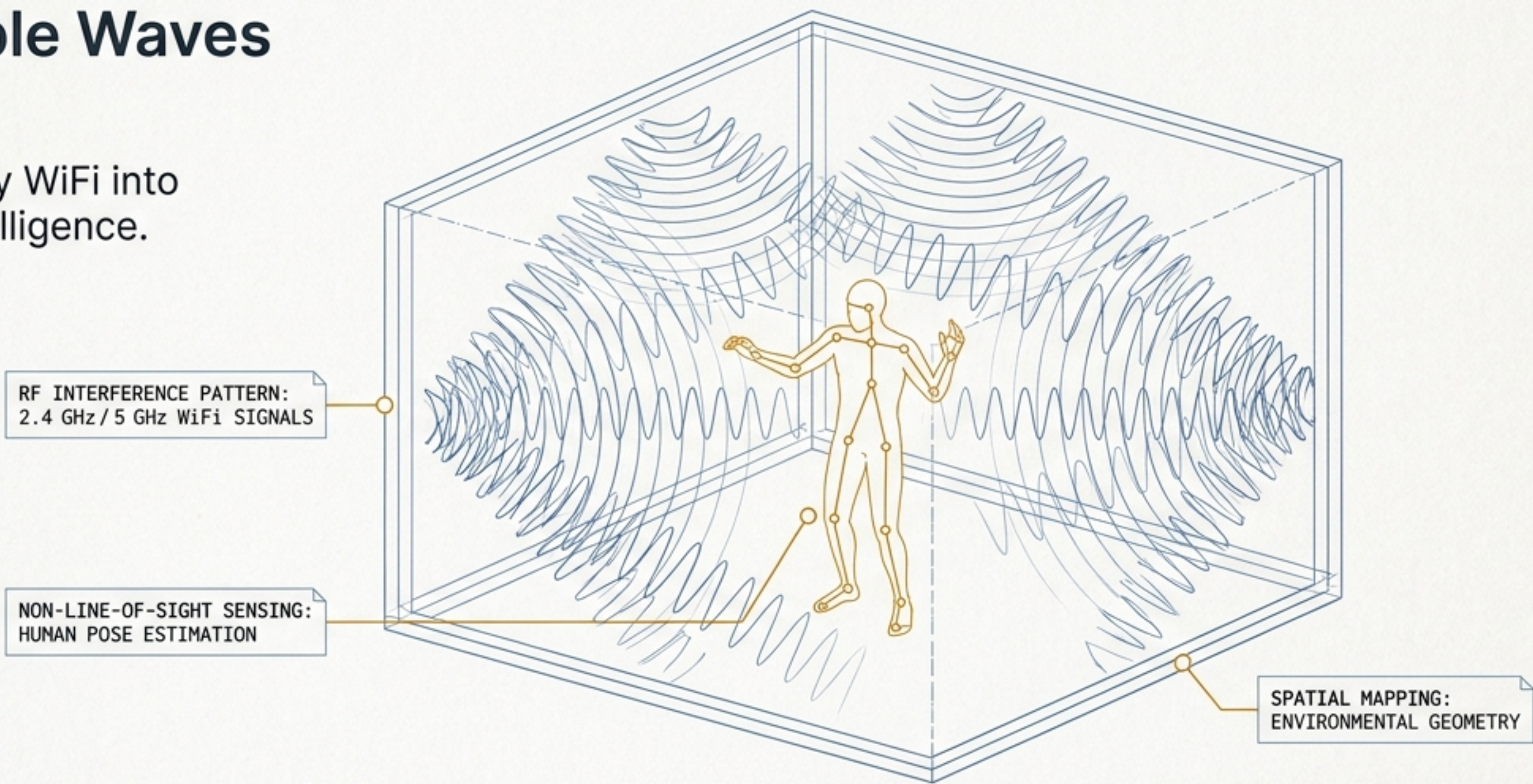


RuView: Invisible Waves Made Visible

Transforming commodity WiFi into zero-camera spatial intelligence.

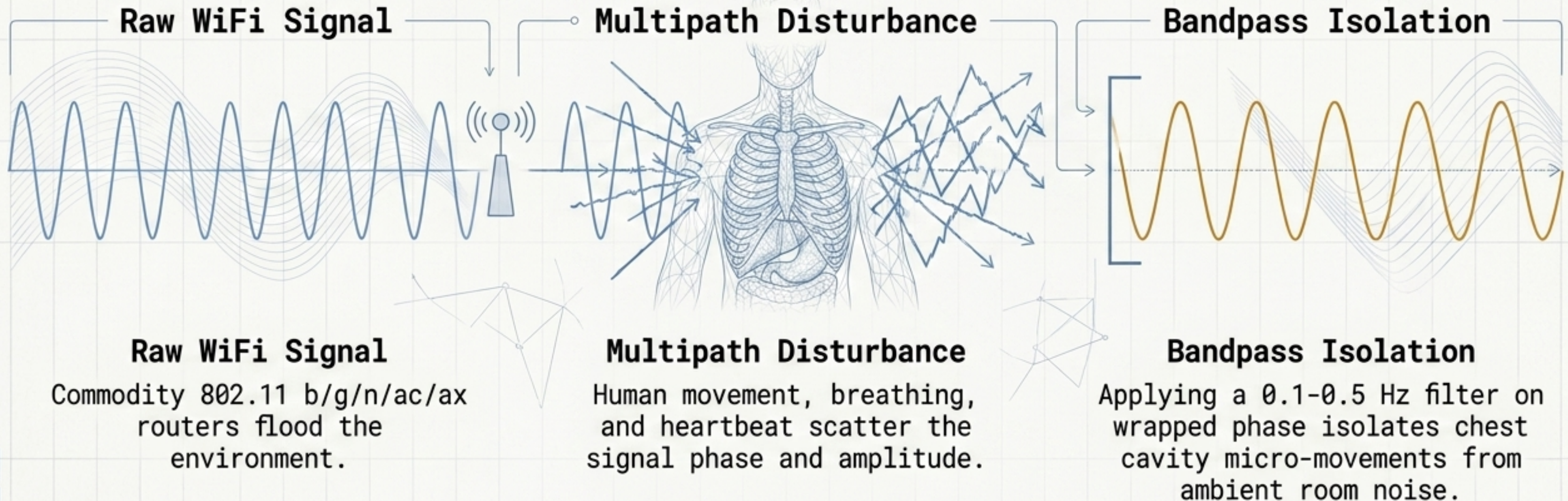


COMMODITY WIFI VS. RUVIEW SENSING				SIGNAL PROCESSING FLOW				
	PRIVACY (CAMERA-FREE)	COST (EXISTING INFRASTRUCTURE)	RESOLUTION (HUMAN SCALE)					
WiFi	✓	✗	✓	WIFI TRANSCEIVER CHANNEL STATE INFORMATION (CSI) CAPTURE SIGNAL PREPROCESSING RUVIEW v0.8.1 MODEL (8 KB) SPATIAL INTELLIGENCE OUTPUT				
RuView	✓	✗	✓					

