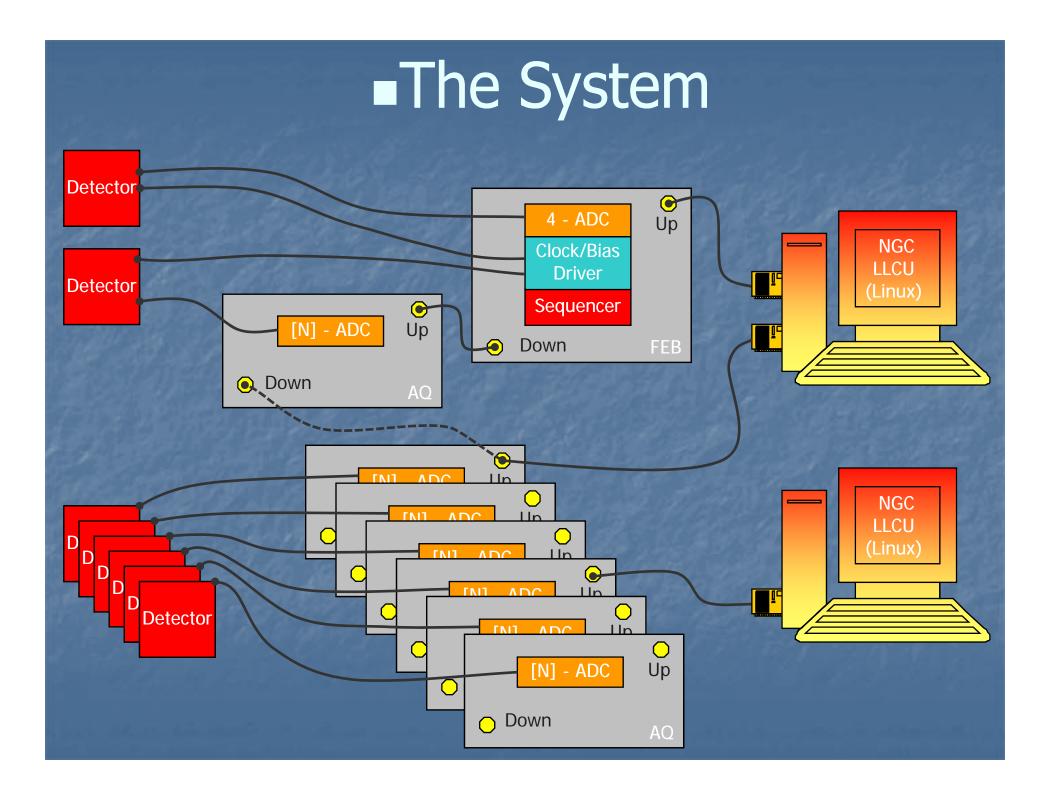
ESO New General detector Controller (NGC)

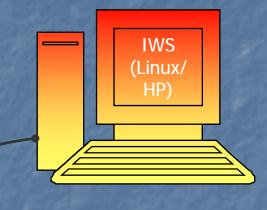
Base Software And Infrared Detector Control Software

