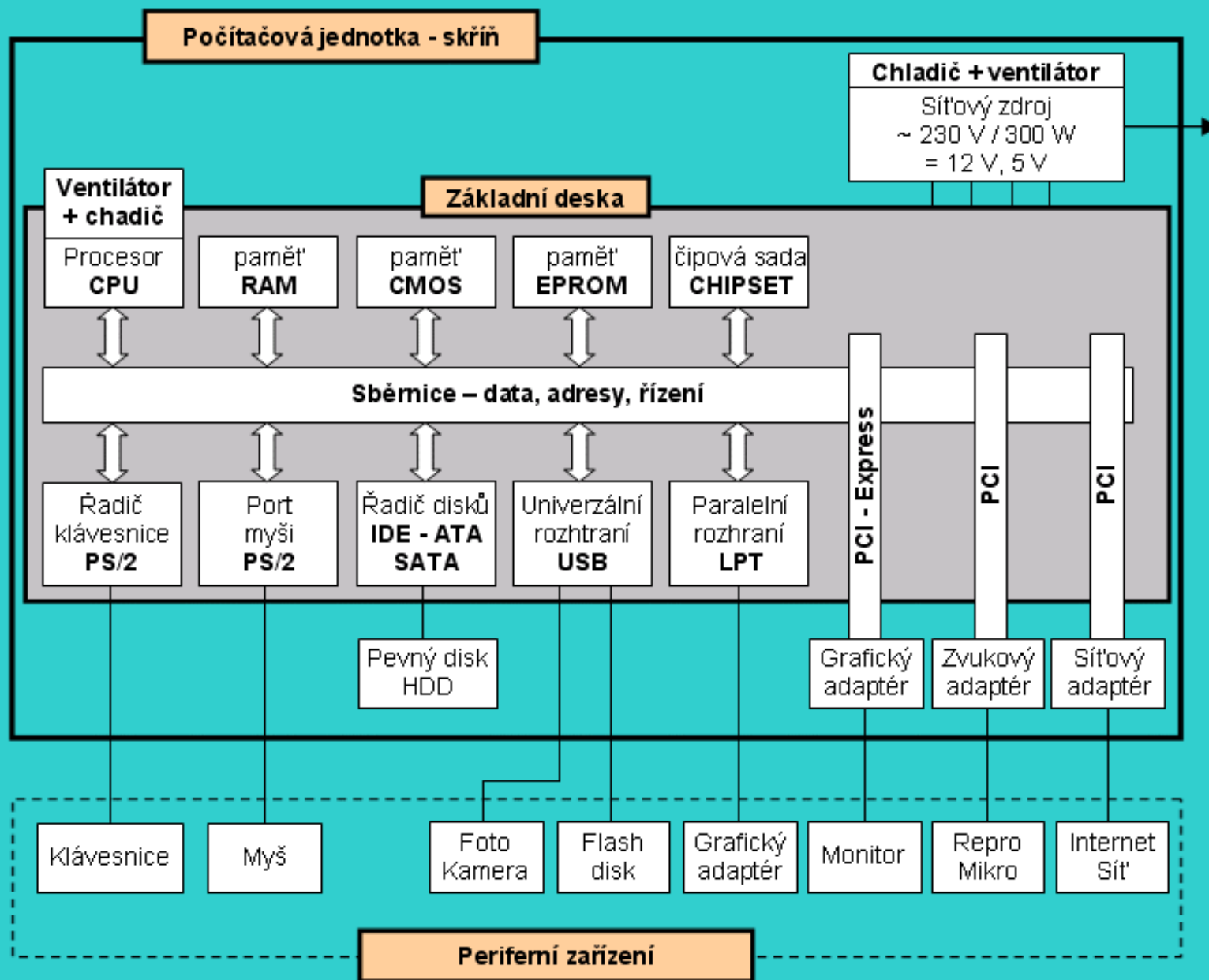
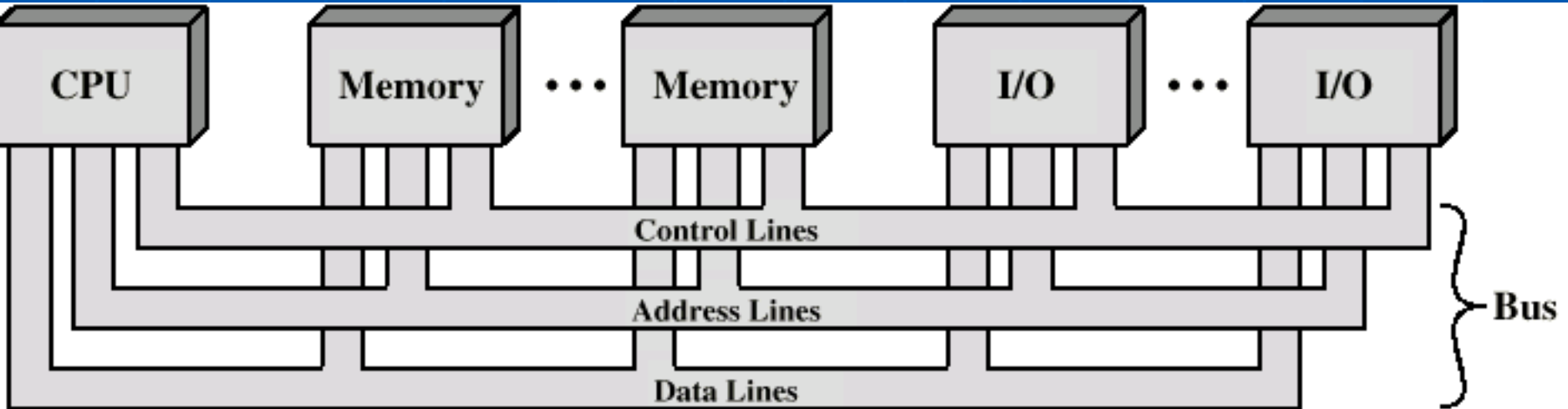


# Blokové schéma osobního počítače



# Sběrnice - funkce

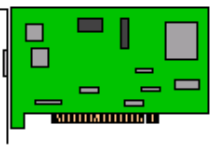
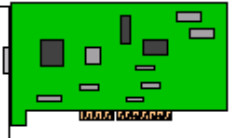
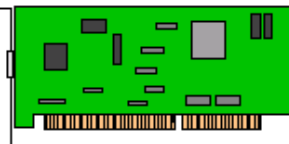
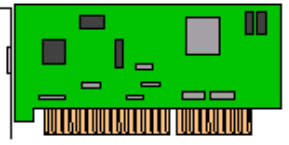
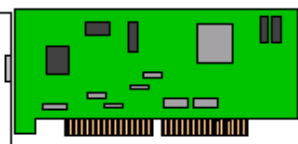
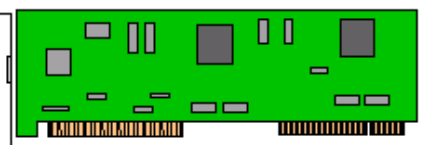


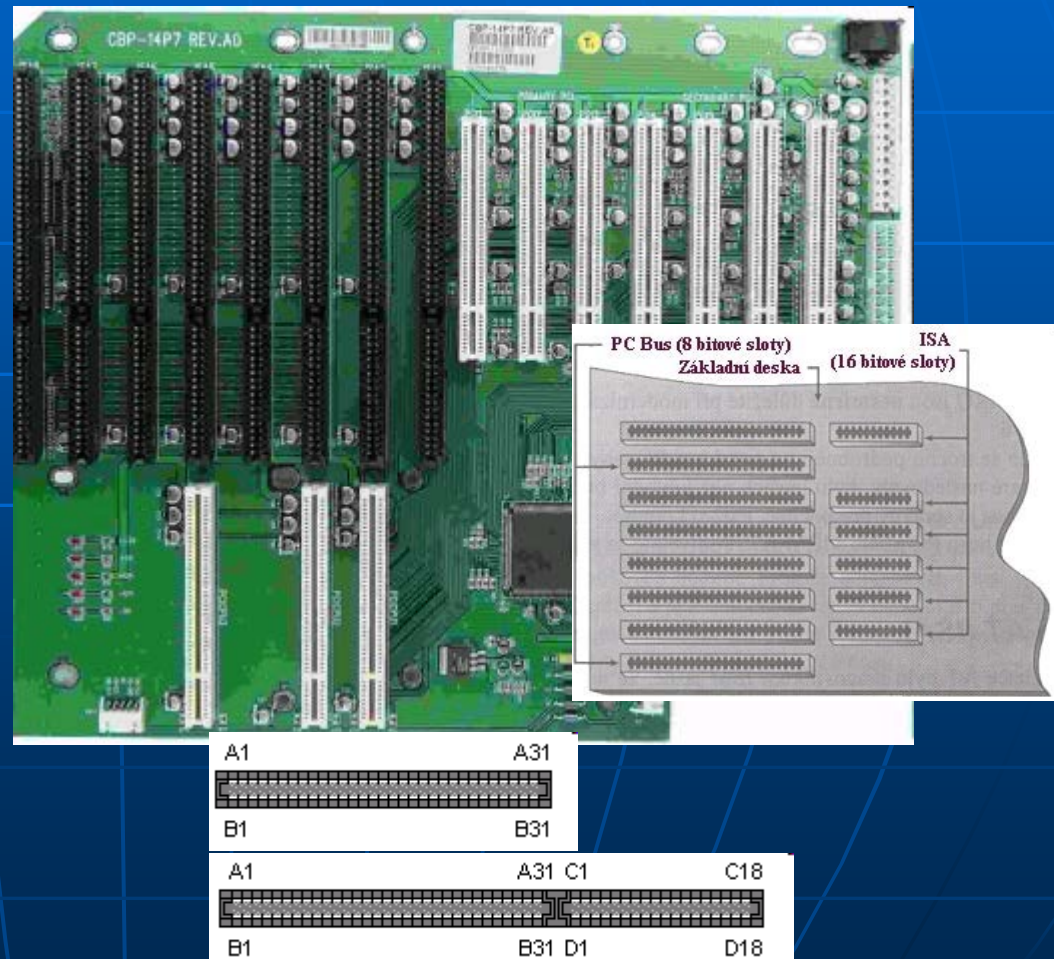
**Figure 3.16 Bus Interconnection Scheme**

# Sběrnice - rozdělení

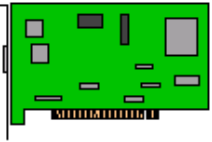
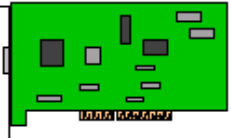
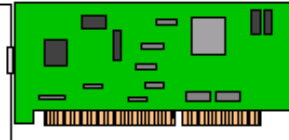
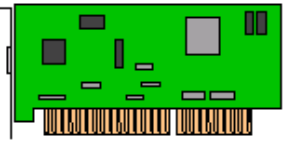
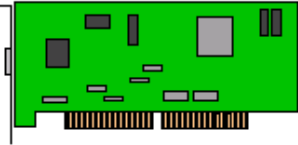
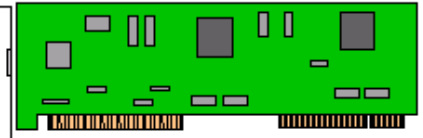
- **paralelní** & **sériové**  
PCI, PCI-X PCI Express, USB
- Typ přenosu dat – počet vodičů & způsob přenosu
- **interní** & **externí**  
■ ISA, PCI, PCI express & USB, FireWare
- **Lokální** & **universální**  
■ VL – Bus PCI

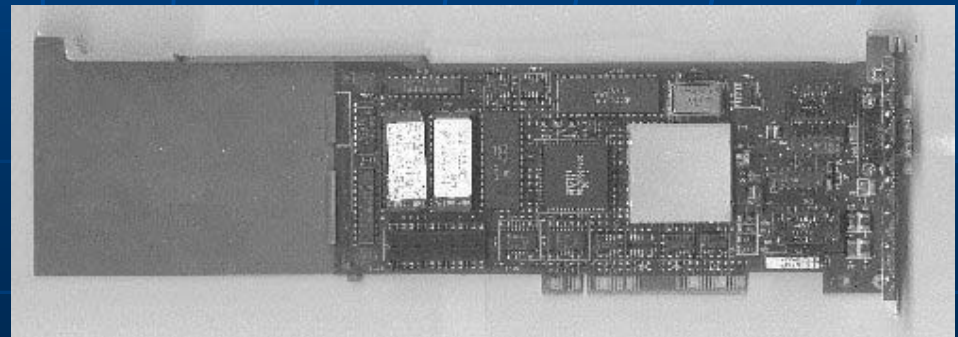
# Vývoj sběrníc PC

| PARALLEL PC BUSES                                                                                           | Bandwidth |            |
|-------------------------------------------------------------------------------------------------------------|-----------|------------|
|                                                                                                             | Bits      | Speed      |
| <b>PCI</b><br>             | 32<br>64  | 33MHz      |
| <b>AGP</b><br>             | 32        | 66-533 MHz |
| <b>ISA</b><br>             | 8<br>16   | 8-10 MHz   |
| <b>EISA</b><br>            | 32        | 8-10 MHz   |
| <b>Micro Channel</b><br> | 32        | 5-20 MHz   |
| <b>VL-bus</b><br>        | 32        | 40MHz      |

