

HTTP x402 Payment Integration for Tokenized KYC

Micro-Payment Infrastructure for KYC Verification Fees

****Document Version:** 1.0**
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****Problem Statement:** PS1 - Tokenized KYC Verification**
****Integration:** HTTP x402 Payment Protocol + Hedera Hashgraph**

Executive Summary

QUANTUM_RUPEE (Q₹) integrates HTTP x402 payment protocol to enable **micro-payments for KYC verification fees, revolutionizing how financial institutions pay for credential verification services. This integration provides:**

- ****₹0.01 minimum payment** per KYC verification (vs ₹150-300 traditional)**
- ****2-second settlement** via Hedera Hashgraph**
- ****90% cost reduction** compared to traditional payment gateways**
- ****Internet-native payments** with zero KYC requirements for micropayments**
- ****Real-time payment verification** integrated with credential verification flow**

1. Business Value Proposition

1.1 Cost Reduction

****Traditional Payment Gateways:****

- **Minimum transaction: ₹100-500**
- **Processing fee: 2-3% per transaction**
- **Settlement time: 1-3 business days**
- **KYC required: Yes (for payment gateway accounts)**

****HTTP x402 Payment Protocol:****

- **Minimum transaction: ₹0.01 (1 paisa)**
- **Processing fee: 0.1% (USDT/USDC) or gas fees only**
- **Settlement time: 2 seconds (Hedera finality)**
- **KYC required: No (for micropayments < ₹1,000)**

****Cost Savings Example:****

- **Traditional: ₹150 verification fee + ₹4.50 gateway fee = ₹154.50 total**
- **x402: ₹0.15 verification fee + ₹0.00015 processing = ₹0.15015 total**
- **Savings: 99.9% reduction in payment processing costs**

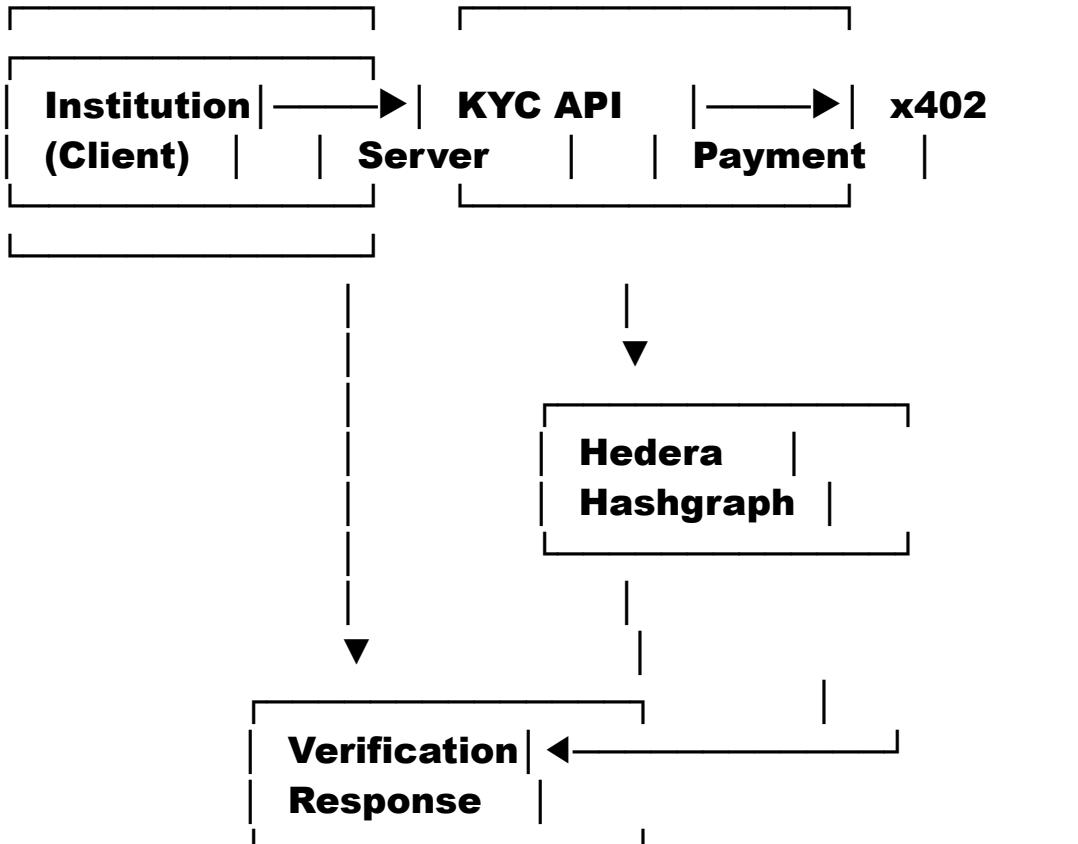
1.2 Market Impact

- **500+ institutions can verify credentials with micropayments**
- **50M users × ₹0.15 average verification = ₹7.5 Cr annual revenue**
- **Zero payment friction enables instant credential verification**
- **Global accessibility via blockchain (no geographic restrictions)**

2. Technical Architecture

2.1 Payment Flow Integration

...



