Communication components

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Chapter 1. CAN/CANopen user guide

Introduction

The CAN/CANopen component consists of four main parts.

- LinCAN driver
- Virtual CAN API (VCA) and libvca
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- CAN monitor

Virtual CAN API (VCA) and libvca

Description and implementation issues

The libvca consists of five parts.

- VCA base (vca_base.c)
- Object dictionary acces (vca_od.c)
- SDO processing (vcasdo_fsm.c)
- PDO processing (vca_pdo.c)
- Miscelaneous and utility functions

The main idea of VCA is to have only one interface between application/library and CAN driver (LinCAN). The access to the CAN driver is different in RTLinux and Linux user space. While the function calls are used in RTLinux, the user space application uses /dev/can device. This is why we need VCA.

Next figures shows how to incorporate all the parts of libvca to work together in both spaces.

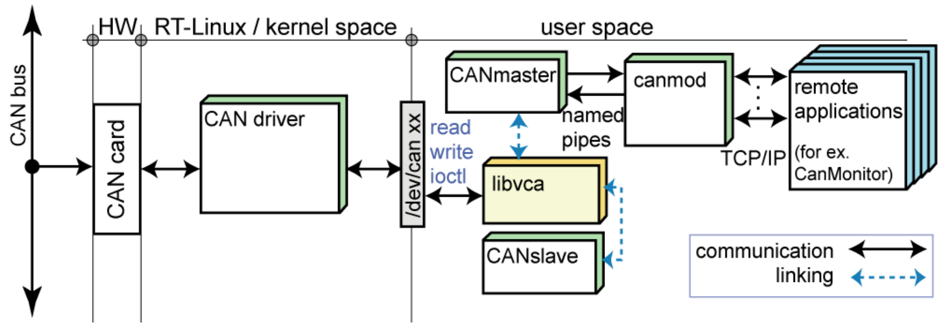


Figure 1-1. Usage of libvca in the Linux user space

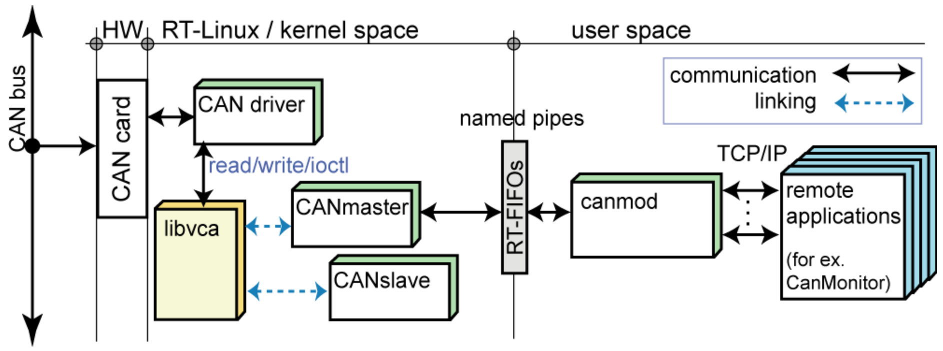


Figure 1-2. Usage of libvca in the RTLinux space

VCA base

VCA base is primarily a set of primitive functions used open/close CAN driver and send/receive CAN message. Where are also couple od IOCTLs shielded by VCA base. Most of VCA base is implemented in `vca_base.c`. One part of VCA base is also logging support used by whole CAN/CANopen component. Log support is implemented in `vca_log.c`.

Next code fragment shows simple usage of VCA primitives.

```
vca_handle_t canhandle;
const char *candev = "/dev/can0";
printf("Opening %s\n", candev);
if (vca_open_handle(&canhandle, candev, NULL, 0) != VCA_OK) {
    perror("open");
    exit(1);
}

while (1) {
    struct canmsg_t readmsg;
    int ret = vca_rec_msg_seq(canhandle, &readmsg, 1);
    if(ret < 0) {
        vca_log("cantest", LOG_ERR, "Error reading message from ’%’s\n", candev);
    }
    else {
        printf("Received message #%lu: id:%lx data:[",i,readmsg.id);
        for(n=0 ; n<readmsg.length ; n++) {
            if(n > 0) printf(" ");
            printf("%.2x", (unsigned char)readmsg.data[n]);
        }
        printf("]\n");
        i++;
    }
}
```

Object dictionary acces

The Object Dictionary (OD) is implemented as a GAVL tree of vcaod_object_t objects. It can be also a GSA array for embeded devices with small amount of memory, but this feature is not implemented yet.

There are three main functions for access to objects in OD.

- vcaod_find_object
- vcaod_get_value
- vcaod_set_value

Using this function one can read or change objects in OD.

```
vca_handle_t canhandle;
const char *candev = "/dev/can0";
printf("Opening %s\n", candev);
if (vca_open_handle(&canhandle, candev, NULL, 0) != VCA_OK) {
    perror("open");
    exit(1);
}

while (1) {
    struct canmsg_t readmsg;
    int ret = vca_rec_msg_seq(canhandle, &readmsg, 1);
    if(ret < 0) {
        vca_log("cantest", LOG_ERR, "Error reading message from ’%’s\n", candev);
    }
    else {
        printf("Received message #%lu: id:%lx data:[",i,readmsg.id);
        for(n=0 ; n<readmsg.length ; n++) {
            if(n > 0) printf(" ");
            printf("%.2x", (unsigned char)readmsg.data[n]);
        }
        printf("]\n");
        i++;
    }
}
```

SDO processing

The core structure for the SDO processing is a vcasdo_fsm_t. This structure holds all the status information about current SDO handshake and also other information like SDO COB IDs, node number etc. SDO processing library do not contain any synchronous call like select(), read(), write() etc. This aproach gives it independancy on used comunication model. Next code example showes, how to deploy SDO library. Fragment is taken from `canslave.c`.

```
// slave SDO communication loop
vcasdo_fsm_t fsm;
// use default SDO COB IDs
vcasdo_init_fsm(&fsm, 0, 0, node);
while(1) {
    // read CAN driver loop
    struct canmsg_t readmsg;
    int ret = vca_rec_msg_seq(canhandle, &readmsg, 1); // 1.
    if(ret <= 0) continue;

    if(fsm->state == sdofsmIdle) { // 2.
        // init communicated data in fsm for new communication
        // load object data and prepare FSM for new communication handshake
        do { // 3.
            int cmd;
            vcasdo_read_multiplexor(readmsg.data + 1, &fsm->index, &fsm->subindex);
            cmd = VCA_SDO_GET_COMMAND(readmsg.data[0]);
            if(cmd == VCA_SDO_INIT_UPLOAD_R) {
                uint32_t abort_code;
                ul_dbuff_t *db = &fsm->data;
                vcaod_object_t *odo;
                int l;
                // load data from OD
                odo = vcaod_find_object(&od_root, fsm->index, fsm->subindex, &abort_coc
                if(!odo) {
                    mylog(LOG_ERR, "[%04x:%02x] not found, ABORTING transfer\n", fsm->i
                    vcasdo_fsm_abort(fsm, abort_code);
                    break;
                // further function calls returns check are omitted for the example
            }
            l = vcaod_get_object_data_size(odo, &abort_code);
            ul_dbuff_set_len(db, l);
            // because object can be an array, wee should set parameter array_index
            l = vcaod_get_value(odo, fsm->subindex, db->data, db->len, &abort_code)
            // FSM is prepared, make it run
            vcasdo_fsm_run(fsm);
        }
        else if(cmd == VCA_SDO_INIT_DOWNLOAD_R) {
            // in case of download nothing special should be done with FSM
            vcasdo_fsm_run(fsm);
        }
    } while(0);
}

// now run new communication or continue in previous one (segmented or block transf
// vcasdo_fsm_taste_msg() generate answer CAN message for incoming CAN message
// according to state of fsm
// if(fsm->state != sdofsmRun) vcasdo_fsm_taste_msg() returns -1 and it does not do
if(vcasdo_fsm_taste_msg(fsm, &readmsg) == 0) { // 4.
    // bad cobid
    mylog(LOG_DEB, "message REFUSED\n");
}
else { // 5.
    if(fsm->state == sdofsmDone) {
        do {
            // SDO transfer complete
            mylog(LOG_INF, "SDO transfer done\n");
            if(!fsm->is_uploader) {
                // store downloaded data to OD
                uint32_t abort_code;if
                ul_dbuff_t *db = &fsm->data;
                int l;
                // store downloaded data to OD
                vcaod_object_t *odo;
                odo = vcaod_find_object(&od_root, fsm->index, fsm->subindex, &abort
                l = vcaod_set_value(odo, fsm->subindex, db->data, db->len, &abort_c
                // transfer is done, no answer will be sent to the CAN
                ul_dbuff_set_len(&fsm->data, 0);
            }
        } while(0);
    }
    else if(fsm->state == sdofsmAbort) {
        // SDO transfer aborted
        mylog(LOG_MSG, "SDO transfer ABORTED: error %x ’%s’\n", fsm->err_no, vcasdo
    }
    else if(fsm->state == sdofsmError) {
        // SDO transfer error
        mylog(LOG_MSG, "SDO transfer ERROR: error %x ’%s’\n", fsm->err_no, vcasdo_a
    }
    else if(fsm->state == sdofsmRun) {
        mylog(LOG_DEB, "SDO transfer RUNNING\n");
    }
    else {
        // unexpected state
        mylog(LOG_ERR, "SDO FSM unexpected state: %i\n", fsm->state);
        fsm->out_msg.length = 0;
    }

    if(fsm->out_msg.length > 0) { // 7.
        // fsm->out_msg.length > 0 signals that message should be sent to CAN
        vca_send_msg_seq(canhandle, &fsm->out_msg, 1);
    }
    // if fsm is not still running reinit communication after all errors, aborting
    if(fsm->state != sdofsmRun) {
            vcasdo_fsm_idle(fsm);
        }
    }
}
vcasdo_destroy_fsm(&fsm);
```

The example above is long but lot of code is OD object getting/setting and extraordinary states logging. The main idea is following.

1. get one CAN message
2. check FSM state, if it is currently serving SDO communication or if it is idle
3. if FSM is idle, parse message, get SDO command and get data from OD in case of upload, than make FSM run.
4. give CAN message to the FSM's vcasdo_fsm_taste_msg() function, it ether process message (and change FSM state in appropriate way) or simply refuses it.
5. if message is not refused, check FSM state again.
6. if fsm->out_msg contains data, send data to CAN
7. go to 1. again

CANopen master SDO communication uses the same library in a very similar manner (see `canmaster.c`). The diference is only in fact that master initialize communication (starts with send) while slave allways starts with CAN message read. If the master wants to start SDO communication it should init SDO FSM for upload or download calling `vcasdo_fsm_upload1()` or `vcasdo_fsm_download1()`.

PDO processing

PDO processing is made using a structure vcaPDOProcessor_t. PDO prosessor knows which OD objects are PDO mapped (because it is written in EDS) and it can store/retrieve them to/from OD automaticaly. Core function is `vcaPDOProcessor_processMsg()`. If one call this function with a message just read from CAN, PDO processor check if it is PDO object and it takes care about appropriate behaviour. For more details see `canslave.c`.

Miscelaneous and utility functions

This is set of help function to parse text, convert it to number or serialize CAN messages to human readable form.

CAN device

CAN slave

Description and implementation issues

Can slave consist of two main parts

- CANslave core
- HW module

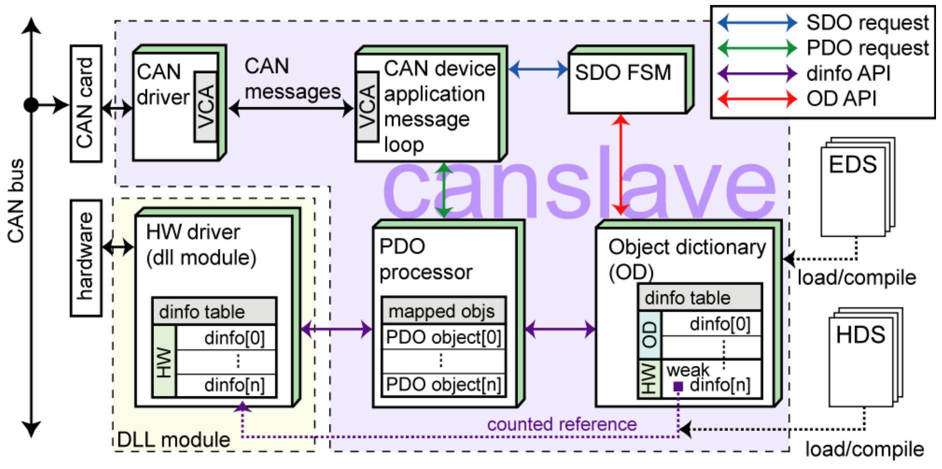


Figure 1-3. CAN Slave block schema

The core is a canslave part which is allways the same. It is responsible for PDO & SDO communication and OD storage. Slave message loop takes CAN messages from CAN. Every message is passed to PDO processor, if it is not processed here than it is passed to SDO FSM (Service Data Object Finite State Machine). SDO FSM process message, if it is part of SDO communication frame or refuse it. If it is SDO, FSM makes all neccessary actions (mainly OD exchange) and prepare CAN answer message. Slave message loop sends such a message back to CAN bus. CAN slave core has also timer (timer is missing in figure below), which is responsible for trigering of synchronous PDOs.

When one starts CAN slave, he should provide EDS and HDS file to it. Slave reads EDS file and it build OD tree according to its contens. In future work will be possible to compile parsed EDS directly to CAN slave core.

EDS Electronic Data Sheet file is a text file describing all objects in the slave object dictionary and its mapping into the PDOs. It has normalized form according to CiA Draft Standard 301.

HDS file contains information which CANopen object in OD is linked to which dinfo in HW module. It is a simple text file with following structure.

```
6000:01 /nascanhw/input01
6200:01 /nascanhw/output01
```

Every line of HDS contains OD object index and subindex and dinfo name to be connected to. Dinfos can be stored in a arbitrary tree like files in directories. First directory on dinfo path is name of DLL which contains this dinfo. For example `/nascanhw/input01` is in `libnascanhw.so`. When HDS file is parsed all needed DLLs are dynamicaly loaded. Thats mean that HW module can consist of more than one *.so file.