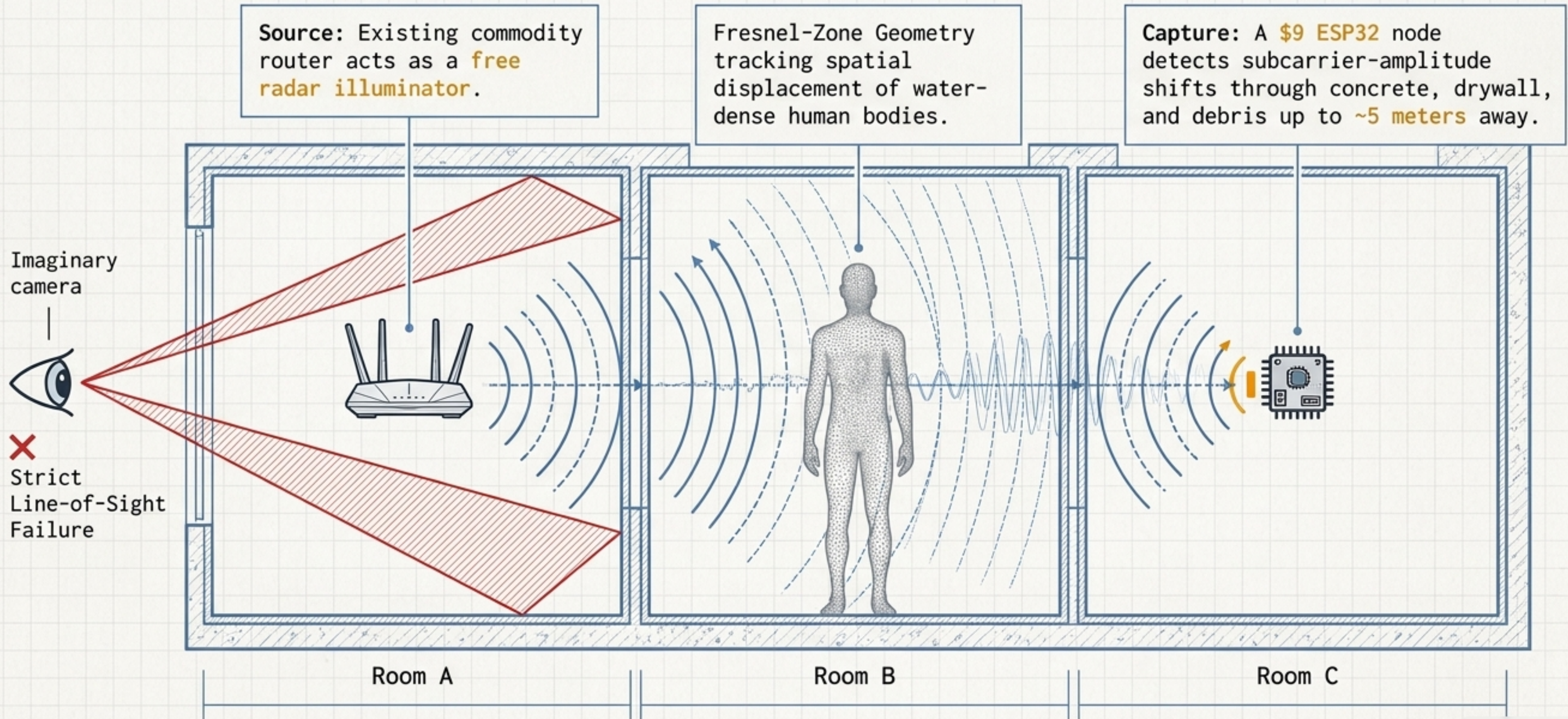
The Post-Camera Spatial Paradigm

	RuView (WiFi)	Optical Cameras	Wearables	Radar/Lidar
Privacy Compliance	Zero-Pixel (GDPR/HIPAA Safe)	High Risk (Consent Required)	Safe	Safe
Physical Range	Through-Wall/ Solid Debris	Strict Line-of-Sight	Body-Bound	Material Dependent
Environment	Absolute Darkness	Needs IR/Light	Any	Any
Hardware Cost	\$0-\$9 / Zone	\$200-\$2k / Zone	\$100+ / User	\$150+ / Zone

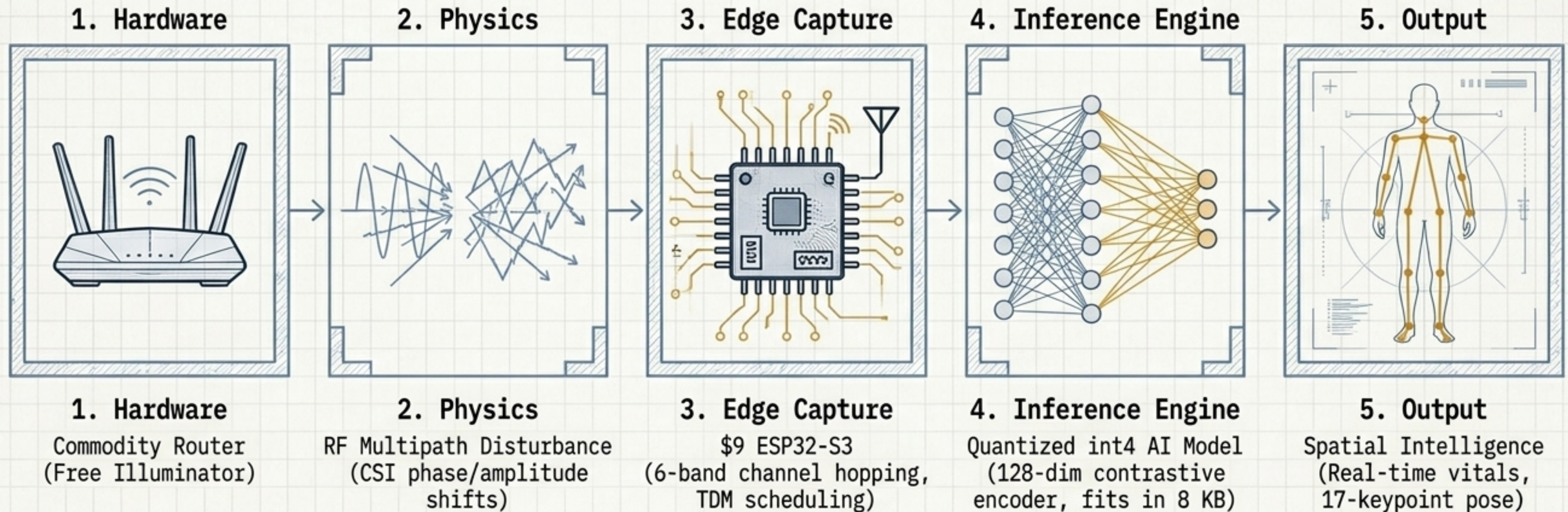
Physics: Channel State Information (CSI)



