> **NOTE**
>
> Join the Astra RPG Discord server!
> There is now a dedicated **Discord server** for Astra RPG Framework and its extensions. Join to **receive notifications** about new extension releases and important updates, **ask for new features**, **report bugs**, **share ideas**, and **showcase your Astra creations** with other developers.
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Introduction

Astra RPG Health extends the base framework, [](Astra RPG Framework), by adding functionality for managing health and calculating damage for entities. The package is designed with the same design philosophy as the base asset: a Scriptable Object-based architecture to encourage flexibility, modularity, and testability. If you're already familiar with the base package, you'll feel right at home with its features.

You can define your own damage types, designate defensive statistics used to reduce each damage type, configure the damage calculation pipeline with the desired steps, configure lifesteal for certain damage types, define strategies to execute upon entity death, and much more.

Astra RPG Health Vocabulary

Damage Type

Damage types represent the different categories of damage that can be inflicted on entities. Common examples include "Physical", "Magical", "Bleeding", "Drowning", etc. You can create custom damage types to suit your game's needs.

Damage Source

Damage sources represent the origin of the damage inflicted. This is highly specific to your game's context. For example, one game might have damage sources such as "Entity", "Environment", "Potion", etc., while another might want to define more specific damage sources like "Attack", "Spell", "Equipment", "Trap", "Environment", "Damage Over Time", etc. The main difference between damage source and damage type is that damage types categorize damage based on its nature, while damage sources identify where the damage originates. The distinction can be subtle, but it's important for game logic and mechanics. We'll return to these concepts later, where we'll see the practical differences between the two.

Heal Source

Heal sources represent the origin of healing. Similar to damage sources, heal sources are specific to your game's context. Common examples include "Potion", "Spell", "Lifesteal", "Ability", "Environment", etc. In

some games, a classic Heal Source definition might include "Self" and "Ally", as these enable mechanics for increasing healing provided/received based on the caster and target.

Barrier

The concept of temporary HP can take various names across different games, though the underlying mechanic remains the same: provide an amount of extra and ephemeral hit points that are deducted instead of health when damage is taken. In Astra, these temporary hit points are called "Barrier".

Raw and Net Damage

Raw Damage refers to the damage that a certain attack or skill intends to inflict. This damage does not account for resistances, critical hits, modifiers, etc. Net Damage is the result of processing Raw Damage while accounting for damage modifiers, resistances, barriers, critical hits, etc.

Damage Modifiers

Damage modifiers are components that can alter calculated damage in various ways. They can be used to implement mechanics such as damage reduction, damage increase, resistances, vulnerabilities, and more. Damage modifiers are generally utilized by the damage calculation pipeline (which we'll see shortly).

How is Astra RPG Health organized and how does it work?

Astra RPG Health Config

The `AstraRPGHealthConfig` is a `ScriptableObject` that serves as the central configuration point for the Astra RPG Health package. It has several properties that allow you to define how the health and damage systems should behave in your game.

With Astra RPG Framework, no configuration was needed. However, Astra RPG Health needs to be configured to work around the actual instances of the base framework's components defined for your game. For example, if you defined a certain statistic for general damage reduction in your game with Astra RPG Framework, you need to inform Astra RPG Health about it so that it can use it when calculating damage. The needed configuration is kept minimal, and convention-over-configuration is applied where possible to reduce the amount of setup required.
Configuration will be deeply discussed later in Package Configuration.

EntityHealth

`EntityHealth` is a brand new `MonoBehaviour` that you can add to your entities to provide them with health management capabilities. Worth mentioning, it exposes the most important method of the package: `TakeDamage()`, which allows you to inflict damage on the entity.

Damage Type

`DamageType` is a `ScriptableObject` that represents a specific type of damage. Each damage type can be optionally configured with a defensive `Stat` that will be used to reduce incoming damage of that type. If a defensive stat is assigned, also a piercing stat can be assigned to ignore a portion of the defense when calculating damage.
Both for the defensive and piercing stat, you can select a `DamageReductionFormula` and a `DefenseReductionFormula` respectively, to define how the stats will affect damage reduction and defense piercing.

Damage Source

`DamageSource`, derived from `ScriptableObject`, represents the origin of the damage inflicted. They don't have any specific properties, but they can be assigned to other objects of the package to create specific behaviors based on the damage source. We will see for what and how in the Workflows.

Damage Reduction Functions

The package comes with three built-in `DamageReductionFunction`s that you can use to define how defensive stats reduce incoming damage:

- `FlatDamageReductionFn`: Reduces damage by a flat amount based on the defense stat value.
- `PercentageDamageReductionFn`: Reduces damage by a percentage based on the defense stat value.
- `LogarithmicDamageReductionFn`: Reduces damage using a logarithmic scale based on the defense stat value.

In case of need, custom damage reduction functions can be created by extending the `DamageReductionFn` class.

Defense Piercing Functions

As for damage reduction functions, the package comes with three built-in `DefensePiercingFunction`s that you can use to define how piercing stats ignore a portion of the defense stat:

- `FlatDefensePiercingFn`: Ignores a flat amount of the defense stat based on the piercing stat value.
- `PercentageDefensePiercingFn`: Ignores a percentage of the defense stat based on the piercing stat value.
- `LogarithmicDefensePiercingFn`: Ignores a portion of the defense stat using a logarithmic scale based on the piercing stat value.

Also in this case, custom defense piercing functions can be created by extending the `DefensePiercingFn` class.

Heal Source

`HealSource`, derived from `ScriptableObject`, represents the origin of healing. Similar to `DamageSource`, they don't have any specific properties, but they can be assigned to other objects of the package to create specific behaviors based on the heal source. We will see for what and how in the Workflows.

Damage Calculation Strategy

The damage calculation pipeline is the component of the framework responsible for processing raw damage and producing net damage. The pipeline will use a given `DamageCalculationStrategy` to determine the sequence of steps to apply when calculating damage.
Therefore, a `DamageCalculationStrategy` is a `ScriptableObject` that defines a sequence of `DamageStep`s to be executed in order when calculating damage.

On-death & on-resurrection `GameAction`s

Astra RPG Framework v1.4.0 introduced the concept of GameAction: a modular and reusable unit of game logic that can be assigned via the inspector to various components to define custom behaviors.

Astra RPG Health leverages Game Actions to define custom behaviors when an entity dies or is resurrected. The framework allows you to assign a default on-death Game Action that will be executed when any entity dies, unless the entity has its own custom on-death Game Action assigned. Similarly, a default on-resurrection Game Action can be assigned to be executed when an entity is resurrected.

Lifesteal Configuration

`LifestealConfig`, deriving from ScriptableObject, allows you to define how lifesteal mechanics work for specific damage types. This allows to bind a statistic to each damage type you want to have lifesteal for. That statistic will be used to calculate the amount of health to restore to the attacker when they deal damage of that type.
The configuration allows also to configure the damage pipeline timing of the lifesteal effect. For example, you might want lifesteal to occur before or after damage reduction is applied. We will see this in detail later in the Workflows.

