

# FLIC (floating interrupt controller)

FLIC handles floating (non per-cpu) interrupts, i.e. I/O, service and some machine check interruptions. All interrupts are stored in a per-vm list of pending interrupts. FLIC performs operations on this list.

Only one FLIC instance may be instantiated.

FLIC provides support to - add interrupts (KVM\_DEV\_FLIC\_ENQUEUE) - inspect currently pending interrupts (KVM\_DEV\_FLIC\_GET\_ALL\_IRQS) - purge all pending floating interrupts (KVM\_DEV\_FLIC\_CLEAR\_IRQS) - purge one pending floating I/O interrupt (KVM\_DEV\_FLIC\_CLEAR\_IO\_IRQ) - enable/disable for the guest transparent async page faults - register and modify adapter interrupt sources (KVM\_DEV\_FLIC\_ADAPTER\_\*) - modify AIS (adapter-interrupt-suppression) mode state (KVM\_DEV\_FLIC\_AISM) - inject adapter interrupts on a specified adapter (KVM\_DEV\_FLIC\_AIRQ\_INJECT) - get/set all AIS mode states (KVM\_DEV\_FLIC\_AISM\_ALL)

Groups:

## KVM\_DEV\_FLIC\_ENQUEUE

Passes a buffer and length into the kernel which are then injected into the list of pending interrupts. attr->addr contains the pointer to the buffer and attr->attr contains the length of the buffer. The format of the data structure kvm\_s390\_irq as it is copied from userspace is defined in usr/include/linux/kvm.h.

## KVM\_DEV\_FLIC\_GET\_ALL\_IRQS

Copies all floating interrupts into a buffer provided by userspace. When the buffer is too small it returns - ENOMEM, which is the indication for userspace to try again with a bigger buffer.

-ENOBUFS is returned when the allocation of a kernel space buffer has failed.

-EFAULT is returned when copying data to userspace failed. All interrupts remain pending, i.e. are not deleted from the list of currently pending interrupts. attr->addr contains the userspace address of the buffer into which all interrupt data will be copied. attr->attr contains the size of the buffer in bytes.

## KVM\_DEV\_FLIC\_CLEAR\_IRQS

Simply deletes all elements from the list of currently pending floating interrupts. No interrupts are injected into the guest.

## KVM\_DEV\_FLIC\_CLEAR\_IO\_IRQ

Deletes one (if any) I/O interrupt for a subchannel identified by the subsystem identification word passed via the buffer specified by attr->addr (address) and attr->attr (length).

## KVM\_DEV\_FLIC\_APF\_ENABLE

Enables async page faults for the guest. So in case of a major page fault the host is allowed to handle this async and continues the guest.

## KVM\_DEV\_FLIC\_APF\_DISABLE\_WAIT

Disables async page faults for the guest and waits until already pending async page faults are done. This is necessary to trigger a completion interrupt for every init interrupt before migrating the interrupt list.

## KVM\_DEV\_FLIC\_ADAPTER\_REGISTER

Register an I/O adapter interrupt source. Takes a kvm\_s390\_io\_adapter describing the adapter to register:

```
struct kvm_s390_io_adapter {
    __u32 id;
    __u8 isc;
    __u8 maskable;
    __u8 swap;
    __u8 flags;
};
```

id contains the unique id for the adapter, isc the I/O interruption subclass to use, maskable whether this adapter may be masked (interrupts turned off), swap whether the indicators need to be byte swapped, and flags contains further characteristics of the adapter.

Currently defined values for 'flags' are:

- KVM\_S390\_ADAPTER\_SUPPRESSIBLE: adapter is subject to AIS (adapter-interrupt-suppression) facility. This flag only has an effect if the AIS capability is enabled.

Unknown flag values are ignored.

## KVM\_DEV\_FLIC\_ADAPTER\_MODIFY

Modifies attributes of an existing I/O adapter interrupt source. Takes a `kvm_s390_io_adapter_req` specifying the adapter and the operation:

```
struct kvm_s390_io_adapter_req {
    __u32 id;
    __u8 type;
    __u8 mask;
    __u16 pad0;
    __u64 addr;
};
```

`id` specifies the adapter and type the operation. The supported operations are:

**KVM\_S390\_IO\_ADAPTER\_MASK**

mask or unmask the adapter, as specified in `mask`

**KVM\_S390\_IO\_ADAPTER\_MAP**

This is now a no-op. The mapping is purely done by the irq route.

**KVM\_S390\_IO\_ADAPTER\_UNMAP**

This is now a no-op. The mapping is purely done by the irq route.

**KVM\_DEV\_FLIC\_AISM**

modify the adapter-interruption-suppression mode for a given isc if the AIS capability is enabled. Takes a `kvm_s390_ais_req` describing:

```
struct kvm_s390_ais_req {
    __u8 isc;
    __u16 mode;
};
```

`isc` contains the target I/O interruption subclass, `mode` the target adapter-interruption-suppression mode. The following modes are currently supported:

- **KVM\_S390\_AIS\_MODE\_ALL**: ALL-Interruptions Mode, i.e. airq injection is always allowed;
- **KVM\_S390\_AIS\_MODE\_SINGLE**: SINGLE-Interruption Mode, i.e. airq injection is only allowed once and the following adapter interrupts will be suppressed until the mode is set again to ALL-Interruptions or SINGLE-Interruption mode.

**KVM\_DEV\_FLIC\_AIRQ\_INJECT**

Inject adapter interrupts on a specified adapter. `attr->attr` contains the unique id for the adapter, which allows for adapter-specific checks and actions. For adapters subject to AIS, handle the airq injection suppression for an isc according to the adapter-interruption-suppression mode on condition that the AIS capability is enabled.

**KVM\_DEV\_FLIC\_AISM\_ALL**

Gets or sets the adapter-interruption-suppression mode for all ISCs. Takes a `kvm_s390_ais_all` describing:

```
struct kvm_s390_ais_all {
    __u8 simm; /* Single-Interruption-Mode mask */
    __u8 nimm; /* No-Interruption-Mode mask */
};
```

`simm` contains Single-Interruption-Mode mask for all ISCs, `nimm` contains No-Interruption-Mode mask for all ISCs. Each bit in `simm` and `nimm` corresponds to an ISC (MSB0 bit 0 to ISC 0 and so on). The combination of `simm` bit and `nimm` bit presents AIS mode for a ISC.

**KVM\_DEV\_FLIC\_AISM\_ALL** is indicated by **KVM\_CAP\_S390\_AIS\_MIGRATION**.

Note: The **KVM\_SET\_DEVICE\_ATTR**/**KVM\_GET\_DEVICE\_ATTR** device ioctls executed on FLIC with an unknown group or attribute gives the error code **EINVAL** (instead of **ENXIO**, as specified in the API documentation). It is not possible to conclude that a FLIC operation is unavailable based on the error code resulting from a usage attempt.

#### Note

The **KVM\_DEV\_FLIC\_CLEAR\_IO\_IRQ** ioctl will return **EINVAL** in case a zero `schid` is specified.