A skyscrapers in a city

Description automatically generated

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# EXECUTIVE SUMMARY

This document delineates Scotiabank’s data management strategy in the context of adopting the Unified Payments Interface (UPI) system. It serves as the foundational blueprint for the integration of UPI within Scotiabank’s data infrastructure.

The document encompasses detailed data tables, an exhaustive data dictionary, and a collection of SQL queries. These components are tailored to support Scotiabank’s strategic initiative to incorporate UPI—a real-time payment system that facilitates inter-bank transactions.

Data tables included in the document provide a structured representation of Scotiabank’s UPI-related data entities. They define the schema for user accounts, transactions, and audit logs, highlighting the relational model that supports UPI transaction processing.

A data dictionary is provided, offering detailed definitions, formats, and permissible values for each data element relevant to UPI transactions. This dictionary is crucial for maintaining data integrity and ensuring that all stakeholders have a uniform understanding of data terms.

A series of SQL queries are documented to facilitate common tasks such as initiating UPI transactions, reconciling accounts, and generating compliance reports. These queries are optimized for performance, considering the high-volume and real-time nature of UPI transactions.

# DATA ELEMENTS & DEFINITION

|  |  |
| --- | --- |
| Users Table | |
| UserID (PK) | VarChar(24) |
| Password | VarChar(64) |
| FirstName | VarChar(50) |
| LastName | VarChar(50) |
| Email | VarChar(320) |
| PhoneNumber | Int |
| Date of Birth | Date |
| Address | Text |
| DateCreated | DateTime |

**Users.UserID**

|  |  |
| --- | --- |
| Field Name: | UserID |
| DataType | VarChar |
| Length: | 24 |
| Purpose: | Unique identifier is permanently assigned to each customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphanumeric |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Users.Password**

|  |  |
| --- | --- |
| Field Name: | Password |
| DataType | VarChar |
| Length: | 64 |
| Purpose: | Highly secured password integrated with MFA used for login |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphanumeric, special characters. |
| Sources: | User generated |
| Security/privacy Constraints: | Encrypted by SHA-256 hash function |

**Users.FirstName**

|  |  |
| --- | --- |
| Field Name: | FirstName |
| DataType | VarChar |
| Length: | 50 |
| Purpose: | Provides the first name identity of the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphabet only |
| Sources: | User generated |
| Security/privacy Constraints: | N/A |

**Users.LastName**

|  |  |
| --- | --- |
| Field Name: | LastName |
| DataType | VarChar |
| Length: | 50 |
| Purpose: | Provides the last name identity of the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphabet only |
| Sources: | User-generated |
| Security/privacy Constraints: | N/A |

**Users.PhoneNumber**

|  |  |
| --- | --- |
| Field Name: | PhoneNumber |
| DataType | Int |
| Length: | 10 |
| Purpose: | First-level Contact with the customer. |
| Unit Type: | N/A |
| Range of Possible Values: | 10 |
| Value Explanation: | Values should be numbers with 10 digits only |
| Sources: | User-generated |
| Security/privacy Constraints: | Encrypted as a part of Critical Risk Data (CRD) |

**Users.DOB**

|  |  |
| --- | --- |
| Field Name: | DOB |
| DataType | Date |
| Length: | N/A |
| Purpose: | Date of birth of the customer. |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | DD/MM/YYYY |
| Sources: | User-generated |
| Security/privacy Constraints: | Encrypted as a part of Critical Risk Data (CRD) |

**Users.Address**

|  |  |
| --- | --- |
| Field Name: | Address |
| DataType | Text |
| Length: | N/A |
| Purpose: | Current latest residing address of the customer. |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | N/A |
| Sources: | User-generated |
| Security/privacy Constraints: | Encrypted as a part of Critical Risk Data (CRD) |

**Users.DateCreated**

|  |  |
| --- | --- |
| Field Name: | DateCreated |
| DataType | DateTime |
| Length: | N/A |
| Purpose: | The timestamp at the time the customer was registered |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | N/A |
| Sources: | System generated by site embedded. |
| Security/privacy Constraints: | N/A |

|  |  |
| --- | --- |
| Accounts Table | |
| AccountID (PK) | VarChar(30) |
| UserID (FK) | VarChar(24) |
| AccountType | Enum |
| AccountNumber | VarChar(50) |
| Balance | Money |
| Currency | Char(10) |
| DateOpened | DateTime |

