Embedded Systems: ARM SWD Protocol

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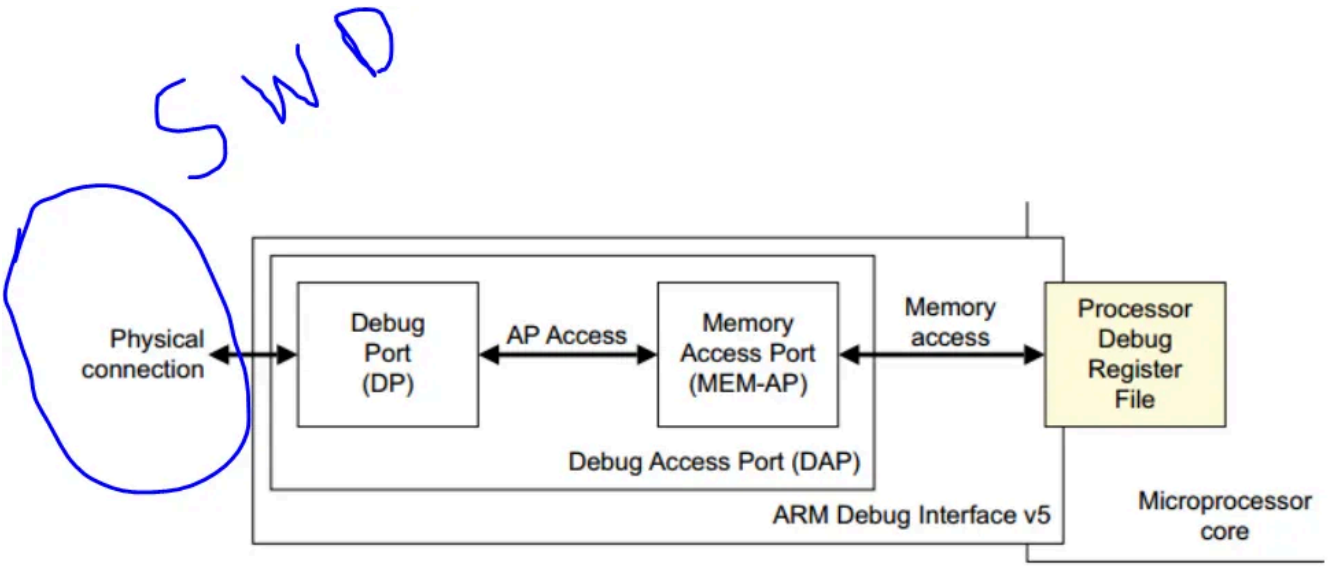
Overview



ARM Debug Infrastructure, SWD as communication Protocol

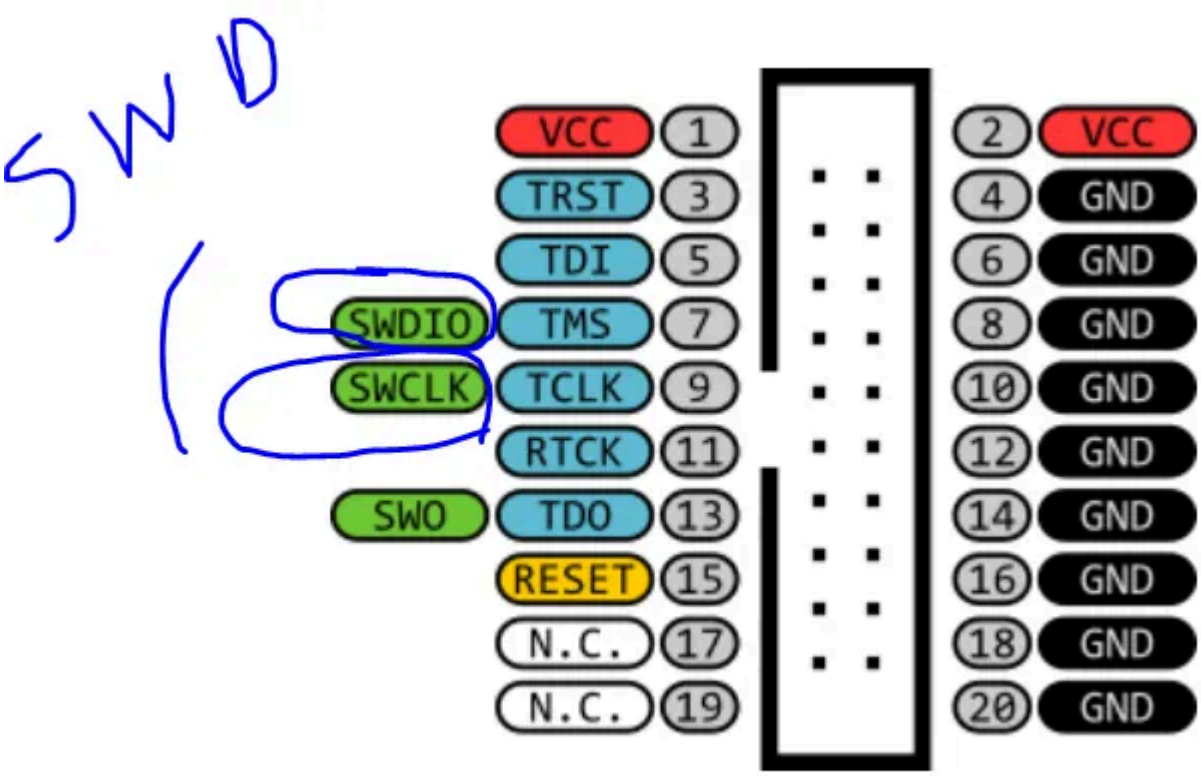
SWD (Serial Wire Debug) is ARM based protocol , and was created as an alternative to JTAG protocol, allowing communication with ARM DAP.

