

Elektronski merni sistemi

Laboratorijska vežba 1

PC kao platforma za realizaciju
savremenog mernog sistema

Vladimir Rajović, 2020/21

Varijante PC računara

- Komercijalni
 - Desktop
 - Laptop
 - PDA,...
- Industrijski PC
 - Single board computer
 - Embedded PC
 - PC/104 i derivati
 - Rack mount PC
 - Panel mount
 - Wall mount PC

Embedded PC



2.5 inch

3.5 inch

5.25 inch

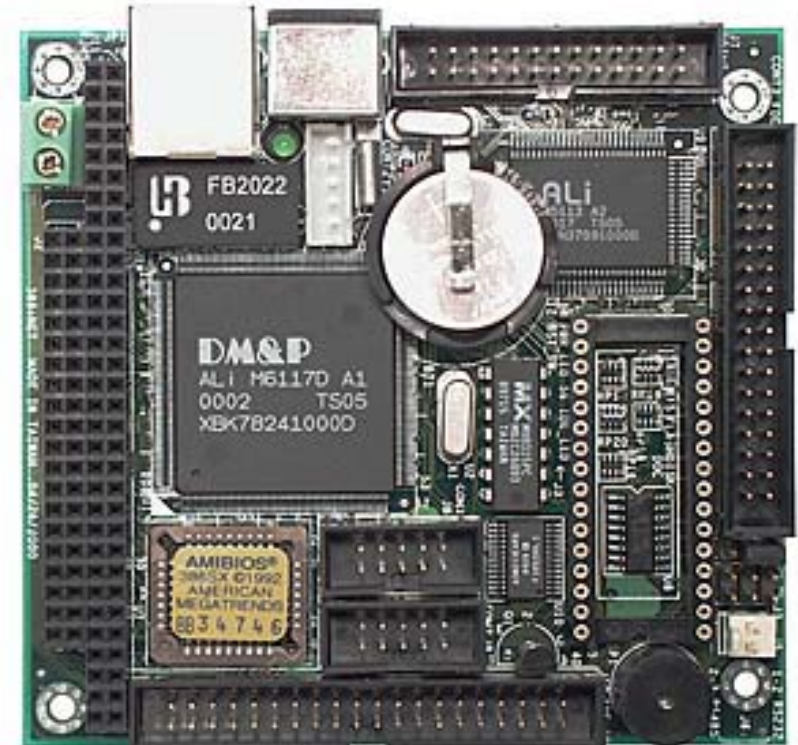
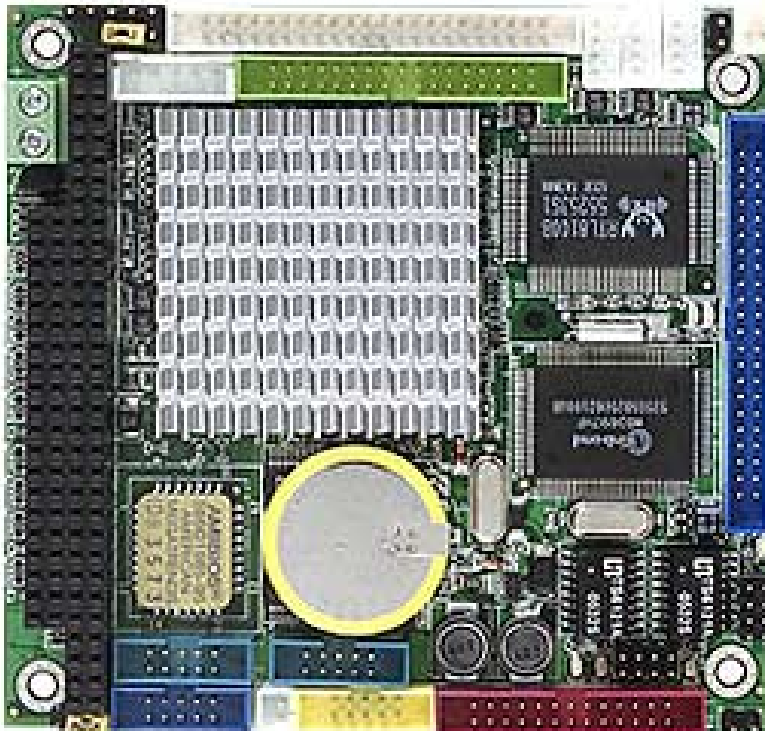
5V, 500mA

Nema podrške za kartice
– sve na istoj pločici

PC/104 i derivati

Kod nekih sistema postoji noseća ploča (backplane) na koju se u slotove povezuju sam računar i dodatne kartice

U ovom slučaju magistrala je takvog oblika da se kartice slažu jedna na drugu



PC/104 i derivati

- signali na magistrali -

- PC/104
ISA
- PC/104-Plus
ISA + PCI
- PCI-104
PCI
- PC/104-Express
PCI + PCI-Express

PC/104 i derivati

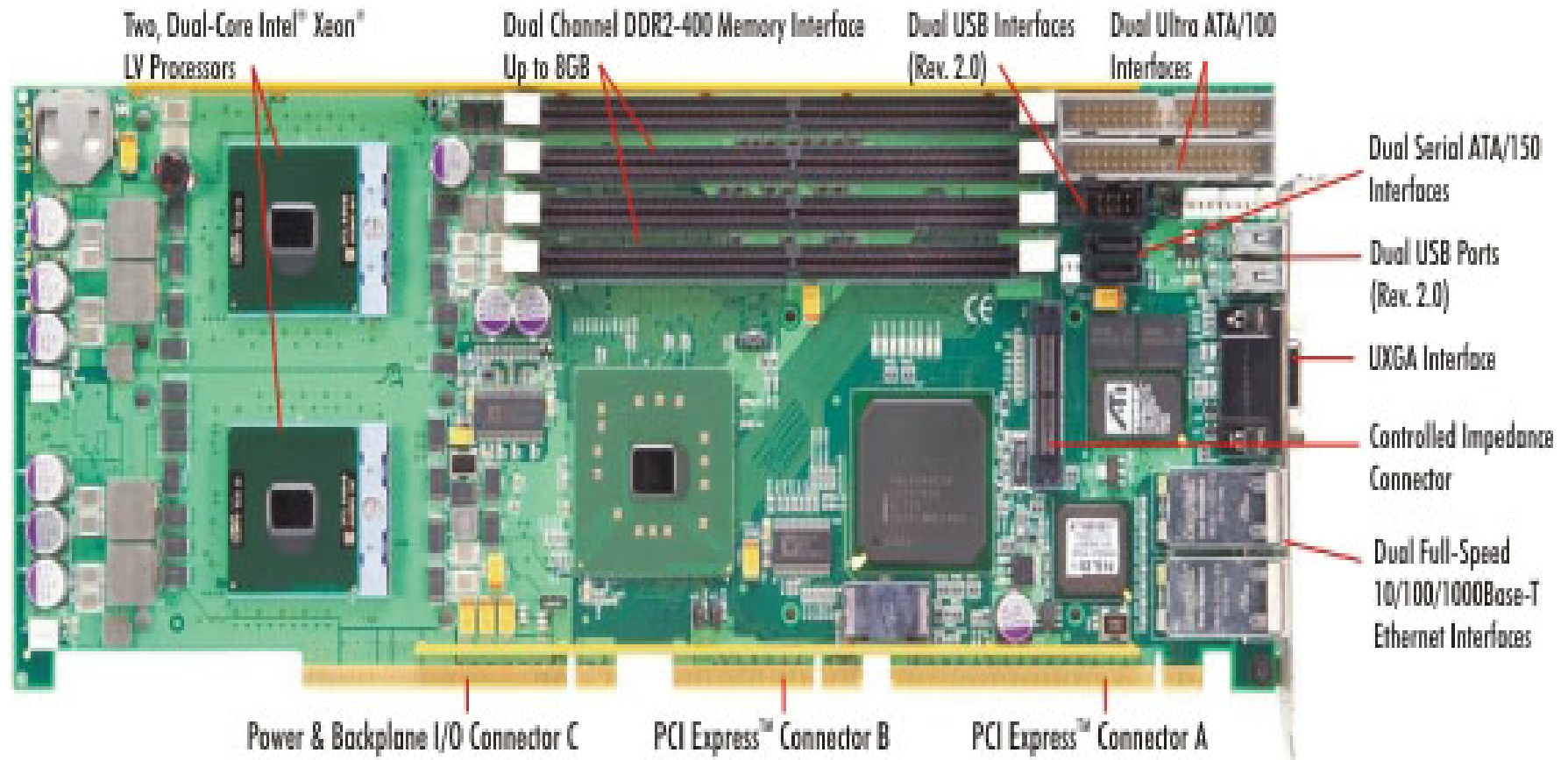
Delovi tipičnog sistema:

