

Technical Brief 20140502 from Missing Link Electronics:

Zynq SSE for Network-Attached Storage for the Xilinx ZC706

For the evaluation of Zynq SSE MLE supports two separate hardware platforms: The Avnet Zynq Mini-ITX board, and the Xilinx ZC706 Development Kit plus the XM104 Adapter Board. This document is for the Xilinx ZC706 plus the XM104 Adapter Board.

Network-Attached Storage (NAS) is a file-level data storage connected to a computer network, typically via Ethernet transporting TCP/IP and/or UDP communication.

MLE's Zynq SATA Storage Extension (Zynq SSE) is a fully integrated and pre-validated system stack comprising 3rd-party SATA Host Controller and DMA IP cores from ASICS World Services, a storage micro-architecture from MLE, Xilinx PetaLinux, and an Open Source SATA Host Controller Linux kernel driver, also from MLE. Zynq SSE utilizes the Xilinx GTX Multi Gigabit Transceivers to deliver SATA I (1.5 Gbps), SATA II (3.0 Gbps), or SATA III (6 Gbps) connectivity. When combined with Zynq's networking capabilities this effectively leads to a demonstration of Networked Storage, or NAS.

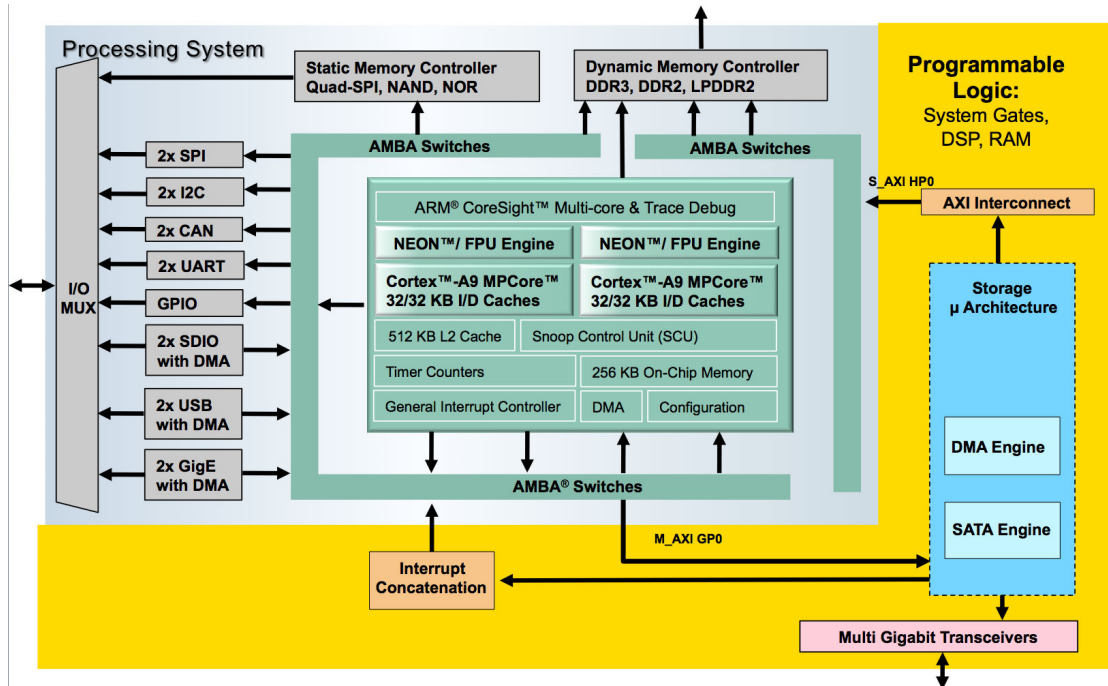
This Technical Brief shows how to setup the Zynq SSE to demonstrate NAS functionality. After going through the steps described herein, you will have a working Linux System running on the Zynq with an attached SATA HDD or SSD, making files stored on the attached disk available to other networked clients.