Health Scaling Component

Astra RPG Health provides a brand new `HealthScalingComponent` that you can use in your `ScalingFormula`s to have skills or abilities scale based on either the attacker or the target's health. You can choose to scale upon one or more among Maximum HP, Current HP, and Missing HP.

Experience Collector

An `ExpCollector` is a `MonoBehaviour` that you can add to your entities to allow them to collect experience points from entities that die and have an  `ExpSource` component attached. The `ExpCollector` can be configured with different strategies ( `ExpCollectionStrategy`) to define under which conditions experience is collected from the dead entity.

 Experience Collection Strategy

An `ExpCollectionStrategy` is a `ScriptableObject` that defines the logic for determining if an entity collects experience upon the death of another entity.

More Game Events

Astra RPG Health comes with many new Game Events that you can use to react to health&damage-related events in your game. Some of the most important ones are:

- `PreDamageGameEvent`: Triggered before damage is applied to an entity. Useful for modifying or canceling damage. Use this for implementing custom passives or effects that need to react before damage is taken.
- `DamageResolutionGameEvent`: Triggered when an entity takes damage. Can be used to react to damage being applied.
- `EntityDiedGameEvent`: Triggered when an entity dies.
- `EntityHealedGameEvent`: Triggered when an entity is healed.
- `EntityResurrectedGameEvent`: Triggered when an entity is resurrected.

And many more events. We will discuss them in detail later in the Workflows.

Package Configuration

Astra RPG Framework needed no configuration. The health package, however, needs to be configured to have the system work around the specific instances of your game. For example, if you defined a "Super Duper All-damage resistance" `Stat` in your game, you need to tell Astra RPG Health to use it when calculating damage.

The package uses a flexible configuration system that balances convenience with explicit control. This page explains how to set up and configure the health system for your game.

Configuration Overview

The Astra RPG Health system uses a **two-tier configuration architecture**:

1. **Global Settings** (`AstraRpgHealthGlobalSettings`) - A lightweight pointer stored in `Resources` that references your active configuration
2. **Gameplay Configuration** (`AstraRpgHealthConfig`) - The actual configuration containing all gameplay parameters

This separation allows you to:

- Switch between different configuration profiles easily (e.g., for testing, different game modes)
- Keep configuration data separate from the loading mechanism
- Support convention-based fallbacks for quick prototyping

Global Settings

Automatic Setup

The package automatically creates the Global Settings asset on first import or when the editor loads. You don't need to do anything manually.

What happens automatically:

1. The `AstraRpgHealthGlobalSettings.asset` is created in `Assets/Resources/`
2. If a default configuration exists (e.g., from imported samples), it's automatically assigned
3. The system is immediately ready to use

> 📁 **Default Location:** `Assets/Resources/AstraRpgHealthGlobalSettings.asset`

Project Settings

You can manage the health system configuration through Unity's Project Settings window:

1. Open **Edit → Project Settings**
2. Navigate to **Astra RPG Health**
3. Assign your desired **Active Config Profile**

Status Indicators:

- ✅ **Gray "Using Explicit Configuration"** - A configuration is explicitly assigned
- ⚠️ **Yellow "Using Fallback"** - No explicit configuration; using convention-based fallback
- 🛑 **Red "No Configuration Found"** - Critical: No configuration available

Quick Actions:

- **Create New Config Asset** - Opens a save dialog to create a new configuration

Convention Over Configuration

The package follows a **convention-over-configuration** philosophy to reduce setup friction:

Fallback Resolution

If no explicit configuration is assigned in Project Settings, the system automatically searches for a configuration named:

> `Astra Rpg Health Config`

located in any `Resources` folder in your project.

Search Order

The configuration provider uses a **three-step loading strategy**:

1. **Explicit Configuration** (Project Settings)
    - Loads `AstraRpgHealthGlobalSettings` from `Resources/AstraRpgHealthGlobalSettings`
    - If it has an `ActiveConfig` assigned, use it
2. **Convention-Based Fallback**
    - Searches for `Astra Rpg Health Config` in any `Resources` folder
    - Logs a warning indicating fallback usage
3. **Error State**
    - If neither is found, logs an error with instructions
    - System will not function until a configuration is provided

> 💡 **Tip:** For production projects, always use **explicit configuration** via Project Settings for clarity and control.

Configuration Loading Strategy

The health configuration is loaded lazily on first access and cached for performance:

```
// Automatically loads configuration on first access
var config = AstraRpgHealthConfigProvider.Instance;

// Pre-load during initialization to avoid runtime overhead
AstraRpgHealthConfigProvider.WarmUp();

// Force reload (useful for testing)
AstraRpgHealthConfigProvider.Reset();
```

When is the configuration loaded?

- Automatically before the first scene loads (via `RuntimeInitializeOnLoadMethod`)
- Lazily when first accessed via `AstraRpgHealthConfigProvider.Instance`
- Explicitly when calling `WarmUp()`

Creating Configuration Assets

If for any reason you need to create a new `AstraRpgHealthConfig` asset, you can do so via two methods:

Via Project Settings

1. Open **Edit** → **Project Settings** → **Astra RPG Health**
2. Unassign any existing configuration, if any
3. Click **Create New Config Asset**
4. Choose a save location
5. The new configuration is automatically assigned

Via Asset Menu

1. Right-click in the **Project Window**
2. Select **Create** → **Astra RPG Health** → **Configuration**
3. Name your configuration
4. Assign it in Project Settings or in the Global Settings asset

---

Health Configuration Reference

> [!INFO] In the `AstraRpgHealthConfig` asset, you can hover over each field to see a tooltip with a brief description.

The `AstraRpgHealthConfig` asset contains all gameplay parameters for the health system. Below is a detailed explanation of each field.

Health

Health Attributes Scaling

Type: `AttributesScalingComponent`
Required: No
Description: Defines how entities' maximum health scales based on character attributes (e.g., Vitality, Endurance).

> **See Also:** Astra RPG Framework Scaling documentation

Generic Flat Heal Amount Modifier Stat

Type: `Stat`
Required: No
Description: The stat that modifies **all** healing received by an entity as a flat amount.

Stacking Behavior:

- Combines **additively** with source-based flat amount modifications

How it works:

- The stat value represents a **flat amount modifier**
- Positive values increase healing, negative values decrease it
- Example: A value of `25` means +25 extra HP healing received

Example:

- Base Heal: 100 HP
- Generic Heal Amount Modifier: 25 (means +25 HP healing received)
- Final Heal: 100 + 25 = **125 HP**

Generic Percentage Heal Amount Modifier Stat

Type: `Stat` **Required:** No **Description:** The stat that modifies **all** healing received by an entity as a percentage. It is applied on top of the flat heal amount modifiers.

