# 1. Short GRL Overview & Analysis

**GRL Elements (Intentional elements, IE's)**

* Softgoal
* Goal
* Task
* Resource
* Belief

**GRL Links**

* Decomposition
  + *Means-end* links
  + AND/IOR/XOR decomposition
  + Relations between an IE and a set of IE
  + Decomposes(IE,{IE1,...,IEn},Type), Type = AND/IOR/XOR
* Contribution
  + Indicate *impact* of one IE's satisfaction on another IE's satisfaction.
  + Relation between any two IE
  + Valued:
    - Qualitative: make, help, some positive, non, some negative, hurt, break
    - Quantitative: domain [-100,100]
  + Contributes(IE1,IE2,Value)
* Dependency
  + Used between IE's of different actors.
  + Relation between any two IE
  + Depends(IE1,IE2)

**GRL Components**

* Actor
  + A grouping of intentional elements and links.

**GRL Evaluation Algorithms**

* Three types of evaluation algorithms:
  + *Qualitative:* Useful in early phase when quantative values are unknown
  + *Quantative*
  + *Hybrid*
* All algorithms have the following steps:

1. Assign satisfaction values to subset of IE's (*GRL Strategy),* qualitative/quantitative
2. Propagate values through links in the following order:
   1. Decompositions
   2. Contributions
   3. Dependencies
3. Compute an actor's satisfaction level using an *importance* attribute

* Defines relative importance of IE over other IE's bound to an actor
* Qualitative: (H)igh, (M)edium, (L)ow, or None
* Quantative: [0,100]

# 2. GRL from an Argumentation Perspective

GRL models are very closely related to practical reasoning (as we discussed in RENext2015, ER2016). In fact, we can view A GRL diagram as a collection of practical reaoning arguments.

Lower costs

+75

Use open source software

The practical reasoning argument in this case is something like:

*Action "use open source software" should be performed, because performing this would promote goal "lower costs"*

Such a practical argument may be attacked in a number of ways [Bench-Capon, 2003]:

1. Performing "use open source software" does not promote goal "lower costs".
2. Performing some other action that is mutually exclusive with *"use open source software"* also promotes the goal "lower costs", and this other action is more desirable.
3. Action "use open source software" cannot be performed.
4. Goal "use open source software" is not a worthy goal.

Attack (2) can possibly be handled by GRL by providing an alternative action with a higher contribution. However, it is not possible to state that two IE's are mutually exclusive **(RIGHT??).**

The following figure shows all attacks, including an extra argument attacking another argument to show that this is also possible.

We have a policy not to use open source software

+75

Using open source software does not lower costs

Use open source software

Lower costs

We have enough money

This policy is not longer in place since 2015

Given this perspective, we can ask ourselves the following question:

**When should the arguments be evaluated?**

* + Suggestions:
    - Arguments can be used to set the GRL Strategies, i.e. evaluation of the IE elements. So if an IE is attacked it may receive a negative evaluation. Different *argument extensions* may correspond to different GRL Strategies.
    - Another option is to remove elements from the model based on arguments. So in the example above, if the contributes-to relation is attacked, it should perhaps not be considered in the evaluation algorithms.

**How to assign values to IE's based on argument extensions?**

* + Suggestion: As a first step, simply use binary values, i.e. +100 and -100 (quantative), or *satisfied* and *conflict* (qualitative)
  + Next step: Some kind of value-based argumentation.
  + Again, some elements of the GRL model may also be inactive due to arguments.

# 3. Examples of Arguments and GRL

**Example 1: Basic Case**

0

* IE1 is not supported or attacked by any argument, so it has evaluation 0.
* Discussion:
  + Does this make sense? If we treat IE1 itself as an argument (as we did in ER2016), then it should be IN, so it receives a positive evaluation.
  + However, intuitively giving it no evaluation seems to make more sense, because then it can be assigned a value by the evaluation algorithms.
  + If we decide that the value of IE1 is positive, then *every IE receives a non-zero initial evaluation value.* This seems very strong!

**Example 2: Single argument that is IN**

-100

Arg2

+100

Arg1

* IE1 is supported by argument 1, which is unattacked and thus IN, so IE1 receives a positive evaluation.
* IE2 is attacked by argument 2, which is unattacked and thus IN, so IE2 receives a negative evaluation.
* Discussion:
  + This makes sense to me.

**Example 3: Single argument that is OUT**

0

Arg2

0

Arg1

* IE1 is supported by argument 1, which is OUT, so IE1 receives a neutral evaluation.
* IE2 is attacked by argument 2, which is OUT, so IE2 receives a neutral evaluation.
* Discussion:
  + This is related to example 1. If IE1 is supported by an argument, but this argument turns out to be invalid, what then?
  + Intuitively I'd say that there is nothing in favor of IE1 anymore, but also nothing against it. So therefore it receives 0.

**Example 4: Multiple arguments for/against IE's**

0

....

....

ArgM

ArgK

ArgN

Arg1

* There are N arguments for supporting IE (N>0) and K-M arguments against it (K-M>0).
* Since the position of IE1 is unclear, it receives a neutral evaluation
* Discussion:
  + I'm not sure what to do here.
  + We could also use some kind of counting, for instance, if there are more arguments supporting IE1 than attacking it, it receives a positive evaluation.
  + This would be a good place to combine it with valued-based argumentation.

**Example 5: Multiple extensions, multiple GRL strategies**

v(IE2)

Arg2

v(IE1)

Arg1

* Arg1 supports IE1, and arg2 suports IE2. However, Arg1 and 2 are in conflict with each other.
* There are two extensions, corresponding to two GRL strategies:

1. Arg1=IN, Arg2=OUT. Then v(IE1)=+100, v(IE2)=0
2. Arg1=OUT, Arg2=IN. Then v(IE1)=0, v(IE2)=-100

* Discussion:
  + I like the idea of combining extension with strategies, it seems to fit naturally.
  + We can use different argumentation semantics, e.g., grounded, preferred, stable.

**Example 6: Combination with GRL evaluation algorithms**

Arg2

Arg1

Softgoal1

+75

-25

* Goal1 contributes positively to softgoal1 (+75)
* Goal2 contributes negatively to softgoal1 (-25)
* Goal1 is supported by Arg1, and Goal2 by Arg2
* Arg1 and Arg2 are in conflict.
* Two extensions:
  + E1: Arg1=IN, Arg2=OUT
  + E2: Arg1=OUT, Arg2=IN
* So two GRL strategies:
  + S1: v(Goal1)=+100, v(Goal2)=0, v(Softgoal1)=0
  + S2: v(Goal1)=0, v(Goal1)=+100, v(Softgoal1)=0
* Applying the quantitative algorithm gives the two models below.

