

Annex 6

Detailed charge control modelling

Introduction

A6.1 As set out in Section 6, Ofcom has developed a cost forecasting model in order to calculate a value of X for the various services covered by the Network Charge Control (NCC) over the period 2005-2009. The value of X is the amount, in real terms, by which BT will, on average, be required to reduce charges each year within each charge control basket. This annex:

- Sets out Ofcom's general methodology;
- Provides an overview of the cost forecasting model;
- Provides details of the construction of the model and the model's calculations; and
- Discusses the key factors in the model affecting the value of X.

Ofcom's methodology

The technology neutral model

A6.2 As the 21CN replaces the PSTN, some existing wholesale products are likely to be replaced by new products which fulfil the same function.

A6.3 The issue of how charges for PSTN-based services should be controlled, and how the cap should reflect the transition to the 21CN are key issues for any new NCC to apply from 2005. Ofcom proposed to have a "technology neutral basket" approach under which the same charge would apply to a given service whether it was provided over the PSTN or over the 21CN. This would give BT good incentives to utilise whichever network minimised costs and also avoid the need for detailed projections of the costs of the 21CN and the rate of migration.

A6.4 Consistent with this approach, Ofcom has developed a cost forecasting model which is "technologically neutral" (see Section 6). The implication of this is that the calculation of unit costs by service type will be based on the total volume of such services going over BT's network, irrespective of the underlying technology used to convey them (i.e. narrowband network switched or IP).

Consultation comments

A6.5 All respondents commenting on this issue agreed with the adoption of the technologically neutral modelling approach (although the support of some was based on this not precluding the regulation of services delivered entirely over the 21CN within the same period). This is further discussed in paragraphs 6.113 to 6.115 of Section 6.

Ofcom's conclusions

A6.6 Due to the positive consultation responses Ofcom has not made any fundamental changes to its technologically neutral modelling approach.

Overview of model

High level structure of model

A6.7 The following sections outline the structure of the model and provide details on the key data inputs, assumptions and main calculations in the model.

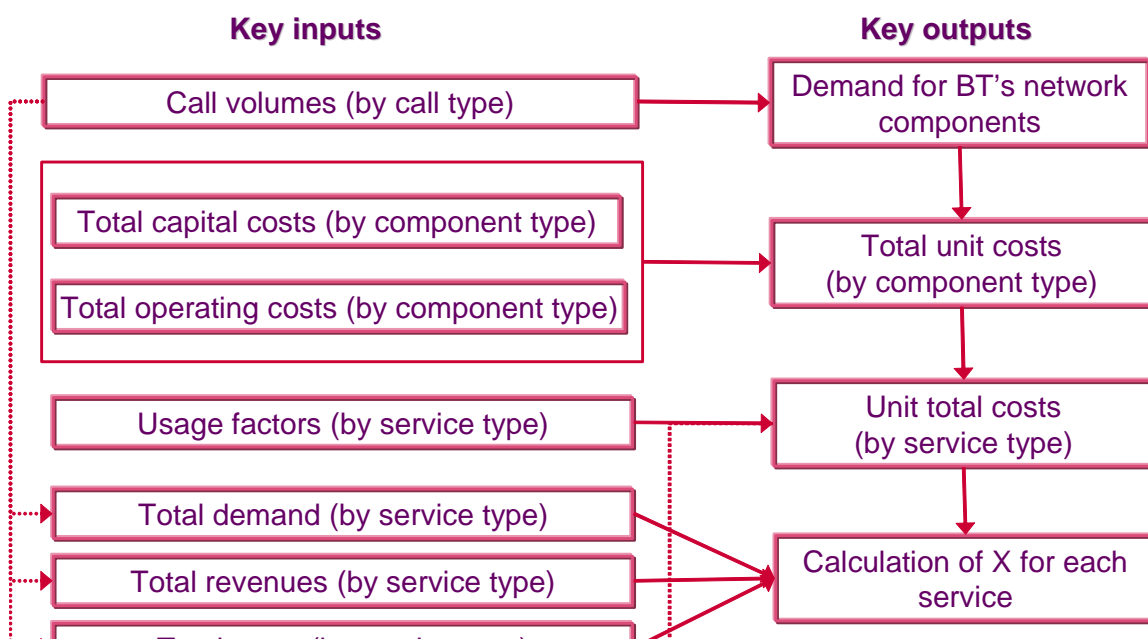
A6.8 The objective of the cost forecasting model is to forecast how BT's costs for the services included in the NCC will change over the period of its existence. This then allows different groups of costs to be combined into different possible charge control baskets.

A6.9 The model is constructed in four blocks. These are:

- **Inputs**, in the form of base year financial data and key assumptions;
- **Key calculations**, such as total capital and operating costs;
- **Interim outputs**, in the form of unit costs for the regulated services; and
- **Key outputs**, such as the construction of the charge control baskets and the calculation of the value of X for each of these.

A6.10 It is useful to understand in broad terms how these different blocks within the model are related and the calculation flow to determine the values of X. The calculation flow involving these blocks is represented simply in Figure A6.1.

Figure A6.1 High level flow diagram of the NCC model



Key inputs to the model

A6.11 The inputs to the model are described in Table A6.1. Key inputs to the model are either in the form of key assumptions or base year data provided by BT.

Table A6.1 – Description of the key inputs to the NCC model

Name	Description
Ofcom call volume forecasts by call type	This sets out Ofcom's forecasts for call volumes (voice and data) between 2004/05 and 2009/10 for BT, Direct Access Operators and Indirect Access Operators. The size of the total market is calculated as the sum of these.
Inflation	This includes historical actual data on inflation rates between 1999/00 and 2003/04 (obtained from the Office of National Statistics).
Cost of capital	This is Ofcom's view of BT's nominal pre-tax cost of capital.
Routing factors	These are provided by BT for each call type and network component type from 2003/04 to 2009/10. They measure the average usage of a particular network component by a specific retail call type.
Usage factors by service type and network component	These are provided by BT in their regulatory financial statements for the year ended 31 March 2004 and measure the average usage of a network component by specific regulated services (e.g. call origination). Usage factors for 2003/04 are forecast unchanged up to 2009/10.
Usage factors by service type and call type	These are provided by BT for each service and call type from 2003/04 to 2009/10. They measure the average usage of a service (e.g. call origination) by a particular call type (e.g. local calls).
Asset price changes	These set out BT's historic asset price changes between 2000/01 and 2003/04. Asset price changes by component type for the forecast period (2004/05-2009/10) are calculated by taking the average of the historical values by asset type and weighting these by the gross replacement cost (GRC) of each component by asset type for 2003/04.
Factor price changes	These set out BT's historic factor price changes for the pay and non-pay operating cost categories between 2000/01 and 2003/04. Factor price changes for the forecast period (2004/05-2009/10) are calculated by taking the average of the historical values.

Starting charges	The model includes the actual average charges for all services for the years 2003/04, 2004/05 and 2005/06, as published by BT. It should be noted that in the March Consultation charges for the years 2004/05 and 2005/06 were calculated by applying the relevant X factor for each service to the previous year's charge. Ofcom has now amended this approach to take account of the actual charges.
Asset volume elasticities (AVEs)	These set out Ofcom's view of the AVEs by asset type for 2003/04. AVEs by component type for 2003/04 are calculated by taking the values by asset type and weighting these by the GRC of each component by asset type for 2003/04. Values for 2003/04 are forecast unchanged to 2009/10.
Cost volume elasticities (CVEs)	These set out Ofcom's view of the CVEs for the pay and non-pay cost categories for 2003/04. CVEs by component type for 2003/04 are calculated by taking the above values and weighting these by the AVE of each component type relative to the average AVE. Values for 2003/04 are forecast unchanged to 2009/10.
Efficiency gains	Ofcom has calculated the constant volume underlying rate of unit cost reduction in BT's PSTN network that it expects to continue in the future (see paragraphs from A6.73 for a detailed discussion).
Network capital costs	These are capital cost schedules provided by BT for the year ended 31 March 2004. They include a breakdown of costs by asset type and component type for various cost components such as Gross Replacement Cost, Net Replacement Cost, Net Current Asset, FCM depreciation, HCA depreciation, CCA Supplemental Depreciation, Capital Expenditure and Disposals.
Network operating costs	These are operating cost schedules provided by BT for the year ended 31 March 2004. They include a breakdown of costs by component type for the pay, non-pay and depreciation cost categories.
Average asset lives	Values for the base year (2003/04) are calculated as the ratio of GRC and OCM depreciation in the base year. Values for 2003/04 are forecast unchanged to 2009/10.

