White Paper

# Data Center Migration and Network Bandwidth Assessments with Cisco MATE Design

## Reduce Risk and Cost by Visualizing the Impact of Migrations

### What You Will Learn

Over the past few years, Internet applications have grown in size and number, and the traffic associated with these applications has drastically increased. Service and content providers have dealt with infrastructure challenges by migrating applications to large-scale data centers.

To reduce risk, cost, planning time, and implementation issues, there are several important considerations regarding the impact of migration, including deterring the impact of associated traffic, rightsizing, and optimizing network infrastructure to reduce build cost.

Using a network planning system reduces the risk, cost and impact of application migration and helps implement an optimal data center design. Cisco® MATE Design helps network planners and design engineers to achieve rapid and accurate traffic modeling. This document outlines how the MATE Design solution can rapidly and reliably model application migration, data center routing policies, and associated latency issues.

### Application Migration and Data Center Modeling with MATE Design

Using Cisco MATE Design, network planners, designers, and engineers can:

- Assess the impact to network infrastructure resulting from the migration of a specific application or all applications within a data center
- Model data center routing policies
- Determine the impact of building a new data center
- Consider latency requirements when placing applications

The following examples demonstrate how MATE Design can help evaluate and forecast the impact of migrating data center applications.

It is important to understand the concept of traffic demands when considering the guidelines for migrating applications. In MATE Design, a demand is the potential traffic flowing in the network. All traffic in a demand has three characteristics in common:

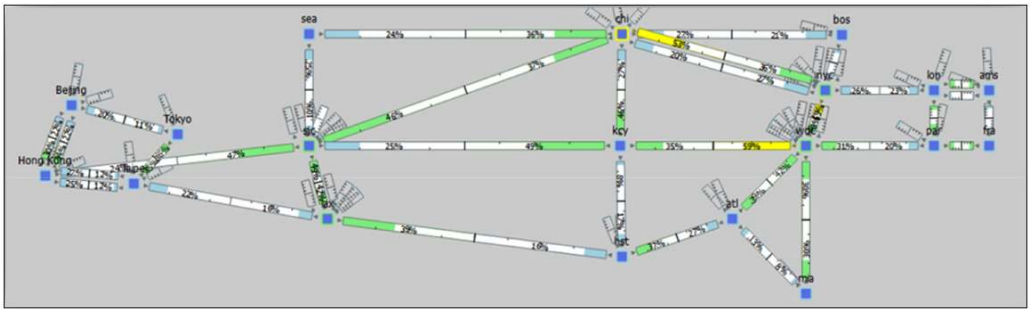
- The traffic is treated the same by the network
- The traffic enters the network at a common point
- The traffic egresses the network at a common point

By simulating the scenario in MATE Design, network planners can see the impact of changes to traffic demand, network topology, element configuration, or other object state. By simply changing the information in the property tables in the network plot, the Simulated Traffic view instantly reflects the update.

## Migrating a Specific Application

Figure 1 shows a model of a service provider network. The provider has a data center in Kansas City, Missouri and Washington, D.C., and a new state-of-the-art facility in Seattle, Washington. Each data center is hosting a number of applications. The provider wants to determine the best location for a video-streaming application.

**Figure 1.** Service Provider Network




By moving application traffic from one data center to another in the model, the impact to the network infrastructure becomes apparent. Simulating the demand reveals the best data center location to move the application, as shown in Figure 2, which displays the demand to an external **Autonomous System (AS)**, highlighted with a blue arrow.

