Discord Attack Notification System - Integration Summary

Date: February 18, 2026
Status: ☑ Implementation Complete - Ready for Testing

1. Overview

The Discord Attack Notification System enables real-time Discord alerts for all NINA IA-detected attacks. The system categorizes attacks into 15 types and sends detailed embeds to a Discord channel via webhook.

Architecture

```
NINA IA Module (detects attacks)
    ↓ (logs alerts)
DiscordIAIntegration (reads alerts)
    ↓ (categorizes)
DiscordNotifier (formats & sends)
    ↓ (HTTP POST)
Discord Webhook (receives)
    ↓
Discord Channel (displays alert)
```

2. Components Created

2.1 `src/daemon/discord_notifier.hpp` & `.cpp` (630 lines)

Purpose: Core Discord notification engine

Key Classes:

- `AttackType` enum - 15 attack classifications
- `AttackDetail` struct - Comprehensive attack information
- `DiscordNotifier` class - Static notification interface

Attack Types Supported:

Category	Types	Examples
Checkpoint	5	Hash tampering, invalid hash, epoch rollback, stale data, unauthorized source
Hashrate/51%	4	51% attack detected, pool-specific, difficulty manipulation, fork attempt

Category	Types	Examples
Network	4	Peer anomaly, flooding (DDoS), network isolation, desynchronization
Security	2	Code tampering, sandbox violation, quarantine triggered

Key Methods:

- `initialize(webhook_url)` - Setup Discord integration
- `isConfigured()` - Check if ready
- `sendAttackAlert(attack)` - Send generic alert
- `send51PercentAlert(pool, confidence, details)` - 51% specific
- `sendCheckpointAttackAlert(type, source_ip, seed_ip, details)` - Checkpoint specific
- `sendNetworkStatus(peer_count, height, timestamp)` - Network monitoring
- `identifyPool(ip)` - Pool identification from IP
- `getSeverityColor(severity)` - Color mapping (1-5 scale)
- `getAttackEmoji(type)` - Attack-specific emojis

Features:

- ☑ JSON Discord embed generation
- ☑ Pool identification from IP (9 known pools)
- ☑ Severity color mapping (blue → red)
- ☑ Comprehensive logging via MINFO/MERROR
- ☑ Timestamp formatting for Discord
- ☑ Alert count tracking

2.2 `src/daemon/discord_ia_integration.hpp` & `.cpp` (270 lines)

Purpose: Bridge between NINA alerts and Discord notifications

Key Class:

- `DiscordIAIntegration` - Static integration interface

Key Methods:

- `initialize()` - Start monitoring thread
- `monitoringLoop()` - Continuous alert checking
- `checkIAAlerts()` - Parse IA logs for attacks
- `processCheckpointAlert()` - Handle checkpoint attacks
- `process51PercentAlert()` - Handle 51% attacks
- `processNetworkAlert()` - Handle network anomalies
- `processSecurityAlert()` - Handle code integrity violations
- `sendCustomAlert(title, description)` - Manual alerts
- `shutdown()` - Graceful shutdown

Attack Categorization:

Checkpoint Attacks:

```
- CHECKPOINT_HASH_TAMPERING     (modified hashes)
- CHECKPOINT_INVALID_HASH       (not in blockchain)
- CHECKPOINT_EPOCH_ROLLBACK     (epoch decreased)
- CHECKPOINT_STALE_DATA         (data > 130 min old)
- CHECKPOINT_UNAUTHORIZED_SOURCE (non-authorized seed)
```

51% Hashrate Attacks:

```
- HASHRATE_51_PERCENT_ATTACK    (>50% hashrate)
- HASHRATE_51_PERCENT_POOL      (specific pool)
- HASHRATE_ATTACK_DETECTED      (difficulty manipulation)
- HASHRATE_FORK_ATTEMPT         (fork attack)
```

Network Attacks:

```
- NETWORK_PEER_ANOMALY          (suspicious behavior)
- NETWORK_PEER_FLOODING         (DDoS)
- NETWORK_ISOLATION             (disconnected)
- NETWORK_DESYNC                (out of sync)
```

Security Attacks:

```
- CODE_TAMPERING                (IA code modified)
- SANDBOX_VIOLATION             (escape attempt)
- QUARANTINE_TRIGGERED          (emergency mode)
```

3. Integration Points

3.1 `src/daemon/ai_integration.h` (Updated)

Changes Made:

1. Added includes:

```
#include "discord_notifier.hpp"
#include "discord_ia_integration.hpp"
```

2. Added Stage 7 initialization:

```
static bool initialize_discord_integration() {
    // Read DISCORD_WEBHOOK environment variable
    // Initialize Discord notifier with webhook URL
    // Start monitoring thread
}
```

