCenter to perform an application migration (Figure 3).

Following is one example of how this can be achieved:

- Using iQuate’s iQCloud, application discovery is performed in an existing environment.
- Cisco CloudCenter enables AppDynamics agents on application virtual machines for performance monitoring.
- AppDynamics captures the performance of the application in the private cloud before migration.
- Cisco CloudCenter, using CloudEndure, moves the application virtual machines to different clouds such as Amazon Web Services (AWS), Microsoft Azure, and Google.
- AppDynamics compares the performance of the application in the public cloud to its performance in the private cloud.

Figure 3. Application migration flow tools used with Cisco CloudCenter

The Action Library feature in Cisco CloudCenter enhances the brownfield import feature by enabling dayN operations on the brownfield and greenfield deployments. Using this feature, Cisco CloudCenter triggers the AppDynamics Agent installation, and the application move is planned using the application discovery data from iQuate. CloudEndure SaaS is then called to do the migration, by replicating the data to the cloud, and subsequently, cutover is planned.
Application discovery

Having a thorough understanding of the applications and their constructs along with their dependencies, is critical in selecting the candidate for migration to cloud. Building a dependency tree for the application components is helpful in understanding the applications. Although multiple tools are available for performing application discovery, we are using an agentless tool: iQuate iQCloud. It is a SaaS-based tool that builds application understanding by capturing and identifying business services, applications, and infrastructure components.

To enable iQuate application discovery for an existing VMware vCenter environment, follow these steps:

**Step 1.** Set up an account with cloud.iquate.com.

**Step 2.** Install iQuate appliance in the vCenter environment.

**Step 3.** Configure the iQuate appliance with the credentials of the virtual machines that need to be monitored to perform application discovery (Figure 4).

**Figure 4.** Viewing discovered application in iQuate

To export the application discovery data from iQuate:

**Step 1.** Log in to the iQuate portal.

**Step 2.** Browse to Reports > My Reports > Application Inventory.

**Step 3.** Export the discovered application data for the applications in the vCenter environment.

Now import the application virtual machines, and enable them for AppDynamics monitoring at the Cisco CloudCenter:

**Step 1.** Log in to Cisco CloudCenter.

**Step 2.** Browse to Virtual Machines > Unmanaged.
Step 3. Based on the application discovery data from iQuate, select the application virtual machines and click Import > Import to CloudCenter to import application virtual machines (Figure 5).

Figure 5. Importing application virtual machines in CloudCenter

Step 4. On import, the virtual machines appear in the Managed tab. Select this virtual machine and click Install Cisco CloudCenter Agent.

Step 5. Browse to Action Library and create the Install AppD Agent action to install the appropriate AppDynamics agent on the virtual machines.

Pre-migration performance
Knowing your application performance is important, as it allows you to see how your application reacts to different kinds of traffic, types of users, slow or error prone paths, and infrastructure-level details such as CPU, memory, and disk performance.

Knowledge of application performance also helps in establishing a performance baseline, specifically when making decisions about migration to cloud. The performance baseline also helps later, in recognizing the benefits of migrating to cloud. AppDynamics can be used to establish a performance baseline for your application when running in on-premises environment. When establishing a baseline, it is critical to know your business transactions of interest. For example, you will care more about the checkout or billing transactions than about product pages. If you know that your checkout transactions have a slower response, you can plan to improve that tier in your application.

It is important to establish Service-Level Agreements (SLAs); technical metrics such as transaction response time, latency, and database response time; and business metrics such as user experience and conversion funnels. Doing so may involve conversations with different teams, like DevOps, application owners, business people, and so on.
To build the pre-migration performance baseline at AppDynamics Controller, follow these steps:

**Step 1.** Make sure traffic is hitting the application.

**Step 2.** Log in to the AppDynamics Controller and navigate to Application > Application Dashboard.

**Step 3.** Define the important business transactions.

**Step 4.** Browse to Dashboards & Reports to define and observe metrics in the application (Figure 6).

**Figure 6.** Pre-Migration performance baseline

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**Migration**

Migrating applications can be lightweight or heavyweight. Depending on how much you know about your application, such as its different components, layers, dependencies, versions, application binaries, and so on, you can decide to do either a lightweight or heavyweight migration. With Cisco CloudCenter, you can perform either type.

