



INSTRUMENTATIE VIRTUALA

CURS 10





Controlul instrumentelor

Objective

3

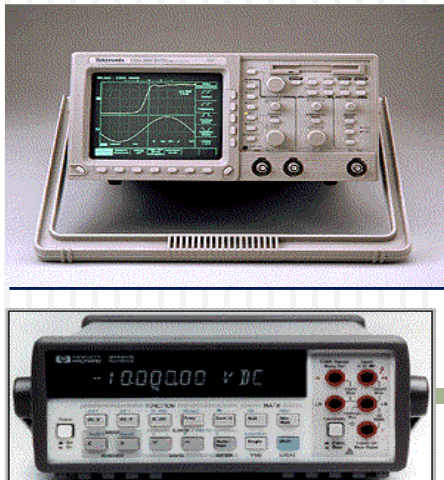
- Instrument Assistant
- Porturi de comunicare: GPIB, Serial, USB
- Arhitectura (VISA): Virtual Instrument Software Architecture
- Driveri de instrument (rețea de driveri NI)
- Funcțiile driverelor de instrument

Introducere in controlul instrumentelor

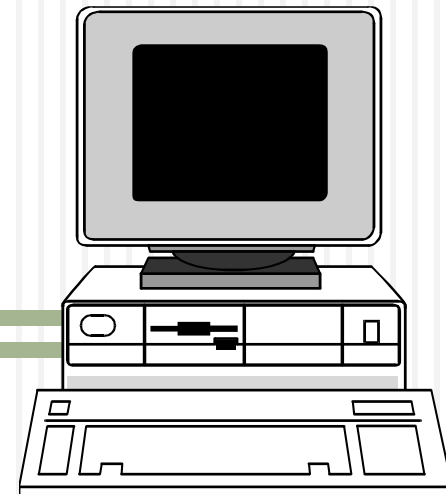
4

- Puteti controla orice instrument daca cunoasteti:
 - Tipul de conector la instrument
 - Tipul de cablu necesar
 - Protocolul de comunicare folosit
- Tipul de conector la instrument
- Proprietatile electrice implicate
- Sa aveti driverul soft corespunzator

Instruments



Computer



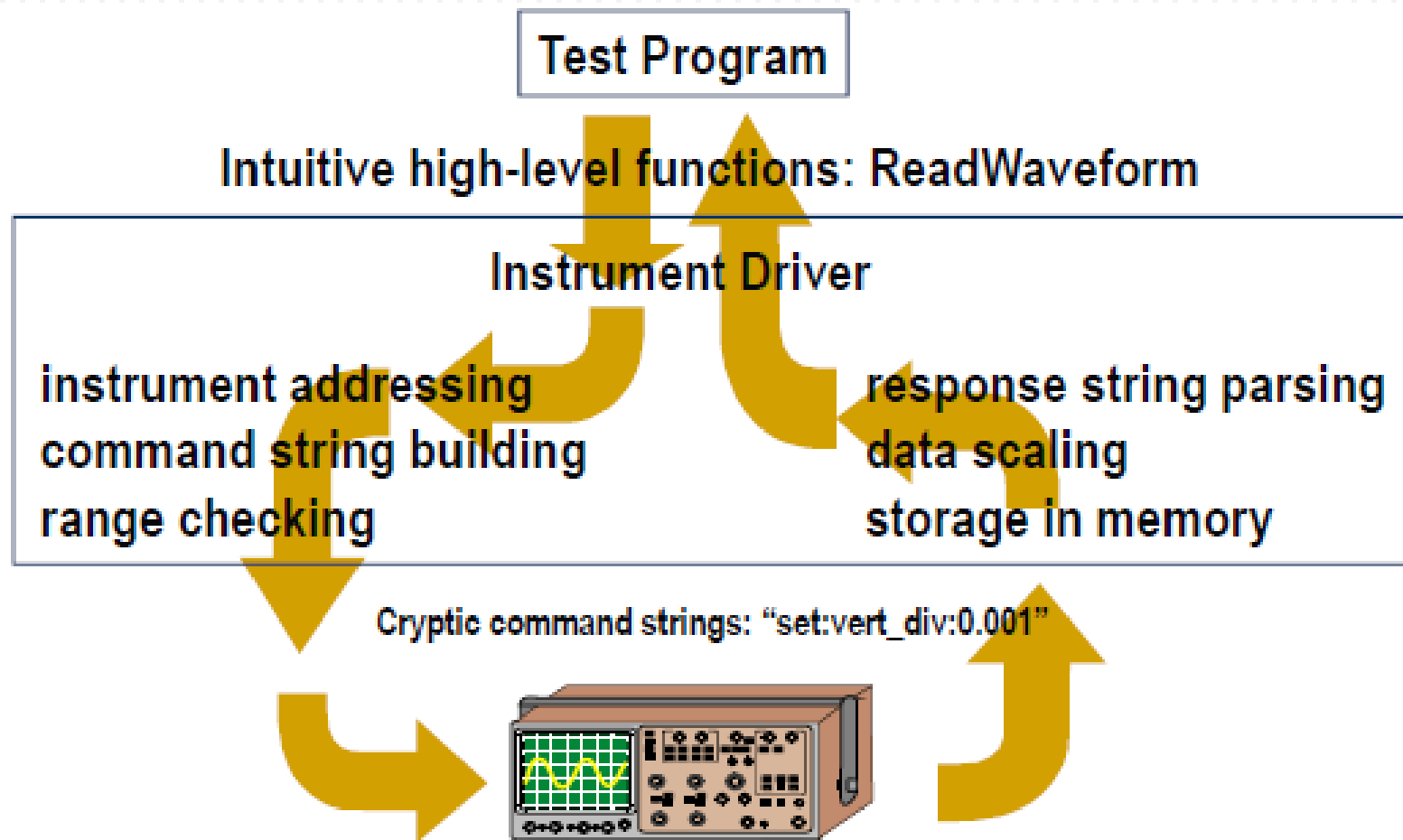
Introducere in controlul instrumentelor

5

- “An **Instrument Driver**, in the context of test and measurement (T&M) application development, is a set of software routines that simplifies remote instrument control. Instrument Drivers are specified by the IVI Foundation^[1] and define an I/O abstraction layer using Virtual Instrument Software Architecture (VISA).”

Sursa https://en.wikipedia.org/wiki/Instrument_Driver

Utilizarea drivere-lor de instrument

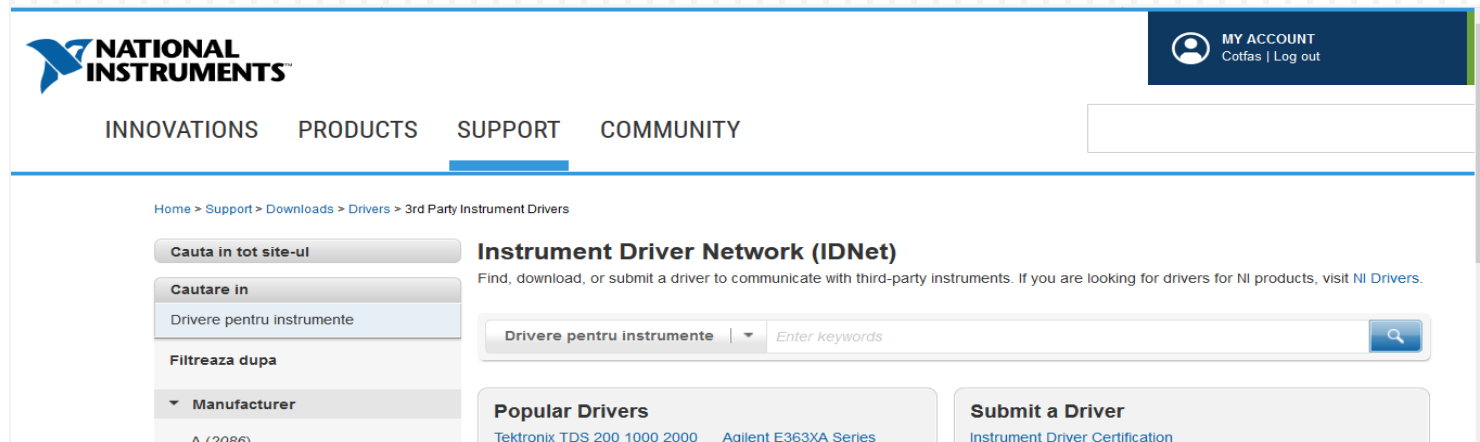


Gasirea drivere-lor de instrument

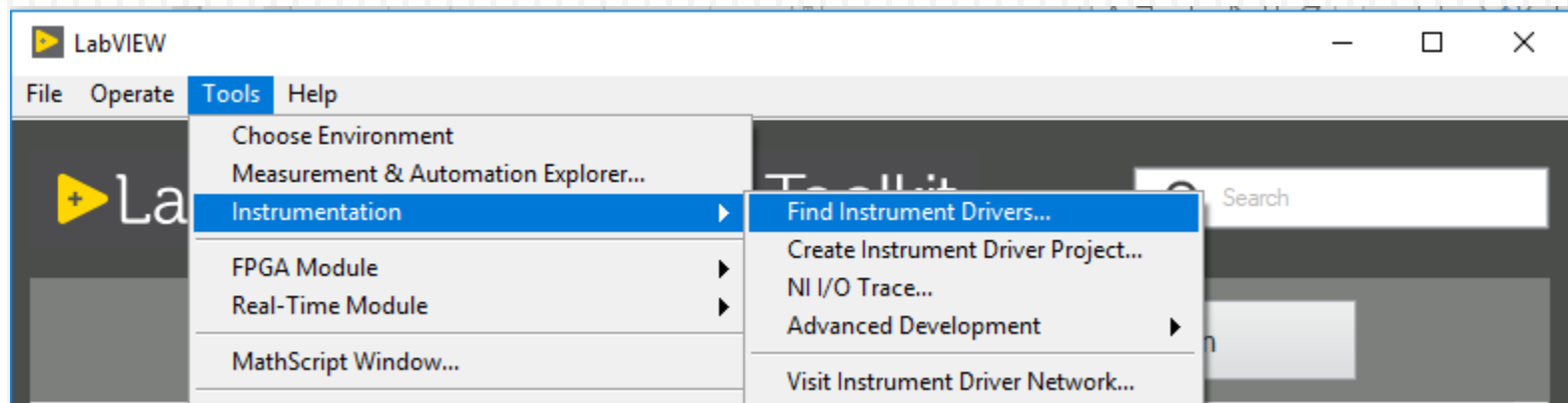
- De la producator
 - ▣ CD, DVD, memory stick sau web site
 - ▣ Oferă doar API (DLLs)
 - ▣ Nu oferă de loc
- NI Instrument Driver Network
 - ▣ Gasirea de drivere
 - ▣ Informatii despre cum se dezvoltă și se utilizează driverele
 - ▣ Incarcarea driverelor dezvoltate personal