- Računar
- ADC
- Digital IO

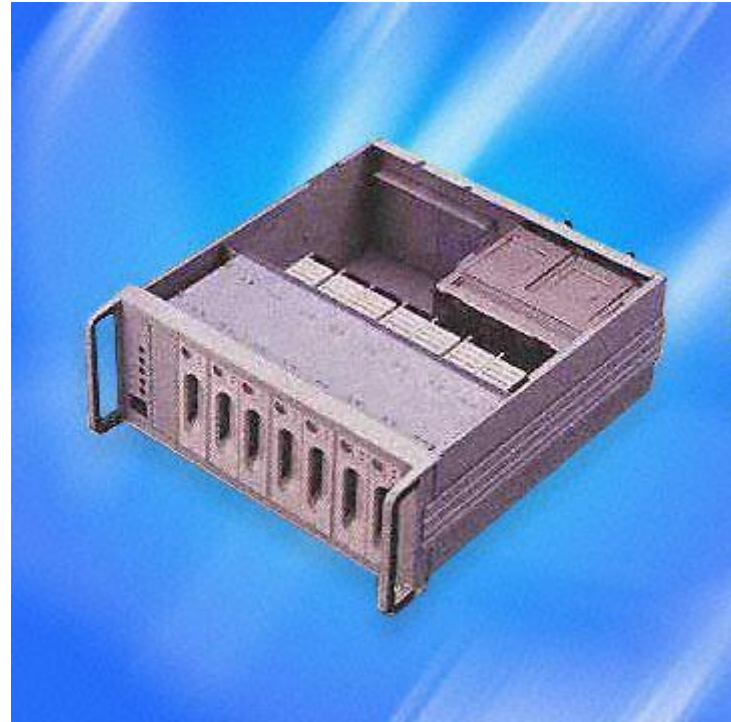
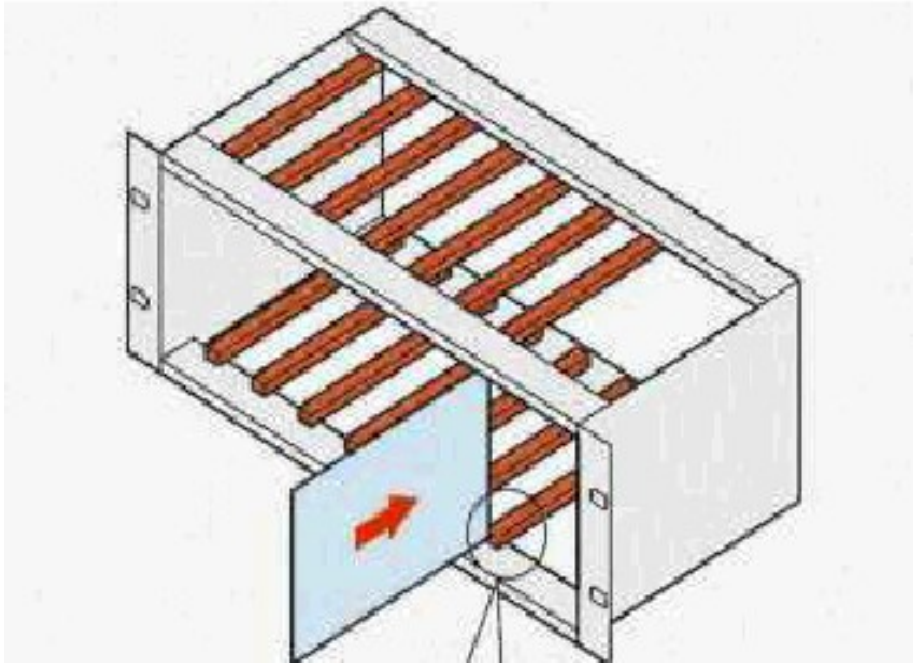
Takodje specijalizovani delovi:

- GPS prijemnici
- WLAN
- USB kontroleri

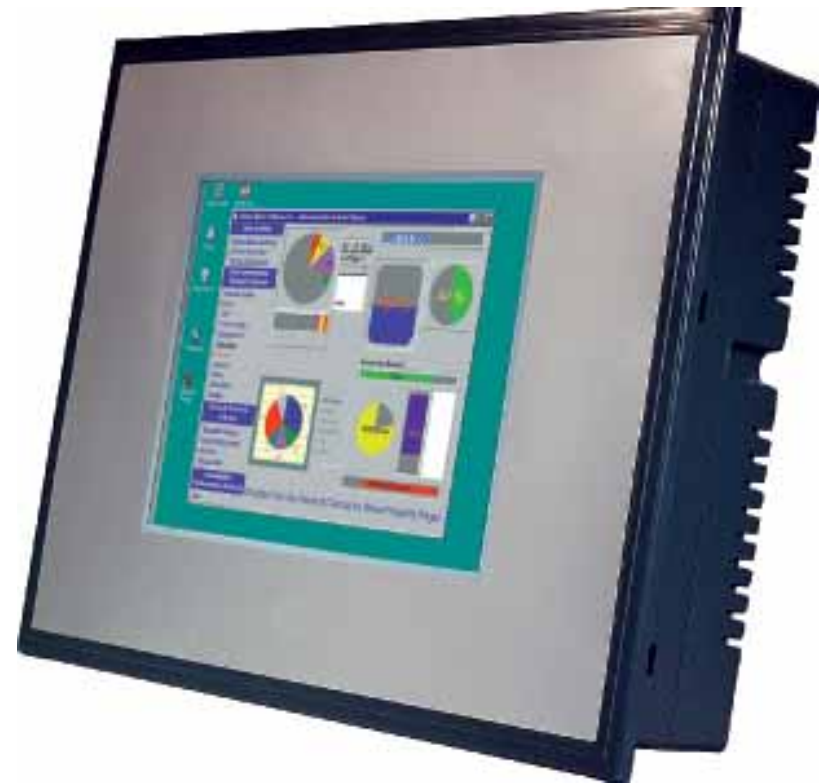
Rack mount



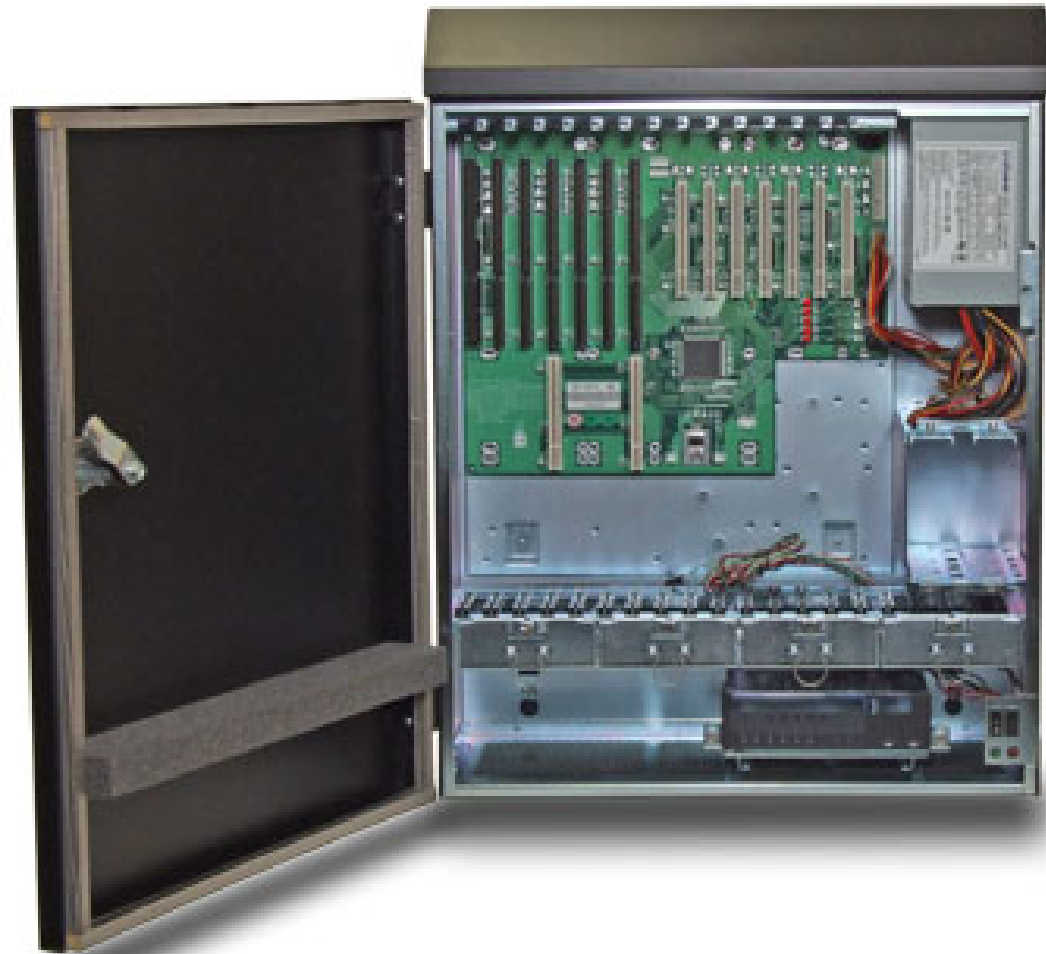
19 inch rack (standard)



Panel mount



Wall mount

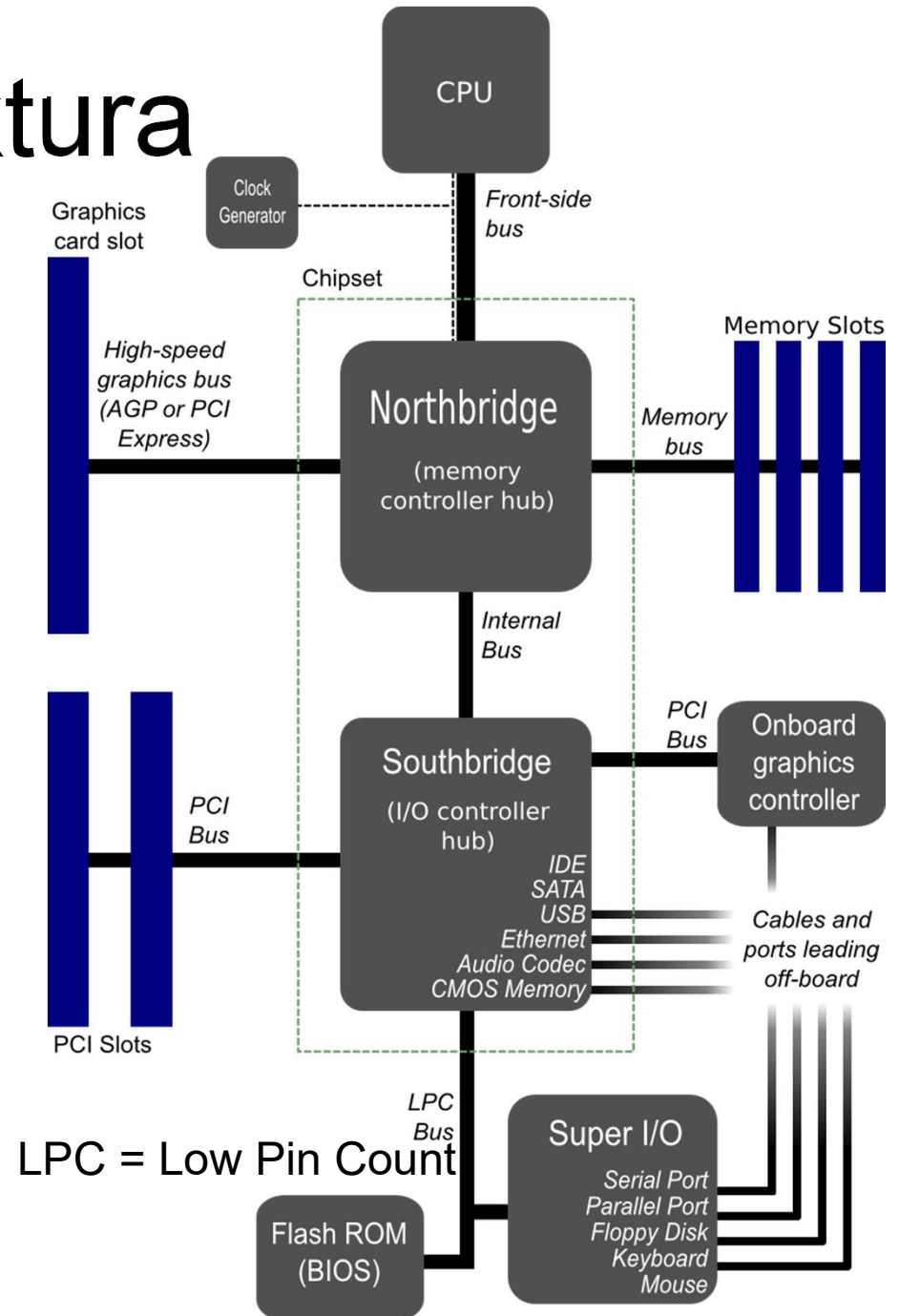
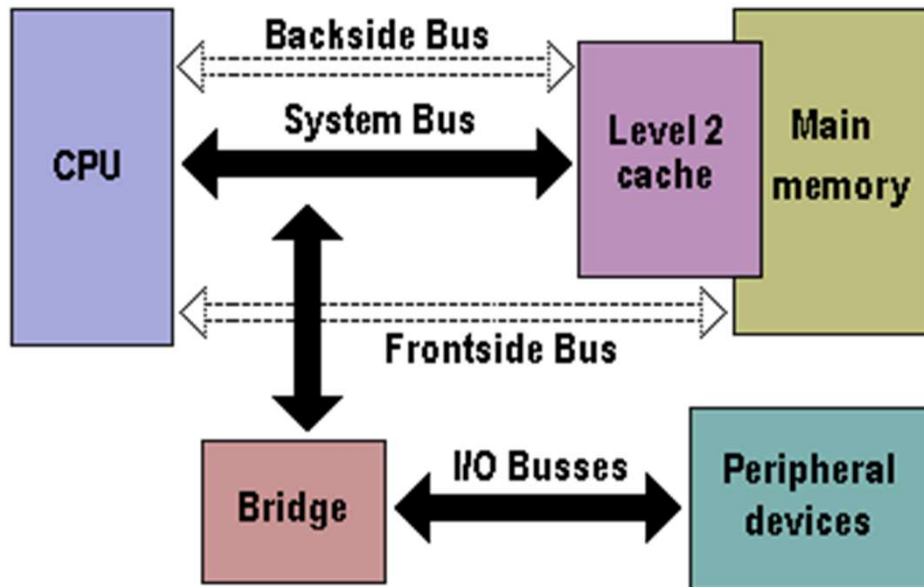


- Neke od arhitektura se zasnivaju samo na single board computer principu
 - PXI
 - VMEBus
 - VXI
 - ...

