VR Framework for Software Exploration & Analysis

Leon Hutans

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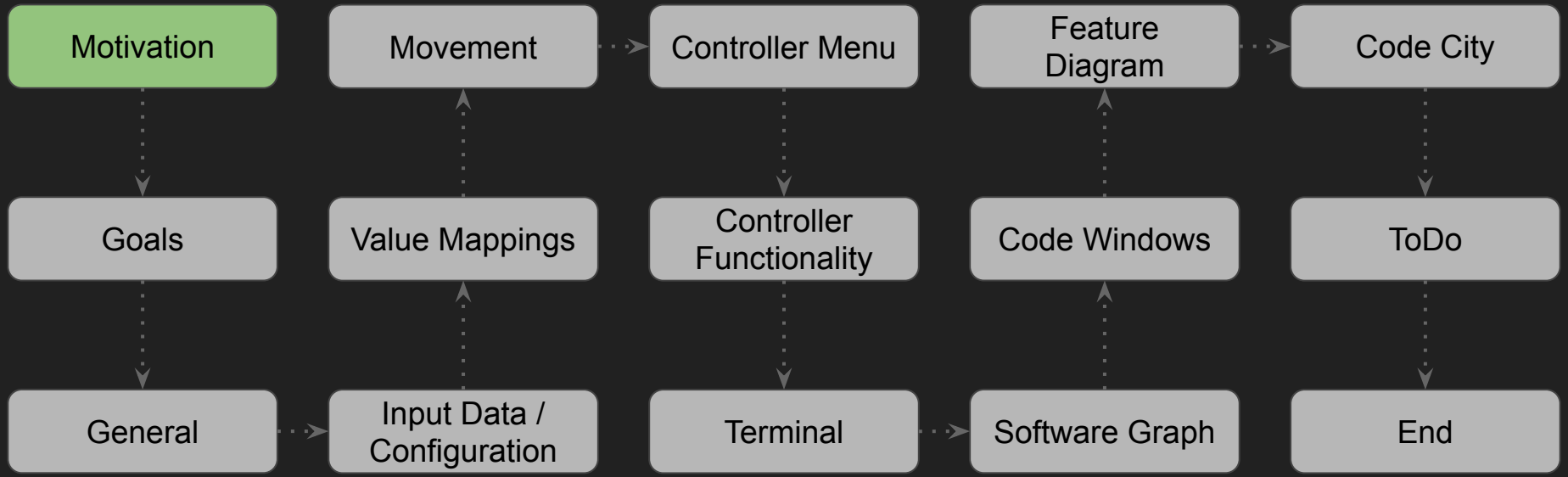
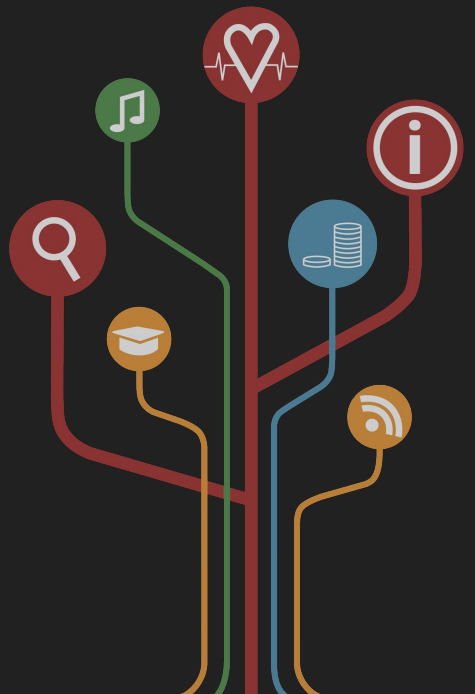

Motivation
Movement
Controller Menu
Feature Diagram
Code City
Goals
Value Mappings
Controller Functionality
Code Windows
ToDo
General
Input Data / Configuration
Terminal
Software Graph
End

Motivation

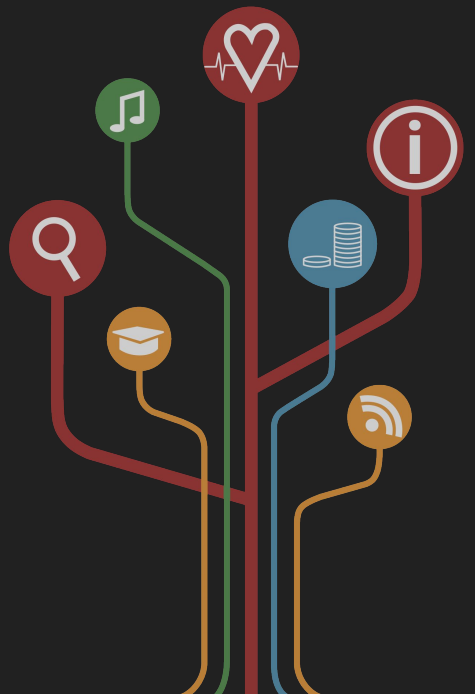
- Increasing complexity of software systems
  → difficult analysis and evaluation
  → yield highly complex data
  → problems (e.g. spatial limitation)
- “How to handle analysis data?”



Motivation

- Increasing complexity of software systems
  → difficult analysis and evaluation
  → yield highly complex data
  → problems (e.g. spatial limitation)
- “How to handle analysis data?”
  → New technologies like VR
  = New opportunities?

→ VR Framework created



Results of Prior Work

...

- Introduced additional visualization / interaction techniques
  - Feature graph and control flow concept
- Good usability and motivated users → much potential
- Found areas of application (education, project man., ...)
- Pointed out problems, suggestions, ideas

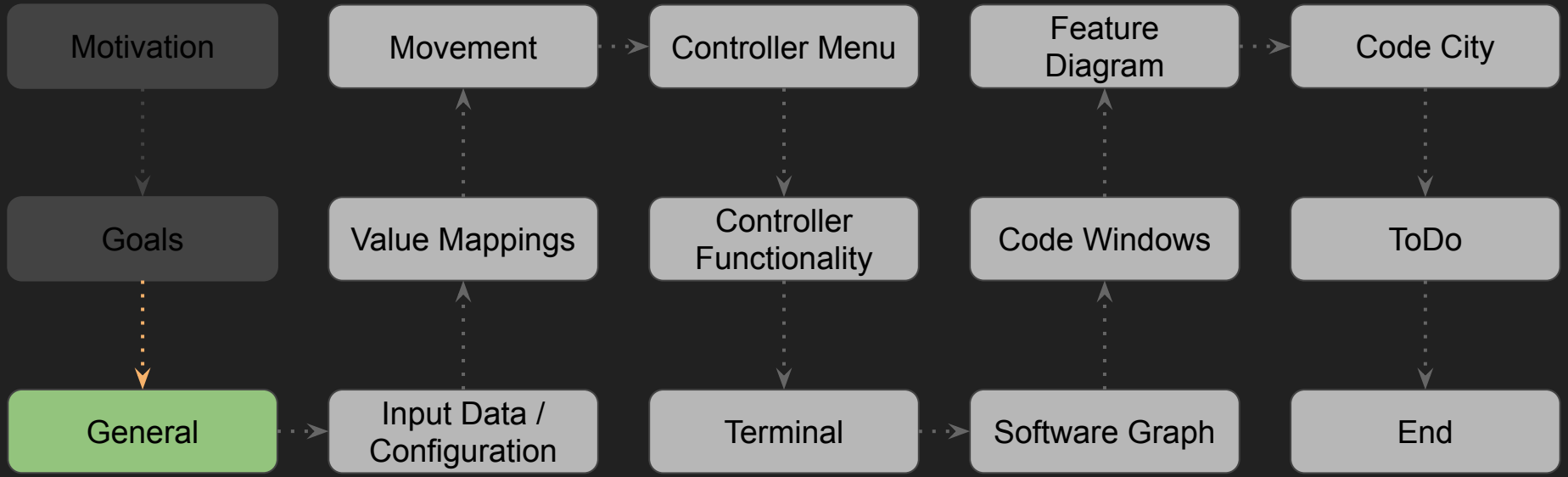
...

