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**Government Blockchain Association**

**Blockchain Maturity Model (BMM)**

*Blockchain Maturity Overview*

|  |  |
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Approvals

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| ACM | Amendment History and Change Management |

**GBA BMM Contributors**

This standard was developed by experts from around the world from a diverse range of industries, technologies, and cultures. This document was drafted by, reviewed, and baselined by the following contributors.

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# Introduction

Blockchain is a rapidly advancing technology. It is the core technology behind cryptocurrency and in about ten years has exploded to become the 7th largest economy in the world. However, it is still very much an immature technology. Organizations around the world are building platforms, application, and implementing the technology in almost every industry. Some governments are in the process of purchasing and acquiring blockchain based solutions. However, they have little if any experience in acquiring, implementing, or maintaining blockchain based systems.

This model is not associated with a specific single domain solution but developed to be applicable to solutions in all domains.

The Blockchain Maturity Model (BMM) overview is to provide a brief description of the BMM and to describe:

* Why is the BMM required for a blockchain solution
* What is the scope and requirements of the BMM
* How to use & maintain the BMM (Vendors, Purchasers, and Administration)

All information of the BMM series shall be documented and detailed up to an extent of not allowing you to remember any information.

## Purpose

This BMM Overview document plays the role of giving directions and guidance to the Standards & Certification working group, facilitator and implementor as how to establish, implement, maintain and continually improve the BMM Requirements. This document plays the role of governance and policy making for the BMM Series.

The purpose of this document is to:

* Provide a guidance to mature BMM Series.
* Review and revise to meet industry standards
* Information needed to evaluate or validate BMM Series.

## Scope

The scope of this document describes the four components of the BMM series applicable to blockchain solutions at all layers (network, protocol, application & transactions). The series includes:

* **BMM Overview (this document)** - describing the common terms, definitions, and concepts universally applied in all of the components of the BMM series.
* **Blockchain Maturity Model Requirements** – describing what criteria is required at each level of maturity to ensure confidence in the solution.
* **Training Program Requirements** – describing the method and criteria for ensuring that individuals have demonstrated their competence required to implement and assess BMM compliance.
* **Assessment Program Requirements** – describing the method and criteria required to plan, conduct, and report BMM assessment results.

## Blockchain Principles

This Blockchain principle is fundamental truth or proposition that serves as the foundation for the BMM requirements. The primary principles, Decentralization & Distributed are fundamentals of a blockchain solution. The secondary principles support to achieve the primary principles or the result of the primary principles.

### Primary Principle

The primary reason that the first blockchain was established in the early 1990’s resulted from a concern that as the world was increasingly relying on digital records and those electronic records could be altered without detection. The researchers pondered what it would be like to live in a world where records could not be trusted. Using the work of David Chaum’s paper "Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups" they developed a system that was decentralized and distributed. Later in 2008 the Bitcoin Whitepaper referred to their work as Bitcoin was deployed.

From the first conceptualization of the technology to the explosive growth of blockchain, trust has been the single most important factor in requirements for blockchain solutions. For that reason, blockchain is sometimes referred to as a “Trust Protocol”. The founders of the blockchain technology identified two major principles that would ensure the trust of digital records. They are Decentralization, and Distribution. These two principles form the bedrock of blockchain technology.

* **Decentralization** – No single entity may make a change to information on a blockchain solution without the approval of the relevant blockchain participants.
* **Distributed** – The function of recording information in a blockchain solution is distributed among a network to mitigate the risk of network outages and tampering with data.

### Secondary Principle

The secondary principles are the result of achieving decentralization and distribution. These secondary principles can be used to determine the degree of decentralization and distribution. They are described below.

* **Consensus** – The state of verified information is confirmed by a group of entities that mutually agree on the integrity of the information. This may be performed by a wide variety of consensus and synchronization mechanisms.
* **Cryptography** – Blockchain solutions use cryptograph to secure transactions and records.
* **Immutability –** The information recorded on a blockchain may never be changed. However, new information may be appended to record a change in state. All information and any appended information is permanently recorded.
* **Incentive Mechanism** – Blockchain solutions include an incentive mechanism to motivate stakeholders to sustain the solution.
* **Peer-to-Peer**- Blockchain solutions use Communiations directly between stakeholders without the involvement of a third-party.
* **Resilience** – No single entity or event may interrupt or prevent access to the blockchain solution.
* **Transparency** - Any change to the information recorded in a blockchain solution is visible and transparent to all users and administrators of the solution.

