

The Cyber-Physical Architecture of Minjerribah's Sovereign Resilience



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Executive Summary

This technical research report presents a comprehensive architectural blueprint for the "Gumpi/Goompi-Node" Community Sovereign Kiosk Network. This initiative is designed to address the unique infrastructural vulnerabilities of Minjerribah (North Stradbroke Island) by deploying a distributed mesh of cyber-physical "Sovereign Nodes." These nodes are engineered to function as high-performance community hubs during periods of abundance, providing gaming, AI services, and tourism interfaces and to seamlessly transition into ultra-low-power, offline-first coordination engines during systemic disruptions.

The impetus for this project is twofold. First, the island's reliance on mainland tethers for power, data, and supply chains creates a fragility that is incompatible with the escalating risks of climate volatility and geopolitical instability. Second, the Queensland Government's \$41

million Dunwich (Gumpi/Goompi) Ferry Terminal Upgrade presents a time-sensitive window (2026-2027) to embed "future-proofing" intelligence into the island's primary gateway.

This document serves as the foundational "Master Plan" for the island's technical community, the builders, coders, and makers. It details the "Multi-Compute" hardware architecture that combines the well-known formats of a **"Telstra phone booth/arcade game cabinet/ATM"** to host and run a 4D digital twin of the island for everyday life, culture and tourism, and then switch to coordinate emergency activities via LoRa mesh in an emergency when the power and internet goes out.

Finally, it outlines the "Builder Roadmap," creating a structured pathway from desktop PC; into a timbre prototype in a community club; to a hardened, government-sanctioned infrastructure network that ensures Minjerrabah becomes a "Civilisation of Sand," resilient against any storm, be it environmental or economic.

1. Strategic Context: The Imperative for Sovereign Infrastructure

1.1 The Fragility of the "Mainland Tether"

Minjerrabah operates at the terminus of a long, brittle logistical tether. Every electron illuminating a lightbulb, every packet of data traversing the NBN, and every litre of fuel powering a vehicle is imported from the mainland, or back-fed into the network via local rooftop solar panels. While this dependency enables modern convenience during periods of stability, it constitutes a catastrophic point of failure during disruptions. The historical data is clear: whether due to cyclones, severe storms or bushfires that sever power lines, or broader grid instabilities, the island is periodically plunged into isolation. Today's disaster management paradigm is reactive, relying on centralised restoration, waiting for the grid to be repaired by skilled workers (mostly non-resident), and/or the ferries to resume.

The "Sovereign Kiosk" concept proposes an inversion of this paradigm. It posits that resilience cannot be achieved by merely hardening the tether; it requires the capability to sever the tether and continue operating. The Kiosk Network assumes isolation as a base operational case, not an anomaly. By decentralizing the island's critical digital functions; mapping, communications, legal knowledge, and resource coordination; into a distributed mesh of self-sustaining nodes, the system achieves antifragility. As individual nodes or links fail, the remaining mesh reconfigures, preserving the community's "collective intelligence" and operational capacity without reliance on a central command in Brisbane or Canberra.

1.2 The "Arcade" Aesthetic as Community Camouflage

A critical failure mode of traditional "emergency infrastructure" is social obsolescence.

Satellite phones stored in lockboxes or dusty emergency terminals are often found to be uncharged, broken, or unfamiliar to users when a crisis actually strikes. Resilience requires daily active use. To solve this human-factor challenge, the Gumpi/Goombi-Node adopts a "Solar-punk Arcade" aesthetic. Housed in custom cabinets reminiscent of 1980s arcade machines inside something like a Telstra phone booth, and also being cashless banking infrastructure like an ATM, these kiosks are designed to invite curiosity and daily interaction.

On a normal Tuesday, the kiosk is a practical community service point: a public information screen for local updates and events, a self-serve directory for services and visitor guidance, and a local computing node that can run tools like mapping, planning dashboards, and on-device artificial intelligence (AI) experiences when appropriate. That everyday use keeps the kiosk maintained, updated, and familiar, so it becomes a trusted, well-used piece of community infrastructure rather than a rarely touched emergency box.

When a disaster hits, it shifts into "offline/disaster mode" without changing the mental model: the same screens and workflows keep working, but with priority on essential functions like local notices, check-ins, help requests, maps, and coordination even when power and internet are unavailable. This dual-use approach is what makes the investment and maintenance worthwhile: it delivers value year-round and becomes a lifeline when conditions turn.

