TELECOM REGULATORY AUTHORITY OF INDIA

Recommendations

On

Issues pertaining to Next Generation Networks (NGN)

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TRAI House
A2/14, Safdarjung Enclave
New Delhi-110029.

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1. Background-Relevance And Impact of NGN

1.1 Emerging technological developments leading to convergence in ICT sector are enabling service providers to provide a wide range of services (multimedia, data, as well as voice) over the same platform through deployment of advanced systems known as Next Generation Networks (NGN). The emergence of NGNs, which are IP-based multi-service networks are driving the changes in the way basic telephony services are delivered. In addition these networks are expected to transition to a common core system to support a range of access technologies and enable converged services to be provided as applications on such system. This enables lot of different services, including voice to be carried over a common network, resulting into reduced costs due to economies of scope and also the efficiency of transport.

1.2 The 'Next Generation Networks' could help develop many more innovative services as demanded by customers with much more flexibility than the traditional networks offer. Such networks could also offer opportunity for third party service providers to develop and provide value-added customer services over the networks owned by other operators. **The next generation network, which has separate transport, control and application layers also enables different operators compete with each other in different layers. As these layers are open, competition could be very aggressive, giving immense benefits to the consumers while providing new opportunities to innovative service providers. Such networks could also be advantageous for rural areas where there is huge demand for information, telecom, and video services and if these services could be delivered at affordable prices, the market could be very large.** Additionally, it is estimated that 70% mobile calls are originated/terminated within the buildings. If NGN is implemented in end-to-end network i.e. in Access as well as Core, then these in-building mobile calls could be completed on fixed network. This will result in substantial saving of scarce resources like spectrum and network costs resulting into optimum utilization of resources. Also, India is the only country where cable TV connections are more than fixed line telephones and such networks could also be leveraged for delivering of multiple advance services to end users, through NGN platform.

1.3   NGNs are still in early stages of design and development world over and are still evolving and therefore present a lot of regulatory challenges. These are pertaining to promotion of competition while maintaining level playing field, addressing new interconnection issues especially those pertaining to IP-PSTN interconnect and handling consumer protection & security concerns. It is also acknowledged that the investment in NGN is risky and clear regulatory policies offer one way to help operators reduce this perceived risk. Regulators around the world are deliberating upon how to formulate enabling regulation in the NGN domain and create attractive business opportunities to promote infrastructure investment in an open environment of the NGNs.

1.4   In India the present licensing regime, which is service-specific does not allow an operator to take full advantage of the technology in an unrestricted manner. While there has been some migration to NGN technologies in the core network by incumbents, the access network is particularly poor and narrowband and could take many years to be fully transitioned to NGN. Many operators with end users connected to PSTN are migrating to IP-based transport, leaving the access part unchanged. The transition to NGN access will be critically dependent on a number of developments including success of alternate access technologies (Cable TV and WiMax being the most important), Unbundling of Local Loop (LLU) and market success of triple play services (video, IP voice and data). Further, the awareness about NGN and innovative services it can provide is not yet wide spread nor are the access networks suitable to support these services.

1.5   As per TRAI Act, TRAI can make recommendations, either suo moto or on a request from the licensor, on

- need and timing for introduction of new service provider;

- measures to facilitate competition and promote efficiency in the operation of telecommunication services so as to facilitate growth in such services.

- technological improvements in the services provided by the service providers.

- type of equipment to be used by the service providers after inspection of equipment used in the network.

- measures for the development of telecommunication technology and any other matter relatable to telecommunication industry in general.

In addition, TRAI has to lay down the standards of quality to be provided by the service providers and ensure the quality of service to be provided by service providers so as to protect the interests of consumers of telecommunication services.

1.6 In view of the above and with an objective of initiating awareness building and thought process among various stakeholders, TRAI released a Study Paper on NGN in July 2005. A questionnaire was also sent to major operators to obtain their preliminary comments on broad high level issues related to NGN. As a next step, a consultation process was initiated to deliberate upon various issues pertaining to Next Generation Networks (NGN) through a consultation paper on "Issues pertaining to Next Generation Networks (NGN)" in January 2006. The open house discussions on this were held at Bangalore and New Delhi during end of February 2006. The comments of the stakeholders received have been analyzed in detail which alongwith the international best practices, form the basis of the conclusion drawn for the recommendations on the various issues pertaining to NGN.

1.7 The recommendations and decisions discussed in the subsequent chapters cover the following main issues: -
   (i)   Need for Awareness Building
   (ii)   Enabling Policy and Licensing Framework
   (iii)   Facilitating Regulatory Initiatives
   (iv)   Technical & Standardisation Issues
   (v)   Need for Cross-Industry & Regulator Collaboration

1.8 The summary of International practices pertaining to NGN from few of developed and developing countries is included as **Annex-I International Experience**.

2.   Need for Awareness Building

2.1 Introduction

2.1.1 NGN deployment in India is still at an early stage, though some telecom service providers including incumbent are in the process of finalizing their plans for deployment of NGN in their networks. This is likely to be implemented in a phased manner starting with core network and then for access network and finally service provision. The timing of migration to NGN could have varying impact on different service providers. This inter-alia would depend upon global developments in this area and also on the plans of various service providers in the country.

2.1.2 To start with there is always a need of awareness for NGN concept among various service providers and other stakeholders especially the consumers. Knowledge about international standardisation initiatives and deployment by major operators as well as the real capabilities of NGN is of paramount importance for success of NGN deployment in a country.

2.2   Summary of Stakeholders' Comments

2.2.1 Regarding relevance, most of the stakeholders opined that NGN has relevance for India covering almost all telecom service providers. It was mentioned by many that in a technology-neutral licensing environment, it would not be appropriate to mandate any particular technology like NGN and this should be left to the operators concerned. It was also mentioned that service providers will have to go for it themselves, as NGN will be the way for them to survive in the future competitive market.

2.2.2 On the other hand, one of the stakeholders stated that in India even 3G networks have not been widely deployed and the definition of NGN is yet to be established internationally. Hence NGN is not very relevant for India in the present scenario. In addition, some of the stakeholders stated that first priority should be to increase the teledensity in the country especially in the rural area and only then we can think of further investment in upgrading the existing networks to NGN.

2.2.3 Some of the stakeholders stated that there is a need to educate all the stakeholders rather than just the service providers. It was mentioned that there should be a task force/ steering committee created to look into the details and

understanding other issues at regulator level with participation from all stakeholders. It was also stated that a core committee involving representatives of TRAI, TEC and industry should closely interact and work with international bodies like ITU, ETSI, 3GPP2 etc. for getting enough knowledge about NGN and then they should educate the other stakeholders in the country and make them aware of latest trends in NGN.

2.2.4 In addition, some of the stakeholders stated that TRAI could organize indepth and continuous educational sessions to begin with. The end result could be the operators and the various entities deciding to form a consultative body or an industry association to continue the deliberations. It was also mentioned that since NGN issues take time to discuss and debate, it might become difficult for TRAI to continue to facilitate logistically and it may be better to facilitate the formation of a quasi government industry body for this task.

2.2.5 Some of the stakeholders mentioned that a few days back OFCOM, the UK regulator, issued advice for consumers on buying and using Voice over Internet Protocol (VoIP) services and it was mentioned that a similar step is required in India to educate consumers about what are the services available through NGN & VOIP.

2.2.6 On the other hand, some of the stakeholders stated that TRAI need not engage explicitly in educating the stakeholders. Such education is an on-going occurrence and all stakeholders should have their own means and methods to achieve the same.

2.2.7 Some stakeholders also mentioned that the migration to NGN should be planned in a phased manner within an agreed timeframe. However some of the stakeholders opined that there is no need to fix a timeframe, as there are many networks operated by many different companies and these will migrate to different technologies on the time and budget scale their owners prefer.

2.3   Analysis of Stakeholders' Comments

2.3.1 From the comments of the stakeholders in the written responses as well as during open house discussions, it is observed that there is a great lack of awareness about various issues pertaining to NGN among stakeholders. Most of the stakeholders appear to be not well versed about the benefits as well as risks involved in NGN migration. Many stakeholders expressed their desire to learn more about NGN before being able to contribute to the fruitful consultation process. Many of

them suggested, the Govt./ regulator should conduct various seminars/ training programmes dealing with various aspects of NGN to bring about the desired level of awareness about various aspects of NGN amongst the stakeholders.

2.3.2 Earlier, TRAI, as a special case conducted some interactive workshops involving various stakeholders and international experts on the emerging Broadband technologies and various regulatory issues related to Internet Telephony and VOIP. These workshops were found to be very useful and effective by the stakeholders. Similarly, from the stakeholders comments it can be observed that there is a need for conducting such training programmes on the various issues pertaining to NGN for educating the stakeholders. It may not be feasible to conduct such programmes by TRAI on a long-term and continued basis because of its pre-occupation in its main regulatory functions. Internationally, such programmes are conducted by ITU and APT and also through some industry bodies, sometime with Govt. support. In India, the technical wings of Govt. like TEC and C-DOT could be roped in for this task. The Advance Level Telecom Training Centre (ALTTC) of the incumbent operator owned by Govt., which is supposed to be well equipped with facilities and faculty to undertake such activity, can also be made use of for this purpose.

