



Cellular Backhaul

The bandwidth upsurge associated with the rollout of new mobile broadband and 4G services shifts the transport burden to the RAN (radio access network) backhaul – the connections between the base stations and their controllers. While in the past a small number of E1/T1 links were sufficient to service 2G and some 3G traffic, the bandwidth requirements of HSPA, 3GPP's UTRAN LTE and mobile WiMAX are of a different scale altogether, leading cellular operators to re-evaluate their backhaul strategy.

Fierce competition is another major factor in the changing landscape of cellular backhaul; one which prevents operators from passing on the costs related to capacity enhancements to the mobile users, who expect more bandwidth and higher quality at lower service rates. The key to successfully controlling the growth in mobile traffic is in decoupling bandwidth from cost, by optimizing transport capacity and migrating to cost-effective backhaul technologies, such as Carrier Ethernet, IP, MPLS, and DSL. As a result, current industry consensus identifies future-proof all-IP RANs as a necessity.

However, while the transition to packet technology is already under way, it nevertheless poses some major challenges for mobile operators and transport providers who need to simultaneously ensure service continuity for legacy 2G (TDM) and 3G (ATM) traffic, while guaranteeing quality requirements for emerging data-intensive and rich-media applications. Service quality is of particular importance in Ethernet, IP and MPLS networks as they inherently introduce impairments, such as packet delay, delay variation and packet loss. For packet transport to meet the "SDH/SONET or better" performance levels that are required for mobile networks, accurate and efficient implementations of resilient clocking and synchronization schemes are a must.

RAD's ETX-204A Carrier Ethernet demarcation device (see page 62-63) and ACE-3xxx multiservice gateways (see pages 74-83) enhance throughput and allow a smooth transition to next-generation backhaul, while minimizing capital investments and shortening service rollout times.

Flexible migration paths

RAD's portfolio of cell-site and aggregation-site gateways offers flexible migration paths to packet backhaul using any available infrastructure, including DSL and fiber, as well as ATM and SDH/SONET. They enable convergence of multi-generation traffic over a unified, packet switched network (PSN), or the use of a hybrid of two traffic-dedicated transport routes, whereby real-time voice and video are carried over existing SDH/SONET or ATM backbones, while UMTS and HSPA data traffic is delivered over a PSN, using pseudowire encapsulation.

The latter approach, also known as "HSDPA offload," allows operators to begin capitalizing on packet transport's economical benefits, while continuing to utilize legacy infrastructure and ensuring stringent quality of service (QoS) for delay-sensitive services. Moreover, once full migration to packet transport is decided on, RAD's cell-site gateways and aggregation hubs easily support converged networks.

Multiservice gateways, multi-standard pseudowire modes

The ACE-3xxx series delivers 2G TDM, 3G ATM and Ethernet traffic over any transport network, efficiently handling real-time voice and best-effort data with cross-generation support, regardless of the underlying physical layer. Supporting all TDM and ATM pseudowire standards, the devices have enhanced OAM and QoS capabilities which maintain uniform, high performance service delivery and backward compatibility for legacy service continuity



over new networks. This allows operators to amortize their large TDM and ATM installed base while moving to next-generation services and enable interoperability in multi-vendor environments.

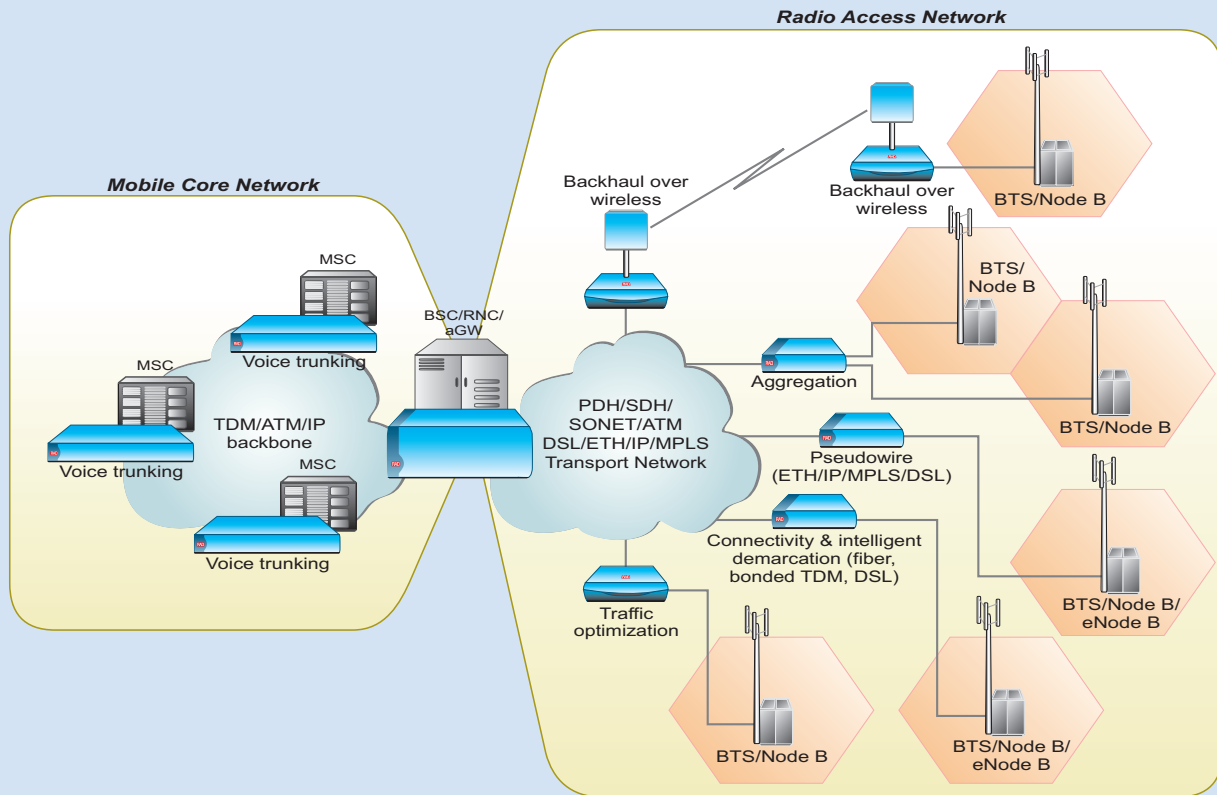
High precision synchronization over packet