What is dinfo? Dinfo is generic structure for passing arbitrary data type among canslave components. Every process value has to have its dinfo in HW module. Every dinfo has getter and setter functions for the primitive data types. At present only the long int and ul_dbuff_t is supported.

You can see the dinfo table on figure inside the OD and also inside the HW module. During CAN device initialization some dinfo structures are allocated. There are two kind of them. HW dinfos resiststing in the driver module are initialized when module is loaded. Every object mentioned in HDS file has also HW dinfo reference in OD. When some object, that do not have HW dinfo (not connected to the hardware), is PDO mapped the fake dinfo is created for that object in OD because the PDO processor allways use only dinfo API for access to any PDO processed object data wheather it comes from HW module or not. All dinfo structures are reference counted, so they are destroyed automatically when they are not needed anymore.

Testing

See the section called *CanMonitor testing*.

CAN master

Description and implementation issues

CAN master is very similar to the CAN slave. Big difference is in ability of CAN-master to communicate with hierarchically higher application via named pipes. This gives an application opportunity to communicate with CANmaster placed in the user space (via named pipes) or in the RT-linux space (via `/dev/rtfxx`).

For more information see `canmaster.c`.

Testing

See the section called *CanMonitor testing*.

CAN monitor

Description and implementation issues

Can monitor component consists of two parts. CAN proxy - **canmond** and Java GUI canmond client **CanMonitor**.

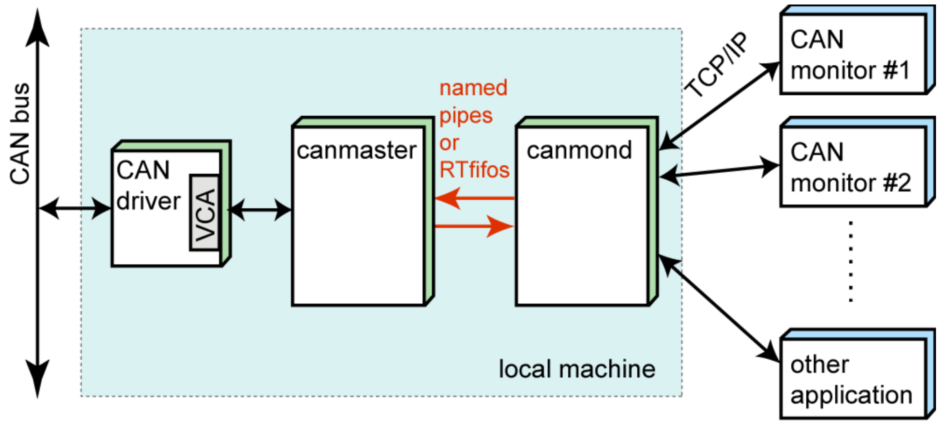


Figure 1-4. CAN monitor component

Canmond is the heard of component. It works like CAN proxy, it is connected using named pipes to the **canmaster** and resends CANopen objects to the all connected applications. Actualy it is a TCP server listenning on port 10001. TCP connection allows clients to be placed wherever on Internet. One can for example read/send CAN messages using a Java applet on his HTML browser. Canmond uses named pipes for communication with canmaster because canmaster can be placed in kernel space (using `/dev/rtfxx`) or in user space and use arbitrary couple of named pipes. This decomposition gives us oportuniti place canmaster in every memory space.

CanMonitor is a GUI Java based application connected to the canmond using UNIX TCP socket. One can send/monitor CAN messages using it. If one has slave EDS (Electronic Data Sheet), he can read/write device OD (Object Dictionary) just by clicking on the mouse.

CanMonitor testing

Program from this package does not need special installation. They can run from any directory. Just type **`make`** in `can/canmon` directory. And copy desired files from `can/_compiled` directory. If you want to compile only one component, type **`make`** in the component's directory.

Restrictions on versions of GNU C or glibc are not known in this stage of project.

Java SDK ver. 1.4 or above is recommended.

Component was tested with real CANopen device WAGO 750-307.

All VCA sources were compiled by GNU C ver. 3.2 and linked with glibc ver. 2.2.5.

All components were also tested with **canmaster** and **canslave** components. In following example is written how.

Example 1 - connecting to real CANopen device

Make sure, that CAN driver and the CAN monitor component is installed and works properly. Check that real CANopen device is connected to your CAN card.

Open two terminal windows. In first window launch **canmaster**.

You should see something like this

```
[fanda@mandrake bin]$ ./canmaster
CANMASTER - CANopen master
canmaster: entering state STATE_INITIALIZING
canmaster: entering state STATE_PREOPERATIONAL
canmaster: entering state STATE_OPERATIONAL
```

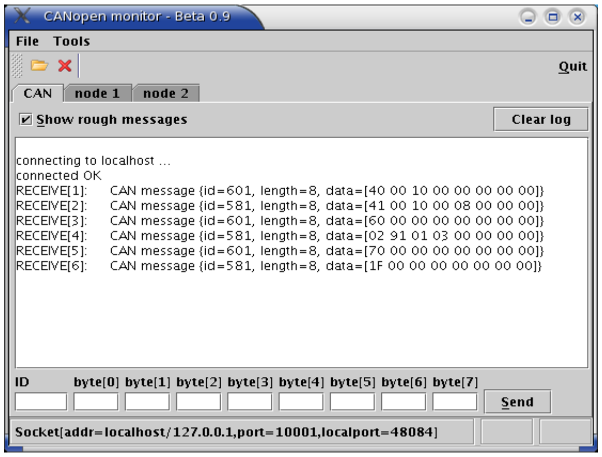
Than you should launch **canmond** on the same machine.

```
[fanda@mandrake bin]$ ./canmond
CANMOND - CAN monitor server
```

If you have a graphical environment with Java installed, you can launch **CanMonitor** with CANopen device EDS file issuing:

```
[fanda@mandrake bin]$ canmonitor -e nascan.eds
loading config from '/home/fanda/.canmonitor/CanMonitor.conf.xml'
connecting to localhost/127.0.0.1
connected OK
```

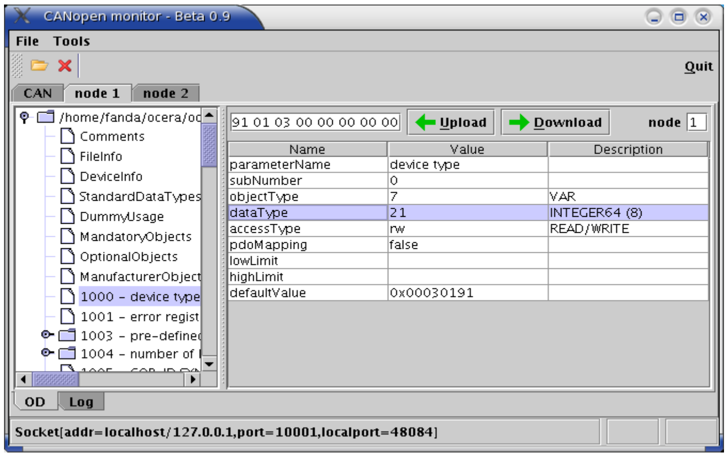
If everything works right, you should see Java application window.



```
connecting to localhost ...
connected OK
RECEIVE[1]:     CAN message {id=601, length=8, data=[40 00 10 00 00 00 00 00]}
RECEIVE[2]:     CAN message {id=581, length=8, data=[41 00 10 00 08 00 00 00]}
RECEIVE[3]:     CAN message {id=601, length=8, data=[60 00 00 00 00 00 00 00]}
RECEIVE[4]:     CAN message {id=581, length=8, data=[02 91 01 03 00 00 00 00]}
RECEIVE[5]:     CAN message {id=601, length=8, data=[70 00 00 00 00 00 00 00]}
RECEIVE[6]:     CAN message {id=581, length=8, data=[1F 00 00 00 00 00 00 00]}
```

Socket[addr=localhost/127.0.0.1,port=10001,localport=48084]

Figure 1-5. CanMonitor message window



91 01 03 00 00 00 00 00

node 1

Name	Value	Description
parameterName	device type	
subNumber	0	
objectType	7	VAR
dataType	21	INTEGER64 (8)
accessType	rw	READ/WRITE
pdoMapping	false	
lowLimit		
highLimit		
defaultValue	0x00030191	

Socket[addr=localhost/127.0.0.1,port=10001,localport=48084]

Figure 1-6. CanMonitor EDS node window

Now you can load device EDS file and upload/download CANopen objects.

Example 2 - connecting to canslave

In this example **canslave** is tested, that means that you do not need any real CANopen device. Tested canslave can resist on same computer as canmaster on can be on other computer connected by CAN bus. If both programs resist on same computer make sure that CAN driver **lincan** was configured to send CAN messages to all other who have open CAN driver on same computer.

Do all steps from example 1. Open terminal window and launch **canslave**. You can launch more canslaves with different node numbers. Do not forget introduce *.EDS file name after -e switch in command line. You should see something like this

```
[fanda@mandrake bin]$ canslave -e nascan.eds
CANSLAVE - CAN slave
canslave: Opening CAN driver: /dev/can0
canslave: Opening EDS: nascan.eds
canslave: entering state STATE_INITIALIZING
canslave: SYNC COB_ID: 0, SYNC period: 0
canslave: entering state STATE_PREOPERATIONAL
canslave: entering state STATE_OPERATIONAL
```

Than you can load to the running **CanMonitor** next EDS file and work with canslave OD or scan the CAN bus traffic.

Installation

CAN commponet uses the OMK make system. There is *no* **./configure** script. The component can be built as a part of OCERA tree or as a stanalone. If it is build as a standalone you should run script **can/switch2standalone**.

```
[fanda@lab3-2 can]$ ./switch2standalone
Default config for /utils/suiut
Default config for /utils/ulut
Default config for /utils/flib
Default config for /utils
Default config for /canvca/libvca
Default config for /canvca/cantest
Default config for /canvca
Default config for /candev/cpickle
Default config for /candev/nascanhw
Default config for /candev
Default config for /canmon/canmond
Default config for /canmon/canmonitor
Default config for /canmon
Default config for /lincan/src
Default config for /lincan/utils
Default config for /lincan
Default config for

To modify required configuration options, create "config.omk" file
and add modified lines from "config.omk-default" file into it

To build project, call simple "make"

GNU make program version 3.81beta1 or newer is required to build project
check by "make --version" command
```

Default configuration of any subcommponent can be changed by introducing a file `config.omk` in the subcommponent directory. Defines in this file simply beats defines in file `config.omk-default`, so you can put there only defines that are different that the default ones in the `config.omk-default`.

For example by default the building of Java application is disabled. That means that there is a line *CONFIG_OC_CANMONITOR=n* in the `config.omk-default`. If you have the Java SDK and the ant build system installed, add the line *CONFIG_OC_CANMONITOR=y* to the file `config.omk` to enable the Java applications to be build.

When you switch to standalone, you can build any particular commponent by running make in the commponent directory.

For more details see file `can/README.makerules`.

You can download make version 3.81beta1 source from http://cmp.felk.cvut.cz/~pisa/can/make-3.81beta1.tar.gz[1] or the binary from http://cmp.felk.cvut.cz/~pisa/can/make-3.81beta1-i586-0.gz[2].

Programs in this package does not need special installation. They can run from any directory. Just type **`make`** in `can/canmon` directory and copy desired files wherever you want. The make process is an out source build. After make you can find your binaries in directory `can/_compiled/bin`. If you want to compile only one component, type **`make`** in the component's directory. That commponent and all commponents in subdirectories will be build.

Restrictions on versions of GNU C or glibc are not known in this stage of project but gcc ver >= 3.0 is recommended. Java SDK ver. 1.4 or above is also recommended (assert keyword support).

API / Compatibility

VCA base API

struct canmsg_t

Name

`struct canmsg_t` — structure representing CAN message

Synopsis

```
struct canmsg_t {
  int flags;
  int cob;
  canmsg_id_t id;
  canmsg_tstamp_t timestamp;
  unsigned short length;
  unsigned char data[CAN_MSG_LENGTH];
};
```

Members

flags

message flags `MSG_RTR` .. message is Remote Transmission Request, `MSG_EXT` .. message with extended ID, `MSG_OVR` .. indication of queue overflow condition, `MSG_LOCAL` .. message originates from this node.

cob

communication object number (not used)

id

ID of CAN message

timestamp

not used

length

length of used data

data[CAN_MSG_LENGTH]

data bytes buffer

Header

canmsg.h

struct canfilt_t

Name

`struct canfilt_t` — structure for acceptance filter setup

Synopsis

```
struct canfilt_t {
  int flags;
  int queid;
  int cob;
  canmsg_id_t id;
  canmsg_id_t mask;
};
```

Members

flags

message flags `MSG_RTR` .. message is Remote Transmission Request, `MSG_EXT` .. message with extended ID, `MSG_OVR` .. indication of queue overflow condition, `MSG_LOCAL` .. message originates from this node. there are corresponding mask bits `MSG_RTR_MASK`, `MSG_EXT_MASK`, `MSG_LOCAL_MASK`. `MSG_PROCESSLOCAL` enables local messages processing in the combination with global setting

queid

CAN queue identification in the case of the multiple queues per one user (open instance)

cob

communication object number (not used)

id

selected required value of cared ID id bits

mask

select bits significand for the comparation; 1 .. take care about corresponding ID bit, 0 .. don't care

Header

canmsg.h

vca_h2log

Name

`vca_h2log` — converts VCA handle to printable number

Synopsis

```
long vca_h2log (vca_handle_t vcah);
```

Arguments

`vcah`
: VCA handle

Header

can_vca.h

Return Value

unique printable VCA handle number

vca_open_handle

Name

`vca_open_handle` — opens new VCA handle from CAN driver

Synopsis

```
int vca_open_handle (vca_handle_t * vcah_p, const char * dev_name,
const char * options, int flags);
```

