Ncore Sharer Promotion Architecture Specification

Rev: 0.82, November 17, 2022

Release Information

Version	Editor	Change	Date
0.4	MK	Initial Document	09/09/2021
0.7	MK	Update after review with team Added a change to improve Read Unique performance	11/10/2021
0.72	MK	Added ACE AIU to UP filed table	04/01/2022
0.80	MK	Updated Snoop response UP table with clarification on promotion cases and SnpRsp DC and DT settings	07/08/2022
0.81	MK	Clarified RetSrc setting for CHI AIU	09/02/2022
0.82	MK	Added missing SnpInvStsh	11/17/2022
Legend:	MK	Mohammed	
	MF	Michael Frank	
	Xx	Whoever else edited this document	

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Product Status

The information in this document is ***Preliminary***.

Web Address

http://www.arteris.com

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Preface

This preface introduces the Arteris® Network-on-Chip Hierarchical Coherency Engine Architecture Specification.

About this document

This technical document is for the Arteris Network-on-Chip Hierarchical Coherency Engine Architecture. It describes the subsystems and their function along with the system's interactions with the external subsystems. It also provides reference documentation and contains programming details for registers.

Product revision status

TBD

Intended audience

This manual is for system designers, system integrators, and programmers who are designing or programming a System-on-Chip (SoC) that uses or intend to use the Arteris Network-on-Chip Hierarchical Coherency System (ANoC-HCS).

Using this document

TBD

Glossary

The Arteris© Glossary is a list of terms used in Arteris© documentation, together with definitions for those terms. The Arteris© Glossary does not contain terms that are industry standard unless the Arteris© meaning differs from the generally accepted meaning.

Typographic conventions

italic

> Introduces special terminology, denotes cross-references, and citations.

bold

> Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.

monospace

> Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.

monospace italic

> Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name. monospace italic Denotes arguments to monospace text where the argument is to be replaced by a specific value. monospace bold Denotes language keywords when used outside example code.

SMALL CAPITALS

> Used in body text for a few terms that have specific technical meanings, that are defined in the Arteris® Glossary. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

Timing diagrams

The following figure explains the components used in timing diagrams. Variations, when they occur, have clear labels. You must not assume any timing information that is not explicit in the diagrams.

Shaded bus and signal areas are undefined, so the bus or signal can assume any value within the shaded area at that time. The actual level is unimportant and does not affect normal operation.
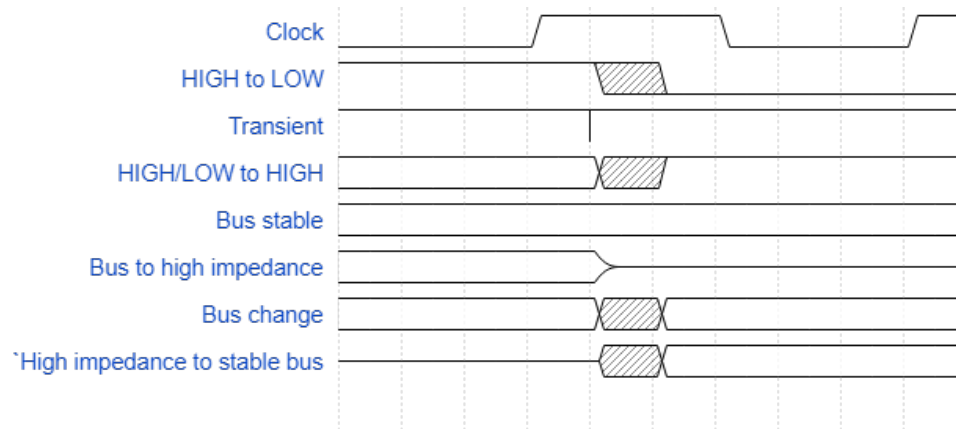
Signals

The signal conventions are:

Signal level

The level of an asserted signal depends on whether the signal is active-HIGH or active-LOW. Asserted means:

- HIGH for active-HIGH signals.
- LOW for active-LOW signals.

Lowercase n

At the start or end of a signal name denotes an active-LOW signal.

Additional reading

This book contains information that is specific to this product. See the following documents for other relevant information.

History of the World II, Mel Brooks.

1 Introduction

The current implementation of NCORE in certain scenarios reads data from DMI/DRAM even when a copy of the cacheline is available in the cache upstream. This specifically happens when snoop filter ends up tracking a cacheline as only sharer and no owners. This specification describes the changes needed promote one of the sharers as an owner for snooping and data retrieval purposes. This is an addendum to current arch and does not have all the details.

1.1 Parameters

No new parameters are introduced

1.2 Unique Presence

This section goes over updated to the unique presence field in snoop request messages Table 1 gives details of different encodings of the field.

UP	Name	Description
00	Reserved	future use for Null filters.
01	Unique Presence	This is the only copy in the system as per the Snoop filter. The snooping AIU maybe able to upgrade the Dtr type being issued to the requesting AIU
10	Reserved	Reserved
11	Unique Permission	The AIU identified in the MPF3 field is authorized to send DtrReq to the requesting AIU

TABLE 1 UNIQUE PRESENCE FIELD

1.2.1 UP = 00

This option maybe used in future for a null filter implementation where snoops are issued one at time i.e., the first caching agent's SnpReq must receive a SnpRsp before the next caching agent's SnpReq is issued. In this case any snooped AIU is authorized to issue a DtrReq. Depending on the type of request, DCE may stop issuing more SnpReq, if the Snooped AIU already sent out a DtrReq.

