QNX and Telescope Control

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Introduction

- The QNX Real Time Operating System
- QNX in a telescope control system: the JACARA GMOUNT

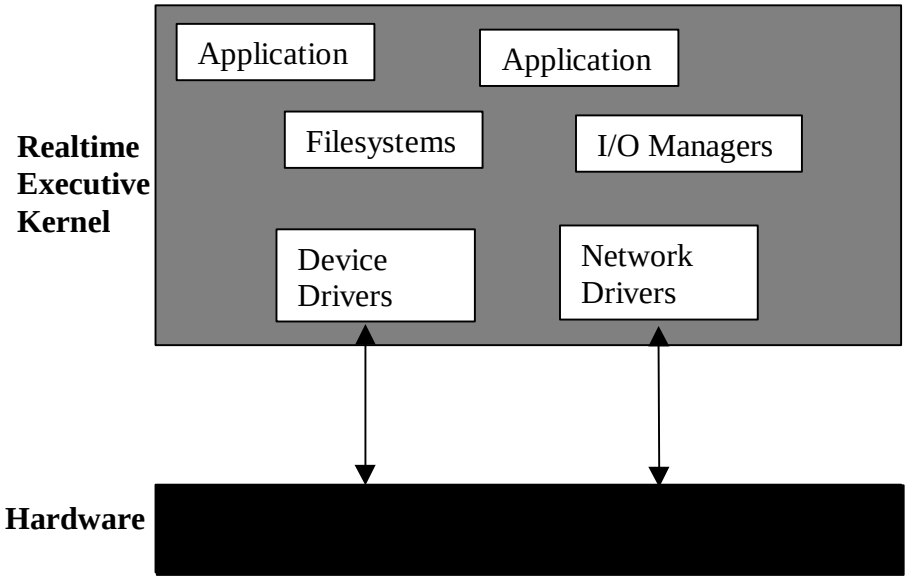
The QNX Real Time Operating System

- Microkernel architecture
- Scheduling
- Inter Process Communication
- Device Drivers
- Hardware Support
- Software Support

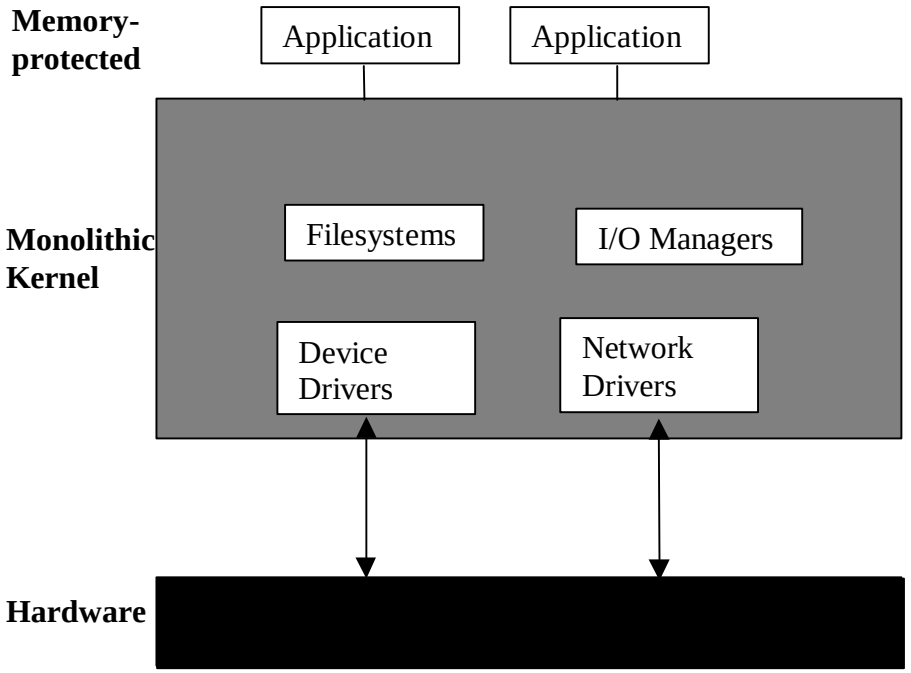
QNX Microkernel Architecture

- All device drivers are independent processes
- All processes provided with memory protection via virtual memory
- Microkernel provides process scheduling, IPC, interrupt handling and low-level network access

