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BlueBoC™

Bluetooth™
Bridge-on-Chip

Sweden • USA • Finland

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Bluetooth Bridge-on-Chip

Product Description

BlueBoC™ is a highly integrated chip providing a plug-and-play solution for Bluetooth connections to the Internet. The chip supports cost efficient Bluetooth-to-Ethernet bridging and makes use of embedded TCP/IP protocols. One of the target applications is high speed modems eg. ADSL and cable modems. BlueBoC provides zero-configuration wireless Ethernet user access to these modems and to TCP/IP applications. BlueBoC simultaneously supports up to seven active users in a Bluetooth piconet. BlueBoC implements the GN (Group Network) and NAP (Network Access Point) profiles of PAN (Personal Area Networking).

Key Features

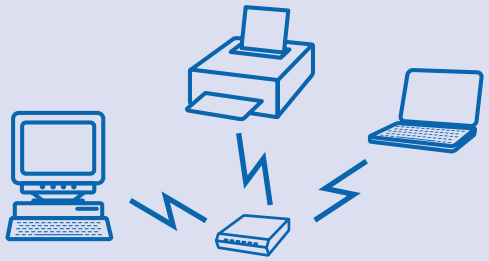
1. Highly integrated Bluetooth-to-Ethernet Bridge device for Hubs, ADSL/Cable modems and Access Points.
2. Bridge between Bluetooth units and between Bluetooth and Ethernet.
3. Compliant with Bluetooth Specification 1.1.
4. Bluetooth Baseband Controller and embedded Bluetooth Stack.
5. IEEE 802.3-compliant Ethernet Media Access Controller (MAC).
6. Media Independent Interface (MII) that connects to any standard IEEE 802.3-compliant 10/100-Mbps physical layer (PHY) device.
7. Embedded TCP/IP protocols.
8. Embedded processor, RTOS and Applications.
9. Supports standard radio interfaces (e.g. Uni- and Bidirectional BlueRF).
10. Remote configuration via SNMP based man-agement with standard MIB support.
11. Security based on Radius and IEEE 802.1x LAN access security.

BlueBoC™ for PAN – application areas

The advent of the Bluetooth PAN (Personal Area Networking) protocol and profile signals the coming of a new generation of datacom products based on Bluetooth. PAN is essentially based on the BNEP (Bluetooth Network Encapsulation Protocol) which emulates Ethernet over Bluetooth. BNEP's low overhead and Ethernet's plug-and-play features match perfectly the characteristics of Bluetooth protocols such as baseband, link management, and service discovery. This presents a radical change from previous solutions in which Bluetooth was indeed treated as a "cable replacement" technology, leading to the continued use of heavy serial line emulation protocols on top of this new type of "cable".

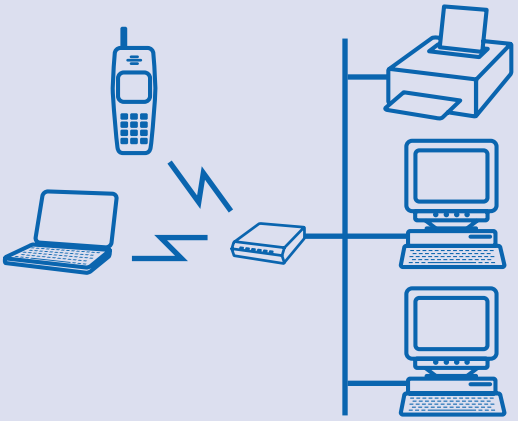
With PAN the technology moves from mere physical cable replacement to both physical and operational cable replacement. This is essential for ad-hoc group networking. It will greatly improve Bluetooth's usefulness and appeal in day-to-day use in a wide range of products, as illustrated below.

