

Next Generation Network (NGN) Study Consultation Questionnaire

Prepared for

Commerce Commission

By

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Introduction

I welcome the opportunity to respond to the above questionnaire. I believe there is great value in having the issues related to the implementation of NGNs addressed in an open forum by industry leaders prior to any full deployment within New Zealand.

My comments on the issues as listed below are ordered under the headings and specific questions as defined by the Commission. Where logical, I have related responses to specific questions in the text

The views expressed below are my own and do not reflect those of any of my clients.

A. Retail and Wholesale Service

A.1. What are your views on the appropriateness or otherwise of retaining the existing commercial models (e.g. PSTN interconnect) in the NGN environment?

The current commercial models were developed for use with “stovepipe” based service platforms. Hence they are most unlikely to be suitable for use in a multimedia over single IP platform environment, as is the NGN. If we persist with the current commercial models used for the PSTN, for example, then it is highly likely that we will stifle innovation in the development of new services, based on many different paradigms of communication, including various forms of redirection service, multimedia and multi-session communications. The existing commercial models will struggle to deal with these service complexities and so new models will certainly be required. Hence it will be important to encourage new models in association with the introduction of NGNs

Related to the need to encourage service innovation is the need for this innovation to be largely independent of the incumbent service provider, even though much of the service functionality may be derived from this service provider through various wholesale arrangements. New commercial models will again be required to support and encourage this independence.

A.2. What do you believe are the appropriate retail and wholesale commercial models for the various NGN services?

The key commercial structures required for the NGN revolve around the need for:

- Horizontal disaggregation of network functionality,
- “Open access” at each layer of the disaggregated model, and
- SLA based interconnection at each layer of the model.

This model, I believe will lead to the best possible outcomes in terms of:

- Economic efficiency,
- Competitive market,
- Service innovation.

The horizontal disaggregation needs to clearly reflect the boundaries between:

- Passive infrastructure capability,

- Active network bit-stream capability,
- Service, application and content capability.

The “open access” needs to reflect the need for service providers to enter the market and deliver any one or more of the above layers, while being able to use other layers of capability on a non-discriminatory basis from any other service provider. Typically it would be expected that there would be only one infrastructure service provider in any given geographical area providing wired access capability. There may well be other service providers providing wireless access capability in the same geographical area, but for the wired infrastructure there will be a monopoly as there is little or no economic benefit to be gained from building multiple wired infrastructures. The only place where this makes any economic sense is where the density of customers is very high, which only occurs in the Central Business Districts of 3 cities in New Zealand. Of course, it would be essential to ensure that all of the infrastructure islands serving various geographical areas are fully interconnected with each other on a non-discriminatory basis to enable any end user connected to any passive infrastructure to be connected to any other end user connected to any other passive infrastructure.

It would be hoped that over time, there would emerge several Network Service Providers delivering bit-stream services over the passive wired infrastructure in any geographical area. This would then ensure that any end user could access services delivered via multiple bit-stream providers, enabling competition to thrive. This could only happen if there are highly capable interconnection arrangements between the Network Service Providers, including the universal support of Service Level Agreements (SLAs) across the network domain boundaries.

Finally in this model, we would expect to see the emergence of many Service and Application Providers, delivering their services over any or all of the Network Service Providers’ capability. This again means that all of the network service providers need to offer access to their bit-stream services on an “open access” non-discriminatory basis for applications and content. This requirement also supports the need for highly capable interconnection arrangements, including inter-boundary SLAs to ensure that customers receive the network performance that they expect when using the applications and content.

In the above model, it is perfectly appropriate for any service provider to offer services across more than one layer of the model. However, when they do so, they need to implement strict separation requirements between the different layers of their business, to ensure no cross-subsidisation within their own business and no discrimination against any other business.

It should be noted that there are some emerging reasons for wireless networks to evolve into a similar type of horizontally disaggregated model in the future also.

