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1 Introduction

1.1 Purpose

This document acts as the guide for the [Blockchain Maturity Model \(BMM\)](#)ⁱ supplemental review for solutions that are designed to support banking and financial services.

1.2 Scope

This document is applicable to banking and financial services blockchain, or distributed ledger technology solutions applied to any form of value transfer whether it be money, securities, commodities, tokens, derivatives or financial transaction life-cycle obligations.

1.3 Use

When performing a BMM assessment of a banking or financial services solution, the lead assessor will review the supplemental requirements in this document with the Solution Point of Contact (SPoC)¹ to determine which requirements are applicable as “Domain” requirements. Achievement of Domain requirements allows for the additional designation of “Banking & Financial Services” to the BMM Certification.

The Lead Appraiser and the SPoC reviews the table below and identifies the Banking & Financial Services Use Case row(s) that are applicable to the solution being assessed. Then the requirements that are marked “R” (Required) or “A” (Applicable-TBD) or “N/A” (Not Applicable) are reviewed to determine applicability of the requirements to the solution. The result of the analysis is recorded in the appraisal plan. The Lead Assessor and the SPoC both sign the appraisal plan to reflect their agreement on the BMM supplemental requirements.

1.4 Use Case / Requirements Matrix

As a representative expectation, the matrix below outlines for each use-case the requirements which would likely be required (R), applicability to be decided within the assessment (A) or not applicable (N/A). Any change to the likely status of the requirement can be agreed between the lead assessor and the solution provider.

¹ See BMM Overview Glossary

Financial Service Use Case	Blockchain/Distributed Ledger Technology Requirements																						
	Distributed Ledger Records	Distributed Settlement	Clearance and Settlement	Real-time Settlement	Scalable	High-Capacity	Reconcilable Records	Auditable Records	Identity Verification	Regulatory Reporting/Monitoring	Third Party Legal Responsibilities	Confidentiality	Transaction and Balances	Double-entry Accounting	Tax Lot Accounting	Fractional Reserve Accounting	Digital Securities Issuance	Lending (Payables/Receivables)	Credit and Risk Mgmt Transaction Data	Future-dated Transactions	Interoperability (Legacy Infrastructure)	Interoperability (Other Networks)	Interoperability (Other Protocols)
Value Transfer Business	R	R	R	A	R	A	R	R	R	R	R	A	R	R	A	N/A	R	A	A	R	R	A	A
Individual Banking	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	R	R	A	A
Private Banking	R	R	R	A	R	R	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	A	A
Institutional Banking	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	A	A
Community Banking	R	R	R	A	R	R	R	R	R	R	R	R	R	R	A	R	A	R	R	R	R	A	A
Micro Lending / Micro Payments	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	R	N/A	R	R	R	R	A	A
Credit Cards	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	N/A	N/A	R	R	R	R	A	A
Debit/Pre-Paid Cards	R	R	R	A	R	R	R	R	A	R	R	R	R	R	N/A	N/A	N/A	R	N/A	R	R	A	A
Central Banks and National Banks	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	N/A	N/A	R	R	R	R	A	A
CBDC	A	A	R	A	R	R	R	R	R	R	R	A	R	R	N/A	A	N/A	N/A	N/A	A	A	A	A
Capital Markets (Debt/Equity)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	R	A	A
Structured Products	R	R	R	A	R	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	R	A	A
Exchange-Traded Derivatives	R	R	R	A	R	R	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	R	A	A
Over-the-Counter (OTC) Derivatives	R	R	R	A	A	A	R	R	R	R	R	R	R	R	R	N/A	R	R	R	R	R	A	A
Retail Investing	R	R	R	A	R	R	R	R	R	R	R	R	R	R	R	N/A	N/A	R	A	R	R	A	A
Institutional Investing	R	R	R	A	R	R	R	R	R	R	R	R	R	R	R	N/A	N/A	R	A	R	R	A	A
Governments	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	N/A	R	R	A	R	R	A	A
Supernational Bodies	R	R	R	A	R	R	R	R	R	R	R	R	R	R	N/A	N/A	R	R	A	R	R	A	A
Crypto Currencies	R	R	R	A	A	A	R	R	A	A	A	A	A	A	A	A	R	A	A	A	A	A	A
CeX	R	R	R	A	A	A	R	R	R	R	R	R	R	R	A	N/A	N/A	A	A	A	A	A	A
DeFi (Incl. DeX)	R	R	R	A	A	A	R	R	A	A	A	A	A	A	A	N/A	A	A	A	A	A	A	A
NFT's	R	R	R	A	A	A	R	R	R	A	A	A	A	A	A	N/A	R	A	A	A	A	A	A
P2P Distributed Apps (DApps)	R	R	R	A	A	A	A	A	A	A	A	A	A	A	A	N/A	N/A	A	A	A	A	A	A