1.3 The Gateway: Alignment with the Dunwich Ferry Terminal Upgrade

The Department of Transport and Main Roads (TMR) is progressing a major upgrade of the Dunwich (Gumpi) ferry terminal, with planning underway and public consultation expected to ramp up in 2026. This is a rare chance to improve how the island functions at its main entry point, because the terminal sets the tone for visitor flow, safety, and day-to-day coordination.

The risk is that the upgrade stays focused on physical works only: more concrete, wider berths, better shelters, and nicer signage. Those improvements matter, but they do not fix the operational chaos that shows up on peak days. The main driver is demand surges combined with fragmented information and uncoordinated arrivals. People turn up at the wrong time, queue in the wrong place, miss updates, and the whole precinct gets jammed.

We propose integrating the Sovereign Kiosk Network as a practical digital layer that supports the new terminal precinct. It helps people understand what is happening in real time, where to go, and what to do when conditions change. It also keeps working during outages through local networking and offline tools. If the terminal hosts a primary node of the kiosk network, the island anchors coordination at its gateway while maintaining local resilience.

This positioning also supports a stronger funding story. The kiosks deliver everyday transport and visitor coordination value, plus disaster capability as a built-in requirement, which aligns with smart transport infrastructure and "Mobility as a Service" style outcomes. This alignment allows the community to pitch the kiosks not just as "disaster prep" (which can be hard to fund), but as "Smart Transport Infrastructure" and "Mobility as a Service" enhancers, which

are categories that unlock access to the \$1.8 billion SEQ City Deal funding pool.

2. Mobility as a Service: Solving the Terminal Chaos

This section details the specific argument to be presented to the Straddie community and TMR during the consultation phase. It reframes the Kiosk from a "tech toy" to an essential component of the terminal's operational viability.

2.1 The Problem: Peak-Demand Chaos

The user's analysis of the current terminal dynamics identifies a critical systems failure that physical expansion alone cannot fix. Every peak holiday period (Easter, Christmas, school holidays) follows a predictable pattern of entropy:

- **The Wave:** Visitors arrive in massive, compressed waves
- **The Blind Spot:** Visitors assume transport will "just work," arriving without firm forward travel plans.
- **The Bottleneck:** The island's bus system, which operates on fixed schedules and limited fleet capacity, cannot scale instantaneously to meet surprise demand.
- **The Result:** Parking pressure explodes as visitors abandon public transport for cars, roads get hammered, and the "arrival experience," a key TMR metric, degrades into frustration and congestion.

This is not a "bus driver problem" or a "parking space problem"; it is an **information asymmetry problem**. The transport operators cannot see the demand coming, and the visitors cannot see the transport constraints. The system is operating blind.

2.2 The Solution: The Kiosk Network as a Smart Access Layer

To solve this, we propose spending a fraction of the \$41 million budget on a "Smart Access Layer" anchored by the Kiosk Network. This aligns with TMR's mandate for "operational efficiency" and "innovation".

2.2.1. The "Straddie Info + Transport" Kiosk:

We position a rugged Sovereign Kiosk at the Dunwich arrival point, then subsequently at Cleveland, Point Lookout, Amity, Myora, Flinders, on each of the ferries and barges, and eventually at all major local hubs and locations. This is not a "fancy sci-fi thing" but a utilitarian, robust touchpoint.

- **Real-Time "Now":** It tells visitors exactly what is happening *today*, beach closures, fire warnings, event schedules, fishing restrictions etc. immediately managing expectations.
- **Wayfinding:** It shows "how to get where you're going" from the current location, integrating real-time bus tracking and shuttle availability.
- **Inclusivity:** Crucially, the kiosk serves the "digital have-nots." Not everyone has a

smartphone, a data plan, or the battery life to navigate complex apps upon arrival. The kiosk is the equalizer, ensuring equity of access to island services.

2.2.2. Capturing Visitor Intent (The Missing Lever):

The most transformative function of the kiosk is its ability to capture "Visitor Intent" in a privacy-preserving, non-creepy way. Currently, transport planning is reactive. The kiosk flips this to predictive.

- **The Mechanism:** Upon arrival (or while waiting at Cleveland), visitors interact with the kiosk or its local Wi-Fi splash page. They answer simple prompts: "Where are you headed?" (Point Lookout, Amity, Camping on Main Beach), "Return time?", "Mobility needs?"
- **The Data Dividend:** If the system knows that of the 400 arrivals, 35% are Point Lookout bound, 25% are going to Amity, and 15% are undecided day-trippers, the transport dispatchers can react *before* the bus queue overflows.
- **Dynamic Dispatch:** This data enables a "shuttle system" to handle the point-to-point peaks. Small electric vans can be dispatched to handle the "last mile" for specific clusters (e.g., diving groups to Amity), freeing up the heavy buses for the main arterial routes. This creates a "Mobility as a Service" ecosystem rather than a rigid bus route.

