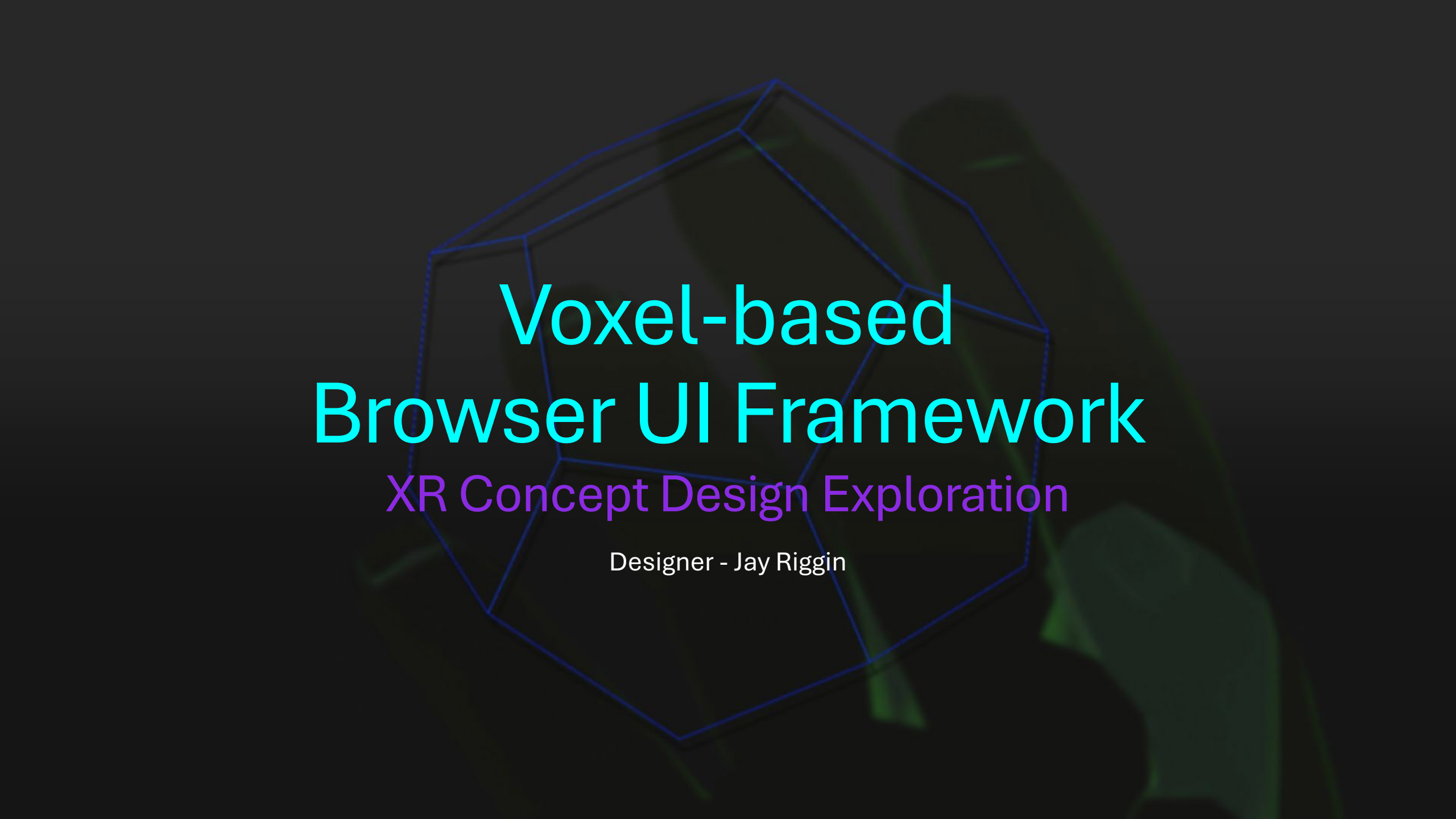


Voxel-based Browser UI Framework

XR Concept Design Exploration

Designer - Jay Riggin

Introduction

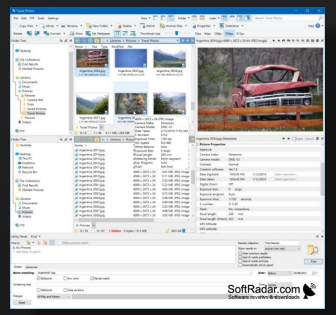
This presentation outlines a UX design exercise focused on reimagining file browsing interfaces for extended reality (XR, MR, AR, VR) environments, particularly for hand and eye-controlled interactions.

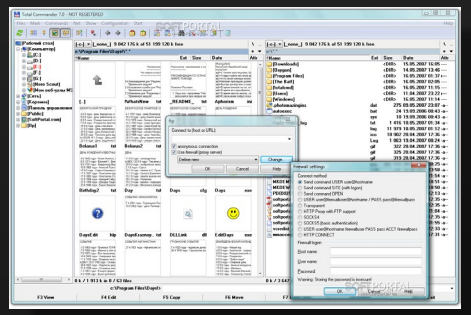
Traditional file management systems like Windows Explorer and Apple Finder are highly effective on PCs but present significant challenges when adapted to extended environments due to their reliance on 2D visual interfaces and mouse-based interactions.

The high-level concept in this presentation is an initial exploration into addressing the challenges of today’s de facto 2D interfaces for use in immersive environments.

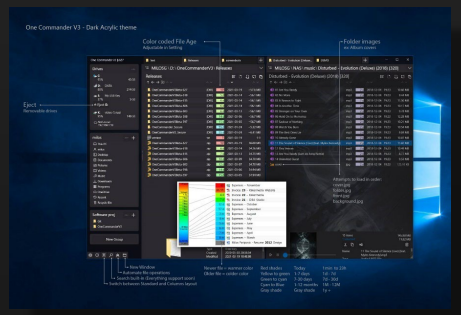
Typical File Browsers

- Various file browser alternatives to the standard Windows Explorer and Apple Finder were researched to identify unique display methods, features, and functionality.

