Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of		
Numbering Policies for Modern Communications	)	WC Docket No. 13-97
IP-Enabled Services	)	WC Docket No. 04-36
Telephone Number Requirements for IP-Enabled Services Providers	)	WC Docket No. 07-243
Telephone Number Portability	)	CC Docket No. 95-116
Developing a Unified Intercarrier Compensation Regime	)	CC Docket No. 01-92
Connect America Fund	)	WC Docket No. 10-90
Numbering Resource Optimization	)	CC Docket No. 99-200
Petition of Vonage Holdings Corp. for Limited Waiver of Section 52.15(g)(2)(i) of the Commission's Rules Regarding Access to Numbering Resources	)	

COMMENTS OF INTERISLE CONSULTING GROUP LLC, TERRA NOVA TELECOM INC., AND AERO COMMUNICATIONS LLC

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Introduction

While the proposal to allow interconnected VoIP providers to have direct access to numbering resources seems innocent at first, some aspects have the potential to seriously destabilize many aspects of the public switched telephone network. At best it will add complexity to PSTN interconnection, an area that has grown almost impossibly complex as rules have been layered upon rules without clear boundaries. At worst it will create chaos both in the obvious assignment of numbers and by forcing more area code splits and/or overlays, and in disrupting both the routing and rating of calls. The Commission must thus proceed with extreme caution.

There is no fundamental need for Interconnected VoIP providers to be given the privileges already granted to common carriers. These companies already have access to numbers from the CLECs that provide them with interconnection. It is also not particularly difficult to establish a CLEC, which could provide direct access to numbers on a retail or wholesale basis. To the extent that an Interconnected VoIP

provider finds CLEC status unduly difficult to achieve or maintain, the Commission may wish to determine whether any states' rules or practices violate the letter or spirit of the Telecom Act and the Commission's Rules. CLECs already accept the responsibilities of common carriage, acting within the Title II framework. To the argument that this is generally onerous, we can only point to the many CLECs that already exist and continue to be certificated, even in the face of a hostile regulatory environment. If it is in fact too onerous, that problem should be addressed directly. Creating a class of non-CLEC entity with a selected subset of CLEC responsibilities and privileges is a poor substitute for proper regulation of CLECs. If however the Commission chooses to proceed, there are many technical and policy issues that need to be addressed. We thus offer these Comments of Interisle Consulting Group LLC and Aero Communications LLC, and additional Comments of Terra Nova Telecom Inc.

Interconnected VoIP has a very low cost of entry

Becoming a CLEC or a CMRS carrier, both of whom currently have access to numbers, requires at least some effort. A CMRS carrier typically requires access to spectrum, while a CLEC requires, among other things, state certification. For a CLEC to host its own numbers, it presumably needs some kind of switching system, capable of interconnecting with the PSTN using Signaling System 7[1]. This too raises the cost of entry. Becoming a VoIP provider, however, is relatively simple. A "switch" can be cobbled together from open-source software on a commodity server. Interconnection can be purchased wholesale from a CLEC or another VoIP provider. There are even complete turnkey "cloud" packages available to enable someone to become a VoIP provider with no hardware of their own. They just begin selling.

A CLEC that is no longer in business once set up a wholesale VoIP business. They discontinued it when a majority of their wholesale customers never sold more than 100 retail lines. If being a CLEC is like opening a restaurant, being a VoIP provider can be the electronic equivalent of a lemonade stand. The

[1] A CLEC is of course allowed to have number blocks of its own even if it leases switching capacity from another CLEC. However, CLECs who lease out wholesale switching capacity do not always allow their switches to host other CLECs' number blocks. Apparently one or more CLECs working with Vonage has offered to host their numbers on its switches. To the extent that Vonage and other non-CLEC VoIP providers are issued their own number blocks, they will also have their own OCNs, and may thus be hosted like CLECs.

number administration system is not designed to cope with this, and must be modified if numbers are to be issued to VoIP providers.

It has also been our experience that some VoIP providers have been very sloppy in maintaining their number inventories. When their customer discontinues service, the number is not reclaimed, and the number is still counted as in service. While this is technically the serving CLEC's responsibility, VoIP providers and other intermediate number holders, and their carriers, should be encouraged to take proper care of the numbers they manage. Allowing non-carriers direct access to numbers might seem to simplify the process, but non-carriers are less likely to be proficient in, or as concerned with, the regulatory niceties associated with being a code or block holder.

