Technical Report on AI and Multimedia Authenticity Standards

Mapping the standardisation landscape

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Executive Summary

This technical report provides a comprehensive overview of the current landscape of standards and specifications related to digital media authenticity and artificial intelligence. It categorizes these standards into five key clusters: content provenance, trust and authenticity, asset identifiers, rights declarations, and watermarking. The report highlights the importance of these standards in ensuring the integrity, traceability, and trustworthiness of digital content, particularly in the context of generative AI and its implications for content creation and distribution.

By mapping the contributions of various Standard Development Organizations (SDOs) and groups, this report identifies existing gaps and opportunities for further standardization. It serves as a valuable resource for stakeholders seeking to navigate the complex ecosystem of digital media standards and implement best practices to safeguard the authenticity and rights of digital assets. The findings underscore the critical role of robust standards in fostering trust and accountability in the evolving digital landscape.

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1. Introduction

This report provides a comprehensive overview of various standards and specifications related to digital media, focusing on content provenance, trust authenticity, asset identifiers, rights declarations, and watermarking. These standards are essential for ensuring the authenticity of both synthetic and non-synthetic digital content. As generative AI continues to evolve, the need for robust standards becomes increasingly critical to protect the interests of creators, consumers, and organizations.

The standards discussed in this report are developed by various Standard Development Organizations (SDOs) and groups, each contributing to different aspects of AI and authenticity. By adhering to these guidelines, organizations can maintain the trustworthiness and provenance of their digital assets, ensuring that content remains authentic and traceable throughout its lifecycle.

1.1. About the AMAS initiative

TBD

1.2. Methodology

The approach taken in this report involves a thorough review of existing standards and specifications related to digital media. The focus is on identifying key areas where standards already exist, and from that, what is still needed to ensure the authenticity and integrity of digital content. From that review, we have broken this report into the categories: content provenance, trust and authenticity, asset identifiers, rights declarations, and watermarking.

2. Categories of Standards

In this white paper, we have clustered those standards and specifications in the scope of this analysis into five categories: content provenance, trust and authenticity, asset identifiers, rights declaration and watermarking. Rights declaration, in turn, is defined in two inclinations: general purpose and opt-out mechanisms. The general purpose rights declaration addresses a broad scope while the opt-out mechanisms refer to a specific aspect of rights declaration that is of relevance to the scope of this document.

2.1. Content Provenance

Content provenance refers to information on the origin and history of digital content. This is an

important tool for the verification of the authenticity and integrity of digital assets. Provenance information helps in tracking the creation, modification, and distribution of content, providing a transparent record that can be used to establish trust and accountability. This is particularly important in use cases and applications where the authenticity of content is paramount, such as in journalism, scientific research, and digital art.

2.2. Trust and Authenticity

Trust and authenticity measures ensure that digital content is genuine and has not been tampered with. Such mechanisms are essential for maintaining the integrity of digital media, especially in environments where content manipulation is a significant concern. By implementing trust and authenticity measures, organizations can protect their digital assets from unauthorized alterations and ensure that consumers can rely on the content they receive.

2.3. Asset Identifiers

Asset identifiers are unique codes assigned to digital content to ensure proper management and tracking. These identifiers help in maintaining a clear and organized record of digital assets, making it easier to organize, manage and distribute content. By using asset identifiers, organizations can ensure that their digital media is properly tracked and accounted for, reducing the risk of loss or unauthorized use.

2.4. Rights Declarations

2.4.1. General Purpose

Rights declarations are formal statements that outline the rights and permissions associated with digital content. These declarations help in clarifying the ownership and usage rights of digital assets, providing a clear framework for how content can be used and shared. By establishing clear rights declarations, organizations can protect their intellectual property and ensure that their digital assets are used in accordance with their intended purpose.

