1 Introduction

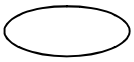
The approach used here is influenced by two papers*: Semantic models for knowledge management [1]*, and *Reasoning with goal models [2]*. Jarvis et al. [1] provide a technique for creating goal models to support strategic business analysts, including a description of the modeling constructs and an automated tool to augment these models with information about real-world events captured from the web. Giorgini et al. [2] further this modeling approach by providing an algorithm to quantify the success or failure of the goal strategy modeled.

The model in the project attempted is a manual effort that presents the structure to which strategies may be applied. It does not provide the application of any one strategy, instances, events or quantification values. Nor does it provide the depth necessary to capture all of the aspects of the business. Rather, it is a starting point for the telecom industry goal model that must be refined as new business needs and real-life events present themselves so that potential strategies may be evaluated.

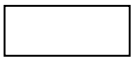
2 Creating the model

2.1 The use of symbols in the goal model

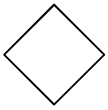
Three basic symbols are used in this modeling technique:



- an oval, which represents a goal;



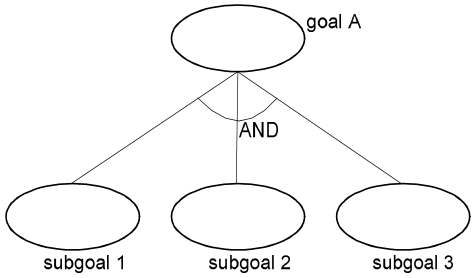
- a rectangle, representing an event, and;



- a diamond which symbolizes an actor or entity.

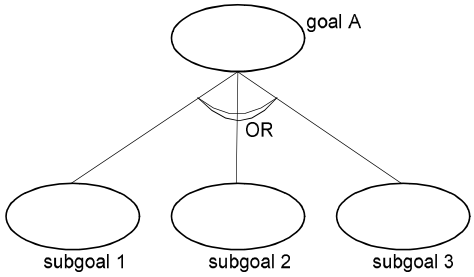
These symbols are linked to each other with annotated lines representing semantic relationships. These relationships include:

AND — In order for goal A to be satisfied, all of subgoals 1, 2 and 3 must be satisfied.



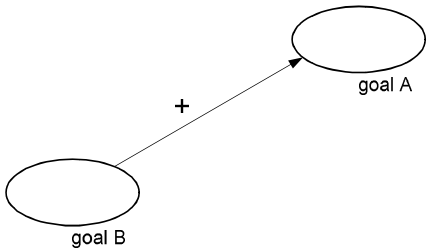
OR

In order for goal A to be satisfied, at least one of subgoals 1, 2 or 3 must be satisfied.



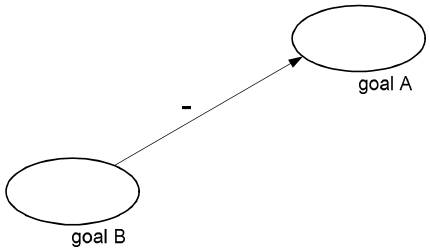
+ positive influence

The satisfaction of goal B positively influences the probability that goal A is satisfied, but does not necessarily satisfy the conditions of goal A.



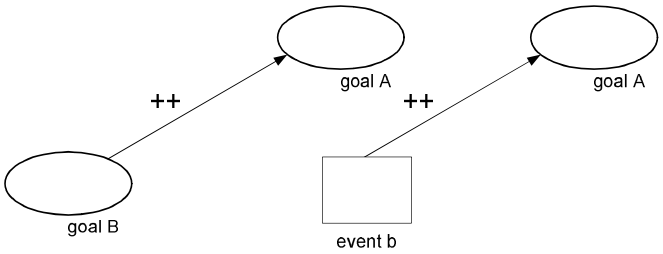
- negative influence

The satisfaction of goal B negatively influences the probability that goal A is satisfied, but does not necessarily preclude the satisfaction of goal A.



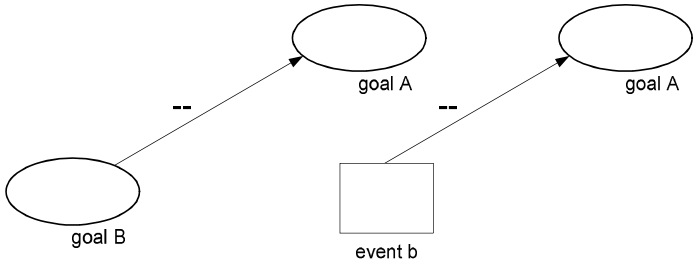
++guarantees satisfaction

If goal B is satisfied, (or some event B occurs,) then goal A is satisfied.