Project Goals

- Improve
- Expand
- Document

Project Goals

- Improve
  - Fix bugs
  - Improve tools
  - Improve performance
  - Improve structure of framework
  - Cleanup existing code
- Expand
  - Add missing functionality
  - Add new interaction techniques
  - Add most important suggestions & ideas
  - Add planned/new types of visualizations
- Document
  - Create possible missing documentation for existing work
  - Document new code and features
  - Document new ideas and the documentation itself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General Framework Information

- Based on the Unity Engine & SteamVR
- Developed for the HTC Vive
- Written in C#
- Single-user application

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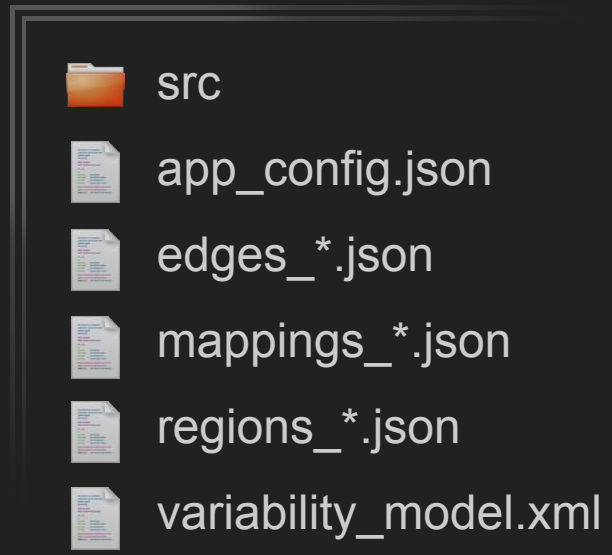
- Written in C#
- Single-user application
- Still an “early” version
  - no introduction scenes
  - no storing/loading on runtime
  - not yet fully optimized

Input Data

- Project data is organized in a “workspace”
- General project configuration
- Software system source code
- NFP- and feature regions
- Edge definitions (control flow, …)
- Variability model (feature model)
- Value Mappings



Input Data > Value Mappings

- Define how values are shown inside the application
- Allow definition of methods (e.g. color methods)

