



## What your site needs in place for MeshTrack to run

The tracking mesh itself is wireless and battery-powered. What the mine provides is the backbone behind it: a wired path from the gateways to the network, a stable internet connection, and – for an on-site deployment – a server that stays up around the clock. This document sets out those requirements so that IT, electrical and operations teams can prepare the site before commissioning.

### INTERNET

#### Stable, redundant connectivity

Cloud hosted: every position report crosses the link, so it needs a second path with automatic failover. On-site: the link carries Sethala's monitoring and alert delivery.

### GATEWAYS

#### Enterprise Ethernet or fibre

Wired PoE connections to every gateway are preferred. Where cabling is impractical, enterprise-grade managed Wi-Fi coverage at the gateway is acceptable.

### ANCHORS

#### Battery operated, placed anywhere

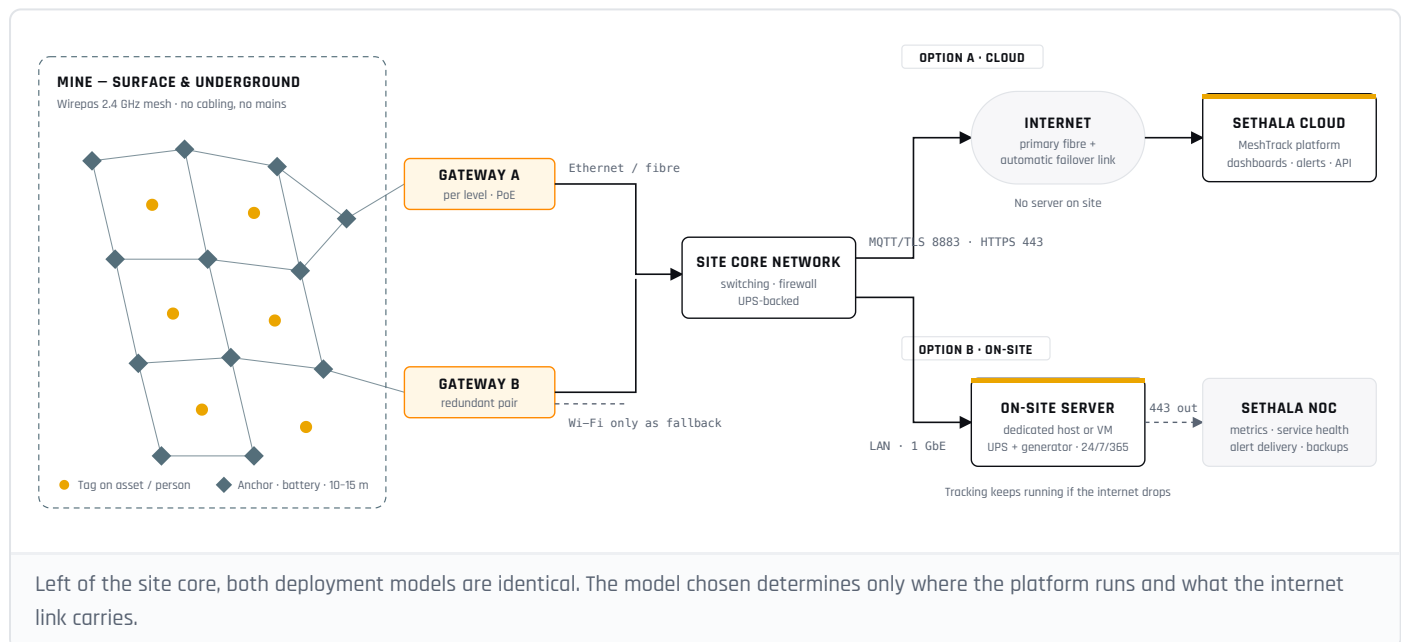
No power or data cabling. Anchors are installed wherever monitoring is needed – haulages, workshops, stores, refuge bays, pit perimeters.

### ON-SITE SERVER

#### Dedicated, powered 24/7/365

A server or VM to the specified resources, on backup power and on the network. Sethala monitors it remotely in real time under the SLA.

