

Velsanet: Next-Generation 3D Distributed Network and AI Integration Strategy

1. Introduction

The meaning of connection is changing.

Networks are no longer just channels for data — they are becoming spaces where intelligence flows.

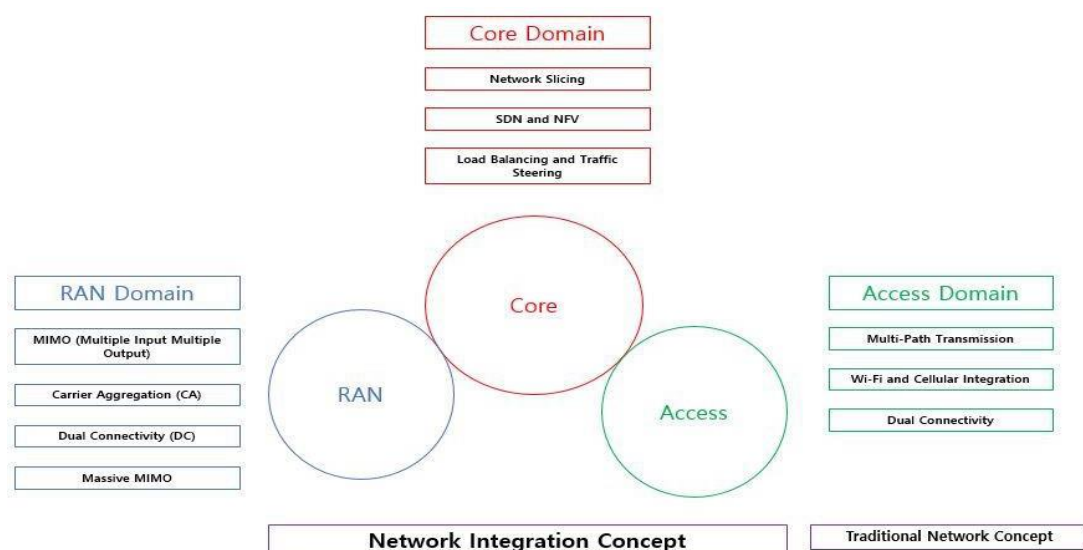
Velsanet envisions a network that senses, understands, and evolves through interaction.

Built on a 3D polyhedral distributed structure, it integrates AI into every layer, allowing information to move with **intent** rather than simple transmission.

Each node participates in a larger **collective intelligence**, creating a network that grows and adapts like a living system.

2. Concept and Vision of Velsanet

Figure: 2.1 Limitations of Existing Networks and the Need for Velsanet



2.1 Limitations of Existing Networks and the Need for Velsanet

Modern internet infrastructure is optimized for data transfer but lacks the ability to interpret **meaning and intent**.

As IoT and streaming technologies accelerate, data traffic surges, latency issues persist, and management grows increasingly complex.

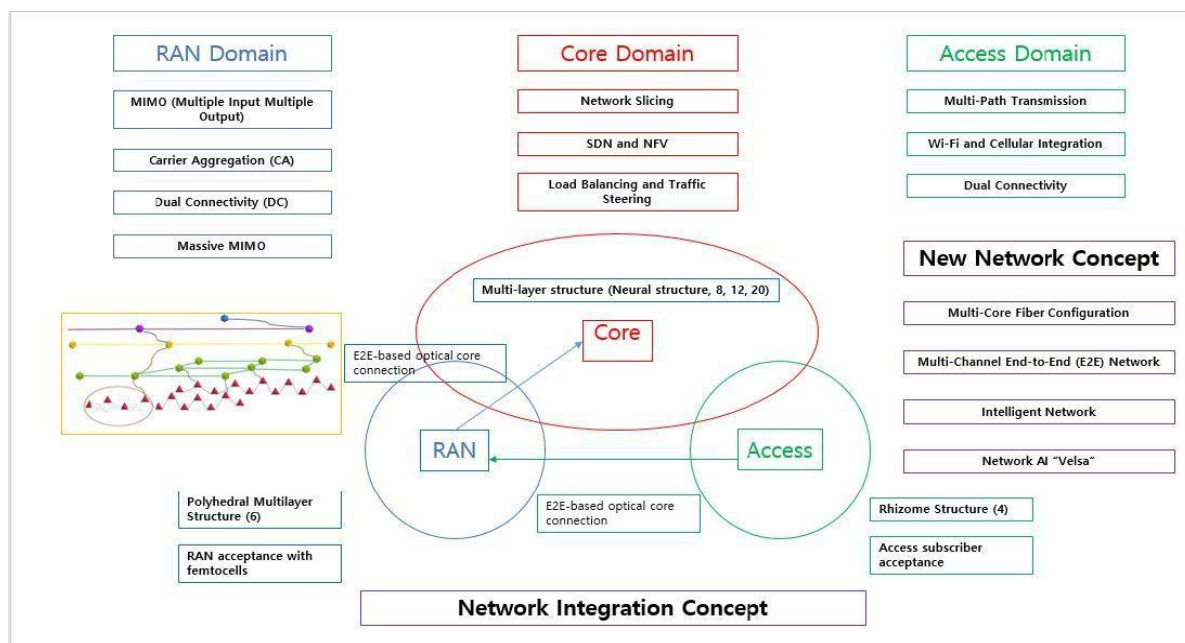
Beyond technical limitations, this reveals a deeper gap — the network fails to carry **human intent or AI cognition** within its flow.

Thus, the next-generation network must evolve from being **data-centric** to **intent-centric**.

Key Limitations:

- **Traffic Explosion:** Overload caused by IoT, video, and streaming data
- **Latency & Instability:** Degraded quality of real-time services
- **Management Complexity:** Diverse protocols and devices reduce efficiency
- **Intent Gap:** Human and AI objectives are not embedded in data transmission

Figure: 2.2 Core Philosophy of Velsanet



2.2 Core Philosophy of Velsanet

Velsanet envisions the network not as a static communication tool, but as a **living intelligent ecosystem**.

Each node acts as a **unit of intent**, interacting with others to form **collective intelligence**. This architecture, built upon a polyhedral 3D distributed structure, enables the network to exchange not only data but **meaning and purpose**.

Through this, Velsanet establishes a framework where intelligence flows naturally across layers,

allowing the system to **think, learn, and grow organically**.

It represents a new paradigm where humans, AIs, and systems evolve together through shared intent and adaptive cooperation.

