

Implications of Open Source Blockchain for increasing efficiency and transparency of the Digital Content Supply Chain in the Australian Telecommunications and Media Industry

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Abstract:

While digital content is key to the Australian Telecommunications and Media industry, there is little industry cooperation to improve the content lifecycle across industry segments including production, distribution and advertising. With the emergence of hyperledger, a Linux Foundation open source program for blockchain shared ledger technology, there is opportunity for the industry to collaborate to improve content lifecycle transparency, trust and efficiency while protecting consumer privacy. Individual business networks and supply chains within the industry can tactically deploy hyperledger as a shadow ledger as a starting point, and, over time, widespread, consistent industry adoption is more likely to be achieved through government regulatory guidelines and a wholesale digital content infrastructure service provider taking a leading role.

Keywords: media and content distribution and protection, industry and regulatory framework for using blockchain, advertising, piracy

Introduction

Creation, distribution and consumption of digital content in its various forms are the core of the Australian Telecommunications and Media industry. While visibility and control of the content across the supply chain is key to the business models of many in the Australian Telecommunications and Media industry, there is no common industry approach to transparency and control of content provenance throughout the content lifecycle.

Provenance is the record of ownership over time, and in the context of content it includes a record of rights, protection, location, distribution and consumption. Content itself takes many shapes including music, movies, news, sports and advertisements, and across the content lifecycle there are multiple parties interested in creating content, controlling distribution and

monitoring consumption in order to monetise the content; the content producer wants to minimise piracy, the content rights owner wants to confirm the music or video was accessed, the advertiser and agency want confirmation the publisher delivered the advertisement, the rating agency wants to confirm the audience.

Instead of a common industry approach to transparency and control of content provenance, today there are disparate approaches to tracking and verifying content distribution and consumption. These approaches are largely opaque, resulting in one party in the supply chain not having clear visibility of what has subsequently happened to the content despite their revenue being directly tied to what happens to that content. Reporting on content publication or delivery is often dependent on disparate systems and standards as well as on manual reporting processes within and across organisations. These factors combine to duplicate function, increase risk of inaccuracy due to human error, decrease trust in the accuracy of the reports and create longer than necessary reporting, reconciliation and settlement periods.

Blockchain is an emerging technology that increases trust and efficiency across business networks. Hyperledger ([Hyperledger, nd](#)) was announced in December 2015 as an open source Blockchain program run by the Linux Foundation, “the non-profit organisation enabling mass innovation through open source” ([Linux, 2015](#)). With the support of the Linux Foundation and its members, Hyperledger is emerging as an important decentralised ledger platform for streamlining and transparently and accurately measuring the transfer of physical and digital assets across supply chains in different industries. Applied to the business networks associated with content in the Australian market, Hyperledger could increase transparency and control of content provenance, resulting in reduced piracy and timely, accurate and transparent accounting and settlements for content distribution.

The Australian Telecommunications and Media Landscape today

The Australian Telecommunications and Media industry comprises a number of segments including telecommunications, broadcast and internet television and radio, newspaper and magazine publishing, content production, content distribution and advertising, all of which are largely Australian heritage and are subject to government regulation.

The increasing ubiquity of the internet, globally coupled with the decreasing cost and increasing availability of powerful consumer electronic devices for accessing the internet, has created a global addressable market for companies based on the internet. In the last several years the largely Australian-heritage organisations in Australian Telecommunications and Media market have been joined by global internet companies including Apple, Facebook,

Google and Netflix whose capabilities include communications, content distribution, content retail and advertising. There are arguments in Australia and other countries that government regulations for traditional domestic communications and media companies should also be applied consistently to include the global internet companies.

Poor Australian standing in global rankings of broadband internet penetration prompted the Australian Federal Government in 2009 to establish National Broadband Networks Company (nbn) to deploy high speed wholesale internet access networks connected to every premises in the country. The nbn goal is to provide a platform for the digital economy and close the digital divide; nbn expects Australia will be the “world’s most connected continent” within three years ([nbn, 2017](#)). With the vast majority of fixed broadband retailers using nbn and many of the cellular operating companies also using or intending to use nbn’s networks for backhaul connectivity from their cell towers to the internet, in the near future almost all digital content in Australia will be transported to and from the premise or mobile device on nbn’s wholesale access networks.

