

# The experience of touch pad driver and application development

Gary Lee

# Agenda

- Mouse, touch pad and pointing devices
- PS/2 protocol
- Evdev – general input driver
- The driver of input device architecture.
- Multi-pointer X
- Q&A

- Mouse, touch pad and pointing devices

- Mouse, touch pad, tablet, touch screen, trackball, pointing stick, ..., etc.
- Relative coordinate and absolute coordinate
- PS/2, USB HID
- Single point, multipoint and multitouch.

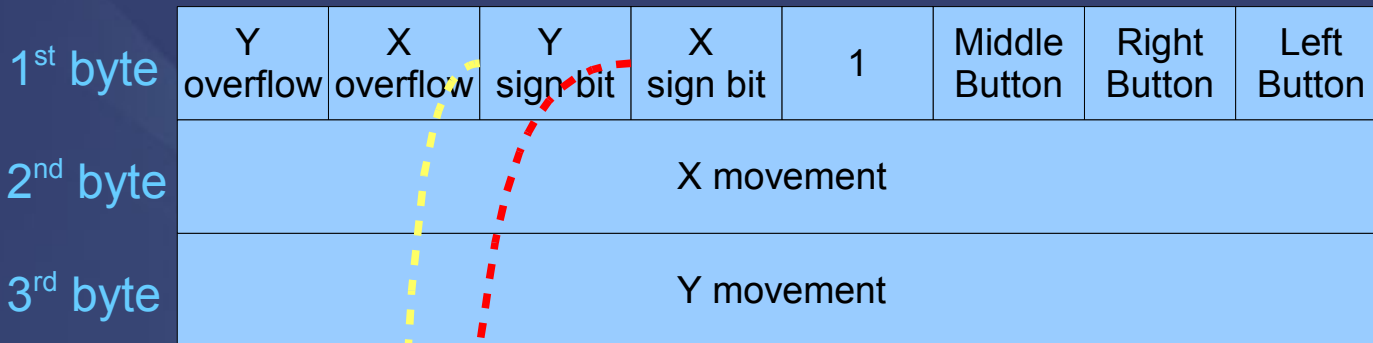
# Touch pad/Touch panel

- Support both absolute coordinate and relative movement.
- Type:
  - Resistive
  - Capacitive
  - Inductive
  - Surface acoustic wave
  - Optics imaging
  - Infrared
  - ...

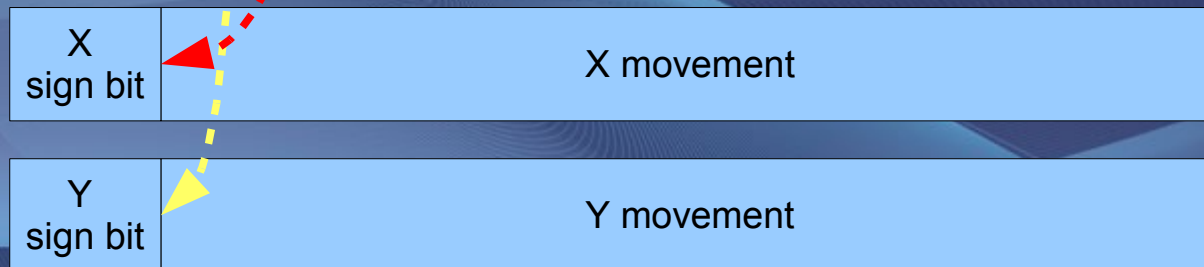
# PS/2 mouse

- Max. data report rate: 40 kbps
- 5V @ 100mA
- Non-hot-pluggable
- Documentation -> IBM Tech Reference(out of print).

