

Number Misuse, Telecommunications Regulations and WCIT

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Current discussions to review international telephony regulations are attempting to include Internet operational matters such as IP number addressing. Placing telecommunications and Internet rules in the same category is problematic, because they have different cost and service structures. Geoff Huston writes that Internet number addressing issues should remain separate from international telephony regulations.

Given the difference in how phone calls and data packets are transited, proxies and packet interception generally do not pose financial threats to sending or receiving parties – these are simply normal Internet operations.

Review of the International Telecommunication Regulations

In Dubai, between 3 to 14 of December 2012, the nations of the world will convene at the [World Conference on International Telecommunications \(WCIT\)](#) to consider a review of the International Telecommunications Regulations (ITRs), the rules which define the general principles for the provision and operation of international telecommunications. Currently the WCIT process is ramping up to consider what aspects of the ITRs should change after the last update 25 years ago. Considering everything that has happened during that time, it could be argued the ITRs should better reflect today's international telecommunications environment.

The international community is not currently aligned regarding the ITR revisions. Some economies advocate the addition of specific operational measures to be added to the ITRs, while others prefer to explicitly include the Internet into the scope of the treaty. This situation gets interesting where these two approaches intersect.

Telephony: Sender pays

The current ITRs were established in a world of telephony. To understand that world, it may be useful to consider how money circulates within it.

In many ways the telephone service model is based on over a century of evolution from the post to the telegraph, which in turn informed the context for telephony. The postal service mode, which started as far back as the 1680s with the penny post in London, was a model where the sender paid for the entire delivery service. As the reach of the postal system extended further and crossed over the boundaries of individual postal service providers,

the “sender pays” model was also extended. The various service providers involved would divide and apportion the original postage money paid by the sender to compensate for their respective roles in the delivery of a letter.

The telephone service, for the most part, has operated in a similar fashion. The caller pays for the entire cost of the call, and the called party pays nothing. When both the caller and the called party are connected to the same carrier this is quite straightforward: the carrier imposes a charge on the caller to cover the cost of the call and some margin of profit.

When we take the same model and apply it to long-distance phone calls that involve multiple carriers, the model becomes more complex. The caller still pays the local carrier the price of establishing the end-to-end call but that carrier cannot keep all of the revenue, because the “terminating carrier” has also incurred significant costs in servicing this call. The telephone industry devised an arrangement to handle this concept of “inter-carrier call accounting financial settlements.” This arrangement usually occurs on a bilateral basis between originating and terminating carriers with the “call minute” as the settlement unit, the cost of which is paid by the originating network to the terminating network.

Settlement payments can be made in both directions between carriers, but the net direction of payments will depend on the balance of calls on the respective networks, the costs incurred, and the specific arrangements between them. If two carriers establish a settlement rate where the call minute termination costs roughly equate to the call minute settlement rate, neither party is relatively advantaged over the other irrespective of whether callers are predominately located in one carrier or the other. In theory, such an arrangement is financially neutral to both carriers.

This is rarely the case in practice, as some carriers set a call minute termination settlement rate well above cost, while also setting very high international call tariffs. This effectively makes outbound calls prohibitively expensive for local subscribers, who then find it cheaper to request that the other party call them. The local carrier generates income from the inter-carrier settlement payments associated with those calls. For example, in the early 1990s it was up to 10 times more expensive to call a US number from France, than to make the call in the other direction.

Over the years the evolution of technology enabled carriers to reduce operation costs, but in many cases inter-carrier call settlement rates remained high. This allowed some carriers to exploit a monopoly position in terminating calls to their country code to generate revenues far beyond the cost of operation. If the carrier was a government-operated entity then this off shore revenue stream was in fact a revenue stream used to subsidize the domestic taxation base. This is well described in Opinion No. 1 of the 1989 ITRs, under the heading “Special Telecommunication Arrangements”, namely:

“for many Members, revenues from international telecommunications are vital for their administrations”

Premium Services and Number Redirect

In more than a century of telephone service, innovations have been few and far between. However two innovations are important to this story: the so-called “premium” services and “number redirect”.

“Premium” telephone services have included a range of information services that attract a higher call cost, such as weather forecasts, sports results, new headlines, and often, sexual services. In these cases the caller pays a higher cost for the call, and the carrier conventionally splits the revenue of the call with the provider of the premium service.

In many countries such services were not permitted, so the conventional premium service was not an option. A clever solution involving “number redirect” , relayed these calls to another country in which the services are legal, circumventing those restrictions. As part of this redirection, the premium service provider would divide the international call accounting revenue with their home carrier. Not only did this effectively bypass regulations relating to locally provided premium services, but it also leveraged off the international call accounting arrangements to the benefit of both the premium service provider and the terminating carrier.

“Fraudulent” practices

The next step in manipulating this system was to avoid arrangements with the destination carrier and redirect a call to an entirely different carrier.

One of the effects of telephone industry deregulation is that in many countries, there are no longer single carriers receiving all incoming international calls, but a number of carriers competing for them.

