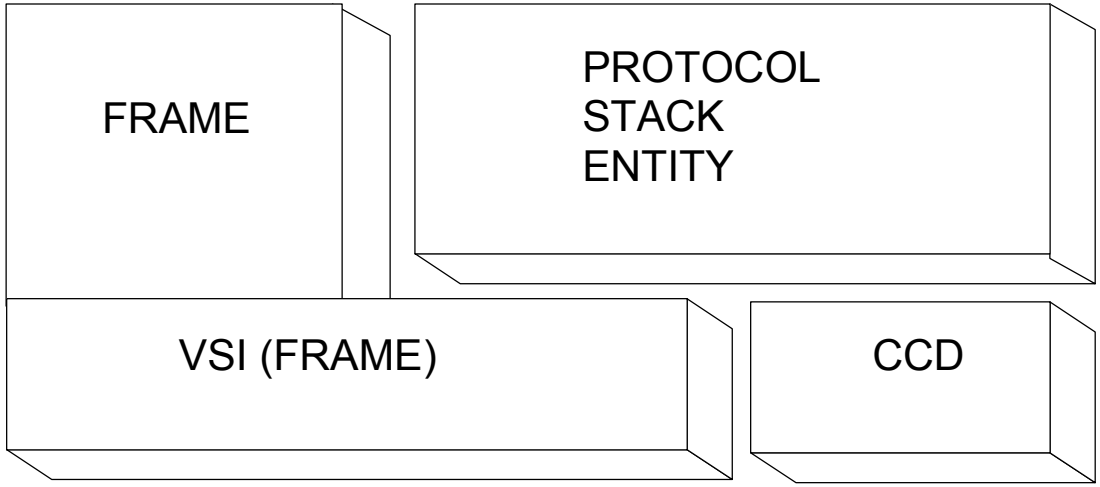
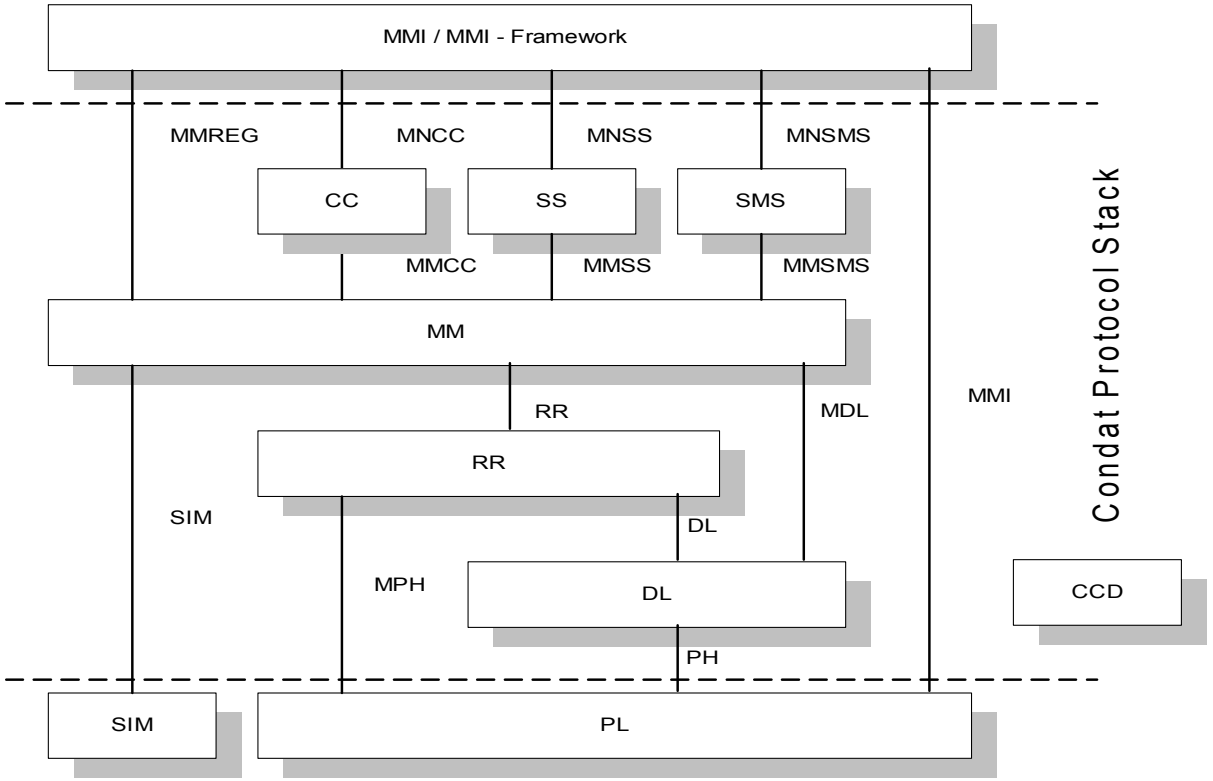
# Condat
# (G23) Coder Decoder