Stacking Behavior:

- Combines **additively** with source-based percentage modifications

How it works:

- The stat value represents a **percentage modifier**
- Positive values increase healing, negative values decrease it
- Example: A value of `20` means +20% extra healing received

Example:

- Base Heal: 100 HP
- Generic Flat Heal Amount Modifier: 20 (means +20 extra HP healing received)
- Generic Percentage Heal Amount Modifier: 20 (means +20% healing received)
- Final Heal: (100 + 20) * 1.20 = **144 HP**

> **WARNING**
> Remember to remove the default lower bound of 0 from your flat and percentage heal modifiers if you want to allow negative values for healing reduction effects. By default, the base framework sets a lower bound of 0 on all stats.

Damage

Default Damage Calculation Strategy

Type: `DamageCalculationStrategy`
Required: No
Description: The default strategy used to calculate net damage when an entity doesn't specify its own strategy.

Purpose:

- Provides a default damage calculation strategy to use for "regular" entities. In most cases, this is sufficient
- Can be overridden per-entity for custom damage pipelines in their `EntityHealth` component

> **See Also:** Damage Calculation Pipeline documentation

Generic Flat Damage Modification Stat

Type: `Stat`
Required: No
Description: A universal flat damage modifier that applies to **all damage received**, regardless of type or source.

Usage:

- Applied in the damage calculation pipeline if `ApplyFlatDmgModifiersStep` is included in the used strategy

Stacking Behavior:

- Combines **additively** with Type and Source **flat** modifications

Example:

- Incoming Damage: 150
- Generic Flat Damage Modification: -20 (means -20 HP of damage taken)
- **Damage Reduction:** -20 → Final Damage: **130**

Generic Percentage Damage Modification Stat

Type: `Stat` **Required:** No **Description:** A universal percentage damage modifier that applies to **all damage received**, regardless of type or source.

Usage:

- Applied in the damage calculation pipeline if `ApplyPercentageDmgModifiersStep` is included in the used strategy

Stacking Behavior:

- Combines **additively** with Type and Source **percentage** modifications

Example:

- Incoming Damage: 150
- Generic Percentage Damage Modification: -20 (means -20% damage taken)
- **Damage Reduction:** -20% → Final Damage: 150 * 0.80 = **120**

> **NOTE**
> If the entity to be healed doesn't have the specified flat/percentage heal modification stats, they will be considered as having a value of 0 for those stats, and therefore no modification will be applied to the healing amount for that entity.

Health Regeneration

Health Regeneration Source

Type: `HealSource`
Required: No
Description: The heal source used for passive regeneration effects.

Use cases:

- Allows tracking and modifying regeneration separately from active healing
- Can be used for effects like "Increase Regeneration by 50%"
- Tracking passive healing in analytics or combat logs

Passive Health Regeneration Stat (HP/10s)

Type: `Stat`
Required: No
Description: Determines the amount of health regenerated passively.

> ⚠ **WARNING**
> The stat value represents health regenerated **per 10 seconds**.

Calculation:

```
Health Per Tick = (Stat Value / 10) * Interval In Seconds
```

Example:

- Stat Value: 50 HP/10s
- Interval: 1 second
- Health Per Tick: (50 / 10) * 1 = **5 HP per second**

Passive Health Regeneration Interval

Type: `float`
Default: 1.0 seconds
Required: Yes (must be > 0)
Description: The time (in seconds) between passive regeneration ticks.

Configuration Examples:

Interval	Stat Value	Result
1.0s	50 HP/10s	5 HP every 1 second

Interval	Stat Value	Result
0.5s	50 HP/10s	2.5 HP every 0.5 seconds
2.0s	50 HP/10s	10 HP every 2 seconds

> **WARNING**
> Smaller intervals increase CPU overhead. Recommended range: 0.5s - 2.0s.

Suppress Passive Regeneration Events

Type: `bool`
Required: No
Description: If enabled, prevents triggering any heal events during passive regeneration ticks. Keep it disabled if you need to track passive regeneration in a combat log or if you have effects that trigger on heal events and should also apply to passive regeneration. If your game doesn't require any of the above and you want to minimize overhead, you can enable this option and skip all heal-related logic during regeneration ticks. Useful if your game has a lot of entities with passive regeneration and you want to optimize performance. If you need both to keep sending regeneration events and to minimize overhead, I advise to increase the regeneration interval and to keep the "Suppress Passive Regeneration Events" option disabled. This way you can have less regeneration ticks and still trigger events for each tick.

Manual Health Regeneration Stat

Type: `Stat`
Required: No
Description: Determines health regenerated when triggering manual regeneration via API. The amount of health regenerated is equal to the value of this stat.

Use Cases:

- **Turn-based systems:** Regenerate health at the end of each turn
- **Rest mechanics:** Trigger regeneration when resting at campfires
- **Time-skip systems:** Apply regeneration for elapsed time

API Usage:

```
// Trigger manual regeneration
entityHealth.ManualHealthRegenerationTick();
```

Lifesteal

Lifesteal Config

Type: `LifestealConfig`
Required: No
Description: Configuration for lifesteal mechanics (healing based on damage dealt).

Typical Settings:

- Lifesteal percentage stat
- Heal source for lifesteal effects
- Restrictions (e.g., only on critical hits, only physical damage)

> **See Also:** Lifesteal documentation

Death

Default On Death Game Action

Type: `GameAction`
Required: Yes
Description: The game action executed when an entity dies (if the entity doesn't have its own on-death game action). Use a composite game action to chain multiple effects.

Common on-death Game Action Ideas:

- **Destroy GameObject** - Removes the entity from the scene
- **Ragdoll** - Enables ragdoll physics
- **Respawn** - Respawns the entity after a delay
- **Loot Drop** - Spawns loot and destroys the entity

Example:

```
Death → Execute composite on-death Game Action → [Spawn Death VFX → Drop Loot →
Destroy GameObject]
```

Default On Resurrection Game Action

Type: `GameAction`
Required: No
Description: The game action executed when an entity is resurrected (if the entity doesn't have its own on-resurrection game action). Use a composite game action to chain multiple effects.

Common on-resurrection Game Action Ideas:

- **Simple Resurrection** - Restores health and enables the entity
- **Resurrection VFX** - Plays visual effects during resurrection
- **Stat Penalties** - Applies temporary debuffs after resurrection

Default Resurrection Source

Type: `HealSource`
Required: Yes
Description: The heal source used when an entity is resurrected.

Use cases:

- Categorizes resurrection healing separately from normal healing
- Allows effects like "Increase Resurrection Healing by 50%"
- Used for analytics and gameplay feedback

Troubleshooting

⚠️ "No Configuration found!" error

Cause: No configuration is assigned and no fallback exists.