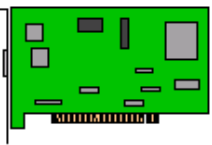
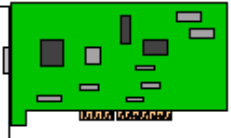
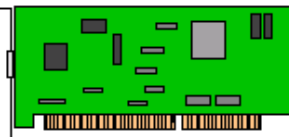
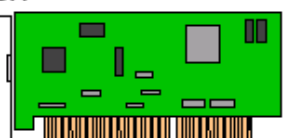
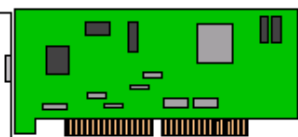
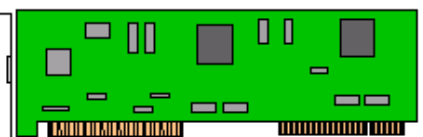


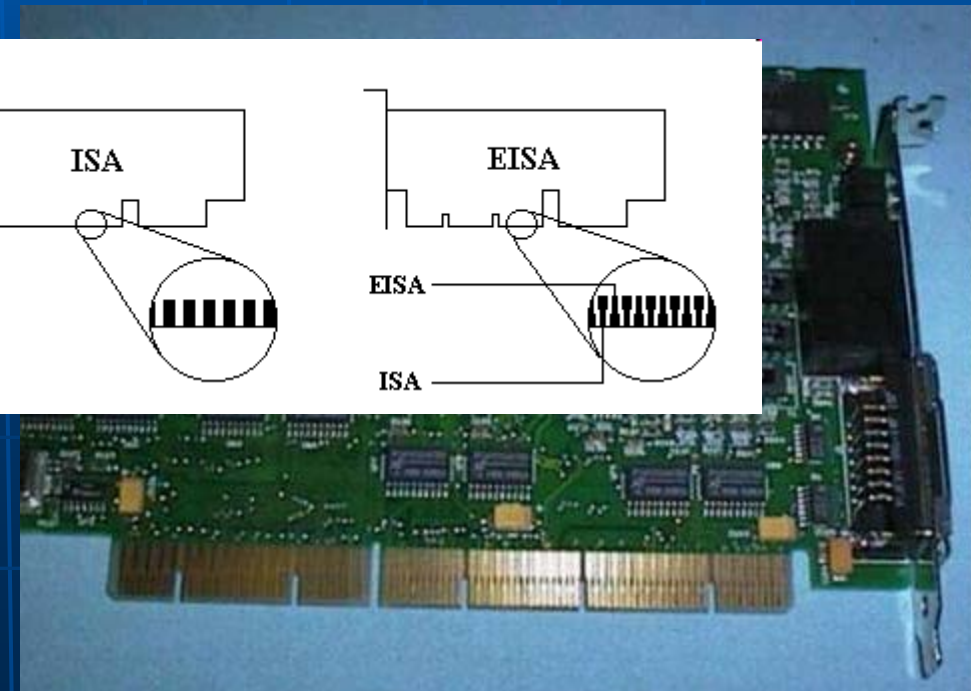
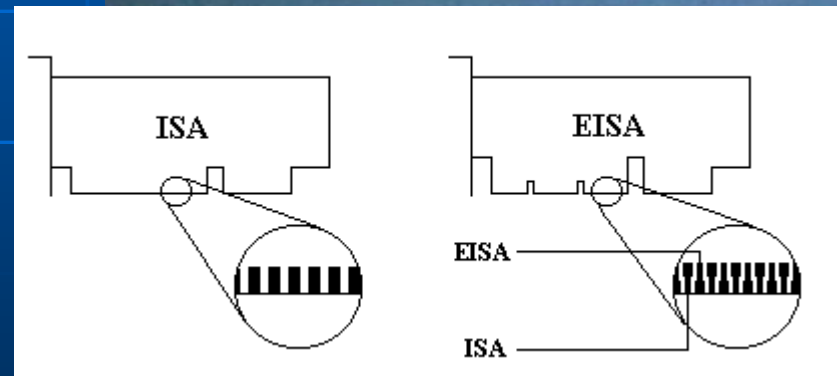
# Vývoj sběrníc PC

| PARALLEL PC BUSES                                                                                           | Bandwidth |               |
|-------------------------------------------------------------------------------------------------------------|-----------|---------------|
|                                                                                                             | Bits      | Speed         |
| <b>PCI</b><br>             | 32<br>64  | 33MHz         |
| <b>AGP</b><br>             | 32        | 66-533<br>MHz |
| <b>ISA</b><br>             | 8<br>16   | 8-10<br>MHz   |
| <b>EISA</b><br>            | 32        | 8-10<br>MHz   |
| <b>Micro Channel</b><br> | 32        | 5-20<br>MHz   |
| <b>VL-bus</b><br>        | 32        | 40MHz         |



# Vývoj sběrníc PC

| PARALLEL PC BUSES                                                                                           | Bandwidth |            |
|-------------------------------------------------------------------------------------------------------------|-----------|------------|
|                                                                                                             | Bits      | Speed      |
| <b>PCI</b><br>             | 32<br>64  | 33MHz      |
| <b>AGP</b><br>             | 32        | 66-533 MHz |
| <b>ISA</b><br>             | 8<br>16   | 8-10 MHz   |
| <b>EISA</b><br>            | 32        | 8-10 MHz   |
| <b>Micro Channel</b><br> | 32        | 5-20 MHz   |
| <b>VL-bus</b><br>        | 32        | 40MHz      |