The ACE-3xxx gateways enable high performance, robust synchronization over packet switched transport, to eliminate the risk of service disruptions and impaired call hand-offs that may result from inherent inaccuracies. Employing state-of-the-art clock recovery and distribution schemes, such as IEEE 1588v2 Precision Time Protocol (PTP), Synchronous Ethernet, NTR (network timing reference) over SHDSL, and adaptive clock recovery (ACR), RAD's RAN gateways support definite frequency accuracy limits for various services, such as +/- 16 ppb (parts per billion) for 2G CDMA and 3G UMTS. They also ensure compliance with G.823/824 synchronization interface

requirements per G.8261 specifications, support enhanced holdover mode, and guarantee QoS priorities for clock traffic.

Backhaul over DSLAM infrastructure

RAD Data Communications has been among the first to leverage wide-spread DSLAM deployments for economical cellular transport where fiber is not available. The ACE-3xxx gateways support multiple xDSL flavors, including ADSL2/2+ and SHDSL.bis with EFM (Ethernet in the First Mile), IMA or M-Pair bonding. In addition, they offer software upgrades to include VDSL capabilities. Such comprehensive functionality presents a convenient solution not only for operators looking for an interim access solution, but also for operators seeking to reduce their dependency on third-party providers as part of a long-term strategy for self-sufficiency.



Cellular backhaul solutions over any network





ACE-3220 Cell-Site Gateway



- **Best-of-breed cell-site gateway, enabling IP RAN access over multimode copper xDSL, as well as over fiber and microwave links**
- **Multiservice support for GSM, GPRS, EDGE, UMTS, HSPA+, LTE, and WiMAX traffic delivery over packet networks**
- **Highly accurate clock regeneration using major industry standards**
- **QoS and traffic management**
- **Multi-standard pseudowire encapsulation over Ethernet, IP and MPLS networks**
- **Interoperable with multiservice aggregation devices from leading vendors with seamless EMS/NMS integration**
- **Small form factor for limited-space installations**
- **Optional temperature-hardened enclosure for outdoor installations (-20°C to 65°C)**

For latest updates visit www.rad.com

RAD's ACE-3220 multiservice cell-site gateway is specifically designed to accommodate the rapid expansion in cellular backhaul traffic resulting from the widespread deployment of new mobile broadband services. It simplifies service provisioning and control by enabling seamless delivery of multi-generation traffic – from 2G to 4G – over the same transport network to ensure continuity for on-going services while moving to an all-IP RAN (radio access network), thus avoiding the cost and operational complexity of maintaining separate networks. Working opposite the ACE-340x and ACE-3600 aggregation-site gateways, as well as third-party multiservice aggregation devices, the ACE-3220 simultaneously supports SHDSL.bis and ADSL2+ to minimize capital investment and shorten service rollout times by leveraging available DSL infrastructure to access ATM, SDH/SONET and high capacity, economical packet switched transport networks.

Any-service-any-port flexibility

The ACE-3220 allows operators to use a variety of interfaces:

- Eight or 16 ATM UNI/IMA/TDM E1/T1 ports
- Optional STM-1/OC-3c ATM port
- Four UTP/SFP Fast Ethernet network or user ports

In addition, it accommodates up to two modular interfaces, including:

- Two ADSL2/2+ ports/VDSL2*
- Four SHDSL ports (IMA, M-Pair and EFM)
- Gigabit Ethernet network or user port

Advanced QoS, pseudowire and OAM features

The advanced shaping and scheduling capabilities of the ACE-3220 permit operators to implement overbooking strategies, enabling them to optimize network utilization, conserve existing resources and reduce the number of leased services required to support their network.

The device also enables operators to converge multi-generation traffic over an all-IP RAN by using standards-based pseudowire (PW) modes, including ATMoPSN, CESoPSN, SAToP, and Ethernet pseudowire, as well as Ethernet bridging and Ethernet to ATM bridging according to RFC 2684. These are enhanced with various QoS schemes, including VLAN priority (802.1p), EXP or ToS/DSCP. In addition to ensuring service resiliency, the ACE-3220 features comprehensive monitoring and diagnostic capabilities, such as pseudowire VCCV-BFD, IP-BFD and GRE Keep-Alive, as well as Ethernet and ATM OAM.

Full range of standard synchronization options

Synchronization in cellular networks is critical to ensure proper quality for mobile services. As radio access networks (RANs) are rapidly transitioning to asynchronous packet switched technologies, which introduce packet delay variation and packet loss, timing distribution and recovery have become a major challenge in the migration to IP backhaul.

With powerful synchronization capabilities, the ACE-3220 ensures highly accurate delivery of 2G, 3G and 4G traffic over packet backhaul. It enables mobile operators and transport providers to eliminate the risk of service disruptions, impaired cell hand-offs and excessive dropped calls, thereby supporting reliable transmission of real-time traffic over PSNs. It also ensures QoS priorities for clock traffic and supports "SDH/SONET or better" performance requirements for voice and video traffic, such as up to 16 ppb (parts per billion) frequency accuracy.

The ACE-3220's SyncToP™ suite enables clock recovery either from the TDM links, the DSL link or from the Ethernet links, using PTPv2 (IEEE 1588v2), Synchronous Ethernet (Sync-E), NTR recovered clock over xDSL, or adaptive clock recovery (ACR). In addition, it features a built-in input clock interface. The ACE-3220 also enables packet timing distribution, using adaptive clock or IEEE 1588v2, as well as physical clock distribution via the TDM and Ethernet links. Furthermore, it provides unique flexibility in supporting the simultaneous use of different clock transfer methodologies, for example, employing 1588v2 to receive the clock from the network then distributing it to the cell-site with Sync-E.