# CCD

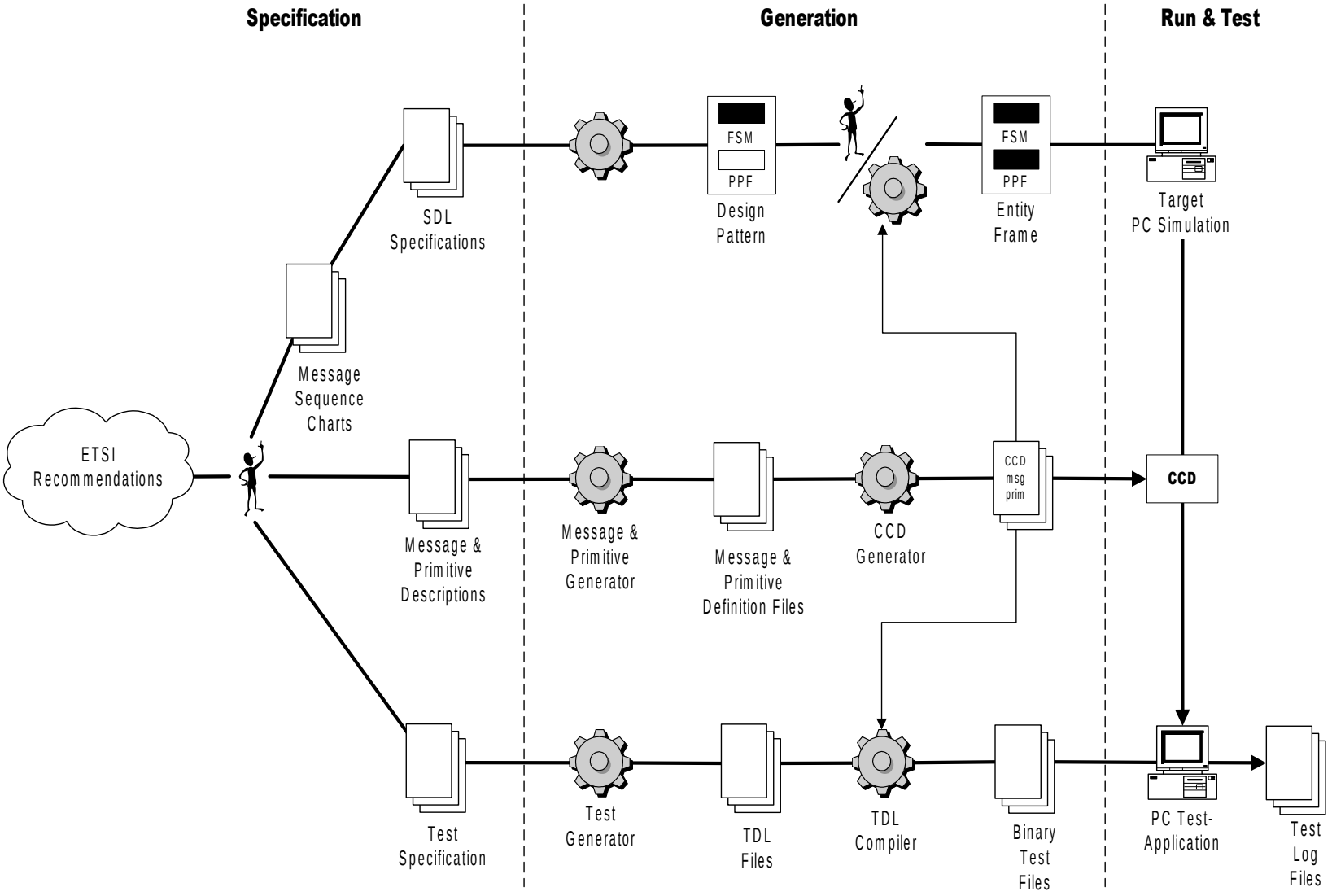
# Structure of Protocol Stack Entity



# Mobile-Station Protocol Architecture



# Protocol Stack Development Method



# CCD - GSM/GPRS/UMTS Coder Decoder System (I)

**Subsystems:**

- **CCDGEN**
- **CCDEDIT**
- **CCD**
- **CCD data base**
- **TAP (Test Application Process)**