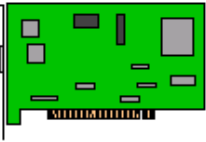




# Vývoj sběrníc PC

## PARALLEL PC BUSES

### PCI



#### Bandwidth

Bits

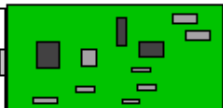
Speed

32

33MHz

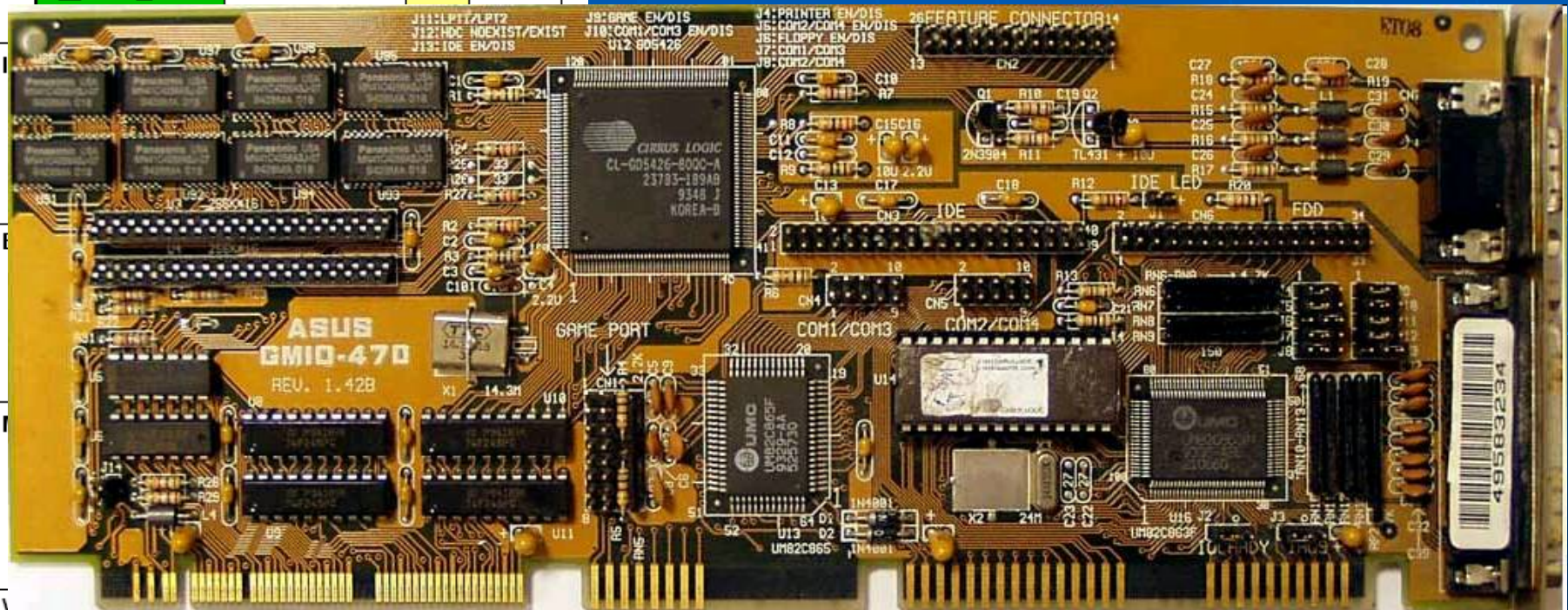
64

### AGP



32

66-533  
MHz



80A 80A 20A

1A

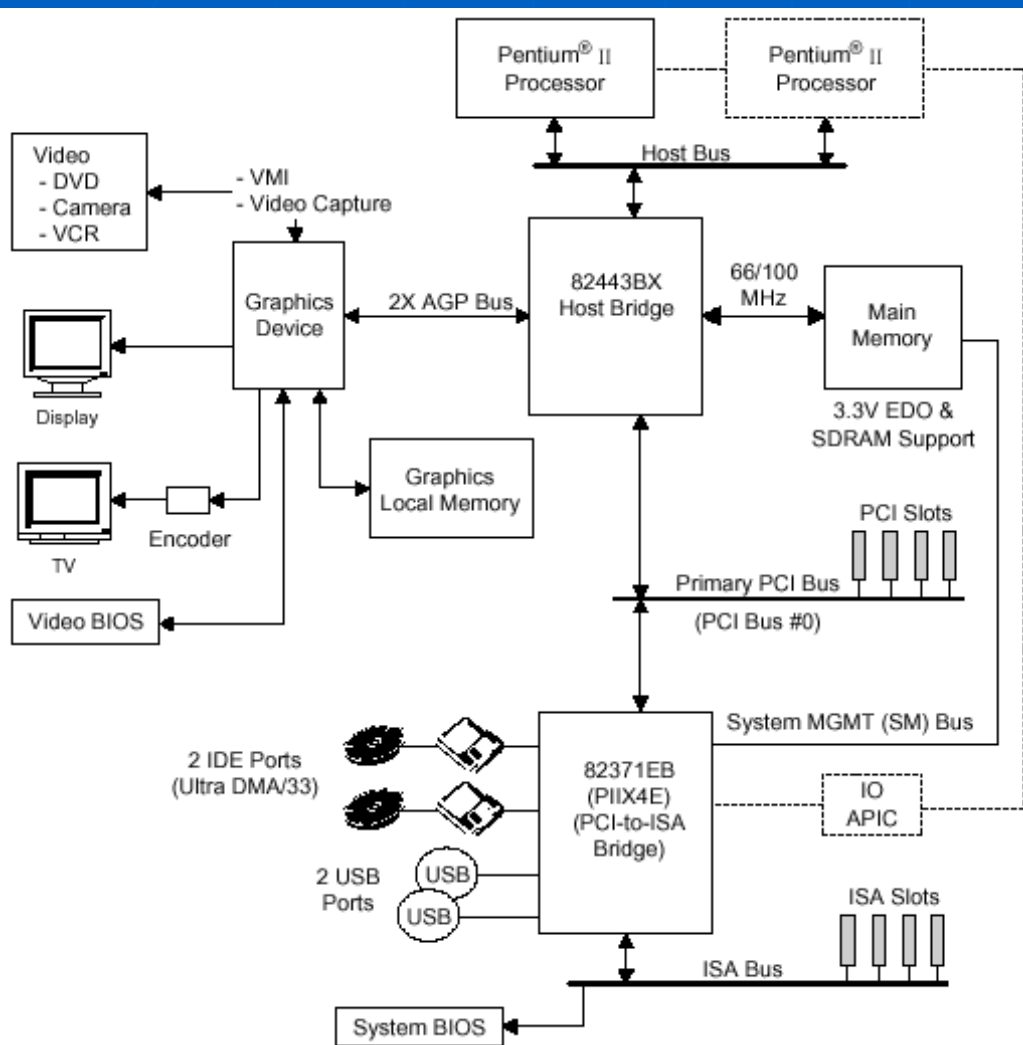


82B 84B 24B

1B

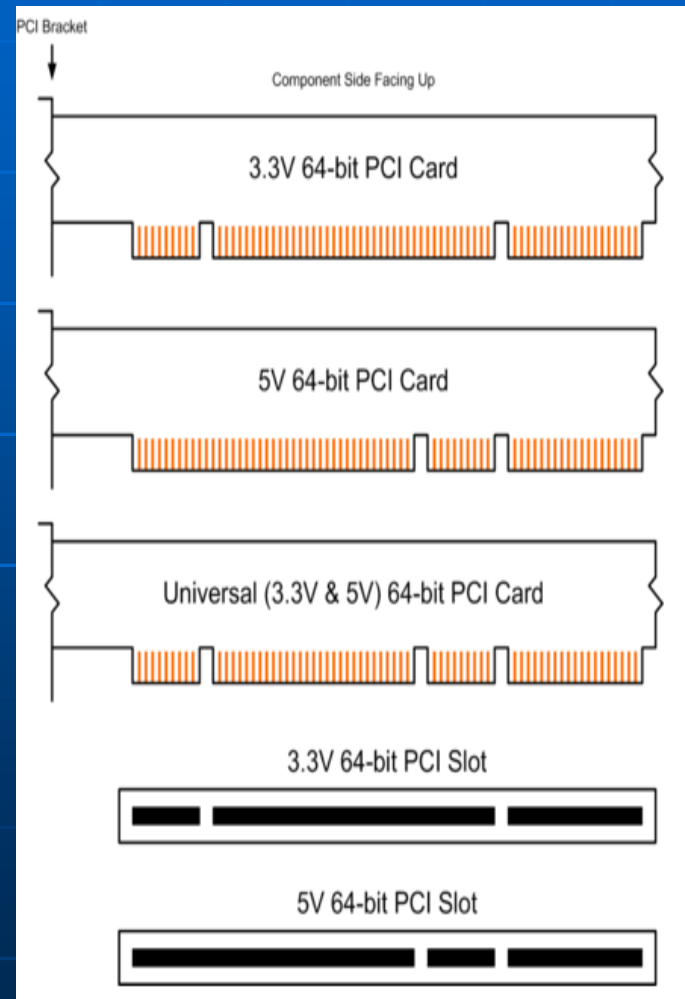
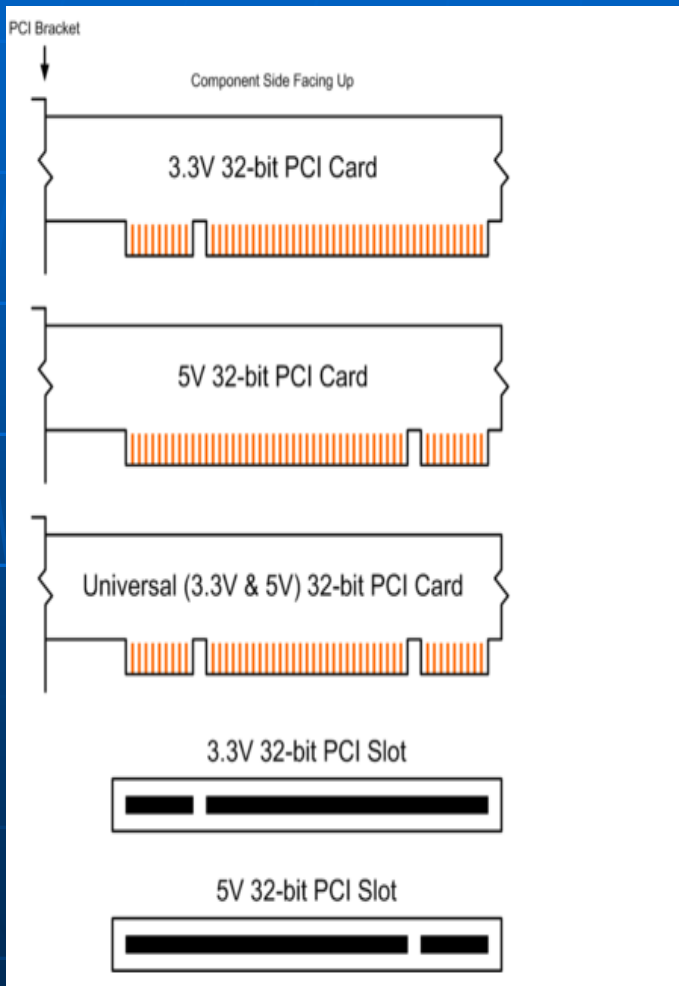


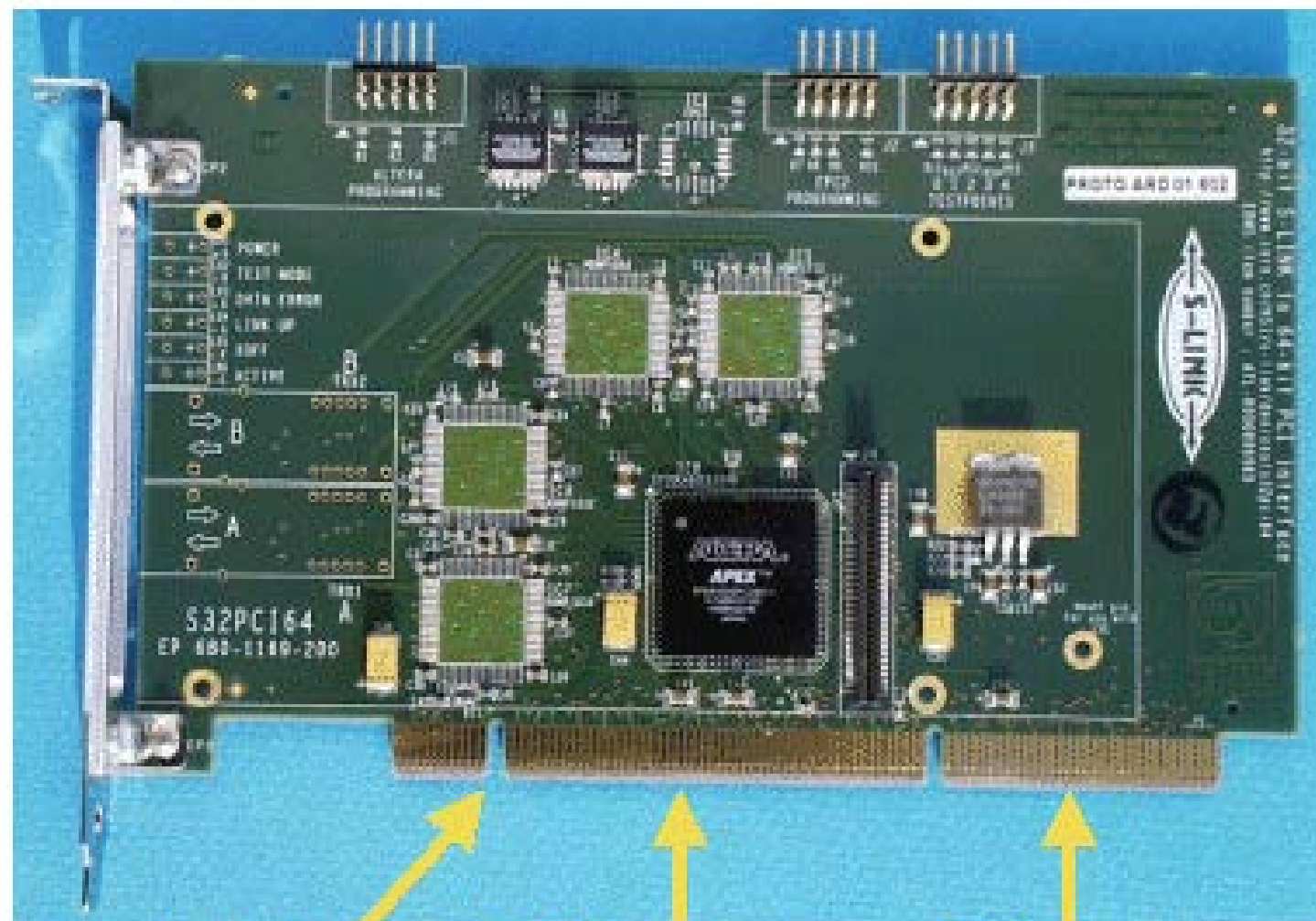
# Základní podoba architektury PC se sběrnicí PCI