2.4.2. Opt-Out Mechanisms

Opt-out mechanisms are a specialized approach to rights declarations that allow users to exclude their content from certain processes, such as data mining or AI training. These mechanisms are essential for protecting the privacy and rights of content creators, ensuring that their digital assets are not used without their consent. By implementing opt-out mechanisms, organizations can provide users with greater control over their content and ensure that their rights are respected.

2.5. Watermarking

Watermarking ensures that digital content is marked in a way that can be used to verify its authenticity and ownership. Watermarking is increasingly used to facilitate the declaration of the rights of content creators and ensuring that their digital assets are not used without their consent. By implementing watermarking measures, organizations can provide users with greater control over their content and make sure that their rights are respected.

3. Overview of Specifications

3.1. Content Credentials (C2PA)

- **SDO/Group:** C2PA
- **Link:** C2PA Specification
- **Status:** Published
- **Media Types:** Any
- **Summary:** This standard provides guidelines for embedding content credentials in digital media to ensure provenance. It outlines methods for attaching metadata to digital assets, which can include information about the creator, creation date, and any modifications made to the content. This helps in maintaining a verifiable record of the content's history.

3.2. Content Credentials (ISO 22144)

- **SDO/Group:** ISO TC 171/SC 2
- **Link:** ISO 22144
- **Status:** In progress
- **Media Types:** Any
- **Summary:** This ISO standard outlines methods for documenting content credentials to maintain provenance. It specifies the types of metadata that should be included and the formats for storing this information. By following these guidelines, organizations can ensure that their digital content is traceable and its authenticity can be verified.

3.3. JPEG Trust Part 1: Core foundation

- **SDO/Group:** ISO/IEC JTC 1/SC 29/WG 1 (JPEG)

- **Link:** ISO/IEC 21617-1:2025, second edition in progress
- **Status:** Published
- **Media Types:** Any, but focused on images
- **Summary:** This standard focuses on ensuring trust in JPEG images through provenance, detection and fact-checking. It provides a framework for embedding metadata in the form of trust indicators directly into JPEG files, allowing users to decide the degree of trust they can put on a digital asset, based on provenance, authenticity, and intellectual property, as a function of their trust profiles. This is particularly useful in contexts where image manipulation is common, such as in social media applications.

3.4. JPEG Trust Part 2: Trust profiles catalogue

- **SDO/Group:** ISO/IEC JTC 1/SC 29/WG 1 (JPEG)
- **Status:** In Progress
- **Media Types:** Any, but focused on images
- **Summary:** This standard introduces a series of Trust Profiles that can be used either as is or as starting points to establish profiles for use in specific workflows, use cases and applications such as broadcasting, digital cameras, AI-powered content generation services, etc.

3.5. JPEG Trust Part 3: Media asset watermarking

- **SDO/Group:** ISO/IEC JTC 1/SC 29/WG 1 (JPEG)
- **Status:** Initiated
- **Media Types:** Images
- **Summary:** This standard is planned to provide an overview of mechanisms used for watermarking of media assets.

3.6. CAWG Metadata

- **SDO/Group:** Creation Assertions Working Group, as part of DIF
- **Link:** CAWG Metadata
- **Status:** Published (new version in progress)
- **Media Types:** Any
- **Summary:** This specification provides a framework for expressing metadata that captures detailed information about the content, including ownership and authorship.

3.7. Originator Profile

- **SDO/Group:** Originator Profile
- **Link:** Originator Profile
- **Status:** In progress
- **Media Types:** Web pages
- **Summary:** This specification provides a framework for documenting the origin of digital content. It includes guidelines for creating and maintaining profiles that capture detailed information about the content's creator and its creation process. This helps in establishing a clear and verifiable record of the content's provenance.

3.8. PROV

- **SDO/Group:** Open Provenance
- **Link:** PROV
- **Status:** Published
- **Media Types:** Any
- **Summary:** This standard offers a model for representing provenance information in digital content. It defines a set of concepts and relationships that can be used to describe the history of a digital asset, including its creation, modification, and distribution. This model can be applied across various types of digital content, providing a flexible and comprehensive approach to provenance documentation.

