MULTIMEDIA: THE ART OF DIGITAL INTEGRATION

From Fundamental Building Blocks to Immersive Systems

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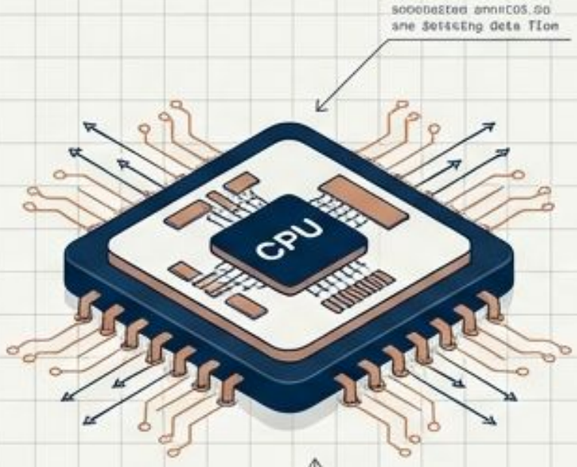
Defining the Multimedia Experience

CRITICAL FACTOR:
It is not just the presence of media, but the INTEGRATION and CONTROL that defines the system.

[Media Elements]

[Computer Control]



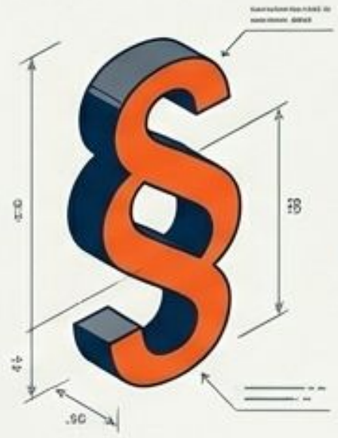
[Multimedia]

Definition Card

A computer-controlled combination of multiple media elements—text, graphics, audio, video, and animation—integrated to convey information or create an experience.

CRITICAL FACTOR:
It is not just the presence of media, but the **INTEGRATION** and **CONTROL** that defines the system.

Layer 1: The Building Blocks

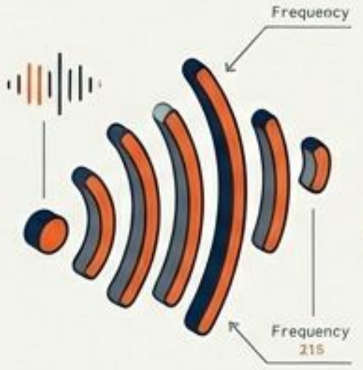


Text

The fundamental unit. Conveys precise info, instructions, and labels. Formats: .txt, .rtf, HTML.

Graphics

Digital visual representation. Includes Bitmaps (photos) and Vectors (logos).

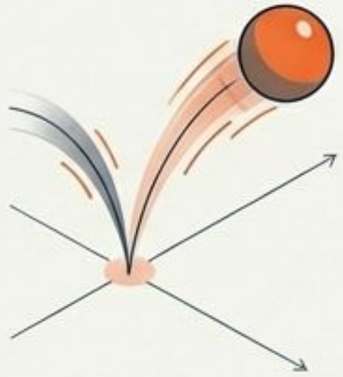


Audio

Adds mood, emphasis, and clarity. Essential for notifications and engagement.

Video

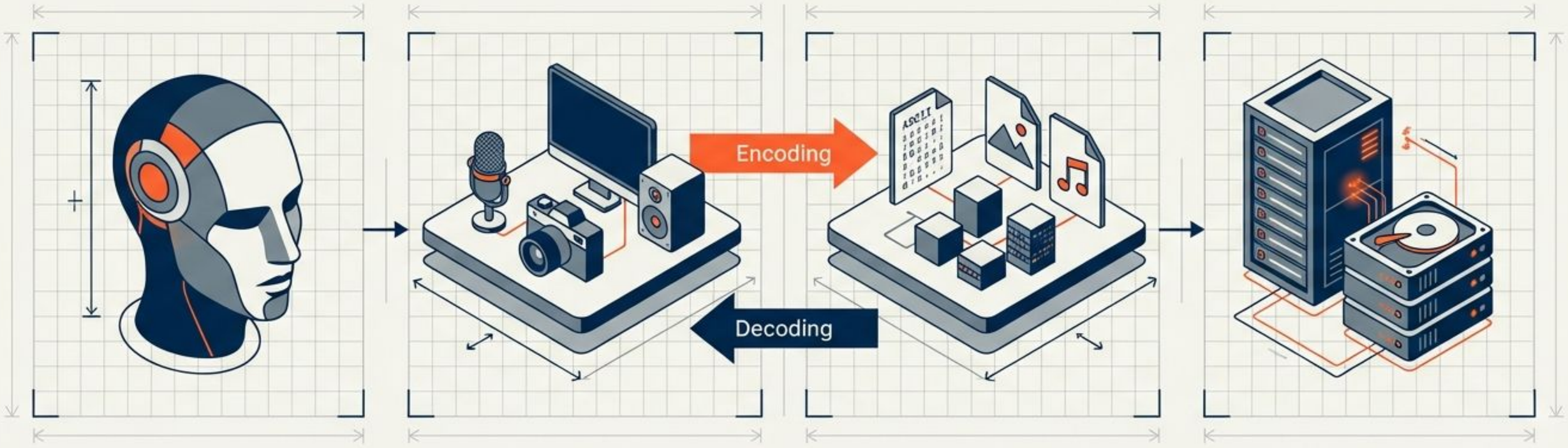
A sequence of frames creating the illusion of motion. Powerful for storytelling.



Animation

Synthetic motion generated from drawings. Distinct from video which captures reality.

