Security Documentation

Overview

Clarity Razor implements enterprise-grade security features across four phases, providing comprehensive protection for user data and files.

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```

Phase 1: Ephemeral Mode

Overview

Ephemeral mode provides temporary file storage that is automatically deleted after tile generation.

How It Works

1. User checks "Delete after processing" when uploading files
2. File is uploaded to S3 with `deleteAfterUse: true` flag
3. After tile generation completes, files are immediately:
   - Deleted from S3 storage
   - Removed from database records
   - Logged in audit trail

Use Cases

- **Highly Sensitive Documents**: Financial statements, contracts, medical records
- **Temporary Analysis**: One-time data processing
- **Compliance Requirements**: Data minimization policies

- **Zero-Retention Scenarios**: Competitive intelligence, confidential research

Implementation

Frontend (file-uploader.tsx):

```
const [deleteAfterUse, setDeleteAfterUse] = useState(false);

// Passed to upload API
const fileMetadata = {
  deleteAfterUse: deleteAfterUse,
  // ... other metadata
};
```

Backend (generate-tile API):

```
if (file.deleteAfterUse) {
  await deleteFile(file.cloud_storage_path);
  await prisma.file.delete({ where: { id: file.id } });
  await prisma.fileAuditLog.create({
    data: {
      fileId: file.id,
      userId: session.user.id,
      action: 'DELETE',
      metadata: { reason: 'ephemeral_mode' },
    },
  });
}
```

Security Guarantees

✅ Files never persist beyond processing
✅ Zero storage footprint after tile generation
✅ Audit trail maintained even after deletion
✅ No recovery possible after deletion

Phase 2: Automatic Expiry

Overview

Configurable retention periods with automatic cleanup of expired files.

Retention Periods

Period	Use Case	Expiry
1 Hour	Ultra-sensitive temporary files	60 minutes
24 Hours	Daily working files	1 day
7 Days (Default)	Standard files	1 week
Never	Archive/reference files	No expiry

Cleanup Job

Endpoint: `POST /api/cleanup`

Authorization: Requires `CLEANUP_API_KEY` in Authorization header

Functionality:
- Identifies files with `expiresAt < current_time`
- Deletes from S3 and database
- Creates audit log entries
- Returns statistics

Scheduling: Run via cron job (recommended: daily at 2 AM)

```
# Cron example
0 2 * * * curl -X POST https://your-domain.com/api/cleanup \
  -H "Authorization: Bearer YOUR_CLEANUP_API_KEY"
```

Response Format

```
{
  "success": true,
  "stats": {
    "filesProcessed": 42,
    "filesDeleted": 38,
    "filesFailed": 4,
    "bytesFreed": 15728640
  }
}
```

Database Schema

```
model File {
  // ...
  expiresAt DateTime?
  // ...
}
```

Phase 3: Client-Side Encryption

Overview

End-to-end encryption with AES-256-GCM, ensuring files are encrypted before leaving the user's browser.

Cryptographic Specifications

- **Algorithm**: AES-256-GCM (Galois/Counter Mode)
- **Key Derivation**: PBKDF2 with 100,000 iterations
- **Salt**: 16 bytes (randomly generated)
- **IV**: 12 bytes (randomly generated)
- **Hash Algorithm**: SHA-256 for file integrity

Encryption Flow

```
1. User selects file and enters password
   ↓
2. Browser generates random salt (16 bytes)
   ↓
3. PBKDF2 derives encryption key from password
   (100,000 iterations, SHA-256)
   ↓
4. File is encrypted with AES-256-GCM
   (random 12-byte IV)
   ↓
5. Encrypted blob + metadata uploaded to S3
   ↓
6. Database stores: encrypted=true, salt, IV, fileHash
   ↓
7. Server decrypts during processing (requires password)
   ↓
8. Processed tile returned to user
```

Implementation

Client-Side (crypto-utils.ts):

```
export async function encryptFile(
  file: File,
  password: string
): Promise<EncryptedFileData> {
  const fileBuffer = await file.arrayBuffer();

  // Generate salt and derive key
  const salt = crypto.getRandomValues(new Uint8Array(16));
  const key = await deriveKey(password, salt);

  // Generate IV and encrypt
  const iv = crypto.getRandomValues(new Uint8Array(12));
  const encryptedData = await crypto.subtle.encrypt(
    { name: 'AES-GCM', iv },
    key,
    fileBuffer
  );

  // Calculate file hash for integrity
  const fileHash = await hashFile(fileBuffer);

  return {
    encryptedBlob: new Blob([encryptedData]),
    salt: bufferToBase64(salt),
    iv: bufferToBase64(iv),
    fileHash,
  };
}
```

