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Ubigate iBG2006™

System Description

www.samsungnetwork.com

The purposes of Safety Concerns are to ensure user's safety and to prevent property losses.
Please read this document carefully for proper use.

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TRADEMARKS

This description should be read before the installation and operation, and the operator should correctly install and operate the product by using this description.

This description may be changed for system improvement, standardization and other technical reasons without prior notice.

If you have a question for the content of manual or want to obtain further information on the updated manual, please contact the homepage below.

Homepage: http://www.samsungdocs.com

GENERAL USER INFORMATION

Radio Frequency Interference

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to FCC Part 15 Rules.
These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own risk.

FCC Requirements

This equipment complies with FCC Part 68 Rules and requirements adopted by Administrative Council for Terminal Attachment (ACTA).

FCC Part 68

The FCC Part 68 label is located on the bottom of the chassis.
The label contains:

- Product Identifier Number
- FCC Registration Number
- Ringer Equivalence Number (REN)

NOTE

If requested, this information must be provided to your telephone company.

Unauthorized Modifications

Any change or modifications performed on this equipment that are not expressly approved in writing by SAMSUNG ELECTRONICS, CO., LTD. could cause non-compliance with the FCC rules and void the user's authority to operate the equipment.

Telephone Connection Requirement

A plug and jack is used to connect this equipment to the premises wiring and telephone network must comply with the FCC Part 68 rules and requirements adopted by the ACTA.
A compliant telephone cord and modular plug is provided with this product which is designed to connect to a compatible Standard Modular jack.
Connection to the telephone network should be made by using standard modular telephone jacks, type RJ-11C. The RJ-11C plug and/or jacks used must comply with the FCC Part 68 rules.

CIRCUIT TYPE	MODULE TYPE	FACILITY INTERFACE CODE	NETWORK JACK
LOOP START LINE	FXO-4M FXO-2M T1E1-2M T1E1-1M	02LS2 04DU9.DN 04DU9.1KN 04DU9.1SN 04DU9.1SN (PRI)	RJ11C RJ48C
DID LINE	FXS-4M FXS-2M T1E1-2M T1E1-1M	02RV2.T 04DU9.BN	RJ11C RJ48C
E & M TIE LINE	T1E1-2M T1E1-1M	TL11M 04DU9.BN	RJ45S RJ48C

Ringer Equivalence Number

The REN is used to determine the number of devices to be connected to a telephone line. If the total allowable REN load is exceeded, the phone circuit may fail to ring. In most cases, the total REN for a telephone line should not exceed Five (5).
Contact Local Telephone Company, to be certain about the number of devices connected to a line, which is determined by the total REN.
For earlier products, the REN is separately shown on the label.

Incidence of Harm

The telephone company will notify you in advance about the temporary discontinuation of service, if this equipment is causing harm to the telephone network.
In case advance notification is not feasible, the telephone company will notify the customer as soon as possible and you will also be advised about your right to file a complaint with the FCC, if it is necessary.

Changes to Telephone Company Equipment or Facilities

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment.
If this happens, the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

Service Center

If you need assistance during troubleshooting, please contact out local office SAMSUNG ELECTRONICS, CO., LTD. for repair or warranty information.
If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved.

Field Repairs

Only technicians certified on the Ubigate iBG2006 are authorized by SAMSUNG ELECTRONICS, CO., LTD. to perform system repairs.
Certified technicians may replace modular parts of a system to repair or diagnose trouble. Defective modular parts can be returned to SAMSUNG ELECTRONICS, CO., LTD. for repair.

General

Connection to party line service is subject to state tariffs. Contact the State Public Utility Commission, Public Service Commission or Corporation Commission for information.

Direct Inward Dialing (DID)

If the equipment is not operating as per the **Proper Answer Supervision** mentioned in FCC Part 68 rules, then it is a violation.
Rules of PROPER ANSWER SUPERVISION:

1. Always On the following DID calls, the Equipment returns Answer Supervision to the Public Switched Telephone Network (PSTN)
   - Answered by the called station.
   - Answered by the attendant.
   - Routed to a recorded announcement that can be administered by the Customer Premises Equipment (CPE) user.
   - Routed to a dial prompt.

2. Always This equipment returns answer supervision on all DID calls forwarded to the PSTN.
   Permissible exceptions are:
   - A call is unanswered.
   - A busy tone is received.
   - A reorder tone is received.

Equal Access Requirements

Through the use of access codes, this equipment is capable of providing user's access to interstate providers of operator services. Modification of this equipment by call aggregators to block access dialing codes is a violation of the Telephone Operator Consumers Act of 1990.

Electrical Safety Advisory

Parties responsible for equipment requiring AC power should consider including an advisory notice in their customer information suggesting them to use a surge arrestor. Telephone companies report that electrical surges, typically lightning transients, are very destructive to customer terminal equipment connected to AC power sources. This has been identified as a major nationwide problem.

Music on Hold Warning

In accordance with US copyright laws, a license may be required from the American Society of Composers, Authors and Publishers (ASCAP) or other similar organizations if copyright music is transmitted through the **Music on Hold** feature.
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Direct Inward System Access (DISA) Warning

The lines used for the DISA feature must have the disconnected Supervision option provided by the telephone company.

As it is impossible to control who may access your DISA line it is suggested that you do not turn this feature on unless you intend to use it. If you do use this feature, it is good practice to frequently change pass codes and periodically review your telephone records for unauthorized use.

Safety Warnings

High touch current earth connection is essential before making telecommunication network connection.

Energy Hazard-careful treatment is needed.

Every wire for communication should be larger than 26 AWG.

Double pole/neutral fusing.

Underwriters Laboratories

The Ubigate iBG2006 system has been tested to comply with Safety Standards in the United States and Canada. This system is listed with Underwriters Laboratories. The cUL Mark is separately shown on the label.

Installation Safety Guidelines and Warnings

Safety Recommendations

The Safety Warnings that appear in this document (such as the one below) indicate a procedure that can harm you if not done correctly.

Electric hazard exists. Verify the power is turned off. Do not work on energized equipment. Working on energized equipment can result in serious electrical shock.

To avoid electric shock, do not connect Safety Extra-Low Voltage (SELV) circuits (found in LAN ports) to Telephone-Network Voltage (TNV) circuits (found in WAN ports).

This equipment must be installed and maintained by properly trained service personnel. Make sure the proper electrical service is available before plugging the unit and turning it on. Disconnect the telecommunication lines before unplugging the main power connector.

Class 1 Laser Product

The Ubigate iBG2006 is equipped with Small Form Pluggable (SFP) laser transceiver on some ports.

Invisible laser radiation may be emitted from disconnected fibers or connectors.
Do not stare into beams or view directly with optical instruments.

Cover Panels

Do not operate the Ubigate iBG2006 with missing blank faceplates and cover panels. These covers prevent exposure to hazardous voltages and currents inside the chassis. They are important to maintaining proper air flow through the chassis. They also prevent electromagnetic interference (EMI) that might disrupt other equipment.

Laser radiation and EMI are present when the router cover panel is open.

Electrostatic Discharge (ESD) Warning

Observe the following guidelines to minimize the potential for Electrostatic Discharge (ESD) damage, which can cause intermittent or complete component failures.

When handling Ubigate iBG2006 or its components, wear grounding wrist straps to avoid ESD damage to the equipment. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.

1. Always use an ESD wrist strap or ankle strap, and verify that it is in direct contact with your skin. Avoid contact between the component and your clothing as it causes ESD damage.

2. When handling any component that is removed from the chassis, verify that the equipment end of your ESD strap is attached to one of the ESD points on the chassis.

3. Use care when installing or uninstalling modules or interface cards. Tighten the captive installation screws to ensure a proper connection when inserting modules or interface cards.

4. When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack.
If you are returning a component, place it in an electrostatic bag before packing it.

INTRODUCTION

Purpose

Ubigate iBG2006™ System Description describes general information for Ubigate iBG2006 hardware description, software description, and additional modules.

Document Content and Organization

This description is composed of four Chapters, two Annex, the Abbreviation, and the Index.

CHAPTER 1. Introducing Ubigate iBG2006

- Ubigate iBG2006 Overview
- Product Specifications
- Ubigate iBG2006 Software Features and Licenses

CHAPTER 2. Hardware Overview

- Ubigate iBG2006 Chassis
- Ubigate iBG2006 Boot Sequence
- Ubigate iBG2006 Front Panel
- Ubigate iBG2006 Rear Panel
- Modules and Internal Option Card Types
- Port Numbering
- Modules and Option Cards

CHAPTER 3. Software Overview

- Management Plane
- Control Plane
- Packet Forwarding Plane

CHAPTER 4. Voice Features

- Introduction to Voice Feature
- Key Features
- Voice Deployment Scenario

ANNEX A. Cable Specifications

ANNEX B. Open Source Announcement

ABBREVIATION

Describes the acronyms used in this description.

INDEX

Index provides main searching keywords to be found.

Conventions

The following types of paragraphs contain special information that must be carefully read and thoroughly understood. Such information may or may not be enclosed in a rectangular box, separating it from the main text, but is always preceded by an icon and/or a bold title.

NOTE

Indicates additional information as a reference.

Information for Product and Technical Support

For questions regarding the product and technical supports:

http://www.samsungnetwork.com

Revision History

EDITION	DATE OF ISSUE	REMARKS
00	08. 2007.	First edition
01	05. 2008.	Added ATOP-1 and ATOI-1 mini modules
02	08. 2008.	Modified Open Source Announcement
03	12. 2009.	Added IVM-U1E
04	03. 2010.	Modified Open Source Announcement
05	08. 2010.	Modified Open Source Announcement

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CHAPTER 1. Introducing Ubigate iBG2006

Chapter1 describes Ubigate iBG2006 overview and specifications.

Ubigate iBG2006 Overview

Main Features, Functions and Benefits

Ubigate iBG2006 router is a modular Wide Area Network (WAN) router. It is a 1U rack-mount unit with slots for interchangeable interface modules. The core of the router is a WAN/Local Area Network (LAN) router that supports multi-protocol routing on WAN/LAN interfaces. Using built-in or optional encryption engine, Ubigate iBG2006 can provide IPSec Virtual Private Network (VPN). Also, using an optional VoIP card, it provides VoIP services. Lastly, it can support hardware Ethernet L2 switching using optional LAN modules.

Samsung's Integrated Switch Router

Ubigate iBG2006 integrates all the essential communication services such as routing, switching, security and VoIP into a single platform that can replace many separate network devices. In addition, versatility of many integrated features and a wide range of network modules provides management simplicity and investment protection while giving Small Medium Businesses (SMBs) room to grow with business expansions. For example, if an SMB wants to reduce the voice communications cost, it can easily do so by enabling voice gateway functionality on Ubigate iBG2006 with a combination of VoIP card and related interface module (s). In addition, variety of Quality of Service (QoS) features and an Ethernet module with Power-over-Ethernet ports of Ubigate iBG2006 will provide necessary infrastructure for Internet Protocol (IP) Telephony.

Furthermore, Ubigate iBG2006 includes many ease-of-use management features to help SMBs to configure, monitor and troubleshoot without difficulty.
Ubigate iBG2006 cost-effectively brings real benefits of network connectivity and convergence as well as network security to SMBs.

Here are highlights of Ubigate iBG2006's features.

Performance and Scalability

- 150 Kpps Routing and 3.8 Gbps Switching Capacity
- Maximum 4 T1, 20 FE UTP ports, and 1 FE SFP ports

Seamless Integration

Full routing, switching, voice and security in a single platform

Simple but Powerful Management

- Customers can manage all aspects of routing, switching, security and voice from a single web-Graphic User Interface (GUI).
- Read-only remote management enables service providers a quick view of the router for easy troubleshooting of Customer Premises Equipment (CPE).

Versatility

- WAN: Clear-channel/channelized T1/E1, Integrated Service Digital Network (ISDN), serial, frame relay, Multi-link Frame Relay (MFR), Point to Point Protocol (PPP) and Multi-Link PPP (MLPPP)
- LAN: 100 Mbps metro Ethernet, 10/100 Mbps Power over Ethernet (PoE), Virtual Local Area Network (VLAN), and 802.1q
- QoS: DiffServ, Auto QoS, Hierarchical QoS, Link Fragmentation and Interleaving (LFI), Service-Level Agreement (SLA), Low-Latency Queuing (LLQ) and Frame Relay (FR) PVC queuing
- Voice: Session Initiation Protocol (SIP), H.323, call manager, Public Switched Telephone Network (PSTN) fallback, Foreign Exchange Subscriber/Direct Inward Dialing (FXS/DID), Foreign Exchange Office/Centralized Automated Message Accounting (FXO/CAMA), ISDN, and T1/E1

Rock-Solid but Flexible Security

IPSec, Generic Routing Encapsulation (GRE), Layer 2 Tunneling Protocol (L2TP), Triple Data Encryption Standard (3DES)/Advanced Encryption Standard (AES), Content Filtering

Branch Office Configuration Example

Employing full routing capabilities and enterprise-class switching capacity as well as integrated security and Voice over Internet Protocol (VoIP) capabilities, Ubigate iBG2006 eliminates a need for many separate network devices at customer sites. Because Ubigate iBG2006 offers a wide range of features and network interfaces, you will be able to introduce new value-added services such as hosted Internet Protocol Private Branch Exchange (IP PBX) and IPSec VPN without requiring additional devices at customer sites that need to be managed separately. In addition, remote management features of Ubigate iBG2006 allow you to graphically configure, monitor or troubleshoot Ubigate iBG2006 as a managed CPE device with ease. With Ubigate iBG2006 on your side, you will boost your revenue while providing a right solution to your customers. Customer may increase productivity for its mobile executives, improved contact center operations, and facilitated expansion and acquisitions.

In Figure 1.1, iBG2006 in Branch 2 is shown to provide features of a router, a switch, a firewall, a VPN concentrator, and a voice gateway for VoIP in a single device.

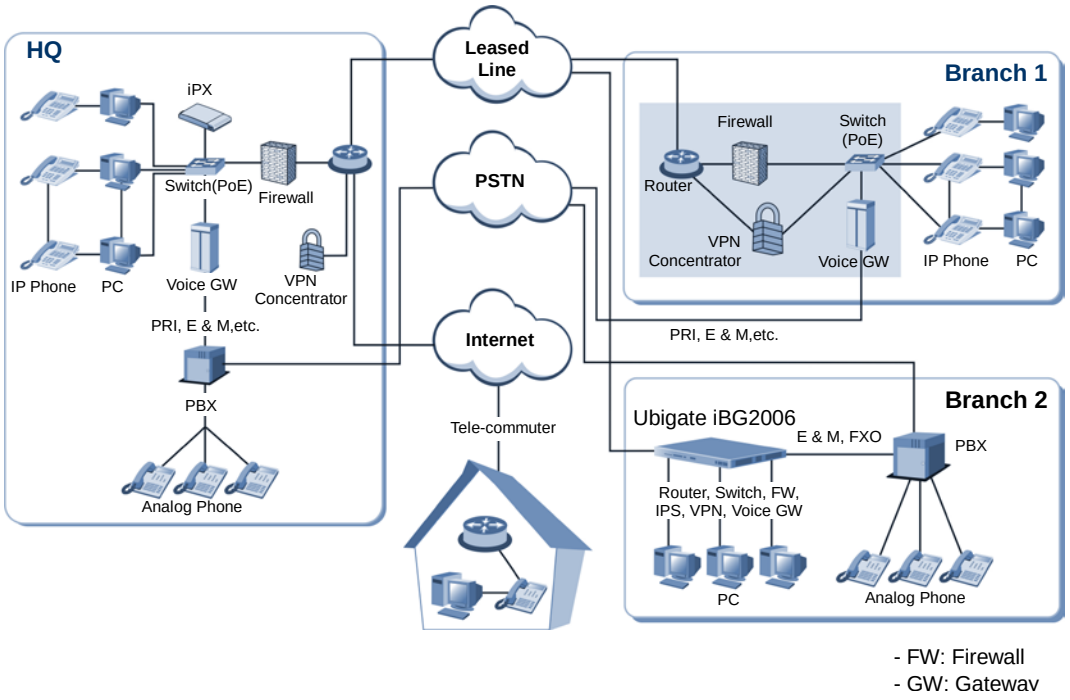

Figure 1.1 Branch Office Configuration Example (Branch 2)

Deployment Scenario

Ubigate iBG2006 is designed to provide WAN-connectivity to a small-to medium sized office as an access router. Ubigate iBG2006 also provides VPN/Firewall functionality on WAN interfaces, so end users can build secure communication channels through the public Internet.

In addition to access router functionality, Ubigate iBG2006 provides Layer 2 Ethernet switching capability for internal traffic. Figure 1.2 shows a typical deployment scenario for Ubigate iBG2006. As shown in the figure, Ubigate iBG2006 provides WAN interfaces such as T1, E1, and metro Ethernet in order to support WAN connectivity. In addition, it is possible to equip Ubigate iBG2006 with up to 20 10/100 Mbps Ethernet ports that will provide Layer-2 Ethernet switching functionality. Ubigate iBG2006 also offers Voice over Internet Protocol (VoIP) gateway capabilities.

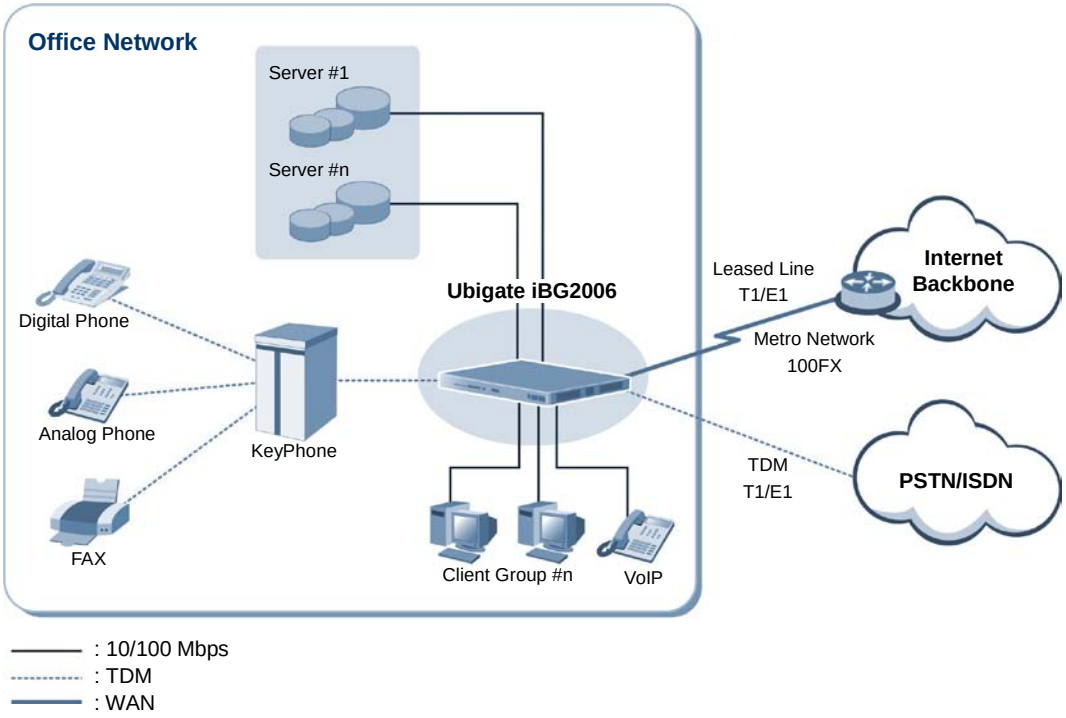

Figure 1.2 Ubigate iBG2006 Office Network Deployment Scenario Example

This allows Ubigate iBG2006 to support IP Phones and analog phones in addition to connectivity to traditional analog and digital PBX systems, enabling a single platform to provide converged voice, data, and video communications.

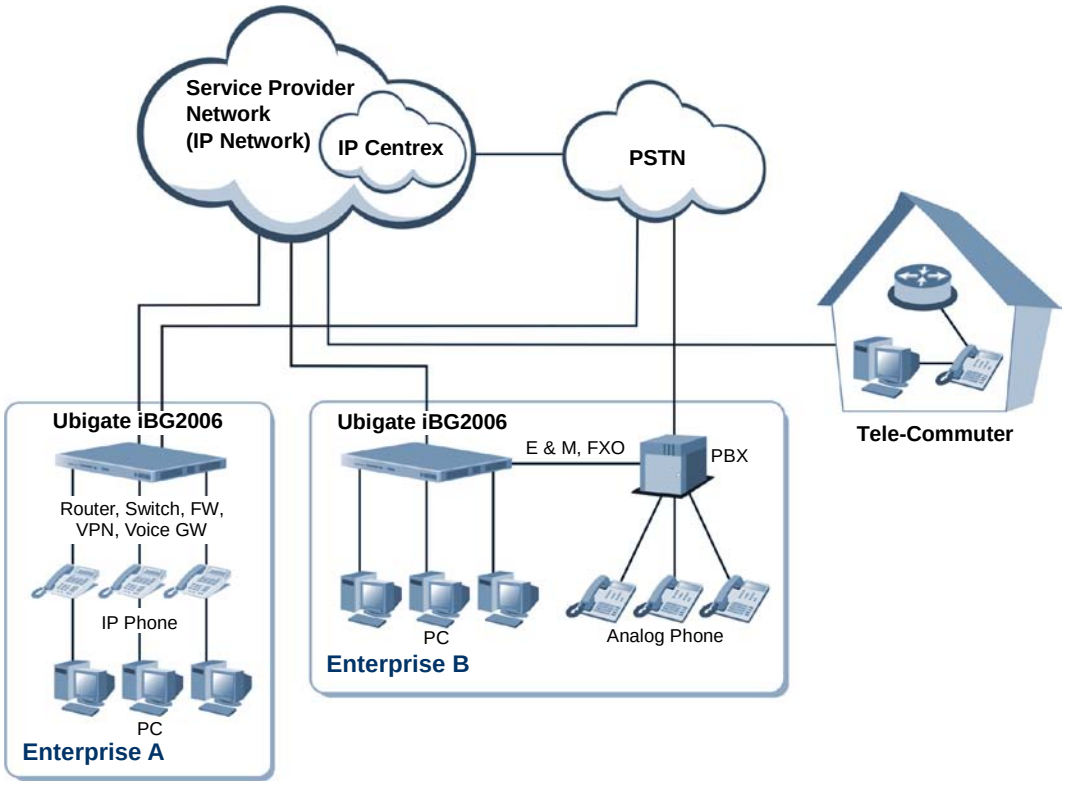

Figure 1.3 Ubigate iBG2006 Enterprise Network Deployment Scenario Example

New Service Offering Example

Basic Connectivity

If simple but reliable internet connectivity is the only requirement, your enterprise can accomplish it with one of many WAN interface cards. Plus, the high-port density switching module eliminates the need for an additional separate Ethernet switch. Furthermore, enterprise customers will have peace of mind, knowing that one of the various modules will satisfy whatever need might arise in the future.

