

# Development of a SERCOS III solution

Remote Lab Demonstration Tutorial 5

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*Revision 001*

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## Revision History

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Document Number	Revision Number	Description	Revision Date
324613	001	Initial release.	November 2010

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# 1 Introduction

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## 1.1 Goals

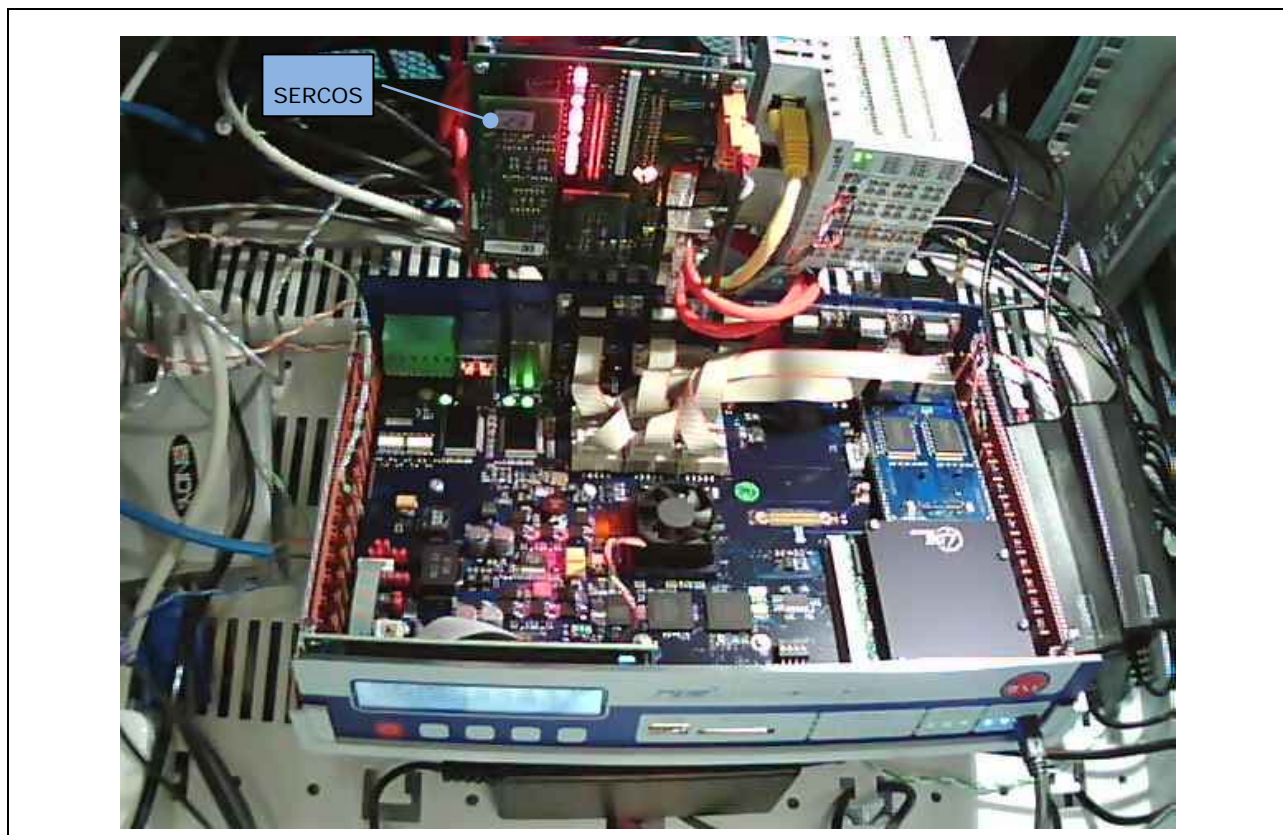
This tutorial shows how to realize a SERCOS III (SERial ReAltime COmmunication System) master on the Hpe\_IRP. This includes:

- Creating an FPGA design using the SERCOS III IP Core from Automata GmbH & Co KG.
- Starting the SERCOS demo application

The Remote Lab (Figure 1) provides a special SERCOS slave. There you can try out the SERCOS demo.

