# TANGO interfacing with NI technology

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# Agenda

- TANGO concepts
- From NI HW/ NI LabVIEW to TANGO

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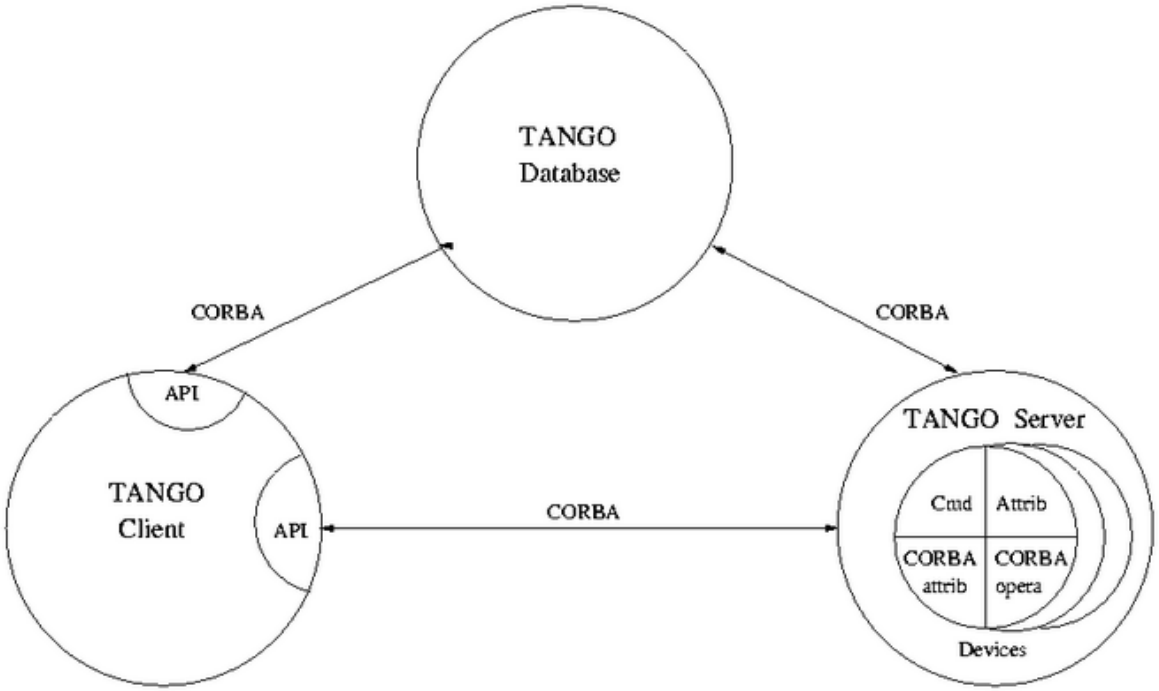
# What is TANGO?

The **TANGO** control system is a free, open source, object oriented, distributed control system (based on CORBA) used for controlling synchrotrons, lasers, physics experiments in over 20 sites.

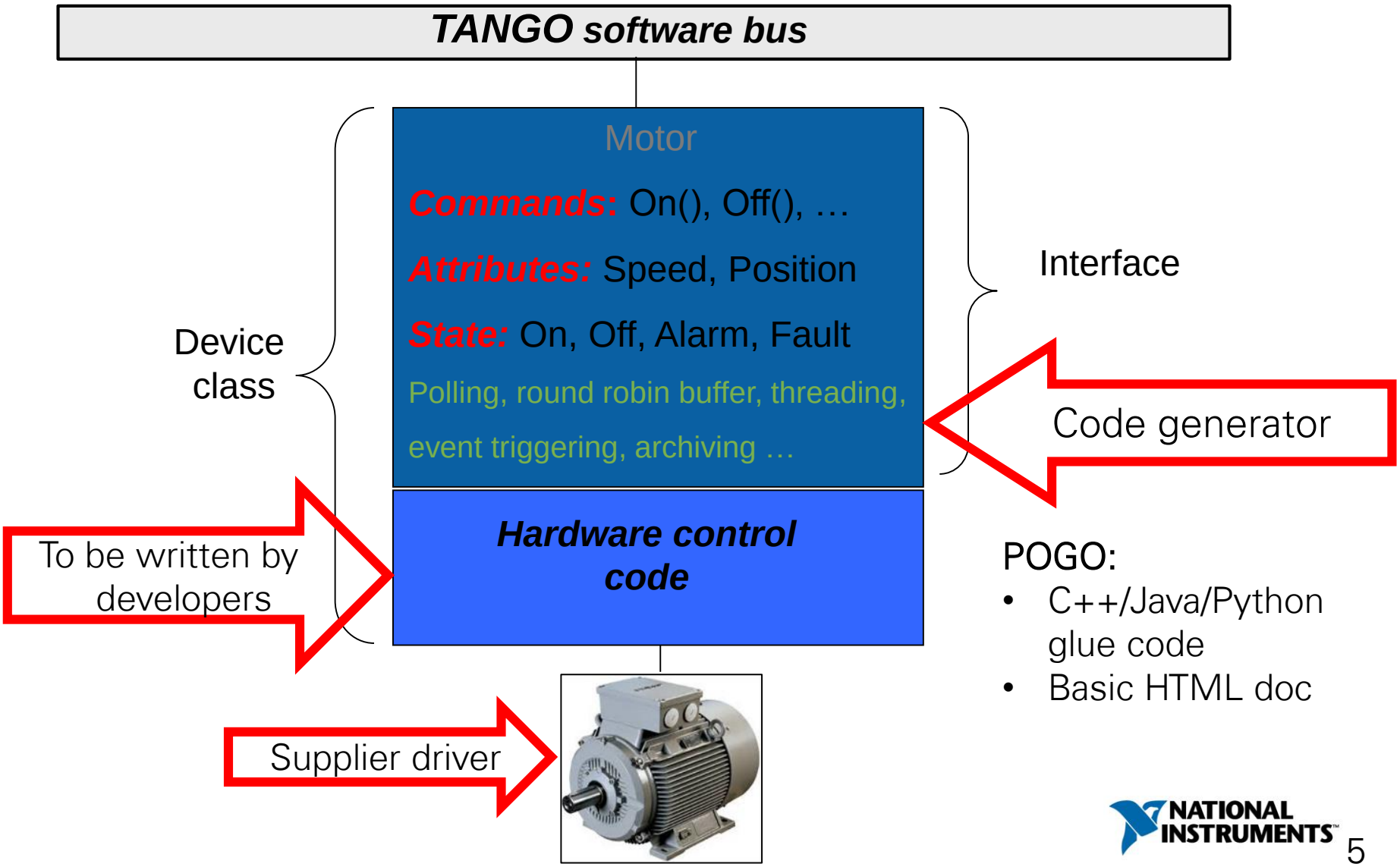
It was initially developed by ESRF and is now developed as a collaborative effort between Alba, Anka, Desy, Elettra, ESRF, FRM II, Solaris , MAX-IV and Soleil institutes.