**Figure 2.** Application Placement Among Data Center Locations

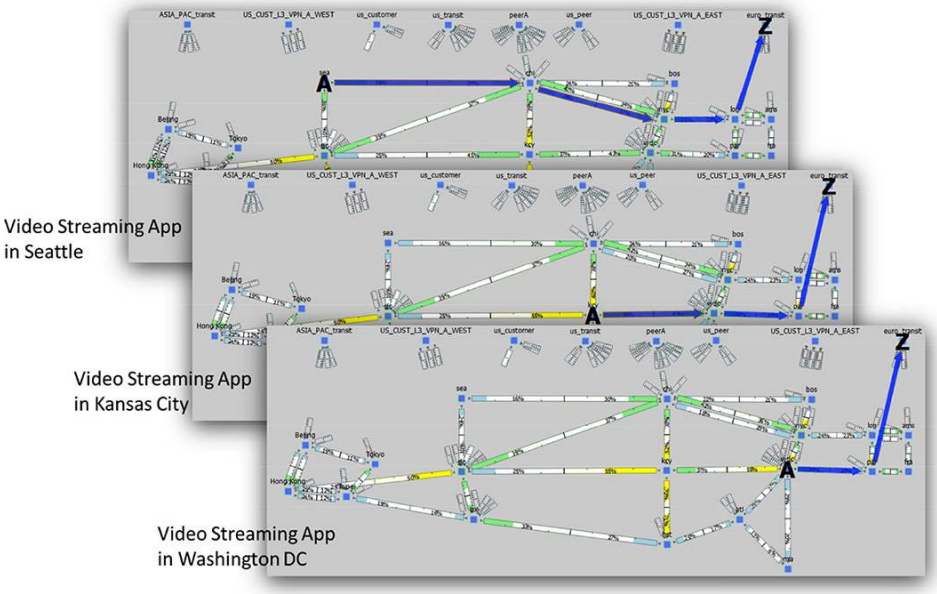
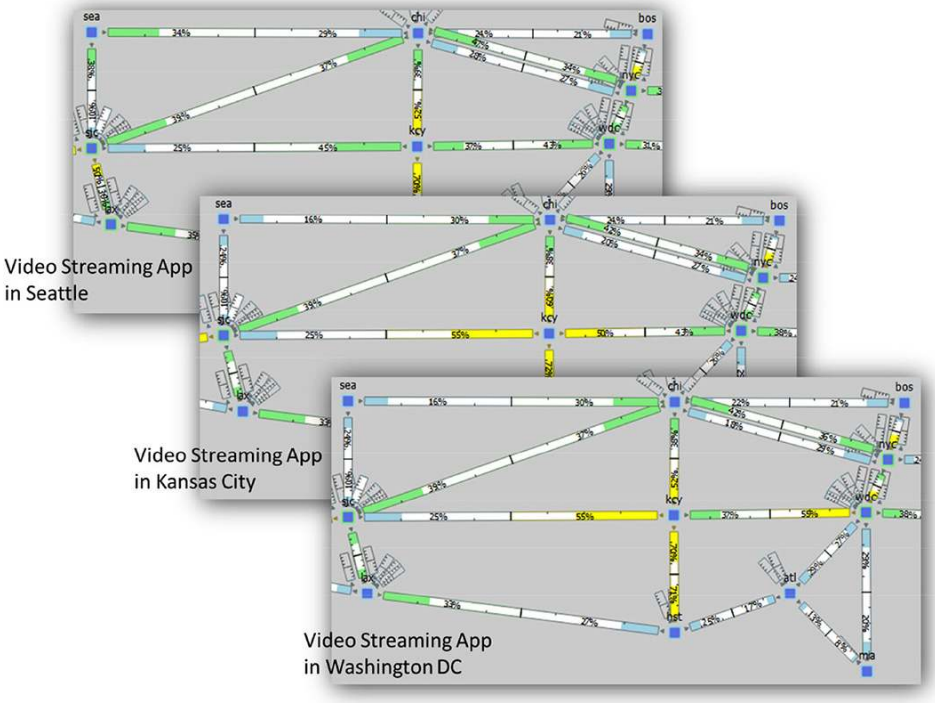


Figure 3 illustrates the Simulated Traffic view of the application placed in each data center site. MATE Design simulates the demand placement and network impact. With MATE Design, it is easy to determine the “what-if” consequences for the following scenarios:

- If the application is placed in the Seattle data center, six interfaces experience higher than 50 percent utilization
- If the application is placed in the Kansas City data center, eight interfaces experience higher than 50 percent utilization
- If the application is placed in the Washington, D.C. data center, nine interfaces experience higher than 50 percent utilization

**Figure 3.** Simulated Traffic View of Application Placement Among Data Center Locations




You can then use the MATE Design Simulation Analysis tool to evaluate various failure situations as a worst-case scenario and how the failure can affect the entire network.

