Neg-o-Net (v.2.0)

Capturing stakeholder negotiation within FIRMA
Relation to other models

- DepNet
- PartNet
- NegoNet v1
- Pandora
- NegoNet v2
- Maastricht
- PanoNet
- NegoDora?
Q.) Why do this?
A.) I’ll give one good reason from many.

- If we can capture plausible negotiation processes we can explore many (thousands) of environmental scenarios and “test” different negotiation strategies for robustness – something that would be impossible with stakeholder “gaming” (for example).
Q.) Can we be Generic and Qualitative?
A.) yes, if we modularize and constrain.

- We want to apply a basic model framework to several FIRMA scenarios. To this end we have modularize by:
  - Agent “Viewpoints”
    - Already much data collected
  - Negotiation “Strategies”
    - On-going (Oxford – gaming, other data Zurich)
  - Environmental Simulation
    - Already have several produced by members
Constraining the term “Negotiation”

• Negotiation is viewed as:
  • Grounded in the attempt, by agents, to induce desirable actions in others
  • Not dependent on shared or even compatible goals or beliefs (agents may have different “viewpoints”)
• In Neg-o-net we have categorized possible negotiation moves into three types:
  • 1. Action haggling – e.g. “I’ll do A if you do B”
  • 2. Belief communication – e.g. “if citizens protest, government become less popular”
  • 3. Goal communication – “It is important to protect the environment”
  • (2 and 3 above come in regular and “meta” flavors).
Representing agent viewpoints with *digraphs*

- Each agent has a set of digraphs representing their subjective “viewpoint”
- Nodes represent subjective world states
- Arcs give causal links between nodes
- Nodes may have associated “trigger” conditions which cause them to become active
Digraph representation of viewpoints in Neg-o-Net

- Each node contains set of “indicator values” characterizing desirability (e.g. pollution, employment etc.).
- Each node lists the actions available to the agent (action repertoire) with an optional cost values.
- Each arc has associated conditions which need to be satisfied to traverse the arc.
System overview

Agent
Indicator weights
Environmental trigger
Negotiation strategy

Event1
Event2

Environmental Simulation

Events / values

Actions

Agent
Indicator weights
Environmental trigger
Negotiation strategy

Actions

Actions

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An agent

Objectives (overall goal)

Haggling, Belief and Goal

Viewpoint node

Current active node

Agent

Indicator weights

Negotiation strategy

Viewpoint – digraph(s)
Illustrative Viewpoints (Simplified Fragments)

Company — max profit first, some env concern — (profit 1, env 0.5)

- New-regulation
  - High Profit
    - Profit=2, Env=1
    - Donation
  - Deregulate
  - Acceptable Profit
    - Profit=1, Env=2
    - Donation
  - Deregulate
  - Possible Loss
    - Profit=0, Env=3
    - Donation

Politician — max pop and hence get votes — (pop 1)

- Donation
  - High-Pop
    - Pop=3
    - Deregulation
    - New-regulation
  - Direct-action
    - Low-Pop
      - Pop=2
      - Deregulation
      - New-regulation
  - Pop-campaign
    - Pop-Problem
      - Pop=0
      - Pop-campaign

Citizen — max env but keep costs low (env 1.5, cost –1)

- New-regulation
  - Env-Good
    - Cost=3, Env=2
    - Political-pressure
  - Env-Concerns
    - Cost=2, Env=1
    - Political-pressure
  - Deregulation
  - Env-Problems
    - Cost=2, Env=0
    - Political-pressure
    - Direct-action
    - Direct-action
    - Pop-campaign
    - Pop-campaign
Current implementation (v.2.0)

- four example haggling strategies:
  - No haggling
  - Some (open dyadic coalition) haggling
  - Best possible coordinated action
  - Policy agent mediated negotiation

- Single active node in viewpoint diagraph
- No belief or goal communication yet
- No environmental model hooked-up
- Conditions on arcs just a conjunction of atomic actions actions
Dyadic Haggling

Agent Indicator weights
Environmental trigger
Negotiation strategy

Company
Citizens
Politician
Example script (input)

# Neg-o-Net script - very simple viewpoint fragments
#

#=========

Agent: Company : The water company   # agent name and description
IndicatorWeights:profit 1 env 0.5   # weights applied to indicators

