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NEW FPGA DEVELOPMENT



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AGENDA

- MMC Development
- GPES Development
- Interfacing Development





MMC Development



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MMC Model Success

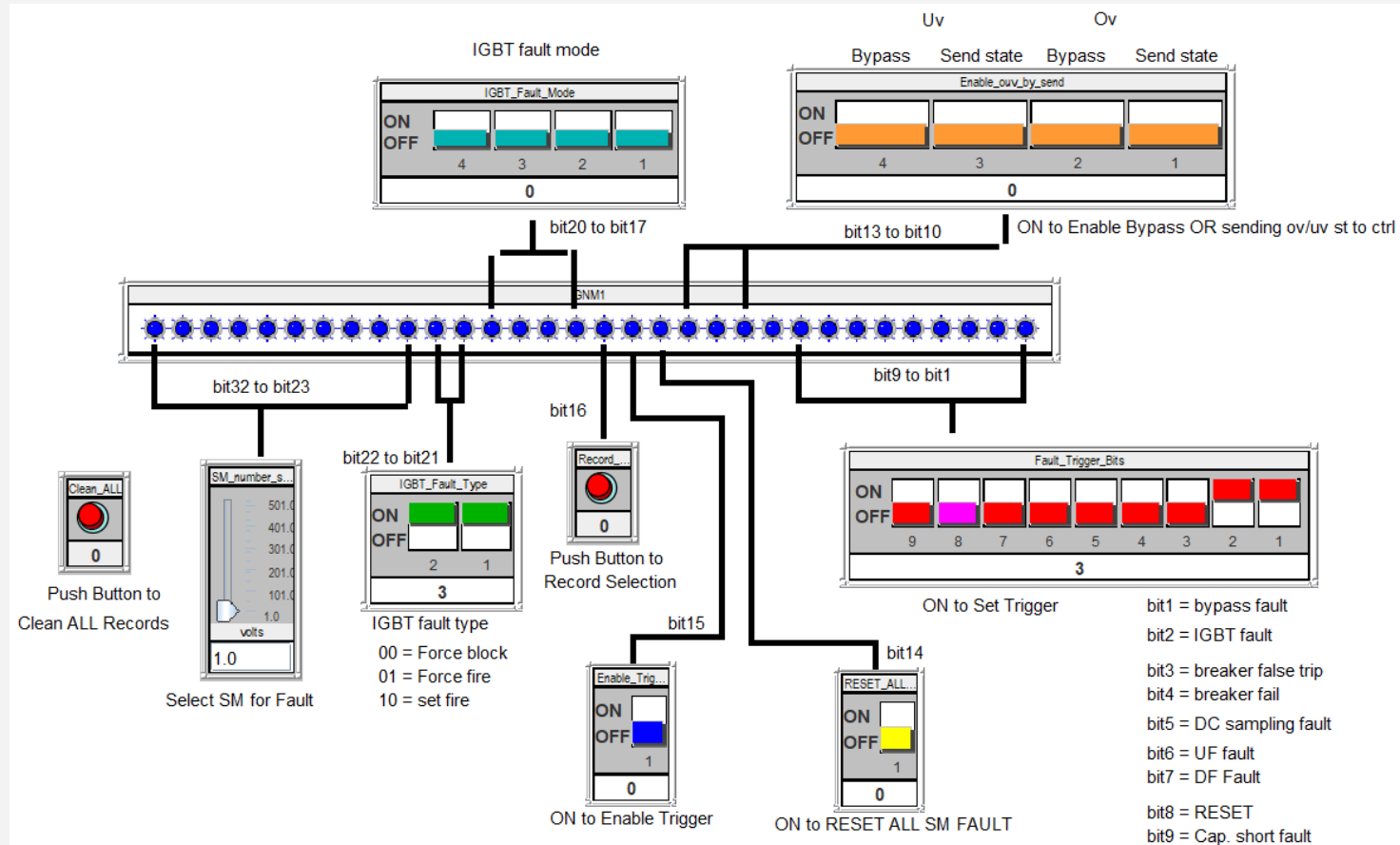
- ✓ Successfully involved in major HVDC projects all around the world, especially in China
- ✓ Model being improved and enhanced to satisfy different requirement from the real projects
- ✓ Being the first time, GMMX model is now used in the Kun-Liu-Long Project of CSG.