# Architecture

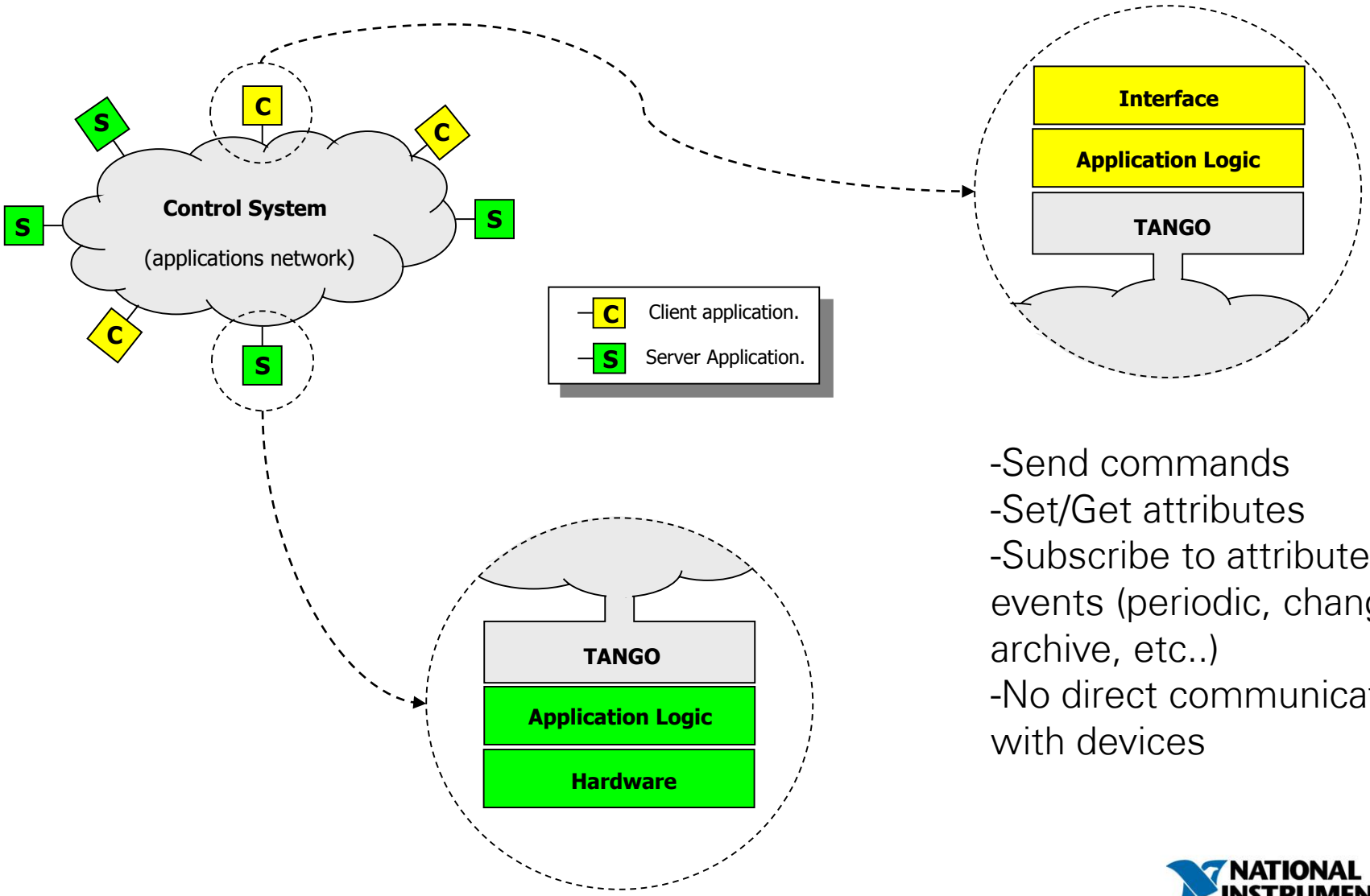
-It's based on a client/server model (in C++, Java or Python).
-It uses CORBA/Zeromq for network communication and the concept of Device Classes with object oriented programming.
-Clients import these Devices via a database.