Solution:

1. Check **Project Settings** → **Astra RPG Health**
2. Assign a configuration or create a new one
3. Alternatively, create a config named `Astra Rpg Health Config` in a `Resources` folder

⚠️ "Using Fallback" warning

Cause: No explicit configuration assigned in Project Settings.

Solution:

1. Open **Project Settings** → **Astra RPG Health**
2. Assign the fallback configuration explicitly
3. This warning is just informational and won't break functionality

⚠️ Configuration not updating in Play Mode

Cause: Configuration is cached on first access.

Solution:

```
// Force reload
AstraRpgHealthConfigProvider.Reset();
```

⚠️ Missing Resources folder

Cause: The `Assets/Resources/` folder doesn't exist.

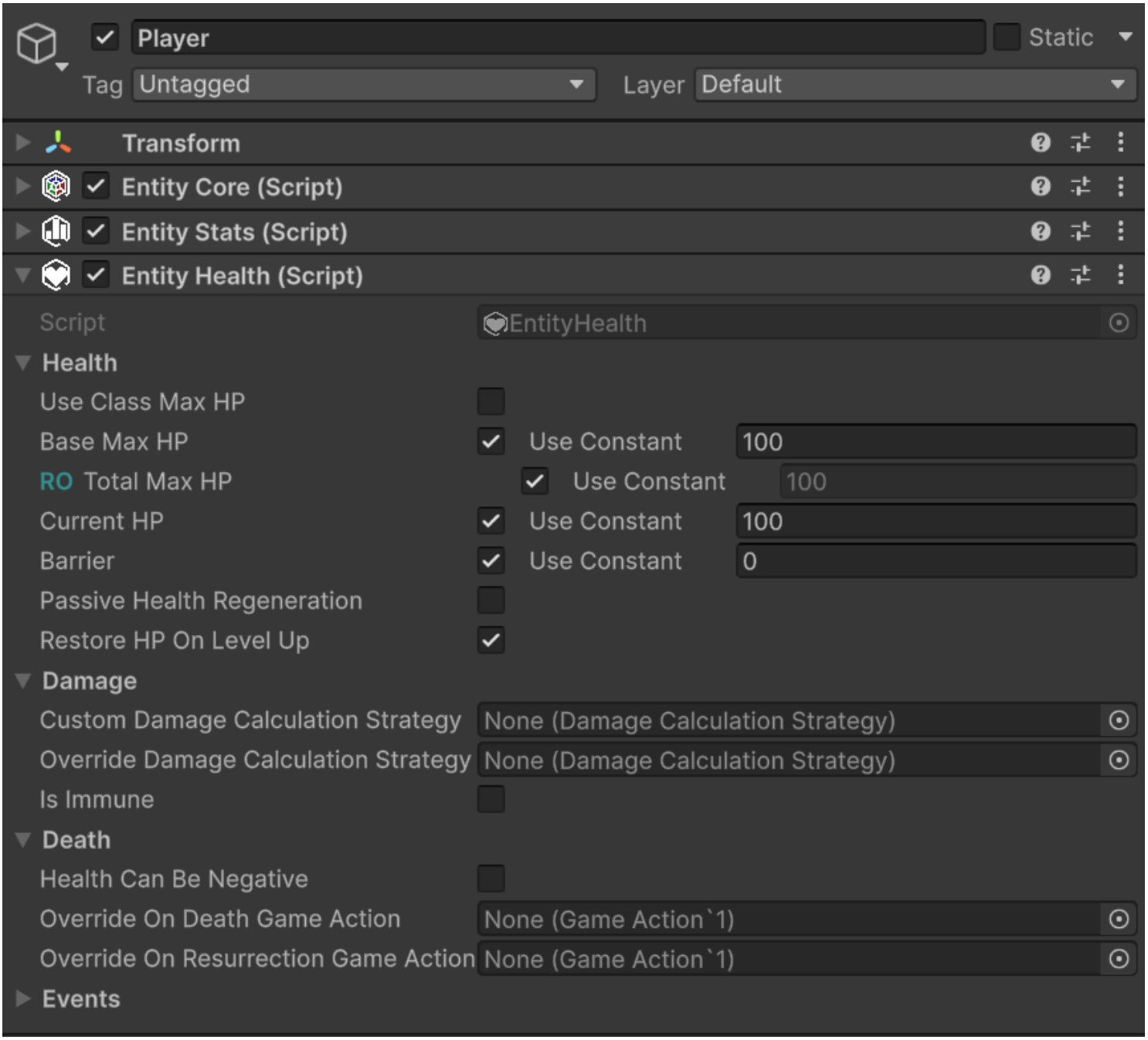
Solution: The package creates it automatically. If it's missing, create it manually:

1. Right-click `Assets`
2. Create → Folder → Name it `Resources`
3. Restart Unity to trigger the bootstrapper

`EntityHealth` Component

With Astra RPG Health, the new `EntityHealth` MonoBehaviour allows you to add health points to an entity. In this way, the entity can take damage and, consequently, die.

Here is an example of the `EntityHealth` component:



The events section is collapsed by default since there are many events, and it is more practical to expand it only when necessary.

Let's proceed in order and analyze every property of the `EntityHealth` component.

Health

- **Use Class Max HP**: Boolean indicating whether to use the max health points defined in the entity's class as the base max health. If disabled, you can manually specify the base max health for the entity.
- **Base Max HP**: LongRef representing the **base** max health of the entity. If "Use Class Max HP" is enabled, this value is marked with teal `RO` (Read Only). Read Only, for LongRef fields, makes `const` values non-editable, and suggests not manually modifying values contained by the associated LongVar variable, if a `const` value is not used.
- **Total Max HP**: LongRef representing the **total** max health of the entity, calculated based on the base max health and any modifiers. This field is always read-only (RO) and is automatically updated when base max health or modifiers change.
- **Current HP**: LongRef representing the entity's current health points. Editable field that is automatically updated when the entity takes damage or is healed. This field is also updated if `Base Max HP` is modified from the inspector.

> **NOTE**
>
> If `Current HP` drops to 0, modifying `Base Max HP` will not update `Current HP`. This is intended behavior, as if an entity is dead, it makes no sense for its health points to be modified by a change in max health. If instead the entity is alive, modifying `Base Max HP` will update `Current HP` accordingly even if `Current HP` is currently 0. This can happen if, for example, you change from 10 base max HP to 25 by deleting the text box with backspace: 10 (backspace) -> 1 (backspace) -> 0 (2 pressed) -> 2 (5 pressed) -> 25. Note that by deleting all numbers and leaving the box empty, `Base Max HP` becomes 0, and consequently `Current HP` also becomes 0. At this point, the entity is considered dead.