New Features of GMMX Model

- New faults: Bypass breaker fail and false trip fault, communication fault, DC sampling fault, etc.
- Trigger fault more flexibly
- Measuring IGBT switching frequency
- Monitoring all SM cap. Voltages, Firing Pulse Words, and SM state on User PC via UDP Ethernet
- HB and FB SM any location
- Support new Valve-to-Control protocol proposed by CSG

Faults and Triggering

- Multiple faults on the same SM
- Trigger faults one SM after the other
- Trigger faults simultaneously for many SMs
- No need to re-compile the case



Monitoring MMC via Ethernet

- A Ethernet cable connected between PC and GTFPGA MMC unit
- SM voltage, firing pulse word, and state monitored

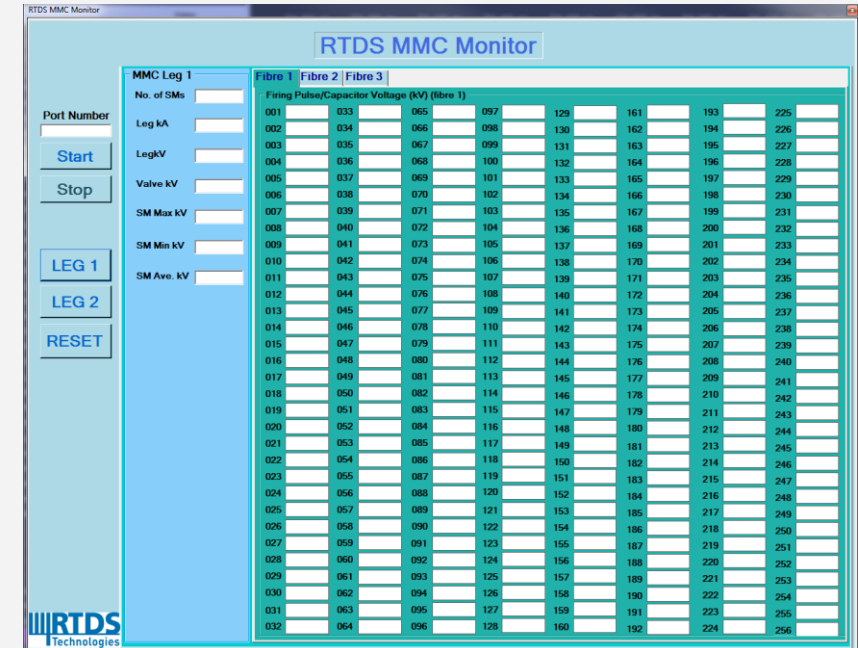
CONFIGURATION OF ETHERNET
 CONFIGURATION OF VALVE TO CONTROLLER COMMUNICATION
 SUB MODULE VALVE PARAMETERS (1 SM only)
 GENERAL MMC BRIDGE PARAMETERS
 CONFIGURATION OF FPGA GENERIC MMC MODEL

Name	Description	Value	Unit	Min	Max
sport	Local UDP Port number	55257		1024	65535
sip1	Local UDP IP Address 1	169		0	255
sip2	Local UDP IP Address 2	254		0	255
sip3	Local UDP IP Address 3	226		0	255
sip4	Local UDP IP Address 4	178		0	255
dport	Remote UDP Port number	15000		1024	65535
dip1	Remote UDP IP Address 1	172		0	254
dip2	Remote UDP IP Address 2	24		0	255
dip3	Remote UDP IP Address 3	2		0	255
dip4	Remote UDP IP Address 4	181		0	255
note	IP address is separated into 4 numbers.				
note1	For ip 169.254.226.178,				
note2	dip1 is 169				
note3	dip2 is 254				
note4	dip3 is 226				
note5	dip4 is 178				

Update Cancel Cancel All

nmpas	Leg No. 1: Max No. Pass-Thru Signals, RTDS to Controls:	4		0 to 6	0	6
nmpa...	Leg No. 2: Max No. Pass-Thru Signals, RTDS to Controls:	0		0 to 6	0	6
eneth	Enable monitoring MMC through Ethernet (UDP):	Yes		0	1	
Port	PB5/NovaCor GTIO Fiber Port Number:	1		1 to 20	1	20