Arguments

`vcah_p`
: points to location filled by new VCA handle

dev_name
: name of requested CAN device, if NULL, default VCA_DEV_NAME is used

options
: options argument, can be NULL

flags
: flags modifying style of open (VCA_O_NOBLOCK)

Header

can_vca.h

Return Value

VCA_OK in case of success

vca_close_handle

Name

`vca_close_handle` — closes previously acquired VCA handle

Synopsis

```
int vca_close_handle (vca_handle_t vcah);
```

Arguments

vcah
: VCA handle

Header

can_vca.h

Return Value

Same as libc `close` returns.

vca_send_msg_seq

Name

`vca_send_msg_seq` — sends sequentially block of CAN messages

Synopsis

```
int vca_send_msg_seq (vca_handle_t vcah, canmsg_t * messages, int
count);
```

Arguments

`vcah`

VCA handle

`messages`

points to continuous array of CAN messages to send

`count`

count of messages in array

Header

can_vca.h

Return Value

Number of sucessfully sent messages or error < 0

vca_rec_msg_seq

Name

`vca_rec_msg_seq` — receive sequential block of CAN messages

Synopsis

```
int vca_rec_msg_seq (vca_handle_t vcah, canmsg_t * messages, int
count);
```

Arguments

vcah
: VCA handle

messages
: points to array for received CAN messages

count
: number of message slots in array

Header

can_vca.h

Return Value

number of received messages or error < 0

vca_wait

Name

`vca_wait` — blocking wait for the new message(s)

Synopsis

```
int vca_wait (vca_handle_t vcah, int wait_msec, int what);
```

Arguments

vcah
: VCA handle

wait_msec
: number of miliseconds to wait, 0 => forever

what
: 0,1 => wait for Rx message, 2 => wait for Tx - free 3 => wait for both

Header

can_vca.h

Return Value

Positive value if wait condition is satisfied

vca_gethex

Name

`vca_gethex` — gets one hexadecimal number from string

Synopsis

```
int vca_gethex (const char * str, int * u);
```

Arguments

`str`

scanned string

`u`

pointer to store got value

Return

the number of eaten chars

Header

can_vca.h

vca_strmatch

Name

`vca_strmatch` — get token from string

Synopsis

```
int vca_strmatch (const char * str, const char * template);
```

Arguments

`str`

scanned string

`template`

token template template consists of characters and '~' matching one or more of spaces ie. '~hello' matches ' hello', ' hello', ' hello' etc.

Return

the number of used chars from str if match or negative value (number of partially matched chars from str - 1) if template does not match

Header

can_vca.h

vca_msg2str

Name

`vca_msg2str` — converts canmsg_t to the string

Synopsis

```
int vca_msg2str (const struct canmsg_t * can_msg, char * buff, int
buff_len);
```

Arguments

`can_msg`

pointer to the serialized CAN message

`buff`

buffer for the serialized string

`buff_len`

max length of serialized string, including terminating zero

Return

the number of written chars not including terminating zero

Header

can_vca.h

vca_byte2str

Name

`vca_byte2str` — converts byte to the string

Synopsis

```
const char* vca_byte2str (unsigned char b, int base);
```

Arguments

`b`

byte to convert

`base`

base, can be (2, 8, 16)

Return

string representation of b in chosen base

Header

can_vca.h

vca_str2msg

Name

`vca_str2msg` — converts the string to the canmsg_t object

Synopsis

```
int vca_str2msg (struct canmsg_t * can_msg, const char * str);
```

Arguments

`can_msg`

pointer to the serialized CAN message

`str`

string representing CAN message

Return

number of read chars if succeed else zero or negative value.

Header

can_vca.h

vca_cmp_terminated

Name

`vca_cmp_terminated` — compares two strings terminated either by '\0' or by `terminator`.

Synopsis

```
int vca_cmp_terminated (const char * pa, const char * pb, char
terminator);
```

Arguments

pa

first string

pb

second string

terminator

aditional char (\0 stil terminates string too), that indicates end of string

Description

Usefull when one works with the path names.

Return

the same value like libc strcmp does.

Header

can_vca.h

vca_log

Name

`vca_log` — generic logging facility for VCA library

Synopsis

```
void vca_log (const char * domain, int level, const char * format,
 ...);
```

Arguments

domain

pointer to character string representing source of logged event, it is `VCA_LDOMAIN` for library itself

level

severity level

format

printf style format followed by arguments

...

variable arguments

Description

This functions is used for logging of various events. If not overridden by application, logged messages goes to the stderr. Environment variable `VCA_LOG_FILENAME` can be used to redirect output to file. Environment variable `VCA_DEBUG_FLG` can be used to select different set of logged events through vca_debug_flg.

Note

There is a global variable `vca_log_cutoff_level`. Only the messages with `level` <= `vca_log_cutoff_level` will be logged. see `can_vca`.h

vca_log_redir

Name

`vca_log_redir` — redirects default log output function

Synopsis

```
void vca_log_redir (vca_log_fnc_t * log_fnc, int add_flags);
```

Arguments

log_fnc

new log output function. Value NULL resets to default function

add_flags

some more flags

SDO processing API

struct vcasdo_fsm_t

Name

`struct vcasdo_fsm_t` — structure representing SDO FSM

Synopsis

```
struct vcasdo_fsm_t {
  unsigned srvcli_cob_id;
  unsigned clisrv_cob_id;
  unsigned node;
  unsigned index;
  unsigned subindex;
  struct timeval last_activity;
  int bytes_to_load;
  int toggle_bit:1;
  int is_server:1;
  int is_uploader:1;
  int state;
  vcasdo_fsm_state_fnc_t * statefnc;
  int err_no;
  ul_dbuff_t data;
  canmsg_t out_msg;
};
```

Members

srvcli_cob_id

SDO server-client COB_ID (default is 0x580 + node), port on which master listen

clisrv_cob_id

SDO client-server COB_ID (default is 0x600 + node), port on which slave listen

node

CANopen node number

index

index of communicated object

subindex

subindex of communicated object

last_activity

time of last FSM activity (internal use)

bytes_to_load

number of stil not uploaded SDO data bytes (internal use)

toggle_bit

(internal use)

is_server

type of FSM client or server (Master or Slave) (internal use)

is_uploader

processing upload/download in state sdofsmRun, sdofsmDone

state

state of SDO (`sdofsmIdle = 0`, `sdofsmRun`, `sdofsmDone`, `sdofsmError`, `sdofsmAbort`)

statefnc

pointer to the state function (internal use)

err_no

error number in state `sdofsmError`.

data

uploaded/downloaded bytes (see `ul_dbuff`.h)

out_msg

if `vcasdo_taste_msg` generates answer, it is stored in the `out_msg`

Header

vcasdo_fsm.h

vcasdo_fsm_upload1

Name

`vcasdo_fsm_upload1` — starts SDO upload using parameters set by previous calling `vcasdo_init_fsm`

Synopsis

```
int vcasdo_fsm_upload1 (vcasdo_fsm_t * fsm);
```

Arguments

`fsm`

FSM to work with

Return

the same as `vcasdo_fsm_upload1`

See also

`vcasdo_fsm_upload1`.

Header

vcasdo_fsm.h

vcasdo_fsm_download1

Name

`vcasdo_fsm_download1` — starts SDO download using parameters set by previous calling `vcasdo_init_fsm`

Synopsis

```
int vcasdo_fsm_download1 (vcasdo_fsm_t * fsm, ul_dbuff_t * data);
```

Arguments

fsm

FSM to work with

data

pointer to &ul_dbuff_t structure where downloaded data will be stored

Return

the same as `vcasdo_fsm_download`

See also

`vcasdo_fsm_download`.

Header

vcasdo_fsm.h

vcasdo_read_multiplexor

Name

`vcasdo_read_multiplexor` — reads index and subindex from multiplexor part of CANopen mesage

Synopsis

```
void vcasdo_read_multiplexor (const byte * mult, unsigned * index,
unsigned * subindex);
```

Arguments

mult

pointer to the multiplexor part of CANopen mesage

index

pointer to place to store read index

subindex

pointer to place to store read subindex

Header

vcasdo_fsm.h

vcasdo_error_msg

Name

`vcasdo_error_msg` — translates err_no to the string message

Synopsis

```
const char* vcasdo_error_msg (int err_no);
```

Arguments

`err_no`

number of error, if FSM state == `sdofsmError`

Return

textual error description.

Header

vcasdo_fsm.h

vcasdo_init_fsm

Name

`vcasdo_init_fsm` — init SDO FSM

Synopsis

```
void vcasdo_init_fsm (vcasdo_fsm_t * fsm, unsigned srvcli_cob_id,
unsigned clisrv_cob_id, unsigned node);
```

Arguments

`fsm`

fsm to init

`srvcli_cob_id`

port to use for server->client communication (default 0x850 used if `srvcli_cob_id`==0)

`clisrv_cob_id`

port to use for client->server communication (default 0x600 used if `clisrv_cob_id`==0)

`node`

number of node on CAN bus to communicate with

Header

vcasdo_fsm.h

vcasdo_destroy_fsm

Name

`vcasdo_destroy_fsm` — frees all SDO FSM resources (destructor)

Synopsis

```
void vcasdo_destroy_fsm (vcasdo_fsm_t * fsm);
```

Arguments

`fsm`

fsm to destroy

Header

vcasdo_fsm.h

vcasdo_fsm_idle

Name

`vcasdo_fsm_idle` — sets SDO FSM to idle state

Synopsis

```
void vcasdo_fsm_idle (vcasdo_fsm_t * fsm);
```

Arguments

`fsm`

SDO FSM

Header

vcasdo_fsm.h

vcasdo_fsm_run

Name

`vcasdo_fsm_run` — starts SDO communication protocol for this FSM

Synopsis

```
void vcasdo_fsm_run (vcasdo_fsm_t * fsm);
```

Arguments

`fsm`

SDO FSM

Header

vcasdo_fsm.h

vcasdo_fsm_abort

Name

`vcasdo_fsm_abort` — aborts SDO communication for this FSM, fill abort out_msg

Synopsis

```
void vcasdo_fsm_abort (vcasdo_fsm_t * fsm, uint32_t abort_code);
```

Arguments

`fsm`

SDO FSM

`abort_code`

code to fill to out_msg

Header

vcasdo_fsm.h

vcasdo_fsm_upload

Name

`vcasdo_fsm_upload` — starts upload SDO communication protocol for this FSM

Synopsis

```
int vcasdo_fsm_upload (vcasdo_fsm_t * fsm, int node, unsigned index,
byte subindex, unsigned srvcli_cob_id, unsigned clisrv_cob_id);
```

Arguments

`fsm`

SDO FSM

`node`

CANopen device node to upload from

`index`

uploaded object index

`subindex`

uploaded object subindex

`srvcli_cob_id`

port to use for server->client communication (default 0x850 used if `srvcli_cob_id`==0)

`clisrv_cob_id`

port to use for client->server communication (default 0x600 used if `clisrv_cob_id`==0)

Return

not 0 if `fsm`->out_msg contains CAN message to sent

Header

vcasdo_fsm.h

vcasdo_fsm_download

Name

`vcasdo_fsm_download` — starts download SDO communication protocol for this FSM

Synopsis

```
int vcasdo_fsm_download (vcasdo_fsm_t * fsm, ul_dbuff_t * dbuff,
int node, unsigned index, byte subindex, unsigned srvcli_cob_id,
unsigned clisrv_cob_id);
```

Arguments

fsm
: SDO FSM

dbuff
: pointer to a ul_dbuff structure to store received/transmitted data

node
: CANopen device node to upload from

index
: uploaded object index

subindex
: uploaded object subindex

srvcli_cob_id
: port to use for server->client communication (default 0x850 used if `srvcli_cob_id`==0)

clisrv_cob_id
: port to use for client->server communication (default 0x600 used if `clisrv_cob_id`==0)

Return

not 0 if `fsm`->out_msg contains CAN message to sent

Header

vcasdo_fsm.h

vcasdo_fsm_taste_msg

Name

`vcasdo_fsm_taste_msg` — try to process msg in FSM

Synopsis

```
int vcasdo_fsm_taste_msg (vcasdo_fsm_t * fsm, const canmsg_t * msg);
```

Arguments

`fsm`

fsm to process msg

`msg`

tasted msg

Return

0 if msg is not eatable for FSM, -1 if message has correct CobID but cann't be processed in current FSM state, 1 if message is processed,

Header

vcasdo_fsm.h

vcasdo_abort_msg

Name

`vcasdo_abort_msg` — translates SDO abort_code to the string message

Synopsis

```
const char* vcasdo_abort_msg (uint32_t abort_code);
```

Arguments

abort_code
abort code

Header

vcasdo_msg.h

../../canvca/libvca/vcasdo_msg.c

Name

../../canvca/libvca/vcasdo_msg.c — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file ../../canvca/libvca/vcasdo_msg.c at this point, but none was found. This dummy section is inserted to allow generation to continue.

PDO processing API

struct vcapdo_mapping_t

Name

struct vcapdo_mapping_t — structure representing mapping of sigle object in PDO

Synopsis

```
struct vcapdo_mapping_t {
  vcaod_object_t * object;
  unsigned char start;
  unsigned char len;
  sui_dinfo_t * dinfo;
};
```

Members

object

  pointer to the mapped object

start

  bit offset of object value in PDO

len

  bit length of object value in PDO

dinfo

  pointer to object data source. Every PDO can be read/written through *dinfo* to the OD or to hardware. Actualy there is no other way for PDO object to do that.