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{
    "name": "Green_Blue",
    "base": "Color_Scale",
    "from": "0.4, 1.0, 0.4, 1.0",
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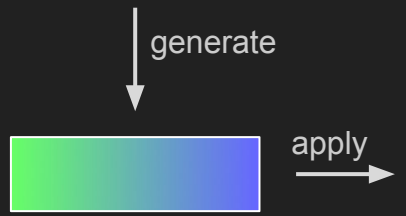
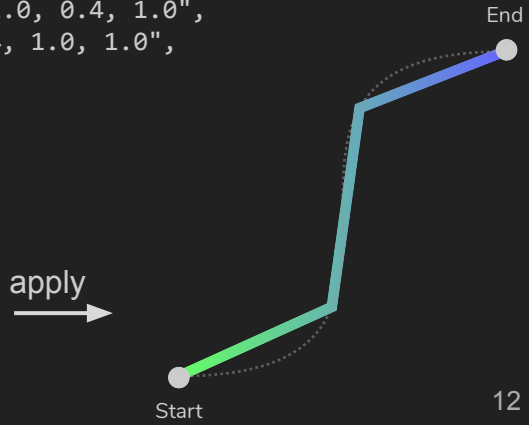
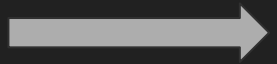
}
```





Input Data > Value Mappings

- Define how values are shown inside the application
- Allow definition of methods (e.g. color methods)
- Mapping types:
  - NFP (color, unit)
  - Feature (color)
  - Edge (color, width, steps)
  - Filename (color)



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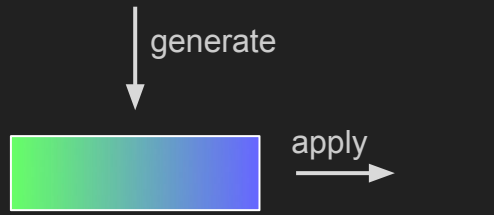