Understanding ‘Medium’: The Translation Layer



[Perception Medium]

Sight, Hearing, Touch

[Presentation Medium]

Input (Mic/Cam) &
Output (Monitor/Speaker)

[Representation Medium]

Digital Formats:
ASCII, JPEG, MP3

[Storage & Transmission]

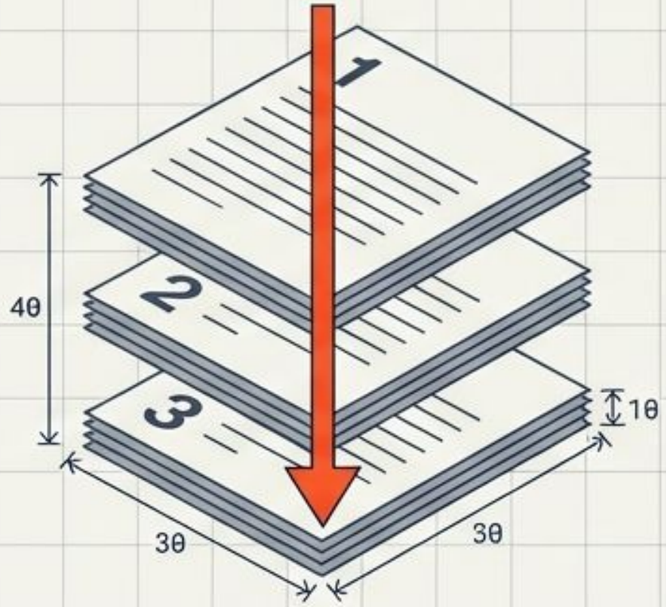
Copper, Fiber, HDD, SSD

Swiss Engineering Modern

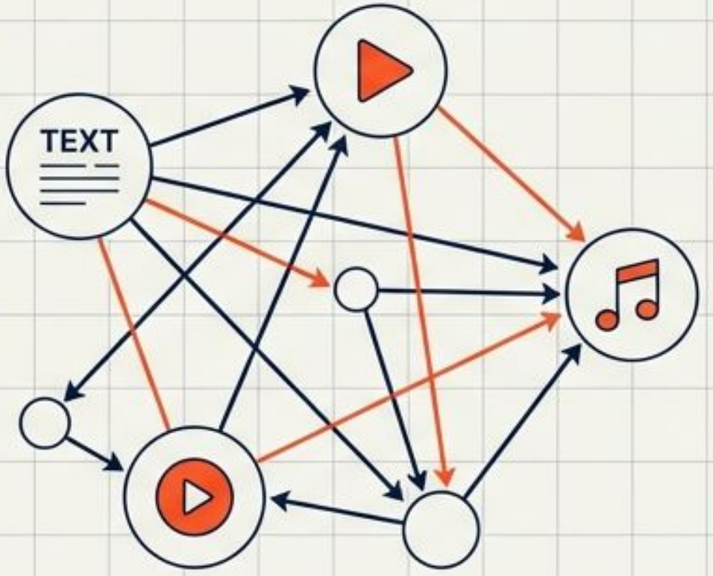
Layer 2: The Logic of Hypermedia

Roboto Mono

Linear (Traditional)



Non-Linear (Hypermedia)



Slate Grey

Slate Grey

Hypertext

Roboto Mono [Structure]

A non-linear, linked structure of text (e.g., Wikipedia).

Hypermedia

Roboto Mono [Multimedia]

An extension of hypertext that links to other media types like images, sound, and video.

Slate Grey

Slate Grey

Global Structure: Elements organized based on the World Wide Web model.

