More 'wireless' Internet" begs the question.

Reading the overview of the President's Council of Advisors on Science and Technology (PCAST)'s latest report, *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth* I'm not surprised. The process begs the question by assuming the answer is more "wireless spectrum" rather than stepping back to ask how we can best serve society.

In this essay I'll focus on the charter of the report rather than the specifics of the report itself. Though I've written about these issues in other essays it is useful to recap them for the readers of the PCAST report. If you want to focus on the future you can skip ahead to "digital!"

The basic problems cited in the report are primarily due to how we fund telecommunications rather than the limits of the technology.

The Internet has shown us how simple it is to connect two devices – to send a message to a device all you need to know is its network address. It doesn't matter whether you use wires or not. Technologies like Wi-Fi allow essentially unlimited wireless capacity already. The devices don't even need to be the same room – they could be anywhere in the world!

This may seem simplistic but isn't this just what happens when you type in the name of a web site and just go there? It doesn't matter if you are using Wi-Fi or wires or cellular.

It's this ability to focus on the problem at end and not all the complexities of the path between that has given us such innovation.

Yet the report attributes all of this to the magic of "wireless" – the technology of Tesla and Marconi – rather than the shift from analog to digital. If anything, wireless, in the sense of LTE is an impediment because eschews abundant Wi-Fi in favor of the incumbent providers' limited facilities.

In many cities there are multiple broadband systems – each of which can cover the entire city – yet they are not available for use as infrastructure. Each connection requires a separate connection and serves only one household or office.

This idea of each connection requiring its own wire or frequency sounds very much like railroads. Indeed the metaphors we use for telecommunications hark back to the days of railroads and telegraphy.

Both railroads and telegraphers carried valuable cargo along paths (rails or wires). The customers paid a fee for transport as a service. The high capital costs and the difficulty in differentiating the product made the business model problematic as Richard White explains in his book *Railroaded*. These problems led to the creation of the ICC which served as the model for the FCC in order to assure an orderly marketplace.

Analog systems have a problem -- in the days of analog telephony the quality of a call become worse as the distance increased because analog systems accumulate static (noise) – that scratchy sound like an old vinyl record. Carriers handle this by knowing if they are carrying a telegram or voice or video so they can tweak things just right. That's how they add value. The telegrams of the 1860's became the message units of landline telephony and the minutes of cellular.

"Digital" changes all this.

Like any technology our first impulse is to treat it as a substitute for the old technology just as the automobile was seen as a horseless carriage. The implicit assumptions of the status quo are built into our very language thus we confuse "communications" in the sense of what happens in a wire to "communications" in the sense that people use it. To put it another way, we fail to notice that the School of Communications in a university is not in the electrical engineering department and we consider a service like Pandora to be "radio".

Digital technology was developed to solve the problem of carrying a telephone signal over a long distance and succeeded far beyond what anyone could've expected. A digital signal, bits, can be carried over any distance without accumulating static because we have just two values – one and zero. If a "one" gets distorted we just turn it back into a one. We don't need to know if it represents text or voice or music or whatever. In fact, because each packet of bits is labeled we don't even need to keep the bits in any particular order nor do we need all of the bits jst lke we can rd this msg without letters all the. (The fact that you can read and understand this sentence shows how you assemble meaning outside of the network).

Bits themselves have no more meaning than the letter "e" in isolation. The meaning comes from context – what we do with them outside of any facilities we use to exchange the bits. This means that value is created outside the network and is thus unavailable to fund the facilities.

So how does a carrier make money carrying bits?

We need to be careful distinguish between the bits themselves and services like "cable TV" and voice calls and SMS. These are examples of making money using bits to create value like a railroad uses its tracks to ship goods. This analogy has its limits and its consequences.

Bits can level the playing field because everyone is using the same alphabet to create services. If you think of Skype as just another phone service then the carrier is not adding value. The value is 100% external.

When you watch a Netflix video over IP the carriers get no benefit from the additional value created by Netflix. They argue that they should because … well because. If the network owner can't distinguish between the different kind of bits then trying to claw back value from particular applications makes no sense.

In telecom classic Netflix would contract for guarantees (Service Level Agreements) and pay extra. Instead Netflix chooses to limit its market to customers for whom the service works. Skype does the same thing and it turns out not only can they offer "phone" calls, they can provide video at no additional cost!