This is based on the need for large amounts of spectrum to support the emerging IMT Advanced technologies. This could result in any geographic area being served by a single wired and single wireless infrastructure, at some future point in time, possibly owned and operated by the same or different Infrastructure Service Providers. Then there would need to be multiple network and application service providers operating seamlessly across both of these infrastructures on an open access basis.

In addition to the above, it needs to be recognized, as indicated under question A1, that the current commercial arrangements associated with interconnection are likely to require change, in order to support the commercial model described above. To be effective this model will require an interconnection arrangement much more aligned to that of the Internet today, than that of the PSTN today. Otherwise it will be incredibly complex to arrange interconnection payments for each individual service across the many service provider boundaries at each layer of the model.

A.3. What are your views on the opportunities, merits or desirability of fostering an environment facilitating services based versus facilities based competition in the evolving NGN market?

As indicated under question A2, I strongly believe that there are merits and opportunities of fostering an environment facilitating services based versus facilities based competition. The key driver of this is the small, highly dispersed population of New Zealand. There is very little value to be gained from building multiple infrastructures to service this population base. A single, robust, highly capable infrastructure (wired and wireless) should be built to serve all New Zealanders. This does not mean that the single infrastructure needs to be owned by one entity – it could be owned by multiple entities on a geographical area basis, with all areas interconnected appropriately to create a seamless national infrastructure.

It should be emphasized that this model particularly applies to access based infrastructure. It is not so critical for backhaul infrastructure, where two or three players can operate on a competitive basis as is the case today. However, even here, there will be some regions where the model should apply, even for regional backhaul, given that competition does not reach out to cover all regions of New Zealand.

A.4. Can you envisage any areas where industry limitations are likely to prevent (e.g. commercial or technical) agreements?

The areas where industry limitations may prevent commercial or technical agreements include:

- Interconnection to achieve “fair” outcomes across network domain boundaries,
- Interconnection at the application service provider layer,
- The provision of access to existing access infrastructure.

The Interconnection between network domains is required to enable any end user to communicate with any other end user or application available on the network of networks, under reasonable terms and conditions and with quality of service to meet all parties expectations. In this context, quality of service also includes security and privacy. This outcome requires that interconnection across the network domain boundaries be implemented in a fair and secure manner. By fair it is intended that the allocation of resources and the commercial arrangements for the use of those resources are fairly distributed between the parties on either side of the boundary. This has both commercial and technical implications.

In terms of the technical implications, there is a need to ensure that any one party does not make it impossible for any other party to deliver the required end user experience for a given application. Hence it is essential for all parties to agree on the allocation of budgets for technical parameters such as latency, jitter and packet loss on an end-to-end basis for given application types. For example, if an end-to-end application requires less than 100ms of latency to enable a good end user experience, then it is essential that any one service provider in the path between the end user and the application host or other end user involved in the application, does not assume all or most of this budget and so make it impossible for any other service provider involved in the same path to deliver on its latency commitments. There needs to be a fair allocation of latency budget (in this case) to enable all service providers to deliver on their SLAs in a reasonable and cost effective manner. This may mean that some service providers have to invest more to achieve their budget allowance. Alternatively, a given service provider may not be able to offer some services to its customers due to not being able to meet the required SLA budget allocations. Any such non support of applications would need to be clearly communicated to customers at the time of purchase of service from that service provider.

This particularly applies in the case of primary line telephone service over NGNs. If one service provider delivers primary line telephone service over say the Internet and another delivers it over a managed NGN, when calls between these two service providers are interconnected there will be a problem in meeting the expectations of the end user connected to the NGN relative to that of the end user connected to the Internet. When calls between these two parties fail, typically due to congestion on the Internet, who bears the costs of customer complaints? Most likely it will be the NGN based service provider as his customer has the higher expectations, but why should this be the case? The fact that one service provider took a lower cost, and

hence less reliable approach to deliver a service, should mean that that party should be responsible for the end user complaint. How can these issues be properly managed? It is most likely that this will be a key area in which some form of regulatory intervention will be required.

It should be noted that the above example is for primary line voice. However, there will be many applications where these same issues will arise in the future.