Current issues with content transparency and trust across the industry

While there is competition within each media industry segment, the content supply chain spans multiple industry segments. Organisations from different segments cooperate to distribute content including music, video, advertising and news, but face issues and risk:

- artists and content producers invest creativity and resource to create new content and are dependent on third parties to distribute their content and make it available through broadcast and online channels. Content producers have significant exposure to the risk of piracy, being unauthorised copying and distribution of their content.
- content rights holders own the rights to long and short form content such as movies and music. Broadcasters and media streaming service providers pay the rights holder when the digital content is broadcast, streamed or downloaded. Rights owners do not have direct access to records from the third-party platforms that deliver their content to consumers yet are compensated by the third-party platform owner based on delivery of their content. Performing rights organisations act on behalf of the rights owners to collect royalties but have no systemic means of identifying where the content is being played across the internet.
- news services have inadvertently relayed misinformation or ‘fake news’ to their readership, a result of the pressure to publish articles ahead of their competition.

- advertising agencies create advertisements and campaigns on behalf of their clients the advertisers. The ad agencies buy advertising inventory (being time or placement slots) from broadcasters and internet media publishers who in turn display the advertisement to the consumer. Advertisers and agencies want validation the advertisement was displayed yet publishers provide no systemic transparency of how long the advertisement was in view. Some Internet media companies do not provide independent verification of how many ads were served. Advertisers want to protect their brands by verifying their ads were not displayed alongside inappropriate material.
- ratings agencies measure and report on audiences and despite the increasing use of consumer electronic devices for viewing there is no common industry model for accurately measuring all viewing on tablets and smartphones.
- telecommunications companies differentiate their service by bundling third party content such as sports, but there is no industry approach to reporting viewer experience across cellular and fixed networks and different devices. Viewers can receive poor quality of experience for different reasons including inadequate network coverage, network congestion or handset issues without the telecommunications service provider or the content distributor knowing or reporting issues exist, much less openly and systematically addressing the quality issues.
- consumers are able to post content to public internet video platforms or distribute content through internet file sharing sites without confirming they have the rights to the content. While it is entirely appropriate for a user to post personal content to social networking sites, community posting of music videos and songs is an issue because it creates advertising revenue for the social networking site without compensating the artists and right holders or recognising the artist may not want their work used for commercial purposes.

The ACMA ([ACMA, 2016](#)) reports that accessing audio, video and news are three of the top ten activities most commonly performed by Australians over the internet, with more than 50 per cent of Australians performing these activities in the six months to June 2016. While the ACMA does not identify what proportion of these activities is access is to Australian content, the ACMA data indicates that a high number of Australians would benefit from an improvement in content services.

