INSTRUMENTATIE VIRTUALA

CURS 10

Controlul instrumentelor

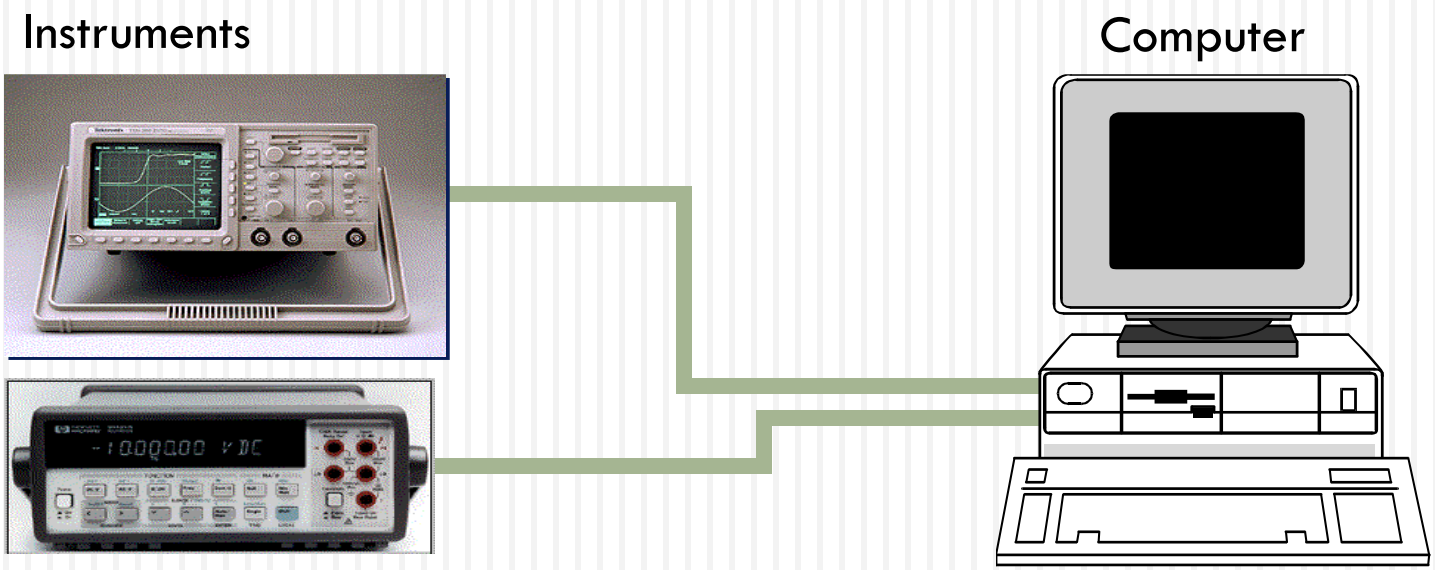
Obiective

- Instrument Assistant
- Porturi de comunicare: GPIB, Serial, USB
- Arhitectura (VISA): Virtual Instrument Software Architecture
- Drivere de instrument (retea de drivere NI)
- Functiile driverelor de instrument

Introducere in controlul instrumentelor

- Puteti controla orice instrument daca cunoasteti:

- Tipul de conector la instrument
- Proprietatile electrice implicate
- Sa aveti driverul soft corespunzator
- Tipul de cablu necesar
- Protocolul de comunicare folosit

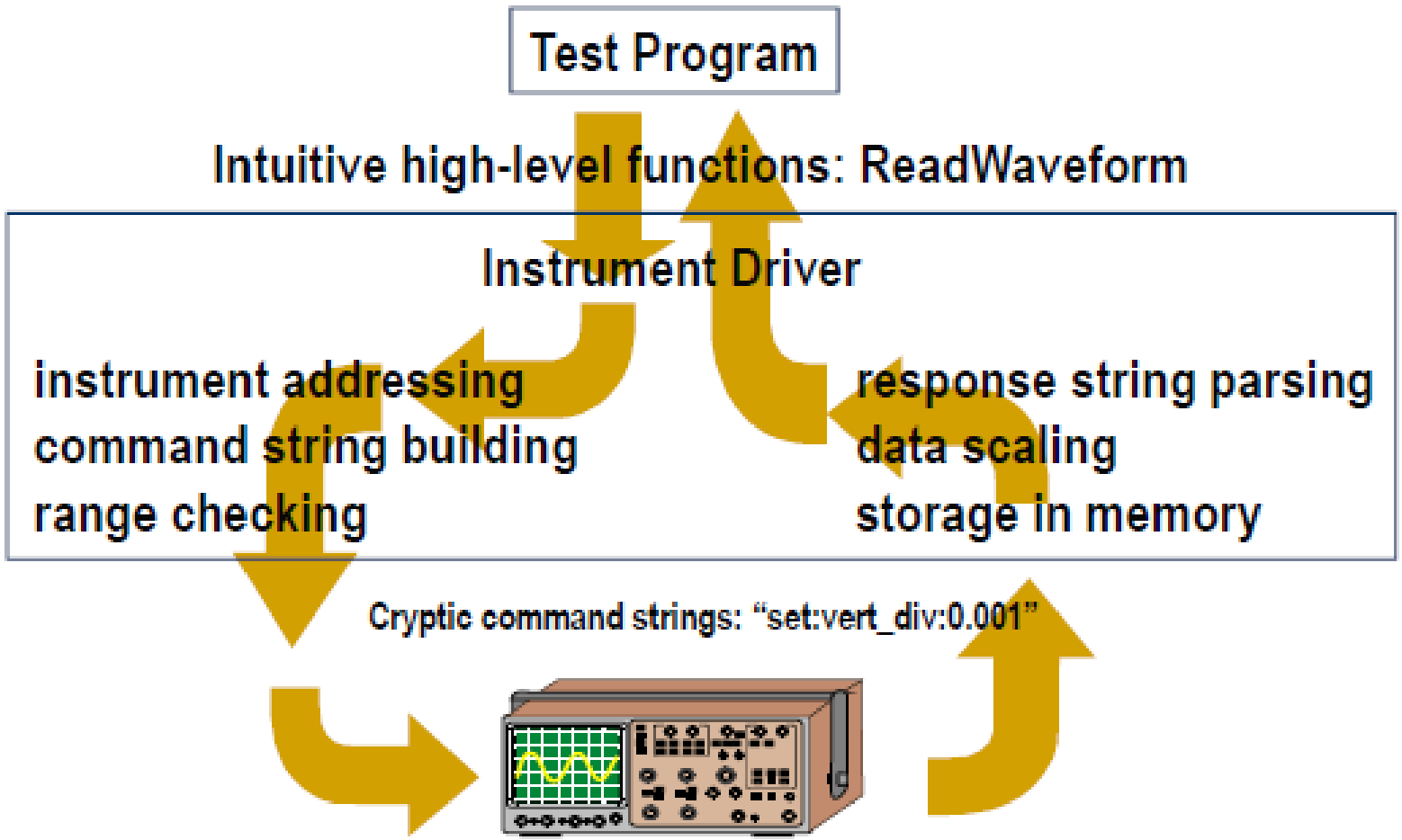


Introducere in controlul instrumentelor

- "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

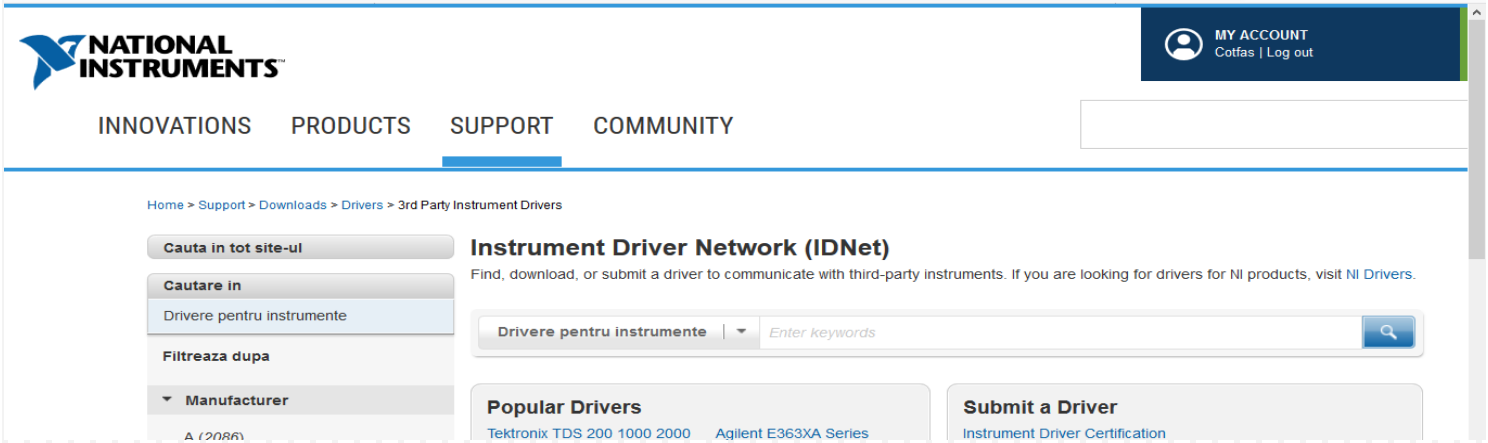


Gasirea drivere-lor de instrument

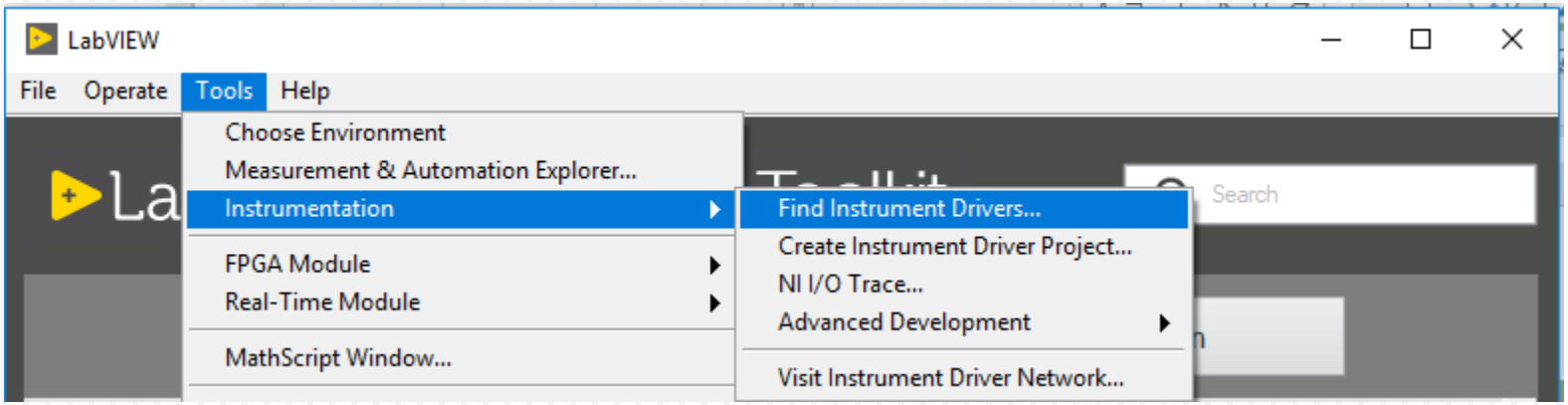
- De la producator
  - CD, DVD, memory stick sau web site
  - Ofera doar API (DLLs)
  - Nu ofera de loc
- NI Instrument Driver Network
  - Gasirea de drivere
  - Informatii despre cum se dezvolta si se utilizeaza driverele
  - Incarcarea driverelor dezvoltate personal