NI Instrument Driver Network

- De pe site www.ni.com/idnet

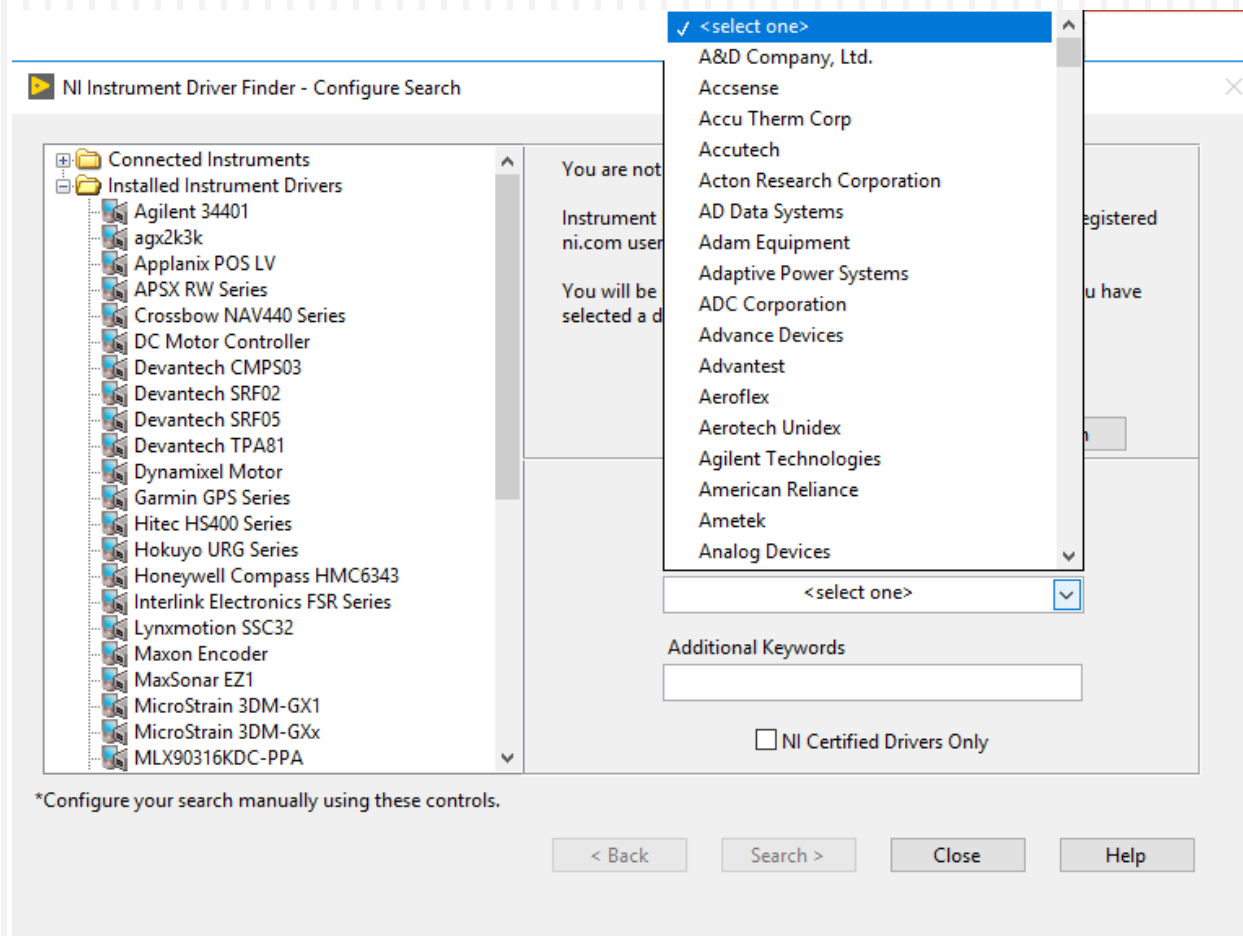


- Cautare direct din LabVIEW



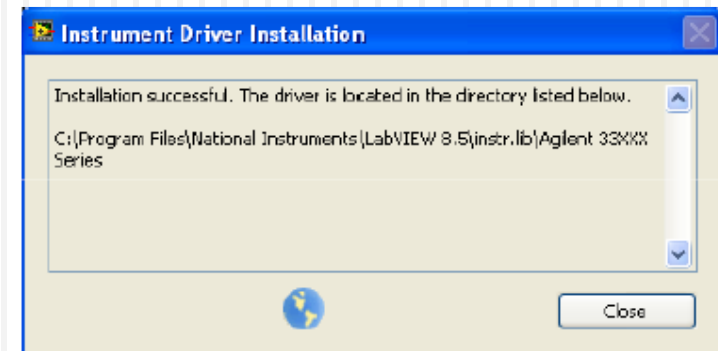
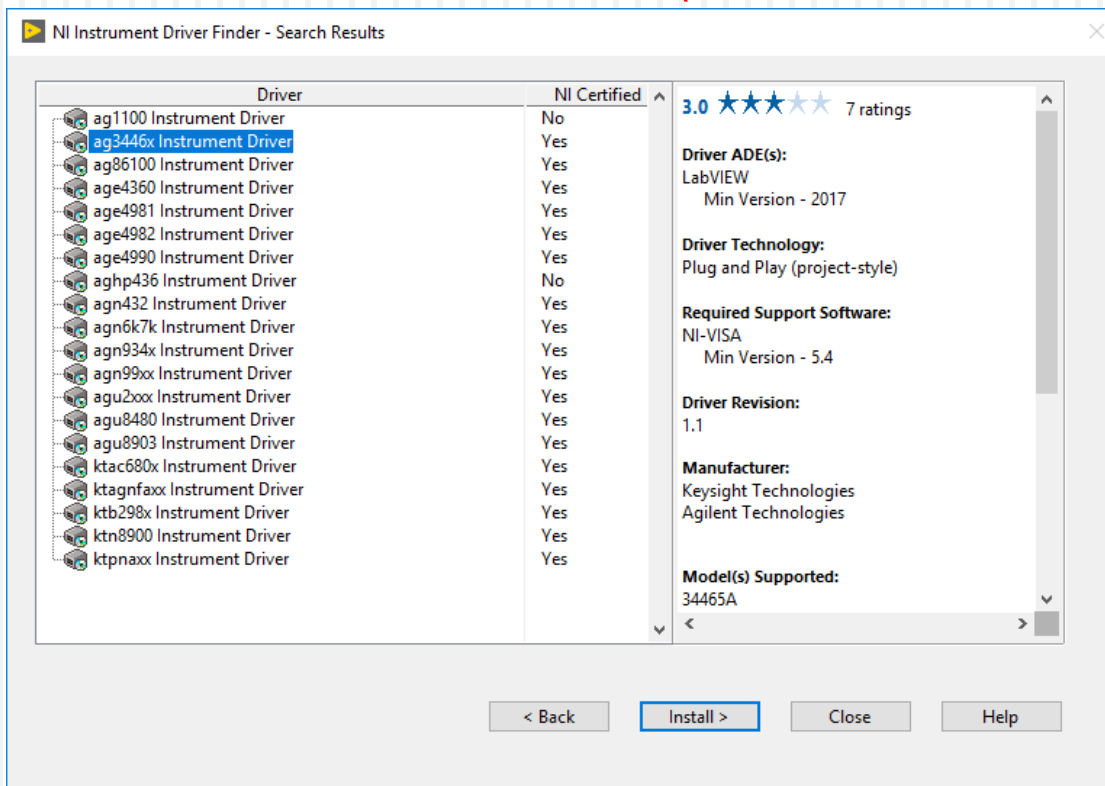
NI Instrument Driver Network

□ Selectarea producatorului



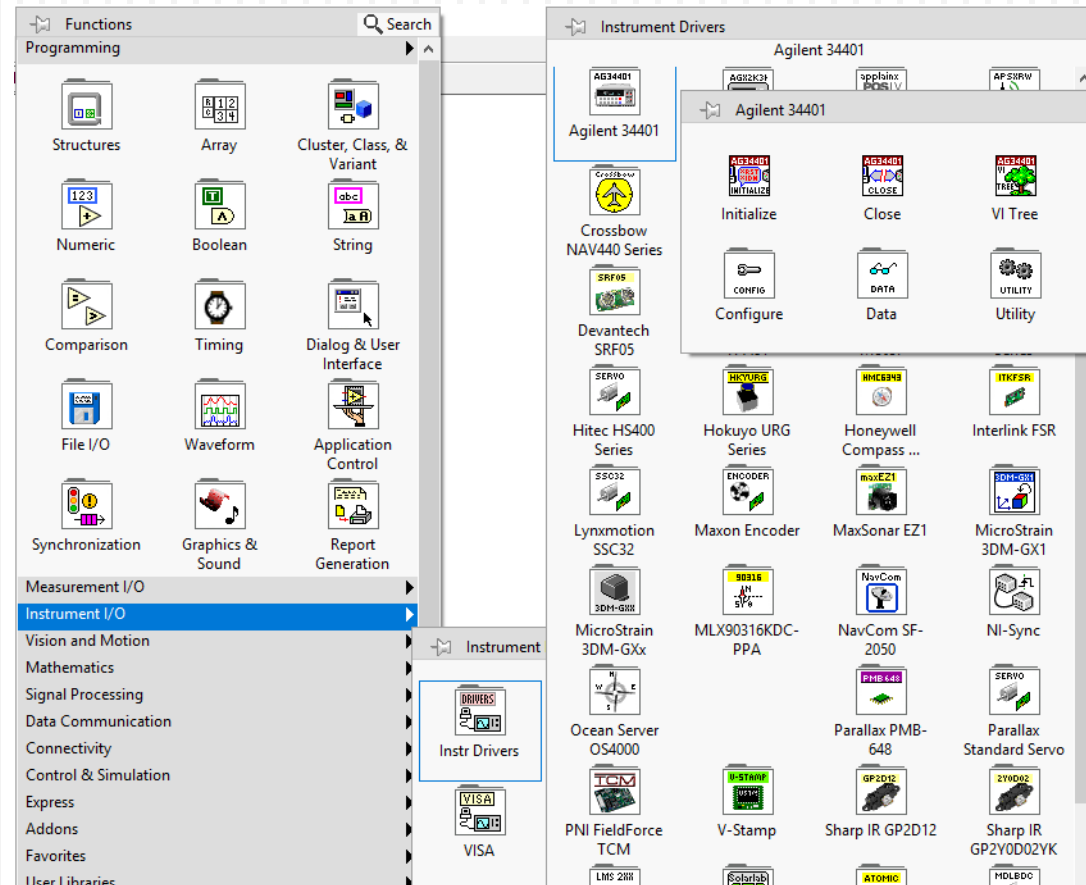
NI Instrument Driver Network

- Selectarea driver-ului de instalat
 - ▣ Instalati libraria de drivere in directorul:
 - LabVIEW xxx\instr.lib



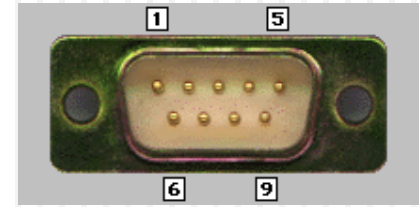
NI Instrument Driver Network

- Utilizare driver
- Accesati driverul prin subpaleta:
 - Functions>>
 - Instrument I/O>>
 - Instrument Drivers



Interfete hardware

- Serial (RS232,...)
- GPIB – IEEE 488
- USB
- FireWire – IEEE 1394
- Ethernet (IEEE 802.3,...)
- Magistrale interne
 - ▣ ISA/PCI/
 - ▣ PCIe/PXle
- Retele industriale
 - ▣ DeviceNET, PROFIBUS, ...

