ecCodes

a new decoder for binary and alphanumeric codes

Enrico Fucile

ECMWF

WMO alphanumeric and binary codes

WMO alphanumeric codes: METAR

FM 15–XIV METAR — **Aerodrome routine meteorological report (with or without trend forecast)**

FM 16–XIV SPECI — **Aerodrome special meteorological report (with or without trend forecast)**

CODE FORM:

METAR or **SPECI** **COR** CCCC YYGGgg**Z** **NIL** **AUTO** dddffGf_mf_m {**KMH** or **KT** or **MPS**} $d_nd_nd_nVd_xd_xd_x$

{**VVVV** or **VVVVNDV** or **CAVOK**} $V_NV_NV_NV_ND_v$ {$RD_RD_R/V_RV_RV_RV_Ri$ or $RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_Ri$} w´w´ {$N_sN_sN_sh_sh_sh_s$ or **VV**$h_sh_sh_s$ or **NSC** or **NCD**}

T´T´/T´$_d$T´$_d$ $QP_HP_HP_HP_H$ REw´w´ {**WS** RD_RD_R or **WS ALL RWY**} (WT_sT_s/SS´) ($RD_RD_R/E_RC_Re_Re_RB_RB_R$)

{(TTTTT or **NOSIG**)} TTGGgg dddffGf_mf_m {**KMH** or **KT** or **MPS**} {VVVV or **CAVOK**} {w´w´ or **NSW**} {$N_sN_sN_sh_sh_sh_s$ or **VV**$h_sh_sh_s$ or **NSC**}

(**RMK** .....)

WMO alphanumeric codes

METAR: Aerodrome observation

METAR EDDF 120550Z 03015KT 1400 R07R/P2000N R07C/P2000N R07L/1900U SN DRSN BR VV/// M04/M04 Q1000 R07L/11//90 R07C/15//90 R07R/15//90 BECMG 4000 NSW=

WMO alphanumeric codes: SYNOP

FM 12–XIV SYNOP **Report of surface observation from a fixed land station**

FM 13–XIV SHIP **Report of surface observation from a sea station**

FM 14–XIV SYNOP MOBIL **Report of surface observation from a mobile land station**

CODE FORM:

SECTION 0 $M_iM_iM_jM_j$ { D . . . . D**** or $A_1b_wn_bn_bn_b$** } $YYGGi_w$ { Iiii* or $99L_aL_aL_a$ $Q_cL_oL_oL_o$**** } $MMMU_{La}U_{Lo}$*** $h_0h_0h_0h_0i_m$***

SECTION 1 i_Ri_xhVV Nddff (00fff) $1s_nTTT$ { $2s_nT_dT_dT_d$ or 29UUU } $3P_0P_0P_0P_0$

{ 4PPPP or $4a_3hhh$ } 5appp $6RRRt_R$ { $7wwW_1W_2$ or $7w_aw_aW_{a1}W_{a2}$ } $8N_hC_LC_MC_H$ $9GGgg$

SECTION 2 $222D_sv_s$ $(0s_sT_wT_wT_w)$ $(1P_{wa}P_{wa}H_{wa}H_{wa})$ $(2P_wP_wH_wH_w)$ $((3d_{w1}d_{w1}d_{w2}d_{w2})$

$(4P_{w1}P_{w1}H_{w1}H_{w1})$ $(5P_{w2}P_{w2}H_{w2}H_{w2}))$ ({ $6I_sE_sE_sR_s$ or ICING + plain language })

$(70H_{wa}H_{wa}H_{wa})$ $(8s_wT_bT_bT_b)$ (ICE + { $c_iS_ib_iD_iz_i$ or plain language })

SECTION 3 333 (0 . . . .) $(1s_nT_xT_xT_x)$ $(2s_nT_nT_nT_n)$ (3Ejjj) (4E´sss) $(5j_1j_2j_3j_4$ $(j_5j_6j_7j_8j_9))$

$(6RRRt_R)$ $(7R_{24}R_{24}R_{24}R_{24})$ $(8N_sCh_sh_s)$ $(9S_PS_Ps_ps_p)$

(80000 (0 . . . .) (1 . . . .) . . . . .)

