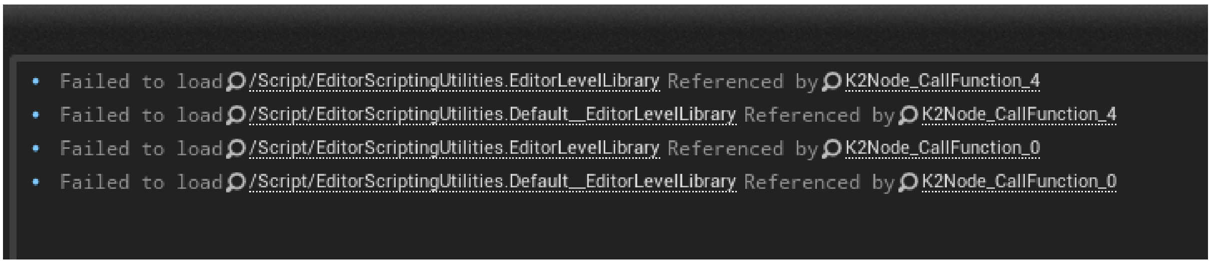
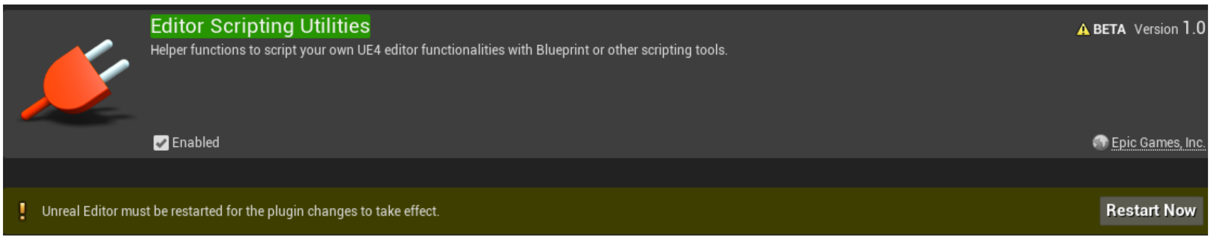
Notes

!!! If you open AI Tools in 4.26 or 4.27 the following errors appear
This is because by default, in 4.26 and 4.27, Editor Scripting Utilities plugin is disabled and the function library is not available. In 4.25 the plugin is enabled by default.
Please, enable the plugin and restart the project. The errors will disappear.



```
• Failed to load /Script/EditorScriptingUtilities.EditorLevelLibrary Referenced by K2Node_CallFunction_4
• Failed to load /Script/EditorScriptingUtilities.Default__EditorLevelLibrary Referenced by K2Node_CallFunction_4
• Failed to load /Script/EditorScriptingUtilities.EditorLevelLibrary Referenced by K2Node_CallFunction_0
• Failed to load /Script/EditorScriptingUtilities.Default__EditorLevelLibrary Referenced by K2Node_CallFunction_0
```



Editor Scripting Utilities

Helper functions to script your own UE4 editor functionalities with Blueprint or other scripting tools.

BETA Version 1.0

☑ Enabled

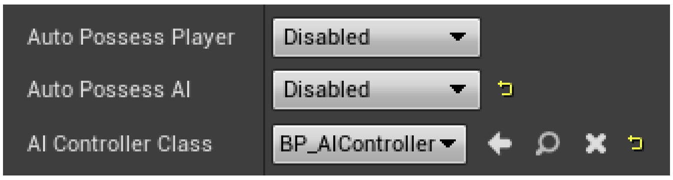
Epic Games, Inc.

! Unreal Editor must be restarted for the plugin changes to take effect.

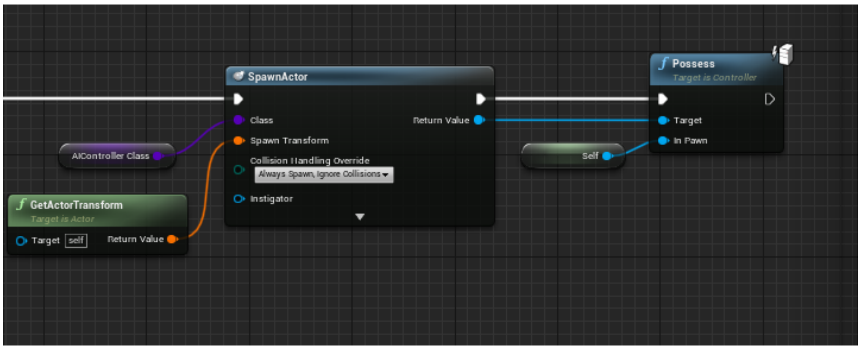
!!! If your AI uses RVO avoidance, turn off RVO when AI is killed, otherwise, even if you turn off collision, player and other AI will still collide with the capsule.

!!! In order to AI avoid Player, you need to turn on RVO for Player too.

!!! AI uses a Custom Controller, set **Auto Possess AI** parameter = Disabled. After AI receives all info about itself (Initialize Event), OnPossess event is manually called.



Auto Possess Player	Disabled
Auto Possess AI	Disabled
AI Controller Class	BP_AIController



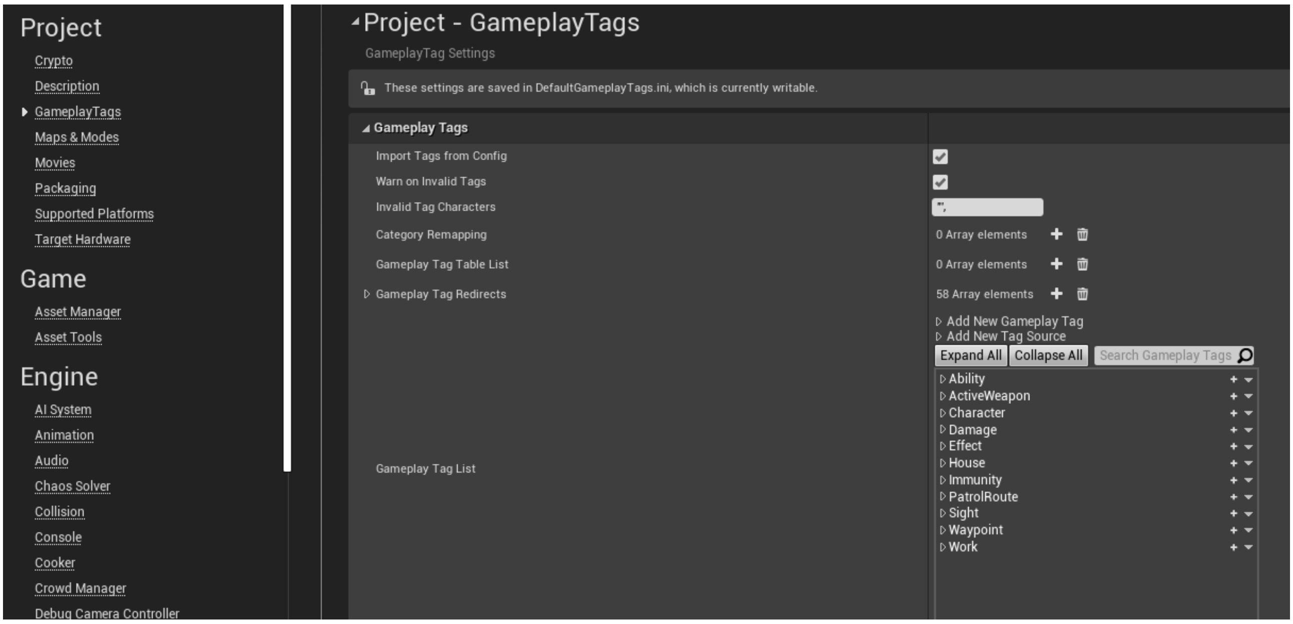
BP_AI -> Class Defaults

First Steps | How to Connect

Gameplay Tags

If you want to connect AI Tools to your Project, before you migrate it, you need to copy gameplay tags.

If you **create new project** from downloaded AI Tools content and open it, in project settings you will find Gameplay Tag List. These tags are used in gameplay logic.



Project - GameplayTags

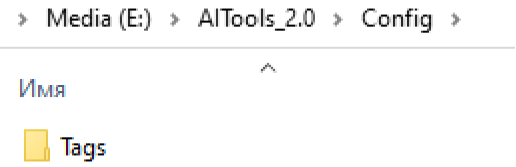
GameplayTag Settings

These settings are saved in DefaultGameplayTags.ini, which is currently writable.

Gameplay Tags

Import Tags from Config	☑
Warn on Invalid Tags	☑
Invalid Tag Characters	",
Category Remapping	0 Array elements
Gameplay Tag Table List	0 Array elements
Gameplay Tag Redirects	58 Array elements
Gameplay Tag List	Add New Gameplay Tag Add New Tag Source Ability ActiveWeapon Character Damage Effect House Immunity PatrolRoute Sight Waypoint Work

In order to copy them to your own project you need to open config folder and copy Tags folder to your project



Media (E:) > AITools_2.0 > Config >

Имя

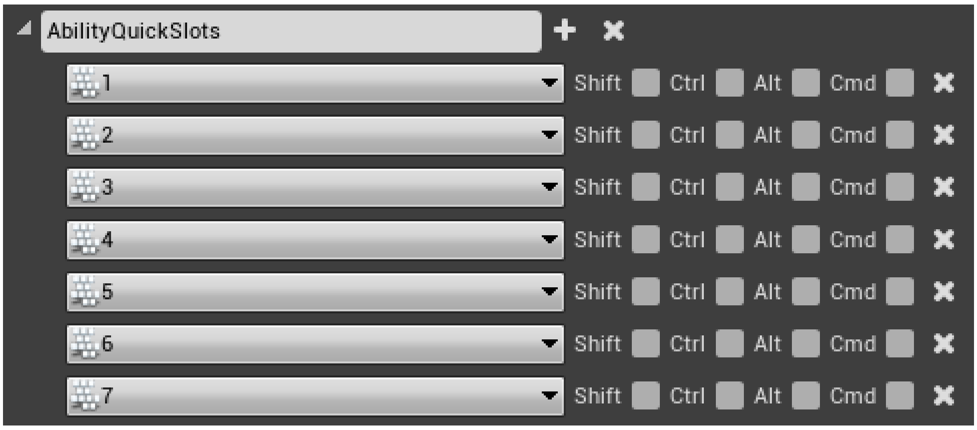
Tags

You can open your project and make sure the tags appear in project settings.

Only after this you can migrate all AI Tools content to your project.

Inputs

Project Settings -> Inputs -> Create the next inputs



AbilityQuickSlots

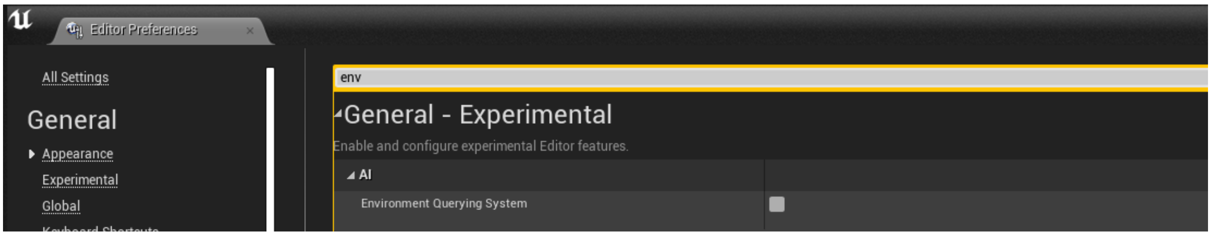
1	Shift □	Ctrl □	Alt □	Cmd □
2	Shift □	Ctrl □	Alt □	Cmd □
3	Shift □	Ctrl □	Alt □	Cmd □
4	Shift □	Ctrl □	Alt □	Cmd □
5	Shift □	Ctrl □	Alt □	Cmd □
6	Shift □	Ctrl □	Alt □	Cmd □
7	Shift □	Ctrl □	Alt □	Cmd □

AI Tools Helper

See the appropriate section.

