Deloitte.

The Future of Transport Registration and Licensing in Australia

Modernising Technology Systems to Equip Transport Regulators for the Future

October 2024

Table of contents

Abstract

- Driver licensing and vehicle registration (R&L) is the main way for governments to regulate safe access to our transport network.
- The transport sector is undergoing significant change. This will require governments to become more dynamic, adaptable, and have the right tools to thrive in a technology-fuelled, data-rich, and artificial intelligence (AI) enabled future.
- Most transport regulators are running their core R&L processes on heavily customised, legacy technology platforms that were developed and implemented at the end of the 20th century.
- Most jurisdictions are planning a significant technology uplift and modernisation strategy.
- A common view of the business and technology capabilities has been developed to support the R&L modernisation journey.
- Overlaying changes in mobility, identity, and customer experience trends will disrupt most R&L capabilities, highlighting the critical need for R&L technology and systems to be flexible and dynamic to accommodate the future.
- We think registration and licensing system modernisation should be delivered through a combination of four key technology 'plays': (i) rebuild, (ii) maintain and contain, (iii) modernise, and (iv) replace. The four plays will be mixed across the R&L technology landscape and decisions on which play to use will depend on balancing between current needs, future obsolescence and transformation
- We have identified four key steps to break down what is a complex transformation challenge:

  (i) Establish a comprehensive reference architecture, (ii) identify components that will change, are high value, or will become obsolete, (iii) make strategic choices against each component to determine which of the four plays is most suitable, and (iv) create a roadmap by reviewing the four plays for each capability across a set of phases that balance risk, cost, and urgency with value, opportunity, and transformation.

Executive summary

The transport sector is undergoing significant change.

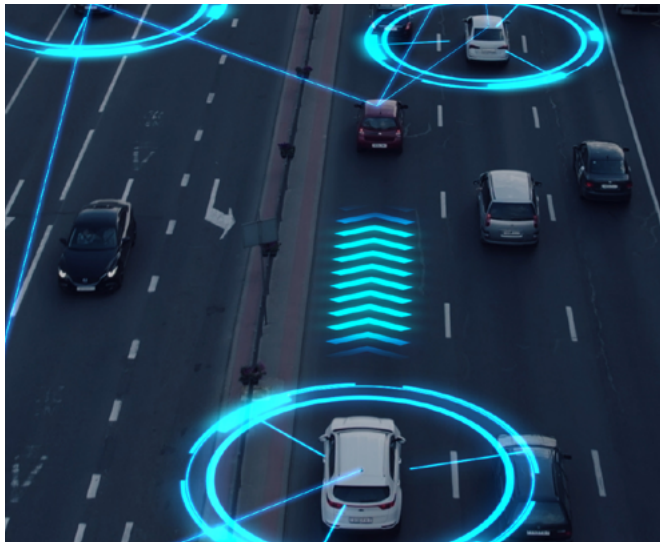
This will require governments to become more dynamic, adaptable, and have the right tools to thrive in a technology-fuelled, data-rich, and artificial intelligence (AI) enabled future. The backdrop to this change is that most regulators are running their core processes on heavily customised, legacy technology platforms that were developed and implemented at the end of the 20th century — they are challenged with a significant 'technology gap'.

Most jurisdictions in Australia and across the globe are now planning significant technology upgrades and modernisation strategies. This paper outlines the changes that will be needed across registration and licensing (R&L). It also suggests an approach for regulators to consider in their journey towards modernisation.

Regulating for the future

The future of transport registration and licensing is being shaped by three main forces:

- **Future of mobility:** Transport is evolving rapidly from single-mode, owner-operated vehicles to multi modal, shared transport and is being transformed by electrification, connected and autonomous vehicles, alongside connected infrastructure. This is changing the shape of transport and will require R&L systems that are flexible and dynamic to take advantage of opportunities and minimise risks.
- **Future of identity:** Digital IDs are beginning to see full-scale adoption overseas and Australia is on the cusp of rolling out digital IDs at both state and federal levels. This will require significant changes to driver registration systems and will open pathways to improved service delivery and data security.
- **Future of customer experience:** Customer expectations are being shaped by improved digital experiences across industries. These enhanced digital expectations are putting pressure on government to deliver excellent experiences. To respond, governments should look to create experiences that are streamlined, personalised, and proactive.