Legend

R = Required

A = Assessment to decide Applicability

N/A = Not Applicable

1.5 Assessment Ratings Considerations

For each agreed requirement, the solution will be deemed to meet or not meet the requirement. A justification for the assessment will be evidenced and recommendations for improvement will be provided. It is important to note that the solution as deemed to meet or not meet the supplemental requirements will be at no greater than the BMM assessment ranking. E.g. if the maturity ranking or relevant capability ranking is a “2”, then the supplemental requirements are assessed as applicable to level “2”. If the solution advances in its capabilities to a higher BMM ranking then, the supplemental requirements will need to be reassessed in accordance with the higher ranking.

2 Banking and Finance Use Cases

The Banking and Finance blockchain or DLT solution should be attributed to one or more of the use cases defined below:

2.1 Value Transfer Business (VTB)

A network that involves the issuance, rewarding, or transfer of digital assets or tokens between network participants.



2.2 Individual Banking

Deposit/savings accounts, checking/debit cards, bill pay, loans, mortgages, interest-rate investment products

2.3 Private Banking

Deposit/savings accounts, checking/debit cards, loans, jumbo mortgages, collateralized lending, private investment products, trusts, family office services

2.4 Institutional Banking

Treasury services, corporate loans, credit intermediation, letters of credit, trade finance, market access for investing/hedging, foreign exchange, custody, corporate credit cards

2.5 Community Banking

Credit Unions, Community Chests, Community Pools, Skill/Service sharing

2.6 Micro-lending/Micro Payments

Facilitation of small payments or small loan processing for low-income communities

2.7 Credit Cards

Credit Card processing/settlement, financed cards processing

2.8 Funded Cards

Credit Card processing/settlement, Pre-funded Debit/Gift Cards

2.9 Central Banking and National Banking

Monetary system and policy, Fiat currency issuance, commercial bank reserves, commercial bank lending, quantitative easing

2.10 CBDC's

Central Bank issued and maintained digital currency, separate from fiat currency.

2.11 Capital Markets

Debt and equity issuance (private/public), investment, hedging and margin financing trade settlement

2.12 Structured Products

Origination, issuance, underwriting and investment, hedging and financing trade settlement of asset backed securities and derivatives

2.13 Exchange-Traded Derivatives

Origination, issuance, underwriting and investment, hedging and financing trade settlement of asset and commodity futures and options



2.14 Over-the-Counter (OTC) Derivatives

Origination, issuance, underwriting and investment, hedging and financing trade settlement of interest rate, equity and credit swaps

2.15 Listed Exchanges

Origination, issuance, underwriting and investment, hedging and financing trade settlement of listed equity investments

2.16 Individual Investing

Secondary markets, Mutual Funds, SMA's, Private Investments

2.17 Institutional Investing

Asset owners (Pensions, Foundations, Insurance, Mutual Funds), investment managers, service providers (custodians, prime brokers, administrators, outsourced middle and back office), transfer agents/registrars, trustees

2.18 Government Funding and Appropriations

E.g. financing, grants, aid payments, tax payments, contracts

2.19 Supernational Bodies (BIS, IMF, World Bank, WTO)

E.g. grant and loans distributions, tariffs, central bank/government borrowing and lending