# CCD - GSM/GPRS/UMTS Coder Decoder System (II)

## CCD data base:

- Data tables describe the structure of Air Interface Messages and Primitves, e.g. IE types, bit field sizes, offset values
- Test system : debug information and primitives
- Statically linked as object or library file to the application.
- Dynamically linked on win32 systems (ccd.dll)
- Tables reside in ...\CDGINC

# CCD Data and Type Generation (I)

**Formal Description of Messages and Primitives (WORD File)**

**CCDGEN**

**CCD Generator**

**CCD Kernel**
CCD Interface
General Coding Rules

Coding Tables for Messages

Message and Primitive Element Description

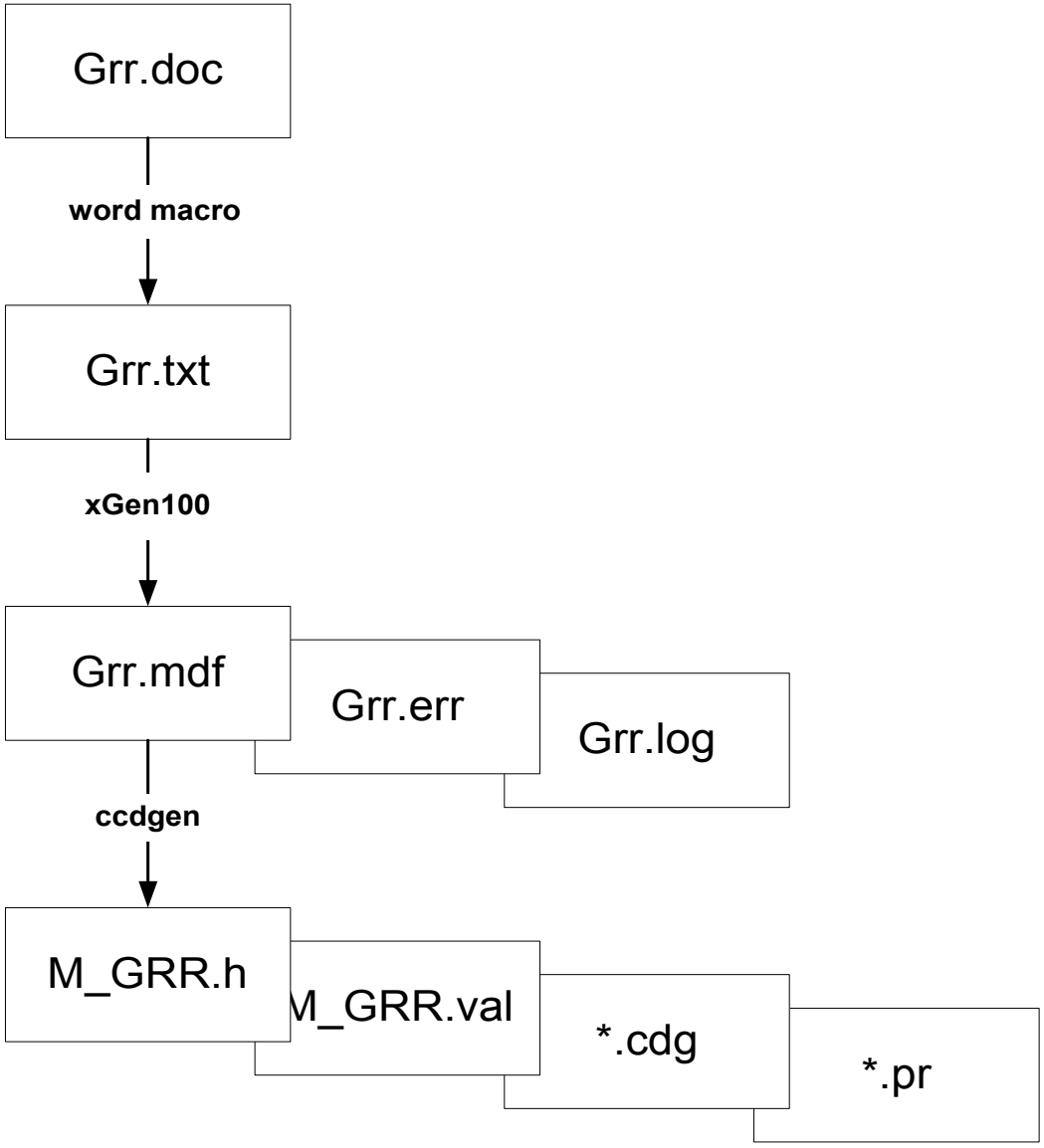
**Include Files**
p_xxx.h
p_xxx.val
m_xxx.h
m_xxx.val
(xxx=SAP/Entity)