Thousands-block pooling will not suffice

If the Commission nonetheless chooses to grant numbers to VoIP providers, the volume of new providers requesting numbers will rapidly overwhelm existing area codes. While Vonage itself, by far the largest such provider unaffiliated with a carrier, may well justify thousands-blocks in some large rate centers, a more likely precedent is what happened in 1996-1999 when CLECs began to come on line and number portability and pooling were not in place. CLECs needed NXX codes in every rate center that they wished to serve, even where they served only a single customer across a leased transport facility. Given the explosive growth of the Internet at the time and the inability (and unwillingness) of most ILECs to serve them, CLECs also offered dial-in services to ISPs. Every CLEC serving ISPs needed numbers that were local to the ISPs' potential customers. They thus had multiple reasons to open NPA-NXX codes by the thousands. Dozens of new NPAs needed to be created over a three-year period. This disrupted the consumers and businesses whose phone numbers were changed by area code splits.

The CLEC drain on NXXs ended when thousands-block pooling was introduced. This allowed a single prefix to serve up to ten carriers. Even an existing ILEC NXX could be shared by CLECs and CMRS carriers, which proved especially useful in small rate centers. Blocks were returned to the pool and far

fewer new prefix codes needed to be created, and far fewer area code splits were required after pooling was fully implemented. However, this worked because there were rarely more than ten CLECs and CMRS carriers serving the same small rate center, and the number of returned blocks usually exceeded the number of carriers in a large one. The decline in dial-up Internet access, and restrictions on prefix code use in some states, also reduced demand. As interconnected VoIP grew[2] and increased CLEC demand for numbers, pooling limited the need for new NPA-NXX codes.

It should be noted that for a retail CLEC to need numbers, it typically needs a physical presence in a rate center. This often involves collocation in an ILEC wire center, or physical transmission facilities (cable, wireless, fiber) into the area. A CLEC can also use EELs to provide DS1-level services to customers in a wire center where it lacks collocation, but it must already be collocated at another wire center in the same LATA and meet certain Commission requirements in order to order EELs.

But with over-the-top VoIP providers operating on a model of sparse, spread-out interconnection (across the Internet in lieu of local loops or other dedicated facilities), they may have one or a dozen customers in many rate centers where they have no other presence. Allocating a minimum block of 1000 numbers to such a company would be extremely wasteful. We agree with the California PUC only to the extent that this problem would require mitigation, if non-carrier VoIP operators were allowed their own number blocks. But we most strenuously disagree with their proposed solution, as we will discuss below.

Vacant number portability is a potential answer

One solution is technically simple, straightforward, efficient, and fair, and could work for both CLECs and interconnected VoIP providers. That is to allow numbers to be assigned individually from a shared pool of vacant numbers. Instead of using the portability database to assign 1000 numbers at a time to a carrier or VoIP provider, a carrier or provider would port-in one or a dozen vacant numbers at a time – essentially the day's or week's requirements – from the pool. The number portability system would then

[2] Some of the Remote Access Servers used as modem pools were converted, via software updates, to Media Gateways , allowing the same facilities formerly used for modems to be used for VoIP interconnection.

treat them like any other ported number, though there would be no corresponding port-out process. Numbers would be ported to a carrier's (LEC or CMRS) LRN.

Of course the ILECs have opposed such a system because it simplifies competitive entry and reduces their competitive advantage, as ILECs by definition have numbers in every rate center they serve. But that is not a reason to oppose vacant-number porting, which is essentially single-number pooling. The real question is whether existing ILEC number blocks should themselves be subject to vacant-number porting, or whether only separate sets of blocks should be set aside for this purpose. We suggest that the former is especially beneficial in rate centers where there are no spare blocks in existing NXX codes, but the latter could be acceptable where vacant blocks can be found. In either case there would be no new NXX codes created. If dedicated blocks are not used, the LNP database would need to have assigned, non-pooled, non-ported numbers added to it, so that existing numbers would not be confused with vacant ones.

LRNs should be reserved for carriers

A number is ported to a Location Routing Number, which itself requires an NPA-NXX code (10,000 numbers) that was initially assigned ("A-block") to the recipient carrier's switch. Thus every carrier entering a LATA requires a new NPA-NXX code, even if pooled blocks exist. This privilege should be reserved for carriers (CLEC and CMRS), not Interconnected VoIP providers. The latter's numbers can be ported, instead, to the LRNs of actual carriers that are willing to host them. Again, a provider that cannot find a willing carrier should not be spared the effort of creating a certificated CLEC affiliate. Making LRNs too easy to get would create undue pressure on the NANP because of the need for new A blocks.

California's proposal has many flaws

The California PUC (CPUC) proposal is far more radical than vacant-number porting. It maintains thousands-block pooling, but replaces it with a combination of geographic number portability and oddball (local to everywhere) numbering for VoIP providers. The former creates routing chaos; the latter gives

VoIP providers a valuable privilege not granted to certificated CLECs, and recapitulates the "Feature Group 2A" problems that arose when wireless number portability was implemented.

