NGN Interconnection Trend And Its Regulation Implication

XIE Xiaoxia

School of Economics & Management
Beijing University of Posts & Telecommunications, Beijing 100876. P.R. China
e-mail: plutonian@tom.com

Liang Xiongjian
School of Economics & Management
Beijing University of Posts & Telecommunications, Beijing 100876. P.R. China
e-mail: liangxj@bupt.edu.cn

Xu Liang
School of Economics & Management
Beijing University of Posts & Telecommunications, Beijing 100876. P.R. China

Abstract: With the development of communication technologies, the business model and regulation framework will change greatly in NGN era. This paper first present the changes what have happened and will happen in the telecommunications interconnection domain, and then make an introduction of underlying background in both technical and commercial aspects. In part 3, we divide the future interconnection forms into three categories, come up with future interconnection paradigm and then make corresponsive considerations on the regulatory implication.

Keywords: NGN, layering, interconnection paradigm, regulation

1. INTRODUCTION

Numerous discussions have focused on NGN technologies recently, however, there’s still less focus on its regulatory implication. And which is the focus of this paper.

In the paper, we first present the changes which had happened and will happen in the domain, and next come up with the underlying rationale of both technical and commercial aspects. On the base of the above, we analyze the interconnection trend in NGN and post several kinds of interconnection forms. Then we try to discuss the regulatory implication of these changes, and consequently what solutions should be built to accelerate the market growth.

2. CHANGES IN THE INTERCONNECTION DOMAIN AND FUTURE TREND

The problem of interconnection arises from the competition in the telecommunication industry. For any user in the network, there’s a need to communicate with others of different networks. Interconnection is a pre-requisite to make it possible for entrants to interconnect at almost any “location in the network”.
International telecommunication Union defined “interconnection” as:

“The commercial and technical arrangements under which service providers connect their equipment, networks and services to enable customers to have access to the customers, services and networks of other service providers.” (ITU, 1995)

Definitely, different companies in different positions in the industry hold different points of view about interconnection. Due to strong economics of scale, the competitive network needs to interconnect with legacy network to provide the same network coverage and services, while the legacy network don’t want to give up the advantages of monopoly.

2.1. Interconnection In Legacy Telecommunications Network

The legacy telecommunications network is a single, closed network. Every network is in exclusive use of a single kind of service, e.g. PLMN, PSTN/ISDN, Data/IP Networks, CATV.

![Figure 1: Legacy network interconnection](image)

In this case, the network interconnection equaled to service interconnection. And the entities involved in the interconnection agreements are different network operators.

We could depict the legacy network interconnection as figure1:

In the figure, service layer and transport layers are integrated, so the network interconnection equaled to the service interconnection.

2.2. Undergoing Changes In Technical Aspects And The Consequent Changes In Interconnection Domain

Recently, telecommunications actors are faced with the transition towards new telecommunications network “Next Generation Network (NGN)” which will support a wide range of services (multimedia, text and data, as well as voice) over a wide range of speeds, from low speed to broadband. Large incumbent telecommunication network operators, in general, are being challenged to shift their network technologies to NGNs in order to increase revenues and reduce the cost by providing multi-media services to their customers. According to Yankee Group, almost 40% of European operators will also launch major packet voice migration plans within the next two years.  

As to the technical aspect, we could notice that the new telecommunications

---

networks are “layering” and “distributed network intelligent”, which comprise merits of the legacy telecommunications network and Internet. The technical availability unbundled service provisioning and transport, and furthermore enabled the openness of the network and service to the independent third party service providers. With reference to the interconnection domain, the new interconnection paradigm involves not only network operators but also independent third party service providers now.

From the functional aspect, we could divide the services into three generic categories: infrastructure layer, bearing service layer and service layer (or value-added service layer).

