

## Edgile 4G: Edge Router with Broad Band Remote Access Server

Edgile 4G is a carrier grade Edge Router that was designed specifically for deployments in central offices aggregating Broadband traffic. The Router has an integrated BRAS functionality for AAA and differentiated billing. The integrated MPLS functionality provides QoS on demand, Virtual Private Networks and Traffic Engineering. The Network Processor based approach gives Edgile 4000 its superior flexibility and low cost -features very much required in the access. The Router works seamlessly with Logic Eastern access switches like Xtera 500/Xtera 1000.

### Features

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#### **Web based service selection allows connection to multiple services simultaneously.**

Earlier approaches like PTA-MD (PPP Termination and Aggregation for Multiple Domain) or dialup necessitated the user to disconnect from one service to the another service. But not so with Web based service selection. There is now no need to install client software. Users can be given personalized services. Internet or corporate access can be made a separate selectable service.

#### **"Distributed PPP Termination" allows ATM free network**

Centralized BRAS based approach was designed for operators that already had an installed base of ATM switches and wanted to use the same for providing Broadband services. It is well known that ATM is not the right technology to carry consumer traffic for the access, especially IP traffic. Moreover the BRASs that were designed were largely for providing comparatively higher speed Internet access and not the highly differentiated IP services like the ones that the customers expect today.

#### **"Per Customer VLAN" helps security and customized treatment**

Ethernet is clearly winning as the ubiquitous and inexpensive media for carrying IP. However IP addresses can be easily "spoofed" and MAC addresses keep on changing and are also difficult to manage. Therefore Carrier grade security usually demands that one VLAN be given per "billable entity". This approach of using Ethernet in the access favors the distributed BRAS approach because of 4096 VLAN per Router port limitation in Ethernet. Maintaining one VLAN per customer also helps to retain the individuality of the customer till the Edge Router so that advanced services like MPLS VPNs, security filters, Rate Control, Drop precedence Quality of service treatment and special routing requirements can be rightfully provided.

#### **DSL Deployment Ready**

Incumbent carriers have massive investments in copper that they want to leverage against wireless access by providing broadband services. DSL is seen to be the access technology of choice here. Almost all current DSLAMs are IP DSLAMs. They terminate ATM over DSL and handover the Ethernet on an Ethernet (100BaseF or 1000BaseF) port. They also tag a user's traffic with a VLAN. The traffic might be PPPoE or RBE (Routed Bridge Encapsulation) encapsulated. Edgile 4G has been designed to take both these encapsulations and handle appropriately.





## Ethernet Deployment Ready

Greenfield carriers and Cable Operators with fiber based core planning to provide broadband services, are focusing more on enterprise and MTU/MDU market segment. They take fiber close the customer and terminate it in an Ethernet switch that in turn delivers the last 100 meters on CAT-5 cabling. The switch provides either IPoE or preferably IPoVLANoE upstream. Numerous services might be asked for, on these connections depending on the size, function and organization of the customer. Edgile 4G has been designed to provide all such services.

## Management Features

Edgile 4G comes with an integrated SNMPv2 based management system that can be used to bring out the full functionality of Edgile 4G very conveniently to the Network Operations Centre. Intuitively designed Graphical User Interface considerably eases the task of service provisioning, service management, billing and statistics collection for network enhancement etc.

### “Differentiated Billing” provides higher revenue and fair billing

Packet/Volume based billing is contentious since the users can not relate to the number of packets they would have pushed for using a particular service. The customer can better relate to an itemized bill at the end of month where she gets to know the number of minutes a particular service was used. This needs sophisticated hardware based accounting. Edgile 4G maintains and provides SLA (Service Level Agreement) minutes per service per customer so that carrier can bill the customer amicably and intelligently. "Fine grained QoS" provides bandwidth optimization and customer satisfaction Unlike traditional BRASs that were primarily designed for higher speed Internet access, Edgile 4G has been designed for delivering superior edge services like VPNs, VoIP, Video multicast, Video conferencing and gaming. These applications need a wide variety of QoS elements to function in a way that will make the customer pay up. Edgile 4G provides the fine grained QoS capabilities that such services expect from the Edge Router.

