Automated Test Equipments

Elias Nicolas
National Instruments - Arabia
Tests and Measurements

Interactive Measurements
- Benchtop
- Non-programmed

Automated Measurements
- Data Acq, Instr I/O
- Programmed

Automated Tests
- Series of meas/tests
- Sequencing (Pass/Fail)

Design

Validation

Manufacturing/Repair

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Electronics Manufacturing Challenges

- Increasing number of products to test
- Escalating device functionality
- Converging technologies (RF, audio, video, digital…)
- Maximizing test throughput
Mil/Aero Systems Test Challenges

- Integration of hundreds of subsystems
- Test coverage and quality a necessity
- Escalating device sophistication
- Converging technologies (RF, audio, video, digital…)
- Long product life-cycles
- Legacy TPS reusability
Top Automated Test Challenges

- Flexibility
  - User-defined system deployable to wide variety of applications

- Performance
  - Measurement Quality, high test throughput

- Lower cost
  - Initial System, Maintenance, Reuse/Flexibility

- Reduced Size
  - Small form factor, less instruments for same measurements

- Longevity and upgradeable
  - Industry standard that enables use of technology upgrades
Components of an Automated Test System

- Test Management Software
- Test Development Software
- Drivers, Services, Hardware Abstraction

- Fixturing/
  Mass Interconnects

- PC or Embedded Controller
- PXI Chassis
- Switching
- Signal Generation
- RF Measurements
- Bus Interfaces (GPIB/LXI/Serial)
PXI Platform

- Rugged, industrial
- Quad-Core CPU
- PXI Express Bus
- Timing, Triggering, and Synchronization
- FPGA, DAQ, Modular Instruments

Windows or Real-Time OS
NI LabVIEW, LabWindows™/CVI, NI TestStand
Application Specific Modules (GPS, RF)
APIs (NI VISA, IVI, NI-DMM)
NI PXIe-1085 High Performance Chassis

Features

• All hybrid PXI Express Chassis
  • 16 hybrid slots, 1 system timing slot

• High Performance
  • Up to 8 GB/s per-slot dedicated bandwidth (x8 gen2)
  • Up to 12 GB/s system bandwidth

• 925 W total power for 0 to 55 °C, no power derating

• 38.25 W cooling capability per slot
  • Hot swappable, individually replaceable fans
  • 4U Tall, 5U rack install space
Over 1200 PXI Products

Data Acquisition and Control
- Multifunction I/O
- Reconfigurable I/O
- Digital I/O
- Analog Input/Output
- Machine Vision
- Motion Control
- Counter/Timers
- Signal Conditioning
- Temperature Meter
- Synchro/Resolver
- LVDT / RVDT
- Digital Event Detector

Modular Instrumentation
- Digital Waveform Generator
- Digital Waveform Analyzers
- Digital Multimeters
- Oscilloscopes / Digitizers
- Signal Generators
- Switching
- RF Signal Generators
- RF Signal Analyzers
- RF Power Meter
- Frequency Counter
- Programmable Power Supply
- Current Source/Measure Module
- Pulse Generator
- Leakage Test Module

Bus Interfaces
- USB, Firewire, SCSI
- Serial, Ethernet
- CAN, DeviceNET
- Serial RS-232/RS-485
- MXI-2 VXI/VME
- LIN
- JTAG
- MIL-STD 1553
- ARINC 429
- FlexRay

Processor Boards
- Multifunction I/O
- IF Transceiver
- Open Interface
- Serial I/O
- High Speed ADC
- Image Acquisition
- Bus Interfaces

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Typical Automated Test System

a. Chassis with up to 17 different instruments (Digital I/O, DMM, SMU, Digitizer, ARB, etc …)
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b. Cables to interface instruments
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b. Cables to interface instruments

c. Test fixture to interface from instruments to device under test (DUT)
Platform For Software Defined Test

All in one PXI Platform!

VOR Tester
COM Tester
Spectrum Analysis
GPS Tester
Power Meter
ADS-B Tester

Multi-Protocol UUT

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Benefit from FPGA Technology
Components of an Automated Test System

**SOFTWARE**
- NI TestStand
  - Test Management, Test Deployment
- NI LabVIEW
- LabWindows™/CVI
- Other Software
  - Measurement Studio, Visual Studio.NET™, ...

**HARDWARE**
- PC or Embedded Controller
- PXI Chassis
- Switching
- Signal Generation
- RF Measurements
- Bus Interfaces (GPIB/LXI/Serial)

**Fixturing/Mass Interconnects**
Role of Test Management Software

Test System Components:

Operations repeated for each device tested:

- Operator interfaces
- User management
- Unit Under Test (UUT) tracking
- Test flow control
- Archiving results
- Test reports

Operations different for each device tested:

- Calibration
- Configuring instruments
- Data acquisition
- Measurements
- Analyzing results
- Test strategies
Sequential vs. Parallel vs. Auto-scheduled Execution

**Sequential**
- Simple 1 UUT test fixture
- Extremely simple code structure
- 12 time blocks for 4 units

**Parallel Testing**
- Multiple UUTs in parallel
- Switching allows hardware to be shared
- ~30–60% decrease in testing time

**Auto-Schedule**
- Same HW setup as above
- TestStand auto-schedules resources
- ~15–20% further decrease in testing time
NI TestStand – Test Management Software

- Graphical development environment
- Automate tests written in any language
- Multithreaded sequence execution
- ASCII, HTML/Web, XML, and ATML report generation
- Access, Oracle, SQL Server database connectivity
NI TestStand – Test Management Software

- Full Featured and Simple User Interfaces are provided in NI LabVIEW, NI LabWindows™/CVI, C#, C++, and VB.NET
- TestStand Deployment Utility builds a simple installer with necessary dependencies
NI TestStand System Architecture

Operator Interface

Sequence Editor

NI TestStand API

NI TestStand Engine

Module Adapters

LabVIEW
LabWindows™/CVI
.NET
C/C++
ActiveX
HTBasic
ATLAS,
Python, Java,
and So On
Other

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Summary

• NI delivers an effective combination of software and hardware that reduces the cost of test for an organization
  • We are NOT a “me too” approach
  • We understand the business challenges faced by automated test organizations
  • We deliver innovation in modular hardware
  • We deliver increased productivity in software
  • We think through and solve the challenges of making hardware and software work together
Thank you!!

Questions?