2.3.3 As seen from the international experience (Annex I), the Hong Kong regulator has released a paper on general overview of NGN to bring about the awareness. Similarly, OFCOM, the UK regulator, has already conducted many consultations with stakeholders to bring awareness and clarity about the issues involved. TRAI had issued a study paper in the middle of last year on the basic concept of NGN, which was followed by the consultation paper on some broad issues of NGN including the technical aspects. Nevertheless, to cover all the issues of NGN in detail for the purpose of educating the stakeholders much more efforts on continued basis are required by multiple agencies.

2.4   Recommendations

In view of the above, it is concluded that there is an urgent need for bringing more awareness regarding various issues pertaining to NGN among different stakeholders including the consumers. It is, therefore, recommended that the Govt. may consider arranging to organize some interactive workshops/seminars through its various agencies like

TEC, C-DOT, ALTTC etc. on various aspects of NGN to bring awareness among different stakeholders.

TRAI on its part could bring out more study papers to discuss various issues of NGN in detail and may also conduct some international seminars/ workshops on this.

3. Enabling Policy and Licensing Framework

3.1 Introduction

3.1.1 New Technological developments always raise challenging policy issues and situation is not different for Next Generation Networks also. In the transition phase toward NGNs the existing licensing policy and regulatory framework need to be evaluated with regard to evolving technology and market structure. The NGN concept of "one network - many services" underlines the necessity and explicitly forces a technology-neutral approach and service-agnostic licensing.

3.1.2 Regulators across the world are debating the need and timing for clear policy aimed at facilitating the migration to NGN. It is acknowledged that the transition to NGN is a paradigm shift and that it offers an opportunity to set in place enabling policies before the actual transition (as opposed to being ex-post as is the case for legacy networks). The licensing regime in NGN domain may be required to be expanded to also cover service-only (non-facility based) operators like resellers so that they are able to provide innovative value added services in competition with traditional network operators. There also appears to be a need to establish a unified/ converged licensing regime to enable the NGN based operators to provide all the telecom, Internet and broadband services through same infrastructure/ network.

3.2 Summary of Stakeholders' Comments

3.2.1 One of the associations of service providers stated that NGN is a technology and not a service and the existing Unified Access Service Provider (UASP) license permits operators to evolve their current networks to NGN. It was also mentioned that existing licensing regime is adequate to take care of new services and as such no change is required in licensing regime for the time being.

3.2.2 On the other hand, one of the stakeholders mentioned that migration of existing operators to NGN would require a substantial change in the existing licensing terms and conditions. Therefore, the regulator must help in clearly defining new licensing terms, which offer enough flexibility to

the operators to provide innovative services and maintaining the level playing field.

3.2.3 Some stakeholders as well as their associations emphasized need for creation of more infrastructure before discussing any service based (non-facility based) competition. It was also mentioned that India has as yet not created either enough infrastructure or enough capacity to consider service based competition, as only 35% population of country is covered by mobile telecom infrastructure. They mentioned that once enough infrastructure is in place, the service-based competition could be considered. In addition, one of the stakeholders stated that there is already sufficient competition in each circle since there are 4 to 7 access providers in each service area. It was also mentioned that access based service competition is already in vogue in mobile segment, unlike the PSTN based fixed/wire line field, wherein the end user based service competition and pace of migration/evolution to NGN had been rather slow. It was further mentioned that with the reduction of NLD and ILD entry fee and revenue share license fees by licensor, there will also be enough competition in NLD/ILD segments and hence presently there is no need to have service-based operators.

3.2.4 Some of the stakeholders also raised the issue of unbundling the local loop of incumbent so as to avoid duplication of access network. It was mentioned that this will also reduce the timeframe for rolling out new services with the deployment of NGN in access, especially in rural areas. It was also mentioned that with the reduced capital cost for the access in rural areas through unbundling, operators would find it much more economical to tap the rural market and hence increase the penetration of new services in rural areas, which in turn can lead to reduction in the digital-divide.

3.2.5 Some of the stakeholders mentioned that as per ITU guidelines on USO, Universal Service Fund should be allocated to a technology, which is cost effective. Since NGN is very cost effective, this only should be considered for USO benefits.

3.2.6 One of the stakeholders stated that there is a need for regulatory steps for allocation of 3G and WiMax spectrum required for Mobile TV services, which can be delivered through NGN. It was also stated that there is a great need for regulatory initiatives to reduce barriers to entry and capital investment and barriers for the use of new technologies.

3.2.7 It was mentioned with respect to provision of emergency services, NGN basically should not be presumed as a new service but should be considered only as a new network. Additionally, the terms and conditions of all respective licenses should be enforced even for NGN based operators.

3.2 Analysis of Stakeholders' Comments

3.3.1 The stakeholders, in general, were of the view that the existing licensing regime, which is technology-neutral, is adequate to take care of new technologies and no change is necessary in the licensing framework. It could be observed from the comments that the technology-neutral policy of Government could support any new innovations in the technologies for the present.

3.3.2 Many stakeholders expressed their viewpoint regarding need for expeditious allocation of frequency spectrum for various advance services in NGN access domain. The need for additional spectrum for WiMax, which can provide high-speed data access comparable to DSL on copper was also pointed out.

3.3.3 Also there is concern regarding inadequate infrastructure in the country to consider any service based competition. Hence, at this stage it is not considered advisable to introduce service based competition for basic telecom services. But to promote NGN migration in access layer, wherein Broadband connectivity is required to deliver NGN based services, need for unbundling of local loop of incumbent has been brought out. Here it is mentioned that seriously concerned with the slow uptake of Broadband in the country last year, TRAI has already reiterated its recommendations on the unbundling of local loop for the re-consideration of the licensor. In addition, TRAI has already recommended to Govt. to introduce 'resale' in IPLC segment of ILD sector w.e.f. February 2007.

3.3.4 It is mentioned that in the Broadband Policy, 2004, there is a provision for review of the performance of various operators regarding the Broadband services. As increase in Broadband penetration is a must for wider deployment of NGN services and since the policy targets for Broadband have not been met, it is the time to undertake the review of various recommendations on Broadband access related issues. It is reiterated that unless various operators are able to deploy NGN in access to provide multiple services its full benefits cannot be made available to customers. In view of emerging NGN scenario and shortfall in reaching broadband policy targets this becomes more imminent and hence an urgent review and follow-up of Broadband policy provisions like unbundling of local loop, delicensing of spectrum in 5.1 – 5.3 GHz band for outdoor usage and identification of some additional spectrum for Broadband access, is needed.

3.3.5 It is also seen that TRAI vide its recommendations on unified licensing regime dated 13th January 2005, already recommended for provision of a single license for all type of telecom, data, video and broadband services. Also there is a

recommendation pertaining to niche operators in the form of 'rural service providers' to provide all the services in rural area with easy entry conditions. In the meantime, the Govt. has also permitted the Unified Access Service Providers (UASP) to provide Internet and Broadband and Internet Telephony services including triple play (voice, data and video together) recently. But this amendment in unified access providers license does not enable them to provide national long distance, international long distance and broadcast services, which can be provided through NGN based infrastructure. Also, license conditions do not explicitly stipulate that the UASP can provide all the innovative services for example Push-to-Talk (PTT) on wireless network, without any restriction. It is possible to enable all these new services through acceptance of TRAI's recommendation on unified licensing by Govt. Any delay in consideration of various steps required to facilitate NGN in the country may lead to lagging behind some of the other developing countries as happened in case of mobile telephony.

3.3.6 Regarding mandating the utilization of USO fund only for NGN based systems, it is mentioned that USO for the present is being disbursed through an open competition process among various service providers to arrive at the minimum cost of providing the access. Therefore, it may not be prudent to mandate any specific technology for such grant, as the operators competing to get the USO support will anyway have to use the least cost solution themselves.

3.3.7 As per the international experiences annexed at Annex I, many developed countries like UK, Netherlands, Hong Kong, Singapore, Japan have already migrated to a single license regime for all the services and migrating towards NGN.

3.4 Recommendations:

In view of the above, it is concluded that there is no immediate need for any new policy initiatives to permit the deployment of NGN by existing licensed telecom operators, except for a single unified license for all the services (data, voice, broadcast) to facilitate and promote its faster deployment. Therefore, following is recommended:

(i) TRAI's recommendations for unified licensing regime dated 13th January 2005 (as modified in recommendations on Issues relating to convergence & competition in Broadcasting & Telecommunications dated 20.3.06) should be considered expeditiously taking into account the revised entry fee and annual license fee for different services, so that various

operators can make best use of NGN platform to provide all types of telecom, data, video and broadcast services through a single license.

(ii) In addition, the niche operators for rural areas, which could be permitted through lower entry barriers as per the above recommendations should also be created at the earliest so that benefits of NGN based services are also passed on to rural masses to improve the rural tele-density and to reduce the digital divide in rural areas.

