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Building an Open ~~Meta~~verse
Development Platform for all

Cyber Physical Systems Overview

11/29/2021

IR4

Leadership

- **Tim Sweeney-** *“The foundations of the technology world were built by makers, not takers. The Internet, the Mach kernel, the Linux kernel, the web. The other guys showed up later & used them to build paywalls around other peoples’ work. Their day of reckoning is coming.”*
- **Rev Lebaredian-** *“No one company or organization can achieve everything necessary to build the metaverse, but we have the potential to build the standards & plumbing collaboratively.”*
- **Royal O’Brien-** *“Openness benefits both corporate & community interests & allows implementations to speak for themselves & creates an open & decentralized community.”*
- **Neil Trevett-** *“Bringing together so many advanced technologies at scale requires standards for interoperability." A PC requires hundreds of standards that are taken for granted. So does plugging it in & connecting it to the web. “The only way to build the metaverse is to build it together.”*

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Objectives

- **Establish-** a highly integrated set of open-source frameworks & open standard best practices into an automated, decentralized & interchangeable Infrastructure Offering to bring actual utility & useability to Lidar & machine interface data in innovative ways
- **Prioritize-** Auditable, transparent, iterative workflows firmly based on the principles of SOLID programming as well as FAIR, CARE, & Openness as a foundation for establishing enterprise, developer & end-user community trust to speed adoption
- **Initiate-** Novel solutions to common problems while creating & iterating on successful results to generate a library of hot-swappable building blocks for the 3D internet
- **Contribute-** To fulfilling the promise of Industry 4 for with a hybrid Private Network, Digital Twin and customizable WASD + Heads Up Display Interface.

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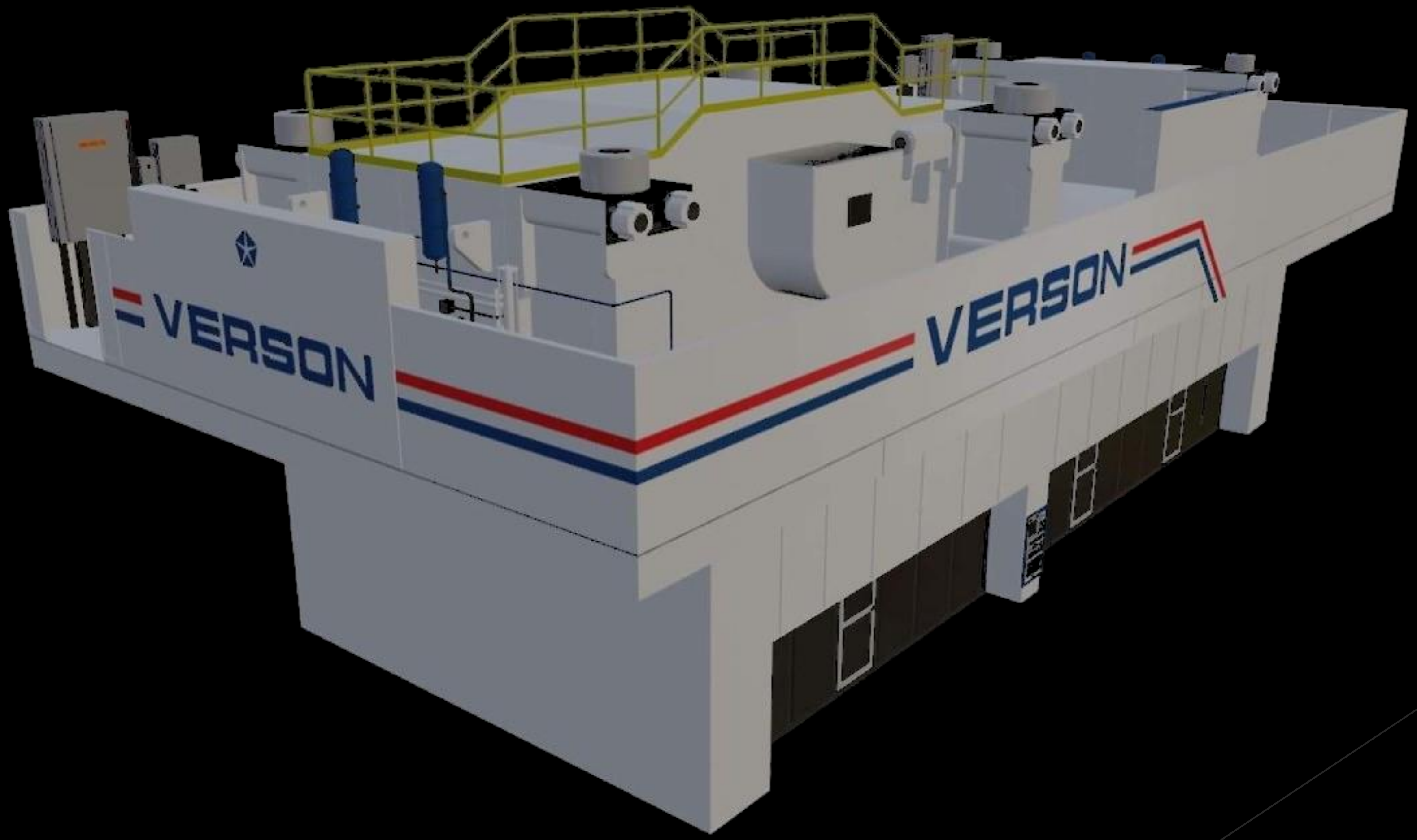
MetaFactory Digital Twin (WSP_Verson)



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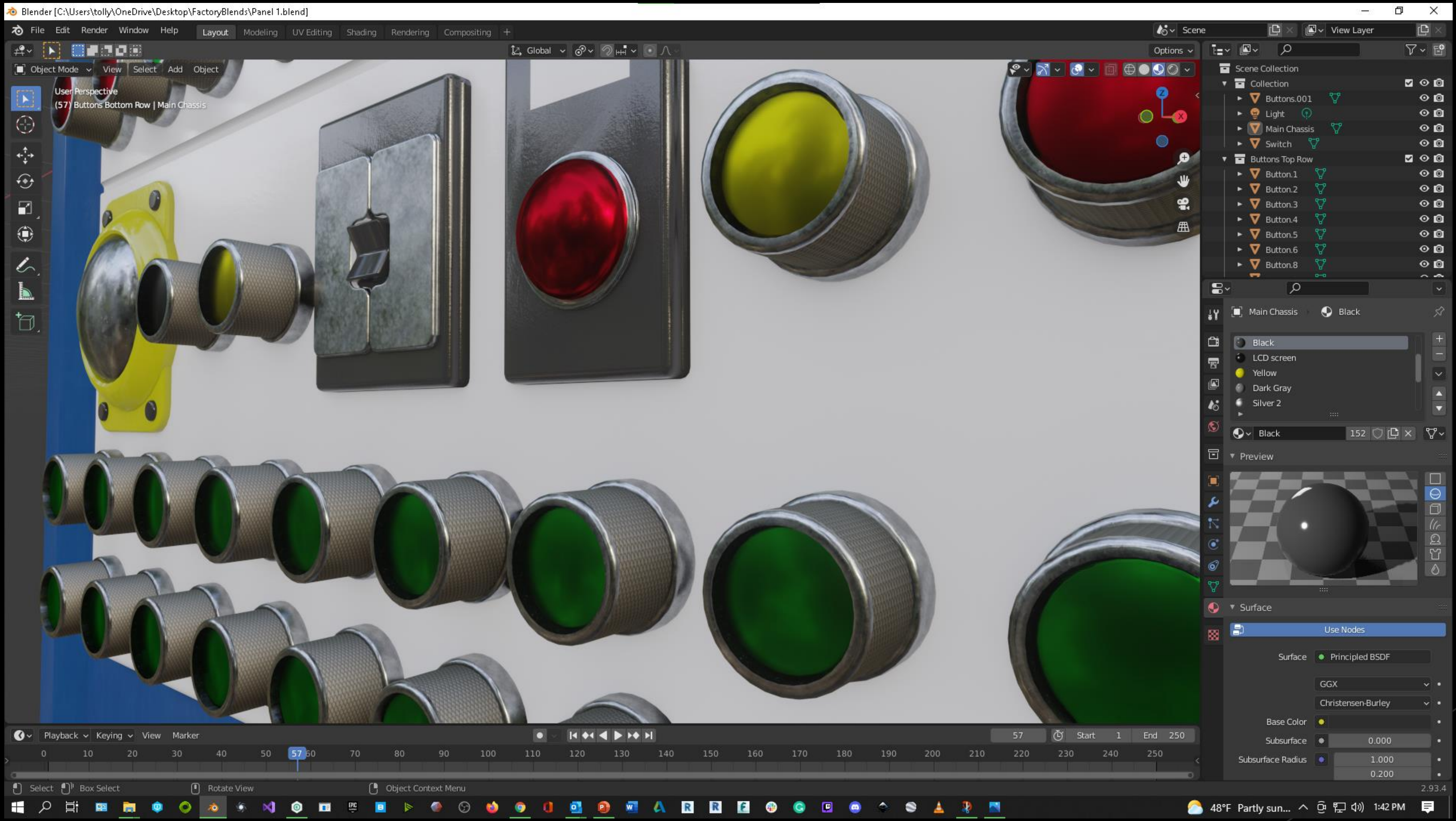
WSP_LINE_03_Control