Key calculations performed in the model

A6.12 There are five key calculations performed by the model:

- Calculation of network component volumes using call volume forecasts by call type;
- Calculation of total network capital costs;
- Calculation of total network operating costs;
- Calculation of total unit costs by service type; and
- Calculation of the value of X for each regulated service.

A6.13 These will be described in detail in the following paragraphs. Calculations are first performed in nominal terms and then converted to real terms using RPI inflation rates (2003/04). Therefore all calculations explained in the tables below are in nominal terms unless otherwise stated. It should however be noted that all key calculations are then converted to real terms and the values of X for various services calculated in real terms too.

Calculation of network component volumes

A6.14 Network component volumes are calculated as the product of call volumes by retail call type and the associated routing factor by component type. Ofcom has prepared its own forecasts of retail call volumes (please see paragraphs A6.50 for detailed discussions).

Calculation of total network capital costs

A6.15 Total capital costs are calculated in three stages:

- First the “steady state”, i.e. no volume growth, level of costs is forecast.
- Second the “additional”, i.e. with a change of volume, level of costs is forecast.
- Finally “steady state” and “additional” costs are summed to give a value for the total network capital costs.

Steady state capital costs

Table A6.2 – The steady state capital and depreciation costs

Calculation	Description
Gross replacement cost (GRC)	The base year (2003/04) GRC values by asset type and component type are provided by BT. The forecasts are calculated as the addition of: a) the sum of the previous year GRC and the product of half of the difference between the previous year capital expenditure and disposals, both multiplied by the asset price trend and b) half of the difference between the current year capital expenditure and the current year disposals.
Operating capability maintenance (OCM) depreciation	The base year (2003/04) OCM depreciation is calculated by summing the HCA depreciation and the CCA supplemental depreciation in the base year. The forecasts are calculated by dividing the GRC in the relevant year by the average asset life, described in Table A6.1.
Capital expenditure (capex)	The base year capital expenditure is equal to the OCM depreciation. The forecasts are calculated by multiplying the previous year capex value by the nominal asset price change and the year on year efficiency gains assumed by Ofcom.
Disposals	It is assumed that in the base year (2003/04) disposals are equal

to capex. The forecasts are calculated by inflating prior year values by the asset price trend.

Net replacement cost (NRC)	<p>The base year (2003/04) NRC values by asset type and component type are provided by BT. The forecasts are calculated as the addition of:</p> <ul style="list-style-type: none"> a) the previous year NRC and the product of half of the difference between the previous year capex and OCM depreciation, both multiplied by the asset price trend; and b) half of the difference between the current year capex and the current year OCM depreciation. <p>This allows for the cost of capital to be earned on the mean capital employed for the year.</p>
----------------------------	--

Net current assets (NCA)	<p>The base year (2003/04) NCA values by component type are provided by BT. The forecasts are calculated by multiplying the previous year net current assets by the inflation rate.</p>
--------------------------	---

Additional capital costs

A6.16 For the additional capital costs, the base year data is always equal to zero because by definition, there is no additional volume growth in the base year.

Table A6.3 – Additional capital and depreciation costs associated with volume growth

Calculation	Description
Additional capex	<p>The forecasts are calculated as the addition of:</p> <ul style="list-style-type: none"> a) the sum of the previous year total GRC and the product of half of the difference between the previous year capital expenditure and disposals, both multiplied by the asset price trend; b) half of the difference between the current year capital expenditure and the current year disposals; and <p>The sum of a) and b) are multiplied by the AVE and component volume change.</p>
Additional GRC	<p>The forecast is calculated by adding:</p> <ul style="list-style-type: none"> a) the product of the previous year additional GRC and the asset price trend and b) half the sum of the previous year additional capex times the asset price change and the current year additional capex. <p>This is calculated over two years because this makes the calculation consistent with a mid-year value.</p>
Additional OCM depreciation	<p>The forecast is calculated by dividing the current year additional GRC by the average asset life.</p>
Additional cumulative OCM depreciation	<p>The forecast is calculated by multiplying the previous year additional cumulative depreciation by the asset price trend, and then adding the current year additional OCM depreciation.</p>
Additional NRC	<p>The forecast is calculated by subtracting the additional cumulative OCM depreciation from the additional GRC.</p>

A6.17 From this point it is possible to calculate the total capital and depreciation costs. The model does this in the way described in Table A6.4.

Table A6.4– Total capital and depreciation costs

Calculation	Description
Total GRC	This is the sum of steady state GRC and additional GRC.
Total capex	This is the sum of steady state capex and additional capex.
Total NRC	This is the sum of steady state NRC and additional NRC.
Total OCM depreciation	This is the sum of steady state and additional OCM depreciation.
Total return on capital	This is the sum of steady state NCA plus total NRC, multiplied by the nominal pre tax cost of capital.
Total holding loss	This is calculated by multiplying the nominal price change by the total NRC minus half the difference between total capex and total OCM depreciation. The total holding loss calculates the decline in the value of the asset base due to asset price changes.
Total capital and depreciation costs	This is calculated by summing the return on capital plus the total OCM depreciation plus the total holding loss.
Real total return on capital	This is the sum of steady state NCA plus total NRC divided by the compound rate of RPI inflation, and then multiplied by the real pre tax cost of capital.
Real total holding loss	This is calculated by multiplying the real price change by the real total NRC minus half the difference between the real total capex and the real total OCM depreciation.
Real total capital costs	This is calculated by summing the real return on capital plus the real total OCM depreciation plus the real total holding loss.

Calculation of total operating costs

A6.18 Operating costs are forecast in a similar manner to capital costs described above.

Table A6.5 – Operating costs

Calculation	Description
Productivity adjusted operating cost change	This is the operating expenditure price changes calculated as the difference between factor price changes and assumed efficiency gain, split by pay and non-pay categories.
Total operating costs (non-pay)	The base year data for 2003/04 is provided by BT. The forecast is calculated by multiplying the previous year value by the productivity adjusted operating cost change, the inflation rate and the product of the component volume change with the CVE for the non-pay cost category.

Total operating costs (pay)	The base year data for 2003/04 is provided by BT. The forecast is calculated by multiplying the previous year value by the productivity adjusted operating cost change, the inflation rate and the product of the component volume change with the CVE for the pay cost category.
Total nominal operating expenditure	This is calculated by summing the total non-pay and pay operating costs.
Total real operating expenditure	This is calculated by dividing the total nominal operating expenditure by the compound inflation rate.

Calculation of total unit costs by service type

A6.19 Total unit costs by service type are calculated as described in the table below.

Table A6.6 – Total costs

Calculation	Description
Real total costs	This is calculated as the sum of the total real capital costs (Table A6.4) and the total real operating costs (Table A6.5)
Real total unit costs	Real total unit costs are calculated as the ratio of real total costs and network component volumes. For FRIACO services, real unit costs are calculated as the ratio of real total costs and total local exchange circuit numbers (or total number of local-tandem circuit numbers in the case of single tandem FRIACO).
Real unit costs by service type	Total unit costs for each service type are calculated as the product of the real unit costs (on a per minute or per circuit basis) and the usage factors by component type for each service.

Key outputs of the model

A6.20 The key outputs of the model are the calculation of the value of X, for the following services:

- Call termination;
- Call origination;
- Single transit;
- Interconnect Specific Basket (ISB);
- Product management, Policy and Planning (PPP); and
- FRIACO at the DLE and Single Tandem FRIACO.

