White Paper

# Cisco MATE Collector: Examining the Effect on CPU Utilization

## What You Will Learn

This paper presents a case study outlining the effect of collection on the network using Cisco® MATE Collector. While there are different ways to measure these effects, one of the primary concerns for most providers is the effect on router CPU utilization. The study shows that router CPU utilization can be expected to increase by 1 to 3 percent for the duration of the collection, which is on the order of seconds per router during a collection "snapshot" interval.

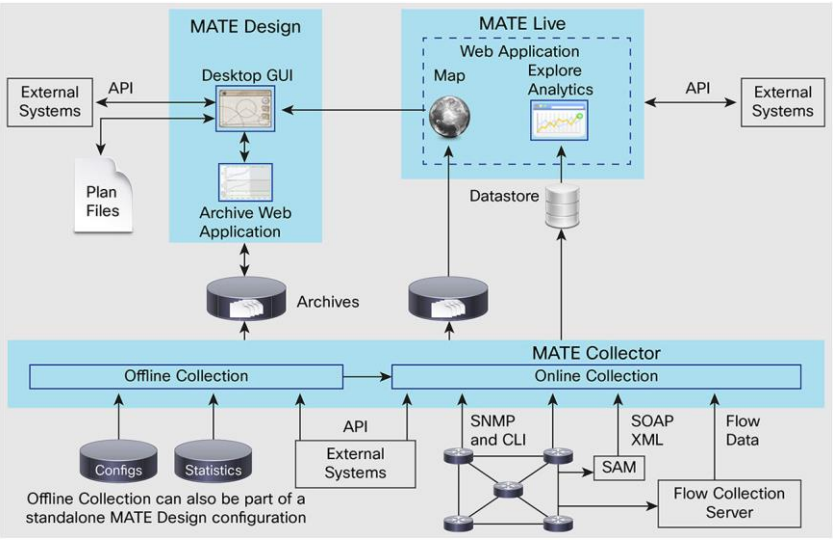
The following sections provide a brief introduction to the Cisco MATE Collector, along with a description of tests conducted to measure any effect on the network and an explanation of the results. The tests were conducted at a customer lab network that simulates a real world service provider network.

## Cisco MATE Collector

Cisco MATE Collector allows you to automate the process of discovering the network topology, polling for measurements, modeling the plan, and storing the results. This automation is achieved by instructing the Cisco MATE Collector on which discovery tasks to deploy. The collected information is stored in a plan file and made available for use in Cisco MATE Design, including the Cisco MATE Design Archive application and the Cisco MATE Live application.

Cisco MATE Collector supports both offline and online collection mechanisms (Figure 1). Offline collection involves processing router configurations or Interior Gateway Protocol (IGP) database. Online collection directly retrieves information from the network using Simple Network Management Protocol (SNMP), router login, NetFlow/IPFIX, or through an Element Management System (EMS) or a Network Management System (NMS).

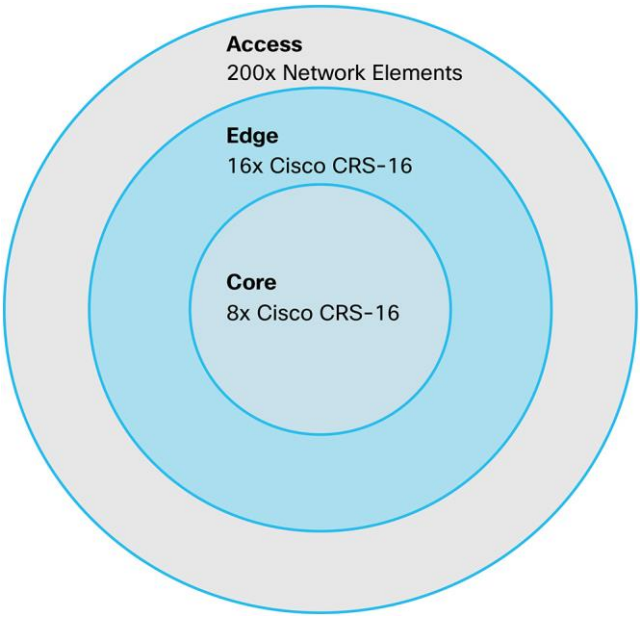
**Figure 1.** Adaptable Online and Offline Tools