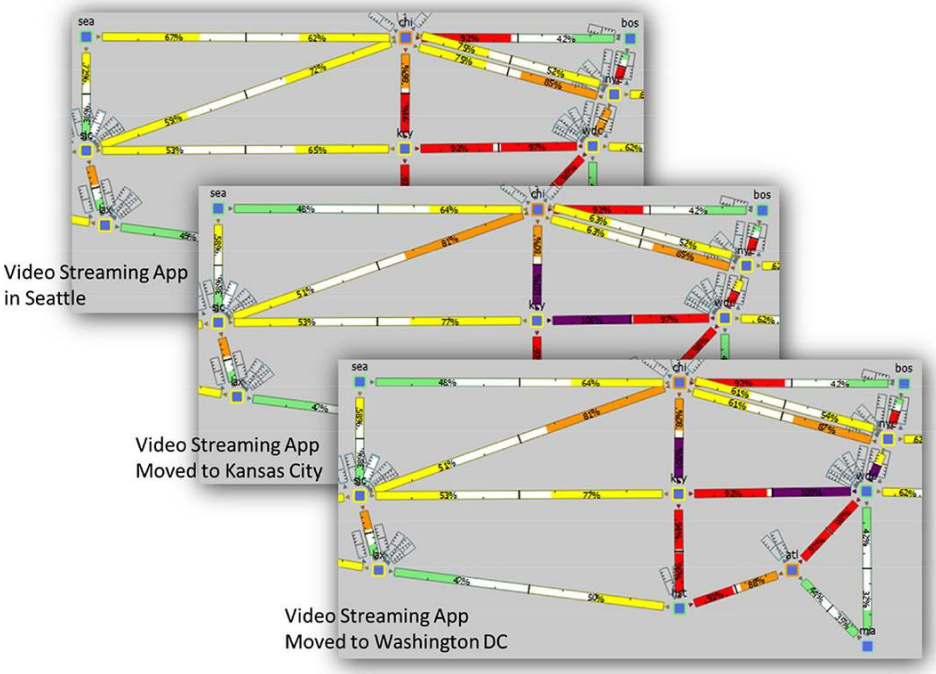
- Worst-case view - This view presents how much risk the rest of the network poses to a specific interface.
- Failure impact view - This view shows how much risk a specific interface poses to the rest of the network.

The worst-case simulation analysis for placing this application in the different sites is shown in Figure 4.

- For Seattle, 22 interfaces would experience a worst-case utilization higher than 75 percent; 10 of those higher than 90 percent, and none of them higher than 100 percent.
- For Kansas City, 23 interfaces would experience a worst-case utilization higher than 75 percent; 11 of those higher than 90 percent, and two of which higher than 100 percent.
- For Washington, D.C., 23 interfaces would experience a worst-case utilization higher than 75 percent; 11 of those higher than 90 percent, and three of which higher than 100 percent.

To reduce the worst-case interface utilization caused by this video streaming application on the current network infrastructure, MATE Design shows that it should be placed in the Seattle data center.

**Figure 4.** Worst-Case Analysis of Application Migration Among Data Center Locations

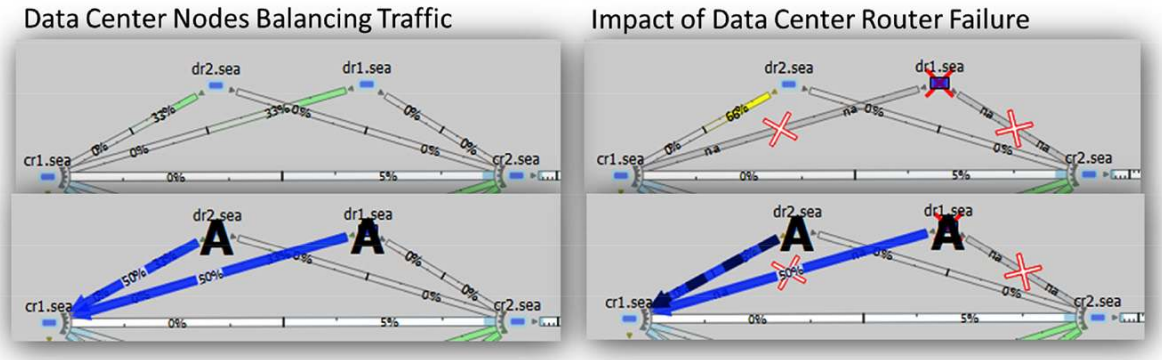


## Modeling Data Center Routing Policies

When modeling data centers, it is necessary to account for redundancy. In this example, the outgoing traffic from a data center server cluster is distributed evenly between two data center routers connected to the backbone of the network. If one data center router fails, the server cluster behind the data center switches its traffic over to the other data center router.

Cisco MATE Design models this example by using an external endpoint with endpoint member edge nodes with the same priority balancing traffic between them. When simulating the failure of one of the data center nodes with the demand selected, the network plot illustrates the old route of the demand with a solid blue arrow and the new route with a dashed arrow, as shown in Figure 5.