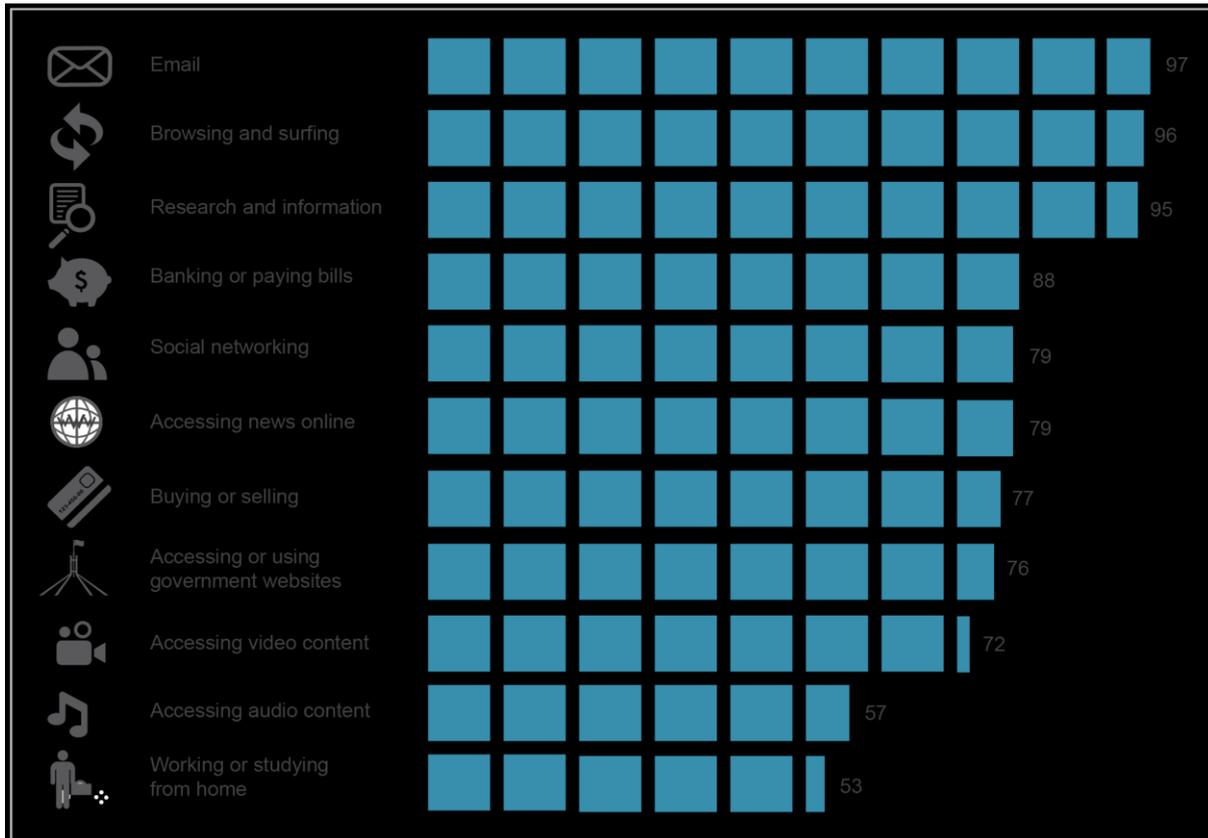


Figure 1- Performing activities online, six months to June 2016 (percentage) Source: ACMA Communications report 2015–16

Current systems and business models are failing many in the industry. An industry-wide collaborative model, not centralised and controlled or monopolised by any one party, for making transparent the content provenance across its lifecycle would address these issues, increasing visibility and control of the content that is key to the business models of most everyone in the Australian Media industry.

Ledgers, Registries and Blockchain as Systems of Record for Assets

A ledger is the system of record for financial transactions and for hundreds of years organisations have maintained ledgers to record their transactions with others and to manage their assets. In this long-established model, each organisation keeps its own ledger and there is no central authority or shared ledger. Maintenance of independent ledgers by each organisation increases the likelihood there will be differences in records across organisations; the ledger of one organisation will show that an account has been settled or goods have been delivered, while the ledger of the other will show that it has not been settled or that there was

an issue with all or part of the delivery. Significant time and effort goes into resolving these differences and achieving consensus.

Governments have long used registries to maintain records of entities in their jurisdiction. Entities include assets such as land, and transfer of land requires all interested parties to meet at the same place and time to reach consensus that the records are accurate before land transfer occurs and the land title registry is updated.

Computer systems of the last sixty years have implemented batch then online electronic ledgers and registries, largely perpetuating pre-existing models of responsibility where each organisation has its own independent ledger and the government as central authority maintains registries of assets and entities in which it has an interest.

The long-standing model of each organisation having its own ledger is being disrupted by technology.

In the last several years Blockchain has emerged to increase consensus and reduce friction across business networks. Blockchain is a decentralised shared ledger technology where each party has its own copy of the ledger, identical to the ledgers of others in the network. Blockchain ensures all relevant parties agree on conditions for the decentralised shared ledger to be updated. Updates are immutable, giving each party confidence in the accuracy of the shared record. Blockchain appeared initially as the transaction ledger underpinning the digital currency Bitcoin, described by its inventor Satoshi Nakamoto ([Nakamoto, 2008](#)) in October 2008 as “a new electronic cash system that’s fully peer-to-peer, with no trusted third party” and in 2014 Gavin Wood ([Wood, 2014](#)) provided the first formal specification for blockchain.

