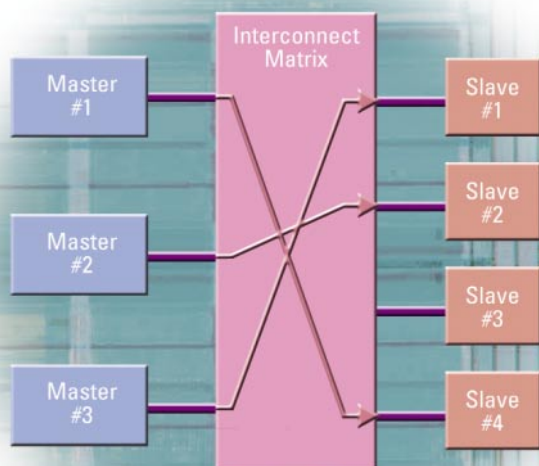


# MULTI-LAYER AHB AHB-LITE



*Multi-layer AHB represents a significant advance in the capabilities of the ARM AMBA™ bus on-chip interconnect strategy, by providing a solution that reduces latencies and increases the bus bandwidth available to multi-master systems.*

*Fully compatible with the current AHB specification, Multi-layer AHB increases the choice of architectures available to the AMBA bus-based designer, and is supported by a comprehensive range of products from ARM.*

*AHB-Lite is a subset of the full AHB specification and is intended for use in designs where only a single bus master is used. This may be a simple single master system, or a Multi-layer AHB system where there is only one AHB master on a layer.*

Multi-layer AHB is an interconnection scheme based on the AHB protocol that allows for parallel access paths between multiple masters and slaves in a system. This is achieved by using a more complex interconnection matrix and gives the benefit of increased overall bus bandwidth as well as a more flexible choice of system architecture.

A key advantage of Multi-layer AHB is that standard AHB master and slave modules may be used without the need for modification.

In situations where the system bottleneck is the result of limited bandwidth across the system bus, Multi-layer AHB solves the issue by multiplying the available bandwidth in proportion to the number of bus layers. Additional benefits arise from the reduction in bus transaction latency as a result of the increased bus capacity.

Using Multi-layer AHB, a wide variety of bus structures can be created. With a single layer the structure is identical to the conventional AHB bus structure. Full Multi-layer AHB consists of a bus layer for each of the bus masters, with each layer connected to every slave through the slave multiplexor. Typical systems are more likely to fit between these structures with slaves connected to a sub-set of the layers, or multiple bus masters on a single layer.

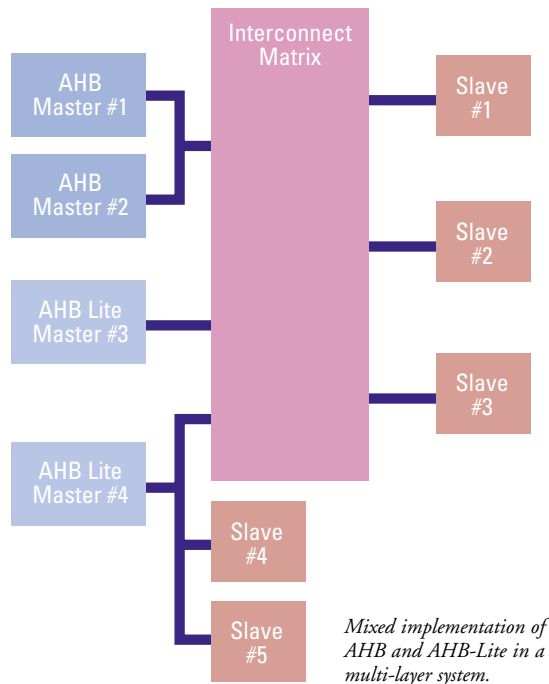
## KEY BENEFITS

- Complex multi-master systems can be constructed which have a flexible architecture. This removes the need to fix design decisions about the allocation of system resources to particular masters at the hardware design stage.
- Each AHB layer can be very simple if it only has one master, so no arbitration or master-to-slave muxing is required. These layers can use the AHB-Lite protocol, described below.
- Arbitration effectively becomes point arbitration at each peripheral, and is only necessary when more than one master wants to access the same slave simultaneously.
- The only hardware that needs to be added to the standard AHB transport infrastructure is the multiplexor block to connect the multiple masters to the peripherals.
- Previously designed masters and slaves can be reused without modification because the multi-layer architecture is compatible with the existing AHB protocol.

# AHB-LITE

Where no arbitration is required between multiple masters, significant simplifications to the AHB interface can be made, resulting in the AHB-Lite interface.

AHB-Lite simplifies the AHB specification by removing the protocol required for multiple bus masters, which includes the request/grant protocol to the arbiter and the split/retry responses from slaves.



## KEY BENEFITS

- Masters designed to the AHB-Lite interface specification can be significantly simpler in terms of interface design, when compared to a full AHB master, enabling faster design and verification.
- A standard “off-the-shelf” bus-mastering wrapper can be used to convert an AHB-Lite master for use in a full AHB system.
- Any master that is already designed to the full AHB specification can be used in an AHB-Lite system without modification.
- The majority of AHB slaves can be used interchangeably in either an AHB or AHB-Lite system.
- AHB slaves that do not use either the Split or Retry response are automatically compatible with both the full AHB and AHB-Lite specification. (Existing AHB slaves which do use Split or Retry responses require an additional “off-the-shelf” wrapper to be used in an AHB-Lite system.)
- Any slave designed for use in an AHB-Lite system will work in both a full AHB and an AHB-Lite design.

## COMPATIBILITY

The table below shows how masters and slaves designed for use in either AHB or AHB-Lite can

be used interchangeably in different systems.	AHB System	AHB-Lite System
AHB Master	◀	◀
AHB-Lite Master	Use ARM AHB Master wrapper	◀
AHB Slave no split/retry	◀	◀
AHB Slave with split/retry	◀	Use ARM AHB Slave wrapper

## AMBA™ FABRIC COMPONENTS

The following bus components are available now from ARM:

### SLAVE MULTIPLEXOR

- Holding Register
  - Required when both ports require simultaneous access.
- HREADY
  - Used to hold off layers without access.
- Local arbiter
  - Controls priority between layers
  - Optimized for slave requirements
  - Can be transfer type dependent.
- Flexible configuration
  - User-defined number of input and output ports.

### AHB-LITE TO AHB MASTER WRAPPER

- Enables masters to be developed for AHB-Lite and AHB systems.
- Adds support for bus request and grant.
- Rebuilds early-terminated bursts.
- Adds ability to retry access to split/retry slaves.

### AHB TO AHB-LITE SLAVE WRAPPER

- Supports split/retry by storing previous transfer
- Non split/retry slaves are already AHB-Lite compatible.

## FURTHER DETAILS

Full details of both Multi-layer AHB and AHB-Lite can be found in the new appendices to the AMBA 2.0 specification, available from the ARM web site: [www.arm.com/AMBA](http://www.arm.com/AMBA)

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