EQS

Some AI in the project can use EQS to navigate in the world.
!!! If you have any issues related to EQS, make sure you enable EQS. Since 4.26 EQS is a plugin that is enabled by default.



env

General - Experimental

Enable and configure experimental Editor features.

AI

Environment Querying System □

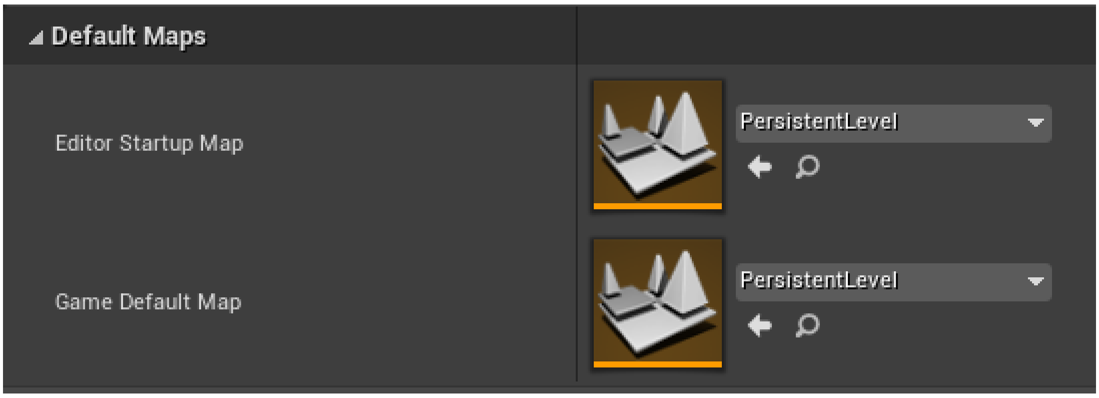
Managers

Place the next managers on Persistent Level. These managers work at runtime.
Day Night Cycle Manager determines the time of day and rotates sun.
Waypoint Manager keeps and provides fast access to all existing target waypoints. AIs use this manager to find needed Point of Interest and find a path.
AI Manager doesn't have much functionality:

- it teleports AI back to their sublevel, if sublevel where AI is in, is unloaded
- while AI is moving along the path, they are bound to **CheckPath** event
- in future I or you can add more functionality like spawning, changing AI state etc

Maps and Modes

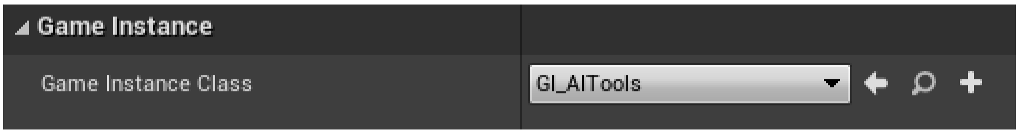
Project Settings -> Maps and Modes -> Set my GI and needed Maps



Default Maps

Editor Startup Map: PersistentLevel

Game Default Map: PersistentLevel

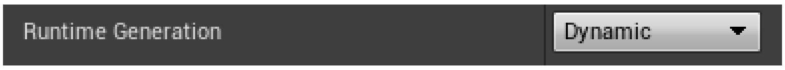


Game Instance

Game Instance Class: GI_AITools

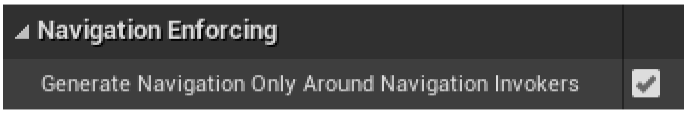
Navigation

My AI generate navmesh around itself as Invoker. To enable Navigation Invoker feature you need to change the following settings.
Project Settings -> Navigation Mesh



Runtime Generation | Dynamic

Project Settings -> Navigation System

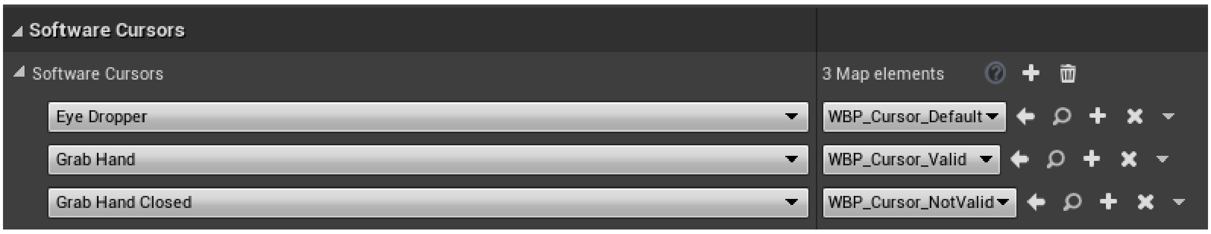


Navigation Enforcing

Generate Navigation Only Around Navigation Invokers ☑

Software Cursors

This is the only visual feature for cursors.
Project Settings -> User Interface



Software Cursors

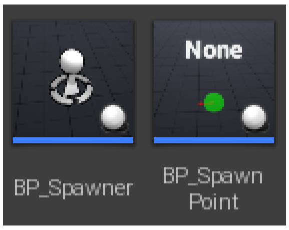
Software Cursors — 3 Map elements

Eye Dropper	WBP_Cursor_Default
Grab Hand	WBP_Cursor_Valid
Grab Hand Closed	WBP_Cursor_NotValid

Spawn System

Overview

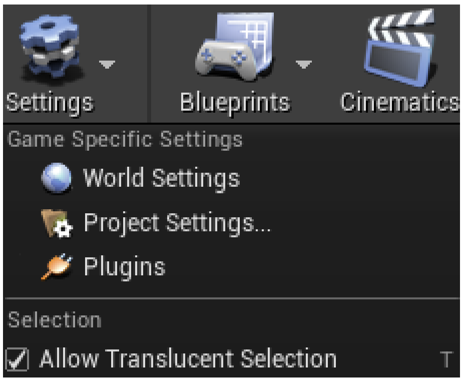
It's useful to note that Spawn System DOESN’T work as a random AI generator.
The system allows you to spawn/respawn AI in the world in a specific location, at a specific time, with pre-set data. You will always know how much and what characters will exist in the world.
There are two main actors: **Spawner** and **Spawn Point**.



!!! If you work with **sublevels**, place Spawner and Spawn Point on sublevel. When sublevel is unloaded (with landscape), **EndPlay** event is triggered in Spawner and Spawn Point. Spawner saves state of all assigned Spawn Points and AI are destroyed. When level is loaded again, Spawner loads needed AI.

!!! There are useful options in **AIToolsHelper** for convenient working with Spawn System.

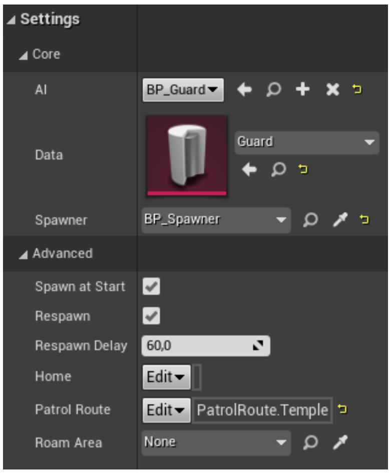
!!! **BP_SpawnPoint** has Static Mesh Component with translucent material. By default you cannot select such an actor in the editor. To fix that, enable **Allow Translucent Selection** option.



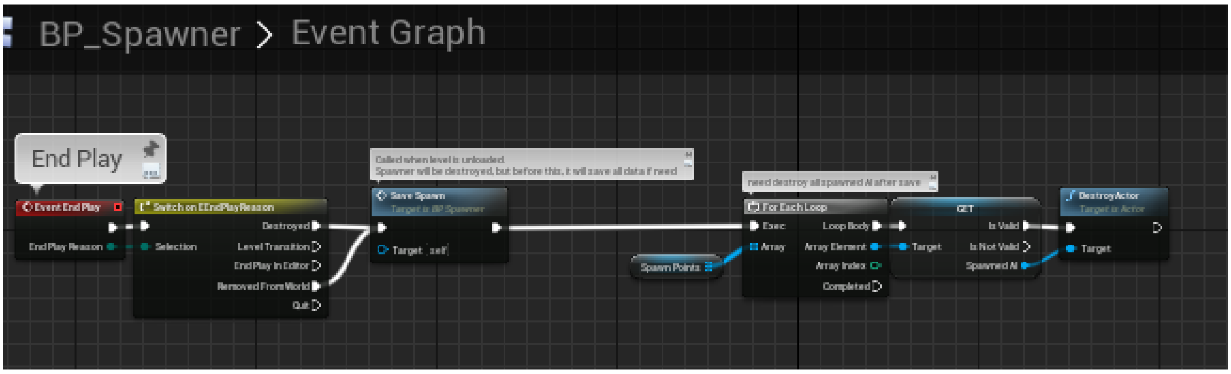
☑ Allow Translucent Selection

Spawner and Spawn Point

All info about AI is specified in **Spawn Point**.

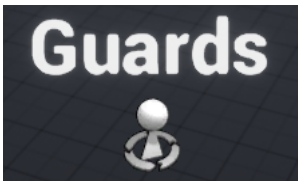

Settings
Core
AI: BP_Guard
Data: Guard
Spawner: BP_Spawner
Advanced
Spawn at Start: ☑
Respawn: ☑
Respawn Delay: 60,0
Home: Edit
Patrol Route: Edit PatrolRoute.Temple
Roam Area: None

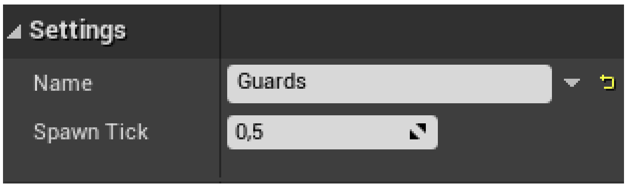
Spawner and **Spawn Point** are placed on sub-level, if you use Level Streaming feature. When sub-level is unloaded, End Play event is triggered in Spawner -> it saves info on all connected spawn points, unloads AI, and then unloads itself. When sub-level is loaded, Spawner loads AI again.


Called when level is unloaded.
Spawner will be destroyed, but before this, it will save all data if need

need destroy all spawned AI after save

On **BeginPlay** event, spawner makes the checks for all connected spawn points (for example, if AI was killed, if AI should be spawned now, or on request), and if result is true, Spawner spawns AI. Here you can set spawn tick. First point, after 0,5 seconds, second point etc. It is useful for performance, since all Characters will not be spawned in one frame.

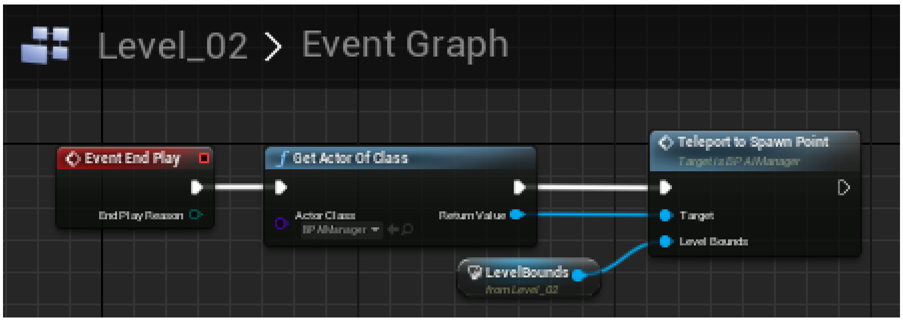



Settings
Name: Guards
Spawn Tick: 0,5

Initially, AI is spawned at spawn point location. During the game, especially if you use sub-levels, AI can be despawned. In this case his location is saved. Later, AI will be loaded at saved location. Info about if AI was killed is also saved. All other progress for AI is not saved.

