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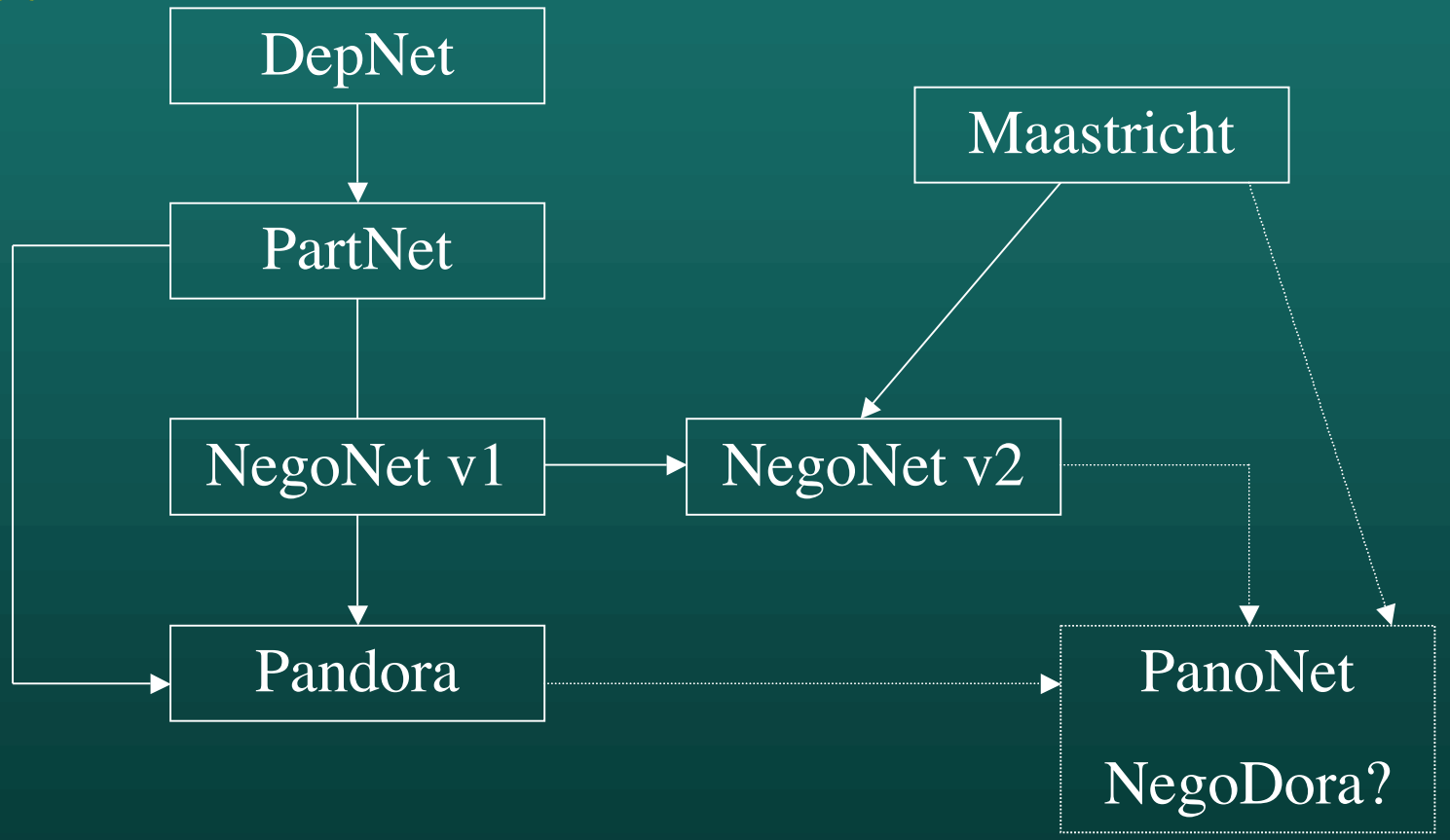
Neg-o-Net (v.2.0)

Capturing stakeholder negotiation within FIRMA

Relation to other models



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")

Unpacking Negotiation - Three types of negotiation “moves”

- 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).