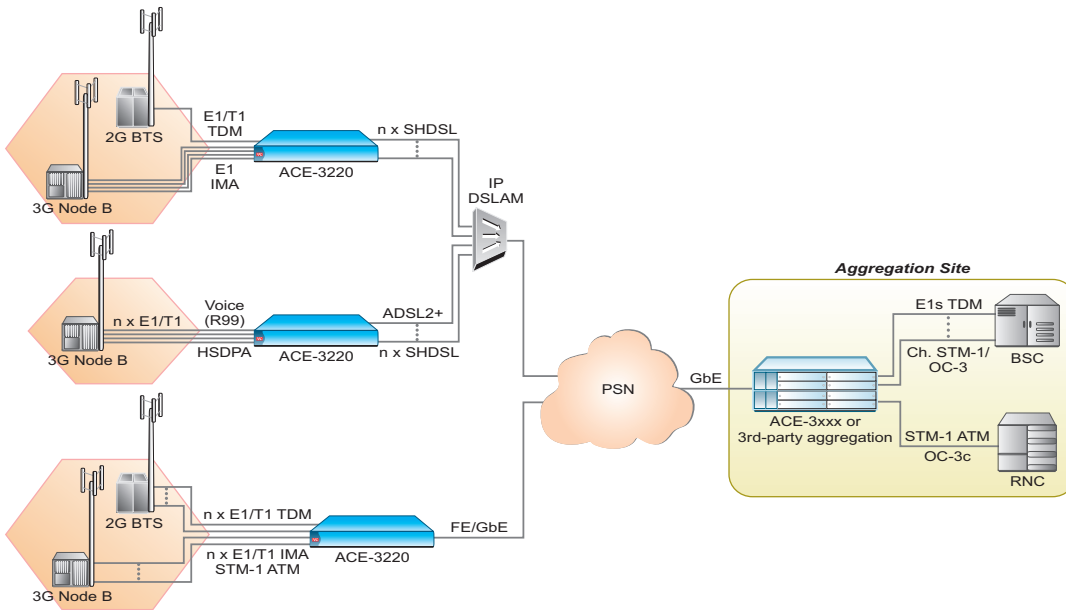
SNMP management

The ACE-3220 features flexible management capabilities, including local management via an ASCII terminal (RS-232). In addition, remote management can be performed either inband or out-of-band, using the network or user ports. Advanced FCAPS (Fault, Configuration, Administration, Performance, Security), and diagnostic tools are provided by RADview-EMS, RAD's carrier-class element management system, via an SNMP-based GUI.

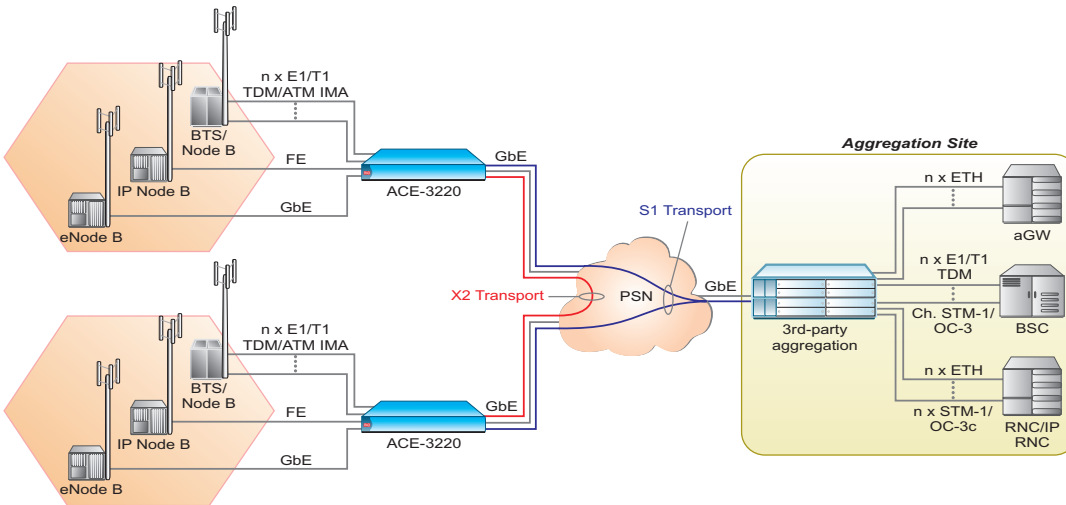
The ACE-3220 also supports a variety of access protocols, including CLI over Telnet, SNMP, Web server, and TFTP. Incorporated security features include Secure Shell (SSH), Web-based Secure Socket Layer (SSL), SNMPv3, and RADIUS, as well as management access control list (ACL).

* Requires software upgrade





Collocation of 2G-3G base stations with PSN access



Collocation of 2G-4G base stations with PSN access





ACE-3105

Cell-Site Gateway



- **Multiservice support for ATM, TDM and Ethernet traffic delivery over packet networks**
- **Supports ADSL2/2+ or SHDSL.bis (IMA, M-Pair and EFM bonding)**
- **Highly accurate clock regeneration using major industry standards**
- **ATM switching and traffic management**
- **Multi-standard pseudowire encapsulation over Ethernet, IP and MPLS networks**
- **Interoperable with multiservice aggregation devices from leading vendors with seamless EMS/NMS integration**
- **Small form factor for limited-space installations (half 19-inch)**
- **Optional temperature-hardened enclosure**

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RAD's ACE-3105 multiservice cell-site gateway is specifically designed to accommodate the rapid expansion in cellular backhaul traffic resulting from the widespread deployment of new mobile broadband services. It simplifies service provisioning and control by enabling simultaneous delivery of GSM, UMTS and HSPA traffic over the same transport network.

Working opposite the ACE-340x and ACE-3600 aggregation-site gateways, as well as third-party multiservice aggregation devices, the ACE-3105 minimizes capital investment and shortens service rollout times by leveraging available DSL infrastructure to access ATM, SDH/SONET and high capacity, economical packet switched networks.

Advanced QoS, pseudowire and OAM features

The advanced ATM shaping and scheduling capabilities of the ACE-3105 permit operators to implement overbooking strategies, enabling them to optimize network utilization, conserve existing resources and reduce the number of leased services required to support their network.

