

Connectivity and Access: legislative and policy outline

Source: Peter Gerrand, June 2008

Many parts of this document have been incorporated into the Policy Matrix as separate proposals. However, they are repeated here in their original context as parts of an integrated layout for future legislation.

1. Connectivity, access and co-operation

These related concepts are fundamental to modern public communications. They reflect the fact that, because distinct telecommunications service providers provide *direct access* to different sets of end users (their own customers/subscribers), it is necessary for service providers to *co-operate* in providing *connectivity* across their networks to deliver public network services between all possible pairs (or sets) of eligible end users. It is for this reason that in the world of traditional public telecommunication services, the service providers are known as ‘common carriers’, i.e. they share the task, in common, of carrying telecommunications traffic.

Any Service Provider A can provide indirect access from its own customers to the customers of Service Provider B, by being granted *access* to the network of Service Provider B – and vice versa. When this access is provided commercially on a wholesale basis, and involves bulk network connections of a kind not available to retail customers, it is often called having *infrastructure access* to the network of the other Service Provider.

For purely private network services, such as within a taxi fleet’s radio network, no connectivity may be needed beyond the private network, and therefore no access is required to other service providers; in these cases, connectivity does not extend beyond the users of the given network (in fact, for taxi radio networks, the connectivity is usually limited to between a central operator and the fleet’s individual taxi drivers). But for public network services, whether for traditional telephone services or more modern Internet-based communication services, the principle of *any-to-any connectivity* applies, requiring co-operation between all participating service providers and interconnection of their networks to deliver that connectivity.

1.1. Any-to-any connectivity

(Global) *any-to-any connectivity* means an obligation on all participating service providers to connect end-users of a designated service to any legitimate information source connected to the same worldwide network, be that another end-user (a person or device) or any provider of that designated service (whether a person or a device or a set of persons and/or devices).¹

¹ This definition is intended to be a technology-free generalisation of the ‘founding definition’ of any-to-any connectivity, developed at a CIRCIT seminar in 1996: “ ‘(Global) any-to-any connectivity’ implies an obligation of distribution providers ‘to connect end-users to any legitimate information source connected to the same worldwide network, be they persons, computers, Internet servers, electronic servers or video servers’ ” (CIRCIT 1996; quoted in Kelso 2007: 194).

Any-to-any connectivity (AAC) has been implicit in the design of public communications networks since the introduction of automated telephone networks; indeed the need for AAC, free of the commercial bias shown by a human telephone operator, is believed to have been the prime motivation for Almon B. Strowger's invention of the first patented automatic telephone switch in 1891. Within 70 years, the AAC concept expanded from connectivity between all subscribers to the same local telephone network, to connectivity between all subscribers to the same automated national network, and thence to the goal of world-wide connectivity between the users of public telephone services on the international telecommunications network.

The social and economic benefits of the AAC principle have been so obvious to the general public, that a similar expectation is now widespread for new digital communication services, and should be incorporated in any future Communications Act: i.e. the AAC principle should be applied to all modern public communications services, including mobile services (such as Short Message Services) and Internet services (such as email and downloading from public websites).

The Object of Part XIC of the Trade Practices Act includes "the objective of achieving any-to-any connectivity in relation to carriage services that involve communication between end users". However the result of recent PhD research by Ross Kelso has been to discover that the incorporation of the AAC principle in the Australian 1997 telecommunications legislation occurred "with a diminished meaning and with less than satisfactory outcomes" (Kelso 2007: 198). For example, the Telecommunications Act 1997 mentions 'connectivity' only once, and in the context of a 'standard telephone service' only (Kelso 2007: 215).

If the AAC obligation is *not* incorporated in a new Communications Act, the absence will provide scope for unscrupulous service providers to provide a technical barrier to other service providers, through insisting on higher charges to provide comprehensive AAC.

The invention of *network numbering and addressing* made it possible for network operators to apply AAC to the connection of telecommunications calls to users on other networks, users to whom they could not be reasonably expected to keep any information for commercial identification purposes. While the principles of network numbering and addressing will be discussed in much more detail in section 6.3 below, it is important to understand at this point that the AAC principle can only in practice be enforced with respect to the *network numbers or addresses* assigned to end users or other sources of information (e.g. Internet websites), and not to any desired end user person or business entity. To put this point more concretely by example: a public telephone network operator is obliged to make best efforts to connect a telephone call to the network termination point, e.g. the phone line, associated

with the dialled telephone number; but cannot be expected to arrange for the user to be ready and able to answer the phone when it rings.

