BiMo—Online Appendix A
A simple example of constructing CANs

Figure 1 gives a simple example to show the idea to build CMN and CAN from the source code. The bottom-left part of Figure 1 is a simple source code snippet, the top part is its CMN, and the bottom-right part is the corresponding CAN.

As shown in Figure 1, there is one interface (viz. Song) and four classes (viz. Composer, Copyright, Propaganda, and Company) defined in the Java code snippet, and thus we can create five nodes in the CMN and CAN—N = {Song, Composer, Copyright, Propaganda, and Company}. Besides, the interface and classes were coupled through ten dependencies that have been marked explicitly using comments "/**/" in the code snippet. For example, five dependencies exist from Propaganda class to Company class, i.e., one instance of *GVA* dependency (cf. `private Company myCompany; /*GVA*/`), one instance of *PAR* dependency (cf. `public void setCompany(Company company/*PAR*/)`), two instances of *ACC* dependencies (cf. `company.cCnt++/*ACC*/;` and `myCompany.cCnt++/*ACC*/;`), and one instance of *MEC* dependency (cf. `myCompany.desc()/*MEC*/;`).

The ten dependencies between the five nodes result from nine relationship types. Thus, we can define a CMN, consisting of nine single-layer software networks (cf. the top part of Figure 1). In each layer, the node set is composed of the five nodes, edges denote the dependency occurring between the corresponding node pairs, and the weight on each link denotes the occurring frequency of the corresponding relationship. For example, as there are two times of ACC dependencies between classes Propaganda and Company, in the single-layer network G_{ACC}, we can create a link from the node of Propaganda to the node of Company, and the weight on the link is 2. Other links in the CNN can be similarly created.

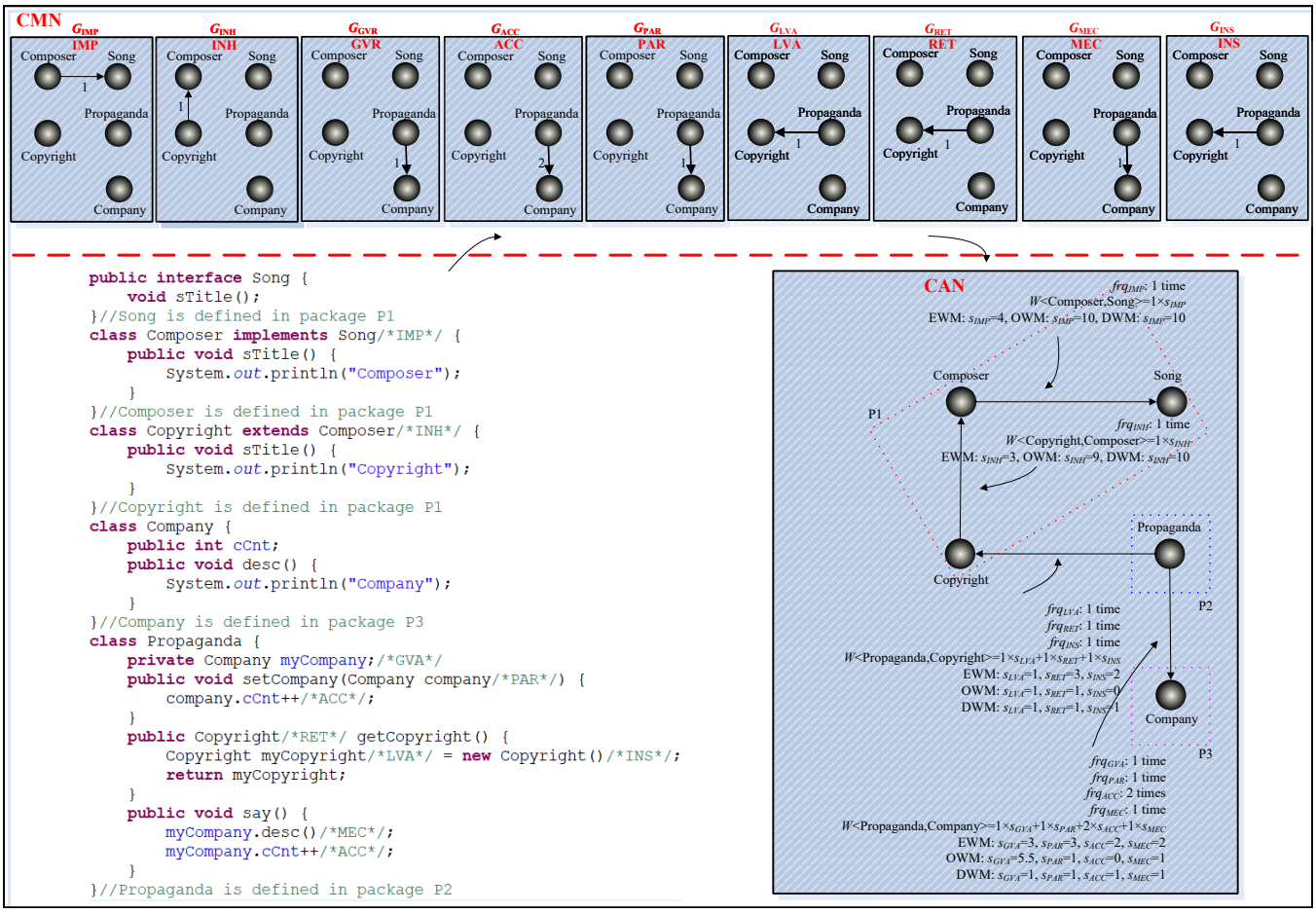

Figure 1: A simple Java code snippet (the bottom-left part) and its corresponding CMN (the top part) and CAN (the bottom-right part). The text beside each link denotes the relationship types that the link represents, the occurring frequency frq_c of each relationship c, the formula to compute the weight associated with each link, and the strength sr of each relationship c.

Based on the CMN, we can get the corresponding CAN by aggregating all the single-layer network in the CMN. For example, five dependencies exist between nodes Propaganda and Company (cf. G_{GVR}, G_{ACC}, G_{PAR}, and G_{MEC}); in the CAN, we keep only one. Then, the weight associated with this link in the CAN is calculated by $w\langle Propaganda, Company\rangle = 1{\times}s_{GVA}{+}1{\times}s_{PAR}{+}2{\times}s_{ACC}{+}1{\times}s_{MEC}$. If we use DWM to assign the weights, then $w\langle Propaganda, Company\rangle = 1 \times 1 + 1 \times 1 + 2 \times 1 + 1 \times 1 = 5$. Other links in the CAN can be similarly created.