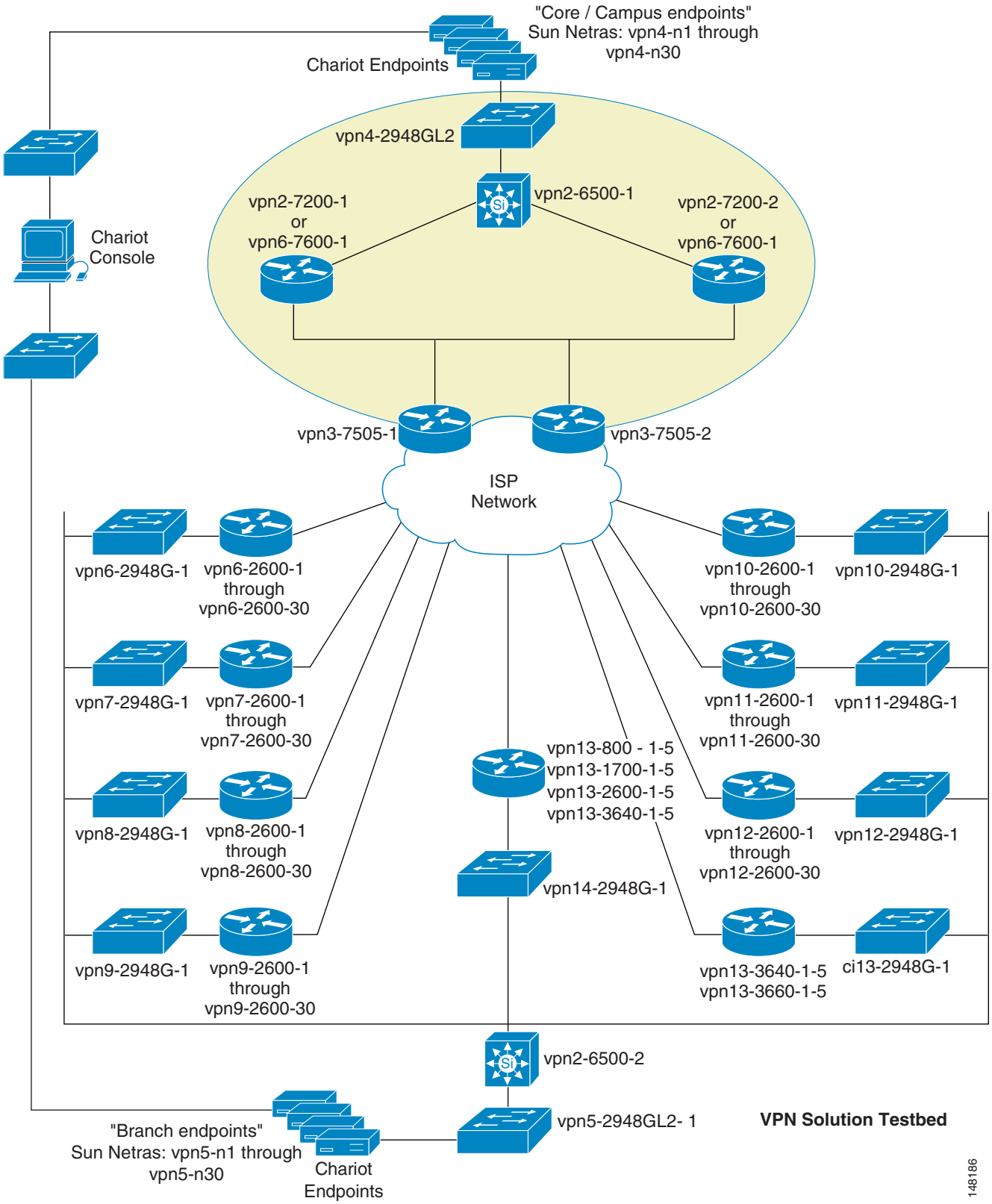
Scalability Test Results (Unicast Only)

This section offers test results from the Cisco test lab, to provide design guidance on the scalability of various platforms in p2p over IPsec VPN designs. IP multicast (IPmc) results are not included.

