DETERMINATION OF INTERCONNECTION RATE

ISSUED BY

NIGERIAN COMMUNICATIONS COMMISSION

This 21st day of June, 2006

INTERCONNECTION RATE DETERMINATION BY THE NIGERIAN COMMUNICATIONS COMMISSION

INTRODUCTION

1. Interconnection is critical to the proper functioning of a competitive communications market. This is recognised in the Nigerian Communications Act 2003 (The Act), which requires network facilities providers and network service providers to provide to other licensees interconnection at any technically feasible location on request.

2. Where network or service providers are unable to agree on the terms and conditions for interconnection, the Commission is empowered to intervene in the public interest, whether or not requested to do so by either party to an interconnection agreement and if necessary, set rules binding on the parties concerning interconnection.

3. On 2 December 2003, the Commission published the Interconnection Rate Determination (the "2003 Determination"), which took effect from the 1 April, 2004. It was to remain valid and binding on licensed operators and the rates were to remain applicable for a minimum of eighteen (18) months.

4. The 2003 Determination stated that the Commission would commence the process of conducting another in-depth study of cost based interconnection rates to take effect on the expiry of the eighteen (18) month period. Given the complexities of commissioning and undertaking such a study and the need to consult affected parties, a study could not, in the opinion of the Commission be commissioned, concluded and consulted upon so that any determination of rates could take effect on the expiry of the eighteen month period. On that basis, the Commission consulted on the extension of and amendment to the 2003 Determination pending the completion of the in-depth study.

5. The Commission wrote to the operators on October 7, 2005 setting out a number of options, including that the network operators negotiate between themselves on agreeable rates, with the result of such negotiation to be communicated to the Commission within three (3) months. The majority of the operators chose this option but considered that the period of three months was too long.

6. The Commission was notified by the Association of Licensed Telecommunications Operators ("ALTON") in a letter dated 25, October 2005, that operators could not reach agreement. The Commission was also informed during the CEO Forum of the 2005 Telecom Summit held on 7 November 2005 that agreement was unlikely. On 16 November 2005, the Commission was informed in a letter from the GSM Consultative

Forum that the operators had not reached agreement. The Commission held a mediatory meeting on 8 December 2005 in order to assist the operators in their negotiations. During this meeting, a number of issues were raised, which are set out in the Consultation Paper. At the end of the meeting, the Commission again requested that the operators attempt to secure agreement.

7. On the basis of letters subsequently received by the Commission from ALTON and other operators, it was clear that the operators were unable to reach an agreement and that they were unlikely to do so in the near future. By this stage, the three (3) month period given to operators on 7 October 2005 had expired.

8. The Commission meanwhile had retained the firm of PricewaterhouseCoopers to undertake an in depth cost study of the interconnection rates.

LEGAL BASIS FOR THIS DETERMINATION

BACKGROUND

1. The Commission's functions and duties are set out in the Nigerian Communications Act 2003 (the "Act"). Section 4 of the Act lists the Commission's functions, which include the facilitation of investments in and entry into the Nigerian market for provision and supply of communications services, equipment and facilities (section 4(a)), the protection and promotion of the interests of consumers against unfair practices including but not limited to matters relating to tariffs and charges and the availability and quality of communications services, equipment and facilities (section 4(b)) and the promotion of fair competition in the communications industry and protection of communications services and facilities providers from the misuse of market power or anti-competitive and unfair practices by other service or facilities providers (section 4(d)).

2. The Commission also has the general responsibility for economic and technical regulation of the communications industry (section 4(w)).

3. Section 4(2) of the Act requires the Commission to carry out its functions, meet its duties and exercise its powers efficiently, effectively and in non-discriminatory and transparent manner and in a way that is best calculated to ensure that there are provided throughout Nigeria, subject to the regulatory controls set out in the Act, all forms of communications services, facilities and equipment on such terms and subject to such conditions as the Commission may from time to time specify.

4. Network services providers and network facilities providers are required by section 96 of the Act to provide to other licensed operators on request by such operators interconnection to their communications systems at any technically feasible locations. Agreements for interconnection must

according to section 97(1)(a) comply with the Act, the regulations and any guidelines published from time to time. Although the terms and conditions of interconnection agreements are to be primarily those agreed on by the parties, section 97(2) of the Act empowers the Commission on its own initiative or at the request of one or both negotiating parties to intervene where the Commission considers that an agreement or a provision of any agreement is inconsistent with the provisions of the Act or subsidiary legislation, where agreement cannot be reached or there is a delay in reaching agreement or if the Commission considers that it is in the public interest to do so.

5. Section 97(2) of the Act therefore provides wide discretion for the Commission to intervene in negotiations for interconnection and in concluded agreements. Further, section 98(3) of the Act provides that the Commission can, following a consideration of the terms and conditions and charges set out in an agreement require the parties to revise the agreement if it is inconsistent with the Act, the regulations or interconnection guidelines.

6. The National Telecommunications Policy also empowers the Commission to publish clear and appropriate studies and standards for any cost analysis required to support the development of equitable interconnection charges. Rate methodologies can also be included in any regulations made by the Commission under section 99 of the Act.

7. The 2003 Determination stated that the Commission would undertake an in-depth cost study of cost based interconnection rates, which would be employed to determine rates following the expiry of the minimum eighteen (18) month period during which the interconnection rates would be applied. An in-depth study of cost based interconnection has now been undertaken. In parallel with the progress of that study, the Commission afforded the operator community the opportunity to agree between themselves interconnection rates.

BASIS FOR SETTING BINDING RULES

8. As set out in the Introduction to this Determination, the Commission has been notified by operators' groups and individual operators that agreement on interconnection rates cannot be reached. The Commission has attempted to facilitate agreement but while the operator community has made every effort to do so, agreement has not proved to be achievable.

9. Interconnection underpins the provision to consumers of a wide range of services and is essential in order to ensure the development of "modern, universal, efficient, reliable, affordable and easily accessible communications services" in Nigeria. This is one of the objectives of the Act itself and is reflected in the Commission's functions, which are described in paragraph 2 of this Section of the Determination. The

Commission considers that this situation must be resolved in order to ensure that efficient and effective interconnection arrangements can be progressed.

