AppNexus Programmable Bidder

AppNexus Programmable Bidder

> This offering is currently in Alpha and available to a limited set of clients. For more information about the AppNexus Programmable Bidder and potential use cases that may apply to your business, reach out to your AppNexus representative.

The **AppNexus Programmable Bidder** empowers you to create your own custom predictive models and upload them directly to our open platform. Using the AppNexus Programmable Bidder, you can:

- Have your data scientists write predictive models in Bonsai, a high-level domain-specific language (DSL) that's very similar to the popular Python language
- Validate and upload your models via our API and assign them to campaigns via our API or UI
- Run your models on our bidders and benefit from our infrastructure's speed, scale, reliability, and lower costs

This page helps you get started.

On This Page

Custom Model Types

Currently, it's possible to create two types of custom predictive models:

Bid Price

The Bid Price model uses a decision tree to determine a campaign's CPM bid. This type of model serves as a campaign's third-party buying strategy, in place of standard CPM strategies like "Bid a Base CPM" or "Optimize to a % Margin".

Bid Modifier

The Bid Modifier model uses a decision tree to adjust a campaign's optimization-derived CPM bid up or down. This type of model is used in conjunction with an AppNexus optimization-based buying strategy like "Optimize to a predicted CPA goal" or "Optimize to a predicted CPC goal".

> The bids calculated by the model are always expressed in the currency set on the advertiser, even if you have specified a different currency for the line item or campaign.

Workflow

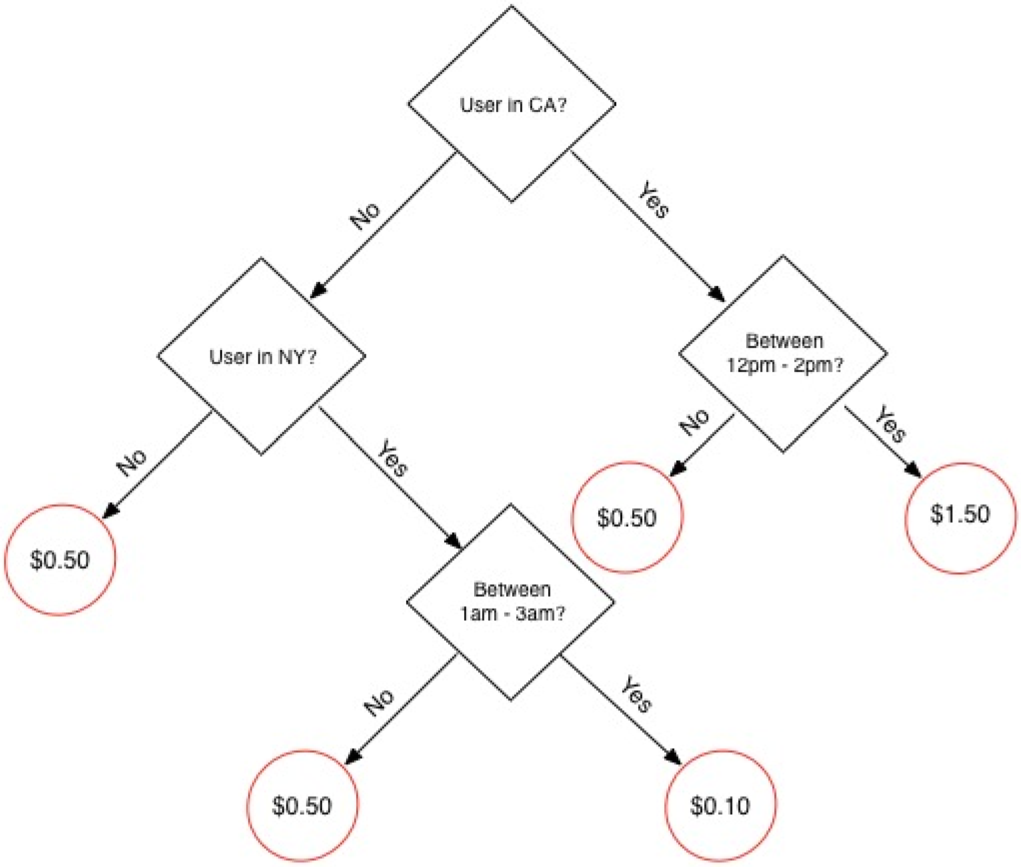
The Alpha workflow requires using the Console API. Alpha clients are expected to have completed our API Onboarding Process before getting started.

