



# Strategic Review of Telecommunications Phase 2

Critical Telecom Corporation, 2005

**Document:** Critical Telecom.Doc  
**Status:** Approved  
**Version:** Final (Version 4.1)  
**Date:** Thursday, 3<sup>rd</sup> February 2005  
**Author:** Edward Parker-Jervis

## CONTENTS

1	BACKGROUND .....	4
2	THE NEED FOR SUB LOOP SERVICE DELIVERY .....	5
3	COST COMPARISON BETWEEN A HYBRID DSL SOLUTION AND ALTERNATIVES... 8	
4	ANSWERS TO THE QUESTIONS IN THE CONSULTATION .....	9
5	REQUESTS TO OFCOM – SPECIFIC ISSUES .....	10
6	APPENDIX A - Details of the cost comparison used.....	12
7	APPENDIX B - Details of the bandwidth vs. coverage tests .....	13

## 1 BACKGROUND

Critical Telecom is a supplier of new generation Broadband Access products, an initial example of which is an Ethernet DSLAM, which is environmentally hardened to a high specification enabling its deployment in the outside plant infrastructure without the requirement of being enclosed in environmentally hardened cabinets and vaults - removing any requirement for air conditioning and humidity control. The GEmini™ Ethernet DSLAM equipment is designed to be – and is being – deployed in street furniture at a distance from Exchanges in some countries to allow higher bandwidth DSL based services to be delivered to more customers over reduced copper loop distances. The services are typically ‘triple play’ based for residential customers and Ethernet for business customers but can include anything where higher bandwidths are a requirement. Such ‘remote’ solutions are normally deployed to complement Exchange based DSLAMs for those customers located at a greater distance from the Exchange than can be served from Exchange based solutions.

The demand for higher bandwidth services, whether Exchange or Remote based is currently low in the UK but has grown significantly in the US, Canada, France, Belgium and a few other European countries – much of the change in approach taking place in the past 12 months. In the UK the level of interest has also grown and is evident in the recent work of the LLU Commercial Group and DSL Task Group - although not yet widely known by the general public. Critical Telecom believes that the demand for these services, and related technical solutions including remote DSLAMs, is likely in the UK well within the effective lifetime of the conclusions from the Strategic Review and hence believe it is important that allowances are made at this stage for the related regulatory issues that arise.

The regulatory issues that we raise below are ones that would perhaps have been better as inputs to Phase 1 of the Strategic Review. However, given the high rate of change in the market for such solutions in the past 12 months, neither we nor others were in a position to raise them in the summer of 2004 and we therefore request that Ofcom consider them now as part of Phase 2.

This response therefore continues with sections as follows:

- Section 2 showing the need for remote launched services generally;
- Section 3 a cost comparison between: i) a fibre to the premises (FTTP) solution; ii) a hybrid scenario with fibre to a modest number of remote cabinets (FTTN) and use of Remote DSLAMs over copper sub loops, and; iii) a fully Exchange based approach to LLU and service delivery; showing that a hybrid solution allows the future higher bandwidth services without the excessive cost and roadwork disruption that a fully fibre solution would entail;
- Section 4 answers to the questions 8 and 13 of the consultation;
- Section 5 requests for Ofcom to address specific issues arising;

and finally:

- Section 6 the details of our calculations on costs;
- Section 7 the details of our rate reach tests.

## 2 THE NEED FOR SUB LOOP SERVICE DELIVERY

In the UK today most customers using DSL are taking a high speed internet access service or, in the business community, using DSL to extend the geographical coverage of corporate private networks and virtual private networks. The rapid take up of such services over the past few years from a background where non-corporate internet access was at the slow speeds possible with dial-up shows the magnitude and speed of the change in the market. Yet when the UK is compared with some countries, for example the US, France, Belgium and in Asia, it is clear that, advanced as our services in the UK are when compared with a few years ago, there remains a considerable way to go. Services in these other countries are expanding with voice, video [both broadcast TV and on-demand services] and business ethernet.

The evolution of DSL in the UK is already moving in the direction of ADSL 2+ delivered services which will allow these newer services in the UK; equally some operators are investigating the use of fibre to the premises (FTTP) solutions for ever higher bandwidth services – both trends showing the accepted market trend towards services needing higher bandwidths in the access network. We have shown a few service examples below.