--prevents satisfaction

If goal B is satisfied, (or some event B occurs,)then goal A is denied.



A goal model is built hierarchically starting with the ultimate goal (usually) at the top of the diagram. For each goal the question *How do I achieve this goal* is asked. The answer is decomposed into subgoals that must be achieved or events that must occur in order to achieve that goal. This decomposition is iterated until all goals can be satisfied or denied. All positive and negative interdependencies including guarantees, preventions (contradictions), positive influences and negative influences are mapped onto the model wherever they are recognized.

One of the issues requiring resolution is the question of when to use the *AND* relationship and when to use the +*(positively influences)* relationship. For example, when trying to describe the goals related to cutting costs (as in Figure 1 below), each of the subgoals represents a means of reducing costs. If one type of cost is reduced but some other is increased, then the goal of reducing costs may not achieved. For this same reason, the +*(positively influences)* relationship cannot be applied alone. There is one possible solution to this problem: That is to have another set of subgoals representing an increase in each category of costs, and to join all of the subgoals to the supergoal strictly using the +*(positively influences)* relationship or the -*(negatively influences)* relationship as appropriate. This solution is illustrated in Figure 2 (on page 4). A future solution may be to create a new relationship symbol.

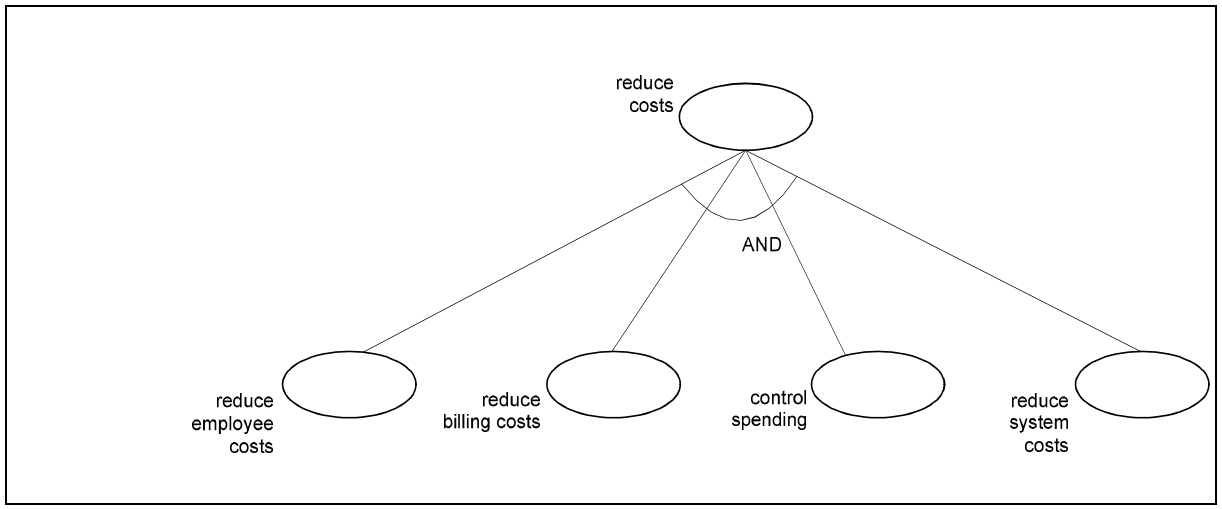


Figure 1 Using AND to describe cost-cutting goals

For the purposes of simplicity, the simplified form – *AND* relationship was used in this exercise, otherwise manual layout of the diagram would have become unwieldy. The model description clarifies, where necessary, decisions made when establishing relationships, including this use of the *AND* relationship.

