

RogueShooter – All Scripts

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RogueShooter – All Scripts

Assets/scripts/Camera/CameraController.cs

```
using UnityEngine;
using Unity.Cinemachine;

// <summary>
// This script controls the camera movement, rotation, and zoom in a Unity game using the Cinemachine package.
// It allows the player to move the camera using WASD keys, rotate it using Q and E keys, and zoom in and out using the mouse scroll wheel.
// The camera follows a target object with a specified offset, and the zoom level is clamped to a minimum and maximum value.
// </summary>
public class CameraController : MonoBehaviour
{
    private const float MIN_FOLLOW_Y_OFFSET = 2f;
    private const float MAX_FOLLOW_Y_OFFSET = 18f;//12f;

    public static CameraController Instance { get; private set; }
    [SerializeField] private CinemachineCamera cinemachineCamera;

    private CinemachineFollow cinemachineFollow;
    private Vector3 targetFollowOffset;

    private float moveSpeed = 10f;
    private float rotationSpeed = 100f;
    private float zoomSpeed = 5f;

    private void Awake()
    {
        if (Instance != null)
        {
            Debug.LogError("CameraController: More than one CameraController in the scene! " + transform + " - " + Instance);
            Destroy(gameObject);
            return;
        }

        Instance = this;
    }

    private void Start()
    {
        cinemachineFollow = cinemachineCamera.GetComponent<CinemachineFollow>();
        targetFollowOffset = cinemachineFollow.FollowOffset;
    }

    private void Update()
    {
        HandleMovement(moveSpeed);
        HandleRotation(rotationSpeed);
        HandleZoom(zoomSpeed);
    }

    private void HandleMovement(float moveSpeed)
    {

```

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```
        Vector2 inputMoveDirection = InputManager.Instance.GetCameraMoveVector();
        Vector3 moveVector = transform.forward * inputMoveDirection.y + transform.right * inputMoveDirection.x;
        transform.position += moveSpeed * Time.deltaTime * moveVector;
    }

    private void HandleRotation(float rotationSpeed)
    {
        Vector3 rotationVector = new Vector3(0, 0, 0);
        rotationVector.y = InputManager.Instance.GetCameraRotateAmount();
        transform.eulerAngles += rotationSpeed * Time.deltaTime * rotationVector;
    }

    private void HandleZoom(float zoomSpeed)
    {
        float zoomIncreaseAmount = 1f;
        targetFollowOffset.y += InputManager.Instance.GetCameraZoomAmount() * zoomIncreaseAmount;

        targetFollowOffset.y = Mathf.Clamp(targetFollowOffset.y, MIN_FOLLOW_Y_OFFSET, MAX_FOLLOW_Y_OFFSET);
        cinemachineFollow.FollowOffset = Vector3.Lerp(cinemachineFollow.FollowOffset, targetFollowOffset, Time.deltaTime * zoomSpeed);
    }

    public float GetCameraHeight()
    {
        return targetFollowOffset.y;
    }
}
```

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Assets/scripts/Camera/CameraManager.cs

```
using System;
using UnityEngine;

public class CameraManager : MonoBehaviour
{
    [SerializeField] private GameObject actionCameraGameObject;

    [SerializeField] private float actionCameraVerticalPosition = 2.5f;
    private void Start()
    {
        // BaseAction.OnAnyActionStarted += BaseAction_OnAnyActionStarted;
        // BaseAction.OnAnyActionCompleted += BaseAction_OnAnyActionCompleted;

        // HideActionCamera();
    }

    void OnEnable()
    {
        BaseAction.OnAnyActionStarted += BaseAction_OnAnyActionStarted;
        BaseAction.OnAnyActionCompleted += BaseAction_OnAnyActionCompleted;
        HideActionCamera();
    }

    void OnDisable()
    {
        BaseAction.OnAnyActionStarted -= BaseAction_OnAnyActionStarted;
        BaseAction.OnAnyActionCompleted -= BaseAction_OnAnyActionCompleted;
    }

    private void ShowActionCamera()
    {
        actionCameraGameObject.SetActive(true);
    }

    private void HideActionCamera()
    {
        actionCameraGameObject.SetActive(false);
    }

    private void BaseAction_OnAnyActionStarted(object sender, EventArgs e)
    {
        switch (sender)
        {
            case ShootAction shootAction:
                Unit shooterUnit = shootAction.GetUnit();
                Unit targetUnit = shootAction.GetTargetUnit();

                Vector3 cameraCharacterHeight = Vector3.up * actionCameraVerticalPosition; //1.7f;
                Vector3 shootDir = (targetUnit.GetWorldPosition() - shooterUnit.GetWorldPosition()).normalized;
```

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```
        float shoulderOffsetAmount = 0.5f;
        Vector3 shoulderOffset = Quaternion.Euler(0, 90, 0) * shootDir * shoulderOffsetAmount;
        Vector3 actionCameraPosition =
            shooterUnit.GetWorldPosition() +
            cameraCharacterHeight +
            shoulderOffset +
            (shootDir * -1);

        actionCameraGameObject.transform.position = actionCameraPosition;
        actionCameraGameObject.transform.LookAt(targetUnit.GetWorldPosition() + cameraCharacterHeight);
        ShowActionCamera();
        break;
    }
}

private void BaseAction_OnAnyActionCompleted(object sender, EventArgs e)
{
    switch (sender)
    {
        case ShootAction shootAction:
            HideActionCamera();
            break;
    }
}
}
```

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Assets/scripts/Camera/FloorVisibility.cs

```
using System.Collections.Generic;
using UnityEngine;

public class FloorVisibility : MonoBehaviour
{
    [SerializeField] private bool dynamicFloorPosition;
    [SerializeField] private List<Renderer> ignoreRendererList;
    private HashSet<Renderer> ignoreSet;
    private Renderer[] rendererArray;
    private int floor;
    private bool? lastVisible;           // vältä turhat muutokset
    private Unit unit;                   // jos kohde on Unit tai sen alla
    private bool forceHidden;            // ulkoinen lukko (esim. kuolema)

    private void Awake()
    {
        rendererArray = GetComponentsInChildren<Renderer>(true);
        unit = GetComponentInParent<Unit>(); // tai GetComponent<Unit>() jos scripti istuu suoraan Unitissa

        if (unit != null)
        {
            // reagoi heti piilotukseen/poistoon
            unit.OnHiddenChangedEvent += OnUnitHiddenChanged;
            forceHidden = unit.IsHidden();
        }

        ignoreSet = new HashSet<Renderer>(ignoreRendererList);
    }

    private void Start()
    {
        floor = LevelGrid.Instance.GetFloor(transform.position);
        Recompute();
    }

    private void OnDestroy()
    {
        if (unit != null) unit.OnHiddenChangedEvent -= OnUnitHiddenChanged;
    }

    private void Update()
    {
        if (dynamicFloorPosition)
        {
            floor = LevelGrid.Instance.GetFloor(transform.position);
        }

        Recompute();
    }
}
```

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```
private void Recompute()
{
    // 1) kamerakorkeuteen perustuva perusnäkyvyys
    float cameraHeight = CameraController.Instance.GetCameraHeight();
    float floorHeightOffset = 2f;
    bool cameraWantsVisible = (cameraHeight > LevelGrid.FLOOR_HEIGHT * floor + floorHeightOffset) || floor == 0;

    // 2) unitin piilotus "lukitsee" näkymättömäksi
    bool visible = cameraWantsVisible && !forceHidden;

    if (lastVisible.HasValue && lastVisible.Value == visible) return; // ei muutosta
    lastVisible = visible;

    ApplyVisible(visible);
}

private void ApplyVisible(bool visible)
{
    foreach (var r in rendererArray)
    {
        if (!r) continue;
        if (ignoreSet.Contains(r)) continue;
        r.enabled = visible;
    }
}

// Jos haluat ulkopuolelta pakottaa piiloon (esim. ragdollin spawner tms.)
public void SetForceHidden(bool hidden)
{
    forceHidden = hidden;
    Recompute();
}

private void OnUnitHiddenChanged(bool hidden)
{
    forceHidden = hidden;
    Recompute();
}

public void AddIgnore(Renderer r)
{
    ignoreRendererList.Add(r);
    ignoreSet.Add(r);
}

public void RemoveIgnore(Renderer r)
{
    ignoreRendererList.Remove(r);
    ignoreSet.Remove(r);
}
}
```

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Assets/scripts/Camera/Look At Camera.cs

```
using UnityEngine;

/// <summary>
/// Turn wordUI elemenets ( Like Unit Health and action points) toward to camera.
/// </summary>
public class LookAtCamera : MonoBehaviour
{
    [SerializeField] private bool invert;

    private Transform cameraTransform;

    private void Awake()
    {
        cameraTransform = Camera.main.transform;
    }

    private void LateUpdate()
    {
        if (invert)
        {
            Vector3 dirToCamera = (cameraTransform.position - transform.position).normalized;
            transform.LookAt(transform.position + dirToCamera * -1);
        } else
        {
            transform.LookAt(cameraTransform);
        }
    }
}
```


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Assets/scripts/Camera/ScreenShake.cs

```
/*
using Unity.Cinemachine;
using UnityEngine;

public class ScreenShake : MonoBehaviour
{
    public static ScreenShake Instance { get; private set; }

    private CinemachineImpulseSource cinemachineImpulseSource;

    private void Awake()
    {
        // Ensure that there is only one instance in the scene
        if (Instance != null)
        {
            Debug.LogError("ScreenShake: More than one ScreenShake in the scene!" + transform + " " + Instance);
            Destroy(gameObject);
            return;
        }

        Instance = this;

        cinemachineImpulseSource = GetComponent<CinemachineImpulseSource>();
    }

    public void Shake(float intensity = 1f)
    {
        cinemachineImpulseSource.GenerateImpulse(intensity);
    }
}
*/

using Unity.Cinemachine;
using UnityEngine;

public class ScreenShake : MonoBehaviour
{
    public static ScreenShake Instance { get; private set; }

    [SerializeField]
    private CinemachineImpulseSource cinemachineRecoilImpulseSource;

    [SerializeField]
    private CinemachineImpulseSource cinemachineExplosiveImpulseSource;

    private void Awake()
```

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```
{  
    // Ensure that there is only one instance in the scene  
    if (Instance != null)  
    {  
        Debug.LogError("ScreenShake: More than one ScreenShake in the scene!" + transform + " " + Instance);  
        Destroy(gameObject);  
        return;  
    }  
  
    Instance = this;  
  
    // cinemachineRecoilImpulseSource = GetComponent<CinemachineImpulseSource>();  
}  
  
public void ExplosiveCameraShake(float ShakeStrength)  
{  
    cinemachineExplosiveImpulseSource.GenerateImpulse(ShakeStrength);  
}  
  
public void RecoilCameraShake(float ShakeStrength)  
{  
    cinemachineRecoilImpulseSource.GenerateImpulse(ShakeStrength);  
}  
}
```

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Assets/scripts/DebuggingAndTesting/GridDebug/CoverDebugGizmos.cs

```
using UnityEngine;

[ExecuteAlways]
[DisallowMultipleComponent]
public class CoverDebugGizmos : MonoBehaviour
{
    [Header("Refs")]
    [SerializeField] private PathFinding pathfinding;
    [SerializeField] private LevelGrid levelGrid;

    [Header("Filter")]
    [Tooltip("Piirretään vain tämä kerros (floor).")]
    [SerializeField] private int visibleFloor = 0;
    [SerializeField] private bool drawOnlyVisibleFloor = true;

    [Header("What to draw")]
    [SerializeField] private bool drawWalls = true;
    [SerializeField] private bool drawLowCover = true;
    [SerializeField] private bool drawHighCover = true;

    [Header("Style")]
    [SerializeField] private float yOffset = 0.05f; // nosta viivaa vähän lattiasta
    [SerializeField] private float edgeInset = 0.48f; // kuinka lähellä ruudun reunaa (0.5 = ihan reunalla)
    [SerializeField] private float wallThickness = 0.08f;
    [SerializeField] private float coverThickness = 0.05f;
    [SerializeField] private float coverLength = 0.35f; // viivan pituus reunan suuntaisesti

    [Header("Colors")]
    [SerializeField] private Color wallColor = new Color(1f, 0.4f, 0.1f, 0.9f); // oranssi
    [SerializeField] private Color lowColor = new Color(0.2f, 1f, 0.2f, 0.9f); // vihreä
    [SerializeField] private Color highColor = new Color(0.2f, 0.5f, 1f, 0.9f); // sininen

    private PathFinding PF => pathfinding ? pathfinding : (pathfinding = FindFirstObjectByType<PathFinding>());
    private LevelGrid LG => levelGrid ? levelGrid : (levelGrid = LevelGrid.Instance);

    private void OnDrawGizmos()
    {
        if (PF == null || LG == null) return;

        int width = PF.GetWidth();
        int height = PF.GetHeight();
        int floors = LG.GetFloorAmount();
        float s = LG.GetCellSize();

        for (int f = 0; f < floors; f++)
        {
            if (drawOnlyVisibleFloor && f != visibleFloor) continue;

            for (int x = 0; x < width; x++)
                for (int z = 0; z < height; z++)
```

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```
{
    var node = PF.GetNode(x, z, f);
    if (node == null) continue;

    Vector3 c = LG.GetWorldPosition(new GridPosition(x, z, f));
    c.y += yOffset;

    // TESTI: piirrä pieni pallo jos ruudulla on coveria
    if (node.GetHighCoverMask() != 0 || node.GetLowCoverMask() != 0)
    {
        Gizmos.color = Color.cyan;
        Gizmos.DrawSphere(c + Vector3.up * 0.2f, 0.05f);
    }

    // Reunakohdat (keskitettyinä reunoille)
    Vector3 n = c + new Vector3(0, 0, +s * edgeInset);
    Vector3 s_ = c + new Vector3(0, 0, -s * edgeInset);
    Vector3 e = c + new Vector3(+s * edgeInset, 0, 0);
    Vector3 w = c + new Vector3(-s * edgeInset, 0, 0);

    // Seinät
    if (drawWalls)
    {
        Gizmos.color = wallColor;
        if (node.HasWall(EdgeMask.N)) DrawEdgeBar(n, Vector3.right, wallThickness, s * 0.9f);
        if (node.HasWall(EdgeMask.S)) DrawEdgeBar(s_, Vector3.right, wallThickness, s * 0.9f);
        if (node.HasWall(EdgeMask.E)) DrawEdgeBar(e, Vector3.forward, wallThickness, s * 0.9f);
        if (node.HasWall(EdgeMask.W)) DrawEdgeBar(w, Vector3.forward, wallThickness, s * 0.9f);
    }

    // Cover (valinnainen: toimii, jos lisäsit CoverMaskin PathNodeen)
    if (drawLowCover)
    {
        Gizmos.color = lowColor;
        if (node.HasLowCover(CoverMask.N)) DrawEdgeBar(n, Vector3.right, coverThickness, s * coverLength);
        if (node.HasLowCover(CoverMask.S)) DrawEdgeBar(s_, Vector3.right, coverThickness, s * coverLength);
        if (node.HasLowCover(CoverMask.E)) DrawEdgeBar(e, Vector3.forward, coverThickness, s * coverLength);
        if (node.HasLowCover(CoverMask.W)) DrawEdgeBar(w, Vector3.forward, coverThickness, s * coverLength);
    }

    if (drawHighCover)
    {
        Gizmos.color = highColor;
        if (node.HasHighCover(CoverMask.N)) DrawEdgeBar(n + Vector3.up * 0.02f, Vector3.right, coverThickness, s * coverLength);
        if (node.HasHighCover(CoverMask.S)) DrawEdgeBar(s_ + Vector3.up * 0.02f, Vector3.right, coverThickness, s * coverLength);
        if (node.HasHighCover(CoverMask.E)) DrawEdgeBar(e + Vector3.up * 0.02f, Vector3.forward, coverThickness, s * coverLength);
        if (node.HasHighCover(CoverMask.W)) DrawEdgeBar(w + Vector3.up * 0.02f, Vector3.forward, coverThickness, s * coverLength);
    }
}
}
```

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```
// Piirtää "paksun viivan" reunan suuntaisesti pienenä laatikkona
private void DrawEdgeBar(Vector3 center, Vector3 along, float thickness, float length)
{
    // along = joko Vector3.right (itä-länsi) tai Vector3.forward (pohjois-etelä)
    Vector3 size = new Vector3(
        Mathf.Abs(along.x) > 0 ? length : thickness,
        thickness,
        Mathf.Abs(along.z) > 0 ? length : thickness
    );
    Gizmos.DrawCube(center, size);
}
```

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Assets/scripts/DebuggingAndTesting/GridDebug/GridDebugObject.cs

```
using UnityEngine;
using TMPro;

// <summary>
// This script is used to display the grid object information in the scene view.
// </summary>
public class GridDebugObject : MonoBehaviour
{
    [SerializeField] private TextMeshPro textMeshPro;

    private object gridObject;
    public virtual void SetGridObject(object gridObject)
    {
        this.gridObject = gridObject;
    }
    protected virtual void Update()
    {
        textMeshPro.text = gridObject.ToString();
    }
}
```

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Assets/scripts/DebuggingAndTesting/GridDebug/PathFindingDebugGridObject.cs

```
using TMPro;
using UnityEngine;

public class PathFindingDebugGridObject : GridDebugObject
{
    [SerializeField] private TextMeshPro gCostText;
    [SerializeField] private TextMeshPro hCostText;
    [SerializeField] private TextMeshPro fCostText;

    [SerializeField] private SpriteRenderer isWalkableSpriteRenderer;

    private PathNode pathNode;
    public override void SetGridObject(object gridObject)
    {
        base.SetGridObject(gridObject);
        pathNode = (PathNode)gridObject;
    }

    protected override void Update()
    {
        base.Update();
        gCostText.text = pathNode.GetGCost().ToString();
        hCostText.text = pathNode.GetHCost().ToString();
        fCostText.text = pathNode.GetFCost().ToString();
        isWalkableSpriteRenderer.color = pathNode.GetIsWalkable() ? Color.green : Color.red;
    }
}
```

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Assets/scripts/DebuggingAndTesting/PathfindingDebug/PathDiagHotkey.cs

```
using UnityEngine;

public class PathDiagHotkey : MonoBehaviour
{
    public KeyCode dumpKey = KeyCode.O;
    public KeyCode resetKey = KeyCode.P;

    void Update()
    {
        var diag = PathfindingDiagnostics.Instance;
        if (diag == null) return;

        if (Input.GetKeyDown(dumpKey))
        {
            Debug.Log(
                $"[PathDiag] Samples={diag.SamplesCount} | Avg={diag.AvgMs:F3} ms | P50={diag.P50Ms:F3} ms | P95={diag.P95Ms:F3} ms | Calls={diag.CallsTotal} | OK={diag.SuccessesTotal} | Fail={diag.FailuresTotal}"
            );
        }

        if (Input.GetKeyDown(resetKey))
        {
            diag.ResetStats();
            Debug.Log("[PathDiag] Reset");
        }
    }
}
```


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Assets/scripts/DebuggingAndTesting/PathfindingDebug/PathfindingDiagnostics.cs

```
#if PERFORMANCE_DIAG

using System;
using System.Collections.Generic;
using UnityEngine;

[DefaultExecutionOrder(-10000)]
public class PathfindingDiagnostics : MonoBehaviour
{
    public static PathfindingDiagnostics Instance { get; private set; }

    [Header("On/Off")]
    public bool enabledRuntime = false;    // kytkin pelissä

    [Header("Window")]
    public int windowSize = 200;          // montako viimeisintä mittausia pidetään

    // Näkyvät lukemat
    public int SamplesCount => samples.Count;
    public double AvgMs { get; private set; }
    public double P95Ms { get; private set; }
    public double P50Ms { get; private set; } // mediaani
    public int CallsTotal { get; private set; }
    public int SuccessesTotal { get; private set; }
    public int FailuresTotal => CallsTotal - SuccessesTotal;

    struct Sample { public double ms; public bool success; public int pathLen; public int expanded; }
    readonly Queue<Sample> samples = new Queue<Sample>();

    void Awake()
    {
        if (Instance != null) { Destroy(gameObject); return; }
        Instance = this;
        DontDestroyOnLoad(gameObject);
    }

    public void AddSample(double ms, bool success, int pathLen, int expanded)
    {
        if (!enabledRuntime) return;

        CallsTotal++;
        if (success) SuccessesTotal++;

        samples.Enqueue(new Sample { ms = ms, success = success, pathLen = pathLen, expanded = expanded });
        while (samples.Count > windowSize) samples.Dequeue();

        RecomputeStats();
    }

    void RecomputeStats()

```

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```
{
    if (samples.Count == 0)
    {
        AvgMs = P95Ms = P50Ms = 0;
        return;
    }

    double sum = 0;
    List<double> arr = new List<double>(samples.Count);
    foreach (var s in samples) { sum += s.ms; arr.Add(s.ms); }

    arr.Sort();
    AvgMs = sum / samples.Count;
    P50Ms = Percentile(arr, 0.50);
    P95Ms = Percentile(arr, 0.95);
}

static double Percentile(List<double> sorted, double p)
{
    if (sorted.Count == 0) return 0;
    double idx = (sorted.Count - 1) * p;
    int lo = (int)Math.Floor(idx);
    int hi = (int)Math.Ceiling(idx);
    if (lo == hi) return sorted[lo];
    double w = idx - lo;
    return sorted[lo] * (1 - w) + sorted[hi] * w;
}

// Helppo nollaus napista
public void ResetStats()
{
    samples.Clear();
    CallsTotal = 0;
    SuccessesTotal = 0;
    AvgMs = P95Ms = P50Ms = 0;
}
}

#else

using UnityEngine;

// Stubbi, joka kääntyy release-buildiin mutta ei tee mitään
public class PathfindingDiagnostics : MonoBehaviour
{
    public static PathfindingDiagnostics Instance => null;
    public bool enabledRuntime => false;
    public void AddSample(double ms, bool success, int pathLen, int expanded) { }
    public void ResetStats() { }
}

#endif
```

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Assets/scripts/DebuggingAndTesting/ScreenLogger.cs

```
using UnityEngine;
using TMPro;
using System.Collections.Generic;

public class ScreenLogger : MonoBehaviour
{
    static ScreenLogger inst;
    TextMeshProUGUI text;
    readonly Queue<string> lines = new Queue<string>();
    [Range(1,100)] public int maxLines = 100;

    void Awake()
    {
        if (inst != null) { Destroy(gameObject); return; }
        inst = this;
        DontDestroyOnLoad(gameObject);

        // Canvas
        var canvasGO = new GameObject("ScreenLogCanvas");
        var canvas = canvasGO.AddComponent<Canvas>();
        canvas.renderMode = RenderMode.ScreenSpaceOverlay;
        canvas.sortingOrder = 9999;

        // Text
        var tgo = new GameObject("Log");
        tgo.transform.SetParent(canvasGO.transform);
        var rt = tgo.AddComponent<RectTransform>();
        rt.anchorMin = new Vector2(0, 0);
        rt.anchorMax = new Vector2(1, 0);
        rt.pivot = new Vector2(0.5f, 0);
        rt.offsetMin = new Vector2(10, 10);
        rt.offsetMax = new Vector2(-10, 210);

        text = tgo.AddComponent<TextMeshProUGUI>();
        text.fontSize = 18;
        text.textWrappingMode = TextWrappingModes.NoWrap;

        Application.logMessageReceived += HandleLog;
    }

    void OnDestroy() { Application.logMessageReceived -= HandleLog; }

    void HandleLog(string msg, string stack, LogType type)
    {
        string prefix = type == LogType.Error || type == LogType.Exception ? "[ERR]" :
            type == LogType.Warning ? "[WARN]" : "[LOG]";
        lines.Enqueue($"{System.DateTime.Now:HH:mm:ss} {prefix} {msg}");
        while (lines.Count > maxLines) lines.Dequeue();
        if (text != null) text.text = string.Join("\n", lines);
    }
}
```

```
}

```

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Assets/scripts/DebuggingAndTesting/Testing.cs

```
using System.Collections.Generic;
using UnityEngine;

/// <summary>
/// This class is responsible for testing the grid system and unit actions in the game.
/// It provides functionality to visualize the grid positions and interact with unit actions.
/// </summary>
public class Testing : MonoBehaviour
{
    [SerializeField] private Unit unit;
    private void Start()
    {
    }

    private void Update()
    {
        if (Input.GetKeyDown(KeyCode.T))
        {
            // ScreenShake.Instance.Shake(5f);

            // ScreenShake.Instance.RecoilCameraShake();

            //Show pathfind line
            /*
            GridPosition mouseGridPosition = LevelGrid.Instance.GetGridPosition(MouseWorld.GetMouseWorldPosition());
            GridPosition startGridPosition = new GridPosition(0, 0, 0);

            List<GridPosition> gridPositionList = PathFinding.Instance.FindPath(startGridPosition, startGridPosition, out int pathLeght, 6);

            for (int i = 0; i < gridPositionList.Count - 1; i++)
            {
                Debug.DrawLine(
                    LevelGrid.Instance.GetWorldPosition(gridPositionList[i]),
                    LevelGrid.Instance.GetWorldPosition(gridPositionList[i + 1]),
                    Color.white,
                    10f
                );
            }
            */
        }

        //Resetoi pelin alkamaan alusta.
        if (Input.GetKeyDown(KeyCode.R))
        {
            if (Mirror.NetworkServer.active) {
                ResetService.Instance.HardResetServerAuthoritative();
            }
        }
    }
}
```

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```
        } else if (Mirror.NetworkClient.active) {  
            // käskytä serveriä  
            ResetService.Instance.CmdRequestHardReset();  
        } else {  
            GameReset.HardReloadSceneKeepMode();  
        }  
    }  
}
```

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Assets/scripts/Editor/PathfindingLinkMonoBehaviourEditor.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEditor;
[CustomEditor(typeof(PathfindingLinkMonoBehaviour))]
public class PathfindingLinkMonoBehaviourEditor : Editor
{
    private void OnSceneGUI()
    {
        {
            PathfindingLinkMonoBehaviour pathfindingLinkMonoBehaviour = (PathfindingLinkMonoBehaviour)target;
            EditorGUI.BeginChangeCheck();
            Vector3 newLinkPositionA = Handles.PositionHandle(pathfindingLinkMonoBehaviour.linkPositionA, Quaternion.identity);
            Vector3 newLinkPositionB = Handles.PositionHandle(pathfindingLinkMonoBehaviour.linkPositionB, Quaternion.identity);
            if (EditorGUI.EndChangeCheck())
            {
                Undo.RecordObject(pathfindingLinkMonoBehaviour, "Change Link Position");
                pathfindingLinkMonoBehaviour.linkPositionA = newLinkPositionA;
                pathfindingLinkMonoBehaviour.linkPositionB = newLinkPositionB;
            }
        }
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Enemy/EnemyAI.cs

```
using System;
using System.Collections;
using UnityEngine;
using Utp;

/// <summary>
/// Control EnemyAI. Go through all possible actions what current enemy Unit can do and chose the best one.
/// Listen to TurnSystem and when turn OnTurnChanged, AI state switch WaitingForEnemyTurn to the TakingTurn state
/// and try to find best action to all enemy Units. All enemy Unit do this independently based on
/// action values.
/// </summary>
public class EnemyAI : MonoBehaviour
{
    public static EnemyAI Instance { get; private set; }

    private enum State
    {
        WaitingForEnemyTurn,
        TakingTurn,
        Busy,
    }

    private State state;
    private float timer;

    void Awake()
    {
        state = State.WaitingForEnemyTurn;

        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;
    }

    private void Start()
    {
        if (GameManager.SelectedMode == GameMode.SinglePlayer)
        {
            TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
        }

        if (GameNetworkManager.Instance != null &&
            GameNetworkManager.Instance.GetNetworkClientConnected() &&
            !GameNetworkManager.Instance.GetNetworkServerActive())
        {
            // Coop gamemode using IEnumerator RunEnemyTurnCoroutine() through the server. No local calls
            if (GameManager.SelectedMode == GameMode.CoOp)
                enabled = false;
        }
    }
}
```


RogueShooter – All Scripts

```
}

/*
void OnEnable()
{
    if (GameManager.SelectedMode == GameMode.SinglePlayer)
    {
        TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
    }
}
*/

void OnDisable()
{
    if (GameManager.SelectedMode == GameMode.SinglePlayer)
    {
        TurnSystem.Instance.OnTurnChanged -= TurnSystem_OnTurnChanged;
    }
}

private void Update()
{
    //NOTE! Only solo game!
    if (GameManager.SelectedMode != GameMode.SinglePlayer) return;
    if (TurnSystem.Instance.IsPlayerTurn()) return;

    //If game mode is SinglePlayer and is not PlayerTurn then runs Enemy AI.
    EnemyAITick(Time.deltaTime);
}

/// <summary>
/// Enemy start taking actions after small waiting time.
/// Update call this every frame.
/// </summary>
private bool EnemyAITick(float dt)
{
    switch (state)
    {
        // It is Player turn so keep waiting untill TurnSystem_OnTurnChanged switch state to TakingTurn.
        case State.WaitingForEnemyTurn:
            return false;

        case State.TakingTurn:
            timer -= dt;
            if (timer <= 0f)
            {
                //Return false when all Enemy Units have make they actions
                if (SelectEnemyUnitToTakeAction(SetStateTakingTurn))
                {
                    state = State.Busy;
                    return false;
                }
            }
    }
}
```

RogueShooter – All Scripts

```
        else
        {
            // If enemy cant make actions. Return turn back to player.
            // NOTE! In Coop mode CoopTurnCoordinator make this.
            if (GameManager.SelectedMode == GameMode.SinglePlayer)
            {
                TurnSystem.Instance.NextTurn();
            }

            // Enemy AI switch back to waiting.
            state = State.WaitingForEnemyTurn;
            return true;
        }
    }
    return false;

    case State.Busy:
        // When Enemy doing action just return.
        // Waiting c# Action call from base action and then call funktion SetStateTakingTurn()
        return false;
    }
    return false;
}

/// <summary>
/// c# Action callback. SelectEnemyUnitToTakeAction use this and when action is ready. This occurs
/// </summary>
private void SetStateTakingTurn()
{
    timer = 0.5f;
    state = State.TakingTurn;
}

/// <summary>
/// Go through all enemy Units on EnemyUnit List and try to take action.
/// </summary>
private bool SelectEnemyUnitToTakeAction(Action onEnemyAIActionComplete)
{
    foreach (Unit enemyUnit in UnitManager.Instance.GetEnemyUnitList())
    {
        if (enemyUnit == null)
        {
            Debug.LogWarning("[EnemyAI][UnitManager]EnemyUnit list is null:" + enemyUnit);
            continue;
        }
        if (TryTakeEnemyAIAction(enemyUnit, onEnemyAIActionComplete))
        {
            return true;
        }
    }
}
```

RogueShooter – All Scripts

```
        return false;
    }

    /// <summary>
    /// Selected Unit Go through all possible actions what Enemy Unit can do
    /// and choosing the best one based on them action value.
    /// Then make action if have enough action points.
    /// </summary>
    private bool TryTakeEnemyAIAction(Unit enemyUnit, Action onEnemyAIActionComplete)
    {
        // Contains Gridposition and action value (How good action is)
        EnemyAIAction bestEnemyAIAction = null;

        BaseAction bestBaseAction = null;

        // Choosing the best action, based on them action value.
        foreach (BaseAction baseAction in enemyUnit.GetBaseActionsArray())
        {
            if (!enemyUnit.CanSpendActionPointsToTakeAction(baseAction))
            {
                // Enemy cannot afford this action.
                continue;
            }

            if (bestEnemyAIAction == null)
            {
                bestEnemyAIAction = baseAction.GetBestEnemyAIAction();
                bestBaseAction = baseAction;
            }
            else
            {
                // Go trough all actions and take the best one.
                EnemyAIAction testEnemyAIAction = baseAction.GetBestEnemyAIAction();
                if (testEnemyAIAction != null && testEnemyAIAction.actionValue > bestEnemyAIAction.actionValue)
                {
                    bestEnemyAIAction = baseAction.GetBestEnemyAIAction();
                    bestBaseAction = baseAction;
                }
            }
        }

        // Try to take action
        if (bestEnemyAIAction != null && enemyUnit.TrySpendActionPointsToTakeAction(bestBaseAction))
        {
            bestBaseAction.TakeAction(bestEnemyAIAction.gridPosition, onEnemyAIActionComplete);
            return true;
        }
        else
        {
            return false;
        }
    }
}
```

RogueShooter – All Scripts

```
/// <summary>
/// When turn changed. Switch state to taking turn and enemy turn start.
/// </summary>
private void TurnSystem_OnTurnChanged(object sender, EventArgs e)
{
    if (!TurnSystem.Instance.IsPlayerTurn())
    {
        state = State.TakingTurn;
        timer = 1f; // Small holding time before action.
    }
}

/// <summary>
/// When playing online: (Coop mode) Server handle All AI actions.
/// </summary>
[Mirror.Server]
public IEnumerator RunEnemyTurnCoroutine()
{
    SetStateTakingTurn();

    while (true)
    {
        if (TurnSystem.Instance.IsPlayerTurn())
        {
            Debug.LogWarning("[EnemyAI] Players get turn before AI has ended own turn! This sould not be possibble");
            yield break;
        }

        bool finished = EnemyAITick(Time.deltaTime);
        if (finished)
            yield break; // AI-Turn ready. CoopTurnCoordinator continue and give turn back to players.

        yield return null; // wait one frame.
    }
}
}
```

RogueShooter – All Scripts

Assets/scripts/Enemy/EnemyAIAction.cs

```
using UnityEngine;

[System.Serializable]
public class EnemyAIAction
{
    public GridPosition gridPosition;
    public int actionValue;
}
```

RogueShooter – All Scripts

Assets/scripts/GameLogic/BattleLogic/TurnSystem.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

public class TurnSystem : MonoBehaviour
{
    public static TurnSystem Instance { get; private set; }

    public event EventHandler OnTurnChanged;
    private int turnNumber = 1;
    private bool isPlayerTurn = true;

    private void Awake()
    {
        // Ensure that there is only one instance in the scene
        if (Instance != null)
        {
            Debug.LogError(" More than one TurnSystem in the scene!" + transform + " " + Instance);
            Destroy(gameObject);
            return;
        }
        Instance = this;
    }

    private void Start()
    {
        // Varmista, että alkutila lähetetään kaikille UI:lle
        PlayerLocalTurnGate.Set(isPlayerTurn); // true = Player turn alussa
        OnTurnChanged?.Invoke(this, EventArgs.Empty); // jos haluat myös muut UI:t liikkeelle
    }

    public void NextTurn()
    {
        // Tarkista pelimoodi
        if (GameManager.SelectedMode == GameMode.SinglePlayer)
        {
            // 1) Muunna käyttämättömät AP:t suojaksi (vain omat unitit)
            ConvertUnusedActionPointsToCoverPoints();

            Debug.Log("SinglePlayer NextTurn");
            turnNumber++;
            isPlayerTurn = !isPlayerTurn;

            OnTurnChanged?.Invoke(this, EventArgs.Empty);

            //Set Unit UI visibility
            PlayerLocalTurnGate.Set(isPlayerTurn);
        }
    }
}
```

RogueShooter – All Scripts

```
        else if (GameManager.SelectedMode == GameMode.CoOp)
        {
            Debug.Log("Co-Op mode: Proceeding to the next turn.");
            // Tee jotain erityistä CoOp-tilassa
        }
        else if (GameManager.SelectedMode == GameMode.Versus)
        {
            Debug.Log("Versus mode: Proceeding to the next turn.");
            // Tee jotain erityistä Versus-tilassa
        }
    }

    private void ConvertUnusedActionPointsToCoverPoints()
    {
        List<Unit> ownUnits = UnitManager.Instance.GetFriendlyUnitList();
        for (int i = 0; i < ownUnits.Count; i++)
        {
            Unit u = ownUnits[i];
            int ap = u.GetActionPoints();
            if (ap <= 0) continue;

            int per = u.GetCoverRegenPerUnusedAP();
            u.RegenCoverBy(ap * per);
        }
    }

    public int GetTurnNumber()
    {
        return turnNumber;
    }

    public bool IsPlayerTurn()
    {
        return isPlayerTurn;
    }

    // ForcePhase on serverin kutsuma. Päivittää vuoron ja kutsuu OnTurnChanged
    public void ForcePhase(bool isPlayerTurn, bool incrementTurnNumber)
    {
        if (incrementTurnNumber) turnNumber++;
        this.isPlayerTurn = isPlayerTurn;
        OnTurnChanged?.Invoke(this, EventArgs.Empty);
    }

    // Päivitä HUD verkon kautta (co-op)
    public void SetHUDFromNetwork(int newTurnNumber, bool isPlayersPhase)
    {
        turnNumber = newTurnNumber;
        isPlayerTurn = isPlayersPhase;
        OnTurnChanged?.Invoke(this, EventArgs.Empty); // <- päivittää HUDin kuten SP:ssä
    }
}
```

--

RogueShooter – All Scripts

Assets/scripts/GameLogic/InputManager.cs

```
#define USE_NEW_INPUT_SYSTEM
using UnityEngine;
using UnityEngine.InputSystem;

public class InputManager : MonoBehaviour
{
    public static InputManager Instance { get; private set; }

    private PlayerInputActions playerInputActions;

    private void Awake()
    {
        // Ensure that there is only one instance in the scene
        if (Instance != null)
        {
            Debug.LogError("InputManager: More than one InputManager in the scene!" + transform + " " + Instance);
            Destroy(gameObject);
            return;
        }
        Instance = this;

#if USE_NEW_INPUT_SYSTEM
        playerInputActions = new PlayerInputActions();
        // Voit halutessasi enablettää koko collectionin:
        // playerInputActions.Enable();
        playerInputActions.Player.Enable();
#endif
    }

#if USE_NEW_INPUT_SYSTEM
    private void OnDisable()
    {
        // Vähintään tämä: disabloi kaikki käytössä olevat mapit
        if (playerInputActions != null)
        {
            // Jos käytät vain Player-mapia:
            playerInputActions.Player.Disable();
            // Tai koko collection:
            // playerInputActions.Disable();
        }
    }

    private void OnDestroy()
    {
        // Vapauta resurssit -> poistaa finalizer-varoituksen
        playerInputActions?.Dispose();
        playerInputActions = null;

        if (Instance == this) Instance = null;
    }
#endif
}
```

RogueShooter – All Scripts

```
    public Vector2 GetMouseScreenPosition()
    {
#if USE_NEW_INPUT_SYSTEM
        return Mouse.current.position.ReadValue();
#else
        return Input.mousePosition;
#endif
    }

    public bool IsMouseButtonDownThisFrame()
    {
#if USE_NEW_INPUT_SYSTEM
        return playerInputActions.Player.Click.WasPressedThisFrame();
#else
        return Input.GetMouseButtonDown(0);
#endif
    }

    public Vector2 GetCameraMoveVector()
    {
#if USE_NEW_INPUT_SYSTEM
        return playerInputActions.Player.CameraMovement.ReadValue<Vector2>();
#else
        Vector2 inputMoveDirection = new Vector2(0, 0);
        if (Input.GetKey(KeyCode.W))
        {
            inputMoveDirection.y = +1f;
        }
        if (Input.GetKey(KeyCode.S))
        {
            inputMoveDirection.y = -1f;
        }
        if (Input.GetKey(KeyCode.A))
        {
            inputMoveDirection.x = -1f;
        }
        if (Input.GetKey(KeyCode.D))
        {
            inputMoveDirection.x = +1f;
        }

        return inputMoveDirection;
#endif
    }

    public float GetCameraRotateAmount()
    {
#if USE_NEW_INPUT_SYSTEM
        return playerInputActions.Player.CameraRotate.ReadValue<float>();
#else
        float rotateAmount = 0;
#endif
    }
}
```

RogueShooter – All Scripts