## TOPOLOGY – FROM A TAG ON A MACHINE TO A SCREEN IN THE CONTROL ROOM



## REQUIREMENTS, LAYER BY LAYER

Each layer lists what must exist and who provides it. Where the two deployment models differ, items are marked **CLOUD** or **ON-SITE** ; unmarked items apply to both.

| LAYER                                        | REQUIREMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PROVIDED BY                                                                                                                  |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Tags &amp; anchors</b><br>FIELD LAYER     | <ul style="list-style-type: none"> <li><b>Anchors are battery operated</b> – no power cabling, no network drop. Place them wherever monitoring is needed: haulages, workshops, stores, lamp rooms, refuge bays, pit perimeters.</li> <li>Spacing of <b>10-15 m</b> for sub-5 m positioning; 25 m is the absolute limit for mesh connectivity only. A tracked tag must sit inside a polygon of more than three anchors.</li> <li>Every level, shaft station and separate structure needs its own grid – coverage does not pass through rock or slab. Anchors at every exit and access-control point provide the unauthorised-removal alert.</li> <li>IP67 industrial housings; intrinsically safe (ATEX / IECEx) variants are specified separately where the hazardous-area classification requires them.</li> </ul> | <b>SETHALA / PARTNER</b><br>Hardware, RF survey and placement plan.<br>Customer provides site access and drawings.           |
| <b>Gateways</b><br>MESH TO NETWORK           | <ul style="list-style-type: none"> <li><b>Enterprise Ethernet or fibre to each gateway is the preferred connection</b> – PoE (802.3af/at) from a managed switch, or a fibre media converter with local 12-24 V DC.</li> <li>Where cabling is not practical, <b>enterprise-grade Wi-Fi</b> (WPA2/3-Enterprise, managed controller, verified signal at the mounting point) is acceptable. Consumer or ad-hoc Wi-Fi is not.</li> <li>Minimum one gateway per level or building; Sethala specifies <b>two per level for redundancy</b>. One gateway serves up to 30,000 m<sup>2</sup>, checked against tag count and reporting cadence.</li> <li>DHCP or static IP on a VLAN that can reach the platform. No inbound connections to a gateway are required.</li> </ul>                                                  | <b>CUSTOMER</b><br>Cabling, switch ports, PoE budget, Wi-Fi coverage. Sethala / partner mounts and commissions.              |
| <b>Site network</b><br>CORE, VLAN & FIREWALL | <ul style="list-style-type: none"> <li>A dedicated VLAN for MeshTrack gateways (and the on-site server), routed through the site firewall.</li> <li><b>CLOUD</b> Outbound from the gateway VLAN to the Sethala cloud on <b>TCP 8883</b> (MQTT/TLS) and <b>TCP 443</b>. Nothing inbound from the internet.</li> <li><b>ON-SITE</b> Gateways reach the server on <b>TCP 8883</b>; operator workstations on <b>TCP 443</b>. The server reaches Sethala outbound on <b>TCP 443</b> only. Nothing inbound from the internet.</li> <li>NTP and DNS available to gateways and server (<b>*.sethala.com</b>, <b>*.meshtrack.co.za</b>).</li> <li>Underground: the gateway VLAN rides the mine's fibre backbone or leaky-feeder data overlay to the shaft-station switches.</li> </ul>                                       | <b>CUSTOMER</b><br>Network design, VLANs, firewall rules. Sethala supplies the port and destination list for change control. |