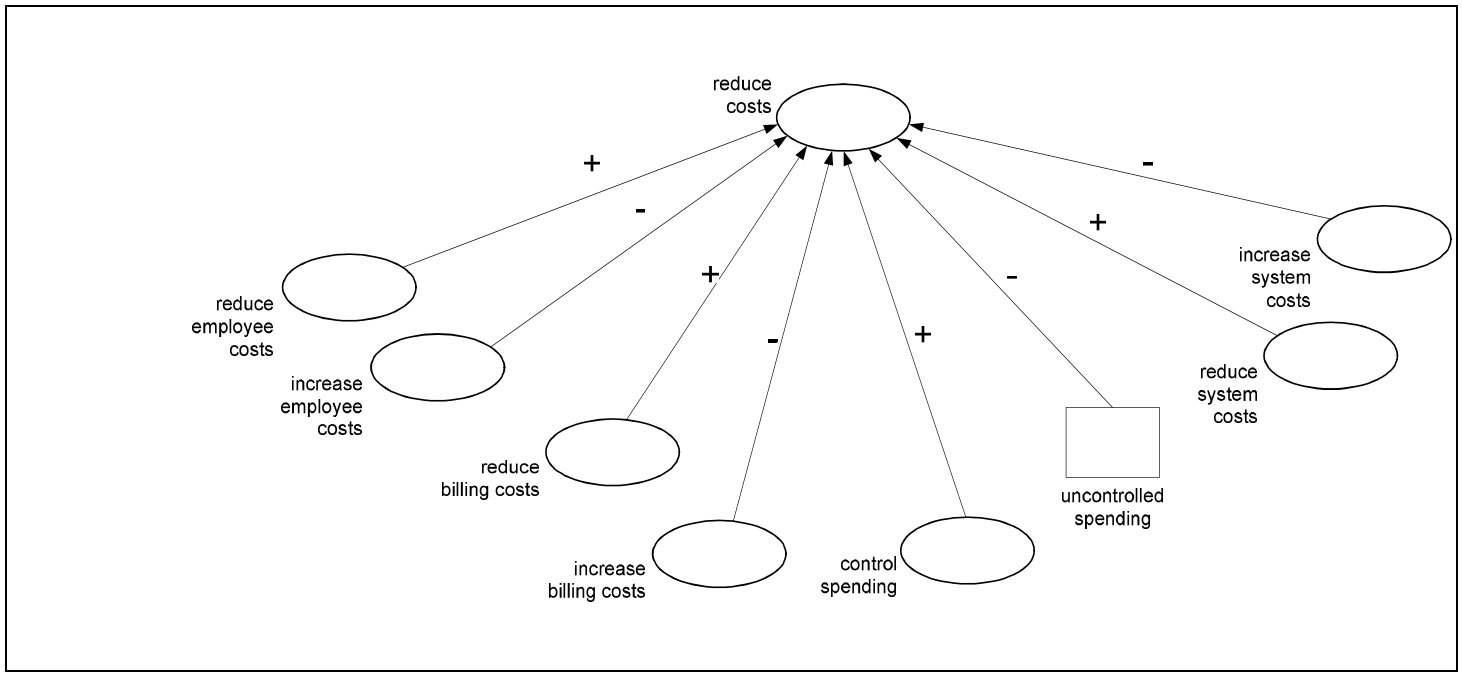


Figure 2 A possible solution to the *AND* problem, when all conditions do not necessarily need to be met.