In case of greenfield deployments, you deploy your application in one cloud, for example vCenter using the cloud-agnostic profile in CloudCenter. The application can then be migrated to another cloud, such as AWS, by backing up any metadata and database in the current environment. The application can then be redeployed in the target environment by restoring its metadata and database. This process is lightweight, since the application binaries are reinstalled and does not involve full migration of servers like virtual machines.
In comparison, when you don’t know everything about your application, which is typically the case with a legacy business application that is running in an on-premises data center, you can use a heavyweight lift-and-shift migration process. Here, the aim is to migrate the application as-is, with few or no changes to the different functions of the application.

Cisco CloudCenter with CloudEndure can perform lift-and-shift migration of brownfield (legacy) applications. You need to run the migrated application in parallel with the on-premises application for some time, after which the appropriate cutover window can be planned.

Follow these steps to migrate application virtual machines to AWS from CloudCenter using CloudEndure:

**Step 1.** Set up an account on the CloudEndure portal at [https://www.cloudendure.com/](https://www.cloudendure.com/).

**Step 2.** Define the destination cloud, such as AWS, and Virtual Private Cloud (VPC)/subnet parameters that needs to be used.

**Step 3.** If required, set up VPN connectivity between the AWS VPC and vCenter environment, if virtual machines are not reachable over public IP.

**Step 4.** Navigate to Action Library and create the Migrate to AWS action.

**Step 5.** Navigate to Virtual Machines > Managed and select the virtual machines that need to be migrated.

**Step 6.** From the Actions drop-down list, choose Migrate to AWS (Figure 7). This calls a script that internally calls the CloudEndure script to perform the migration.

Figure 7. Migrating application virtual machines in CloudCenter

Note: Be sure to configure the object mapping in Actions Library to apply the action for imported virtual machines.
Step 7. Log in to the CloudEndure portal and go to Live Migration. You can then view the status of the application migration (Figure 8).

Figure 8. Viewing migration of application virtual machines in CloudEndure

The migrated application virtual machines appear as new virtual machines in Cisco CloudCenter. You need to import these to Cisco CloudCenter management to have a better visibility into cloud spend and to perform dayN lifecycle actions.

Perform these steps to import virtual machines to Cisco CloudCenter after they are migrated to AWS:

Step 1. Log in to Cisco CloudCenter.
Step 2. Navigate to Virtual Machines > Unmanaged.
Step 3. The migrated application virtual machines show up as “Unmanaged” in the AWS cloud at CloudCenter.
Step 4. Select the necessary application virtual machines and click Import > Import to CloudCenter.
Step 5. Test and perform the cutover by performing DNS/network changes.

Post-migration performance and comparison

With large number of organizations consuming cloud, monitoring performance and availability is no more an afterthought. Understanding the performance of the application when it is running in the cloud is critical not only to the current application but also to the future application migration projects. It becomes a key metric for cloud projects. You would like to make sure that the tool you are using for monitoring an application’s performance in an on-premises environment continues to work even when the application is migrated to the cloud.

With AppDynamics, once the application is enabled for performance monitoring in an on-premises environment, it stays enabled as the application is migrated to the cloud. Because a lift-and-shift migration method was performed, the AppDynamics agent is moved along with the application, and it continues to report the metrics to the AppDynamics Controller. You can view the historical performance data and compare the performance of the application when running in the cloud with the performance in the on-premises environment: pre-migration versus post-migration.
To build a post-migration performance baseline at the AppDynamics Controller, follow these steps:

**Step 1.** Make sure traffic is hitting the application after its cutover to AWS.

**Step 2.** Log in to the AppDynamics Controller.

**Step 3.** Navigate to the Dashboards & Reports tab.

**Step 4.** Observe the dashboard metrics and build a performance baseline comparison (Figure 9).

**Figure 9.** Viewing a pre- and post-migration comparison in AppDynamics

![AppDynamics Dashboard](image)

Additional resources

If you have further questions, refer to the following additional resources:

- Cisco CloudCenter information: [https://www.cisco.com/go/cloudcenter](https://www.cisco.com/go/cloudcenter)
- CloudCenter product documentation: [https://docs.cloudcenter.cisco.com/](https://docs.cloudcenter.cisco.com/)
• End-user documentation:

• AppDynamics:
  https://www.appdynamics.com/

• AppDynamics product documentation:
  https://docs.appdynamics.com/

• iQuate:
  http://www.iquate.com/

• CloudEndure:
  https://www.cloudendure.com/

• CloudEndure product documentation:
  https://docs.cloudendure.com/

For a complete list of all of our design and deployment guides for the Cisco Multicloud Portfolio, including Cloud Consume, visit https://www.cisco.com/go/clouddesignguides.

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