**Figure 5.** Data Center Routing Model




## Migrating All Applications in a Data Center

To illustrate the impact on the network when all applications need to be migrated, let's revisit the service provider from the earlier example. The data center in Washington, D.C. is scheduled for closure. The applications in this data center need to be migrated to either Kansas City or Seattle.

Cisco MATE Design can determine the best location with the least impact by rapidly simulating the impact.

- If all applications were migrated to Seattle, 10 interfaces would experience traffic utilization higher than 50 percent. In addition, 24 interfaces would experience a worst-case utilization higher than 75 percent, 12 of those higher than 90 percent, and one of them higher than 100 percent.
- If all applications were migrated Kansas City, six interfaces would experience traffic utilization higher than 50 percent. Also, 22 interfaces would experience a worst-case utilization higher than 75 percent, nine of those higher than 90 percent, and three higher than 100 percent.

Based on the results of the worst-case simulation analysis, the best location to migrate the applications would be the Seattle data center.

**Figure 6.** Simulated Traffic View of Migrating Multiple Applications to Kansas City and Seattle Data Centers

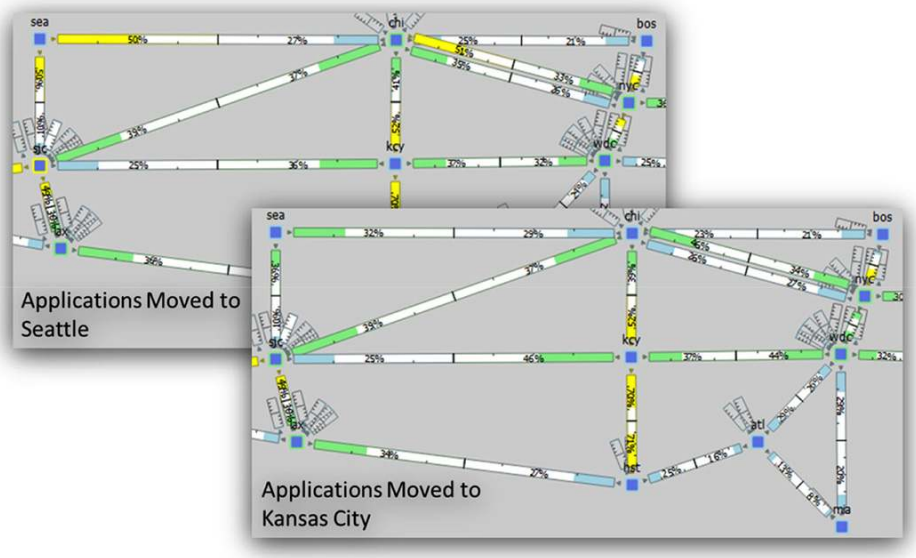
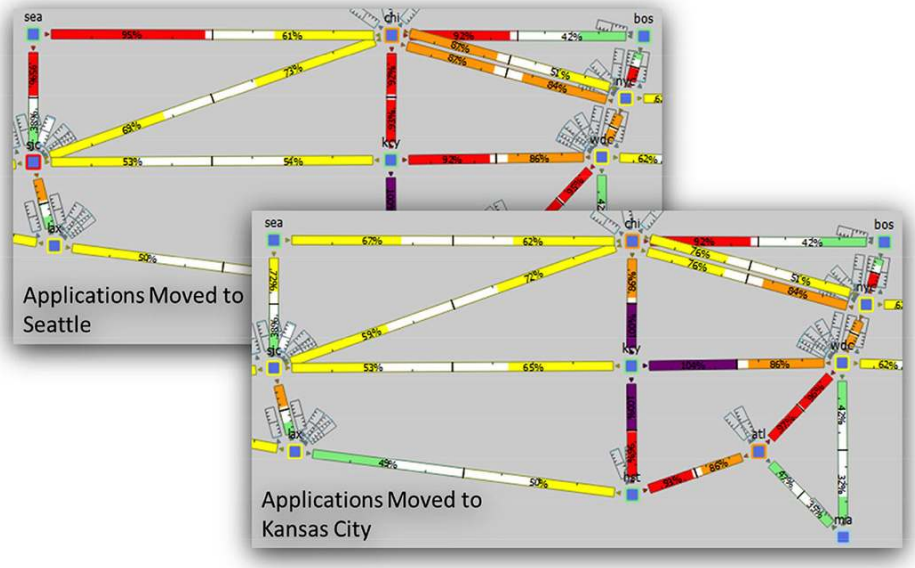



**Figure 7.** Worst-Case Analysis of Migrating Multiple Applications to Kansas City and Seattle Data Centers



## Building a New Data Center

A service provider wants to determine the best place to build a data center with the least network cost and infrastructure changes needed. The locations have been narrowed to Los Angeles, Houston, Texas, and Boston, Massachusetts. Using Cisco MATE Design, the service provider can simulate the demand placement, view the impact on the network infrastructure, and determine the best location.