The device also enables operators to converge multi-generation traffic over an all-IP RAN by using IMA/UNI or standards-based CES/SAToP pseudowire (PW) encapsulation, as well as Ethernet bridging and Ethernet to ATM bridging according to RFC 2684. These are enhanced with various QoS schemes, including VLAN priority (802.1p), EXP or ToS/DSCP. Comprehensive monitoring and diagnostic capabilities such as pseudowire VCCV-BFD, IP-BFD and GRE Keep-Alive, as well as ITU-I.610 ATM OAM.

In addition, the ACE-3105 supports Ethernet pseudowires over MPLS per RFC 4448.

The device uses PPP over Ethernet (PPPoE) protocol to allow HSDPA connectivity in a variety of DSL-based cellular backhaul applications.

Full range of standard synchronization options

Synchronization in cellular networks is critical to ensure proper quality for mobile services. As radio access networks (RANs) are rapidly transitioning to asynchronous packet switched technologies, which introduce packet delay variation and packet loss, timing distribution and recovery have become a major challenge in the migration to IP backhaul.

With powerful synchronization capabilities, the ACE-3105 ensures highly accurate delivery of 2G, 3G and 4G traffic over packet backhaul. It

enables mobile operators and transport providers to eliminate the risk of service disruptions, impaired cell hand-offs and excessive dropped calls, thereby supporting reliable transmission of real-time traffic over PSNs. It also ensures QoS priorities for clock traffic and supports "SDH/SONET or better" performance requirements for voice and video traffic, such as up to 16 ppb (parts per billion) frequency accuracy. The ACE-3105's SyncToPTM suite enables clock recovery from the TDM links or from the DSL link, using PTPv2 (IEEE 1588v2), NTR recovered clock over xDSL or adaptive clock recovery (ACR). In addition, it supports adaptive clock distribution.

SNMP management

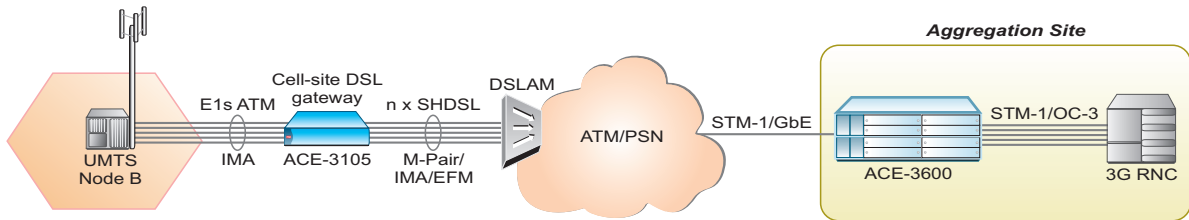
The ACE-3105 features flexible management capabilities, including local management via an ASCII terminal (RS-232). In addition, remote management can be performed either inband or out-of-band, using the network or user ports. Advanced FCAPS (Fault, Configuration, Administration, Performance, Security) and diagnostic tools are provided by RADview-EMS, RAD's carrier-class element management system, via an SNMP-based GUI.

The ACE-3105 also supports a variety of access protocols, including CLI over Telnet, SNMP, Web server, and TFTP. Incorporated security features include Secure Shell (SSH), Web-based Secure Socket Layer (SSL), SNMPv3, and RADIUS, as well as management access control list (ACL).

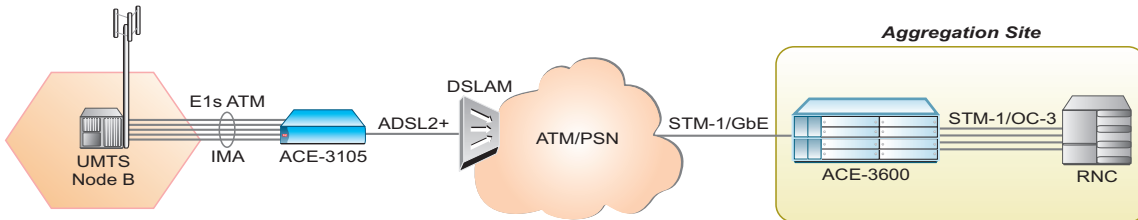
Available configurations

The ACE-3105 incorporates up to two Fast Ethernet ports for PSN traffic and/or for inband management. In addition, it features up to four E1/T1 ports in UNI, IMA, CES or SAToP modes. The device is available either with four SHDSL.bis interfaces or with an ADSL2/2+ port.

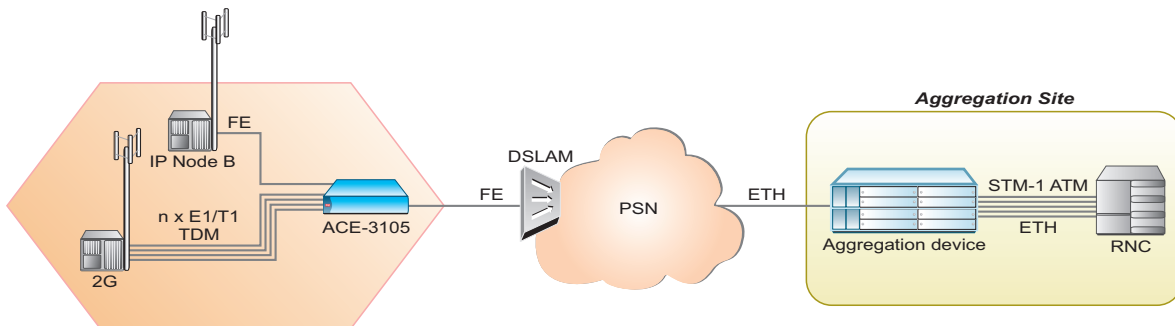




HSDPA offload over ATM or PSN



HSDPA offload over ADSL2+ over ATM or PSN



Colocation of IP Node B + 2G E1/T1 over PSN





ACE-3100

ACE-3100, ACE-3200

Cell-Site Gateways



- **Multiservice support for ATM, TDM and Ethernet traffic delivery over packet networks**
- **Any-service-any-port flexibility**
- **Highly accurate clock regeneration using major industry standards**
- **ATM switching and traffic management**
- **Multi-standard pseudowire encapsulation over Ethernet, IP and MPLS networks**
- **Interoperable with BSS from major vendors**

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RAD's ACE-3100 and ACE-3200 multiservice cell-site gateways are specifically designed to accommodate the rapid expansion in cellular backhaul traffic resulting from the widespread deployment of new mobile broadband services. They simplify service provisioning and control by enabling simultaneous delivery of GSM, UMTS and HSPA traffic over the same transport network.