Header

vca_pdo.h

struct vcapdolst_object_t

Name

`struct vcapdolst_object_t` — structure representing single PDO object

Synopsis

```
struct vcapdolst_object_t {
  gavl_node_t my_node;
  struct vcaPDOProcessor_t * pdo_processor;
  unsigned long cob_id;
  unsigned char transmition_type;
  unsigned flags;
  unsigned char sync_every;
  unsigned char sync_counter;
  uint16_t inhibit_time;
  uint16_t event_timer;
  unsigned char pdo_buff[8];
  int mapped_cnt;
  vcapdo_mapping_t * mapped_objects;
  evc_rx_hub_t rx_hub;
};
```

Members

my_node
: structure necessary for storing node in GAVL tree

pdo_processor
: pointer to PDO processor servicing this PDO

cob_id
: COB ID of PDO

transmition_type
: type of PDO transmission according to DS301 table 55

flags
: PDO characteristics and parsed transmission_type

sync_every
: synchronous PDO will be processed every n-th SYNC message

sync_counter
: auxiliary variable for `sync_every`

inhibit_time
: minimum gap between two PDO transmissions (multiples of 100 us)

event_timer
: if nonzero, PDO is transmitted every *`event_timer`* ms. Valid only in transmission modes 254, 255. (!vcapdoFlagSynchronous && !vcapdoFlagRTROnly)

pdo_buff[8]
: buffer for received/transmitted PDO

mapped_cnt
: number of mapped objects in OD

mapped_objects
: array to structures describing mapping details for all mapped objects

rx_hub
: If PDO communication is event driven, appropriate events are connected to this hub

See also

GAVL usage (`ul_gavlchk.c`)

Header

vca_pdo.h

struct vcapdolst_root_t

Name

`struct vcapdolst_root_t` — structure representing root of OD

Synopsis

```
struct vcapdolst_root_t {
  gavl_node_t * my_root;
};
```

Members

my_root

object dictionary GAVL tree root

See also

GAVL usage (`ul_gavlchk`.c)

Header

vca_pdo.h

struct vcaPDOProcessor_t

Name

`struct vcaPDOProcessor_t` — structure used for PDO communication

Synopsis

```
struct vcaPDOProcessor_t {
  vcapdolst_root_t pdolst_root;
  // TODO send_to_can_fnc:remove this hack and add queue of outcoming CAN messages// tc
  vcaod_root_t * od_root;
  //vcaDinfoManager_t * dinfo_mgr;
  int node_id;
};
```

Members

pdolst_root

GAVL containing all defined &vcapdolst_object_t structures send_to_can_fnc

PDOProcessor should use this function if it needs to send CAN message during processing

od_root

pointer to used OD (necessary for PDOs creation and initialization in `vcaPDOProcessor_createPDOLIst`)

dinfo_mgr

pointer to used DinfoManager (providing HW dinfos during initialization)

node_id

Node number, optional parameter, if it is specified, default PDO COB-IDs can be assigned if they are not specified in EDS. If *`node_id`* is 0, then it is ignored.

Description

vcaPDOProcessor is responsible for all PDO related tasks in CANopen device

Header

vca_pdo.h

vcaPDOProcessor_init

Name

`vcaPDOProcessor_init` — vcaPDOProcessor constructor

Synopsis

```
void vcaPDOProcessor_init (vcaPDOProcessor_t * proc);
```

Arguments

`proc`

pointer to PDO processor to work with

Header

vca_pdo.h

vcaPDOProcessor_destroy

Name

`vcaPDOProcessor_destroy` — vcaPDOProcessor destructor

Synopsis

```
void vcaPDOProcessor_destroy (vcaPDOProcessor_t * proc);
```

Arguments

`proc`

pointer to PDO processor to work with

Description

It releases all PDO objects

Header

vca_pdo.h

vcaPDOProcessor_setOD

Name

`vcaPDOProcessor_setOD` — assign OD to PDOProcessor

Synopsis

```
void vcaPDOProcessor_setOD (vcaPDOProcessor_t * proc, vcaod_root_t *
od_root);
```

Arguments

`proc`

pointer to PDO processor to work with

od_root

assigned root of Object Dictionary

Header

vca_pdo.h

vcaPDOProcessor_createPDOList

Name

`vcaPDOProcessor_createPDOList` — scans OD and creates all valid PDO structures.

Synopsis

```
int vcaPDOProcessor_createPDOList (vcaPDOProcessor_t * proc);
```

Arguments

proc

pointer to PDO processor to work with

Description

It also deletes previously created PDO structures (if any).

Return

0 or negative number in case of an error

Header

vca_pdo.h

_vcaPDOProcessor_disconnectDinfoLinks

Name

`_vcaPDOProcessor_disconnectDinfoLinks` — disconnect all PDOs and their dinfo structures

Synopsis

```
void _vcaPDOProcessor_disconnectDinfoLinks (vcaPDOProcessor_t * proc);
```

Arguments

`proc`

pointer to PDO processor to work with

Description

Actualy it only decrements RefCnt, so only dinfos with RefCnt==1 will be deleted

Note

this function is internal and it is not a part of VCA PDO public interface.

Header

vca_pdo.h

vcaPDOProcessor_connectDinfoLinks

Name

`vcaPDOProcessor_connectDinfoLinks` — scans defined PDOs and makes necessary data links from PDOs to OD and HW

Synopsis

```
void vcaPDOProcessor_connectDinfoLinks (vcaPDOProcessor_t * proc);
```

Arguments

`proc`

pointer to PDO processor to work with

Description

Disconnect all connected dinfos. For each mapped object tries to find appropriate dinfo asking DinfoManager. If DinfoManager returns NULL, thats means, that no HW is connected to this object. In such case function creates dbuff_dinfo for data stored in OD and connect it to mapped PDO.

Header

vca_pdo.h

vcaPDOProcessor_processMsg

Name

`vcaPDOProcessor_processMsg` — tries to process *`msg`*

Synopsis

```
int vcaPDOProcessor_processMsg (vcaPDOProcessor_t * proc, canmsg_t *
msg);
```

Arguments

`proc`

pointer to PDO processor to work with

`msg`

CAN msg to proceed

Return

zero if msg is processed

Header

vca_pdo.h

../../canvca/libvca/vca_pdo.c

Name

`../../canvca/libvca/vca_pdo.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../canvca/libvca/vca_pdo.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

OD access API

struct vcaod_root_t

Name

`struct vcaod_root_t` — structure representing root of OD

Synopsis

```
struct vcaod_root_t {
  gsa_array_field_t my_root;
};
```

Members

my_root
: object dictionary GAVL tree root

Header

vca_od.h

struct vcaod_object_t

Name

`struct vcaod_object_t` — structure representing single object in OD

Synopsis

```
struct vcaod_object_t {
#ifndef CONFIG_OD_GSA
  gavl_node_t my_node;
#endif
  unsigned index;
  int subindex;
  unsigned char data_type;
  unsigned object_type;
  int access;
  unsigned flags;
  char name[VCAOD_OBJECT_NAME_LEN];
  struct vcaod_object_t * subobjects;
  int subcnt;
  vcaod_dbuff_t value;
  sui_dinfo_t * dinfo;
};
```

Members

my_node

structure neccessary for storing node in GAVL tree, is NULL for subindicies

index

index of object

subindex

subindex of subobject or -1 if object is not subobject

data_type

can be one of (BOOLEAN, INTEGER8, ...)

object_type

type of object (DOMAIN=2, DEFTYPE=5, DEFSTRUCT=6, VAR=7, ARRAY=8, RECORD=9)

access

access attributes (RW, WO, RO, CONST)

flags

flags can be: `VCAOD_OBJECT_FLAG_MANDATORY` object is mandatory/optional, `VCAOD_OBJECT_FLAG_PDO_MAPPING` object is supposed to be PDO mapped, `VCAOD_OBJECT_FLAG_WEAK_DINFO` *`dinfo`* is weak pointer

name[VCAOD_OBJECT_NAME_LEN]

textual name of object

subobjects

pointer to array of subobjects (definition==DEFSTRUCT, RECORD) or NULL

subcnt

number of subobjects

value

object values (definition==ARRAY) or single value (other definitions). If definition==ARRAY all values have the same length and they are stored sequently in `value`

dinfo

Reference to dinfo associated with current object. There are couple of reasons for such a association. 1. Object is PDO mapped but its value doesn't come from HW dinfo (it is not tecnological value) - in such a case dbuff dinfo is created and referenced from that OD object. 2. Object is PDO mapped and its value comes from HW dinfo (it is tecnological value) - in such a case only weak reference is in OD object. When HW module is unloaded or dinfo will be destroyed from any reason, also weak reference to it will be cleared to NULL. 3. Object is not PDO mapped but its value comes from HW dinfo - in such a case even SDO communication sholud read that dinfo to get the propper object value.

Header

vca_od.h

vcaod_find_object

Name

`vcaod_find_object` — finds object in OD. This function is not a part of the SDO API

Synopsis

```
vcaod_object_t* vcaod_find_object (vcaod_root_t * odroot, unsigned ix,
unsigned subix, uint32_t * abort_code);
```

Arguments

`odroot`

object dictionary

`ix`

object index

`subix`

object subindex, ignored if object does not have subobjects

`abort_code`

Pointer to the abort code in case of an ERROR. It can be NULL, than it is ignored. Abort codes are defined in CANopen standart 301 and can be translated to text calling `vcasdo_abort_msg`.

Return

found object or NULL

Header

vca_od.h

vcaod_get_value

Name

`vcaod_get_value` — reads object value from Object Dictionary and copies them to caller buffer

Synopsis

```
int vcaod_get_value (const vcaod_object_t * object, int array_index,
void * buff, int len, uint32_t * abort_code);
```

Arguments

`object`

object from dictionary, see. `vcaod_find_object`

`array_index`

if object is an array `array_index` specifies which index to get, othervise it is ignored.

`buff`

buffer to write requested data

`len`

length of the buffer

`abort_code`

Pointer to the abort code in case of an ERROR. It can be NULL, than it is ignored. Abort codes are defined in CANopen standart 301 and can be translated to text calling `vcasdo_abort_msg`.

Return

number of read bytes negative value in case of an error

Header

vca_od.h

vcaod_set_value

Name

`vcaod_set_value` — copies object value from caller's buffer to Object Dictionary

Synopsis

```
int vcaod_set_value (vcaod_object_t * object, int array_index, const
void * buff, int len, uint32_t * abort_code);
```

Arguments

`object`

object from dictionary, see. `vcaod_find_object`

`array_index`

if object is an array, array_index, tells which item to get, in other case it is simply ignored.

`buff`

buffer containing written data

`len`

length of the data

`abort_code`

area to fill the abort code in case of an ERROR. It can be NULL, than it is ignored. Abort codes are defined in CANopen standart 301 and can be translated to text calling `vcasdo_abort_msg`.

Description

Function sets whole buffer to zeros before it starts to copy object data to it, even if buffer is larger than data.

Return

number of stored data bytes negative value in case of an error

Header

vca_od.h

vcaod_get_object_data_size

Name

`vcaod_get_object_data_size` — get size of object in bytes

Synopsis

```
int vcaod_get_object_data_size (const vcaod_object_t * object, uint32_t
* abort_code);
```

Arguments

`object`

object from dictionary, see. `vcaod_find_object`

`abort_code`

area to fill the abort code in case of an ERROR. It can be NULL, than it is ignored. Abort codes are defined in CANopen standart 301 and can be translated to text calling `vcasdo_abort_msg`.

Return

number of stored data bytes negative value in case of an error

Header

vca_od.h

od_item_set_value_as_str

Name

`od_item_set_value_as_str` — set object value from its string representation.

Synopsis

```
int od_item_set_value_as_str (vcaod_object_t * item, const char *
valstr);
```

Arguments

item

object to set

valstr

string representation of object value

Return

negative value in case of an error

Header

vca_od.h

vcaod_od_free

Name

`vcaod_od_free` — release all OD memory

Synopsis

```
void vcaod_od_free (vcaod_root_t * odroot);
```

Arguments

`odroot`
: pointer to the object dictionary root

Header

vca_od.h

vcaod_dump_od

Name

`vcaod_dump_od` — debug function, dumps OD to log

Synopsis

```
void vcaod_dump_od (vcaod_root_t * odroot);
```

Arguments

`odroot`
: root, which contains OD

Header

vca_od.h

vcaod_get_dinfo_ref

Name

`vcaod_get_dinfo_ref` — returns reference to dinfo corresponting to *`obj`*

Synopsis

```
sui_dinfo_t * vcaod_get_dinfo_ref (vcaod_object_t * obj, int
create_weak);
```

Arguments

obj

object from OD

create_weak

if there is no HW dinfo for object, creates temporary dbuff dinfo

Description

If `obj` allready has its &dinfo assigned `vcaod_get_dinfo_ref` returns this pointer, if it is not function creates new &dinfo object.