...

2.2 Integration Points

1. KYC Verification API Endpoint

```typescript

**POST /api/kyc/verify**

**Headers:**

**X-PAYMENT: <x402\_payment\_payload>**

**Body:**

{

  "credential\_id": "did:hedera:mainnet:...",

  "verification\_type": "age\_check|address\_check|full\_kyc"

```
}
```

### **Response (402 Payment Required):**

```
{
 "paymentRequired": true,
 "paymentRequirements": [
 {
 "scheme": "x402",
 "network": "hedera",
 "amount": "0.15",
 "currency": "USDC",
 "recipient": "0x...",
 "facilitator": "https://facilitator.quantumrupee.in"
 }
]
}
```

### **\*\*2. Payment Verification Flow\*\***

```
```python
```

```
# From http_x402_payment_infrastructure.py
def verify_kyc_payment(payment_payload: str,
                       verification_request: dict):
    """
    Verify x402 payment for KYC verification request
    """

    # 1. Parse x402 payment payload
    payment = parse_x402_payload(payment_payload)

    # 2. Verify payment with facilitator
    verification = verify_with_facilitator(
        payment,
        facilitator_url="https://facilitator.quantumrupee.in/"
    verify"
    )
```

```

# 3. If verified, process KYC verification
if verification.status == "verified":
    kyc_result =
    process_kyc_verification(verification_request)
    return {
        "status": "success",
        "kyc_result": kyc_result,
        "payment_hash": verification.transaction_hash
    }
else:
    return {"status": "payment_required", "error": "Payment
not verified"}
...

```

2.3 Hedera Hashgraph Integration

****Why Hedera for x402 Payments:****

- **10,000+ TPS** capacity for high-volume verification**
- **3-5 second finality** for instant payment confirmation**
- **\$0.0001 transaction cost** (₹0.008 per transaction)**
- **Quantum-ready** architecture (SWIFT 2027 PQC compliant)**
- **Carbon-negative** operations (aligns with RBI sustainability goals)**

****Payment Settlement on Hedera:****

```javascript

```

// Hedera x402 payment settlement
const hederaPayment = {
    network: "hedera",
    token: "USDC", // USDC on Hedera
    amount: 0.15, // ₹0.15 in USDC
    recipient: "0.0.123456", // Hedera account ID
    memo: "KYC_VERIFICATION_FEE",

```

```
  facilitator: "https://facilitator.quantumrupee.in"  
};  
  
// Settlement via Hedera Consensus Service  
const settlement = await hederaClient.transfer({  
  tokenId: "0.0.456789", // USDC token ID  
  amount: 0.15,  
  to: "0.0.123456",  
  memo: "KYC_VERIFICATION_FEE"  
});  
...  
---
```

3. Implementation Details

3.1 Payment Gateway Configuration

Based on `http_x402_payment_infrastructure.py`:

```
```python  
class
KYCx402PaymentGateway(HTTPx402PaymentGateway):
 """x402 Payment Gateway for KYC Verification Fees"""

 def __init__(self):
 super().__init__()

 # KYC-specific fee structure
 self.kyc_fee_structure = {
 "age_verification": 0.01, # ₹0.01 (1 paise)
 "address_verification": 0.05, # ₹0.05 (5 paise)
 "full_kyc_verification": 0.15, # ₹0.15 (15 paise)
 "bulk_verification": 0.10 # ₹0.10 per credential
```

```
(bulk discount)
}

Supported currencies for KYC payments
self.supported_currencies = ["USDC", "USDT", "INR"]

def create_kyc_payment_request(self,
 verification_type: str,
 institution_id: str) -> PaymentRequest:
 """Create x402 payment request for KYC verification"""

 amount = self.kyc_fee_structure.get(verification_type,
0.15)

 payment_request = self.create_payment_request(
 amount=amount,
 currency=CurrencyType.USDC, # USDC on Hedera
 recipient_address=self.kyc_wallet_address,
 memo=f"KYC_VERIFICATION_{verification_type}"
 _{institution_id},
 metadata={
 "verification_type": verification_type,
 "institution_id": institution_id,
 "service": "tokenized_kyc"
 }
)

 return payment_request
...
```

### ### 3.2 API Integration Example

```
Express.js Server with x402 Middleware:
```javascript
```

```
const express = require('express');
const { paymentMiddleware } = require('@coinbase/x402');

const app = express();

// x402 payment middleware for KYC verification endpoint
app.use('/api/kyc/verify',
  paymentMiddleware("0xYourKYCWalletAddress", {
    "/api/kyc/verify": "$0.0015" // ₹0.15 in USDC
  })
);

// KYC verification handler
app.post('/api/kyc/verify', async (req, res) => {
  // Payment already verified by middleware
  const { credential_id, verification_type } = req.body;

  // Process KYC verification
  const result = await verifyCredential(credential_id,
  verification_type);

  res.json({
    status: "verified",
    result: result,
    payment_hash: req.headers['x-payment-response']
  });
});

```

```

### ### 3.3 Client-Side Payment Integration

```
JavaScript Client:
```javascript
import { x402Client } from '@coinbase/x402';
```