3. Virtual Simulation Testing: Before pouring concrete for the new terminal, the Kiosk's "Virtual Minjerrabah" engine allows planners to test these assumptions. We can run "What If" scenarios in the digital twin:

- *Scenario A:* "What happens to parking needs if we add 10 EV shuttles instead of a bus?"
- *Scenario B:* "What is the maximum serviceable population with current infrastructure?"
- *Scenario C:* "What happens to traffic & pedestrian flow during each Marquee Event?"
- *Scenario D:* "What happens to disaster recovery KPI's with a mesh Kiosk network?"

This "Simulation First" approach prevents costly infrastructure mistakes. By having Kiosks as the *platform* for this simulation, we make the hardware essential to the design process itself.

2.3 The "Future-Proofing" Argument

The "Business Case" developed by TMR must account for the changing nature of transport and climate so the terminal is designed for the next 20 years, not the last 20.

- **Climate Resilience:** The terminal kiosks act as "Master Nodes" for the island's disaster resilience mesh. It is the redundancy layer that ensures the terminal can function (ticketing, coordination, communication, accounting) even if the mainland grid fails.
- **Electrification:** The kiosk integrates with the future EV charging infrastructure, acting as the payment and management gateway for the electric shuttle fleet.
- **Data Sovereignty:** By owning the kiosk network, the community (via **Ready S.E.T. Co.** "The Straddie Employment and Training Co-operative" partnering with QYAC and the Chamber of Commerce) would own the visitor data. This prevents third-party platforms

from monopolizing the island's tourism intelligence.

3. Hardware Architecture: Multi-Compute Nodes

To achieve the "Super Multi-Functional" mandate, serving as both a high-end compute node and an apocalypse-proof communications beacon, each Master-Node utilizes a Multi-Compute Architecture. This involves physically separating the Mains Power and Survival (Low Power, Battery) modes within the same chassis, managed by a smart power-switching layer.

3.1 The "Abundance" Stack (Grid/Solar High)

When power is abundant (Grid ON or Battery > 60%), the kiosk activates its high-performance workstation core. By utilizing a full ATX or E-ATX form factor, the system removes the thermal and expansion limitations of smaller builds, allowing for maximum computational throughput.

- Primary Compute Unit (PCU): A high-performance workstation motherboard supporting multi-GPU configurations and massive memory pools.
- Specification: High-core-count x86 architecture (e.g., AMD Threadripper or Intel Core i9) on an E-ATX platform. This provides the PCIe 5.0 lanes necessary for multi-GPU setups and up to 256GB of DDR5 RAM.
- Function: This unit powers the Virtual Minjerribah digital twin (Unreal Engine 5), handles high-fidelity rendering, and runs localized Large Language Models (LLMs) for natural language interaction, processing millions of words of regional data and logs with minimal latency.
- AI Acceleration (The Brain): Integration of dedicated Nvidia RTX GPUs alongside a Hailo-8L NPU (13 TOPS).
- Why: While the GPUs handle heavy LLM inference, the Hailo NPU provides an energy-efficient "always-on" layer for computer vision (e.g., monitoring terminal traffic) and real-time translation between Jandai and international languages.
- Display & Interaction:
 - Main Screen: A ruggedized 24-32 inch 4K touch screen (1000+ nits) protected by 6mm polycarbonate.
 - VR Tether: High-bandwidth I/O ports for VR headsets, enabling immersive "dives" into the Virtual Minjerribah simulations.

3.2 The "Survival" Stack (Grid/Solar Low)

When the grid fails or the battery dips below 30%, the Abundance Stack performs a graceful

shutdown. Control is handed over to the Survival Stack—a microcontroller-based environment designed for extreme longevity.