Secure Connectivity

Nowadays, the need to protect enterprise networks has become an absolute requirement and connecting to the network without protection is unthinkable. Ubigate iBG2006 provides firewall and VPN features for complete protection of both voice and data. For higher throughput, a hardware VPN acceleration engine is also available. Whatever the size of an enterprise and whatever the need is, an enterprise customer can safely connect branch offices to headquarters, protect both audio and video traffic, and prevent malicious attacks, using Ubigate platforms.

Toll Bypass

The ability to utilize your current data link to carry quality voice provides tremendous savings on voice communications. With the voice gateway module in Ubigate iBG2006, you can easily and rapidly deploy a VoIP solution.

PSTN Fallback and Survivable IP Telephony

In addition to toll bypass capability, iBG2006 supports PSTN fallback and Survivable IP telephony features. When IP phones are configured to work with iBG2006 and an optional IP PBX, iBG2006 can connect IP phones to an IP network so that an end user can make a phone call without going through PSTN. However, if the IP network is down for any reason, IP phone cannot work. Since having reliable phone service is essential to business customers, iBG2006 provides Survivable IP telephony feature as well as PSTN fallback service. When the IP network connectivity is not available, iBG2006 can reroute VoIP packets coming from IP phones to PSTN by using a voice gateway which can be installed in it (PSTN fallback). If a connection to an external IP PBX fails, iBG2006 can provide basic IP PBX functionalities on behalf of the external IP PBX (Survivable IP Telephony).

Complete Solution

With all these features implemented-routing, switching, security and voice-nothing comes close to Ubigate iBG2006 in terms of richness of features and meeting customer needs. Furthermore, Ubigate iBG2006 can perform at full wire-speed even when most of value-added features are enabled. Wherever and however it is deployed, Ubigate iBG2006 will satisfy any enterprise customer's need.

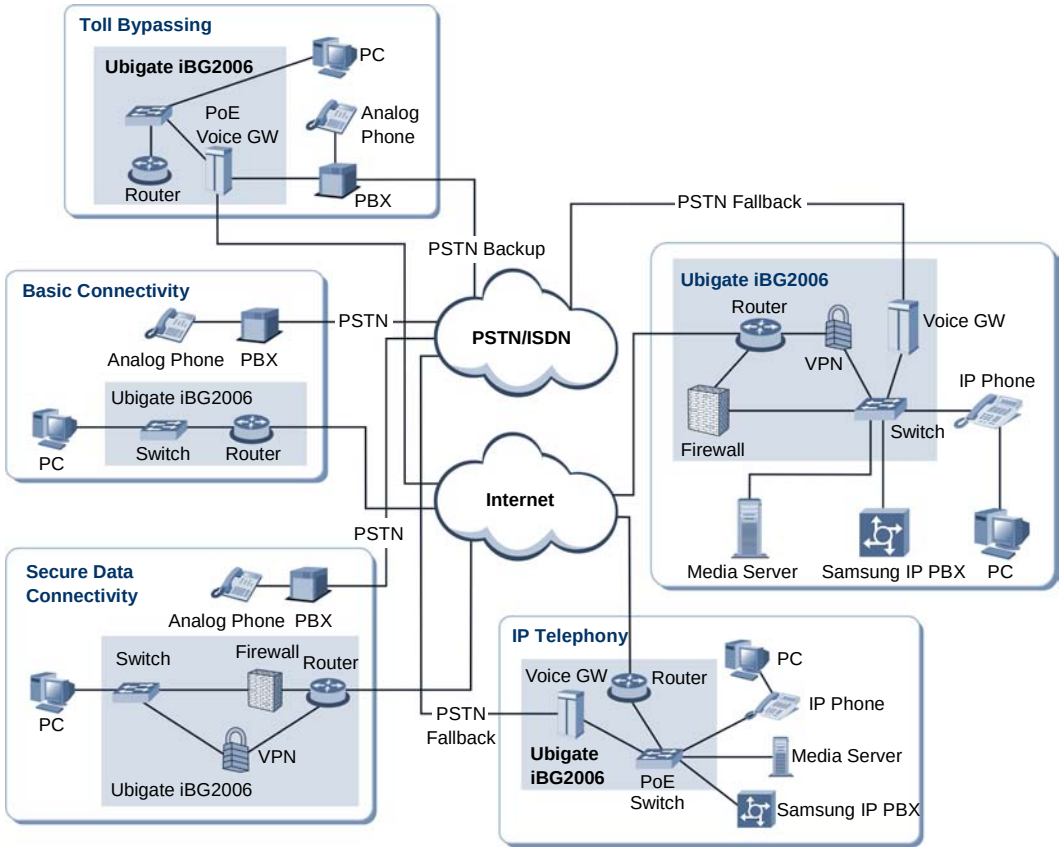

Figure 1.4 New Service Offering Example

Product Specifications

Ubigate iBG2006 Specifications

The following table lists specifications for Ubigate.

ITEM	Specification
Router Memory	- Typical: 256 MB - Maximum: 1 GB
Compact Flash Memory	- Typical: 128 MB - Maximum: 256 MB
Boot ROM	2 MB
AC Power Supply (Use RPS provided by Samsung)	- Input Voltage: 100~240 V - Frequency: 50~60 Hz - Power Consumption: 100 W
High Temperature (Operating)	104°F (+40°C)
Low Temperature (Operating)	32°F (0°C)
High Temperature (Non-Operating)	158°F (+70°C)
Low Temperature (Non-Operating)	-13°F (-25°C)
Humidity (Operating)	5 to 95%, non-condensing
Dimension (H × W × D)	- Height: 1.75 inch (44.45 mm) - Width: 17.38 inch (441.5 mm) (Including rack-mounting brackets: 17.56 inch, 446 mm) - Depth: 13.8 inch (350.5 mm)
Weight	5.2 Kg
Altitude	0 to 13,123 ft (0 to 4, 018 m)
Regulatory & Safety Compliance	- MIC Type Approval/EMC Registration - IEC 60950-1/EN 60950-1/UL 60950-1 - EN 55022/EN 55024/EN 61000-3-2/ EN 61000-3-3 - FCC Part 15 Class A - FCC Part 68

Interfaces

The following tables provide specifications for E1/T1 WAN, and Ethernet LAN interfaces.

E1 WAN Interface

Specifications	Descriptions
Receive line rate	2.048 Mbps ± 50 ppm (payload = 1.984 Mbps)
Line code	HDB3
Framing CRC	non-CRC (ITU G.704), and unframed
Input signal	DSX-1, 0 to -24 dB
Output signal build out	long-haul or short-haul
Impedance	75 or 120 ohm
Connectors	RJ-48C
Timing	Internal or network
Pulse density	ITU G.703

T1 WAN Interface

Specifications	Descriptions
Receive line rate	1.544 Mbps ± 32 ppm
Line code	B8ZS or AMI
Framing	D4 or ESF
Interface ESF FDL	- AT & T TR-54016-1986 - AT & T TR-54016-1989 - ANSI T1.403-1989
Input signal	DSX-1, 0 to -24 dB
Output signal build out	0, -7.5 dB, -5 dB
Equalization	0 to 655 ft. (DSX-1)
Impedance	100 ohm
Connectors	RJ-48C
Timing	Internal or network
Pulse density	AT & T TR-62411; HDLC Inversion, forced

Ethernet LAN Interface

Specifications	Descriptions
Data flow	Full-duplex or half-duplex
Connectors	RJ-45
Data speed	10/100 Mbps, auto negotiating

Modules and Internal Option Cards

Ubigate iBG2006 supports several kinds of modules and internal option cards.

- Mini modules
- Internal option cards

The following table lists Ubigate iBG2006 modules and internal option cards.

Name		Detailed Description
Internal Option Cards	VPN-A	IPSec VPN option card
	VoP-16	VoIP 16 ch gateway card
	VoP-32	VoIP 32 ch gateway card
	VoP-64	VoIP 64 ch gateway card
	IVM-U1E	Integrated Voice Mail option card
WAN Interface Modules	BRI-1ST	1-port ISDN BRI-S/T interface mini module
	BRI-2ST	2-port ISDN BRI-S/T interface mini module
	BRI-1U	1-port ISDN BRI-U interface mini module
	BRI-2U	2-port ISDN BRI-U interface mini module
	T1E1-1M	1-port channelized T1/E1 mini module
	T1E1-2M	2-port channelized T1/E1 mini module
	WTE-1SM	1-port serial network mini module
	WTE-2SM	2-port serial network mini module
	ATOP-1	1-port ADSL over POTS mini module
	ATOI-1	1-port ADSL over ISDN mini module
LAN Interface Modules	LMF-4M	4-port FE (UTP) mini module
	LMF-8M	8-port FE (UTP) mini module

(Continued)

Name		Detailed Description
Voice Modules	FXO-2M	2-port Analog FXO mini module
	FXO-4M	4-port Analog FXO mini module
	FXS-2M	2-port Analog FXS/DID mini module
	FXS-4M	4-port Analog FXS/DID mini module

Mini module slots have the following limitation. Voice service modules such as FXO, FXS, and T1/E1 cards (if they are used to carry voice traffic) can be plugged into all of the four slots. However, data service modules cannot be plugged into all of them. Specifically, LMF-4M can be plugged into slot 0 and slot 2 only. LMF-8M can be plugged into slots 0-1 and slots 2-3. WAN modules such as T1E1-1M and T1E1-2M can be plugged into slot 1 and 3 only if they are used to carry data traffic.

Memory

Ubigate iBG2006 supports the following types of memory:

- Double-Data-Rate II Synchronous Dynamic Random Access Memory (DDR II SDRAM): This type of memory stores the running configuration and routing tables. It also buffers packets at the network interfaces.
  The base configuration shipped from the factory has 256 MB of main memory. The Small Outline Dual In-line Memory Module (SODIMM) slot can be used to upgrade the main memory to a maximum of 1 GB.
- Compact Flash memory card: The base configuration shipped from the factory has a 128 MB Compact Flash memory card, which can be upgraded to a maximum of 256 MB. Ubigate iBG2006 supports one Compact Flash memory card slot. Compact Flash memory card is used to store application code images.
- Internal Flash Memory: Ubigate iBG2006 includes 2 MB of internal flash memory which is used to boot the router.

Power Supply

The basic Power Supply Module of the Ubigate iBG2006 provides +12 VDC at with an AC input between 100 and 240 VAC. Ubigate iBG2006 supports two kinds of AC Power Supply.

- SPA 100 provides +12 VDC at 100 W
- SPA 230 provides + 12 VDC at 100 W and +48 VDC at 130 W.

iBG2006 doesn't support DC Power Supply.

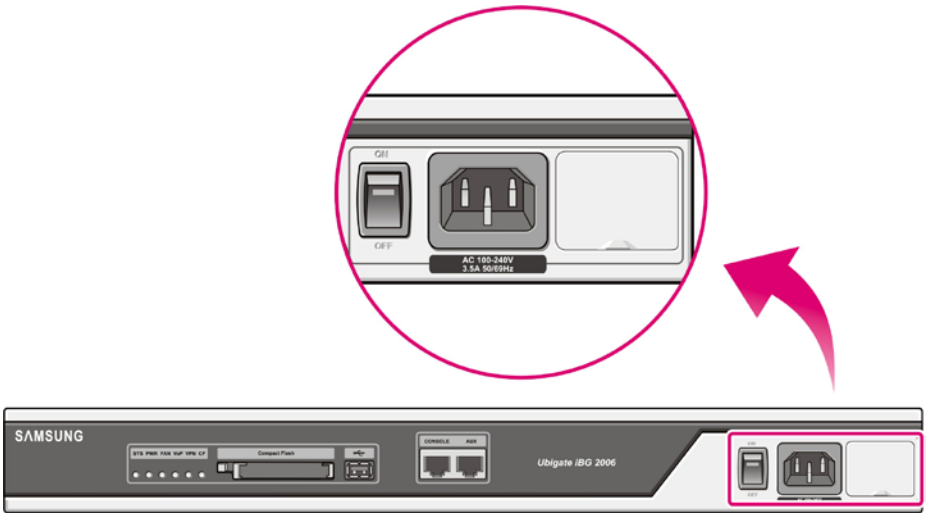

Figure 1.5 Power Supply

Ventilation

There are three fans on the right side of the system which blow air inside and then air goes through the system out to the left side. On both sides, there are grids of holes where air comes in and goes out. When installing Ubigate iBG2006, ensure to make room around the system in order not to block air flow.

Figure 1.6 Ventilation

Real-Time Clock and NVRAM

Ubigate iBG2006 Real Time Clock and Non-volatile RAM (NVRAM) provide two basic functions to the router:

- Ubigate iBG2006 provides a real-time clock so that Ubigate iBG2006 router can maintain the correct date and time.
- Ubigate iBG2006 provides a small block (32 KB) of battery-backed-up static RAM (SRAM) storage.

Ubigate iBG2006 Software Features and Licenses

Switch/Router Features

The following table lists the switch/router features supported by iBG2006.

Category	Features and Licenses	
L2 LAN Switching	- L2 Switching - Line-Rate at FE	
Layer 2 Protocols	- VLAN (802.1q, Port) - STP, Rapid STP, Multiple STP - Port Mirroring - 802.1x Authentication - IGMP Snooping	
WAN Protocols	- ISDN BRI/PRI, HDLC - FR/MLFR, PPP/MLPPP - PPP/MLPPP over ISDN - FR Congestion Management and Traffic Policing	
Routing Protocols	- Static Routing - OSPF v1/v2, RIP v1/v2 - IGMP v1/v2/v3 - PIM-SM/SSM, DVMRP - VRRP - Policy-Based Forwarding/Routing	
Quality of Service	DiffServ	- Classification (MF, Flow Label) - Marker (SrTCM/TrTCM) - Policing/Shaping - Queuing (CBQ, PQ) - Scheduling (Deficit RR) - Congestion Avoidance (WRED)
	- Bandwidth Guarantee, SLA - Hierarchical QoS - LFI - Mapping of IP DSCP field to Frame Relay DE bit - QoS for FR PVC - Queuing for IPSec Encryption Engine	
Load Balancing	- Per Flow (ECMP) - Per Packet	

(Continued)

Category	Features and Licenses	
Performance	Routing	- IPv4 Forwarding: 150 Kpps - Max. Route Table Size: 32 K - Max. MAC Table Size: 8 K
	Switching: 3.8 Gbps	
Management	- Multilevel Administration Access (MLA) - SNMP v1/v2/v3, RMON 1, 2, 3, and 9 - CLI, Telnet, NTP, tftp, BOOTP, DHCP, SSHv2, SCP - Web based GUI, MIBs - Logging & Reporting, Diagnostic - True Flash File System - System Image rollback	
AAA Client	- 802.1x - RADIUS - TACACS+	

Security Features

The following table lists the security features supported by iBG2006.

Category	Features and Licenses
Secure Connectivity	- IPSec for Site to Site - IPSec for Remote Access - hub-and-spoke support - Encryption (DES, 3DES, AES) - L2TP, GRE - Data Integrity (MD5, SHA-1) - Authentication (XAUTH) - Key Management (Manual, IKE v1 (PKI, Pre-shared)) - NAT Traversal
Internal Security	- AAA, 802.1x - ACL - MAC Address Filtering

(Continued)

Category	Features and Licenses	
Attack Defense	- Route mode - Packet Filtering - Stateful Packet Inspection - NAT (1:1, N:1, Reverse, Dynamic) - ALG (FTP, DNS, TFTP, RPC, HTTP (WEB), and SMTP) - Application Content filtering (Java, ActiveX) - Dos/DDoS Protection - IP/TCP fragment attack protection - IP Spoofing Protection - URL Filtering - DMZ	
Management	- Reporting - Logging	
Certification	- Firewall: ICSA - VPN: ICSA, CC, FIPS 140-2	
Performance	Firewall	- Performance: 60 Kpps - Concurrent Sessions: 64 K - Sessions setup rate: 700 sessions/Sec
	VPN	- Performance: 130 Mbps - Maximum Tunnels: 1,000 - Tunnel Setup rate: 3 tunnels/sec

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CHAPTER 2. Hardware Overview

Chapter2 describes the hardware overview.

Ubigate iBG2006 is enclosed in a rack-mount 1U enclosure, designed for installation in a standard 19-inch or 23-inch rack. The unit is approximately 17.38” wide, 13.8” deep and 1.75” high. The front panel has LED indicators, console port, and auxiliary port. All modules and all cabling, including power cables, are installed from the rear.

Ubigate iBG2006 Modularity

Ubigate iBG2006 is designed as a modular router, with much of the router’s functionality defined by the installed modules. Except for the two internal option cards, all active circuitry of Ubigate iBG2006 is on modules that may be installed from the rear of the unit. If any of these modules fails, it may be replaced without removing the unit from the rack and without modifying the rest of the router. Further, except for at least one power supply and the main board, all modules are optional.

Ubigate iBG2006 Routing and Switching Engine

The routing and switching engine (main board) contains the central processor of the router, core peripherals and memory, a Compact Flash connector, a number of external interfaces, including serial management ports, an SFP Fast Ethernet port, four Fast Ethernet ports, a USB port, and finally four slots for mini modules.

The VoIP and VPN/IPSec option cards are small daughter boards that mount on the main board and provide enhanced functionality for the router.

Up to four mini modules can be installed from the rear panel. They provide a selection of voice or WAN interface ports for Ubigate iBG2006.

Mini modules may be installed into an operating system with power on. However, they should be inserted with cables removed.

Ubigate iBG2006 Chassis

Ubigate iBG2006 is designed for mounting in a 19-inch or 23-inch rack. Different mounting brackets are available for the different rack widths.

The following figure is an isometric view of the router from the rear, with both the main chassis and the fan tray unit shown without the external enclosure.

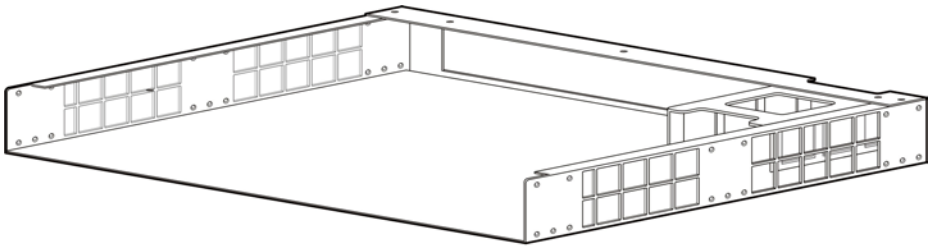


Figure 2.1 Isometric View

Ubigate iBG2006 Boot Sequence

All circuitry within Ubigate iBG2006 (except the power supplies and fans) is reset to its initial state by the reset circuitry on the main board.
During normal operation, the reset circuitry monitors an internal power supply of the main board and, after it reaches a normal operating level, generates a reset pulse to the routing processor and all of the other circuitry on the main board.
The main board reset circuitry also includes a watchdog timer. The watchdog timer causes Ubigate iBG2006 reset if the programmed interval elapses without the processor triggering the watchdog.

Ubigate iBG2006 boot is the sequence of software-driven events starting from the reset pulse to the loading and running of the application image.
On reset, the processor starts executing instruction from a specific location in the boot ROM. This first software run is the boot loader. After CPU memory controller initialization, the boot loader locates, verifies, and runs a boot image located in CF memory. The boot image then continues with the necessary initialization, decompresses, and moves itself to RAM. Once moved to RAM, control is given to boot software residing in RAM. At this point the additional initialization of hardware and driver software is performed before SNOS (Samsung Network Operating System) can be loaded onto RAM from flash. The SNOS software prepares Ubigate iBG2006 for forwarding packets through the interfaces at which time Ubigate iBG2006 is fully up and running. There are various software services that support the application software. These include a file system, logging, monitoring, validation of downloaded image and flash update.

Ubigate iBG2006 Front Panel

The front panel of Ubigate iBG2006 has LEDs in order to indicate the router's performance and operation status as shown Figure 2.2. Proper LED status is shown as follows.

