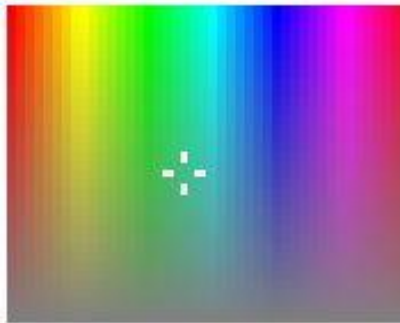
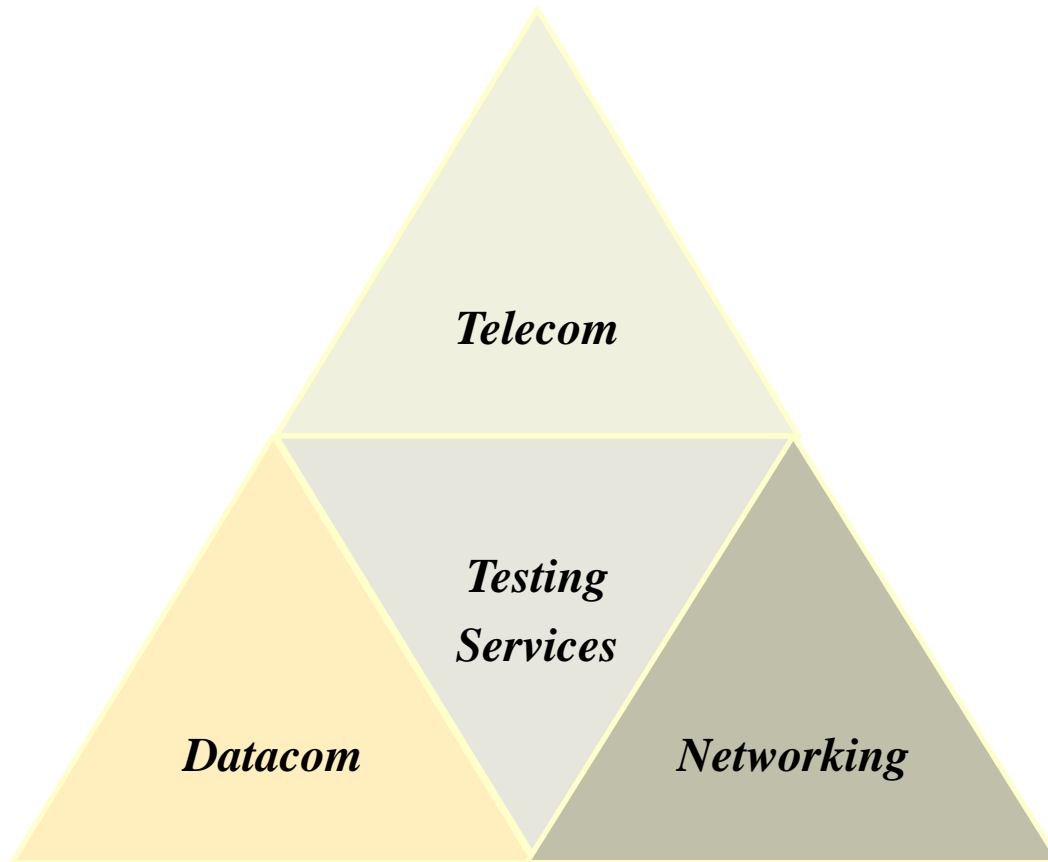




Spectrum of Testing Expertise



Testing Services Spectrum



Testing Services

Categories

- ***Product Testing***

Focusing upon Implemented Protocols, Features and Functionality in a Product

- ***Production Testing***

Focusing upon Manufacturing and Assembly of PCB's / Hardware on Production Floor

Expertise - Testing Technology Domains

- ***Networking Domain***

L2/ L3 Switches and Routers, High capacity 10GbE modular switch for ISP, Standalone Ethernet switches for Enterprise segment, Access point routers

- ***Telecom Domain***

Pseudowire Transmission, Wireless IP Backhaul (Abis Interface), GSM Network Testing, SIGTRAN Network Testing

- ***Wireless Domain***

WLAN Testing (802.11 a/b/g/n), Access Point Routers for Indoor and Outdoor Applications, Point to Point / Point to Multi Point Radios Testing