Technology challenges facing transport registration and licensing

Most R&L technology platforms in use today were developed in the infancy of enterprise computing. The core technology was designed and developed before the internet, before mobile and cloud, and well in advance of the AI transformation we are witnessing today.

Challenges associated with the underlying technology platforms include system rigidity, lack of interoperability, lack of documentation and scarce skill sets, missed opportunities, and security risks.

Many state and territory governments across Australia are thinking about, or have commenced, a shift off legacy technology systems. This is a complex and substantial undertaking given the critical importance of the availability and security of the systems, and there is a history of costly, failed attempts.

Technology capabilities needed to underpin regulator of the future

R&L technology systems are inherently complex. When thinking about the future changes that will be required, a good starting point is to agree on a common view of the necessary business and technology capabilities in the current and future systems. We have developed a reference architecture for R&L to support regulators in their modernisation journey. This will be a useful framework to support interstate and global dialogue, and sharing of lessons learned.

Using the R&L Reference Architecture (page 08) as a base, the 'three futures' are mapped as an overlay. This shows the changes in the transport sector that will disrupt most R&L capabilities, highlighting the critical need for R&L technology and systems to be flexible and dynamic for the future.

R&L Reference Architecture

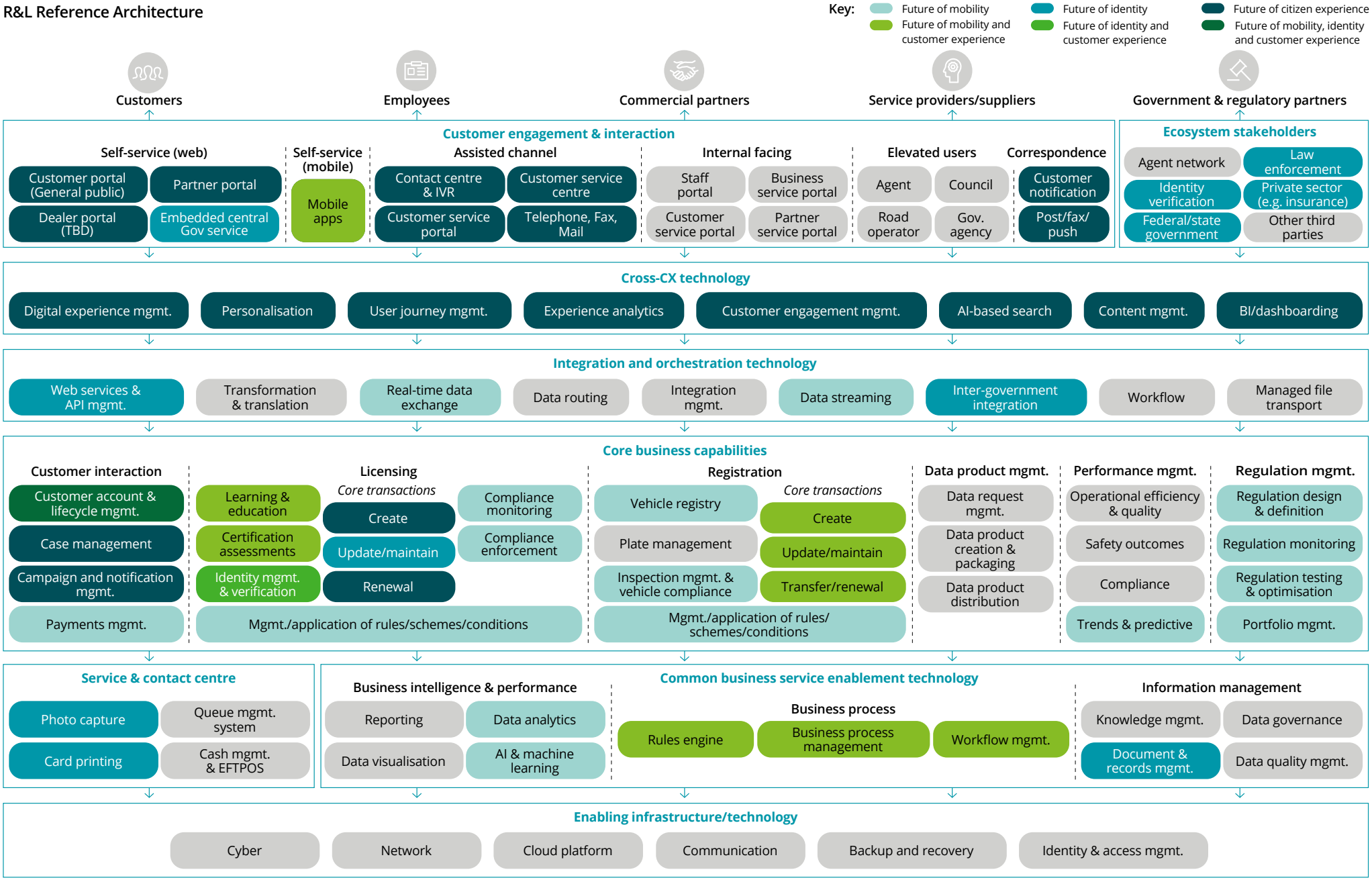


Figure 1: R&L Reference Architecture | Source: Deloitte 2024

The macro view of this analysis is that there is almost 'no stone will be left unturned' across the R&L system landscape. The case for modernisation is clear. But this is more than replacing old with new — there will be some areas that become obsolete, some that need to be transformed, and some that were never contemplated. Successfully navigating the modernisation journey will require making the right decisions about where to invest, how to invest, and when to invest.

Approaches to transitioning off legacy technology

Modernising legacy transport R&L system is not a one-size-fits-all dash to the finish line. Our perspective is that R&L system modernisation can be delivered through four key technology 'plays'. Recognising that the systems are typically not deployed as one single monolith, there are a range of choices across the components and technologies that are part of the legacy R&L environment.