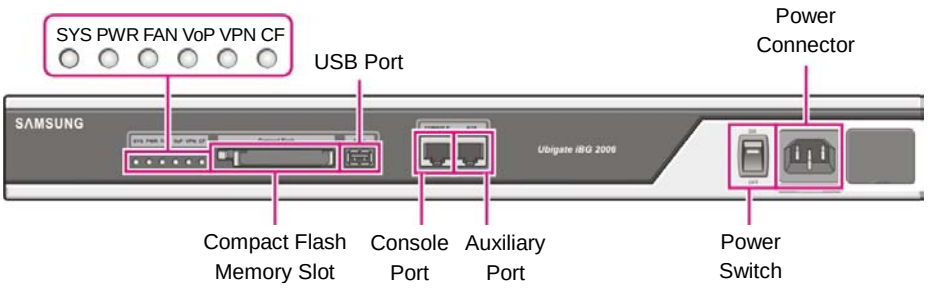


Figure 2.2 Ubigate iBG2006 Front View

Front LED Description

LED	Indication & Color	Description
SYS	Solid green	System is operating normally.
	Blinking green	Running ROM monitor with no errors detected.
	Amber	Router is receiving power but malfunctioning.
	Off	Router is not receiving power.
PWR	Solid green	Power supply installed and operating normally.
	Amber	Power supply installed but powered off or fault condition detected.
	Off	Power supply not present.
FAN	Solid green	Fan is operating properly.
	Amber	Fan present with failure.
VoP	Solid green	VoP or IVM card present and enabled.
	Amber or Red	VoP or IVM card present with failure.
	Off	VoP and IVM card not present.
VPN	Solid green	VPN card present and enabled.
	Amber or Red	VPN card present with failure.
	Off	VPN card not present.
CF	Solid green	Compact Flash memory being accessed.
	Off	Compact Flash memory not mounted or not being accessed.

The front panel also has the following connectors.

Front Connector Description

Connector	Description
Compact Flash Memory Slot	Slot for Compact Flash memory card
USB Port	Supports USB2.0 interface
Console Port	Serial port supporting local monitoring and configuring
Auxiliary Port	Serial port supporting remote monitoring
Power Switch	Power switch
Power Connector	AC power connector

Compact Flash Memory Card

The Compact Flash memory card is used to store application code images. The Compact Flash code storage device can be programmed while the iBG2006 is operating normally. The Compact Flash memory cards are sensitive to Electrostatic Discharge Damage (ESD). Therefore, it should be handled with appropriate care.
The Compact Flash memory card slot supports 128 MB, and 256 MB memories.

USB Port

The Universal Serial Bus (USB) port is USB 2.0 compliant. USB interface (Type A) is configured as a host. USB flash memory module can be used to store an image or configuration file like the installed CF memory card.
USB flash memory module is non-secure but is available in 64 MB, 128 MB, or 256 MB capacities.

Console Port

The Console Port is an RS-232, serial, asynchronous serial port that operates at up to 115 Kbps. The Console Port is activated immediately after system reset and allows the system operator to directly control the system using the Command Line Interface.

Auxiliary Port

The RJ-45 auxiliary port is used for connecting to an external.

Ubigate iBG2006 Rear Panel

Ubigate iBG2006 rear panel has LEDs, connectors and mini module slots as shown in Figure 2.3. Ubigate iBG2006 rear panel has one Fast Ethernet SFP port and four 10/100 Fast Ethernet ports, all of which are built-in.

Here are the description of the LEDs, connectors and min-module slots.

Rear LED Description

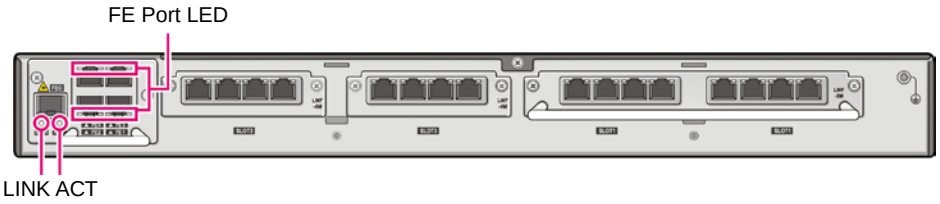


Figure 2.3 Ubigate iBG2006 Rear LED

LED	Indication & Color	Description
FE SFP LINK LED	Solid Green	Link is established with speed 100 Mbps.
	Off	Link fail or not connected
FE SFP ACT LED	Blinking Amber	Blinking amber indicates transmit/receive activity with speed 100 Mbps.
	Off	No activity
FE Port Left LED	Solid Green	Link is established with speed 10/100 Mbps.
	Off	Link fail or not connected
FE Port Right LED	Blinking Amber	Blinking amber indicates transmit/receive activity with speed 10/100 Mbps.
	Off	No activity

Rear Connector Description

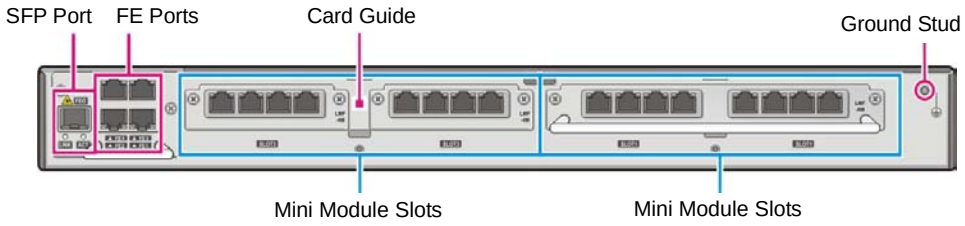


Figure 2.4 Ubigate iBG2006 Rear Connector

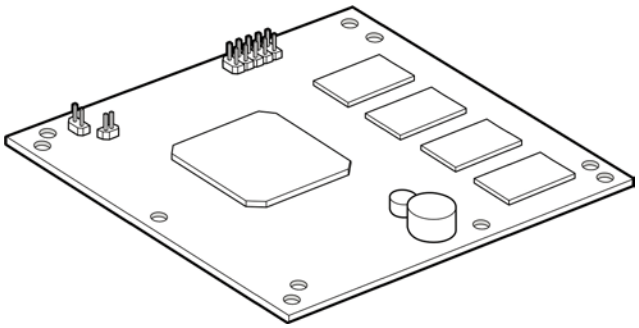
Connector	Description
SFP Port	Support optional FE SFP modules
FE Ports	Supports Fast Ethernet interface
Mini Module Slots	A variety of data and interface cards can be plugged into mini module slots. Depending on the widths of modules, up to four modules can be plugged.
Card Guide	Guides inserting mini module (Remove guides when install double wide mini module LMF-8 M)
Ground Stud	Screw holes for grounding lug

NOTE

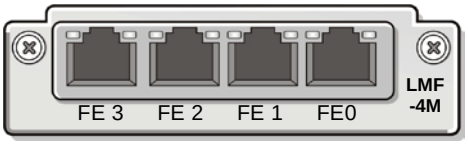
Mini module slots has the following limitation. Voice service modules such as FXO, FXS, and T1/E1 cards (if they are used to carry voice traffic) can be plugged into any of the four slots. However, data service modules cannot be plugged into all of the four slots.
LAN modules such as LMF-4M. Specifically, LMF-4M can be plugged into slot 0 and slot 2 only. LMF-8M can be plugged into slots 0-1 and slots 2-3. WAN modules such as T1E1-1M and T1E1-2M can be plugged into slot 1 and 3 only if they are used to carry data traffic.

Modules and Internal Option Card Types

This section describes the modules supported in Ubigate iBG2006 release 1.0, including internal option cards and mini modules that connect into dedicated slots in the chassis. Following figure shows them.



Internal Option Card



Mini Module

Double Wide Mini Module

Figure 2.5 Internal Option Card and Mini Modules

Port Numbering

This section describes the port number conventions used by Ubigate routers such as iBG3026, iBG2016, iBG2006, and iBG1000.

Ports on a network module are numbered in a format: *network module slot-number/interface-number*, and ports on a mini module are numbered in a format: *network module slot-number/mini module slot number/interface-number*.

Network modules are numbered from right to left, starting with slot number one. If there is more than one row, the bottom row is numbered first, from right to left, starting at slot one, then the next row up is numbered, from right to left, starting with the next slot number based on the lower rows last (left most) numbered slot. The main board is considered as network module slot 0.

Mini modules are numbered from right to left, starting with slot number zero. If there is more than one row, the bottom row is numbered first, from right to left, starting at slot zero, then the next row up is numbered, from right to left, starting with the next slot number based on the lower rows last (left most) numbered slot.

Ports on any mini module or network module are numbered from right to left, starting with port number zero. If there is more than one row of ports on a given module, the bottom row is numbered first, from right to left, starting at port zero, then the next row up is numbered, from right to left, starting with the next port number based on the lower rows last (left most) numbered port.

Main Board Port Numbering

There are five LAN interfaces on the main board-one Fast Ethernet SFP port and four Fast Ethernet UTP ports. They are numbered 0/x *since the main board is considered as network module slot 0.* The SFP port is numbered as 0/0. Then, the Fast Ethernet ports follow the numbering rule and are numbered right to left bottom to top starting with one.

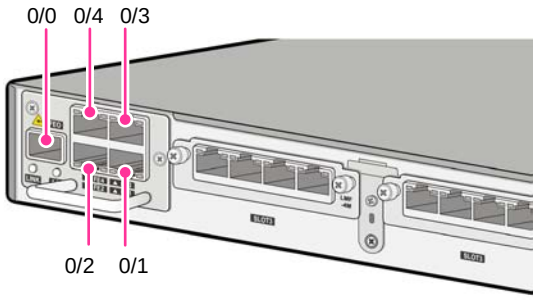


Figure 2.6 LAN Port Numbering

Mini Module Port Numbering

Mini modules have one, two, or four ports. Port numbering is from right to left, starting with port number zero: (X = 0, 1, 2, or 3)

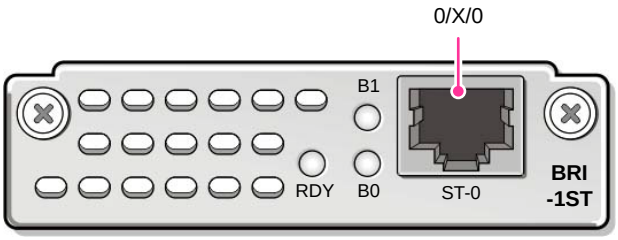


Figure 2.7 1-Port Mini Module Port Numbering

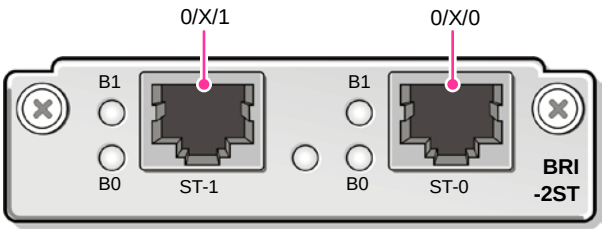


Figure 2.8 2-Port Mini Module Port Numbering

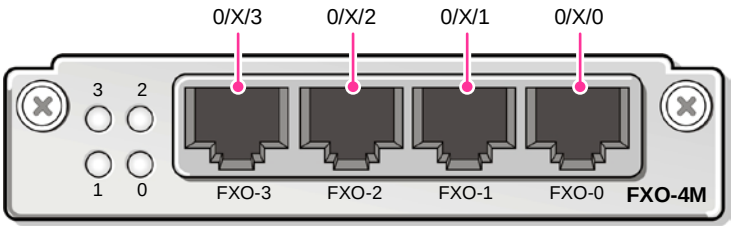


Figure 2.9 4-Port Mini Module Port Numbering

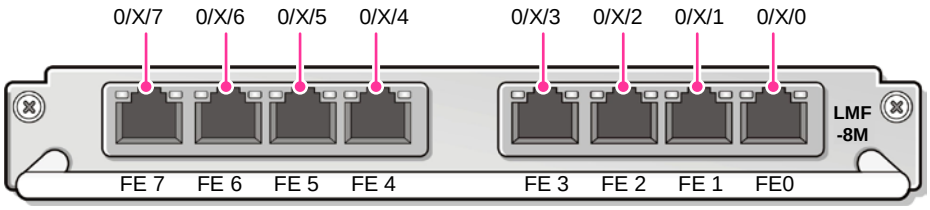


Figure 2.10 8-Port Double Wide Mini Module Port Numbering

Port Numbering Examples

Port	Numbering	Corresponding Ports
Main board LAN Ports	0/1, 0/2, 0/3 and 0/4	Copper Fast Ethernet ports.
	0/0	Optical Fast Ethernet port
Mini Module Ports	0/0/0	Port zero on a mini module in sub-slot zero.
	0/3/3	Port three on a mini module in sub-slot three.
Double Wide Mini Module Port	0/0/0 thru 0/2/7	Port zero on an 8-port LAN mini module in sub-slot zero through port seven on an 8-port LAN mini module in sub-slot two.

Modules and Option Cards

Internal Option Cards

VPN-A (IPSec VPN Option Card)

The IPSec VPN option card is used to provide high-performance IPSec VPN service for iBG2006. It has a hardware encryption engine which offloads IPSec processing from the main CPU, so that iBG2006 can provide IPSec service without major performance degradation. Like the VoIP option card, it is an internal card that mounts on the main board and that must be installed onto the main board before the main board is inserted into the chassis. Because this card is internally mounted on the main board, it is not hot-swappable.

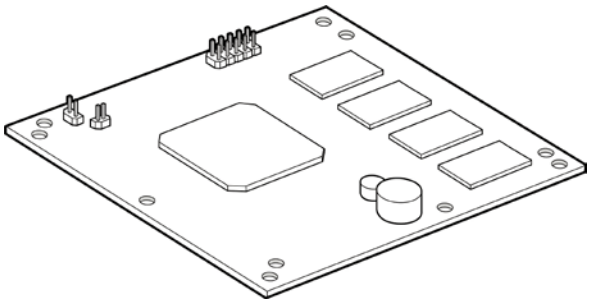


Figure 2.11 VPN-A Internal Option Card

VoP-16, VoP-32, VoP-64 (VoIP Option Card)

The VoIP option card is used to support VoIP features. It includes a VoIP processing DSP and a TDM switch. It is an internal card that mounts on the main board and must be installed onto the main board before the main board is inserted into the chassis. Because this card is internally mounted on the main board, it is not hot-swappable.

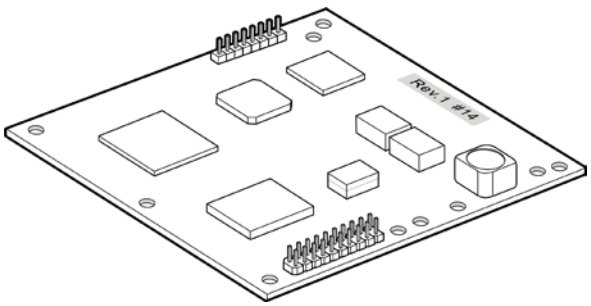


Figure 2.12 VoP-16, 32, 64 Internal Option Cards

IVM-U1E (Integrated Voice Mail Option Card)

The IVM-U1E option card performs two main functions, VoIP function and VM (Voice Mail) function. Using this option card, iBG2006 can provide a voice gateway feature and voice mail feature. It must be installed on the dedicated slot of the main board.

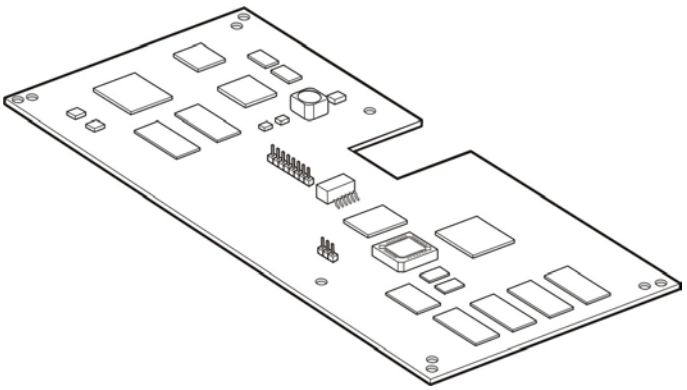


Figure 2.13 IVM-U1E Internal Option Card

WAN Interface Module

BRI-1ST (1-Port ISDN BRI S/T Mini Module)

This module provides one ISDN BRI S/T interface port, supporting two voice or data timeslots. Voice timeslots are connected to the DSP block in the voice card while data timeslots are connected to the main CPU.

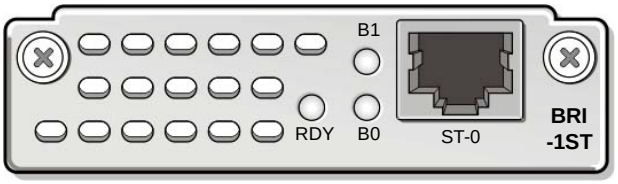


Figure 2.14 BRI-1ST Mini module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	GREEN	The module passed it's self-test and is available to the router.
	OFF	Reset, Power down, or Removal state
ST-0 B0	GREEN	Active connection on the first B channel in port 0
	OFF	Disconnected on the first B channel in port 0
ST-0 B1	GREEN	Active connection on the second B channel in port 0
	OFF	Disconnected on the second B channel in port 0

BRI-2ST (2-Port ISDN BRI S/T Mini Module)

This module provides two ISDN BRI S/T interface ports, each supporting two voice or data timeslots. Voice timeslots are connected to the DSP block in the voice card while data timeslots are connected to the main CPU.

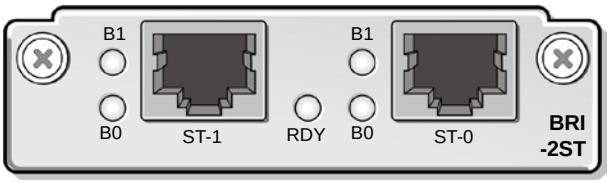


Figure 2.15 BRI-2ST Mini module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	GREEN	The module passed its self-test and is available to the router
	OFF	Reset, Power down, or Removal state
ST-0 B0	GREEN	Active connection on the first B channel in port 0
	OFF	Disconnected on the first B channel in port 0
ST-0 B1	GREEN	Active connection on the second B channel in port 0
	OFF	Disconnected on the second B channel in port 0
ST-1 B0	GREEN	Active connection on the first B channel in port 1
	OFF	Disconnected on the first B channel in port 1
ST-1 B1	GREEN	Active connection on the second B channel in port 1
	OFF	Disconnected on the second B channel in port 1

BRI-1U (1-Port ISDN BRI U Mini Module)

This module provides one ISDN BRI U interface port, supporting two voice or data timeslots. The ISDN BRI U mini module interfaces to ISDN Basic Rate networks and supports two 64 Kbps B channels and a 16 Kbps D channel. The ISDN BRI U mini module may be configured as either an LT (network end) or NT (CPE end). The ISDN BRI U mini module provides 2B1Q encoding.

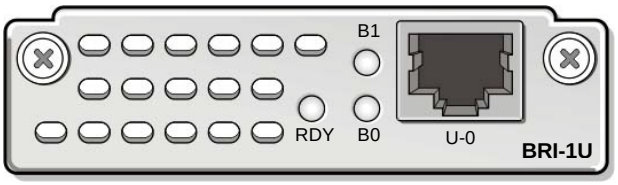


Figure 2.16 BRI-1U Mini module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	GREEN	The module passed its self-test and is available to the router.
	OFF	Reset, Power down, or Removal state
U-0 B0	GREEN	Active connection on the first B channel in port 0
	OFF	Disconnected on the first B channel in port 0
U-0 B1	GREEN	Active connection on the second B channel in port 0
	OFF	Disconnected on the second B channel in port 0

BRI-2U (2-Port ISDN BRI U Mini Module)

This module provides two ISDN BRI U interface ports, each supporting two voice or data timeslots. The ISDN BRI U mini module interfaces to ISDN Basic Rate networks and supports two 64 Kbps B channels and a 16 Kbps D channel. The ISDN BRI U mini module may be configured as either an LT (network end) or NT (CPE end). The ISDN BRI U mini module provides 2B1Q encoding.

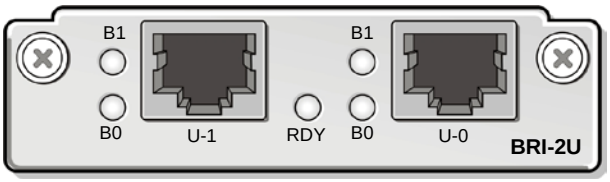


Figure 2.17 BRI-2U Mini module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	GREEN	The module passed its self-test and is available to the router.
	OFF	Reset, Power down, or Removal state
U-0 B0	GREEN	Active connection on the first B channel in port 0
	OFF	Disconnected on the first B channel in port 0
U-0 B1	GREEN	Active connection on the second B channel in port 0
	OFF	Disconnected on the second B channel in port 0
U-1 B0	GREEN	Active connection on the first B channel in port 1
	OFF	Disconnected on the first B channel in port 1
U-1 B1	GREEN	Active connection on the second B channel in port 1
	OFF	Disconnected on the second B channel in port 1

T1E1-1M (1-Port T1/E1 Mini Module)

This 1-Port T1/E1 mini module provides one T1 port, running at 1.544 Mbps and supporting 24 voice or data timeslots, or one E1 port, running at 2.048 Mbps and supporting 30 voice or data timeslots.
This module supports a generic 1-port T1 or E1 trunk interface for voice, data, and integrated voice and data applications. The mini module provides basic structured and unstructured service for T1 or E1 networks.
The mini module can be used to provide a trunk interface for voice and data services, to provide fractional n x 64-kbps service for WANs (Frame Relay or leased line), or to provide time-division multiplexing (TDM) drop-and-insert (voice and data integration) services.
The T1/E1 mini module provides voice and data access to the PSTN domain through TDM ports, and includes an integrated Channel Service Unit/Data Service Unit (CSU/DSU).