Core Principles:

- **Integration & Scalability:** Unified management of diverse devices and services
- **Flexible Structure:** 3D polyhedral design for horizontal and vertical expansion
- **Intelligent Management:** AI-based autonomous optimization
- **Multi-Optical-Core E2E:** Direct, parallel user–service connections
- **Independence from the Internet:** Operates as a self-contained network
- **Intent-Driven Networking:** Connections based on meaning, not just data
- **Collective Intelligence & Organic Growth:** A network that evolves like a living organism

3. Technical Structure of Velsanet

3.1 Polyhedron-Based Network Structure

- **Node Design**
 - **Variety of Polyhedra:** Each node takes various polyhedron forms such as tetrahedron (4 faces), cube (6 faces), octahedron (8 faces), dodecahedron (12 faces), and icosahedron (20 faces).
 - **Modular Composition:** Nodes are modularly designed for easy assembly and expansion as needed.
 - **Unique Identifier:** Each node has a unique identifier determining its position and role within the network.
- **Network Topology**

- **Hierarchical Structure:** Nodes are arranged hierarchically based on physical location and function.
- **Mesh Network:** Multiple connections between nodes enhance path diversity and stability.
- **3D Scalability:** Supports both horizontal and vertical expansion to maximize space efficiency.
- **Node Structure and Function Overview**

Figure: 3.1a Overview of Polyhedron-Based Node Structures and Optical Cores






Node	Structure	Color	Optical Cores
Tetrahedron (4)	Access Network	Green 	8
Hexahedron (6)	RAN-Based Microcell	Yellow 	32
Octahedron (8)	Urban Network	Red 	192
Dodecahedron (12)	Regional Network	Blue 	1536
Icosahedron (20)	National Backbone Network	Purple 	18,432

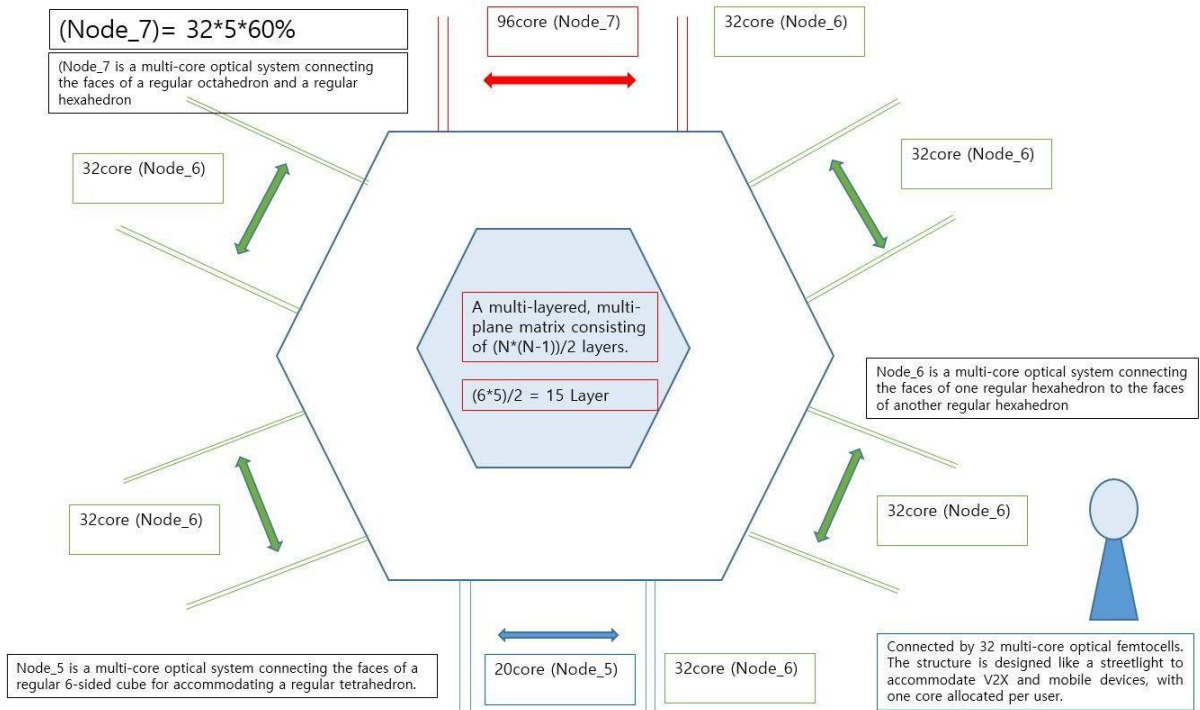
Figure: 3.1b Functional Roles of Nodes in the Velsanet Network

Node	Function	Color	Optical Cores
Node_5	Regional Access Interconnection	Light Green 	20
Node_7	RAN & Regional Network	Orange 	112
Node_10	Urban Backbone Network	Sky Blue 	864
Node_16	National & Global Backbone	Gray 	9984

- **Horizontal Nodes (Optical Core Coordination within the Same Layer)**
 - **Role:** Manage parallel optical core connectivity within the same layer, preventing unnecessary bottlenecks and ensuring efficient data pathways.
 - **Scalability:** As the layers scale up, optical core density increases, expanding coverage.

- **Vertical Nodes (End-to-End Optical Core Connectivity)**
 - **Role:** Direct optical core connectivity between hierarchical layers for maximum performance, maintaining seamless communication across different network levels with guaranteed reliability.
 - **Elimination of Distributed Traffic Dependency:** Unlike traditional internet models, Velsanet eliminates distributed traffic dependency, ensuring more efficient data flow.
- **Velsanet Network Principles**
 - **Horizontal Coordination:** Horizontal nodes coordinate optical core connectivity within the same layer.
 - **Vertical Connectivity:** Vertical nodes establish hierarchical optical core connections, maintaining structural integrity.
 - **Optical Core Density:** Optical core density increases with node level, ensuring future scalability.
 - **Polyhedral Design:** The polyhedral design enhances the reliability and efficiency of next-generation networks.
- **Future Scalability & Technological Advancements**
 - **Optical Cable Structures:** Optical cable structures do not support branching, preserving network consistency.
 - **Multi-Optical Transceivers:** The development of multi-optical transceivers optimizes optical core efficiency.
 - **Nano-Optical Cable Advancements:** Nano-optical cable advancements will drive the future of hyperconnected infrastructure.
 - **Cable Color Standards:** Defining cable colors and standards enhances real-world management and maintenance.
 - **Polyhedral Framework:** A polyhedral-based framework ensures an intuitive and streamlined education process.

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- Figure: 3.1c: Velsanet Hierarchical Polyhedral Network Connection Concept



3.2 Rhizome Network and Multidimensional Connections

- **Rhizome Network**

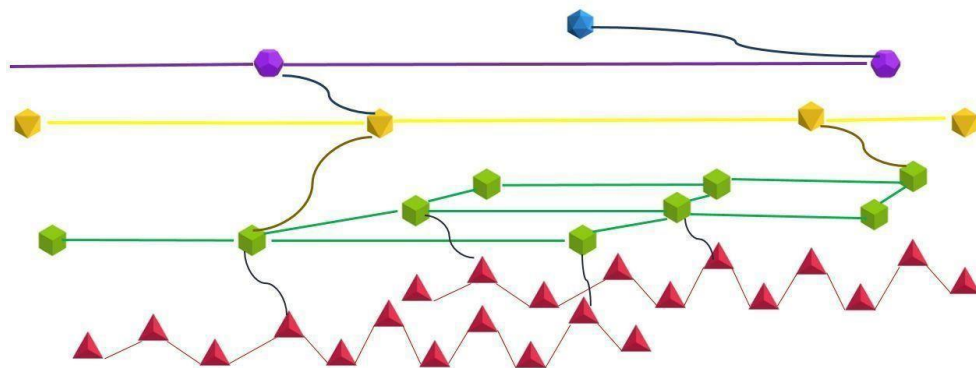
- **Main Constituents: Union of Users:** Formed based on voluntary participation and collaboration of users, each acting as a node and member of the network.
- **Decentralization:** Nodes are equally connected without a central hub.
- **Organic Growth:** The network grows and expands autonomously like plant roots.
- **Resilience:** The entire network operates unaffected even if specific nodes fail.

