EtherBone – A Network Layer for the Wishbone SoC Bus

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Overview

1. What is Wishbone ?
2. Remote Wishbone
3. EtherBone vs The Establishment
4. EtherBone Applications
5. EtherBone Packet Layout
6. EtherBone Architecture
7. Conclusion

What is Wishbone?

What is Wishbone ?

System-on-Chip (SoC) bus

- Connects modules inside an FPGA
- Simple Interface
- Ver. B4 supports pipelined streaming
- OpenSource, no royalties

What is Wishbone ?

So it's ...

- Powerful
- Easy to use

- and confined to the chip

But why stop at
the FPGA's borders ?

Towards new shores

- Wishbone goes remote

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Remote Wishbone

We want to talk to...

- FPGAs
- MCUs
- CPUs
- all of them, no matter what distance

Remote Wishbone

We want to be...

- as transparent as possible
- as fast as possible
- as versatile as possible
- low in protocol overhead

Remote Wishbone

What Interface and Protocol
are suitable for those requirements?

- Network Interface
    - Routable Transport Protocol (no custom)
        - Streaming Protocol
            - WB Operation Protocol

Remote Wishbone

Wishbone

Remote Wishbone

Wishbone

\+ Ethernet

Remote Wishbone

Wishbone

\+ Ethernet

\+ IP

Remote Wishbone

Wishbone

\+ Ethernet

\+ IP

\+ UDP

Remote Wishbone

Wishbone

\+ Ethernet

\+ IP

\+ UDP

\+ A Packet format

Remote Wishbone

Wishbone

\+ Ethernet

\+ IP

\+ UDP

\+ A Packet format

\+ Some Tricks

Remote Wishbone

Wishbone

\+ Ethernet

\+ IP

\+ UDP

\+ A Packet format

\+ Some Tricks

EtherBone

The little differences

- EtherBone vs The Establishment

EtherBone vs The Establishment

Established Protocols:

- CORBA
- SOAP
- RDMA
- Myrinet

EtherBone vs The Establishment

Established Protocols:

- ~~CORBA~~
- ~~SOAP~~
- RDMA
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EtherBone vs The Establishment

Established Protocols:

- ~~CORBA~~
- ~~SOAP~~
- RDMA
- ~~Myrinet~~

EtherBone vs The Establishment

Established Protocols

-
-
- **RDMA**
-

So why not just use RDMA ?

EtherBone vs RDMA

EtherBone:

- Any Ethernet hardware
- WB Bus
- Fidelity / Transparency
- Focus on latency
- Determinism

(fast) RDMA:

- Custom Hardware
- Any Bus
- Only Data, no bus syntax
- Focus on bandwith
- Non-Deterministic

EtherBone vs RDMA

EtherBone:

- Any Ethernet hardware
- WB Bus
- Fidelity / Transparency
- Focus on latency
- Determinism

5,000 new FAIR & CERN timing nodes like this.

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Where the bones are buried

- EtherBone Applications

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EtherBone Applications

EtherBone is very close to hardware.

We could...

EtherBone Applications

... be very fast indeed

- Control Systems
- Timing Systems

EtherBone Applications

... make WB cores not even see it's there

- (almost) transparent bridges
- Easy Hardware to Hardware Connection
- Easier Software to Hardware Connection

EtherBone Applications

... build cool remote toys

- In-System-Programmer
- JTAG Debugger
- Logic Analyser
- Boundary Scan Interface

