TELECOMMUNICATIONS®
MAGAZINE

# A Holistic Approach to Wireless Buildout

David Stern and Don Coover

*It takes work on two fronts—RF and fixed telephony —to succeed.*

When building today's wireless networks, operators often place a premium on RF engineering and ignore the requirements of the network's fixed telephony side. The result is a system that fails to meet the dynamic needs of a rapidly expanding industry—one that costs carriers unnecessary expense through increased churn and inefficient design. A holistic, or hybrid, approach to wireless network buildout can mean the difference between success and failure.

A holistic approach requires engineers to recognize and focus on marketing, RF and telephony project plans. The marketing plan is the project's master blueprint and identifies goals. With the marketing plan in mind, RF and network engineers must create solutions for each part of the system, anticipating consumer needs and demands. When implemented, the RF buildout serves as the bricks and the executed network buildout becomes the mortar supporting the structure. Together they connect the wireless system into a true hybrid network that functions as a cohesive solution for the wireless provider.

The original MTS/IMTS (mobile telephone service/improved MTS) networks of the 1940s were half-duplex and/or full-duplex radio networks with manual and/or semiautomatic telephony interconnects. In the 1970s, the introduction of cellular proved that automatic signaling transmitted across the air interface and through the base station could emulate traditional landline telephony functionality and features. These features, including off-hook, call waiting, call forwarding and MF (multifrequency) signaling, could be processed by analog telephony switches such as the AT&T-1A platform. This hybrid, full-duplex radio with a telephony switch interface allowed the wireless industry to deploy an infrastructure compatible with the PSTN. For the first time, a wireless carrier could offer mobility with Class 5 interconnectivity, a capability that essentially created today's wireless market. While some early projections predicted 1 million subscribers by 2000, actual counts were close to 10 million by 1990.

As the demand for wireless escalates, most providers still choose to give precedence to the RF plan and buildout. After all, the RF coverage area represents wireless functionality, and customers are eager to purchase mobility. The RF plan determines the wireless network's coverage and capacity. This initial focus on the RF plan seems the shortest and most direct route in an industry where time to market remains a driving factor. In terms of traditional engineering, the RF plan represents the network's line side and is plagued with obstacles involving construction, permits and labor issues, often becoming the critical path in project management.

## Problems

With emphasis on RF buildout, many operators began to "back burner" the fixed portion or "trunk side" of their wireless networks. In the past, it was relatively easy to obtain a T1 in 45 days. Unfortunately, when new wireless licenses were released, all carriers were on similar buildout schedules, and interconnect orders flowed in at the same time. LECs and IXCs were deluged with orders for interconnection facilities from start-ups and expanding wireless providers. At the same time, the burgeoning ISP industry demanded similar facilities, sometimes in much greater volumes, from the same wireline providers. Most wireless providers planned only minimal PSTN capacity, since most engineers believed this was not the critical path in building a network. As many wireless companies faced network bottlenecks, they began to look beyond initial PSTN requirements and began planning for several years of fixed-network expansion and evolution.

Over time, the pitfalls caused by focusing on RF buildout and neglecting the network side become evident—similar to a house built with cheap mortar. The resulting structure becomes unstable, the initial marketing plan falls short of its mark, and systems are not always able to meet growing consumer needs.

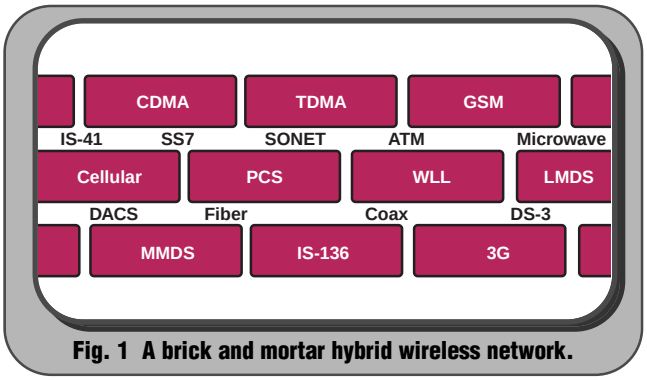


**Fig. 1 A brick and mortar hybrid wireless network.**

An inadequate RF plan cannot serve current or future subscriber needs. The best course of action to repair or expand a poorly planned RF system is often the most costly and time consuming: Tear it down and start from scratch.