Blender [C:\Users\tolly\OneDrive\Desktop\FactoryBlends\Panel 1.blend]

User Perspective
(57) Buttons Bottom Row | Main Chassis

Main Chassis › Black

Black 152

Surface: Principled BSDF

GGX

Christensen-Burley

Subsurface 0.000

Subsurface Radius 1.000 0.200

Start 1 End 250

METAFACTORY

Portable Infrastructure

- As a company that creates our own tools & finds value in open standards & open-source code, we owe ourselves & our adopters the flexibility to have easily inter-changeable infrastructure components. Both to mitigate risk & foster advancements
- Each platform component or part of the stack is replaceable with a similar solution. We think of each part of the Platform as a brick. While they have specific uses, there are often opportunities to swap those bricks in favor of internally created tools or switch an open standard or open-source solution even implement a commercial offering that is already being used or better serves the project's objective long term
- Applying our own SOLID based “Disintegration” theory helps adopters remain goal-oriented and, for the most part, remain technology agnostic. One of the intrinsic values of our Platform is its ability to stitch together dissimilar software packages & create a uniform method of access to each with an interface that ties them together in an intuitive & standardized way

SOLID Concepts

Single Resposibility Principle

A class should have only a Single responsibility (i.e., only one potential change in the software specification should be able to affect the specification of the class)

Open / Closed Principle

A software module (it can be a class or method) should be open for extension but closed for modification.

Liskov Substitution Principle

Objects in a program should be replaceable with instances of their subtypes without altering the correctness of that program

Interface Segregation Principle

Client should not be forced to depend upon interfaces that they do not use

Dependency Inversion Principle

Program to an interface not, an implementation

An Enterprise Framework offering

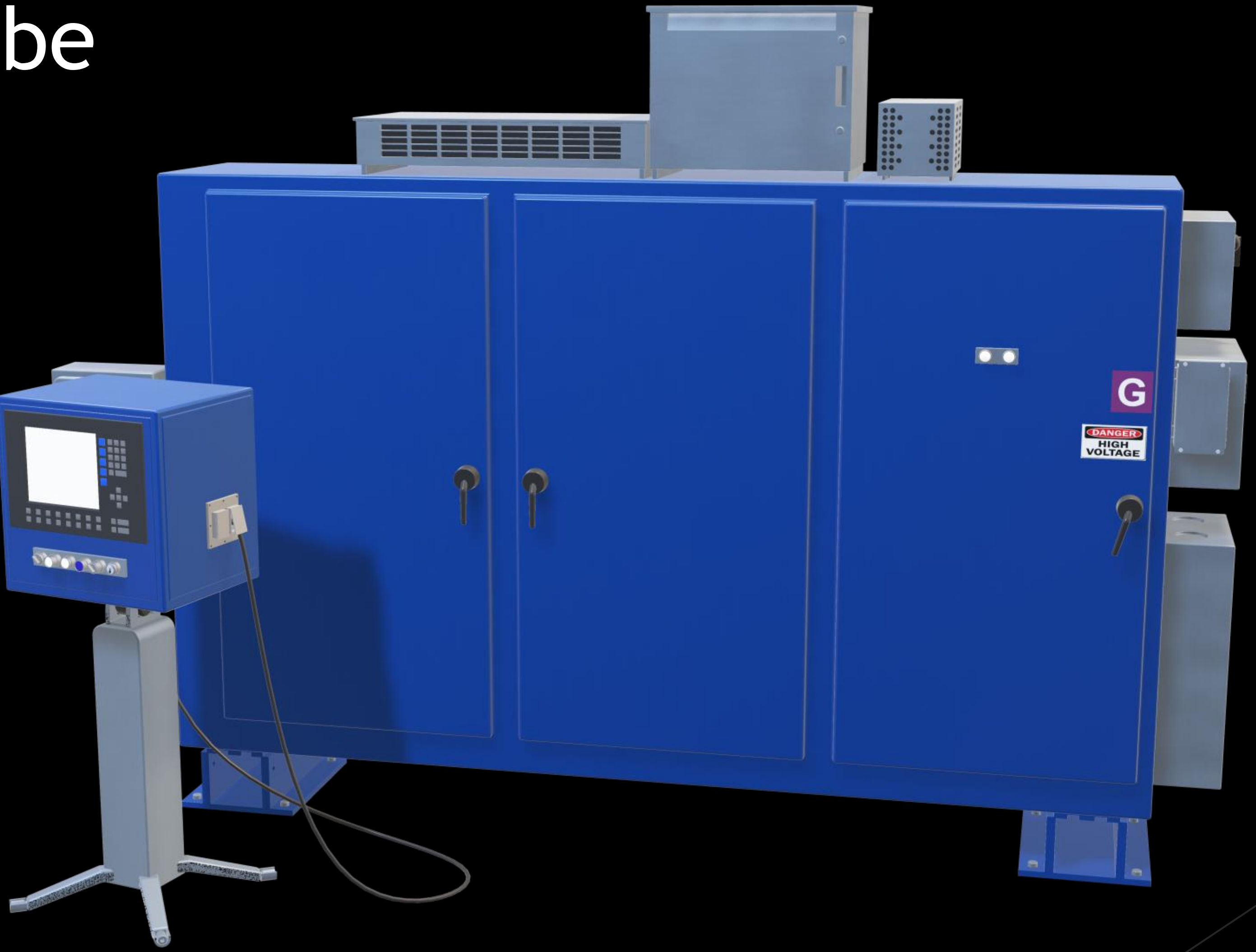
Truth be told

- If persistent, any motivated small team or funded group can use & build with the same open-source tools & frameworks from scratch to reach comparable results.
- However, if the fragmented implementation of supporting technologies persists in splinters, long term Interoperability will suffer because of the increased variance in interpretations & implementations. thereby becoming harder & harder to support over time. This will ultimately result in increased abandoned, orphaned, & stranded incompatible projects

A Proposed Solution

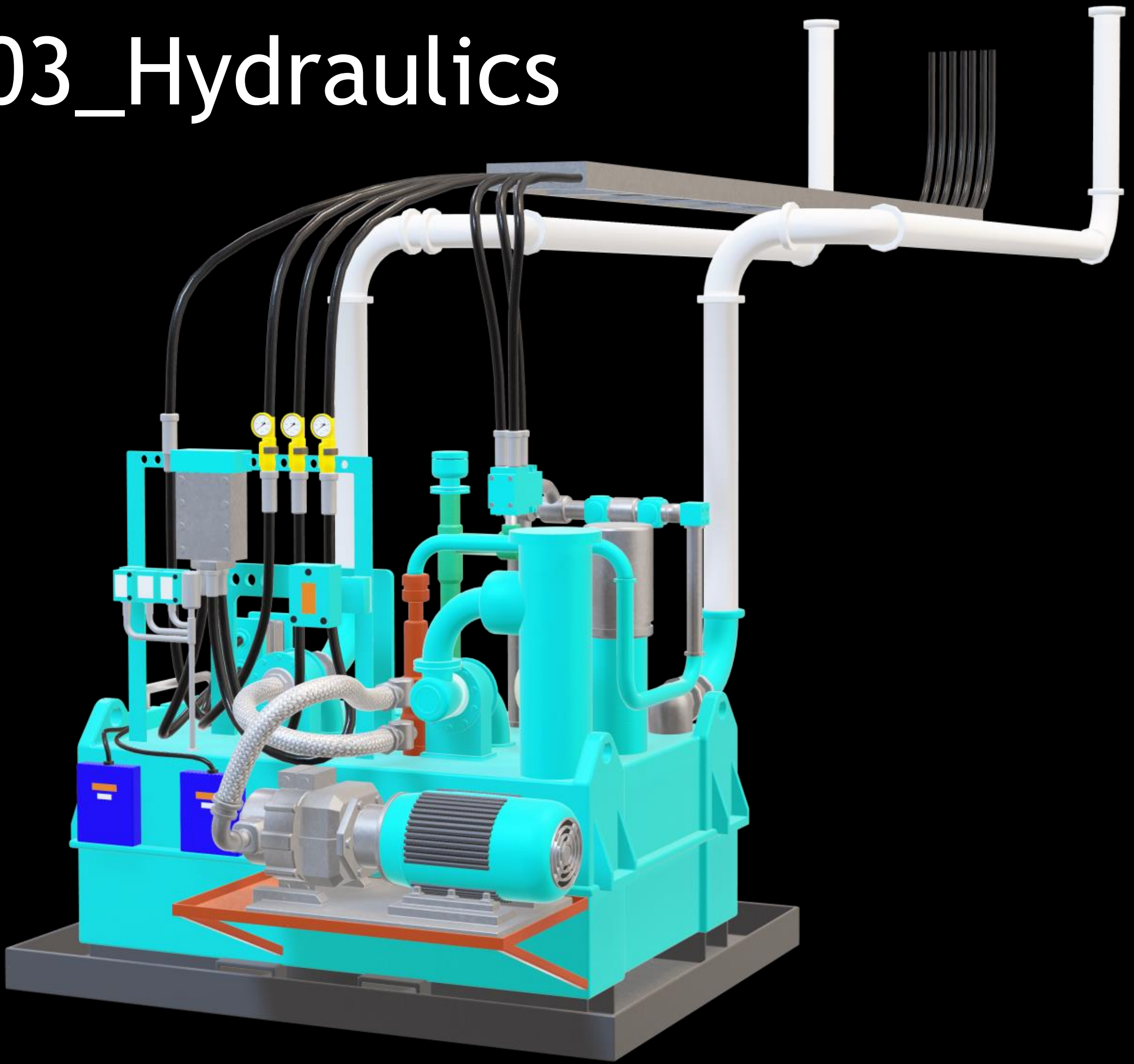
- With the support of the community, we aim to provide integration and support on baseline and custom needed infrastructure to help lower the barrier of entry for Enterprise & individuals alike to enter the field.
- Offering reduced time to market, reduced cost, empowering adopters to focus on their content & the experience for their end-users

