Gating in 8051 Microcontroller

In the **8051 microcontroller**, **gating** refers to a feature that allows the timers (Timer 0 and Timer 1) to be controlled by an external signal, typically from a pin (e.g., **INT0** or **INT1**). This feature is enabled or disabled using the **GATE bit** in the **TMOD (Timer Mode) register**.

Gating in 8051 Timers

- When **gating is enabled**, the timer will only run if the external pin (**INT0** for Timer 0 or **INT1** for Timer 1) is held high. This allows external hardware to control the operation of the timer.
- When **gating is disabled**, the timer runs independently of the external pin, and its operation is controlled solely by the **TR0** or **TR1** bits in the **TCON register**.

TMOD Register and GATE Bit

The **TMOD (Timer Mode) register** is used to configure the operating mode of Timer 0 and Timer 1. It is an 8-bit register, divided into two 4-bit fields:

- Lower 4 bits: Control Timer 0.
- Upper 4 bits: Control Timer 1.

Each 4-bit field has the following structure:

Bit	Name	Description
3	GATE	Gating control bit.
2	C/T	Counter/Timer select bit.
1	M1	Mode bit 1.
0	M0	Mode bit 0.

- **GATE Bit**:
  - When **GATE = 1**, the timer is gated. It will only run if the external pin (**INT0** or **INT1**) is high **and** the corresponding **TR0** or **TR1** bit in the TCON register is set.
  - When **GATE = 0**, the timer runs independently of the external pin, and its operation is controlled solely by the **TR0** or **TR1** bit.

How Gating Works

- **GATE = 1**:
  - The timer will only run if:
    - The corresponding **TR0** or **TR1** bit in the TCON register is set.
    - The external pin (**INT0** for Timer 0 or **INT1** for Timer 1) is high.

  - This allows external hardware to control the timer's operation.

- **GATE = 0**:
  - The timer runs as long as the corresponding **TR0** or **TR1** bit in the TCON register is set.
  - The external pin (**INT0** or **INT1**) has no effect on the timer's operation.

Example Use Case

Gating is useful in applications where you want to measure the duration of an external event. For example:

- You can use Timer 0 to measure the width of a pulse on the **INT0** pin.
- Set **GATE = 1** for Timer 0.
- Start the timer by setting **TR0 = 1**.
- The timer will only run while the **INT0** pin is high, effectively measuring the pulse width.

Summary

- **Gating** in the 8051 allows external pins (**INT0** or **INT1**) to control the operation of Timer 0 or Timer 1.
- It is enabled by setting the **GATE bit** in the **TMOD register**.
- When **GATE = 1**, the timer runs only if the external pin is high and the corresponding **TR0** or **TR1** bit is set.
- When **GATE = 0**, the timer runs independently of the external pin.
- Gating is useful for applications like pulse width measurement or synchronizing timer operation with external events.