- **Barrier**: LongRef representing any barrier points (or temporary HP) of the entity. The barrier absorbs damage before it affects the entity's health points.
- **Passive Health Regeneration**: Boolean that decrees whether the entity passively regenerates HP over time or not. The regeneration frequency, as well as the statistic to consider for the amount of passively regenerated HP, are defined in the Astra RPG Health Config configuration.
- **Restore HP On Level Up**: Boolean indicating whether the entity is fully healed when leveling up.

Damage

For a better understanding of the first two properties of this section, I recommend taking a look at the Damage Calculation Strategy documentation. Simply put, a Damage Calculation Strategy defines how the damage an entity is about to take is calculated (e.g., applying damage reduction for the defensive stat first, or damage absorption by the barrier first, when to apply the critical multiplier, etc.). Also recall that a default strategy can be assigned via configuration. See Default Damage Calculation Strategy.

- **Custom Damage Calculation Strategy**: Field of type `DamageCalculationStrategy`. If the entity should use a custom damage calculation strategy, you can specify it here. This, if defined, takes precedence over the default one defined via configuration. A common use case could be, for example, a boss that cannot take more than 10% of its max health in damage at a time.
- **Override Damage Calculation Strategy**: Field of type `DamageCalculationStrategy`. If defined, it takes precedence over all other damage calculation strategies. Designed to be assigned at runtime to implement special effects or for testing/debug. For example, an entity is affected by a debuff that turns all physical damage into guaranteed critical hits. This debuff could therefore be implemented through a custom strategy assigned to the entity in this field.
- **Is Immune**: Boolean indicating whether the entity is immune to all damage or not. If enabled, the entity will take no damage, regardless of the damage calculation strategy used.

Death

- **Health Can Be Negative**: Boolean indicating whether the entity's health points can drop below 0 before dying. If disabled, the entity's health points will never drop below 0, and the entity will die as soon as its health points reach 0. If enabled, the entity's health points can drop below 0, and the entity will die only when its health points reach a specified negative value (Death Threshold).
- **Death Threshold**: LongRef representing the entity's death threshold. Visible only if "Health Can Be Negative" is enabled. If the entity's health points reach this threshold, the entity dies.
- **Override On Death Game Action**: Game Action that is automatically executed when the entity dies. If defined, this takes precedence over the one defined in the configuration. Useful for implementing special behaviors upon an entity's death (for example, entities that explode upon death dealing area damage).
- **Override On Resurrection Game Action**: Game Action that is automatically executed when the entity is resurrected. If defined, this takes precedence over the one defined in the configuration. Useful for implementing special behaviors upon an entity's resurrection.

Damage vs RemoveHealth and Heal vs AddHealth

`EntityHealth` provides a couple of public methods to increase current HP and two to decrease them:

- `Heal` and `AddHealth` to increase current HP.
- `TakeDamage` and `RemoveHealth` to decrease current HP.

`TakeDamage` and `Heal` are extensively documented in the Dealing Damage to an Entity and Healing an Entity sections respectively. However, this sounds like a good moment to introduce the difference between these two pairs of methods, and when to use one or the other.

It is important to clarify why two different methods exist to increase and decrease current HP, and when to use one or the other.

`AddHealth` and `RemoveHealth` operate at a lower level of abstraction than `Heal` and `Damage`, as they directly modify the entity's current HP by a specified `long` value, without passing through the damage calculation pipeline or without taking into account any healing or damage modifiers. They are very predictable and direct methods, and are mainly used internally by the framework. These methods can be useful in specific situations where the gain of HP is not due to healing, or the loss of HP is not due to damage, but rather to particular mechanics that require a direct modification of current HP. For example, suppose that following a cutscene we want to force the player's HP to 1. In this case, we could use `RemoveHealth` to remove all HP except 1, without having to worry about any damage modifiers or the damage calculation strategy that would alter the damage taken based on the player's stats and equipment, as well as raising damage events that could trigger game logic we don't want to activate in this specific case.

`Heal` and `TakeDamage`, on the other hand, are more complex methods that take into account various factors such as the damage calculation strategy, damage immunity, healing modifiers, etc. These methods are intended to be used primarily by game developers to apply damage and healing to entities, as they guarantee that all mechanics and rules of the health system are respected. For example, if you want to inflict damage on an entity, it is advisable to use the `TakeDamage` method, so that the damage is calculated correctly based on the configured damage calculation strategy, and that any immunities or modifiers are taken into consideration. Unsurprisingly, `Heal` and `TakeDamage` internally use `AddHealth` and `RemoveHealth` to effectively modify the entity's current HP after calculating the net HP gain or loss to apply.

In 99% of cases, you will use `Heal` and `TakeDamage` to apply healing and damage to entities. `AddHealth` and `RemoveHealth` are available to cover rarer and more particular use cases.

Events

Events are, by default, collapsed as there are many of them and they would expand excessively in the inspector. By opening them, we should see something like this:

In the image, you see already assigned events, but when you first add the component, all events will be unassigned and empty.

Let's start by introducing the difference between *Global Events* and *Extra Events*.

Global Events

Global Events are fundamental events that transmit important information to the whole framework. Events assigned to these slots must have a global scope, i.e., they must be able to be listened to by any entity or system in the game. These events are used by the framework to handle essential features, such as lifesteal and other mechanics that require centralized communication between the various parts of the system.

> **WARNING**
> Reserving these slots for events of a global nature is fundamental to ensure the correct functioning of the framework. Assigning Game Event instances that are specific to one or a few entities would involve operating problems at the framework level.

Extra Events

Extra Events, instead, are designed to transmit information to specific components or a restricted circle of entities. A practical example is the communication between the player's EntityHealth and the HUD displaying their HP: only the player possesses a dedicated HUD, so it is useful to assign an exclusive event for this interaction. In this way, the GameEvent associated with the player's EntityHealth is listened to only by the HUD, guaranteeing clear compartmentation and greater efficiency. Thus, the HUD does not receive events from all entities, but only those relevant to the player.

Events Breakdown

Here is a detailed description of each event. Each type of event has both the global event and a list of extra events, but it is sufficient to describe each event once.

Damage Related Events

To better understand the first two events of this section, I recommend taking a look at the Damage documentation to get a better understanding of damage in Astra RPG Health.

- **Pre Damage Info Event**: Event raised before the entity takes damage, and before the damage calculation pipeline calculates the net damage. This event transmits information about the damage the entity is about to take, such as the damage type, the damage source (an entity, `null` if not applicable), the damage source type (e.g., environmental, skill, trap, etc.), the raw damage you intend to inflict, and other relevant information. For more details regarding the context parameter and its fields, refer to the API documentation PreDamageContext. This event can be useful for implementing passive abilities or, in general, advanced mechanics that trigger effects in response to specific conditions related to the damage an entity is about to take. For example, a debuff or status modifier that amplifies critical damage taken by 50% when the damage type is "Fire", or a passive

ability that negates all instances of damage currently being taken if they had raw damage less than 50.