| LAYER                                            | REQUIREMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PROVIDED BY                                                                                                                                                                                                   |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internet</b><br>SITE TO SETHALA               | <ul style="list-style-type: none"> <li> <b>CLOUD</b> <b>All position data is sent to the cloud.</b> The link is part of the tracking path: if it drops, the control room goes blind until it returns. Business-grade service with redundancy is required.         </li> <li> <b>CLOUD</b> <b>Two independent links</b> – primary fibre plus a second path on different infrastructure (second provider, licensed microwave or LTE/5G) with automatic failover at the firewall.         </li> <li> <b>ON-SITE</b> <b>Tracking does not depend on the internet</b> – it runs on the site LAN. The link lets Sethala monitor the server and services, deliver alerts by SMS / email / push, push updates and take off-site backups.         </li> <li> <b>ON-SITE</b> Stable business-grade link with a backup path (LTE/5G is adequate) so monitoring and alert delivery survive a primary outage.         </li> </ul> | <b>CUSTOMER</b><br>ISP contracts and failover. Sethala verifies reachability and latency at commissioning.                                                                                                    |
| <b>Compute</b><br>WHERE THE PLATFORM RUNS        | <ul style="list-style-type: none"> <li> <b>CLOUD</b> Hosted and operated by Sethala. No server, storage or backup equipment on site. Operators use a modern browser; no client installation.         </li> <li> <b>ON-SITE</b> <b>A dedicated physical server or a VM with reserved resources</b> (VMware, Proxmox or Hyper-V), sized per project – see page 4.         </li> <li> <b>ON-SITE</b> 1 GbE to the site core (two NICs preferred), fixed IP and DNS name so the web interface is served over HTTPS with a valid certificate.         </li> <li> <b>ON-SITE</b> <b>Online 24/7/365.</b> Maintenance windows are agreed in advance; unplanned downtime is a tracking outage for the whole site.         </li> </ul>                                                                                                                                                                                        | <b>CLOUD: SETHALA</b><br>Platform, operations, backups, upgrades.<br><br><b>ON-SITE: CUSTOMER</b><br>Hardware or VM, power, physical security. Sethala installs, hardens, operates and monitors the software. |
| <b>Power</b><br>KEEPING THE BACKBONE UP          | <ul style="list-style-type: none"> <li>Tags and anchors: battery – nothing to provide.</li> <li>Gateways: PoE from switches that are on UPS. A switch that loses power takes every gateway behind it, and that section, off the map.</li> <li>Site core (switching, firewall, internet CPE): UPS with generator or mine emergency-power changeover.</li> <li> <b>ON-SITE</b> Server: dual power supplies on a UPS sized for at least 30 minutes, generator-backed, with clean-shutdown signalling.         </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                               | <b>CUSTOMER</b><br>UPS, generator changeover, electrical installation to mine standards.                                                                                                                      |
| <b>Monitoring &amp; SLA</b><br>REMOTE OPERATIONS | <ul style="list-style-type: none"> <li> <b>CLOUD</b> Sethala monitors the platform continuously; gateway heartbeat exposes a site-side outage immediately in the control room and at Sethala.         </li> <li> <b>ON-SITE</b> <b>Sethala monitors the server, its resources and service metrics in real time, remotely, as part of the SLA</b> – CPU, memory, disk, container health, message throughput and gateway heartbeat.         </li> <li> <b>ON-SITE</b> Remote access is an outbound-only encrypted tunnel from the server to Sethala; no inbound firewall rule and no VPN account on the customer side. Nightly encrypted backups are pushed off site.         </li> <li>Alerts to people go out by email, SMS, push notification, Telegram or webhook into the mine's own systems.</li> </ul>                                                                                                          | <b>SETHALA</b><br>3rd-line support and platform operations under the SLA. Partner or customer carries on-site 1st and 2nd line.                                                                               |



## INTERNET LINK – STABLE AND REDUNDANT MATTERS MORE THAN FAST

Mesh telemetry is small. What the platform needs from the internet link is consistency: low loss, steady latency, and a second path that takes over on its own.

### Option A – Cloud hosted LINK CARRIES TRACKING

Every position report, sensor reading and alert crosses this link.

|                          |                                                                                                                  |
|--------------------------|------------------------------------------------------------------------------------------------------------------|
| Service class            | Business fibre with SLA, dedicated to the site (not shared with guest or contractor Wi-Fi)                       |
| Bandwidth                | 20 / 20 Mbps minimum symmetrical; more where dashboards are viewed off site                                      |
| Latency to Sethala cloud | < 150 ms round trip, steady                                                                                      |
| Packet loss              | < 1 % sustained                                                                                                  |
| Redundancy               | <b>Required.</b> Second link on independent infrastructure, automatic failover at the firewall, tested quarterly |
| If the link drops        | Gateways cannot deliver reports; live map and alerts pause until the link returns                                |

### Option B – On-site server LINK CARRIES MONITORING

Tracking stays on the LAN; the link is for Sethala's oversight and outbound alerts.

|                          |                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------|
| Service class            | Business-grade fibre or fixed wireless                                                                                 |
| Bandwidth                | 10 / 10 Mbps minimum; nightly off-site backup completes within the window                                              |
| Latency to Sethala cloud | < 250 ms round trip                                                                                                    |
| Packet loss              | < 2 % sustained                                                                                                        |
| Redundancy               | <b>Strongly recommended.</b> LTE/5G failover is adequate – it protects alert delivery and Sethala's ability to respond |
| If the link drops        | Tracking and in-app alerts continue; SMS/email alerts, remote monitoring and backups resume when it returns            |