16/08/2008

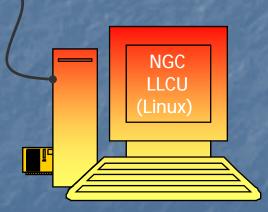
J. Stegmeier



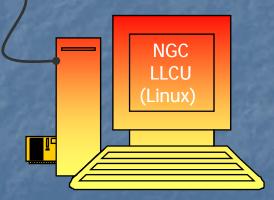
Computing Architecture



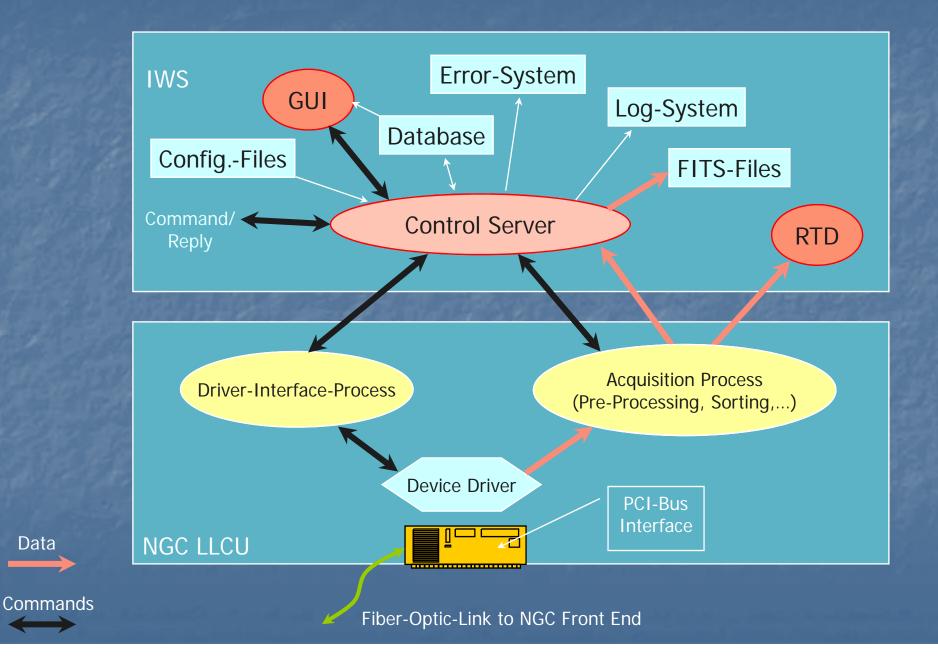
Instrument LAN Fast Ethernet/ Gigabit-Ethernet



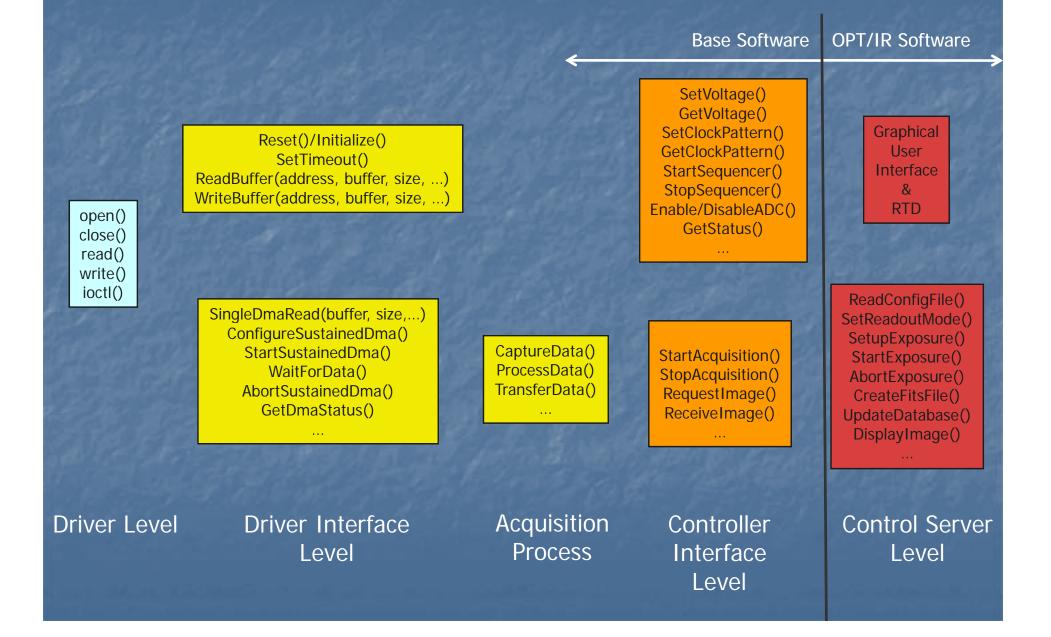
With the current Linux-PC model we can achieve 200 Mbytes/s sustained input data-rate with co-adding (double correlated read-out)