**PS Entities**

**CCD (Target)**

**CCD (Test)**

# CCD Data and Type Generation (II)



# CCD Data and Type Generation (III)

## CCDGEN:

Creation of C include files and SDL files from Primitive Description Files (PDF) and Message Description Files (MDF).

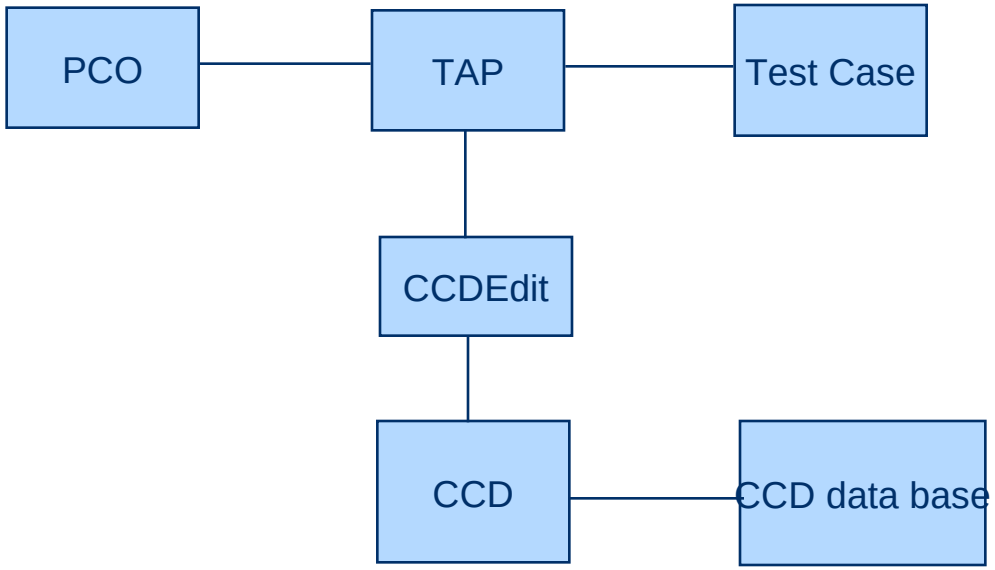
```
...

$(CDGINC)\mconst.cdg: $(MDFFILES)
     $(TESTDRIVE)
     cd $(MSGDIR)
     -md $(CDGINC)
     $(CCDGEN) -l -t -h -m64 -a2 -o$(CDGINC) $(**B)
...
$(CDGINC)\pconst.cdg: $(PDFFILES)
     $(TESTDRIVE)
     cd $(PRIMDIR)
     -md $(CDGINC)
     $(CCDGEN) -l -t -h -m64 -p -a0 -o$(CDGINC) $(**B)
```

