MIPS Data Transfer Instructions

Opcode rt, immed (rs)

- rt: the loaded or stored value
- immed (rs): the memory address
  - rs: base address
  - immed: signed 16-bit offset value (displacement)
- full address = base + offset
  - allows a full 32 bit address
  - can address ± 32KB from base address
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Some examples:

\begin{verbatim}
lw $8, 46($10)     # $8 = memory[$10+46]
sw $8, 46($10)     # memory[$10+46] = $8
lb $9, -256($10)   # $9 = sign-extended(memory[$10-256])
lbu $9, -256($10)  # $9 = zero-extended(memory[$10-256])
sh $9, -256($10)   # memory[$10-256] = the least
                   # significant halfword of $9
\end{verbatim}
I-type Format

I-type format used for data transfer instructions

```
31 26 20 16
[ opcode ][ rs ][ rt ][ immed ]
25 21 15 0
```

- **opcode** = operation
  - opcode = data transfer instruction
- **rs** = base address
- **rt** = register value that is loaded from or stored to memory
- **immed** = address offset in bytes, $\pm 2^{15}$
  - sign-extended when used (replicate msb)

```
lw $14, 8($sp)
[ 35 ][ 29 ][ 14 ][ 8 ]
```