Each of the four plays can be applied to a range of components across the R&L technology landscape in various stages and across varying timelines — this creates a 'mosaic' across the reference architecture. Think of these options as a palette of colours that can be painted across the system architecture for a given point in time or phase. With this in mind, there are always many options to consider — the right mix, planned appropriately with a sound understanding of the future can be the difference between a work of art that delivers value over time or a mess of colours on a page that disrupts the business and creates future technical debt.

Key Play 1: Re-build

This approach is about re-building functions on a modern cloud platform-as-a-service (PaaS); gaining efficiency by not managing the underlying platform resources. This play should be considered if no cost-effective alternatives exist It could also be relevant for high-value functions that have limited options in the software market, or where there is ready access to strong development capability.

Key Play 2: Maintain and contain

This is all about enabling legacy systems to operate alongside modern platforms while also increasing reliability and security. It usually involves putting a modernised cloud computing wrapper around what is still at its core a legacy application. This approach is an interim solution before more significant modernisation. It is also appropriate for functions that are stable or may be facing future obsolescence.

Key Play 3: Modernise

This approach involves converting the legacy code to a modern code base. It will deliver reduced maintenance costs while also enabling more rapid enhancements and supporting faster, less complex integrations with other modern systems. Reliability and security are also significantly improved. This approach is most appropriate for core, high-value components where there are limited practical options in the market from software vendors and/or where the extent of business change associated with replacement is considered too great a risk.

Key Play 4: Replace

A replacement approach is valid if the market has established cloud software-as-a-service (SaaS) vendors that can support current needs and the investment roadmap is aligned to the future needs of the regulator. This approach is appropriate for core and high-value components and may deliver a relatively short return on investment where modernisation or re-build costs are significant. Managing change, however, is significant and is often underestimated in large system implementations.

Next steps to modernise transport regulatory systems

Step 1: Create a reference architecture for your R&L systems

Create a reference architecture that aligns to future needs — leverage the R&L Reference Architecture where appropriate. The R&L Reference Architecture is a key foundation for strategy development and transformation program design to achieve policy and business objectives while also supporting the future change in transport and societies. With a common reference architecture in place, the big, complicated challenge is broken into bite-sized chunks that can support strategic analysis and decision making.

