

PUBLIC-INTEREST FINDING FOR PROPRIETARY-MATERIAL USE

ROUTE: VAR DES NO: VAR
PROJECT NO: VAR COUNTY: VAR
PROJECT DESCRIPTION: Programmatic approval.
FHWA OVERSIGHT: YES NO
PROPRIETARY MATERIAL:
Routers (SR) and Ethernet Routing Switches (ERS):

ERS 8800, ERS 8300, ERS 5600, ERS 5530, ERS 4500, ERS 2500, SR 3120, SR 4134,
Manufactured by Nortel Networks Corporation (Nortel).

1. Description of Need:

The ITS Technology Deployment Division of the Indiana Department of Transportation is seeking approval to create a recurring special provision and ultimately incorporate into the Standard Specifications equipment essential to the creation and maintenance of the INDOT ITS network.

Routers and routing switches are designed to join multiple area networks. On the INDOT network they serve as in intermediate destinations for network traffic: receive TCP/IP packets, look inside each packet to identify the source and target IP address, and direct packets accordingly. Multitude of configurations allows designer select model/configuration guarantying various functionalities.

Required functionalities include:

- Provide unique addressing in the network using Internet Protocol address.
- Provide protection from unwanted intrusions of unauthorized users (firewall)
- Provide separation of multiple networks in one physical location.
- Provide creation of required back-bone multi-layer redundancy with minimal hardware.
- Provide ability to use for communication wireless or fiber optic devices.
- Provide wide range of the bandwidth.

2. Product History: These devices have been chosen at the inception of the system approximately 15 years ago and since are the main part of each core (back-bone and TMC), field core (relay sites), and remote component. Over 400 of ERS and routers combined are currently being used in Indiana. They demonstrate very high reliability (over 96% uptime) and maintainability. Desired product is currently listed on INDOT Approved Materials List for Traffic Signal and ITS Control Equipment under ITS Networking Equipment. Testing was conducted according the ITM No. 950-10P

3. Product Availability: ERS/SR, manufactured by Nortel/Avaya, is only product on the market, meeting all requirements. Although there are routing switches and routers on the market providing unique IP addressing, firewall protection, and separation of multiple networks, none of them is capable of interfacing with existing network. There were no attempts by the manufacturers to present their products to be tested to **ITM No. 950-10P**. Google search for Ethernet Router Switch or Router returns multiple devices, meeting some of the requirements, but not all.

4. Product Cost: There is no equipment on the market to make cost comparison. The next closest product is the SSA-G1018-0652 suite priced at \$15,298.99. However, this product will not communicate with the existing field and core hardware.

5. Project Compatibility: Desired product is the only product on the market that is compatible with existing ITS hardware. Application matrix below describes which model can be used for which application. The lowest cost ERS/SR model is being selected for any particular project based on the technology needs.

Model \ Function	ERS 8800	ERS 8300	ERS 5600	ERS 5530	ERS 4500	ERS 2500	SR 3120	SR 4134
Ethernet Routing Switch	X	X	X	X	X	X		
Secure Router							X	X
Unique IP addressing	X	X	X	X	X	X	X	X
Fire Wall Protection	X	X	X	X	X	X	X	X
Modular	X	X						
Stackable			X	X	X			
Managing of large networks, high capacity, high complexity.	X							
Managing of mid-size networks, high capacity, high complexity.		X						
Managing of sub-midsize networks			X	X	X			
Managing Wide Area Networks (WAN)	X	X	X	X	X	X	X	X
IP Telephony								X
Cost (Dependent on configuration)	\$40,000 to \$70,000	\$30,000 to \$65,000	\$4,800 to \$8,800	\$5,400	\$1,230 to \$4,000	\$1,000 to \$3,000	\$400	\$15,000
Application	Back-bone, TMC	Back-bone, TMC	Relay Sites	Relay Sites	Remote Sites	Remote Sites	Remote Sites	High capacity phone communication

6. Maintenance: Desired equipment is designed such a way, that most of maintenance functions: monitoring up/down time, restoring functionality, updating/upgrading – can be done remotely, which drives down maintenance cost. Training is available on line in Wiki Notes, accessible for tech personnel from any location in Indiana. Low failure rate (less then 3% including “acts of God”) and short order turn around time results in the minimal storage requirement.

