



L2 Aliasing of EVM based Addresses Version 1.0



L2 Aliasing of EVM based Addresses Version 1.0

Project Specification Draft

Open Project:

[Layer 2 Working Group](#), an initiative of [Oasis Open Projects](#)

Project Chair:

Dan Shaw (daniel.shaw@ethereum.org), [Ethereum Foundation](#), Andreas Freund (a.freundhaskel@gmail.com), [Ethereum Foundation](#)

Editors:

Kelvin Fichter (kelvin@optimism.io)

Andreas Freund (a.freundhaskel@gmail.com)

Daniel Goldman (dgoldman@offchainlabs.com)

Related work:

NA

Abstract:

The document describes the minimal set of business and technical prerequisites, functional and non-functional requirements for Aliasing of EVM based Addresses that when implemented ensures that two or more Layer 1, Layer 2, or Sidechains can identify and translate EVM based addresses from different Layer 1, Layer 2, or Sidechains.

Status:

This document is no longer under active development and is a Project Specification Draft as of April 2023. The L2 WG is looking for implementers of the specification to move the specification to Full Project Specification.

Comments on this work can be provided by opening issues in the project repository.

Keywords:

The keywords “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “NOT RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [\[RFC2119\]](#) when, and only when, they appear in all capitals, as shown here.

Citation format:

When referencing this specification the following citation format should be used:

[evm-based-l2-address-aliasing-v1.0] *EVM based Address Aliasing Specification Version 1.0*. Edited by Kelvin Fichter, and Andreas Freund. 08 February 2023. OASIS Standard. <https://github.com/eea-oasis/L2/tree/main/workitems/EVM-based-L2-address-aliasing/evm-based-l2-address-aliasing-v1.0-psd01.md>. Latest stage: <https://github.com/eea-oasis/L2/tree/main/workitems/EVM-based-L2-address-aliasing/evm-based-l2-address-aliasing-v1.0-psd01.md>.

Notices

Copyright © OASIS Open 2023. All Rights Reserved.

Distributed under the terms of the OASIS [IPR Policy](#).

For complete copyright information please see the Notices section in the Appendix.

Table of Contents

[1 Introduction](#)

[1.1 Overview](#)

[1.2 Glossary](#)

[1.3 Typographical Conventions](#)

[1.3.1 Requirement Ids](#)

[2 Concepts and Design](#)

[3 Aliasing of EVM based Addresses Specification](#)

[4 Conformance](#)

[4.1 Conformance Targets](#)

[4.2 Conformance Levels](#)

[Appendix A - References](#)

[A.1 Normative References](#)

[A.2 Non-Normative References](#)

[Appendix B - Security Considerations](#)

[B.1 Data Privacy](#)

[B.2 Production Readiness](#)

[B.3 Internationalization and Localization](#)

[Appendix C - Acknowledgments](#)

[Appendix D - Revision History](#)

[Appendix E - Notices](#)

1 Introduction

The L2 WG is an open-source initiative with a scope to

- Identify and document the most relevant use cases and business requirements for Layer 2 and other Blockchain Scalability solutions for EVM compatible public blockchains
- Define a technical standard with identification and differentiation of classes of scalability solutions as required that meet both ecosystem and enterprise requirements, with a particular focus on interoperability between Layer 2 solutions for EVM compatible public blockchains
- For EVM compatible public blockchains, identify, document, and devise solution approaches for Layer 2 Blockchain scalability solution specific challenges such as MEV, block (gas) limits, TVL concentration, etc.
- Identify and document characteristics of Layer 2 Blockchain environments for EVM compatible public blockchains that will be key in addressing mainstream and enterprise adoption.

The work is an [Ethereum Community Project](#), which is managed by [OASIS](#).

1.1 Overview

The ability to deterministically derive addresses of a digital asset or an externally owned account (EOA) in EVM based execution frameworks for L1s, L2s, Sidechains based on an origin chain of an asset or EOA, known as address aliasing, simplifies interoperability between EVM based L1s, L2s, and Sidechains because:

- It allows messages from chain A (source chain) to unambiguously address asset A (smart contract) or EOA on chain Y (target chain), if asset A or EOA exists on Chain X and on Chain Y.
- It allows a user to deterministically verify the source chain of a message, and, if required, directly verify the origin chain of asset A or EOA and its state on its origin chain utilizing a canonical token list of the (message) source chain.

Note, that address aliasing between non-EVM and EVM-based L1s, L2s, and Sidechains, and between non-EVM-based L1s, L2s, and Sidechains is out of scope of this document.

1.2 Glossary

Address Aliasing

Refers to a method by which an address is associated with another (destination) address.