- **Multilayer** Mesh Network

- **Main Constituents: Union of Service Providers:** Service providers collaborate to build and operate network infrastructure, including telecom companies and content providers.
- **Hierarchical Structure:** Physical infrastructure and service layers are separated, each performing specialized functions.
- **Multiple Path Settings:** Prevents network congestion through

traffic distribution and alternative paths.

- **Quality of Service Assurance:** Maintains high levels of QoS through cooperation among service providers.
- **Multidimensional Connections**
 - **Physical and Logical Connections:** Optimizes data transmission through mapping of interconnections between individual channels.
 - **Interaction between Users and Service Providers:** Supports smooth communication between users and service providers, with the Rhizome and multilayer mesh networks complementing each other.
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- *Figure: 3.2 Velsanet Multi-Layer Multi-Plane Optical Network Architecture Diagram*

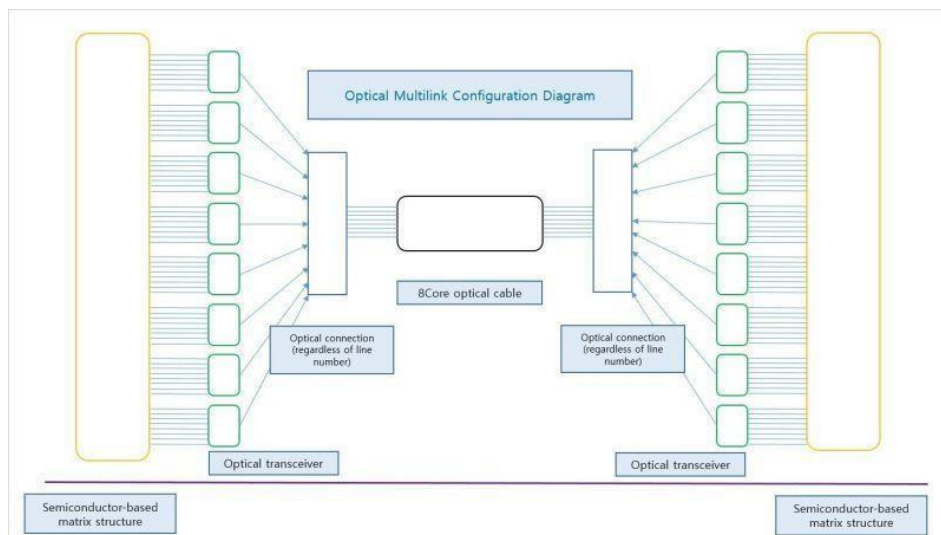


3.3 Multichannel Multimodal Communication System

- **Channel Structure**
 - **Multichannel Connections:** Structured with multichannel connections, without channel distinctions based on service types.
 - **Digital Signal Basis:** Accepts any form of signal capable of digital transmission.
 - **No Need for Frequency Bandwidth Management:** Efficient communication is possible without frequency bandwidth management through mapping interconnections of individual channels.
- **Acceptance of Femtocell-Based Mobile Communication Networks**
 - **Alignment of Wireless Multichannel and Wired Optical Core:** Integrates wireless multichannels with wired optical core

multichannels to form a unified network.

- **Implementation of a Global Single Telecom Operator:** Enables the world to implement services as a single telecom operator.
- **Multimodal Communication**
 - **Integration of Voice, Video, and Data:** Enhances user experience by simultaneously processing various forms of data.
 - **Real-Time Translation and Conversion:** Provides real-time conversion between different modalities using AI.
- **QoS (Quality of Service) Assurance**
 - **Intelligent Traffic Management:** Network AI analyzes and adjusts traffic in real-time.
 - **Maintenance of Service Quality:** Maintains high levels of service quality through efficient management of individual channels.
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- *Figure: 3.3 Velsanet Optical Multilink and High-Speed Transceiver Configuration Diagram*



3.4 E2E Multichannel Intelligent Network

- **Strengthening End-to-End Communication**
 - **Direct Connections:** Minimizes intermediate nodes or hubs to provide direct connections between users and services.

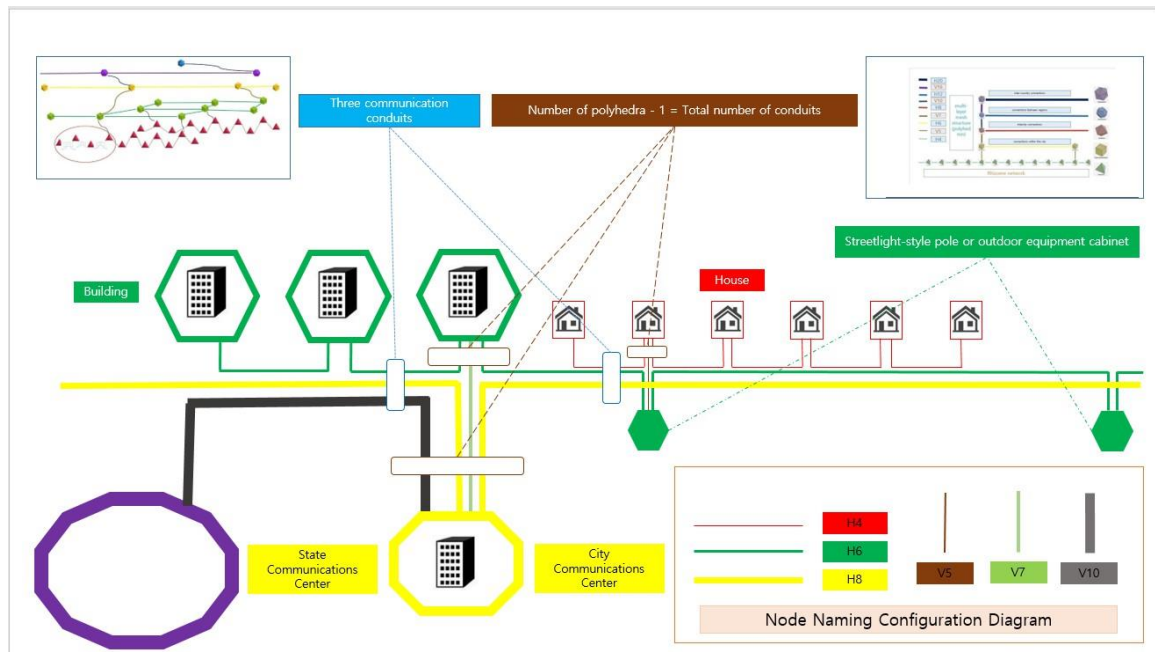
- **Reduction of Latency:** Minimizes communication delays by reducing unnecessary routing.
- **Multichannel Basis**
 - **Parallel Data Transmission:** Maximizes bandwidth by transmitting data in parallel through multiple channels.
 - **Connection through Channel Mapping:** Realizes efficient data transmission through mapping of interconnections between individual channels.
- **Intelligent Network Management**
 - **Real-Time Optimization:** Optimizes network paths and resources in real-time using AI algorithms.
 - **Prediction and Response:** Predicts traffic patterns and usage to respond proactively.

