
Linux Pcmcia Documentation

The kernel development community

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PCMCIA DRIVER

1.1 sysfs

New PCMCIA IDs may be added to a device driver `pcmcia_device_id` table at runtime as shown below:

```
echo "match_flags manf_id card_id func_id function device_no \  
prod_id_hash[0] prod_id_hash[1] prod_id_hash[2] prod_id_hash[3]" > \  
/sys/bus/pcmcia/drivers/{driver}/new_id
```

All fields are passed in as hexadecimal values (no leading 0x). The meaning is described in the PCMCIA specification, the `match_flags` is a bitwise or-ed combination from `PCMCIA_DEV_ID_MATCH_*` constants defined in `include/linux/mod_devicetable.h`.

Once added, the driver probe routine will be invoked for any unclaimed PCMCIA device listed in its (newly updated) `pcmcia_device_id` list.

A common use-case is to add a new device according to the manufacturer ID and the card ID (from the `manf_id` and `card_id` file in the device tree). For this, just use:

```
echo "0x3 manf_id card_id 0 0 0 0 0 0" > \  
/sys/bus/pcmcia/drivers/{driver}/new_id
```

after loading the driver.

DEVICE TABLE

Matching of PCMCIA devices to drivers is done using one or more of the following criteria:

- manufacturer ID
- card ID
- product ID strings _and_ hashes of these strings
- function ID
- device function (actual and pseudo)

You should use the helpers in `include/pcmcia/device_id.h` for generating the struct `pcmcia_device_id[]` entries which match devices to drivers.

If you want to match product ID strings, you also need to pass the crc32 hashes of the string to the macro, e.g. if you want to match the product ID string 1, you need to use

```
PCMCIA_DEVICE_PROD_ID1("some_string", 0x(hash_of_some_string)),
```

If the hash is incorrect, the kernel will inform you about this in “dmesg” upon module initialization, and tell you of the correct hash.

You can determine the hash of the product ID strings by catting the file “modalias” in the `sysfs` directory of the PCMCIA device. It generates a string in the following form: `pcmcia:m0149cC1ABf06pfn00fn00pa725B842DpbF1EFEE84pc0877B627pd00000000`

The hex value after “pa” is the hash of product ID string 1, after “pb” for string 2 and so on.

Alternatively, you can use `crc32hash` (see `tools/pcmcia/crc32hash.c`) to determine the crc32 hash. Simply pass the string you want to evaluate as argument to this program, e.g.: `$ tools/pcmcia/crc32hash “Dual Speed”`

LOCKING

This file explains the locking and exclusion scheme used in the PCCARD and PCMCIA subsystems.

3.1 A) Overview, Locking Hierarchy:

pcmcia_socket_list_rwlock

- protects only the list of sockets

- **skt_mutex**

- serializes card insert / ejection

- **ops_mutex**

- * serializes socket operation

3.2 B) Exclusion

The following functions and callbacks to struct pcmcia_socket must be called with “skt_mutex” held:

```
socket_detect_change()  
send_event()  
socket_reset()  
socket_shutdown()  
socket_setup()  
socket_remove()  
socket_insert()  
socket_early_resume()  
socket_late_resume()  
socket_resume()  
socket_suspend()  
  
struct pcmcia_callback *callback
```

The following functions and callbacks to struct pcmcia_socket must be called with “ops_mutex” held:

```
socket_reset()
socket_setup()

struct pccard_operations      *ops
struct pccard_resource_ops    *resource_ops;
```

Note that `send_event()` and `struct pcmcia_callback *callback` must not be called with “ops_mutex” held.

3.3 C) Protection

3.3.1 1. Global Data:

```
struct list_head pcmcia_socket_list;
protected by pcmcia_socket_list_rwsem;
```

3.3.2 2. Per-Socket Data:

The `resource_ops` and their data are protected by `ops_mutex`.

