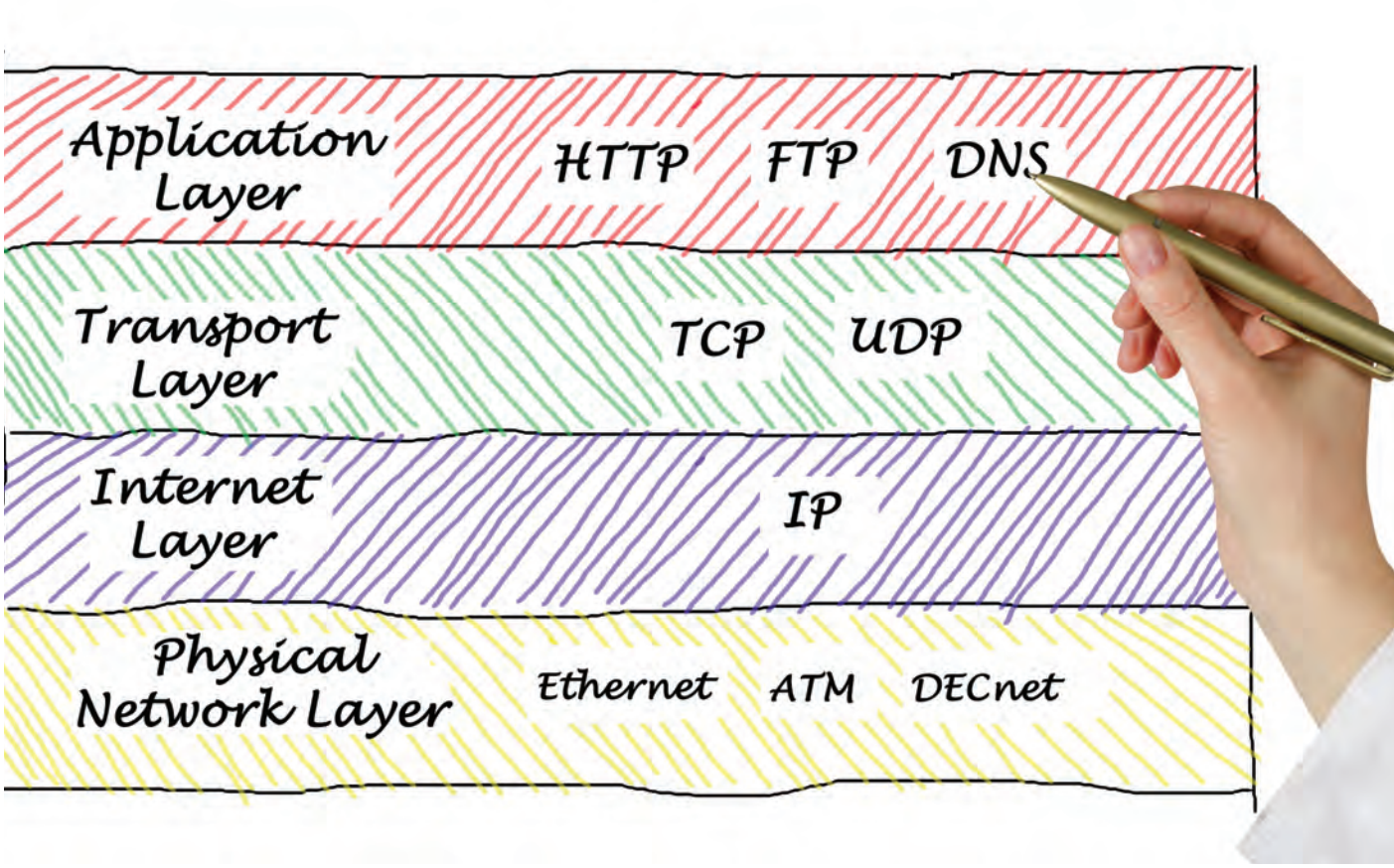


REVIEWING THE LAYERED MODEL

More than 10 years ago, as the move to digital took off, there was much debate about using a layered regulatory model to mirror the new world. Now, write **IVOR KING** and **DEREK WILDING,** it's making a comeback in Australia. But does it have merit?