2.20 Crypto currency networks

Payment services for public blockchain, open-source crypto currencies

2.21 Crypto currency exchanges (CeFi)

Centralized cryptocurrency-to-fiat currency or cryptocurrency-to-cryptocurrency exchanges

2.22 DeFi Protocols (incl. DeX)

Public, open-source decentralized protocols for smart contracts covering crypto staking, swaps, derivatives, insurance and market making

2.23 NFT's

Issuance and trading of unique digital tokens via open-source public protocols recording transfers to open-source, public-blockchains

2.24 P2P Distributed Applications (DApps)

Crypto-non-custodial wallets (no recourse)

Crypto network access/analysis/reporting



3 Banking and Finance Solution Requirements:

The specific requirements, some, or all of which may apply to blockchain solutions implemented in the banking and financial services use-cases, are as follows:

3.1 Auditable Records

The solution shall generate ledger reporting to meet general or use-case audit requirements.

Example: The solution uses unique transaction and or asset lot identifier to import/export to a financial reporting system.

Note: Any data generated by an algorithm, rather than a read/write function, will need to be reconciled back to the original distributed ledger.

3.2 Credit and Risk Management Transaction Data (Payables/Receivables)

The solution's ledger reflects the underlying transactional obligations, where the obligations are reflected as future-dated payables and receivables, to be able to measure credit exposure and calculate downstream the risk management of any borrowed, loaned and collateralized assets.

3.3 Clearance & Settlement

The solution shall:

- Reflect settlement finality of executed transactions for digital assets controlled within the network.
- Process clearance and settlement, where applicable, include transfers, trading, financing, and lending transactions.

3.4 Confidentiality

Transaction on the shared distributed ledger shall be anonymous and confidential between the counterparties and any network intermediary.

Example: A transacting hosting node, a transactional protocol.

An analogy is like a stock exchange ticker. A security, an amount and a price are disclosed and published but the buyer and seller are not disclosed.

3.5 Digital Securities Issuance

The solution shall:

- Issue and control securities that are only perfected in the network within which they are held.



Example: it is a single asset, not a token reflecting another asset – e.g. Bitcoin, Ether

- Allow for registrars, transfer agents and mechanisms to service corporate actions such as dividends, income, stock transformations and proxy voting etc. for digitized legacy assets.

3.6 Distributed Ledger Records

The solution shall require that the ledger is distributed among several nodes. And, while all nodes may not be required to hold an entire copy of the ledger, no single node shall hold the only copy of all or part of the ledger.

3.7 Distributed Settlement

The solution shall require that any settlement of a transaction is recorded without the need of a central authority.

3.8 Double-entry Accounting

The solution shall:

- Use double-entry accounting standards to record transactions on an immutable ledger or sub-ledger to be able to produce one-to-one reconcilable transaction and balance records for any downstream general ledger.
- Record transactions formatted to be configurable with GAAP/IFRS² or equivalent jurisdictionally defined accounting standards.

3.9 Fractional Reserve Accounting

The solution shall provably reflect the loan assets vs the liabilities and reserves that back them and show the money supply increase.

Example: The solution correlates the increase in the number of fiat currency or CBDC tokens.

Notes: Commercial banks can expand the money supply by leveraging loans to a regulatory-defined factor vs reserves. This requires any commercial bank to provably reflect the loan assets vs the liabilities and reserves that back them and show the money supply increase.

Current crypto currencies are fully paid for long assets that can only be transferred and not leveraged directly. In DeFi protocols leverage can be created by on-lending staked assets through further chains of DeFi protocols but this is not fractional reserve accounting.

² GAAP (generally accepted accounting principles) / IFRS (international financial reporting standards)



3.10 Future-dated transactions (obligations)

The solution shall record future-dated payables-receivables in the immutable record on the date it was agreed/executed and reflected on the date it will be settled.

Note: This is critical for reconciliation and accrual reporting.

3.11 High Capacity

The solution meets the capacity requirements of high transaction volume use-cases.

3.12 Identity Verification

The solution shall comply with applicable know your customer and know your counterparty regulations.

