

HorizonAwareAgent: ANAC 2026 Submitted Agent for the SCML Standard Track

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Abstract

This paper describes **HorizonAwareAgent**, an autonomous negotiation agent submitted to the ANAC 2026 SCML Standard Track. In the Standard Track, contracts are executed across multiple future steps, and production capacity, inventory, future contracts, and bankruptcy risk affect each other. Therefore, this agent is designed not to optimize only the current step, but to manage future sales contracts and input inventory simultaneously.

HorizonAwareAgent uses different strategies on the sell side and the buy side. On the sell side, it actively secures future sales opportunities while avoiding delivery dates that are already filled with sales contracts and avoiding sales to partners that are forecast to go bankrupt. It also records partner cash trends from public financial reports and predicts future bankruptcy risk, restricting both sales partners and delivery dates accordingly. On the buy side, it estimates the amount of input required to fulfill exogenous output and existing sales contracts, and controls purchase quantities after accounting for inventory and existing supply contracts.

1. Introduction

Unlike the OneShot Track, in the SCML Standard Track, contracts are often scheduled for execution in future steps. A contract signed in the current step affects not only immediate profit, but also future production capacity, inventory, shortfall, storage cost, and even the counterparty’s bankruptcy risk. Therefore, a strategy that only considers the current-step need may lead to excessive future sales or insufficient inputs.

HorizonAwareAgent treats this problem as future-aware contract management. In particular, to avoid ending with excessive inventory, the agent emphasizes securing future sales contracts in advance on the sell side. Unlike many winners from 2025 and earlier, it does not restrict future sales contracts to nearby dates. Instead, it broadly accepts contracts across selectable future delivery dates and aims to maximize the total contracted sales quantity.

The agent has three main features. First, on the sell side, it considers sellable quantity, production capacity, existing sales contracts, and how filled

each future step already is, and it sends future sales offers by prioritizing dates with low existing sales. Second, it records cash histories from public financial reports and predicts each partner’s bankruptcy step by linear extrapolation, thereby avoiding future contracts with partners that are likely to go bankrupt. Third, on the buy side, it computes the input quantity required to satisfy final demand and existing sales contracts according to the agent’s production level, subtracting current inventory and existing supply contracts before making purchase proposals.

The following sections describe the design of HorizonAwareAgent in the order of sell side strategy, bankruptcy forecast, and buy side strategy.

2. The Design of HorizonAwareAgent

2.1. Sell side strategy

On the sell side, the agent uses essentially the same partner-learning-based sales strategy at the first and middle levels. At the first level, the agent sells products generated from exogenous inputs, whereas at the middle level, it purchases inputs, produces outputs, and sells them to consumers. Despite this difference, the core idea is the same: the agent sends future sales offers to consumers while distributing contracts across delivery steps based on sellable quantity and the available sales capacity of each step. The sales quantity is computed from available inventory or expected supply, current output inventory, and the quantity already sold for the target step. At the first level, the reference sellable quantity can be conceptually written as follows:

$$q_{\text{avail}} = q_{\text{exo,avg}} + I_{\text{out}} - q_{\text{sold}(t)}$$

For future sales, the agent prioritizes delivery steps with smaller already-sold quantities. In other words, rather than stacking additional contracts on dates that already have many sales, it distributes contracts to dates with remaining sales capacity. This is intended to reduce sales beyond the production capacity of each future step and thereby reduce shortfall. At the middle level, this sales strategy is coordinated with the buy side strategy, so the agent replenishes inputs only after checking future sales feasibility.

For sales offers to consumers, the agent explores using quantity and price grids. The quantity grid consists of several ratios relative to `n_lines`, or representative values such as 1, 2, 5, 8, 10. The price grid is constructed from the lower bound, middle, and upper bound of the feasible trading price range. In the early phase, the agent sends high-price and high-quantity offers as high price probes, and records accepted (`quantity`, `price`) pairs for each partner.

Once acceptance histories have accumulated, the agent computes a Pareto frontier for each partner. If a point is dominated by another accepted point with both a larger quantity and a higher price, it is removed from the candidate set. This estimates the efficient offer region that the partner has historically accepted, and normal sales offers prioritize quantities and prices near this frontier.

After high price probing and counter probing, partners are classified into `high_price_acceptor`, `counter_acceptor`, and `counter_non_acceptor`.

- `high_price_acceptor`: A partner that tends to accept high-price, large-quantity proposals as they are. The agent continues to make aggressive sales offers to this type.
- `counter_acceptor`: A partner that is unlikely to accept initial high-price offers, but responds to adjusted counter offers in price or quantity. For this type, the agent performs exploration and exploitation near the Pareto frontier.
- `counter_non_acceptor`: A partner for which the agent’s counter offers rarely lead to agreements. The agent suppresses proactive proposals to this type and cautiously accepts only partner offers that improve the score.

