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**Assignment no:** 01

**Name of the assignment:** Zodiac OpenFlow Switch (Configure)

**Objectives:**

- ◆ Configure and interact with Zodiac FX OpenFlow Switch.
- ◆ Exploring the Zodiac FX context.

**Theory:**

**Zodiac FX Switch**

Zodiac FX is the first OpenFlow switch designed to sit in a desk, not in a datacenter. Until now the power of Software Defined Networking (SDN) was only available to the administrators of large corporate networks. Even though there are numerous free or open source SDN controllers the one thing that was missing was a small, affordable OpenFlow switch. In this demo, we present Zodiac FX the world's smallest OpenFlow Software Defined Network Switch.

**Zodiac FX Description:**

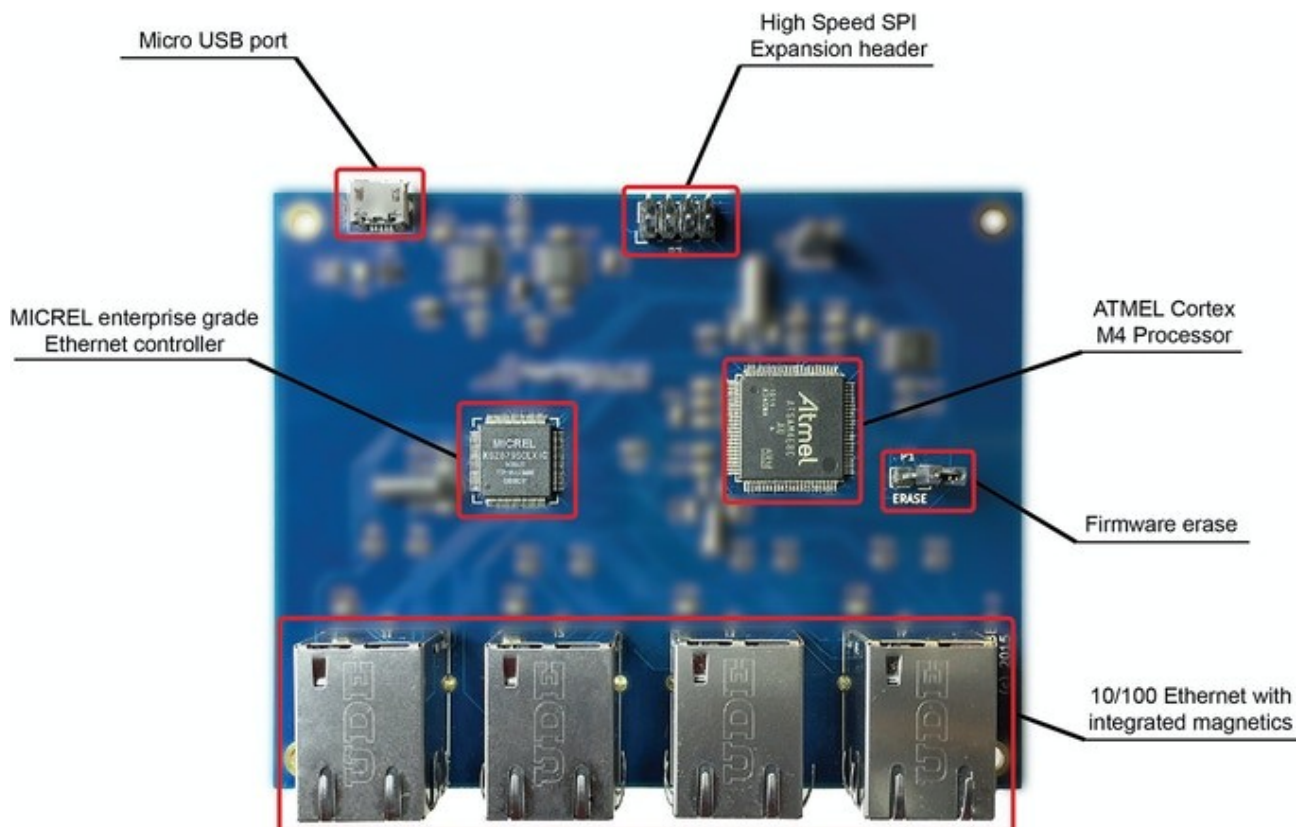
The Zodiac FX is a 4 port network development board designed for hobbyists, students, researchers, embedded developers or anyone who requires a low cost network development platform. Even though it was initially designed to allow affordable access to OpenFlow enabled hardware it's open source firmware it can be used in any number of other applications. By providing the firmware source code users are free to not only create their own versions but also use it as a basis for a completely different type of device. Some such applications may include: Router, Bridge, Load Balancer, Web server, VPN concentrator and many more.