# GSM/GPRS/UMTS Test System (I)

## TAP:

- Test Application Process
- Uses the CCD and CCDEDIT functionality



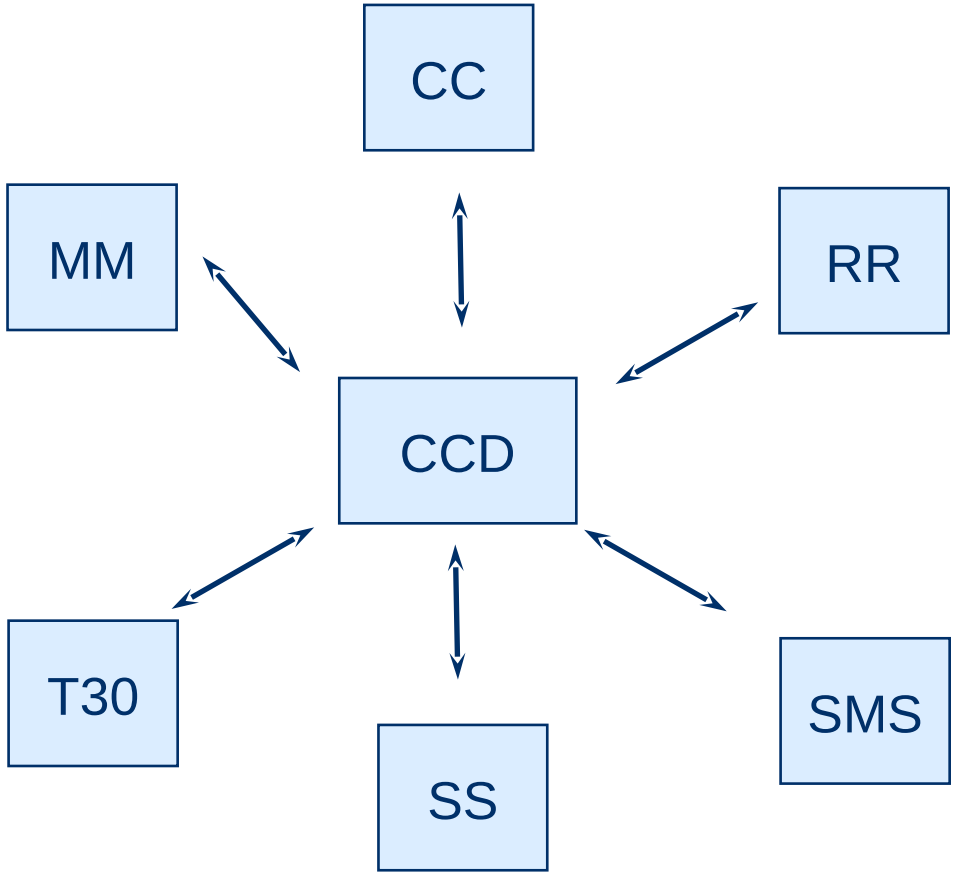
# GSM/GPRS/UMTS Test System (II)

**CCDEDIT:** C function library providing Iterator functionality for the CCD data base.

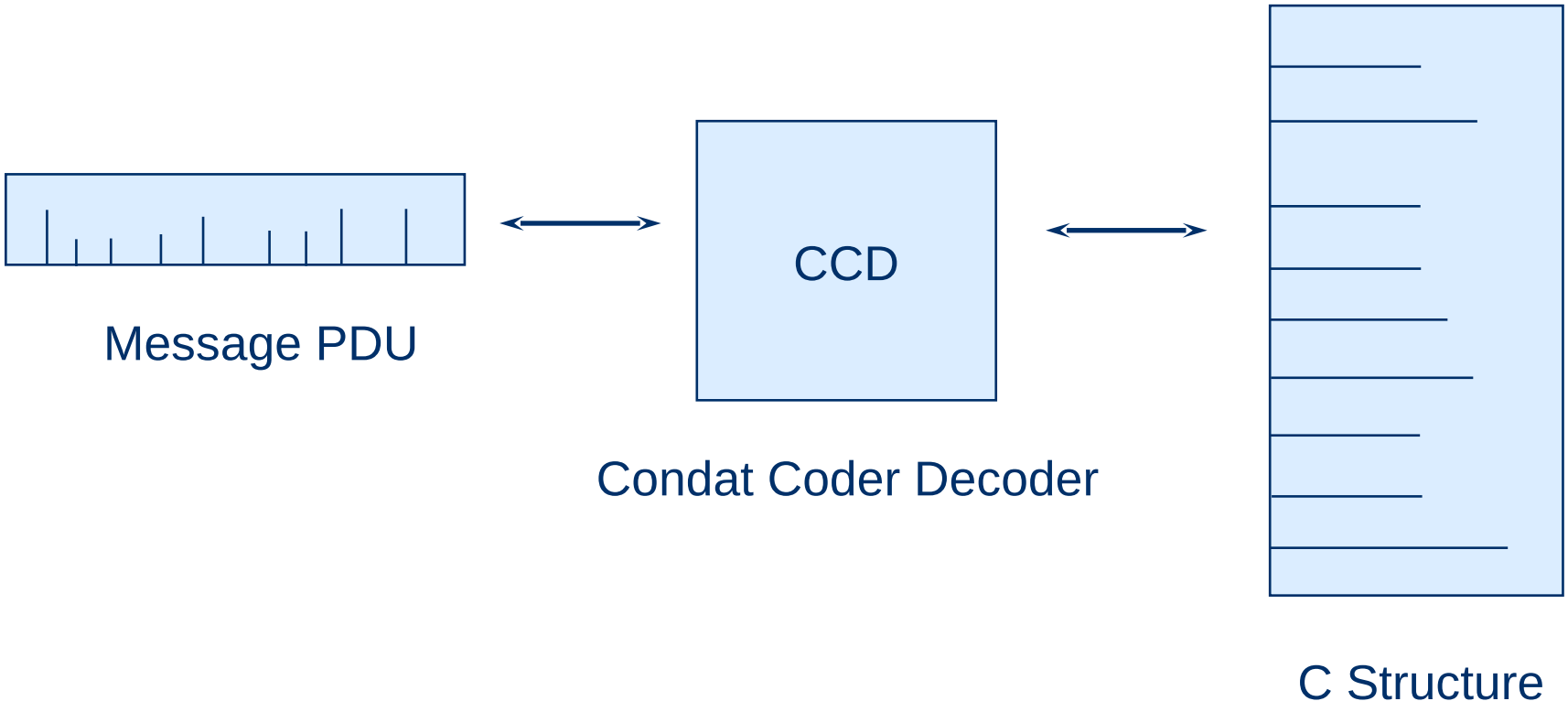
- Iterate thru the IEs of an Air Interface Message
- Iterate thru the components of a Primitive
- Especially used for test case definition and execution

```
RR_ESTABLISH_REQ
                estcs               ESTCS_MOB_ORIG
                sdu
                {
                component           MM
                direction           UPLINK
                pd                  U_IMSI_DETACH_IND
                ti                  TI_0
                mob_class_1         MOB_CLASS_1
                mob_ident           MOB_IDENT_IMSI
                }
```