Working opposite the ACE-340x and ACE-3600 aggregation-site gateways, as well as opposite third-party multiservice aggregation devices, the ACE-3100 and ACE-3200 minimize capital investment and shorten service rollout times by leveraging available infrastructure to access ATM, SDH/SONET and high capacity, economical packet switched transport networks.

The ACE-3100 and ACE-3200 incorporate flexible port configuration to allow aggregation of circuit-emulated (CES/SAToP) TDM E1/T1s, fractional E1/T1 UNIs or several IMA links into a single network interface.

Advanced QoS, pseudowire and OAM features

The advanced ATM shaping and scheduling capabilities of the ACE-3100 and ACE-3200 permit operators to implement overbooking strategies, enabling them to optimize network utilization, conserve existing resources and reduce the number of leased services required to support their network.

The devices also enable operators to converge multi-generation traffic over an all-IP RAN by using IMA/UNI or standards-based CES/SAToP pseudowire (PW) encapsulation, as well as Ethernet to ATM bridging according to RFC 2684 (ACE-3200). These are enhanced with various QoS schemes for delivering ATM and TDM traffic over Layer 2 and Layer 3 networks, including VLAN priority (802.1p), EXP or ToS/DSCP. Comprehensive monitoring and diagnostic capabilities include VCCV-BFD and ITU-I.610 ATM OAM, as well as IP-BFD and GRE Keep-Alive (ACE-3200). In addition, the ACE-3200 supports Ethernet pseudowires over MPLS per RFC 4448.

Full range of standard synchronization options

Synchronization in cellular networks is critical to ensure proper quality for mobile services. As radio access networks (RANs) are rapidly transitioning to asynchronous packet switched technologies, which introduce packet delay variation and packet loss, timing distribution and recovery have become a major challenge in the migration to IP backhaul.

With powerful synchronization capabilities, the ACE-3100 and ACE-3200 ensure highly accurate delivery of 2G and 3G traffic over packet backhaul. They enable mobile operators and transport providers to eliminate the risk of service disruptions, impaired cell hand-offs and excessive dropped calls, thereby supporting reliable transmission of real-time traffic over PSNs. They also ensure QoS priorities for clock traffic and support "SDH/SONET or better" performance requirements for voice and video traffic, such as up to 16 ppb (parts per billion) frequency accuracy. The devices' synchronization capabilities include clock recovery from the TDM links or from the Ethernet links, using adaptive clock recovery (ACR). In addition, they support adaptive clock distribution.

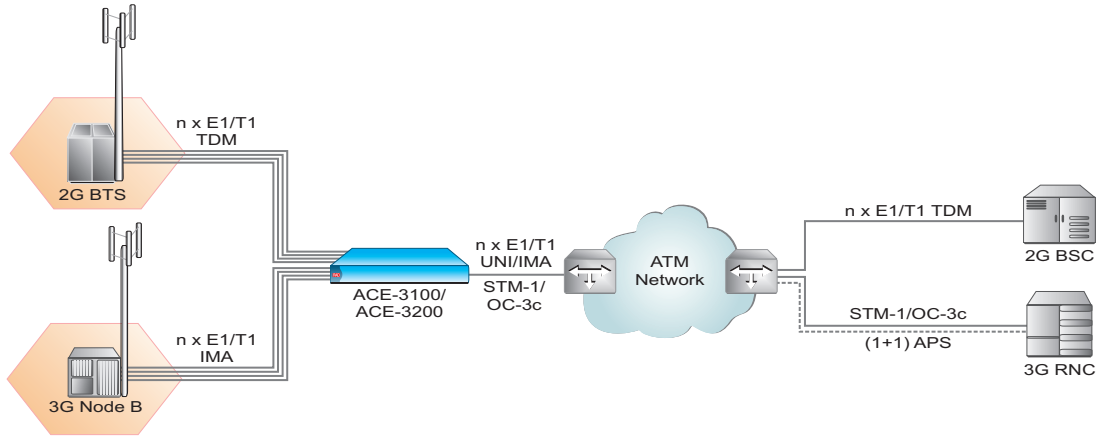
SNMP management

The ACE-3100 and ACE-3200 feature flexible management capabilities, including local management via an ASCII terminal (RS-232). In addition, remote management can be performed either inband or out-of-band, using the network or user ports. Advanced FCAPS (Fault, Configuration, Administration, Performance, Security) and diagnostic tools are provided by RADview-EMS, RAD's carrier-class element management system, via an SNMP-based GUI.

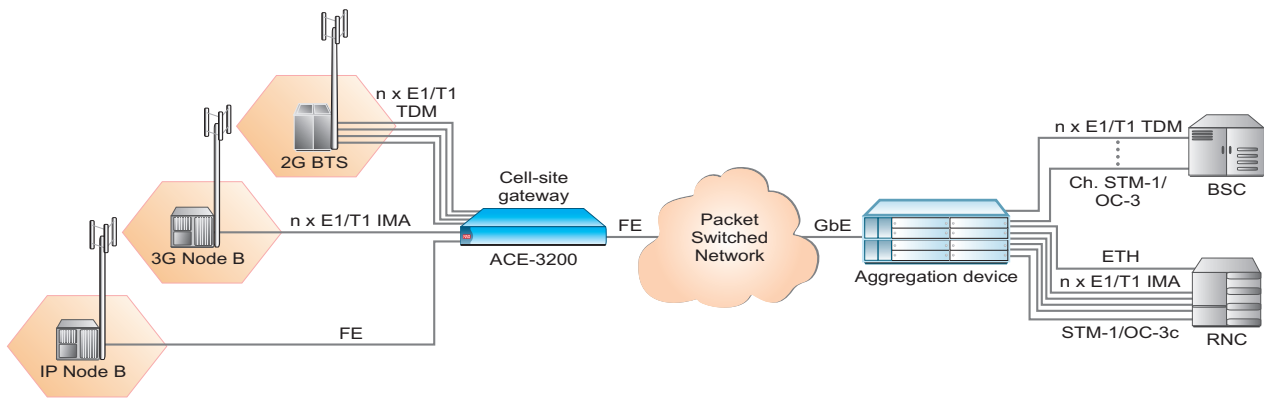
The ACE-3100 and ACE-3200 also support a variety of access protocols, including CLI over Telnet, SNMP, Web server, and TFTP. Incorporated security features include Secure Shell (SSH), Web-based Secure Socket Layer (SSL), SNMPv3, and RADIUS, as well as management access control list (ACL).