Return

pointer to associated dinfo with reference count increased or NULL if creation fails

Header

vca_od.h

../../canvca/libvca/vca_od.c

Name

`../../canvca/libvca/vca_od.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../canvca/libvca/vca_od.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../canvca/libvca/vca_dinfomgr.h

Name

`../../canvca/libvca/vca_dinfomgr.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../canvca/libvca/vca_dinfomgr.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../canvca/libvca/vca_dinfomgr.c

Name

`../../canvca/libvca/vca_dinfomgr.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../canvca/libvca/vca_dinfomgr.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

libulut API

ul_dbuff_init

Name

`ul_dbuff_init` — init memory allocated for dynamic buffer

Synopsis

```
int ul_dbuff_init (ul_dbuff_t * buf, int flags);
```

Arguments

buf

buffer structure

flags

flags describing behaviour of the buffer only UL_DBUFF_IS_STATIC flag is supported. in this case buffer use unly static array sbuf

Description

Returns capacity of initialised buffer

ul_dbuff_destroy

Name

`ul_dbuff_destroy` — frees all resources allocated by buf

Synopsis

```
void ul_dbuff_destroy (ul_dbuff_t * buf);
```

Arguments

buf

buffer structure

ul_dbuff_prep

Name

`ul_dbuff_prep` — sets a new len and capacity of the buffer

Synopsis

```
int ul_dbuff_prep (ul_dbuff_t * buf, int new_len);
```

Arguments

buf

buffer structure

new_len

new desired buffer length

Description

Returns new buffer length

struct ul_dbuff

Name

`struct ul_dbuff` — Generic Buffer for Dynamic Data

Synopsis

```
struct ul_dbuff {
  unsigned long len;
  unsigned long capacity;
  int flags;
  unsigned char * data;
  unsigned char sbuff[UL_DBUFF_SLEN];
};
```

Members

len

actual length of stored data

capacity

capacity of allocated buffer

flags

only one flag (`UL_DBUFF_IS_STATIC`) used now

data

pointer to dynamically allocated buffer

sbuff[UL_DBUFF_SLEN]
: static buffer for small data sizes

ul_dbuff_set_capacity

Name

`ul_dbuff_set_capacity` — change capacity of buffer to at least *`new_capacity`*

Synopsis

```
int ul_dbuff_set_capacity (ul_dbuff_t * buf, int new_capacity);
```

Arguments

`buf`
: buffer structure

`new_capacity`
: new capacity

Description

Returns real capacity of reallocated buffer

ul_dbuff_set_len

Name

`ul_dbuff_set_len` — sets a new len of the buffer, change the capacity if neccessary

Synopsis

```
int ul_dbuff_set_len (ul_dbuff_t * buf, int new_len);
```

Arguments

`buf`

buffer structure

`new_len`

new desired buffer length

Description

Returns new buffer length

ul_dbuff_set

Name

`ul_dbuff_set` — copies bytes to buffer and change its capacity if neccessary like memset

Synopsis

```
int ul_dbuff_set (ul_dbuff_t * buf, byte b, int n);
```

Arguments

`buf`

buffer structure

`b`

appended bytes

`n`

number of apended bytes

Returns

length of buffer

ul_dbuff_cpy

Name

`ul_dbuff_cpy` — copies bytes to buffer and change its capacity if neccessary

Synopsis

```
int ul_dbuff_cpy (ul_dbuff_t * buf, const void * b, int n);
```

Arguments

buf

buffer structure

b

appended bytes

n

number of apended bytes

Returns

length of buffer

ul_dbuff_cat

Name

`ul_dbuff_cat` — appends bytes at end of buffer and change its capacity if neccessary

Synopsis

```
int ul_dbuff_cat (ul_dbuff_t * buf, const void * b, int n);
```

Arguments

buf

buffer structure

b

appended bytes

n

number of apended bytes

Returns

length of buffer

ul_dbuff_strcat

Name

`ul_dbuff_strcat` — appends str at dhe end of buffer and change its capacity if neccessary

Synopsis

```
int ul_dbuff_strcat (ul_dbuff_t * buf, const char * str);
```

Arguments

buf

buffer structure

str

string to append

Description

Returns number length of buffer (including terminating '\0')

ul_dbuff_strcpy

Name

`ul_dbuff_strcpy` — copy str to the buffer and change its capacity if neccessary

Synopsis

```
int ul_dbuff_strcpy (ul_dbuff_t * buf, const char * str);
```

Arguments

buf

buffer structure

str

string to copy

Description

Returns number length of buffer (including terminating '\0')

ul_dbuff_append_byte

Name

`ul_dbuff_append_byte` — appends byte at dhe end of buffer and change its capacity if neccessary

Synopsis

```
int ul_dbuff_append_byte (ul_dbuff_t * buf, unsigned char b);
```

Arguments

buf

buffer structure

b

appended byte

Description

Returns number length of buffer (including terminating '\0')

ul_dbuff_ltrim

Name

`ul_dbuff_ltrim` — remove all white space characters from the left

Synopsis

```
int ul_dbuff_ltrim (ul_dbuff_t * buf);
```

Arguments

buf
: buffer structure

Return

new length of buffer

ul_dbuff_rtrim

Name

`ul_dbuff_rtrim` — remove all white space characters from the right

Synopsis

```
int ul_dbuff_rtrim (ul_dbuff_t * buf);
```

Arguments

buf
: buffer structure

Description

if buffer is terminated by ’\0’, than is also terminated after rtrim

Return

new length of buffer

ul_dbuff_trim

Name

`ul_dbuff_trim` — remove all white space characters from the right and from the left

Synopsis

```
int ul_dbuff_trim (ul_dbuff_t * buf);
```

Arguments

buf

buffer structure

Description

Returns number length of buffer (including terminating '\0')

ul_dbuff_cpos

Name

`ul_dbuff_cpos` — searches string for char

Synopsis

```
int ul_dbuff_cpos (const ul_dbuff_t * buf, unsigned char what,
unsigned char quote);
```

Arguments

buf

searched dbuff

what

char to find

quote

skip str areas quoted in quote chars<br> If you want to ignore quotes assign '\0' to quote in function call

Return

position of what char or negative value

ul_str_cpos

Name

`ul_str_cpos` — searches string for char

Synopsis

```
int ul_str_cpos (const unsigned char * str, unsigned char what,
unsigned char quote);
```

Arguments

str

zero terminated string

what

char to find

quote

skip str areas quoted in quote chars If you want to ignore quotes assign '\0' to quote in function call

Return

position of what char or negative value

ul_str_pos

Name

`ul_str_pos` — searches string for substring

Synopsis

```
int ul_str_pos (const unsigned char * str, const unsigned char *
what, unsigned char quote);
```

Arguments

`str`

zero terminated string

`what`

string to find

`quote`

skip str areas quoted in quote chars If you want to ignore quotes assign '\0' to quote in function call

Return

position of what string or negative value

ul_str_ncpy

Name

`ul_str_ncpy` — copies string to the buffer

Synopsis

```
int ul_str_ncpy (unsigned char * to, const unsigned char * from, int
buff_size);
```

Arguments

`to`

buffer where to copy str

`from`

zero terminated string

`buff_size`

size of the *`to`* buffer (including terminating zero)

Description

Standard strncpy function have some disadvatages (ie. do not append term. zero if copied string doesn't fit in to buffer, fills whole rest of buffer with zeros)

Returns strlen(to) or negative value in case of error

ul_dbuff_cut_pos

Name

`ul_dbuff_cut_pos` — cut first *`n`* bytes from *`fromdb`* and copies it to *`todb`*.

Synopsis

```
void ul_dbuff_cut_pos (ul_dbuff_t * fromdb, ul_dbuff_t * todb, int n);
```

Arguments

`fromdb`

buffer to cut from

`todb`

buffer to copy to

`n`

position where to cut

Description

If *`n`* is greater than fromdb.len whole *`fromdb`* is copied to *`todb`*. If *`n`* is negative position to cut is counted from the end of *`fromdb`*. If *`n`* is zero *`fromdb`* stays unchanged and todb is resized to len equal zero.

ul_dbuff_cut_delimited

Name

`ul_dbuff_cut_delimited` — cuts bytes before delimiter + delimiter char from *`fromdb`* and copies tham to the *`todb`*

Synopsis

```
void ul_dbuff_cut_delimited (ul_dbuff_t * fromdb, ul_dbuff_t * todb,
char delimiter, char quote);
```

Arguments

`fromdb`

buffer to cut from

`todb`

buffer to copy to

`delimiter`

delimiter char

`quote`

quoted delimiters are ignored, *`quote`* can be '\0', than it is ignored.

Description

If *`fromdb`* doesn't contain delimiter *`todb`* is trimmed to zero length.

ul_dbuff_cut_token

Name

`ul_dbuff_cut_token` — cuts not whitespaces from `fromdb` to `todb`.

Synopsis

```
void ul_dbuff_cut_token (ul_dbuff_t * fromdb, ul_dbuff_t * todb);
```

Arguments

fromdb

buffer to cut from

todb

buffer to copy to

Description

Leading whitespaces are ignored. Cut string is trimmed.

evc_link_init

Name

`evc_link_init` — Initialize Event Connector Link

Synopsis

```
int evc_link_init (evc_link_t * link);
```

Arguments

link

pointer to the link

Description

Link reference count is set to 1 by this function

Return Value

negative value informs about failure.

evc_link_new

Name

`evc_link_new` — Allocates New Event Connector Link

Synopsis

```
evc_link_t * evc_link_new ( void);
```

Arguments

void

no arguments

Description

Link reference count is set to 1 by this function

Return Value

pointer to the new link or `NULL`.

evc_link_connect

Name

`evc_link_connect` — Connects Link between Two Hubs

Synopsis

```
int evc_link_connect (evc_link_t * link, evc_tx_hub_t * src,
evc_rx_hub_t * dst, evc_prop_fnc_t * prop);
```

Arguments

link

pointer to the non-connected initialized link

src

pointer to the source hub of type &evc_tx_hub_t

dst

pointer to the destination hub of type &evc_rx_hub_t

prop

propagation function corresponding to source and destination expected event arguments

Description

If ready flag is not set, link state is set to ready and reference count is increased.

Return Value

negative return value indicates fail.

evc_link_init_standalone

Name

`evc_link_init_standalone` — Initialize Standalone Link

Synopsis

```
int evc_link_init_standalone (evc_link_t * link, evc_rx_fnc_t * rx_fnc,
void * context);
```

Arguments

link

pointer to the link

rx_fnc

pointer to the function invoked by event reception

context

context for the `rx_fnc` function invocation

Description

Link reference count is set to 1 by this function

Return Value

negative value informs about failure.

evc_link_new_standalone

Name

`evc_link_new_standalone` — Allocates New Standalone Link

Synopsis

```
evc_link_t * evc_link_new_standalone (evc_rx_fnc_t * rx_fnc, void *
context);
```

Arguments

rx_fnc

callback function invoked if event is delivered

context

context provided to the callback function

Description

Link reference count is set to 1 by this function

Return Value

pointer to the new link or `NULL`.

evc_link_connect_standalone

Name

`evc_link_connect_standalone` — Connects Standalone Link to Source Hubs

Synopsis

```
int evc_link_connect_standalone (evc_link_t * link, evc_tx_hub_t * src,
evc_prop_fnc_t * prop);
```

Arguments

`link`

pointer to the non-connected initialized link

`src`

pointer to the source hub of type &evc_tx_hub_t

`prop`

propagation function corresponding to hub source and standalone `rx_fnc` expected event arguments

Description

If ready flag is not set, link state is set to ready and reference count is increased.

Return Value

negative return value indicates failure.

evc_link_delete

Name

`evc_link_delete` — Deletes Link from Hubs Lists

Synopsis

```
int evc_link_delete (evc_link_t * link);
```

Arguments

`link`

pointer to the possibly connected initialized link

Description

If ready flag is set, link ready flag is cleared and reference count is decreased. This could lead to link disappear, if nobody is holding reference.

Return Value

positive return value indicates immediate delete, zero return value informs about delayed delete.

evc_link_dispose

Name

`evc_link_dispose` — Disposes Link

Synopsis

```
void evc_link_dispose (evc_link_t * link);
```

Arguments

`link`

pointer to the possibly connected initialized link

Description

Deletes link from hubs, marks it as dead, calls final death `propagate` for the link and if link is *`malloced`*, releases link occupied memory.

evc_tx_hub_init

Name

`evc_tx_hub_init` — Initializes Event Transmition Hub

Synopsis

```
int evc_tx_hub_init (evc_tx_hub_t * hub);
```

Arguments

hub

pointer to the &evc_tx_hub_t type hub

Return Value

negative return value indicates failure.

evc_tx_hub_done

Name

`evc_tx_hub_done` — Initializes Event Transmition Hub

Synopsis

```
void evc_tx_hub_done (evc_tx_hub_t * hub);
```

Arguments

hub

pointer to the &evc_tx_hub_t type hub

evc_tx_hub_propagate

Name

`evc_tx_hub_propagate` — Propagate Event to Links Destinations

Synopsis

```
void evc_tx_hub_propagate (evc_tx_hub_t * hub, va_list args);
```

Arguments

hub

pointer to the &evc_tx_hub_t type hub

args

pointer to the variable arguments list

Description

The function propagates event to the connected links, it skips links marked as *dead*, *blocked* or *delete_pend*. If the link is not marked as *recursive*, it ensures, that link is not called twice.

evc_tx_hub_emit

Name

`evc_tx_hub_emit` — Emits Event to Hub

Synopsis

```
void evc_tx_hub_emit (evc_tx_hub_t * hub,  ...);
```

Arguments

hub

pointer to the &evc_tx_hub_t type hub

...

variable arguments

Description

The function hands over arguments to `evc_tx_hub_propagate` as &va_list.

evc_rx_hub_init

Name

`evc_rx_hub_init` — Initializes Event Receiption Hub

Synopsis

```
int evc_rx_hub_init (evc_rx_hub_t * hub, evc_rx_fnc_t * rx_fnc, void *
context);
```

Arguments

hub

pointer to the &evc_rx_hub_t type hub

rx_fnc

pointer to the function invoked by event reception

context

context for the `rx_fnc` function invocation

Return Value

negative return value indicates failure.

evc_rx_hub_done

Name

`evc_rx_hub_done` — Finalize Event Receiption Hub

Synopsis

```
void evc_rx_hub_done (evc_rx_hub_t * hub);
```

Arguments

hub

pointer to the &evc_rx_hub_t type hub

struct evc_link

Name

`struct evc_link` — Event Connector Link

Synopsis

```
struct evc_link {
  struct src;
  unsigned standalone:1;
  } dst;
  evc_prop_fnc_t * propagate;
  int refcnt;
  unsigned recursive:1;
  unsigned blocked:1;
  unsigned ready:1;
  unsigned dead:1;
  unsigned delete_pend:1;
  unsigned malloced:1;
  unsigned standalone:1;
  unsigned tx_full_hub:1;
  unsigned rx_full_hub:1;
  short taken;
};
```

Members

src

describes source of the event link, contains pointer to &evc_tx_hub_t and *`peers`* links list

standalone

link is used for standalone function invocation

dst

determines destination of the event, it can be *`standalone`* `rx_fnc` function with with *`context`* or &evc_tx_hub_t in the *`multi`* case

propagate

pointer to the arguments propagation function,

refcnt

link reference counter

recursive

link can propagate could be invoked recursively, else recursive events are ignored by link

blocked

event propagation is blocked for the link, can be used by application

ready

link is ready and has purpose to live - it connects two active entities dead

link is dead and cannot propagate events

delete_pend

link is being deleted, but it is taken simultaneously, delete has to wait for finish of the propagate and to moving to the next link

malloced

link has been malloced and should be automatically freed when referenc counts drop to zero

standalone

link is used for standalone function invocation

tx_full_hub

`src` points to the full hub structure

rx_full_hub

`dst` points to the full hub structure

taken

link is in middle of the propagation process

Description

The link delivers events from the source to the destination. The link specific function `propagate` is called for each link leading from the hub activated by `evc_tx_hub_emit` and `evc_tx_hub_propagate`. The propagate function is responsible for parameters transformation before invocation of standalone or destination hub `rx_fnc` function.

