Internet Bandwidth: It's Time for Accountability

Net Forecasts – Peter J. Sevcik
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We are in a New Network Economy, so it is important to understand some of the fundamental metrics upon which that economy operates. Bandwidth is to the Internet as labor is to manufacturing and oil is to the automobile. Small changes in a balance of supply and demand precipitate huge impacts on the total economic system – inevitably many people are hurt during a shift of the balance.

Two years ago, I wrote a column disputing the often-heard claim that the Internet is "doubling every 3.5 months" (see BCR, January 1999, pp. 12-14). While noting that the Internet had been on a growth rate of doubling demand every 8 months, I projected that the growth rate was slowing, to a doubling every 11 months. More than a year later, in mid 2000, the market research firm RHK reported results of a study which agreed with my forecast -- traffic had slowed to an 11-month doubling rate.

Now it's a sign of the Internet's incredible growth, that a doubling every 11 months can be considered a slow down; just about every other industry and economic system would love to be growing that fast. The issue, however, as discussed in January 1999 column, is the impact a slowing growth rate can and will have on business plans, and the broader question is whether even the 11-month doubling rate is sustainable.

Supply: Capacity in the Internet Core

In January 1999, I maintained that bandwidth within the core of the North American Internet had been doubling every 7 months but would slow to a doubling every 10 months. To confirm this trend, I turned to the *Boardwatch* Directory of Internet Services, which contains a detailed database of all the North American ISPs (see www.ispworld.com). I added up the bandwidth available at the core backbone ISPs per *Boardwatch's* definition of the core – Tier 1 service providers that supply access to Tier 2 and Tier 3 ISPs. This approach indicates that, at the end of 2000, the total trunk capacity available within the Internet core was about 6,000 Gbps.

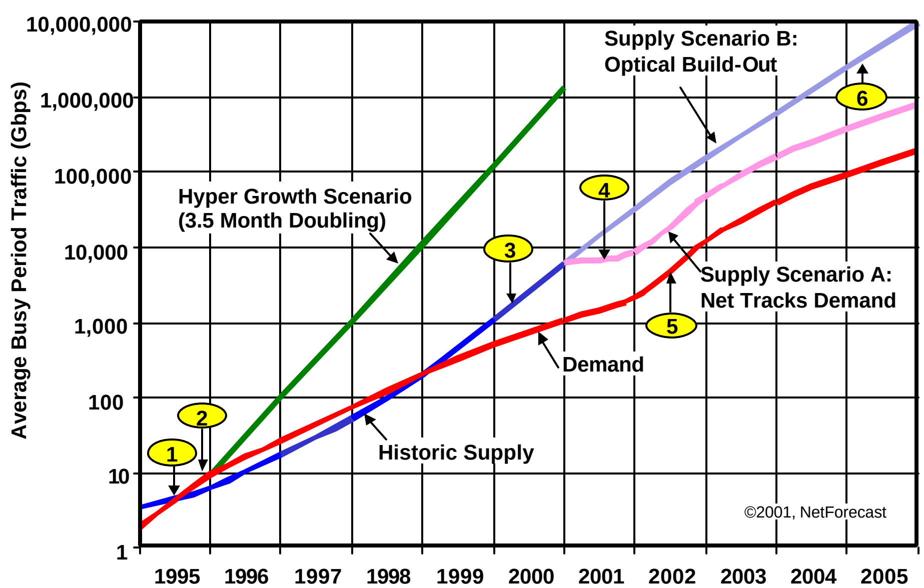

Figure 1 – North American Internet Core

Another approach to estimating capacity is to count the number of OC-48 and OC-192 trunks are in service by counting such ports on routers. Here I turned to Tam Dell'Oro, who I view as the most authoritative source for such numbers, and who told me that her research has found that the leading router vendors sold a total of 15,300 OC-48 and 100 OC-192 interfaces in 1999 and 2000. That is a huge installed base of very high-speed interfaces; only one-tenth of these interfaces would be needed in the Internet core to support all the current capacity, so clearly there are many additional OC-48 circuits outside the Internet core.

The surprising result of this analysis is that supply -- i.e., bandwidth capacity -- has been doubling every 5 months over the last two years. This is much faster than anticipated, and is alarming relative to the growth rate in demand. Something will have to change.