```
        if (Input.GetKey(KeyCode.Q))
        {
            rotateAmount = +1f;
        }
        if (Input.GetKey(KeyCode.E))
        {
            rotateAmount = -1f;
        }

        return rotateAmount;
    #endif
}

    public float GetCameraZoomAmount()
    {
    #if USE_NEW_INPUT_SYSTEM
        return playerInputActions.Player.CameraZoom.ReadValue<float>();
    #else
        float zoomAmount = 0f;
        if (Input.mouseScrollDelta.y > 0)
        {
            zoomAmount = -1f;
        }
        if (Input.mouseScrollDelta.y < 0)
        {
            zoomAmount = +1f;
        }

        return zoomAmount;
    #endif
    }
```

RogueShooter – All Scripts

Assets/scripts/GameLogic/MouseWorld.cs

```
using UnityEngine;

/// <summary>
/// This class is responsible for handling mouse interactions in the game world.
/// It provides a method to get the mouse position in the world space based on the camera's perspective.
/// </summary>

public class MouseWorld : MonoBehaviour
{
    private static MouseWorld instance;
    [SerializeField] private LayerMask mousePlaneLayerMask;

    private void Awake()
    {
        instance = this;
    }

    public static Vector3 GetMouseWorldPosition()
    {
        Ray ray = Camera.main.ScreenPointToRay(InputManager.Instance.GetMouseScreenPosition());
        Physics.Raycast(ray, out RaycastHit raycastHit, float.MaxValue, instance.mousePlaneLayerMask);
        return raycastHit.point;
    }

    /// <summary>
    /// Ignore non visible objects, floors and walls what FloorVisibily has set to hidden.
    /// </summary>
    public static Vector3 GetPositionOnlyHitVisible()
    {
        Ray ray = Camera.main.ScreenPointToRay(InputManager.Instance.GetMouseScreenPosition());
        RaycastHit[] raycastHitArray = Physics.RaycastAll(ray, float.MaxValue, instance.mousePlaneLayerMask);
        System.Array.Sort(raycastHitArray,
            (a, b) => a.distance.CompareTo(b.distance));

        foreach (RaycastHit raycastHit in raycastHitArray)
        {
            if (raycastHit.transform.TryGetComponent(out Renderer renderer))
            {
                if (renderer.enabled)
                {
                    return raycastHit.point;
                }
            }
        }
        return Vector3.zero;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/GameLogic/Player/PlayerController.cs

```
using System;
using Mirror;
using UnityEngine;

///<summary>
/// PlayerController handles per-player state in a networked game.
/// Each connected player has one PlayerController instance attached to PlayerController GameObject prefab
/// It tracks whether the player has ended their turn and communicates with the UI.
///</summary>
public class PlayerController : NetworkBehaviour
{
    [SyncVar] public bool hasEndedThisTurn;

    public static PlayerController Local; // helppo viittaus UI:lle

    public override void OnStartLocalPlayer()
    {
        base.OnStartLocalPlayer();
        Local = this;
    }

    // UI-nappi kutsuu tätä (vain local player)
    public void ClickEndTurn()
    {
        if (!isLocalPlayer) return;
        if (hasEndedThisTurn) return;
        if (NetTurnManager.Instance && NetTurnManager.Instance.phase != TurnPhase.Players) return;
        CmdEndTurn();
    }

    [Command(requiresAuthority = true)]
    void CmdEndTurn()
    {
        if (hasEndedThisTurn) return;
        hasEndedThisTurn = true;

        // Estä kaikki toiminnot clientillä
        TargetNotifyCanAct(connectionToClient, false);

        // Varmista myös että koordinaattori löytyy serveripuolelta:
        if (NetTurnManager.Instance == null)
        {
            Debug.LogWarning("[PC][SERVER] NetTurnManager.Instance is NULL on server!");
            return;
        }

        NetTurnManager.Instance.ServerPlayerEndedTurn(netIdentity.netId);
    }
}
```

RogueShooter – All Scripts

```
// Server kutsuu tämän kierroksen alussa nollatakseen tilan
[Server]
public void ServerSetHasEnded(bool v)
{
    hasEndedThisTurn = v;
    TargetNotifyCanAct(connectionToClient, !v);
}

[TargetRpc]
void TargetNotifyCanAct(NetworkConnectionToClient __, bool canAct)
{
    // Update End Turn Button
    var ui = FindFirstObjectByType<TurnSystemUI>();
    if (ui != null)
        ui.SetCanAct(canAct);
    if (!canAct) ui.SetTeammateReady(false, null);

    // Lock/Unlock UnityActionSystem input
    if (UnityActionSystem.Instance != null)
    {
        if (canAct) UnityActionSystem.Instance.UnlockInput();
        else UnityActionSystem.Instance.LockInput();
    }

    // Set AP visibility in versus game
    PlayerLocalTurnGate.Set(canAct);
}
}
```

RogueShooter – All Scripts

Assets/scripts/GameLogic/Player/PlayerLocalTurnGate.cs

```
using System;
using System.Collections.Generic;
using System.Diagnostics;

/// <summary>
/// Static gate that tracks whether the local player turn is. (e.g., enabling/disabling UI).
/// Other systems can subscribe to the <see cref="LocalPlayerTurnChanged"/> event to update their state
/// </summary>
///
public static class PlayerLocalTurnGate
{
    // public static int PlayerReady { get; private set; }

    // public static event Action<int> OnPlayerReadyChanged;
    /// <summary>
    /// Gets whether the local player can currently act.
    /// </summary>
    public static bool LocalPlayerTurn { get; private set; }

    /// <summary>
    /// Event fired whenever the <see cref="LocalPlayerTurn"/> state changes.
    /// The bool argument indicates the new state.
    /// </summary>
    public static event Action<bool> LocalPlayerTurnChanged;

    /// <summary>
    /// Updates the <see cref="LocalPlayerTurn"/> state.
    /// If the value changes, invokes <see cref="LocalPlayerTurnChanged"/> to notify listeners.
    /// </summary>
    /// <param name="canAct">True if the player may act; false otherwise.</param>
    public static void Set(bool canAct)
    {
        if (LocalPlayerTurn == canAct) return;
        LocalPlayerTurn = canAct;
        LocalPlayerTurnChanged?.Invoke(LocalPlayerTurn);
    }

    public static void SetCanAct(bool canAct)
    {
        LocalPlayerTurn = canAct;
        LocalPlayerTurnChanged?.Invoke(LocalPlayerTurn);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/GameModes/GameModeManager.cs

```
using UnityEngine;
using Utp;

/// <summary>
/// This class is responsible for managing the game mode
/// It checks if the game is being played online or offline and spawns units accordingly.
/// </summary>
public enum GameMode { SinglePlayer, CoOp, Versus }
public class GameModeManager : MonoBehaviour
{
    public static GameMode SelectedMode { get; private set; } = GameMode.SinglePlayer;

    public static void SetSinglePlayer() => SelectedMode = GameMode.SinglePlayer;
    public static void SetCoOp() => SelectedMode = GameMode.CoOp;
    public static void SetVersus() => SelectedMode = GameMode.Versus;

    void Start()
    {
        // if game is offline, spawn singleplayer units
        if (!GameNetworkManager.Instance.IsNetworkActive())
        {
            SpawnUnits();
        }
        else
        {
            Debug.Log("Game is online, waiting for host/client to spawn units.");
        }
    }

    private void SpawnUnits()
    {
        if (SelectedMode == GameMode.SinglePlayer)
        {
            SpawnUnitsCoordinator.Instance.SpwanSinglePlayerUnits();
            return;
        }
    }
}
```


RogueShooter – All Scripts

Assets/scripts/GameModes/GameReset.cs

```
using UnityEngine.SceneManagement;

public static class GameReset
{
    public static void HardReloadSceneKeepMode()
    {
        // GameManager.SelectedMode säilyy, jos se on staattinen / DontDestroyOnLoad
        var scene = SceneManager.GetActiveScene().name;
        SceneManager.LoadScene(scene);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/GameObjects/DestructibleObject.cs

```
using System;
using Unity.Mathematics;
using UnityEngine;
using Mirror;
using System.Collections;

public class DestructibleObject : NetworkBehaviour
{
    // public static event EventHandler OnAnyDestroyed;

    private GridPosition gridPosition;
    [SerializeField] private Transform objectDestroyPrefab;
    [SerializeField] private int health = 3;

    // To prevent multiple destruction events
    private bool isDestroyed;

    private bool _walkabilitySet;
    void Awake()
    {
        isDestroyed = false;
    }

    private void Start()
    {
        gridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
        TryMarkBlocked();
    }

    /// <summary>
    /// Marks the grid position as blocked if not already set.
    /// </summary>
    private void TryMarkBlocked()
    {
        if (_walkabilitySet) return;

        if (PathFinding.Instance != null)
        {
            PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, false);
            _walkabilitySet = true;
        }
        else
        {
            // jos PathFinding käynnistyy myöhemmin (scene-reload + spawn)
            StartCoroutine(DeferBlockOneFrame());
        }
    }

    private IEnumerator DeferBlockOneFrame()
    {

```

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```
yield return null; // 1 frame
if (PathFinding.Instance != null)
{
    Debug.Log("Later update: Deferring walkability set for destructible object at " + gridPosition);
    PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, false);
    _walkabilitySet = true;
}
}

public GridPosition GetGridPosition()
{
    return gridPosition;
}

public void Damage(int damageAmount, Vector3 hitPosition)
{
    if (isDestroyed) return;

    health -= damageAmount;
    if (health > 0) return;

    int overkill = math.abs(health) + 1;
    health = 0;
    isDestroyed = true;

    if (isServer)
    {
        RpcPlayDestroyFx(hitPosition, overkill);
        RpcSetSoftHidden(true);
        StartCoroutine(DestroyAfter(0.30f));
        return;
    }

    // Offline (ei serveriä eikä clienttia)
    if (!NetworkClient.active && !NetworkServer.active)
    {
        PlayDestroyFx(hitPosition, overkill);
        SetSoftHiddenLocal(true);
        StartCoroutine(DestroyAfter(0.30f));
        PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, true);
        EdgeBaker.Instance.RebakeEdgesAround(gridPosition);
    }
}

private void PlayDestroyFx(Vector3 hitPosition, int overkill)
{
    var t = Instantiate(objectDestroyPrefab, transform.position, Quaternion.identity);
    ApplyPushForceToChildren(t, 10f * overkill, hitPosition, 10f);
}

[ClientRpc]
private void RpcPlayDestroyFx(Vector3 hitPosition, int overkill)
```

RogueShooter – All Scripts

```
{
    // Clientit: toista sama paikallisesti
    PlayDestroyFx(hitPosition, overkill);
}

private void ApplyPushForceToChildren(Transform root, float pushForce, Vector3 pushPosition, float PushRange)
{
    foreach (Transform child in root)
    {
        if (child.TryGetComponent<Rigidbody>(out Rigidbody childRigidbody))
        {
            childRigidbody.AddExplosionForce(pushForce, pushPosition, PushRange);
        }

        ApplyPushForceToChildren(child, pushForce, pushPosition, PushRange);
    }
}

private IEnumerator DestroyAfter(float seconds)
{
    yield return new WaitForSeconds(seconds);

    if (isServer)
    {
        // Server: vapauta ruutu ja rebake serverillä
        PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, true);
        EdgeBaker.Instance.RebakeEdgesAround(gridPosition);

        // Lähetä sama clienteleille ennen tuhoa
        RpcOnDestroyed(gridPosition);

        // Pieni hengähdys (valinnainen, usein ei pakollinen)
        // yield return null;

        NetworkServer.Destroy(gameObject);
    } else {
        // Offline-tapaus tms.
        Destroy(gameObject);
    }
}

// Lisää tämä luokkaan
[ClientRpc]
private void RpcOnDestroyed(GridPosition pos) {
    // Clientin paikallinen kopio/visualisointi
    if (PathFinding.Instance != null)
        PathFinding.Instance.SetIsWalkableGridPosition(pos, true);
    EdgeBaker.Instance.RebakeEdgesAround(pos);
}

// Varmistus myös tilanteeseen, jossa RPC hukkuu tai tulee myöhässä
public override void OnStopClient() {
```

RogueShooter – All Scripts

```
        if (PathFinding.Instance != null)
            PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, true);
        EdgeBaker.Instance.RebakeEdgesAround(gridPosition);
    }

    [ClientRpc]
    private void RpcSetSoftHidden(bool hidden)
    {
        SetSoftHiddenLocal(hidden);
    }

    private void SetSoftHiddenLocal(bool hidden)
    {
        foreach (var r in GetComponentsInChildren<Renderer>(true))
            r.enabled = !hidden;

        foreach (var c in GetComponentsInChildren<Collider>(true))
            c.enabled = !hidden;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/GameObjects/Door.cs

```
using UnityEngine;
using Mirror;
using System;

public class Door : NetworkBehaviour, IInteractable
{
    [Header("State")]
    [SyncVar(hook = nameof(OnIsOpenChanged))]
    [SerializeField] private bool isOpen = false;    // alkutila scene-objektille

    [SerializeField] string openParam = "IsOpen";
    [SerializeField] float interactDuration = 0.5f;

    private GridPosition gridPosition;
    private Animator animator;

    // Interact-viiveen hallinta (vain kutsujan koneella UI/turn-rytmitystä varten)
    private Action onInteractComplete;
    private bool isActive;
    private float timer;

    private static bool NetOffline => !NetworkClient.active && !NetworkServer.active;

    private void Awake()
    {
        animator = GetComponent<Animator>();

        // Pakota alkupose heti oikein (ei välähdyksiä)
        animator.SetBool("IsOpen", isOpen);
        animator.Play(isOpen ? "DoorOpen" : "DoorClose", 0, 1f);
        animator.Update(0f);
    }

    private void Start()
    {
        gridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
        LevelGrid.Instance.SetInteractableAtGridPosition(gridPosition, this);

        // AINA: päivitä käveltävyys tämän hetken tilan mukaan
        if (PathFinding.Instance != null)
        {
            PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, isOpen);
        }
    }

    private void Update()
    {
        if (!isActive) return;
    }
}
```

RogueShooter – All Scripts

```
        timer -= Time.deltaTime;
        if (timer <= 0f)
        {
            isActive = false;
            onInteractComplete?.Invoke();
            onInteractComplete = null;
        }
    }

    // KUTSUTAAN InteractActionista (sekä offline, host että puhdas client)
    public void Interact(Action onInteractComplete)
    {
        // Gate (estää spämmin)
        if (isActive) return;

        this.onInteractComplete = onInteractComplete;
        isActive = true;
        timer = interactDuration; // haluttu viive actionille

        if (NetOffline)
        {
            // SINGLEPLAYER: vaihda paikallisesti
            ToggleLocal();
        }
        else if (isServer)
        {
            // HOST / SERVER: vaihda suoraan serverillä
            ToggleServer();
        }
        else
        {
            // PUHDAS CLIENT: pyydä serveriä
            CmdToggleServer();
        }
    }

    [Command(requiresAuthority = false)]
    private void CmdToggleServer()
    {
        ToggleServer();
    }

    [Server]
    private void ToggleServer()
    {
        isOpen = !isOpen; // Tämä käynnistää hookin kaikilla
        // EI suoraa animator-kutsua täällä; hook hoitaa sen kauniisti
    }

    private void ToggleLocal()
    {
        // Offline-haara: päivitä animaatio ja pathfinding paikallisesti
    }
}
```

RogueShooter – All Scripts

```
        isOpen = !isOpen;
        ApplyAnimator(isOpen);
        PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, isOpen);

    }

    // SyncVar hook – ajetaan kaikilla kun isOpen muuttuu serverillä
    private void OnIsOpenChanged(bool oldVal, bool newVal)
    {
        ApplyAnimator(newVal);

        // Pathfinding vain serverillä (tai offline Startissa/ToggleLocalissa)
        if (PathFinding.Instance != null)
            PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, newVal);
    }

    private void ApplyAnimator(bool open)
    {
        animator.SetBool(openParam, open);
    }

    // Nämä jätetään jos muu koodi tarvitsee suoraviivaisia kutsuja
    public void OpenDoor()
    {
        if (NetOffline || NetworkServer.active)
        {
            isOpen = true; // käynnistää hookin vain serverillä; offline: päivitä itse
            if (NetOffline)
            {
                ApplyAnimator(true);
                PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, true);
            }
        }
    }

    public void CloseDoor()
    {
        if (NetOffline || NetworkServer.active)
        {
            isOpen = false;
            if (NetOffline)
            {
                ApplyAnimator(false);
                PathFinding.Instance.SetIsWalkableGridPosition(gridPosition, false);
            }
        }
    }
}
```


RogueShooter – All Scripts

Assets/scripts/GameObjects/IInteractable.cs

```
using System;
using UnityEngine;

public interface IInteractable
{
    void Interact(Action onInteractComplete);
}
```

RogueShooter – All Scripts

Assets/scripts/GameObjects/InteractableItem.cs

```
using System;
using UnityEngine;
using Mirror;
public class InteractableItem : NetworkBehaviour, IInteractable
{
    [Header("State")]
    [SyncVar(hook = nameof(OnIsInteractChanged))]
    [SerializeField] private bool isGreen;

    [Header("Visuals")]
    [SerializeField] private Material greenMaterial;
    [SerializeField] private Material redMaterial;
    [SerializeField] private MeshRenderer meshRenderer;

    [Header("Interact")]
    [SerializeField] private float interactDuration = 0.5f;

    private GridPosition gridPosition;
    private Action onInteractComplete;
    private bool isActive;
    private float timer;

    private static bool NetOffline => !NetworkClient.active && !NetworkServer.active;

    void Awake()
    {
        // Pakota alkupose heti oikein (ei välähdyksiä)
        if (!meshRenderer) meshRenderer = GetComponentInChildren<MeshRenderer>();
        SetVisualFromState(isGreen);
    }
    private void Start()
    {
        gridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
        LevelGrid.Instance.SetInteractableAtGridPosition(gridPosition, this);
        // SetColorRed();
    }
    private void Update()
    {
        if (!isActive) return;

        timer -= Time.deltaTime;
        if (timer <= 0f)
        {
            isActive = false;
            onInteractComplete?.Invoke();
            onInteractComplete = null;
        }
    }

    private void SetColorGreen()
```

RogueShooter – All Scripts

```
{
    isGreen = true;
    meshRenderer.material = greenMaterial;
}

private void SetColorRed()
{
    isGreen = false;
    meshRenderer.material = redMaterial;
}

public void Interact(Action onInteractComplete)
{
    this.onInteractComplete = onInteractComplete;
    isActive = true;
    timer = interactDuration;

    if (NetOffline)
    {
        // SINGLEPLAYER: vaihda paikallisesti
        ToggleLocal();
    }
    else if (isServer)
    {
        // HOST / SERVER: vaihda suoraan serverillä
        ToggleServer();
    }
    else
    {
        // PUHDAS CLIENT: pyydä serveriä
        CmdToggleServer();
    }
}

private void ToggleLocal()
{
    isGreen = !isGreen;
    SetVisualFromState(isGreen);
}

[Server]
private void ToggleServer()
{
    // SERVER: muuta vain tila; visuaali päivittyy hookista kaikkialla
    isGreen = !isGreen;
    SetVisualFromState(isGreen); // valinnainen: tekee serverille välittömän visuaalin ilman uutta SyncVar-kirjoitusta
}

[Command(requiresAuthority = false)]
void CmdToggleServer() => ToggleServer();

private void OnIsInteractChanged(bool oldValue, bool newVal)
```

RogueShooter – All Scripts

```
{  
    SetVisualFromState(newVal);  
}  
  
private void SetVisualFromState(bool state)  
{  
    if (!meshRenderer) return;  
    meshRenderer.material = state ? greenMaterial : redMaterial;  
}  
}
```

RogueShooter – All Scripts

Assets/scripts/GameObjects/ObjectSpawnPlaceholder.cs

```
using Mirror;
using UnityEngine;
/// <summary>
/// This class is responsible for spawning objects in the game.
/// This object is only placeholder, which spawns the actual object and then destroys itself.
/// Because spawning must be done by the server, this object must exist on the server.
/// </summary>
public class ObjectSpawnPlaceholder : MonoBehaviour
{
    [SerializeField] private GameObject objectPrefab;
    public GameObject Prefab => objectPrefab;

    private void Start()
    {
        // OFFLINE: ei verkkoa -> luo paikallisesti (näky heti)
        if (!NetworkClient.active && !NetworkServer.active)
        {
            Instantiate(objectPrefab, transform.position, transform.rotation);
            Destroy(gameObject);
        }

        // PUHDAS CLIENT: serveri spawnaa oikean → poista placeholder heti
        if (NetworkClient.active && !NetworkServer.active)
        {
            Destroy(gameObject);
            return;
        }
    }

    public void CreateObject()
    {
        // ONLINE: server luo ja spawnaa
        if (NetworkServer.active)
        {
            Debug.Log($"[ObjectSpawnPoint] Spawning object at {transform.position}");
            var go = Instantiate(objectPrefab, transform.position, transform.rotation);
            NetworkServer.Spawn(go);
            Destroy(gameObject);
            return;
        }
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Grid/GridObject.cs

```
using System.Collections.Generic;
using UnityEngine;

// <summary>
// This class represents a grid object in the grid system.
// It contains a list of units that are present in the grid position.
// It also contains a reference to the grid system and the grid position.
// </summary>
public class GridObject
{
    private GridSystem<GridObject> gridSystem;
    private GridPosition gridPosition;
    private List<Unit> unitList;
    private IInteractable interactable;

    public GridObject(GridSystem<GridObject> gridSystem, GridPosition gridPosition)
    {
        this.gridSystem = gridSystem;
        this.gridPosition = gridPosition;
        unitList = new List<Unit>();
    }

    public override string ToString()
    {
        string unitListString = "";
        foreach (Unit unit in unitList)
        {
            unitListString += unit + "\n";
        }
        return gridPosition.ToString() + "\n" + unitListString;
    }

    public void AddUnit(Unit unit)
    {
        unitList.Add(unit);
    }

    public void RemoveUnit(Unit unit)
    {
        unitList.Remove(unit);
    }

    public List<Unit> GetUnitList()
    {
        unitList.RemoveAll(u => u == null);
        return unitList;
    }

    public bool HasAnyUnit()
    {

```

RogueShooter – All Scripts

```
// Poista tuhotut viitteet (Unity-null huomioiden)
unitList.RemoveAll(u => u == null);
return unitList.Count > 0;
}

public Unit GetUnit()
{
    for (int i = unitList.Count - 1; i >= 0; i--)
    {
        if (unitList[i] == null) { unitList.RemoveAt(i); continue; }
    }
    return unitList.Count > 0 ? unitList[0] : null;
}

public IInteractable GetInteractable()
{
    return interactable;
}

public void SetInteractable(IInteractable interactable)
{
    this.interactable = interactable;
}
}
```

RogueShooter – All Scripts

Assets/scripts/Grid/GridPosition.cs

```
using System;
using NUnit.Framework;

// <summary>
// This struct represents a position in a grid system.
// It contains two integer values, x and z, which represent the coordinates of the position in the grid.
// It also contains methods for comparing two GridPosition objects, adding and subtracting them, and converting them to a string representation.
// </summary>
public struct GridPosition:IEquatable<GridPosition>
{
    public int x;
    public int z;

    public int floor;

    public GridPosition(int x, int z, int floor)
    {
        this.x = x;
        this.z = z;
        this.floor = floor;
    }

    public override bool Equals(object obj)
    {
        return obj is GridPosition position &&
            x == position.x &&
            z == position.z &&
            floor == position.floor;
    }

    public bool Equals(GridPosition other)
    {
        return this == other;
    }

    public override int GetHashCode()
    {
        return GetHashCode.Combine(x, z, floor);
    }

    public override string ToString()
    {
        return $"x:{x}, z:{z}, floor:{floor}";
    }

    public static bool operator ==(GridPosition a, GridPosition b)
    {
        return a.x == b.x && a.z == b.z && a.floor == b.floor;
    }
}
```


RogueShooter – All Scripts

```
public static bool operator !=(GridPosition a, GridPosition b)
{
    return !(a == b);
}

public static GridPosition operator +(GridPosition a, GridPosition b)
{
    return new GridPosition(a.x + b.x, a.z + b.z, a.floor + b.floor);
}

public static GridPosition operator -(GridPosition a, GridPosition b)
{
    return new GridPosition(a.x - b.x, a.z - b.z, a.floor - b.floor);
}
}
```

RogueShooter – All Scripts

Assets/scripts/Grid/GridSystem.cs

```
using System;
using UnityEngine;

/// <summary>
/// This class represents a grid system in a 2D space.
/// It contains methods to create a grid, convert between grid and world coordinates,
/// and manage grid objects.
/// </summary>

public class GridSystem<TGridObject>
{
    private int width;
    private int height;
    private float cellSize;
    private int floor;

    private float floorHeigth;
    private TGridObject[,] gridObjectsArray;

    public GridSystem(int width, int height, float cellSize, int floor, float floorHeigth, Func<GridSystem<TGridObject>, GridPosition, TGridObject> createGridObject)
    {
        this.width = width;
        this.height = height;
        this.cellSize = cellSize;
        this.floor = floor;
        this.floorHeigth = floorHeigth;

        gridObjectsArray = new TGridObject[width, height];

        for (int x = 0; x < width; x++)
        {
            for (int z = 0; z < height; z++)
            {
                GridPosition gridPosition = new GridPosition(x, z, floor);
                gridObjectsArray[x, z] = createGridObject(this, gridPosition);
            }
        }
    }

    /// Purpose: This method converts grid coordinates (x, z) to world coordinates.
    /// It multiplies the grid coordinates by the cell size to get the world position.
    public Vector3 GetWorldPosition(GridPosition gridPosition)
    {
        return new Vector3(gridPosition.x, 0, gridPosition.z) * cellSize +
            new Vector3(0, gridPosition.floor, 0) * floorHeigth;
    }

    /// Purpose: This is used to find the grid position of a unit in the grid system.
    /// It is used to check if the unit is within the bounds of the grid system.
```

RogueShooter – All Scripts

```
/// It converts the world position to grid coordinates by dividing the world position by the cell size.
public GridPosition GetGridPosition(Vector3 worldPosition)
{
    return new GridPosition( Mathf.RoundToInt(worldPosition.x/cellSize),
        Mathf.RoundToInt(worldPosition.z/cellSize),
        floor);
}

/// Purpose: This method creates debug objects in the grid system for visualization purposes.
/// It instantiates a prefab at each grid position and sets the grid object for that position.
public void CreateDebugObjects(Transform debugPrefab)
{
    for (int x = 0; x < width; x++)
    {
        for(int z = 0; z < height; z++)
        {
            GridPosition gridPosition = new GridPosition(x, z, floor);
            Transform debugTransform = GameObject.Instantiate(debugPrefab, GetWorldPosition(gridPosition), Quaternion.identity);
            GridDebugObject gridDebugObject = debugTransform.GetComponent<GridDebugObject>();
            gridDebugObject.SetGridObject(GetGridObject(gridPosition));
        }
    }
}

/// Purpose: This method returns the grid object at a specific grid position.
/// It is used to get the grid object for a specific position in the grid system.
public TGridObject GetGridObject(GridPosition gridPosition)
{
    return gridObjectsArray[gridPosition.x, gridPosition.z];
}

/// Purpose: This method checks if a grid position is valid within the grid system.
/// It checks if the x and z coordinates are within the bounds of the grid width and height.
public bool IsValidGridPosition(GridPosition gridPosition)
{
    return gridPosition.x >= 0 &&
        gridPosition.x < width &&
        gridPosition.z >= 0 &&
        gridPosition.z < height &&
        gridPosition.floor == floor;
}

public int GetWidth()
{
    return width;
}

public int GetHeight()
{
    return height;
}
}
```

--

RogueShooter – All Scripts

Assets/scripts/Grid/GridSystemVisual.cs

```
using System;
using System.Collections.Generic;
using Unity.VisualScripting;
using UnityEngine;

/// <summary>
/// This class is responsible for visualizing the grid system in the game.
/// It creates a grid of visual objects that represent the grid positions.
/// </summary>
public class GridSystemVisual : MonoBehaviour
{
    public static GridSystemVisual Instance { get; private set; }

    [Serializable]
    public struct GridVisualTypeMaterial
    {
        public GridVisualType gridVisualType;
        public Material material;
    }
    public enum GridVisualType
    {
        white,
        Blue,
        Red,
        RedSoft,
        Yellow
    }

    /// Purpose: This prefab is used to create the visual representation of each grid position.
    [SerializeField] private Transform gridSystemVisualSinglePrefab;
    [SerializeField] private List<GridVisualTypeMaterial> gridVisualTypeMaterialList;

    /// Purpose: This array holds the visual objects for each grid position.
    private GridSystemVisualSingle[, ] gridSystemVisualSingleArray;

    private void Awake()
    {
        /// Purpose: Ensure that there is only one instance in the scene
        if (Instance != null)
        {
            Debug.LogError("More than one GridSystemVisual in the scene!" + transform + " " + Instance);
            Destroy(gameObject);
            return;
        }

        Instance = this;
    }
}
```

RogueShooter – All Scripts

```
private void Start()
{
    gridSystemVisualSingleArray = new GridSystemVisualSingle[
        LevelGrid.Instance.GetWidth(),
        LevelGrid.Instance.GetHeight(),
        LevelGrid.Instance.GetFloorAmount()
    ];

    /// Purpose: Create a grid of visual objects that represent the grid positions.
    /// It instantiates a prefab at each grid position and sets the grid object for that position.
    for (int x = 0; x < LevelGrid.Instance.GetWidth(); x++)
    {
        for (int z = 0; z < LevelGrid.Instance.GetHeight(); z++)
        {
            for (int floor = 0; floor < LevelGrid.Instance.GetFloorAmount(); floor++)
            {
                GridPosition gridPosition = new(x, z, floor);
                Transform gridSystemVisualSingleTransform = Instantiate(gridSystemVisualSinglePrefab, LevelGrid.Instance.GetWorldPosition(gridPosition),
Quaternion.identity);
                gridSystemVisualSingleArray[x, z, floor] = gridSystemVisualSingleTransform.GetComponent<GridSystemVisualSingle>();
            }
        }
    }

    UnitActionSystem.Instance.OnSelectedActionChanged += UnitActionSystem_OnSelectedActionChanged;
    UnitActionSystem.Instance.OnBusyChanged += UnitActionSystem_OnBusyChanged;
    // LevelGrid.Instance.onAnyUnitMoveGridPosition += LevelGrid_onAnyUnitMoveGridPosition;

    UpdateGridVisuals();
}

/*
void OnEnable()
{
    UnitActionSystem.Instance.OnSelectedActionChanged += UnitActionSystem_OnSelectedActionChanged;
    LevelGrid.Instance.onAnyUnitMoveGridPosition += LevelGrid_onAnyUnitMoveGridPosition;
}
*/

void OnDisable()
{
    UnitActionSystem.Instance.OnSelectedActionChanged -= UnitActionSystem_OnSelectedActionChanged;
    // LevelGrid.Instance.onAnyUnitMoveGridPosition -= LevelGrid_onAnyUnitMoveGridPosition;
}

public void HideAllGridPositions()
{
    for (int x = 0; x < LevelGrid.Instance.GetWidth(); x++)
    {
        for (int z = 0; z < LevelGrid.Instance.GetHeight(); z++)
        {
            for (int floor = 0; floor < LevelGrid.Instance.GetFloorAmount(); floor++)
```

RogueShooter – All Scripts

```
        {
            gridSystemVisualSingleArray[x, z, floor].Hide();
        }
    }
}

private void ShowGridPositionRange(GridPosition gridPosition, int range, GridVisualType gridVisualType)
{
    List<GridPosition> gridPositionsList = new List<GridPosition>();

    for (int x = -range; x <= range; x++)
    {
        for (int z = -range; z <= range; z++)
        {
            GridPosition testGridPosition = gridPosition + new GridPosition(x, z, 0);

            if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition))
            {
                continue;
            }

            int testDistance = Mathf.Abs(x) + Mathf.Abs(z);
            if (testDistance > range)
            {
                continue;
            }

            gridPositionsList.Add(testGridPosition);
        }
    }

    ShowGridPositionList(gridPositionsList, gridVisualType);
}

private void ShowGridPositionRangeSquare(GridPosition gridPosition, int range, GridVisualType gridVisualType)
{
    List<GridPosition> gridPositionsList = new List<GridPosition>();

    for (int x = -range; x <= range; x++)
    {
        for (int z = -range; z <= range; z++)
        {
            GridPosition testGridPosition = gridPosition + new GridPosition(x, z, 0);

            if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition))
            {
                continue;
            }
        }
    }
}
```

RogueShooter – All Scripts

```
        gridPositionsList.Add(testGridPosition);
    }
}

ShowGridPositionList(gridPositionsList, gridVisualType);
}

public void ShowGridPositionList(List<GridPosition> gridPositionList, GridVisualType gridVisualType)
{
    foreach (GridPosition gridPosition in gridPositionList)
    {
        gridSystemVisualSingleArray[gridPosition.x, gridPosition.z, gridPosition.floor].
        Show(GetGridVisualTypeMaterial(gridVisualType));
    }
}

private void UpdateGridVisuals()
{
    HideAllGridPositions();
    Unit selectedUnit = UnitActionSystem.Instance.GetSelectedUnit();
    if (selectedUnit == null) return;

    BaseAction selectedAction = UnitActionSystem.Instance.GetSelectedAction();

    GridVisualType gridVisualType;

    switch (selectedAction)
    {
        default:
        case MoveAction moveAction:
            gridVisualType = GridVisualType.white;
            break;
        case TurnTowardsAction turnTowardsAction:
            gridVisualType = GridVisualType.Blue;
            break;
        case ShootAction shootAction:
            gridVisualType = GridVisualType.Red;
            ShowGridPositionRange(selectedUnit.GetGridPosition(), shootAction.GetMaxShootDistance(), GridVisualType.RedSoft);
            break;
        case GrenadeAction grenadeAction:
            gridVisualType = GridVisualType.Yellow;
            break;
        case MeleeAction meleeAction:
            gridVisualType = GridVisualType.Red;
            ShowGridPositionRangeSquare(selectedUnit.GetGridPosition(), 1, GridVisualType.RedSoft);
            break;
        case InteractAction interactAction:
            gridVisualType = GridVisualType.Blue;
            break;
    }
}
```


RogueShooter – All Scripts

```
        ShowGridPositionList(  
            selectedAction.GetValidGridPositionList(), gridVisualType);  
    }  
  
    private void UnitActionSystem_OnSelectedActionChanged(object sender, EventArgs e)  
    {  
        UpdateGridVisuals();  
    }  
  
    private void LevelGrid_onAnyUnitMoveGridPosition(object sender, EventArgs e)  
    {  
        UpdateGridVisuals();  
    }  
  
    private void UnitActionSystem_OnBusyChanged(object sender, bool e)  
    {  
        UpdateGridVisuals();  
    }  
  
    private Material GetGridVisualTypeMaterial(GridVisualType gridVisualType)  
    {  
        foreach (GridVisualTypeMaterial gridVisualTypeMaterial in gridVisualTypeMaterialList)  
        {  
            if (gridVisualTypeMaterial.gridVisualType == gridVisualType)  
            {  
                return gridVisualTypeMaterial.material;  
            }  
        }  
        Debug.LogError("Cloud not find GridVisualTypeMaterial for GridVisualType" + gridVisualType);  
        return null;  
    }  
}
```

RogueShooter – All Scripts

Assets/scripts/Grid/GridSystemVisualSingle.cs

```
using UnityEngine;

/// <summary>
/// This class is responsible for visualizing a single grid position in the game.
/// It contains a MeshRenderer component that is used to show or hide the visual representation of the grid position.
/// </summary>
public class GridSystemVisualSingle : MonoBehaviour
{
    [SerializeField] private MeshRenderer meshRenderer;

    public void Show(Material material)
    {
        meshRenderer.enabled = true;
        meshRenderer.material = material;
    }
    public void Hide()
    {
        meshRenderer.enabled = false;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Grid/LevelGrid.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

/// @file LevelGrid.cs
/// @brief Core grid management system for RogueShooter.
///
/// The LevelGrid defines and manages the tactical grid used by all gameplay systems.
/// It stores spatial occupancy data, translates between world-space and grid-space coordinates,
/// and provides the structural backbone for the pathfinding and edge-baking systems.
///
/// ### Overview
/// Each level in RogueShooter is represented as one or more layered grids (floors).
/// Every grid cell corresponds to a physical area in the game world and may contain
/// references to units, obstacles, or other gameplay entities. The LevelGrid keeps
/// this data synchronized with the actual scene state and provides efficient lookup
/// and update operations.
///
/// ### System integration
/// - **LevelGrid** - Manages spatial layout, unit occupancy, and coordinate conversions.
/// - **EdgeBaker** - Uses LevelGrid data (width, height, cell size, floor count) to detect edge obstacles.
/// - **PathFinding** - Queries LevelGrid to determine walkable areas and world→grid mapping for A* searches.
///
/// ### Key features
/// - Multi-floor grid architecture with configurable width, height, and cell size.
/// - Fast world→grid coordinate conversion for unit and object placement.
/// - Real-time occupancy tracking of all units on the grid.
/// - Scene rebuild capability (`RebuildOccupancyFromScene`) for reinitializing unit positions after reload.
/// - Event-driven notifications for unit movement (`onAnyUnitMoveGridPosition`).
///
/// ### Why this exists in RogueShooter
/// - The game's turn-based, tile-based design requires precise spatial logic independent of Unity's physics.
/// - Provides a unified "source of truth" for spatial relationships used by both AI and player systems.
/// - Keeps the game's tactical layer deterministic, debuggable, and efficient.
///
/// In summary, this file defines the foundational grid layer of RogueShooter's tactical engine,
/// acting as the shared coordinate and occupancy system for all movement, visibility, and interaction logic.
///
/// <summary>
/// This class is responsible for managing the game's grid system.
/// It keeps track of the units on the grid and their positions.
/// It provides methods to add, remove, and move units on the grid.
/// Note: This class Script Execution Order is set to be executed after UnitManager.cs. High priority.
/// </summary>
public class LevelGrid : MonoBehaviour
{
    public static LevelGrid Instance { get; private set; }

    public const float FLOOR_HEIGHT = 4f;
    public event EventHandler onAnyUnitMoveGridPosition;
```

RogueShooter – All Scripts

```
[SerializeField] private Transform debugPrefab;
// [SerializeField] private bool debugVisible = true;
[SerializeField] private int width;
[SerializeField] private int height;
[SerializeField] private float cellSize;
[SerializeField] private int floorAmount;

private List<GridSystem<GridObject>> gridSystemList;

private void Awake()
{
    // Ensure that there is only one instance in the scene
    if (Instance != null)
    {
        Debug.LogError("LevelGrid: More than one LevelGrid in the scene!" + transform + " " + Instance);
        Destroy(gameObject);
        return;
    }
    Instance = this;

    gridSystemList = new List<GridSystem<GridObject>>(floorAmount);

    for (int floor = 0; floor < floorAmount; floor++)
    {
        var gridSystem = new GridSystem<GridObject>(
            width, height, cellSize, floor, FLOOR_HEIGHT,
            (GridSystem<GridObject> g, GridPosition gridPosition) => new GridObject(g, gridPosition)
        );
        //gridSystem.CreateDebugObjects(debugPrefab);
        gridSystemList.Add(gridSystem); // NullReferenceException: Object reference not set to an instance of an object!
    }
}

private void Start()
{
    PathFinding.Instance.Setup(width, height, cellSize, floorAmount);
}

public GridSystem<GridObject> GetGridSystem(int floor)
{
    if (floor < 0 || floor >= gridSystemList.Count) { Debug.LogError($"Invalid floor {floor}"); return null; }
    return gridSystemList[floor];
}

public int GetFloor(Vector3 worldPosition)
{
    return Mathf.RoundToInt(worldPosition.y / FLOOR_HEIGHT);
}
```

RogueShooter – All Scripts

