The Physical Function Baseband Device Configuration Using `pf_bb_config`

The `pf_bb_config` tool configures baseband device physical functions (PF) on the host system using memory-mapped I/O operations. This tool parses parameters from device-specific configuration files, allowing administrators to customize physical functions, create virtual functions (VF) and enable direct hardware access for virtual machines.

Prerequisites

- The `vfio-pci` module built into the kernel

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1 What is `pf_bb_config`?

`pf_bb_config` is a tool that enables you to configure broadband devices on your host system. The tool accesses the configuration space and sets parameters using memory-mapped I/O (MMIO) read and write operations.

The particular broadband device configuration parameters are parsed from a passed configuration file specific to that device.

2 Installing the `pf_bb_config` tool

The physical function broadband devices configuration tool is not delivered as part of the pre-built images. To use it, you need to install it first:

1. Refresh repositories:

```
> sudo zypper ref
```

2. Install the `pf-bb-config` package:

```
> sudo transactional-update pkg install pf-bb-config
```

3. In certain cases, you may need to use the Data Plane Development Kit. To install it, run:

```
> sudo transactional-update --continue pkg install dpdk
```

4. Reboot the system:

```
> sudo reboot
```

3 Usage of `pf_bb_config`

To run the `pf_bb_config` tool, use the following command:

```
# pf_bb_config DEVICE_NAME [-h] [-c PATH_TO_CONFIG_FILE] [-p PCI_ID] [-v VFIO_TOKEN] [-f
 FFT_LUT_FILE]
```

Where the arguments and options have the following meaning:

DEVICE_NAME

The device name is mandatory.

-h

To print out help.

-c PATH_TO_CONFIG_FILE

Passes the configuration file to use for the particular BB device. Configuration examples are installed to `/opt/pf-bb-config/`. For details regarding these examples, refer to *Section 3.2, "Configuration examples description"*.

-p PCI_ID

Specify the PCI ID of the device to be configured.

-v VFIO_TOKEN

Provide a VFIO token that can be obtained using the **`uuid`** command:

```
# uuid=$(cat /proc/sys/kernel/random/uuid)
```

Then, to display it:

```
# echo $uuid
```

-f FFT_LUT_FILE

Using the option, you can provide an alternative FFT LUT file. If not specified, the default one is used.

3.1 Using the `vfio-pci` module

To enable your device's direct access to hardware resources, you need to use the vfio-pci driver. Before proceeding further, ensure that the following conditions are met:

- The vfio-pci module is built in.
- Intel™ VT-d is enabled in kernel and UEFI and implemented in IOMMU.
- IOMMU is enabled on runtime. To check that, run the command:

```
> sudo dmesg | grep "DMAR: IOMMU"
```

- DPDK is installed.

If the above conditions are met, you can enable the vfio-pci driver as described below.

1. The vfio-pci module is loaded automatically during boot. You just need to pass parameters to the module. You can do that in three ways:

   - pass the following parameters on the kernel CLI:

     ```
     vfio_pci.enable_sriov=1 vfio_pci.disable_idle_d3=1
     ```

   - set the required parameters after the system is fully booted:

     ```
     # echo 1 | sudo tee /sys/module/vfio_pci/parameters/enable_sriov

     # echo 1 | sudo tee /sys/module/vfio_pci/parameters/disable_idle_d3
     ```

   - or you can use **`modprobe`** to load the module with these parameters:

     ```
     # modprobe vfio-pci enable_sriov=1 disable_idle_d3=1
     ```

2. Bind the PF with the vfio-pci module:

   ```
   > sudo PATH_TO_DPDK/usertools/dpdk-devbind.py --bind=vfio-pci $PCI_DRIVER_ADDRESS
   ```

3. Configure the device using the `pf_bb_config` tool:

   ```
   > sudo ./pf_bb_config ACC100 -v 00112233-4455-6677-8899-aabbccddeeff -c acc100/
   acc100_config_2vf_4g5g.cfg
   ```

4. For example, create two VFs on the device:

   ```
   > sudo echo 2 | sudo tee /sys/bus/pci/devices/0000:$PF_PCI_DEVICE_ADDRESS/
   sriov_numvfs
   ```

3.2 Configuration examples description

You can find the broadband devices confiration examples in `/opt/pf-bb-config`. Each device has a specific set of configuration files, however, all configuration files follow the same format.

```
[section name]
key = value
; This is a comment.
```

The following section provides details regarding ACC100/ACC200 accelerator.

3.2.1 The ACC100/ACC200 configuration

In the examples `/opt/pf-bb-config/acc*`, you can adjust the following attributes:

`pf_mode_en`
: If set to 1, all queues on the device are assigned to physical functions (PF) and none are assigned to virtual functions (VF). PF and VF are mutually exclusive.

`num_qgroups`
: There are eight queue groups available that you can allocate to *all* operations.

`num_vf_bundles`
: Choose a value between 1 and 16. The available DDR is then split.

`num_aqs_per_groups`
: Defines the maximum count of atomic queues in a single queue group.

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