Carrier Ethernet Switch Router
ECR-1000 Series

A Carrier Ethernet Solution for Next Generation Transport Networks
(Manufactured under license from IIT-Bombay)

Electronics Corporation of India Limited
ECIL’s ECR-1000 series carrier Ethernet switch routers offer next generation networking solution in the Carrier Ethernet segment for transport network. Deploying an innovative technology developed by the Gigabit Networking laboratory at IIT Bombay, these series of Transport Switches and Routers are poised to set new price/performance benchmarks in the telecommunication industry.

Applications: ECR-1000 Series Switch Routers are tailored for optimum performance in the following applications:

* Data-Center
* Metropolitan/Wide Area Network
* Carrier Ethernet Transport
* Broadband Service
* Metro/Core Transport
* As a replacement to SDH/SONET

Technology:

The path-breaking technology of ECR-1000 Series Switch Routers conceptualized at the Gigabit Networking Laboratory at IIT Bombay collapses the lower three layers of the Internet protocol stack into a single layer. For backward compatibility with existing systems the transport switch/router uses the common denominator of Ethernet – while supporting carrier-class features and providing an ultra-fast routing fabric. The lower three layers of the protocol stack – namely the network, data-link and physical layer are collapsed into a smart Carrier Ethernet layer that facilitates layer-2 service provisioning, routing and transport functionality. The ECR-1000 Series Switch Routers provide inherent topological security feature thus positioning these products as the core components of any secure transport network.

Networks with ECR-1000 Series Switch Routers establish an end-to-end communication system that is based entirely on Ethernet - over fiber in the metro and copper in the local area network, facilitating support of services at the data layer. This ECR-1000 Series Switch Router solution takes into cognizance, network hierarchy and interconnection methodology in MANs/enterprises and advances in Carrier Ethernet technology (PBB-TE/MPLS-TP) and applies these two concepts to create a unique end-to-end high-speed communication system.

This solution also provides an all-Ethernet wide area networking framework that involves a unique addressing and routing mechanism, and leads to a scalable, hierarchical, easy upgradable, cost efficient and service-oriented transport network architecture. The network-wide requirements of...
emerging services especially video, mobile backhaul and data-center, indicates a need to keep data in the lower layers—thereby conserving energy, lowering CAPEX and OPEX as well as providing better managed functionality. ECR-1000 Series Switch Router proposes a solution that addresses the problem of providing end-to-end communication while keeping information in the data and optical layers.

**Benefits:**

The present version of the Internet with IP as the dominant network protocol, Ethernet as the MAC protocol and WDM at the physical layer is not cost-and-performance-wise efficient in meeting the challenges in emerging services particularly as energy sources plummet. With our proposed technology ECR-1000 Series Switch Router supports WDM fabric at layer 1 – hence facilitates excellent fiber utilization and minimizes energy consumption.

A proprietary yet compliant with standards, Carrier Ethernet based routing mechanism of ECR - 1000 Series Switch Router facilitates routing in a domain that supports end-to-end communication scheme, with low cost, low energy consumption, low latency and small foot print.

**Managed Services:**

ECR-1000 Series Switch Router facilitates layer 2 managed ESP support and layer 3 managed LSP support. ECR-1000 Series Switch Router facilitates reservation of bandwidth for sessions (deterministic behavior) as well as enables differentiation of frames into control, data and Both

**Salient Features:**

**WDM fabric support:** At layer 1, it supports WDM – hence facilitates excellent fiber utilization.

**OTN support:** supporting OTN facilitates up to 1000km reach without regeneration of the optical signal – making this technology connect the metropolitan cities in India using external transponder.

**Carrier Ethernet support:** Up to 12 interfaces, each of which support between 1 Gbps and 10 Gbps traffic with Carrier Ethernet services.

**Service Support:** Each interface supports a multitude of services with each service adopting granularity from 1Mbps to 10 Gbps in increments of 10Mbps.