Swiss Engineering Modern

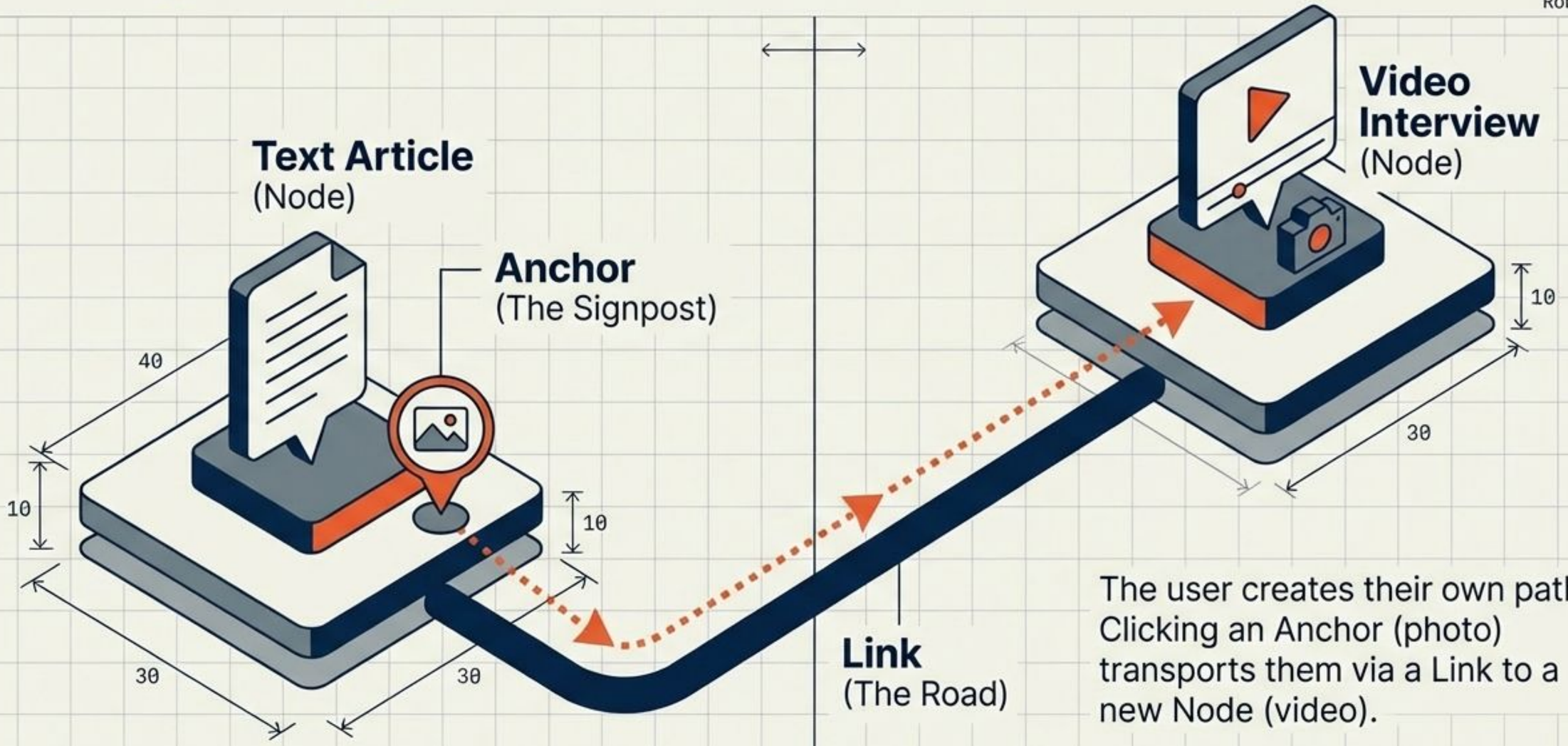
Navigating the Structure

Roboto Mono

Text Article
(Node)

Anchor
(The Signpost)

Video Interview
(Node)



Link
(The Road)

The user creates their own path. Clicking an Anchor (photo) transports them via a Link to a new Node (video).

Slate Grey

Slate Grey

Roboto Mono

Slate Grey

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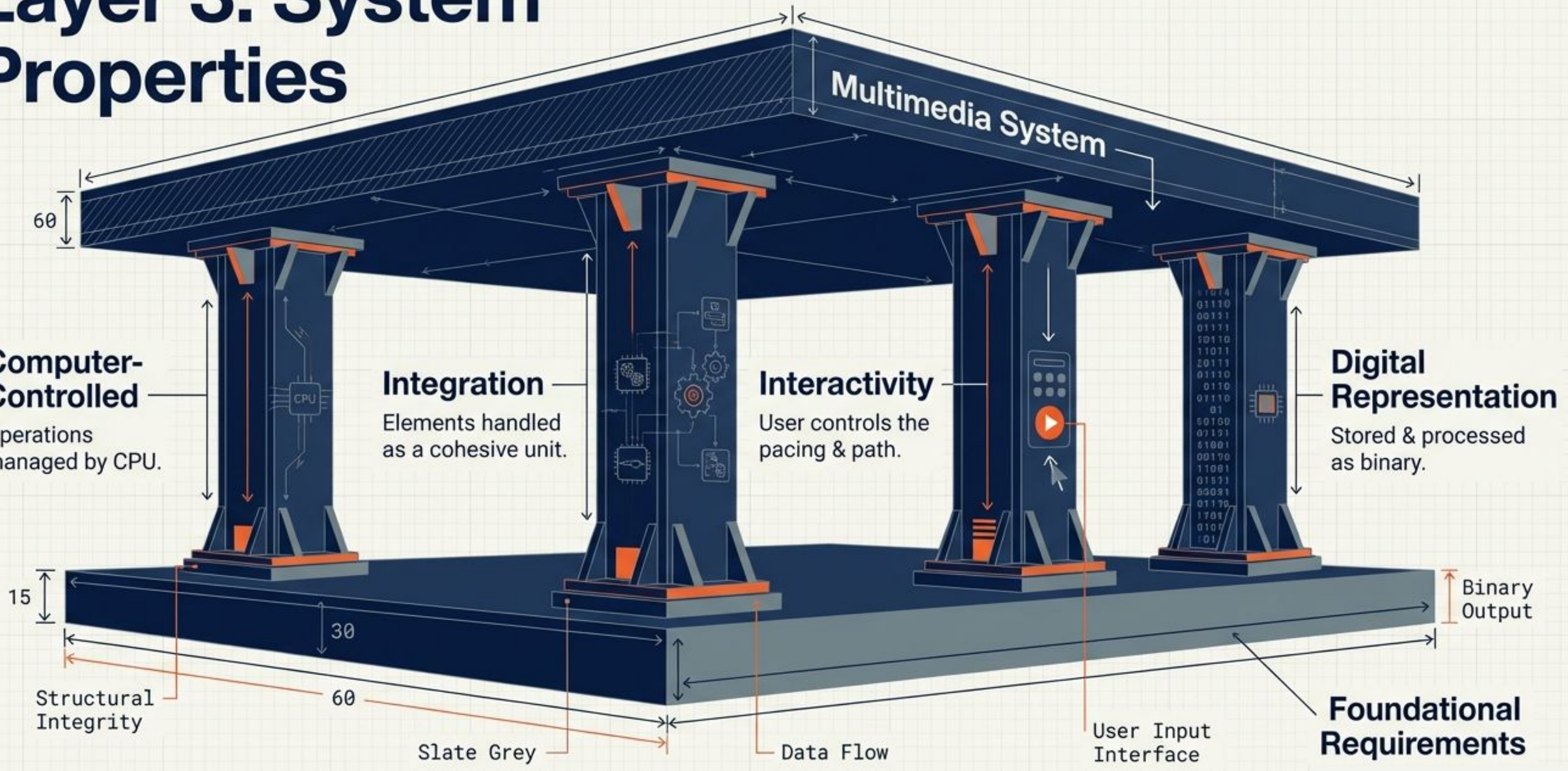
Roboto Mono →