Teleport AI

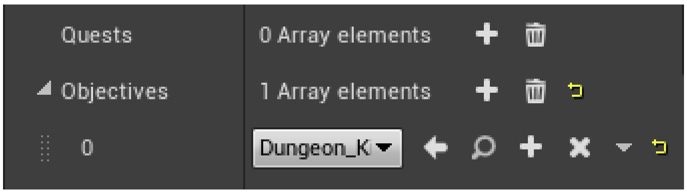
In this demo, most of the time all Pawns move around their own sub-levels. Since Spawners and Spawn Points are placed on sublevels, when sublevel is unloaded, all spawn points with AI are unloaded too.
But what if some AI from sublevel_1 are moving on sublevel_2. In this case, when sublevel_02 is unloaded, we need to teleport these AI back to sublevel_01.
To implement this, I use the next logic.
EndPlay event in Level Blueprint is triggered at the end, after all actors on sublevel are destroyed.



Using BoxOverlap and LevelBounds we can find all AI from sublevel_02, and teleport them back to their initial spawn position.

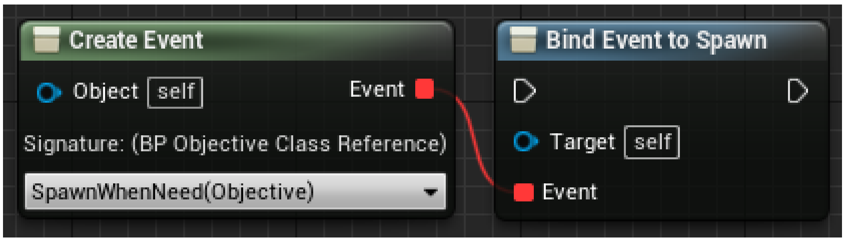
Spawn on Request

Let’s look at how AI can be spawned on request. For example, from the quest system.
I have another project RPGTools with AITools and Quest System.
Spawn Point has two new parameters: **Quests** and **Objectives**

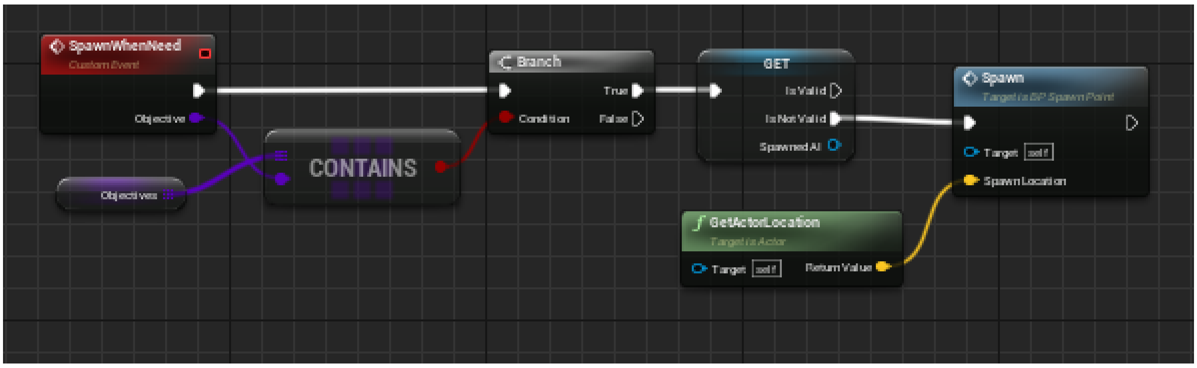


Quests	0 Array elements
Objectives	1 Array elements
0	Dungeon_K

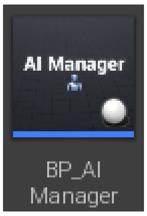
On **Initialization** Spawn Point binds to Quest Manager to Spawn dispatcher event.



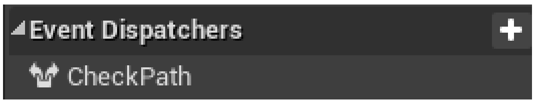
When objective is activated, this event is triggered, and if spawn point has this objective, AI is spawned.



AI Manager

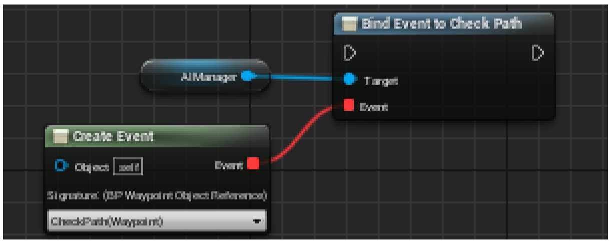


Manager is placed on Persistent Level.
Currently there is not much functionality in it.
There is Event Dispatcher

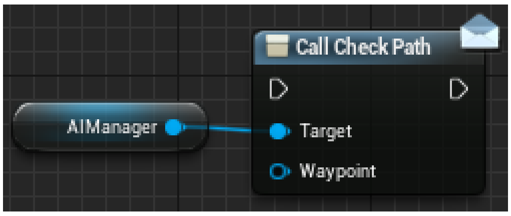


Open **MovingAlongPath** task.

During this task, AI bind to event dispatcher.



See Waypoints section. Using this manager we can send message to all Pawns, currently moving along Path.



Waypoint System

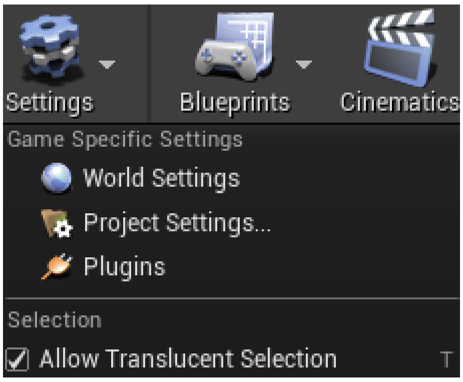
Overview

With **Waypoint System** you can create Points of Interest and connect them into the waypoint network, giving AI the ability to find these Points and build a path to them, for example, along roads. Such a system is very useful for creating a simulation of living world.

!!! If you work with **sublevels**, place waypoints on sublevel. When sublevel is unloaded (with landscape), waypoints are unloaded too, and AI can't build a path to unloaded sublevel.

!!! Use **AIToolsHelper** for convenient working with waypoints.

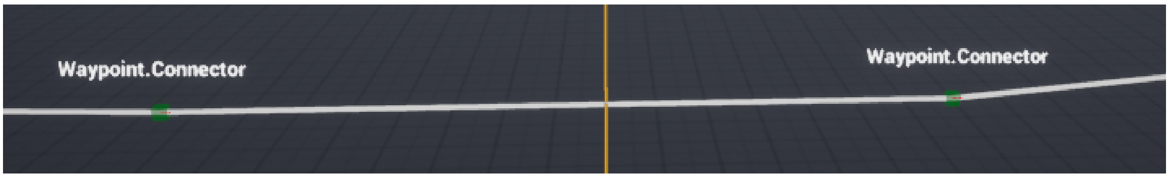
!!! **BP_Waypoint** has Static Mesh Component with translucent material. By default you cannot select such an actor in the editor. To fix that, enable **Allow Translucent Selection** option.



☑ Allow Translucent Selection T

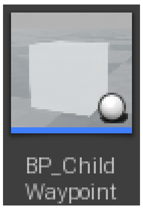
Waypoints

Basic Waypoint is used only to connect all waypoints into one network. It doesn't contain any info, except one case.
There are basic waypoints at the border of sublevels that connect two networks from different sublevels into one. Such waypoints have a Waypoint.Connector tag.



When waypoint is unloaded, **EndPlay** event is triggered and the waypoint sends a message to all Pawns, currently moving along waypoints, to check path. If unloaded waypoint is in a path, AI interrupts the current task.
AI should have a possibility to build a path using only BP_Waypoint. Target Waypoint is taken for path building only if the next waypoint (neighbor) = finish.

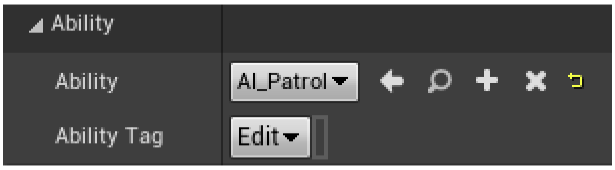
Target Waypoint is used to create Point of Interest. It has all needed information (tags, abilities etc).
Tags are needed to find waypoint.
Parameters from **Ability** section determine what AI will do (what ability will use) when he comes to waypoint.
Parameters from **Advanced** section are created for specific behavior.
Parameters from **Preview** section are used to adjust waypoint's location.
Target Waypoint is child of BP_Waypoint.



Child Waypoint is also used to create Point of Interest. This waypoint is used in several cases.
Case 1. More than one pawn can be at this place at the same time. See Musicians place. There should be two pawns at this place. When first Pawn comes to waypoint, it will be waiting for the second Pawn. This logic is implemented in BT_Civilian in branch Work.
Case 2. Only one pawn in place, and he has to make several actions at several places. See Blacksmith place. He moves to the first waypoint in array, uses Ability, and then moves to next waypoint. Pawn will move between waypoints in the sequence in which they were connected with target waypoint.
All these cases require custom logic that depends on game design.
In all cases when we use child waypoint, it should have ability, not target waypoint.

Waypoints Abilities

Using **Ability** parameter all pawns will use the same ability at this waypoint.

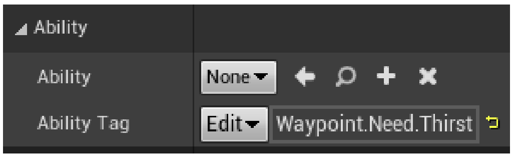


Ability

Ability: AI_Patrol

Ability Tag: Edit

Using **AbilityTag** parameter each Pawn will use own ability.



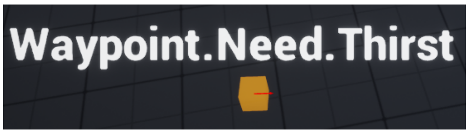
Ability

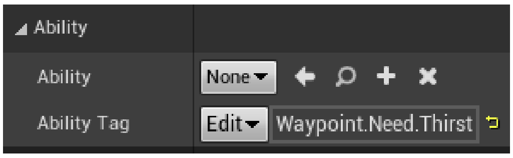
Ability: None

Ability Tag: Edit Waypoint.Need.Thirst

Let’s look at animals and lake. When animal comes to the lake, it drinks water. “Drink water” is ability. Ability has animation. Animals can have different skeletons, different animations, and different abilities. In other cases, it can be necessary to create ability with unique mechanics for specific pawn.

So, I set tag. And then in data asset (for Deer and Sheep) in WaypointAbilities map I add new element with the same tag and specific ability.

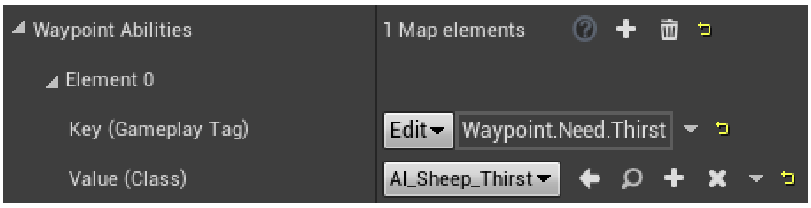




Ability

Ability: None

Ability Tag: Edit Waypoint.Need.Thirst



Waypoint Abilities: 1 Map elements

Element 0

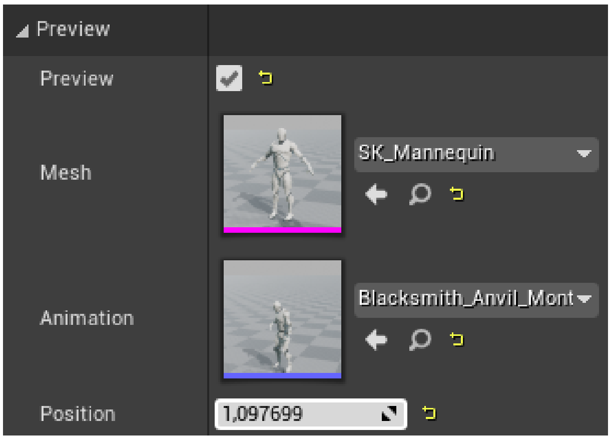
Key (Gameplay Tag): Edit Waypoint.Need.Thirst

Value (Class): AI_Sheep_Thirst

Preview

Parameters from **Preview** section are used to adjust waypoint’s location.