**Tier 1 services**  
 High Speed Internet  
 Voice [VoIP]  
 Single Channel PAL

Bandwidth:  
 Today ~ 4.5Mbps  
 2007 ~ 3.0 Mbps

**Tier 2 services**  
 High Speed Internet  
 Voice [VoIP]  
 2 basic chan. TV  
 or  
 1 HDTV channels of  
 DVD quality.  
 SME Ethernet  
 Service

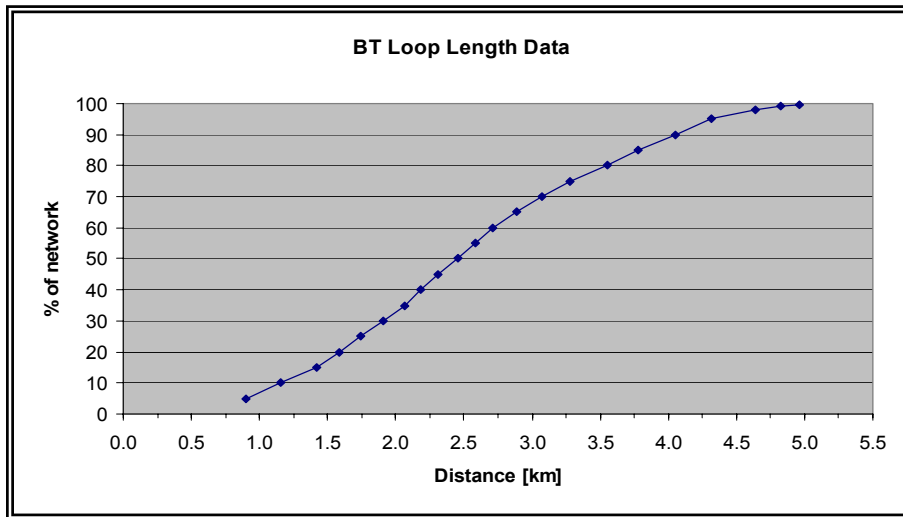
Bandwidth estimate:  
 Today ~ 8 Mbps  
 2007 ~ 5 Mbps

**Tier 3 services**  
 High Speed Internet  
 Voice [VoIP]  
 Several basic chan. TV  
 or  
 2-3 HDTV channels of  
 DVD quality.

Enterprise Ethernet  
 Service

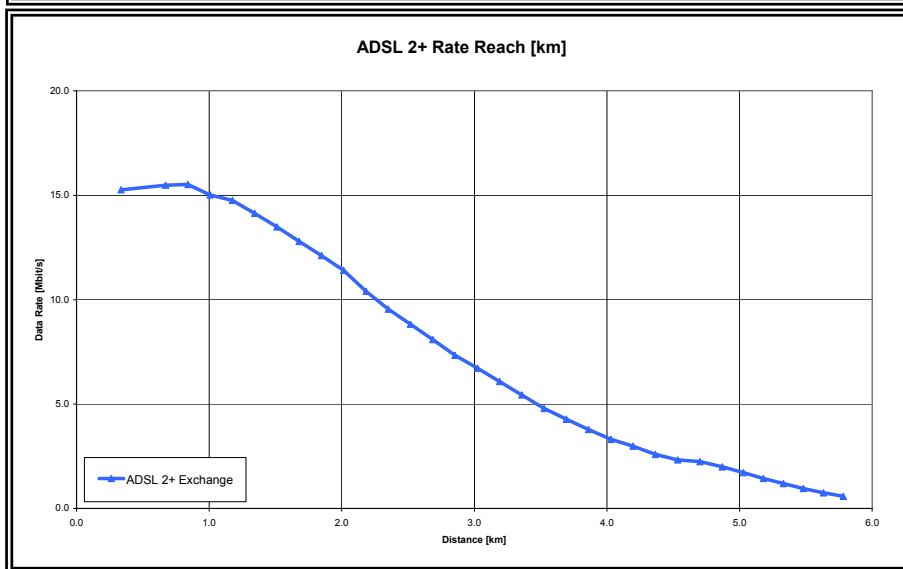
Bandwidth estimate:  
 Today 15-18 Mbps  
 2007 10-12 Mbps

In the analysis on the following pages we have assumed significant advances in video / TV codec technology and have used the lower bandwidths shown in the above examples rather than those that would be required today.