A6.21 For each service, the value of X is determined so as to ensure zero super-normal profits by the end of the next charge control period (i.e. the end of 2009/10) by following the calculations as set out in Table A6.7 below. Super-normal profits are calculated as the difference between total revenues and total costs (including the return on capital employed) for each service.

Table A6.7 – Calculation of the value of X

Calculation	Description
Unit charges	Unit average charges for 2003/04, 2004/05 and 2005/06 are provided by BT. The values of X for the new charge control period are calculated by the model so as there are no super-normal profits by 2009/10. For two or more services that fall within the same basket (such as Call Origination) this is calculated so that the sum of their costs is equal to the sum of their revenues by the end of the charge control period.
Total revenues	These are calculated as the product of unit revenues and service volumes.
Unit costs	These are calculated as explained in Table A6.6.
Total costs	These are calculated as the product of unit costs and service volumes.
Super-normal profits	These are calculated as the difference in total revenues and total costs for each service. X is set so that super-normal profits for 2009/10 are equal to zero for each service or basket of services.

A6.22 Although the calculation of X for each basket is as explained in Table A6.7 above there are some differences introduced for some of the services. These are briefly described below.

Call origination and call termination

A6.23 Call origination and call termination are subject to different values of X as calculated by the model. The difference in the values of X between the two is over 1%, which Ofcom believes to be material. The two key reasons for this difference are: a) the different values of starting profits where call origination is £18m higher than call termination in 2003/04 and b) the extra costs of intermediate services such as emergency and operator assistance (“OA”) that need to be recovered via call origination (but not call termination). If this approach were substituted by one where the excess profits and costs are recovered over both of the services then this would give rise to the situation where one service (i.e. call termination) is over-recovering and the other one (i.e. call origination) is under-recovering. Ofcom does not believe this to be an acceptable position and hence has applied different values of X to call termination and call origination as calculated by the model.

Single Transit

A6.24 As discussed in paragraphs 6.149 to 6.156 of Section 6 Ofcom has made an allowance for the bad debt risk BT faces in Single Transit. The amount of bad debt to be included in the model is calculated as follows:

- Total payments to terminating operators for single transit ("ST") and inter tandem transit ("ITT") for the financial years ended 31 March 2004 and 31 March 2005 are provided by BT. Forecasts are calculated by inflating prior year values by the change in total ST and ITT volumes.
- The actual total gross revenue apportionable to ST is calculated as the sum of the product of the total revenue (referred to in the above bullet point) and the proportion of ST volumes to the total ST and ITT volumes and the ST revenue calculated by the model. Forecasts are calculated by inflating prior year revenues by the rate of change of payments to terminating operators and the rate of change of ST volumes over the total of ST and ITT volumes.
- Finally the ST bad debt cost is calculated as the product of the bad debt percentage (0.25% as discussed in Section 6) and the gross revenue apportionable to ST. The amount of bad debt calculated is then added to the total cost of ST as calculated by the main model.

ISB

A6.25 The ISB basket is modelled on a stand alone basis as the cost drivers (circuits rather than minutes) and individual cost components (circuits rather than PSTN network components) making up this basket are different to those of the core model. The approach taken to model the ISB basket can be summarised as follows:

- The basket is made up of three key services: connections, fixed rentals and per km rentals. Each of these services include Customer Sited Interconnect (CSI), Intra Building Circuits (IBC), Interconnection Extension Circuits (IEC), Re-arrangements and ISI Transmission Link.
- Base year charges are calculated as base year total actual revenues (as per BT's regulatory financial statements for the year end 31 March 2004) divided by total volumes. Unit charges are then forecast to change in proportion to the value of X. Total forecast revenues are calculated as the product of the forecast unit charges and volumes of the services.
- Total costs for base year are calculated as the sum of the return on capital employed and operating costs. These are then forecast in proportion to exogenous variables such as AVE, CVE, efficiency gain, input price changes and volumes changes.
- Unit forecast costs are calculated as total forecast costs divided by total volumes.

PPP

A6.26 PPP is now subject to separate controls outside the ISB basket. This is because the cost drivers for these two services are different, where PPP costs are largely salary related and are driven by the interconnecting activity of other operators.

A6.27 In addition, the base year costs and revenues for PPP have been adjusted to take into account the changes introduced by the July 2004 PPP decision¹:

- £5.1m of Service Centre costs are excluded from the PPP basket and reflected in part in the ISB basket (£3.7m);
- PPP costs are recovered over all retail call volumes, including BT to BT minutes (in the past cost recovery was over interconnect call volumes only); and
- £3.4m of wholesale product costs are added to the PPP basket, this being the cost of supplying BT's Retail division.

FRIACO

A6.28 The key differences introduced when calculating the value of X for FRIACO are as follows:

- Unit costs are calculated on a per circuit basis i.e. taking into consideration the total number of circuits; and
- The construction of the charge for FRIACO has different components as explained further in the paragraphs below.

A6.29 Unit costs for FRIACO at the DLE ("DLE FRIACO") are calculated by taking into consideration the total numbers of Local Exchange ("LE") circuits. Similarly unit costs for single tandem FRIACO ("ST FRIACO") are calculated by taking into consideration the total numbers of Local Tandem ("LT") circuits.

A6.30 The charge for DLE FRIACO is based on three components and the value of X calculated is applied to each of these cost components individually. The cost components are:

- (A) Local exchange call origination (LECO) circuit
- (B) FRIACO port at the DLE
- (C) PPP² per FRIACO port

A6.31 In calculating the charge for DLE FRIACO, the charge for the LECO circuit is multiplied by an adjustment ratio³ which reflects the number of call origination circuits required per FRIACO port. Therefore the charge for DLE FRIACO can be represented as:

¹ http://www.ofcom.org.uk/consult/condocs/rev_bt_pm/statement/statement.pdf

² Please note that this is the portion of PPP charged to FRIACO.

³ For more detailed discussion on the AR for DLE FRIACO please see Annex 9.

$$A \times \text{adjustment ratio (LECO)} + B + C$$

A6.32 A similar approach is taken for calculating the charge for ST FRIACO. For this two further charges would need to be specified (in addition to the ones listed above for DLE FRIACO) which are:

- (D) Local tandem circuit (excluding FRIACO port at tandem switch)
- (E) FRIACO port at tandem switch

A6.33 There is again the need to identify the relevant adjustment ratio reflecting the number of DLE ports and local-tandem circuits required per tandem port. Therefore the charge for ST FRIACO can be represented as:

$$A \times \text{adjustment ratio (LECO)} + (B+D) \times \text{adjustment ratio (L-T)} + C + E$$

Consultation comments

A6.34 Respondents had various comments on the structure of the NCC model as discussed in the below paragraphs.

- All respondents commenting on this suggested that call origination and call termination should have the same X as the two services are essentially made up of the same network components. As explained in paragraph A6.23 Ofcom does not believe this to be appropriate. For more discussions on this point see paragraphs 6.128 to 6.132 in Section 6.
- All respondents agreed that PPP and ISB services should be subject to separate controls as the competitive conditions of these two services are different. For more discussions see paragraphs 6.122 to 6.127 in Section 6.
- BT noted that it could not achieve Ofcom's projected efficiency gains in PPP, as half of the cost is pay, which it believes will rise in real terms. Ofcom has applied the efficiency factor to all operating costs for all network components. Hence Ofcom believes PPP should be subject to the same efficiency factor as the other network components.
- UKCTA, Energis and C&W stated that there should be separate sub-caps on each type of interconnection circuit (i.e. connection, fixed rentals and per km rentals) to reduce potential price volatility and other risks on operators. Ofcom does not agree with this approach, as there is no evidence that BT has not met its SMP conditions in pricing these services (see paragraph 6.126).
- BT noted that all base year costs should be adjusted to incorporate the effects of newly arranged future 'cumulo' rates bills⁴. However, Ofcom

⁴ Cumulo rates refer to BT's business rates paid on its network business.

rejects the approach of selectively including specific changes in costs (even where these are known) to offset against an empirically observed efficiency trend. In order to avoid the appearance of subjectivity, this approach would require an attempt to map out all known or expected cost changes over the next NCC period, which is not practicable.