7. Engineering Analysis: This application is programmatic by nature and unique not to a specific ITS project, but to the ITS architecture that is already in place. ERS and SR are essential components that allow communication between TMC and core and field hardware. The specifications are needed for synchronization with existing system and not unique to the specific project.

8. Expanded Economic Analysis: Due to the fact, that there is no equipment on the market to do comparison life cycle analysis, it may be stated that actual yearly maintenance cost is low. The average life cycle of the ERS is evaluated as 10 years. There are units currently in service installed in 2005. Annual replacement rate, including damage done by lightning, is negligible. Replacement of ERS and SR is predominantly driven by technology progress, rather than wear.

9. Contractual or Performance Implications: Use of desired items does not impose any restrictions on the use of other items on the contracts.

10. Attach Supplemental Documentation: Attached are:

- a) INDOT ITS Architecture;
- b) ITM # 950-10P ITS Ethernet Switches.

11. Length of Time that Approval is Effective: 10/2011 until 10/2014

Prepared By: Konstantin Veygman

Field Engineer

INDOT-ITS Technology Deployment Division

Date:

Based upon the above finding, the use of the proprietary material listed is in the public interest and is hereby approved.

APPROVED: Don J. B. Zia Date: 16 Nov 2011
INDOT Deputy Commissioner
Engineering Services and Design Support

APPROVED: [Signature] Date: 11-22-11
Federal Highway Administration

INDOT has developed ITS infrastructure in urban areas statewide. It consists of vehicle detection, Closed Circuit TV cameras (CCTV), Highway Advisory Radio (HAR) sites, Dynamic (Variable) Message Signs (DMS), Travel Time Signs (TTS), and Virtual Weigh-in-motion (VWIM), Weigh-in-Motion (WIM), and Automatic Traffic Recorder (ATR) stations.

All data collected by the detectors and cameras is distributed to the Traffic Management Centers (TMCs). Information addressed to the driving public is sent from TMCs to the DMSs, HARs, and TTSs.

Communication to and from TMCs is provided via hybrid wireless/fiber optic means. The communication system is based on a "Back Bone", consisting of several nodes called Communication Data Processors (CDPs), connected with each other via redundant circuits (licensed wireless or fiber optic). The TMC is connected directly to the CDPs. Networking and communication equipment located at the TMC comprises the TMC Core Devices group. Field Core Devices installed at CDPs and major nodes include FCC Licensed and non-licensed wireless equipment, terminating and interfacing Fiber Optic equipment, and other networking equipment.

A typical INDOT ITS System consists of up to 3 distinguished groups of devices, described as follows.

1. Traffic Management Center (TMC) Core Devices. This group consists of major networking and communication equipment.
2. Field Core Devices. This group consists of FCC Licensed and non licensed wireless equipment, terminating and interfacing Fiber Optic equipment, and all networking equipment.
3. Field Devices. This group consists of:
 - a) Public information devices: DMS, TTS, HAR;
 - b) Detection devices: CCTV Cameras, non-invasive inductive detectors, microwave detectors;
 - c) ~~Communication and networking devices: field processors, radios,~~
fiber optic equipment, field switches.
 - d) Traffic Monitoring System devices: Virtual Weigh-in-motion (VWIM), Weigh-in-Motion (WIM), and Automatic Traffic Recorder (ATR): system controllers, roadway sensors, and communication and networking devices.