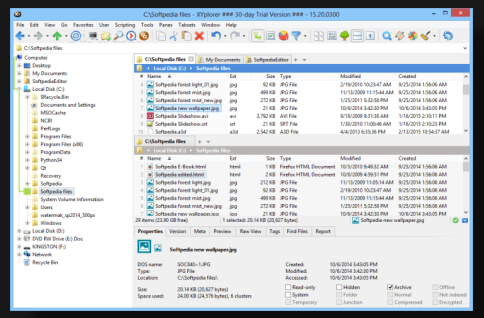




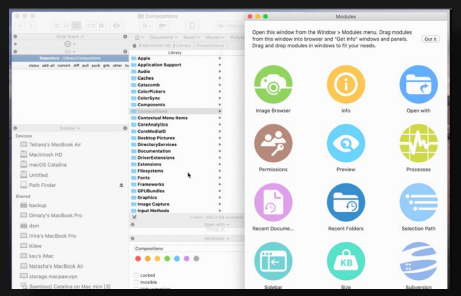
Windows

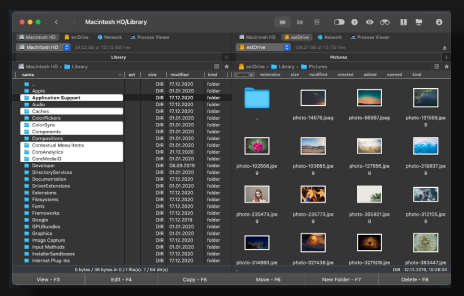


MAC



Directory Opus, Total Commander, XYplorer

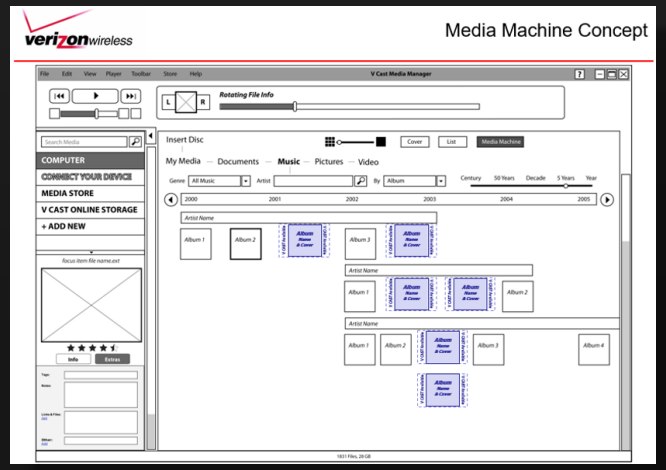


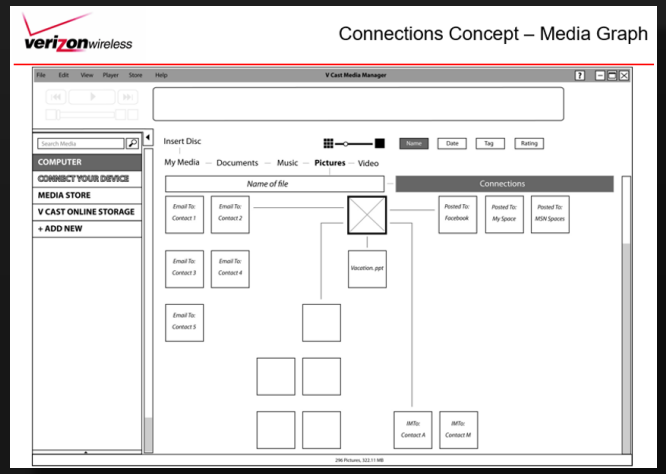


Path Finder, Forklift, Commander One

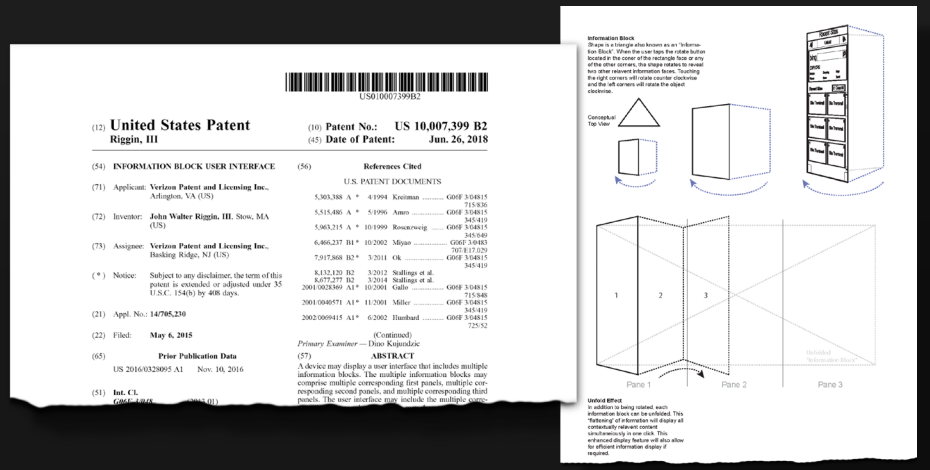
Browser Experience Inspiration

- Design explorations and concepts I created for alternative media-based products and interfaces inspired the design direction of the experience in this presentation.



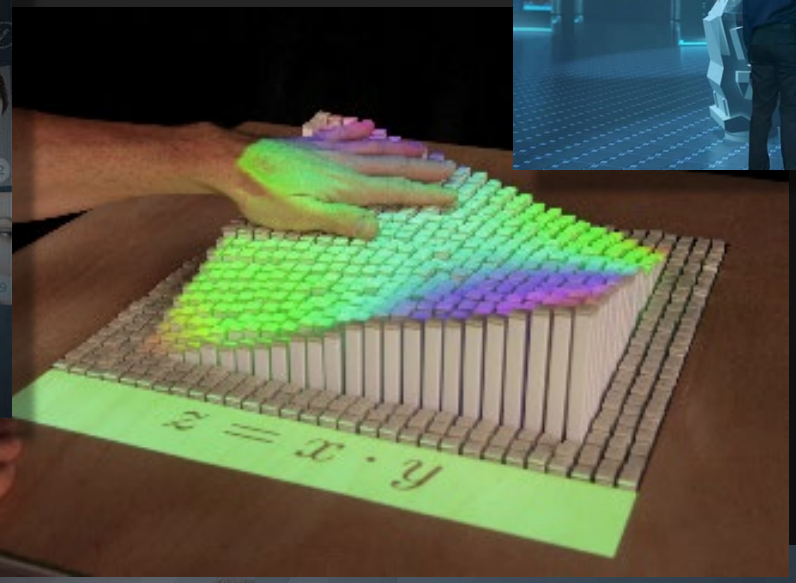


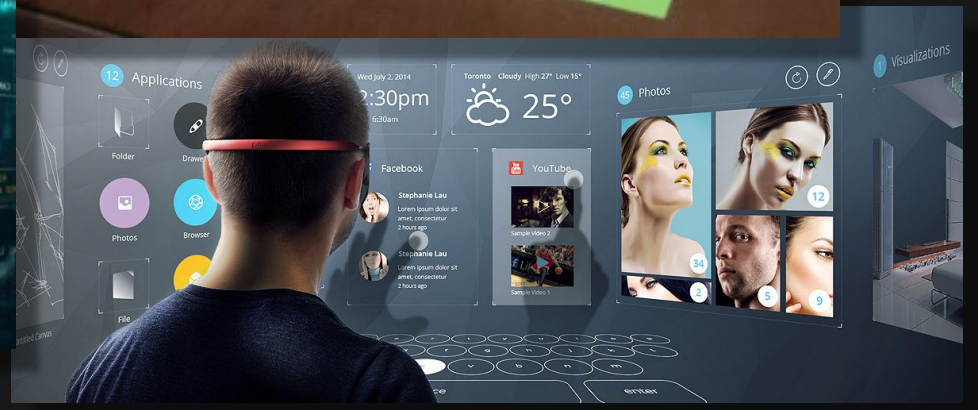
Omni-channel framework



[View patent US10007399B2]

Other Inspiration





Design Considerations

- **Ergonomics** – Keep interactions with gestures efficient to reduce fatigue and minimize repetitive stress leading to cognitive load.
- **Field-of-View** – UI components and experience should be based on user visual limitations – binocular, monocular, cumulative view, and foveal vision.
- **Accessibility** – Further investigation is required.
- **Location-Context** – Location-based services (LBS) could drive the information within the UI framework.
  - Leveraging geospatial data could contextualize the experience.
- **Data Object Associations** – Presentation and organization can be visualized based on object history, metadata, links, files, media types, etc.
- **UI Affordances** – Are peripheral devices available for interaction, such as keyboards and other devices?
- **Omni-Channel/Screen** – What is the mode in which the information is displayed? Screen availability? Immersive capability? Resolution? Noise in the user's environment?
- **Workflow Flexibility** – Novice users and expert user flows should be supported.

Concept Overview

- A voxel-based, container, and dodecahedron, node-object framework.
- Base node-object is central with peripheral, contextual information, functionality, and sub-hierarchal content
- A mosaic structure is formed by groupings of Directory/Containers and Node objects.