As a stand-alone Bluetooth wireless Ethernet bridge/hub in home networks



Integrated, or plug-in, into cable or ADSL modems

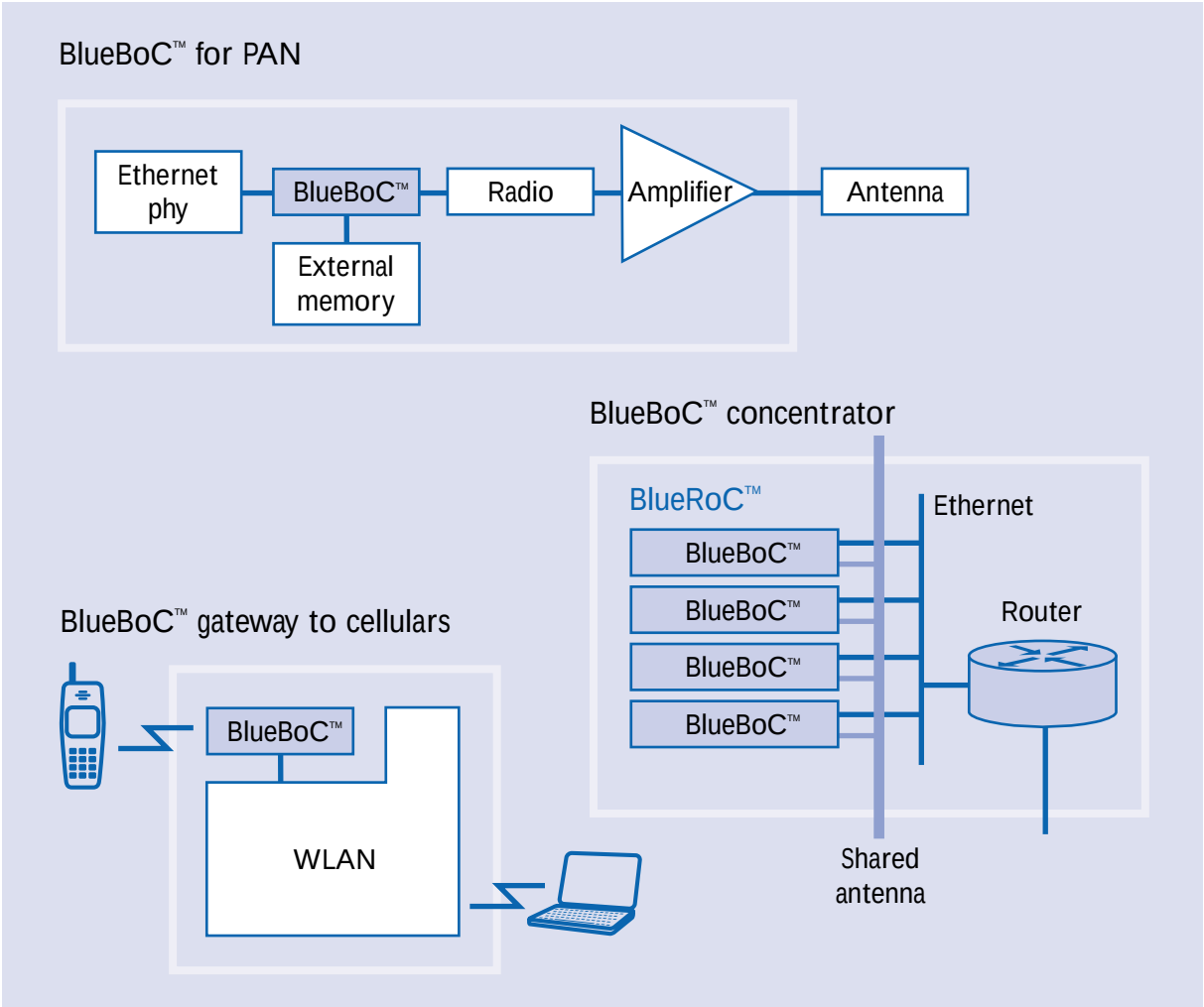
As a stand-alone network access point in small offices, shops, restaurants etc



BlueBoC™ reference designs

BlueBoC is a highly integrated chip that can be applied in various products as illustrated by a number of reference designs provided:

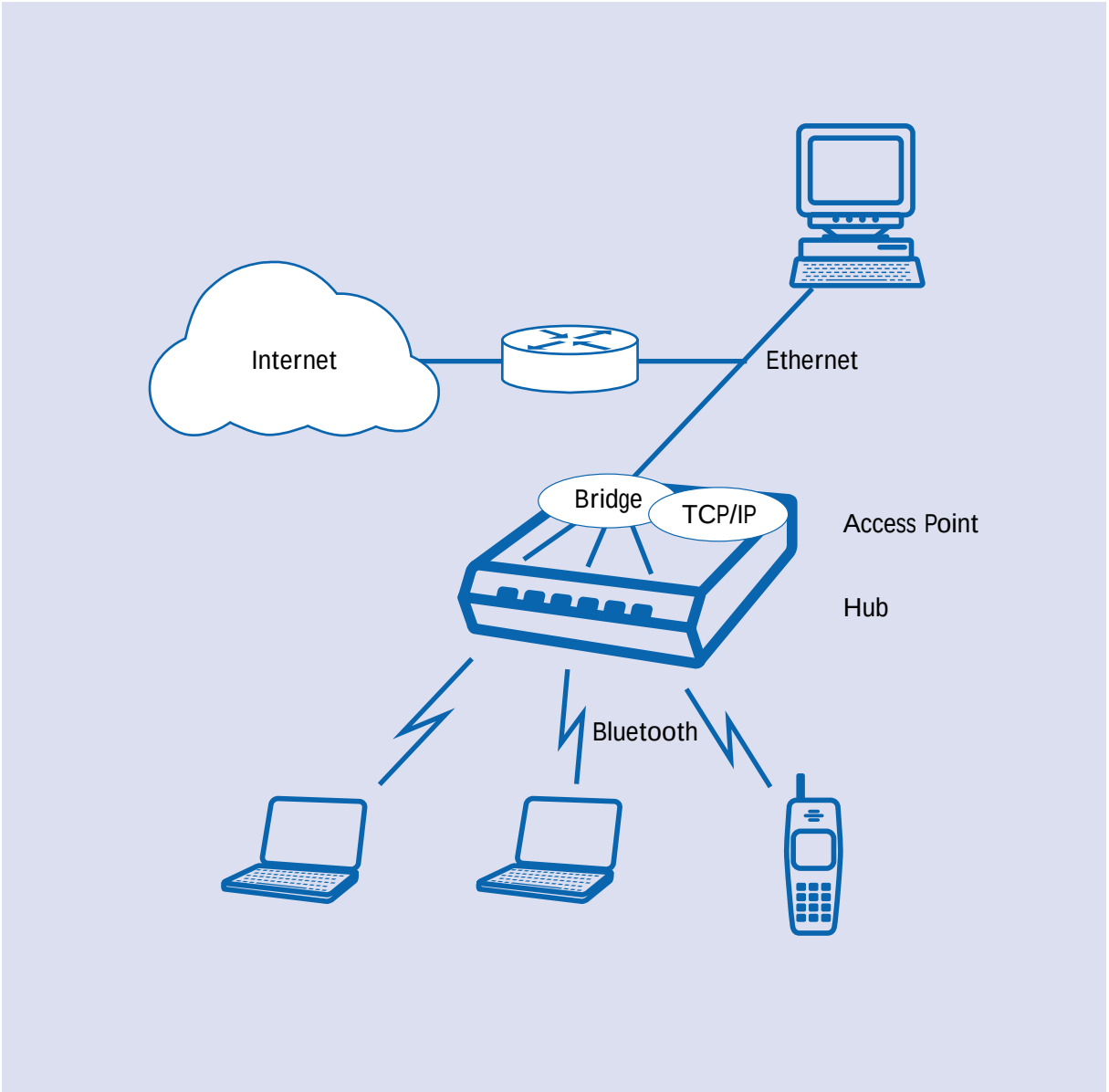
1. BlueBoC for PAN: This reference design includes the necessary external components to implement access points based on Bluetooth. It consists of the BlueBoC chip and external components for memory, radio, antenna and the optional Bluetooth 100 meter range amplifier.
2. BlueBoC concentrator: This reference design implements BlueRoC (Router-on-Chip set) by concentrating a number of BlueBoCs into a compact device. The patented system solution implements a shared antenna system. This enables BlueRoC to circumvent physical constraints otherwise imposed by radio saturation problems. BlueBoCs are further interconnected via an Ethernet backplane. Each BlueBoC forms a piconet, and up to 10 BlueBoC piconets can operate within the same geographical area without intrusive service degradation.
3. BlueBoC gateway to cellulars: This reference design combines BlueBoC for PAN with an access point based on Wireless LAN (IEEE 802.11a). This can be used in products that wish to serve both WLAN enabled laptops and palmtops, as well as PAN-enabled cellulars.



Ethernet bridging using BlueBoC™

An access point based on BlueBoC will typically operate as a bridging device forwarding Ethernet frames between PAN users connected to it over Bluetooth. Such users can be PAN-enabled portables and cellular phones. BlueBoC based access points will also provide data forwarding between PAN users and external units over the Ethernet interface. Access control can be enforced through authentication by using Radius servers accessible over the fixed Ethernet interface.