Example - Reduce billing costs

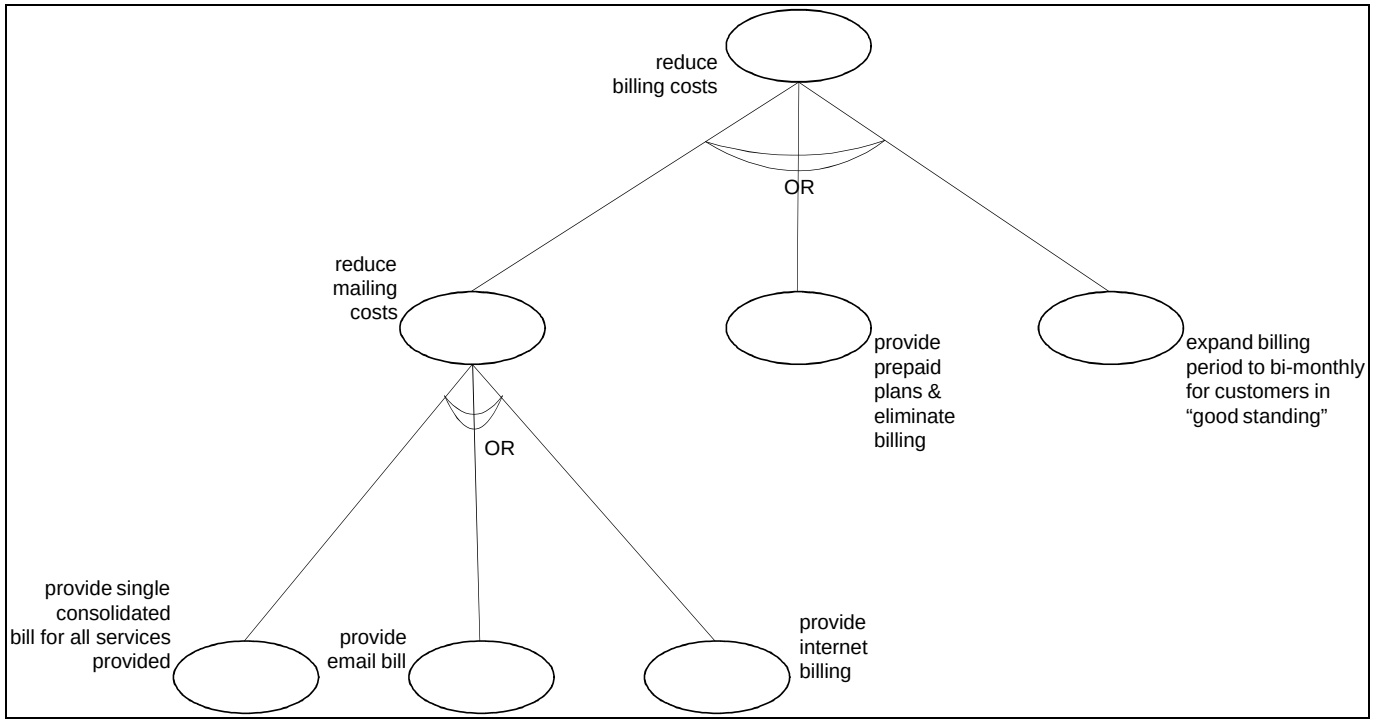


Figure 3 Reduce billing costs goal and subgoals

The billing costs addressed in this diagram are concerned with the cost of generating and mailing a bill to a customer. We look at the number of bills generated for a single customer, the method of delivery of the bill, and the frequency of each bill being generated.

Currently, in many telecom companies, separate bills are provided for each product subscribed to. For example, if a customer has a cable, a cell phone, and internet service, they receive a separate bill for each one of these products. By consolidating these bills, which are all going to the same household, into a single bill, the mailing costs (stamps and enclosures) can be significantly reduced. To extend this concept, if a customer has internet service, it would be more useful to provide them with an internet billing account which allows them to review their charges as they are accrued. Even broader application of the electronic bill would be to provide an email bill to any customer for which you have an email address and eliminate mailing costs entirely.

Prepaid plans are another way to eliminate billing. By allowing the customer to buy flat-rate services in advance for a longer period, no bills need to be generated. An alternative to this is to bill customer who are consistently in good standing every second month – thereby halving the mailing costs.

Marketing likes to add enclosures to bills. Some of the goals provided here precludes that capability. An expansion of this model could include this co-dependency.

Evaluating strategies using the model

The next step in the use of this model would be to evaluate strategies using the model itself. For example, the following scenarios would be interesting to evaluate:

- Several strategies were recommended but are not included here.

Quantification

Though Giorgini et al. [2] have made inroads into the application of quantification to evaluate the degree of goal accomplishment, this author feels that their approach does not address the dollar-value-estimates that strategists and planners need to make decisions and determine the correct strategy to adopt. Currently spreadsheets are used to fine-tune the expected dollar outcome of implementing a particular strategy. This applies especially in the Telecom industry where the decision to apply large outlays of cash to product development is determined based on projected costs and revenues and expected cash flows. The model must be able to assess dollars and percentages in addition to the occurrence of events, incorporating dollar value thresholds and calculations in the determination of the accomplishment of the goal when necessary. The dollar value of one subgoal result must be able to interact with another to determine the effect on the supergoal. To accomplish this, the spreadsheet-like functionality must be incorporated into the logic of the modeling technique.

Enhancing the model through automation

It is the understanding of this author that another student is attempting to automate this modeling process. Given the limited exposure of this project, it may nonetheless be useful to provide a few suggestions that may contribute to the usability of the product, though I suspect much of this has already been considered:

- Incorporate the spreadsheet functionality described in Subsection 4.2 Quantification, above. A single click on a goal should permit the strategist to view the financial outcome of their scenario for that particular goal. You should also have the ability to toggle the permanent display of financial information in goals.
- Use colour for the relationship lines. For example, green for positive and red for negative. Based on the weight of the relationship, you may want to scale the colour – much like the technique currently used for colour mapping of grid diagrams today.
- Use colour to signify financial information: Gains in green, losses in red, no change in black.
- Allow the ability to fold/unfold goals related to the goal selected. This is analogous to the folder metaphor used in Windows. It would be useful to be able to zone-in on a single goal and look at only those goals directly related to it. It would also be useful to trace how a single goal is related to a top-level goal – a kind of a critical path from that goal to the ultimate goal.

References

[1] Raoul Jarvis, Gregory McArthur, John Mylopoulos, Patricia Rodriguez-Gianolli and Shun Zhou. Semantic models for knowledge management, *Proceedings of Second International Conference on Web Information Systems Engineering (WISE'01) Volume 1, December 03 - 06, 2001*, Kyoto, Japan

[2] Paolo Giorgini, John Mylopoulos, Eleonora Nicchiarelli, and Roberto Sebastiani. Reasoning with goal models, *Proceedings of the 21st International Conference on conceptual Modeling (ER2002),* October 2002, Tampere, Finland, LNCS - Springer Verlag.