ARM DAP consists of two modules: DP(Debug port) and AP(Access Port), SWD protocol used mainly to communicate with DP part (this path known as SWD-DP path), and then DP used to selected appropriate AP and read/write data through the selected AP.

Pinout

SWD is 2-pin Interface (SWDIO/SWCLK), the protocol use Bi-directional line for data known by S
directional

In term of physical connection, those pins are added on top of existing JTAG connector as we can see below



SWD Physical Connector

Protocol Description

Each sequence of operations on the wire consists of two or three phases:

Packet request:

The external *host* debugger issues a request to the DP. The DP is the *target* of the request.

Acknowledge response:

The target sends an acknowledge response to the host.

Data transfer phase:

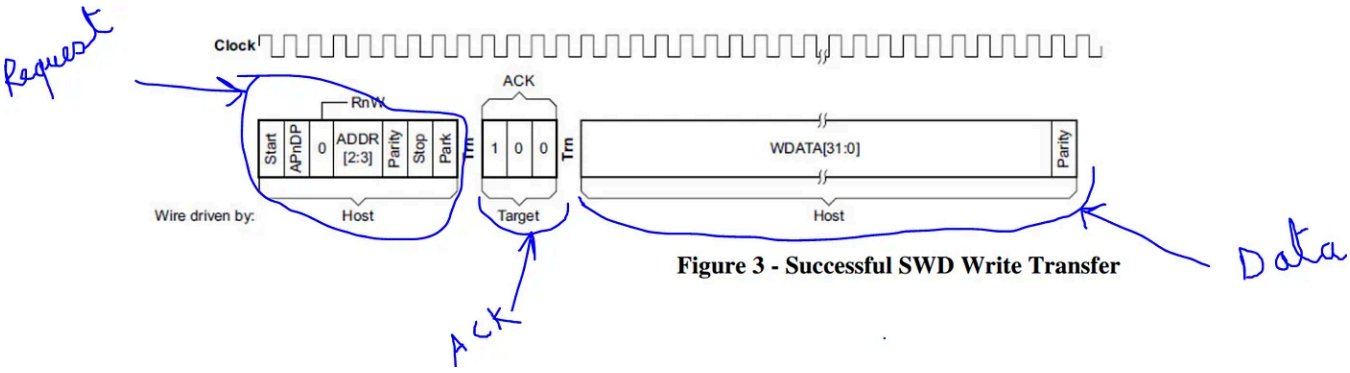
This phase is only present when either:

- a data read or data write request is followed by a valid (OK) acknowledge response.
- the ORUNDETECT flag is set to 1 in the CTRL/STAT Register, see *The Control/Status Register, CTRL/STAT*.

The data transfer is one of:

- target to host, following a read request (RDATA)
- host to target, following a write request (WDATA).

Example of SWD write operation on SWD lines:



SWD Write Operation (SWD-DP)

JTAG vs SWD

JTAG Pos:

- Widely used in multiple devices and processor family (not limited to ARM like SWD)

- Offer more functionalities beside debugging , liek Boundary Scan testing, PCB faults c

JTAG Cons:

- Requires more pins than SWD, so not suitable for system which has limited pinout resources.
- More sophisticated in term of implementation compared to SWD (requires state machine implementation on TAP level).