**BT Copper Loop Length Data**

*Source: BT attenuation distribution data (with calculated distance based on assumptions)*



**Bandwidth vs. Distance Profile for ADSL 2+**

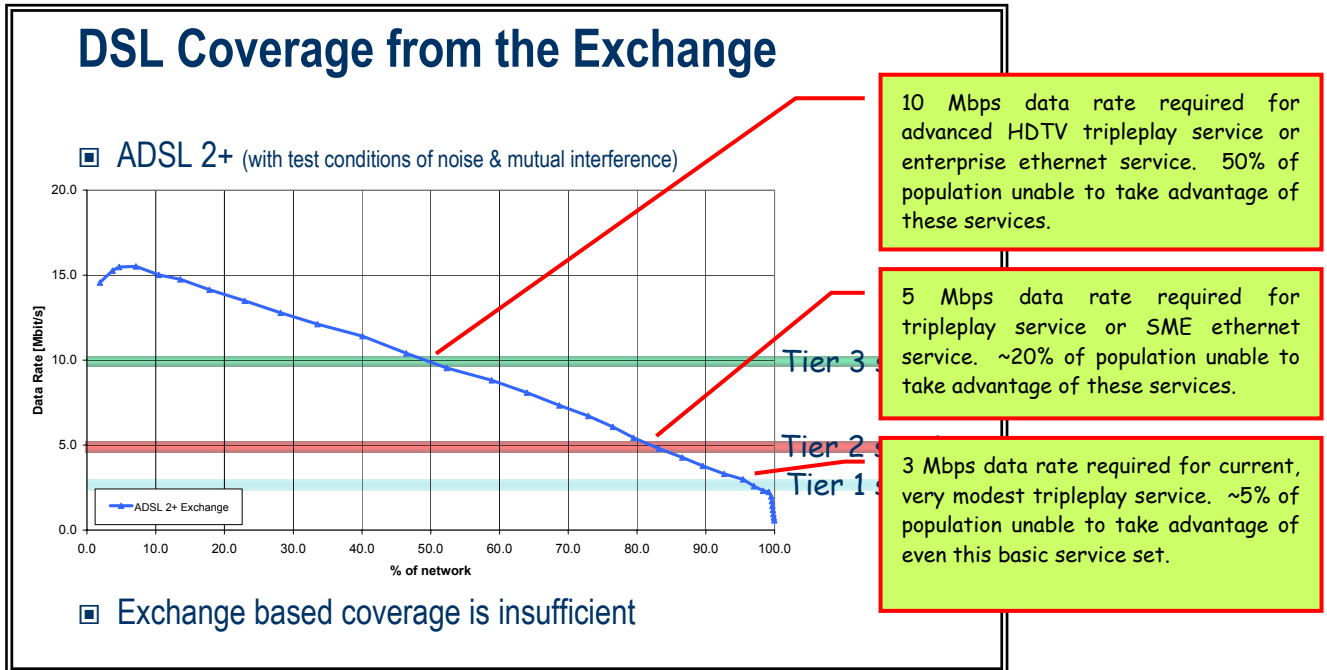
*Source: CT Rate Reach measurements with ADSL 2+*

In the graphs above we show the population versus distance profile for the UK population and a typical bandwidth vs. distance graph for ADSL 2+. Putting these together, on the following page, with an overlay of the required service bandwidths shows that the services to a large proportion of the UK population will be unable to grow using Exchange launched ADSL 2+ alone. We therefore conclude that either a fibre based solution or a remote launched DSL solution will be required in the UK for us to match demand from consumers and for our business community to remain competitive with other advanced countries.

Note that in coming to this conclusion we have also considered potential satellite and wireless solutions, which can certainly match the bandwidth requirements, but which we conclude do not offer the scope to serve large portions of the population.

