MIPS Data Transfer Instructions

Opcodes: 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:

- lw $t0, 46($t2) # $t0 = memory[$t2+46]
- sw $t0, 46($t2) # memory[$t2+46] = $t0
- lb $t1, -256($t2) # $t1 = sign-extended (memory[$t2-256])
- lbu $t1, -256($t2) # $t1 = zero-extended (memory[$t2-256])
- sh $t1, -256($t2) # memory[$t2-256] = the least significant halfword of $t1
I-type Format

I-type format used for data transfer instructions

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

```
    lw $t6, 8($sp)
```

<table>
<thead>
<tr>
<th>31</th>
<th>26</th>
<th>20</th>
<th>16</th>
<th>25</th>
<th>21</th>
<th>15</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>opcode</td>
<td>rs</td>
<td>rt</td>
<td>immed</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>35</th>
<th>29</th>
<th>14</th>
<th>8</th>
</tr>
</thead>
</table>