3.9. Overview of trustworthiness in artificial intelligence

- **SDO/Group:** ISO/IEC JTC 1/SC 42
- **Link:** ISO/IEC TR 24028:2020
- **Status:** Published
- **Media Types:** n/a
- **Summary:** This standard offers an overview of trustworthiness in artificial intelligence. It provides guidelines for assessing the reliability and integrity of AI systems, ensuring that they produce trustworthy results. This is crucial in applications where AI is used to generate or manipulate digital content, as it helps in maintaining the authenticity of the output.

3.10. Framework for trust-based media services

- **SDO/Group:** ITU-T
- **Link:** ITU-T Y.3054
- **Status:** Published
- **Media Types:** n/a
- **Summary:** This framework provides guidelines for trust-based media services. In particular, it includes methods for establishing and maintaining trust in digital media platforms, ensuring that users can rely on the content they access. This is particularly important in contexts where media services are used to distribute sensitive or high-value content.

3.11. Trust.txt

- **SDO/Group:** JournalList
- **Link:** Trust.txt
- **Status:** Initiated
- **Media Types:** Web pages
- **Summary:** This specification outlines methods for establishing trust in digital content. It includes guidelines for creating and maintaining trust.txt files, which can be used to document the trustworthiness of digital assets. This helps in ensuring that users can verify the authenticity of the content they receive.

3.12. Chromium Reputation Provider Framework

- **SDO/Group:** Google's Chrome Team
- **Link:** Chromium Reputation Provider Framework
- **Status:** Initiated
- **Media Types:** Web pages
- **Summary:** This framework provides guidelines for reputation management in digital content. It includes methods for assessing and maintaining the reputation of digital assets, ensuring that users can trust the content they access. This is particularly important in contexts where reputation is a key factor in determining the value and reliability of digital media.

3.13. International Standard Content Code (ISCC)

- **SDO/Group:** ISO/TC 46/SC 9
- **Link:** ISO 24138
- **Status:** Published
- **Media Types:** Any
- **Summary:** This standard provides a unique identifier for digital content. It includes guidelines for creating and maintaining ISCC codes, which can be used to track and manage digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.14. Unique Media Identifier (UMid)

- **SDO/Group:** IWA 44
- **Link:** UMid
- **Status:** Published
- **Media Types:** Any
- **Summary:** This specification offers a unique identifier for media content. It includes methods for creating and maintaining UMid codes, which can be used to track and manage media assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.15. TDM Reservation Protocol

- **SDO/Group:** W3C
- **Link:** TDMRep
- **Status:** Published
- **Media Types:** Web pages, EPub and PDF
- **Summary:** This protocol provides guidelines for reserving content from text and data mining. It includes methods for creating and maintaining TDMRep files, which can be used to document the reservation of digital assets. This helps in ensuring that content is not used for data mining without the creator's consent.

3.16. Spawning ai.txt

- **SDO/Group:** Spawning

- **Link:** Spawning ai.txt
- **Status:** Published
- **Media Types:** Any
- **Summary:** This specification offers a method for opting out of AI training. It includes guidelines for creating and maintaining ai.txt files, which can be used to document the opt-out of digital assets. This helps in ensuring that content is not used for AI training without the creator's consent.

3.17. Robots.txt

- **SDO/Group:** IETF
- **Link:** RFC 9309
- **Status:** Published
- **Media Types:** Any
- **Summary:** This standard provides guidelines for excluding content from web crawlers. It includes methods for creating and maintaining robots.txt files, which can be used to document the exclusion of digital assets. This helps in ensuring that content is not accessed by web crawlers without the creator's consent.