# TANGO devices



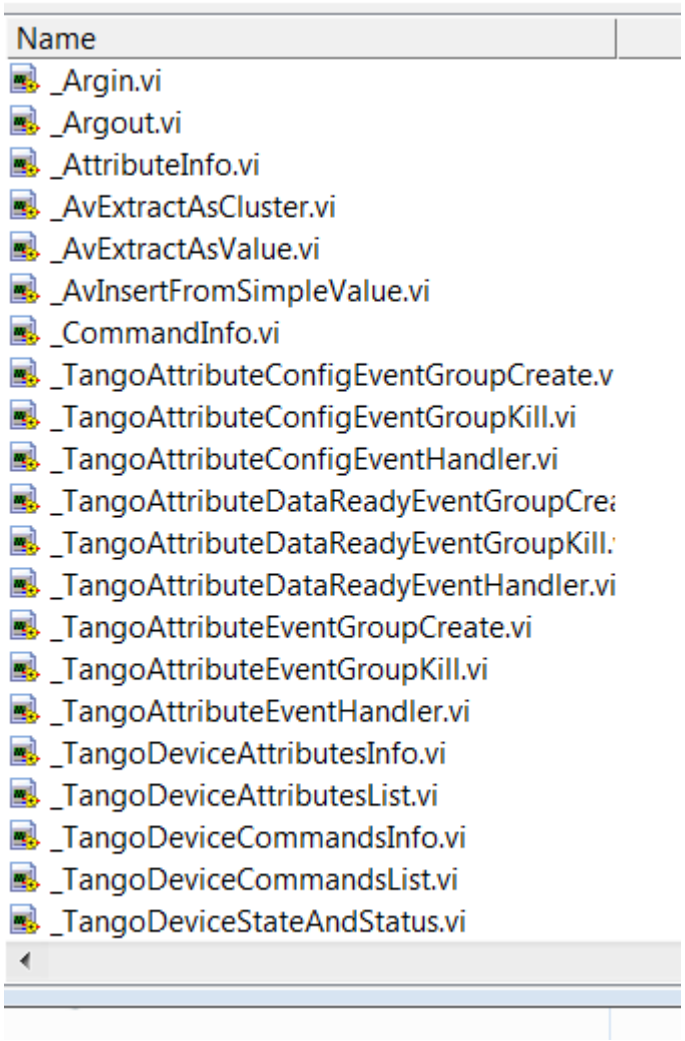
# Clients/Servers

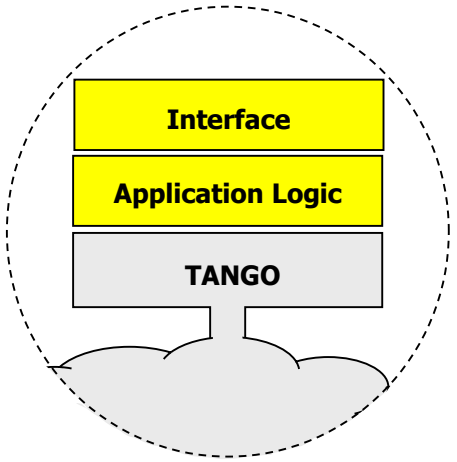



-Send commands
-Set/Get attributes
-Subscribe to attributes events (periodic, change, archive, etc..)
-No direct communication with devices

# TANGO-NI interface

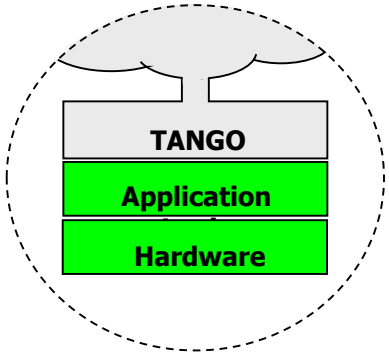
# LabVIEW client (binding)




- Developed by Synchrotron SOLEIL (Nicolas LERLERCQ)
- Last tested versions : LV 2013 for Windows and Linux (TANGO 8.1.2)