The embedded TCP/IP on BlueBoC is used both to manage the access point/hub as well as to support embedded applications, e.g. a locally resident WAP/Web server. The Ethernet back-end can also be employed to remotely manage the access point or to perform content management of the embedded applications.

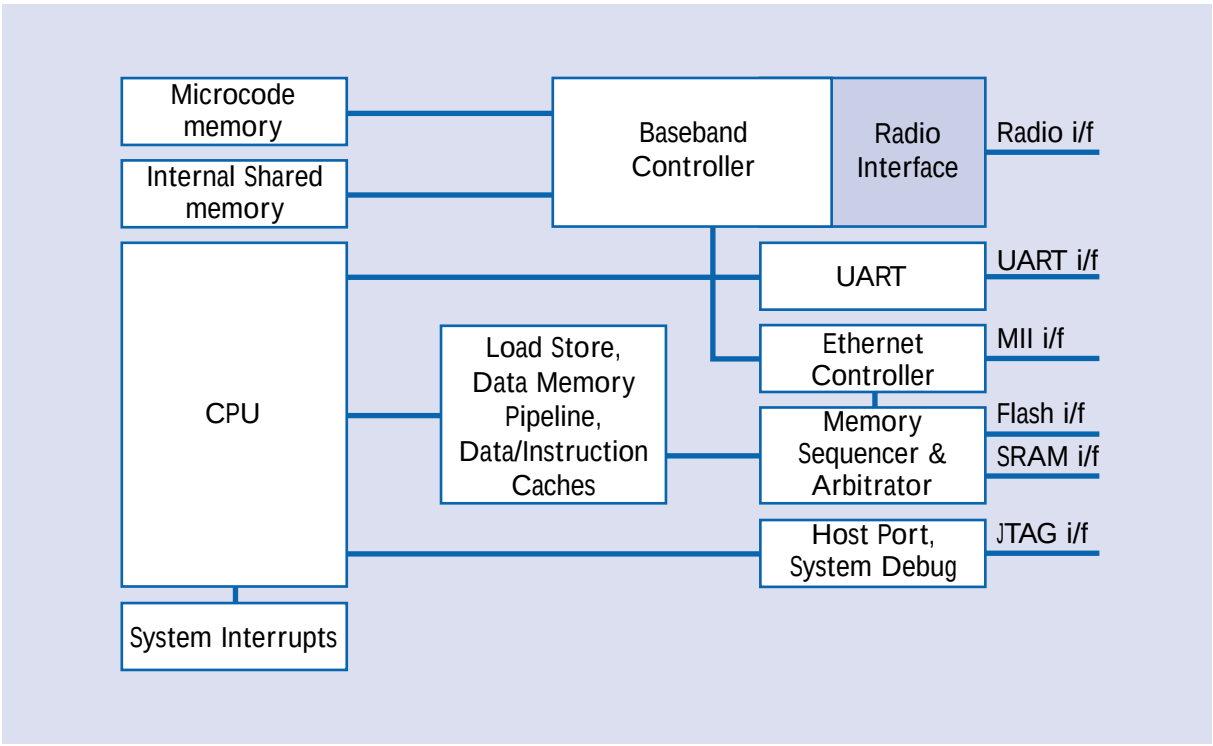


System overview

BlueBoC integrates the following components in a single chip:

1. Bluetooth baseband controller performs all of the real time activities required by the physical and part of the link controller layers defined by the Bluetooth protocol stack.
2. On-chip RAM implementing a shared memory area, and required for payload buffering, bridge filtering database etc.
3. IEEE 802.3-compliant Ethernet Media Access Controller (MAC) with Media Independent Interface (MII) that connects to any standard IEEE 802.3-compliant 10/100-Mbps physical layer (PHY) device.
4. Embedded Bluetooth protocol stack which integrates the Lower Layer with the Upper Layer (LM, HCI, L2CAP and SDP).
5. A high-quality, scalable RTOS (Real-Time Operating System) offering full functionality for concurrent operation, reconfiguration, and multiprocessing.
6. A Real-Time TCP/IP Communications Suite including support for TCP, IP, UDP, Telnet, HTTP and SNMP.
7. Timers and interrupt handling logic.
8. Programmable radio interface for interfacing to different radio architectures including a number of programmable general purpose register which could be mapped to a specific radio control line. By default, BlueBoC is configured to support the Unidirectional BlueRF interface (e.g. used in Ericsson IP based products).
9. Embedded PAN profile and NAP/GN Bridging Service.