Hence in terms of the commercial arrangements, the issues associated with this situation become clear. Who is responsible for dealing with and hence assuming the costs associated with customers not receiving service outcomes which meet their expectations associated with what they purchased? In addition, taking again the primary line voice example again, it is highly likely that we will end up with the situation where one party has invested significant capital in network reach, whereas another has invested very little in network reach, but still wants his customers to be able to connect to all end users on the network. How should the cost of service be shared fairly between these two service providers? Both have a right to make their individual investment choices, but the commercial arrangements need to ensure that the service provider that has invested in customer reach is adequately compensated for that investment. There cannot be situations where any service provider ends up "freeloading" on any other service provider. Any such opportunity for freeloading will certainly distort incentives for future investment, which is highly undesirable.

Another area of concern will be the use of existing access infrastructure. Will service providers be able to access existing infrastructure on a fair basis? This is certainly becoming true for copper with the introduction of unbundled local loop. However, will these provisions need to expand to encompass other forms of infrastructure such as ducts, dark fibre, poles, etc? This is another area of great potential for difficulty, if not properly addressed.

A.5. Can you envisage any areas where policy support would likely aid or facilitate agreements?

I think the two generic areas of interconnect and open access, as identified under question A4 above will require some degree of policy support in order to achieve the best possible outcomes for end users.

A.6. Can you envisage any areas where significant barriers to entry are likely to emerge?

If the issues discussed under questions A4 and A5 above are not properly addressed then this outcome is likely. At the same time, a properly implemented horizontally disaggregated network model for NGN deployment should minimize the

opportunities for parties to create barriers to entry. However, this has yet to be proven conclusively anywhere in the world and so we must be vigilant to the introduction of new barriers to entry.

One of the areas that will be challenging will be the preparation, implementation and management of SLAs across NGN domain boundaries. These SLAs are essential to ensure satisfactory end user experience for many services that will be supported on these NGNs, but could present some serious difficulties, such as the fairness issues raised under question A4. Because the concept of open access at the service and application layer is relatively new, there are likely to be many potential issues to be discovered in this arena also.

The best examples of service layer interconnection today apply to MVNOs in the mobile service space. Although many of these vehicles have been implemented few have been successful business models, and so there must be some lessons that we can learn from these models.

B. Architecture

B.1. What technical issues need to be resolved to allow you to offer the services you would like to be able to offer today, and over the next 1-3 years?

As a consultant, I will not be offering services myself. However, I believe that the key issues to be resolved are the following:

- The technical requirements for IP Interconnection,
- The commercial requirements for IP Interconnection,
- The allocation of impairment budgets between service providers to ensure satisfactory end user experience,

In the above, it is intended to include interconnection at all layers of a horizontally disaggregated network architecture, including:

- Infrastructure,
- Network or bit-stream,
- Service, application and content.

Without these issues being addressed, we will end up with islands of NGN deployment, and quite possibly domination by one or a small number of NGN service providers.

B.2. What commercial issues need to be resolved to allow you to offer the services you would like to be able to offer today, and over the next 1-3 years?

In any form of interconnection, the technical and commercial issues need to be addressed coherently. The commercial approach drives the technical approach and visa versa. The arrangements must be implemented to achieve fairness in terms of both the technical and commercial conditions. The key issues required to be addressed over the next 1-3 years are those identified in the discussion above, namely:

- The conditions associated with open access at the infrastructure, bit-stream and service, application and content layers of the horizontally disaggregated architecture,
- The interconnection conditions applying at the boundaries of any network domain to enable any end user to access any service, application or content across the network of networks,
- The interconnection conditions applying at all layers of the horizontally disaggregated network architecture.

B.3. Which of these issues do you believe can be satisfactorily resolved through the current industry work groups in a timely manner?

Hopefully all of the above issues can be successfully resolved through the current industry working groups in a timely manner. This would be the best possible outcome for the industry as a whole. Any regulatory intervention should be a last resort.