WSP_Probe



SIMULARENT

WSP_LINE03_Hydraulics



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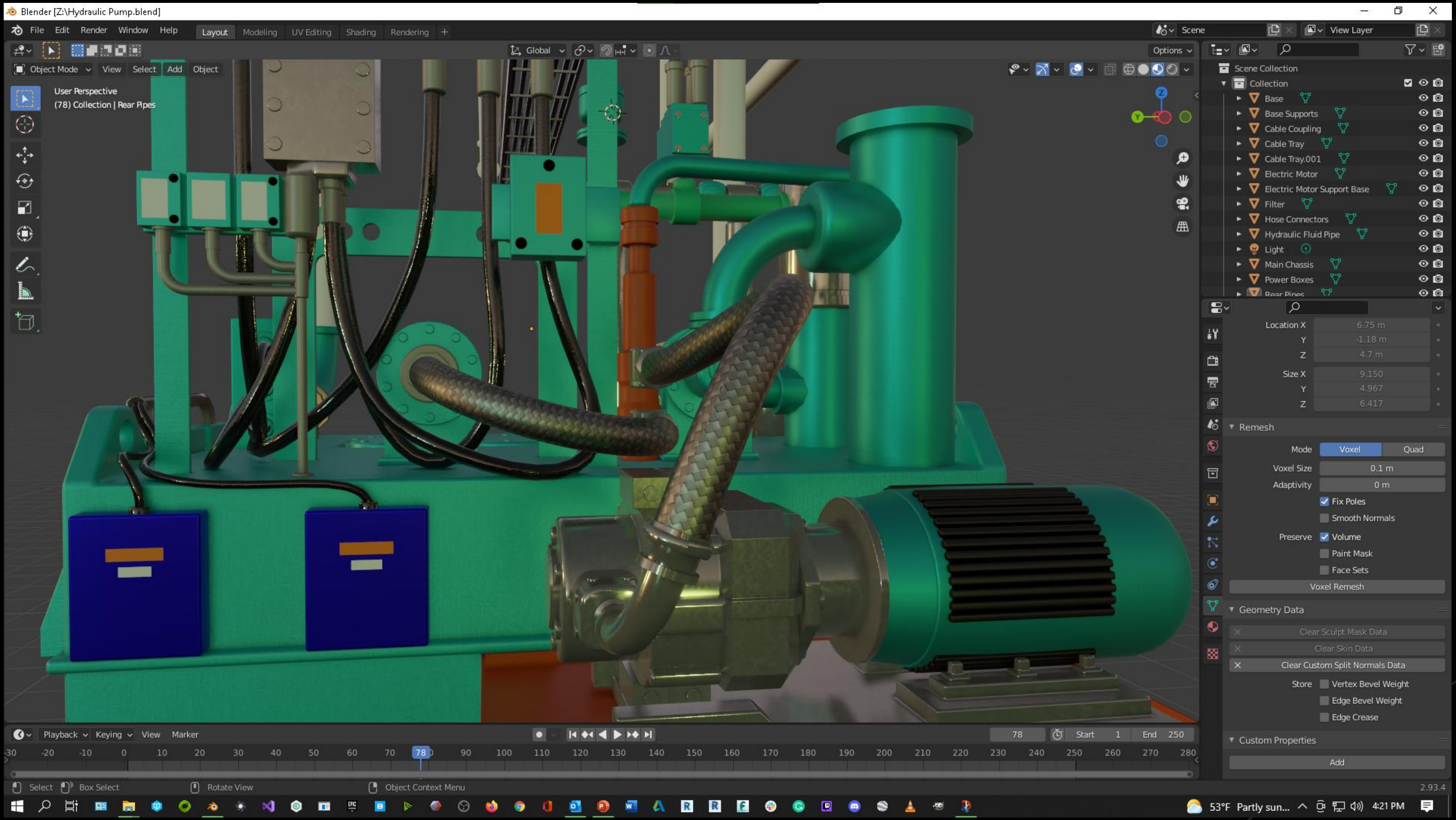
WSP_LINE03_Hydraulics



Scene Collection
- Collection
  - Base
  - Base Supports
  - Cable Coupling
  - Cable Tray
  - Cable Tray.001
  - Electric Motor
  - Electric Motor Support Base
  - Filter
  - Hose Connectors
  - Hydraulic Fluid Pipe
  - Light
  - Main Chassis
  - Power Boxes
  - Rear Pipes

Location X 6.75 m
Y -1.18 m
Z 4.7 m

Size X 9.150
Y 4.967
Z 6.417

Remesh

Mode ● Voxel ○ Quad
Voxel Size 0.1 m
Adaptivity 0 m
☑ Fix Poles
☐ Smooth Normals
Preserve ☑ Volume
☐ Paint Mask
☐ Face Sets
Voxel Remesh

Geometry Data

Clear Sculpt Mask Data
Clear Skin Data
Clear Custom Split Normals Data
Store ☐ Vertex Bevel Weight
☐ Edge Bevel Weight
☐ Edge Crease

Custom Properties

Add

Current frame 78 · Start 1 · End 250

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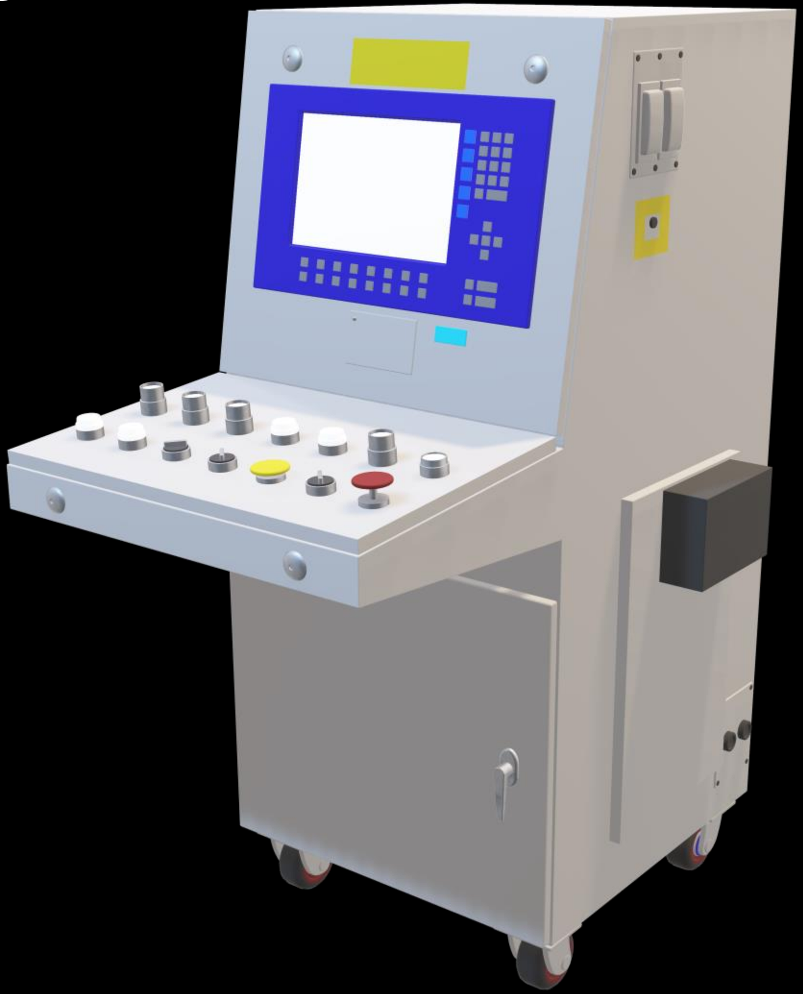
WSP_Controls