Reset all variables to defaults before playing the game, since animation will play and affect performance.



Preview

Preview ☑

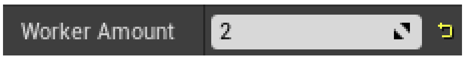
Mesh: SK_Mannequin

Animation: Blacksmith_Anvil_Mont

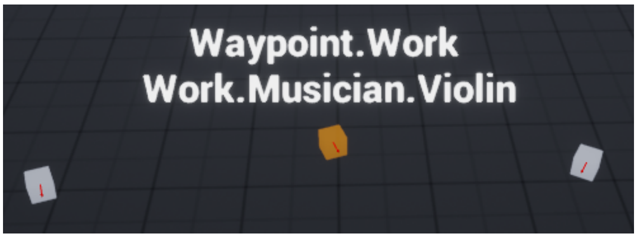
Position: 1,097699

Advanced

Sometimes, several AI’s may need to work at the same place simultaneously. In the demo these are Musicians. In this case ChildWaypoint’s amount should be equal to Worker’s Amount.

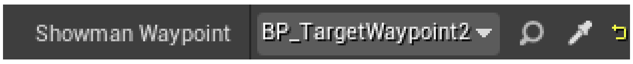


Worker Amount: 2

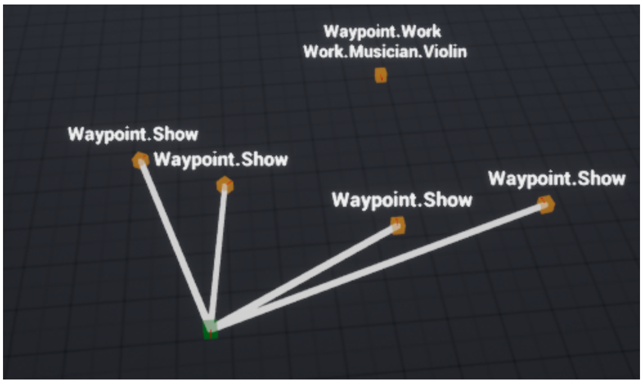


Each Show has a Showman. When civilian wants to visit a show he need to find only those target waypoints where Showman is at work place.

In this case, we need to assign Target ‘Show’ Waypoint with Target ‘Work’ Waypoint.



Showman Waypoint: BP_TargetWaypoint2

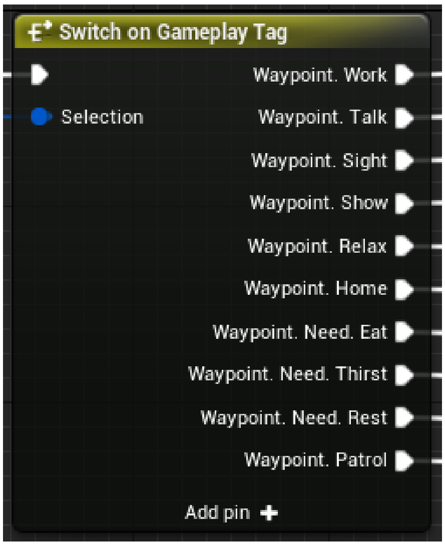


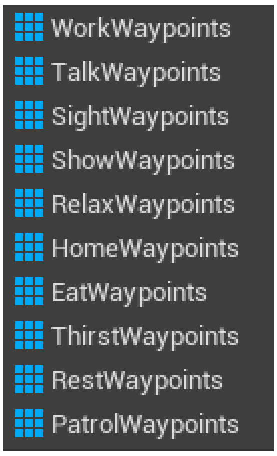
Waypoint Manager

BP_WaypointManager is placed on Persistent Level. There are no any settings in the manager. Manager just **keeps** all existing **target waypoints** in several containers. It is useful for performance, since AI finds needed waypoint much faster.

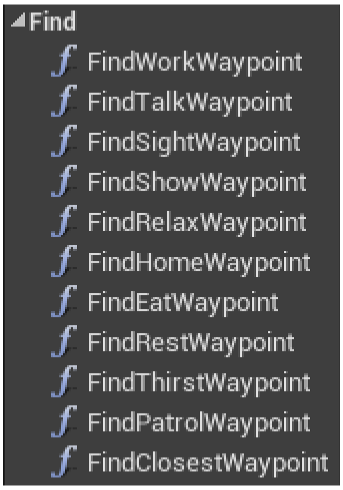
If you open **BP_TargetWaypoint** you find **BeginPlay** and **EndPlay** events. In this way the manager knows when waypoint is appeared and when it is destroyed. It helps the manager to keep an up-to-date list of waypoints.

Manager adds the waypoint to the container according to the received tag.





AI uses a custom function from the manager to find needed waypoints.

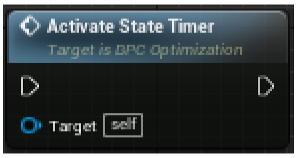


If you have added **a new target waypoint** to your game and want to add it to the manager, you need:

- create or duplicate variable (container)
- add new pin to switch node in AddWaypoint and RemoveWaypoint functions
- create function to find waypoint (algorithm)

Optimization

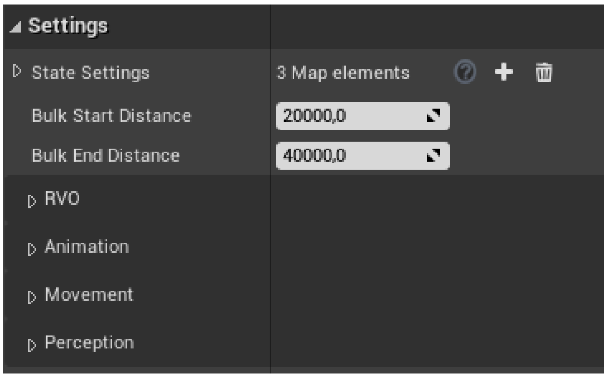
BPC_Optimization is connected to AI character class.
Component is initialized automatically on **BeginPlay** event.
On Initialization it activates State timer.



On each N second, the component checks distance from Owner to Player and updates a State.
There are 3 states:

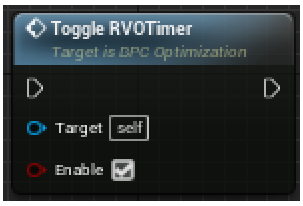
- **Real** (<199 m from Player by default)
- **Bulk** (200 - 399 m from Player by default)
- **Inactive** (400+ m from Player by default)

Depending on the states, the optimization settings are applied to AI.
You can select the component and change default settings.
State Settings are applied on each check.
Animation and **Movement** settings are applied once on Initialization.



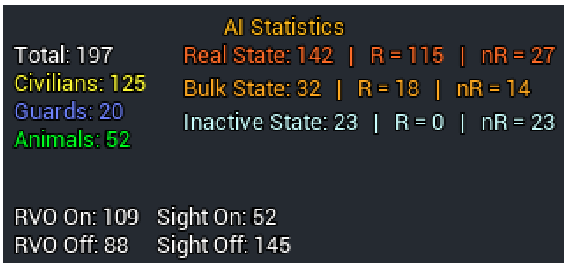
Settings
State Settings 3 Map elements
Bulk Start Distance 20000,0
Bulk End Distance 40000,0
RVO
Animation
Movement
Perception

The separate timer is activated for **RVO**.



Since RVO affects quite a lot of performance, it makes sense to disable it when there are no Pawns in radius N. In demo I disable RVO also when AI is at home, and enable it when it leaves home.

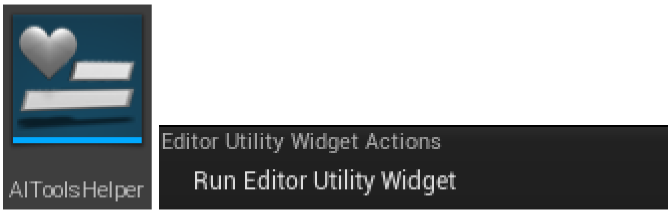
Also I detected that **Perception** starts work with delay when amount of AI > 50. The greater amount, the greater delay.
To fix it, I just disable **Perception Sight Sense** when AI is at a distance more than 50 meters from Player.



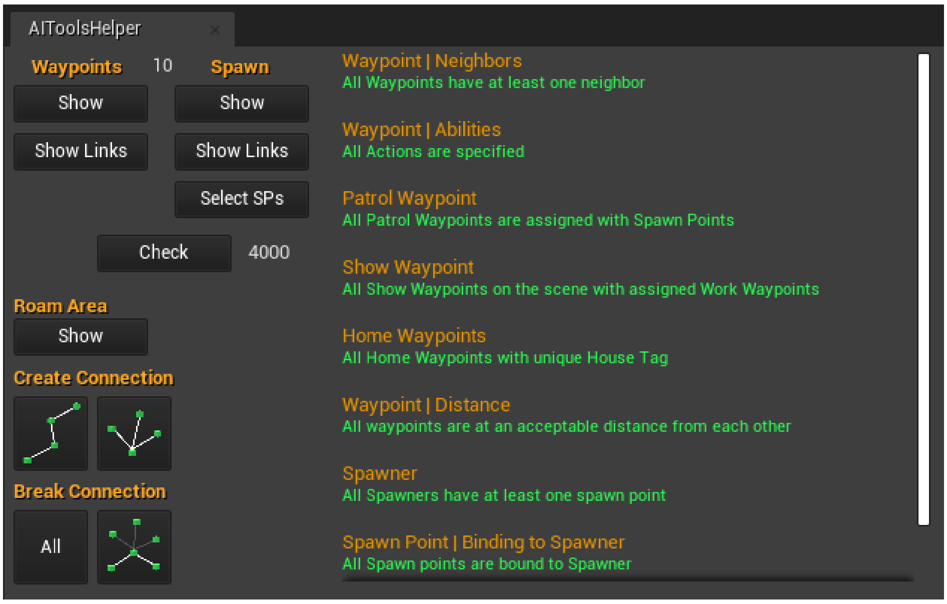
```
                      AI Statistics
Total: 197           Real State: 142  |  R = 115  |  nR = 27
Civilians: 125       Bulk State: 32  |  R = 18  |  nR = 14
Guards: 20           Inactive State: 23  |  R = 0  |  nR = 23
Animals: 52

RVO On: 109   Sight On: 52
RVO Off: 88   Sight Off: 145
```

AI Tools Helper

AIToolsHelper is an Editor Utility Widget that will help you to work with AI Tools.
Click RMB on the asset in order to Run it.



You can place this window as you like.
Hover cursor on each button to see description.



Waypoint | Neighbors
All Waypoints have at least one neighbor

Waypoint | Abilities
All Actions are specified

Patrol Waypoint
All Patrol Waypoints are assigned with Spawn Points

Show Waypoint
All Show Waypoints on the scene with assigned Work Waypoints

Home Waypoints
All Home Waypoints with unique House Tag

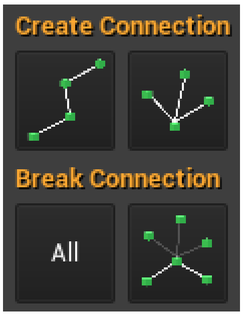
Waypoint | Distance
All waypoints are at an acceptable distance from each other

Spawner
All Spawners have at least one spawn point

Spawn Point | Binding to Spawner
All Spawn points are bound to Spawner

Earlier it was necessary to connect Waypoints using Details Panel and Pick Actor tool .
I tried to speed up this process and have added new functions with which you can do it.

Now you need to use these buttons to connect Waypoints.
I haven't come up with a faster way to do this with Blueprints.