Non-Line-of-Sight: Multipath Penetration



The 8 KB Intelligence Pipeline



Cold-start on Pi 5: 8.4 ms | Embedding Speed: 164,183 emb/s | Held-out Accuracy: 82.3%

Self-Learning WiFi AI Engine



Self-Supervised (Default)

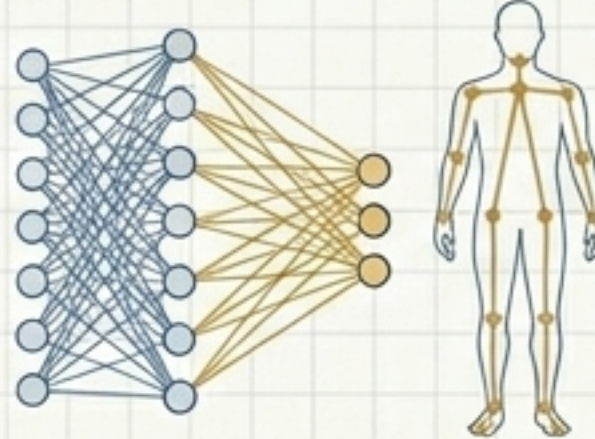


Input: Raw WiFi data only.

Output: Understands WiFi signal structure, room identification, anomaly detection.

Time: ~30-second ambient calibration. **No human labeling.**

Supervised (Fine-tuning)



Input: WiFi data + body pose labels.

Output: Full pose tracking + environment fingerprints.

Cross-Modal (Advanced)



Input: WiFi data + camera footage (MediaPipe).

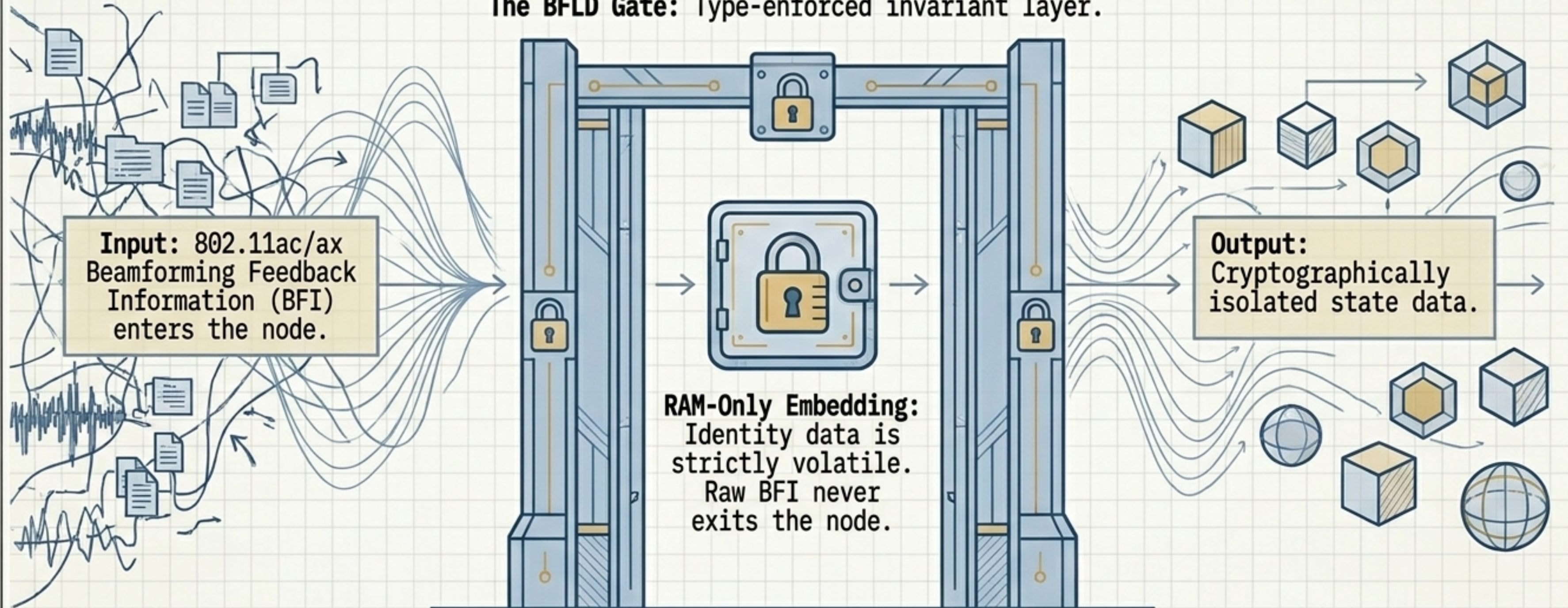
Output: Fingerprints aligned with visual understanding.
End-to-end pipeline in **2.1 s** for **400 epochs**.

Hardware Footprint: Entire model fits in **55 KB** of memory. Uses **2 KB** per-room MicroLoRA adapters for instant environmental adaptation.

Absolute Privacy: The BFLD Gate

Security Guarantees: Cross-site correlation is mathematically impossible via per-site BLAKE3 keyed hashing and daily rotation. No video, no pixel data, no GDPR/HIPAA imaging liabilities.