```
public void AddUnitAtGridPosition(GridPosition gridPosition, Unit unit)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    gridObject.AddUnit(unit);
}

public List<Unit> GetUnitListAtGridPosition(GridPosition gridPosition)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    if (gridObject != null)
    {
        return gridObject.GetUnitList();
    }
    return null;
}

public IInteractable GetInteractableAtGridPosition(GridPosition gridPosition)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    if (gridObject != null)
    {
        return gridObject.GetInteractable();
    }
    return null;
}

public void SetInteractableAtGridPosition(GridPosition gridPosition, IInteractable interactable)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    gridObject?.SetInteractable(interactable);
}

public void RemoveUnitAtGridPosition(GridPosition gridPosition, Unit unit)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    gridObject.RemoveUnit(unit);
}

public void UnitMoveToGridPosition(GridPosition fromGridPosition, GridPosition toGridPosition, Unit unit)
{
    RemoveUnitAtGridPosition(fromGridPosition, unit);
    AddUnitAtGridPosition(toGridPosition, unit);
    onAnyUnitMoveGridPosition?.Invoke(this, EventArgs.Empty);
}

public GridPosition GetGridPosition(Vector3 worldPosition)
{
    int floor = GetFloor(worldPosition);
    return GetGridSystem(floor).GetGridPosition(worldPosition);
}
```

RogueShooter – All Scripts

```
public Vector3 GetWorldPosition(GridPosition gridPosition)
{
    return GetGridSystem(gridPosition.floor).GetWorldPosition(gridPosition);
}

public bool IsValidGridPosition(GridPosition gridPosition)
{
    if (gridPosition.floor < 0 || gridPosition.floor >= floorAmount)
    {
        return false;
    }
    return GetGridSystem(gridPosition.floor).IsValidGridPosition(gridPosition);
}

public int GetWidth() => GetGridSystem(0).GetWidth();

public int GetHeight() => GetGridSystem(0).GetHeight();

public int GetFloorAmount() => floorAmount;

public float GetCellSize() => cellSize;

public bool HasAnyUnitOnGridPosition(GridPosition gridPosition)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    return gridObject.HasAnyUnit();
}

public Unit GetUnitAtGridPosition(GridPosition gridPosition)
{
    GridObject gridObject = GetGridSystem(gridPosition.floor).GetGridObject(gridPosition);
    return gridObject.GetUnit();
}

public void ClearAllOccupancy()
{
    if (gridSystemList == null) return;

    for (int floor = 0; floor < gridSystemList.Count; floor++)
    {
        var grid = gridSystemList[floor];
        if (grid == null) continue;

        for (int x = 0; x < grid.GetWidth(); x++)
        {
            for (int z = 0; z < grid.GetHeight(); z++)
            {
                var gp = new GridPosition(x, z, floor);
                var gridObj = grid.GetGridObject(gp);
                gridObj?.GetUnitList()?.Clear();
            }
        }
    }
}
```

RogueShooter – All Scripts

```
    }  
}  
  
/// <summary>  
/// Rebuilds all grid occupancy data by scanning the current scene for active units.  
///  
/// What it does:  
/// - Clears all existing unit occupancy from the <see cref="LevelGrid"/>.  
/// - Finds every active <see cref="Unit"/> in the scene.  
/// - Converts each unit's world position into a grid position and re-registers it.  
///  
/// Why this exists in RogueShooter:  
/// - Used after a scene or level is (re)loaded to ensure that the grid accurately reflects  
///   the current in-scene unit placements.  
/// - Called by systems like <see cref="GameModeSelectUI"/> and <see cref="ServerBootstrap"/>  
///   to synchronize game state after spawning or initialization events.  
///  
/// Implementation notes:  
/// - Intended for runtime reinitialization, not per-frame updates.  
/// - Safe to call at any time; automatically rebuilds the occupancy layer from scratch.  
/// </summary>  
public void RebuildOccupancyFromScene()  
{  
    ClearAllOccupancy();  
    var units = FindObjectsByType<Unit>(FindObjectsSortMode.None);  
    foreach (var u in units)  
    {  
        var gp = GetGridPosition(u.transform.position);  
        AddUnitAtGridPosition(gp, u);  
    }  
}
```

RogueShooter – All Scripts

Assets/scripts/Helpers/AllUnitsList.cs

```
using Mirror;  
using UnityEngine;  
  
[DisallowMultipleComponent]  
public class FriendlyUnit : NetworkBehaviour {}  
  
[DisallowMultipleComponent]  
public class EnemyUnit : NetworkBehaviour {}
```


RogueShooter – All Scripts

Assets/scripts/Helpers/AuthorityHelper.cs

```
using Mirror;

public static class AuthorityHelper
{
    /// <summary>
    /// Checks if the given NetworkBehaviour has local control.
    /// Prevents the player from controlling the object if they are not the owner.
    /// </summary>
    public static bool HasLocalControl(NetworkBehaviour netBehaviour)
    {
        return NetworkClient.isConnected && !netBehaviour.isOwned;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Helpers/FieldCleaner.cs

```
using System.Linq;
using UnityEngine;
using UnityEngine.SceneManagement;
using Utp;

public class FieldCleaner : MonoBehaviour
{
    public static void ClearAll()
    {
        // Varmista: älä yritä siivota puhtaalta clientiltä verkossa
        if (GameNetworkManager.Instance != null &&
            GameNetworkManager.Instance.GetNetWorkClientConnected() &&
            !GameNetworkManager.Instance.GetNetWorkServerActive())
        {
            Debug.LogWarning("[FieldCleaner] Don't clear field from a pure client.");
            return;
        }

        // Find all friendly and enemy units (also inactive, just in case)
        var friendlies = Resources.FindObjectsOfTypeAll<FriendlyUnit>()
            .Where(u => u != null && u.gameObject.scene.IsValid());
        var enemies = Resources.FindObjectsOfTypeAll<EnemyUnit>()
            .Where(u => u != null && u.gameObject.scene.IsValid());

        foreach (var u in friendlies) Despawn(u.gameObject);
        foreach (var e in enemies) Despawn(e.gameObject);

        // Tyhjennä UnitManagerin listat (suojattu null-checkillä)
        UnitManager.Instance?.ClearAllUnitLists();

        // Nollaa myös ruudukon miehitys - sceneen jääneet objektit eivät jää kummittelemaan
        LevelGrid.Instance?.ClearAllOccupancy();
    }

    static void Despawn(GameObject go)
    {
        // if server is active, use Mirror's destroy; otherwise normal Unity Destroy
        if (GameNetworkManager.Instance.GetNetWorkServerActive())
        {
            GameNetworkManager.Instance.NetworkDestroy(go);
        }
        else
        {
            Destroy(go);
        }
    }

    public static void ReloadMap()
    {
        Debug.Log("[FieldCleaner] Reloading map.");
    }
}
```

RogueShooter – All Scripts

```
        SceneManager.LoadScene(SceneManager.GetActiveScene().name);  
    }  
}
```

RogueShooter – All Scripts

Assets/scripts/LevelCreation/MapContentSpawner.cs

```
using System.Collections;
using Mirror;
using UnityEngine;

public class MapContentSpawner : NetworkBehaviour
{
    // (Valinnainen) ettei bakea ajeta klientillä monta kertaa
    private static bool s_clientBakedOnce;

    public override void OnStartServer()
    {
        base.OnStartServer();
        StartCoroutine(SpawnThenBake());
    }

    private IEnumerator SpawnThenBake()
    {
        Debug.Log("[MapContentSpawner] Spawning map content on server...");

        // 1) Spawnaa kaikki NetworkIdentity-suojat serverillä
        var spawnPoints = FindObjectsByType<ObjectSpawnPlaceholder>(FindObjectsSortMode.None);
        foreach (var sp in spawnPoints)
            sp.CreateObject(); // tämä kutsuu NetworkServer.Spawn(...)

        // 2) Server-bake (jos serveri käyttää edge-dataa esim. AI:hin)
        EdgeBaker.Instance.BakeAllEdges();

        // 3) Odota 1 frame → varmistaa että spawn-viestit ehtivät klienteille
        yield return null;

        // 4) Käske kaikkia klientejä bake'amaan omassa päässään
        RpcBakeAllEdgesOnClients();
    }

    [ClientRpc]
    private void RpcBakeAllEdgesOnClients()
    {
        if (s_clientBakedOnce) return; // valinnainen vartija
        EdgeBaker.Instance.BakeAllEdges();
        s_clientBakedOnce = true;
        // Jos hover-UI tarvitsee refreshin, kutsu se tässä:
        // GridSystemVisual.Instance?.RefreshAll?.Invoke();
        Debug.Log("[MapContentSpawner] Client received RPC: BakeAllEdges()");
    }

    // BONUS: myöhäisille liittyjille (late join) – kun tämä scene-objekti spawnaa klientille
    public override void OnStartClient()
    {
        base.OnStartClient();
        StartCoroutine(BakeNextFrameOnClient());
    }
}
```

RogueShooter – All Scripts

```
    }

    private IEnumerator BakeNextFrameOnClient()
    {
        yield return null; // odota että kaikki scene-spawnit on valmiit klientilläkin
        if (!s_clientBakedOnce)
        {
            EdgeBaker.Instance.BakeAllEdges();
            s_clientBakedOnce = true;
            Debug.Log("[MapContentSpawner] OnStartClient: BakeAllEdges()");
        }
    }
}
```

RogueShooter – All Scripts

Assets/scripts/LevelCreation/SpawnUnitsCoordinator.cs

```
using System.Linq;
using UnityEngine;
using Mirror;

public class SpawnUnitsCoordinator : MonoBehaviour
{
    public static SpawnUnitsCoordinator Instance { get; private set; }
    private bool enemiesSpawned;

    // --- Lisää luokan alkuun kentät ---
    [Header("Co-op squad prefabs")]
    public GameObject unitHostPrefab;    // -> UnitSolo
    public GameObject unitClientPrefab;  // -> UnitSolo Player 2

    [Header("Enemy spawn (Co-op)")]
    public GameObject enemyPrefab;

    [Header("Spawn positions (world coords on your grid)")]
    public Vector3[] hostSpawnPositions = {
        new Vector3(0, 0, 0),
        new Vector3(2, 0, 0),
    };
    public Vector3[] clientSpawnPositions = {
        new Vector3(0, 0, 6),
        new Vector3(2, 0, 6),
    };
    public Vector3[] enemySpawnPositions = {
        new Vector3(4, 0, 8),
        new Vector3(6, 0, 8),
    };

    void Awake()
    {
        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;
    }

    public GameObject[] SpawnPlayersForNetwork(NetworkConnectionToClient conn, bool isHost)
    {
        GameObject unitPrefab = GetUnitPrefabForPlayer(isHost);
        Vector3[] spawnPoints = GetSpawnPositionsForPlayer(isHost);

        if (unitPrefab == null)
        {
            Debug.LogError($"[NM] {(isHost ? "unitHostPrefab" : "unitClientPrefab")} puuttuu!");
            return null;
        }
        if (spawnPoints == null || spawnPoints.Length == 0)
        {

```

RogueShooter – All Scripts

```
        Debug.LogError($"[NM] {(isHost ? "hostSpawnPositions" : "clientSpawnPositions")} ei ole asetettu!");
        return null;
    }

    var spawnedPlayersUnit = new GameObject[spawnPoints.Length];
    for (int i = 0; i < spawnPoints.Length; i++)
    {
        var playerUnit = Instantiate(unitPrefab, spawnPoints[i], Quaternion.identity);
        if (playerUnit.TryGetComponent<Unit>(out var u) && conn.identity != null)
            u.OwnerId = conn.identity.netId;
        spawnedPlayersUnit[i] = playerUnit;
    }

    return spawnedPlayersUnit;
}

public GameObject GetUnitPrefabForPlayer(bool isHost)
{
    if (unitHostPrefab == null || unitClientPrefab == null)
    {
        Debug.LogError("Unit prefab references not set in SpawnUnitsCoordinator!");
        return null;
    }

    return isHost ? unitHostPrefab : unitClientPrefab;
}

public Vector3[] GetSpawnPositionsForPlayer(bool isHost)
{
    if (hostSpawnPositions.Length == 0 || clientSpawnPositions.Length == 0)
    {
        Debug.LogError("Spawn position arrays not set in SpawnUnitsCoordinator!");
        return new Vector3[0];
    }

    return isHost ? hostSpawnPositions : clientSpawnPositions;
}

public GameObject[] SpawnEnemies()
{
    var spawnedEnemies = new GameObject[enemySpawnPositions.Length];

    for (int i = 0; i < enemySpawnPositions.Length; i++)
    {
        var enemy = Instantiate(GetEnemyPrefab(), enemySpawnPositions[i], Quaternion.identity);
        spawnedEnemies[i] = enemy;
    }

    SetEnemiesSpawned(true);
    return spawnedEnemies;
}
```

RogueShooter – All Scripts

```
public Vector3[] GetEnemySpawnPositions()
{
    if (enemySpawnPositions.Length == 0)
    {
        Debug.LogError("Enemy spawn position array not set in SpawnUnitsCoordinator!");
        return new Vector3[0];
    }

    return enemySpawnPositions;
}

public void SetEnemiesSpawned(bool value)
{
    enemiesSpawned = value;
}

public bool AreEnemiesSpawned()
{
    return enemiesSpawned;
}

public GameObject GetEnemyPrefab()
{
    if (enemyPrefab == null)
    {
        Debug.LogError("Enemy prefab reference not set in SpawnUnitsCoordinator!");
        return null;
    }
    return enemyPrefab;
}

public void SpwanSinglePlayerUnits()
{
    SpawnPlayer1UnitsOffline();
    SpawnEnemyUnitsOffline();
}

// Singleplayer Gamemode Spawn units. hardcoded for now.
// Later we can make it more generic with arrays and prefabs like in Co-op.
private void SpawnPlayer1UnitsOffline()
{
    Instantiate(unitHostPrefab, hostSpawnPositions[0], Quaternion.identity);
    Instantiate(unitHostPrefab, hostSpawnPositions[1], Quaternion.identity);
}

private void SpawnEnemyUnitsOffline()
{
    Instantiate(enemyPrefab, enemySpawnPositions[0], Quaternion.identity);
    Instantiate(enemyPrefab, enemySpawnPositions[1], Quaternion.identity);
}

//
}
```


RogueShooter – All Scripts

Assets/scripts/MenuUI/BackButtonUI.cs

```
using UnityEngine;
using UnityEngine.UI;

public class BackButtonUI : MonoBehaviour
{
    // Serialized fields
    [Header("Canvas References")]
    [SerializeField] private GameObject connectCanvas; // this (self)
    [SerializeField] private GameObject gameModeSelectCanvas; // Hidden on start

    [Header("Buttons")]
    [SerializeField] private Button backButton;

    private void Awake()
    {
        // Add button listener
        backButton.onClick.AddListener(BackButton_OnClick);
    }

    private void BackButton_OnClick()
    {
        // Sign out the player from Unity Services
        Authentication authentication = connectCanvas.GetComponent<Authentication>();
        authentication.SignOutPlayerFromUnityServer();

        // Hide the connect canvas and show the game mode select canvas
        connectCanvas.SetActive(false);
        gameModeSelectCanvas.SetActive(true);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/MenuUI/GameModeSelectUI.cs

```
using UnityEngine;
using UnityEngine.UI;

public class GameModeSelectUI : MonoBehaviour
{
    // Serialized fields
    [Header("Canvas References")]
    [SerializeField] private GameObject gameModeSelectCanvas; // this (self)
    [SerializeField] private GameObject connectCanvas; // Hidden on start

    // UI Elements
    [Header("Buttons")]
    [SerializeField] private Button coopButton;
    [SerializeField] private Button pvpButton;

    private void Awake()
    {
        // Ensure the game mode select canvas is active and connect canvas is inactive at start
        gameModeSelectCanvas.SetActive(true);
        connectCanvas.SetActive(false);

        // Add button listeners
        coopButton.onClick.AddListener(OnClickCoOp);
        pvpButton.onClick.AddListener(OnClickPvP);
    }

    public void OnClickCoOp()
    {
        GameManager.SetCoOp();
        OnSelected();
    }

    public void OnClickPvP()
    {
        GameManager.SetVersus();
        OnSelected();
    }

    public async void OnSelected()
    {
        Authentication authentication = connectCanvas.GetComponent<Authentication>();
        await authentication.SingInPlayerToUnityServerAsync();

        FieldCleaner.ClearAll();
        StartCoroutine(ResetGridNextFrame());
        gameModeSelectCanvas.SetActive(false);
        connectCanvas.SetActive(true);
    }

    private System.Collections.IEnumerator ResetGridNextFrame()
```

RogueShooter – All Scripts

```
{
    yield return new WaitForEndOfFrame();
    var lg = LevelGrid.Instance;
    if (lg != null) lg.RebuildOccupancyFromScene();
}

public void Reset()
{
    // Pieni "siivous" ennen reloadia on ok, mutta ei pakollinen
    FieldCleaner.ClearAll();

    if (Mirror.NetworkServer.active)
    {
        ResetService.Instance.HardResetServerAuthoritative();
    }
    else if (Mirror.NetworkClient.active)
    {
        ResetService.Instance.CmdRequestHardReset();
    }
    else
    {
        // Yksinpeli
        GameReset.HardReloadSceneKeepMode();
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Online/Authentication.cs

```
using System;
using System.Threading.Tasks;
using Unity.Services.Authentication;
using Unity.Services.Core;
using UnityEngine;

/// <summary>
/// This class is responsible for handling the authentication process.
/// It initializes the Unity Services and signs in the user anonymously.
/// Required when using Unity Relay, as it provides player authentication
/// and enables online multiplayer without port forwarding or direct IP connections.
/// </summary>
public class Authentication : MonoBehaviour
{
    public async Task SingInPlayerToUnityServerAsync()
    {
        try
        {
            await UnityServices.InitializeAsync();
            await AuthenticationService.Instance.SignInAnonymouslyAsync();
            Debug.Log("Logged into Unity, player ID: " + AuthenticationService.Instance.PlayerId);
        }
        catch (Exception e)
        {
            Debug.LogError(e);
        }
    }

    public void SignOutPlayerFromUnityServer()
    {
        if (AuthenticationService.Instance.IsSignedIn)
        {
            AuthenticationService.Instance.SignOut();
            Debug.Log("Player signed out of Unity Services");
        }
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Online/Connect.cs

```
using UnityEngine;
using TMPPro;
using Mirror;
using Utp;
using UnityEngine.SceneManagement;

/// <summary>
/// This class is responsible for connecting to a game as a host or client.
///
/// NOTE: Button callbacks are set in the Unity Inspector.
/// </summary>
public class Connect : MonoBehaviour
{
    [SerializeField] private GameNetworkManager gameNetworkManager; // vedä tämä Inspectorissa
    [SerializeField] private TMP_InputField ipField;

    void Awake()
    {
        // find the NetworkManager in the scene if not set in Inspector
        if (!gameNetworkManager) gameNetworkManager = NetworkManager.singleton as GameNetworkManager;
        if (!gameNetworkManager) gameNetworkManager = FindFirstObjectByType<GameNetworkManager>();
        if (!gameNetworkManager) Debug.LogError("[Connect] GameNetworkManager not found in scene.");
    }

    public void HostLAN()
    {
        LoadSceneToAllHostLAN();
    }

    public void ClientLAN()
    {
        // Jos syöte kenttä puuttuu/tyhjä → oletus localhost (sama kone)
        string ip = (ipField != null && !string.IsNullOrEmpty(ipField.text))
            ? ipField.text.Trim()
            : "localhost"; // tai 127.0.0.1

        gameNetworkManager.networkAddress = ip; // <<< TÄRKEIN KOHTA
        gameNetworkManager.JoinStandardServer(); // useRelay=false ja StartClient()
    }

    public void Host()
    {
        if (!gameNetworkManager)
        {
            Debug.LogError("[Connect] GameNetworkManager not found in scene.");
            return;
        }
    }
}
```

RogueShooter – All Scripts

```
        LoadSceneToAllHost();
    }

    public void Client()
    {
        if (!gameNetworkManager)
        {
            Debug.LogError("[Connect] GameNetworkManager not found in scene.");
            return;
        }

        gameNetworkManager.JoinRelayServer();
    }

    /// <summary>
    /// Starts a LAN host and loads the current scene for all clients.
    /// </summary>
    public void LoadSceneToAllHostLAN()
    {
        gameNetworkManager.StartStandardHost();
        var sceneName = SceneManager.GetActiveScene().name;
        NetworkManager.singleton.ServerChangeScene(sceneName);
    }

    /// <summary>
    /// Starts a relay host and loads the current scene for all clients.
    /// </summary>
    public void LoadSceneToAllHost()
    {
        gameNetworkManager.StartRelayHost(2, null);
        var sceneName = SceneManager.GetActiveScene().name;
        NetworkManager.singleton.ServerChangeScene(sceneName);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Online/CoopTurnCoordinator.cs

```
using System.Collections;
using System.Collections.Generic;
using System.Linq;
using Mirror;
using UnityEngine;

public class CoopTurnCoordinator : NetworkBehaviour
{
    public static CoopTurnCoordinator Instance { get; private set; }

    void Awake()
    {
        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;
    }

    [Server]
    public void TryAdvanceIfReady()
    {
        if (NetTurnManager.Instance.phase == TurnPhase.Players && NetTurnManager.Instance.endedPlayers.Count >= Mathf.Max(1, NetTurnManager.Instance.requiredCount))
        {
            StartCoroutine(ServerEnemyTurnThenNextPlayers());
        }
    }

    [Server]
    private IEnumerator ServerEnemyTurnThenNextPlayers()
    {
        // Asettaa vihollisen WordUI: (Action Points) näkyviin.
        UnitUIBroadcaster.Instance.BroadcastUnitWorldUIVisibility(true);

        // 1) Vihollisvuoro alkaa
        RpcTurnPhaseChanged(NetTurnManager.Instance.phase = TurnPhase.Enemy, NetTurnManager.Instance.turnNumber, false);

        // Silta unit/AP-logiikalle (sama kuin nyt)
        if (TurnSystem.Instance != null)
        {
            TurnSystem.Instance.ForcePhase(isPlayerTurn: false, incrementTurnNumber: false);
        }

        // Aja AI
        yield return RunEnemyAI();

        // 2) Paluu pelaajille + turn-numero + resetit
        NetTurnManager.Instance.turnNumber++;
        NetTurnManager.Instance.ResetTurnState();

        if (TurnSystem.Instance != null)
        {

```

RogueShooter – All Scripts

```
        TurnSystem.Instance.ForcePhase(isPlayerTurn: true, incrementTurnNumber: false);
    }

    // 3) Lähetä *kaikille* (host + clientit) HUD-päivitys SP-logiikan kautta
    RpcTurnPhaseChanged(NetTurnManager.Instance.phase = TurnPhase.Players, NetTurnManager.Instance.turnNumber, true);

    // Asettaa pelaajien WordUI: (Action Points) näkyviin.
    UnitUIBroadcaster.Instance.BroadcastUnitWorldUIVisibility(false);
}

[Server]
IEnumerator RunEnemyAI()
{
    if (EnemyAI.Instance != null)
        yield return EnemyAI.Instance.RunEnemyTurnCoroutine();
    else
        yield return null; // fallback, ettei ketju katkea
}

// ---- Client-notifikaatiot UI:lle ----
[ClientRpc]
public void RpcTurnPhaseChanged(TurnPhase newPhase, int newTurnNumber, bool isPlayersPhase)
{
    // Päivitä paikallinen SP-UI-luuppi (ei Mirror-kutsuja)
    if (TurnSystem.Instance != null)
        TurnSystem.Instance.SetHudFromNetwork(newTurnNumber, isPlayersPhase);

    // Vaihe vaihtui → varmuuden vuoksi piilota mahdollinen "READY" -teksti
    var ui = FindFirstObjectByType<TurnSystemUI>();
    if (ui != null) ui.SetTeammateReady(false, null);
}

// Näyttää toiselle pelaajalle "Player X READY"
[ClientRpc]
public void RpcUpdateReadyStatus(int[] whoEndedIds, string[] whoEndedLabels)
{
    var ui = FindFirstObjectByType<TurnSystemUI>();
    if (ui == null) return;

    // Selvitä oma netId
    uint localId = 0;
    if (NetworkClient.connection != null && NetworkClient.connection.identity)
        localId = NetworkClient.connection.identity.netId;

    bool show = false;
    string label = null;

    // Jos joku muu kuin minä on valmis → näytä hänen labelinsa
    for (int i = 0; i < whoEndedIds.Length; i++)
    {
        if ((uint)whoEndedIds[i] != localId)
```


RogueShooter – All Scripts

```
        {
            show = true;
            label = (i < whoEndedLabels.Length) ? whoEndedLabels[i] : "Teammate";
            break;
        }
    }

    ui.SetTeammateReady(show, label);
}

// ---- Server-apurit ----
[Server] string GetLabelByNetId(uint id)
{
    foreach (var kvp in NetworkServer.connections)
    {
        var conn = kvp.Value;
        if (conn != null && conn.identity && conn.identity.netId == id)
            return conn.connectionId == 0 ? "Player 1" : "Player 2";
    }
    return "Teammate";
}

[Server]
public string[] BuildEndedLabels()
{
    // HashSetin järjestys ei ole merkityksellinen, näytetään mikä tahansa toinen
    return NetTurnManager.Instance.endedPlayers.Select(id => GetLabelByNetId(id)).ToArray();
}
}
```

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Assets/scripts/Online/GameNetworkManager.cs

```
using System;
using System.Collections.Generic;
using Mirror;
using UnityEngine;
using Unity.Services.Relay.Models;

namespace Utp
{
    [RequireComponent(typeof(UtpTransport))]
    public class GameNetworkManager : NetworkManager
    {
        public static GameNetworkManager Instance { get; private set; }
        private UtpTransport utpTransport;

        /// <summary>
        /// Server's join code if using Relay.
        /// </summary>
        public string relayJoinCode = "";

        public override void Awake()
        {
            if (Instance != null && Instance != this)
            {
                Destroy(gameObject);
                return;
            }
            Instance = this;

            base.Awake();
            autoCreatePlayer = false;

            utpTransport = GetComponent<UtpTransport>();

            string[] args = Environment.GetCommandLineArgs();
            for (int key = 0; key < args.Length; key++)
            {
                if (args[key] == "-port")
                {
                    if (key + 1 < args.Length)
                    {
                        string value = args[key + 1];

                        try
                        {
                            utpTransport.Port = ushort.Parse(value);
                        }
                        catch
                        {
                            UtpLog.Warning($"Unable to parse {value} into transport Port");
                        }
                    }
                }
            }
        }
    }
}
```

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```
    }  
    }  
    }  
    }  
}  
  
public override void OnStartServer()  
{  
    base.OnStartServer();  
    SpawnUnitsCoordinator.Instance.SetEnemiesSpawned(false);  
  
    if (GameModeManager.SelectedMode == GameMode.CoOp)  
    {  
        ServerSpawnEnemies();  
    }  
}  
  
/// <summary>  
/// Get the port the server is listening on.  
/// </summary>  
/// <returns>The port.</returns>  
public ushort GetPort()  
{  
    return utpTransport.Port;  
}  
  
/// <summary>  
/// Get whether Relay is enabled or not.  
/// </summary>  
/// <returns>True if enabled, false otherwise.</returns>  
public bool IsRelayEnabled()  
{  
    return utpTransport.useRelay;  
}  
  
/// <summary>  
/// Ensures Relay is disabled. Starts the server, listening for incoming connections.  
/// </summary>  
public void StartStandardServer()  
{  
    utpTransport.useRelay = false;  
    StartServer();  
}  
  
/// <summary>  
/// Ensures Relay is disabled. Starts a network "host" - a server and client in the same application  
/// </summary>  
public void StartStandardHost()  
{  
    utpTransport.useRelay = false;  
    StartHost();  
}
```

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```
}

/// <summary>
/// Gets available Relay regions.
/// </summary>
///
public void GetRelayRegions(Action<List<Region>> onSuccess, Action onFailure)
{
    utpTransport.GetRelayRegions(onSuccess, onFailure);
}

/// <summary>
/// Ensures Relay is enabled. Starts a network "host" - a server and client in the same application
/// </summary>
public void StartRelayHost(int maxPlayers, string regionId = null)
{
    utpTransport.useRelay = true;
    utpTransport.AllocateRelayServer(maxPlayers, regionId,
    (string joinCode) =>
    {
        relayJoinCode = joinCode;
        Debug.LogError($"Relay join code: {joinCode}");
        StartHost();
    },
    () =>
    {
        UtpLog.Error($"Failed to start a Relay host.");
    });
}

/// <summary>
/// Ensures Relay is disabled. Starts the client, connects it to the server with networkAddress.
/// </summary>
public void JoinStandardServer()
{
    utpTransport.useRelay = false;
    StartClient();
}

/// <summary>
/// Ensures Relay is enabled. Starts the client, connects to the server with the relayJoinCode.
/// </summary>
public void JoinRelayServer()
{
    utpTransport.useRelay = true;
    utpTransport.ConfigureClientWithJoinCode(relayJoinCode,
    () =>
    {
        StartClient();
    },
    () =>
    {

```

RogueShooter – All Scripts

```
        UtpLog.Error($"Failed to join Relay server.");
    });
}

public override void OnValidate()
{
    base.OnValidate();
}

bool addPlayerRequested;

/// <summary>
/// Make sure that the clien sends a AddPlayer request once the scene is loaded.
/// </summary>
public override void OnClientSceneChanged()
{
    base.OnClientSceneChanged();

    if (!NetworkClient.ready) NetworkClient.Ready();

    // Send AddPlayer message only once
    if (NetworkClient.connection != null &&
        NetworkClient.connection.identity == null &&
        !addPlayerRequested)
    {
        addPlayerRequested = true;
        NetworkClient.AddPlayer();
    }
}

public override void OnStopClient()
{
    base.OnStopClient();
    addPlayerRequested = false; // nollaa vartija disconnectissa
}

public override void OnClientDisconnect()
{
    base.OnClientDisconnect();
    addPlayerRequested = false;
}

/// <summary>
/// Tämä metodi spawnaa jokaiselle clientille oman Unitin ja tekee siitä heidän ohjattavan yksikkönsä.
/// </summary>
public override void OnServerAddPlayer(NetworkConnectionToClient conn)
{
    if (playerPrefab == null)
    {
        Debug.LogError("[NM] Player Prefab (EmptySquad) puuttuu!");
    }
}
```

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```
    return;
}
base.OnServerAddPlayer(conn);

// 2) päättä host vs client
bool isHost = conn.connectionId == 0;

// 3) spawnaa pelaajan yksiköt ja anna authority niihin
var units = SpawnUnitsCoordinator.Instance.SpawnPlayersForNetwork(conn, isHost);
foreach (var unit in units)
{
    Debug.Log($"[NM] Spawning player unit {unit.name} for connection {conn.connectionId}, isHost={isHost}");
    NetworkServer.Spawn(unit, conn); // authority tälle pelaajalle
}

// päivitä pelaajamäärä koordinaattorille
var coord = NetTurnManager.Instance;
//var coord = CoopTurnCoordinator.Instance;
if (coord != null)
    coord.ServerUpdateRequiredCount(NetworkServer.connections.Count);

// Jos nyt on Players-vuoro, avaa toiminta tälle uudelle clientille
if (NetTurnManager.Instance && NetTurnManager.Instance.phase == TurnPhase.Players)
{
    var pc = conn.identity ? conn.identity.GetComponent<PlayerController>() : null;
    if (pc != null) pc.ServerSetHasEnded(false); // -> TargetRpc avaa UI:n
}

// Asettaa pelaajan UI:n pelaajan vuoroksi.
if (CoopTurnCoordinator.Instance && NetTurnManager.Instance)
{
    CoopTurnCoordinator.Instance.RpcTurnPhaseChanged(
        NetTurnManager.Instance.phase,
        NetTurnManager.Instance.turnNumber,
        true
    );
}

// --- VERSUS (PvP) – host aloittaa ---
if (GameManager.SelectedMode == GameMode.Versus)
{
    var pc = conn.identity != null ? conn.identity.GetComponent<PlayerController>() : null;
    if (pc != null && PvPTurnCoordinator.Instance != null)
    {
        // Rekisteröi pelaaja PvP-vuoroon (host saa aloitusvuoron PvPTurnCoordinatorissa)
        PvPTurnCoordinator.Instance.ServerRegisterPlayer(pc);
    }
    else
    {
        Debug.LogWarning($"[NM] PvP rekisteröinti epäonnistui: PlayerController tai PvPTurnCoordinator puuttuu.");
    }
}
```

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```
}

[Server]
public void ServerSpawnEnemies()
{
    // Pyydä SpawnUnitsCoordinatoria luomaan viholliset
    var enemies = SpawnUnitsCoordinator.Instance.SpawnEnemies();

    // Synkronoi viholliset verkkoon Mirrorin avulla
    foreach (var enemy in enemies)
    {
        if (enemy != null)
        {
            NetworkServer.Spawn(enemy);
        }
    }
}

public override void OnServerDisconnect(NetworkConnectionToClient conn)
{
    base.OnServerDisconnect(conn);
    // päivitä pelaajamäärä koordinaattorille
    var coord = NetTurnManager.Instance;
    //var coord = CoopTurnCoordinator.Instance;
    if (coord != null)
        coord.ServerUpdateRequiredCount(NetworkServer.connections.Count);
}

public bool IsNetworkActive()
{
    return GetNetWorkServerActive() || GetNetWorkClientConnected();
}

public bool GetNetWorkServerActive()
{
    return NetworkServer.active;
}

public bool GetNetWorkClientConnected()
{
    return NetworkClient.isConnected;
}

public NetworkConnection NetWorkClientConnection()
{
    return NetworkClient.connection;
}

public void NetworkDestroy(GameObject go)
{
    NetworkServer.Destroy(go);
}
```

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```
}  
  
public void SetEnemies()  
{  
    SpawnUnitsCoordinator.Instance.SetEnemiesSpawned(false);  
  
    if (GameManager.SelectedMode == GameMode.CoOp)  
    {  
        ServerSpawnEnemies();  
    }  
}  
}
```


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Assets/scripts/Online/NetSceneReload.cs

```
using Mirror;
using UnityEngine.SceneManagement;

public static class NetSceneReload {
    public static void ReloadForAll()
    {
        string sceneName = SceneManager.GetActiveScene().name;
        NetworkManager.singleton.ServerChangeScene(sceneName);
    }
}
```

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Assets/scripts/Online/NetTurnManager.cs

```
using UnityEngine;
using Mirror;
using System.Collections.Generic;
using System.Collections;
using System.Linq;
///<summary>
/// NetTurnManager coordinates turn phases in a networked multiplayer game.
/// It tracks which players have ended their turns and advances the game phase accordingly.
///</summary>
public enum TurnPhase { Players, Enemy }
public class NetTurnManager : NetworkBehaviour
{
    public static NetTurnManager Instance { get; private set; }
    [SyncVar] public TurnPhase phase = TurnPhase.Players;
    [SyncVar] public int turnNumber = 1;

    // Seurannat (server)
    [SyncVar] public int endedCount = 0;
    [SyncVar] public int requiredCount = 0; // päivitetään kun pelaajia liittyy/lähtee

    public readonly HashSet<uint> endedPlayers = new();

    void Awake()
    {
        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;
    }

    public override void OnStartServer()
    {
        base.OnStartServer();
        // jos haluat lukita kahteen pelaajaan protoa varten:
        if (GameManager.SelectedMode == GameMode.CoOp) requiredCount = 2;
        StartCoroutine(DeferResetOneFrame());
    }

    [Server]
    private IEnumerator DeferResetOneFrame()
    {
        yield return null; // odota että SpawnObjects on valmis
        ResetTurnState(); // nyt RpcUpdateReadyStatus on turvallinen
    }

    [Server]
    public void ResetTurnState()
    {
        phase = TurnPhase.Players;
        endedPlayers.Clear();
        endedCount = 0;
    }
}
```

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```
    SetPlayerStartState();
}

[Server]
public void ServerPlayerEndedTurn(uint playerNetId)
{
    // PvP: siirrä vuoro heti vastustajalle
    if (GameManager.SelectedMode == GameMode.Versus)
    {
        if (PvPTurnCoordinator.Instance)
            PvPTurnCoordinator.Instance.ServerHandlePlayerEndedTurn(playerNetId);
        return;
    }

    if (phase != TurnPhase.Players) return;          // ei lasketa jos ei pelaajavuoro
    if (!endedPlayers.Add(playerNetId)) return;       // älä laske tuplia

    endedCount = endedPlayers.Count;

    // Ilmoita kaikille, KUKA on valmis → UI näyttää "Player X READY" toisella pelaajalla. Käytössä vain Co-opissa
    if (GameManager.SelectedMode == GameMode.CoOp)
    {
        // Asettaa yksiköiden UI Näkyvyydet
        UnitUIBroadcaster.Instance.BroadcastUnitWorldUIVisibility(false);

        CoopTurnCoordinator.Instance.
            RpcUpdateReadyStatus(
                endedPlayers.Select(id => (int)id).ToArray(),
                CoopTurnCoordinator.Instance.BuildEndedLabels()
            );

        CoopTurnCoordinator.Instance.TryAdvanceIfReady();
    }
}

[Server]
public void ServerUpdateRequiredCount(int playersNow)
{
    requiredCount = Mathf.Max(1, playersNow); // Co-opissa yleensä 2
                                              // jos yksi poistui kesken odotuksen, tarkista täyttyikö ehto nyt

    if (GameManager.SelectedMode == GameMode.CoOp)
    {
        CoopTurnCoordinator.Instance.TryAdvanceIfReady();
    }
}

public void SetPlayerStartState()
{
    // Asettaa pelaajan tilan pelaajan vuoroksi.
    foreach (var kvp in NetworkServer.connections)
    {
```

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```
        var id = kvp.Value.identity;
        if (!id) continue;
        var pc = id.GetComponent<PlayerController>();
        if (pc) pc.ServerSetHasEnded(false); // <<< TÄRKEIN RIVI
    }
}
```

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Assets/scripts/Online/NetVisibility.cs

```
using Mirror;
using UnityEngine;

public class NetVisibility : NetworkBehaviour
{
    [SerializeField] private GameObject target; // se esine jonka näkyvyyttä halutaan ohjata

    [SyncVar(hook = nameof(OnChanged))]
    private bool isVisible;

    void OnChanged(bool _, bool now) => Apply(now);

    public override void OnStartClient() => Apply(isVisible);

    private void Apply(bool now)
    {
        if (target) target.SetActive(now);
    }

    // --- SERVER-API ---
    [Server] public void ServerShow()          { isVisible = true;  Apply(true); }
    [Server] public void ServerHide()          { isVisible = false; Apply(false); }
    [Server] public void ServerSetVisible(bool v){ isVisible = v;    Apply(v);    }

    // --- CLIENT-API (authority) ---
    [Command] private void CmdSetVisible(bool v) => ServerSetVisible(v);