Scalability Test Bed Network Diagram

Figure 4-1 shows the scalability test bed network diagram.

Figure 4-1 Scalability Test Bed Network



Scalability Test Methodology

The headend scalability test bed consists of a number of Cisco branch routers (various types, including the 1700, 2600, 3600, 3700, 1800, 2800, and 3800 families) homed to various types of headends. For most of the traffic sent through the network, flows are established using the Ixia Chariot testing tool. The bps mix of traffic is approximately 35 percent UDP and 65 percent TCP; application types represented in the mix include the following: VoIP, FTP, DNS, HTTP, POP3, and TN3270. The average packet size is 188 bytes, from headend to branch, and 144 bytes from branch to headend. This relatively small average packet size ensures that the scalability results presented support a converged network design, and tends to be fairly conservative. A network carrying data-only traffic, with a larger average packet size, may achieve better bps performance than that listed here. However, the pps performance given a specific CPU value should be the same.

Some traffic is also generated by the Cisco IP SLA feature in IOS, formerly known as Cisco Service Assurance Agent (SAA), using the HTTP Get script, with the branch routers making an HTTP Get call to an HTTP server in the core. Testing was conducted without fragmentation occurring in the network by setting the MTU to 1300 bytes on the test endpoints.

The following tables show results for testing with a configuration for p2p GRE over IPsec tunnel aggregation. The routing protocol used during testing was EIGRP unless otherwise stated. The traffic mix used, as stated earlier, is converged data and g.729 VoIP.

Headend Scalability Test Results—p2p GRE over IPsec

Table 4-1 shows results for the testing with the configuration for a p2p GRE over IPsec design and no other Cisco IOS features such as IOS Firewall, PAT, ACLs, IPS, or QoS.

Table 4-1 Scalability Test Results—p2p GRE over IPsec Only

Platform	# of Tunnels	# Voice Calls	Throughput (Kpps)	Throughput (Mbps)	CPU %
Cisco 7200VXR with NPE-G1 and dual SA-VAM2	500	240	40.0	82.5	80%
Cisco 7600 Sup720 VPN SPA	1000 (Both p2p GRE tunnels and IPsec tunnels on VPN SPA)	3537	480.0	1050.0	N/A
	1000 (p2p GRE tunnels on Sup720 and IPsec tunnels on VPN SPA)	4137	521.0	1110.0	N/A
Cisco 7200VXR and Cisco 7600 Dual Tier Headend Architecture	3000 (1000 p2p GRE tunnels on each of three Cisco 7200VXR with IPsec tunnels on VPN SPA)	est. 4000	601 in total Up to 203 Kpps on each of three 7200VXR	-	N/A

Note that headend scalability testing did not include an exhaustive evaluation of the maximum number of tunnels that can be terminated to headend devices. In addition, scalability testing of the branch routers was performed with two tunnels per branch. This did not include exhaustive testing of the number of tunnels these various platforms can support.

Headend Scalability Test Results—p2p GRE Only

Table 4-2 shows results for the testing with the configuration for a p2p GRE only design and no other Cisco IOS features such as IOS firewall, PAT, ACLs, IPS, or QoS. The purpose for these results is to provide the reader with the p2p GRE only results for designing a Dual Tier Headend Architecture. The IPsec only results can be found in the *IPsec Direct Encapsulation Design Guide* at the following URL: http://www.cisco.com/en/US/docs/solutions/Enterprise/WAN_and_MAN/Dir_Encap.html.

Table 4-2 Scalability Test Results—p2p GRE Only

Platform	# of Tunnels	# Voice Calls	Throughput (Kpps)	Throughput (Mbps)	CPU %
Cisco 7200VXR with NPE-G1	1000	1377	203.7	414.2	79%
Cisco 7600 Sup720[1]	1000	4437	665.7	1675.3	N/A

1. These results are limited by the test bed traffic load limitation. This platform is expected to exceed these results.

Branch Office Scalability Test Results

Table 4-3 shows results for testing with a configuration for p2p GRE over IPsec. A single tunnel was configured to the aggregation headend. These results include other integrated Cisco features such as IOS Firewall, PAT, and ACLs, but not QoS or IPS.