Blockchain:

An open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way.

Bridge:

Provides a connection that allows for the transfer of digital tokens or data between two different Layer 1, Layer 2 or Sidechain systems.

Externally Owned Account

An Ethereum address that is controlled by a cryptographic private key.

Layer 1:

A base blockchain network, such as Bitcoin, or Ethereum, and its underlying infrastructure that validates and finalizes transactions without the need of another blockchain network.

Layer 2:

A secondary framework or protocol that is built on top of an existing Layer 1 system in such a way that it inherits the security properties of the Layer 1 system while allowing for a higher transaction throughput than the Layer 1 system.

Layer 3:

A tertiary framework or protocol that is built on top of an existing Layer 2 system in such a way that it inherits the security properties of the Layer 2 system while allowing for an improvement of a Layer 2 characteristic such as higher transaction throughput than the Layer 2 system or transaction privacy.

Sidechain:

A secondary blockchain connected to the main blockchain with a two-way peg and using its own trust assumptions.

Two-Way Peg:

A mechanism by which tokens are transferred between a blockchain and a Sidechain and back at a fixed or otherwise deterministic exchange rate.

1.3 Typographical Conventions

1.3.1 Requirement Ids

A requirement is uniquely identified by a unique ID composed of its requirement level followed by a requirement number, as per convention **[RequirementLevelRequirementNumber]**.

There are four requirement levels that are coded in requirement ids as per below convention:

[R] - The requirement level for requirements which IDs start with the letter *R* is to be interpreted as **MUST** as described in [RFC2119](#).

[D] - The requirement level for requirements which IDs start with the letter *D* is to be interpreted as **SHOULD** as described in [RFC2119](#).

[O] - The requirement level for requirements which IDs start with the letter *O* is to be interpreted as **MAY** as described in [RFC2119](#).

Note that requirements are uniquely numbered in ascending order within each requirement level.

Example : It should be read that [R1] is an absolute requirement of the specification whereas [D1] is a recommendation and [O1] is truly optional.

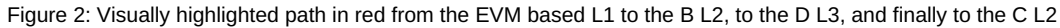
2 Concepts and Design

The ability to unambiguously, and deterministically, relate an address for a digital asset (smart contract) or an externally owned account (EOA) between EVM based L1s, L2s, and Sidechains where this digital asset or EOA exists, also known as address aliasing, is critical prerequisite for interoperability between EVM based L1s, L2s, and Sidechains. However, there is currently no way to do so in a standardized way – imagine every internet service provider were to define its own IP addresses.

Hence, this document establishes an unambiguous and deterministic standard for EVM based address aliasing based on the concept of root → leaf where an address alias is derived based on the address on the origin chain and an offset which is an immutable characteristic of the origin chain.

See Figure 1 for the conceptual root → leaf design with offset.

rather clarify the connections between the different possible paths an asset can take from an L1 to different L2/L3s and the `relativAddress` of that asset, we visually highlight in red the path from the EVM based L1 to the B L2, to the D L3, and finally to the C L2.



The requirements below are only valid for EVM based L1s, L2, or Sidechains. Address aliasing for non-EVM systems is out of scope of this document.

An address alias – `addressAlias` – to be used between Chain A and Chain B MUST be constructed as follows: `addressAlias (Chain A) = offsetAlias (for Chain A) relativeAddress (on Chain A) offsetAlias (for Chain B)`

[R2]

[R2] testability: `offsetAlias` can be parsed and split using existing open source packages and the result compared to `knowrchainId` used in the construction.

The `chainId` used in the `offsetAlias` MUST NOT be zero (0)

[R4]

[R4] testability: The length of the `chainId` string can be converted to bytes and then compared to 8.

In case the chainId has less than 16 digits the chainId MUST be padded with zeros to 16 digits.

03 August 2025 - Page 4 of 8

Non-Standards Track Work Product

[R5] testability: chainId can be parsed and split using existing open source packages and the result compared to knowrchainId used in the construction. Subsequently the number of zeros used in the padding can be computed and compared to the expected number of zeros for the padding.

[R6]

The offsetAliasfor Ethereum Mainnet as the primary anchor of EVM based chains MUST be 0x11111000 due to current adoption of this offset by existing L2 solutions.

An example of address alias for the USDC asset would be `addressAlias = 0x1111A0b86991c6218b36c1d19D4a2e9Eb0cE3606eB481111`

[R6] testability: This requirement is a special case of [R1]. Hence, it is testable.

[R7]

The `relativeAddress` of an Externally Owned Account (EOA) or Smart Contract on a chain MUST either be the smart contract or EOA address of the origin chain or a `relativeAddress` of an EOA or Smart Contract from another chain.