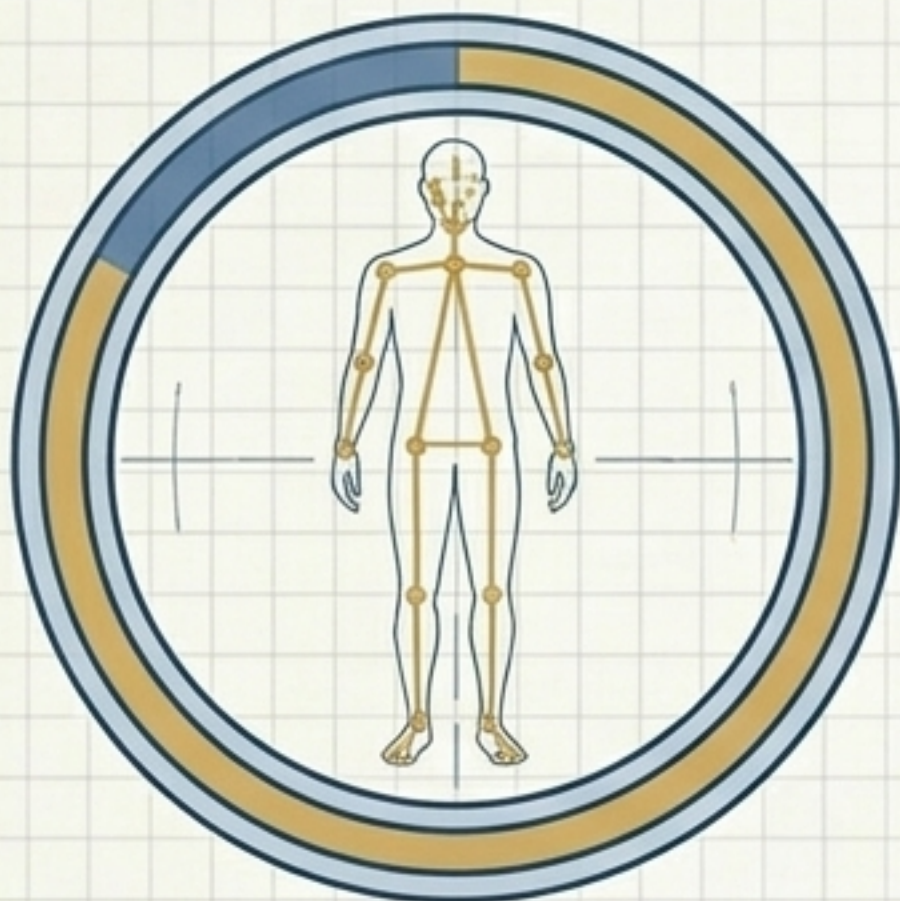
The BFLD Gate: Type-enforced invariant layer.



Validated Primitives & Performance Metrics

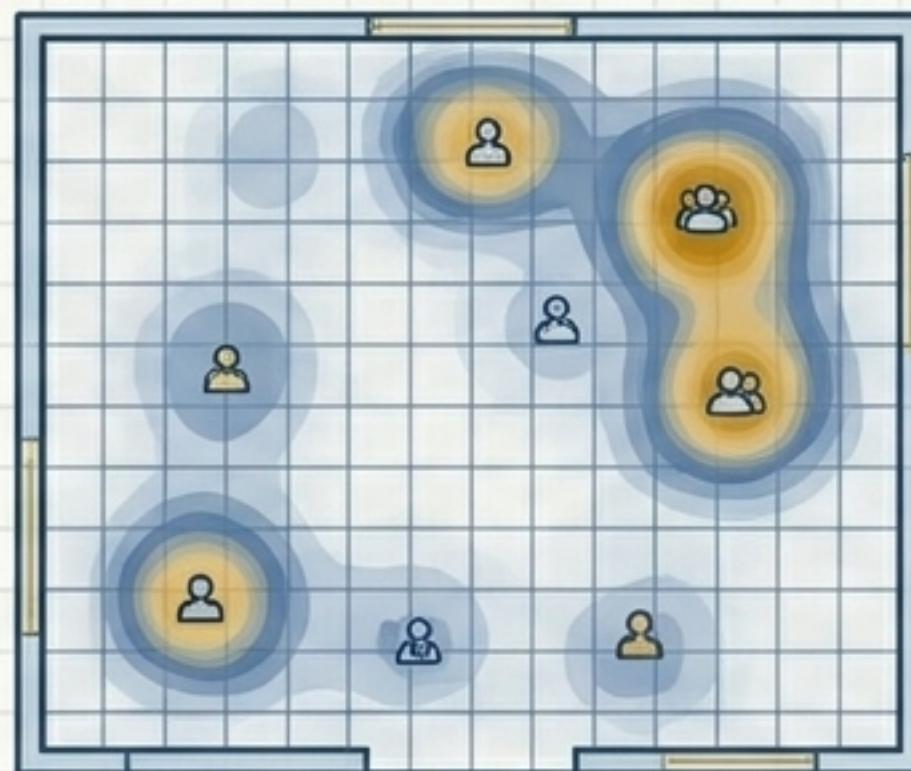


17-Keypoint Pose Estimation



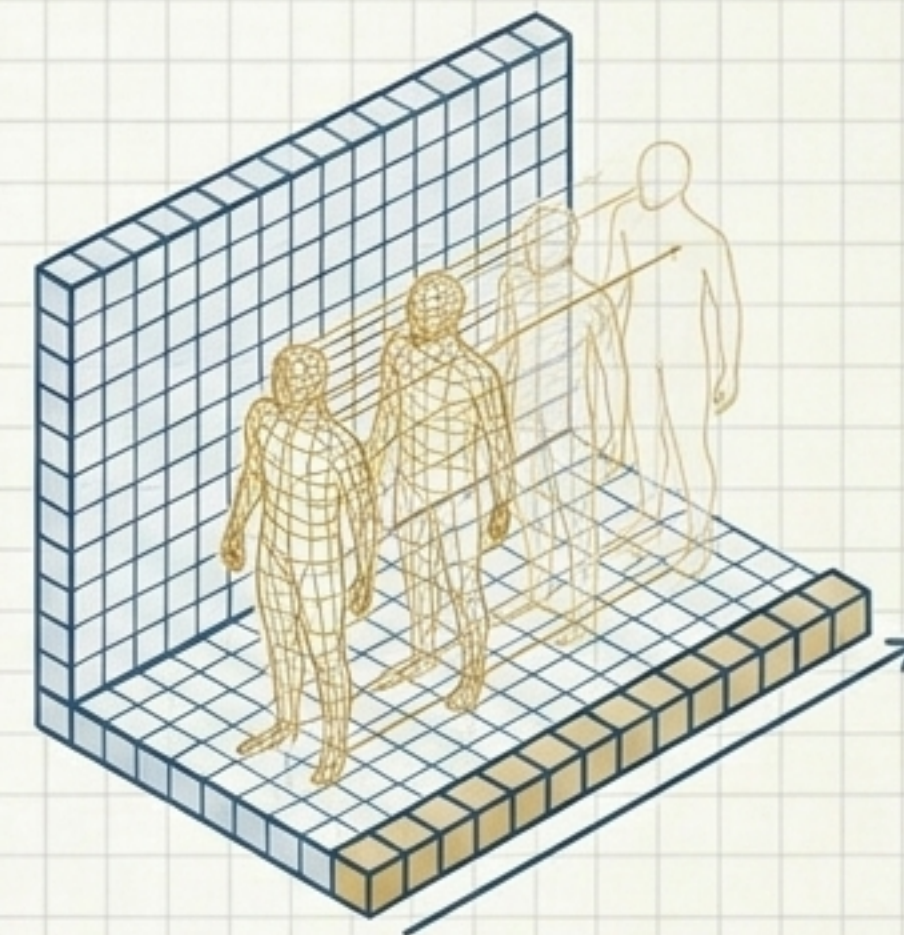
82.69% torso-PCK@20 on MM-Fi (SOTA, beating MultiFormer).

