

## **An Overview**

The MLT is a cost effective tool for xDSL prequalification, essential tool for loop trouble diagnosis and post-installation service validation.

Adjacent systems within a cable binder that transmit or receive data in the same frequency range can create cross talk interference or noise. Cross talk can be caused by insufficient cable shielding, excessively large disparity between signal levels in adjacent circuits, unbalanced lines, and overloaded carrier systems.

The general quality of the outside plant can be determined with the standard tip-to-ring (T-R), tip-to-ground (T-G), and ring-to-ground (R-G) parameters including DC voltage and resistance along with AC voltage, resistance, and capacitance. The longitudinal balance measurements of the loop are important to ensure of efficient delivery of voice and/or xDSL services. An unbalanced circuit caused by unbalanced longitudinal currents or power-line harmonics can cause cross talk noise, causing bit errors that result in slower xDSL transmissions.

The electrical data of a loop pair could be obtained through a MLT test. Then the above conditions or status of the loop pair could be derived through detailed intelligent cross analysis of the MLT data.

## **OSS Interface**

From the perspective of testing and monitoring, OSS systems can be broadly classified as supporting two types of circuits, designed (e.g., special services, T1 circuits) and switched circuits. For services targeted at residential users, the predominance of pairs in service will be supporting switched services. In today's environment, switched services are tested with existing POTS TOS, such as Lucent Technologies' mechanized loop testing (MLT), using NTT access at the switch or the bypass pair of a DLC. The NTT access is addressed using the telephone number while the bypass pair is controlled by the pair gain test controller (PGTC).

For designed circuits (special services), a work order record design (WORD) document is created in TIRKS that will list all of the equipment in the circuit. The TIRKS WORD documents should contain the necessary test access information prior to the circuit being provisioned.

## **Metallic Loop Test (MLT) Data**

MLT is an umbrella testing capability utilized by local telephone companies for over 25 years. It is a system that performs a variety of tests and provides results indicative of the performance of the local loop being tested, from the switch to the customer premises. Components of the MLT testing capability are listed below:

- Direct Current (DC) Tests

- ❑ Alternating Current (AC) Tests
- ❑ Standard POTS Termination
- ❑ Nonstandard Terminations (2 party and Key Systems)
- ❑ Foreign Electromotive Force (FEMF) Tests
- ❑ Line in Use Tests
- ❑ Opens Test
- ❑ Length of Loop Measurement (only on single party POTS of good working pair - TOK)
- ❑ Ringer Test
- ❑ ROH Test
- ❑ Soak Test
- ❑ Thermistor Test
- ❑ This test checks for the presence of a thermistor on the line. Thermistors are present in some PBXs and Key Telephone Systems.
- ❑ Longitudinal Balance Test (measures how likely it is that the line is noisy)
- ❑ Line Circuit Test
- ❑ Draw and Break Dial Tone Test
- ❑ Intercept Test

The MLT example shown below reflects data returned by a FULL MLT test. A “FULL” MLT test performs an extensive series of tests (see list above) automatically to provide a comprehensive report on the loop tested.

```

TV EC 111 PRTR          REQ BY          CB 602          06-28-96 0822P

TN 999 932 0000        SW: ESS-5D OE: 04015-521-40
REQ                   L#    CMT          CA          CO: TESTABLE DLCS
                   TEMP (F)        PR          OVER          OSP:
                   FULLX          TERM: SINGLE PARTY
VER 0: TEST OK

CRAFT: DC SIGNATURE    MLT: DC SIGNATURE    AC SIGNATURE
KOHMS VOLTS            KOHMS VOLTS          KOHMS          RNGRS
3500          T-R        3500          T-R        18          YES T-R
3500          0 T-G        3500          0 T-G        381         T-G
3500          0 R-G        3500          0 R-G        382         R-G

CENTRAL OFFICE        BALANCE
LINE CKT OK          CAP 99 %          LOOP LENGTH = 27500 FT
DIAL TONE OK        LONG 65 DB
01

```

Listed below are components of a LOOP Test and a high level definition of the test component.