(iii) Also, for facilitating the NGN migration in access network various provisions of broadband policy 2004 need to be followed up and reviewed expeditiously especially those pertaining to following:

a. Unbundling of local loop (item 3.1(b) of Broadband Policy 2004)

b. Delicensing of 5.1-5.3 GHz band for outdoor usage for Broadband access (item 3.1(e) of Broadband Policy 2004)

c. Identification of additional spectrum bands, which are not in high usage, for deployment of Broadband services in access (item 3.1(e) of Broadband Policy 2004)

4. Facilitating Regulatory Initiatives

4.1 Introduction

4.1.1 NGN deployment presents a range of challenges for regulators due to implications of technical differences between circuit switched (CS) and Packet Switched (PS) transmission. As already mentioned, the first and obvious challenge arises from new ever-evolving technology of IP (Internet Protocol), which is based on packet switching. On the other hand, the current regulatory principles & practices are closely related to circuit switched (CS) environment. Some of the traditional regulatory requirements could become less relevant in NGN domain and a few others may remain but change their character. Fresh analysis and assessment is required to be done to a large extent to evaluate the suitability of existing interconnection and other regulations in the NGN domain and enabling modifications may be required to be considered.

4.1.2 Another challenge comes from the fact that NGN is more than a new technology applied to existing legacy networks. It represents a paradigm shift where the communication services market becomes heavily integrated with information society services. As a consequence, the regulatory concerns shift upwards to the higher layers of the network hierarchy.

4.1.3 The NGN vision reflects a unified core network, which can encompass all PSTN, Mobile, Internet and Cable TV type of traffic. In a long transition period legacy networks will continue to exist, but over time these are expected to be transformed and upgraded to enable additional types of services. Some 'new' interconnection products will be needed in the all-IP NGN environment for core network interconnection for example those based on capacity, quality, fixed bit rate, variable bit rate etc. and type of service (voice, video, data etc.). Thus while evaluating any regulation that should apply to a given interconnection product, it is necessary to consider the type/category/ quality of service to be interconnected.

4.1.4 Moreover, specific requirements of QoS for various services and regulatory requirements like location information in case of emergency services & lawful interception and monitoring in an IP environment could lead to additional costs which are difficult to evaluate at this stage, but could be significant while implementing NGN in future. Therefore need for an investment friendly and risk-averting regulation while maintaining level

playing field and protecting consumer interests is of paramount importance for facilitating NGN deployment.

4.2 Summary of Stakeholders' Comments

4.2.1 Some stakeholders opined that with migration to NGNs by the service providers, the level playing field among them is likely to be disturbed, which should be the main regulatory concern. It was also mentioned that NGN is only a technology that is used to deliver the end product or service, and thus there is no requirement to have separate and specific regulatory approaches or measures for NGN. It was also stated that the regulator should ensure level playing field amongst existing market players and a light touch approach to regulation would be appropriate. It was further stated that convergence issues should be handled first and NGN will happen automatically after that.

4.2.2 In addition, some other stakeholders proposed that regulator must adopt a policy of Light-touch regulation for NGNs as any tight regulation may stifle the growth of new innovative services and there may not be enough competition. Some other stakeholders opined that there is a great need for regulatory facilitations to reduce barriers to the use of new technologies and to start with regulatory initiative should be there only to bring together the entire stakeholders in the discussion group through a joint consultative committee. It was also stated that in the initial years there should not be any regulation so that NGN can grow in a free environment like cable industry and Internet and only when industry achieves a reasonable growth, appropriate regulatory measures can be introduced.

4.2.3 Some stakeholders stated that at present ITU is also examining various regulatory and other related issues pertaining to migration to NGN environment, and regulator should wait for some time for ITU policies to be firmed up on this important technological evolution. It was also opined that any regulation at this stage might hamper the natural evolution of NGN.

4.2.4 On the other hand, some stakeholders stated that regulatory initiatives are necessary in the NGN context for addressing key issues like Interconnection, Numbering plans, QoS, Security and Legal Interception and Monitoring etc. It was also opined by one of the stakeholders that as an extension of consultation paper on Interconnect Exchange, there is a need to have a separate detailed consultation on the various interconnection

issues in NGN context. It was also suggested that detailed regulations on Interconnection, QoS and IUC (Interconnect Usage Charges) for NGN should be specified as soon as possible.

4.2.5 It was also mentioned that issues like Numbering plans, Standardization, Interconnections & interoperability, QoS in NGN environment, Security aspects / legal interception & monitoring etc. need to be sorted out well in advance to avoid any delay in deploying NGN. It was further mentioned that now is the right time for formulating regulatory approaches, as we should be prepared for NGN migration, which has already been delayed. Few stakeholders also mentioned that interconnection and interoperability are very important issues, which must be addressed before hand and timely so as to minimize disputes among stakeholders later on.

4.2.6 Regarding QOS regulation, it was opined that ITU through NGN-GSI has done significant work on QoS standards and TRAI should interact with ITU to study these. It was also mentioned that NGN is not a new service, rather it's a new technology, therefore, the existing QoS regulations/guidelines of the regulator should be applicable to the services being delivered by a service provider, licensed to operate such services irrespective of the underlying technology.

4.2.7 On the other hand, one of the stakeholders mentioned that regulator must provide QoS regulation for NGN as it is different than the legacy network and in addition there is also a need to have a QoS regulation for infrastructure such as leased lines taken by service based operators from facility based operators. In addition, some other stakeholders mentioned that there should be separate QoS parameters for Core network and for NGN services as both can go independently. It was also mentioned that QoS Standards are necessary, but for their implementation adequate spectrum availability and fair play in interconnection is required to be ensured.

4.3   Analysis of Stakeholders' Comments

4.3.1 Stakeholders in general were of the opinion that there must be some regulation in place before deploying NGNs, to address the issues pertaining to level playing field. As a variety of service offerings are expected over NGN this could complicate the matter for defining a set of regulatory principles. Almost all the stakeholders were of opinion that the regulator must accord top priority to the issue of addressing level playing field among various service providers i.e. the existing and new as well as facility based and non-facility based, in the NGN domain.

4.3.2 Many stakeholders strongly desired that there is need to bring out regulations in certain areas like interconnection, IUC etc., which will help in reducing the risk factor for operators deploying NGN. New regulatory initiatives are also necessary on various issues like Numbering plans, Standardization, Interconnections & interoperability, QoS in NGN environment, Security aspects / legal intercepts & service monitoring etc. to ensure fair play in market place in the competitive scenario.

4.3.3 There appears to be an urgent need for defining inter-connection rules so as to avoid unnecessary delays/litigation in deploying NGNs. Essentially, the network for distance and volume or time based PSTN services would have to interconnect with the network for flat rate or capacity/ bandwidth based Internet business model. If this approach is further extended, there could be significant transition problems where network operators that benefit from voice termination revenues may object to a requirement to terminate IP voice packets under a single flat rate arrangement. On the other hand, a general volume based IP termination solution could jeopardise the market for value added services based on Internet.

4.3.4 One option, which emerges from above is that one should not rush through any regulation on NGN and we should watch international scenario and developments at ITU in this regard. In the meantime, a detailed consultation process on various interconnection issues could be initiated with close interaction with industry.

4.3.5 Regarding best international practices as seen from Annex I, many prominent regulators of the developed countries like OFCOm (UK), IDA (Singapore) and OFTA (Hong Kong) have initiated consultation process with the stakeholders for arriving at the requisite regulation for the NGN domain.

4.4 Decision of Authority

In view of above, it is concluded that a comprehensive regulation pertaining to interconnection and QOS is required in the long term for the motivation of operators to invest in NGN and also to avoid any situation of disputes later on. For this purpose, there is a need to have a detailed consultation with stakeholders on the issues pertaining to interconnection entities, products, types and charging methodology for IUC in addition to specific requirements for QOS pertaining to NGN based networks.

For this, TRAI will bring out a separate consultation paper in a short time frame to include the latest international

practices and developments on these issues through broad association with industry.

5. Technical & Standardisation Issues

5.1 Introduction

5.1.1 Unlike traditional telecommunication networks, which have been developed with globally agreed technical standards, the IP based NGN will be a collection of heterogeneous subsystems connected to each other through a variety of configurations. To ensure ubiquity, interoperability and a competitive marketplace, NGN services and applications need to be based on accepted open and consensus-based international standards. Therefore, there appears to be an urgent need to deliberate upon the importance and trends of technical development and standardisation in order to facilitate conducive environment for NGN evolution in the country.

5.1.2 In addition, policies even though broadly technology-neutral are required to be based on the technical feasibility of the services and underlying networks that can be established economically. For this reason, generally, the policy makers and regulators need to set up technology experts groups actively involved in the study of development of NGN systems. The international standardisation efforts have to be analyzed for their suitability and customization for the national requirements.

5.2 Summary of Stakeholders' Comments

5.2.1 Some of the stakeholders stated that there is a need to establish a joint technical group, which has the support and mandate of whole industry. It was mentioned that TEC is the appropriate organization for this assignment as they are already doing it for other technologies. It was also suggested that an enhancement of TEC/ C-DOT or a new dedicated working group of industry with support from TEC/ C-DOT can be considered for this task.