The rise of digital platforms and the emergence of over the top (OTT) providers have helped shape an environment where services are becoming increasingly detached from the underlying infrastructure used to deliver them. This presents challenges for communications regulation.

In this environment, we might expect intense focus on regulatory design – on adapting the regulatory framework to meet contemporary conditions. But an early spurt of interest in replacing regulatory "silos" with cross-platform regulation designed for a converged communications environment appears to have stalled. In this article, we review the position of the "layered model" of communications as a framework for regulatory design, and ask whether it is still as attractive as it once seemed – whether such a model is equipped to provide a framework for policy and regulatory analysis in an environment where platforms and providers can supply services at more than one layer, or can move to deliver a service over a layer with a lower regulatory burden and cost.

THE LAYERED MODEL

The changing communications environment, characterised by rapid technological change, the ubiquity and speed of broadband networks, increasingly sophisticated consumer devices, miniaturisation, and virtualisation of physical infrastructure, was brought into sharp relief by the recent review of Australia's communications regulator, the Australian Communications and Media Authority (ACMA), undertaken by the Department of Communications and the Arts. The first recommendation of the 2017 ACMA review[1] was that the ACMA remit should "cover all the layers of the communications market, including infrastructure, transport, devices, content and applications".

In Australia at least, the layered approach to communications underpins discussions about the future of the regulatory regime. A layered model for regulation has been defined as establishing a "set of layers, each with its own set of permitted functions, to serve as a guide to regulatory decision-making".[2] The model has been advocated by theorists, e.g. Richard Whitt, who wrote:[3]

"...a layers model can assist policymakers in targeting regulation to foster needed competition at the core (or lower layers) of the network, while preserving and enhancing innovation at the edge (or upper layers)... the layers analysis offers a fresh and compelling way to look at legacy US legal and regulatory policies."

The layered approach can be contrasted with the "siloed" approach that characterises regulation in Australia, but also with the EU regulatory

framework based on "two directives that cover transmission networks and services, as well as information society services, but not the content of the services delivered over those networks".[4] The EU framework separates information services from the underlying network. Comparing the layered approach to an EU regulatory framework, the conclusion is that a layered model allows for "more refined classification and granular treatment among services".[4]

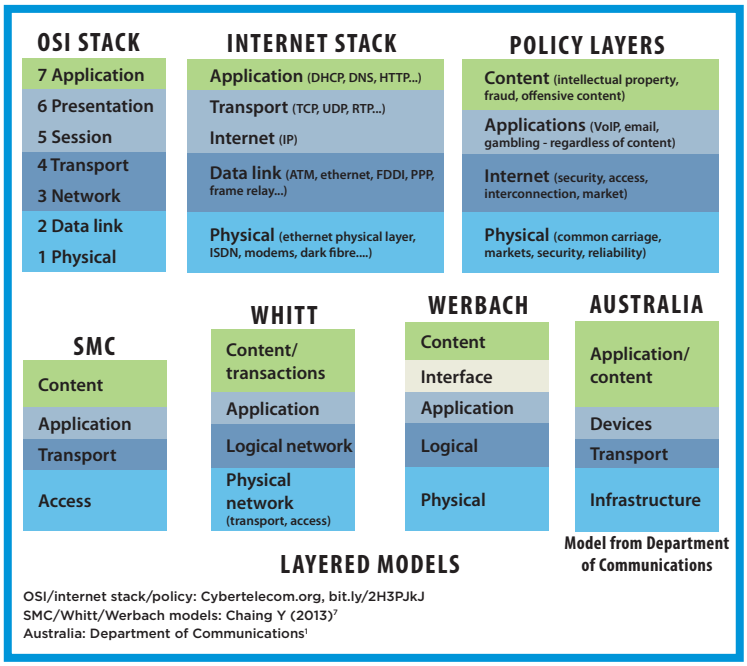
Initially grounded in the OSI layer model published in 1984, this model has been adapted and simplified into models containing fewer layers for regulatory and policy analysis: content, applications, logical layer (IP) and the physical layer.[3] This is the most common breakdown of the layered model in use in regulatory frameworks.[2,5] There are other versions of the layered model, but they are essentially similar. The full OSI model has 7 layers (see graphic).