BlueBoC™ block diagram



Software architecture

BlueBoC implements the Generic Access Profile (GAP) and the two PAN profiles, Network Access Point and Group Network. These profiles provide Ethernet bridging services.

BlueBoC applications are built on a high-quality, scalable RTOS which offers full functionality for concurrent operation, reconfiguration, and multiprocessing.

The TCP/IP stack provides a UNIX BSD 4.4 compatible socket library for embedded BlueBoC applications to communicate with TCP/IP peers across the network. The stack includes support for TCP, IP, UDP, HTTP, SNMP and Telnet.

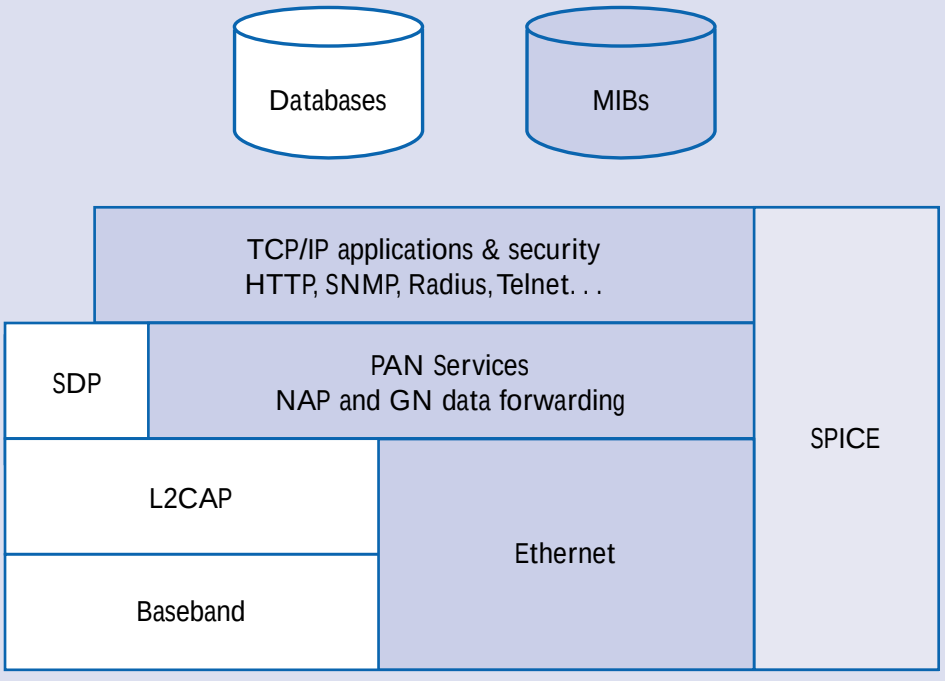
The Bluetooth protocol stack consists of the Bluetooth upper protocols, an integrated (embedded) HCI layer, the Bluetooth lower layer protocols, a baseband device driver and an infrastructure holding all in place and providing software services to the protocols.

The Network Access Point (NAP) bridging entity provides MAC relay services between any device connected to the Bluetooth NAP service and the Ethernet interface (IEEE 802.3 physical port). It implements the parts of IEEE 802.1D (bridging) applicable to Bluetooth Personal Area Networks as specified in the Bluetooth SIG PAN Profile. This includes learning, forwarding and basic filtering. The NAP entity further provides access to the SNMP/HTTP based network management entity of BlueBoC.

The Group Network (GN) entity is similar to NAP with the difference that it only bridges between devices connected via Bluetooth. Hence, GN does not forward traffic to the physical Ethernet interface. This can be employed to confine Bluetooth Ethernet packets to the local piconet.

SPICE is the Spirea Control Entity. It implements key element management and control functions of BlueBoC. It distributes events to applications and configures underlying Bluetooth resources to accommodate actual needs, e.g. discoverability and connectability. SPICE employs HCI to configure the radio and link controller resources.