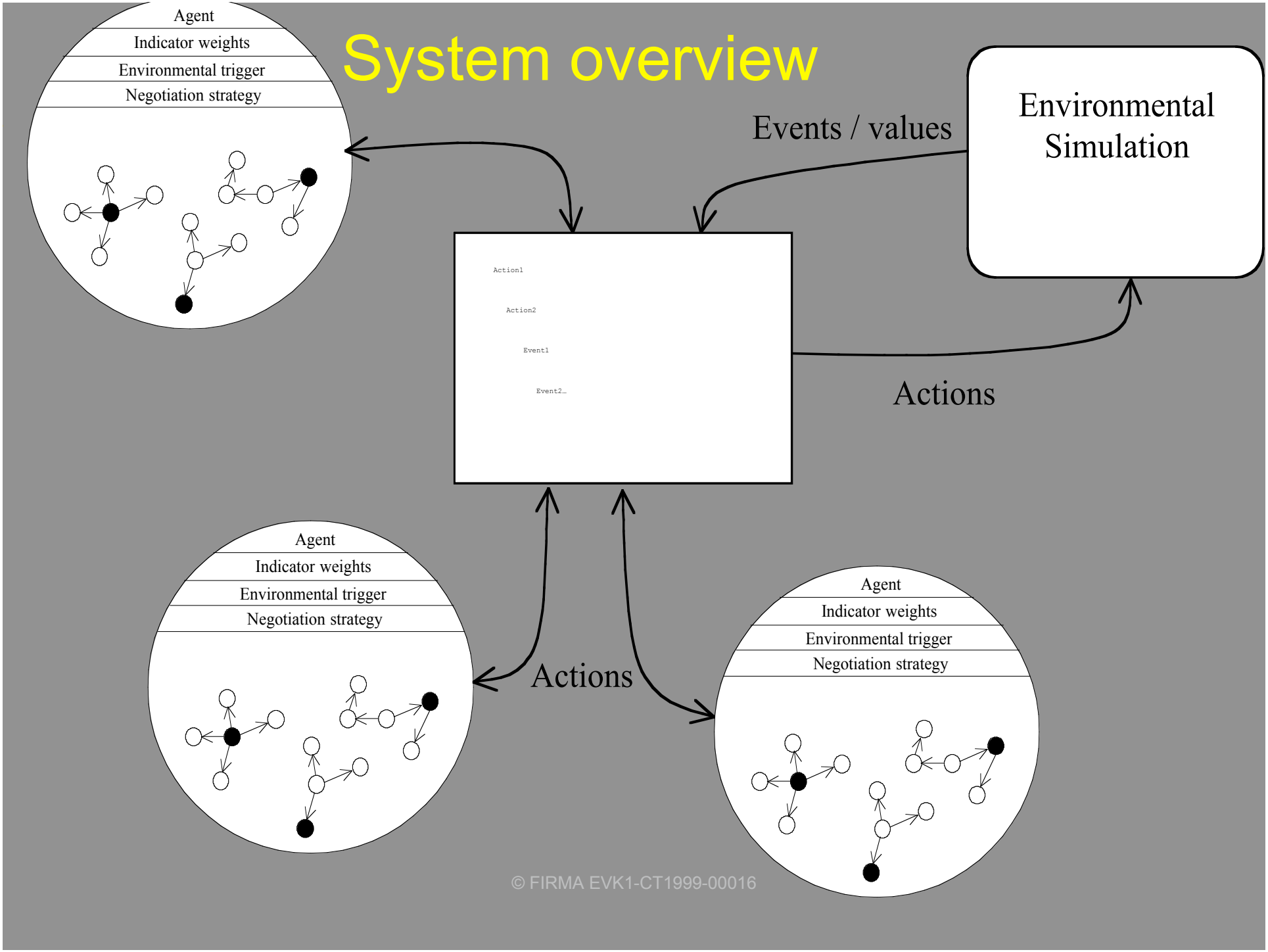
Representing agent viewpoints with *digraphs*

- Each agent has a set of diagraphs 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

