Network Capacity Expansion System

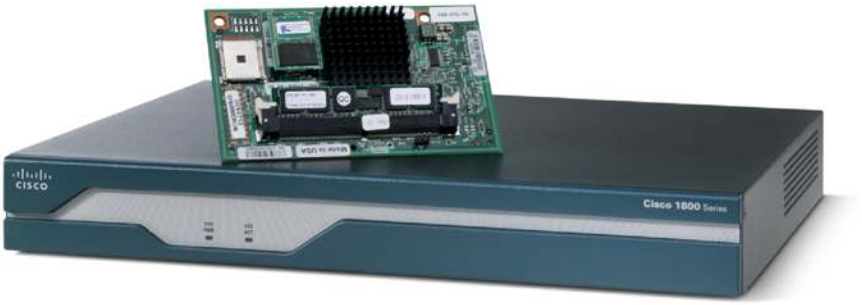
Expanding Capacity of Wide Area Networks at Remote and Mobile Sites

Multisite and global organizations today are facing several unique wide area network (WAN) challenges: the need to provide employees with instant access to centrally located information, the requirement to continuously back up and replicate mission-critical data to centrally managed data centers, the desire to provide satisfactory experience for IP phone and video communication, and the mandate to control bandwidth costs without sacrificing application availability and performance.

The Network Capacity Expansion System (NCE) is designed to help organizations address these challenges. Cisco NCE is a transport layer performance enhancing proxy (PEP) that increases the amount of available bandwidth at small to midsized branch offices and remote locations. It is designed to cost-effectively accelerate data transfer over the WAN by overcoming bandwidth and latency limitations. With NCE, multisite organizations get more data through and more value out of their existing WAN links.

Building on the strengths of the award-winning Cisco® integrated services routers (ISRs), Cisco NCE (Figure 1) is a small-footprint cost-effective module that transparently integrates into the ISR and natively uses capabilities of Cisco IOS® Software. With millions deployed worldwide, ISRs support the needs of multisite organizations that want to integrate advanced network services, such as NCE, into their remote site networks.

Figure 1. Network Capacity Expansion Advanced Integration Module with Cisco 1841 Integrated Services Router



Key Features	Key Benefits
• Typical 3 to 20 times higher WAN throughput • Simple and fast to deploy (in minutes) • Fully transparent to other network services	• Expands available bandwidth • Reduces bandwidth utilization • Improves data transfer rates

The NCE Advantage

Designed to meet the needs of small and midsize remote sites, NCE focuses on three primary areas:

Throughput

Bandwidth specifies the maximum data transfer rate achievable on a WAN link. Latency, congestion, and packet loss determine the actual transfer rate (throughput). Cisco NCE uses two techniques to take throughput past the bandwidth limit: virtual bandwidth expansion and improved bandwidth utilization. Compression and packet-bundling algorithms increase effective bandwidth. Packet flow control and TCP optimization mitigate effects of congestion and latency to improve utilization of available bandwidth. The combined effect of these technologies results in a dramatic expansion of available WAN link capacity and enables extremely fast data transfer rates over the WAN.

Integration

Cisco NCE is a hardware extension of Cisco IOS Software and therefore tightly integrated into the network fabric. Such a close integration helps ensure that bandwidth optimizations and routing decisions are happening simultaneously without the added overhead of another interception. The tight integration has the added benefit of minimal configuration and once deployed requires no monitoring. Moreover, NCE is directly integrated into the Cisco Express Forwarding switching path, helping ensure complete transparency to other network services and all security provisions. Finally, NCE has been built ground up for ISRs and leverages the internal ISR hardware architecture.

Cost-Effectiveness

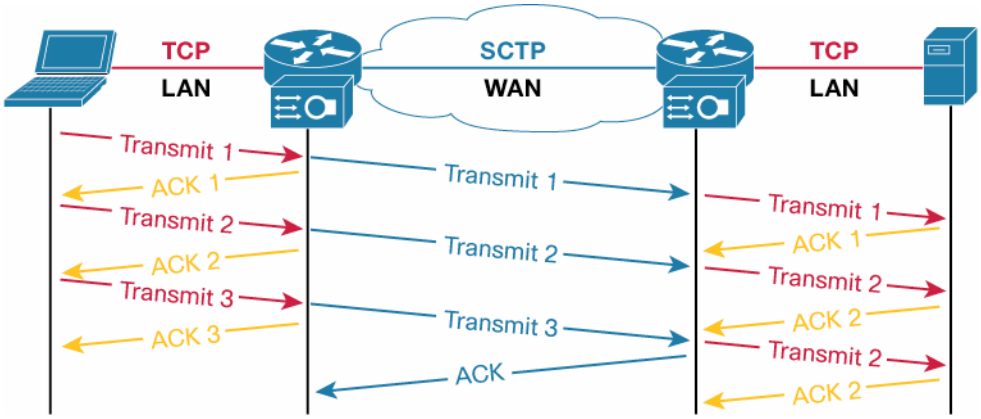
Cisco NCE performs no application-specific traffic optimization and is not classified as a WAN optimization controller (WOC). Cisco Wide Area Application Services (WAAS) fall into this product category, providing additional benefits. However, by focusing on the root causes of poor WAN throughput—limited bandwidth and network latency, eliminating complexities associated with vendor-specific application optimizations, and keeping costs low—NCE offers unbeatable price for performance, simplicity, and transparency. Designed to meet the needs of small and medium-sized remote sites, NCE is easy to use and maintain and uses the ISR for a low total cost of ownership.