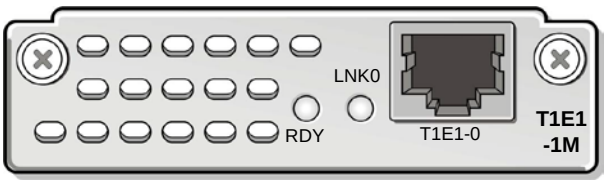


Figure 2.18 T1E1-1M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	Green	The mini module is operational and power on.
	Off	Indicates that the port is Power down.
LNK 0	Green	Indicates that the port is enabled (Carrier Detect).
	Amber	Indicates an alarm condition exists on the remote end of one of the T1/E1 ports. On Remote End, detected alarm condition: - RDI (Remote Detect Indication) - AIS (Alarm Indication Signal).
	Red	Indicates that an alarm condition exists locally on one of the T1/E1 ports. Locally, detected alarm condition: - LOS (Loss of Signal) - OOF (Out-of-Frame)
	Off	Indicates that the port is not enabled.

T1E1-2M (2-Port T1/E1 Mini Module)

This 2-Port T1/E1 mini module provides two T1 ports, each running at 1.544 Mbps and supporting 24 voice or data timeslots, or two E1 ports, each running at 2.048 Mbps and supporting 30 voice or data timeslots.
This module supports generic 1 or 2-port T1 or E1 trunk interfaces for voice, data, and integrated voice and data applications. The mini module provides basic structured and unstructured service for T1 or E1 networks.
The mini module can be used to provide trunk interfaces for voice and data services, to provide fractional n x 64-kbps service for WANs (Frame Relay or leased line), or to provide time-division multiplexing (TDM) drop-and-insert (voice and data integration) services.
The T1/E1 mini module provides voice and data access to the PSTN domain through TDM ports, and includes integrated channel service unit/data service units (CSU/DSU).

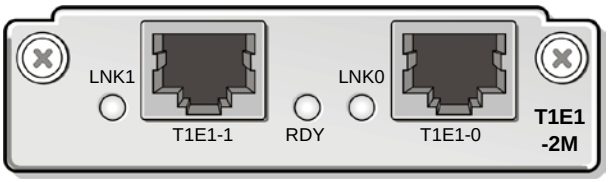


Figure 2.19 T1E1-2M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	Green	The mini module is operational and power on.
	Off	Indicates that the port is Power down.
LNK 0 LNK 1	Green	Indicates that the port is enabled (Carrier Detect).
	Amber	Indicates that an alarm condition exists on the remote end of one of the T1/E1 ports. On Remote End, detected alarm condition: - RDI (Remote Detect Indication) - AIS (Alarm Indication Signal).
	Red	Indicates that an alarm condition exists locally on one of the T1/E1 ports. Locally, detected alarm condition: - LOS (Loss of signal) - OOF (Out-of-Frame)
	Off	Indicates that the port is not enabled.

WTE-1SM (1-Port Serial Mini Module)

This Mini module provides one serial port, running in either DTE or DCE mode at a data rate of up to 8.0 Mbps. The interface mode for the port may be independently selected as V.35, RS-232/V.28, RS-449/V.11, EIA-530, EIA-530A, or X.21/RS-422.

Figure 2.20 WTE-1SM Network Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	Green	All diagnostics pass, and the Network Module is operational.
	Off	Power down or removal status.
LNK 0	Green	Green indicates normal operation. The module is connected to the external DSU, and the signals TA (DTE available) and CA (DCE available) are active.
	Red	Red indicates serial interface error. Mismatch between serial cable and interface type or operation mode.
	Amber	Loopback mode on
	Off	LED off indicates that the port is neither connected to the DSU nor in loopback mode.

WTE-2SM (2-Port Serial Mini Module)

This mini module provides two serial ports, each running in either DTE or DCE mode at a data rate of up to 8.0 Mbps. The interface mode for each port may be independently selected as V.35, RS-232/V.28, RS-449/V.11, EIA-530, EIA-530A, or X.21/RS-422.

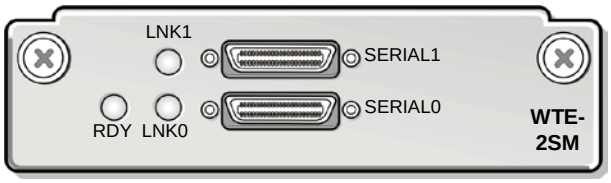


Figure 2.21 WTE-2SM Network Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
RDY	Green	All diagnostics pass, and the Network Module is operational.
	Off	Power down or removal status.
LNK 0 LNK 1	Green	Green indicates normal operation. The module is connected to the external DSU, and the signals TA (DTE available) and CA (DCE available) are active.
	Red	Red indicates serial interface error. Mismatch between serial cable and interface type or operation mode.
	Amber	Loopback mode on
	Off	LED off indicates that the port is neither connected to the DSU nor in loopback mode.

ATOP-1 (1-Port ADSL Over POTS Mini Module)

This mini module provides ADSL high-speed digital data transfer between a single CPE subscriber and the central office.

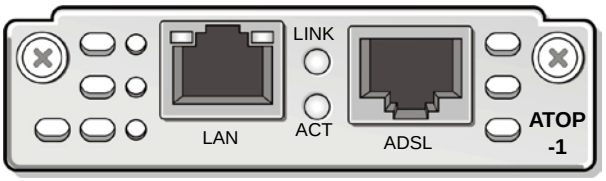


Figure 2.22 ATOP-1 Mini Module

The following table explains the LEDs states in detail.

ADSL Port LEDs

LED	Indication & Color	Description
LINK	Solid Green	Indicates that the Link is established
	Blinking Green	Indicates that the Link is being established
	Off	Indicates that the port is not enabled
ACT	Solid Green	Indicates that the transmit/receive is not active
	Blinking Green	Indicates that the transmit/receive is active
	Off	Indicates that the port is not enabled

LAN Port LEDs

LED	Indication & Color	Description
Link	Solid Green	Link is established with speed 10/100 Mbps.
	Off	Link failure or no connection.
Activity	Blinking Orange	Blinking orange indicates transmit/receive activity with speed 10/100 Mbps.
	Off	No activities.

ATOI-1 (1-Port ADSL Over ISDN Mini Module)

This mini module provides ADSL high-speed digital data transfer between a single CPE subscriber and the central office.

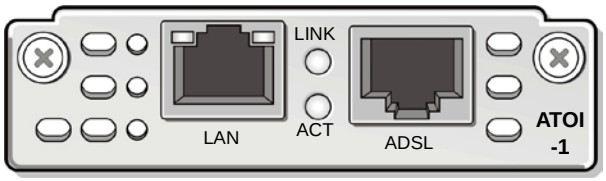


Figure 2.23 ATOI-1 Mini Module

The following table explains the LEDs states in detail.

ADSL Port LEDs

LED	Indication & Color	Description
LINK	Solid Green	Indicates that the Link is established
	Blinking Green	Indicates that the Link is being established
	Off	Indicates that the port is not enabled
ACT	Solid Green	Indicates that the transmit/receive is not active
	Blinking Green	Indicates that the transmit/receive is active
	Off	Indicates that the port is not enabled

LAN Port LEDs

LED	Indication & Color	Description
Link	Solid Green	Link is established with speed 10/100 Mbps.
	Off	Link failure or no connection.
Activity	Blinking Orange	Blinking orange indicates transmit/receive activity with speed 10/100 Mbps.
	Off	No activities.

LAN Interface Modules

LMF-4M (4-Port Fast Ethernet Mini Module)

This module provides four 10/100 Base-T Ethernet ports and can be plugged into the LAN mini module slots. Note, however, that LMF-4M should be installed in the slot0 and slot2 only, in order to provide 10/100 Ethernet connectivity.

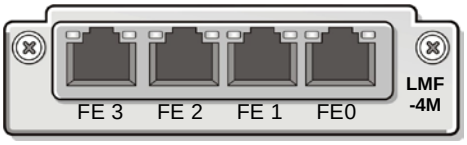


Figure 2.24 Four-port Fast Ethernet Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
Link	Solid Green	Link is established with speed 10/100 Mbps.
	Off	Link failure or no connection.
Activity	Blinking Orange	Blinking orange indicates transmit/receive activity with speed 10/100 Mbps.
	Off	No activities.

LMF-8M (8-Port Fast Ethernet Mini Module)

This module provides 8 10/100 Base-T Ethernet ports and installs in one of the double wide mini module slots. LMF-8M should be installed in the slot0 and slot2.

Figure 2.25 Eight-port Fast Ethernet Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
Link	Solid Green	Link is established with speed 10/100 Mbps.
	Off	Link failure or no connection.
Activity	Blinking Orange	Blinking orange indicates transmit/receive activity with speed 10/100 Mbps.
	Off	No activities.

Voice Modules

FXO-2M (2-Port Analog FXO Mini Module)

This module provides two analog voice channel ports for connecting to PBX station lines or FXS/DID lines from a Central Office of the Public Switched Telephone Network (PSTN). The voice channels are connected to the DSP block internally.

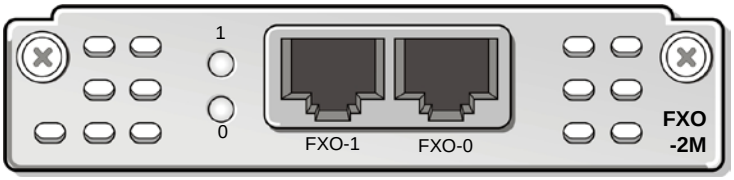


Figure 2.26 FXO-2M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
FXO-0 FXO-1	Green	The port0/1 connection is active.
	Amber	The port0/1 connection is abnormal or in initial state.
	Red	The port0/1 connection is in alarm status.
	Off	No port0/1 activity is occurring.

FXO-4M (4-Port Analog FXO Mini Module)

This module provides four analog voice channel ports for connecting to PBX station lines or FXS/DID lines from a Central Office of the Public Switched Telephone Network (PSTN). The voice channels connect to the DSP block internally.

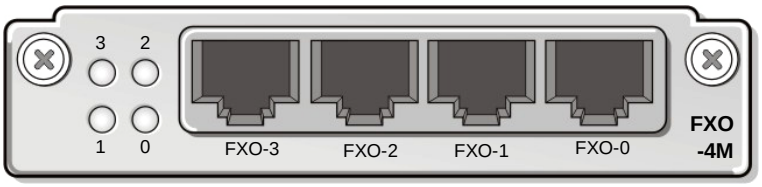


Figure 2.27 FXO-4M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
FXO-0 FXO-1 FXO-2 FXO-3	Green	The port0/1/2/3 connection is active.
	Amber	The port0/1/2/3 connection is abnormal or in initial state.
	Red	The port0/1/2/3 connection is in alarm status.
	Off	No port0/1/2/3 activity is occurring.

FXS-2M (2-Port Analog FXS/DID Mini Module)

This module provides two analog voice channel ports for connecting to Plain Old Telephone Services (POTS) telephones or fax machines.
The voice channels are connected to the DSP block internally.

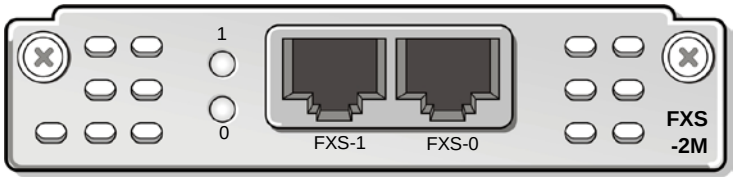


Figure 2.28 FXS-2M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
FXS-0 FXS-1	Green	The port0/1 connection is active.
	Amber	The port0/1 connection is abnormal or in initial state.

FXS-4M (4-Port Analog FXS/DID Mini Module)

This module provides four analog voice channel ports for connecting to Plain Old Telephone Services (POTS) telephones or fax machines.
The voice channels are connected to the DSP block internally.

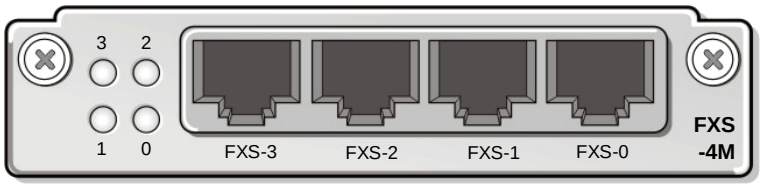


Figure 2.29 FXS-4M Mini Module

The following table explains the LEDs states in detail.

LED	Indication & Color	Description
FXS-0 FXS-1 FXS-2 FXS-3	Green	The port0/1/2/3 connection is active.
	Amber	The port0/1/2/3 connection is abnormal or in initial state.

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CHAPTER 3. Software Overview

Chapter3 describes the overview of the Software features supported by iBG2006.

Management Plane

The management plane consists of Command Line Interface (CLI), Simple Network Management Protocol (SNMP), and the web-based management interface of Ubigate iBG2006.
See the User Interface section for descriptions of the CLI and web-based management interface.

SNMP

To allow network management systems to remotely manage Ubigate iBG2006 products, SNMP v1/v2/v3 are supported. The Structure of Management Interface-SMIv1 and SMIv2-as defined by RFC 1155 and 1902 are supported.

MIB Information

A number of feature-specific RFC Standard Management Information Base (MIB)s and Enterprise MIBs are supported. The Configuration Guide has listed the respective MIBs that are supported in iBG2006.

Community-based Authentication

Community-based SNMP v2 is supported, i.e., SNMP v2c.
This SNMP framework associates each message with a ‘community’ as defined in SNMP v1 **[RFC 1157]**.

User-Based Security Model (USM)

The User-based Security Model (USM) for SNMP v3 **[RFC2574]** is supported.

To protect data integrity, USM uses MD5 and the Secure Hash Algorithm as keyed hashing algorithms for digest computation. This directly protects against data modification attacks, indirectly provides data origin authentication, and defends against masquerade attacks.

USM uses loosely synchronized monotonically increasing time indicators to defend against certain message stream modification attacks. Automatic clock synchronization mechanisms based on the protocol are specified without dependence on third-party time sources and concomitant security considerations.

USM uses the Data Encryption Standard (DES) in the cipher block chaining (CBC) mode to protect against disclosure.

View-Based Access Control Model (VACM)

The view-based access control model for SNMP **[RFC2575]**, which controls access to management information, is supported.

For security reasons, it is often beneficial to restrict the access rights of some groups to only a subset of the management data in the management domain. To provide this capability, access to a context is through an MIB view, which details a specific set of managed object types within that context.

TRAPS

All applicable standard and enterprise traps are supported. The trap support also follows the AgentX architecture. The sub-agents will generate traps whenever necessary and forward it to the master-agent using AgentX protocol. The master-agent will form a TRAP Packet Data Unit (PDU) and forward it to the pre-configured Network Management Station/Trap receiving station. Ubigate iBG2006 product supports more than one trap-host (up to 5) to send traps to.

RMON

Remote network Monitoring (RMON-1) is supported for LAN (Ethernet) interfaces as prescribed by RFC 1757. RMON groups 1, 2, 3 and 9 are supported.

The following are the groups supported:

- The Ethernet Statistics Group
  The Ethernet statistics group contains statistics measured by the probe for each monitored Ethernet interface on this device.
  This group consists of the etherStatsTable.
- The History Control Group
  The history control group controls the periodic statistical sampling of data from various types of networks.
  This group consists of the historyControlTable.
- The Ethernet History Group
  The Ethernet history group records periodic statistical samples from an Ethernet network and stores them for later retrieval.
  This group consists of the etherHistoryTable.

COMMAND LINE INTERFACE (CLI)

The Command Line Interface forms the link between the end user and the features of the device with a text-based interface. Users can issue commands that need to be executed on Ubigate iBG2006. The CLI provider's editor support for easy command editing/navigation, command history, and command completion.
The system operator is presented with a command prompt when logged into Ubigate iBG2006.
Each command is terminated by a new line (Enter key). The command string is passed on to the parser for syntax and semantic check. If the command has syntax error, the parser prints an error message and returns to prompt.
If the command is syntactically correct, the parser calls the target function. The function is executed and return value is displayed back at the prompt. It can be an error message or a confirmation message of the operation.
Some commands can return a value zero and the parser displays the prompt again without any message.
The CLI supports EMACS editor keystrokes. This is provided to facilitate correction/editing commands while entering commands.

This is restricted to single line editing. Some example keystrokes include:

- CTRL-A: Takes the cursor to beginning of line
- CTRL-E: Takes the cursor to end of line (last character)

The CLI maintains the list of user entered commands. You can get the list of previously executed commands by entering ‘UP-ARROW’.
The CLI stores a maximum of 100 commands. This is a configurable value.

CLI Privilege Levels

The CLI supports four levels of privileges. PRIVILEGE_ADMIN is the highest and PRIVILEGE_NORMAL being lowest.

The order of privileges is:

- PRIVILEGE_ADMIN 1
- PRIVILEGE_CONFIGURE 2
- PRIVILEGE_TEST 3
- PRIVILEGE_NORMAL4

CLI Omnipresent Commands

The CLI supports omnipresent commands. The user at any level can execute these commands. These commands include: display, clear, save, show, ping, telnet, trace, mtrace, write, dir, and erase. For details refer to the Command Reference.

WEB GUI (HTTP Server)

The Web GUI (iBG-DM) is an additional interface that is supported on Ubigate iBG2006 product. This allows end users to monitor and configure the device. The GUI is targeted at Novice and Intermediate users only.
The supported browser is Internet Explorer 5.5+.

iBG-DM supports web based management tool that allows the system operator to configure LAN and WAN interfaces, routing, VoIP, Network address Translation (NAT), firewalls, Virtual Private Networks (VPNs) and other features on the router. In addition, iBG-DM provides simple fault, performance, security management functions.
The figure shows network diagram when iBG-DM is used.

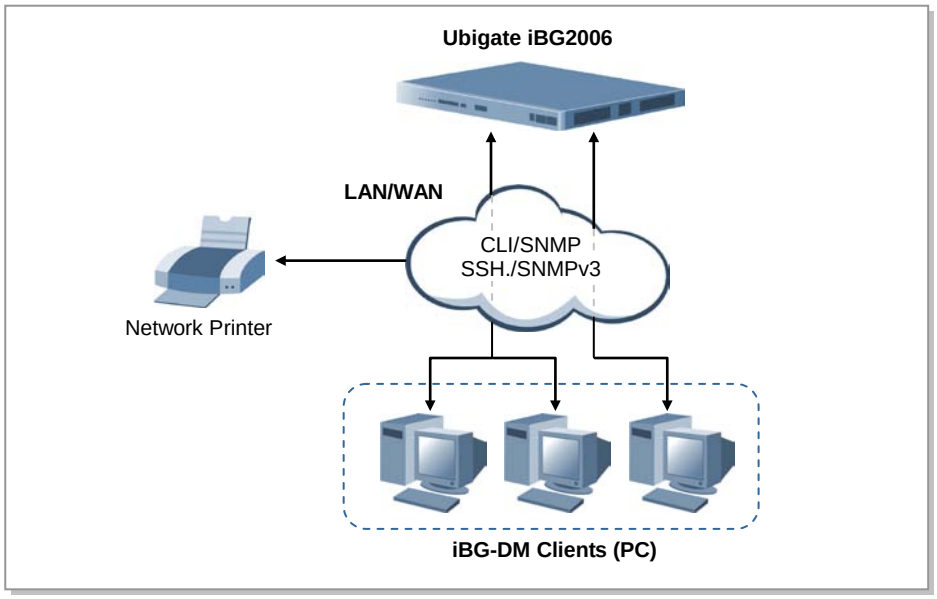

Figure 3.1 iBG-DM Management Network Diagram

Control Plane

The control plane of Ubigate iBG2006 includes routing protocols for L3 routing and spanning tree protocols for L2 packet processing, more specifically:

- L2 Control Protocols, consisting of Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and Internet Group Management Protocol (IGMP) Snooping
- Unicast Protocols, consisting of Open Shortest Path First (OSPF) and Routing Information Protocol (RIP)
- Multicast Protocols, consisting of Protocol Independent Multicast-Sparse Mode (PIM-SM), PIM-Source Specific Multicast (PIM-SSM), and Distance Vector-Multicast Routing Protocol (DVMRP)
- WAN Protocols, consisting of PPP, Frame Relay, High-level Data Link Control procedure (HDLC) and ISDN

Layer2 Protocols

The Layer2 module consists of 3 major components, each running as a task:

- xSTP for Spanning Tree Protocol, this task includes VLAN Bridge module, and Internet Group Management Protocol (IGMP) Snooping module.
- Authentication Daemon (AUTHD) for 802.1x port authentication protocol

xSTP consists of Bridge and VLAN modules, IGMP Snooping module, STP or RSTP or MSTP state machine and the communication modules to exchange messages with other components.
RSTP is the superset of STP and MSTP is the superset of RSTP. Therefore, in order to run the two or three protocols simultaneously, running only achieves the purpose.

The following table lists the L2 protocols supported in more detail.