3. Updated `initialize_ia_module()`:

```
// Stage 7: Call initialize_discord_integration()
```

4. Updated `shutdown_ia_module()`:

```
// Shutdown DiscordIAIntegration before closing IA
DiscordIAIntegration::shutdown();
```

7-Stage Daemon Initialization Sequence:

1. ☑ Get IA Module instance
2. ☑ Initialize IA Security Module
3. ☑ Validate code integrity
4. ☑ Initialize Checkpoint Monitor
5. ☑ Initialize Hashrate Recovery Monitor
6. ☑ Initialize Checkpoint Validator
7. ☑ **Initialize Discord IA Integration** (NEW)

3.2 `src/daemon/CMakeLists.txt` (Updated)

Changes Made:

```
set(daemon_sources
  # ... existing files ...
  discord_notifier.cpp
  discord_ia_integration.cpp
)
```

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4. Configuration

4.1 Environment Variable Setup

To enable Discord notifications, set the webhook URL:

```
# Linux/Mac
export DISCORD_WEBHOOK="https://discordapp.com/api/webhooks/YOUR_WEBHOOK_ID/YOUR_WEBHOOK_TOKEN"

# Windows (PowerShell)
$env:DISCORD_WEBHOOK="https://discordapp.com/api/webhooks/YOUR_WEBHOOK_ID/YOUR_WEBHOOK_TOKEN"

# Windows (CMD)
set DISCORD_WEBHOOK=https://discordapp.com/api/webhooks/YOUR_WEBHOOK_ID/YOUR_WEBHOOK_TOKEN
```

Finding Your Webhook URL:

1. Go to Discord Server Settings → Webhooks
2. Create or select a webhook
3. Copy the "Webhook URL"
4. Format: `https://discordapp.com/api/webhooks/{ID}/{TOKEN}`

4.2 Startup Behavior

With Webhook Configured:

```
[IA] Stage 7: Initializing Discord IA Integration...
[IA-Discord] Initializing IA to Discord integration...
[IA-Discord] Discord notifier configured
╔══════════════════════════════════════════════════════════════╗
║  ✅ IA-DISCORD INTEGRATION ESTABLISHED                        ║
║                                                              ║
║  Monitoring:                                                 ║
║  ✓ Checkpoint attacks (hash tampering, rollback)             ║
║  ✓ 51% hashrate attacks (pool identification)                ║
║  ✓ Network anomalies (peer behavior, isolation)              ║
║  ✓ Code integrity violations                                 ║
║  ✓ Security quarantines                                      ║
║                                                              ║
║  Discord Channel: Receiving real-time attack alerts          ║
╚══════════════════════════════════════════════════════════════╝
```

Without Webhook Configured:

```
[IA] Stage 7: Initializing Discord IA Integration...
[IA-Discord] DISCORD_WEBHOOK environment variable not set
[IA-Discord] ℹ  Set DISCORD_WEBHOOK to enable Discord alerts
[IA-Discord] ⚠  Discord notifier not configured
```

5. Alert Examples

5.1 Checkpoint Hash Tampering Alert

```
🚨 CHECKPOINT HASH TAMPERING ATTACK
Severity: 🔴 CRITICAL (5/5)

Source IP: 203.0.113.45
Claimed Seed: 87.106.7.156 (Seed1)
Checkpoints Affected: height 1250000 (invalid hash)
Status: Hash mismatch - blockchain rejected

NINA Response: Source IP blacklisted
Recommendation: Monitor for pattern confirmation
```

5.2 51% Hashrate Attack Alert

```
🔴 51% HASHRATE CONCENTRATION ATTACK
Severity: 🔴 CRITICAL (5/5)

Pool: Antpool (Pool classification: Antpool)
Hashrate: 63% of network
Attack Confidence: 95%

Network Impact: Fork risk detected
NINA Response: Difficulty adjustment enabled
Recommendation: Activate emergency difficulty adjustment
```

5.3 Network Isolation Alert

```
⚠️ NETWORK ISOLATION
Severity: 🟡 MEDIUM (3/5)

Issue: Node isolated from network
Peer Count: 0 connected peers
Height: Block 1249856 (network at 1250000)

NINA Response: Attempting reconnection
Recommendation: Check network connectivity
```

5.4 Code Integrity Violation Alert

```
◍ CODE TAMPERING DETECTION
Severity: ◍ CRITICAL (5/5)

Violation: IA code integrity check failed
Details: Unexpected bytes detected in ai_module.cpp
Hash Mismatch: Expected SHA-256 xyz, got abc

NINA Response: Entering quarantine mode - automatic remediation
Recommendation: Node in isolation mode pending verification
```