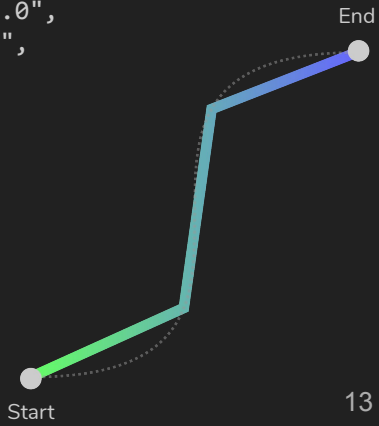

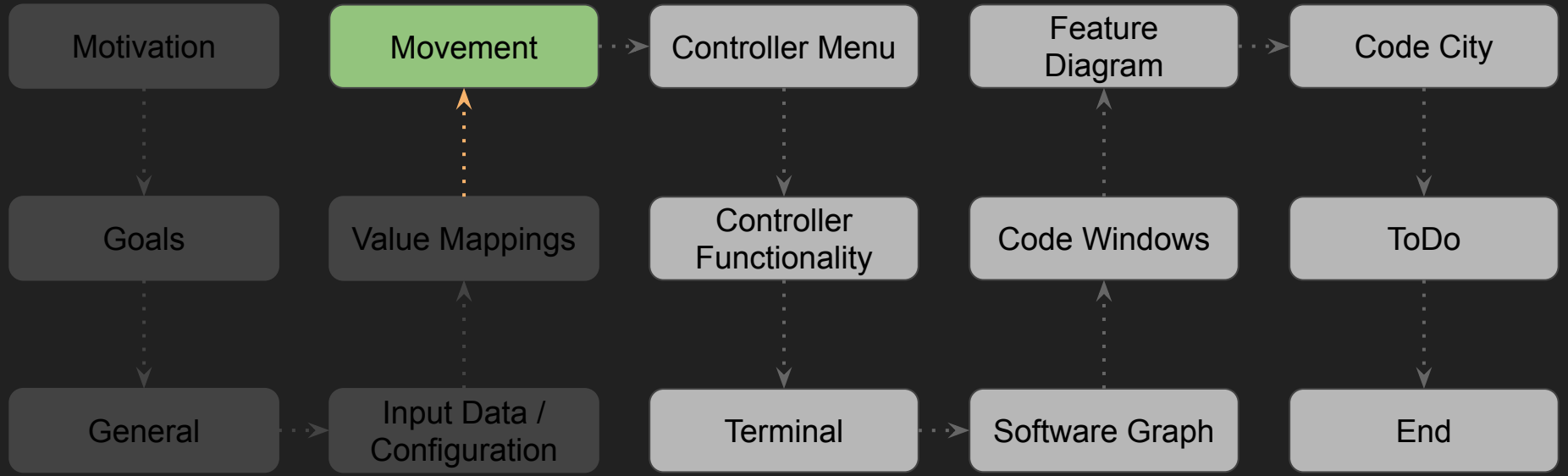
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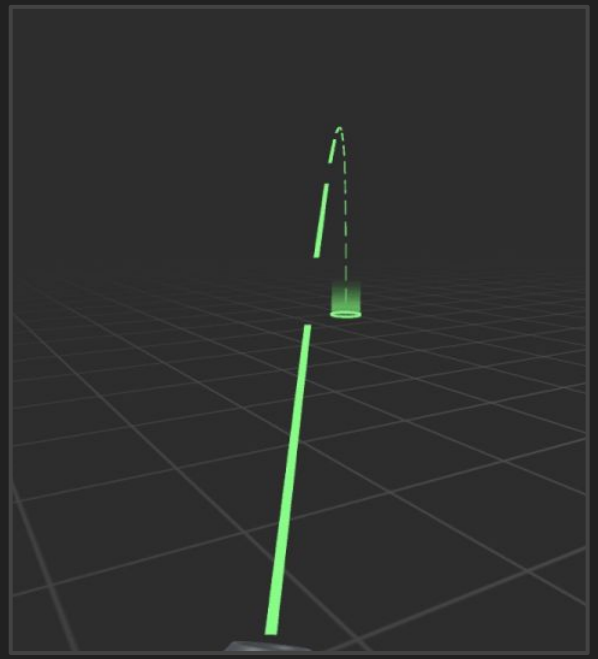
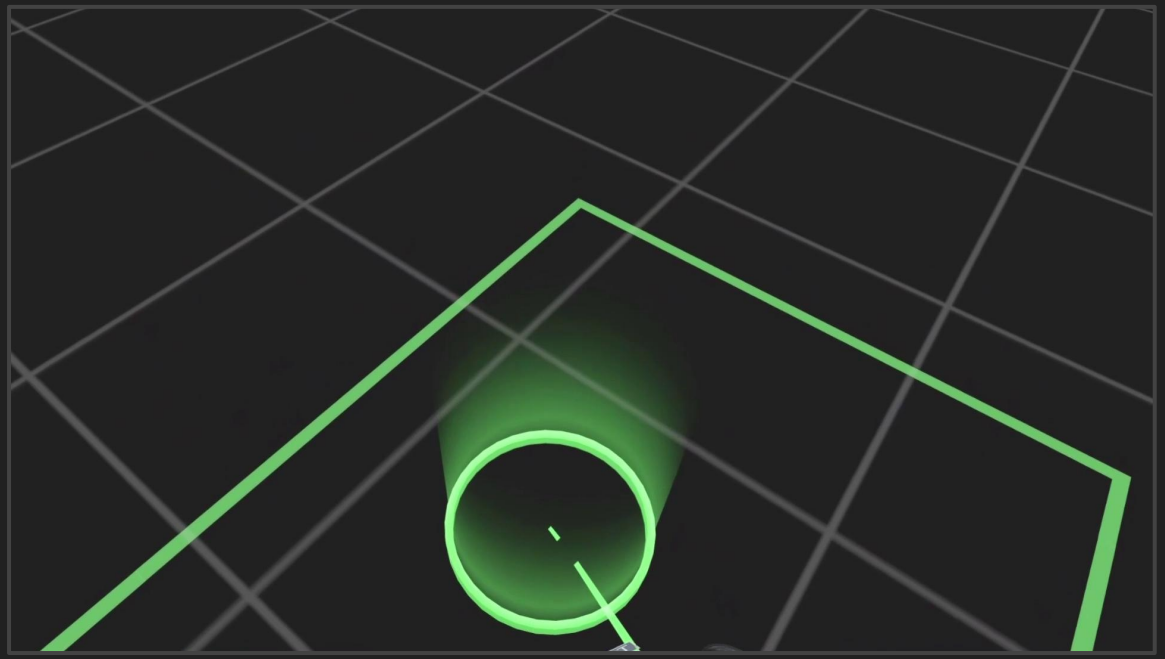
Movement

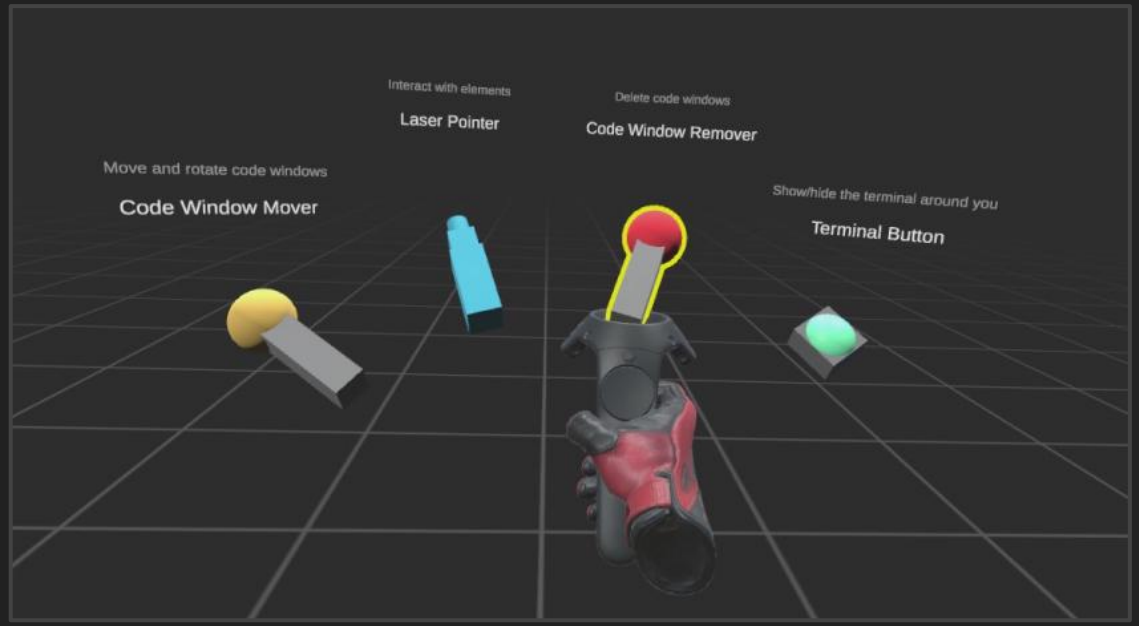
- “Click & Teleport”





Controller Menu

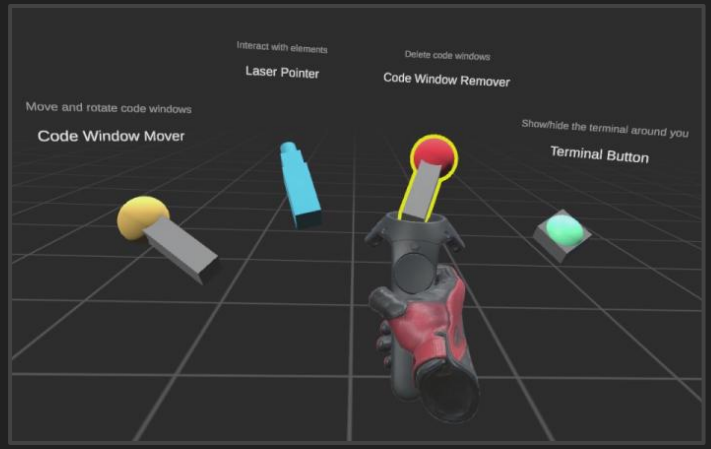
- Changes the way a controller works and looks like

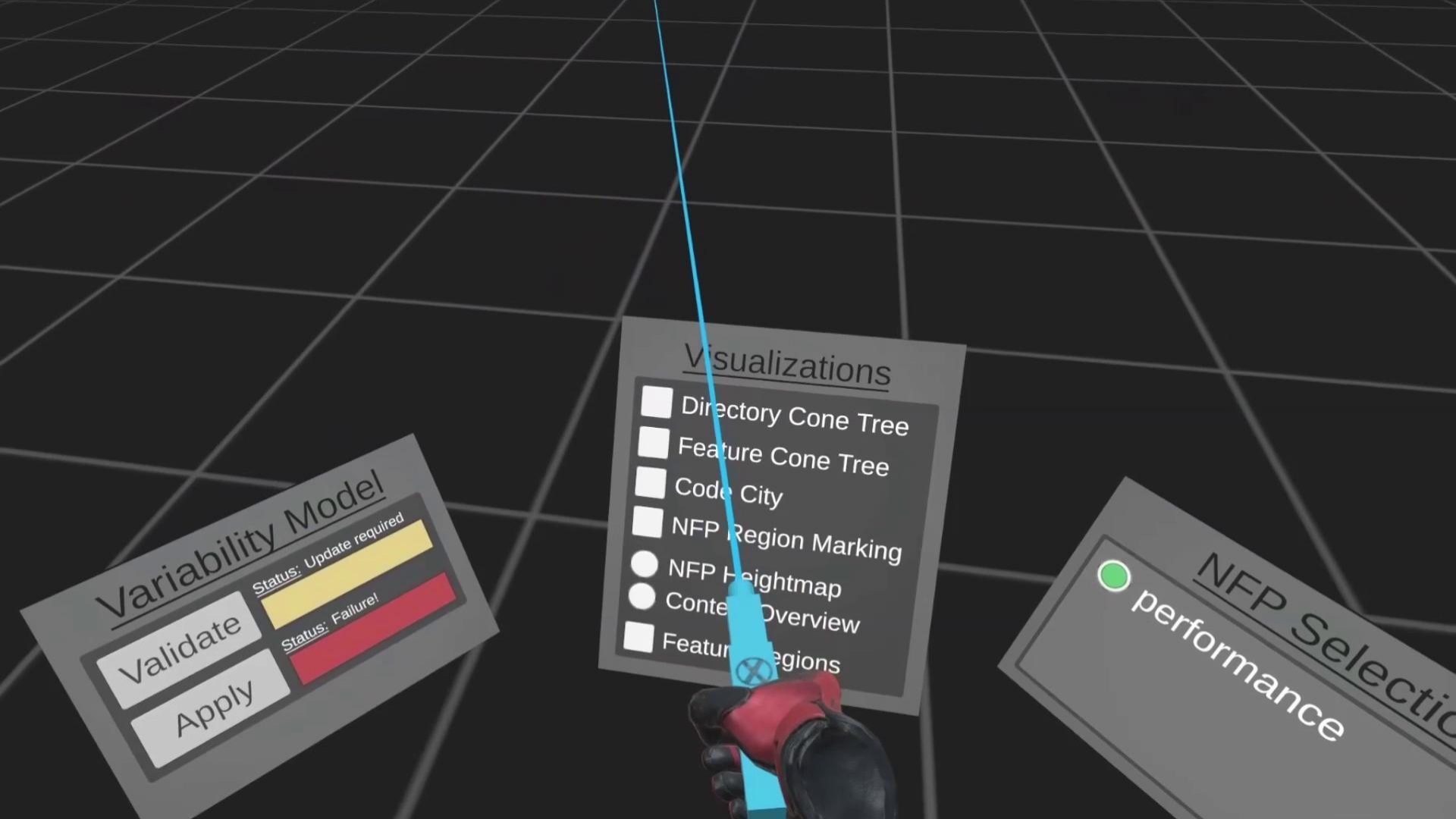



Code Window Mover
Terminal Button

Controller Functionality

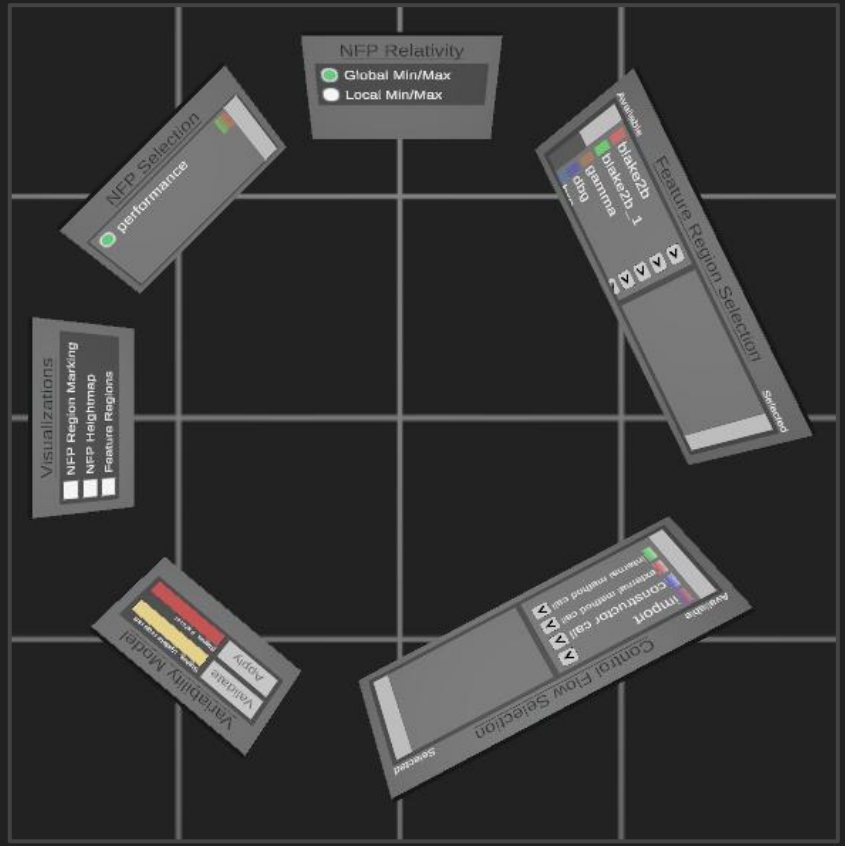
- Laser Pointer
  - Interact with UI & world
- Code Window Mover
  - Position & rotate code windows
- Code Window Remover