Step 1. Identify Your Requirements

You will write your custom model as a decision tree, where branches of the tree express conditions that lead to specific outputs (bid prices in the case of a Bid Price Model and bid multipliers in the case of a Bid Modifier Model). The conditions can be based on a set of AppNexus features and feature values. Before writing your tree:

- Take a close look at the Bonsai Features that are available.
- Sketch how you want to use tree features to determine outputs.
- Be sure to take advantage of AppNexus reporting data in identifying the right features and values:
  - Standard Console Reporting (customer login required)
  - Log-Level Data Feeds (customer login required)

>> Example: Decision tree for bid pricing



Use custom models for pricing, not targeting
Use custom models to determine how to price impressions, not how to target them. For targeting impressions, you should continue to use the **Targeting** section of campaign setup in the UI or the Profile Service for targeting via the API.

Step 2. Create Your Decision Tree

Once you know the features and steps you want to follow to price or modify bids for a campaign, write them as a decision tree in our Bonsai Language. Use the examples on that page as well as the simple example below to jumpstart your understanding of how to write your tree.

> **Use tabs for indentation, not spaces**
> In Bonsai, indentation is used to group expressions (similar to Python). Be sure to use **tabs** to indicate line indentation. Spaces are not currently supported.

>> Example: Bonsai tree for bid pricing

> Lines beginning with # are comments to help you understand the logic of this tree.

```
# This tree determines a bid price as follows:
# 1. If the user is in California, and the hour is between 12pm and 14pm there, bid
$1.50.
# 2. If the user is in New York, and the hour is between 1am and 3am there, bid $0.10.
# 3. Otherwise, bid $0.50.

if every region = "US:CA", user_hour range (12,14):
 1.5
elif every region = "US:NY", user_hour range (1,3):
 0.1
else:
 0.5
```

Step 3. Encode Your Decision Tree

Base64-encode your decision tree.

>> Example: Base64-encoded

```
IyBUaGlzIHRyZWUgZGV0ZXJtaW5lcyBhIGJpZCBwcmljZSBhcyBmb2xsb3dzOgojIDEuIElmIHRoZSB1c2VyIG
lzIGluIENhbGlmb3JuaWEsIGFuZCB0aGUgaG91ciBpcyBiZXR3ZWVuIDEycG0gYW5kIDE0cG0gdGhlcmUsIGJp
ZCAkMS41MC4KIyAyLiBJZiB0aGUgdXNlciBpcyBpbiBOZXcgWW9yaywgYW5kIHRoZSBob3VyIGlzIGJldHdlZW
4gMWFtIGFuZCAzYW0gdGhlcmUsIGJpZCAkMC4xMC4KIyAzLiBPdGhlcndpc2UsIGJpZCAkMC41MC4KCmlmIGV2
ZXJ5IHJlZ2lvbiA9ICJVUzpDQSIsIHVzZXJfaG91ciByYW5nZSAoMTIsMTQpOgoJMS41CmVsaWYgZXZlcnkgcm
VnaW9uID0gIlVTOk5ZIiwgdXNlcl9ob3VyIHJhbmdlICgxLDMpOgoJMC4xCmVsc2U6CgkwLjU=
```

Step 4. Check Your Decision Tree for Errors

Use the Custom Model Parser Service to check the validity of your decision tree.

- In the JSON request, put your base64-encoded tree in the `model_text` field as a string.
- If there are errors, use the `error` field in the response to help you identify and resolve Bonsai syntax or feature errors. See Error Messages for guidance.
- If there are no errors, the `size` field in the response shows you the size of your tree in Lisp, which is the format that AppNexus stores trees. Make sure the `size` is less than 3MB, or 3,145,728 bytes.

> If the tree is larger than 3MB, you will not be able to add the tree.

>> Example: JSON file containing your base64-encoded tree

```
$ cat check_tree.json

{
    "custom-model-parser": {
  "model_text":
"IyBUaGlzIHRyZWUgZGV0ZXJtaW5lcyBhIGJpZCBwcmljZSBhcyBmb2xsb3dzOgojIDEuIElmIHRoZSB1c2VyI
GlzIGluIENhbGlmb3JuaWEsIGFuZCB0aGUgaG91ciBpcyBiZXR3ZWVuIDEycG0gYW5kIDE0cG0gdGhlcmUsIGJ
pZCAkMS41MC4KIyAyLiBJZiB0aGUgdXNlciBpcyBpbiBOZXcgWW9yaywgYW5kIHRoZSBob3VyIGlzIGJldHdlZ
W4gMWFtIGFuZCAzYW0gdGhlcmUsIGJpZCAkMC4xMC4KIyAzLiBPdGhlcndpc2UsIGJpZCAkMC41MC4KCmlmIGV
2ZXJ5IHJlZ2lvbiA9ICJVUzpDQSIsIHVzZXJfaG91ciByYW5nZSAoMTIsMTQpOgoJMS41CmVsaWYgZXZlcnkgc
mVnaW9uID0gIlVTOk5ZIiwgdXNlcl9ob3VyIHJhbmdlICgxLDMpOgoJMC4xCmVsc2U6CgkwLjU="
    }
}
```