## Measuring the Effect of Collection on the Network

To study the effect of collection on the network, tests were conducted in a customer lab that simulates a service provider core network with 200 routers. While the customer network consisted of multivendor equipment the objective of the tests was to focus on Cisco® Carrier Routing System (CRS) routers running Cisco IOS® XR Software. (To comply with our nondisclosure agreement, all references to customer data have been omitted.)

**Figure 2.** Representative Topology of the Test Network




As shown in Figure 2, the test network ran Open Shortest Path First version 2 (OSPFv2) and had a scaled Resource Reservation Protocol - Traffic Engineering (RSVP-TE) setup with 2500 RSVP-TE tunnels (LSPs). Traffic generators were connected to the network and were used to send bi-directional traffic over the LSPs. Test network dimensions included:

- Total size of the network: 200 network elements (routers, switches, and optical devices)
- Total number of LSPs: 2500
- Total traffic through the core network: Approximately 100 Gb
- Total number of Cisco CRS routers profiled: 25
- Average number of interfaces on a Cisco CRS router: 800 (physical and logical interfaces)
- Operating System: Cisco CRS-1 16-Slot System running Cisco IOS XR Release 4.2.4
- Cisco CRS 16-Slot Line Card Chassis Route Processor B Specifications can be found here: http://www.cisco.com/c/en/us/products/collateral/routers/carrier-routing-system/product_data_sheet0900aecd8053b020.html

## Cisco MATE Collector Configuration

The study next examined the Cisco MATE Collector configuration, because it influences the performance of the collection and how it affects the network. Four basic questions were examined to better understand the Cisco MATE Collector configuration.

## What Is Collected?

For this test, Cisco MATE Collector was configured to collect the following network properties:

- IGP (OSPFv2 Link-State Data Base): The OSPF LSDB is collected through login access to the seed router.
- Vendor: Vendor information is obtained using Login or SNMP.
- Nodes: The list of nodes is obtained from the IGP database.
- Interfaces: Interface information and interface statistics are retrieved using SNMP.
- LSP: LSP information and LSP statistics are retrieved using SNMP.

**Note:** While the network was running BGP at the peering points, Cisco MATE Collector was not configured to collect BGP-related information as part of this test.

## What Are the SNMP and Login Access Configuration Parameters?

Cisco MATE Collector allows the user to specify “SNMP” and “Login” access parameters. These parameters give the user controls that can limit the effects of collection on network elements. For this test, default SNMP and Login parameters were used and Table 1 summarizes the configured values.

**Table 1.** Summary of Configured Values for SNMP and Login Parameters

| SNMP Property | Value |
|---|---|
| **SNMP_max_timeout** | 3 |
| **SNMP_query_retries** | 5 |
| **SNMP_max_queries_per_router** | 5 |
| **SNMP_max_variables_per_query** | 16 |
| **SNMP_max_message_size** | 1472 |
| **SNMP_bulk_query_responses** | 16 |
| **LOGIN_num_retries** | 1 |
| **LOGIN_timeout** | 15 |
| **LOGIN_session_idle_timeout** | 15 |
| **LOGIN_session_timeout** | 300 |

## How Often Does Collection Run?

For this case study, Cisco MATE Collector was scheduled to execute a collection cycle (snapshot) every 15 minutes.

## What Is the Overall Duration of Collection?

The test was conducted over a period of three weeks. During this entire period, the router was profiled to obtain CPU utilization.

## Router CPU Profiling Results

Cisco CRS-1 Route Processor B CPU was profiled by examining the CPU usage at frequent intervals when Cisco MATE Collector was running in the network. CPU usage was measured by an external script that gathered the CPU usage on each CRS router by running the “top” command on the Route Processor terminal every 30 seconds. In addition to performing the test on a single-chassis Cisco CRS platform, the test was also performed on a multi-chassis Cisco CRS platform. Please note here that the “ambient” router CPU utilization, when the Cisco MATE Collector was **not** running, was observed to be between 1 and 2 percent.

