

Interpreting concept maps

An informal set of notes by Duane Nickull, dnickull@adobe.com

Introduction:

Concept maps are a simple convention for brainstorming concepts during the development of software systems and or architecture thereof. Concepts maps are a two dimensional format composed of concepts (objects) and associations (relationships). Associations may be named to provide clarity.

Unlike other more specific types of architectural artifacts, concept maps may mix and match components that often may not appear together. The advantage of having less constraints is that concept maps are more free to depict a robust picture of what the architect wants to declare. Compare this with classic architectural diagrams such as the Data Model View, Component/Technology View and others.

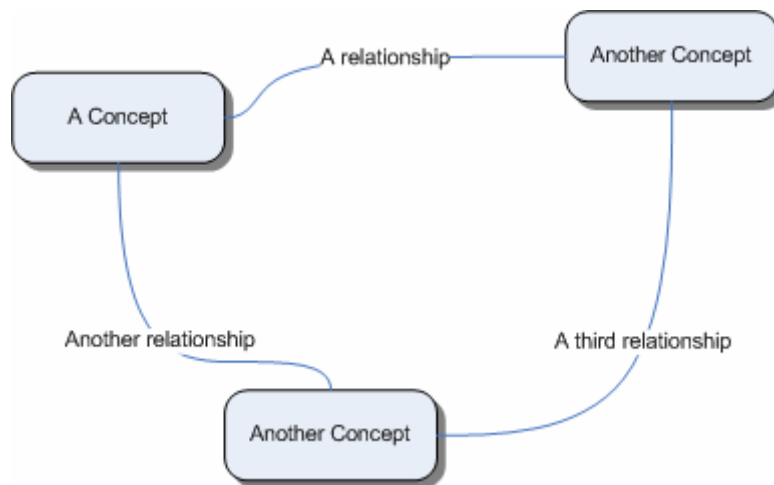


Figure 1 – a basic concept map

Each of the rounded rectangles above represents a concept. Concepts may be considered abstract and do not have to be actual physical objects. A real world implementation of a specific concept could be an object, element, process, technical infrastructure component or it may not be implemented at all (if it is an abstract concept, it cannot be implemented).

Generalized Associations

Concept maps use non-arrowed lines to depict associations between two concepts. If a concept is associated to another concept and there is no arrow on the line, the association is generalized. This may be depicted as follows:



Figure 2 – a generalized association between two concepts

The interpretation of the above concept map is an inference that “Concept A is associated with Concept B”. The nature of that association is not specified. No additional inference should be placed on the association.

Variation – Weak Inference

In order to depict a weak or secondary inference, a dotted line may be used for convention to depict an association that is not primary in nature. The convention indicates that the concepts are related however the extent of the association is not completely quantifiable.

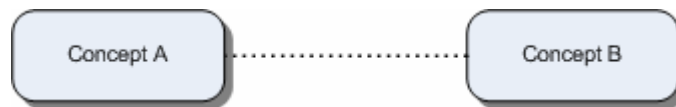


Figure 3 – a generalized, weak inference association between two concepts

In figure three, Concept A and Concept B are associated, however it is not clear at this time what the extent, nature or dependency of that association is.

By convention, a black dotted line (not dashed line) should be used to denote this type of association.

No name SHALL be used in a weak inference association.

Named Associations

If a concept is associated to another concept with a non-arrowed line and it has a name, the nature of the association is open to interpretation. Accordingly, some basic rules are applicable.

1. A named association is a specialization of a more generalized association;
2. If no arrow is present, it is a binary (two party) association and not a unilateral association in nature.



Figure 4 – a specialized association between two concepts

In the figure above, Concept A uses Concept B and the inverse is also true. There is equal weight applied to each of the two axioms:

1. Concept A uses Concept B
2. Concept B uses Concept A

Named, Unilateral Associations

Another variant of the concept map convention is to depict a named, unilateral relationship.

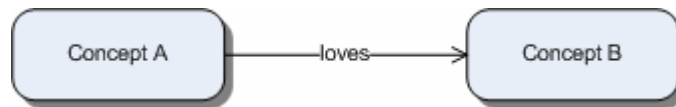


Figure 5 – a specialized, unilateral association between two concepts

The nature of the association in Figure 5 is that the named association is only applicable in one direction and the reciprocal axiom is not true. This is quite different from stating that it is unknown.

The following inferences are true in Figure 5:

1. Concept A loves Concept B
2. Concept B does not love Concept A
3. Concept B is not aware Concept A exists.

Visibility

As noted in the association above, an arrow also denotes visibility. In Figure 5, concept A is not visible to Concept B. To rectify this, a Concept map employ two specialized, unilateral associations.

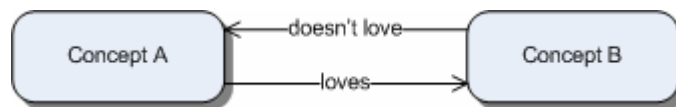


Figure 6 – a specialized, multi-lateral association between two concepts

As illustrated in Figure 6, Concept A loves Concept B, however Concept B is both aware of and also does not love Concept A. The following inferences are true for Figure 6:

1. Concept A loves Concept B;
2. Concept B is aware of Concept A's existence;
3. Concept B does not love Concept A

Visibility via Chained Associations

A circumstance may exist where there are more than two concepts and they are related via several unilateral named associations. Each Concept map SHOULD be as explicit as possible, without becoming overloaded with associations. It is the responsibility of each Concept Map author to determine a suitable level of detail for their audience.



Figure 7 – a specialized, association involving three concepts

In the Concept Map example Figure 7, Concept C “invokes” Concept B AND Concept B uses Concept A. One may infer from this there is a relationship between Concept C and Concept A. Indirectly, there is however Concept C is NOT visible to Concept A and inversely, Concept A is NOT visible to Concept C.

The following inferences may be made from Figure 7

1. Concept C invokes Concept B;
2. Concept B is not aware of Concept C (this may be confusing due to the nature of the named association. “Invokes” clearly suggests that B should be aware of who is invoking it. **Be careful!**);
3. Concept B uses Concept A;
4. Concept A is not aware of Concept B;
5. Concept C is not aware of Concept A;
6. Concept A is not aware of Concept C;

Authors note: Should the words “is visible” replace “is not aware of”??