- **Survival Compute Unit (SCU):** A microcontroller cluster (Raspberry Pi Pico W or ESP32-S3) focused purely on mission-critical communications. These chips consume milliwatts and are immune to the OS corruption common in complex PCs during power instability.
- **Display:** A dedicated E-Ink (Electronic Paper) Panel mounted alongside the main screen. Because E-ink requires zero power to maintain an image, it will indelibly display the last known emergency bulletin, safe zone maps, or SES updates even if the battery dies completely.
- **Communication Array (The Mesh):**
 - **LoRa Transceiver:** A Meshtastic-compatible module (RAKwireless WisBlock 4631) on the 915 MHz band, creating a long-range, low-bandwidth text mesh between Dunwich, Amity, and Point Lookout.
 - **Satellite Uplink:** A Starlink Mini integrated into the roof. The SCU "pulses" the dish (e.g., 5 minutes every hour) to burst-sync critical data to the global internet while conserving battery.
 - **Wi-Fi Beacon:** The ESP32 broadcasts a "Captive Portal" (SSID: Straddie_Emergency), allowing residents to download offline maps and upload status reports via their phones without needing an app.

3.3 Power Delivery and Conversion (The Circulatory System)

To maintain the "Multi-Compute" separation, the node utilizes two distinct power delivery paths. This ensures that a failure in the high-draw workstation components cannot take down the emergency survival systems.

- **Abundance Power Supply (AC/DC & DC/DC):** * Specification: A 1200W-1600W Industrial Grade 80+ Titanium PSU (e.g., Seasonic Prime or a fanless medical-grade unit).
 - **Role:** When Grid/Solar Abundance is active, this converts 240V AC or 24V DC (via high-wattage inverter) to the precise voltages required by the ATX/E-ATX motherboard and multiple GPUs.
 - **Protection:** All internal boards are conformal coated to prevent salt-air corrosion—a non-negotiable requirement for hardware longevity at Point Lookout.
- **Survival Power Path (DC-DC):**
 - **Specification:** A dedicated, wide-input (18V–36V) DC-DC Buck Converter (e.g., Vicor or Mean Well).
 - **Role:** This bypasses the main workstation PSU entirely. it pulls directly from the 24V LiFePO4 bank to provide a steady 5V/3.3V to the Survival Stack (SCU, LoRa, E-ink).
 - **Efficiency:** Designed for >95% efficiency to ensure that even a tiny solar trickle during a storm

can keep the mesh network alive.

- Solar Charge Controller:
- Specification: 60A MPPT (Maximum Power Point Tracking) Controller with Bluetooth or RS485 monitoring.
- Role: This is the primary gatekeeper, managing the 400W–600W solar input to safely charge the LiFePO4 bank. It provides the real-time telemetry used by the "Intelligent Shedding" logic to decide when to kill the PCU.

3.4 Power Management & Intelligent Shedding

Reliability is physics. The kiosk must be energy-positive and prioritize the survival of the network over the "wow factor" of the AI.

- Generation: 400W–600W of semi-flexible monocrystalline solar panels.
- Storage: LiFePO4 (Lithium Iron Phosphate) battery bank (24V 200Ah). LiFePO4 is chemically stable (unlike Li-ion) and offers 4000+ charge cycles.
- Shedding Logic:
- > 60% Charge: Full Abundance Mode. Power is routed to the high-end PSU; GPUs, VR, and Gaming are active.
- < 60% Charge: Economy Mode. Throttles PCU power limits and dims screen brightness to 400 nits.
- < 30% Charge: Survival Mode. The main PSU is physically disconnected via a high-current relay. Only the Survival DC-DC path remains active (E-ink, LoRa, Mesh).
- < 10% Charge: Hibernation. Deep sleep; system wakes only on a LoRa emergency interrupt.

3.5 Physical Hardening & Enclosure

- The "Phone Booth" Retrofit: Repurposed Telstra booths provide a watertight, iconic chassis.
- Thermal Engineering: Due to the heat of the Queensland climate and the high-performance ATX components, the enclosure utilizes a passive stack effect for ventilation. For bushfire resilience, active louvers seal the unit if smoke or extreme heat is detected.
- EMP Hardening: The Survival Stack is housed within a nested Faraday cage (copper mesh lining) to ensure communication remains viable even after a Carrington-class solar flare or major electromagnetic event.

3.6 Shared Compute and Different Node Types

To make the network reliable, the hardware is split into four levels. This keeps the community connected and ensures information is available where it is needed.

1. Master-Nodes

These serve as the primary powerhouses for heavy tasks like managing a digital twin. They are the most expensive and use workstation motherboards with plenty of room for memory and graphics cards to process data quickly. These units provide a gateway for complex local projects and regional management.

2. Minor-Nodes

These cheaper units act as bridges for neighborhoods. They are mid-range computers that manage local information and help the main hubs stay in sync. They offer a reliable way for people to access shared tools and data every day.