The CPUC proposal requests that only a limited number of rate centers be opened to VoIP providers, but that "all calls to VoIP providers are deemed to be local calls for numbering administration purposes". Thus many VoIP subscribers would not receive a local number, but instead their number would be local to the entire country[3]. This makes it a non-geographic or "oddball" number, even though it is nominally associated with some rate center somewhere and looks like a local number. It would differ from an 800 number only to the extent that a caller on a measured-rate plan would pay the local rate for the call; for flat-rate callers, it would be as cheap as an 800 call. It would lack only the branding and visibly non-geographic nature of the 8xx-series service access codes. Not only would this cannibalize 800 revenues, it would provide a very unnatural incentive for subscribers to move from certificated common carriers *to* uncertificated interconnected VoIP services. If these numbers were not given oddball status, then VoIP customers would be a toll call to their neighbors, which would cause other obvious problems.

Feature Group 2A, like 800 service, was essentially a reverse-charged service. Cellular carriers were allowed to assign these oddball numbers, which were a local call from anywhere in their home LATA, but paid a usage fee, akin to originating access, for such calls. Given the higher cellular per-minute prices of the 1990s, this was not a problem, though it might be today. Feature Group 2A was eliminated once wireless number portability was ordered. Had it not been eliminated, a Feature Group 2A number could have been ported to a wireline carrier. The ILECs had no intention of allowing wireline customers, theirs or any of their competitors', to have Feature Group 2A-type services undercutting 800-service rates. Thus it was eliminated. The CPUC proposal revives this question. Would a non-geographic VoIP number be portable? If so, what would prevent a certificated LEC from porting one in? It becomes a tangled web indeed, which is one reason why the CPUC proposal is so unworkable.

[3] This problem would still exist, albeit on a more limited scale, if such numbers were only local to their own LATA, as was the usual case with Feature Group 2A.

But in addition to these call-price rating problems, their proposal causes routing problems for other carriers. Calls are routed between carriers based on entries in the LERG Routing Guide. Before local number portability, each prefix code was assigned in the LERG to a homing tandem, and calls to that prefix could be sent to that tandem. For the most part, tandem switches had service areas consisting of specific rate centers.

LNP caused routing to become more complex. Now, the "N-1" switch is responsible for "dipping" the called number to see if it was ported. (Pooled number blocks are all treated as ported.) The dip returns the Location Routing Number (LRN) of the switch that currently hosts the number.

Under Verizon's interpretation, this dip is done by the terminating tandem switch, so the switch that hosts the LRN must have trunks to every tandem serving the rate centers served by that switch. Other carriers must have trunks to the tandems within their local calling area. Thus a number ported from carrier X to carrier Y will remain on the same tandem, regardless of whether the LRN of carrier Y's switch is in that tandem sector.

Under AT&T's interpretation, though, the correct route to carrier Y's switch is to the tandem that serves carrier Y's LRN, which can be anywhere in the LATA. This requires carriers in most AT&T multi-tandem LATAs to have trunks into all tandem switches in the LATA, even if they do not serve those sectors.

Now throw non-geographic prefix codes into the mix and observer the results, assuming that numbers are still limited to their native LATA. In AT&T LATAs, this will have minimal impact, as other carriers already need trunks to every tandem, but in Verizon multi-tandem LATAs, it would require some carriers to need additional trunks. Until these are added, "local" calls to some VoIP numbers might fail. (This would probably not be the case in California, but could impact several eastern states.) 800 calls do not fail: While the LERG directs terminating local calls to a specific tandem, 800 calls are handled by an IXC, who can be reached via any originating access tandem.

This would be a new wrinkle in the already-complex world of intercarrier routing. Add to it the impact on call rating, and on the market distortions of a virtually-free 800-like service, and the folly of the California approach is obvious.

If numbers could be ported nationally, then someone would need to pay for calls to be sent long-distance to the terminating LATA. This could impose substantial costs on originating carriers if they were required to pay for this additional transit. Thus it should be the responsibility of the porting-away carrier to provide at minimum a homing tandem connection in the prefix code's native LATA, so that carriers could send local calls there without engaging an IXC. They should also provide a second homing tandem connection in the ported-to LATA, allowing carriers in that LATA to deliver the call locally. That way, the cost of geographic portability is incurred by the providers that requests it, not carriers that originate calls to them.