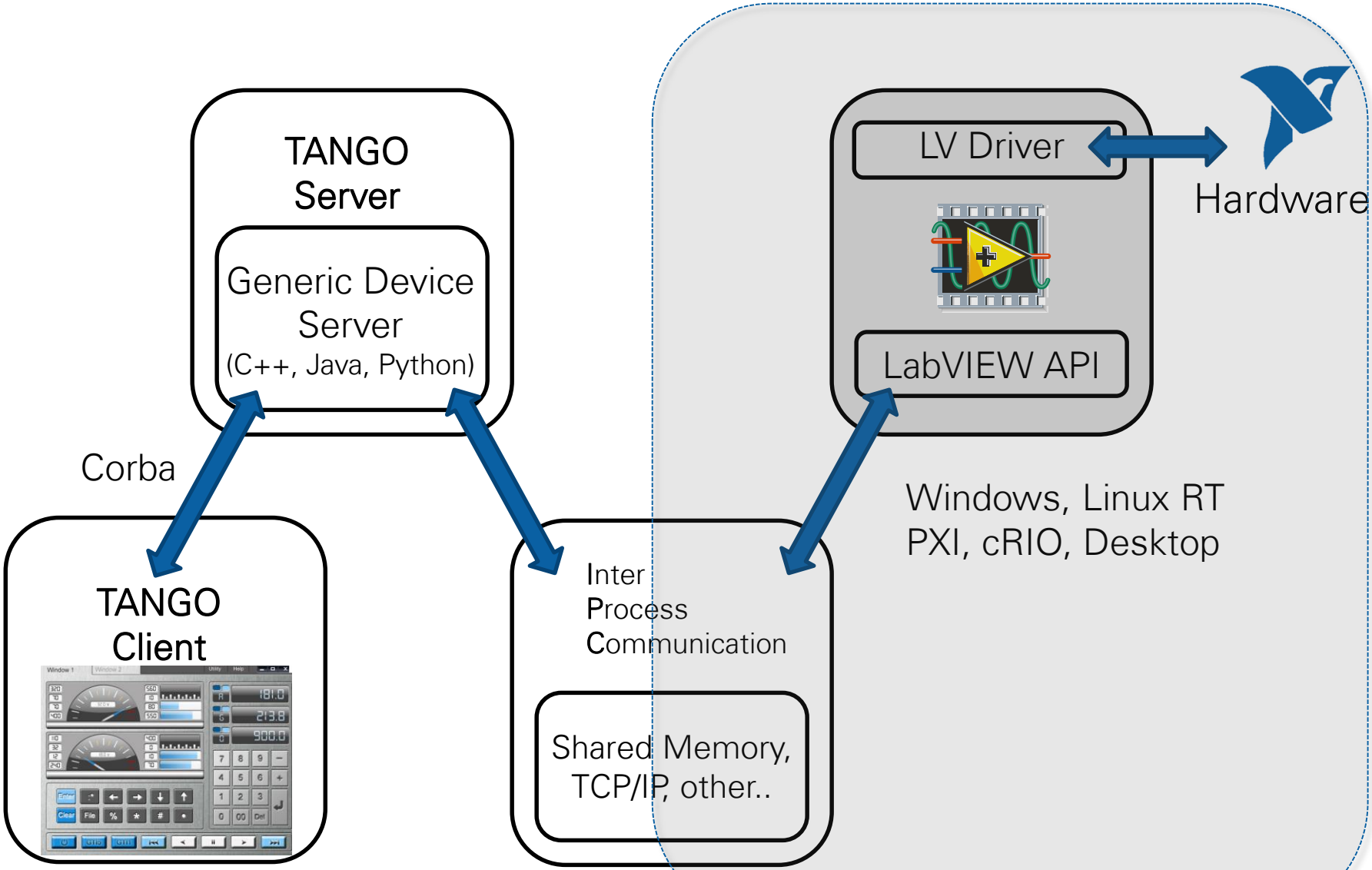
# TANGO-NI HW bridge (Device Server)




## 2 options:

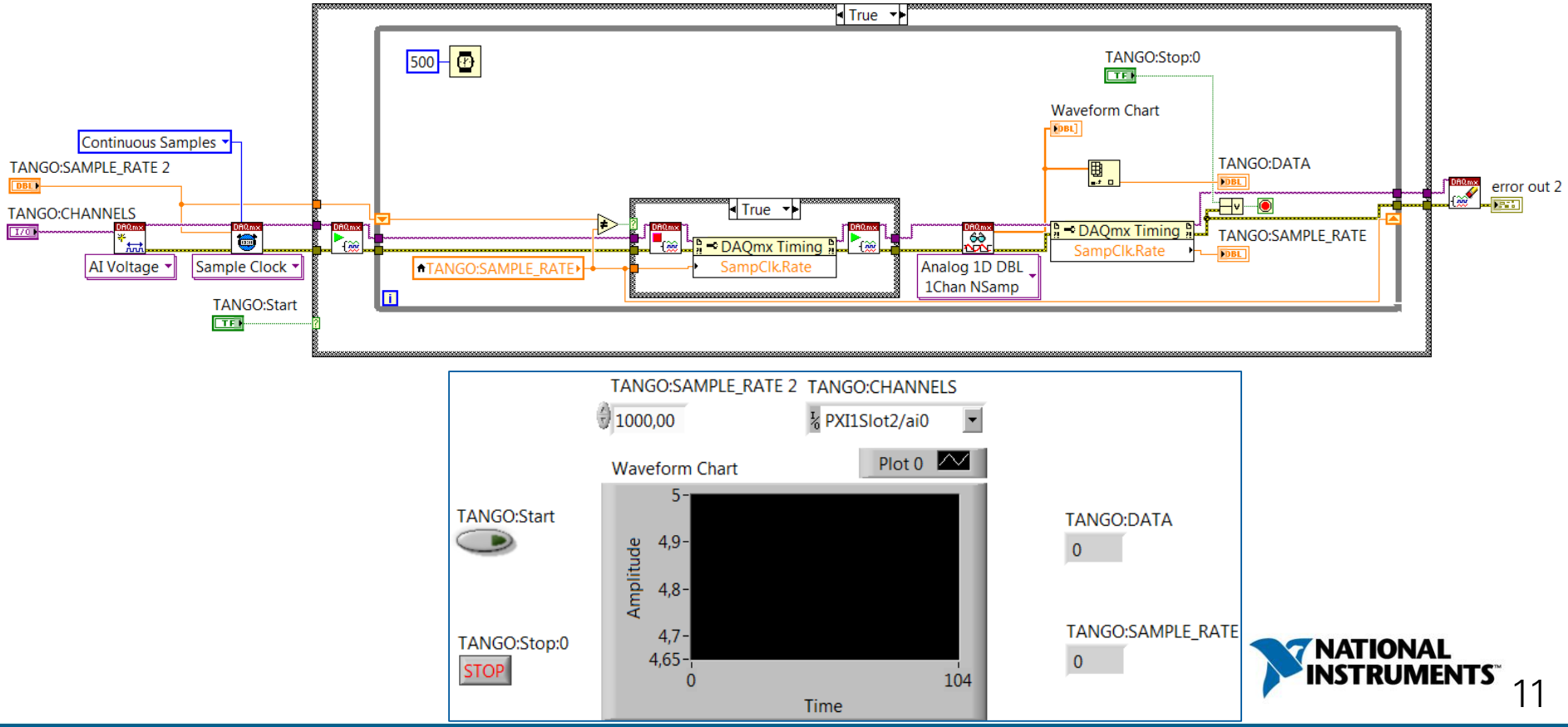
- TANGO Server and NI HW are on the same machine
  - One can develop his Device Server for NI HW by creating a class for this HW and calling its NI driver
- TANGO Server and NI HW are NOT on the same machine
  - One can do the same and calls will be done remotely through a chosen communication protocol (TCP/IP, etc..)