Both Netflix and the viewer are customers. The providers are not competing with other providers as much as they are competing with their customers!

The carriers control the paths and can and do limit the capacity available to customers and keep much of it for their own services. Yet that isn't enough to prevent the competition from creating value with what is available. Video providers can adapt in many ways such as reducing the video image or by caching at the edge or … well whatever they can imagine.

The carriers have a problem – how do you fight against an idea – a paradigm shift?

Even if we stick with the traditional framing the apparent scarcity is due to an inherent conflict of interest and not the lack of "spectrum" or fiber.

We can remove this conflict of interest by separating the applications from the transport. But that isn't enough. If bits have no intrinsic value and the transport provider can't depend on adding value then how do you fund the infrastructure? We don't fund expensive highways and sidewalks as a profit center so why do we put profiting providers first and benefiting the economy and society second?

Before we go rushing off to add more capacity to the "wireless pipes" (spectrum bands) we need to think about fundamental questions. For that matter why is capacity the primary goal? It's a measure that fits well into familiar services like watching video content.

The capacity story fits very well into a business model that tries to associate value with the number of bits transported and justifies investments based on the need to assure that those who depend on the network for video will get what they expect.

The Netflix example is indeed video but based on finding opportunistic capacity instead of assured capacity. If you want Netflix in your home you can buy adequate connectivity within your home. If you and your neighbors want it you can hire people to facilitate local connectivity and pay them like you do for any common infrastructure like roads and sidewalks.

The real power of the opportunity framing is that we need not try to make every wire and radio to be a profit center. This removes a major impediment to innovation – the need to authenticate each connection and justify each application to a carrier.

This makes connectivity is very simple – I use the term "Ambient Connectivity" for this new framing. You can just assume connectivity anywhere just like we assume sidewalks. It now becomes (relatively) simple to do connected healthcare. Your pacemaker can stay connected to your provider without worrying about the path.

The idea of adding frequencies is fixed firmly in the analog past. It doesn't address the real issue which is relationships between the two end points independent of any network

Digital!

Compared with the analog framing, the digital framing seems almost magical. The idea that you can just type in "rmf.vc" and immediately see the web page or that we can have video conferences without having to pay a service provider has become so ordinary that we fail to notice that we can only do so if we've made separate arrangements for connectivity either by having a subscription or agreeing to a provider's terms. As we've seen, today devices require negotiating with the carrier in order to connect at distance.

We can provide universal connectivity by funding connectivity in the same way that we fund other infrastructure like sidewalks and roads. We do need to be careful and avoid comparison with paying for a consumable like electricity. The reason I prefer the term ambient connectivity is

that we can assume it is all around us. A device can just reach out and assume connectivity just like you can expect a sidewalk or path in a city.

We can own the wires and radios locally and at a regional level. Again there is ample precedent in how we fund existing infrastructure. By comparison with sidewalks wires and radios cost very little and, as we've seen with similar technologies, we can expect the kind of Moore's law style hypergrowth that has given us gigabit connectivity within our homes and offices at little or no ongoing cost.

Once we can assume ambient connectivity we can start to explore what is possible.

Your heart monitor can alert your physician prior to a full attack and also alert an ambulance so it can meet you where you are. It doesn't take much capacity to make this work – just the opposite. It requires the ability to exchange a few bits without having third parties in the middle demanding payment. They will get paid – but not extracting a fee each time we communicate.

We need to look ahead rather than backwards and ask PCAST how to best serve the public good even if that answer requires disruptive change.

Additional Reading

I (and others) go into more detail on these concepts:

- Ambient Connectivity a new framing for connectivity outside the constrictions of pipes.
- The Costumer as God Doc Searls article in the July 21st 2012 Wall St Journal. He mentions some of the promise of ambient connectivity.
- From DIY To Internet a more detail presentation on the shift from a telecommunications framing to connectivity.
- Purpose vs. Discovery. One way limit ourselves is by building infrastructure with the limits or purpose built in. If we take advantage of opportunities we can do far more with what is already available.
- Not Super. Broadband is not much of a super highway.
- Assuring Scarcity – the cellular plan for assuring the scarcity that maximizes their profits.
- Railroaded. Richard White's book on the railroad business in the western US which provide the blueprint for much to today's telecommunications policies.
- Spectrum as Farmland. Our policies treat spectrum as if it were real estate.

Much more at http://frankston.com/public.