10. As part of the parallel operator negotiation process commenced before the expiry of the minimum eighteen (18) month period set out in the 2003 Determination, agreement on interconnection rates has not occurred and does not appear to be reasonably foreseeable. The Commission therefore considers that it is necessary to intervene in negotiations for interconnection in order to determine interconnection rates for a further specified period.

11. For the reasons summarised above, the Commission considers that it is in the public interest to intervene at its own instance to determine interconnection rates to be applied by all fixed and mobile operators, both in concluded agreements and when negotiating interconnection.

In reliance on section 97(2)(c) of the Act, the Commission makes this Determination.

PROCESS ADOPTED

1. The 2003 Determination stated that the Commission would undertake another in-depth cost study in order to assist in the determination of any rates following the expiry of the minimum eighteen (18) month period for the rates adopted in the 2003 Determination. In August 2005, the Commission appointed a consultant, PricewaterhouseCoopers to undertake this study.

2. PricewaterhouseCoopers (www.pwc.com) provides industry-focused assurance, tax and advisory services for public and private clients. More than 120,000 people in 144 countries connect their thinking, experience and solutions to build public trust and enhance value for clients and their stakeholders.

3. PricewaterhouseCoopers offers a range of services designed to help governments, regulators and telcos develop and maintain a comprehensive regulatory strategy, including scenario planning, policy definition, strategic communications, and a well-organised regulatory function with the processes and procedures needed to achieve objectives.

4. Formed more than 15 years ago, a core team of 40 specialist telecoms consultants combine deep telecoms expertise with marketing, organisational, engineering, financial and economic skills.

5. In line with its commitment to a policy of openness, transparency, fairness, and participatory regulation, the Commission invited stakeholders for initial meetings with the consultant in attendance, to discuss matters related to

interconnection. These meetings took place between 05 December to 09 December 2005.

6. At the meetings with the operators the Commission explained the rationale for the appointment of PwC, the work that will be undertaken by PwC and the level of cooperation required from operators. During the course of these meetings, PwC met with some operators representing different license groups to explain the consultancy, discuss issues of interconnection and elicit required information and documentation. Attached as **Appendix A** are the questions and critical issues addressed during the meetings.

7. Following these meetings, PwC provided the Commission with recommendations in relation to the regulation of interconnection.

8. In relation to the level of cost based interconnection rates, there are mainly three methods that can be used to determine acceptable levels of interconnections rates:

- Top-down cost models
- Bottom-up cost models
- International benchmarks.

9. Top–down cost models are based on detailed historical accounting information of the operator(s) concerned. This information is then adjusted with a view to quantifying the long run incremental costs (LRIC) of interconnection services. The extensive historical accounting records that would be required for this method are not presently available at an appropriate level of detail for the operators concerned in Nigeria.

10. Bottom–up cost models essentially simulate a network operator's network in a computer programme quantifying the required type and amount of assets, such as cell sites, base stations, network links, etc. depending on demand levels. The model then applies prices as well as depreciation and cost of capital rules to the required network and non-network assets in order to produce annualised costs.

11. This approach has a number of advantages, including the following: data requirements are more limited than with top-down models, projected volumes and prices can be used instead of historical data to arrive at a better approximation of expected cost levels, and the model can be flexed relatively easily to quantify the unit costs for different operators' networks or for different scenarios (e.g. different levels of demand growth).

12. International benchmarks have often been used by regulators in the absence of reliable costing information. Due to differences between operating environments in different countries (e.g. geographical,

demographic, demand, labour costs), the task of adjusting international benchmark can be challenging.

13. In the light of the above an approach based on Bottom–Up costing models has been used to quantify the costs of interconnection services.

14. A number of recommendations were provided in relation to the approach that should be applied in carrying out the cost modelling.

15. The recommendations concerning interconnection, including the recommendation that each network operator should, for each numbering area for which it has been allocated numbers, designate a point of interconnection located in the geographic location of that number area. Network operators will be given a three (3) month period from the date of this Determination to designate relevant points of interconnection. Where a network operator cannot within the three (3) month period designate a point of interconnection in a number area for which it has been allocated numbers, the operator will be required to designate for a limited period of no more than three (3) months, an existing point of interconnection located as close as possible to that number area as the designated point of interconnection for that number area and other areas. Such interim designation to be made only with the prior approval of the Commission.

16. This obligation is intended to encourage network operators to rationalise their network investment and installation and to incentivise network roll-out. It is also intended to address an area of concern raised by network operators in the period leading up to this Determination that more specific interconnection rates were required, reflecting the services being provided and covering the costs incurred. Once implemented, this new approach will have the following effect. Calls to a number located in a region for which a point of interconnection has been designated using that point of interconnection shall be charged the interconnection rate determined for Far-end Handover. Calls to a number located in that region which do not use the point of interconnection designated for that numbering area shall be charged at the rate determined for Near-end Handover

17. Other recommendations are summarised in the following table:

ISSUE	**RECOMMENDATION**
Use Bottom-Up or Top-Down modelling approach?	Use a Bottom-Up costing approach
Networks to be modelled	Build two models, one for GSM and one for CDMA
Cost concept	Use of a LRIC plus mark-up approach

Historic versus forward-looking costs	Use forward-looking costs
Time Horizon	Calculate last financial year network costs based on past, current and future demand
Network Topology	Build a network based on scorched node approach
Capital Maintenance	Apply the Financial Capital Maintenance concept
Direct and indirect operating costs	Use mark-up to model OPEX
Annualisation options for Economic Depreciation	Use a tilted annuity and include the option to calculate simple annuity
Services modelled and retail costs	Model national onnet and offnet as well as international outgoing and international incoming call services, as well as the corresponding messaging services (SMS). Exclude retail costs from interconnection rates
Treatment of Common Costs	Use EPMU approach (Equi-proportionate mark-up)
Quality of Service	Model should be based on actual traffic profiles but on target QoS parameters
Cost of Capital	Use the WACC as analysed by PwC.
Other issues	Include Nigerian specific factors

18. As set out in the table above, PwC thereafter built a model for mobile networks and a model for fixed networks. The mobile network model is based on GSM technology and the fixed network model is based on CDMA technology in order to reflect the fact that, in Nigeria, CDMA has become the technology of choice for most operators holding a fixed licence.