The Processes



Software Hierarchy



Software Modules

	dicNGC	- Dictionary (both OPT/IR)	alled a set and the
	ngcdrv	- Device Driver	EN MUSSIE
	ngcb	- Driver Interface and Basic Routines	– Base SW
	ngcpp	- Pre-Processing	171715 224
	ngcdcs	- Control Software & Server	
	ngcgui ngcrtd	Engineering & IR GUIEngineering & IR Real-Time Display	IR SW + Opt. SW (engineering)
	ngciracq	- IR Acquisition Processes	
	ngcircon	- IR Control SW & Server	– IR SW
	ngclcu	- NGC-LCU Interface SW (IR, for VLTI)	
15	205726 lines of code		

- The modules will be part of the VLTSW Releases.
- All modules contain Test Procedures for TAT (automated testing).

Driver and Interface

Device Driver for Linux kernels 2.4 and 2.6 (software module "ngcdrv").

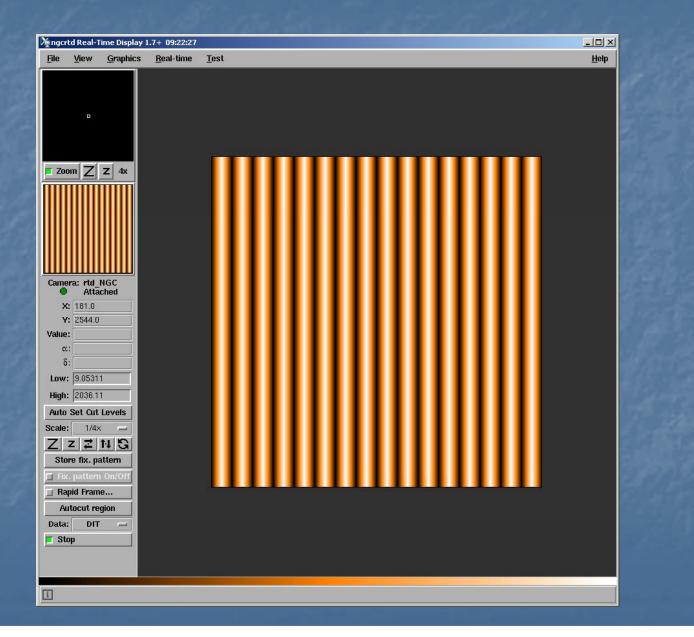
- One channel for System Control (COM) and one channel for sustained DMA data transfer.
- Driver Interface Libraries hide changes in the HW-communication protocol and changes in the operating system (LINUX kernel) and make the SW transparent to the next SW layer. They are part of the NGC Base Software, which also contains some other functionality (such as a transparent threads interface, priority control, etc.) and a Simulator for the NGC HW (software module "ngcb").

Acquisiton Processes

- The pre-processing framework for the multi-threaded Acquisition Process has been taken over from IRACE (software module "ngcpp").
- Currently this is required mainly for the data preprocessing in IR applications.
- Template Processes have been developed, which are an easy-to-use and stand-alone tool to visualize NGC rawdata on the RTD.

The acquisition processes for the ESO Standard IR Detectors (HAWAII 1Kx1K, HAWAII2-RG 2Kx2K, ...) are assembled in a separate software module ("ngciracq"). Special setups (e.g. mosaics) for specific instruments may require special software modules ("xxacq").

NGC Real Time Display ("ngcrtd")



Controller Interface

- The controller interface provides Modular Objects for Sequencer-, CLDC- and ADC-Control, for interfacing to the Acquisition Process and for the Asynchronous Data Reception (software module "ngcdcs").
- These objects can be assembled in the Control Server in an arbitrary way to reflect all functionality of any NGC hardware configuration (i.e. Multiple Instances of Sequencer-, CLDC-, ADC-modules and any number of Acquisition Processes). The module configuration is done through a System Configuration File.
- The control server can be used as NGC-HW Control Sub-System of the NGCOSW. That is the maximum degree of communality as the same compiled and linked object is used by both applications to access the HW. It can be configured at Run-Time for the one or the other purpose.