Team MLE has spent significant efforts to try and test all aspects of Zynq SSE. However, if you feel that you encounter something not right, or if you do have any questions, please do not hesitate to contact us. The best way to contact MLE is to fill out the Contact Request Form at

<http://MLEcorp.com/ZynqSSE>

Block Diagram

The block diagram shown below gives an overview over the Zynq SSE reference design: Within the Zynq Programmable Logic (PL) the MLE storage micro-architecture instantiates the DMA and the SATA Host Controller IP blocks. The storage micro-architecture itself interfaces with the Zynq Processing System (PS) via the high-performance AXI HP0 slave port. The ARM A9 in the PS runs Xilinx Petalinux and the SATA Linux kernel driver.



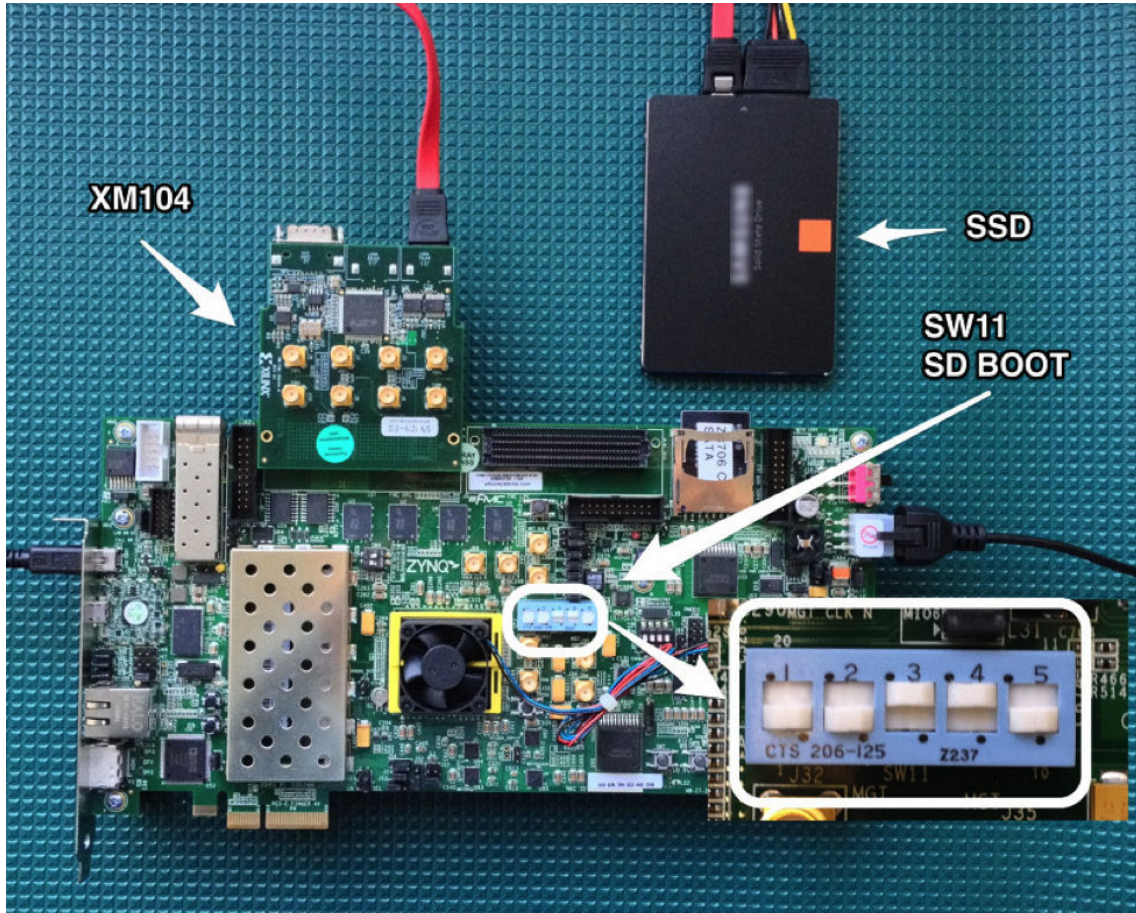
Implementation

Implementation Details	
Design Type	PS + PL
SW Type	Linux (Petalinux)
CPUs	2 CPUs 700 MHz
PS Features	DDR, USB, UART, ETHERNET
PL Cores	ASICS.WS SATA IP
Boards/Tools	ZC706, XM104
Xilinx Tools Version	Vivado 2014.1, PETALINUX 2013-2
Other Details	Samsung 840 SSD(including Cable and Power Supply), SD-Card

Address Map			
	Base Address	Size	Interface
SATA IP	0x41000000	4K	S AXI
DMA IP	0x41010000	4K	S AXI, M AXI

Files Provided	
BOOT.bin	Compilation of Bitstream, FSBL and U-Boot
Image.ub	Linux Ramdisk Image

Step by Step Instructions



Hardware needed:

- ZC706 Board (including Power supply)
- XM104 FMC Board
The XM104 Adapter Card is available from Avnet:
<http://www.em.avnet.com/en-us/design/drc/Pages/Xilinx-FMC-XM104-Connectivity-Card.aspx>
- Mini USB Cable for USB Console

- Supported SSD (for Example Samsung 840) **WARNING, the SSD will be formatted, so save the data on it.**