SECTION 4 444 N´C´H´H´C_t

SECTION 5 555 Groups to be developed nationally

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WMO alphanumeric codes: SYNOP

SYNOP: synoptic observation

AAXX 13094 03002 45462 /0514 10097 20073 30238 40256
58011 90850 333 88/11=

Table Driven Code Forms

BUFR

Binary Universal Form for the Representation of meteorological data

GRIB

General Regularly-distributed Information in Binary form

BUFR elements

2 bits

6 bits

8 bits

Class 04 – BUFR/CREX Location (time)

TABLE REFERENCE F	X	Y	ELEMENT NAME	BUFR UNIT	BUFR SCALE	BUFR REFERENCE VALUE	BUFR DATA WIDTH (Bits)	CREX UNIT	CREX SCALE	CREX DATA WIDTH (Characters)
0	04	001	Year	Year	0	0	12	Year	0	4
0	04	002	Month	Month	0	0	4	Month	0	2
0	04	003	Day	Day	0	0	6	Day	0	2
0	04	004	Hour	Hour	0	0	5	Hour	0	2
0	04	005	Minute	Minute	0	0	6	Minute	0	2
0	04	006	Second	Second	0	0	6	Second	0	2
0	04	007	Seconds within a minute (microsecond accuracy)	Second	6	0	26	Second	6	8
0	04	011	Time increment	Year	0	–1024	11	Year	0	4
0	04	012	Time increment	Month	0	–1024	11	Month	0	4
0	04	013	Time increment	Day	0	–1024	11	Day	0	4
0	04	014	Time increment	Hour	0	–1024	11	Hour	0	4
0	04	015	Time increment	Minute	0	–2048	12	Minute	0	4
0	04	016	Time increment	Second	0	–4096	13	Second	0	4
0	04	017	Reference time period for accumulated or extreme data	Minute	0	–1440	12	Minute	0	4
0	04	021	Time period or displacement	Year	0	–1024	11	Year	0	4
0	04	022	Time period or displacement	Month	0	–1024	11	Month	0	4
0	04	023	Time period or displacement	Day	0	–1024	11	Day	0	4
0	04	024	Time period or displacement	Hour	0	–2048	12	Hour	0	4
0	04	025	Time period or displacement	Minute	0	–2048	12	Minute	0	4
0	04	026	Time period or displacement	Second	0	–4096	13	Second	0	4
0	04	031	Duration of time relating to following value	Hour	0	0	8	Hour	0	3
0	04	032	Duration of time relating to following value	Minute	0	0	6	Minute	0	2

(continued)

