Kepler-TANGO Integration at ELI-ALPS

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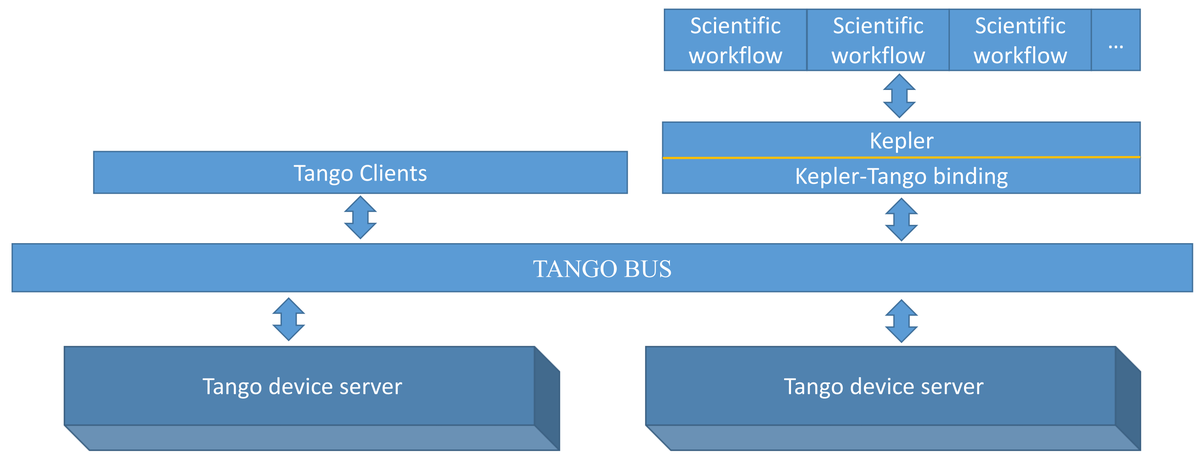
Motivation

ELI-ALPS is one of the three pillars of the European Extreme Light Infrastructure project. As a research facility, the infrastructure will contain a large number of experimental devices and equipment which have to be managed and controlled by a robust and flexible system. We found that the TANGO Control system is able to address this complexity. But using TANGO by researchers for experiment design is not obvious, because it requires programming knowledge. Scientific workflow systems provide easy-to use graphical interface to create applications, therefore we decided to integrate TANGO with the Kepler workflow system to facilitate the flexibility of the control system.

Main concept

- One TANGO actor represents one TANGO Device
- The user is able to select a TANGO actor from the list of available ones (i.e. the TANGO devices in the TANGO database)
- An input/output port of a TANGO actor represents an attribute or a command of the corresponding TANGO Device
- The user is able to filter which TANGO attributes and/or commands appear as ports of the corresponding TANGO actor.



TANGO Controls architecture with Kepler and scientific workflows.

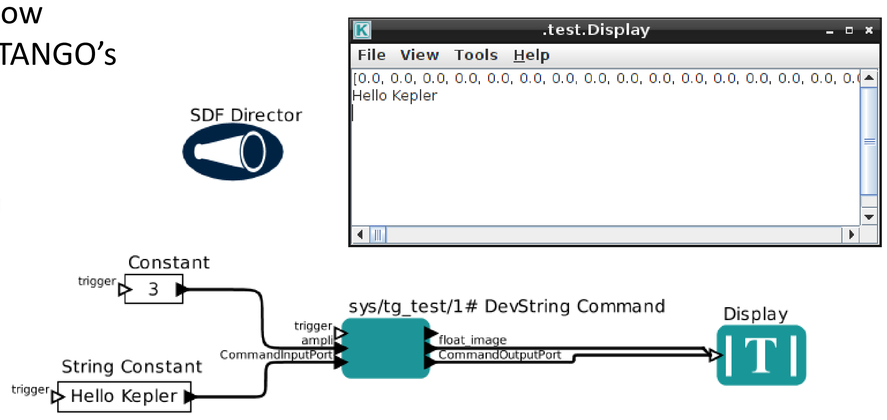
Steps of the development

1) Hard-coded integration

Goal: whether the workflow system capable of adopt TANGO's unique functionalities.