- ***VoIP Domain***

SIP, SDP, H.323, IPTV, IP Phones, Enterprise IP PBX

- ***Production Test Automation***

ICT, JTAG, Boundary Scan Testing, Test Fixtures

Product Testing

- *Functional Testing – Black box / White box Product Specification Testing*
- *Protocol Testing – Testing for standard protocol compliance*
- *System Integration Testing – Complete System Testing*
- *Soak and Load Testing*
- *Acceptance Testing*
- *Interoperability Testing*
- *Regression Testing – Automated testing using PERL/ TCL or proprietary scripting language*
- *Environmental Testing – Testing for temperature, Moisture / Humidity and Vibration*

Testing Processes (Product Testing)

- *Define Test Methodologies*
- *Test Specifications and Test Plans creation*
- *Architecture Planning, Design and Development of Test Automation Framework*
- *Development of Test Cases and Test scripts*
- *Automation of Test Suites for different protocols/functionality*
- *Test equipments, tools selection and evaluation*
- *Integration with existing Test Cases, Tools and Equipments*

Protocols Expertise (Product Testing)

- *UDP, TCP/IP, ARP, RARP, FDDI, VLAN*
- *DHCP, ICMP, IGMP, IPV4, IPV6, PIM, RIP, RSVP*
- *IGRP, EIGRP, OSPF, ISIS, CIDR, BGP, EGP*
- *PPP, L2TP, LACP, STP, RSTP, MSTP, MPLS, VPLS, LLDP*
- *ATM, SONET, SDH, PWE, VRRP, MSDP, VPN, LDAP, NetBIOS*
- *SNMP, SMTP, RTSP, TACACS, RADIUS*
- *H.323, RTP, RTCP, SIP, SDP, SIP, SGCP*

Production Testing

- *Test Fixtures Design and Development*
- *Design and Development of In Circuit Tester's for complex Analog, Digital and RF products*
- *JTAG BSCAN Test Development and Integration to Test Fixtures*
- *In System Programming*
- *In System Calibration*
- *Design , Development and Integration of Functional Tests*
- *Test Equipments / Instruments Integration*
- *Test Software Design, Development and Integration*
- *Configuration and Programming of standard In Circuit Testers from Agilent, Teradyne*

Test Fixtures Design and Development (Production Testing)

- *Mechanical Design*

- * *Table Based*

- * *Box Based*

- * *With/Without Pneumatic Control*

- * *Test Nodes access from Top / Bottom side*

- * *Cassette Design*

- *Test Probes and Test Receptacle selection*

Design and Development of In Circuit Tester (Production Testing)

- *Design and Development of 'Bed of Nails' hardware to access :-*
 - * *DUT Test Points, Via's, Through Hole Pins, SMD Pins*
- *Review of DUT Schematic, Layout and CAD data from ICT perspective*
- *Feedback / Suggestion for Test Pads location and Test Coverage improvement*
- *Test Equipments like DMM, Freq. Counter, Signal Generator, Spectrum Analyzer, Electronic Load, JTAG controller , Data Acquisition Unit etc. integration using :*
 - * *GPIB, RS232, USB, Ethernet*

Design and Development of In Circuit Tester (Production Testing) ...contd.

Support for Tests like :-

- *Opens and Shorts*

To detect any open and short due to solder bridging, missing component, faulty component, wrong orientation

- *Unpowered Analog*

Constant AC/DC Voltage Test

- To test Resistors/Capacitors/Inductor

Constant Current Test

- To test Diodes / LEDs / Transistor PN junctions

Design and Development of In Circuit Tester (Production Testing) ...contd.

Support for Tests like :-

- *Unpowered Vectorless*

*To test/locate device pins which are not soldered properly esp.
for SMT connectors*

- *Controlled Power Up*

To test/monitor in rush current for DUT

- *Powered Digital / Analog / Mixed Signal*

*- To test electrical characteristics of a Device / Component via I/V
based Signature Analysis*

- Freq. Measurements, Voltage Measurement

JTAG BSCAN Testing (Production Testing)

- *Design and Development of JTAG BSCAN Tests*
 - * *Infrastructure Test*
 - * *Pull-Up / Pull-Down Test*
 - * *Interconnection Test*
 - * *Cluster Test for Non-BSCAN devices*

- *Board to Board BSCAN Test*
 - * *To test functionally different DUT's simultaneously*

- *Integration with ICT and Test Fixture*
 - * *BSCAN Main Chain Access*
 - * *BSCAN Local Chain(s) Access*

In System Programming (Production Testing)

- *JTAG BSCAN based In System Programming of Device(s) like :-*
 - * *EEPROM, CPLD, FLASH Memory*

- *ICT based In System Programming for Device(s) like :-*
 - * *Microcontrollers*

Functional Testing (Production Testing)