Figure 3 shows a graph of CPU utilization data. The duration of time as a percent of the total duration of the test is illustrated on the horizontal axis. CPU utilization observed for a specific duration of time appears on the vertical axis. For instance, in the case of the single-chassis Cisco CRS router, the CPU utilization was observed at 2 percent for 30 percent of the time, 3 percent for 30 percent of the time, 4 percent for 10 percent of the time and 5 percent for 30 percent of the time. On the whole, the CPU utilization was rarely (1 percent of the time) observed over 5 percent, and never observed above 15 percent.

- In the case of the single-chassis Cisco CRS-16 system, the mean CPU utilization was observed at 3.5 percent, with a standard deviation of 1.3 percent. Discounting for the steady state CPU utilization of 1.5 percent, the **network collection resulted in average increase of 1 to 2 percent**.

**Figure 3.** Single Chassis Cisco CRS CPU Utilization

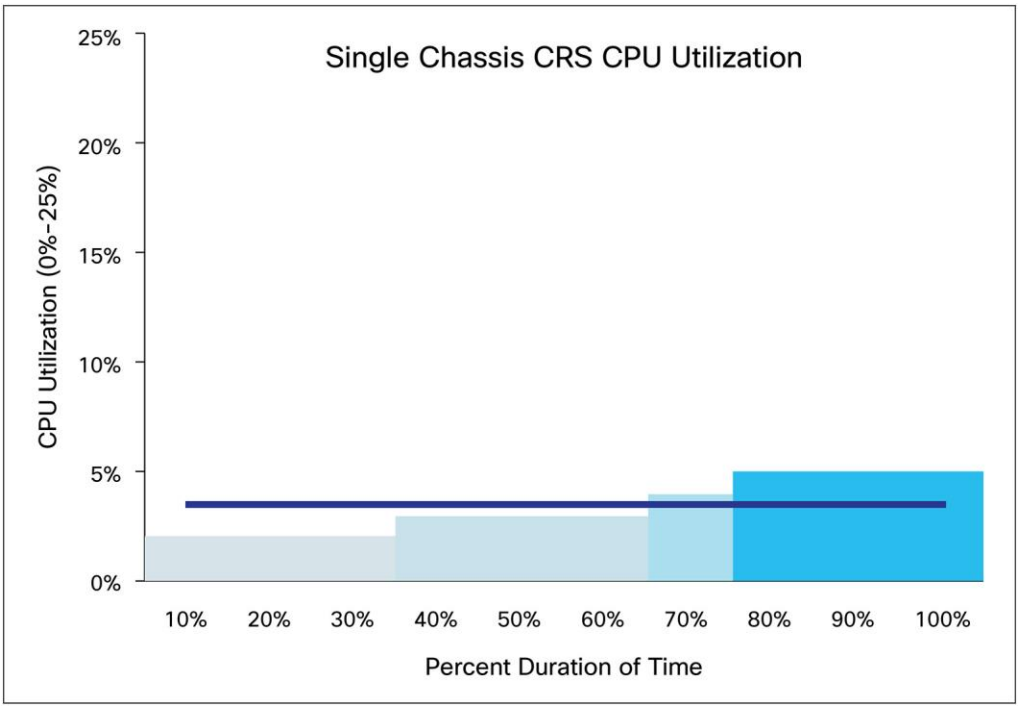
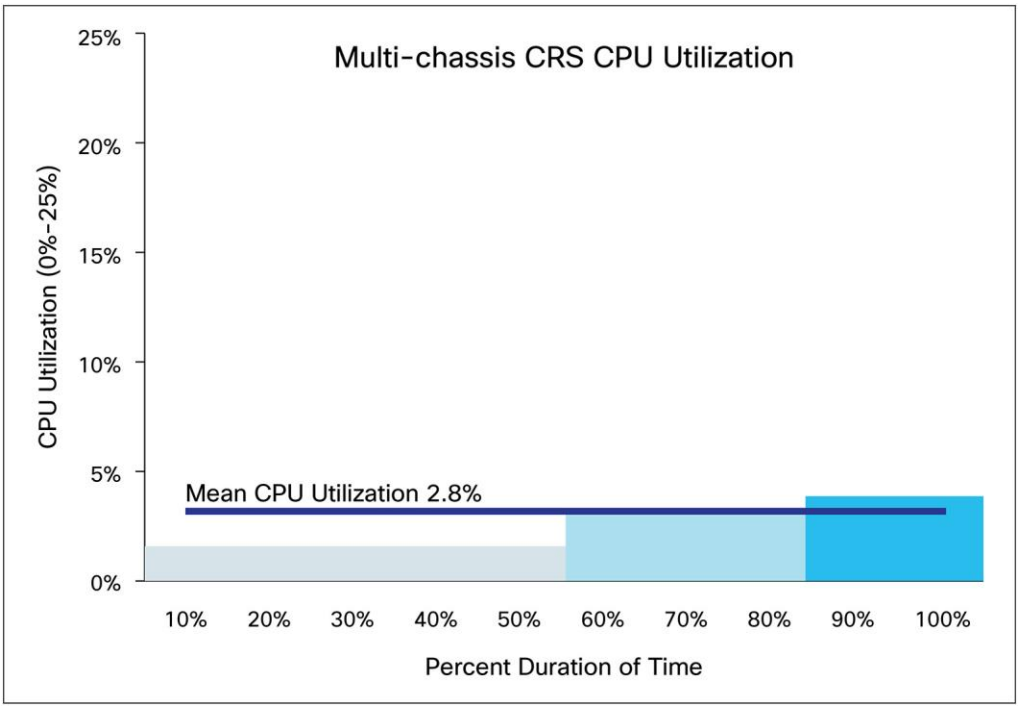