[CSIRO \(2017a\)](#) state “Distributed ledgers can store digitised representations of real-world transactions that may be trusted to prove the history of an asset or object. By tracing the transactions, the identity of the asset or object (or the current owner) can also be demonstrated.”

Blockchain operates in a decentralised mode, that is, without the control of a central authority and with each party having the same copy of the ledger. Decentralisation is a key distinguishing feature of blockchain, in that the typical datastore or ledger today is centralised within an organisation and not decentralised across a business network. Decentralisation reduces the likelihood of monopolisation of the supply chain.

The Financial Services Sector is leading industry adoption of blockchain in different types of business networks including private equities, funds transfer and consumer lending. The IBM Institute for Business Value ([IBM, 2017](#)) cites Walmart, Maersk and Everledger as examples of Blockchain being applied to supply chains for physical assets. Walmart is a retailer starting

to use blockchain to increase trust in the food quality by tracking food across the supply chain. Maersk is a global transport and logistics company that is using blockchain to better manage its supply chains to increase the trust each party in the supply chain has in the accuracy of the trade documentation, estimated to be one fifth of transport costs today. Everledger is using blockchain to track diamond provenance across the lifecycle from mining onwards.

SecureKey (Ligaya, 2017) is using blockchain to share customer identity across organisations, reducing the administrative overhead of meeting 'Know Your Customer' regulations. IBM and others have released both OpenHorizon as an open source platform for edge computing and BlueHorizon as an experimental platform, using blockchain to enable discovery and leasing of available third-party compute resource on 'edge of network' platforms outside the data centre.

Recently Hyperledger was established as a Linux Foundation open source program for private and permission-based blockchain. Open Source is an approach to software development where the software is shared across the global community, enabling many thousands of developers to collaborate to inspect and improve the software code. Open source has fundamentally changed the software industry, with development organisations using and building offerings on Open Source and leveraging the global developer community rather than constructing proprietary software using only the resources within their own organisation. Enterprises and government are increasingly using open source to increase the flexibility and speed of development of their key systems while reducing the dependency on commercial off the shelf software packages. This reduces time, effort and skill required to build new software, resulting in higher quality innovation and standardisation occurring more quickly.

While there are alternate open source blockchains, as a program run by the Linux Foundation, Hyperledger has significant membership from technology companies and financial services providers so is likely to continue to gain significant and widespread support.

IBM Research (Cachin, 2016) describe the architecture of Hyperledger as "a permissioned blockchain platform aimed at business use. It is open-source and based on standards, runs user-defined smart contracts, supports strong security and identity features, and uses a modular architecture with pluggable consensus protocols."

As a permissioned blockchain, Hyperledger maintains privacy; while each party in the hyperledger business network has a copy of the Hyperledger decentralised ledger, transactions are only visible to parties who have permission, unlike public blockchains where all parties have visibility of all transactions. This is important in a supply chain where some organisations are competitors; one supplier need not know the customer has given an order to another supplier. This is also important in avoiding the significant energy consumption issue created by the 'proof-of-work' computational workloads of public blockchain.

‘Smart contracts’ between parties in the business networks are recorded as business rules in each instance of the Hyperledger. As the transaction occurs, for example as the physical asset is transferred from one owner to another, relevant parties verify the transaction has occurred and the business rules in the smart contract in the Hyperledger blockchain are executed. Each Hyperledger is updated to record the transaction with the record being signed and able to be verified.

There is a widespread view that hyperledger will become a technology integral to the internet; in the same way that HTTP is the internet protocol for requesting and transporting web pages, hyperledger is expected to become the internet protocol for transactions across business networks for all industries. Harvard Business Review ([Iansiti & Lakhani, 2017](#)) state “TCP/IP unlocked new economic value by dramatically lowering the cost of connections. Similarly, blockchain could dramatically reduce the cost of transactions. It has the potential to become the system of record for all transactions.”