Nongeographic numbers may be a long-term solution for all services

The Commission asks (at 120), "...What are the practical and policy implications if we were to transition telephone numbers to non-geographic distribution? What would be an appropriate timeframe and process for doing so?" Geographic numbers today exist for several reasons, which need to be taken into account when considering such a major change to the numbering plan:

- Technology: Until Local Number Portability, telephone numbers were addresses, and were used for call routing purposes. They are still used to some extent for that purposes today, since N-1 dipping limits local number portability, but 800 numbers illustrate the ability to dip numbers and assign them nationally. The distinction is that the dip is at the originating end of the call. This is becoming more common for local calls anyway, for cost-optimization purposes, so this technical barrier is no longer significant.
- Human factors. Seven-digit numbers in the 3-4 format were standardized in the US after studies found that they were easy to learn. Adding an area code was not a major problem because a

given local area only has a few area codes at most, so they do not create an arbitrary 10-digit number to memorize. Non-geographic numbering would however result in longer effective local numbers. This is mitigated to a large extent by the widespread use of speed dialing, standard in mobile devices and often available in wireline devices. But it is a real issue.

- Rating. This is the key problem with non-geographic numbers today. Tolls (retail) and intercarrier compensation (wholesale) are based on what rate center a number is assigned to, and while flat-rate (no domestic tolls) service plans are becoming more of the norm, intercarrier rates are still hopelessly tied up in historic rating constructs. Intercarrier compensation needs to be *fully* unified before geographic numbering can end. This would imply no distinction between local, toll, ISP, CMRS, etc., based on the origin of the call, but payment on a point-of-interconnection to destination basis, *ignoring* originating number (or JIP). This is essentially how the Internet operates today. Because the FCC did not choose this approach in the CAF Order, and has not completed intercarrier compensation reforms (the FNPRM from that Order being still undecided), rating issues will require most numbers to be geographic until at least 2020, if only to allow billing to be transparent and consumers to know what calls are subject to local rates.

But once those issues are dealt with, a careful evolution towards non-geographic telephone numbering might eventually make sense. Telephone numbers, after all, are *names*, not addresses; the address role in the PSTN is now occupied by the Location Routing Number. So the transition to generally non-geographic numbering could take place, after intercarrier compensation reform is complete. But the cost needs to be considered, considering that calls will need to be routed to the appropriate terminating switch or tandem, and small carriers do not have trunks to every LATA. Geographic number portability should not be allowed to harm small, locally-focused service providers. Dual homing of ported numbers, as described above, is one possible palliative.

This leads to the same conclusion for the question the Commission asks [at 64]: "Are geographic limitations on porting directly between an interconnected VoIP provider and another carrier necessary?"

These limits should be no different for VoIP providers than for any other provider. Nomadic VoIP providers are already given a pass on paying Feature Group A charges for interstate foreign exchange service. Thus they can port numbers to out-of-geography customers, but the call is rated to its NPA-NXX rate center. This should not change. Instead, Feature Group A should be abolished, such lines should be viewed as local exchange service, and there should be no surcharges for foreign exchange service for anyone. Foreign exchange is a way to provide geographic number portability where the entire cost is appropriately borne by the porting carrier. Feature Group A access charges are a vestige of obsolete toll revenue protection and because VoIP provides an out for so many users, it simply hurts the regulated PSTN more than it helps PSTN carriers retain revenues.

But this has nothing to do with IP *per se*. The PSTN is clinging to an out of date regulatory model based on the technological limitations of the early 20th century, when long-distance transmission costs were high. It is fiber optics, not IP, that create the low cost per mile per call that makes the current model obsolete. Creating a new model and only applying it to VoIP is unjustly discriminatory.

The Commission thus raises questions [at 123] about the future of numbering:

> If the Commission were to modify the number assignment rules, we seek comment on how a revised number assignment policy might be administered. For example, should the Commission create a unified or national numbering regime that would apply equally to all service providers, regardless of location? How should this regime incorporate the current authority of the various state commissions? For the purpose of number administration, what if any relevant distinctions between service providers would warrant different treatment? We also seek comment on whether certain numbers, such as those traditionally associated with major cities, are likely to remain more desirable even if we transitioned from geographic number assignment. We also seek comment on the best way would be to implement any changes, to avoid abrupt transitions and ensure seamless provision of service to consumers.

These are good questions to ask in context of the future of PSTN numbering, but not about just VoIP or mobile or any other service per se. For many purposes, locality of telephone number is desirable. It makes local numbers easier to learn (fewer "chunks" of information, whether individual digits or familiar 3-digit blocks, to memorize) and it does give local businesses some connection to their markets. And some familiar urban area codes do carry some cachet, whether or not this is fairly distributed among providers. (Pooling individual numbers would reduce the advantages held by incumbents who have more blocks in the older area codes.) A good approach would be to encourage states to begin by consolidating rate centers, as this would reduce the need for so many blocks. States could still keep authority over geographic numbers. Also, caution is needed so that originating local carriers are not required to establish connections to every tandem in the country, a move which would dramatically favor national players over local ones.

