Research Topic Handout – Problems and Solutions

Daniel Szymczak
McMaster University

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Note: This handout was created as a companion-piece to my supervisory committee meeting presentation for June 28, 2018

1 Too much duplication!

In any given piece of software, the same knowledge will appear across a number of different artifacts. Manually entering this knowledge in multiple places introduces the potential for errors to occur.

From our case study on a fuel pin in a nuclear reactor, we see h_g – a symbol which appears in the Software Requirements Specification (SRS), the Literate Programmer's Manual (LPM), and the source code.

The following table shows a (simplified) definition of h_g taken from the SRS. Its defining equation also appears in Equation 1, which was taken from the LPM.

Number	**DD1**
Label	h_g
Equation	$h_g = \frac{2k_ch_p}{2k_c+\tau_ch_p}$
Description	h_g is the gap conductance ...
...	

$$h_g = \frac{2k_ch_p}{2k_c + \tau_ch_p} \tag{1}$$

We then see the same equation appear in the corresponding C code for h_g given by:

```
double calc_hg(double k_c,double h_b,double tau_c)
{
 return (2*(k_c)*(h_p)) / ((2*(k_c)) + (tau_c*(h_p)));
}
```

This situation comes up all the time and writing the same information in multiple places is tedious. Wouldn't it make more sense to encode a definition once and automatically reuse it wherever necessary in our artifacts?

2 Inter-/intra-artifact consistency

3 (Re-)Certification is expensive

[2, 3, 1, 4]

References

[1] Center for Devices and Radiological Health, CDRH. General principles of software validation; final guidance for industry and FDA staff. Technical report, US Department Of Health and Human Services Food and Drug Administration Center for Devices and Radiological Health Center for Biologics Evaluation and Research, York, England, January 2002.

[2] CSA. Quality assurance of analytical, scientific, and design computer programs for nuclear power plants. Technical Report N286.7-99, Canadian Standards Association, 178 Rexdale Blvd. Etobicoke, Ontario, Canada M9W 1R3, 1999.

[3] CSA. Guideline for the application of N286.7-99, quality assurance of analytical, scientific, and design computer programs for nuclear power plants. Technical Report N286.7.1-09, Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6, 1-800-463-6727, 2009.

[4] U.S. Food and Drug Administration. Infusion pumps total product life cycle: Guidance for industry and fda staff. online, December 2014.