

Internet Peering has Obsolesced Interconnection Regulation

The old adage is true here; “if it ain’t broke don’t fix it.” The Internet peering marketplace works exceptionally well and it has for its entire twenty year history. The unparalleled success, growth, and resiliency of the unregulated model for the Internet backbone peering marketplace has been nothing short of phenomenal in enabling and ensuring everyone reasonable access to the Internet.

Summary of What Congress Needs to Know

As Congress considers modernizing communications legislation concerning Internet peering and interconnection issues, it is imperative to understand how Internet peering and voice interconnection are fundamentally different from two key policymaking perspectives.

A. How Internet networks are completely different from railroad and electricity networks.

1. Place-independent vs. place-dependent
2. Software-dependent vs. hardware dependent
3. Digital vs. analog

B. How IP packet networking fundamentally differs from legacy voice interconnection.

1. Circuit technology vs. packet-switching technology
2. Continuous vs. discontinuous transmission
3. Predictable vs. unpredictable transmission
4. Unitary service vs. multiple services
5. Centralized vs. decentralized architectures
6. Location-driven vs. location-agnostic
7. Best efforts vs. guarantees
8. Accounting simplicity vs. complexity
9. Access vs. connection

Given the reality described below -- that inter-networked computer networks are effectively the opposite of railroad, electricity, and telephone networks -- trying to impose telephone interconnection rules on IP inter-networking is akin to forcing a square peg into a round hole. It predictably breaks both the peg and the hole.

A. How are Internet networks completely different than railroad and electricity networks?

1. Place-independent vs. place-dependent

Railroad and electricity interconnection is *place*-dependent, Internet “interconnection” is not place or physical-location-dependent.

This is a huge difference as physical-place-dependency can create a physical interconnection chokepoint in railroads or electricity. In contrast there are no physical-place-dependent chokepoints for the Internet because one can access/connect to the Internet from many different places, through many different entities, and via many different technologies, e.g. electrically via wires like copper or coax, optically via different fiber configurations, or wirelessly via many different licensed and unlicensed frequencies and providers.

Choice of place, facility, provider, and technology mean multiple dimensions of competition and no lasting chokepoints because if one encounters a temporary congestion problem in one part of the Internet, one has the

choice to take their traffic and business elsewhere. No chokepoints mean no need for proscriptive regulation of Internet peering arrangements.

2. Software-dependent vs. hardware dependent

Railroad and electricity interconnection is hardware-dependent, whereas Internet interconnection is *software*-dependent. Railroads and electric networks require one universal physical standard of wheel gauge and axle width, or physical electrical transformers and wall plugs, to interconnect to these respective networks. In contrast, the software design and protocol of Internet connections make interconnection hardware-agnostic, seamless and automatic, and hence inherently competitive and choice-rich.

Simply, the genius of Internet packet-technology networks is that they do not require any interconnection, permission, or negotiation points, because inherent in Internet Protocol is that packets are automatically routed seamlessly between different internet networks to their destination by design. Inherently Internet packet technology makes the concept of telephone interconnection obsolete because the technology supplants what used to require hardware and regulation to achieve. Most simply, Internet protocol innovation inherently obviates an FCC role for regulating Internet peering arrangements.

3. Digital vs. analog

Railroad and electricity interconnection involved *analog* technology, whereas Internet peering must involve *digital* computer technology. Importantly, railroads required a set *continuous* physical path or circuit from point A to point B. Electricity networks require a *continuous* electrical circuit from origin to destination.

In contrast, digital technology in general, and Internet packet technology in particular, is *discontinuous* -- the antithesis of a telephone or electrical *continuous* circuit. It is this inherently *discontinuous* digital innovation that enables IP networks to be place-agnostic and hardware-agnostic, and inherently competitive and choice-rich.

More specifically, the innovation of digital IP packet networks subdivides information into many small packets to enable more efficient transmission. The packets get individually-routed unpredictably and comingled with other packets to minimize bandwidth waste. At the ultimate destination, the packets get immediately reassembled by any device anywhere. Internet Protocol is inherently a competitive technology, inherently made even more competitive by Moore's law, which ensures digital networks continually enjoy rapidly declining computing costs.

B. How does IP packet networking fundamentally differ from legacy voice interconnection?

1. Circuit technology vs. packet-switching technology

Interconnection is a telephone-technology-specific concept. It was created and designed for circuit-switching telephone technology that purposefully produces dedicated electrical circuits connecting specific telephones.

In stark contrast, inter-networking or "peering" is an Internet-technology-specific concept. It was created and designed for packet-switching Internet technology. It purposefully subdivides information into many small packets to enable much more efficient transmission.

2. Continuous vs. discontinuous transmission

Interconnection is all about creating and maintaining a continuous electrical circuit, while inter-networking is all about one computer network facilitating the forwarding of data packets to another computer network based on a discontinuous system of Internet protocol packet delivery.

3. Predictable vs. unpredictable transmission

The predictable transmission path of telephone circuit-switched connections is exact opposite of the unpredictable transmission path of Internet packet delivery.

4. Unitary service vs. multiple services

The PSTN was designed to provide one service -- voice. In stark contrast, the Internet was designed to enable any product or service one could invent. On the Internet voice is an app. Consequently, the Internet can mimic the PSTN easily and cheaply with Voice over IP (VoIP), just like the Internet can mimic broadcasting with video streaming.

5. Centralized vs. decentralized architectures

Telephone technology by design is centrally-organized in a hub-and-spoke manner utilizing central office switches to connect calls. Internet technology by design is decentralized utilizing routers which simultaneously forward commingled packets between computer networks via routing tables and "best efforts."

6. Best efforts vs. guarantees

Since the predictable and centralized design of a telephone network naturally lends itself to predictable, 99.999% reliability and operation, it is naturally conducive to a centralized management regulatory construct like common carrier interconnection.

However, the unpredictable, "best efforts," and decentralized Internet design is antithetical and inherently hostile to a centralized management regulatory construct like common carrier interconnection.

7. Location-driven vs. location-agnostic

Interconnection is important in a circuit-switched network because one must connect at the nearest geographic point, which inherently limits competitive interconnection choices. However, inter-networking or peering with other computer networks can largely happen without respect to location so consequently an Internet entity inherently has many competitive choices to inter-network and access the Internet.

8. Accounting simplicity vs. complexity

Lastly, interconnection is an economic concept focused on accounting and billing for originating and terminating voice traffic by seconds or minutes. By design Internet technology does not originate or terminate connections; it breaks information into packets, commingles and forwards them for reassembly on any device anywhere. Accounting for individual end-to-end bit routes would require pervasive deep packet inspection technology that could also be used simultaneously for surveillance.

9. Access vs. connection

One does not "connect" to the Internet, one accesses it. The PSTN "interconnects" different entities based on compulsory, regulated, interconnection-agreements. The Internet inter-networks different entities based on voluntary, unregulated "inter-networking" or "peering" agreements. Simply, circuit-switched technology can need regulation to ensure interconnection, whereas Internet technology does not because the design of the Internet naturally facilitates voluntary and competitive inter-networking or peering access to the Internet in a location-agnostic and technology-agnostic manner.