Result: It is able to

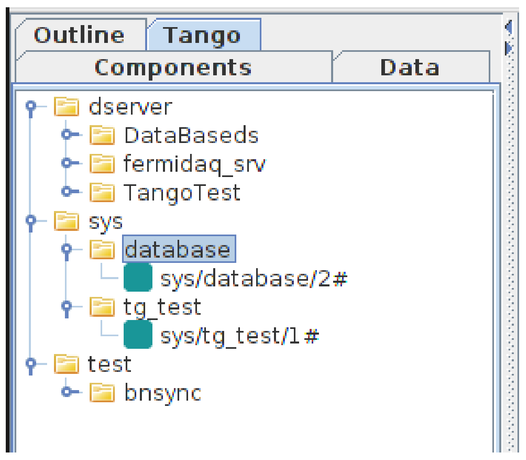
- ✓ handle the connection of a device
- ✓ manage the execution of a command
- ✓ read/write some attributes



2) Database level integration

Goal: facilitate deploying the TANGO actors on the workflow canvas by choosing from the list of available TANGO actors.

Result: The extension appearing on a separate tab is able to query the available devices from the TANGO Database and to integrate it in a way that the user can conveniently deploy TANGO actors.



3) Complete type conversion

Goal: solve the type conversion. which experienced as one of the most challenging task.

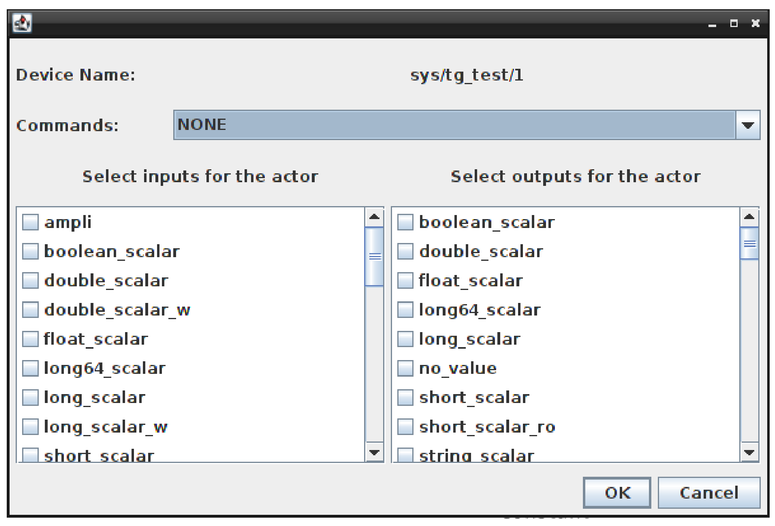
Result: for basic datatypes the conversion is obvious. In case of exotic types, the developers have to agree on a general integration.

Tango type	Kepler Token
Boolean scalar	BooleanToken
Boolean Spectrum and Image	BooleanMatrixToken
Byte, short and int Scalars	IntToken
Byte, short and int Spectrums and Images	IntMatrixToken
Long Scalar	LongToken
Long Spectrum and Image	LongMatrixToken
Double Scalar	DoubleToken
Double Spectrum and Image	DoubleMatrixToken
Float Scalar	FloatToken
Float Spectrum and Image	DoubleMatrixToken
String Scalar	StringToken
String Spectrum	arrayType(string)
String Image	arrayType(arrayType(string))
DevState Scalar	StringToken
DevState Spectrum	arrayType(string)
DevState Image	arrayType(arrayType(string))
DevEncoded	unsupported
DoubleStringArray and LongStringArray	RecordToken

4) Configuring ports (attributes, command)