There is a view that regulation should be based on the principle of layer separation – minimising "layer crossing" – to ensure there is a direct connection between the "layer at which the law aims to produce an effect and the layer directly affected by regulation".[6] More recently, Yao-kuo Chiang echoes the view that layer crossing should be avoided.[7]

The ACMA presented a shortened version of the layered approach in its "broken concepts" report, as well as in a follow-up paper, where it considered emerging challenges with concepts underpinning telecoms regulation in Australia.[8] The diagram (page 15) shows the version of the layered model used in the ACMA's report, as well as the previous siloed approach.

An inherent benefit of the layered model is the ability to separate out content from the transport infrastructure used to convey that content. The model also recognises the engineering reality of how communications and the internet IP stack operate, and it has the potential for application across IP-based broadcasting services and telecoms regulation. The ACMA notes that the layered approach "allows for a targeted policy approach that applies legislative, regulatory or other controls at the appropriate point in the service and/or content delivery stack".[8]

In favouring the layered approach, the Department of Communications uses the ACMA's simplified model, but it combines applications and content, and adds a devices layer in the ACMA review report. The collapsing of applications and content layers is not present in ACMA writing in the lead-up to the report, and it is not fully explained. Devices are defined as being "an essential means to access communications networks. Devices include televisions, radios, mobile phones and tablets." The ACMA review report recognises the growing and key role of devices, and their facilitation of greater mobility. However, there is limited detail on the addition of the devices layer, other than that it forms an important layer in the stack from infrastructure through to content. In its first submission to the review, the ACMA discusses the implications of the internet of things (IoT), with its reliance on devices: "Such developments potentially give rise to massive numbers of connected devices generating huge quantities of data that may be collected, analysed and further utilised."



OSI/internet stack/policy: Cybertelecom.org, bit.ly/2H3PJkJ
SMC/Whitt/Werbach models: Chaing Y (2013)[7]
Australia: Department of Communications[1]

The common approach of collapsing the layered model into four layers has been critiqued on the basis that it "deprives the layer model of much of its analytical power and misperceives the network layer's function as the basis for universal connectivity", as Christopher Yoo says.[5] As he adds, the separation of the transport and network layers is one of the key architectural decisions underpinning the internet. Others argue that the model has been widely misunderstood and misrepresented in its application, not helped by the multiple variations on the original OSI model.[9] This is an aspect that Australian regulators will have to confront if the applications and content combination is to be enacted.

The ACMA has noted five key enablers of the internet economy: infrastructure, devices, services/apps, digital information/digital content, and user interactions with these elements, and in a submission in response to a draft of the ACMA review report, the ACMA supports the use of a layered approach "to identify the scope of government interest in the communications sector".[10] The ACMA further notes that it provides the flexibility to "manage the transition from existing legislation" and to "accommodate new developments in media and communications".

CRITIQUES OF THE LAYERED MODEL

Engineering bias. It has been said that the layered model derives from an engineering model for IP communications. While this has worked well for network design, this does not smoothly translate into a foundation for public policy on communications regulation. Further, an end-user might expect a model to be designed from their perspective, or at least from that of a regulator, rather than that of an engineer. David Reed notes, "What is good for the engineer is not easily applicable to the regulator, at least not in terms of adoption of a rigid framework required for consistent regulatory decision-making."[2] The engineering bias inherent in the layered model also means that engineering concepts are sometimes offered as "substitutes for conventional tools of policy analysis".[5] The layered model has been invoked in the context of justifying regulation for the lower levels of the stack, leaving the upper levels free from scrutiny.

Related to the engineering bias criticism is the failure to recognise the roles of institutions "involved in the regulation/legal/political processes that shape both the structure of the infocommunications

industry and how it works".[11] Martin Fransman writes that these institutions could be included in the overall "analytical framework" missing from the layered model.[11] Others attempt to address these shortcomings in the layered model as follows:[4]

"First, implementation and enforcement of the layered model itself will result from dynamic legal and regulatory processes. Secondly, financial markets are tremendously influential through the availability of capital investment funds... Thirdly, innovation and standards processes led by universities and standards bodies yield tremendous influence, e.g. advancing technology, establishing interconnection rules that affect service provider interactions. Fourthly, demand drivers for the services reflected by the layers are an important influence."

While the layered model may omit the effects of these institutions, their influence on the market and regulatory environment, and interactions between them and service providers, the model does benefit from its simplicity – a trade-off acknowledged by Fransman.