19. Between the period of November to December 2005, data request were written and sent out to the following operators in order to populate the models:

- MTN Nigeria Communications limited (MTN)
- Vee Networks Limited (V- mobile)

- Glo Mobile Limited (Glo)
- Nigeria Mobile Telecommunications Limited (M-Tel)
- Nigerian Telecommunications Limited (Nitel)
- Multilinks Telecommunications Limited (Multilinks)
- Starcomms Nigeria limited (Starcomms)
- Intercellular Nigeria Limited (Intercellular)
- Independent Telephone Network Limited (ITN)

These requests were followed by telephone and email discussions to elaborate and explain the nature of the data.

20. Data was received from the following operators: MTN, V-Mobile, M-Tel, Nitel, Multilinks, Starcomms and Intercellular in response to the Commission's requests.

21. The Commission and its Consultants PwC met with these operators during the week starting 16th of January 2006 in order to discuss the data requirements and parameters used for the model. (See Appendix B for description of data requested)

22. Between February and April 2006, the consultants reviewed and analysed the data received from the operators. These reviews showed certain inconsistencies with international standards and incongruence of data between operators of similar category.

23. Based on the above the consultant visited these operators in April 2006 to reconcile these inconsistencies and acquire additional information.

24. Data required for the bottom-up model can be split into three different types:

    (a) Demand: Number of billed minutes, average call duration, call statistics

    (b) Network: Blocking probability, design capacity per network element type, sectorisation, use of spectrum

    (c) Financials: Unit costs per network element, opex, indirect capex, licence fees

25 It was very difficult to obtain financial data from some of these operators and we could not totally rely on what was available because we could not verify these figures. The lack of financial data and the questionable reliability of some of the financial information provided meant that PwC

had to express some judgment on how to interpret and adjust the financial input of the model.

26. All estimates used in the model have been discussed with the operators and were only replaced when actual and reliable data was provided by operators.

27. The methodology adopted was based on the dimensioning of network based on traffic demand as well as the calculation of the cost an efficient operator will incur on this basis. The Nigerian operating environment was also taken into account.

28. The model is constructed in such a way that running sensitivities on key parameters can easily be done by changing the values of key input parameters.

29. On May 3 2006, the Commission held a consultative meeting with operators and other stakeholders. The Consultant's recommendations were discussed and majority of the operators found these recommendations acceptable. Additionally operators were provided with the electronic version of the model for fixed and mobile services and their respective manuals. In this model version commercially sensitive information had been replaced with proxy data.

30. Operators were expected to study the model and provide comments to the Commission by 19 May 2006. This deadline was extended based on request from operators to 30 May, 2006. A number of submissions received after this deadline have also been taken into consideration in making this determination

CONSIDERATION OF SUBMISSIONS MADE BY OPERATORS

The purpose of this section is to provide an overview of the comments received as well as the responses of the Commission to these comments. Comments not directly relevant to interconnection, such as comments relating to retail tariff, price cap etc have not been included in this determination.

The comments received have been summarised and grouped by subject area. The names of the operators making the individual comments are not included.

1. Comments on the Regulation of Call Termination

1.1 Rationale for regulation of call termination

Comment: One operator expressed its explicit agreement with the rationale provided for the regulation of termination services.

1.2 Differential rates for fixed termination

Comment: The Commission had proposed to implement differential fixed termination rates depending on whether the call is delivered in the numbering area where it is terminated or elsewhere.

One operator pointed out that mobile operators have already built out much transit infrastructure and fixed operators have not. It was suggested that, on this basis, there was no need to discriminate between near end and far end hand-over.

Response: The Commission cannot follow this argument, because the Commission considers differential termination rates as a closer reflection of costs than averaged rates and hence give more efficient signals for investment.

Comment: Another operator suggested that differential termination rates would fail to encourage fixed operators to build out transmission infrastructure.

Response: It is the view of the Commission that the incentives to build infrastructure do not depend on whether the originating operator provides fixed or mobile services: each originating operator has three options in delivering calls to fixed operators: carry the call to the area code where it is terminated, hand it over to terminating operator elsewhere, or use (and pay) a transit operator. Each operator, whether fixed or mobile, can benefit from the lower (far end) fixed termination rates by delivering the call where it needs to be terminated.

Comment: The same operator also suggested that near end termination rates should be calculated on the basis of distance.

Response: The Commission believes that distance related termination charges would be significantly more complex to quantify and implement given current information availability and billing system capabilities.

Comment: It was claimed that the proposed regime would harm GSM operators by obliging them to carry the traffic to the far-end.

Response: The proposed regime does not oblige any operator to choose the far end hand-over option.

Comment: It was questioned whether a study had been conducted to analyse the cause of underinvestment in the transit network.

Response: The point of differential termination rates is to provide efficient incentives to all operators. Essentially, differential termination rates compensate originating operators if and when they carry the call close to its location of termination. The transit element of the charge is based on costs. The fact that this method results in efficient investment signals

(other operators will enter the transit segment if they can provide the service more efficiently) is known from basic economic theory and hence does not require a study.

Comment: It was also suggested that an adequate mark-up for externalities, service charge, and opportunity costs should be included in the transit element of the charge.

Response: The Commission believes that the rationale of cost based pricing should be applied to the transit elements of the charge in the same way as it is applied to the termination elements of the charge (and to mobile termination rates).

Comment: One comment also implied that a fixed termination charge should be set and that, in case of far end hand-over, the originating operator would subtract a transit charge from the termination charge payable to the terminating operator. It was suggested that the result might be a negative number, in which case the terminating operator would have to pay the originating operator instead of being paid for the termination.

Response: The Commission does not agree wth this position. Negative termination charges are not cost based.

1.3 Definition of Hand-over

Comment: Some further suggestions on alternative ways of quantifying differential termination charges were made including the following: further zoning according to 6 geo-political regions, a review of calling areas, and a calculation of a transit element based on the operating and capital costs incurred by the operator handling the transit conveyance.

