Broadband Perspectives

It's the applications enabled by the connection's quality

Not everything can be photographed in natural light. In photography, you can set up a camera in a very dark room and leave the lens wide open for ever and get zero exposure on the negative if the number of photons falling on the film per unit of time is below some threshold. This has a fancy name: Reciprocity Failure - which describes certain non-linear aspects of film's response to light levels.
See: <http://en.wikipedia.org/wiki/Photographic_exposure>

Well wireless bits are just electromagnetic photons. So, by analogy, if not enough bits are available per unit of time, some things are simply impossible. The "exposure" is never realized and is meaningless.
See: <http://en.wikipedia.org/wiki/Photon>

Consider, if you will, the situation in the Pacific island Kingdom of Tonga. On Tonga it costs a local ISP about $13K per month for a link that provides 2 Mbps down and 1 mbps up - with the increased latency of a geosynchronous satellite connection as opposed to a terrestrial connection. An islander will pay about $2,500 per month US for 512 Kbps down/128 Kbps up. With this very limited capacity, how realistic is it to expect that people living on Tonga will find it "normal" to work with applications that use large files, such as the Democracy Now, mentioned below? The flow of bits as electromagnetic photons, combined with their substantial latency, is such that it prevents the islanders from benefiting from modern applications running on high capacity, high quality connections.

Note: Latency is another dimension of a network that must be taken into consideration when evaluating the sorts of applications a connection can support. Some readers will remember the "latency" that made overseas calls so interesting in the past. Others may have experienced problems introduced by latency in VoIP conversations. The latency dimension is usually overlooked in discussions of the quality of a connection. In general, the lower the latency in a packet switched network, the higher the quality. Too often all that is discussed is the cost of a connection and the bandwidth of a connection. To keep this brief note simpler, latency is not further considered here. It needs to be more fully addressed in another paper. For more on latency see:
<http://en.wikipedia.org/wiki/Latency_%28engineering%29>

For more on the Kingdom of Tonga:
<http://www.cia.gov/cia/publications/factbook/geos/tn.html>

To explore the implications of very large files, we can look into Democracy Now's new recommendation that the members of their network use bittorrent/Azureus <http://www.democracynow.org/bittorrent_help.shtml> to down load the daily TV show they produce. These are about 700 megabyte files in high definition AVI format -- not simple video postage stamps ala Rocketboom <http://www.rocketboom.com/vlog/>.

Now, ideally it would take less than 1 hour to download a one hour TV show. In an ideal world, a connection with Comcast's best 6 Mbps capacity would theoretically take about 16 minutes to FTP a 700 megabyte Democracy Now show file. In the non ideal real world the times would be longer. This strongly suggest that one of Verizon's new $15.00/mo 768 Kbps connections [.768 Mbps] could take at least 7.8X longer, or just over 2 hours FTP this same file.

By way of comparison, and as a competition check, it is worth pointing out that today a citizen of Hong Kong, with a readily available connection with 1 Gbps capacity, could, theoretically, FTP this same 700 MB file in less than 6 seconds - 167X faster a Comcast customer in the US.

The fact of the matter is that these ideal performance are rare indeed. But for the purposes of this paper they serve to create a reasonable apples to apples comparison. Note: P-2-P distribution solutions eliminate the bottlenecks created by very limited numbers of FTP file servers, but the many variables that make P-2-P effective also make comparisons very hard. Thus I used FTP as a source of base line comparisons.

All in all, this means that a connections with a capacity of 768 Kbps is 7.8X more difficult than a connection with a capacity of 6 Mbps. And that this same 6 Mbps capacity is 167X less responsive than the capacity of a 1 Gbps connection in Hong Kong. This makes working with large files a difficult choice for the citizen of Tonga, a possibility for a citizen of America, and a no brainer in Hong Kong. Thus the capacity of our connections to send and receive bits can be a barrier to applications, such as the Democracy

Now program, that assume large file capacities -- or it can be an enabler. Is this justice as fairness for all? Do we wish to institutionalize the notion that some of us are more equal than the others of us? What else? What other applications does too little capacity, or too much latency, render too difficult and thus meaningless?

What do we want for our citizens? The best platform possible or should we be willing to ask them to settle for 1/167th of what our competitors have to work with?