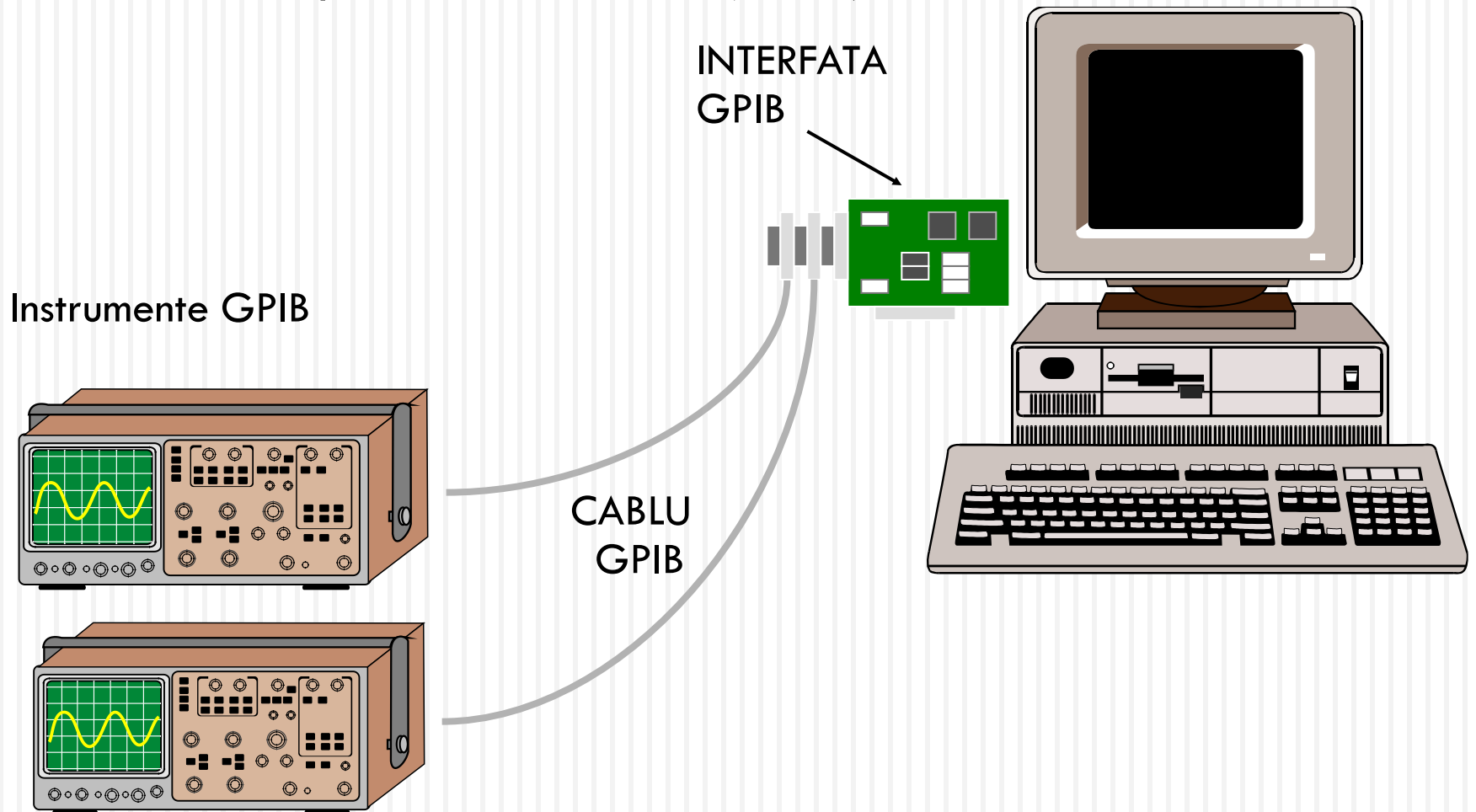


PCI EXPRESS®

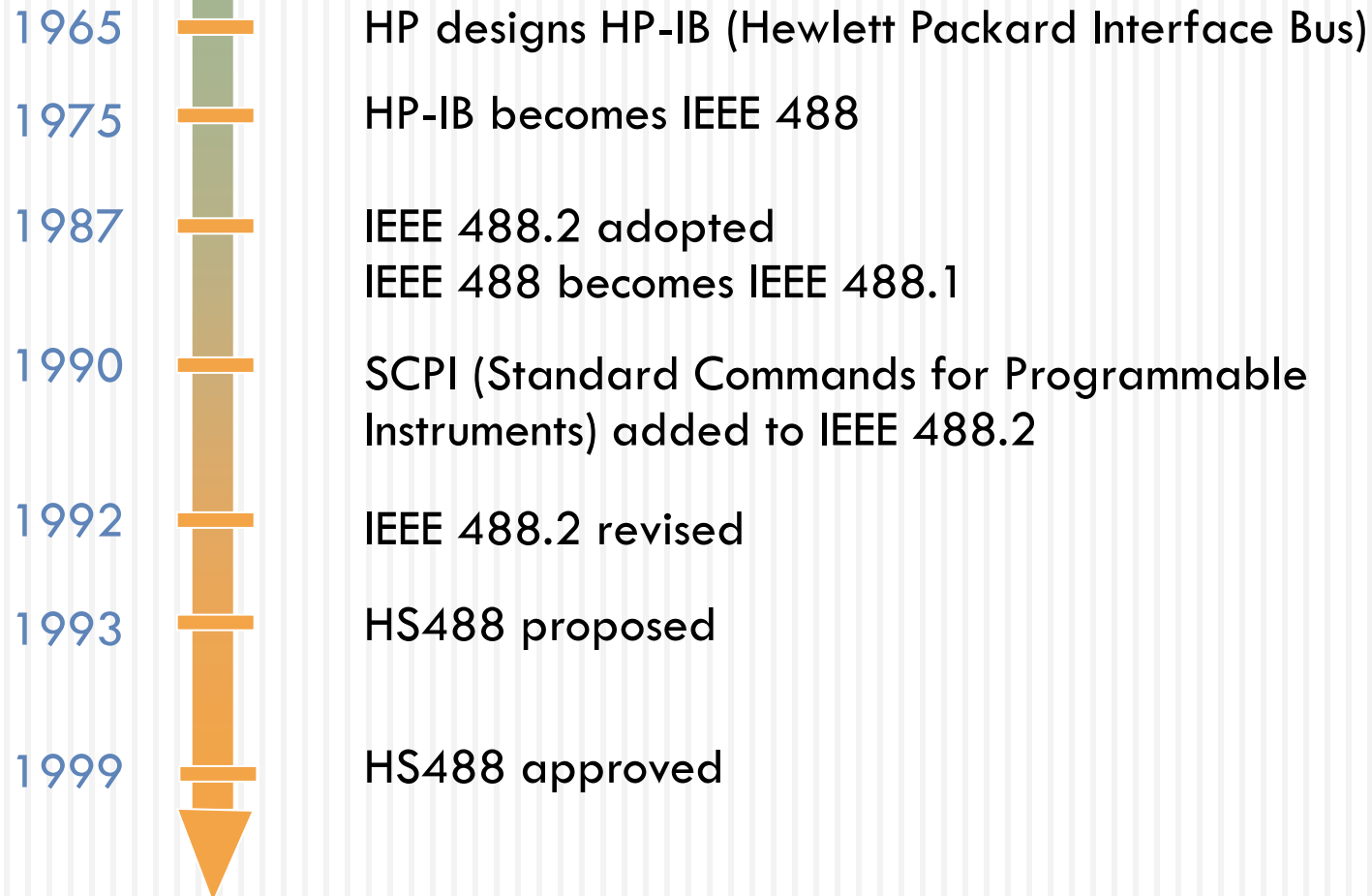


Comunicatia GPIB

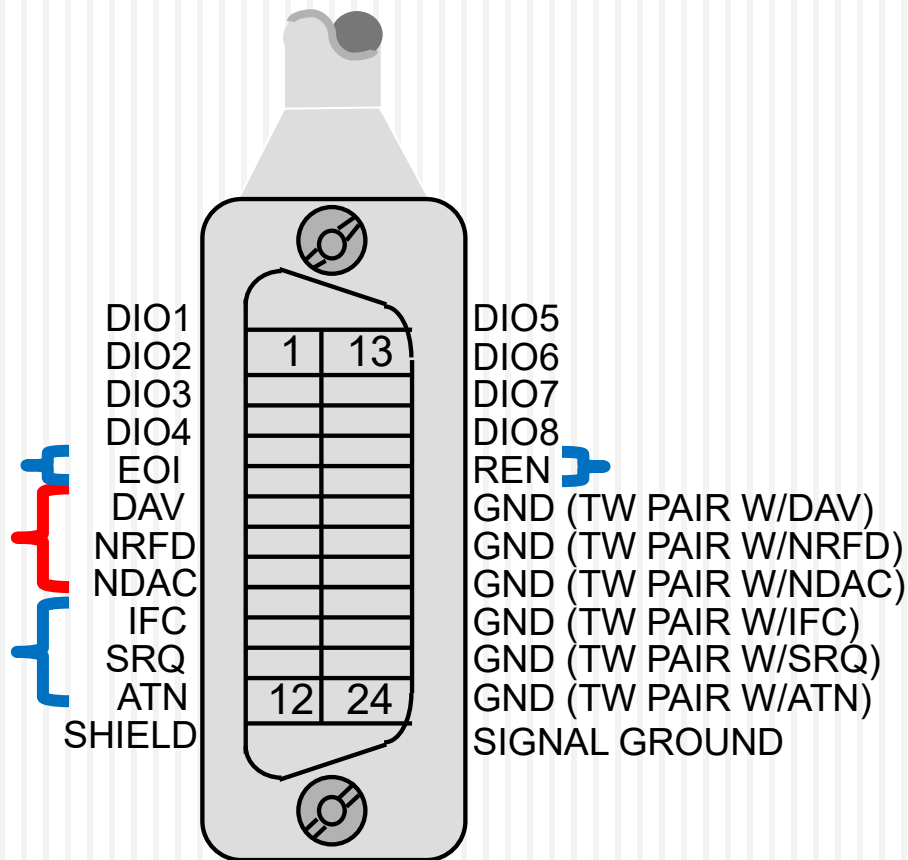
General Purpose Interface Bus (GPIB)



Standards Introduction



GPIB – Specificatii Hardware

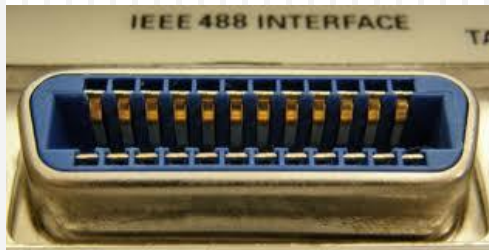


- Lungimea maxima a cablului intre dispozitive = 4 m (2 m average)
- Lungime maxima = 20 m
- Numar maxim de dispozitive = 15 (cam 2/3 alimentate)
- Interfata de comunicare digitala:
 - 8 linii de date
 - 3 linii de handshaking
 - 5 linii de control
- 1MB/s pana la 8MB/s

GPB Hardware

- Dispozitivele si interfetele GPB au o adresa unica intre 0 si 30:
 - ▣ In mod normal adresa 0 este atribuita interfetei GPB
 - ▣ Instrumentele pot avea adresele intre 1 si 30
 - ▣ Dispozitivele GPB pot fi “talkers, listeners, or controllers”.