# CCD Usage Relation



# GSM/GPRS/UMTS Coder Decoder Component (I)



# GSM/GPRS/UMTS Coder Decoder Component (II)

**CCD:**

- C funtions provided to convert Air Interface Messages into C structures and vice versa
- Avoid bit operations in client code
- Target independent

```
GLOBAL void for_setup (T_CC_DATA * cc_data, T_U_SETUP * setup)
{
    PALLOC_MSG (data, MMCC_DATA_REQ, U_SETUP);

    TRACE_FUNCTION ("for_setup()");

    ccd_codeMsg (CCDENT_CC,
                 UPLINK,
                 (T_MSGBUF *) &data->sdu,
                 (UBYTE    *) setup,
                 NOT_PRESENT_8BIT);

    for_pd (data, cc_data);
}
```

# GSM/GPRS/UMTS Coder Decoder Component (III)

## CCD error handling:

```
#include ccdapi.h
...
USHORT parlist[6];
UBYTE  first_err;

 memset (parlist,0, sizeof (parlist));
 first_err = ccd_getFirstError (CCDENT_CC, parlist);
 /*
  * Error Handling
  */
 switch (first_err)
 {
   case ERR_COMPREH_REQUIRED: /* comprehension required */
        for_set_mandatory_error (cc_data, (UBYTE)parlist[0]);
        break;
   case ERR_MAND_ELEM_MISS:   /* Mandatory elements missing */
                              /*
                               * Error handling is carried
                               * out by checking the content.
                               */
        break;
  }
```

# CCD - Decoding Example (I)

**Example message: SAT Command in sat.doc**

## Definition:

| long name | short name | ID | direction |
|---|---|---|---|
| SAT Command | stk_cmd | 0b00000000 | downlink |

## Elements:

| ID | long name | short name | ref | ref [1] | pres | type | len |
|---|---|---|---|---|---|---|---|
| | Message Type | msg_type | 6.12 | | M | V3 | 1 |
| 0xD0 | Proactive SIM Command | pas_cmd | 5.1 | 13.2 | O | TLV5 | 2-258 |

# CCD - Decoding Example (II)

**Information Element pas_cmd in sat.doc**

## Definition:

| long name | short name | Len |
|---|---|---|
| Proactive SIM Command | pas_cmd | 2-255 |