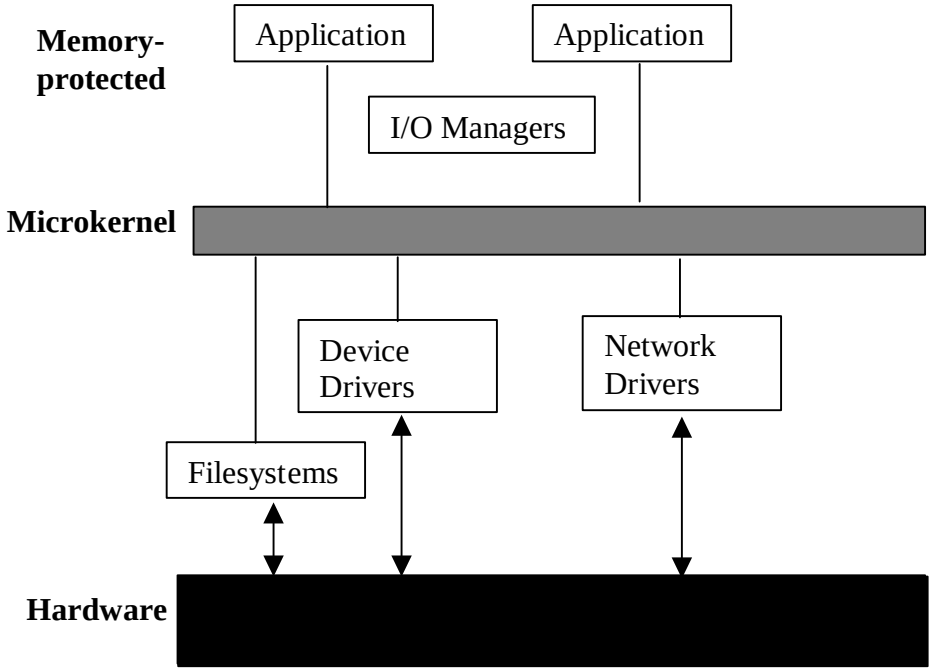
Flat Architecture



Monolithic Architecture



QNX Microkernel Architecture



QNX Process Scheduling

- 32 Priorities
- 3 scheduling methods: FIFO, round-robin and adaptive
- Interrupt latency ~ 3.3 microseconds on P166
- Scheduling latency ~4.7 microseconds on P166

QNX Inter Process Communication

- Messages: synchronous communication with acknowledgement
- Proxies: Non-blocking event notification
- Signals: Traditional asynchronous inter process communication

Device Drivers

- Start up as standard processes
- Adding new drivers does not affect rest of running system
- Debug at source level, no kernel rebuilds

Hardware Support

- Traditionally embedded x86 applications
- Now added MIPS and PowerPC
- Support for ISA, PCI, PCMCIA, PC/104

Software Support

- Development on Windows 95/NT or on QNX development host
- Watcom C/C++ compiler
- Remote debuggers
- Photon microGUI