>> Example: POST to the custom-model-parser service

```
$ curl -b cookies -c cookies -X POST -d @check_tree.json
'https://api.appnexus.com/custom-model-parser'

{
    "response": {
        "service": "custom-model-parser",
        "method": "post",
        "custom-model-parser": {
            "model_text": "(if (and (region = 3922) (user_hour range 12 14)) 1.5 (if
(and (region = 3950) (user_hour range 1 3)) 0.1 0.5))",
            "size": 111
        },
        "dbg_info": {
            "instance": "62.bm-hbapi.prod.nym2",
            "slave_hit": false,
            "db": "master",
            "user::reads": 0,
            "user::read_limit": 100,
            "user::read_limit_seconds": 0,
            "user::writes": 1,
            "user::write_limit": 60,
            "user::write_limit_seconds": 0,
            "reads": 0,
            "read_limit": 100,
            "read_limit_seconds": 0,
            "writes": 0,
            "write_limit": 60,
            "write_limit_seconds": 0,
            "awesomesauce_cache_used": false,
            "count_cache_used": false,
            "warnings": [
            ],
            "time": 1111.7432117462,
            "start_microtime": 1441225225.4388,
            "version": "1.16.151",
            "slave_lag": 1,
            "member_last_modified_age": 1441225225,
            "output_term": "not_found"
        }
    }
}
```

Step 5. Add Your Decision Tree as a Custom Model

Once you've confirmed that your tree is valid, use the Custom Model Service to add your encoded decision tree to AppNexus. Be sure to:

- Set the correct custom model type in the `model_output` field:
    - For a Bid Price model, use `"bid"`.
    - For a Bid Modifier model, use `"bid_modifier"`.
- Put your base64-encoded tree in the `model_text` field as a string.
- Provide a unique `name`. This is required and will make it easier to select the correct model in the UI.
- Provide the `advertiser_id` to which the custom model belongs. You will be able to use the model only in campaigns under this advertiser.

>> Example: JSON file defining your custom model

```
$ cat custom_model.json

{
    "custom_model": {
     "name": "Bid by Region/Hour of Day",
     "member_id": 958,
        "advertiser_id": 39776,
        "custom_model_structure": "decision_tree",
        "model_output": "bid",
  "model_text":
"aWYgZXZlcnkgZGV2aWNlX3R5cGUgPSAiT3RoZXJzIChpbmNsdWRpbmcgUEMpIiwgdXNlcl9ob3VyIHJhbmdlI
Cg5LDE4KToKCTEuNQplbGlmIGV2ZXJ5IGRldmljZV90eXBlIGluICgiVGFibGV0IiwgIlBob25lIiksIHVzZXJ
faG91ciBpbiAoNSw2LDcsOCwxOSwyMCwyMSwyMik6CgkyCmVsc2U6CgkwLjU="
    }
}
```

>> Example: POST to `custom-model` service

```
$ curl -b cookies -c cookies -X POST -d @custom_model.json
'https://api.appnexus.com/custom-model'

{
    "response": {
        "status": "OK",
        "count": 1,
        "id": "329",
        "start_element": 0,
        "num_elements": 100,
        "custom_model": {
            "id": 329,
            "name": "Bid by Region/Hour of Day",
            "member_id": 958,
            "advertiser_id": 39776,
            "custom_model_structure": "decision_tree",
            "model_output": "bid",
            "model_text":
"aWYgZXZlcnkgcmVnaW9uID0gIlVTOkNBIiwgdXNlcl9ob3VyIHJhbmdlICgxMiwxNCk6CgkxLjUKZWxpZiBld
mVyeSByZWdpb24gPSAiVVM6TlkiLCB1c2VyX2hvdXIgcmFuZ2UgKDEsMyk6CgkwLjEKZWxzZToKCTAuNQ=",
            "original_text": "if every region = \"US:CA\", user_hour range
(12,14):\n\t1.5\nelif every region = \"US:NY\", user_hour range
(1,3):\n\t0.1\nelse:\n\t0.5",
            "active": true,
            "last_modified": "2015-09-22 20:52:53"
        },
        "dbg_info": {
            "instance": "64.bm-hbapi.prod.nym2",
            "slave_hit": true,
            "db": "10.3.129.206",
            "awesomesauce_cache_used": false,
            "count_cache_used": false,
            "warnings": [
            ],
            "time": 39.799213409424,
            "start_microtime": 1438028779.7596,
            "version": "1.15.572",
            "slave_lag": 0,
            "member_last_modified_age": 21425,
            "output_term": "custom_model"
        }
    }
}
```