- *CLI based Diagnostics Tests :*
 - * *Boot Loader Based*
 - * *Operating System Based*

- *JTAG Based Cluster Test*

Test Software Design, Development and Integration (Production Testing)

■ *Control Layer*

- * *ATE / ICT / Test Fixture Initialization*
- * *Control Test Execution Flow*
- * *Control and interface of various Equipments / Instruments*
- * *Determine Test PASS/FAIL status*

■ *User/Operator Interface Layer*

- * *GUI / CLI based user interface for configuring and running tests*
- * *Provision for scanning DUT Barcode using Barcode reader*

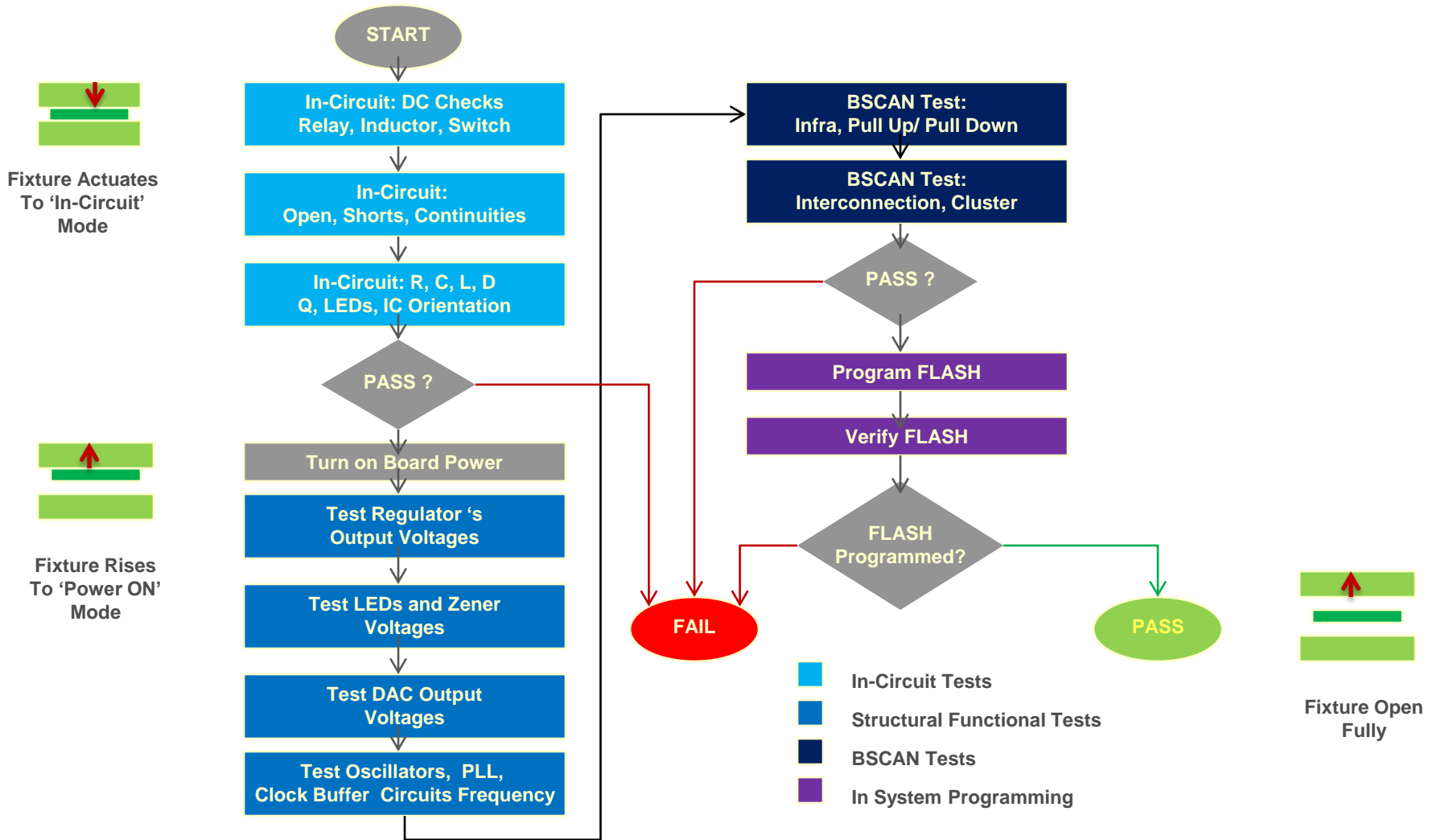
■ *Database Layer*

- * *Access to dump/fetch Test Results to/from Database*

■ *Report Generation Layer*

- * *Test Reports generation in various formats :-
CSV, XLS, Text, PDF*

Typical Test Execution Flow (Production Testing)



