

Huawei NetEngine AR6000 & AR600 Series Enterprise Routers

Performance Comparison Versus Cisco ISR Routers

Executive Summary

NetEngine AR6000 and NetEngine AR600 are Huawei's next-generation high-performance routers ideal for a wide range of network sizes and application scenarios in various industries. They provide strong forwarding performance with multiple integrated functions, such as SD-WAN, cloud management, routing, switching, virtual private network (VPN), security, voice, 5G, and Multiprotocol Label Switching (MPLS). They offer high performance required by enterprises to achieve service diversity and cloudification.

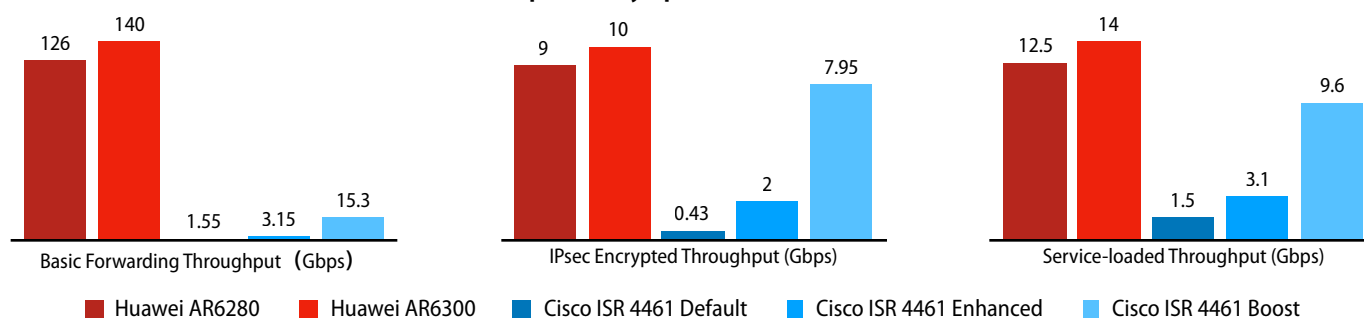
Tolly tested and compared performance of Huawei routers against similar Cisco routers under the same conditions. Test results show that Huawei NetEngine AR6000 series routers deliver superior performance over Cisco ISR 4000 series routers, and Huawei NetEngine AR600 series routers offer higher performance than Cisco ISR 1000 series routers.

The Bottom Line

Huawei NetEngine AR6000 & AR600 Series Routers:

- 1 Deliver better results than comparable Cisco ISR series routers in basic forwarding performance, IPsec encrypted performance, and service-loaded performance
- 2 Can achieve their maximum performance without the purchase of extra licenses (except NetEngine AR650 series). In contrast, Cisco ISR series routers' native performance is only as low as 5% of their maximum performance. Customers need to purchase additional licenses to activate the maximum performance of Cisco ISR routers

Performance Comparison between Huawei NetEngine AR6000 Series Routers and Cisco ISR Series Routers (High-end Models)
(Reported by Spirent TestCenter)



Notes: 1. Huawei routers can achieve their maximum performance without the purchase of extra licenses. Cisco's default performance refers to the native performance of Cisco routers without the purchase of extra licenses; enhanced performance refers to the performance of Cisco routers with the "Performance" and "HSECK9" licenses loaded and activated; Boost performance refers to the performance of Cisco routers with the "Booster (or Boost)" and "HSECK9" licenses loaded and activated. 2. Service-loaded performance tests involve the quality of service (QoS), access control list (ACL), and network address translation (NAT) services. For details about service settings and structure of IMIX packets in each test, see the Test Methodology section.

Source: Tolly, December 2019

Figure 1



Test Results

Huawei's next-generation NetEngine AR6000 series routers include NetEngine AR6300, NetEngine AR6280, and NetEngine AR6100 sub-series; NetEngine AR600 series routers include NetEngine AR650 and NetEngine AR610 sub-series. Models of different series are designed to adapt to service networking requirements of enterprises at different sizes.

Tolly engineers tested multiple models of Huawei NetEngine AR6000 series and NetEngine AR600 series routers and compared their performance with those of comparable Cisco ISR 4000 series and ISR 1000 series routers. Test results are provided in three categories: high-end models, mid-range models, and low-end models. Huawei NetEngine AR6140-16G4XG and NetEngine AR617VW do not have comparable Cisco models tested and their test results are displayed in Table 1 on page 6.

