



D5.1 - Integrated Emergency Profiles

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1 PHYSICAL INTEROPERABILITY PROFILES

Physical Interoperability Profiles are the main part of Physical Interoperability Layer. They contain data and information about physical connection with the communication medium and specify the data acquisition procedure. Physical Interoperability Profiles match the interoperability definition and can successfully be used in Physical Interoperability Layer, as they allow connection of a large variety of devices with specified interface and protocol to systems such as C2-SENSE Framework.

Physical Interoperability Profiles are based on the XML data format. Its structure is universal for all the profiles and is represented in Figure 1. In this structure, all important components regarding physical communication with the device are included.

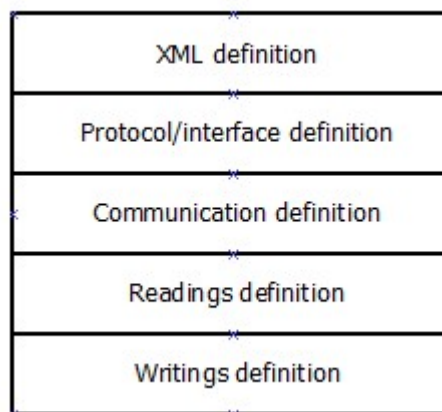


Figure 1 Universal structure of physical profile

Universal structure of physical profile includes all important information about device and data to be collected from the communication medium. Profile is strictly adapted to the physical interface and protocol. Information included in proper field (for example communication specification) are unlimited, so basically every detail of configuration can be specified in the profile.

Protocol/interface definition is required for recognizing the selected communication type and create new adapter in accordance to that choice. Communication definition contains all the important parameters, which should be included during interface and protocol configuration. Having these two definitions specified, it is possible to establish the connection between system and considered communication medium. Readings definition of data acquisition specifies details about data to read, e.g. variable type, number of bits to read or if it is signed or not, while writings definition provides specifications of values to be written in the communication device.

Physical Interoperability Profiles are not integrated with any other layer, because they are considered as hardware profiles and it makes more sense to treat them separately than Technical Interoperability Profiles and focus on seamless interfacing of physical devices with C2-SENSE components through these profiles.

Physical Interoperability Profiles include information about the interface and protocol necessary to link communication medium with IP based Gateway, which is equal with linking the communication medium with C2-SENSE. IP based Gateway includes set of libraries responsible for protocols and interfaces support. To sum up, this definition signalizes which library should be used during adapter creation process. However, every device has its own communication parameters (for example baud rate or parity in case of RS interfaces).

In C2-SENSE, 3 Physical Interoperability Profiles have been developed and tested:

1. GPRS modem, connected to the PC with RS232 interface and MODBUS RTU protocol
2. Device for electrical parameters measurement
3. 866MHz or 433 MHz Radio Transceivers

In these above described cases, three adapters are created automatically and they are in charge of following readings:

- Adapter 1 (GPRS) – two temperature measurements, two relative humidity measurements, two rainfall measurements.
- Adapter 2 (Power meter) – Network voltage, network frequency, THD (Total Harmonic Distortion).
- Adapter 3 (Radio) – three temperature measurements, three relative humidity measurements.