Test Equipments/Tools Expertise

Test Equipments

- *Networking - IXIA, JDSU Testpoint, IP Netsim, EXFO/Nethawk*
- *Telecom - GL Communication, PUMA E1 Analyzer, ANT20*
- *Wireless - Agilent WLAN Tester, Lite Point,
Rohde & Schwarz Spectrum Analyzer*
- *Hardware Testing - Mixed Signal Oscilloscope, Logic Analyzer,
Signal Generator*
- *Production Testing - JTAG Technologies, GOPEL*

Tools

- *Wireshark/Ethereal, Nethawk M5/EAST, Commview*
- *LabVIEW, MATLAB*
- *Selenium, HP Quick Test*

Test Environment

Programming Languages

- *PERL, TCL, C, JAVA, HTML, Proprietary Scripting Language*

Platforms

- *Linux, Windows*

Database

- *MySQL, SQL*

Web Interface

- *Apache, CGI-PERL, PHP, HTML*



Testing Projects Past Experience

Projects Overview

- *High Capacity 10 GbE Modular Switch*
 - *Management Blade*
 - *I/O Blade*
 - *Networking Blade*
- *Standalone Layer 2 Ethernet Switches*
- *Wi-Fi Access Points*
- *IP Backhaul Testing*
- *Megapixel IP Camera*

High Capacity 10 GbE Modular Switch

- ***Highlights***

- *Aggregating residential triple-play services, business services and wireless backhaul services on a common platform*
- *Prioritized VPN, Internet access, Voice-over-IP (VoIP) and other applications over E-Line or multi-point E-LAN connections to business subscribers*
- *High-bandwidth wireless backhaul with the scale to support bandwidth and roaming for thousands of simultaneous customer connections*

- ***Processor***

- *MIPS Multicore - Management Blade*
- *BCM1125 and BCM1250 - I/O Blade*
- *PowerQUICC MPC8548 - Networking Blade*

- ***Testing Performed***

- *System Integration, Functional, Protocol, Load/Soak and Regression Testing*
- *Tools Used: IXIA, Wireshark*
- *Protocols Verified: VLAN, STP, LACP, RSTP, OSPF, BGP*
- *Test Automation Suites Development using PERL, TCL and IXIA*

Standalone Layer2 Ethernet Switches

- ***Highlights***
 - *Intelligent and manageable Layer-2 Switches designed for enterprises requiring gigabit Ethernet to the port/user/desktop*
 - *Unique Combination of Copper & Fiber*
 - *Power over Ethernet on All Ports*
- ***Processor***
 - *RTL8389M*
- ***Testing Performed***
 - *System Integration, Functional, Protocol, Load/Soak, Regression and Environmental Testing*
 - *Testing Tool Used: IXIA*
 - *Protocols Verified: QoS, ACL, LACP, SNMP, IGMP Snooping, VLAN, STP, RSTP, MSTP*
 - *Test Automation Suites Development using PERL, TCL and IXIA*

Wi-Fi Access Points

- ***Highlights***

- ***IEEE 802.11 b/g/n(2.4 GHz) Outdoor Access Point***
- ***Multi-Modes: AP, MSSID, Repeater, Client***
- ***Works on MIMO technology***
- ***Frame Aggregation (A-MPDU, A-MSDU)***

- ***Processor***

- ***Atheros AR7161 / AR 9220***

- ***Testing Performed***

- ***System Integration, Functional, Protocol, Load/Soak, Regression and Environmental Testing***
- ***Testing Tool Used: WLAN Tester, JDSU Testpoint, Commview, Wireshark***
- ***Protocols Verified: IEEE 802.11 b/g/n (2.4 Ghz), 802.11i, 802.11X, SNMP***

IP Backhaul Testing

- *Highlights*

- *Converts E1 to Ethernet and Vice versa. So this can replace the GSM E1 back haul Connectivity between the BTS and BSC to Ethernet based backhaul.*
- *Aggregating residential triple-play services, business services and wireless backhaul services on a common platform*
- *Transport of E1, T1, E3, T3 or STS-1 TDM Signals Over Packet Networks*
- *Full Support for All Mapping Methods: SAToP, CESoPSN, TDMoIP, HDLC, Unstructured, Structured, Structured with CAS, AAL1, AAL2*