### “QoS for NetMeeting” helps Video Conferencing and Business grade VoIP

Loading sophisticated conferencing software into customer's computers is an expensive and yet inadequate proposition for the carrier. This is because the new installation invariably leads to some compatibility issues with the applications already installed on the customer's machine. This leads to a lot of calls to the customer care. Microsoft NetMeeting however is usually already loaded as a part of Windows and the probability of incompatibility is minimal. Edgile 4G therefore provides QoS over WAN links to H.323 based software. This minimizes the calls made to the carrier call centre. Most users can have an immediate video conferencing experience since they are already familiar with NetMeeting.

### “QoS on Demand” solves the Call Admission Control problem

Edgile 4G allows the network to dynamically (using MPLS RSVP-TE) check the availability of bandwidth before allowing a connection to be made. This ensures that the existing connections of consumers do not suffer quality deterioration when a new connection is made. This was not possible earlier where a premium customer packet would always take precedence over a general customer packet and spoil movie/music experience.

### “High Availability” helps honor uptime SLAs

Corporations or even Small/Medium Sized Enterprises paying/are willing to pay large amount of money to get stable, high speed Internet access. Especially IT enabled service companies or knowledge based research firms incur huge losses due to Internet access down time. Edgile 4G has features where it can be deployed in clusters (of two or more) with required protocols working between them to ensure that failure of one does not disrupt any service.

## Single PCB gives “High Reliability” and “Substantially Reduced Costs”

Edgile 4G has been designed as a monolithic PCB but keeping in mind that redundancy would be required at some locations in a carrier grade network. This way the carrier can choose to upgrade some time after the first installation. Single PCB based system saves the costs in backplane, connectors, multiple PCBs, management processor and also large chassis and cooling. It also improves hardware reliability and software stability.

## Software architecture gives “High Reliability”

Edgile 4G software has been designed keeping in mind the learning from design of large telephony switch software. The software allows Hitless software upgrades and high availability operation. The architecture has separate processes that handle routing, management and forwarding. In case where protection is achieved using two Edgiles connected back to back, there is an option to run the processes for system management and routing/switching protocols run on both Edgiles. State is maintained between the primary and secondary processors (auto-designated). The secondary processor takes over the operation if the primary fails. Since the forwarding tables with link management functions are on separate processors, this failover is transparent to packet forwarding or link management. Each process uses multiple threads to prioritize tasks. There are supervisory tasks that keep monitoring the health of other tasks and in case of a watch dog timer running out, can kill and re-spawn the tasks with the right state.

## Network processor based approach gives “High Flexibility”

In the ever changing Telecom Carrier world (and especially in the edge/access where one directly deals with the end customer) the requirements keep adding. There are new protocols, new constraints, new ALGs (Application Level Gateways) that keep coming up in this part of the network. Edgile 4G uses Network processors to provide the right performance that is required at this network location and simultaneously adapt to newer packet/protocol processing.

## Specifications Access lists help provide firewalls, a value added service

Edgile 4G provides protection to end customers by filtering unwanted access made to the customer's PC or Network Computing Resources. Explicit commands can be given to allow a particular traffic. All traffic that is not explicitly allowed to pass through it filtered out.

## Multicasting helps provide Video Multicast

Video Multicast is another lucrative service that the Network Service Provider can charge its customers. Edgile4G supports IGMPv2 and PIM-SM for multicast routing.

## NAT helps in IP Address Conservation, Management and security

Scarcity of IPv4 addresses are a major concern for NSPs. Edgile 4G provisions for various types of NAT on customer packets for Address Conservation. The customers can get a fixed IP address (where they can run web servers or ftp servers), a dynamic IP address or an overloaded NAT IP address.