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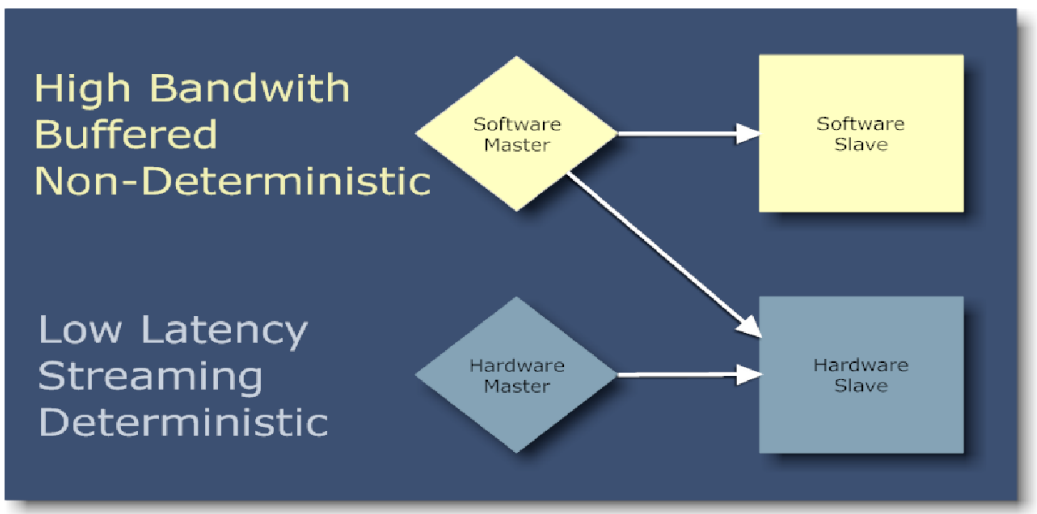
EtherBone Applications

