microelectronics group

Lucent Technologies
Bell Labs Innovations

NEWPORT ATM Access SoC

Features

- System-on-a-chip IC supports low-speed ATM access for next-generation wireless base transmission station, base station controller, and wireline remote access concentrator applications.
- IC provides an integrated octal framer that supports T1/E1/J1/J2 formats.
- Supports inverse multiplexing over ATM (IMA) over selected group and link mappings ranging from four 2-link groups up to one 8-link group per ATM Forum AF-PHY-0086.000.
- Integrates an AAL2/AAL5 segmentation and reassembly (SAR) function for support of low-speed data or voice traffic per ITU I.363.2 & ITU I.363.5 respectively.
- Enables ATM layer user network interface (UNI) or IMA mode, selectable on a per-link basis for flexible transport of delay-critical voice and data traffic.
- Enables cell-site daisy-chaining through cell switching of pass-through traffic via an ATM switch.
- Guarantees QOS for a variety of traffic types (including delay-sensitive voice, real-time data, non-real-time data, and signaling information) through an advanced hierarchical three-level priority scheduler and per-VC queueing.
- Support for 2048 AAL2 CIDs (up to 250 per link).
- Support for 2048 high-speed data connections (VCs) via integrated context memory.
- Filters control cells and accepts control cells via host microprocessor interface.
- Designed in 0.16 µm, low-power CMOS technology.
- 3.3 V digital I/O compatibility; 1.5 V core power supply.
- –40 °C to +85 °C temperature range.
- 520-pin EBGA package

Description

NEWPORT provides a highly flexible network interface solution for next-generation wireless infrastructure applications requiring transport of voice, data, and video. Efficient transport of narrowband voice and broadband data information in ATM access applications requires guaranteed network QOS for user and transmission efficiency for wireline and wireless network operators. Constructed using Lucent's state-of-the-art 0.16 µm CMOS technology, the chip has an integrated octal framer, IMA processor, cell scheduler and router, and AAL2/AAL5 SAR functions. The advanced cell scheduler implementation and algorithms are leveraged from Bell Laboratories' research for best-in-class operation.

NEWPORT operates in either UNI or IMA mode (selectable on a per span-line basis). The complete AF-PHY-0086.000 MIB is supported. Flexible provisioning of link and group combinations are possible to enable a mix of IMA and UNI mappings. For example, four span-lines may be provisioned in UNI mode to transport AAL2-mapped voice traffic while four different span lines may be provisioned as a single IMA group to transport AAL5-mapped high-speed data traffic. Or all eight spans may be provisioned as a single IMA group to transport both AAL2 and AAL5 VCs with traffic-shaping over the high-speed link.

Support for AAL2 is provided via an SSCS function that maps/demaps variable-sized packets from AAL0 cells into/from AAL2 CIDs. A single AAL2 VC is supported per span-line along with the maximum amount of CIDs per VC (250). Up to 64 AAL2 VCs are programmable on the TDM interfaces.

High-speed data traffic is carried in AAL5 VCs which are routed through from the span-line(s) to the system interface switch fabric toward their destinations. NEWPORT provides support for up to 2048 simultaneous AAL5 VCs via an internal context memory.

NEWPORT provides integrated policing, F4/F5 OAM cell processing, and statistics collection for performance monitoring. Communication with NEWPORT is accomplished through a 32-bit microprocessor interface.

Description (continued)

The system interface is through a UTOPIA-2 interface with support for both 8-bit and 16-bit data bus width.

Future enhancements of NEWPORT include IMA expansion port for 23 additional links with group control provided by NEWPORT.