Presence & Occupancy



82.3% held-out temporal-triplet accuracy.

Environment Future Prediction



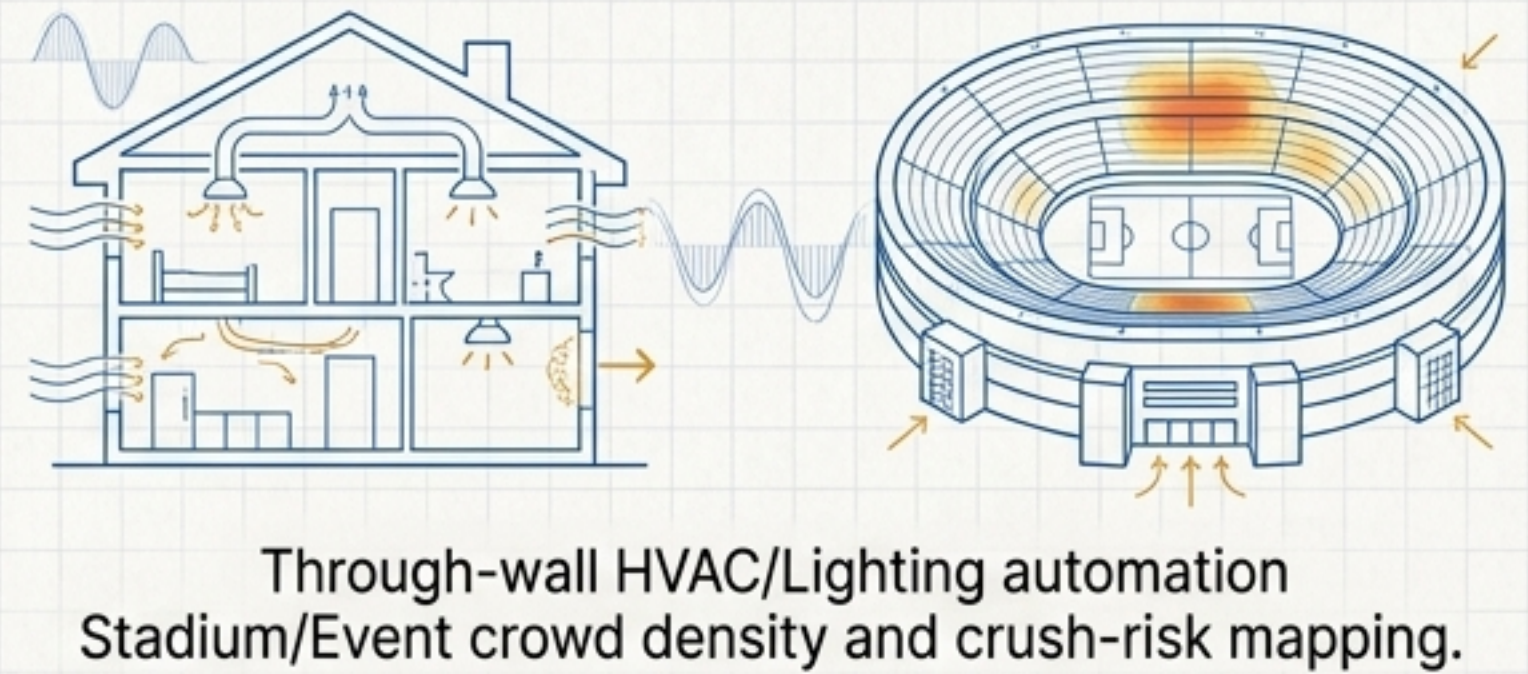
15-frame future occupancy prediction (209 ms inference via OccWorld TransVQVAE).

Applied Spatial Intelligence

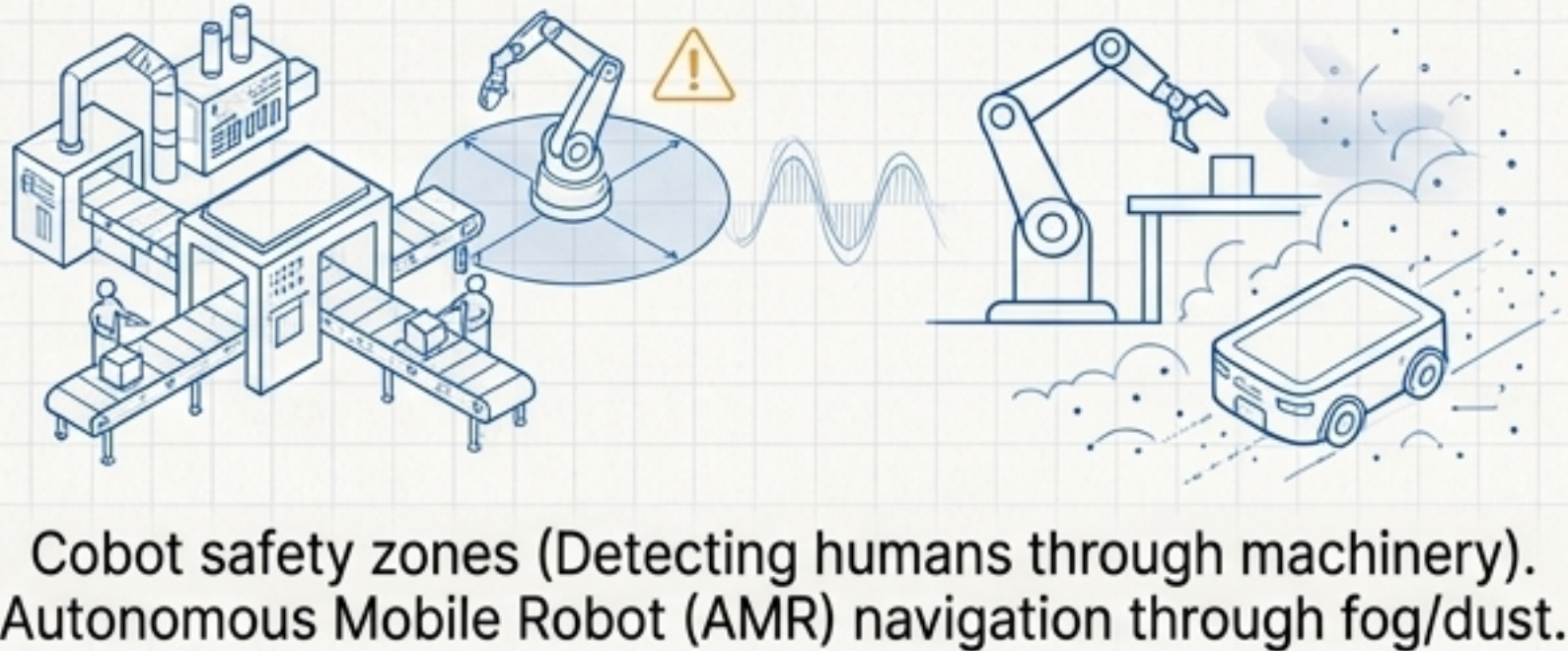
Everyday (Healthcare & Retail)