  - Remove spawned code windows
- Terminal Button
  - Show/Hide the terminal surrounding the user

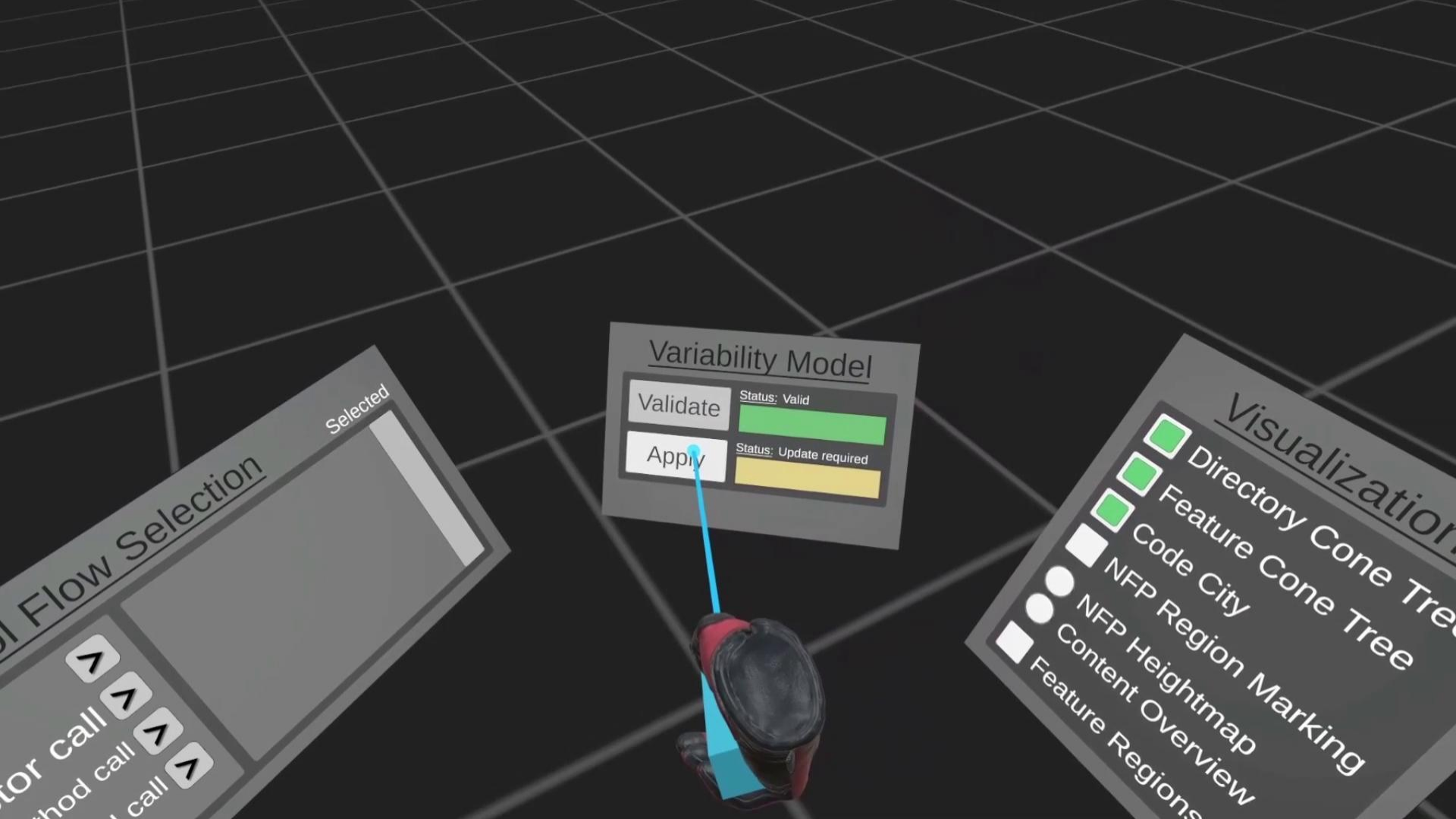



Variability Model
Validate
Apply
Status: Update required
Status: Failure!
Visualizations
Directory Cone Tree
Feature Cone Tree
Code City
NFP Region Marking
NFP Heightmap
Overview
egions
NFP Selecti
performance

Terminal

- Surrounds and sticks to the user
- Access to configurations
  - NFPs
  - Edges
  - Features
- Allows to enable/disable visualizations
- Validation of feature model configuration




Variability Model
Validate
Status: Valid
Apply
Status: Update required
Selected
Visualization
Directory Cone Tree