SWD Pos:

- Less Pin count required , only two pins required (SWCLK/SWDIO).
- Faster than JTAG

SWD Cons:

- Limited functionalities in comparison to JTAG (used only for debugging)
- Not always reliable/stable when using it for long time
- Limited to ARM based chips

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AP[2:0]	Privileged access	Unprivileged access	Notes
000	No access	No access	Any access generates a permission fault
001	Read/Write	No access	Privileged access only
010	Read/Write	Read-only	Any unprivileged write generates a permission fault
011	Read/Write	Read/Write	Full access
100	UNPREDICTABLE	UNPREDICTABLE	Reserved
101	Read-only	No access	Privileged read-only
110	Read-only	Read-only	Privileged and unprivileged read-only
111	Read-only	Read-only	Privileged and unprivileged read-only

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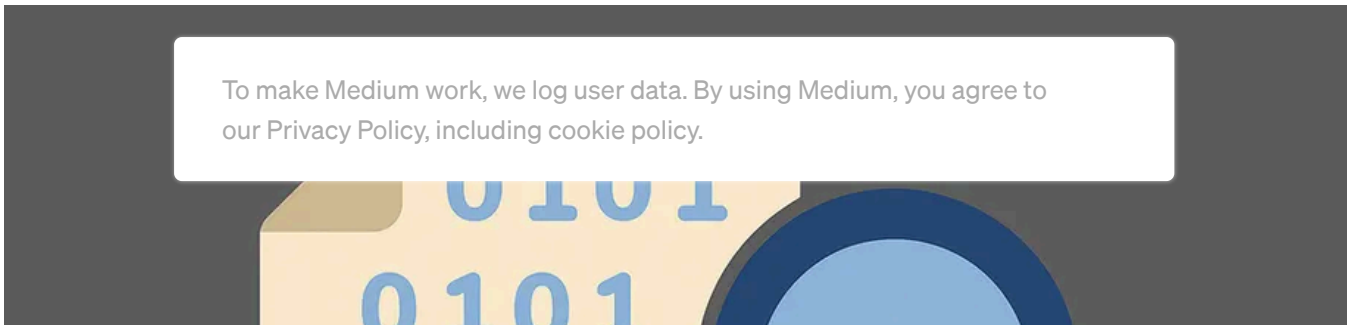

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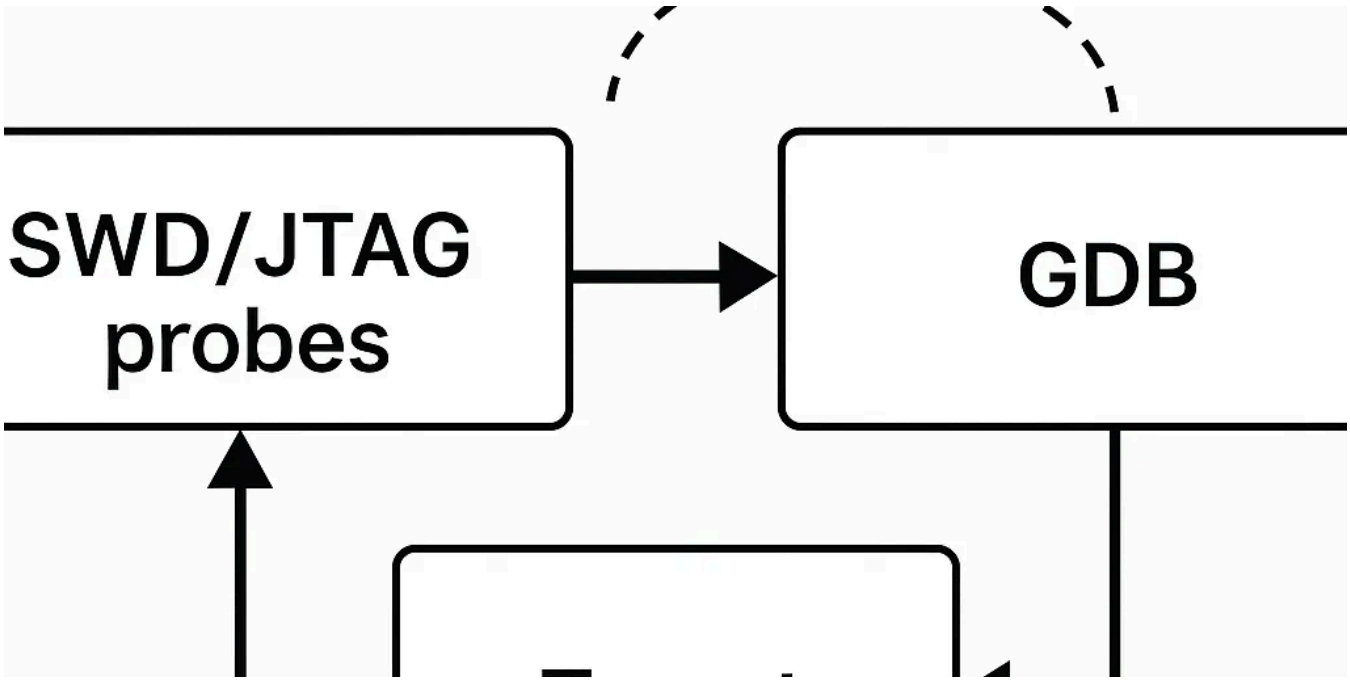