GPIB Hardware



GPIB-USB



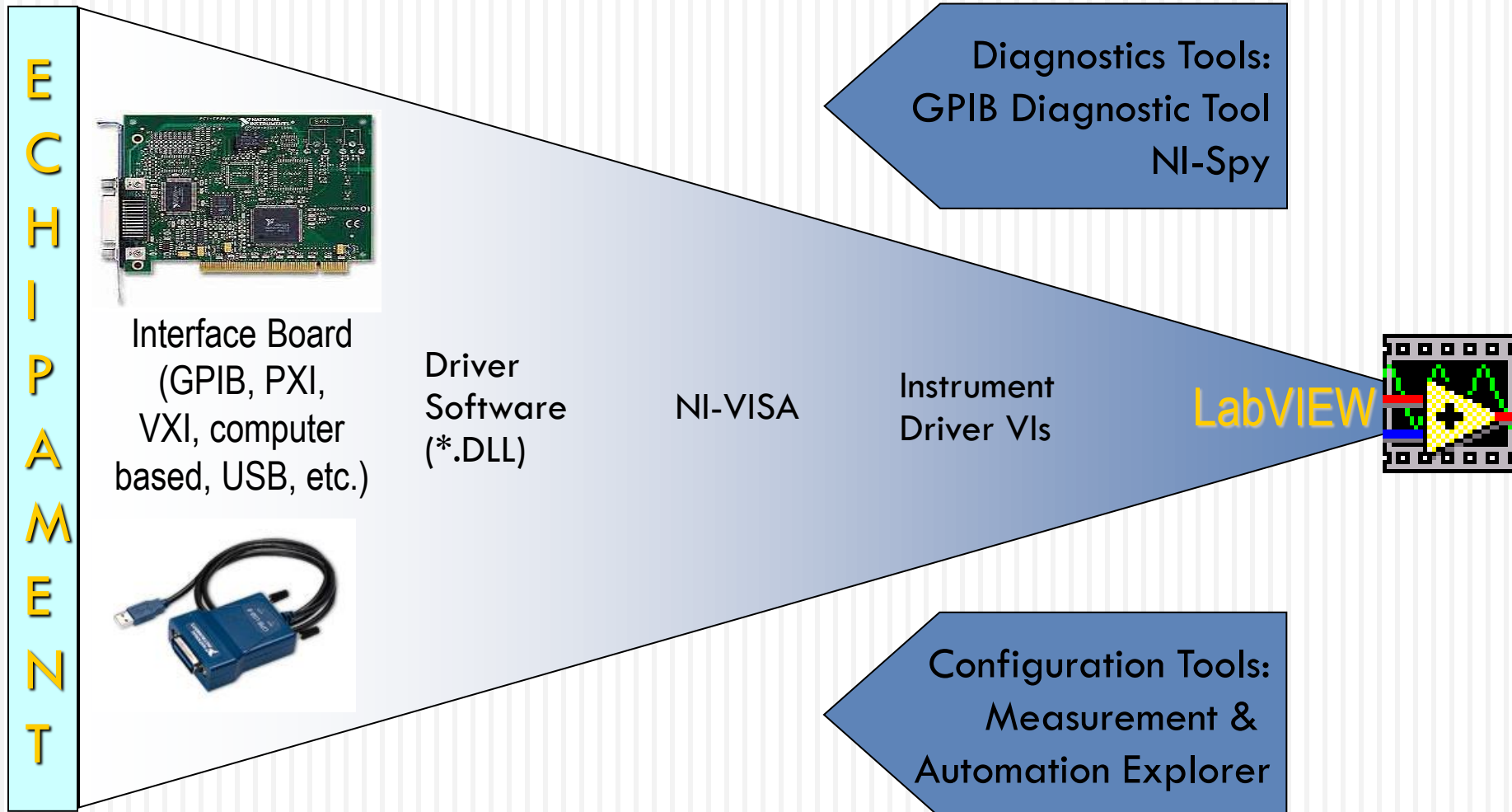
GPIB-RS232



GPIB-PCI

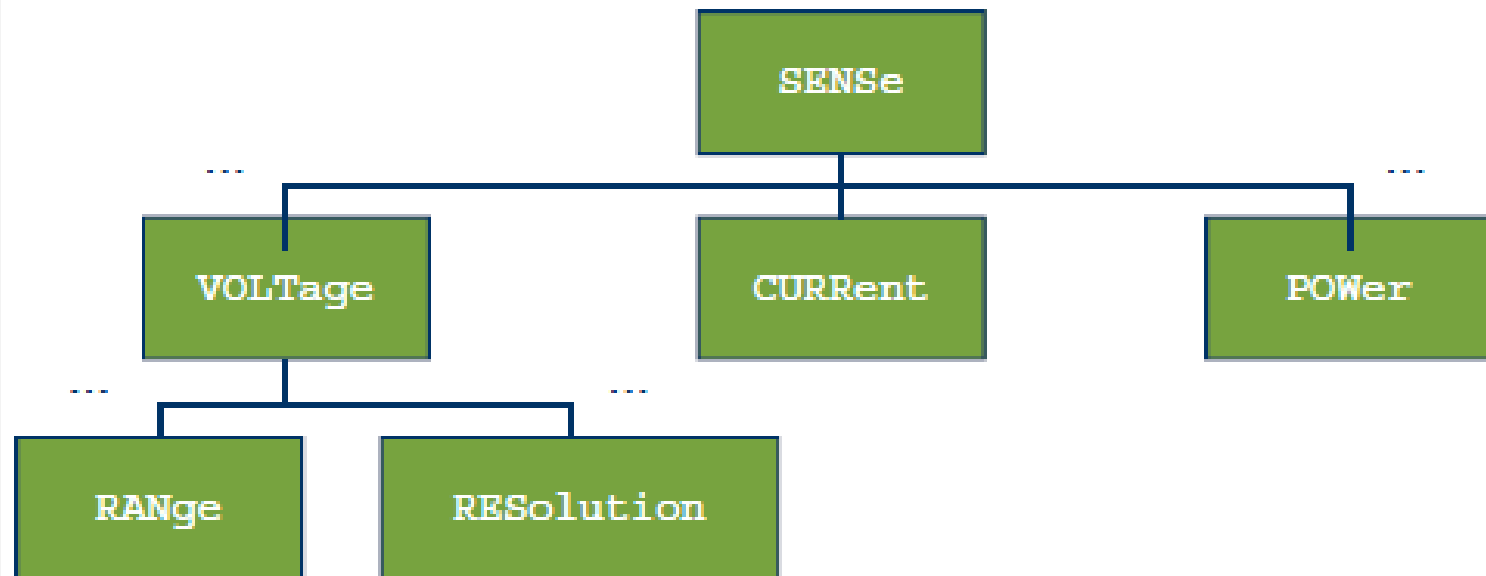
Interfete de instrument software

GPIB Architecture software — Windows



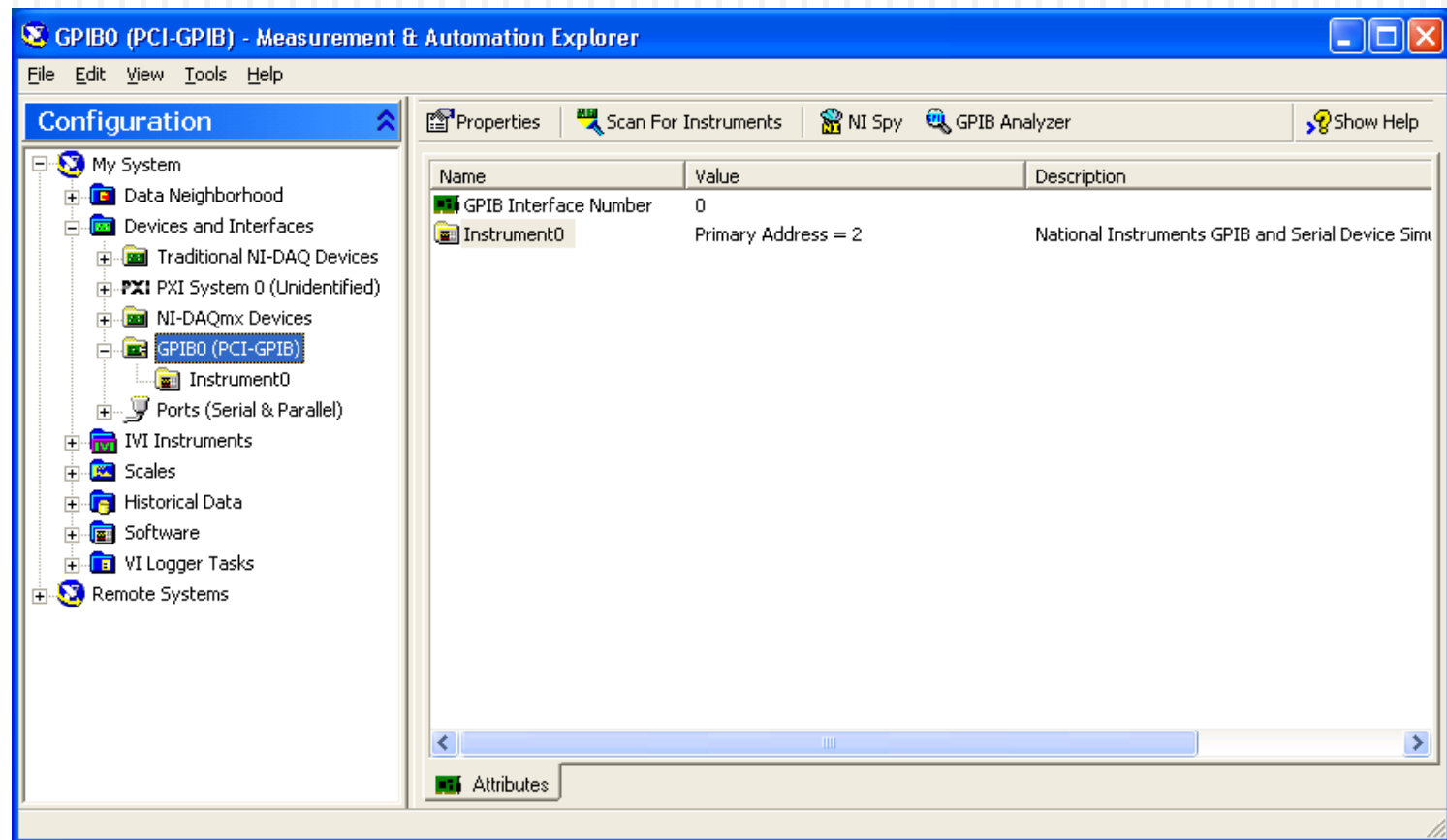
Programarea cu SCPI

- Standard Commands for Programmable Instruments
 - ▣ Comenzi standard de tipul: *IDN?, *RST, *TST?, ...
 - ▣ Structura comenzilor ierarhica:
 - Forma lunga
 - Forma scurta



Configurarea placi GPIB si a Instrumentului

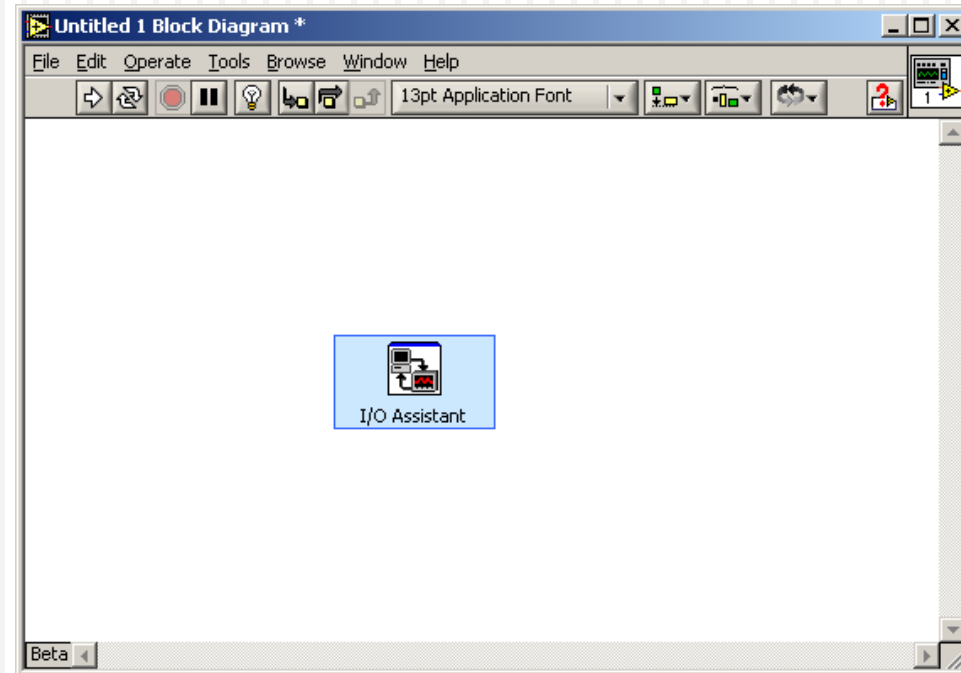
Folosim: Measurement & Automation Explorer (MAX)