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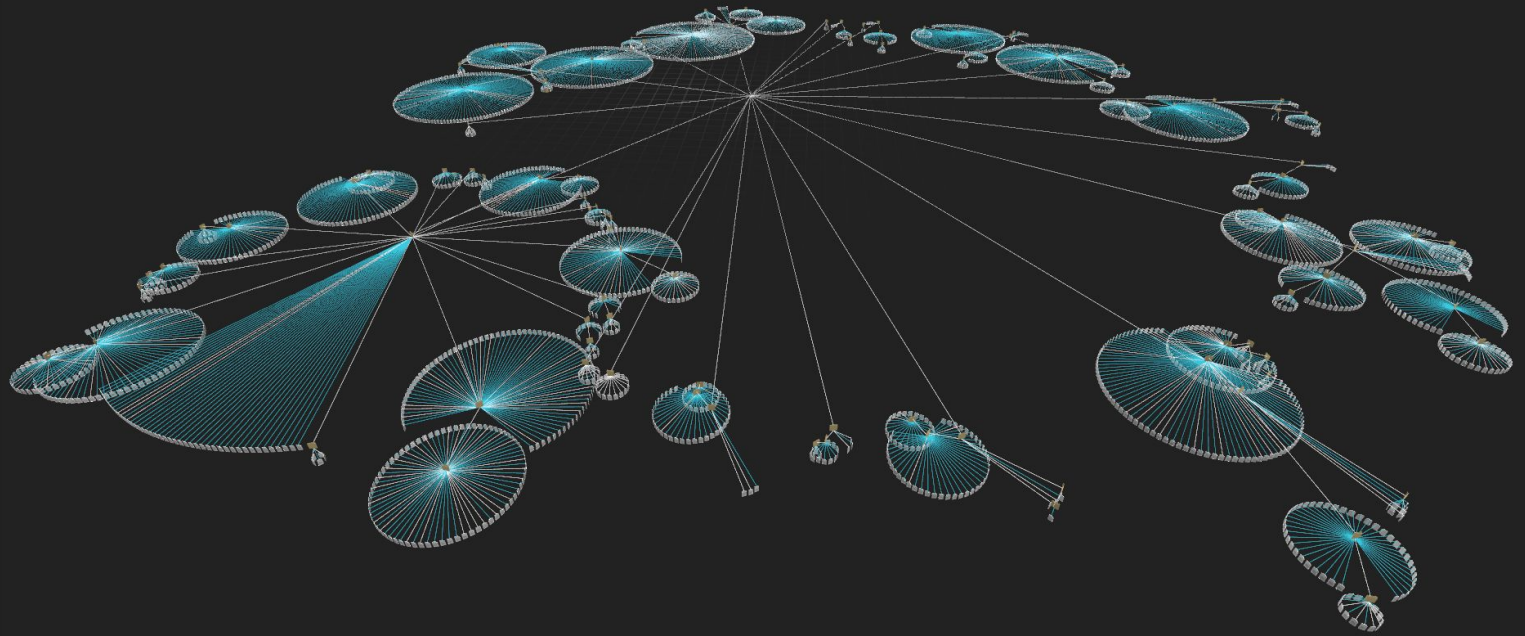
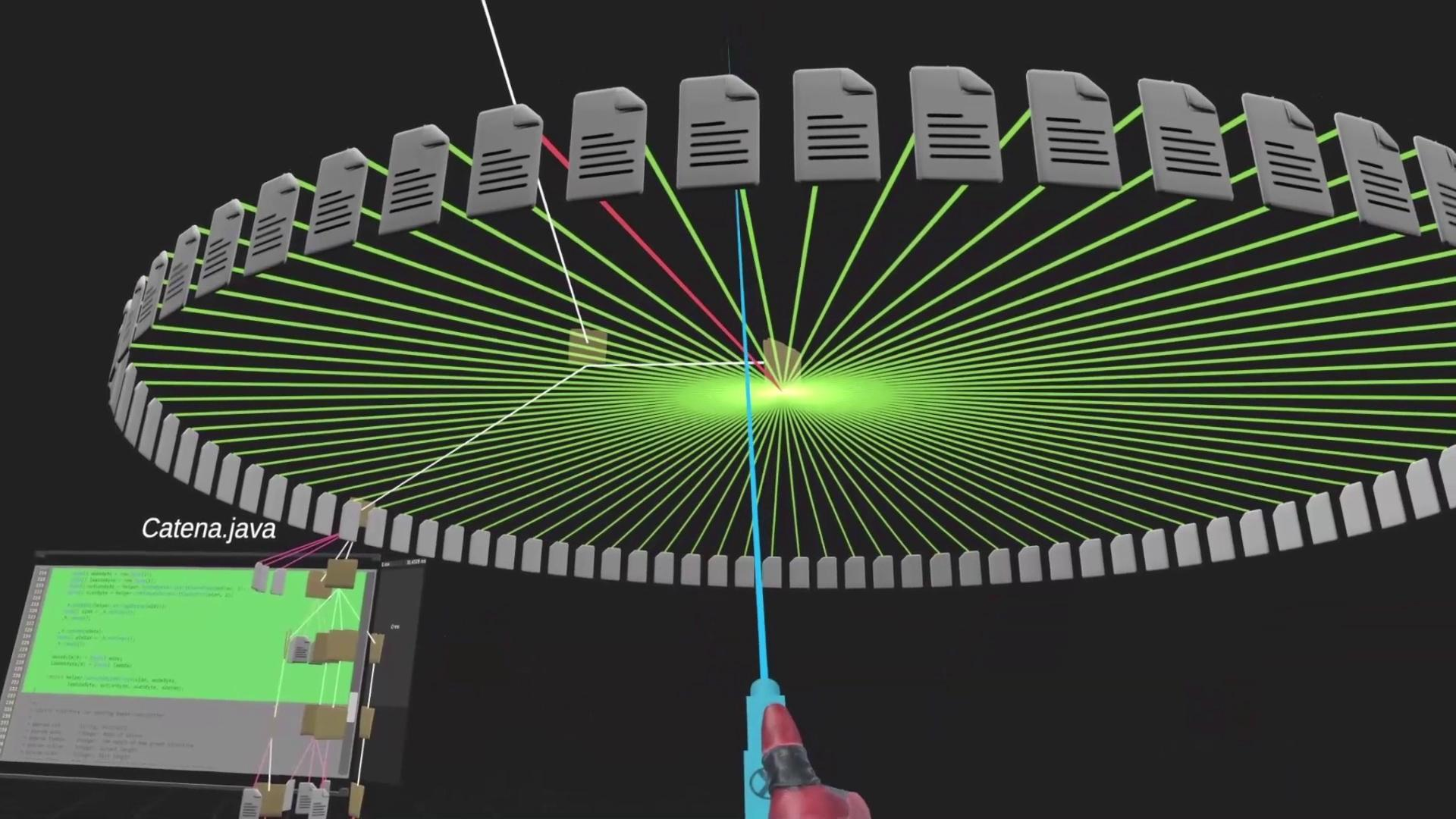
NFP Heightmap
Content Overview

Software Graph

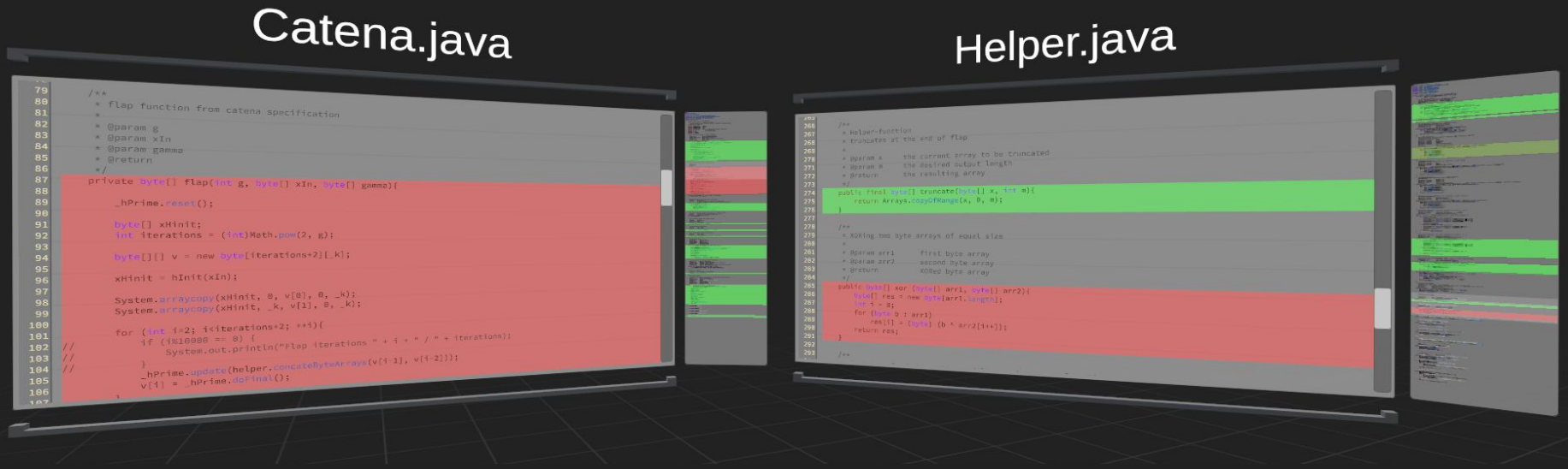
- Visualization of directory hierarchy using Cone-Tree layout
- Bubble Tree Drawing Alg. & Smallest Enclosing Disks

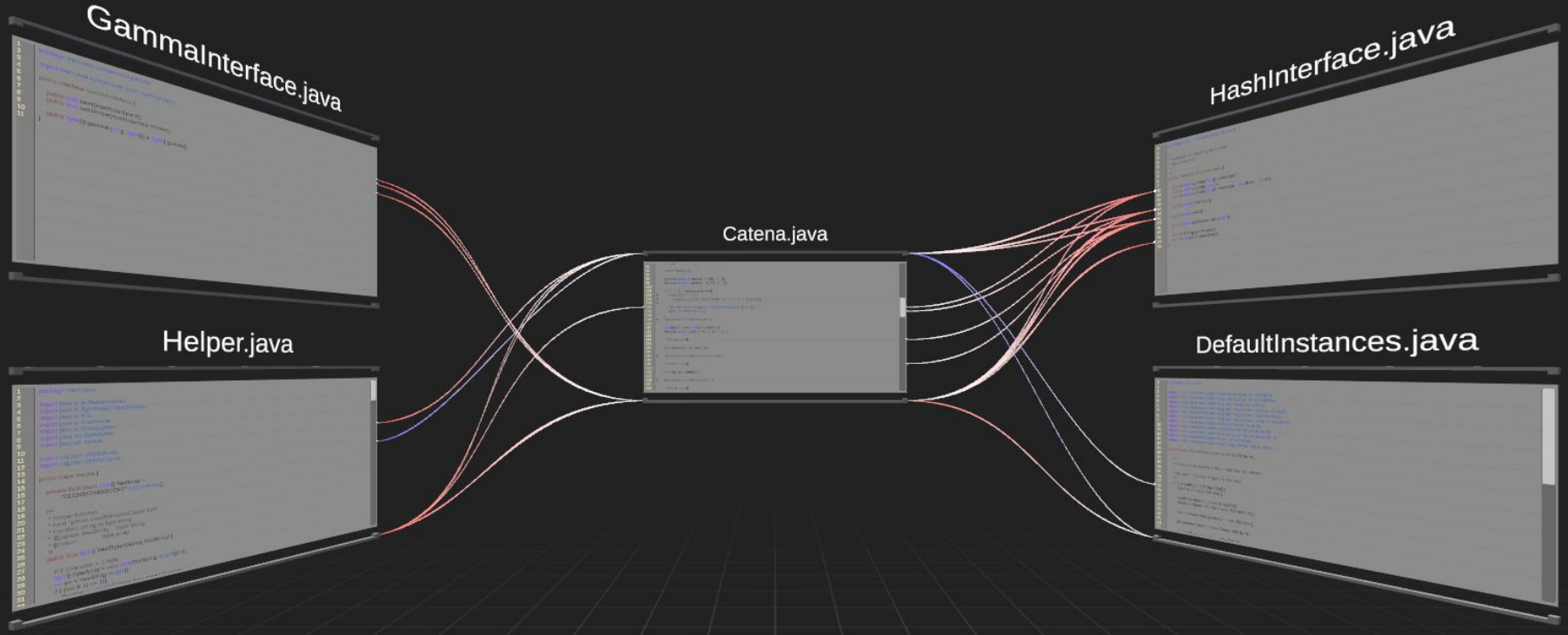


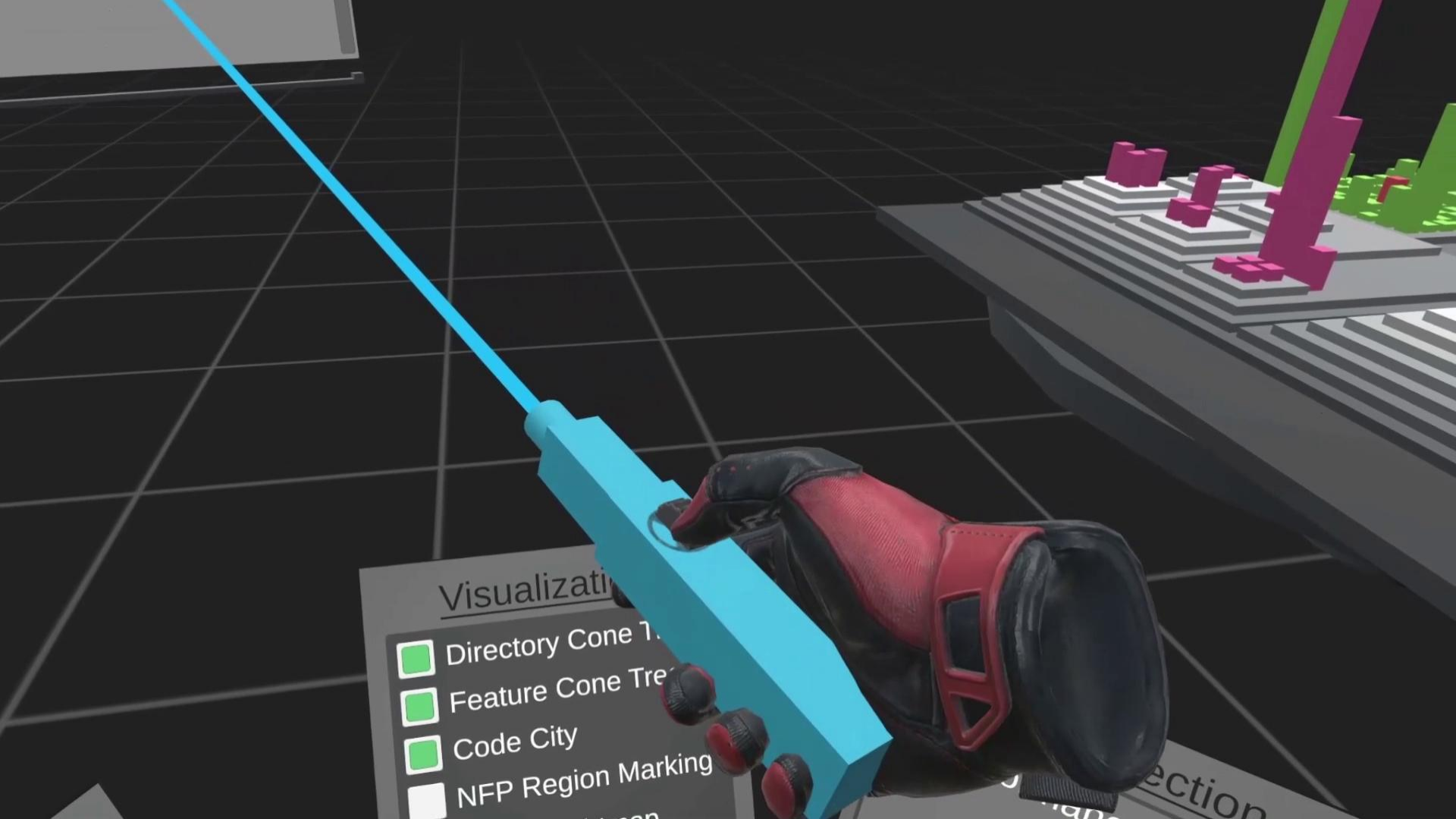

Catena.java

Code Windows

- Show content of files, NFP- and feature regions
- In- and outgoing edges connect to them

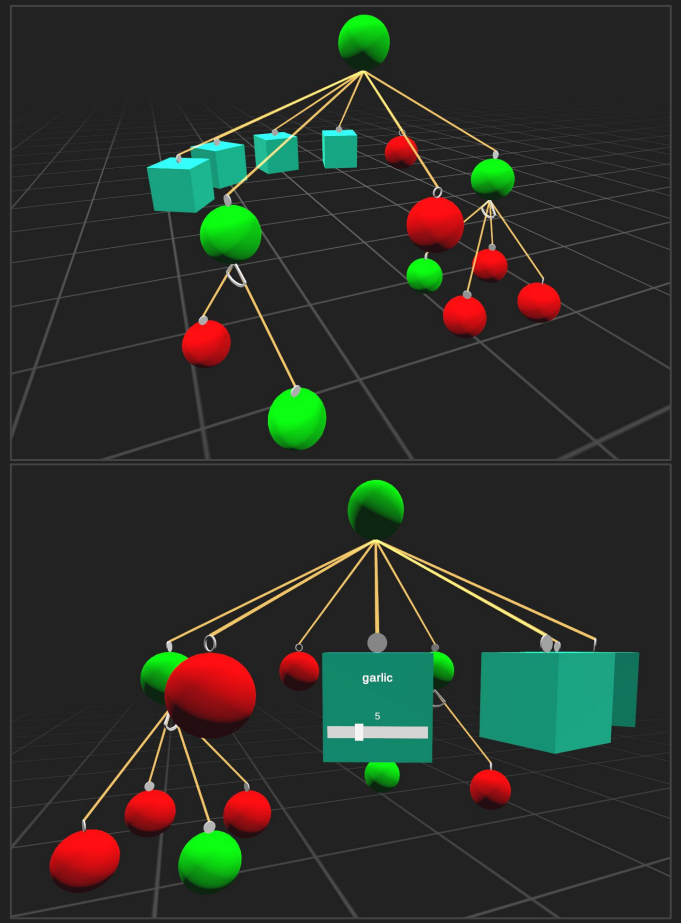


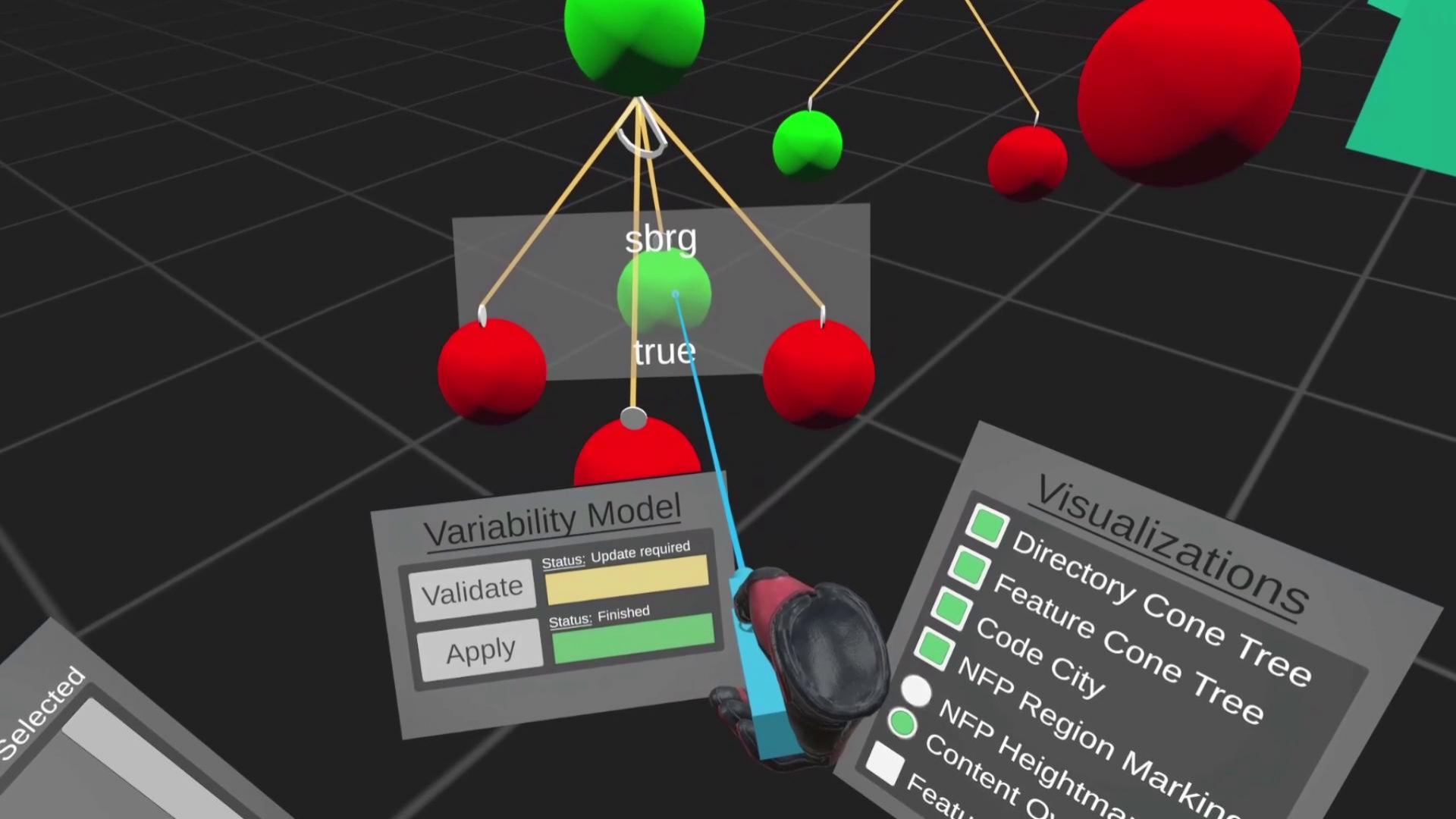

GammaInterface.java
Helper.java
Catena.java