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BUFR operators

BUFR Table C – ***Data description operators (Edition 3)***

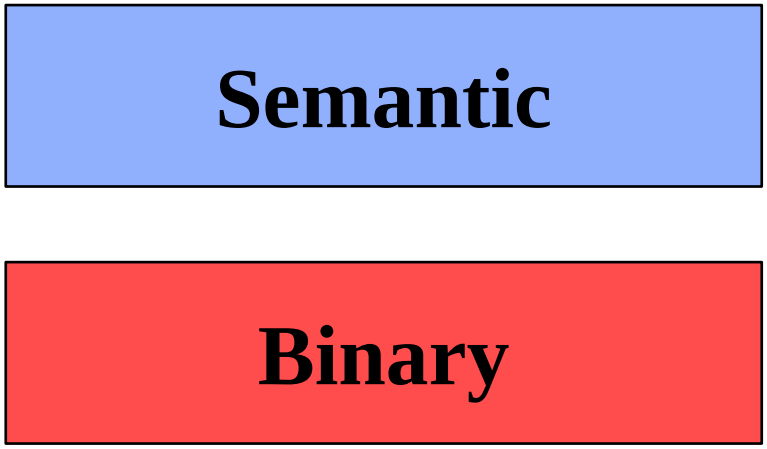
TABLE REFERENCE F	TABLE REFERENCE X	OPERAND	OPERATOR NAME	OPERATION DEFINITION
2	01	Y	Change data width	Add (Y–128) bits to the data width given for each data element in Table B, other than CCITT IA5 (character) data, code or flag tables.
2	02	Y	Change scale	Add Y–128 to the scale for each data element in Table B, other than CCITT IA5 (character) data, code or flag tables.
2	03	Y	Change reference values	Subsequent element descriptors define new reference values for corresponding Table B entries. Each new reference value is represented by Y bits in the Data section. Definition of new reference values is concluded by coding this operator with Y = 255. Negative reference values shall be represented by a positive integer with the left-most bit (bit 1) set to 1.
2	04	Y	Add associated field	Precede each data element with Y bits of information. This operation associates a data field (e.g. quality control information) of Y bits with each data element.
2	05	Y	Signify character	Y characters (CCITT International Alphabet No. 5) are inserted as a data field of Y x 8 bits in length.
2	06	Y	Signify data width for the immediately following local descriptor	Y bits of data are described by the immediately following descriptor.
2	21	YYY	Data not present	Data values present in Section 4 (Data section) corresponding to the following YYY descriptors shall be limited to data from classes 1–9, and class 31.

WMO binary codes: BUFR SYNOP

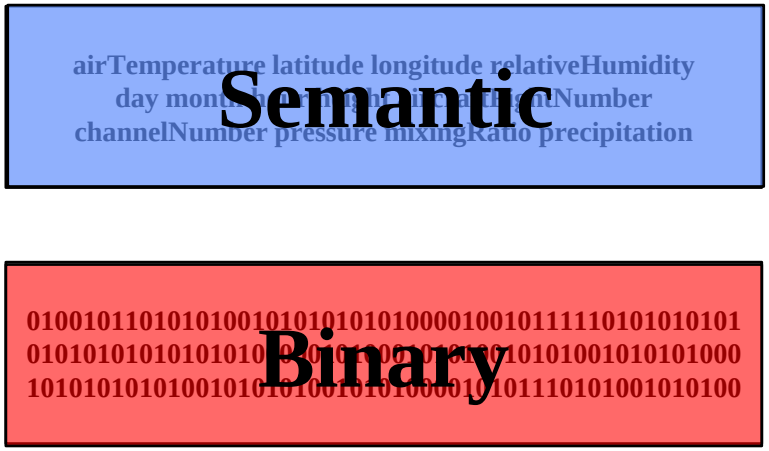
		0 12 103	Dew-point temperature (scale 2)	$s_nT_dT_dT_d$	K, 2
		0 13 003	Relative humidity		%, 0
			Visibility data		
	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)		m, 2
		0 20 001	Horizontal visibility	**VV**	m, –1
			Precipitation past 24 hours		
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)		m, 2
		0 13 023	Total precipitation past 24 hours	$R_{24}R_{24}R_{24}R_{24}$	kg m^{-2}, 1
			Height of sensor above local ground (set to missing to cancel the previous value)		m, 2
			Cloud data		
	3 02 004	0 20 010	Cloud cover (total)	**N**	%, 0
		0 08 002	Vertical significance		Code table, 0
		0 20 011	Cloud amount (of low or middle clouds)	$\mathbf{N_h}$	Code table, 0
		0 20 013	Height of base of cloud	**h**	m, –1
		0 20 012	Cloud type (low clouds C_L)	$\mathbf{C_L}$	Code table, 0
		0 20 012	Cloud type (middle clouds C_M)	$\mathbf{C_M}$	Code table, 0
		0 20 012	Cloud type (high clouds C_H)	$\mathbf{C_H}$	Code table, 0
			Individual cloud layers or masses		
	1 01 000		Delayed replication of 1 descriptor		
	0 31 001		Delayed descriptor replication factor		Numeric, 0
	3 02 005	0 08 002	Vertical significance		Code table, 0
		0 20 011	Cloud amount (N_s)	$\mathbf{N_s}$	Code table, 0
		0 20 012	Cloud type (C)	**C**	Code table, 0
		0 20 013	Height of base of cloud (h_sh_s)	$\mathbf{h_sh_s}$	m, -1
			Clouds with bases below station level		
3 02 036	1 05 000		Delayed replication of 5 descriptors		
	0 31 001		Delayed descriptor replication factor		Numeric, 0