- Los Angeles
  - Twelve interfaces experience traffic utilization higher than 50 percent.
  - Thirty-six interfaces experience a worst-case utilization higher than 75 percent; 15 of those higher than 90 percent, and none of them higher than 100 percent.
- Houston
  - Eleven interfaces experience traffic utilization higher than 50 percent.
  - Thirty-two interfaces experience a worst-case utilization higher than 75 percent; 14 of those higher than 90 percent, and seven of them higher than 100 percent.
- Boston
  - Twelve interfaces experience traffic utilization higher than 50 percent.
  - Thirty-six interfaces experience a worst-case utilization higher than 75 percent; 18 of those higher than 90 percent, and five of them higher than 100 percent.

Based on the results of the worst-case simulation analysis, the best location to build a new data center is Los Angeles.

**Figure 8.** Simulated Traffic View of New Data Center Locations

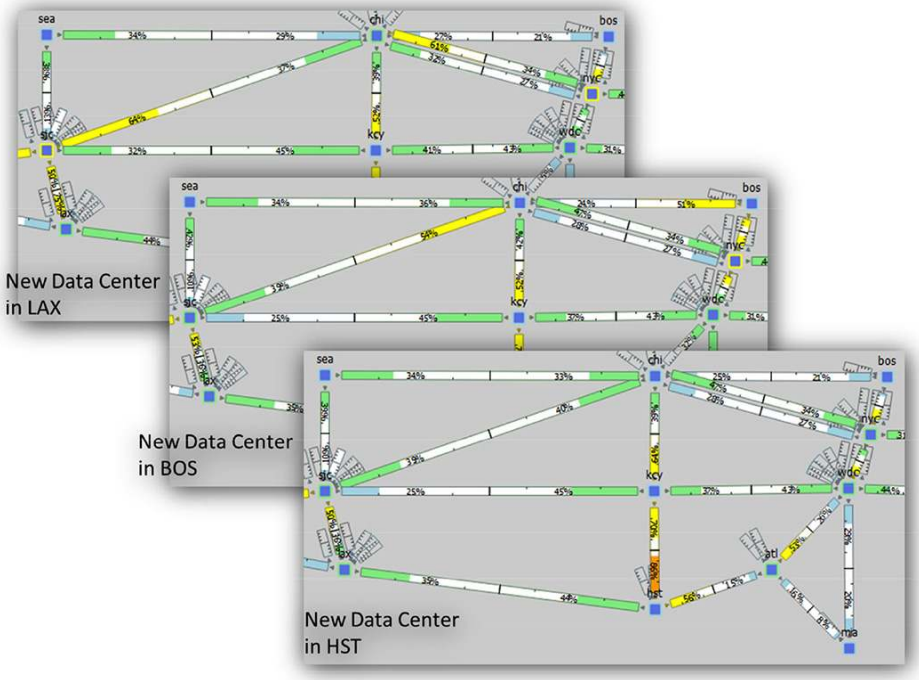
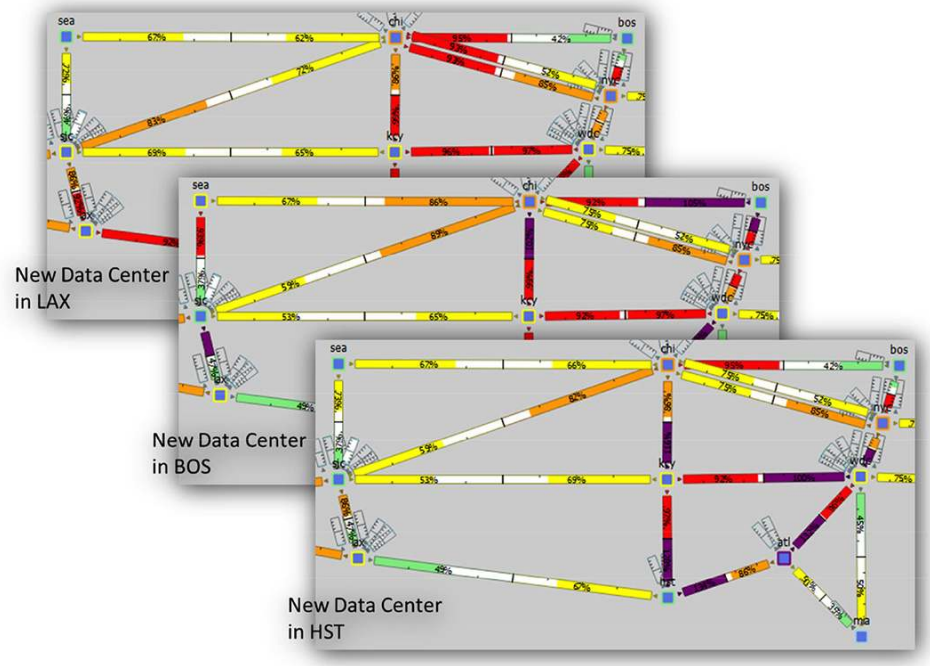


