

ADSL Network Testing – Installation to Operation

Asymmetric Digital Subscriber Link (ADSL) networks provide a new set of challenges for operators, especially for those moving from a traditional circuit switched voice network to a virtual routed data network.

White Paper *ADSLNESTWP*

Testing the World's Digital Networks



TrendCommunications

INTRODUCTION

Asymmetric Digital Subscriber Link (ADSL) networks provide a new set of challenges for operators, especially for those moving from a traditional circuit switched voice network to a virtual routed data network.

A computer user who makes use of a telephone line to connect to the internet has been limited by the voice bandwidth constraints up until now. Current modems are limited to operate in a bandwidth up to about 3.8kHz, because of the requirement that traditional voice circuits are being used to route the connection. The introduction of ADSL breaks free of this because the data connection from the local exchange to the internet service provider (ISP) is separated from the voice traffic and routed directly over an optimised data network. The ADSL link between the customer and local exchange is not limited by the voice bandwidth any more, but only by the capabilities of the copper wires. ADSL modems are designed to make the maximum use of the connection and can offer link speeds up to 8Mbit/s depending on the technology used. Most public services limit the connection speed to perhaps 256kbit/s upstream and 1 or 2 Mbit/s downstream.

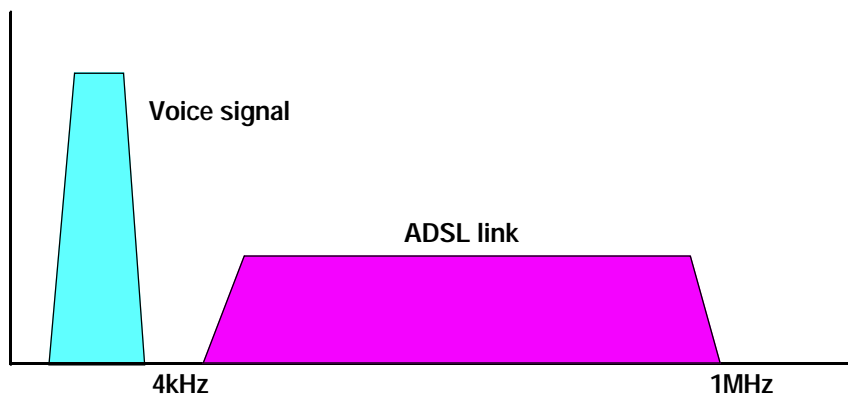
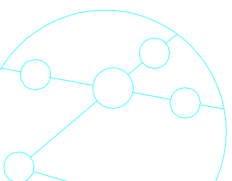


Figure 1 Signal bandwidth use on local copper wiring

Each user has an ADSL connection to the network that is managed independently from any other user. Asynchronous Transfer Mode (ATM) is used as the data connection layer over which the IP data protocol is encapsulated, and it is the ATM layer that is seen by the rest of the network as the link between user and service provider. The DSLAM is the equipment that provides the interworking between the DSL physical connection to the customer equipment and the high speed data connection into the network. Reliable operation of the DSL network is centred around proving that the DSLAM is working correctly and that the data connection between the customer and network are OK.



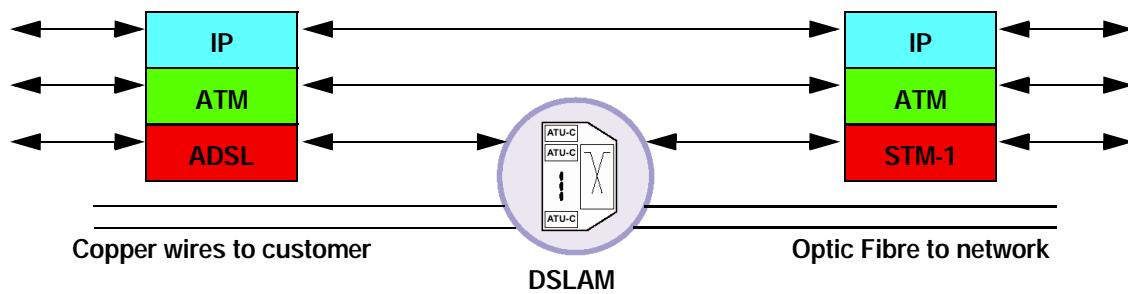
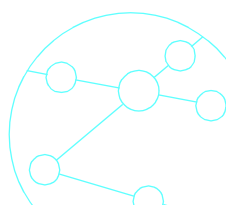


Figure 2 Protocol model diagram

DSL Network Testing

Reliable operation of the DSL network equipment can be confirmed using suitable test methods. This can be approached by testing the equipment either at a protocol layer or by testing each piece of equipment separately. Testing the protocol layer will confirm reliable operation of the data connection through the network, alternatively testing each piece of equipment separately will prove the correct installation and setup of that device. Of course, both approaches can be combined to thoroughly test all the equipment in the network, but this can be too excessive when the cost is considered.