# Generic architecture for LV-TANGO

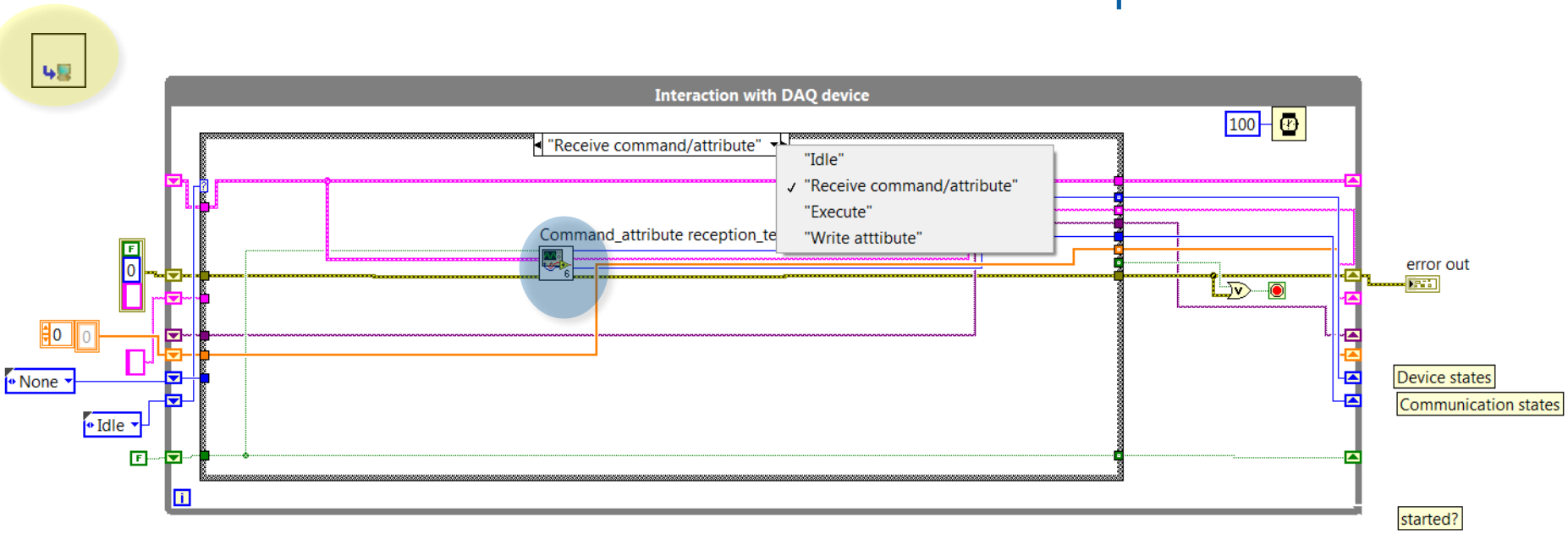


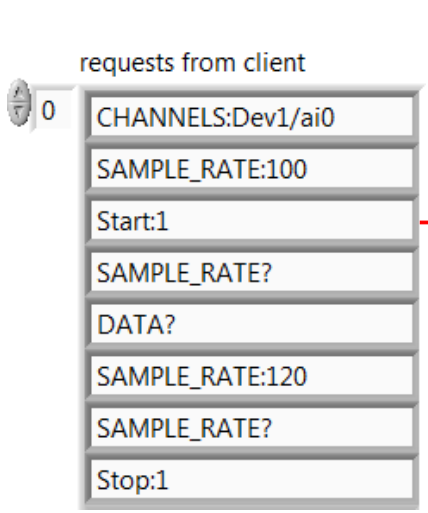
# Remote Device Server : DAQ application example