Delayed replication

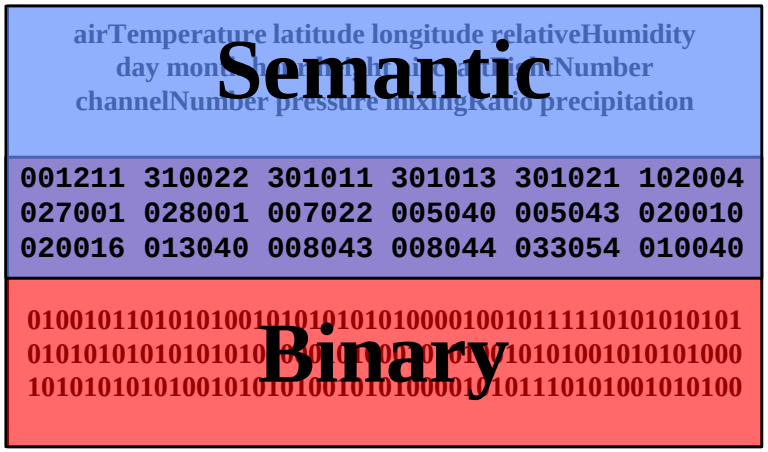
BUFR 2 layers model

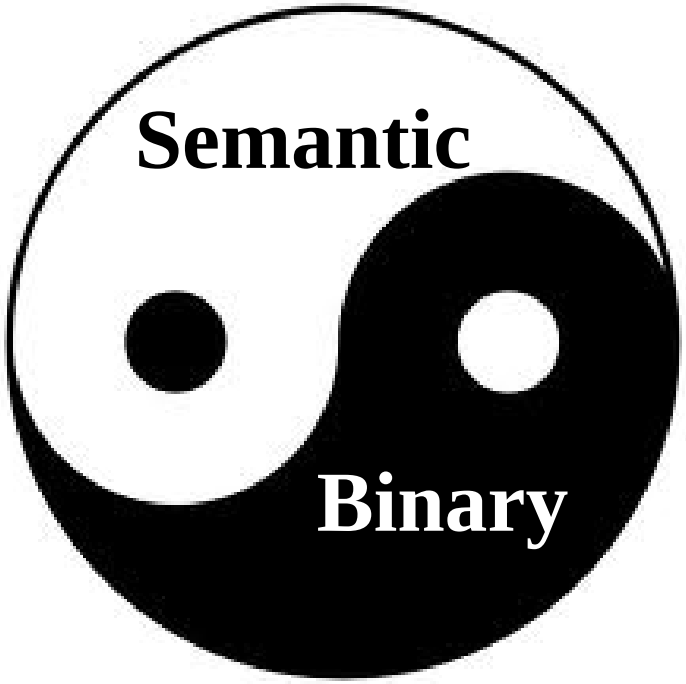


BUFR 2 layers model

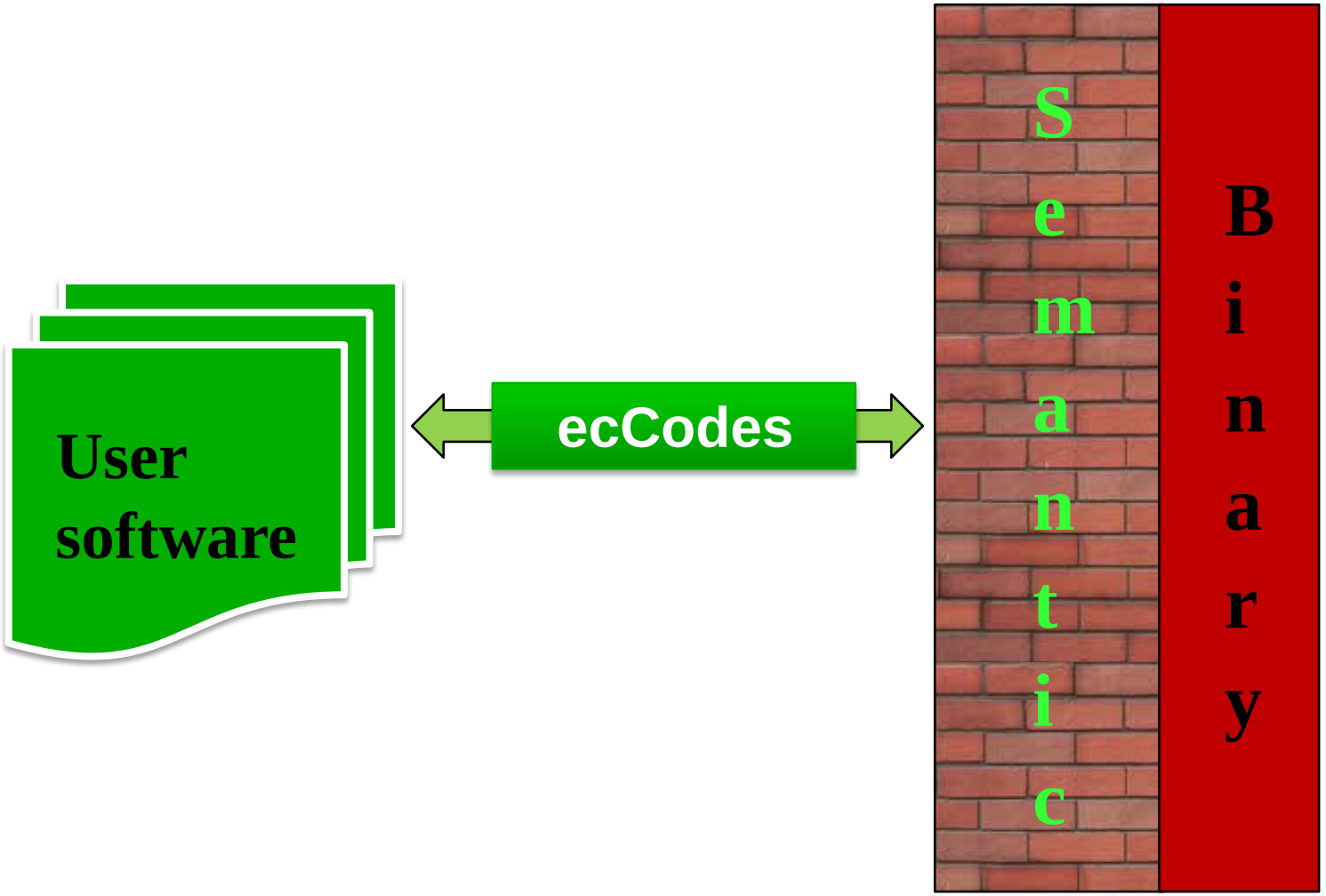


BUFR 2 layers model




Semantic
Binary

ecCodes view



ecCodes semantics approach

One single get function for all message types

Clear text identifiers

```
dt=codes_get(m,'dewPointTemperature')
```

```
dt9=codes_get(m,'/hour=9/dewPointTempera
```