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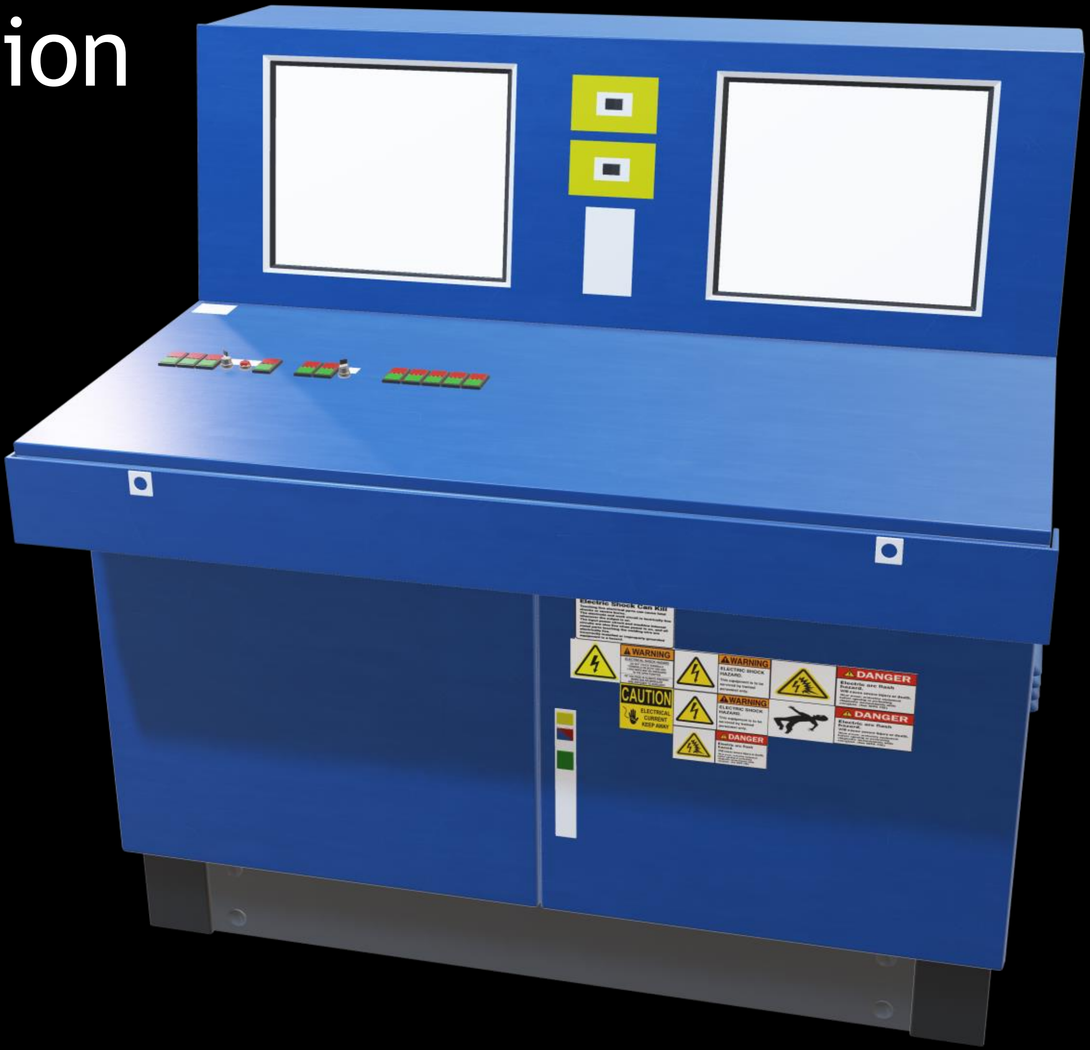
WSP_Station



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Nokia 5G hardware

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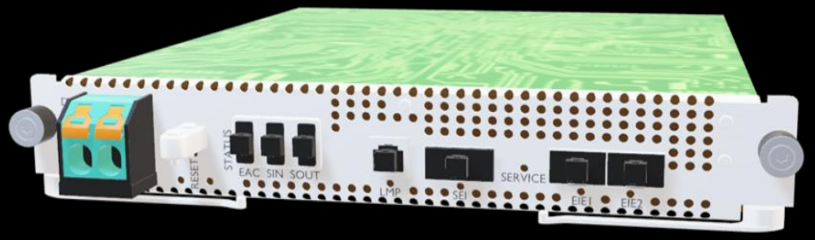
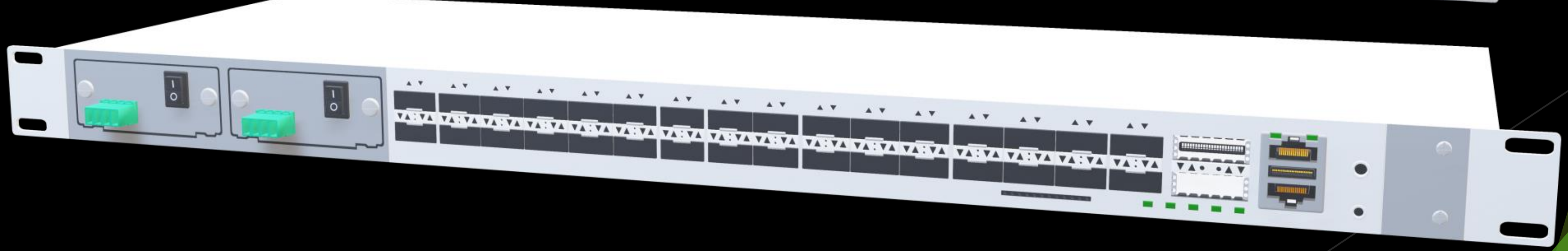


NOKIA
NOKIA



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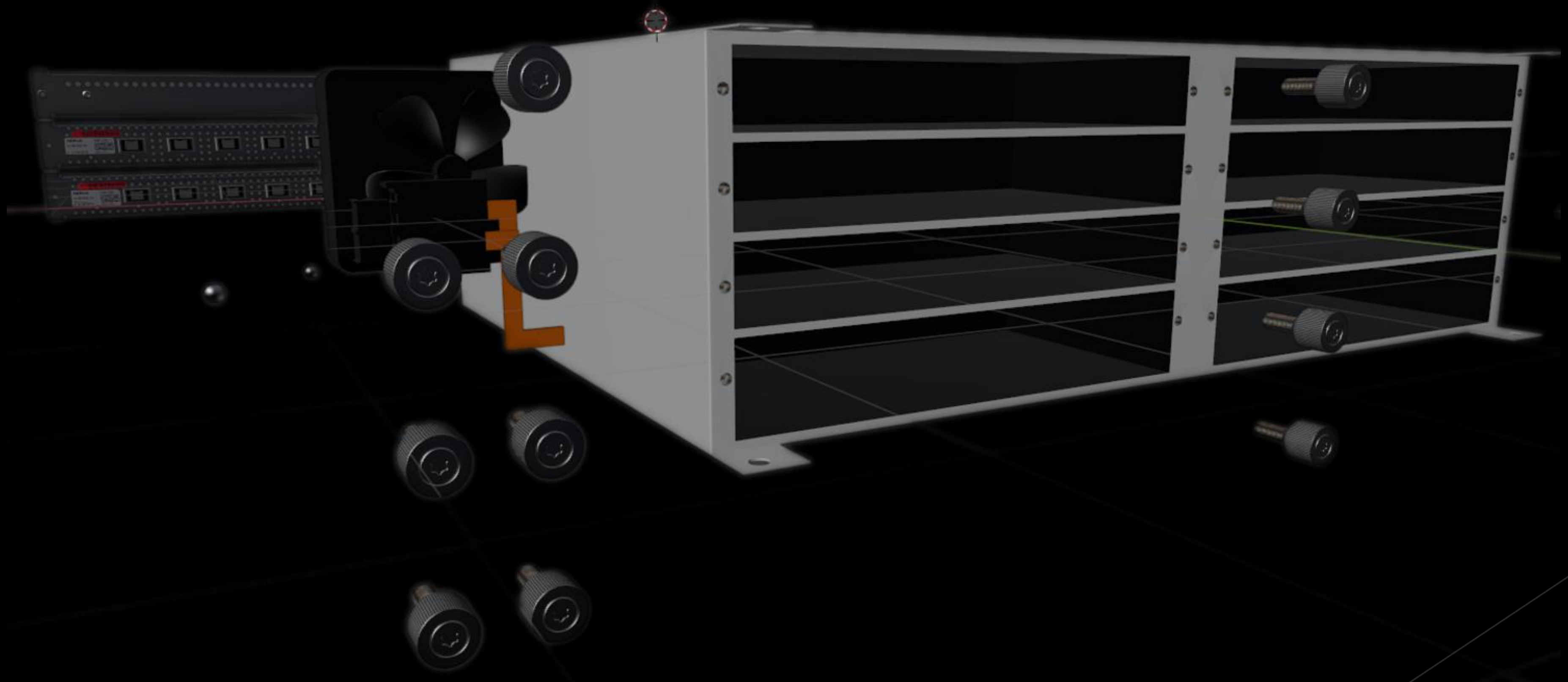
5G Network Simulation tools



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Global Scale Multiplayer Simulations

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Included Standard Tools

- **Unified-** Development CI/CD Platform with automation to support your project from concept to completion
- **Nexus-** Of modular Tools, frameworks, Pipelines, Assets, Code & Blueprints selected or designed to be easily integrated into or out of clients' projects
- **Robust-** Scalable network resources based on time tested proven methods
- **Extensible-** Development offerings to assure long term confidence
- **Automation-** Focused on mitigating common time-consuming tasks, to save your team time & money
- **Leverage-** The benefits & features of the entire ecosystem’s validated tools accelerate your projects success