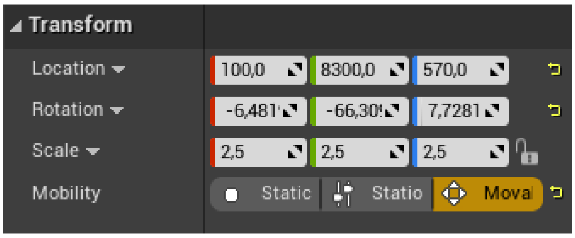
The special video will be uploaded on youtube. In the video I will talk about **Checks**.

!!! **Tick** event is working when Helper is run. For all selected waypoints, I find neighbors that AREN'T linked with a waypoint (one-side connection). If they are found, I break the connection. It is useful to clear neighbors when you duplicate Waypoint.

!!! Button style is not saved when you recompile the widget or re-run editor.

Day and Night Cycle Manager

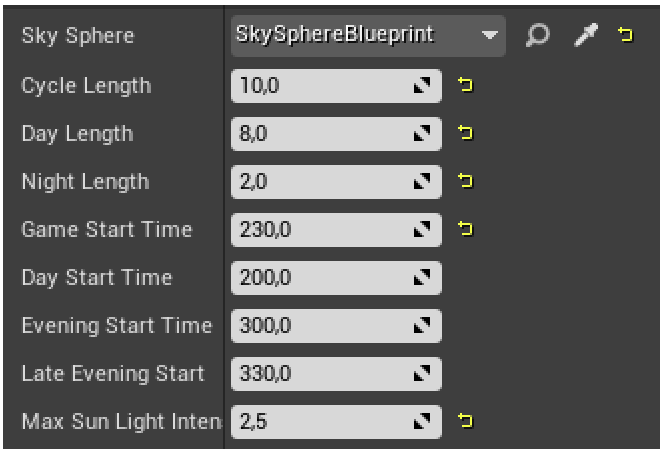
!!! If your Sun (Directional Light) is not moving, make sure you set Mobility property as “Movable”



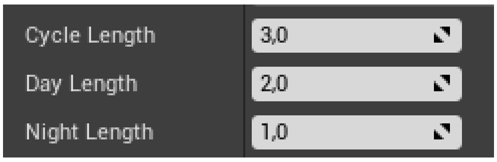
Transform			
Location	100,0	8300,0	570,0
Rotation	-6,481	-66,30	7,7281
Scale	2,5	2,5	2,5
Mobility	○ Static	Statio	Moval

BP_DayNightCycleManager is placed on the Persistent Level.
Manager does the following actions:

- determines current time of day
- updates sun position and slightly changes sun light intensity

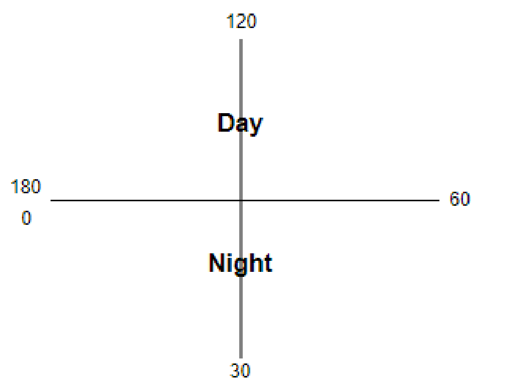


Sky Sphere	SkySphereBlueprint
Cycle Length	10,0
Day Length	8,0
Night Length	2,0
Game Start Time	230,0
Day Start Time	200,0
Evening Start Time	300,0
Late Evening Start	330,0
Max Sun Light Inten	2,5

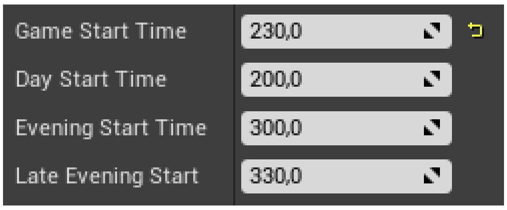


Cycle Length	3,0
Day Length	2,0
Night Length	1,0

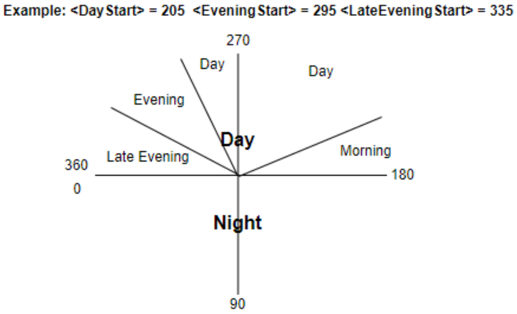
Example (in sec): <Cycle> = 180 <Day> = 120 <Night> = 60

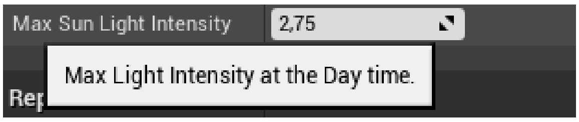


There are 5 times: morning, day, evening, late evening, night.
For example, Blacksmith can work until the evening, and then go for a walk and relax in the town until the late evening.



Game Start Time	230,0
Day Start Time	200,0
Evening Start Time	300,0
Late Evening Start	330,0


Example: <DayStart> = 205 <EveningStart> = 295 <LateEveningStart> = 335
270
Day
Day
Evening
Day
Morning
360
Late Evening
0
180
Night
90

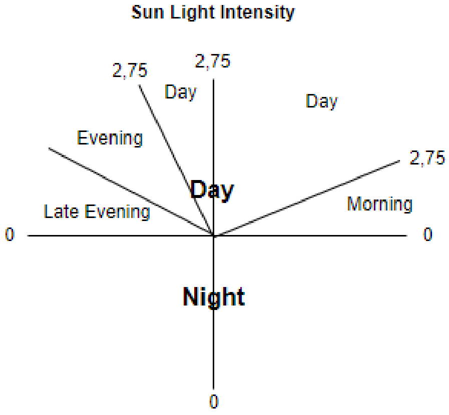


Max Sun Light Intensity 2,75

Max Light Intensity at the Day time.

Rep

Light Intensity is changed during the rotation of sun. Automatically changes the same value in Light Source.

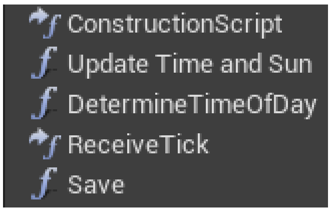


Replace with your own Manager

Usually, such managers are standalone: the project knows almost nothing about them and it is easy to add them to other projects.
Let's say you have no problem with your manager to work in AI Tools (changes lighting etc.).
You just need to make sure that AI gets info (checks time of day) correctly.

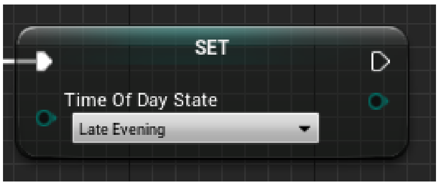
So, after you have added the manager to AI Tools, you need:

1. Open my manager (**BP_DayNightCycleManager**) and copy/paste all logic to your manager

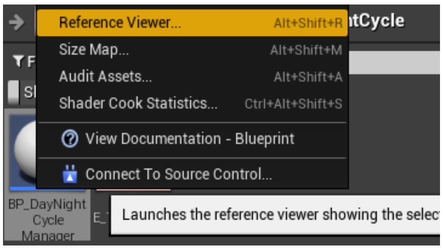


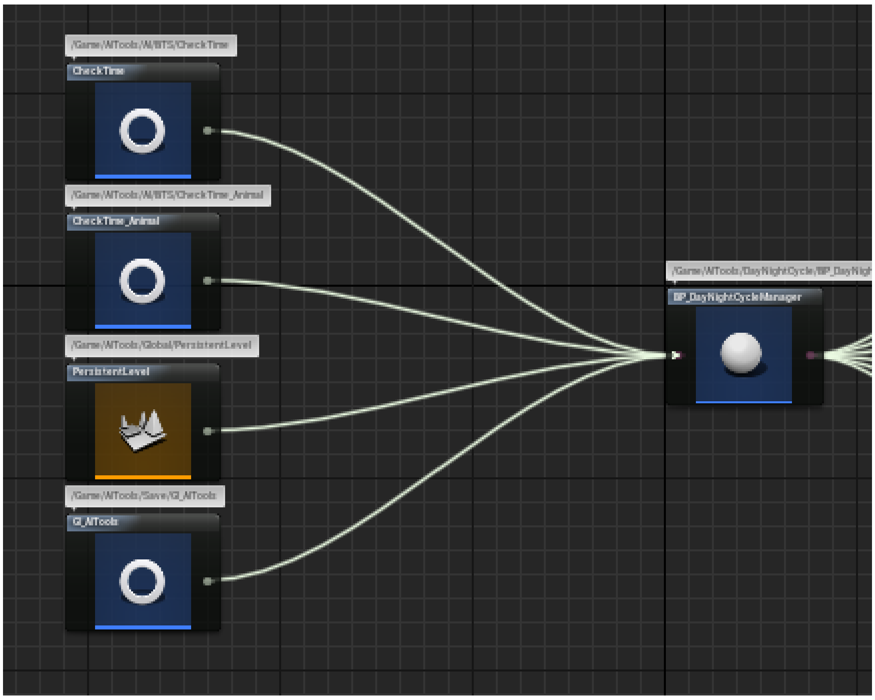
All these functions + construction script + related variables ofc

Using the "DetermineTimeOfDay" function, your manager can determine the current time of day, and save it to the variable.

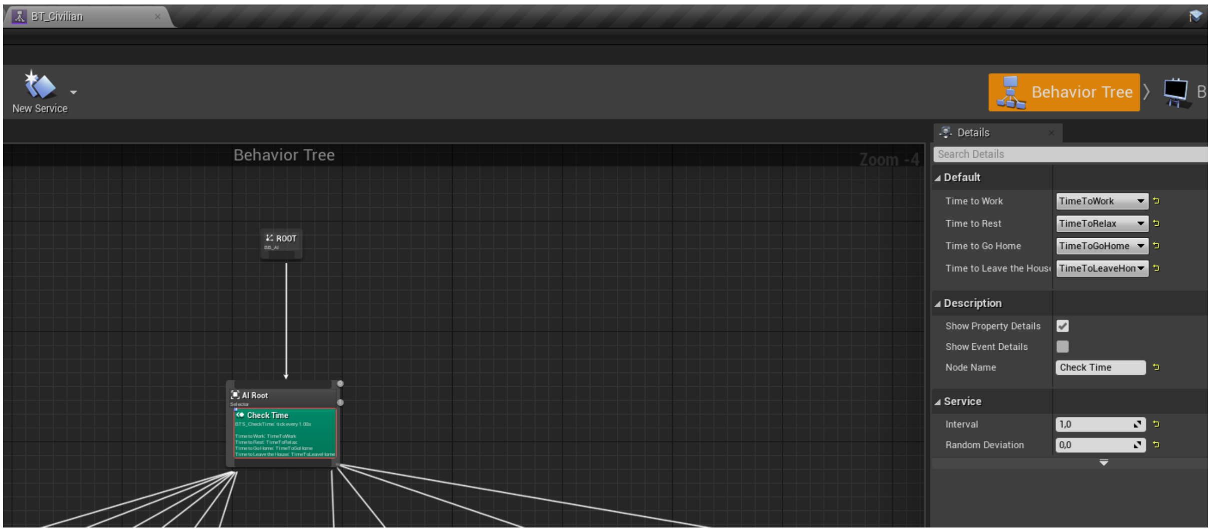


2. Open **Reference Viewer** tool, to find out which assets are linked to the old manager


Reference Viewer... Alt+Shift+R
Size Map... Alt+Shift+M
Audit Assets... Alt+Shift+A
Shader Cook Statistics... Ctrl+Alt+Shift+S
View Documentation - Blueprint
Connect To Source Control...
BP_DayNight Cycle Manager
Launches the reference viewer showing the selec


/Game/AITools/AI/BTS/CheckTime
CheckTime
/Game/AITools/AI/BTS/CheckTime_Animal
CheckTime_Animal
/Game/AITools/Global/PersistentLevel
PersistentLevel
/Game/AITools/Save/GI_AITools
GI_AITools
/Game/AITools/DayNightCycle/BP_DayNigh
BP_DayNightCycleManager

3. If you open **BT_Civilian** and BT_Animal, you will see that each N seconds AI checks time using **BTS_CheckTime** and **BTS_CheckTime_Animal**.
   Just open them and replace references.