- **Damage Resolution Event**: Event raised after the entity has taken or ignored damage. Similarly to the context parameter of the previous event, this event transmits detailed information about the damage just taken or ignored. For more details regarding the context parameter and its fields, refer to the API documentation DamageResolutionContext.

In general, the thumb rule for deciding whether to use the Pre Damage Info Event or the Damage Resolution Event is the following: if you want to manipulate the damage an entity is about to take, it is better to subscribe to Pre Damage Info Event, and modify the context as desired; if instead you want to react to the damage an entity has just taken, and trigger effects in response to it, it is better to subscribe to Damage Resolution Event, and react based on the information transmitted by its context.

Health Related Events

- **Gained Health Event**: Event raised when the entity gains HP, whether through healing or other mechanisms (e.g., Max HP modifiers that caused a gain of health). Refer to the EntityHealthChanged Context API for more details on the context parameter.
- **Lost Health Event**: Event raised when the entity loses HP, whether through taking damage or other mechanisms (e.g., Max HP modifiers that caused a loss of health). The context parameter of this event is the same as the previous one, so refer to the EntityHealthChangedContext API for more details.

> **NOTE**
>
> Because `TakeDamage` and `Heal` internally invoke `RemoveHealth` and `AddHealth`, calling these methods will also raise the `EntityGainedHealth` and `EntityLostHealth` events respectively.

- **Max Health Changed Event**: Event raised when an entity's total max health points change. This event is raised both when total max hp increase and when they decrease. See EntityMaxHealth ChangedContext API for more details on the context parameter.
- **Entity Died Event**: Event raised when the entity dies. See EntityDiedContext API for more details on the context parameter.

Healing Related Events

- **Pre Heal Event**: Event raised before the entity is healed. This event transmits information about the healing the entity is about to receive, such as the amount of HP you intend to heal, the entity that provided the healing (`null` if not applicable), the heal source (e.g., skill, item, potion, etc.) and other relevant information. For more details regarding the context parameter and its fields, refer to the API documentation PreHealContext. The amount of health points intended to heal, transmitted by this event, is the value before applying any healing modifiers. This event can be useful for

implementing passive abilities or, in general, advanced mechanics that trigger effects in response to specific conditions related to the healing an entity is about to receive. For example, a buff that amplifies healing derived from potions (heal source) by 30%.

- **Entity Healed Event**: Event raised when the entity has been healed. This event transmits information about the healing just received, such as the amount of HP the entity actually gained after the application of any healing modifiers. For more on the context parameter see the Received HealContext API.

Here too, as for damage events, the thumb rule for deciding whether to use the Pre Heal Event or the Entity Healed Event is the following: if you want to manipulate the healing an entity is about to receive, it is better to subscribe to Pre Heal Event, and modify the context as desired; if instead you want to react to the healing an entity has just received, and trigger effects in response to it, it is better to subscribe to Entity Healed Event, and react based on the information transmitted by its context.

Resurrection Related Events

- **Entity Resurrected Event**: Event raised when the entity is resurrected. See ResurrectionContext API for more details on the context parameter.

Damage

Damage Sources

Damage Types

Defensive Stats

Defense Penetration

Damage Calculation Pipeline

PreDamageContext and DamageResolutionContext

Damage Step

Damage Calculation Strategy

Dealing Damage to an Entity

The API method you will use the most with this package is certainly `TakeDamage`, whose responsibility is to apply damage to the entity, taking into account modifiers, immunity, the damage calculation strategy, and other relevant mechanics. This method takes a `PreDamageContext` as input.

The recommended way via code to inflict damage on an entity is as follows:

1. Construct an instance of `PreDamageContext` with all relevant information about the damage you intend to inflict through its fluent builder.
2. Call `TakeDamage` passing the newly constructed context.

Suppose we are implementing a skill that deals 50 fire damage to the target. The code to apply damage to the target could be the following:

```
// Assuming that:
// - dmgType is a DamageType representing fire damage
// - dmgSource is a DamageSource representing the damage coming from a skill
// - target is the EntityCore that we want to damage
// - skillCaster is the EntityCore that casts the skill

// first we ensure that the target has an EntityHealth component
if (target.TryGetComponent(out EntityHealth targetHealth)) {
    // then we build the PreDamageContext with all the relevant information
    var preDamageContext = PreDamageContext.Builder
            .WithAmount(50)
            .WithType(dmgType)
            .WithSource(dmgSource)
```

```
            .WithTarget(target)
            .WithDealer(skillCaster)
            .Build();

    // finally, we call TakeDamage to apply the damage to the target
    targetHealth.TakeDamage(preDamageContext);
}
```

Thanks to the `PreDamageContext` fluent builder, the IDE will automatically suggest the fields to fill in one at a time. As long as it presents them one at a time, it means they are required fields. If instead it presents more than one at a time, it means those fields are optional, and you can decide whether to fill them in or build the context without them. Optional fields are, for example, the critical hit flag and the critical multiplier. In the example, for simplicity, I did not fill in these fields.

Now, we know that hardcoding the damage value directly in the code is not a good practice. Let's see how to use a `ScalingFormula` to dynamically calculate the amount of damage to inflict. The step builder creation would become the following:

```
// Assuming that scalingFormula is a ScalingFormula that calculates the damage amount based
on the skill caster's stats...

// ...we calculate the damage amount by evaluating the scaling formula
long damageAmount = scalingFormula.CalculateValue(skillCaster);
var preDamageContext = PreDamageContext.Builder
        .WithAmount(damageAmount)
        .WithType(dmgType)
        .WithSource(dmgSource)
        .WithTarget(target)
        .WithDealer(skillCaster)
        .Build();
```

Healing

An entity can be healed in 4 different ways:

- Direct healing through the `Heal` method.
- Health regeneration. This can be passive, as defined in the Health Regeneration configuration, so automatically triggered by the framework every so often, or it can be manually activated via the `ManualHealthRegenerationTick` method. Also for the latter, you must configure the statistic to consider for the calculation of healing through the configuration.
- Through lifesteal, that is healing the entity based on the damage dealt. However, lifesteal functioning is detailed in Lifesteal as it deserves a dedicated section.
- Via resurrection with the two `Resurrect` methods. One to resurrect the entity with a percentage of HP, and one to resurrect it with a fixed amount of health points. Applicable only if the entity is dead. Also resurrection is detailed in a dedicated section, Resurrection.

> **NOTE**
>
> Regeneration (both passive and manual), lifesteal, and resurrection all use, behind the scenes, the `Heal` method to effectively heal the entity.

We will first introduce some concepts that are common to all the four healing methods, and then we will analyze direct healing and health regeneration. As aforesaid, lifesteal and resurrection are analyzed in their respective sections, Lifesteal and Resurrection.