    /// Kutsu tätä mistä tahansa: hoitaa sekä server- että client-puolen.
    public void SetVisibleAny(bool v)
    {
        if (isServer) ServerSetVisible(v);
        else          CmdSetVisible(v); // vaatii client authorityn tälle objektille
    }
}
```

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Assets/scripts/Online/PvpClientState.cs

```
using UnityEngine;
using System;
public class PvpClientState : MonoBehaviour
{
    public static bool IsMyTurn { get; set; }
}

public static class PvpClientEvents
{
    public static event Action<uint, int> OnTurnChanged;

    public static void RaiseTurnChanged(uint turnOwnerNetId, int turnNo)
        => OnTurnChanged?.Invoke(turnOwnerNetId, turnNo);
}
```

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Assets/scripts/Online/PvpPerception.cs

```
using System.Reflection;
using Mirror;
using UnityEngine;

public class PvpPerception : MonoBehaviour
{
    // Kutsu tätä aina kun vuoro vaihtuu (ja bootstrapissa)
    public static void ApplyEnemyFlagsLocally(bool isMyTurn)
    {
        var units = FindObjectsByType<Unit>(FindObjectsSortMode.None);

        foreach (var u in units)
        {
            var ni = u.GetComponent<NetworkIdentity>();
            if (!ni) continue;

            // Onko tämä yksikkö minun (tässä clientissä)?
            bool unitIsMine = ni.isOwned || ni.isLocalPlayer;

            // Vuorologiikka:
            // - Jos on MINUN vuoro: vastustajan yksiköt ovat enemy
            // - Jos EI ole minun vuoro: MINUN omat yksiköt ovat enemy
            bool enemy = isMyTurn ? !unitIsMine : unitIsMine;

            SetUnitEnemyFlag(u, enemy);
        }
    }

    static void SetUnitEnemyFlag(Unit u, bool enemy)
    {
        // Unitissa on [SerializeField] private bool isEnemy; -> käytä BindingFlagsia! :contentReference[oaicite:1]{index=1}
        var field = typeof(Unit).GetField("isEnemy",
            BindingFlags.Instance | BindingFlags.NonPublic | BindingFlags.Public);
        if (field != null) { field.SetValue(u, enemy); return; }

        // Varalle, jos joskus lisääs setterin
        var m = typeof(Unit).GetMethod("SetEnemy",
            BindingFlags.Instance | BindingFlags.Public | BindingFlags.NonPublic,
            null, new[] { typeof(bool) }, null);
        if (m != null) { m.Invoke(u, new object[] { enemy }); return; }

        Debug.LogWarning("[PvP] Unitilta puuttuu isEnemy/SetEnemy(bool). Lisää jompikumpi.");
    }
}
```

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Assets/scripts/Online/PvPTurnCoordinator.cs

```
using System.Collections.Generic;
using System.Linq;
using Mirror;
using UnityEngine;

public class PvPTurnCoordinator : NetworkBehaviour
{
    public static PvPTurnCoordinator Instance { get; private set; }

    [SyncVar] private uint currentOwnerNetId; // kumman pelaajan vuoro on

    void Awake()
    {
        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;
    }

    // Kutsutaan, kun pelaaja liittyy. Hostista tehdään aloitusvuoron omistaja.
    [Server]
    public void ServerRegisterPlayer(PlayerController pc)
    {
        // Host (connectionId == 0) asettaa aloitusvuoron, jos ei vielä asetettu
        if (currentOwnerNetId == 0 && pc.connectionToClient != null && pc.connectionToClient.connectionId == 0)
        {
            currentOwnerNetId = pc.netId;
            pc.ServerSetHasEnded(false); // host saa toimia
            foreach (var other in GetAllPlayers().Where(p => p != pc))
                other.ServerSetHasEnded(true); // muut lukkoon varmuudeksi

            RpcTurnChanged(GetTurnNumber(), currentOwnerNetId);
        }
        else
        {
            // Myöhemmin liittynyt (client) - lukitaan kunnes hänen vuoronsa alkaa
            pc.ServerSetHasEnded(true);
            RpcTurnChanged(GetTurnNumber(), currentOwnerNetId);
        }
    }

    // Kutsutaan, kun joku painaa End Turn
    [Server]
    public void ServerHandlePlayerEndedTurn(uint whoEndedNetId)
    {
        var players = GetAllPlayers().ToList();
        var ended = players.FirstOrDefault(p => p.netId == whoEndedNetId);
        var next = players.FirstOrDefault(p => p.netId != whoEndedNetId);
        if (next == null) return; // ei vastustajaa vielä

        // Nosta vuorolaskuria (kierrätetään olemassaolevaa turnNumberia)
        if (NetTurnManager.Instance) NetTurnManager.Instance.turnNumber++;
    }
}
```


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```
currentOwnerNetId = next.netId;

// Anna seuraavalle vuoro
next.ServerSetHasEnded(false); // avaa syötteen ja nappulan
// ended pysyy lukossa (hasEndedThisTurn = true)
RpcTurnChanged(GetTurnNumber(), currentOwnerNetId);
}

int GetTurnNumber() => NetTurnManager.Instance ? NetTurnManager.Instance.turnNumber : 1;

[ClientRpc]
void RpcTurnChanged(int newTurnNumber, uint ownerNetId)
{
    // Päivitä paikallinen HUD "player/enemy turn" -logiikalla
    bool isMyTurn = false;
    if (NetworkClient.connection != null && NetworkClient.connection.identity != null)
        isMyTurn = NetworkClient.connection.identity.netId == ownerNetId;

    PvpPerception.ApplyEnemyFlagsLocally(isMyTurn);

    if (TurnSystem.Instance != null)
        TurnSystem.Instance.SetHudFromNetwork(newTurnNumber, isMyTurn);
}

[Server]
IEnumerable<PlayerController> GetAllPlayers()
{
    foreach (var kvp in NetworkServer.connections)
    {
        var id = kvp.Value.identity;
        if (!id) continue;
        var pc = id.GetComponent<PlayerController>();
        if (pc) yield return pc;
    }
}
}
```

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Assets/scripts/Online/ResetService.cs

```
using System.Collections;
using Mirror;
using UnityEngine.SceneManagement;

public class ResetService : NetworkBehaviour
{
    public static ResetService Instance;

    // LIPPU: ajetaan post-reset -alustus, kun uusi scene on valmis
    public static bool PendingHardReset;

    void Awake() => Instance = this;

    [Command(requiresAuthority = false)]
    public void CmdRequestHardReset()
    {
        if (!NetworkServer.active) return;
        HardResetServerAuthoritative();
    }

    [Server]
    public void HardResetServerAuthoritative()
    {
        PendingHardReset = true; // <-- vain lippu päälle
        var nm = (NetworkManager)NetworkManager.singleton;
        var scene = SceneManager.GetActiveScene().name;
        nm.ServerChangeScene(scene);
        // ÄLÄ tee mitään tähän enää
    }

    [ClientRpc]
    public void RpcPostResetClientInit(int turnNumber)
    {
        // odota 1 frame että UI-komponentit ovat ehtineet OnEnable/subscribe
        StartCoroutine(_ClientInitCo(turnNumber));
    }

    private IEnumerator _ClientInitCo(int turnNumber)
    {
        yield return null;

        // 1) Avaa paikallinen "saa toimia" -portti (triggaa LocalPlayerTurnChanged)
        PlayerLocalTurnGate.SetCanAct(true);

        // 2) Päivitä HUD (näyttää "Players turn", aktivoi End Turn -napin logiikkaasi vasten)
        TurnSystem.Instance?.SetHudFromNetwork(turnNumber, true);
    }
}
```

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Assets/scripts/Online/ServerBootstrap.cs

```
using System.Collections;
using Mirror;
using UnityEngine;
using Utp;
/// <summary>
/// This ensures that the server starts correctly and in the correct order.
/// </summary>

[DefaultExecutionOrder(10000)]          // aja myöhään
[DisallowMultipleComponent]
public class ServerBootstrap : NetworkBehaviour
{
    public override void OnStartServer()
    {
        // varmistaa että tämä ei ajaudu clientillä
        StartCoroutine(Bootstrap());
    }

    private IEnumerator Bootstrap()
    {
        // 1) Odota että Mirror on spawnannut scene-identiteetit
        //    (2 frameä riittää, mutta odotetaan lisäksi koordinaattorit)
        yield return null;
        yield return null;

        // Odota kunnes koordinaattori(t) ovat varmasti olemassa ja spawned
        yield return new WaitUntil(() =>
            CoopTurnCoordinator.Instance &&
            CoopTurnCoordinator.Instance.netIdentity &&
            CoopTurnCoordinator.Instance.netIdentity.netId != 0
        );

        // 2) Nollaa vuorologiikka vain serverillä
        NetTurnManager.Instance.ResetTurnState(); // EI UI-RPC:itä täällä

        // 3) Spawnaa viholliset vain Co-opissa ja vain jos tarvitaan
        if (GameModeManager.SelectedMode == GameMode.CoOp &&
            !SpawnUnitsCoordinator.Instance.AreEnemiesSpawned())
        {
            GameNetworkManager.Instance.SetEnemies();
        }

        // 4) Rakenna occupancy nykyisestä scenestä (unitit/esteet)
        LevelGrid.Instance?.RebuildOccupancyFromScene();

        // 5) Pakota aloitus Players turniin ja turnNumber = 1
        NetTurnManager.Instance.turnNumber = 1;
        NetTurnManager.Instance.phase = TurnPhase.Players;
        TurnSystem.Instance?.ForcePhase(isPlayerTurn: true, incrementTurnNumber: false);
    }
}
```

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```
// 6) Nyt on turvallista lähettää UI/RPC:t kaikille
var endedIds = System.Array.Empty<int>();
var endedLabels = CoopTurnCoordinator.Instance.BuildEndedLabels();

CoopTurnCoordinator.Instance.RpcUpdateReadyStatus(endedIds, endedLabels);
CoopTurnCoordinator.Instance.RpcTurnPhaseChanged(
    NetTurnManager.Instance.phase,
    NetTurnManager.Instance.turnNumber,
    true // isPlayersPhase
);

// (valinnainen) piilota enemy-WorldUI tms. alussa
UnitUIBroadcaster.Instance?.BroadcastUnitWorldUIVisibility(false);

// (valinnainen) client-init, jos sinulla on tällainen
ResetService.Instance?.RpcPostResetClientInit(NetTurnManager.Instance.turnNumber);

NetTurnManager.Instance.SetPlayerStartState();
}
}
```

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Assets/scripts/Online/Sync/NetworkSync.cs

```
using Mirror;
using Mirror.Examples.CharacterSelection;
using UnityEngine;

/// <summary>
/// NetworkSync is a static helper class that centralizes all network-related actions.
///
/// Responsibilities:
/// - Provides a single entry point for spawning and synchronizing networked effects and objects.
/// - Decides whether the game is running in server/host mode, client mode, or offline mode.
/// - In online play:
///   - If running on the server/host, spawns objects directly with NetworkServer.Spawn.
///   - If running on a client, forwards the request to the local NetworkSyncAgent, which relays it to the server via Command.
/// - In offline/singleplayer mode, simply instantiates objects locally with Instantiate.
///
/// Usage:
/// Call the static methods from gameplay code (e.g. UnitAnimator, Actions) instead of
/// directly instantiating or spawning prefabs. This ensures consistent behavior in all game modes.
///
/// Example:
/// NetworkSync.SpawnBullet(bulletPrefab, shootPoint.position, targetPosition);
/// </summary>
public static class NetworkSync
{
    /// <summary>
    /// Spawns a bullet projectile in the game world.
    /// Handles both offline (local Instantiate) and online (NetworkServer.Spawn) scenarios.
    ///
    /// In server/host:
    ///   - Instantiates and spawns the bullet directly with NetworkServer.Spawn.
    /// In client:
    ///   - Forwards the request to NetworkSyncAgent.Local, which executes a Command.
    /// In offline:
    ///   - Instantiates the bullet locally.
    /// </summary>
    /// <param name="bulletPrefab">The bullet prefab to spawn (must have NetworkIdentity if used online).</param>
    /// <param name="spawnPos">The starting position of the bullet (usually weapon muzzle).</param>
    /// <param name="targetPos">The target world position the bullet should travel towards.</param>
    public static void SpawnBullet(GameObject bulletPrefab, Vector3 spawnPos, Vector3 targetPos)
    {
        if (NetworkServer.active) // Online: server or host
        {
            var bullet = Object.Instantiate(bulletPrefab, spawnPos, Quaternion.identity);
            if (bullet.TryGetComponent<BulletProjectile>(out var bulletProjectile))
                bulletProjectile.Setup(targetPos);
            NetworkServer.Spawn(bullet);
            return;
        }
    }
}
```

RogueShooter – All Scripts

```
if (NetworkClient.active) // Online: client
{
    if (NetworkSyncAgent.Local != null)
    {
        NetworkSyncAgent.Local.CmdSpawnBullet(spawnPos, targetPos);
    }
    else
    {
        // fallback if no local agent found (shouldn't happen in a correct setup)
        Debug.LogWarning("[NetworkSync] No Local NetworkSyncAgent found, falling back to local Instantiate.");
        var bullet = Object.Instantiate(bulletPrefab, spawnPos, Quaternion.identity);
        if (bullet.TryGetComponent<BulletProjectile>(out var bulletProjectile))
            bulletProjectile.Setup(targetPos);
    }
}
else
{
    // Offline / Singleplayer: just instantiate locally
    var bullet = Object.Instantiate(bulletPrefab, spawnPos, Quaternion.identity);
    if (bullet.TryGetComponent<BulletProjectile>(out var bulletProjectile))
        bulletProjectile.Setup(targetPos);
}
}

// HUOM: käytä tätä myös AE:stä (UnitAnimatorista)
public static void SpawnGrenade(GameObject grenadePrefab, Vector3 spawnPos, Vector3 targetPos)
{
    if (NetworkServer.active) // Online: server tai host
    {
        var go = Object.Instantiate(grenadePrefab, spawnPos, Quaternion.identity);
        if (go.TryGetComponent<GrenadeProjectile>(out var gp))
            gp.Setup(targetPos); // ASETUS ENNEN spawnia
        NetworkServer.Spawn(go);
        return;
    }

    if (NetworkClient.active) // Online: client
    {
        if (NetworkSyncAgent.Local != null)
        {
            NetworkSyncAgent.Local.CmdSpawnGrenade(spawnPos, targetPos);
        }
        else
        {
            // Sama fallback kuin luodeissa (jos näin haluat)
            Debug.LogWarning("[NetworkSync] No Local NetworkSyncAgent found, falling back to local Instantiate.");
            var go = Object.Instantiate(grenadePrefab, spawnPos, Quaternion.identity);
            if (go.TryGetComponent<GrenadeProjectile>(out var gp))
                gp.Setup(targetPos);
        }
    }
}
else
```

RogueShooter – All Scripts

```
{
    // Offline / Singleplayer
    var go = Object.Instantiate(grenadePrefab, spawnPos, Quaternion.identity);
    if (go.TryGetComponent<GrenadeProjectile>(out var gp))
        gp.Setup(targetPos);
}

/// <summary>
/// Apply damage to a Unit in SP/Host/Client modes.
/// - Server/Host: call HealthSystem.Damage directly (authoritative).
/// - Client: send a Command via NetworkSyncAgent to run on server.
/// - Offline: call locally.
/// </summary>
public static void ApplyDamageToUnit(Unit target, int amount, Vector3 hitPosition)
{
    if (target == null) return;

    if (NetworkServer.active) // Online: server or host
    {
        var healthSystem = target.GetComponent<HealthSystem>();
        if (healthSystem == null) return;

        healthSystem.Damage(amount, hitPosition);
        UpdateHealthBarUI(healthSystem, target);
        return;
    }

    if (NetworkClient.active) // Online: client
    {
        var ni = target.GetComponent<NetworkIdentity>();
        if (ni && NetworkSyncAgent.Local != null)
        {
            NetworkSyncAgent.Local.CmdApplyDamage(ni.netId, amount, hitPosition);
            return;
        }
    }

    // Offline fallback
    target.GetComponent<HealthSystem>()?.Damage(amount, hitPosition);
}

public static void ApplyDamageToObject(DestructibleObject target, int amount, Vector3 hitPosition)
{
    if (target == null) return;

    if (NetworkServer.active) // Online: server or host
    {
        target.Damage(amount, hitPosition);
        return;
    }
}
```

RogueShooter – All Scripts

```
if (NetworkClient.active) // Online: client
{
    var ni = target.GetComponent<NetworkIdentity>();
    if (ni && NetworkSyncAgent.Local != null)
    {
        NetworkSyncAgent.Local.CmdApplyDamageToObject(ni.netId, amount, hitPosition);
        return;
    }
}

// Offline fallback
target.Damage(amount, hitPosition);
}

private static void UpdateHealthBarUI(HealthSystem healthSystem, Unit target)
{
    // → ilmoita kaikille clientele, jotta UnitWorldUI saa eventin
    if (NetworkSyncAgent.Local == null)
    {
        // haetaan mikä tahansa agentti serveriltä (voi olla erillinen manageri)
        var agent = Object.FindFirstObjectByType<NetworkSyncAgent>();
        if (agent != null)
            agent.ServerBroadcastHp(target, healthSystem.GetHealth(), healthSystem.GetHealthMax());
    }
    else
    {
        NetworkSyncAgent.Local.ServerBroadcastHp(target, healthSystem.GetHealth(), healthSystem.GetHealthMax());
    }
}

public static void UpdateCoverUI(Unit target)
{
    int current = target.GetPersonalCover();
    int max = target.GetPersonalCoverMax();

    // Sama logiikka kuin HP:lle
    if (NetworkSyncAgent.Local == null)
    {
        var agent = Object.FindFirstObjectByType<NetworkSyncAgent>();
        if (agent != null)
            agent.ServerBroadcastCover(target, current, max);
    }
    else
    {
        Debug.Log("Broadcastataan cover UI: Target" + target + "Current cover:" + current + "/" + max);
        NetworkSyncAgent.Local.ServerBroadcastCover(target, current, max);
    }
}

/// <summary>
/// Server: Control when Pleyers can see own and others Unit stats,
```


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```
/// Like only active player AP(Action Points) are visible.
/// When is Enemy turn only Enemy Units Action points are visible.
/// Solo and Versus mode handle this locally because there is no need synchronisation.
/// </summary>
public static void BroadcastActionPoints(Unit unit, int apValue)
{
    if (unit == null) return;

    if (NetworkServer.active)
    {
        var agent = Object.FindFirstObjectByType<NetworkSyncAgent>();
        if (agent != null)
            agent.ServerBroadcastAp(unit, apValue);
        return;
    }

    // CLIENT-haara: lähetä peilauspyyntö serverille
    if (NetworkClient.active && NetworkSyncAgent.Local != null)
    {
        var ni = unit.GetComponent<NetworkIdentity>();
        if (ni) NetworkSyncAgent.Local.CmdMirrorAp(ni.netId, apValue);
    }
}

public static void SpawnRagdoll(GameObject prefab, Vector3 pos, Quaternion rot, uint sourceUnitNetId, Transform originalRootBone, Vector3 lastHitPosition, int overkill)
{
    if (NetworkServer.active)
    {
        var go = Object.Instantiate(prefab, pos, rot);

        if (go.TryGetComponent<UnitRagdoll>(out var rg))
        {
            rg.SetOverkill(overkill);
            rg.SetLastHitPosition(lastHitPosition);
        }

        // Set sourceUnitNetId so that clients can find the original unit
        if (go.TryGetComponent<RagdollPoseBinder>(out var ragdollBinder))
        {
            ragdollBinder.sourceUnitNetId = sourceUnitNetId;
            ragdollBinder.lastHitPos = lastHitPosition;
            ragdollBinder.overkill = overkill;
        }

        else
        {
            Debug.LogWarning("[Ragdoll] Ragdoll prefab lacks RagdollPoseBinder component.");
        }

        NetworkServer.Spawn(go);
        return;
    }
}
```

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```
    }

    // offline fallback
    var off = Object.Instantiate(prefab, pos, rot);
    if (off.TryGetComponent<UnitRagdoll>(out var unitRagdoll))
    {
        unitRagdoll.SetOverkill(overkill);
        unitRagdoll.SetLastHitPosition(lastHitPosition);
        unitRagdoll.Setup(originalRootBone);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Online/Sync/NetworkSyncAgent.cs

```
using System;
using Mirror;
using UnityEngine;
/// <summary>
/// NetworkSyncAgent is a helper NetworkBehaviour to relay Commands from clients to the server.
/// Each client should have exactly one instance of this script in the scene, usually attached to the PlayerController GameObject.
///
/// Responsibilities:
/// - Receives local calls from NetworkSync (static helper).
/// - Sends Commands to the server when the local player performs an action (e.g. shooting).
/// - On the server, instantiates and spawns networked objects (like projectiles).
/// </summary>
public class NetworkSyncAgent : NetworkBehaviour
{
    public static NetworkSyncAgent Local; // Easy access for NetworkSync static helper
    [SerializeField] private GameObject bulletPrefab; // Prefab for the bullet projectile
    [SerializeField] private GameObject grenadePrefab;

    public override void OnStartLocalPlayer()
    {
        base.OnStartLocalPlayer();
        Local = this;
    }

    /// <summary>
    /// Command from client → server.
    /// The client requests the server to spawn a bullet at the given position.
    /// The server instantiates the prefab, sets it up, and spawns it to all connected clients.
    /// </summary>
    /// <param name="spawnPos">World position where the bullet starts (usually weapon muzzle).</param>
    /// <param name="targetPos">World position the bullet is travelling towards.</param>
    [Command(requiresAuthority = true)]
    public void CmdSpawnBullet(Vector3 spawnPos, Vector3 targetPos)
    {
        if (bulletPrefab == null) { Debug.LogWarning("[NetSync] bulletPrefab missing"); return; }

        // Instantiate on the server
        var go = Instantiate(bulletPrefab, spawnPos, Quaternion.identity);

        // Setup target on the projectile
        if (go.TryGetComponent<BulletProjectile>(out var bp))
        {
            bp.Setup(targetPos);
        }

        // Spawn across the network
        NetworkServer.Spawn(go);
    }

    [Command(requiresAuthority = true)]
```

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```
public void CmdSpawnGrenade(Vector3 spawnPos, Vector3 targetPos)
{
    if (grenadePrefab == null) { Debug.LogWarning("[NetSync] grenadePrefab missing"); return; }

    var go = Instantiate(grenadePrefab, spawnPos, Quaternion.identity);
    if (go.TryGetComponent<GrenadeProjectile>(out var gp))
        gp.Setup(targetPos); // tärkeää: ennen Spawnia

    NetworkServer.Spawn(go);
}

/// <summary>
/// Client → Server: resolve target by netId and apply damage on server.
/// then broadcast the new HP to all clients for UI.
/// </summary>
[Command(requiresAuthority = true)]
public void CmdApplyDamage(uint targetNetId, int amount, Vector3 hitPosition)
{
    if (!NetworkServer.spawned.TryGetValue(targetNetId, out var targetNi) || targetNi == null)
        return;

    var unit = targetNi.GetComponent<Unit>();
    var hs = targetNi.GetComponent<HealthSystem>();
    if (unit == null || hs == null)
        return;

    // 1) Server tekee damagen (kuten ennenkin)
    hs.Damage(amount, hitPosition);

    // 2) Heti perään broadcast → kaikki clientit päivittävät oman UI:nsa
    // (ServerBroadcastHp kutsuu RpcNotifyHpChanged → hs.ApplyNetworkHealth(..) clientillä)
    ServerBroadcastHp(unit, hs.GetHealth(), hs.GetHealthMax());
}

[Command(requiresAuthority = true)]
public void CmdApplyDamageToObject(uint targetNetId, int amount, Vector3 hitPosition)
{
    if (!NetworkServer.spawned.TryGetValue(targetNetId, out var targetNi) || targetNi == null)
        return;

    var obj = targetNi.GetComponent<DestructibleObject>();
    if (obj == null)
        return;

    obj.Damage(amount, hitPosition);
}

// ---- SERVER-puolen helperit: kutsu näitä palvelimelta
[Server]
public void ServerBroadcastHp(Unit unit, int current, int max)
{
    var ni = unit.GetComponent<NetworkIdentity>();
```

RogueShooter – All Scripts

```
        if (ni) RpcNotifyHpChanged(ni.netId, current, max);
    }

    [Server]
    public void ServerBroadcastCover(Unit unit, int current, int max)
    {
        var ni = unit.GetComponent<NetworkIdentity>();
        if (ni) RpcNotifyCoverChanged(ni.netId, current, max);
    }

    [Server]
    public void ServerBroadcastAp(Unit unit, int ap)
    {
        var ni = unit.GetComponent<NetworkIdentity>();
        if (ni) RpcNotifyApChanged(ni.netId, ap);
    }

    // ---- SERVER → ALL CLIENTS: Cover-muutos ilmoitus
    [ClientRpc]
    void RpcNotifyCoverChanged(uint unitNetId, int current, int max)
    {
        if (!NetworkClient.spawned.TryGetValue(unitNetId, out var id) || id == null) return;

        var unit = id.GetComponent<Unit>();
        if (unit == null) return;

        unit.ApplyNetworkCover(current, max);
    }

    // ---- SERVER → ALL CLIENTS: HP-muutos ilmoitus
    [ClientRpc]
    void RpcNotifyHpChanged(uint unitNetId, int current, int max)
    {
        if (!NetworkClient.spawned.TryGetValue(unitNetId, out var id) || id == null) return;

        var hs = id.GetComponent<HealthSystem>();
        if (hs == null) return;

        hs.ApplyNetworkHealth(current, max);
    }

    // ---- SERVER → ALL CLIENTS: AP-muutos ilmoitus
    [ClientRpc]
    void RpcNotifyApChanged(uint unitNetId, int ap)
    {
        ApplyApClient(unitNetId, ap);
    }

    [Command]
    public void CmdMirrorAp(uint unitNetId, int ap)
    {
        RpcNotifyApChanged(unitNetId, ap);
    }
}
```

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```
    }

    void ApplyApiClient(uint unitNetId, int ap)
    {
        if (!NetworkClient.spawned.TryGetValue(unitNetId, out var id) || id == null) return;
        var unit = id.GetComponent<Unit>();
        if (!unit) return;

        unit.ApplyNetworkActionPoints(ap); // päivittää arvon + triggaa eventin
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Online/WeaponVisibilitySync.cs

```
using Mirror;
using UnityEngine;

public class WeaponVisibilitySync : NetworkBehaviour
{
    [Header("Unit Weapons Refs")]
    [SerializeField] private Transform rifleRightHandTransform;
    [SerializeField] private Transform rifleLeftHandTransform;
    [SerializeField] private Transform meleeLeftHandTransform;
    [SerializeField] private Transform grenadeRightHandTransform;

    private NetVisibility rifleRightVis, rifleLeftVis ,meleeLeftVis, grenadeRightVis;

    void Awake()
    {
        if (rifleRightHandTransform) rifleRightVis = rifleRightHandTransform.GetComponent<NetVisibility>();
        if (rifleLeftHandTransform) rifleLeftVis= rifleLeftHandTransform.GetComponent<NetVisibility>();
        if (meleeLeftHandTransform) meleeLeftVis = meleeLeftHandTransform.GetComponent<NetVisibility>();
        if (grenadeRightHandTransform) grenadeRightVis = grenadeRightHandTransform.GetComponent<NetVisibility>();
    }

    // --- OWNER kutsuu tätä (esim. AE:ssä) ---
    public void OwnerRequestSet(bool rifleRight,bool rifleLeft, bool meleeLeft, bool grenade)
    {
        // Offline: suoraan paikalliset
        if (!NetworkClient.active && !NetworkServer.active)
        {
            SetLocal(rifleRight, rifleLeft, meleeLeft, grenade);
            return;
        }

        // Online: vain omistaja saa pyytää
        var ni = GetComponent<NetworkIdentity>();
        if (isClient && ni && ni.isOwned)
        {
            CmdSet(rifleRight, rifleLeft,meleeLeft, grenade);
        }
    }

    [Command(requiresAuthority = true)]
    private void CmdSet(bool rifleRight, bool rifleLeft ,bool meleeLeft, bool grenade)
    {
        // Serverissä voi halutessa käyttää server-authoritatiivista NetVisibilityä:
        // jos käytössä, aseta serverillä -> SyncVar/RPC hoitaa muille
        if (rifleRightVis) rifleRightVis.ServerSetVisible(rifleRight);
        if (rifleLeftVis) rifleLeftVis.ServerSetVisible(rifleLeft);
        if (meleeLeftVis) meleeLeftVis.ServerSetVisible(meleeLeft);
        if (grenadeRightVis) grenadeRightVis.ServerSetVisible(grenade);
    }
}
```

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```
// Lisäksi varma ClientRpc (jos NetVisibility ei kata kaikkea):
RpcSet(rifleRight, rifleLeft ,meleeLeft, grenade);
}

[ClientRpc]
private void RpcSet(bool rifleRight, bool rifleLeft ,bool meleeLeft, bool grenade)
{
    SetLocal(rifleRight, rifleLeft ,meleeLeft, grenade);
}

private void SetLocal(bool rifleRight,bool rifleLeft, bool meleeLeft, bool grenade)
{
    // Jos sinulla on NetVisibility, käytä sen "pehmeää" piilotusta,
    // muuten pelkkä SetActive/renderer.enabled
    if (rifleRightHandTransform) rifleRightHandTransform.gameObject.SetActive(rifleRight);
    if (rifleLeftHandTransform) rifleLeftHandTransform.gameObject.SetActive(rifleLeft);
    if (meleeLeftHandTransform) meleeLeftHandTransform.gameObject.SetActive(meleeLeft);
    if (grenadeRightHandTransform) grenadeRightHandTransform.gameObject.SetActive(grenade);

    // Esim. renderer-tason piilotus:
    // ToggleRenderers(rifleTransform, rifle);
    // ToggleRenderers(meleeTransform, melee);
    // ToggleRenderers(grenadeTransform, grenade);
}

private static void ToggleRenderers(Transform t, bool visible)
{
    if (!t) return;
    foreach (var r in t.GetComponentsInChildren<Renderer>(true))
        r.enabled = visible;
}
}
```


RogueShooter – All Scripts

Assets/scripts/PriorityQueue.cs

```
using System;
using System.Collections.Generic;

/// <summary>
/// A lightweight, generic min-heap-based Priority Queue implementation used internally for game logic,
/// especially pathfinding and AI decision-making.
///
/// This class provides a simple and efficient way to retrieve the next element with the lowest priority value.
/// It avoids external dependencies for performance and maintainability within Unity builds.
///
/// Design notes specific to RogueShooter:
/// - Used by the pathfinding and tactical AI systems to determine optimal movement and action order.
/// - Provides deterministic and garbage-free priority management during runtime (no LINQ or heap allocations).
/// - Does not support key priority updates ("decrease-key") – instead, updated items are re-enqueued,
///   and outdated entries are safely ignored by the higher-level game logic.
///
/// In short, this queue enables efficient and predictable priority handling for all turn-based tactical calculations,
/// without relying on .NET's built-in PriorityQueue (which is unavailable in some Unity versions).
/// </summary>
public sealed class PriorityQueue<T>
{
    private (T item, int priority)[] _heap;
    private int _count;

    public int Count => _count;

    public PriorityQueue(int initialCapacity = 64)
    {
        if (initialCapacity < 1) initialCapacity = 1;
        _heap = new (T, int)[initialCapacity];
        _count = 0;
    }

    public void Clear()
    {
        Array.Clear(_heap, 0, _count);
        _count = 0;
    }

    public void Enqueue(T item, int priority)
    {
        if (_count == _heap.Length) Array.Resize(ref _heap, _heap.Length * 2);
        _heap[_count] = (item, priority);
        SiftUp(_count++);
    }

    public T Dequeue()
    {
        if (_count == 0) throw new InvalidOperationException("PriorityQueue is empty");
        T result = _heap[0].item;

```

RogueShooter – All Scripts

```
    _heap[0] = _heap[--_count];
    _heap[_count] = default;
    if (_count > 0) SiftDown(0);
    return result;
}

public bool TryDequeue(out T item)
{
    if (_count == 0)
    {
        item = default;
        return false;
    }
    item = Dequeue();
    return true;
}

public T Peek()
{
    if (_count == 0) throw new InvalidOperationException("PriorityQueue is empty");
    return _heap[0].item;
}

public int PeekPriority()
{
    if (_count == 0) throw new InvalidOperationException("PriorityQueue is empty");
    return _heap[0].priority;
}

private void SiftUp(int idx)
{
    while (idx > 0)
    {
        int parent = (idx - 1) >> 1;
        if (_heap[parent].priority <= _heap[idx].priority) break;
        (_heap[parent], _heap[idx]) = (_heap[idx], _heap[parent]);
        idx = parent;
    }
}

private void SiftDown(int idx)
{
    while (true)
    {
        int left = (idx << 1) + 1;
        if (left >= _count) break;
        int right = left + 1;
        int smallest = (right < _count && _heap[right].priority < _heap[left].priority) ? right : left;
        if (_heap[idx].priority <= _heap[smallest].priority) break;
        (_heap[idx], _heap[smallest]) = (_heap[smallest], _heap[idx]);
        idx = smallest;
    }
}
```

```
}  
}
```

RogueShooter – All Scripts

Assets/scripts/Units/CoverSystem/CoverService.cs

```
using UnityEngine;

public static class CoverService
{
    public enum CoverType { None, Low, High }

    public static int GetCoverMitigationBase(CoverType t)
        => t == CoverType.High ? 50 : (t == CoverType.Low ? 25 : 0);

    public static int GetCoverMitigationPoints(CoverType t)
    {
        int basePts = GetCoverMitigationBase(t);
        return Mathf.RoundToInt(basePts);
    }

    public static CoverType EvaluateCoverHalfPlane(GridPosition attacker, GridPosition target, PathNode node)
    {
        if (attacker.floor != target.floor) return CoverType.None; // pidä yksinkertaisena

        int dx = attacker.x - target.x;
        int dz = attacker.z - target.z;

        if (node == null) return CoverType.None;

        bool ge = false; // "greater or equal" rajalla?
        bool facesN = ge ? (dz >= 0) : (dz > 0);
        bool facesS = ge ? (dz <= 0) : (dz < 0);
        bool facesE = ge ? (dx >= 0) : (dx > 0);
        bool facesW = ge ? (dx <= 0) : (dx < 0);

        bool high =
            (facesN && node.HasHighCover(CoverMask.N)) ||
            (facesS && node.HasHighCover(CoverMask.S)) ||
            (facesE && node.HasHighCover(CoverMask.E)) ||
            (facesW && node.HasHighCover(CoverMask.W));

        if (high) return CoverType.High;

        bool low =
            (facesN && node.HasLowCover(CoverMask.N)) ||
            (facesS && node.HasLowCover(CoverMask.S)) ||
            (facesE && node.HasLowCover(CoverMask.E)) ||
            (facesW && node.HasLowCover(CoverMask.W));

        return low ? CoverType.Low : CoverType.None;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/CoverSystem/CoverVisualizer.cs

```
using UnityEngine;

[DisallowMultipleComponent]
public class CoverVisualizer : MonoBehaviour
{
    [Header("Refs")]
    [SerializeField] private PathFinding pathfinding;
    [SerializeField] private LevelGrid levelGrid;
    [SerializeField] private Camera cam;
    [SerializeField] private Material unlitTransparentMat; // Unlit/Transparent tms.