Default

Time to Work: TimeToWork

Time to Rest: TimeToRelax

Time to Go Home: TimeToGoHome

Time to Leave the Hous: TimeToLeaveHon

Description

Show Property Details: ☑

Show Event Details: □

Node Name: Check Time

Service

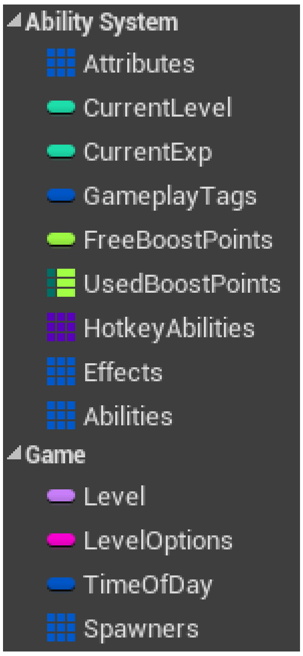
Interval: 1,0

Random Deviation: 0,0

4. The same for **GI_AITools**. Just replace references.

Saving and Loading

The following data is saved (**SG_AITools**):

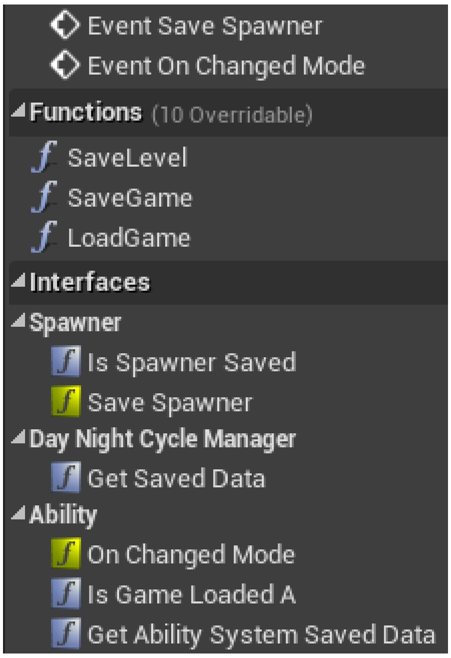


Ability System
- Attributes
- CurrentLevel
- CurrentExp
- GameplayTags
- FreeBoostPoints
- UsedBoostPoints
- HotkeyAbilities
- Effects
- Abilities

Game
- Level
- LevelOptions
- TimeOfDay
- Spawners

2 classes are used for saving:

- **GI_AITools** is always used (teleport between levels or saving in file)
- **SG_AITools** is used to save game to file

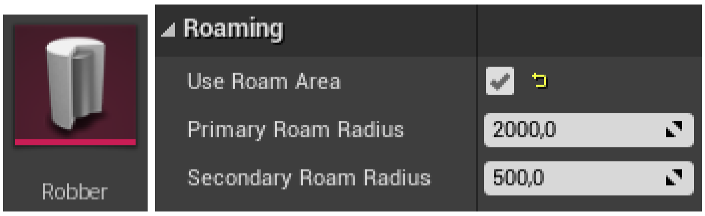
SaveLevel is called when the player teleports between levels. **SaveLevel** + **SaveGame** are called when the player saves the game to file. **LoadGame** is called when the player loads the game. **SaveSpawner** event is called by Spawner, when sublevel is unloaded. **OnChangedMode** event is called when Player switches between ThirdPerson and TopDown modes. AbilityManager and other actors use interfaces to get saved data when the game starts.	 Event Save Spawner Event On Changed Mode Functions (10 Overridable) SaveLevel SaveGame LoadGame Interfaces Spawner Is Spawner Saved Save Spawner Day Night Cycle Manager Get Saved Data Ability On Changed Mode Is Game Loaded A Get Ability System Saved Data

Behavior Templates

Roaming around Roam Area

Roaming is implemented in **BT_Animal** and **BT_Robber**.

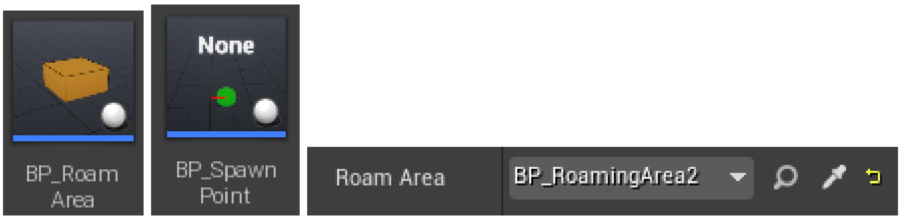
Open Robber preset and find **Roaming** section.



Roaming

Use Roam Area	☑
Primary Roam Radius	2000,0
Secondary Roam Radius	500,0

There are Primary Roaming and Secondary Roaming.
If **UseRoamArea** is enabled, AI will roam around a special area. You need to place **BP_RoamArea** on sub-level and select it in SpawnPoint.



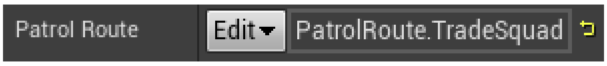
Roam Area: BP_RoamingArea2

If **UseRoamArea** is disabled, AI will roam around spawner in **PrimaryRoamArea** radius.
When AI comes to place, during N seconds he roams around himself. This is secondary roaming, and you also can set **SecondaryRoamRadius** for this.

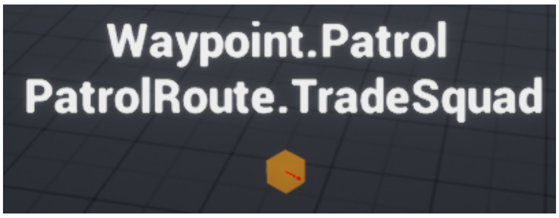
Guard | Patrolling

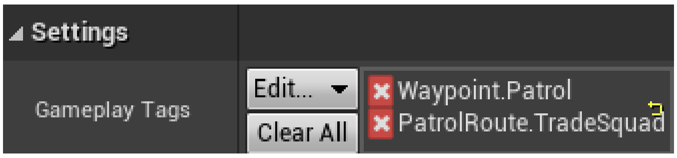
Guard patrols between Target Patrol Waypoints according to a given route.
PatrolRoute is set in SpawnPoint.

Guard
PatrolRoute.TradeSquad


Patrol Route | Edit | PatrolRoute.TradeSquad

The same tag is added to Target Waypoint.


Waypoint.Patrol
PatrolRoute.TradeSquad

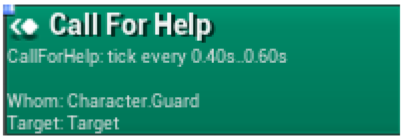

Settings

Gameplay Tags | Edit... | Clear All
Waypoint.Patrol
PatrolRoute.TradeSquad

To create new patrol route just create new Gameplay Tag. And set this new tag in waypoint and spawn point actors.
AI doesn't move between waypoints in order, he gets closest or farthest waypoint randomly. This algorithm is created in Waypoint Manager. **FindPatrolWaypoint** function.

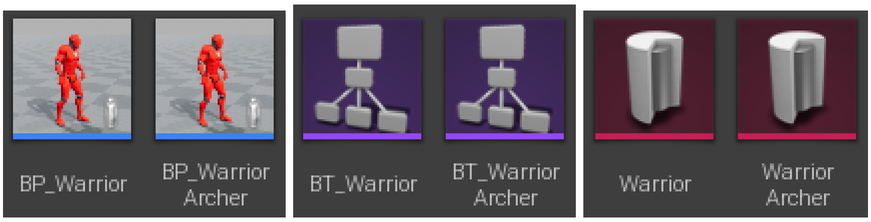
Guard can be Pushed.
Player can interact with Guard, if Guard is Quest Giver (works only in RPG Tools).
Equipment Manager is added to **BP_Guard**. On BeginPlay event I add sword and bow. There are no more differences.

Guard goes into Combat state when receives damage from target, or receives request to help.
When Guard is in Combat state he calls for help from other guards.


Call For Help
CallForHelp: tick every 0.40s..0.60s

Whom: Character.Guard
Target: Target

Arena Warriors

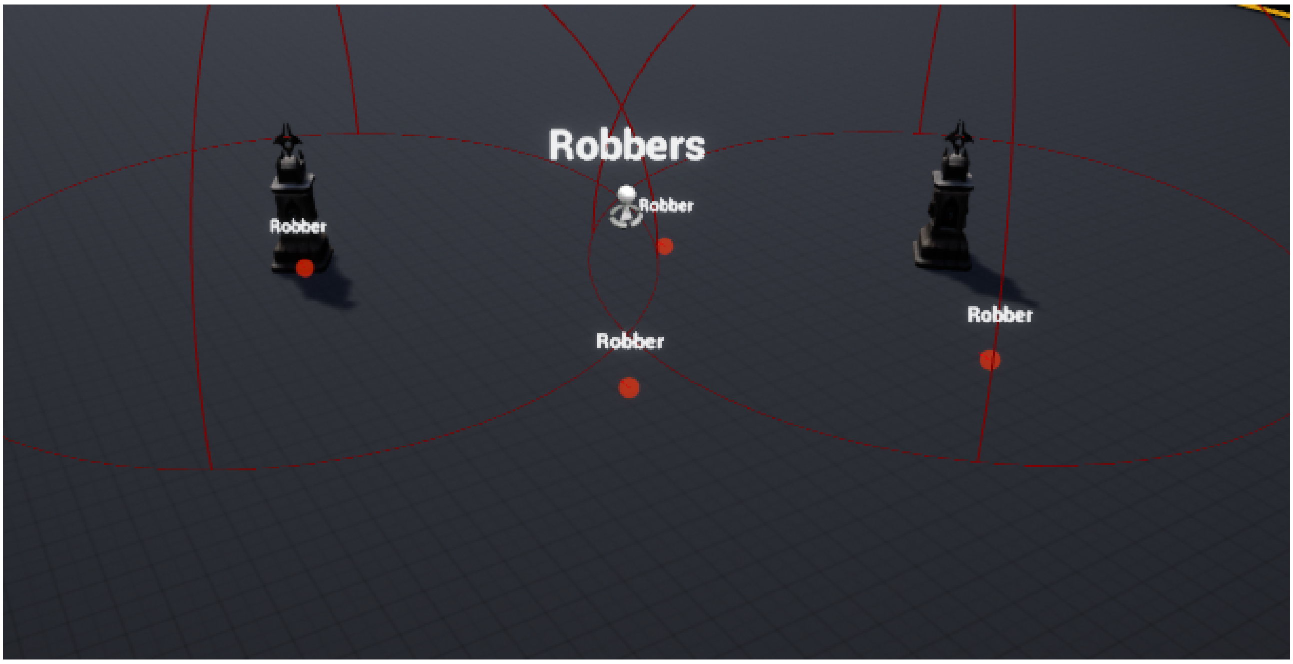


Warriors are spawned in Arena. There is only combat behavior in these behavior trees. When Player leaves line of sight, AI just stands. These AIs are created only to test Ability System. Data assets are set in **BP_AISpawner** when AIs are spawned.

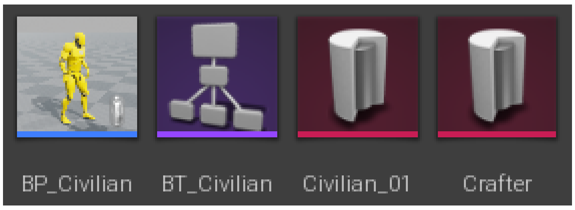
Equipment Manager is added to **BP_Warrior** and **BP_WarriorArcher**. On BeginPlay event I initialize the manager and add sword and bow. There are no more differences.