The “main” struct `pcmcia_socket` is protected as follows (read-only fields or single-use fields not mentioned):

- by `pcmcia_socket_list_rwsem`:

```
struct list_head      socket_list;
```

- by `thread_lock`:

```
unsigned int          thread_events;
```

- by `skt_mutex`:

```
u_int                suspended_state;
void                 (*tune_bridge);
struct pcmcia_callback *callback;
int                  resume_status;
```

- by `ops_mutex`:

```
socket_state_t       socket;
u_int                 state;
u_short              lock_count;
pccard_mem_map        cis_mem;
void __iomem          *cis_virt;
struct { }           irq;
io_window_t           io[];
pccard_mem_map        win[];
struct list_head      cis_cache;
size_t                fake_cis_len;
```

```

u8          *fake_cis;
u_int      irq_mask;
void      (*zoom_video);
int      (*power_hook);
u8      resource...;
struct list_head devices_list;
u8      device_count;
struct      pcmcia_state;

```

3.3.3 3. Per PCMCIA-device Data:

The “main” struct `pcmcia_device` is protected as follows (read-only fields or single-use fields not mentioned):

- by `pcmcia_socket->ops_mutex`:

```

struct list_head socket_device_list;
struct config_t  *function_config;
u16              _irq:1;
u16              _io:1;
u16              _win:4;
u16              _locked:1;
u16              allow_func_id_match:1;
u16              suspended:1;
u16              _removed:1;

```

- by the PCMCIA driver:

```

io_req_t      io;
irq_req_t     irq;
config_req_t  conf;
window_handle_t win;

```


DRIVER CHANGES

This file details changes in 2.6 which affect PCMCIA card driver authors:

- **pcmcia_loop_config() and autoconfiguration (as of 2.6.36)** If *struct pcmcia_device* **p_dev->config_flags* is set accordingly, *pcmcia_loop_config()* now sets up certain configuration values automatically, though the driver may still override the settings in the callback function. The following autoconfiguration options are provided at the moment:
 - CONF_AUTO_CHECK_VCC : check for matching Vcc
 - CONF_AUTO_SET_VPP : set Vpp
 - CONF_AUTO_AUDIO : auto-enable audio line, if required
 - CONF_AUTO_SET_IO : set ioport resources (->resource[0,1])
 - CONF_AUTO_SET_IOMEM : set first iomem resource (->resource[2])
- **pcmcia_request_configuration -> pcmcia_enable_device (as of 2.6.36)** *pcmcia_request_configuration()* got renamed to *pcmcia_enable_device()*, as it mirrors *pcmcia_disable_device()*. Configuration settings are now stored in *struct pcmcia_device*, e.g. in the fields *config_flags*, *config_index*, *config_base*, *vpp*.
- **pcmcia_request_window changes (as of 2.6.36)** Instead of *win_req_t*, drivers are now requested to fill out *struct pcmcia_device *p_dev->resource[2,3,4,5]* for up to four ioport ranges. After a call to *pcmcia_request_window()*, the regions found there are reserved and may be used immediately – until *pcmcia_release_window()* is called.
- **pcmcia_request_io changes (as of 2.6.36)** Instead of *io_req_t*, drivers are now requested to fill out *struct pcmcia_device *p_dev->resource[0,1]* for up to two ioport ranges. After a call to *pcmcia_request_io()*, the ports found there are reserved, after calling *pcmcia_request_configuration()*, they may be used.
- **No dev_info_t, no cs_types.h (as of 2.6.36)** *dev_info_t* and a few other typedefs are removed. No longer use them in PCMCIA device drivers. Also, do not include *pcmcia/cs_types.h*, as this file is gone.
- **No dev_node_t (as of 2.6.35)** There is no more need to fill out a “*dev_node_t*” structure.
- **New IRQ request rules (as of 2.6.35)** Instead of the old *pcmcia_request_irq()* interface, drivers may now choose between:
 - calling *request_irq/free_irq* directly. Use the IRQ from **p_dev->irq*.
 - use *pcmcia_request_irq(p_dev, handler_t)*; the PCMCIA core will clean up automatically on calls to *pcmcia_disable_device()* or device ejection.