GPIB in LabVIEW – functii high level

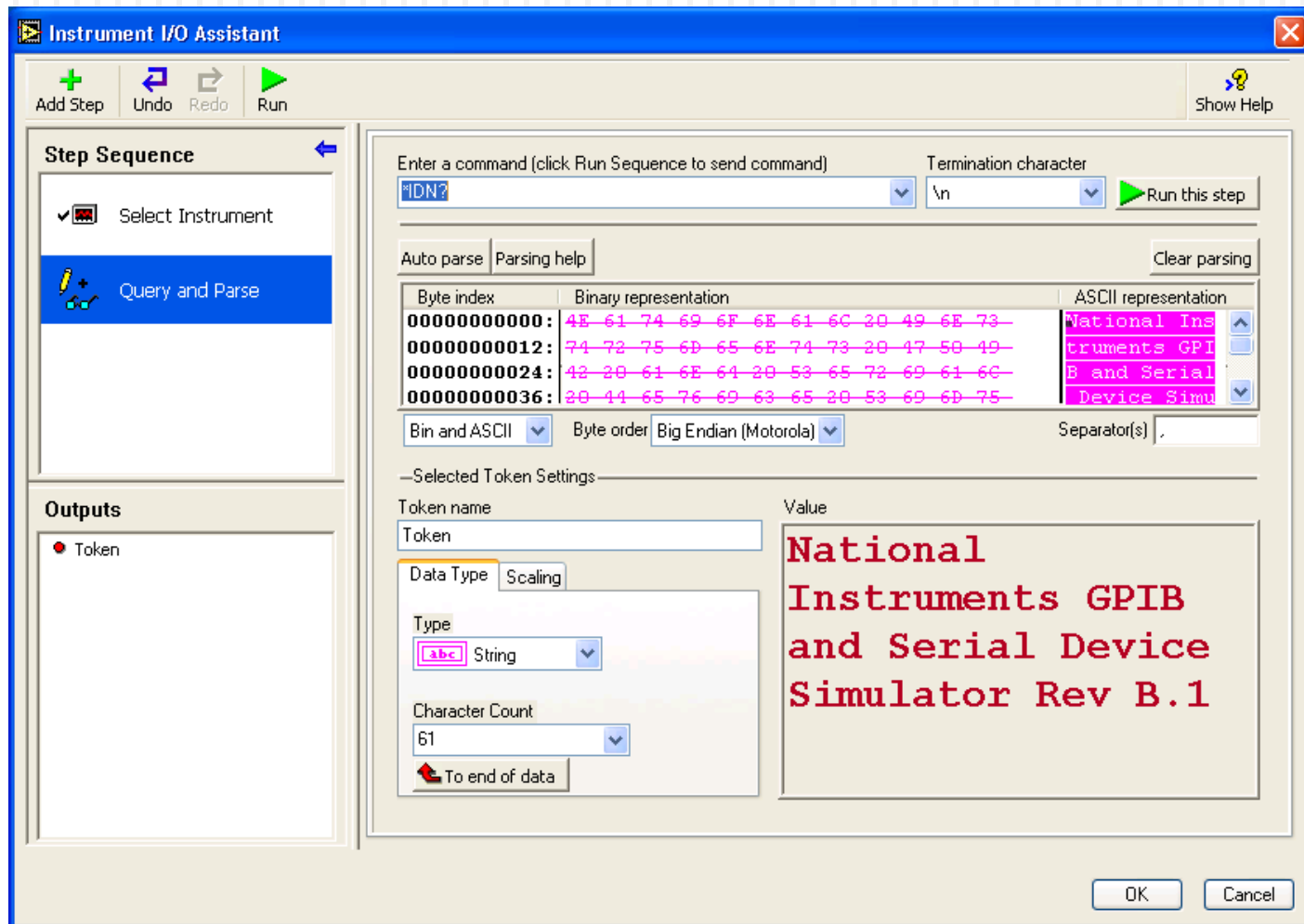
25

- Instrument I/O Assistant
 - Accesibil printr-un VI Express din mediul LabVIEW
 - Setarea comunicarii cu un dispozitiv (placa DAQ) si configurarea achizitiei pas cu pas – folosind o interfata de configurare



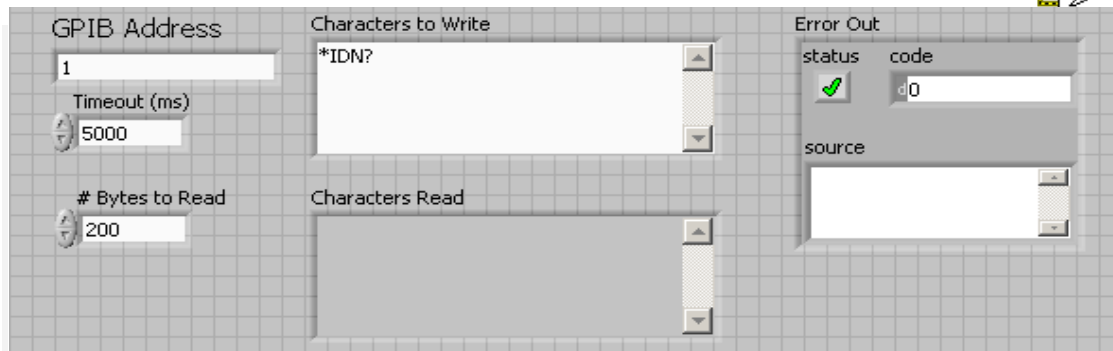
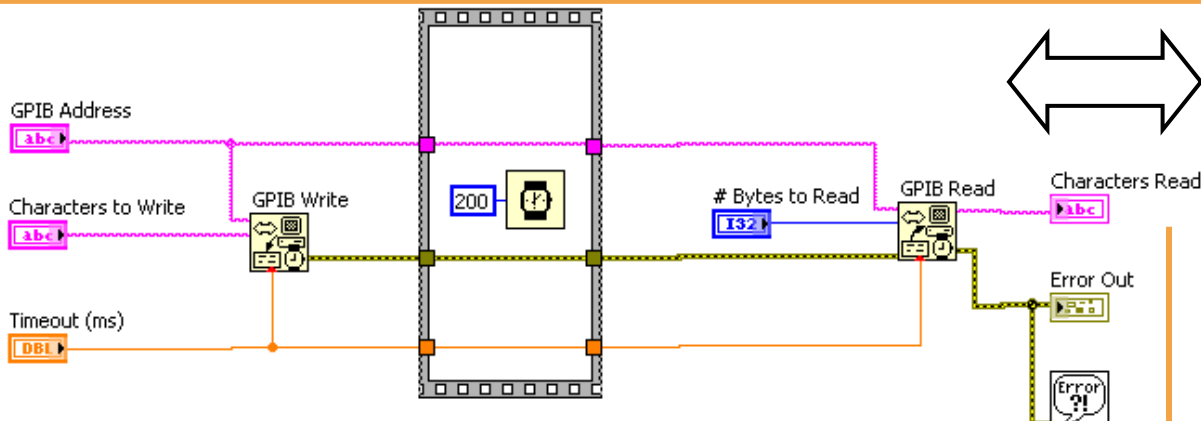
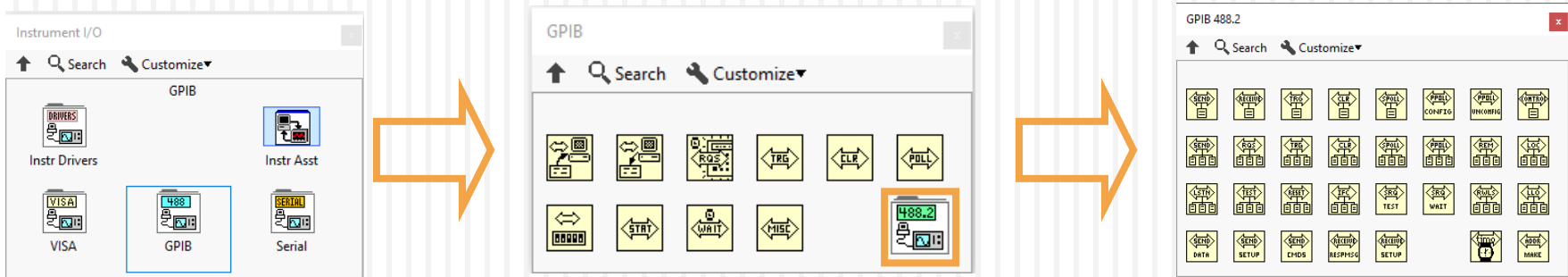
GPIB in LabVIEW – functii high level

26

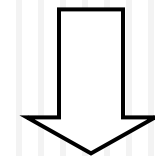


GPIB in LabVIEW – functii intermediare

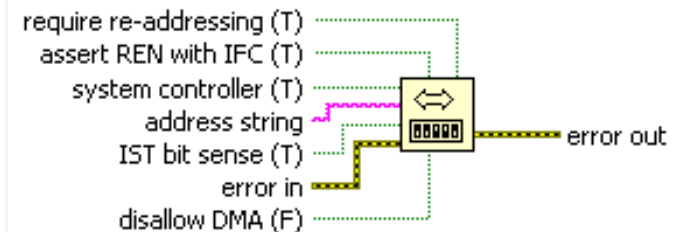
27



Pentru initializarea interfeței GPIB se folosește nodul "GPIB Initialization", înainte de a folosi nodurile de R/W

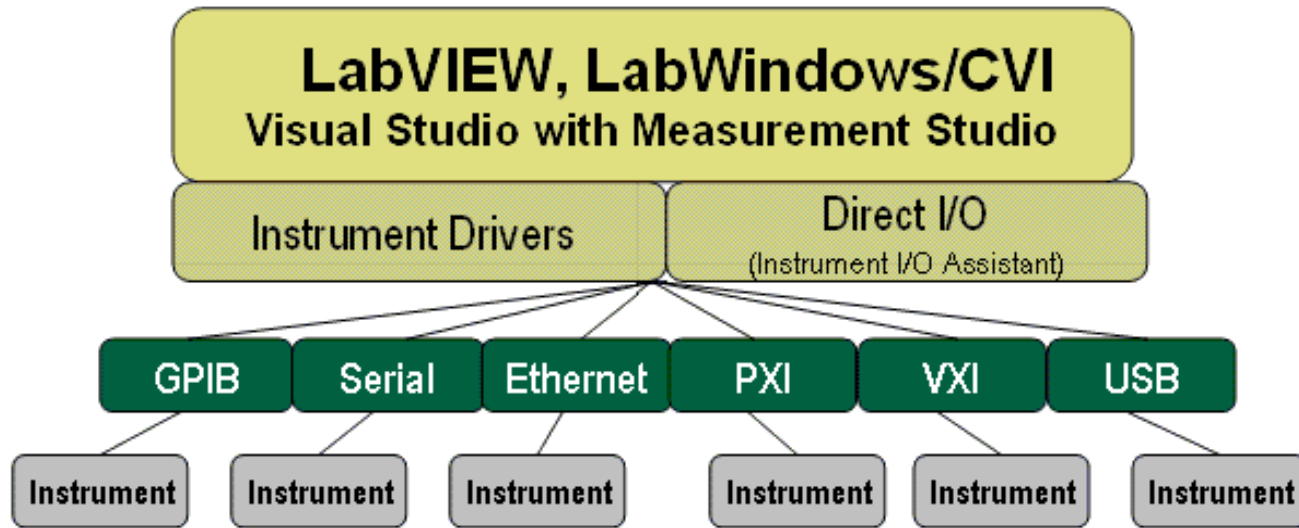


GPIB Initialization



Configures the GPIB interface at **address string**.

Virtual Instrument Software Architecture – VISA



- Independenta de platforma
- VISA este un backbone pentru IVI si drivere pentru instrumente Plug & Play
- Independenta de interfata
- Trebuie cunoscute comezi SCPI pentru a realiza un program direct cu VISA

Terminologia VISA

29

- **Resource** - Instrument pe portul Serial sau Paralel
- **Session** - Legarea la o Resursa
- **Instrument Descriptor** - Localizarea acestei Resurse
 - Format: Interface Type::Address::INSTR
 - Examples:

GPIB0::1::INSTR
GPIB0::4::INSTR
GPIB0::10::INSTR
ASRL1::INSTR
ASRL2::INSTR
ASRL3::INSTR
ASRL10::INSTR

Instrument Descriptor Syntax

30

- Resource Name contine informatii despre interfata
- Se poate lucra cu VISA Aliases

Interfata	Sintaxa Resource Name
Serial	ASRL[board] [:: <i>INSTR</i>]
GPIB	GPIB[board] :: <i>primary address</i> [:: <i>INSTR</i>]
VXI	VXI[board] :: <i>VXI logical address</i> [:: <i>INSTR</i>]
GPIB-VXI	GPIB-VXI[board] [:: <i>GPIB-VXI primary address</i>] :: <i>VXI logical address</i> [:: <i>INSTR</i>]

Numele Resursei VISA

31

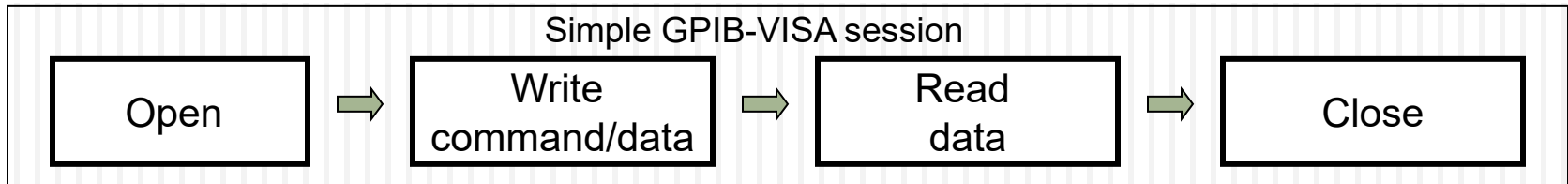
- Numele exact si locatia instrumentului
- Foloseste “**VISA Resource Name**” pentru control
- Se poate specifica intregul nume al resursei pentru a forma un **VISA Alias**



The image shows a screenshot of a software interface with a light gray background. It contains two labels, "VISA resource name" and "VISA resource name 2", positioned above two text input fields. The first input field contains the text "I GPIB0::2::INSTR" and has a small downward-pointing arrow on its right side. The second input field contains the text "I devsim" and also has a small downward-pointing arrow on its right side.