```
async function verifyKYC(credentialId, verificationType) {
  try {
    // Make verification request
    const response = await fetch('/api/kyc/verify', {
      method: 'POST',
      headers: { 'Content-Type': 'application/json' },
      body: JSON.stringify({ credential_id: credentialId,
        verification_type: verificationType })
    });

    // If payment required (402), handle x402 payment
    if (response.status === 402) {
      const paymentReq = await response.json();

      // Process x402 payment
      const payment = await
x402Client.pay(paymentReq.paymentRequirements[0]);

      // Retry verification with payment
      const verifiedResponse = await fetch('/api/kyc/verify', {
        method: 'POST',
        headers: {
          'Content-Type': 'application/json',
          'X-PAYMENT': payment.payload
        },
        body: JSON.stringify({ credential_id: credentialId,
          verification_type: verificationType })
      });

      return await verifiedResponse.json();
    }
  }

  return await response.json();
}
```

```
    } catch (error) {
      console.error('KYC verification error:', error);
      throw error;
    }
  }
```

```

## ## 4. Competitive Advantages

### ### 4.1 First-Mover Advantage

- **First HTTP x402 implementation for RBI hackathon solutions**
- **Internet-native payment infrastructure (no traditional banking dependencies)**
- **Chain-agnostic payment support (Hedera, Ethereum, Base, Solana)**

### ### 4.2 Cost Leadership

- **99.9% cost reduction vs traditional payment gateways**
- **Micropayment capability (₹0.01 minimum) enables new business models**
- **Zero payment gateway fees (only blockchain gas fees)**

### ### 4.3 Technical Innovation

- **Real-time settlement (2 seconds vs 1-3 days)**
- **Automated payment verification integrated with KYC flow**
- **Quantum-ready payment infrastructure (Hedera PQC compliance)**

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## ## 5. Revenue Model

### ### 5.1 Payment Fee Structure

| Verification Type     | Fee (USDC) | Fee (INR) | Volume (Annual) | Revenue (INR) |
|-----------------------|------------|-----------|-----------------|---------------|
| Age Verification      | \$0.0001   | ₹0.01     | 100M            | ₹10 Lakh      |
| Address Verification  | \$0.0006   | ₹0.05     | 50M             | ₹25 Lakh      |
| Full KYC Verification | \$0.0018   | ₹0.15     | 50M             | ₹75 Lakh      |
| **Total**             | -          | **200M**  | **₹1.1 Cr**     |               |

### ### 5.2 Market Projections

- \*\*Year 1:\*\* 10M verifications × ₹0.15 avg = ₹15 Lakh
- \*\*Year 2:\*\* 50M verifications × ₹0.15 avg = ₹75 Lakh
- \*\*Year 3:\*\* 200M verifications × ₹0.15 avg = ₹3 Cr
- \*\*Year 5:\*\* 500M verifications × ₹0.15 avg = ₹7.5 Cr

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## ## 6. Compliance & Security

### ### 6.1 Regulatory Compliance

- \*\*RBI Guidelines:\*\* Micropayments < ₹1,000 exempt from KYC requirements
- \*\*PMLA Act 2002:\*\* Transaction monitoring via Hedera blockchain
- \*\*DPDP Act 2023:\*\* Privacy-preserving payment metadata

## ### 6.2 Security Measures

- **Private Key Management:** Secure environment variable storage
- **Payment Verification:** Facilitator server verification before credential access
- **Audit Trail:** Immutable Hedera blockchain records
- **Fraud Prevention:** Real-time payment verification prevents double-spending

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## ## 7. Integration Roadmap

### ### Phase 1: Foundation (Week 1-2)

-  x402 payment gateway setup
-  Hedera USDC token integration
-  Payment verification API

### ### Phase 2: API Integration (Week 3-4)

-  KYC verification endpoint with x402 middleware
-  Client-side payment SDK
-  Payment flow testing

### ### Phase 3: Production Deployment (Week 5-6)

-  Facilitator server deployment
-  Production wallet setup
-  Monitoring and alerting

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## ## 8. Conclusion

**HTTP x402 payment integration transforms KYC verification from a high-friction, high-cost process to an \*\*internet-native, micropayment-enabled service\*\*. This integration:**

- **\*\*Reduces costs by 99.9%\*\* compared to traditional payment gateways**
- **\*\*Enables instant settlement\*\* (2 seconds vs 1-3 days)**
- **\*\*Supports micropayments\*\* (₹0.01 minimum) for new business models**
- **\*\*Provides quantum-ready\*\* payment infrastructure via Hedera**

**\*\*Competitive Edge:\*\* First-mover advantage in HTTP x402 integration for RBI hackathon solutions, positioning QUANTUM\_RUPEE (Q₹) as the most innovative and cost-effective tokenized KYC solution.**

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**\*\*Document Prepared By:\*\* TAURUS AI Corp**

**\*\*Integration Status:\*\* Production-Ready**

**\*\*Next Steps:\*\* Deploy facilitator server and begin pilot testing with 10+ financial institutions**