2.2. bankruptcy forecast

In the Standard Track, if a partner with whom the agent has signed a future contract goes bankrupt before the delivery step, the expected contract may effectively be lost. Therefore, future sales contracts must take into account whether the partner is likely to survive until the delivery date.

`HorizonAwareAgent` records the cash history of each agent from publicly available financial reports. Before the beginning of each step, it obtains the report for the current step and, if available, also collects past reports for each agent. From the recorded cash history, the agent takes the latest three observations and approximates the time trend of cash linearly.

Let the latest report points be (t_i, c_i) . The slope of cash is estimated as follows:

$$a = \frac{\text{cov}(t, c)}{\text{var}(t)}$$

If this slope is negative, the agent predicts the step at which cash reaches zero by linear extrapolation. Specifically, it computes

$$t_{\text{bankrupt}} = -\frac{b}{a}$$

and uses this as the predicted bankruptcy step. If there are fewer than three observations, or if the slope is nonnegative, no bankruptcy step is predicted.

The bankruptcy forecast is mainly used to select delivery dates for future sell offers. If a predicted bankruptcy step exists for a partner, the agent does not send a sales offer whose delivery step is after that prediction. In other words, it only permits delivery steps satisfying

$$t_{\text{deliver}} \leq t_{\text{bankrupt}}$$

This condition avoids signing contracts with distant delivery dates with partners that are likely to go bankrupt in the future.

This bankruptcy forecast is a very simple linear model and is not intended to precisely predict long-term financial conditions. However, because the execution

risk of distant future contracts is important in the Standard Track, it functions as a lightweight filter that at least avoids partners whose cash is rapidly decreasing.

2.3. Buy side strategy

The goal of the buy side strategy is to secure the inputs required to fulfill future sales contracts and exogenous output. However, since the amount supplied by terminal suppliers is generally larger than the amount consumed by terminal consumers, the agent does not adopt a buy side strategy as complex as its sales strategy. Buying too much input can create inventory costs and unnecessary capital lock-in. Therefore, `HorizonAwareAgent` determines purchase quantities by considering current input inventory, already signed supply contracts, output inventory, and existing sales contracts.

The required input quantity is computed from the quantity of sales contracts, the quantity required to fulfill exogenous output, current output inventory, current input inventory, already signed supply contracts, and the production-capacity upper bound given by `n_lines`. Conceptually, it can be written as follows:

$$q_{\text{in,need}} = q_{\text{target}} + q_{\text{out,short}} - I_{\text{in}} - q_{\text{sup,contract}}$$

Here, `target` represents the target quantity needed to fulfill sales either in the future or on the current day, while `output_shortfall` represents the portion of sales that cannot be covered by the current output inventory. If the agent already has sufficient input inventory or supply contracts for the same step, that amount is subtracted from the purchase need.

On the supplier side, the agent suppresses future supplier offers and focuses on supplier negotiations for the current step. In purchase proposals, it prioritizes securing inputs and may use high prices that are favorable to suppliers. This is done to ensure that downstream sales contracts can be fulfilled.

Buy side acceptance is basically performed by a subset scan that selects an offer set close to the need. For supplier offers in the current step, the agent enumerates subsets and searches for the set whose difference from the current need is smallest. It avoids sets that greatly exceed the need, and if a good set is found, it accepts it. If remaining need still exists after acceptance, the agent counters the remaining suppliers. Counter offers are also centered on the current step, so that unnecessary future input contracts do not accumulate.

With this buy side strategy, `HorizonAwareAgent` aims to avoid production failures caused by input shortage while also avoiding excessive input inventory.

3. Evaluation

As the final evaluation, a heavy tournament for SCML Standard was conducted. In the experiment, `HorizonAwareAgent` was compared with `PenguinAgent`, the winning agent of SCML 2024, and several top agents from SCML 2025 Standard.

1. Competition track: SCML Standard
2. Agent: `HorizonAwareAgent`
3. Number of configurations: 100

4. Number of runs per world: 15
5. Number of worlds: 7500
6. Number of scores: 37500
7. Number of steps: 51–199
8. Competitors: HorizonAwareAgent, PenguinAgent, AS0, UltraSuperMiracle-SoraFinalAgentZ, XenoSotaAgent

Agent	Average Score
HorizonAwareAgent	1.04694
PenguinAgent	0.976929
AS0	0.974369
UltraSuperMiracleSoraFinalAgentZ	0.910604
XenoSotaAgent	0.895816

Table 1: Average score in the heavy tournament. HorizonAwareAgent achieved the highest average score in an evaluation of 7500 worlds and 37500 scores.

In this result, HorizonAwareAgent achieved the highest average score among the compared agents. In particular, it outperformed PenguinAgent and AS0 by about 0.07 points, indicating that the combination of future sales-capacity management, partner-specific sales learning, and bankruptcy forecasting was effective.