# now we have a set of nodes and links which belong to the agent

Node: Acceptable-Profit : the company is in profit
Indicators: profit 1 env 2
Action: Donation : the company donates to the politician
Link: New-Regulation => Possible-Loss : the company moves to a possible loss
Link: Deregulation => High-Profit : the company moves to high profit

Node: Possible-Loss : the company is in a possible loss situation
Indicators: profit 0 env 3
Action: Donation : the company donates to the politician
Link: Deregulation => High-Profit : the company moves to high profit

Node: High-Profit : the company is in high profit
Indicators: profit 2 env 1
Action: Donation : the company donates to the politician
Link: New-Regulation => Possible-Loss : the company moves to a possible loss
Example run (output - haggling)

>>> Iteration 1

Perception phase:
-----------------
The water company (Company):
the company is in profit (Acceptable-Profit)
The politician (Politician):
the politician has a low popularity (Low-Pop)
The citizens (Citizen):
the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The agents are attempting some coordination of actions via haggling
------------------------------------------------------------------------------------------------------------------
   agent Company says to all: I require action Deregulation. Can anyone help?
   agent Politician says to all: I require action Donation. Can anyone help?
   agent Company says to all: I can offer action Donation.
   agent Politician says to agent Company: will you agree to do actions { Donation } ?
   agent Company replies: only if you can offer actions { Deregulation } in return.
   agent Politician says to agent Company: Okay, I can do that
   agent Politician says to all: I have agreed to perform action(s) { Deregulation }
   agent Company says to all: I have agreed to perform action(s) { Donation }

Action phase:
--------------
The water company (Company):
the company donates to the politician (Donation)
The politician (Politician):
the politician secures deregulation (Deregulation)
>>> Iteration 2

Perception phase:
---------------
The water company (Company):
  the company moves to high profit
  the company is in high profit (High-Profit)
The politician (Politician):
  donations will help popularity
  the politician has a high popularity (High-Pop)
The citizens (Citizen):
  the citizens think deregulation will lead to problems
  the citizens are deeply concerned about environmental problems (Env-Problems)

Negotiation phase: The agents are attempting some coordination of actions via haggling
-------------------------------------------------------------
  agent Politician says to all: I require action Donation. Can anyone help?
  agent Politician says to all: I'm getting nowhere, I retract my previous offers and requirements!

Action phase:
----------
The citizens (Citizen):
  the citizens take direct action (Direct-Action)
Example run continued (output)

>>> Iteration 3

Perception phase:
-----------------
The water company (Company):
  the company is in high profit (High-Profit)
The politician (Politician):
  direct action by citizens will lead to low popularity
  the politician has a very low popularity (Pop-Problem)
The citizens (Citizen):
  direct action is sometimes necessary
  the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The agents are attempting some coordination of actions via haggling
-----------------------------------------------------------------------------------------------------------------
>>> Iteration 4

Perception phase:
-----------------
The water company (Company):
  the company is in high profit (High-Profit)
The politician (Politician):
  the popularity campaign has done some good
  the politician has a low popularity (Low-Pop)
The citizens (Citizen):
  the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The agents are attempting some coordination of actions via haggling
---------------------------------------------------------------------
  agent Politician says to all: I require action Donation. Can anyone help?
  agent Politician says to all: I'm getting nowhere, I retract my previous offers and requirements!

Action phase:
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Policy Agent Mediated Negotiation
Policy agent mediated Negotiation

- Policy agent has preference weights over the other agents
- It proposes plans to the agents to maximize preferences
- Agents respond indicating their own satisfaction levels based on their preferences and any actions that they can perform
- Policy agent then extends/updates its viewpoint to include these – i.e. it learns
- So policy agent can start with an empty viewpoint and induce one from dialogues with agents
Example Script (input)

# Neg-o-Net script - very simple viewpoint fragments
#
#
#======== A minimal policy agent
Agent: Policy : The policy agent
IndicatorWeights: Company 1 Politician 1 Citizen 1
Node: Do-Nothing : the policy agent considers the situation
Indicators: Company 1 Politician 1 Citizen 1

#======== The company agent
Agent: Company : The water company # agent name and description
IndicatorWeights: profit 1 env 0.5 # weights applied to indicators

