**ETL-Aware Sequence Synchronization Solution**

**Technical Implementation Documentation**

**Version:** 1.0  
**Date:** August 18, 2025  
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**System:** Oracle GoldenGate Sequence Replication

**Executive Summary**

This solution implements table-based sequence synchronization between Legacy (ALS) and Modernized (ENTITYDEV) Oracle systems using GoldenGate replication. The approach ensures TINSIDCNT sequence values remain synchronized during ETL operations while maintaining system autonomy.

**Architecture Overview**

**Components**

1. **Legacy System (ALS)**: Source of truth for sequence values via control table
2. **GoldenGate Replication**: Table-based replication of sequence control data
3. **Modernized System (ENTITYDEV)**: Synchronized consumer with ETL coordination

**Data Flow**

Legacy ALS → SEQUENCE\_CONTROL table → GoldenGate → ALS Replica → ENTITYDEV Sync

**Implementation Steps**

**Phase 1: Legacy System Setup (ALS)**

**Prerequisites:**

* SYSDBA access to ALS database
* GoldenGate installed and configured
* Supplemental logging enabled

**Execution Steps:**

1. **Enable Supplemental Logging** (as SYSDBA)
2. ALTER DATABASE ADD SUPPLEMENTAL LOG DATA;
3. ALTER DATABASE ADD SUPPLEMENTAL LOG DATA (ALL) COLUMNS;
4. **Create Control Infrastructure**
   * Execute sections 1.1-1.7 from the complete scripts
   * Update initial TINSIDCNT value (currently ~254,223,193)
   * Grant appropriate privileges
5. **Verify Installation**
6. SELECT \* FROM SEQUENCE\_CONTROL WHERE SEQUENCE\_NAME = 'TINSIDCNT';
7. SELECT GET\_NEXT\_SEQUENCE\_VALUE('TINSIDCNT') FROM DUAL;

**Phase 2: GoldenGate Configuration**

**Extract Setup (ALS):**

1. Create parameter file: EXT\_SEQ\_CTRL.prm
2. Configure GGSCI commands:
3. ADD EXTRACT EXT\_SEQ\_CTRL, TRANLOG, BEGIN NOWADD EXTTRAIL ./dirdat/sc, EXTRACT EXT\_SEQ\_CTRLSTART EXTRACT EXT\_SEQ\_CTRL

**Replicat Setup (ENTITYDEV):**

1. Create parameter file: REP\_SEQ\_CTRL.prm
2. Configure GGSCI commands:
3. ADD REPLICAT REP\_SEQ\_CTRL, EXTTRAIL ./dirdat/scSTART REPLICAT REP\_SEQ\_CTRL

**Phase 3: Modernized System Setup (ENTITYDEV)**

**Prerequisites:**

* Database links to ALS replica and direct legacy systems
* Appropriate TNS aliases configured

**Execution Steps:**

1. **Create Database Links**
2. CREATE DATABASE LINK als\_replica\_link
3. CONNECT TO replica\_user IDENTIFIED BY replica\_password
4. USING 'ALS\_REPLICA\_TNS\_ALIAS';
5. **Install Synchronization Framework**
   * Execute sections 3.1-3.9 from complete scripts
   * Test basic connectivity and sync functionality
6. **Configure Scheduled Jobs**
   * Review job schedules (currently disabled)
   * Enable jobs after testing phase completion

**ETL Coordination Strategy**

**Timing Windows**

| **Time Period** | **Phase** | **Actions** |
| --- | --- | --- |
| 2:45-3:00 AM | PRE\_ETL\_SYNC\_WINDOW | Execute lag-aware synchronization |
| 3:00-4:00 AM | ETL\_ACTIVE\_WINDOW | Monitor only, minimal interference |
| 4:00-4:30 AM | POST\_ETL\_VALIDATION | Validate and report results |
| Other times | NORMAL\_OPERATIONS | Regular 15-minute sync cycles |

