

### OPASKA!

- ☞ Ovi materijali namijenjeni su isključivo studenticama/studentima koji su upisali predmet "Računala i procesi" na FER u šk. g. 2002/2003.
- ☞ Za svako drugo korištenje potrebna je pismena suglasnost autora!
- ☞ Materijali služe kao pomoć u praćenju predavanja, a ne kao njihova zamjena jer se ne mogu tumačiti izvan konteksta predavanja!



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Mario Žagar



Sveučilište u Zagrebu

Fakultet elektrotehnike i računarstva

(FER)

## RAČUNALA I PROCESI

### 3. Računala i procesi

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### Proces - u užem smislu

- ☞ čin fizikalne ili kemijske promjene, uključujući kombiniranje materije ili pretvaranje energije
- ☞ proces se odvija u postrojenju (koje može egzistirati i bez procesa, ali proces ne može bez postrojenja)



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### Proces - u užem smislu (II)

- ☞ svaki proces (osim najnižeg) se može dijeliti na podprocese (destilacija, dovod vode, hlađenje,...)
- ☞ elementi upravljanja, u ljudskom smislu (management), u tehničkom (control)
- ☞ tehnički na nižim razinama (uz proces), management - od najnižih do vrha



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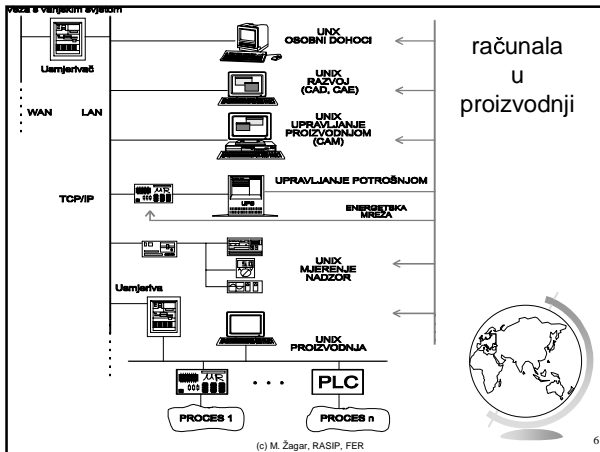
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## Računala i procesi

- ☞ algoritmi za pojedine strojeve - vrlo različiti, sve uglavnom "po mjeri"
- ☞ na višoj razini upravljanje je sve manje tehničko, a sve više ekonomski, društveni, politički usmjereno (management) (otok Tri milje)
- ☞ računala se mogu primjenjivati postepeno ili sve od jednom



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## Koraci prilikom razvoja

- ☞ proučavanje procesa,
- ☞ pronalaženje algoritma
- ☞ sklopovlje
- ☞ programska podrška
- ☞ puštanje u pogon



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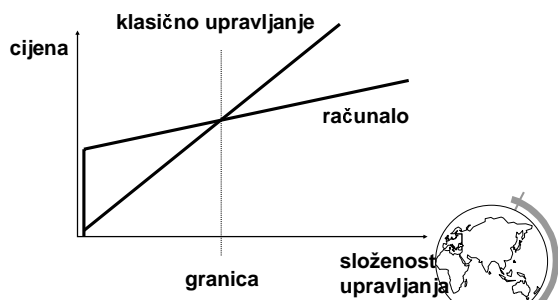
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## Ekonomičnost inst. računala



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## Zašto rač., a ne analog. svijet

- ☞ 10 - 100 funkcija uz istu cijenu (PIO)
- ☞ manje dimenzije (mikroroč.)
- ☞ veće mogućnosti obrade podataka (izvedene veličine)
- ☞ fleksibilnost (RAM)
- ☞ manja osjetljivost na smetnje
- ☞ mogućnost složenih algoritama



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## A u "slobodno" vrijeme:

- ☞ otvoreni krug, poboljšani rad pri mjerenju (podešavanje, ...)
- ☞ zatvoreni krug, promjenjivo pojačanje (Siemens A/D), različiti PID algoritmi
- ☞ pomoćni poslovi (spremanje podataka, formatiranje izvješća, upravljanje potrošnjom energije, ...)
- ☞ samoučenje



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## "Inteligencija"

