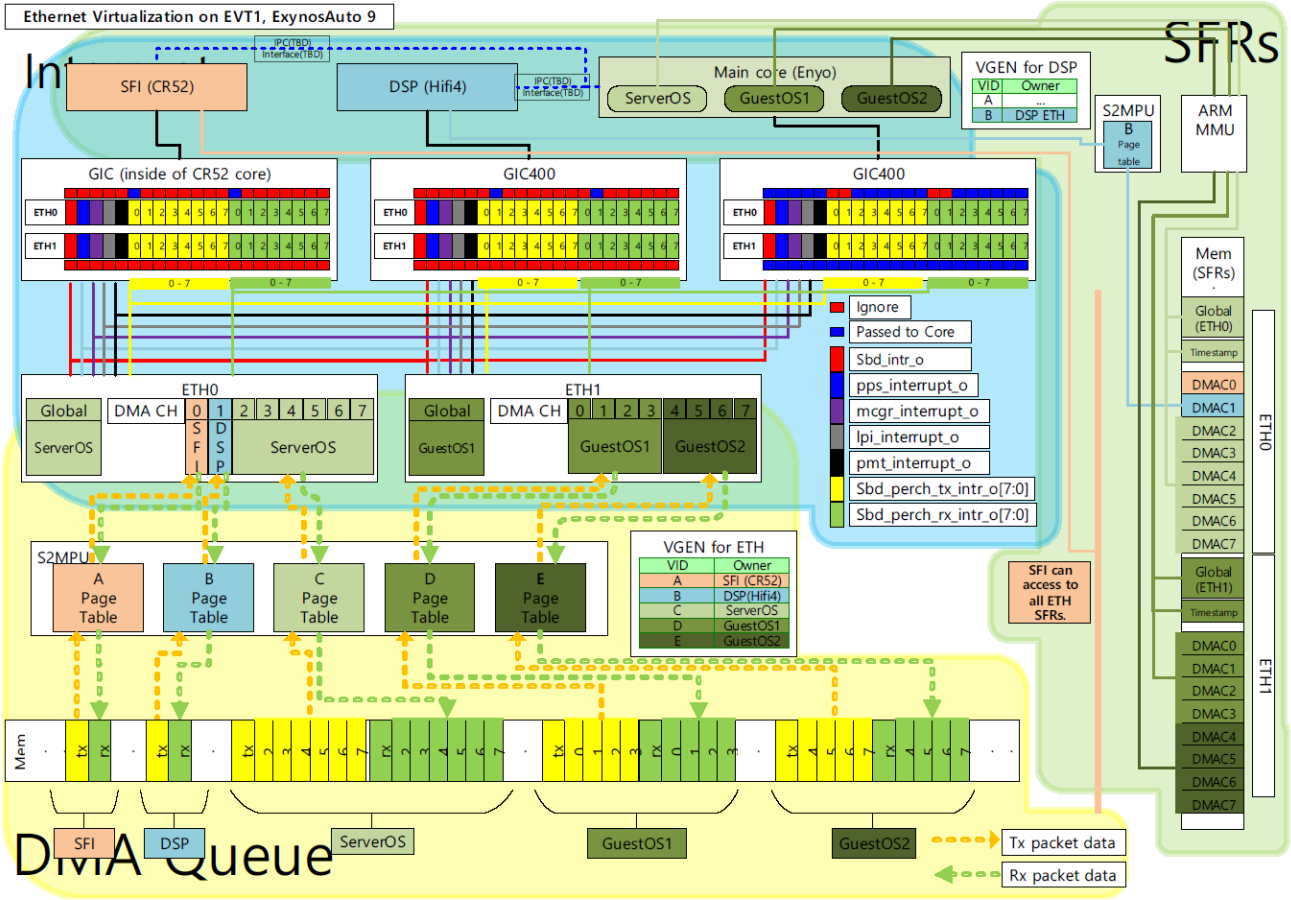
HPT Architecture for Ethernet

2022.04.12 | Samsung

VIRTUALIZATION OVERVIEW OF V910 ETHERNET



WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

- **If you want to change assignment of DMA channels, you should modify below files.**
  - SYS domain device tree
  - IVI domain device tree
  - HCB
    - SYS domain vplatform file
    - IVI domain vplatform file
    - S2MPU
    - VGEN
    - VDEV

WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

□ SYS domain device tree(sources/linux_sys_dts-la/linux_sys/exynosauto9-discovery-linux-vm.dts)

- SYS domain will have Ethernet driver as back-end.
- Properties

```
pinctrl-0 = <&eth0_mdc_mdio &eth0_rgmii &eth0_pps_out>;    // set the pin control to use mcgr
mac-address = [001234567890];          // set mac address for SYS domain
seqos,hpt;                             // HPT is enabled with this property.
seqos,ndev-dma-ch-map = <0 1 2 3>;     // the array of DMA channels to assign to this domain.
seqos,vlink-compatible = "vseqos1";    // the name of vdev which defined in the file,
                                       // sources/vl/hcb/linux_sys-and_ivi/hcb/exynosauto9-hyp/exynosauto9-
                                       // discovery-hyp-vdevs.dtsi
seqos,ptp-enable;                      // enable PTP for SYS domain.
dmas = <&pdma0 22>;                    // Information of pdma to use it for MCGR
dma-names = "mcgr";                    // set the name of dma as “mcgr”
status = "okay";
```

WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

- **IVI domain device tree(sources/Android-kernel/and_ivi_dts-la/and_ivi/exynosauto9-discovery-android-vm.dts)**
  - IVI domain will have Ethernet driver as front-end
  - Properties

```
mac-address = [001234567893];          // Set MAC address for IVI domain
seqos,hpt;                             // HPT is enabled with this property.
seqos,hpt-client-mode;                 // HPT-Front-end mode will be enabled with this property.
seqos,ndev-dma-ch-map = <4 5 6>;       // the array of DMA channels to assign to this domain.
seqos,vlink-compatible = "vseqos1";    // the name of vdev which defined in
                                       // /vl/hcb/linux_sys-and_ivi/hcb/exynosauto9-hyp/exynosauto9-
                                       // discovery-hyp-vdevs.dtsi
/delete-property/ pinctrl-name;        // To remove pin control node since front-end driver doesn't have right
/delete-property/ pinctrl-0;           // to access to pinctrl registers
status = "okay";
```

WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

□ HCB (sources/vl/hcb/linux_sys-and_ivi/hcb/)

– SYS domain vplatform (linux_sys-and_ivi/hcb/linux_sys/exynosauto9-discovery-vplatform-linux-vm.dts)

```
// ETH_PPS_SEL only can assigned to eth0.
ENABLE_VPLAT_ETH_PPS_SEL(eth0);

ENABLE_VPLAT_ETH_BASE_WITH_TS(eth0);

/*
 * The assignment of each DMA channel is as below.
 * SYS(BE): 0, 1, 2, 3
 * AND(FE): 4, 5, 6
 * SFI(Early-BE): 7
 */

ENABLE_VPLAT_ETH_DMA_CH(eth0_ch0);
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch1);
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch2);
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch3);
```

– IVI domain vplatform (linux_sys-and_ivi/hcb/and_ivi/exynosauto9-discovery-vplatform-android-vm.dts)

```
// Enable DMA ch 4 to 6 to AND domain as HPT FE.
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch4);
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch5);
ENABLE_VPLAT_ETH_DMA_CH(eth0_ch6);
```

WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

HCB (sources/vl/hcb/linux_sys-and_ivi/hcb/)