## Blockchain Key Components

Key components including assets, nodes, consensus mechanisms, infrastructure/network, system, participants, protocols, records, and smart contracts or life cycle scripts.

For any solutions, the roles and responsibilities, the assets to be transacted and the transaction types will

# BMM Structure & Content

Using The BMM

# Using & Maintaining the BMM

The Exclusions and assumptions considered in the blockchain solution to be declared. The limitations of exclusions within the principals of Blockchain(TBD as what can be excluded and what shall not, As what can be assumed and what shall not).

need to be agreed and defined.

## References

The BMM has five components [[1]](#footnote-1)in the series. They are:

* BMM Overview <Provides the need >
* Blockchain Maturity Requirements
* Training Program Requirements
* Assessment Program Requirements
* BMM Terms & Definitions

This document describes the Blockchain Maturity Requirements that form the basis for both training and certification.

## Overview

Why – The GBA Standards and Certification working group initiated the focuses on assuring and ensuring the quality, accountability, reliability, and sustainability of blockchain solutions.

The capabilities defined in the Blockchain Maturity Model (BMM), are articulated in two types of requirements and expectations for assessment. There are Generic requirements & expectations, and Domain specific requirements & expectations.

Generic requirements & expectations refer to the set of elements that a blockchain solution should have for it to be a reliable solution. Domain specific are a set of elements that are necessary for the application of blockchain technology to specific domains.

Within each element, there are five levels. The five levels relate to degrees of reliability and dependability for the given element ~~or domain specific element~~.  The five levels are:

* Level 1: Initial
* Level 2: Documented
* Level 3: Validated
* Level 4: Production
* Level 5: Optimizing

To be assessed at any level, all expectations of that level, and below, must be met for all the capabilities.

### Level 1: Initial

The Initial Level is the baseline level. It represents the state of having some portion of the element documented and implemented. For a solution to achieve level one, there must be some evidence that the activities described in the Element description has been documented and/or implemented.

### Level 2: Documented

Elements are assessed as “Documented” when there is evidence that the activities described in the BMM element description have been incorporated into the charter, plans, designs, or other solution documentation. The documentation should be sufficient to provide confidence to investors, potential users & customers that the solution (or potential solution) has the capability to implement the element when deployed into a production environment.

### Level 3: Validated

Elements are assessed as “Validated” when there is adequate evidence that the solution demonstrates that it functions as intended, generating the expected outcome and is a proof-of-concept. The system demonstrates that each element of the system has the capability to satisfy its operational requirements over the lifecycle of the solution.

### Level 4: Production

Elements are assessed as “Production” when there is adequate evidence that they work as intended, generating the expected outcome, together with all the other parts of the blockchain solution. Hence, the solution is capable of operational deployment, with supporting documentation and recording of its performance.

### Level 5: Optimizing

Elements are assessed as “Optimizing” when there is adequate evidence that they can maintain continuity of their operations, with consistent and reliable performance, over a long-period period. Solutions are also expected to demonstrate adequate evidence that they can adapt to the appropriate scale of deployment, while maintaining consistent and reliable performance.

## Terms & Definitions

The terms and definitions used in this model are recorded in Appendix A: Terms & Definitions.

# Elements

For a solution to be reliable for use by organizations, it must be capable of meeting requirements and expectations in the following elements:

* Distribution
* Infrastructure Sustainability
* Governance
* Identity
* Interoperability
* Performance
* Privacy
* Reliability
* Resilience
* Security
* Synchronization

The following subparagraphs describe each element along with requirements and expectations associated with each level.

## Distribution[[2]](#footnote-2)

## Governance

## Identity Management

## Interoperability

## Performance

## Privacy

## Reliability

## Resilience (Fault Tolerance)

## Security

## Synchronization

## Infrastructure Sustainability

# Continual Improvement Requirements

The sustainable requirements below are supplemental to the BMM overview described above. The sustainable requirements are applicable to achieving a sustainable BMM series. The following sustainable requirements are available.