- ☞ provjera ulaznih veličina, testiranje (LED), dijagnostika
- ☞ osjetila, auto vozi 500 km/h
- ☞ dijagnostika pogrešnog
- ☞ kriva 5. lopatica u turbini :-)
- ☞ složeniji algoritmi
- ☞ komunikacija s operaterom (viša razina)
- ☞ različiti planovi ovisno o situaciji
- ☞ umjetna inteligencija, eksp. sustavi



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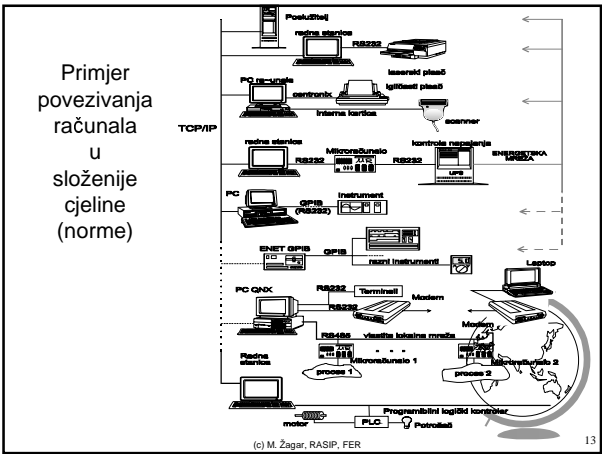
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### Način uporabe procesnih računala (po mjestu ugradnje)

- ☞ samostalno
- ☞ hijerarhijski princip
- ☞ raspodijeljeni princip
- ☞ kombinirano

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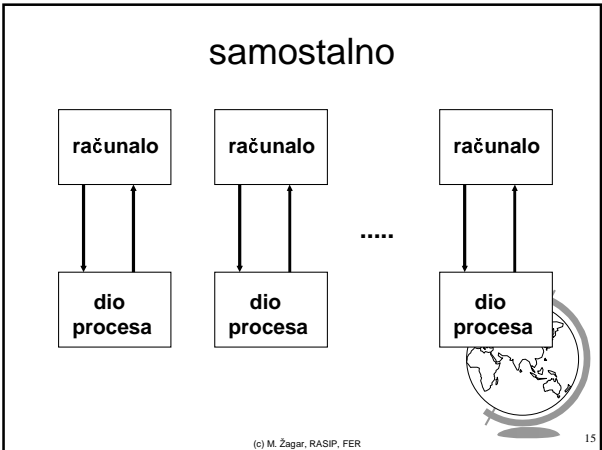
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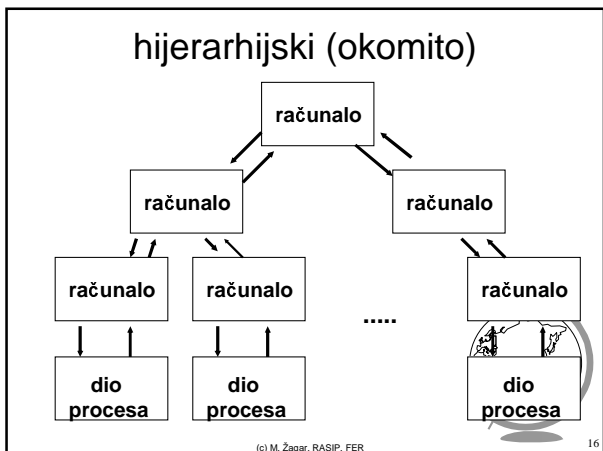
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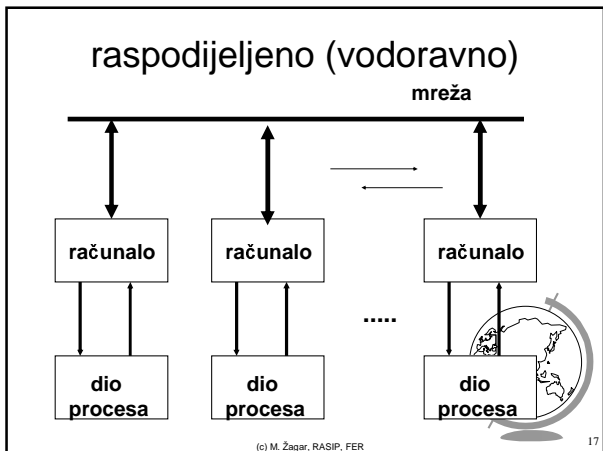
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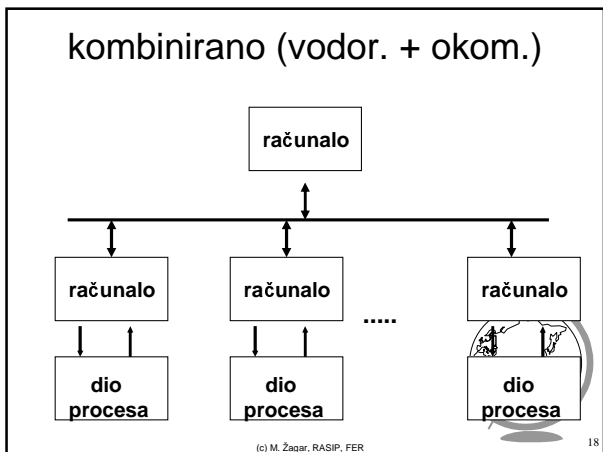
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## Način uporabe procesnih računala (po ulozi)

