Given:

Address Size: 16 bits

Word Size: 16 bits

Block Size: 4 words × 16 bits = 64 bits = 8 bytes per block

Associativity: 2-way (since each section has 2 blocks = 2-way set associative)

Cache Capacity: 4096 words = 4096 × 2 bytes = 8192 bytes = 8 KB

Solution:

1. Calculate Number of Cache Blocks

- Each block = 4 words = 8 bytes
- Cache size = 8192 bytes
- Number of blocks = 8192 / 8 = 1024 blocks

2. Determine Number of Sets

- It is 2-way set associative (2 blocks per set)
- Number of sets = 1024 / 2 = 512 sets

3. Breakdown of 16-bit Address

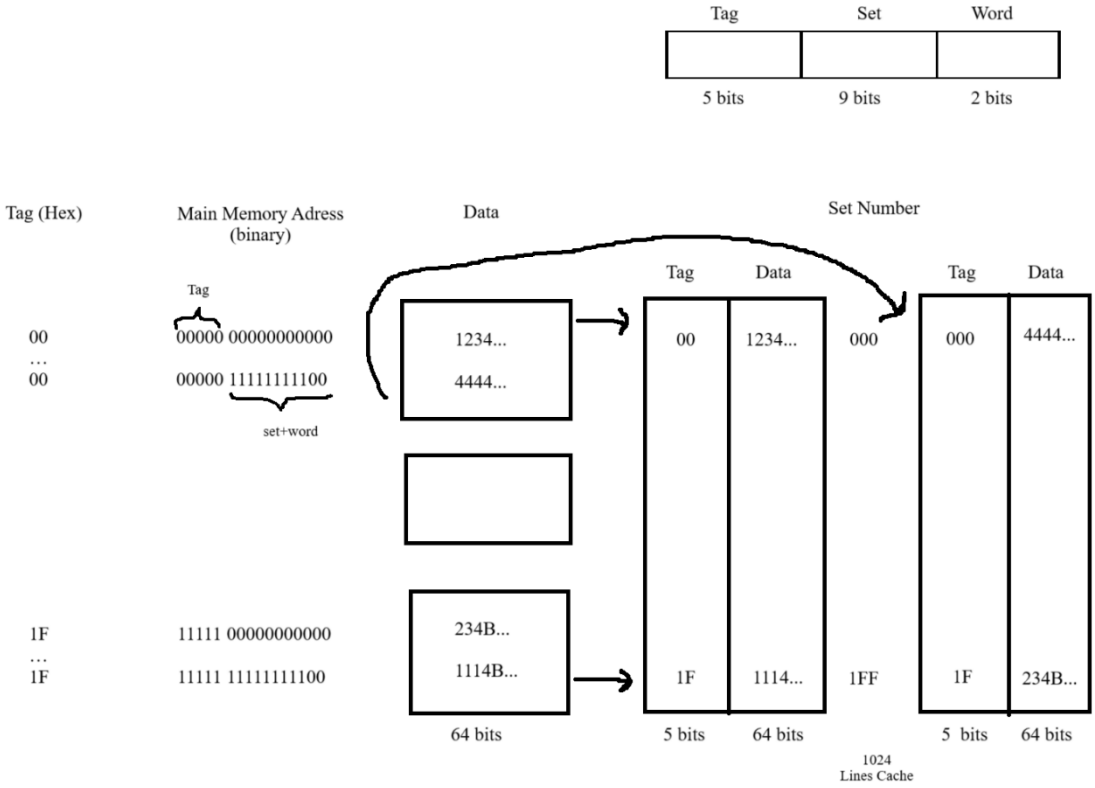
We divide the address into:

Block Offset:
- Each block = 4 words = 2 bits to identify the word inside the block
- So, 2 bits for offset

Set Index:
- 512 sets = 2^9 → 9 bits for set index

Tag:
- Total address = 16 bits
- Tag = 16 - (9 + 2) = 5 bits for tag

Diagram:


Tag
Set
Word
5 bits
9 bits
2 bits
Tag (Hex)
Main Memory Adress (binary)
Data
Set Number
Tag
00
…
00
00000 00000000000
00000 11111111100
set+word
1234...
4444...
1F
…
1F
11111 00000000000
11111 11111111100
234B...
1114B...
64 bits
Tag
Data
00
1234...
1F
1114...
5 bits
64 bits
000
1FF
1024
Lines Cache
Tag
Data
000
4444...
1F
234B...
5 bits
64 bits