Response: The current numbering regime is not based on geo-political zoning arrangement; therefore this suggestion is not feasible as this time. The solution recommended by the Commission is cost based and hence includes operating and capital costs.

1.4 Termination of international incoming traffic

Comment: One operator suggested that termination of international incoming traffic need not be regulated and claimed that the rationale for its regulation had not been provided by the Commission.

Another suggestion was made that the market should decide on the termination rate and the amount of revenue retained by the international gateway operator.

Response: The rationale has been provided for all termination services, namely that they are bottleneck services. This applies to all call termination services irrespective of whether calls are originated in Nigeria or elsewhere.

Comment: It was suggested that, instead of regulating the termination of international calls the NCC should combat fraudulent and illegal call termination.

Response: Notwithstanding the merits of combating fraud, the Commission does not believe that this can substitute regulation of bottleneck services.

Comment: Further arguments advanced against the regulation of international incoming traffic included the loss of revenue for the terminating operator.

Response: The termination charges payable under the proposed regime already cover the costs incurred by the terminating operator, including a fair return on capital. This is in line with International practice that interconnect rates should be cost based.

Comment: It was suggested that high volumes of traffic might be dumped as a result and reference was made to the QoS impact this would have.

Response: The Commission would be interested in receiving substantiating information demonstrating that (i) settlement rates do not cover the proposed termination charge and (ii) that high volumes of international incoming calls are 'dumped' as a result. The Commission has infact liberalized international gateway licences so the incentive for illegal international gateway operators is reduced.

2. Comments relating to the Mobile Costing Model

2.1 Busy hour Erlangs

Comment: Operators had been asked to provide evidence on the amount of traffic carried during the 'busy hour'. In response to this request, an operator provided data in support of a busy hour traffic percentage of 10%.

Response: The Commission has accepted this view which is in line with international experience.

2.2 Licence fees

Comment: It was suggested that the total initial cost of purchasing the mobile license, i.e. a fee of $285m, should be reflected in the model for mobile services.

Response: Engineering models which are used for regulatory purposes are normally based on current or forward looking costs. The forward looking cost of spectrum is given by the price at which GSM spectrum can be bought at present. The costs of an efficient entrant today are given by current prices and not by historical costs incurred by other operators. Hence the Commission has used the current price of spectrum in the model. It should also be noted that the fee of $285m was not merely the license fee as it included Spectrum fees for a period of 15 years, numbers for 10 million lines as well as the value of the 5 year exclusivity.

2.3 Dimensioning of the radio network

Comment: One operator suggested that the cost model should be based on coverage requirements of the licence rather than achieved coverage.

Response: This method carries a risk of rewarding operators for not fulfilling their licence obligations.

Comment: A claim was made that no provision had been made in the cost model to reflect the population density variations in Nigeria and the impact on mobile operations.

Response: This is not the case. The model takes into account the differences in population density and in traffic distributions between regions (see for instance sections 4.4 and 7 of the mobile model).

Comment: A mobile operator provided information in relation to the use of spectrum. The PwC model that had been circulated to stakeholders contained a re-use factor of 7, which corresponds to a high level of assumed efficiency in the use of spectrum. The operator referred to above provided the following information: the re-use factor per cell for both 900 and 1800 is 12. As a result of a higher re-use factor, the maximum carriers per cell would change to 2 (for both types of spectrum).

Response: The Commission accepts that, in practice, a practical maximum re-use factor is likely to be higher than 7 in Nigeria and has accepted the proposed parameters.

2.4 Dimensioning of switching and transmission network

Comment: A claim was made that fixed network capacities for the Home Location Registers (HLRs) and the IN platform tend to be higher than those of mobile networks, contrary to what is reflected in the sample models.

Response: The capacity constraints for HLRs and IN platforms depend on the type of equipment used. Information provided by fixed and mobile operators indicates that fixed operators tend to use lower priced equipment with lower capacity limits. Publicly available information can be used to ascertain that the capacity limits used for the various types of equipment are not unreasonable. Information received from other operators corroborates the view taken by the NCC.

Comment: One operator insisted that the true capacity for MSCs is lower in Nigeria than might be assumed elsewhere (110,000 subscribers per MSC instead of 300,000 – 400,000 subs per MSC). The arguments offered in support of this claim included different subscriber behaviour, per second billing, and a large proportion of pre-paid subscribers.

Response: The Commission remains unconvinced by this claim because it is not borne out by the data received from operators in Nigeria (number of MSCs and number of subscribers).

Comment: One operator claimed that, in its network, the number of hops per BTS microwave link was 4.4 (instead of 1.4 in the cost model).

Response: The Commission remains unconvinced by this claim. A sample of BTS microwave links had been provided by the operator, showing the number of hops for each link in the sample. However, the sample comprised only a small fraction of the operator's BTS links and there was no indication that this sample could be regarded as representative of the entirety of links. Based on international experience and the information provided by operators the Commission decided to leave the initial parameter of 1.4 hops per microwave link unchanged.

3 Comments relating to the Fixed Costing Model

3.1 SMS

Comment: One operator pointed out that the 'fixed' model does not include SMS traffic. It was pointed out by another operator that the diagram of the cost model for fixed services did not show the SMSC and that this was an important omission.

Response: The fixed services model does not include SMS because historical data on SMS traffic provided by operators to 'fixed' numbers were insignificant and would not have a material effect on the cost estimated for call termination.

3.2 Limited mobility

Comment: One operator expressed concerns that the 'fixed' cost model did not include the 'limited mobility' provided by wireless network operators.

Response: As a matter of fact, the 'fixed' cost model is based on CDMA technology and takes limited mobility into account..

3.3 Technology

Comment: One operator suggested that the cost model for fixed termination should take into account the costs of fixed wire networks as well as the costs of fixed wireless technology networks.

Response: The Commission has taken the view that, over the last few years, CDMA technology has become the predominant technology for the provision of 'fixed' services in Nigeria.