Step 6. Assign Your Custom Model to a Campaign

This step changes depending on the type of custom model you are using and whether you're using the API or UI to assign your model to a campaign. Expand the relevant option below for instructions.

Bid Price Model

>> Using the API

Use the Campaign Service to assign your custom model to a campaign. Be sure to:

- Set `cpm_bid_type` to `"custom_model"`.
- Provide the `id` of your custom model in the `bid_model` object.
- Set `inventory_type` to `"real_time"`.

JSON file defining your campaign

```
$ cat campaign.json

{
    "campaign": {
     "name": "Custom Model Campaign - Bid by Region/Hour of Day",
        "cpm_bid_type": "custom_model",
        "bid_model": {
   "id": 329
  },
        "line_item_id": 34287,
  "inventory_type": "real_time"
    }
}
```

POST to campaign service

```
$ curl -b cookies -c cookies -X POST -d @campaign.json
'https://api.appnexus.com/campaign?advertiser_id=45278'

{
    "response": {
        "status": "OK",
        "count": 1,
        "start_element": 0,
        "num_elements": 100,
        "campaign": {
            "id": 9061978,
            "state": "active",
            "parent_inactive": false,
            "code": null,
            "advertiser_id": 45278,
            "line_item_id": 34287,
            "creative_id": null,
            "pixel_id": null,
            "short_name": null,
            "name": "Custom Model Campaign - Bid Based on Region/Hour of Day",
            "profile_id": 31746900,
            "start_date": "2015-06-03 00:00:00",
            "end_date": null,
            "timezone": "EST5EDT",
            "priority": 5,
            "cadence_modifier_enabled": false,
            "cpc_goal": null,
            "cpm_bid_type": "custom_model",
            "base_bid": 0,
            "min_bid": null,
            "max_bid": null,
            "bid_margin": 0,
            "roadblock_creatives": false,
            "roadblock_type": "no_roadblock",
            "inventory_type": "real_time",
            "last_modified": "2015-06-03 16:25:15",
            "max_learn_bid": null,
            "cadence_type": "advertiser",
            "member_id": 958,
            "click_url": null,
            "require_cookie_for_tracking": true,
            "allow_unverified_ecp": false,
            "defer_to_li_prediction": false,
            "ecp_learn_divisor": null,
            "projected_learn_events": null,
            "learn_threshold": 3,
            "cpc_payout": null,
            "comments": null,
            "optimization_version": "v7",
            "learn_override_type": null,
            "base_cpm_bid_value": null,
            "impression_limit": null,
            "bid_multiplier": null,
            "remaining_days": null,
            "total_days": null,
            "supply_type_action": "exclude",
            "supply_type": null,
            "creatives": null,
            "pixels": null,
            "optimization_lookback": null,
            "campaign_modifiers": null,
            "labels": null,
            "broker_fees": null,
            "valuation": null,
            "bid_model": {
                "id": 329,
                "name": "Bid Based on Region/Hour of Day",
                "active": "1"
            },
            "lifetime_budget": null,
            "lifetime_budget_imps": null,
            "daily_budget": null,
            "daily_budget_imps": null,
            "enable_pacing": null,
            "allow_safety_pacing": null,
            "lifetime_pacing": null,
            "lifetime_pacing_span": null
        },
        "dbg_info": {
            "instance": "61.bm-hbapi.prod.nym2",
            "slave_hit": true,
            "db": "10.3.129.211",
            "awesomesauce_cache_used": false,
            "count_cache_used": false,
            "warnings": [
            ],
            "time": 48.674821853638,
            "start_microtime": 1436503279.2047,
            "version": "1.15.558",
            "slave_lag": 0,
            "member_last_modified_age": 1395,
            "output_term": "campaign"
        }
    }
}
```