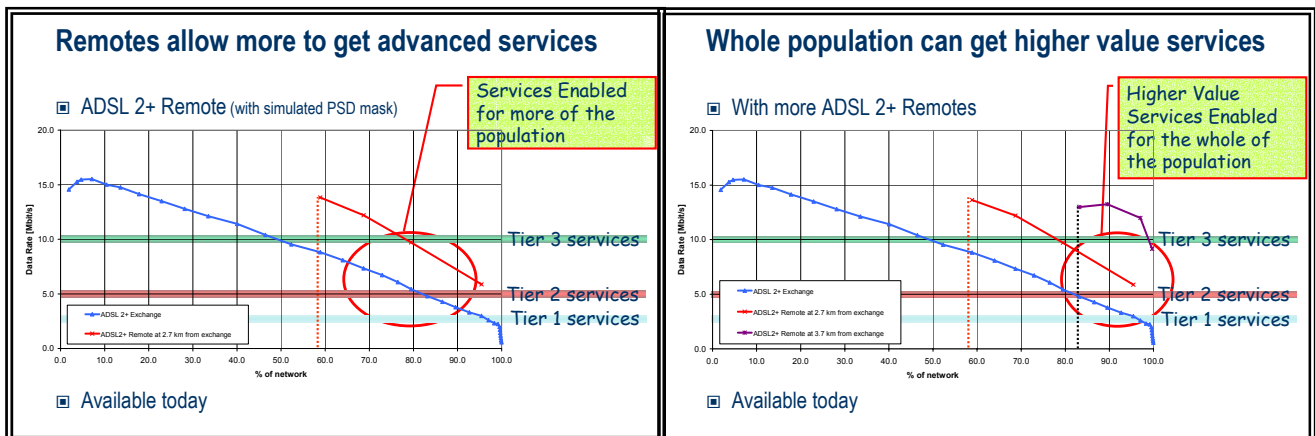
In the cost comparison (section 3 below) we show that the investment for FTTP solutions is considerably higher than for DSL solutions, while also requiring considerable disruption in the streets to get fibre to each and every street in the UK.

We therefore believe strongly that 'UK plc' needs a high bandwidth access solution based on remote launched DSL capability in order to remain competitive in the world and for its citizens to enjoy services comparable with those of other developed countries.



This graph, derived from the data in the two smaller graphs above, clearly shows that significant portions of the UK population would be unable to benefit from new, advanced services – reducing the competitiveness of 'UK plc' and significantly disadvantaging more remote and rural communities. We have allowed for advances in video coding that are expected to be in use from 2007 in the data rates used for this illustration.

The growth of demand over time can be accommodated with increasing deployment of remotes. See below.



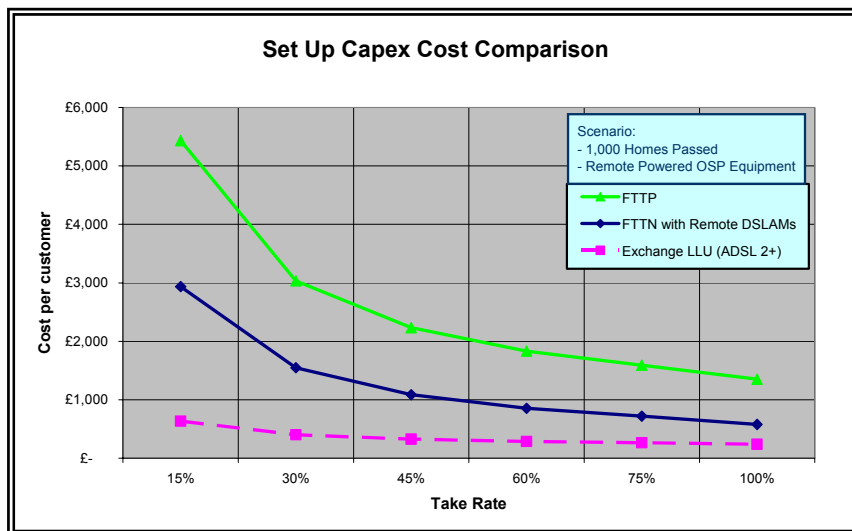
*With a remote deployed at ~2,7 km from the exchange coverage for Tier 2 services can be increased from 80% to almost 100%*