Ofcom's conclusions

A6.35 Ofcom has subjected Call Origination and Call Termination to separate values of X as calculated by the model.

A6.36 Ofcom has subjected PPP and ISB services to separate charge controls. Further, for reasons outlined in paragraph A6.34, Ofcom has not subjected each different ISB service (connections, fixed rentals and per km rentals) to separate sub-caps.

Model periods

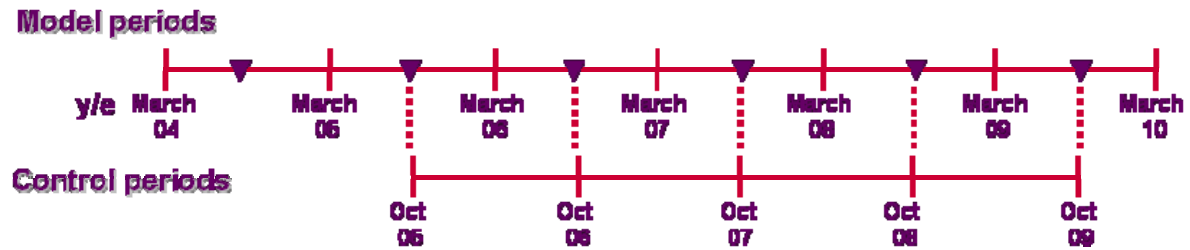
A6.37 The model uses BT's base year data for the financial year end 31 March 2004 (2003/04) and forecasts cost values between 2004/05 and 2009/10. The values of X for the next charge control are calculated over a four year modelling period between 2005/06 and 2009/10. The next NCC period starts in October 2005 which is half way through 2005/06.

A6.38 The model is based on BT's financial years and assumes that all expenditure occurs halfway through the year. By taking this approach the cost forecasts calculated by the model align with the start of the charge control periods as shown in the figure below.

A6.39 It should be noted that the model does not use actual cost and volume data for the year ending 31 March 2005 (year 2004/05), but forecasts these as explained above. The reasons for adopting this approach are:

- The effect of PSTN run-down, which is likely to have increased operating costs and decreased capital costs, making 2004/05 data inappropriate as the basis of the technologically neutral model; and
- The difficulty in confirming at this stage the level and accuracy of 2004/05 volumes provided by BT by retail call type and standard service, combined with the fact that Ofcom already has a reasonable base of volume data with which to forecast BT volumes.

Figure A6.1 High level flow diagram of the NCC model



Consultation comments

A6.40 All respondents commenting on this issue agreed that it is appropriate to set the next NCCs to last for four years. This seems mainly due to the fact that respondents welcome the stability provided by a longer charge control and also due to the adoption of the technologically neutral approach that addresses the modelling challenges associated with migration to the 21CN network. For more discussions see paragraphs 6.116 to 6.117 in Section 4.

Ofcom's conclusion

A6.41 In view of favourable consultation responses Ofcom has kept a four year modelling period for the next charge control.

Discussion of key parameters effecting the value of X

A6.42 The value of X calculated for each of the regulated services depends on a number of key model parameters which are discussed below. In the March Consultation, Ofcom identified reasonable ranges for these key parameters. In the light of responses, Ofcom has concluded on appropriate values for the key parameters as set out below.

Cost basis

A6.43 In previous charge control reviews, Oftel modelled the charge control on two different cost bases; Long Run Incremental Costs plus an Equal Proportional Mark-Up for common costs (LRIC+EPMU) and Current Cost Accounting with Fully Allocated Costs (CCA FAC). The final charges were based on LRIC+EPMU. This was for consistency with the LLU charges which were set in 2000 on the basis of LRIC+EPMU data. Consistency was considered necessary in order to avoid the double recovery of some costs, firstly in the charge for LLU and secondly in the charges for network services which could result from inconsistent treatments of common costs. In addition it was noted that the total costs of inland conveyance on a LRIC+EPMU basis were not significantly different from CCA FAC. However, the decision was not based on any claimed intrinsic superiority of LRIC+EPMU over CCA FAC, which was regarded as likely to be little different, although both these were regarded as superior to historic cost (HCA) FAC which did not provide appropriate entry or investment signals.

A6.44 In the March Consultation, Ofcom published values of X based on both methods, and indicated that the final values of X selected would vary depending on the cost basis chosen.

A6.45 Ofcom has decided to set the new control using CCA FAC as the cost basis. This decision is driven and supported by the fact that the use of CCA FAC is:

- More transparent and reliable. CCA FAC data is based on BT's audited regulatory financial statements whereas LRIC+EPMU data are produced more irregularly and to a lower standard of audit.
- Consistent with the overall principle of cost recovery. The values of X in the network charge control are set so as to allow BT just to recover its costs including common costs and an appropriate return on capital in the final year of the cap. LRIC+EPMU and CCA FAC are alternative cost definitions which are consistent with overall cost recovery and can be used for this purpose.
- Consistent with Ofcom's legal requirements. The condition by which BT's charges are controlled requires them to be reasonably derived from costs on a forward looking long run incremental cost basis and allowing an appropriate mark up for the recovery of common costs and an appropriate return on capital employed. Where the firm is dominant, LRIC+EPMU is generally regarded as consistent with this requirement. However, CCA FAC should also be consistent with this approach, particularly where LRIC costs have been derived from such CCA FAC cost data in the first place. In this case the implicit mark-up is equal to the difference between CCA FAC and LRIC and it may not be too dissimilar to EPMU.
- Consistent with floors and ceilings. Ofcom has conducted the necessary investigations to ensure that CCA FAC costs are between LRIC floors and SAC ceilings for the relevant services.
- Consistent with other price controls. The network charge control, the LLU and WLR charges and the NTS retail uplift will all be reset on a consistent basis in a similar timeframe. Furthermore, the retail price cap was set on a CCA FAC basis.

Consultation comments

A6.46 UKCTA, C&W, Energis and Scottish and Southern Energy plc support Ofcom's move to CCA FAC as the cost basis on the basis of the greater transparency and audit assurance it provides. BT noted benefits to both cost bases, and in addition noted that the cost basis decision should be applied consistently across regulated products. For more discussions see paragraphs 6.137 to 6.138 in Section 6.

A6.47 Other respondents have not made a specific reference to this matter.

Ofcom's conclusions

A6.48 Based on paragraph A6.46 detailing the advantages of moving to CCA FAC as the cost basis and the favourable consultation responses, Ofcom has used this as the cost basis in determining the values of X.

Volumes

A6.49 Telecommunication networks are characterised by significant economies of scale and an increase in retail volumes, caused by market growth or increased market share, is likely to lead to a much smaller proportionate increase in total costs than total revenues. Hence, BT's profitability is highly affected by the total retail market growth rates and BT's share of it. Ofcom has prepared its own retail volume forecasts based on recent past trends of BT, Direct Access and Indirect Access call volumes (both voice and data).

A6.50 Ofcom receives quarterly information from BT and other operators on line and retail traffic volumes as part of its ongoing market intelligence work. Ofcom has looked at recent trends in these data, together with additional information provided by BT in the context of this review, to produce forecasts of volumes over the next four years. Call volumes for any call type are calculated as the product of the moving average number of calls per line and the average number of lines.

A6.51 The Ofcom base case scenario is based on the following total market growth trends. The methodology used in putting the forecasts together is explained in detail in paragraphs A6.55 to A6.68.

Table A6.8 – Ofcom market growth forecasts for 2005-2009

Ofcom central case	Compound annual growth rate ("CAGR") 2005-2009
Business Access Lines	-4.4%
Residential Access Lines	-0.04%
Local Calls	-3.0%
National Calls	-3.0%
NTS calls	-0.5%
Data Dial	-4.7%
FRIACO	-47.1%
Incoming International Calls	-4.1%
Calls from Mobiles	-7.5%
Outgoing International Calls	-3.0%
Calls to mobiles	-3.0%
Voice over IP (VoIP)	+48.4%

A6.52 Similarly Ofcom's base case scenario assumes the following market share for BT by the end of the next charge control period in 2009.