- ❑ PEMF: identifies excess AC or DC voltage on the loop

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- ❑ DC series: identifies a short, ground, or cross to working pair; verifies special terminations (e.g., PBXs), verifies other line equipment (e.g., range extenders).
- ❑ ROH: distinguishes between a short and receiver – off hook condition
- ❑ AC signature: verifies POTS terminations, identifies special terminations (e.g., key systems); identifies an open fault.
- ❑ Longitudinal Balance: shows a line’s susceptibility to noise
- ❑ Thermistor: checks for the presence of a thermistor on the line.
- ❑ Opens: measures the distance from the open to the central office and from the open to the termination, and the capacitive balance.
- ❑ Soak: measures DC resistance over time to see if the ground fault is “swinging” or can be “dried out”.
- ❑ Length of Loop: measures the length of loop from the central office to the termination.
- ❑ Line in Use: determines if the line is busy, busy with speech or has permanent signal.
- ❑ Intercept: identifies non-working telephone number and suspended service.

As you can see from the MLT screen example and the diversity of the test results listed above there is a great deal of reasonably technical data that must be analyzed to provide a comprehensive and accurate assessment of the loop. It is critical to note that these test results simply remain numbers until intelligent analysis is applied. In the manual environment that most telephone companies operate in today this required intelligence resides in the training and experience of Repair Clerks, Maintenance Administrators and/or Testers. Consequently trouble administration and loop pre-qualification remain very much a function of the quality of the people analyzing the test results and influenced by their individual knowledge, workload, productivity pressure and a variety of non-technical issues.

Through their ICAS (Intelligent Customer Advocate System) suite of products, CyberObject provides proven system capability that utilizes knowledge based, rules based analysis to provide not only raw test results, but also the ability to instantly analyze diverse data and deliver a consistent, optimal, “Next Steps” path to your business.

## MLT Data Analysis

Interpreting MLT data requires a person to possess extensive electrical/telephony knowledge and experience. CyberObject’s iSmart module of the Telecom iSuite is a distributed and rule-based expert system that is capable of performing **comprehensive** analysis over MLT data as well as cross analysis with other data sources (other OSS such as LMOS, WFA, ACIS, LFACS, PREDICTOR, ... etc. and customers themselves). The iSmart module will give you accurate trouble diagnosis with correct “prescription” (action items) and pin point you the Expected Trouble Location (ETL).

The **iSmart** derives *hundreds* of different status codes about the loop pair by performing *comprehensive* analysis on the MLT data. The correctness of a status code would be

confirmed by a cross analysis over multiple set of electrical properties. The following is the partial list of status codes through analyzing the FULL MLT test data by the **iSmart** module.

TOK	Loop Pair Tested OK
OPEN_IN	Loop Pair Tested Open
AC_FEMF	Foreign AC on Loop Pair
MDF_TEST	Require Main Distribute Frame Test
RESISTIVE_FAULT	Loop Pair Light Shorted
PROVE_IN_OUT	Tip Grounded
LIGHT_GROUND	Ring Light Grounded
MEDIUM_GROUND	Ring Medium Grounded
MODERATE_GROUND	Tip Moderate Grounded
HARD_GROUND	Ring Hard Grounded
SHORT_IN_CO	Loop Pair Short in Central Office
HARD_SHORT	Loop Pair Hard Short
MEDIUM_SHORT	Loop Pair Medium Short
HARD_BATTERY	Excessive DC on Tip
LIGHT_BATTERY	Light DC On Tip
BATTERY_IN_CO	DC On Ring of CO Side
HARD_BATTERY	Excessive DC On Ring
OPEN_CA	Open Out Cable
OPEN_OUT_NEAR_DROP	Open Near Drop
DB_BALANCE	DB Unbalance

## Telecom iSuite

With over ten year experiences working around RBOC's OSS, CyberObject has developed a field proven product - **Telecom iSuite** that provides seamless, boundless and integrated data access to an array of OSSs of various RBOCs through Internet, Intranet and Wireless. Beyond data access, CyberObject has gone one step further, equipped with **iSmart** module in its **Telecom iSuite** to apply business intelligence over data at various data flow points within an enterprise and/or cross the enterprises.

**iSuite** is able to route your MLT request (data access request) to the right TOS (OSS) of the right RBOC transparently. This enables you to define your own business processes based your own business needs for loop prequalification, trouble administration, installation & repair across the board without defining and/or following special processes dictated by the RBOCs.