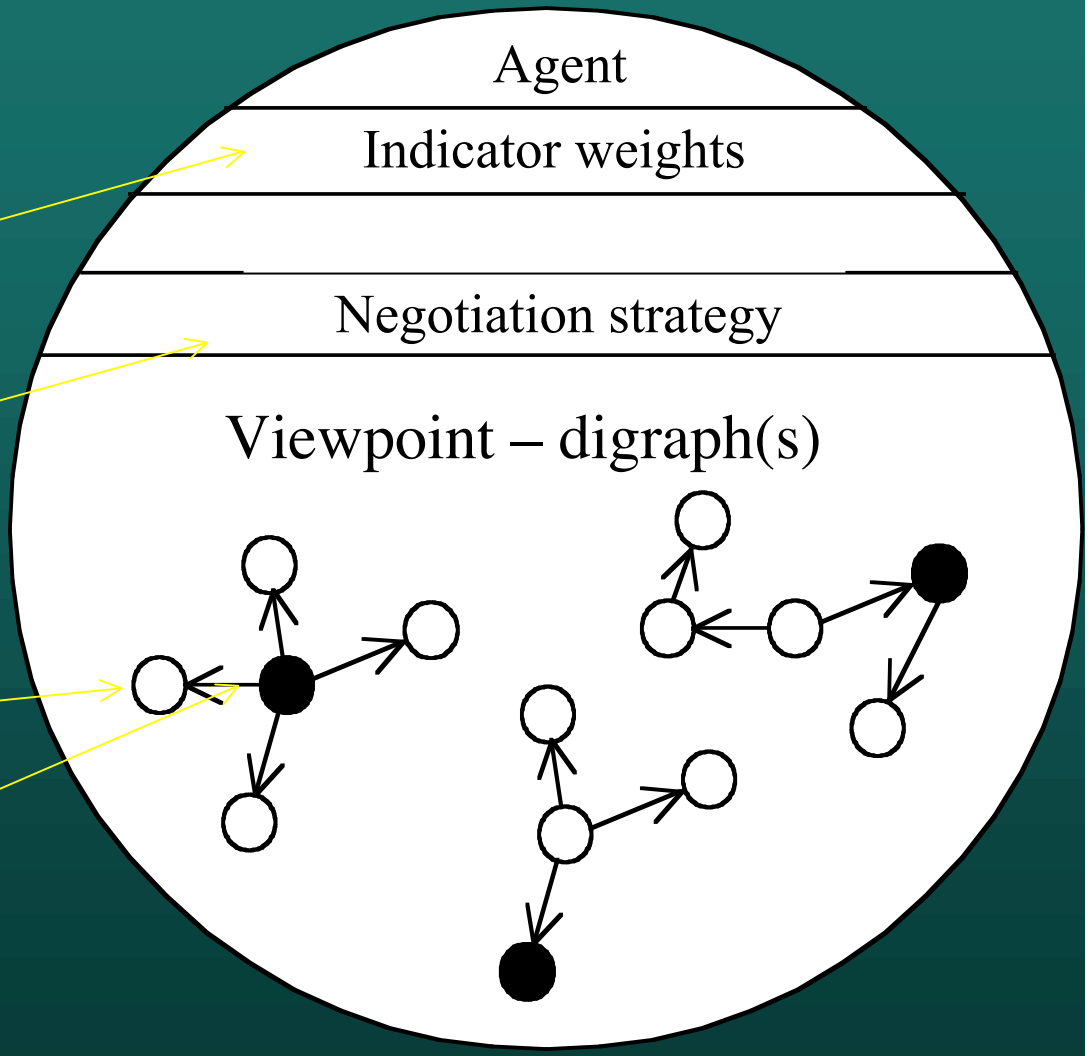
Digraph representation of viewpoints in Neg-o-Net

- 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



An agent



Objectives (overall goal)