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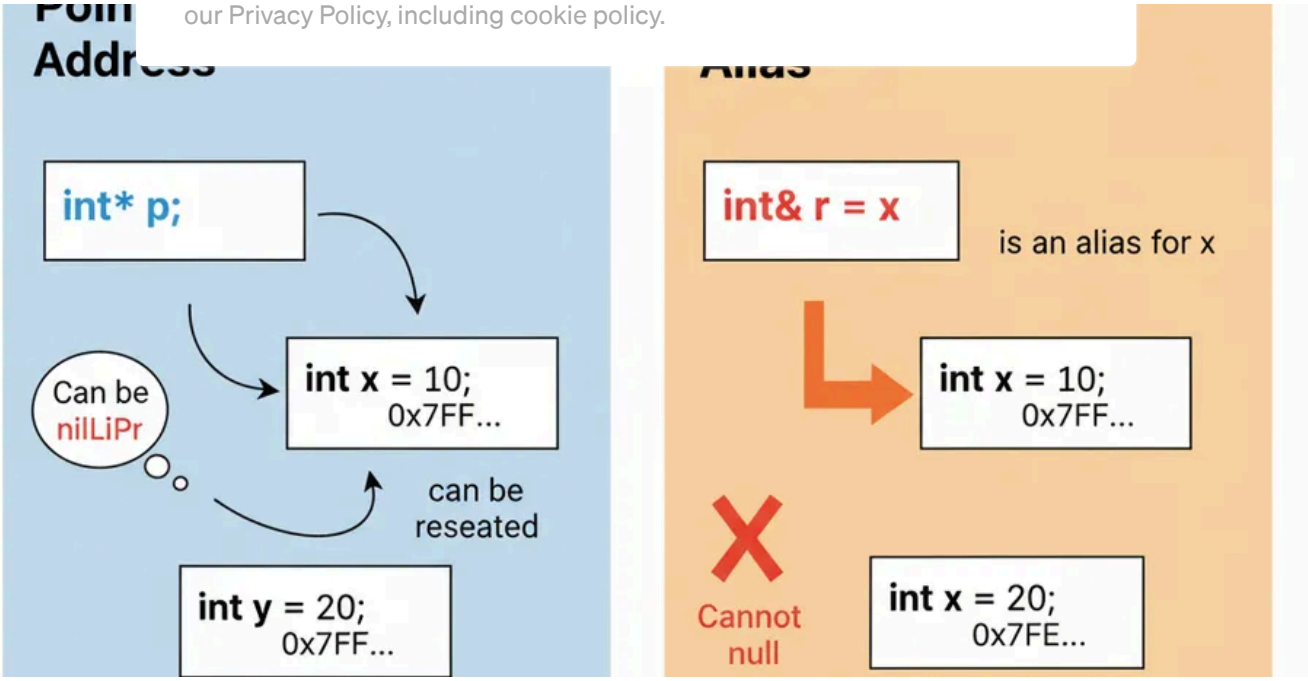