2 RS-MODBUS PROFILE FOR GPRS MODEM

RS-MODBUS profile has been specified for RS-232/RS-485 interfaces connected with MODBUS RTU or MODBUS ASCII protocols. It is for creation of adapters to the device and data collection from sensors, which are connected to this device. It has been tested on the example of communicating with GPRS device, whose interface is RS-232 and protocol is MODBUS RTU. Another configuration of the physical profile can be connection of the device, which is communicating by RS-232 or RS-485 interface, but it has no strictly applied protocol (it is sending raw data in form of strings).

```
<?xml version="1.0"?>
<Device id="1">
  <Description>
    Adapter for GPRS modem, connected to the PC with RS232 interface and MODBUS-RTU protocol
  </Description>
  <Communication_spec type="RS/MODBUS">
    <serial_port>/dev/ttyUSB1</serial_port>
    <baud_rate>9600</baud_rate>
    <byte_size>8</byte_size>
    <parity>NONE</parity>
    <stopbits>1</stopbits>
    <timeout>0.15</timeout>
    <instr_address>1</instr_address>
    <mode>rtu</mode>
  </Communication_spec>
  <Readings>
    <!-->Read temperature 1</!-->
    <Reading id="1">
      <!--> READ SPECIFICATION </!-->
      <var_type>int</var_type>
      <bits>16</bits>
      <signed>True</signed>
      <read_type>3</read_type>
      <register_address>64</register_address>
      <num_of_dec_reg>0</num_of_dec_reg>
      <!--> WORKFLOW SPECIFICATION </!-->
      <period>60</period>
      <mute>False</mute>
    </Reading>
  </Readings>
</Device>
```

```

<!--> DESCRIPTION SPECIFICATION <!-->
<sensor_name>Temperature sensor 1</sensor_name>
<phen_name>Temperature</phen_name>
<description_phen>Temperature no. 1</description_phen>
<unit>C</unit>
<geo_location>[52.147,20.967]</geo_location>
</Reading>
<!-->Read temperature 2<!-->
<Reading id="2">
<!--> READ SPECIFICATION <!-->
  <var_type>int</var_type>
  <bits>16</bits>
  <signed>True</signed>
  <read_type>3</read_type>
  <register_address>65</register_address>
  <num_of_dec_reg>0</num_of_dec_reg>
  <!--> WORKFLOW SPECIFICATION <!-->
  <period>60</period>
  <mute>False</mute>
  <!--> DESCRIPTION SPECIFICATION <!-->
  <sensor_name>Temperature sensor 2</sensor_name>
  <phen_name>Temperature</phen_name>
  <description_phen>Temperature no. 2</description_phen>
  <unit>C</unit>
  <geo_location>[52.277,21]</geo_location>
</Reading>
<!--> Read humidity 1<!-->
<Reading id="3">
<!--> READ SPECIFICATION <!-->
  <var_type>int</var_type>
  <bits>16</bits>
  <signed>True</signed>
  <read_type>3</read_type>
  <register_address>66</register_address>
  <num_of_dec_reg>0</num_of_dec_reg>
  <!--> WORKFLOW SPECIFICATION <!-->
  <period>60</period>
  <mute>False</mute>
  <!--> DESCRIPTION SPECIFICATION <!-->
  <sensor_name>Humidity sensor 1</sensor_name>
  <phen_name>Relative humidity</phen_name>
  <description_phen>Humidity no. 1</description_phen>
  <unit>%</unit>
  <geo_location>[52.147,20.967]</geo_location>
</Reading>
<!--> Read humidity 2<!-->
<Reading id="4">
<!--> READ SPECIFICATION <!-->
  <var_type>int</var_type>
  <bits>16</bits>
  <signed>True</signed>
  <read_type>3</read_type>
  <register_address>67</register_address>
  <num_of_dec_reg>0</num_of_dec_reg>
  <!--> WORKFLOW SPECIFICATION <!-->
  <period>60</period>
  <mute>False</mute>
  <!--> DESCRIPTION SPECIFICATION <!-->
  <sensor_name>Humidity sensor 2</sensor_name>

```

```

        <phen_name>Relative humidity</phen_name>
        <description_phen>Humidity no. 2</description_phen>
        <unit>%</unit>
        <geo_location>[52.277,21]</geo_location>
    </Reading>
    <!--> Read rainfall 1 </!-->
    <Reading id="5">
    <!--> READ SPECIFICATION </!-->
        <var_type>float</var_type>
        <bits></bits>
        <signed></signed>
        <read_type>3</read_type>
        <register_address>0</register_address>
        <num_of_dec_reg>2</num_of_dec_reg>
        <!--> WORKFLOW SPECIFICATION </!-->
        <period>60</period>
        <mute>False</mute>
        <!--> DESCRIPTION SPECIFICATION </!-->
        <sensor_name>Rainfall sensor 1</sensor_name>
        <phen_name>Rainfall</phen_name>
        <description_phen>Rainfall no. 1</description_phen>
        <unit>mm/h</unit>
        <geo_location>[52.147,20.967]</geo_location>
    </Reading>
    <!--> Read rainfall 2 </!-->
    <Reading id="6">
    <!--> READ SPECIFICATION </!-->
        <var_type>int</var_type>
        <bits>32</bits>
        <signed>False</signed>
        <read_type>3</read_type>
        <register_address>0</register_address>
        <num_of_dec_reg></num_of_dec_reg>
        <!--> WORKFLOW SPECIFICATION </!-->
        <period>60</period>
        <mute>False</mute>
        <!--> DESCRIPTION SPECIFICATION </!-->
        <sensor_name>Rainfall sensor 2</sensor_name>
        <phen_name>Rainfall</phen_name>
        <description_phen>Rainfall no. 2</description_phen>
        <unit>mm/h</unit>
        <geo_location>[52.277,21]</geo_location>
    </Reading>
</Readings>
<Writings>
    <Writing id="1">
        <var_type>int</var_type>
        <bits>16</bits>
        <signed>True</signed>
        <value>1</value>
        <write_type>4</write_type>
        <register_address>6</register_address>
        <num_of_dec_reg>0</num_of_dec_reg>
    </Writing>
</Writings>
</Device>