Configuration Files

- The detector voltages are defined in a Voltage Configuration File in Short-FITS format (xxx.v).
- The voltage configuration files can be loaded to any CLDC instance in the system.
- The Clock-Patterns can be defined both in ASCII-Format (xxx.clk, IRACE-style) and in a new Binary Format (xxx.bclk, output of the Graphical Editing Tool BlueWave). The formats can be converted automatically.
- Synchronization with external events (e.g. trigger) can be done after any state in any clock-pattern.
- A new Sequencer Programming Language has been defined to make maximum use of the new HW capabilities (all code is executed at the same speed-level within the firmware). File extension is "xxx.seq".

Multiple Sequencer Instances within one system are supported.

Sequencer Programs

- The sequencer programs are fully driven by Setup Parameters (e.g. DET.DIT, DET.NDIT, window parameters, ...).
- Support of Arithmetic Expression Evaluation (TCLsyntax) to derive any program-loop parameter from the setup parameters and to compute attributes like exposure time estimations and minimum DIT.
- Support of Sub-Routines and Include-Files to minimize the code length.
- The program complexity can be scaled:
 - Simply do not "USE" any setup parameter.
 - Simply omit the "SCRIPT" part for arithmetic expression evaluation.

Infrared Setup

The data-taking is defined through "Read-Out Modes":

- Read-out modes are defined by the Sequencer Program(s) running on the sequencer module(s) and by the corresponding Acquisiton Process(es) to be launched.
- Read-out modes are selected by Name or a Unique ID (a Default Mode can be given).
- Window Read-Out is done by evaluating the window parameters within the sequencer program.
- The read-out modes and the voltage- and clock-patternconfiguration files to be loaded when going ON-LINE are defined in a Detector Configuration File. This also defines the detector parameters (size, type, name, mosaic arrangement, ...).

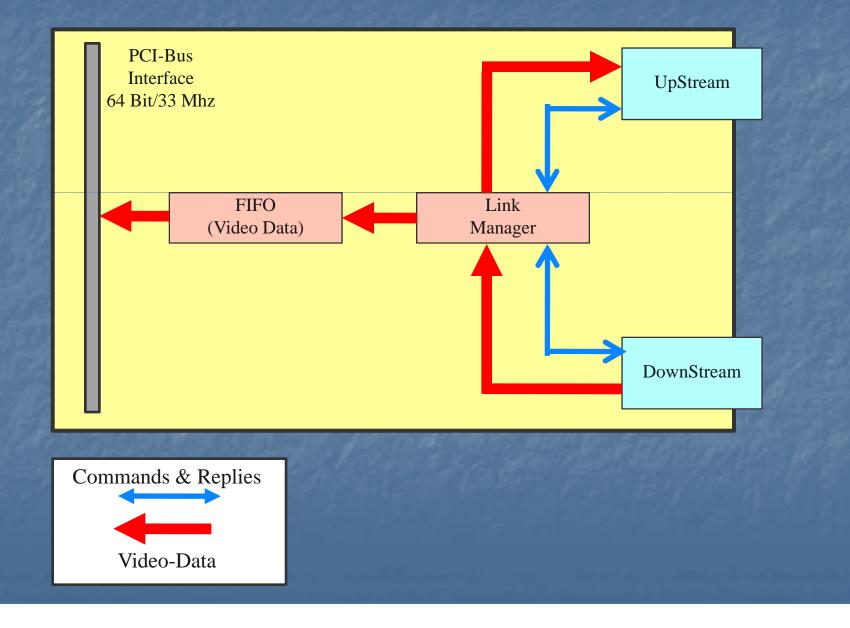
Infrared "Exposures"

- Sustained Detector Read-Out and Video Display on the RTD (display remains active during the "Exposure").
- User-definable Frame-Types (DIT, STDEV, HCYCLE, intermediate results...). The types can be selected to be generated <u>and/or</u> stored during an "exposure".
- Exposure Break-Conditions can be set per "per frametype".
- Individual SW-Windows per frame-type.
- Sustained Data-Transfer between NGC-LLCU and IWS for application specific Post-Processing (slow control loops, e.g. secondary auto-guiding).
- Burst-Mode for fast raw data acquisition.