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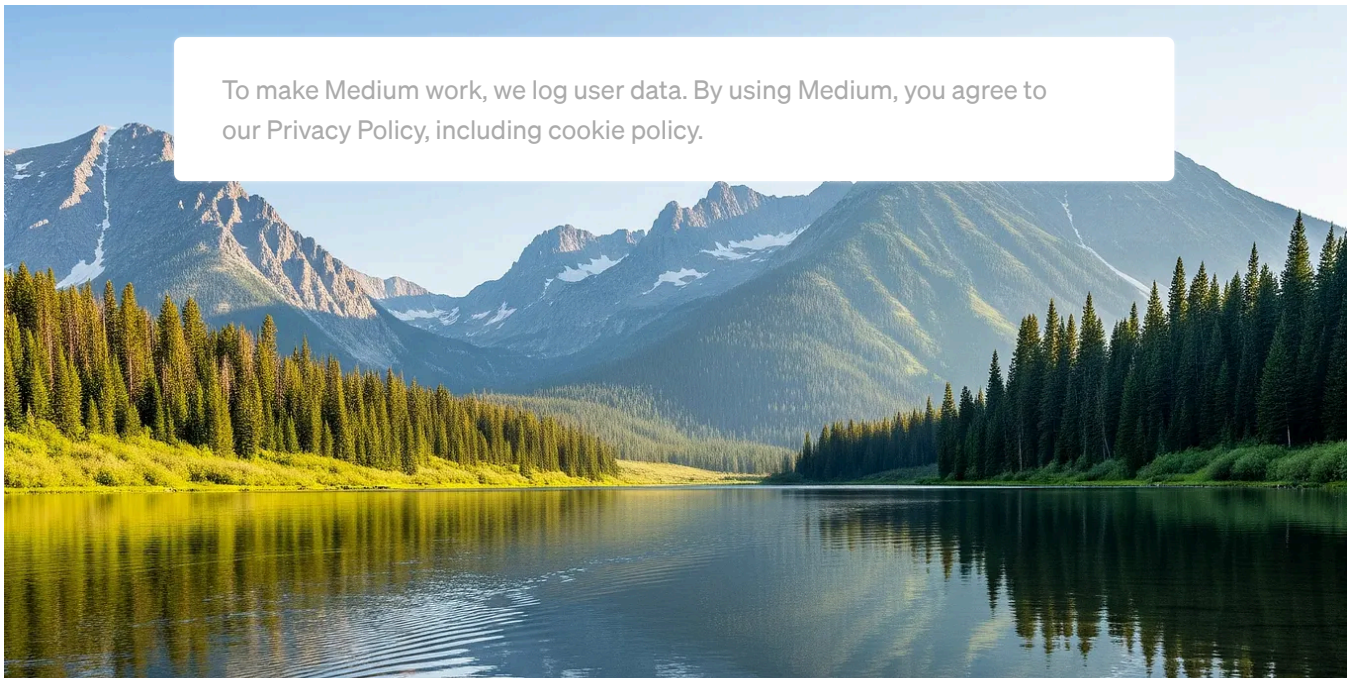

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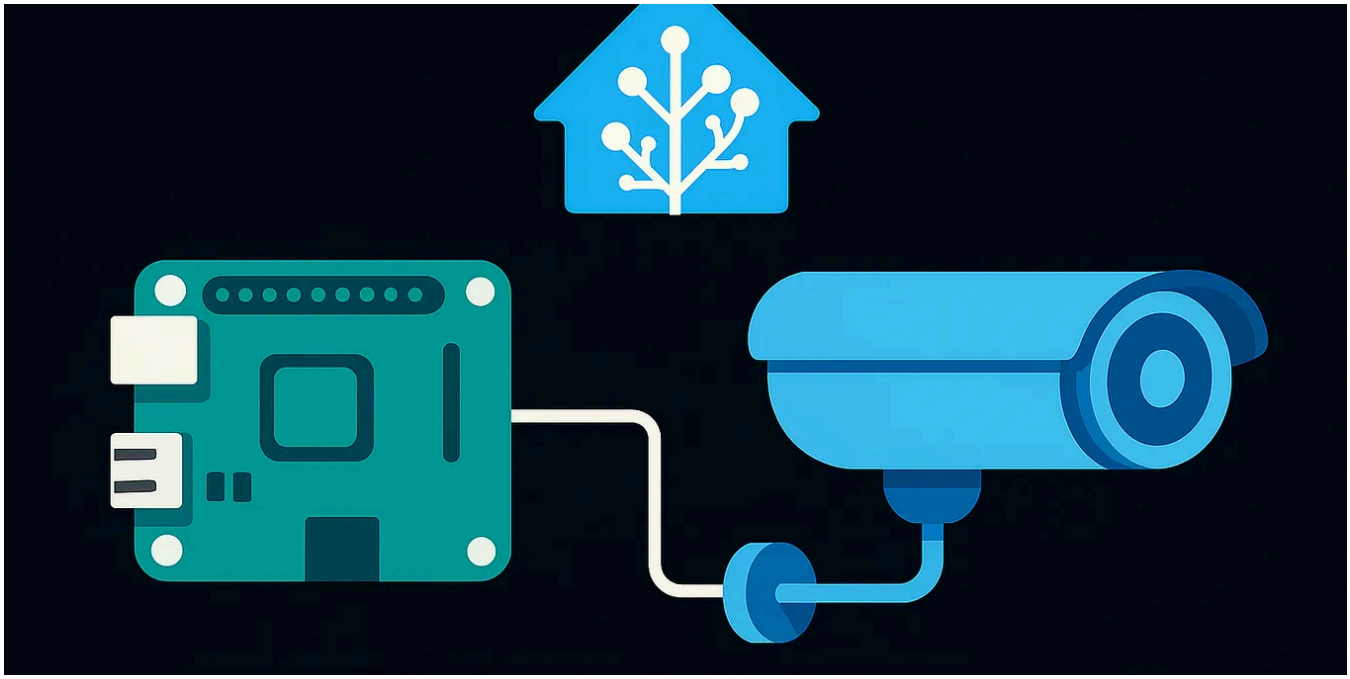