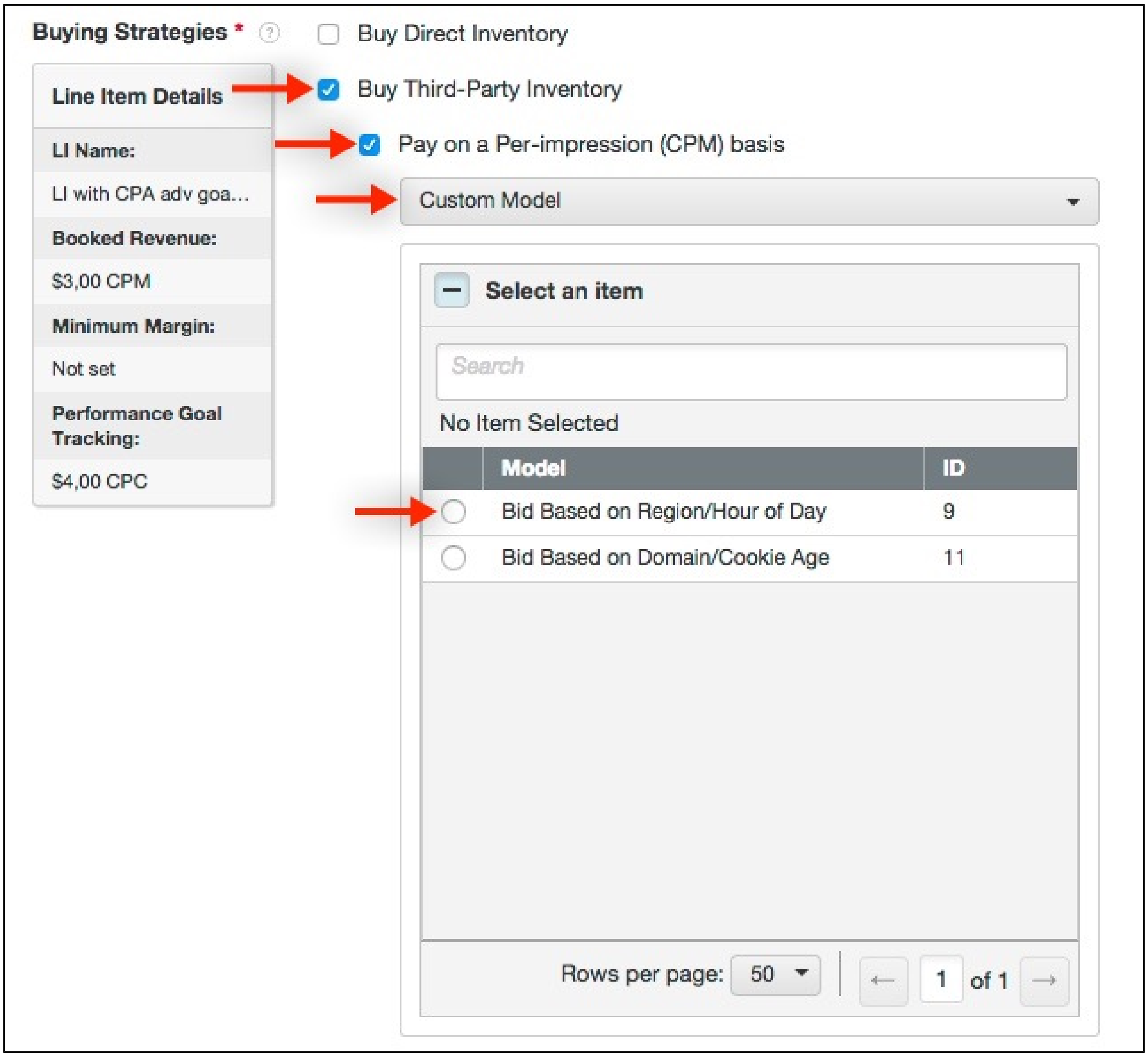
>> Using the UI

When you set up your campaign in Console, set your **Buying Strategy** as follows:

1. Check **Buy Third-Party Inventory**.

> Make sure that **Buy Direct Inventory** is NOT checked; custom models are supported for third-party buying only, not for direct buying.

2. Check **Pay on a Per-impression (CPM) basis**.
3. Select **Custom Model** from the drop-down.
4. Choose the relevant model.