5.2.2 Some stakeholders also emphasized the need for adaptation of international standards for NGNs so as to facilitate global interoperability. It was also stated that at first standards for NGN should be analyzed and agreed upon for the country and then issues related to interconnection should be addressed, to avoid any investments made by operators in non-standard technology.

5.2.3 One of the stakeholders emphasized that standardisation seems necessary in this respect, especially with regard to protocols in a multi-technology and multi-operator environment. It was also

stated that 3GPP, IETF & ITU are actively engaged in the standardization activities, whose recommendations/guidelines should be made use of.

5.2.4 Some stakeholders stated that it would be better to form a joint committee to examine all the technical issues regarding NGN specifications, QOS and security matters. It was suggested that this committee could be formed by taking representatives from DOT, TEC, TRAI, Service providers, NASSCOM and technical institutions like IITs etc. It was also stated that associations of service providers should also be co-opted in this committee. Some other mentioned that only TEC should be entrusted the job of finalising the specifications for NGN after consulting various manufacturers, service providers, technical institutions, Nasscom etc.

5.2.5 It was also mentioned there are presently no standard requirements by TEC for NGN interconnect, but there are interface requirements, which are specified for media gateways as an interface between IP-based networks and PSTN. Some stakeholders opined that TEC should start preparing the interface requirements for NGN. It was also mentioned that interface approval is not only required for NGN to NGN but is also required for NGN to interface with legacy networks (PSTN). It was further suggested that TEC or a group consisting of TEC's and industry's representatives could be asked to formulae interface specifications to ensure inter-operability between existing networks and NGNs.

5.2.6 Some of the stakeholders also opined that in the prevailing concept of NGN, it is likely to be limited to urban areas only and may create more imbalances in urban-rural divide. It was stated that there may be need for finding more cost effective and innovative technological solutions for facilitating NGN migration in the rural environment.

5.2.7 Regarding IPv6, some of the stakeholders stated that it is a must for NGN. Some stakeholders also mentioned that IPv6 features should be incorporated right at the beginning while finalising the technical details for NGN. It was further suggested that the deployment and standardisation work for NGN and IPv6 should be taken up together as in case IPv6 implementation is delayed the cost implications could be high.

5.2.8 On the other hand, some stakeholders opined that IPv6 is not a feature of NGN but it gives additional address space so the IPv6 should automatically be incorporated in finalising the specifications/ standards for NGN. In addition, Asia Pacific Network Information Centre (APNIC) suggested that the deployment of IPv6 will be required in future, and that discussion of NGNs should assume that IPv6 would be used.

They also mentioned that any cost analysis for a transition of existing services to NGNs must assume that an IPv6 network is in place, or include the cost of transition to IPv6 from existing IPv4 infrastructure.

5.2.9 Some of the stakeholders stated that IPv6 should not be mandated for NGN, but it might be desirable to have it. At the very least, a mixed IPv4/v6 network with a planned migration into IPv6 needs to be considered where the NGN is likely to be built over existing operators infrastructure.

5.2.10 As regards security related issues for NGNs are concerned, it was mentioned that as per the terms and conditions of licenses issued by the licensor legal interceptions are always being done for the legacy networks. Some of the stakeholders stated that there is a need to address the security related issues in NGN context and technical specifications on security related issues should be finalized before finalization of technical standards. It was also mentioned that otherwise the technical standards, if not in conformity with security specifications, would be required to be amended, which may result in delay and higher costs later on.

5.2.11 In addition, one of the stakeholders emphasized the need for a detailed analysis of Security related issues and formation of a special consultative committee involving security agencies, industry experts, TEC and regulator to go into it.

5.3 Analysis of Stakeholders' Comments

5.3.1 Stakeholders emphasized the need for a common joint agency, which could monitor technical development for NGN at various international fora like ITU, EU, IETF etc. It was also suggested by stakeholders that TEC is the most appropriate agency for this work, in association with industry.

5.3.2 As per the international experiences it is seen in many developing countries, such joint bodies have been formed. For example in UK, an industry body called NICC (Networks Interoperability Consultative Committee) looks into the various aspects of technical standards and their customization for the national needs. Similarly, in Singapore, the regulator IDA is playing an active role in promoting formation of an industry led alliance to collaborate in the areas of inter-operability and inter-working in a multi-operator, multi-platform environment.

5.3.3 For induction of any new technology, the interoperability aspects are required to be studied in detail by some expert group and interface requirements need to be specified. In addition, technical analysis is required for suitability of

technology for the security oriented legal monitoring and access to emergency services. Therefore, these appears to be need for formation of a cross industry body for planning, analyzing and customization of standards pertaining to NGN.

5.4 Recommendations

In view of the above, it is concluded that there is an urgent need for setting up of a joint consultative group to study and analyse various international standards for NGN for their applicability and customization for the country. For this purpose, it is recommended that

(i) **TEC to be called upon to study and analyze various international developments pertaining to NGN so as to incorporate the same in Indian context and develop interface requirements for the same in a time bound manner.**

(ii) **In addition, a cross industry joint consultative group consisting of TEC, Service providers, technical institutions, vendors etc. to be set up for analyzing NGN standards & their customization for national requirement.**

(iii) **Various issues related with legal interception and security monitoring as well as access to emergency services in NGN domain need to be studied in detail by associating the relevant agencies in coordination with security agencies.**

(iv) **The relevance of IPv6 for NGN networks and the related cost implications for the operators also needs to be analyzed in detail.**

6. Need for Cross-Industry & Regulator Collaboration

6.1 Introduction

6.1.1 Migration to NGN can be a cause of major concern for service providers in terms of their operations and business models. The facilitating regulation needs to ensure that any such transition is as smooth as possible with clear forward-looking interconnection regime and adequate industry involvement. Regulators generally involve the industry to evolve a universally acceptable timetable for NGN migration.

6.1.2 Industry and other stakeholders' interaction are essential for evolving regulation that benefits the operators, consumers and the society as a whole. Most of the developed countries, which are in advance stages of NGN migration have considered setting up of a cross industry body comprising of all the major players to manage the transition and deliberate upon the issues pertaining to standards, interconnection timeframe etc. in addition to organizing awareness and educational programmes for stakeholders.

6.1.3 In UK, Ofcom has created an independent industry body called "NGN Co" to manage key aspects of transition to NGN. The responsibility of this body include producing a reference interconnect architecture for NGN, setting out detailed transition plan and also a plan for communication to consumers, in addition to overseeing the transition.

6.2 Summary of Stakeholders' Comments

6.2.1 Stakeholders during open house sessions as well as in written responses mentioned that since NGN is a new emerging technology, which is ever evolving, it would be appropriate to set up an inter-industry group/committee for in-depth study of all related issues for any further decisions.

6.2.2 Some of the stakeholders proposed a committee consisting representatives from C-DOT, TEC, Licensor, Regulator & service providers to examine all the issues so that transition/migration from TDM networks to NGNs is very smooth and systematic. Some other are of the view that regulator should encourage setting up of a cross-industry body comprising of all the major players to manage the transition and the purview of such body should cover technology, interconnection, timeframe etc.

6.2.3 Some of the stakeholders mentioned that it will be better to select the best and practicable aspects of the OFCOM and IDA

and move forward with the full backing of Industry, Government and academic Institutions.

6.2.4 In addition, some of the stakeholders mentioned that though timetable for transition to NGN should be left to the market forces but industry and regulator should form a joint consultative body to plan and monitor this.

6.3 Analysis of Stakeholders' Comments

6.3.1 Stakeholders in general are of the opinion that there is an urgent need for the creation of a high-level coordination committee for NGN having a fair representation of all industry players and regulators. Such committee through mutual interactions and agreements could chalk out the NGN implementation strategy for the country. It could consist of representatives from Licensor, Regulator, DOT, TEC & service providers, vendors, academicia and examine all the relevant issues so that transition/migration from TDM networks to NGNs is very smooth and systematic.

6.3.2 In past also, in case of some of the complex technical issues, TRAI has involved the industry closely to arrive at the optimum regulatory solution taking into consideration the views of all the parties concerned through common interactive discussion forums. Some of the examples of such joint committees are Task Force for growth of Internet & Broadband in the country, High-level technical committee for interconnection issues, Expert technical committee on Interconnect Exchange, technical committee on issues related with IN committee on Broadband and telephony over Cable TV networks.

6.3.3 As seen from the international practices, the example of UK regulator OFCOM, to develop an effective industry led process to ensure smooth transition to NGN appears to be most suitable. In UK, NGN industry coordination committee (NGN Co.) has been formed as a regulator's initiative to manage the NGN transition in all respects.

6.4 Decision of Authority

In view of the above, it is concluded that there is a need for setting up of a joint consultative committee under the aegis of regulator involving industry to deliberate upon the various issues related to interconnection, QOS, awareness building and migration timetable for NGN. For this purpose, it is decided that

(i)   An expert committee named 'NGN eCO' i.e. 'NGN expert Committee' will be constituted by TRAI co-opting experts from DOT, TEC, C-DOT, service providers, vendors and academicia.