NI Instrument Driver Network

- De pe site www.ni.com/idnet

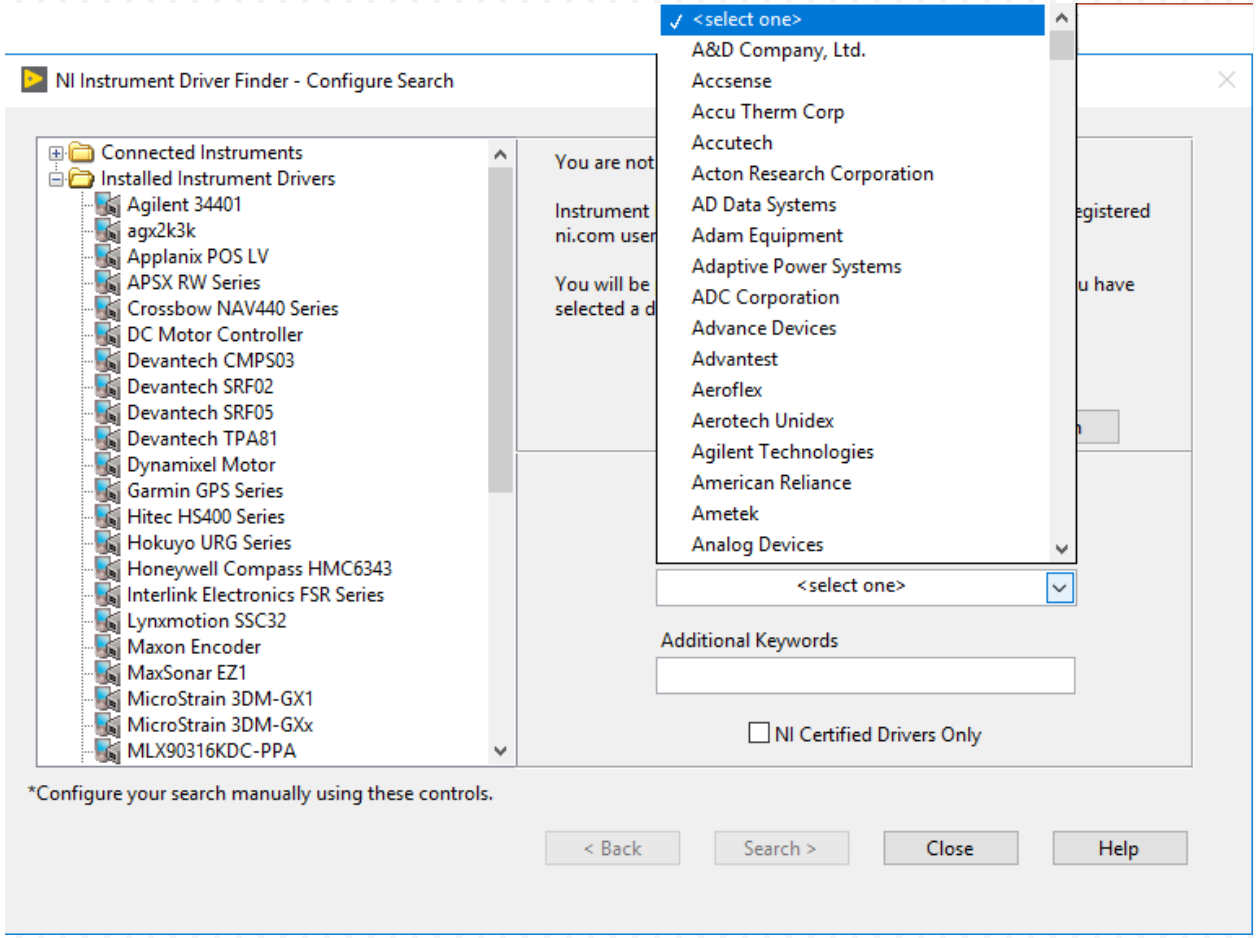


- Cautare direct din LabVIEW



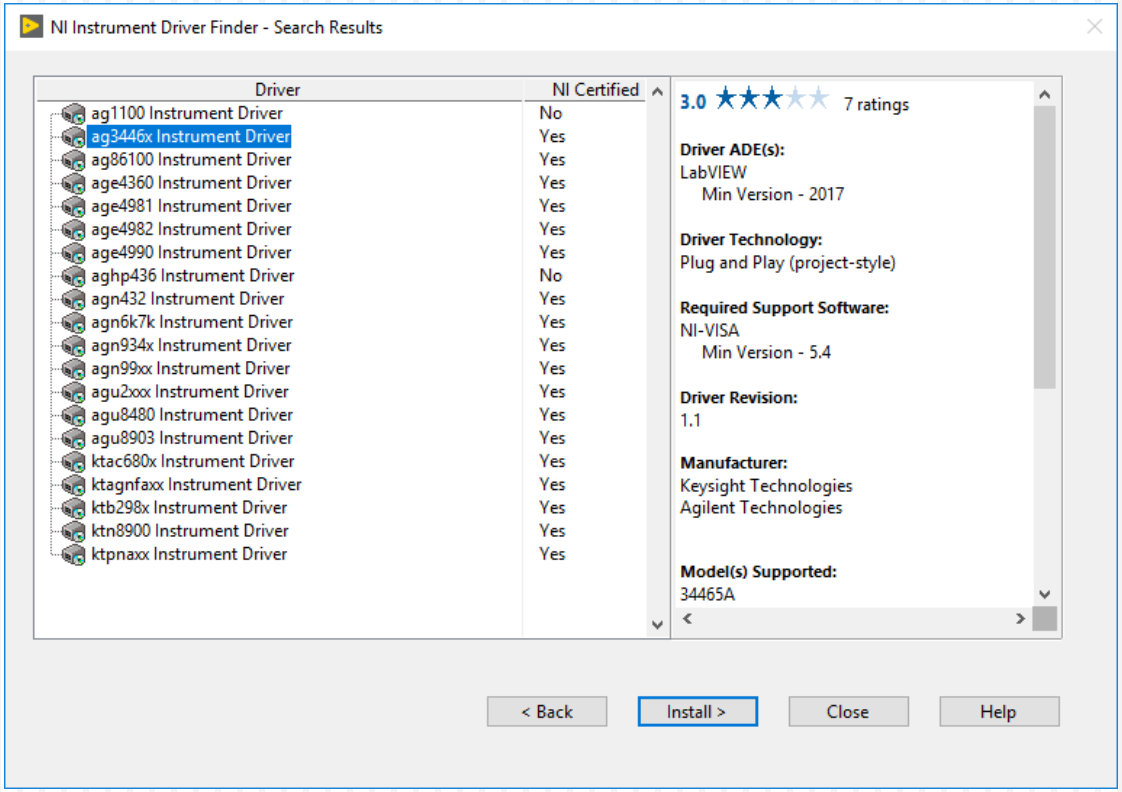
NI Instrument Driver Network

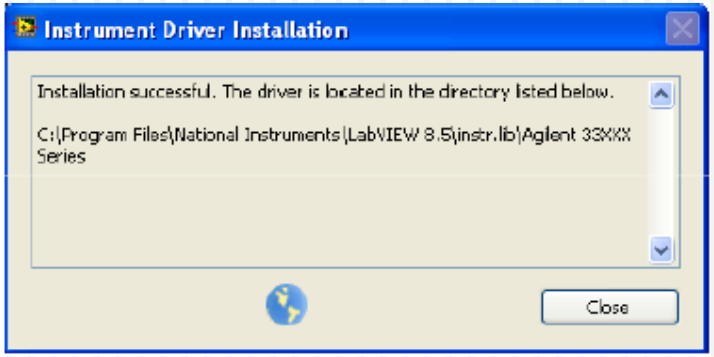
- Selectarea producatorului



NI Instrument Driver Network

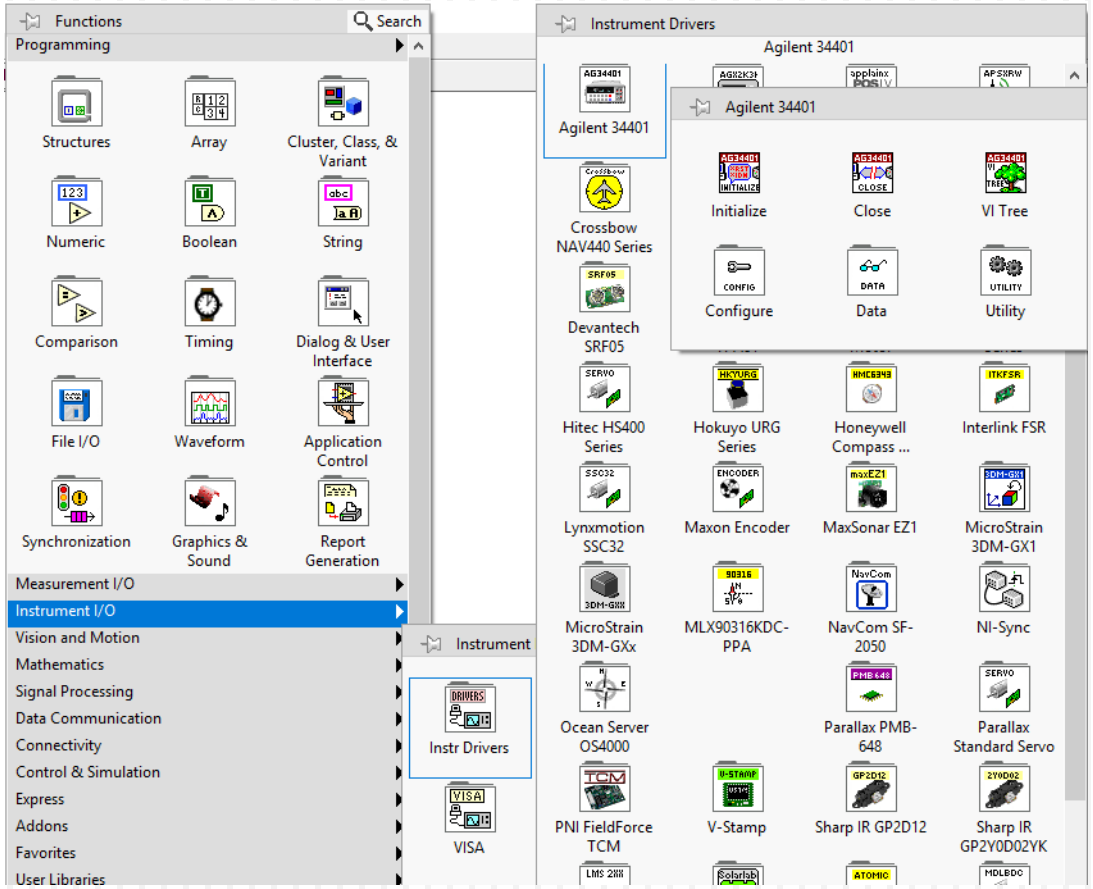
- Selectarea driver-ului de instalat
  - Instalati libraria de drivere in directorul:
    - LabVIEW xxx\instr.lib