**Routing support:** a proprietary routing mechanism facilitates fast routing in a network domain.

**Optical networks** are comprised of functionality providing transport, multiplexing, routing, supervision and survivability of client signals that are processed predominantly in the photonic domain. Supporting OTN, ECR-1000 Series Switch Router facilitates up to 1000km reach without regeneration of the optical signal.
different traffic types (for QoS purposes). The ECR-1000 Series Switch Router can create ESPs and this is particularly important in the metro/access/core – by logically dividing a 1 GbE or a 10 GbE link into multiple tunnels like pseudowires. ECR-1000 Series Switch Router provides granularity of an ESP from 1 Mbps to 10 Gbps in increments of 10 Mbps.

Low-cost: The technology is an order of magnitude lower in cost compared to similar products in the market.

Low energy consumption and small footprint: The technology consumes less power and has a smaller footprint than comparable solutions.

Low latency: being one of the fastest routers in the world, this solution makes the technology unique to data-center and other service oriented communication needs.

Ethernet Line Service (E-Line Service) support of ECR-1000 Series Switch Router provides a point to point Ethernet virtual connection between two User to Network Interfaces (UNIs). The E-line service is used for Ethernet point-to-point connectivity. In the ECR-1000 Series Switch Router the E-Line service is configured through the “E-line Service” tab available on the NMS. The source and destination addresses (MAC or IP address), port details and the granularity for the E-line service are specified during configuration.

Ethernet LAN service (E-LAN Service) provides multipoint connectivity i.e. it may connect two or more UNIs. Subscriber data from one UNI can be received at one or more of the other UNIs. Each UNI is connected to a multipoint EVC (Ethernet Virtual Connection). As new sites (UNIs) are added, they are connected to the same multipoint EVC thus simplifying the provisioning and service activation. In the ECR-1000 Series Switch Router E-LAN service is configured using the “Multicast/ELAN” service tab on the NMS.
Both multicast and broadcast are supported under E-LAN service. In multicast service, flooding is restricted to the specified number of devices, whereas in broadcast the packets are forwarded to each and every end device.

**Network Management System (NMS):**

The network management system EC – Inter Networking Operating System (EC-INOS) is used for configuring the ECR-1000 Series Switch Routers in the network. In a running network with heterogeneous elements, all routers are detected by EC-INOS, thus providing full network view and planning. Network BOM, fiber planning, amplifier placement etc. can also be steered through the network management tools.

### Salient Features

* Point and click operation for service provisioning.
  * Multicast group support: 256 per router
  * Alarms
  * QoS supported: 4 and 8 levels (future) user configurable
  * RJ45 interface
  * Up to 5 Mbps
  * Scalable up to 2000 nodes

The other features supported by ECR-1000 Series Switch Routers which can be configured through EC-INOS are:

* Unicast
* Multicast
* E-Line
* E-LAN
* Rate-limiting

EC-INOS opening menu can be used to navigate/configure the ECR-1000 Series Switch Router as per the application requirement. They are:

* Data-Center.

* Metro Transport.
* ROADM (Reconfigurable optical add-drop multiplexer).
* CESR (Carrier Ethernet Switch Router).
* VPN (Virtual Private Network).

Ports of a router are configured through EC-INOS. The ports towards the client side are configured as edge ports and the ports connecting to other ECR-1000 Series Switch Routers are configured as core ports. Options for edge port configuration, traffic granularity, committed burst size (CBS), priority of the incoming traffic, receive/transmit flow control, auto negotiation and port protocol support can also be configured.

The granularity can be selected as multiple of Mbps of traffic for the purpose of streamlining to a particular flow, thereby achieving tunneling behavior leading to better Quality of Service (QoS) and enhanced Quality of Experience (QoE). CBS is enabled only for the Edge ports with a value ranging from “1” to “10” Maximum Transmission Unit (MTU) and with four levels of priority for the incoming traffic. The port protocol support is also available with IPv4, IPv6, MAC, IPv4/MAC, IPv6/MAC, VLAN, VLAN/MAC options. Based on the option selected, the incoming traffic address lookup is created.
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Fig. 7 EC-INOS network topology view

Fig. 8 EC-INOS Port Configuration
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Product Matrix:

<table>
<thead>
<tr>
<th></th>
<th>Physical Interfaces</th>
<th>Port to port Routing (seconds)</th>
<th>Switching Fabric (Gbps)</th>
<th>Power Rating (Watt)</th>
<th>Power Consumption (Watt)</th>
<th>Height (RU)</th>
<th>RPS</th>
<th>Rack Mountable</th>
<th>NMS Support</th>
<th>Tag Based VPN Support</th>
<th>Multicast Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>2x10Gbps, 10x1Gbps</td>
<td>1 micro</td>
<td>60</td>
<td>150</td>
<td>80</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
<td>GUI</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1010</td>
<td>4x10Gbps, 8x1Gbps</td>
<td>1 micro</td>
<td>96</td>
<td>250</td>
<td>180</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>GUI</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Technical Parameters:

**Layer 1: Protocol support**
- ECR-1000: 2x10GigE, 10x1GigE, Client side GigE
- ECR-1010: 4x10GigE or 4xODU2 OTN G.709, 8x1GigE, Client side GigE or ODU0, C-band 50 GHz and 100 GHz spacing (O1100 module), L-band 50 GHz and 100 GHz spacing (O1100 module), Laser chirp < ITU tolerance, Support for burst mode optics (client).

**Layer 2: Data Link support**
- Carrier Ethernet Support.
- IEEE802.1Qay support Scalable to meet RFC 5317/5921/5654/5860 MPLS-TP.
- IEEE802.1ag Ethernet Connectivity Fault Management (CFM) support.
- ITU.T. Y.1731 compliant.
- ELINE and ELAN support.

**Layer 3: Routing Specification**
- 1 microsecond port to port routing for up to 50% load.
- <3 microseconds for 50-75% load.
- <9 microseconds for full load.
- 1000 unique entries for FEC.
- Intra-domain routing support.
- IPv4 and IPv6 support.
- L3 VPN support.

**Hardware Security**
- Single FPGA based.
- Control plane: integrated with NMS.
- Memory to FPGA: with ECC.
- Granularity 10 Mbps to 10 Gbps in increments of 10 Mbps.
ECR - 1000 Specifications

- Proprietary routing and switching mechanism.
- Compatible with legacy/current technology.
- Compatible interfaces.  
  1GE Copper PHY, 1GE Fiber PHY.
  10GE Copper PHY, 10GE Fiber PHY.
- Online Network management system (NMS).
- NMS port.
- 0-50 degrees operating temperature.
- Redundant and hot swappable power supply.
- Performs transport (layer 1), switching (layer 2), forwarding (layer 2.5), routing (layer 3) in a single fabric.
- Less footprint of available systems.
- Energy Consumption of max 70 watts for 60 Gbps switching and routing fabric.
- Physical layer: GigE, 10GigE, WDM, CWDM, PON.
- OTN: (Future Release) ODU0, ODU1, ODU2 and ODU-Flex using an external transponder.

Security:
- Inherent topological security
- Cryptographic Authentication within 802.1x. (future release)

Connectivity Fault Management: provides 20 ms restoration

Power:
- 230vAC/110vAC.
- 150W max rating.

Confirms to Standards below:
- EN 60825-1 Safety of Laser Products - Part 1
- EMC: FCC Part 15 Class A (USA)
- GR-63-Core: NEBS, Physical Protection
- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-5 Surge

Layer 1 protocol support:
- 2x10GigE

Layer 2: Data Link support:
- Carrier Ethernet Support.
- IEEE802.1Qay support/Scalable to meet RFC 5317/5921/5654/5860 MPLS-TP.
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- <9 microseconds for full load.
- 1000 unique entries for FEC.
- Intra-domain routing support.
- IPv4 and IPv6 support
- BGP emulation for Inter-domain communication. (optional feature - future release)
- L3 VPN support.

**Physical & Environmental factors:**

- Box size: 1 RU
- 300mm depth, 19” rack mountable
- Humidity: up to 80% @ condensation.

**Hardware Security:**

- Single FPGA based.
- Control plane: integrated with NMS.
- Granularity 10 Mbps to 10 Gbps in increments of 10 Mbps.

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