– VDEV (sources/vl/hcb/linux_sys-and_ivi/hcb/exynosauto9-hyp/exynosauto9-discovery-hyp-vdevs.dtsi)

```
&vm2_vdevs {
            ...
            vseqos_be_0: vseqos@be.0 {
                        compatible = "vseqos1";
                        server;
                        info = "vseqos_ctrl";
            };
};

&vm3_vdevs {
            ...
            vseqos_fe {
                        peer-phandle = <&vseqos_be_0>;
                        client;
                        info = "vseqos_ctrl";
            };
};
```

– S2MPU (exynosauto9-hyp/exynosauto9-discovery-en-s2mpu/exynosauto9-discovery-en-hwp-s2mpu-system.dtsi)

```
&s2mpu_fsys2 {
        compatible = "samsung,s2mpu,node";
        enable_type = <ENABLE_MANUAL>;
        vgen_addr = <0x17DD0000 0x17DF0000 0x17CB0000>;
};
```

WAY TO CONFIGURE ETHERNET HPT IN THE DEVICE-TREE

- **HCB (sources/vl/hcb/linux_sys-and_ivi/hcb/)**
  - VGEN (exynosauto9-hyp/exynosauto9-discovery-en-vgen/exynosauto9-discovery-en-hwp-vgen-system.dtsi)

```
&vgen_ethernet0 {
        compatible = "samsung,vgen";
        mask = <MASK>;
        //DO NOT SET the blocking_vid for SYS-domain.
        //blocking_target must be same for the IP using same s2mpu.
        blocking_vid = <AND>;
        blocking_target = <7>;
        vid=<SYS>,                  // DMA Channel 0 Rx
        <SYS>,                      // DMA Channel 0 Tx
        <SYS>,                      // DMA Channel 1 Rx
        <SYS>,                      // DMA Channel 1 Tx
        <SYS>,
        <SYS>,
        <AND>,
        <AND>,
        <AND>,
        <AND>,
        <AND>,
        <AND>,
        <AND>,
        <AND>,
        <DEFAULT>,                  // DMA Channel 7 Rx
        <DEFAULT>;                  // DMA Channel 7 Tx
        axid=<0>,
        ...
        <15>;
};
```