The proportion of fixed wireless subscribers as a percentage of all fixed line subscribers have increased significantly. On this basis, the

Commission believes that a cost model based on this predominant technology is best suited to capture the reality of the operating environment of operators providing fixed services in Nigeria.

3.4 Other parameter issues

Comment: One operator has submitted a number of alternative network parameters, including slightly different numbers of voice channels and channel payload, as well as the number of simultaneous calls per cell.

Response: The fixed cost model is not sensitive to these parameters, at least not in the range suggested by the operator in question.

Comment: The operator also submitted some alternative parameters that are related to the amount of traffic (Erlang, Erlang per user, and subscribers per cell) and to the resulting number of BSCs.

Response: The Commission understands that this data was based on projections and expected subscriber numbers and traffic volumes. As no data was provided for the actual number of subscribers and actual traffic volumes in 2005 the Commission has decided to rely on the actual traffic and subscriber data provided by the other operators.

4. General issues relating to both Costing Models

4.1 Routing factors

Comment: It was suggested by one operator that the appropriate routing factor for calls to local and national for both BTS and BSC under Switching and Access would be '1' instead of '2'. The same suggestion was made for transmission links (BTS – BSC and BSC – MSC).

Response: The routing factor '2' which is applied in the case of on-net calls takes account of the fact that on-net calls require call origination and call termination on the same operator's network, hence use 2 base stations, 2 MSCs, and the corresponding transmission links.

4.2 Demand growth

Comment: It was pointed out by one stakeholder that the model does not project the growth of the network beyond 2005.

Response: It is true that the cost models design a network based on 2005 traffic and calculate unit service costs on this basis. There are a number of reasons why this approach has been adopted:

• Given the significant volume growth experienced in the past few years, the Commission was not confident that the relatively small projected volume growth was likely to be accurate.

• Network dimensioning on the basis of historical volumes has the further advantage that the equipment volumes calculated by the model can be cross checked against actual volumes used by different operators.

• Given that volumes are increasing over time the use of 2005 volumes and assets results in slightly higher unit costs and should enable operators to accelerate network build-out.

• Arguably, the volumes of 2005 could have been combined with the costs of a network dimensioned on the basis of 2006 volumes. The rationale for this approach would be that operators dimension networks based on the volume expected in the following year. However, all available evidence on quality of service and network congestion suggests that, currently, network operators in Nigeria have not caught up with current volumes and that their networks have definitely not got any spare capacity to deal with expected volume growth in the following year.

4.3 Allocation of costs to services

Comment: A suggestion was made by one operator that it was not clear how costs are apportioned to services. It was claimed that the model does not make this readily apparent.

Response: A careful study of the cost model provided to stakeholders will show that all details relating to the allocation of costs to services are provided in the model: routing factors specify the extent to which network elements are used by different services. Service volumes and routing factors are then used to spread the cost of network elements between services based on relative usage. All formulae relating to this process are contained in the excel model provided to stakeholders.

4.4 Operating costs

Comment: One operator provided additional detail on the level of the total cost of security and the total cost of power generation in 2005.

Response: The Commission reviewed this evidence and found it to be in line with the corresponding operating costs used in the model (when regarded on a per subscriber basis).

4.5 Treatment of joint and common costs and overheads

Comment: One operator pointed out that, following ITU recommendations, incremental facility based costs should be 'reconciled' with joint and common costs as well as overheads.

Response: The cost model provided by the Commission applies an appropriate mark-up to the network costs to account for joint and common costs, as well as overheads where applicable.

4.6 Treatment of retail costs

Comment: With regard to operating costs to be included in the calculation of interconnect charges, it was suggested that the mark-up used to calculate the operating costs (depending on capital expenditure) should account for factors such as marketing, subscriber acquisition costs, promotion costs, dealer commissions and subsidies.

Response: Retail costs should be recovered through retail charges, i.e. from the operator's own customers, not through interconnect charges, i.e. from the customers of other operators.

Comment: It was also suggested that a further, mark-ups should accommodate network externalities such as the benefits derived by other parties for every new subscriber connected.

Response: It was not pointed out by the stakeholder submitting this comment whether the same logic should be made to apply to fixed and mobile services. Arguably, network externalities are largely for smaller networks. In any case, following the decision of regulators in various other jurisdictions no mark-ups were included to account for network externalities.

4.7 Operator specific information

Comment: It was suggested that interconnect rates should reflect the relative age of the respective operator's equipment, subscriber base and operator location.

Response: The Commission does not accept this proposal, for a number of reasons: The interconnection rates should reflect the costs of an efficient operator and therefore the corresponding assumptions should apply in relation to the age of the assets etc. The Commission concedes that there may be cost differences between operators due to differences in subscriber density, terrain, etc. However, a uniform (operator independent) termination rate encourages investment and coverage in areas where subscribers can be reached with fewer resources – which is efficient. Finally, the calculation of differential interconnection rates (i.e. different rates for each operator depending on each operator's operating environment) would be extremely resource intensive if not impossible, given the large number of operators in Nigeria and given the limited amount of information available on some of the operators.

4.8 Cost of Capital

Comment: It was pointed out that a study would be essential as part of this cost study in ascertaining the cost of capital (WACC).

Response: The Commission did not receive any submissions indicating views on what an appropriate level would be for cost of capital in the context of the Nigerian telecoms sector. Therefore the NCC commissioned a study for determining cost of capital. Based on the study, a WACC (weighted average cost of capital) of 29% was used for fixed services and a WACC of 27% for mobile services in this determination.

4.9 Model complexity and transparency

Comment: One operator felt constrained in commenting on the mobile model and claimed that "in a number of respects, it is not known how the values will be applied".

Response: Engineering models are complex. This is not surprising as they are designed to accomplish a complex task: dimension a theoretical network based on demand data and the operating environment, as well as quantifying the costs of such a network and allocating it between services. Understanding such models requires some expertise in engineering, economics and accounting, as well as a certain literacy in excel models. The Commission has provided electronic copies of the models which show every formula. Hence the use of each parameter is fully transparent to the initiated reader of the model and model documentation.

4.10 Time frame

Comment: One operator considered a period of 6 months too short for development of bottom-up costing model, compared to 18 months the process has taken in other jurisdictions.