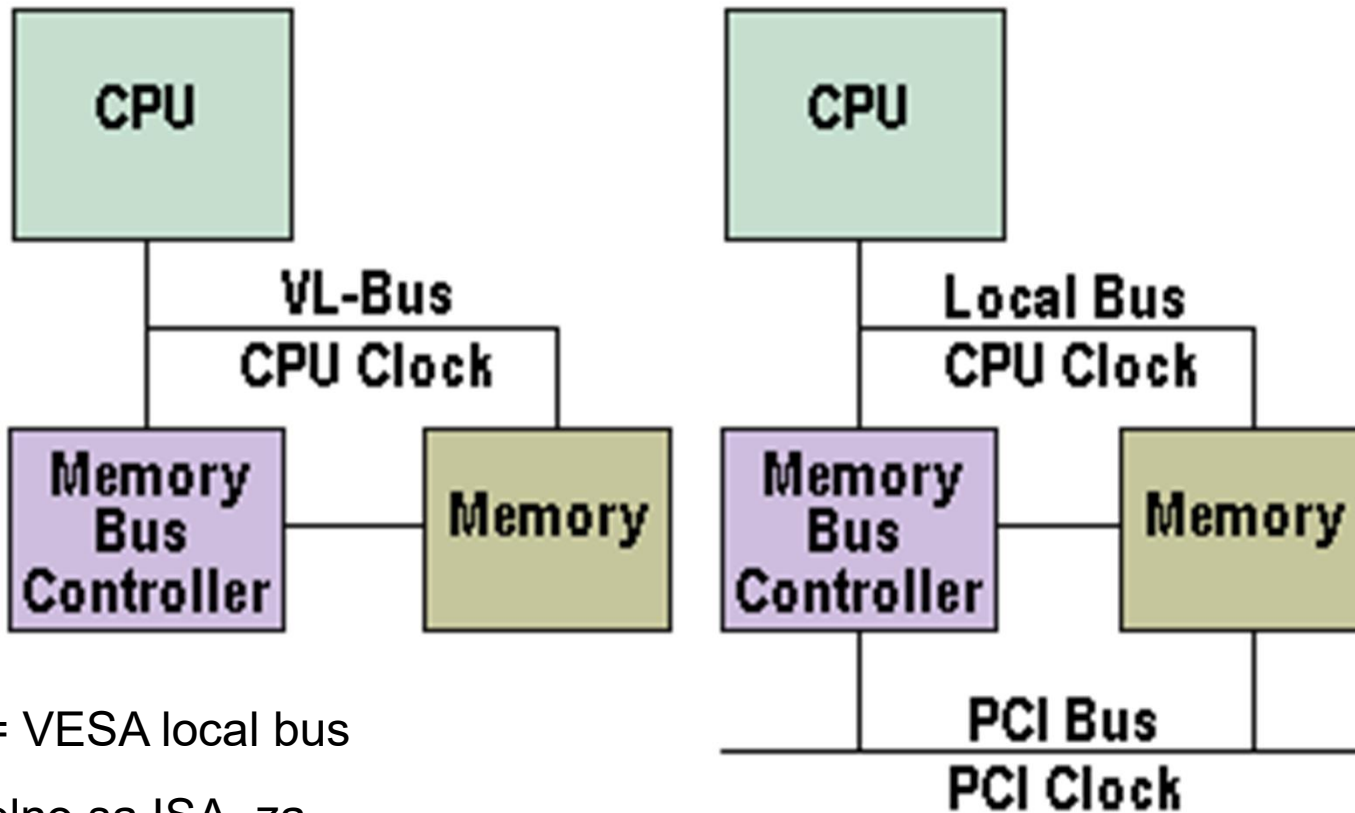
PC arhitektura

Backside Bus
CPU <-> Cache memory

Frontside Bus
CPU <-> North Bridge



PCI - Peripheral Component Interconnect - BUS

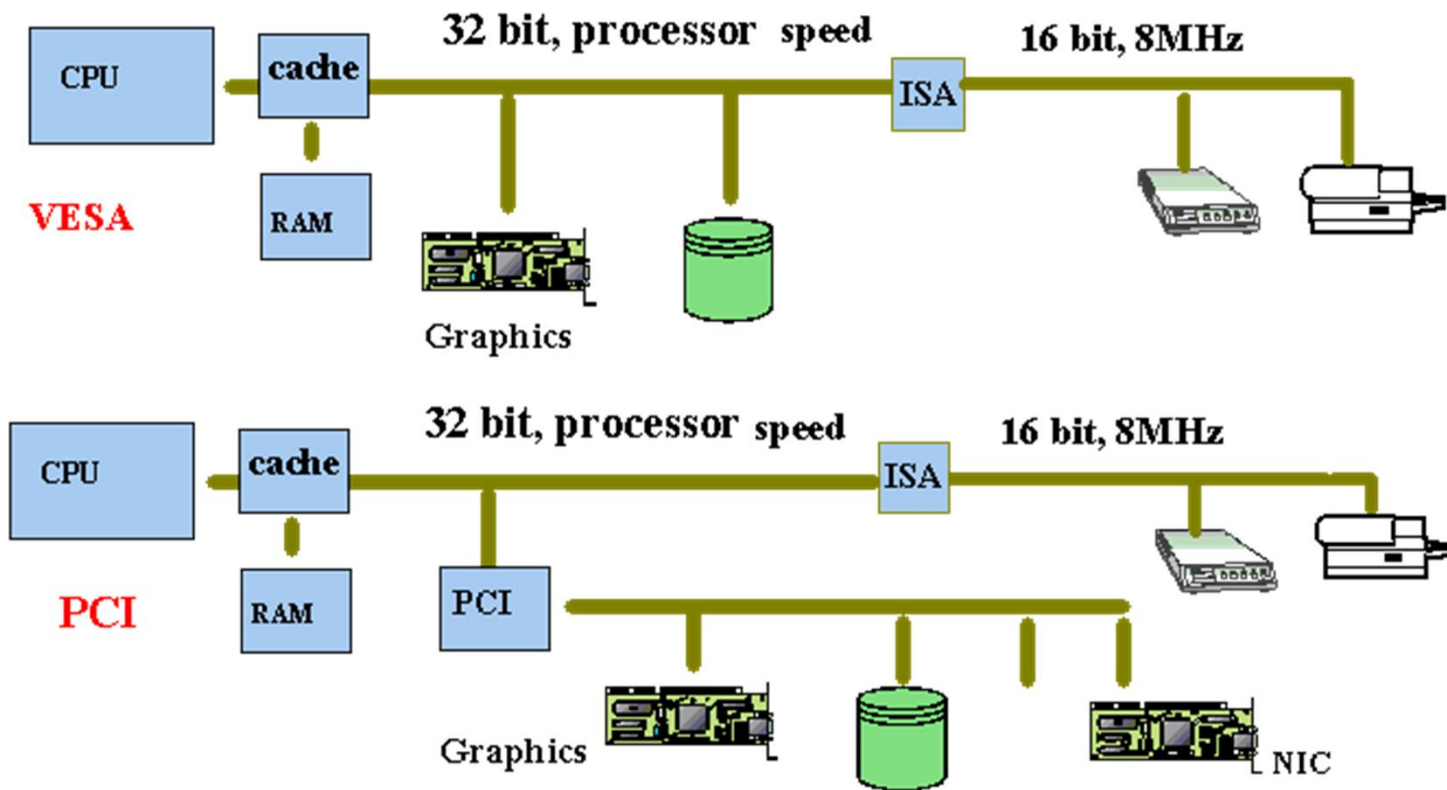


VLB = VESA local bus

paralelno sa ISA, za
memory mapped IO i
DMA

PCI vs VESA

PCI is processor independent, VESA is cheaper, performance difference



PCI- karakteristike


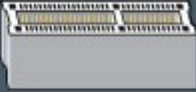
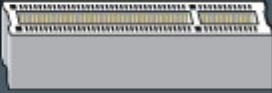
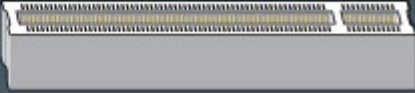
- Prvi standard na 33MB/s, a poslednji na 133MB/s
- Deljene linije za prekid (ukupno 4)
- PnP sistem
- Direktan pristup memoriji
- 32-bitna magistrala
- Problem – dele se resursi (gigabitni ethernet)

PCI EXPRESS

- Serijski prenos preko nekoliko pun dupleks staza (lane)