Update Cancel Cancel All

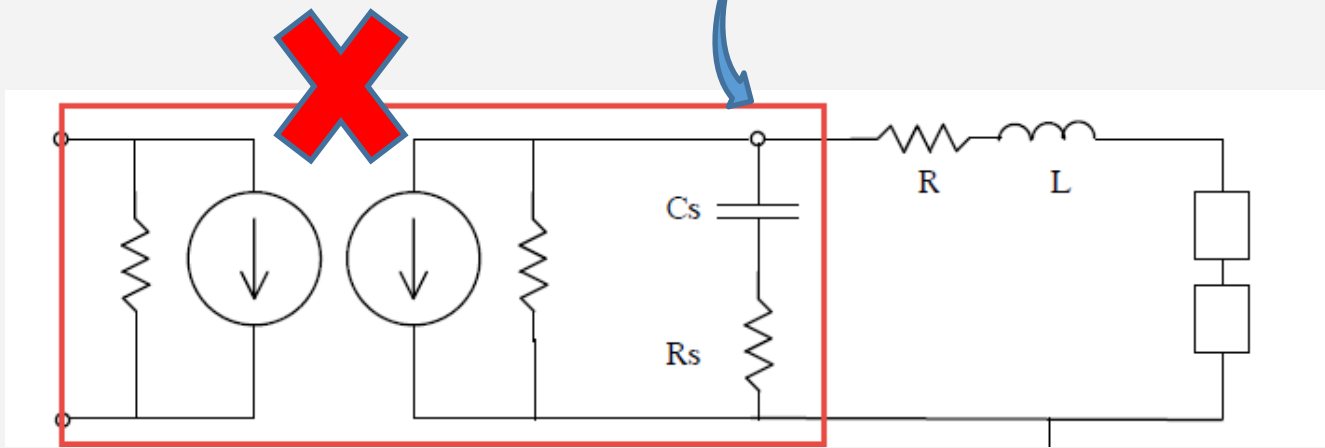
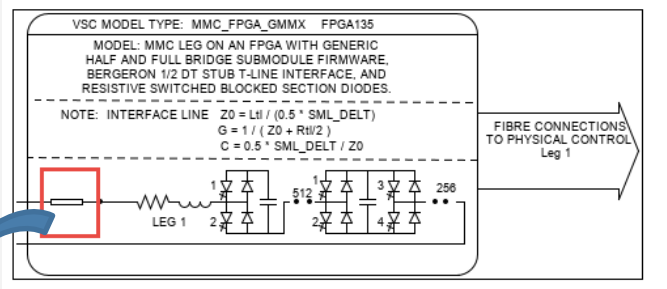


MMC Models in Substep

- ✓ U5 model and controller
- ✓ GMMX model and controller
- ✓ GMMX 6vlv model and controller
- ✓ GMT3 model (controller same as for GMMX)
- ✓ GMSD (serial double submodule) model (controller same as for GMMX)
- ✓ Upgraded MMC5 model supporting HB/FB mixed

New Development Next Step

- Like many other components in substep interface t-line eliminated
- More accuracy and flexibility





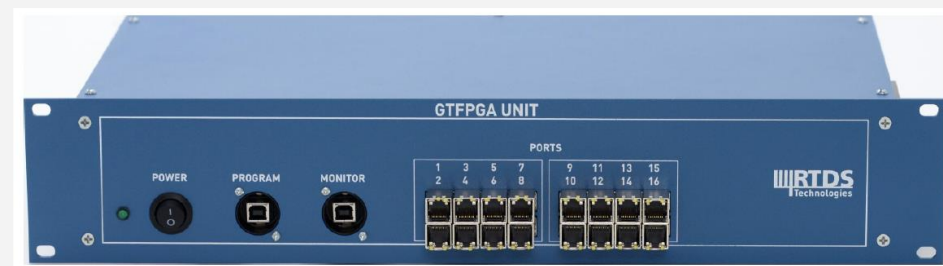
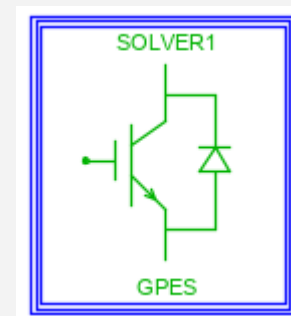
GPES Development