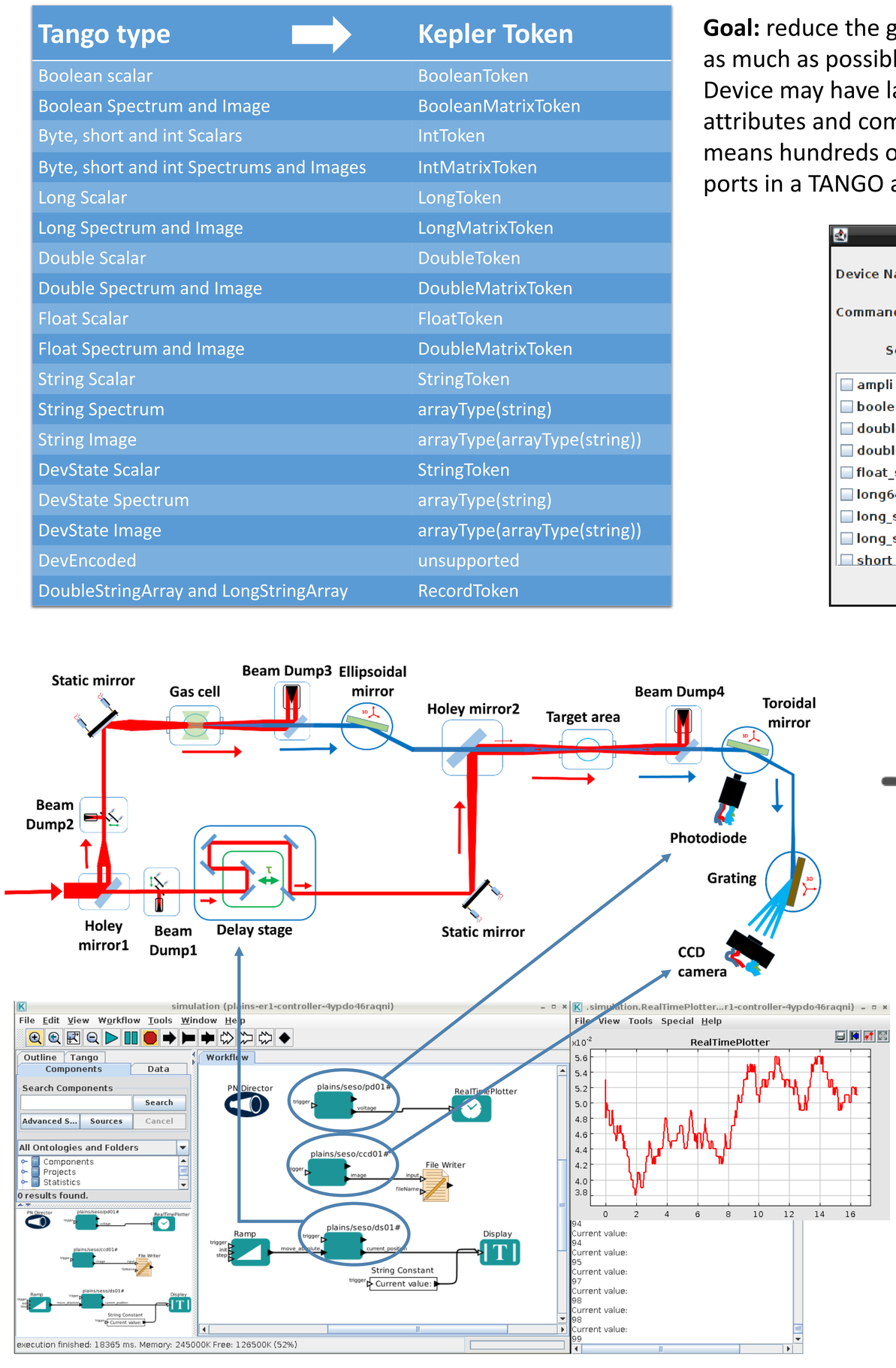
Goal: reduce the graphical elements as much as possible. One TANGO Device may have large number of attributes and commands, which means hundreds of input and output ports in a TANGO actor.

Result: The users should choose the attributes and the command in advance.



Beamline Simulation

For a proof of concept, a simple control system was created on top of a simulated beamline to demonstrate the usability of the prototype. From control side the following parts are static: holey mirrors, gas cell, beam dump 3 and 4 and target area while beam dump 1 and 2, ellipsoidal mirror, spherical mirror, photodiode and CCD camera can be controlled. In this Kepler demonstration only the delay stage was moved. The diagram shows the measured voltage (by photodiode) as the function of the delay.



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