3.5 Fault Tolerance and Reduced Recovery Urgency

The Velsanet distributed network boasts strong **fault tolerance** via multiple paths:

- **Alternate Routes:** Traffic is automatically rerouted during failures, preventing complete service outages.
- **Low Recovery Urgency:** A single failure doesn't immediately disrupt overall operations, reducing the need for urgent repairs.
- **Timely Restoration:** While individual failures are non-critical, prolonged issues can weaken redundancy, so swift repairs are still advisable.
- **Velsanet Philosophy:** Leveraging multiple parallel conduits and intelligent routing without a centralized hub ensures a stable and flexible network.

Figure: 3.5 New Fiber Optic Configuration & Conduit Design

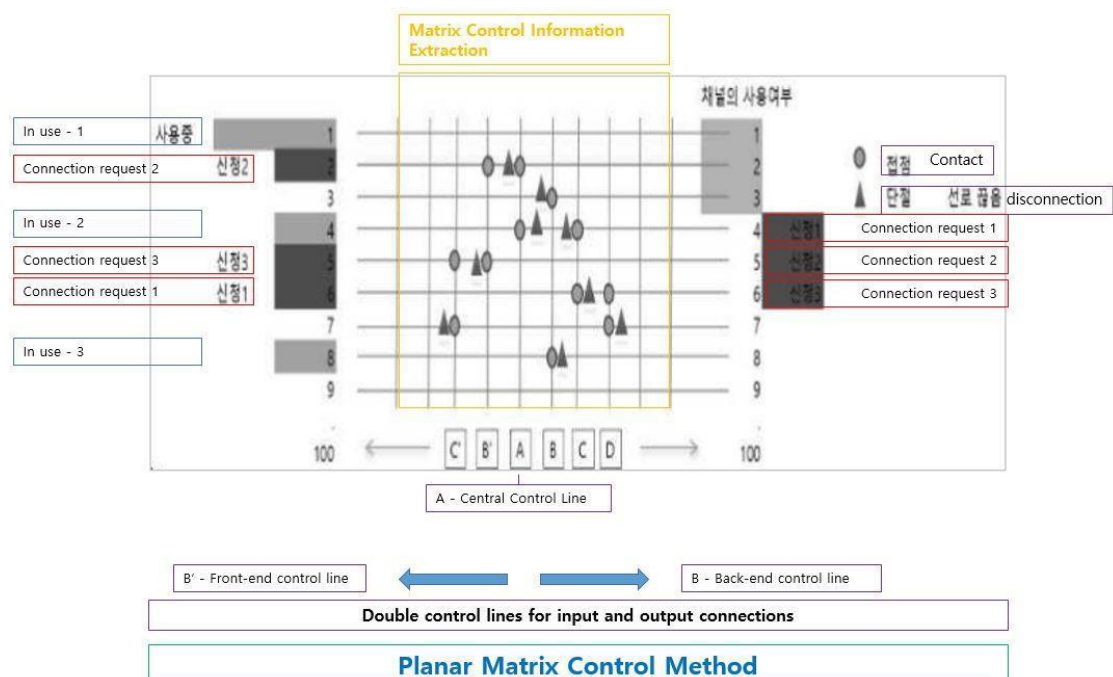


4. Network AI and MAS Structure

4.1 Velsa: The Heart of Network AI

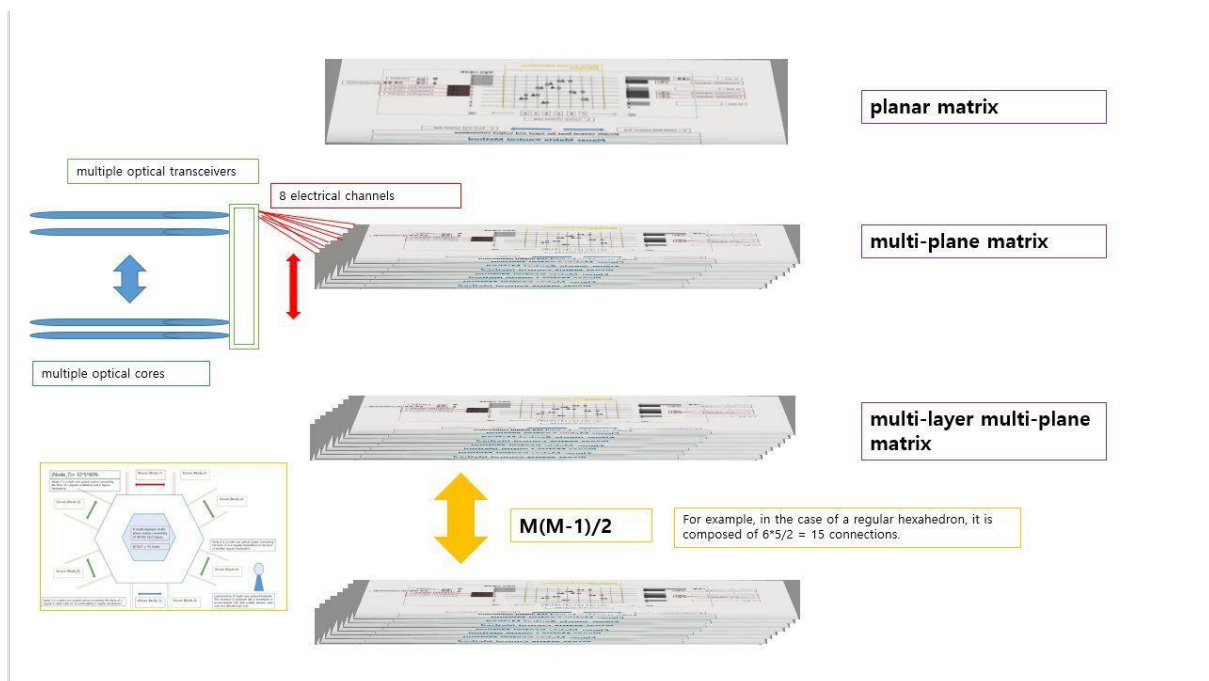
Velsa is the core AI engine of Velsanet, responsible for data collection, analysis, predictive modeling, and self-learning capabilities across the network. It optimizes and manages the network by combining a central control system with a distributed agent system, maximizing efficiency and stability.