Layer 3: System Properties



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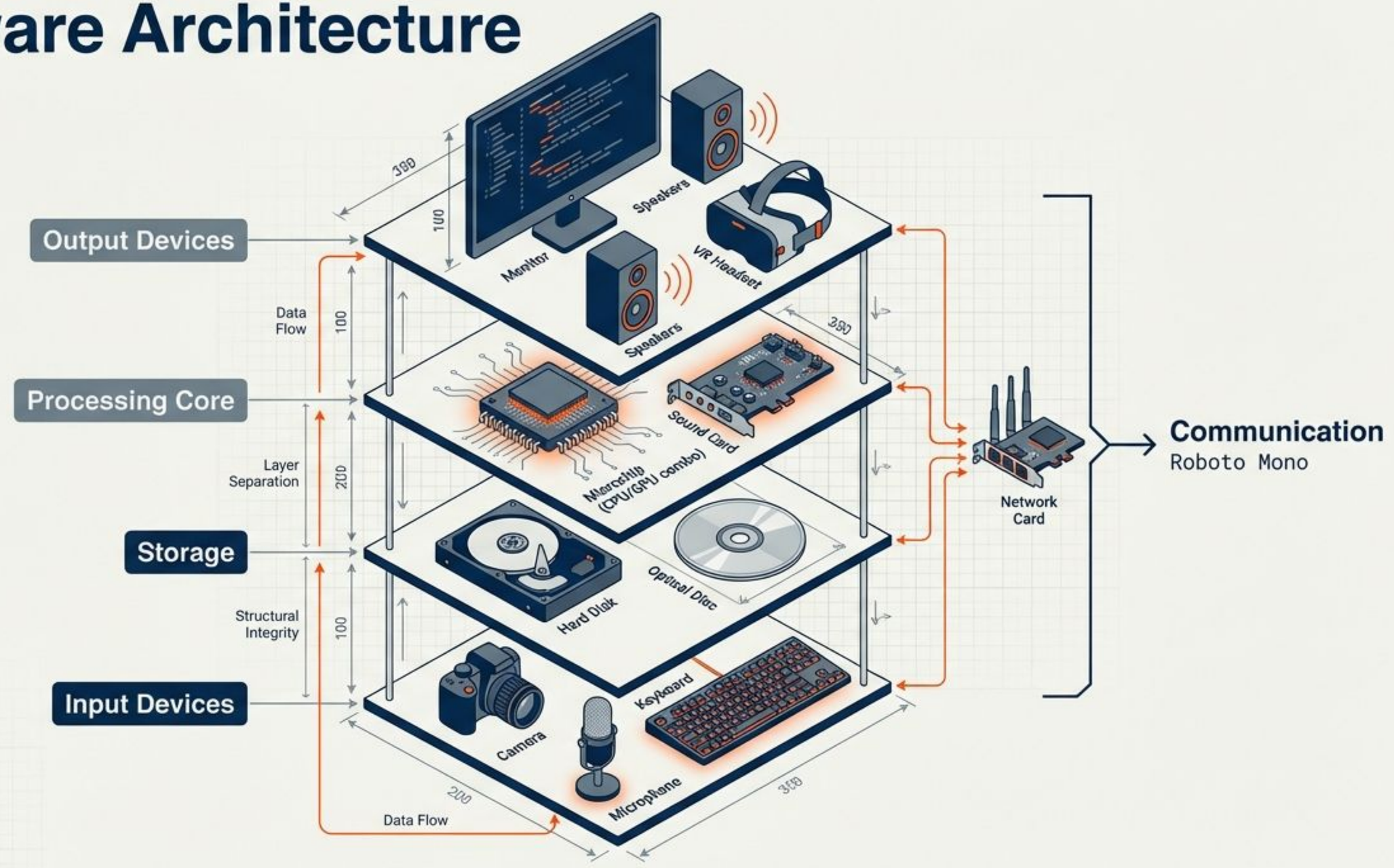
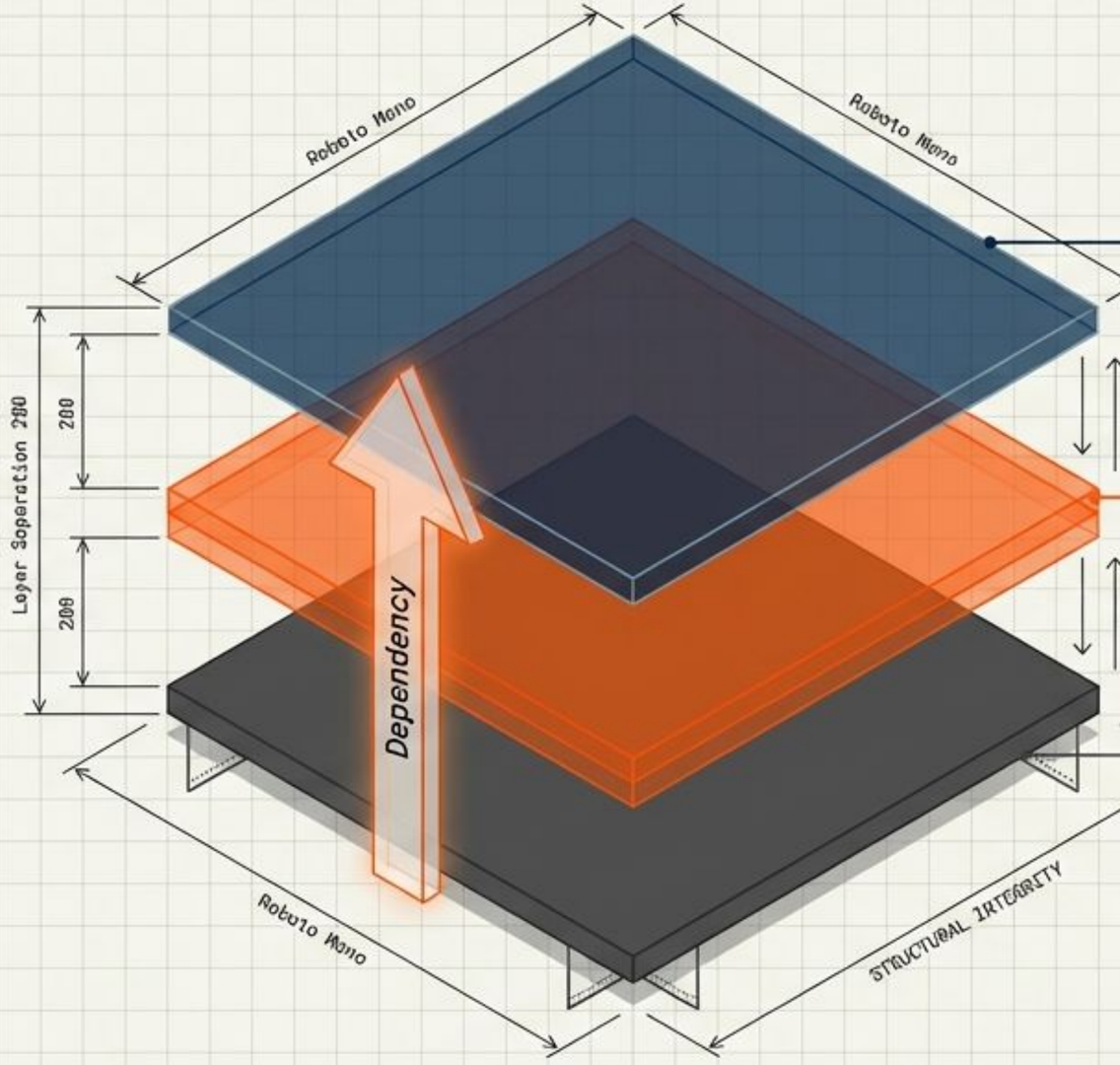
Hardware Architecture