Given the above, how should we properly define the term broadband? What is the capacity/latency threshold below which a connection is not considered to be broadband? I suggest that the lowest threshold is 10 Mbps. To be competitive on the global stage, we should consider a threshold of at least 100 Mbps, if not 1 Gbps.

This leads to the following thought experiment. Ask yourself how many megabytes per day a modern and well connected participant in a network of the near future might want to download per day on average. 700 megabytes of Democracy Now + X megabytes of Podcasts + Y megabytes of vidcasts + Z megabytes of what ever else was of interest PLUS all of the megabytes of our creations we wish to share with others. And all of this needs to be downloaded/uploaded in some reasonable amount of our time. The question is, what is reasonable? What will give us a robust platform for a sustainable economy in a networked world economy?

This thought experiment suggest that our average, actively engaged, networked citizen might well require at least 100 Mbps of capacity just for openers. Consider the case in Tonga where 512 Kbps of capacity downstream costs about $2500 per month. Consider, then, the case in Japan, and else where, where 100 Mbps of capacity is becoming the norm. Does Boston want to be like Tonga or does Boston want to be more competitive than the offerings in Japan, Hong Kong etc? It makes a real difference as to the applications that can be supported in a meaningful way.

Here, for example, are some current prices in Hong Kong. They offer an interesting perspective of what is possible today in a competitive environment:

1 Gbps [symmetrical] @ $215 US/mo = $0.22 per Mbps

100 Mbps [symmetrical] @ $34 US/mo = $0.34 / Mbps

10   Mbps [symmetrical] @ $16 / mo. = $1.60 / Mbps

Or more generally:

The Kingdom of Tonga: Consumer rate is $4883 per 1 Mbps [asymmetrical] for .512 Mbps of capacity = 533X more costly than U.S;

U.S.: (Comcast) consumer rate is $9.17 per 1 Mbps for 6 Mbps of capacity = 42X more costly more than Hong Kong

Hong Kong: Consumer rate is $0.22 per 1 Mbps [symmetrical] for 1 Gbps of capacity. This is a stunning 167X performance advantage over Comcast's best current offering - for under 4X the cost [$55 vs $215].

If we pay more for less in Boston, can we truly claim to be world leader in connectivity?   Today a person living in Boston with a 6 Mbps connection is enjoying a capacity that is about 12X greater than that enjoyed by an islander on Tonga, but is only 1/167 of the capacity available in Hong Kong. The fact is that a premium consumer grade connection capacity in Boston is a lot closer to the conditions in the Kingdom of Tonga than those in Hong Kong.

Note: It does not matter what approach a society takes to offer their citizens truly Big Broadband capacities. The fact is that these real world capacities are the realities we have to compete with today and going forward. How they are provisioned does not alter the fact that they set the bar for competition in the network of interconnected modern societies, their markets and their commons.

There are further interesting implications.

1] How much back haul would be required to support 1 million users each with 100 Mbps of symmetrical capacity? With 1Gbps of symmetrical capacity? And what would the latency of these connections be?

2] In a P-2-P one-for-all-and-all-for-one environment each person increases his or her assets per download but also uploads 120% to 150% of what they download [share ratio of 1.2 - 1.5] as their contribution back to the commons [Cooperative gain]. What, then, are the implications for the demands on the infrastructure for the distribution of bits in this quantity within a 24 hour time frame? Currently, the cable companies have no idea what the upper limit on upstream demand is. We suspect they are afraid to discover what the answer is.

3] The above illustrates that it is already possible today to integrate our drives for creating community with our drives for increasing our private wealth. We can do this now in such a way that the integration is greater than the sum of the parts. This cooperative gain creates the value that will drive our future economy. This is also the cooperative gain that B. Franklin saw as the means to creating and sustaining a middle class.

All of this demonstrates why it is important that American cities, towns and counties use Buckminster Fuller's concept of Comprehensive Anticipatory Design Science as they considers the best set of principals that will guide them towards the goals implied by the vision above.

Just what sort of heuristic, First Mile Out, P-2-P, low latency , mesh network, supported by what kind of Cognitive Software Defined Radios, should we be anticipating? Will we be ready for 1 Gbps WiFi capacity? It is on the horizon. Or rather, what sort of principals will allow us to grow into the above anticipated vision?

Now how do we get our elected officials -- and their advisors -- to understand all of this?