Intercarrier compensation is already far too complex

The Commission raises specific questions regarding how intercarrier compensation should be handled, both for the VoIP provider and the competitive tandem provider through whom the VoIP provider accesses PSTN carriers. These questions need to be placed in context. The existing intercarrier compensation system is not merely complex, it has essentially achieved *fractal*[4] complexity. There is simply no getting to the bottom of it! So many point rules and overlapping cases, jurisdictional separations, and rate elements have been added over the years that it is unlikely that *anyone* understands them all. Recent reforms, in the Connect America Fund Order, do little to simplify things. They make certain rates closer *in level* to one another, but the different rate *structures* remain in place. Thus a call may be local, intraLATA toll, CMRS-local, CMRS inter-MTA, interLATA intrastate toll, interLATA interstate toll, ISP-bound, VoIP-originated, etc., all of which result in different rates' being applicable. Per-minute rates may differ at origination, transit, and termination, and the *direction* of originating rates

[4] A fractal is a geometric entity of fractional dimensionality, as described by the late Benoit Mandelbrot in *The Fractal Geometry of Nature*. Their key property is that their complexity is the same at every level of magnification, so that "zooming in" on a fractal shape does not lead to a level where the shape becomes relatively simple.

may change (originating access is paid *to* the originating carrier while reciprocal compensation is paid *by* the originating carrier). And even *fixed* rates for transport circuits *to* a carrier's switch may be prorated based upon the percentage of calls in each classification (PLU, PIU, PLF, etc.), which is essentially a backdoor usage fee.

What the Commission should *not* do is create even more complexity by creating yet another set of rates for interconnected VoIP providers that have their own numbers. Under current rules, a non-carrier VoIP provider is a customer of the originating carrier it hires, so calls are originating under the carrier's OCN. But the rate center of the carrier's ANI is theoretically not used; the applicable rate center, for local/toll purposes, is the subscriber's number (CID). The terminating carrier, for reciprocal compensation or access charge purposes, bills the carrier's OCN. This is already an exception to the common rule where interLATA calls are delivered on meet-point trunks, not local trunks, and it is not clear how widely it is being enforced.

If the VoIP operator's OCN is used in conjunction with the calls it originates, terminating carriers should *not* be required to negotiate separate interconnection agreements with each and every VoIP operator. The OCN should be limited to number assignment purposes, not billing. This bilateral system of end-office compensation is already burdensome. The VoIP provider's wholesale carrier (who may be a competitive tandem provider) should be responsible for intercarrier compensation. Since competitive tandem providers typically pass calls between multiple providers, they already have contractual relationships in place. Thus they should pass along their own OCN, not the VoIP provider's, and take responsibility for the calls they originate.

An alternative, to bill the tandem provider for all calls originated by VoIP providers who subtend it, would be unworkable, as it would require *all* calls placed within a LATA by a given VoIP operator to be billed to that tandem provider, even those that took a different route. That would lead to misbilling for directly-handed (non-tandem) calls delivered to a willing terminating carrier by the originating VoIP operator. Billing the tandem provider for calls placed through it, but with the VoIP operator's OCN,

would add complexity to the billing process which, as noted, is already overwhelmed. And the tandem providers would be on the hook for charges they'd in turn have to collect from their customers. This is not a short-term solution.

The term "VoIP" refers to at least two very different things

When discussing IP interconnection, it is critical to distinguish between two very different uses of the term "VoIP". One, exemplified by Vonage, is voice over the Internet. This "over the top" voice service does not offer the high quality of transmission that a good PSTN service can provide, for the simple reason that today's Internet operates in a "best efforts" packet transfer mode where some packet discard is the norm, not a sign of under-provisioning[5]. Under conditions of congestion, Internet voice call quality degrades, or calls can be lost. An over-the-top voice call, for instance, can be heavily degraded when someone else in the same home downloads a movie. It is these over-the-top providers who are the principal subject of this Docket.

The other type of VoIP has voice carried over IP over a managed service, not the public Internet. Examples of this are enterprise Centrex services delivered over MPLS and/or Carrier Ethernet, SIP trunking delivered over MPLS, and PacketCable. Indeed the number of PacketCable subscriptions greatly exceeds the number of over-the-top VoIP subscriptions. Since these calls do not touch the Internet, they can provide reliable, high-quality service competitive with TDM, with negligible packet loss and only some serialization (packetization and transmission) delay as the inevitable quality attenuation. Managed VoIP is capable of supporting facsimile, modems, and other sensitive applications.