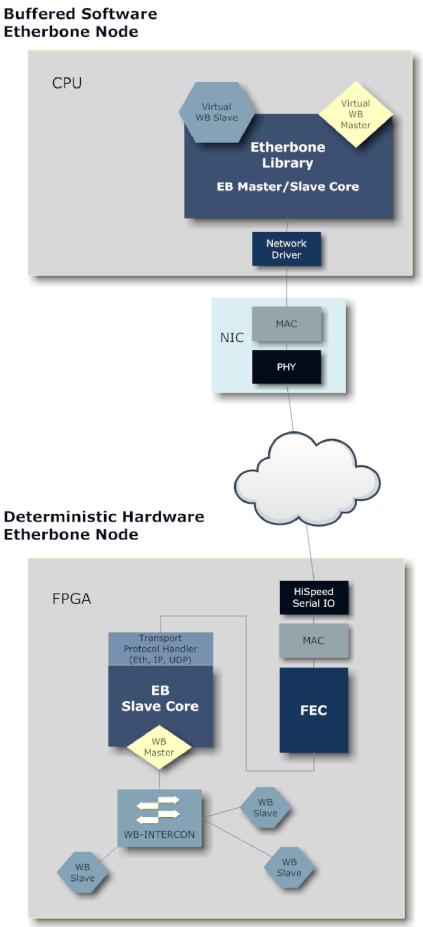


Types of EtherBone nodes and their compatibility

Bone structure

- EtherBone Architecture

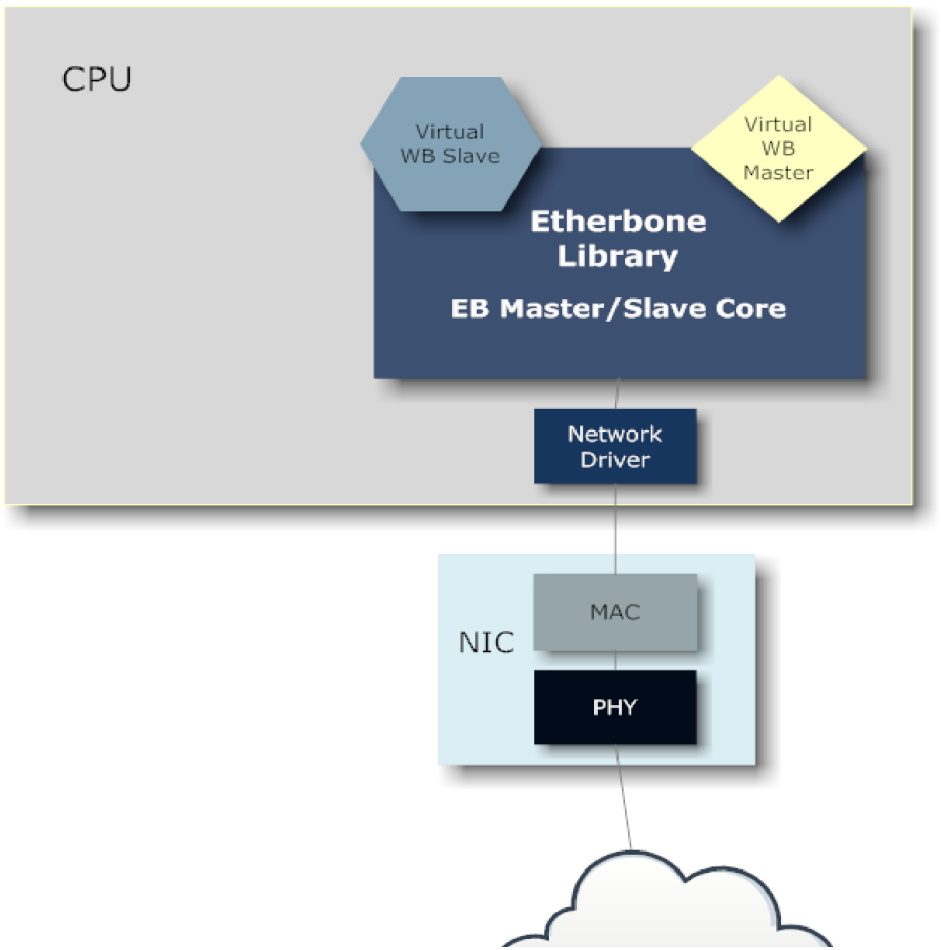
EtherBone Architecture



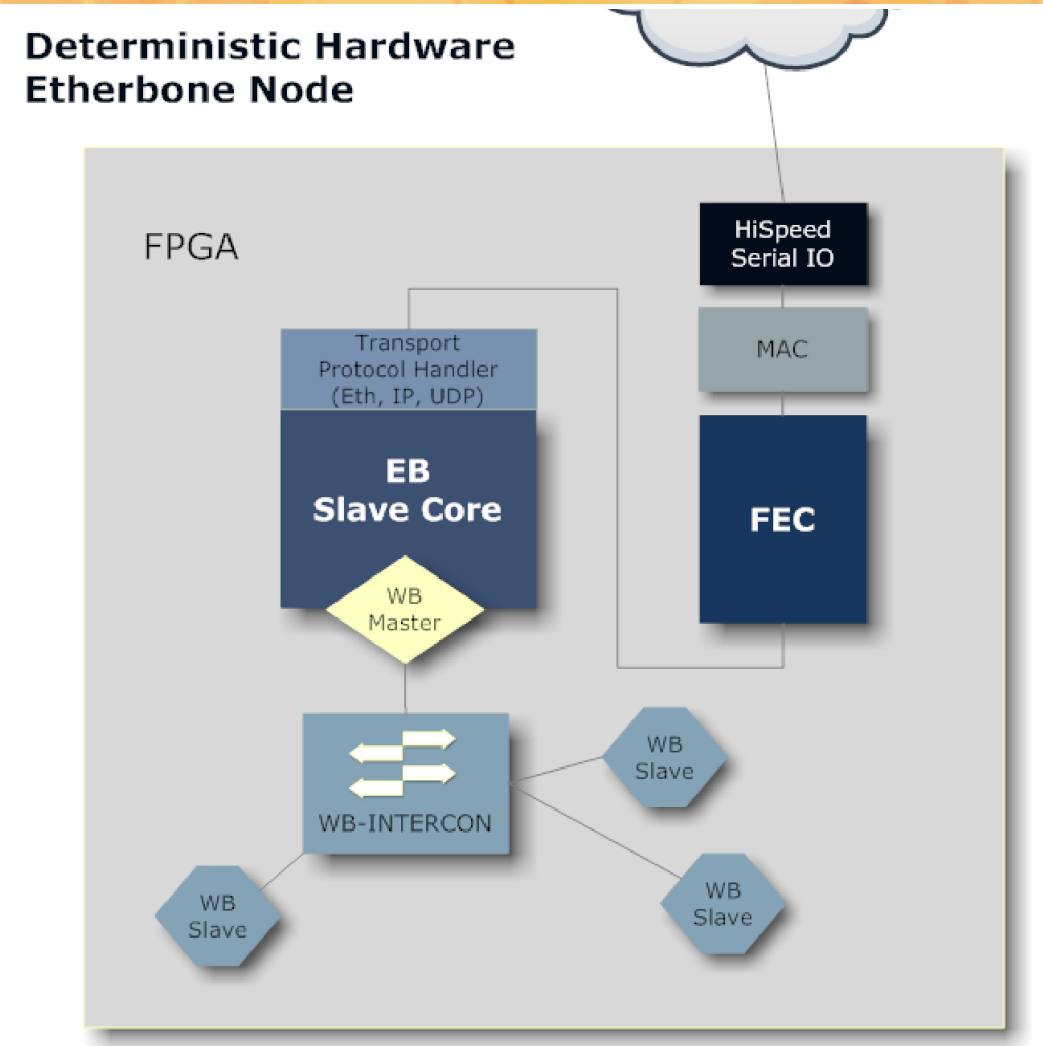