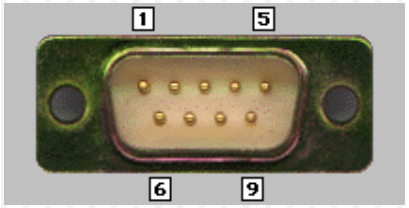
NI Instrument Driver Network

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



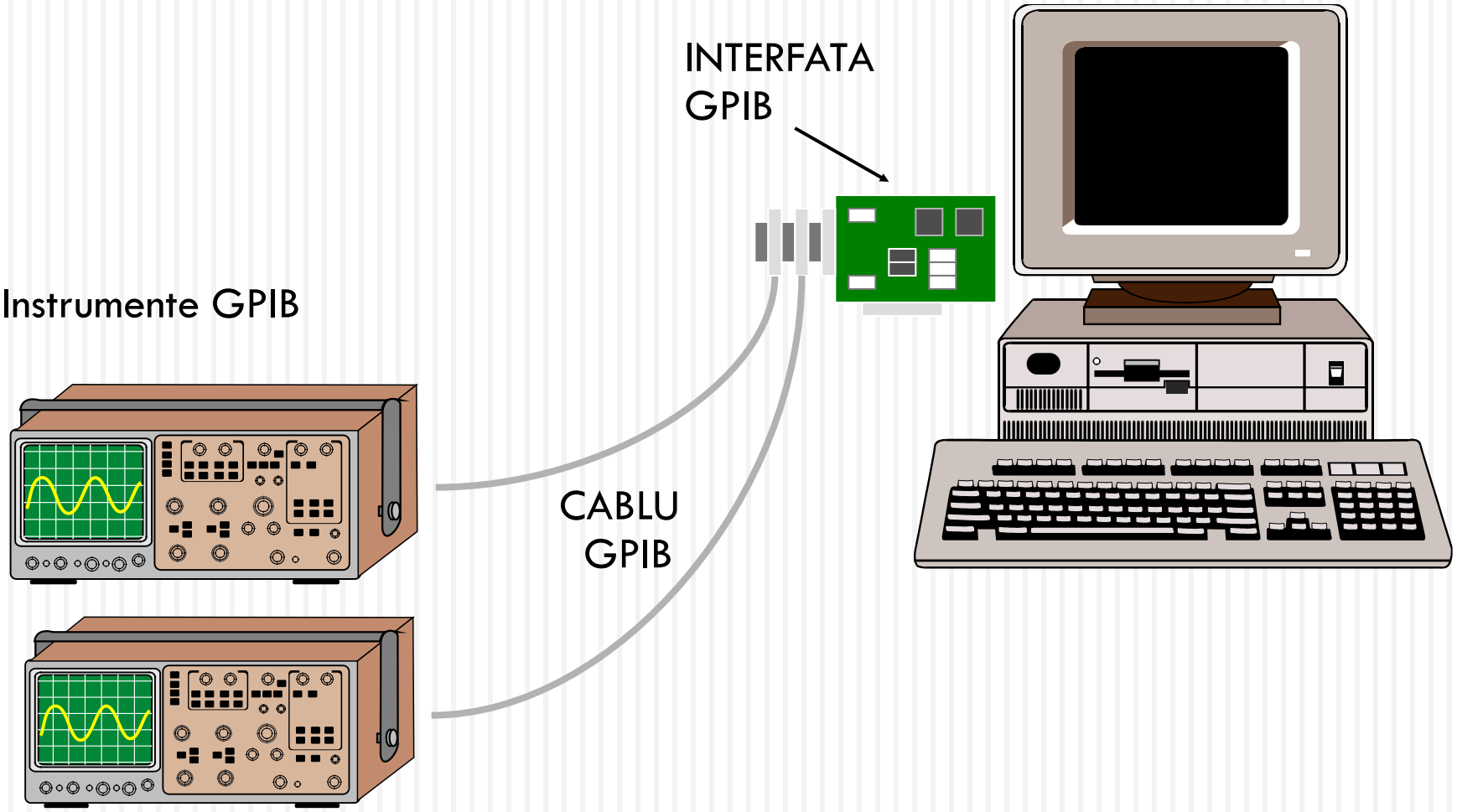
Interfete hardware

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



Comunicatia GPIB

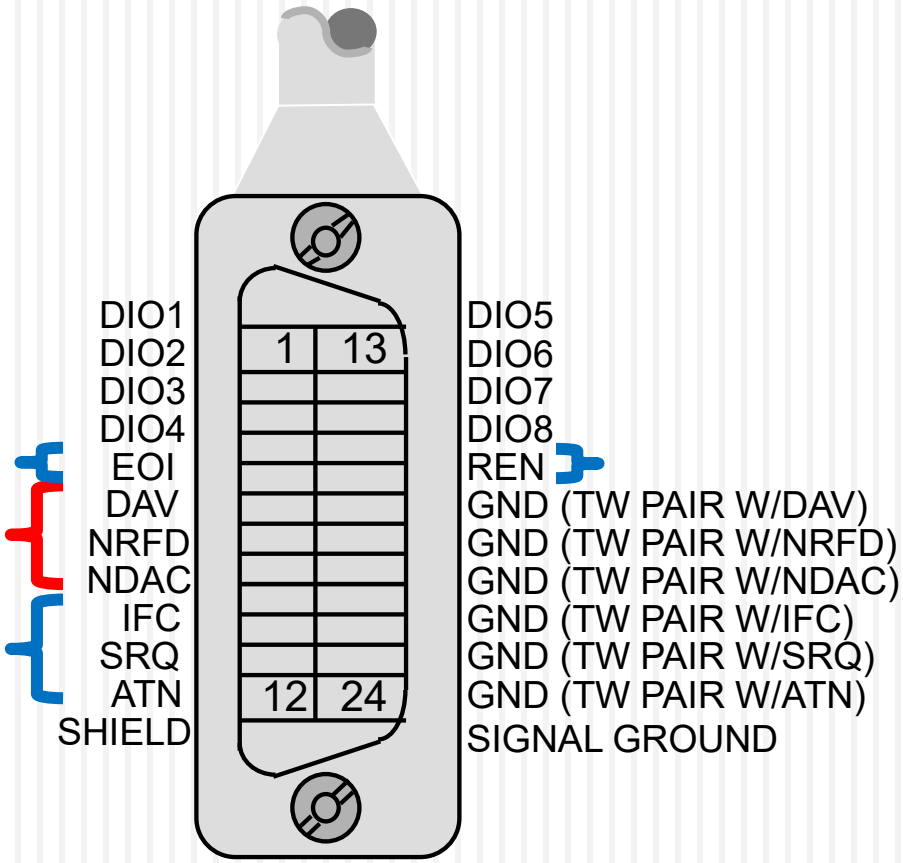
General **P**urpose **I**nterface **B**us (GPIB)



Standards Introduction

1965	HP designs HP-IB (Hewlett Packard Interface Bus)
1975	HP-IB becomes IEEE 488
1987	IEEE 488.2 adopted IEEE 488 becomes IEEE 488.1
1990	SCPI (Standard Commands for Programmable Instruments) added to IEEE 488.2
1992	IEEE 488.2 revised
1993	HS488 proposed
1999	HS488 approved

GPIB – Specificatii Hardware

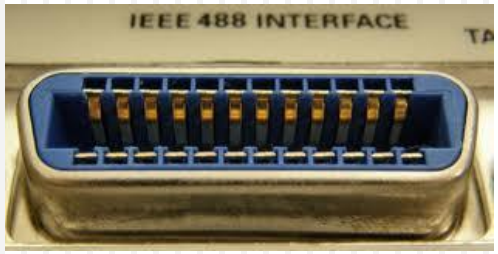


- Lungimea maxima a cablului intre dispozitive = 4 m (2 m average)
- Lungime maxima = 20 m
- Numar maxim de dispozitive = 15 (cam 2/3 alimentate)
- Interfata de comunicare digitala:
  - 8 linii de date
  - 3 linii de handshaking
  - 5 linii de control
- 1MB/s pana la 8MB/s