Table A6.9 – Ofcom's assumptions for BT's market share in 2009/10

Ofcom central case	BT market share in 2009/10
Business Access Lines	78.5%
Residential Access Lines	82.2%
Local Calls	43.5%
National Calls	36.2%
NTS calls	68.1%

Data Dial	43.5%
FRIACO	100.0%
Incoming International Calls	48.9%
Outgoing International Calls	23.4%
Calls to mobiles	49.2%
Voice over IP (VoIP)	51.8%

A6.53 When preparing the volume forecasts for the next charge control Ofcom has taken four key factors into consideration:

- Number of fixed telephone lines and average usage patterns;
- The level of competition;
- The growth of data traffic over Broadband (“DoB”); and
- The growth of Voice over Broadband (“VoB”).

The number of telephone lines and average usage pattern

A6.54 Ofcom has considered trends in both the number of telephone lines and the average usage pattern in its forecasts. While there has been a small decline in the total number of fixed lines over the last couple of years a large proportion of this is thought to be accounted for by the reduction in second lines for internet access following increased broadband migration. The rate of decline has slowed in recent quarters and further significant falls seems unlikely. This is reflected in the forecasts.

A6.55 Second, overall traffic volumes will be affected by average usage patterns. Average volumes per line have shown a clear downward trend over recent years although again this fall has slowed over 2004. This slowdown is likely to reflect mobile penetration reaching saturation levels reducing the rate of any substitution effect. Average usage may also have been stimulated by the reduction in call costs.

The level of competition

A6.56 The total volume of traffic over BT’s network will be influenced by the level of competition. This has been most obvious in recent quarters through the take off of competition from carrier-pre-selection (“CPS”) although this is unlikely to significantly affect the volume of originating and terminating traffic on BT’s network.

A6.57 Ofcom assumes CPS call volumes in 2009/10 to be around 30% of total lines, roughly twice the current levels and believes this to be a reasonable assumption.

The growth of DoB

A6.58 In preparing its volume forecasts Ofcom has also made explicit assumptions about broadband data substitution during the next charge control period. Significant falls in metered and unmetered narrowband internet usage are projected for the next

control period for the NCC (Ofcom and BT agree on this although differ as to the amount). The greater the extent to which this reduction is reflected in the projections used to derive the values of X in the NCC, the lower will tend to be the values of X produced (i.e. it loosens the control, possibly significantly). There are, however, arguments for not reflecting the forecast reduction in its entirety in the model. When calculating the effect of broadband data substitution Ofcom has sought to clarify two key important points:

- What level of broadband substitution should be taken into account (discussed in paragraphs A6.60-A6.63 below); and
- How should the effects of broadband substitution be reflected in the volume forecasts (discussed in paragraph A6.64-A6.65).

What level of broadband substitution should be taken into account

A6.59 The arguments in favour of not allowing for the full forecast reduction in narrowband volumes due to broadband substitution are as follows:

- Ofcom is of the view that there is an economy of scope at both the retail and network level between narrowband and broadband traffic. If a minute of BT narrowband traffic switches to BT broadband, some of the network components used will be the same, as will some of the retailing activity; and
- If broadband substitution were fully reflected in the narrowband forecast, BT would have an incentive to maximise the forecast amount of such substitution in order to get a lower X on the NCC.

A6.60 The counter-arguments are based on limits to the economy of scope:

- BT may well lose share to LLU and cable operators when customers switch to broadband. It would not be able to recover network or retail costs from LLU customers. Ofcom forecasts total LLU take-up by 2009/10 to be about 30%-40% of the broadband total currently assumed in the model. So if one removes all LLU from the total for PSTN forecasting purposes on the grounds that LLU operators will not use BT's network, this leaves a maximum of about 60%-70% for possible inclusion in narrowband volumes; and
- During the control period, BT will be running both PSTN and 21CN and the degree of commonality between them is limited. If one assumes the common costs between PSTN and 21CN to be ducts, copper, fibre and a proportion of building costs this would represent around 15%-25% of BT's PSTN costs (calculated on a GRC basis).

A6.61 Based on the above arguments, in the March Consultation Ofcom had concluded that the proportion of broadband substitution that could be added back to narrowband volumes is between 20% (to represent a minimum level of possible economies of scale based on network commonality) and 60% (representing the

portion of volumes left after forecast migration to LLU i.e. the maximum view of economies of scope and the incentive effects described above).

A6.62 Ofcom has now decided to use a figure of 30%, closer to the bottom of the range. The choice of a number at the bottom of the range acknowledges the argument that BT could lose additional market share as customers switch to broadband and the likely extent of re-use of components as well as the provision of appropriate incentives and protection of narrowband customers. Paragraph A6.71 gives further detail on this decision.

How should the effects of broadband substitution be reflected in the volume forecasts

A6.63 Ofcom has assumed that the figure for total broadband subscribers reaches around 14m by the end of the next charge control (which is more than double its level in 2003/04). Of the annual growth in broadband subscriber numbers, 90% is assumed to come from narrowband users. It is then assumed that 30% of broadband substitution should be treated as remaining on the narrowband network for modelling purposes to reflect economies of scope and incentives. The annual (absolute) growth in broadband subscribers is then multiplied by (30% x 90%, i.e. the percentage of broadband substitution not remaining on the narrowband network) to give the reduction in forecast narrowband volumes due to broadband substitution.

A6.64 This is then divided between metered and unmetered narrowband subscribers according to the proportions of each in total narrowband subscriber numbers. The relevant calculated reduction is then subtracted from the metered and unmetered narrowband subscriber bases in each year and then expressed as a percentage decline. BT's forecast rates of the decline in narrowband data are then adjusted for the difference between its own forecast reduction due to broadband substitution and this Ofcom-calculated figure. The results are then used as the forecast rates of decline in the NCC model.

The growth in VoB

A6.65 Ofcom has followed a similar methodology in taking into account the effects of broadband substitution in voice over the next charge control, although some of the assumptions differ and these are explained in the paragraphs below.

A6.66 VoB forecasts prepared by Ovum⁵ suggest a total user base of around 6 million by 2008, which is equivalent to around 20% of total lines. In preparing its volume forecasts Ofcom has assumed VoB call minutes to be 20% of total retail call minutes by 2009/10.

A6.67 As for data, Ofcom has treated 30% of the projected reduction in PSTN volumes due to VoIP substitution as remaining on the PSTN. This means that the remainder (70% x 20%) of VoIP calls will substitute conventional retail call minutes and leave the PSTN. However, of this latter group of VoIP calls BT have acknowledged that a proportion may still return for termination on the PSTN and have provided routing factors for these.

⁵ Consumer VoIP forecasts, Ovum, August 2004.

Consultation comments

A6.68 There have been varied responses to the volume forecasts (see paragraphs 6.133 to 6.136 in Section 6). C&W pointed out the difficulty of making robust assumptions on the broadband economies of scope and that Ofcom should take into account its policy aims when deciding on the matter. UKCTA and Energis noted the forecasts to be too pessimistic and urged Ofcom to use the upper end of broadband substitution being added back i.e. 60%. On the other hand Scottish and Southern Electric and Thus found the forecasts reasonable.