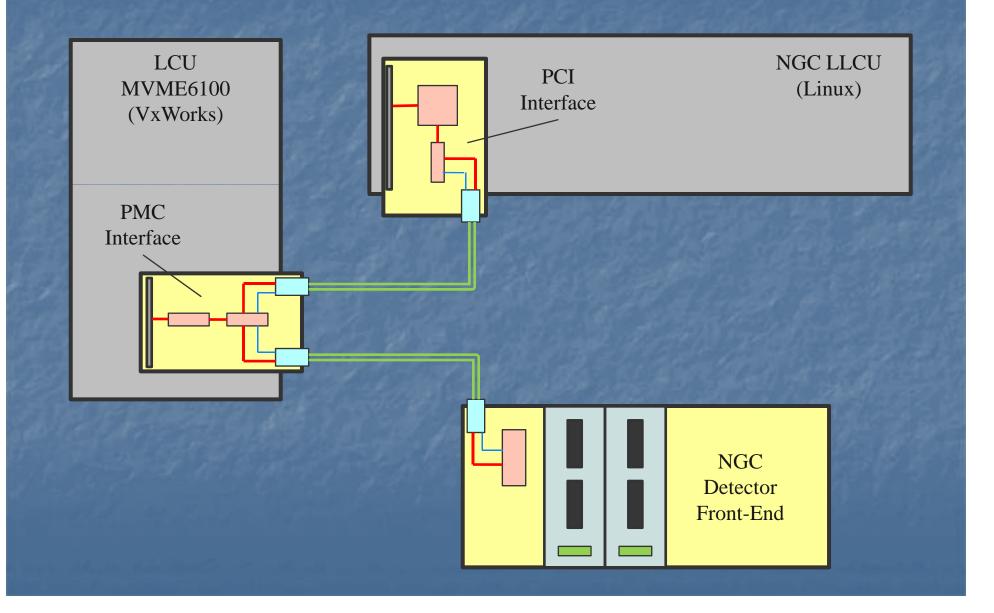
Graphical User Interface ("ngcgui")

