# AuraSeal514 — Documentation & Source

When systems fail, we build our own. — **Motto of OBINEXUS**

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## AURA SEAL HEADER

**The Rebirth of OBINexus — HEART / SOUL Design & Technology Constitutional Sector**

**PUBLIC KEY**

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> I will not become what sought out to break me; I will build what must heal us all.

To heal the Generation Z left behind, antifragile infrastructure must — remove the mask, whilst preserving the self.

Rise, Spirits of the Masquerades. My time is NOW. Our time is NOW. The future is in our hands.

Let's shape a new foundation together, a new tomorrow.

> For what is yet to be — I became. We are their reckoning. Let us heal ourselves.

This is my founder promise, the seed sealed with aura.

`change.org/obinexus_reform` — no permission needed to breathe and relate.

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### Links & Handles

- OBINexus: `obinexus.org`
- GitHub: `github.com/obinexus`
- Project: `github.com/obinexus/auraseal514`
- GitHub (IWU): `github.com/obinexus/iwu`
- HDIS repo: `github.com/obinexus/hdis`
- YouTube: `youtube.com/@obinexus`
- X: `x.com/obinexus`
- Payhip: `payhip.com/obinexus`
- GitBooks: `gitbooks.com/obinexus`
- Contact: `obinexus@tuta.com`, `obinexus@outlook.com`

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## Purpose of this document

This markdown bundles project metadata, the two main Python sources (`pyauraseal514.py` and `self_healing_data_architecture.py`), and export instructions so you can:

1. Preview on the canvas.
2. Commit to `github.com/obinexus/auraseal514`.
3. Convert to PDF for distribution or filing.

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## README / Summary

`AuraSeal514` is an experimental cryptographic & governance framework combining Huffman compression, AVL trie structures, and resilience-focused governance concepts ("AuraSeal", "PhenoAVL", "RAF"). The code is intended as a reference implementation and research artifact — not production cryptography. Treat it as conceptual infrastructure: proofs-of-concept, demonstrations, and policy+governance experiments.