    [Header("Raycast")]
    [SerializeField] private LayerMask groundMask = ~0; // millä layereilla lattia/maa on

    [Header("Style")]
    [SerializeField] private float yOffset = 0.05f; // nosta vähän lattiasta
    [SerializeField] private float edgeInset = 0.48f; // 0.45-0.49
    [SerializeField] private float barLen = 0.90f; // suhteessa cellSizeen
    [SerializeField] private float barWidth = 0.06f; // X/Z -ohuus
    [SerializeField] private float barHeight = 0.06f; // Y-paksuus
    [SerializeField] private Color lowColor = new(0.2f, 1f, 0.2f, 0.55f);
    [SerializeField] private Color highColor = new(0.2f, 0.5f, 1f, 0.80f);

    [Header("Walls (optional)")]
    [SerializeField] private bool showWalls = true;
    [SerializeField] private Color wallColor = new(1f, 0.4f, 0.1f, 0.80f);

    Transform n,e,s,w; MeshRenderer rn,re,rs,rw; float cell;

    void Awake() {
        if (!pathfinding) pathfinding = FindFirstObjectByType<PathFinding>();
        if (!levelGrid) levelGrid = LevelGrid.Instance;
        if (!cam) cam = Camera.main;

        cell = levelGrid.GetCellSize();
        (n,rn) = CreateBar("N");
        (e,re) = CreateBar("E");
        (s,rs) = CreateBar("S");
        (w,rw) = CreateBar("W");
        HideAll();
    }

    (Transform, MeshRenderer) CreateBar(string name) {
        var go = GameObject.CreatePrimitive(PrimitiveType.Cube);
        go.name = $"CoverHover_{name}";
        Destroy(go.GetComponent<Collider>());
        go.transform.SetParent(transform, false);
        var mr = go.GetComponent<MeshRenderer>();
        if (unlitTransparentMat) mr.sharedMaterial = unlitTransparentMat;
    }
}
```

RogueShooter – All Scripts

```
        go.SetActive(false);
        return (go.transform, mr);
    }

    void Update() {
        BaseAction action = UnitActionSystem.Instance.GetSelectedAction();
        if (action == null) return;
        if (!pathfinding || !levelGrid || !cam || action.GetActionName() != "Move") { HideAll(); return; }

        var ray = cam.ScreenPointToRay(Input.mousePosition);
        if (!Physics.Raycast(ray, out var hit, 500f, groundMask, QueryTriggerInteraction.Collide)) { HideAll(); return; }

        // Ruudukkoon
        var gp = levelGrid.GetGridPosition(hit.point);
        var node = pathfinding.GetNode(gp.x, gp.z, gp.floor);
        if (node == null || !node.GetIsWalkable()) { HideAll(); return; }

        var c = levelGrid.GetWorldPosition(gp);
        c.y += yOffset;

        // Reunan keskikohdat
        var north = c + new Vector3(0, 0, cell * edgeInset);
        var south = c + new Vector3(0, 0, -cell * edgeInset);
        var eastP = c + new Vector3(cell * edgeInset, 0, 0);
        var westP = c + new Vector3(-cell * edgeInset, 0, 0);

        // N/S = pituus X-suunnassa, E/W = pituus Z-suunnassa
        DrawBar(node.HasHighCover(CoverMask.N), node.HasLowCover(CoverMask.N), node.HasWall(EdgeMask.N), n, rn, north, new Vector3(cell*barLen, barHeight, barWidth));
        DrawBar(node.HasHighCover(CoverMask.S), node.HasLowCover(CoverMask.S), node.HasWall(EdgeMask.S), s, rs, south, new Vector3(cell*barLen, barHeight, barWidth));
        DrawBar(node.HasHighCover(CoverMask.E), node.HasLowCover(CoverMask.E), node.HasWall(EdgeMask.E), e, re, eastP, new Vector3(barWidth, barHeight, cell*barLen));
        DrawBar(node.HasHighCover(CoverMask.W), node.HasLowCover(CoverMask.W), node.HasWall(EdgeMask.W), w, rw, westP, new Vector3(barWidth, barHeight, cell*barLen));
    }

    void DrawBar(bool high, bool low, bool wall, Transform tr, MeshRenderer mr, Vector3 pos, Vector3 size) {
        if (!high && !low && !(showWalls && wall)) { tr.gameObject.SetActive(false); return; }
        tr.gameObject.SetActive(true);
        tr.position = pos;
        tr.localScale = size;

        // Väri prioriteetilla: seinä > high cover > low cover
        var color = (showWalls && wall) ? wallColor : (high ? highColor : lowColor);
        var m = mr.material; // runtime-instanssi
        m.color = color;
    }

    void HideAll() {
        if (n) n.gameObject.SetActive(false);
        if (e) e.gameObject.SetActive(false);
        if (s) s.gameObject.SetActive(false);
        if (w) w.gameObject.SetActive(false);
    }
}
```

--

RogueShooter – All Scripts

Assets/scripts/Units/CoverSystem/EdgeBaker.cs

```
using System;
using UnityEngine;

[DefaultExecutionOrder(500)] // After Pathfindingin
[DisallowMultipleComponent]

/// @file EdgeBaker.cs
/// @brief Edge-based obstacle detection and wall baking system for RogueShooter.
///
/// The EdgeBaker scans the environment to detect narrow obstacles (walls, fences, railings, doorframes)
/// between adjacent grid cells and encodes them as edge-wall flags in the pathfinding data.
/// This ensures that unit movement and line-of-sight calculations align precisely with physical geometry.
///
/// ### Overview
/// EdgeBaker operates immediately after walkability baking has been performed by the `PathFinding` system.
/// It iterates through all walkable cells and performs four narrow physics checks (north, east, south, west)
/// to detect thin colliders lying between grid borders. Any detected obstacle is stored as an `EdgeMask`
/// flag on both affected nodes to maintain symmetric connectivity.
///
/// ### System integration
/// - **LevelGrid** - Provides spatial dimensions and world→grid coordinate mapping for each cell.
/// - **PathFinding** - Supplies the `PathNode` data structure where edge walls are stored and queried.
/// - **EdgeBaker** - Bridges the physical Unity scene and the logical pathfinding layer by detecting edge blockers.
///
/// ### Key features
/// - Detects fine-grained edge blockers that are smaller than a full grid cell.
/// - Writes edge-wall data symmetrically to adjacent nodes (no “one-way walls”).
/// - Supports incremental rebaking after runtime geometry changes (doors opening, walls destroyed).
/// - Uses Physics.CheckBox for reliable thin-edge detection with adjustable thickness and scan height.
/// - Operates deterministically and independently of Unity’s NavMesh system.
///
/// ### Why this exists in RogueShooter
/// - The game’s tactical combat requires accurate cover and movement restrictions based on geometry.
/// - Standard per-cell walkability alone cannot capture small barriers or partial walls.
/// - This system creates a precise “micro-collision” layer between cells, allowing units to interact
///   with the environment in a realistic and strategically meaningful way.
///
/// In summary, this file defines the edge-detection system that enhances the grid-based pathfinding
/// with sub-cell precision, ensuring that RogueShooter’s movement, visibility, and cover mechanics
/// reflect the actual physical layout of each combat environment.
///
/// <summary>
/// Automatically detects and marks impassable edges between walkable grid cells,
/// based on physical obstacles present in the scene (walls, fences, railings, doorframes, etc.).
///
/// This component “bakes” thin collision lines along cell borders using Physics.CheckBox tests,
/// writing wall data directly into the PathFinding grid nodes (via EdgeMask flags).
/// It ensures that movement and line-of-sight calculations align with the actual environment geometry.
///
/// Design notes specific to RogueShooter:
```


RogueShooter – All Scripts

```
/// - Used right after walkability baking to identify fine-grained obstacles between adjacent cells.
/// - Prevents units from moving or shooting through narrow environmental blockers
///   that don't occupy a full cell (e.g., half-walls, railings, or destroyed doorframes).
/// - Enables more realistic tactical cover and movement logic without relying on Unity's full NavMesh system.
/// - Automatically rebakes affected areas when dynamic obstacles (like doors or destructible walls) change state.
/// </summary>
public class EdgeBaker : MonoBehaviour
{
    public static EdgeBaker Instance { get; private set; }

    [Header("References")]
    [SerializeField] private PathFinding pathfinding;
    [SerializeField] private LevelGrid levelGrid;

    [Header("When to run")]
    [SerializeField] private bool autoBakeOnStart = true;

    [Header("Edge scan")]
    [Tooltip("Layerit, jotka edustavat RUUTUJEN VÄLISIÄ, ohuita liikkumista estäviä juttuja (kaiteet, seinäviivat, ovenpielet, tms.)")]
    [SerializeField] private LayerMask edgeBlockerMask;

    [Header("Cover scan")]
    [SerializeField] private LayerMask coverMask;

    [Tooltip("Reunan skannauksen 'nauhan' paksuus suhteessa cellSizeen (0.05-0.2 on tyypillinen).")]
    [Range(0.01f, 0.5f)]
    [SerializeField] private float edgeStripThickness = 0.1f;

    [Tooltip("Kuinka korkealta skannataan (metreinä). Yleensä hieman ukkelin pään korkeuden yläpuolelle.")]
    [SerializeField] private float edgeScanHeight = 2.0f;

    [Header("Cover height")]
    [SerializeField] private float lowCoverY = 1.0f;    // ~vyötärö
    [SerializeField] private float highCoverY = 1.6f;   // ~pää/olkapää

    // ---- Lyhyet aliasit, ettei tarvitse arvailla mistä mikäkin tulee ----
    private PathFinding PF => pathfinding != null ? pathfinding : (pathfinding = FindFirstObjectByType<PathFinding>());
    private LevelGrid LG => levelGrid != null ? levelGrid : (levelGrid = LevelGrid.Instance);

    private int Width;
    private int Height;
    private int FloorAmount;
    private float CellSize;

    private void Awake()
    {
        if (Instance != null && Instance != this) { Destroy(gameObject); return; }
        Instance = this;

        if (pathfinding == null) pathfinding = FindFirstObjectByType<PathFinding>();
        if (levelGrid == null) levelGrid = LevelGrid.Instance;
    }
}
```

RogueShooter – All Scripts

```
Width = levelGrid.GetWidth();
Height = levelGrid.GetHeight();
FloorAmount = levelGrid.GetFloorAmount();
CellSize = levelGrid.GetCellSize();

}

private void Start()
{
    if (autoBakeOnStart) BakeAllEdges();
}

// ----- PUBLIC API -----
/// <summary>
/// Performs a full edge bake across the entire grid.
///
/// Clears all previously marked walls, then scans every walkable cell
/// in all floors to detect thin obstacles (edges) between neighboring cells.
///
/// Design notes specific to RogueShooter:
/// - This is typically called once at level initialization, right after walkability checks.
/// - It ensures that all cell borders reflect real physical blockers,
///   so units cannot move or shoot through walls, fences, or other narrow obstacles.
/// - Provides the foundation for accurate tactical pathfinding and cover detection.
/// </summary>
public void BakeAllEdges()
{
    if (!Preflight()) return;

    // 1) Clear all existing wall data from every node in every floor
    for (int f = 0; f < FloorAmount; f++)
        for (int x = 0; x < Width; x++)
            for (int z = 0; z < Height; z++)
            {
                var node = PF.GetNode(x, z, f);
                if (node != null) node.ClearWalls();
            }

    // 2) Scan each walkable cell and bake its N/E/S/W edge data
    for (int f = 0; f < FloorAmount; f++)
        for (int x = 0; x < Width; x++)
            for (int z = 0; z < Height; z++)
            {
                var gp = new GridPosition(x, z, f);
                if (!IsWalkable(gp)) continue;

                BakeEdgesForCell(gp);
            }
}
```

RogueShooter – All Scripts

```
/// <summary>
/// Rebuilds edge data locally around a given grid position.
///
/// Used when the environment changes dynamically – for example,
/// when a door opens or closes, or when a wall is destroyed.
/// This function rescans a small area instead of rebaking the entire map,
/// keeping pathfinding and cover data up to date with minimal performance cost.
///
/// Design notes specific to RogueShooter:
/// - Ensures that tactical movement and line-of-sight stay accurate
///   after real-time map changes during combat.
/// - Called automatically by interactive elements like doors or destructible props.
/// </summary>
public void RebakeEdgesAround(GridPosition center, int radius = 1)
{
    if (!Preflight()) return;

    // Loop through a square area centered on the target grid position
    for (int dx = -radius; dx <= radius; dx++)
        for (int dz = -radius; dz <= radius; dz++)
        {
            var gp = new GridPosition(center.x + dx, center.z + dz, center.floor);
            if (!IsValidGridPosition(gp) || !IsWalkable(gp)) continue;

            var node = PF.GetNode(gp.x, gp.z, gp.floor);
            if (node == null) continue;

            // 1) Clear old wall data
            node.ClearWalls();

            // 2) Rescan and rebuild edge data for this cell
            BakeEdgesForCell(gp);
        }
}

// ----- CORE -----
/// <summary>
/// Scans the four borders (N/E/S/W) of a single walkable grid cell and writes edge-wall flags.
///
/// What it does:
/// - Builds four thin, axis-aligned 3D “strips” (AABBs) that sit exactly on the cell borders.
/// - Uses Physics.CheckBox to detect narrow blockers (rails, thin walls, door frames) at a chosen height.
/// - For every detected blocker, sets the matching EdgeMask flag on the current node
///   and mirrors the opposite flag on the neighboring node to keep graph connectivity symmetric.
///
/// Why this exists in RogueShooter:
/// - Our levels contain many obstacles that do NOT fill the whole cell but still block movement/LOS across an edge.
/// - Baking per-edge blockers yields more faithful tactical movement and cover behavior than cell-only walkability.
/// - Keeping the data symmetric (both sides of the shared edge agree) avoids pathfinding inconsistencies.
///
/// Implementation notes:
```

RogueShooter – All Scripts

```
/// - Each cell does a constant amount of physics work (4 × Physics.CheckBox).
/// - The strip thickness is a fraction of the cell size (edgeStripThickness), tuned to “catch” thin geometry
///   without overlapping interiors.
/// - The scan runs at edgeScanHeight (centered at Y = edgeScanHeight * 0.5), typically around head-height,
///   so low floor clutter doesn’t cause false positives while walls/rails are still detected.
/// </summary>
private void BakeEdgesForCell(GridPosition gridPosition)
{
    var node = PF.GetNode(gridPosition.x, gridPosition.z, gridPosition.floor);
    node.ClearCover();

    // World-space center of this cell (at floor level)
    Vector3 center = LG.GetWorldPosition(gridPosition);
    float sellSize = CellSize;

    // Place the four strip centers exactly on the cell borders and lift to mid-scan height.
    float scanHeight = edgeScanHeight * 0.5f;
    Vector3 north = center + new Vector3(0f, scanHeight, +sellSize * 0.5f);
    Vector3 south = center + new Vector3(0f, scanHeight, -sellSize * 0.5f);
    Vector3 east = center + new Vector3(+sellSize * 0.5f, scanHeight, 0f);
    Vector3 west = center + new Vector3(-sellSize * 0.5f, scanHeight, 0f);

    PathBlocker(north, south, east, west, sellSize, node, gridPosition);
    WallCovers(north, south, east, west, sellSize, node, gridPosition);
}

private void PathBlocker(Vector3 north, Vector3 south, Vector3 east, Vector3 west, float sellSize, PathNode node, GridPosition gridPosition)
{
    // Define half-extents for the thin scanning strips:
    // - North/South strips are long along Z, thin along X.
    // - East/West strips are long along X, thin along Z.
    // Height half-extent is half of edgeScanHeight (so total box height == edgeScanHeight).
    Vector3 halfNorthSouth = new(sellSize * edgeStripThickness * 0.5f, edgeScanHeight * 0.5f, sellSize * 0.45f);
    Vector3 halfEastWest = new(sellSize * 0.45f, edgeScanHeight * 0.5f, sellSize * edgeStripThickness * 0.5f);

    // Probe NORTH edge; if blocked, mark N on this node and S on the northern neighbor.
    if (HasEdgeBlock(north, halfNorthSouth, Quaternion.identity))
    {
        node.AddWall(EdgeMask.N);
        MarkOpposite(gridPosition, +0, +1, EdgeMask.S);
    }
    // Probe SOUTH edge; mirror to the southern neighbor.
    if (HasEdgeBlock(south, halfNorthSouth, Quaternion.identity))
    {
        node.AddWall(EdgeMask.S);
        MarkOpposite(gridPosition, +0, -1, EdgeMask.N);
    }
    // Probe EAST edge; mirror to the eastern neighbor.
    if (HasEdgeBlock(east, halfEastWest, Quaternion.identity))
    {
        node.AddWall(EdgeMask.E);
    }
}
```

RogueShooter – All Scripts

```
        MarkOpposite(gridPosition, +1, +0, EdgeMask.W);
    }
    // Probe WEST edge; mirror to the western neighbor.
    if (HasEdgeBlock(west, halfEastWest, Quaternion.identity))
    {
        node.AddWall(EdgeMask.W);
        MarkOpposite(gridPosition, -1, +0, EdgeMask.E);
    }
}

private void WallCovers(Vector3 north, Vector3 south, Vector3 east, Vector3 west, float sellSize, PathNode node, GridPosition gridPosition)
{
    // --- Cover (sama geometria saa olla eri layerillä kuin edgeBlocker) ---
    // Tehdään matala ja korkea testi erikseen: low = vain vyötäröosuma, high = osuu myös pään korkeuteen.
    // Rajataan boksi vain yhdelle Y-korkeudelle (pieni korkeus), ettei pöydän jalat tms. vaikuta.
    Vector3 lowHalfNS = new Vector3(sellSize * edgeStripThickness * 0.5f, 0.1f, sellSize * 0.45f);
    Vector3 lowHalfEW = new Vector3(sellSize * 0.45f, 0.1f, sellSize * edgeStripThickness * 0.5f);
    Vector3 highHalfNS = lowHalfNS;
    Vector3 highHalfEW = lowHalfEW;

    // pisteet cover-korkeuksille
    Vector3 nLow = new Vector3(north.x, lowCoverY, north.z);
    Vector3 nHigh = new Vector3(north.x, highCoverY, north.z);
    Vector3 sLow = new Vector3(south.x, lowCoverY, south.z);
    Vector3 sHigh = new Vector3(south.x, highCoverY, south.z);
    Vector3 eLow = new Vector3(east.x, lowCoverY, east.z);
    Vector3 eHigh = new Vector3(east.x, highCoverY, east.z);
    Vector3 wLow = new Vector3(west.x, lowCoverY, west.z);
    Vector3 wHigh = new Vector3(west.x, highCoverY, west.z);

    // North
    bool nLowHit = Physics.CheckBox(nLow, lowHalfNS, Quaternion.identity, coverMask);
    bool nHighHit = Physics.CheckBox(nHigh, highHalfNS, Quaternion.identity, coverMask);
    if (nHighHit) node.AddHighCover(CoverMask.N);
    else if (nLowHit) node.AddLowCover(CoverMask.N);

    // South
    bool sLowHit = Physics.CheckBox(sLow, lowHalfNS, Quaternion.identity, coverMask);
    bool sHighHit = Physics.CheckBox(sHigh, highHalfNS, Quaternion.identity, coverMask);
    if (sHighHit) node.AddHighCover(CoverMask.S);
    else if (sLowHit) node.AddLowCover(CoverMask.S);

    // East
    bool eLowHit = Physics.CheckBox(eLow, lowHalfEW, Quaternion.identity, coverMask);
    bool eHighHit = Physics.CheckBox(eHigh, highHalfEW, Quaternion.identity, coverMask);
    if (eHighHit) node.AddHighCover(CoverMask.E);
    else if (eLowHit) node.AddLowCover(CoverMask.E);

    // West
    bool wLowHit = Physics.CheckBox(wLow, lowHalfEW, Quaternion.identity, coverMask);
    bool wHighHit = Physics.CheckBox(wHigh, highHalfEW, Quaternion.identity, coverMask);
    if (wHighHit) node.AddHighCover(CoverMask.W);
}
```

RogueShooter – All Scripts

```
    else if (wLowHit) node.AddLowCover(CoverMask.W);
}

/// <summary>
/// Checks whether a physical obstacle exists along a specific cell edge.
///
/// Uses Physics.CheckBox with the configured <see cref="edgeBlockerMask"/> to detect
/// any geometry that should prevent movement or line-of-sight across that border.
///
/// Why this exists in RogueShooter:
/// - We rely on thin colliders (walls, railings, doorframes) placed between grid cells.
/// - Detecting those lets the pathfinding system respect scene geometry more accurately
///   than simple per-cell walkability checks.
/// - Called four times per cell (once for each direction) during edge baking.
///
/// Implementation notes:
/// - Returns true if *any* collider in the given layer mask overlaps the test volume.
/// - QueryTriggerInteraction.Ignore avoids false positives from trigger colliders.
/// </summary>
private bool HasEdgeBlock(Vector3 center, Vector3 halfExtents, Quaternion rot)
{
    return Physics.CheckBox(center, halfExtents, rot, edgeBlockerMask, QueryTriggerInteraction.Ignore);
}

/// <summary>
/// Mirrors an edge-wall flag to the neighboring grid cell so both sides of the shared border agree.
///
/// What it does:
/// - Computes the neighbor position by offset (dx, dz) on the same floor.
/// - If the neighbor node exists, adds the opposite direction wall flag to it.
///
/// Why this exists in RogueShooter:
/// - Keeps pathfinding data consistent between adjacent nodes.
/// - Prevents “one-way walls,” where one node thinks the edge is blocked
///   but its neighbor does not – a common cause of desyncs in tactical grids.
///
/// Implementation notes:
/// - This method assumes edge baking is done in grid order, so each pair
///   of adjacent cells will eventually synchronize their shared edge data.
/// </summary>
private void MarkOpposite(GridPosition a, int dx, int dz, EdgeMask oppositeDir)
{
    var b = new GridPosition(a.x + dx, a.z + dz, a.floor);
    if (!IsValidGridPosition(b)) return;

    var nb = PF.GetNode(b.x, b.z, b.floor);
    if (nb == null) return;

    // Add the mirrored wall flag to the neighbor node
    nb.AddWall(oppositeDir);
}
```

RogueShooter – All Scripts

```
// ----- HELPERS -----  
/// <summary>  
/// Performs a quick validation before baking begins.  
///  
/// Checks that references to <see cref="PathFinding"/> and <see cref="LevelGrid"/> are valid,  
/// either through serialized fields or automatic runtime lookup.  
///  
/// Why this exists in RogueShooter:  
/// - Prevents null-reference errors during scene startup.  
/// - Ensures that the grid and pathfinding systems are fully initialized  
///   before attempting any edge scanning or node modification.  
///  
/// Implementation notes:  
/// - Logs descriptive errors to help diagnose missing scene references.  
/// - Returns false if any critical dependency is missing, stopping the bake safely.  
/// </summary>  
private bool Preflight()  
{  
    if (PF == null)  
    {  
        Debug.LogError("[EdgeBaker] Pathfinding reference missing (and not found automatically).");  
        return false;  
    }  
    if (LG == null)  
    {  
        Debug.LogError("[EdgeBaker] LevelGrid reference missing (and not found automatically).");  
        return false;  
    }  
    return true;  
}  
  
/// <summary>  
/// Determines whether the specified grid position corresponds to a walkable node.  
///  
/// Why this exists in RogueShooter:  
/// - Edge baking should only occur on cells that units can actually occupy.  
/// - Avoids unnecessary physics checks for blocked or void cells (improves performance).  
///  
/// Implementation notes:  
/// - Fetches the node from PathFinding and queries its <c>GetIsWalkable()</c> flag.  
/// </summary>  
private bool IsWalkable(GridPosition gp)  
{  
    var node = PF.GetNode(gp.x, gp.z, gp.floor);  
    return node != null && node.GetIsWalkable();  
}  
  
/// <summary>  
/// Validates that a given grid position exists within the bounds of the level grid.  
///  
/// Why this exists in RogueShooter:  
/// - Edge baking frequently queries neighboring cells ( $\pm 1$  in X/Z).
```

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```
/// - Ensures that no out-of-range indices are accessed, preventing runtime errors.
///
/// Implementation notes:
/// - Uses LevelGrid's built-in <c>IsValidGridPosition()</c> if available for the current floor.
/// - Falls back to manual bounds checking if no grid system reference is found.
/// </summary>
private bool IsValidGridPosition(GridPosition gp)
{
    var gridSystem = LG.GetGridSystem(gp.floor);
    if (gridSystem != null) return gridSystem.IsValidGridPosition(gp);

    return gp.x >= 0 && gp.z >= 0 && gp.x < Width && gp.z < Height && gp.floor >= 0 && gp.floor < FloorAmount;
}
}
```


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Assets/scripts/Units/EmptySquad.cs

```
using UnityEngine;

/// <summary>
/// GameNetorkManager is required to have a NetworkManager component.
/// This is an empty class just to satisfy that requirement.
/// </summary>
public class EmptySquad : MonoBehaviour
{
}
```

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Assets/scripts/Units/HealthSystem.cs

```
using System;
using UnityEngine;

public class HealthSystem : MonoBehaviour
{
    public event EventHandler OnDead;
    public event EventHandler OnDamaged;

    [SerializeField] private int health = 100;
    private int healthMax;

    // To prevent multiple death events
    private bool isDead;
    private Vector3 lastHitPosition;
    public Vector3 LastHitPosition => lastHitPosition;

    private int overkill;
    public int Overkill => overkill;

    void Awake()
    {
        healthMax = health;
        isDead = false;
    }

    public void Damage(int damageAmount, Vector3 hitPosition)
    {
        if (isDead) return;

        health -= damageAmount;
        if (health <= 0)
        {
            overkill = Math.Abs(health) + 1;
            health = 0;

            if (!isDead)
            {
                lastHitPosition = hitPosition;
                isDead = true;
                Die();
            }
        }

        OnDamaged?.Invoke(this, EventArgs.Empty);
    }

    private void Die()
    {
        OnDead?.Invoke(this, EventArgs.Empty);
    }
}
```

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```
public float GetHealthNormalized()
{
    return (float)health / healthMax;
}

public int GetHealth()
{
    return health;
}

public int GetHealthMax()
{
    return healthMax;
}

public void ApplyNetworkHealth(int current, int max)
{
    healthMax = Mathf.Max(1, max);
    health = Mathf.Clamp(current, 0, healthMax);
    OnDamaged?.Invoke(this, EventArgs.Empty);
}
}
```

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Assets/scripts/Units/Unit.cs

```
using Mirror;
using System;
using System.Collections;
using UnityEngine;

/// <summary>
///     This class represents a unit in the game.
///     Actions can be called on the unit to perform various actions like moving or shooting.
///     The class inherits from NetworkBehaviour to support multiplayer functionality.
/// </summary>
[RequireComponent(typeof(HealthSystem))]
[RequireComponent(typeof(MoveAction))]
[RequireComponent(typeof(TurnTowardsAction))]
public class Unit : NetworkBehaviour
{
    private const int ACTION_POINTS_MAX = 100;

    [SyncVar] public uint OwnerId;

    // --- Cover state ---
    private int personalCover;
    private int personalCoverMax;
    private int thisTurnStartingCover;

    // Valinnainen: UI:lle
    public event Action<int, int> OnCoverPoolChanged;

    // Skillit:
    // [SerializeField] private UnitSkills skills; // sisältää CoverAbilityn tason tms.
    [SerializeField] public UnitArchetype archetype;
    [SerializeField] private WeaponDefinition currentWeapon;
    public static event EventHandler OnAnyActionPointsChanged;
    public static event EventHandler OnAnyUnitSpawned;
    public static event EventHandler OnAnyUnitDead;

    public event Action<bool> OnHiddenChangedEvent;

    [SerializeField] public bool isEnemy;

    private GridPosition gridPosition;
    private HealthSystem healthSystem;

    private BaseAction[] baseActionsArray;

    private int actionPoints = ACTION_POINTS_MAX;

    private int maxMoveDistance;

    [SyncVar(hook = nameof(OnHiddenChanged))]
```

RogueShooter – All Scripts

```
private bool isHidden;

private Renderer[] renderers;
private Collider[] colliders;
private Animator anim;

private void Awake()
{
    renderers = GetComponentsInChildren<Renderer>(true);
    colliders = GetComponentsInChildren<Collider>(true);
    TryGetComponent(out anim);

    healthSystem = GetComponent<HealthSystem>();
    baseActionsArray = GetComponents<BaseAction>();
    maxMoveDistance = GetComponent<MoveAction>().GetMaxMoveDistance();
}

private void Start()
{
    if (archetype != null)
    {
        personalCoverMax = archetype.personalCoverMax;
    }
    personalCover = personalCoverMax;

    // kerro UI:lle heti
    OnCoverPoolChanged?.Invoke(personalCover, personalCoverMax);

    if (LevelGrid.Instance != null)
    {
        gridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
        LevelGrid.Instance.AddUnitAtGridPosition(gridPosition, this);
    }

    TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;

    healthSystem.OnDead += HealthSystem_OnDead;

    OnAnyUnitSpawned?.Invoke(this, EventArgs.Empty);

    if (archetype != null)
    {
        personalCoverMax = archetype.personalCoverMax;
    }

    personalCover = personalCoverMax;
    thisTurnStartingCover = personalCover;
}

private void Update()
{
```

RogueShooter – All Scripts

```
GridPosition newGridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
if (newGridPosition != gridPosition)
{
    GridPosition oldGridposition = gridPosition;
    gridPosition = newGridPosition;
    LevelGrid.Instance.UnitMoveToGridPosition(oldGridposition, newGridPosition, this);
}
}

/// <summary>
///     When unit get destroyed, this clears grid system under destroyed unit.
/// </summary>
void OnDestroy()
{
    if (LevelGrid.Instance != null)
    {
        gridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
        LevelGrid.Instance.RemoveUnitAtGridPosition(gridPosition, this);
    }
}

public T GetAction<T>() where T : BaseAction
{
    foreach (BaseAction baseAction in baseActionsArray)
    {
        if (baseAction is T t)
        {
            return t;
        }
    }
    return null;
}

public GridPosition GetGridPosition()
{
    return gridPosition;
}

public Vector3 GetWorldPosition()
{
    return transform.position;
}

public BaseAction[] GetBaseActionsArray()
{
    return baseActionsArray;
}

public bool TrySpendActionPointsToTakeAction(BaseAction baseAction)
{
    if (CanSpendActionPointsToTakeAction(baseAction))
```

RogueShooter – All Scripts

```
{
    SpendActionPoints(baseAction.GetActionPointsCost());
    return true;
}
return false;
}

public bool CanSpendActionPointsToTakeAction(BaseAction baseAction)
{
    if (actionPoints >= baseAction.GetActionPointsCost())
    {
        return true;
    }
    return false;
}

private void SpendActionPoints(int amount)
{
    actionPoints -= amount;

    OnAnyActionPointsChanged?.Invoke(this, EventArgs.Empty);
    NetworkSync.BroadcastActionPoints(this, actionPoints);
}

public int GetActionPoints()
{
    return actionPoints;
}

/// <summary>
///     This method is called when the turn changes. It resets the action points to the maximum value.
/// </summary>
private void TurnSystem_OnTurnChanged(object sender, EventArgs e)
{
    actionPoints = ACTION_POINTS_MAX;
    thisTurnStartingCover = personalCover;
    OnAnyActionPointsChanged?.Invoke(this, EventArgs.Empty);
}

/// <summary>
///     Online: Updating ActionPoints usage to otherplayers.
/// </summary>
public void ApplyNetworkActionPoints(int ap)
{
    if (actionPoints == ap) return;
    actionPoints = ap;
    OnAnyActionPointsChanged?.Invoke(this, EventArgs.Empty);
}

public bool IsEnemy()
{
    return isEnemy;
}
```

RogueShooter – All Scripts

```
}

private void HealthSystem_OnDead(object sender, System.EventArgs e)
{
    OnAnyUnitDead?.Invoke(this, EventArgs.Empty);
    if (!NetworkServer.active)
    {
        // OFFLINE: suoraan tuho
        if (!NetworkClient.active) { Destroy(gameObject); return; }
        return;
    }

    // Piilota jotta client ehtii kopioida omaan ragdolliin tiedot
    isHidden = true;
    SetSoftHiddenLocal(true);
    StartCoroutine(DestroyAfter(0.30f));
}

private IEnumerator DestroyAfter(float seconds)
{
    yield return new WaitForSeconds(seconds);
    NetworkServer.Destroy(gameObject);
}

private void SetSoftHiddenLocal(bool hidden)
{
    bool visible = !hidden;
    foreach (var r in renderers) if (r) r.enabled = visible;
    foreach (var c in colliders) if (c) c.enabled = visible;
    if (anim) anim.enabled = visible;
}

public int GetPersonalCover()
{
    return personalCover;
}

public void SetPersonalCover(int damage)
{
    personalCover = damage;
    OnCoverPoolChanged?.Invoke(personalCover, personalCoverMax);
    NetworkSync.UpdateCoverUI(this);
}

public float GetHealthNormalized()
{
    return healthSystem.GetHealthNormalized();
}

private void OnHiddenChanged(bool oldVal, bool newVal)
{
}
```


RogueShooter – All Scripts

```
        OnHiddenChangedEvent?.Invoke(newVal);
    }

    public bool IsHidden()
    {
        return isHidden;
    }

    public int GetMaxMoveDistance()
    {
        return maxMoveDistance;
    }

    public void RegenCoverOnMove(int distance)
    {
        int regenPerTile = archetype != null ? archetype.coverRegenOnMove : 5;

        int tileDelta = distance / 10;

        int coverChange = regenPerTile * tileDelta;
        int newCover = personalCover + coverChange;
        if (newCover <= thisTurnStartingCover )
        {
            newCover = thisTurnStartingCover;
        }
        personalCover = Mathf.Clamp(newCover, 0, personalCoverMax);

        OnCoverPoolChanged?.Invoke(personalCover, personalCoverMax);
    }

    public void RegenCoverBy(int amount)
    {
        int before = personalCover;
        personalCover = Mathf.Clamp(personalCover + amount, 0, personalCoverMax);

        OnCoverPoolChanged?.Invoke(personalCover, personalCoverMax);
    }

    public int GetCoverRegenPerUnusedAP()
    {
        return archetype != null ? archetype.coverRegenPerUnusedAP : 1;
    }

    public int GetPersonalCoverMax() => personalCoverMax;

    public float GetCoverNormalized()
    {
        return (float)personalCover / personalCoverMax;
    }
}
```

RogueShooter – All Scripts

```
public void ApplyNetworkCover(int current, int max)
{
    personalCoverMax = max;
    personalCover     = Mathf.Clamp(current, 0, max);
    OnCoverPoolChanged?.Invoke(personalCover, personalCoverMax);
}
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitActions/Actions/BaseAction.cs

```
using UnityEngine;
using Mirror;
using System;
using System.Collections.Generic;

/// <summary>
/// Base class for all unit actions in the game.
/// This class inherits from NetworkBehaviour and provides common functionality for unit actions.
/// </summary>
[RequireComponent(typeof(Unit))]
public abstract class BaseAction : NetworkBehaviour
{
    public static event EventHandler OnAnyActionStarted;
    public static event EventHandler OnAnyActionCompleted;

    protected Unit unit;
    protected bool isActive;
    protected Action onActionComplete;

    protected virtual void Awake()
    {
        unit = GetComponent<Unit>();
    }

    // Defines the action button text for the Unit UI.
    public abstract string GetActionName();

    // Executes the action at the specified grid position and invokes the callback upon completion.
    public abstract void TakeAction(GridPosition gridPosition, Action onActionComplete);

    // Checks if the specified grid position is valid for the action, when mouse is over a grid position.
    public virtual bool IsValidGridPosition(GridPosition gridPosition)
    {
        List<GridPosition> validGridPositionsList = GetValidGridPositionList();
        return validGridPositionsList.Contains(gridPosition);
    }

    // Returns a list of valid grid positions for the action.
    public abstract List<GridPosition> GetValidGridPositionList();

    // Returns the action points cost for performing the action.
    public virtual int GetActionPointsCost()
    {
        return 1;
    }

    // Called when the action starts, sets the action as active and stores the completion callback.
    // Prevents the player from performing multiple actions at the same time.
```

RogueShooter – All Scripts

```
protected void ActionStart(Action onActionComplete)
{
    isActive = true;
    this.onActionComplete = onActionComplete;

    OnAnyActionStarted?.Invoke(this, EventArgs.Empty);
}

// Called when the action is completed, sets the action as inactive and invokes the completion callback.
// Allows the player to perform new actions.
protected void ActionComplete()
{
    isActive = false;
    onActionComplete();

    OnAnyActionCompleted?.Invoke(this, EventArgs.Empty);
}

public Unit GetUnit()
{
    return unit;
}

public void MakeDamage(int damage, Unit targetUnit)
{
    // Peruspaikat (world-space)
    Vector3 attacerPos = unit.GetWorldPosition() + Vector3.up * 1.6f; // silmä/rinta
    Vector3 targetPos = targetUnit.GetWorldPosition() + Vector3.up * 1.2f;
    // Suunta
    Vector3 dir = targetPos - attacerPos;
    if (dir.sqrMagnitude < 0.0001f) dir = targetUnit.transform.forward; // fallback
    dir.Normalize();

    // Siirrä osumakeskus hieman kohti hyökkääjää (0.5-1.0 m toimii yleensä hyvin)
    float backOffset = 0.7f;
    Vector3 hitPosition = targetPos - dir * backOffset;

    // (valinnainen) pieni satunnainen sivuttaisjitter, ettei kaikki näytä identtiseltä
    Vector3 side = Vector3.Cross(dir, Vector3.up).normalized;
    hitPosition += side * UnityEngine.Random.Range(-0.1f, 0.1f);

    NetworkSync.ApplyDamageToUnit(targetUnit, damage, hitPosition);
}

public void ApplyHit(int damage, Unit targetUnit, bool melee)
{
    var ct = GetCoverType(targetUnit);

    if (ct == CoverService.CoverType.None && !melee)
    {
        MakeDamage(damage, targetUnit);
        return;
    }
}
```

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```
}

int mitigate = CoverService.GetCoverMitigationPoints(ct);
int toCover = Mathf.Max(0, damage - mitigate);

int before = targetUnit.GetPersonalCover();
int after = before - toCover;

if (after >= 0)
{
    targetUnit.SetPersonalCover(after);
    NetworkSync.UpdateCoverUI(targetUnit);
}
else
{
    targetUnit.SetPersonalCover(0);
    NetworkSync.UpdateCoverUI(targetUnit);
    MakeDamage(-after, targetUnit);
}
}

public CoverService.CoverType GetCoverType(Unit targetUnit)
{
    var gp = targetUnit.GetGridPosition();
    var node = PathFinding.Instance.GetNode(gp.x, gp.z, gp.floor);
    var ct = CoverService.EvaluateCoverHalfPlane(unit.GetGridPosition(), targetUnit.GetGridPosition(), node);
    return ct;
}

public enum RotateTargetType
{
    Unit,
    GridPosition
}

public bool RotateTowards(Vector3 targetPosition, float rotationSpeed = 10f)
{
    // Suuntavektori
    Vector3 aimDirection = (targetPosition - unit.GetWorldPosition()).normalized;
    aimDirection.y = 0f;

    transform.forward = Vector3.Slerp(transform.forward, aimDirection, Time.deltaTime * rotationSpeed);

    // Kääntyminen on suoritettu.
    float tolerance = 0.99f;
    float dot = Vector3.Dot(transform.forward.normalized, aimDirection);
    return dot > tolerance;
}

// ----- ENEMY AI ACTIONS -----

/// <summary>
```

RogueShooter – All Scripts

```
/// ENEMY AI:
/// Empty ENEMY AI ACTIONS abstract class.
/// Every Unit action like MoveAction.cs, ShootAction.cs and so on defines this differently
/// Contains gridposition and action value
/// </summary>
public abstract EnemyAIAction GetEnemyAIAction(GridPosition gridPosition);

/// <summary>
/// ENEMY AI:
/// Making a list all possible actions an enemy Unit can take, and shorting them
/// based on highest action value.(Gives the enemy the best outcome)
/// The best Action is in the enemyAIActionList[0]
/// </summary>
public EnemyAIAction GetBestEnemyAIAction()
{
    List<EnemyAIAction> enemyAIActionList = new();

    List<GridPosition> validActionGridPositionList = GetValidGridPositionList();

    foreach (GridPosition gridPosition in validActionGridPositionList)
    {
        // All actions have own EnemyAIAction to set griposition and action value.
        EnemyAIAction enemyAIAction = GetEnemyAIAction(gridPosition);
        enemyAIActionList.Add(enemyAIAction);
    }

    if (enemyAIActionList.Count > 0)
    {
        enemyAIActionList.Sort((a, b) => b.actionValue - a.actionValue);
        return enemyAIActionList[0];
    }
    else
    {
        // No possible Enemy AI Actions
        return null;
    }
}
```

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Assets/scripts/Units/UnitActions/Actions/GranadeAction.cs

```
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class GranadeAction : BaseAction
{
    public event EventHandler ThrowGranade;

    public event EventHandler ThrowReady;

    public Vector3 TargetWorld { get; private set; }

    [SerializeField] private Transform grenadeProjectilePrefab;

    private int maxThrowDistance = 7;

    private void Update()
    {
        if (!isActive)
        {
            return;
        }
    }

    public override string GetActionName()
    {
        return "Granade";
    }

    public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
    {
        return new EnemyAIAction
        {
            gridPosition = gridPosition,
            actionValue = 0,
        };
    }

    public override List<GridPosition> GetValidGridPositionList()
    {
        List<GridPosition> validGridPositionList = new();

        GridPosition unitGridPosition = unit.GetGridPosition();

        for (int x = -maxThrowDistance; x <= maxThrowDistance; x++)
        {
            for (int z = -maxThrowDistance; z <= maxThrowDistance; z++)
```

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```
{
    GridPosition offsetGridPosition = new(x, z, 0);
    GridPosition testGridPosition = unitGridPosition + offsetGridPosition;

    // Check if the test grid position is within the valid range
    if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition)) continue;
    int testDistance = Mathf.Abs(x) + Mathf.Abs(z);
    if (testDistance > maxThrowDistance) continue;

    validGridPositionList.Add(testGridPosition);
}

}

return validGridPositionList;
}

public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
{
    ActionStart(onActionComplete);
    TargetWorld = LevelGrid.Instance.GetWorldPosition(gridPosition);
    StartCoroutine(TurnAndThrow(.5f, TargetWorld));

}

private IEnumerator TurnAndThrow(float delay, Vector3 targetWorld)
{
    // Odotetaan kunnes RotateTowards palaa true
    float waitAfterAligned = 0.1f; // pienen odotuksen verran
    float alignedTime = 0f;

    while (true)
    {
        bool aligned = RotateTowards(targetWorld);

        if (aligned)
        {
            alignedTime += Time.deltaTime;
            if (alignedTime >= waitAfterAligned)
                break; // ollaan kohdistettu ja odotettu tarpeeksi
        }
        else
        {
            alignedTime = 0f; // resetoit jos ei vielä kohdallaan
        }

        yield return null;
    }

    ThrowGranade?.Invoke(this, EventArgs.Empty);
}
```


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```
    }  
  
    public void OnGrenadeBehaviourComplete()  
    {  
        ThrowReady?.Invoke(this, EventArgs.Empty);  
        ActionComplete();  
    }  
}
```

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Assets/scripts/Units/UnitActions/Actions/InteractAction.cs

```
using System;
using System.Collections.Generic;

public class InteractAction : BaseAction
{
    private void Update()
    {
        if (!IsActive)
        {
            return;
        }
    }

    public override string GetActionName()
    {
        return "Interact";
    }

    public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
    {
        return new EnemyAIAction
        {
            gridPosition = gridPosition,
            actionValue = 0,
        };
    }

    public override List<GridPosition> GetValidGridPositionList()
    {
        List<GridPosition> validGridPositionList = new();