1.2.2 UP = 01

Unique Presence option maybe set only when one unique copy of the is cache line is present in the system. The snooped AIU in this case may upgrade the Dtr type to be issued from shared to unique. This is a legacy option that will be carried forward, benefit of this option is not quantified.

1.2.3 UP = 10

This option is reserved, with this new change in architecture the older functionality of this option is merged into UP = 11 option. This is done to simplify specification and design.

1.2.4 UP = 11

Unique Permission option is set to identify the AIU that is authorized to send the DtrReq. The Identified AIUs Funit ID is specified in the MPF3 field. If an owner is present in the system, then the owner is identified in the MPF3 field, if there are no owners and one or more sharers are present then one of the sharers is identified in the MPF3 field. The Snooped AIU is authorized to send the DtrReq if its own Funit ID matches the Funit ID in the MPF3 field of the SnpReq.

1.3 DCE Details

Table 2 shows details on how the UP and MPF3 field needs to be set for different snoop request. X here denotes don't care, Implementation may set it zero or any random value.

SnpReq	Condition	UP	MPF3	Notes
SnpClnDtr / SnpNoSDInt / SnpVldDtr /	Null filter	00	X	Future use
	Unique Owner/Sharer	01	X	AIU may upgrade to Unique Dtr
	Owner is identified Multiple sharers	11	Owner	
	Owner not identified Multiple Sharers	11	Find first Sharer	One of the sharer is promoted as owner
SnpInvDtr*	Null filter	00	X	Future use
	Unique Owner/Sharer	01	X	Issue DTR as per current spec of Snoop response map
	Owner is identified Multiple sharers	11	Owner	One owner and Multiple sharers are present in the system, issue DTW to DMI instead of DTR, In this case SnpRsp DC must be '0' and DT must be 2'b01
	Owner not identified Multiple Sharers	11	Find first Sharer	One of the sharers is promoted as owner, multiple sharers are present in the system, issue DTW to DMI instead of DTR , In this case SnpRsp DC must be '0' and DT must be 2'b01
SnpNitc/ SnpNitcMI / SnpNitcCI	Null filter	00	X	Future use
	Unique Owner/Sharer	01	X	
	Owner is identified Multiple sharers	11	Owner	
	Owner not identified Multiple Sharers	11	Find first Sharer	One of the sharer is promoted as owner

SnpReq	Condition	UP	MPF3	Notes
SnpInvDtw / SnpClnDtw / SnpInv / SnpInvStsh/ SnpUnqStsh / SnpStshUnq / SnpStshShd	Null filter	00	X	Future use
	Unique Owner/Sharer	01	X	AIU may do a DtwDataCln
	Owner is identified Multiple sharers	11	X	No DTR for this snoop so MPF3 is don't care
	Owner not identified Multiple Sharers	11	X	No sharer promotion in this case

TABLE 2 DCE UP AND MPF3 FILED SETTING

*Currently DCE issues SnpInvDtw for Read Unique when there is more than one agent with the copy of CL. This will need to change so that DCE issues SnpInvDtr for all Read Unique cases with UP settings as specified in the table above corresponding changes need to be made in AIUs. Motivation behind this change is to improve Read Unique performance when there is more than one copy of the CL in the system. The implementation of using SnpInvDtw may cause the DMI read when data is clean.

1.4 AIU Details

Table 3 gives details on different actions the AIUs need to take based on the UP and MPF3 field in different SnpReq.

SnpReq	UP	MPF3	CHI AIU RetToSrc	NCAIU with Proxy Cache	ACE AIU	Action
SnpClnDtr / SnpNoSDInt / SnpVldDtr / SnpInvDtr / SnpNitcMI / SnpNitcCI/ SnpNitc	00	X	Not set	-	-	Future use
	01	X	Set	-	-	AIU may upgrade to Unique DtrReq based on the Snoop response mapping specification
	11	Match	Set	Provide data even if in SC state	Provide data if provided by the ACE agent	AIU must send out the appropriate DtrReq based on the snoop response mapping specification (for SnpInvDtr this may be a DTW based on Table 2)
	11	No Match	Not set	Do not provide data	Drop data if provided by the ACE agent	AIU must not send out the DtrReq
SnpInvDtw / SnpClnDtw / SnpInv / SnpUnqStsh / SnpStshUnq / SnpStshShd	00	X	Not set	-	-	Future use
	01	X	Not set	-	-	AIU may do a DtwDataCln based on the Snoop response mapping specification
	11	X	Not set	-	-	No DTR for this snoop
	11	X	Not set	-	-	No DTR for this snoop

TABLE 3 AIU UP ACTION

2 Opens

Questions/Feedback/Need to discuss:

3 Glossary

Arteris

A NoC Company

NCore3

A coherent NoC provided by Arteris with AMBA interfaces and built-in caches.

4 Notes

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