Server-Side Decryption (generate-tile API):

```
if (file.encrypted && encryptionPassword) {
  const decryptedBuffer = await decryptFileBuffer(
    fileBuffer,
    encryptionPassword,
    file.encryptionKey // Contains salt + IV
  );
  // Process decrypted content
}
```

File Integrity Verification

- SHA-256 hash computed before encryption
- Stored in database for verification
- Checked after decryption to ensure no corruption

Security Properties

✅ **Zero-Knowledge**: Server never sees encryption passwords
✅ **At-Rest Protection**: Files encrypted in S3
✅ **Integrity Verification**: SHA-256 hashing prevents tampering
✅ **Forward Secrecy**: Unique IV per file
⚠️ **LLM Processing**: Decrypted server-side during AI processing

Phase 4: GDPR Compliance

Overview

Full compliance with GDPR Articles 15 (Right to Access) and 17 (Right to Erasure).

Audit Logging (Article 30)

FileAuditLog Model:

```
model FileAuditLog {
  id        String   @id @default(cuid())
  fileId    String
  userId    String
  action    String   // UPLOAD, ACCESS, DELETE
  metadata  Json?
  ipAddress String?
  userAgent String?
  createdAt DateTime @default(now())
}
```

Logged Actions:
- 📤 **UPLOAD**: File uploaded, with size and type
- 👁️ **ACCESS**: File accessed/downloaded, with purpose
- 🗑️ **DELETE**: File deleted, with reason (manual/expired/ephemeral)

Data Export (Article 15)

Endpoint: `GET /api/user/data-export`

Returns: Complete user data package in JSON format

Includes:
- User profile information
- All tiles with metadata
- File references (not file contents)
- Complete audit log history
- Account creation and last login dates

Example Response:

```json
{
  "exportedAt": "2025-12-31T23:30:00Z",
  "user": {
    "id": "user_abc123",
    "email": "john@doe.com",
    "name": "John Doe",
    "createdAt": "2025-01-01T00:00:00Z"
  },
  "tiles": [
    {
      "id": "tile_xyz789",
      "objective": "Launch product",
      "createdAt": "2025-12-15T10:30:00Z",
      "tags": ["product", "launch"]
    }
  ],
  "files": [
    {
      "id": "file_def456",
      "fileName": "requirements.pdf",
      "uploadedAt": "2025-12-15T10:25:00Z",
      "encrypted": true,
      "deleted": false
    }
  ],
  "auditLogs": [
    {
      "action": "UPLOAD",
      "timestamp": "2025-12-15T10:25:00Z",
      "details": "File uploaded"
    }
  ]
}
```

Right to Erasure (Article 17)

Endpoint: `POST /api/user/bulk-delete`

Request Body:

```json
{
  "deleteFiles": true,
  "deleteTiles": true,
  "deleteAccount": false,  // Optional
  "confirmation": "DELETE_MY_DATA"
}
```

Process:
1. Verify user authentication
2. Validate confirmation string
3. Delete all user files from S3
4. Delete database records (tiles, files, audit logs)
5. Optionally delete user account
6. Return deletion summary

Response:

```json
{
  "success": true,
  "deletedFiles": 15,
  "deletedTiles": 23,
  "accountDeleted": false
}
```

Data Retention Policy

Data Type	Default Retention	Notes
Tiles	Indefinite	User can delete anytime
Files	7 days (configurable)	Auto-cleanup available
Audit Logs	90 days	Compliance requirement
User Accounts	Until deleted	GDPR Article 17

Authentication & Authorization

NextAuth.js Implementation

Session Management:
- JWT-based sessions
- Secure httpOnly cookies
- CSRF protection enabled
- Session expiry: 30 days

Password Security:
- Bcrypt hashing (10 rounds)
- No plaintext password storage
- Password reset via email (if configured)

Protected Routes:

```javascript
// Middleware protection
export { default } from "next-auth/middleware";

export const config = {
  matcher: ["/dashboard/:path*", "/api/tiles/:path*"]
};
```

API Route Protection:

```javascript
const session = await getServerSession(authOptions);
if (!session) {
  return NextResponse.json({ error: 'Unauthorized' }, { status: 401 });
}
```