Heal Source

Relative path: `Heal Source`

A `HealSource` represents the source of healing. Some examples of `HealSource` could be: healing potions, skills, passive regeneration, lifesteal, system (e.g., the player is healed to max health during the tutorial by a support machine), and so on. The `HealSource` is an important concept as it allows distinguishing between different sources of healing, and thus applying specific healing modifiers for each healing source, in addition to the generic healing modifiers that apply to all healing sources. Furthermore, `HealSources` are important because they are communicated in healing contexts, and therefore in the listeners of healing events, allowing the latter to react specifically based on the healing source that triggered the event. Thanks to this, you could, for example, implement a buff that increases the healing received from healing potions. Finally, `HealSources` pave the way for the implementation of a combat log that tracks not only the amount of healing received but also the healing source, allowing the player to have a deeper understanding of what healed them most effectively in a specific game situation.

An instance of `HealSource` in the inspector looks like this:

You can notice that there are two properties to configure for each `HealSource`:

- **Flat Heal Modification Stat**: the statistic to consider in an entity to apply flat, specific healing modifiers for this healing source. Positive values of this statistic increase the healing received from this source, while negative values decrease it. If the entity does not have this statistic, a value of 0 will be considered for this statistic, and therefore no specific flat healing modifier will be applied for this healing source.
- **Percentage Heal Modification Stat**: the statistic to consider in an entity to apply percentage, specific healing modifiers for this healing source. Positive values of this statistic increase the healing received from this source, while negative values decrease it. If the entity does not have this statistic, a value of 0 will be considered for this statistic, and therefore no specific percentage healing modifier will be applied for this healing source.

Heal Modifiers

Heal modifiers are statistics that influence the amount of healing received by an entity. They can influence it positively or negatively, depending on the value. There are two types of healing modifiers: generic heal modifiers, which apply to all healing sources, and source-specific heal modifiers, which apply only to a specific healing source. Furthermore, healing modifiers can be flat or percentage-based. Flat healing modifiers influence the amount of healing received by adding or subtracting a fixed amount of HP to the healing, while percentage healing modifiers influence the amount of healing received by multiplying the healing by a certain factor. It is important to note that flat healing modifiers are applied before percentage healing modifiers. Therefore, percentage modifications will also affect the impact of flat healing modifiers.
For percentage modifiers, a statistic with a value of 120 increases the healing by 120%, while a statistic with a value of -25 decreases the healing by 25%.

Generic healing modifiers are summed with the source-specific ones: flat modifiers are added together, as are the percentage ones.

Finally, if an entity does not possess the statistic associated with a healing modifier in its Stat Set, a value of 0 will be considered for that statistic, and therefore no healing modifier will be applied for that

statistic.

Clearly, to provide healing modifiers to entities, since they are statistics, you must proceed through the Stat Modifiers APIs, as described in the Understanding Stat Modifier Types section of the base framework documentation.

Example of Heal Modifiers

Suppose we want to calculate the healing received by an entity using a healing potion. Here are the example values:

Definition of the statistics used in the example:

- **Potion Heal Flat Modifier**: Source-specific statistic (the potion) that adds or subtracts a fixed value to the HP healed by the potion.
- **Potion Heal Percentage Modifier**: Source-specific statistic (the potion) that increases or decreases the potion's healing by a percentage.
- **Generic Flat Heal Modifier**: Generic statistic that applies to all healing sources, adding or subtracting a fixed value to the HP healed.
- **Generic Percentage Heal Modifier**: Generic statistic that applies to all healing sources, increasing or decreasing the healing by a percentage.

Phase	Value	Calculation	Result
Base healing	80 HP	-	80 HP
Flat modifiers	Potion Heal Flat Modifier: 50 Generic Flat Heal Modifier: -10	50 - 10 = 40 HP 80 + 40	120 HP
Percentage modifiers	Potion Heal Percentage Modifier: 20% Generic Percentage Heal Modifier: 10%	20% + 10% = 30% 120 × 1.3	156 HP

Final healing received: 156 HP

This table clearly shows how flat and percentage modifiers are summed, and how the final result is reached.

Direct Healing

The `Heal` method is the most straightforward way to heal an entity. It takes a `PreHealContext` as input, which contains all relevant information about the healing you intend to apply and operates as follows:

1. It checks if the entity is dead. If the entity is dead, will rais an exception, as you cannot heal a dead entity. If you want to resurrect a dead entity, check the Resurrection section.

2. It checks if the healing to be applied is marked as a critical hit and, if so it applies the critical multiplier to the healing amount.
3. It retrieves and applies the generic and `HealSource`-specific **flat** heal modifiers for the entity.
4. It retrieves and applies the generic and `HealSource`-specific **percentage** heal modifiers for the entity.
5. It retrieves the heal modifiers specific to the heal source.
6. It sums the retrieved modifiers and applies them to the healing amount.
7. It increases the entity's current HP by the final healing amount.
8. It raises the *Entity Healed Event* with a `HealResolutionContext` containing all relevant information about the healing that was just applied.
9. It returns the `HealResolutionContext` created in the previous step so that the caller can use it for further processing if needed.

The `Heal` method, differently from the `TakeDamage` method, cannot be configured to reorder the steps of the healing pipeline. This choice was made as healing is generally more straightforward than damage, and there are usually no mechanics that require reordering the steps of the healing pipeline. Therefore, I evaluated simplicity and ease of use more important than flexibility for this method.

`Heal` Usage Example

Suppose we want to heal an entity for 20% of its total max HP. The code could be the following:

```
// Assuming that:
// - healSource is a HealSource representing the healing coming from a skill
// - skillCaster is the EntityCore that casts the healing skill
// - target is the EntityCore that we want to heal

if (target.TryGetComponent(out EntityHealth targetHealth)) {
    // in case the target has a EntityHealth component...
    long healAmount = target.GetMaxHpPortion(0.2d);

    PreHealContext preHealContext = PreHealContext.Builder
        .WithAmount(healAmount)
        .WithSource(healSource)
        .WithHealer(skillCaster)
        .WithTarget(target.EntityCore)
        .Build();

    targetHealth.Heal(preHealContext);
}
```

It is not a good practice to hardcode the healing amount directly in code (20% of max hp in the example). Hardcoded values make tuning and balancing difficult, prevent reuse across different skills or

items, and force code changes and recompilation for values that designers or content creators should be able to tweak. Prefer one of these approaches instead:

- **Serialize the amount** as an inspector-editable field so designers can tweak values without touching code.
- **Use a `ScalingFormula`** (or equivalent) to compute the heal amount dynamically from the caster's or target's stats, allowing the effect to scale with progression and remain data-driven.