Figure: 4.1a Matrix Control Information Extraction System



- **A - Central Control Line:** Represents the central control system of the network, managing data flow.
- **B' - Front-end Control Line & Back-end Control Line:** Dual control lines for input and output connections, ensuring the stability of data transmission.
- **Planar Matrix Control Method:** Optimizes data transmission paths through a multi-layer, multi-plane structure.

Figure: 4.1b Multiple Optical Transceivers and Electrical Channels Structure



- **Multiple Optical Cores:** The core element of data transmission, enabling parallel data transmission through multiple channels.
- **Multi-layer, Multi-plane Matrix:** For example, in the case of a regular hexahedron, it consists of 6 faces and 15 connections, optimizing data transmission paths.
- **8 Electrical Channels:** Used to maximize data transmission speeds.
- **Central Intelligent Engine**
 - **Data Collection and Analysis:** Collects data across the network and applies big data analysis techniques.
 - **Predictive Modeling:** Anticipates network conditions through machine learning and deep learning for proactive measures.

- **Self-Learning Capability:** Continuously enhances performance by learning user patterns and network traffic.
- **Network Optimization**
 - **Resource Allocation:** Efficiently distributes network resources to optimize performance.
 - **Fault Response:** Automatically executes recovery procedures and provides alternative paths in case of failures.

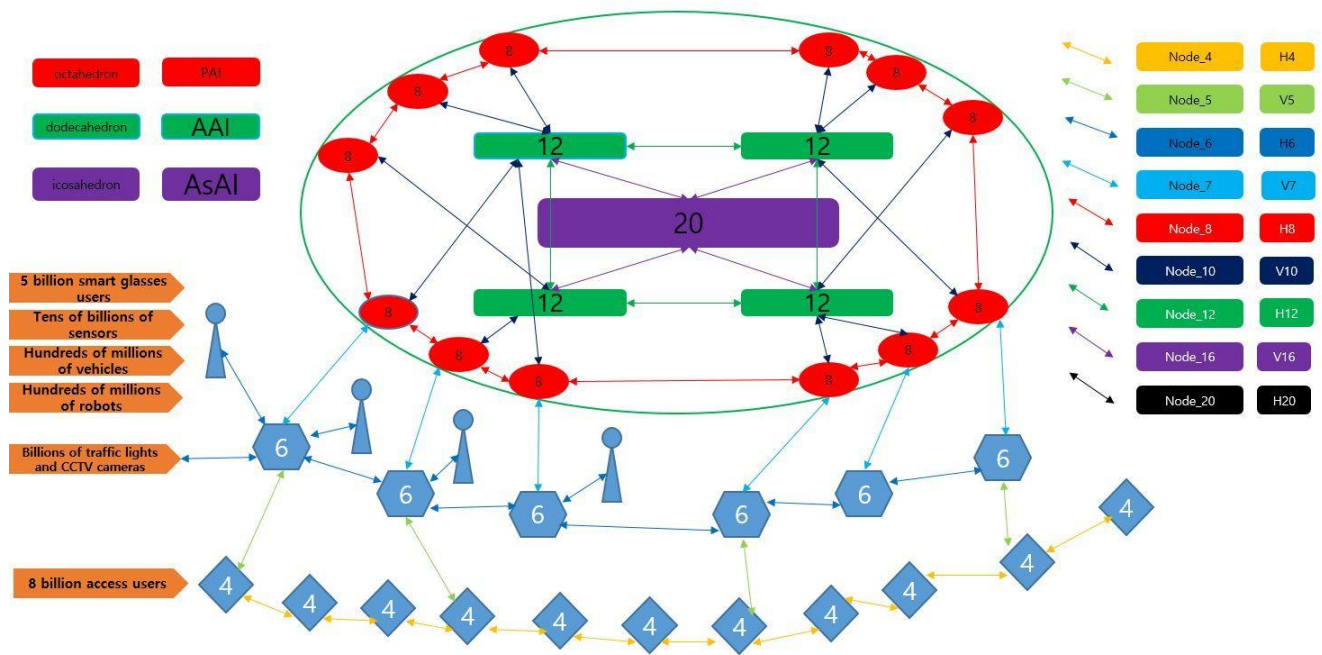
4.2 AI Agent Architecture in Velsanet

Velsanet introduces a multi-agent system structured across three intelligent layers: Personal AI (PAI), Agent AI (AAI), and Assistant/System AI (AsAI). These agents operate autonomously while cooperating through a parallel E2E infrastructure.

- **PAI (Personal AI):** Represents the user's personal context, intention, and environment. It manages local decisions and interfaces with the user via multimodal interaction.
- **AAI (Agent AI):** Coordinates clusters of PAI within a region. It performs real-time orchestration and intelligent resource distribution across octahedral nodes.
- **AsAI (Assistant AI):** Oversees AAI cooperation across domains. It supports prediction, policy integration, and multi-domain collaboration among high-level services using dodecahedron and icosahedron structures.

This model replaces centralized intelligence with distributed decision-making embedded directly into the network topology, creating an adaptive, intelligent infrastructure across all layers.

Figure 4.2: Application of Velsa – a parallel E2E AI architecture integrating PAI, AAI, and AsAI.