![Figure 2: Future Telecommunications Service Layering](image)

As FCC states: “Major technology changes, which occur naturally in competitive as well as regulated markets, are always likely to disrupt existing models of competition”. In the new telecommunications industry, relevant markets may arise in layers and hierarchical structure within a layer. Recently, different kinds of companies have emerged in the industry, such as Virtual Telecommunications Operators, independent NPs (network providers), SPs (service providers), CPs (content providers), etc. But for simplicity, we could categorize these companies into three kinds. They are:

**The Infrastructure Operators** supply physical security guarantee and connectivity among points of bearing service layer. In this layer, the operators could provide services such as: L1 VPN, broadband and circuit wholesale, trunk rent, equipment rent, optical infrastructure and wavelength rent, etc.

**The Network Operators** supply network-based services, e.g. transport service, QoS, L2VPN, L3VPN, internet access.

**The Service Operators** are in charge of service control and network management. Meanwhile, they also provide numerous kinds of multimedia services and applications,

---

2 Here, the “transport” layer does not refer to the 4th layer in the OSI model but accommodate the functions in the network layer and underlying layers in OSI model.
including instant messaging (text and video), advanced presence information, video
messaging, collaborative tools, location-based services for mobile and nomadic users,
and so on.

In theory, the above three role could independently exist. But the fact is that the
bearing operators hold the essential physical resources but position in the bottom of the
value chain where profits limited. They have to face the challenge of redistribution of
revenues among players in the industry. Considering current status of ISP in Internet,
legacy network operators could not be willing to lose control in underlying resources.

As to service operators, they develop customer-orientated services and applications
on the top-level of the value chain and hold large profit space. But it must expand on the
base of services supplied by bearing operators, including not only the transport but also
issues like security, service quality and billing etc.

2.3. Future Interconnection Paradigm

For the interdependence of bearing and specific-service, we could depict the future
interconnection forms as following figure: interconnection in the service domain,
interconnection in the network-related domain and interconnection in the infrastructure.
The underlying interconnection forms formed pre-requisite of the top ones.

Here, we define service as a set of applications, such as Instant Messaging (text and
video), video telephony, video messaging, location-based services for mobile and
nomadic users, audio, video and text conferencing etc. Valid uses of NGN services across
different core network involve interconnection among different layers from
network-related interconnection service and service-specific interconnection.

![Figure 3: future interconnection layering model](image-url)
3. IMPLICATIONS OF NEW INTERCONNECTION PARADIGM

3.1. Regulation Principal

After the introduction to changes in the industry, we now come into the discussion about the regulation about the interconnection in the future.

First we must establish regulation principles to guide the specific regulation resolution. There have been different descriptions about it from different institute or different countries. Here we quote the regulation principle of OECD:

- Promote competition
- Equality of access
- Regulatory withdrawal
- Favorable climate for investment

Here, we make an assumption that the bearing service layer has a real standardized interconnection interface carrying higher layering interface protocols for a specific-service layer.

The figure 4\(^3\) depicts these commercial relationships between the entities involved in NGN communications.

---

\(^3\) It was modified from wik-Consult “The Economics of IP Networks—Market, Technical and Public Policy Issues Relating to Internet Traffic Exchange”, page 8}
3.2. Access Of Service Operators To Network Operators

1. Entities involved

In this kind of interconnection agreements, Service operator provides value-added service. Network operator, maybe a generic network service provider or an integrated service provider, provides underlying bearing service and furthermore network-related intelligence/applications.
2. Interconnection Forms
   - Service operator A vs Generic Network operator B

   Here, B provides underlying service for B and holds the “bottleneck” resource, for example network address translations and firewalls, routing table, quality of service capabilities, network coverage, termination capabilities.

   The potential control points held by A are calling set-up capabilities, proprietary standards, interoperability, application programming interfaces.

   The negotiation depends on the relative market power of two parties and the regulation policy.

   - Service operator A vs Integrated service provider C

   We’ve referred that many operators are bundling network-related services with value-added services, and what we care about is whether this kind of bundles blocks competition. If one service of the bundle is in monopoly, the other service markets could remain competitive. This kind of access is our focus.

   To some extent, it is like the one-way access in legacy telecommunications network. Value-added service provider needs integrated service provider’s bottleneck services (including hard and soft). But it’s not the case in reverse.

3. Charge

   Charge is the most important factor in the interconnection agreement.