Example using a `ScalingFormula` to calculate the heal amount at runtime:

```
// Assuming that scalingFormula is a ScalingFormula that calculates the heal amount
// based on the skill caster's stats...
long healAmount = scalingFormula.CalculateValue(skillCaster);

PreHealContext preHealContext = PreHealContext.Builder
    .WithAmount(healAmount)
    .WithSource(healSource)
    .WithHealer(skillCaster)
    .WithTarget(target.EntityCore)
    .Build();

targetHealth.Heal(preHealContext);
```

Recommended pattern when healing programmatically:

1. Construct a `PreHealContext` with all relevant information using the fluent builder.
2. Call `Heal` passing the constructed context.

The `PreHealContext` fluent builder is helpful because it guides you through required inputs first — the IDE will typically present required builder steps one at a time. When the builder presents multiple fields together, those fields are optional and can be omitted.

Health Regeneration

Health regeneration is a mechanism that allows an entity to passively regenerate its health over time. In games generally, this mechanic is implemented through discrete regeneration ticks. Ticks, depending on the game, can be marked by the passage of time, or by certain events, like the end of a turn in a turn-based game.
This package supports both passive and manual regeneration.

Passive Health Regeneration

Passive regeneration, to work, needs to be configured through the Health Regeneration section of the package configuration. The following parameters should be configured there:

- **Health Regeneration Source**: the `HealSource` to associate with regeneration (passive and manual). The package will use this `HealSource` to create the healing contexts to pass to the `Heal` method when it's time to regenerate health.
- **Passive Health Regeneration Stat (HP/10s)**: the amount of HP the entity regenerates every 10 seconds. The package will take care of scaling this amount based on the time that passes between consecutive ticks, to ensure smooth and consistent regeneration.
- **Passive Health Regeneration Interval**: the time interval, in seconds, between one regeneration tick and the next.

Additionally, it is important to remember to enable passive regeneration on the entity's `EntityHealth`.

To give an example, if we want an entity to regenerate 5 HP every 0.5 seconds, we must configure the "Passive Health Regeneration Interval" parameter to 0.5, and the entity must have the statistic associated with "Passive Health Regeneration Stat (HP/10s)" set to a value of 100 (5 HP every 0.5 seconds correspond to 10 HP per second, which correspond to **100 HP every 10 seconds**).

Performance Considerations

Before making any considerations about performance, I want to remind you that premature optimization is the root of all evil. Before taking actions to optimize performance, a real performance problem should be identified through profiling. That said, since by default passive regeneration raises Entity Healed Events (global and extra), it's important to consider the performance impact if you have a large number of entities regenerating health simultaneously with a very short regeneration interval. If there were also several listeners subscribed to the global Entity Healed Event, you would get several function calls at each regeneration tick X each entity. If this becomes a performance issue for your game, you have several levers available to optimize performance:

- **Increase the regeneration interval**: by increasing the regeneration interval, the number of regeneration ticks per time unit is reduced, and therefore the number of Entity Healed Events raised.
- **Disable the raising of Entity Healed Events for passive regeneration**: if you don't need to react to passive regeneration through the listeners of Entity Healed Events, you can disable the raising of these events for passive regeneration through the configuration. This way, even if you have a large number of entities regenerating health simultaneously with a very short regeneration interval, you won't have a significant performance impact due to raised events and associated function calls.
- **Use Extra Entity Healed Events**: if you only need to react to the passive regeneration of one or some specific entities, you can configure these entities to raise an Extra Entity Healed Event specifically for passive regeneration, and subscribe your listeners to this event instead of the global Entity Healed Event. This way, the only function calls you'll have at each tick will be those of the listeners subscribed to the specific Extra Entity Healed Event of the entities configured to raise it, thus reducing the performance impact.

I would like to reiterate that, unless you have identified a real performance problem through profiling, it is not necessary to take any of these actions to optimize performance. You probably won't have any

performance issues even with a thousand entities and dozens of listeners subscribed to the global Entity Healed Event.

Manual Health Regeneration

Manual regeneration is instead triggered manually through the `ManualHealthRegenerationTick()` API method.

This method, when called, triggers a regeneration tick for the entity. Note that the statistic considered for the health calculation does NOT coincide with the one configured for passive regeneration, but is a separate statistic, also set via the package configuration, specifically: Manual Health Regeneration Stat. The value of this statistic determines the amount of HP regenerated at each manual regeneration tick. Obviously, healing modifiers, both generic and those specific to the heal source configured for regeneration, will also affect manual regeneration, just like passive regeneration.

Passive vs Manual Health Regeneration: Which One Should I Use?

If you have doubts about which type of regeneration to use, here are some guidelines that might help you choose:

- **Real Time**: if your game is in real-time, passive regeneration is generally more suitable, as it integrates better with continuous gameplay flow.
- **Turn-Based**: if your game is turn-based, manual regeneration is generally more suitable, as you can trigger it at the end of each turn, ensuring more precise control over the game flow.
- **Regeneration in the base**: if your game involves a regeneration mechanic that only happens when the character is in a specific location (e.g., a base), you can use passive regeneration, but activate it only when the character is in that location, and deactivate it when they leave. If, on the other hand, you want it to be active even when the character is outside the base, but still want it to be stronger when in the base, you can assign a specific Heal Modifier for the regeneration's Heal Source when the character is in the base, to increase the amount of HP regenerated when the character is at the base. Upon leaving the base, you can remove this Heal Modifier to reduce the amount of HP regenerated.
- **Regeneration out of combat**: if your game features regeneration that only happens when the character is out of combat, you can use passive regeneration, turning it on when out of combat, and turning it off when entering combat. Or, if you want it to be active during combat as well, but stronger out of combat, you can (as with base regeneration) add a specific Heal Modifier for the regeneration's Heal Source when the character is out of combat.
- **Regeneration as a buff**: if the entity receives a buff providing HP regeneration according to a specific timing, you can use manual regeneration to trigger regeneration ticks perfectly aligned with the timing intended by the buff.

Clearly, these are just guidelines, not strict rules. For every problem, there are always several possible solutions, and choosing the best one always depends on the specific context of your game and the mechanics you want to implement. So, if you feel a solution different from the suggested ones fits your game better, feel free to use it.

Lifesteal

Health Scaling Component

Resurrection

Advanced topics

Limitations

Requirements

- Astra RPG Framework
- Unity 6 or later

Package Contents

Samples

Installation instructions

Importing Astra RPG Health and its samples

1. From the package manager, import Astra RPG HEalth. You can find the package in the "My Assets" section.
2. After importing, head to the "In Project" section, always in the Package Manager, and click on "AstraRPGHealth".
3. Click on the "Samples" tab and import the samples you desire. Find out more about the samples in the Samples documentation.
4. If you imported the "Example scene and instances" samples you need to import also TextMeshPro Essentials. Click on "Window > TextMeshPro > Import TMP Essential Resources".

Changelog

All notable changes to this project will be documented in this file.

The format is based on Keep a Changelog.

[1.0.0] - 2025-10-30

Added

- Initial release of Astra RPG Health.

Migration Guide