The control loop applications in ARM boards

This document describes a particular application which is used as a skeleton for the EMS board: the control loop application. This application is built using the embOBJ framework and some HW timers provided by HAL. The HW timers offer a configurable but precise periodic control loop executed at maximum priority and the embOBJ framework offers more advanced services such as multitasking for lower priority tasks, UDP networking, error management etc.

The control loop executes in round robin three high priority tasks: one for reception, one for doing operations, and one for transmission. When the MPU is not involved in any of the above three tasks the scheduler of OSAL allows other tasks to execute. Typically those tasks are embedded in suited objects (the backdoor, the listener, the error handler, etc.).

Approval History

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# The control loop application

To be done.

## To be done

Bla bla bla.

Rumenta utile per editing del document

BEHAVIOUR OF EMS AT POWER ON

eUpdater

WAIT MODE

Timeout of 5 seconds

SERVICE MODE

eApplication

EMS services

(info + FW update)

CAN gateway

(FW update of CAN dev)

Received a UDP packet on 3333

eLoader

**Figure 1**: The behaviour of the EMS at power on.

## dxxwqcwe

c wedcdcxswcxs.

## sdcewcxzc

b nytnty nt.

### UDP protocol for EMS service

dxewdwedw.

|  |  |  |
| --- | --- | --- |
| COMMAND | OPC | Description |
| CMD\_SCAN | 0xFF | The EthLoader sends it in broadcast to query existing devices.  PKT = {OPC}  The EMS sends back a reply of 14 bytes:  PKT = {OPC, D01, .. , D13}, where  D01: module->info.entity.version.major  D02: module->info.entity.version.minor  D03: BOARD\_TYPE\_EMS = 0x0A  D04-D07: IP net mask  D08-D13: MAC address |
| CMD\_CANGTW\_START | 0x20 | The EthLoader sends it to start the CAN gateway mode on EMS.  PKT = {OPC}  At reception, the EMS enters in CAN gateway mode. The EMS initialises the CAN1 and CAN2, sends twice the BOARD command over CAN to force the boards to enter in bootloader, and then it enables the communication CAN1 / CAN2 🡨🡪 UDP port 3334. The whole startup takes two seconds.  It sends back NOTHING. |

**Table 1** – UDP commands on service port 3333.

### UDP protocol for CAN gateway service

When the can cedcedcewcewqcweq. The UDP packets use the following protocol to exchange CAN frames between a host and the attached CAN boards.

UPD PACKET FOR CAN GATEWAY

UDP CAN GTW

HEADER

BODY

8 BYTES

16\* N BYTES

**Figure 2**: The UDP CAN GTW frame used for can gateway service.

HEADER OF UPD PACKET FOR CAN GATEWAY

HEADER

BODY

8 BYTES

SIGN

N

DUMMY

1 BYTE

1 BYTE

6 BYTES

Used to recognize a valid frame: 0x12

Number of CAN frames

**Figure 3**: The header of the UDP CAN GTW frame.

BODY OF UDP PACKET FOR CAN GATEWAY

HEADER

16\*N BYTES

CANFRAME

BODY

i = 1 .. HEADER.N

CANX

LEN

ID

DUMMY

DATA

1 BYTE

1 BYTE

2 BYTES

4 BYTES

8 BYTES

CAN1 (1) or CAN2 (2)

Of DATA field

CAN ID at 11 bits

CAN data

**Figure 4**: The body of the UDP CAN GTW.