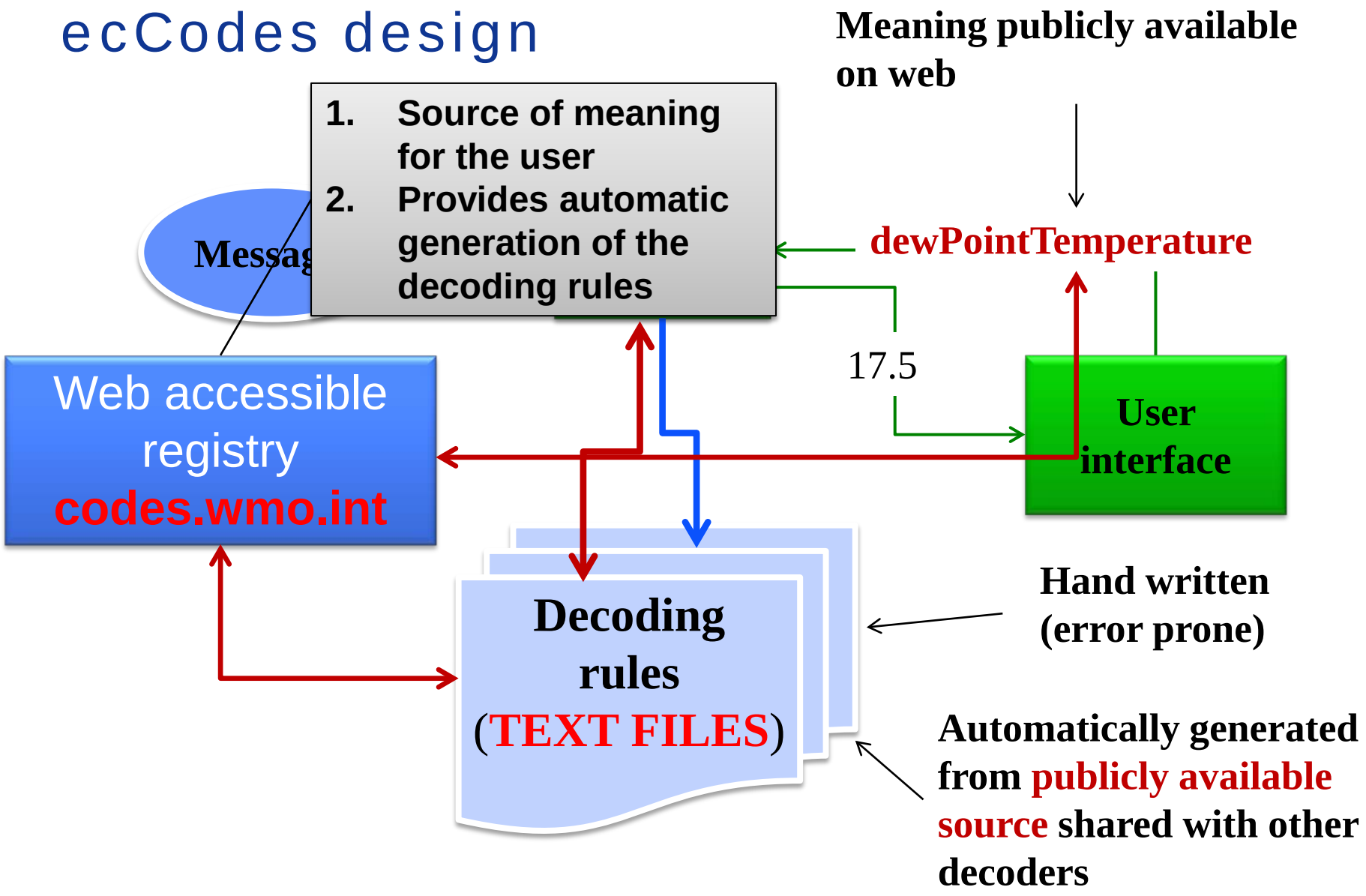
Tree like / hierarchical access

```
backscatter=codes_get(m,'/beamIdentifier=2/backscatter')
```

```
radiance=codes_get(m,'/channelNumber=45/radiance')
```

