

New Concept for VMEbus Interfaces....

VMEcore™ IP Core and VMEbus Interface Writer™ Products

Wade D. Peterson

Silicore Corporation, Minneapolis, MN

TEL: (763) 478-3567 FAX: (763) 478-3568

email: wadep@silicore.net website: www.silicore.net

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Our Objectives Are...



- Silicore Corporation has developed a new VMEbus hardware interface technology.
- The industry desperately needs new VMEbus interface chips.
- We have developed a proof-of-concept prototypes.
- We're taking the next step.

First, Some Background Information...



- Short introduction to system-on-chip & IP core technologies.
- The impact of SOC on the μ C board industry.
- The need for new VMEbus interface chips.
- A sneak preview of new VMEbus IP cores.
- The WISHBONE interconnection (a μ C bus for SOC).

What the Heck is System-on-chip (SOC)?



- System-on-chip is exactly what it says...the ability to build entire systems on a single semiconductor device.
- This includes CPU, RAM, ROM, I/O, FIFO, network interface, bus interface and all of the 'glue' logic.
- It's a lot like VMEbus or cPCI, except that the integration occurs at the chip level.

What's this 'IP Core' Thing Anyway?



- IP core: Intellectual Property Core.
- These are the building blocks for SOC.
- They contain the functional elements such as CPU, network interfaces, bus interface etc.
- There is currently a budding IP core industry.
- Many new IP cores are being released, almost daily.

So, What's all the Fuss About?



- SOC is a new paradigm in the semiconductor world.
- This is a juggernaut that can't be ignored!
- It alters the way we buy semiconductor technology.
- It's brought about by new chips and development tools.
- The full impact will be felt over the next 5-10 years.

Effects on the μ C Board Industry



- SOC will not undermine the usefulness of μ C boards:
 - There will always be a need for board level products.
 - End users won't want to screw around with SOC.
- SOC will change:
 - Several business aspects of μ C boards.
 - How we design and deliver technology on μ C boards.

Business Aspects



- SOC technology will allow μ C board manufacturers to do a better job of differentiating their products.
- That's because SOC allows more choices for board builders.
- This will result in better profit margins for board manufacturers, and more choices for end users.

Technology Aspects



- Board makers and end users will also benefit, as it gives them a greater choice of technologies.
- Let's take a look at some of these choices...

Latest Semiconductor Technology



- We are starting to see a trend where the latest technologies are available first as IP cores.
- Great examples: NGIO, CPU and DSP cores.
- Companies will need to adopt SOC technologies if they want to maintain a technological 'edge'.
- Small, innovative companies are also creating IP Cores.
- That's because they're relatively cheap to develop.

The Big Ugly: Parts Obsolescence



- Parts obsolescence is a major problem in the industry.
- Soft IP cores are portable.
- As target devices (parts) become obsolete, they can be upgraded to the latest technology.
- This is really a return to the multiple vendor sources that we were accustomed to in the 1980's.
- This means less dependence on single-source vendors.

The Need to go Faster, Faster and still Faster



- SOC is an inherently high speed technology.
- On-chip capacitance and inductance is very low, especially when compared to circuit board technologies.
- FPGA toggle rates are now approaching 1 GHz.
- SOC is a very attractive way to increase system speed.

Other Benefits...



- SOC solutions require less power.
- SOC solutions are very compact.
- Parts are available in a wide variety of costs, speeds, packages, voltages and temperature ranges.
- Radiation hardened parts are available (military!).
- JTAG support is very common, and easy to do on FPGAs.

Drawbacks of SOC



- The industry is in the 'wild-west' stage.
- Some key, de-facto standards haven't developed yet.
- Tool costs are high, but are coming down.
- Lack of infrastructure among μ C board manufacturers.
- Substantial learning curves.
- Lack of IP cores for VMEbus.
- Lack of an interconnection standard.

A Quick Overview of SOC integration



- Since many system-on-chip technologies are unfamiliar to the audience, let's take a look at how it's done...