Existing ITS infrastructure is being expanded according with ITS Strategic Deployment Plan located at:

http://trafficwise.org/stratplan/TrafficManagementStrategicPlan_v2-4.pdf

Each ITS project involving Federal Funds adheres to the National ITS Architecture and the Systems Engineering Process as defined in 23 CFR 940. A Systems Engineering form is being completed and submitted to the FHWA for review and approval on each federally funded ITS project.

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT**

**PROCEDURE FOR BENCH TESTING, FIELD TESTING, AND APPROVAL LIST
REQUIREMENTS FOR ITS ETHERNET SWITCHES
ITM No. 950-10P**

1.0 SCOPE.

- 1.1 This test procedure covers the methods that an ITS Ethernet Switch is evaluated in the field, and is placed, maintained, or removed from an approval list.
- 1.2 The values stated in either English or acceptable SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other, without combining values in any way.
- 1.3 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 Indiana Standards.

806 Approval List Requirements

2.2 NTCIP Standards.

1103 NTCIP Transportation Management Protocol (TMP)
9012 NTCIP Testing Guide for Users

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101 and NEMA TS-2 Section 1.

4.0 SIGNIFICANCE AND USE. This ITM is used to evaluate, approve, maintain approval, and remove from the approval listing an ITS Ethernet Switch which is placed on the Department's List of Approved Traffic Signal and ITS Control Equipment. Each model of the ITS Ethernet Switch will be bench tested and field tested separately.

5.0 APPARATUS.

5.1 Complete ITS fully functional system

6.0 SAMPLING. The manufacturer shall furnish, at no cost to the Department; one randomly selected production-run ITS Ethernet Switch of each model for bench testing and field testing.

7.0 PROCEDURE.

7.1 The manufacturer of the material shall submit the Preliminary Product Material Evaluation Form (Appendix A) for each model type of the ITS Ethernet Switch which the manufacturer is requesting to be added to the listing.

7.2 The manufacturer of the material shall submit with the Evaluation Form the following:

7.2.1 An invoice showing an initial zero dollar amount (\$0.00) for the use of the evaluation sample material during the evaluation. The invoice shall also list the deferred cost of the material that the Department would pay if the material is purchased the instead of returned upon the successful completion of the evaluation.

7.2.2 A certification of environmental testing shall be furnished with each major unit approval request indicating the unit has been tested and is in accordance with the environmental requirements from NTCIP. The certification shall specify the model and serial number of the ITS Ethernet Switch tested. A complete log of each test shall be provided to the Department and will be maintained by the Department. The log shall show which, if any, component failed during the test, when the component failed, and what steps were taken to repair the AFP. The log shall include the date of testing, name and title of person conducting the tests, a record of conditions throughout the tests, and a temperature and humidity verses time chart. The maximum report interval of any chart shall be 24 h. The chart shall be from a recording machine used to monitor the status of the environmental chamber during testing.

7.2.3 Operation and Maintenance Manual(s), including theory of operation, schematics and components parts listing

7.2.4 One randomly selected production run ITS Ethernet Switch for bench testing and field testing

7.2.5 List of required software and any additional items required to realize the full potential of the product

8.0 SUBMITTAL REVIEW. The documentation, including the environmental testing, will be reviewed for usability of the ITS Ethernet Switch with Department approved NTCIP based ITS system in Indiana. The manufacturer's recommended schedule and extent of maintenance will be reviewed for acceptability.