* Revision Frequency of the BMM series
* Financial Charges and requirements
* Usage of Domain Specific Requirements.

The requirements are described below in the sub-paragraphs.

## Revision Frequency of the BMM series

The revisions are applicable on all the series:

* BMM Overview
* Blockchain Maturity Requirements
* Training Program Requirements
* Assessment Program Requirements
* BMM Terms & Definitions
  + 1. **BMM Overview**

Reviewed every year for any sustainable growth on this BMM overview document to give better clarity on the usage of the BMM series to the user.

* + 1. **Blockchain Maturity Requirements**

Reviewed every year for any sustainable growth.

### Training Program Requirements

Training content for the BMM – to be started from the Overview covering BC revolution, the primary and secondary principles, explanation of Glossary, points of interpretations to be identified, type and extent of documented information across BMM, Rules-to achieve Level 1 maturity a BC solution should achieve Level 1 in all the 11 elements; As a value addition if the levels of an element is capable of achieving next level, the same will be communicated to the client as per the assessment contract conditions. However, the Maturity Level Announcement (MLA) will be announced only for the completeness of all 11 elements for a specific level.

Reviewed every year for any sustainable growth.

### Assessment Program Requirements

Assessment contract condition – If a client is applying for a Specific Level Assessment (SLA), the BC solution will be assessed only for that level and the Maturity Level Announcement will be communicated, no further value addition will be provided (for example if a client is asking for maturity level 1 then only that level’s effort will be calculated and performed). If a client is applying for Cross Level Assessment (CLA), the BC solution will be assessed across all levels and as per the criteria (to achieve Level 1or 2 or 3 or 4 or 5 maturity a BC solution should achieve Level 1or 2 or 3 or 4 or 5 in all the 12 elements accordingly) and subsequently Maturity Level Announcement will be made for the level which has covered all 12 elements and as a value addition the extent of maturity achieved to the maximum across all the 12 elements also will be communicated by Maturity Profile to the client as per the contract conditions.

The Maturity Level Announcement will be made available in the GBA website for 18 months from the report date.

Reviewed every year for any sustainable growth.

### BMM Terms & Definitions

Reviewed every year for any sustainable growth.

## Approval mechanism of the BMM series

### Working Draft

Voting for finalization –Minimum 80% within our Group (for each element /area) <Any oppositions on the 80% needs to be considered>.

Group Draft – Voting for Finalization – Minimum 80% within Our Group (Overall) <Any oppositions on the 80% needs to be considered>

Percentage calculation based on the Participation of Group members and if the percentage is less than the specified level revisiting and revision to be done.

### Final Draft

Voting for finalization –Minimum 70% Among all the Working Groups <Any oppositions on the 70% needs to be considered>

Percentage calculation based on the Participation as each Working Group and if the percentage is less than the specified level revisiting and revision to be done.