	ACE-3200	ACE-3100
E1/T1 ports	8 or 16	0 or 4
ATM-155 ports (SFP)	0 or 2	1 or 2
Fast Ethernet ports (UTP or SFP)	2 for PSN traffic and/or inband management	2 for PSN traffic and/or inband management
Power supply	Single/dual, fixed	Single, fixed





Cellular backhaul over ATM networks



Cellular backhaul over PSN networks





ACE-3600

RNC-Site Gateway



- **Multiservice support for ATM and Ethernet traffic delivery over packet networks**
- **Modular carrier-grade platform with full system redundancy**
- **Multi-standard pseudowire encapsulation over Ethernet, IP and MPLS networks**
- **Highly accurate clock distribution from RNCs to cell sites and hub sites over packet**
- **ATM switching and traffic management**
- **Advanced management system**

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RAD's ACE-3600 is a carrier-class multiservice aggregator, specifically designed to accommodate the rapid expansion in cellular traffic resulting from the widespread deployment of new mobile broadband services. It ensures the most economical allocation of backhaul resources in delivering UMTS and HSPA traffic over packet networks. Typically located at RNC sites, the ACE-3600 works opposite the ACE-310x and ACE-32xx cell-site gateways and aggregates STM-1/OC-3c (ATM) traffic over Ethernet, IP or MPLS networks.

The ACE-3600 is a modular platform housing a variety of interfaces, including STM-1/OC-3c UNI and GbE. Its advanced carrier-grade features include full system, power, link, and module redundancy for enhanced service protection.

Advanced pseudowire, QoS and OAM features

The ACE-3600 enables operators to converge multi-generation traffic, including voice and HSPA services, over an all-IP RAN by using standard ATM pseudowire (PW) encapsulation per RFC 4717. These attributes are enhanced with various QoS schemes, including VLAN priority (802.1p), EXP or ToS/DSCP, as well as comprehensive monitoring and diagnostic capabilities, including pseudowire VCCV-BFD and ITU-I.610 ATM OAM.

The advanced shaping and scheduling capabilities of the ACE-3600 permit operators to implement overbooking strategies, enabling them to optimize network utilization, conserve existing resources and reduce the number of leased services required to support their network.

Full range of standard synchronization options

Synchronization in cellular networks is critical to ensure proper quality for mobile services. As radio access networks (RANs) are rapidly transitioning to asynchronous packet switched technologies, which introduce packet delay variation and packet loss, timing distribution and recovery have become a major challenge in the migration to IP backhaul.

With powerful synchronization capabilities, the ACE-3600 ensures highly accurate delivery of 3G traffic over packet backhaul. It enables mobile operators and transport providers to eliminate the risk of service disruptions, impaired cell hand-offs and excessive dropped calls, thereby

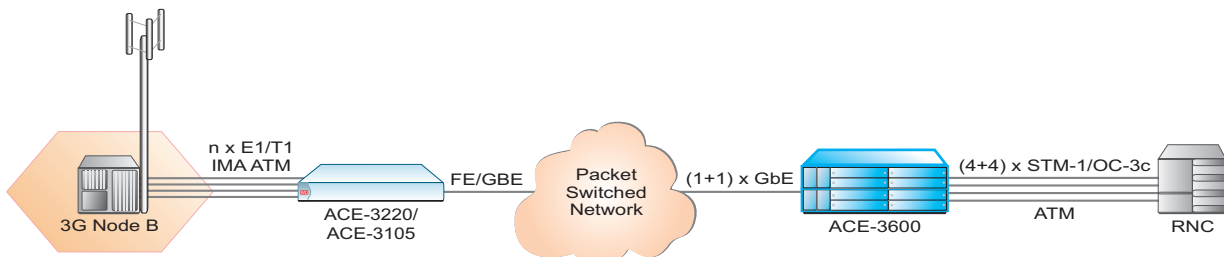
supporting reliable transmission of real-time traffic over PSNs. It also ensures QoS priorities for clock traffic and supports "SDH/SONET or better" performance requirements for voice and video traffic, such as up to 16 ppb (parts per billion) frequency accuracy. The ACE-3600's synchronization capabilities include packet timing distribution using adaptive clock.

SNMP management

The ACE-3600 features flexible management capabilities, including local management via an ASCII terminal (RS-232). In addition, remote management can be performed either inband or out-of-band, using the network or user ports, or the dedicated management port. Advanced FCAPS (Fault, Configuration, Administration, Performance, Security) and diagnostic tools are provided by RADview-EMS, RAD's carrier-class element management system, via an SNMP-based GUI.

The ACE-3600 also supports a variety of access protocols, including CLI over Telnet, SNMP, Web server, and TFTP. Incorporated security features include Secure Shell (SSH), Web-based Secure Socket Layer (SSL), SNMPv3, and RADIUS, as well as management access control list (ACL).

