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Items (1) Summary:

Item	ID	Name	Category	State / State Date
1	400536 SDS Documentation	MTN PUSH & PULL SERVICE UP-TIME ENHANCEMENT (JOB SCHEDULER IMPLEMENTATION) - Documentation (SDS, DAR and PR)	Enhanceme nt	Approved 09/10/2025, 10:51:47



SYSTEM DESIGN SPECIFICATION

For : MTN PUSH & PULL SERVICE UP-TIME ENHANCEMENT (JOB SCHEDULER IMPLEMENTATION)

Documentation (SDS, DAR and PR)

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1.0 Background

1.1 Description:

The MTN Push and Pull service uptime through the implementation of a job scheduler. The initiative stems from recurring service timeouts caused by idle VPN tunnel connections between FirstBank Ghana and MobileMoney LTD (MTN Ghana). These disruptions negatively impact customer experience and hinder the bank's digital service delivery. The proposed solution involves deploying a Windows service that will periodically ping/telnet (tnc) the tunnel IP to maintain an active VPN session, thereby ensuring continuous availability of the push/pull service.

1.2 Purpose and Scope:

Implement a Service to maintain persistent VPN connectivity between FirstBank Ghana and MobileMoney LTD (MTN Ghana), thereby eliminating service timeouts and improving customer experience. PROJECT: IMPLEMENTATION JOB SCHEDULER SERVICE - MTN PUSH & PULL

1.3 Parent

[SDS Documentation 400536](https://dev.azure.com/FirstBankLtd/First%20Bank%20Devops/_workitems/edit/400536) * MTN PUSH & PULL SERVICE UP-TIME ENHANCEMENT (JOB SCHEDULER IMPLEMENTATION)

1.4 Project Contacts:

2.0 Solution Architecture

2.1 System Decomposition:

- [Scheduler Orchestrator]
 - Evaluates CRON/Calendars/Windows, resolves dependencies, enqueues ready jobs into TSQ.
 - Handles missed triggers via restart-safe catch-up logic and reconciliation jobs.
 - Single active leader with distributed lock to avoid double scheduling.
- [Task Scheduling Queue (TSQ)]
 - Persistent queue for ready-to-run work with priority and visibility timeouts.
 - Supports backpressure, rate limits, and dead-letter queues (DLQ) for poison tasks.
- [Job Definition Registry]

- Stores job metadata, CRON expressions, calendars, SLAs, dependencies, concurrency limits, retry/backoff policy, and idempotency keys.
- Suggested entities: `jobs`, `schedules`, `triggers`, `dependencies`, `runs`, `run_logs`, `post_attempts`, `queue_items`.
- **[Execution Workers]**
 - Horizontally scalable workers that dequeue from TSQ, execute tasks, implement retries with jittered backoff, and enforce timeouts.
 - Idempotent by contract; persist checkpoints to enable safe re-runs.
- **[Posting Engine]**
 - Writes results to target systems using an Outbox/Transactional Outbox pattern.
 - Enforces idempotency using composite keys (e.g., `job_id + target_system + period + payload_hash`).
 - Provides DLQ for posting failures and reconciliation processes.
- **[API Gateway & Admin Console]**
 - CRUD for jobs/schedules, manual triggers, pause/resume, approvals, inspection of runs, replays.
 - RBAC for Admin/SchedulerOps/Auditor roles.
- **[Calendar & Time Service]**
 - Centralized time zone handling (IANA/Olsen db), DST-safe computation, business-day calendars, holiday sets, blackout/maintenance windows.
- **[Observability & Audit]**
 - Metrics (latency, success rate, queue depth), tracing, structured logs, audit tables.
 - Alarms on SLA breach, dead-letter growth, posting error spikes.
- **[Config & Secrets]**
 - Versioned configs with feature flags.
 - Secure secret storage and rotation.
- **[Data Stores]**

- Relational DB for metadata/audit.
- Optional cache for hot lookups (e.g., Redis).
- Object storage for large payloads/artifacts.

2.2 Solution Overview:

- **Objective:** Implement a resilient, time-accurate Job Scheduler for “Time Enhancement” workloads that can orchestrate, execute, and post results to downstream systems with strong guarantees against duplicates, missed triggers, and partial postings.
- **Key Capabilities:**
 - **Scheduling:** CRON/Calendar-based, time zone-aware, supports dependencies and SLAs.
 - **Execution:** Scalable workers with retries, backoff, and idempotent job design.
 - **Posting:** Robust posting engine with deduplication, outbox pattern, and reconciliation.
 - **Observability:** Full audit trail, metrics (SLOs), tracing, and alerting.
 - **Ops & Safety:** Backpressure, DLQ, circuit breakers, feature flags, blue/green deploys.
- **Assumptions:**
 - TSQ = Task Scheduling Queue (the project’s central queue for scheduled and triggered work). If TSQ instead means Temporary Storage Queue (e.g., CICS), please confirm.
 - “Posting” = Writing completed job outcomes to target systems (e.g., payroll/ERP/timesheets).
 - Environment is Windows; deployment targets could be Windows services/containers.

3.0 Changes to System Components

3.1 Front End Changes:

3.2 Logic Layer Changes:

3.3 Integration Later Changes:

3.4 Database Changes:

4.0 Requirement – Design Traceability (Functional and Non-Functional)

Its a background service without tables

5.0 Related Works:

Parent (1)

Related (4)

Job scheduler to be easily configurable, So that I can adjust ping intervals and thresholds based on network performance
| 400092 Task

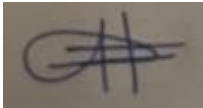
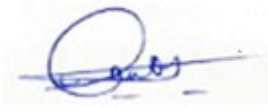
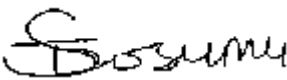
MTN PUSH & PULL SERVICE UP-TIME ENHANCEMENT (JOB SCHEDULER IMPLEMENTATION) | 400090 Product Backlog Item
Documentation (SDS, DAR and PR) | 400093 Task

MTN PUSH & PULL SERVICE UP-TIME ENHANCEMENT (JOB SCHEDULER IMPLEMENTATION) | 400535 DaR Document

6.0 DevOps Details (Repo, CI-CD Pipelines and PullRequest)

7.0 Appendixes

7.0 Reviews and Approval

Functional Role	Name	Signature	Date
Created By:	Michael Osei-Bobie		03/10/2025, 09:01:38
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