**Features of zodiac FX:**

The Zodiac FX provides many of the features of an OpenFlow switch costing thousands of dollars, yet is small enough to fit in the palm of your hand. Some of those amazing features include:

- ◆ 4 x 10/100 Fast Ethernet ports with integrated magnetics
- ◆ Command line interface accessible via USB virtual serial port
- ◆ Amdel ATSAM4E Cortex M4 processor
- ◆ Support for OpenFlow 1.0, 1.3 & 1.4
- ◆ 512 entry software flow table

- ◆64KB frame buffer with non-blocking store and forward
- ◆802.1q VLAN support for 64 groups from 4096 IDs
- ◆Per port based 802.1x authentication
- ◆802.1w Rapid Spanning Tree Protocol (RSTP)
- ◆16 ACLs per port
- ◆2KB jumbo frame support
- ◆QoS / CoS prioritisation with 802.1q tag insertion
- ◆Auto MDIX with X-over detection
- ◆Per port link and activity LEDs
- ◆High speed SPI expansion header
- ◆USB powered
- ◆Ultra small size of only 10 cm x 8 cm



## **What is OpenFlow?**

OpenFlow is the protocol that makes Software Defined Networking possible. OpenFlow was originally developed by researchers at Stanford University and is now supported by all major networking vendors. At the centre of an OpenFlow network is an SDN controller, this is where your applications are installed. OpenFlow is used to communicate to the switches on your network which then process the data going through their ports using what are called "flows". These flows are generated by your application based on the task you have programmed it to perform.

## **IP addressing:**

### **Static IP Addressing**

With static IP addressing, addresses are assigned manually, and have to be provisioned carefully so that each device has its own address—with no overlap. When you connect a new device, you would have to select the "manual" configuration option and enter in the IP address, the subnet mask, the default gateway and the DNS server(s).

### **Dynamic Host Configuration Protocol (DHCP):**

DHCP takes all of the manual work out of IP addressing. Generally, the device that's at the "top" of your home network—whether it's a standalone firewall or a router/gateway device or your Control home controller—will provide DHCP by default as a service on the network. When DHCP is enabled, a new device connected to the network asks the DHCP server for an address, and the server assigns one from its pool of unused locations. The server itself tracks which addresses are used and which addresses are available, and keeps a record of which addresses have been assigned to the various devices. This ensures that addresses don't conflict with each other. However, it also means that, if a device goes offline, when it reconnects it may not have the same IP address it had before.

Mixing Configurations: It's entirely possible to mix static IP and DHCP addressing schemes.

Since the default DHCP address range is between 100 and 149, you'll want to avoid all of the addresses between 192.168.1.100 and 192.168.1.149 when you're assigning static IP addresses.

That leaves the ranges from 2-99 and from 150-254 wide open, which is usually plenty for most home networks.

### **Virtual Local Area Network (VLAN)**

A VLAN is a group of devices on one or more LANs that are configured to communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. There are two main reasons for the development of VLANs:

1. the amount of broadcast traffic
2. increased security

Broadcast traffic increases in direct proportion to the number of stations in the LAN. The goal of the virtual LAN (VLAN) is the isolation of groups of users so that one group is not interrupted by the broadcast traffic of another. By segregating a group of devices to a particular VLAN, a switch will block broadcasts from devices in that VLAN to devices that are not in that VLAN instead of flooding it out every port. VLANs also have the benefit of added security by separating the network into distinct logical networks. Traffic in one VLAN is separated from another VLAN as if they were physically separate networks. If traffic is to pass from one VLAN to another, it must be routed.

Each VLAN is identified by a VLAN ID (VID), which is usually a number. They can reside on only a single switch, or they can be distributed throughout the entire network on each switch. Each VLAN is a broadcast domain. Each device in a VLAN, regardless of its physical location, can communicate directly with every other device in the same VLAN. However, they cannot communicate outside of the VLAN except through a router. A VLAN is usually created using physical ports.