Response: Given the urgency of the issues, especially in relation to the regulation of interconnection rates, the Commission has dealt with this project as a matter of urgency – whilst adhering at all times to highest quality standards. It must also be noted that the time it takes to accomplish a task should not be an issue but rather the effort put into it. The Commission has also taken advantage of recent advances in computing and data processing to cut down on transaction time.

5. Other Comments

Comment: A suggestion was made to clarify that, in the 'fixed' cost model, it should be clarified that service IDs 'Fixed 101' and 'Fixed 102' refer to on-net calls.

Response: The Commission accepted this proposal.

Comment: A suggestion was made that, for maximum transparency, the final model and report should be published.

Response: The final version of the model will contain confidential data such as traffic volumes and projections, cost information, etc. It is therefore unlikely that the Commission will publish a fully populated version of the model. Given that a version of the model containing all the formulae has been made available to operators it must be conceded that the process has been extremely transparent.

Comment: One operator suggested that legacy issues, such as pension liabilities should be taken into account in setting interconnection rates.

Response: As pointed out above, efficient interconnection rates are based on the costs incurred by an efficient operator entering the market today. Such operator would not have any legacy issues to deal with.

A couple of operators claimed to have found errors in one of the models.

Response: These operators did not provide sufficient information to the Commission in order for the Commission to be able to identify and if necessary, rectify such errors.

6 Conclusions

The Commission would like to thank all operators who have submitted information in relation to the regulation of interconnection rates, the costing models and in relation to the regulation of retail prices.

The Commission has carefully considered the information provided by stakeholders and has taken a view on parameters and regulatory measures in the light of this information and in the light of other information – based on international experience and on publicly available information.

The process of arriving at a new regulatory regime for the interconnection of operators and for retail pricing in Nigeria has been conducted in a climate of openness and with a view to providing maximum transparency to all parties without compromising on the confidentiality of commercially sensitive information.

The Commission is confident that the results will make significant contribution to the development of a thriving telecoms sector in Nigeria and hence to the benefit of consumers and industry alike.

DETERMINATION

1. The Commission hereby determines that:

   a) The interconnection rate for Fixed Call Termination using Near-end Handover shall be **N10.80** (ten naira eighty kobo);

   b) The interconnection rate for Fixed Call Termination using Far-end Handover shall be **N9.10** (nine naira ten kobo)

   c) The interconnection rate for Mobile Call Termination shall be **N11.40** (Eleven naira forty kobo)

   d) The interconnection rate for termination in Nigeria of an international incoming call is the interconnection rate determined for Fixed Call Termination using Near-end Handover, Fixed Call Termination using Far-end Handover or Mobile Call Termination as applicable.

2. The interconnection rates determined in paragraph 1 above shall be applied by and payable (including by way of internal transfer pricing) to all licensees who have been allocated numbers by the Commission.

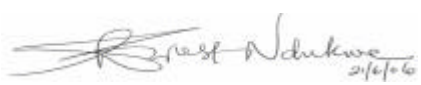
3. In this Determination, unless the context requires otherwise the following expressions shall have the meanings set out below.

"Far-end Handover"	Where a call intended for Fixed Call Termination is delivered to the terminating operator at a point of interconnection designated by that operator as serving the number range including the called number at the interconnection rate for far-end Handover.
"Fixed Call Termination"	Termination by the receiving operator of a call intended for a number within a range ascribed to fixed services in the national numbering plan and allocated to the receiving operator which call has been delivered to that operator by an interconnected operator (which operator may be the originating operator or another operator, including an operator providing transit of the call through its telecommunications network) at a point of interconnection and routed by the terminating operator through its telecommunications

	network.
"Mobile Call Termination"	Termination by the receiving operator of a call intended for a number within a range ascribed to mobile services in the national numbering plan and allocated to the receiving operator which call has been delivered to that operator by an interconnected operator (which may be the originating operator or another operator, including an operator providing transit of the call through its telecommunications network) at a point of interconnection and routed by the terminating operator through its telecommunications network.
"Near-end Handover"	Where a call intended for Fixed Call Termination is delivered to the terminating operator at a point of interconnection which has not been designated by that operator as serving the number range including the called number at the interconnection rate for far-end Handover.

5. This Determination shall take effect from 22nd September, 2006 and remain valid and binding on Licensees for the services specified in paragraphs 1(a) to (d) of this Section, until further reviewed by the Commission.

Dated this 21th day of June, 2006.



Engr. Ernest C.A. Ndukwe
Executive Vice-Chairman

Nigerian Communications Commission
Abuja – Nigeria.

APPENDIX A

ISSUES DISCUSSED WITH OPERATORS

DURING STAKEHOLDER MEETINGS (DECEMBER 05 TO 09, 2005)

The following agenda was used for the stakeholder meetings in December 2005

1. Introduction and objectives
   - 1.1. Process leading up to this meeting
   - 1.2. Process going forward
   - 1.3. Role of PwC
   - 1.4. Objectives of this meeting

Interconnection

2. Views on the current interconnection arrangements:
   - 2.1. Interconnection products/services requiring explicit regulation
     - 2.1.1. List of services for fixed – mobile interconnection
     - 2.1.2. List of services for mobile – fixed interconnection
     - 2.1.3. List of services for mobile – mobile interconnection
     - 2.1.4. List of services for fixed – fixed interconnection
   - 2.2. Identification of deficiencies or inequities in current interconnection regime
     - 2.2.1. Operational issues
     - 2.2.2. Technical issues
     - 2.2.3. Commercial issues
   - 2.3. Degree of cost orientation
     - 2.3.1. Do you have information on the costs of interconnection services (for your company)?
     - 2.3.2. In your view, what are the services for which interconnection rates.
       - …are cost based
       - …exceed service costs
       - …are below service costs

3. Changes to interconnection arrangement which would improve efficiency of market
   - 3.1. Operational changes
     - 3.1.1. How would these changes increase efficiency?
   - 3.2. Technical changes
     - 3.2.1. How would these changes increase efficiency?
   - 3.3. Commercial changes
     - 3.3.1. How would these changes increase efficiency?