A6.69 Vodafone had the following specific comments:

- Vodafone noted that the decline in business exchange lines of 4.5% is unwarranted based on their own calculations. Ofcom has consistently applied the approach discussed in paragraph A6.50 in calculating its volume forecasts and believes the data and the results to be reasonable. In particular, it has estimated the trend over a period including both rising and falling volumes, which is therefore not unduly influenced by recent falls.
- Vodafone noted that BT's business exchange line market share in 2009/10 should be held at 83% (as per 2003/04). Ofcom notes that the decrease in BT's business exchange lines from 83.5% in 2003/04 to 78.5% in 2009/10 is not material and does not have a material effect on the values of X calculated. In addition the number of business exchange lines is forecast in a consistent manner with all retail call types and Ofcom believes this to be a reasonable approach.
- Vodafone requested an explanation as to why calls from fixed phones to mobiles reduce at the same rate as local and national calls, while call from mobiles to fixed decrease at a faster rate. Ofcom notes that the total market figures for calls from fixed phones to mobiles is based on BT call volumes only (as data from other operators is not fully available). If we compare BT-only calls from fixed phones to mobiles with BT-only calls from mobiles to fixed phones these levels of reduction are more comparable, being -7.5% and -5.1% respectively. Ofcom believes that there is no necessary reason for these type of calls to decrease at the same rate as this may be influenced by changes in the relative prices of mobile-mobile, fixed-mobile and mobile-fixed calls.
- Vodafone noted that it is not clear whether Ofcom is anticipating any impact on volumes from the growing price competition represented by CPS. Ofcom notes that the effect of price competition on volumes is not explicitly modelled. However, the effect of falling prices will be reflected in the trends used to generate the forecasts.
- Vodafone noted that Ofcom's forecast methodology for the growth of VoIP are unclear. The methodology applied by Ofcom in calculating the VoIP forecasts is explained in detail in paragraphs A6.59 to A6.68.

- Vodafone noted that quarterly volume data published by Ofcom and Oftel show a considerable fluctuation. In preparing its volume forecasts Ofcom has only taken into account historic data from Q3 2001 onwards hence avoiding issues arising from inconsistent definitions prior to this period. The year 2001 was also one of large scale take up of CPS and FRIACO, and therefore distortion of any trends is avoided by excluding these earlier periods. Ofcom believes that a mild fluctuation in actual volume trends is not unreasonable.

A6.70 BT, on the other hand, articulated the following thoughts:

- BT noted that forecast volumes should decline between 6% to 7% (or greater) per annum. In the March Consultation Ofcom had noted overall retail call volumes to decline by 4.5% between 2005-2009. The updated volume forecasts used in this statement suggest a decline in the same period of 6%, broadly in line with the BT figure.
- BT stated that broadband add-back should be 12% or less. Ofcom has set out above its reasons for using a figure of 30%. It also believes that, under certain assumptions, BT's view that at most 12% of costs are common between narrow and broadband is in fact consistent with 30% add-back. In addition, Ofcom's add-back assumption should be considered in the context of the other assumptions in the model. For example, it could be argued that a higher forecast for total broadband subscriber numbers should be accompanied by a lower projection for the proportion of subscribers who switch from narrowband and a higher rate of add-back. This is because higher broadband subscriber numbers may indicate that broadband services are attracting customers who had not previously considered the internet worthwhile, and also increases the subscriber base over which costs can be recovered. It should also be noted that the values of X in the network charge control model are not highly sensitive to changes in the add-back assumption. For example, the combined effect of increasing broadband subscribers from 13.2m to 14.2m and increasing add-back from 20% to 30% might change the modelled call origination X by about 0.2%, which after rounding may not even change the final value of X.
- BT stated that broadband add-back effectively results in double counting, as the economy of scope is already reflected in the 4.5% annual rate of efficiency growth assumed. For the following reasons, Ofcom does not accept that the add-back double-counts the economy of scope effect.
 - Firstly, in the period to 2003/04 used to estimate the underlying rate of real unit cost reduction, the number of broadband subscribers was small relative to the number of narrowband subscribers and relative to the number of broadband subscribers expected in future. The impact of broadband economies of scope will therefore also have been relatively small in the period to 2003/04. Ofcom's report on the telecommunications market 2005 shows that, at the end of 2003, there were only 3.2m broadband subscribers, a number

which is expected to grow to some 14m by the end of the next charge control period.

- Secondly, it is arguable that any such effect would be offset by a related factor not captured in Ofcom's efficiency modelling. It is not clear that, to the extent that there has been broadband substitution of narrowband traffic in the period to 2003/04, this has resulted in a reduction in BT's PSTN network costs. Indeed, to the extent that PSTN volumes have been lower than they would otherwise have been in this period as a result of broadband substitution, PSTN unit costs will tend to have been higher than they would have been in the absence of such substitution. As Ofcom has made no adjustment to past volumes to allow for this effect, it is arguable that the measured rate of real unit cost reduction over the period used for Ofcom's efficiency modelling is in fact an understatement of the underlying rate.
- Thirdly, Ofcom has conducted a detailed examination of the sources of the reductions in BT's unit costs in the period 1999/00 to 2003/04. It has been decided that the reduction is in part due to accounting adjustments which it is not legitimate to regard as repeatable, while others are genuine efficiency gains of a kind which it is reasonable to expect BT to continue to make in future⁶. Ofcom believes that, to the extent that these result from economies of scope arising from the introduction of new services, it is reasonable to expect BT to continue to benefit from the introduction of new services in this way (particularly as it moves to the NGN, although no additional allowance has been made for this).

Ofcom's conclusions

A6.71 Ofcom believes that the volume forecasts set out in paragraph A6.51, reflecting the analysis in this annex, and a figure of 30% add-back of reductions in PSTN volumes due to broadband substitution, are reasonable positions.

Efficiency

Ofcom's efficiency calculations

A6.72 The efficiency factor is an important parameter as it determines the rate by which real unit capital and operating expenditure are expected to decrease year on year before taking account of volume and input price changes. It should be noted that no adjustments are made to the efficiency factor to include the effect of anticipated savings from 21CN. Ofcom's calculations suggest a range of 4.5% to 5.5% for the year on year efficiency figure. When calculating the efficiency factor to be included in the model Ofcom has taken into account three key factors, which are all discussed below:

⁶ For a discussion of the accounting adjustments included in the calculation of the efficiency factor please see paragraphs A6.82-A6.83 below.

- BT's underlying rate of real unit cost reduction over the period 1999/00 and 2003/04;
- Accounting adjustments to BT's financial data for 2003/04; and
- BT's efficiency relative to that of appropriate comparator companies.

BT's underlying rate of real unit cost reduction

A6.73 Ofcom has assumed that, in a technology-neutral sense, BT will be able to achieve the same underlying rate of real unit cost reduction over the period 2005/06 to 2009/10 as it has over the period 1999/00 to 2003/04. The method used was to estimate the underlying rate of unit cost reduction for each network component and then aggregate this to a single figure for the unit cost reduction as follows:

- First, the actual rate of year on year total cost reduction over the period 1999/00 to 2003/04 was calculated for each component. This was based on operational costs excluding depreciation. Certain accounting adjustments which occurred over this period were reversed from the 2003/04 data to ensure that the starting (1999/00) and closing (2003/04) periods were stated on a comparable basis (for more discussion see paragraphs A6.76-A6.77).
- Second, the year on year volume changes were calculated for each component.
- Third, the year on year constant volume change in unit costs was calculated by dividing the year on year total cost change by the product of volume change and the cost volume elasticity for each component. An average change in real unit costs for the period over 1999/00 and 2003/04 was then calculated.
- The average real unit cost reduction over the period 1999/00 and 2003/04 was further adjusted by excluding the extent to which this reflected catch up of BT's inefficiency at the start of the period⁷ and changes in input prices⁸ that had occurred over the same period and including the expected catch up of current BT inefficiency over the next six years (2004/05 to 2009/10)⁹.
- Finally, the average real unit cost reduction as calculated above for each network component was aggregated to a single figure by using

⁷ This was calculated by comparing the level of BT inefficiency at the total cost level (compared to the US LECs) as calculated by NERA for the years 2003/04 and 1999/00.

⁸ Changes in input prices are the weighted average of the pay and non-pay category input prices between 1999/00 and 2003/04.