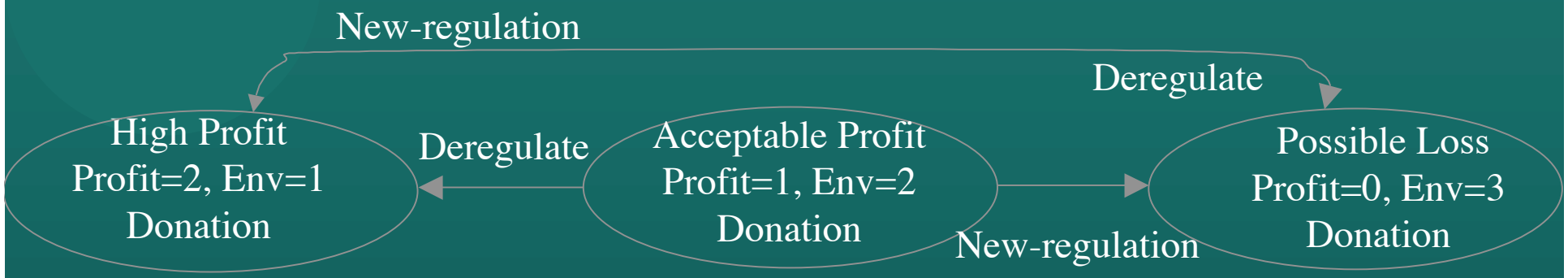
Haggling, Belief and Goal

Viewpoint node

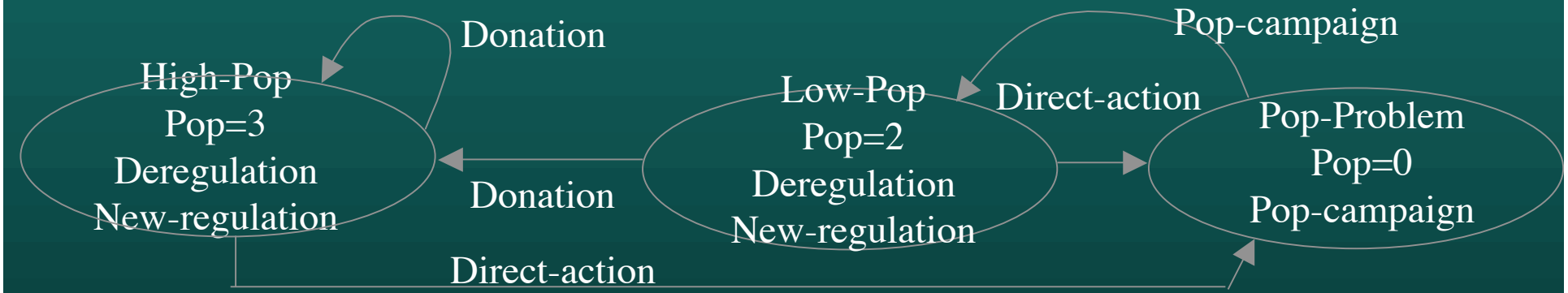
Current active node

Illustrative Viewpoints (Simplified Fragments)

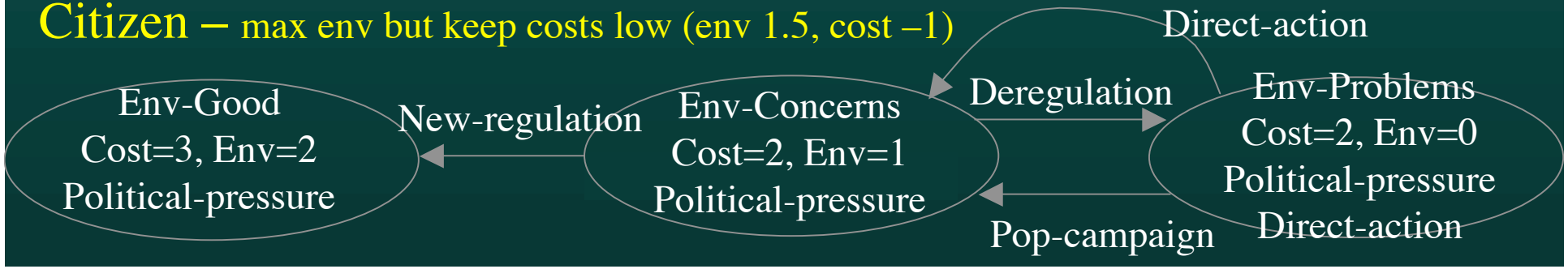
Company – max profit first, some env concern – (profit 1, env 0.5)



