

# Trait

Traits are low-level data blocks (components) comprising subjects. Unlike [Details](#), Traits are plain UStruct data. They are managed manually by the framework in a cache-efficient manner and mainly targeted towards the runtime performance.

## Creating Traits

All of the Unreal Engine's UStructs should be available within Apparatus automatically. If you can't see your struct somewhere in the Traits list, double-click on it in the Content Browser so it gets loaded. Generally speaking you should do it only once, since it gets loaded automatically if there are any references to it.

### C++ Workflow

You should mainly refer to the official Unreal Engine manual on creating [UStructs](#).

You basically create a header (.h) file and optionally a source (.cpp) file. An example of such header-only Trait would be:

```
// Fill out your copyright notice in the Description page of Project
Settings.

#pragma once

#include "CoreMinimal.h"
#include "MyTrait.generated.h"

/**
 *
 */
USTRUCT(BlueprintType)
struct MY_API FMyTrait
{
    GENERATED_BODY()

public:

    UPROPERTY(BlueprintReadWrite, EditAnywhere)
    float VelocityX = 0;

    UPROPERTY(BlueprintReadWrite, EditAnywhere)
    float VelocityY = 0;
};
```

You could omit the **UPROPERTY** specifications but with the fields exposed like that you can now use `MyTrait` both in your C++ code and within BPs.

## Garbage Collection Notes

As it was already said earlier Apparatus uses its own low-level memory model to store Traits efficiently. This comes at a certain cost. Basically you have to manually guarantee the safety for references to other UObjects (Actors, Components, etc) within your Traits, since those should be reference-counted by the Garbage Collector which is absent.

Luckily, you can do it quite easily by referencing the same objects a certain asset or object via some global GC-managed UObject instance and retaining them this way. This global object may also be **added to root** to be retained. You may also add the referenced objects to root explicitly, before assigning them to Trait properties.

Referencing other Subjects via Subject Handles is perfectly fine though and is managed by Apparatus itself. Only remember that those Handles are like weak references. They don't hold the Subject referenced, they just invalidate themselves when the Subject is destroyed (despawned).

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