Table 4-3 Branch Office Scalability Test Results

Platform	HW Encryption	# Voice Calls	Throughput (Kpps)	Throughput (Mbps)	CPU %
Cisco 3845 ISR	On-board	187	24.0	48.8	81%
	AIM-VPN/HPII-Plus	420	27.1	50.1	80%
Cisco 3825 ISR	On-board	143	18.2	36.6	81%
	AIM-VPN/EPII-Plus	156	20.1	42.8	79%
Cisco 2851 ISR	On-board	90	11.4	23.8	79%
	AIM-VPN/EPII-Plus	120	14.9	30.8	80%
Cisco 2821 ISR	On-board	45	6.0	13.6	53%
	AIM-VPN/EPII-Plus	97	12.3	25.9	78%
Cisco 2811 ISR	On-board	19	2.6	5.8	79%
	AIM-VPN/EPII-Plus	27	3.6	8.0	80%

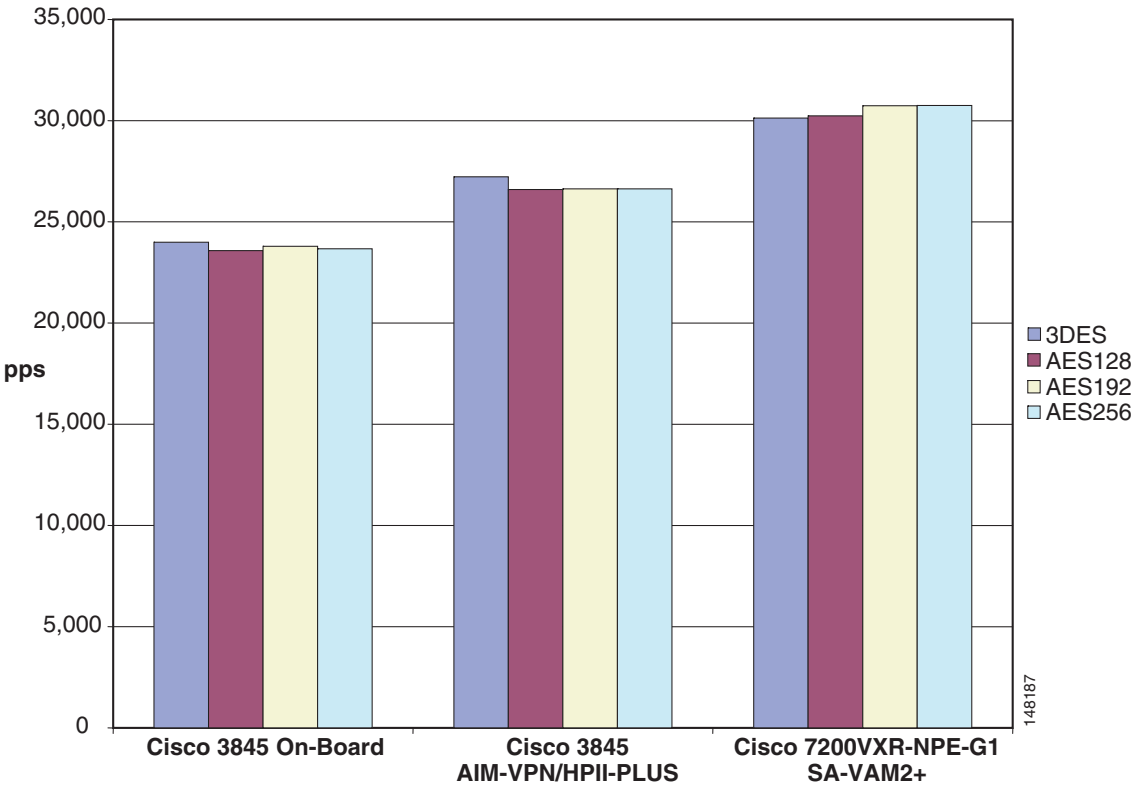
Table 4-3 Branch Office Scalability Test Results

