

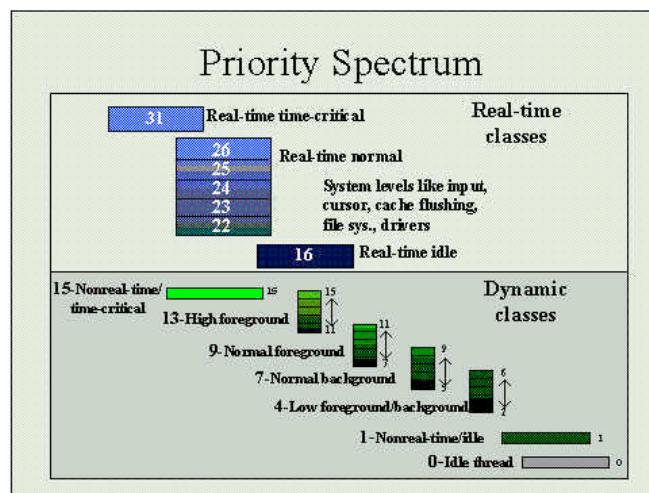
## Windows NT and Real-Time?

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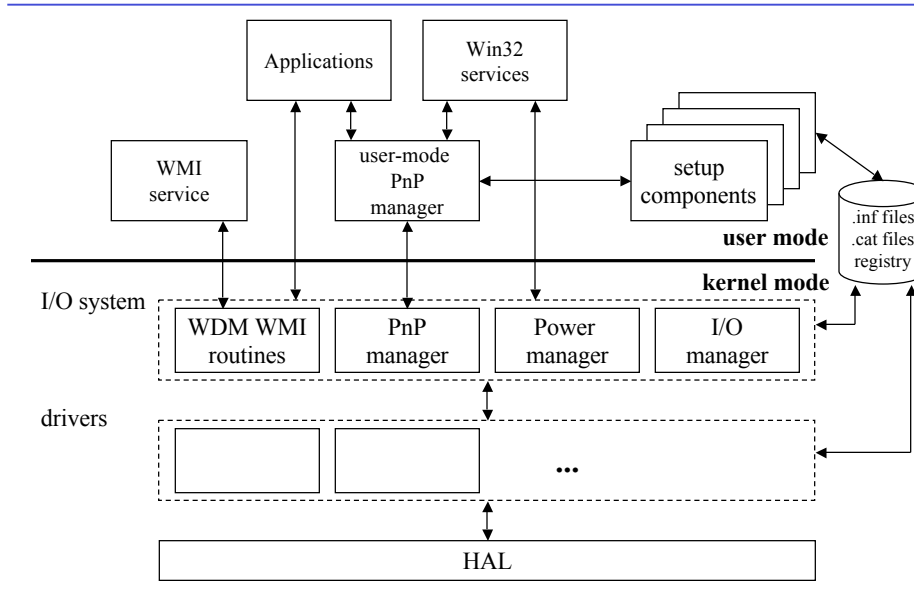
- Reading: “**Inside Microsoft Windows 2000**”, (Solomon, Russinovich, Microsoft Programming Series)
  - “**Real-Time Systems and Microsoft Windows NT**” (MSDN Library)
  - “**Windows XP with RTX - The off-the-shelf platform for Integrated Communication Equipment**” ([www.venturcom.com](http://www.venturcom.com))
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## Priorities in Windows NT/2000