## NAT helps Security

Most residential customers would get their IP addresses behind the Edgile NAT. Since these IP addresses would not be available to somebody on the Internet, it provides security attacks that need the IP address to be known. It provides one additional level of security.





## Specifications

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- **Construction**
  - Carrier Grade
  - Small Form Factor Plug-ins for flexibility
  - Rack Mount 19" option
  - Power Supply Options:
    - 48 Volt DC (-36VDC to -72VDC)
    - 220 Volt AC
- **Interfaces**
  - Four 1000BaseLX/SX
  - Two 100BaseTX Management Ports
  - Two RJ11 Console Ports
- **Interface Encapsulations**
  - IP over Ethernet
  - IP over VLAN over Ethernet
  - IP over MPLS over Ethernet\*
  - Ethernet over MPLS over Ethernet (draft martini)\*
  - IP over PPP over Ethernet (RFC 2364)
  - IP over PPP over VLAN over Ethernet
  - Simultaneous Online subscribers IPoVLANoE 24k
  - Simultaneous Online subscribers: PPPoVLANoE 24k
  - PPP call delay < 1 second
  - PPP call capacity > 250/second
  - ARP entry table: 16k
- **Services**
  - Premium Broadband Internet
  - MPLS BGP VPNs (RFC 2547)\*
  - Layer 2 VPNs (Draft Martini VPNs\*)
  - Network games
  - Leased line services over Ethernet
  - Video on demand
  - Music on demand
  - Video Multicast
- **Forwarding**
  - Routed forwarding only
  - Up to 5 Gbps of forwarding capacity
  - Up to 12 Mpps forwarding and processing rate
  - Line Rate IP forwarding for 20,000 prefixes
- **QoS**
  - Deep packet classification and filtering for 8,000 policies
  - Priority scheduling
  - Weighted Round Robin
  - Weighted Random Early Detect
- **Rate Control**
  - Policing via 8,000 two bucket policers
  - DSCP Packet marking
  - Three levels of drop precedence per output queue (supported by WRED)
  - Hierarchical output bandwidth shaping
    - Based on Physical Interface
    - Based on Logical Interface
    - Based on Customer Login
  - Parameters: Max upstream average flow, max downstream average flow, downstream peak flow, upstream excessive burst
  - User Bandwidth: 128k to maximum bandwidth
  - Granularity 64 kbps
- **Access lists**
  - Based on Source IP address, Destination IP address, Source Socket, Destination Socket, Interface, VLAN ID
  - Number of Rules: 1K
- **Address Management**
  - DHCP Relay
  - IPCP Parameter Negotiation

\* To be made available in next immediate release.

- **Routing**

  - Up to 20000 logical interfaces
  - Up to 128000 labels/LSPs
  - 500,000 BGP RIB-In paths
  - 1000+ BGP peers
  - 1000+ OSPF instances
  - 4096 VLAN interfaces per port
  - 20,000 global IPv4 routes per forwarding table
  - 200 VRFs per system \*
  - 1000 IPv4 Routes per VRF\*
  - Supports IP unnumbered addresses
  - Multi ISP selection: Number of ISPs supported: 16\*
  - Routing
  - BGPv4: Confederations, route reflectors, damping, multi-protocol extensions
  - OSPFv2: TE Extensions
  - RIPv1, RIPv2
  - MPLS\*
  - RFC 2547bis\*
  - IETF Draft Martini\*
  - LDP: Downstream unsolicited\*
  - RSVP-TE: Fast Restoral\*
  - QoS on demand\*
  
- **Security**

  - PAP
  - CHAP
  - RADIUS Authentication
  - Multiple levels of administrative passwords
  - Transmit and receive packet filtering
  - Service Access Lists
  - Firewall
  - Source Address Validation
  - Secured ARP
  - Dynamic VLAN + IP address binding. Implemented by DHCP
  - Static VLAN + IP address binding
  - Account and port binding to ensure user id and password are not misused
  - Limit the number of DHCP requests per VLAN to prevent malicious attack on DHCP server
  - Restrict the number of PPP sessions per VLAN
  - Trace malicious users
  