VISA in LabVIEW

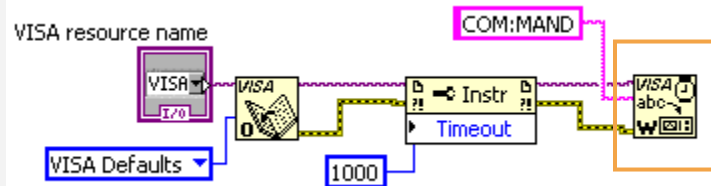
32



- Deschiderea sesiunii VISA utilizand resursa instrumentului. Configurarea timeout-ului

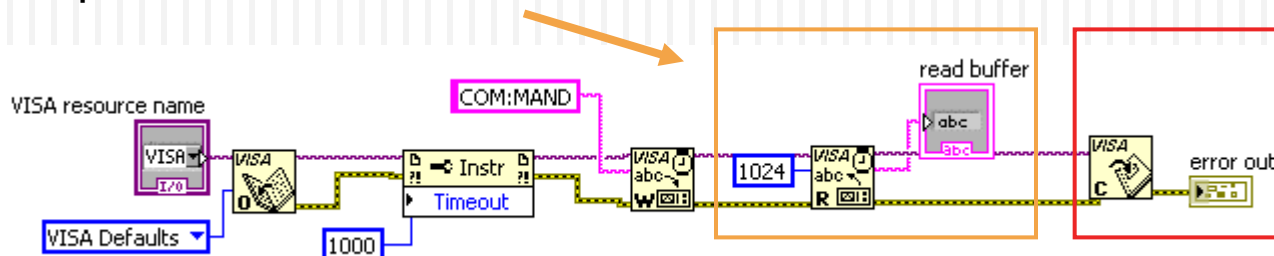


- Scrierea comenzii catre instrument cu nodul Write



- Citirea raspunsului de la instrument

- Inchiderea sesiunii VISA

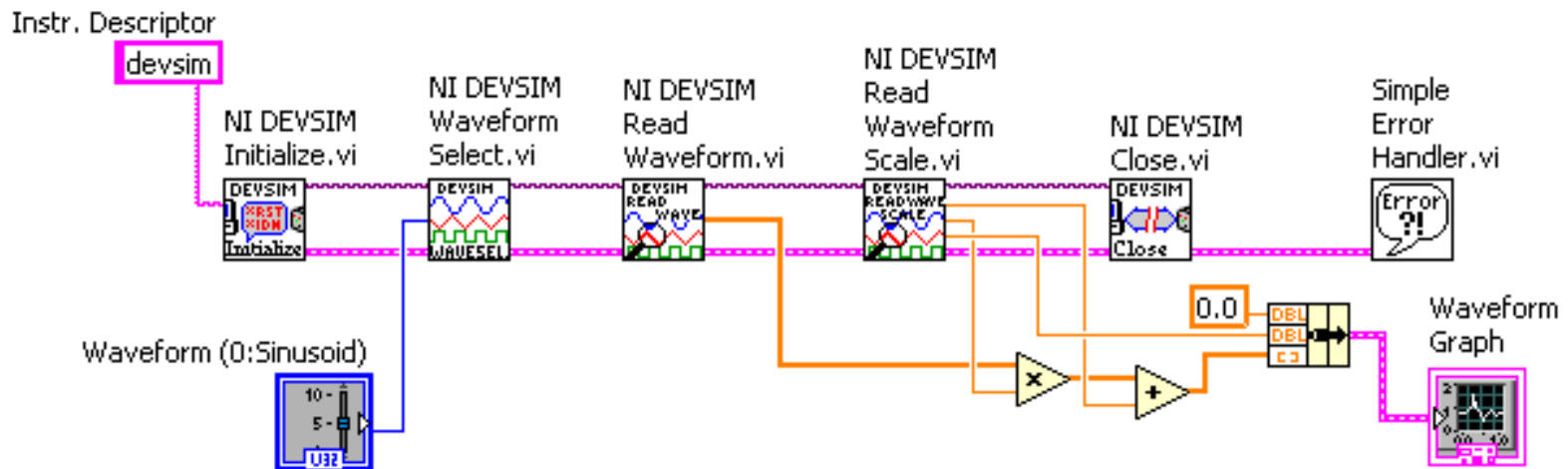


Se recomanda utilizarea functiilor VISA in detrimentul celor GPIB, datorita versatilitatii VISA

Drivere de instrument

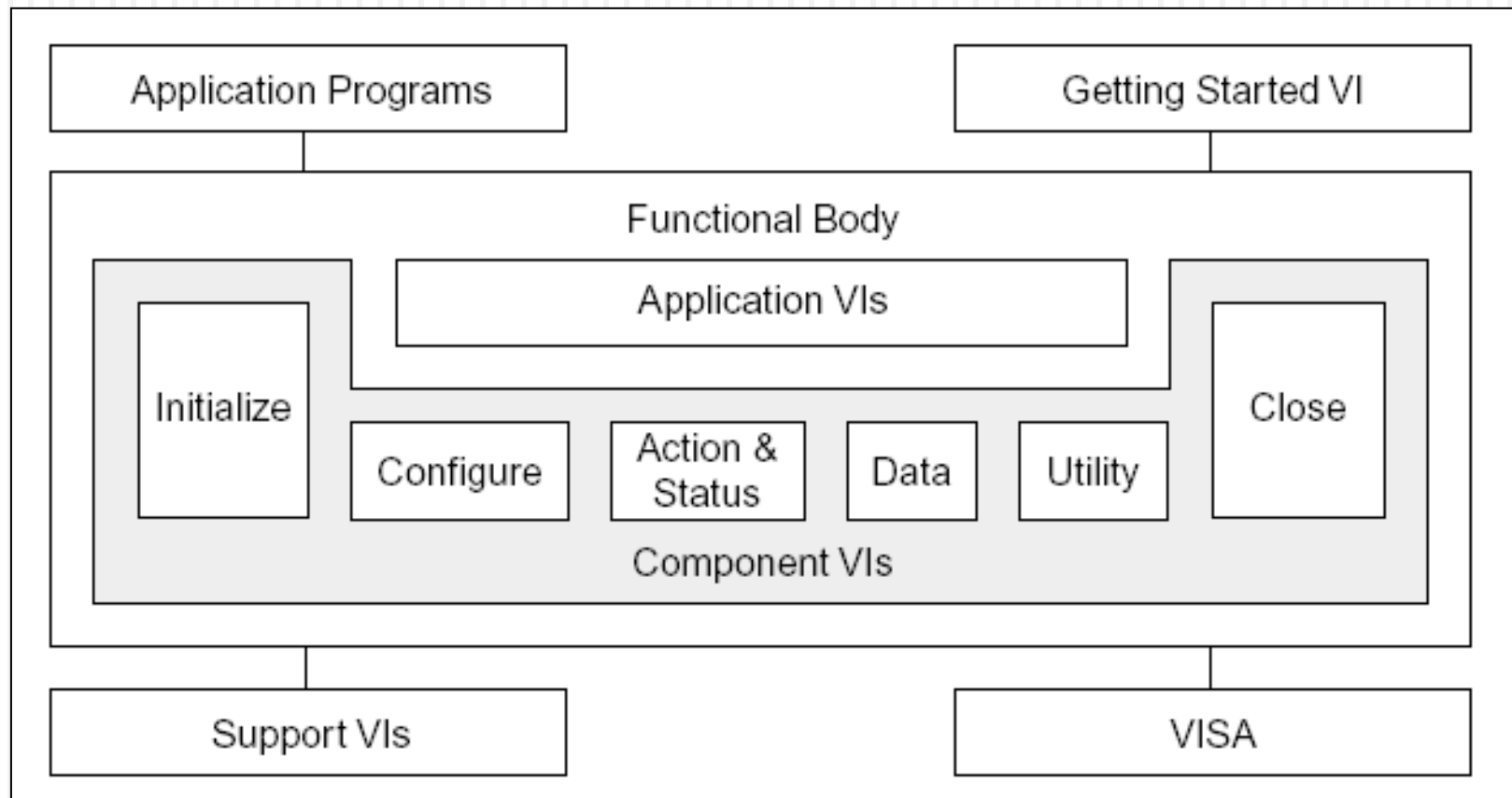
33

- Exista mai mult de 8000 drivere de instrumente pentru LabVIEW
- Programarea simplificata la “high—level API”