3.13 Interoperability (legacy infrastructure)

The solution shall include the capability to bring value into (i.e. issue new or digitize legacy assets) or deliver value (i.e. draw down “burn” or redeem new or digitized legacy assets) out of the network. This includes the ability to settle transactions in and out of Blockchain/DLT network with counterparties outside the network.

3.14 Interoperability (other networks)

The solution shall have the capability to transfer or reflect tokens of assets between networks operating the same blockchain/DLT protocol.

3.15 Interoperability (other protocols)

The solution shall have the capability to transfer or reflect tokens of assets between networks operating different blockchain/DLT protocols.

3.16 Lending (Payables/Receivables)

The solution shall have the capability to reflect current-date or future-dated obligations of loaned asset transfers as journal entries within the immutable distributed ledger.

Note: Pending transactions in a smart contract or other type of algorithm do not qualify.

3.17 Real-time Settlement

The solution shall achieve settlement finality upon the first recording of an executed transaction to the distributed ledger.

3.18 Reconcilable Records

The solution shall record:

- Internal trial balances (i.e. debits = credits in the distributed ledger) and balance monitoring (i.e. total quantity of assets controlled within the ledger are accounted for)



- Line-item debits and credits for all transfers ticked and tied one-to-one to the equivalent records in an upstream or downstream system or ledger.

3.19 Regulatory Reporting/Monitoring

The solution shall record the data to report and monitor:

- AML/Suspicious Activity
- Transaction Reporting
- Assets, Liabilities and Equity Sub-Balance Sheet Reporting
- Compliance Requirements e.g. payments travel rule
- Tax Reporting

3.20 Scalable

The solution shall be linearly scalable (vertical and horizontal) for transaction processing.

Note: Simple addition of more nodes, transacting parties, assets, transaction types results in an equivalent increase in solution throughput and capacity.

3.21 Tax-Lot Accounting

The solution records data in formats that generate cost basis Tax Lots

3.22 Third Party Legal Responsibilities

The solution shall be capable of executing Powers of Attorney to authorize or confirm transactions and to indemnify the network and participants from errors or fraud either caused or erroneously approved by any third party validators within the solution

3.23 Transaction and Balances

The solution shall generate bank statement and/or asset custody reporting.



Appendix A: Banking and Financial Services Fundamentals

The simplest summary of the financial services is that it is the facilitation of transfers between those people who have money and those who need it or can provide a service for it.

- An individual can deposit funds in a bank;
- a bank allows the individual to pay people from whom they have bought goods and services via wires, checks, debit and credit cards;
- Various payments solutions allow participants to transfer funds within or above the banking system payments infrastructure;
- a bank can use those deposits or borrow further funds to lend to individuals or businesses;
- a credit card company borrows funds to lend money to individuals or businesses;
- a company, via a broker, can issue debt or equity to fund its business;
- a broker can provide access to markets to buy and sell equity or debt instruments for individuals and legal entities;
- a broker can provide financial advice and investment guidance to individuals or legal entities;
- a bank or broker can provide access to exchange-traded or over-the-counter (OTC) markets to buy or sell derivatives of underlying securities for individuals or legal entities;
- Exchanges, Alternatives Trading Systems (ATS), Electronic Trading Networks (ETN's), Liquidity Pools etc can be accessed by licensed brokers to provide to trade all financial instruments.
- Order books or market makers provide liquidity for exchanges or OTC markets;
- Depositories, Clearing Houses, Trust Banks or Clearing Brokers allow market participants to clear and settle all financial products;
- an investment manager can attract funds from savers;
- a fund can invest in companies, securities or other financial instruments;
- Funds will use transfer agent, back-office operations, custody and fund administration service providers to manage and account for their investment portfolios and client reporting;
- Banks and brokers can provide financing for leveraged investment strategies;
- a bank can provide Treasury Services to large, complex, some global legal entities;
- a global bank can provide foreign exchange to facilitate global trade;
- A bank or broker can offer financial instruments to hedge risk or price volatility.