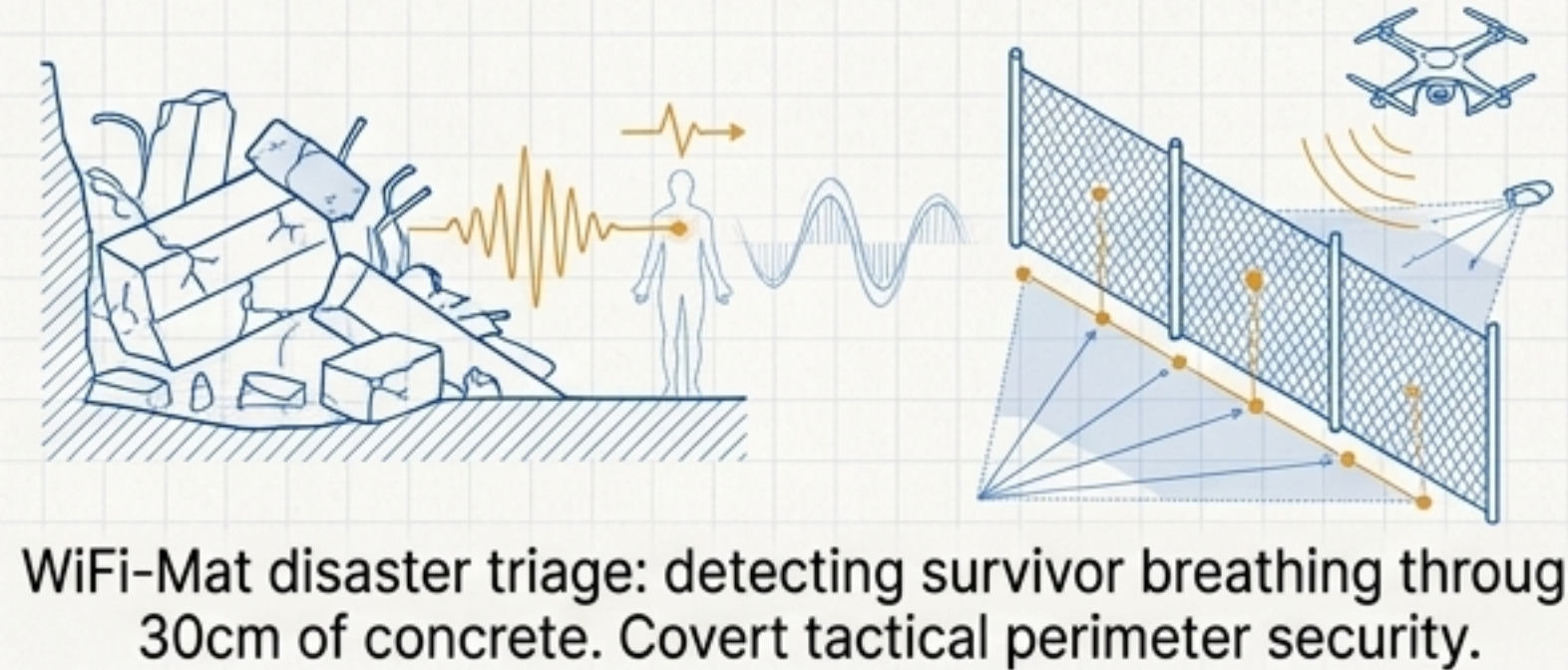
Specialized (Smart Home & Venues)