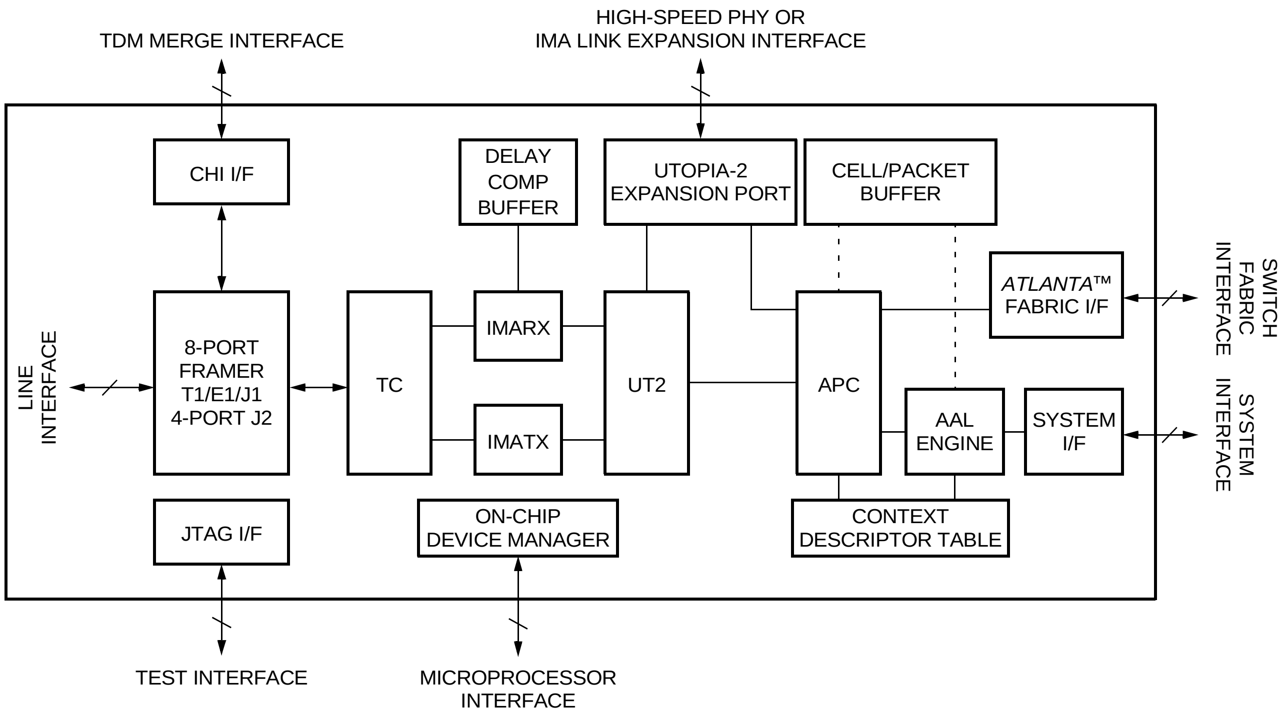

Figure 1. Block Diagram of NEWPORT Device

Applications

NEWPORT is intended for use in next-generation wireless base transceiver stations (BTSs) and base station controllers (BSCs). With the advent of new subscriber personal data assistants and air-interface technology that enable higher user access bit rates, wireless infrastructure must be designed to efficiently transport a broad range of data, ranging from low-speed compressed speech (~8 kbits/s per user) up to high-speed data (~384 kbits/s per user). Moreover, the high-speed data may consist of real-time (delay-sensitive) or non-real-time (delay-insensitive) user information. The BSC to BTS interface should ensure efficient transmission to minimize operating costs of the wireless network infrastructure in the presence of bursty high-speed data.

Efficient voice and data transport will be required with existing legacy TDM transmission or with SONET transmission to minimize operating costs for the service provider. Efficient transport will be provided by ATM infrastructure and associated AAL2 and AAL5 processing of voice and data.

As shown in Figure 2, NEWPORT resides on a network interface card (NIC) to receive ATM cells and to distribute them to destination modem line cards within the BTS.

NEWPORT may be used in an analogous manner on the BSC span-line terminator function to terminate/source IMA groups and perform AAL2 SSCS functionality (for routing individual packets to destination transcoder elements in the reverse link and for multiplexing packets into an AAL2 VC in the forward link).

Likewise, AAL5 VCs are routed through to the destination modem function within the BSC (and perhaps to an external interworking function (IWF) for processing of packet-switched or circuit-switched data).