#### WORKED EXAMPLE

**1,000** tags

reporting every 10 s across  
4 gateways

#### MESSAGES

**100** per second

position + sensor reports,  
all gateways

#### WIRE THROUGHPUT

**≈ 0.2** Mbps

~200 bytes per report incl.  
MQTT + TLS

#### PER MONTH

**≈ 60** GB

uncapped, or ≥ 100 GB  
plan on the backup link



## ON-SITE SERVER – A MACHINE THAT IS NEVER SWITCHED OFF

### Baseline specification

Option B only · up to ~1,000 tags, 12 months of history · final sizing per the Deployment & Handover Record

|                  |                                                                                               |
|------------------|-----------------------------------------------------------------------------------------------|
| Form             | Dedicated 1U/2U rack server, or a VM with resources <b>reserved</b> (not shared or ballooned) |
| CPU              | <b>8 vCPU</b> x86-64, 2.5 GHz or faster                                                       |
| Memory           | <b>32 GB</b> RAM                                                                              |
| Storage          | <b>500 GB</b> NVMe / SSD on redundant storage (RAID 1/10 or resilient datastore)              |
| Network          | 2 × 1 GbE, fixed IP, DNS name for the web interface                                           |
| Operating system | Ubuntu Server 24.04 LTS – installed and hardened by Sethala                                   |
| Larger sites     | Multi-shift or > 2,500 tags: <b>16 vCPU · 64 GB · 1 TB</b> , quoted per project               |
| Location         | Server room or IT cabinet: dust-controlled, cooled, physically secured                        |

### Firewall rules the server needs

No inbound rules from the internet – Sethala works over the server's own outbound connection.

|           |                                                                                                                |
|-----------|----------------------------------------------------------------------------------------------------------------|
| LAN → srv | <b>TCP 443</b> – operator browsers, web app and API                                                            |
| GW → srv  | <b>TCP 8883</b> – gateways, MQTT over TLS (1883 only inside the gateway VLAN)                                  |
| srv → WAN | <b>TCP 443</b> – Sethala identity service (user sign-in), monitoring, alert delivery, updates, off-site backup |
| srv → WAN | <b>UDP 123</b> NTP · <b>UDP/TCP 53</b> DNS                                                                     |
| srv → WAN | Outbound-only encrypted management tunnel to Sethala (WireGuard-based, <b>UDP 51820</b> , falls back to 443)   |
| WAN → srv | <b>None.</b> No port forwarding, no public IP, no customer VPN accounts required                               |

**Sign-in needs the internet even on site.** User authentication is issued by Sethala's identity service so that accounts, roles and access revocation are handled centrally. Sessions already signed in keep working through a short outage.

## OPERATIONS – WHAT SETHALA WATCHES, AND WHAT THE MINE KEEPS RUNNING

### Sethala, under the SLA

24/7/365 remote monitoring · no inbound ports required

- Real-time platform metrics: gateway heartbeat, message throughput, positioning health, alert-engine state
- **ON-SITE** Real-time server metrics: CPU, memory, disk, container health, certificate expiry – thresholds page Sethala before a user notices
- **ON-SITE** Nightly encrypted off-site backup and a tested restore path to replacement hardware
- Security patches and platform upgrades in agreed windows
- 3rd-line support and escalation; the partner or the mine's IT carries 1st and 2nd line on site

### The mine

- Keep the gateway VLAN, switches and internet link on protected power and within the agreed availability
- **ON-SITE** Keep the server powered, cooled and physically secure; give Sethala notice of planned power or network work
- Notify Sethala of network changes (IP ranges, firewall policy, ISP changes) through change control before they happen
- Provide site access and an escort for gateway or anchor work
- Nominate a site contact for alert escalation and a technical contact for network queries



## GATEWAY CONNECTIVITY

### Preferred – wired

|           |                                                                                                                                                  |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Medium    | Cat6/6A Ethernet $\leq$ 90 m from a managed access switch, or single-mode fibre with a media converter for longer runs and underground backbones |
| Power     | PoE 802.3af/at from the switch (budget $\geq$ 15 W per gateway), or local 12–24 V DC where fibre is used                                         |
| Switching | Managed switch, gateway ports in the MeshTrack VLAN, on UPS-backed power                                                                         |
| Mounting  | 3–4 m high, clear of large metal masses, within the anchor grid it serves; IP-rated enclosure underground                                        |

### Acceptable – enterprise Wi-Fi

|                |                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------|
| Standard       | 802.11ac/ax on a managed controller; WPA2/3-Enterprise or a dedicated PSK SSID per site                                 |
| Coverage       | $\geq$ -65 dBm and $\geq$ 25 dB SNR at the gateway mounting point, confirmed by survey before installation              |
| Power          | Local mains via a UPS-backed circuit or 12–24 V DC – Wi-Fi gateways are not PoE-fed                                     |
| Not acceptable | Consumer routers, mesh extenders, guest SSIDs, captive portals, or links that share an access point with public traffic |

**Sizing rule.** Minimum one gateway per level, building or separate structure; Sethala designs two per level so that a single gateway failure does not blind the level. One gateway serves up to 30,000 m<sup>2</sup> and is checked against the tag count and reporting cadence in the placement plan.