struct evc_tx_hub

Name

`struct evc_tx_hub` — Event Transmit Hub

Synopsis

```
struct evc_tx_hub {
  ul_list_head_t links;
};
```

Members

links

list of links outgoing from the hub

struct evc_rx_hub

Name

`struct evc_rx_hub` — Event Receiving Hub

Synopsis

```
struct evc_rx_hub {
  ul_list_head_t links;
  evc_rx_fnc_t * rx_fnc;
  void * context;
};
```

Members

links

    list of links incoming to the hub

rx_fnc

    function invoked when event arives

context

    context for `rx_fnc`

evc_link_inc_refcnt

Name

`evc_link_inc_refcnt` — Increment Link Reference Count

Synopsis

```
void evc_link_inc_refcnt (evc_link_t * link);
```

Arguments

`link`

    pointer to link

evc_link_dec_refcnt

Name

`evc_link_dec_refcnt` — Decrement Link Reference Count

Synopsis

```
void evc_link_dec_refcnt (evc_link_t * link);
```

Arguments

`link`

pointer to link

Description

if the link reference count drops to 0, link is deleted from hubs by `evc_link_dispose` function and if *`malloced`* is sed, link memory is disposed by `free`. Special handlink can be achieved if `propagate` returns non-zero value if called with *`ded`* link.

gavl_first_node

Name

`gavl_first_node` — Returns First Node of GAVL Tree

Synopsis

```
gavl_node_t * gavl_first_node (const gavl_root_t * root);
```

Arguments

`root`

GAVL tree root

Return Value

pointer to the first node of tree according to ordering

gavl_last_node

Name

`gavl_last_node` — Returns Last Node of GAVL Tree

Synopsis

```
gavl_node_t * gavl_last_node (const gavl_root_t * root);
```

Arguments

`root`

GAVL tree root

Return Value

pointer to the last node of tree according to ordering

gavl_is_empty

Name

`gavl_is_empty` — Check for Empty GAVL Tree

Synopsis

```
int gavl_is_empty (const gavl_root_t * root);
```

Arguments

`root`

GAVL tree root

Return Value

returns non-zero value if there is no node in the tree

gavl_search_node

Name

`gavl_search_node` — Search for Node or Place for Node by Key

Synopsis

```
int gavl_search_node (const gavl_root_t * root, const void * key, int
mode, gavl_node_t ** nodep);
```

Arguments

`root`

GAVL tree root

`key`

key value searched for

`mode`

mode of the search operation

`nodep`

pointer to place for storing of pointer to found node or pointer to node which should be parent of inserted node

Description

Core search routine for GAVL trees searches in tree starting at *`root`* for node of item with value of item field at offset *`key_off`* equal to provided **`key`* value. Values are compared by function pointed by **`cmp_fnc`* field in the tree *`root`*. Integer *`mode`* modifies search algorithm: `GAVL_FANY` .. finds node of any item with field value **`key`*, `GAVL_FFIRST` .. finds node of first item with **`key`*, `GAVL_FAFTER` .. node points after last item with **`key`* value, reworded - index points at first item with higher value of field or after last item

Return Value

Return of nonzero value indicates match found. If the *`mode`* is ored with `GAVL_FCMP`, result of last compare is returned.

gavl_find

Name

`gavl_find` — Find Item for Provided Key

Synopsis

```
void * gavl_find (const gavl_root_t * root, const void * key);
```

Arguments

`root`
: GAVL tree root

`key`
: key value searched for

Return Value

pointer to item associated to key value.

gavl_find_first

Name

`gavl_find_first` — Find the First Item with Provided Key Value

Synopsis

```
void * gavl_find_first (const gavl_root_t * root, const void * key);
```

Arguments

`root`
: GAVL tree root

`key`
: key value searched for

Description

same as above, but first matching item is found.

Return Value

pointer to the first item associated to key value.

gavl_find_after

Name

`gavl_find_after` — Find the First Item with Higher Key Value

Synopsis

```
void * gavl_find_after (const gavl_root_t * root, const void * key);
```

Arguments

`root`

GAVL tree root

`key`

key value searched for

Description

same as above, but points to item with first key value above searched *`key`*.

Return Value

pointer to the first item associated to key value.

gavl_insert_node_at

Name

`gavl_insert_node_at` — Insert Existing Node to Already Computed Place into GAVL Tree

Synopsis

```
int gavl_insert_node_at (gavl_root_t * root, gavl_node_t * node,
gavl_node_t * where, int leftright);
```

Arguments

root

GAVL tree root

node

pointer to inserted node

where

pointer to found parent node

leftright

left (1) or right (0) branch

Return Value

positive value informs about success

gavl_insert_node

Name

`gavl_insert_node` — Insert Existing Node into GAVL Tree

Synopsis

```
int gavl_insert_node (gavl_root_t * root, gavl_node_t * node, int
mode);
```

Arguments

root

GAVL tree root

node

pointer to inserted node

`mode`

if mode is `GAVL_FAFTER`, multiple items with same key can be used, else strict ordering is required

Return Value

positive value informs about success

gavl_insert

Name

`gavl_insert` — Insert New Item into GAVL Tree

Synopsis

```
int gavl_insert (gavl_root_t * root, void * item, int mode);
```

Arguments

`root`

GAVL tree root

`item`

pointer to inserted item

`mode`

if mode is GAVL_FAFTER, multiple items with same key can be used, else strict ordering is required

Return Value

positive value informs about success, negative value indicates malloc fail or attempt to insert item with already defined key.

gavl_delete_node

Name

`gavl_delete_node` — Deletes/Unlinks Node from GAVL Tree

Synopsis

```
int gavl_delete_node (gavl_root_t * root, gavl_node_t * node);
```

Arguments

root
: GAVL tree root

node
: pointer to deleted node

Return Value

positive value informs about success.

gavl_delete

Name

`gavl_delete` — Delete/Unlink Item from GAVL Tree

Synopsis

```
int gavl_delete (gavl_root_t * root, void * item);
```

Arguments

root
: GAVL tree root

item
: pointer to deleted item

Return Value

positive value informs about success, negative value indicates that item is not found in tree defined by root

gavl_delete_and_next_node

Name

`gavl_delete_and_next_node` — Delete/Unlink Item from GAVL Tree

Synopsis

```
gavl_node_t * gavl_delete_and_next_node (gavl_root_t * root,
gavl_node_t * node);
```

Arguments

root

GAVL tree root

node

pointer to actual node which is unlinked from tree after function call, it can be unalocated or reused by application code after this call.

Description

This function can be used after call `gavl_first_node` for destructive traversal through the tree, it cannot be combined with `gavl_next_node` or `gavl_prev_node` and root is emptied after the end of traversal. If the tree is used after unsuccessful/unfinished traversal, it must be balanced again. The height differences are inconsistent in other case. If traversal could be interrupted, the function `gavl_cut_first` could be better choice.

Return Value

pointer to next node or NULL, when all nodes are deleted

gavl_cut_first

Name

`gavl_cut_first` — Cut First Item from Tree

Synopsis

```
void * gavl_cut_first (gavl_root_t * root);
```

Arguments

`root`

GAVL tree root

Description

This enables fast delete of the first item without tree balancing. The resulting tree is degraded but height differences are kept consistent. Use of this function can result in height of tree maximally one greater the tree managed by optimal AVL functions.

Return Value

returns the first item or NULL if the tree is empty

struct gavl_node

Name

`struct gavl_node` — Structure Representing Node of Generic AVL Tree

Synopsis

```
struct gavl_node {
  struct gavl_node * left;
  struct gavl_node * right;
  struct gavl_node * parent;
  int hdiff;
};
```

Members

left

pointer to left child or NULL

right

pointer to right child or NULL

parent

pointer to parent node, NULL for root

hdiff

difference of height between left and right child

Description

This structure represents one node in the tree and links *`left`* and *`right`* to nodes with lower and higher value of order criterion. Each tree is built from one type of items defined by user. User can decide to include node structure inside item representation or GAVL can malloc node structures for each inserted item. The GAVL allocates memory space with capacity sizeof(gavl_node_t)+sizeof(void*) in the second case. The item pointer is stored following node structure (void**)(node+1);

struct gavl_root

Name

`struct gavl_root` — Structure Representing Root of Generic AVL Tree

Synopsis

```
struct gavl_root {
  gavl_node_t * root_node;
  int node_offs;
  int key_offs;
  gavl_cmp_fnc_t * cmp_fnc;
};
```

Members

root_node

pointer to root node of GAVL tree

node_offs

offset between start of user defined item representation and included GAVL node structure. If negative value is stored there, user item does not contain node structure and GAVL manages standalone ones with item pointers.

key_offs

offset to compared (ordered) fields in the item representation

cmp_fnc

function defining order of items by comparing fields at offset *`key_offs`*.

gavl_node2item

Name

`gavl_node2item` — Conversion from GAVL Tree Node to User Defined Item

Synopsis

```
void * gavl_node2item (const gavl_root_t * root, const gavl_node_t *
node);
```

Arguments

root

GAVL tree root

node

node belonging to *root* GAVL tree

Return Value

pointer to item corresponding to node

gavl_node2item_safe

Name

gavl_node2item_safe — Conversion from GAVL Tree Node to User Defined Item

Synopsis

```
void * gavl_node2item_safe (const gavl_root_t * root, const
gavl_node_t * node);
```

Arguments

root

GAVL tree root

node

node belonging to *root* GAVL tree

Return Value

pointer to item corresponding to node

gavl_node2key

Name

`gavl_node2key` — Conversion from GAVL Tree Node to Ordering Key

Synopsis

```
void * gavl_node2key (const gavl_root_t * root, const gavl_node_t *
node);
```

Arguments

`root`

GAVL tree root

`node`

node belonging to *`root`* GAVL tree

Return Value

pointer to key corresponding to node

gavl_next_node

Name

`gavl_next_node` — Returns Next Node of GAVL Tree

Synopsis

```
gavl_node_t * gavl_next_node (const gavl_node_t * node);
```

Arguments

node

node for which accessor is looked for

Return Value

pointer to next node of tree according to ordering

gavl_prev_node

Name

`gavl_prev_node` — Returns Previous Node of GAVL Tree

Synopsis

```
gavl_node_t * gavl_prev_node (const gavl_node_t * node);
```

Arguments

node

node for which predecessor is looked for

Return Value

pointer to previous node of tree according to ordering

gavl_balance_one

Name

`gavl_balance_one` — Balance One Node to Enhance Balance Factor

Synopsis

```
int gavl_balance_one (gavl_node_t ** subtree);
```

Arguments

subtree

pointer to pointer to node for which balance is enhanced

Return Value

returns nonzero value if height of subtree is lowered by one

gavl_insert_primitive_at

Name

`gavl_insert_primitive_at` — Low Lewel Routine to Insert Node into Tree

Synopsis

```
int gavl_insert_primitive_at (gavl_node_t ** root_nodep, gavl_node_t *
node, gavl_node_t * where, int leftright);
```

Arguments

root_nodep

pointer to pointer to GAVL tree root node

node

pointer to inserted node

where

pointer to found parent node

leftright

left (>=1) or right (<=0) branch

Description

This function can be used for implementing AVL trees with custom root definition. The value of the selected *left* or *right* pointer of provided *node* has to be NULL before insert operation, i.e. node has to be end node in the selected direction.

Return Value

positive value informs about success

gavl_delete_primitive

Name

`gavl_delete_primitive` — Low Lewel Deletes/Unlinks Node from GAVL Tree

Synopsis

```
int gavl_delete_primitive (gavl_node_t ** root_nodep, gavl_node_t *
node);
```

Arguments

root_nodep
: pointer to pointer to GAVL tree root node

node
: pointer to deleted node

Return Value

positive value informs about success.

gavl_cut_first_primitive

Name

`gavl_cut_first_primitive` — Low Lewel Routine to Cut First Node from Tree

Synopsis

```
gavl_node_t * gavl_cut_first_primitive (gavl_node_t ** root_nodep);
```

Arguments

`root_nodep`

pointer to pointer to GAVL tree root node

Description

This enables fast delete of the first node without tree balancing. The resulting tree is degraded but height differences are kept consistent. Use of this function can result in height of tree maximally one greater the tree managed by optimal AVL functions.

Return Value

returns the first node or NULL if the tree is empty

gsa_struct_init

Name

`gsa_struct_init` — Initialize GSA Structure

Synopsis

```
void gsa_struct_init (gsa_array_t * array, int key_offs, gsa_cmp_fnc_t
* cmp_fnc);
```

Arguments

`array`

pointer to the array structure declared through `GSA_ARRAY_FOR`

`key_offs`

offset to the order controlling field obtained by `UL_OFFSETOF`

`cmp_fnc`

function defining order of items by comparing fields at offset *`key_offs`*.

gsa_delete_all

Name

`gsa_delete_all` — Delete Pointers to the All Items in the Array

Synopsis

```
void gsa_delete_all (gsa_array_t * array);
```

Arguments

`array`

pointer to the array structure declared through `GSA_ARRAY_FOR`

Description

This function releases all internally allocated memory, but does not release memory of the *`array`* structure

gsa_bsearch_indx

Name

`gsa_bsearch_indx` — Search for Item or Place for Item by Key

Synopsis

```
int gsa_bsearch_indx (gsa_array_t * array, void * key, int key_offs,
gsa_cmp_fnc_t * cmp_fnc, int mode, unsigned * indx);
```

Arguments

`array`

pointer to the array structure declared through `GSA_ARRAY_FOR`

`key`

key value searched for

`key_offs`

offset to the order controlling field obtained by `UL_OFFSETOF` *`cmp_fnc`*

function defining order of items by comparing fields

`mode`

mode of the search operation

`indx`

pointer to place, where store value of found item array index or index where new item should be inserted

Description

Core search routine for GSA arrays binary searches for item with field at offset *`key_off`* equal to *`key`* value Values are compared by function pointed by **`cmp_fnc`* field in the array structure *`array`*. Integer *`mode`* modifies search algorithm: `GSA_FANY` .. finds item with field value **`key`*, `GSA_FFIRST` .. finds the first item with field value **`key`*, `GSA_FAFTER` .. index points after last item with **`key`* value, reworded - index points at first item with higher value of field or after last item

Return Value

Return of nonzero value indicates match found.

gsa_find

Name

`gsa_find` — Find Item for Provided Key

Synopsis

```
void * gsa_find (gsa_array_t * array, void * key);
```

Arguments

`array`

pointer to the array structure declared through `GSA_ARRAY_FOR`

`key`

key value searched for

Return Value

pointer to item associated to key value or `NULL`.

gsa_find_first

Name

`gsa_find_first` — Find the First Item for Provided Key

Synopsis

```
void * gsa_find_first (gsa_array_t * array, void * key);
```

Arguments

`array`
: pointer to the array structure declared through `GSA_ARRAY_FOR`

`key`
: key value searched for

Description

same as above, but first matching item is found.