Attributes of a Node

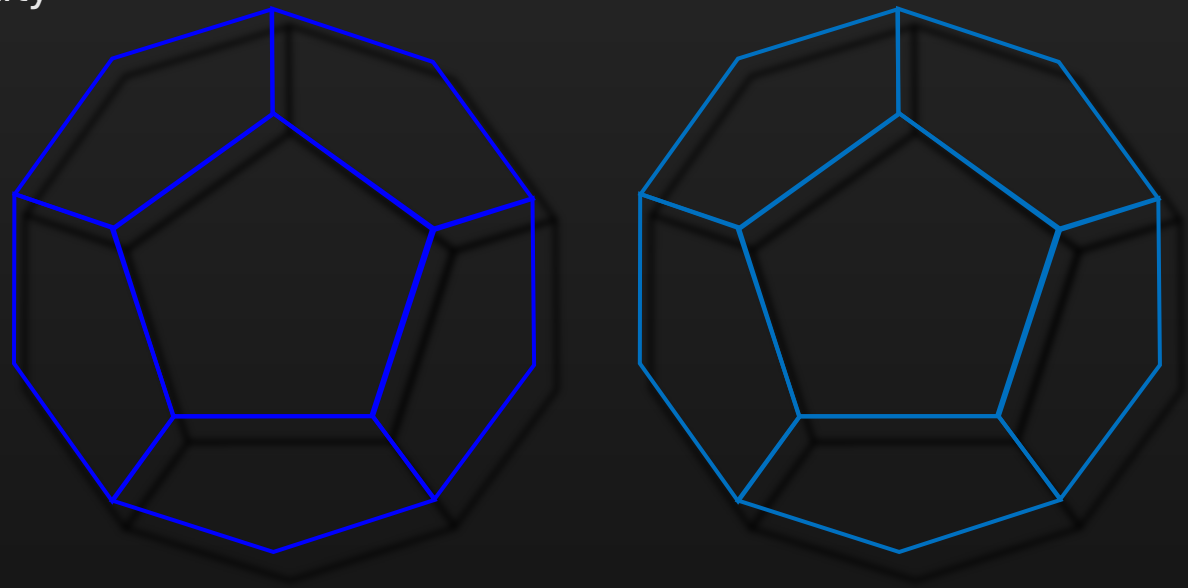
- Dodecahedron geometry.
- Each pentagon-based geometry has two primary information chunks – center-facing pentagon shape.
- Each primary, central, information chunk can convey up to five contextual sub-info chunks – one per side.
- Sub-info chunks can hold any data type, mode control, function access, or be kept open for user-defined content.

Node Anatomy

Information Efficiency

Exponential Access

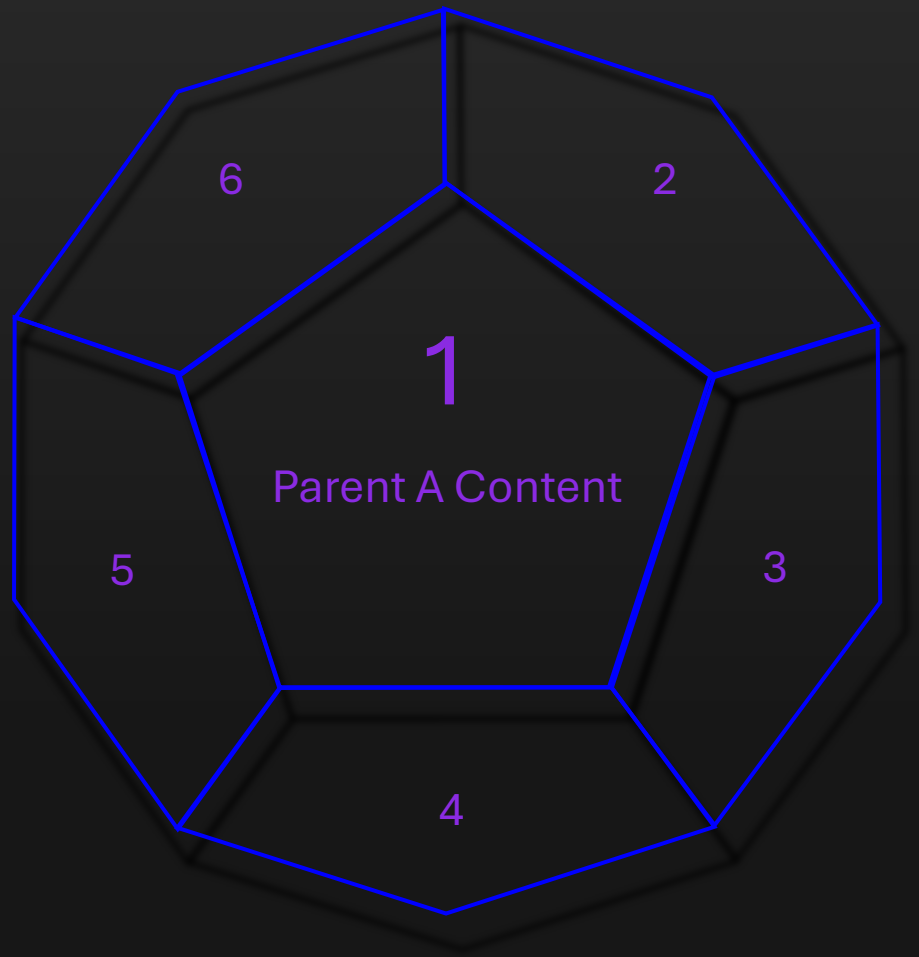
- Pentagon shape maximizes content availability
- Two-sided UI node
- One central primary content area/side
- Five surrounding contextual areas/side
- Six data elements total displayed – side
- 12 data elements total/node