High-End Models

Tested high-end routers include: Huawei NetEngine AR6280 (configured with the Service and Router Unit SRU-400H) and NetEngine AR6300 (configured with the Service and Router Unit SRU-600H); and Cisco's flagship model ISR 4461 of ISR 4000 series.

Huawei routers can achieve their maximum performance without the purchase of extra licenses. Cisco's routers provide low native performance. Customers need to purchase performance licenses of required levels to activate performance at the corresponding levels. In the tests, Cisco routers at three performance levels were used:

- Default performance: native performance of Cisco routers, without the purchase of extra licenses;

- Enhanced performance: performance of Cisco routers with the "Performance" and "HSECK9" licenses loaded and activated;
- Boost performance: performance of Cisco routers with the "Booster (or Boost)" and "HSECK9" licenses loaded and activated.

For details about the test results, see Figure 1 on page 1. The detailed results are described as follows:

Basic Forwarding

Huawei NetEngine AR6280 supports 126Gbps Layer 3 IMIX throughput with IMIX packets and NetEngine AR6300 supports 140Gbps Layer 3 throughput with IMIX packets.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4461 supports 1.55Gbps, 3.15Gbps, and 15.3Gbps Layer 3 throughput with IMIX packets, respectively.

Results show that Huawei NetEngine AR6280 delivers 7 to 80 times higher basic L3 IMIX forwarding performance than Cisco ISR 4461, and Huawei NetEngine AR6300 offers 8 to 89 times better basic L3 IMIX forwarding performance than Cisco ISR 4461.

IPsec Performance

Huawei NetEngine AR6280 supports 9Gbps IPsec encrypted throughput, and NetEngine AR6300 supports 10Gbps IPsec encrypted throughput.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4461 supports an IPsec encrypted throughput of 0.43Gbps, 2Gbps, and 7.95Gbps, respectively.

Huawei
Technologies,
Co., Ltd

NetEngine
AR6000 & AR600
Series Router

Performance
Evaluation



Tested
December
2019

Test results show that Huawei NetEngine AR6280 delivers 13% to 20 times higher IPsec encrypted throughput than Cisco ISR 4461, and Huawei NetEngine AR6300 offers 25% to 22 times better IPsec encrypted throughput than Cisco ISR 4461.

Service-Loaded Performance

Service-loaded performance tests involve QoS, ACL, and NAT services. QoS services include rate limiting and EF queue. The ACL service includes 500 ACL rules. The NAT service includes 50,000 NAT sessions.

Huawei NetEngine AR6280 supports 12.5Gbps service-loaded throughput, and NetEngine AR6300 supports 14Gbps service-loaded throughput.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4461 supports a service-loaded throughput of 1.5Gbps, 3.1Gbps, and 9.6Gbps, respectively.

Test results show that Huawei NetEngine AR6280 delivers 30% to 7.3 times higher service-loaded throughput than Cisco ISR 4461, and Huawei NetEngine AR6300 offers 45% to 8.3 times better service-loaded throughput than Cisco ISR 4461.



Mid-Range Model

Tested mid-range routers include: Huawei NetEngine AR6121 and Huawei NetEngine AR6140-9G-2AC; and Cisco ISR 4321.

Huawei's routers can achieve their maximum performance without the purchase of extra licenses. Cisco's routers provide low native performance. Customers need to purchase performance licenses of required levels to activate performance at the corresponding levels. In the tests, Cisco routers at three performance levels were used:

- Default performance: native performance of Cisco routers, without the purchase of extra licenses;
- Enhanced performance: performance of Cisco routers with the "Performance" and "HSECK9" licenses loaded and activated;
- Boost performance: performance of Cisco routers with the "Booster (or Boost)" and "HSECK9" licenses loaded and activated.

Figure 2 shows the test results. The detailed results are described as follows:

Basic Forwarding

Huawei NetEngine AR6121 supports 4Gbps Layer 3 throughput with IMIX packets and NetEngine AR6140-9G-2AC supports 6Gbps Layer 3 throughput with IMIX packets.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4321 supports 50Mbps, 100Mbps, and 2Gbps Layer 3 throughput with IMIX packets, respectively.

