

The Internet of Things versus the Access Framing

This column [appeared](#) in the July 2013 issue of the IEEE CE Magazine. You should read it there if you have access. You may also want look at the related article, [The Internet: Missing the Light](#), at CircleID.

My previous column was [“Not in Control”](#).

Bits Versus Electrons

The Internet of Things Versus the Access Framing

By Bob Frankston

Having used connected computers for nearly half a century, I take it for granted that the Internet is about seamless connectivity that starts locally, at home. However, to most people, the Internet is something they access only after agreeing to pay a service provider because, in the past, the Internet was the province of university researchers with only limited access to outsiders.

This view must change if we are to realize the benefits of the Internet as fundamental infrastructure. When we talk about Internet access, we accept the idea that the Internet is something with a boundary around it. To access it, we must negotiate with service providers.

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As I wrote in my April column in *IEEE Consumer Electronics Magazine*, “(Not) in Control of Your Home,” if we are to connect devices, the so-called Internet of Things (IoT), we must assume what I call ambient connectivity. We cannot have each device being forced to negotiate for each connection. Even more problematic is when we need to deal with

a third party (ISP, Telco, or Cableco) that must make a profit from each message, for example, that a medical monitor might send.

To understand the different points of view, we need to look at the history of online services so that we can compare it with a connectivity perspective.

IN THE BEGINNING

Consumer online services started to become available in the late 1970s, with Prodigy, CompuServe, and AOL being among the most well known. There were also many small services, known as bulletin board systems (BBSs), that allowed people with a similar interest to create their own community or club.

The typical mode of remote access was the dumb terminal via a dial-up modem. The modem utilized the existing phone network by treating the data connection as another phone call. You would have a phone number for each club and connect your terminal to that one specific club. To the phone company, these calls were just more traffic for their intelligent network. Dedicated resources would be assigned to each call for the duration of the connection.

The Internet club was different in that the machines were permanently connected and all of the resources were available at once. This diversity forced the separation of the Internet protocol (IP) from application protocols such as Transmission Control Protocol (TCP). The big innovation in IP was the minimalist approach of best-efforts transport of the packet.

Until the early 1990s, the Internet was indeed a closed club in that it was limited to academic purposes only, although some managed to find ways to exchange mail between the commercial networks and systems on the Internet.

Tim Berners-Lee took advantage of the opportunity afforded by the widespread connectivity of the Internet to create a World Wide Web. Today, we simply say “the Web” but, in the 1990s, the worldwide reach was the most unbelievable aspect. Anyone anywhere could host a Web server on his or her PC or at commercial sites as long as it was reachable over the Internet. In response to the demand for Web access, many BBSs evolved to become ISPs. AOL added Web access to its repertoire.

Of course, the traditional carriers wanted to get into the business too. They repurposed the infrastructure they had built for interactive TV for Internet access. The cable TV companies happened to use coaxial cables to extend the broadband TV signals, hence the name broadband. The telephone companies developed asynchronous digital subscriber lines (ADSLs) to carry TV and repurposed the technology to connect to Internet gateways.

Both broadband and DSL connectivity were modeled on the dialup modem with an IP address acting like a phone number. Connectivity to the Internet was another service in the mix of services that included TV channels and telephone lines. Just like you paid for each telephone number and each set-top box, the original plan was that you

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Both broadband and DSL connectivity were modeled on the dialup modem with an IP address acting like a phone number. Connectivity to the Internet was another service in the mix of services including television channels and telephone lines. Just like you paid for each telephone number and each set top box, the original plan was that you would pay a monthly fee for an IP address for each connected computer. The idea of Internet access as a service also fit well into the FCC’s regulatory framework. Or so it seemed.

Indeed the machines on the Internet are like a club just like users on a given Bulletin Board System were members of a club. The access metaphor assumes that people are outside the Internet and need to cross a boundary in order to get into the club. By establishing a boundary the carriers can have a business based on charging people for allowing them to cross that boundary. This makes the ability to communicate the exception not the norm!

A Different View

My view of the Internet is very different from the access paradigm. I was reminded of this recently when I replaced one of my Insteon light switches. If I want to use it to turn on a particular light I just associate the light (ID#03.23.45 for example) with the particular button. I’m using this as my example because it is very clear that there is no network as such – the devices just use whatever wires or radios they can to exchange messages.

This is the way IP works but we lose sight of the essential simplicity when we start talking about a “local area network” as if it were a separate thing rather than just a way to use our own wires and radios. As owners we can add capacity and devices as we wish to meet our own needs. As someone who has been online since the 1960’s it was natural for me to put my home computers on a network. (At that time even having more than one computer was unusual.)

In 1994, rather than connecting a single computer to the (the computers on) the Internet I wanted to be able to share that connection with the other computers in my house. In doing so I discovered Network Address Translation which made my entire home network appear as a single computer to the rest of the Internet. I was working at Microsoft at the time but mostly worked at home because of the 2500 mile commute. This distance gave me a chance to do my own research and the opportunity to apply this experience by assuring that Windows shipped with Internet support (IP) and a NAT for Internet Connection Sharing (ICS) already installed starting with Windows 98SE. My most important requirement was that it “just work” both within the home and in interconnecting with other machines around the world. To most people it was simply about shared web browsing.

As a result home networks are interconnected with the rest of the Internet just like university networks are. The “access” framing worked well-enough for us to accept it. Because we don’t have ownership of the wires outside our homes we can’t invest in more creative ways to use them. While we could use better technology to increase connectivity within our homes we are limited to offerings from providers because my neighbors and I don’t own the facilities between our houses.

It’s not a Capacity Problem

Instead of demanding the rights of ownership we accept the limitations of the access model. We are limited to the choices offered and adding more providers only gives us more of the same. We don’t have a capacity problem. We have a metaphor problem which leads the carriers to try to reinforce the old business model of charging for connections. We need to remove the need to charge for access by financing the facilities we use as a common resource, just as we do with roads and sidewalks.

The problems with the concept of “access” become far more acute and absurd as we become increasingly more mobile and expect to be connected everywhere. We’re back to having each device needing its own account from one of the providers available at a given location. If we want to see the weather on our wrist device we can’t just have it connect. Instead it must relay through another connected device and the providers are trying to set rules for how you can share a connection.

This is very much reminiscent of the 1990’s effort to limit how many PC’s could share a single connection. And just like I did then at home, I can work around this using NATs, but with far more twisting and winding passages. To put it simply – the access model and the “Internet of Things” are at odds. The reason we are excited about IoT is that we can focus on the things without being bogged down in the

complexities of communications, that is, the mechanics of gaining access.

The lesson of the Internet is that we are all members of the club and not outsiders. While most clubs need to collect dues to cover the costs, this club is likely to recover the costs by eliminating the expense of maintaining a barrier around the Internet. But the real benefit comes when we take advantage of the new opportunities and can literally improve the quality of life with connected healthcare and other vital services. We must be able to do so, unencumbered.

Connectivity in itself is very simple. Just as I can simply add an Insteon switch anywhere without a network I should be able to use any available connection, especially the superabundant Wi-Fi. The goal of ambient connectivity is to get the benefits of being a participant, rather than being an outsider who must access someone else's "Internet".