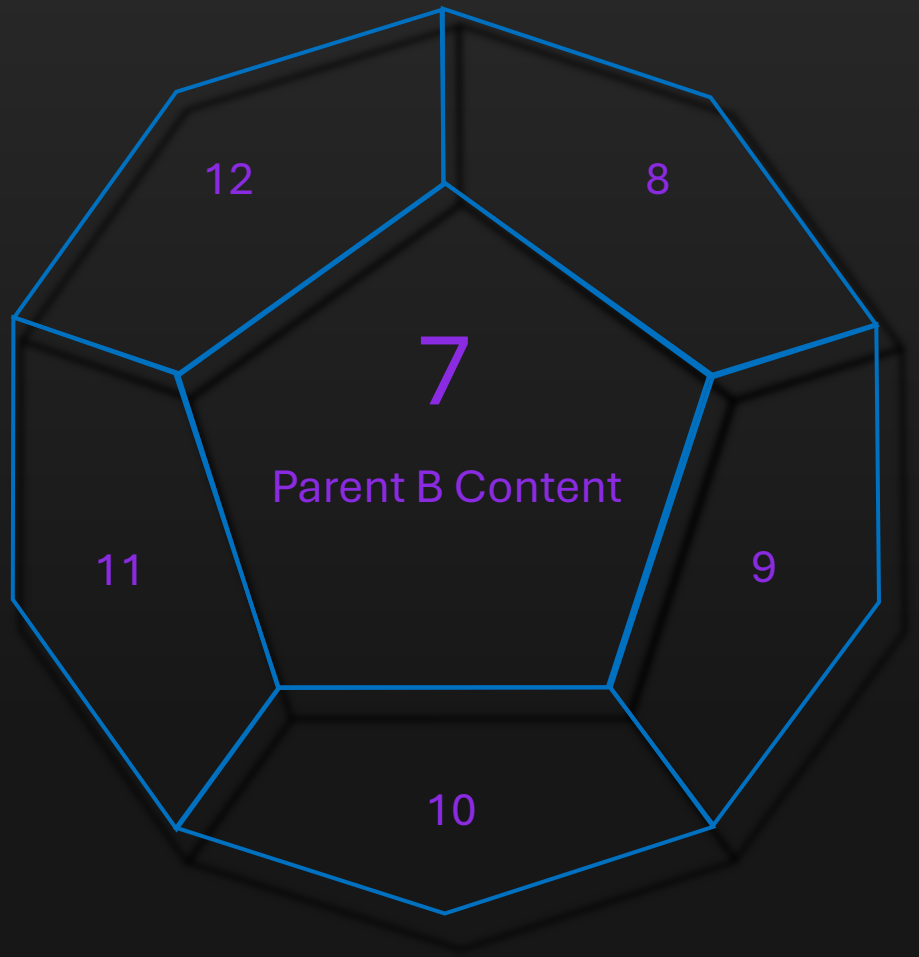
A side

B side

Base Node Structure



A side

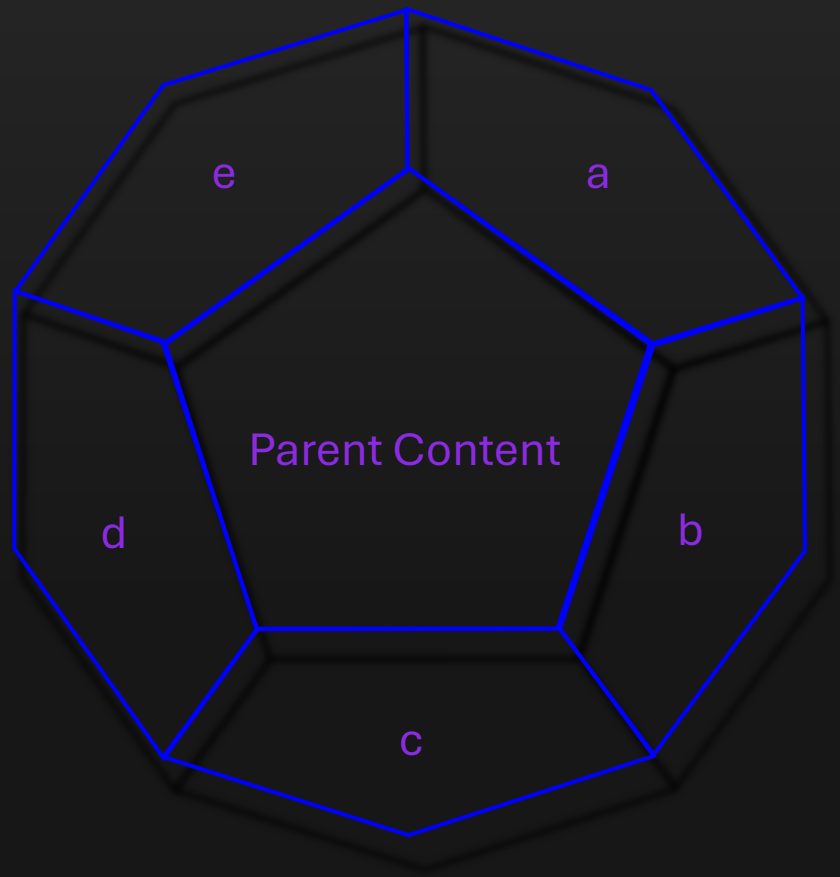


B side

Contextual Information Chunks

Exponential Access Via Scale

- Menus
- Metadata
- Relevant functions
- User-defined option
- Data element associations
  - Links
  - Icons & Media
  - Documents
  - Etc.

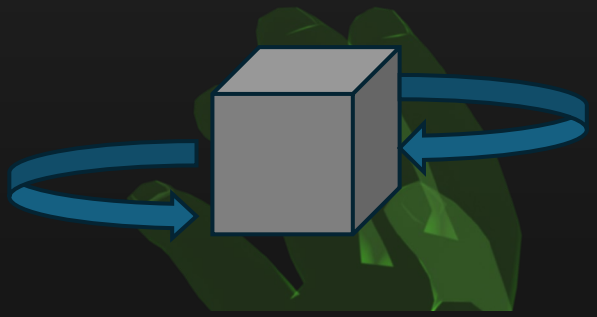


Directories/Containers

Nesting Nodes – Directories/Containers

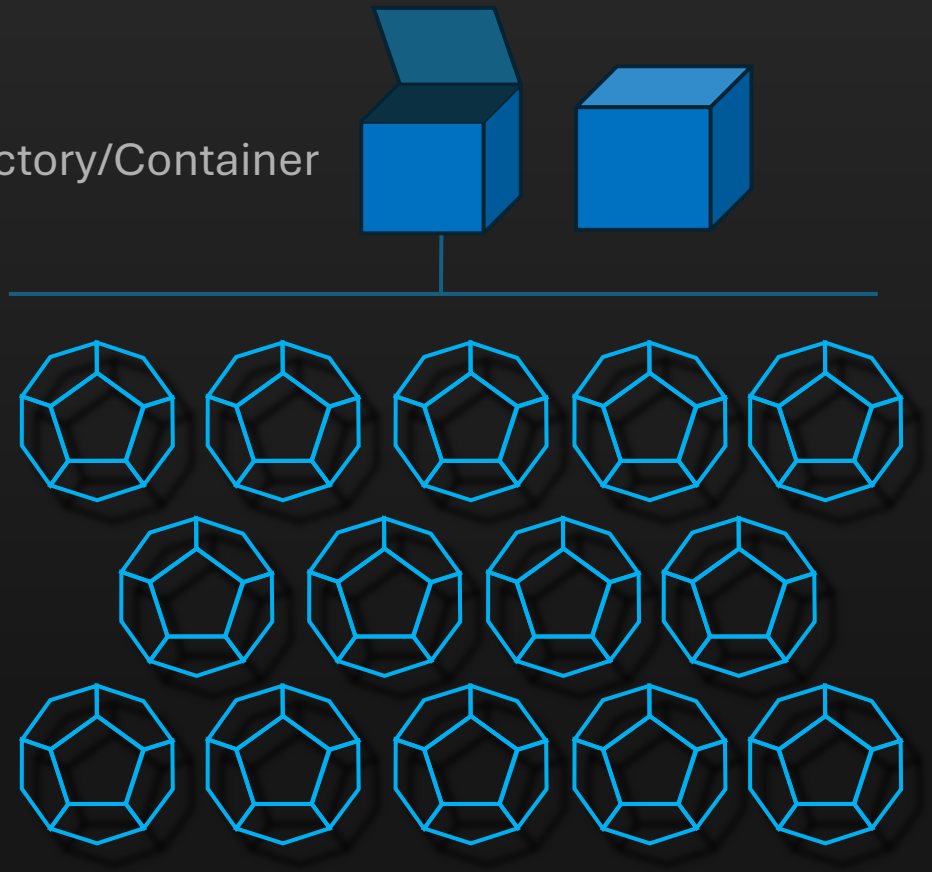
Groupings and Associations

- Directory/Containers will identify groups of nodes.
- A cube shape shall represent a Directory/Container.
- Conceptually, the cube can have an open or closed top, indicating the state.



Directory/Container Interaction

- Can rotate, providing direct access to nested directories or other relevant functions.