SOC / System Integration Philosophy



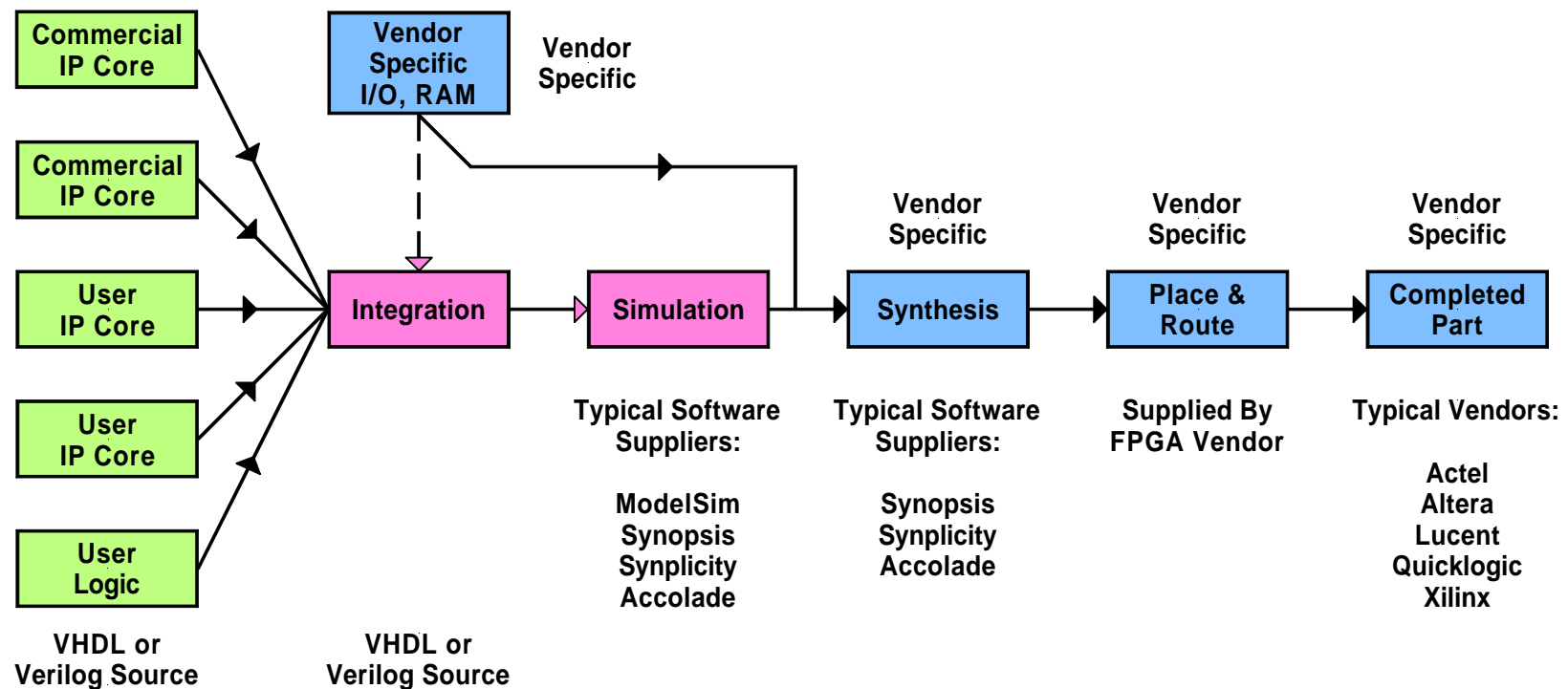
- Microcomputer bus systems are integrated at the board level.
- SOC systems are integrated at the IP core level.

Target Devices



- SOC is used on FPGA and ASIC target devices.
- FPGA: Field Programmable Gate Array:
 - Lower entry cost, higher production cost ($<10K$ pcs/yr).
 - Shorter lead times.
- ASIC: Application Specific Integrated Circuit:
 - Higher entry cost, lower production cost ($>10K$ pcs/yr).
 - Longer lead times.

