

# Programska podrška mjernih i procesnih sustava

Branko Jeren i Predrag Pale

Fakultet elektrotehnike i računarstva  
Zavod za elektroničke sustave i obradbu signala

---

---

---

---

---

---

---

---

# I/O system

programska podrška  
za ulazno-izlazne jedinice i poslove

---

---

---

---

---

---

---

---

# Od čega se sastoji

- HW
  - računalo
  - sklopovska sučelja,  
međusklop (*interface*)
  - uređaji, periferne jedinice (*device*)
- SW




---

---

---

---

---

---

---

---

## Što očekujemo od I/O SW ?




---

---

---

---

---

---

---

---

## Zahtjevi na SW za I/O

- modularnost
  - jasno odvojeni modul za svaki (vrstu) međusklop
- skalabilnost
  - neograničeni broj istovjetnih uređaja i/ili međusklopova
- slojevitost
  - samo jedan sloj modula se bavi posebnostima uređaja
- uniformnost
  - jednaki korisnički pristup bilo kojem uređaju/međusklopu

---

---

---

---

---

---

---

---

## Apstrakcije i slojevi

- korisnička biblioteka I/O modula
  - specifične potrebe i vrste I/O poslova prevodi na jednoobrazne kernel pozive
- kernel calls (system calls)
  - isti za sve tipove međusklopova
  - potpuno odvajaju korisnika/aplikaciju od HW
- device driver
  - posebni za svaki međusklop
  - jedan upravlja više istovjetnih međusklopova/uređaja
  - pripremaju posao interrupt rutinama
- prekidni servisi (interrupt rutine)
  - obavljaju stvarni I/O posao

---

---

---

---

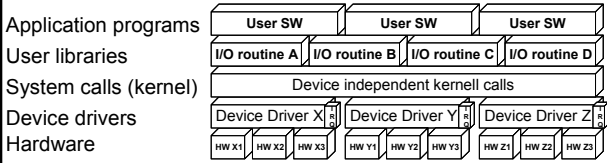
---

---

---

---

## Slojevi I/O SW




---

---

---

---

---

---

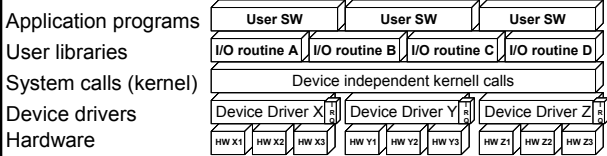
---

---

---

---

## System calls




---

---

---

---

---

---

---

---

---

---

## I/O moduli kernela

- pet osnovnih rutina
  - open
  - close
  - read
  - write
  - ioctl
- istovjetne za sve fizičke uređaje i odgovarajuće međusklopove
- sve složenije I/O funkcije moraju se kombinirati iz pet osnovnih (ali na razini korisničkih biblioteka)

---

---

---

---

---

---

---

---

---

---

## SysCall: open (name)

- simboličko ime uređaja
- open for read/write
- blocking/nonblocking open
- sinkronizacija

---

---

---

---

---

---

---

---

## SysCall: close (fd)

- zaustavlja, gasi HW
- čisti memoriju
- oslobađa (za vrijeme upotrebe postavljena) zauzeća

---

---

---

---

---

---

---

---

## SysCall: read (fd, buffer, length)

- učitava željeni broj bajtova s uređaja
- blocking/nonblocking rad

---

---

---

---

---

---

---

---

## SysCall: write (fd, buffer, length)

- zapisuje željeni broj bajtova na uređaj
- blocking/nonblocking rad

---

---

---

---

---

---

---

---

## SysCall: ioctl (...)

- upravljanje međusklopom (specifično za svaki pojedini međusklop)
- zapravo, on samo prosjeđuje naredbe i strukture device driveru

---

---

---

---

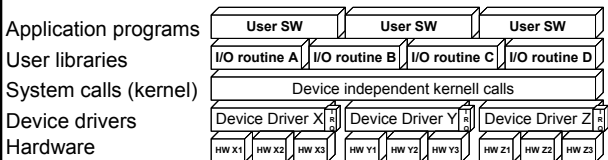
---

---

---

---

## Device Drivers




---

---

---

---

---

---

---

---

## Device Driver

- rutine su korespondentne system callovima
  - open
  - close
  - read
  - write
  - ioctl
- priprema posao za IRQ rutinu
- pokreće postupak
  - završetak prvog podzadatka (npr. prijem jednog znaka)
  - pokreće IRQ rutinu koja pokreće slijedeći podzadatak
  - sve do posljednjeg
- blocking/nonblocking

---

---

---

---

---

---

---

---

---

---

## Problem nedijeljivog resursa

- primjer: printer, zvučnik, disk
- istovremeno, isprepletano korištenje bi:
  - izmiješalo podatke
  - mijenjalo stanje uređaja/resursa i vršene funkcije
  - mijenjalo podešenost, konfiguraciju uređaja
- potreba za prioritetima
- potreba za nonblocking radom

---

---

---

---

---

---

---

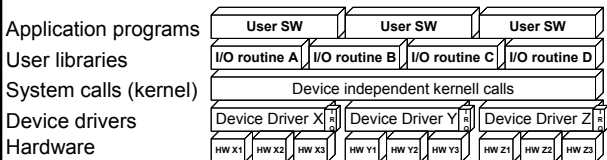
---

---

---

## Rješenje: Spooling

### Simultaneous Peripheral Operations On-line




---

---

---

---

---

---

---

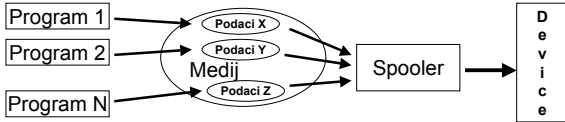
---

---

---

# SPOOLING

- jedan korisnički program (spooler) pristupa periferiji
- svi korisnici (programi) ostavljaju svoje zahtjeve na dijeljivom mediju
- spooler raspodjeljuje zahtjeve na resurs prema unaprijed dogovorenim pravilima




---

---

---

---

---

---

---

---

---

---

## Programska podrška mjernih i procesnih sustava

www.zesoi.fer.hr  
(<http://www.ZESOI.FER.hr/hrzesoi/dodip/ppmips.htm>)

ppmps@zesoi.fer.hr

---

---

---

---

---

---

---

---

---

---