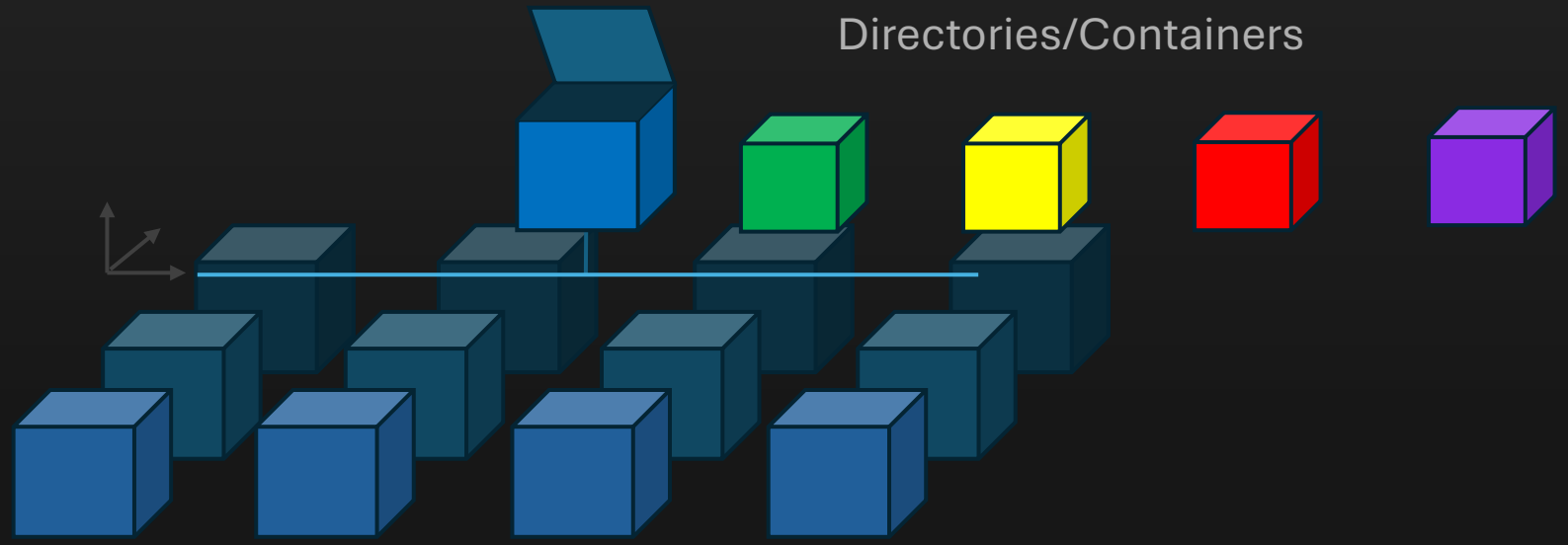


Node Mosaic nested in a container.

Nesting Nodes – Directories/Containers

Groupings and Associations

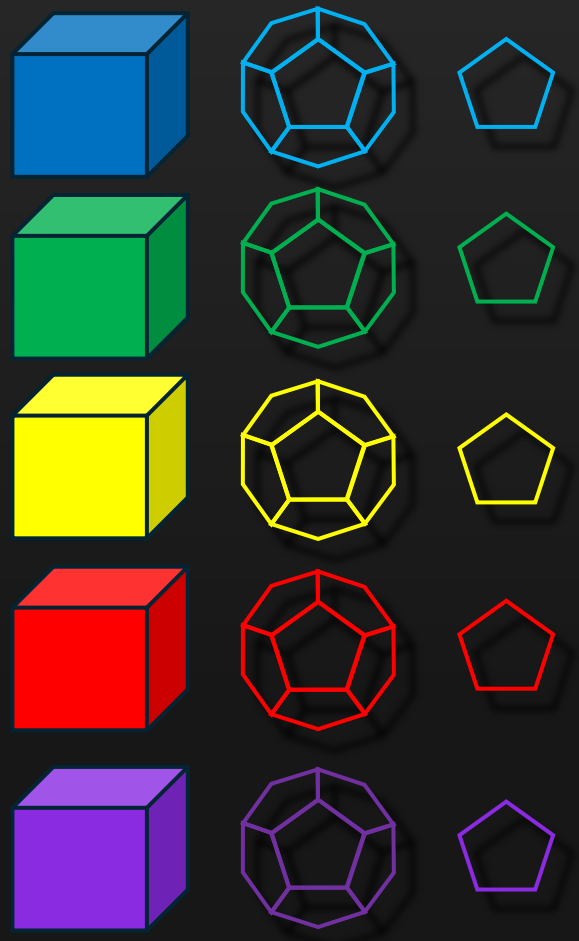
- Directory/Containers can also hold other Directory/Containers.
- Nested Directories will fall into a 3D matrix (Voxel).



Nested Containers – Voxel Design

Pre-Attentive Processing with Shape & Color

- Colors shall be user-definable to convey specific data element types and assist with pre-attentive processing of UI objects.
- Nodes will gracefully degrade based on viewing distance or eye/camera normal in Z-Depth.
- Increased distances will create mosaic-like visual displays, heatmaps of data topology, or digital fabrics which can overly the digital topography/ landscape.