MGC Control Panel - @wdcs					
File Mode Online Help					
ONLINE idle Mode HW-SIM Detector Config	uration Hawaii2RG Read-Mode Double -				
Exposure: Start Abort End Naming Scheme: request — Reset Name :	I PARAM FRAME HISTORY NAME G S BREAK WINDOW DIT 1 0 [1, 1, 2048, 2048]				
Format : extension Image: File-History CLEAR Status success Multiple Files ngc.fits Image: File-History Image:	TNT 1 1 1, 1, 2048 All STDEV 0 0 1, 1, 2048, 2048 J				
Exposure Time 00:00:05	SX: 1 NX: 2048 Full Frame Break: 0 SY: 1 NY: 2048 Event Frame 0 0 0				
CLDC 1 Voltage-File COMMON/CONFIGFILES/NGCIRSW/Hawaii2RG,v	CLDC-1 - Acquisition 1 Start Stop ACQ-1 -				
Status enabled CLDC Enable Disable Save Restore All Voltages	CLDC Status running Continuous Mode Performance Monitor				
Bias - DC1-VDD - Telemetry	Enable All Burst : 0 _ Transfer				
3.3000 Restore	Disable All				
3.0000 3.7000	Process Statistics				
Set: 3.300 Telemetry: 3.301 Mon-1: 1 Mon-2: 1 PA: 0 Diode: 0	ngciracq#2R62				
	SX: 1 NX: 2048				
Status running Deed att Working Trigger Mode	SY: 1 NY: 2048				
Status running Read-out Window Ingger Mode Statt All Time Factor : 20 \$X : 1 NX : 2048	Command :				
Time radio Stop All Time Add : 0 SY: 1 NY: 2048	tel:				
Clock-File EM/COMMON/CONFIGFILES/NGCIRSW/Hawaii2RG.clk Break All	Name Low (Set Val.) High (Set Val.) clk[1]: clk1Lo-FSYNCB 0,000 0,000 3,300 3,300				
Program MON/CONFIGFILES/NGCIRSW/Hawaii2RGDblCor.seq	c1k[2]: c1k2Lo-VCLK 0,000 (0,000) 3,300 (3,300) c1k[3]: c1k3Lo-LSYNCB 0,000 (0,000) 3,300 (3,300)				
DIT : 1.0000000 (s) Run-Ctrl	clk[4]; clk4Lo-HCLK 0,000 (0,000) 3,300 (3,300) clk[5]; clk5Lo-READEN 0,000 (0,000) 3,300 (3,300) clk[6]; clk5Lo-RESETEN 0,000 (0,000) 3,300 (3,300)				
ADC Module 2 Units: 32 Offset (V) ADC-2 -	clk[7]: clk7Lo-MAINRESETB 0.000 (0.000) 3.300 (3.300) clk[8]: clk8Lo-BUFDISABLE 3.300 (3.300) 3.300 (3.300) clk[9]: clk9Lo-FASTENPAD 0.000 (0.000) 0.000 (0.000) clk[10]: clk10Lo-MOBECTRL1 3.300 (3.300 (3.300) 3.300 (3.300)				
Delay : 0 Mode : Normal - Monitor1 : 1	clk[11]; clk11L=MODECTRL2 3,300 (3,300) 3,300 (3,300) clk[12]; clock12Lo=CSB 0,000 (0,000) 3,300 (3,300) clk[13]; clock13Lo 0,000 (0,000) (0,000) (0,000)				
Pkt-Size: 16 Sim: Numbers — Monitor2: 1	clk[14]: clock14Lo 0,000 (0,000) 3,300 (3,300) clk[15]: clock15Lo 0,000 (0,000) 0,000 (0,000) 7				
Pkt-Cnt: 0 Cvt1 Cvt2 Filter Clamp					
Abort Reset	Clear Dump				

PMC Interface (for VLTI)



VLTI-System



NGC-LCU Interface Software

- Software module "*ngclcu*".
- VxWorks Device Driver for the NGC PMC Interface card.
- Sustained DMA (64 Bit / 33 MHz, 128 MPixels/s)
- Data Capture Library
- Possibility to install a User-Defined Interrupt Service Routine (to minimize the latency).
- Latency: min. 4 μs, max. 6 μs depending on the configurable DMA-Blocksize (32 512 Bytes).
- Maintenance & Test Tools
 - Remote access from NGC-LLCU to board registers
 - Visualize data on RTD
 - Check data integrity

Preview

- Integration into VLTSW-Release.
- New Detectors (Aquarius).
- Control SW for Sidecar ASIC.
- General procedure for Multiple Window Read-Out.
- Handling of the Guide-Window for the HAWAII2-RG array (parallel exposures).
- Acquisition processes for AO-Applications.

Documentation

VLT-MAN-ESO-13660-4510
 VLT-MAN-ESO-13660-4085
 VLT-MAN-ESO-13660-4086
 VLT-MAN-ESO-13660-4560
 VLT-LIS-ESO-13660-3907
 VLT-LIS-ESO-13660-3908

NGC - User Manual NGC Infrared DCS - User Manual NGC Optical DCS - User Manual NGC-LCU Interface SW – User Manual NGC Project Glossary NGC Project Acronyms