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 the base address

Some examples:

```assembly
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
```
I-type Format

I-type format used for data transfer instructions

- **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)

\[ \text{lw $14$, 8($sp)$} \]

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<tr>
<th>35</th>
<th>29</th>
<th>14</th>
<th>8</th>
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- \( \text{lw} \) = load word
- \$14\) = register
- \(8\) = value to load