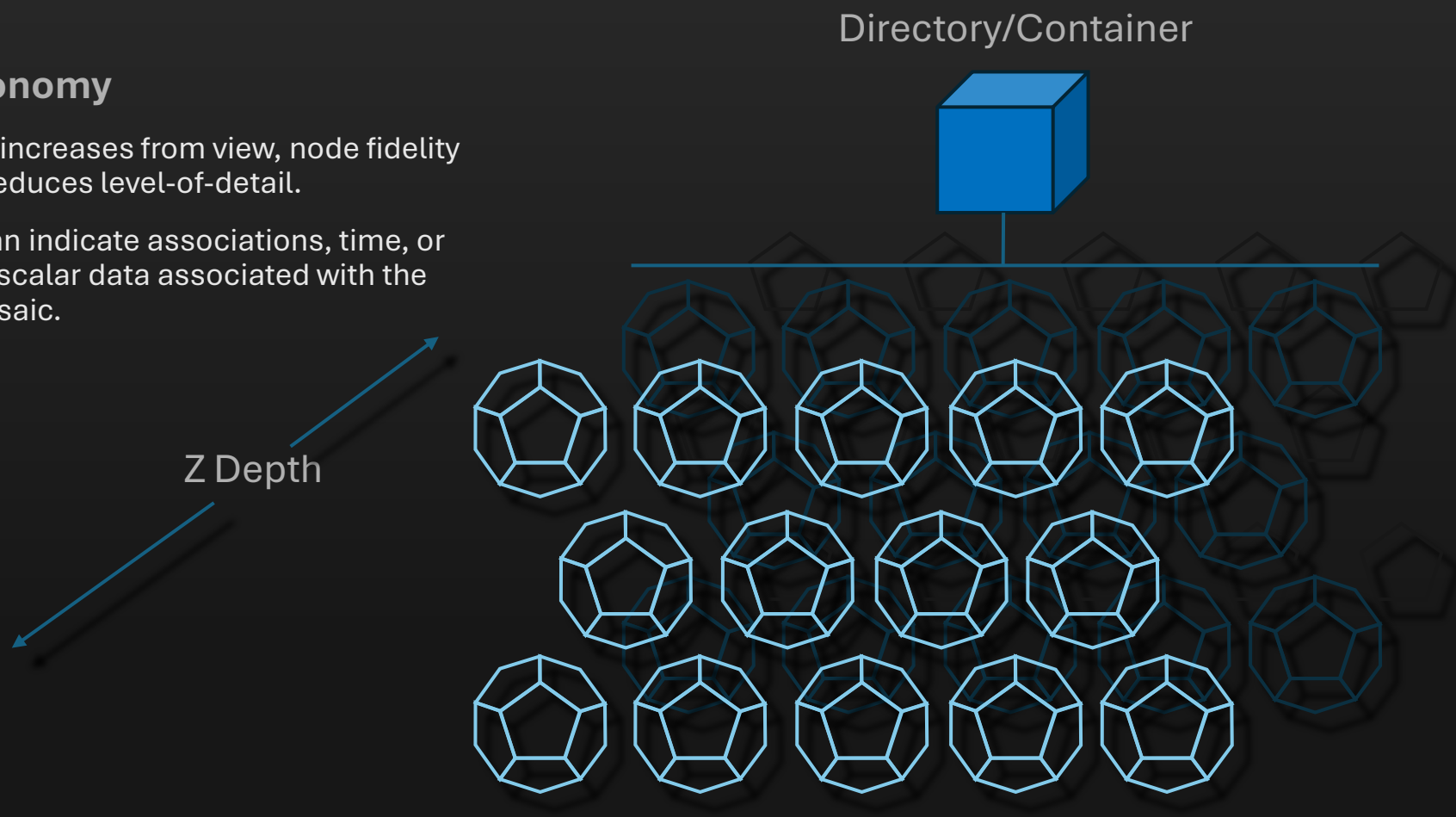
Directories/Containers

Nodes near & gracefully degraded with depth

Z-Depth

Visual Taxonomy

- As Z-Depth increases from view, node fidelity gracefully reduces level-of-detail.
- Distance can indicate associations, time, or any type of scalar data associated with the node or mosaic.



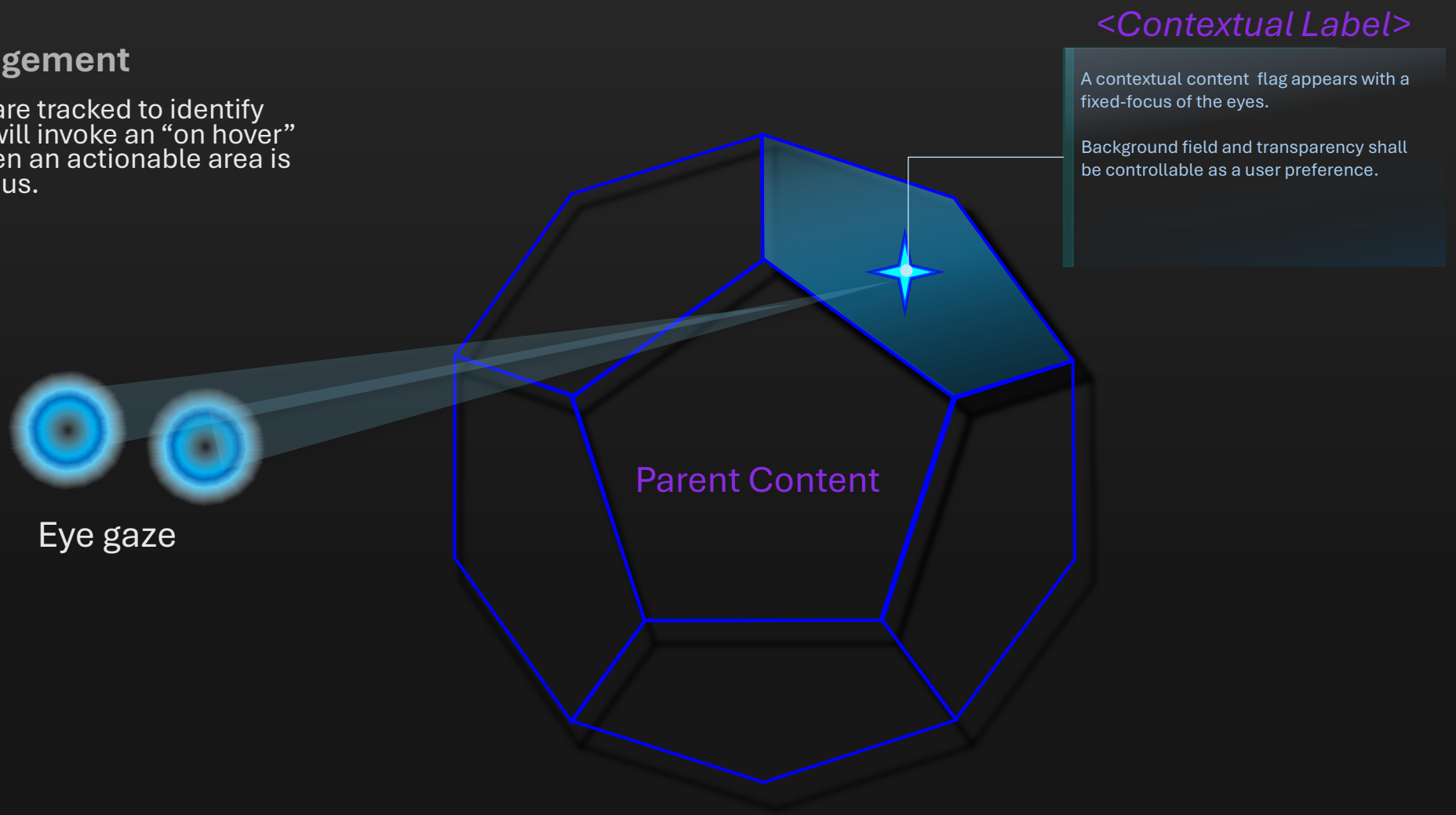
Voxel Node Mosaic nested in a container.

Node Interaction

Contextual Node Information Engagement

Visual Engagement

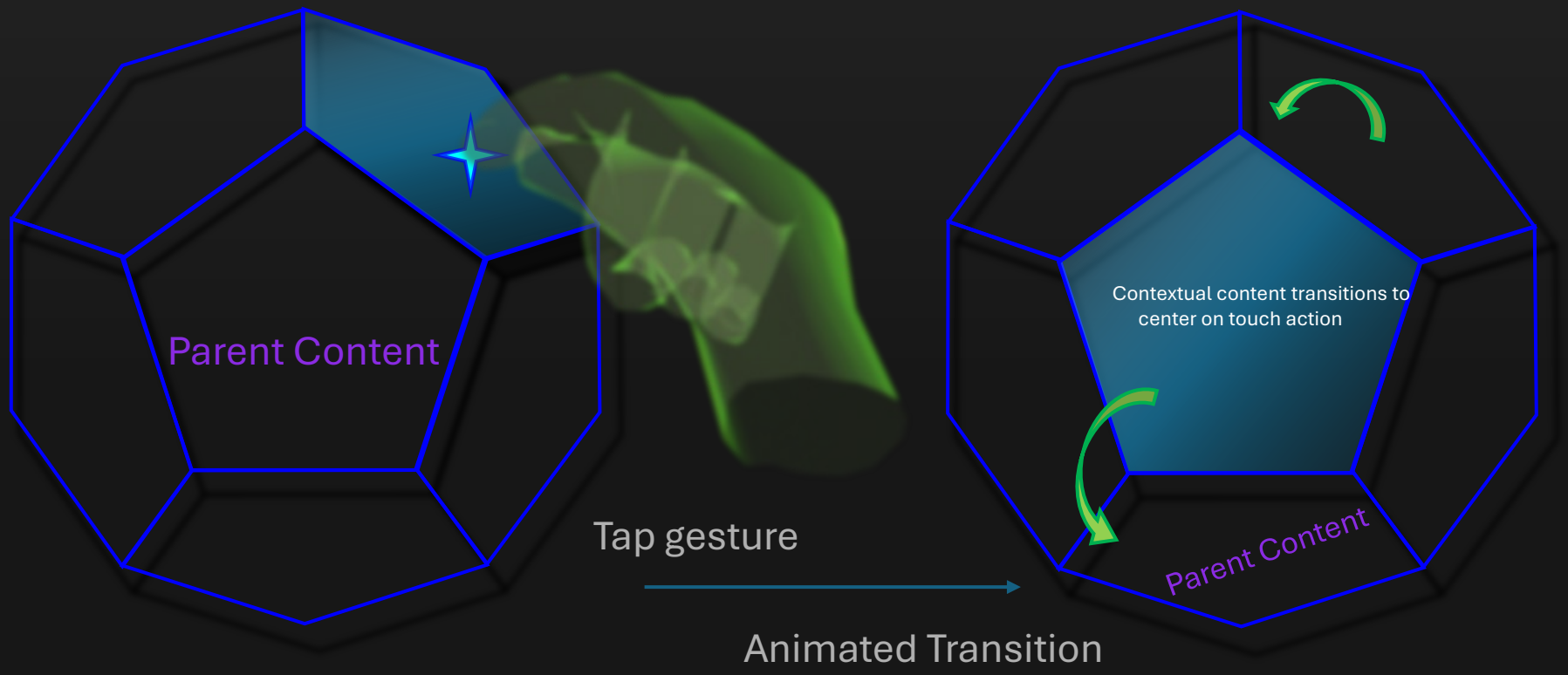
- Users' eyes are tracked to identify gaze which will invoke an "on hover" function when an actionable area is receiving focus.