INITIALIZE SEQUENCE OF HPT

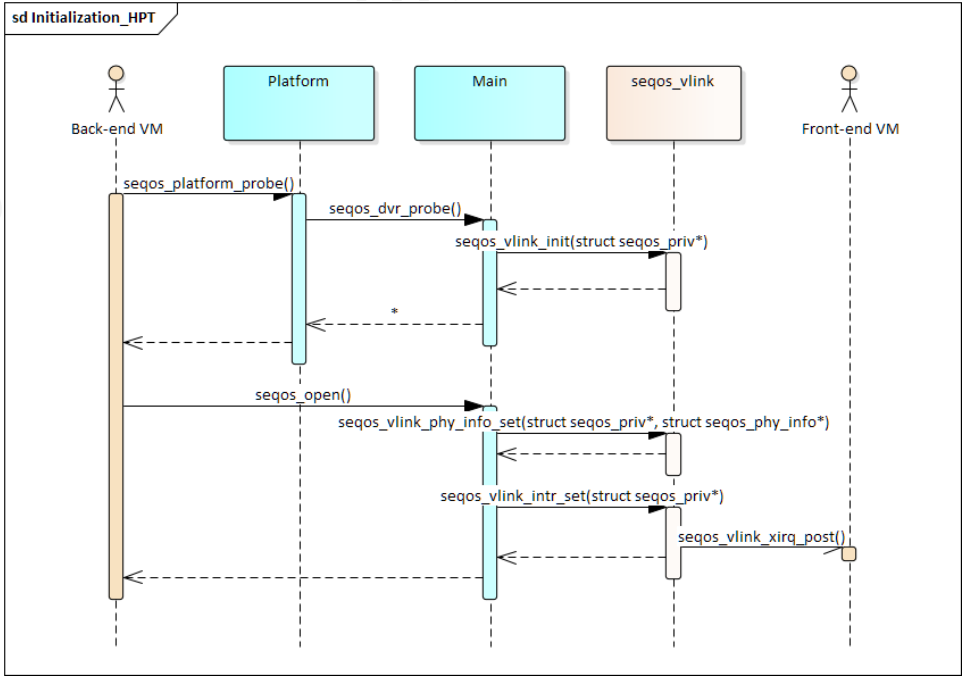
□ Basic initialize sequence

– Probe

- Before open the interface, vlink will be initiazlied.
- vlink Initialize includes allocating shared memory and attaching inter-vm interrupt(xIRQ).

– Open

- Shares PHY info to Front-end driver.
- Posts xIRQ to notify the status of interface.



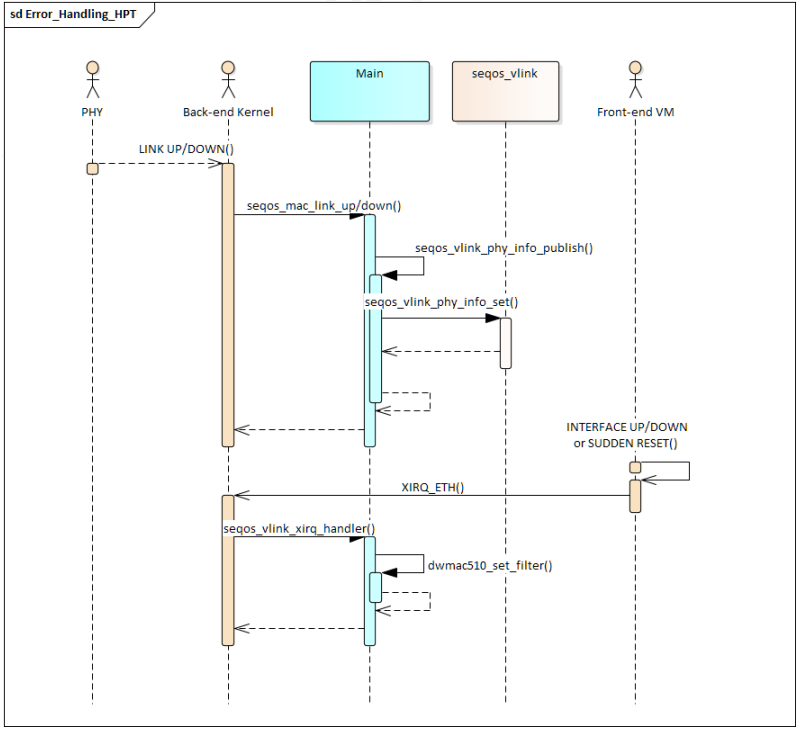
ERROR HANDLING OF HPT

PHY Link up/down from BE

- When PHY link state has changed, the call back function will be called.
- Then, PHY info will be written on shared memory and FE PHY state machine will be changed as this shared status