The Internet at a Crossroads

The history of Internet traffic and capacity along with a few scenarios of future growth are shown in Figure 1. The figure shows that the Internet was in trouble soon after browsers became free -- traffic jumped during 1995, and the service providers were caught off guard. With demand overwhelming capacity, performance problems were inevitable, which led Bob Metcalfe to predict an Internet "collapse" by the end of 1995.

However, by 1999, the underlying cause of the performance problems -- bandwidth capacity -- had been largely resolved, and demand had slowed to a more reasonable rate. Today, in January 2001 the network is over-provisioned in North America to the point where the need for additional investment is questionable. We're already hearing about service providers being over-extended, because they anticipated demand that has not materialized; concern is high within the financial community. More service providers probably will have to make serious cutbacks in capital procurements and layoff staff. Some equipment manufacturers are already writing off sales for which they will never be paid.

Scenario A – Build the 'Net for Demand

So the net result is that life in the New Economy will adhere to some of the principles that governed the Old Economy: Internet growth will have to track demand rather than be driven by a "if-you-build-it-they-will-come" philosophy.

Figure 1 reflects this change in carrier thinking in the curve labeled Scenario A. Under Scenario A, the total bandwidth during 2001 will be nearly flat. This will create trouble within the industry, as we transition from a mindset of aggressive construction to rational planning; the shake-out of marginal players will continue.

Scenario B – Build the 'Net for Performance

The big impediment to shifting mission-critical business applications, telephony and new interactive application to the Internet is not bandwidth, it's latency. The future is *not* in big-bandwidth pipes among a few cities, but rather in having a direct pipe among *all* cities.

Assuming there are about 250 major POPs in the U.S., it would take 62,250 circuits to directly connect every POP with every other POP by a single hop trunk. At 10-Gbps per trunk, this would require 622,500 Gbps of capacity. Given the new WDM and *lambda* provisioning systems on the horizon, this is a piece of cake. Packets will travel between any two points in the U.S. in less than 25 milliseconds. The 'Net will have spare capacity to handle sites that are hot one day and cold the next. What do you want to connect to today?

Let's assume that the industry matures over the next few years to the point where a "Big Three" emerges, and let's add another 50 percent of bandwidth for the very popular routes, such as New York to Los Angeles. This implies that a few big core NSPs provision about 3 million Gbps of capacity for Internet traffic, and that this bandwidth is extremely under-utilized so that every transaction on the 'Net can run as fast as possible. The Internet is now a sub-second, response-time platform!

If we stay on the recent rate of growing capacity, Scenario B seems to be attainable by the end of 2004. And by the end of 2005, there will be enough *additional* capacity to let every man, woman and child in the United States watch two unique individual DVD quality movies served across the country – all at the same time!

Figure 1 highlights some of the events discussed above by showing the following numbered milestones:

1 Netscape IPO
2 Bob Metcalfe predicts Internet collapse
3 Over-provisioning ushers SLAs
4 “Flat” market during transition
5 Entertainment is the next “killer app”
6 Sub-second anywhere to anywhere

A Call for Transparency

The Internet has not been doubling every 3.5 months, despite what you might hear. Figure 1 shows how far off that hyper-growth scenario is. But the myth continues because it’s useful -- it helps get money out of investors and keep stock prices inflated. The realistic choices facing planners and investors is reflected in Scenarios A and B in Figure 1.

Looking at the evidence and evaluating the chances for those scenarios, I think that Scenario A will prevail in 2001. The industry’s in for a tough year; we’re more likely to see pessimism doubling every 3.5 months over the prospects for the Internet economy rather than bandwidth doubling. However, long term, I think that Scenario B will emerge as the winning end game.

It’s ironic that one of the major benefits of the ‘Net -- information transparency -- manifests itself in many parts of the economy more than in the Internet business itself. The data in Figure 1 is very difficult to gather and compile; it represents the best I could do from the sketchy data available. Most industry players have an incentive to keep this data secret in order to bolster their market positions. Similarly, the market research firms that continually issue glowing reports, seem to place a higher value on loyalty to their clients than to realistic assessment of the situation.

If we try to keep Internet planners and investors in the dark, the New Economy will be adopting some of the worst characteristics of the Old Economy. It’s time for Internet service providers to supply data about their capacity and demand to an impartial group that will compile and share it with the public. It is time for accountability.

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Note: This article is an updated version of the originally published column.

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