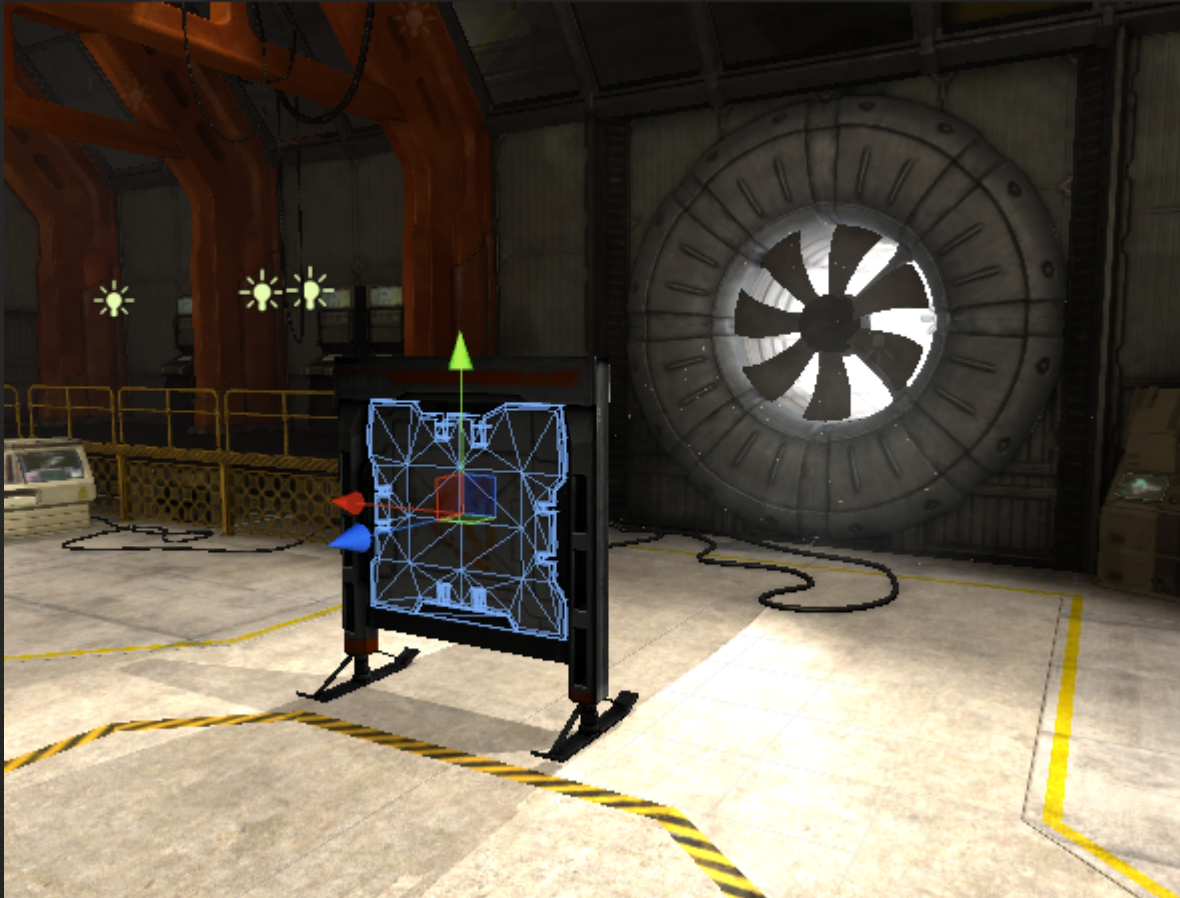


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Model Based Testing a 3D game engine



Simple game object physics



Model Actions

- **SetMass (float)**

Sets mass of rigid body. Higher mass requires higher force to move it.