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6. Monitoring & Diagnostics

6.1 Checking Discord Notifier Status

```cpp
// In any daemon code:
std::string status = DiscordNotifier::getStatus();
MINFO("[DEBUG] Discord status: " << status);
```

6.2 Manual Alert Sending

```cpp
// For testing or manual alerts:
std::string attack_title = "Manual Security Alert";
std::string attack_description = "Testing Discord integration";
DiscordIAIntegration::sendCustomAlert(attack_title, attack_description);
```

6.3 Daemon Logs

Discord integration logs are prefixed with `[IA-Discord]`:

```
[IA-Discord] Monitoring thread started
[IA-Discord] Alert detected, processing...
[IA-Discord] Processing checkpoint alert from 203.0.113.45
[IA-Discord] 🚨 Processing 51% attack alert
```

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7. Testing Checklist

Before deploying to production, verify:

- ☐ Environment variable `DISCORD_WEBHOOK` is set
- ☐ Discord webhook URL is valid and accessible
- ☐ Test channel has webhook permissions

- □ Daemon starts without errors (Stage 7 initialization)
- □ Test checkpoint attack alert (modify checkpoint hash)
- □ Test 51% detection (simulate high hashrate peer)
- □ Test network anomaly alert (disconnect peer)
- □ Test code integrity check (trigger IA validation)
- □ Verify alerts appear in Discord channel within 5 seconds
- □ Check attack type classification is correct
- □ Verify severity coloring (blue/yellow/red)
- □ Check pool identification accuracy
- □ Test daemon shutdown (Discord integration closes cleanly)

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8. Security Considerations

8.1 Webhook URL Protection

- ☑ Only set via environment variable (not configuration file)
- ☑ Not logged or displayed in daemon output
- ☑ Validated on initialization

8.2 IA Isolation Maintained

- ☑ IA code cannot directly access Discord
- ☑ IA has no network access (by design)
- ☑ Daemon acts as intermediary
- ☑ All IA operations remain sandboxed

8.3 Alert Integrity

- ☑ Alerts generated from IA logs (verifiable source)
- ☑ Attack categorization uses consistent logic
- ☑ Timestamps from system clock
- ☑ IP addresses from verified peer connections

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9. Future Enhancements

Potential improvements:

1. Configuration file support for webhook URL
2. Severity thresholds (mute low-severity alerts)
3. Alert rate limiting (prevent Discord spam)
4. Attack-specific Discord channels
5. Weekly attack summary reports
6. Historical alert tracking (database)
7. Pool database expansion (500+ pools)
8. Geolocation of attack sources
9. Alert metrics dashboard

10. Integration with other platforms (Slack, Telegram)

10. Files Summary

File	Lines	Status	Purpose
`src/daemon/discord_notifier.hpp`	190	☑ Created	Attack types, notification interface
`src/daemon/discord_notifier.cpp`	350	☑ Created	Webhook communication, JSON formatting
`src/daemon/discord_ia_integration.hpp`	120	☑ Created	Integration interface, alert processors
`src/daemon/discord_ia_integration.cpp`	270	☑ Created	Monitoring loop, attack categorization
`src/daemon/ai_integration.h`	Updated	☑ Modified	Stage 7 initialization + shutdown
`src/daemon/CMakeLists.txt`	Updated	☑ Modified	Build configuration

Total New Code: 930 lines of production code

11. Deployment Instructions

11.1 Build

```
cd /path/to/ninacatcoin
mkdir build && cd build
cmake ..
make -j4 daemon
```

11.2 Configure Webhook

```
# Get your Discord webhook URL first
export DISCORD_WEBHOOK="https://discordapp.com/api/webhooks/YOUR_ID/YOUR_TOKEN"
```

11.3 Run with Discord Integration

```
./bin/ninacatcoind --data-dir=/path/to/data
```

11.4 Verify in Logs

```
tail -f ~/.ninacatcoin/logs/daemon.log | grep "IA-Discord"
```

12. Conclusion

The Discord Attack Notification System is fully integrated into the NINA IA framework. The system:

☑ Detects 15 types of attacks (checkpoint, 51%, network, security)
☑ Sends real-time alerts to Discord
☑ Identifies attacking pools by IP
☑ Categorizes severity from blue (info) to red (critical)
☑ Maintains IA sandbox isolation
☑ Integrates seamlessly into daemon startup
☑ Requires only 1 environment variable to activate

Ready for Testing and Deployment