Buying Strategies *

☐ Buy Direct Inventory

☑ Buy Third-Party Inventory

☑ Pay on a Per-impression (CPM) basis

Custom Model

Line Item Details

LI Name:	LI with CPA adv goa...
Booked Revenue:	$3,00 CPM
Minimum Margin:	Not set
Performance Goal Tracking:	$4,00 CPC

Select an item

Search

No Item Selected

	Model	ID
○	Bid Based on Region/Hour of Day	9
○	Bid Based on Domain/Cookie Age	11

Rows per page: 50 ← 1 of 1 →

Bid Modifier Model

>> Using the API

Use the Campaign Service to assign your custom model to a campaign. Be sure to:

- Set `cpm_bid_type` to an optimization-based buying strategy (`"predicted"` or `"margin"`) and any corresponding required fields.
    - In the JSON below, for example, we set `cpm_bid_type` to `"predicted"` and `cpc_click_goal` to `1.00` to optimize CPM bids to a predicted $1.00 CPC goal.
- In the `bid_modifier_model` object, provide the `id` of the custom model that will modify the campaign's CPM bids.
- Set `inventory_type` to `"real_time"`.

JSON file defining your campaign

```
$ cat campaign.json

{
    "campaign": {
        "name": "Custom Model Campaign - Modify Bid Based on Region/Hour of Day",
        "cpm_bid_type": “predicted”,
        “cpc_goal”: 1.00,
        "bid_modifier_model": {
            "id": 148
        },
        "line_item_id": 34287,
        "inventory_type": "real_time"
    }
}
```

POST to campaign service

```
$ curl -b cookies -c cookies -X POST -d @campaign.json
'https://api.appnexus.com/campaign?advertiser_id=45278'

{
    "response": {
        "status": "OK",
        "count": 1,
        "id": 10101640,
        "start_element": 0,
        "num_elements": 100,
        "campaign": {
            "id": 10101640,
            "state": "inactive",
            "parent_inactive": false,
            "code": null,
            "advertiser_id": 45278,
            "line_item_id": 34287,
            "creative_id": null,
            "pixel_id": null,
            "short_name": null,
            "name": "Custom Model Campaign - Modify Bid Based on Region/Hour of Day",
            "profile_id": null,
            "start_date": null,
            "end_date": null,
            "timezone": "EST5EDT",
            "priority": 5,
        "cadence_modifier_enabled": true,
        "cpc_goal": 1,
        "cpm_bid_type": "predicted",
        "base_bid": null,
        "min_bid": null,
        "max_bid": null,
        "bid_margin": 0,
        "roadblock_creatives": false,
        "roadblock_type": "no_roadblock",
        "inventory_type": "real_time",
        "last_modified": "2015-08-10 20:59:49",
        "max_learn_bid": null,
        "cadence_type": "advertiser",
        "member_id": 958,
        "click_url": null,
        "require_cookie_for_tracking": true,
        "allow_unverified_ecp": false,
        "defer_to_li_prediction": false,
        "ecp_learn_divisor": null,
        "projected_learn_events": null,
        "learn_threshold": 3,
        "cpc_payout": null,
        "comments": null,
        "optimization_version": "v7",
        "learn_override_type": null,
        "base_cpm_bid_value": null,
        "impression_limit": 40000,
        "bid_multiplier": 1,
        "remaining_days": null,
        "total_days": null,
        "supply_type_action": null,
        "supply_type": null,
        "creatives": null,
        "pixels": null,
        "optimization_lookback": null,
        "campaign_modifiers": null,
        "labels": null,
        "broker_fees": null,
        "valuation": null,
        "bid_model": null,
        "bid_modifier_model": {
            "id": 148,
            "name": "Modify Bid Based on Region/Hour of Day",
            "active": "1"
        },
        "lifetime_budget": null,
        "lifetime_budget_imps": null,
        "daily_budget": null,
        "daily_budget_imps": null,
        "enable_pacing": null,
        "allow_safety_pacing": null,
        "lifetime_pacing": null,
        "lifetime_pacing_span": null
    },
    "dbg_info": {
        "instance": "64.bm-hbapi.prod.nym2",
        "slave_hit": false,
        "db": "master",
        "awesomesauce_cache_used": false,
        "count_cache_used": false,
        "warnings": [
        ],
        "time": 1010.1411342621,
        "start_microtime": 1439240389.0273,
        "version": "1.15.580",
        "slave_lag": 0,
        "member_last_modified_age": 1439240389,
        "output_term": "campaign"
        }
    }
}
```