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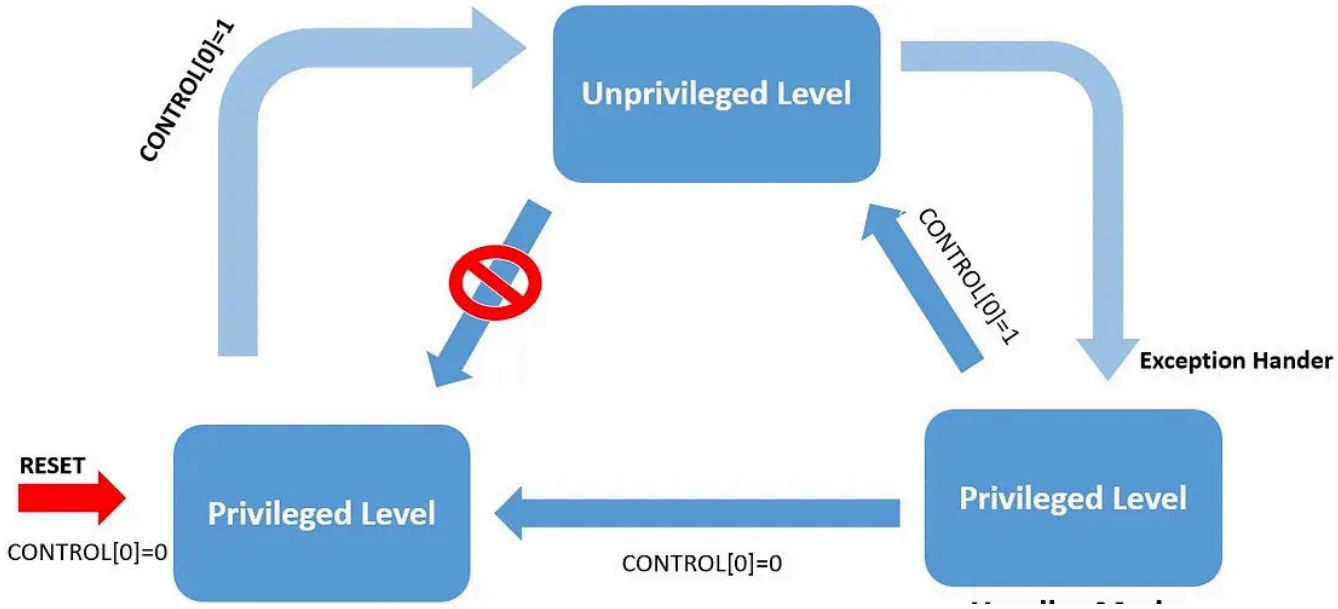