SW/HW EtherBone Nodes

EtherBone Architecture

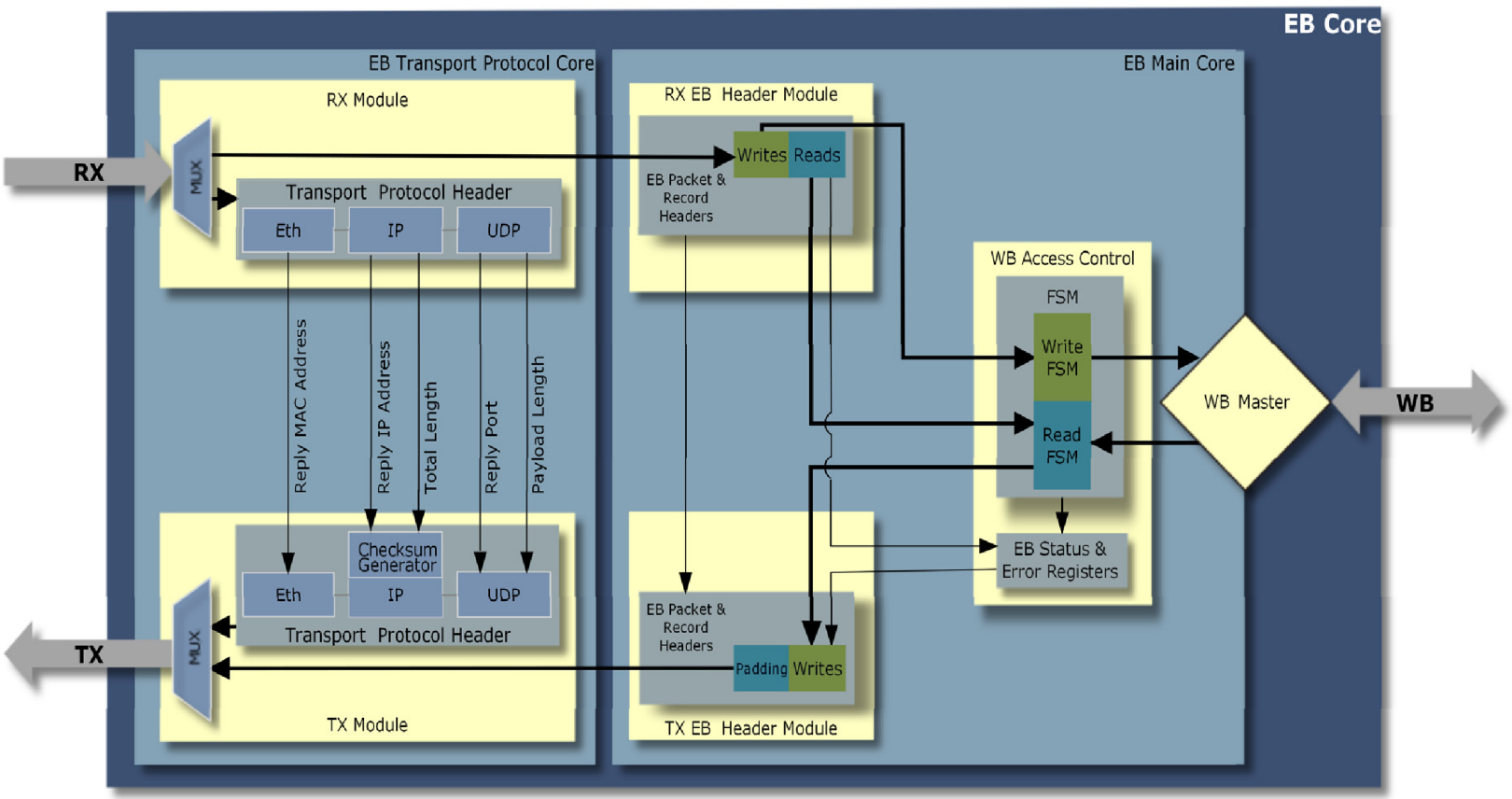
Buffered Software Etherbone Node



EtherBone Architecture



EtherBone Architecture

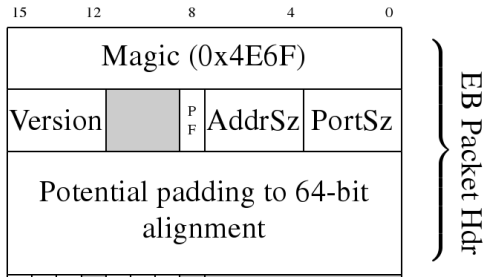


EtherBone Hardware Slave