**Accounts.AccountID**

|  |  |
| --- | --- |
| Field Name: | AccountID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | The unique identifier is permanently assigned to each customer account |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Accounts.UserID**

|  |  |
| --- | --- |
| Field Name: | UserID |
| DataType | VarChar |
| Length: | 24 |
| Purpose: | The unique identifier is permanently assigned to each customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphanumeric |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Accounts.AccountType**

|  |  |
| --- | --- |
| Field Name: | AccountType |
| DataType | Enum |
| Length: | N/A |
| Purpose: | Identifies the type of account associated with the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Savings, checking, credit |
| Value Explanation: | Values should be from the range of given value |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Accounts.AccountNumber**

|  |  |
| --- | --- |
| Field Name: | AccountNumber |
| DataType | VarChar |
| Length: | 50 |
| Purpose: | Provides the account number associated with the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values should be from the range of given value |
| Sources: | Mobile banking |
| Security/privacy Constraints: | Encrypted as a part of Critical Risk Data (CRD) |

**Accounts.Balance**

|  |  |
| --- | --- |
| Field Name: | Balance |
| DataType | Money |
| Length: | N/A |
| Purpose: | Money available in the account associated with the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Retains and round-off up to two decimal places |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Accounts.Currency**

|  |  |
| --- | --- |
| Field Name: | Currency |
| DataType | Char(10) |
| Length: | N/A |
| Purpose: | Type of currency associated with the customer’s account |
| Unit Type: | N/A |
| Range of Possible Values: | CAD, USD |
| Value Explanation: | It should be either from the range |
| Sources: | System generated |
| Security/privacy Constraints: | N/A |

**Accounts.DateOpened**

|  |  |
| --- | --- |
| Field Name: | DateOpened |
| DataType | DateTime |
| Length: | N/A |
| Purpose: | The timestamp at the time the account was opened |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | N/A |
| Sources: | System generated by site embedded. |
| Security/privacy Constraints: | N/A |

|  |  |
| --- | --- |
| VPI Table | |
| ReceiverVPIID (PK- Composite key) | VarChar(30) |
| SenderVPIID (PK- Composite key) | VarChar(30) |
| UserID (FK) | VarChar(24) |
| DefaultAccountID (FK) | Varchar(30) |
| VPI | VarChar(30) |
| DateCreated | DateTime |

**VPI.ReceiverVPIID**

|  |  |
| --- | --- |
| Field Name: | ReceiverVPIID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | Unique number associated with Receiver Virtual Payment Identity |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**VPI.SenderVPIID**

|  |  |
| --- | --- |
| Field Name: | SenderVPIID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | Unique number associated with Sender Virtual Payment Identity |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**VPI.UserID**

|  |  |
| --- | --- |
| Field Name: | UserID |
| DataType | VarChar |
| Length: | 24 |
| Purpose: | The unique identifier is permanently assigned to each customer. |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values will be alphanumeric |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**VPI.DefaultAccountID**

|  |  |
| --- | --- |
| Field Name: | DefaulltAccountID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | The unique identifier is permanently assigned to each customer account |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**VPI.VPI**

|  |  |
| --- | --- |
| Field Name: | VPI |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | A virtual Payment identifier is assigned to each account chosen by the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**VPI.DateCreated**

|  |  |
| --- | --- |
| Field Name: | DateCreated |
| DataType | DateTime |
| Length: | N/A |
| Purpose: | The timestamp at the time the customer was registered |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | N/A |
| Sources: | System generated |
| Security/privacy Constraints: | N/A |

|  |  |
| --- | --- |
| Transaction Table | |
| TransactionID (PK) | Int |
| SenderVPIID (CK) | VarChar(30) |
| ReceiverVPIID (CK) | VarChar(30) |
| Amount | Money |
| Currency | Char(10) |
| TransactionDate | DateTime |
| Status | Enum |
| Remarks | Text |

**Transaction.TransactionID**

|  |  |
| --- | --- |
| Field Name: | TransactionID |
| DataType | Int |
| Length: | N/A |
| Purpose: | Unique number associated with each transaction |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Transaction.SenderVPIID**

|  |  |
| --- | --- |
| Field Name: | SenderVPIID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | The unique number associated with Sender Virtual Payment Identity |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Transaction.ReceiverVPIID**

|  |  |
| --- | --- |
| Field Name: | ReceiverVPIID |
| DataType | VarChar |
| Length: | 30 |
| Purpose: | The unique number associated with Receiver Virtual Payment Identity |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | N/A |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Transaction.Amount**

|  |  |
| --- | --- |
| Field Name: | Amount |
| DataType | Money |
| Length: | N/A |
| Purpose: | The amount specified for the transaction |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Retains and round-off up to two decimal places |
| Sources: | Mobile banking |
| Security/privacy Constraints: | N/A |

**Transaction.Currency**

|  |  |
| --- | --- |
| Field Name: | Currency |
| DataType | Char(10) |
| Length: | N/A |
| Purpose: | Type of currency associated with the customer’s account |
| Unit Type: | N/A |
| Range of Possible Values: | CAD, USD |
| Value Explanation: | It should be either from the range |
| Sources: | System generated |
| Security/privacy Constraints: | N/A |