Contextual Chunk Selection (Focus)

Dynamic UI

- On selection, the contextual content will transition to the center
- Dodecahedron geometry becomes apparent with rotation.

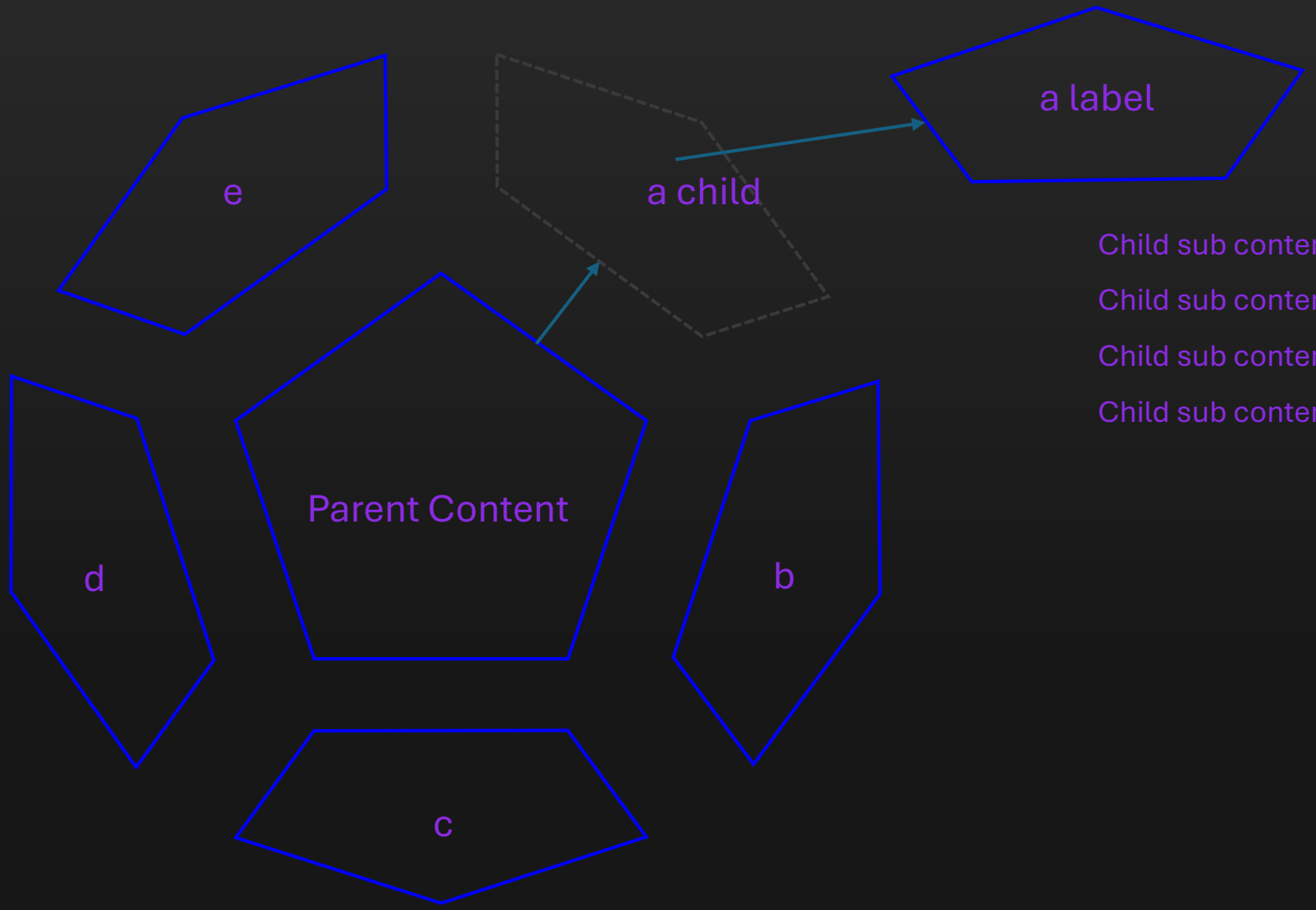


Hierarchical Exploration

Node Exploded View

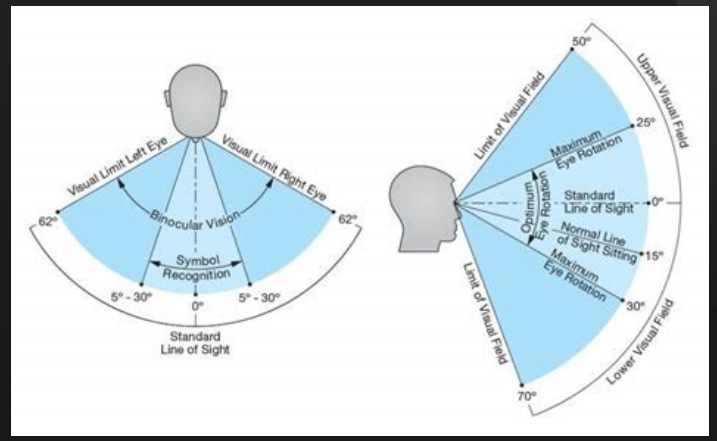
- Nodes can visually separate, providing the user the ability to dive deeper into associated content and functionality.

- Contextual child content can transition and detach from the node's parent content area and become a sub-directory window with data/content below.