Instead of routing calls based solely on the dialed country code, originating carriers can route calls based on number blocks within the country code and use different transit routes based on number block rules. This can result in better deals for premium service providers and call-terminating carriers. In this case, the carrier receiving the call can be bypassed, even though their country code is being used. From their perspective they are being defrauded of legitimate settlement revenues through the “misuse” of the number block drawn from their country code. If the country code carrier discovers this unauthorized number block diversion, then they could withdraw the

number block and stop the international call occurring. It may still be possible for the premium service provider, in alliance with the transit carriers, to convince local carriers that the number block diversion is still legitimate. While the country code carrier might see the problem, their ability to enforce carriers in other countries to respect their authority regarding the use of their number blocks is not always clear. Sometimes these carriers may not have the resources to detect that this has occurred and they are usually far from being able to enforce a remedy.

Role of the ITRs

Some economies highlight the unauthorized use of telephone numbers drawn from their E.164 country code block as a case of “Number Misuse.” This situation of number misuse provides motivation for proposals to augment the scope of the ITRs.

Supporting the insertion of number misuse in the ITRs gives governments an enforcement role in making others conform to the conventions of country code management. Essentially, economies presenting these proposals would like other governments to force their authorized carriers to only direct outbound international calls to other authorized carriers.

Inexorable Revenue Leakage

If one strips off the particulars of premium services and number redirection, the fundamental motivation for this measure is intended to ameliorate an inevitable revenue leakage of international call accounting settlement payments. The intended targets of this proposed regulatory measure are those carriers that base their pricing schedules on bypassing traditional call accounting arrangements.

However, practices such as Voice over IP (VoIP) trunking, are already commonplace. In this case, the calling carrier maps a conventional call into a VoIP trunk directly into an in-dial block within the called country receiving the call. This measure effectively bypasses the conventional call accounting measures and is passed back into the telephone network as if it were a locally originated call. The call may then attract only a domestic call fee, or at most be subject to domestic inter-carrier call termination tariffs, which are generally far lower than their international counterparts’ rates.

The combination of these mechanisms that use the Internet, and user services such as Skype, are exerting massive downward pressure on what carriers can charge for conventional phone services. In an effort to retain some level of market share an increasing number of carriers are motivated to embrace IP-based approaches

and bypass these imposed inter-carrier international settlement charges.

For many countries in the developing world this shift represents a twofold financial blow. Not only are they seeing their foreign-sourced revenue stream disappear with the reduction in call termination minutes, but they are also seeing growing IP traffic volumes, which represent a significant additional domestic cost.

It therefore comes as no surprise to see some economies advocating an international regulatory response to reverse these developments.

Internet Number “Misuse”

The continual erosion of the traditional telephone business through the onslaught of new technology is not at all surprising. There have been recent moves to extend efforts to regulate the telephone industry to Internet addressing and routing. It seems surprising to apply the problem of “number misuse” to both E.164 numbers and IP addresses.

If extended to IP numbers, it would appear that the current proposals regarding “number misuse” would create regulations to the effect that IP packets should be routed to the destination address specified in the packet, and not rerouted and terminated elsewhere. This may seem reasonable at first glance, but by no means does it occur all of the time. As part of the normal course of IP network operations many operators deploy equipment that intercepts packets rather than delivering them to their destination.

Why do network operators regularly “misuse” IP addresses by deliberately intercepting packets and generating a synthetic response?

Packet Diversion

The most prevalent reason is operational in the use of proxies and, in particular, web proxies that can dramatically increase the performance and efficiency of ISP networks. These devices sit “on the wire”, intercepting web fetches and caching the downloaded data. This means subsequent fetches can use the cached content, rather than forwarding the request on to the intended site. This is by no means unusual. The rationale for this form of “address misuse” is to improve performance for the end user while reducing the data volumes being shifted across the transit links.

Is the deployment of a web proxy an instance of fraud?

To answer this question we need to compare accounting and settlement practices in the Internet with those in the telephony world described above. In the Internet case, the sender does not “pay all the way” to get a packet from its source to its intended destination. In general, every IP

packet could be thought of as being partially funded by both the sender and the receiver as it transits from one to the other.

The user who generated the packet pays for an ISP service, and that ISP may purchase transit services from another ISP and so on, for sequenced transit services. However, at a peering exchange point, or within a provider network, the sender’s money “runs out”. However the packet is not unfunded, because at this point the receiver’s services take over, and the packet transits a path, which is funded by the receiving ISP’s transit services, on to the receiver’s ISP and ends at the receiving end user.

As long as the proxy is faithful, the end user gets precisely the same content in addition to improved performance and the benefits of a more efficient network. The content provider wins also because the correct content is delivered to the user without incremental cost of packet handling at the content site. The content provider is not funding the proxy, so in effect content delivery by proxy is free to the content provider. In this case there is no end-to-end service payment on the part of the user that would trigger an inter-carrier settlement payment, so it is difficult to see how this action damages any party to the transaction.