3. Edge-Nodes

These small devices are placed around the island to monitor the environment, such as fire risks or tide levels, and provide mobile phones the ability to sync and send or receive sms and data packets if phone networks are down or the user is out of range. They use very little power and connect to the mesh network to share simple updates or provide a Wi-Fi entry point for residents. They are fundamental for keeping the community aware of local conditions.

4. Mobile-Nodes

These are lightweight units used on drones or in portable kits. They help fill gaps in the network during an emergency or assist with stewardship of island resources through mapping. They are built to move and provide support wherever a connection is needed.

4. Software Architecture: The Sovereign Stack

The software governing the Gumpi-Node rejects the fragility of the Cloud in favor of a "**Local-First**" (Offline-First) architecture. The kiosk does not *fetch* data from the internet; it *is* the internet for its local vicinity.

4.1 The "Truth Engine" & CRDT Synchronization

The central challenge in a decentralized network is data consistency. If User A logs "Road Blocked" at Amity, and User B logs "Road Clear" at Dunwich, and the network is partitioned, how do we resolve the truth?

- **Conflict-Free Replicated Data Types (CRDTs):** We utilize CRDTs as the mathematical foundation of the database. CRDTs allow concurrent edits on multiple nodes without locking the database. When the nodes reconnect (via LoRa mesh or a "data mule")

vehicle), the CRDT algorithms merge the data deterministically. No central server is needed to arbitration.

- *Implementation:* Libraries like **Yjs** or **Automerger** handle the data structures.
- *Database:* **RxDB** or **PouchDB** running locally. These databases are designed to store data on the device first and sync in the background, ensuring the kiosk is always fast and functional regardless of connection status.

4.2 The Mesh Protocol (Meshtastic)

The nervous system of the survival stack is **Meshtastic**, an open-source project that turns LoRa radios into an encrypted, off-grid text network.

- **Topology:** The network forms a mesh. A message from Dunwich hops from Kiosk A -> House B -> Tower C -> Kiosk D in Amity. This multi-hop capability navigates the island's hilly terrain where line-of-sight is often blocked.
- **Encryption:** All emergency traffic is encrypted using AES-256. Channels can be segmented: a public "Town Square" for general chat, and a private "SES Ops" channel for first responders.
- **Store-and-Forward:** If a node is isolated, it stores messages. When a "Data Mule" (e.g., a bus or ranger truck equipped with a node) passes by, the kiosk bursts the stored messages to the vehicle, which carries them to the next connected zone.

4.3 Decentralized Identity (DID) & Governance

To prevent spoofing (e.g., a bad actor broadcasting a fake "Tsunami Warning"), the system relies on **Decentralized Identifiers (DIDs)** and **Verifiable Credentials (VCs)**.

- **Web of Trust:** The kiosk does not check a password against a Google server. It verifies the cryptographic signature of the user's DID.
- **Role-Based Authority:** A user holding a "QYAC Ranger" VC (Verifiable Credential) is automatically granted elevated privileges. Their posts are flagged as "Verified" and prioritized by the mesh bandwidth. This creates a "Web of Trust" that functions entirely offline.

5. Functional Verticals: A "Super Multi-Functional" Hub

The Gumpi-Node is designed to be the "Swiss Army Knife" of community infrastructure. It aggregates functions that are usually siloed into a single, accessible interface.

5.1 Mapping & Real-Time Data (The Digital Twin)

The kiosk is the portal to **Virtual Minjerribah**, the 4D digital twin of the island.

- **Normal Mode:** Tourists use the twin to explore the island virtually ("Fly over Blue Lake"), plan hikes, and view real-time bus locations overlaid on the 3D map.

- **Disaster Mode:** The twin becomes a survival tool. It runs simulations: "Show me the flood risk at high tide with a 2m storm surge." The kiosk's GPU (or pre-cached data on the Survival Stack) renders the inundation map, helping residents identify safe zones and evacuation routes.
- **Sensor Fusion:** The kiosk acts as a sensor node, ingesting data (temperature, wind speed, smoke levels, foot traffic counts) and feeding it into the local digital twin instance, improving the accuracy of the simulation for everyone.

5.2 Cultural Integration & Translations

Minjerrabah's culture is its soul. The kiosk uses its AI core to bridge the language gap.