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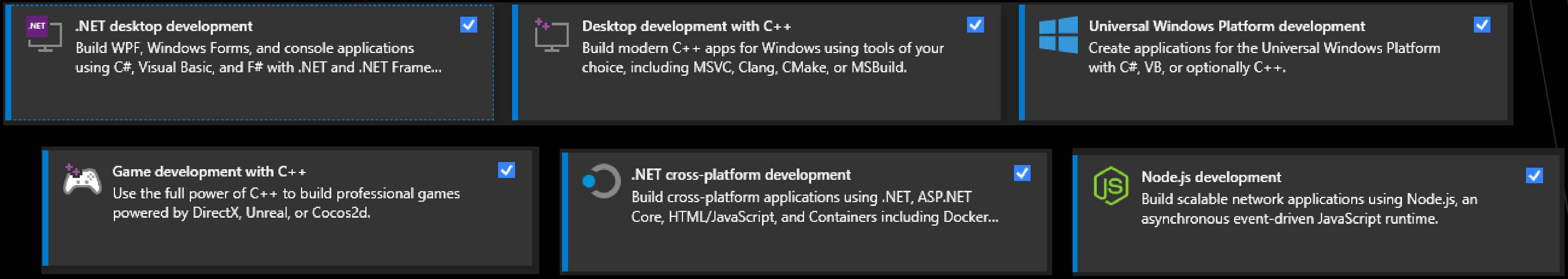
Visual Studio 2019 internal IDE



.NET desktop development ☑
Build WPF, Windows Forms, and console applications using C#, Visual Basic, and F# with .NET and .NET Frame...

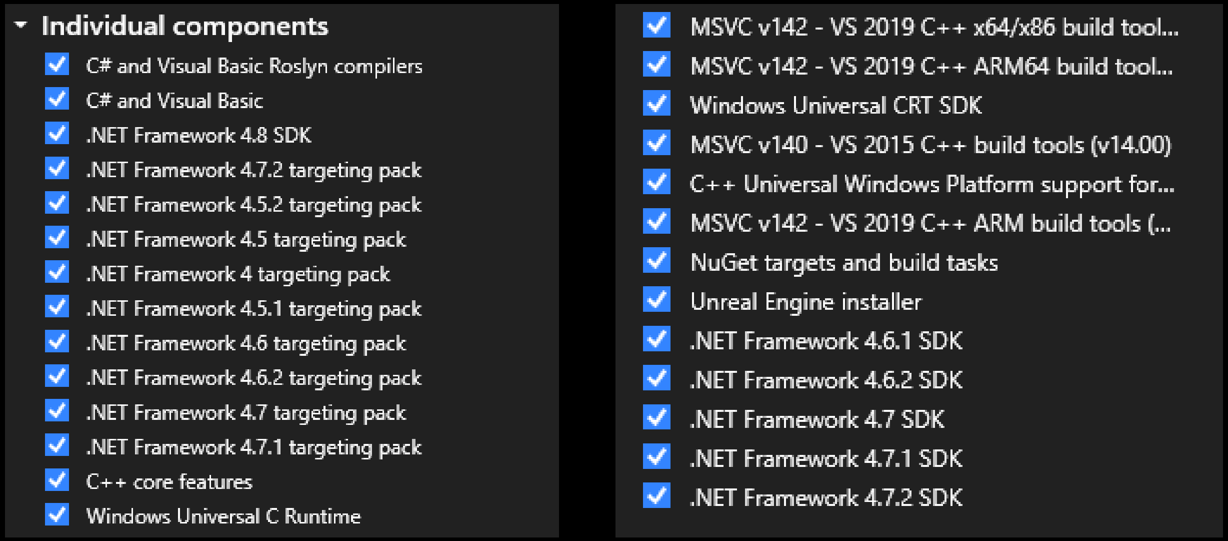
Desktop development with C++ ☑
Build modern C++ apps for Windows using tools of your choice, including MSVC, Clang, CMake, or MSBuild.

Universal Windows Platform development ☑
Create applications for the Universal Windows Platform with C#, VB, or optionally C++.

Game development with C++ ☑
Use the full power of C++ to build professional games powered by DirectX, Unreal, or Cocos2d.

.NET cross-platform development ☑
Build cross-platform applications using .NET, ASP.NET Core, HTML/JavaScript, and Containers including Docker...

Node.js development ☑
Build scalable network applications using Node.js, an asynchronous event-driven JavaScript runtime.



Individual components

- ☑ C# and Visual Basic Roslyn compilers
- ☑ C# and Visual Basic
- ☑ .NET Framework 4.8 SDK
- ☑ .NET Framework 4.7.2 targeting pack
- ☑ .NET Framework 4.5.2 targeting pack
- ☑ .NET Framework 4.5 targeting pack
- ☑ .NET Framework 4 targeting pack
- ☑ .NET Framework 4.5.1 targeting pack
- ☑ .NET Framework 4.6 targeting pack
- ☑ .NET Framework 4.6.2 targeting pack
- ☑ .NET Framework 4.7 targeting pack
- ☑ .NET Framework 4.7.1 targeting pack
- ☑ C++ core features
- ☑ Windows Universal C Runtime
- ☑ MSVC v142 - VS 2019 C++ x64/x86 build tool...
- ☑ MSVC v142 - VS 2019 C++ ARM64 build tool...
- ☑ Windows Universal CRT SDK
- ☑ MSVC v140 - VS 2015 C++ build tools (v14.00)
- ☑ C++ Universal Windows Platform support for...
- ☑ MSVC v142 - VS 2019 C++ ARM build tools (...
- ☑ NuGet targets and build tasks
- ☑ Unreal Engine installer
- ☑ .NET Framework 4.6.1 SDK
- ☑ .NET Framework 4.6.2 SDK
- ☑ .NET Framework 4.7 SDK
- ☑ .NET Framework 4.7.1 SDK
- ☑ .NET Framework 4.7.2 SDK

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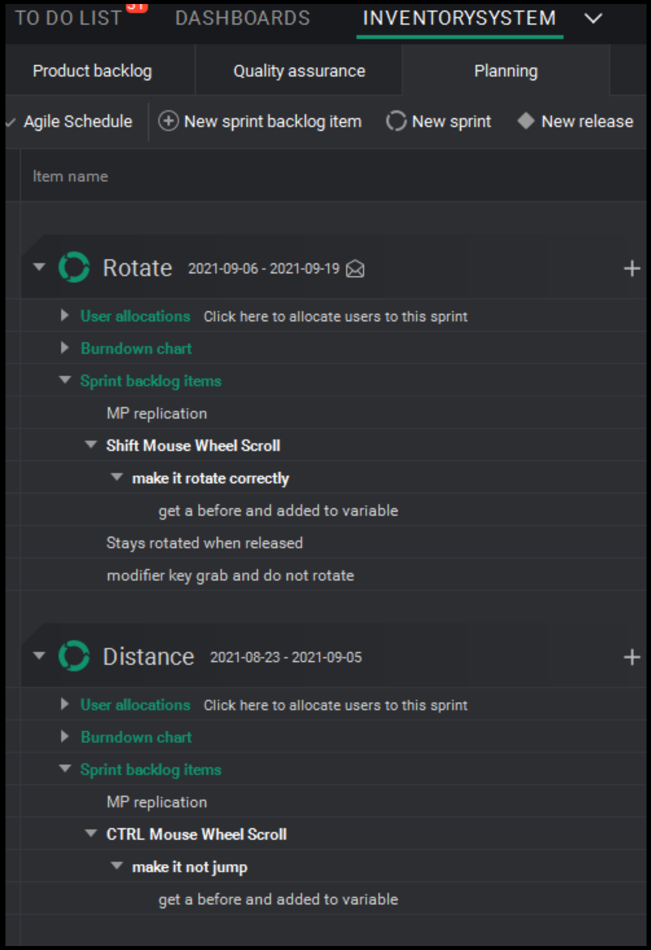
Hansoft (Agile) Plan, Track, & Manage


TO DO LIST DASHBOARDS INVENTORYSYSTEM

Product backlog | Quality assurance | Planning

Agile Schedule | New sprint backlog item | New sprint | New release

Item name

Rotate 2021-09-06 - 2021-09-19

- User allocations Click here to allocate users to this sprint
- Burndown chart
- Sprint backlog items
  - MP replication
  - Shift Mouse Wheel Scroll
    - make it rotate correctly
      - get a before and added to variable
  - Stays rotated when released
  - modifier key grab and do not rotate

Distance 2021-08-23 - 2021-09-05

- User allocations Click here to allocate users to this sprint
- Burndown chart
- Sprint backlog items
  - MP replication
  - CTRL Mouse Wheel Scroll
    - make it not jump
      - get a before and added to variable

The native Windows, OS X, or Linux client allows batch updating & removes your click/wait experience.
You can change attributes & workflows on the fly.

Teams get to use their favorite project management methods: Scrum, Gantt, Kanban, Waterfall, SAFe & more.

Refine, prioritize, estimate, & give any other custom attribute to your deliverables. Everyone works from a joint backlog that scales.

Teams can track their tasks. Managers can track teams. Decision makers get dynamic reporting & analytics they need for real-time insights — from big picture to details. Visualize problems immediately so, you can correct them before they delay progress.