Return Value

pointer to the first item associated to key value or `NULL`.

gsa_find_indx

Name

`gsa_find_indx` — Find the First Item with Key Value and Return Its Index

Synopsis

```
void * gsa_find_indx (gsa_array_t * array, void * key, int * indx);
```

Arguments

`array`
: pointer to the array structure declared through `GSA_ARRAY_FOR`

`key`
: key value searched for

`indx`
: pointer to place for index, at which new item should be inserted

Description

same as above, but additionally stores item index value.

Return Value

pointer to the first item associated to key value or `NULL`.

gsa_insert_at

Name

`gsa_insert_at` — Insert Existing Item to the Specified Array Index

Synopsis

```
int gsa_insert_at (gsa_array_t * array, void * item, unsigned where);
```

Arguments

`array`
: pointer to the array structure declared through `GSA_ARRAY_FOR`

`item`
: pointer to inserted Item

`where`
: at which index should be *`item`* inserted

Return Value

positive or zero value informs about success

gsa_insert

Name

`gsa_insert` — Insert Existing into Ordered Item Array

Synopsis

```
int gsa_insert (gsa_array_t * array, void * item, int mode);
```

Arguments

`array`

pointer to the array structure declared through `GSA_ARRAY_FOR`

`item`

pointer to inserted Item

`mode`

if mode is `GSA_FAFTER`, multiple items with same key can be stored into array, else strict ordering is required

Return Value

positive or zero value informs about success

gsa_delete_at

Name

`gsa_delete_at` — Delete Item from the Specified Array Index

Synopsis

```
int gsa_delete_at (gsa_array_t * array, unsigned indx);
```

Arguments

array

pointer to the array structure declared through `GSA_ARRAY_FOR`

indx

index of deleted item

Return Value

positive or zero value informs about success

gsa_delete

Name

`gsa_delete` — Delete Item from the Array

Synopsis

```
int gsa_delete (gsa_array_t * array, void * item);
```

Arguments

array

pointer to the array structure declared through `GSA_ARRAY_FOR`

item

pointer to deleted Item

Return Value

positive or zero value informs about success

gsa_resort_buble

Name

`gsa_resort_buble` — Sort Again Array If Sorting Criteria Are Changed

Synopsis

```
int gsa_resort_buble (gsa_array_t * array, int key_offs, gsa_cmp_fnc_t
* cmp_fnc);
```

Arguments

array

pointer to the array structure declared through `GSA_ARRAY_FOR`

key_offs

offset to the order controlling field obtained by `UL_OFFSETOF`

cmp_fnc

function defining order of items by comparing fields

Return Value

non-zero value informs, that resorting changed order

gsa_setsort

Name

`gsa_setsort` — Change Array Sorting Criterion

Synopsis

```
int gsa_setsort (gsa_array_t * array, int key_offs, gsa_cmp_fnc_t *
cmp_fnc);
```

Arguments

array

pointer to the array structure declared through `GSA_ARRAY_FOR`

key_offs

new value of offset to the order controlling field

cmp_fnc

new function defining order of items by comparing fields at offset *key_offs*

Return Value

non-zero value informs, that resorting changed order

../../utils/ulut/ul_gsacust.c

Name

`../../utils/ulut/ul_gsacust.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_gsacust.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_gsacust.h

Name

`../../utils/ulut/ul_gsacust.h` — Document generation inconsistency

Oops

Warning

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struct gsa_array_field_t

Name

`struct gsa_array_field_t` — Structure Representing Anchor of ustom GSA Array

Synopsis

```
struct gsa_array_field_t {
  void ** items;
  unsigned count;
  unsigned alloc_count;
};
```

Members

items

pointer to array of pointers to individual items

count

number of items in the sorted array

alloc_count

allocated pointer array capacity

../../utils/ulut/ul_hptree.c

Name

`../../utils/ulut/ul_hptree.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_hptree.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_hptree.h

Name

`../../utils/ulut/ul_hptree.h` — Document generation inconsistency

Oops

> **Warning**
>
> The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_hptree.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_htimbase.c

Name

`../../utils/ulut/ul_htimbase.c` — Document generation inconsistency

Oops

> **Warning**
>
> The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_htimbase.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_htimdefs.h

Name

`../../utils/ulut/ul_htimdefs.h` — Document generation inconsistency

Oops

> **Warning**
>
> The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_htimdefs.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_htimer.c

Name

`../../utils/ulut/ul_htimer.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_htimer.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

struct ul_htim_node

Name

`struct ul_htim_node` — Timer queue entry base structure

Synopsis

```
struct ul_htim_node {
#ifndef UL_HTIMER_WITH_HPTREE
  ul_hpt_node_t node;
#else
  ul_hpt_node_t node;
#endif
  ul_htim_time_t expires;
};
```

Members

node

regular GAVL node structure for insertion into

node

regular GAVL node structure for insertion into

expires

time to trigger timer in &ul_htim_time_t type defined resolution

Description

This is basic type useful to define more complete timer types

struct ul_htim_queue

Name

`struct ul_htim_queue` — Timer queue head/root base structure

Synopsis

```
struct ul_htim_queue {
#ifndef UL_HTIMER_WITH_HPTREE
  ul_hpt_root_field_t timers;
#else
  ul_hpt_root_field_t timers;
#endif
  int first_changed;
};
```

Members

timers

root of FLES GAVL tree of timer entries

timers

root of FLES GAVL tree of timer entries

first_changed

flag, which is set after each add, detach operation which concerning of firsts scheduled timer

Description

This is basic type useful to define more complete timer queues types

struct ul_htimer

Name

`struct ul_htimer` — Standard timer entry with callback function

Synopsis

```
struct ul_htimer {
  ul_htim_node_t htim;
  ul_htimer_fnc_t * function;
  unsigned long data;
};
```

Members

htim

basic timer queue entry

function

user provided function to call at trigger time

data

user selected data

Description

This is standard timer type, which requires *`data`* casting in many cases. The type of *`function`* field has to be declared in “ul_htimdefs.h” header file.

struct ul_htimer_queue

Name

`struct ul_htimer_queue` — Standard timer queue

Synopsis

```
struct ul_htimer_queue {
  ul_htim_queue_t htim_queue;
};
```

Members

htim_queue

the structure wraps &ul_htim_queue structure

Description

This is standard timer type, which requires *`data`* casting in many cases

../../utils/ulut/ul_htimmstime.c

Name

`../../utils/ulut/ul_htimmstime.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_htimmstime.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_itbase.h

Name

`../../utils/ulut/ul_itbase.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_itbase.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

list_add

Name

`list_add` — add a new entry

Synopsis

```
void list_add (struct list_head * new, struct list_head * head);
```

Arguments

new
: new entry to be added

head
: list head to add it after

Description

Insert a new entry after the specified head. This is good for implementing stacks.

list_add_tail

Name

`list_add_tail` — add a new entry

Synopsis

```
void list_add_tail (struct list_head * new, struct list_head * head);
```

Arguments

new
: new entry to be added

head
: list head to add it before

Description

Insert a new entry before the specified head. This is useful for implementing queues.

list_del

Name

`list_del` — deletes entry from list.

Synopsis

```
void list_del (struct list_head * entry);
```

Arguments

`entry`

the element to delete from the list.

Note

list_empty on entry does not return true after this, the entry is in an undefined state.

list_del_init

Name

`list_del_init` — deletes entry from list and reinitialize it.

Synopsis

```
void list_del_init (struct list_head * entry);
```

Arguments

`entry`

the element to delete from the list.

list_move

Name

`list_move` — delete from one list and add as another's head

Synopsis

```
void list_move (struct list_head * list, struct list_head * head);
```

Arguments

`list`

the entry to move

`head`

the head that will precede our entry

list_move_tail

Name

`list_move_tail` — delete from one list and add as another's tail

Synopsis

```
void list_move_tail (struct list_head * list, struct list_head *
head);
```

Arguments

`list`

the entry to move

`head`

the head that will follow our entry

list_empty

Name

`list_empty` — tests whether a list is empty

Synopsis

```
int list_empty (struct list_head * head);
```

Arguments

head
: the list to test.

list_splice

Name

`list_splice` — join two lists

Synopsis

```
void list_splice (struct list_head * list, struct list_head * head);
```

Arguments

list
: the new list to add.

head
: the place to add it in the first list.

list_splice_init

Name

`list_splice_init` — join two lists and reinitialise the emptied list.

Synopsis

```
void list_splice_init (struct list_head * list, struct list_head *
head);
```

Arguments

list
: the new list to add.

head
: the place to add it in the first list.

Description

The list at *list* is reinitialised

list_entry

Name

`list_entry` — get the struct for this entry

Synopsis

```
list_entry ( ptr,  type,  member);
```

Arguments

ptr
: the &struct list_head pointer.

type
: the type of the struct this is embedded in.

member

the name of the list_struct within the struct.

list_for_each

Name

`list_for_each` — iterate over a list

Synopsis

```
list_for_each ( pos,  head);
```

Arguments

pos

the &struct list_head to use as a loop counter.

head

the head for your list.

__list_for_each

Name

`__list_for_each` — iterate over a list

Synopsis

```
__list_for_each ( pos,  head);
```

Arguments

pos

the &struct list_head to use as a loop counter.

head

the head for your list.

Description

This variant differs from `list_for_each` in that it's the simplest possible list iteration code, no prefetching is done. Use this for code that knows the list to be very short (empty or 1 entry) most of the time.

list_for_each_prev

Name

`list_for_each_prev` — iterate over a list backwards

Synopsis

```
list_for_each_prev ( pos,  head);
```

Arguments

pos

the &struct list_head to use as a loop counter.

head

the head for your list.

list_for_each_safe

Name

`list_for_each_safe` — iterate over a list safe against removal of list entry

Synopsis

```
list_for_each_safe ( pos,  n,  head);
```

Arguments

pos

the &struct list_head to use as a loop counter.

n

another &struct list_head to use as temporary storage

head

the head for your list.

list_for_each_entry

Name

`list_for_each_entry` — iterate over list of given type

Synopsis

```
list_for_each_entry ( pos,  head,  member);
```

Arguments

pos

the type * to use as a loop counter.

head

the head for your list.

member

the name of the list_struct within the struct.

list_for_each_entry_reverse

Name

`list_for_each_entry_reverse` — iterate backwards over list of given type.

Synopsis

`list_for_each_entry_reverse ( pos,  head,  member);`

Arguments

`pos`
: the type * to use as a loop counter.

`head`
: the head for your list.

`member`
: the name of the list_struct within the struct.

list_for_each_entry_safe

Name

`list_for_each_entry_safe` — iterate over list of given type safe against removal of list entry

Synopsis

`list_for_each_entry_safe ( pos,  n,  head,  member);`

Arguments

`pos`
: the type * to use as a loop counter.

`n`
: another type * to use as temporary storage

`head`
: the head for your list.

`member`
: the name of the list_struct within the struct.

../../utils/ulut/ul_list.h

Name

`../../utils/ulut/ul_list.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_list.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_utdefs.h

Name

`../../utils/ulut/ul_utdefs.h` — Document generation inconsistency

Oops

Warning

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../../utils/ulut/ul_utexport.h

Name

`../../utils/ulut/ul_utexport.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_utexport.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/ulut/ul_utmalloc.h

Name

`../../utils/ulut/ul_utmalloc.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/ulut/ul_utmalloc.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

libsuiut API

../../utils/suiut/sui_dievc.h

Name

`../../utils/suiut/sui_dievc.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dievc.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

sui_dinfo_inc_refcnt

Name

`sui_dinfo_inc_refcnt` — Increase reference count of DINFO

Synopsis

```
void sui_dinfo_inc_refcnt (sui_dinfo_t * datai);
```

Arguments

datai
: Pointer to dinfo structure.

File

sui_dinfo.c

sui_dinfo_dec_refcnt

Name

`sui_dinfo_dec_refcnt` — Decrease reference count of DINFO

Synopsis

```
void sui_dinfo_dec_refcnt (sui_dinfo_t * datai);
```

Arguments

datai
: Pointer to dinfo structure.

Description

If the reference count reaches zero, DINFO starts to be destroyed. The event `SUEV_COMMAND` with command `SUCM_DONE` is sent to dinfo, next event `SUEV_FREE` is emmited or direct `free` is called the `SUEV_FREE` is disabled.

File

sui_dinfo.c

sui_create_dinfo

Name

`sui_create_dinfo` — Creates new dynamic DINFO

Synopsis

```
sui_dinfo_t * sui_create_dinfo (void * adata, int afdig, long amin,
long amax, long ainfo, sui_datai_rdfnc_t * rd, sui_datai_wrfnc_t *
wr);
```

Arguments

adata

DINFO type specific pointer to the data

afdig

Number of fractional digits if the fixed decimal point format is used

amin

The minimal allowed value

amax

The maximal allowed value

ainfo

DINFO type specific pointer

rd

Pointer to the read processing function

wr

Pointer to the write processing function

Return Value

Pointer to newly created DINFO.