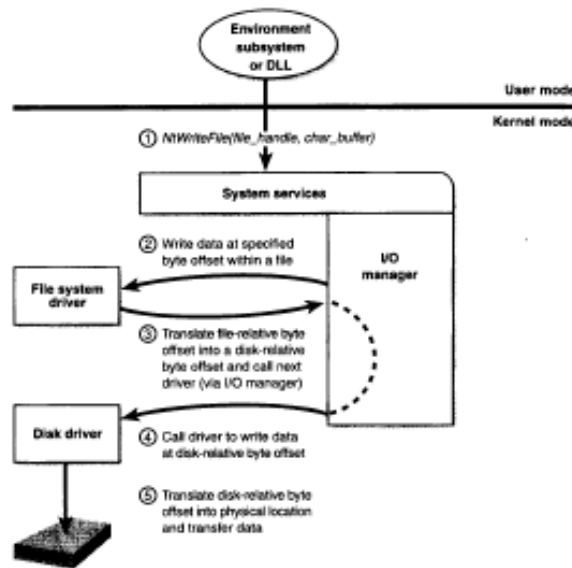
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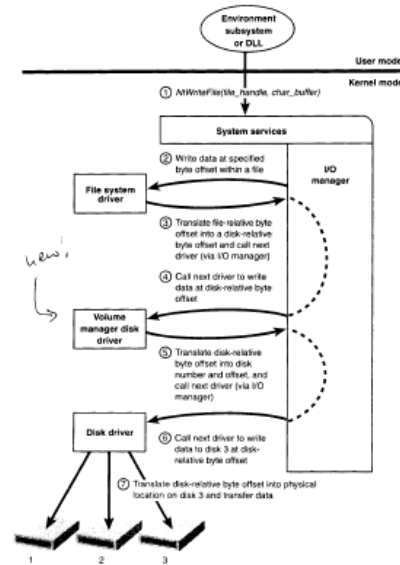
## IO System Components (Windows 2k)



## Device Driver Layering

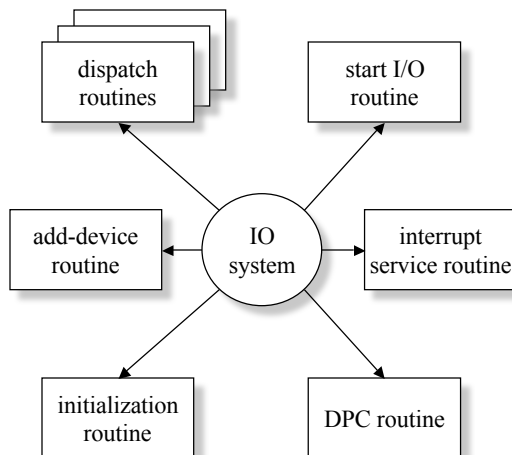


## Device Driver Layering (2)



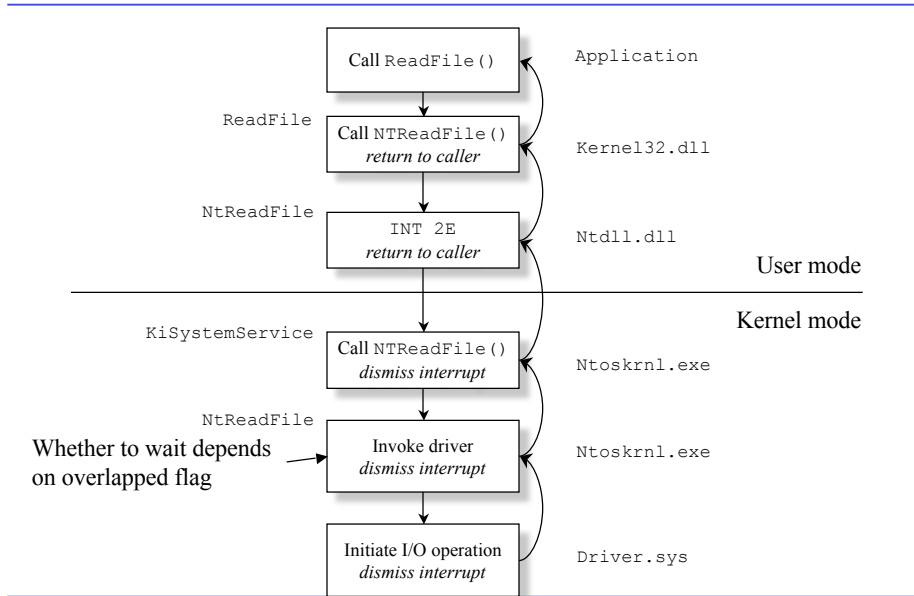
## Primary Device Driver Routines

- NT/2000 device drivers run entirely within the system process and have access to all hardware through the HAL. A typical device driver will have several components:

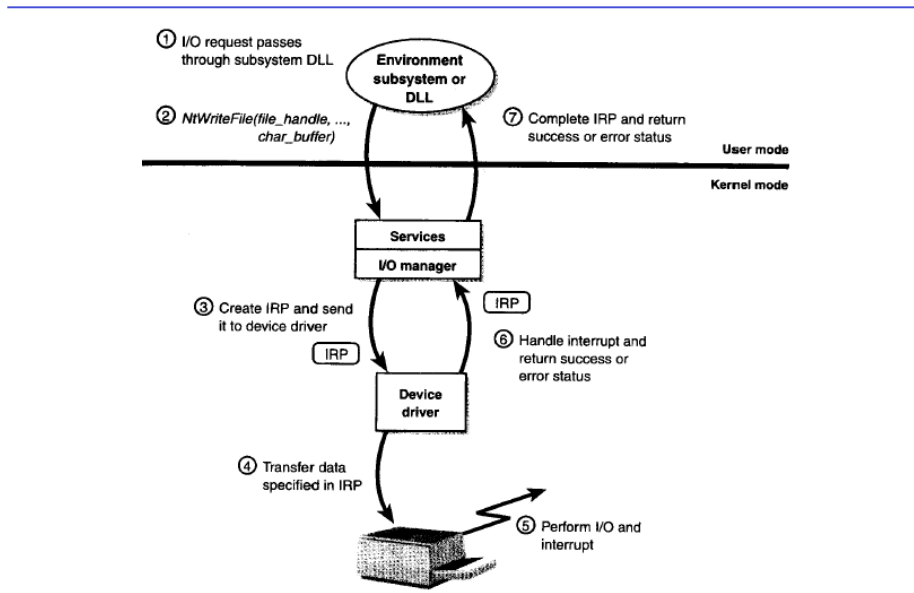


- Initialization routine This routine initializes hardware and sets up data structures used by the driver at startup time.
- Interrupt service routine (ISR) This routine handles an interrupt on the device that the device driver controls.
- Deferred processing call (DPC) One or more DPCs handle non-time-critical processing for the driver.
- System thread Some, but not all, drivers will have a system thread for very low-priority work.

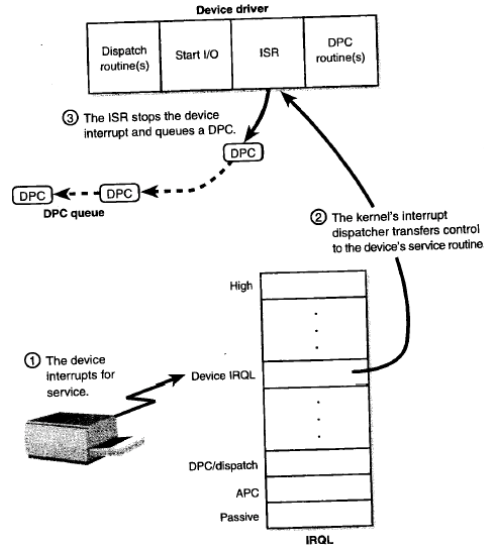
## Control Flow for an IO Operation



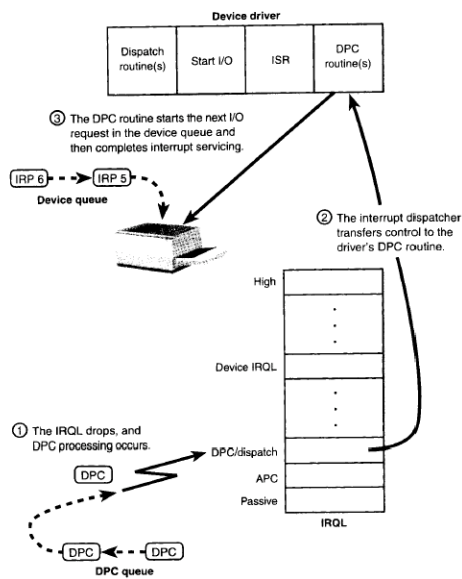
## Queueing and Completing a Synchronous Request