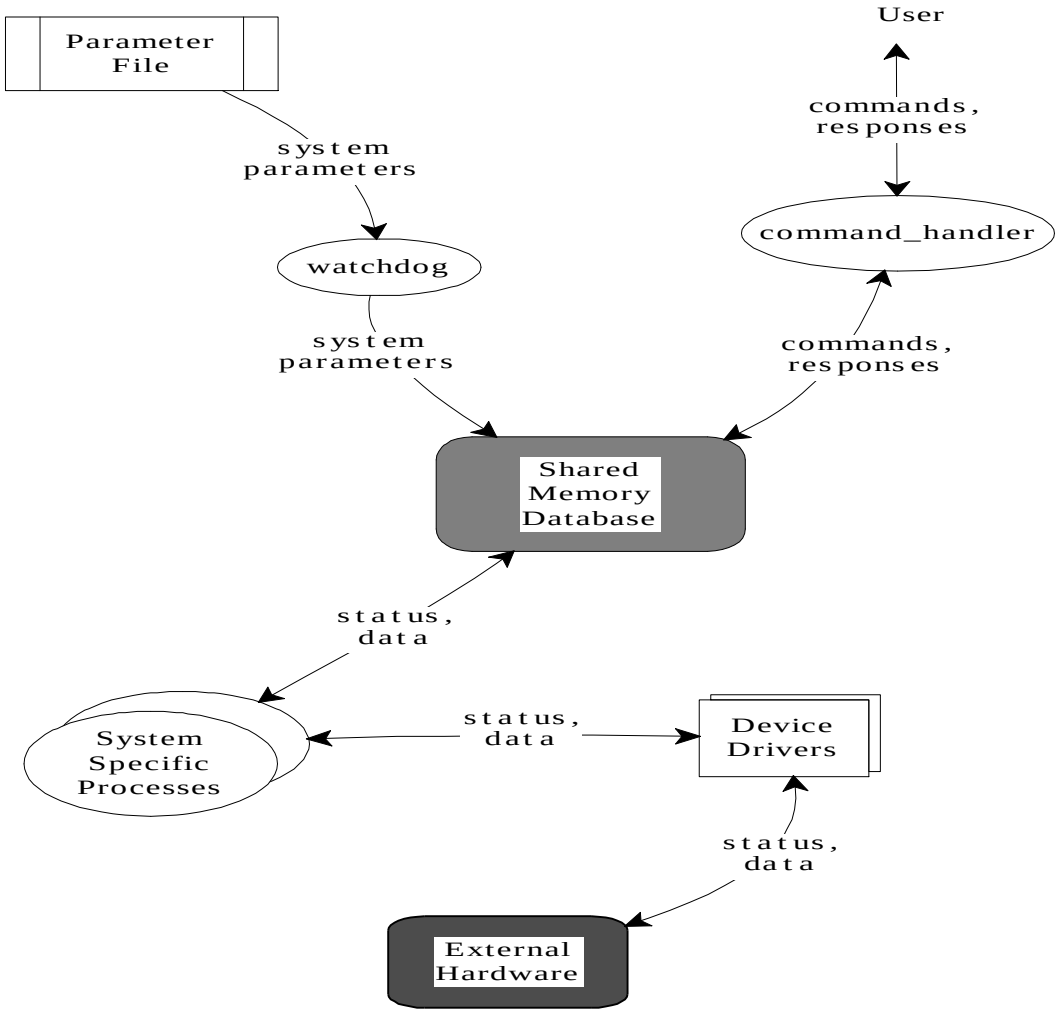
QNX in a Telescope Control System: the JACARA GMOUNT

- JACARA
- System Overview
- Watchdog process
- Drivers
- Time critical sections
- Hardware

JACARA

- Joint Australian Centre for Astrophysical Research in the Antarctic
- Generic Mount System
- ADIMM: Automated Differential Image Motion Monitor
- AFOS: a UV instrument

System Overview



Watchdog Process

- Initiates startup of entire system
- Creates shared memory database
- Reads parameters from file and loads database.
- Spawns known processes
- Polls shutdown flag at low rate
- SIGCHILD signal if a child process terminates

Device Drivers

- Simple stateless client/server model
- Commissioning handset
- Axis control hardware
- Blinkenlighten
- GPS receiver

Time Critical Sections

- Close velocity servo loop
- Encoded axis positions captured every 10 milliseconds
- Axis control process runs at a higher priority than kernel and with the FIFO scheduling class

Hardware

- RTD 486 SX processors with co-processors
- PC/104 stack
- 3U Eurocard rack-mount
- ISA bus extended on custom backplane

QNX Summary

Pros

- Ease of development
- Ease of driver testing

Cons

- Proprietary networking
- Limited processor support