- *Processor*

- *MPC8313*

- *Testing Performed*

- *System Integration, Functional, Protocol, Load/Soak, Regression and Environmental Testing*
- *Tool Used: PUMA, JDSU Testpoint, ANT20*
- *Protocols/ Standards Verified: E1, RLC/ MAC, Pseudowire Transmission, 802.3, 802.11*
- *Test Automation Suites Development using PERL, JDSU Testpoint and PUMA*

Megapixel IP Camera

- ***Highlights***

- *Surveillance options like motion detection, Privacy masking ,enabling alarms, face detection etc.*
- *Actions on alarms can be message to through mail, SMS, uploading video to FTP or playing sound.*

- ***Processor***

- *DM365*

- ***Testing Performed***

- *System Integration, Functional, Load/ Soak, Environmental and Regression Testing*
- *Testing Tool Used: IP NetSim*
- *Protocols Verified: IPv4, IPv6, HTTP, HTTPS, FTP, SMTP, Bonjour, UPnP, SNMP V1/V2/V3, DNS, DynDNS, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP*

Case Study #1

Test Automation of Modular Gigabit Switch's having L2 and L3 functionality

Case Study #1 ...contd.

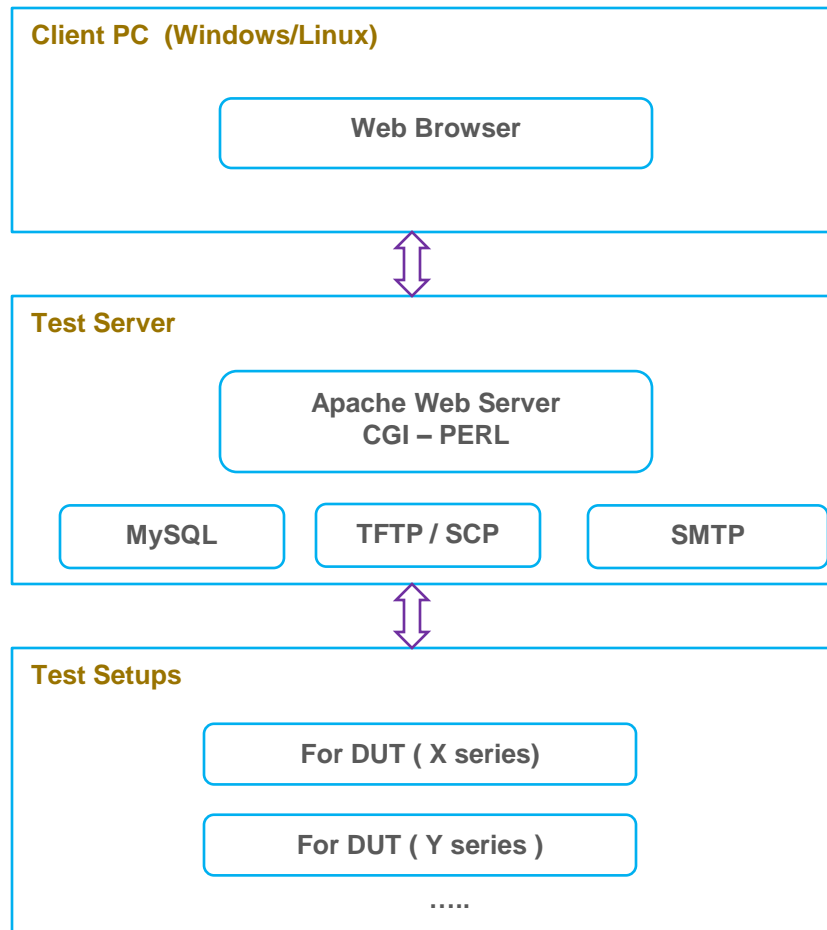
Test Automation of Modular Gigabit Switch's having L2 and L3 functionality

- *Test Automation Framework creation using :-
PERL, TCL, IXIA, SMTP, SNMP, SSH2,
MySQL, Apache Webserver, CGI-PERL*
- *Test Plans creation*
- *~2K Test Cases development*
- *Test Suites development for different protocols/features :-
VLAN, STP, RSTP, RIP, OSPF, BGP, PIM,
ESRP, VRRP, RADIUS, TACACS, LDAP, LACP*
- *Regression testing support on remote test setups both from
Command Line and Web Interface*
- *Support to run different categories of test cases :-
Functional, Conformance, Performance/Stress,
CLI, System Level, Interoperability*
- *Provision to auto upgrade new firmware to DUT before actual testing*
- *Auto Email notification for test results*

Case Study #1 ...contd.