- Umesto da fizički formiraju magistralu svi uređaji se povezuju na prekidačku logiku. Sa viših nivoa konekcija se vidi kao magistrala.
- Po jednoj stazi se ostvaruje protok od 2.5Gbps.
- Postoje varijante sa x1, x2, x4, x8, x16 i x32 staza
- Staze se raspoređuju optimalno, tako da može istovremeno da komunicira više uređaja
- Jedna logička veza može koristiti više staza

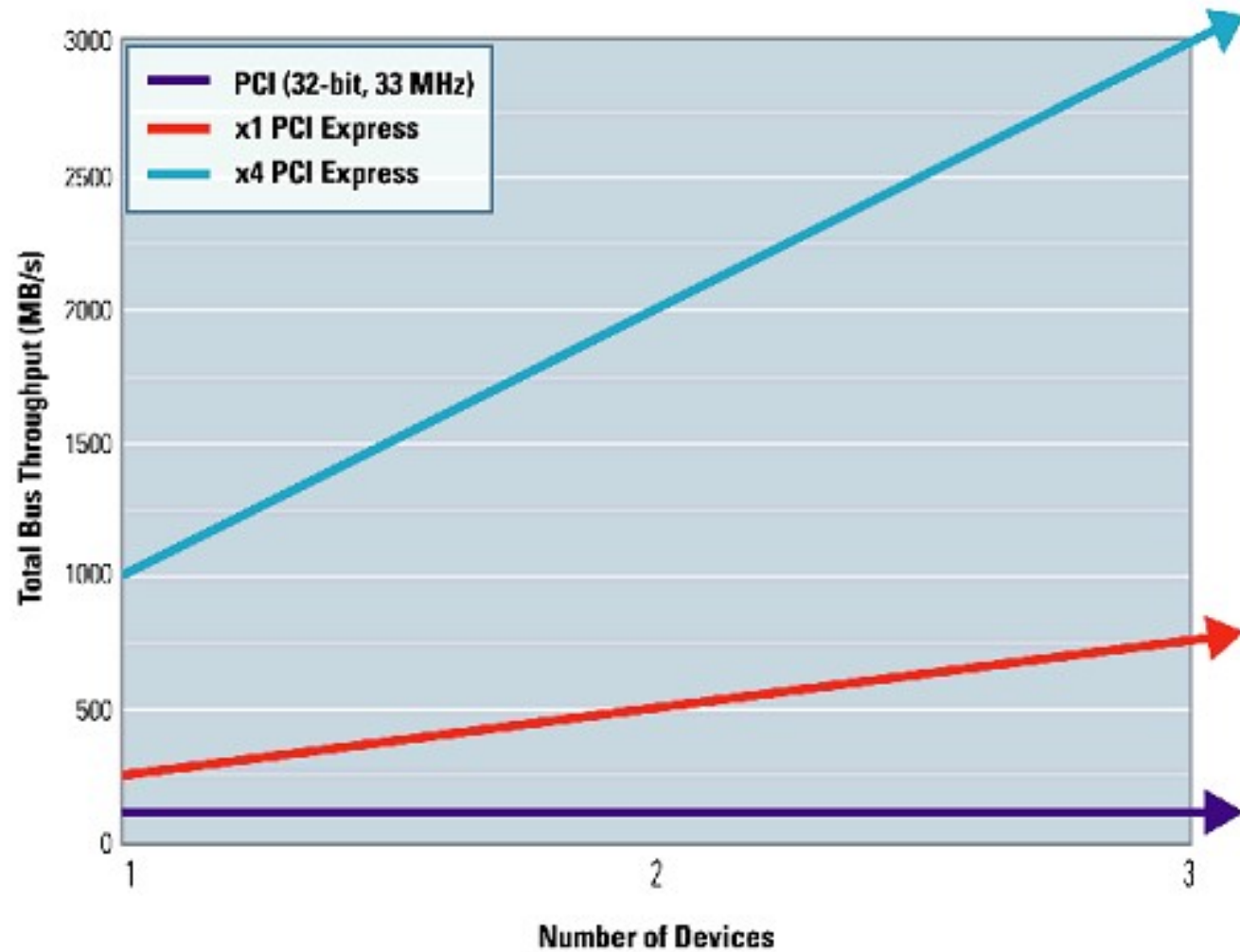
PCI EXPRESS

PCI Express Example Connectors

x1	BANDWIDTH Single direction: 2.5 Gbps/200 MBps Dual Directions: 5 Gbps/400 MBps	
x4	BANDWIDTH Single direction: 10 Gbps/800 MBps Dual Directions: 20 Gbps/1.6 GBps	
x8	BANDWIDTH Single direction: 20 Gbps/1.6 GBps Dual Directions: 40 Gbps/3.2 GBps	
x16	BANDWIDTH Single direction: 40 Gbps/3.2 GBps Dual Directions: 80 Gbps/6.4 GBps	