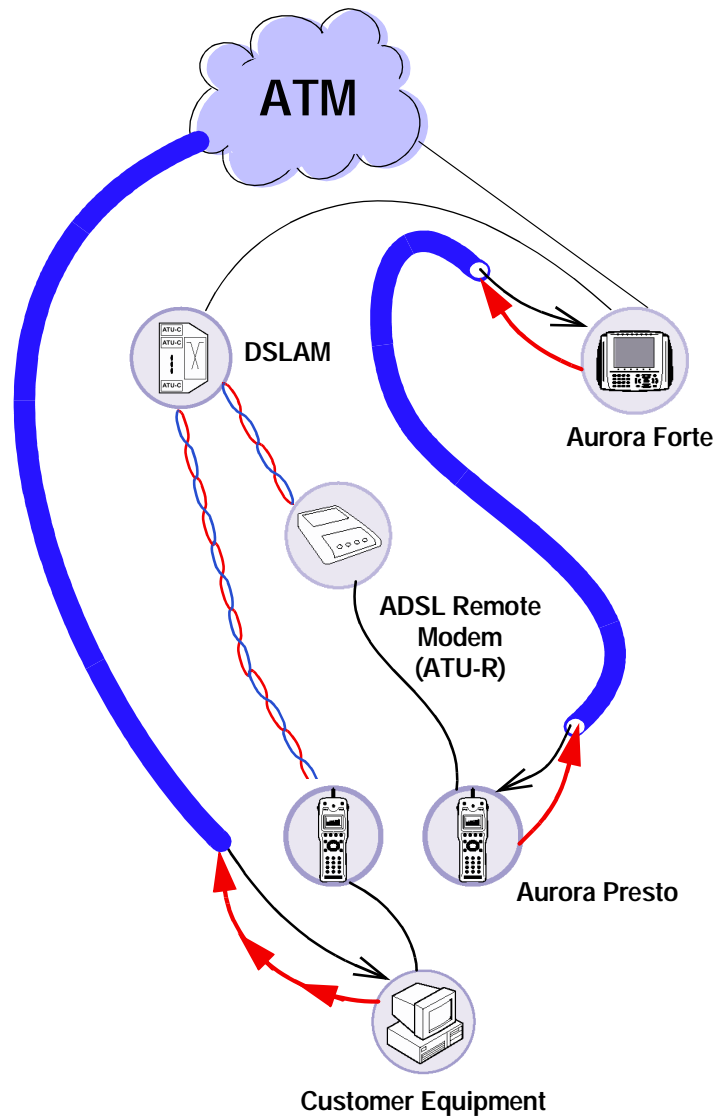


Figure 3 Testing DSLAM installation

ADSL Testing

It was described in the introduction that ADSL re-uses the existing copper link between the customer and local exchange. The technology extends the usable bandwidth from 4kHz to 1MHz, this makes it much more susceptible to faults and degradation. When the connection is made using ADSL equipment it is possible to interrogate the link in order to discover the performance that is being achieved. Testing at this level can provide information about the performance of the copper connection, the DSLAM ATU-C card and the customers ATU-R modem. A dedicated tester can address this with known reliable operation and can provide a variety of test functions:

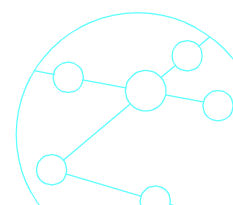
- Emulate ATU-C or ATU-R terminations. Prove that synchronisation achieved.
- Provide performance statistics, e.g. upstream/downstream data rates.
- Golden modem operation of tester to replace the ATU-R modem and measure data performance with live customer traffic.

ATM Testing

Although ADSL is providing the method of encoding data onto the copper wires, it is an ATM link that provides the communication path between the customers equipment, the backbone network and Service Provider. ATM layer testing will prove the correct setup of the network equipment, error free performance and that the data is routed to the correct destination.

Example test functions are:

- Ability to connect to a variety of network interfaces – E1, E3, DS1, DS3, ATM25, OC3/STM1.
- Telecom frame testing for network alarms and errors. This is a common area for faults and a comprehensive test is necessary.
- Emulate user by sending example traffic profiles, including loading the network to prove that required performance is being provided.
- Auto-configure up to all the received cellstreams to discover the traffic that is being sent. This can discover rogue cellstreams that are being routed incorrectly.
- ATM BERT or QoS (O.191) tests to prove connection reliability.
- IP PING test to prove traffic routing at the IP layer.
- Monitor in-service traffic to provide traffic policing for verifying or enforcing traffic contracts on the user data before it can cause congestion within the network.



Trend Product Range

Trend Communications provides a range of network testing equipment for use during Installation and Maintenance of ADSL and ATM networks.

Aurora Presto is a sophisticated ADSL physical layer test that includes ATM layer test capabilities.

Aurora Forte is an advanced ATM tester operating from E1/DS1 up to OC3/STM1 data rates.

These two products can be used individually or together to comprehensively test the performance and reliability of a DSL network.

Testing Examples

DSLAM Installation

Problem: how do you prove that the DSLAM is installed and configured properly?

Solution: Aurora Presto to Aurora Forte circuit testing.