Step 2: Consider the three future trends — mobility, identity, and customer experience

Consider key future challenges, developments, and opportunities facing the transport sector and your organisation, and work through how the components of the reference architecture will be impacted. This will result in a strategic view of where and how future developments will play out over time that can be linked directly to business capabilities and technology components.

Step 3: Determine which plays make sense, where, and when

With an understanding of the impact of future change (against the R&L Reference Architecture), it's time to systematically review the transformation choices considering the non-technology factors such as available workforce skills, the R&L agency's change capacity and culture. Consider each of the four plays against each of the components of the R&L Reference Architecture. This will build a mosaic view of how to transform the technology.

Step 4: Construct a roadmap

The R&L technology landscape is complex and there will by multiple plays occurring at any one point of the transformation. It is important to create a roadmap to coordinate how and when components are replaced and to gauge the impact on processes and value. Given the longer-term planning needed to support R&L transformation, this should be accomplished by considering earlier phases that emphasise risk, cost, and urgency and later phases that focus on value, opportunity, and transformation.

1.0 Regulating for the future

1.1 Why transport systems are regulated

A safe, efficient, and sustainable transport system is vital to Australia's prosperity.[1] In 2020–21, transport activity contributed $164 billion to the Australian economy, representing around 8% of gross domestic product (GDP). [2]

Governments play a key role in encouraging and informing safe practices and ensuring safety standards while minimising compliance costs and barriers to innovation, to support productivity growth and improved living standards.[3] The Australian Government and all State and Territory Governments are committed to Vision Zero — that is, zero deaths and serious injuries on our roads by 2050. However, there is still work to do. During the 12 months ended April 2024, there were 1,310 road deaths, an increase of 11.2% from the previous year.[4]

1.2 Role and importance of registration and licensing

R&L plays a crucial role in government efforts to regulate safe and efficient access to the transport network. It ensures that individuals using the network have the necessary training and skills, and that their vehicles meet the required safety standards.[5] There are currently 22 million driver licences and 21 million vehicle registrations in Australia, representing 65% of the Australian population.

1 Department of Infrastructure, Transport, Regional Development, Communications and the Arts (2023) Transport strategy & policy, Available at: https://www.infrastructure.gov.au/infrastructure-transport-vehicles/transport-strategy-policy
2 Australian Bureau of Statistics (2023). Australian Transport Economic Account: An Experimental Transport Satellite Account, 2010-11 to 2020-21. Available at: https://www.abs.gov.au/statistics/economy/national-accounts/australian-transport-economic-account-experimental-transport-satellite-account/latest-release#:~:text=Total%20transport%20activity%20contributed%207.
3 Productivity Commission (2020), National Transport Regulatory Reform, No. 94, 7 April 2020, Available at: https://www.pc.gov.au/inquiries/completed/transport/report/transport.pdf
4 Department of Infrastructure, Transport, Regional Development, Communications and the Arts (2024), Road deaths Australia, April 2024, Available at: https://www.bitre.gov.au/sites/default/files/documents/rda_apr_24.pdf
5 NSW Resources Regulator, Licensed activities | NSW Resources Regulator, Available at: https://www.resourcesregulator.nsw.gov.au/safety/licences-and-registrations/licensed-activities#:~:text=Licensing%20is%20a%20way%20of