# Standard PS/2 mouse



Movement data (9-bit 2's complement integers)



# Wheel Mouse

1 <sup>st</sup> byte	Y overflow	X overflow	Y sign bit	X sign bit	1	Middle Button	Right Button	Left Button
2 <sup>nd</sup> byte	X movement							
3 <sup>rd</sup> byte	Y movement							
4 <sup>th</sup> byte	<b>Z movement</b>							

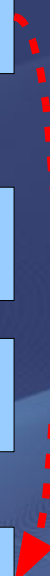
## Movement data

X sign bit	X movement
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Y sign bit	Y movement
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## Wheel data

<b>Z movement</b>
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# Wheel Mouse

1 <sup>st</sup> byte	Y overflow	X overflow	Y sign bit	X sign bit	1	Middle Button	Right Button	Left Button
2 <sup>nd</sup> byte	X movement							
3 <sup>rd</sup> byte	Y movement							
4 <sup>th</sup> byte	0	0	5 <sup>th</sup> button	4 <sup>th</sup> button	Z movement			

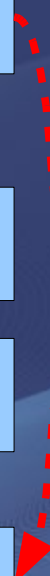
## Movement data

X sign bit	X movement
------------	------------

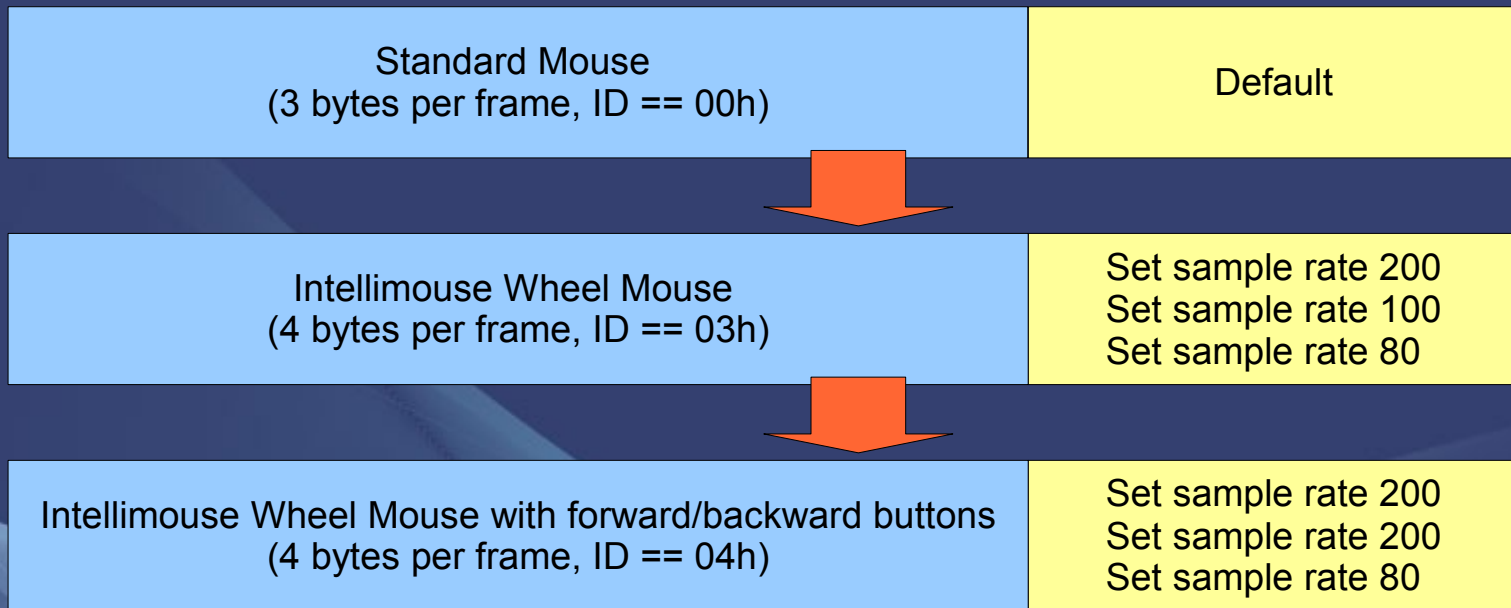
Y sign bit	Y movement
------------	------------