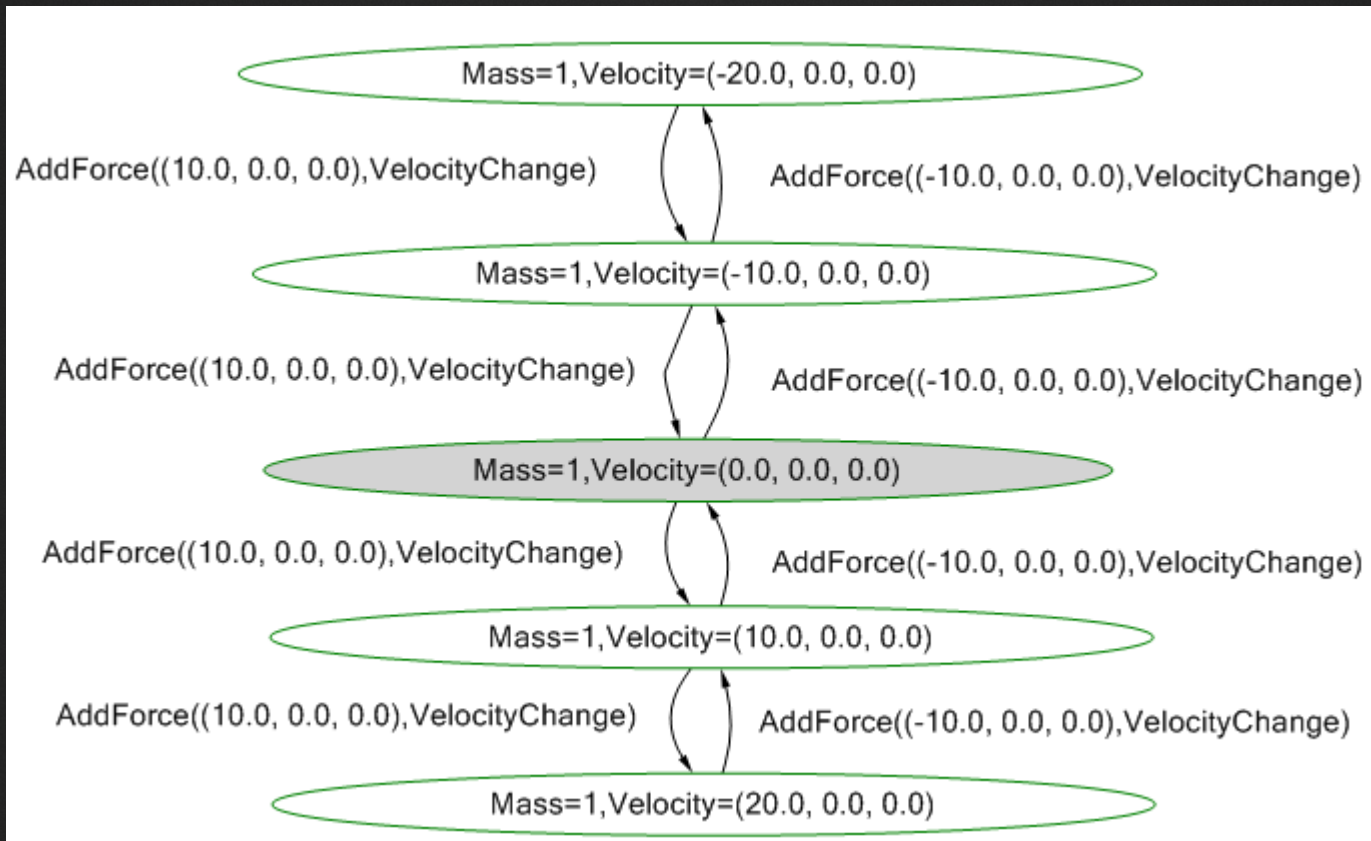
- **AddForce (vector, mode)**

Adds specified force (vector) to object, in order to make it move.

Force Modes

- **Force**
Add a continuous force to the rigidbody, using its mass.
- **Acceleration**
Add a continuous acceleration to the rigidbody, ignoring its mass.
- **Impulse**
Add an instant force impulse to the rigidbody, using its mass.
- **VelocityChange**
Add an instant velocity change to the rigidbody, ignoring its mass.

