Literate Scientific Software

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Overview

Literate Scientific Software

- Motivation
  - Improve verifiability, maintainability and reusability.
  - Save money and time
- One “source,” multiple views
  - Requirements
  - Design
  - Test Cases
  - Build instructions
  - ...

Recap

Last time:

- Took a look at a simple example from a project involving a fuel pin.
- Discussed the challenges of managing change throughout the software documentation.
- Proposed encapsulating all of the requisite knowledge in one source composed of “chunks”.

Example: h_g and h_c

A simple example taken from the SRS for FP

SRS

Example: h_g and h_c

The source

The current source consists of:

1. The recipe
2. Common knowledge (chunks)
3. Specific knowledge (chunks)

Example: h_g and h_c

The Recipe

```
srsBody = Document ((S "SRS for ") :+:
    (N $ h_g ^. symbol) :+:
    (S " and ") :+: (N $ h_c ^. symbol))
    (S "Spencer Smith") [s1,s2]

s1 = Section (S "Table of Units")
    [s1_intro, s1_table]

s1_table = Table [S "Symbol", S "Description"] $ mkTable
    [(\x -> Sy (x ^. unit)),
     (\x -> S (x ^. descr))
    ] si_units

s1_intro = Paragraph (S "Throughout this ...
```

...

Example: h_g and h_c

Common Knowledge

```
metre, kilogram, second, kelvin, mole, ampere, candela :: FundUnit
metre    = fund "Metre"    "length (metre)"                "m"
kilogram = fund "Kilogram" "mass (kilogram)"               "kg"
second   = fund "Second"   "time (second)"                 "s"
kelvin   = fund "Kelvin"   "temperature (kelvin)"          "K"
mole     = fund "Mole"     "amount of substance (mole)"    "mol"
ampere   = fund "Ampere"   "electric current (ampere)"     "A"
candela  = fund "Candela"  "luminous intensity (candela)" "cd"
```

Example: h_g and h_c

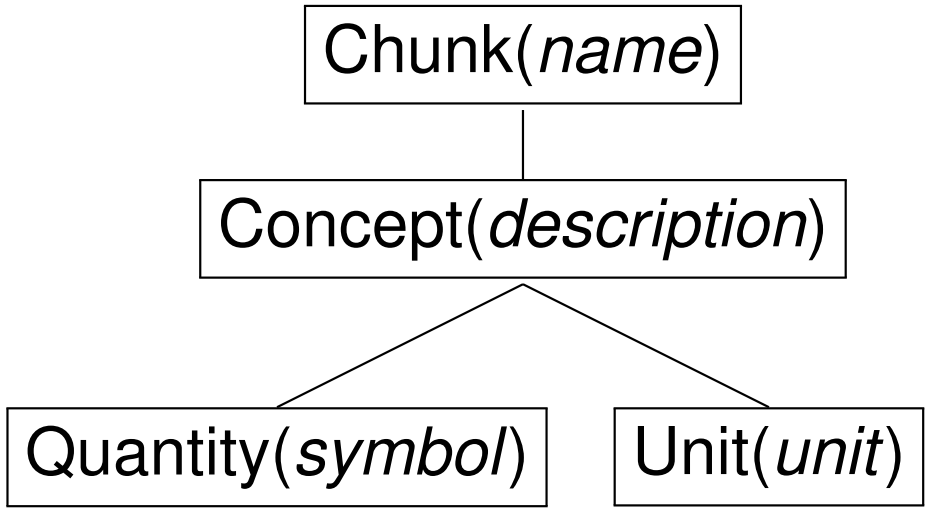
Specific Knowledge

```
h_c_eq :: Expr
h_c_eq = ((Int 2):*(C k_c):*(C h_b)) :/
    ((Int 2):*(C k_c) :+ ((C tau_c):*(C h_b)))

h_c :: EqChunk
h_c = EC (UC (VC "h_c"
    "convective heat transfer coefficient
        between clad and coolant"
    (sub h c) ) heat_transfer) h_c_eq
```

Framework Design

Chunks



Framework Design

Recipes

Micro-layout language:

- subscripts
- superscripts
- concatenation
- . . .

Framework Design

Recipes

Macro-layout language:

- Document
- Section
- Paragraph
- Equation
- Table
- …

Framework Design

Benefits

1. Zero knowledge duplication
2. Traceability

Next Steps

What next?

- Generate the rest of the example.
- Finish implementing different document ”views”.
  - Ex. SRS with/without derivations.
- Implement additional document types.
- Generate the source code.
- Implement more examples.

Thank You!