- One has to adapt his LV application architecture (state machine, events,…) to:
  - communicate with the client (via the Device Server) by using a communication protocol instead of LV front panel controls
  - make some attributes available at any time if needed



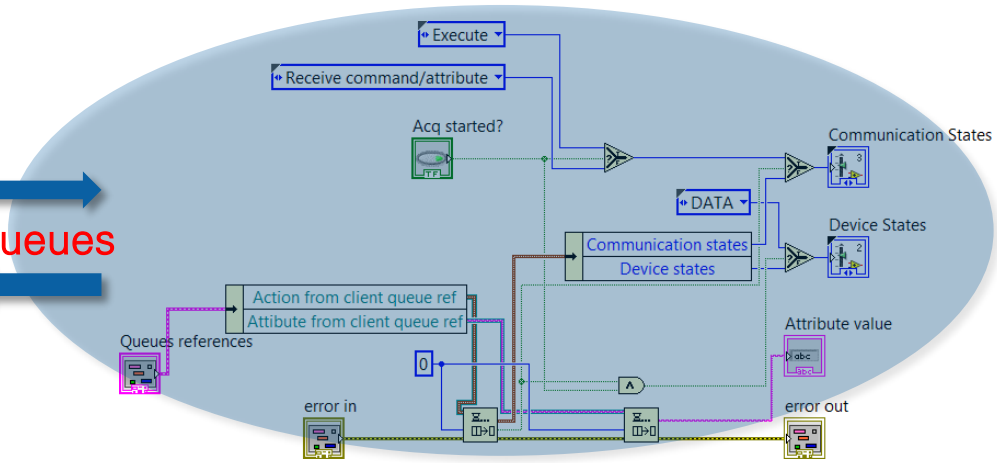
# State machine: Get client requests



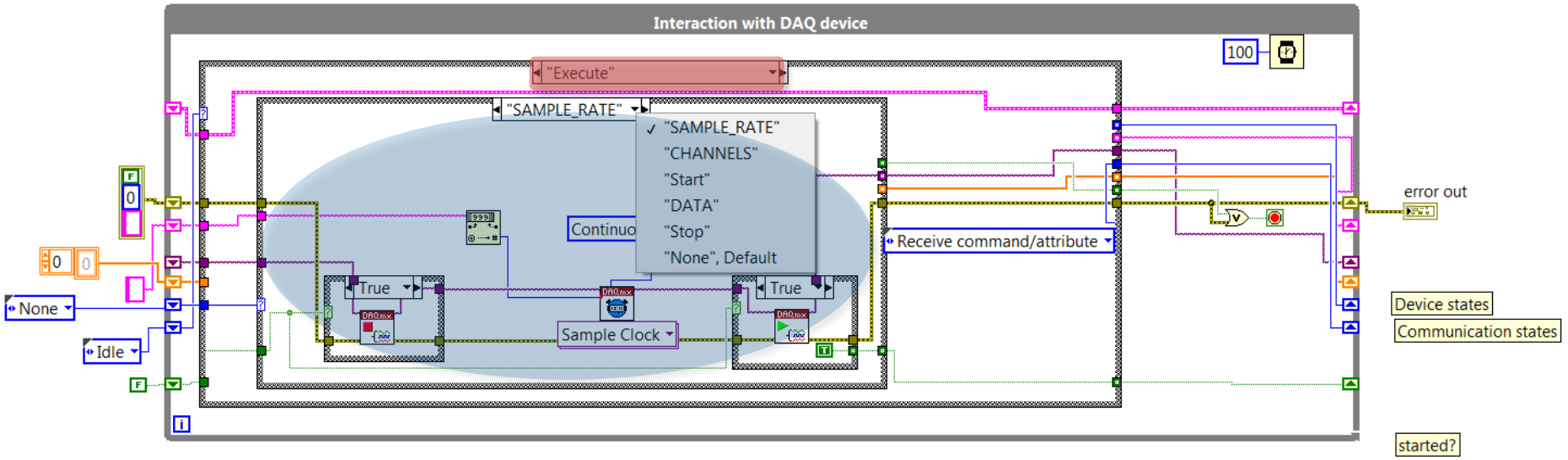