A Basic Physics Model



Model Implementation using Spec Explorer

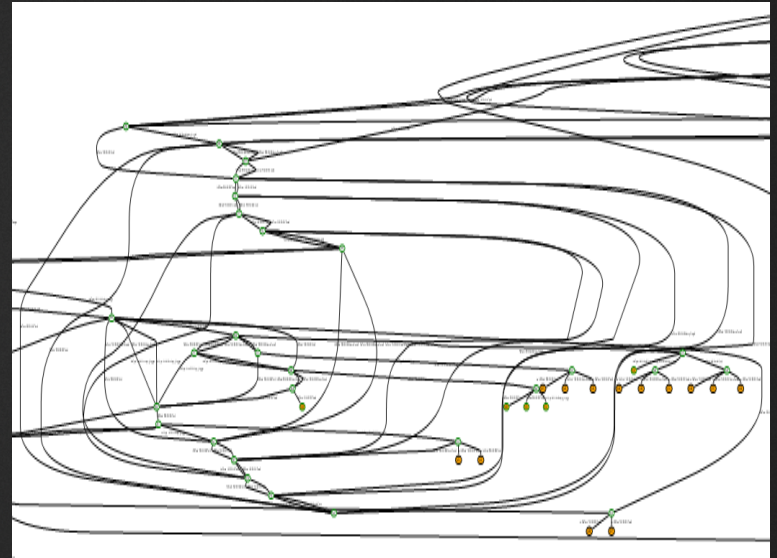
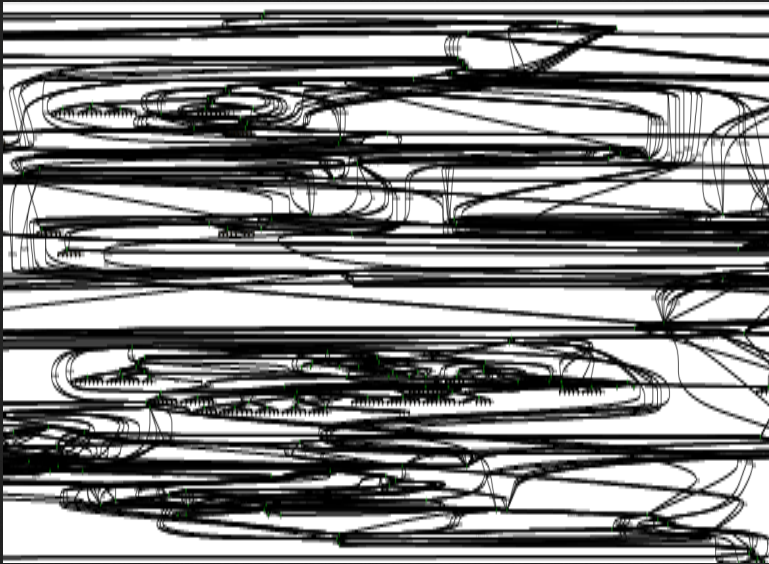
```
[Rule]
public static void AddForce([Domain("ForcePower")] Vector3 force, [Domain("ForceModeValue")] ForceMode forceMode)
{
    const float fixedDeltaTime = 0.02f; // = 50 FPS

    switch (forceMode)
    {
        case ForceMode.Acceleration:
            ModelState.Velocity += force * fixedDeltaTime;
            break;
        case ForceMode.Force:
            ModelState.Velocity += force * fixedDeltaTime / ModelState.Mass;
            break;
        case ForceMode.Impulse:
            ModelState.Velocity += force / ModelState.Mass;
            break;
        case ForceMode.VelocityChange:
            ModelState.Velocity += force;
            break;
    }
}

[Rule]
public static void SetMass([Domain("Mass")] float mass)
{
    Condition.IsFalse(ModelState.Mass.Equals(mass));

    ModelState.Mass = mass;
}
```

Limiting the Model Outcome State Space



Unity Runtime Test Framework

Test Case



Runtime Test Framework

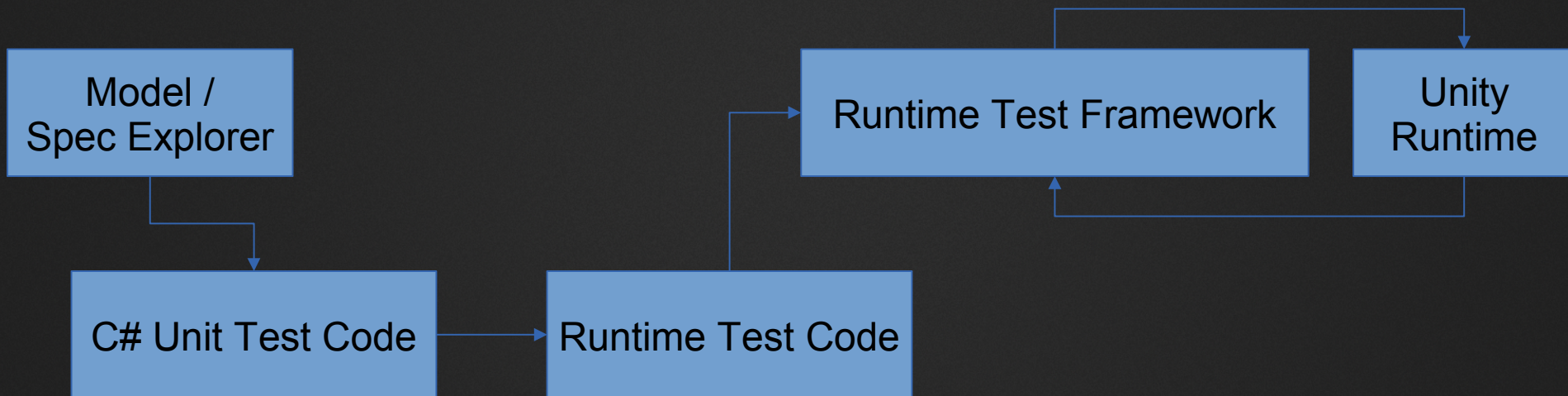


Runtime Players



plus more ...

Connecting the Model and Framework



Connecting the Model and Framework - solution

- Spec Explorer generates C# unit tests
- Runtime Test Framework requires one class per test case
- Dynamic code generation from model generated test cases