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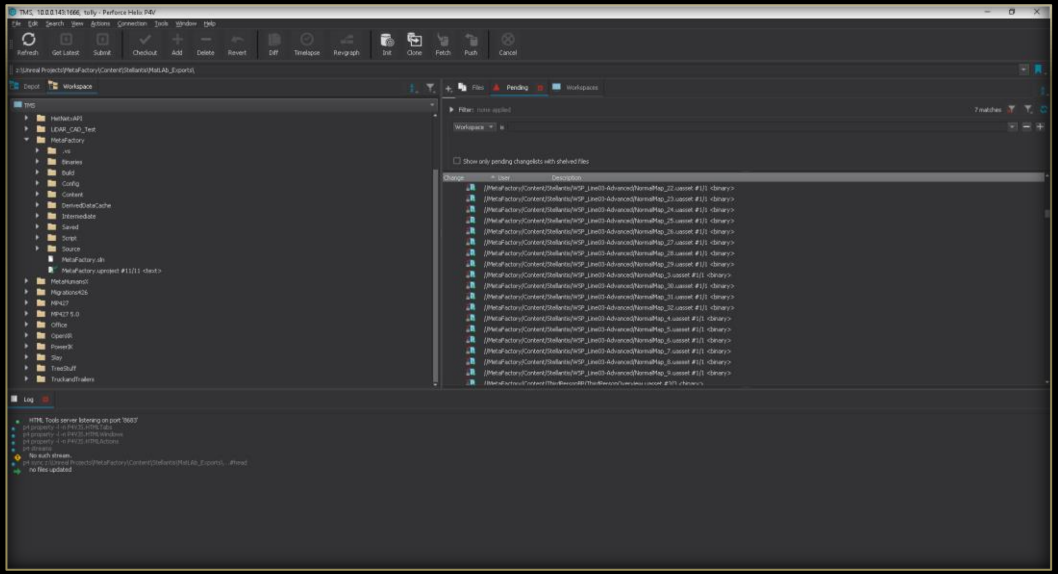
P4V Version Control


TMS, 10.0.0.143:1666, tolly - Perforce Helix P4V
File Edit Search View Actions Connection Tools Window Help
Refresh Get Latest Submit Checkout Add Delete Revert Diff Timelapse Revgraph Init Clone Fetch Push Cancel
Depot Workspace
Files Pending Workspaces
Filter: none applied
7 matches
Workspace is
Show only pending changelists with shelved files
Change User Description
Log

```
z:\Unreal Projects\MetaFactory\Content\Stellantis\MatLAb_Exports\
```

```
TMS
  HetNet-API
  LIDAR_CAD_Test
  MetaFactory
    .vs
    Binaries
    Build
    Config
    Content
    DerivedDataCache
    Intermediate
    Saved
    Script
    Source
    MetaFactory.sln
    MetaFactory.uproject #11/11 <text>
  MetaHumansX
  Migrations426
  MP427
  MP427 5.0
  Office
  OpenXR
  PowerIK
  Slay
  TreeStuff
  TruckandTrailers
```

```
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_22.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_23.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_24.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_25.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_26.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_27.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_28.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_29.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_3.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_30.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_31.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_32.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_4.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_5.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_6.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_7.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_8.uasset #1/1 <binary>
//MetaFactory/Content/Stellantis/WSP_Line03-Advanced/NormalMap_9.uasset #1/1 <binary>
//MetaFactory/Content/ThirdPersonBP/ThirdPersonOverview.uasset #3/3 <binary>
```

```
HTML Tools server listening on port '8683'
p4 property -l -n P4VJS.HTMLTabs
p4 property -l -n P4VJS.HTMLWindows
p4 property -l -n P4VJS.HTMLActions
p4 streams
 No such stream.
p4 sync z:\Unreal Projects\MetaFactory\Content\Stellantis\MatLAb_Exports\...#head
 no files updated
```

Enterprise-scale Development Tools

- Accelerate workflows & help you conquer deadlines with P4V version control + project management software (Hansoft).
- Integration with Hansoft - an enterprise Agile planning tool that provides a single platform for decision-making at the project, program, & portfolio levels.
- Used internally by the Unreal Engine source control team.
- Free for up to 5 users

METAFACTORY

Distributed Compilation (Paid)

INCREDIBUILD

From Source – To Compiled Installer / Client

- Easy to use
- Already integrated in the Unreal Engine Source
- Already integrated in Visual Studio
- Load the client & license file – point it at the coordinator
- Pricey for a bootstrap
- Good for a funded startup/company

Unreal Editor 4.27.0 · MetaFactory
Copyright © Epic Games, Inc. All rights reserved.

45% - Finalizing load of IntProperty_0....

Distributed Compilation (Free)

FASTBUILD

From Source – To Compiled Installer / Client

- Before building UE from source:
- FASTBuild executables must be in
- \Engine\Extras\ThirdPartyNotUE\FASTBuild. (These must be the FASTBuild executables modified by Epic & included in the GitHub source code repository.
- FASTBuild.cs must be place in \Engine\Source\Programs\UnrealBuildTool\System.

Unreal Editor 4.27.0 · MetaFactory
Copyright © Epic Games, Inc. All rights reserved.

45% - Finalizing load of IntProperty_0....

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Dedicated Server Build Process

UE From GitHub – d/l via Jenkins – build with automation

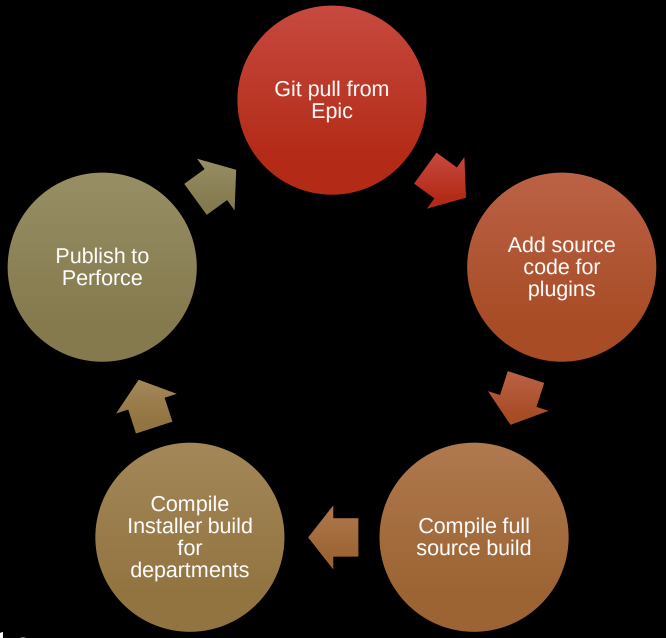
Continuous build cycle with the latest source code from Unreal Engine.

Automated Jenkins latest git pull from the Unreal Engine GitHub repository.

Correct errors & achieve 100% build success with full source build.

Correct errors & achieve 100% build success for Installer build used in various departments (art, kinematics, HUD, API, QA).

Publish to Perforce source control for each department to be synchronized with the latest stable Unreal Engine editor internal build.


Git pull from Epic
Add source code for plugins
Compile full source build
Compile Installer build for departments
Publish to Perforce