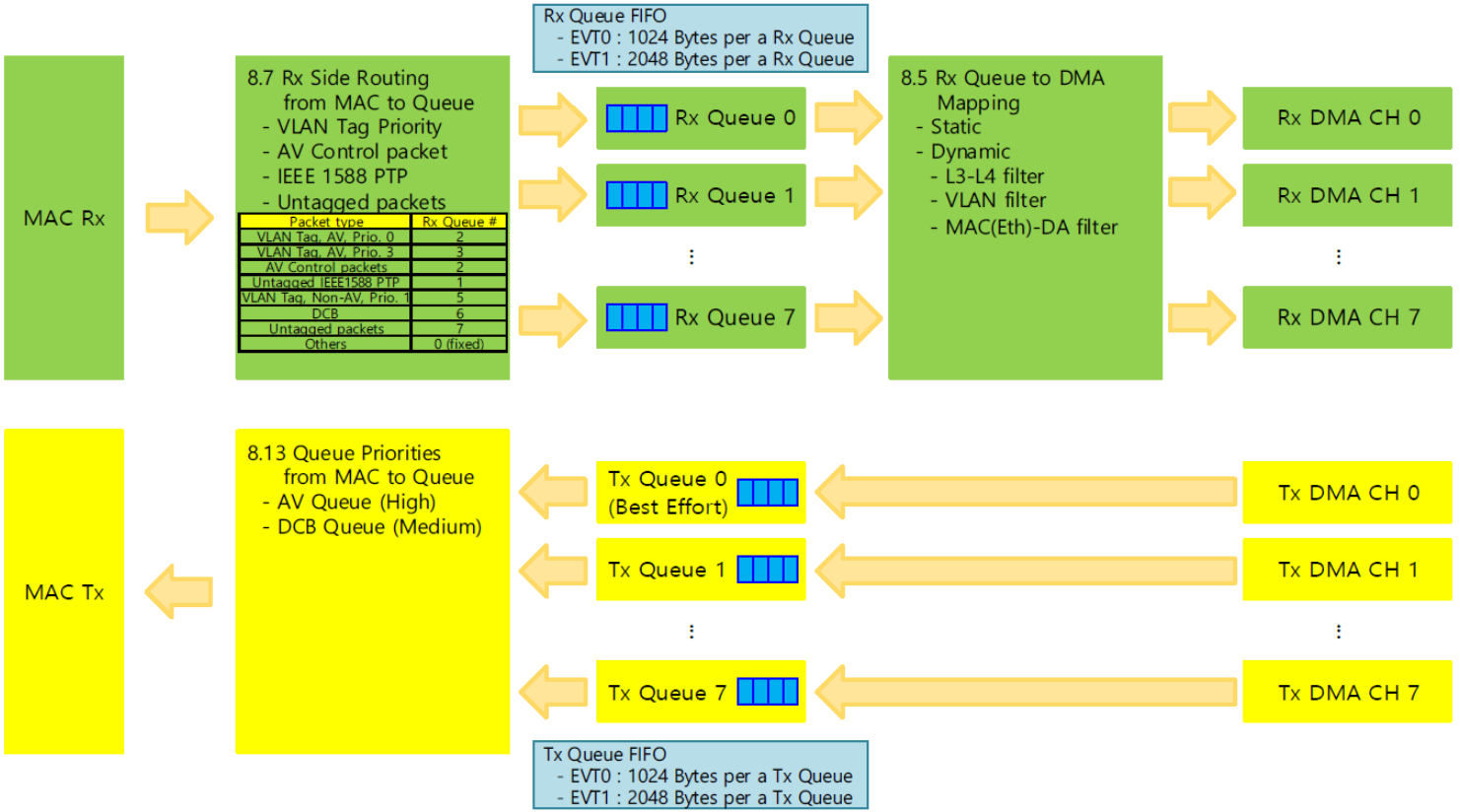
Interface up/down or sudden reset on FE

- When the status changed, the XIRQ will be posted from FE.
- BE will be handled it and update the filter information to prevent queue full.