Integration of Soft IP Cores on an FPGA



The Need For New VMEbus Semiconductors

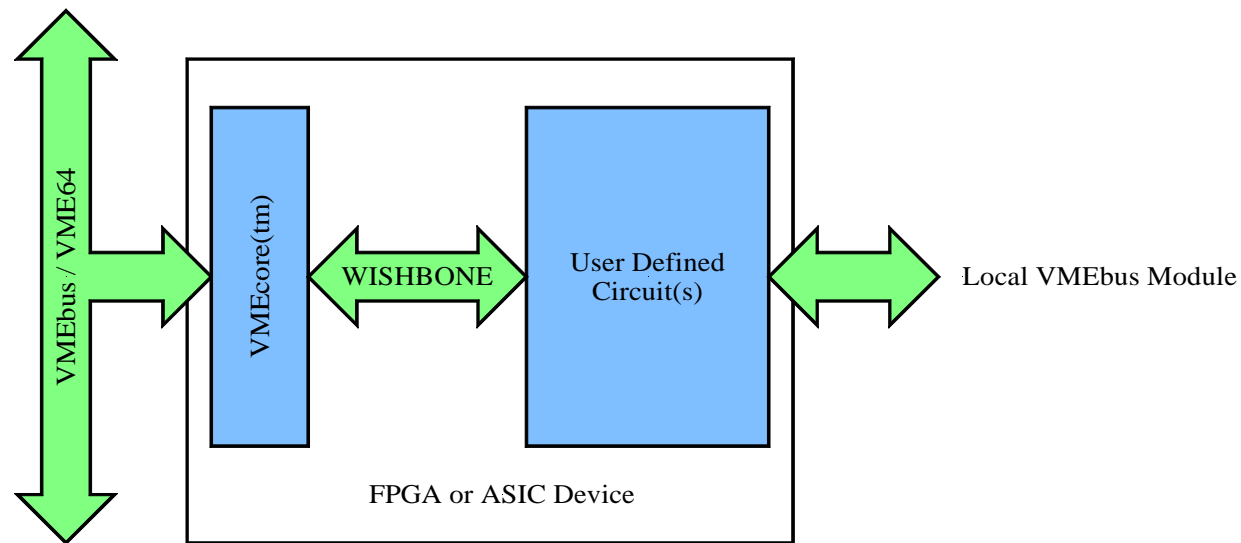


- VMEbus interface chip technology is beginning to lag.
- Semiconductor manufacturers aren't keeping up anymore:
 - New interface standards (VME320, T&M, hot-swap, etc.).
 - Wide temperature and radiation hardening.
 - Packaging and voltages.
 - JTAG support (especially for ball grid array packaging).

Sneak Peak: VMEcore™

Advance Information

- We decided to take advantage of this new situation by creating some new VMEbus interface chips.
- The new product is called VMEcore™.



VMEcore™

Advance Information

- VMEcore™ is a VHDL Soft IP core toolkit.
- Suitable for FPGA or ASIC.
- Supports all interfaces in ANSI/VITA 1-1994 (VME64).
- Insures compliance with the VMEbus standard.

VMEcore™

Advance Information

- Local WISHBONE interconnect.
- Full VMEbus bandwidth to 40/80 Mbyte/sec.
- Incorporates third generation synchronous technology.
- Clever design eliminates common interface problems.

■ The full toolkit will support:

- Master
- Slave
- Location monitor
- Interrupter
- Handler
- Bus arbiter

- A general purpose VMEbus IP core is very difficult.
- There are 10^{22} combinations of VMEbus interface!
- VMEmore™ supports all of these combinations!

- A unique software package called the **VMETbus Interface Writer™** creates a VHDL soft IP core to the user's specifications.
- VMETbus interface options are entered into the software, and it generates a VHDL soft IP core!
- A complete test bench (with test vectors) is also created!
- Here's a demonstration....

Standard Interconnection Architecture



- There is no standard interconnection architecture on SOC, at least nothing similar to a microcomputer bus.
- This makes it difficult to integrate systems.
- We have created the WISHBONE interconnection to solve this problem.
- WISHBONE is very similar to other μ C buses.
- It's tailored toward SOC applications.

WISHBONE Architecture



- Simple, compact, logical IP core hardware interface.
- It's independent of:
 - Hardware technology (FPGA, ASIC, etc.).
 - IP core delivery method (soft, firm or hard).
 - Hardware description languages (VHDL, Verilog[®], etc).
 - Synthesis, router or layout tools.