## Wheel data

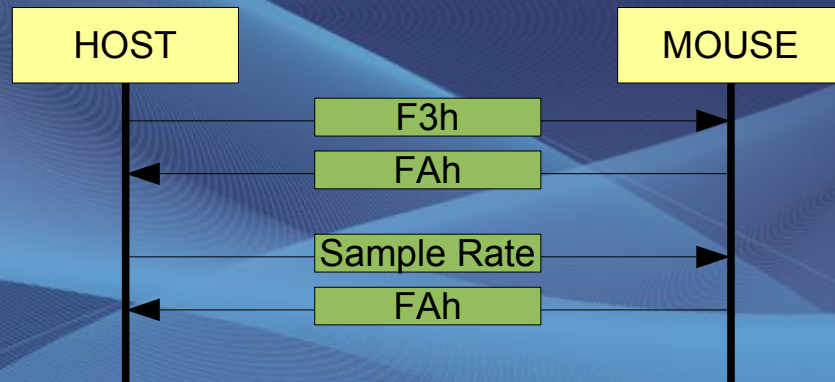
Z movement
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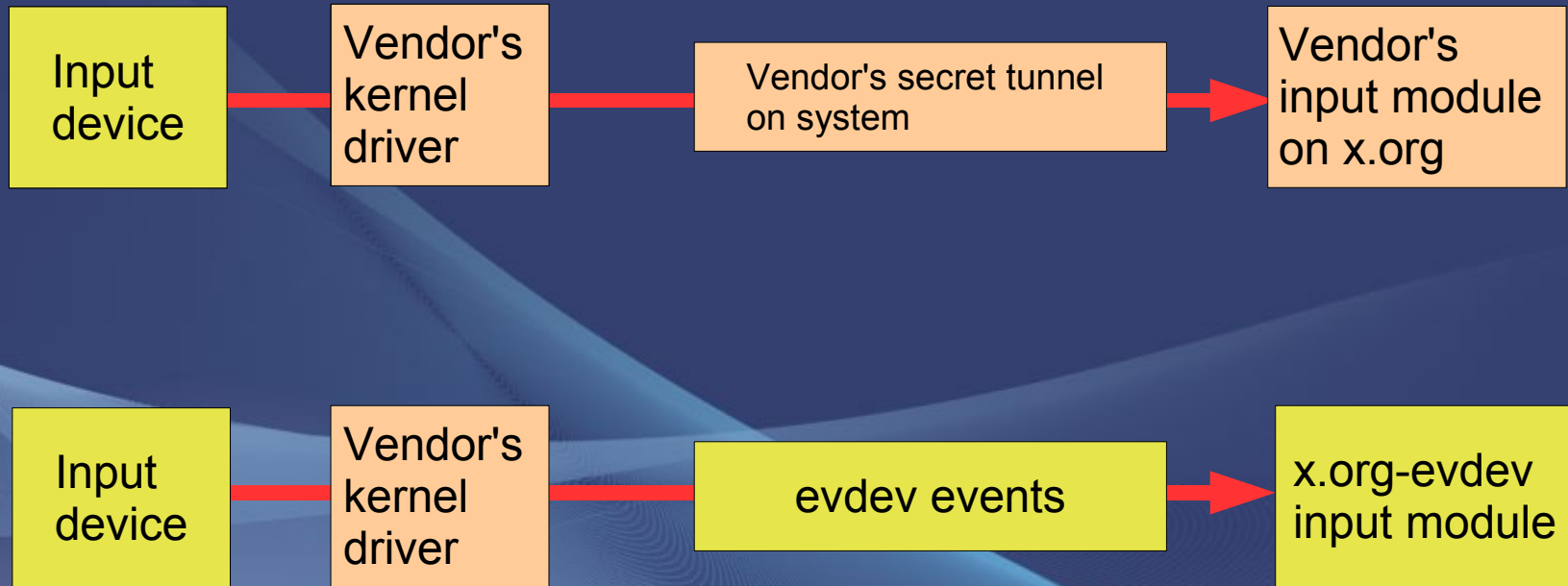
# Mode switching