The best way to envisage these transactions is to reflect them in a balance sheet and income statement. However, it is important to note that in use-cases like custody, the assets do not appear on the custody bank's balance sheet, although they are reflected as part of the asset owner's balance sheet (e.g. private individual, fund or corporation).



Figure 1 below is an intuitive way to understand a balance sheet. Although we are taught that,

$$\text{Assets} = \text{Liabilities} + \text{Equity} \text{ or } \text{Assets} - \text{Liabilities} = \text{Equity},$$

what it really means is:

$$\text{What you Own} - \text{What you Owe} = \text{What you are worth}.$$

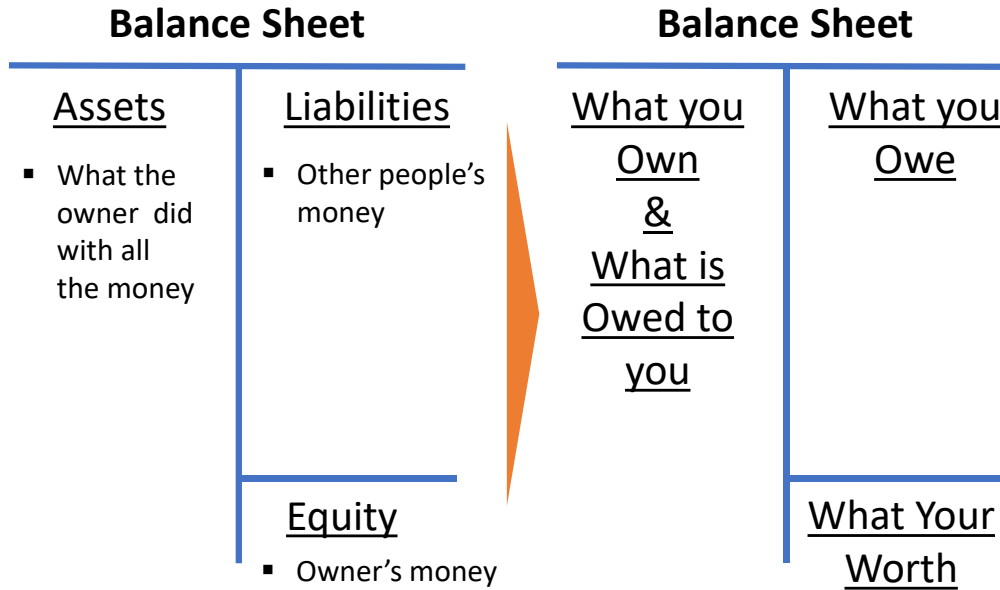


Figure 1: Balance Sheet Explained © LAS Corporation 2021

The profitability of a business is reflected in the Income Statement with:

$$\text{Revenues} - \text{Expenses} = \text{P\&L (profit or loss)}$$

This creates an increase or decrease in the net cash on the assets' side of the balance sheet and an equivalent, equal adjustment to the retained earnings on the Equity's side of the balance sheet as shown below in Figure 2.