Retail price regulation

4. Views on the effectiveness of competition
   4.1. Does competition effectively constrain retail prices for…
      - …fixed operators?
      - …mobile operators?
5. Operator dominance and appropriate market definition
   5.1. What are relevant markets for competition purposes?
   5.2. In these markets, are there dominant operators?
      5.2.1. Which ones?

6. Retail price regulation
   6.1. Suitability of price regulation as a remedy
   6.2. Appropriate form of price regulation, e.g. price caps (limits), price cap mechanisms, and service baskets, etc.
   6.3. alternative regulatory remedies

Other matters

7. Any other matters which you believe are relevant to the study

APPENDIX B

Description of data request

January, 2006

1. Introduction

The purpose of this document is to help operators with the completion of the data request. During our meetings with the operators held the week starting on 16th January, additional clarifications were requested on several items. Those items have now been described in more details in the following sections.

1.1 Background

As part of the project "Development of Tariff, Interconnection Rate and Price Cap Regulation", PwC is required to build a Bottom-Up Long Run Incremental Cost (LRIC) model for the Nigerian Communications Commission (NCC).

The purpose of this model is to assist the NCC in setting up interconnection rates.

1.2 Data request in a general pro-forma

The data request is a general pro-forma sent to all GSM operators and the leading PTOs. It may be altered by the operators in order to provide a better reflection of their own network and associated costs. If needed operators may amend the data request and suggest an alternative so that the modelling for interconnect rate may more closely reflect their network design and unit costs.

2. Traffic demand and call statistics

2.1 Users

Number of users refers to the number of active users i.e. users who have made or received at least one call during the last 3 months.

2.2 Traffic volumes for voice services and SMS

Traffic volumes refer to successful calls or SMS either billed or unbilled. Expected number of minutes per service is required for the years 2006 & 2007. If information is not available at that level of granularity please

provide some high level growth forecast for the next two years applicable to total traffic.

Calls to voicemail include both deposit and retrieval of voicemails.

2.3 Call statistics

Average call duration should be split for all services if possible or at least between GSM, FWA & Intl. The average number of bytes per SMS can be estimated based on a sample of CDRs.

Set-up time or non conversation holding time corresponds to the period starting for the time the calling party dials a number and stopping when the receiving party picks up the call.

Percentage of successful calls refers to the number of answered calls divided by the number of call attempts. Note that unsuccessful calls include calls not answered because the receiving party was unavailable to take the call as well as dropped calls due to network congestion.

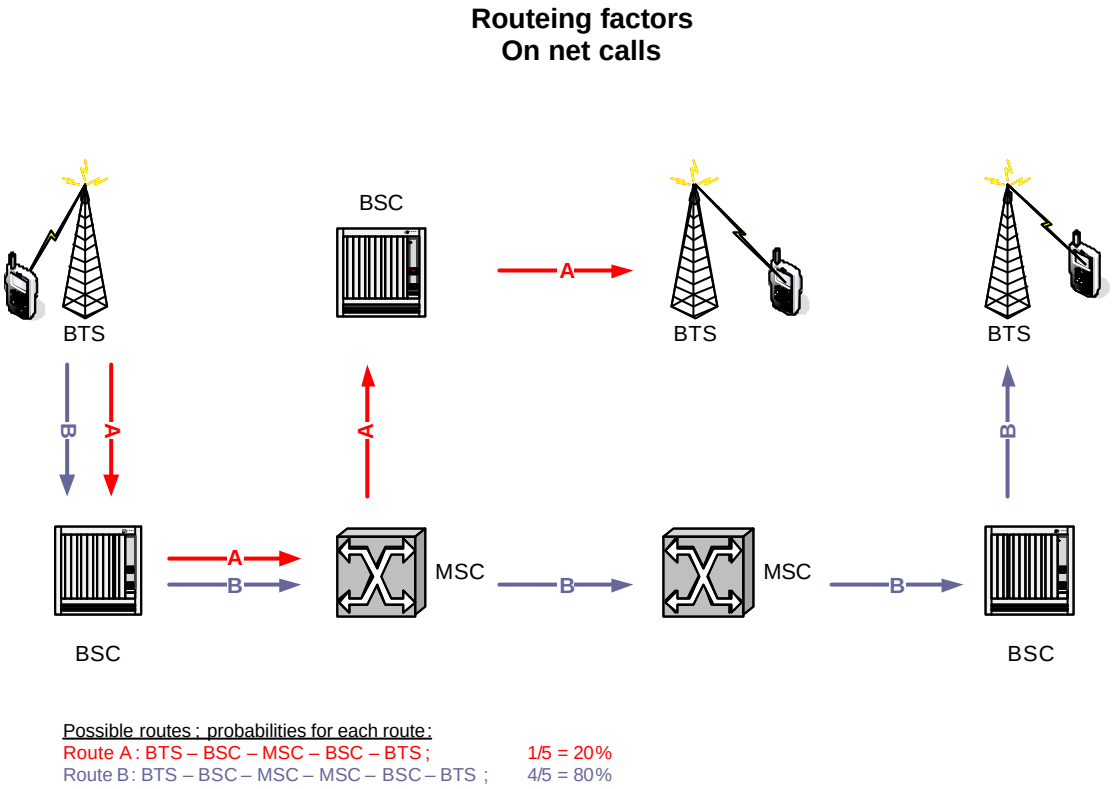
The Busy Hour is the busiest hour in terms of call volumes in Erlang during a busy day i.e. a working day. Total erlang traffic during the busy hour divided by total traffic during a working day equals % of BU daily traffic. The number of busy days is the number of days during the week which have the same high level of traffic during the BH. This number of busy days is generally equal to number of working days per week.

3. Routeing factors

Each service uses different network elements depending on which route this service takes through the network to get delivered. In order to capture how many switching and transmission network elements are used by each mobile service, a routeing table needs to be completed. Each route is weighted according to the probability that a service takes this route.

The following Figure 1 shows the routeing table for an on net call with a hypothetical mobile network of 5 MSCs. Taking a probabilistic approach and assuming that each MSC is of a similar size, we consider that the probability of the call terminating on any of the five MSC is equal i.e. $1/5 = 20\%$.