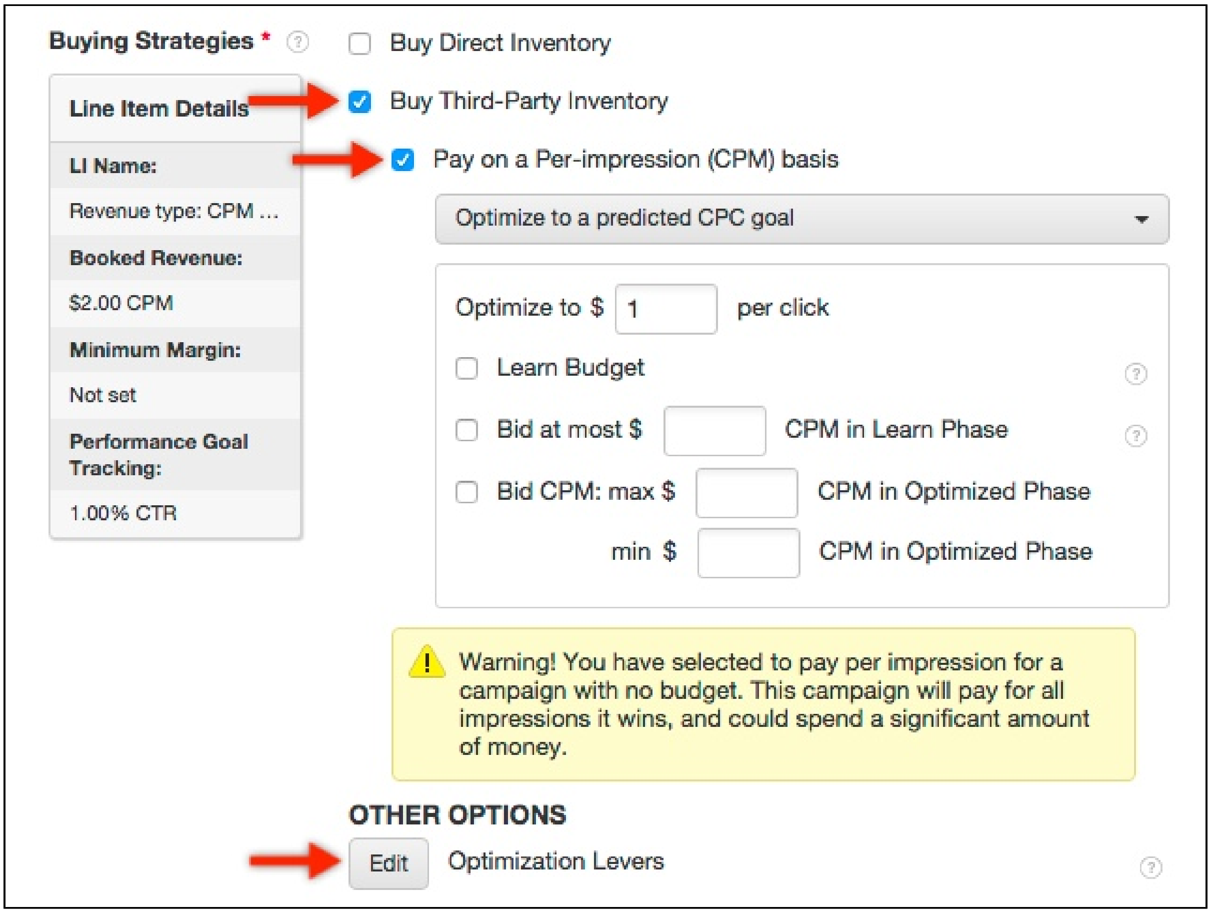
>> Using the UI

When you set up your campaign in Console, set your **Buying Strategy** as follows:

1. Check **Buy Third-Party Inventory**.

   > Make sure that **Buy Direct Inventory** is NOT checked; custom models are supported for third-party buying only, not for direct buying.

2. Check **Pay on a Per-impression (CPM) basis**.
3. Select an AppNexus optimization-based buying strategy such as "Optimize to a predicted CPA Goal" or "Optimize to a predicted CPC Goal" and enter the corresponding required fields.
   - In the example below, we've selected **Optimize to a predicted CPC goal** and set $**1.00** as the goal to optimize to.
4. Click **Optimization Levers**.



Buying Strategies * ?