An example of the former instance would be the relative address of wrapped USDC, `relativeAddress = 0x1111A0b86991c6218b36c1d19D4a2e9Eb0cE3606eB481111`, and an example of the latter would be the relative address of wrapped USDC on Polygon, `relativeAddress = 0x00000000000001371111A0b86991c6218b36c1d19D4a2e9Eb0cE3606eB4811110000000000000137`.

Finally, an example of an address alias for a message to another L1, L2, or Sidechain for wrapped USDC from Ethereum on Arbitrum would be:

```
addressAlias = 0x00000000000421611111A0b86991c6218b36c1d19D4a2e9Eb0cE3606eB4811110000000000042161
```

[R7] testability: Since this document is dealing with EVM-based systems with multiple live implementations, there are multiple known methods of how to verify if an address belongs to an EOA or a smart contract.

[R8]

The order of the `offsetAliases` in an `addressAlias` MUST be ordered from the `offsetAlias` of the root chain bracketing the `relativeAddress` on the root chain through the ordered sequence of `offsetAliases` of the chains on which the digital asset exists.

For example, a valid `addressAlias` of an asset on chain A bridged to chain B and subsequently to chain C and that is to be bridged to yet another chain from chain C would be:

```
addressAlias = chainId(C) chainId(B) chainId(A) relativeAddress chainId(A) chainId(B) chainId(C)
```

However, the reverse order is invalid:

```
addressAlias = chainId(A) chainId(B) chainId(C) relativeAddress chainId(C) chainId(B) chainId(A)
```

[R8] testability: Since [R1] is testable and since [R8] is an order rule for the construction in [R1], which can be tested by applying logic operations on the output of [R1] tests, [R8] is testable.

Note, that a proof that a given order is provably correct is beyond the scope of this document.

4 Conformance

This section describes the conformance clauses and tests required to achieve an implementation that is provably conformant with the requirements in this document.

4.1 Conformance Targets

This document does not yet define a standardized set of test-fixtures with test inputs for all MUST, SHOULD, and MAY requirements with conditional MUST or SHOULD requirements.

A standardized set of test-fixtures with test inputs for all MUST, SHOULD, and MAY requirements with conditional MUST or SHOULD requirements is intended to be published with the next version of the standard.

4.2 Conformance Levels

This section specifies the conformance levels of this standard. The conformance levels offer implementers several levels of conformance. These can be used to establish competitive differentiation.

This document defines the conformance levels of EVM based Address Aliasing as follows:

- **Level 1:** All MUST requirements are fulfilled by a specific implementation as proven by a test report that proves in an easily understandable manner the implementation's conformance with each requirement based on implementation-specific test-fixtures with implementation-specific test-fixture inputs.
- **Level 2:** All MUST and SHOULD requirements are fulfilled by a specific implementation as proven by a test report that proves in an easily

Non-Standards Track Work Product

understandable manner the implementation's conformance with each requirement based on implementation-specific test-fixtures with implementation-specific test-fixture inputs.

- **Level 3:** All MUST, SHOULD, and MAY requirements with conditional MUST or SHOULD requirements are fulfilled by a specific implementation as proven by a test report that proves in an easily understandable manner the implementation's conformance with each requirement based on implementation-specific test-fixtures with implementation-specific test-fixture inputs.

[D1]

A claim that a canonical token list implementation conforms to this specification **SHOULD** describe a testing procedure carried out for each requirement to which conformance is claimed, that justifies the claim with respect to that requirement.

[D1] testability: Since each of the non-conformance-target requirements in this documents is testable, so must be the totality of the requirements in this document. Therefore, conformance tests for all requirements can exist, and can be described as required in [D1].

[R9]

A claim that a canonical token list implementation conforms to this specification **atLevel 2** or higher **MUST** describe the testing procedure carried out for each requirement at **Level 2** or higher, that justifies the claim to that requirement.

[R9] testability: Since each of the non-conformance-target requirements in this documents is testable, so must be the totality of the requirements in this document. Therefore, conformance tests for all requirements can exist, be described, be built and implemented and results can be recorded as required in [R9].

Appendix A - References

This appendix contains the normative and non-normative references that are used in this document.

While any hyperlinks included in this appendix were valid at the time of publication, OASIS cannot guarantee their long-term validity.

A.1 Normative References

The following documents are referenced in such a way that some or all of their content constitute requirements of this document.

[RFC2119]

S. Bradner, Key words for use in RFCs to Indicate Requirement Levels, <http://www.ietf.org/rfc/rfc2119.txt>, IETF RFC 2119, March 1997.