# Varianty sběrnic PCI



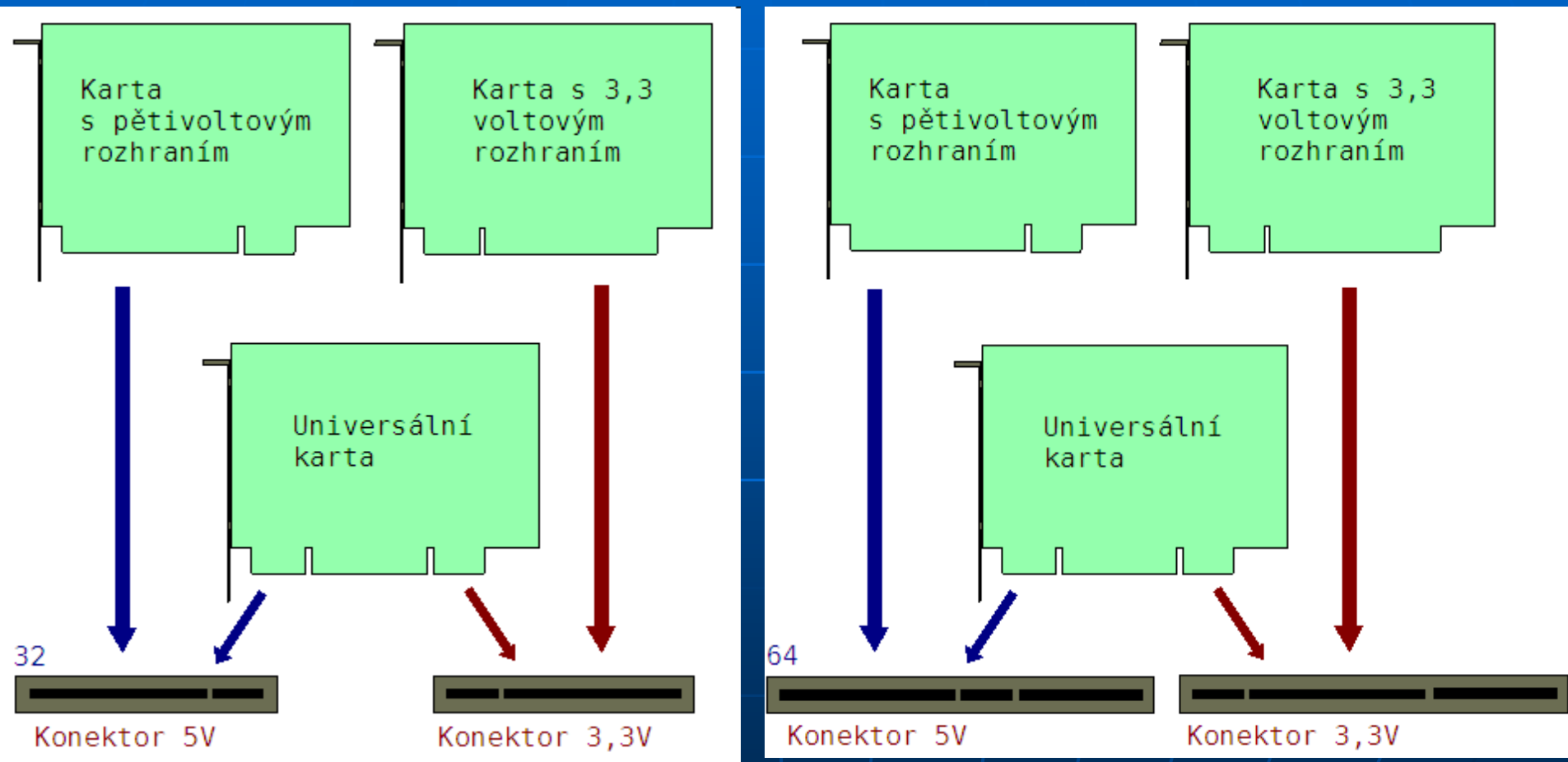


Klíč pro  
3,3  
voltové  
rozhraní

Oblast  
rozhraní 32  
bitů

Oblast  
rozhraní 64  
bitů

# Varianty sběrnic PCI



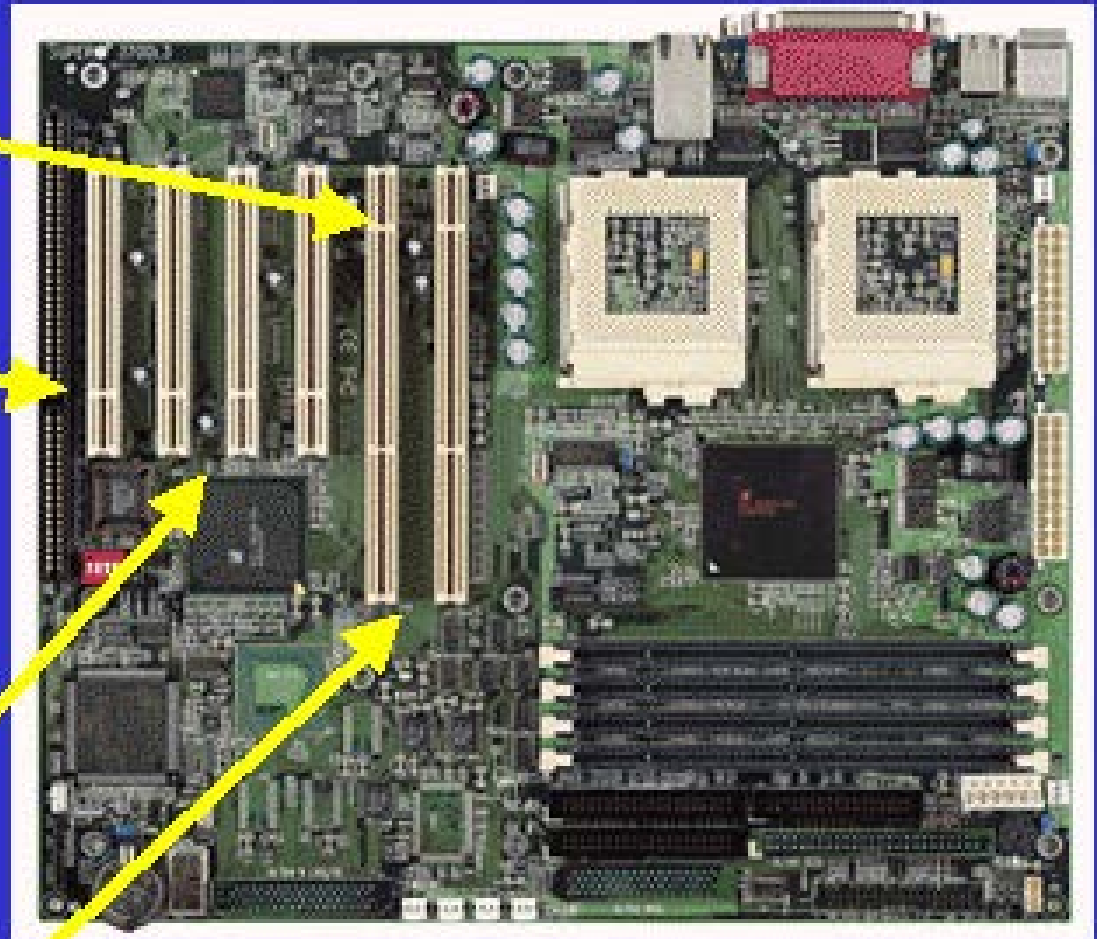
## Strana konektorů

Klíč pro rozhraní  
3,3 voltů

Klíč pro rozhraní  
5 voltů

Čtveřice slotů pro 32  
bitové PCI karty

Dvojice slotů pro 64  
bitové PCI karty



# Verze PCI - X





# Typy PCI a PCI - X

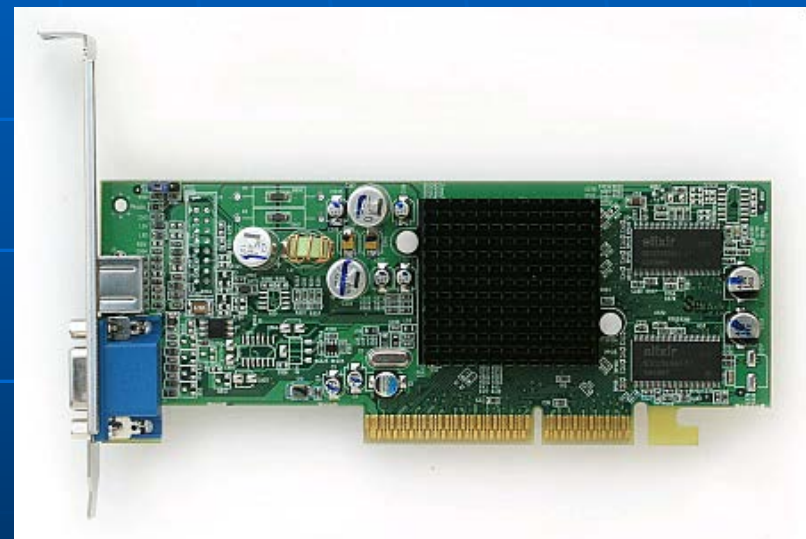
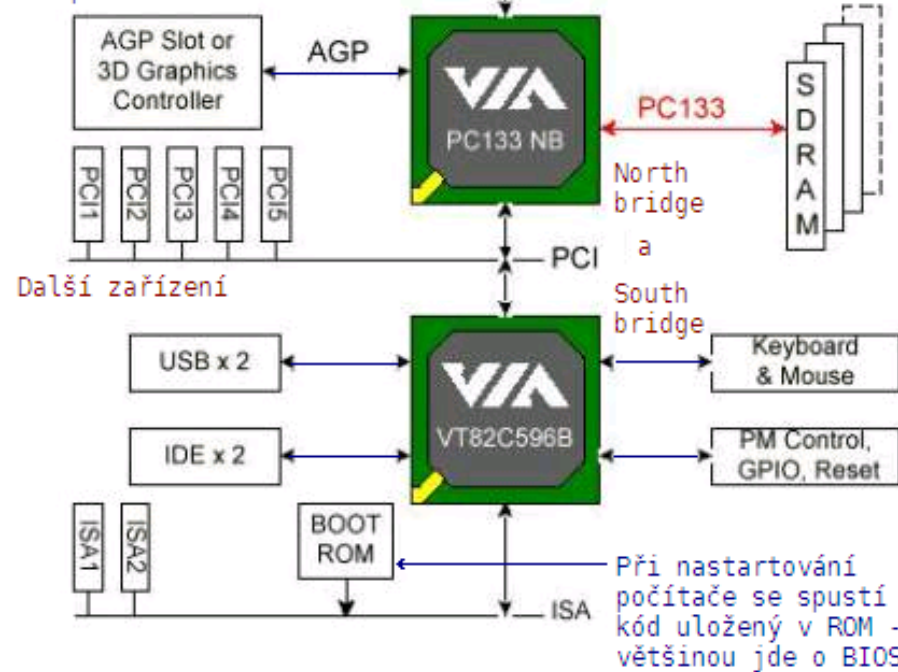
| Typ sběrnice            | PCI - 33  |     | PCI - 66  |     | PCI-X 66 |     | PCI-X 133 |      | PCI-X 266     |      |      | PCI-X 533     |      |      |
|-------------------------|-----------|-----|-----------|-----|----------|-----|-----------|------|---------------|------|------|---------------|------|------|
| Počet datových bitů     | 32        | 64  | 32        | 64  | 32       | 64  | 32        | 64   | 16            | 32   | 64   | 16            | 32   | 64   |
| Počet pinů              | 49        | 81  | 49        | 81  | 50       | 82  | 50        | 82   | 36            | 50   | 82   | 36            | 50   | 82   |
| Přenosová rychlost MB/s | 133       | 266 | 266       | 533 | 266      | 533 | 533       | 1066 | 533           | 1066 | 2133 | 1066          | 2133 | 4266 |
| Napájecí napětí         | 5V, 3,3 V |     | 5V, 3,3 V |     | 3,3 V    |     | 3,3 V     |      | 1,5 V a 3,3 V |      |      | 1,5 V a 3,3 V |      |      |

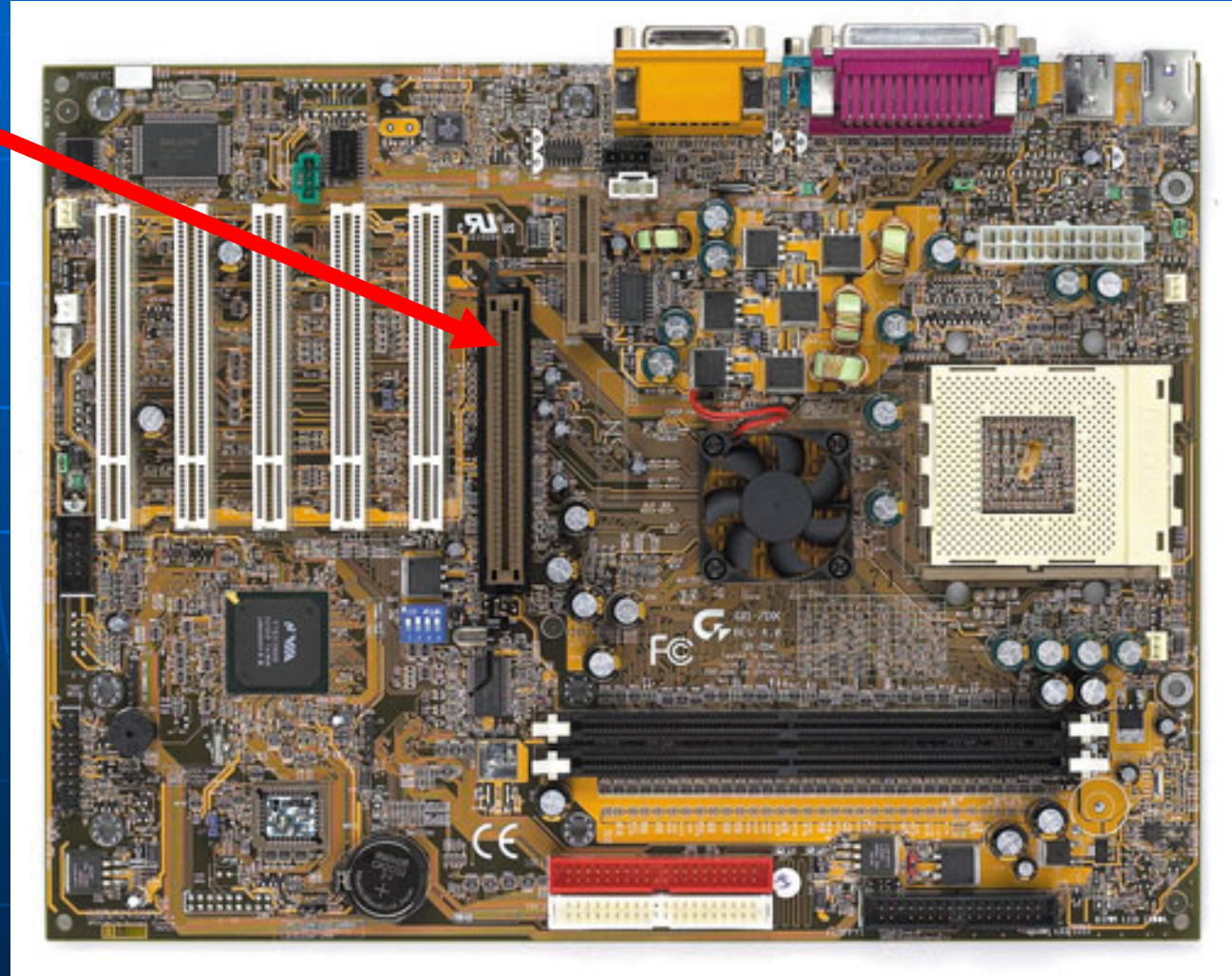
Grafická karta  
je v tomto  
případě  
připojena přes  
AGP port

Místo pro  
připojení  
mikroprocesoru

Slot-1 or Socket-370

Operační  
paměť  
připojená  
přes  
zvláštní  
sběrnici



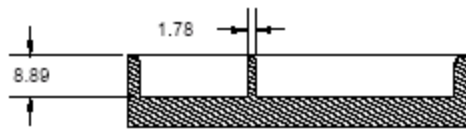


# Verze AGP a jejich vzájemná kompatibilita

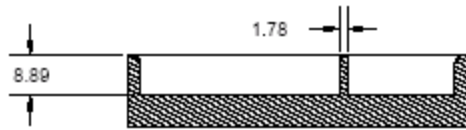
| Verze   | Podporované rychlosti | Úroveň signálů                    |
|---------|-----------------------|-----------------------------------|
| AGP 1.0 | 1× 2×                 | 3,3 V                             |
| AGP 2.0 | 1× 2× 4×              | 3,3 V nebo 1,5 V                  |
| AGP Pro | 1× 2× 4×              | 3,3 V nebo 1,5 V                  |
| AGP 3.0 | 1× 2× 4× 8×           | 1,5 V ovšem pro rychlost 8× 0,8 V |

| Označení | Hodinová frekvence | Režim přenosu      | Výsledná rychlost |
|----------|--------------------|--------------------|-------------------|
| AGP 1×   | 66 MHz             | 32 bitů za takt    | 266 MB.s-1        |
| AGP 2×   | 66 MHz             | 2× 32 bitů za takt | 533 MB.s-1        |
| AGP 4×   | 66 MHz             | 4× 32 bitů za takt | 1066 MB.s-1       |
| AGP 8×   | 66 MHz             | 8× 32 bitů za takt | 2133 MB.s-1       |