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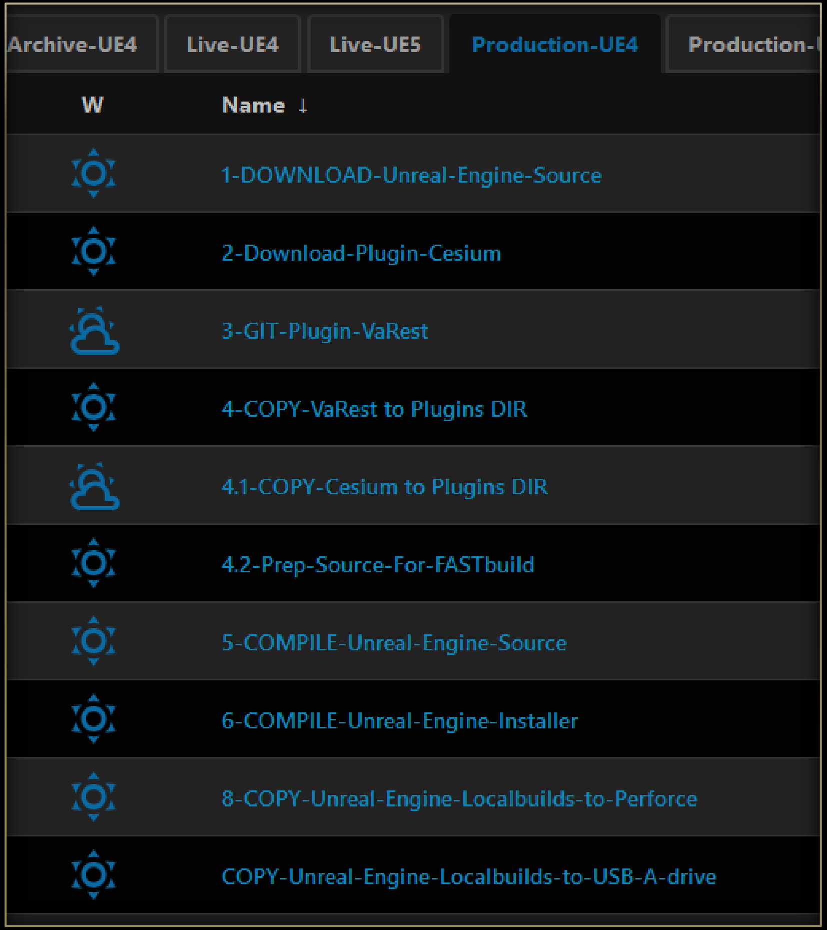
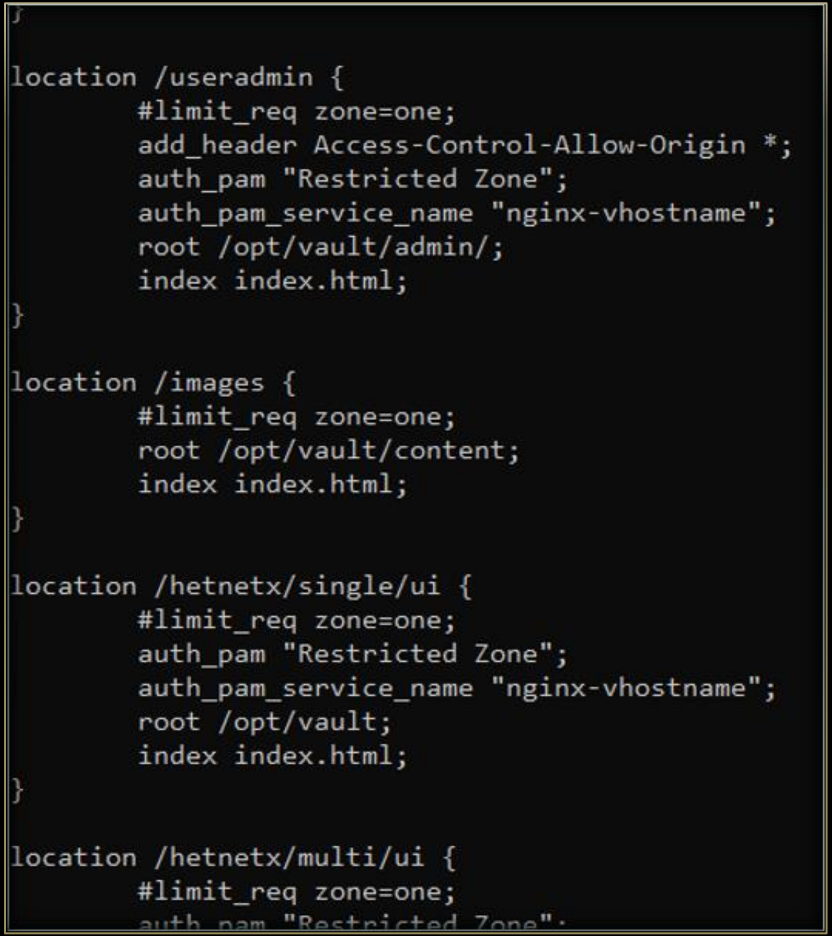
Unreal Engine Installer Build Process



W	Name ↓
☼	1-DOWNLOAD-Unreal-Engine-Source
☼	2-Download-Plugin-Cesium
⛅	3-GIT-Plugin-VaRest
☼	4-COPY-VaRest to Plugins DIR
⛅	4.1-COPY-Cesium to Plugins DIR
☼	4.2-Prep-Source-For-FASTbuild
☼	5-COMPILE-Unreal-Engine-Source
☼	6-COMPILE-Unreal-Engine-Installer
☼	8-COPY-Unreal-Engine-Localbuilds-to-Perforce
☼	COPY-Unreal-Engine-Localbuilds-to-USB-A-drive

- Copy these to the LocalBuilds directory from the GitHub source build location after compilation:
- /Setup.bat /Engine/Binaries/Win64/UnrealVersionSelector-Win64-Shipping.exe
- Distribute the Installer build to various departments & run Setup.bat & UnrealVersionSelector-Win64-Shipping.exe

RISOR application firewall



```
}

location /useradmin {
        #limit_req zone=one;
        add_header Access-Control-Allow-Origin *;
        auth_pam "Restricted Zone";
        auth_pam_service_name "nginx-vhostname";
        root /opt/vault/admin/;
        index index.html;
}

location /images {
        #limit_req zone=one;
        root /opt/vault/content;
        index index.html;
}

location /hetnetx/single/ui {
        #limit_req zone=one;
        auth_pam "Restricted Zone";
        auth_pam_service_name "nginx-vhostname";
        root /opt/vault;
        index index.html;
}

location /hetnetx/multi/ui {
        #limit_req zone=one;
        auth_pam "Restricted Zone";
```

NGINX API filtering & redirection

- Hardened by default
- Inverse Internet Routing
- MySQL integration
- Streamlined configuration
- No extraneous modules

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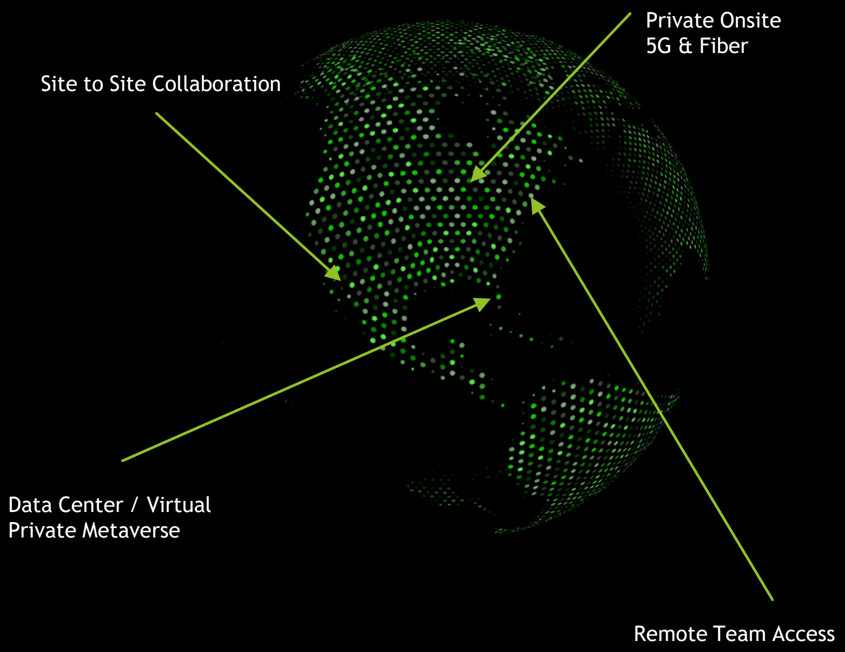
MetaVPN Secure Remote Access



- Simularent API controlled executive management plane
- Require a client access config file for a quick way to disconnect users & keep them from reconnecting after being locked or deleted, it can 0 byte & used as a means of granular access control
- React JS dashboard with MySQL user credential storage via encrypted user information. Easy add/remove/lock user access.
- All actions require confirmation. The system is built for non-technical users to control system access.

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~~Meta~~verse TeleSystem

- On-site standalone or private cloud-based User to User voice, text chat & voicemail
- On-demand missed message historic retention & retrieval; for example: if a user steps away from his workstation or needs to mute incoming audio, they can retrieve & listen to past/ missed messages
- Enterprise-grade Asterisks PBX's & SIP trunks enable The real world being able to call into a simulation & a simulation being able to make & receive calls to & from the real world with existing hardware. (just like the Matrix)
- Simularent API & UI Administration
- Embedded FFmpeg Audio /Video System
- Real-world & In game ~~Meta~~Telephony network
- Perhaps the worlds first ~~Meta~~verse's Utility company.

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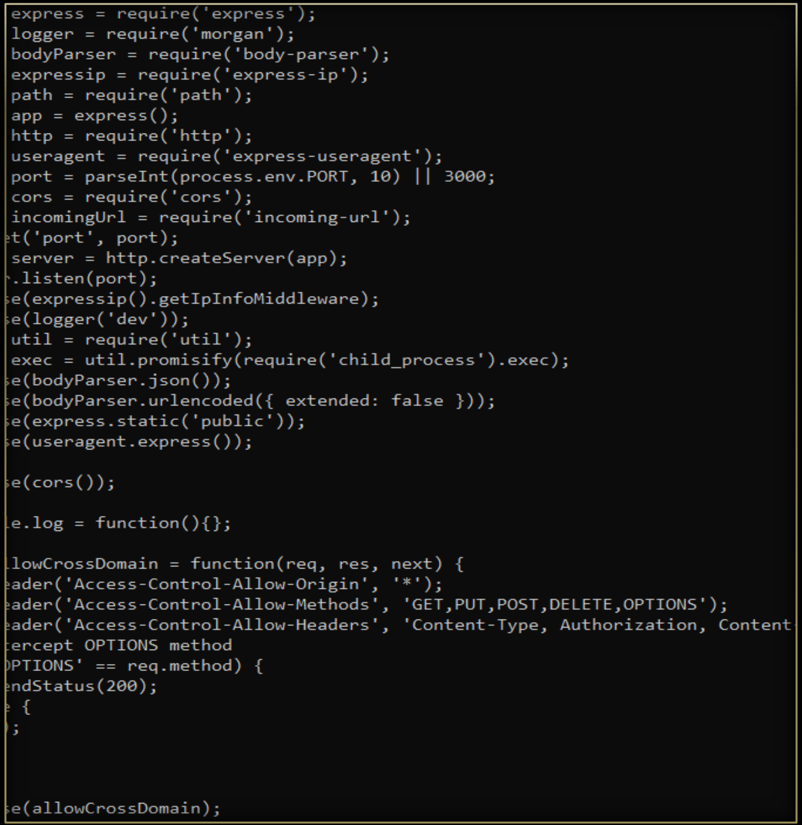
Simularent API