A.2 Non-Normative References

[EIP55]

Vitalik Buterin , Alex Van de Sande, "Mixed-case checksum address encoding", <https://github.com/ethereum/EIPs/blob/master/EIPS/eip-55.md>, EIP Repository, January 2016

...

Appendix B - Security Considerations

B.1 Data Privacy

The standard does not set any requirements for compliance to jurisdiction legislation/regulations. It is the responsibility of the implementer to comply with applicable data privacy laws.

B.2 Production Readiness

The standard does not set any requirements for the use of specific applications/tools/libraries etc. The implementer should perform due diligence when selecting specific applications/tools/libraries.

There are security considerations as to the Ethereum-type addresses used in the construction of `relativeAddress`.

If the Ethereum-type address used in `relativeAddress` is supposed to be an EOA, the target system/recipient should validate that the `codehash` of the source account is `NULL` such that no malicious code can be executed surreptitiously in an asset transfer.

If the Ethereum-type address used in `relativeAddress` is supposed to be a smart contract account representing an asset, the target system/recipient should validate that the `codehash` of the source account matches the `codehash` of the published smart contract solidity code to ensure that the source smart contract behaves as expected.

Lastly, it is recommended that as part of `relativeAddress` validation the target system performs an address checksum validation as defined in [EIP-55].

B.3 Internationalization and Localization

Given the non-language specific features of EVM-based address aliasing, there are no internationalization/localization considerations.

Appendix C - Acknowledgments

The following individuals have participated in the creation of this specification and are gratefully acknowledged.

Participants:

Gabriel Barros

Kelvin Fichter

Andreas Freund

Daniel Goldman

...

Appendix D - Revision History

Revisions made since the initial stage of this numbered Version of this document have been tracked or [Github](#).

Appendix E - Notices

Copyright © OASIS Open 2022. All Rights Reserved.

All capitalized terms in the following text have the meanings assigned to them in the OASIS Intellectual Property Rights Policy (the "OASIS IPR Policy"). The full [Policy](#) may be found at the OASIS website.

This specification is published under the [CC0 1.0 Universal \(CC0 1.0\)](#) license. Portions of this specification are also provided under the [Apache License 2.0](#).

All contributions made to this project have been made under the [OASIS Contributor License Agreement \(CLA\)](#).

For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the [Open Projects IPR Statements](#) page.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published, and distributed, in whole or in part, without restrictions of any kind, provided that the above copyright notice and this section are included on all such copies and derivative works. However, this document itself may not be modified in any way, including by removing the copyright notice or references to OASIS, except as needed for the purpose of developing any document or deliverable produced by an OASIS Open Project (in which case the rules applicable to copyrights, as set forth in the OASIS IPR Policy, must be followed) or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by OASIS or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and OASIS DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY OWNERSHIP RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. OASIS AND ITS MEMBERS WILL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY USE OF THIS DOCUMENT OR ANY PART THEREOF.

As stated in the OASIS IPR Policy, the following three paragraphs in brackets apply to OASIS Standards Final Deliverable documents (Project Specifications, OASIS Standards, or Approved Errata).

[OASIS requests that any OASIS Party or any other party that believes it has patent claims that would necessarily be infringed by implementations of this OASIS Standards Final Deliverable, to notify OASIS TC Administrator and provide an indication of its willingness to grant patent licenses to such patent claims in a manner consistent with the IPR Mode of the OASIS Open Project that produced this deliverable.]

[OASIS invites any party to contact the OASIS TC Administrator if it is aware of a claim of ownership of any patent claims that would necessarily be infringed by implementations of this OASIS Standards Final Deliverable by a patent holder that is not willing to provide a license to such patent claims in a manner consistent with the IPR Mode of the OASIS Open Project that produced this OASIS Standards Final Deliverable. OASIS may include such claims on its website but disclaims any obligation to do so.]

[OASIS takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this OASIS Standards Final Deliverable or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on OASIS' procedures with respect to rights in any document or deliverable produced by an OASIS Open Project can be found on the OASIS website.]

Non-Standards Track Work Product

Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this OASIS Standards Final Deliverable, can be obtained from the OASIS TC Administrator. OASIS makes no representation that any information or list of intellectual property rights will at any time be complete, or that any claims in such list are, in fact, Essential Claims.]

The name “OASIS” is a trademark of [OASIS](https://www.oasis-open.org/), the owner and developer of this specification, and should be used only to refer to the organization and its official outputs. OASIS welcomes reference to, and implementation, and use of, specifications, while reserving the right to enforce its marks against misleading uses. Please see <https://www.oasis-open.org/policies-guidelines/trademark> for the above guidance.