3.18. Vocabulary for Expressing Content Preferences for AI

- **SDO/Group:** IETF
- **Link:** ietf-aipref-vocab-00
- **Status:** In Progress
- **Media Types:** Any
- **Summary:** This document proposes a standardized vocabulary of use cases that can be targeted when expressing machine-readable opt-outs related to Text and Data Mining (TDM) and AI training. The vocabulary is agnostic to specific opt-out mechanisms and enables declaring parties to communicate restrictions or permissions regarding the use of their digital assets in a structured and interoperable manner.

3.19. Open Binding of Content Identifiers (OBID)

- **SDO/Group:** SMPTE

- **Link:** SMPTE ST 2112-10:2020
- **Status:** Published
- **Media Types:** Audio
- **Summary:** This standard provides guidelines for binding content identifiers to digital media. It includes methods for creating and maintaining OBID files, which can be used to document the binding of digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.20. X.ig-dw: Implementation Guidelines for Digital Watermarking

- **SDO/Group:** ITU-T SG17
- **Link:** 2413-PLEN
- **Status:** Published, but temporary
- **Media Types:** Images, video
- **Summary:** This guideline offers methods for implementing digital watermarking. It includes guidelines for creating and maintaining watermark files, which can be used to document the watermarking of digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.21. Specification of Digital Rights Management (DRM) Technology for Digital Publications

- **SDO/Group:** ISO/IEC JTC 1/SC 34
- **Link:** ISO/IEC 23078-1:2024
- **Status:** Published
- **Media Types:** EPub and PDF
- **Summary:** This standard provides an overview of DRM technologies for digital publications. It includes guidelines for creating and maintaining DRM files, which can be used to document the DRM of digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.22. A Review of Medical Image Watermarking Requirements for Teleradiology

- **SDO/Group:** NIH
- **Link:** Medical Image Watermarking
- **Status:** Published
- **Media Types:** Images
- **Summary:** This review outlines the requirements for watermarking medical images for teleradiology. It includes guidelines for creating and maintaining watermark files, which can be used to document the watermarking of medical images. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.23. Evaluation Tools for Persistent Association Technologies

- **SDO/Group:** ISO/IEC JTC 1/SC 29/WG 11 (MPEG)
- **Link:** ISO/IEC TR 21000-11:2004
- **Status:** Published
- **Media Types:** Video
- **Summary:** This standard provides tools for evaluating persistent association technologies. It includes guidelines for creating and maintaining evaluation files, which can be used to document the evaluation of digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.24. IEEE Draft Standard for Evaluation Method of Robustness of Digital Watermarking Implementation in Digital Contents

- **SDO/Group:** IEEE
- **Link:** IEEE P3361
- **Status:** In progress
- **Media Types:** Any

- **Summary:** This draft standard offers methods for evaluating the robustness of digital watermarking. It includes guidelines for creating and maintaining evaluation files, which can be used to document the evaluation of digital assets. This helps in ensuring that content is properly accounted for and can be easily identified and retrieved.

3.25. H.MMAUTH: Framework for authentication of multimedia content

- **SDO/Group:** ITU-T SG21/Q9
- **Link:** H.MMAUTH
- **Status:** In progress
- **Media Types:** Video
- **Summary:** This Draft Recommendation specifies a technical solution for the verification of multimedia content integrity, enabling users to confirm the authenticity of the content by its creators, such as governments, companies, or news organizations. The solution is based on the digital signing of data streams. The content creator (encoder) uses a private key to sign the content, while the recipient (decoder) uses a corresponding public key to verify the authenticity. The public key, necessary for verification, is not derived directly from the data stream but is obtained through a trusted, independent method, such as a third-party trust center.

3.26. H.274(V4): Versatile supplemental enhancement information messages for coded video bitstreams

- **SDO/Group:** JVET (ITU-T SG21 & ISO/IEC JTC 1/SC 29/ WG5)
- **Link:** H.274(V4)
- **Status:** In progress
- **Media Types:** Video
- **Summary:** This specification contains the draft text for changes to the versatile supplemental enhancement information messages for coded video bitstreams (VSEI) standard (Rec. ITU-T H.274 | ISO/IEC 23002-7), to specify additional SEI messages, including encoder optimization information, source picture timing information , object mask information, modality information, text description information, generative face video, generative face video enhancement, digitally signed content initialization, digitally signed content selection, and digitally signed content verification SEI messages and updates to the neural-network post-filter characteristics SEI message.