However, I am yet to be convinced that some form of regulatory intervention won't be required. The current scope of the working group activity is very narrow and there appears to be little willingness to constructively address the fairness issues, either on a technical or commercial basis. On the other hand, it is still early in the process and I hope that these broader issues will eventually receive the right level of attention.

B.4. Do you envisage any issues in NGN interconnect or in relation to current peering arrangements?

As identified above, this is the key area that I believe there will be issues, both from a technical and commercial perspective.

B.5. Do you envisage any issues in NGAN to NGN interconnect?

The specific issues associated with next generation access networks are yet to emerge to any real extent. Certainly there will be some issues with certain architectures and implementations. Most of these issues will arise around the implementation of "open access" approaches. For Passive Optical Networks (PON) for example, there are some severe challenges in delivering a simple, robust open access at the passive level. It is more likely that open access will need to be implemented at a bit-stream level. Similarly, it will be interesting to see how sub-loop unbundling of fibre to the node (FTTN) unfolds. Are there many situations where the economics of deploying a second DSLAM in a cabinet is realistic? If it proves to be the case that sub-loop unbundling is in general uneconomic, then what is the alternative? My assumption is that it will again be bit-stream based interconnection. Such a bit-stream will need to be highly functional in order to meet the needs of a wide variety of access seekers. Defining such a highly functional bit-stream service is expected to be highly challenging, based on the E-UBA experience to date.

B.6. Do you envisage any issues around NGN to service, content and application provider interconnect?

As mentioned earlier, this is a relatively new interface for the industry to deal with. Except in the case of pure Internet, the experience to date with this type of open interface has been less than successful. The critical issue will be defining suitable and fair SLAs across the boundary between the application and content providers and the Network Service Providers. Unfortunately these parties will come to the table with quite different expectations, as evidenced by the experience with the Internet. Service, application and content providers often expect to receive full access to a network service providers customer base at zero cost and with guaranteed delivery performance. On the other hand, the network service providers have traditionally expected very high returns on their investment in reach to access customers. Hence it can be expected that closing this gap in expectations will be troublesome.

B.7. Do you envisage any issues around agreement on appropriate parameters and values relating to Quality of Service in the NGN environment?

From a technical perspective, the issues around Quality of Service (QoS) and security associated with interconnection will be the key elements which will be challenging to achieve agreement on within the industry forums. There are several different definitions for these parameters which will add to the confusion. QoS also encompasses network termination devices and even CPE, which makes demarcation challenging and bounds of responsibility difficult to define. In the end though, it should be the end user needs that determine the requirements for both QoS and

security. This will require service providers to take on more responsibility for NGN based services than has been the case with traditional services. They will need to ensure that the end-to-end path, including theirs and other parties equipment is suitably configured to deliver the required end user experience.

In addition, there is the issue of QoS budget distribution as identified under A4 above. This will require service providers to agree on how much budget is available to each service provider. No service provider will be keen to constrain their impairment budget, as it will require additional investment to enable guarantees to be achieved on a consistent basis. This issue will certainly result in considerable debate between service providers. It is highly likely that some form of intervention will be required to achieve the best outcome for end users.

B.8. Do you envisage any issues around the integration with the developing open access fibre networks?

This shouldn't be a tremendously challenging issue when the fibre networks are interconnected at the passive level, involving duct, tube or dark fibre and are configured to be truly "open access". There will need to be clearly defined SLAs covering all of the requirements related to provisioning and service assurance, but otherwise the technical parameters should be quite straightforward.

The commercial issues are probably less straightforward, with pricing for ducts, tubes and dark fibre being challenging issues to address. Each different service provider will have different requirements on return on investment and assumptions around infrastructure utilization, which can dramatically impact on the economics of this environment.

C. Transition

C.1. Can you comment on the need or timing to migrate from IPv4 to IPv6 and any role you see for government in this transition?

