The UDUNITS-2 Package for Handling Units of Physical Quantities

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What About the Package?

- Written in C

- Converts between string specifications of units of physical quantities and binary representations

- Operates on binary units
    - Unary: raise to a power, logarithm, etc.
    - Binary: multiply, divide, compare, etc.

- Converts numeric values between binary units

- Has a library and a utility

Converting from String to Binary

Include <udunits2.h>

...

ut_system* system = ut_read_xml(NULL);

ut_unit*   watt = ut_parse(system, "joule/second", UT_ASCII);

ut_unit*   fahrenheit = ut_parse(system, "K/1.8 @ 459.67", UT_ASCII);

ut_unit*   wattPerOhm = ut_parse(system, "(kg·m²)/(s³·Ω)", UT_LATIN1);

The supported characters encodings are US ASCII, ISO 8859-1 (Latin-1), and UTF-8

Unary Operations

Include <udunits2.h>

...

ut_unit*   yard = ut_scale(3, foot);

ut_unit*   celsius = ut_offset(kelvin, 273.15);

ut_unit*   meter2 = ut_raise(meter, 2);

ut_unit*   meter = ut_root(meter2, 2);

ut_unit*   bel1mW = ut_log(10, milliwatt);

ut_free(yard);

Binary Operations

```
ut_unit* newtonMeter = ut_multiply(newton, meter);
ut_unit* meterPerSecond = ut_divide(meter, second);
If (unit1.compare(unit2) == 0) {...}
```

Converting Values

```
If (ut_are_convertible(foot, meter)) {
    cv_converter*    footToMeter = ut_get_converter(foot, meter);
    float            meter = cv_convert_float(footToMeter, 3f);
    float*           feet = ...; /* array of n floats */
    float*           meters = ...; /* array of at least n floats */
    cv_convert_floats(footToMeter, feet, n, meters);
    cv_free(footToMeter);
}
```

UDUNITS-2 Utility

$ **udunits2 -A**

udunits2: using default XML database

You have: **watt**

You want:

    m2.kg.s-3

You have: **furlongs/fortnight**

You want: **cm/minute**

    1 furlongs/fortnight = 0.997859 cm/minute

    x/(cm/minute) = 0.997859 (x/(furlongs/fortnight))

You have: **^D**

$

XML Database

```xml
<?xml version="1.0" encoding="US-ASCII"?>
<unit-system>
    <import>udunits2-prefixes.xml</import>
    <import>udunits2-base.xml</import>
    <import>udunits2-derived.xml</import>
    <import>udunits2-accepted.xml</import>
    <import>udunits2-common.xml</import>
</unit-system>
```

XML Database of Common Units

```xml
<?xml version="1.0" encoding="US-ASCII"?>
<unit-system>
    <unit>
        <def>4.5359237e-1 kg</def>
        <aliases>
            <name><singular>avoirdupois_pound</singular></name>
            <name><singular>pound</singular></name>
            <symbol>lb</symbol>
        </aliases>
    </unit>
    ...
</unit-system>
```

Resources

- Included with netCDF-4

- Web Site

  http://www.unidata.ucar.edu/software/udunits

- Support

  support-udunits@unidata.ucar.edu