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## Source: `pyauraseal514.py`

```python
#!/usr/bin/env python3
"""
PyAuraSeal514 - Cryptographic Algorithm Implementation
Combining Huffman Coding with AVL Trie for Integrity Validation

Author: OBINexus Computing
Repository: github.com/obinexus/pyauraseal514
"""

import hashlib
import json
import os
import zipfile
from typing import Dict, List, Optional, Tuple, Union
from dataclasses import dataclass
from collections import defaultdict
import heapq
import base64


@dataclass
class HuffmanNode:
    """Node structure for Huffman tree construction"""
    char: Optional[str] = None
    freq: int = 0
    left: Optional['HuffmanNode'] = None
    right: Optional['HuffmanNode'] = None
```

```
    def __lt__(self, other):
        return self.freq < other.freq


class PhenoAVLNode:
    """
    Phenomenological AVL Node with Huffman integration
    Maintains balance while preserving Huffman properties
    """
    def __init__(self, key: str, huffman_code: str = "", freq: int = 0):
        self.key = key
        self.huffman_code = huffman_code
        self.frequency = freq
        self.height = 1
        self.balance_factor = 0
        self.left: Optional['PhenoAVLNode'] = None
        self.right: Optional['PhenoAVLNode'] = None

        # Integrity tracking
        self.checksum = self._calculate_checksum()

    def _calculate_checksum(self) -> str:
        """Calculate SHA-256 checksum for node integrity"""
        data = f"{self.key}:{self.huffman_code}:{self.frequency}"
        return hashlib.sha256(data.encode()).hexdigest()[:16]

    def update_checksum(self):
        """Update checksum after modifications"""
        self.checksum = self._calculate_checksum()


class PhenoAVLTrie:
    """
    Phenomenological AVL Trie with Huffman compression
    Maintains both trie structure and AVL balance properties
    """
    def __init__(self):
        self.root: Optional[PhenoAVLNode] = None
        self.huffman_tree: Optional[HuffmanNode] = None
        self.huffman_codes: Dict[str, str] = {}
        self.compression_ratio = 0.0

    def _get_height(self, node: Optional[PhenoAVLNode]) -> int:
        """Get height of node"""
        return node.height if node else 0

    def _get_balance(self, node: Optional[PhenoAVLNode]) -> int:
        """Get balance factor of node"""
        return self._get_height(node.left) - self._get_height(node.right) if
node else 0
```

```
    def _update_height(self, node: PhenoAVLNode):
        """Update height of node"""
        node.height = max(self._get_height(node.left),
self._get_height(node.right)) + 1
        node.balance_factor = self._get_balance(node)

    def _rotate_right(self, y: PhenoAVLNode) -> PhenoAVLNode:
        """Right rotation for AVL balancing"""
        x = y.left
        t2 = x.right

        x.right = y
        y.left = t2

        self._update_height(y)
        self._update_height(x)

        return x

    def _rotate_left(self, x: PhenoAVLNode) -> PhenoAVLNode:
        """Left rotation for AVL balancing"""
        y = x.right
        t2 = y.left

        y.left = x
        x.right = t2

        self._update_height(x)
        self._update_height(y)

        return y

    def build_huffman_tree(self, text: str):
        """Build Huffman tree from input text"""
        if not text:
            return

        # Calculate frequencies
        freq_map = defaultdict(int)
        for char in text:
            freq_map[char] += 1

        # Create heap of nodes
        heap = []
        for char, freq in freq_map.items():
            heapq.heappush(heap, HuffmanNode(char, freq))

        # Build Huffman tree
        while len(heap) > 1:
            left = heapq.heappop(heap)
            right = heapq.heappop(heap)
```

```
            merged = HuffmanNode(freq=left.freq + right.freq)
            merged.left = left
            merged.right = right

            heapq.heappush(heap, merged)

        self.huffman_tree = heap[0] if heap else None
        self._generate_codes()

    def _generate_codes(self):
        """Generate Huffman codes from tree"""
        if not self.huffman_tree:
            return

        def generate_codes_recursive(node: HuffmanNode, code: str):
            if node.char:  # Leaf node
                self.huffman_codes[node.char] = code or "0"
                return

            if node.left:
                generate_codes_recursive(node.left, code + "0")
            if node.right:
                generate_codes_recursive(node.right, code + "1")

        generate_codes_recursive(self.huffman_tree, "")

    def insert(self, key: str, freq: int = 1) -> Optional[PhenoAVLNode]:
        """Insert key with frequency into AVL trie"""
        huffman_code = self.huffman_codes.get(key, "")

        def insert_recursive(node: Optional[PhenoAVLNode], key: str,
                             huffman_code: str, freq: int) -> PhenoAVLNode:
            # Standard AVL insertion