1.1.1. Call status indicators

Connectivity on the traditional Public Switched Telephone Network (PSTN) is made evident to end users by a set of audible call status indicators, transmitted to the end user's telephone when setting up, receiving or clearing down telephone calls. The basic call status indicators began when the PSTN serviced fixed line (access) voice services only, and have continued to be used as national PSTN numbering plans since the 1980s have included increasing ranges of numbers for mobile access users. The basic call status indicators should be maintained as the underlying technology for public switched telephone services changes to IP-based switching, to meet community expectations. **The essential call status indicators should be specified by the regulator when 'declaring' any public communication service, thereby implying an obligation on all participating service providers to provide these status indicators.**

As a brief example, the following call status indicators should be declared essential for the public switched telephone service, to meet ongoing community expectations. During the call set-up phase, the calling party (A Party) should receive dial tone within a set time interval, indicating that the network is ready for the A Party to transmit the digits comprising the number of the called party (B Party), using a keypad or other user interface. Within a set time after the last digit has been sent, the A Party should receive one of the following status indicators: ringing tone, busy tone, network congestion tone or an explanatory 'no progress' recorded message from a relevant service provider. The provision of ringing tone to the A Party should closely coincide in time with the provision of a ringing signal to the B Party's telephone or other terminating device.

The technical regulator (currently ACMA) should be authorised to develop and maintain schedules of call status indicators for declarable public communication services.

1.1.2. Mobile voice and SMS services

The concept of AAC needs to be extended to mobile telephone services in Australia, by enforcing a 'roaming' hand-over obligation on mobile carriers not providing radio coverage to a customer or to a called party in a given location, if the location is covered by another mobile carrier.

In other words, the failure of a mobile carrier to provide radio coverage of a location in Australia, either temporarily or over an extended period, should not provide any legal excuse from the AAC obligation, if that location is covered by another licensed public mobile carrier. This stipulation will require all mobile carriers to negotiate practical roaming agreements with other mobile carriers in Australia.

This principle applies equally to SMS services and mobile voice services.

1.1.3. Voice over IP communication services

An increasing volume of voice communication services are being carried over IP-based infrastructure, whether the voice calls start or terminate on conventional telephone connections or on personal computers or similar devices.

A simple test as to whether such a call takes place as part of a public communication service is to ascertain if the call has been directed to a number or address within a public network numbering or addressing plan.

If the call is directed to a national or international telephone number, the call will require connection via a public network service, even if the majority of the supporting network infrastructure is IP-based. In these cases, the requirements of AAC must be met by the participating service providers.

If the call is directed to an address within a private network, e.g. a Skype user name, then the service is a private communication service.

If the call is directed to an IP address, the test lies in whether the IP address corresponds to a public website (supporting public VoIP services, e.g. by automatically forwarding voice calls to an audio information source or to a public telephone number) or to a private IP address. In the first case, the address is by inference supporting a public communication service, and the AAC obligation applies. This case is dealt with at greater length in the following section.

1.1.4. Internet based services

Internet services rely upon the use of common, national and international 'backbone' transmission links in order to forward Internet Protocol (IP) based traffic to IP-addressed computers. To be IP-addressable, computers (or computer-embedded devices) must be connected directly to networks operated by Internet Service Providers (ISPs), who assign IP addresses from within their allocated ranges of IP addresses to their clients' computer servers, either dynamically (short term) or semi-permanently.

IP addresses are allocated to ISPs by regional Internet Protocol address Registries (of which APNIC serves the Australia-Pacific region), which in turn are loosely accountable to ICANN, the governing body for Internet addresses (both domain names and IP numbers). ICANN has much more direct supervision of the registration of Internet *domain names*, which it manages via contracts with the registries operating Top Level Domains (with the exception of some country code Top Level Domains (ccTLDs), whose registries continue to operate somewhat autonomously).

In Australia, the .au ccTLD is administered by auDA (www.auda.org.au) under contract to ICANN. In turn, auDA delegates the management of second-level subdomains (2LDs) of .au, such as asn.au, com.au, csiro.au, edu.au, id.au, net.au, org.au and gov.au, to registry administrators. Some of these subdomains, such as asn.au, com.au, id.au, net.au and org.au, are denoted as 'open 2LDs' by auDA, meaning that registration of end user domain names

is carried out competitively on the open market by auDA-accredited *domain name registrars*. Other domains, such as *csiro.au*, *edu.au* and *gov.au*, are denoted as 'closed 2LDs' and registration takes place by direct application to the 2LD administrator, which applies highly selective eligibility conditions particular to that subdomain.

A third category is that of 'community geographic 2LDs', where the 2LD corresponds to the official abbreviation for an Australian State or mainland Territory (e.g. *act.au*, *qld.au*, *nt.au*, *wa.au*), for which auDA has appointed a commercial administrator to manage direct registration of Australian geographic placenames as domain names (e.g. *dandenong.vic.au*, *katherine.nt*). It will be deduced that the 'community geographic 2LDs' amount to a set of eight 'closed 2LDs' having a common administrator and a common set of eligibility rules. (By a quirk of history, Australia's off-shore territories Norfolk Island, Cocos Island and Christmas Island have been assigned ccTLDs in their own right: *.nf*, *.cc* and *.cx*.)