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



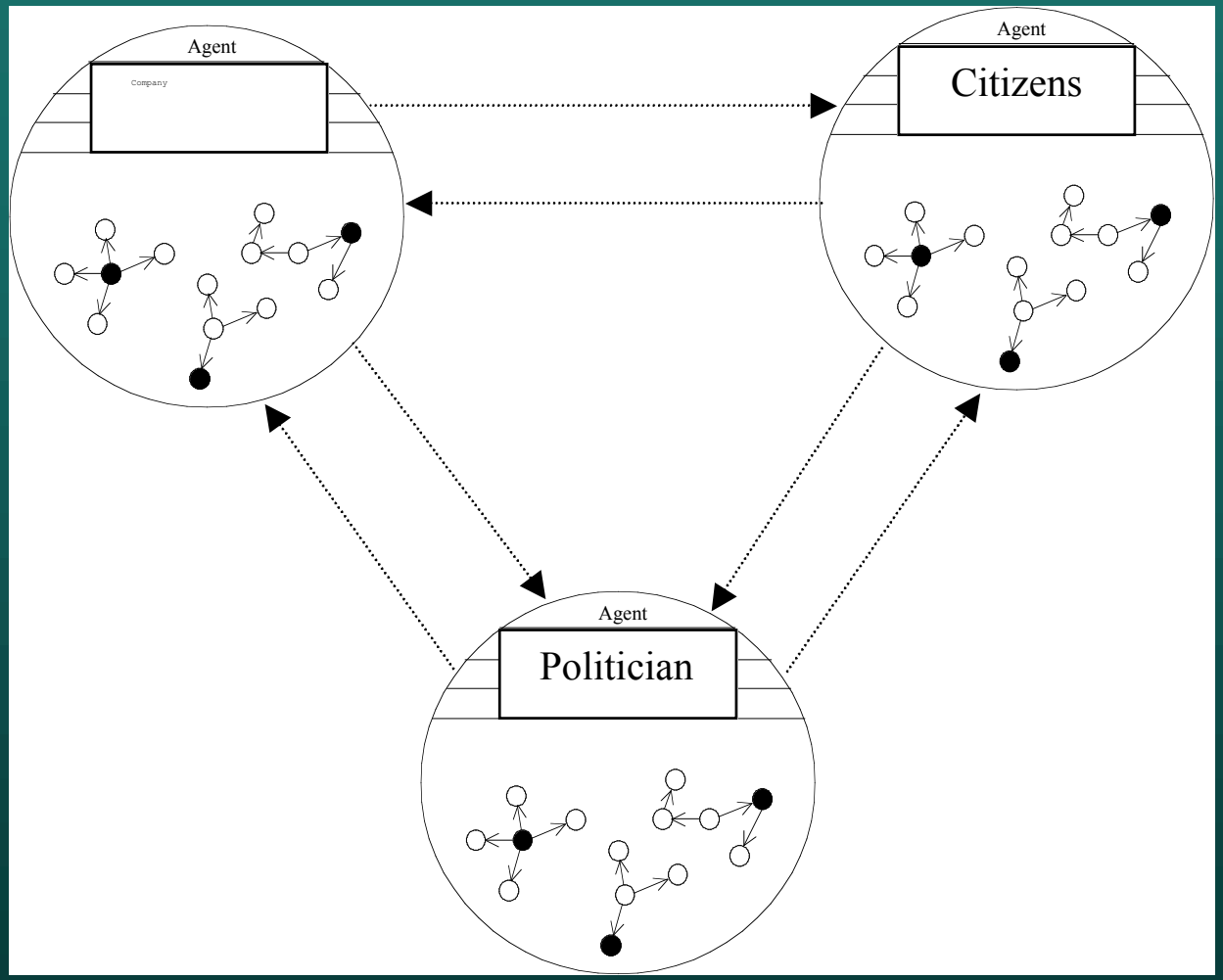
Citizen – max env but keep costs low (env 1.5, cost –1)



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



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)