- **no cs_error / CS_CHECK / CONFIG_PCMCIA_DEBUG (as of 2.6.33)** Instead of the cs_error() callback or the CS_CHECK() macro, please use Linux-style checking of return values, and – if necessary – debug messages using “dev_dbg()” or “pr_debug()”.
- **New CIS tuple access (as of 2.6.33)** Instead of pcmcia_get_{first,next}_tuple(), pcmcia_get_tuple_data() and pcmcia_parse_tuple(), a driver shall use “pcmcia_get_tuple()” if it is only interested in one (raw) tuple, or “pcmcia_loop_tuple()” if it is interested in all tuples of one type. To decode the MAC from CISTPL_FUNCCE, a new helper “pcmcia_get_mac_from_cis()” was added.
- **New configuration loop helper (as of 2.6.28)** By calling pcmcia_loop_config(), a driver can iterate over all available configuration options. During a driver’s probe() phase, one doesn’t need to use pcmcia_get_{first,next}_tuple, pcmcia_get_tuple_data and pcmcia_parse_tuple directly in most if not all cases.
- **New release helper (as of 2.6.17)** Instead of calling pcmcia_release_{configuration,io,irq,win}, all that’s necessary now is calling pcmcia_disable_device. As there is no valid reason left to call pcmcia_release_io and pcmcia_release_irq, the exports for them were removed.
- Unify detach and REMOVAL event code, as well as attach and INSERTION code (as of 2.6.16):

```
void (*remove)          (struct pcmcia_device *dev);  
int (*probe)            (struct pcmcia_device *dev);
```

- Move suspend, resume and reset out of event handler (as of 2.6.16):

```
int (*suspend)          (struct pcmcia_device *dev);  
int (*resume)           (struct pcmcia_device *dev);
```

should be initialized in struct pcmcia_driver, and handle (SUSPEND == RESET_PHYSICAL) and (RESUME == CARD_RESET) events

- **event handler initialization in struct pcmcia_driver (as of 2.6.13)** The event handler is notified of all events, and must be initialized as the event() callback in the driver’s struct pcmcia_driver.
- **pcmcia/version.h should not be used (as of 2.6.13)** This file will be removed eventually.
- **in-kernel device<->driver matching (as of 2.6.13)** PCMCIA devices and their correct drivers can now be matched in kernelspace. See ‘[Device table](#)’ for details.
- **Device model integration (as of 2.6.11)** A struct pcmcia_device is registered with the device model core, and can be used (e.g. for SET_NETDEV_DEV) by using handle_to_dev(client_handle_t * handle).
- **Convert internal I/O port addresses to unsigned int (as of 2.6.11)** ioaddr_t should be replaced by unsigned int in PCMCIA card drivers.
- **irq_mask and irq_list parameters (as of 2.6.11)** The irq_mask and irq_list parameters should no longer be used in PCMCIA card drivers. Instead, it is the job of the PCMCIA core to determine which IRQ should be used. Therefore, link->irq.IRQInfo2 is ignored.
- **client->PendingEvents is gone (as of 2.6.11)** client->PendingEvents is no longer available.

- **client->Attributes are gone (as of 2.6.11)** client->Attributes is unused, therefore it is removed from all PCMCIA card drivers
- **core functions no longer available (as of 2.6.11)** The following functions have been removed from the kernel source because they are unused by all in-kernel drivers, and no external driver was reported to rely on them:

```
pcmcia_get_first_region()  
pcmcia_get_next_region()  
pcmcia_modify_window()  
pcmcia_set_event_mask()  
pcmcia_get_first_window()  
pcmcia_get_next_window()
```

- **device list iteration upon module removal (as of 2.6.10)** It is no longer necessary to iterate on the driver's internal client list and call the ->detach() function upon module removal.
- **Resource management. (as of 2.6.8)** Although the PCMCIA subsystem will allocate resources for cards, it no longer marks these resources busy. This means that driver authors are now responsible for claiming your resources as per other drivers in Linux. You should use request_region() to mark your IO regions in-use, and request_mem_region() to mark your memory regions in-use. The name argument should be a pointer to your driver name. Eg, for pcnet_cs, name should point to the string "pcnet_cs".
- **CardServices is gone** CardServices() in 2.4 is just a big switch statement to call various services. In 2.6, all of those entry points are exported and called directly (except for pcmcia_report_error(), just use cs_error() instead).
- **struct pcmcia_driver** You need to use struct pcmcia_driver and pcmcia_{un,}register_driver instead of {un,}register_pccard_driver