Product Description

Cisco NCE acts as a transparent PEP (Figure 2) that terminates sender's TCP session locally, compresses and bundles the sender's data, sends the data to a remote peer encapsulated in a Stream Control Transmission Protocol (SCTP), unbundles and decompresses the data, and establishes a new TCP session remotely to deliver the data to its destination.

For remote and mobile sites, NCE is available in the Advanced Integration Module (AIM) form factor that is supported on all the modular ISRs, including the Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845 Integrated Services Routers. There are two AIM configurations differing by the amount of outbound bandwidth supported.

Figure 2. Network Capacity Expansion System PEP Architecture



Cisco NCE is a symmetric solution that requires a pair of peer devices between end nodes. Each NCE module is capable of simultaneously increasing throughput for multiple peers, allowing hub-to-spoke and meshed deployments. For central office (headend) aggregation, NCE is available in the Network Module Extended (NME) form factor that is supported on the Cisco 3825 and 3845 ISRs. Table 1 summarizes the various supported NCE configurations.

Table 1. Supported Cisco NCE Configurations

SKU	Use Case	WAN Capacity	ISR Platforms	Number of Remote Peers	Users
AIM-TPO-1	Bandwidth/link optimization	2 Mbps (T1/E1)	Cisco 1841, 2801, 2811, 2821, and 2851 ISRs	5	<25
AIM-TPO-2	Bandwidth/link optimization	4 Mbps (2xT1/E1)	Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845 ISRs	10	<50
NME-TPO	Headend aggregation	45 Mbps	Cisco 3825 and 3845 ISRs	50	–

Compression Increases Effective Bandwidth

Cisco NCE implements several compression techniques to overcome bandwidth limitations: payload compression, redundant header elimination, and efficient packet packing. For payload compression, NCE uses hardware implementation of the open standard Deflate algorithm with dynamic Huffman coding that preserves compression dictionaries across multiple packets. Payload compression yields 3:1 to 10:1 compression on standard benchmarks (Standard Canterbury Corpus). For redundant header elimination, NCE multiplexes several TCP sessions into a single SCTP stream, substituting TCP headers with the much smaller SCTP “chunk” identifiers. Finally, for efficient packet packing, NCE tightly bundles multiple compressed packets into the path maximum transmission unit (MTU), helping to ensure that no partially filled data link layer frame is sent across the WAN.

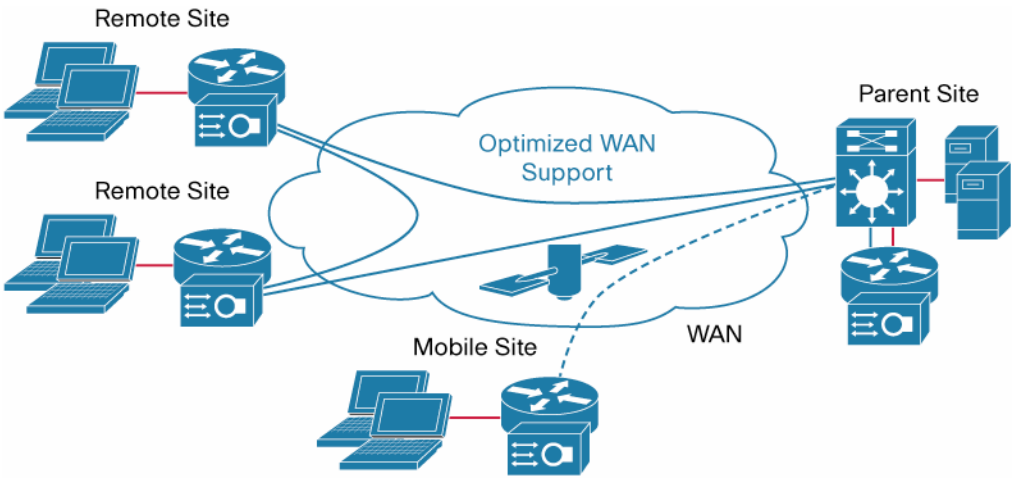
Transport Optimization Improves Bandwidth Utilization