3.27. H.VADS: Assessment criteria for video authenticity detection services

- **SDO/Group:** ITU-T SG21/Q7
- **Link:** H.VADS
- **Status:** In progress
- **Media Types:** Video
- **Summary:** This Draft Recommendation provides a comprehensive assessment framework for video authenticity detection services. It specifies the requirements, assessment categories, key metrics, and methods to evaluate the capabilities of video authenticity detection services. Assessment categories cover the detection of various forms of intra-frame and inter-frame manipulation, as well as the overall performance of authenticity detection services. By establishing a structured, criteria-based approach, this Draft Recommendation would guide the development, evaluation, and selection of reliable and effective video authenticity detection services.

4. Standardization Map

4.1. Overview

Table 1. Table of Standard Categorization

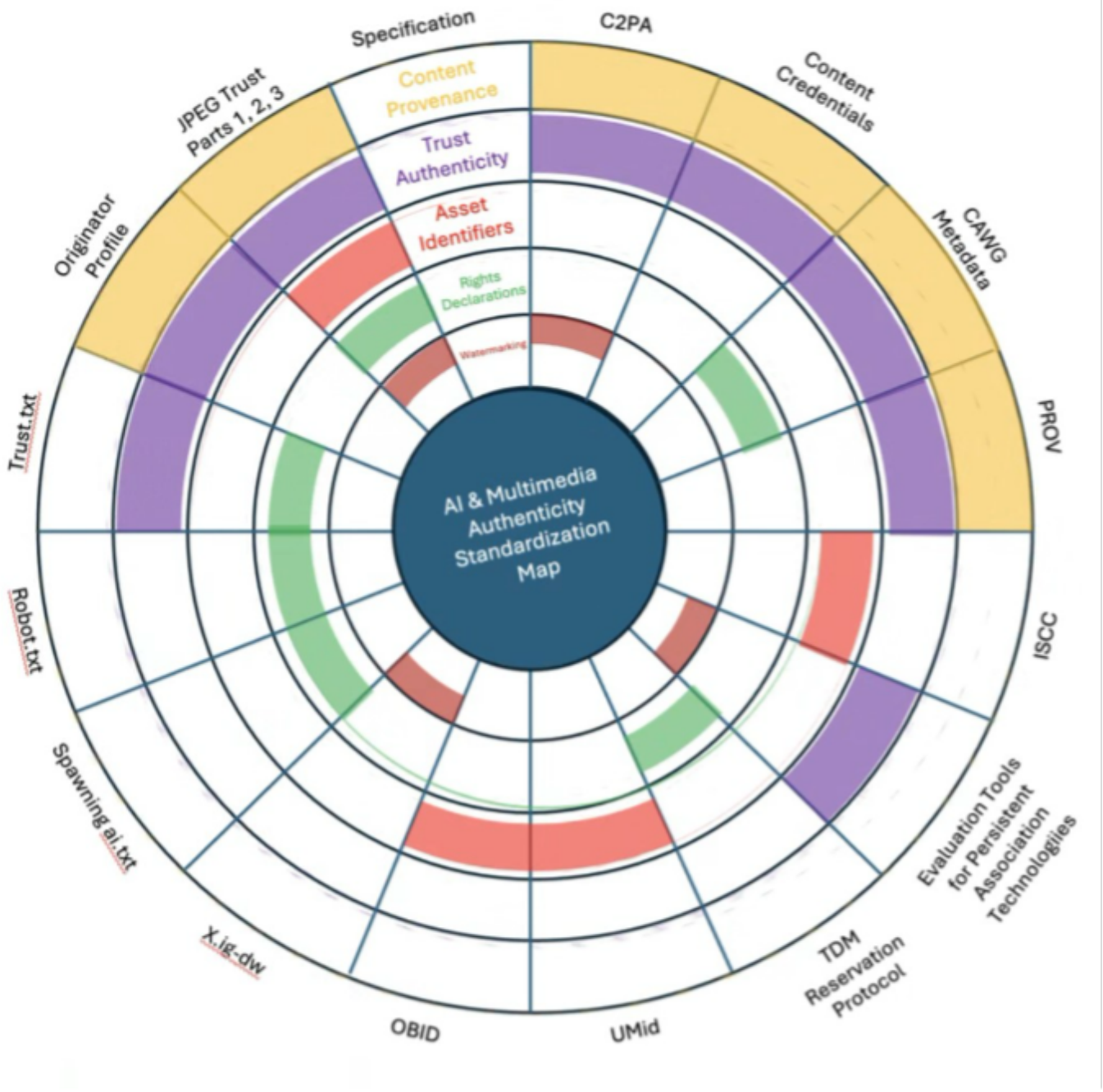
Specification	Content Provenance	Trust and Authenticity	Asset Identifiers	Rights Declarations	Watermarking
Content Credentials (C2PA)	X	X			X
Content Credentials (ISO 22144)	X	X			
JPEG Trust Part 1	X	X	X	X	
JPEG Trust Part 2		X			