Indeed nothing about this type of VoIP distinguishes it from any other telephony service. It bears all of the hallmarks of Title II telephone services. IP in this case is actually a form of time division multiplexing (TDM), but differs from older so-called "TDM" in that the time division multiplexing of the

[5] The primary rate control technique in the TCP/IP protocol suite is the slow-start algorithm in TCP, in which flows slow down after a packet loss is detected. Streaming UDP flows such as those used by VoIP do not slow down, but absent prioritization, they are as likelyto be randomly lost as TCP data packets.

transmission medium is *asynchronous*, using the IP and UDP headers to identify individual bearer connections, vs. *synchronous*, wherein the time slot's position in a clocked time frame identifies the bearer connection. IP here is not used to access the Internet; it is simply some bits in a multiplexing header. Most CLECs today are probably already using VoIP in this manner for at least some of their traffic. Thus they do not need new rules. And while cable companies typically operate PacketCable services through separate subsidiaries from the CLECs that perform public network interconnection, the CLEC is there to interconnect and order numbers.

Another Commission docket is addressing whether carriers should be required to provide VoIP interconnection between carriers. Managed-network SIP trunking has become a common new standard for interconnection, already used between consenting non-ILECs. There is no reason to consider this to *not* be part of the Public Switched Telephone Network! Just as TDM using Signaling System 7 gradually replaced the MF-signaled voice-frequency trunks that were prevalent 30 years ago, and which today's Switched Access tariffs still describe as if they were the norm, VoIP trunking over managed facilities using SIP for signaling is simply an optional new form of PSTN intercarrier facility which is growing rapidly in popularity. Intercarrier compensation should also reflect this, and not provide artificial incentives to encourage or discourage it.

IP Interconnection can bypass the PSTN

But what about inter-provider connections *via* the Internet? While the quality may be less than ideal, interconnection between two over-the-top providers could itself take place over-the-top, avoiding the PSTN, even if dialed using PSTN numbers. This could potentially avoid any ILECs and tariffed interconnection for such calls. It could thus make a useful "high usage" route – a first choice to be used when available, not the final route choice in a routing list – for consenting VoIP providers. They would however need a way to find each other, mapping their telephone numbers to Internet destinations (such as URIs or IP addresses). One existing mechanism for this is Carrier ENUM, in which E.164 telephone numbers are mapped to Domain Name Service (DNS) names. Participation in a Carrier ENUM database

(there are several) and direct interconnection in this manner should be considered voluntary and optional, and outside of the scope of current intercarrier compensation rules (or Title II at all). Providers could then resort to PSTN interconnection, at regulated rates, as a final route.

A different question is whether non-carrier VoIP providers should have a right of interconnection, whether other carriers must interconnect with VoIP providers upon request. Here we circle back to the question of common carriage. Certificated common carriers (LEC and CMRS) are entitled to interconnection, and to have their calls delivered, at regulated prices. If a VoIP provider wishes to be a common carrier, it can of course seek CLEC certification. But given the low entry barrier to becoming a VoIP provider, mandating direct interconnection would be burdensome to the existing carrier community. Even if these providers are granted numbers, and even if they use Carrier ENUM amongst themselves, mandatory interconnection should remain a privilege of certificated carriers, who are subject to greater oversight and have more at stake.

Internet constructs are irrelevant to PSTN interconnection

While Carrier ENUM is a useful tool for those who choose to use the public Internet to bypass the PSTN entirely, it is irrelevant to PSTN interconnection. The Commission asks [at 53]

> …For example, some parties note that carriers have historically relied primarily on the LERG and LNP databases to route calls, but these databases cannot identify Session Initiation Protocol (SIP) endpoints. Some parties additionally note that the preference to route calls to the VoIP provider's CLEC partner via PSTN trunks, rather than to the VoIP provider directly, has hampered the implementation of VoIP interconnection.

There is certainly nothing wrong with using the PSTN for interconnection – it offers superior call quality and reliability compared to the public Internet, and its model of mandatory interconnection at regulated prices is often more desirable than the voluntary best-efforts model of the Internet. Thus while Carrier ENUM may be useful as a high-usage route for voluntary usage, the Commission should not attempt to

force calls onto the Internet. Furthermore, SIP endpoints are identified using only Internet naming constructs (DNS name and/or IP address), which are again voluntary mechanisms operated outside of the scope of Commission supervision. It would certainly not be a consensus position for the Internet itself to come under greater Commission scrutiny simply for the sake of telephone calls which choose to use it.

Carrier ENUM should remain thus outside of the mandatory scope of LERG and LNP databases. If, on an experimental basis, an industry consensus forms to permit those databases to be voluntarily populated with Internet names in addition to their required PSTN information, little harm would be done. But it must be noted that most SIP calls and most telephone calls that use IP in their multiplexing arrangement do not use the Internet. SIP trunks are typically bilateral, usually through Session Border Controllers, often using private IP addresses. Likewise, PacketCable is entirely separate from the Internet, and ENUM has no relevance to it. Only over-the-top applications use it, and these must not be confused with any future transition to IP-based protocols, over managed facilities, *within* the PSTN itself.