Total road transport registrations and licences in Australia

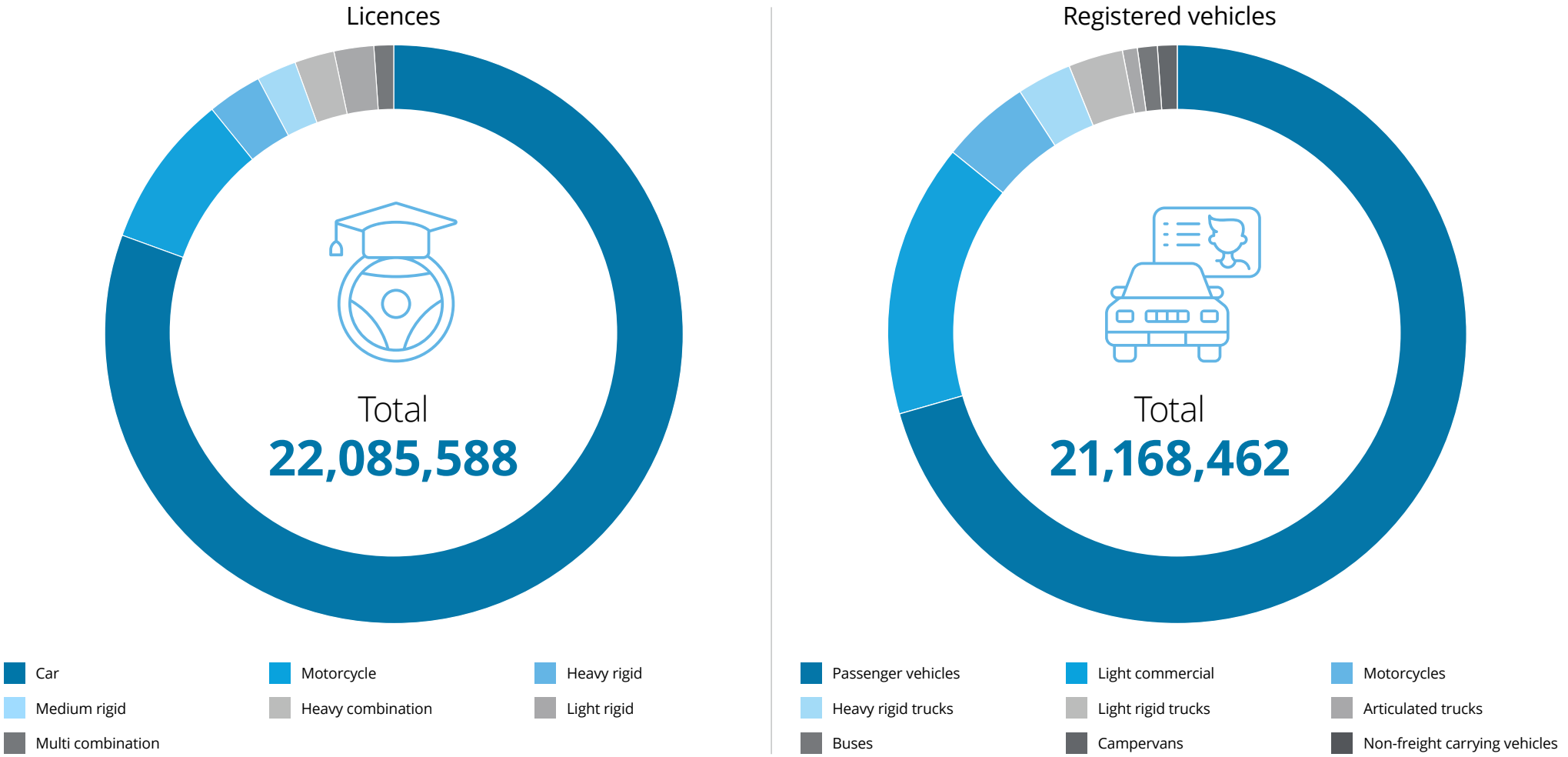


Figure 2: Total road transport registrations and licences in Australia | Source: Department of Infrastructure, Transport, Regional Development, Communications and the Arts (2023), Bureau of Infrastructure and Transport Research Economics Statistical Report, Australian Infrastructure and Transport Statistics Yearbook 2023, Tables 6.13[6] and 6.8, December 2023, Available at: https://www.bitre.gov.au/sites/default/files/documents/bitre-yearbook-2023.pdf

6 Note: where someone holds a car licence and a heavy vehicle licence, this is counted twice.

Transport registration and licensing value chain (illustrative reference model)