HashInterface.java
DefaultInstances.java


Visualizati
Directory Cone T
Feature Cone Tre
Code City
NFP Region Marking

Feature Diagram

- Visual representation (Cone-Tree) of the feature model
  - Spheres = binary options
  - Cubes = numerical options
- Allows configuration of ft. model
- Can be validated and applied
- Configuration affects values of NFPs through perf.-infl.-model




sbrg
true
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Apply
Status: Finished
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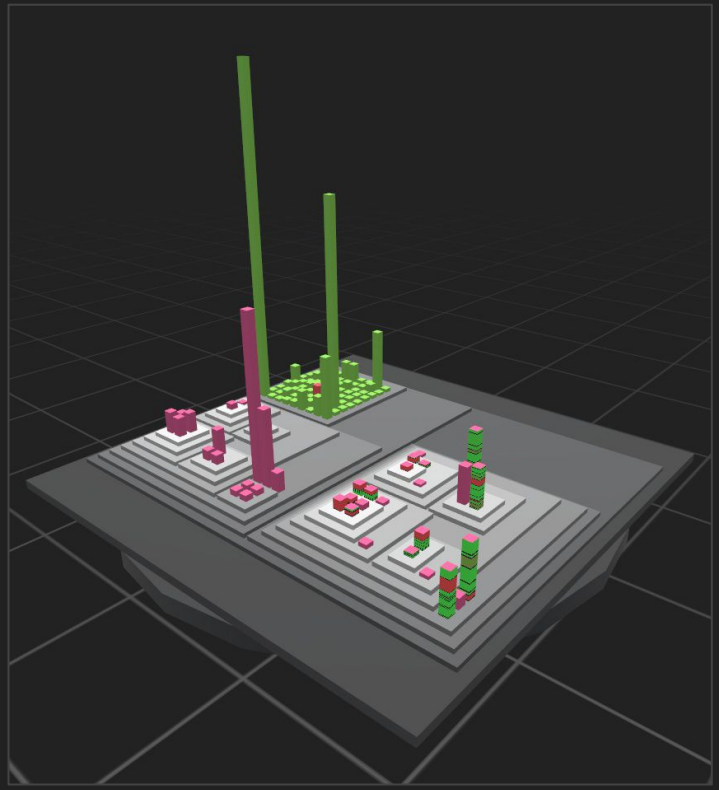
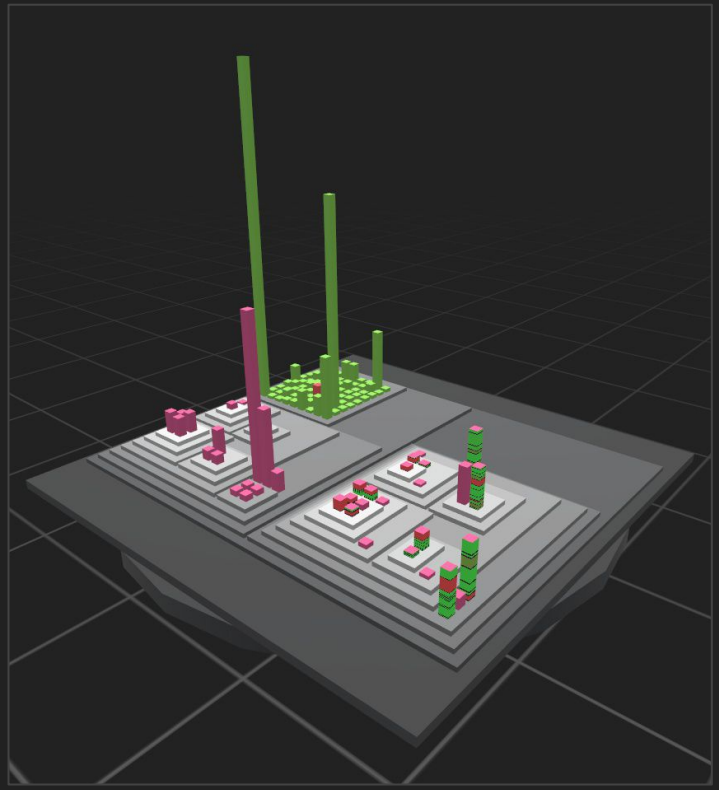
Code City

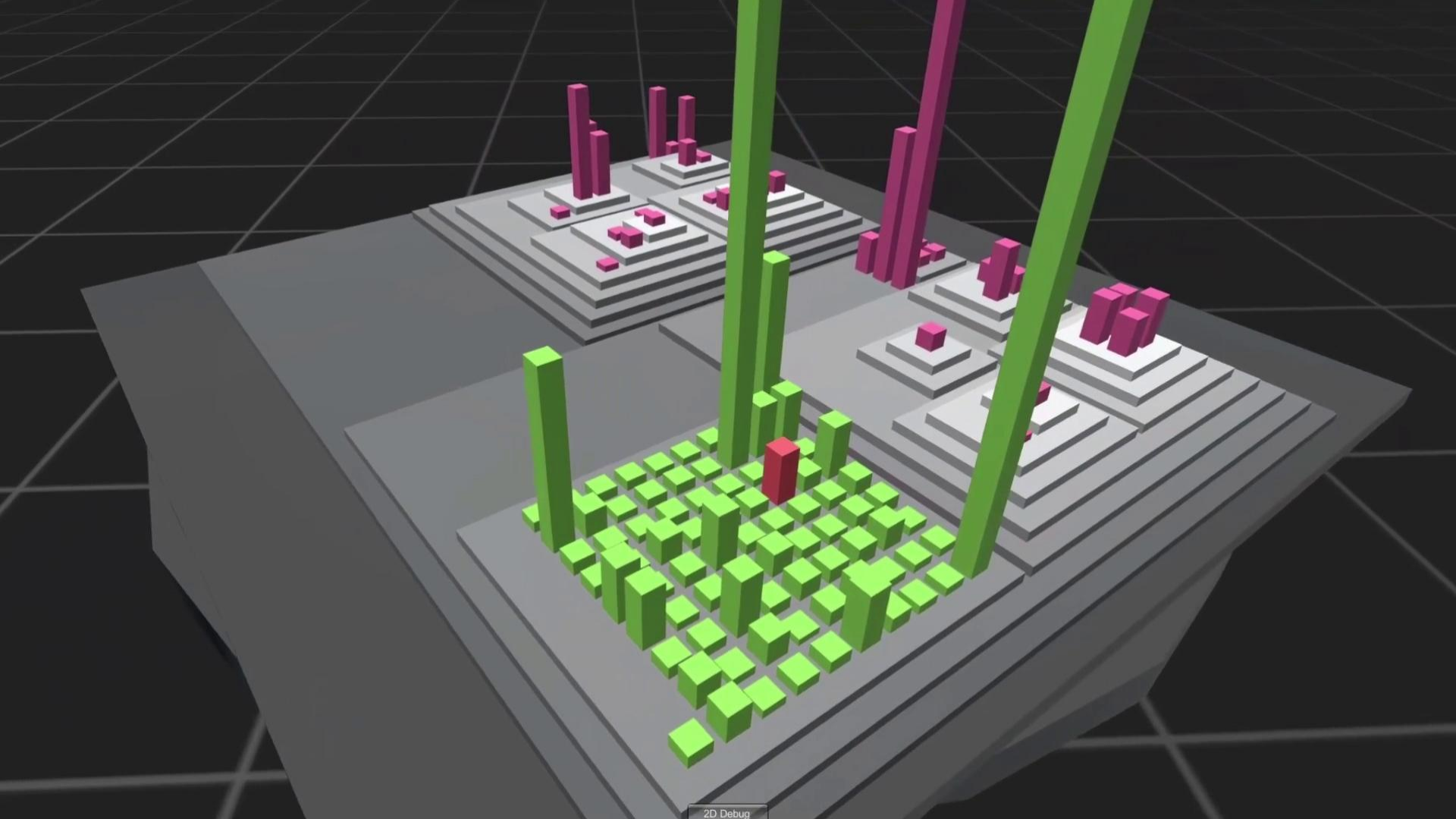