Technology-specific rules are improper

The Commission's loose use of the term "VoIP" and its granting of certain privileges to its users implies a certain lack of technological neutrality. While "IP" is fashionable and "IP transition" is the Commission's code word for network modernization, it is simply not justifiable, nor likely to be legal, for the Commission to define users of some protocols as having special rights and privileges not conveyed to others. "IP", to be specific, is not a protocol developed by the Commission, or managed in any kind of open standardization process subject to the Administrative Procedures Act or other oversight. Rather, IP is a voluntary protocol created by a loosely-managed trade group, the Internet Engineering Task Force (IETF). The IETF has two current definitions of IP, version 4 (the one currently in widespread use) and version 6 (a proposal from the early 1990s that has been two years from widespread adoption for almost two decades). But there could be other protocols developed in the future, outside of the IETF process, that offer additional capabilities. Would a network built out of these protocols be allowed to carry PSTN traffic on the same terms as the one using 1978's IP version 4 or 1994's IP version 6? Given that the role

of IP in some managed networks is little more than as a multiplexing shim, would omitting that shim (for example, Voice over Carrier Ethernet or Voice over MPLS) give the interconnecting regulated network a reason to charge a different rate? This would be extremely detrimental to progress.

We thus distinguish between the Internet and the PSTN not on the basis of protocol but upon business model. The PSTN is a common carrier service with mandated interconnection at regulated rates. Its technology has changed over time, and may now include "IP", its predecessors and successors. The Internet, in contrast, is a voluntary agreement among network operators to exchange traffic for their mutual benefit. Thus there is no bright-line distinction in the Internet between providers and customers, or between "peers" vs. "upstream" providers. It is a relatively pure market, where deals can be made. And today's big-I Internet is essentially a prototype, an example of an internet (little-i), of which there could be many, using different protocols. The Commission should thus be careful not to confuse "Internet Protocol" as it exists today (IETF specifications) with "internet protocols" that may exist in the future, nor with "internets" that may exist today or in the future.

By the same token, if telephone numbers are made available to "VoIP" providers who today use IP and may or may not use the public big-I Internet, they should be available on identical terms to other operators who may use other protocols, but which nonetheless do at some point interconnect with the worldwide PSTN. To not do so would be to pick winners and losers even before the game is played.

Competitive tandem operations are common, but rules are confusing

The Commission inquires, at 51, about competitive tandem operations, as these may play a role in VoIP operation. It should be noted, however, that when a *non-carrier* VoIP operator interconnects to the PSTN through a LEC, it is that LEC who is technically the originating carrier, and whose OCN is used for bilateral reciprocal compensation purposes. Thus the LEC is acting as an end office, not as a tandem, from the PSTN perspective. It appears to be the case that Vonage is working with Neutral Tandem, and Neutral Tandem is primarily engaged in the competitive provision of tandem services. But since Vonage

is not a carrier and is not subject to reciprocal compensation obligations on its own, the simplest answer in its case is to apply the obligations to Neutral Tandem as they exist today, regardless of which carrier obtained the number block from the NANPA.

Still, an issue does arise when a certificated carrier is the customer of the competitive tandem provider. Since this is not spelled out clearly in the Rules, it is generally left to interconnection agreements. Here there are differences between the major ILECs. Verizon and AT&T allow competitive tandem operation, and Neutral Tandem itself has opted in to Interconnection Agreements originally negotiated by the late AT&T Corp., which was not primarily engaged in competitive tandem operation. CenturyLink-Qwest (CLQ), however, has explicit language in its boilerplate ICA forbidding carriers from interconnecting to it indirectly. Thus for a competitive tandem operator to sign up a carrier customer in CLQ territory and send any of that customer's traffic to CLQ, it must persuade its customer to amend its CLQ agreement, and also change its LERG listings to show it as subtending the competitive tandem. Otherwise the competitive tandem is limited to purely "transit" traffic, which does not come from nor go to CLQ.

Noting the CLQ issue, the general rule seems to be that reciprocal compensation for local traffic is bilateral, and while the competitive tandem operator may bill a transit fee, end office reciprocal compensation is billed end to end. Thus a CLEC that purchases competitive tandem service will pay the competitive tandem provider for transit and bill, reciprocally, the ILEC for traffic they exchange, even if it does not have its own trunks to the ILEC.