A domain name can be registered in advance of receiving an IP address for it; but no Internet traffic can be physically directed to a domain name until it has been allocated an IP address by a relevant ISP. There do exist websites which are addressable only by their IP addresses (i.e, without the allocation of a domain name), but these are relatively rare on the Internet. The URLs (Universal Resource Locators) used in Internet browsers can operate on either IP addresses or domain names when searching for a website.

1.1.5. Email services

The use of email has become a staple communication service amongst most Australian businesses, governments and citizens, and therefore deserves to be supported and protected as a public communication service.

Email addresses are expressed in the form *username@[domain name]* and will only be accepted if the website addressed by *[domain name]* has an associated email server.

The principle of AAC for email should be imposed on Internet Service Providers, with the exception of email addresses on Internet addresses that are proscribed by the Australian Government, in which case a status indicator message should be returned to the originating party, explaining the reason for the failure to transmit the email message.

1.1.6. Internet browsing

Internet browsing has also become a staple communication service for Australian businesses, governments and citizens; increasingly it is becoming the preferred medium for communication between government agencies and citizens. For this reason Internet browsing, whether as a one-way (non-interactive) or two-way (inter-active) communication service, should be supported and protected as a public communication service.

The principle of AAC should be imposed on Internet Service Providers, with the exception of website addresses (URLs) that are proscribed by the

Australian Government, in which case a status indicator message should be returned to the originating party, explaining the reason for the failure to service the browsing request.

1.1.7. Internet download services and the principle of network neutrality

Internet downloading services are in general services from one Internet user (an online information source) to another (the consumer of that information). They therefore do not have the character of a public communication service. In many cases the information will only be downloaded if an explicit or implicit contractual arrangement has been registered between the participating parties.

However the principle of *network neutrality* is most relevant to these services, whether accessed under private contract or not between the participating parties.

Network neutrality refers to the obligation on ISPs to deliver an information stream across the network with a performance that is independent of the network addresses of the end parties (except in situations where network congestion or network faults cause a deterioration to all traffic transmitted through the affected parts of the network). It is a concept that is taken for granted in the traditional Public Switched Telephone Network; for that reason, the term *network neutrality* is mostly used when referring to information services across the Internet.

Network neutrality can be regarded as a form of selective network connectivity, but it would be more practical to treat it as a form of undesirable discrimination on end-to-end performance supplied between connected end-points. In the absence of a legislated obligation of network neutrality on participating ISPs, an ISP can contract selectively to provide information services, e.g. video streaming, from certain network sources only at user-acceptable speeds and by default pass a similar service from other information sources (or to end users directly connected to other ISPs) at a deliberately inferior speed. It would seem that the issue of network neutrality is more an issue for Trade Practices attention than for the Communications Act.

1.2. Numbering and addressing

Any-to-any connectivity (AAC) has been an important feature of the public telephone network since automated subscriber trunk dialling switching was introduced between interconnected national networks. To facilitate its planning, an international telephone numbering plan was developed by the International Telecommunications Union from the 1950s and has been kept regularly updated. This has led to greater harmonisation between the numbering plans of national networks, e.g. in matters of number length for national telephone numbers and the access codes used for calling international telephone numbers.

2. Access

Note on what this heading covers.

This heading covers the separate but related concepts of **end-user access** and **infrastructure access**.

End-user access refers to access by an **end-user** to a set of telecommunication services, using customer equipment (e.g. a mobile phone, laptop computer, fixed line telephone, fixed computer, etc) connected to a telecommunications network. The traditional term **customer access network** (CAN) refers to that part of a telecommunications network that provides end-user access to telecommunication services via transmission technology (whether radio, copper network, coaxial cable, optical fibres, or a combination of these and other technologies) to a switching node where numbering or addressing information is necessary to progress the routing of the telecommunication service further. Consideration of end-user access covers at least the following principles:

- Issues of equity in physical access by end-users subject to disabilities.
- The customer relationship between the end user and the provider of the relevant CAN in terms of rights and obligations for provision of end-user access.
- Rights of access by end-users to free national services such as connection to service directories and to emergency services.
- Rights of appeal by an end-user to an industry ombudsman for alleged significant lapses in performance by a telecommunications service provider.

Infrastructure access refers to access by a service provider to the network infrastructure owned or operated by another service provider, in order to provide any-to-any connectivity (AAC) for a given telecommunication service. Infrastructure access therefore includes interworking between local and long-distance (or 'backbone') networks, between national and international networks, peer interworking between different Internet Service Providers, as well as interconnection of long-distance networks to a particular CAN within that CAN – the most problematic area for inter-carrier regulatory disputes over infrastructure access for broadband service delivery over the past decade.

Infrastructure access covers whatever measures are needed to ensure that communications resources will be efficiently shared by service providers needing to collaborate in the delivery of end-to-end services. It will need to serve the main policy objectives for communications, whatever they will be. Some relevant objectives likely to be included in any list are

- encouraging competition in service delivery,
- encouraging seamless and efficient delivery of end-to-end services, and
- encouraging investment in infrastructure.