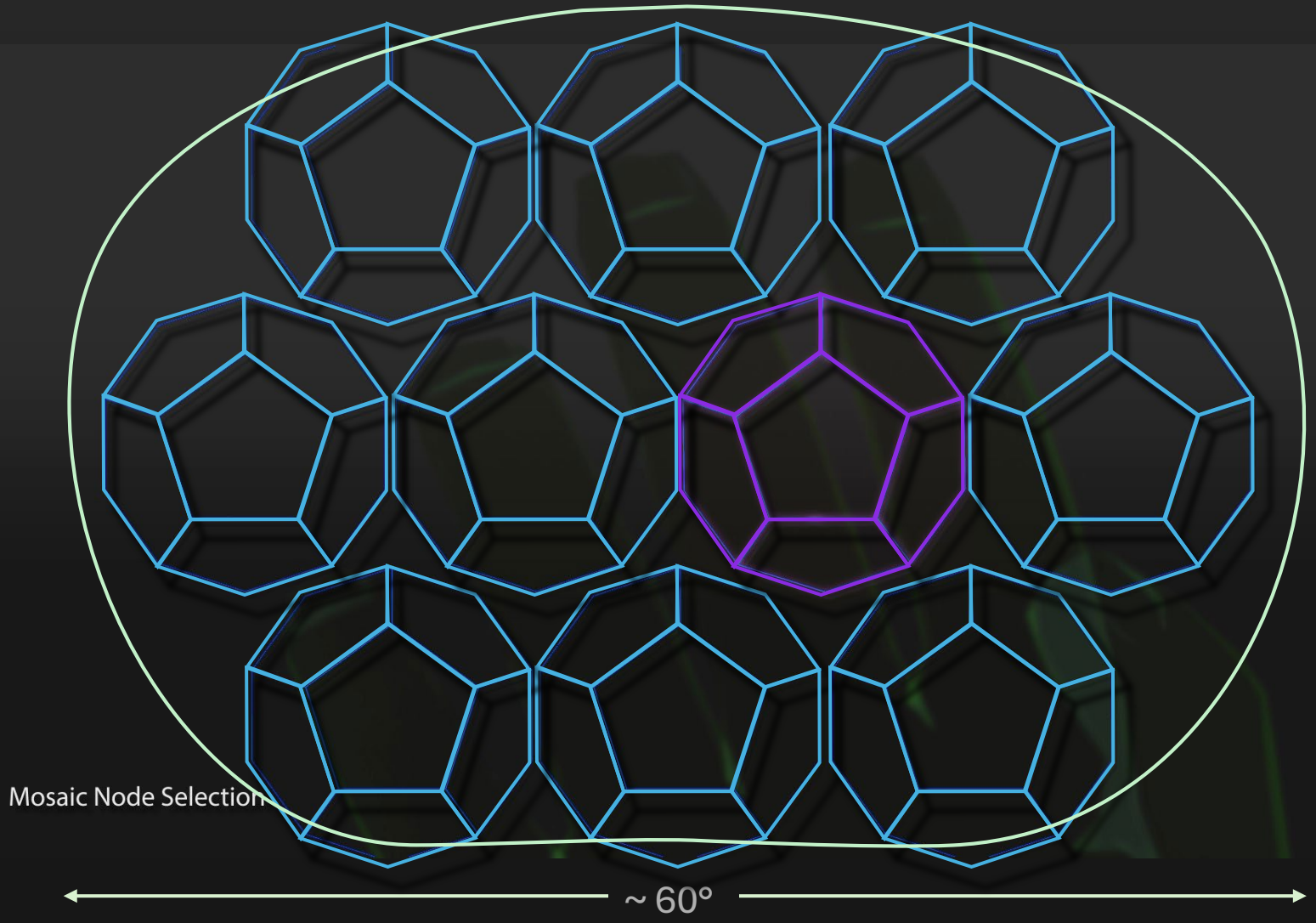


Mosaic Visual Field-of-View

- Binocular vision = ~114° - 120°
- Monocular vision = ~160°
- Cumulative = ~ 200° - 220°
- Foveal vision = ~ 1° - 2°



Optimize node size to achieve maximum density and provide a target large enough to acquire with focus with a visual gaze.



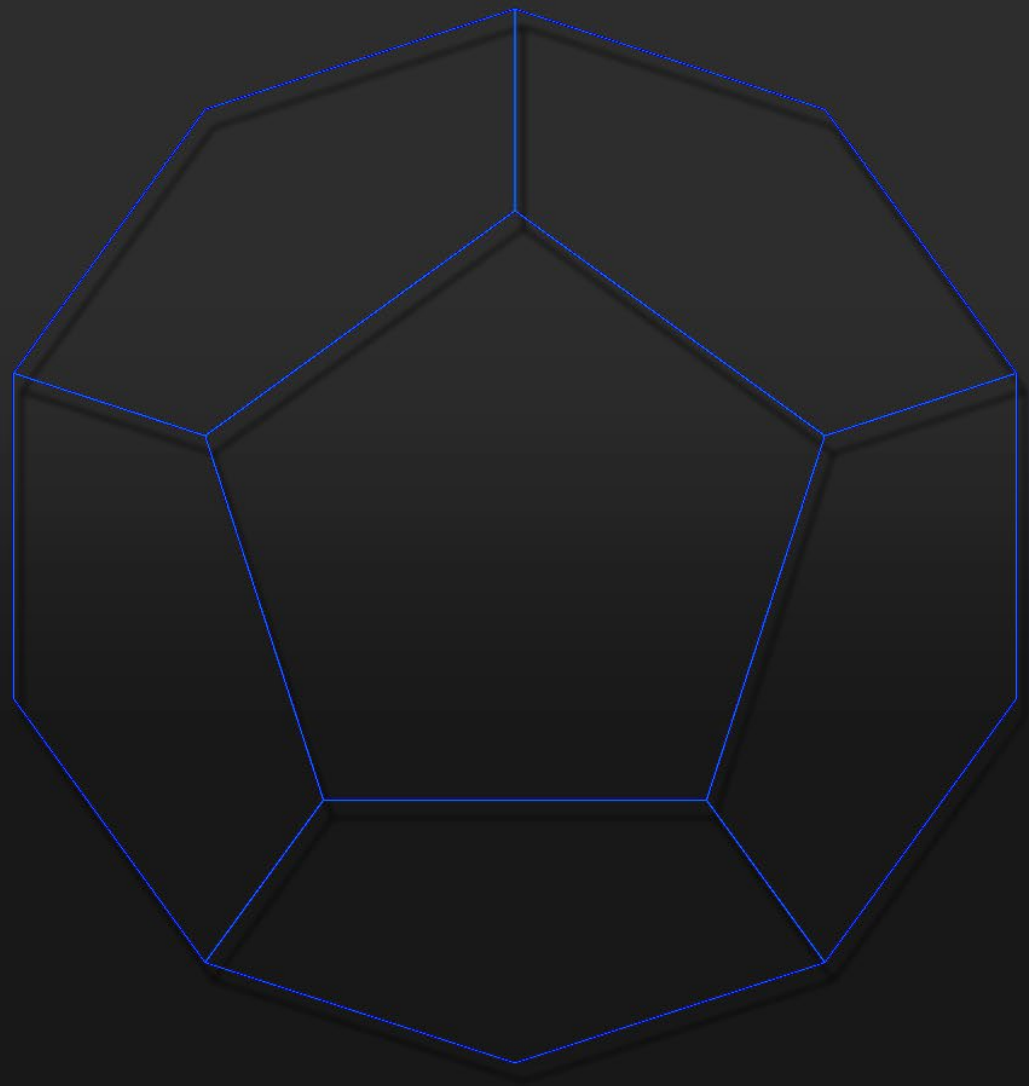
Design Constraints

- Pentagon shape limits contextual/child content to six total item without some form of interaction.
- Shape allows access to six chunks of information simultaneously, falling within the sweet spot of seven to five menu choices preferred for good information design.

Technical Challenges & Risks

- Exhaustive interactions have not been explored for interacting with each contextual content chunk.
- Accessibility issues have not been scrutinized.
- Scale of Directory/Containers and Nodes could be problematic for labeling -further investigation required.

Basic Node UI Interaction Simulation - Video



Base Node

Appendix

Reference URLs

- **Directory Opus**
- **Total Commander**
- **XYplorer**
- Path Finder
- Fork Lift
- Commander One
- Field of view content
- VR UI
- Digital topography
- Flat Virtual
- BAE System HoloLens