The Software Stack



Consumption

Media Players & Viewers (VLC, Browsers).

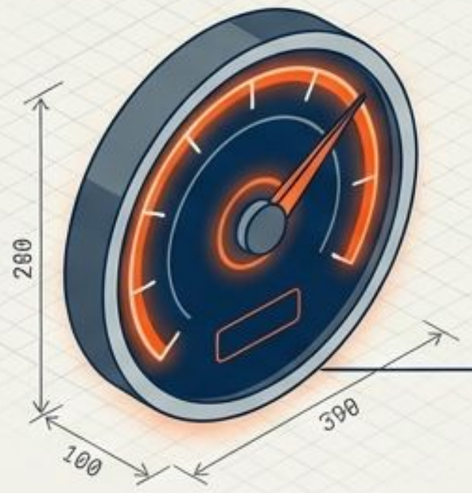
Creation

Authoring & Editing Tools (Adobe Animate, Photoshop, Premiere).

Operation

Operating System (Windows, macOS, Linux). Handles multitasking & extensions.

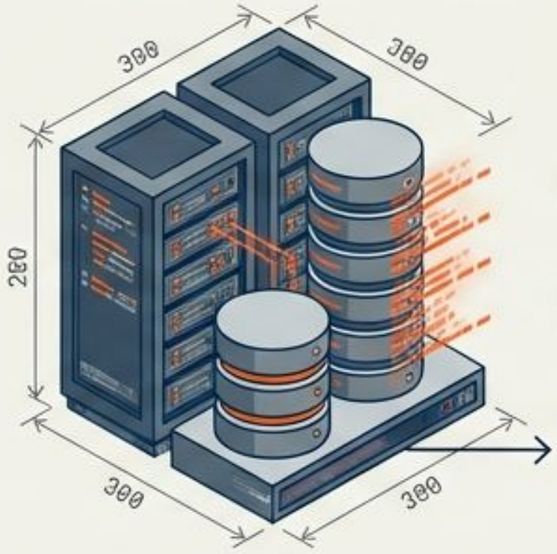
System Characteristics & Requirements



Processing Power

High-end CPU needed for rendering and encoding.

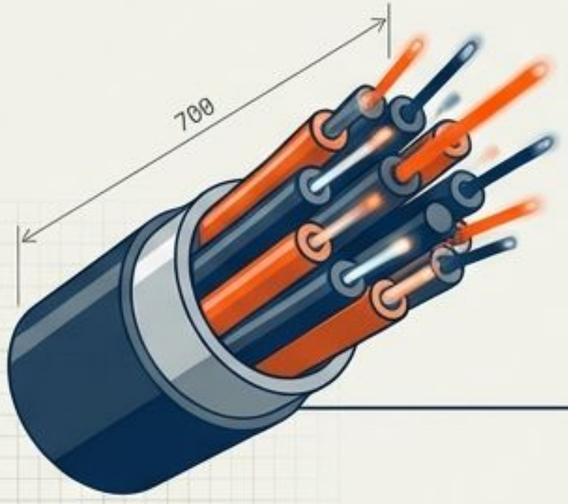
High Performance
Roboto Mono



Storage & Access

Large capacity drives with high-speed retrieval rates.

Data Throughput
Roboto Mono



Bandwidth

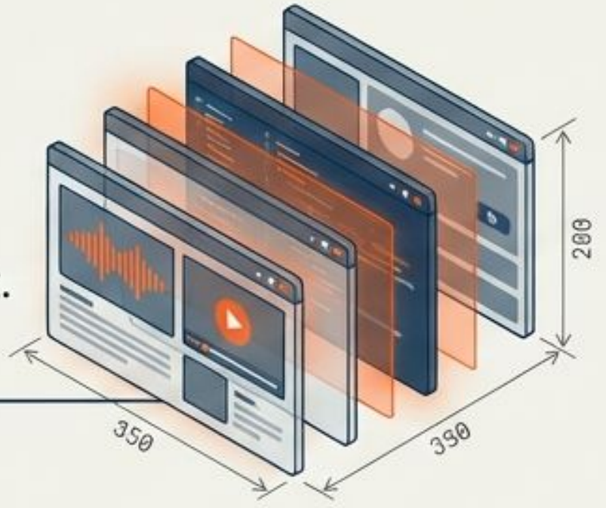
High-speed networks essential for streaming.