⁹ It is reasonable to expect inefficiency existing at the start of the charge control period to be eliminated over the life of the control, just as competitive pressure would force companies to become efficient in a competitive market. The underlying rate of cost reduction over the period of the charge control is therefore adjusted to reflect expected catch-up of current inefficiency. This is equal to the level of BT inefficiency at the total cost level (compared to the US LECs) calculated by NERA for 2003/04.

the cost weights by network components for either 1999/00 or 2003/04. As the use of these cost weights has a material impact on the final value of the efficiency factor and neither approach can be regarded as being the best, Ofcom has decided to use the average cost weights (for 1999/00 and 2003/04) when calculating the final efficiency factor.

Accounting adjustments for BT's data in 2003/04

A6.74 During the current charge control period BT introduced new cost allocation systems and implemented a number of improvements on how costs are measured and captured. These developments have had a direct impact on BT's financial performance as measured in the regulatory financial statements and in particular have reduced operating costs (excluding depreciation) in BT's core network through accounting adjustments.

A6.75 While Ofcom is satisfied that all material accounting adjustments were reflected and properly accounted for, Ofcom believes that two of them may in fact be regarded as relating to efficiency gains rather than simply a one-off accounting adjustment. The two adjustments in question relate to the:

- Apportionment of accommodation costs within the network components ("adjustment A"). This adjustment arises as a result of BT apportioning building costs to switches. The total accounting adjustment amounts to £32.7m of which a) £14.1m is due to the change in BT's apportionment methodology and b) £18.6m is due to the switches becoming smaller over time. Ofcom believes that the latter is an efficiency gain that could be repeated in the future and therefore has not added the amount of £18.6m to the operating costs in 2003/04.
- Reclassification of costs out of the core network into Select Services ("adjustment B"). A proportion of core network costs (amounting to £13.3m) have been apportioned to Select Services. Ofcom considers that there is no reason why BT will not in future introduce similar services to those that gave rise to this cost re-allocation, with its associated economy of scope. Ofcom notes that BT's 21CN changes are partly being introduced to enhance the customer experience, and considers that such changes should be viewed in the same way as Ofcom is treating other efficiency issues. That is, that were a hypothetical PSTN network to continue to exist, BT would seek to make improvements using that network rather than the 21CN. In the same way that Ofcom is not adjusting for specific 21CN savings within the 2005-9 NCC, in place of a hypothetical projection, Ofcom does not assume that BT's range of services would stand still for the purposes of modelling a hypothetical PSTN network. Ofcom has therefore not adjusted the operational costs in 2003/04 for this accounting adjustment.

A6.76 The combined total effect of these adjustments was to reduce network costs by £46m. Ofcom believes that £18.6m of adjustment A and all of adjustment B arise as a result of 'economies of scope' and thus should be treated as genuine cost

reductions when calculating BT's efficiency. Had Ofcom fully accepted these two adjustments, the efficiency range quoted in paragraph A6.72 would have reduced, all other things being equal, by about 1%.

BT's efficiency relative to that of appropriate comparator companies

A6.77 As in the last NCC review, Ofcom has commissioned economic consultants NERA to carry out studies to examine the efficiency of BT's network relative to appropriate comparator companies, principally the US Local Exchange Carriers (LECs). These studies expand upon the comparative efficiency analysis which has previously been undertaken by NERA for Oftel in relation to other charge controls in place on BT.

A6.78 The study uses data for the US LECs for the years 1996 to 2003 to model the determinants of total network costs. Based on this model, the study then makes use of accounting and other data produced by BT, to assess BT's comparative efficiency in 2002/03 to 2003/04. The model tries to explain the level of a firm's costs by reference to a number of cost drivers such as service volumes and other observable (exogenous) variables, such as geographic and demographic differences in the areas in which the firms operate. From the remaining unexplained costs, those due to relative efficiency are then identified.

A6.79 NERA's conclusion is that, when measured at the level of total costs BT is in the region of 0.8% to 3.8% inefficient in its provision of services over its network as a whole relative to the top performing decile of the US LECs. The lower bound of this range is determined by analysis using a constant cost of capital across all firms (BT's comparative efficiency varies from 0.8% to 1.3% as the cost of capital used varies from 11% to 13%). The 3.8% upper bound is determined by regression analysis which allows the cost of capital to vary between different firms. Ofcom's preferred approach conceptually is to use the upper bound, in which the cost of capital varies, but given some concerns about the regression involved, considers that it is reasonable to base BT's overall efficiency score on the mid-point of constant and varying cost of capital figures calculated by NERA.

A6.80 The approach used by NERA to identify the asset base and resulting capital costs of the US LECs reflects the actual asset base of each firm. In previous studies NERA had, owing to a lack of publicly available data, imposed the characteristics of BT's asset base on the US LECs (for example, by imposing BT's asset lives, cost of capital rate and NBV/GBV ratio on the LECs' asset bases). This change to the approach for quantifying the LECs' asset bases now allows the capital requirements faced by each individual firm to influence the capital costs used in the study. Given this, NERA considered it appropriate to allow the cost of capital to vary between the different firms in the sample. However, the identification of appropriate cost of capital rates for each company was found to be a non-trivial exercise. Therefore, given the potential inaccuracies in the rates identified by NERA, regressions were also run applying a constant cost of capital across all firms.

A6.81 NERA also assessed BT's comparative efficiency at the level of operating cost plus depreciation as this measure of cost is not reliant on the identification of an appropriate cost of capital rate to apply to the firms in the sample. This analysis

indicated that BT is in the region of 0.5% inefficient relative to the top performing decile of the US LECs.

A6.82 The NERA study also provided figures for the annual rate of cost reduction, independent of volume changes, experienced by the US LECs. This can be thought of as the rate at which efficient firms should be getting more efficient over time. These figures suggest a real unit cost reduction of 1.5% per annum. This however is less appropriate for use in the NCC model than the rate calculated from BT's data discussed above as it is derived from data which includes access costs. To the extent that possibilities for cost reductions in access are relatively limited, it might be thought likely to be an underestimate of core network cost reductions.

Consultation comments

A6.83 The comments received on the efficiency factor were varied (see paragraphs 6.118 to 6.119 in Section 6). BT, UKCTA, C&W and Energis agreed with Ofcom's approach of not adjusting the efficiency factor to include any efficiency gains resulting from 21CN. These respondents also agreed with the range for the efficiency factor of 2.5%-4.5% proposed by Ofcom in the March Consultation.

A6.84 Scottish and Southern Electric plc found Ofcom's proposed approach of not assuming any efficiencies in costs beyond the normal level as unduly conservative. Ofcom does not agree with this assertion: it would not be appropriate for Ofcom to take into account efficiency gains arising from 21CN, while excluding any associated start-up and parallel running costs.

A6.85 BT has made a number of observations with regards to the calculation of the efficiency factor which are summarised below:

- BT noted that certain one-off accounting adjustments are dealt with inappropriately. These relate to adjustments A and B discussed in paragraph A6.76. BT notes that recognition of the one off nature of these accounting adjustments would suggest an annual efficiency factor of 2%. As discussed in paragraph A6.77 Ofcom believes over 50% of the former and 100% of the latter savings arise as a result of economies of scope.
- BT stated that the use of the upper decile as the efficiency benchmark creates an unrealistic high target. BT points out that a company operating in a competitive environment would earn its cost of capital, hence the appropriate benchmark would be the average rather than decile. BT references a paper prepared by Professor Paul Grout in response to the partial private circuits charge control consultation. Ofcom responded to this point in a recent decision on the partial private circuits charge control.¹⁰ As set out in that document, Ofcom is of the view that the sample of US LECs used to assess BT's comparative efficiency is not representative of a sample of US companies of average competitiveness or efficiency, as at least some of the

¹⁰ http://www.ofcom.org.uk/consult/condocs/ppc_charge_control/statement/#content

operators in the sample faced limited competition, particularly during the earlier part of the time period covered by the study. Hence Ofcom considers it appropriate to adopt an efficiency benchmark above the average of the group.