   On one hand, the Service Operator charged for the value service brought to the customers, and paid to the Network Operator for the access to the network or other functions, e.g. routing, QoS, mobility. Meanwhile, the Network Operator could get money from the customer for the access service.

   Without regulation, the charges are determined in the commercial agreements and are dependent on the relative market power. And other pricing principles will be considered under regulation. But the cost will be essentially the basis of pricing.

4. Regulation implication

   If the interconnection settlement is not appropriate, the price signal will mislead the resource allocation and meanwhile provide wrong market signal for the new comer. Another question is that integrated operators usually complain that the new comers always execute the “skim-strategy” to come into the profitable service market and avoid the universe service obligation.

3.3. Interconnection Between Network Operators

   1. Entities involved

   In the case of interconnection inside the network-related domain, the different Network Operators come into the interconnection agreement.

   2. Interconnection Forms

   According to the relative market powers of the different parties involved in the agreement, there will be basically two forms of interconnection, quite similar to the case of Internet interconnection.

       - Symmetric
In the case, the values different parties brought to the agreement are approximately equal. This case is similar to “peering” in internet interconnection. Here, the settlement is free and the parties involved could exchange traffic and related routing information between their networks.

- Asymmetric

In the case, the values different parties brought to the agreement are not equal. This case is similar to “transit” in internet interconnection. Here, the bigger network operator charged to the smaller one. The point is the rationale of the charge settlement.

3. Charge

Without regulation, interconnection arrangements would be made if each of the party perceives that they have more benefits than costs from the interconnection arrangement.

The future telecommunications networks are IP-based. Naturally the interconnection settlement between network operators should shift from time-based to traffic-flow-based.

The point is that if the settlement cost-oriented should be based on cost per packet or other factors, maybe, bandwidth, QoS, volume, scope and scale of the network etc. should be considered.

4. Regulation implications

Here the regulation resolution should be focused on the asymmetric agreement. If the market is competitive, the SMP, and interconnection obligation should be made clear.

3.4. Interconnection Between Service Operators/Providers

1. Entities involved

In this kind of interconnection, different service operators/providers come into the interconnection agreement.

2. Interconnection Forms

From the above introduction, we could know that the potential control point held by service operators/providers, such as: call set-up capabilities, proprietary standards, interoperability, application programming interfaces. Service operators have the capabilities to build entry barriers in specific service market.

The kind of interconnection could also be categorized into:

- Symmetric
  - In the case, the values different parties brought to the agreement are approximately equal. And the settlement depends on the commercial negotiations.
- Asymmetric
  - In the case, the values different parties brought to the agreement are not equal. Here, the bigger network operator charged to the smaller one. The point is the rationale of the charge settlement.

3. Charges

Because of the control point, the leading service operators could build market entry barriers to the new comers. So the settlement model is becoming a challenging issue in
the industry. What is the value factor to be considered? Traffic flow is obviously not a good one.

Another issue to be considered is “universal service”. What is the definition of “universal service”? Who will take the obligation? How much the compensation to the cost?

4. Regulation implications

Without regulation, interconnection arrangements would be made if each of the party perceives that they have more benefits than costs from the interconnection arrangement. But if market failure occurred, the regulation should be made.

In the legacy telecommunications, the service domain is not the focus of the regulation framework. So it’s necessary to take it into consideration. What kinds of service need government intervention? How to judge the market failure?

And here the different service kinds should be considered. Against different kind, we should establish different resolution.

To the extent that a policy objective no longer applies, what information requirements should apply (obligation on service provider and customer) If this option is taken the following addresses the issue of what information customers must be told.

4. CONCLUSION

The introductions of new technology and concept, especially the layering concept in NGN, have changed and will change the industry and consequently the regulation resolution. To adapt to these changes, an analysis of the current market and a new regulation framework will be essential. After analyzing the changes in the interconnection domain, we come up with a interconnection layering model and address its implication to regulation.

REFERENCES
1. Alison Birkett, Next Generation Networks ad the EU regulatory framework for electronic communications: EU experiences and perspectives, 2004