**Figure 4.** Multi-chassis Cisco CRS-16 CPU Utilization




- In the case of the **multi-chassis Cisco CRS-16** router the mean CPU utilization was observed at 2.8 percent with a standard deviation of 1 percent. Discounting for the steady state CPU utilization of 1.5 percent, the **network collection resulted in average increase of 1 percent.**

## Analysis and Conclusion

This case study shows that the effect on the router CPU of running Cisco MATE Collector is relatively small: The observed CPU utilization on Cisco CRS routers that can be attributed to collection was, on average, between 1 to 3 percent. For 97 percent of the time, CPU utilization was less than 5 percent.

Furthermore, the increase in CPU utilization only occurs during collection, which lasts for only seconds per router for each collection (snapshot) interval. Although this study was conducted on a specific provider network, our observations, across a large set of deployments, have consistently shown that the Cisco MATE Collector has a minimal effect on the router CPU.

Cisco MATE Collector follows a pragmatic and use case-based approach to collection. It has been fine tuned to collect only necessary pieces of information from the network, thus avoiding “over collection.” Due to our unique position within the industry, Cisco has the opportunity to observe and analyze the characteristics of a variety of networks and configurations. This knowledge supports continued enhancement to the collection workflows, by carefully ordering collection tasks to reduce any effect on the network by performing targeted collection.

## For More Information

The Cisco MATE portfolio offers a comprehensive selection of products that help service providers architect, design, and manage superior networks. http://www.cisco.com/c/en/us/products/routers/service-provider-infrastructure-software/index.html.

Cisco MATE Collector automatically gathers and continuously maintains information on infrastructure elements, topology, operational state, and traffic statistics for network planning and analytics. It is used extensively by both Cisco MATE Design and MATE Live. http://www.cisco.com/c/en/us/products/routers/mate-collector/index.html.

Cisco MATE Design is a market-leading integrated system for design, engineering, and planning of IP/MPLS networks. http://www.cisco.com/c/en/us/products/routers/mate-design/index.html.

Cisco MATE Live rapidly delivers in-depth network analytics with efficient navigation to both current and historical data for making critical business and technical decisions. http://www.cisco.com/c/en/us/products/routers/mate-live/index.html.

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