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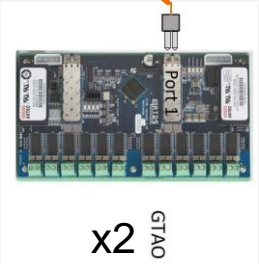
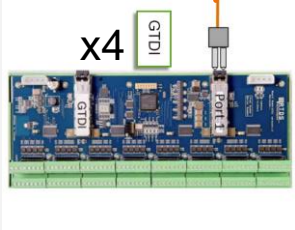
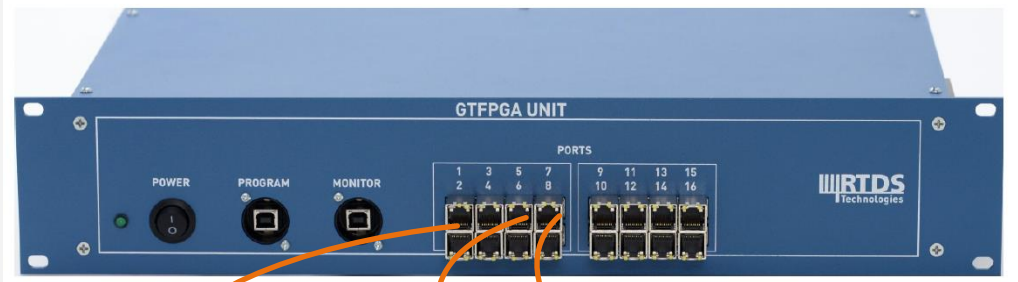
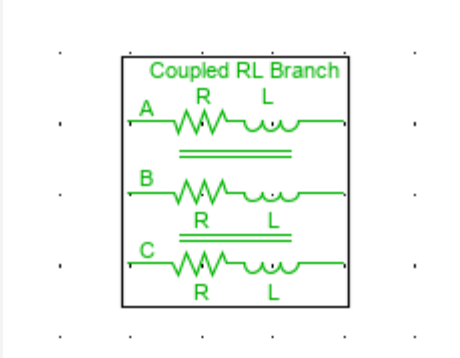
GPES Simulation Platform

- A Generic Power Electronics Solver (GPES) on GTFPGA
- Uses powerful parallel processing power of FPGA
- Can model power circuits with arbitrary circuit configurations
- Larger network (128 nodes and 256 branches) and smaller time step (400+ ns), e.g., the dc breaker needs 110+ nodes and 200+ switches



New Components

- Three-phase coupled RL component added
- 4 GTDI cards connected to Port 1-4 for firing 256 switches
- 2 GTA0 cards connected to Port 5-6 for analogue output

