Subblock Ordering

C

A block of data elements (whether bytes, halfwords, words, or doublewords) can be retrieved from storage in two ways: in sequential order, or using a subblock order. This chapter describes these retrieval methods, with an emphasis on subblock ordering.

C.1 Sequential Ordering

Sequential ordering retrieves the data elements of a block in serial, or sequential, order.

Figure C-1 shows a sequential order in which byte 0 is taken first and byte 7 is taken last.

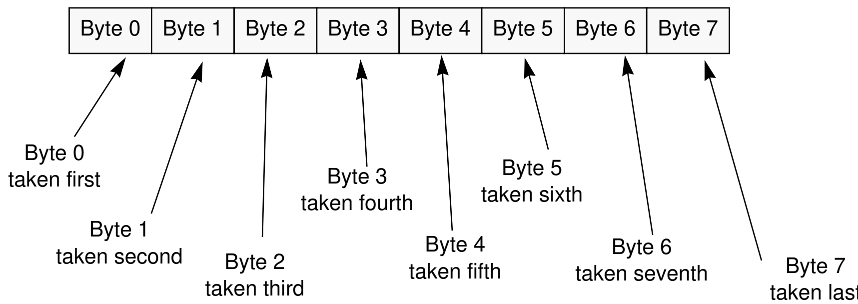

Figure C-1 Retrieving a Data Block in Sequential Order

C.2 Subblock Ordering

Subblock ordering allows the system to define the order in which the data elements are retrieved. The smallest data element of a block transfer for the R400 is a doubleword, and Figure C-2 shows the retrieval of a block of data that consists of 8 doublewords, in which DW2 is taken first.

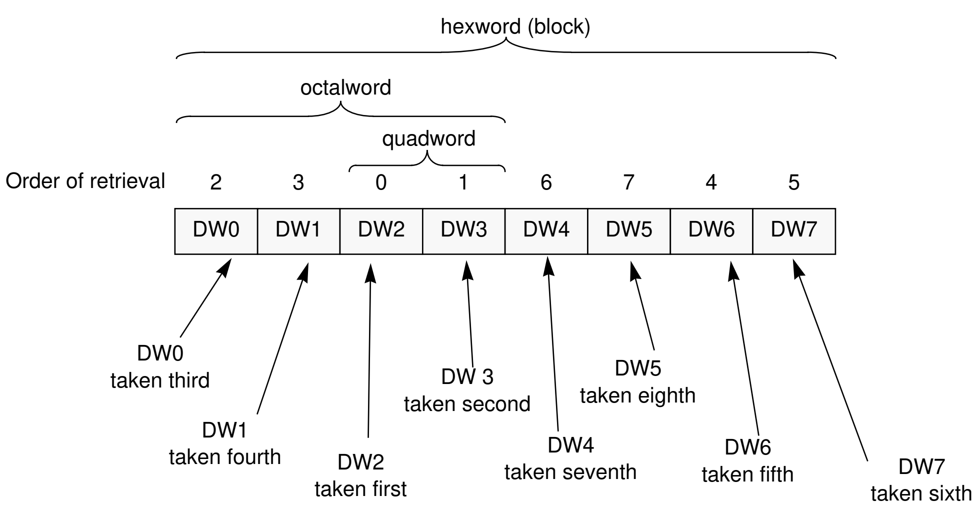

Figure C-2 Retrieving Data in a Subblock Order

Using the subblock ordering shown in Figure C-2, the doubleword at the target address is retrieved first (DW2), followed by the remaining doubleword (DW3) in this quadword.

Next, the quadword that fills out the octalword are retrieved in the same order as the prior quadword (in this case DW0 is followed by DW 1). This is followed by the remaining octalword (DW8, DW7, DW4, DW5), that fills out the hexword.

It may be easier way to understand subblock ordering by taking a look at the method used for generating the address of each doubleword as it is retrieved. The subblock ordering logic generates this address by executing a bit-wise exclusive-OR (XOR) of the starting block address with the output of a binary counter that increments with each doubleword, starting at doubleword zero (000_2).

Using this scheme, Tables C-1 through Table C-3 list the subblock ordering of doublewords for a 32-word block, based on three different starting-block addresses: 0010_2, 1011_2, and 0101_2. The subblock ordering is generated by an XOR of the subblock address (either 0010_2, 1011_2, and 0101_2) with the binary count of the doubleword (0000_2 through 1111_2). Thus, the eighth doubleword retrieved from a block of data with a starting address of 0010_2 is found by taking the XOR of address 0010_2 with the binary count of DW8, 0111_2. The result is 0101_2, or DW5 (shown in Table C-1).

The remaining tables illustrate this method of subblock ordering, using various address permutations.

Table C-1 Sequence of Doublewords Transferred Using Subblock Ordering: Address 0010_2

Cycle	**Starting Block Address**	**Binary Count**	**Double Word Retrieved**
1	0010	0000	0010
2	0010	0001	0011
3	0010	0010	0000
4	0010	0011	0001
5	0010	0100	0110
6	0010	0101	0111
7	0010	0110	0100
8	0010	0111	0101
9	0010	1000	1010
10	0010	1001	1011
11	0010	1010	1000
12	0010	1011	1001
13	0010	1100	1110
14	0010	1101	1111
15	0010	1110	1100
16	0010	1111	1101

Table C-2 Sequence of Doublewords Transferred Using Subblock Ordering: Address 1011_2

Cycle	Starting Block Address	Binary Count	Double Word Retrieved
1	1011	0000	1011
2	1011	0001	1010
3	1011	0010	1001
4	1011	0011	1000
5	1011	0100	1111
6	1011	0101	1110
7	1011	0110	1101
8	1011	0111	1100
9	1011	1000	0011
10	1011	1001	0010
11	1011	1010	0001
12	1011	1011	0000
13	1011	1100	0111
14	1011	1101	0110
15	1011	1110	0101
16	1011	1111	0100

Table C-3 Sequence of Doublewords Transferred Using Subblock Ordering: Address 0101_2

Cycle	Starting Block Address	Binary Count	Double Word Retrieved
1	0101	0000	0101
2	0101	0001	0100
3	0101	0010	0111
4	0101	0011	0110
5	0101	0100	0001
6	0101	0101	0000
7	0101	0110	0011
8	0101	0111	0010
9	0101	1000	1101
10	0101	1001	1100
11	0101	1010	1111
12	0101	1011	1110
13	0101	1100	1001
14	0101	1101	1000
15	0101	1110	1011
16	0101	1111	1010