Optical Speed
Roboto Mono

Multitasking OS

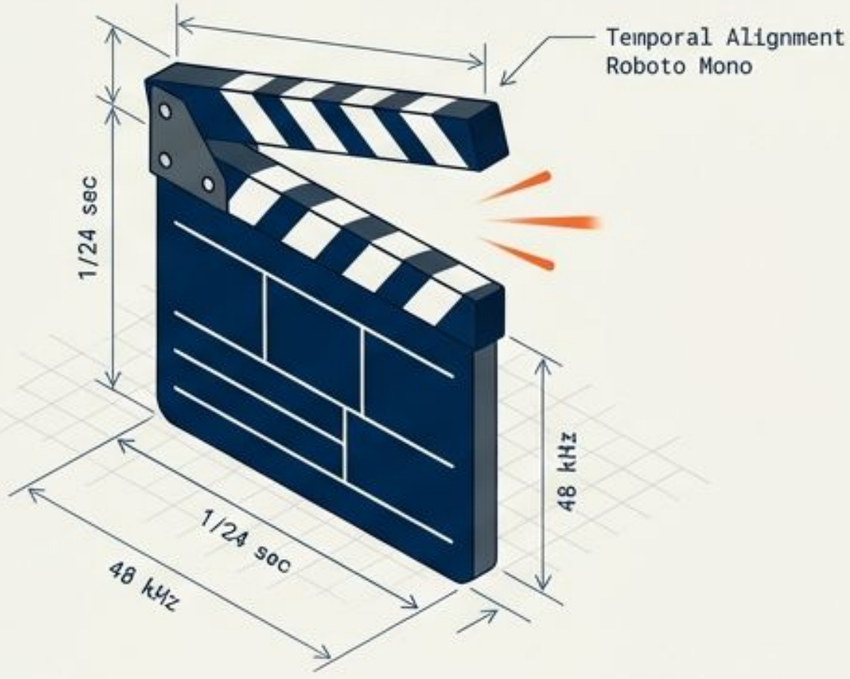
Simultaneous handling of audio, video, and user input.

Concurrency
Roboto Mono



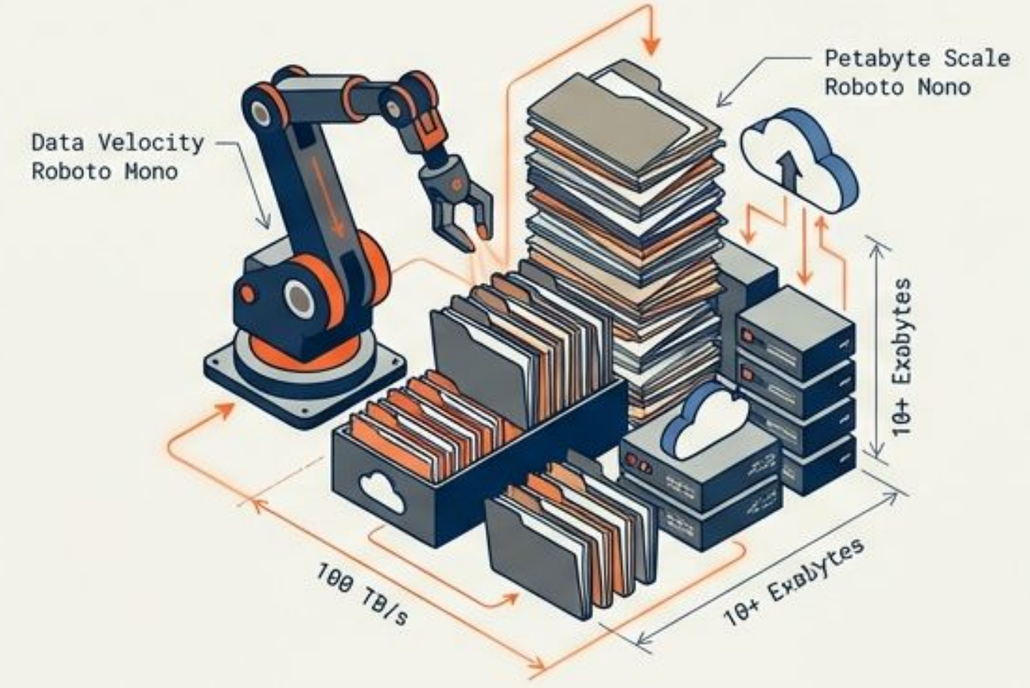
Layer 4: Engineering Challenges (Part I)

Synchronization



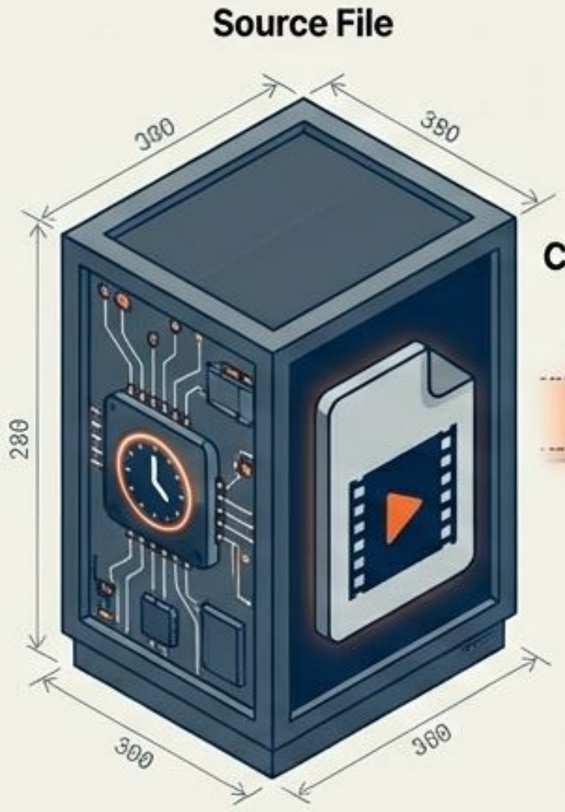
Definition: Temporal coordination of independent media streams.
The Stakes: Lip-sync failure breaks the illusion of reality.