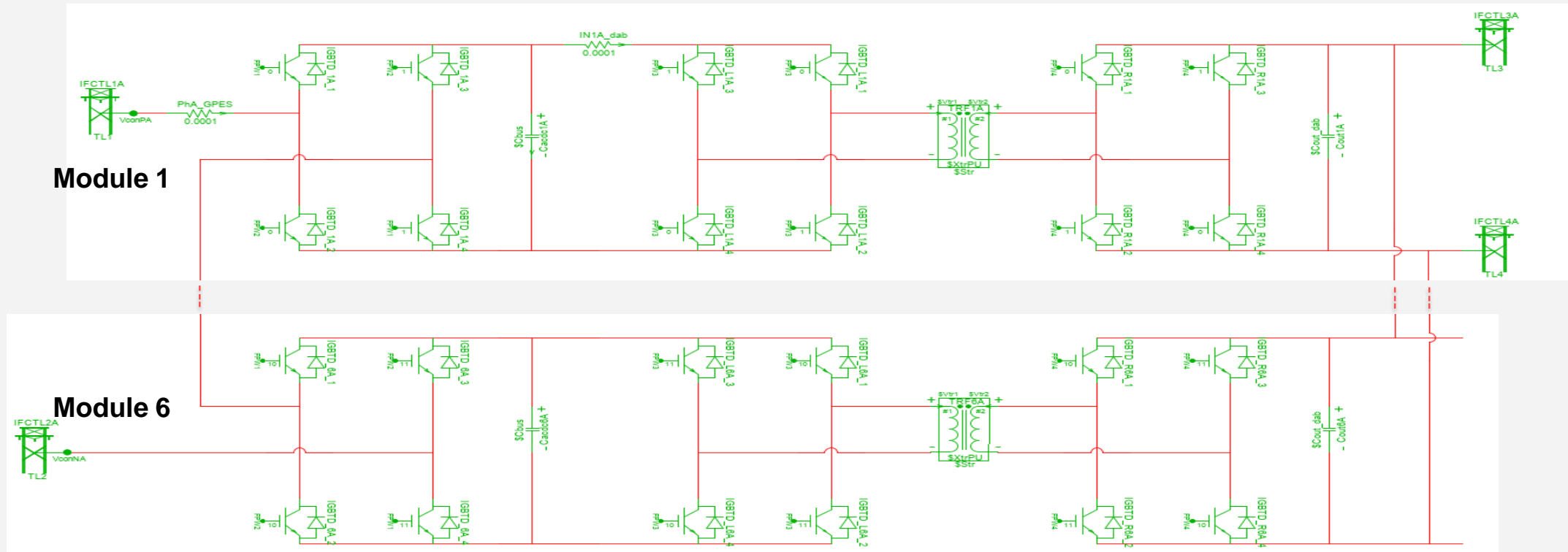


Aurora

External device

GPES Example: DC-DC Transformer

- Up to 15 modules modelled in one GPES unit





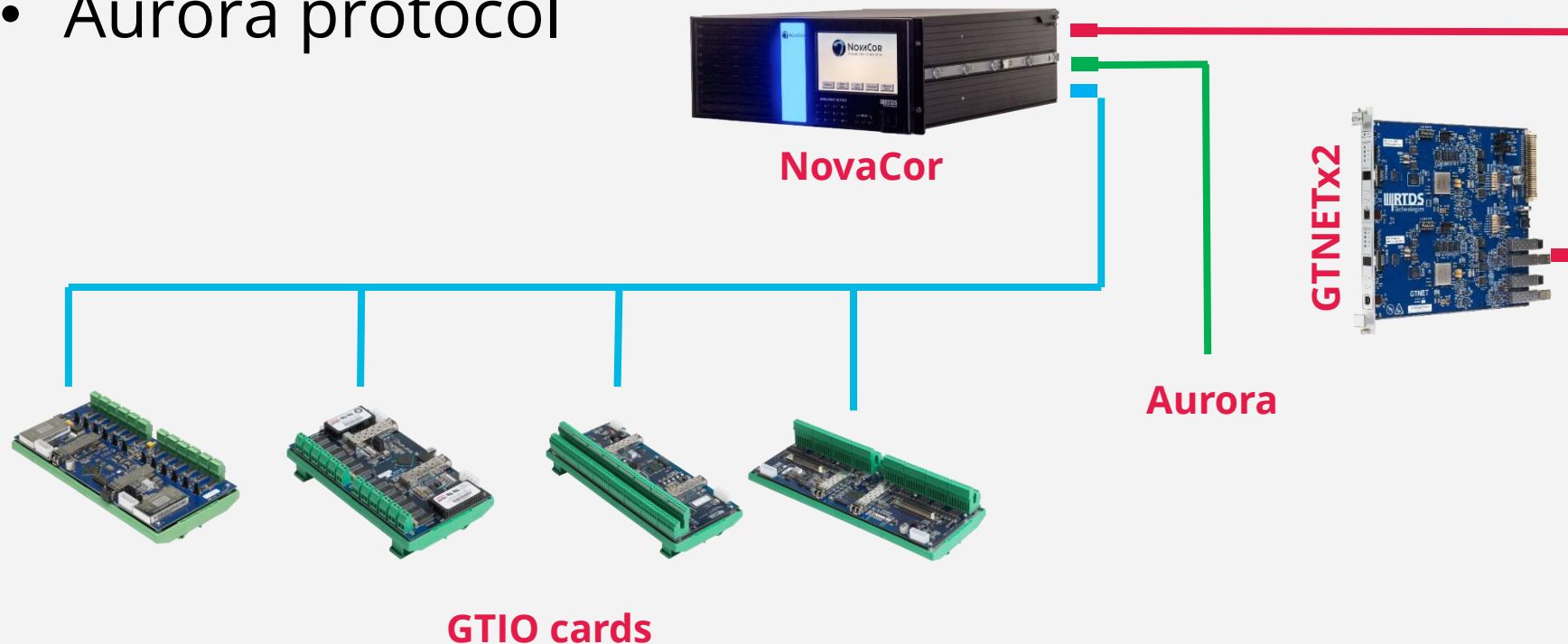
Interfacing Development