## Elements:

| ID | long name | short name | ref | ref [1] | type | len |
|---|---|---|---|---|---|---|
| 0x81 | Command details | cmd_details | 5.2 | 12.6 | TLV5 | 5 |
| 0x82 | Device identities | dev_ids | 5.3 | 12.7 | TLV5 | 4 |
| | Command parameters | cmd_prms | 6.10 | 12 | V5 | 0-246 |

# CCD - Decoding Example (III)

## Message Describing in Intermediate Format MDF:

```
VAR   cmd_prms          "Parameters"
      1952

COMP  pas_cmd           "Proactive SIM Command"   0xD0
{
   GSM5_TLV          cmd_details              ;  Command details
   GSM5_TLV          dev_ids                  ;  Device identities
   GSM5_V            cmd_prms                 ;  Command parameters
}

MSG   stk_cmd         downlink      0b01000000   ;  SAT Command
{
   GSM3_V            msg_type                 ;  Message Type
   GSM5_TLV          pas_cmd                  ;  Proactive SIM Command
}
```

# CCD - Decoding Example (IV)

## C-Structure types to contain decoded stk_cmd:

```
typedef struct
{
  UBYTE          msg_type;      /*<  0:  1> Message type  */
  UBYTE          v_pas_cmd;     /*<  1:  1> valid-flag        */
  T_pas_cmd      pas_cmd;   /*<  2:257> Proactive SIM Command */
} T_STK_CMD;
```

**And for Target:**

```
typedef struct
{
  UBYTE          msg_type;  /*<  0:  1> Message type  */
  UBYTE          _align0;     /*<  1:  1> alignment        */
  UBYTE          _align1;     /*<  2:  1> alignment        */
  UBYTE          v_pas_cmd; /*<  3:  1> valid-flag       */
  T_pas_cmd      pas_cmd;  /*<  4:272> Proactive SIM Command */
} T_STK_CMD;
```

# CCD - Decoding Example (V)

## Test function to decode an stk_cmd message:

```
char msgstr[] = “00 D0 3d
81 03 01 10 01
82 02 81 83
85 1f 43 6f 6e 66 69 72 6d 65 7a 20 6c 27 61 70 70 65 6c 0b 91 00 00
00 00 00 21 69 16 69 00 01 01 86 0b 90 00 00 00 00 00 21 69 16 69
71 88 04 80 50 00 00“;
T_MSGBUF   msgbuf; UBYTE      target[4096];
while (strlen (msgstr)) {
  sscanf (msgstr, "%x", &byte);
  msgbuf.buf[i++] = (UBYTE) byte;
  msgstr +=3; }
msgbuf.l_buf = i*8;
msgbuf.o_buf = 0;
ccd_decodeMsg(..., &msg_buf, target, 0xff);
```

# CCD - Decoding Example (VI)

## Debugger Output for C Structure after Decoding:

```
OUTPUT=(T_STK_CMD*) target;
|___msg_type                    0x00
|___v_pas_cmd                   0x01
|___pas_cmd
|      |___v_cmd_datails        0x01
|      |___cmd_details
|      |      |___cmd_nr        0x01
|      |      |___cmd_typ       0x10
|      |      |___cmd_qlf       0x01
|      |___v_dev_ids            0x01
|      |___dev_ids
|      |      |___src_dev       0x81
|      |      |___des_dev       0x83
|      |___v_cmd_prms           0x01
|      |___cmd_prms
|      |      |___l_cmd_prms    0x01a0
|      |      |___o_cmd_prms    0x0000
|      |      |___b_cmd_prms    0x0012c686"Confirmez l'appel"
```

# CCD - Development and Test Process - Files (I)

**Set environment:**

\gpf\initvars.bat

**Generate CCD data:**

- For PC call \g23m\condat\int\bin\makcdg.bat and build the PS using MSDev
- For target call „perl \g23m\g23.pl“ which uses \gpf\ccd\ccddata.mk
- Both procedures use \gpf\bin\xgen100.exe and \gpf\bin\ccdgen.exe
- Outputs: ...\cdginc\, ...\cdginc_fd_gp\, ccddata.lib and ccddata_dll.dll

# CCD - Development and Test Process - Files (II)

## Build Test Application:

- go to \gpf\tap\ and call gnumake
- or call gnumake TAP_VERSION=OLD
- output will be e.g. tap2_gprs.exe
- under \gpf\bin\ or \gpf\tap\obj\