Data Management



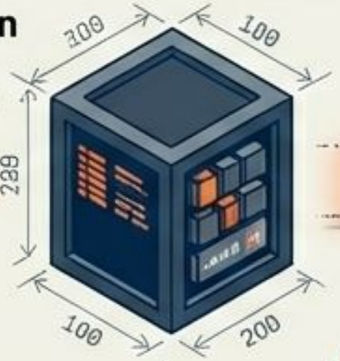
Definition: Storing and indexing unstructured binary data.
The Stakes: Managing billions of hours of content (e.g., YouTube) at scale.

Layer 4: Engineering Challenges (Part II)



Source File

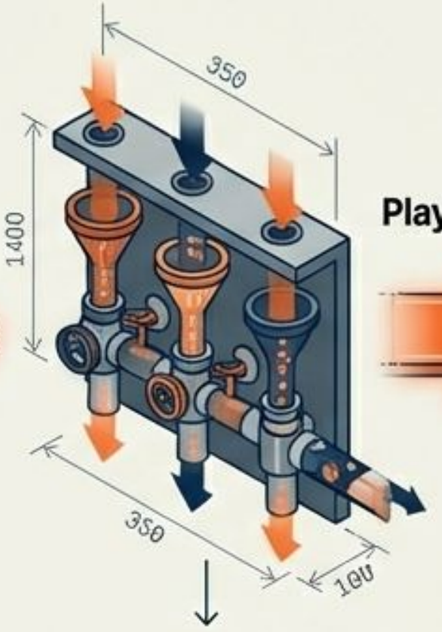
Compression (Codec)
Roboto Mono



Bandwidth Channel
Roboto Mono

Requirement: Stable 25+ Mbps for 4K.

Compressed Data
Algorithms shrink files for storage/transmission.
Roboto Nono



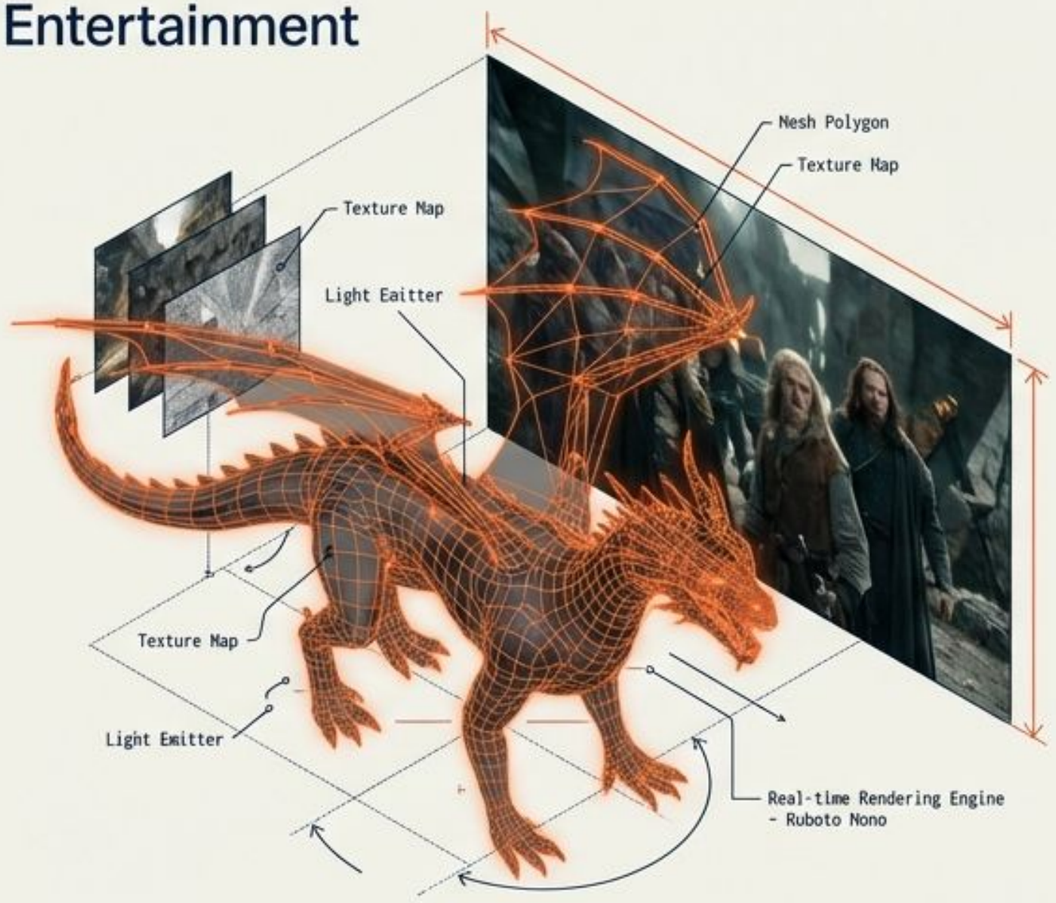
Quality of Service (QoS)
Minimizing delay, jitter, and data loss.
Slate Grey

Playback

Playback
Roboto Mono

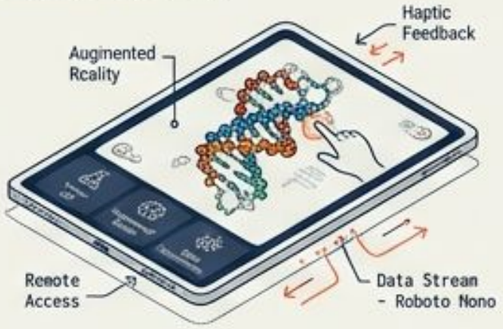
Layer 5: Scope & Application

Entertainment



VFX, Gaming, Streaming.

Education



Virtual labs, MOOCs, E-learning.