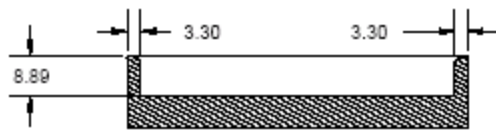




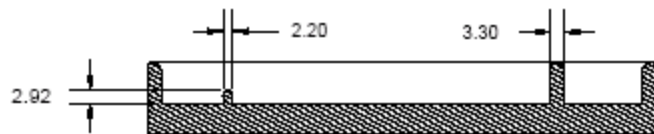
AGP 3.3V



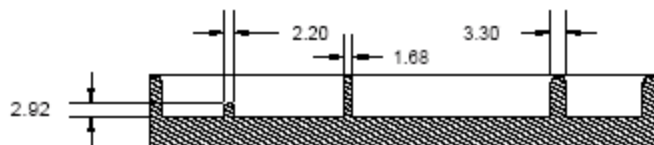
AGP 1.5V



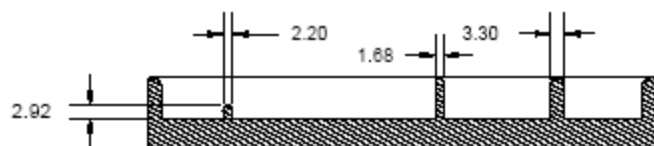
AGP UNIVERSAL



AGP Pro UNIVERSAL



AGP Pro 3.3V



AGP Pro 1.5V



1.5V  
Slot



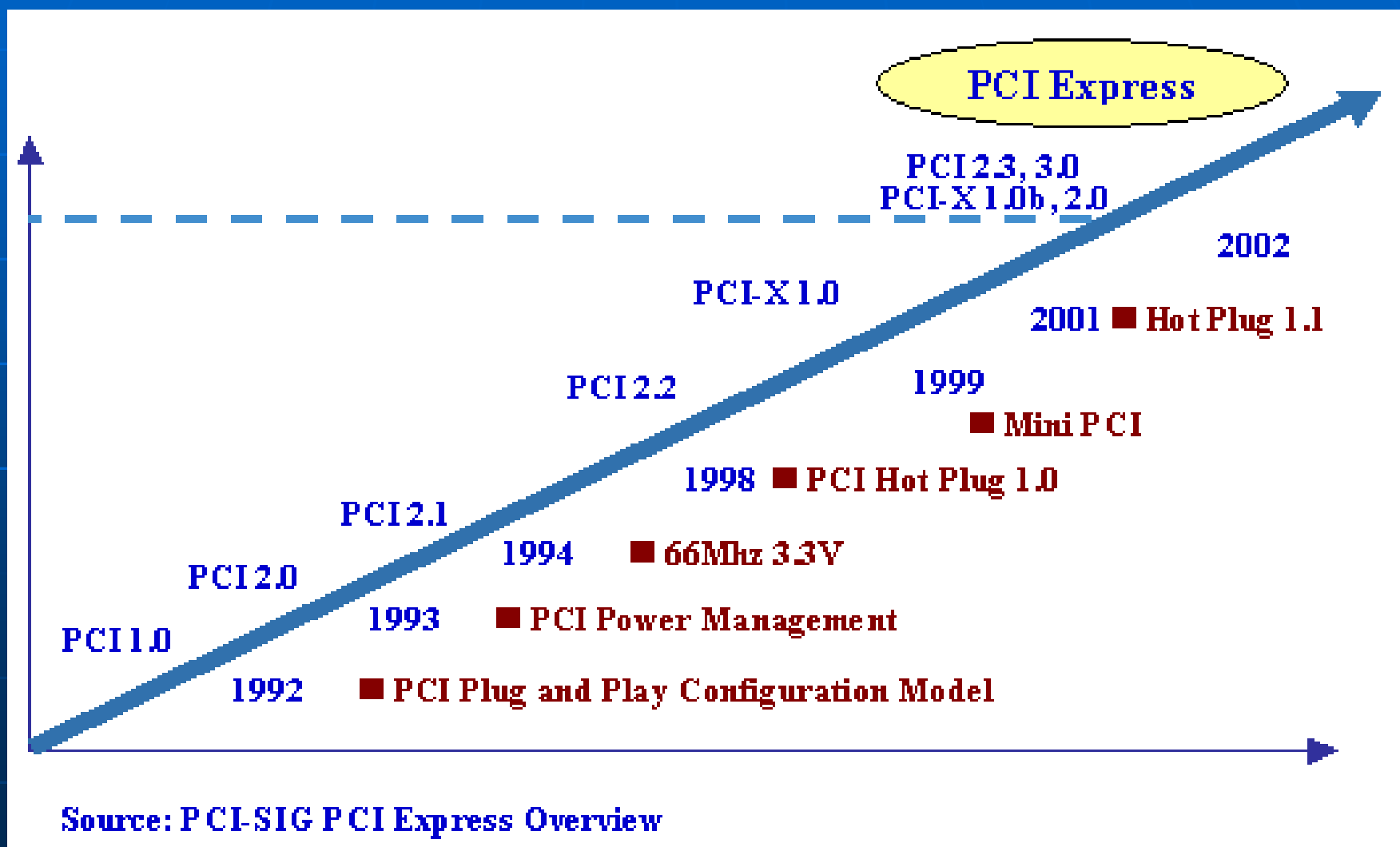
3.3V  
Slot



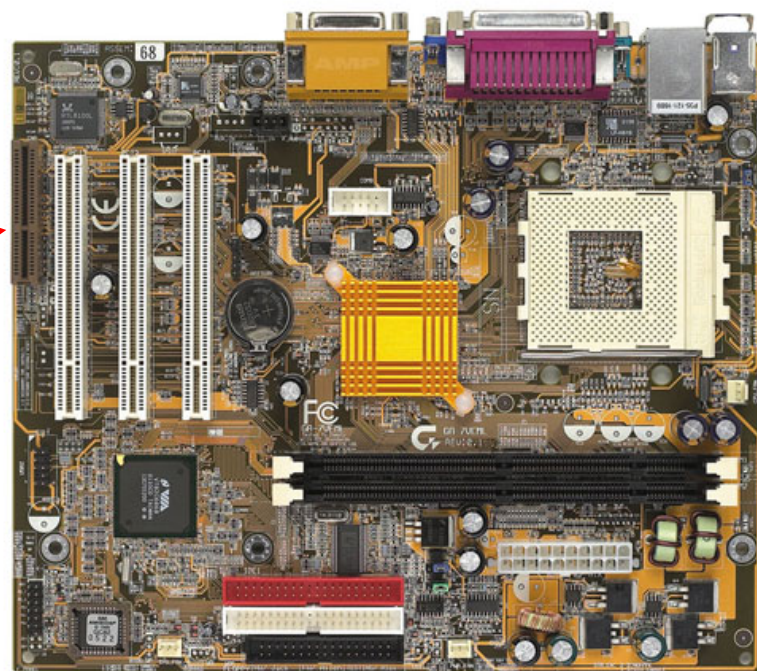
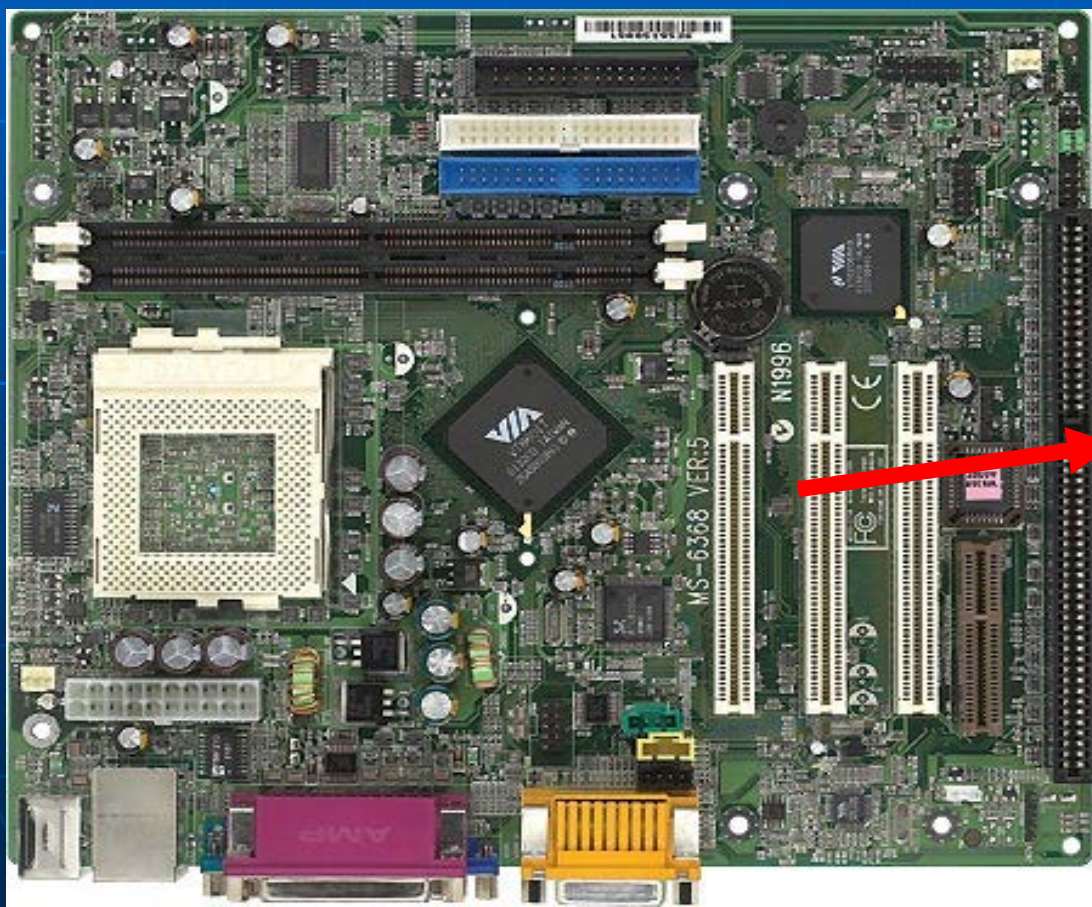
3.3V 1.5V



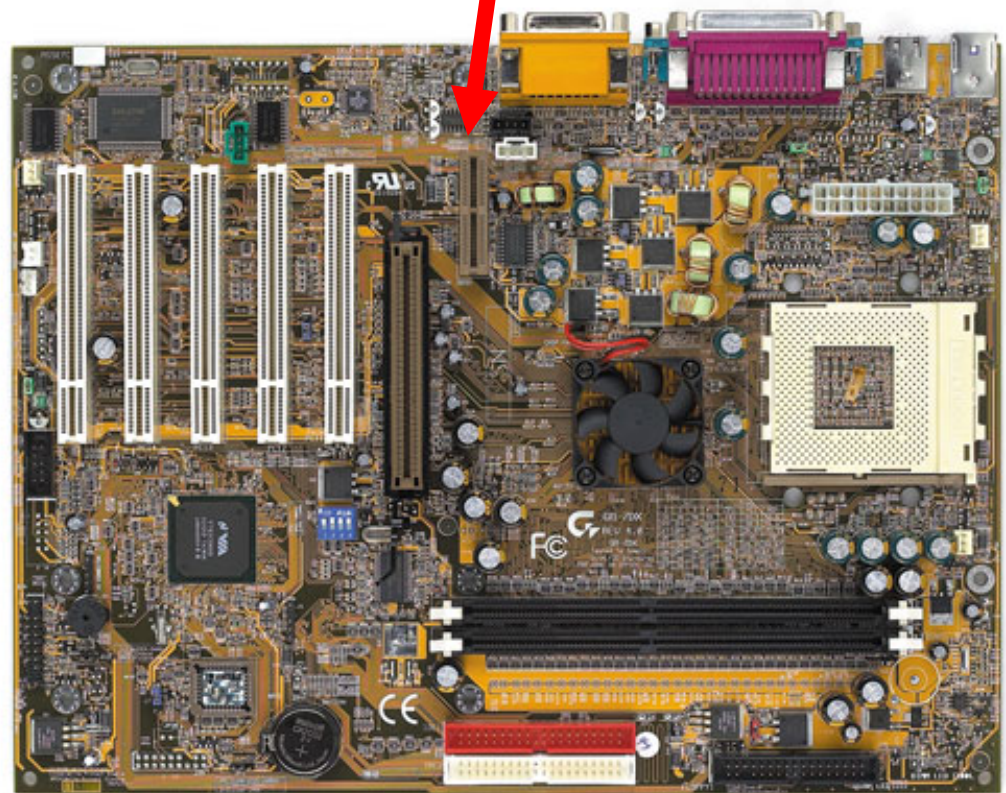
# Postupný vývoj sběrníc PCI, PCI-X a PCI Express