This document assumes familiarity with the environment of the Hpe\_IRP which is described in [4] of Section 1.2.

**Figure 1. Remote lab setup**



## 1.2 Referenced Documents

Ref	Document	Document Number/Location
1	Intel Remote Lab Access Guide	Contact your Intel representative
2	Hpe® Industrial Reference Platform (IRP) User Manual	<a href="http://www.ge-research.com/attach/UserManual-Hpe_IRP.pdf">http://www.ge-research.com/attach/UserManual-Hpe_IRP.pdf</a>
3	Hpe® desk Basic Manual	<a href="http://www.ge-research.com/attach/UserManual_HpeDesk_basic.pdf">http://www.ge-research.com/attach/UserManual_HpeDesk_basic.pdf</a>
4	Remote Lab Demonstration	324614

## 2 Quickstart guide

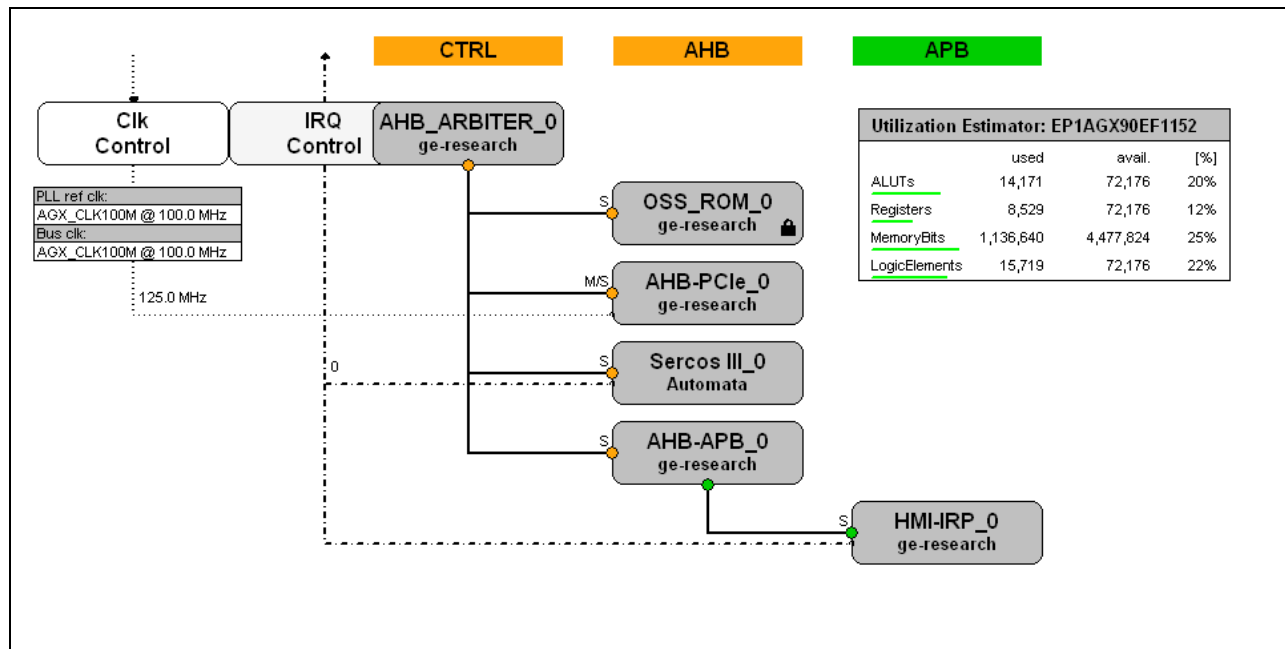
SERCOS III requires two 100Base-TX or 100Base-FX Full Duplex physical layer entities. We use a dedicated hardware MAC layer to reach the short jitter requirements of less than 1µs. By using the FPGA we can extend the Hpe\_IRP with such a hardware-based SERCOS MAC.

### 2.1 Creating an FPGA design

First we create an FPGA design with the SERCOS III IP Core.