Test results show that Huawei NetEngine AR6121 delivers 1 to 79 times higher basic forwarding performance than Cisco ISR

4321, and Huawei NetEngine AR6140-9G-2AC offers 2 to 119 times better basic forwarding performance than Cisco ISR 4321.

IPsec Performance

Huawei NetEngine AR6121 supports 2.32Gbps IPsec encrypted throughput, and NetEngine AR6140-9G-2AC supports 2.72Gbps IPsec encrypted throughput.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4321 supports an IPsec encrypted throughput of 40Mbps, 100Mbps, and 460Mbps, respectively.

Results show that Huawei NetEngine AR6121 delivers 4 to 57 times higher IPsec encrypted throughput than Cisco ISR 4321, and Huawei NetEngine AR6140-9G-2AC offers 5 to 57 times better IPsec encrypted throughput than Cisco ISR 4321.

Service-Loaded Performance

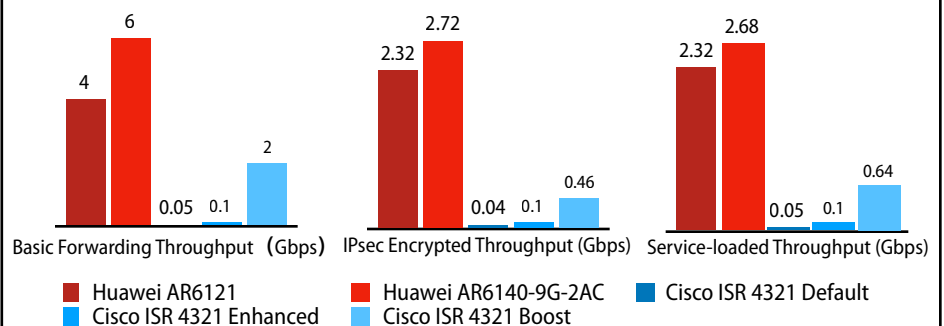
Service-loaded performance tests involve QoS, ACL, and NAT services. QoS services include rate limiting and EF queue priority. The ACL service includes 100 ACL rules. The NAT service includes 10,000 NAT sessions.

Huawei NetEngine AR6121 supports up to 2.32Gbps service-loaded throughput, and NetEngine AR6140-9G-2AC supports up to 2.68Gbps service-loaded throughput.

Varying with the default, enhanced, and boost performance levels, Cisco ISR 4321 supports a service-loaded throughput of 50Mbps, 100Mbps, and 640Mbps, respectively.

Results show that Huawei NetEngine AR6121 delivers 2.6 to 45.4 times higher service-loaded throughput than Cisco ISR 4321, and Huawei NetEngine AR6140-9G-2AC offers 3.2 to 52.6 times better service-loaded throughput than Cisco ISR 4321.

Performance Comparison between Huawei NetEngine AR6000 Series Routers and Cisco ISR Series Routers (Mid-range Models)
(Reported by Spirent TestCenter)



Notes: 1. Huawei routers can achieve their maximum performance without the purchase of extra licenses. Cisco's default performance refers to the native performance of Cisco routers without the purchase of extra licenses; enhanced performance refers to the performance of Cisco routers with the "Performance" and "HSECK9" licenses loaded and activated; Boost performance refers to the performance of Cisco routers with the "Booster (or Boost)" and "HSECK9" licenses loaded and activated. 2. Service-loaded performance tests involve the QoS, ACL, and NAT services. For details about service settings and structure of IMIX packets in each test, see the Test Methodology section.

Source: Tolly, December 2019

Figure 2



Low-End Model

Tested low-end routers include: Huawei NetEngine AR651C and NetEngine AR651W; and Cisco ISR 1100-8P.

Huawei NetEngine AR650 series routers can be loaded with licenses to offer higher performance. In the tests, Huawei routers at two performance levels were used:

- default performance: native performance of Huawei routers, without the purchase of extra licenses;
- Enhanced performance: performance of Huawei routers with the "Performance" license loaded and activated.

Cisco's routers provide low native encrypted throughput. Customers need to purchase performance licenses to achieve the enhanced performance. In the tests, Cisco routers at two performance levels were used:

- Default performance: native performance of Cisco routers, without the purchase of extra licenses;
- Enhanced performance: performance of Cisco routers with the "HSECK9" license loaded and activated. Cisco 1100-8P has the "Boost" license integrated by default, so it does not have an additional "Boost" level like the Cisco ISR 4000 series. "Enhanced" level is the best performance level it supports.