(ii)   This committee will handle at least the following issues:

    a. NGN awareness building programme.

    b. Timetable for NGN migration in the country.

    c. Background paper to be used for consultation on Interconnection and QOS issues by TRAI.

7.   Summary of Recommendations

The gist of various recommendations is reproduced below:

7.1   The Govt. may consider arranging to organize some interactive workshops/seminars through its various agencies like TEC, C-DOT, ALTTC etc. on various aspects of NGN to bring awareness among different stakeholders.

7.2

(i)   TRAI's recommendations for unified licensing regime dated 13th January 2005 (as modified in recommendations on Issues relating to convergence & competition in Broadcasting & Telecommunications dated 20.3.06) should be considered expeditiously taking into account the revised entry fee and annual license fee for different services, so that various operators can make best use of NGN platform to provide all types of telecom, data, video and broadcast services through a single license.

(ii)   In addition, the niche operators for rural areas, which could be permitted through lower entry barriers as per the above recommendations should also be created at the earliest so that benefits of NGN based services are also passed on to rural masses to improve the rural tele-density and to reduce the digital divide in rural areas.

(iii)   Also, for facilitating the NGN migration in access network various provisions of broadband policy 2004 need to be followed up and reviewed expeditiously especially those pertaining to following:
   a. Unbundling of local loop (item 3.1(b) of Broadband Policy 2004)
   b. Delicensing of 5.1-5.3 GHz band for outdoor usage for Broadband access (item 3.1(e) of Broadband Policy 2004)
   c. Identification of additional spectrum bands, which are not in high usage, for deployment of Broadband services in access (item 3.1(e) of Broadband Policy 2004)

7.3

(i)   TEC to be called upon to study and analyze various international developments pertaining to NGN so as to incorporate the same in Indian context and develop interface requirements for the same in a time bound manner.

(ii)   In addition, a cross industry joint consultative group consisting of TEC, Service providers, technical institutions, vendors to be set up etc. for analyzing NGN standards & their customization for national requirement.

(iii)   Various issues related with legal interception and security monitoring as well as access to emergency services in NGN domain need to be studied in detail by associating the relevant agencies in coordination with security agencies.

(iv)   The relevance of IPv6 for NGN networks and the related cost implications for the operators also needs to be analyzed in detail.

International Experience

A. International Experience

A number of other regulators, especially in Europe and the Far East, are evaluating the impact of NGN transition for their telecom sectors and for the wider economy. Of these, Ofcom (UK) is by far the most advanced in its thinking followed to some extent by the regulators in Singapore and Netherlands. The other regulators are in the process of concluding their consultations on the subject and are pushing industry led initiatives to regulate the transition to NGNs. Regulators seem to be similar in their thought process on regulating NGNs and on creating policies to aid its transition.

The prevailing situation in some of the developed countries is described in following sections:

A.1   UK

The UK is one of the most competitive Broadband markets in Europe. Incumbent BT faces tough competition from both cablecos and alternative ADSL ISPs. BT holds just 24% of the retail market; the two largest cablecos NTL and Telewest hold 22% and 12% of the market. At the moment, most alternative xDSL ISPs resell BT's wholesale product, which makes differentiation on price or speed difficult to achieve.

Prices have dropped over the past year, and consequently, Forrester expects residential broadband penetration to more than double from 2004 to 2010, eventually reaching 42% of all UK households.

It is likely that it will wait out the storm in anticipation of a favourable repositioning once 21CN is rolled out. It is plausible that BT could also use 21CN to disrupt, disadvantage or inconvenience its UK competitors. We do not expect this to happen to a significant degree, primarily because the regulator is devoting significant attention to 21CN and its impact on competitors. It is likely that BT will be forced to give access to 21CN in ways that actually improve the lives of its competitors.

A.1.1   Technology trends

BT has embarked on its 21CN project to replace all of its core networks, including the PSTN, with a unified NGN. The 21CN project aims to substantially replace all of BT's existing network platforms (PSTN, ISDN, IP, ATM, FR, SHDS etc.) with a single unified IP platform. The investment is concentrated in the period 2005 to 2008, and is estimated to be around £3 -£5 billion. After 2008 it will still take several more years to migrate a long tail of customers onto the new platform. The most rural areas of the UK will most likely not be upgraded as part of 21CN - solutions for these areas will probably be worked out at a later date.

The primary benefit of 21CN will be cost reduction. BT's fragmented network platform is particularly costly to run, but it also supports a hugely complex legacy product portfolio, with many bespoke products - some that only serve one major customer. The rationalisation of this product set should yield very significant cost savings and headcount reductions.

Fig 1:Current BT network
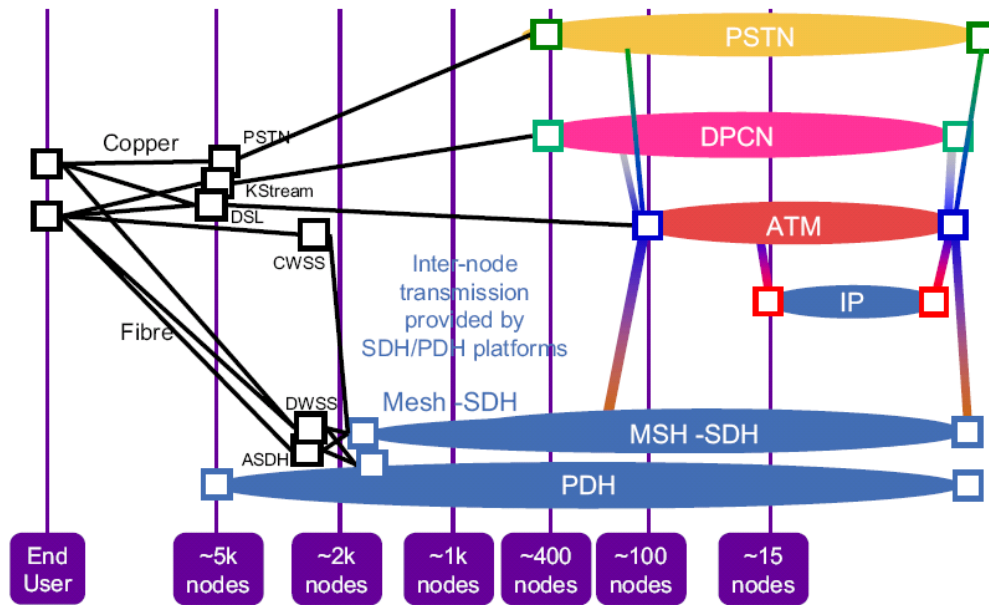
Source: Morgan Stanley

Fig 2:Single IP Architecture

Source: Morgan Stanley
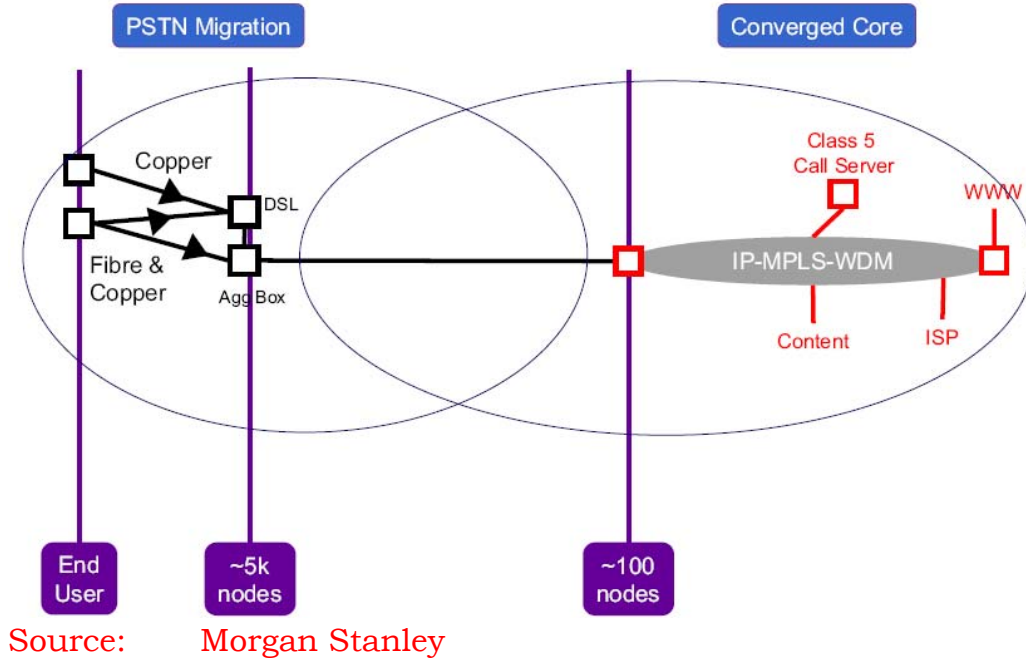
The BT case illustrates the independence of core network upgrade decisions from access network decisions. BT is at the leading edge of core network development, and at the trailing edge of access network upgrades (with significant resistance to even ADSL2 introduction). Conversely, operators such as Belgacom are at the leading edge of access network upgrades, but have no announced plans for retiring their PSTNs. In broad terms, all access network upgrades can be made to work with existing or new core networks situations, and all core network upgrades can be made to work with existing or new access networks.