**Key Procedures**

**PRE\_ETL\_SEQUENCE\_SYNC**: Ensures sequences are synchronized before ETL operations

* Waits up to 10 minutes for replication lag resolution
* Creates checkpoint for comparison
* Validates sync status before ETL proceeds

**SYNC\_WITH\_LAG\_HANDLING**: Core synchronization with intelligent waiting

* Monitors both legacy direct and replica values
* Handles replication lag gracefully
* Provides detailed logging and status updates

**Monitoring and Alerting**

**Status Views**

**V\_SEQUENCE\_SYNC\_STATUS**: Real-time sync status

SELECT \* FROM V\_SEQUENCE\_SYNC\_STATUS WHERE SEQUENCE\_NAME = 'TINSIDCNT';

**V\_ETL\_COORDINATION\_STATUS**: Current ETL phase and recommendations

SELECT \* FROM V\_ETL\_COORDINATION\_STATUS;

**Key Metrics**

* **SYNC\_HEALTH**: WITHIN\_TOLERANCE, LOCAL\_BEHIND, LOCAL\_AHEAD
* **DIFFERENCE**: Numeric difference between replica and local values
* **LAST\_SYNC\_TIME**: Timestamp of most recent synchronization
* **REPLICATION\_LAG**: Seconds between legacy and replica updates

**Alert Thresholds**

* **Sequence Difference > 25**: Beyond cache tolerance, requires sync
* **Replication Lag > 60 seconds**: Automatic alert generation
* **Sync Failure**: Logged to LOCAL\_SEQUENCE\_STATUS with error details

**Error Handling and Recovery**

**Automatic Recovery**

1. **Sequence Restart Method** (Oracle 18c+):
2. ALTER SEQUENCE TINSIDCNT RESTART START WITH <new\_value>;
3. **Drop/Recreate Fallback** (Earlier versions):
4. DROP SEQUENCE TINSIDCNT;
5. CREATE SEQUENCE TINSIDCNT START WITH <new\_value> ...;

**Emergency Procedures**

**EMERGENCY\_SEQUENCE\_RESET**: For critical situations

* Analyzes maximum TIN\_SID values in actual data
* Resets sequence to safe starting point
* Updates control tables when possible

**Manual Intervention Points:**

* GoldenGate process failures
* Extended replication lag (>10 minutes)
* ETL job conflicts during sync window

**Testing and Validation**

**Pre-Production Testing**

1. **Basic Sync Test**:
2. EXEC SYNC\_SEQUENCE\_FROM\_REPLICA('TINSIDCNT');
3. EXEC VERIFY\_SEQUENCE\_SYNC;
4. **ETL Coordination Test**:
5. EXEC PRE\_ETL\_SEQUENCE\_SYNC;
6. -- Run test ETL operations
7. SELECT \* FROM SEQUENCE\_SYNC\_CHECKPOINT WHERE CHECKPOINT\_TYPE = 'PRE\_ETL';
8. **Lag Handling Test**:
9. EXEC SYNC\_WITH\_LAG\_HANDLING('TINSIDCNT', 120); -- 2-minute max wait

**Production Validation**

**Daily Checks:**

* Review V\_SEQUENCE\_SYNC\_STATUS for health status
* Monitor REPLICATION\_LAG\_ALERTS for unresolved issues
* Validate ETL job completion without sequence conflicts

**Weekly Reviews:**

* Analyze SEQUENCE\_SYNC\_CHECKPOINT trends
* Review GoldenGate lag statistics
* Verify data comparison results (minus queries)

**Configuration Parameters**

**Customizable Settings**

| **Parameter** | **Default** | **Description** |
| --- | --- | --- |
| Sequence Cache Size | 20 | Oracle sequence cache setting |
| Sync Tolerance | 25 | Acceptable difference before sync trigger |
| Max Wait Time | 300 seconds | Maximum lag wait during ETL coordination |
| Regular Sync Interval | 15 minutes | Normal operations sync frequency |
| Replication Lag Alert | 60 seconds | Alert threshold for lag monitoring |

