The Public Packet Infrastructure

Column: Bits vs. Electrons

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OUR NEW INFRASTRUCTURE

Today, there is a demand for more broadband as people realize the importance of being connected to the Internet, whether to access websites, stream entertainment, attend school, attend family events, work remotely, and so much more. This demand has been driven by the success of today's Internet. It is now time to recognize the Internet as infrastructure.[1]

The Internet's best-effort approach[2] has allowed us to share the abundant capacity latent in the existing facilities by converting all traffic into packets. By the late 1990s, the Web had generated a demand for more generic capacity, which could be used for any purpose. The surprise was that voice and even video calls worked well without a reserved path.

This is an example of the virtuous cycle we can get when we create opportunity for innovation. Unlike traditional telephony, the Internet's packets are not tied to any particular purpose. The capacity added for one application enables innovation that drives demand. That is the power of a packet-based infrastructure.

This is why I write about creating opportunity. I can't predict exactly what people would do with the opportunity, but I can identify how to enable innovation or, more to the point, permissionless innovation. Having to ask permission limits us to innovation which can be justified beforehand and makes it difficult to explore ideas before they are proven valuable.

Having to justify the cost of innovation is another barrier. When Dan Bricklin and I first implemented the electronic spreadsheet (VisiCalc), we had no idea how valuable it would be. Therefore, we priced it based on the prices of video games rather than business software. That low price enabled people to discover uses far beyond high-profile business applications.

Today the packet-based approach of the Internet provides us with an abundant opportunity for innovation. Once one has a single broadband connection, even applications that were previously too expensive for day-to-day use become feasible. Today people can have a casual video conference because we no longer have to justify the cost of the dedicated circuits necessary for Picture Phone®.

Now that the Internet is becoming infrastructure, the limitations of repurposing the underlying telecommunications infrastructure are becoming apparent. With the Internet as a service, we worry about affordability and a digital divide. With an infrastructure approach, the digital divide concern goes away because we can assume connectivity.

Less obvious is the cost of being unable to assume connectivity unless someone has a subscription and, even then, only if the subscription is in good order. When we use protocols like Bluetooth to connect a medical monitor to a cellular phone, we have a potential failure at each link in the path. To implement an innovative application using the Internet, we need to convince users to pay for a connection just for that application.

We need to recognize that the world has changed. Telecommunications services are applications on top of a packet-based infrastructure. Cellular telephony is based on packets. Video and audio (radio) content is increasingly streamed over the Internet. You don't need to tune into a radio station – you just ask Alexa or go to a station's website and can listen anywhere in the world.

A nice benefit is that the cost of a native packet-based infrastructure is far lower than traditional

telecommunications because it allows us to tap into the abundance of the commons and because a generic packet-based infrastructure is simpler than managing the competing requirements of each application within a network.

Local ownership drives a virtual cycle as each community can invest in meeting their own needs and tap into the value of the infrastructure as a whole.

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In the days of the dial-up, access to the Internet was a premier application (remember AOL?). With IP as the underlying infrastructure, paying for Internet access feels like double billing. When we switch the economic model from subscribing to individual lines to pooling resources to pay for shared facilities, we start to think very differently about connectivity. This is another example of a virtuous cycle.

I use the term Ambient Connectivity™ for this architectural assumption. When writing a program, I don't think about how that will connect to the Internet. That's a problem for the user. If you get a broadband or cellular connection, it is a common resource for all applications.

An infrastructure approach is simple since all we need do is provide generic connectivity rather than individual subscriber lines. A side benefit is that users aren't limited to the fixed capacity of a single line for each house and phone. They can tap into the abundant shared capacity.

This is the genius of the Internet protocols. TCP is a way to share the common facilities. Instead of getting a circuit busy, it's up to you to decide whether you have sufficient capacity for a phone call or streaming. Today we're at the point that applications such as video streaming already work well, so I no longer have to explain that as a future possibility The key is to recognize that when there is a need for more capacity (or, sometimes, any capacity) we simply add more generic capacity.