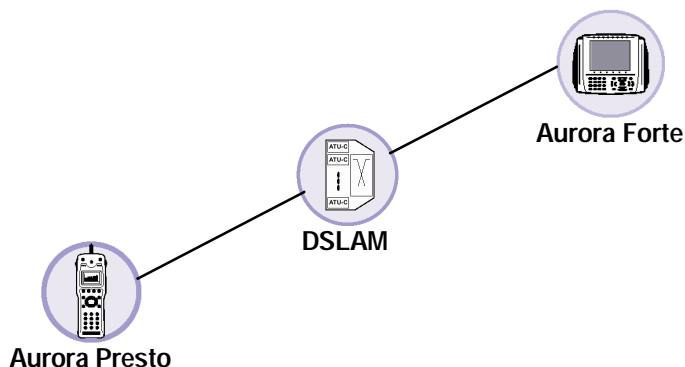


Figure 4 Testing the DSLAM installation and configuration

1. Aurora Presto can prove that ATU-C cards are functioning OK by synchronising to the DSL signal. This can be repeated for each individual card as it is installed, or brought into service.
2. Aurora Forte connected to network interface of DSLAM will prove that network port is working OK. Physical layer operation is proven by alarm monitoring on Aurora Forte.
3. Prove correct DSLAM operation by sending BERT data on ATM VCCs from Aurora Presto through each ATU-C card. Aurora Forte can be configured in Through Mode and this will loop all received data from every VCC (up to 256 circuits) back to Aurora Presto. Aurora Presto will receive back the sent data and this proves that VCC routing through the DSLAM is OK.

ATU-R Installation

Problem: how do you prove the customer's connection and ATU-R modem is operating OK?

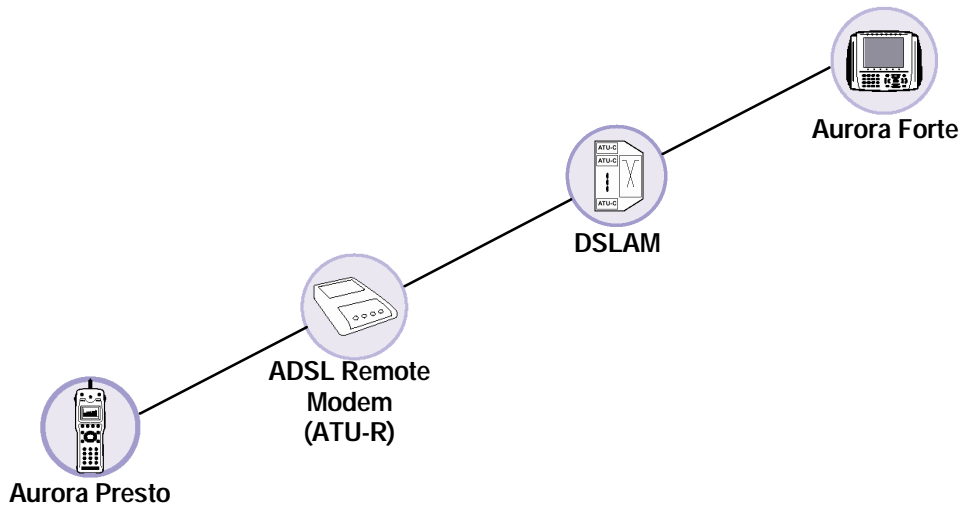
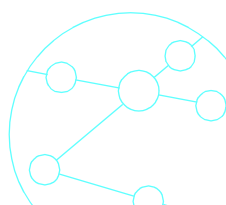


Figure 5 Testing the customer's connection and ATU-R modem

1. Aurora Forte in End Point Emulation mode will work with Aurora Presto to make an Asymmetric Bit Error Rate Test. Aurora Presto and Aurora Forte are each configured to do the ATM BERT, but with different data rates. They each send the data to the other tester and measure the cell rate and any data errors. This proves that required data rate is available in up-stream and down-stream directions, and that connection is error free.
2. Aurora Presto can make an IP-Ping test to Aurora Forte, or vice-versa, to prove packet routing over the ADSL/ATM connection.



DSLAM Monitoring

Problem: how do you prove that DSLAM is operating OK when in service?

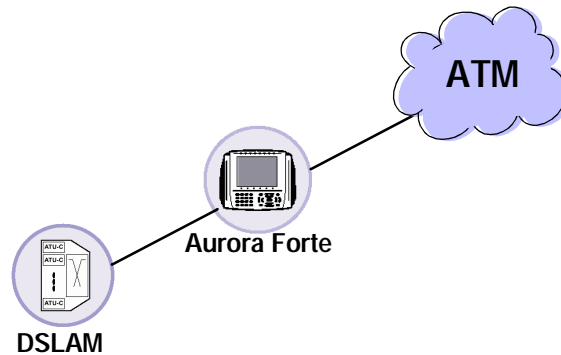


Figure 6 Monitoring the DSLAM

1. Aurora Forte can be installed in-line between the DSLAM and the live ATM network. Aurora Forte will monitor all active VCCs telling you the actual data rate and check for alarm conditions.
2. Traffic Policing can be used from Aurora Forte to restrict data flow from heavy users if required. This can help when traffic congestion is causing problems.



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