Layer2 Protocol	Description
Bridge	LAN bridging allows extension of LAN by supporting connection of multiple LAN segments. MAC addresses of a datagram that flows through bridges are examined to build a table of known destinations. If the destination of a datagram is on the same segment as the source of the datagram, the bridge drops the datagram because forwarding is not required. However, if the destination is on another segment, the bridge transmits the datagram on that segment only. If the bridge does not know the destination segment, it transmits the datagram on all segments except the source segment (a technique known as flooding).
VLAN	The VLAN Module manages the table and information for 802.1q, 802.1p and 802.1v. Currently, MAC based VLAN is supported.
IGMP Snooping	IGMP snooping module can passively snoop on IGMP packets to learn the IP Multicast group membership. IGMP snooping module supports IGMP v1, v2 and v3.
Additional L2 Functions	Port Mirroring and Broadcast Storm Suppression
802.1x	iBG2006 supports 802.1x port authentication control protocol and management. 802.1x-port authentication offers an effective framework for authenticating and controlling user traffic to a protected network. 802.1x ties the Extensible Authentication Protocol (EAP) to both the wired and wireless LAN media and supports multiple authentication methods, such as token cards, Kerberos, one-time passwords, certificates, and public key authentication. Variable authentication methods support with EAP (EAP-MD5, TLS, TTLS, PEAP) is dependent on the support of the client and the authentication server. RADIUS was primarily used by ISPs who authenticated username and password before the user got authorized to use the ISP's network. 802.1x does not specify what kind of back-end authentication server must be present, but RADIUS is the ‘de-facto’ back-end authentication server used in 802.1x.

Unicast Routing

Interior Gateway Protocols such as RIP and OSPF are supported in Ubigate iBG2006.

Multicast Routing Protocols

The following Multicast routing modules are supported.

Multicast Routing Protocols	Description
IGMPv2: Internet Group Membership Protocol	The Internet Group Management Protocol (IGMP) is used between IP hosts and IP routers. IP Host reports their multicast group membership to the neighboring multicast routers expressing their desire to receive multicast traffic destined for the group. Multicast routers use IGMP to learn, for each of their attached physical networks, which groups have members. IGMP should be enabled on both hosts and routers that want to receive multicast traffic.
PIM-SM: Protocol Independent Multicast-Sparse Mode	Protocol Independent Multicast (PIM) protocol routes multicast packets to multicast groups. PIM is protocol independent because it can leverage whichever unicast routing protocol is used to populate unicast routing table. PIM-SM tries to send multicast data only to networks that have active receivers. This is achieved by having a common Rendezvous Point (RP) known to the senders and receivers and forming shared trees from the RP to the receivers.
DVMRP: Distance Vector Multicast Routing Protocol	Distance Vector Multicast Routing Protocol (DVMRP) is a multicast routing protocol that provides an efficient mechanism for connectionless datagram delivery to a group of hosts across an inter-network. It is a distributed protocol that dynamically generates IP multicast delivery trees using a technique called Reverse Path Multicasting.

WAN Protocols

Ubigate iBG2006 uses mini modules (up to 2) for providing WAN connectivity. The protocols such as PPP and Frame Relay (including their multilink variations) are supported in Ubigate iBG2006 to provide link layer connectivity. Also, the ISDN interfaces are supported.

WAN Protocols	Descriptions
Frame Relay	Frame Relay (FR) is one of the widely used transport protocols for Wide Area Networking (WAN) community. The objective of FR is to provide WAN connectivity to both remote routers and FR switches. The protocol stack can provide both RFC1490 based multi-protocol encapsulation as well as PVC switching. Also, standard frame relay congestion management procedures based on frame relay traffic parameters-Bc, Be and CIR- (ingress policing, egress shaping/rate limiting) are supported. The following LMI types are supported-LMI Rev 1, Stratacom/Cisco LMI, T1.617 Annex D, Q.933 Annex A and alternately, the LMI can be disabled (None). Apart from these, fragmentation and inverse ARP are supported over FR PVCs.
HDLC	High-Level Data Link Control (HDLC) is a bit-oriented synchronous data link layer protocol developed by the International Organization for Standardization (ISO). The original ISO standards for HDLC were: - ISO 3309-Frame Structure - ISO 4335-Elements of Procedure - ISO 6159-Unbalanced Classes of Procedure - ISO 6256-Balanced Classes of Procedure The current standard for HDLC is ISO 13239, which replaces all of those standards. HDLC provides both connection oriented and connectionless service. HDLC can be used for point to multipoint connections, but is now used almost exclusively to connect one device to another, using what is known as Asynchronous Balanced Mode (ABM). The other modes are Normal Response Mode and Asynchronous Response Mode.

(Continued)

WAN Protocols	Descriptions
PPP	The Point-to-Point Protocol (PPP) provides a standard method for transporting multi-protocol datagram over point-to-point links. These links provide full-duplex simultaneous bi-directional operation and are assumed to deliver packets in order. PPP is comprised of 3 main components: A method for encapsulating multi-protocol datagram. In Ubigate iBG2006, PPP is used on the links that use HDLC-like framing (on the WAN side over T1 physical interfaces). The details of the encapsulations can be found in RFC1662 and RFC2516. A Link Control Protocol (LCP) for establishing, configuring and testing the data-link connection. The details of this can be found in RFC 1661. A family of Network Control Protocols (NCPs) for establishing and configuring different network layer protocols. There is a NCP for each network protocol for example, IPCP for IP networks. Optionally, before PPP NCP is established, peers may need to authenticate themselves and any failure during this can result in the link termination. There are two authentication protocols: Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP). In addition to the above, PPP will also interface with AAA for username/password validations. The PPP is the most ubiquitous WAN protocol today for internet access and/or leased line connectivity to a remote office. When the bandwidth requirements go beyond a single T1 (and DS3 being expensive or unavailable) multilink PPP can be used to create a bigger bandwidth pipe.

(Continued)

WAN Protocols	Descriptions
ISDN	WAN interfaces are connected typically using leased lines such as T1/E1, but there are chances that the T1/E1 links goes down due to various reasons thereby resulting in the loss of wan connectivity. The wan connectivity comes up only when the T1/E1 links are restored. Hence there is a need to have an alternate connectivity till the T1/E1 links are restored. When the primary connectivity (T1/E1) links go down, ISDN can be used as a secondary connection. ISDN can be used as a dial up connection to connect to Internet or a remote server for certain amount of time until the primary T1/E1 links are restored. ISDN can also exist as an independent interface to provide remote connectivity to Headquarters and/or for Internet connectivity in a very similar way to the other interfaces like T1/E1. In certain countries the ISDN connections are not so expensive that they can be used as the primary connections as well. iBG2006 supports BRI ISDN interface (s) through a mini module. ISDN PRI is also supported via T1 and E1 interfaces. ISDN BRI and PRI user-side protocols are supported to provide interconnection to PSTNs. Ubigate iBG2006 can also act as a network side element.

Packet Forwarding Plane

The Router Subsystem is a software-based router that can flexibly support a variety of routing protocols. Packet headers may be examined and modified as required to support routing between links supporting different protocols. Received packets are moved into the main memory by the source interface using DMA. The routing processor on the main board examines each packet header in the main memory, makes the routing decision, modifies the packet as required, and inserts the packet into the transmit queue for the appropriate destination. The destination interface then copies the packet from main memory using DMA and transmits the packet.
Packet data is stored in data buffers that are separate from the descriptor structures used by the source and destination DMA Controllers.
This allows the processor to get a packet ready for transmission without copying it from one buffer to another.

To support both switching and routing functionality for Ethernet packets, Ubigate iBG2006 includes an Ethernet Subsystem connecting various modules in Ubigate iBG2006. The major components are an Ethernet switch on the main board that provides switched connectivity between the routing processor and the LAN mini modules, four RJ45 fast Ethernet ports on the main board, and one Small Form Factor Pluggable (SFP) optical fast Ethernet port.

The forwarding plane consists of the following software components:

- Layer 2 Forwarding component: This component performs layer 2 forwarding functions.
- Layer 3 Forwarding component: This component performs IPv4 unicast, and IPv4 multicast forwarding functions.
- Firewall/VPN component: This component performs the firewall and IPSec based VPN functions in conjunction with Layer 3 Forwarding component.
- ACL component: This component performs ACL based stateless firewall function for packets received on the WAN and main board Fast Ethernet interfaces.
- QoS component: This component performs the QoS functions for packets received from WAN interfaces as well as packets transmitted to WAN interfaces.
- Tunneling component: This component performs the GRE and IPIP tunneling functions.

CHAPTER 4. Voice Features

This chapter describes an overall voice feature that Ubigate iBG2006 provides.

Introduction to Voice Feature

Ubigate iBG2006 is a high performance enterprise access router that provides a VoIP gateway feature using a VoIP gateway module.
Using VoIP gateway module, Ubigate iBG2006 can support real-time, two-way voice communications between the packet network and circuit network.

Network Architecture

The iBG2006 network architecture is shown in the following figure.

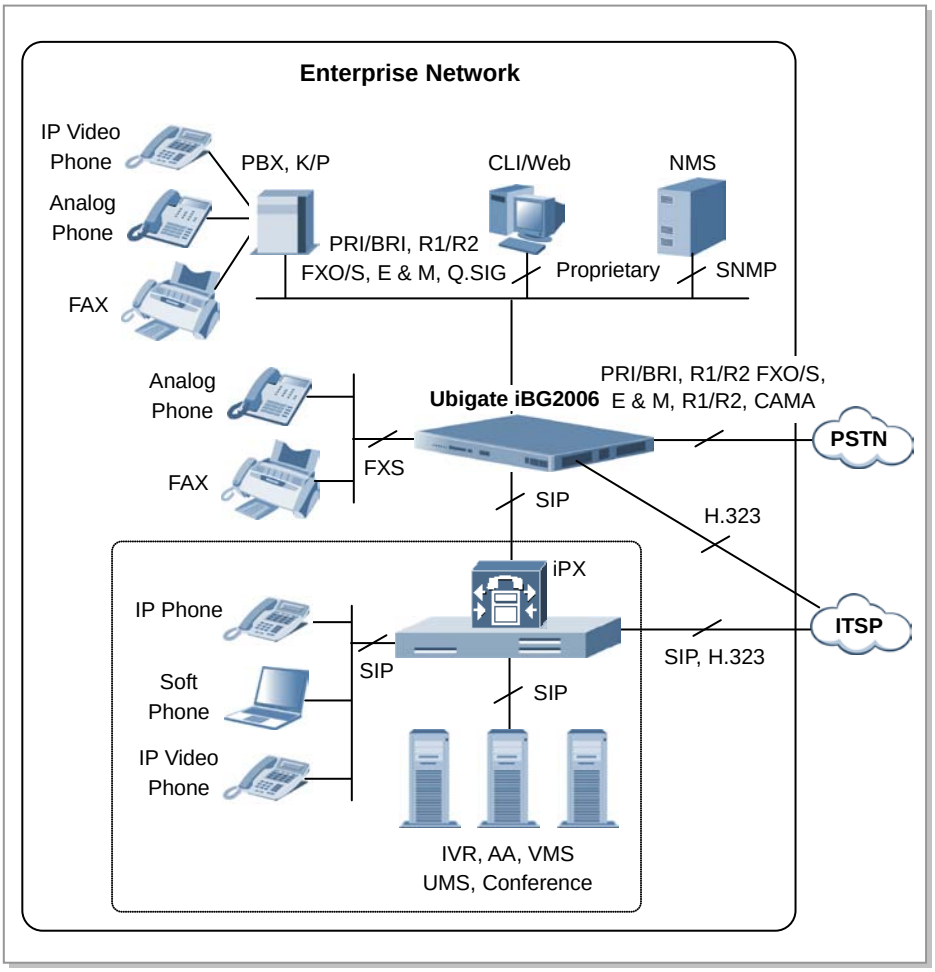

Figure 4.1 Ubigate iBG2006 Network Diagram

The external entities that interwork with Ubigate iBG2006 over a network are as follows:

Ubigate iBG2006

Ubigate iBG2006 acts as the interface between a traditional voice network and the IP network. It interfaces with traditional voice networks (PBX and PSTN) through digital trunk interfaces, such as T1/E1, ISDN PRI/BRI, and Q.SIG and analog trunk interfaces, such as FXS (DID), FXO, and CAMA.
Ubigate iBG2006 terminates the PSTN/ISDN and analog trunk signals and acts as a VoIP gateway, converting the TDM to VoIP packets and vice versa. It communicates with the iPX using standard protocols, such as SIP.

iPX (Ubigate IP PBX)

iPX performs the call processing functions and interfaces with Ubigate iBG2006 over the packet network using protocols, such as SIP.
iPX interfaces with the packet network using SIP for call management and processing. A single iPX can perform call processing for one or more Ubigate iBG2006's.

IP Phone/Softphone

IP phone and Softphone provide a generic voice call service over IP network. IP phone and Softphone, to support the basic calls and supplementary service, interface with iPX using SIP Protocol (Samsung SIP Extension) which has a partial extension from a standard.

Analog Phone/FAX

An analog phone is the terminal providing generic voice call service using the legacy analog line. FAX is the terminal providing fax service using the legacy analog line.

PBX, K/P

PBX or Key phone are equipments connecting in-house extension calls or external calls using legacy analog and digital method, instead of IP Network method.

CLI/Web GUI

CLI and Web GUI are OAM interfaces provided by Ubigate iBG2006. Various OAM functions of Ubigate iBG2006 can be controlled using CLI or Web GUI from any desktop or laptop computer.

NMS

iBG2006 and iPX can be controlled through NMS (Network Management System) optionally. For this, iBG2006 and iPX support SNMPv1/v2/v3.

IVR/AA/VMS/UMS/Conference Servers

These equipments provide various services, such as VMS, IVR, AA, and Conference, which are not provided by Ubigate iBG2006 and iPX.

Interface between Network Entities

The interface specifications for interworking with network entities are as follows:

Ubigate iBG2006-iPX Interface

Ubigate iBG2006 and iPX use the Session Initiation Protocol (SIP) for call signaling. They use standard RFC3261-based SIP, with extensions. Samsung proprietary headers are used for VoIP services.
For management, a TCP/IP-based proprietary protocol is used to load subscriber profiles, feature and access-code information, and additional information for survivability.

Ubigate iBG2006-PSTN Interface

This is the interface used for interworking between existing PSTN and voice calls. PRI, BRI, FXO, FXS (DID), R1, R2, and CAMA are used as signaling method. T1, E1, Analog Trunk and Analog Line are used as physical layers.

- Analog I/F: DID (FXS), DOD (FXO)
- Digital I/F: T1 CAS E & M, T1 R1, E1 R2 MFC, E1 R2 DTMF, ISDN-PRI/BRI (user side)

Ubigate iBG2006-Analog Phone Interface

This is the interface used by Ubigate iBG2006 to provide voice calls to the generic analog phone. FXS is used.

Ubigate iBG2006-PBX Interface

This is the interface Ubigate iBG2006 uses to interwork with legacy PBX. PRI, BRI, R1, R2, FXO, Q.SIG, and DID are used as signaling methods. T1, E1, Analog Trunk, and Analog Line are used as the physical layers.

- Analog I/F: FXS, FXO
- Digital I/F: T1 CAS FXS/FXO/E & M, E1 R2 MFC, E1 R2 DTMF, ISDN-PRI/BRI (user & network side), ISDN-Q.SIG

Ubigate iBG2006-CLI/Web GUI Interface

This is the interface iBG2006 uses to interwork with CLI and Web Client to provide OAM functions. It uses the TCP/IP-based proprietary interface developed by Samsung.

Ubigate iBG2006-NMS Interface

The NMS uses this interface for integrated control of multiple iBG2006's. The interface uses the SNMP protocol and proprietary Samsung MIB.

Operation Mode

When Ubigate iBG2006 operates as an SIP gateway, it can work in iPX interworking mode, in which it interworks with SIP network via iPX, or in a stand-alone mode (or Toll Bypass mode), in which it directly interworks with other SIP gateways with or without an SIP server.
When connectivity with Ubigate iPX fails in iPX interworking mode, iBG2006 automatically switches to survivable telephony mode to provide basic and limited call supplementary services without Ubigate iPX.
The detailed operation mode is described below.

iPX Interworking Mode

In iPX interworking mode, Ubigate iBG2006 is registered in Ubigate iPX using a REGISTER method to perform operation. iPX manages multiple IP phones and Ubigate iBG2006's. Generally, Ubigate iBG2006 delivers voice calls to iPX via the SIP protocol. Ubigate iPX can decide to route a call to other iBG2006's, IP phones, or SIP/H.323 servers.

The generic network configuration in iPX interworking mode is shown in Figure 4.1. Figure 4.2 shows Ubigate iPX controlling the corporate VoIP network in a headquarter office. Multiple Ubigate iBG2006's reside in individual branch offices. In addition, multiple IP phones exist in the headquarters and each branch. The company's iBG2006's and IP phones are registered in iPX, and iPX controls the overall routing of the internal and external calls.

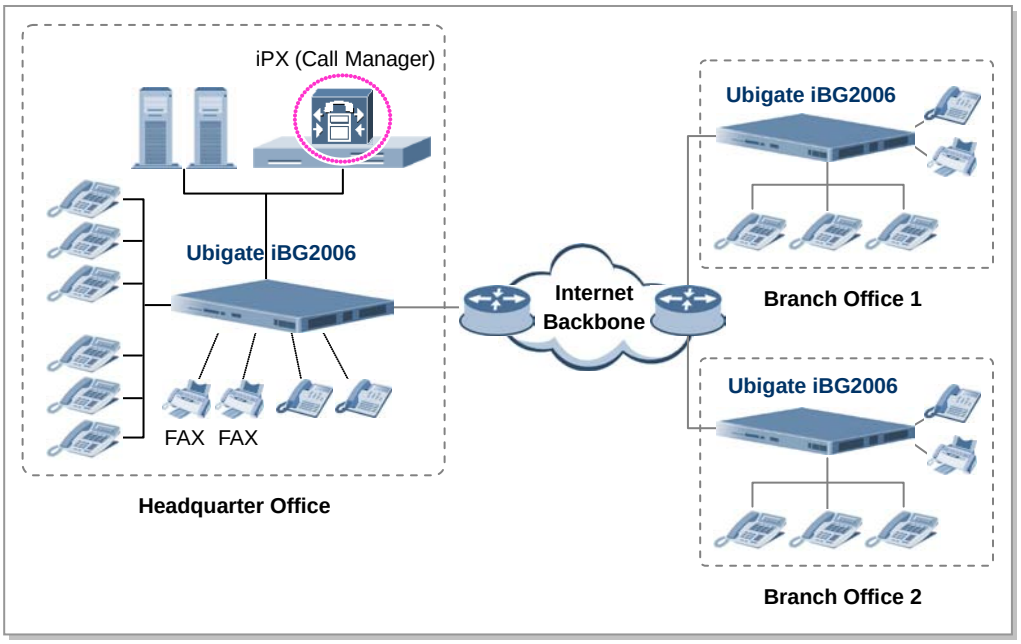

Figure 4.2 Example of iPX Interworking Mode Network Configuration

Survivable Telephony Mode

In iPX interworking mode, all the calls over VoIP network are generally controlled by iPX. All originating and terminating calls (from/to IP Phone or Analog Phone) will be unavailable if iPX fails (for example, due to link failure) or access to iPX is blocked. To overcome this failure, Ubigate iBG2006 continuously monitors the status of its connection to iPX, and if a failure is detected, it automatically switches to survivable telephony mode in which it can provide basic voice services independently.

In a Survivable Telephony mode, the default call and minimum supplementary services within the same branch are provided. Depending on the fault type and settings of Ubigate iBG2006, some calls can be provided to other branch.

Stand-alone mode (or Toll Bypass mode)

Stand-alone mode is the mode where Ubigate iBG2006 works without iPX (or Proxy Server). Therefore, it is connected to other network entities without separate dependency registration procedure.

If Ubigate iBG2006 operates in a Stand-alone mode, the remote office can be multiple different Ubigate iBG2006's, and Ubigate iBG2006 directly determines call routing according to the dial plan settings.

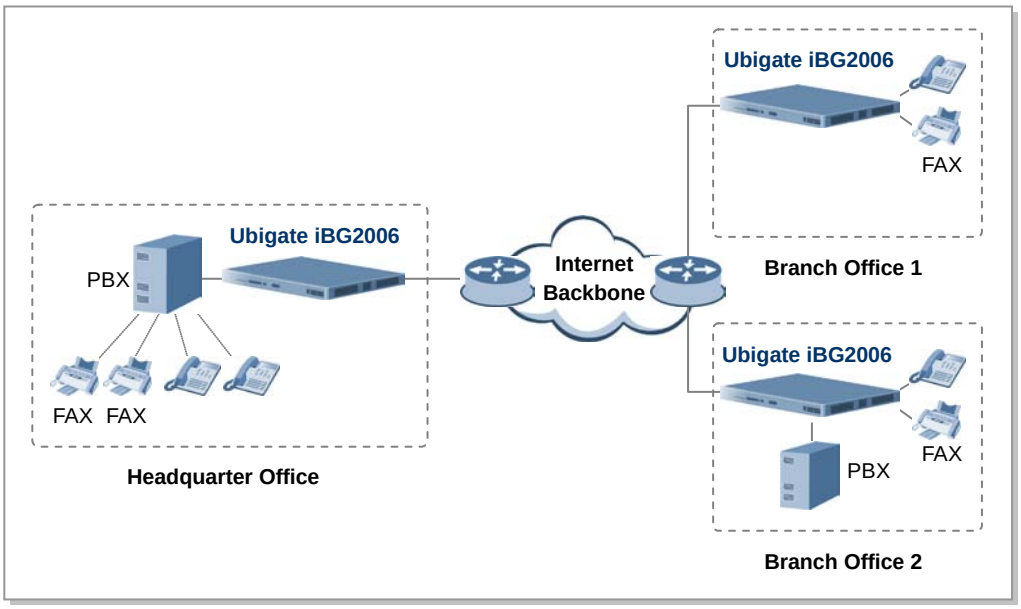

Figure 4.3 Example of Stand-alone mode network configuration

Figure 4.3 shows the stand alone mode network configuration.
In this network configuration, a separate iPX and IP phone do not exist.
The internal call in each office (headquarter and branch) is made by using the legacy PBX as in the headquarters and Branch Office 2, or analog phone or Fax is directly connected to Ubigate iBG2006 as in Branch office 1.
The communication between HQ and a branch, or between individual branches is carried out via VoIP over IP network through Ubigate iBG2006.