**Figure 9.** Worst-Case Traffic View of New Data Center Locations




## Latency Requirements in Placing an Application

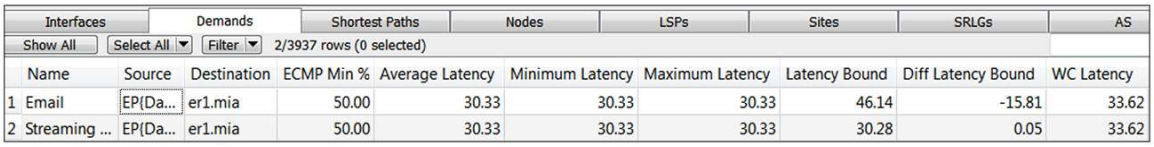
Each application has a specific set of latency requirements. For example, a video streaming application must maintain the least amount of latency, while an email application has more relaxed latency requirements. Cisco MATE Design can identify the best location to place an application based on its latency requirements.

Cisco MATE Design has a suite of tools to model latency. The Latency Bound Initializer, shown in Figure 10, evaluates the maximum acceptable latency for a demand. MATE Design determines the maximum and minimum latency and average latency and then identifies latency-bound violations - demands with a maximum latency in excess of the latency bound specified for the demand. When placing an application, it is important to reduce latency-bound violations as much as possible.

**Figure 10.** Latency Requirements

A single demand with the same source and destination for each application is selected in the property tables in Figure 11. Based on these results, the average, minimum, and maximum latency vales are the same for each application. But the demand requirements for each application are different. As a result, the video streaming application exceeds the established latency bound. By contrast, the email application will arrive at the destination well within the required, application latency requirements.

**Figure 11.** Comparing Demand Latency Between Applications




| | Name | Source | Destination | ECMP Min % | Average Latency | Minimum Latency | Maximum Latency | Latency Bound | Diff Latency Bound | WC Latency |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Email | EP(Da... | er1.mia | 50.00 | 30.33 | 30.33 | 30.33 | 46.14 | -15.81 | 33.62 |
| 2 | Streaming ... | EP(Da... | er1.mia | 50.00 | 30.33 | 30.33 | 30.33 | 30.28 | 0.05 | 33.62 |

In the first example, Cisco MATE Design identified the best data center to place a streaming video application based on interface utilization. Factoring in latency for each data center, the following results are obtained.

- Seattle
  - Six interfaces experience traffic utilization higher than 50 percent.
  - Twelve interfaces experience a worst-case utilization higher than 75 percent, with five of them higher than 90 percent.
  - Twelve demands have latency bound violations, three of which longer than one millisecond (ms).
- Kansas City
  - Seven interfaces experience traffic utilization higher than 50 percent.
  - Fourteen interfaces experience a worst-case utilization higher than 75 percent, with four of them higher than 90 percent.
  - Fifteen demands have latency-bound violations, six of which longer than one ms.
- Washington, DC
  - Seven interfaces experience traffic utilization higher than 50 percent.
  - Ten interfaces experience a worst-case utilization higher than 75 percent, with three of them higher than 100 percent.
  - Nine demands have latency-bound violations, six of which are longer than one ms.

Taking into consideration all the information that MATE Design has provided, it would be best to place the streaming video application in the Seattle data center.

## Conclusion

Modeling data center “what if” scenarios is practical using Cisco MATE Design. These scenarios provide key guidelines as to how to migrate data center applications with knowledge of the impact that the migrations will have. Accordingly, the guidelines help you reduce the cost of the data center migration, and support a more optimal network in terms of meeting utilization and latency requirements.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