Array is returned.
Dynamically allocated in FORTRAN

ecCodes design



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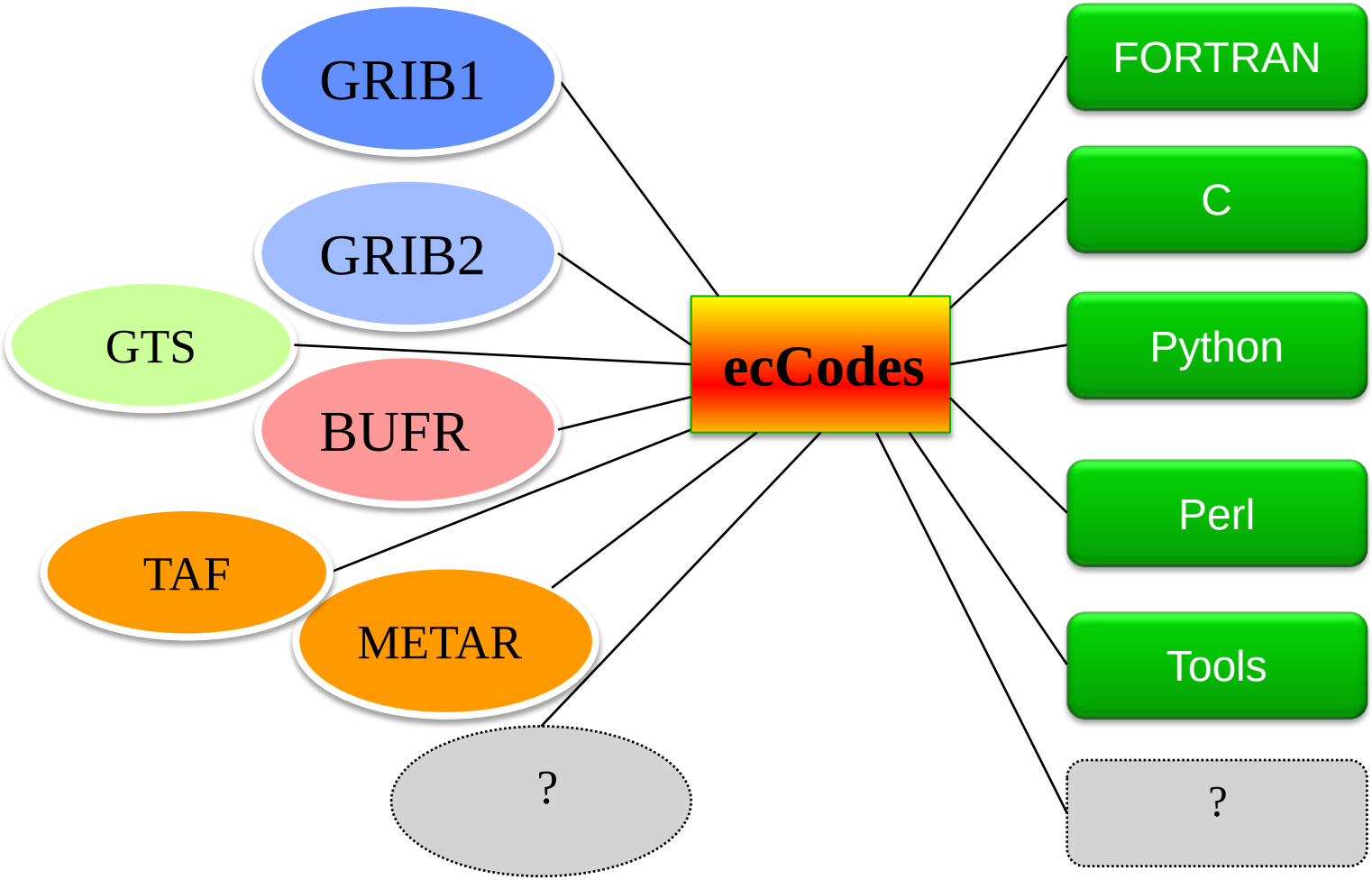
ecCodes messages and bindings



ecCodes coming soon

- **Under development, currently in a prototype stage**
- **Beta version will be available soon from software.ecmwf.int**
- **Back compatible with grib_api**