Public Access

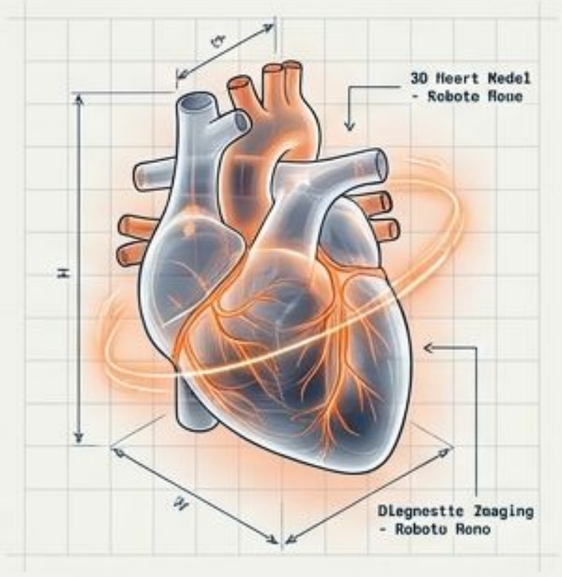
Museum guides, Airport info.

Business

Video conferencing, Product demos.

Specialized Use Cases

Medicine



Surgery simulation, Telemedicine, Diagnostic imaging.

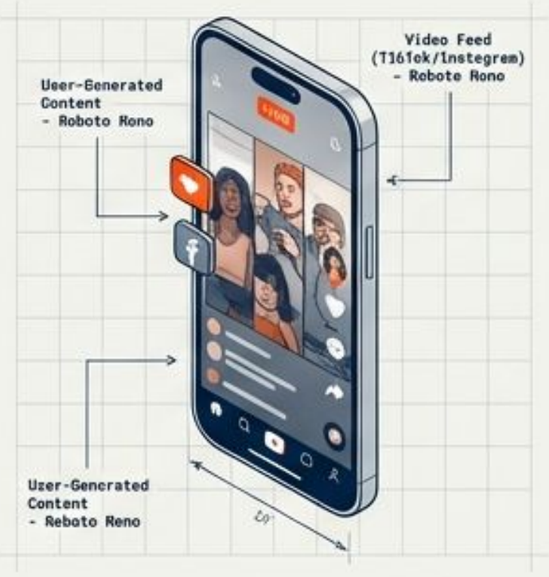
Gov & Defense

Pilot training simulators, Digital signage.

VR & AR

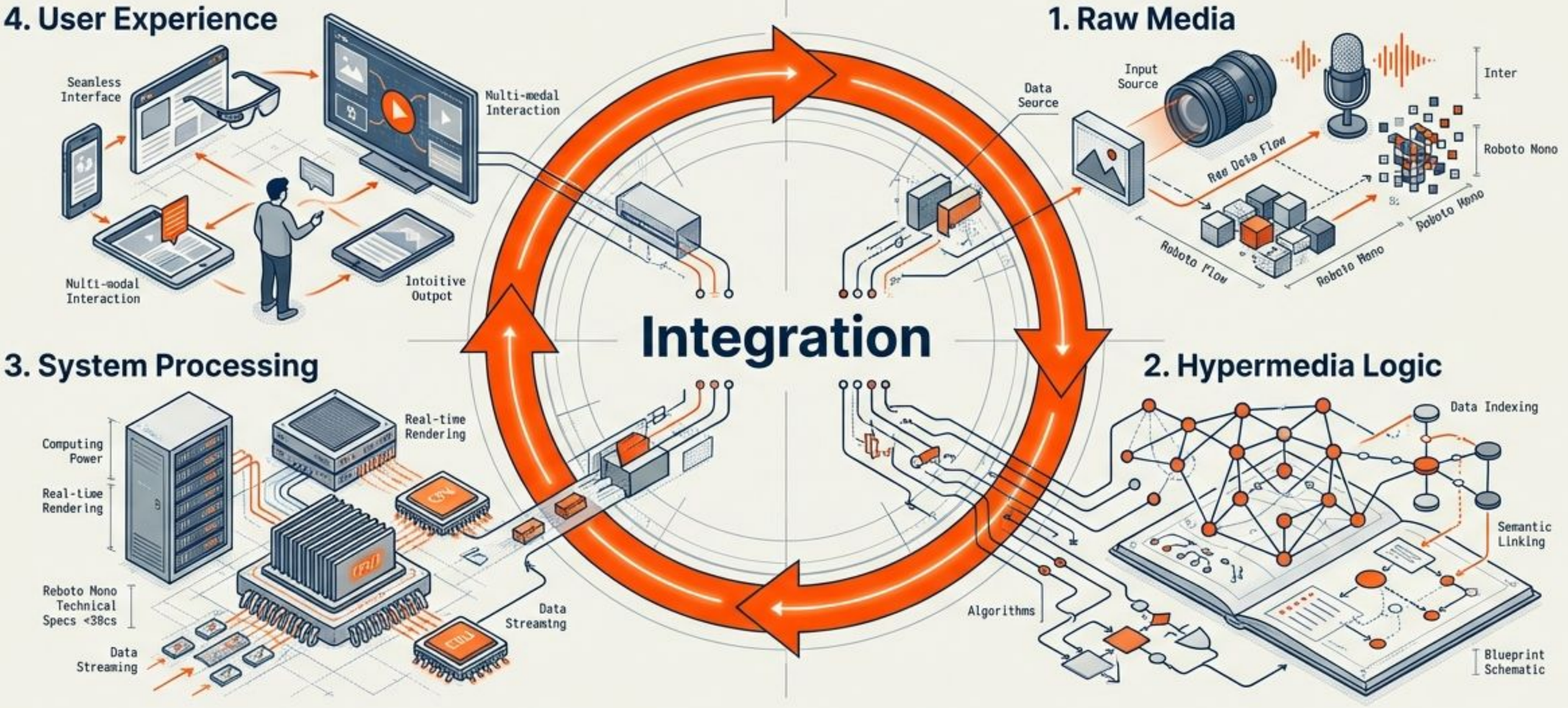
Immersive training & Retail visualization (e.g., IKEA Place).

Social Media



User-generated content backbone (TikTok, Instagram).

The Ubiquitous System



Multimedia has evolved from a technological novelty to the primary interface of human communication. It requires orchestrating complex engineering constraints to deliver seamless, intuitive experiences.

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