GPIB Hardware

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

GPIB Hardware



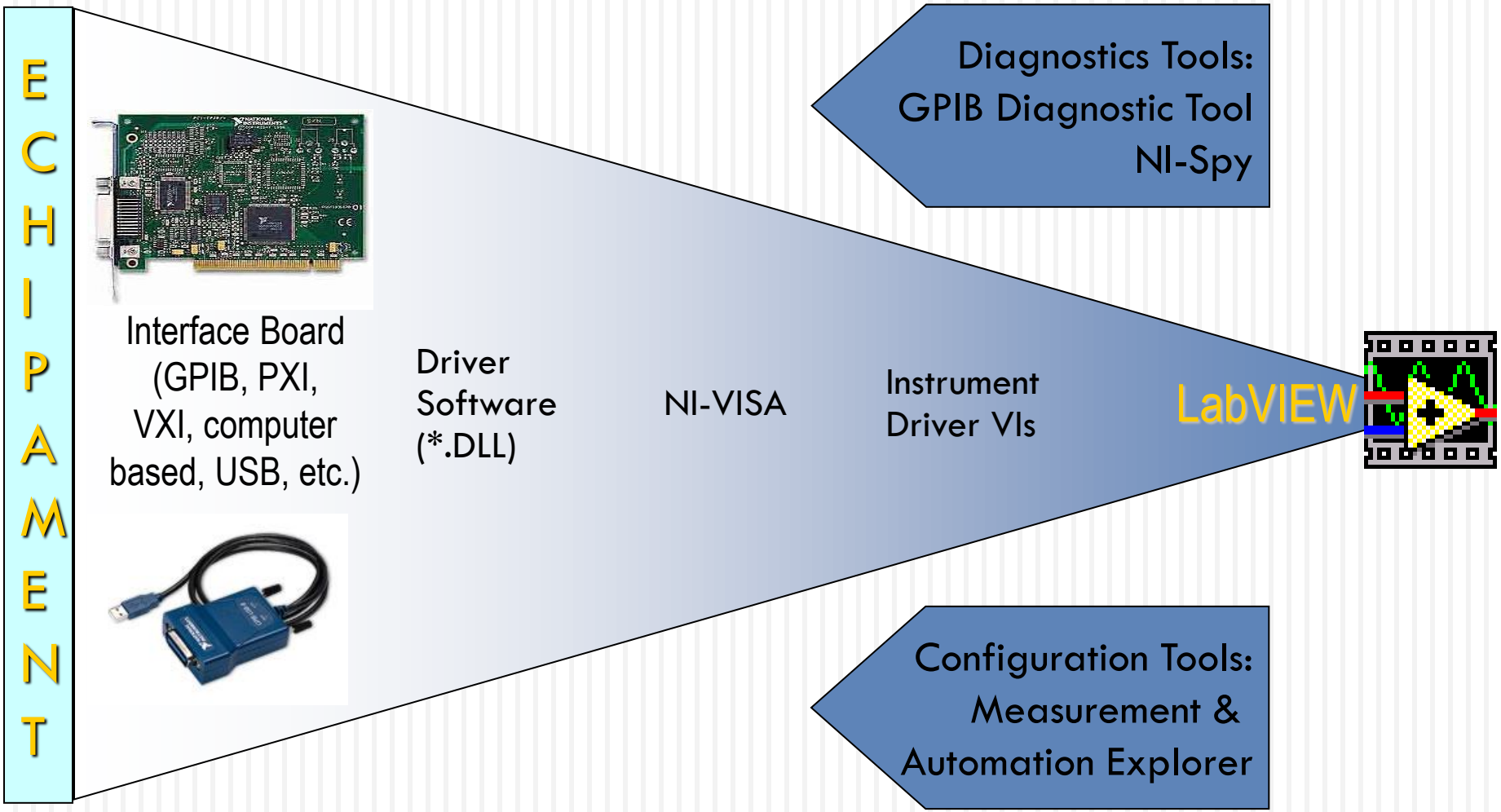
GPIB-USB

GPIB-RS232

GPIB-PCI

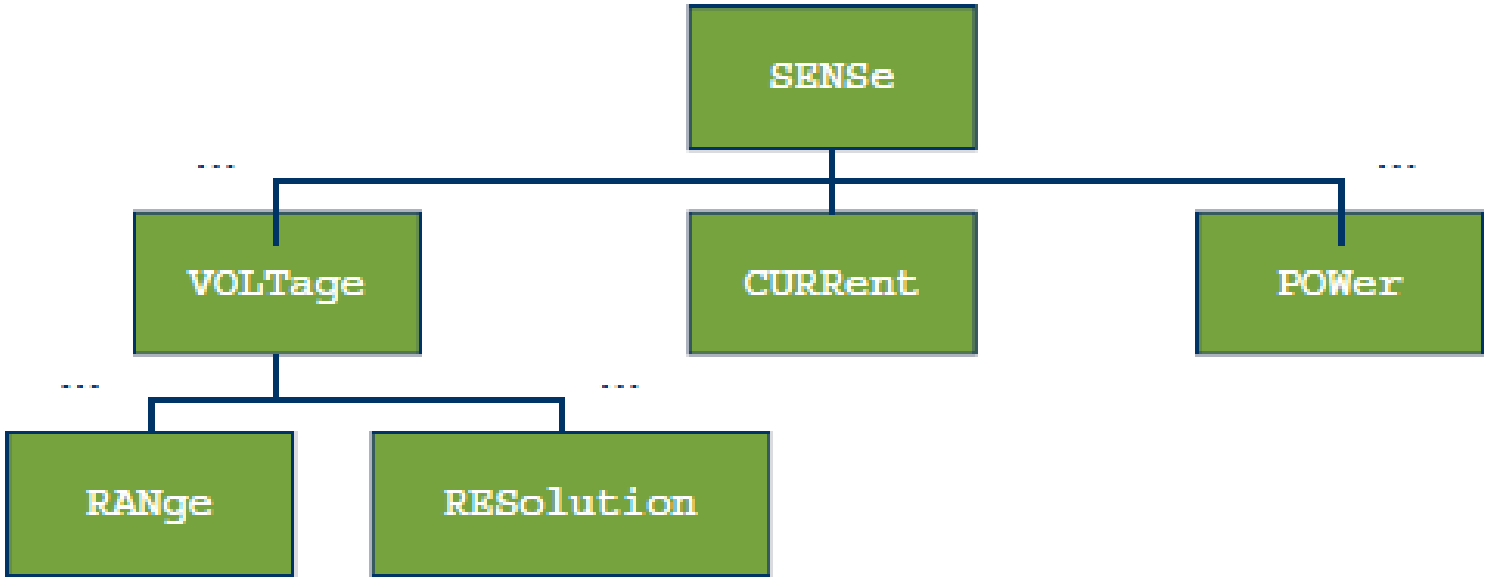
Interfete de instrument software

GPIB Arhitectura software — Windows



Programarea cu SCPI

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



Programarea cu SCPI - Exemple

- Configurare - interogare
- Interogare

:ACQuire:MODe — Set → / → Query

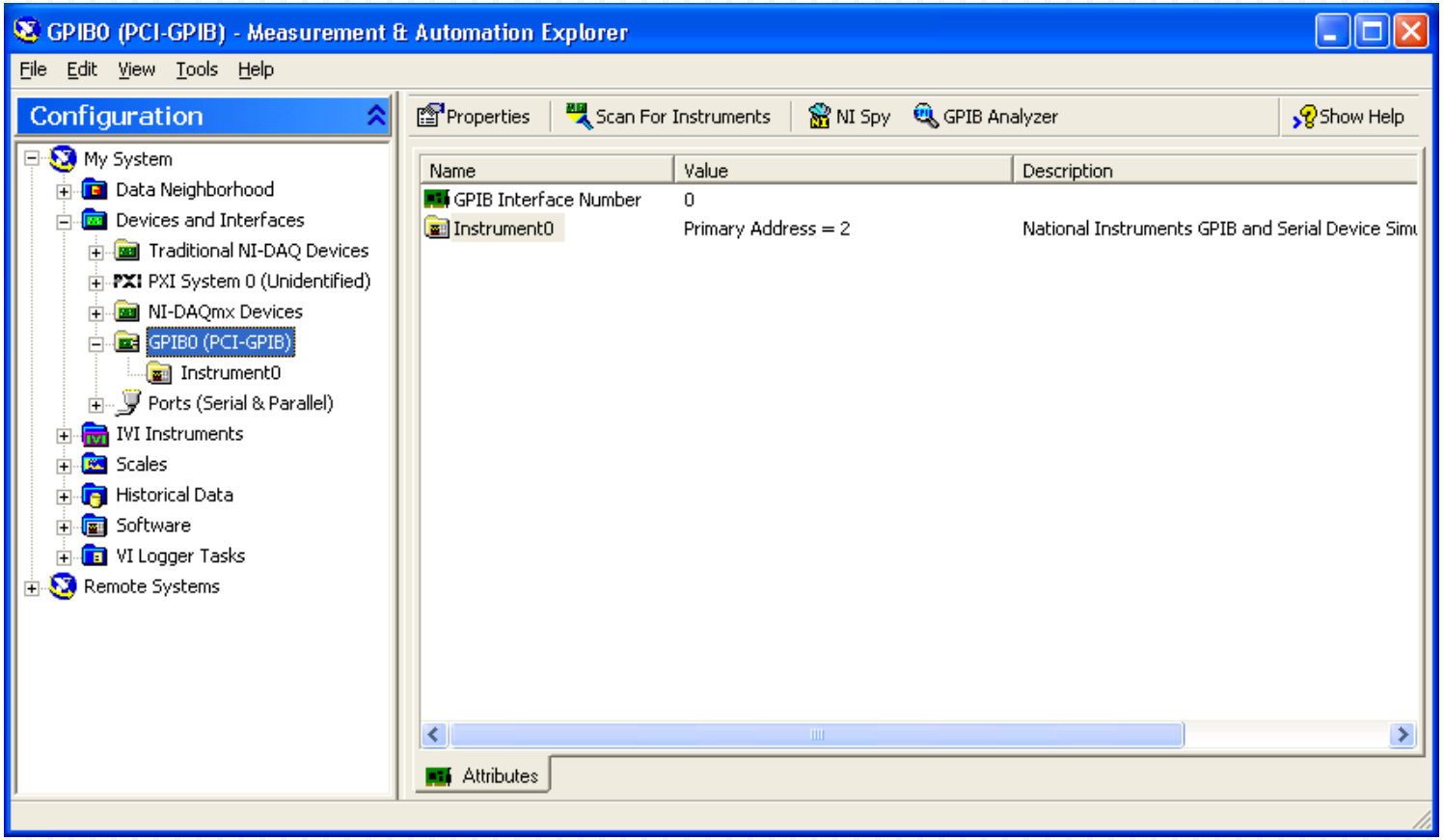
Description	Selects or returns the acquisition mode. Same as: Acquire key → F1 ~ F3			
Syntax	< Long >		< Short >	
	:acquire:mode <NR1>		:acq:mod <NR1>	
	:acquire:mode?		:acq:mod?	
Parameter	<NR1>	Mode	<NR1>	Mode
	0	Normal	2	Average
	1	Peak detect		
Example	:acquire:mode 2 :acquire:average 2		Selects the average acquisition mode, and select the average number 4	

:MEASure:VPP — → Query

Description	Returns the peak-to-peak amplitude (difference between maximum and minimum amplitude) Same as: Measure key → F1~F5 → F3 (Vpp)	
Syntax	< Long >	< Short >
	:measure:vpp?	:meas:vpp?
Returns	<NR3>	
Note	Before using this command, select the measurement channel. See the example below.	
Example	:measure:source 1 :measure:vpp?	Selects Channel 1, and then measures the peak-to-peak amplitude.

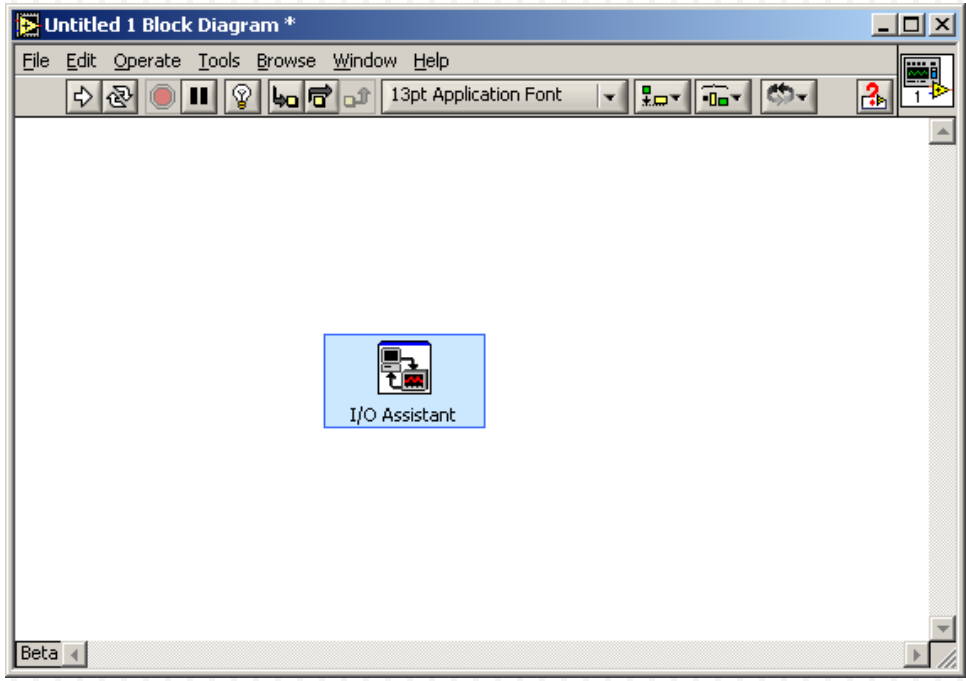
Configurarea placi GPIB si a Instrumentului

Folosim: Measurement & Automation Explorer (MAX)