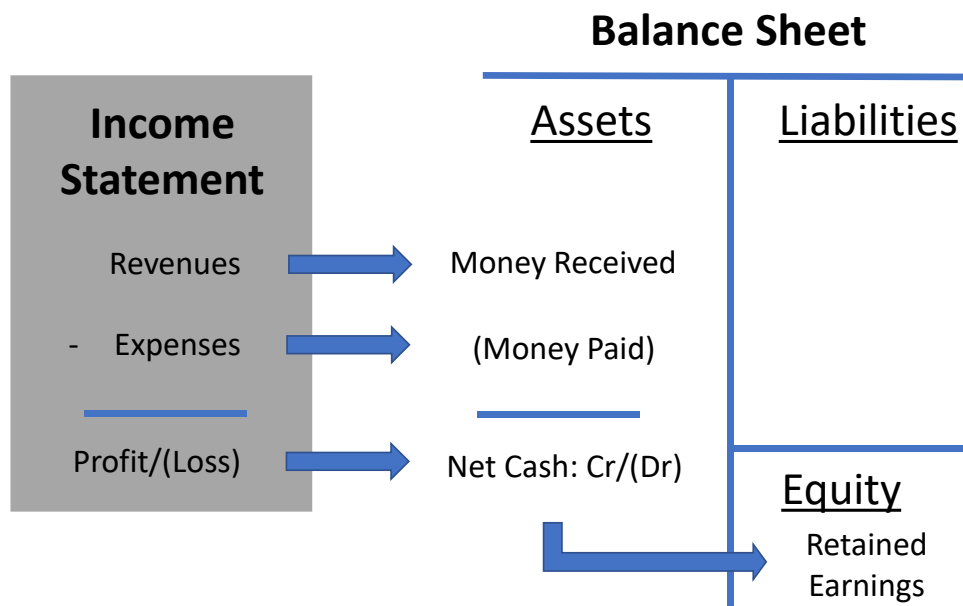


Figure 2: The Income Statement's Relationship to the Balance Sheet © L4S Corporation 2021

A high-level summary of Banks or Brokers balance sheets is shown below with the highlighted benefit of T+0 or real-time settlement in reducing the balance sheet asset (i.e. cost of capital) requirements.

Bank/Broker Balance Sheet

<u>Assets</u>	<u>Liabilities</u>
<i>Unsettled Trades (T+1, +2, +3, +n)</i> <ul style="list-style-type: none"> ▪ Cash/Securities Receivables 	<ul style="list-style-type: none"> ▪ Cash Deposits/Securities Payables
<i>Unsettled FX Trades (TomNext, Spot)</i> <ul style="list-style-type: none"> ▪ Gains net by C/Party 	<ul style="list-style-type: none"> ▪ Losses net by C/Party
<i>Unsettled FX Fwd Trades</i> <ul style="list-style-type: none"> ▪ Gains net by C/party 	<ul style="list-style-type: none"> ▪ Losses net by C/Party
<i>Borrowed/Loaned Cash and/or Securities</i> <ul style="list-style-type: none"> ▪ Cash/Securities Receivables 	<ul style="list-style-type: none"> ▪ Cash Deposits/Securities Payables
<i>Derivatives Contracts</i> <ul style="list-style-type: none"> ▪ Cash/Securities Receivables 	<ul style="list-style-type: none"> ▪ Cash Deposits/Securities Payables
<i>Other, general Assets</i>	<i>Financing: CP, Loans, Bonds etc.</i>
<i>SLR Assets</i>	<u>Equities</u>
<i>HQL/LCR Assets</i>	<ul style="list-style-type: none"> ▪ Bank/Broker Capital ▪ Bank Central Bank Reserves
<i>Tier 1 Assets</i>	

T+0 (real-time)
 Balance Sheet
 Reduction

US Banking Regs: SLR = Statutory Liquidity Ratio, HQL = High Quality Liquid, LCR = Liquidity Coverage Ratio
Note: *Securities under Broker Type 1, Bank Custody or Administration are not reflected on the balance sheet. U.S. requires crypto currencies to be recorded on Custodian's balance sheet.*

Figure 3: High-level Bank/Broker Balance Sheet Representation © L4S Corporation 2021

The balance sheet and income statement have transactions recorded in two accounts, where one is debited and the other is credited. If both accounts are on one-side of the balance sheet, then there is no change to the total size of the balance sheet but an Asset or a Liability and/or Equity are transformed or reclassified. If both accounts are on different sides of the balance sheet then they increase or decrease both sides of the balance sheet equally. It is important to note that any monies, securities or other assets owed between parties will be reflected as payables and receivables, which will be 'drawn down' when the debts repaid and the settlement of the transfer of assets is reflected in the balance sheet.

What will be demonstrated through the various examples is how the various transactions within the different sections of the financial services are reflected on the balance sheet.

A key requirement for any distributed ledger is that it can reflect double-entry accounting for both long transfers and payables/receivables (including future-dated obligations).



Appendix B: List of References

ⁱ <https://gbaglobal.org/blockchain-maturity-model>