AIONYX - Some insights

4. April 2024

What means AIONYX?

AIONYX is a fusion of the god **Aion** and goddess **Nyx**. Aion is a Hellenistic deity associated with time and the time which Aion presents is perpetual, unbounded, ritual and cyclic. Nyx is the Greek Goddess of the night, and the daughter of Chaos. It is said that she was created near the beginning of time.

The fusion of these two was a perfect product name for us. This is the simple story behind the name **AIONYX**, so nothing related to AI even if you can of course do AI stuff with it 😊.

AIONYX is a registered trademark of NetTimeLogic.

What is AIONYX?

AIONYX is an extremely modular hardware platform which consists of a base board and a bunch of modules. The high modularity of the platform allows to configure your system as you require it. Easy extensibility is given and new features can be added with new modules.

The idea of this platform has started by having a device which allows to evaluate all our FPGA IP Core products. Since our IP Cores have also a highly modular approach, we followed-up this on the hardware platform AIONYX.

Beside an evaluation platform much more will be possible, like full products including our IP Cores. This could be a HSR/PRP Redbox, a TSN Switched End-node, a redundant PTP Grandmaster, a high-speed IO device or an Edge Server.

The hardware platform AIONYX is not only interesting for the hobbyist scene or evaluation purposes also the industry can profit from it. One goal is also robustness and stability, so every module is mounted with screws. The form factor (160x100 mm) is design to fit perfect into a housing and can be used to design full products.

The two main interfaces modules which AIONYX is using, are compatible with two already defined interfaces on the development board market. One is the Digilent Pmod™ Interface and the other on the Digilent Zmod™ Interface compatible with the connector of the SYZYGY specification. So the Pm and Zm modules can also be used with other base or development boards on the market.

A great overview of development boards you can find in the links below on the tech blog on FPGA design by Jeff Johnson.
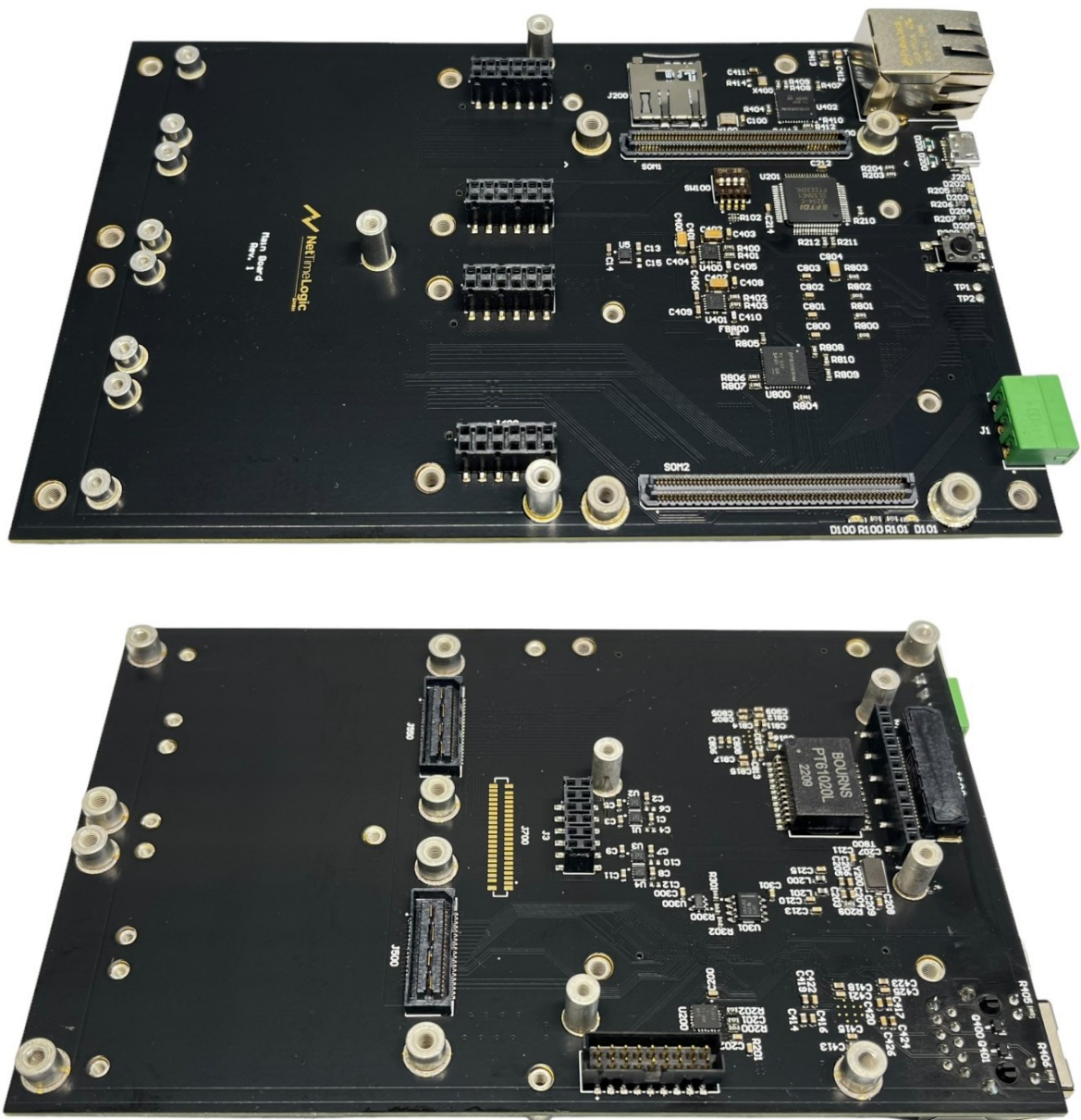
Development boards with Pmod™interface(s):