Specification	Content Provenance	Trust and Authenticity	Asset Identifiers	Rights Declarations	Watermarking
JPEG Trust Part 3					X
CAWG Metadata	X	X		X	
Originator Profile	X	X			
PROV	X	X			
Overview of trustworthiness in artificial intelligence		X			
Framework for trust-based media services		X			
Trust.txt		X		X	
Chromium Reputation Provider Framework		X			
International Standard Content Code (ISCC)			X		
Unique Media Identifier (UMid)			X		
TDM Reservation Protocol				X	
Spawning ai.txt				X	
Robots.txt				X	

Specification	Content Provenance	Trust and Authenticity	Asset Identifiers	Rights Declarations	Watermarking
Vocabulary for Expressing Content Preferences for AI				X	
Open Binding of Content Identifiers (OBID)			X		
X.ig-dw: Implementation Guidelines for Digital Watermarking					X
Specification of Digital Rights Management (DRM) Technology for Digital Publications				X	
A Review of Medical Image Watermarking Requirements for Teleradiology					X
Evaluation Tools for Persistent Association Technologies		X			X

Specification	Content Provenance	Trust and Authenticity	Asset Identifiers	Rights Declarations	Watermarking
IEEE Draft Standard for Evaluation Method of Robustness of Digital Watermarking Implementation in Digital Contents					X
H.MMAUTH: Framework for Authentication of Multimedia Content		X			
H.274(V4): Versatile supplemental enhancement information messages for coded video bitstreams		X			
H.VADS: Assessment criteria for video authenticity detection services		X			