Robber

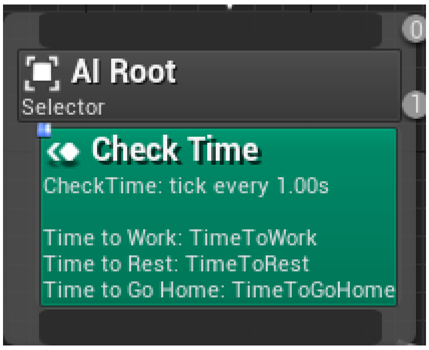
Robbers roam around an area (**BP_RoamArea**), and when they see enemy (Player), they attack.
Combat behavior is the same as in BT_WarriorArcher.
This AI is created only as content for a future Quest in RPGTools.
Nearby there are two Towers that can be destroyed.
Equipment Manager is added to **BP_Robber**. On BeginPlay event I initialize the manager and add sword and bow. There are no more differences.



Civilian



Only Civilian behavior (BT_Civilian) depends on Time of Day.
Every N seconds AI checks the current time and automatically changes its behavior if necessary.

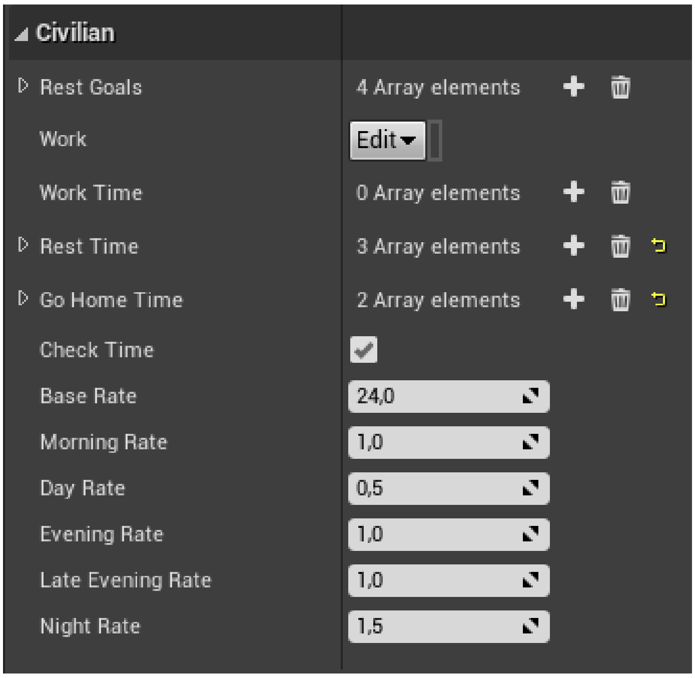


AI Root
Selector

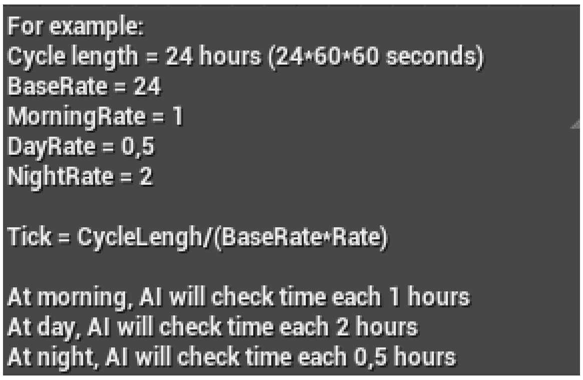
Check Time
CheckTime: tick every 1.00s

Time to Work: TimeToWork
Time to Rest: TimeToRest
Time to Go Home: TimeToGoHome

There are 3 types of needs: work, rest, go home.
In the data asset (created from **PDA_AI**) you can change the following settings.



Civilian	
Rest Goals	4 Array elements
Work	Edit
Work Time	0 Array elements
Rest Time	3 Array elements
Go Home Time	2 Array elements
Check Time	☑
Base Rate	24,0
Morning Rate	1,0
Day Rate	0,5
Evening Rate	1,0
Late Evening Rate	1,0
Night Rate	1,5

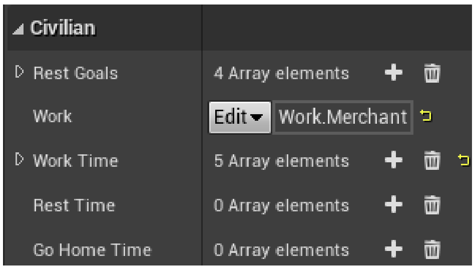


For example:
Cycle length = 24 hours (24*60*60 seconds)
BaseRate = 24
MorningRate = 1
DayRate = 0,5
NightRate = 2

Tick = CycleLengh/(BaseRate*Rate)

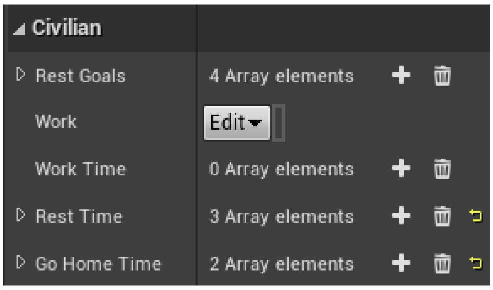
At morning, AI will check time each 1 hours
At day, AI will check time each 2 hours
At night, AI will check time each 0,5 hours

Civilian can be a worker. In order to add this role you need to set a special **Work.Tag** and **Work Time**. In this case I don’t want my workers to go home. so that Work Time contains all day times.



Civilian	
Rest Goals	4 Array elements
Work	Edit Work.Merchant
Work Time	5 Array elements
Rest Time	0 Array elements
Go Home Time	0 Array elements

To create a town crowd, I use Civilian_01 and Civilian_02 data assets.
Such AIs just walk around town and perform one of 4 rest goals.



Civilian

Rest Goals — 4 Array elements

Work — Edit

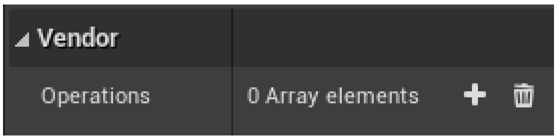
Work Time — 0 Array elements

Rest Time — 3 Array elements

Go Home Time — 2 Array elements

Civilian can be pushed.

Player can interact with Civilian, if he is Vendor, or there are available quests or objectives (in RPG Tools). Vendor operations are set in data asset.



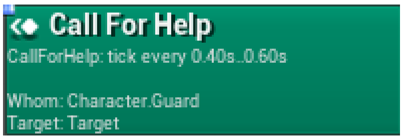
Vendor

Operations — 0 Array elements

Civilian goes into Combat state when he receives damage from target.

In Combat state, Civilian uses Warrior’s behavior. But Equipment Manager is not added to character class, therefore Civilian doesn’t use Weapons.

When Civilian is in Combat state he calls for help from guards.



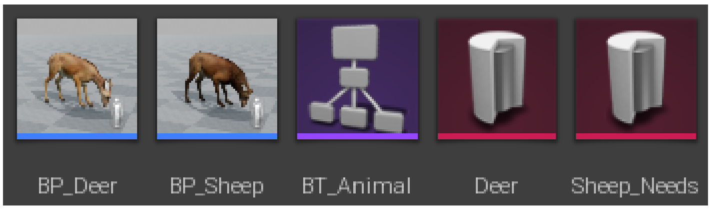
Call For Help

CallForHelp: tick every 0.40s..0.60s

Whom: Character.Guard

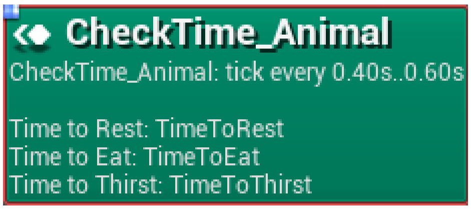
Target: Target

Animal



I want to say that I don’t really like the current implementation, since it doesn’t support extensibility. I already think about another implementation.

In addition to base attributes, Animal can have **Energy**, **Hunger** and **Thirst** attributes.
On Activation BT, a special timer is activated.
Each N seconds, Energy, Hunger, Thirst attribute values are decreased.
When value is equal to 0, AI performs a special task to satisfy the need.

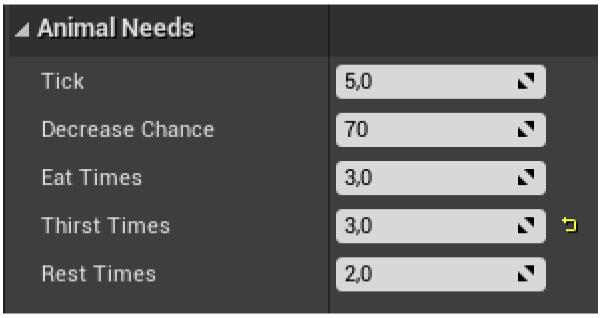


CheckTime_Animal

CheckTime_Animal: tick every 0.40s..0.60s

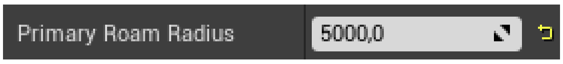
Time to Rest: TimeToRest
Time to Eat: TimeToEat
Time to Thirst: TimeToThirst

Tick and **Times** mean how often Attribute value will be decreased.
DecreaseChance is added for a more realistic implementation. In this way AI won’t crowd.
Value to Decrease = AttributeMaxValue/(DayNightCycleLenght / Times / Tick)



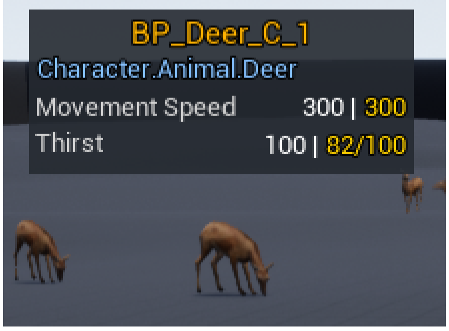
Animal Needs	
Tick	5,0
Decrease Chance	70
Eat Times	3,0
Thirst Times	3,0
Rest Times	2,0

Deer roams around an area in radius N from Spawner.



Primary Roam Radius 5000,0

Deer has two attributes: Movement Speed and Thirst.

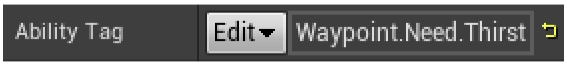


BP_Deer_C_1
Character.Animal.Deer

Movement Speed	300 | 300
Thirst	100 | 82/100

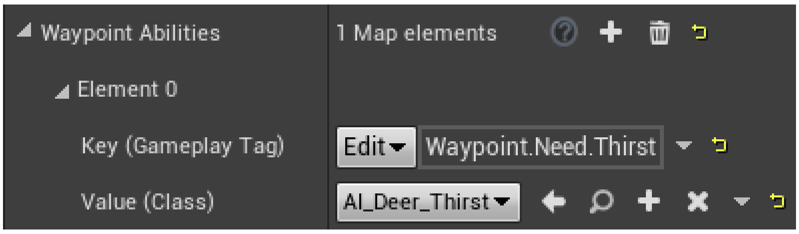
When deer sees an **enemy**, movement speed is increased and he **runs away** using EQS.
Enemy is set in data asset.
When **Thirst** is equal to 0, Deer tries to find the closest Point of Interest in order to drink water.

Note that Ability Tag is set instead of Ability class. It is because the animals with different skeletons (and therefore with different abilities) can use this Target Waypoint.



Ability Tag Edit Waypoint.Need.Thirst

Real Ability is set in data asset.



Waypoint Abilities 1 Map elements

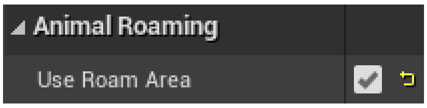
Element 0

Key (Gameplay Tag) Edit Waypoint.Need.Thirst

Value (Class) AI_Deer_Thirst

Sheeps are implemented in two versions.