WISHBONE Specification



- Informal, open standard.
- No royalties or licensing required.
- The bus specification can be downloaded for free.
- See our website at www.silicore.net.

WISHBONE Features



- Synchronous protocol.
- One data transfer per clock cycle.
- Variable speed handshaking protocol.
- Speed is limited only by the target semiconductor technology.

WISHBONE Features



- MASTER/SLAVE architecture.
- Up to 64-bit address and data paths (expandable).
- BIG ENDIAN or LITTLE ENDIAN byte lane ordering.
- Multiprocessing support.
- Memory-mapped, FIFO and crossbar configurations.
- Various interconnection methods (dual I/O, three-state).

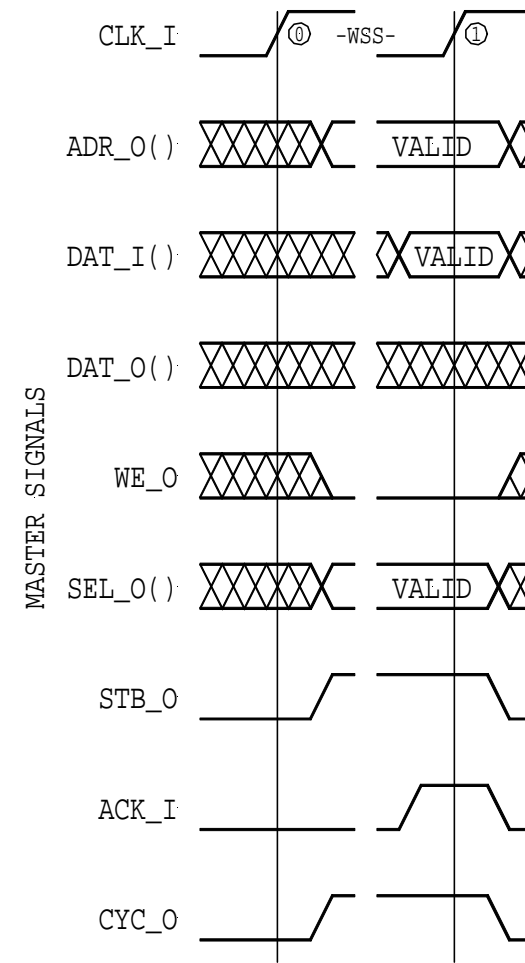
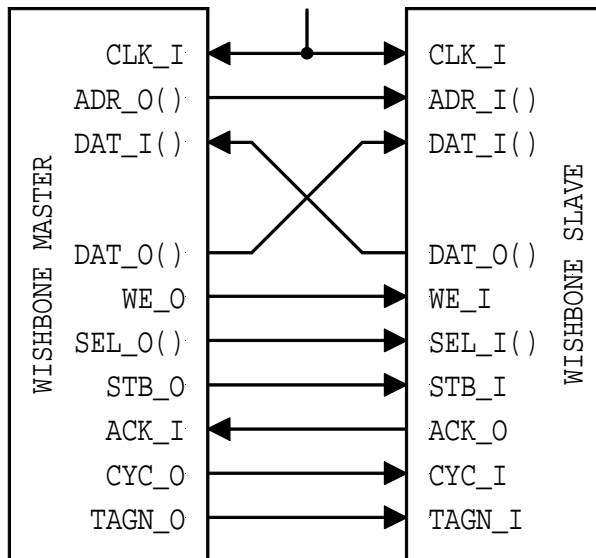
WISHBONE Bus Cycles



- Full set of popular data transfer protocols, including:
 - READ/WRITE cycle
 - BLOCK transfer cycle
 - RMW cycle
 - EVENT cycle

Typical WISHBONE READ Cycle

■ Here's a typical READ Cycle:



What Do We Need to Finish?



- Silicore Corporation is seeking first round venture capital development funds for VMEcore™.
- The VMEbus Interface Writer™ product would debut later.
- We believe this to be a very viable product idea.
- The conservative business plan looks good!

Other Factoids



- The VMEbus interface IC market was about \$86M in '98.
- We believe there are two patentable inventions in the product.