- 9.0 BENCH TESTING.** The ITS Ethernet Switch will be bench tested for compatibility with all ITS equipment assemblies used by the Department. The ITS Ethernet Switch will be verified for full NTCIP functionality and full manufacturer's claimed optional functionality.
- 10.0 FIELD TESTING.** The field testing of the ITS Ethernet Switch will consist of installing the ITS Ethernet Switch in an actual ITS cabinet for a period of up to 12 months to monitor the following:
- 10.1** A log of any failures for the ITS Ethernet Switch
 - 10.2** The relative ease of use for the field personnel
 - 10.3** Overall build quality and expected lifecycle of the ITS Ethernet Switch. The build quality and expected life shall be comparable with existing ITS Ethernet Switches.
- 11.0 REPORT.** A final report will include the notations and findings from the electronic bench test and field testing results and documentation.
- 12.0 APPROVAL LIST.**
- 12.1 Approval of ITS Ethernet Switch.** The ITS Ethernet Switch model may be placed on the approval list when the following conditions are met:
 - 12.1.1** A potential net benefit to the Department is realized by inclusion of the item on the list.
 - 12.1.2** The unit passes the NTCIP environmental requirements
 - 12.1.3** The required documentation is submitted.
 - 12.1.4** The bench and field testing are completed with satisfactory results.
 - 12.1.5** No excessive amount of routine or periodic maintenance is required.
 - 12.1.6** There are no failures with any of the different types of ITS assemblies or individual components used by the Department.
 - 12.1.7** All manuals, documents, and required software to realize the full potential of the Aries Field Processor are submitted.
 - 12.1.8** Only minimal maintenance operations were necessary during the field testing.

12.2 Maintaining Approval.

12.2.1 The ITS Technology Deployment Division of TMBU shall be notified each time any update or revision is made and an explanation of the benefits of the change shall be submitted. Operations Support Division will determine if and to what extent a revision is to be placed into field operation and may fully re-evaluate the ITS Ethernet Switch with the revision.

12.2.2 If the manufacturer makes any changes to an approved model to correct a non-NTCIP compliant or safety issue, the Department shall be notified immediately. The manufacturer shall correct all existing equipment purchased by the Department either directly, by contract, or through agreement prior to the change being incorporated at the manufacturer's production level.

12.2.3 A design change to an approved model shall require a submittal of documented changes. At the discretion of the Department, resubmission of the model for testing, and evaluation may be required. Permanent addition or removals of component parts or wires, printed circuit board modifications, or revisions to memory or processor software, are examples of items that are considered to be design changes.

12.3 Removal from Approval List. ITS Ethernet Switch will be removed from an approval list for, but not limited to, the following reasons:

12.3.1 Changes in the ITS Ethernet Switch components or production process that fail testing and/or evaluation

12.3.2 If three consecutive years elapse without furnishing the ITS Ethernet Switch

12.3.3 Performance of the ITS Ethernet Switch no longer meets the intended purpose

12.3.4 Recurring similar product failures indicate a manufacturer's defect

**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF OPERATIONS SUPPORT
PRELIMINARY INFORMATION FOR PRODUCT MATERIAL EVALUATION**

Trade Name _____ Date _____

Manufacturer _____ Patented? Yes _____ No _____ Applied for _____

Address _____
Street No (P. O. Box) City State Zip Code

Representative _____ Phone No () _____

Address _____
Street No (P. O. Box) City State Zip Code

Product Information _____

Materials Composition _____

** Is this product considered HAZARDOUS MATERIAL when disposing of non-used or surplus materials? Yes _____ No _____

** What is the shelf life of this material? Years _____ Months _____ N/A _____

Recommended Use-Primary _____

Recommended Use-Alternate _____

Advantages and/or Benefits _____

**** Materials specifications by manufacturer, installation/operation manual, maintenance manual, literature, test results, guarantee, hazardous material data sheets, plan, picture or sketch must be submitted with this form. In the case of electronic devices the schematic diagram, parts list, and parts layout diagram must be submitted for each printed circuit board within the device.**

Meets following specifications:

AASHTO _____

ASTM _____

OTHER _____

Use by highway authorities or similar agencies in other states.

Agency	Years Used	Remarks
_____	_____	_____
_____	_____	_____
_____	_____	_____

**** Has product ever been evaluated by and rejected for use by a governmental agency?**

Yes _____ No _____ If yes, by what agency and for what reason?