## Build Test-DLL:

- call \gpf\bin\mktc.bat
- it reads \g23m\condat\ms\doc\test\x.doc
- output is \g23m\condat\ms\tds\x\xy.tds
- and \g23m\condat\ms\test\test_x*.dll

# CCD - Miscellaneous (ccd-lib)

**Different variations :** e.g. ccd_npc_tr_db.lib

- _tr, _db, _npc, _na7, _ar, _po, _vx
- Trace, Debug, Nucleus emulation on Win32, Nucleus on ARM7, GTI on ARM, pSOS, vxworks

**Library is an object of ClearCase control:**

- See also gpf_memo_cclabels.doc.
- CCD objects independent from ccd data tables in CCD_2.2.0 and onwards
- Read about versions: readme_ccd.txt
- Documentation: ccd_api.doc, faq_ccd.html and ccd_userguide.doc

# CCD - Miscellaneous (ccddata)

**Different cdginc files:**

-> High potential for functioning problems

- Alignment bytes depend on processor type (check ccdgen call for -a0, -a1 or -a2)
- No CCD_SYMBOLS for target (no name column in mcomp.cdg)
- PS, TAP, PCO must use the same ccd data tables.

# CCD - Miscellaneous (Instructions in ctrl column)

| Instruction | meaning of instruction | example |
|---|---|---|
| [0..CONSTANT] | array of bytes (also USHORT in *.pdf) | [0..MAX_RFL_NUM_LIST] |
| [varname+number..CONSTANT] | array of bytes (also USHORT in *.pdf) | [rfl_cont_len+3..19] |
| [.CONSTANT] | array , dot marks a bitarray | (SETPOS){ident_type = ID_TYPE_TMSI} [.32] |
| BCDODD[numbers] | BCD numbers starting with digit1 | |
| BCDEVEN[numbers] | BCD numbers starting with digit2 | BCDEVEN[2] or BCDEVEN[0..20] |
| { ... } | conditional | {flag=1 AND flag2=1 OR flag=0} |
| ( ... ) | command sequence | (GETPOS,:,4,+,:,1,+,SETPOS) |
| GETPOS | get the bitstream pointer | (GETPOS,:,4,+,:,1,+,SETPOS) |
| SETPOS | set bit stream pointer | (SETPOS) {type_of_identity # ID_TYPE_NO_IDENT AND type_of_identity # ID_TYPE_TMSI} BCDODD [0..16] |
| KEEP,regNr | keep value of a variable in ccd register | (KEEP,1) see GRR.doc chapter 5.65 |
| TAKE,regNr | Take the value of ccd register | [.(TAKE,1)+1..8] see GRR.doc chapter 5.136 |
| MAX,regNr | Compare and keep the maximum in ccd register from a variable and ccd register | (MAX,2) see GRR.doc chapter 5.73 and 5.74 |
| : | duplicate the element | (GETPOS,:,4,+,:,1,+,SETPOS) |
| ^ | swap the two elements | see CC.doc chapter 5.4 bearer capability |
| + * - | first middle last octett | see CC.doc chapter 5.4 bearer capability |
| AND OR XOR | logical operations: AND, OR and XOR | {flag=1 AND flag2=1 OR flag=0} |
| = # < > | comparisions | (KEEP,1) {n_r_cells # 0} |
| (22) or (0) | Maximum length of spare padding bits | S_PADDING .00101011 (22) means if the message consists of less than 22 bytes then fill up with the bit pattern<br>S_PADDING .00101011 (0) means if the message doesn't end on octett boundary then fill up to octett boundary with bit pattern eg.: xxxx1011 |

# CCD - Miscellaneous (memory issues)

- **Dose CCD do memset() to 0?** Yes, using l_buf. So be careful with filling l_buf.
- **What are SHARED_CCD_BUF, CCD_START, CCD_END and _decodedMsg?** They help to use CCD internal allocated but shared memory. **Usage:**

```
CCD_START;
  {
   UBYTE ccdRet;
   MCAST( com, COMPONENT );
   memset( com, 0, sizeof( T_COMPONENT ));
   ccdRet = ccd_decodeMsg (CCDENT_FAC,
                           UPLINK,
                           (T_MSGBUF *) &mnss_facility_ind -> fac_inf,
                           (UBYTE    *) _decodedMsg,
                           COMPONENT);
}
CCD_END;
```