

June 2007

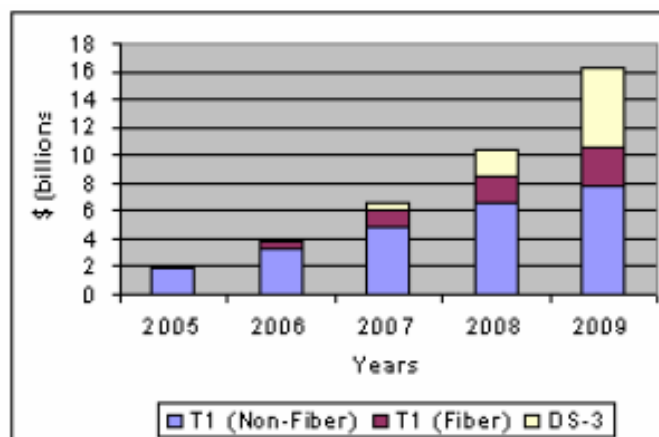
The Backhaul Conundrum

Over 90% of cellular backhaul in the U.S. uses T1s despite problems with availability and cost.

Mobile voice and data customers rarely give any thought to it, but whenever they hit “send”, their communications need to get from wherever they are to the Public Switched Telephony Network or the Internet backbone. While we all know that radio waves transmit the traffic from our mobile device to a router, base station or other receiver, things get a lot murkier shortly thereafter. This is the realm of backhaul – relaying voice and data traffic from receivers (typically located on cell towers or, in the case of mesh WiFi networks, frequently lamp posts) to the core network. And these days, backhaul is getting hot.

Today, the most common means of backhaul is via leased T1 lines, typically from a Local Exchange Carrier. While these work well enough that over 90% of cellular backhaul in the U.S. uses T1s, there are two main problems: availability and cost. In the case of the former, there are many locations where people want a T1 and can’t access one. In the case of the latter, T1s (which carry 1.54 mbps) cost several hundred dollars per month each. In the aggregate, over \$2.5 billion is spent every year for cellular backhaul. While this is a wonderful thing if you happen to be leasing T1’s, it’s a big problem for wireless carriers, and it’s getting worse. The “culprit” is mobile broadband, which is growing rapidly and increasing the need for backhaul – with projections of a four-fold increase by 2010 as shown in the graph below.

U.S. Wireline Backhaul Spending



Source: GeoResults

To help address the weaknesses of T1s, a host of companies are positioning products and services that can replace them. Let’s take a look at some of the key technologies and spectrum:

- Microwave – While T1s dominate here in the U.S., outside the U.S. point-to-point microwave networks backhaul 60% of the base



SPECIALISTS IN SATELLITE, MEDIA AND TELECOM INVESTMENT BANKING

Outside the U.S. point-to-point microwave networks backhaul 60% of the base stations world wide.

stations world wide. Microwave equipment is inexpensive and uses licensed spectrum to provide data rates of ~15 mbps over ranges of up to 20 miles. Typical equipment costs are \$8,000 to \$10,000 per link.

- WiMax – In addition to point-to-multipoint applications, WiMax can also be used for backhaul. Typical data rates of up to 50 mbps are achievable, with ranges of up to 20 miles. WiMax equipment is also quite cost competitive (typically less than \$2,000 per link), but to ensure QOS licensed spectrum must be used.
- Millimeter Wave – An emerging technology is the use of point-to-point millimeter wave (sometimes called E-band) transmitters. These radios are capable of much higher data rates (up to 2.3 gigabits per second) over shorter ranges of a few miles. The transmission profiles for these radios are a pencil beam, which essentially means that there is no limit on the number of radios that can share the frequency in a given geographic region. Because of this, the FCC simply requires users to register rather than granting licenses over a geographic region. Millimeter wave transmissions are subject to rain fade, which reduces the range during heavy downpours. Typical millimeter wave equipment prices are around \$20,000 per link.
- Free Space Optics – This approach uses infrared lasers to transmit data at rates of up to several hundred megabits per second over ranges of several hundred meters. Like all light waves, these transmissions require a clear line of sight and are susceptible to interference from fog and, to a much lesser extent, rain. Typical FSO links are around \$10,000.
- Satellite – In many instances in the third world, the terrestrial infrastructure is absent or very distant. In these cases, backhauling traffic over satellite can be cost effective compared to multiple traffic hops. Satellite infrastructure also benefits from being more secure than terrestrial, reducing costs from theft and vandalism. While equipment costs for satellite backhaul are reasonably modest (several thousand dollars per site), bandwidth costs are significant. As such, satellite bandwidth is best reserved for use with voice, which has a higher revenue per bit than data applications.

We expect that [non T1] technologies are likely to see significant growth over the next couple of years.

We expect that all of these technologies are likely to see significant growth over the next couple of years, and that the companies operating in the sector will share in this growth.



SPECIALISTS IN SATELLITE, MEDIA AND TELECOM INVESTMENT BANKING

The table on the following page lists just a few of the many, many substantial players in each of these technologies. For additional information please contact the author.

Company	Microwave	WiMax	Millimeter Wave	Free Space Optics
Advantech	•			
AirFiber				•
Airspan		•		
Alcatel Lucent	•			
Alvarion		•		
Bridgewave			•	
Dragonwave Communications			•	
E-band			•	
Ericsson	•			
Exalt Communications	•			
Flight Transport				•
Gigabeam			•	
Harris Stratex	•			
LightPointe				•
Loea			•	
Moseley Technologies	•			
Motorola	•	•		
Optical Access				•
Terabeam/Proxim		•	•	•

By John Stone
Near Earth LLC