- **Jandai Language AI:** Using the Hailo-8L NPU, the kiosk runs a local translation model trained on the Jandai language (in partnership with MMEICAC). Users can speak to the kiosk in English and hear the phrase in Jandai, or scan signage to see translations.
- **Oral Histories:** The "Songlines" archive allows users to listen to Elders' stories attached to specific geolocations on the map. This data is stored on-device and protected by Indigenous Data Sovereignty protocols—some stories may only be unlocked when the user is physically present at the relevant site.

5.3 Legal RAG & Governance (The "Overcompliance" Engine)

Navigating the regulatory landscape of a tri-jurisdictional island (Federal, State, Council) is complex.

- **Legal Assistant:** The kiosk hosts a quantized version of the **Legal RAG (Retrieval-Augmented Generation) AI**. A builder can ask, "What are the height restrictions for a shed in Point Lookout?" The AI retrieves the exact clause from the locally cached *Redland City Plan 2025*, providing a citation and summary without needing the internet.
- **Gamified Democracy:** The kiosk serves as a secure polling station. Using "Local Vote" scenarios, the community can deliberate on issues (e.g., "Should we have speed cameras for 4WDs on Main beach? Or should we build island-wide town to town transport and disaster preparedness tunnels on the island and turn the sand spoil into geopolymer blocks for artificial reefs that triple as aquatic life support, island erosion prevention and anchors for tidal and wave energy production?"). Residents cast votes signed with their DIDs. The results are tallied transparently on the blockchain/CRDT ledger, creating a verifiable record of community sentiment.

5.4 Tourism & Art (The Braided Economy)

- **Digital Art Gallery:** In idle mode, the 4K screen displays high-resolution works by local artists. Generative art, created by the AI using real-time weather and tide data as "seeds," creates a living, ever-changing ephemeral info-art unique to Straddie.
- **C-Hour Integration:** The C-hour is a proposed time banking non-speculative digital

token specifically for "Regenerative Volunteering" where 1-hour of community or environmental volunteering eg: toad and tadpoles removal = 1 C-Hour. The kiosk is the ATM of the "Braided Economy." Users can check their "Community Hour" (C-Hour) balance, finding volunteering opportunities (e.g: Building a Community Garden, mentoring youth, helping elderly to understand technology, would all earn C-Hours) or redeeming credits for local services, wellbeing programs and VIP event tickets. This keeps economic value circulating within the community and motivates more coordinated volunteering that benefits everyone and the environment..

6. The "Builder" Roadmap: From Shed to Shore

This is not a theoretical exercise. We are mobilizing the "tech-nerds," builders, and makers of Straddie to construct this reality. The roadmap moves from low-fidelity prototypes to infrastructure-grade deployment.

6.1 Phase 1: The "Wooden Prototype" (Months 1-3)

- **Objective:** Rapid validation of the software stack and user experience.
- **The Build:** An attractive but simple wooden arcade cabinet housing 2 standard PC monitors, a gaming PC for simulations, a small form factor PC for local AI, a Raspberry Pi 5 and meshtastic long range network connector.
- **The "Game":** We gamify the testing. The "game" on the arcade machine is a disaster simulation. Users navigate the map and create scenarios that test the logic.
- **Community Meetups:** We launch the "Project Arcade" weekly builder meetups.
 - *Week 1:* Hardware Hack – identify available donations or purchase items.
 - *Week 2:* Mesh Lab – flashing Meshtastic radios and range testing in the bush.
 - *Week 3:* Solar Punk – wiring solar panels, charge controllers and batteries.
 - *Week 4:* Code Jam – getting the offline database to sync with mobile phones.

6.2 Phase 2: The "Alpha" Unit (Months 4-6)

- **Objective:** A weather-proof, field-deployable unit.
- **The Build:** Transition to a metal enclosure (something like a weatherproof phone booth).
- **Deployment:** Placement at a friendly local host for real-world stress testing.
- **Content:** Loading the "Digital Welcome Pack" and bus timetables.

6.3 Phase 3: The "Beta" Network (Months 7-12)

- **Objective:** Multi-node mesh testing.
- **The Build:** Constructing 2-3 additional units.
- **Deployment:** Placing nodes at Amity Point, Myora, Flinders and Point Lookout to test the cross-island LoRa link.
- **The Drill:** A "Grid-Down Simulation." We cut the internet to the kiosks and attempt to

coordinate a local news update using only the mesh network.

6.4 Workforce Development (Ready S.E.T. Co. Integration)

This project is a job creation engine. Through "Ready S.E.T. Co." (A proposed Straddie Employment and Training Co-operative), we formalize the skills learned in the meetups into "Micro-Credentials".