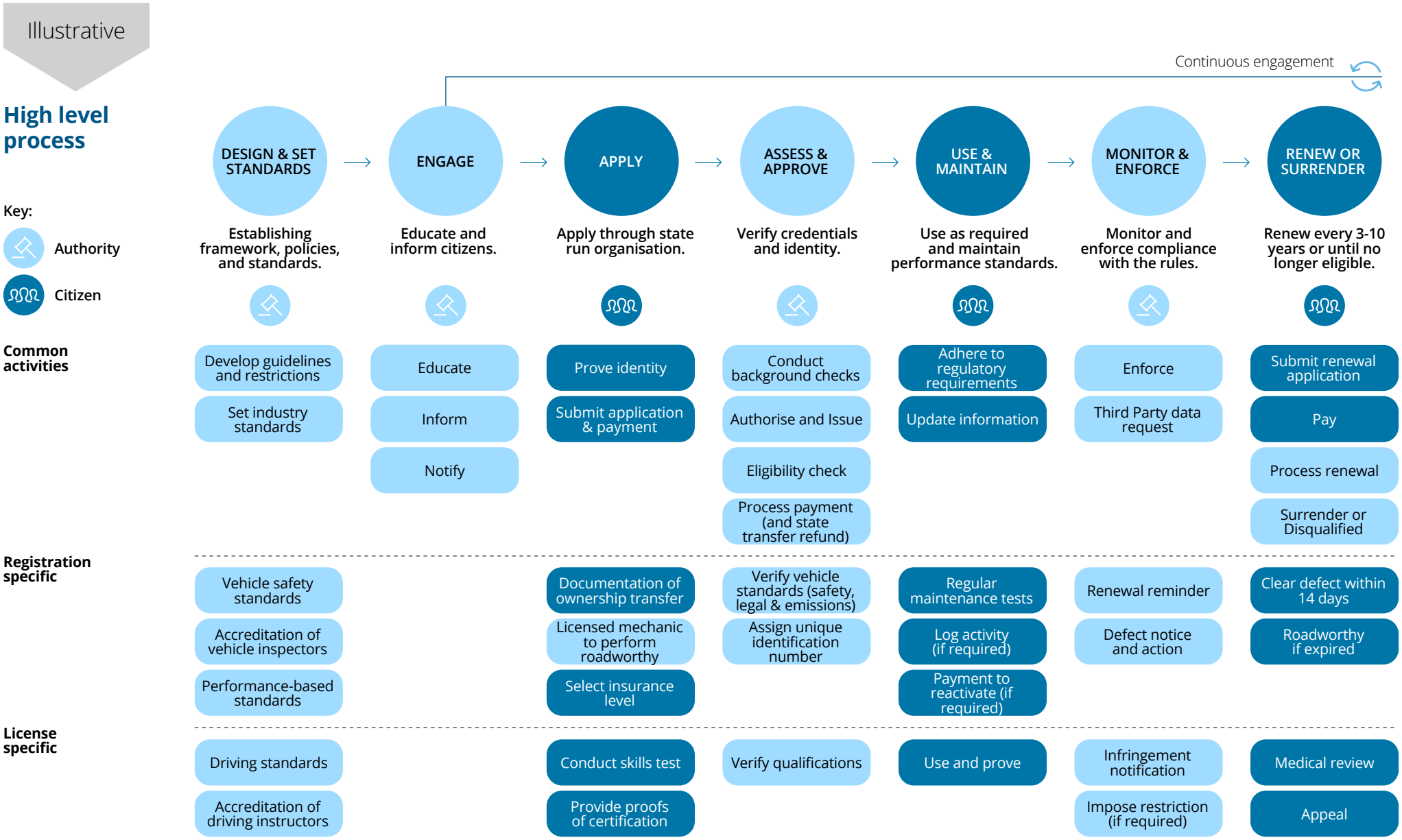


Figure 3: Transport registration and licensing value chain (illustrative reference model)| Source: Deloitte 2024

1.3 Role of registration and licensing in identity and customer experience

R&L is an important form of identity and a major touch point for transport customers to engage with government.

Proving identity is an essential part of the transport regulatory chain, and driver licences are the most widely accepted identity credential in Australia.[7] They are used for accessing various services such as property purchase, domestic flights, bank accounts, and entry into establishments like pubs.