*With remotes to cover communities at different distances from the exchange full coverage of Tier 3 services is possible (2 shown for illustration)*

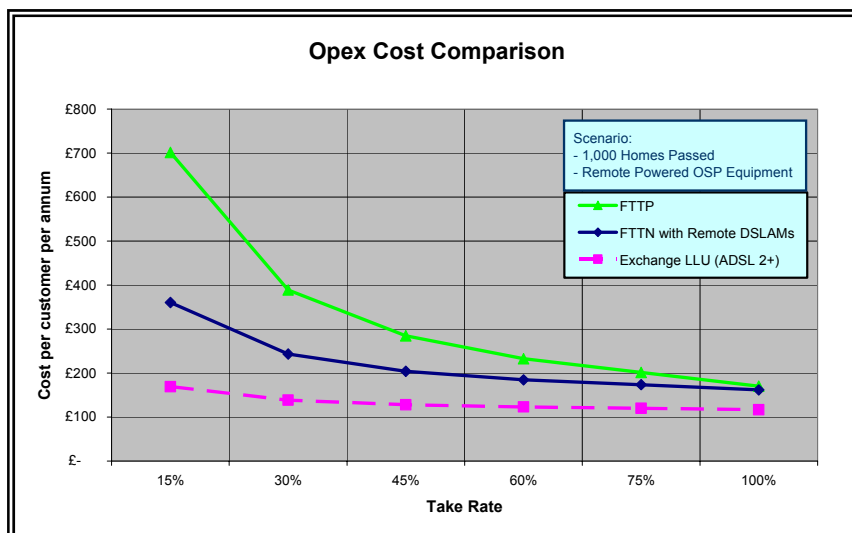
### 3 COST COMPARISON BETWEEN A HYBRID DSL SOLUTION AND ALTERNATIVES

We have analysed the costs of deployment for 3 access scenarios; i) a fibre to the premises (FTTP) solution; ii) a hybrid scenario with fibre to a modest number of remote cabinets (FTTN) and use of Remote DSLAMs over copper sub loops, and; iii) a fully Exchange based approach to LLU and service delivery;. We have indicated in the previous section the drawbacks of using scenario iii) and this is therefore shown dotted on the graph.

It is clear from this analysis that a hybrid scenario of FTTN and Remote DSLAMs offers the most cost effective, mass market solution for providing new advanced services to the residential and business customers. This solution remains, in our analysis, the most cost effective to operate on an ongoing basis for all realistic penetration rates.



It is worth noting additionally that a significant portion of the ongoing costs of the FTTN – Remote DSLAM solution derive from the application of full local loop costs to the sub loop. This is the current commercial situation but is not one that may be realistic long term as there should be considerable savings if only a portion of the current copper network were needing maintenance.



While we, as a supplier rather than an operator, have refrained from making a full business case comparison it is clear that the use of FTTN with Remote DSL is a very likely practical choice for the future...a view which we see supported by the high level of activity on the subject worldwide in the past 12 months.

## 4 ANSWERS TO THE QUESTIONS IN THE CONSULTATION

### Q8 Do you agree with Ofcom's proposed approach to current generation broadband?

Critical Telecom clearly has an interest in the success of DSL generally and would not want to detract from any effort to improve the market conditions for its use, whether by BT or competitors. Never-the-less there are areas where an overly intense focus on Exchange based DSL could detract from the long term future of DSL in general and it is in this context that we have made this submission to the Strategic Review.

We believe that Ofcom should have regard to the service availability for the whole UK population and that, as we have shown above, there is good reason to include use of DSL on sub-loops in this regard. Therefore, as a principle for Ofcom to use in its judgements for the Strategic Review and thereafter, we propose that: "Regulations, processes and technical standards decided in the short term should not be formulated in such a way that sub loop use is legally, practically or technically disadvantaged for the medium and long term."

Some specific areas which we have identified are included in the following section. These are not necessarily exhaustive and we therefore propose the principal above be also adopted by Ofcom.