### **Methodology**

Zodiac FX Command Line Interface (Z-CLI): The Zodiac CLI provides the ability to configure setting and monitor the operation of the Zodiac FX. To simplify operations the CLI uses the concept of a context's, this limits the available commands to only those available in the currently selected context. There are currently four available contexts:

- Base,
- Config,
- OpenFlow SDN-Labsand
- Debug.

To enter the required context simply type the name of the context on the command line while at the base level. The return to the base level type exit. The current context is shown in bracket between the device name and the prompt. The following sections describe the commands available within each context; please note that all commands are lower-case only.

**1. Base Functionalities:** The following commands are available in this context:

**config** Enter the config's context.

**openflow** Enter the OpenFlow's context.

**debug** Enter the debug's context.

**show status** Displays the current device status.

**show ports** Displays information about each Ethernet port including state, VLAN membership and traffic statistics.

**show version** Display the firmware version.

**help** Display a list of available commands.

## 2. Config Functionalities: The following commands are available in this context:

**save** Saves the current configuration to non-volatile memory.

**show config** Display the current device configuration.

**show vlans** Displays a list of the currently configured VLANs.

**set name < name >** Sets the device name. Maximum of 16 characters, entries will be truncated.

**set mac-address < mac address >** Sets the MAC address of the device. The MAC address assigned to the device is located on a label on the underside of the device.

**set ip-address < ip address >** Sets the device IP address

**set netmask < netmask >** Set the device netmask

**set gateway < ip address >** Sets the default gateway of the device

**set of-controller < ip address >** Sets the IP address the OpenFlow controller

**set of-port < tcp port >** Sets the TCP port of the OpenFlow Controller

**set of-version < version >** Sets the device to only connect to an controller using the OpenFlow version specified. A value of 0 disables this function and allows the device to negotiate the version.

**add vlan < vlan id > < vlan name >** Creates a new vlan. Valid IDs are 1-4096 and names must be less than 16 characters.

**delete vlan < vlan id >** Deletes an existing vlan.

**set vlan-type < vlan id > < type >** Set the vlan to either openflow or native.

**add vlan-port < vlan id > < port >** Assigns a ethernet port to the designated vlan. A port can only be a member of one vlan.

**delete vlan-port < port >** Remove the named Ethernet port from a vlan.

**factory reset** Configures and saves the configuration back to the factory test configuration.

**exit** Return the context back the base level.

## 3. OpenFlow Functionalities: The following commands are available in this context:

**show status** Displays the OpenFlow status.

**show flows** Displays a list of the currently installed flows.

**enable** Enables the OpenFlow functionality.

**disable** Disables the OpenFlow functionality.

**clean** flows Disabling OpenFlow will clear the flow tables and

**exit** Return the context back the base level.

**4. Debug Functionalities:** The following commands are available in this context:

**read register** Display the value of the KSZ8795 register.

**write register < value>** Writes the value into the defined KSZ8795 register.

**exit** Return the context back the base level

**Question 5.1: Explain the difference between the Native and OpenFlow ports?**

**Ans:**

By default, two VLANs are configured on the Zodiac FX:

- "OpenFlow", with ID 100
- "Native", with ID 200

**"OpenFlow" Port:**Intended for general network traffic. Connect these ports to network hosts.

**"Native" Port:** intended for management traffic. Connect this port to the OpenFlow controller.

By default, ports 1-3 are set as OpenFlow ports. Port 4 is set to Native.

**Question 5.2: Why we cannot use dynamic IP between zodiac and lab-PC?**

**Ans:**

Because zodiac and controller IP address are configured in the code as static address.

**Question 5.3: What is the difference between and OpenFlow and non-OpenFlow switch (apart from the support of openflow)**

**Ans:**

The architecture of the network is different; an OpenFlow switch works only when a controller is active.

**Question 5.4: Provided others examples of commercial OpenFlow switches.**

**Ans:**

- ✓ HP,
- ✓ Huawei any open-flow switch is valid.

#### Exercise 4.1.1: Using the USB-MiniUSB cable connect to Zodiac FX.

**Ans:**

We don't have any zodiac FX for this reason we can't connect to the zodiac with the computer using a USB-MiniUSB cable.

#### Exercise 4.1.2: In a terminal check if the device is detected using the following the command lines

a. Run `cd /dev`

b. Run `ls` and look for the `ttyACMx` (where x represent the number that your Linux OS give to the device.)

**Ans:**

we don't have any zodiac FX.