Robotics & Industrial

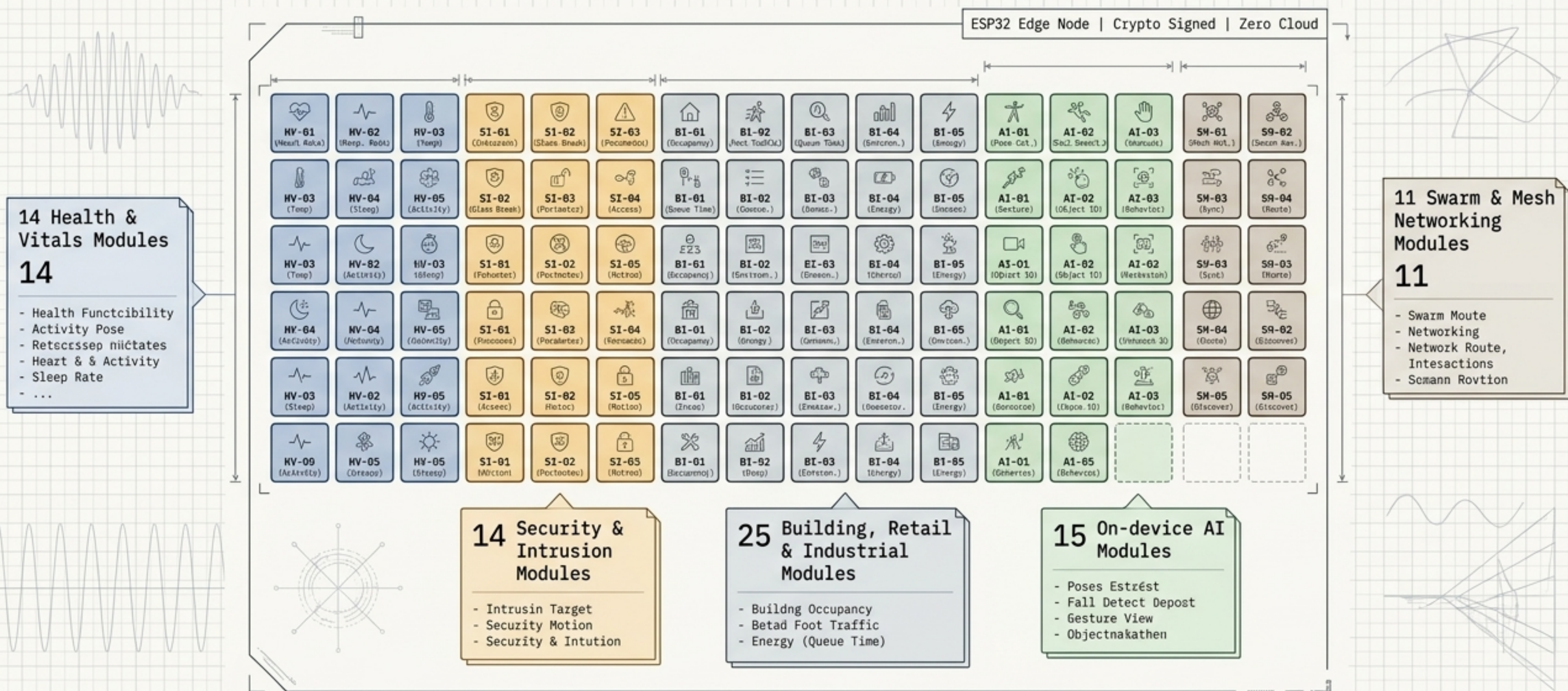


Extreme (Search, Rescue & Defense)



The Edge Ecosystem: 105 Pluggable Modules

Context: Small, cryptographically signed binaries running entirely on the ESP32 edge node. Zero cloud dependency.



Micro-Intelligence: Health & Security Edge

Health & Vitals



- **sleep-apnea** [4 KB]: Detects respiratory cessation during sleep.
- **cardiac-arrhythmia** [8 KB]: Spots irregular heartbeat rhythms.
- **fall-detect** [402 KB]: Two-stage impact + stillness detector via ambient feature stream.

Security & Perimeter

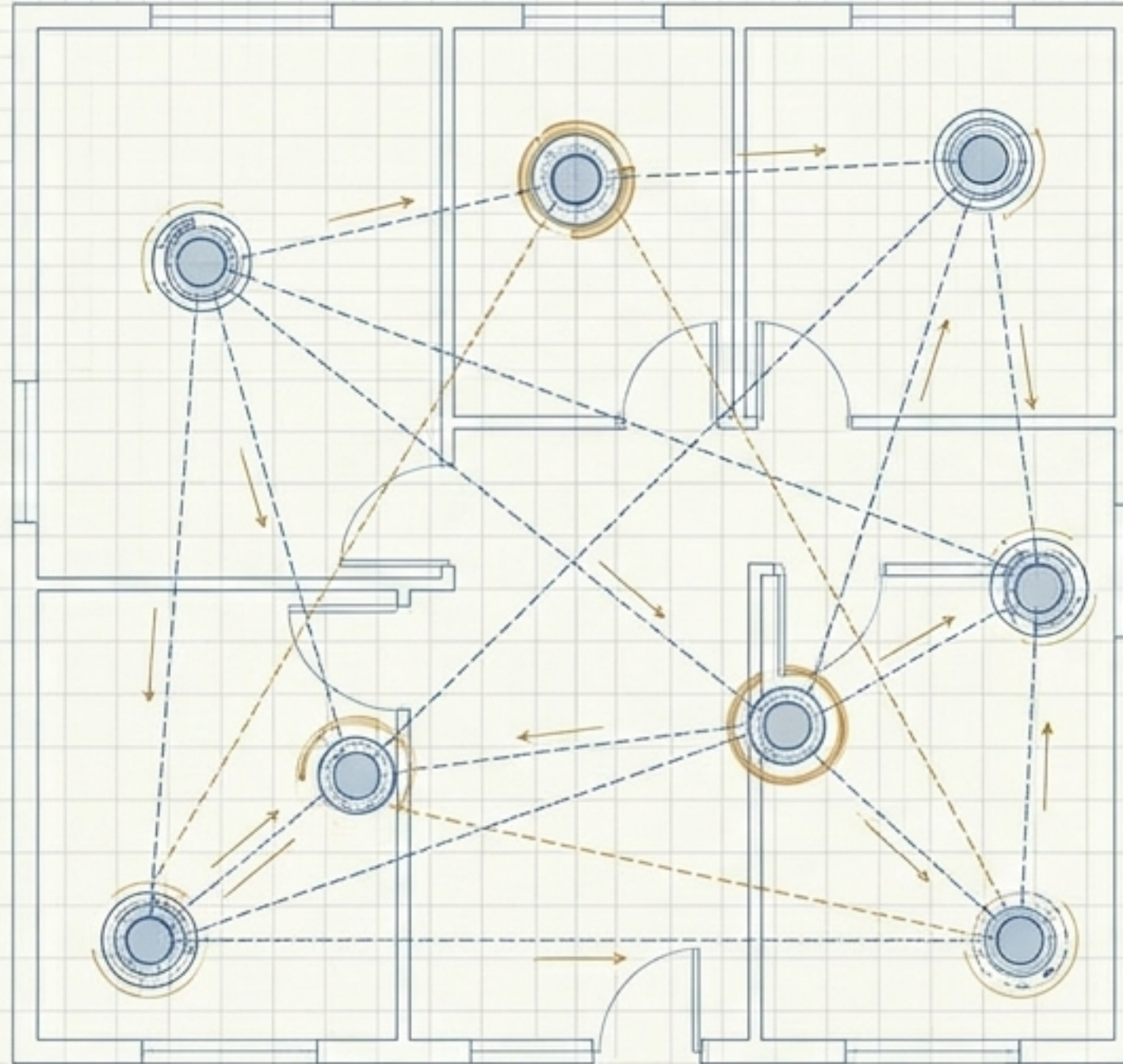


- **intrusion** [6 KB]: Unauthorized room entry alerts via spatial disruption.
- **prompt-shield** [10 KB]: Blocks signal replay and injection attacks on the seed.
- **glass-break** [451 KB]: Acoustic bang + shatter detector distinguishing breaks from ordinary noise.