Applications (continued)

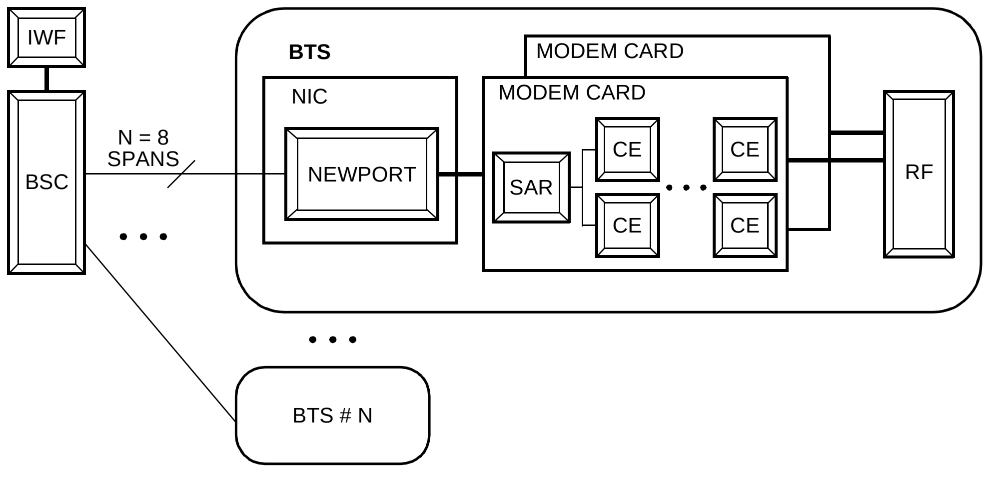

Figure 2. BTS NIC Application

In general, AAL2 VCs are used to transport compressed speech traffic while AAL5 VCs are used to transport high-speed data traffic. Because AAL2 CIDs may be destined for different channel elements, NEWPORT provides an AAL and SSCS function to demap individual packets (CIDs) from the AAL2 VC and to forward them to their destinations via AAL0 cells (possibly performing a reassembly function in the case of straddled cells). Similarly, AAL5 VCs may be destined for different channel elements. However, in this case, the AAL5 SAR function is done on the modem channel card so that the entire packet may be reassembled prior to encoding and block interleaving operations performed on the packet prior to transmission over the air. NEWPORT merely forwards AAL5 cells toward their destination, performing only a logical-to-physical address translation.

In order to meet QOS latency requirements for real-time sensitive high-speed data packets, the BSC to BTS interface may consist of one or more IMA groups. IMA provides a method of aggregating the capacity of several span-lines into a high-speed interface by distributing cells across the individual links in a round-robin sequence at the transmit end. At the receive end, the IMA machine demultiplexes the cells from the individual links into a composite high-speed interface. NEWPORT provides full flexibility to allocate span-lines into IMA groups or as UNI links. The result of IMA is that large packets are transmitted with lower latency while the network operator utilizes low-speed span-lines that cost less than higher-speed links such as T3/E3. Also, T3/E3 link access may not be readily available to meet topologies for typical BTS deployments.

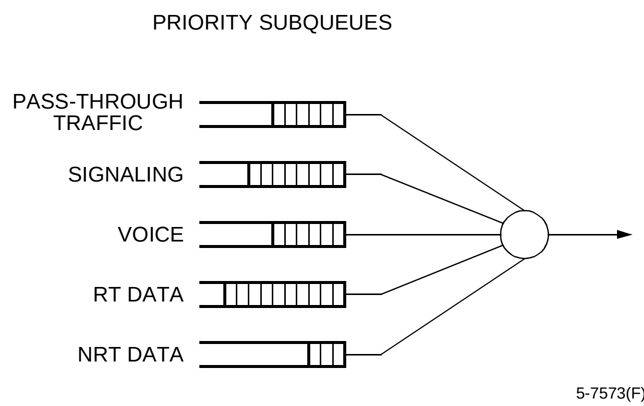

Figure 3. Egress Scheduler, 1 per PHY

Table 1. Illustration of Latency Reduction by IMA

User Rate	ΔT1	ΔN x T1
14.4 kbits/s	NA	NA
144 kbits/s	1.875 ms	NA
384 kbits/s	5 ms	2.5 ms @ 2 links/group
2048 kbits/s	26 ms	3.25 ms @ 8 links/group

Applications (continued)