#### Exercise 4.1.3: Open Putty Software: run the command `sudo putty` and configure it using the following procedure:

Configure the communication as show in the figure:

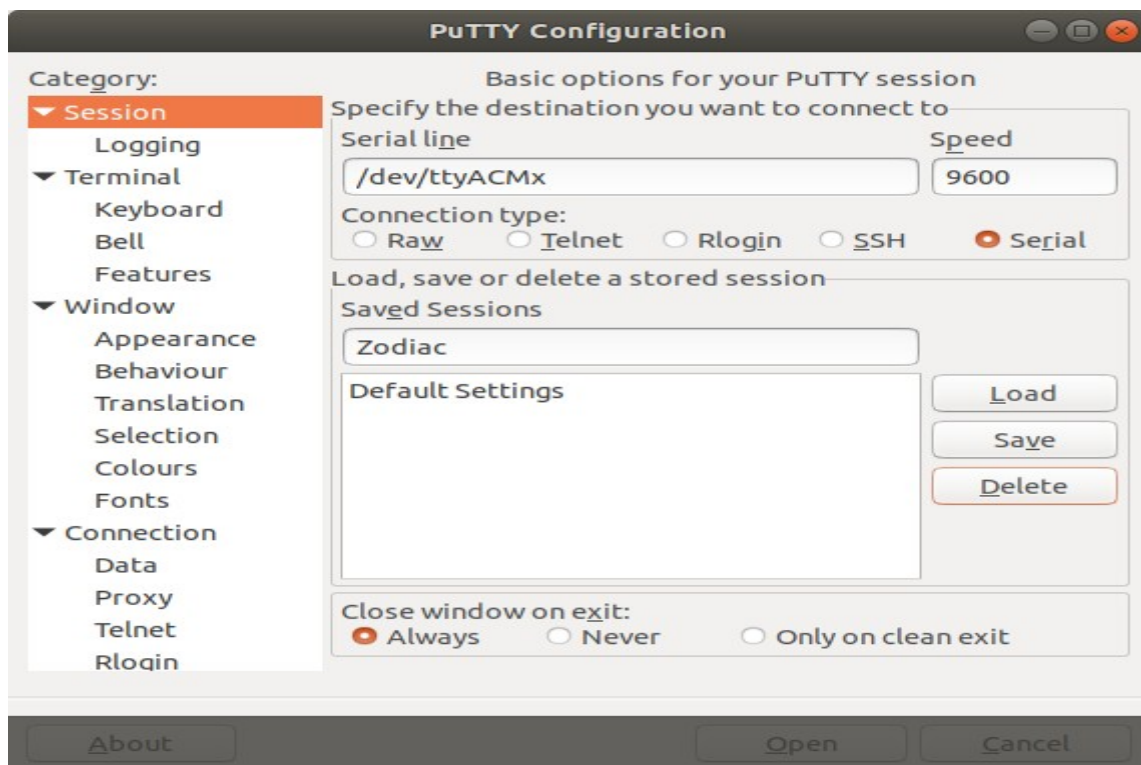
Serial Line: `/dev/ttyACMx`

Tick serial

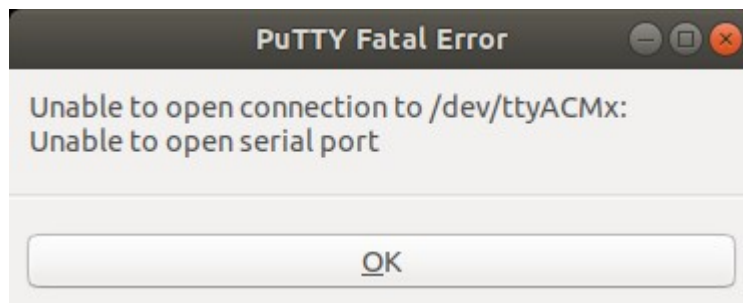
Provide a name example Zodiac

Save the session

**Ans:**



The following error will occur because we don't have any zodiac FX connected to my PC.



### **Conclusion:**

When i try to complete the assignment i found several problems. Such as I need a zodiac FX but I don't have any zodiac FX to connect with pc and can't configure putty software. According the exercise given in this assignment we need a Zodiac Fx(which will connect with a computer through a USB cable) to complete the assignment . But we don't have any zodiac Fx. The following error occur when I try to configure the putty software because zodiac FX are not connected to the computer.

