

# Executive Summary



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*“There is a Chinese curse which says, ‘May he live in interesting times.’ Like it or not, we live in interesting times...”*

— Robert F. Kennedy, June 7, 1966

When TeleGeography launched its *International Bandwidth* series two years ago, deregulation of the global sector had opened the market to dozens of new operators. Advances in telecommunications technology were pushing capacity to levels previously unfathomable. Analysts and entrepreneurs alike were heralding the advent of a “New Economy.”

The curse of living in such times became all too clear during 2001. With excess capacity flooding the market, competition has heightened dramatically. Revenues and stock values have plummeted while investor funding has evaporated. Where “dynamic” was once used to describe the international bandwidth market, “volatile” seems to be the current adjective of choice. What happened and why? More importantly, what will happen next?

To provide some insight into these sober questions, this inaugural edition of *Terrestrial Bandwidth* builds on TeleGeography’s research on terrestrial bandwidth supply and demand. *Terrestrial Bandwidth 2002* begins by quantifying the supply of fiber-based capacity—both current and potential. A basic overview of bandwidth products, contracts, technology, and costs provides context for understanding how that supply is bought, sold, and produced. The report then examines the demand side of the equation and the combined effects of supply and demand on pricing trends. The latter half of the report profiles over 80 terrestrial systems in Europe and the Americas. Both on its own or in tandem with its companion volume *Submarine Bandwidth 2002*, *Terrestrial Bandwidth 2002* explores the changing dynamics of the long-haul bandwidth marketplace.

### Supply

The construction boom experienced at the end of the twentieth century has yielded a vast supply of fiber-optic capacity and a diverse array of suppliers. Over the past year, a number of bandwidth providers have disappeared, unable to surmount the debt incurred through ambitious network construction. Others have scaled back their activities and pruned plans for network expansion while diversifying their product and service offerings. In the midst of such volatility, incumbent carriers have re-emerged as the industry's prominent players—nearly all of the few companies still extending their networks in 2001 were owned by incumbents.

While the number of providers may be dwindling, supply remains abundant, if not excessive. Major cities in the U.S., for example, are routinely traversed by a thousand (or more) pairs of optical fiber while pan-European networks have laid hundreds of pairs through population centers. Only a small portion of those fibers are actually lit: on average, 10 percent of potential wavelengths on 10 percent of available fiber pairs. As a result, only one to two percent of potential bandwidth is active. However minor that proportion might seem, the amount of lit capacity it represents is staggering. New York, for example, has 23.5 Tbps running through it on domestic and international networks; London has 6.5 Tbps on international networks alone. Such tremendous bandwidth isn't the exclusive domain of international commercial centers, as second-tier cities (e.g., Cleveland and Basel) along important routes also boast terabits per second of capacity. The potential capacity is even more astonishing, reaching petabits per second in the U.S. (on domestic and international networks) and hundreds of terabits in Europe (on international networks alone).

### Demand

The incredible supply available in the bandwidth market has generated much discussion of an industry glut. Given the tremendous amount of fiber laid over the past few years and the waning of dark fiber sales, industry analysts and network builders have focused on the distinction between oversupply of fiber and oversupply of bandwidth. That the current supply of fiber exceeds demand is now a foregone conclusion, but, according to many in the industry, surplus fiber does not directly imply surplus bandwidth—after all, only a small portion of that fiber is actually lit. TeleGeography's research, unfortunately, suggests that a bandwidth glut does indeed exist alongside the fiber glut. London has 6.5 Tbps of capacity running through it on cross-border networks, yet the combined bandwidth on Internet, voice, and private data networks to and from the top forty European metropolitan areas (ranked by international circuit usage) was only 1.6 Tbps in 2001. Even Harrisburg, Pennsylvania, one of the most bandwidth-starved U.S. cities studied in this report, has access to capacity equivalent to over one STM-1 circuit per capita.

How severe is this disjuncture between supply and demand? TeleGeography research indicates that demand is certainly growing, though not as vigorously as the industry might hope. The Internet has long been touted as the pivotal driver of bandwidth demand, and research confirms its importance in generating demand for bandwidth products and services. Between 2000 and 2001, international Internet bandwidth tripled, far outpacing growth on other, private networks. While still robust, the rate of Internet bandwidth growth appears to be slowing, despite increased broadband access to homes and businesses.