# now we have a set of nodes and links which belong to the agent
Node: Acceptable-Profit : the company is in profit
Indicators: profit 1 env 2
Action: Donation : the company donates to the politician
Link: New-Regulation => Possible-Loss : the company moves to a possible loss
Link: Deregulation => High-Profit : the company moves to high profit

Node: Possible-Loss : the company is in a possible loss situation
Indicators: profit 0 env 3
Action: Donation : the company donates to the politician
Link: Deregulation => High-Profit : the company moves to high profit
Example run (output – policy)

>>> Iteration 1

Perception phase:
-----------------
The policy agent (Policy):
  the policy agent considers the situation (Do-Nothing)
The water company (Company):
  the company is in profit (Acceptable-Profit)
The politician (Politician):
  the politician has a low popularity (Low-Pop)
The citizens (Citizen):
  the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The policy agent is mediating a negotiation process
---------------------------------------------------------------------------------------------
The policy agent (Policy) says to all:
  we propose plan: no actions are taken { none }
The water company (Company) says to the policy agent:
  we are not happy with the proposed plan
  we propose that the company moves to high profit { Deregulation }
The politician (Politician) says to the policy agent:
  we are not happy with the proposed plan
  we propose that donations will help popularity { Donation }
The citizens (Citizen) says to the policy agent:
  we have no further proposals
  we are happy with the proposed plan
The policy agent (Policy) says to all:
we propose plan: donations will help popularity { Donation }
The water company (Company) says to the policy agent:
we have no further proposals
however, we refer to our previous proposals
The politician (Politician) says to the policy agent:
we have no further proposals
we are happy with the proposed plan
The citizens (Citizen) says to the policy agent:
we have no further proposals
we are happy with the proposed plan
The policy agent (Policy) says to all:
we propose plan: the company moves to high profit { Deregulation }
The water company (Company) says to the policy agent:
we have no further proposals
we are happy with the proposed plan
The politician (Politician) says to the policy agent:
we have no further proposals
however, we refer to our previous proposals
The citizens (Citizen) says to the policy agent:
we are not happy with the proposed plan
we propose that no actions are taken { none }
The policy agent (Policy) says to all:
we have no more proposals to make
The policy agent (Policy) says to all:
we have considered your responses and we propose that donations will help popularity { Donation }

Action phase:
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Policy agent says to Company agent: please perform action Donation
Company agent says to Policy agent: OK.
>>> Iteration 2

Perception phase:
-----------------
The policy agent (Policy):
  donations will help popularity
  induced state proposed by agent Politician (induced-world-state2)
The water company (Company):
  the company is in profit (Acceptable-Profit)
The politician (Politician):
  donations will help popularity
  the politician has a high popularity (High-Pop)
The citizens (Citizen):
  the citizens have concerns about the environment (Env-Concerns)

Negotiation phase: The policy agent is mediating a negotiation process
-----------------------------------------------------------------------------
The policy agent (Policy) says to all:
  we propose plan: no actions are taken { none }
The water company (Company) says to the policy agent:
  we are not happy with the proposed plan
  we propose that the company moves to high profit { Deregulation }
The politician (Politician) says to the policy agent:
  we have no further proposals
  we are happy with the proposed plan
The citizens (Citizen) says to the policy agent:
  we have no further proposals
  we are happy with the proposed plan
Example run continued (output)

The policy agent (Policy) says to all:
we propose plan: the company moves to high profit { Deregulation }
The water company (Company) says to the policy agent:
we have no further proposals
we are happy with the proposed plan
The politician (Politician) says to the policy agent:
we have no further proposals
we are happy with the proposed plan
The citizens (Citizen) says to the policy agent:
we are not happy with the proposed plan
we propose that no actions are taken { none }
The policy agent (Policy) says to all:
we have no more proposals to make
The policy agent (Policy) says to all:
we have considered your responses and we propose that no actions are taken { none }

Action phase:
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Policy agent says to all: do nothing
What next?

• Bring Policy agent closer to Masstricht case study
• Will require increased intelligence in policy agent
• Allow agents to have multiple networks for each issue
• Perhaps this could be achieved in a hierarchical way using an “internal” policy agent…..
Recursive negotiation?