Test Automation of Modular Gigabit Switch's having L2 and L3 functionality

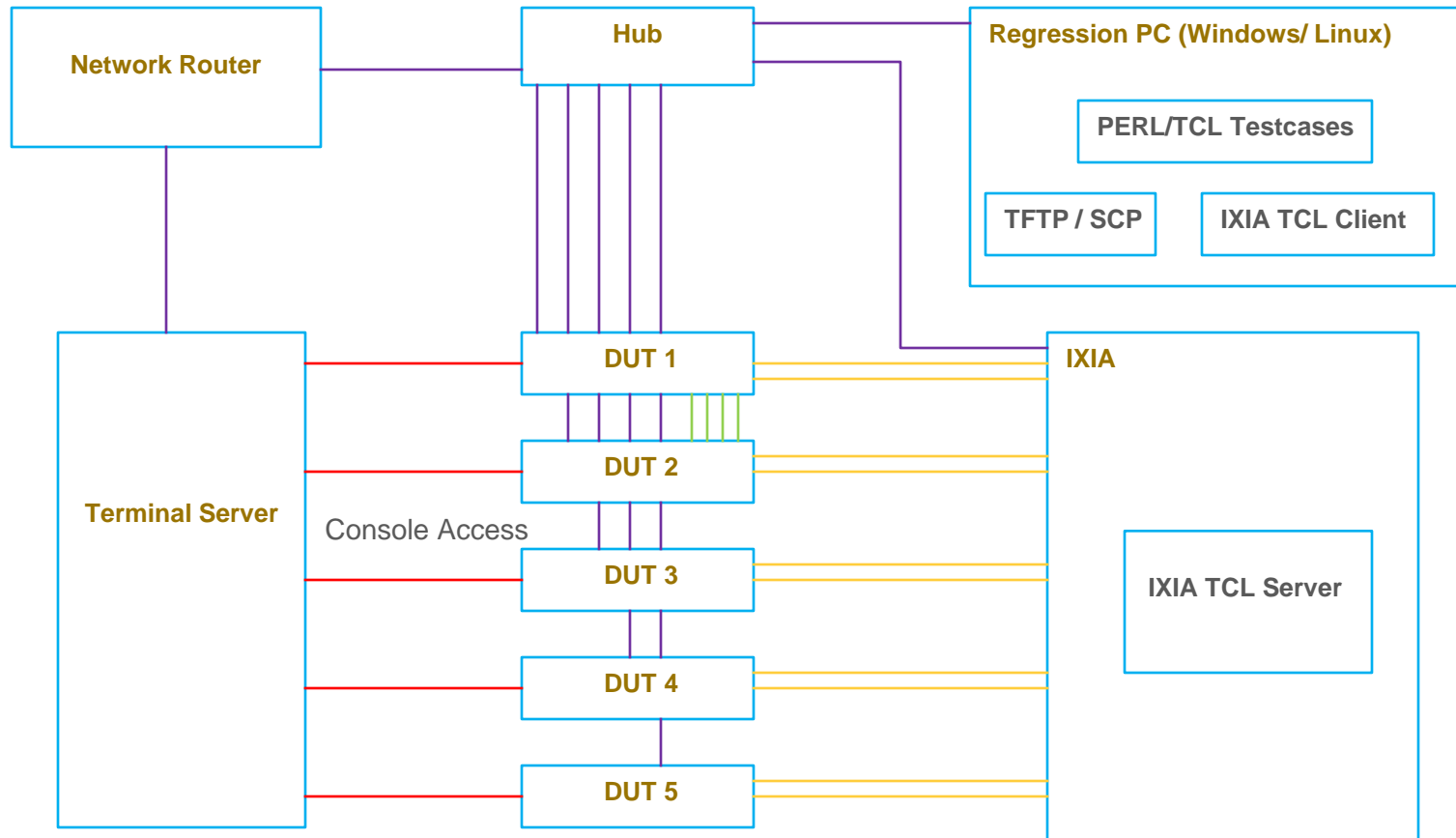
Automation Framework



Case Study #1 ...contd.