Driver licences are a major touchpoint for transport customers to engage with government. In 2018-19, 80% of all customer interactions with the government in Queensland went through the Department of Transport and Main Roads.[8] In 2022–23, millions of R&L transactions were facilitated in New South Wales by Service NSW.[9]

1.4 Trends impacting on future registration and licensing

When thinking about the future of R&L, there are three trends that will have the most impact — the future of mobility, the future of identity, and the future of customer experience.

The future of mobility

01 Evolving transportation modes and models

Over the last decade, the transportation ecosystem has expanded to include new operating models, technologies, and modes such as ride-hailing, car-sharing, bike-sharing, micromobility, and digital trip planning, ticketing, and payment. Future transportation will involve shared mobility services, electric vehicles, self-driving cars, micro-transit shuttles, e-scooters, truck platooning, drone delivery, and connected vehicles and infrastructure.

These changes will impact R&L systems. For example, self-driving cars may require new classifications and certifications for autonomous driving systems. Shared mobility services will require flexible R&L systems to accommodate temporary registrations and unique insurance requirements for shared vehicles.

02 Data everywhere

The future trends in transport will generate substantial amounts of valuable data for policymakers and industry stakeholders. Connected vehicles allow for real-time interaction with other vehicles, infrastructure, and traffic management systems.[10]

Enhanced data can improve risk-based enforcement, decision-making, planning, and policy implementation in R&L processes. Smart infrastructure technologies like connected traffic signals can also enhance traffic management and safety while facilitating real-time data exchange between vehicles and infrastructure.

03 Climate, zero emissions, and renewables

Transport is one of the biggest contributors to CO2 emissions in Australia. Transport agencies need to take a leadership role on reducing emissions and promoting renewable energy travel. This includes promoting zero emission vehicles, supporting new technologies, supporting EV infrastructure deployment, and leveraging renewable power sources for the network.

Governments are already offering incentives on vehicle registration. For example, to support the uptake of electric vehicles in South Australia, the government is providing a $3,000 subsidy and a three-year registration exemption on eligible new battery electric and hydrogen fuel cell vehicles registered from October 2021.[11]

7 Austroads (2023), Securing Your Identity, Available at: https://austroads.com.au/drivers-and-vehicles/registration-and-licensing/securing-your-identity
8 «Transport and Main Roads Queensland 2018–19 Annual Report. Available at: https://www.publications.qld.gov.au/dataset/d9a277e6-e91d-4368-a6e8-2b9856820aaa/resource/a78f1915-e5e6-4e2c-8780-4148c5f249ea/download/section-2-tmr-2018-19-annual-report.pdf
9 Service NSW (2024), Annual Report 2022–23, Available at: https://www.service.nsw.gov.au/system/files/2024-03/Service%20NSW%20Annual%20Report%202022-23.pdf
10 Austroads (2020), Future Vehicle 2030, Available at: https://austroads.com.au/publications/connected-and-automated-vehicles/ap-r623-20
11 SA Department of Treasury and Finance (2024), Incentives for electric vehicles, Available at: https://www.treasury.sa.gov.au/Growing-South-Australia/incentives-for-electric-vehicles

The future of identity

Digital licences have been introduced by several state and territory governments in Australia, including Victoria, Queensland, and New South Wales. These digital licences are an alternative to traditional physical licences.

Globally, there is a growing trend towards digital ID, and this is changing the status of a driver licence as an identity document. Digital ID provides a digital confirmation of the owner's identity by verifying existing documents such as passports. It eliminates the need for individuals to repeatedly provide ID documents and allows multiple services to avoid collecting and retaining copies of personal documents.[12]