### Q13 What should Ofcom's regulatory approach be to next generation access networks?

We do not see significant differences in the application of the principal proposed above in current, or 'next generation', access networks. We would however point out that the portions of the population at a greater distance from an exchange – those potentially disadvantaged without sub loop services – are not exclusively in either rural or urban areas and so any regulatory criteria based on this distinction alone is unlikely to be sufficient.

## 5 REQUESTS TO OFCOM – SPECIFIC ISSUES

There are a number of infrastructure elements involved in deploying a sub loop service that differ potentially from full loop services. We have identified these as being, i) the fibre connection between the Exchange and the street cabinets used for housing remote DSLAMs, including; ii) Exchange fibre distribution frames; iii) the street cabinets housing the remote DSLAMs themselves; iv) the existing BT wiring cabinets – which may in some cases be used for the remote DSLAMs; v) the copper sub loop from the wiring cabinet to the customer.

There are equally some elements of the current infrastructure that would not be used – at least if the voice path from the remote DSLAM were transported over a Next Generation Network; vi) the residual copper loop from the Exchange to the wiring cabinet; vii) the Exchange main distribution frame.

Of these we believe that regulation would need to be reviewed in all cases to ensure the first principle of this review is sustained as the market develops - “Promote competition at the deepest levels of infrastructure where it will be effective and sustainable”. There are 3 aspects which we see as key and where careful thought is required to ensure both fairness to operators and to ensure ‘UK plc’ has the best opportunity to compete in the global marketplace. These 3 aspects are:

- a. Regulation of fibre in the local loop;
- b. Ensuring that co-location / co-mingling of multiple operators in street furniture is enabled from the 1<sup>st</sup> operator onwards;
- c. Ensuring loop costs are fairly apportioned to the sub loop.

Dealing with each of these in turn:

### **Fibre in the local loop**

For remote DSL based services to be provided there is an inherent requirement for the operator to obtain very high speed access to the street wiring cabinets. This is provided over fibre in most current equipment and hence the terminology used – in North America - tends to talk of Fibre To The Node (FTTN) hybrid DSL architectures. In the UK the nearest equivalent is termed ‘Deep Fibre’. Ofcom should give consideration that fibre - where used as an inherent part of the copper access network – should be regulated in the same way as copper in this part of the network. The alternative would be to force all operators desiring to provide services from the street cabinet to provide their own fibre routes – the resultant route digging would hardly be a welcome proposition for local councils & residents nor likely to be a good economic solution. The caveat above “...where used as an inherent part of the copper access network...” is therefore important because the regulator would not, we believe, wish to generally involved in regulating fibre networks, whether in the access, metro or core.

### **Co-location / co-mingling in street furniture**

In planning for the deployment of sub loop services, using remote DSLAMs it seems unlikely that there is a realistic option of using BT’s current street wiring cabinets to house any DSLAMs – however small or environmentally hardened these DSLAMs may be. We therefore see that there is

a requirement to put additional street furniture in place in close proximity to the existing cabinets. If such new deployments are being planned it would be essential to ensure that they support the needs of multiple operators. We propose that Ofcom introduce a mandatory but simple consultation to be initiated by the 1st operator to gauge the level of interest of other operators on an exchange area by exchange area basis.

**Apportioning sub loop costs**


Looking at the current cost based pricing that is in use for LLU (MPF elements) we note that sub loop pricing is significantly out of date and that it was set, when last updated, at the then same levels at that of full local loops. It may be reasonable to suppose that there are some cost savings associated with a reduction in the amount / length of copper that has to be maintained in the network and on Exchange MDFs. Accordingly we believe there should be a review of the commercial aspects of sub loop use to match the apparent high level of interest in the subject at the Ofcom technical groups.

## 6 APPENDIX A - Details of the cost comparison used

As stated above we have used 3 scenarios to model the costs of deployment. These are illustrated below in summary form and the full details are included in the spreadsheet that is attached to this submission.