4.2. Graphical Representations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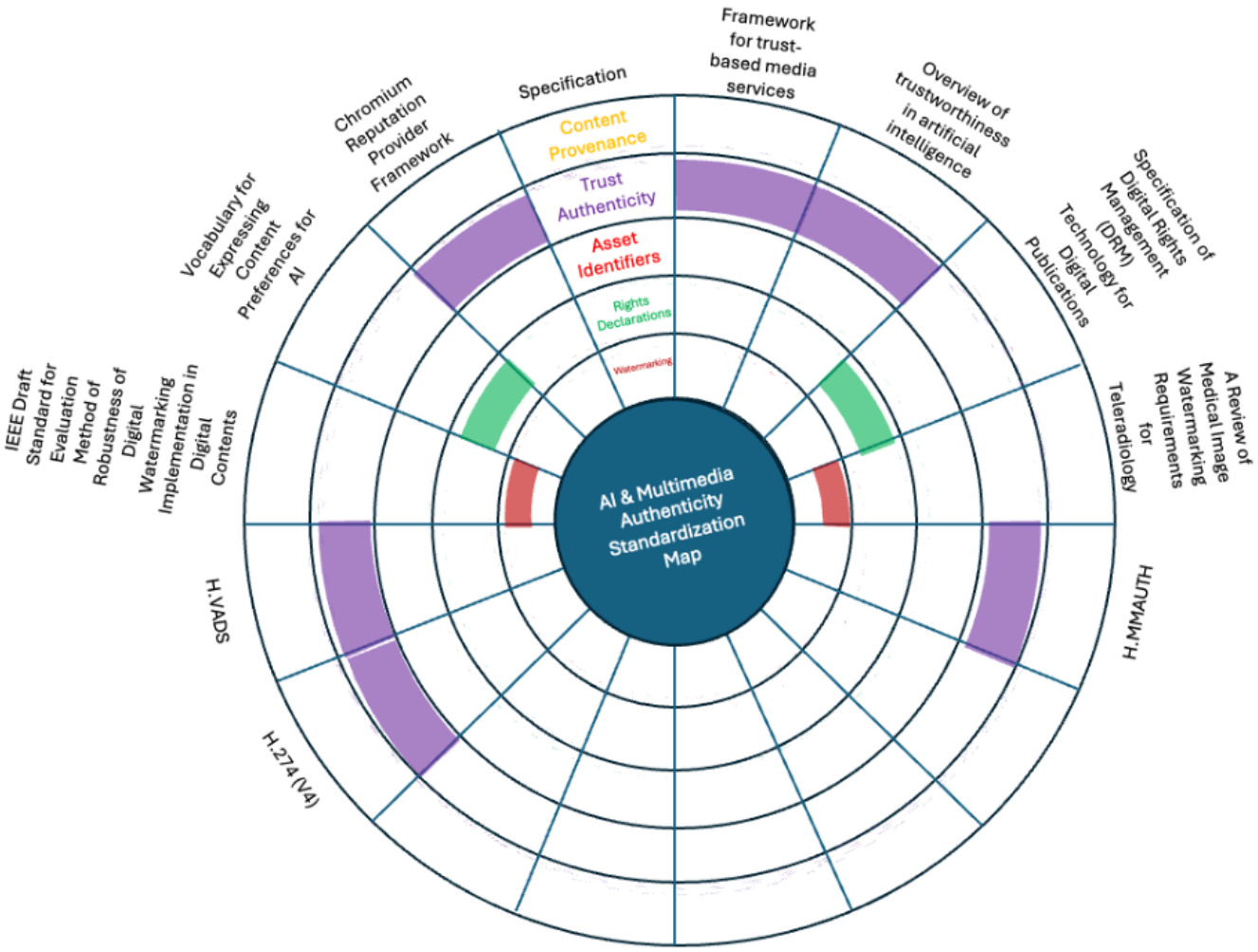

5. Identified Gaps and Opportunities

TBD

6. Conclusion and next steps

Through the categorization of these existing standards into key areas, we have highlighted their critical role in fostering trust, accountability, and integrity in the digital ecosystem. The findings underscore the importance of continued collaboration among Standard Development Organizations (SDOs), industry stakeholders, and researchers to address existing gaps and emerging challenges.

As next steps, it is essential to focus on the harmonization of overlapping standards and the development of interoperable frameworks that can be widely adopted across industries. Emerging areas of work, such as the integration of decentralized technologies for enhanced provenance management and the exploration of new watermarking techniques for synthetic media, present

exciting opportunities for innovation. Additionally, fostering awareness and adoption of these standards through education, advocacy, and pilot implementations will be crucial in ensuring their effectiveness and impact.

The evolving nature of digital media and AI technologies necessitates a proactive approach to standardization. By staying ahead of technological advancements and fostering a collaborative ecosystem, we can build a robust foundation for the authenticity and trustworthiness of digital content in the years to come.