```

The XML presented above is an example implementation RS-MODBUS Physical Profile. Details of it are as follows:

- **<Device id="1">**
 - Root tag has an attribute *id*, which specifies number of the adapter to create
- **<Description>**
 - Only for the informational purposes (optional)
- **<Communication_spec type="RS/MODBUS">**
 - Type of communication. This example is provided for the RS/MODBUS type. Child tags depend on the type attribute.
- **<serial_port>/dev/ttyUSB0</serial_port>**
 - Serial port to enter manually. In case of Linux it will be e.g. /dev/ttyUSB0, /dev/ttyUSB1 etc. In case of Windows, it will be e.g. COM1, COM2, COM3 etc.
- **<baud_rate>9600</baud_rate>**
 - Selectable baud rate of the device. Possible options:
 - 4800
 - 9600
 - 14400
 - 19200
 - 28800
 - 38400
 - 57600
 - 115200
- **<parity>NONE</parity>**
 - Selectable, options (with capital letters):
 - NONE
 - EVEN
- **<stopbits>1</stopbits>**
 - Selectable, options:
 - 1
 - 2
- **<timeout>0.15</timeout>**
 - Manually inserted *float* number
- **<instr_address>1</instr_address>**
 - Manually inserted *int* number. Typically in the range from 1 to 249
- **<mode>rtu</mode>**
 - Selectable with two options (lowercase letters):
 - rtu
 - ascii
- **<Readings>**
 - As there are many readings possible, there are many Reading child elements inside Readings.
- **<Reading id="1">**
 - Every reading has its own specification.
- **<register_address>64</register_address>**
 - Manually inserted *int*.
- **<period>60</period>**
 - Manually inserted *int*. Can be 0 (zero).
- **<mute>False</mute>**
 - Selectable:
 - True

- False
- **<sensor_name>Temperature sensor 1</sensor_name>**
 - Manually inserted *string*. Specifies the name of the sensor.
- **<phen_name>Temperature</phen_name>**
 - Manually inserted *string*. Specifies the thing that sensor measures.
- **<description_phen>Temperature no. 1</description_phen>**
 - Manually inserted *string*. Description about sensor measurement.
- **<unit>C</unit>**
 - Manually inserted *string*. Unit of measurement.
- **<geo_location>[40.5,50]</geo_location>**
 - Manually inserted list of floats
- **<var_type>int</var_type>**
 - Selectable, with 3 options:
 - int
 - float
 - string
- **<bits>16</bits>**
 - Depends on *var_type*. See below tables. Selectable, with four options:
 - empty
 - 1
 - 16
 - 32
- **<signed>True</signed>**
 - Depends on *var_type* and *bits*. See below tables.
- **<read_type>3</read_type>**
 - Depends on *var_type* and *bits*. See below tables.
- **<num_of_dec_reg>0</num_of_dec_reg>**
 - Depends on *var_type* and *bits*. See below tables.

Case 1: *var_type* = int

bits	If bits = 1	If bits = 16	If bits = 32
read_type	1 or 2	3 or 4	3 or 4
num_of_dec_reg	0	Manually insert. int	0
signed	empty	True or False	True or False

Case 2: *var_type* = float

bits	Empty
read_type	3 or 4
num_of_dec_reg	2 or 4
signed	empty

Case 3: *var_type* = string

bits	Empty
read_type	3 or 4
num_of_dec_reg	Manually inserted <i>int</i>
signed	empty