File

sui_dinfo.c

sui_create_dinfo_int

Name

`sui_create_dinfo_int` — Creates DINFO for signed integer or fixed point data

Synopsis

```
sui_dinfo_t * sui_create_dinfo_int (void * adata, long aidxsize, int
asize);
```

Arguments

`adata`
: Pointer to the signed char, short, int, long or fixed point data

`aidxsize`
: Allowed range of indexes form 0 to *`aidxsize`*-1, if zero, then no check

`asize`
: The size of the integer type representation returned by `sizeof`

Return Value

Pointer to newly created DINFO.

File

sui_dinfo.c

sui_create_dinfo_uint

Name

`sui_create_dinfo_uint` — Creates DINFO for unsigned integer or fixed point data

Synopsis

```
sui_dinfo_t * sui_create_dinfo_uint (void * adata, long aidxsize, int
asize);
```

Arguments

adata

Pointer to the unsigned char, short, int, long or fixed point data

aidxsize

Allowed range of indexes form 0 to *aidxsize*-1, if zero, then no check

asize

The size of the integer type representation returned by `sizeof`

Return Value

Pointer to newly created DINFO.

File

sui_dinfo.c

sui_rd_long

Name

`sui_rd_long` — Reads long integer data from specified DINFO

Synopsis

```
int sui_rd_long (sui_dinfo_t * datai, long idx, long * buf);
```

Arguments

datai

Pointer to the DIONFO

idx

Index of read data inside DINFO.

buf

Pointer to where the read value is stored

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo.c

sui_wr_long

Name

`sui_wr_long` — Writes long integer data to specifies DINFO

Synopsis

```
int sui_wr_long (sui_dinfo_t * datai, long idx, const long * buf);
```

Arguments

`datai`

Pointer to the DIONFO

`idx`

Index of read data inside DINFO.

`buf`

Pointer to the new data value

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo.c

dinfo_scale_proxy

Name

`dinfo_scale_proxy` — Creates value scale proxy DINFO

Synopsis

```
sui_dinfo_t * dinfo_scale_proxy (sui_dinfo_t * dfrom, long ainfo, long
amultiply, long adivide);
```

Arguments

`dfrom`

  Pointer to the underlying DINFO

`ainfo`

  The local DINFO specific parameter

`amultiply`

  Multiply factor

`adivide`

  Divide factor

Description

Creates scaling proxy DINFO. Read value is multiplied by *`amultiply`* factor and then divided by *`adivide`* factor. The long integer overflow is not checked. If the full checking is required use `sui_lintrans_proxy` instead which works with wider numbers representations and checks for all overflow cases.

Return Value

Pointer to newly created DINFO.

File

sui_dinfo.c

dinfo_simple_proxy

Name

`dinfo_simple_proxy` — Creates simple proxy DINFO

Synopsis

```
sui_dinfo_t * dinfo_simple_proxy (sui_dinfo_t * dfrom, long ainfo);
```

Arguments

`dfrom`

Pointer to the underlying DINFO

`ainfo`

The local DINFO specific parameter which specifies index value for calling of underlying DINFO

Return Value

Pointer to newly created DINFO.

File

sui_dinfo.c

../../utils/suiut/sui_dinfochk.c

Name

`../../utils/suiut/sui_dinfochk.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dinfochk.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/suiut/sui_dinfo_dbuff.c

Name

`../../utils/suiut/sui_dinfo_dbuff.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dinfo_dbuff.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

sui_dinfo_dbuff_create

Name

`sui_dinfo_dbuff_create` — Creates DINFO for ul_dbuff structure

Synopsis

```
sui_dinfo_t * sui_dinfo_dbuff_create (ul_dbuff_t * db, long aidxsize);
```

Arguments

`db`

Pointer to the dbuff

`aidxsize`

Allowed range of indexes form 0 to *`aidxsize`*-1, if zero then no check

Returns

Pointer to newly created DINFO.

File

sui_dinfo_dbuff.c

sui_dinfo_dbuff_rd_dbuff

Name

`sui_dinfo_dbuff_rd_dbuff` — Reads ul_dbuff data from specified DINFO

Synopsis

```
int sui_dinfo_dbuff_rd_dbuff (sui_dinfo_t * di, long idx, ul_dbuff_t *
dbuf);
```

Arguments

`di`

Pointer to the DIONFO

`idx`

Index of read data inside DINFO.

`dbuf`

Pointer to where the read value is stored

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo_dbuff.c

sui_dinfo_dbuff_wr_dbuff

Name

`sui_dinfo_dbuff_wr_dbuff` — Writes ul_dbuff data to specifies DINFO

Synopsis

```
int sui_dinfo_dbuff_wr_dbuff (sui_dinfo_t * di, long idx, const
ul_dbuff_t * dbuf);
```

Arguments

di

Pointer to the DIONFO

idx

Index of read data inside DINFO.

dbuf

Pointer to the dbuff

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo_dbuff.c

sui_dinfo_dbuff_rd_long

Name

`sui_dinfo_dbuff_rd_long` — Reads long integer data from specified dbuff DINFO

Synopsis

```
int sui_dinfo_dbuff_rd_long (sui_dinfo_t * di, long idx, long * buf);
```

Arguments

di

Pointer to the DIONFO

idx

Index of read data inside DINFO.

buf

Pointer to the dbuff

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo_dbuff.c

sui_dinfo_dbuff_wr_long

Name

`sui_dinfo_dbuff_wr_long` — Writes long integer data to specified dbuff DINFO

Synopsis

```
int sui_dinfo_dbuff_wr_long (sui_dinfo_t * di, long idx, const long *
buf);
```

Arguments

di

Pointer to the DIONFO

idx

Index of read data inside DINFO.

buf

Pointer to the dbuff

Return Value

Operation result code, `SUDI_DATA_OK` in the case of success.

File

sui_dinfo_dbuff.c

../../utils/suiut/sui_dinfo.h

Name

`../../utils/suiut/sui_dinfo.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dinfo.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/suiut/sui_dtrans.c

Name

`../../utils/suiut/sui_dtrans.c` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dtrans.c` at this point, but none was found. This dummy section is inserted to allow generation to continue.

../../utils/suiut/sui_dtrans.h

Name

`../../utils/suiut/sui_dtrans.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dtrans.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

sui_dtree_lookup

Name

`sui_dtree_lookup` — Find dinfo in the named dinfo database

Synopsis

```
int sui_dtree_lookup (sui_dtree_dir_t * from_dir, const char * path,
sui_dtree_dir_t ** found_dir, sui_dinfo_t ** datai);
```

Arguments

from_dir

the directory to start from

path

path from directory to dinfo or directory

found_dir

the optional pointer to space that would hold pointer to directory of found dinfo

datai

optional pointer to store the found dinfo

Return Value

SUI_DTREE_FOUND, SUI_DTREE_DIR, SUI_DTREE_NOPATH, SUI_DTREE_ERROR

File

sui_dtree.c

../../utils/suiut/sui_dtree.h

Name

`../../utils/suiut/sui_dtree.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_dtree.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

sui_dtree_mem_lookup

Name

`sui_dtree_mem_lookup` — Find dinfo in the named dinfo database

Synopsis

```
int sui_dtree_mem_lookup (sui_dtree_dir_t * from_dir, const char *
path, int * consumed, sui_dtree_dir_t ** found_dir, sui_dinfo_t **
datai);
```

Arguments

`from_dir`

the directory to start from

`path`

path from directory to dinfo or directory

`consumed`

pointer to location for numeber of consumed characters from path

`found_dir`

the optional pointer to space that would hold pointer to directory of found dinfo

`datai`

optional pointer to store the found dinfo

Return Value

SUI_DTREE_FOUND, SUI_DTREE_DIR, SUI_DTREE_NOPATH, SUI_DTREE_ERROR

File

sui_dtreemem.c

struct sui_dtree_memdir_t

Name

`struct sui_dtree_memdir_t` — Ancestor of sui_dtree_dir_t which containing sui_dtree_memnode_t GAVL list .

Synopsis

```
struct sui_dtree_memdir_t {
  sui_dtree_dir_t dir;
  gavl_cust_root_field_t name_root;
};
```

Members

dir

base struct (Container_of technology). Containing dir needs it.

name_root

GAVL with children of type &sui_dtree_memnode_t

Header

sui_dtreemem.h

struct sui_dtree_memnode_t

Name

`struct sui_dtree_memnode_t` — structure representing single node in memtree.

Synopsis

```
struct sui_dtree_memnode_t {
  char * name;
  int node_type;
  gavl_node_t name_node;
  union ptr;
  void * dll_handle;
};
```

Members

name

: structure neccessary for storing node in GAVL tree, is NULL for subindicies

node_type

: type of node contens (dir or dinfo)

name_node

: the structure can be stored in GAVL tree thanks to that field

ptr

: pointer to dinfo or directory that this node contains.

dll_handle

: if memnode is one imported from DLL, DLLs handle is stored here. (else it is 0)

Description

Node can contain `dinfo` or `directory` (&sui_dtree_dir_t).

Header

sui_dtreemem.h.h

struct sui_event

Name

`struct sui_event` — Common suitk event structure

Synopsis

```
struct sui_event {
  unsigned short what;
};
```

Members

what

: Code of event.(See 'event_code' enum with 'SUEV_' prefix)

File

sui_base.h

enum event_code

Name

`enum event_code` — Code of SUITK events ['SUEV_' prefix]

Synopsis

```
enum event_code {
  SUEV_MDOWN,
  SUEV_MUP,
  SUEV_MMOVE,
  SUEV_MAUTO,
  SUEV_KDOWN,
  SUEV_KUP,
  SUEV_DRAW,
  SUEV_REDRAW,
  SUEV_COMMAND,
  SUEV_BROADCAST,
  SUEV_SIGNAL,
  SUEV_GLOBAL,
  SUEV_FREE,
  SUEV_NOTHING,
  SUEV_MOUSE,
  SUEV_KEYBOARD,
  SUEV_MESSAGE,
  SUEV_DEFMASK,
  SUEV_GRPMASK
};
```

Constants

SUEV_MDOWN

    Mouse button is down.

SUEV_MUP

    Mouse button is up.

SUEV_MMOVE

    Mouse is in move.

SUEV_MAUTO

SUEV_KDOWN

    Key is down.

SUEV_KUP
: Key is up.

SUEV_DRAW
: Draw widget.

SUEV_REDRAW
: Redraw widget.

SUEV_COMMAND
: Command event.

SUEV_BROADCAST
: Bradcast event.

SUEV_SIGNAL
: ?

SUEV_GLOBAL
: ?

SUEV_FREE
: ?

SUEV_NOTHING
: ?

SUEV_MOUSE
: ?

SUEV_KEYBOARD
: ?

SUEV_MESSAGE
: ?

SUEV_DEFMASK
: ?

SUEV_GRPMASK
: ?

File

sui_base.h

enum command_event

Name

`enum command_event` — Command codes for command event ['SUCM_' prefix]

Synopsis

```
enum command_event {
  SUCM_VALID,
  SUCM_QUIT,
  SUCM_ERROR,
  SUCM_MENU,
  SUCM_CLOSE,
  SUCM_ZOOM,
  SUCM_RESIZE,
  SUCM_NEXT,
  SUCM_PREV,
  SUCM_HELP,
  SUCM_OK,
  SUCM_CANCEL,
  SUCM_YES,
  SUCM_NO,
  SUCM_DEFAULT,
  SUCM_FOCUSASK,
  SUCM_FOCUSSET,
  SUCM_FOCUSREL,
  SUCM_INIT,
  SUCM_DONE,
  SUCM_NEWDISPLAY,
  SUCM_DISPNUMB,
  SUCM_CHANGE_STBAR,
  SUCM_NEXT_GROUP,
  SUCM_PREV_GROUP,
  SUCM_EVC_LINK_TO
};
```

Constants

SUCM_VALID

VALID command event.

SUCM_QUIT

QUIT command event.

SUCM_ERROR

ERROR command event.

SUCM_MENU

MENU command event. Open, select, close, ... menu.

SUCM_CLOSE

CLOSE command event.

SUCM_ZOOM

ZOOM command event.

SUCM_RESIZE

RESIZE command event.

SUCM_NEXT

NEXT command event. Mainly for change widget focus by pressing TAB key.

SUCM_PREV

PREV command event. Mainly for change widget focus by pressing SHIFT+TAB key.

SUCM_HELP

HELP command event.

SUCM_OK

OK button pressed.

SUCM_CANCEL

CANCEL button pressed.

SUCM_YES

YES button pressed.

SUCM_NO

NO button pressed.

SUCM_DEFAULT

DEFAULT button pressed.

SUCM_FOCUSASK

Which widget has focus ?

SUCM_FOCUSSET

Set focus to the widget.

SUCM_FOCUSREL

Release focus from the widget.

SUCM_INIT

Initialize widget.

SUCM_DONE

Done widget - decrement reference counter, deallocate widget data.

SUCM_NEWDISPLAY

Create new screen from pointer to screen.

SUCM_DISPNUMB

Create new screen from number to screen.

SUCM_CHANGE_STBAR

Status bar is changed.

SUCM_NEXT_GROUP

Change focus between groups (like as ALT+TAB in Windows).

SUCM_PREV_GROUP

Change focus between groups.

SUCM_EVC_LINK_TO

Delegate connection of the EVC link to the proxy or target object

File

sui_base.h

../../utils/suiut/sui_internal.h

Name

`../../utils/suiut/sui_internal.h` — Document generation inconsistency

Oops

Warning

The template for this document tried to insert the structured comment from the file `../../utils/suiut/sui_internal.h` at this point, but none was found. This dummy section is inserted to allow generation to continue.

Notes

1. http://cmp.felk.cvut.cz/~pisa/can/make-3.81beta1.tar.gz
2. http://cmp.felk.cvut.cz/~pisa/can/make-3.81beta1-i586-0.gz