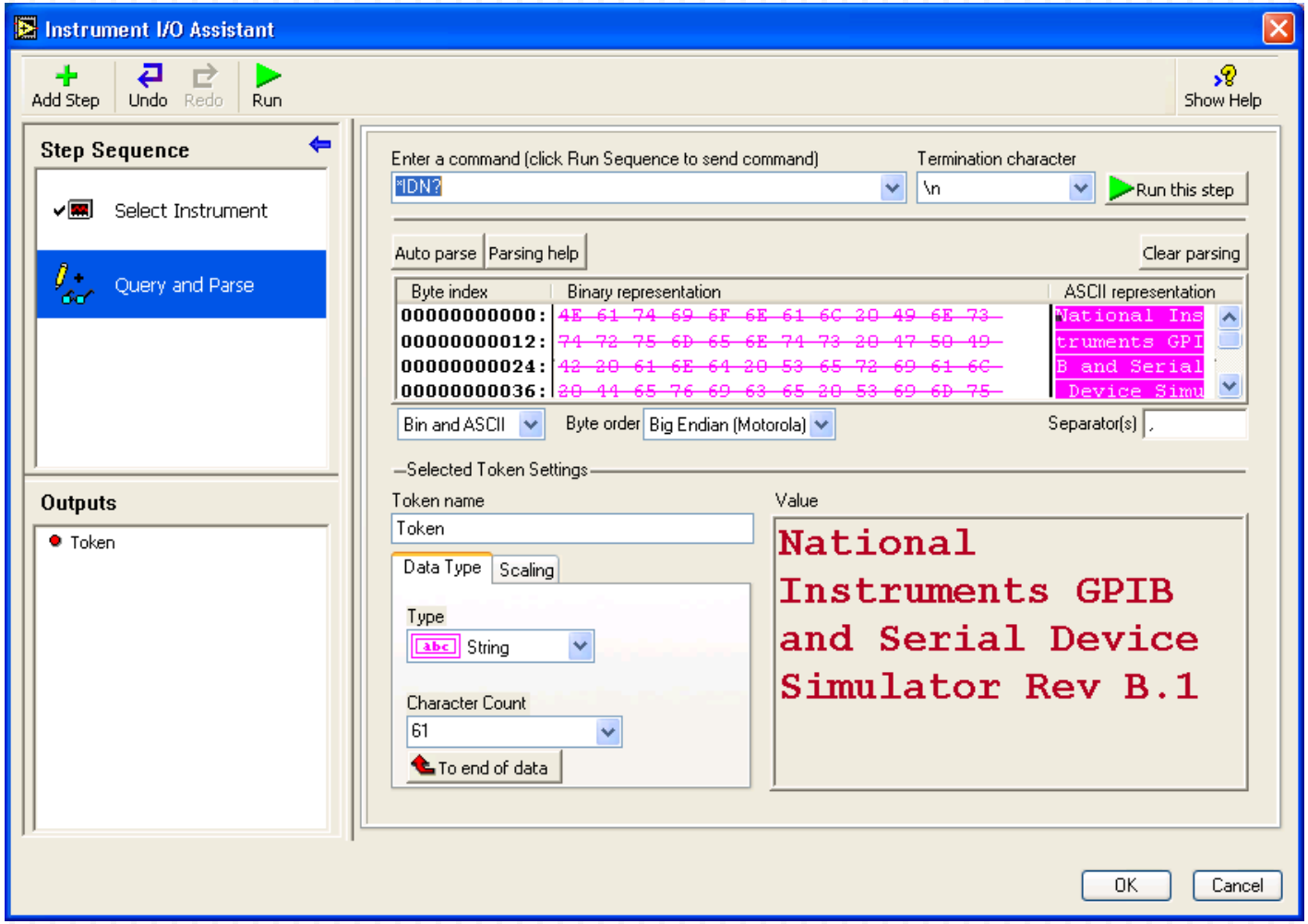


GPIB in LabVIEW – functii high level

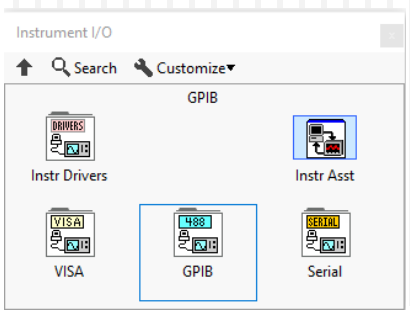
- Instrument I/O Assistant
  - Accesibil printr-un VI Express din mediul LabVIEW
  - Setarea comunicarii cu un dispozitiv (placa DAQ) si configurarea achizitiei pas cu pas – folosind o interfata de configurare

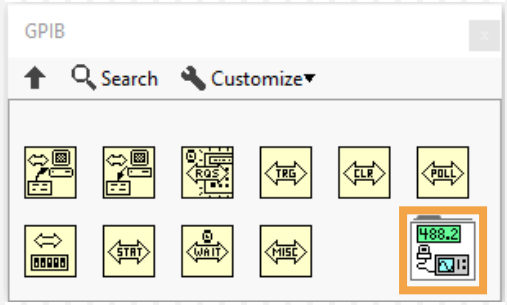


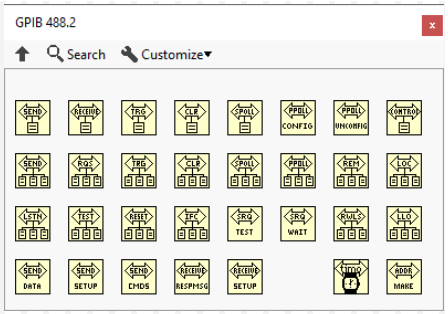
GPIB in LabVIEW – functii high level

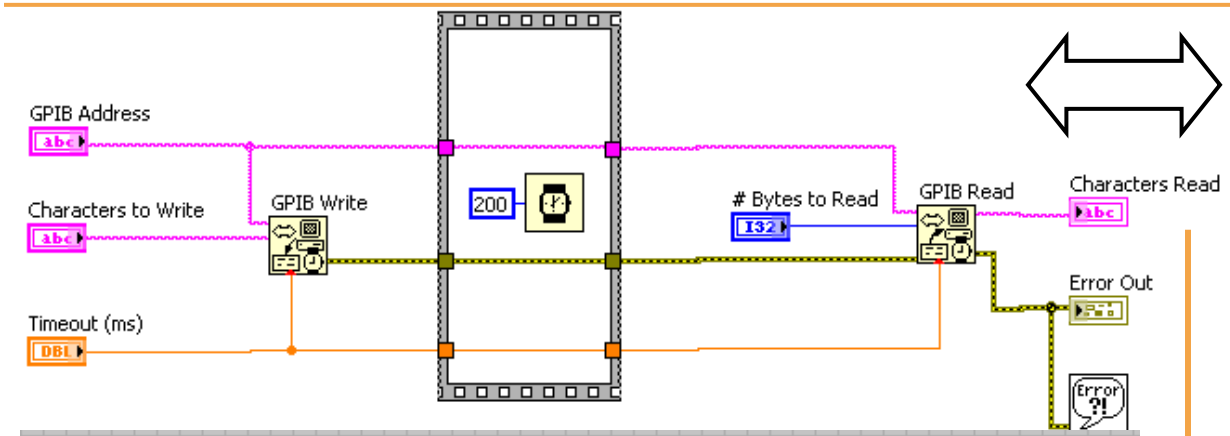


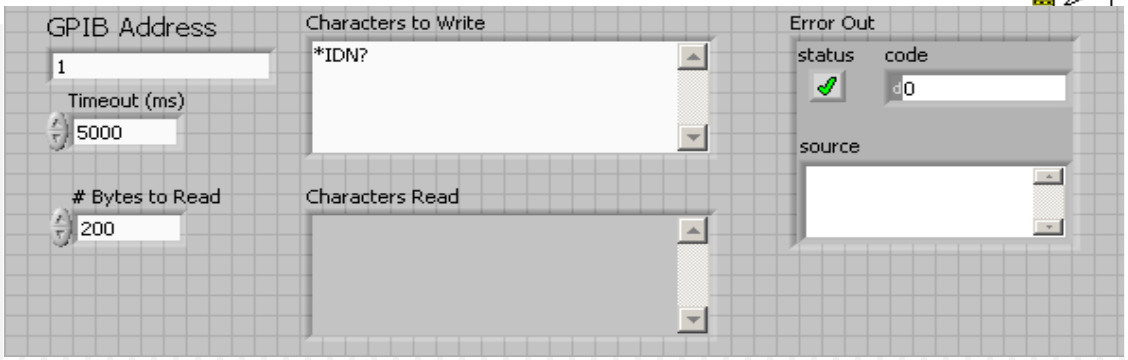
GPIB in LabVIEW – functii intermediate



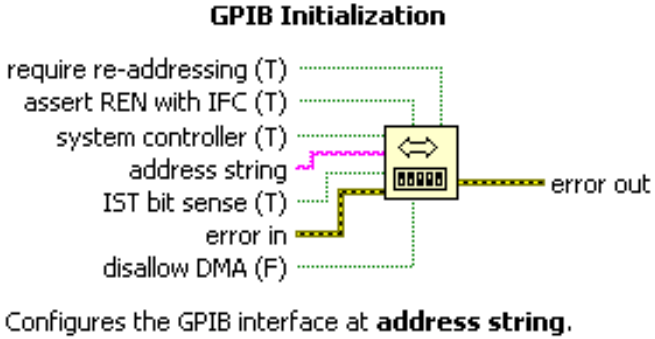




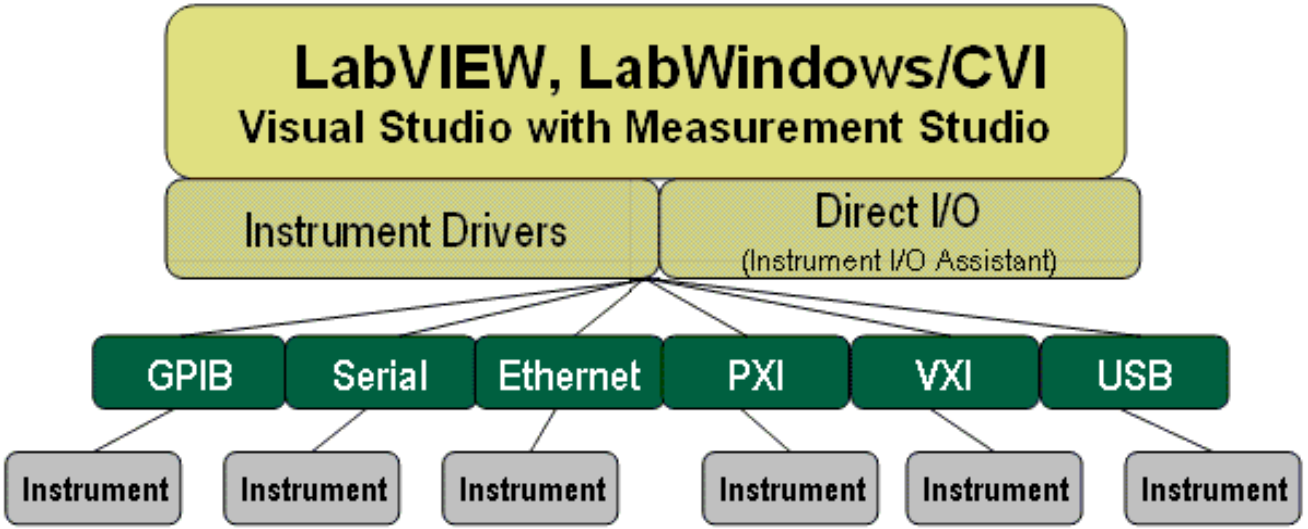




Pentru initializarea interfetei GPIB se foloseste nodul "GPIB Initialization“, inainte de a folosi nodurile de R/W



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

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

Instrument Descriptor Syntax

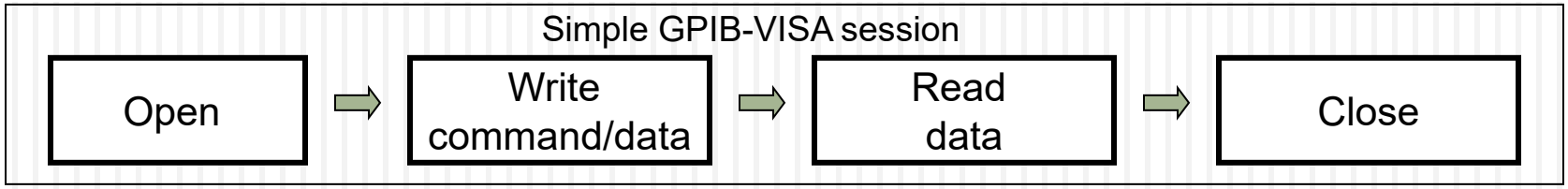
- Resource Name contine informatii despre interfata
- Se poate lucra cu VISA Aliases

Interfata	Sintaxa Resource Name
Serial	`ASRL[board][::INSTR]`
GPIB	`GPIB[board]::`*`primary address`*`[::INSTR]`
VXI	`VXI[board]::`*`VXI logical address`*`[::INSTR]`
GPIB-VXI	`GPIB-VXI[board][::`*`GPIB-VXI primary address`*`]::`*`VXI logical address`*`[::INSTR]`

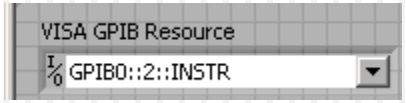
Numele Resursei VISA

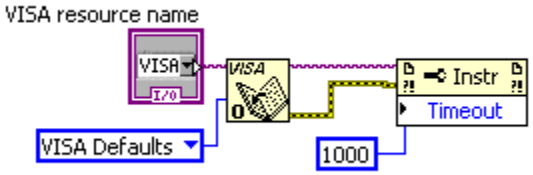
- Numele exact si locatia instrumentului
- Foloseste "**VISA Resource Name**" pentru control
- Se poate specifica intregul nume al resursei pentru a forma un **VISA Alias**