Set sample rate



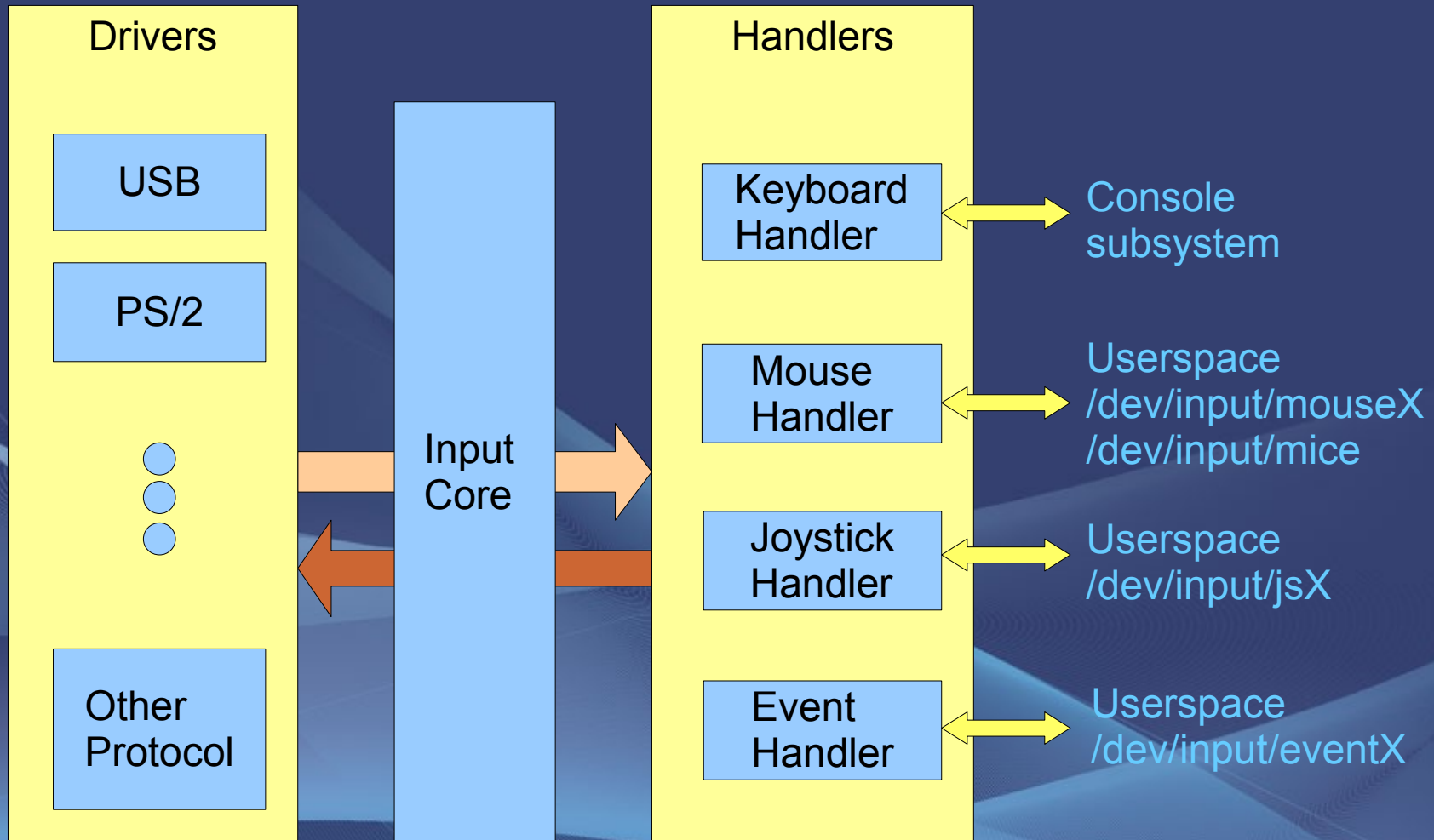
# Pointing device on Linux and X.org



# evdev

- Generic Linux input event interface
- xf86-input-evdev module
- Pass events generated in the kernel or in the X.org server to a program.
- Comes with the standard distribution.