https://www.fpgadeveloper.com/list-of-fpga-dev-boards-with-pmod/

Development boards with Zmod™ (SYZYGY) interface(s):

https://www.fpgadeveloper.com/list-of-fpga-dev-boards-with-syzygy/

AIONYX - Base Board

The Base Board is a carrier board for the AMD Kria™ K26 SOM Module. Most SOM IO Pins are spent for the 4x PMOD (HDIO) and the 2x ZMOD (HPIO) connectors.

Additionally, it has a Backplane connector and an IO Header for future extension. The Power Supply is also designed as a module which can be easily exchanged.

Beside that it has standard connections like JTAG, Ethernet to the processing system, USB-UART for the processing system and the FPGA and an SD-Card and of course a lot of smaller stuff 😊.

Base Board - Backplane

Especially for industrial use cases, sometimes more Ethernet or general IO ports a required. To allow this the AIONYX Base Board has foreseen the concept of a Backplane via a connector. On this connector it has a 1 Gigabit Ethernet interface, I2C and SPI and all kind of synchronization related signals (IRIG, PPS, 10MHz, etc.) to allow also full synchronization over the Backplane. If desired the complete power supply on the Base Board can be removed and sourced via the Backplane or vice versa. The Backplane connector has 5V, 3.3V 1.8V, the Ethernet lines and 27 IO pins.

Base Board - IO Header

The IO Header allows to connect a flexible cable (FFC/FPC) to the base board. It allows to have a detached PCB or also a PCB with a display. The IO Header provides 5V, 3.3V, 1.8V and 28 user IO pins.

AIONYX - Power Supply

The first version of the AIONYX Power Supply offers a wide range of input voltages. From 9V to 36V DC everything is possible. Additionally, it is an isolated power supply.

It provides the 5V, 3.3V and 1.8V for the Base Board and all modules with enough margin for extensions. Since it is also a module it can be easily replaced and adapted to customer or environmental needs.
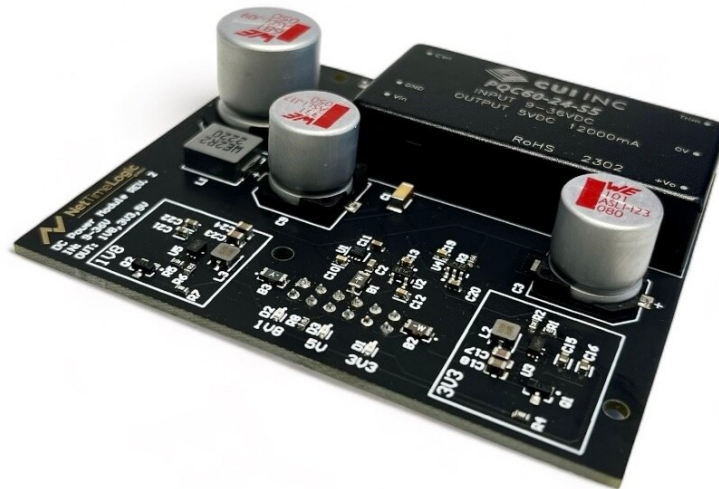
AIONYX - Pm Modules

For lower bandwidth requirements AIONYX uses Pm Modules which are Pmod™ compatible modules with Pmod Interface Type 1A (Expanded GPIO) according to the Digilent Pmod™ Interface Specification. The Pm Modules follow the size specification of 20.32mm width and the connector on the Base Board have the specified distance of 22.86mm between two modules, so even double Pm Modules will be possible.

Currently, most AIONYX Pm modules have a relation to our main working area of time synchronization, but there are of course a lot of other modules possible. Feel free to contact us if you have a great idea for an interface or the need for a specific module.

Following modules exist:

Pm GNSS u-blox M9N (Datasheet)

This module can be used for a device which needs a primary source like GNSS. It can be ideally combined with our TOD Slave and the PPS Slave IP Cores to synchronize our Adjustable Clock. All this happens completely in the FPGA without the need of software interaction.