Will demonstration be provided? Yes _____ No _____

Availability: Seasonal _____ Nonseasonal _____ Delivery at site _____

After receipt of order, are quantities limited? Yes _____ No _____

** Will FREE SAMPLES be furnished? Yes _____ No _____
If yes, Quantity Furnished _____

** If the sample is salvageable, do you desire to have it returned Yes _____ No _____

(Desired return of salvageable samples will be at the supplier's expense.)
(The manufacturer agrees upon the return of salvageable samples, such samples may be damaged or non-operable. Normal care will be taken that the samples, when returned, are in operable condition; INDOT, however, does not guarantee that the returned samples are operable.)

Will laboratory analysis be furnished? Yes _____ No _____

** Approximate cost _____ Royalty Cost _____

When was the product introduced to the market? _____

This product is an alternate for what product? _____

Will warranty be provided? Yes _____ No _____ If yes, for how long? _____

Background of company, including principal products _____

What offices of the Indiana Department of Transportation have been contacted?

Additional Information _____

(Attach additional sheets as necessary)

Person furnishing information _____
Name Title

Address _____
Street No (P. O. Box) City State Zip Code

Items marked ** **MUST BE RESPONDED TO** or further consideration may not be given for this product.

Please mail this form to: **Manager, Office of Traffic Engineering
100 N. Senate Ave., Room N925
Indianapolis, IN 46204-2249**

If INDOT elects to evaluate your product/material - traffic signal equipment will be shipped to:

**Electronic Technician 1
Indiana Department of Transportation
7701 East Melton Street
Gary, IN 46403**

While all other materials to be evaluated will be shipped to:

**ITS Field Engineer
Indiana Department of Transportation
8620 East 21st Street
Indianapolis, IN 46219**

Is a 19-inch rack-mountable version available?

Avaya Response:

Yes, there is a 19-inch rack-mountable version of the Ethernet Routing Switch 8600 switch.

Is this component compliant with any level of the network equipment building system (NEBS) requirements GR-63-CORE?

Avaya Response:

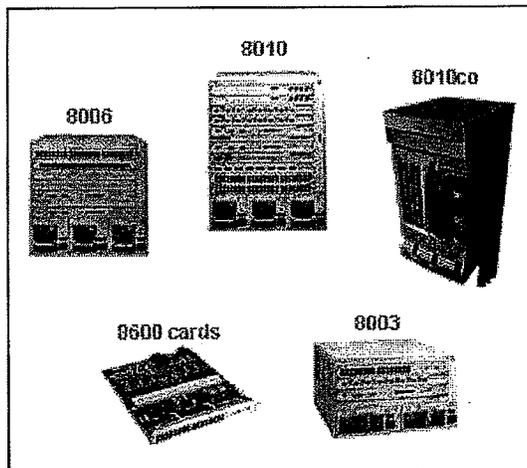
Yes. Nortel provides a NEBS3-compliant Ethernet Routing Switch 8600 chassis (the 8010CO chassis). This carrier-grade version of the Ethernet Routing Switch 8600 is designed for Metro Ethernet service providers, and will house all Ethernet Routing Switch 8600 modules.

What chassis models are available?

Avaya Response:

Nortel Ethernet Routing Switch 8600 chassis models use Ethernet technology to offer a scalable, modular product that allows you to choose a wide variety of configurations to best meet your network requirements. With four available chassis (see the figure below) and a range of modules, the Ethernet Routing Switch 8600 offers a simple, cost-effective and high-speed platform for connectivity to the metro optical infrastructure.

Figure: Nortel Ethernet Routing Switch 8600 models provide flexible options that meet a wide range of enterprise and service provider requirements.



Nortel provides four fault-tolerant Ethernet Routing Switch 8600 Series chassis models:

- **Ethernet Routing Switch 8010CO:** For service provider central offices, the NEBS3-compliant 10-slot chassis is designed for demanding environments, with enhanced cooling and electromagnetic interference (EMI) protection features.

Product Overview

Provide a description of your switching solution.

