CompactPCI Technology

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CompactPCI uses ...

- PCI Electricals
  - 32/64 bit multiplexed address/data path
  - 33/66 MHz clock rate
  - Synchronous single transfer and block mode signalling
  - Developed by INTEL in 1992 as a chip level interconnect for motherboards
  - Extended for option cards in 1994, updated most recently in 1999 by PCI SIG
PCI Performance

- **PCI bus Speeds**
  - 133Mbytes/sec peak
    - 32bits, 5.0V, 33MHz bus clock
  - 266Mbytes/sec
    - 64bits, 33MHz bus clock
  - Theoretical Maximum of 532Mbytes/sec
    - 64bits, 66MHz, 3.3V
  - Extensible to 1066 Mbytes/sec
    - PCI-X, 64 bits, 133MHz
CompactPCI leverages...

- “Standard” off-the-shelf PCI bus:
  - Processor core logic specific to processor architecture
  - Chip level peripherals stable across architectures and generations
  - Software and development tools in common with desktop and server systems
Desktop PCI Slot Count

- PCI spec allows 10 loads:
  - A PCI chip is a load
  - Desktop connectors represent a load
- Desktop PCI: chip is 1 load, connector is 1 load = 2 loads per plug-in card.
- CPU support chipset and GPIO chip on motherboard = 2 loads
- Therefore, 4 slots/system maximum in desktop PC PCI without PCI to PCI bridging
CompactPCI Slot Count

- **CompactPCI**:  
  - chip is one load  
  - connector is approx. 1/8 load (controlled impedance, minimal reflections)
- Therefore, **CompactPCI** can have 8 slots
- Extensively simulated, tested
- This can be easily expanded with bridge chips (7 more slots/chip)
CompactPCI uses ...

- Eurocard Mechanicals
  - IEEE 1101.10
    - Improved Injector/Ejector
    - Better Grounding for ESD protection
    - Extensive shielding meets CE requirements
    - Alignment pins, keys, insert/eject handles
  - IEEE 1101.11 Allowed (Rear Panel I/O)
    - Standard method of providing rear panel I/O
    - 80mm card depth, mirrors front of chassis 3U/6U Modules
CompactPCI uses ...

- 2 mm pin-and-socket type
  - socket half on plug-in cards
  - Pin half on backplane
- Originally developed by Siemens for telecom applications
- Meets IEC-917 and IEC 1076-4-101 standards
CompactPCI connector

- IEC 61076-4-101 connector utilization
  - J1/P1 for 32 bit PCI (110 pins)
  - J2/P2 for 64 bit extensions (110 pins)
  - J3/P3 for rear IO (95 pins)
  - J4/P4 for H.110 CT bus or rear IO (110 pins)
  - J5/P5 for general purpose or telecom IO (110 pins)
CompactPCI Components

CompactPCI Backplane

233mm (9.17in.)

160mm (6.3 in.)

I/O Panel

J5
J4
J3
J2
J1

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CompactPCI SBC

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CompactPCI System
CompactPCI leverages ...

- General purpose desktop and server architectures
  - Intel processors and chipsets
  - Alpha processors and chipsets
  - Chip level PCI devices
- General purpose operating systems
  - Windows
  - UNIX
CompactPCI also supports ...

- Embedded processor architectures
  - MC68K
  - PPC
  - StrongARM
- Embedded OS’s
  - VxWorks (also for Intel and Alpha)
  - pSOS
  - LynxOS
Specifications developed under jurisdiction of PCI Industrial Computer Manufacturers’ Group, PICMG, an industry consortium of over 400 members

- PICMG 2.0 Rev 2.1 CompactPCI Core Spec
  - PICMG 2.1 Rev 1.0 Hot Swap
  - PICMG 2.5 Rev 1.0 Computer Telephony
  - PICMG 2.2 Rev 1.0 VME64 Extensions
CompactPCI evolution

- PICMG 2.0 Rev 3.0
  - Update incorporating Hot Swap and CT Extensions, 66 MHz operation
- Keying
- Bridging
- Dual CompactPCI System Slot
- Instrumentation Extensions
- System Management
- Hot Swap Modular Power
CompactPCI evolution

- Conduction Cooled CompactPCI
- System Slot Hot Swap
- Multicomputing
- IO Enhancements
  - PCI-X
  - NGIO
  - FutureIO
CompactPCI and VME64x

- CompactPCI and VME share common mechanicals
- VME64x signals have been mapped to CompactPCI J4 and J5
- Hybrid CompactPCI/VME systems have been built
- VME SBCs typically use PCI as a local bus
- PCI/VME bridge silicon available
VME SBC

Alpha 21164A
L1=8/8KB (I/D)
L2=96KB

L3 Board level
2 MB Cache

Dynamic Memory
(4 DIMM slots)
16 to 512 MBytes

Core Logic

User
FEPROM.
5 / 3.5 MB

Serial
Lines
3 Timers
& Clock
NVRAM
32 KByte

Peripheral Component Interconnect (PCI)

VME64
backplane
bus

SIO
ISA BRIDGE

SCSI-2
Ethernet

Parallel
Keyboard
& Mouse

P2 conn.

AUI: Handle connector

6Ux160
Form
Factor

32
128
memory bus
256

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## CompactPCI and VME

<table>
<thead>
<tr>
<th></th>
<th>CompactPCI</th>
<th>VME</th>
<th>VME64x</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peak data rate</strong></td>
<td>133 MB/s (PCI32 @ 33MHz)</td>
<td>40 MB/s</td>
<td>80 MB/s D64</td>
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<tr>
<td></td>
<td>266 MB/s (PCI64 @ 33MHz)</td>
<td></td>
<td>160 MB/s 2eVME</td>
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<tr>
<td></td>
<td>532 MB/s (PCI64 @ 66MHz)</td>
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<td>320 MB/s 2eSST</td>
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<td><strong>Cards/System w/o Bridging</strong></td>
<td>8</td>
<td>21</td>
<td>21</td>
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<td><strong>Bus logic</strong></td>
<td>CMOS</td>
<td>TTL</td>
<td>ETL</td>
</tr>
<tr>
<td><strong>3.3 v migration</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
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</tbody>
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VME Advantages vs CompactPCI

- **Multicomputing**
  - Distributed interrupt handling
- **Wide variety of processor architectures**
  - General purpose
  - DSPs
- **Wide variety of auxiliary interconnects**
  - RACEway
  - SKYchannel
  - Myrinet

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CompactPCI Advantages vs VME

- Leverages hardware and software investment for mainstream desktops and server market
- Intelligent IO
- Flexible configuration of system peripherals on local bus
- Greater aggregate BW to memory than competing VME protocol enhancements
- Tighter coupling to memory bus than VME
Will there ever be another VME?
- Longevity
- Evolution
- Backward compatibility

Probably not, but there is an alternative
- Choose a robust HW platform that will track emerging desktop/server technology trends
- Insert technology as it matures
Internet pointers

  - CompactPCI
  - PCI/ISA
  - VME
  - RTOS

- http://www.picmg.org/
  - Membership information
  - Specification Directory
  - Product Directory