The industry in New Zealand could remain using IPv4 for many years into the future. However, this would certainly lead to more complicated and restrictive implementations of NGN technology and services. Instead the introduction of NGNs should be considered to be the opportunity to make the break to introduce IPv6 on a more wide scale basis. The use of IPv6 can be used to reduce the complexity of home multimedia implementations involving a full range of telephony, fast Internet and video services. The number of home devices that need to be addressed will explode exponentially over the next decade, making the use of IPv6 very attractive, as compared to dealing with the same range of devices behind Network Address Translation (NAT) using IPv4.

The big issue however will not be how to introduce IPv6, but rather how to remove IPv4 from networks. The proliferation of IPv4 and the associated wide spread use of NAT is so ingrained into networks today that it will be a major challenge to remove it over the next few decades. Hence it is certain that for many years to come we will need to support a mixed version environment, with all its inherent complexities.

It will be difficult for Government to play a constructive role within this environment. The best role for Government is to:

- Encourage the industry to transition to IPv6 as soon as possible,
- Provide a leadership role in terms of supporting IPv6 in all Government network initiatives,
- Taking the lead in terms of removing IPv4 from Government network environments.

C.2. Can you comment on the need for revisions to numbering plans for new services, and the need or otherwise for non-geographic codes recognising increasing user nomadicity?

There is a great need to support nomadicity on NGNs. It is expected to be a very popular service capability. However, it is also essential to deal with all of the issues that it creates, before nomadicity becomes widely available. The issues include:

- Number plans to support nomadicity,
- Authentication of nomadic devices,
- Impact of nomadic devices on emergency services,
- Security issues introduced through the use of nomadic devices.

Fortunately there is a major focus on approaches to address these issues within international standards bodies, but certainly there is no perfect solution which can be implemented today.

It will be essential, for example for any early implementations of primary line voice service to not enable nomadicity. If this is enabled, it will be nearly impossible in the near term to provide any useful information for use in providing emergency services.

C.3. Do you have a view as to the best approach in dealing with stranded assets in the event of significant network rearrangements?

I am of the view that service providers should manage their own assets with respect to end of life and even premature end of life. There are very few events which are not apparent to a well informed service provider, several years in advance of their occurrence. Certainly there will be significant transition of technologies over the next decade or so, with much of it related to NGN implementation. However most of the transitions likely over the next 5 or so years are obvious now in macro form at least. Certainly the rollout of FTTN by Telecom is well defined several years into the future and the end outcome is known at least 4 years in advance of the final deployment. The increasing use of fibre to the premise (FTTP) is also clearly evident, with the only variable being the rate of transition.

However, any service provider should make their own judgment based on the available information and manage their own risk accordingly. There should be no need for further Regulatory intervention in this regard.

C.4. Do you have a view on emergency service, mains powering and location information in an NGN environment?

The management of these issues during the transition to NGN is critical. It is essential to maintain a satisfactory emergency service environment for public safety and this should not be compromised by the evolution to NGN technology. Furthermore, all service providers need to play their part in achieving the best possible outcomes with respect to emergency services.

In this regard, the Emergency Management Act is very helpful in defining some minimum expectations for service providers. Under this Act all service providers operating under the terms of the Telecommunications Act 2006 are designated as required to support a range of "Lifeline" obligations. These provisions when appropriately interpreted require that that service providers deliver a certain level of service continuity in the event of a disaster, including that resulting in a loss of electric power for a nominal duration. Hence it is essential that all customers that are offered a primary line telephone service are also offered the option of backup power in the event of a power outage for a defined duration. Hence it is essential that service providers at least offer backup power facilities as part of their service offerings.

In terms of location information, this can be readily supplied with proper design in a fixed service environment. Provisions are available in standard equipment to enable proper authentication of customer equipment and the matching of access ports to access lines and the passing of this information to the service provider. This will deliver suitable location information for fixed devices at low cost. However, the same is not true for nomadic or mobile devices. In some countries the location of mobile devices is mandated within defined error bounds, and this approach may need to be considered for New Zealand. Similarly, there are means to provide location information associated with nomadic devices, but this is certainly more troublesome as mentioned above.