- **Multicasting**

  - IGMPv2
  - IGMP v3 \*
  - PIM-SM
  
- **NAT**

  - Allows Live IP, Dynamic NAT and Port overload
  - Number of newly set up concurrent sessions: 4k per second
  - Number of connections per service port: 32k
  - Address pool: 1k public address pools (512 poolNAT, 512 interfaceNAT)
  - Number of IP addresses per pool: 1k
  - Static map: 1k total
  - Application Layer Gateways ECHO, ECHO relay in ICMP, FTP, PING, H.323, IPSec
  
- **Network Management**

  - TELNET
  - SNMPv2
  - Command Line Interface
  - Web based management Interface
  
- **Weight**

  - 12 Kg
  
- **Power options**

  - 220 VAC/-48 VDC

\* To be made available in next immediate release.

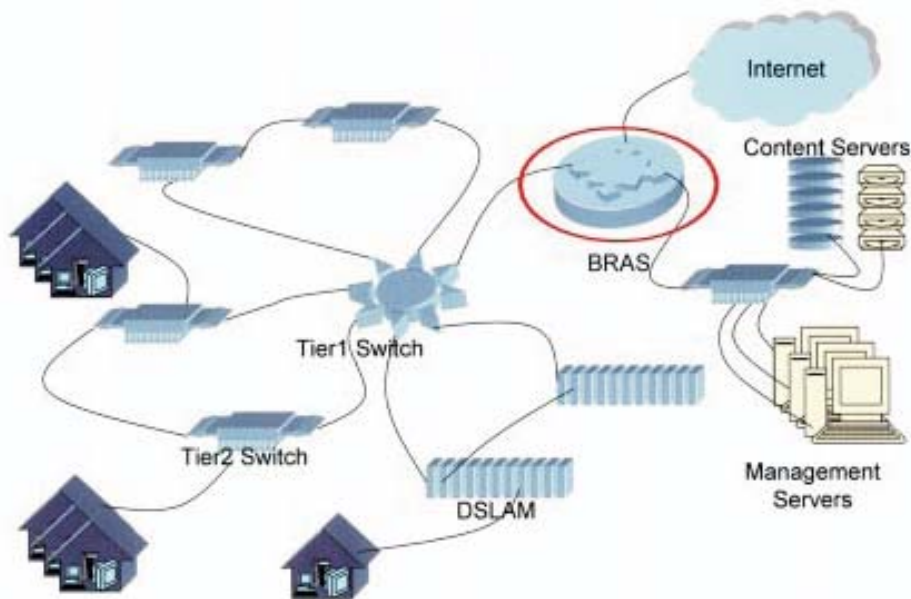


- **Temperature** 0°C to 60°C
- **Relative Humidity** 10% to 90% non-condensing

## Applications

FTTC networks set up and maintained by Local Cable Operators  
 Small Office/Home Office Ethernet Switch  
 Networking of Enterprise Network and Campus Network

## TYPICAL TRIPLE PLAY NETWORK



As shown by the diagram, the traffic from various service providers and their customers carrying various services (voice, video and data) is aggregated by Tier-2 switches (like Xtera 500 and Xtera 1000). The uplinks of Tier-2 switches are in turn consolidated by Tier-1 switches and fed to BRAS. In DSL deployments, Tier-1 switches collect traffic from DSLAMs rather than Tier-2 switches. In both cases the Edgile-4G provides the subscriber sensitivity and service sensitivity. Edgile-4G is the point where Quality of Service and Call Admission Control considerations are implemented. The billing information is collected and passed to the RADIUS server. The Video on Demand and Video Multicast sources are also injected at this point. Edgile-4G also serves as the first MPLS-PE node in the network.



B-2 Sector-31, Noida, U.P., INDIA  
 Phone : 91-120-2455112  
 Telefax : 91-120-2455059  
 e-mail : info@logiceastern.com