Cisco NCE implements several optimization techniques to mitigate the effects of latency, packet loss and congestion: TCP protocol optimization and packet flow control. For TCP optimization, NCE transparently splices SCTP streams into TCP sessions that connect end nodes. The open standard SCTP inherits all the benefits of TCP, adds reliability features, and was designed ground up to overcome inefficiencies inherent in TCP. The use of SCTP to encapsulate traffic leads to a significant improvement in bandwidth utilization. For packet flow control, NCE paces WAN-bound traffic to match the prevailing WAN conditions, helping to ensure that packets are not dropped because of congestion.

Deployment Is Simple and Fast

Deploying NCE takes minutes. Various options are available for headend configuration depending on the number of remote sites and bandwidth dedicated to each site. (See Figure 3.)

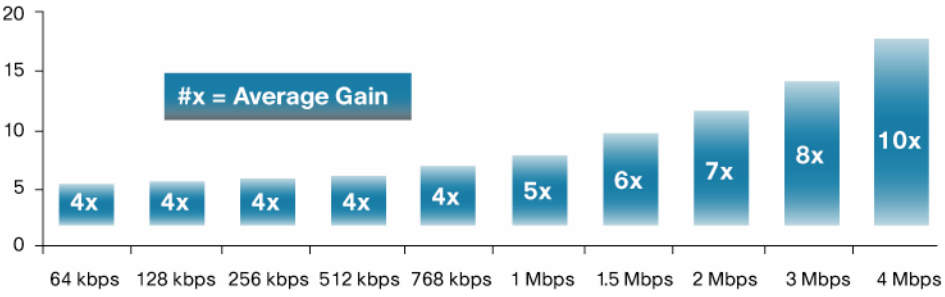
Figure 3. Sample NCE Deployment



Performance

Although actual throughput gain depends on the specifics of a traffic profile, on standard file sets NCE has consistently demonstrated increase in effective bandwidth by more than 400 percent (Figure 4).

Figure 4. NCE Throughput Gain for Typical Remote Site



Features

Table 2. Cisco NCE Feature List

Network Capacity Expansion System Features

Network Capacity Expansion System Features	

General Features
• Expands capacity for up to 4-Mbps WAN links
• Improves transfer rates for all TCP traffic
• Scales up to 50 simultaneous user
• Supported on all modular ISRs
• Cost-effective hardware extension of Cisco IOS Software
• Tightly integrated into Cisco Express Forwarding switching path:
  ◦ Full transparency to other network services
  ◦ Full transparency to security provisions
• Small-footprint with low environmental impact
• Transparent integration with real-time traffic
• Preserves Type of Service (TOS) field
• Handles up to 10 simultaneous tunnels
Optimization Techniques
• SCTP encapsulated TCP optimization:
  ◦ Optimal initial window size
  ◦ Large maximum window size
  ◦ Selective acknowledgments
  ◦ Chunk-based retransmission
  ◦ Advanced congestion control
  ◦ Acknowledgment spoofing
  ◦ Transmission rate pacing
  ◦ Path MTU discovery
  ◦ Fast retransmit
• Hardware-based Deflate compression:
  ◦ Dual-pass hardware implementation
  ◦ Multipacket compression dictionaries
  ◦ LZ77 compression/dynamic Huffman coding
• Intelligent bandwidth management:
  ◦ Peak and guaranteed bandwidth configuration
• Data bundling and header optimization:
  ◦ Asymmetric path optimization
  ◦ Header compression
  ◦ Packet packing
	Fault-Tolerance Capabilities
	• Router-monitored device health status
	• Fail-to-wire upon all types of device failures
	• No mechanical or moving parts
	Deployment Modes
	• Hub-and-spoke and meshed traffic flows
	• Supports variety of deployment modes:
	  ◦ Spoke to hub
	  ◦ Spoke to spoke
	  ◦ Spoke to multiple hubs
	  ◦ Spoke to multiple spokes
	• Satellite, 3G/wireless, and terrestrial WANs
	Device Management
	• Simple CLI management and monitoring
	Headend Aggregation
	• Cisco 3800 Series Integrated Services Routers with multiple NCE modules:
	  ◦ Scale up to 160 Mbps outbound traffic
	  ◦ Aggregate up to 200 remote sites
	• Numerous options based on deployment size
	Network Interfaces
	• Point-to-point WAN interfaces
	• Point-to-multipoint Gigabit Ethernet
	• Generic routing encapsulation (GRE) tunnels
	• IP Security (IPSec) tunnels
	Cisco IOS Software Feature Set
	• Release 12.4 (15)XY with IP Base and above
	Information Logging
	• NetFlow
	• Syslog
	• Simple Network Management Protocol (SNMP)