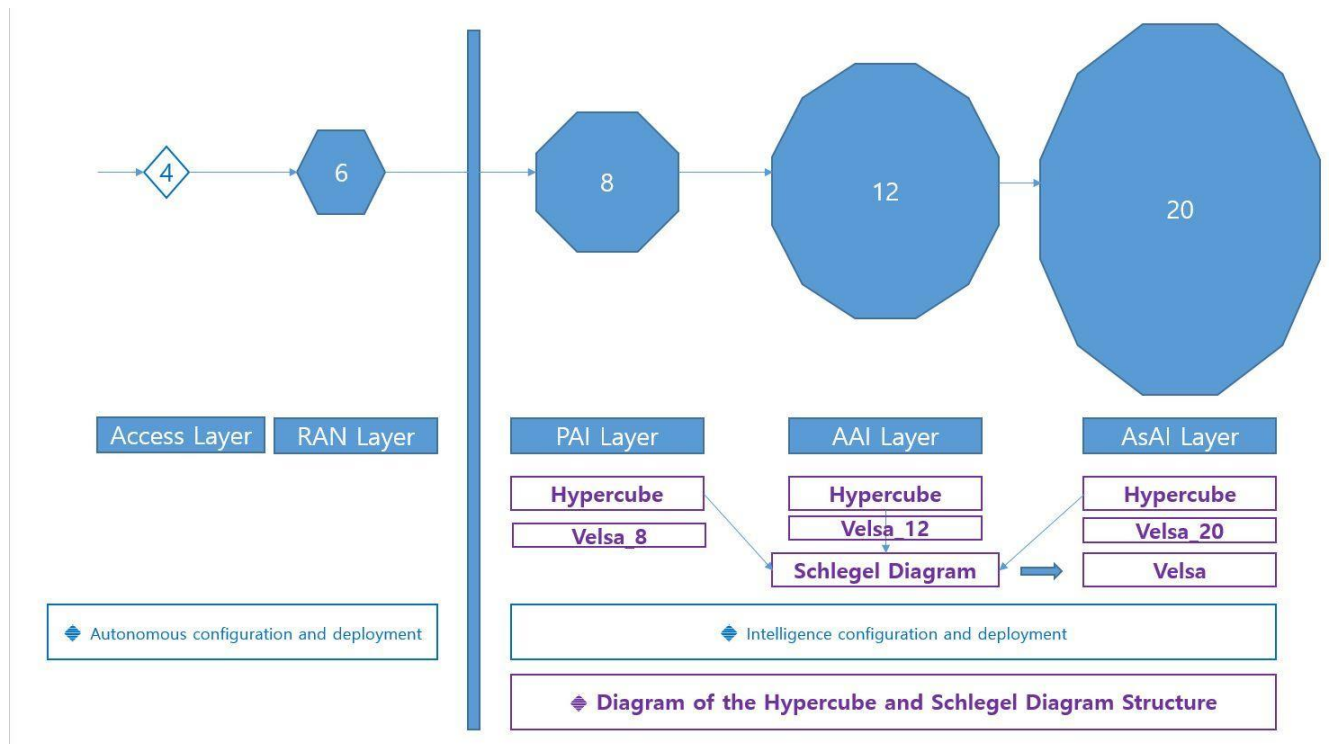
4.3 Layered Deployment and Polyhedral Node Model

The Velsanet architecture organizes network and intelligence layers using geometric node structures. Nodes based on 4, 6, 8, 12, and 20-faced polyhedra correspond to different network functions and AI agents.

- **Node_4 (Tetrahedron) and Node_6 (Hexahedron):** Represent access and RAN connectivity layers.
- **Node_8 (Octahedron):** Hosts Personal AI agents and enables device-level cognitive interaction.
- **Node_12 (Dodecahedron):** Operates Agent AI with dynamic coordination of edge intelligence.
- **Node_20 (Icosahedron):** Supports Assistant AI with global and high-dimensional orchestration.

These polyhedral layers are mapped onto a Q7 hypercube structure, with Schlegel diagram projections representing multidimensional expansion and connectivity.

Figure 4.3: Layered Deployment Model with Schlegel diagram-based polyhedral node structure.



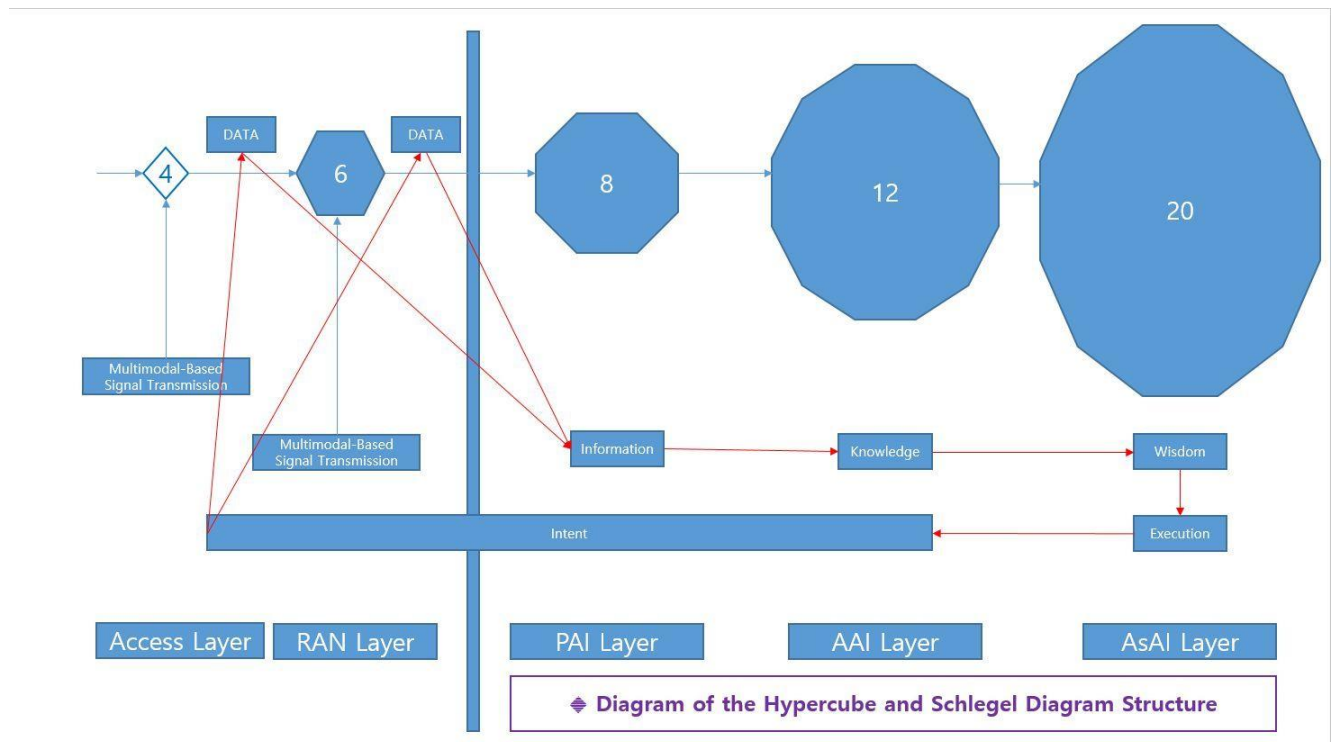
4.4 Intent-Based Flow of Cognitive Signal

Velsanet redefines network cognition as a flow of intent across all signal layers. In this architecture, intention governs every phase—from perception to action—across Access, RAN, and the AI layers (PAI, AAI, AsAI).

- **Data:** Generated by multimodal sensors, collected at Node_4 and Node_6 levels.
- **Information:** Contextualized within PAI nodes (Node_8), where user intent is structured.
- **Knowledge:** Constructed by AAI (Node_12), synthesizing multiple PAI streams to create situational models.
- **Wisdom:** Formed at the AsAI level (Node_20), integrating knowledge across domains for strategic decisions.
- **Execution:** Actionable commands returned to lower layers or external systems.

All of this flows on the backbone of "intent." Intent not only aligns signal paths, but coordinates inter-agent collaboration and autonomous decision-making. This intent structure connects multimodal signal transmission directly to cognition.

Figure 4.4: Intent-centered flow of data, information, knowledge, and wisdom across intelligent layers.