Given the widespread deployment of various forms of proxy services across the entire Internet, the beneficial outcomes of improved performance and network efficiency, and the option for content providers to use techniques that in effect mark content as not cacheable, it’s extremely challenging to conclude that these practices constitute “address misuse”. Therefore, the use of traffic diversion and intercepting proxies are not generally regarded as an example of intentional fraud or even an accepted case of address misuse. It’s just part of how today’s Internet operates.

Packet Interception

On the Internet there is also deliberate interception and discarding of packets in flight. Is this also a case of “misuse” of IP addresses?

That’s a very hard case to make when you consider that such actions are exactly how firewalls work, and almost every operational IP network uses a firewall in some form. The purpose of a firewall is to intercept all packets, and discard those that match a pre-determined set of rules relating to acceptable and unacceptable packets.

Many users run firewalls that deliberately block all incoming connection requests unless they match quite specific rules; and many ISPs run firewalls that deliberately block access to the ISP’s local services from users who are not direct customers. At the same time, many countries have regulations that block access to certain content, enforced either through government-operated facilities, or obligations imposed by carrier licenses.

Users, service providers, carriers, and governments all use various forms of packet interception. Are they all guilty of number misuse? Should we support changes to the ITRs to obligate governments to completely stop this practice?

Aside from many other motivations for firewalls, security continues to be a concern for Internet operators, and there is no doubt that firewalls are an important tool in this regard. Irrespective of the various views that are expressed at a national level about censorship, intellectual property rights, and the position of common carriers and users, it seems unlikely that the ITRs would want to obligate governments to outlaw firewalls and filters as a consequence of its revision.

WCIT and the ITRs - Where to From Here?

The international call accounting arrangements used by the telephone world, and the use of structurally embedded imbalances in call accounting settlement rates, are still major issues in the ITR discussions. This accounting imbalance is sanctioned in the resolutions of the 1988 World Administrative Telegraph and Telephone Conference, particularly Resolution 3, concerning the apportionment of revenues provided for structural cross-subsidization of the developing world, which set forth the fixing of asymmetric call accounting rates between developed and developing economies.

The world of telecommunications is increasingly privatized, commercial, and competitive. We no longer see an exclusive collection of publicly funded monopolies operating effectively as instruments of national governments. Private operators can seek ways to minimize their costs in order to improve the competitive position of their business.

Changes in this industry over the past 25 years have brought profound shifts in both the engineering of communications infrastructure and, as we've seen, have triggered profound shifts in the pricing of consumer services. Prices have shifted from a transactional to a "connection rental" model in which transit costs are bundled into services. This has led to profound changes in the manner in which money moves between the network operators themselves.

Perhaps the separation of carriage and content has greater and more lasting significance in this industry. We have now seen the rise of highly valuable content-centric enterprises whose business model relies on a ubiquitous and abundant underlying communications infrastructure, but which are not financially beholden to the infrastructure operators. They have been able to forge direct relationships with consumers without having to deal with any form of mediation or brokerage imposed by carriage providers. The current value of these content enterprises dwarf the residual value of the carriage service sector, and

the outlook for this sector highlights a continuing shift in value away from carriage service providers and into the areas of content-based services.

Given the sheer scale of these changes in this industry over the past quarter century it seems that one cannot simply fold the Internet seamlessly into the current framework of the telecommunications regulation by the prolific insertion of "and the Internet" into the ITRs.

Packets are not circuits, and the mechanisms used to engineer packet networks are entirely different than those used with the circuit switches that supported traditional telephony services. This difference encompasses far more than engineering. The way in which users pay for services differ, and this shift in the retail tariff structure of the Internet service implies a forced change in the way in which carriers interact to support a cohesive framework of network interconnection.

The concept of a "call" has no direct counterpart in the Internet. To extend this further into the area of "call accounting" and "caller pays" is an extension that does not clearly map into the Internet. So when the existing ITRs refer to inter-carrier call accounting financial settlements, there is no clear translation of such a concept into the Internet. When we extend this inter-carrier interconnection framework into structural imbalances in call accounting settlement rates, and take it even further to the concepts of number misuse and call termination bypass, all forms of connection between traditional telephony and Internet get completely lost.

This should not imply that the ITRs are merely a historic relic overtaken by comprehensive shifts in both the technology and service models. The ideals behind the ITRs, in relation to the essential role of international communications, are worthy ideals that should not be discarded lightly, if at all.

In setting forth a framework for supporting an efficient and effective global communications system, the obligations stated in the current ITRs to make international telecommunications services accessible remain as current now as they were in 1988.

As we review the changes of the past quarter century and try to peer into what may emerge over the next quarter century, perhaps less is best in this area. Rather than adding regulations that attempt to address specific incidents of number misuse, and engage in efforts to include the Internet into these already detailed provisions relating to inter-carrier settlement models, perhaps the best set of ITRs we could have for tomorrow's world will support a common regulatory framework that is both minimal with respect to describing particular technologies and service frameworks, and more encompassing in supporting this incredibly valuable common resource of a communications service that truly embraces the entire world.