| **Term** | **Definition** |
| --- | --- |
| Administrative Control | The ability to make changes to either node hardware or ledger updates. |
| Asset | Anything that has value to a stakeholder. See ISO/TS 19299:2015 3.3 |
| Block | Structured data comprising block data and a block header |
| Block data | Structured data comprising zero or more transaction records or references to transaction records. |
| Block header | Structured data that includes a cryptographic link to the previous block unless there is no previous block |
| Block reward | reward given to miners or validators after a block is confirmed in a block chain system |
| Blockchain | distributed ledger with confirmed transactions organized in an append-only, sequential chain using cryptographic links |
| Blockchain system | system that implements a blockchain |
| Charter | The term “charter’ or “project charter” refers to one or more documents that describes how the blockchain solution will be implemented. It could be a proposal, white paper, project plan, design document, technical data package or any other combination of work products that define the intentions of parties to implement a blockchain solution. |
| Components | Referred to nodes, consensus mechanisms, infrastructure/network, system, deterministic scripts and smart contracts. |
| Consensus | Agreement among DLT nodes that a transaction is [validated](https://www.iso.org/obp/ui/#iso:std:iso:22739:ed-1:v1:en:term:3.81) and that the distributed ledger contains a consistent set and ordering of validated [transactions](https://www.iso.org/obp/ui/#iso:std:iso:22739:ed-1:v1:en:term:3.77) |
| Consensus Mechanism | Rules and procedures by which consensus is reached |
| Consensus Mechanisms |  |
| Crypto-asset | Digital asset implemented using cryptographic techniques |
| Cryptocurrency | crypto-asset designed to work as a medium of value exchange |
| Cryptographic hash function | function mapping binary strings of arbitrary length to binary strings of fixed length, such that it is computationally costly to find for a given output an input that maps to the output, it is computationally infeasible to find for a given input a second input that maps to the same output, and it is computationally infeasible to find any two distinct inputs that map to the same output |
| Cryptographic link | Reference, constructed using a cryptographic hash function technique, that points to data. |
| Cryptography | Discipline that embodies the principles, means, and methods for the transformation of data in order to hide their semantic content, prevent their unauthorized use, or prevent their undetected modification. |
| Decentralization | This term is used to describe the degree to which decision or actions can be taken by a single party compared to a general population of stakeholders |
| Decentralization |  |
| Decentralization Score | A value or measure that describes the level of decentralization. It consists of multiplying the number of validator nodes by the percentage of nodes that need to achieve consensus. |
| Decentralized application DApp | Application that runs on a decentralized system |
| Decentralized system | distributed system wherein control is distributed among the persons or organizations participating in the operation of the system |
| Digital Asset | **Asset** that exists only in digital form or which is the digital representation of another asset. |
| Domain Area | The set of functions that are necessary for the application of blockchain technology for specific uses. |
| Element | A single characteristic that a blockchain solution should have for it to be a reliable solution. |
| Elements | The set of characteristics that a blockchain solution should have for it to be a reliable solution. |
| Immutability | property wherein ledger records cannot be modified or removed once added to a distributed ledger |
| Interoperability | The ability of two or more systems or applications to exchange information and assets. It also includes the ability to mutually use the information and assets that have been exchanged. |
| Key Component | A component that if it fails or is degraded would negatively impact the overall performance of the blockchain solution. |
| Nodes |  |
| Shall | Referring to a mandatory requirement. |
| Should | Refers to support the establishment, implementation, maintenance and continually improve. |
| Smart Contract |  |
| Transaction Finalization |  |

Special thanks to the following people for their hard work, contributions, and inputs:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Amendment History and Change Management | | | | |
| Version | Changes / Reasons | Change reference | Changed by | Date |
| v0.1/draft | Initial | Initial | Executive Director | 01Oct2020/  01Nov2020 |
| v0.2/draft | Compliance with other Guideline and Standards added as Section 3.2.1 and subsequent section numbers changed until Section 3.2.9. Ballot Presentation changed to Ballot Delivery. Included 3.2.7 Ballot Return. | Section 3.2 and Sub Sections (SS) and their requirements | Executive Director | 06Nov2020 |
| v0.3/draft | This new Appendix ACM added for tracking the amendments and manage the changes. | Appendix ACM | Working Group Leader | 24Nov2020 |
| V0.4/draft | 2.9 Reliability element inclusion.  Deletion of the sub sections of the Functional Areas 3.1 and 3.2  Inclusion of the reference of Technical |  |  | 07Jan2021 |
| Ver 0.5/draft | Addition in introduction, Detailing the level five of the Governance in par to Definition towards global.  Detailed this BMM as Requirements & Expectations. |  |  | 21Jan2021 |
| Ver0.6/draft | Addition of 10th element “Sustainability”, With in the meetings held it has been decided to have the ISO standards referred for reaching the expectations. Against each level the requirements will be given. Security level approach will be maintained for all the elements. Removing the Functional areas (3.1 to 3.2.9) from this document. The Levels 3 and 4 amended. |  |  | 22Apr2020 |

1. At the present time, this document is a draft component that is under review and comment. [↑](#footnote-ref-1)
2. See the glossary for the term “Decentralization” [↑](#footnote-ref-2)