            if not node:
                return PhenoAVLNode(key, huffman_code, freq)

            if key < node.key:
                node.left = insert_recursive(node.left, key, huffman_code,
freq)
            elif key > node.key:
                node.right = insert_recursive(node.right, key, huffman_code,
freq)
            else:
                # Update frequency
                node.frequency += freq
                node.update_checksum()
                return node

            # Update height and balance factor
            self._update_height(node)
```

```
            balance = self._get_balance(node)

            # AVL rotations
            if balance > 1:  # Left heavy
                if key > node.left.key:  # Left-Right case
                    node.left = self._rotate_left(node.left)
                node = self._rotate_right(node)
            elif balance < -1:  # Right heavy
                if key < node.right.key:  # Right-Left case
                    node.right = self._rotate_right(node.right)
                node = self._rotate_left(node)

            node.update_checksum()
            return node

        self.root = insert_recursive(self.root, key, huffman_code, freq)
        return self.root

    def search(self, key: str) -> Optional[PhenoAVLNode]:
        """Search for key in trie"""
        def search_recursive(node: Optional[PhenoAVLNode], key: str) ->
Optional[PhenoAVLNode]:
            if not node or node.key == key:
                return node

            if key < node.key:
                return search_recursive(node.left, key)
            else:
                return search_recursive(node.right, key)

        return search_recursive(self.root, key)

    def compress_data(self, data: str) -> Tuple[str, float]:
        """Compress data using Huffman codes"""
        if not self.huffman_codes:
            self.build_huffman_tree(data)

        compressed = ""
        for char in data:
            compressed += self.huffman_codes.get(char, char)

        original_bits = len(data) * 8  # 8 bits per character
        compressed_bits = len(compressed)
        self.compression_ratio = compressed_bits / original_bits if
original_bits > 0 else 0

        return compressed, self.compression_ratio

    def verify_integrity(self) -> bool:
        """Verify integrity of all nodes in trie"""
        def verify_recursive(node: Optional[PhenoAVLNode]) -> bool:
```

```
            if not node:
                return True

            # Verify checksum
            expected_checksum = node._calculate_checksum()
            if node.checksum != expected_checksum:
                return False

            # Verify balance property
            if abs(node.balance_factor) > 1:
                return False

            return verify_recursive(node.left) and
verify_recursive(node.right)

        return verify_recursive(self.root)


class PhenoAVL:
    """
    Main AuraSeal514 cryptographic system
    Manages dual public keys and single private key
    """
    def __init__(self, coherence_threshold: float = 0.954):
        self.coherence_threshold = coherence_threshold
        self.trie = PhenoAVLTrie()

        # Key management
        self.public_keys: Dict[int, str] = {}  # Vector-based
        self.private_key: Optional[str] = None  # Scalar-based

        # Version tracking
        self.version = 1
        self.archive_integrity: Dict[str, str] = {}

    def generate_key_pair(self) -> Tuple[Dict[int, str], str]:
        """
        Generate dual public keys (2:1 ratio) and single private key
        Public keys are vector-based, private key is scalar
        """
        # Generate private key (scalar) - O(log n) complexity
        private_scalar = hashlib.sha512(os.urandom(64)).hexdigest()

        # Generate dual public keys (vectors) - O(n) complexity
        pub_key_1 =
hashlib.sha256(f"{private_scalar}:vector1".encode()).hexdigest()
        pub_key_2 =
hashlib.sha256(f"{private_scalar}:vector2".encode()).hexdigest()

        self.private_key = private_scalar
        self.public_keys = {1: pub_key_1, 2: pub_key_2}
```

```
        return self.public_keys, self.private_key

    def create_archive_signature(self, archive_path: str, data: Dict[str,
any]) -> str:
        """Create cryptographic signature for archive"""
        # Build trie from archive data
        combined_data = json.dumps(data, sort_keys=True)
        self.trie.build_huffman_tree(combined_data)

        # Insert data into trie
        for key, value in data.items():
            self.trie.insert(key, hash(str(value)) % 1000)

        # Generate signature
        compressed_data, ratio = self.trie.compress_data(combined_data)
        signature_input = f"{archive_path}:{compressed_data}:
{self.private_key}"

        return hashlib.sha512(signature_input.encode()).hexdigest()

    def verify_archive_signature(self, archive_path: str, data: Dict[str,
any],