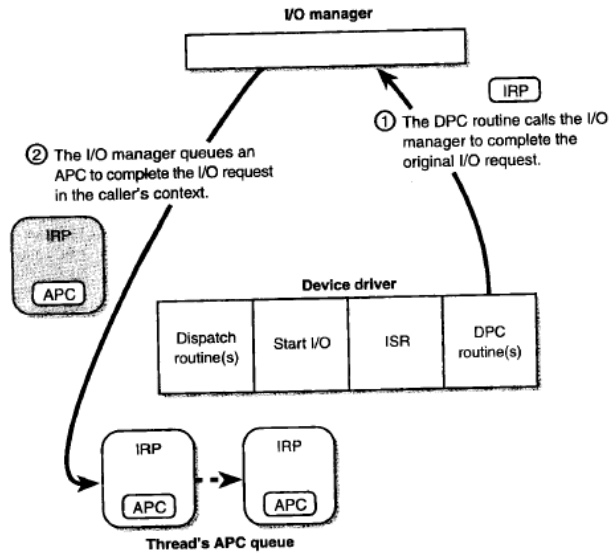
## Servicing a Device Interrupt (only Phase I)



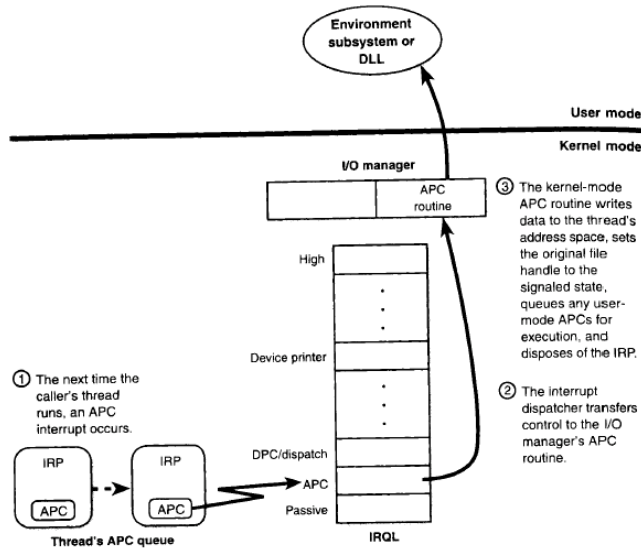
## Servicing a Device Interrupt (Phase II)



## Completing an I/O Request (Phase I)



## Completing an I/O Request (Phase II)





## Windows 2000/NT and Real-Time Processing

- Windows 2000/NT does not prioritize device IRQs in controllable way.
- User-level applications execute only when a processor's IRQL is at passive level.
- System's devices and device drivers - not the OS - ultimately determine the worst-case delay.
- This is a problem with off-the-shelf hardware and drivers.
- System designer must bound the length of device's ISR and DPC in the worst case.
- Embedded versions of Windows NT/2000 provide control over memory footprint etc, but are not real-time capable.
- Extensions of real-time kernels can be provided through custom extensions of the HAL.

## VenturCom RTX Architecture

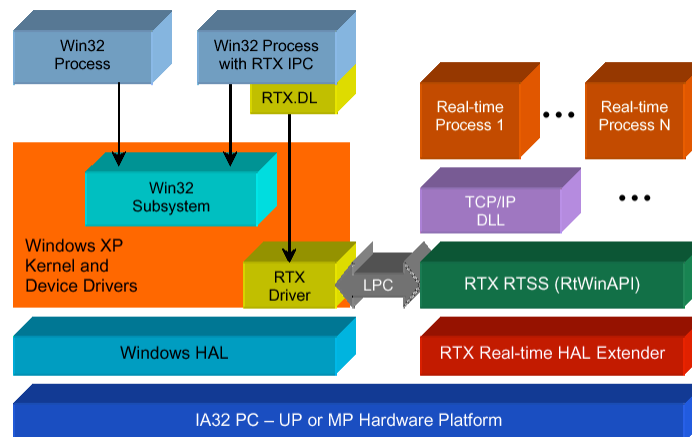


Figure 1: RTX Architecture