Scaling Intelligence: AI & Swarm Arrays

On-Device AI

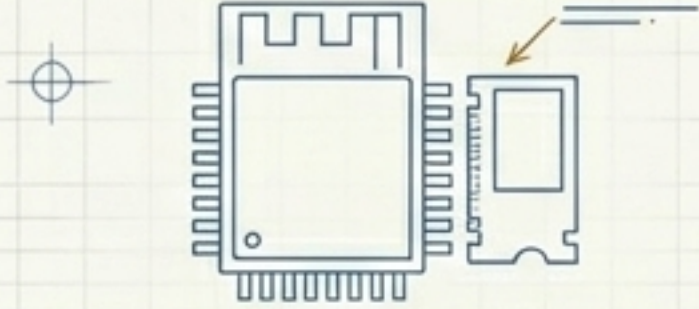
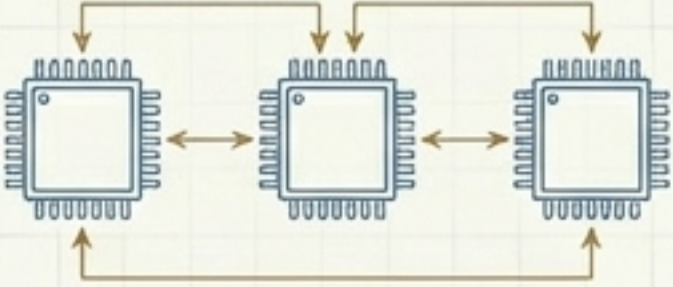
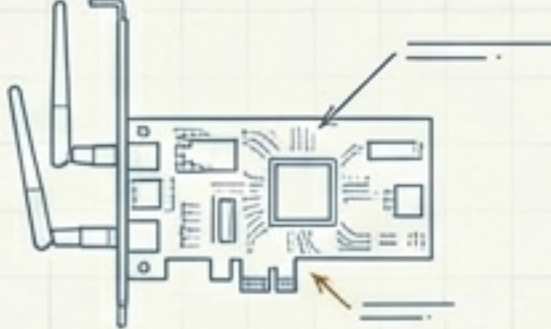
- **ewc-lifelong** [8 KB]: Model learns new routines without forgetting old baseline patterns.
- **anomaly-attractor** [10 KB]: Self-tunes to normal room states and flags deviations.
- **federated-learning** [18 KB]: Trains AI across multiple seeds without sharing raw spatial data.



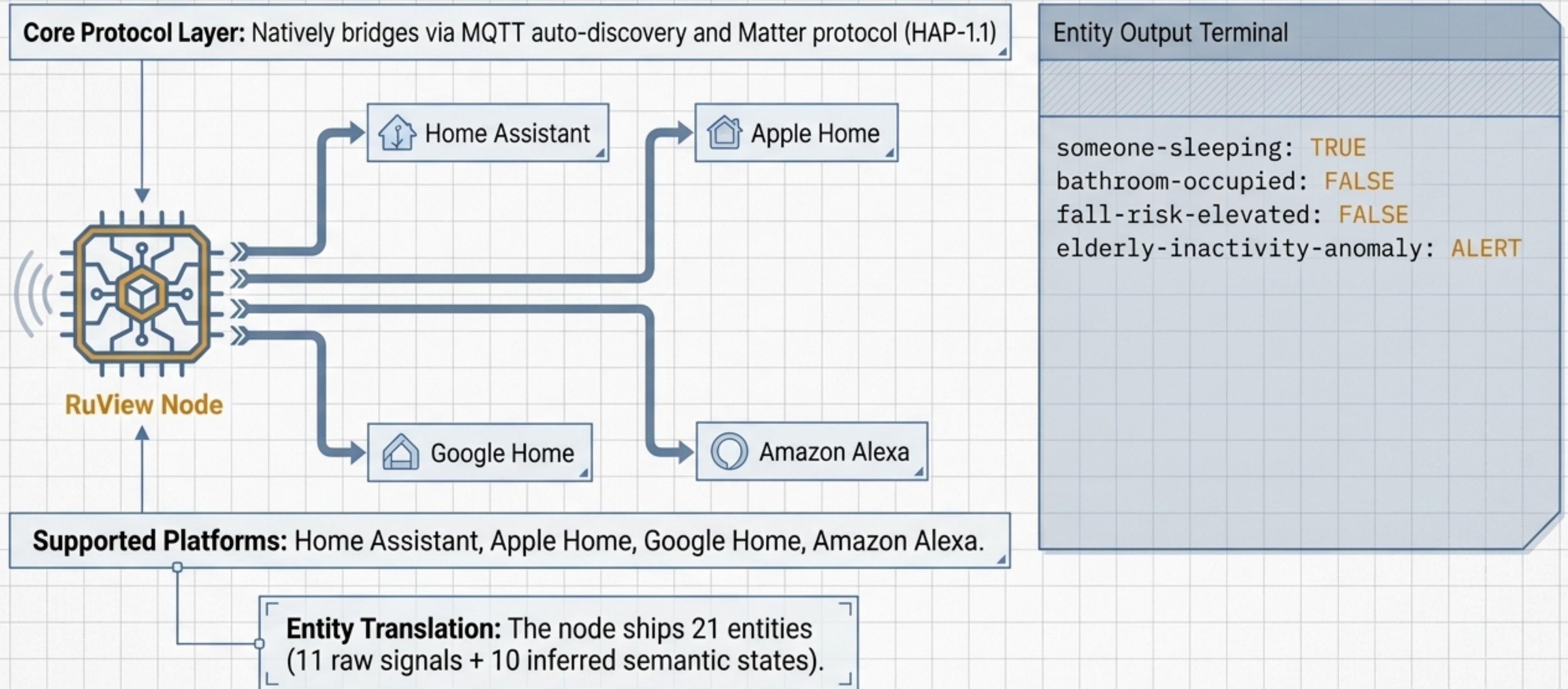
Swarm Mechanics

- **swarm-consensus** [16 KB]: Nodes vote before executing critical environmental state changes.
- **swarm-witness-federation** [12 KB]: Shares tamper-proof Ed25519 audit trails across the mesh.

Deployment Architecture

	Tier 1: "ESP32 + Cognitum Seed (Recommended)".	Cost: ~\$140. Capabilities: Full CSI pipeline, 105-cog catalog, persistent vector store, 17-keypoint pose, witness chain.
	Tier 2: "ESP32 Mesh".	Cost: ~\$54 (3-6x ESP32-S3 + Router). Capabilities: Full real-time vitals and presence via multi-frequency channel hopping.
	Tier 3: "computer network card, write 'Research NIC'".	Cost: \$50-\$100 (Intel 5300 / Atheros). Capabilities: Full CSI with 3x3 MIMO for high-fidelity spatial capture.
	Tier 4: "a laptop, write 'Consumer Laptop'".	Cost: \$0. Capabilities: RSSI-only mode. Coarse presence and motion detection.

Universal Ecosystem Integration



The Ambient Computing OS

Takeaway: RuView is not just a sensor. It is a self-calibrating, privacy-first spatial operating system built entirely on the physics of invisible waves.

Ubiquitous Hardware:

Powered by \$9 chips and existing routers. No new massive infrastructure.

Absolute Privacy:

Edge-local processing. No cameras. No cloud dependency.

Infinite Scale:

From a single bedroom sleep-apnea monitor to a 100-node warehouse safety grid.