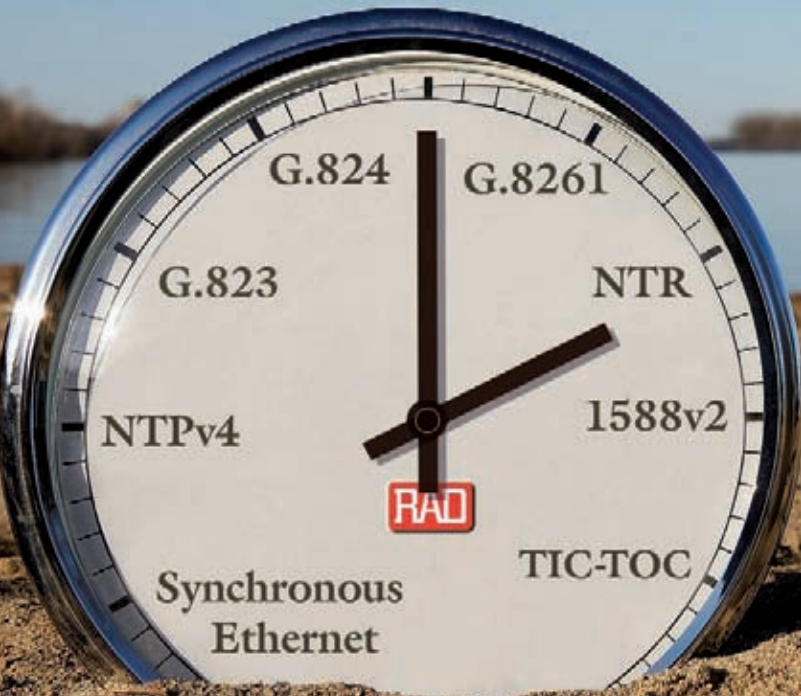
The ACE-3600 is a 2U-high, 19-inch chassis with a rack-mount option. Its compact dimensions enable easy installation in limited spaces.



Mobile backhauling of 3G Node B RNC over PSN



Do you have the right **timing**?



For LTE and all-IP RANs

Successful migration to 4G LTE and packet-based radio access networks (RANs) depends on high-quality synchronization and timing accuracy, without which operators and transport providers run the risk of service disruptions, impaired cell hand-offs and excessive dropped calls.

The contributing author of major standards for timing and synchronization over packet transport, RAD has incorporated robust clock recovery and distribution capabilities into a variety of PSN (packet switched network) access gateways and demarcation devices to enable highly accurate, seamless delivery of 2G, 3G and 4G traffic over packet backhaul:

- Support IEEE 1588-2008 (1588v2), Synchronous Ethernet, Adaptive Clock Recovery and NTR
- Ensure SDH/SONET-level quality for real-time voice and video over packet
- Choose where to upgrade: Flexible bridging of different timing/synchronization methods
- Reduce CapEx: No need for dedicated clocking hardware
- Lower OpEx: Optimize bandwidth utilization for efficient clock transfer



ETX-204A
Carrier Ethernet Demarcation
Device



ACE-3220
Cell-Site Gateway



ACE-3400

ACE-3400, ACE-3402

Aggregation-Site Gateways



- **Multiservice support for ATM, TDM and Ethernet traffic delivery over packet networks**
- **Modular carrier-grade platform with full system redundancy**
- **Multi-standard pseudowire encapsulation over Ethernet, IP and MPLS networks**
- **Highly accurate clock distribution from BSCs/RNCs to cell sites and hub sites over packet**
- **ATM switching and traffic management**
- **Advanced management system**
- **Designed for 2G, 3GPP, and WiMAX**

For latest updates visit www.rad.com

RAD's ACE-3400 and ACE-3402 are carrier-class multiservice aggregators, specifically designed to accommodate the rapid expansion in cellular traffic resulting from the widespread deployment of new mobile broadband services. They ensure the most economical allocation of backhaul resources in delivering GSM, UMTS and next-generation 3GPP traffic over ATM, SDH/SONET and packet networks.

Typically located at hub sites or BSC/RNC sites, they work opposite the ACE-310x and ACE-32xx cell-site gateways. Their advanced carrier-grade features include full system, power and link redundancy for enhanced service protection. Featuring any-service-any-port flexibility, the ACE-3400 and ACE-3402 are modular platforms housing a variety of interfaces, including E1/T1, STM-1/OC-3c UNI, channelized STM-1/OC-3 and GbE.

Advanced pseudowire, QoS, and OAM features

The ACE-3400 and ACE-3402 enable operators to converge multi-generation traffic, including voice and HSPA services, over an all-IP RAN by using IMA/UNI or standards-based CES/SAToP pseudowire (PW) encapsulation. These are enhanced with various QoS schemes, including VLAN priority (802.1p), EXP or ToS/DSCP, as well as comprehensive monitoring and diagnostic capabilities, including pseudowire VCCV-BFD and ITU-I.610 ATM OAM. In addition, they support Ethernet pseudowires over MPLS per RFC 4448 and end-to-end redundancy for PW service protection.

The advanced shaping and scheduling capabilities of the ACE-3400 and ACE-3402 permit operators to implement overbooking strategies, enabling them to optimize network utilization, conserve existing resources and reduce the number of leased services required to support their network. Typical applications for RAD's aggregation-site gateways include grooming ATM traffic and aggregating VC-12/VT 1.5 circuits into a single IMA, channelized STM-1/OC-3 or Gigabit Ethernet uplinks. Additionally, the ACE-3400 aggregates TDM (CES) or ATM (UNI/IMA) E1/T1 traffic over STM-1/OC-3c links.

Full range of standard synchronization options

Synchronization in cellular networks is critical to ensure proper quality for mobile services. As radio access networks (RANs) are rapidly transitioning to asynchronous packet switched technologies, which introduce packet delay variation and packet loss, timing distribution and recovery have become a major challenge in the migration to IP backhaul.

With powerful synchronization capabilities, the ACE-3400 and ACE-3402 ensure highly accurate delivery of 2G, 3G and 4G traffic over packet backhaul. They enable mobile operators and transport providers to eliminate the risk of service disruptions, impaired cell hand-offs and excessive dropped calls, thereby supporting reliable transmission of real-time traffic over PSNs. They also ensure QoS priorities for clock traffic and supports "SDH/SONET or better" performance requirements for voice and video traffic, such as up to 16 ppb (parts per billion) frequency accuracy. The devices' synchronization capabilities include packet timing distribution using adaptive clock, as well as physical clock distribution via the TDM and Ethernet links.