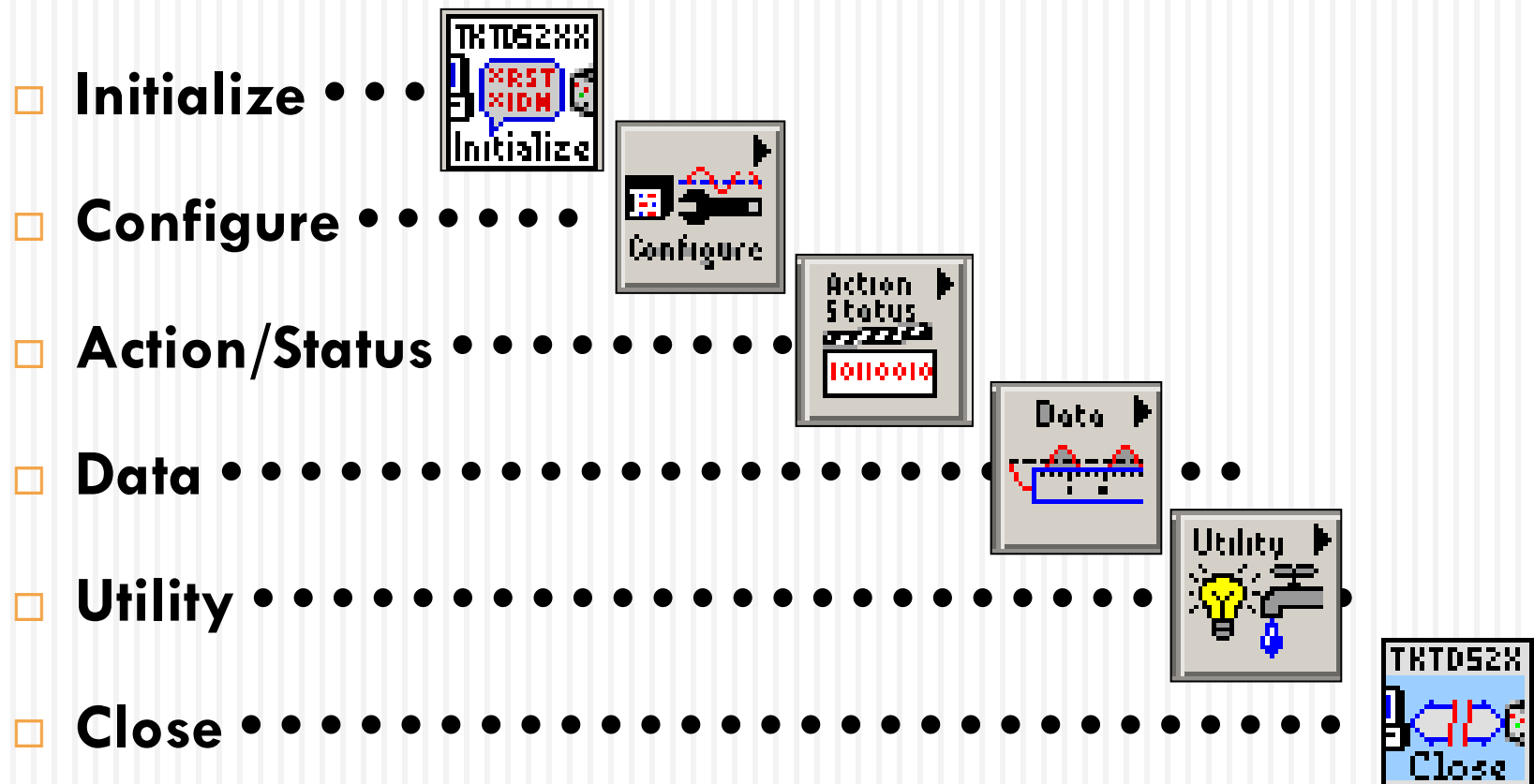
Model de driver de instrument

34



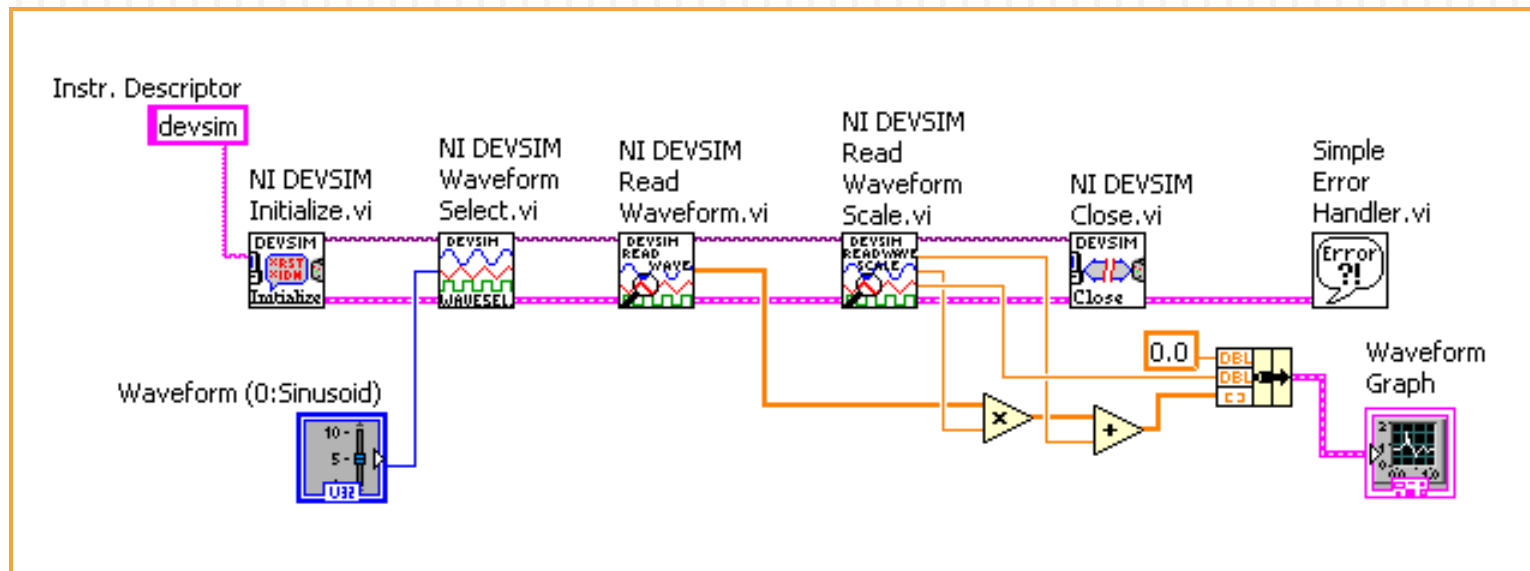
VI-uri pentru Driver de Instruments

35



Toate acestea puse in aplicatie

36

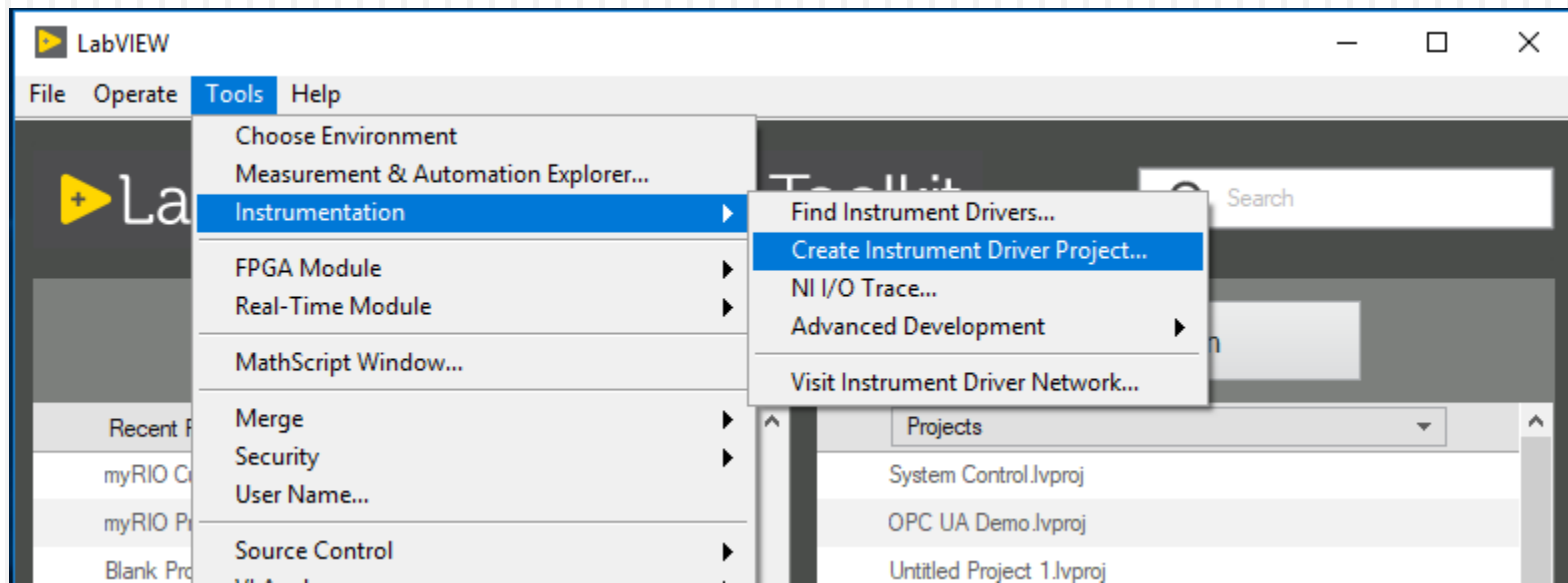


- Initializarea Instrumentului
- Realizarea operatiei (operatiilor)
- Inchiderea Instrumentului
- Verificare: daca exista erori

Ex. Instrument Driver in LabVIEW

37

- Crearea unui proiect de tip Instrument Driver



Ex. Instrument Driver in LabVIEW

38

□ Instrument Driver - Oscilloscope

The image displays four sequential screenshots of the LabVIEW Instrument Driver Wizard, illustrating the process of creating a new instrument driver for an oscilloscope.

1. Create New Instrument Driver Project: This window shows the initial setup. The "Project type" is set to "New driver from template". The "Source driver" list includes various instrument types, with "Oscilloscope" selected. The list also includes Counter, DC Power Supply, Digital Multimeter, Function Generator, Power Meter, Spectrum Analyzer, General Purpose (message-based), and General Purpose (register-based).

2. Set New Driver Identifier and Driver Description: This window allows setting the driver identifier (example: "Agilent 34401") and the driver description (LabVIEW Plug and Play instrument driver for <fill in information about manufacturer, model, and type of the instrument>).

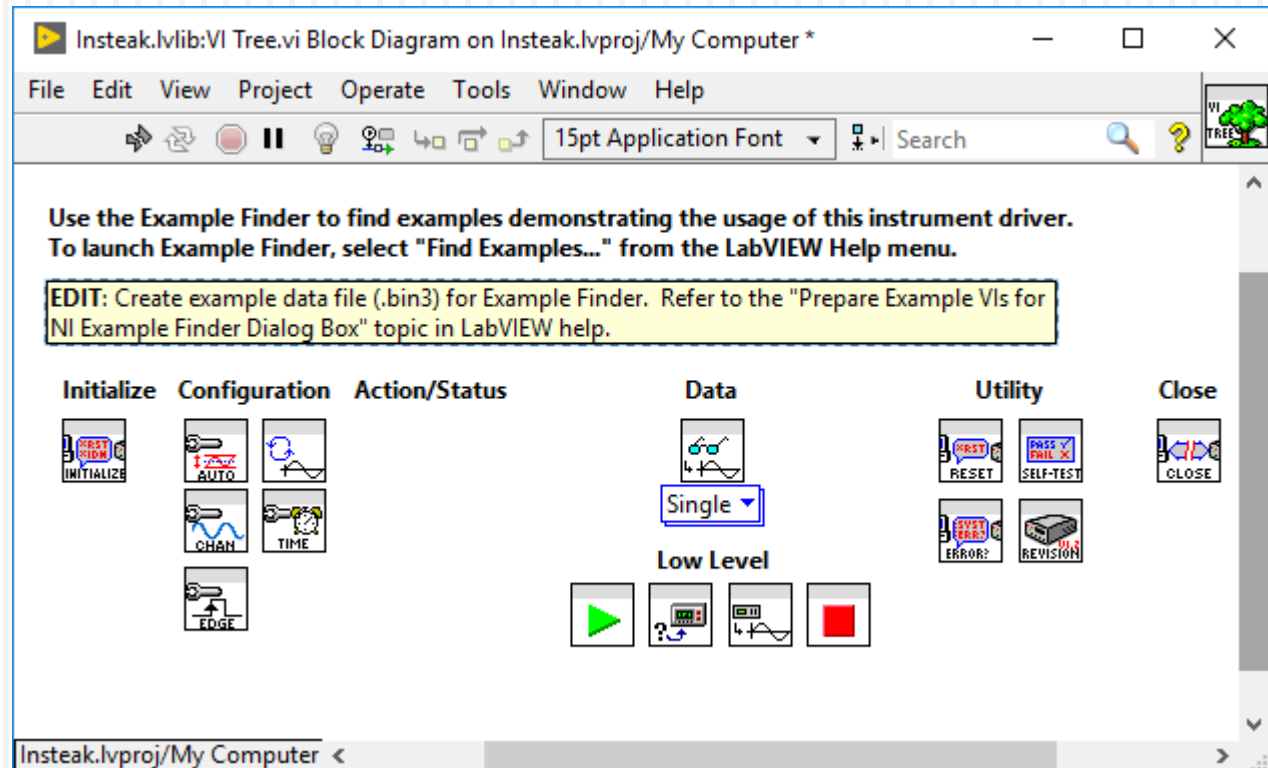
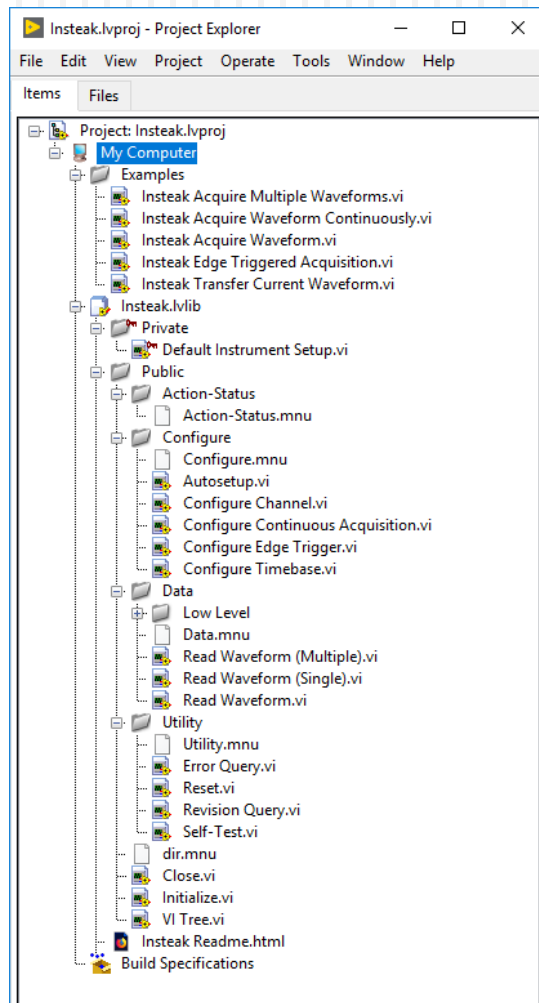
3. Creating Driver ... Please Wait: This window shows the progress of the driver creation process. It includes an "Overall Progress" bar and a "Saving VIs" bar.