Figure 3 shows the test results. The detailed results are described as follows:

Basic Forwarding

Huawei NetEngine AR651C and NetEngine AR651W support 4Gbps Layer 3 throughput with IMIX packets at both the default and enhanced levels.

Cisco ISR 1100-8P supports about 2Gbps Layer 3 throughput with IMIX packets at both the default and enhanced levels.

Results show that Huawei NetEngine AR651C and NetEngine AR651W deliver 100% higher basic forwarding performance than Cisco ISR 1100-8P.

IPsec Performance

Huawei NetEngine AR651C supports 1.82Gbps IPsec encrypted throughput at both the default and enhanced levels, and NetEngine AR651W supports a default-level IPsec encrypted throughput of 2.6Gbps and an enhanced-level IPsec encrypted throughput of 2.72Gbps.

Varying with the default and enhanced performance levels, Cisco ISR 1100-8P supports an IPsec encryption throughput of 40Mbps and 370Mbps, respectively.

Results show that Huawei NetEngine AR651C delivers 3.9 to 44.5 times higher IPsec encrypted throughput than Cisco ISR 1100-8P, and Huawei NetEngine AR651W offers 6 to 67 times greater IPsec encrypted throughput than Cisco ISR 1100-8P.

Service-Loaded Performance

Service-loaded performance tests involve QoS, ACL, and NAT services. QoS services include rate limiting and EF queue priority. The ACL service includes 100 ACL rules. The NAT service includes 10,000 NAT sessions.

Huawei NetEngine AR651C supports a default-level service-loaded throughput of 1.24Gbps and an enhanced-level service-loaded throughput of 1.9Gbps, and NetEngine AR651W supports a default-level service-loaded throughput of 1.24Gbps and an enhanced-level service-loaded throughput of 2.48Gbps.

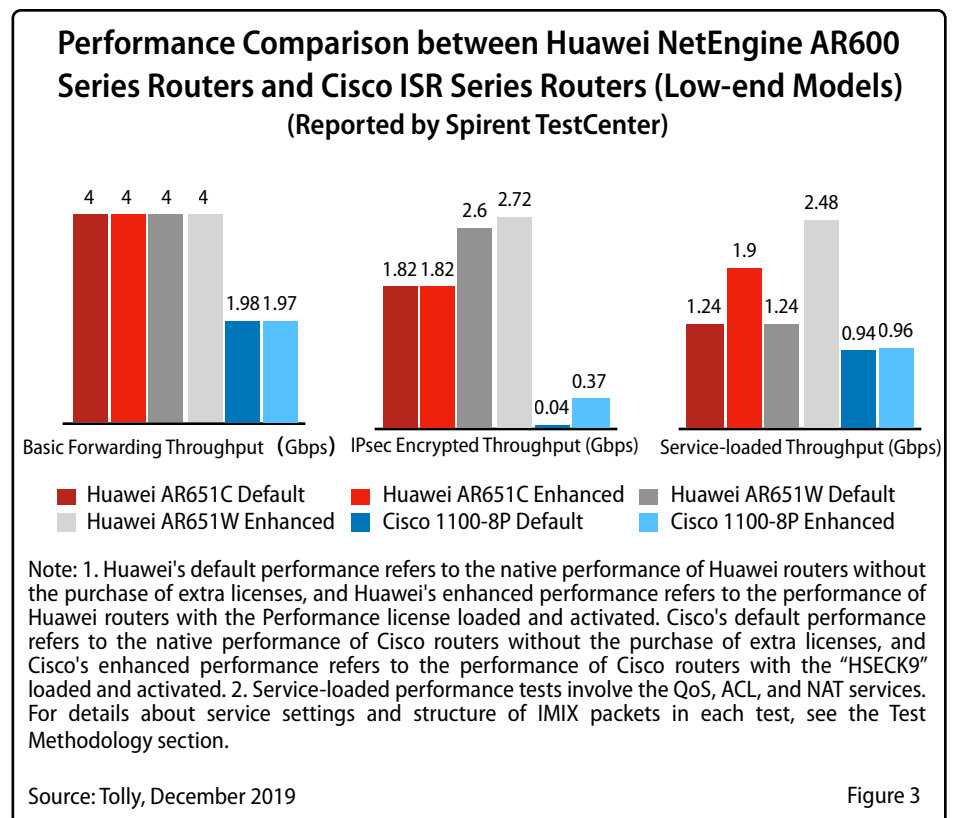


Figure 3

Cisco ISR 1100-8P supports a service-loaded throughput of about 950Mbps at both the default and enhanced performance levels.