VISA in LabVIEW

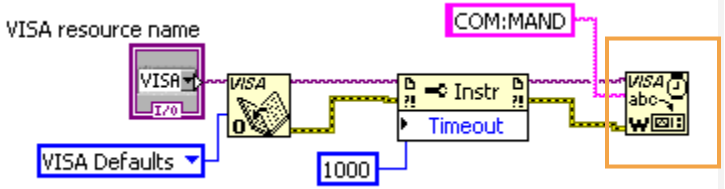


- Deschiderea sesiunii VISA utilizand resursa instrumentului. Configurarea timeout-lui

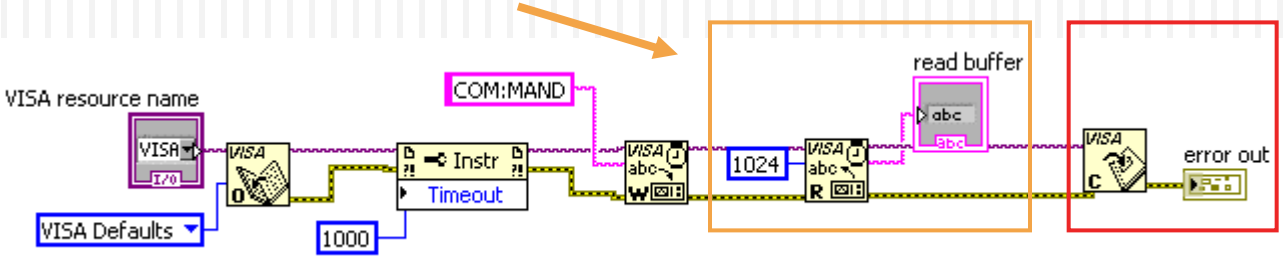




- Scrierea comenzii catre instrument cu nodul Write



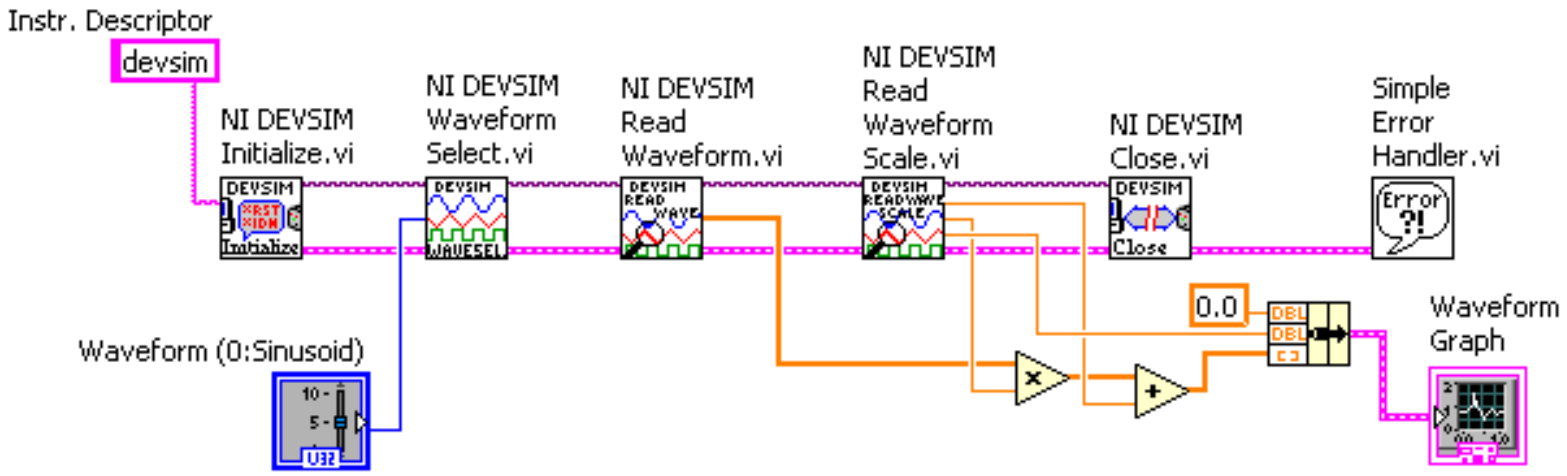
- Citirea raspunsului de la instrument
- Inchiderea sesiunii VISA



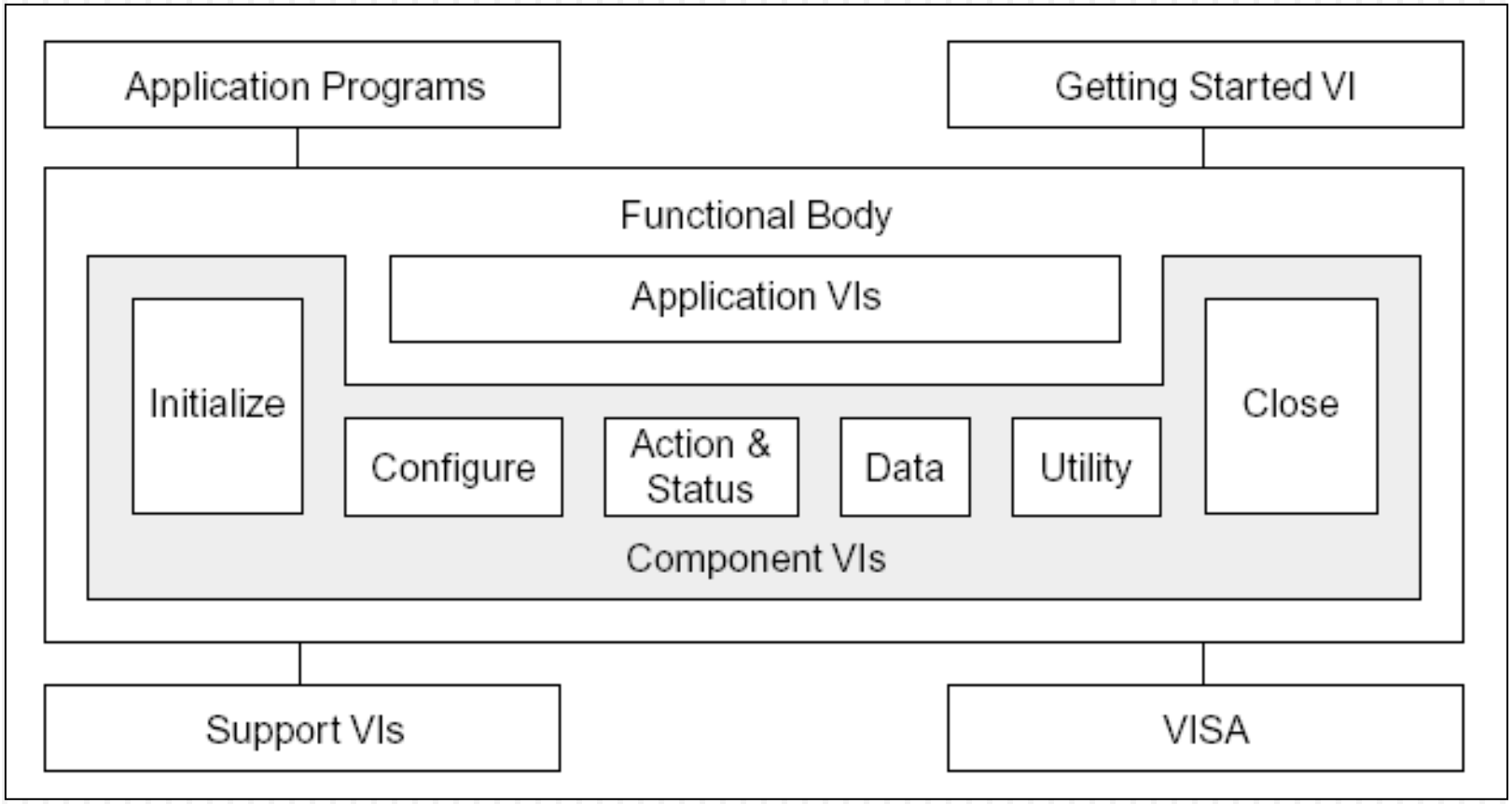
Se recomanda utilizarea functiilor VISA in detrimental celor GPIB, datorita versatilitatii VISA