Protocol stack overview



External interfaces

The default Ericsson radio interface is able to perform all functionality needed to establish a robust and fast connection to the baseband controller. The interface is able to support the unidirectional method for data transfer between the RF transceiver and the baseband controller according to the BlueRF specification and it will support the RXMODE2. The supported serial control interface is JTAG based on the Boundary-Scan Architecture (IEEE1149.1). The interface signals are grouped in four interfaces; the data interface, input control interface, output control interface and serial control interface. The serial interface uses a JTAG serial communication protocol. The protocol is compliant with the IEEE Std 1149.1.

The MAC controller complies with IEEE 802.3. It fully supports 10- or 100-Mbps and half- or full duplex operations. It further has a media-independent interface (MII) that connects to any standard IEEE 802.3-compliant 10/100-Mbps physical layer (PHY) device.

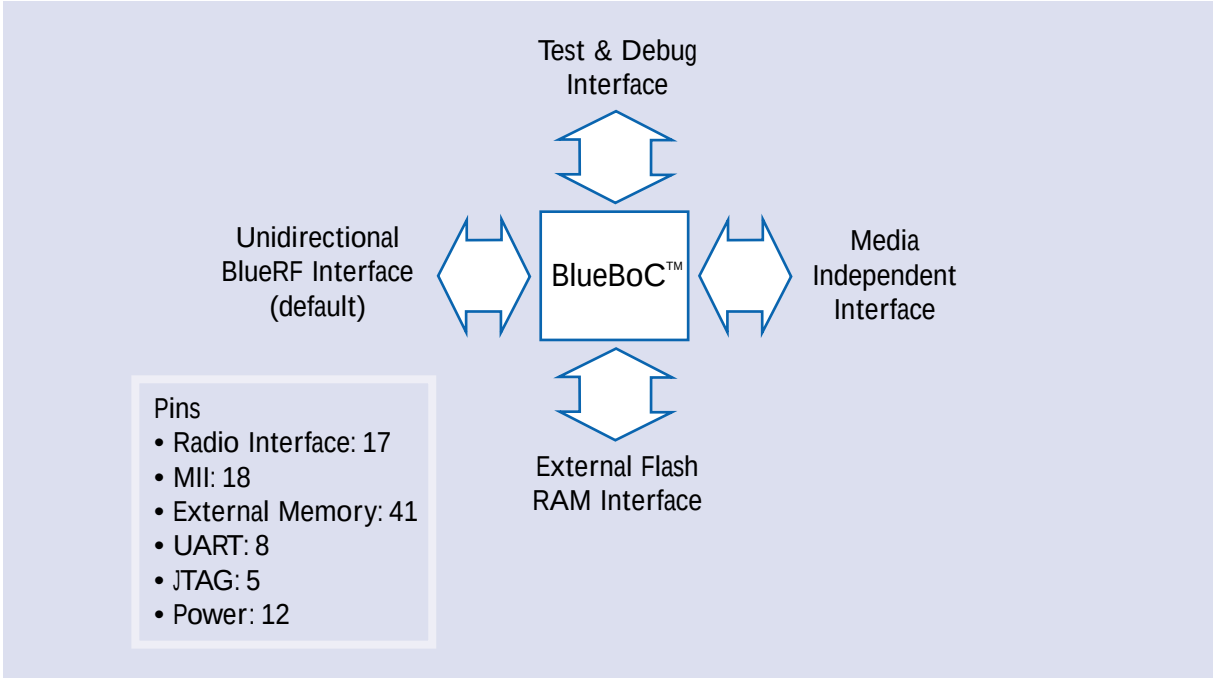
MII has the following characteristics:

1. Capable of supporting 10 Mbs and 100 Mbs rates.
2. Synchronous to CPU clock reference.
3. 4-bit wide transmit and receive data paths.
4. It provides a simple management interface.
5. It provides a full duplex operation.

