

# BenSolo – Agent for ANAC Repeated Multilateral Negotiations in Arbitrary Domains

ΠΟΛΥΠΡΑΚΤΟΡΙΚΑ ΣΥΣΤΗΜΑΤΑ

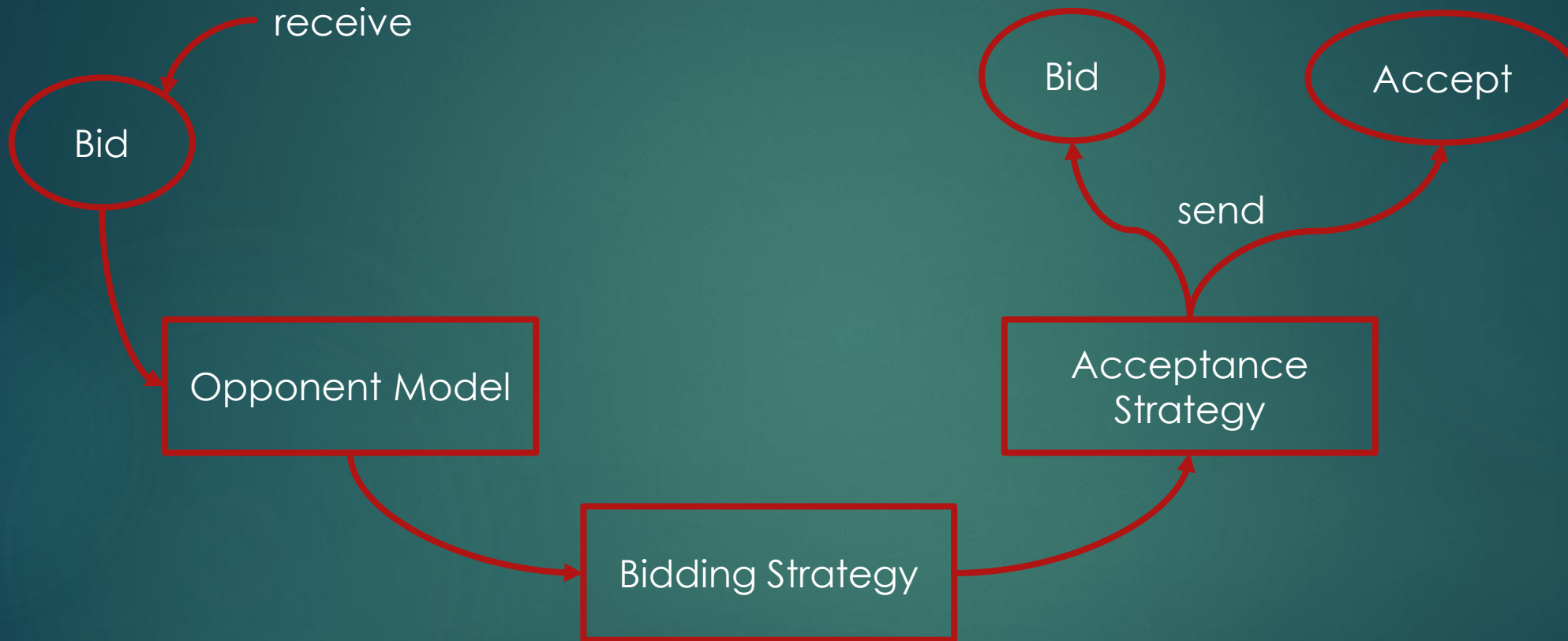
# Outline

2

- General Design
- Opponent Model
- Bidding Strategy
- Acceptance Condition
- Tests
- Conclusion & Future Work

# General Design

3



# Opponent Model

4

- Input: Set of opponent's bids + Negotiation trace
- Output: Estimated Utility

$$\text{Estimated Utility} += \text{Issue Weight} * \text{Value Weight}$$

- Update every bidding round
- Similar to frequency modeling

# Bidding Strategy

At the start of the negotiation:

- Select Random bids
- Getting to know your opponent's model

Once you have a clearer image of opponent's model:

$$U_{\text{target}}(t) = (1 - U_r) * (1 - t^S) + U_r$$

$U_r$  : minimum acceptable utility

$S$  : concession shape

$t$  : negotiations timeline

- Range of bids close to the target
- Goal: Maximize opponent's minimum utility

# Acceptance Condition

6

Vastardis Giorgos, Brellas Ioannis COMP517

- In this framework it's better to accept late
- Must have an agreement

Our Very Simple Acceptance Strategy:

If Generated Bid Utility  $\leq$  Offered Bid Utility  
then Accept  
else Counter Offer

# Tests

7

Vastardis Giorgos, Brellas Ioannis COMP517

| Party Domain            | Value      |
|-------------------------|------------|
| Rounds to consensus     | 136        |
| Distance to Pareto/Nash | 0.046/0.54 |
| Social Welfare          | 2.00167    |
| BenSolo                 | 0.79451    |
| Boulware                | 0.81333    |
| Conceder                | 0.39383    |

| Smart Grid              | Value      |
|-------------------------|------------|
| Rounds to consensus     | 172        |
| Distance to Pareto/Nash | 0.0/0.4344 |
| Social Welfare          | 2.15618    |
| BenSolo                 | 0.76983    |
| Group2                  | 0.89390    |
| AgentHP                 | 0.49246    |

| Triangular Fight        | Value    |
|-------------------------|----------|
| Rounds to consensus     | 129      |
| Distance to Pareto/Nash | 0.0/0.05 |
| Social Welfare          | 0.41984  |
| BenSolo                 | 0.16148  |
| kawaii                  | 0.16148  |
| TUDMixedStrategyAgent   | 0.09689  |

| University              | Value     |
|-------------------------|-----------|
| Rounds to consensus     | 135       |
| Distance to Pareto/Nash | 0.0/0.113 |
| Social Welfare          | 2.69407   |
| BenSolo                 | 0.94094   |
| DrageKnight             | 0.95722   |
| SENGOKU                 | 0.79591   |

# Conclusion & Future Work

## Conclusion:

- Decent Performance
- Mostly Close to Optimal but not to Nash

## Future Work:

- More sophisticated acceptance strategy (e.g. bid history)
- Treat early bids as more important
- Model opponent's accepting threshold



# Thank you!