4.5 Intention as the Core of Cognitive Flow

In the Velsanet paradigm, "intention" is not merely a trigger—it is the **substrate** that underlies the entire cognitive process:

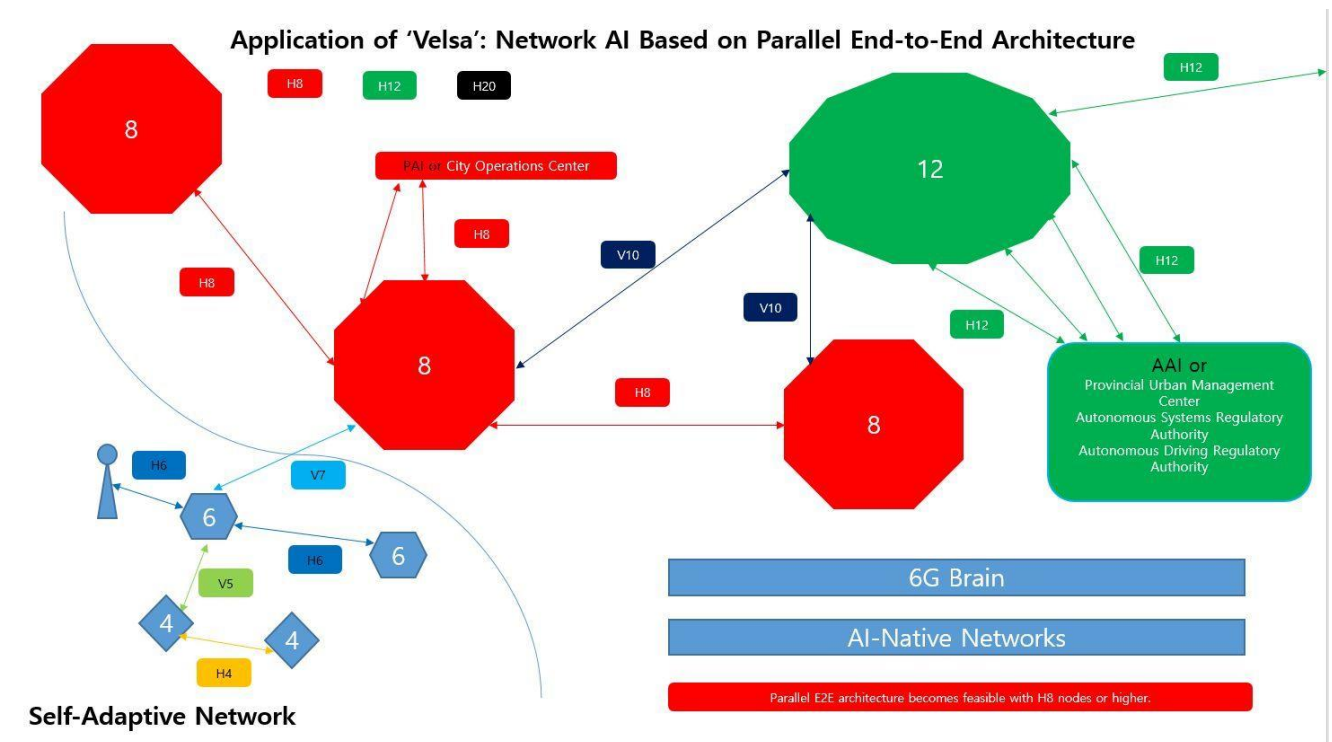
1. **Data:** Raw signals from the environment or devices.
2. **Information:** Structured and contextualized data.
3. **Knowledge:** Relational understanding among information units.
4. **Wisdom:** Judgment and insight derived from knowledge.
5. **Execution:** Intelligent actions based on contextual wisdom.

All five stages are driven and unified by **intention**. Intention is the axis around which Velsanet's AI agents—PAI, AAI, and AsAI—sense, infer, coordinate, and act.

- **PAI** captures and expresses personal-level intentions.
- **AAI** aligns and reconciles multiple PAIs to build situational knowledge.
- **AsAI** synthesizes cross-regional intentions into executable policies and strategies.

This intention-driven architecture enables a truly autonomous and adaptive network, where cognition is not imposed from above but emerges from the intelligent alignment of purpose across all layers.

Figure 4.5: Intention-driven structure of data-to-execution across layered AI agents.



5. Application Fields and Service Integration

5.1 Innovation in Broadcasting and Communication

Velsanet enables next-generation media and communication services:

- **Next-Generation Communication Services:** Supports real-time holographic communication through its multichannel connections. Users can engage in live 3D hologram calls that require simultaneous high-bandwidth data streams.
- **Immersive Experience:** By facilitating 3D holograms and rich media, the network allows users to enjoy a more realistic and immersive communication experience.
- **High Bandwidth Support:** Large volumes of data for holography are handled with ease; the network provides the high bandwidth necessary to transmit holographic or ultra-high-definition content without quality loss.
- **No Integration with the Internet:** Velsanet operates independently from the traditional internet, which enhances security and stability for broadcasting services by isolating them from broader internet traffic and threats.

- **Dedicated Network Environment:** It provides a network environment optimized specifically for broadcasting and communication services (like AR/VR streaming, live holographic events), ensuring these applications run smoothly without competing with general internet traffic.

5.2 Integration of Autonomous Driving and IoT

Velsanet's architecture supports emerging IoT and autonomous vehicle ecosystems:

Autonomous Driving Vehicle Network

- **Real-Time Data Exchange:** Vehicles share traffic conditions, sensor data, and telemetry with each other (V2V) and with infrastructure like traffic lights and road sensors (V2I) in real time, improving situational awareness on the road.
- **Enhanced Safety Systems:** Immediate warnings and coordinated responses (such as automatic braking or rerouting) are enabled to prevent accidents, as vehicles and infrastructure can react collectively to hazards or sudden changes.

IoT Device Management

- **Interoperability among Devices:** Velsanet integrates a vast array of IoT devices (from different manufacturers and with different protocols) under one network. This unified management means devices can seamlessly communicate and be controlled regardless of vendor or standard.
- **Energy Efficiency:** The network supports low-power communication modes, extending the battery life of IoT sensors and devices by using efficient channels and optimizing communication schedules (important for remote or battery-operated IoT devices).

5.3 Industrial Automation and Smart Cities

Velsanet accelerates the development of smart industries and cities:

Implementation of Smart Factories

- **Real-Time Production Management:** The network monitors and controls production lines in real-time, enabling immediate adjustments to manufacturing processes and quick responses to any issues on the factory floor.

- **Predictive Maintenance:** Using sensor data and AI analysis, Velsanet assesses machine conditions continuously to predict when equipment might fail or require maintenance, thus preventing downtime with proactive repairs.

Smart City Infrastructure

- **Traffic Management Systems:** City-wide traffic data is analyzed to optimize traffic light control and routing. The network can adjust signals on the fly and guide autonomous vehicles to alleviate congestion in real time.
- **Energy Management:** Velsanet monitors energy usage across the city (buildings, grid, streetlights, etc.) and manages it efficiently. It can balance load, reduce waste, and respond to peaks by intelligently controlling devices and distributing resources.