        GridPosition unitGridPosition = unit.GetGridPosition();

        for (int x = -1; x <= 1; x++)
        {
            for (int z = -1; z <= 1; z++)
            {
                GridPosition offsetGridPosition = new(x, z, 0);
                GridPosition testGridPosition = unitGridPosition + offsetGridPosition;

                if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition)) continue;
                IInteractable interactable = LevelGrid.Instance.GetInteractableAtGridPosition(testGridPosition);
                if (interactable == null) continue;
                validGridPositionList.Add(testGridPosition);
            }
        }

        return validGridPositionList;
    }
}
```

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```
public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
{
    IInteractable interactable = LevelGrid.Instance.GetInteractableAtGridPosition(gridPosition);
    interactable.Interact(OnInteractComplete);
    ActionStart(onActionComplete);
}

private void OnInteractComplete()
{
    ActionComplete();
}
}
```

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Assets/scripts/Units/UnitActions/Actions/MeleeAction.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

public class MeleeAction : BaseAction
{
    public static event EventHandler OnAnyMeleeActionHit;

    public event EventHandler OnMeleeActionStarted;
    public event EventHandler OnMeleeActionCompleted;
    [SerializeField] private int damage = 100;

    private enum State
    {
        MeleeActionBeforeHit,
        MeleeActionAfterHit,
    }

    private int maxMeleedDistance = 1;
    private State state;
    private float stateTimer;
    private Unit targetUnit;

    private void Update()
    {
        if (!isActive)
        {
            return;
        }
        stateTimer -= Time.deltaTime;
        switch (state)
        {
            case State.MeleeActionBeforeHit:
                if (targetUnit != null)
                {
                    if (RotateTowards(targetUnit.GetWorldPosition()))
                    {
                        stateTimer = Mathf.Min(stateTimer, 0.4f);
                    }
                }
                break;
            case State.MeleeActionAfterHit:
                break;
        }

        if (stateTimer <= 0f)
        {
            NextState();
        }
    }
}
```

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```
private void NextState()
{
    switch (state)
    {
        case State.MeleeActionBeforeHit:
            state = State.MeleeActionAfterHit;
            float afterHitStateTime = 1f;
            stateTimer = afterHitStateTime;
            ApplyHit(damage, targetUnit, true);
            OnAnyMeleeActionHit?.Invoke(this, EventArgs.Empty);
            break;
        case State.MeleeActionAfterHit:
            OnMeleeActionCompleted?.Invoke(this, EventArgs.Empty);
            ActionComplete();
            break;
    }
}

public override string GetActionName()
{
    return "Melee";
}

public override List<GridPosition> GetValidGridPositionList()
{
    List<GridPosition> validGridPositionList = new();

    GridPosition unitGridPosition = unit.GetGridPosition();

    for (int x = -maxMeleedDistance; x <= maxMeleedDistance; x++)
    {
        for (int z = -maxMeleedDistance; z <= maxMeleedDistance; z++)
        {
            GridPosition offsetGridPosition = new(x, z, 0);
            GridPosition testGridPosition = unitGridPosition + offsetGridPosition;

            if (!LevelGrid.Instance.HasAnyUnitOnGridPosition(testGridPosition)) continue;

            Unit targetUnit = LevelGrid.Instance.GetUnitAtGridPosition(testGridPosition);
            // Make sure we don't include friendly units.
            if (targetUnit.IsEnemy() == unit.IsEnemy()) continue;
            // Check if the test grid position is within the valid range
            if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition)) continue;

            validGridPositionList.Add(testGridPosition);
        }
    }

    return validGridPositionList;
}

public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
```

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```
{
    targetUnit = LevelGrid.Instance.GetUnitAtGridPosition(gridPosition);

    state = State.MeleeActionBeforeHit;
    float beforeHitStateTime = 0.7f;
    stateTimer = beforeHitStateTime;
    OnMeleeActionStarted?.Invoke(this, EventArgs.Empty);
    ActionStart(onActionComplete);
}

//----- ENEMY AI ACTIONS -----
public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
{
    return new EnemyAIAction
    {
        gridPosition = gridPosition,
        actionValue = 200,
    };
}
}
```

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Assets/scripts/Units/UnitActions/Actions/MoveAction.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

/// <summary>
/// The MoveAction class is responsible for handling the movement of a unit in the game.
/// It allows the unit to move to a target position, and it calculates valid move grid positions based on the unit's current position.
/// </summary>
public class MoveAction : BaseAction
{
    public event EventHandler OnStartMoving;
    public event EventHandler OnStopMoving;

    GridPosition thisTurnStartingGridPosition;
    GridPosition thisTurnEndridPosition;

    [SerializeField] private int maxMoveDistance = 4;

    private int distance;

    private List<Vector3> positionList;
    private int currentPositionIndex;

    private bool isChangingFloors;
    private float differentFloorsTeleportTimer;
    private float differentFloorsTeleportTimerMax = .5f;

    private void Start()
    {
        distance = 0;
        thisTurnStartingGridPosition = unit.GetGridPosition();

        TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
    }

    private void TurnSystem_OnTurnChanged(object sender, EventArgs e)
    {
        thisTurnStartingGridPosition = unit.GetGridPosition();
        distance = 0;
    }

    private void Update()
    {
        if (!isActive) return;

        Vector3 targetPosition = positionList[currentPositionIndex];

        if (isChangingFloors)
```

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```
{
    Vector3 targetSameFloorPosition = targetPosition;
    targetSameFloorPosition.y = transform.position.y;
    Vector3 rotateDirection = (targetSameFloorPosition - transform.position).normalized;

    float rotationSpeed = 10f;
    transform.forward = Vector3.Slerp(transform.forward, rotateDirection, Time.deltaTime * rotationSpeed);
    differentFloorsTeleportTimer -= Time.deltaTime;
    if (differentFloorsTeleportTimer < 0f)
    {
        isChangingFloors = false;
        transform.position = targetPosition;
    }
}
else
{
    Vector3 moveDirection = (targetPosition - transform.position).normalized;

    // Rotate towards the target position
    float rotationSpeed = 10f;
    transform.forward = Vector3.Slerp(transform.forward, moveDirection, Time.deltaTime * rotationSpeed);

    // Move towards the target position
    float moveSpeed = 6f;
    transform.position += moveSpeed * Time.deltaTime * moveDirection;
}

float stoppingDistance = 0.2f;
if (Vector3.Distance(transform.position, targetPosition) < stoppingDistance)
{
    thisTurnEndridPosition = LevelGrid.Instance.GetGridPosition(transform.position);
    DistanceFromStartingPoint();

    currentPositionIndex++;
    if (currentPositionIndex >= positionList.Count)
    {
        OnStopMoving?.Invoke(this, EventArgs.Empty);
        ActionComplete();
    }
    else
    {
        targetPosition = positionList[currentPositionIndex];
        GridPosition targetGridPosition = LevelGrid.Instance.GetGridPosition(targetPosition);
        GridPosition unitGridPosition = LevelGrid.Instance.GetGridPosition(transform.position);

        if (targetGridPosition.floor != unitGridPosition.floor)
        {
            //Different floors
            isChangingFloors = true;
        }
    }
}
```


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```
        differentFloorsTeleportTimer = differentFloorsTeleportTimerMax;
    }
}

}

public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
{
    List<GridPosition> pathGridPositionsList = PathFinding.Instance.FindPath(unit.GetGridPosition(), gridPosition, out int pathLength, maxMoveDistance);

    currentPositionIndex = 0;
    positionList = new List<Vector3>();

    foreach (GridPosition pathGridPosition in pathGridPositionsList)
    {
        positionList.Add(LevelGrid.Instance.GetWorldPosition(pathGridPosition));
    }

    OnStartMoving?.Invoke(this, EventArgs.Empty);
    ActionStart(onActionComplete);
}

private void DistanceFromStartingPoint()
{
    int newDistance = PathFinding.Instance.CalculateDistance(thisTurnStartingGridPosition, thisTurnEndGridPosition);

    int delta = newDistance - distance;
    if (Mathf.Abs(delta) < 10) return;
    if (delta != 0)
    {
        Debug.Log($"Net distance delta: {delta / 10} tiles");
        unit.RegenCoverOnMove(delta);
    }

    distance = newDistance;
}

public override List<GridPosition> GetValidGridPositionList()
{
    var valid = new List<GridPosition>();
    var candidates = new HashSet<GridPosition>(); // estää duplikaatit

    GridPosition unitPos = unit.GetGridPosition();
    int startFloor = unitPos.floor;

    // Jos maxMoveDistance on RUUTUJA, kustannusbudjetti on *10 per ruutu*
    const int COST_PER_TILE = 10;
    int moveBudgetCost = maxMoveDistance * COST_PER_TILE;

    // --- 1) Nykyisen kerroksen ruudut (perus-offsetit) ---
```

RogueShooter – All Scripts

```
for (int dx = -maxMoveDistance; dx <= maxMoveDistance; dx++)
{
    for (int dz = -maxMoveDistance; dz <= maxMoveDistance; dz++)
    {
        var test = new GridPosition(unitPos.x + dx, unitPos.z + dz, startFloor);
        candidates.Add(test);
    }
}

// --- 2) Linkkien kautta saavutettavat kerrokset (hybridi) ---
var links = PathFinding.Instance.GetPathfindingLinks();
if (links != null && links.Count > 0)
{
    foreach (var link in links)
    {
        // A -> B
        if (link.gridPositionA.floor == startFloor)
        {
            int lbToA = PathFinding.Instance.CalculateDistance(unitPos, link.gridPositionA);
            if (lbToA <= moveBudgetCost)
            {
                int remaining = moveBudgetCost - lbToA;
                int radiusTiles = Mathf.Max(0, remaining / COST_PER_TILE);

                for (int dx = -radiusTiles; dx <= radiusTiles; dx++)
                {
                    for (int dz = -radiusTiles; dz <= radiusTiles; dz++)
                    {
                        var aroundB = new GridPosition(
                            link.gridPositionB.x + dx,
                            link.gridPositionB.z + dz,
                            link.gridPositionB.floor
                        );
                        candidates.Add(aroundB);
                    }
                }
            }
        }

        // B -> A
        if (link.gridPositionB.floor == startFloor)
        {
            int lbToB = PathFinding.Instance.CalculateDistance(unitPos, link.gridPositionB);
            if (lbToB <= moveBudgetCost)
            {
                int remaining = moveBudgetCost - lbToB;
                int radiusTiles = Mathf.Max(0, remaining / COST_PER_TILE);

                for (int dx = -radiusTiles; dx <= radiusTiles; dx++)
                {
                    for (int dz = -radiusTiles; dz <= radiusTiles; dz++)
                    {
```

RogueShooter – All Scripts

```
        var aroundA = new GridPosition(
            link.gridPositionA.x + dx,
            link.gridPositionA.z + dz,
            link.gridPositionA.floor
        );
        candidates.Add(aroundA);
    }
}
}
}
}

// --- 3) Suodata & tee vain yksi A* per kandidaatti (välimuistilla) ---
foreach (var test in candidates)
{
    // Perusvalidoinnit
    if (!LevelGrid.Instance.IsValidGridPosition(test)) continue;
    if (test == unitPos) continue;
    if (LevelGrid.Instance.HasAnyUnitOnGridPosition(test)) continue;
    if (!PathFinding.Instance.IsWalkableGridPosition(test)) continue;

    // Heuristiikkakarsinta (Manhattan*10): jos edes optimistinen kustannus > budjetti, skip
    int lowerBound = PathFinding.Instance.CalculateDistance(unitPos, test);
    if (lowerBound > moveBudgetCost) continue;

    // *** VAIN YKSI A* per ruutu (mutta nyt cachetettuna saman framen sisällä) ***
    if (!TryGetPathCostCached(unitPos, test, out int pathCost)) continue; // ei polkua
    if (pathCost > moveBudgetCost) continue;

    valid.Add(test);
}

return valid;
}

public override string GetActionName()
{
    return "Move";
}

// --- Per-frame pathfinding cache ---
private struct PathQuery : IEquatable<PathQuery> {
    public GridPosition start;
    public GridPosition end;
    public bool Equals(PathQuery other) => start == other.start && end == other.end;
    public override bool Equals(object obj) => obj is PathQuery pq && Equals(pq);
    public override int GetHashCode() => (start.GetHashCode() * 397) ^ end.GetHashCode();
}

private struct PathCacheEntry {
    public bool exists;
```

RogueShooter – All Scripts

```
    public int cost;
    // Jos joskus haluat itse polun, voit lisätä: public List<GridPosition> path;
}

// Yhteinen cache tälle actionille (voisi olla myös static jos haluat jakaa yli instanssien)
private Dictionary<PathQuery, PathCacheEntry> _pathCache = new Dictionary<PathQuery, PathCacheEntry>(256);
private int _cacheFrame = -1;

private bool TryGetPathCostCached(GridPosition start, GridPosition end, out int cost)
{
    // Nollaa cache kerran per frame
    int frame = Time.frameCount;
    if (_cacheFrame != frame) {
        _pathCache.Clear();
        _cacheFrame = frame;
    }

    var key = new PathQuery { start = start, end = end };
    if (_pathCache.TryGetValue(key, out var entry)) {
        cost = entry.cost;
        return entry.exists;
    }

    // Ei ollut välimuistissa -> laske kerran
    var path = PathFinding.Instance.FindPath(start, end, out int pathCost, maxMoveDistance);
    bool exists = path != null;
    _pathCache[key] = new PathCacheEntry { exists = exists, cost = pathCost };

    cost = pathCost;
    return exists;
}

public int GetMaxMoveDistance()
{
    return maxMoveDistance;
}

/// <summary>
/// ENEMY AI:
/// Move toward to Player unit to make shoot action.
/// </summary>
public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
{
    int targetCountAtGridPosition = unit.GetAction<ShootAction>().GetTargetCountAtPosition(gridPosition);

    return new EnemyAIAction
    {
        gridPosition = gridPosition,
        actionValue = targetCountAtGridPosition * 10,
    };
}
}
```

--

RogueShooter – All Scripts

Assets/scripts/Units/UnitActions/Actions/ShootAction.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

public class ShootAction : BaseAction
{
    public static event EventHandler<OnShootEventArgs> OnAnyShoot;

    public event EventHandler<OnShootEventArgs> OnShoot;

    public class OnShootEventArgs : EventArgs
    {
        public Unit targetUnit;
        public Unit shootingUnit;
    }

    private enum State
    {
        Aiming,
        Shooting,
        Cooloff
    }

    [SerializeField] private LayerMask obstaclesLayerMask;
    private State state;
    [SerializeField] private int maxShootDistance = 7;
    [SerializeField] private int damage = 30;
    [SerializeField] private WeaponDefinition weapon;

    private float stateTimer;
    private Unit targetUnit;
    private bool canShootBullet;

    // Update is called once per frame
    void Update()
    {
        if (!isActive) return;

        stateTimer -= Time.deltaTime;
        switch (state)
        {
            case State.Aiming:
                if (targetUnit != null)
                {
                    if (RotateTowards(targetUnit.GetWorldPosition()))
                    {
                        stateTimer = Mathf.Min(stateTimer, 0.4f);
                    }
                }
            }
        }
    }
}
```

RogueShooter – All Scripts

```
        break;
    case State.Shooting:
        if (canShootBullet)
        {
            Shoot();
            canShootBullet = false;
        }
        break;
    case State.Cooloff:
        break;
}

if (stateTimer <= 0f)
{
    NextState();
}
}

private void NextState()
{
    switch (state)
    {
        case State.Aiming:
            state = State.Shooting;
            float shootingStateTime = 0.1f;
            stateTimer = shootingStateTime;
            break;
        case State.Shooting:
            state = State.Cooloff;
            float cooloffStateTime = 0.5f;
            stateTimer = cooloffStateTime;
            break;
        case State.Cooloff:
            ActionComplete();
            break;
    }
}

private void Shoot()
{
    OnAnyShoot?.Invoke(this, new OnShootEventArgs
    {
        targetUnit = targetUnit,
        shootingUnit = unit
    });

    OnShoot?.Invoke(this, new OnShootEventArgs
    {
        targetUnit = targetUnit,
        shootingUnit = unit
    });
}
```

RogueShooter – All Scripts

```
// Laske tulos
var result = ShootingResolver.Resolve(unit, targetUnit, weapon);

// Debug: näe mihin kategoriaan osui
Debug.Log($"[{unit.name}] → [{targetUnit.name}] | {result.tier} | dmg:{result.damage}");

switch (result.tier)
{
    case ShotTier.CritMiss:
        // Täysi huti – ei vaikutusta
        Debug.Log("Critical miss! Bullet flies off wildly.");
        return;

    case ShotTier.Miss:
        if (GetCoverType(targetUnit) == CoverService.CoverType.None)
        {
            MakeDamage(damage, targetUnit);
            return;
        }

        if (targetUnit.GetPersonalCover() <= 0)
        {
            MakeDamage(damage/3, targetUnit);
            return;
        }

        targetUnit.SetPersonalCover(
            Mathf.Max(0, targetUnit.GetPersonalCover() - result.damage));
        // NetworkSync.UpdateCoverUI(targetUnit);
        return;

    case ShotTier.Graze:
        if (GetCoverType(targetUnit) == CoverService.CoverType.None)
        {
            MakeDamage(damage, targetUnit);
            return;
        }

        if (targetUnit.GetPersonalCover() <= 0)
        {
            MakeDamage(damage/2, targetUnit);
            return;
        }

        targetUnit.SetPersonalCover(
            Mathf.Max(0, targetUnit.GetPersonalCover() - result.damage));
        // NetworkSync.UpdateCoverUI(targetUnit);
        return;

    case ShotTier.Hit:
```


RogueShooter – All Scripts

```
        if (GetCoverType(targetUnit) == CoverService.CoverType.None)
        {
            MakeDamage(damage, targetUnit);
            return;
        }

        targetUnit.SetPersonalCover(
            Mathf.Max(0, targetUnit.GetPersonalCover() - result.damage));
        // NetworkSync.UpdateCoverUI(targetUnit);
        // Normaaali osuma → käytetään jo olemassa olevaa pipelinea
        ApplyHit(result.damage, targetUnit, false);
        return;

    case ShotTier.Crit:
        targetUnit.SetPersonalCover(
            Mathf.Max(0, targetUnit.GetPersonalCover() - result.damage));
        // NetworkSync.UpdateCoverUI(targetUnit);
        Debug.Log("Critical hit!");
        // Kriittinen osuma – ohitetaan cover
        MakeDamage(result.damage, targetUnit);
        return;
    }
}

}

public override int GetActionPointsCost()
{
    return 1;
}

public override string GetActionName()
{
    return "Shoot";
}

public List<GridPosition> GetValidActionGridPositionList(GridPosition unitGridPosition)
{
    List<GridPosition> validGridPositionList = new();

    for (int x = -maxShootDistance; x <= maxShootDistance; x++)
    {
        for (int z = -maxShootDistance; z <= maxShootDistance; z++)
        {
            for (int floor = -maxShootDistance; floor <= maxShootDistance; floor++)
            {
                GridPosition offsetGridPosition = new(x, z, floor);
                GridPosition testGridPosition = unitGridPosition + offsetGridPosition;

                // Check if the test grid position is within the valid range and not occupied by another unit
                if (!LevelGrid.Instance.IsValidGridPosition(testGridPosition)) continue;
                int testDistance = Mathf.Abs(x) + Mathf.Abs(z);
                if (testDistance > maxShootDistance) continue;
            }
        }
    }
}
```

RogueShooter – All Scripts

```
        if (!LevelGrid.Instance.HasAnyUnitOnGridPosition(testGridPosition)) continue;

        Unit targetUnit = LevelGrid.Instance.GetUnitAtGridPosition(testGridPosition);
        if (targetUnit == null) continue;
        // Make sure we don't include friendly units.
        if (targetUnit.IsEnemy() == unit.IsEnemy()) continue;

        Vector3 unitWorldPosition = LevelGrid.Instance.GetWorldPosition(unitGridPosition);
        Vector3 shootDir = (targetUnit.GetWorldPosition() - unitWorldPosition).normalized;
        float unitShoulderHeight = 2.5f;
        if (Physics.Raycast(
            unitWorldPosition + Vector3.up * unitShoulderHeight,
            shootDir,
            Vector3.Distance(unitWorldPosition, targetUnit.GetWorldPosition()),
            obstaclesLayerMask))
        {
            //Target Unit is Blocked by an Obstacle
            continue;
        }
        validGridPositionList.Add(testGridPosition);
    }
}

return validGridPositionList;
}

public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
{
    targetUnit = LevelGrid.Instance.GetUnitAtGridPosition(gridPosition);

    state = State.Aiming;
    float aimingStateTime = 1f;
    stateTimer = aimingStateTime;

    canShootBullet = true;

    ActionStart(onActionComplete);
}

public Unit GetTargetUnit()
{
    return targetUnit;
}

public int GetMaxShootDistance()
{
    return maxShootDistance;
}

/// ----- AI -----
```

RogueShooter – All Scripts

```
/// <summary>
/// ENEMY AI: Make a list about Player Units what Enemy Unit can shoot.
/// </summary>
public override List<GridPosition> GetValidGridPositionList()
{
    GridPosition unitGridPosition = unit.GetGridPosition();
    return GetValidActionGridPositionList(unitGridPosition);
}

/// <summary>
/// ENEMY AI: How "good" target is. Target who have a lowest health, gets a higher actionvalue
/// </summary>
public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
{
    Unit targetUnit = LevelGrid.Instance.GetUnitAtGridPosition(gridPosition);

    return new EnemyAIAction
    {
        gridPosition = gridPosition,
        actionValue = 100 + Mathf.RoundToInt((1 - targetUnit.GetHealthNormalized()) * 100f), //Take at target who have a lowest health.
    };
}

public int GetTargetCountAtPosition(GridPosition gridPosition)
{
    return GetValidActionGridPositionList(gridPosition).Count;
}
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitActions/Actions/TurnTowardsAction.cs

```
using System;
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

/// <summary>
///     This class is responsible for spinning a unit around its Y-axis.
/// </summary>
/// <remarks>
///     Change to turn towards the direction the mouse is pointing
/// </remarks>

public class TurnTowardsAction : BaseAction
{
    private enum State
    {
        StartTurning,
        EndTurning,
    }
    private State state;
    public Vector3 TargetWorld { get; private set; }

    private float stateTimer;
    GridPosition gridPosition;

    private void Update()
    {
        if (!isActive)
        {
            return;
        }
        stateTimer -= Time.deltaTime;
        switch (state)
        {
            case State.StartTurning:
                if (RotateTowards(TargetWorld))
                {
                    stateTimer = 0;
                }
                break;
            case State.EndTurning:
                break;
        }

        if (stateTimer <= 0f)
        {
            NextState();
        }
    }
}
```

RogueShooter – All Scripts

```
    }
}

private void NextState()
{
    switch (state)
    {
        case State.StartTurning:
            state = State.EndTurning;
            float afterTurnStateTime = 0.5f;
            stateTimer = afterTurnStateTime;

            break;
        case State.EndTurning:
            ActionComplete();
            break;
    }
}

public override void TakeAction(GridPosition gridPosition, Action onActionComplete)
{
    TargetWorld = LevelGrid.Instance.GetWorldPosition(gridPosition);
    this.gridPosition = gridPosition;
    state = State.StartTurning;
    float beforeTurnStateTime = 0.7f;
    stateTimer = beforeTurnStateTime;
    ActionStart(onActionComplete);
}

public override string GetActionName()
{
    return "Turn";
}

public override List<GridPosition> GetValidGridPositionList()
{
    List<GridPosition> validGridPositionList = new();

    GridPosition unitGridPosition = unit.GetGridPosition();

    for (int x = -1; x <= 1; x++)
    {
        for (int z = -1; z <= 1; z++)
        {
            GridPosition offsetGridPosition = new(x, z, 0);
            GridPosition testGridPosition = unitGridPosition + offsetGridPosition;
            validGridPositionList.Add(testGridPosition);
        }
    }

    return validGridPositionList;
}
```

RogueShooter – All Scripts

```
public override int GetActionPointsCost()
{
    return 100;
}

/// <summary>
/// ENEMY AI:
/// Currently this action has no value. Just testing!
/// </summary>

public override EnemyAIAction GetEnemyAIAction(GridPosition gridPosition)
{
    return new EnemyAIAction
    {
        gridPosition = gridPosition,
        actionValue = 0,
    };
}
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitActions/ScreenShakeActions.cs

```
using System;
using UnityEngine;

public class ScreenShakeActions : MonoBehaviour
{
    private void Start()
    {
        ShootAction.OnAnyShoot += ShootAction_OnAnyShoot;
        GrenadeProjectile.OnAnyGranadeExploded += GrenadeProjectile_OnAnyGranadeExploded;
        MeleeAction.OnAnyMeleeActionHit += MeleeAction_OnAnyMeleeActionHit;
    }

    private void OnDisable()
    {
        ShootAction.OnAnyShoot -= ShootAction_OnAnyShoot;
        GrenadeProjectile.OnAnyGranadeExploded -= GrenadeProjectile_OnAnyGranadeExploded;
    }

    private void ShootAction_OnAnyShoot(object sender, ShootAction.OnShootEventArgs e)
    {
        ScreenShake.Instance.RecoilCameraShake(1f);
    }

    private void GrenadeProjectile_OnAnyGranadeExploded(object sender, EventArgs e)
    {
        ScreenShake.Instance.ExplosiveCameraShake(2f);
    }

    private void MeleeAction_OnAnyMeleeActionHit(object sender, EventArgs e)
    {
        ScreenShake.Instance.RecoilCameraShake(3f);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitActions/UnitActionSystem.cs

```
using System;
using kcp2k;
using UnityEngine;
using UnityEngine.EventSystems;

/// <summary>
/// This script handles the unit action system in the game.
/// It allows the player to select units and perform actions on them, such as moving or shooting.
/// It also manages the state of the selected unit and action, and prevents the player from performing multiple actions at the same time.
/// Note: This class Script Execution Order is set to be executed before UnitManager.cs. High priority.
/// </summary>
public class UnitActionSystem : MonoBehaviour
{
    public static UnitActionSystem Instance { get; private set; }

    public event EventHandler OnSelectedUnitChanged;
    public event EventHandler OnSelectedActionChanged;
    public event EventHandler<bool> OnBusyChanged;
    public event EventHandler OnActionStarted;

    // This allows the script to only interact with objects on the specified layer
    [SerializeField] private LayerMask unitLayerMask;
    [SerializeField] private Unit selectedUnit;

    private BaseAction selectedAction;

    // Prevents the player from performing multiple actions at the same time
    private bool isBusy;

    private void Awake()
    {
        selectedUnit = null;
        // Ensure that there is only one instance in the scene
        if (Instance != null)
        {
            Debug.LogError("UnitActionSystem: More than one UnitActionSystem in the scene!" + transform + " " + Instance);
            Destroy(gameObject);
            return;
        }
        Instance = this;
    }

    private void Start()
    {
    }

    private void Update()
    {
        // Debug.Log(LevelGrid.Instance.GetGridPosition(MouseWorld.GetMouseWorldPosition()));
        // Prevents the player from performing multiple actions at the same time
    }
}
```


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```
    if (isBusy) return;

    // if is not the player's turn, ignore input
    if (!TurnSystem.Instance.IsPlayerTurn()) return;

    // Ignore input if the mouse is over a UI element
    if (EventSystem.current.IsPointerOverGameObject()) return;

    // Check if the player is trying to select a unit or move the selected unit
    if (TryHandleUnitSelection()) return;

    HandleSelectedAction();
}

private void HandleSelectedAction()
{
    if (selectedUnit == null || selectedAction == null) return;

    GridPosition targetGridPosition;

    if (InputManager.Instance.IsMouseButtonDownThisFrame() && selectedAction is ShootAction)
    {
        Ray ray = Camera.main.ScreenPointToRay(InputManager.Instance.GetMouseScreenPosition());
        if (Physics.Raycast(ray, out RaycastHit hit, float.MaxValue, unitLayerMask))
        {
            if (hit.transform.TryGetComponent<Unit>(out Unit unit))
            {
                if (unit.IsEnemy())
                {
                    targetGridPosition = unit.GetGridPosition();
                    TryExecuteSelectedAction(targetGridPosition);
                }
            }
        }
    }
    else if (InputManager.Instance.IsMouseButtonDownThisFrame())
    {
        // entinen logiikka: klikkaus ruutuun
        Vector3 world = MouseWorld.GetPositionOnlyHitVisible(); // lattiat ym. näkyvyysfiltteri
        targetGridPosition = LevelGrid.Instance.GetGridPosition(world);
        TryExecuteSelectedAction(targetGridPosition);
    }
}

private void TryExecuteSelectedAction(GridPosition gp)
{
    // (valmiiksi olemassa olevaa logiikkaa)
    int steps = selectedUnit.GetMaxMoveDistance();
    int moveBudgetCost = PathFinding.CostFromSteps(steps);
    int estCost = PathFinding.Instance.CalculateDistance(selectedUnit.GetGridPosition(), gp);
    if (estCost > moveBudgetCost * 10) return;
```

RogueShooter – All Scripts

```
        if (!selectedAction.IsValidGridPosition(gp) ||
            !selectedUnit.TrySpendActionPointsToTakeAction(selectedAction)) return;

        SetBusy();
        selectedAction.TakeAction(gp, ClearBusy);
        OnActionStarted?.Invoke(this, EventArgs.Empty);
    }

    /// <summary>
    ///     Prevents the player from performing multiple actions at the same time
    /// </summary>
    private void SetBusy()
    {
        isBusy = true;
        OnBusyChanged?.Invoke(this, isBusy);
    }

    /// <summary>
    ///     This method is called when the action is completed.
    /// </summary>
    private void ClearBusy()
    {
        isBusy = false;
        OnBusyChanged?.Invoke(this, isBusy);
    }

    /// <summary>
    ///     This method is called when the player clicks on a unit in the game world.
    ///     Check if the mouse is over a unit
    ///     If so, select the unit and return
    ///     If not, move the selected unit to the mouse position
    /// </summary>
    private bool TryHandleUnitSelection()
    {
        if (InputManager.Instance.IsMouseButtonDownThisFrame())
        {
            Ray ray = Camera.main.ScreenPointToRay(InputManager.Instance.GetMouseScreenPosition());
            if (Physics.Raycast(ray, out RaycastHit hit, float.MaxValue, unitLayerMask))
            {
                if (hit.transform.TryGetComponent<Unit>(out Unit unit))
                {
                    if (AuthorityHelper.HasLocalControl(unit) || unit == selectedUnit) return false;
                    SetSelectedUnit(unit);
                    return true;
                }
            }
        }

        return false;
    }

    /// <summary>
```

RogueShooter – All Scripts

```
///     Sets the selected unit and triggers the OnSelectedUnitChanged event.
///     By defaults set the selected action to the unit's move action. The most common action.
/// </summary>
private void SetSelectedUnit(Unit unit)
{
    if (unit.IsEnemy())
    {
        if(selectedAction is ShootAction)
        {
            HandleSelectedAction();
        }
        return;
    }
    selectedUnit = unit;
    // SetSelectedAction(unit.GetMoveAction());
    SetSelectedAction(unit.GetAction<MoveAction>());
    OnSelectedUnitChanged?.Invoke(this, EventArgs.Empty);
}

/// <summary>
///     Sets the selected action and triggers the OnSelectedActionChanged event.
/// </summary>
public void SetSelectedAction(BaseAction baseAction)
{
    selectedAction = baseAction;
    OnSelectedActionChanged?.Invoke(this, EventArgs.Empty);
}

public Unit GetSelectedUnit()
{
    return selectedUnit;
}

public BaseAction GetSelectedAction()
{
    return selectedAction;
}

// Lock/Unlock input methods for PlayerController when playing online
public void LockInput() { if (!isBusy) SetBusy(); }
public void UnlockInput() { if (isBusy) ClearBusy(); }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitAnimator.cs

```
using UnityEngine;
using System;
using Mirror;

[RequireComponent(typeof(MoveAction))]
public class UnitAnimator : NetworkBehaviour
{
    [Header("UnitWeaponVisibilitySync")]
    [SerializeField] private WeaponVisibilitySync weaponVis;

    [Header("Animators")]
    [SerializeField] private Animator animator;
    [SerializeField] private NetworkAnimator netAnim;

    [Header("Projectiles")]
    [SerializeField] private GameObject bulletProjectilePrefab;
    [SerializeField] private GameObject grenadeProjectilePrefab;

    [Header("Spawnpoints")]
    [SerializeField] private Transform shootPointTransform;
    [SerializeField] private Transform rightHandTransform;

    private static bool IsNetworkActive() => NetworkClient.active || NetworkServer.active;

    private void Awake()
    {
        if (TryGetComponent<MoveAction>(out MoveAction moveAction))
        {
            moveAction.OnStartMoving += MoveAction_OnStartMoving;
            moveAction.OnStopMoving += MoveAction_OnStopMoving;
        }

        if (TryGetComponent<ShootAction>(out ShootAction shootAction))
        {
            shootAction.OnShoot += ShootAction_OnShoot;
        }

        if (TryGetComponent<GranadeAction>(out GranadeAction granadeAction))
        {
            granadeAction.ThrowGranade += GrenadeAction_ThrowGranade;
            granadeAction.ThrowReady += GrenadeAction_ThrowReady;
        }

        if (TryGetComponent<MeleeAction>(out MeleeAction meleeAction))
        {
            meleeAction.OnMeleeActionStarted += MeleeAction_OnMeleeActionStarted;
            meleeAction.OnMeleeActionCompleted += MeleeAction_OnMeleeActionCompleted;
        }
    }
}
```

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```
private void Start()
{
    EquipRifle();
}

void OnDisable()
{
    if (TryGetComponent<MoveAction>(out MoveAction moveAction))
    {
        moveAction.OnStartMoving -= MoveAction_OnStartMoving;
        moveAction.OnStopMoving -= MoveAction_OnStopMoving;
    }

    if (TryGetComponent<ShootAction>(out ShootAction shootAction))
    {
        shootAction.OnShoot -= ShootAction_OnShoot;
    }

    if (TryGetComponent<GranadeAction>(out GranadeAction granadeAction))
    {
        granadeAction.ThrowGranade -= GrenadeAction_ThrowGranade;
        granadeAction.ThrowReady -= GrenadeAction_ThrowReady;
    }

    if (TryGetComponent<MeleeAction>(out MeleeAction meleeAction))
    {
        meleeAction.OnMeleeActionStarted -= MeleeAction_OnMeleeActionStarted;
        meleeAction.OnMeleeActionCompleted -= MeleeAction_OnMeleeActionCompleted;
    }
}

private void MoveAction_OnStartMoving(object sender, EventArgs e)
{
    animator.SetBool("IsRunning", true);
}

private void MoveAction_OnStopMoving(object sender, EventArgs e)
{
    animator.SetBool("IsRunning", false);
}

private void ShootAction_OnShoot(object sender, ShootAction.OnShootEventArgs e)
{
    if (!IsNetworkActive())
    {
        animator.SetTrigger("Shoot");
    }
    else
    {
        netAnim.SetTrigger("Shoot");
    }

    Vector3 target = e.targetUnit.GetWorldPosition();
```

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```
float unitShoulderHeight = 2.5f;
target.y += unitShoulderHeight;
NetworkSync.SpawnBullet(bulletProjectilePrefab, shootPointTransform.position, target);
}

private void MeleeAction_OnMeleeActionStarted(object sender, EventArgs e)
{
    EquipMelee();
    if (!IsNetworkActive())
    {
        animator.SetTrigger("Melee");
    }
    else
    {
        netAnim.SetTrigger("Melee");
    }
}

private void MeleeAction_OnMeleeActionCompleted(object sender, EventArgs e)
{
    EquipRifle();
}

private void GrenadeActionStart()
{
    weaponVis.OwnerRequestSet(rifleRight: false, rifleLeft: true, meleeLeft: false, grenade: false);
}

private Vector3 pendingGrenadeTarget;
private GrenadeAction pendingGrenadeAction;
private void GrenadeAction_ThrowGrenade(object sender, EventArgs e)
{
    pendingGrenadeAction = (GrenadeAction)sender;
    pendingGrenadeTarget = pendingGrenadeAction.TargetWorld;
    GrenadeActionStart();
    if (!IsNetworkActive())
    {
        animator.SetTrigger("ThrowGrenade");
    }
    else
    {
        netAnim.SetTrigger("ThrowGrenade");
    }
}

// ----- START Grenade Animation events START -----
// Event marks is set in animation. UnitAnimations -> Throw Grenade Stand
public void AE_PickGrenadeStand()
{
    EquipGrenade();
}

public void AE_ThrowGrenadeStandRelease()
{
}
```

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```
// --- GUARD: jos pending on jo käytetty, älä tee mitään (estää tuplan samalta koneelta)
if (pendingGrenadeAction == null) return;

// --- GATE: onlinessa vain omistaja-client saa jatkaa (server ja ei-ownerit return)
if (NetworkClient.active || NetworkServer.active)
{
    var ni = GetComponentInParent<NetworkIdentity>();
    if (!(isClient && ni && ni.isOwned)) return;
}

// Mistä kranaatti lähtee (sama logiikka kuin luodeilla)
Vector3 origin = rightHandTransform.position;

// Kutsu keskitettyä synkkaa (täsmälleen kuin luodeissa)
NetworkSync.SpawnGrenade(grenadeProjectilePrefab, origin, pendingGrenadeTarget);

// Siivous kuten ennen
pendingGrenadeAction?.OnGrenadeBehaviourComplete();
pendingGrenadeAction = null;
}

public void AE_OnGrenadeThrowStandFinished()
{
    EquipRifle();
}

//----- END Grenade Animation events END -----
private void GrenadeAction_ThrowReady(object sender, EventArgs e)
{
    weaponVis.OwnerRequestSet(rifleRight: false, rifleLeft: true, meleeLeft: false, grenade: false);
}

private void EquipRifle()
{
    weaponVis.OwnerRequestSet(rifleRight: true, rifleLeft: false, meleeLeft: false, grenade: false);
}

private void EquipMelee()
{
    weaponVis.OwnerRequestSet(rifleRight: true, rifleLeft: false, meleeLeft: true, grenade: false);
}

private void EquipGranade()
{
    weaponVis.OwnerRequestSet(rifleRight: false, rifleLeft: true, meleeLeft: false, grenade: true);
}
}
```

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Assets/scripts/Units/UnitAnimatorEventRelay.cs

```
using UnityEngine;

/// <summary>
/// This is needed so that animation event-bound functions in UnitAnimator can be used. Such as AE_Throw Grenade Stand Release()
/// </summary>
public class AnimationEventRelay : MonoBehaviour
{
    [SerializeField] private UnitAnimator unitAnimator;

    void Awake()
    {
        // Etsi parentista jos ei asetettu Inspectorissa
        if (!unitAnimator) unitAnimator = GetComponentInParent<UnitAnimator>();
    }

    // Täsmälleen sama nimi kuin Animation Eventin Function-kentässä
    public void AE_ThrowGrenadeStandRelease()
    {
        unitAnimator?.AE_ThrowGrenadeStandRelease();
    }

    public void AE_PickGrenadeStand()
    {
        unitAnimator?.AE_PickGrenadeStand();
    }
}
```


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Assets/scripts/Units/UnitArchetypes/UnitArchetype.cs

```
using UnityEngine;

[CreateAssetMenu(menuName = "RogueShooter/UnitArchetype")]
public class UnitArchetype : ScriptableObject
{
    [Header("Base skills")]
    public int personalCoverMax = 200;
    public int coverRegenOnMove = 1;
    public int coverRegenPerUnusedAP = 50;

    public int shootingSkill = 0;           // 0..10
    public int accPerSkill = 3;             // +3% tarkkuutta / taso
    public int lowCoverPenalty = 12;        // -12% osumatodennäköisyys
    public int highCoverPenalty = 25;       // -25%

    [Header("Progression (optional)")]
    public AnimationCurve coverMaxByLevel = AnimationCurve.Linear(1, 200, 10, 300);
    public AnimationCurve regenByLevel = AnimationCurve.Linear(1, 20, 10, 35);
}
```

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Assets/scripts/Units/UnitArchetypes/UnitSkills.cs

```
using UnityEngine;

[System.Serializable]
public class UnitSkills
{
    public int personalCoverMax = 200;
    public int CoverRegenOnMove = 20;
    public float coverMitigationMultiplier = 1f; // varalle jatsoon (+% vaimennukseen)
}
```

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Assets/scripts/Units/UnitManager.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

/// <summary>
/// This class is responsible for managing all units in the game.
/// It keeps track of all units, friendly units, and enemy units.
/// It listens to unit spawn and death events to update its lists accordingly.
/// Note: This class Script Script Execution Order is set to be executed after UnitActionSystem.cs. High priority.
/// </summary>
public class UnitManager : MonoBehaviour
{
    public static UnitManager Instance { get; private set; }
    private List<Unit> unitList;
    private List<Unit> friendlyUnitList;
    private List<Unit> enemyUnitList;

    private void Awake()
    {
        if (Instance != null)
        {
            Debug.LogError("There's more than one UnitManager! " + transform + " - " + Instance);
            Destroy(gameObject);
            return;
        }
        Instance = this;

        unitList = new List<Unit>();
        friendlyUnitList = new List<Unit>();
        enemyUnitList = new List<Unit>();
    }

    private void Start()
    {
        Unit.OnAnyUnitSpawned += Unit_OnAnyUnitSpawned;
        Unit.OnAnyUnitDead += Unit_OnAnyUnitDead;
    }

    void OnEnable()
    {
        Unit.OnAnyUnitSpawned += Unit_OnAnyUnitSpawned;
        Unit.OnAnyUnitDead += Unit_OnAnyUnitDead;
    }

    void OnDisable()
    {
        Unit.OnAnyUnitSpawned -= Unit_OnAnyUnitSpawned;
        Unit.OnAnyUnitDead -= Unit_OnAnyUnitDead;
    }
}
```

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```
private void Unit_OnAnyUnitSpawned(object sender, EventArgs e)
{
    Unit unit = sender as Unit;
    unitList.Add(unit);

    if (unit.IsEnemy())
    {
        enemyUnitList.Add(unit);
    }
    else
    {
        friendlyUnitList.Add(unit);
    }
}

private void Unit_OnAnyUnitDead(object sender, EventArgs e)
{
    Unit unit = sender as Unit;
    unitList.Remove(unit);

    if (unit.IsEnemy())
    {
        enemyUnitList.Remove(unit);
    }
    else
    {
        friendlyUnitList.Remove(unit);
    }
}

public List<Unit> GetUnitList()
{
    return unitList;
}

public List<Unit> GetFriendlyUnitList()
{
    return friendlyUnitList;
}

public List<Unit> GetEnemyUnitList()
{
    return enemyUnitList;
}

public void ClearAllUnitLists()
{
    unitList.Clear();
    friendlyUnitList.Clear();
    enemyUnitList.Clear();
}
```

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```
}  
}
```

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Assets/scripts/Units/UnitPathFinding/PathFinding.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;

/// @file PathFinding.cs
/// @brief Core pathfinding system for RogueShooter.
///
/// This component implements the game's grid-based navigation logic using a custom A* algorithm
/// with full support for multi-floor environments, movement budgets, and edge-based wall detection.
///
/// ### Overview
/// The pathfinding system converts Unity scene geometry into an abstract tactical grid used
/// by both player and AI units. Each cell is represented by a `PathNode` containing walkability,
/// cost, and edge-wall information. The system supports 8-directional movement (N, NE, E, SE, S, SW, W, NW)
/// and dynamically links multiple floors through designer-placed `PathfindingLink` components.
///
/// ### System integration
/// - **LevelGrid** - Defines grid dimensions and provides world-to-grid coordinate conversions.
/// - **EdgeBaker** - Scans scene colliders to detect thin obstacles between cells and marks walls accordingly.
/// - **PathFinding** - Performs A* searches using the processed node and edge data.
///
/// ### Key features
/// - Fully deterministic and allocation-free per search (generation-ID based node reuse).
/// - Accurate obstacle handling using edge blockers (no corner clipping or one-way walls).
/// - Move-budget based path truncation for tactical range queries and AI planning.
/// - Extensible multi-floor connectivity via `PathfindingLink` objects.
/// - Optional runtime diagnostics through `PathfindingDiagnostics` (profiling search times and expansions).
///
/// ### Why this exists in RogueShooter
/// - The game's tactical, turn-based design requires predictable and grid-aligned movement.
/// - Unity's built-in NavMesh system is unsuitable for deterministic tile-based combat logic.
/// - Custom A* implementation allows tight integration with game-specific mechanics such as
///   cover, destructible walls, and limited-range actions.
///
/// In summary, this file defines the core pathfinding logic that powers all unit movement
/// and AI navigation in RogueShooter, ensuring consistency between physical scene geometry
/// and tactical gameplay rules.

