VOUnits 1.0 ➛ 1.1: a version bump to the standard

Norman Gray (University of Glasgow)
and Markus Demleitner (University of Heidelberg)

IVOA Northern Fall Interop, 2022:
2022 October 20

kg m s-2

```
kg m s-2
```

```
kg m /s**(2)
```

```
kg m s-2

kg m /s**(2)

kg.m/s2
```

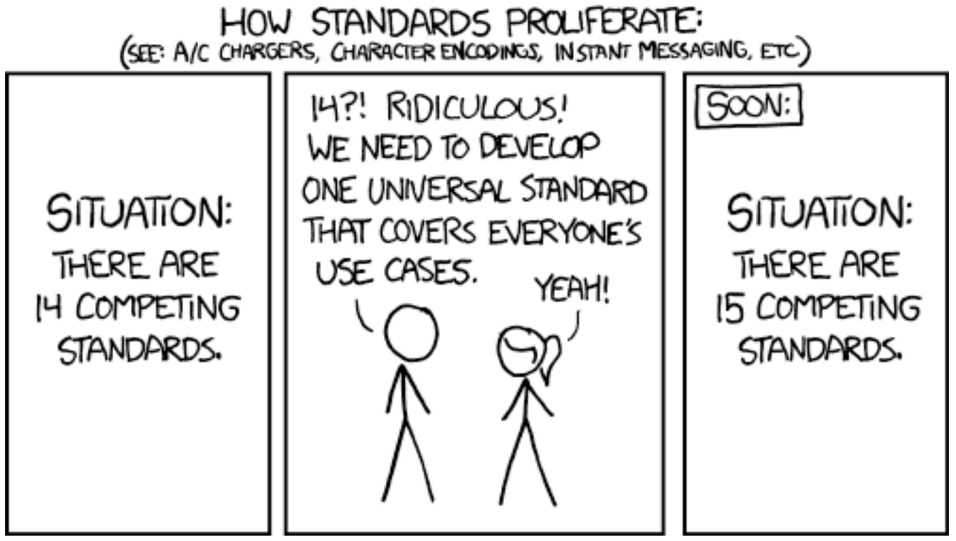
Which syntax do you pick?

Which units are permitted?

How do you validate unit strings?

What do you *do* with a unit string?

Hence VOUnits 1.0!



And *of course* I'm going to cite https://xkcd.com/927/

VOUnits specification

www.ivoa.net/documents/VOUnits/

VOUnits specification

www.ivoa.net/documents/VOUnits/

Demleitner, Derriere, Gray, Louys & Ochsenbein (2014)

- Contains a survey of current syntaxes (FITS, OGIP, CDS), adding deduced formal grammars for them (and discovering ambiguities in the process).
- Adds a new syntax, as much as possible in the intersection of existing ones, but with some extensions.
- If a string successfully parses in two distinct grammars, it means the same in both.
- Units: known, preferred, deprecated, and explicit support for 'unknown' units.
- Doesn't object to `inch`, for example, but would parse `furlong` as the femto-'urlong'.
- Draws on QUDT v1 – qudt.org.
- v1.1 is in preparation/discussion in 2022, with only minor changes and clarifications.

Non-specification (ie, evading pain-points)

The specification aims to be minimal, evading potential headaches

Non-specification (ie, evading pain-points)

The specification aims to be minimal, evading potential headaches

- No support for ‘quantities’: units plus an amount, ‘2m/s’.
- No commitments about definitions of quantities (eg, atomic seconds vs astronomical).
- No definition of an algorithm for determining equivalence (is ‘m/s’ equivalent to ‘km/s’? or ‘km/ks’?).
- Unexpected units are not rejected, but labelled as such.
- All ASCII characters (ie, no ‘Å’).

Implementations

Any standard needs implementations, to debug and to support uptake

Implementations

Any standard needs implementations, to debug and to support uptake

The standard isn't finished until the early implementers stop complaining

Implementations

Any standard needs implementations, to debug and to support uptake

The standard isn't finished until the early implementers stop complaining

- Reference implementation: Unity library – a parser library for both Java and C, which confirms validity, reports invalid or deprecated units, and reformats into other syntaxes (including LaTeX siunitx). See https://purl.org/nxg/dist/unity and doi:10.5281/zenodo.6949817
- DaCHS – docs.g-vo.org/DaCHS/ – a parallel implementation with a different grammar formalism, intended to investigate loose ends and muddy corners of the developing standard.
- Astropy units – docs.astropy.org/en/stable/units/

Validation exercise, Derriere and Landais

- CDS/Vizier in November 2021
- 26% of column metadata had one or other 'invalid' unit string
- 'Obvious' edits brought this down to 11% invalid, half of which are sexagesimal representations of angle, and half the rest are part of the prompt for discussion of v1.1
- Potentially errors below 0.1% (typos and exotic cases)

Validation exercise, Derriere and Landais

- CDS/Vizier in November 2021
- 26% of column metadata had one or other 'invalid' unit string
- 'Obvious' edits brought this down to 11% invalid, half of which are sexagesimal representations of angle, and half the rest are part of the prompt for discussion of v1.1
- Potentially errors below 0.1% (typos and exotic cases)

wiki.ivoa.net/internal/IVOA/InterOpApr2022Ops/VizieR_VOUnits.pdf

VOUnits 1.1: next steps?

- The current standard is v1.0: https://www.ivoa.net/documents/VOUnits/
- Current document: draft https://ivoa.net/documents/VOUnits/20220525/index.html and 'issues': https://github.com/ivoa-std/VOUnits/issues/ (and see also closed ones for a record of changes).
- Detailed/minor questions:
  - Is '%' a unit? (YES, but strictly as an exception; ie, there is no open door to 'ppm').
  - Scalefactors: is '25.4mm' a unit? (yuk, but this has been seen in the wild, so YES).
  - If we're allowing log(W) (and we do), should we allow log(1e3W)? (yuk, but if we allow the previous item, this should be allowed, too, on POLA grounds, so YES).
- The above changes are in the document at present. If thee have just cause to object, let thee now speak, or else hereafter forever hold thy peace.

Norman Gray – https://www.astro.gla.ac.uk/users/norman/

Markus Demleitner – https://www.tfiu.de/homepage/