Key Features

This section presents key features of Ubigate iBG2006 voice capability.

VoIP Gateway

The VoIP gateway function delivers voice calls between PSTN and IP network. Ubigate iBG2006 acts as the interface between a traditional voice network and the IP network. Ubigate iBG2006 interfaces with the traditional voice networks (PBX and PSTN) through T1/E1/ISDN-PRI interfaces and analog trunk interfaces such as DID and FXO. Ubigate iBG2006 terminates PSTN/ISDN and analog trunk signals and acts as an interface with IP network by interworking with SIP proxy, SIP registrar, SIP gateway, SIP terminal, H.323 gatekeeper, H.323 gateway, and others.

SIP Signaling

Ubigate iBG2006 serves as a SIP gateway using SIP signaling according to RFC 3261 standard, and interworks with other SIP network entities residing on a network in the following way.

Direct Connection

Direct connection enables call processing without SIP registration.
It is used where there is no iPX or an proxy server directly connected to a network, where signaling is executed directly among gateways without passing through iPX or an SIP proxy server.

Indirect Connection via SIP Proxy Server

Indirect connection enables Ubigate iBG2006 to act as an SIP gateway for iPX or an SIP proxy server.
With this indirect connection, Ubigate iBG2006 performs registration in iPX or SIP proxy server in regard to register.

H.323 Signaling

Ubigate iBG2006 serves as an H.323 gateway using SIP signaling compatible with H.323 v5, and interworks with other H.323 network entities residing on a network in the following way.

H.323 Gateway Mode

In H.323 gateway mode, Ubigate iBG2006 serves as a gateway in a zone managed by a gatekeeper of ITSP.
If Ubigate iBG2006 operates in a gateway mode, Ubigate iBG2006 performs general GK registration procedure using RRQ. A gatekeeper identifies Ubigate iBG2006 as a gateway to be managed in a zone, and Ubigate iBG2006 provides the H.323 Gateway characteristics necessary for default call signaling.

H.323 Direct Mode

Direct mode enables call processing without H.323 registration.
It is used when signaling is performed directly between gateways without passing through a gatekeeper.

PSTN Signaling

Ubigate iBG2006 acts as a VoIP gateway for interconnecting between legacy PSTN and VoIP networks. To interwork with PSTN seamlessly, Ubigate iBG2006 supports various PSTN signaling that have been in use for several decades.

Ubigate iBG2006 supports following PSTN signaling.

- Analog FXS: loop-start, ground-start
- Analog FXO: loop-start, ground-start
- Analog DID (Direct Inward Dial)
- ISDN BRI Q.931: network side, user side
- T1-CAS E & M: wink, immediate, delay
- T1-CAS FXO: ground start, loop start

- T1-CAS FXS: ground start, loop start
- E1-CAS R2: MFC, DTMF
- T1/E1 ISDN PRI Q.931: user side, network side
- T1 R1

Ubigate iBG2006 supports following R2 Country variants.

- Australia
- Brazil
- China
- East Europe
- Hong Kong
- India
- ITU, Korea
- Thailand
- Mexico

Ubigate iBG2006 supports following ISDN Country variants.

- AT & T 4ESS (User Side-PRI, Network Side-PRI)
- AT & T 5ESS (User Side-PRI/BRI-Network Side-PRI/BRI)
- ETSI (User & Network Side-PRI/BRI)
- Australian Telecom (User Side-PRI/BRI and Network Side-PRI)
- National ISDN-1 (User Side-BRI)
- NTT (User & Network Side-PRI/BRI)
- Northern Telecom DMS-100 (User Side & Network Side-PRI/BRI)
- Northern Telecom DMS-250 (User Side & Network Side-PRI)
- Telcordia TR-303, TMC & CSC (User & Network Side-PRI)
- National ISDN-2 (User & Network Side-PRI)
- Q.SIG (PRI)

Voice Codecs

Ubigate iBG2006 acts as a VoIP gateway converting the TDM to packets and vice versa, and supports the following voice codecs:

- ITU-T G.711-Pulse code modulation (PCM) of voice frequencies
- ITU-T G.711 Appendix I-A high quality low-complexity algorithm for packet loss concealment with G.711
- ITU-T G.711 Appendix II-A comfort noise payload definition for ITU-T G.711 use in packet-based multimedia communication systems.
- ITU-T G.723.1-Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 Kbit/s
- ITU-T G.723.1 Annex A-Speech coders: Silence compression scheme
- ITU-T G.726-40, 32, 24, 16 Kbit/s adaptive differential pulse code modulation (ADPCM)
- ITU-T G.729-Coding of speech at 8 Kbit/s using conjugate-structure algebraic-code-excited linear-prediction (CS-ACELP)
- ITU-T G.729 Annex A-Reduced complexity 8 Kbit/s CS-ACELP speech codec
- ITU-T G.729 Annex B-A silence compression scheme for G.729 optimized for terminals conforming to Recommendation V.70

Security

Ubigate iBG2006 provides such functions as S/MIME, TLS, sRTP and IPSec to ensure voice security.
S/MIME and TLS ensure security for SIP signaling, and sRTP ensures security for media. IPSec ensures security not only for signaling and media but also for all information between two devices connected via IPSec.

S/MIME (Secure MIME)

S/MIME provides an end-to-end security function for the SIP messages transmitted/received from/to a network entity. That is, only the final terminal over an IP network can interpret the message encrypted with S/MIME, and the Call Manager, Softswitch, etc. which is on the way cannot.

TLS

TLS can provide a Hop-by-Hop Security function for SIP messages transceived to or from a network entity.

sRTP (Secure RTP)

sRTP is for encoding and transceiving end-to-end RTP data over an IP network to prevent the conversation wiretapping.

IPSec

IPSec function is used to encode and transmit/receive all packet data between two nodes connected via IPSec. Since both SIP/H.323 signaling and RTP are a type of packet data, they are transmitted/received after being encoded.
It is usually used for Ubigate iBG2006-iPX or between Ubigate iBG2006's.

Call Routing and Digit Manipulation

Call Routing

Incoming calls passing through Ubigate iBG2006 can be routed to the PSTN, such as Port and Trunk Group, or to the VoIP network, such as the H.323 Session Target or SIP Session Target. Routing Control is the procedure used to determine the route calls take from various destinations. The final routing route is determined based on various settings, such as Dial Plan, Preference, Hunting Scheme, etc.

Digit Manipulation

Ubigate iBG2006 allows digit manipulation of a dial string before it passes the dial string to the telephony device.

Digits Stripping and Prefixes

Digits stripping and prefixes make digit deletion and insertion before sending outbound POTS peers.
For digits stripping, Ubigate iBG2006 deletes the left-justified digits that explicitly match the destination pattern when Ubigate iBG2006 matches a dial string to an outbound POTS dial peer.
For prefixes, Ubigate iBG2006 may add specific digits to the front of the dialed string before it is forwarded to the telephony interface.

Forward Digits

Ubigate iBG2006 defines the number of digits and then forwards to the telephony interface. It controls the number of digits stripped before the dialed string is passed to the telephony interface.

Digit Translation

Digit translation rules are used to manipulate the calling number (ANI) or called number (DNIS) digits for a voice call or to change the numbering type of a call.
Translation rules are used to convert a telephone number into a different number before the call is matched to an inbound dial peer or before the call is forwarded by the outbound dial peer.

Call Block

Ubigate iBG2006 provides call-blocking function based on the calling or called number.

Access Group

An access group is associated with an incoming VoIP call so that the terminating gateway can initiate appropriate services, such as number translation and incoming call control.
An access group consists of one or multiple access lists. Each access list is configured by IP address style.

Trunk Group

A trunk group is a logical grouping of interfaces with the same signaling characteristics. The trunk group can be configured as the target of an outbound dial peer.

Trunk group hunt scheme

Ubigate iBG2006 provides trunk hunt schemes for outgoing calls.
A hunt scheme is a selection procedure for choosing an interface or voice port. A trunk group with several trunk group members uses a hunt scheme to select an idle channel for routing an outgoing call. Several hunt schemes are supported, as follows.

Block/Unblock

If trunk group is blocked or unblocked, each voice-port is blocked or unblocked because a trunk-group is a set of voice-ports. That is identical to the result of a ‘busyout forced’ operation on each voice-port.

If a trunk group is blocked, Ubigate iBG2006 attempts to block a call as follows:

- For POTS signaling (R2-MFC) that supports a block mechanism, Ubigate iBG2006 sends a ‘Block’ message.
- For POTS signaling (FXS, FXO, T1-CAS) that doesn’t support a block mechanism, Ubigate iBG2006 plays Fast-Busy Tone for an Inbound Call Attempt or changes a line status to ‘seized’.
- For ISDN signaling, Ubigate iBG2006 shuts down an ISDN signaling stack, by default, or sends a release message with a specific fail code.

Multiple Trunk Group per Dial-Peer

Multiple trunk group support permits up to 12 trunk groups to be provisioned as a target in a POTS dial-peer. Because the dial peer can have more than one target destination, this capability reduces the number of dial peers that need configuration.
During a call setup request for an outbound call, the software searches for an idle channel in an outbound dial peer, using a list of trunk groups.
The trunk groups are searched sequentially by priority. If no idle channel is available in the highest priority trunk group, the next priority trunk group is searched. When a channel is found, the trunk group member containing the channel is used for the outbound call. If the call setup returns a glare condition and the software attempts a call retry, the search for another idle channel starts from the beginning of the list of multiple trunk groups.

Call Admission Control (CAC)

Voice CAC is one of the techniques used to maintain reasonable voice quality. For real-time delay-sensitive traffic, such as voice, it is better to deny network access when there is congestion condition than to allow traffic onto the network to be dropped and delayed.
CAC is a deterministic and informed decision made before a voice call is established and is based on whether the required network resources are available to provide suitable QoS for the new call.

Local CAC

Local CAC mechanisms affect the outgoing Ubigate iBG2006.
The CAC decision is based on nodal information, such as the status of the Max. calls.

Ubigate iBG2006 provides CAC based on the system-wide maximum call number. CAC permits Ubigate iBG2006 to deny incoming calls exceeding a preconfigured threshold, allowing the selection of a system-wide maximum call value. This feature helps ensure the quality of service of existing calls and reliability of system processes by preventing system overload caused by excessive incoming calls. The feature rejects new calls, with minor disruption for system users. The administrator of Ubigate iBG2006 sets the threshold at which new calls are rejected.

Ubigate iBG2006 provides CAC based on maximum call number per Dial-Peer.

Ubigate iBG2006 provides CAC based on Physical DS0 limitation.

Resource-based CAC

Resource based CAC mechanisms operate on the outgoing Ubigate iBG2006. The CAC decision is based on nodal information, such as the state of the CPU, memory, and DSP channels load level.

Ubigate iBG2006 provides CAC based on CPU utilization. The CAC Based on CPU utilization permits Ubigate iBG2006 to deny incoming calls exceeding a preconfigured threshold, allowing the selection of a system CPU load level value. This feature helps ensure the quality of service of existing calls and reliability of system processes by preventing system overload caused by excessive incoming calls. The feature rejects new calls, with minor disruptions for system users.
Administrator of Ubigate iBG2006 sets a threshold at which new calls are rejected. This CPU load threshold can be set anywhere from 20% to 90%.

Ubigate iBG2006 provides CAC based on memory utilization. CAC Based on memory utilization permits Ubigate iBG2006 to deny incoming calls exceeding a preconfigured threshold, allowing the selection of a system memory load level value. This feature helps ensure the quality of service of existing calls and reliability of system processes by preventing system overload caused by excessive incoming calls. The feature rejects new calls, with minor disruptions for system users.
Administrator of Ubigate iBG2006 sets the threshold at which new calls are rejected. This memory load threshold can be set anywhere from 20% to 90%.

Ubigate iBG2006 provides CAC based on DSP utilization. CAC Based on DSP channel utilization permits Ubigate iBG2006 to deny incoming calls exceeding a preconfigured threshold, allowing the selection of a system DSP channel load level value. This feature helps ensure the quality of service of existing calls and reliability of system processes by preventing system overload caused by excessive incoming calls. The feature rejects new calls, with minor disruptions for system users.
Administrator of Ubigate iBG2006 sets a threshold at which new calls are rejected. This DSP load threshold can be set anywhere from 20% to 100%.

Voice Services

FAX

Ubigate iBG2006 supports FAX pass-through and SIP/H.323 T.38 FAX relay.

T.38

Ubigate iBG2006 negotiates fax relay transmission by exchanging capability information in Session Description Protocol (SDP) messages and H.323 messages.
T.38 Annex D procedures are used for the changeover from VoIP to fax mode during a call.
For SIP, a normal VoIP call is initially established using SIP INVITE requests. The DSP of Ubigate iBG2006 must be informed that it can support T.38 mode while it is switched to voice mode. During the call, when the DSP of Ubigate iBG2006 detects fax flags, Ubigate iBG2006 initiates a SIP INVITE mid-call to signal the desire to change the media stream.

FAX Pass-through

Ubigate iBG2006 does not distinguish a fax call from a voice call.
Fax communication between the two fax machines is carried entirety in-band over a voice call.
Fax up-speed is similar to pass-through in that the fax call is carried in-band over the voice call.
The difference is that, when using up-speed, Ubigate iBG2006 is to some extent aware of the fax call. Although relay mechanisms are not employed, with up-speed the gateways recognize a CED fax tone and automatically change the voice codec to G.711, if necessary, and turn off Echo Cancellation (EC) and Voice Activity Detection (VAD) for the duration of the call.

DTMF Relay

The reliable DTMF relay feature provides reliable digit relay between Ubigate iBG2006's or between Ubigate iBG2006 and iPX when a low-bandwidth codec is used.

RFC2833

Ubigate iBG2006 supports RFC 2833 for reliable DTMF relay.
Ubigate iBG2006 relaying DTMF tones provides a standardized means of transporting DTMF tones in Real-time Transport Protocol (RTP) packets, according to section 3 of RFC 2833.

DTMF events through SIP signaling

Ubigate iBG2006 supports NOTIFY method for DTMF relay.
The SIP event notification mechanism uses NOTIFY method to signal when certain telephony events take place. In order to send DTMF signals using the NOTIFY method, the gateway notifies the subscriber when DTMF digits are signaled by the originator. The notification contains a message body with a SIP response status line.

Ad-hoc Conference

Ad-hoc conferencing function provides the conferencing resource of DSP contained in an Ubigate iBG2006, providing high voice quality for supplementary services, such as 3-way conferencing of iPX.

For Ad-hoc conferencing, Ubigate iBG2006 interworks with iPX using SIP, and the service is controlled by iPX.

Private Line Automatic Ringdown (PLAR)

Ubigate iBG2006 provides PLAR (Private Line Automatic Ringdown) and OPX (Off premises extension).

PLAR

PLAR circuits have statically configured endpoints and do not require users to dial to connect calls. PLAR provides a mechanism to create a switched Voice over IP (VoIP) call without digit dialing.

PLAR OPX

OPX allows remote users on Foreign Exchange Station (FXS) ports to appear to a central PBX as physical extensions. Ubigate iBG2006 offers toll-bypass VoIP services without having Ubigate iBG2006 provide dial-tone or change their existing dial plan. OPX allows stations at remote sites to appear to a PBX as physically connected stations.

Local Voice Busy Out (LVBO)

LVBO provides Ubigate iBG2006 with the ability to monitor the state of various network interfaces, both LANs and WANs, and busy back the trunk to the PSTN interface if any of the monitored links fail.

If an ISDN line enters a LVBO state, a specific fail code is sent regarding the ISDN Inbound Call Attempt to indicate a ‘busyout’ status.

For LVBO, the PSTN (FXS, FXO, T1/E1 CAS) signaling line operates in the following way.

- If a call enters an analog FXS, a Fast-Busy Tone is sent to indicate that the relevant line is busy.
- Regarding the inbound call attempt, such as FXO, T1-CAS FXS/FXO/ E & M, and T1-R1, Ubigate iBG2006 enables a remote office to see that the relevant line is in ‘busyout’ status.
- Since a block message exists for E1-R2, a block message is sent to a remote office to block the call attempt by a remote office; and an unblock message is sent when the LVBO status is released, putting the line in idle status.

Supplementary Services

Ubigate iBG2006 provides the following supplementary services for the iPX interworking mode, survivable telephony mode, and Stand Alone mode.

iPX Interworking Mode

When running in iPX interworking mode, Ubigate iBG2006 provides the supplementary services under iPX control.

- Calling Line Identification (CLID)
- Call Forward-All
- Call Forward-Busy
- Call Forward-NoAnswer
- Call Hold and Retrieve
- Call Park
- Call Pickup Group
- Call Pickup Direct
- Call Pickup Universal
- Call Restriction by User
- Call Waiting and Retrieve
- Call Transfer-Blind
- Call Transfer-Consultative
- Call Forwarding to VMS-All
- Call Forwarding to VMS-Busy
- Call Forwarding to VMS-NoAnswer
- Call Back Busy Subscriber
- Call Override
- Call Intrusion
- Privacy
- Wake-up Call
- Do Not Disturb (DND)
- Absentee Service (ABS)
- Conference calls

- Ad-hoc conference
- Group Call
- Distinctive Ring
- Music On Hold Service
- Malicious Call
- Follow Me

Survivable Telephony Mode

When running in survivable telephony mode, Ubigate iBG2006 provides the following supplementary services to FXS and IP Phone subscribers, these services interwork with iPX via iPX.

- Calling Line Identification (CLID)
- Call Forward-All
- Call Forward-Busy
- Call Forward-NoAnswer
- Call Hold and Retrieve
- Call Pickup Group
- Call Pickup Direct
- Call Pickup Universal
- Call Waiting and Retrieve
- Call Transfer-Blind
- Call Transfer-Consultative
- Distinctive Ring

Stand Alone Mode

When running in stand alone mode, Ubigate iBG2006 provides the following supplementary services to interconnected FXS subscribers.

- CLID
- Call Hold and Retrieve
- Call Pickup Group
- Call Pickup Direct
- Call Pickup Universal
- Call Waiting and Retrieve
- Call Transfer-Blind
- Call Transfer-Consultative
- Distinctive Ring

E911 Support

Ubigate iBG2006 supports an Enhanced 911 (E911). E911 is an emergency telephone system capable of automatically displaying the callback number (and in some cases the location) of a person who dials emergency call numbers (911) to request emergency help from public safety agencies.
The North American emergency E911 phone system consists of a voice network built largely outside of the normal Public Switched Telephone Network (PSTN) on which common voice traffic rides. They are treated specially because they are routed differently within PSTN. Calls to emergency services are routed based on the calling number, not the called number.
The calling number is checked against a database of emergency service providers that cross-references the service providers for the caller's particular location. When this information is known, the call is then routed to the proper Public Service Answering Point (PSAP), which, in turn, dispatches services to the caller's location.

High Availability of Voice Feature

As enterprises extend their IP telephony and high-value application deployments from central sites to remote offices, one of the factors considered vital in deployment is the ability to cost-effectively provide backup redundancy functions at the remote branch office. However, the size and number of these small-office sites precludes most enterprises from deploying dedicated call-processing servers, unified messaging servers, or multiple WAN links to each site to achieve the high availability required.

Ubigate iBG2006 provides a high availability voice solution as Table 4.1.

Table 4.1 High Availability Cases

Item	Local iPX Through LAN	Remote iPX Through WAN
WAN Link Fail (iPX Alive)	PSTN Fallback - Analog call → PSTN - VoIP call → PSTN - Controlled by iPX	Survivable Telephony - Analog call → PSTN - VoIP call → PSTN - Controlled by Ubigate iBG2006 (iPX is down)
iPX Down (WAN Link Alive)	Survivable Telephony - Analog call → PSTN, IP N/W - VoIP call → PSTN, IP N/W - Controlled by Ubigate iBG2006	Survivable Telephony - Analog call → PSTN, IP N/W - VoIP call → PSTN, IP N/W - Controlled by Ubigate iBG2006

PSTN Fallback

Ubigate iBG2006 monitors the status of the IP network (WAN).
When WAN fail is detected, it automatically redirects calls to the PSTN.
When the WAN link is restored, call routing reverts back to the IP Network.
This feature is called PSTN fallback and allows an end-user to give a reasonable guarantee of call completion.

Survivable Telephony

Ubigate iBG2006 provides survivable telephony functionality, which is very important for remote branch office connected over the WAN links.
When a link which is only linked to IP network was failed, there is no way to communicate with iPX at the central sites. Then, it is impossible to VoIP call setup through iPX. Even in this case, Ubigate iBG2006 has ability to provide the voice call services to local subscriber not only analog phones but also IP Phones.
In iPX interworking mode, Ubigate iBG2006's acts as a stateless proxy server, which sends and receives SIP message between IP phone and iPX transparently. When IP phone registers to iPX, Ubigate iBG2006 finds the information of IP phone location and subscriber profile. Ubigate iBG2006 always checks WAN connection status between iPX and Ubigate iBG2006. If Ubigate iBG2006 detects connection fail, it automatically switches to survivable telephony mode.

In survivable telephony mode, Ubigate iBG2006 acts as an SIP server for local call. Using IP phone location and subscriber profile information, Ubigate iBG2006 provides basic call and restricted supplementary services.

Active calls between users on the same LAN are not affected by WAN failure and will last for the duration of the call. Survivable telephony provides below services:

- Local extension dialing IP phone to IP phone calls
- IP phone to PSTN calls
- IP phone to analog device calls

It is recommended that all Ubigate iBG2006's in remote offices maintain direct links to the PSTN for backup callout capability. This is particularly important for maintaining emergency calling capability.