Hyperledger to increase transparency and trust across the Media Industry

At time of writing, there were 65 hyperledger use cases ([Hyperledger, 2017](#)) published in the hyperledger wiki, 28 covering capital markets and financial services, 19 for government and only 2 directly related to content and media, being ‘Sensitive Record Tracking’ and ‘Music Publishing’.

In much the same way, the Finance Sector and industries with physical supply chains are gaining improvements in trust and efficiencies through blockchain, blockchain could similarly improve benefit to the Australian content marketplace by increasing transparency and trust across the digital content supply chain.

Key examples of how blockchain could improve the digital content supply chain in Australia are listed here:

- **content producers** could reduce the risk of piracy by using blockchain to more tightly control and have visibility of content provenance at each step in the supply chain. In conjunction with content protection technologies, the blockchain would vary the keys and watermarks being applied to the content at each stage in the distribution process, making it easier to more quickly identify and address exactly where in the supply chain piracy is occurring, whether inside the media institutions or at the edge of network by consumers.

By connecting the content to the blockchain and embedding validation rules and content protection methods supported by all parties into the blockchain, content

distribution occurs only with the agreement and oversight of all parties. Individual items of content could only be played in a certified player that has received from the blockchain approval and keys to play this specific item of content.

Extending this model to allow the blockchain or investigators to access records from Internet Service Providers could identify premises if not individuals in the community that are illegally copying and distributing content.

The scale of the piracy issue is significant; [Village Roadshow](#) stating “visits to pirate sites in 2015 were estimated at 78.5 billion worldwide. In Australia a frightening 1.24 billion visits” and “Australians have taken to piracy at a far greater per cap than virtually anywhere else in the world – way ahead of the USA.” At risk is the viability of many in the movie industry and the cultural implications associated with reduction or loss of the Australian narrative provided by the movie industry.

- **content creators** such as musicians, content rights holders and performing rights organisations will be privy to service provider delivery transactions, ensuing timely agreement on what was played where and when. As Deloitte ([Shelkovnikov, 2016](#)) state, “A common blockchain platform, employing identity management and smart contracts, locks in rules for how revenue flows from consumer to artist every time a piece of content is played or streamed, reducing the costs associated with collecting and managing statistics, maintaining copyright databases and distributing royalty payments.”

Enabling, for example, independent musicians and film makers to assert the rights to their content and be quickly remunerated for community consumption could encourage artists to create and release more material. ACMA ([ACMA, 2016](#)) reported that in a recent seven day period, “19 per cent of adult Australians had used a streaming music service such as Spotify, Pandora or iTunes radio,” which suggests that improved transparency and accuracy and timeliness of payments would affect a large number of artists and rights holders.

- **Accredited news services** and accredited freelance journalists, having validated new information is accurate, will be able to log the validation of the news, information and source into the blockchain to ensure there is an accurate record of the validation linked to the news content. Syndicated news services, publishers and news consumers will inspect the blockchain in order to be confident the information is accurate regardless of where it is published.
- **advertisers and agencies** sharing a blockchain with publishers including the internet media companies will be able to more quickly and accurately confirm what

ads were placed where and for how long, significantly decreasing reconciliation efforts. Advertisers could also specify what classes of content the ad should be displayed (or not displayed) alongside. All parties would have consistent visibility of what ads were displayed where and when (including what other content was displayed) regardless of whether the ad was rendered in a browser, injected into a streaming service or presented in the social networking app or web page of an internet media company. ACMA (ACMA, 2016) puts national expenditure for online advertising in 2015 at \$6.02 billion, suggesting that increased transparency and efficiency would provide substantial benefit.