## POWER – THREE TIERS, ONLY ONE OF THEM YOURS TO WORRY ABOUT

### Field devices

- Anchors: internal battery, multi-year life at standard cadence; replacement is scheduled from the platform's battery reporting
- Tags: battery; level is reported per asset and a low-battery alert is raised
- Nothing to install – no electrical work in the workings

### Gateways & network

- Gateways powered by PoE from the access switch, or local 12–24 V DC where fibre is used
- Access switches, core and firewall on UPS; generator or emergency-power changeover for extended outages
- Internet CPE (fibre ONT / LTE router) on the same protected supply – a live server with a dead router still cannot alert anyone

### On-site server

- Dual redundant PSUs on separate UPS-fed circuits where available
- UPS runtime  $\geq$  30 min at load, with USB/network signalling for an orderly shutdown before batteries are exhausted
- Generator-backed feed so the server rides through mine power events without a restart

**Underground.** Gateway and switch enclosures underground follow the mine's IP rating, ventilation and hazardous-area requirements. Power and data to those enclosures are the mine's electrical scope; Sethala specifies each gateway's power and port needs per location in the placement plan.

## SITE READINESS CHECKLIST

Commissioning is scheduled once every applicable item is confirmed. Work through this with the mine's IT and electrical leads.

| NETWORK                  |                                                                                                                 |                   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------|
| <input type="checkbox"/> | Gateway VLAN created and routed through the firewall                                                            | CUSTOMER          |
| <input type="checkbox"/> | PoE switch port (or fibre + local DC) at every gateway position on the placement plan                           | CUSTOMER          |
| <input type="checkbox"/> | Where Wi-Fi is used: enterprise Wi-Fi coverage verified at each gateway mount with a site survey                | CUSTOMER          |
| <input type="checkbox"/> | Outbound TCP 8883 and 443 permitted from the gateway VLAN to Sethala cloud                                      | CLOUD CUSTOMER    |
| <input type="checkbox"/> | Server firewall rules applied (443 from LAN, 8883 from gateways, 443/123/53 outbound, nothing inbound from WAN) | ON-SITE CUSTOMER  |
| <input type="checkbox"/> | DNS and NTP reachable from the gateway VLAN                                                                     | CUSTOMER          |
| INTERNET                 |                                                                                                                 |                   |
| <input type="checkbox"/> | Primary business-grade link installed and meeting the latency and loss targets                                  | CUSTOMER          |
| <input type="checkbox"/> | Second, independent link with automatic failover – tested by pulling the primary                                | CLOUD CUSTOMER    |
| <input type="checkbox"/> | Backup link (LTE/5G acceptable) with automatic failover                                                         | ON-SITE CUSTOMER  |
| SERVER (OPTION B)        |                                                                                                                 |                   |
| <input type="checkbox"/> | Dedicated host or reserved-resource VM provisioned to the agreed specification                                  | ON-SITE CUSTOMER  |
| <input type="checkbox"/> | Fixed IP, DNS name and 1 GbE connection to the site core                                                        | ON-SITE CUSTOMER  |
| <input type="checkbox"/> | Ubuntu 24.04 installed and hardened, platform deployed, monitoring connected                                    | ON-SITE SETHALA   |
| <input type="checkbox"/> | First off-site backup completed and restore verified                                                            | ON-SITE SETHALA   |
| POWER                    |                                                                                                                 |                   |
| <input type="checkbox"/> | Access switches feeding gateways, core network and internet CPE on UPS with generator changeover                | CUSTOMER          |
| <input type="checkbox"/> | Server on UPS ≥ 30 min with shutdown signalling, generator-backed feed                                          | ON-SITE CUSTOMER  |
| FIELD                    |                                                                                                                 |                   |
| <input type="checkbox"/> | Anchor placement plan signed off against the mine's survey drawings                                             | SETHALA / PARTNER |
| <input type="checkbox"/> | Site access, escorts and hazardous-area classification confirmed for every install location                     | CUSTOMER          |
| <input type="checkbox"/> | Gateways mounted, powered and reporting heartbeat to the platform                                               | SETHALA / PARTNER |

CUSTOMER REPRESENTATIVE · NAME, SIGNATURE, DATE

SETHALA REPRESENTATIVE · NAME, SIGNATURE, DATE