Cisco 2801 ISR	On-board	19	2.6	5.8	83%
	AIM-VPN/EPII-Plus	30	3.9	8.4	79%
Cisco1841 ISR	On-board	19	2.5	5.7	82%
	AIM-VPN/BPII-Plus	30	3.9	8.8	80%
Cisco 1811W with no BVI configured	On-board	33	7.6	16.0	81%
Cisco 1811W with BVI configured	On-board	60	4.3	9.3	82%
Cisco 871W with no BVI configured	On-board	8	2.0	4.4	85%
Cisco 871W with BVI configured	On-board	15	1.1	2.4	84%

AES versus 3DES Scalability Test Results

Both 3DES and AES encryption are available in all products shown here, including hardware-accelerated IPsec. Not every test was executed with both 3DES and AES; however, several snapshot tests were performed to compare performance. As shown in Figure 4-2, results are relatively comparable, with little to no variation in performance, even for AES with wider key lengths.

Figure 4-2 Comparison of 3DES and AES Performance



Failover and Convergence Performance

Customers may have different convergence time requirements. The design principles in this guide were used to perform scalability tests with up to 500 branch offices aggregated to two or three headend routers. See Load Sharing with Failover Headend Resiliency Design, page 2-21 for more details.

The following test was performed by powering off one of the headend devices to simulate a complete headend failure. The network fully converged after a maximum of approximately 32 seconds for all 240 branches. The test scenario is shown in Table 4-4.

Table 4-4 Three Headend Load Sharing with Failover

	Headend 1	Headend 2	Headend 3
Cisco 7200VXR NPE-400	Cisco IOS version 12.1(9)E	Cisco IOS version 12.1(9)E	Cisco IOS version 12.1(9)E
Starting condition	27 Mbps 80 branches 32% CPU	28 Mbps 80 branches 32% CPU	44 Mbps 80 branches 37% CPU
During failover	Powered off	41 Mbps 120 branches 46% CPU	56 Mbps 120 branches 50% CPU

The same test was then performed with 500 branch offices aggregated to two headend devices. All 250 branches from the powered-off headend successfully failed over to the single surviving headend. In this test, the network fully converged after approximately 32 seconds.

During the re-convergence, when the powered-off headend was restored, the convergence of each branch took approximately two seconds each, with the total time for re-convergence at about five and one-half minutes. Table 4-5 shows the resulting CPU utilization percentages.

Table 4-5 Two Headend Load Sharing with Failover

	Headend 1	Headend 2
Cisco 7200VXR NPE-G1	Cisco IOS version 12.2(13)S	Cisco IOS version 12.2(13)S
Starting condition	37.5 Mbps 250 branches 43% CPU	35.6 Mbps 250 branches 43% CPU
During failover	Powered off	45.7 Mbps 500 branches 84% CPU

Because of the normal TCP backoff process, the total traffic levels through the surviving router may be temporarily lower after a failure than the total traffic before failure.

Software Releases Evaluated

Table 4-6 shows the software releases used in the scalability testing.

Table 4-6 Software Releases Evaluated

Cisco Product Family	SW Release
Cisco 7600 VPN SPA	Cisco IOS 12.2(18)SXE2
Cisco Catalyst 6500 VPNSM	Cisco IOS 12.2(17d)SXB1
Cisco 7200VXR	Cisco IOS 12.2(13)S Cisco IOS 12.1(9)E Cisco IOS 12.3(5)
Cisco branch office routers (17xx, 26xx, 36xx, 37xx)	Cisco IOS 12.3(8)T5
Cisco branch office ISRs (1841, 28xx, 38xx)	Cisco IOS 12.3(8)T5 Cisco IOS 12.3(11)T2
Cisco remote office routers (831)	Cisco IOS 12.3(8)T5
Cisco remote office routers (871W and 1811W)	Cisco IOS 12.3(14)YT1

Before selecting Cisco IOS software, perform the appropriate research on cisco.com, and if you have technical questions, consult with Cisco Customer Advocacy (TAC).