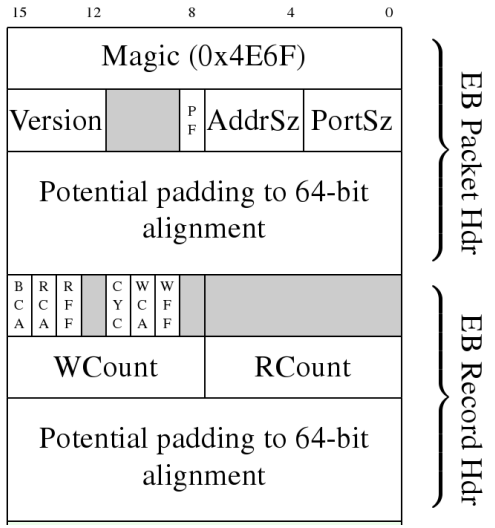
Wrapped up nicely

- EtherBone Packet Layout

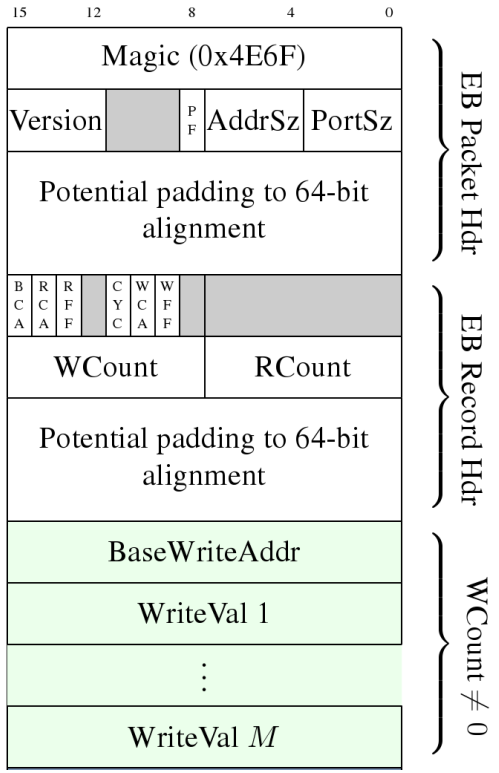
EtherBone Packet Layout



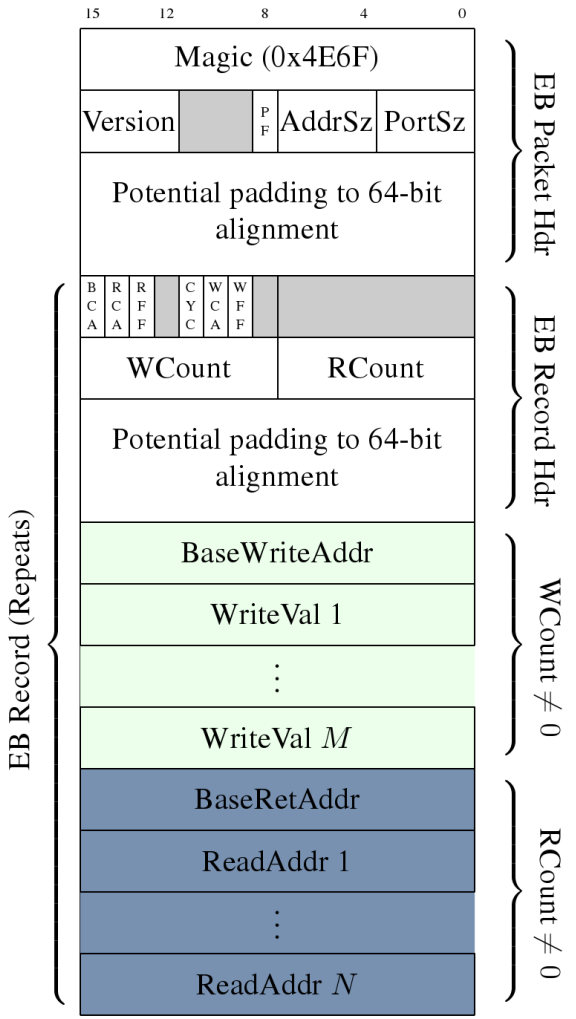
EtherBone Packet Layout



EtherBone Packet Layout