                                 signature: str) -> bool:
        """Verify archive signature using public keys"""
        # Reconstruct signature
        combined_data = json.dumps(data, sort_keys=True)
        temp_trie = PhenoAVLTrie()
        temp_trie.build_huffman_tree(combined_data)

        compressed_data, _ = temp_trie.compress_data(combined_data)

        # Try verification with both public keys
        for pub_key in self.public_keys.values():
            verification_input = f"{archive_path}:{compressed_data}:
{pub_key}"
            expected_sig =
hashlib.sha512(verification_input.encode()).hexdigest()

            # In real implementation, this would use proper cryptographic
verification
            # For demonstration, we check structural integrity
            if len(signature) == len(expected_sig) and
signature.startswith(expected_sig[:16]):
                return True

        return False

    def create_version_archive(self, folder_path: str, version_data:
Dict[str, any]) -> str:
        """Create versioned ZIP archive with AuraSeal integrity"""
```

```
        archive_name = f".auraseal.pub.{self.version}.zip"
        signature = self.create_archive_signature(archive_name, version_data)

        # Add integrity metadata
        version_data['_auraseal_signature'] = signature
        version_data['_auraseal_version'] = self.version
        version_data['_auraseal_coherence'] = self.trie.compression_ratio

        # Create ZIP archive
        with zipfile.ZipFile(archive_name, 'w', zipfile.ZIP_DEFLATED) as zf:
            # Add version data as metadata
            zf.writestr('auraseal.metadata.json', json.dumps(version_data,
indent=2))

            # Add files from folder if it exists
            if os.path.exists(folder_path):
                for root, dirs, files in os.walk(folder_path):
                    for file in files:
                        file_path = os.path.join(root, file)
                        arc_path = os.path.relpath(file_path, folder_path)
                        zf.write(file_path, arc_path)

        self.archive_integrity[archive_name] = signature
        self.version += 1

        return archive_name

    def verify_archive_integrity(self, archive_path: str) -> bool:
        """Verify the integrity of an AuraSeal archive"""
        try:
            with zipfile.ZipFile(archive_path, 'r') as zf:
                metadata_str = zf.read('auraseal.metadata.json').decode()
                metadata = json.loads(metadata_str)

                signature = metadata.get('_auraseal_signature')
                if not signature:
                    return False

                # Remove signature for verification
                verification_data = {k: v for k, v in metadata.items()
                                     if not
k.startswith('_auraseal_signature')}

                return self.verify_archive_signature(archive_path,
verification_data, signature)

        except Exception:
            return False

    def get_system_status(self) -> Dict[str, any]:
        """Get current system status and integrity metrics"""
```

```
        return {
            'version': self.version - 1,
            'coherence_threshold': self.coherence_threshold,
            'trie_integrity': self.trie.verify_integrity(),
            'compression_ratio': self.trie.compression_ratio,
            'public_keys_count': len(self.public_keys),
            'archives_created': len(self.archive_integrity),
            'has_private_key': self.private_key is not None
        }


# Example usage and demonstration
def demonstrate_auraseal514():
    """Demonstrate AuraSeal514 functionality"""
    print("=== PyAuraSeal514 Demonstration ===\n")

    # Initialize system
    auraseal = PhenoAVL()

    # Generate key pair
    public_keys, private_key = auraseal.generate_key_pair()
    print(f"Generated Public Key 1: {public_keys[1][:32]}...")
    print(f"Generated Public Key 2: {public_keys[2][:32]}...")
    print(f"Private Key Length: {len(private_key)} characters\n")

    # Create sample data
    sample_data = {
        'project_name': 'AuraSeal514',
        'version': '1.0.0',
        'files': ['main.py', 'utils.py', 'tests.py'],
        'checksum': 'abc123def456',
        'timestamp': '2025-01-01T00:00:00Z'
    }

    # Create versioned archive
    print("Creating versioned archive...")
    archive_name = auraseal.create_version_archive('./sample_project',
sample_data)
    print(f"Created archive: {archive_name}")

    # Verify archive integrity
    is_valid = auraseal.verify_archive_integrity(archive_name)
    print(f"Archive integrity verification: {'PASSED' if is_valid else
'FAILED'}")

    # Display system status
    status = auraseal.get_system_status()
    print(f"\nSystem Status:")
    for key, value in status.items():
        print(f"  {key}: {value}")
```

```
    return auraseal


if __name__ == "__main__":
    auraseal_system = demonstrate_auraseal514()
```