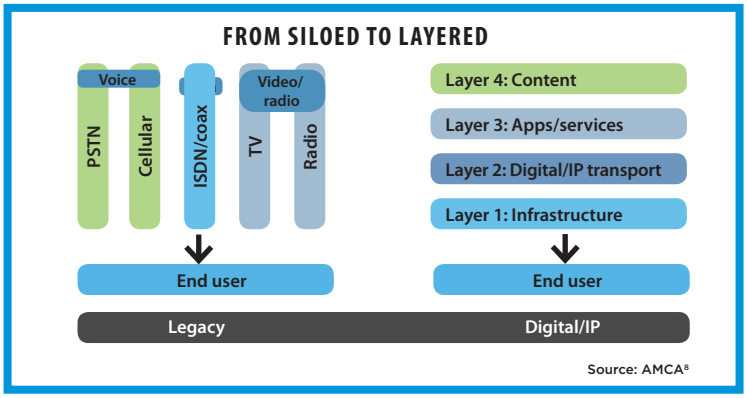
Inflexibility. Fransman also notes that a layered model is "essentially static in that it does not include processes of change and their causes", and so it requires an "additional analytical framework". This framework should be designed to enable understanding of the processes of change in the communications industry, identifying the "prime movers". In his 2002 article Fransman makes no further attempt to define what this framework might look like. The layered model presupposes that "the current layered structure of network systems, namely those based upon the internet, will remain relatively stable in the foreseeable future".[2]

The New Millennium Research Council (NMRC) argues that "as technology develops, it is not necessarily following the prescripts of the network layers model. There may, indeed, be valid economic and technological reasons for bundling applications or integrating between layers".[12] Rapid technological change has shown that systems, and their underlying models, can adapt.

While the layered model is relatively good at accounting for differences between layers, it is poor at accounting for differences within layers: e.g. differences between fixed and mobile networks, or between local access networks and the core network, within the network layer, says Fransman.

Chiang notes the importance of flexibly applying the layered model, arguing that the model should be used as a structured lens through which to evaluate providers, and not as a new model for regulation. In his view, based on analysis of reforms in Malaysia, the UK and Taiwan, the layered model was not intended to entirely replace the previous siloed approach. The layered model "is an analytical tool for policy considerations, not a regulatory framework", and to apply it as the basis for communications regulation would lead to failure.[7]

An additional criticism is that in regulating based on layers, the model encourages the creation of artificial barriers between layers, leading to undue restrictions on larger players in the market which would ordinarily be vertically integrated. In turn, this could result in poorer cost outcomes for consumers.[12]



Innovation. Reed contends that the layered model can have a stifling effect on innovation – "regulatory oversight and approval processes will hinder deployment and development of new capabilities and services based on cross-layer technologies".[2] Having artificial barriers, or differences in regulation between layers, could lead to a developer choosing not to innovate across layers in platforms and/or technology. If one layer is subject to a less hostile regulatory regime, the incentive is to develop at the less regulated layer, which may not result in the best or most cost-effective solution for the end-user.

The layered model can allow for regulation to be "compartmentalised and minimised by targeting only the appropriate layer".[9] In practice, with reference to the Sicker-Mindel-Cooper (SMC) model, this may unduly favour the application layer, advantaging OTT players. In turn, this disadvantages infrastructure providers, and does not encourage innovation at the transport or physical end of the stack. This bias is also evident in the ACMA review: "The bottom layers are the most scale and capital intensive (e.g. infrastructure owners), while the upper layers are more innovation intensive (e.g. applications and content)." There is limited consideration of whether this must always be the case, and whether the lower layers are doomed to lack innovation. The NMRC argues that:[12]

> **If one layer has a less hostile regime, the incentive is to develop at the less regulated layer.**

"By isolating the physical infrastructure layer and imposing restrictive regulatory rules on its owner, opportunities for an important source of network innovation may be lost. Quarantined to the physical layer, and constrained in its profitability, the infrastructure provider foresees insufficient return to justify the enormous investment that often is necessary to retrofit an embedded network for a new technology."