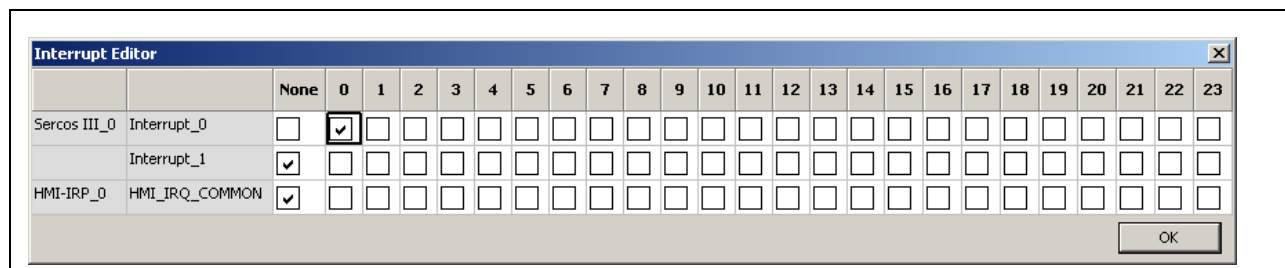
Use Hpe\_Desk to generate a design as shown in Figure 2. For details on the Hpe\_Desk usage, refer to [4].

Figure 2. FPGA design



Double click the IRQ Control and connect the interrupts as shown in Figure 3.