- BT has also made some confidential comments on the appropriateness of the modelling methodology and data used by NERA. Ofcom does not consider that any of the issues raised by BT justify a change in the efficiency factor which should be used.
- BT believes that the efficiency factor should not be higher than 2%. BT points out that the “frontier shift” calculated by NERA is around 1.5% and this further supports the fact that the efficiency factor should be no greater than 2%. As noted in paragraph A6.82 above, the NERA efficiency frontier is likely to be less appropriate for modelling NCC costs as it would include efficiencies of both access and core networks.
- On cost weights (see A6.74), BT has suggested that 2003/04 weights should be used, based mainly on assuming that rates of unit cost reduction are the same for each component in the future as they were historically. However, Ofcom believes that this is not necessarily a valid assumption. Data suggest very large variability in rates of efficiency gain for individual components from year to year, while overall efficiency growth is more stable. One reason may be that technical change is not a smooth process but is embodied in investments which occur at infrequent intervals. Thus if there are large cost reductions in one component in one year, this may not be repeated in the next year because it is unlikely that BT would replace new equipment so soon. Instead it might be more likely to invest in making savings in one of the areas where costs have fallen less rapidly. This approach supports the use of the average between 1999/2000 and 2003/04 cost weights, rather than reflecting 2003/04 cost weights alone.

Ofcom’s conclusion

A6.86 Ofcom’s calculations suggest a range of 4.5% to 5.5% for the year on year efficiency figure depending on whether the low or high estimate of comparative inefficiency is used, and on the treatment of BT’s proposed accounting adjustments. The lower value would be consistent with using the low NERA catch-up value and making a partial adjustment for BT’s Select Services accounting adjustment. This range is slightly higher than the one presented in the March Consultation, and the reason for this is the use of the average cost weights (see paragraph A6.74). In selecting the final value of the efficiency factor a degree of judgement needs to be applied to ensure that the value calculated is a reasonable target going forward, for example by comparison with the historical precedents. As a result of this Ofcom has decided to use 4.5% as a reasonable year on year efficiency gain.

Asset-volume elasticities (AVEs)

A6.87 An asset-volume elasticity is defined as the percentage increase in gross assets, valued at replacement cost, for a 1% increase in volume. In the March Consultation

Ofcom has assumed, as a central case, asset-volume elasticities of 0.38 for inland conveyance (network) costs with upper and lower cases of 0.45 and 0.32 respectively. These were based on assumptions used in the last price control review, which were based on a top-down model of BT's costs.

A6.88 Ofcom has also considered whether the AVEs used in the model for the next charge control period should be materially different to the ones used for the last charge control period because of the projected decline in PSTN volumes, especially of narrowband data traffic. Ofcom believes the use of the same AVEs as the last charge control is appropriate given Ofcom's "technologically neutral" approach. As noted earlier this models a hypothetical ongoing network rather than explicitly modelling the transition to the 21CN. As such large decreases in overall call volumes are not forecast. In addition, previous controls have not adjusted AVEs to take account of growth in predominantly off-peak traffic (which would have resulted in tougher Xs).

A6.89 Ofcom has used the central value (which equates to 0.38 for inland call conveyance) as the asset volume elasticity in producing the final values of X.

Consultation comments

A6.90 BT commented that as PSTN volumes are shrinking assets are less likely to be responsive to volumes and that an AVE of 0.2 or less is justified. As explained in paragraph A6.89 Ofcom's approach is technologically neutral and hence no change to the AVE values is required.

Ofcom's conclusions

A6.91 As discussed in paragraph A6.89 as a result of Ofcom's technologically neutral approach no change to the central AVE values is required.

Cost-volume elasticities (CVEs)

A6.92 A cost-volume elasticity is defined as the percentage increase in costs for a 1% increase in volume. CVEs in telecommunications are typically significantly less than one, reflecting the economies of scale. In the March Consultation Ofcom has assumed, as a central case, a cost-volume elasticity of 0.25 for inland conveyance (network) costs, with upper and lower cases of 0.3 and 0.2 respectively. These were based on assumptions used in the last price control review.

A6.93 As with AVEs, Ofcom has considered whether the CVEs used in the model for the next charge control period should be materially different to the ones used for the last charge control period because of the projected decline in PSTN volumes, especially of narrowband data traffic. Ofcom believes the use of the same CVEs as the last charge control is appropriate given Ofcom's technologically neutral approach. As noted earlier this models a hypothetical ongoing network rather than explicitly modelling the transition to the 21CN. As such large decreases in overall call volumes are not forecast. In addition, previous controls have not adjusted CVEs to take account of growth in predominantly off-peak traffic (which would have resulted in tougher Xs).

A6.94 Ofcom has used the central value (which equates to 0.25 for inland call conveyance) as the cost volume elasticity in producing the final values of X.

Consultation comments

A6.95 BT commented that as PSTN volumes are shrinking costs are less likely to be responsive to volumes and that a CVE of 0.2 or less is justified. As explained in paragraph A6.94 Ofcom's approach is technologically neutral and hence no change to the CVE values is required.

Ofcom's conclusions

A6.96 As discussed in paragraph A6.94 as a result of Ofcom's technologically neutral approach no change to the central CVE values is required.

Investment levels

A6.97 Two approaches to the forecasting of investment were considered in the March Consultation . One was to incorporate BT's own forecasts for PSTN investment which reflect the rundown of the PSTN over time. However, given the level of uncertainty over the need for future investment in the PSTN, and the level of investment required for the new IP network, it is unlikely that a meaningful forecast could be made based on BT's investment figures.

A6.98 The second approach was to use the model to derive projections for investment. This is most consistent with Ofcom's technologically neutral approach of modelling a single ongoing network and the assumption that wholesale services will continue to be provided over either the 21CN or PSTN. In a steady state, and if actual asset lives are properly reflected in BT's regulatory financial statements, capital expenditure should be equal to CCA (OCM) depreciation. Capital expenditure can then be forecast as the sum of two components, one equal to the OCM depreciation at base year volumes and one to allow for investment necessary to support volume growth over the period, determined by the AVE. This has the merit of producing projections of investment that are consistent with whatever level of traffic growth is forecast. Ofcom has used this second approach in finalising the values of X.

Cost of Capital

A6.99 The cost of capital is the minimum rate of return which investors require in order to be persuaded to invest in BT. In a competitive market; one would expect competitive pressure on prices and profits to reduce returns approximately to the cost of capital. While actual returns in any year might differ from the cost of capital, for example, if a firm introduced an innovative product, one would not expect to see returns persistently above (or below) the cost of capital in a competitive market.

A6.100 Ofcom's practice is to set 'X' so that the value of BT's rate of return projected by the financial model for the last year of the price control is equal to the cost of capital. This approximates to the workings of a competitive market in which excess profits are gradually eroded by competition.

A6.101 Ofcom has now concluded its review of BT's cost of capital as discussed in Section 6 and its view is that an appropriate value for BT's core network is 11.4%.

Change in asset and other input prices

A6.102 BT has provided data on changes in nominal asset prices between 2000/01 and 2003/04. The average of these values has been used as the basis for forecasts of future changes in real asset prices over the next price control period. The implied average change in real asset prices across inland call conveyance is a reduction of 2.14% per annum.

A6.103 BT has provided data on changes in nominal prices per unit of labour or other inputs between 2000/01 and 2003/04. The average of these values has been used as the basis for forecasts of future changes in real input prices over the next price control period. A real increase in labour costs (per unit of labour) of 1.37% per annum has been assumed. A real reduction in other input costs (per unit of input) of 1.99% per annum has been assumed.

A6.104 Asset and other input price assumptions have been based on past trends as discussed above.

Conclusions on the values of X

A6.105 The values of X calculated by Ofcom for the various services controlled under the NCC and based on the assumptions described in the above paragraphs are summarised in the table below.

Table A6.10 – Values of X applying to NCC services

Service	Future controls 2005-9
Call termination	RPI – 5.00%
Call origination	RPI – 3.75%
Single transit	RPI – 11.50%
Local-tandem conveyance	Safeguard cap of RPI – 0%
Interconnection circuits (ISB)	RPI – 5.25%
Product management, policy and planning (PPP)	RPI + 0.75%
DLE FRIACO	RPI – 8.00%
Single Tandem FRIACO	RPI – 8.50%