Source: IBM ©2005 HowStuffWorks

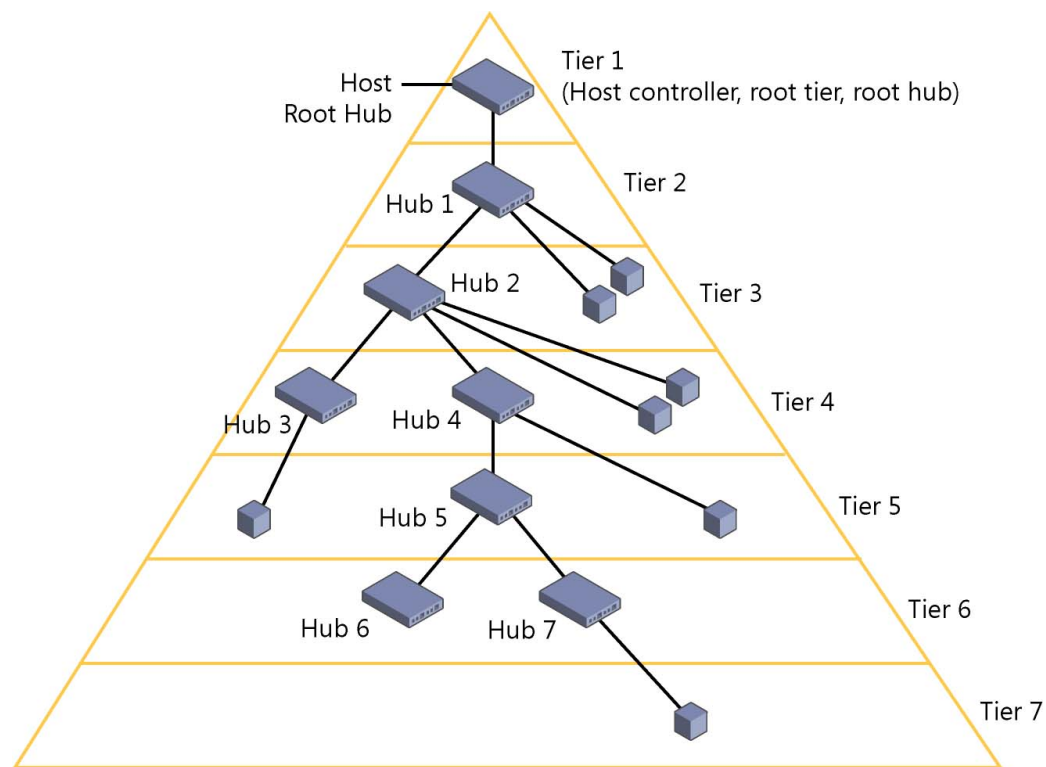
PCI vs PCIe



USB

- USB 1.0 (1996) 1.5 Mbit/s **LowSpeed**
- USB 1.1 (1998) 12 Mbit/s **FullSpeed**
- Nasledio RS232
- Poludupleks
- PnP sistem
- Obezbedjuje 500mA napajanja
- Može da se korišćenjem ekspanzionih hub-ova poveže do 127 uređaja

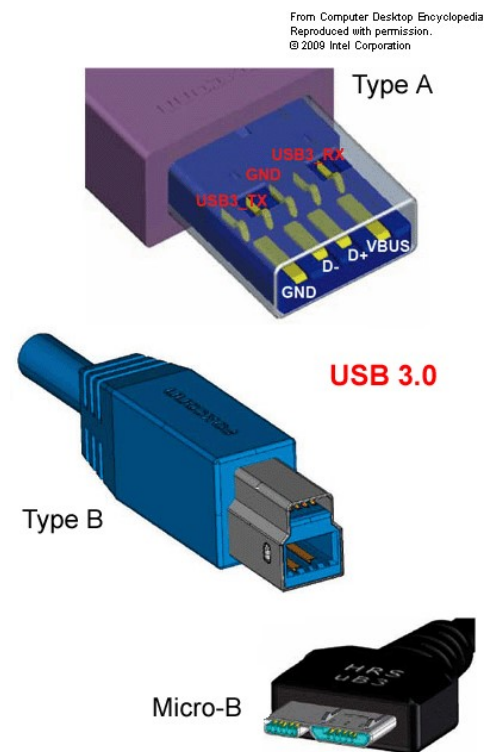
- USB 2.0 (2000) - 480Mbit/s **HiSpeed**
- Dvosmerna poludupleks serijska magistrala (4 žice)



- USB 3.0 (2008) – 5Gbit/s **SuperSpeed**
- Pun duplex serijska magistrala (9 žica)
 - 4 žice iz USB2.0
 - Dodatne žice za prenos velikim brzinama

USB 3.0 Standard-A and Standard-B

Pin	Color	Signal name ('A' connector)	Signal name ('B' connector)
1	Red		VBUS
2	White		D-
3	Green		D+
4	Black		GND
5	Blue	StdA_SSRX-	StdB_SSTX-
6	Yellow	StdA_SSRX+	StdB_SSTX+
7	Shield	GND_DRAIN	
8	Purple	StdA_SSTX-	StdB_SSRX-
9	Orange	StdA_SSTX+	StdB_SSRX+
Shell	Shell	Shield	



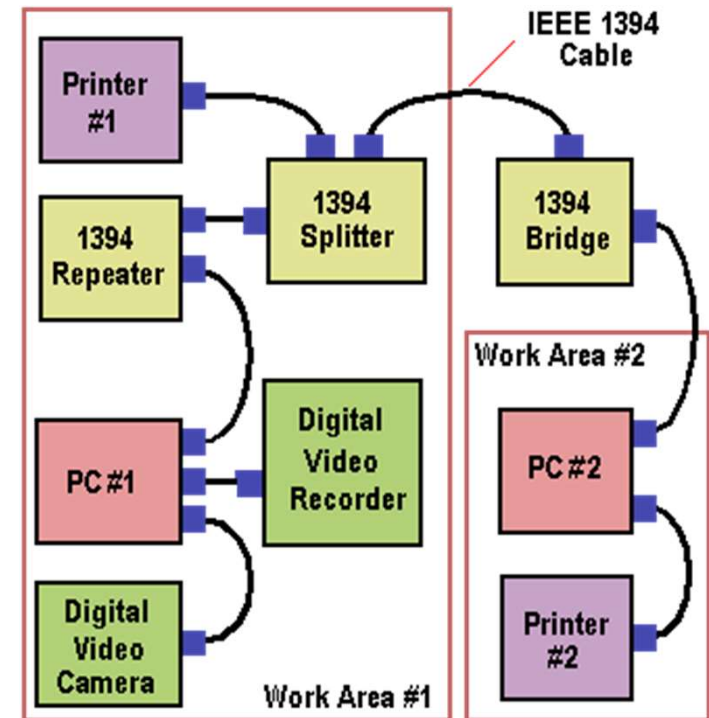
- USB 3.0 (2008) – 5Gbit/s
 - Obezbedjuje 900mA, uz istovremenu komunikaciju punom brzinom
 - Obezbeđuje 1.5A, ali bez komunikacije (punjači)

IEEE 1394-Fire Wire

- Serijska magistrala (maksimalno 63 uređaja na magistrali)
- Opšte namene ali praksa ga je usmerila ka upotrebi u audio/video sistemima
- U odnosu na USB ima bolje karakteristike po pitanju rada u realnom vremenu
- Trenutni cilj: 6.4Gbit/s

IEEE 1394-Fire Wire

- IEEE1394 -1995
 - 100, 200 i 400 Mbit/s, poludupleks (S100, S200, S400 modovi)
 - dužina kabla 4.5m max
 - do 16 kablova mogu biti vezani u lanac korišćenjem internih ili spoljašnjih ripitera (u S400 modu maksimalno 72m)
 - 6 pinski konektor sadrži i priključke za napajanje preko kojih periferija može da se napaja (~30V, 7-8W)



IEEE 1394-Fire Wire

- IEEE1394a-2000
 - tehnička unapređenja
 - standardizovan i 4pinski konektor bez napajanja
- IEEE1394b-2002
 - Novi modovi: S800, S1600, S3200
 - Novi konektor
 - S3200 mod na udaljenostima do 100m



IEEE 1394-Fire Wire

- IEEE1394c-2006
 - Glavno unapređenje definisanje zajedničkog porta za Firewire i Ethernet
- IEEE1394-2008
 - Integracija prethodnih standarda u jedinstven standard

Stiv Džobs je 2008. godine izjavio da je Firewire mrtav...