# Kernel Input Subsystem



# Kernel Input Events

- `include/linux/input.h`

```
void input_event(struct input_dev *dev, unsigned int type, unsigned int code, int value);
```

```
#define input_report_key(a,b,c) input_event(a, EV_KEY, b, !!c)  
#define input_report_rel(a,b,c) input_event(a, EV_REL, b, c)  
#define input_report_abs(a,b,c) input_event(a, EV_ABS, b, c)
```

```
// EV_KEY: absolute binary results, such as keys and buttons.
```

```
// EV_REL: relative results, such as the axes on a mouse.
```

```
// EV_ABS: absolute integer results, such as the axes on a joystick or for a tablet.
```

# Send a movement data

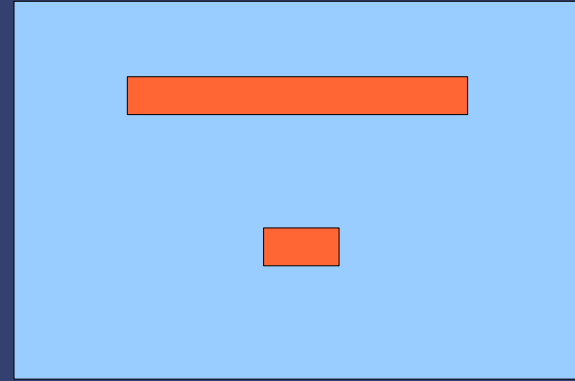
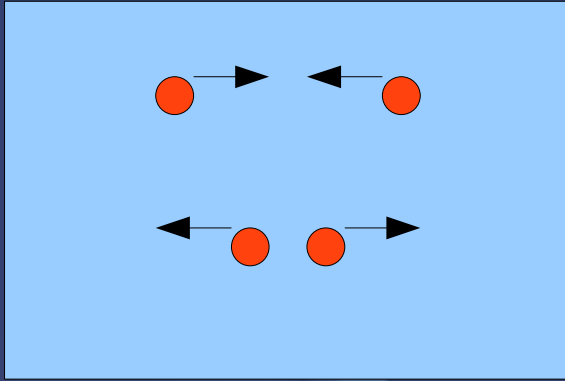
...

```
input_report_rel(dev, REL_WHEEL, vert_wheel_value);  
input_report_rel(dev, REL_HWHEEL, horz_wheel_value);  
input_report_key(dev, BTN_LEFT, left_btn_down);  
input_report_key(dev, BTN_MIDDLE, middle_btn_down);  
input_report_key(dev, BTN_RIGHT, right_btn_down);  
input_report_rel(dev, REL_X, rel_x);  
input_report_rel(dev, REL_Y, rel_y);  
input_sync(dev);
```

# Multipoint/Multitouch support

- The must-to-have feature for input device vendor.
- The must-to-have feature for windowing system.
- The must-to-have feature for PC environment, mobile device,....

# Multi-pointer or gesture?



- Some hardware implementation can't support multi-pointer. But, it can support gesture.
- Multi-pointer is difficult than gesture.

# Multi-Pointer X

- <http://wearables.unisa.edu.au/mpx/>
- By PeterHutterer
- MPX / Multi-Point X was merged to master in May of this year(2008).
- Merged into X.org 7.5.
- MPX made X Input Extension version 2 needed.

# The problem of multipoint or multitouch

- No standard.
- Only a few of applications support multipoint or multitouch.
- How do gestures map to application's operations?
- User training?

# Configuration Utility.

- To integrate with specific desktop environment or not?
- I18n issue?
- Cross-platform?
- Suggestion:
  - WxWidgets + XRC

Q & A

Thank you.

# Reference

- <http://www.computer-engineering.org/ps2protocol/>
- <http://www.linuxjournal.com/article/6396>
- <http://www.linuxjournal.com/article/6429>
- [http://wiki.laptop.org/images/9/99/Gen-2\\_touch.pdf](http://wiki.laptop.org/images/9/99/Gen-2_touch.pdf)
- <http://mirror.linux.org.au/pub/linux.conf.au/2008/slides/088->
- <http://www.x.org/wiki/Development/Documentation/InputEventProcessing>