Product Specifications

Table 3. Cisco NCE Module Specifications

	AIM-TPO-1	AIM-TPO-2	NME-TPO
Router platforms	Cisco 1841, 2801, 2811, 2821, 2851 ISRs	Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845 ISRs	Cisco 3825, and 3845 ISRs
Cisco IOS Software (on router)	Cisco IOS Software Release 12.4(15)XY or later	Cisco IOS Software Release 12.4(15)XY or later	Cisco IOS Software Release 12.4(15)XY or later
Cisco NCE Software (on module)	Cisco NCE Software 1.0 or later (TPO-SW-1.0-K9)	Cisco NCE Software 1.0 or later (TPO-SW-1.0-K9)	Cisco NCE Software 1.0 or later (TPO-SW-AGGR-1.0-K9)
Connectivity	Internal Gigabit Ethernet	Internal Gigabit Ethernet	Internal Gigabit Ethernet
RAM	512 MB	1GB	1 GB
Physical characteristics	Dimensions: 5.25 x 3.35 x 0.75 in (13.3 x 2.41 x 8.26 cm) Weight: 0.20 lb (0.09 kg) maximum	Dimensions: 5.25 x 3.35 x 0.75 in (13.3 x 2.41 x 8.26 cm) Weight: 0.20 lb (0.09 kg) maximum	Dimensions: 1.55 x 7.10 x 7.2 in (3.9 x 18 x 18.3 cm) Weight: 1.5 lb (0.7 kg) maximum

	AIM-TPO-1	AIM-TPO-2	NME-TPO
Operating environment	Operating humidity: 5 to 90% noncondensing Operating temperature: 23 to 122°F (-5 to 50°C) Nonoperating temperature: 40 to 158°F (-40 to 70°C) Operating altitude: 0 to 13,000 ft (0 to 3963m)	Operating humidity: 5 to 90% noncondensing Operating temperature: 23 to 122°F (-5 to 50°C) Nonoperating temperature: 40 to 158°F (-40 to 70°C) Operating altitude: 0 to 13,000 ft (0 to 3963m)	Operating humidity: 5 to 95% noncondensing Operating temperature: 32 to 104°F (0 to 40°C) Nonoperating temperature: -40 to 185°F (-40 to 85°C) Operating altitude: 0 to 10,000 ft (0 to 3000m)
Safety	FCC Part 15 Class A; EN55022 Class A; AS/NZS 3548 Class A; CISPR22 Class A; VCCI Class A; EN55024; EN61000-3-2; and EN61000-3-3	FCC Part 15 Class A; EN55022 Class A; AS/NZS 3548 Class A; CISPR22 Class A; VCCI Class A; EN55024; EN61000-3-2; and EN61000-3-3	FCC Part 15 Class A; EN55022 Class B; AS/NZS 3548 Class A; CISPR22 Class B; VCCI Class B; EN55024; EN61000-3-2; and EN61000-3-3
EMC	FCC Part 15 Class A; EN55022 Class A; AS/NZS 3548 Class A; CISPR22 Class A; VCCI Class A; EN55024; EN61000-3-2; and EN61000-3-3	FCC Part 15 Class A; EN55022 Class A; AS/NZS 3548 Class A; CISPR22 Class A; VCCI Class A; EN55024; EN61000-3-2; and EN61000-3-3	FCC Part 15 Class A; EN55022 Class B; AS/NZS 3548 Class A; CISPR22 Class B; VCCI Class B; EN55024; EN61000-3-2; and EN61000-3-3

Ordering Information

To place an order, visit the Cisco ordering home page. Table 4 gives ordering information.

Table 4. Part Numbers for Cisco NCE Modules and Software

Product Part Number	Description
AIM-TPO-1	Cisco NCE Advanced Integration Module for Cisco 1800, 2800 and 3800 Series Integrated Services Routers, 512 MB RAM
AIM-TPO-2	Cisco NCE Advanced Integration Module for Cisco 1800, 2800 and 3800 Series Integrated Services Routers, 1GB RAM
NME-TPO	Cisco NCE Advanced Integration Module for Cisco 3800 Series Integrated Services Routers, 1 GB RAM
TPO-SW-1.0-K9	Cisco NCE 1.0 Software Image for AIM-TPO-1 and AIM-TPO-2
TPO-SW-AGGR-1.0-K9	Cisco NCE Aggregation 1.0 Software Image for NME-TPO

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about Cisco NCE solutions, visit http://www.cisco.com/go/nce or contact your local Cisco account representative. For more information about Cisco integrated services routers, visit http://www.cisco.com/go/isr or contact your local Cisco account representative.

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