

# Experiences Using Linux Based VME Controller Boards

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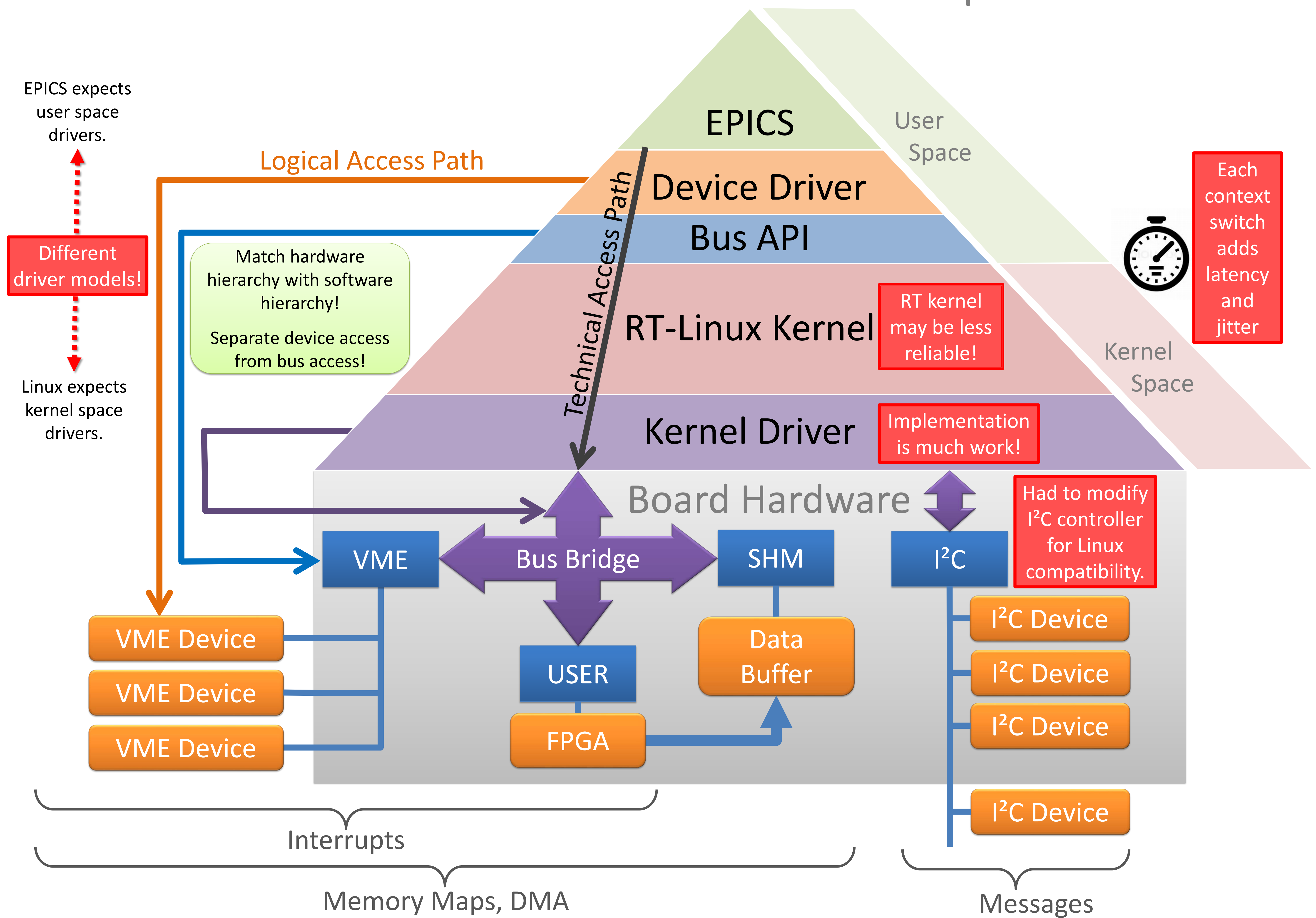
## Linux advantages

- True multi-process environment
- Open source software
- Standard Linux tools
- Easier development and debugging
- **Linux is for free!**

## Linux disadvantages (for IOCs)

- Hardware access needs kernel driver
- No standard user space interrupts or DMA
- Context switch from and to kernel adds latency
- No community support for „exotic“ hardware
- Kernel API changes often

## EPICS Device Access Overview and “Hot Spots”



### Bus driver must be in kernel

- Handle interrupt of bus bridge
- Control access to hardware resources
- Resolve concurrent access
- Allocate and clean up hardware resources

### Device driver can be in user space

- Access through Linux character device files
- File events for device interrupts
- Register access through memory maps
- DMA with *ioctl()*

### Critical parts

#### Interrupts

- Need RT-kernel for low latency and low jitter
- Must disable interrupt while in user space handler

#### DMA

- Need user space DMA for efficient block transfer
- Must handle scattered memory mapping
- Must serialize concurrent requests

#### Memory maps

- Need maps for quick device register access
- Must release maps even when program crashes

## Conclusion

- Integration of exotic hardware is **difficult and time consuming**
- **Unexpected problems** wait everywhere
- Still Linux has **advantages** once everything runs satisfactory

But: There is no such thing as free lunch.