EtherBone Packet Layout



Playing tricks on packets

- EtherBone Transmission

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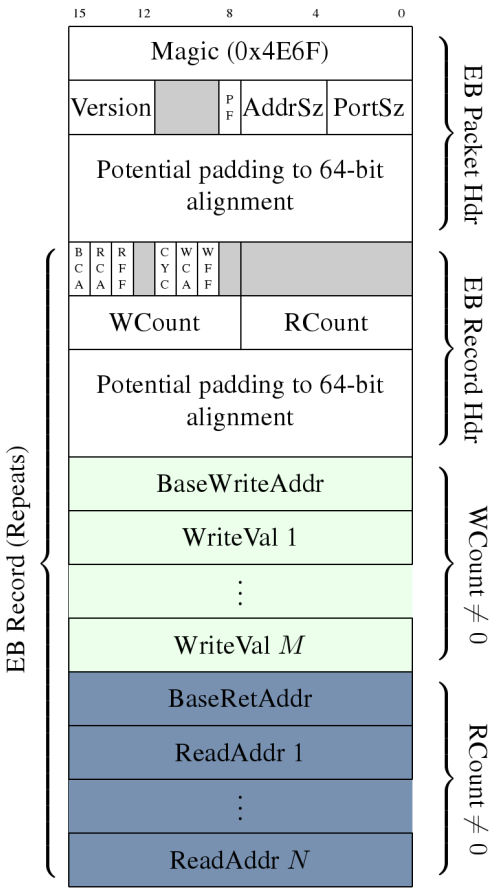
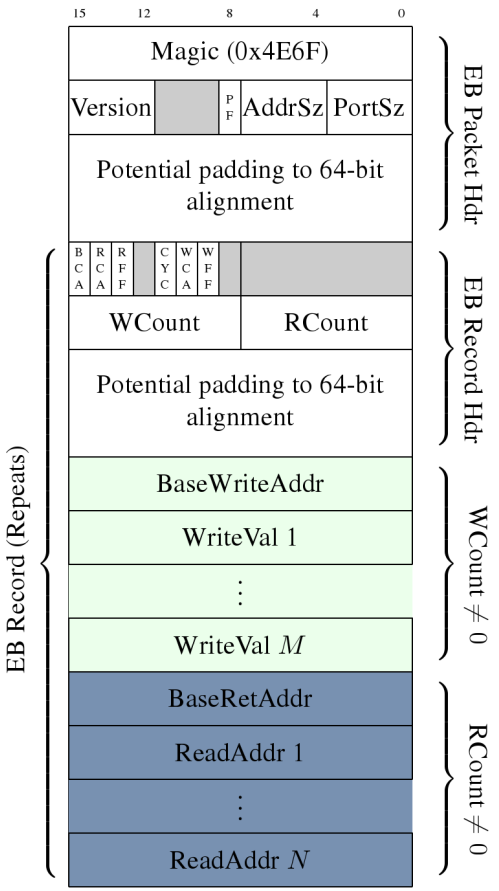
EtherBone Transmission

