



ADC IP-RAN Solutions
Building a Flexible,
Cost-Effective Infrastructure



ADC IP-RAN Solutions

Building a Flexible, Cost-Effective Infrastructure

Executive Summary

In today's mobile services marketplace, wireless carriers face a range of significant challenges that impact their ability to deliver new services profitably and remain competitive. Competition for subscribers has become fiercer with near-saturation in many global markets, while rapid growth in developing nations is forcing carriers to build out new infrastructure quickly and cost-effectively. Moreover, customers are demanding new services, higher bandwidth, and better quality of service, while the migration to 3G and 4G protocols that is required to provide those services is forcing major changes to network infrastructure.

Wireless carriers must evolve their radio access networks (RANs) to remain competitive, but they must do so while carefully managing capital and operational budgets. There are three key challenges to overcome: improving coverage in all areas, increasing backhaul capacity, and managing evolution to new protocols.

ADC, a world leader in providing network infrastructure products and services, offers an IP-RAN solution portfolio that enables wireless carriers to successfully evolve their networks to meet the business and technology imperatives of today's marketplace.



Background

As carriers roll out 3G and 4G mobile services, it has become clear that the legacy macro-area mobile infrastructure is not sufficient to provide those services. Operating at higher frequencies and carrying more bandwidth to support new services such as video, GPS navigation, and location-based services, 3G and 4G services are forcing wireless carriers to address key problems with new solutions.

Radio infrastructure is in flux. W-CDMA and HSPA deployments have begun in earnest, and LTE and WiMAX are on the horizon. Existing macro cell sites and base stations (BTS) often lack the capacity to support bandwidth increases beyond 1 Mbps per subscriber. Operators have already split macro cells into smaller units in an effort to maximize their limited spectral budgets, but this does not solve the backhaul problem, and this challenge will only increase as new protocols are deployed.

Traditionally, macro wireless networks have relied on large, “boomer” towers that provide blanket coverage. However, this approach to delivering wireless signals is difficult to sustain in the 3G and 4G environments. There are several issues:

- **Insufficient coverage** – 3G and 4G networks commonly operate at frequencies above 2GHz, which attenuate much more quickly than the lower frequencies used in 2G networks. In traditional macro networks, there are “shadow” areas where signals can’t reach, such as urban canyons (where buildings block signals from the nearest tower), the interiors of buildings (where building materials block signals) and dense public facilities (subways, airports, stadiums, and arenas). These shadow areas are exacerbated by the introduction of new frequencies and data intensive protocols.
- **Expansion difficulties** – Large BTS/cell site deployments are costly, making traditional network expansion expensive. In addition, local governments in urban as well as residential areas are increasingly reluctant to allow unfettered deployment of large cell sites due to aesthetic and health concerns.
- **Rising OPEX costs** – Skyrocketing fuel prices and higher numbers of distributed cell sites are making it difficult for carriers to rein in the cost of maintaining their macro BTS deployments.
- **Poor flexibility** – It can be difficult to retrofit existing cell sites to deliver new protocols and services. A cell that was designed for only voice services at lower frequency bands will shrink due to the lower propagation of the higher frequencies and the high capacity demands of new data services, creating a need for smaller cells. In addition, adding new protocols and services to existing cells while maintaining service for legacy services creates a challenge for network planning and efficient radio utilization.
- **Insufficient and expensive backhaul capacity** – Typically, macro cellular sites rely on T1/E1 lines operating at 1.5/2.0 Mbps. To support higher bandwidth and new services, carriers have been required to continue adding new lines, often by leasing them from competitors. Carriers must find new ways to reduce backhaul costs, which now typically represent more than 30 percent of OPEX.

Unfortunately, there is no single infrastructure solution that addresses all of these challenges. What is needed is an integrated suite of products that delivers new capabilities, improves coverage, and reduces costs while giving carriers the flexibility to address specific markets.



ADC's IP-RAN Solution Portfolio

The ADC IP-RAN strategy promotes microcellular RANs that enhance legacy macro network infrastructure with the addition of Distributed Antenna Systems (DAS), picocells, microcells, and new IP backhaul solutions. The IP-RAN solution portfolio uses industry-leading digital and IP technologies and enables wireless carriers to leverage their existing macro network assets by distributing signals from existing BTS sites and BTS hotels to small, cost-effective remote radios, or by addressing coverage and capacity challenges with innovative IP-fed picocell and microcell base stations. This strategy enables wireless carriers to cost-effectively address coverage issues while adding capacity and gaining service flexibility.