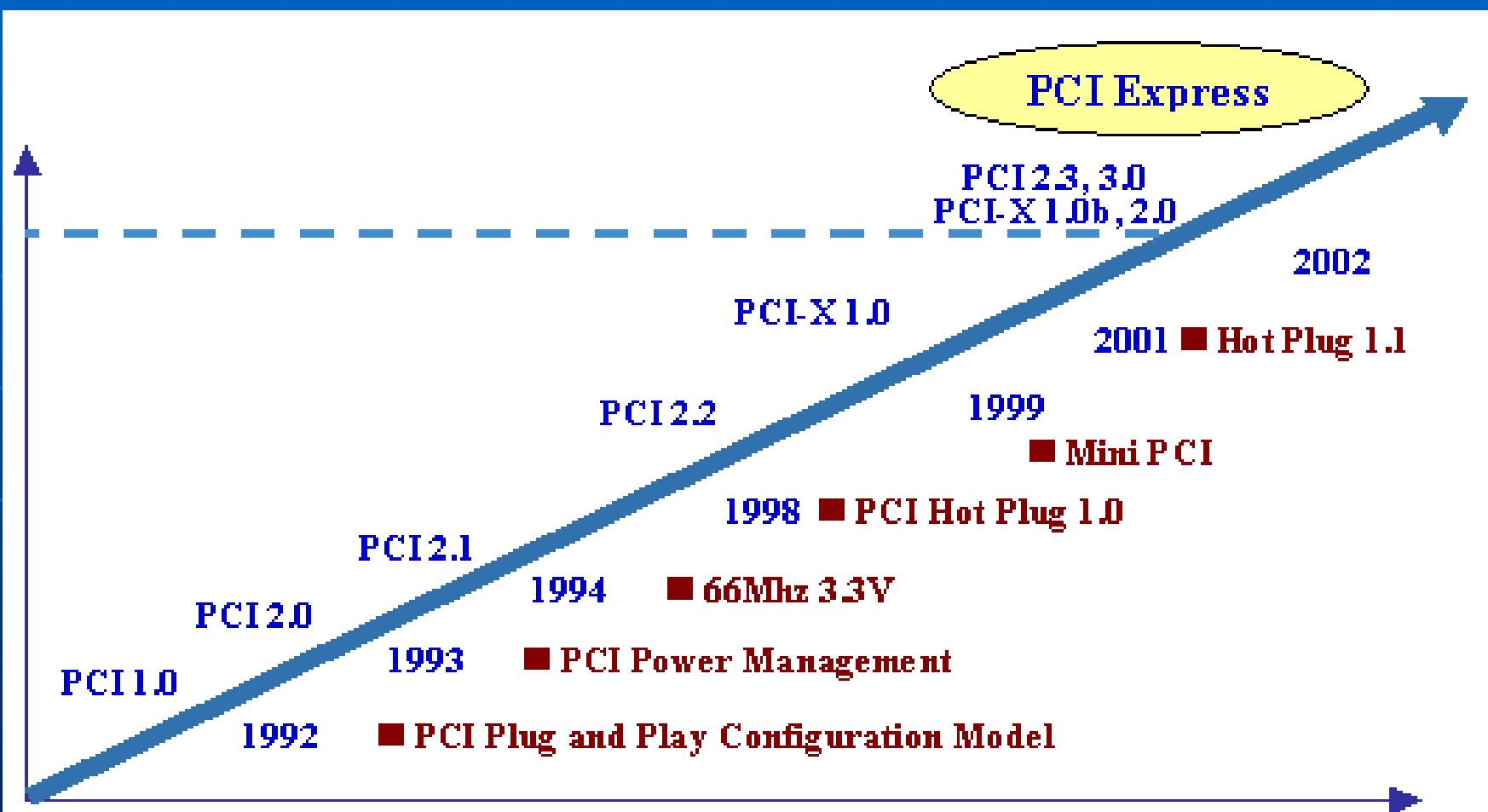
# Další sběrnice - AMR, CNR, ACR





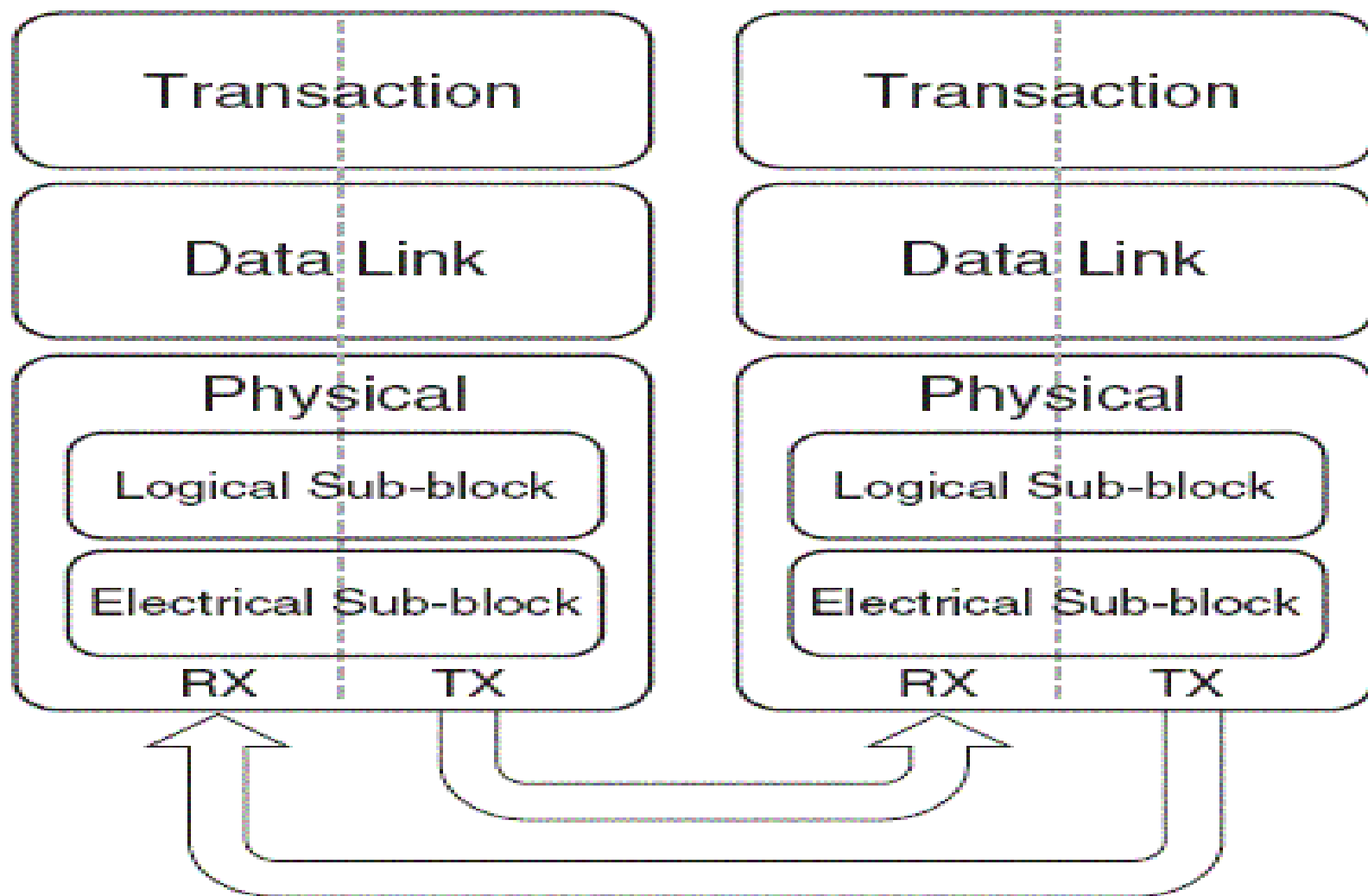


# Postupný vývoj sběrníc PCI, PCI-X a PCI Express



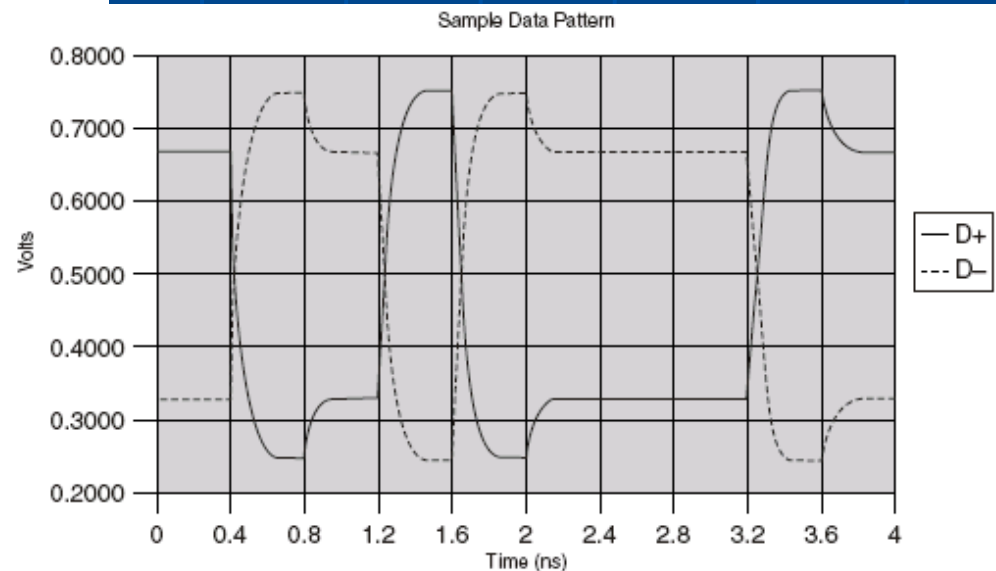
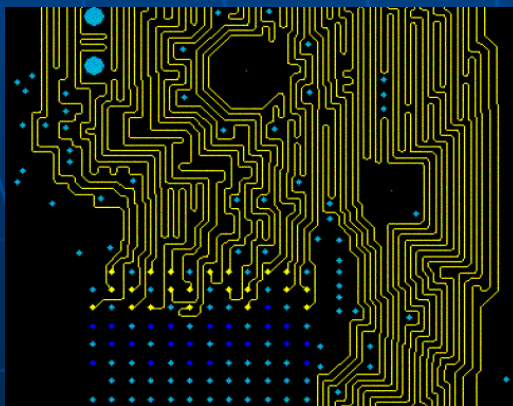
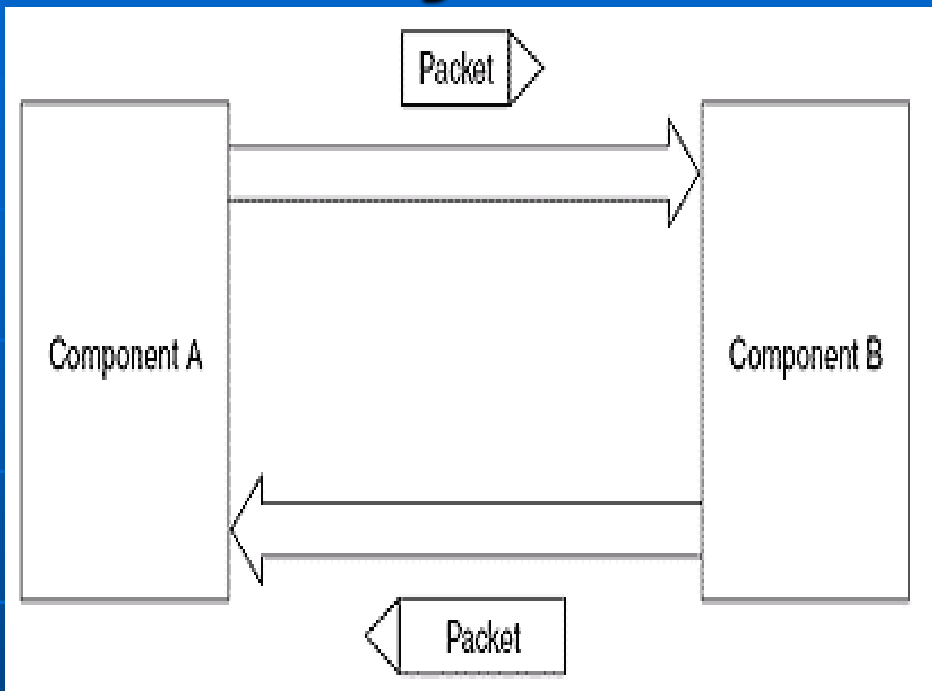
Source: PCI-SIG PCI Express Overview