Market power and competition. Douglas Sicker and Joshua Mindel argue that "the main advantage of a layered policy approach is that it creates a level playing field for regulated entities and services, avoiding inconsistencies" – which may not always be beneficial if policymakers are aiming to make decisions designed to affect specific markets.[13] Theorists acknowledge that the siloed model of communications regulation encouraged "system

gaming by stakeholders", with providers becoming "quite adept at manipulating this regulatory system with an eye toward accruing cost savings by qualifying for less-burdensome regulatory requirements".[14] However, it is not clear that the layered model avoids this problem, or whether it can exacerbate it.

Reed reveals some bias, viewing the market as the rightful arbiter of the "technical winners and losers", with the layered model sacrificing "technical neutrality". He contends that "the imposition of open access requirements on facilities-based carriers ultimately perverts the true price of various elements by regulatory machination with the overall result of inefficiency". Reed also views the layered approach as unnecessarily focused on unbundling the service from the infrastructure.[2]

Yoo acknowledges a beneficial effect of the layering model on competition, while also noting negative effects, coming to the view that layering does not necessarily promote competition.[5] A traditional focus of regulation at the lower levels of the stack can also allow for market power to be exercised at the upper layers without appropriate regulatory scrutiny or oversight. The increasingly globalised nature of operations, as we move up the stack and the service becomes more remote from the underlying infrastructure, also contributes to this challenge for regulators.

THE PROBLEM WITH THE 'SILOED' APPROACH

In its 2011 report,[8] the ACMA used the example of the "standard telephone service" (STS) to highlight difficulties with legacy concepts. The STS, which fits under "voice services", is under siege from convergence and the increasing role of VoIP services – typically provided by overseas-based OTT entities. Nonetheless, the ACMA said it remains "the principal legislative anchor for a range of consumer safeguards".

The STS concept is based on a "single unitary concept of an STS" that "does not reflect well the characteristics by which services can now be differentiated. Voice services may now be offered over a range of platforms using a number of different protocols." For example, VoIP services often do not have the characteristics of an STS as defined by the siloed model, and so may not be caught by consumer safeguards, such as the requirement to provide a capability to call "triple zero".

The STS concept is designed for a "vertically integrated industry environment, with the emphasis on a specific service type tied to a particular network type" (e.g. PSTN). In the current environment, communications services can be provided by an OTT entity, operating only at the higher layers of the stack. Many of the difficulties government and industry experience with the STS concept stem from its origins in a vertically integrated, siloed legacy approach to telecoms.

Moving up the stack, the innovators are often global corporate entities that may be harder to regulate effectively due to jurisdictional and conflict of laws issues. In addition, more virtualisation higher up the stack – including for services that were often provided by infrastructure further down the stack, such as networking-as-a-service and cloud services, creates greater difficulties for the application of a traditional layered model.

> **"That the layered model discourages vertical integration is seen by some as a weakness."**

Regulating on the basis of layers can result in services being provided at a layer that is subject to the least onerous regulation, as compliance will generally be a cost. Although regulators would not wish to have this role, a market response to differential regulation at different layers could leave regulators "placed in the key role of designing the layered networks systems through their frequent regulatory decisions".[2] The ACMA has acknowledged this challenge, with IoT "creating an even more complex communications environment in which network elements can and are being emulated in software ('virtualisation'), leading to more sophisticated and subtle interconnection between networks, devices, services and content."

Criticisms are noted of the SMC version of the layered model: it can hinder vertical integration and erect effective barriers between layers, and preclude realisation of economies of scale and scope "across the unbundled interfaces".[9] The layered model can also result in unreasonably burdensome regulation at the transport layer.[12]

In rejecting these criticisms of their layered model, Sicker and Lisa Blumensaadt argue that, on the contrary, in allowing regulation to be more targeted, the layered approach will not stifle innovation in cross-layer technologies nor prevent the realisation of economies of scale. They also take the view that the layered model does not affect structural separation.[9]

While vertical integration can have both positive and negative effects on economic efficiency, Sicker and Mindel say that "serious problems arise when a dominant provider can assert their control of multiple layers or combine their layers with those of other providers in an exclusionary and anticompetitive manner".[13] Problems emerge where a provider has control of a whole layer, e.g. physical access with a historical monopoly, and then charges significant sums to give other providers access.