Voice Deployment Scenario

In this Section, we describe various service scenarios that can be provided using Ubigate iBG2006 VoIP system.

PSTN Toll Bypass

Ubigate iBG2006 provides voice and fax toll bypass capabilities as shown in Figure 4.4. In this scenario a telephonic device attached to a PBX or Key Phone System will be connected to Ubigate iBG2006 through an analog or digital trunk connection.

When Ubigate iBG2006 is in an iPX interworking mode, a call is established across the network by Ubigate iBG2006 and iPX.

The iPX communicate across the IP network using SIP or H.323.

Packets are then routed over the IP network to destination where the reverse operation is performed and thus the call is completed over the IP network bypassing the traditional toll network, PSTN. When Ubigate iBG2006 is in Stand-alone mode, a call is established across the IP network between Ubigate iBG2006's without iPX.

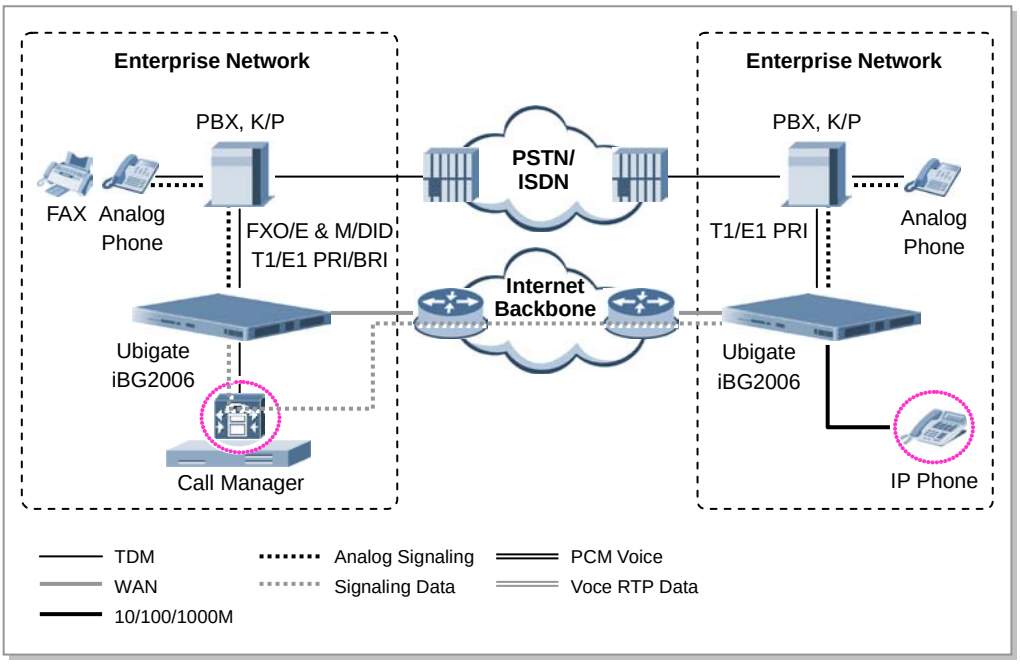

Figure 4.4 Toll Bypass for Voice and Fax services

IP Phones

Figure 4.5 illustrates a second scenario involving an IP phone connected to Ubigate iBG2006. The SIP phone communicates directly with iPX using the SIP protocol that passes through Ubigate iBG2006. The iPX's communicate with each other across the IP network via SIP to establish and maintain the call. The packets are then routed across the IP network from IP phone to IP phone, completing the connection. The second requirement for IP phones connected to Ubigate iBG2006 is the connection of Ubigate iBG2006 to the PBX or PSTN, enabling the IP phones to make calls to traditional phones.
In this case, the IP phones communicate with the iPX and, in turn, the iPX establishes the call to the PBX or PSTN through Ubigate iBG2006.
The packets from the IP phone are then routed through DSP and delivered to the PBX or PSTN via analog or digital trunk lines.

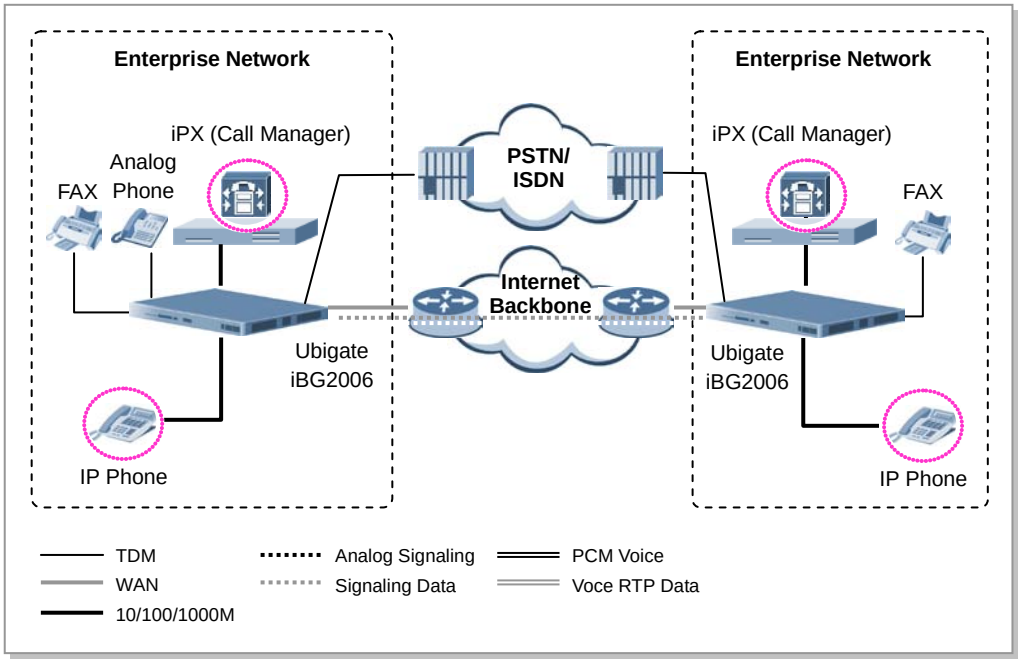

Figure 4.5 Connection to IP Phone, Analog Phone and FAX

Management System

Ubigate iBG2006's are controlled using several management systems or a Command Line Interface (CLI), as shown in Figure 4.6. There is an integrated Graphical User Interface (GUI) that allows the users to configure Ubigate iBG2006's. CLI is a text line interface permitting users to configure and retrieve the status of individual, connected systems.

The Network Management System (NMS) uses Simple Network Management Protocol (SNMP) to communicate with Ubigate iBG2006's.

The SNMP 'get' and 'set' commands can be used to configure either system and retrieve current configuration and status information. These Management Systems can be located anywhere in the IP network.

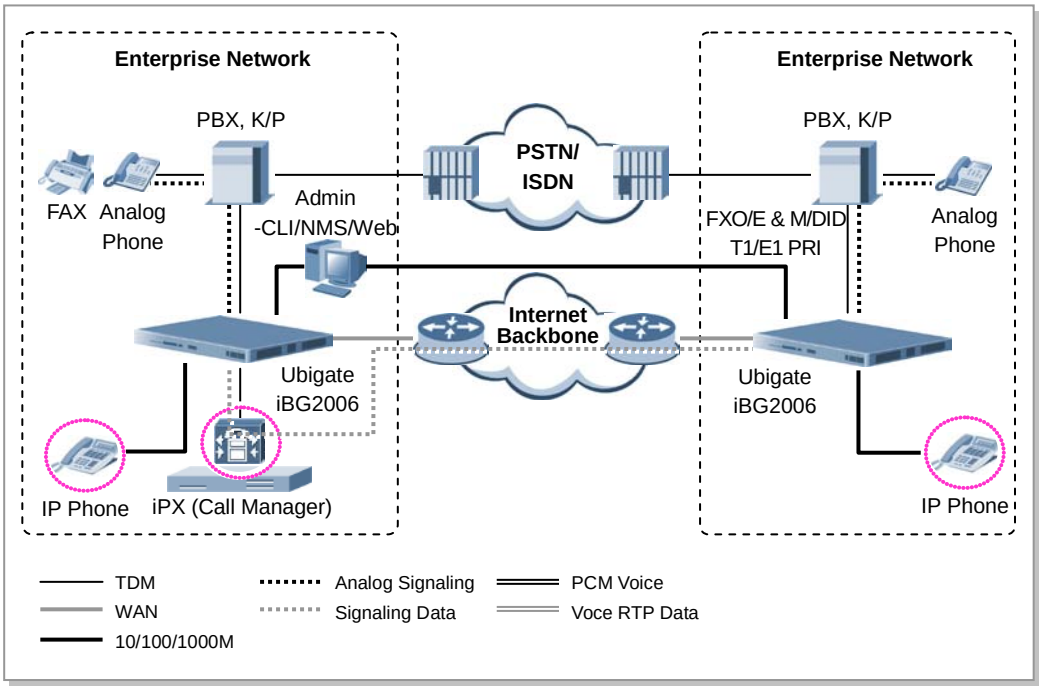

Figure 4.6 Management using CLI/GUI/NMS

ANNEX A. Cable Specifications

Console Port (Main Board) Cable

Cable Shape

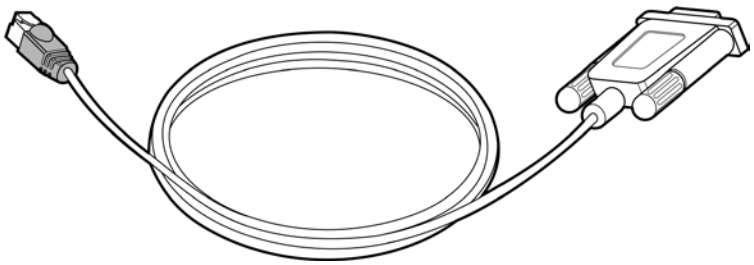

Figure A.1 Console Port Cable

Cable Signaling and Pinout

Console Port (RJ-45)	Console Device (DB-9)	Console Port (RJ-45)	Console Device (DB-9)
Pin	Signal	Pin	Signal
1	RTS	8	CTS
2	DTR	6	DSR
3	TxD	2	RxD
4	GND	5	GND
5	GND	5	GND
6	RxD	3	TxD
7	DSR	4	DTR
8	CTS	7	RTS

Auxiliary Port (Main Board) Cable

Cable Shape

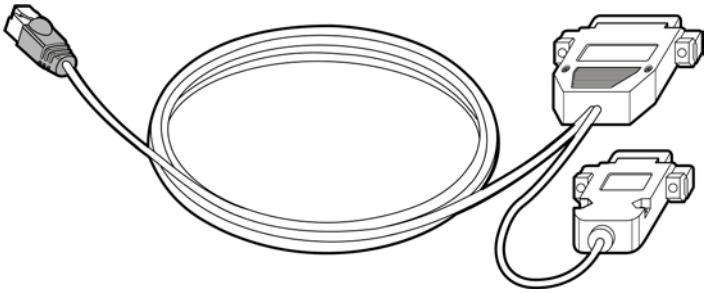

Figure A.2 Auxiliary Port Cable

Cable Signaling and Pinout

Auxiliary Port (DTE)		Modem		
RJ-45 Pin	**Signal**	**DB-9 Pin**	**DB-25 Pin**	**Signal**
1	RTS	7	4	RTS
2	DTR	4	20	DTR
3	TxD	3	2	TxD
4	GND	5	7	GND
5	GND	5	7	GND
6	RxD	2	3	RxD
7	DSR	6	8	DCD
8	CTS	8	5	CTS

BRI-1U, BRI-2U Mini Module Cable

Cable Shape

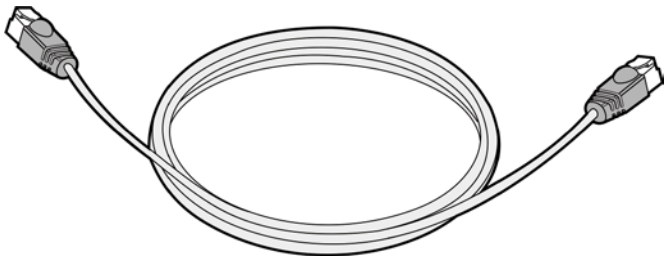

Figure A.3 BRI-2U Mini Module Cable

Cable Signaling and Pinout

8 Pin[1)]	Function
3	No connection
4	Signal-Tip
5	Signal-Ring
6	No connection

1) Pins 1, 2, 7 and 8 are not used.

BRI-1ST, BRI-2ST Mini Module Cable

Cable Shape

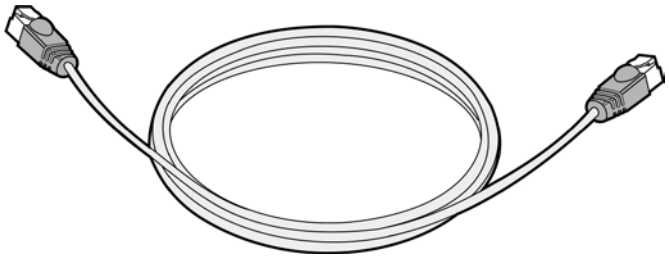

Figure A.4 BRI-2ST Module Cable

Cable Signaling and Pinout

8 Pin[1)]	TE[2)]	NT[3)]	Polarity
3	Transmit	Receive	+
4	Receive	Transmit	+
5	Receive	Transmit	–
6	Transmit	Receive	–

1) Pins 1, 2, 7 and 8 are not used.
2) TE refers to terminal terminating layer 1 aspects of TE1. TA, and NT functional groups (this applies to the ISDN BRI S/T WIC).
3) NT refers to network terminating layer 1 aspects of NT1 and NT2 functional groups.

LMF-4M, LMF-8M Module Cable

Cable Shape

- Cable Length: 6/10 feet
- Standard, Straight-Through Wiring (both ends are the same)
- 10/100 Base-T interfaces

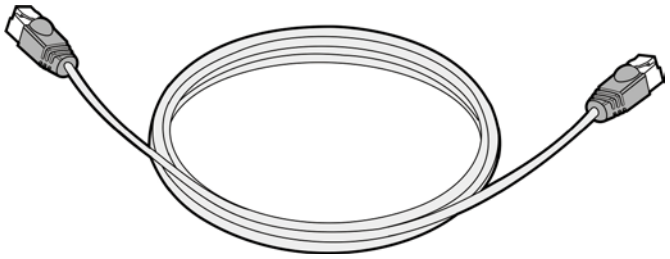

Figure A.5 LMF-4M, LMF-8M Module Cable

Cable Signaling and Pinout

RJ45 Pin #	Wire Color (T568A)	1000 Base-T Signal
1	White/Green	BI_DA+
2	Green	BI_DA-
3	White/Orange	BI_DB+
4	Blue	BI_DC+
5	White/Blue	BI_DC-
6	Orange	BI_DB-
7	White/Brown	BI_DD+
8	Brown	BI_DD-

T1E1-1M, T1E1-2M Module Cable

Cable Shape

- RJ-48C to RJ-48C Cable

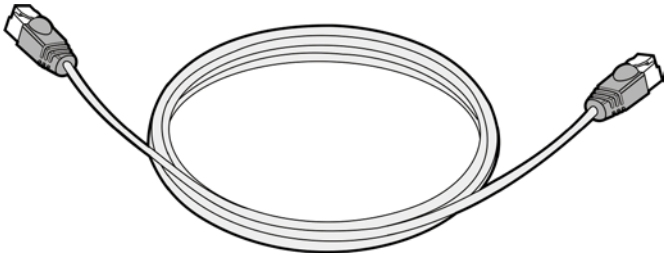

Figure A.6 T1E1-2M, T1E1-1M Module Cable

Cable Signaling and Pinout

RJ-11 connector		RJ-11 connector	
Pin	**Signal**	**Signal**	**Pin**
1	RXPING	TXRING	4
2	RXTIP	TXTIP	5
4	TXRING	RXRING	1
5	TXTIP	RXTIP	2

ATOP-1, ATOI-1 Module Cable

Cable Shape

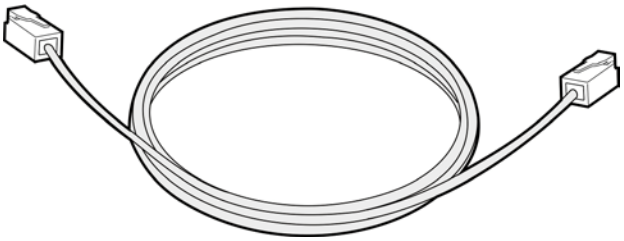

Figure A.7 ATOP-1, ATOI-1 Module Cable

Cable Signaling and Pinout

RJ-11 connector		RJ-11 connector	
Pin	**Signal**	**Signal**	**Pin**
1	-	-	1
2	-	-	2
3	Ring	Ring	3
4	Tip	Tip	4
5	-	-	5
6	-	-	6

FXO-2M, FXO-4M, FXS-2M, FXS-4M Module Cable

Cable Shape

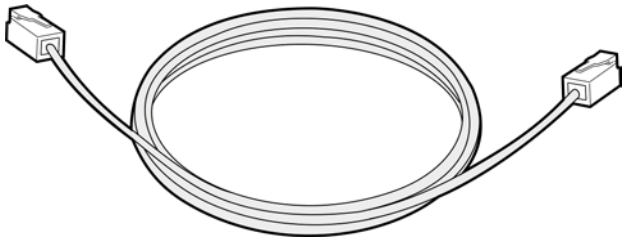

Figure A.8 FXO-4M, FXS-4M Module Cable

Cable Signaling and Pinout

RJ-11 connector		RJ-11 connector	
Pin	**Signal**	**Signal**	**Pin**
1	-	-	1
2	-	-	2
3	Ring	Ring	3
4	Tip	Tip	4
5	-	-	5
6	-	-	6

WTE-1SM/2SM Module Cable (X.21 DCE)

Cable Shape

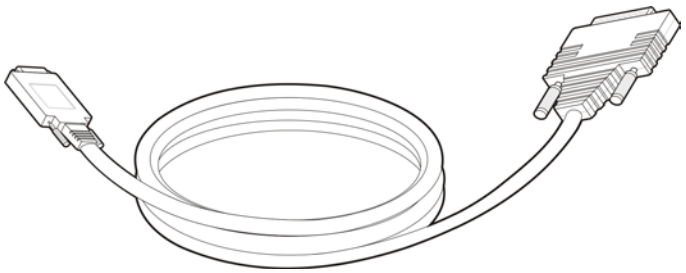

Figure A.9 WTE-1SM/2SM Module Cable (X.21 DCE)

Cable Signaling and Pinout

SMART Serial		DB15 Female	
PIN	**Signal**	**Signal**	**PIN**
21	-	-	-
SHELL	-	Shield GND	1
26	GND	Circuit GND	8
-	Not Used	Not Used	
8	O_RTS/CTS	INDICATION+	5
9	O_DTR/DSR+	INDICATION-	12
11	I_CTS/RTS+	CONTROL+	3
10	I_DSR/DTR+	CONTROL-	10
5	I_RXD/TXD+	TRANSMIT+	2
18	I_RXD/TXD-	TRANSMIT-	9
2	O_TXCE/RXC+	TIMING+	6
15	O_TXCE/RXC-	TIMING-	13
1	O_TXD/RXD+	RECEIVE+	4
14	O_TXD/RXD-	RECEIVE-	11
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (X.21 DTE)

Cable Shape

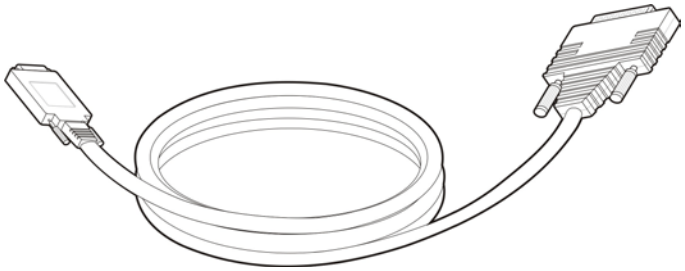

Figure A.10 WTE-1SM/2SM Module Cable (X.21 DCE)

Cable Signaling and Pinout

SMART Serial		DB15 Male	
PIN	Signal	Signal	PIN
21	-	-	-
24	-	-	-
SHELL	-	Shield GND	1
26	GND+	CCT GND	8
-	Not Used	Not Used	
11	I_CTS/RTS+	INDICATION+	5
10	I_DSR/DTR+	INDICATION-	12
8	O_RTS/CTS+	CONTROL+	3
9	O_DTR/DSR+	CONTROL-	10
1	O_TXD/RXD+	TRANSMIT+	2
14	O_TXD/RXD-	TRANSMIT-	9
4	I_RXC/TXCE+	TIMING+	6
17	I_RXC/TXCE-	TIMING-	13
5	I_RXD/TXD+	RECEIVE+	4
18	I_RXD/TXD-	RECEIVE-	11
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS232 DCE)

Cable Shape

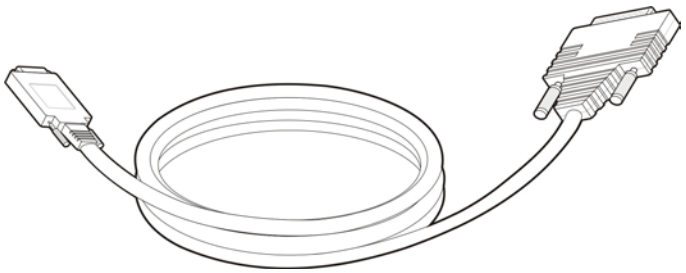

Figure A.11 WTE-1SM/2SM Module Cable (RS232 DCE)