Results show that Huawei NetEngine AR651C delivers 30% to 100% higher service-loaded throughput than Cisco ISR 1100-8P, and Huawei NetEngine AR651W offers 30% to 160% better service-loaded throughput than Cisco ISR 1100-8P.

Test Methodology

Basic Forwarding

The performance tests were conducted using the RFC 2544 test suite of Spirent TestCenter. IMIX packets were sent as the test traffic, with weights of 64-byte, 594-byte, and 1518-byte Ethernet frames being 7, 4, and 1, respectively. The test result was the total throughput with zero packet loss.

IPsec Performance

Two devices were used in the IPsec performance tests. For high-end models, three IPsec VPN tunnels were established between the two devices; for mid-range and low-end models, six IPsec VPN tunnels were established between the two devices. The performance tests were conducted using the RFC 2544 test suite of Spirent TestCenter. All traffic was encrypted and forwarded between two devices with IPsec. IMIX packets were sent as the test traffic, with weights of 90-byte, 92-byte, 596-byte, and 1418-byte Ethernet frames being 5867, 200, 2366, and 1567, respectively. The test result was the total throughput with no packet loss recorded by Spirent TestCenter.

Service-Loaded Performance

QoS, ACL, and NAT services were configured on devices to perform service-loaded performance tests. On high-end models, 500 ACL rules and 50,000 NAT sessions were

used; on low-end and mid-range models, 100 ACL rules and 10,000 NAT sessions were used; on the lowest-end model — Huawei NetEngine AR617VW, 10 ACL rules and 1,000 NAT sessions were used. Bidirectional traffic was used for the test. QoS scheduling and NAT were performed for outgoing traffic, and NAT sessions were matched for incoming traffic. In the test, Spirent TestCenter was used to transmit test traffic. IMIX packets were sent as the test traffic, with weights of 66-byte, 594-byte, and 1518-byte Ethernet frames being 62, 24, and 15, respectively. The test result was the total throughput of the device.

The outgoing QoS rate limit on the devices was set to be half of the final total throughput result. Oversubscribed outgoing traffic was sent with EF and AF priorities. No

packet loss occurred for EF traffic, and excess traffic in the AF queue was lost. The rate of the incoming traffic was set to be 1/2 of the final total throughput result, and no packet loss occurred. As the result, incoming traffic's throughput plus outgoing traffic's throughput make the final total throughput.

Packet Forwarding Rate

The RFC 2544 test suite of Spirent TestCenter was used. 64-byte frames were sent to test the maximum packet forwarding rate of each device. The test result show the packet forwarding rate with no packet loss.