- ☞ jedno računalo, više procesnih cjelina (hijerarhija)
- ☞ postavljanje parametara (eng. set point)
- ☞ neposredno digitalno upravljanje (eng. Direct Digital Control, DDC)



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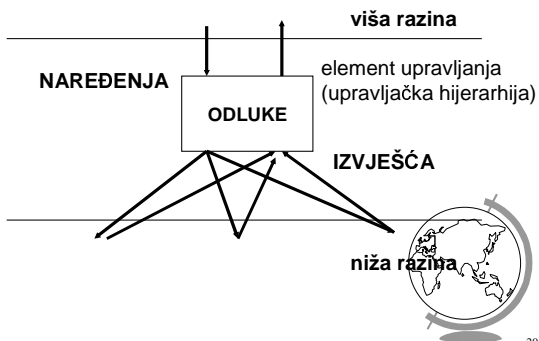
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## Hijerarhijski princip



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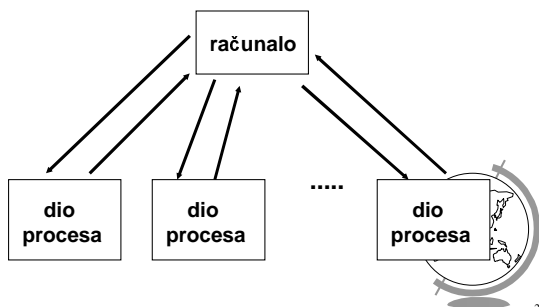
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## hijerarhijska organizacija upravljanja - jedno računalo više procesnih cjelina



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### Svojstva:

- ☞ složeno, dugo se gradi
- ☞ teško promjene
- ☞ ako stane računalo, stalo je sve
- ☞ nekad bilo sad se spominjalo



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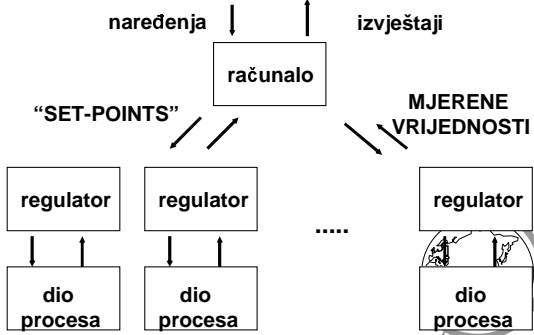
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### Postavljanje parametara procesa ("set-point")



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### Svojstva:

- ☞ računalo prvenstveno postavlja vrijednosti, parametre procesa
- ☞ lako se prelazi s jednog vođenja na drugo
- ☞ u slučaju kvara, svaki regulator samostalno nastavlja s radom
- ☞ moguća postepena izgradnja sustava
- ☞ kombinacija klasičnih i "novih" rješenja