Drivere de instrument

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

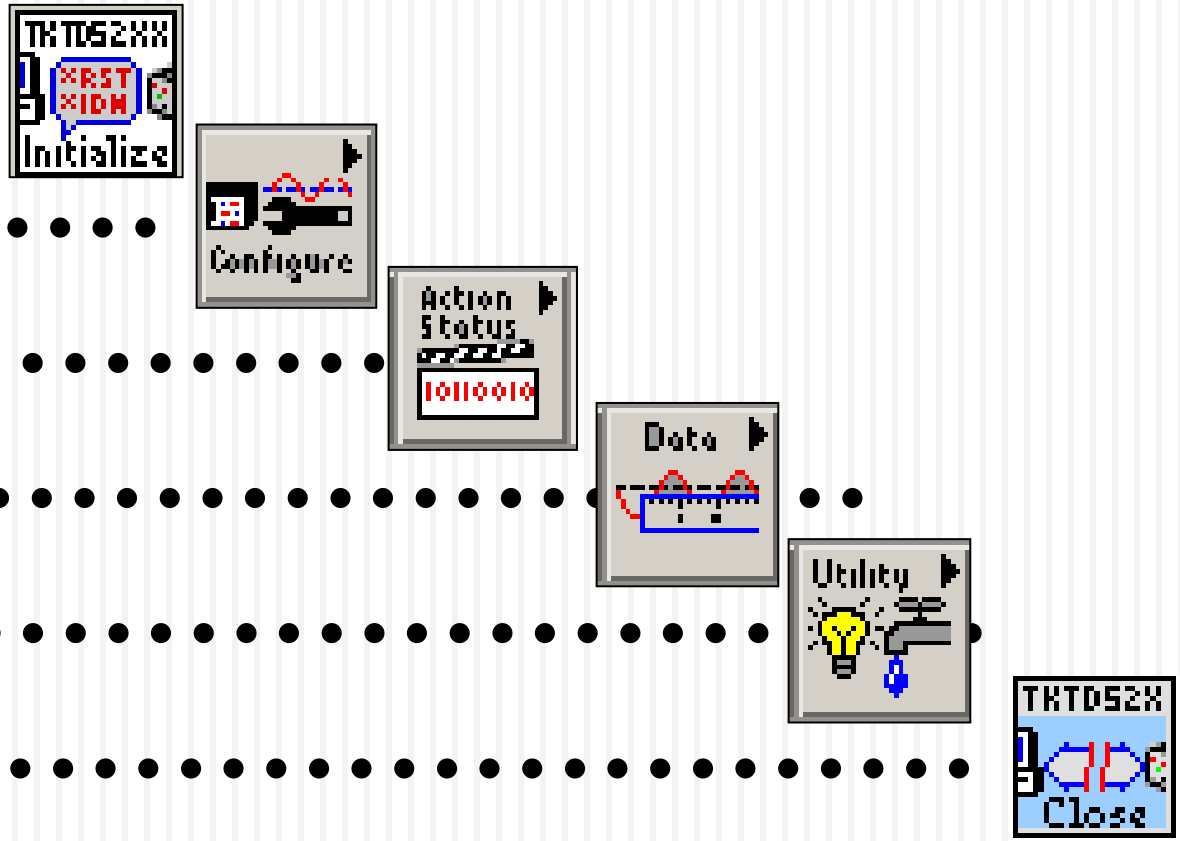


Model de driver de instrument

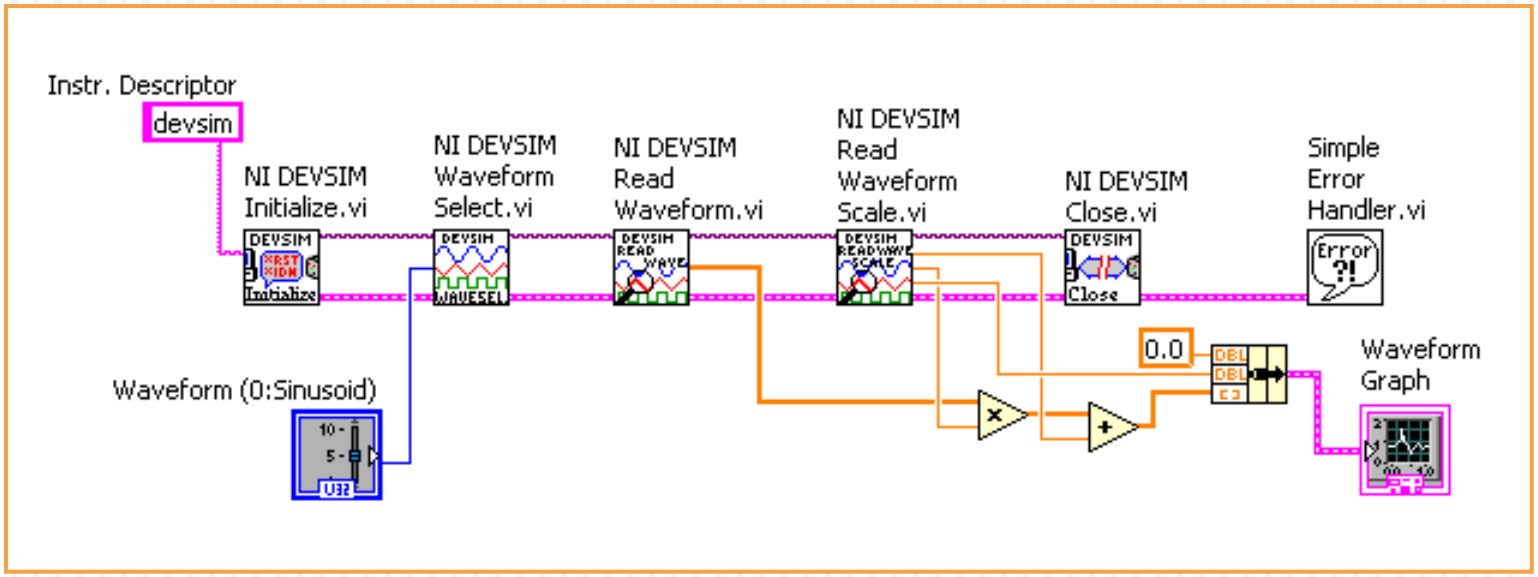


VI-uri pentru Driver de Instruments

- Initialize • • •
- Configure • • • • • •
- Action/Status • • • • • • • • •
- Data •
- Utility •
- Close •



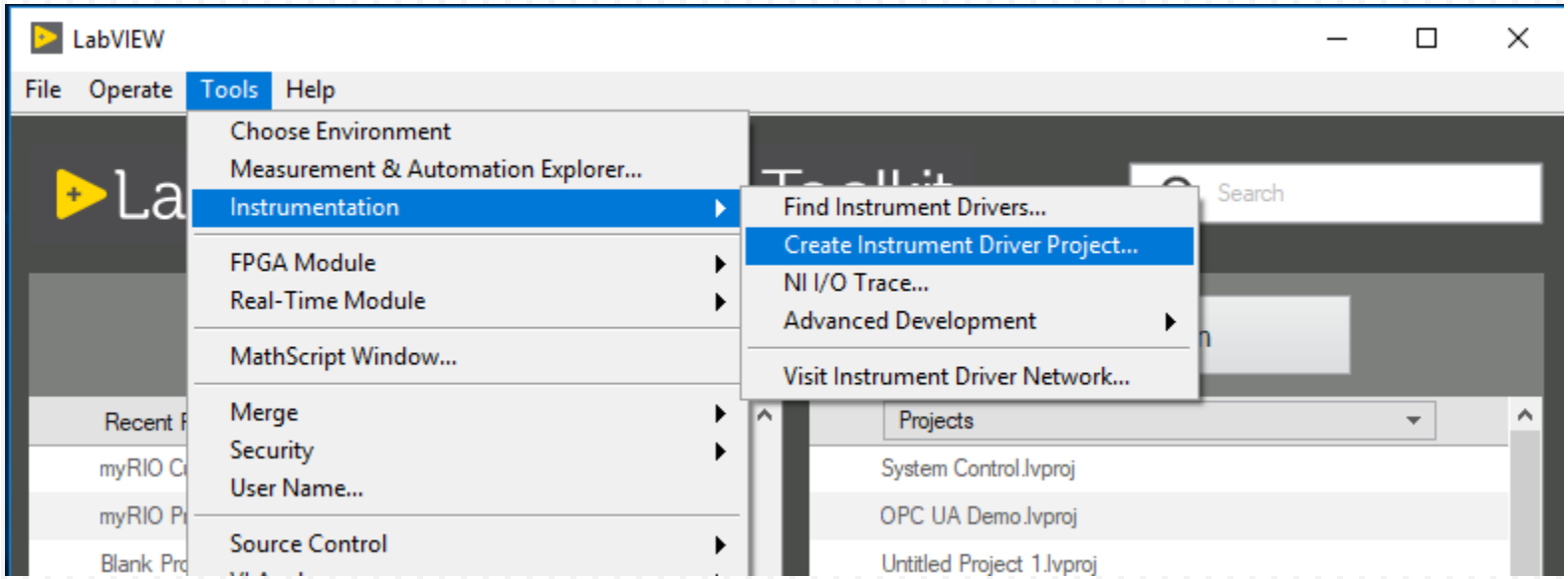
Toate acestea puse in aplicatie



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

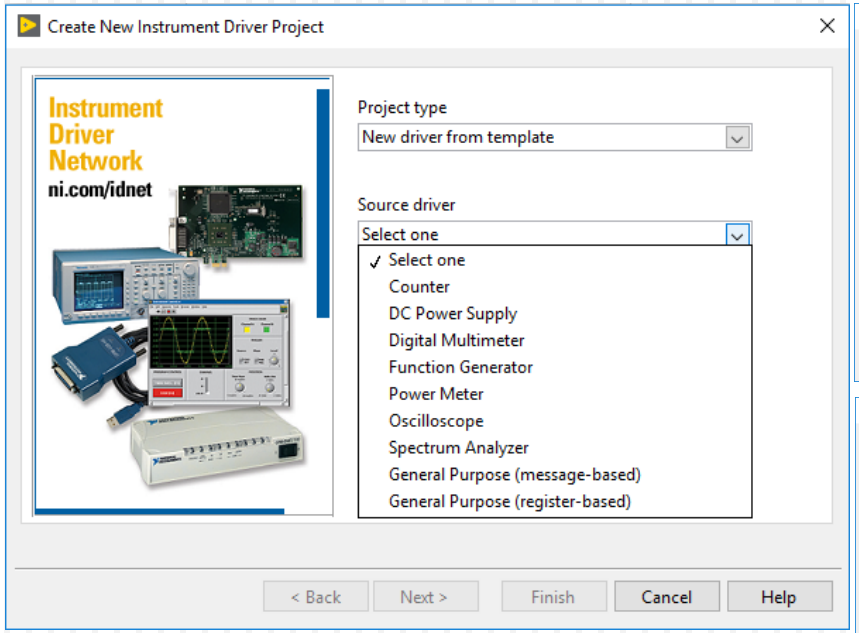
Ex. Instrument Driver in LabVIEW

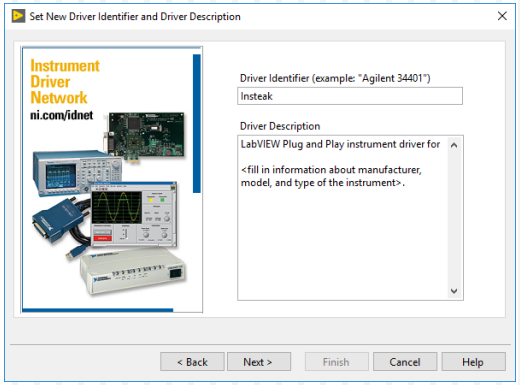
- Crearea unui proiect de tip Intrument Driver