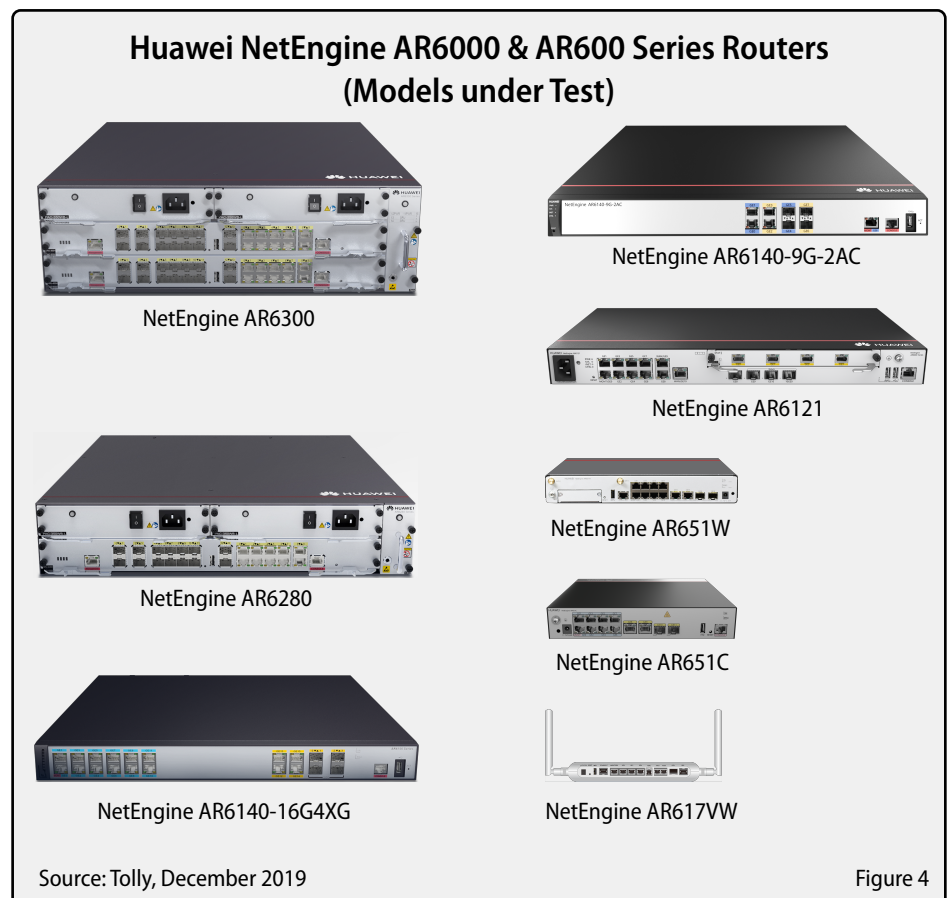


Figure 4



Huawei NetEngine AR6000 & AR600 Series and Cisco 4000 & 1000 Series Routers Tolly Verified Performance

		Basic Forwarding IMIX Packets (Gbps)	IPsec Performance IMIX Packets (Gbps)	Service-loaded Performance IMIX Packets (Gbps)
Huawei NetEngine AR6300 + SRU600H		140	10	14
Cisco ISR4461	Default	1.55	0.425	1.5
	Enhanced	3.146	2	3.1
	Boost	15.3	7.95	9.6
Huawei NetEngine AR6280 + SRU400H		126	9	12.5
Huawei NetEngine AR6140-16G4XG		20	7.75	9
Huawei NetEngine AR6140-9G-2AC		6	2.72	2.68
Huawei NetEngine AR6121		4	2.32	2.32
Cisco ISR4321	Default	0.0475	0.04	0.05
	Enhanced	0.1025	0.1	0.1
	Boost	2	0.456	0.64
Huawei NetEngine AR651W	Default	4	2.6	1.24
	Enhanced	4	2.72	2.48
Huawei NetEngine AR651C	Default	4	1.82	1.24
	Enhanced	4	1.82	1.9
Cisco 1100-8P	Default	1.975	0.04	0.94
	Enhanced ¹	1.969	0.365	0.96
Huawei NetEngine AR617VW		1.04	0.28	0.474

Notes: 1. Cisco 1100-8P has the "Boost" license integrated by default, so it does not have an additional "Boost" level like Cisco ISR 4000 series. "Enhanced" level is the best performance level it supports. 2. Please see the Test Results section or notes under Figure 1, 2 and 3 for the meaning of each level.

Source: Tolly, December 2019

Table 1



About Tolly

The Tolly Group companies have been delivering world-class ICT services for over 30 years. Tolly is a leading global provider of third-party validation services for vendors of ICT products, components and services.

You can reach the company by E-mail at sales@tolly.com, or by telephone at +1 561.391.5610.

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Devices Under Test

Vendor	Model	Firmware Version
Huawei Technologies Co., Ltd.	NetEngine AR617VW	AR610 V300R019C10SPC100
	NetEngine AR651C	AR650 V300R019C00SPC300
	NetEngine AR651W	AR650 V300R019C10
	NetEngine AR6121	AR6121 V300R019C10
	NetEngine AR6140-9G-2AC	AR6140 V300R019C00SPC300
	NetEngine AR6140-16G4XG	AR6140 V300R019C00SPC300
	NetEngine AR6280	AR6280 V300R019C00SPC300
	NetEngine AR6300	AR6300 V300R019C00SPC300
Cisco Systems, Inc.	1100-8P (C1111-8PLTELA)	Cisco IOS XE Software, Version 16.08.01
	ISR4321	Cisco IOS XE Software, Version 16.09.03
	ISR4461	Cisco IOS XE Software, Version 16.09.02

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