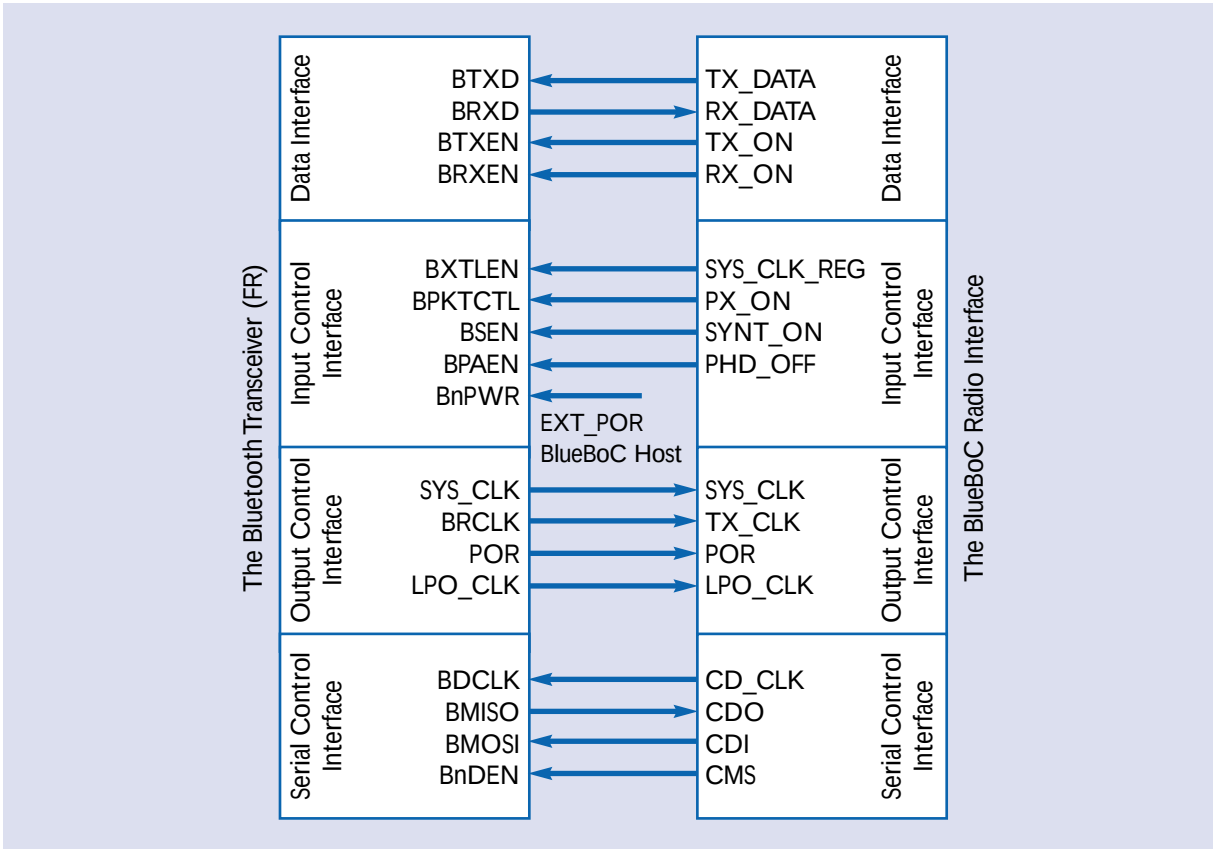
BlueBoC memory interface supports 2 Mbyte SRAM data memory configured as two 1 Mbyte memory banks. It also supports Flash for program memory. The address bus is 20 bit wide to allow 1 Mbyte within each bank. This configuration provides a 16-bit SRAM with byte support. Data could be stored and loaded in SRAM in byte format (8-bit) or word format (16-bit). Program code is fetched from the FLASH only in word format (16-bit).

UART is an Universal Asynchronous Receiver Transmitter with integrated baud rate generator. It is used for the test and debug interface. It is also used to flash the software. It supports ASYNCH, 8-bit data, one stop bit and no parity. The baud rate used for BlueBoC is 115200. The default direction is DTE type. JTAG serial communication protocol is supported for BlueBoC. The protocol is compliant with the IEEE Std 1149.1.

BlueBoC™ interfaces



Radio interface



Network management and security

Network management and security facilities are essential for access points and their operators and users. BlueBoC implements a well balanced set of embedded such facilities to enable simple and secure operation while maintaining efficiency. The facilities are useful both for access points and hubs used in isolation or in very large access networks.