### Scenario 1: FTTP

- ▣ 1000 homes

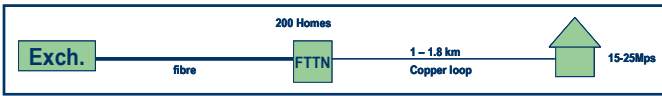


- ▣ New dig & cable £60/m. 5 splitter locations to serve 1000 homes
- ▣ 50% of Exch.-Splitter route existing [1.5km per splitter location]
- ▣ 1km plus 5m/home of new dig from splitter location
- ▣ 10% to 20% maintenance p.a. on dig / fibre
- ▣ Optical eqpt.: Exch. ~£47/line, Customer site £280 [\$500]
- ▣ Exch. costs from BT co-mingling pricing for 1 rack: MCU1

The cost comparisons (see graphs in section 3 for the summary) include equipment and other network and staff costs associated with deployment of networks. For Exchange costs we have used BT's co-mingling prices with the MCU1 option in all cases and for the copper we have used BT's Metallic Path Facility (MPF) pricing. The BT sub loop pricing used has been updated to reflect price changes in MPF pricing generally since the price list was first published but has not been changed to reflect any reduction in likely ongoing costs as a result

### Scenario 2: FTTN with Remote DSLAMs

- ▣ 1000 homes



- ▣ New dig & cable £60/m. 5 node locations to serve 1000 homes
- ▣ 50% of Exch.-Node route existing [1.5km Exch.-Node location]
- ▣ 10% maintenance p.a. on Exch.-Node dig / fibre
- ▣ Remote DSLAM costs £84/line incl. remote powering
- ▣ Basic street cabinet required: £2,000
- ▣ Exch. costs from BT co-mingling pricing for 1 rack: MCU1
- ▣ Sub Loops at same BT price as complete loops

of their shorter lengths and reduced MDF complexity.

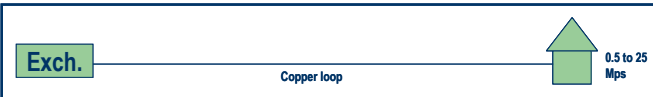
The full details are in the attached spreadsheet and Critical Telecom would be pleased to provide further explanation if desired.



Cost comparison detail - final.xls

### Scenario 3: Exch. launched DSL

- ▣ 1000 homes



- ▣ No new fibre or copper
- ▣ DSLAMs ~ £50 / line (ADSL 2+)
- ▣ Exch. costs from BT co-mingling pricing for 1 rack: MCU1
- ▣ LLU costs & opex estimated based on BT pricing
- ▣ Limited bandwidth coverage. Included for reference only

Note that there are multiple worksheets in this spreadsheet.

## 7 APPENDIX B - Details of the bandwidth vs. coverage tests

The bandwidth vs. distance and network percentage data used in this submission is derived from two principal information sources:

- a. Critical Telecom's own testing of ADSL2+ Remote DSLAM in the laboratory.
- b. BT's published information on attenuation distribution in its network;

These are further detailed below:

- a. Critical Telecom has carried out testing of its own ADSL2+ Remote DSLAMs and Broadcom chipset based ADSL2+ CPE in the laboratory. This was done using a line simulator, AWG 26 cable and with a noise and cross talker environment to match, as closely as practical, the standard BT test scenario for such types of network test. These results have been adjusted to correct for UK cable types by matching the attenuation characteristics at 300kHz. Further calculations have been carried out on the measured test results to show how the effect of Power Spectral Density (PSD) masks at the Remote DSLAMs would modify the effective bandwidth to customers served by these Remote DSLAMs. The approach used for these PSD calculations is based on that provisionally agreed by the DSL Task Group on 14<sup>th</sup> January 2005, applied mathematically. The noise and interference characteristics applied to the testing include -140 dB/Hz noise and 20 ADSL2+ cross talkers. The impact of the cross-talkers is significant, reducing the short distance effective bit rate from the theoretical maximum of ~ 25Mbps to the 15 to 16 Mbps achieved in the tests. The effect is less significant as the distance from the exchange increases and the cross talk levels approach the noise floor.
- b. BT has published the attenuation distribution for its [copper] network in the following paper, available to members of the DSL Task Group of the Ofcom NICC: PNO-DSLTM/CP38(04)2.

Note: Indicative figures for the attenuation vs. distance characteristics typically applied to BT's [copper] cable network have been used. Where this submission uses distance as a parameter it should be noted that this is based on such indicative figures and may not be entirely accurate in any one part of the actual BT network.