

# The UDUNITS-2 Package for Handling Units of Physical Quantities

Steve Emmerson  
2010 Unidata Workshop

# 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 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 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](mailto:support-udunits@unidata.ucar.edu)