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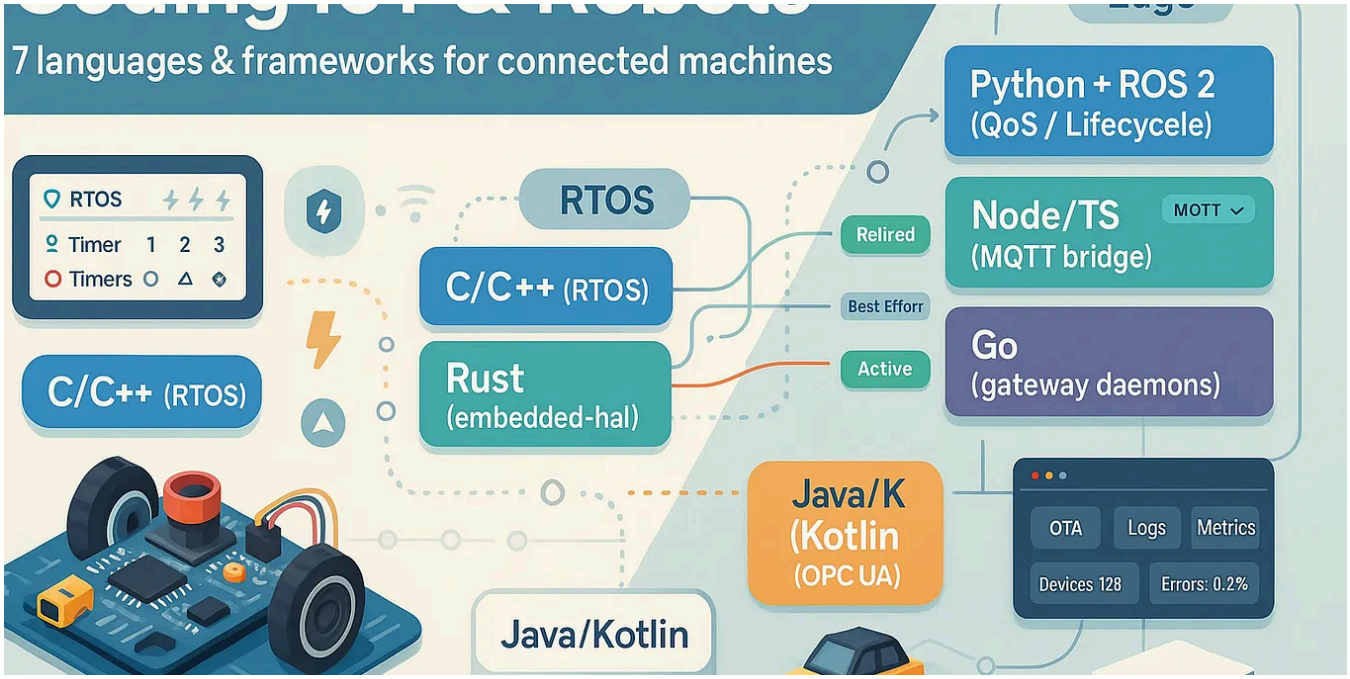

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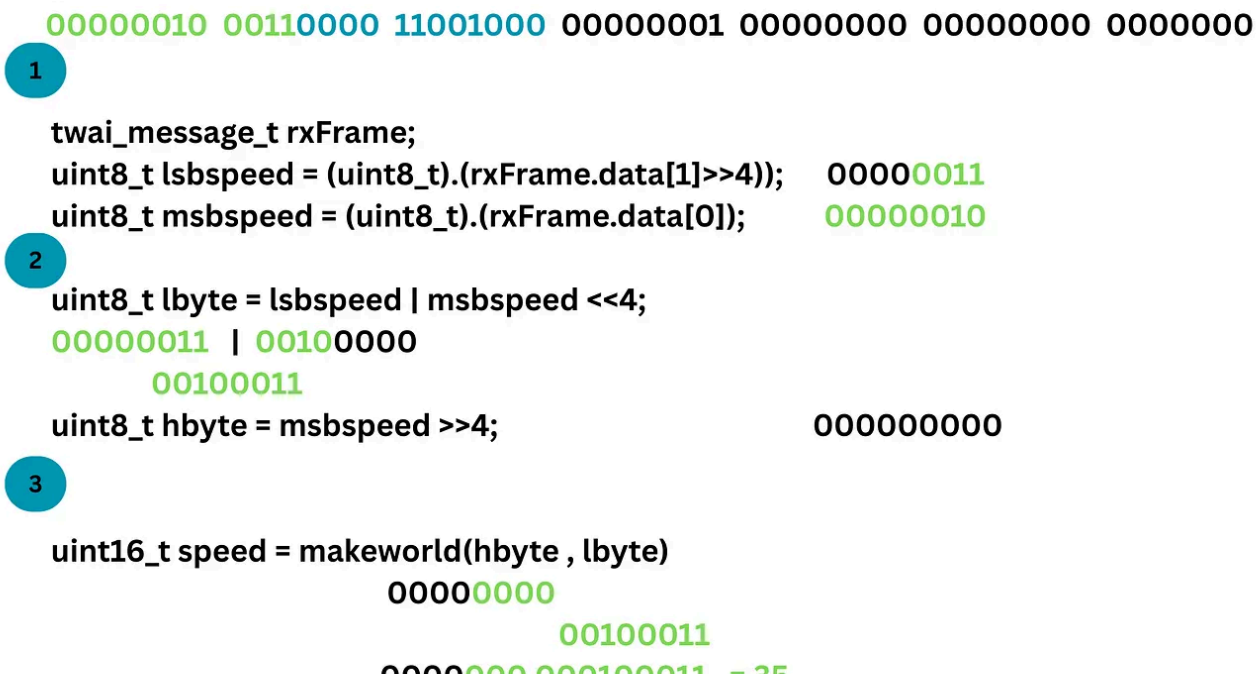