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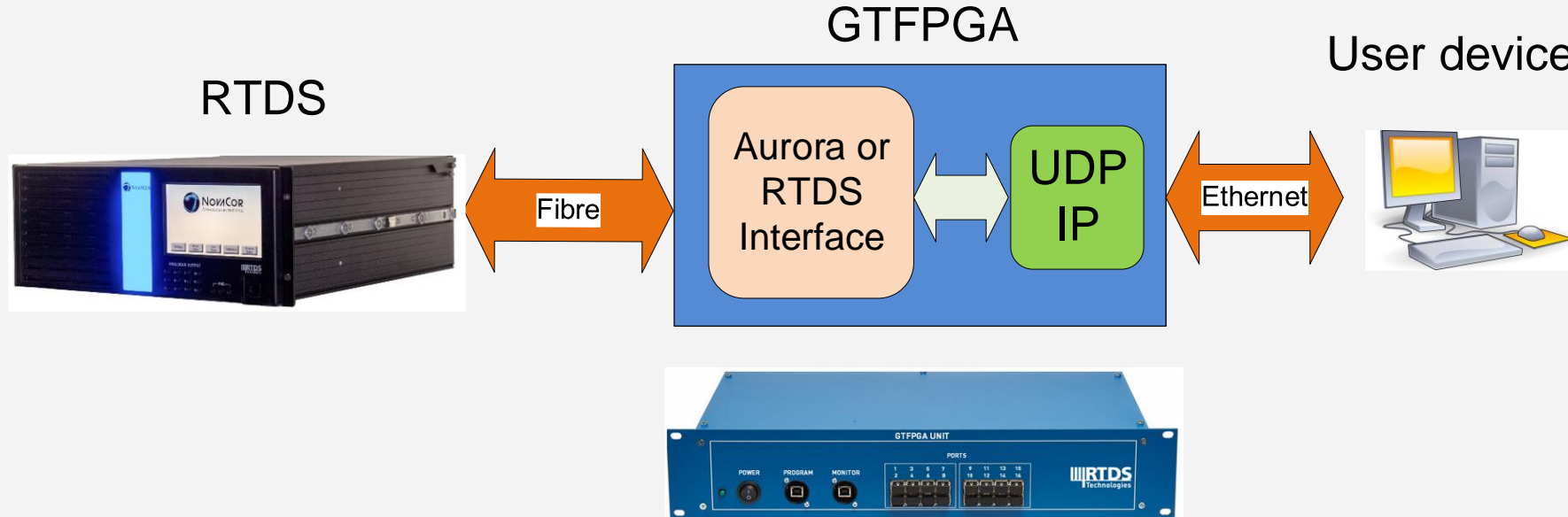
Interfacing to RTDS

- Convectional way: GTIO cards
- Network communication: GTNET cards, various protocols
- Aurora protocol