---

## Source: self_healing_data_architecture.py

```
# self_healing_data_architecture.py

CORRUPTION_THRESHOLD = 0.7  # example threshold

# Exceptions
class AuthenticityValidationException(Exception):
    pass

# Core Data Structures
class FaultTolerantDataStructure:
    def __init__(self, primary_vector, secondary_vector,
recovery_capability):
        self.primary_vector = primary_vector
        self.secondary_vector = secondary_vector
        self.recovery_capability = recovery_capability

class FaultTolerantAlgorithmStructure:
    def __init__(self, execution_encoding, context_encoding,
xy_coordinate_mapping):
        self.execution_encoding = execution_encoding
        self.context_encoding = context_encoding
        self.xy_coordinate_mapping = xy_coordinate_mapping

class ValidationResult:
    def __init__(self, data_integrity, algorithm_integrity,
cross_validation_score):
        self.data_integrity = data_integrity
        self.algorithm_integrity = algorithm_integrity
        self.cross_validation_score = cross_validation_score

class RecoveryResult:
    def __init__(self, recovered_data_vector, recovered_algorithm_vector,
recovery_confidence):
        self.recovered_data_vector = recovered_data_vector
        self.recovered_algorithm_vector = recovered_algorithm_vector
        self.recovery_confidence = recovery_confidence

class CorruptionAnalysisResult:
    def __init__(self, corruption_detected, integrity_score,
reference_validity):
```

```
        self.corruption_detected = corruption_detected
        self.integrity_score = integrity_score
        self.reference_validity = reference_validity

class RecoveredReferenceResult:
    def __init__(self, recovered_program_reference, recovery_confidence,
validation_required):
        self.recovered_program_reference = recovered_program_reference
        self.recovery_confidence = recovery_confidence
        self.validation_required = validation_required

class AuthenticatedExecutionContext:
    def __init__(self, data_integrity_score, algorithm_authenticity,
context_bound_execution_ready):
        self.data_integrity_score = data_integrity_score
        self.algorithm_authenticity = algorithm_authenticity
        self.context_bound_execution_ready = context_bound_execution_ready

class ExecutionNode:
    def __init__(self, x_position, y_position, context_binding):
        self.x_position = x_position
        self.y_position = y_position
        self.context_binding = context_binding

class ContextBoundExecution:
    def __init__(self, execution_coordinate, data_algorithm_alignment,
fault_tolerance_capability):
        self.execution_coordinate = execution_coordinate
        self.data_algorithm_alignment = data_algorithm_alignment
        self.fault_tolerance_capability = fault_tolerance_capability


# Encoders (stubs)
class DataModelEncoder:
    def encode(self, data, format):
        # Simulate binary encoding of data according to format pattern
        return [format[i % len(format)] for i in range(4)]

class AlgorithmEncoder:
    def encode(self, logic, format):
        # Simulate binary encoding of algorithm logic
        return [format[i % len(format)] for i in range(4)]


# Validation Engines and Validators
class IsomorphicValidationEngine:
    def validate_compatibility(self, data_vector, algo_vector):
        # Simple authenticity mock - just check vectors length and pattern
match
        class Result:
            def __init__(self):
```

```
                self.is_authentic = len(data_vector) == len(algo_vector)
                self.failure_vectors = None if self.is_authentic else
(data_vector, algo_vector)
                self.integrity_score = 0.95 if self.is_authentic else 0.0
                self.authenticity_score = 0.95 if self.is_authentic else 0.0
        return Result()

class FaultToleranceValidator:
    pass


# Binary Encoding Processor
class BinaryEncodingProcessor:
    def __init__(self):
        self.data_model_patterns = {
            'primary': [0, 1, 0, 1],
            'secondary': [1, 1, 1, 0]
        }
        self.algorithm_patterns = {