- **ratings agencies** participating in the blockchain will have timely and accurate fine grade data on the audience viewing behaviour, down to whether the show was paused and at what point viewing ceased, provided this data is collected from the media player or the delivery platform. Blending data from media players and content platforms with usage data from Internet Service Providers would enable the ratings agencies to analyse the content consumption habits for a household across all content platforms and devices without identifying the individuals.
- **telecommunications companies** measuring quality of experience technology can use blockchain to transparently share viewer quality of experience data with the content distributors, rights holders and advertisers, enabling the all parties to understand and then improve the viewer experience.
- **consumers** posting content to platforms would need to identify themselves assert they have permission, with the record being held in blockchain. Breach of copyright could then be taken up with the known person posting the content; applying the SecureKey example to this scenario, blockchain can provide a trusted and private service for consistently identifying users and consumers across media organisations.

Where file sharing software is used to distribute pirated content, a regulatory regime is needed to enable legal agencies to monitor file sharing activity and user behaviour and to intercept suspicious file sharing traffic, inspecting any associated blockchain as the agreed system of record to determine if the file sharing is authorised, and blocking the traffic it is not.

This is analogous to the Federal Police's authority today to inspect physical goods entering the country through ports and State Police being able to enter a property in their jurisdiction under warrant and undertake searches. The argument here is this model can be applied to protection of digital content, with blockchain being used to provide all authorised parties with a clear record trusted by all parties of identity, commercial transactions and content provenance. Decryption keys for the content and the Virtual Private Networks (being

encrypted sessions) in which the content is transported could securely be held in the blockchain, only accessible by approved parties including legal agencies with proper authority.

It is important to acknowledge that while many of these requirements and use cases can be addressed today without blockchain, the distinguishing capability of blockchain that makes these use cases easier to address is decentralisation. This establishes trust across business networks without introducing centralised control.

Importantly, there is no need to displace existing systems when deploying blockchain as a Shadow Ledger. In this model, the blockchain augments existing systems in each enterprise and, is granted read-only access to existing transaction records in those systems. This enables a holistic view of the end-to-end supply chain to be established without the likelihood of taking down the existing systems. A shadow ledger to track content consumption can be initially implemented by only a small number of entities in the business network, an application which meets Harvard Business Review's innovation adoption model by being "relatively high in novelty but need(ing) only a limited number of users to create immediate value" ([Iansiti & Lakhani, 2017](#)).

Moving beyond a Shadow Ledger role, the blockchain could progress to providing an active role, such as approving the playing of content as outlined earlier. The barrier to adoption is higher with this application as it requires content distribution systems to be modified.

The design of these blockchain applications would be established over time as stakeholders in the business networks collaborate to solve common problems. The blockchain applications will comprises the decentralised blockchain, interfaces to external systems such as media players and content distribution networks, and end-user interfaces to provide users with services such as logging of new content, visualisation and reporting.

As with any system, non-functional requirements including latency, availability and access control need to be factored into the design and implementation. While blockchain is not a low-latency or high volume technology today, significant efforts are being made to address these points, and like any technology the success of blockchain services will be dependent on identification and good design of applications with non-functional requirements that fall within the current limits of non-functional capability.

The argument here is not for a single blockchain to bind all organisations together, but instead for archipelagos where blockchains operate in different areas, doing so with consistent frameworks, standards and intent. The value lies not only in improved efficiencies and quality, but also in the data aggregated from multiple industry blockchains. Subject to privacy laws, data on content viewing habits for the country could be shared with those who contribute to

the blockchains. Anonymised blockchain data could also be sold to third parties for analysis in the same way that weather and credit card data is sold today.

The timeframe for experiment, implementation within small business networks, subsequent linking of business networks followed by widespread adoption is not clear and could take a decade or more. Drawing an analogy with TCP/IP, a technology which transformed communication but took decades to become mainstream, Harvard Business Review ([Iansiti & Lakhani, 2017](#)) view blockchain as a similar foundational technology; “True blockchain-led transformation of business and government, we believe, is still many years away ... while the impact will be enormous, it will take decades for blockchain to seep into our economic and social infrastructure. The process of adoption will be gradual and steady.” ([Iansiti & Lakhani, 2017](#)). A survey by the IBM Institute of Business Value indicates a majority of respondents intend to implement a blockchain by 2020.

