Neutron Scattering Instrument Control System Modernization -**Front-End Hardware and Software Adaption Problems**

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When the FRM-2 neutron source went into operation (2002) and many instruments were moved from the closed-down Jülich reactor to the new facility, it was agreed on a choice of front-end hardware and the TACO middleware from ESRF. To keep up with software standards, it was decided recently to switch to TACO's successor - the TANGO control software. For a unified "user experience", new graphical user interface software "NICOS-2" is being developed by the software group at FRM2. While general semantics of TACO and TANGO don't look very different at a first glance, and adaption of device servers seemed to be straightforward at first, various problems in practical operation were found. The problems were due to differences in state handling, timing behavior and error reporting. These problems, and the changes that had to be made to ensure reliable operation again, will be described.



- NICOS-2 is a Python and Python-Qt based control software. It supports TACO and TANGO for device access.
- NICOS and TANGO are used on BIODIFF, DNS, ANTARES, MIRA, POLI and others. Use on more instruments is planned.
- Front end computers and operating systems have been unified on most instruments. (CentOS)

Instruments at FRM-II



Problems seen:

- High load on frontend computers, permanent hard disk activity
- Random command execution errors, showing patterns depending on usage history
- Command timeouts even when TANGO timeout was increased
- "Sluggish" user interface behavior



Device servers which histogram data in real

time. The "Histogramming" part has been a standalone process, for easy commisioning and debugging.

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A9	NICOS - guest at localhost:1301	_ = ×
Application Device commands Scan commands Other commands Script contro	rol <u>T</u> ools <u>H</u> elp	
Connect 📭 Exit 🕘 💷 🗸 🔲 🗸 🕲		
Experiment Info 💿 Instrument Script Editor Scar	Control detz × NICOS devices	Ø
Proposal Device: detz	Filter:]
THE Set NewSetup() Detector 7 avis	Run	10

Analysis and Solutions:

- NICOS is a demanding UI, accesses device servers permanently from multiple threads
- TANGO does not forgive command execution times larger than the serialization timeout on accesses by multiple clients

Jsers		Current value: 0.000 mm		detectube01	0	The device is in ON state.
ocal Contact		Status:		detectube02	0	The device is in ON state.
				detectube03	0	The device is in ON state.
Setups absorber, pi		Control device		detectube04	0	The device is in ON state.
		Limits: -3.0 to 913.0		pump02	0	The device is in ON state.
Samples TestSample				pump03	0	The device is in ON state.
		Move to: 0.000 mm		vacuumtube1	0.000 mbar	The device is in ON state.
nvironments		Mara y Basat Stan Maya		vacuumtube2	0.000 mbar	The device is in ON state
nilatus muth	NewSample('TestSample'	More V Reset Stop Move		vacuumtube3	0.000 mbar	The device is in ON state
ectors pliatus, myth				vavalve01	open	The device is in ON state
ns		Parameters		vavalve02	open	The device is in ON state
		Name Value		vavalve03	open	The device is in ON state
Remark	abslimits (-3.0.913.0)		vavalve04	open	The device is in ON state	
	backlash 0.0		vavalve05	open	The device is in ON state	
	description Detector 7 axis		vavalve06	open	The device is in ON state	
	dragerror 1.0		vevalve01	open	The device is in ON state	
	fmtstr % 3f		vevalve02	open	The device is in ON state	
	iitter 0.0		vevalve03	open	The device is in ON state	
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		loopdelay 0.3		bspy	0.000 mm	The device is in ON stat
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	4:03] creating device 'vaval	obsreadings 100		🔵 pchi	0.000 deg	The device is in ON stat
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4:03] creating device 'vaval 4:03] creating device 'vaval 4:03] creating device 'veval 4:03] creating device 'veval	precision 0.01		O py	0.000 mm	The device is in ON state	
	speed 50.0		o pz	0.000 mm	The device is in ON state	
	target None					
	unit mm		ionichamber1	0.000 cps	The device is in ON state	
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	4:03] standard detectors are	usenlimits (-5.0, 915.0)		ionichamber2	0.000 cps	The device is in ON state
	4:03] setups loaded: absorb	warminits None	r-axs,	ionichamber2	. 0 cps	The device is in ON state
	5:55] >>> [guest 2015-10			pindiode1	0.000 cps	The device is in ON state
	6:46] >>> [guest 2015-10	Plot history		pindiode1 int	0 cps	The device is in ON state
	6:46] >>> [guest 2015-10		=	pindiode1 mo	. out	The device is in ON state
			pindiodecal	0.000 cps	The device is in ON state	
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Screenshot of NICOS UI

- Front end computers which worked well with TACO might be too small for TANGO
- OS updates can cause increased ressource usage (in particular memory)
- Memory shortage and OS background activity leads to paging and slowdown
- Device server commands which (in the worst case) can be slower than the serialization timeout need to be redefined to be executed asynchronously, split into "start" and "get state" parts
- Device server states can not be easyly added, needs creative reinterpretation