British Telecom's (BT) has selected Huawei Technologies as one of next generation network (NGN) equipment suppliers. Once the contracts are finalized, Huawei will manufacture, supply and install multi-service network access (MSAN) components and transmission equipment. Huawei is the only Chinese firm among a total of eight companies that were selected to supply equipment out of more than 300 candidates after two years of discussions and negotiation. Other companies selected by BT include Fujitsu, Alcatel, Ericsson, Cisco, Lucent, Siemens, and Ciena.

A. 1.2 Regulatory trends

21CN represents the most significant change in BT's network. In this case it creates the first ever opportunity to ensure that the network of an incumbent operator accommodates competition from the outset.

Ofcom's role is to ensure that there is clarity as to the regulatory policy requirements necessary to support effective competition. Ofcom does not wish to become involved in the detailed design of BT's network. However Ofcom intends to ensure that BT is able to provide access to its network in a manner that supports the further development of competitive markets. By providing clarity as to those regulatory policies that flow from this access obligation, Ofcom wants to help BT and others be clear about the constraints within which they should design their networks.

Ofcom has proposed key regulatory principles in the Telecoms Review. They are that Ofcom should:

1. promote competition at the deepest levels of infrastructure where it will be effective and sustainable;
2. focus regulation to deliver equality of access beyond those levels;
3. as soon as competitive conditions allow, withdraw from regulation at other levels;
4. promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach;
5. accommodate varying regulatory solutions for different products and where appropriate, different geographies;
6. create scope for market entry that could, over time, remove economic bottlenecks; and
7. in the wider communications value chain, unless there are enduring bottlenecks, adopt light-touch economic regulation based on competition law and the promotion of interoperability.

Application of regulatory principles –

- **Principle 1: Competition at greatest depth.**

    – Geographic depth within the topology of 21CN, i.e. how close to the customer is access provided. There are three geographic levels within 21CN at which it might be possible to provide access: the local loop (MDF/MSAN sites), the metro node and the core node. It is likely that a combination of access remedies will be required, focusing on access at MDF/MSAN sites in those geographies where this is likely to result in

sustainable competition, and providing metro node access elsewhere.

– Service level depth. There is likely to be a choice between end-to-end services (e.g. wholesale calls), service-specific interconnection services (e.g. voice call origination), a generic interconnection service (e.g. bitstream interconnection) or physical unbundling (e.g. LLU). Consistent with its regulatory principles, Ofcom believes regulation should be focussed as deep in this service stack as possible, recognising that this might vary with different geographies. If, for example, some form of access is made available at the MSAN, then there would be a preference for this to be at the physical or bitstream level rather than service specific.

- **Principle 2: Equality of access**

  – The design of key regulated access and interconnection products must support equality of access. In particular, new regulated 21CN access and interconnect products will need to support 'equivalence of inputs', so that BT uses the same products, at the same price, managed using the same systems and processes as alternative providers.

  – Reduced time to market is expected to be one of the key benefits of 21CN, so an effective process for the introduction of new regulated products will also be important. Even where existing regulated products currently support equivalence of access, they may have to evolve in light of new capabilities introduced by 21CN. For example, the requirement to support equivalence of access to the local access network might require changes to the existing LLU service, and may require consideration of some form of bitstream access at the MSAN.

- **Principle 3: Regulatory withdrawal**

  21CN might allow for regulatory withdrawal because:

  – 21CN may be the vehicle for the delivery of improved equivalence in relation to BT's wholesale services. This should allow other providers to compete in downstream markets and create the conditions where BT's downstream services, particularly at the retail level, could be deregulated.

  – At the wholesale or network level a key theme of 21CN is convergence. If convergence is effective, this should allow a reduction in service specific wholesale regulation, and a greater focus on generic access and interconnection remedies (LLU, bitstream interconnection).

- **Principle 4: Favourable climate for investment**

  – An important general principle is that regulation of NGNs should not simply be seen as a 'zero-sum' game, where Ofcom's primary concern is to decide how the benefits of BTs investment in 21CN should be divided between BT and the rest of industry. Instead, the aim should be to promote a favourable investment climate for industry as a whole, in order to deliver the greatest possible benefit to consumers of an industry wide migration to NGN.

  – There are a number of ways in which Ofcom can influence the investment climate:

  1. Providing regulatory clarity and predictability

  2. Ensuring alternative providers have confidence in BT's regulated products

  3. Setting appropriate regulated returns for BT's regulated products, that take account of the commercial and technical risks associated with its investment in 21CN

  4. Ensuring the migration to 21CN minimises the impact on existing investments (and thereby also minimises the perceived risk associated with new investments) whilst enabling BT to close its existing networks as soon as reasonable

  Application of principles to key forms of access and interconnection –

  Ofcom is considering the application of these principles in four key areas:

  1. Access and interconnection at the level of the local access network (MDF sites / MSAN nodes)

  2. Access and interconnection at the level of the core network (Metro nodes)

  3. Access to the intelligence and applications layers of 21CN

  4. Systems and processes

  The focus at this stage is on generic access and interconnection remedies, such as physical unbundling and bit-stream interconnection, which can be used to deliver a broad range of downstream services.

  - Access at the local access network level (MDF/ MSAN site) – At the MDF/ MSAN site there are two main alternatives for the provision of access to the local access network, i.e. local loop unbundling (LLU), and some form of interconnection with

the MSAN. Applying the first regulatory principle, Ofcom favours the deeper option, i.e. LLU, where this can lead to effective and sustainable competition. However, two factors suggest that an alternative to LLU, i.e. some form of interconnect with the MSAN, should be considered, at least in some areas, as a more effective means of promoting competition at this level.

 – BT's deployment of 'broadband dial-tone' to its narrowband customers could create a major challenge for LLU-based operators. BT will be able to migrate customers to broadband almost immediately whilst the manual LLU process is likely to take several days at best.

 – LLU is unlikely to be viable in all geographies, particular in those areas (e.g. rural areas) where there is a lower number of households connected to each MDF site.

 • Access at the core network level (Metro node) – The current level of interconnection with BT's existing core network suggests that conveyance between metro nodes is potentially competitive. However, in moving to 21CN there may be differences in the location and topology of metro nodes compared to existing networks which might, albeit temporarily, lessen competition at this level.

 • Intelligence and application layers – Ofcom believe that it is possible that 21CN will create new access bottlenecks at the intelligence and application layers. For example, an alternative provider may be able to deliver a voice service based on the use of bitstream access at the MSAN, but they may need access to additional functionality at the application layer (e.g. customer location data, session control functionality) in order to be able to compete effectively. Some of these functions may be needed on a reciprocal basis, others may relate solely to BT, whilst others could be developed on a commercial basis.

 • Systems and processes – The operational processes and systems associated with key products must support equality of access, so that alternative providers are able to order and manage key products using the same processes and systems as BT's retail activities. A key enabler of this is likely to be BT's Next Generation OSS, a distributed OSS architecture based on off-the-shelf commercial systems linked by standard industry interfaces. This is expected to replace the vertically integrated OSS systems currently in use.

A.1.3 Effective Industry led process

Ofcom is trying to develop an effective industry led process to ensure that the transition to NGNs is successful. It has highlighted the following areas which require industry involvement –

- Development of the obligatory products to be offered on 21CN, both migrated existing products and new SMP access and interconnect products

- Development of the commercial terms for the migration and new SMP products

- Technical standardisation to support next generation access and interconnect products

- Planning and management of the migration to NGNs

- Addressing consumer protection issues

- Addressing other cross industry NGN issues

Fig 3: How Ofcom is involving the industry
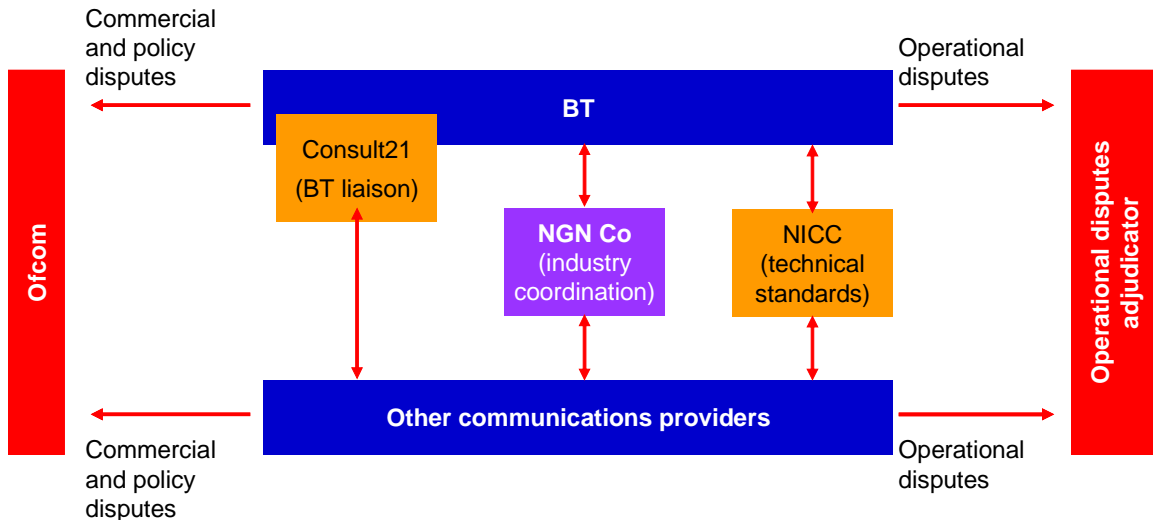
A. 2 China

A. 2.1 Technology trends

The China Netcom fixed telecom service provider has chosen Alcatel's Chinese unit Alcatel Shanghai Bell to implement a full-scale, nationwide network evolution to Next Generation Network (NGN). Under the agreement, Alcatel will deploy a nationwide

long-distance NGN trial network covering all 31 provinces of China, and also roll-out tandem and local NGN networks in two provinces.