Test Automation of Modular Gigabit Switch's having L2 and L3 functionality

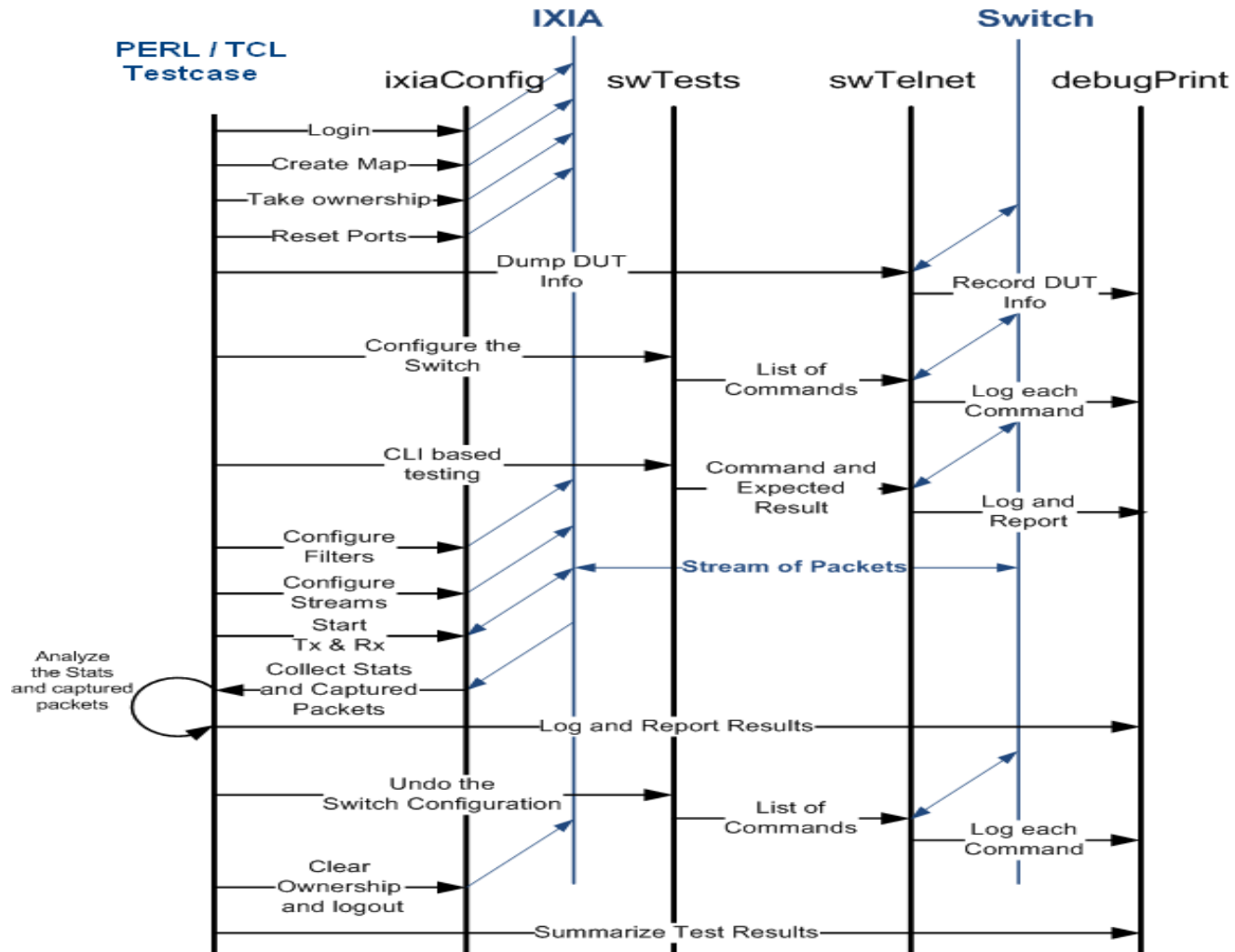
Typical Test Setup for DUT



Case Study #1 ...contd.