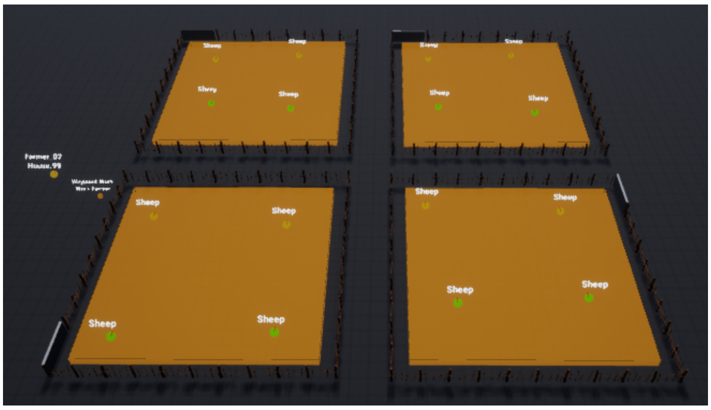
Both versions roam around a special Roam Area that is set in SpawnPoint. The option is enabled in data asset.



Animal Roaming

Use Roam Area ☑

Sheeps without needs haven’t enemies. They just roam.

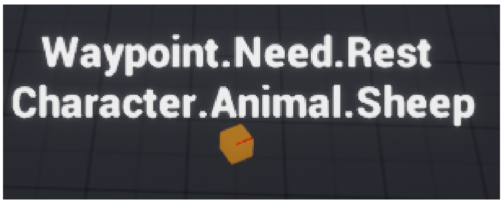


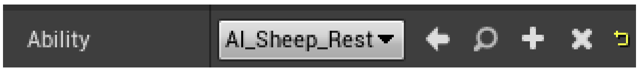
Sheeps with needs have **Energy** and **Thirst** attributes. They also haven’t enemies.

For Thirst, the implementation is the same as for Deer.

For Energy, there are other waypoints with Animal Tag and Ability class.

This is done so that only sheep can use this Point of Interest.





Ability AI_Sheep_Rest

Change Log

2.1

14.10.2021

I wanted to add Squads, AI Companion, Carnivores (one animal hunts others), but decided to make it for the next update because it takes quite a bit of work.
The update for AI Tools also includes an update for Ability System.

Update for Ability System

Top Down

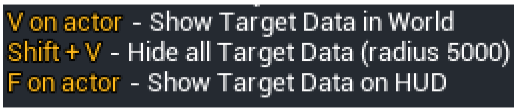
- Camera Rotation (only Z axis) is added
- All abilities have been reworked. Now all abilities in this mode are fully unique
  In future I will add abilities to this mode from any top down games like Dota 2, in order to test the system and demonstrate new mechanics.

Third Person

- All abilities for Warrior have been reworked
- Archer abilities are added

AI

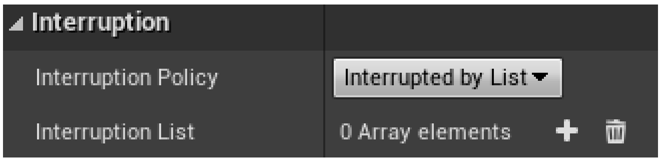
- Warrior + Archer combat behavior is added
- Visual debugging is added
  Now you can watch what abilities, tags, attributes and effects AI has at runtime.



V on actor - Show Target Data in World
Shift + V - Hide all Target Data (radius 5000)
F on actor - Show Target Data on HUD

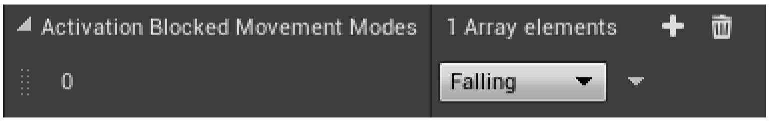
Overall

- Simple **Equipment Manager** is added
  Works only with weapons.
- Interruption Ability policy is added
  Now a certain ability can be interrupted by casting of another certain ability.



Interruption
Interruption Policy: Interrupted by List
Interruption List: 0 Array elements

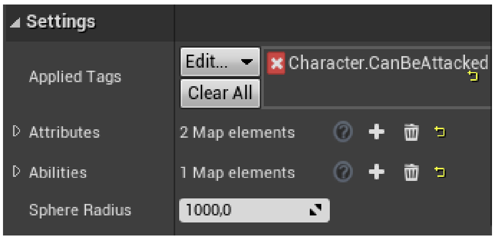
- Movement modes can block ability casting
  For example, when character is falling or flying or swimming he cannot cast abilities.



Activation Blocked Movement Modes: 1 Array elements
0: Falling

Tower

- Now can be destroyed

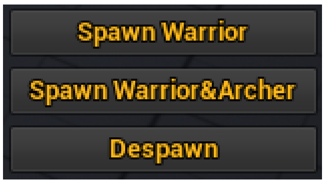


Settings
Applied Tags: Character.CanBeAttacked
Attributes: 2 Map elements
Abilities: 1 Map elements
Sphere Radius: 1000,0

Update for AI Tools

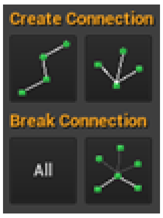
Scene

- Scene content has been fully reworked
  World will be slightly redesigned. Animations and props will be added.
- Towers and Robbers are added
  Towers can be destroyed. This is content for future quest in RPG Tools.
- Arena is added
  Arena is a place where spawned Warriors appear. These warriors are created to test Ability System.

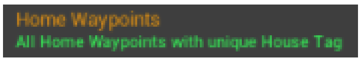


Helper

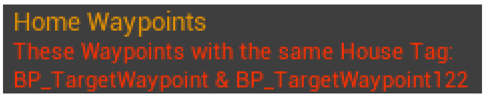
- Create Connection and Break Connection buttons are added
  I create these buttons to speed up the process. Now you need to use them to create waypoint network.



- CheckHomeWaypoints is added to Check function



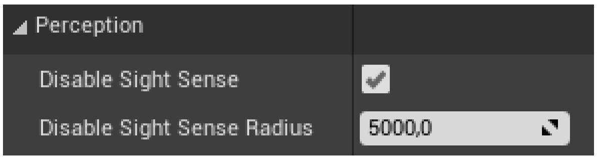
Home Waypoints
All Home Waypoints with unique House Tag



Home Waypoints
These Waypoints with the same House Tag:
BP_TargetWaypoint & BP_TargetWaypoint122

Optimization

- Now Perception Sight Sense can be disabled
  I detected that Perception starts work with delay when amount of AI > 50. The greater amount, the greater delay.



Perception

Disable Sight Sense ☑

Disable Sight Sense Radius 5000,0

AI Guard

- Equipment Manager has been added. Guard has Sword and Bow
- Warrior + Archer combat behavior is added

AI Civilian

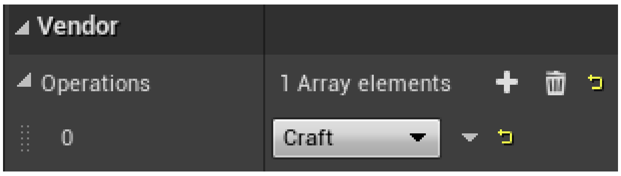
- Now **Rest Goal** ISN'T repeated twice
- Blacksmith ability has been improved. AI takes a hammer in hand when comes to anvil

AI Animal

- Now when AI satisfies the need, he casts ability during the time that is set in BT, not in ability
- Hunger is removed since Deers and Sheeps eat all the time
- Deers and Sheeps are reworked. See **Animal** section

Overall

- AI Menu is added for Vendors
- **VendorOperations** option is added to data asset
  Player can interact with AI if array ISN’T empty.
  For the current list all widgets are already added to WBP_Menu_AI.

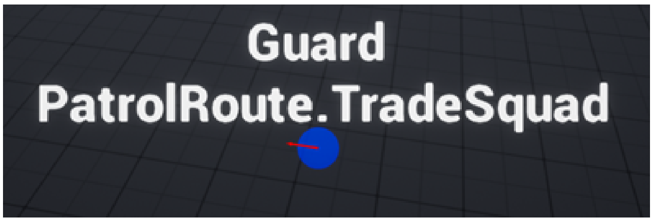


Vendor

Operations — 1 Array elements

0 — Craft

- **MoveTo task** has been created
  Sometimes, if RichTestIncludesAgentRadius is false in base MoveTo task, AI could not reach waypoint. I don’t know why, so I created a custom task to fix this bug.
- **RotateTowards** task is reworked. Now AI changes rotation immediately
- Now **RoamArea** can be rotated in Editor
- Now **Patrol Route Tag** is displayed for Spawn Point with Guard



Guard
PatrolRoute.TradeSquad

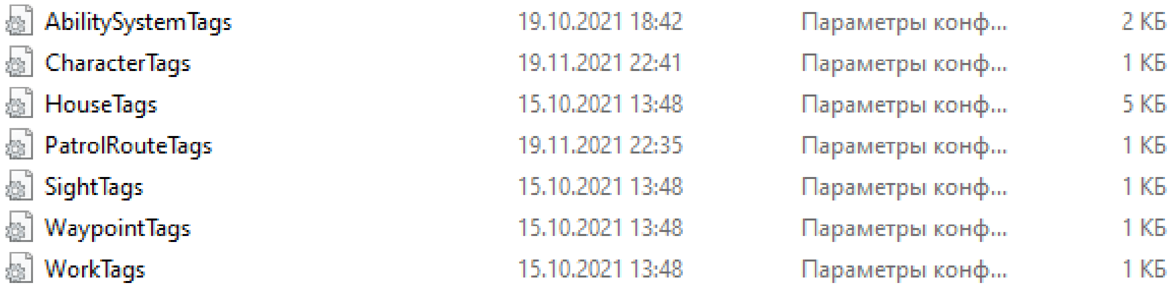
- Now, in editor, when you set MaxLightIntensity, DayNightCycleManager automatically changes Light Intensity in Light Source in actor with which it is bound
- Connector Waypoint has been removed
  *Now **Neighbors** variable is a soft reference that means you can link actors from different sublevels.*
  *See **Waypoints** section. A special Connector tag should be added to BP_Waypoint.*
- Path Finding algorithm is improved
  Now the find process for the closest waypoint starts only if the finish waypoint is more than 5 meters away.
- Bug Fix: Now AI location is saved when sublevel is unloaded
- Now Player Location is loaded, when game is loaded (works correctly when you teleport between persistent levels)

- Several minor improvements around the entire project that include refactoring

2.1.1

20.11.2021

- Hotfix: Tags from **DefaultGameplayTags.ini** are copyed to **PatrolRouteTags.ini** and **CharacterTags.ini**



AbilitySystemTags	19.10.2021 18:42	Параметры конф...	2 КБ
CharacterTags	19.11.2021 22:41	Параметры конф...	1 КБ
HouseTags	15.10.2021 13:48	Параметры конф...	5 КБ
PatrolRouteTags	19.11.2021 22:35	Параметры конф...	1 КБ
SightTags	15.10.2021 13:48	Параметры конф...	1 КБ
WaypointTags	15.10.2021 13:48	Параметры конф...	1 КБ
WorkTags	15.10.2021 13:48	Параметры конф...	1 КБ

When you wanted to migrate AITools to your own project you needed to copy the Tags folder. Some tags were placed in DefaultGameplayTags.ini and were not copied. Now, all tags will be copied.

2.1.2

14.03.2022

Ability System

- See 1.1

AI Tools

- Fixed issue. Now **Day Night Cycle** data is saved correctly

  Earlier, if the game is started in the world without the Manager, when teleporting to world with the manager, incorrect data is loaded and game is started at night.

  Appropriate check is added to manager (Begin Play event).
- Fixed issue. Now the player cannot Interact with AI in ‘Combat’ state

  ***Character.Combat** tag is added to **InteractionBlockedTags** (AbilityManager).*
- Fixed issue. Now the player cannot jump when he is dead or has control effect

  ***JumpBlockedTags** variable and **CanJump** function are created in AbilityManager.*

  The appropriate check is added to player controller.