Figure 1 Routeing factors for on net mobile calls



Source: PwC

Based on a probabilistic approach and Figure 1, the routeing factors for on net calls are:

	Probability	BTS	BSC	MSC	HLR	BTS - BSC	BSC - MSC	MSC - MSC	MSC - Voicemail platform	MSC - SMS Platform	Mobile voicemail platform	SMS Platform	Mobile IN - prepaid platform	Interconnect
Route A	20%	2	2	1	1	2	2	0	0	0	0	0	1	0
Route B	80%	2	2	2	1	2	2	1	0	0	0	0	1	0
Outgoing - Calls to on net	Weighted avg	2	2	1.8	1	2	2	0.8	0	0	0	0	1	0

The routeing factors will be specific to each operator based on their network structure. It is requested from each operator to estimate its routeing factors for all its conveyance services.

4. Network design parameters

4.1 General Criteria

A 1% air interface blocking probability means that 1% of calls are lost at the air interface level. The network blocking probability refers to the probability of loosing the call at the switching or transmission level.

The capacity planning max load factor is the maximum capacity of a network element before an additional similar network element is added.

4.2 Spectrum

Due to interference, frequency cannot be re-used across adjacent cells so the frequency bandwidth available for one cell is lower than the total spectrum frequency available. The re-use factor is therefore used to divide the allocated spectrum frequency to obtain the actual available frequency per cell after taking into account interference.

Maximum carriers per sector are the theoretical maximum number of carriers that can be produced in one sector based on the amount of spectrum available.

4.3 Coverage

Operators are required to provide an estimate of their coverage in the 6 Nigerian regions and a specified list of main cities. If no coverage estimate is available pls provide the number of BTSs, the average number of sectors per BTS and their average radius for each region and listed cities. If coverage is available but under a different geographical split of Nigeria pls provide coverage according to that split but define each area in number of km^2 and location.

4.4 Sectorisation

Information on sectorisation of BTS is required per region. If the split per region is not available please provide total number for the whole of Nigeria.

4.5 Sites

Sites refer to physical location and include all types of sites. However if for instance, a BTS and a BSC are collocated at the same site, this site is only counted once.

4.6 Access and switching equipment

Number of units and design capacity per access and switching elements are to be split per vendor. The unit of measurement for the capacity of each network element has been provided. However if this unit does not correspond to the unit used by network engineers please rectify and specify which unit is used and what is the design capacity. The design capacity refers to the theoretical maximum capacity as stated by equipment suppliers.

Network engineers plan their network in advance of future demand. This planning period varies for each network element generally according to how difficult it is to commission, install and integrate a particular network element.

4.7 Transmission equipment

Leased transmission capacity should be split out between the different providers. Please add the names of the providers, the number of E1s capacity leased and the medium used to transmit.

4.8 Other general information on Transmission

Microwave hops per BTS are an estimate which can be based on a sample. Traffic per E1 in Erlang is the average erlang traffic measured per E1 in the network. The maximum number of TRXs per E1 is the maximum number of TRXs that one E1 link can cater for to transmit all the traffic generated by those TRXs between BTS and BSC.

4.9 Point of interconnection

Number of POIs with other operators and their locations are required for all four GSM operators and the top five FWA operators in terms of volume exchanged.

5. Unit investment and Opex

5.1 Unit investment for access and switching network elements

The current unit price corresponds to the purchasing price of one unit of a network element if this unit was to be bought today. Hence the current unit price of a BTS is the vendor price as of today for one BTS.

Supervision and installation costs are the additional expenses necessary for one asset to become fully operational.

5.2 Unit investment for own built transmission network elements

For transmission links which are owned and have been capitalised pls indicate the unit price and the relevant network element. For instance, depending on what transmission medium is used i.e. microwave, fibre or satellite pls indicate the relevant unit prices e.g. price of a microwave tower, a satellite transceiver or a kilometre of duct or trench.

5.3 Indirect capital expenditure

All capital expenditure which can not directly be allocated to one of the network elements listed in 5.1 and 5.2 is classified as indirect. Some broad categories of indirect capex have been proposed pls complete and amend those categories if necessary.

5.4 Operational expenditure for leased transmission infrastructure

Operational expenditure on leased lines equals the amount of the payments made to leased lines providers during the year.

5.5 Direct operating costs

In order to capture higher operational expenditure due to the Nigerian context, a breakdown of opex for BTS and BTS' site has been provided. Pls complete this breakdown and provide as much detail and comments as possible.

The list of all network opex excluding opex on BTS and BTS' site can be modified to reflect the categorisation of those costs in operators' accounts.

5.6 Retail operating costs

Customer acquisition costs correspond to subsidies or other costs incurred while attracting new customers. The costs of free SIM cards are one example of such costs. Sales, Marketing and Promotion are all the retail costs associated with the provision of retail services and advertising campaigns. Retail billing includes the costs of invoicing customers.

5.7 Common and other opex

Any opex which has not already been allocated to network or retail opex has to be included in common and other opex. The salaries of people employed working for general services at the head office are one example of such costs.

5.8 Cost and revenues for last financial year

P&L figures for the latest available financial year are to be provided at a high level.

5.9 Bad debt due to interconnection

With respect to costs associated to bad debt due to operators failing to pay for interconnection or delaying those payments, pls state in details what those costs are to your firm and how you classify them.

5.10 Unbalanced international traffic

The information required is here to assess the extent of the issue of traffic which is terminated as local traffic even if it was originated internationally.

5.11 Cost of capital

The cost of capital is the combined cost of debt and equity borne by a company. These two sources of capital are weighted together to derive a weighted average cost of capital for the company in question. The standard CAPM approach is set out below:

$$WACC_{post\ tax} = r_{Debt}\frac{D}{D+E}(1-T)+r_{Equity}\frac{E}{D+E}$$

where:

r_{Debt} = Risk free rate + debt risk premium

r_{Equity} = Risk free rate + Beta * market risk premium

T = Marginal tax rate

D = Market value of debt

E = Market value of equity