HOW THE QUEUE IS HANDLES FOR REQUESTS IN ETHERNET

□ Rx/Tx Packet flow concept

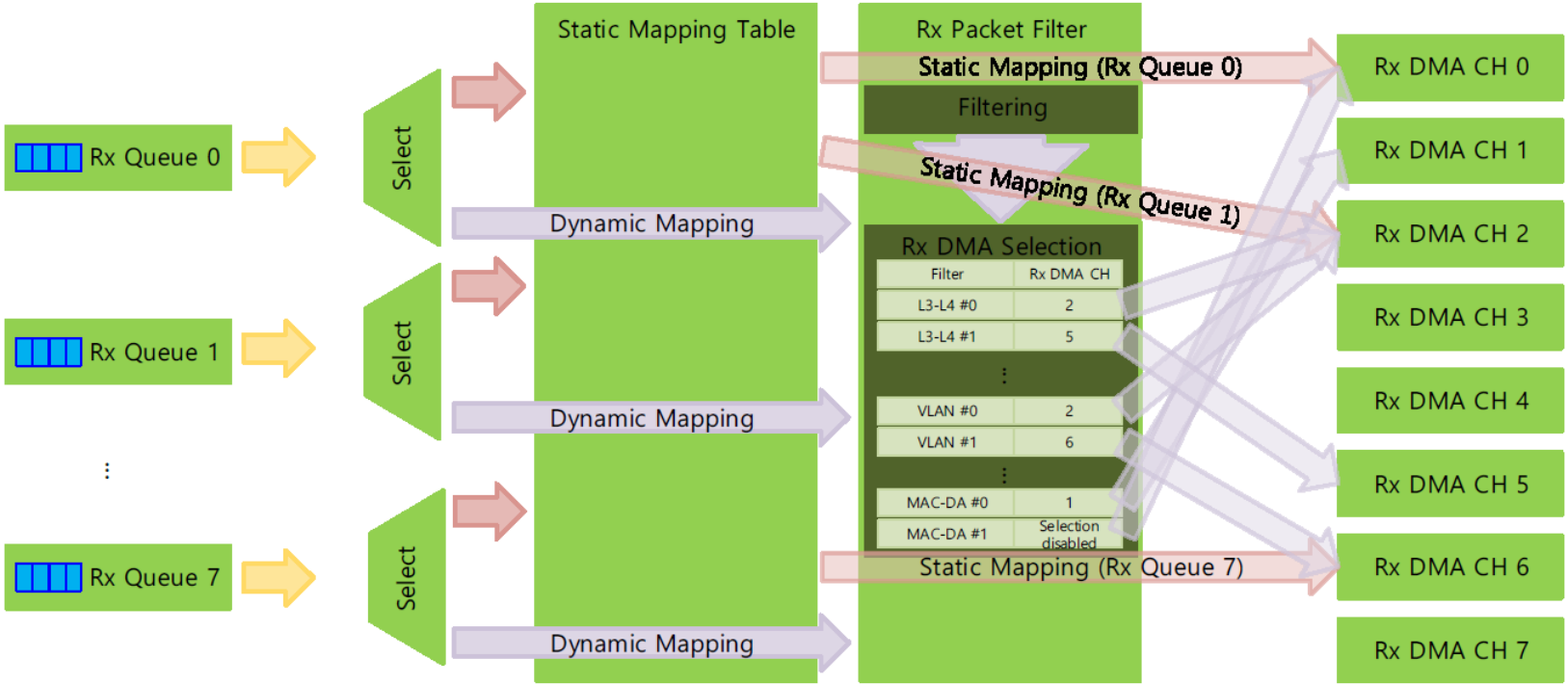


HOW THE QUEUE IS HANDLES FOR REQUESTS IN ETHERNET

- **Tx perspective**
  - The DMA Channel will be selected by configuration of qdisc.
  - The H/W Queue will be selected statically. (e.g. Tx DMA Ch. 0 → Tx Queue 0, Tx DMA ch. 1 → Tx Queue 1)
- **Rx perspective**
  - The Rx Queue will be selected by static mapping or below dynamic mapping mechanisms.
    - VLAN Proirity
    - AV Control packets
    - IEEE 1588 PTP packets
    - Untagged packets
  - The Rx DMA will be selected by static mapping or below Dynamic mapping mechanisms.
    - Ethrenet Destination Address
    - VLAN Tag
    - L3-L4 filter

HOW THE QUEUE IS HANDLES FOR REQUESTS IN ETHERNET

- **Mapping between Rx Queues and Rx DMA Channels**



HOW THE QUEUE IS HANDLES FOR REQUESTS IN ETHERNET

- **Dynamic Rx Packet filter from Queue to DMA Channels**