Regulating ownership across layers raises additional policy challenges. The fact that the layered model discourages vertical integration is seen by some as a weakness of the model, e.g. NMRC argues that the model ignores potential benefits to consumers of vertical integration and cross-subsidising provision of services across layers.[12]

THE ROLE OF PLATFORMS

Recent writing has also examined the crucial role of platforms in the communications environment,

considering platform markets and interconnected systems, and assessing regulatory intervention on this basis. K.C. Claffy and David Clark define a platform as "a technology providing a set of capabilities on top of which many different products can be developed and deployed".[15] They use Microsoft Windows, iOS and Android as examples of platforms, identifying four types (see figure).

Another writer, Johannes Bauer, says platforms "enable the assembly of complementary modules into the systems needed to create value. In a complex socio-technical system such as ICT, multiple platforms co-exist."[16] Claffy and Clark discuss the role of multi-sided platforms (MSPs) and propose an MSP-based model, viewing platforms as constituting layers in the communications ecosystem. They argue that platform layers are more stable than the layers above and below them, and so platforms and platform layers provide a better focus for regulation.

Bauer notes that these platform markets allow for a high degree of plasticity and generativity, i.e. allowing non-traditional players to enter the markets, and creating expanded opportunities for innovation. MSPs can face multiple markets, e.g. a telecoms provider can act as a retail service provider, wholesaler of services, and video-on-demand provider (e.g. in Australia, Optus through English Premier League football streaming). The focus on innovation has been prominent in recent ICT policy in the UK and Australia, and is an equally important imperative for telecoms regulation.

Bauer notes that vertical separation is damaging to innovation for MSPs, which are able to optimise profits by "looking at all related market sides simultaneously". He argues that regulatory policy should not only look to one market when regulating MSPs, particularly where networks are operating as MSPs. Focusing on online platforms to inform regulatory policy has been considered in European discussion on a consistent regulatory approach to a functional single digital market.[17,18] That discussion has recognised the growing role of platforms, and the influence of platform providers across multiple regulatory frameworks (e.g. Microsoft, Apple, Google).

TAKING STOCK

The layered model has value in describing the communications environment and elements being regulated. In particular, it supports an understanding of functional separation – separating the "physical facilities from the applications and content that travel over them".[9] Apart from some developments on the role of platforms, this analysis has shown that limited recent attention has been paid to evolutions and alternatives to the layered model as a basis for regulatory policy. And platform analysis can be seen as complementary – affording a greater understanding of market forces at play for multi-sided platforms, economic aspects of regulation with the shift to the platform economy, and fostering innovation.

However, as demonstrated in this article, changes in internet technologies put pressure on the layered model, and highlight its inflexibility. Yoo argues

PLATFORM TYPES

USE \ CONSTRUCTION	One firm	Several firms
Industry (external)	Single firm industry platform (iOS, Android, Windows, Facebook)	Multi-firm industry platform (internet)
Internal (to the creators)	Internal single-firm platform (iOS, Android, Windows, Facebook	Internal multi-firm platform (VoIP)

Source: Claffy and Clark[15]

that "policymakers should adopt a more dynamic perspective that allows for the possibility that the optimal layered structure may change over time".[5] Many critiques of the layered model are speculative, and not based on quantitative or qualitative evidence demonstrating negative effects. The literature also omits recent discussion of the outcomes of any layered regulatory implementations, as the debate was at its height from 2002–2006.

Related to this dearth of analysis is the absence of alternative proposals. One alternative approach involves focusing on a functional, rather than a technological view of the layers. Taking this approach, the layered model provides a framework for understanding facilities and services from a functional, or end-user, perspective. The expansion of the model to include devices recognises the importance of the consumer experience, and arguably any regulatory framework should focus on the consumer experience of communications services, and whether consumers are able to perform functions with a high degree of availability, privacy and security, and at a reasonable cost.

All of this raises the question of what is the purpose of regulation, and how its priorities (for example, the promotion of innovation and investment) are to be established. This thinking was part of the ACMA's work in identifying broken[8] (and enduring)[19] concepts, and it was the subject of an important piece of work by Robert Picard and Victor Pickard, highlighted also in Intermedia.[20] There are significant differences between the two approaches, some of which relate to territorial and historical variations. In any event, further discussion of the value of the layered model – or indeed of any alternative – needs to start with the principles underlying regulatory design.

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