**Environment-Specific Variables**

**Replace in scripts before deployment:**

* your\_schema: Actual schema name containing SEQUENCE\_CONTROL
* replica\_schema: Schema name in ALS replica database
* your\_gg\_password: GoldenGate user password
* 254223193: Current TINSIDCNT value from production
* TNS aliases and connection details

**Security Considerations**

**Required Privileges**

**Legacy System (ALS):**

* CREATE TABLE, CREATE SEQUENCE, CREATE PROCEDURE
* SELECT, INSERT, UPDATE on SEQUENCE\_CONTROL
* EXECUTE on custom functions and procedures

**GoldenGate User:**

* SELECT on SEQUENCE\_CONTROL table
* Appropriate GoldenGate replication privileges

**Modernized System (ENTITYDEV):**

* CREATE DATABASE LINK
* CREATE TABLE, CREATE VIEW, CREATE PROCEDURE
* DBMS\_SCHEDULER privileges for job creation

**Network Security**

* Database links use encrypted connections (recommended)
* GoldenGate trail files encrypted in transit
* Access restricted to designated service accounts

**Performance Considerations**

**Expected Impact**

**Minimal Performance Impact:**

* Table-based replication more efficient than sequence replication
* Sync operations occur primarily outside business hours
* Cache settings minimize sequence-related locks

**Monitoring Points:**

* GoldenGate lag during high-volume periods
* Database link response times
* ETL job duration changes

**Optimization Opportunities**

* Adjust sync frequency based on business requirements
* Implement parallel processing for multiple sequences
* Consider partitioning for historical checkpoint data

**Deployment Checklist**

**Pre-Deployment**

* [ ] Backup current TINSIDCNT sequence values on both systems
* [ ] Verify GoldenGate connectivity and permissions
* [ ] Test database links and TNS connectivity
* [ ] Validate current sequence difference (should be minimal)

**Deployment Steps**

* [ ] Execute Phase 1: Legacy system setup
* [ ] Execute Phase 2: GoldenGate configuration
* [ ] Execute Phase 3: Modernized system setup
* [ ] Verify basic sync functionality
* [ ] Test ETL coordination procedures

**Post-Deployment**

* [ ] Enable scheduled jobs after testing
* [ ] Monitor first ETL cycle (3 AM job)
* [ ] Validate data comparison results
* [ ] Document any environment-specific adjustments
* [ ] Train operations team on monitoring procedures

**Rollback Plan**

* [ ] Disable GoldenGate processes
* [ ] Reset sequences to pre-deployment values
* [ ] Remove control tables and procedures
* [ ] Restore original application sequence usage

**Support and Maintenance**

**Regular Maintenance**

**Daily:**

* Monitor sync status and resolve alerts
* Review ETL coordination logs
* Check GoldenGate process health

**Weekly:**

* Analyze sequence trend reports
* Review and resolve lag alerts
* Validate data comparison accuracy

**Monthly:**

* Purge old checkpoint and log data
* Review and optimize sync intervals
* Update documentation with lessons learned

**Troubleshooting Guide**

**Common Issues:**

1. **Sequence Divergence > 25**
   * Check GoldenGate replication status
   * Verify database link connectivity
   * Execute manual sync: SYNC\_SEQUENCE\_FROM\_REPLICA
2. **Extended Replication Lag**
   * Review GoldenGate manager and process logs
   * Check network connectivity between systems
   * Consider temporary increase in sync wait times
3. **ETL Job Conflicts**
   * Verify pre-ETL sync completion before 3 AM
   * Check for locked sequences or tables
   * Review ETL job timing and dependencies

**Contact Information**

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**Conclusion**

This ETL-aware sequence synchronization solution provides robust, reliable synchronization of TINSIDCNT values between Legacy and Modernized systems while maintaining operational independence. The table-based approach with intelligent lag handling ensures business continuity during critical ETL operations while enabling accurate data comparison and validation.

Regular monitoring and adherence to the operational procedures outlined in this document will ensure long-term success of the synchronization solution.