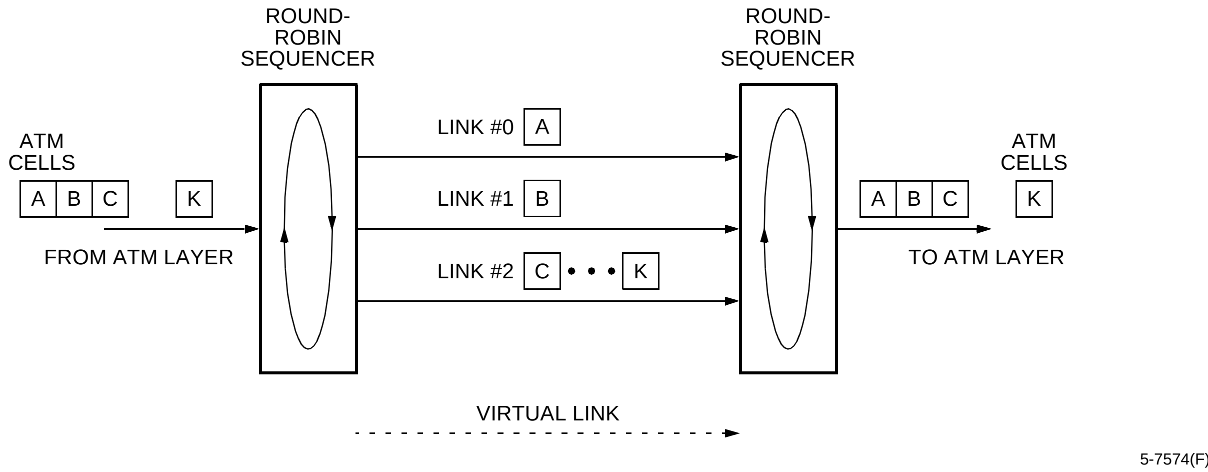

Figure 4. IMA Concept

Datacom Applications

NEWPORT is also intended for data applications in products such as remote access concentrators and edge or access switches.

The edge or access application typically aggregates several low-speed ATM lines into a higher-speed channel for efficient access to a backbone network. This application is illustrated in Figure 5. NEWPORT manages traffic transports across the low-speed TDM links for multiple T1/E1 IMA links or UNI links. NEWPORT provides a direct interface to Lucent's high-speed ATM switching devices.

The remote access concentrator application typically provides aggregation and compression of several low-speed lines (carrying 64 kbits/s PCM voice or low-speed data) onto a statistically multiplexed, concentrated span-line. This voice trunking application is illustrated in Figure 6 with ATM layer management and AAL2 processing.

NEWPORT provides the ability to terminate such ATM data as well as to map compressed voice and minipackets into ATM/AAL2 for transport over low-speed span-lines.

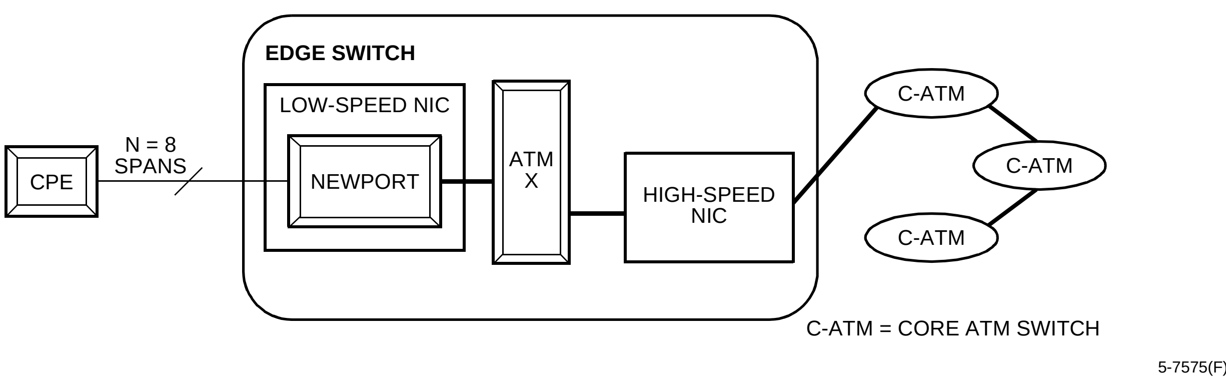

Figure 5. Edge/Access Switch Application

Applications (continued)

