1- Changings in FSConfig.py file:

A. Adding a network adapter(Ethernet device) and connecting it to I/O bus (PCI bus): (function connectX86ClassicSystem)

```
#adding Ethernet device
x86_sys.ethernet = IGbE_e1000(pci_bus=0, pci_dev=1, pci_func=0)

# connect ethernet device to I/O bus
        x86_sys.ethernet.pio = x86_sys.iobus.master
        x86_sys.ethernet.config = x86_sys.iobus.master
        x86_sys.ethernet.dma = x86_sys.iobus.slave
        x86_sys.ethernet.InterruptLine = 17
```

B. Adding the address range for Ethernet device to bridge ranges:

```
x86_sys.bridge.ranges = \
        [
        AddrRange(x86_sys.pc.south_bridge.io_apic.pio_addr,
                x86_sys.pc.south_bridge.io_apic.pio_addr +
                APIC_range_size - 1),
        AddrRange(IO_address_space_base,
                interrupts_address_space_base - 1),
        AddrRange(pci_config_address_space_base,
                Addr.max),
        AddrRange(0x30000000, 0x30020000)
        ]
```

C. There is a miss configuration in FSConfig.py file, you should change the bus_id of PCI bus to 0 and ISA bus to 1. You should change the bus id in the following lines(makeX86System function):

```
        pci_bus = X86IntelMPBus(bus_id = 0, bus_type='PCI')
        base_entries.append(pci_bus)
        isa_bus = X86IntelMPBus(bus_id = 1, bus_type='ISA')
        base_entries.append(isa_bus)
        connect_busses = X86IntelMPBusHierarchy(bus_id=1,subtractive_decode=True,
parent_bus=0)
        assign_8259_to_apic = X86IntelMPIOIntAssignment(
        interrupt_type = 'ExtInt',
        polarity = 'ConformPolarity',
        trigger = 'ConformTrigger',
```

```
        source_bus_id = 1,
        source_bus_irq = irq,
        dest_io_apic_id = io_apic.id,
        dest_io_apic_intin = 0)
         assign_to_apic = X86IntelMPIOIntAssignment(
        interrupt_type = 'INT',
        polarity = 'ConformPolarity',
        trigger = 'ConformTrigger',
        source_bus_id = 1,
        source_bus_irq = irq,
        dest_io_apic_id = io_apic.id,
        dest_io_apic_intin = apicPin)
```

D. Create an entry in MP Table and configure the interrupt line assignment of the device(makeX86System function):

```
        pci_dev1_inta = X86IntelMPIOIntAssignment(
        interrupt_type = 'INT',
        polarity = 'ConformPolarity',
        trigger = 'ConformTrigger',
        source_bus_id = 0,
        source_bus_irq = 0 + (1 << 2),
        dest_io_apic_id = io_apic.id,
        dest_io_apic_intin = 17)
        base_entries.append(pci_dev1_inta)
```

for more information about X86IntelMPIOIntAssignment class and its parameters, take a look at gem5/src/arch/x86/bios/IntelMP.py. In this case, we assign interrupt line #17 to Ethernet device.

E. For adding the capability of running x86 dual system, add the following lines to the makeDualRoot function:

```
        elif hasattr(testSystem, 'pc'):
        self.etherlink.int0 = Parent.testsys.ethernet.interface
        self.etherlink.int1 = Parent.drivesys.ethernet.interface
```

2-changes in fs.py file:

line 176,

- drive_sys = makeX86System(drive_mem_mode, DriveMemClass, np, bm[1])

+ drive_sys = makeLinuxX86System(drive_mem_mode, DriveMemClass, np, bm[1])

3-changes in the disk image:

Make sure that the following line is exist in the etc/fstab file in your disk image:

```
# <file system> <mount point>   <type>  <options>              <dump>  <pass>
proc            /proc           proc    nodev,noexec,nosuid 0       0
```

(if you are using the disk image that is provided in gem5 webpage for x86 full system simulation , you should update etc/fstab)

4-After the linux system booted up successfully, type the following commands in gem5 terminal to setting up network(http://www.m5sim.org/Running_gem5):

```
#ifconfig eth0 192.168.0.11 txqueuelen 1000
#ifconfig lo 127.0.0.1
```

after that, if you type ifconfig, the output will be:

```
# ifconfig
eth0    Link encap:Ethernet  HWaddr 00:90:00:00:00:01
        inet addr:192.168.0.10  Bcast:192.168.0.255  Mask:255.255.255.0
        inet6 addr: fe80::290:ff:fe00:1/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)
        Memory:30000000-30020000
lo      Link encap:Local Loopback
        inet addr:127.0.0.1  Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING  MTU:16436  Metric:1
        RX packets:12 errors:0 dropped:0 overruns:0 frame:0
        TX packets:12 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:1008 (1008.0 b)  TX bytes:1008 (1008.0 b)
```