ADC's IP-RAN solution portfolio includes products that address coverage, capacity, and backhaul challenges.

FlexWave™ Outdoor Distributed Antenna Systems (DAS)

ADC's FlexWave Universal Radio Head (URH) products are innovative, compact, low-cost, and flexible solutions that distribute wireless coverage and capacity. The versatility and small size of these products allows service providers to quickly deploy networks in areas where zoning restrictions often hinder installation of standard cell sites. The URH products also facilitate greater centralization of base station capacity by delivering the coverage formerly provided by distributed macro BTS, thereby enabling carriers to reduce maintenance costs, maximize use of new and existing radio resources, and provide maximum flexibility for future network changes. In addition, FlexWave URH systems are stealth solutions that can be used in lieu of standard cell sites where zoning restrictions or site acquisitions become issues.

InterReach Indoor Distributed Antenna System (DAS)

ADC's InterReach Unison® and Fusion® products extend cellular coverage inside buildings and public facilities of all sizes. Used with either a roof-mounted antenna and repeater or a locally-deployed micro or pico BTS, ADC's indoor DAS products distribute wireless signals throughout any above-ground or underground structure. Based on industry-standard active, hub-and-spoke architecture, InterReach Unison and Fusion are easy to deploy, provide uniform, high-performance coverage; and offer full management and alarming via standard SNMP consoles.

FlexWave Base Station System (BSS)

ADC's FlexWave BSS is an industry leading IP-fed RAN solution which provides cost-effective, dedicated wireless capacity across a broad range of applications, including small/medium-sized offices, large enterprises, factories, ships, islands, military bases, and other remote sites. Compliant with all applicable industry standards, the FlexWave BSS includes both a simple "plug-and-play" picocell that connects over standard Cat 5 cable, and a "deploy anywhere" microcell which shares the same cost-effective IP backhaul, BSC and OMC-R. The FlexWave BSS can be deployed either stand-alone or as a radio capacity feeder into ADC's indoor and outdoor DAS solutions. Either way, the operator can realize significant benefits in terms of cost savings, deployment flexibility, and faster time to market by using IP instead of traditional TDM backhaul.

FlexWave Backhaul Solutions

ADC's FlexWave Millimeter Wave (MMW) solution provides a 1.25-gigabit wireless Ethernet data pipeline that delivers fiber-equivalent performance, reliability and security, but without the high deployment costs associated with outdoor fiber installation. Using FlexWave MMW, gigabit wireless Ethernet links may be established over distances of up to 3-4 miles with carrier class availability. Secure remote monitoring and control via SNMP are easily accessed via an IP network connection. FlexWave MMW provides superb IP connectivity, ease of installation and affordable cost, making it an ideal solution for Wi-Fi, WiMAX, and fronthaul for radio heads or mobile network extension and backhaul links, business WAN or IP connections.

ADC's LoopStar® 780, meanwhile, provides standards-based circuit emulation services that allow TDM trunks to be backhauled over an Ethernet-based network while simultaneously supporting IP multimedia services to cellular users. The LoopStar 780 can be deployed at either the cell tower or the BTS hotel location for operator flexibility.



Benefits of IP-RAN Solutions

With a range of solutions that address wireless coverage, capacity, and backhaul, ADC's IP-RAN portfolio delivers several key benefits to wireless operators.

CAPEX Reduction

Microcellular networks can offer significant savings compared with a traditional macro BTS deployment by reducing site development expenditures and maximizing radio utilization:

1. ADC offers solutions that promote use of alternative, low-cost real estate to cover macro and in-building networks.
2. Utilizing ADC's efficient RF transport solution, operators can optimize radio utilization by simulcasting radios over multiple radiating points, including in-building. This not only efficiently utilizes the BTS and Node B but also the BSC and RNC network controllers.
3. ADC's remote radio solutions can be deployed almost anywhere: on the sides of buildings, on utility poles, on overhead lines, and on or under street fixtures. In addition, a single remote radio can support multiple bands and protocols, further reducing site development expenditures and accelerating time to market.
4. ADC's remote radio DAS solutions are protocol-agnostic, allowing operators to design RF distribution networks without the need for a forklift upgrade when a new protocol or service is introduced.
5. ADC's IP base station solutions allow an operator to deploy additional capacity in the network exactly where it is needed, and at far lower cost than expanding the macro BTS network. This not only saves money in covering in-building or other problem spots in the network, but also saves money by off-loading the macro network, thereby delaying or reducing CAPEX spend on macro network capacity expansion.
6. ADC's innovative FlexWave MMW wireless backhaul solution delivers high-bandwidth connectivity without the cost of trenching and running fiber.
7. ADC's LoopStar 780 allows an operator to smoothly transition from TDM to IP without a forklift replacement of transmission equipment.