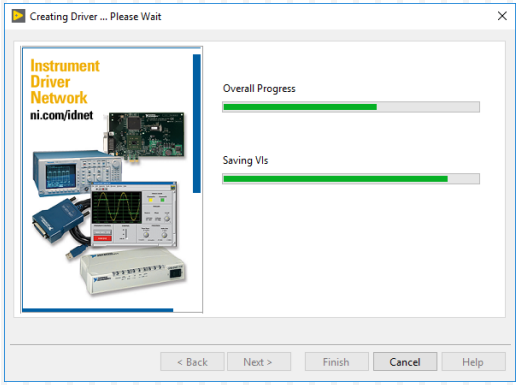


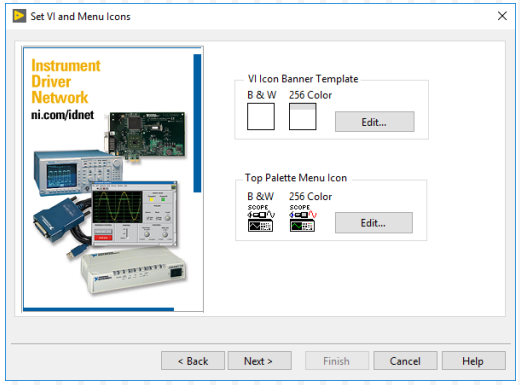
Ex. Instrument Driver in LabVIEW

- Intrument Driver - Osciloscop



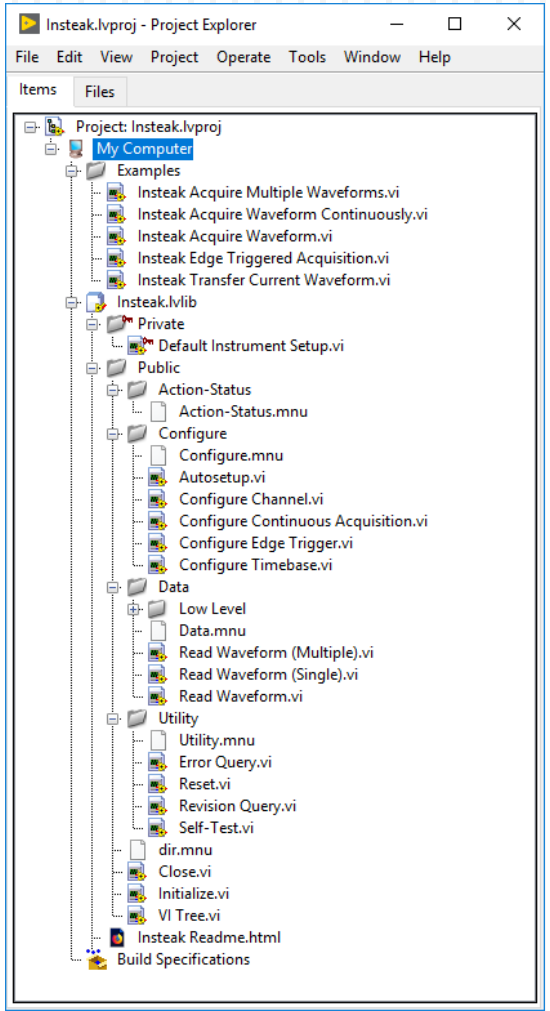


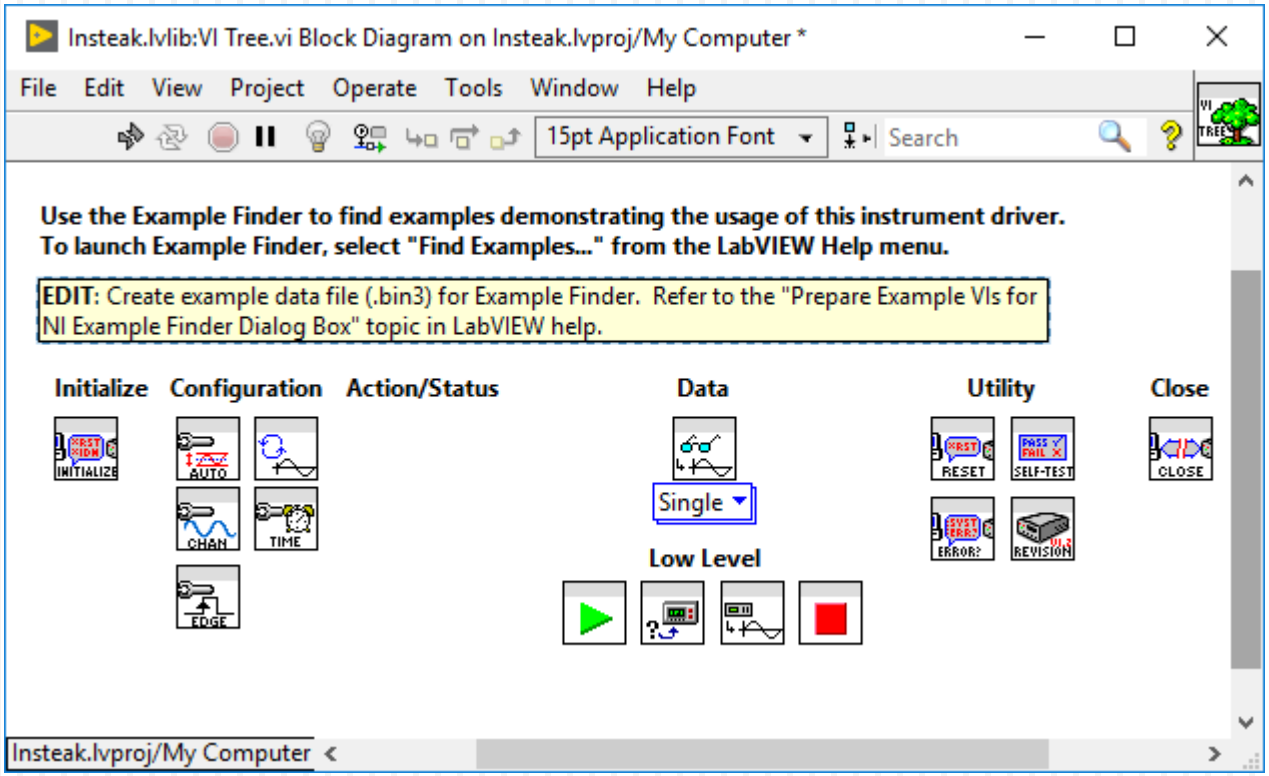




Ex. Instrument Driver in LabVIEW

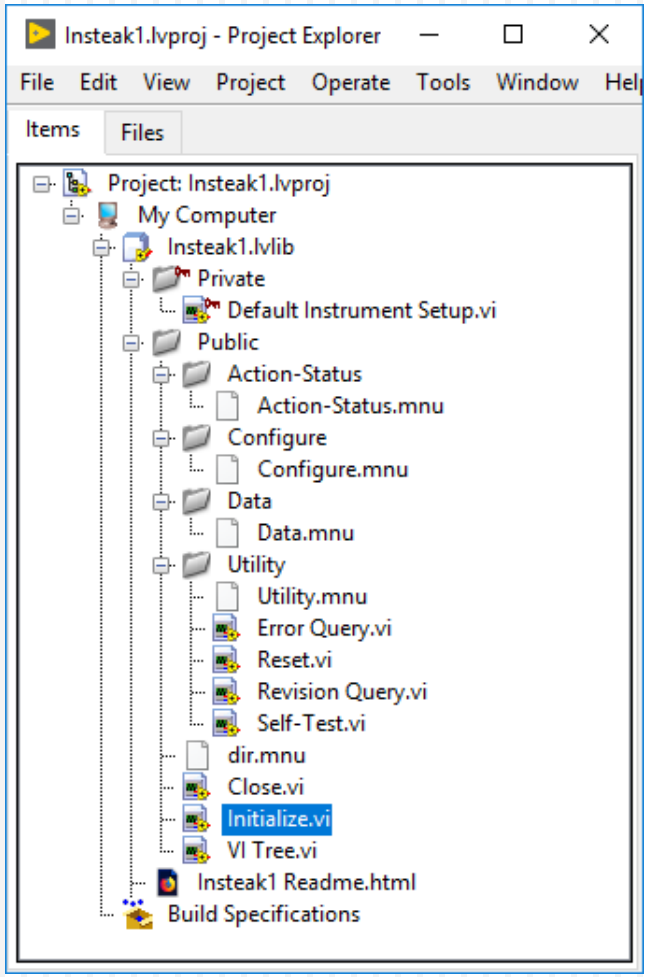
- Intrument Driver - Osciloscop

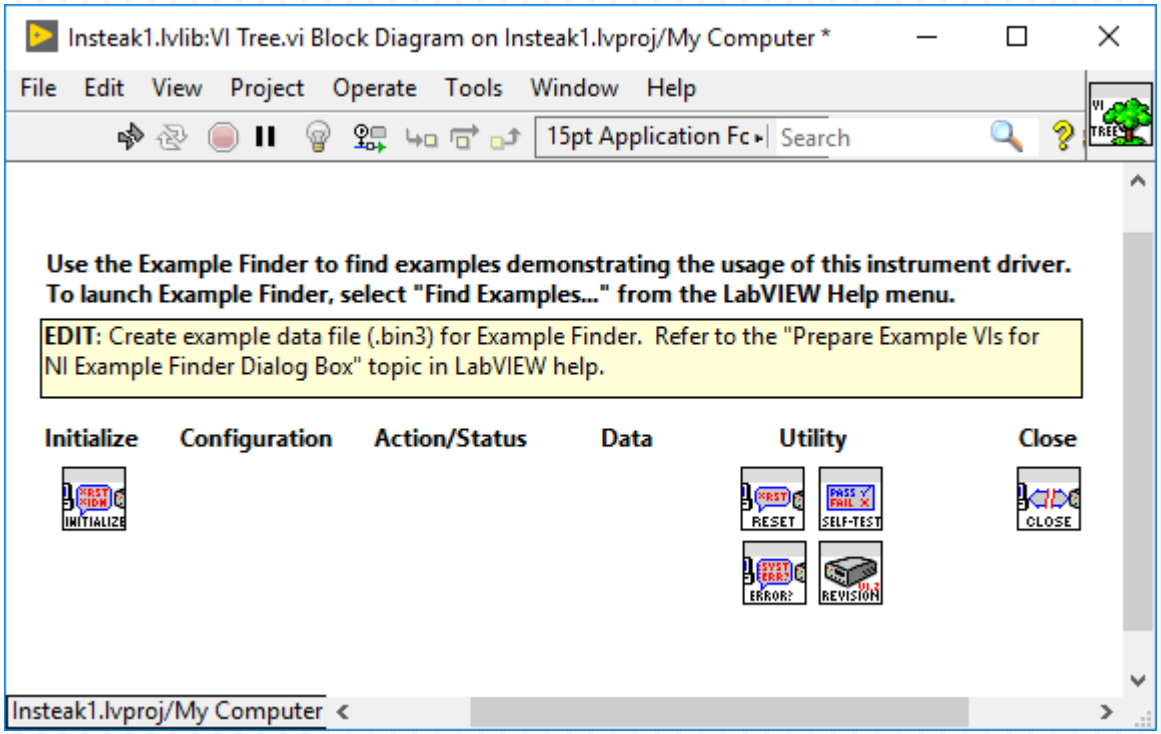




Ex. Instrument Driver in LabVIEW

- Intrument Driver – General purpose (message-based)





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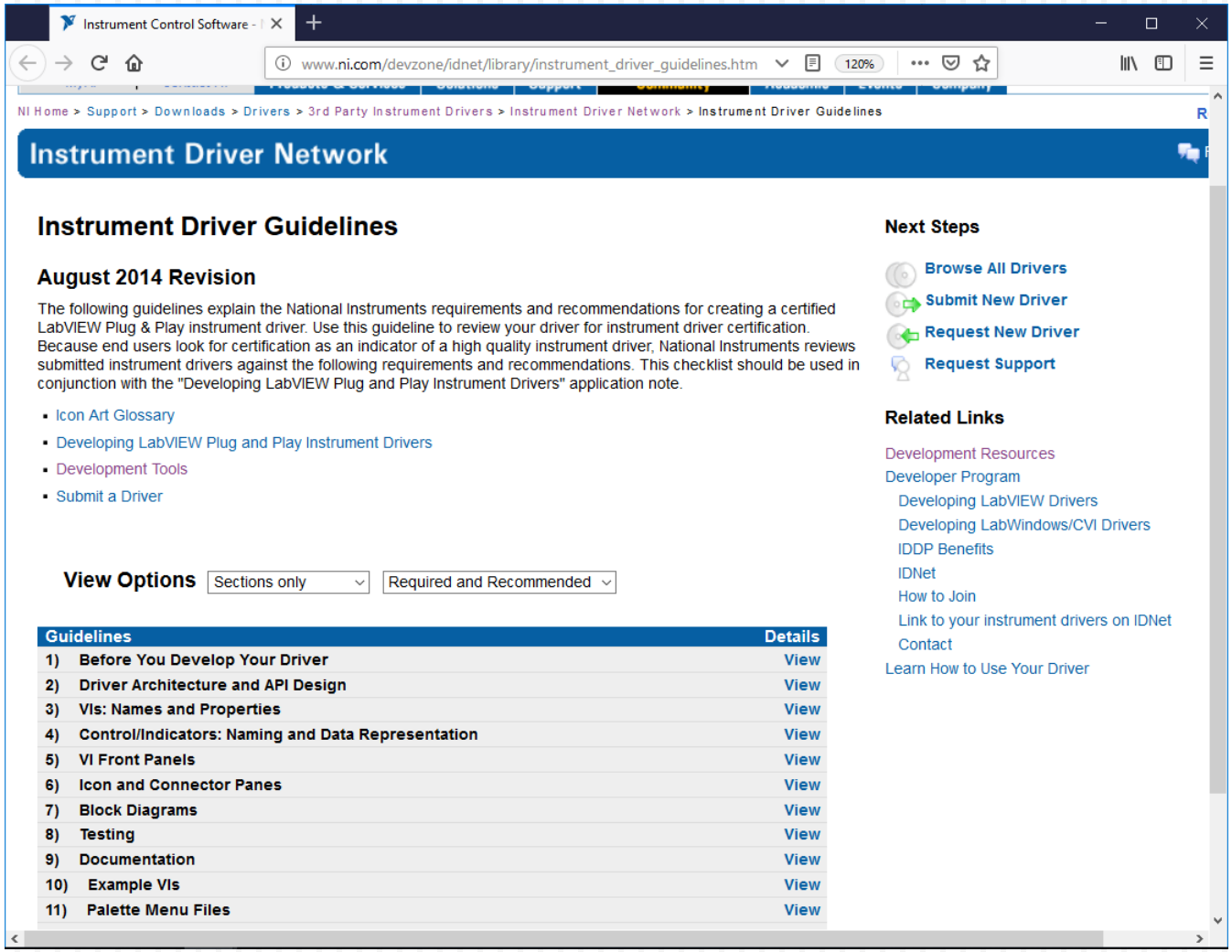
- http://www.ni.com/devzone/idnet/development.htm
- http://www.ni.com/devzone/idnet/library/instrument_driver_guidelines.htm