# Vrstvy sběrnice PCI Express

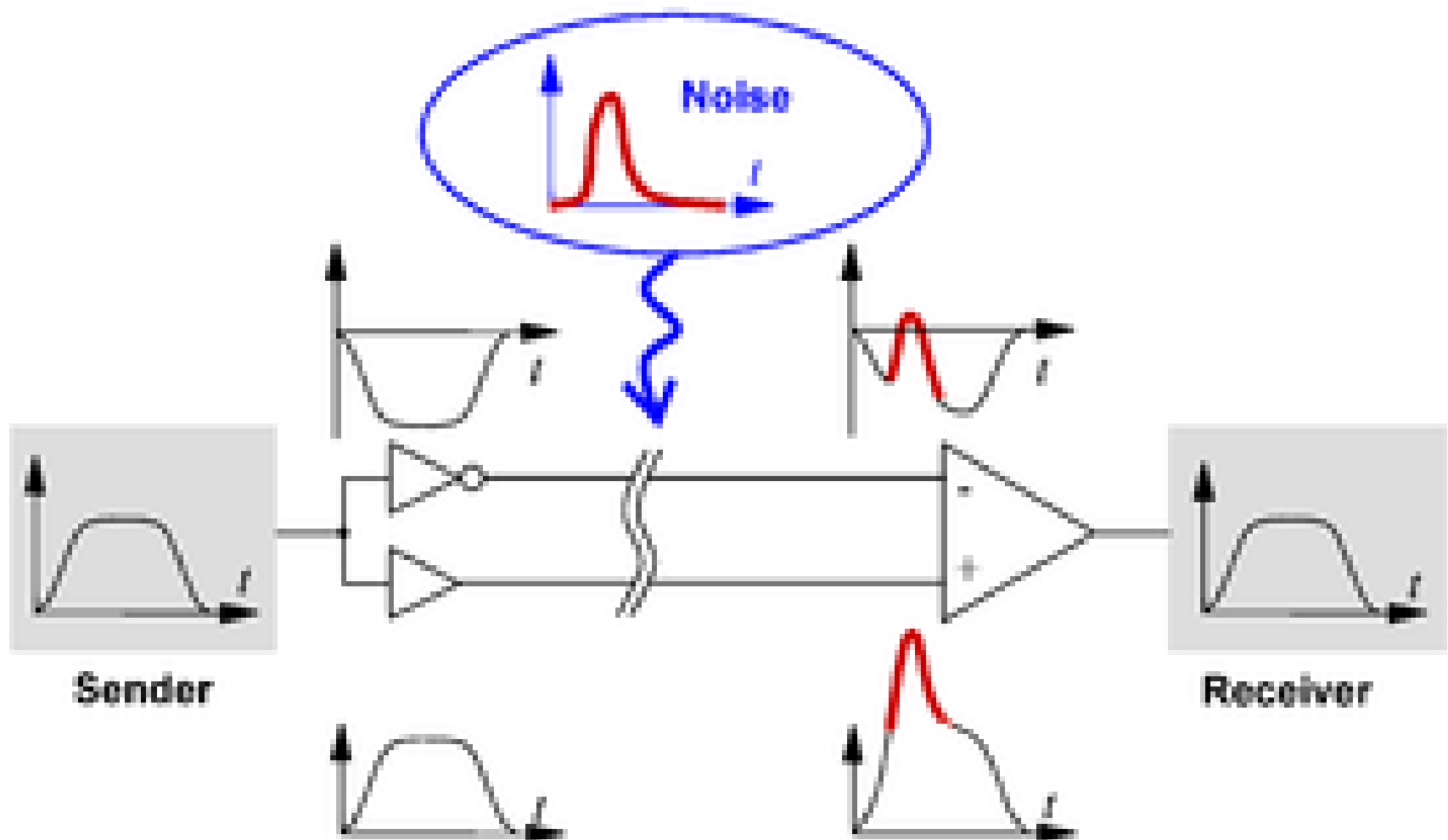




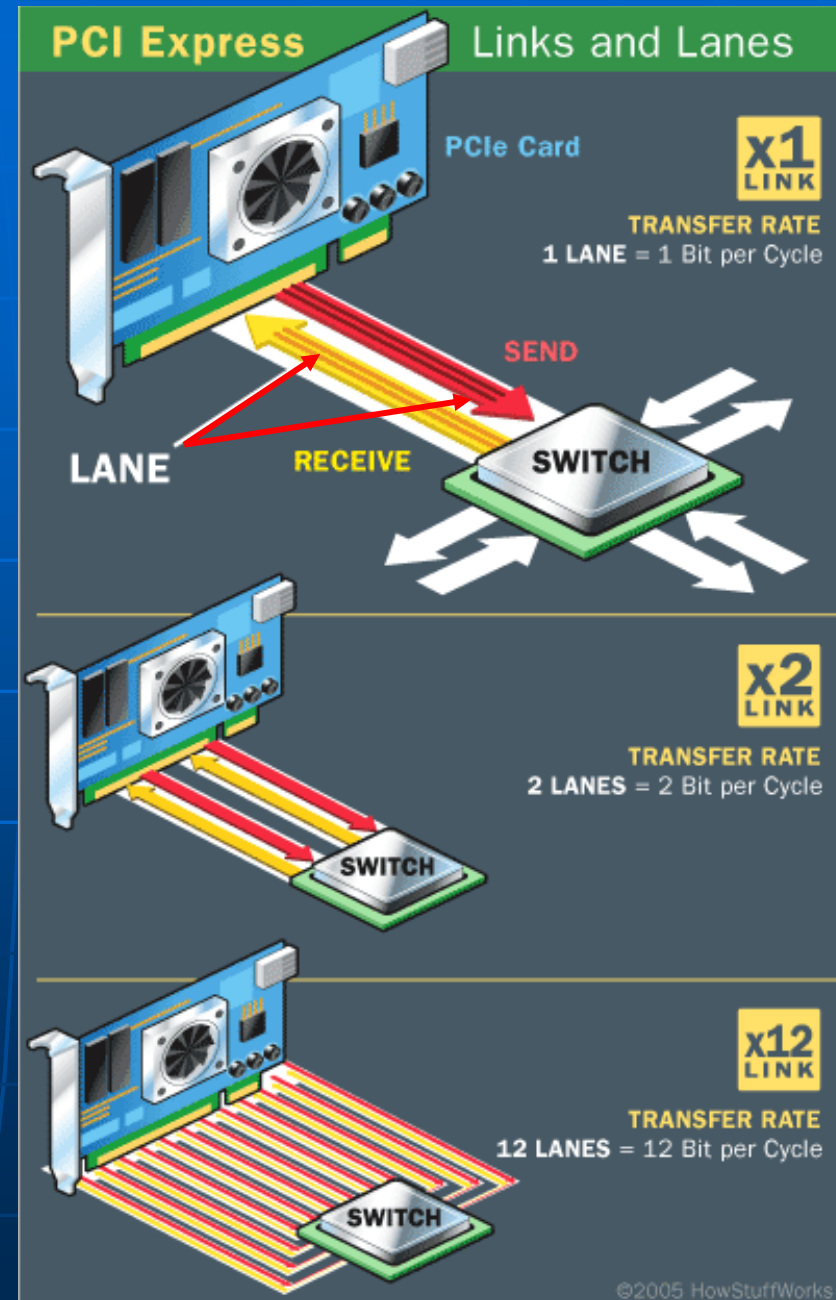
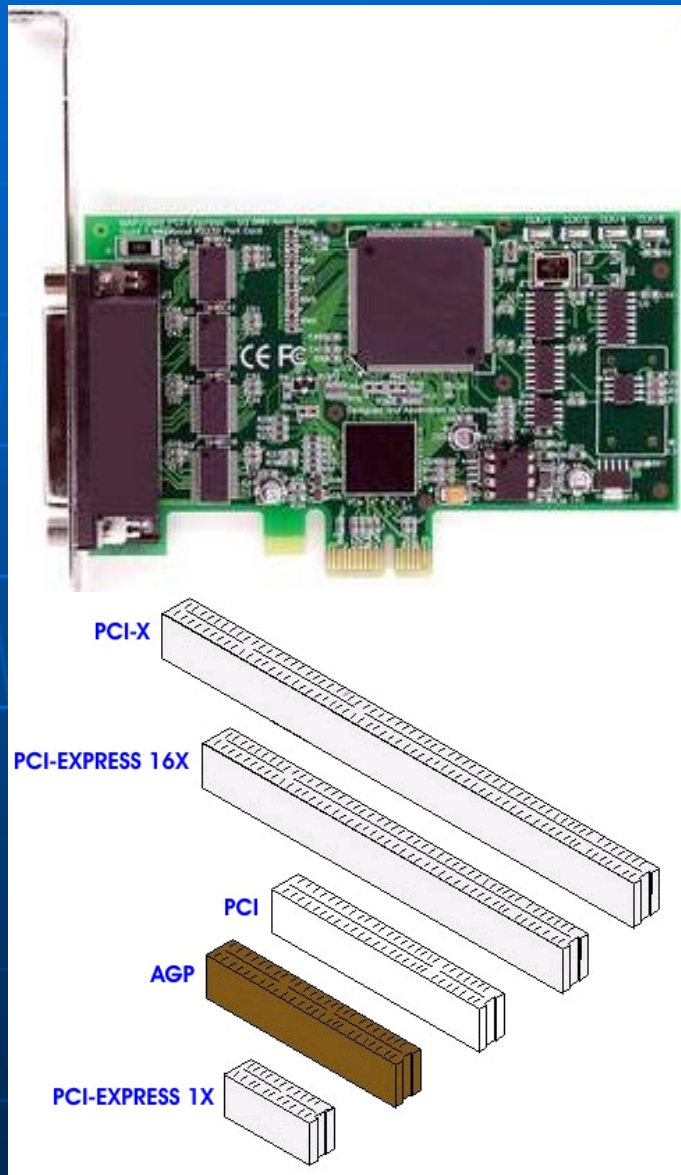
# Základy technologie PCI Express