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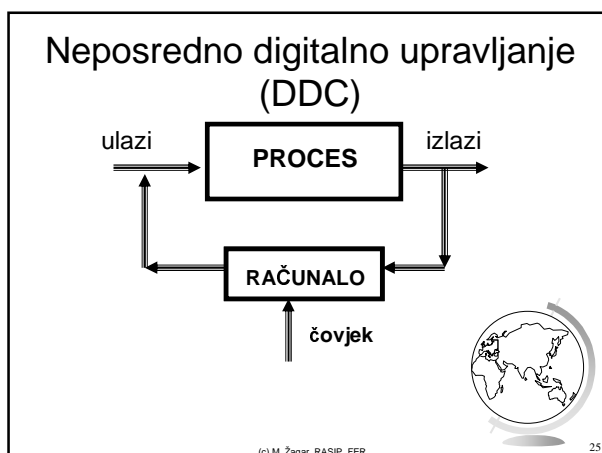
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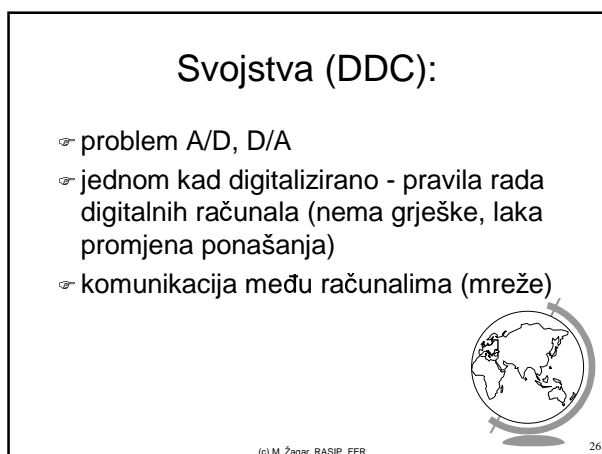
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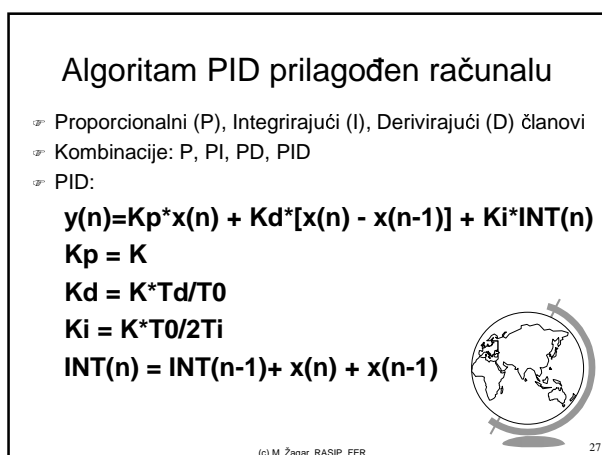
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### PID

The diagram shows two plots. The left plot shows a step response where the output (odziv) follows a step change in the input (pobuda) with a delay and overshoot. The right plot shows a disturbance response where the output returns to its setpoint after a disturbance is introduced.

- ☞ Primjer za Z80 / 2 MHz - 12 ms
- ☞ A/D, formatiranje, 5 zbrajanja, 3 množenja, defomatiranje, D/A

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### cijena/snaga računala

The graph plots 'cijena računala' (computer price) on the y-axis against 'snaga računala' (computer power) on the x-axis. The curve shows an exponential increase in price as power increases. A list of factors contributing to this is provided:

- organizacija,
- dužina riječi,
- takt,
- broj naredaba,
- adresiranje
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### Vanjske podjele računala

- ☞ I. generacija (centralizam)
- ☞ II. generacija (mreža)
- ☞ III. mreža sastavni dio računala
- ☞ IV. računalo je mreža, mreža je računalo