Overall, a plan needs to be adopted by the industry players to put in place appropriate measures to ensure that these capabilities are delivered through the deployment of NGNs. If the industry cannot do this themselves, or choose to dilute these essential requirements, then this may require specific action by the regulator. In terms of public safety, it is certainly an issue which merits intervention, if the industry fails to cease on these issues in a robust manner themselves.

D. Environment

D.1. Is access to physical infrastructure such as ducts, poles and rights of way likely to impact on NGN rollouts?

Access to physical infrastructure such as ducts, poles and rights of way will become an increasing problem for NGN deployments, if "open access" type principles are not established for access to these facilities. New Zealand cannot afford to either have

- A bottleneck situation with respect to these assets, or
- Economically afford to have multiple service providers building independent access networks alongside one another.

The economics of access deployment in New Zealand requires that these assets be made available in a non-discriminatory manner for all service providers to use.

D.2. What is your view on the ability to provide services into multi-tenant buildings, and the potential to share optical line termination equipment?

The preferred approach to deal with multi-tenant buildings is to ensure that there is "open access" to the passive infrastructure serving any such building and to provide services to the building using the horizontally disaggregated services approach. Although such a building may be provided with a single passive infrastructure, it should be capable of being supplied with bit-stream services from several Network Service Providers and associated with each Network Service Provider there should be a large number of Application Service Providers offering a large array of competing services, applications and content.

For each individual building the above service delivery model would require the use of shared optical line terminal equipment, either on a shared port basis or on a rich bit-stream basis. Either approach could be implemented, and there are examples of both in use overseas. However, establishing the model in New Zealand may require some intervention to ensure fair and open access is actually achieved for all service providers and that the end users within the multi-tenant building receive a wide range of choice at a reasonable price.

D.3. Do you have a view of the role of the regulator and other industry bodies (e.g. TCF) in the evolving NGN environment?

The regulator should play the minimal role possible in the implementation of the NGN environment. To the greatest extent possible, the industry should use its forums such as the TCF to determine the best approach to the implementation of a seamless network of NGNs, supporting the widest possible range of applications and content. Regulation should be the last resort in the implementation of this environment.

On the other hand, there is tremendous value in signaling to the industry at an early stage where the potential competitive and economic bottlenecks may lie, and by this means give industry a clear opportunity to address the issues themselves. This resolution can be time bound, so that industry clearly understands that beyond a certain time, regulatory intervention on a given issue could be undertaken. This approach should keep industry focused on achieving outcomes within its own forums.

As an additional point, it is essential that any resolution of NGN issues is achieved based on well understood international best practice and internationally recognized standards. Hence it is essential that the New Zealand industry forums adopt these international standards to the greatest possible extent, to ensure that New Zealand leverages off global economies of scale and scope in equipment manufacture.

D.4. Do you have a view on whether or how the "Ladder of Investment" model could operate in the NGN environment?

No comment.

D.5. Do you see any issues or opportunities relating to the access to and use of spectrum now, and potentially emerging from the current Telecommunications and Broadcasting convergence?

The critical issue with convergence relates to the availability of prime content to all service providers. It is essential that 1 or 2 content providers do not dominate the market for prime content and stop others from getting access to it on a fair and reasonable basis. This is particularly important when such action stops some segments of the population from accessing this content under any reasonable conditions.

It is also essential that end users can make their choice as to how they want their content delivered and by whom and know that they will get access to the best content through this means. In an NGN this includes the ability to choose between traditional broadcast means of delivery, including "free to air" and subscription or those services offered via NGNs, such as video on demand or streaming video. The ability for individuals to make these choices should not be constrained by market power.

It is essential that in addressing the access infrastructure bottleneck issues through regulation that we don't simply shift the bottleneck to the application and content parts of the NGN. Hence there is both:

- An opportunity to get much more flexible and competitive delivery of content or
- The threat of content being constrained in the ways that it is delivered to end users in New Zealand.

In the latter case it is almost certain that New Zealand will fall behind the rest of the world in terms of rich content delivery, which is certainly not a desired outcome.