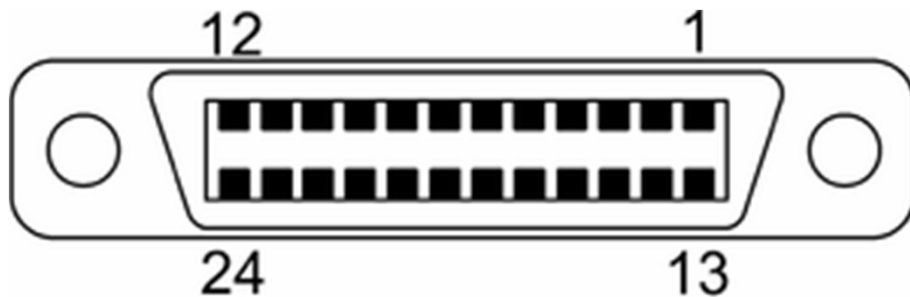
IEEE488 (GPIB)

- Do 15 uređaja (mernih instrumenata) dele paralelnu magistralu na koju se povezuju na red (daisy-chaining). Najsporiji uređaj određuje brzinu prenosa. Maksimalna brzina je oko 1Mbps u originalnom standardu, i oko 8Mbps u kasnijim proširenjima
- Magistrala se sastoji od 16 signalnih linija — 8 dvosmernih koje se koriste za razmenu podataka, tri za dogovaranje (handshake), i pet za nadgledanje (kontrolu) magistrale — uz 8 linija mase.

IEEE488 (GPIB)



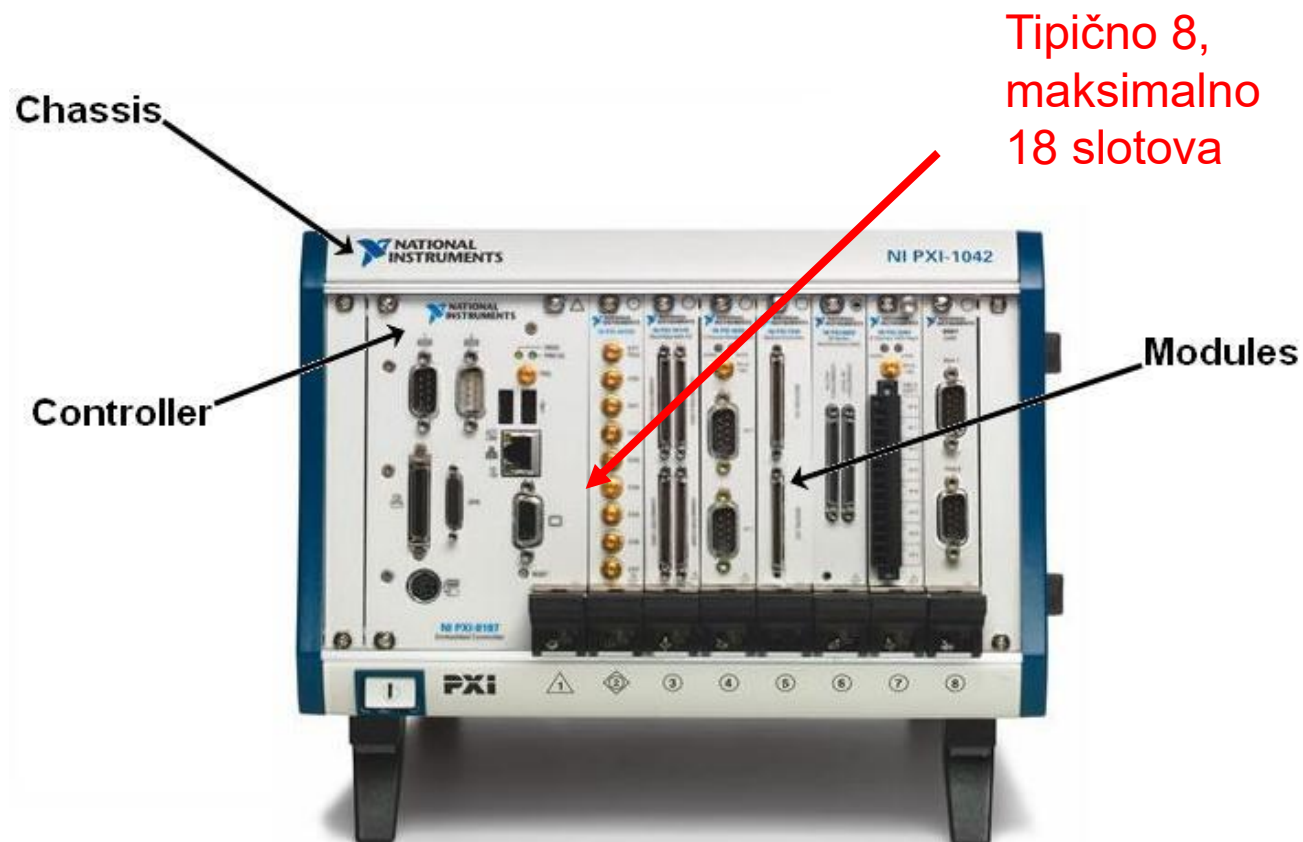
Copyright © 1999-2006 Artisan Scientific



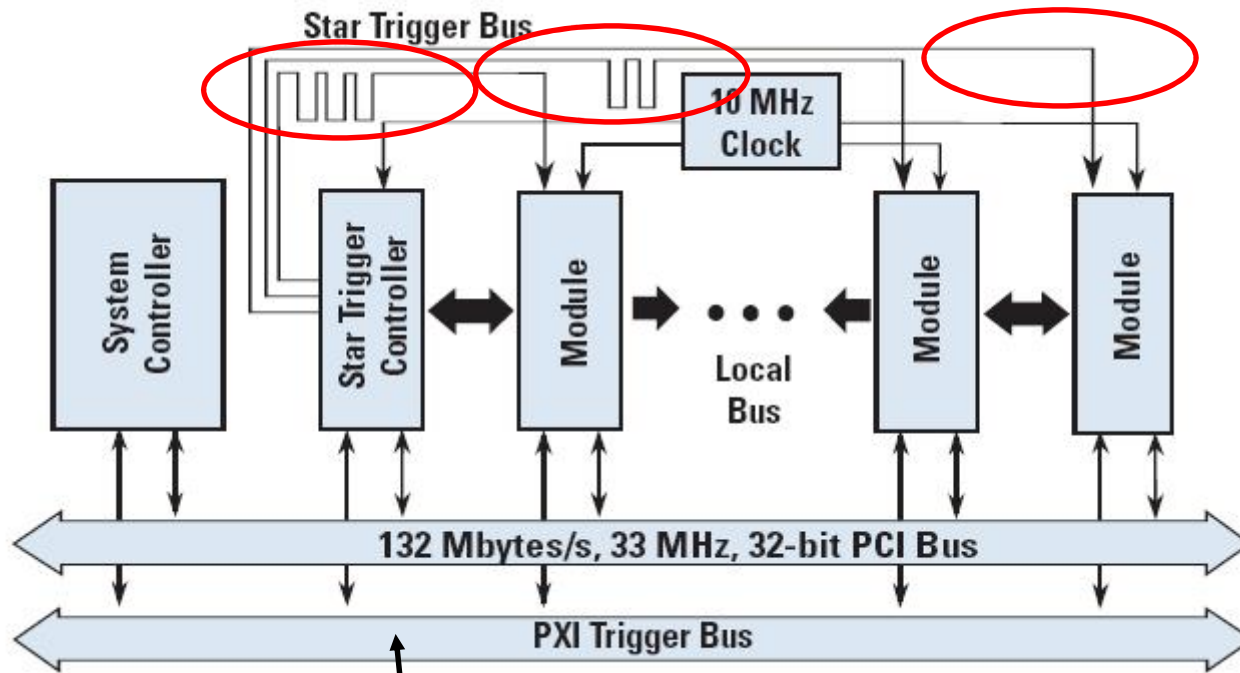
Pin 1	DIO1	Data input/output bit.
Pin 2	DIO2	Data input/output bit.
Pin 3	DIO3	Data input/output bit.
Pin 4	DIO4	Data input/output bit.
Pin 5	EOI	End-of-identify.
Pin 6	DAV	Data valid.
Pin 7	NRFD	Not ready for data.
Pin 8	NDAC	Not data accepted.
Pin 9	IFC	Interface clear.
Pin 10	SRQ	Service request.
Pin 11	ATN	Attention.
Pin 12	SHIELD	
Pin 13	DIO5	Data input/output bit.
Pin 14	DIO6	Data input/output bit.
Pin 15	DIO7	Data input/output bit.
Pin 16	DIO8	Data input/output bit.
Pin 17	REN	Remote enable.
Pin 18	GND	(wire twisted with DAV)
Pin 19	GND	(wire twisted with NRFD)
Pin 20	GND	(wire twisted with NDAC)
Pin 21	GND	(wire twisted with IFC)
Pin 22	GND	(wire twisted with SRQ)
Pin 23	GND	(wire twisted with ATN)
Pin 24	Logic ground	