- Power Supply for SSD
- Ethernet Cable to connect Host PC and ZC706
- SD Card (2 GB or bigger)
- PC for UART console and Ethernet

Software Assembly:

1. Format the SD Card using FAT32 File system
2. Put image.ub and BOOT.bin into the root directory of the SD Card

Hardware Assembly:

1. Insert the SD Card into the ZC706 SD Slot
2. Connect the XM104 card to the HPC Port of the ZC706
3. Connect the mini USB cable to the UART port of the ZC706 and the USB Port of your PC
4. Connect the Ethernet port of the host pc to the ethernet port of the ZC706
5. Connect the SSD to the XM104 SATA 1 port using the SATA Cable.
6. Connect the SSD to power
7. Switch the ZC706's SW11 to SD Boot mode (as shown in picture)
8. Connect the ZC706 to the Power Supply

The system should now look like in the supplied image

Startup:

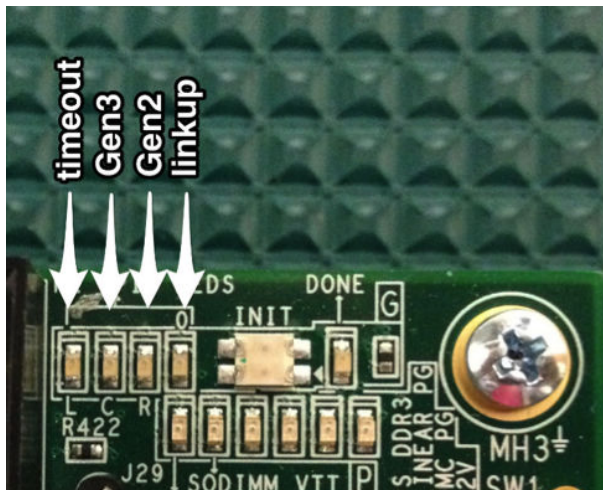
1. Switch on the ZC706
2. On the PC open a Serial Terminal on the new serial port using the settings 115200 Baud 8N1
3. Observe the Linux System booting
4. After some time you should see a screen similar to the screenshot in the Expected Results.
5. Login using
 - Login:root
 - Password: root
6. configure the ethernet port on the host PC to have an IP address of 192.168.0.1 and a subnet mask of 255.255.255.0

7. The ZYNQ-board has an pre-supplied IP of 192.168.0.2
8. now connect to the ZYNQ-board using an FTP program and start transferring data to it

LED Description

Status LEDs can be found in the upper right corner of the board, next to the power switch. The associated meanings can be seen in the following table and in the Image below.