PM CLK RTC (Datasheet)

The Pm Clk Rtc base board contains the RV-3028-C7 RTC from Micro Crystal - The Art of Timing. It is designed to have a piggy-back board with a specific oscillator. Currently we are using the SiT5356 from SiTime. Different oscillator piggy-back boards will follow.

To achieve good holdover and in general high accuracy in the synchronization, a stable oscillator is key. With this module you get a high precision oscillator and the frequency can be fine-tuned via I2C. It can be perfectly combined with our Adjustable Clock and an add-on FPGA module which does convert the adjustments for the SiTime chip and writes them via I2C. The module also contains a RTC which can be combined with the RTC Master IP Core which will allow you to start with a time close to the actual time.

PM GPIO NC (no connector)

The Pm Gpio module is available with three different connector options. This one does not have a connector assembled. You can assemble our own connector with 2.54 mm pitch or solder directly wires to the available holes.

The module provided 6 general purpose IOs and it contains dual supply bus transceivers which allow to bring a wide range of voltages (1.65V to 5.5V) into the 3.3V FPGA pins which are used for Pmod™ compatible modules. Additionally, it is possible to use an external voltage. So, if you would like to create from a 3.3V FPGA pin e.g. a 5V signal, you can feed 5V from externally and you get the 5V signal from the Pm Gpio module. The direction can be selected for each channel via a dipswitch.

PM GPIO (Datasheet)

This version of the Pm Gpio module contains an 8-pin connector with 6 Gpios, a ground pin and a pin for an external voltage.

PM GPIO SMA ([Datasheet](#))

This version of the Pm Gpio module contains 2 SMA connectors. The other Gpios, the ground pin and the pin for an external voltage can be still used via the header (not assembled).

PM GPIO FO ([Datasheet](#))

The Pm Gpio fiber optical output is ideal for environment where immunity to electromagnetic interference is important. It can be used to transfer PPS, IRIG or other single wired signals from DC up to 50 MBaud (like UART). It can be perfectly combined with a [PPS Master](#), an [IRIG Master](#) or also a [TOD Master](#) IP Core.

PM GPIO FI ([Datasheet](#))

The Pm Gpio fiber optical input is the complement module for the Pm Gpio FO. It support also from DC up to 50 MBaud and can be combined with a [PPS Slave](#), an [IRIG Slave](#) or a [TOD Slave](#) IP Core.

PM AD9544 (with Analog Devices AD9544)

The Pm Module AD9544 can be used if a more advanced and configurable PLL is required than the PLL in the FPGA offers. This is important to be compliant with different ITU profiles which are requiring SyncE. Two sources from the FPGA can be feed into the AD9544 PLL's. Two outputs are going back to the FPGA and two are available on SMA connectors. Via I2C everything can be controlled and configured. With our [PTP OC](#) and the [SyncE Node](#) IP Cores you can get a ITU compliant device.

A lot of others are in the pipeline and soon available:

- PM GNSS FURUNO GT88 (coming soon)
- PM EXTENDER (coming soon)
- PM GPIO RAW (coming soon)
- PM GNSS PROTEMPIS ICM720
- PM ADC
- PM DAC
- PM RJ45 (for Time Of Day not Ethernet)
- PM GPIO High Range

Check out our store to see which ones are available:

[Pmod™ compatible modules](#)

AIONYX - Zm Modules

For interfaces with higher bandwidth requirements AIONYX uses Zm Modules which are Zmod™ connector compatible modules and have the same form factor and voltages as defined in the SYZYGY Specification for Standard Peripheral. The first modules are focusing on Ethernet based communication. So mainly modules with Ethernet PHYs and different connectors. Since also this shall fit into our main working area, all synchronization related aspects were considered. This also means that the recovered PHY clocks can be used or the clock for the PHY can be provided via the connector.

Following modules exist:

ZM ETH 1000 RJ45

For all the Ethernet based synchronization protocols AIONYX has the Zm ETH 1000 RJ45 module. It contains two independent PHYs where the recovered clock PHY clock of each is available on the connector. The clock for the PHY can be provided via the connector or optionally the onboard oscillator can be used. The PHY supports 10, 100 and 1000 MBits.

Some others are in the pipeline and soon available:
- ZM ETH 1000 SFP (coming soon)

- ZM ETH 10 SPE
- ZM ETH 100 SPE
- ZM ETH 1000 SPE

Check out our store to see which ones are available:
Zmod™ compatible modules

AIONYX - What comes next?

The AIONYX hardware platform is still in the growing phase. A lot of modules are as prototypes available and will be soon available in our shop.
Also the base board and the ZM ETH 1000 RJ45/SFP are ready for production and will be soon available.
Modules are not the only ongoing thing. There are also full products in the pipeline which make use of the AIONYX modules and the NetTimeLogic IP cores.
The concept below is built with four AIONYX modules and four FPGA IP Cores from NetTimeLogic. As result we have a powerful PTP Grandmaster for a very attractive price!

Stay tuned! The modularity of AIONYX will offer nearly infinite possibilities!