- Based on work by Richard Wettel
- Shows folder / file layout of the software using a city metaphor
- Foundations represent folders
- Buildings represent files

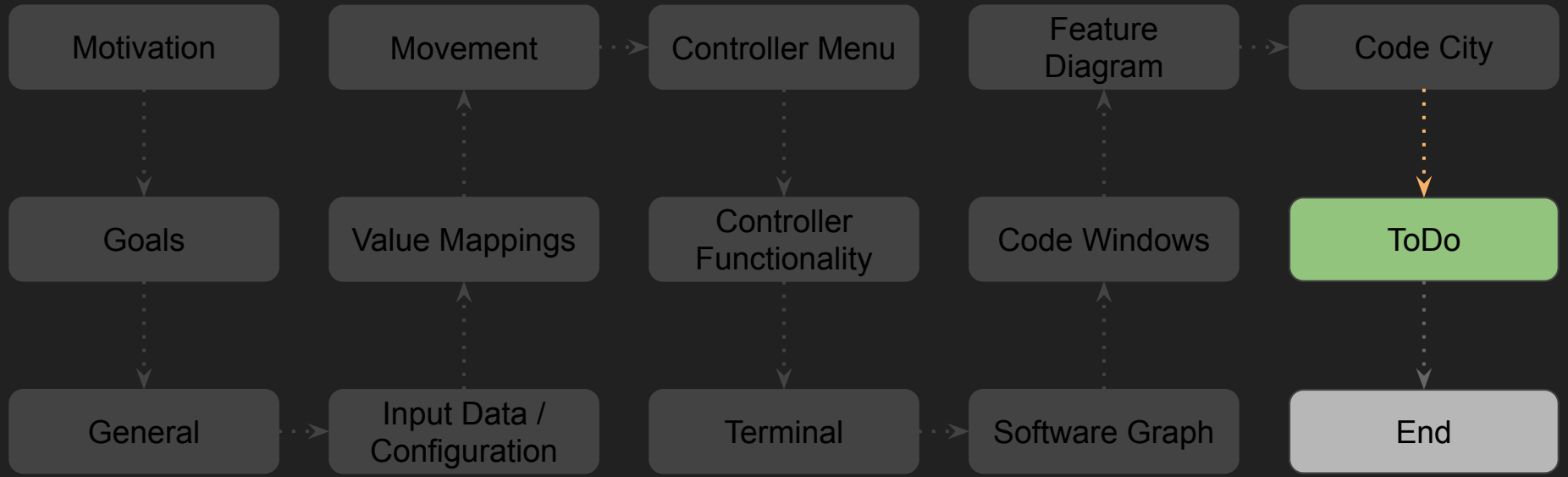


Code City

- Width, length, height, color can represent different properties
- Added a texture to show NFP regions of a file and their values
- Interaction possible
  - Get information on hover
  - Open files on click




2D Debug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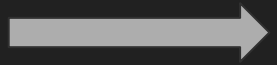

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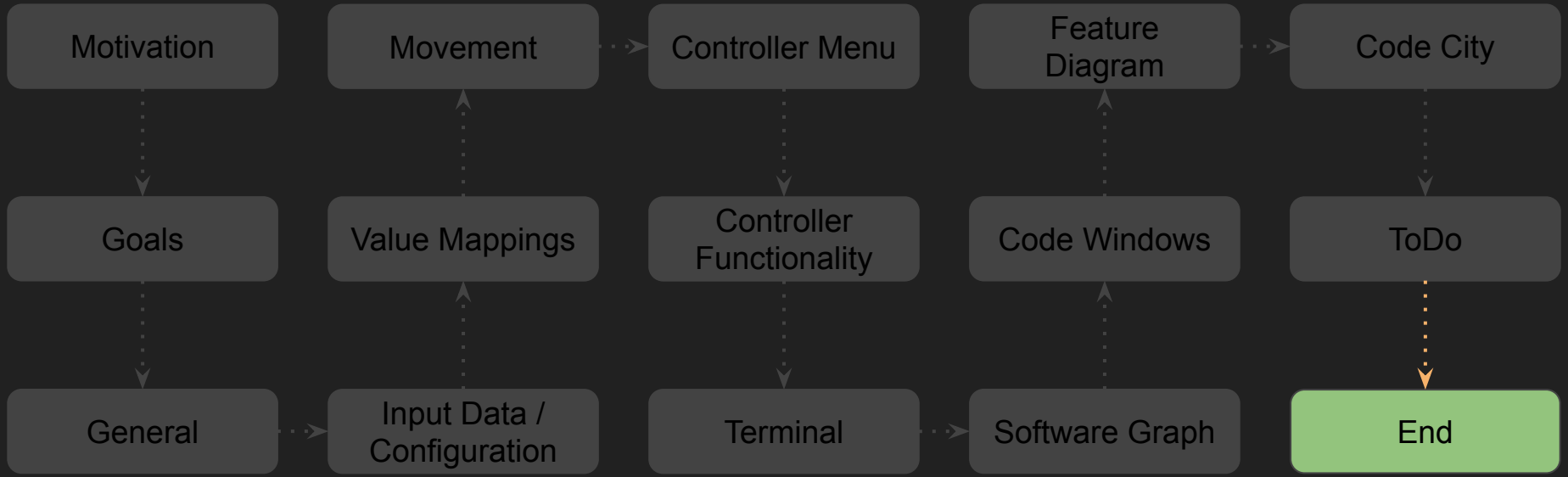
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