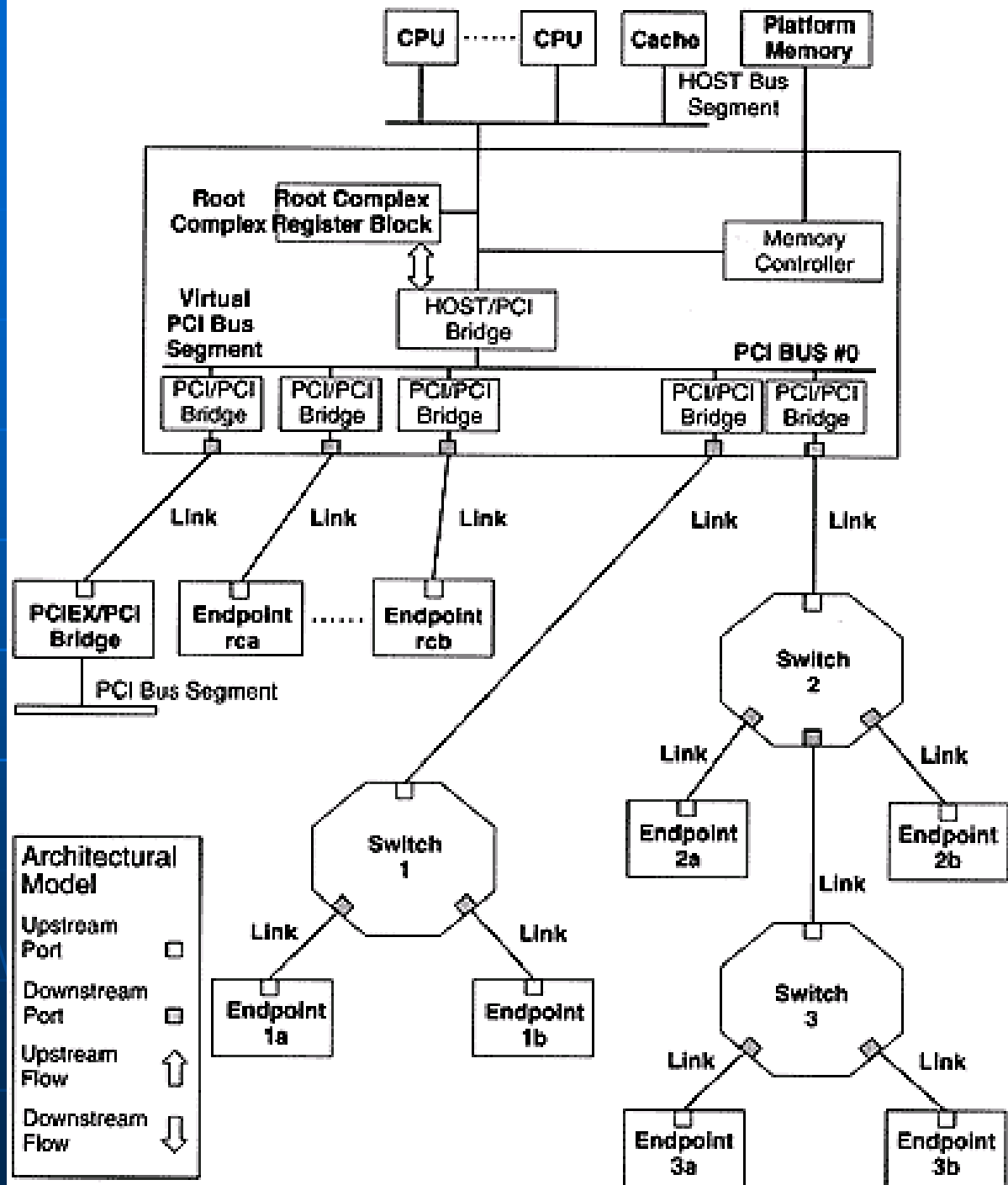


# Diferenciální signál - *differential signaling*



# PCI Express Link







**Case  
Back**

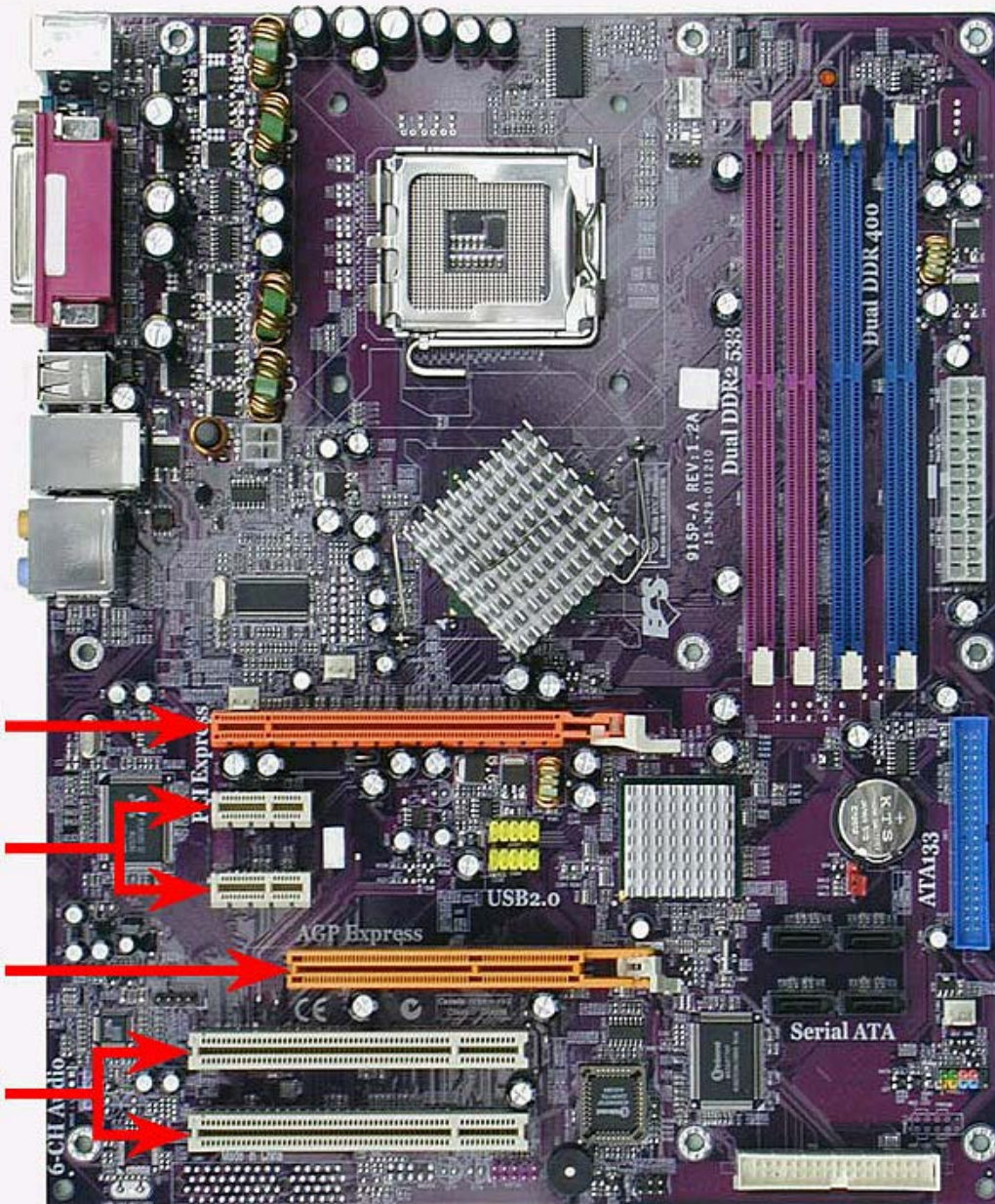
**Case  
Front**

**PCI-Express x16**

**PCI-Express x1**

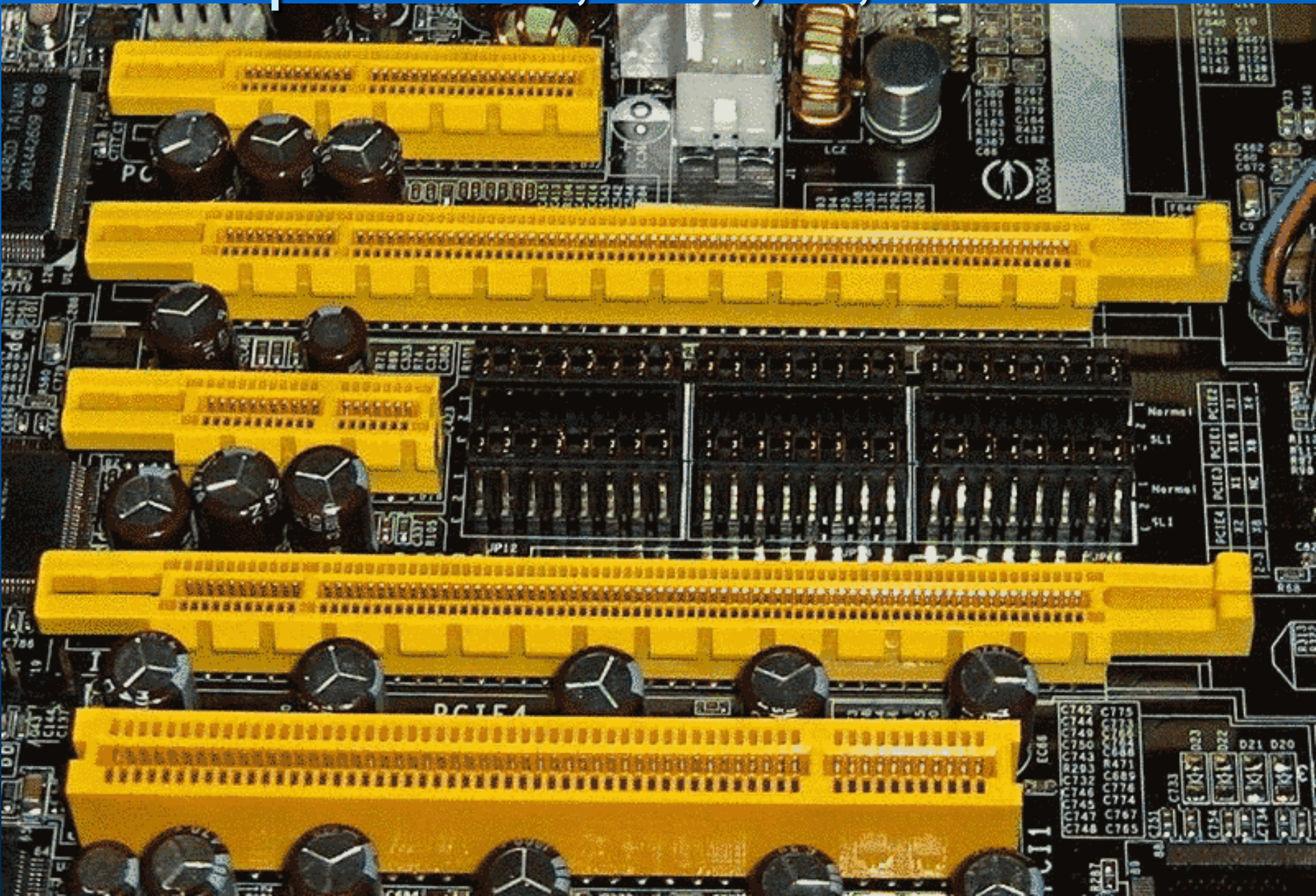
**AGP**

**PCI**





# PCI Express 4x, 16x, 1x, 16x a PCI

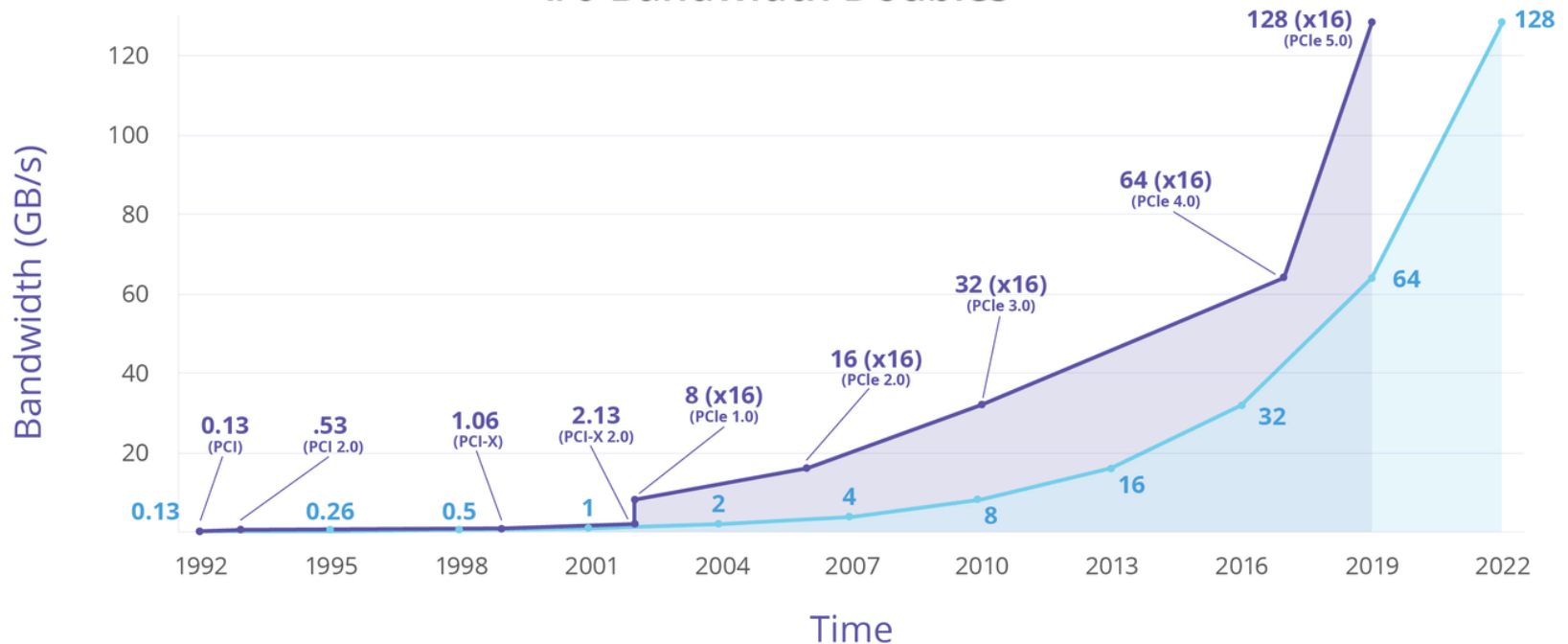


# Existující verze PCI Express



## EVERY 3 YEARS

I/O Bandwidth Doubles

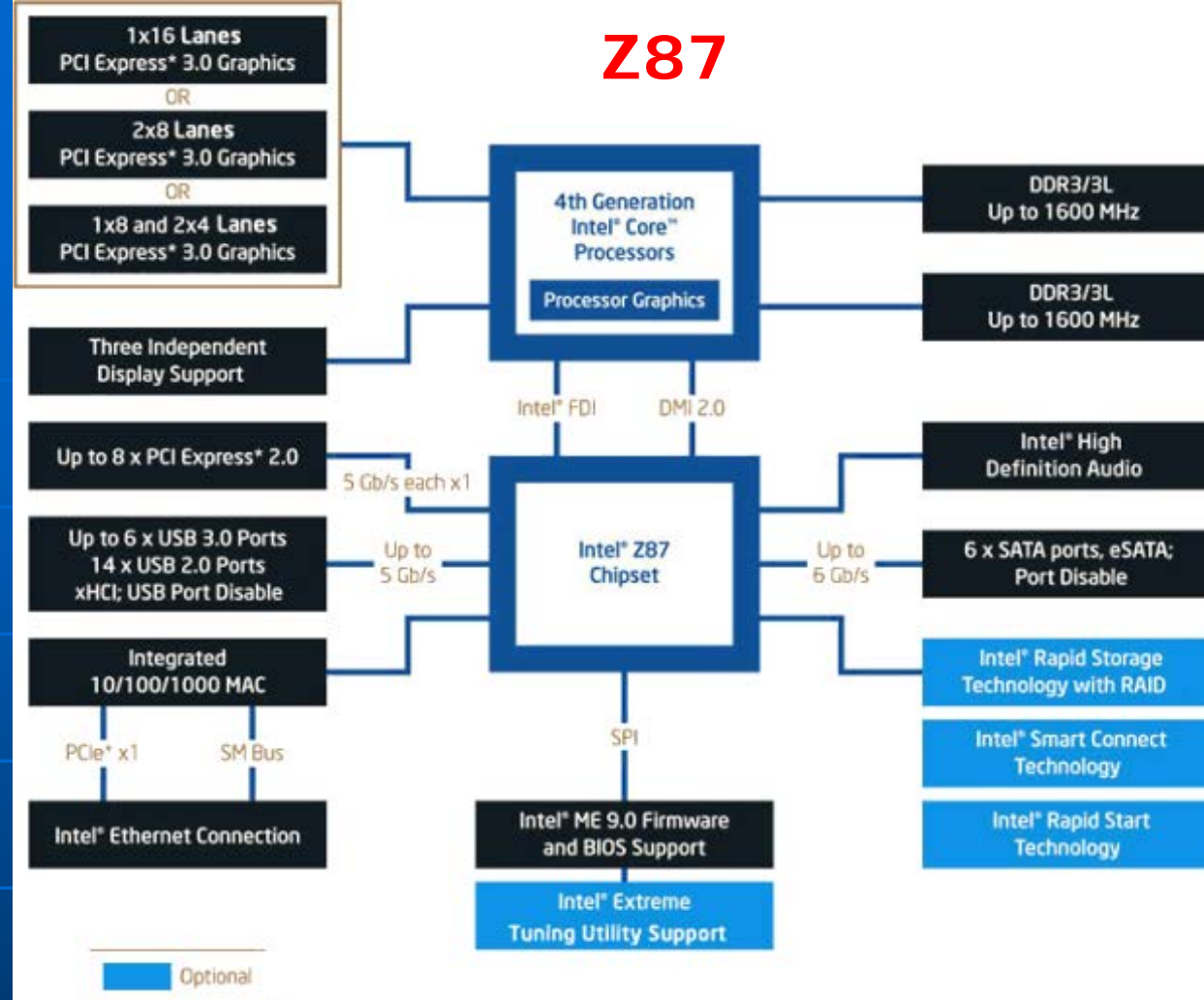


PCI BANDWIDTH 1992-2019

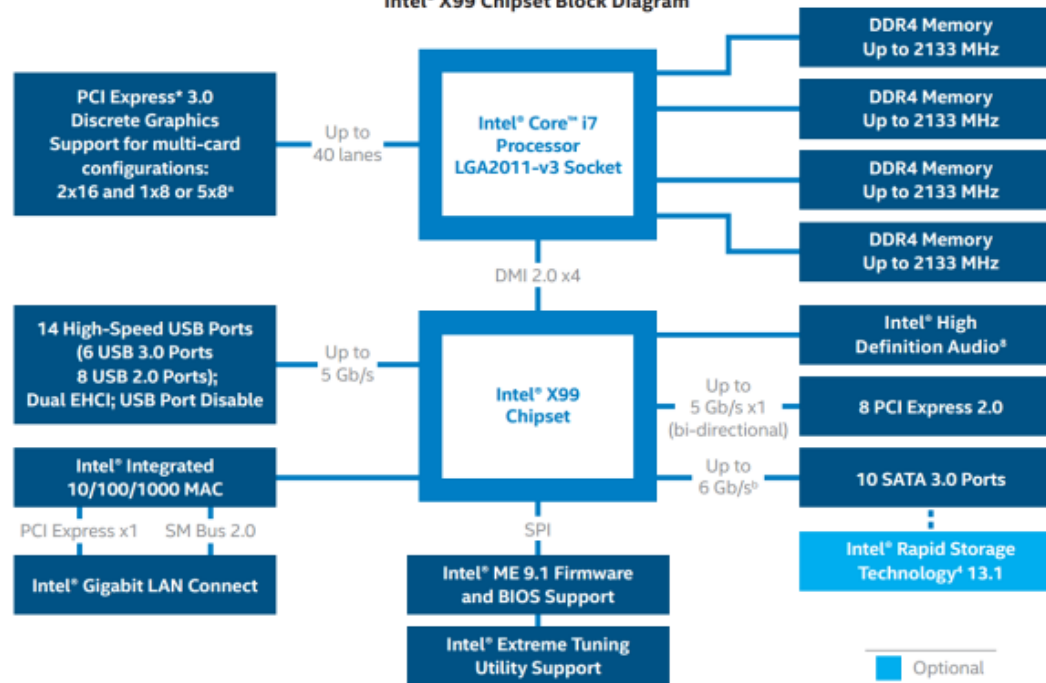
— Actual Bandwidth (GB/S) — I/O Bandwidth Doubles Every Three Years



# Z87



Intel® X99 Chipset Block Diagram



<sup>a</sup> 3 slots available but need additional logic onboard to support more slots. 5x8 configuration requires additional system clocks to be provided by third party components.

<sup>b</sup> All SATA ports capable of 6 Gb/s.