Figure 1. Top 20 European Cities Ranked by Number of Providers Connected



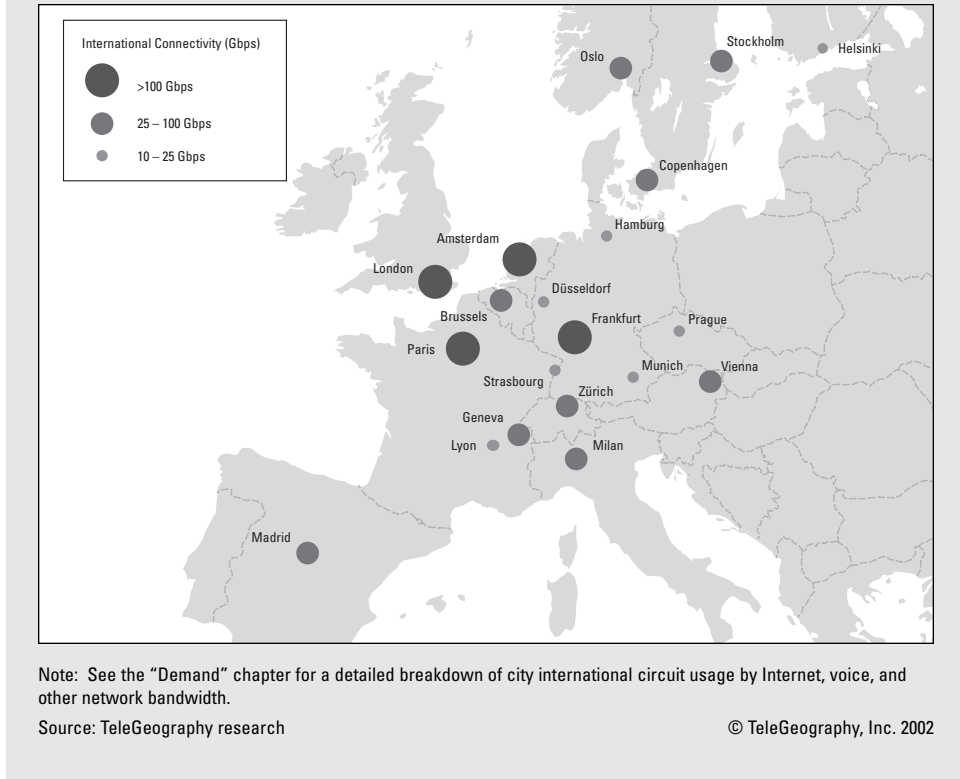
Rank	City	Number of Providers	Rank	City	Number of Providers
1.	Frankfurt	28	11.	Hannover	18
2.	London	27	12.	Zürich	18
3.	Düsseldorf	27	13.	Milan	17
4.	Paris	26	14.	Copenhagen	16
5.	Amsterdam	25	15.	Nuremberg	16
6.	Hamburg	23	16.	Leipzig	16
7.	Berlin	22	17.	Madrid	16
8.	Munich	22	18.	Stockholm	15
9.	Brussels	22	19.	Cologne	15
10.	Stuttgart	20	20.	Rotterdam	15

Notes: Bandwidth providers include operators offering capacity on their own network build and/or via fiber leased from other network providers. Providers included were those who offered cross-border connectivity at 155 Mbps (or higher) as part of their standard service offerings. Maps are designed to illustrate intercity connectivity and do not necessarily reflect the exact physical routing of fiber.