6. Technical Challenges and Solutions

6.1 Miniaturization and Efficiency of Equipment

As network devices become more complex, Velsanet addresses size and efficiency challenges:

High-Density Circuit Design

- **3D Integrated Circuits:** Uses 3D chip integration technologies to stack and interconnect circuit components vertically, greatly enhancing space utilization within devices.
- **Application of Nanotechnology:** Incorporates nanoscale components and materials to increase performance while reducing size and power consumption of optical and electronic elements.

Heat Management and Cooling Technology

- **Efficient Heat Dissipation Structure:** Devices are designed with optimized thermal layouts (e.g., heat pipes, graphene layers) to spread and dissipate heat evenly, maintaining stability.
- **Liquid Cooling Systems:** For high-performance optical core transceivers and processors, Velsanet can employ advanced liquid cooling solutions, effectively

removing heat and allowing devices to operate at peak performance without overheating.

6.2 Development of Signal-Based Communication Protocols

To fully utilize multichannel capabilities, Velsanet explores advanced communication protocols:

Signal Processing Algorithms

- **High-Speed Modulation Techniques:** Research is ongoing into new modulation methods (beyond traditional QAM, OFDM, etc.) that can pack more data into optical/electrical signals, thereby increasing transmission speeds on each channel.
- **Error Detection and Correction:** Robust algorithms are employed to detect and correct errors in transmission in real time, ensuring data integrity even over high-speed or noisy channels.

Protocol Development

- **Acceptance of Digital Signals:** Velsanet's protocols are designed to accept and integrate all forms of digital signals, whether from legacy systems or novel devices, providing universal compatibility for any digital data.
- **Channel Mapping Technology:** The network implements intelligent channel mapping which efficiently assigns and translates data streams to available channels, optimizing throughput and minimizing interference by dynamically re-routing signals as needed.

6.3 Security and Privacy Protection

Security is a core focus in Velsanet's independent network design:

Encryption Technology

- **Quantum Encryption:** Velsanet looks toward future-proof security by considering quantum encryption methods. These techniques use principles of quantum mechanics to secure communications against even quantum-computer attacks.

- **End-to-End Encryption:** All data transmitted across Velsanet can be encrypted from the source to the destination, ensuring that even if intercepted, the data remains confidential and unaltered.

Access Control and Authentication

- **Multi-Factor Authentication:** The network supports strong authentication methods, combining something users know (passwords), have (devices or tokens), and are (biometrics) to verify identities.
- **Permission Management System:** Fine-grained access control policies manage what users and devices can do in the network, ensuring each entity only accesses resources it's permitted to.

Privacy Protection Policy

- **Data Minimization Principle:** Velsanet adheres to collecting and storing only what data is absolutely necessary, reducing risk by not hoarding excess personal or sensitive information.
- **Providing Transparency:** Users are clearly informed about how their data is used and for what purposes. This openness builds trust and allows users to understand and control their data footprint.

7. Collective Intelligence and Organic Growth in the Velsanet Network

7.1 Concept of Collective Intelligence

The collective intelligence of Velsanet is a **distributed cognitive structure** formed through the **exchange of intent**.

Each node operates as an independent unit of intelligence, generating shared understanding and direction through feedback.

Intelligence adjusts autonomously without central control, allowing the entire network to function as a unified cognitive system.

7.2 Cognitive Circulation Structure

Velsanet expands the **DIKWEI structure**

(Data → Information → Knowledge → Wisdom → Execution → Intent)

into a **collective cognitive cycle**.

Each node collects data, shares information, and reflects execution results at the level of intent.

This cycle enables continuous learning and renewal across the entire network, operating as a **self-reconfiguring mechanism of intelligence**.

7.3 Structure of Organic Growth

The growth of Velsanet is based on **self-organization** and **adaptive evolution**.

The network restructures itself according to environmental and intentional changes, sustaining morphological expansion through its parallel E2E architecture and polyhedral nodes.

This structure functions as a **self-evolving system** in which intelligence develops autonomously.

7.4 Ecological Intelligence

Velsanet extends into an **intelligent ecology**

where humans, AIs, cities, and environments interact as cognitive entities.

Each element acts independently yet maintains balance through the exchange of intent and signals.

This structure is founded on **co-evolution rather than control**, allowing the network to operate as an integrated, living cognitive organism.

8. AI-Native Network Structure and Intelligent Connectivity

8.1 Introduction

Velsanet is not a network with intelligence added to it.

It is a network **in which intelligence exists as structure**.

The system does not merely transmit data — it **interprets intent, understands context, and evolves through connection**.

8.2 Structural Intelligence of the Network

Each node functions as both a communication point and a cognitive unit.
Learning and reasoning occur everywhere in the network.

- **Node 6:** foundation for spatial and temporal awareness
- **Node 8:** personalized intelligence linking intent and environment
- **Node 12:** relational and regional coordination
- **Node 20:** collective reasoning and global cognition

Intelligence is spatially distributed, and intent flows organically through the network.

8.3 Parallel E2E Connectivity

Connections are formed by intent and sustained through understanding.
Each link interprets its own interaction and adjusts dynamically within the flow.
Information exchange occurs as **semantic interaction**, not as packet transmission.
The network evolves into a system that **thinks through its own connections**.

8.4 Organic Evolution and Collective Learning

New nodes and intelligences merge seamlessly into the shared continuum.
Local insights expand into global comprehension.
Intent becomes memory; memory transforms into new awareness.
Through this cycle, the network **learns, remembers, and reshapes itself**.

8.5 Meaning of AI-Native Design

In Velsanet, the physical and cognitive layers are one.
Form equals function; structure equals intelligence.
Every signal carries purpose, and every connection reflects understanding.

Intelligence is not hosted on the network —
the network itself is intelligence.

9. Conclusion

Velsanet is an innovative solution designed to overcome the limitations of existing networks and meet future communication demands. As a multi-optical-core, end-to-end multichannel intelligent network, it supports direct and efficient communication between users and services, for example providing the multichannel connections needed for holographic communication. Its channel structure connects multiple channels without service-type distinctions, accepting any form of signal capable of digital transmission. Velsanet also accommodates femtocell-based mobile networks, aligning wireless multichannels with wired optical core multichannels – enabling the world to function as a single global telecom operator in practice.

By combining the Rhizome network of users with a multilayer mesh network of service providers, Velsanet forms a unified ecosystem of users and services. The polyhedron-based 3D distributed network structure, intelligent network management through MAS, and close collaboration between Central AI and Auxiliary AIs all maximize network efficiency and stability. Additionally, through strategic partnerships with global telecom companies and active collaboration with academia, we aim to pursue technology disclosure and transparency, realizing the democratization of technology.

Through these efforts, Velsanet will open the era of personal AI and lead innovation across various industrial fields – transforming not only how we communicate, but also how we live and interact in an increasingly connected world.

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