Network on a chip

The Network on a chip is a pair of low pin count uni-directional bus. The data is transferred in packets on a nine bit bus. Bit 8 is a control bit indicating a framing byte. The bus supports a few basic packets. These are listed in the table below:

Code	Name	Comment
000	Idle	Used to fill the bus
001	Read	Starts a read operation
010	ReadResponse	Responds to a read (With data)
011	Write	Starts a write operation (With data)
100	WriteResponse	Indicates a write has completed
101	Reserved	Reserved for future use
110	Message	A message to another node
111	End	Ends a variable packet

The data is coded as:

8	7	6	5	4	3	2	1	0
1	Code			Code dependent				

Different codes have different packet formats. These formats are indicated below:

Idle Code

8	7	6	5	4	3	2	1	0
1	0	0	0	X	X	X	X	X

The idle code is ignored by a device. It may be inserted at any time, and is used to indicate there is no message present. A master may insert it if data is not available. No more than 15 idle codes should be inserted in an active packet. The idle code will be inserted by routers when required. Routers are not required to propagate the idle code.

Read Code

8	7	6	5	4	3	2	1	0
1	0	0	1	Len	Ones	AddrLen		
0	SourceID							

The read message is used to start a read operation. The read operation contains an address and length field. The address field is variable length. The length is encoded using the AddrLen field.

000	1 byte
001	2 bytes
010	3 bytes
011	4 bytes
100	5 bytes
101	7 bytes
110	8 bytes
111	12 bytes

The ‘Ones’ field indicates if the unsent bytes should be considered zeros or ones by the device.

A sourceID field is next sent. This field will be used by the read response field to send data back to the originator.

The Address is send immediately after the sourceID field. (The command bit will be zero)

The read length is sent after the address. The ‘Len’ bit indicates if the length field is one byte (0), or 2 bytes (1).

The read command does not require an end command. The length is determined by the first byte.

The NoC interface should discard any read requests that are to an address not contained in the device.

ReadResponse Code

The readResponse code provides data after a read request has been sent.

8	7	6	5	4	3	2	1	0
1	0	1	0	Reserved	Err	Err Code		
0	ReturnID							

The ReadResponse returns the sourceID as the ReturnID. This allows the NoC route the message back to the originator.

The ReturnID is followed by any returned data. At the end of the data, An End command is used.

Any read error will set the Err bit, and a 3 bit error code. The error code is device dependent. There may or may not be data returned on a read.

Write Code

The write code starts a write operation. It is like a read except it also contains the write data.

8	7	6	5	4	3	2	1	0
1	0	1	1	Len	Ones	AddrLen		
0	SourceID							

The len, Ones, AddrLen, and SourceID work the same as the Read Code.

The write data follows the length field. The write code does not require an End command code. The length is tracked by the network.

WriteResponse Code

The write response code indicate the completion of a write.

8	7	6	5	4	3	2	1	0
1	1	0	0	Reserved	Err	Err Code		
0	ReturnID							

The return ID is used by the NoC for routing back to the requester.

The err bit indicates a problem with the write. The problem is further identified by the Err Code. The errors are device dependent.

Message Code

A message is sent to a central message area. The nature and operation of a message is system dependent.

8	7	6	5	4	3	2	1	0
1	1	1	0	MLen				

The Mlen field encodes the number of bytes in the message. A message may contain up to 31 bytes of message.

Most devices will not receive a message, and it can simply be discarded.

End Code

8	7	6	5	4	3	2	1	0
1	1	1	1	X	X	X	X	X

The end code is used to terminate a readResponse variable length data.

They are ignored in any other position.

The system has two buses. One carries data to the device, and one Carries data from the device. These are named as follows:

Name	Size	Dir	Comment
CmdW	1	In	Command bit written to the device NoC interface
DataW	8	In	Data with the command bit
CmdR	1	Out	Command bit from interface to system
DataR	8	Out	Data from interface to system