Nodejs API
Data Tx/Rx From
Unreal Engine Runtime



```
express = require('express');
logger = require('morgan');
bodyParser = require('body-parser');
expressip = require('express-ip');
path = require('path');
app = express();
http = require('http');
useragent = require('express-useragent');
port = parseInt(process.env.PORT, 10) || 3000;
cors = require('cors');
incomingUrl = require('incoming-url');
t('port', port);
server = http.createServer(app);
.listen(port);
e(expressip().getIpInfoMiddleware);
e(logger('dev'));
util = require('util');
exec = util.promisify(require('child_process').exec);
e(bodyParser.json());
e(bodyParser.urlencoded({ extended: false }));
e(express.static('public'));
e(useragent.express());

e(cors());

e.log = function(){};

lowCrossDomain = function(req, res, next) {
ader('Access-Control-Allow-Origin', '*');
ader('Access-Control-Allow-Methods', 'GET,PUT,POST,DELETE,OPTIONS');
ader('Access-Control-Allow-Headers', 'Content-Type, Authorization, Content
ercept OPTIONS method
PTIONS' == req.method) {
ndStatus(200);
 {
;



e(allowCrossDomain);
```

- Node JS latest version
- pm2 cluster mode
- Minimal NPM install
- Interacts with several shell scripts
- Debian 11

SIMULARENT

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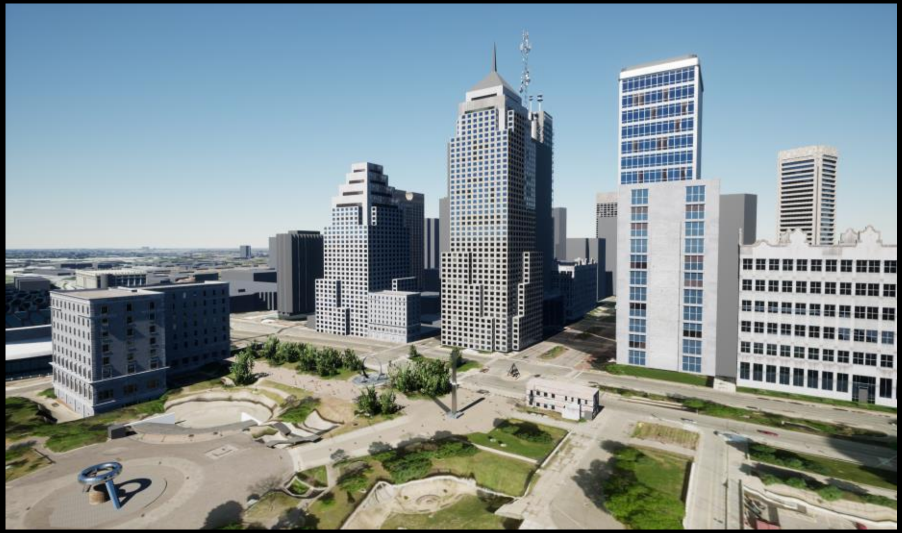
Cesium for Unreal Hacks

- Cesium Multiplayer + Pixel Steaming with advanced Character controls
- EPSG CRS to UE4 Geo reference calibration blueprint
- Inverse GPS character tracker + xR presence can log a user’s simulation location aligned to a real-world location
- 3D Tiles Next ready
- In transit Cesium for Unreal data Manipulation (hide/ add) of buildings, textures & Metadata

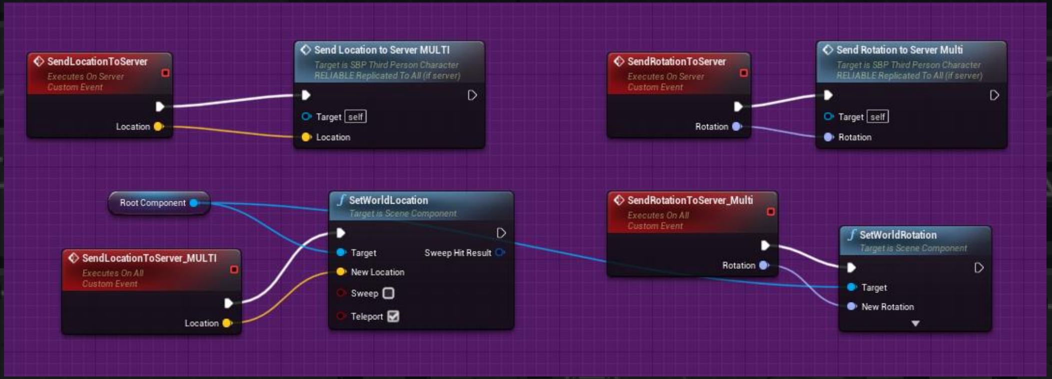


METAFACTORY

Metaverse focused pawn

SBP_ThirdPersonCharacter

- Replication for appropriate actions. Easily duplicated for new functions.
- Several operating modes presented via the HUD
- Simularent Inverse Kinematics Solver for Cyber Physical Robotics Control systems
- Metadata retrieval from properly formatted in-session assets.
- In game Linux Shell & access to the stack. (Enterprise only)

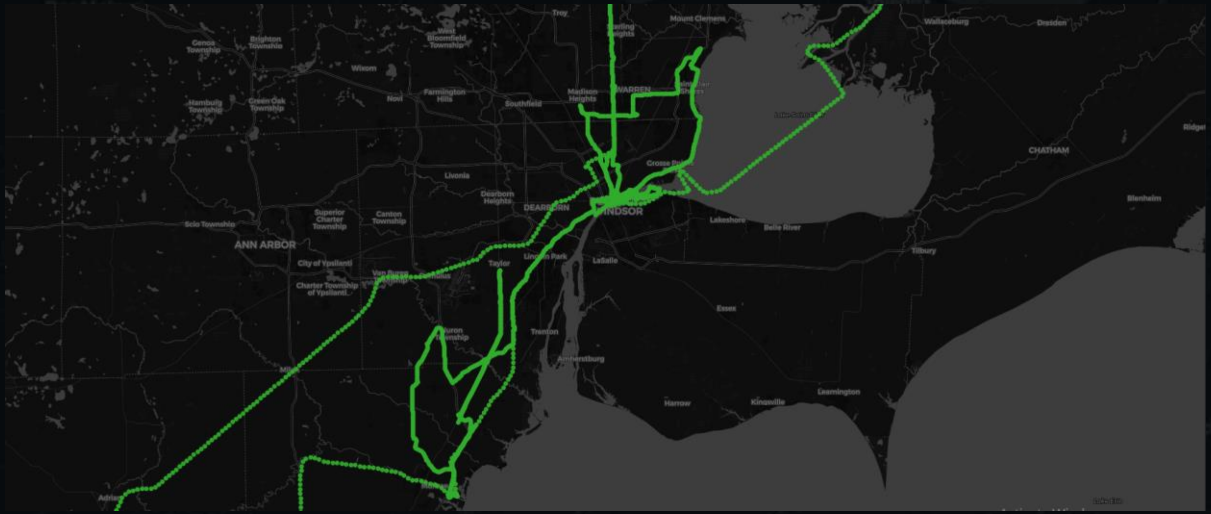


SIMULARENT

User Pawn position monitoring

Displayed outside of simulation via Grafana

- Separate remote browser access to precision in-session user avatar location Metadata
- Realtime Metadata from properly prepared Unreal Engine assets.
- In session HUD sends data to API & displays on world map.
- User x,y,z location & selected asset locations become visible, with any data that needs to be sent from any blueprint or CPP feature.



SIMULARENT

DeepFind & DeepReplace

A Tool for adding full Datasmith features into in a source build & other uses

Install — Install a vanilla version of the UE, using the Epic Games installer, that matches the source build version.

Use — Use DeepFind to get the "BuildId" from the vanilla installation's "\Engine\Build\Build.version" file.

Use — Use DeepFind to get the "BuildId" from the compiled UE editor "\Engine\Build\Build.version" file after building the internal UE editor from Epic Games GitHub source.

Copy — Copy the "/Plugins/Enterprise" directory from the vanilla installation of UE to the compiled version of UE, into the "/Plugins/Enterprise" directory (DELETE THE CONTENTS OF THE DIRECTORY FIRST).

Use — Use DeepReplace to change the "BuildId" in each of the ".modules" files recursively under the "/Enterprise/" directory to match the "BuildId" that was found in the vanilla install.

Enable — Enable the Plugin – Datasmith SDK within the source build of UE.

change .modules files for unreal.js “A Powerful & Potentially Dangerous Tool”

METAFACTORY

EPIC
MegaGrants
RECIPIENT

Thank you

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