Source: TeleGeography research

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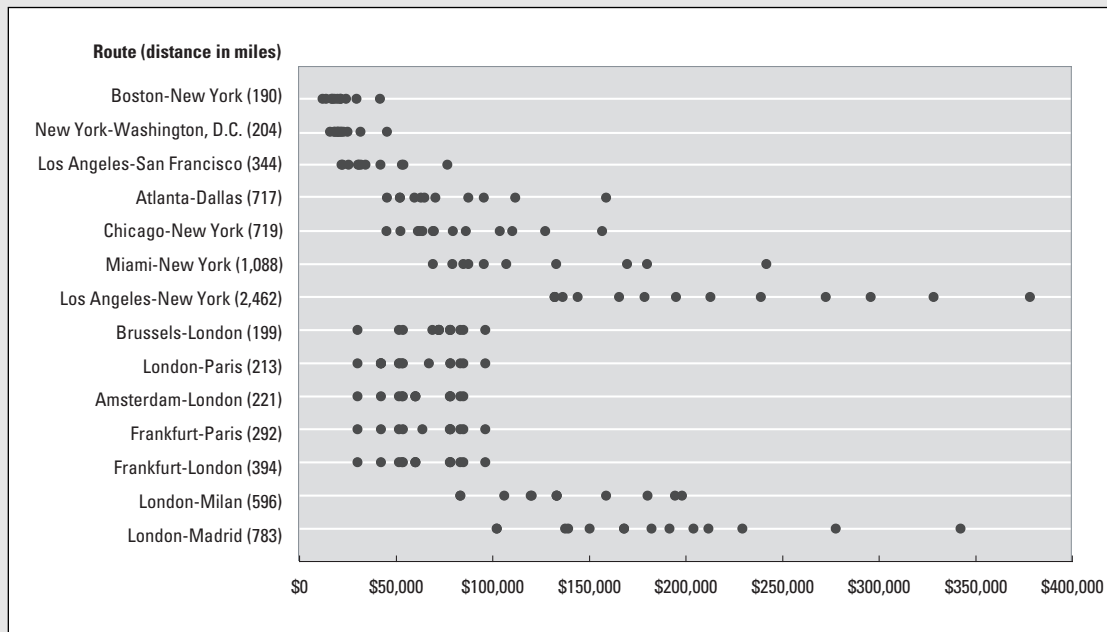
Figure 2. International Circuit Usage by City, 2001



For all the industry worry over capacity gluts, it is ironic that the supply/demand equation now has little bearing on price changes. The overhang of bandwidth is so large that, for the foreseeable future, the supply/demand equation will not strongly determine price swings in either direction. With bandwidth prices already at or even below costs, however, it seems unlikely that the capacity overhang, alone, can depress prices any further. If prices do continue their steep descent, it will be due to other market forces—cheaper provisioning costs or distressed sales by providers nearing bankruptcy—rather than the continuing capacity glut.

### Pricing

The supply/demand mismatch has had a particularly corrosive effect on bandwidth pricing and, by extension, provider revenues. Many carriers had counted on falling prices as part of their business strategies, although none was prepared for the rapid declines witnessed in the past few years. Annual STM-1 lease prices on major European routes have fallen by 85 to 90 percent from 1999 to 2002. During the first quarter of 2000, an OC-3 lease between Los Angeles and New York went for \$1.8 million; two years later, the same lease traded at under \$190,000.

**Figure 3. OC-3/STM-1 Lease Prices on Major Routes, First Quarter 2002**

Note: Points represent prices quoted in the first quarter of 2002.

Source: TeleGeography research

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While the decline of prices has been consistent across the sector, prices themselves vary widely among carriers. During the first quarter of 2002, the Los Angeles-New York lease mentioned above was priced anywhere between \$150,000 and \$350,000. On major routes, the highest price was often four times the lowest price (see Figure 3. OC-3/STM-1 Lease Prices on Major Routes, First Quarter 2002). Thus, the market remains highly opaque, both to buyers and sellers. Just as the proliferation of bandwidth providers during the late 1990s caused many to overestimate their market share, few carriers in today's market have systematic knowledge of the overall state of prices or their position relative to competitors' prices.

## Cursed?

The terrestrial bandwidth industry once seemed an Elysian field in which networks were deployed in feverish anticipation of explosive demand and fantastic profits, but no longer. Network construction has practically ceased, yet supply remains excessive. Demand is growing, though not as spectacularly as before. Prices have plummeted to cost or below-cost levels, but there's no guarantee they won't fall further. With many carriers already bankrupt and several teetering on the verge of bankruptcy, the industry seems poised for even greater turbulence. Such is the curse of an industry in interesting times. 🗝️

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