Test Automation of Modular Gigabit Switch's having L2 and L3 functionality

Typical Test Case Execution Flow



Case Study #2

Production Test Automation for BTS and BSC Modules

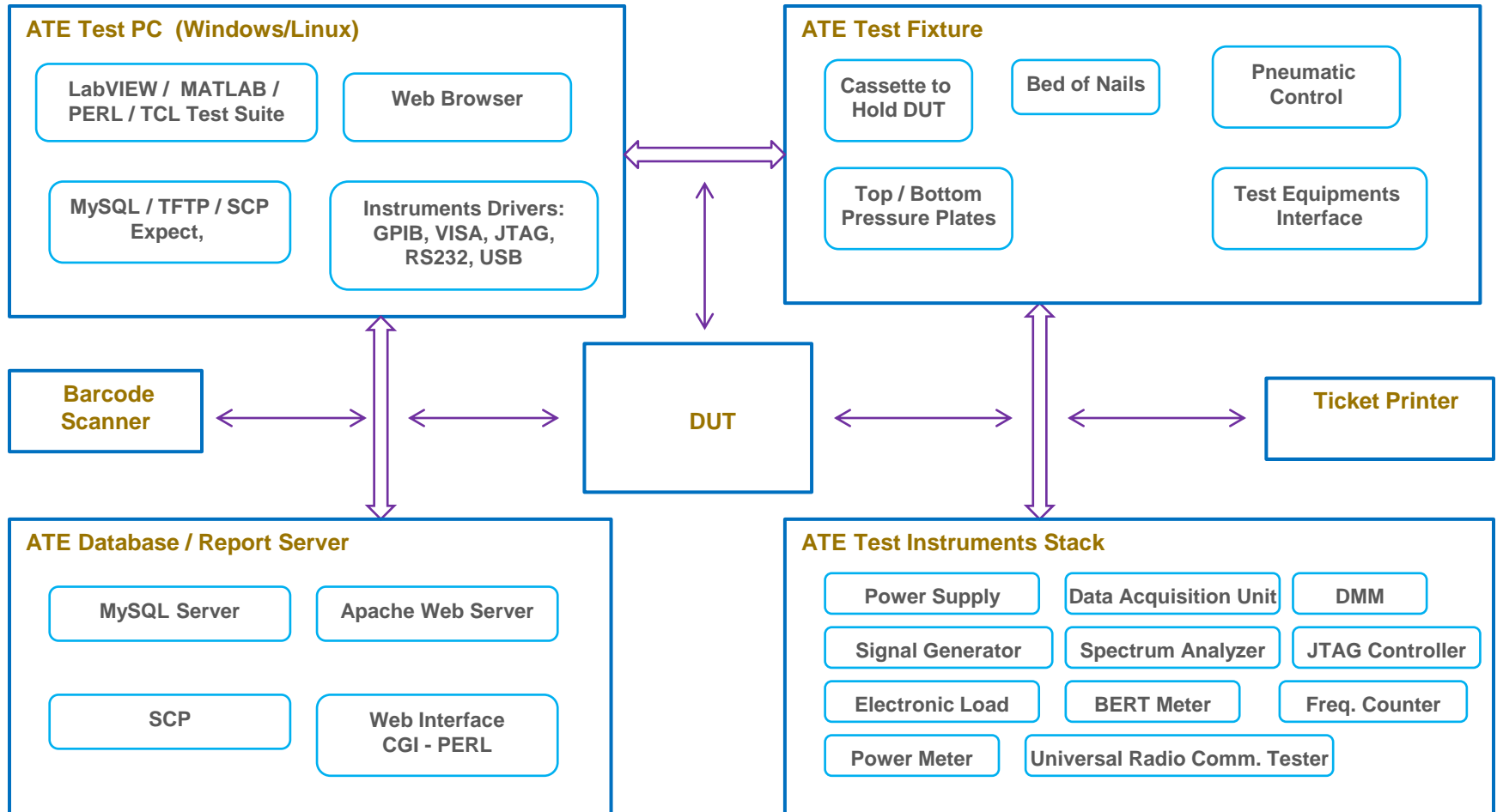
Case Study #2 ...contd.

Production Test Automation for BTS and BSC Modules

- **Complete ATE Design and Development for various Modules**
- **Generic Test Fixtures Design and Development :-**
 - * **Box Based, Table Based , With/Without Pneumatic control**
- **Generic In Circuit Testers Design and Development :-**
 - * **Analog, Digital, Mixed Signal and RF sections**
- **JTAG BSCAN Test Development and Integration**
- **In System Programming support :-**
 - * **Firmware Loading**
 - * **Loading of Persistent information like MAC Address, Serial Number, Default Configuration, Calibrated Values for Power Index's**
- **Test Equipments Integration :-**
 - * **DMM, Freq. Counter, Electronic Load, Signal Generator, Spectrum Analyzer, E1 BERT Meter, Power Supply**
 - * **Interfaces: GPIB, RS232, USB, Ethernet, USB to GPIB converter**
- **ATE integration with Barcode Scanner and Ticket Printer**
- **Test Automation Framework creation using :-**
 - * **LabVIEW, MATLAB, PERL, TCL, NI VISA, TFTP, SCP, MySQL, Apache Webserver, CGI-PERL**

Case Study #2 ...contd.

Production Test Automation for BTS and BSC Modules Automation Framework





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TECHNOLOGIES

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for
all dimensions of
Embedded Product Development
life cycle*

*“**From Concept to Customer**”*