- **Indigenous & Local Developer Pathway:** Training local youth in AI, Prompt Engineering, Game Design, Python, Linux, GIS mapping and more.
- **Hardware Technicians:** Certifying locals in solar maintenance and electronics repair. This ensures the network is maintained by the community, for the community.

7. Conclusion: The Digital Handshake

The Gumpi-Node project transforms the "post-mining vacuum" into a canvas for innovation. By building this network, we do not just create kiosks; we create a nervous system for the island that is resilient, sovereign, and deeply human.

The Dunwich Ferry Terminal upgrade gives us the timeline. The cyclones give us the urgency. The technology gives us the capability. The "Mobility as a Service" pitch gives us the funding argument. All that remains is for the community to pick up the tools.

We are not waiting for the NBN to save us. We are building our own safety net, and we are making it look like an arcade game because resilience should be joyful.

Call to Action:

1. **Join the "Straddie Mesh Builders" Signal Group.**
2. **Scavenge:** We need arcade parts, solar panels, and old cabinets.
3. **Meetup:** Saturday, 10 AM, Dunwich Hall. Topic: "Hacking the Phone Booth."

Let the game begin.

Technical Appendix: Component Specifications

Hardware Bill of Materials (BoM) - "Alpha" Prototype

Component	Specification	Purpose
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Primary Compute	LattePanda Mu or NVIDIA Jetson Orin or RTX series GPU 40/50 series	High-perf AI/Gaming/Digital Twin
AI Accelerator	Raspberry Pi AI Kit (Hailo-8L)	Edge AI inference (Vision, Legal RAG)
Survival Compute	Raspberry Pi Pico W / ESP32-S3	Ultra-low power comms & display controller
LoRa Radio	Meshtastic Module (RAK4631 or T-Beam)	915MHz Mesh Networking
Display (Main)	24" - 32" High-Brightness Capacitive Touch	Main UI (1000 nits+)
Display (Survival)	7" - 10" E-Ink / E-Paper	Low-power emergency bulletins
Solar Panel	400W Flexible Monocrystalline	Power generation (Curved roof fit)
Battery	24V 200Ah LiFePO4	Energy storage (Safe, long-life)
Enclosure	Retrofitted Telstra Booth / Custom Steel	Weather/Vandal protection

Software Stack

Layer	Technology	Function
OS	Alpine Linux / Ubuntu Core	Container host OS
Database	RxDB / PouchDB	Local-first, sync-capable DB
Sync Protocol	Yjs / Automerge (CRDTs)	Conflict-free data merging
Mesh Protocol	Meshtastic	LoRa routing & messaging

Digital Twin	Unreal Engine 5 (Linux build)	3D Simulation & Visualization
Identity	W3C DIDs & Verifiable Credentials	Decentralized Auth & Trust

Dunwich Ferry Terminal Upgrade - Project Snapshot

Parameter	Detail
Budget	\$41 Million
Completion	2027 (Planning underway now)
Key Partners	TMR, Redland City Council, QYAC
Focus Areas	Sense of arrival, culture, connectivity
Opportunity	Integrate Kiosk as "Digital Gateway" in scope

Works cited

1. GPT Straddie Disaster Kiosks.pdf
2. Dunwich (Gumpi) Ferry Terminal Upgrade | Department of Transport and Main Roads, accessed January 26, 2026, <https://www.tmr.qld.gov.au/projects/dunwich-gumpi-ferry-terminal-upgrade>
3. A faster more connected SEQ region | State Development, Infrastructure and Planning, accessed January 26, 2026, <https://www.statedevelopment.qld.gov.au/infrastructure/projects-and-programs/south-east-queensland-seq-city-deal/a-faster-more-connected-seq-region>
4. Council welcomes SEQ City Deal commitment to Dunwich ferry terminal upgrade, accessed January 26, 2026, <https://www.redlandsc coasttoday.com.au/2023/07/council-welcomes-seq-city-deal-commitment-to-dunwich-ferry-terminal-upgrade/>
5. Projects, plans and opportunities | Redland City Council, accessed January 26, 2026, <https://www.redland.qld.gov.au/Business-and-investment/Projects-plans-and-opportunities>
6. Digital Kiosks | Unlock Inclusive Self-Service Experiences - Level Access, accessed January 26, 2026, <https://www.levelaccess.com/blog/unlocking-kiosk-accessibility-tips-for-inclusive-compliant-self-service-experiences/>