/// <summary>
/// Grid-based A* pathfinding for 8-directional movement (N, NE, E, SE, S, SW, W, NW) across multiple floors.
///
/// What it does:
/// - Builds and queries a per-floor grid of PathNodes and computes shortest paths using A* with an octile heuristic.
/// - Respects fine-grained edge blockers (walls/rails/doorframes) baked by <see cref="EdgeBaker"/> so units can't
///   cut corners or move/shoot through narrow obstacles.
/// - Supports optional move budgets (in "steps") for tactical range queries and AI decisions.
/// - Supports explicit inter-cell "links" (stairs/elevators/hatches) that connect arbitrary cells and floors.
///
/// Why this exists in RogueShooter:
/// - The game is turn-based and tile-based; we need deterministic, frame-stable paths that match tactical rules,
```

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```
/// not freeform NavMesh paths.
/// - Edge-aware movement prevents diagonal corner-cutting and enforces cover/door behavior consistent with combat.
/// - Budgeted pathfinding enables fast “reachable area” calculations for UI previews and AI planning.
///
/// Design notes:
/// - Uses a lightweight custom PriorityQueue and generation IDs to avoid per-search allocations and stale scores.
/// - Movement costs: straight = 10, diagonal = 20 (octile distance for heuristic and step costs).
/// - Runs after <see cref="LevelGrid"/> initialization; floor walkability is raycasted once, edges baked next,
/// then A* queries can safely rely on up-to-date node/edge data.
/// - Optional debug visualizations can create grid debug objects for inspection in the editor.
/// </summary>
public class PathFinding : MonoBehaviour
{
    public static PathFinding Instance { get; private set; }

    private const int MOVE_STRAIGHT_COST = 10;
    private const int MOVE_DIAGONAL_COST = 20;

    [Header("Debug")]
    [SerializeField] private bool showDebug = false;
    [SerializeField] private Transform gridDebugPrefab;

    [Header("Layers")]
    [SerializeField] private LayerMask obstaclesLayerMask;
    [SerializeField] private LayerMask floorLayerMask;

    [Header("Links")]
    [SerializeField] private Transform pathfindingLinkContainer;

    private int width;
    private int height;
    private int currentGenerationID = 0;

    private List<GridSystem<PathNode>> gridSystemList;
    private List<PathfindingLink> pathfindingLinkList;

    private void Awake()
    {
        if (Instance != null)
        {
            Debug.LogError("PathFinding: More than one PathFinding in the scene! " + transform + " - " + Instance);
            Destroy(gameObject);
            return;
        }
        Instance = this;
    }

    /// <summary>
    /// Initializes the pathfinding system and builds all per-floor grid data.
    ///
    /// What it does:
    /// - Creates a <see cref="GridSystem{PathNode}"/> for each floor with the given dimensions.
```

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```
/// - Performs raycast-based walkability detection for every grid cell using floor and obstacle layers.
/// - Invokes <see cref="EdgeBaker"/> to detect thin edge blockers between walkable cells.
/// - Collects any explicit <see cref="PathfindingLink"/> connections (stairs, elevators, etc.) from the scene.
///
/// Why this exists in RogueShooter:
/// - Converts the 3D scene geometry into a grid-based navigation map used by all AI and tactical systems.
/// - Ensures that units move on valid walkable surfaces and respect real physical barriers.
/// - Keeps the runtime logic deterministic and self-contained without relying on Unity's NavMesh.
///
/// Implementation notes:
/// - Should be called once during level initialization (by LevelGrid or GameManager).
/// - Automatically performs full edge baking after walkability setup.
/// - Uses layer masks for flexibility: <c>floorLayerMask</c> defines valid surfaces, <c>obstaclesLayerMask</c> blocks them.
/// </summary>
public void Setup(int width, int height, float cellSize, int floorAmount)
{
    this.width = width;
    this.height = height;

    gridSystemList = new List<GridSystem<PathNode>>();

    // 1) Create one grid per floor
    for (int floor = 0; floor < floorAmount; floor++)
    {
        GridSystem<PathNode> gridSystem = new GridSystem<PathNode>(
            width, height, cellSize, floor, LevelGrid.FLOOR_HEIGHT,
            (GridSystem<PathNode> g, GridPosition gridPosition) => new PathNode(gridPosition)
        );

        // Optional: visualize grid in editor for debugging
        if (showDebug && gridDebugPrefab != null)
        {
            gridSystem.CreateDebugObjects(gridDebugPrefab);
        }

        gridSystemList.Add(gridSystem);
    }

    // 2) Raycast: determine which cells are walkable or blocked
    float raycastOffsetDistance = 1f;
    float raycastDistance = raycastOffsetDistance * 2f;

    for (int x = 0; x < width; x++)
    {
        for (int z = 0; z < height; z++)
        {
            for (int floor = 0; floor < floorAmount; floor++)
            {
                GridPosition gridPosition = new GridPosition(x, z, floor);
                Vector3 worldPosition = LevelGrid.Instance.GetWorldPosition(gridPosition);

                // Default to non-walkable
            }
        }
    }
}
```


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```
        GetNode(x, z, floor).SetIsWalkable(false);

        // Downward ray: detect if a valid floor exists under this cell
        if (Physics.Raycast(
            worldPosition + Vector3.up * raycastOffsetDistance,
            Vector3.down,
            raycastDistance,
            floorLayerMask))
        {
            GetNode(x, z, floor).SetIsWalkable(true);
        }

        // Upward ray: short check for obstacles blocking this space
        if (Physics.Raycast(
            worldPosition + Vector3.down * raycastOffsetDistance,
            Vector3.up,
            raycastDistance,
            obstaclesLayerMask))
        {
            GetNode(x, z, floor).SetIsWalkable(false);
        }
    }
}

// 3) Bake edges between cells (walls, rails, etc.)
EdgeBaker.Instance.BakeAllEdges();

// 4) Gather explicit pathfinding links (stairs, lifts, portals)
pathfindingLinkList = new List<PathfindingLink>();
if (pathfindingLinkContainer != null)
{
    foreach (Transform linkTf in pathfindingLinkContainer)
    {
        if (linkTf.TryGetComponent(out PathfindingLinkMonoBehaviour linkMb))
        {
            pathfindingLinkList.Add(linkMb.GetPathfindingLink());
        }
    }
}

}

/// <summary>
/// Finds a path between two grid positions using the A* algorithm with an optional move budget.
///
/// What it does:
/// - Serves as the public entry point for pathfinding queries.
/// - Wraps the internal implementation (<see cref="FindPathInternal"/>) while exposing a simpler interface.
/// - Returns a list of grid positions representing the optimal route, or <c>null</c> if no valid path exists.
///
/// Why this exists in RogueShooter:
/// - Gameplay systems (player input, AI, ability targeting) request paths through this single method.
```

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```
/// - The move budget allows computing reachable tiles for tactical range previews (e.g. 6 steps max).
///
/// Implementation notes:
/// - <paramref name="moveBudgetSteps"/> can be set to <c>int.MaxValue</c> for unrestricted pathfinding.
/// - Outputs <paramref name="pathLength"/> as total F-cost (movement cost + heuristic) of the found path.
/// </summary>
public List<GridPosition> FindPath(
    GridPosition startGridPosition,
    GridPosition endGridPosition,
    out int pathLeght,
    int moveBudgetSteps)
{
    return FindPathInternal(startGridPosition, endGridPosition, out pathLeght, moveBudgetSteps);
}

/// <summary>
/// Core A* pathfinding algorithm implementation with movement budget and edge-aware navigation.
///
/// What it does:
/// - Expands nodes using standard A* logic (G = actual cost, H = heuristic, F = G + H).
/// - Honors per-edge blockers from <see cref="EdgeBaker"/> via <c>CanStep()</c>.
/// - Supports a movement budget (in "steps") to limit search range for tactical actions.
/// - Uses a lightweight custom <see cref="PriorityQueue{T}"/> for open list management.
///
/// Why this exists in RogueShooter:
/// - Provides deterministic and efficient tactical pathfinding across destructible, multi-floor maps.
/// - Integrates movement range rules directly into path expansion, avoiding separate "reachable area" passes.
/// - Enables AI and player systems to share the same consistent grid and cost rules.
///
/// Algorithm overview:
/// 1. Convert <paramref name="moveBudgetSteps"/> into internal cost units (straight = 10, diagonal = 20).
/// 2. Early reject if even the heuristic distance exceeds the available budget.
/// 3. Initialize open and closed sets and enqueue the start node.
/// 4. While the open queue is not empty:
///     - Dequeue the node with the lowest F-cost.
///     - If its G-cost exceeds the movement budget → skip.
///     - If this is the end node → reconstruct the path and return.
///     - Otherwise, expand all valid neighbors that are walkable and not blocked by edges.
/// 5. Return <c>null</c> if no path exists within the allowed movement cost.
///
/// Performance notes:
/// - Avoids heap allocations via <see cref="EnsureInit"/> using generation IDs.
/// - Supports optional runtime diagnostics through <see cref="PathfindingDiagnostics"/> (#if PERFORMANCE_DIAG).
/// - Handles diagonal movement correctly with octile distances and no corner clipping.
/// </summary>
private List<GridPosition> FindPathInternal(
    GridPosition startGridPosition,
    GridPosition endGridPosition,
    out int pathLeght,
    int moveBudgetSteps)
{
```

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```
#if PERFORMANCE_DIAG

    var diag = PathfindingDiagnostics.Instance;
    bool diagOn = diag != null && diag.enabledRuntime;

    System.Diagnostics.Stopwatch sw = null;
    if (diagOn) { sw = new System.Diagnostics.Stopwatch(); sw.Start(); }

    int expanded = 0; // kuinka monta solmua laajennettiin (pop + käsittely)

#endif

// 1) Convert step-based budget to internal movement cost units
int moveBudgetCost = (moveBudgetSteps == int.MaxValue)
    ? int.MaxValue
    : moveBudgetSteps * MOVE_STRAIGHT_COST;

// Early pruning: skip search if even the heuristic distance exceeds the move budget
int minPossibleCost = CalculateDistance(startGridPosition, endGridPosition);
if (minPossibleCost > moveBudgetCost)
{
    pathLeght = 0;
}

#if PERFORMANCE_DIAG

    if (diagOn) { sw.Stop(); diag.AddSample(sw.Elapsed.TotalMilliseconds, false, 0, expanded); }

#endif

return null;
}

currentGenerationID++;

var openQueue = new PriorityQueue<PathNode>();
HashSet<PathNode> openSet = new HashSet<PathNode>();
HashSet<PathNode> closedSet = new HashSet<PathNode>();

PathNode startNode = GetGridSystem(startGridPosition.floor).GetGridObject(startGridPosition);
PathNode endNode = GetGridSystem(endGridPosition.floor).GetGridObject(endGridPosition);

// Initialize start node
EnsureInit(startNode);
startNode.SetGCost(0);
startNode.SetHCost(CalculateDistance(startGridPosition, endGridPosition));
startNode.CalculateFCost();

openQueue.Enqueue(startNode, startNode.GetFCost());
openSet.Add(startNode);

// 2) Main A* loop
while (openQueue.Count > 0)
{
```

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```
// Dequeue the node with the lowest F-cost; skip outdated entries
PathNode currentNode = openQueue.Dequeue();
if (closedSet.Contains(currentNode)) continue;

EnsureInit(currentNode);

#if PERFORMANCE_DIAG
    expanded++;
#endif

// Stop expanding if the current path already exceeds move budget
if (currentNode.GetGCost() > moveBudgetCost)
    continue;

// Goal reached → build final path
if (currentNode == endNode)
{
    pathLeght = endNode.GetFCost();
    var path = CalculatePath(endNode);
}

#if PERFORMANCE_DIAG
    if (diagOn)
    {
        sw.Stop();
        diag.AddSample(sw.Elapsed.TotalMilliseconds, success: true, pathLen: path.Count, expanded: expanded);
    }
#endif

return path;
}

openSet.Remove(currentNode);
closedSet.Add(currentNode);

// 3) Expand all valid neighbor nodes
foreach (PathNode neighbourNode in GetNeighbourList(currentNode))
{
    if (closedSet.Contains(neighbourNode)) continue;

    if (!neighbourNode.GetIsWalkable())
    {
        closedSet.Add(neighbourNode);
        continue;
    }

    EnsureInit(neighbourNode);

    int stepCost = CalculateDistance(currentNode.GetGridPosition(), neighbourNode.GetGridPosition());
    int tentativeG = currentNode.GetGCost() + stepCost;

    // Skip paths that already exceed movement budget
    if (tentativeG > moveBudgetCost)
        continue;
}
```

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```
// If this route to the neighbor is cheaper, record it
if (tentativeG < neighbourNode.GetGCost())
{
    neighbourNode.SetCameFromPathNode(currentNode);
    neighbourNode.SetGCost(tentativeG);
    neighbourNode.SetHCost(CalculateDistance(neighbourNode.GetGridPosition(), endGridPosition));
    neighbourNode.CalculateFCost();

    if (!openSet.Contains(neighbourNode))
    {
        openQueue.Enqueue(neighbourNode, neighbourNode.GetFCost());
        openSet.Add(neighbourNode);
    }
    else
    {
        // No decrease-key in PriorityQueue → push duplicate, old entry ignored when dequeued
        openQueue.Enqueue(neighbourNode, neighbourNode.GetFCost());
    }
}
}

// 4) No valid path within move budget
pathLeght = 0;

#if PERFORMANCE_DIAG
    if (diagOn)
    {
        sw.Stop();
        diag.AddSample(sw.Elapsed.TotalMilliseconds, success: false, pathLen: 0, expanded: expanded);
    }
#endif

return null;
}

/// <summary>
/// Octile-distance cost between two grid positions for 8-directional movement.
///
/// What it does:
/// - Computes the admissible A* heuristic and unit step costs using:
///   diagonal = min(|dx|, |dz|), straight = | |dx| - |dz| |.
/// - Returns MOVE_DIAGONAL_COST * diagonal + MOVE_STRAIGHT_COST * straight.
///
/// Why this exists in RogueShooter:
/// - Matches our movement rules exactly (orthogonal and diagonal with different costs),
///   keeping A* both admissible and consistent (no overestimation).
///
/// Implementation notes:
```

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```
/// - MOVE_STRAIGHT_COST = 10, MOVE_DIAGONAL_COST = 20 to align with budget-in-steps logic.
/// </summary>
public int CalculateDistance(GridPosition a, GridPosition b)
{
    GridPosition d = a - b;
    int xDistance = Mathf.Abs(d.x);
    int zDistance = Mathf.Abs(d.z);
    int diagonal = Mathf.Min(xDistance, zDistance);
    int straight = Mathf.Abs(xDistance - zDistance);
    return MOVE_DIAGONAL_COST * diagonal + MOVE_STRAIGHT_COST * straight;
}

/// <summary>
/// Retrieves the grid system instance for a given floor index.
///
/// What it does:
/// - Returns the <see cref="GridSystem{PathNode}" /> corresponding to the specified floor.
///
/// Why this exists in RogueShooter:
/// - Supports multi-floor pathfinding where each floor maintains its own grid structure.
/// - Allows systems to query and operate on nodes per-floor without global lookups.
///
/// Implementation notes:
/// - Assumes grids were created during <see cref="Setup" /> and stored in <c>gridSystemList</c>.
/// </summary>
private GridSystem<PathNode> GetGridSystem(int floor) => gridSystemList[floor];

/// <summary>
/// Retrieves a single pathfinding node at the given (x, z, floor) position.
///
/// What it does:
/// - Resolves to the correct grid system (via <see cref="GetGridSystem" />) and returns its node.
///
/// Why this exists in RogueShooter:
/// - Simplifies code that frequently needs to access individual nodes by absolute coordinates.
/// - Used heavily in A*, edge baking, and AI systems for node-level data manipulation.
///
/// Implementation notes:
/// - Returns <c>null</c> if the grid system or node does not exist (should not normally happen after Setup()).
/// </summary>
public PathNode GetNode(int x, int z, int floor)
    => GetGridSystem(floor).GetGridObject(new GridPosition(x, z, floor));

/// <summary>
/// Converts a unit orthogonal delta (dx, dz) into an EdgeMask direction.
///
/// What it does:
/// - Maps (0,+1)→N, (+1,0)→E, (0,-1)→S, (-1,0)→W.
/// - Returns <see cref="EdgeMask.None" /> for non-orthogonal deltas.
///
/// Why this exists in RogueShooter:
/// - Used by <see cref="CanStep" /> to check per-edge walls symmetrically for orthogonal moves.
```

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```
/// - Keeps edge checks readable and centralized.
///
/// Implementation notes:
/// - Diagonal deltas are intentionally not mapped (handled separately in <see cref="CanStep"/>).
/// </summary>
private EdgeMask DirFromDelta(int dx, int dz)
{
    if (dx == 0 && dz == +1) return EdgeMask.N;
    if (dx == +1 && dz == 0) return EdgeMask.E;
    if (dx == 0 && dz == -1) return EdgeMask.S;
    if (dx == -1 && dz == 0) return EdgeMask.W;
    return EdgeMask.None;
}

/// <summary>
/// Returns the opposite edge direction (N↔S, E↔W).
///
/// What it does:
/// - Maps a cardinal edge to its opposite; otherwise returns <see cref="EdgeMask.None"/>.
///
/// Why this exists in RogueShooter:
/// - Ensures symmetric edge checks (A's east equals B's west) in movement validation.
/// - Avoids "one-way walls" by enforcing consistency across neighboring nodes.
/// </summary>
private EdgeMask Opposite(EdgeMask d) => d switch
{
    EdgeMask.N => EdgeMask.S,
    EdgeMask.E => EdgeMask.W,
    EdgeMask.S => EdgeMask.N,
    EdgeMask.W => EdgeMask.E,
    _ => EdgeMask.None
};

/// <summary>
/// Determines whether movement from cell A to cell B is allowed,
/// honoring edge walls and preventing diagonal corner-cutting.
///
/// What it does:
/// - Validates that the delta is a single orthogonal or diagonal step.
/// - For orthogonal moves: blocks movement if either side of the shared edge has a wall flag.
/// - For diagonal moves: requires at least one orthogonal "L-shaped" two-step route to be clear
///   (A→X→B or A→Z→B), preventing cutting through blocked corners.
///
/// Why this exists in RogueShooter:
/// - Enforces tactical rules consistent with baked edge data (from EdgeBaker).
/// - Prevents unrealistic diagonal slips past doorframes/rails and yields robust cover behavior.
///
/// Implementation notes:
/// - Uses <see cref="DirFromDelta"/> and <see cref="Opposite(EdgeMask)"/> to test symmetric edge walls.
/// - For diagonals, both intermediate orthogonal neighbors must be valid and walkable before testing paths.
/// </summary>
private bool CanStep(GridPosition a, GridPosition b)
```

RogueShooter – All Scripts

```
{
    int dx = b.x - a.x;
    int dz = b.z - a.z;

    bool diagonal = Mathf.Abs(dx) == 1 && Mathf.Abs(dz) == 1;
    bool ortho = (dx == 0) ^ (dz == 0);
    if (!diagonal && !ortho) return false; // Disallow jumps longer than 1 cell

    var nodeA = GetNode(a.x, a.z, a.floor);
    var nodeB = GetNode(b.x, b.z, b.floor);

    // ORTHOGONAL MOVE: both sides of the shared edge must be open
    if (ortho)
    {
        var dir = DirFromDelta(dx, dz);
        if (dir == EdgeMask.None) return false;
        if (nodeA.HasWall(dir)) return false;           // wall on A's side
        if (nodeB.HasWall(Opposite(dir))) return false; // wall on B's side
        return true;
    }

    // DIAGONAL MOVE: require at least one clear L-route (no corner clipping)
    var aToX = new GridPosition(a.x + dx, a.z, a.floor);
    var aToZ = new GridPosition(a.x, a.z + dz, a.floor);

    // Both intermediates must be inside bounds and walkable to be considered
    if (!IsValidGridPosition(aToX) || !IsValidGridPosition(aToZ)) return false;
    if (!IsWalkable(aToX) || !IsWalkable(aToZ)) return false;

    // Route 1: A -> X -> B (two orthogonal steps)
    bool pathViaX = CanStep(a, aToX) && CanStep(aToX, b);

    // Route 2: A -> Z -> B (two orthogonal steps)
    bool pathViaZ = CanStep(a, aToZ) && CanStep(aToZ, b);

    return pathViaX || pathViaZ;
}

private bool IsValidGridPosition(GridPosition gridPosition)
{
    return LevelGrid.Instance.GetGridSystem(gridPosition.floor).IsValidGridPosition(gridPosition);
}

private bool IsWalkable(GridPosition gridPosition)
{
    PathNode node = GetNode(gridPosition.x, gridPosition.z, gridPosition.floor);
    return node != null && node.GetIsWalkable();
}

/// <summary>
```


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```
/// Collects all valid neighbor nodes (up to 8) for A* expansion from the given node.
///
/// What it does:
/// - Iterates orthogonal and diagonal neighbors within the current floor bounds.
/// - Filters out non-walkable cells early.
/// - Uses <see cref="CanStep"/> to enforce edge walls and anti-corner-cutting rules.
/// - Additionally appends any explicit link targets (e.g., stairs/elevators) connected to this cell.
///
/// Why this exists in RogueShooter:
/// - Centralizes movement rules so both AI and player pathfinding share identical constraints.
/// - Supports multi-floor traversal via designer-authored links without special-casing A*.
///
/// Implementation notes:
/// - Neighbor order is stable to keep behavior deterministic across runs.
/// - Links bypass edge checks by design (they represent explicit allowed transitions).
/// </summary>
private List<PathNode> GetNeighbourList(PathNode currentNode)
{
    List<PathNode> result = new List<PathNode>(8);

    GridPosition gp = currentNode.GetGridPosition();

    // Candidate offsets (W, SW, NW, E, SE, NE, S, N)
    static IEnumerable<(int dx, int dz)> Offsets()
    {
        yield return (-1, 0); // W
        yield return (-1, -1); // SW
        yield return (-1, +1); // NW

        yield return (+1, 0); // E
        yield return (+1, -1); // SE
        yield return (+1, +1); // NE

        yield return (0, -1); // S
        yield return (0, +1); // N
    }

    // 1) Same-floor neighbors with edge rules
    foreach (var (dx, dz) in Offsets())
    {
        int nx = gp.x + dx;
        int nz = gp.z + dz;

        // Bounds check
        if (nx < 0 || nz < 0 || nx >= width || nz >= height) continue;

        var ngp = new GridPosition(nx, nz, gp.floor);

        // Early reject: must be walkable
        if (!IsWalkable(ngp)) continue;

        // Respect edge blockers and corner rules
    }
}
```

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```
        if (!CanStep(gp, ngp)) continue;

        result.Add(GetNode(nx, nz, gp.floor));
    }

    // 2) Explicit links (stairs/lifts/portals) – allowed transitions across floors
    foreach (GridPosition linkGp in GetPathfindingLinkConnectedGridPositionList(gp))
    {
        // Varmista ettei mennä ulos
        if (!IsValidGridPosition(linkGp)) continue;
        if (!IsWalkable(linkGp)) continue;

        // Links intentionally bypass edge checks; they model designer-approved moves
        result.Add(GetNode(linkGp.x, linkGp.z, linkGp.floor));
    }

    return result;
}

/// <summary>
/// Returns all grid positions directly connected to the given position via explicit pathfinding links.
///
/// What it does:
/// - Searches the prebuilt <see cref="pathfindingLinkList"/> for connections where the given cell
///   is either endpoint (A or B).
/// - Collects and returns the corresponding linked destinations.
///
/// Why this exists in RogueShooter:
/// - Enables multi-floor traversal and special transitions (stairs, elevators, hatches, ladders, etc.)
///   that bypass standard neighbor logic.
/// - Keeps such transitions data-driven: designers place <see cref="PathfindingLinkMonoBehaviour"/> objects
///   in the scene instead of hardcoding connections.
///
/// Implementation notes:
/// - Links are treated as bidirectional: A↔B.
/// - The returned positions are later validated for walkability before use.
/// </summary>
private List<GridPosition> GetPathfindingLinkConnectedGridPositionList(GridPosition gridPosition)
{
    List<GridPosition> result = new List<GridPosition>();
    if (pathfindingLinkList == null || pathfindingLinkList.Count == 0) return result;

    foreach (PathfindingLink link in pathfindingLinkList)
    {
        if (link.gridPositionA == gridPosition) result.Add(link.gridPositionB);
        if (link.gridPositionB == gridPosition) result.Add(link.gridPositionA);
    }
    return result;
}

/// <summary>
/// Reconstructs a complete path from the end node by backtracking through parent pointers.
```

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```
///
/// What it does:
/// - Traces the <c>CameFrom</c> chain from the goal node back to the start.
/// - Reverses the collected list and converts it into grid positions for gameplay use.
///
/// Why this exists in RogueShooter:
/// - Converts A*'s internal node traversal history into a usable list of <see cref="GridPosition"/> steps.
/// - Provides a deterministic, minimal path sequence for units to follow.
///
/// Implementation notes:
/// - Result always includes both the start and end positions.
/// - Returned list is ordered from start → goal.
/// </summary>
private List<GridPosition> CalculatePath(PathNode endNode)
{
    List<PathNode> pathNodes = new List<PathNode> { endNode };
    PathNode current = endNode;

    while (current.GetCameFromPathNode() != null)
    {
        pathNodes.Add(current.GetCameFromPathNode());
        current = current.GetCameFromPathNode();
    }

    pathNodes.Reverse();

    List<GridPosition> gridPositions = new List<GridPosition>(pathNodes.Count);
    foreach (PathNode n in pathNodes) gridPositions.Add(n.GetGridPosition());

    return gridPositions;
}

/// <summary>
/// Returns whether the given grid position is currently walkable.
///
/// Why this exists in RogueShooter:
/// - Unified query for gameplay/AI to check if a tile can be occupied.
/// - Mirrors the internal node flag computed during Setup() (raycasts + edge bake).
/// </summary>
public bool IsWalkableGridPosition(GridPosition gridPosition)
    => GetGridSystem(gridPosition.floor).GetGridObject(gridPosition).GetIsWalkable();

/// <summary>
/// Sets the walkability of a grid position at runtime.
///
/// Why this exists in RogueShooter:
/// - Dynamic gameplay (e.g., collapses, placed barricades, hazards) can toggle occupancy rules.
/// - Lets designers/systems override the initial raycast result if needed.
///
/// Implementation notes:
/// - Consider calling <see cref="EdgeBaker.RebakeEdgesAround"/> if geometry changes near this tile.
/// </summary>
```

RogueShooter – All Scripts

```
public void SetIsWalkableGridPosition(GridPosition gridPosition, bool isWalkable)
    => GetGridSystem(gridPosition.floor).GetGridObject(gridPosition).SetIsWalkable(isWalkable);

/// <summary>
/// Lazily resets per-search A* fields on a node using a generation ID guard.
///
/// What it does:
/// - If the node was last touched in a previous search (generation mismatch),
///   resets G/H/F, clears the “came from” pointer, and marks the node with the current generation.
///
/// Why this exists in RogueShooter:
/// - Avoids per-search heap allocations and dictionary clears by reusing nodes safely.
/// - Ensures stale scores from earlier searches never leak into the current query.
///
/// Implementation notes:
/// - Must be called on any node before reading/updating A* fields during a search.
/// </summary>
void EnsureInit(PathNode node)
{
    if (node.LastGenerationID != currentGenerationID)
    {
        node.SetGCost(int.MaxValue);
        node.SetHCost(0);
        node.CalculateFCost();
        node.ResetCameFromPathNode();
        node.MarkGeneration(currentGenerationID);
    }
}

/// <summary>
/// Converts a movement budget in steps to internal cost units.
///
/// Why this exists in RogueShooter:
/// - Keeps UI/AI logic readable (work in “steps”) while A* uses cost units (10 per orthogonal step).
/// </summary>
public static int CostFromSteps(int steps) => steps * MOVE_STRAIGHT_COST;

/// <summary>
/// Gets all explicit pathfinding links collected from the scene (stairs, elevators, robes).
///
/// Why this exists in RogueShooter:
/// - External systems (UI, debugging, AI) may need to inspect or visualize cross-cell/floor connections.
/// </summary>
public List<PathfindingLink> GetPathfindingLinks()
{
    return pathfindingLinkList ?? new List<PathfindingLink>();
}

public int GetWidth()
{
    return width;
}
```

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```
public int GetHeight()
{
    return height;
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitPathFinding/PathfindingLink.cs

```
using UnityEngine;

public class PathfindingLink
{
    public GridPosition gridPositionA;
    public GridPosition gridPositionB;
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitPathFinding/PathfindingLinkMonoBehaviour.cs

```
using UnityEngine;

public class PathfindingLinkMonoBehaviour : MonoBehaviour
{
    public Vector3 linkPositionA;
    public Vector3 linkPositionB;

    void OnDrawGizmos()
    {
        Gizmos.color = Color.yellow;
        Vector3 aW = transform.TransformPoint(linkPositionA);
        Vector3 bW = transform.TransformPoint(linkPositionB);
        Gizmos.DrawSphere(aW, 0.15f);
        Gizmos.DrawSphere(bW, 0.15f);
        Gizmos.DrawLine(aW, bW);
    }

    public PathfindingLink GetPathfindingLink()
    {
        return new PathfindingLink
        {
            gridPositionA = LevelGrid.Instance.GetGridPosition(linkPositionA),
            gridPositionB = LevelGrid.Instance.GetGridPosition(linkPositionB),
        };
    }
}
```

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Assets/scripts/Units/UnitPathFinding/PathNode.cs

```
[System.Flags]
public enum EdgeMask { None = 0, N = 1, E = 2, S = 4, W = 8 }

[System.Flags]
public enum CoverMask { None = 0, N = 1, E = 2, S = 4, W = 8 }

public class PathNode
{
    private GridPosition gridPosition;
    private int gCost;
    private int hCost;
    private int fCost;
    private PathNode cameFromPathNode;

    private bool isWalkable = true;
    private EdgeMask walls; // ← ruudun reunaesteet

    private CoverMask highCover; // täyskorkea suoja suunnittain
    private CoverMask lowCover; // matala suoja suunnittain

    public void ClearWalls() => walls = EdgeMask.None;
    public void AddWall(EdgeMask dir) => walls |= dir;
    public bool HasWall(EdgeMask dir) => (walls & dir) != 0;

    public void ClearCover() { highCover = CoverMask.None; lowCover = CoverMask.None; }
    public void AddHighCover(CoverMask d) => highCover |= d;
    public void AddLowCover(CoverMask d) => lowCover |= d;
    public bool HasHighCover(CoverMask d) => (highCover & d) != 0;
    public bool HasLowCover(CoverMask d) => (lowCover & d) != 0;

    public CoverMask GetHighCoverMask() => highCover;
    public CoverMask GetLowCoverMask() => lowCover;

    public PathNode(GridPosition gridPosition)
    {
        this.gridPosition = gridPosition;
    }

    public int LastGenerationID { get; private set; } = -1;
    public void MarkGeneration(int generationID) => LastGenerationID = generationID;

    public override string ToString()
    {
        return gridPosition.ToString();
    }

    public int GetGCost()
    {

```


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```
        return gCost;
    }

    public int GetHCost()
    {
        return hCost;
    }

    public int GetFCost()
    {
        return fCost;
    }

    public void SetGCost(int gCost)
    {
        this.gCost = gCost;
    }

    public void SetHCost(int hCost)
    {
        this.hCost = hCost;
    }

    public void CalculateFCost()
    {
        fCost = gCost + hCost;
    }

    public void ResetCameFromPathNode()
    {
        cameFromPathNode = null;
    }

    public void SetCameFromPathNode(PathNode pathNode)
    {
        cameFromPathNode = pathNode;
    }

    public PathNode GetCameFromPathNode()
    {
        return cameFromPathNode;
    }

    public GridPosition GetGridPosition()
    {
        return gridPosition;
    }

    public bool GetIsWalkable()
    {
        return isWalkable;
    }
```

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```
    public void SetIsWalkable(bool isWalkable)
    {
        this.isWalkable = isWalkable;
    }

    public bool IsWalkable()
    {
        return isWalkable;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitRagdoll/RagdollPoseBinder.cs

```
using System.Collections;
using Mirror;
using UnityEngine;

/// <summary>
/// Online: Client need this to get destroyed unit rootbone to create ragdoll form it.
/// </summary>
public class RagdollPoseBinder : NetworkBehaviour
{
    [SyncVar] public uint sourceUnitNetId;
    [SyncVar] public Vector3 lastHitPos;
    [SyncVar] public int overkill;

    [ClientCallback]
    private void Start()
    {
        StartCoroutine(ApplyPoseWhenReady());
    }

    private IEnumerator ApplyPoseWhenReady()
    {
        {
            var (root, why) = TryFindOriginalRootBone(sourceUnitNetId);
            if (root != null)
            {
                if (TryGetComponent<UnitRagdoll>(out var unitRagdoll))
                {
                    unitRagdoll.SetOverkill(overkill);
                    unitRagdoll.SetLastHitPosition(lastHitPos);
                    unitRagdoll.Setup(root);
                }
                yield break;
            }

            Debug.Log($"[Ragdoll] waiting root for netId {sourceUnitNetId} ({why})");

            yield return new WaitForEndOfFrame();
            Debug.LogWarning($"[RagdollPoseBinder] Source root not found for netId {sourceUnitNetId}");
        }
    }

    private static (Transform root, string why) TryFindOriginalRootBone(uint netId)
    {
        {
            if (netId == 0) return (null, "netId==0");
            if (!Mirror.NetworkClient.spawned.TryGetValue(netId, out var id) || id == null)
                return (null, "identity not in NetworkClient.spawned");

            // Löydä UnitRagdollSpawn myös hierarkiasta
            var spawner = id.GetComponent<UnitRagdollSpawn>()
                ?? id.GetComponentInChildren<UnitRagdollSpawn>(true)
                ?? id.GetComponentInParent<UnitRagdollSpawn>();
            if (spawner == null) return (null, "UnitRagdollSpawn missing under identity");
        }
    }
}
```

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```
        if (spawner.OriginalRagdollRootBone == null) return (null, "OriginalRagdollRootBone null");  
        return (spawner.OriginalRagdollRootBone, null);  
    }  
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitRagdoll/UnitRagdoll.cs