**iSuite** enables

- ❑ sales partners or organizations to perform MLT for loop prequalification via Internet/Intranet without *geographical and/or enterprise* boundary,
- ❑ customer service representative (CSR) to *intelligently* perform *consistent and accurate* trouble diagnosis while the customer is still on line,

- technician to perform real time MLT using PDA, Handheld computer, Smart Phone via wire/wireless for quick field problem resolution (it provides technician expert level of step-by-step instructions for installation and repair based on the real situation and MLT data),
- customer to diagnose his/her own trouble (*customer-self service*) via Internet and IVR.

With its superior modular design, **iSuite** can be easily extended to communicate with new systems. If you have been given a proprietary API to access MLT, it would be very easy and quick to code an **iProxy** module using this API. Then accessing this MLT is readily available to all the clients.

## Appendix I: *i*Suite Architecture & Modules

From the front end, **iHub** provides a secured universal access interface to users “anywhere” with different media interfaces.

- **Web/Internet (*iWeb*)**

**iWeb** provides client access via Internet that enables “customer self-service”. There is no need for plug-in, ActiveX or any other types of “Active Components”. And it is available to any platforms (Mac, Windows, Unix, Be, ... etc.) with a Web Browser supporting JavaScript 2.0 and above. This will reach more than 95% of the Internet users.

- **Voice (*iVoice*)**

**iVoice** integrates IVR (Interactive Voice Response) with the **iHub**, **iProxy**, and **iSmart** to bring the same level of sophistication as the **iWeb** over voice access. Through the **iSmart** module, **iVoice** provides dynamic and intelligent voice interaction vs. static scripted interaction.

- **Wireless (*iWAP*)**

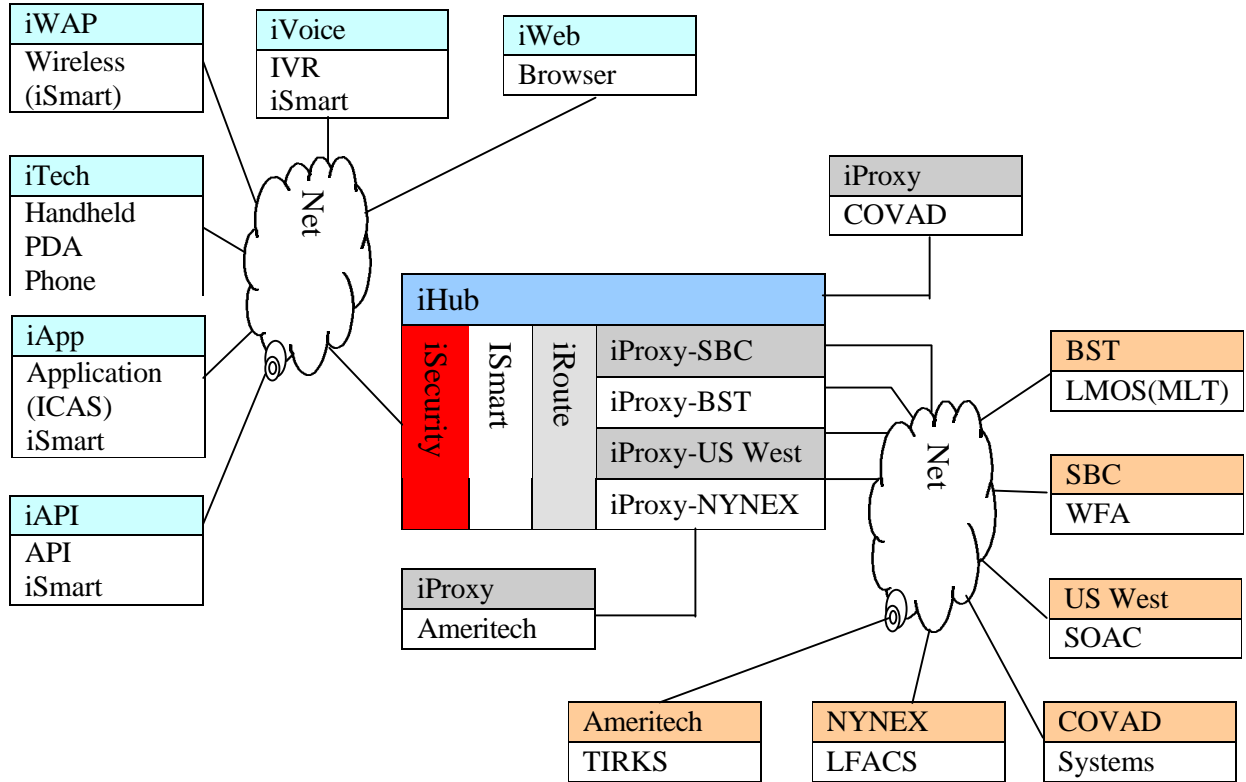
**iWAP** provides handheld computers, PDAs, Smart Phones with wireless access to **iHub** services in WAP (Wireless Application Protocol).