**Transaction.TransactionDate**

|  |  |
| --- | --- |
| Field Name: | TransactionDate |
| DataType | DateTime |
| Length: | N/A |
| Purpose: | The timestamp at the time the customer performs the transaction |
| Unit Type: | N/A |
| Range of Possible Values: | N/A |
| Value Explanation: | N/A |
| Sources: | System generated |
| Security/privacy Constraints: | N/A |

**Transaction.Status**

|  |  |
| --- | --- |
| Field Name: | Status |
| DataType | Enum |
| Length: | N/A |
| Purpose: | Provides the status of the transaction initiated by the customer |
| Unit Type: | N/A |
| Range of Possible Values: | Pending, Completed, Cancelled, Failed |
| Value Explanation: | Values should be from the range of given value |
| Sources: | System generated |
| Security/privacy Constraints: | N/A |

**Transaction.Remarks**

|  |  |
| --- | --- |
| Field Name: | Remarks |
| DataType | Text |
| Length: | N/A |
| Purpose: | Customers can leave remarks on the transaction to log |
| Unit Type: | N/A |
| Range of Possible Values: | Min/Max values |
| Value Explanation: | Values should be from the range of given value |
| Sources: | User-generated |
| Security/privacy Constraints: | N/A |

# SCOTIABANK DATABASE



# SCOTIABANK DATABASE AFTER NORMALIZATION



**Cardinality between the tables:**

* Users to Accounts: One-to-Many (1 user can have multiple accounts, but each account is linked to only report.
* One Users to VPI: One-to-Many (1 user can have multiple VPIs, but each VPI is linked to only 1 user).
* Accounts to VPI: One-to-Many (1 account can have multiple VPIs, but each VPI is linked to only 1 account).
* Transactions to Transactions\_VPI: One-to-Many (1 transaction can involve multiple VPIs through sender and receiver roles, but each entry in Transactions\_VPI is linked to only 1 transaction).
* VPI to Transactions\_VPI: Many-to-Many (a VPI can be involved in multiple transactions in different roles).

This schema maintains the integrity of the database, ensures normalization up to 3NF, and clearly defines the relationships between entities using appropriate cardinalities.

# QUERIES

* **The below query showcases how to retrieve the transaction history for a specific account within a date range:**

SELECT \* FROM Transaction WHERE AccountID = 'specific\_account\_id'

AND TransactionDate BETWEEN 'start\_date' AND 'end\_date';

* **The below query showcases how to list all users who have made a transaction over a certain amount:**

SELECT DISTINCT Users.UserID, Users.FirstName, Users.LastName

FROM Users

JOIN Accounts ON Users.UserID = Accounts.UserID

JOIN Transaction ON Accounts.AccountID = Transaction.AccountID

WHERE Transaction.Amount > 'specified\_amount';

* **The below query showcases how to identify the account with the highest number of transactions in a given period:**

SELECT AccountID, COUNT(TransactionID) AS NumberOfTransactions

FROM Transaction

WHERE TransactionDate BETWEEN 'start\_date' AND 'end\_date'

GROUP BY AccountID

ORDER BY NumberOfTransactions DESC

LIMIT 1;

* **The below query showcases how to get the total transaction volume for each VPI role:**

SELECT VPI.Role, SUM(Transaction.Amount) AS TotalAmount

FROM Transaction

JOIN Transactions\_VPI\_Association ON Transaction.TransactionID = Transactions\_VPI\_Association.TransactionID

JOIN VPI ON Transactions\_VPI\_Association.VPIID = VPI.VPIID

GROUP BY VPI.Role;

* **The below query showcases how to identify all users who have not made any transactions since a specific date (possibly inactive users):**

SELECT Users.UserID, Users.FirstName, Users.LastName

FROM Users

LEFT JOIN Accounts ON Users.UserID = Accounts.UserID

LEFT JOIN Transaction ON Accounts.AccountID = Transaction.AccountID

WHERE Transaction.TransactionID IS NULL OR Transaction.TransactionDate < 'specified\_date';

# RACI MATRIX

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Task** | **Abimbola Sanni** | **Bhupinder Singh** | **Geethu Joy** | **Yash Surti** | **Maheep Kaur** |
| Raci Matrix | **I,C** | I,C | I,C | R | I,C |
| Noramalization | **I,C** | I,C | I,C | I,C | R |
| Data Elements and Definition | A,I,C | R | I,C | I,C | **I,C** |
| Visio Diagram | A,I,C | I,C | R | **I,C** | I,C |
| Table Creation | R | I,C | I,C | I,C | I,C |
| Queries | A,I,C | **I,C** | **I,C** | R | I,C |

# REFERENCES

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