Cable Signaling and Pinout

SMART Serial		DB25 Female	
PIN	**Signal**	**Signal**	**PIN**
23	-	-	-
SHELL	-	Shield GND	1
6	B_DCD/DCD+	DCD	8
19	GND+	GND	7
11	I_CTS/RTS+	RTS	4
12	I_DSR/DTR+	DTR	20
13	B_LL/LL+	LTST	18
26	GND+	GND	-
8	O_RTS/CTS	CTS	5
7	O_DTR/DSR+	DSR	6
5	I_RXD/TXD+	TXD	2
18	GND+	GND	-
4	I_RXC/TXCE+	TXCE	24
17	GND+	GND	-
3	B_TXC/TXC+	TXC	15
16	GND+	GND	-
2	O_TXCE/RXC+	RXC	17

(Continued)

SMART Serial		DB25 Female	
PIN	**Signal**	**Signal**	**PIN**
15	GND+	GND	-
1	O_TXD/RXD+	RXD	3
14	GND+	GND	-
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS232 DTE)

Cable Shape

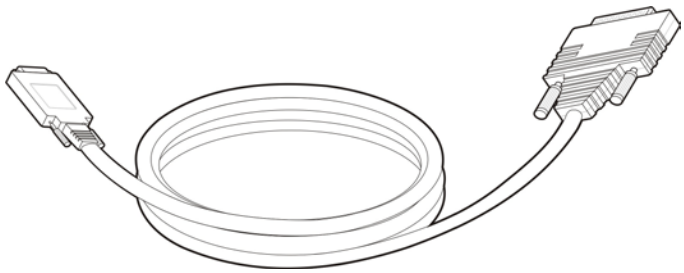

Figure A.12 WTE-1SM/2SM Module Cable (RS232 DTE)

Cable Signaling and Pinout

SMART Serial		DB25 Male	
PIN	Signal	Signal	PIN
23	-	-	-
24	-	-	-
SHELL	-	Shield GND	1
6	B_DCD/DCD+	DCD	8
19	GND+	GND	7
11	I_CTS/RTS+	CTS	5
12	I_DSR/DTR+	DSR	6
13	B_LL/LL+	LTST	18
26	GND+	GND	-
8	O_RTS/CTS	RTS	4
7	O_DTR/DSR+	DTR	20
1	O_TxD/RxD+	TXD	2
14	GND+	GND	-
2	O_TXCE/RXC+	TXCE	24
15	GND+	GND	-
3	B_TXC/TXC+	TXC	15
16	GND+	GND	-
4	I_RXC/TXCE+	RXC	17

(Continued)

SMART Serial		DB25 Male	
PIN	**Signal**	**Signal**	**PIN**
17	GND+	GND	-
5	I_RxD/TxD+	RXD	3
18	GND+	GND	-
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS449 DCE)

Cable Shape

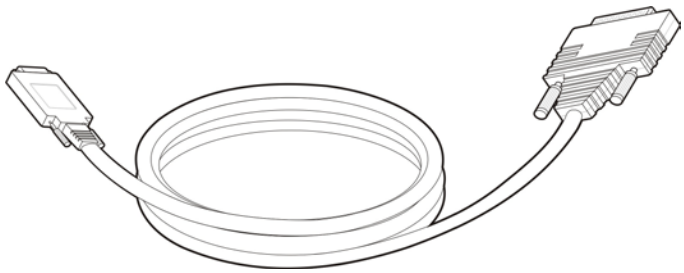

Figure A.13 WTE-1SM/2SM Module Cable (RS449 DCE)

Cable Signaling and Pinout

SMART Serial		DB37 Female	
PIN	**Signal**	**Signal**	**PIN**
SHELL	-	Shield GND	1
11	I_CTS/RTS+	RS+	7
10	I_CTS/RTS-	RS-	25
22	-	SG	19
-	-	RC	20
12	I_DTR/DSR+	TR+	12
25	I_DTR/DSR-	TR-	30
8	O_RTS/CTS+	CS+	9
9	O_RTS/CTS-	CS-	27
5	I_RXD/TXD+	SD+	4
18	I_RXD/TXD-	SD-	22
4	I_RXC/TXCE+	TT+	17
17	I_RXC/TXCE-	TT-	35
3	B_TXC/TXC+	ST+	5
16	B_TXC/TXC-	ST-	23
2	O_TXCE/RXC+	RT+	8
15	O_TXCE/RXC-	RT-	26

(Continued)

SMART Serial		DB37 Female	
PIN	**Signal**	**Signal**	**PIN**
1	O_TXD/RXD+	RD+	6
14	O_TXD/RXD-	RD-	24
7	O_DTR/DSR+	DM+	11
20	O_DTR/DSR-	DM-	29
6	B_DCD/DCD+	RR+	13
19	B_DCD/DCD-	RR-	31
13	B_LL/LL+	LL	10
26	GND+	SC	37
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS449 DTE)

Cable Shape

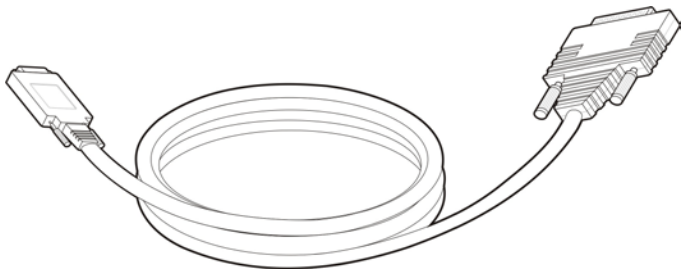

Figure A.14 WTE-1SM/2SM Module Cable (RS449 DTE)

Cable Signaling and Pinout

SMART Serial		DB37 Male	
PIN	**Signal**	**Signal**	**PIN**
SHELL	-	Shield GND	1
8	O_RTS/CTS	RS+	7
9	O_RTS/CTS-	RS-	25
22	-	SG	19
24	-	RC	20
7	O_DTR/DSR+	TR+	12
20	O_DTR/DSR-	TR-	30
11	I_CTS/RTS+	CS+	9
10	I_CTS/RTS-	CS-	27
1	O_TXD/RXD+	SD+	4
14	O_TXD/RXD-	SD-	22
2	O_TXCE/RXC+	TT+	17
15	O_TXCE/RXC-	TT-	35
3	B_TXC/TXC+	ST+	5
16	B_TXC/TXC-	ST-	23
4	I_RXC/TXCE+	RT+	8
17	I_RXC/TXCE-	RT-	26

(Continued)

SMART Serial		DB37 Male	
PIN	**Signal**	**Signal**	**PIN**
5	I_RXD/TXD+	RD+	6
18	I_RXD/TXD-	RD-	24
12	I_DTR/DSR+	TR+	11
25	I_DTR/DSR-	TR-	29
6	B_DCD/DCD+	RR+	13
19	B_DCD/DCD-	RR-	31
13	B_LL/LL+	LL	10
26	GND+	SC	37
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (V.35 DCE)

Cable Shape

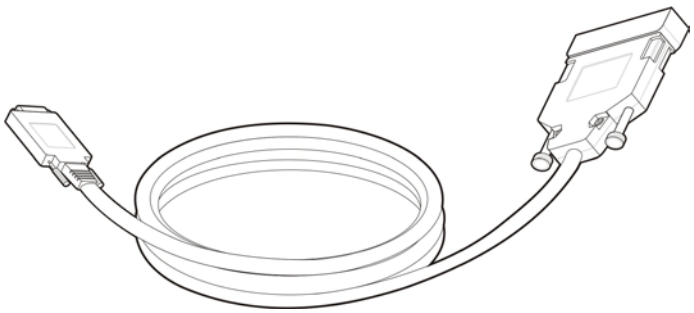

Figure A.15 WTE-1SM/2SM Module Cable (V.35 DCE)

Cable Signaling and Pinout

SMART Serial		V.35 RECEPT.	
PIN	**Signal**	**Signal**	**PIN**
22	-	-	-
23	-	-	-
SHELL	-	Shield GND	A
11	I_CTS/RTS+	RTS	C
12	I_DSR/DTR+	DSR	H
8	O_RTS/CTS	CTS	D
7	O_DTR/DSR+	DSR	E
6	B_DCD/DCD+	RLSD	F
19	GND+	-	-
13	B_LL/LL+	LT	K
26	-	GND	B
5	I_RXD/TXD+	SD+	P
18	I_RXD/TXD-	SD-	S
1	O_TXD/RXD+	RD+	R
14	O_TXD/RXD-	RD-	T
4	I_RXC/TXCE+	SCTE+	U
17	I_RXC/TXCE-	SCTE-	W

(Continued)

SMART Serial		V.35 RECEPT.	
PIN	**Signal**	**Signal**	**PIN**
2	O_TXCE/RXC+	SCR+	V
15	O_TXCE/RXC-	SCR-	X
3	B_TXC/TXC+	SCT+	Y
16	B_TXC/TXC-	SCT-	AA
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (V.35 DTE)

Cable Shape

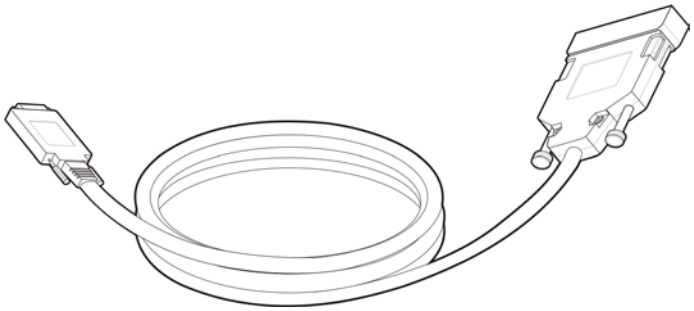

Figure A.16 WTE-1SM/2SM Module Cable (V.35 DTE)

Cable Signaling and Pinout

SMART Serial		V.35 RECEPT.	
PIN	Signal	Signal	PIN
22	-	-	-
23	-	-	-
24	-	-	-
SHELL	-	Shield GND	A
8	O_RTS/CTS	RTS	C
7	O_DTR/DSR+	DTR	H
11	I_CTS/RTS+	CTS	D
12	I_DSR/DTR+	DSR	E
6	B_DCD/DCD+	RLSD	F
19	GND+	-	-
13	B_LL/LL+	LT	K
26	GND	GND	B
1	O_TXD/RXD+	SD+	P
14	O_TXD/RXD-	SD-	S
5	I_RXD/TXD+	RD+	R
18	I_RXD/TXD-	RD-	T

(Continued)

SMART Serial		V.35 RECEPT.	
PIN	**Signal**	**Signal**	**PIN**
2	O_TXCE/RXC+	SCTE+	U
15	O_TXCE/RXC-	SCTE-	W
4	I_RXC/TXCE+	SCR+	V
17	I_RXC/TXCE-	SCR-	X
3	B_TXC/TXC+	SCT+	Y
16	B_TXC/TXC-	SCT-	AA
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS530A DTE)

Cable Shape

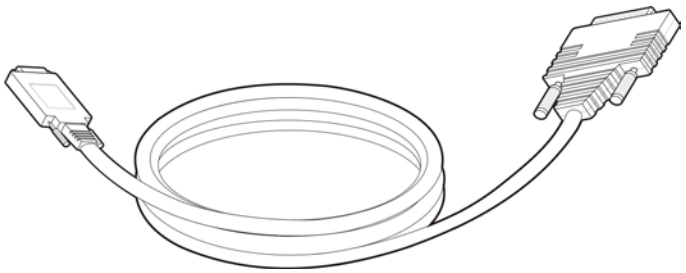

Figure A.17 WTE-1SM/2SM Module Cable (RS530A DTE)

Cable Signaling and Pinout

SMART Serial		DB25 Male	
PIN	Signal	Signal	PIN
21	-	-	-
22	-	-	-
24	-	-	-
SHELL	-	-	1
8	O_RTS/CTS	RTS+	4
9	O_RTS/CTS-	RTS-	19
7	O_DTR/DSR+	DTR+	20
20	GND+	GND	23
11	I_CTS/RTS+	CTS+	5
10	I_DSR/RTS-	CTS-	13
1	O_TXD/RXD+	TXD+	2
14	O_TXD/RXD-	RXD-	14
2	O_TXCE/RXC+	TXCE+	24
15	O_TXCE/RXC-	TXCE-	11
3	B_TXC/TXC+	TXC+	15
16	B_TXC/TXC-	TXC-	12

(Continued)

SMART Serial		DB25 Male	
PIN	**Signal**	**Signal**	**PIN**
4	I_RXC/TXCE+	RXC+	17
17	I_RXC/TXCE-	RXC-	9
5	I_RXD/TXD+	RXD+	3
18	I_RXD/TXD-	RXD-	16
12	I_DSR/DTR+	DSR+	6
25	GND	GND	-
6	B_DCD/DCD+	DCD+	8
19	B_DCD/DCD-	DCD-	10
13	B_LL/LL+	LL	18
26	GND	GND	7
SHELL	-	-	SHELL

WTE-1SM/2SM Module Cable (RS530 DTE)

Cable Shape

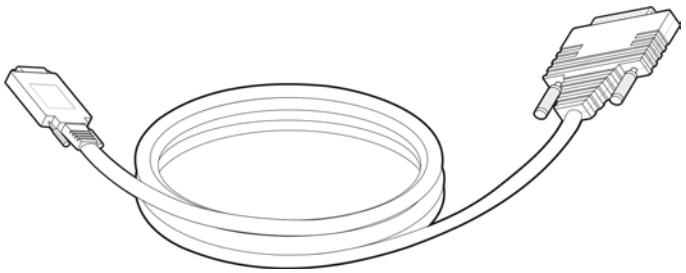

Figure A.18 WTE-1SM/2SM Module Cable (RS530 DTE)

Cable Signaling and Pinout

SMART Serial		DB25 Male	
PIN	Signal	Signal	PIN
21	-	-	-
23	-	-	-
24	-	-	-
SHELL	-	Shield GND	1
8	O_RTS/CTS	RTS+	4
9	O_RTS/CTS-	RTS-	19
7	O_DTR/DSR+	DTR+	20
20	O_DTR/DSR-	DTR-	23
11	I_CTS/RTS+	CTS+	5
10	I_DSR/RTS-	CTS-	13
1	O_TXD/RXD+	TxD+	2
14	O_TXD/RXD-	TxD-	14
2	O_TXCE/RXC+	TxCE+	24
15	O_TXCE/RXC-	TXCE-	11
3	B_TXC/TXC+	TxC+	15
16	B_TXC/TXC-	TXC-	12
4	I_RXC/TXCE+	RXC+	17

(Continued)

SMART Serial		DB25 Male	
PIN	Signal	Signal	PIN
17	I_RXC/TXCE-	RXC-	9
5	I_RXD/TXD+	RXD+	3
18	I_RXD/TXD-	RXD-	16
12	I_DSR/DTR+	DSR+	6
25	I?DSR/DTR-	DSR-	22
6	B_DCD/DCD+	DCD+	8
19	B_DCD/DCD-	DCD-	10
13	B_LL/LL+	LL	18
26	GND	GND	7
SHELL	-	-	SHELL

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Version 2, June 1991

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RSA Data Security, Inc., MD5 message-digest algorithm

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ABBREVIATION

3DES	Triple Data Encryption Standard

A

AES	Advanced Encryption Standard
ATOI	ADSL Transmission Over ISDN
ATOP	ADSL Transmission Over POTS
AS	Autonomous Systems
AUTHD	Authentication Daemon

B

BRI	Basic Rate Interface

C

CAC	Call Admission Control
CAMA	Centralized Automated Message Accounting
CHAP	Challenge Handshake Authentication Protocol
CLI	Command Line Interface
CPE	Customer Premises Equipment
CSPF	Constraint-based Shortest Path First
CSU	Channel Service Unit

D

DDR SDRAM	Double Data Rate Synchronous Dynamic Random Access Memory
DID	Direct Inward Dialing
DMA	Direct Memory Access
DS	Dual Stack
DS3	Digital Signal level-3
DSP	Digital Signal Processor
DSU	Data Service Unit
DV-MRP	Distance Vector-Multicast Routing Protocol

E

E & M	Ear and Mouse
EAP	Extensible Authentication Protocol
EC	Echo Cancellation
ESD	Electrostatic Discharge Damage

F

FR	Frame Relay
FTP	File Transfer Protocol
FXO	Foreign Exchange Office
FXS	Foreign Exchange Subscriber

G

GRE	Generic Routing Encapsulation
GUI	Graphic User Interface

H

HDLC	High-level Data Link Control
HSSI	High Speed Serial Interface

I

IGMP	Internet Group Management Protocol
IP	Internet Protocol
IP PBX	Internet Protocol Private Branch Exchange
IPSec	Internet Protocol Security
iPX	IP PBX
IVM	Integrated Voice Mail

L

L2TP	Layer 2 Tunneling Protocol
LAN	Local Area Network
LLQ	Low-Latency Queuing
LVBO	Local Voice Busy Out

M

MAC	Media Access Control
MLDv1	Multicast Listener Discovery Protocol
MLPP	Multi Level Precedence and Preemption
MSTP	Multiple Spanning Tree Protocol

N

NCP	Network Control Protocol

O

OPX	Off Premises Extension
OSPF	Open Shortest Path First

P

PAP	Password Authentication Protocol
PDU	Packet Data Unit
PDU	Protocol Data Units
PIM	Protocol Independent Multicast
PIM-SM	Protocol Independent Multicast-Sparse Mode
PLAR	Private Line Automatic Ringdown

PoE	Power-over-Ethernet
POTS	Plain Old Telephone Services
PPP	Point to Point Protocol
PSAP	Public Service Answering Point
PSTN	Public Switched Telephone Network

Q

QoS	Quality of Service
QRM	Quality of service Resource Manager

R

RIP	Routing Information Protocol
RIPng	Routing Information Protocol next generation
RMON	Remote Network Monitoring
RP	Rendezvous Point
RSTP	Rapid Spanning Tree Protocol
RTOS	Real-Time Operating System

S

SDP	Session Description Protocol
SF	Smart Forwarder
SFP	Small Form Factor Pluggable
SIP	Session Initiation Protocol
SLA	Service-Level Agreement
SMB	Service Message Block
SNMP	Simple Network Management Protocol
SODIMM	Small Outline Dual In-line Memory Module
STP	Spanning Tree Protocol

T

TCP	Transmission Control Protocol
TDM	Time Division Multiplexer
TFTP	Trivial File Transfer Protocol
TLS	Transparent LAN Service

U

UDP	User Datagram Protocol
USB	Universal Serial Bus
UTP	Unshield Twisted Pair

V

VAD	Voice Activity Detection
VC	Virtual Circuit
VCID	Virtual Circuit Identification
VLAN	Virtual Local Area Network
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network

W

WAN	Wide Area Network

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WEEE SYMBOL INFORMATION

Correct Disposal of This Product (Waste Electrical & Electronic Equipment)

(Applicable in the European Union and other European countries with separate collection systems)

This marking on the product, accessories or literature indicates that the product and its electronic accessories (e.g., charger, headset, USB cable) should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

BATTERY SYMBOL INFORMATION

Correct disposal of batteries in this product

(Applicable in the European Union and other European countries with separate battery return systems.)

This marking on the battery, manual or packaging indicates that the batteries in this product should not be disposed of with other household waste at the end of their working life. Where marked, the chemical symbols Hg, Cd or Pb indicate that the battery contains mercury, cadmium or lead above the reference levels in EC Directive 2006/66.
If batteries are not properly disposed of, these substances can cause harm to human health or the environment.

To protect natural resources and to promote material reuse, please separate batteries from other types of waste and recycle them through your local, free battery return system.

Ubigate iBG2006™

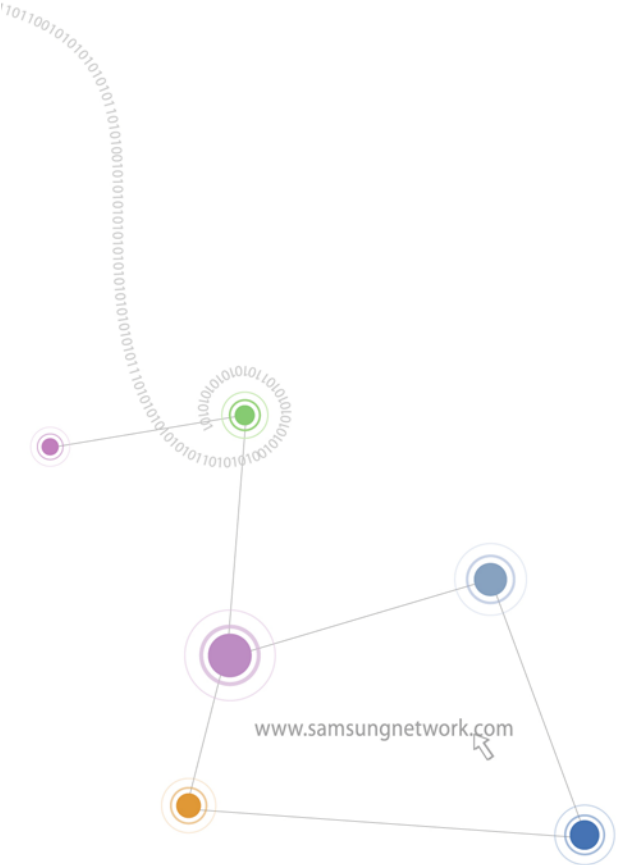
System Description

SAMSUNG ELECTRONICS

SAMSUNG DIGITall
everyone's invited™

Experience the power of one
Ubigate iBG2006™

System Description



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