## Bandwidth Planning

Recognizing that RF and network planning are interdependent is key to the success

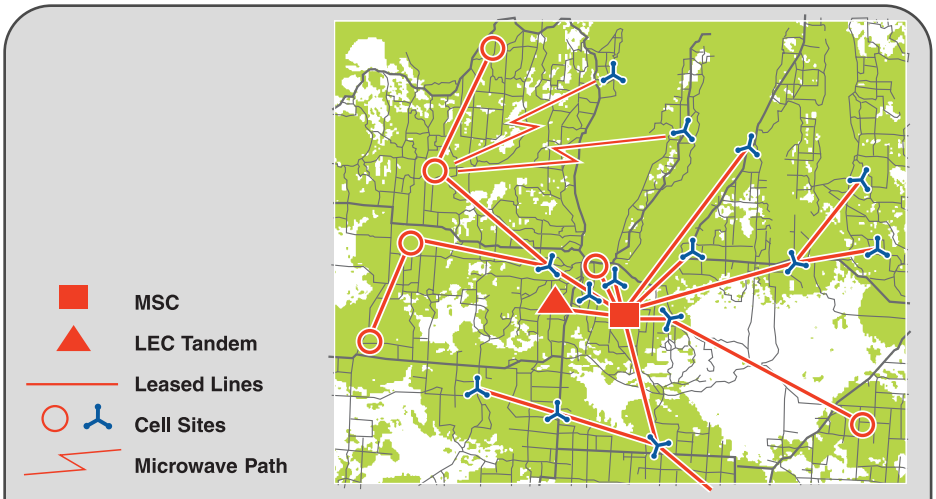


**Fig. 2 An efficient hybrid network.**

of future wireless network buildouts. The hybrid nature of wireless systems requires that network planning take on an important new dimension: bandwidth planning.

Bandwidth planning must be a collaborative effort among the marketing, RF engineering and network engineering departments. This new blueprint projects major marketing initiatives, traffic events and venues, and the resources required to service them. All wireless operators have a limited amount of radio spectrum. Once a frequency-reuse plan has reached its saturation point, incremental channels can no longer be added.

Bandwidth planning requires that engineers run a sensitivity analysis outlining the effects of sudden increases or decreases in traffic and including plans to address significant traffic changes. A decrease in traffic is normally viewed as reserve capacity, but a saturated frequency reuse plan may require reallocation of RF channels. This reallocation could potentially cause an "overbuild" situation at a particular site. Most often, excess interconnection, or backhaul capacity, cannot be reallocated in the same manner as RF capacity and leads to unnecessary operating and capital expense.

The opposite condition exists when there is a lack of interconnect and/or backhaul capacity at a site with reserve channels. If a particular site has excess channels built into the frequency reuse plan but lacks the incremental base-station hardware, the problem is often addressed by deploying new hardware within one to two weeks. However, if that same site has inadequate interconnect and/or backhaul facilities, implementing this can take months depending upon routing of the facilities and other possible network bottlenecks.

The following three components are vital for the success of tomorrow's wireless hybrid systems:

- *Marketing plan*. This blueprint dictates what the wireless system should accomplish: coverage areas on highways and byways, in-building penetration, capacity issues, features capabilities and objectives.
- *RF plan*. This manifestation of the marketing plan gives strength to the system, addressing coverage and capacity and striving to meet the marketing plan's needs.
- *Telephony network*. This plan is the mortar that holds the structure together by supporting PSTN interconnectivity and functionality. It allows for the RF plan's design with consideration ofswitching and capacity needs and plans for improvement and expansion.

Increased competition and rapid wireless technological development have accelerated the need for improved recognition of the interdependencies of RF and network engineering. Based on a recent Yankee Group study, U.S. wireless penetration is expected to increase from 37 percent to 62 percent by 2005. This tremendous growth, coupled with industry initiatives such as LNP (local number portability) and location-based services, requires comprehensive bandwidth expansion planning for wireless operators to remain competitive and profitable. Consumers demand seamless roaming abilities with full feature-sets that parallel or exceed wireline capabilities. With 3G and broadband wireless just around the corner, operators that plan their networks accordingly will excel. ■

**David Stern**
(dstern@vcomm-eng.com)

**Don Coover**
(dcoover@vcomm-eng.com)

**David Stern** *and* **Don Coover** *are vice presidents at V-COMM.*