GPIO LED LEFT	Timeout LED, indicates the Timeout of the IP core.
GPIO LED CENTER	Gen3 Link, indicates 6 GBit/s connection
GPIO LED RIGHT	GEN2 Link, indicate 3 GBit/s connection
GPIO LED 0	Linkup and Activity



Expected Results

As a result you should be having a running Linux system on the Zynq board. The UART Console output should be similar to the screenshot below.

Also you will have file-system access to the attached SSD using FTP, and by this evaluate and test the Zynq Sata Storage extension.

The Evaluation Reference Design (ERD) of the Zynq SSE comprises a hardware license management which allows to run full SATA functionality for up to 12 hours after power-up. After approximately 12 hours the evaluation expires, which is indicated by illuminating the LED 'timeout'. You will also notice that the Linux kernel driver informs you of having lost the SATA link to the SSD/HDD.

```

1. ssh
ssh      zsh      ssh

You are running the Evaluation Reference Design (ERD) of MLE's
Zynq SATA Storage Extension (ZynqSSE). The ZynqSSE is licensed
according to MLE's Product License Agreement, available for
review at http://MLEcorp.com/US-license

This ERD comes without support and will time-out approximately
12 hours after power-up.

For sales and technical support please visit us at:

    http://MLEcorp.com/ZynqSSE

Thank you for trying MLE's ZynqSSE!
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PetaLinux v2013.04 (Yocto 1.3) ZC706_SATA ttyPS0

ZC706_SATA login: root
Password:
root@ZC706_SATA:~# hdparm -i /dev/sda

/dev/sda:

Model=PLEXTOR PX-128M5S, FwRev=1.01, SerialNo=P02246103066
Config={ Fixed }
RawCHS=16383/16/63, TrkSize=0, SectSize=0, ECCbytes=0
BuffType=unknown, BuffSize=unknown, MaxMultSect=16, MultSect=1
CurCHS=16383/16/63, CurSects=16514064, LBA=yes, LBAsects=250069680
IORDY=on/off, tPIO={min:120,w/IORDY:120}, tDMA={min:120,rec:120}
PIO modes:  pio0 pio3 pio4
DMA modes:  mdma0 mdma1 mdma2
UDMA modes: udma0 udma1 udma2 udma3 udma4 udma5 *udma6
AdvancedPM=no WriteCache=enabled
Drive conforms to: unknown: ATA/ATAPI-1,2,3,4,5,6,7

* signifies the current active mode

root@ZC706_SATA:~# aws_satah 41000000.satahc: PROT interrupt, nstat:0x46f40010, estat:0x00000001,
SError:0x00010002
ata1: exception Emask 0x10 SAct 0x0 SErr 0x10002 action 0xe frozen
ata1: nstat 0x46f40010
ata1: SError: { RecovComm PHYRdyChg }
ata1: hard resetting link
ata1: SATA link down (SStatus 0 SControl 300)
ata1: hard resetting link
ata1: SATA link down (SStatus 0 SControl 300)
ata1: limiting SATA link speed to 1.5 Gbps
ata1: hard resetting link
ata1: SATA link down (SStatus 0 SControl 310)
ata1.00: disabled
ata1: EH complete
ata1.00: detaching (SCSI 0:0:0:0)
sd 0:0:0:0: [sda] Synchronizing SCSI cache
sd 0:0:0:0: [sda]
Result: hostbyte=0x04 driverbyte=0x00
sd 0:0:0:0: [sda] Stopping disk
sd 0:0:0:0: [sda] START_STOP FAILED
sd 0:0:0:0: [sda]
Result: hostbyte=0x04 driverbyte=0x00

[0] 0:builtin 1:zc706-console* 2:petalinux 3:zsh-          "topf" 20:00 07-May-14

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