TCP/IP chain

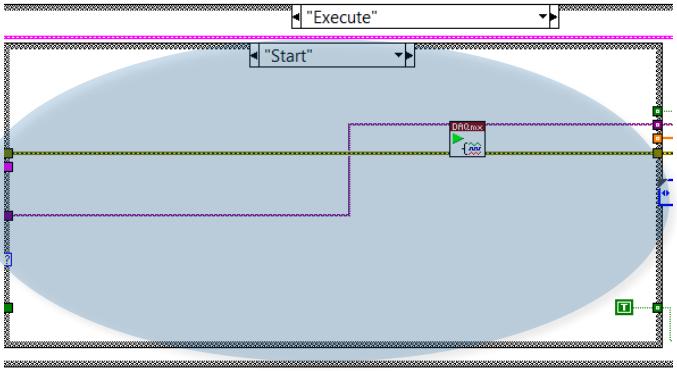
LV Queues

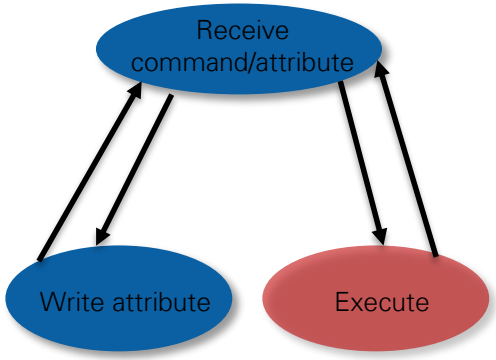


# State machine: Handle client requests

## Set attributes/Run actions

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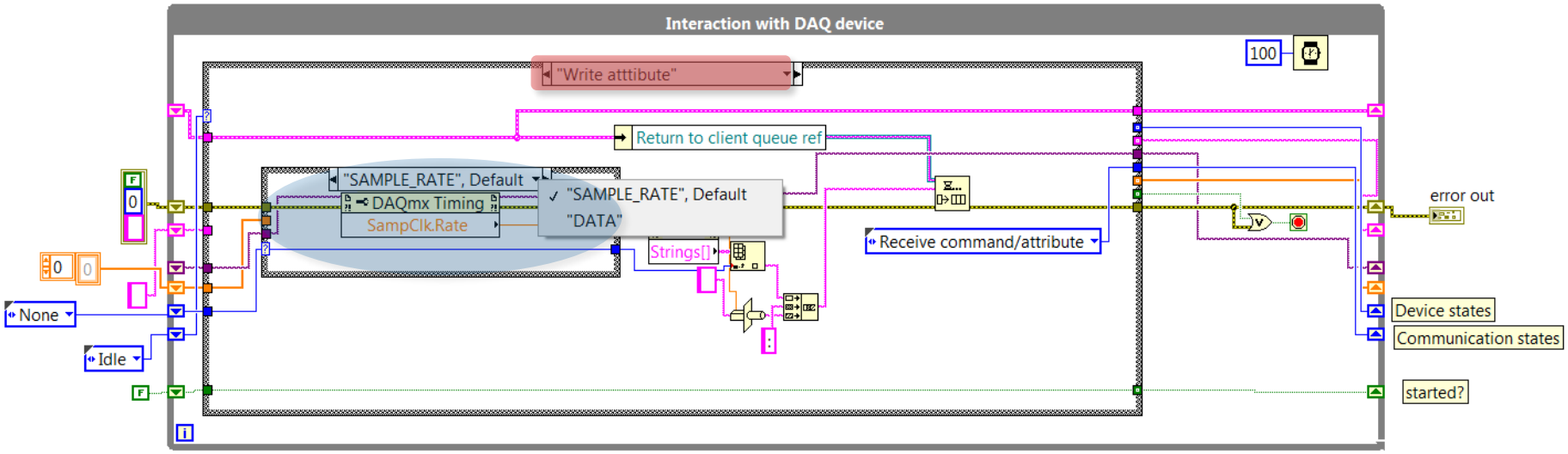
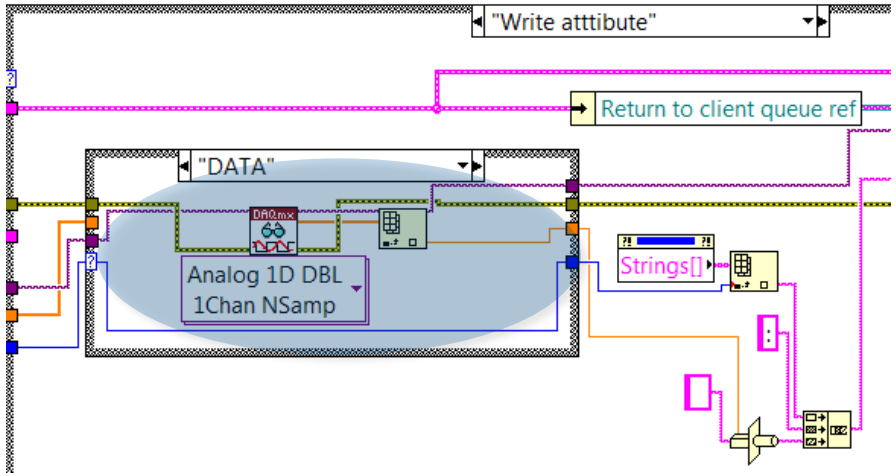
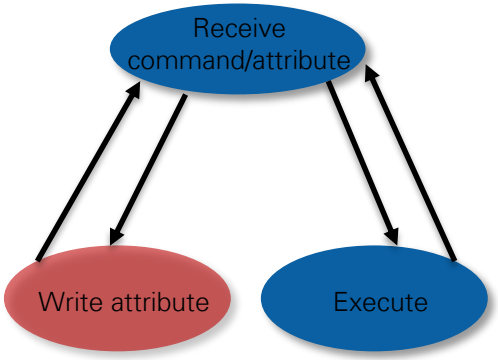
# State machine: Handle client requests