Alcatel will provide its IP multimedia subsystem (IMS)-compliant NGN solution including Alcatel 5020 Soft switch, Alcatel 7500 family of media gateways and Alcatel multi-service access gateways linking voice and broadband. Upon completion of the deployment, China Netcom customers will be able to enjoy a host of next generation voice over IP and enhanced communication services.

As part of the deal, Alcatel will also support Chine Netcom in transforming its existing fixed network in Heilongjiang Province to intelligence network with NGN technology. The transformation will enable the operator to provide new fixed services with improved intelligence and enhanced mobility.

Alcatel will also deploy a new NGN network in Tianjin city for delivery of converged voice and broadband services.

A.3 Japan

Japan has a strong competitive Broadband market with a penetration of 16%. It leads technology deployment, in terms of NGN access network such as VDSL, VoIP, and Fibre to the Home (FTTH). FTTH is popular in Japan, with over a million homes currently connected and 80,000 to 90,000 more customers connected every month according to Japanese government data.

The incumbent telephone companies, NTT-East and NTT-West, are by far the dominant FTTH suppliers in Japan. There is more competition in the DSL market, where Yahoo! Broadband (Yahoo! BB) has gained significant market share and several smaller providers have made inroads. Yahoo! BB is unique in that it serves as an access provider, ISP, and content provider all in one place. Hence NTT is aggressively rolling out FTTH to compete with ADSL

The Japanese consumer has become accustomed to very high speed data services. DSL download rates of 40Mbps are common. FTTH services are offered at 100Mbps bidirectional as a way to distinguish them from the DSL offerings. Drivers for higher speeds include voice over IP (VoIP), peer-to-peer file transfer (P2P), Internet education and remote e-training, on-line gaming, large file emails (e.g. photographs), IP virtual private networks (IP VPNs) for teleworking, and streaming video over IP.

In Japan, FTTH is viewed primarily as a replacement for DSL high speed data – as opposed to the US where FTTH is viewed primarily as a vehicle for triple play (voice, video, and data)

service delivery. DSL is viewed by many in Japan as an "unfair" delivery technology since only those closest to the central office (CO) can achieve the highest speeds. As distances between CO and home increase, the available DSL bandwidth decreases. This is not the case with FTTH, which can offer 100Mbps speeds to all customers.

The business case of the incumbent FTTH provider in Japan is based on the concept that providing high speed data will create a market for services. Therefore, the network provider does not always have to be the service provider. The network provider bases its business model on selling bandwidth to the end customer as well as to the service providers. The Internet market in Japan can be segmented into access providers who supply the FTTH (and DSL) infrastructure, the Internet Service Providers (ISPs) who provide access to the Internet over that high speed data infrastructure, and the Content Providers who provide services on top of the data network.

Fig 4:Japans regional FTTH deployment
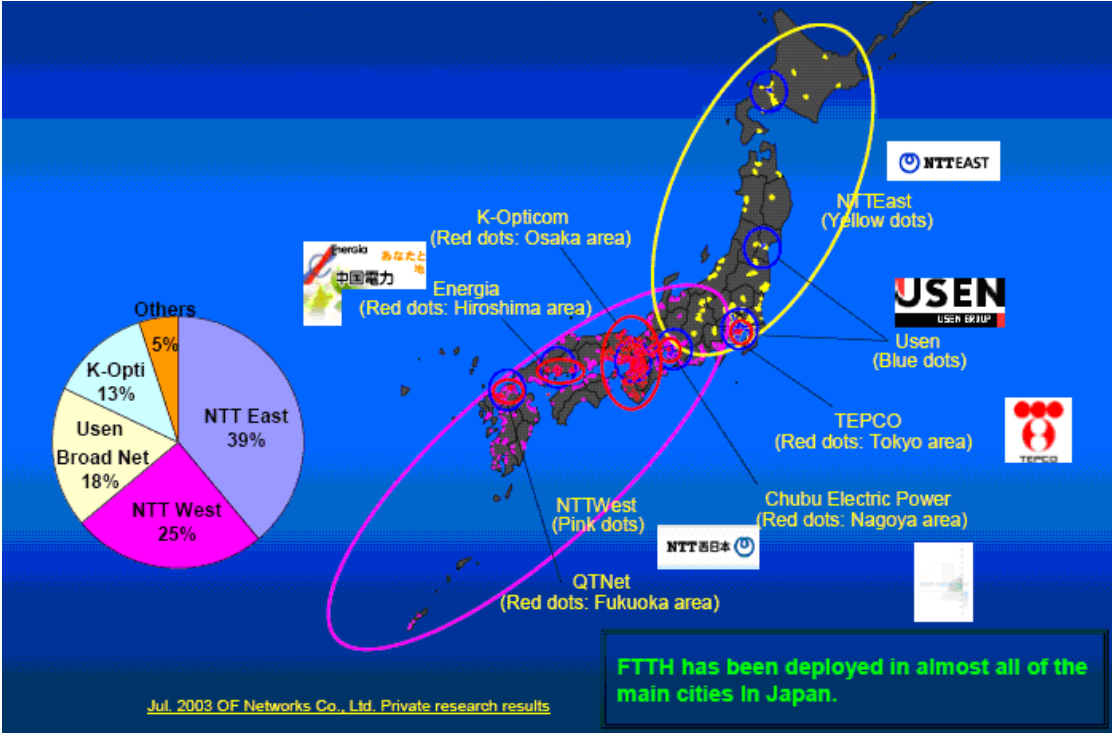
A. 3.1 Technology trends

The Japanese FTTH market is dominated by the incumbent telephone companies NTT-East and NTT-West. When NTT

decided upon the ITU-T G.983 B-PON standards as their technology of choice for FTTH deployment, they instructed a select set of equipment suppliers to build the equipment necessary to deploy that technology. B-PON OLTs and ONTs were contracted, as well as the surrounding support equipment (switches, routers, etc.).

Since NTT had significant experience in high speed data to the home from their DSL business, they recognized the value of an IP-based network beyond the OLT (for IP-based video and voice services, IP-based handoffs to ISPs, less expensive IP-based switches, etc.). Therefore, NTT is deploying a set of BPON standard equipment that looks like E-PON in that it has Ethernet1-based network interfaces. This interesting combination of standards (Ethernet and B-PON) has resulted in a very cost-effective and flexible network.

NTT has decided to place the ONT (home user device) inside the home. Some network operators in other countries typically require the ONTs to be outdoor mounted to avoid entering the end-users' homes. This adds cost to the ONT due to hardening and security requirements, but allows much simpler access for installation and maintenance. Outside mounting also allows the network operator to avoid running optical cable into the home, although this advantage is dubious, as power cables and data cables must usually be run into the home anyway.

The Japanese model for FTTH ONTs is more like a DSL model, where the end-user equipment is located inside the home or office. This significantly reduces the cost of the ONT since hardening and security measures are not required. An internal ONT does require that the installer enter the home.

NTT has selected EPON for their FTTH deployment. EPON provides variable length packets designed for data transmission. APON was initially set up for TDM voice and it sends voice and video data as separate packets which are not always efficiently filled.

With an EPON deployment NTT can't broadcast video but can provide VOD. But consumer demand is for data so EPON satisfies the requirements.

1Gbps4A single fibre is shared by multiple users for capital efficiency

- PON (Passive Optical Network) for Household customers (Fig 5) – A Passive Optical Network (PON) is a fibre to the premises configuration in which unpowered optical splitters are used to enable a single optical fibre to serve multiple premises, typically 32. A PON consists of an Optical Line Termination (OLT) at the communication company's office and a number of

Optical Network Units (ONUs) near end users. It is, in other words, a point-to-multipoint configuration, which reduces the amount of fibre required compared with point to point.