Another option that could be considered is one wherein the transit network may be willing to accept responsibility for billing, instead of its being bilateral end to end. This would be more similar to the rule that applies to IXCs with access traffic. A carrier who purchases wholesale long distance service pays the IXC, who in turn pays the terminating carriers. No bilateral end-to-end billing is required, though the IXC also pays the tandem providers at either end of the call, if applicable. Because VoIP providers are not carriers, their supplier CLECs provide a similar service for their local traffic as well. Thus in this arrangement the terminating carrier would bill the transit provider (CLEC, whose OCN denotes the

intraLATA billing responsibility just as the IXC's interLATA billing responsibility is denoted via its CIC), who bills the originating carrier. This to some degree parallels the Internet's business model, wherein upstream service includes all destinations reached by the upstream provider, without ISPs having to bill each other based on end-to-end traffic flow. It need not, however, be forced upon unwilling competitive transit providers.

Routing of calls should not be put at risk

The Commission asks [at 129] ... "What are the restrictions imposed by providers of the various database services (e.g., BIRRDS/LERG, NPAC, and LIDB/CNAM) on access to the databases? Should these databases be modified or eliminated in a world without geographic numbers? What restrictions would need to be eliminated or modified?" These databases play a critical role in the stability and reliability of the PSTN. While BIRRDS/LERG is a slow process that, by design, makes opening or rehoming a new NPA/NXX code take over two months, the Internet's approach, wherein anyone's BGP advertisements take immediate effect, is too risky for the PSTN. Note that at one point, BGP messages from China caused US government traffic to be detoured through a Chinese military intelligence site. Even for numbers that are non-geographic, there should be some kind of homing for each LRN.

One thing that would need to change for making numbering generally non-geographic would be the way number portability works. Right now it is based on N-1 dipping, wherein the call is typically dipped by the terminating tandem. This is geographically limiting. For numbers to generally be non-geographic, dipping of all domestic calls at the originating SSP (end office or originating tandem) could be required. The *address* of a telephone call is the LRN, which only coincidentally looks like a telephone number. The actual phone number is a name. It is more like DNS in the Internet, wherein the application (phone call) cannot be initiated without a database dip. Once the call is dipped, it can be routed normally to the LRN, which need not be in the same LATA as the actual telephone number. This does however raise the question of cost. Who pays for the transport of "local" calls to distant LATAs? Interexchange carriers require payment. And even dipping the LNP database incurs a per-call charge, unless the carrier keeps a

mirror. Carriers do not now need to dip interLATA calls. These costs imposed by geographic number portability should not be externalized to calling carriers, but borne by the carriers or VoIP providers whose number are non-geographic.

Not everything must change. The Commission asks [at 130] "We also seek comment on how numbering schemes and databases integral to the operations of PSTN call routing will need to evolve to operate well in IP-based networks. We seek comment generally on what databases need to be modified, how they should be modified" While geographic portability of any and all numbers would require changes to the way LNP works, IP itself should have precisely zero impact on numbering schemes and PSTN databases. While over-the-top connections could make use of Carrier ENUM, those represent the exception. Evolving the PSTN to use IP simply means changing the multiplexing format and signaling on the trunks. While today's TDM circuits require certain parameters to be locally datafilled, IP requires a different set of parameters. But that is done on an interface-by-interface basis. PSTN trunks should go over dedicated circuits or through Session Border Controllers, and their IP addresses may be private (per RFC 1918).

The Internet-PSTN boundary should be enshrined, not violated

VoIP providers should not be confused with actual PSTN carriers. Direct interconnection should not be required. The Commission asks [at 131]: "Some parties note that carriers have historically relied primarily on the LERG and LNP databases to route calls, but these databases cannot identify SIP endpoints. Some parties additionally note that the preference to route calls to the VoIP provider's CLEC partner via PSTN trunks, rather than to the VoIP provider directly, has hampered the implementation of next generation interconnection." These publicly-addressable SIP endpoints only exist "over the top", since PSTN SIP trunk interconnection would most likely involve private addresses, conveyed privately, and use managed facilities, not the Internet. PSTN carriers should not be required to send calls to the public Internet, or to expose their networks directly to it. CLECs who work with OTT providers take that responsibility upon themselves. The Internet is not a managed service. SIP and the IP address space do not belong to the Commission. It is a voluntary space coordinated by ICANN, a private entity with

consultative, not regulatory, authority, and the Internet should not itself fall under the regulatory purview of the Commission simply because it happens to carry PSTN-bound calls over the top. Risk caused by the use of the Internet for telephony should be borne by those who choose to do so, not by PSTN providers *or* ISPs. Internet technology should be free to evolve independently of the Commission, not be bound to rules that may be convenient for today's over-the-top VoIP providers but obsolete in the future.

In summation, we ask the Commission to move with extreme caution. There is no urgent problem here. It should not further complicate call rating or routing. Intercarrier compensation is already hopelessly complex. The Internet was not designed to meet PSTN standards of reliability and should not be held to it, nor should the PSTN be allowed to suffer because of it. Numbering is a critical part of the PSTN and changes to how it is managed should only be made with extreme caution.

Respectfully Submitted,

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