□ Buy Direct Inventory

☑ Buy Third-Party Inventory

☑ Pay on a Per-impression (CPM) basis

Optimize to a predicted CPC goal

Optimize to $ 1 per click

□ Learn Budget

□ Bid at most $ CPM in Learn Phase

□ Bid CPM: max $ CPM in Optimized Phase

min $ CPM in Optimized Phase

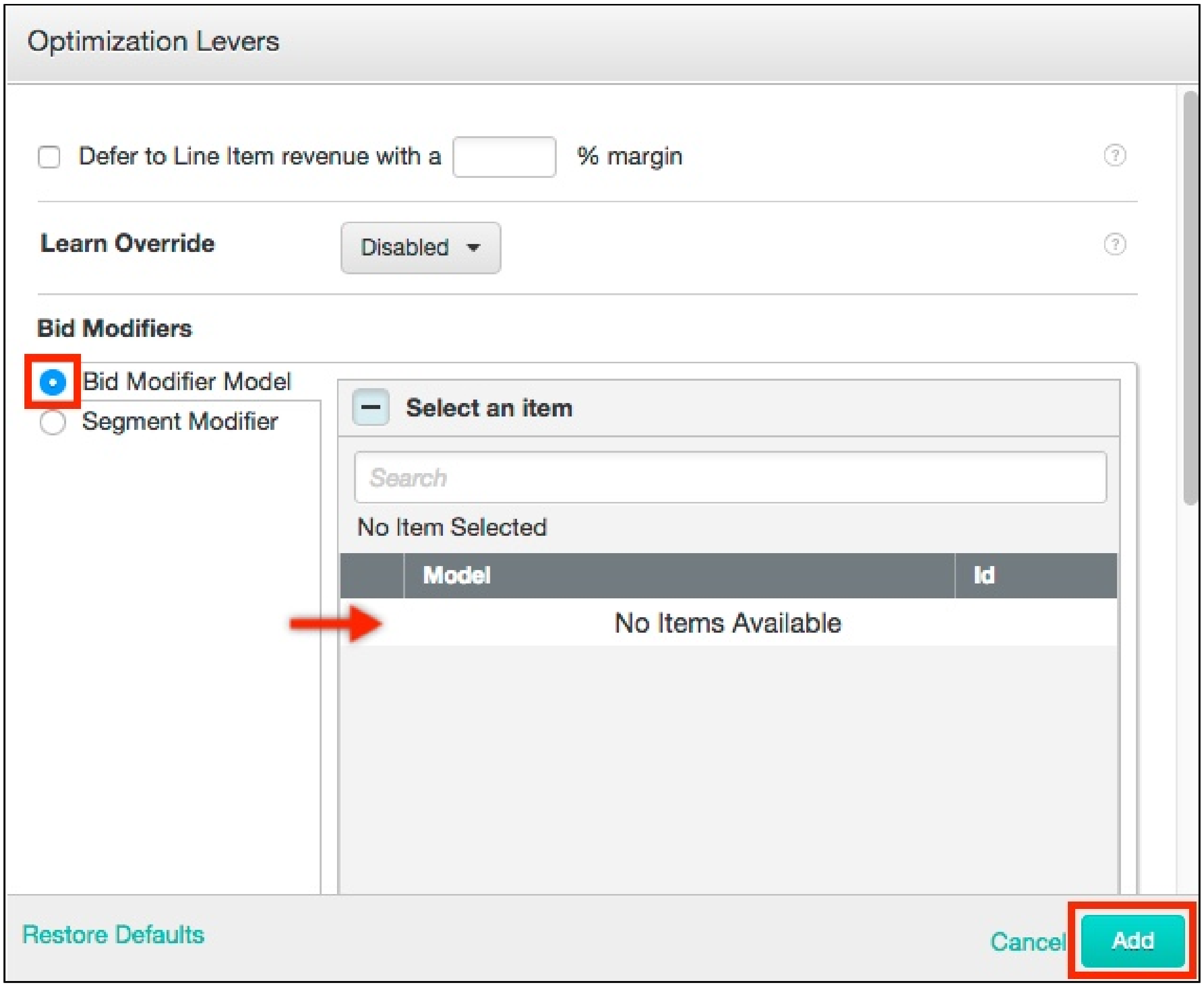
Warning! You have selected to pay per impression for a campaign with no budget. This campaign will pay for all impressions it wins, and could spend a significant amount of money.

OTHER OPTIONS

Edit Optimization Levers

Line Item Details
LI Name:
Revenue type: CPM ...
Booked Revenue:
$2.00 CPM
Minimum Margin:
Not set
Performance Goal Tracking:
1.00% CTR

5. In the **Optimization Levers** dialog:
   a. Select **Bid Modifier Model**.
   b. Choose the custom model that will modify the campaign's optimization-based CPM bids.
   c. Click **Add**.



Optimization Levers

□ Defer to Line Item revenue with a % margin

Learn Override: Disabled

Bid Modifiers

● Bid Modifier Model

○ Segment Modifier

Select an item

No Item Selected

Model	Id
No Items Available	

Related Topics

- Bonsai Features
- The Bonsai Language
- Custom Model Parser Service
- Custom Model Service
- Campaign Service