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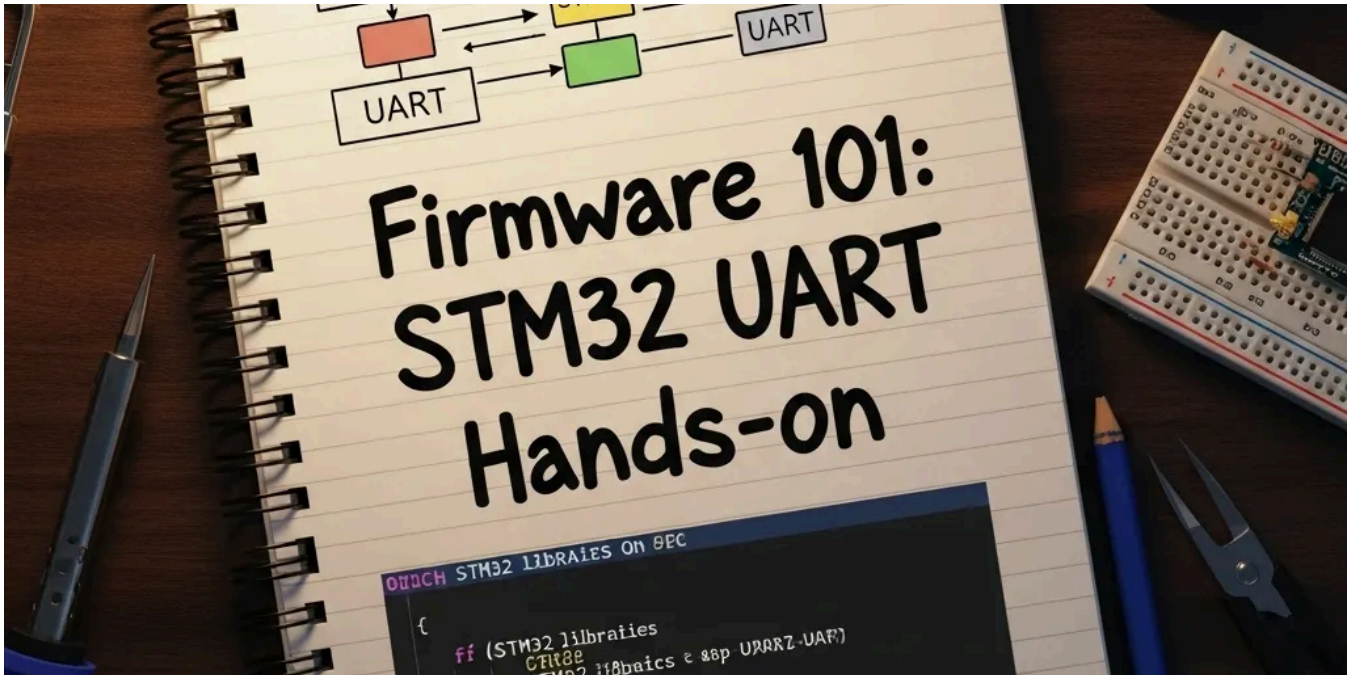
Learning Bitwise Operations and Shifting via a CAN Bus Example

For a task, I have to work with CAN bus and extract data from binary messages. The data comes as 8 bytes, and each byte contains 8 bits...

Aug 27



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