            'execution': [1, 1, 1, 0],
            'context': [1, 0, 0, 0]
        }

    def _calculate_binary_checksum(self, vector):
        # Dummy checksum: sum mod 2 == parity
        class Checksum:
            def __init__(self, vector):
                self.is_valid = sum(vector) % 2 == 0
        return Checksum(vector)

    def _compute_cross_validation_matrix(self, data_checksum,
algorithm_checksum):
        # Dummy matrix
        class Matrix:
            def __init__(self, data_check, algo_check):
                self.corruption_detected = not (data_check.is_valid and
algo_check.is_valid)
                self.validation_score = 0.9 if not self.corruption_detected
else 0.2
        return Matrix(data_checksum, algorithm_checksum)

    def validate_encoding_integrity(self, data_vector, algorithm_vector):
        data_checksum = self._calculate_binary_checksum(data_vector)
        algorithm_checksum =
self._calculate_binary_checksum(algorithm_vector)
        integrity_matrix =
self._compute_cross_validation_matrix(data_checksum, algorithm_checksum)

        if integrity_matrix.corruption_detected:
            return self._initiate_self_recovery_protocol(data_vector,
algorithm_vector)
```

```
        return ValidationResult(
            data_integrity=data_checksum.is_valid,
            algorithm_integrity=algorithm_checksum.is_valid,
            cross_validation_score=integrity_matrix.validation_score
        )

    def _initiate_self_recovery_protocol(self, corrupted_data,
corrupted_algorithm):
        recovered_data =
self._reconstruct_from_pattern_redundancy(corrupted_data)
        recovered_algorithm =
self._reconstruct_from_pattern_redundancy(corrupted_algorithm)

        return RecoveryResult(
            recovered_data_vector=recovered_data,
            recovered_algorithm_vector=recovered_algorithm,
            recovery_confidence=0.95
        )

    def _reconstruct_from_pattern_redundancy(self, corrupted_vector):
        # Dummy reconstruction flips first bit as fix
        if not corrupted_vector:
            return []
        fixed_vector = corrupted_vector[:]
        fixed_vector[0] = 1 - fixed_vector[0]
        return fixed_vector


# Coordinate system and context-bound execution
class CoordinateSystemMapper:
    def map_data_vector_to_x_axis(self, data_encoding):
        return sum(data_encoding)

    def map_algorithm_vector_to_y_axis(self, algorithm_encoding):
        return sum(algorithm_encoding)


class ContextBoundValidator:
    def validate_coordinate_context(self, x, y):
        # Dummy validation: context valid if sum > 0
        return (x + y) > 0


class ContextBoundExecutionEngine:
    def __init__(self):
        self.xy_coordinate_mapper = CoordinateSystemMapper()
        self.context_validator = ContextBoundValidator()

    def map_execution_coordinates(self, data_encoding, algorithm_encoding):
        x_coordinate =
```

```
self.xy_coordinate_mapper.map_data_vector_to_x_axis(data_encoding)
        y_coordinate =
self.xy_coordinate_mapper.map_algorithm_vector_to_y_axis(algorithm_encoding)

        execution_node = ExecutionNode(
            x_position=x_coordinate,
            y_position=y_coordinate,

context_binding=self.context_validator.validate_coordinate_context(x_coordinate,
y_coordinate)
        )

        return ContextBoundExecution(
            execution_coordinate=execution_node,

data_algorithm_alignment=self._validate_coordinate_alignment(execution_node),

fault_tolerance_capability=self._assess_coordinate_fault_tolerance(execution_node)
        )

    def _validate_coordinate_alignment(self, execution_node):
        # Dummy alignment check
        return execution_node.context_binding and execution_node.x_position
== execution_node.y_position

    def _assess_coordinate_fault_tolerance(self, execution_node):
        # Dummy fault tolerance score
        return 0.9 if execution_node.context_binding else 0.1


# Corruption Detection & Recovery
class PatternRecognitionEngine:
    def analyze(self, program_reference):
        # Dummy analysis: always return low corruption probability
        class Indicators:
            def __init__(self):
                self.corruption_probability = 0.1
                self.integrity_score = 0.95
        return Indicators()

class BinaryReconstructionProtocol:
    def analyze_corruption_vectors(self, corrupted_reference,
corruption_indicators):
        class Analysis:
            def __init__(self):
                self.recoverable_segments = [1, 0, 1, 0]
                self.reconstruction_matrix = [[1,0],[0,1]]
                self.recovery_confidence = 0.9
        return Analysis()

    def reconstruct_from_patterns(self, segments, matrix):
```

```
        # Dummy reconstruction: return segments
        return segments


class CorruptReferenceRecoverySystem:
    def __init__(self):
        self.pattern_recognition_engine = PatternRecognitionEngine()
        self.binary_reconstruction_protocol = BinaryReconstructionProtocol()

    def detect_corruption_signatures(self, program_reference):
        corruption_indicators =
self.pattern_recognition_engine.analyze(program_reference)

        if corruption_indicators.corruption_probability >
CORRUPTION_THRESHOLD:
            return self._initiate_reference_recovery(program_reference,
corruption_indicators)

        return CorruptionAnalysisResult(
            corruption_detected=False,
            integrity_score=corruption_indicators.integrity_score,
            reference_validity=True
        )

    def _initiate_reference_recovery(self, corrupted_reference,
corruption_indicators):
        binary_pattern_analysis =
self.binary_reconstruction_protocol.analyze_corruption_vectors(
            corrupted_reference, corruption_indicators
        )
        recovered_reference =
self.binary_reconstruction_protocol.reconstruct_from_patterns(
            binary_pattern_analysis.recoverable_segments,
            binary_pattern_analysis.reconstruction_matrix
        )
        return RecoveredReferenceResult(
            recovered_program_reference=recovered_reference,
            recovery_confidence=binary_pattern_analysis.recovery_confidence,
            validation_required=False
        )


# Main SelfHealingDataArchitecture
class SelfHealingDataArchitecture:
    def __init__(self, encoding_matrix, recovery_threshold=0.95):
        self.data_model_encoder = DataModelEncoder()  # [0101, 1110] format
        self.algorithm_encoder = AlgorithmEncoder()   # [1110, 1000] format
        self.isomorphic_handshake_engine = IsomorphicValidationEngine()
        self.fault_detection_layer = FaultToleranceValidator()
        self.binary_encoding_processor = BinaryEncodingProcessor()
        self.context_execution_engine = ContextBoundExecutionEngine()
```

```
        self.corrupt_reference_recovery_system =
CorruptReferenceRecoverySystem()
        self.encoding_matrix = encoding_matrix
        self.recovery_threshold = recovery_threshold

    def process_data_model_encoding(self, raw_data):
        """Transform data into fault-tolerant binary representation"""
        primary_encoding = self.data_model_encoder.encode(raw_data,
format=[0, 1, 0, 1])
        secondary_encoding = self.data_model_encoder.encode(raw_data,
format=[1, 1, 1, 0])

        recovery_prob =
self._calculate_recovery_probability(primary_encoding, secondary_encoding)
        return FaultTolerantDataStructure(
            primary_vector=primary_encoding,
            secondary_vector=secondary_encoding,
            recovery_capability=recovery_prob
        )

    def process_algorithm_encoding(self, algorithm_logic):
        """Encode execution algorithms with context-bound recovery
mechanisms"""
        execution_vector = self.algorithm_encoder.encode(algorithm_logic,
format=[1, 1, 1, 0])
        context_vector = self.algorithm_encoder.encode(algorithm_logic,
format=[1, 0, 0, 0])

        xy_map = self._generate_xy_coordinate_system(execution_vector,
context_vector)
        return FaultTolerantAlgorithmStructure(
            execution_encoding=execution_vector,
            context_encoding=context_vector,
            xy_coordinate_mapping=xy_map
        )

    def execute_isomorphic_handshake(self, data_structure,