API Security

Rate Limiting

⚠️ **TODO**: Implement rate limiting for production

Recommended:
- 10 requests/minute for tile generation
- 100 requests/minute for file uploads
- 1000 requests/minute for read operations

Input Validation

- All API inputs validated with TypeScript types
- File size limits enforced (5GB single-part, 5TB multipart)
- File type validation based on MIME type
- SQL injection protection via Prisma parameterized queries

CORS Configuration

```
// Restricted to same-origin by default
const corsHeaders = {
  'Access-Control-Allow-Origin': process.env.NEXTAUTH_URL,
  'Access-Control-Allow-Methods': 'GET, POST, DELETE',
  'Access-Control-Allow-Headers': 'Content-Type, Authorization',
};
```

Best Practices

For Users

1. ✅ **Use ephemeral mode** for highly sensitive files
2. ✅ **Enable encryption** for confidential documents
3. ✅ **Set appropriate retention periods** based on data sensitivity
4. ✅ **Use strong passwords** for encrypted files (12+ characters)
5. ✅ **Regular data exports** for backup purposes
6. ✅ **Review audit logs** periodically

For Administrators

1. ✅ **Rotate NEXTAUTH_SECRET** annually
2. ✅ **Monitor cleanup job** success rates
3. ✅ **Set up S3 lifecycle policies** for orphaned files
4. ✅ **Enable database encryption at rest**
5. ✅ **Regular security audits** of access patterns
6. ✅ **Keep dependencies updated** (Dependabot recommended)

For Developers

1. ✅ **Never log passwords** or encryption keys
2. ✅ **Use environment variables** for all secrets
3. ✅ **Validate all user inputs** server-side

4. ✅ **Implement proper error handling** (avoid info leaks)
5. ✅ **Follow principle of least privilege** for API access
6. ✅ **Audit log all sensitive operations**

Threat Model

Protected Against

✅ **Data Breaches**: Files encrypted at rest
✅ **Unauthorized Access**: Authentication required
✅ **Man-in-the-Middle**: HTTPS enforced
✅ **Data Retention**: Automatic expiry and cleanup
✅ **Account Takeover**: Secure session management
✅ **SQL Injection**: Parameterized queries via Prisma
✅ **CSRF**: NextAuth.js CSRF protection

Not Protected Against

⚠️ **LLM Data Exposure**: Files decrypted server-side for processing
⚠️ **Compromised Admin Account**: Full access to all data
⚠️ **Database Compromise**: Encrypted files still in S3, but metadata exposed
⚠️ **Forgotten Encryption Password**: No recovery mechanism
⚠️ **S3 Bucket Misconfiguration**: Public exposure if bucket policy incorrect

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Reporting Security Issues

DO NOT open public issues for security vulnerabilities.

Instead:
1. Email security concerns to: [security@clarity-razor.com]
2. Include:
- Description of the vulnerability
- Steps to reproduce
- Potential impact
- Suggested fix (if any)
3. Allow 90 days for patching before public disclosure

Bug Bounty: Not currently available

Security Checklist

Pre-Deployment

- [ ] All environment variables set securely
- [ ] NEXTAUTH_SECRET generated with strong entropy
- [ ] CLEANUP_API_KEY configured
- [ ] S3 bucket policy reviewed and tested

- [ ] Database connection uses SSL
- [ ] HTTPS/TLS certificates configured
- [ ] CORS policies restrictive
- [ ] Error messages don’t leak sensitive info

Post-Deployment

- [ ] Automated cleanup job scheduled
- [ ] Monitoring and alerting configured
- [ ] Regular database backups enabled
- [ ] Security headers configured (CSP, HSTS, etc.)
- [ ] Dependency scanning enabled (Dependabot)
- [ ] Penetration testing completed
- [ ] Incident response plan documented

Compliance Matrix

Requirement	Feature	Status
GDPR Article 15	Data export API	✅ Complete
GDPR Article 17	Right to erasure	✅ Complete
GDPR Article 30	Audit logging	✅ Complete
GDPR Article 32	Encryption at rest	✅ Complete
GDPR Article 32	Access controls	✅ Complete
HIPAA	Not certified	❌ N/A
SOC 2	Not certified	❌ N/A

Last Updated: December 31, 2025
Version: 1.0
Maintained By: Clarity Razor Security Team