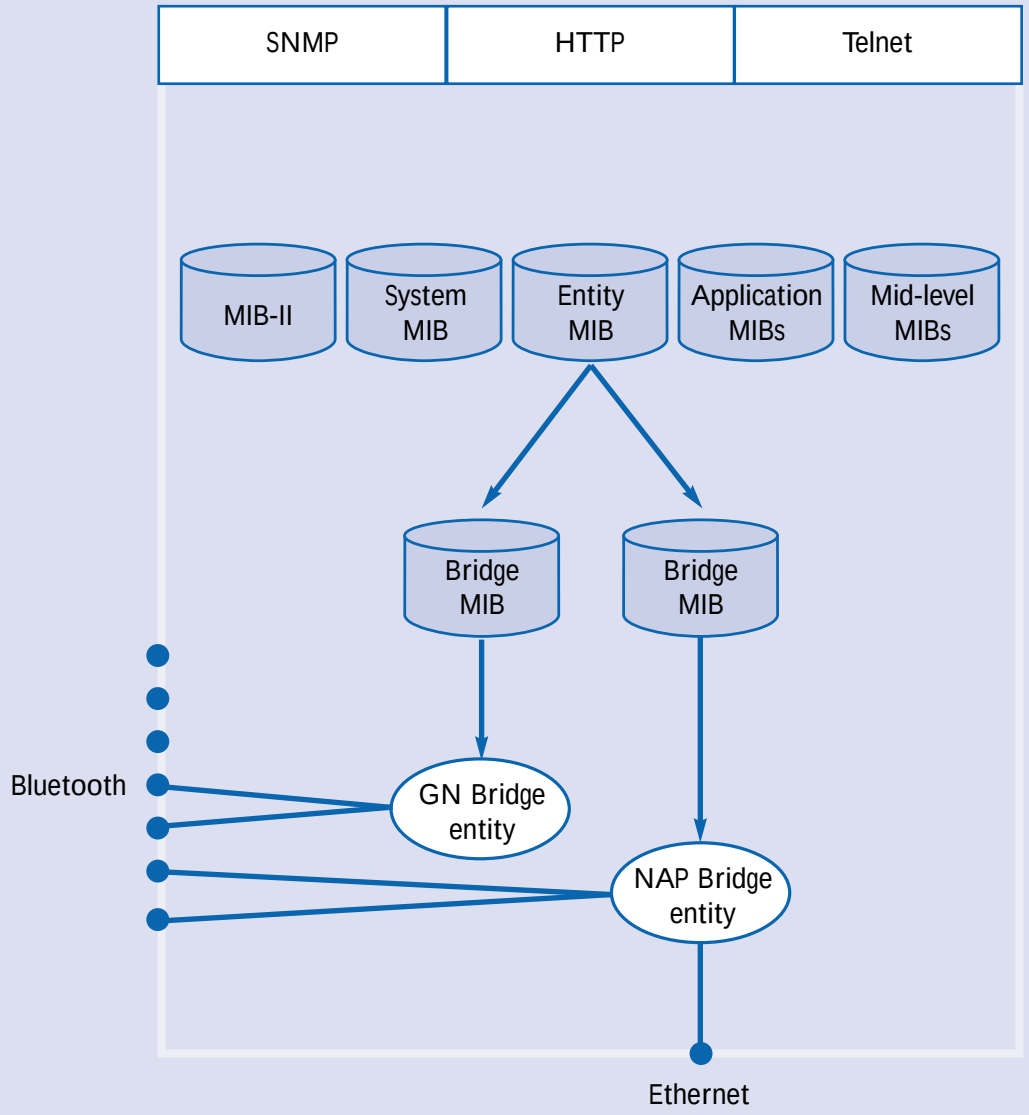
The following MIBs (Management Information Bases) are included on BlueBoC:

1. MIB II (RFC 1213), including Interfaces, IP, TCP, UDP, and SNMP groups.
2. Entity MIB (RFC 2737), to support management of multiple bridging entities
3. Bridge MIB (RFC 1493), to manage the bridging entities.
4. Application and system MIBs pertaining to the running software and system environment, as well as to key Bluetooth baseband objects and objects pertaining to SIG profile system parameters. These MIBs include variables for managing host systems and applications, derived from RFC 1514, RFC 2287, and others.
5. Scheduling MIB (RFC 2591), to support scheduling of actions internally within BlueBoC, e.g. to reconfigure baseband parameters depending on the expected load.

Any SNMP version is supported, and the extensible SNMP agent is easily enhanced with additional MIBs. Web access via standard web browsers to the MIBs is also provided, as well as Telnet login. For access point manufacturers targeting very large neworks, distributed network management facilities can easily be accommodated for.

BlueBoC relies on IEEE 802.1x for service security of the NAP service. The Extensible Authentication Protocol (EAP) Over LAN (EAPOL) is used for this. Port access control is achieved through authentication via a RADIUS server.

BlueBoC™ network management facilities



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- Focus on low cost solutions

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