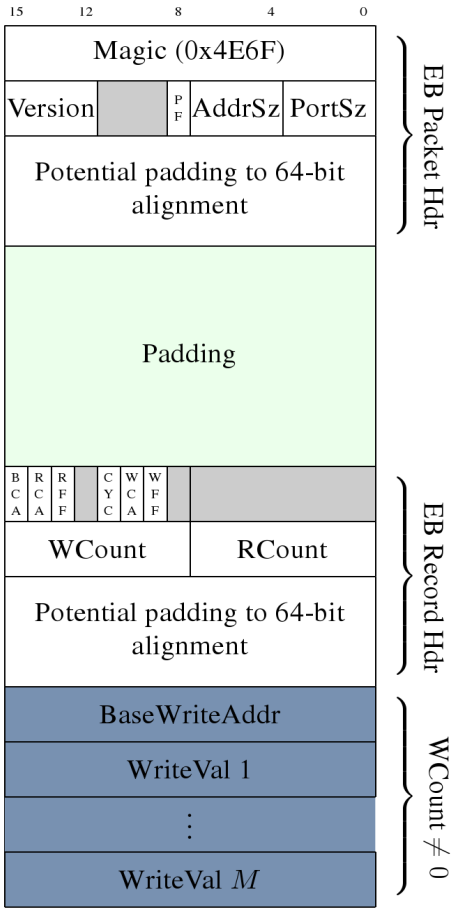


Request

EtherBone Transmission



Request



Reply

EtherBone Transmission

A salute to symmetry:
Know the length, know it all

- IP length field
- IP checksum
- UDP length field
- UDP checksum = 0

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EtherBone in a nutshell

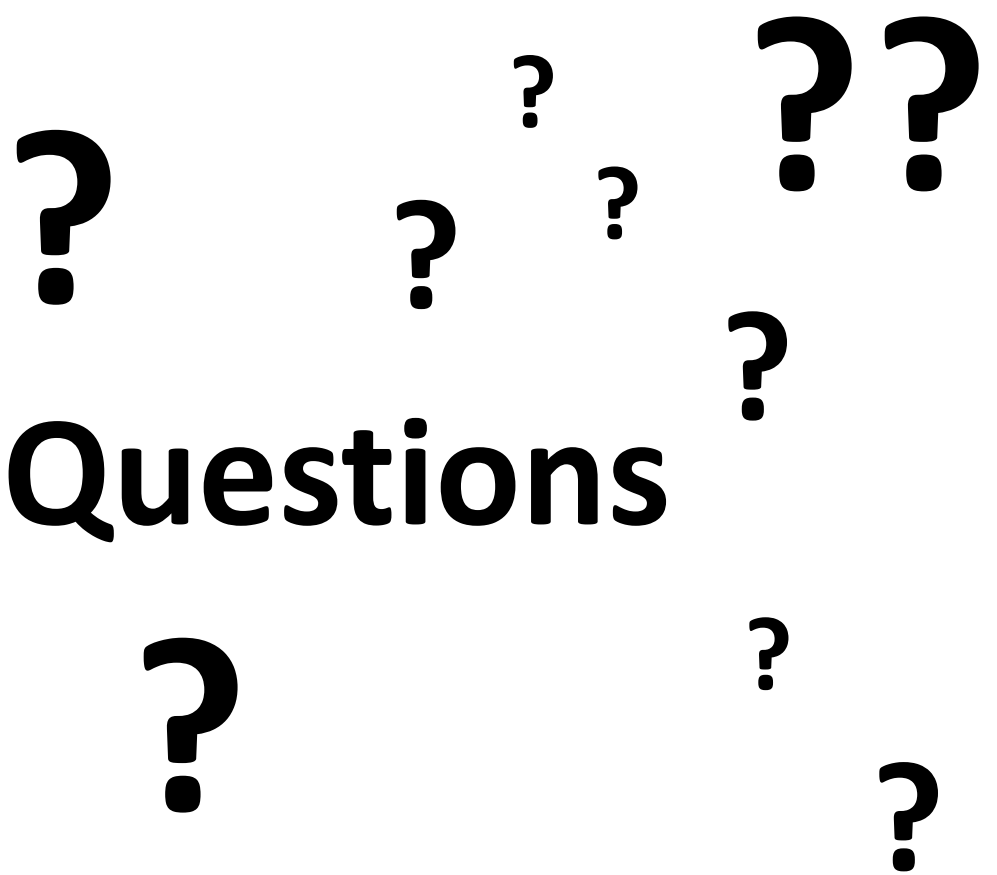
- Conclusion

Conclusion

EtherBone is ...

- low level
- an (almost) transparent bus bridge
- available in software and HDL
- good for time critical applications
- enabling remote embedded tools

Questions and Answers



Thank you

For your time and attention

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