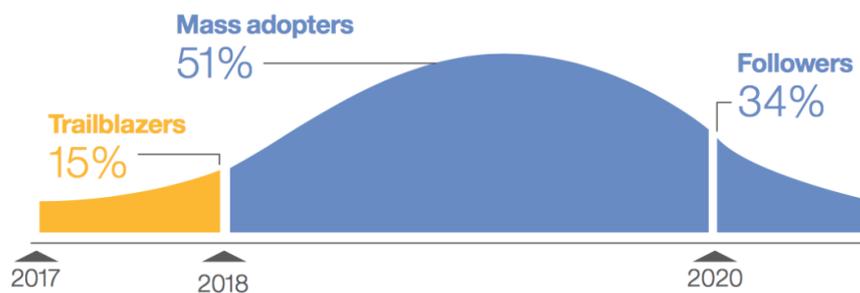


Figure 2: Intended Adoption of Blockchain over time (Source: IBM Institute of Business Value)

Deloitte ([Shelkovnikov, 2016](#)) relay the view that the World Economic Forum, “doesn’t expect the tipping point for the technology (blockchain) to occur until around 2027,” with a survey showing the “majority of experts and executives in the information and communications technology sector expected at least ten per cent of global GDP to be stored on blockchain platforms by 2025”.

Potential Role of Government

The Australian Communications and Media Authority (ACMA) is the Australian statutory authority charged with ensuring affective and efficient operations of the legislation and regulation that governs the Australian Telecommunications and Media industry. ACMA could facilitate industry exploration of blockchain in order to stimulate representative industry discussion and confirm likely commercial and community benefits measured as improved efficiency balanced with maintenance of viewer privacy.

A number of government regulatory framework considerations exist for blockchain: these include protection of end-user privacy; the ability for an independent musician to easily assert and maintain their rights to the content they have created and track usage and be compensated for use; the ability to compel global internet companies to tear down material which has been posted to their sites without the permission of or compensation to the rights holder; the ability for legal entities to proactively investigate and reduce piracy; and Government access to industry blockchain records in order to facilitate introduction of taxation of digital goods and services in the transforming economy.

While there is nothing stopping different businesses collaborating to construct a mutually beneficial blockchain today, widespread industry adoption of blockchain could be accelerated by a trusted service provider intermediary to manage the technical program of work and provide the capability to the market as a service. The intermediary could be a consortium or single entity but would act as a wholesaler or service provider requiring a wide spectrum of skills including design, construction and operation of software and extensive knowledge of business networks and telecommunications and content distribution networks.

With nbn's goal ([NBN, 2016](#)) of being a platform for the digital economy and almost all content traversing nbn networks in a few years, and nbn having many of the required capabilities and operating in a wholesale model, nbn is in a unique position to play a key role in deploying industrial-grade blockchain applications and infrastructure for the telecommunications and media industry and amortising the cost over an appropriate term while recovering the investment over time by charging as a service provider.

The wholesale content infrastructure could include content distribution networks, hosting of hyperledger and quality of experience measurement in nbn physical infrastructure at the edge of the network. Given their extensive footprint of technical infrastructure across the Australian continent, this wholesale content infrastructure could be deployed at the edge of the nbn networks, close to premises, thereby reducing latency and improving service quality. nbn also has the Operational and Business Support Systems and expertise to enable monitoring of the infrastructure and assurance, availability of and charging for these wholesale services.

Conclusion

While Australian Telecommunications and Media organisations strive to improve internal efficiencies and compete within their segments, blockchain appears to offer a novel, trusted approach to solving a range of media industry issues. There is opportunity to increase transparency, trust and efficiencies across industry segments through using Hyperledger, the open source blockchain decentralised ledger platform. Individual business networks within

the industry can tactically deploy Hyperledger as a shadow ledger as a starting point, and beneficial industry adoption is more consistently and easily facilitated through government and a wholesale digital content infrastructure provider taking a leading role. Sustained cross-industry collaboration over several years will be needed to realise benefits for the industry and the community.

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