If we assume ambient connectivity in building systems, then we will get ambient connectivity. This is not an abstract field of dreams argument but rather a pragmatic recognition of what happens when we give communities ownership of their local facilities and an understanding of the power of local connectivity.

The challenge is to think in terms of a native packet infrastructure rather than approaching each problem one by one. For example, instead of addressing the digital divide with complex subsidies, we eliminate the concept of a subscription.

Once we can assume ambient connectivity, we start thinking in terms of a digital bridge that enables us to use the connectivity to help people take advantage of the available connectivity. We can think in terms of systems. A connected smoke detector can be part of an environmental monitoring system. The firefighters can stay connected even when in transit.

Ambient connectivity is about more than connecting to the Internet, but for now, there is enough value in "more Internet" to justify a packet infrastructure. As a packet infrastructure becomes available, we can explore new opportunities for connected healthcare. We don't need a separate Internet of Things.

Enabling the PPI

We already have a packet-based infrastructure, but it's locked away by an economic model that prevents us from connecting simply to collect a subscription fee. We need only change how we think about connectivity and don't have to spend money on a separate PPI.

The challenge is to confront "we've always done it that way" and bugaboos such as worrying about "running out of Internet" [sic]. That's difficult in the abstract, but we can start by realizing that the PPI approach is the norm on campuses, in businesses, and in our homes. At home you just plug in a device and don't worry about logging in or a separate subscription for each device[iii].

I use the term "Campus model" model because it provides coverage over a geographic area – a campus. It seems natural because it doesn't make sense to require an account for each lap top or light bulb, or printer. Perhaps this is why it isn't obvious that the same model makes sense for a larger community such as a city. Getting a municipality on board is a challenge because we still frame our policy decisions in terms of the givens of telecommunications and metaphors such as water flow models.

It makes more sense to work with small communities such as coops that serve their members and pool resources for the common benefit. Coops that serve a geographic community are well-positioned to provide local infrastructure. It could be a rural coop or a neighborhood group in a city.

The resources can be used to hire a professional staff to install and maintain the facilities. The costs would be no higher than a traditional broadband service and likely to be very much lower without the need for complex wiring to prevent users from connecting without a subscription. Instead, we get the abundance of the commons and direct value to the community. Schools can focus on education rather than getting students connected. Farmers can simply mount monitors on livestock and track them even when wander far from home.

There are already some house developments[iv] and apartment buildings which have open connectivity but don't

take advantage of the full potential of the infrastructure. This is no surprise – it took more than a decade for people to take advantage of home networks and sell IP printers and light bulbs for home use. While I originally sold home networking as shared Internet access, it wasn't limited and thus enabled innovation in use. Providing Internet access is the first step. It can be complemented by assuring wired and wireless coverage throughout the campus (or housing development) to realize the full value of what is already in place.

That's another example of a virtuous cycle. Anyone can extend the coverage without having to make complex arrangements and enabling more applications.

As communities start to assure connectivity, they can share expertise, and cities can learn from their examples. The compelling economic advantages alone will encourage further adoption, and, at some point, the PPI will become the norm.

Some cities are already moving towards enabling a PPI. Forward-looking CIOs are negotiating what some have called a prenup. When writing an RFP (Request for Proposals), they can require that the city gain ownership of the gear over time and have the right to shift to an infrastructure model. This helps address the reluctance to change while creating an opportunity for transformative value.

The reason I'm confident is that home networks used to require a subscription for each device. Today nearly 100% of home networks use the campus model. A per-device subscription would be unthinkable. And, soon, a subscription model transition to an infrastructure model and become the norm.

[i] https://rmf.vc/IEEEBBToInfrastructure.
[ii] https://rmf.vc/IEEERefactoringCE
[iii] Yes, there is typically a password for Wi-Fi but that's not about economics. A PPI can offer open access while allowing existing applications to continue to rely on such a security perimeter.
[iv] https://www.bbcmag.com/property-of-the-month/creating-a-frictionless-fiber-broadband-experience-sunbridge-in-central-florida