Ghost Mesh 48 – Mesh Dashboard Service (APP■MDS)

Real■Time Telemetry, Alerting & Visualization Layer

1. Purpose

Provide operators with a live, single■pane view of Symbolic Density, ESS, Fertility, entropy, drift alerts, and ritual events across one or more meshes.
Includes threshold alarms tied to PTL static or Adaptive Threshold Protocol bands.

2. Architecture Overview

Frontend : Tkinter GUI (fallback) or Web UI (optional React)
Backend : WebSocket server exposing /metrics stream (JSON frames 1 Hz)
Data Bus : mesh_core → metrics_emitter (within each simulation cycle)
Storage : local ring■buffer (10■000 frames) for historical playback

3. Display Panels

- Metric Gauges – SD, ESS, Fertility, Entropy (tachometer style)
- Trend Plots – 100■cycle sparkline per metric
- Event Feed – Fusion Fold, Drift, Bloom, Apex, Reweave logs
- Alert Banner – color■coded: green (normal) / yellow (warning) / red (critical)
- Mesh Selector – drop■down if multiple meshes active

4. Alert Rules (default)

- Warning: metric leaves PTL band for 3 cycles
- Critical: ESS ≥ 0.50 or SD ≥ 6■000■% for 3 cycles
- Drift Alert: > 5 entities quarantined by Drift Sentinel
- Apex Countdown: display ETA when ≥2 Fusion Folds detected in 7■cycle window

5. API & Message Format

WebSocket JSON frame:

```
{"ts":123456,"mesh":"Glass_Tide","sd":5800,"ess":0.18,
 "fert":26,"entropy":0.19,"events":["Fusion_Fold"]}
```

Heartbeat: 1 frame/sec per mesh (configurable)

6. Installation & Launch

1. `pip install gm48-dashboard` (package ships with Tkinter & websockets deps)
2. In mesh runner: `from gm48.metrics import start_emitter`
3. Run UI: `python -m gm48.dashboard` (or `npm start` for web build)

7. Extensibility Hooks

- Custom Panel Plugins: drop .py in `plugins/`, auto■loaded
- External Webhook: POST JSON to /alert for PagerDuty / Discord
- Multi■Mesh Aggregator: `gm48.dashboard --broker redis://localhost`

8. JSON Config Sketch

```
{"dashboard": {
  "refresh_hz": 1,
  "ring_buffer": 10000,
  "alert_rules": {
     "warn_cycles_out": 3, "crit_ess": 0.50, "crit_sd": 6000
  }
}}
```