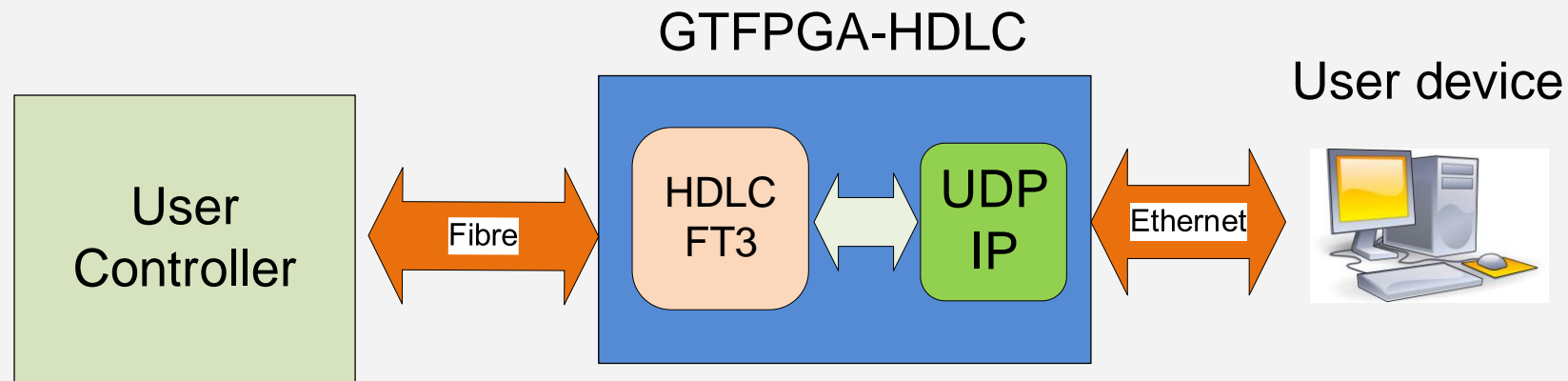
Interfacing via GTFPGA

- User device interface to RTDS through Ethernet (UDP)



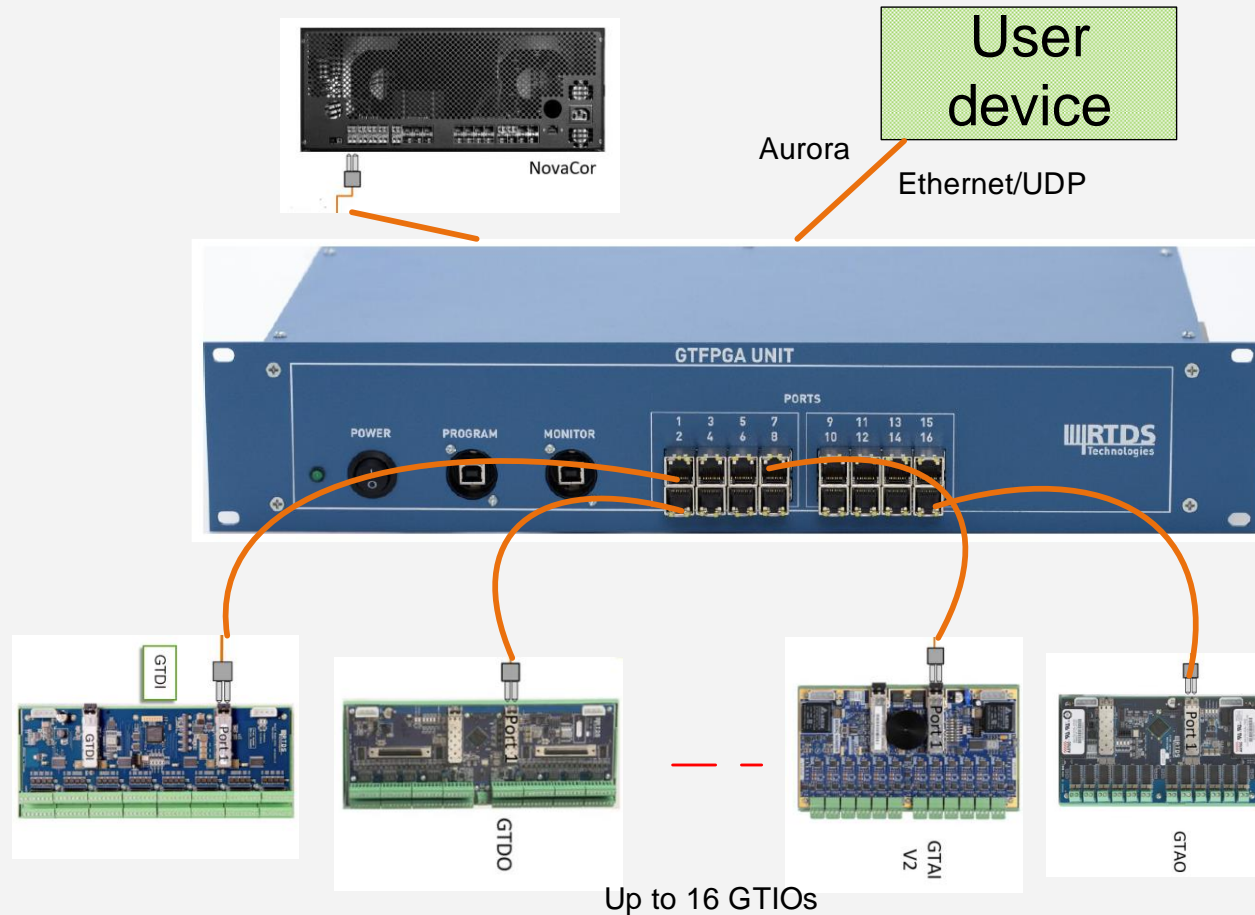
Interfacing via GTFPGA

- User device (UDP) interfacing to controller (FT3)