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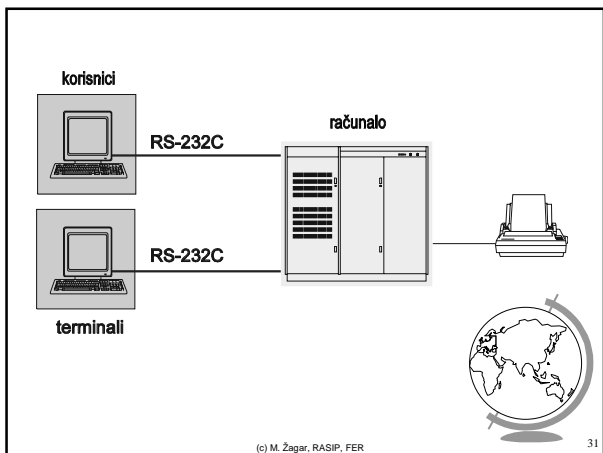
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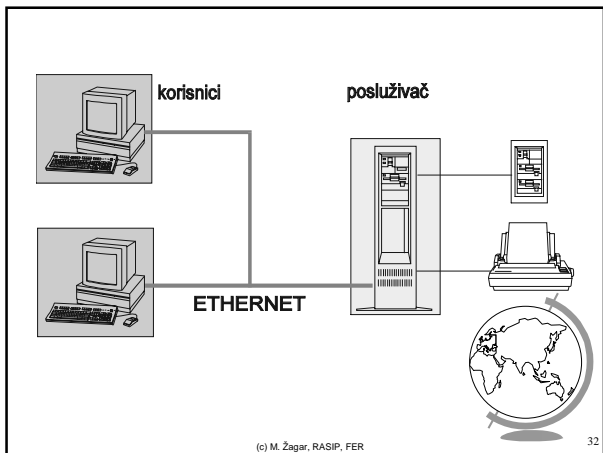
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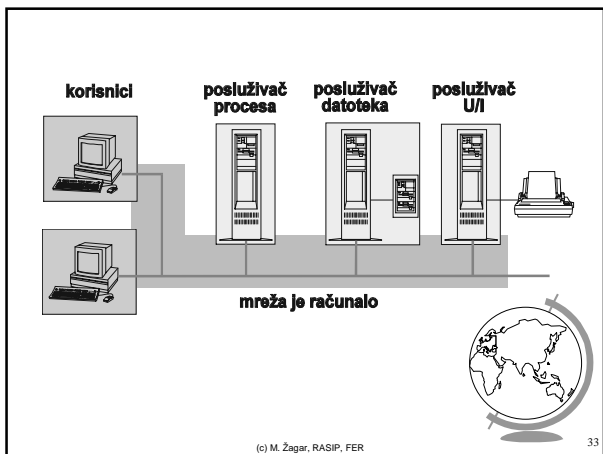
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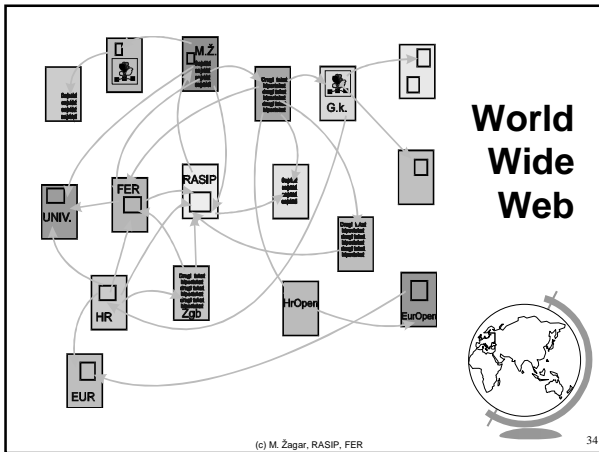
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### Organizacije računala:

- ☞ oko interne sabirnice (eng. motherboard)
  - veća brzina, manje U/I
  - dobro za velika računala
- ☞ oko zajedničke sabirnice (eng. backplane)
  - sve jedinice (moduli) jednaki tretman
  - modularnost, prilagodljivost (dodavanje modula po mjeri)
- ☞ paralelni sustavi, više sabirnica
  - veće brzine obrade
  - svaki procesor svoj posao
  - redundancija, veća pouzdanost (RAID)



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### Arhitektura računala

- ☞ CISC - RISC
- ☞ registri, memorija
- ☞ cache
  - locality of reference principle (ideja već u PDP 8)
  - cache 5-10 puta brža tehnologija
- ☞ stog (Java)
- ☞ prekidi (context switching)



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## Prekidi

- ☞ obični, nemaskirajući, vektorski (Z80)
- ☞ višerazinski (MC68xxx)
- ☞ uvjetni prijenos je sve (PIC)
- ☞ prioriteti (daisy chain) (Z80)
- ☞ fiksne adrese (Z80)
- ☞ bridovi (I8085)
- ☞ brzina promjena (context switching)
- ☞ organizacija U/I
  - memory mapped U/I (Motorola)
  - direct U/I (Intel)



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## Arhitektura prilagođena radu u stvarnom vremenu

- ☞ stvarno vrijeme?
- ☞ sklopovske prilagodbe
- ☞ programske prilagodbe
- ☞ općenite prilagodbe



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