Figure 3. Interrupt configuration

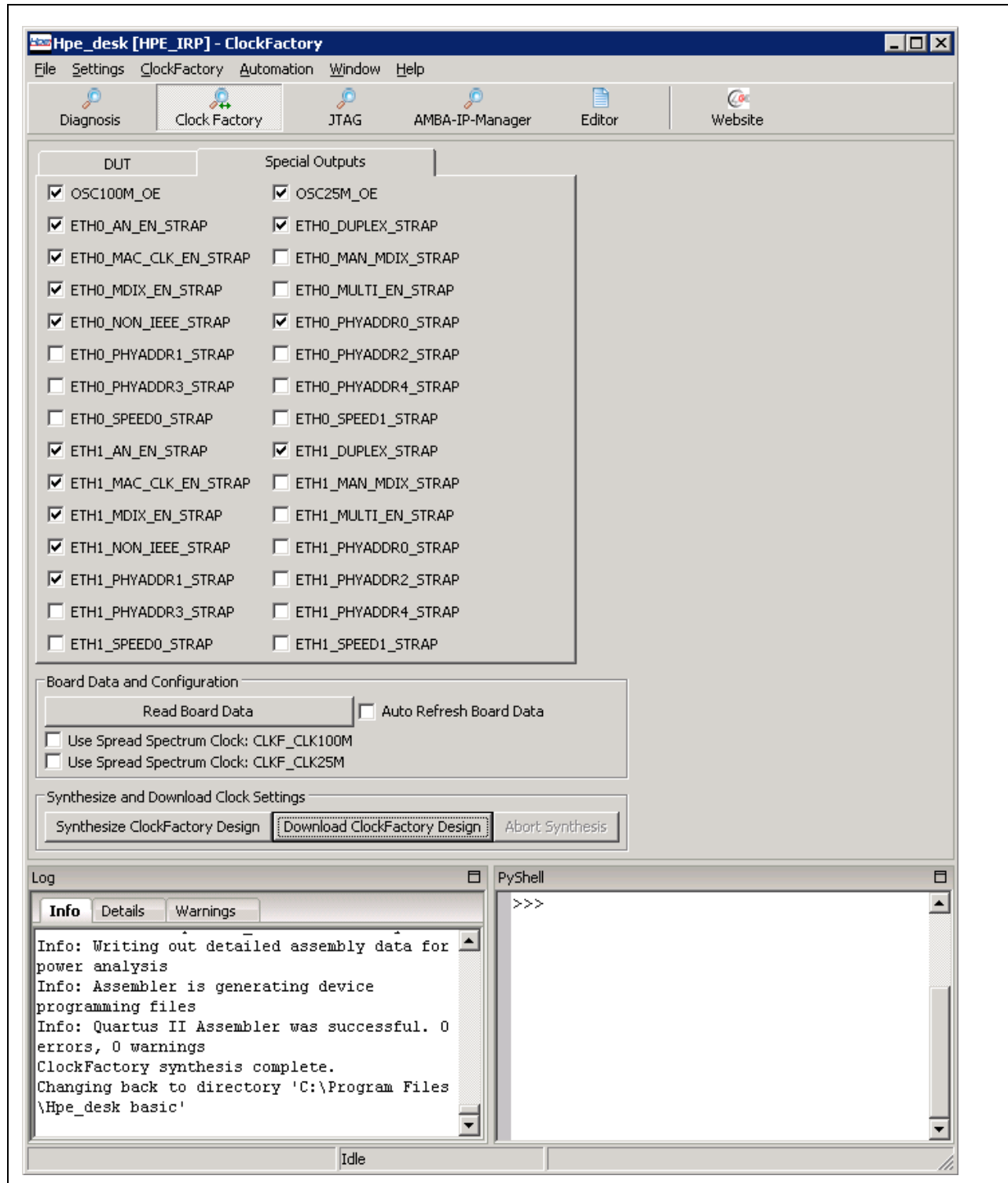


Synthesize the design. If you do not want to wait until the synthesis has finished, you can open a prebuilt Hpe\_Desk project in the Remote Lab.

Before downloading the design into the FPGA, check the clock factory settings. In Hpe\_desk select "Clock Factory", select the tab "Special Outputs" and click "Read Board Data". Compare your settings to the ones shown in Figure 4, especially "ETH0\_PHYADDR0\_STRAP" and "ETH1\_PHYADDR1\_STRAP".

If your settings differ from those in Figure 4, change your settings such that they match the ones in Figure 4. Then click "Synthesize ClockFactory Design" and "Download ClockFactory Design".

Figure 4. Clock factory configuration



## 2.2 Check the running configuration

After restarting the Hpe\_IRP, check that the FPGA contains the correct design. The command `lsfpga` should produce the following output:

```

irp@hpe_irp ~ $ /usr/sbin/lsfpga
OSS_ROM version: 4
ROM size       : 956 bytes
Number of IPs  : 6
Timestamp      : 2010-09-10, 18:05:19 (0x4c8a573f)
AIM info size  : 0 bytes
CRC            : 0xb59ca716 [OK]

00 AHB Arbiter: Gleichmann Electronis Research (rev:1)
01 OSS ROM: Gleichmann Electronis Research (rev:1)
02 AHB<->PCIe Bridge: Gleichmann Electronis Research (rev:1)
03 SERCOS III Master: Automata (rev:1)
04 AHB<->APB Bridge: Gleichmann Electronis Research (rev:1)
05 HMI: Gleichmann Electronis Research (rev:1)

```

Check if the driver `hpe_irp_sercos3_uio` is loaded:

```

irp@hpe_irp ~ $ lsmod
Module                Size  Used by
hpe_irp_sercos3_uio  3036  0
uio                   10500  1 hpe_irp_sercos3_uio
hpe_irp_hmi           6788  0
pcspkr                2524  0
sdhci_pci             7548  0
sdhci                 18592  1 sdhci_pci
e1000e               110060  0
hpe_irp_bridge        9980  0
hpe_irp_bus           4508  3 hpe_irp_sercos3_uio,hpe_irp_hmi,hpe_irp_bridge

```

## 2.3 Download and install test program

The Hpe\_IRP contains a demo application which shows how to control the LEDs of the SERCOS slave shown in Figure 1. It is located under:

```
/home/irp/Hpe_IRP_support/Demo_designs/3d_Party/Automata
```

If it is not there, or contains an outdated version, it can be installed and/or updated through the Gentoo Software Management Tool `emerge`. To download and install the demo program use the following command:

```
sudo emerge app-examples/sercos-III-master-demo
```

Change to the `irp` user's home directory and unpack the demo:

```

cd
tar xjf Hpe_IRP_support/Demo_designs/3d_Party/Automata/sercos-III-master-demo-1.0.tar.bz2

```

Change to the new directory, compile and run the program:

```

cd sercos-III-master-demo-1.0/GettingStarted
make
sudo ./master_app

```

The SERCOS master should appear and activity can be seen on the SERCOS slave (the top-left PCB in Figure 1). For more details refer to the `readme.txt` document.