- FTTB (Building) with VDSL, LAN Switches for Apartment customers (Fig 6)

Fig 5:Several customers share a fibre with a fibre splitter installed outside the plant
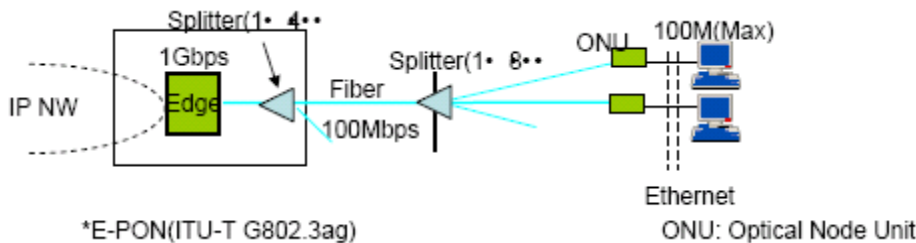
Fig 6:Sharing a fibre, with a LAN SW / VDSL installed in customers' premises
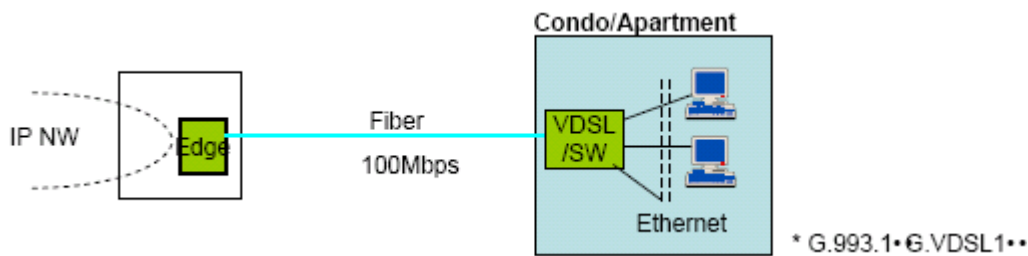
A. 4 Singapore

Singapore was the first country in the world to deploy ADSL commercially when SingTel launched its Magix service in November 1997. Presently, all its households have copper installed and by end-2005, the Government predicts broadband access will be pervasive across the country.

The Singaporean Government is committed to making Singapore one of the most connected cities in the world. Its Singapore ONE project is a broadband network launched in June 1998, using fibre backbones and a combination of fibre, DSL and cable for last mile access. Singapore has a high level of awareness of broadband technology and some surveys report that up to 99% of the population is covered by broadband networks.

7B. 5.1 Technology trends

SingTel has implemented a global IP network backbone using Juniper Networks routing platforms. SingTel's ConnectPlus IP backbone is comprised of an IP core and edge routing platforms offering advanced IP services including Secure Remote Access, Virtual Private Networks (VPNs), Voice over IP (VoIP), Multicast and the highest levels of Quality of Service (QoS).

SingTel believes that the market is ready for a next-generation global IP network that can meet the current and emerging business data communication needs. SingTel has chosen an infrastructure that is designed to provide the highest level of reliability and performance for our IP network and can support a full range of advanced IP services.

ConnectPlus was built with Juniper Networks T320, M20, and M10i platforms. These support the creation of Multiprotocol Label Switching (MPLS) networks and utilize the fault-tolerant, modular JUNOS operating system to provide a rich set of reliable network features. The Juniper Networks T320 is a 10 Gigabit-per-second core routing platform with scalability and extensive ultra-dense aggregation support including ATM, Frame Relay, SONET/SDH and Metro Ethernet. The Juniper Networks M20 and M10i edge routing platforms provide ASIC-based network routing.

A. 4.1 Regulatory trends

In February 2005, IDA unveiled its latest initiative called Next Generation I-Hub, a secured, high-speed and ubiquitous network to drive next generation connectivity. By leveraging on the country's strengths in terms of its pervasive communication infrastructure, pro-business policy environment and plentiful ICT skilled manpower, the SupraHub envisages the creation of an island wide ubiquitous network in the period running up to 2009.

IDA intends to support the provision of a multi-channel platform that achieves convergence between Wired & Wireless, Data & Voice and Broadcasting & Telecommunication services. It is considering plans that include developing a favourable IP licensing regime, encouraging IPv6 adoption and investing in fibre to the home (FTTH).

IDA will play an active role in promoting the formation of industry-led alliances, exchanges and marketplaces while collaborating with industry to deploy infrastructure for ubiquitous offerings. Potential industry alliances can be forged

in the areas of inter-roaming, interoperability and interworking in a multi-operator, multiplatform environment

In October 2005, the Infocomm Development Authority of Singapore (IDA) and Cisco Systems have signed an $18 million three-year Memorandum of Intent (MOI) to advance Internet Protocol (IP) networking in Singapore.

The investments will focus on three areas: the development of next-generation networking technologies; the development of skilled infocomm network professionals; and the establishment of a Singapore Solutions Centre in Singapore to help local enterprises bring their products and solutions to market.

One potential area in this collaboration is to study the feasibility of deploying next-generation integrated voice, video and data networks that will provide the country with seamless, ubiquitous wired and wireless connectivity.

The second focus area is to develop and upgrade the skills and competency level of network professionals and students in Singapore through training and certification, local and overseas industry attachments and scholarships, and enhancing the resources of the more than 20 educational institutions under the Cisco Networking Academy. The objective is to train more than 600 infocomm professionals and students over three years.

The third area covered by the agreement is the establishment of a Singapore Solutions Centre that will help Singapore-based enterprises to develop, test, showcase and market their products and solutions. The ultimate aim of the centre is to help turn Singapore into a key developer of advanced IP networking technologies.

A.5 Hong Kong

Although NGN has not yet come into play in Hong Kong in a widespread scale, some pre-NGN installation and IP-based services such as VoIP services, broadband Internet access, broadband pay-TV service and etc. are already available for the general public while Centrex IP and IP-VPN has become part of some private / corporate networks.

Some fixed telecoms network services (FTNS) operators have already launched some sort of NGN service to its corporate clients based on MPLS / IP technology while some others are planning their NGN programs and implementation schedules. It can be reasonably expected that NGN and the relevant services will become popular in the foreseeable future in Hong Kong. OFTA, the telecom regulator, believes the pace at which NGN is

evolved quite depends on the business initiative of the carriers and the demand of the market.

A.5.1   Technology trends

Hong Kong Broadband Network Limited (HKBN) is a wholly-owned subsidiary of City Telecom (H.K.) Limited and a Broadband telecommunication enterprise in Hong Kong. In June 2002, HKBN built the largest Metro Ethernet IP network in the world, covering 1.2 million homes. Earlier this year (2005), HKBN announced the official launch of its bb1000 service, a symmetric 1Gbps for the Residential market. HKBN believes that Hong Kong is the first market in the World whereby 1/3rd of the total households, approximately 800,000 households out of a total of 2.2 million households, can now enjoy World Leading FTTH (Fibre-to-the-Home) symmetric 1Gbps Internet access service.

bb1000 is the fastest Internet access service in Hong Kong, being up to 166x faster downstream and 1,950x faster upstream than the advertised bandwidth by the leading Asymmetric Digital Subscriber Line (ADSL) deployment in Hong Kong. bb1000 targets premium residential users, such as Home Office or Remote Office access applications.

HKBN is expanding its coverage and capacity with a Cisco IP Next Generation Network (IP NGN), using Cisco ROADM (Reconfigurable Optical Add/Drop Multiplexer) technology together with HKBN's existing ONS 15454 Multiservice Transport Platform (MSTP) optical core, providing total network capacity approaching 2 Terabits per second.

With an IP-centric network, HKBN aims to increase the scope of its service offerings and expand its network coverage to 80% of homes in Hong Kong. This will increase their ability to deliver innovative new services, improve their operational and capital expenditure efficiencies, and advance the network and service control that they and their customers need for long-term business success.

HKBN was seeking a flexible and highly scalable DWDM (Dense Wavelength Division Multiplexing) solution to help reduce maintenance and support costs. HKBN believes that a completely integrated optical network will deliver ongoing CapEx and OpEx savings. With the deployment of the Cisco solution, HKBN aims to achieve an 80% throughput for the 10 Mbps and 100 Mbps high-speed broadband service.

The implementation of the ROADM solution on HKBN's network infrastructure will start at the end of August and finish by early October. Upon completion, HKBN's optical core will consist of multiple rings spanning the territory of Hong Kong.

The new network capacity will be about 2 Terabits. This will allow faster and more flexible service deployment and maintain smooth operation as the number of customers increases.

A.5.2 Regulatory trends

OFTA recently released a paper on a general overview of Next Generation Networks (NGN). At present, OFTA has not prescribed any HKTA specifications for NGN as it believes that there are no internationally accepted standard on NGN yet. It plans to keep monitoring the standards development on NGN and its deployment and consult with the industry on how to adopt any specifications for NGN in the future.

OFTA has invited its members to offer supplementary information and comments on the paper about the standards development and deployment trend of NGN over the world. It has also asked the members to advise on the need and timing for the adoption of technical specifications for NGN in Hong Kong.