7. Minjerribah (North Stradbroke Island) Public Transport Strategy 2024, accessed January 26, 2026,
https://www.tmr.qld.gov.au/_/media/aboutus/corpinfo/publications/minjerribah-north-stradbroke-island-public-transport-strategy/minjerribah-north-stradbroke-island-public-transport-strategy-2024.pdf?rev=d26757662122437780051aa66a54d1fc&sc_lang=en&extension=pdf&size=4215908&hash=A76ABC6DF08F652CDA52820AEBDDDF0F6
8. accessed January 1, 1970, uploaded:ChatGPT Image Jan 26, 2026, 11_57_43 AM.jpg
9. Buy a Raspberry Pi AI Kit, accessed January 26, 2026,
<https://www.raspberrypi.com/products/ai-kit/>
10. Raspberry Pi AI Kit, accessed January 26, 2026,
<https://datasheets.raspberrypi.com/ai-kit/raspberry-pi-ai-kit-product-brief.pdf>
11. AI HATs - Raspberry Pi Documentation, accessed January 26, 2026,
<https://www.raspberrypi.com/documentation/accessories/ai-hat-plus.html>
12. Large Touchscreen / Kiosk Hardware - User Experience Stack Exchange, accessed January 26, 2026,
<https://ux.stackexchange.com/questions/82912/large-touchscreen-kiosk-hardware>
13. Dreamcade Vision 40 | 4-Player Arcade Cabinet, accessed January 26, 2026,
<https://www.dreamarcades.com/vision40.php>
14. Build a LoRa Communication System with Raspberry Pi Pico W: Long Range IoT Made Easy - YouTube, accessed January 26, 2026,
https://www.youtube.com/watch?v=XV_J2V2Bvx4
15. DIY LoRa & Wi-Fi Module for Raspberry Pi Pico - Instructables, accessed January 26, 2026,
<https://www.instructables.com/DIY-LoRa-Wi-Fi-Module-for-Raspberry-Pi-Pico/>
16. Meshtastic Hardware- RAK & LILYGO - Rokland, accessed January 26, 2026,
<https://store.rokland.com/pages/meshtastic-hardware-rak-lilygo>
17. Devices | Supported Hardware Overview - Meshtastic, accessed January 26, 2026, <https://meshtastic.org/docs/hardware/devices/>
18. Middleware for distributed applications in a LoRa mesh network - UPCommons, accessed January 26, 2026,
<https://upcommons.upc.edu/bitstreams/7b8bab4d-7c74-48ad-9033-6a5661275ee0/download>
19. Local First / Offline First | RxDB - JavaScript Database, accessed January 26, 2026,
<https://rxdb.info/offline-first.html>
20. STOP Relying on Public Networks | Build Your Own Off Grid Communication System, accessed January 26, 2026,
https://www.youtube.com/watch?v=EobQEHOP_Ro
21. Let's talk emergencies - What equipment would you use? : r/meshtastic - Reddit, accessed January 26, 2026,
https://www.reddit.com/r/meshtastic/comments/1fy95kj/lets_talk_emergencies_what_equipment_would_you_use/
22. LoRaX: Repurposing LoRa as a Low Data Rate Messaging System to Extend

- Internet Boundaries - Elizabeth Belding, accessed January 26, 2026,
https://ebelding.cs.ucsb.edu/sites/default/files/publications/lorax_for_compass_2022.pdf
23. A Resilient LoRa-Based Solution to Support Pervasive Sensing - MDPI, accessed January 26, 2026, <https://www.mdpi.com/2079-9292/12/13/2952>
 24. Open Kiosk - Hackster.io, accessed January 26, 2026,
https://www.hackster.io/Mukesh_Sankhla/open-kiosk-a0ccc9
 25. Kiosk mode for edge computing with Kairos and Kubernetes - Spectro Cloud, accessed January 26, 2026,
<https://www.spectrocloud.com/blog/kiosk-mode-for-edge-computing-with-kairos-and-kubernetes>
 26. Local-first software: You own your data, in spite of the cloud - Ink & Switch, accessed January 26, 2026, <https://www.inkandswitch.com/essay/local-first/>
 27. Question on Notice No. 644 Asked on 22 May 2024 DR M ROBINSON ASKED MINISTER FOR TRANSPORT AND MAIN ROADS AND MINISTER FOR DIGIT - Queensland Parliament, accessed January 26, 2026,
<https://documents.parliament.qld.gov.au/tableoffice/questionsanswers/2024/644-2024.pdf>