SNMP management

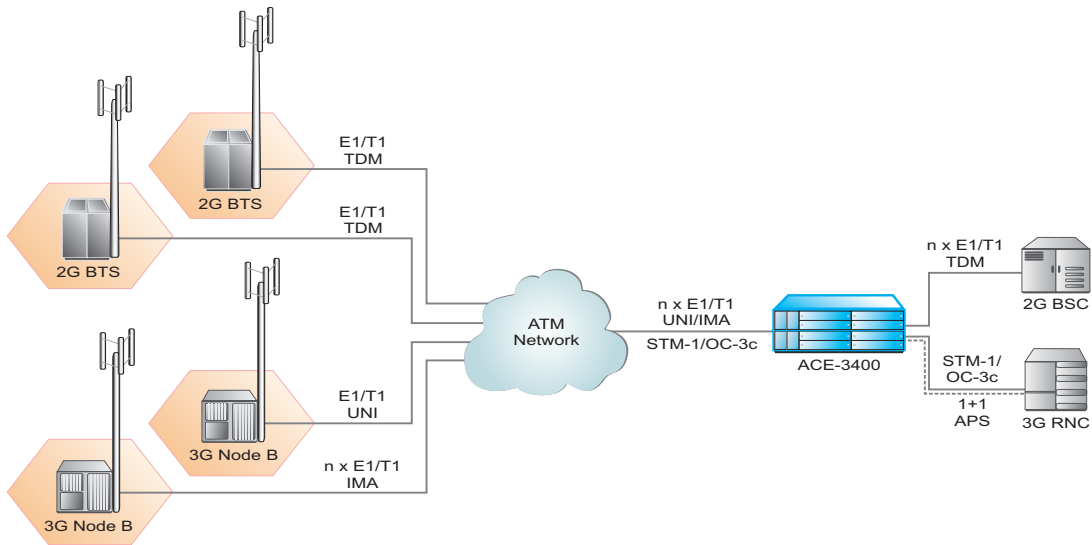
The ACE-3400 and ACE-3402 feature flexible management capabilities, including local management via an ASCII terminal (RS-232). In addition, remote management can be performed either inband or out-of-band, using the network or user ports, or the dedicated management port. Advanced FCAPS (Fault, Configuration, Administration, Performance, Security) and diagnostic tools are provided by RADview-EMS, RAD's carrier-class element management system, via an SNMP-based GUI.

The ACE-3400 and ACE-3402 also support a variety of access protocols, including CLI over Telnet, SNMP, Web server, and TFTP. Incorporated security features include Secure Shell (SSH), Web-based Secure Socket Layer (SSL), SNMPv3, and RADIUS, as well as management access control list (ACL).

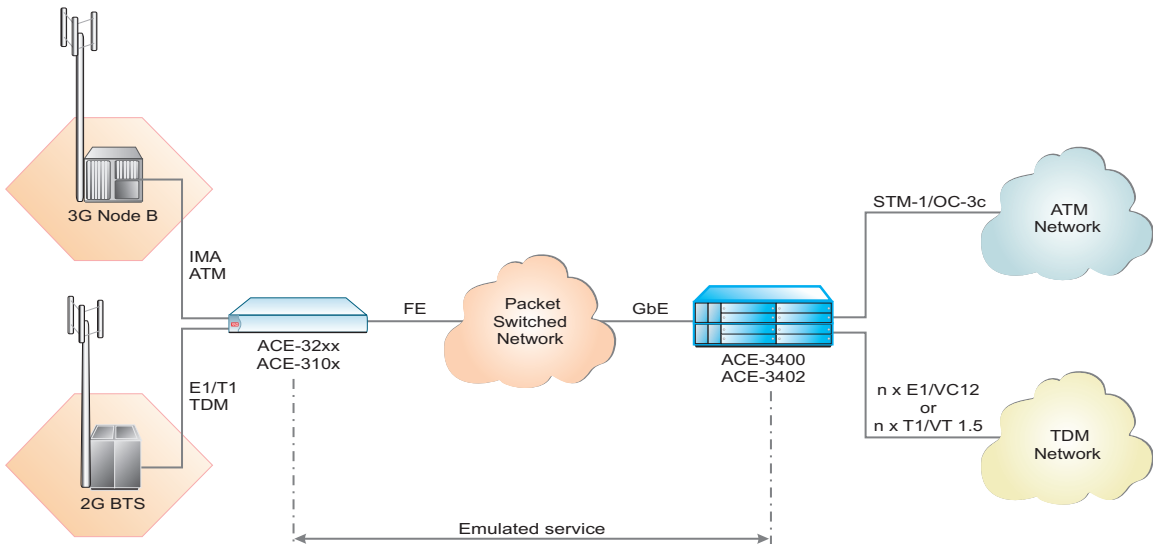
The ACE-3400 and the ACE-3402 fit 19-inch racks and enable easy installation in limited spaces.

Features	ACE-3400	ACE-3402
Optional interfaces:		
• E1/T1	32/63	N/A
• VC-12/VT 1.5	63/84	63/84
• STM-1/OC-3c UNI	1+1	1+1
• Channelized STM-1/OC-3	1+1	1+1
• Gigabit Ethernet uplink	1+1	1+1
Management Fast Ethernet interface	✓	✓
Station clock (2 Mbps)	✓	✓
Height	3U	2U





Aggregation at the controller site



Emulated TDM and ATM service



Preparing Your **Backhaul** for Next Generation **Mobile Networks?**



We have some great ideas for you.

Need to decide between a hybrid and converged backhaul approach to LTE migration?

Looking for efficient ways to lower your transition costs?

Need to ensure accurate synchronization for 2G, 3G and 4G services?

Learn about RAD's best of breed backhaul solutions:

- Cell-site Gateways (**ACE-3220**, page 74; **ACE-3200**, page 78)
- Cell-site Demarcation Gateways (**ETX-204A**, page 62)
- Aggregation Site Gateways (**ACE-3400/3402**, page 82)