4. Set VI and Menu Icons: This window allows setting the VI icon banner template (B & W or 256 Color) and the top palette menu icon (B & W or 256 Color).

Ex. Instrument Driver in LabVIEW

39

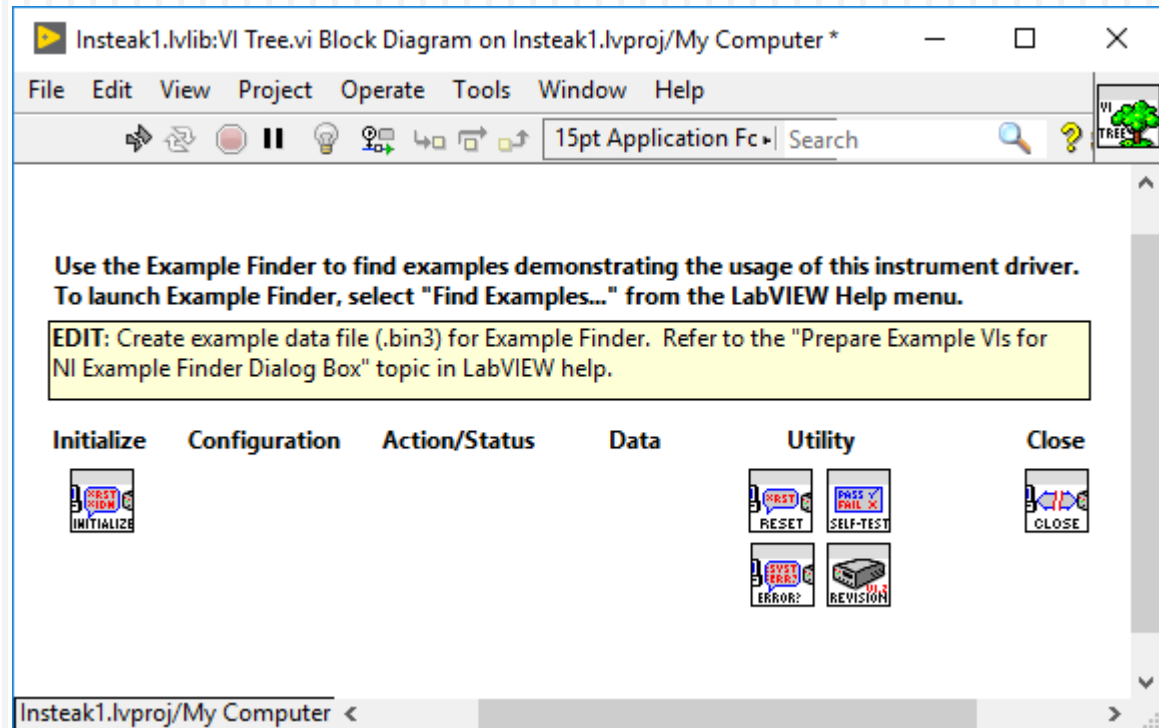
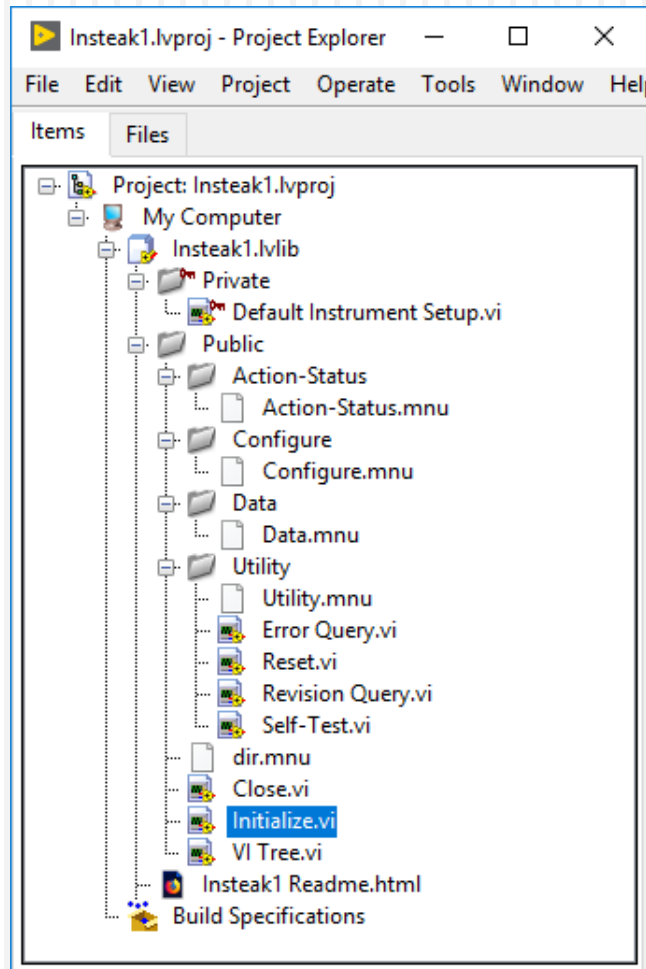
Instrument Driver - Oscilloscope



Ex. Instrument Driver in LabVIEW

40

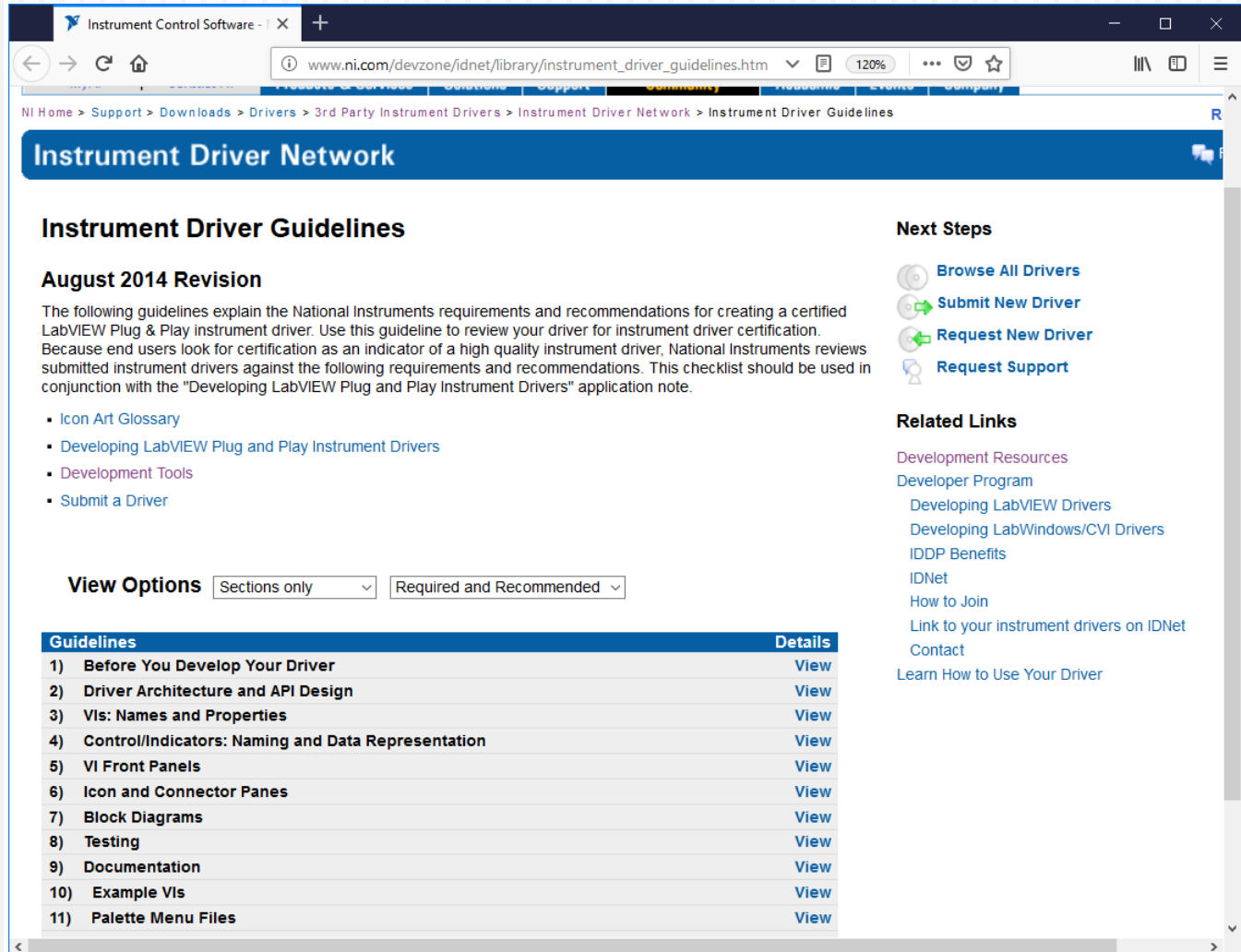
□ Instrument Driver – General purpose (message-based)



Link-uri utile

41

- <http://www.ni.com/devzone/idnet/development.htm>
- http://www.ni.com/devzone/idnet/library/instrument_driver_guidelines.htm



The screenshot shows a web browser window displaying the 'Instrument Driver Guidelines' page from the National Instruments (NI) website. The browser's address bar shows the URL: www.ni.com/devzone/idnet/library/instrument_driver_guidelines.htm. The page title is 'Instrument Driver Guidelines'. The main content area is titled 'Instrument Driver Network' and 'Instrument Driver Guidelines'. It includes a section for the 'August 2014 Revision' which explains the guidelines for creating a certified LabVIEW Plug & Play instrument driver. Below this, there is a list of links: 'Icon Art Glossary', 'Developing LabVIEW Plug and Play Instrument Drivers', 'Development Tools', and 'Submit a Driver'. On the right side, there are 'Next Steps' (Browse All Drivers, Submit New Driver, Request New Driver, Request Support) and 'Related Links' (Development Resources, Developer Program, Developing LabVIEW Drivers, Developing LabWindows/CVI Drivers, IDDP Benefits, IDNet, How to Join, Link to your instrument drivers on IDNet, Contact, Learn How to Use Your Driver). At the bottom, there is a 'View Options' section with two dropdown menus: 'Sections only' and 'Required and Recommended'. Below this is a table with two columns: 'Guidelines' and 'Details'.

Guidelines	Details
1) Before You Develop Your Driver	View
2) Driver Architecture and API Design	View
3) VIs: Names and Properties	View
4) Control/Indicators: Naming and Data Representation	View
5) VI Front Panels	View
6) Icon and Connector Panes	View
7) Block Diagrams	View
8) Testing	View
9) Documentation	View
10) Example VIs	View
11) Palette Menu Files	View