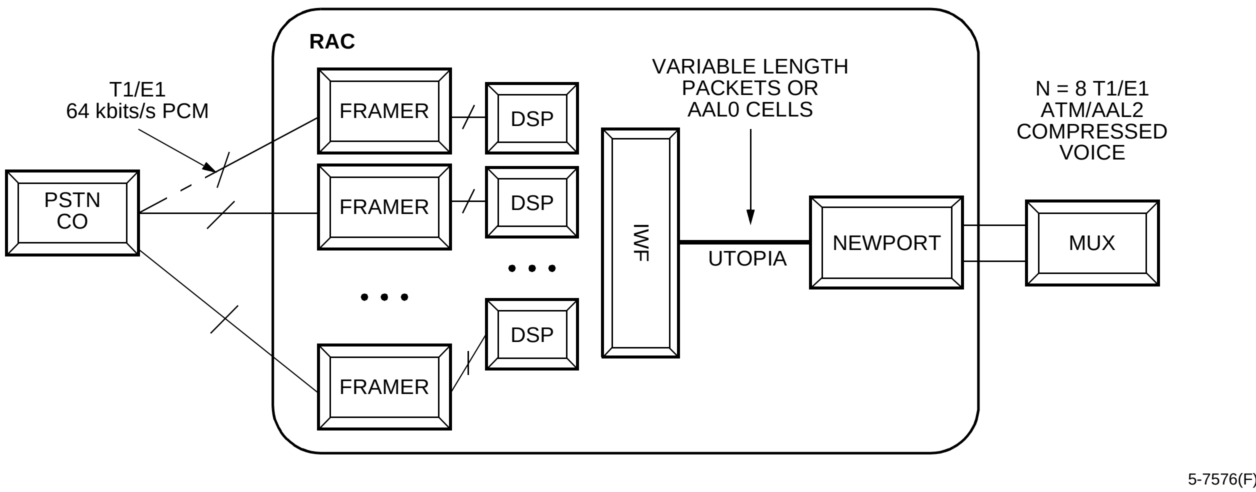

Figure 6. Remote Access Concentrator Application

High Performance

NEWPORT's scalable architecture is designed to support non-low-speed access, such as T3, E3, or OC-3, using external framers. In effect, the T1/E1/J1/J2 framer, transmission convergence function, and IMA blocks are bypassed for access to the ATM scheduler and SAR functions. The high-speed ATM access application is illustrated in Figure 7. The framer-bypass mode is enabled because the SAR/scheduler engine is scalable up to 155 Mbits/s.

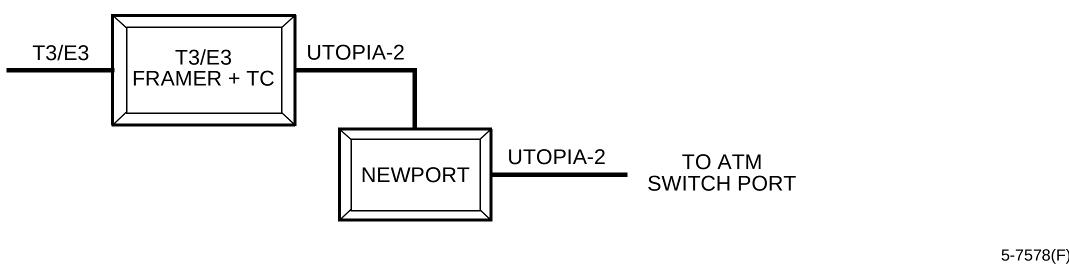

Figure 7. High-Speed Access

Future Enhancements

- Increased connection management to 16k CIDs
- DSL IMA management to 8—32 links

Standards

- ITU I.363.2
- ITU I.366.1
- ITU I.366.2
- ITU I.363.5
- ITU I.432
- ITU I.361
- ITU I.371
- ITU G.704
- ITU G.804
- ITU G.732
- ITU G.706
- ITU I.610
- ITU G.775
- ITU G.773
- ITU G.735
- ITU G.965
- ITU O.162
- *ANSI** T1.403
- *ANSI* T1.231
- ATM Forum af-phy-0086.000
- ATM Forum af-phy-0086.001
- ATM Forum af-phy-0029.000
- ATM Forum af-phy-0039.000
- ATM Forum Traffic Management 4.1
- ETS 300.417-1-1
- TR-NWT-000170

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