OPEX Reduction

ADC solutions reduce OPEX expenditures in a number of ways:

1. ADC's indoor and outdoor DAS products promote centralization of BTS radio capacity, which results in increased trunking efficiency and decreased backhaul cost.
2. A centralized BTS approach enables infrastructure sharing, lowering on-going lease costs, technician travel/fuel costs, site maintenance/upgrade costs, and heating and cooling costs.
3. The use of IP backhaul in ADC's solutions provides tremendous on-going OPEX savings—as much as a 75 percent reduction in costs as compared to traditional E1/T1 backhaul techniques.
4. In many cases, an operator can actually leverage “free” IP-backhaul already in place at an enterprise location by connecting an IP-fed picocell to an existing DSL modem or corporate LAN.
5. ADC's indoor DAS products feature extensive end-to-end alarming and remote maintenance capabilities, including full SNMP support that reduces life cycle costs.



Coverage

ADC's IP-RAN portfolio allows carriers to completely eliminate coverage gaps in the macro network with equipment that is cost-effective, easy to deploy, and easy to maintain. Carriers can use distributed radios anywhere coverage is needed, thereby working around traditional obstructions, eliminating shadow areas in networks, and improving customer satisfaction. ADC provides stealth remote solutions that blend with the surroundings, providing coverage without affecting the surrounding environment's aesthetics.

Capacity

ADC's solutions allow for maximum radio efficiencies by distributing capacity with the DAS solutions or by adding capacity with the picocell and microcell products and offloading the surrounding macro cells. By serving high-density populations in buildings or public facilities, carriers can reduce strain and improve service quality in the macro network while improving service to those in areas where the macro network doesn't normally reach. ADC's microcellular solutions provide methods to split cells to address growing capacity requirements and maximize use of limited spectral resources.

Upgrade Path

As wireless protocols evolve through 3G and 4G, ADC provides solutions that support future changes without major upgrades. ADC's DAS solutions are protocol-agnostic, allowing operators to design cells for optimal coverage in the RAN while distributing capacity from centralized radio suites. Needs for additional capacity or upgrades to new protocols are accomplished at the central radio suite without any changes to the RAN, greatly reducing operating expenses and one-time site development expenditures without forklift upgrades.



Business Improvements – The Bottom Line

By adding cost-effective capacity, coverage, and flexibility to the infrastructure, ADC's IP-RAN portfolio delivers several key business improvements for wireless providers.

1. A microcellular IP-RAN approach improves customer satisfaction and reduces churn.
2. A microcellular IP-RAN approach enables much faster deployment, allowing carriers to scale coverage, capacity, and services in days or weeks as opposed to months or years.
3. A microcellular IP-RAN approach allows carriers to help enterprise customers standardize on reliable, low-cost wireless infrastructure, further cementing carrier relationships.
4. A microcellular IP-RAN approach reduces CAPEX and OPEX.
5. A microcellular IP-RAN approach improves the carrier's long-term business case by extending use of the network through future protocol upgrades without major RAN upgrades.

Conclusion

In an environment where mobile subscribers demand new services and competition is tougher than ever, wireless carriers must evolve their infrastructure to gain flexibility and performance while reducing costs. ADC's IP-RAN portfolio and microcellular approach works with existing infrastructure to maximize investment leverage while offering highly efficient and cost-effective ways to deliver new services with higher bandwidth, better coverage, and faster backhaul. With a broad solution set and a global customer service organization, ADC is the wireless industry's premier partner for future service evolution and profitable network expansion.

WHITE PAPER



Website: www.adc.com

From North America, Call Toll Free: 1-800-366-3891 • Outside of North America: +1-952-938-8080

Fax: +1-952-917-3237 • For a listing of ADC's global sales office locations, please refer to our website.

ADC Telecommunications, Inc., P.O. Box 1101, Minneapolis, Minnesota USA 55440-1101

Specifications published here are current as of the date of publication of this document. Because we are continuously improving our products, ADC reserves the right to change specifications without prior notice. At any time, you may verify product specifications by contacting our headquarters office in Minneapolis. ADC Telecommunications, Inc. views its patent portfolio as an important corporate asset and vigorously enforces its patents. Products or features contained herein may be covered by one or more U.S. or foreign patents. An Equal Opportunity Employer

106744AE 7/08 Original © 2008 ADC Telecommunications, Inc. All Rights Reserved