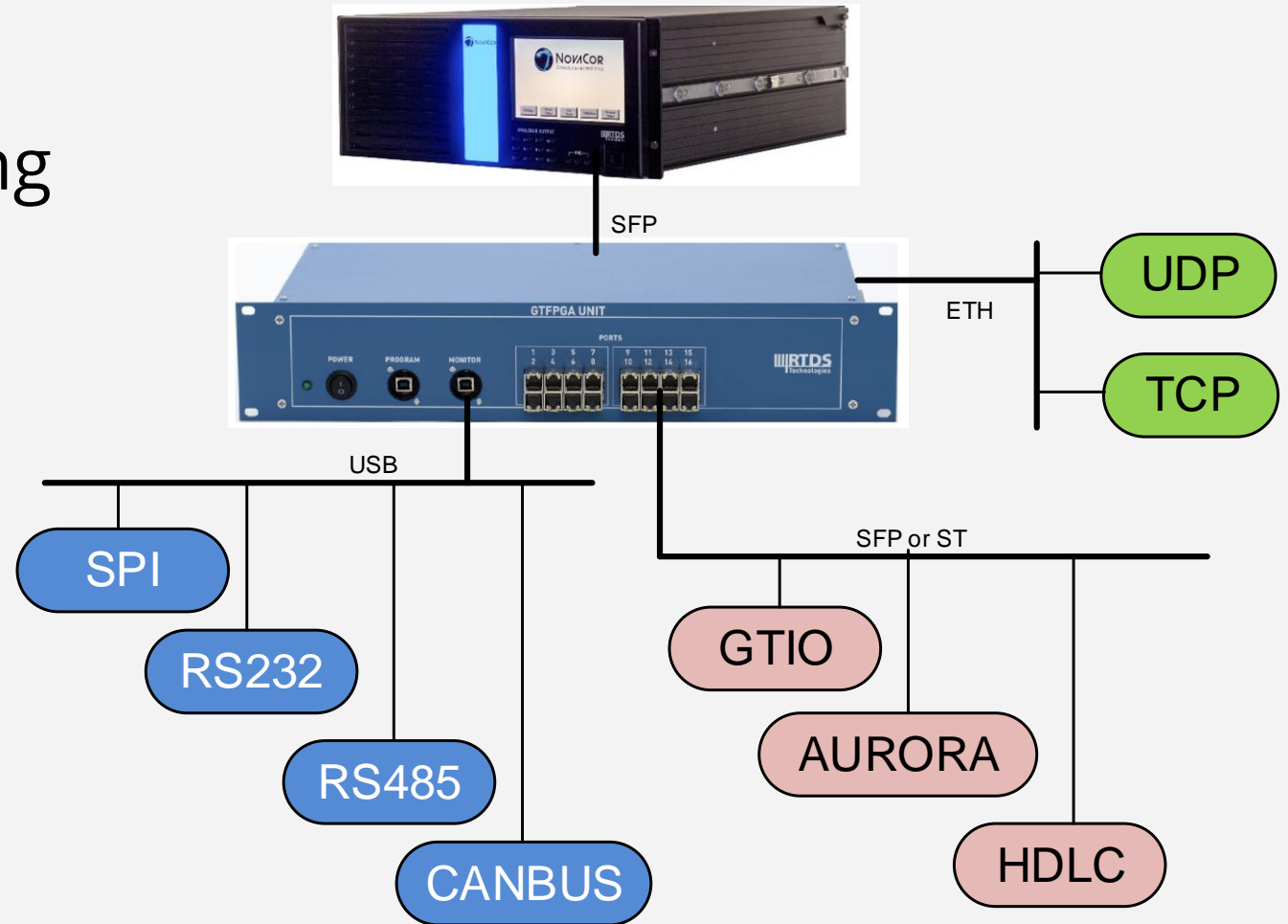
Interfacing via GTFPGA

- GTIO cards connected to RTDS or User Devices



Interfacing via GTFPGA

- More general
- Include many interfacing methods in a single GTFPGA



**Any comment,
new requests
are welcome.**

**We are here to
listen.**





**THANK YOU!
QUESTIONS?**



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