Maintenance Metric

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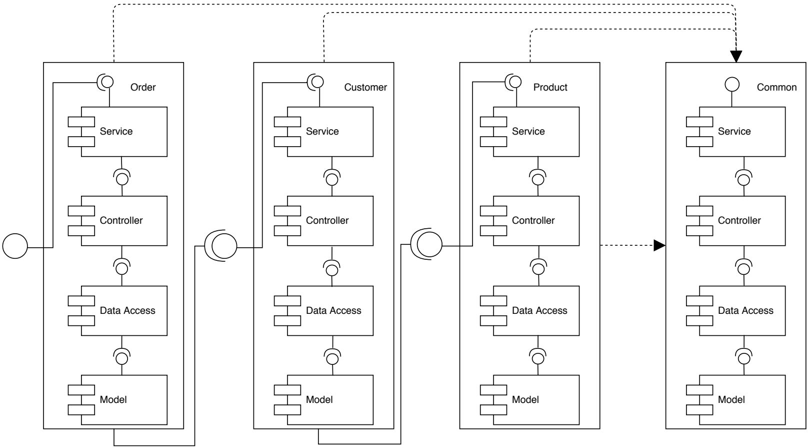
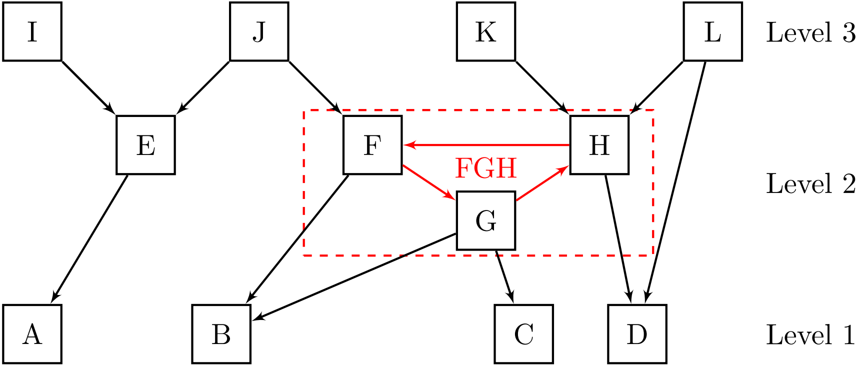
A good vertical design



Dependency graph with a cycle group



Efferent Coupling: The number of classes on which a given class depends.
Afferent Coupling: How many classes depend on a given class.

First approach to define a metric

$$c_i = \frac{size(i) * (1 - \frac{inf(i)}{numberOfComponentsInHigherLevels(i)})}{n} \tag{1}$$

Where:

- n is the total number of components;
- $size(i)$ is the number of components in the logical node;
- $inf(i)$ is the number of components influenced by c_i.

First approach to define a metric

Example for node A:

First approach to define a metric

Example for node A:

$$c_A = \frac{1 * (1 - \frac{3}{8})}{12} = 0.052 \tag{2}$$

$$ML_1 = 100 * \sum_{i=1}^{k} c_i \tag{3}$$

- k is the total number of logical nodes, which is smaller than n if there are cyclic component dependencies.

Penalty

Cyclic dependencies have a negative influence on maintainability, especially if the cycle group contains a larger number of nodes.

$$penalty(i) = \begin{cases} \frac{5}{size(i)}, & \text{if } size(i) > 5 \\ 1, & \text{otherwise} \end{cases} \tag{4}$$

$$ML_2 = 100 * \sum_{i=1}^{k} c_i * penalty(i) \tag{5}$$

Some tunnings...

- It did not work very well for small modules with less than 100 components;

$$ML3 = \begin{cases} (100 - n) + \frac{n}{100} * ML_2, & \text{if } n < 100 \\ ML_2, & \text{otherwise} \end{cases} \tag{6}$$

- In some projects, developers said the metric does not fitted well because to them it was difficult to maintain the system although the value of metric showed the opposite.

Some tunnings...

The **cyclicity of a package cycle group** is the square of the number of packages in the group. A cycle group of 5 elements has a cyclicity of 25.

The **cyclicity of a whole system** is just the sum of the cyclicity of all cycle groups in the system.

The relative cyclicity of a system is defined as follows:

$$relativeCiclicity = 100 * \frac{\sqrt{sumOfCyclicity}}{n} \tag{7}$$

Where n is the total number of packages.

Maintainability Level Alternative

As an example assume a system with 100 packages. If all these packages are in a single cycle group the relative cyclicity can be computed as:

$$100 * \frac{\sqrt{100^2}}{100} = 1 \tag{8}$$

If we have 50 cycle groups of 2 packages we get:

$$100 * \frac{\sqrt{50 * 2^2}}{100} \approx 14,1\% \tag{9}$$

$$ML_{alt} = 100 * (1 - \frac{\sqrt{sumOfPackageCyclicity}}{n_p}) \tag{10}$$

Where n_p is the total number of packages.

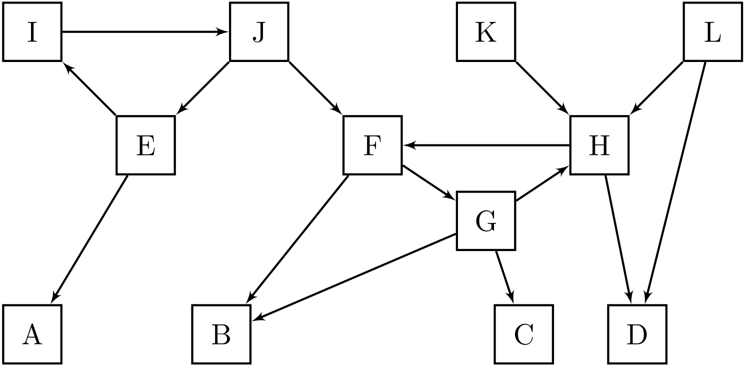
The final formula

$$ML_4 = min(ML_3, ML_{alt}) \tag{11}$$

We simply argue that for good maintainability both the component structure and the package/namespace structure must well designed. If one or both suffer from bad design or structural erosion, maintainability will decrease too.

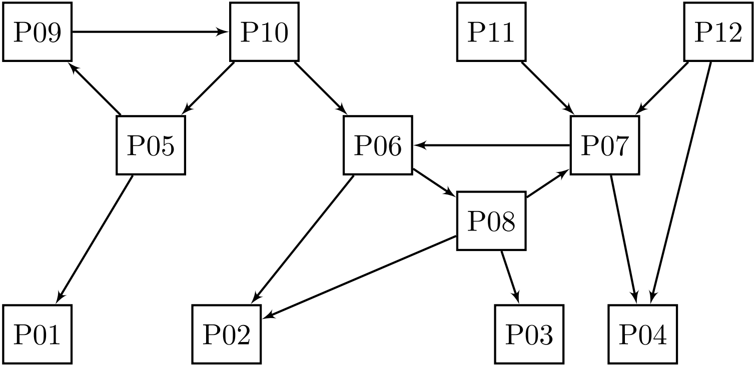
Exercises

Compute ML_3 for the following graph.



Exercises

Compute ML_{alt} for the following graph.



https://github.com/dsanmartins/AulaProfValter