- **Technician (*iTech*)**

Integrated with **iWAP** and **iSmart**, **iTech** does not only provide field technician with data access but also provide step-by-step expert help in field trouble shootings and resolutions. For example, equipped with a portable device such as PDA, Handheld Computer, Smart Phone, ...etc., a technician will be able to initiate a MLT, receive the MLT data as well as the step-by-step instructions on installing a new service or fixing a trouble while he is driving towards the field location. With the GPS/GIS integration, **iHub** shall be able to track the activities of all technicians in real time.

- **Application Programming Interface (*iAPI*).**

**iAPI** provides application programming interface to enable existing or new application to access **iHub** services.



From the backend, **iHub** seamlessly integrates internal (within a enterprise) and external (outside of the enterprise) systems to provide transparent intelligent data access and analysis.

**iHub** is completely modularized and component based in design. **iHub** provides a set of *soft slots*, you can plug in an array of **iProxy** modules into these slots to securely access any form of data anywhere in any communication protocol. The best part is that all you need to do is to program an **iProxy** module and this could be done in just a few dozen lines of code in many cases.

The **iProxy** module could be plugged in as a separate process or a thread within the **iHub** process.

CyberObject has an array of **iProxy** modules readily available to access various OSS of RBOCs.

Several **iHubs** can be inter-connected to provide superior scalability, reliability, security and flexibility.



The **iSmart** module is a light weighted distributed expert system engine. **iSmart** could be embedded into any of our **iSuite** modules such as **iHub**, **iProxy**, **iWeb**, **iVoice**, **iWAP**, ... etc. to provide seamless intelligent data access/analysis. **iSmart** enables you to build your business intelligence, logic, procedures and processes into a knowledge base without technical programming.

## Appendix II: Inventory of Telecom *iProxy* Modules

The following is the list of the ***iProxy*** modules available today from CyberObject. With these *iProxy* modules, it is ready to access OSS systems of almost all RBOCs. Most importantly, these ***iProxy*** module does not only provide you with data but also capable of perform data analysis with the *iSmart* module embedded. You may not have expertise to interpret the proprietary OSS data, but *iProxy* does.

The ***iProxy*** modules could be plugged into ***iHub*** as a separate process or as a thread running in *iHub*.

<i>iProxy</i> Name	<b><i>iProxy</i> Description</b>
<i>iProxy</i> -MLT	Access to LMOS MLT of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -DMLT	Access to LMOS DMLT of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -LFACS	Access to Loop Facility information of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -TE	Access to LMOS Trouble Entry of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -TR	Access to LMOS Trouble Report of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -RST	Access to LMOS RST of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -DATH	Access to LMOS Abbreviated Trouble History of RBOC and <i>iSmart</i> analysis
<i>iProxy</i> -DLETH	Access to LMOS Long/Detailed Trouble History of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -DMLR	Access to LMOS Display Maintenance Line Record of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -RTE	Access to LMOS building Route (RTE) of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -WFA/DO	Access to WFA Dispatch Out of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -WFA/DI	Access to WFA Dispatch In of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -WFA/C	Access to WFA/C of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -ACIS	Access to customer information of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -ASON	Access to Order information of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -COSMOS	Access to COSMOS of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -PREDICTOR	Access to PREDICTOR of RBOC with <i>iSmart</i> analysis
<i>iProxy</i> -SWITCH	Access to SWITCH of RBOC
<i>iProxy</i> -TIRKS	Access to TIRKS of RBOC
<i>iProxy</i> -SOAC	Access to SOAC of RBOC
<i>iProxy</i> -Oracle	Access to Oracle Database
<i>iProxy</i> -SQL Server	Access to Microsoft SQL Server Database
<i>iProxy</i> -Informix	Access to Informix Database
<i>iProxy</i> -Sybase	Access to Sybase Database

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