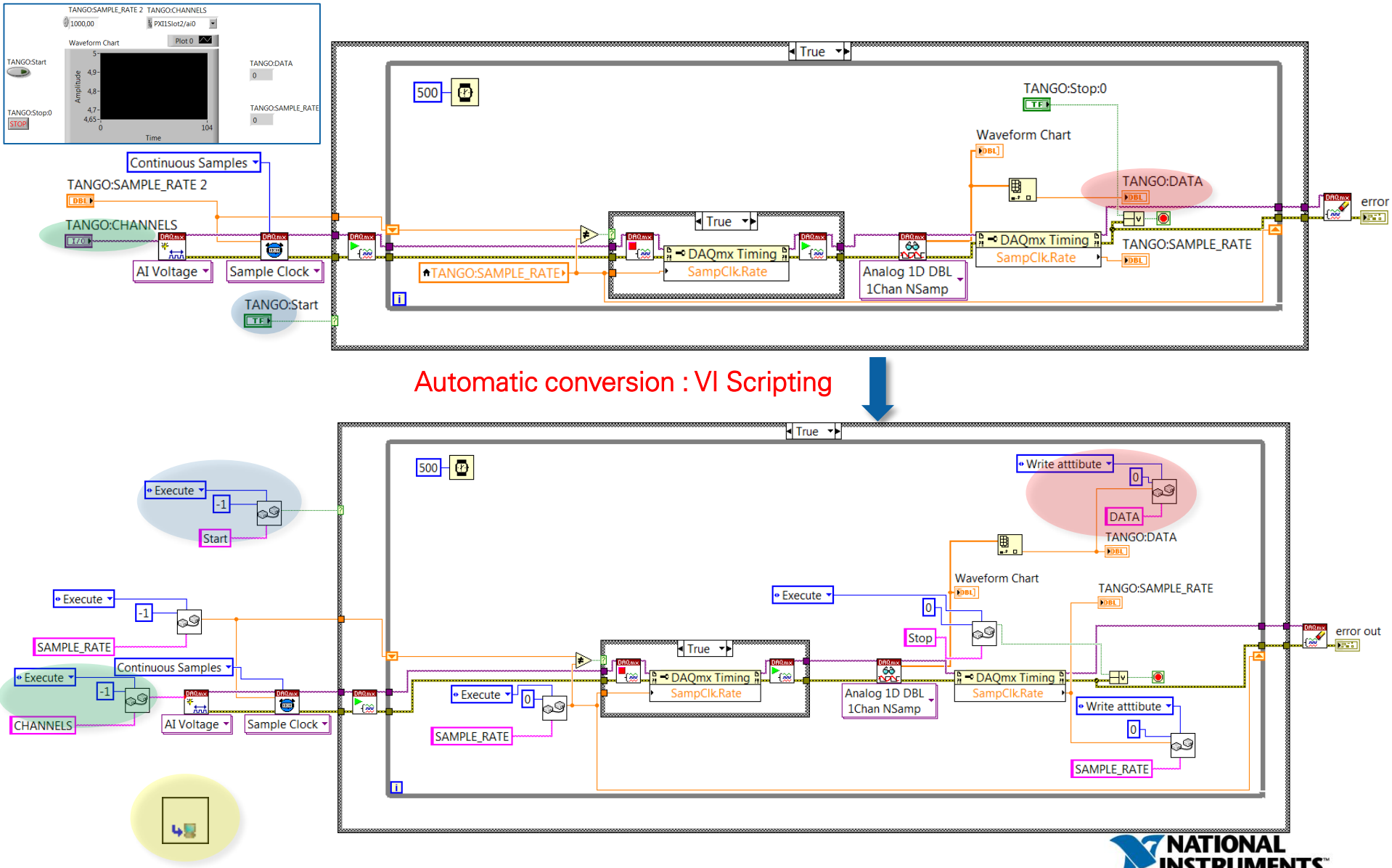
## Get attributes values



# Automatic conversion: no data flow change



# State machine vs automatic conversion

| Architecture | Pros | Cons |
|---|---|---|
| State machine | • Modular, scalable<br>• Good graphical understanding | • Need to "rethink" the application and break into sub-steps |
| Automatic conversion | • Very quick method<br>• Minor changes to the original application | • Not very modular (new actions, attributes)<br>• All attributes/actions evaluated at each iteration<br>• Reconfiguration not easy |

# Other examples

- Two applications using LV as a device server:

  ✓ LULI : ensure hardware safety by stopping their laser experiment in case of a failure (1 PXI chassis, LV RT, 2 R-Series)

  -LV RT application is the TANGO device (communication with Linux device server via TCP/IP)

  -DAQ board is the device via direct access (Linux driver)

  ✓SOLEIL : control power supplies, pulses generator.. for the LINAC with 3 PCI DAQ boards

  -LV application (with DAQmx) is the device (communication with Linux device server with Datasocket)

- TANGO-EPICS bridge (Cosylab) for ESRF to allow TANGO users to interface to existing EPICS IOCs and avoid rewriting a new TANGO device server.

# Conclusion

- TANGO is an object oriented middleware where devices belong to classes (Commands, attributes).
- Several tools exist to assist developers in creating their device classes
- Device servers can access directly or remotely to HW.
- The application accessing to HW has to be structured according to the foreseen commands/attributes.
- One can also think about a generic device server targeting LV applications with generic templates….

Thanks for your attention

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