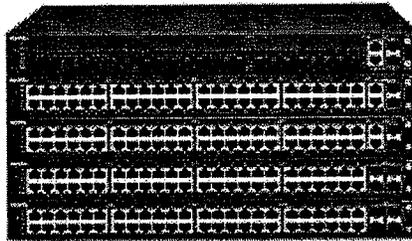
Avaya Response:

Nortel Ethernet Routing Switch 4500 series provides the resiliency, security and convergence readiness that application and competition-driven enterprise networks require. The Ethernet Routing Switch 4500 delivers flexible Ethernet switching with Power over Ethernet models for simplified network deployments to help drive lower Total Cost of Ownership.

Ethernet Routing Switch 4500 switches provide:

- Fast Ethernet infrastructure to support advanced applications or convergence
- Seamless migration from Fast Ethernet to Gigabit
- Gigabit to the desktop

Figure: Ethernet Routing Switch 4500 Series



Nortel Ethernet Routing Switch 4500 highlights:

- Stackable 10/100 and 10/100/1000 switching with and without Power over Ethernet
- High-performance, non-blocking switch delivering up to 320 Gbps stacking architecture
- Advanced resiliency with fail-safe stacking, Distributed Multi-Link Trunking (MLT) and redundant power option
- Sophisticated Quality of Service with Layer 2-4 traffic filters, prioritization based on 802.1p and DiffServ, marking, re-coloring and traffic shaping with flexible egress hardware queues
- Power to IP phones, wireless access points, network cameras, security, lighting and access control devices through Power over Ethernet
- High-density desktop connectivity, supporting up to 400 10/100 ports or 384 10/100/1000 ports — all managed as a single entity

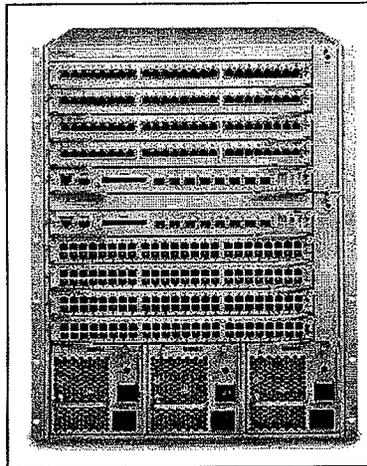
3.0 Layer 1: Hardware

Provide an overview of your Switch.

Avaya Response:

The ERS 8300 is a next generation cost effective, Power-over-Ethernet (PoE)-enabled, modular Ethernet Routing Switch (see figure below). Providing medium-high density 10G Ethernet and high density 10/100/1000 connectivity, high-performance Layer 3 switching, industry leading resiliency, security and services, the ERS 8300 is the solution for enterprises seeking to extend the intelligence of their network from the network core to the edge.

Figure: Ethernet Routing Switch 8300: Providing Power over Ethernet to the Wiring Closet.



For enterprises deploying the next generation of converged communication such as IP telephony, wireless LANs, and multimedia applications such as distance learning and video surveillance, the ERS 8300 is the common sense approach for their networks. As emerging applications introduce new traffic patterns and wireless access makes securing the edge increasingly important, the ERS 8300 helps ensure security is not compromised as the network changes to meet these needs.

The ERS 8300 complements the Ethernet Routing Switch 8600 in the network core and offers a reliable end-to-end modular switching solution for enterprises.

The ERS 8300 is available in two chassis models:

- Ethernet Routing Switch 8310: The 10-slot chassis is designed for high density campus wiring closet and backbones needing the highest levels of availability and scalability.
- Ethernet Routing Switch 8306: The 6-slot chassis is designed for medium-sized, lower-density wiring closets and backbones.

The ERS 8300 is a high-density 10/100/1000 switch with redundant and hot-swappable switch fabrics, I/O modules and power supplies and support for standards-based PoE to power IP phones, Web cameras and wireless access points. It provides guaranteed