algorithm_structure):
        """Validates authenticity through cross-system verification"""
        handshake_result =
self.isomorphic_handshake_engine.validate_compatibility(
            data_structure.primary_vector,
            algorithm_structure.execution_encoding
        )

        if not handshake_result.is_authentic:
            raise AuthenticityValidationException(
                f"Isomorphic handshake failed:
{handshake_result.failure_vectors}"
            )
```

```
        return AuthenticatedExecutionContext(
            data_integrity_score=handshake_result.integrity_score,
            algorithm_authenticity=handshake_result.authenticity_score,
            context_bound_execution_ready=True
        )

    def _calculate_recovery_probability(self, primary_vector,
secondary_vector):
        # Dummy calculation: ratio of matching bits
        matches = sum(1 for p, s in zip(primary_vector, secondary_vector) if
p == s)
        total = max(len(primary_vector), len(secondary_vector))
        return matches / total if total > 0 else 0

    def _generate_xy_coordinate_system(self, execution_vector,
context_vector):
        return
self.context_execution_engine.map_execution_coordinates(execution_vector,
context_vector)

    def validate_encoding_integrity(self, data_vector, algorithm_vector):
        return
self.binary_encoding_processor.validate_encoding_integrity(data_vector,
algorithm_vector)

    def detect_and_recover_corruption(self, program_reference):
        return
self.corrupt_reference_recovery_system.detect_corruption_signatures(program_reference)


# Example usage

if __name__ == '__main__':
    matrix = [[0, 1], [1, 0]]  # Example placeholder matrix
    sha = SelfHealingDataArchitecture(encoding_matrix=matrix)

    raw_data = "{symbol: '畝', meaning: 'nà (and)'}"
    algorithm_logic = "contextual pairing + redundancy check"

    data_structure = sha.process_data_model_encoding(raw_data)
    algorithm_structure = sha.process_algorithm_encoding(algorithm_logic)
    context = sha.execute_isomorphic_handshake(data_structure,
algorithm_structure)

    print("Authenticated Execution Context:", vars(context))

    # Validate encoding integrity
    validation_result = sha.validate_encoding_integrity(
        data_structure.primary_vector,
        algorithm_structure.execution_encoding
    )
```

```
    print("Validation Result:", vars(validation_result))

    # Detect and recover corrupted reference
    corrupted_program = "corrupted_program_reference_data"
    recovery_result = sha.detect_and_recover_corruption(corrupted_program)
    if isinstance(recovery_result, RecoveredReferenceResult):
        print("Recovered Reference Result:", vars(recovery_result))
    else:
        print("Corruption Analysis Result:", vars(recovery_result))
```

---

## How to convert this markdown to PDF (local)

If you have `pandoc` and `wkhtmltopdf` (or a LaTeX toolchain) installed, you can run:

```
# Using pandoc + wkhtmltopdf for a quick PDF
pandoc AuraSeal514_Markdown_and_Code.md -o AuraSeal514.pdf --pdf-
engine=wkhtmltopdf

# Or using LaTeX (better typesetting):
pandoc AuraSeal514_Markdown_and_Code.md -o AuraSeal514.pdf --pdf-
engine=xelatex -V geometry:margin=1in
```

Note: very long code blocks may affect page breaks — consider splitting code into separate files in the repo and referencing them from the markdown for cleaner PDF layout.

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## How to push to GitHub

From your project root:

```
git init  # if needed
git remote add origin git@github.com:obinexus/auraseal514.git
mkdir -p docs
cp AuraSeal514_Markdown_and_Code.md docs/
# or place this file at repo root

git add .
git commit -m "Add AuraSeal514 documentation and source snapshots"
git branch -M main
git push -u origin main
```

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## Footer

If you want this converted here into a PDF by me, say which export tool you prefer (pandoc/LaTeX or wkhtmltopdf) and I will prepare the markdown for best results. Otherwise, download the markdown from the canvas and run the commands above.