```
using System.Collections.Generic;
using UnityEngine;

public class UnitRagdoll : MonoBehaviour
{
    [SerializeField] private Transform ragdollRootBone;

    private Vector3 lastHitPosition;

    private int overkill;

    public Transform Root => ragdollRootBone;

    public void Setup(Transform originalRootBone)
    {
        MatchAllChildTransforms(originalRootBone, ragdollRootBone);
        // Vector3 randomDir = new Vector3(Random.Range(-1f, +1f), 0, Random.Range(-1, +1));
        ApplyPushForceToRagdoll(ragdollRootBone, 500f + overkill, lastHitPosition, 50f);
    }

    /// <summary>
    /// Sets all ragdoll bones to match dying unit bones rotation and position
    /// </summary>
    private static void MatchAllChildTransforms(Transform sourceRoot, Transform targetRoot)
    {
        var stack = new Stack<(Transform sourceBone, Transform targetBone)>();
        stack.Push((sourceRoot, targetRoot));

        while (stack.Count > 0)
        {
            var (currentSourceBone, currentTargetBone) = stack.Pop();

            currentTargetBone.SetPositionAndRotation(currentSourceBone.position, currentSourceBone.rotation);

            if (currentSourceBone.childCount == currentTargetBone.childCount)
            {
                for (int i = 0; i < currentSourceBone.childCount; i++)
                {
                    stack.Push((currentSourceBone.GetChild(i), currentTargetBone.GetChild(i)));
                }
            }
        }
    }

    private void ApplyPushForceToRagdoll(Transform root, float pushForce, Vector3 pushPosition, float PushRange)
    {
        foreach (Transform child in root)
        {
```

RogueShooter – All Scripts

```
        if (child.TryGetComponent<Rigidbody>(out Rigidbody childRigidbody))
        {
            childRigidbody.AddExplosionForce(pushForce, pushPosition, PushRange);
        }

        ApplyPushForceToRagdoll(child, pushForce, pushPosition, PushRange);
    }

    public void SetLastHitPosition(Vector3 hitPosition)
    {
        lastHitPosition = hitPosition;
    }

    public void SetOverkill(int overkill)
    {
        this.overkill = overkill;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitRagdoll/UnitRagdollSpawn.cs

```
using System;
using UnityEngine;

[RequireComponent(typeof(HealthSystem))]
public class UnitRagdollSpawn : MonoBehaviour
{
    [SerializeField] private Transform ragdollPrefab;
    [SerializeField] private Transform originalRagdollRootBone;
    public Transform OriginalRagdollRootBone => originalRagdollRootBone;

    private HealthSystem healthSystem;

    // To prevent multiple spawns
    private bool spawned;

    private void Awake()
    {
        healthSystem = GetComponent<HealthSystem>();
        healthSystem.OnDead += HealthSystem_OnDied;
    }

    private void HealthSystem_OnDied(object sender, EventArgs e)
    {
        if (spawned) return;
        spawned = true;
        Vector3 lastHitPosition = healthSystem.LastHitPosition;
        int overkill = healthSystem.Overkill;
        var ni = GetComponentInParent<Mirror.NetworkIdentity>();
        uint id = ni ? ni.netId : 0;

        NetworkSync.SpawnRagdoll(
            ragdollPrefab.gameObject,
            transform.position,
            transform.rotation,
            id,
            originalRagdollRootBone,
            lastHitPosition,
            overkill);

        healthSystem.OnDead -= HealthSystem_OnDied;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitsControlUI/TurnSystemUI.cs

```
using System;
using UnityEngine;
using UnityEngine.UI;
using TMPPro;
using Utp;

///<summary>
/// TurnSystemUI manages the turn system user interface.
/// It handles both singleplayer and multiplayer modes.
/// In multiplayer, it interacts with PlayerController to manage turn ending.
/// It also updates UI elements based on the current turn state.
///</summary>
public class TurnSystemUI : MonoBehaviour
{
    [SerializeField] private Button endTurnButton;
    [SerializeField] private TextMeshProUGUI turnNumberText;           // (valinnainen, käytä SP:ssä)
    [SerializeField] private GameObject enemyTurnVisualGameObject;    // (valinnainen, käytä SP:ssä)
    [SerializeField] private TextMeshProUGUI playerReadyText;         // (Online)

    bool isCoop;
    private PlayerController localPlayerController;

    void Start()
    {
        isCoop = GameManager.SelectedMode == GameMode.CoOp;

        // kiinnitä handler tasan kerran
        if (endTurnButton != null)
        {
            endTurnButton.onClick.RemoveAllListeners();
            endTurnButton.onClick.AddListener(OnEndTurnClicked);
        }

        if (isCoop)
        {
            // Co-opissa nappi on DISABLED kunnes serveri kertoo että saa toimia
            TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
            SetCanAct(false);
        }
        else
        {
            // Singleplayerissa kuuntele vuoron vaihtumista
            if (TurnSystem.Instance != null)
            {
                TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
                UpdateForSingleplayer();
            }
        }

        if (playerReadyText) playerReadyText.gameObject.SetActive(false);
    }
}
```


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```
}

void OnDisable()
{
    TurnSystem.Instance.OnTurnChanged -= TurnSystem_OnTurnChanged;
}

// ===== julkinen kutsu PlayerController.TargetNotifyCanAct:ista =====
public void SetCanAct(bool canAct)
{
    if (endTurnButton == null) return;

    endTurnButton.onClick.RemoveListener(OnEndTurnClicked);
    if (canAct) endTurnButton.onClick.AddListener(OnEndTurnClicked);

    endTurnButton.gameObject.SetActive(canAct); // jos haluat pitää aina näkyvissä, vaihda SetActive(true)
    endTurnButton.interactable = canAct;
}

// ===== nappi =====
private void OnEndTurnClicked()
{
    // Päättely co-op -tila tilannekohtaisesti (ei SelectedMode)
    bool isOnline =
        NetTurnManager.Instance != null &&
        (GameNetworkManager.Instance.GetNetworkServerActive() || GameNetworkManager.Instance.GetNetworkClientConnected());
    if (!isOnline)
    {
        if (TurnSystem.Instance != null)
        {
            TurnSystem.Instance.NextTurn();
        }
        else
        {
            Debug.LogWarning("[UI] TurnSystem.Instance is null");
        }
        return;
    }
}

CacheLocalPlayerController();
if (localPlayerController == null)
{
    Debug.LogWarning("[UI] Local PlayerController not found");
    return;
}
// Instantly lock input
if (UnitActionSystem.Instance != null)
{
    UnitActionSystem.Instance.LockInput();
}
// Prevent double clicks
SetCanAct(false);
```

RogueShooter – All Scripts

```
// Lähetä serverille
localPlayerController.ClickEndTurn();

//Päivitä player ready hud
}

private void CacheLocalPlayerController()
{
    if (localPlayerController != null) return;

    // 1) Varmista helpoimman kautta
    if (PlayerController.Local != null)
    {
        localPlayerController = PlayerController.Local;
        return;
    }

    // 2) Fallback: Mirrorin client-yhteyden identity
    var conn = GameNetworkManager.Instance != null
        ? GameNetworkManager.Instance.NetworkClientConnection()
        : null;
    if (conn != null && conn.identity != null)
    {
        localPlayerController = conn.identity.GetComponent<PlayerController>();
        if (localPlayerController != null) return;
    }

    // 3) Viimeinen oljenkorsi: etsi skenestä local-pelaaja
    var pcs = FindObjectsByType<PlayerController>(FindObjectsSortMode.InstanceID);
    foreach (var pc in pcs)
    {
        if (pc.isLocalPlayer) { localPlayerController = pc; break; }
    }
}

// ===== singleplayer UI (valinnainen) =====
private void TurnSystem_OnTurnChanged(object s, EventArgs e) => UpdateForSingleplayer();

private void UpdateForSingleplayer()
{
    if (turnNumberText != null)
        turnNumberText.text = "Turn: " + TurnSystem.Instance.GetTurnNumber();

    if (enemyTurnVisualGameObject != null)
        enemyTurnVisualGameObject.SetActive(!TurnSystem.Instance.IsPlayerTurn());

    if (endTurnButton != null)
        endTurnButton.gameObject.SetActive(TurnSystem.Instance.IsPlayerTurn());
}
```

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```
// Kutsutaan verkosta
public void SetTeammateReady(bool visible, string whoLabel = null)
{
    if (!playerReadyText) return;
    if (visible)
    {
        playerReadyText.text = $"{whoLabel} READY";
        playerReadyText.gameObject.SetActive(true);
    }
    else
    {
        playerReadyText.gameObject.SetActive(false);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitsControlUI/UnitActionBusyUI.cs

```
using UnityEngine;

/// <summary>
/// This class is responsible for displaying the busy UI when the unit action system is busy
/// </summary>
public class UnitActionBusyUI : MonoBehaviour
{
    private void Start()
    {
        UnitActionSystem.Instance.OnBusyChanged += UnitActionSystem_OnBusyChanged;
        Hide();
    }

    void OnEnable()
    {
        UnitActionSystem.Instance.OnBusyChanged += UnitActionSystem_OnBusyChanged;
    }

    void OnDisable()
    {
        UnitActionSystem.Instance.OnBusyChanged -= UnitActionSystem_OnBusyChanged;
    }

    private void Show()
    {
        gameObject.SetActive(true);
    }

    private void Hide()
    {
        gameObject.SetActive(false);
    }

    /// <summary>
    /// This method is called when the unit action system is busy or not busy
    /// </summary>
    private void UnitActionSystem_OnBusyChanged(object sender, bool isBusy)
    {
        if (isBusy)
        {
            Show();
        }
        else
        {
            Hide();
        }
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitsControlUI/UnitActionButtonUI.cs

```
using UnityEngine;
using UnityEngine.UI;
using TMPro;

/// <summary>
///     This class is responsible for displaying the action button TXT in the UI
/// </summary>

public class UnitActionButtonUI : MonoBehaviour
{
    [SerializeField] private TextMeshProUGUI textMeshPro;
    [SerializeField] private Button actionButton;
    [SerializeField] private GameObject actionButtonSelectedVisual;

    private BaseAction baseAction;

    public void SetBaseAction(BaseAction baseAction)
    {
        this.baseAction = baseAction;
        textMeshPro.text = baseAction.GetActionName().ToUpper();

        actionButton.onClick.AddListener(() =>
        {
            UnitActionSystem.Instance.SetSelectedAction(baseAction);
        } );
    }

    public void UpdateSelectedVisual()
    {
        BaseAction selectedbaseAction = UnitActionSystem.Instance.GetSelectedAction();
        actionButtonSelectedVisual.SetActive(selectedbaseAction == baseAction);
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitsControlUI/UnitActionSystemUI.cs

```
using System;
using System.Collections.Generic;
using UnityEngine;
using TMPro;

/// <summary>
///     This class is responsible for displaying the action buttons for the selected unit in the UI.
///     It creates and destroys action buttons based on the selected unit's actions.
/// </summary>

public class UnitActionSystemUI : MonoBehaviour
{
    [SerializeField] private Transform actionButtonPrefab;
    [SerializeField] private Transform actionButtonContainerTransform;
    [SerializeField] private TextMeshProUGUI actionPointsText;

    private List<UnitActionButtonUI> actionButtonUIList;

    private void Awake()
    {
        actionButtonUIList = new List<UnitActionButtonUI>();
    }

    private void Start()
    {
        if (UnitActionSystem.Instance != null)
        {
            UnitActionSystem.Instance.OnSelectedUnitChanged += UnitActionSystem_OnSelectedUnitChanged;
            UnitActionSystem.Instance.OnSelectedActionChanged += UnitActionSystem_OnSelectedActionChanged;
            UnitActionSystem.Instance.OnActionStarted += UnitActionSystem_OnActionStarted;
        }
        else
        {
            Debug.Log("UnitActionSystem instance found.");
        }
        if (TurnSystem.Instance != null)
        {
            TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
        }
        else
        {
            Debug.Log("TurnSystem instance not found.");
        }

        Unit.OnAnyActionPointsChanged += Unit_OnAnyActionPointsChanged;
    }

    /*
    void OnEnable()
    {

```

RogueShooter – All Scripts

```
        if (UnitActionSystem.Instance != null)
        {
            UnitActionSystem.Instance.OnSelectedUnitChanged += UnitActionSystem_OnSelectedUnitChanged;
            UnitActionSystem.Instance.OnSelectedActionChanged += UnitActionSystem_OnSelectedActionChanged;
            UnitActionSystem.Instance.OnActionStarted += UnitActionSystem_OnActionStarted;
        } else
        {
            Debug.Log("UnitActionSystem instance found.");
        }
        if (TurnSystem.Instance != null)
        {
            TurnSystem.Instance.OnTurnChanged += TurnSystem_OnTurnChanged;
        } else
        {
            Debug.Log("TurnSystem instance not found.");
        }

        Unit.OnAnyActionPointsChanged += Unit_OnAnyActionPointsChanged;
    }
    */
    void OnDisable()
    {
        UnitActionSystem.Instance.OnSelectedUnitChanged -= UnitActionSystem_OnSelectedUnitChanged;
        UnitActionSystem.Instance.OnSelectedActionChanged -= UnitActionSystem_OnSelectedActionChanged;
        UnitActionSystem.Instance.OnActionStarted -= UnitActionSystem_OnActionStarted;
        TurnSystem.Instance.OnTurnChanged -= TurnSystem_OnTurnChanged;
        Unit.OnAnyActionPointsChanged -= Unit_OnAnyActionPointsChanged;
    }

    private void CreateUnitActionButtons()
    {
        Unit selectedUnit = UnitActionSystem.Instance.GetSelectedUnit();
        if (selectedUnit == null)
        {
            Debug.Log("No selected unit found.");
            return;
        }
        actionButtonUIList.Clear();

        foreach (BaseAction baseAction in selectedUnit.GetBaseActionsArray())
        {
            Transform actionButtonTransform = Instantiate(actionButtonPrefab, actionButtonContainerTransform);
            UnitActionButtonUI actionButtonUI = actionButtonTransform.GetComponent<UnitActionButtonUI>();
            actionButtonUI.SetBaseAction(baseAction);
            actionButtonUIList.Add(actionButtonUI);
        }
    }

    private void DestroyActionButtons()
```

RogueShooter – All Scripts

```
{
    foreach (Transform child in actionBarContainerTransform)
    {
        Destroy(child.gameObject);
    }
}

private void UnitActionSystem_OnSelectedUnitChanged(object sender, EventArgs e)
{
    DestroyActionButtons();
    CreateUnitActionButtons();
    UpdateSelectedVisual();
    UpdateActionPointsVisual();
}

private void UnitActionSystem_OnSelectedActionChanged(object sender, EventArgs e)
{
    UpdateSelectedVisual();
}

private void UnitActionSystem_OnActionStarted(object sender, EventArgs e)
{
    UpdateActionPointsVisual();
}

private void UpdateSelectedVisual()
{
    foreach (UnitActionButtonUI actionButtonUI in actionBarUIList)
    {
        actionButtonUI.UpdateSelectedVisual();
    }
}

private void UpdateActionPointsVisual()
{
    // Jos tekstiä ei ole kytketty Inspectorissa, poistu siististi
    if (actionPointsText == null) return;

    // Jos järjestelmä ei ole vielä valmis, näytä viiva
    if (UnitActionSystem.Instance == null)
    {
        actionPointsText.text = "Action Points: -";
        return;
    }
    Unit selectedUnit = UnitActionSystem.Instance.GetSelectedUnit();
    if (selectedUnit == null)
    {
        actionPointsText.text = "Action Points: -";
        return;
    }
    actionPointsText.text = "Action Points: " + selectedUnit.GetActionPoints();
}
```


RogueShooter – All Scripts

```
/// <summary>
///     This method is called when the turn changes. It resets the action points UI to the maximum value.
/// </summary>
private void TurnSystem_OnTurnChanged(object sender, EventArgs e)
{
    UpdateActionPointsVisual();
}

/// <summary>
///     This method is called when the action points of any unit change. It updates the action points UI.
/// </summary>
private void Unit_OnAnyActionPointsChanged(object sender, EventArgs e)
{
    UpdateActionPointsVisual();
}
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitSelectedVisual.cs

```
using System;
using UnityEngine;

/// <summary>
/// This class is responsible for displaying a visual indicator when a unit is selected in the game.
/// It uses a MeshRenderer component to show or hide the visual representation of the selected unit.
/// </summary>
public class UnitSelectedVisual : MonoBehaviour
{
    [SerializeField] private Unit unit;
    [SerializeField] private MeshRenderer meshRenderer;

    private void Awake()
    {
        if (!meshRenderer) meshRenderer = GetComponentInChildren<MeshRenderer>(true);
        if (meshRenderer) meshRenderer.enabled = false;
    }

    private void Start()
    {
        /*
        if (UnitActionSystem.Instance != null)
        {
            UnitActionSystem.Instance.OnSelectedUnitChanged += UnitActionSystem_OnSelectedUnitChanged;
            UpdateVisual();
        }
        */
    }

    void OnEnable()
    {
        if (UnitActionSystem.Instance != null)
        {
            UnitActionSystem.Instance.OnSelectedUnitChanged += UnitActionSystem_OnSelectedUnitChanged;
            UpdateVisual();
        }
    }

    void OnDisable()
    {
        if (UnitActionSystem.Instance != null)
        {
            UnitActionSystem.Instance.OnSelectedUnitChanged -= UnitActionSystem_OnSelectedUnitChanged;
            UpdateVisual();
        }
    }

    /*
    private void OnDestroy()
    {

```

RogueShooter – All Scripts

```
        if (UnitActionSystem.Instance != null)
            UnitActionSystem.Instance.OnSelectedUnitChanged -= UnitActionSystem_OnSelectedUnitChanged;
    }
    */
    private void UnitActionSystem_OnSelectedUnitChanged(object sender, EventArgs empty)
    {
        UpdateVisual();
    }

    private void UpdateVisual()
    {
        if (!this || meshRenderer == null || UnitActionSystem.Instance == null) return;
        var selected = UnitActionSystem.Instance.GetSelectedUnit();
        meshRenderer.enabled = unit != null && selected == unit;
    }
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitStatsUI/UnitUIBroadcaster.cs

```
using Mirror;

public class UnitUIBroadcaster : NetworkBehaviour
{
    public static UnitUIBroadcaster Instance { get; private set; }
    void Awake() { if (Instance == null) Instance = this; }

    // Tätä saa kutsua vain serveri (hostin serveripuoli)
    [Server]
    public void BroadcastUnitWorldUIVisibility(bool already)
    {
        if (!NetworkServer.active) return;

        // käy kaikki serverillä tunnetut unitit läpi
        foreach (var kvp in NetworkServer.spawned)
        {
            var unit = kvp.Value.GetComponent<Unit>();
            if (!unit) continue;

            // serveri voi laskea logiikan: pitääkö tämän unitin AP näkyä
            bool visible = ShouldBeVisible(unit, already);

            // lähetä client-puolelle että tämän unitin UI asetetaan
            RpcSetUnitUIVisibility(unit.netId, visible);
        }
    }

    // Tätä kutsuu serveri, suoritetaan kaikilla clienteilla
    [ClientRpc]
    private void RpcSetUnitUIVisibility(uint unitId, bool visible)
    {
        if (NetworkClient.spawned.TryGetValue(unitId, out var ni) && ni != null)
        {
            var ui = ni.GetComponentInChildren<UnitWorldUI>();
            if (ui != null) ui.SetVisible(visible);
        }
    }

    // serverilogiikka omistajan perusteella
    [Server]
    private bool ShouldBeVisible(Unit unit, bool already)
    {
        // Kaikki pelaajat ovat valmiina joten näytetään vain vihollisen AP pisteet.
        if (already)
        {
            return unit.IsEnemy();
        }

        // Co-Op
        bool playersPhase = TurnSystem.Instance.IsPlayerTurn();
    }
}
```

RogueShooter – All Scripts

```
bool ownerEnded = false;
if (unit.OwnerId != 0 &&
    NetworkServer.spawned.TryGetValue(unit.OwnerId, out var ownerId) &&
    ownerId != null)
{
    var pc = ownerId.GetComponent<PlayerController>();
    if (pc != null) ownerEnded = pc.hasEndedThisTurn;
}

// 2) Päättä näkyvyys
if (playersPhase)
{
    // Pelaajavaihe: näytä kaikki ei-viholliset, joiden omistaja EI ole lopettanut
    return !unit.IsEnemy() && !ownerEnded;
}
else
{
    // Vihollisvaihe: näytä vain viholliset
    return unit.IsEnemy();
}
}
```

RogueShooter – All Scripts

Assets/scripts/Units/UnitStatsUI/UnitWorldUI.cs

```
using UnityEngine;
using TMPro;
using System;
using UnityEngine.UI;
using Mirror;
using System.Collections.Generic;

/// <summary>
/// Displays world-space UI for a single unit, including action points and health bar.
/// Reacts to turn events and ownership rules to show or hide UI visibility
/// </summary>
public class UnitWorldUI : MonoBehaviour
{
    [SerializeField] private TextMeshProUGUI actionPointsText;
    [SerializeField] private Unit unit;

    [SerializeField] private Image healthBarImage;
    [SerializeField] private HealthSystem healthSystem;

    [SerializeField] private Image personalCoverBarImage;

    /// <summary>
    /// Reference to the unit this UI belongs to.
    /// Which object's visibility do we want to change?
    /// </summary>
    [Header("Visibility")]
    [SerializeField] private GameObject actionPointsRoot;

    /// <summary>
    /// Cached network identity for ownership.
    /// </summary>
    private NetworkIdentity unitIdentity;

    // --- NEW: tiny static registry for ready owners (co-op only) ---
    // private static readonly HashSet<uint> s_readyOwners = new();
    // public static bool HasOwnerEnded(uint ownerId) => s_readyOwners.Contains(ownerId);

    private void Awake()
    {
        unitIdentity = unit ? unit.GetComponent<NetworkIdentity>() : GetComponentInParent<NetworkIdentity>();
    }

    private void Start()
    {
        Unit.OnAnyActionPointsChanged += Unit_OnAnyActionPointsChanged;
        healthSystem.OnDamaged += HealthSystem_OnDamaged;
        unit.OnCoverPoolChanged += Unit_OnCoverPoolChanged;
    }
}
```

RogueShooter – All Scripts

```
UpdateActionPointsText();
UpdateHealthBarUI();
Unit_OnCoverPoolChanged(unit.GetPersonalCover(), unit.GetPersonalCoverMax());

// Co-opissa. Ei paikallista seuranta. Ainoastaan alku asettelu
if (GameManager.SelectedMode == GameMode.CoOp)
{
    if (unit.IsEnemy())
    {
        actionPointsRoot.SetActive(false);
    }

    return;
}

PlayerLocalTurnGate.LocalPlayerTurnChanged += PlayerLocalTurnGate_LocalPlayerTurnChanged;
PlayerLocalTurnGate_LocalPlayerTurnChanged(PlayerLocalTurnGate.LocalPlayerTurn);
}

private void OnDisable()
{
    Unit.OnAnyActionPointsChanged -= Unit_OnAnyActionPointsChanged;
    healthSystem.OnDamaged -= HealthSystem_OnDamaged;
    PlayerLocalTurnGate.LocalPlayerTurnChanged -= PlayerLocalTurnGate_LocalPlayerTurnChanged;
    unit.OnCoverPoolChanged -= Unit_OnCoverPoolChanged;
}

private void OnDestroy()
{
    Unit.OnAnyActionPointsChanged -= Unit_OnAnyActionPointsChanged;
    healthSystem.OnDamaged -= HealthSystem_OnDamaged;
    PlayerLocalTurnGate.LocalPlayerTurnChanged -= PlayerLocalTurnGate_LocalPlayerTurnChanged;
    unit.OnCoverPoolChanged -= Unit_OnCoverPoolChanged;
}

private void UpdateActionPointsText()
{
    actionPointsText.text = unit.GetActionPoints().ToString();
}

private void Unit_OnAnyActionPointsChanged(object sender, EventArgs e)
{
    UpdateActionPointsText();
}

private void UpdateCoverBarUI()
{
    Debug.Log("Cover now" + unit.GetCoverNormalized());
    personalCoverBarImage.fillAmount = unit.GetCoverNormalized();
}
```

RogueShooter – All Scripts

```
}

private void Unit_OnCoverPoolChanged(int current, int max)
{
    UpdateCoverBarUI();
}

private void UpdateHealthBarUI()
{
    healthBarImage.fillAmount = healthSystem.GetHealthNormalized();
}

/// <summary>
/// Event handler: refreshes the health bar UI when this unit takes damage.
/// </summary>
private void HealthSystem_OnDamaged(object sender, EventArgs e)
{
    UpdateHealthBarUI();
}

/// <summary>
/// SinglePlayer/Versus: paikallinen turn-gate. Co-opissa ei käytetä.
/// </summary>
private void PlayerLocalTurnGate_LocalPlayerTurnChanged(bool canAct)
{
    if (GameManager.SelectedMode == GameMode.CoOp) return; // Co-op: näkyvyys tulee RPC:stä
    if (!this || !gameObject) return;

    bool showAp;
    if (GameManager.SelectedMode == GameMode.SinglePlayer)
    {
        showAp = canAct ? !unit.IsEnemy() : unit.IsEnemy();
    }
    else // Versus
    {
        bool unitIsMine = unitIdentity && unitIdentity.isOwned;
        showAp = (canAct && unitIsMine) || (!canAct && !unitIsMine);
    }

    actionPointsRoot.SetActive(showAp);
}

public void SetVisible(bool visible)
{
    actionPointsRoot.SetActive(visible);
}
}
```


RogueShooter – All Scripts

Assets/scripts/Weapons/BulletProjectile.cs

```
using Mirror;
using UnityEngine;

public class BulletProjectile : NetworkBehaviour
{
    [SerializeField] private TrailRenderer trailRenderer;
    [SerializeField] private Transform bulletHitVfxPrefab;

    [SyncVar] private Vector3 targetPosition;

    public void Setup(Vector3 targetPosition)
    {
        this.targetPosition = targetPosition;
    }

    public override void OnStartClient()
    {
        base.OnStartClient();

        if (trailRenderer && !trailRenderer.emitting) trailRenderer.emitting = true;
    }

    private void Update()
    {
        Vector3 moveDirection = (targetPosition - transform.position).normalized;

        float distanceBeforeMoving = Vector3.Distance(transform.position, targetPosition);

        float moveSpeed = 200f; // Adjust the speed as needed
        transform.position += moveSpeed * Time.deltaTime * moveDirection;

        float distanceAfterMoving = Vector3.Distance(transform.position, targetPosition);

        // Check if we've reached or passed the target position
        if (distanceBeforeMoving < distanceAfterMoving)
        {
            transform.position = targetPosition;

            if (trailRenderer) trailRenderer.transform.parent = null;

            if (bulletHitVfxPrefab)
                Instantiate(bulletHitVfxPrefab, targetPosition, Quaternion.identity);

            // Network-aware destruction
            if (isServer) NetworkServer.Destroy(gameObject);
            else Destroy(gameObject);
        }
    }
}
```

```
}
```

RogueShooter – All Scripts

Assets/scripts/Weapons/GranadeProjectile.cs

```
using System;
using UnityEngine;
using Mirror;
using System.Collections;

public class GrenadeProjectile : NetworkBehaviour
{
    public static event EventHandler OnAnyGranadeExploded;

    [SerializeField] private Transform granadeExplodeVFXPrefab;
    [SerializeField] private float damageRadius = 4f;
    [SerializeField] private int damage = 30;
    [SerializeField] private float moveSpeed = 15f;
    [SerializeField] private AnimationCurve arcYAnimationCurve;

    [SyncVar(hook = nameof(OnTargetChanged))] private Vector3 targetPosition;

    private float totalDistance;
    private Vector3 positionXZ;
    private const float MIN_DIST = 0.01f;

    private bool isExploded = false;

    private bool _ready;

    public override void OnStartClient()
    {
        base.OnStartClient();
    }

    public void Setup(Vector3 targetWorld)
    {
        var groundTarget = SnapToGround(targetWorld);
        // Aseta SyncVar, hook kutsutaan kaikilla (server + clientit)
        targetPosition = groundTarget;
        RecomputeDerived(); // varmistetaan serverillä heti
        _ready = true;
    }

    private Vector3 SnapToGround(Vector3 worldXZ)
    {
        return new Vector3(worldXZ.x, 0f, worldXZ.z);
    }

    void OnTargetChanged(Vector3 _old, Vector3 _new)
    {
        // Kun SyncVar saapuu clientille, laske johdetut kentät sielläkin
        RecomputeDerived();
        _ready = true;
    }
}
```

RogueShooter – All Scripts

```
private void RecomputeDerived()
{
    positionXZ = transform.position;
    positionXZ.y = 0f;

    totalDistance = Vector3.Distance(positionXZ, targetPosition);
    if (totalDistance < MIN_DIST) totalDistance = MIN_DIST; // suoja nollaa vastaan
}

private void Update()
{
    if (!_ready || isExploded) return;

    Vector3 moveDir = targetPosition - positionXZ;
    if (moveDir.sqrMagnitude < 1e-6f) moveDir = Vector3.forward; // varadir, ettei normalized → NaN
    moveDir.Normalize();

    positionXZ += moveSpeed * Time.deltaTime * moveDir;

    float distance = Vector3.Distance(positionXZ, targetPosition);
    if (totalDistance < 1e-6f) totalDistance = 0.01f;
    float distanceNormalized = 1f - (distance / totalDistance);
    distanceNormalized = Mathf.Clamp01(distanceNormalized);

    float maxHeight = totalDistance / 4f;
    float positionY = arcYAnimationCurve != null
        ? arcYAnimationCurve.Evaluate(distanceNormalized) * maxHeight
        : 0f;

    if (float.IsNaN(positionY)) positionY = 0f; // viimeinen pelastus
    transform.position = new Vector3(positionXZ.x, positionY, positionXZ.z);

    float reachedTargetDistance = .2f;

    if ((Vector3.Distance(positionXZ, targetPosition) < reachedTargetDistance) && !isExploded)
    {
        isExploded = true;
        if (NetworkServer.active || !NetworkClient.isConnected) // Server or offline
        {
            Collider[] colliderArray = Physics.OverlapSphere(targetPosition, damageRadius);

            foreach (Collider collider in colliderArray)
            {
                if (collider.TryGetComponent<Unit>(out Unit targetUnit))
                {
                    NetworkSync.ApplyDamageToUnit(targetUnit, damage, targetPosition);
                }
                if (collider.TryGetComponent<DestructibleObject>(out DestructibleObject targetObject))
                {
                    NetworkSync.ApplyDamageToObject(targetObject, damage, targetPosition);
                }
            }
        }
    }
}
```

RogueShooter – All Scripts

```
        }
    }
}

// Screen Shake
OnAnyGranadeExploded?.Invoke(this, EventArgs.Empty);
// Explode VFX
Instantiate(granadeExplodeVFXPrefab, targetPosition + Vector3.up * 1f, Quaternion.identity);

if (!NetworkServer.active)
{
    Destroy(gameObject);
    return;
}

// Online: Hide Granade before destroy it, so that client have time to create own explode VFX from original Granade pose.
SetSoftHiddenLocal(true);
RpcSetSoftHidden(true);
StartCoroutine(DestroyAfter(0.30f));
}

private IEnumerator DestroyAfter(float seconds)
{
    yield return new WaitForSeconds(seconds);
    NetworkServer.Destroy(gameObject);
}

[ClientRpc]
private void RpcSetSoftHidden(bool hidden)
{
    SetSoftHiddenLocal(hidden);
}

private void SetSoftHiddenLocal(bool hidden)
{
    foreach (var r in GetComponentsInChildren<Renderer>())
    {
        r.enabled = !hidden;
    }
}
}
```

RogueShooter – All Scripts

Assets/scripts/Weapons/ShootingResolver.cs

```
using UnityEngine;

public struct ShotResult {
    public ShotTier tier;
    public int damage;           // paljonko "vahinkoa" tämä laukaus tuottaa
    public bool bypassCover;     // true = suoraan Healthiin (Crit)
    public bool coverOnly;       // true = vain cover-pooliin (Miss/Graze)
}

public static class ShootingResolver
{
    public static RangeBand GetBand(float dist, WeaponDefinition w)
    {
        if (dist <= 1.2f) return RangeBand.Melee;
        if (dist <= w.closeMax) return RangeBand.Close;
        if (dist <= w.mediumMax) return RangeBand.Medium;
        if (dist <= w.longMax) return RangeBand.Long;
        return RangeBand.Extreme;
    }

    public static int BaseAcc(RangeBand b, WeaponDefinition w) => b switch
    {
        RangeBand.Melee => w.meleeAcc,
        RangeBand.Close => w.closeAcc,
        RangeBand.Medium => w.mediumAcc,
        RangeBand.Long => w.longAcc,
        _ => w.extremeAcc
    };

    public static int CritStart(RangeBand b, WeaponDefinition w) => b switch
    {
        RangeBand.Melee => w.critStartMelee,
        RangeBand.Close => w.critStartClose,
        RangeBand.Medium => w.critStartMedium,
        RangeBand.Long => w.critStartLong,
        _ => w.critStartExtreme
    };

    // Palauttaa myös käytetyn cover-penaltin (UI:lle, debugiin).
    public static ShotResult Resolve(Unit attacker, Unit target, WeaponDefinition w)
    {
        // etäisyys & band
        Vector3 a = attacker.GetWorldPosition();
        Vector3 t = target.GetWorldPosition();
        float dist = Vector3.Distance(a, t);
        var band = GetBand(dist, w);

        // lähtötarkkuus
        int acc = BaseAcc(band, w);
    }
}
```

RogueShooter – All Scripts

```
// skillibonus
// var arch = attacker ? attacker.GetComponent<Unit>()?.GetComponent<Unit>() : null; // ei tarvita, käytä suoraan:
// var atArch = attacker != null ? attacker.archetype : null; // jos säilytät viitteen julkisesti, käytä attacker.archetype
// int skill = attacker.GetComponent<Unit>().isServer ? 0 : 0; // älä näin – käytä suoraan attacker.archetype
// var atkArch = attacker.GetComponent<Unit>().GetComponent<UnitArchetype>(); // jos ei ole helposti käsillä, lisää Unitille getter archetypeen

int skillBonus = (attacker as Unit)?.archetype != null
    ? (attacker as Unit).archetype.shootingSkill * (attacker as Unit).archetype.accPerSkill
    : 0;
acc += skillBonus;

// cover-penalty suunnasta
var targetGridPosition = target.GetGridPosition();
var node = PathFinding.Instance.GetNode(targetGridPosition.x, targetGridPosition.z, targetGridPosition.floor);
var ct = CoverService.EvaluateCoverHalfPlane(attacker.GetGridPosition(), target.GetGridPosition(), node);
int coverPenalty = 0;
if ((attacker as Unit)?.archetype != null)
{
    var archA = (attacker as Unit).archetype;
    coverPenalty = ct == CoverService.CoverType.High ? archA.highCoverPenalty :
        ct == CoverService.CoverType.Low ? archA.lowCoverPenalty : 0;
}
acc -= coverPenalty;

// rajaa 0..100 ja heitto
acc = Mathf.Clamp(acc, 0, 100);
int roll = UnityEngine.Random.Range(1, 101);

// määritä tier kynnysten mukaan
int critStart = CritStart(band, w); // esim. 80-90
int hitStart = Mathf.Max(35, acc - 15); // pehmeä siirtymä: mitä parempi acc, sitä alempaa alkaa "Hit"
int grazeStart = Mathf.Max(15, acc / 2); // pienikin acc antaa mahdollisuuden grazeen

ShotTier tier;
if (roll > Mathf.Max(critStart, acc + 5)) tier = ShotTier.Crit; // pieni "over-roll" mahdollistaa critin
else if (roll > hitStart) tier = ShotTier.Hit;
else if (roll > grazeStart) tier = ShotTier.Graze;
else if (roll > 10) tier = ShotTier.Miss;
else tier = ShotTier.CritMiss;

// rakenna tulos
var res = new ShotResult { tier = tier };

switch (tier)
{
    case ShotTier.CritMiss:
        res.damage = 0;
        res.coverOnly = false; // ei mitään vaikutusta
        res.bypassCover = false;
        break;

    case ShotTier.Miss:
```

RogueShooter – All Scripts

```
        res.damage = Mathf.RoundToInt(w.baseDamage * w.missChipFactor);
        res.coverOnly = true;    // vaikuttaa vain cover-pooliin
        res.bypassCover = false;
        break;

    case ShotTier.Graze:
        res.damage = Mathf.RoundToInt(w.baseDamage * w.grazeFactor);
        res.coverOnly = true;    // vain cover-pooliin
        res.bypassCover = false;
        break;

    case ShotTier.Hit:
        res.damage = w.baseDamage;
        res.coverOnly = false;   // normaali pipeline (ensin cover-mitigation, sitten personal cover, ylijäämä healthiin)
        res.bypassCover = false;
        break;

    case ShotTier.Crit:
        res.damage = w.baseDamage + w.critBonusDamage;
        res.coverOnly = false;
        res.bypassCover = true;  // ohita cover completely (suoraan healthiin)
        break;
}

#ifdef UNITY_EDITOR
    DebugShot(attacker, target, w, band, acc, roll, res);
#endif

return res;
}

#ifdef UNITY_EDITOR
    private static void DebugShot(Unit attacker, Unit target, WeaponDefinition w, RangeBand band, int acc, int roll, ShotResult result)
    {
        string txt =
            $"<b>{attacker.name}</b> → <b>{target.name}</b>\n" +
            $"Weapon: {w.name}\n" +
            $"Range: {band} | Roll: {roll}\n" +
            $"Accuracy: {acc}% | Result: <color={((result.tier==ShotTier.Crit ? "lime" : result.tier==ShotTier.Hit ? "cyan" : result.tier==ShotTier.Graze ? "yellow" : "red"))}>{result.tier}</color>\n" +
            $"Damage: {result.damage} | " +
            $"{{(result.bypassCover ? "Bypass Cover" : result.coverOnly ? "Cover Only" : "Normal")}}";

        // Tulostaa konsoliin
        Debug.Log(txt);

        // Näyttää tekstin maailmassa (Scene/Game näkymässä)
        Vector3 pos = target.transform.position + Vector3.up * 2.0f;
        //UnityEditor.Handles.Label(pos, txt.Replace("<b>", "").Replace("</b>", ""));
    }
#endif
}
```


--

RogueShooter – All Scripts

Assets/scripts/Weapons/WeaponDefinition.cs

```
using UnityEngine;

public enum RangeBand { Melee, Close, Medium, Long, Extreme }
public enum ShotTier { CritMiss, Miss, Graze, Hit, Crit }

[CreateAssetMenu(menuName="RogueShooter/Weapon")]
public class WeaponDefinition : ScriptableObject
{
    [Header("Base damage")]
    public int baseDamage = 10;
    public int critBonusDamage = 8;
    public float grazeFactor = 0.4f; // 40% damage
    public float missChipFactor = 0.2f; // 20% damage (vain coveriin)

    [Header("Optimal ranges (world units)")]
    public float closeMax = 4f;
    public float mediumMax = 9f;
    public float longMax = 15f;

    [Header("Hit chance baseline by band (% before skill/cover)")]
    public int meleeAcc = 95;
    public int closeAcc = 80;
    public int mediumAcc = 65;
    public int longAcc = 45;
    public int extremeAcc = 25;

    [Header("Crit thresholds by band (bonus tuning)")]
    public int critStartMelee = 90;
    public int critStartClose = 85;
    public int critStartMedium = 80;
    public int critStartLong = 70;
    public int critStartExtreme = 60;
}
```