Example run continued (output)

```
>>> 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
---

Action phase:

The politician (Politician):
 the politician tries a popularity campaign (Pop-Campaign)

Example run continued (output)

>>> Iteration 4

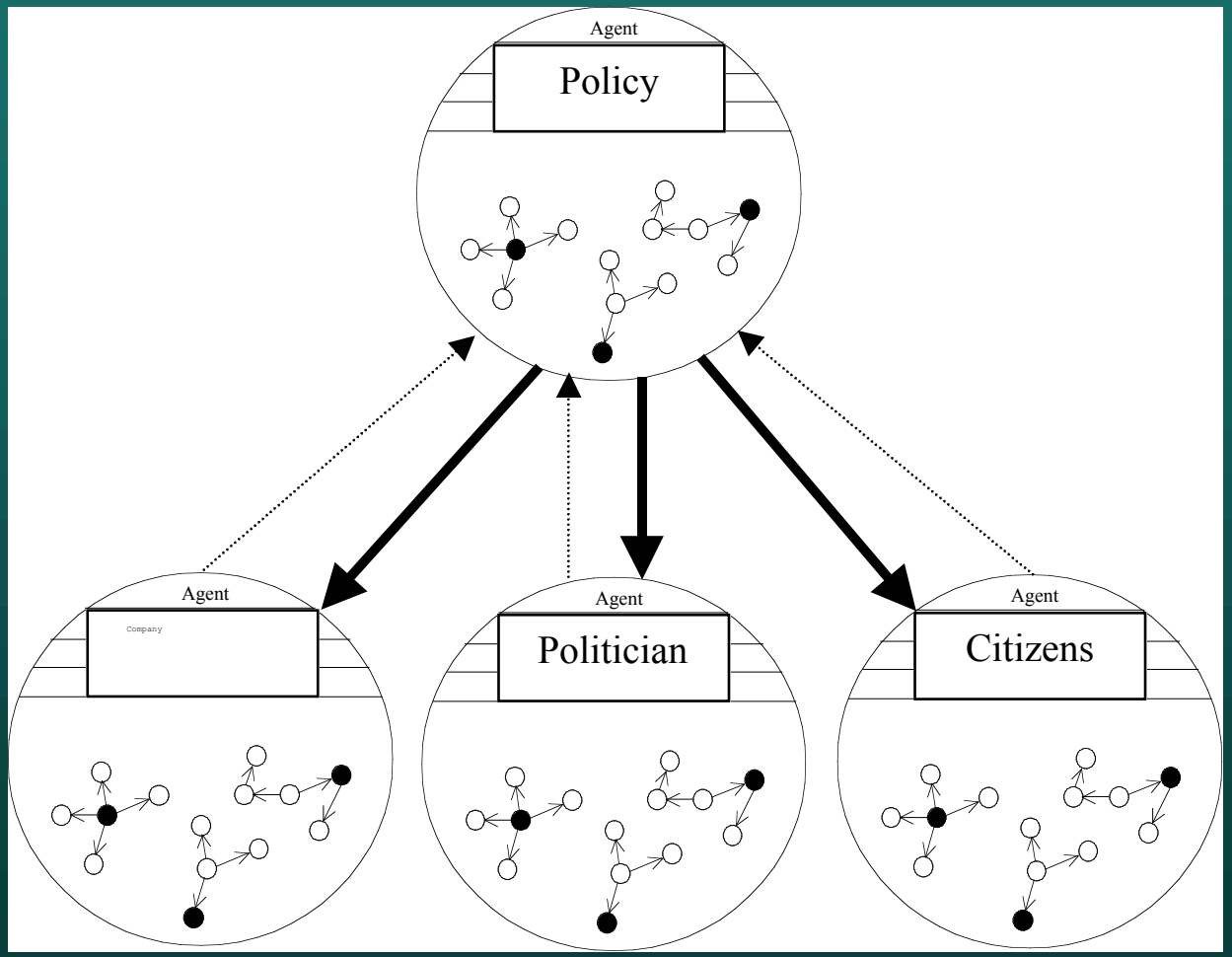
Perception phase:

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:

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 it's 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 futher proposals
 we are happy with the proposed plan

Example run continued (output)

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:

Policy agent says to Company agent: please perform action Donation
Company agent says to Policy agent: OK.

Example run continued (output)

>>> 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 futher proposals
 we are happy with the proposed plan
The citizens (Citizen) says to the policy agent:
 we have no futher 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:

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 achived in a hiarchical way using an “internal” policy agent…..

Recursive negotiation?