PXI

- PCI eXtensions for Instrumentation



Arhitektura magistrale



8 deljenih linija

Kontrola externim računarom



Kontrola sopstvenim modulom



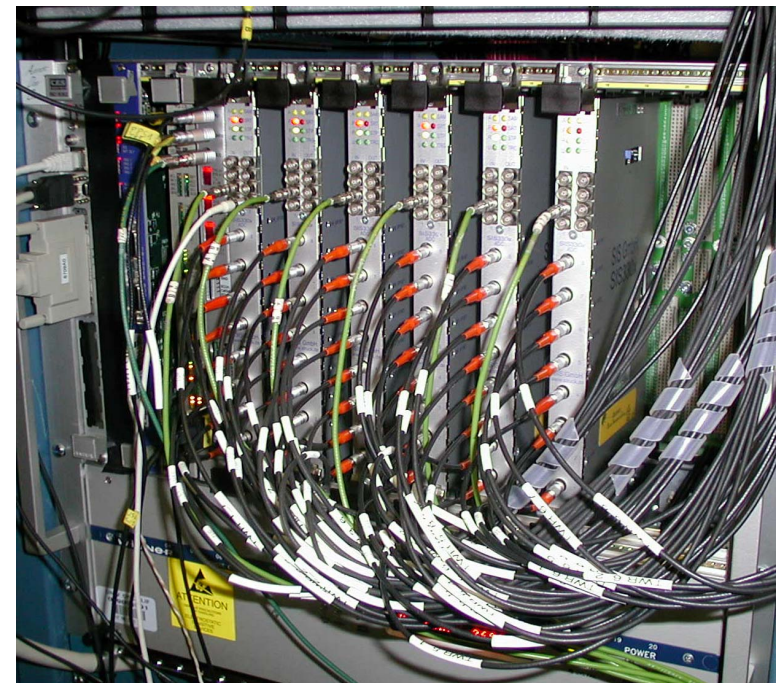
Tipovi akvizicionih modula

1150 tipova 2006. godine

- Analog Input and Output
- Boundary Scan
- Bus Interface & Communication
- Carrier Products
- Digital Input and Output
- Digital Signal Processing
- Functional Test and Diagnostics
- Image Acquisition
- Prototyping Boards
- Instruments
- Motion Control
- Power Supplies (PXI)
- Receiver Interconnect Devices
- Switching
- Timing Input and Output

VME (VersaModule Eurocard)

- Napravljen jos 1981, kao standard za back-plane sisteme
- U početku korišćen sa procesorom MC68000
- Podržava 64 bitnu magistralu sa tipičnom brzinom prenosa od 40Mbit/s



VXI (VMEbus eXtensions for Instrumentation)

- Razvijen 1988 kao unapređenje VMEbusa, dodatni magistralni signali za okidanje i sinhronizaciju



do 13 slotova

Pregled i poređenje komunikacionih interfejsa

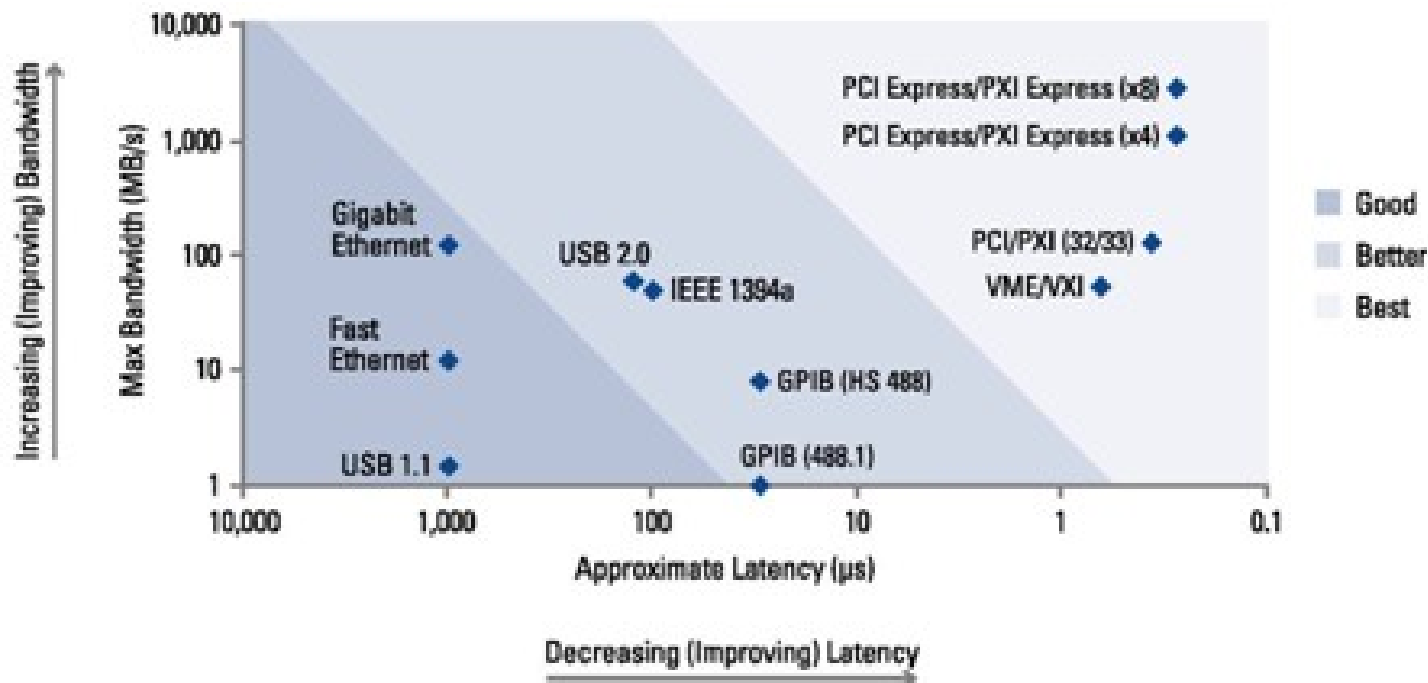


Figure 3: PXI and PXI Express provide the highest bandwidth and lowest latency