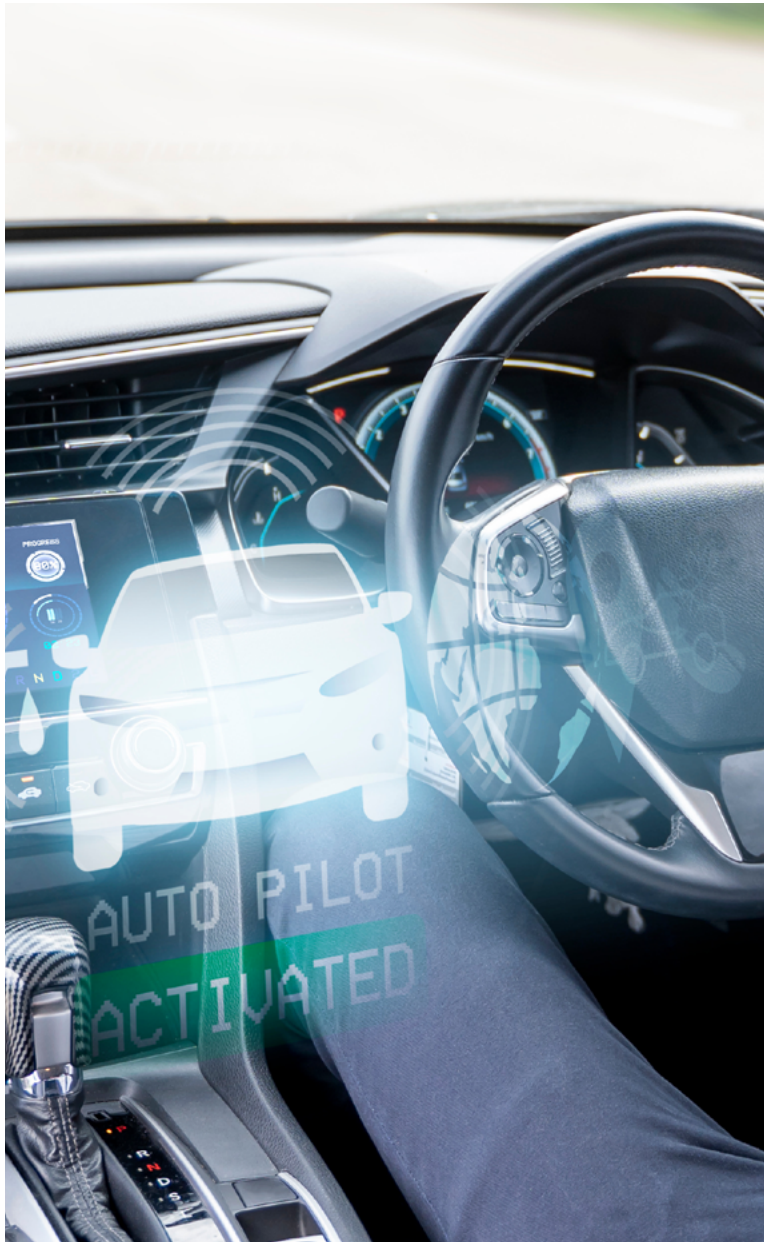
Countries like Estonia and Singapore have already achieved broad community saturation of digital ID. In Australia, the potential introduction of a national digital ID is being signalled by the Digital Identity Act 2024 (Cth) and a related investment announcement of around $780 million.[13] Denmark's MitID is as an example of a national digital ID being used for accessing government services, financial services, and private organisations.[14]

Digital ID is also a core component of digital public infrastructure (DPI), which consists of shared systems for the public sector built on open standards and focused on access, innovation, and driving digital economies. Australia has limited DPI but aims to expand its footprint to deliver secure public services more effectively. The adoption of a national digital ID would be an important step towards comprehensive DPI.[15]

By securely linking R&L information to tokenised identities through DPI, transport agencies can mitigate security risks associated with storing personal information in core systems. The increasing incidence of identity crime and high-profile cyber-attacks emphasises the need for a secure digital credential.

As the role of digital ID expands in Australia, it will be crucial to consider how to manage identity data, verify identities, and support digital and physical identities during the transitionary state while maintaining equity across society. In August 2024, the Australian Government announced the Trust Exchange (TEx) initiative which will be a significant shift to give citizens more control of their data. TEx will be a secure means for Australians to digitally share official information already held by the Australian Government, including a driver's licence, with a third party to verify who you are (your identity) with what you can do (your credentials).

The integration of digital ID into R&L systems is an opportunity to improve security and ensure seamless customer experiences. Transport agencies must prioritise secure management of identity data and diligently address privacy concerns throughout this transformation process.



12 Australian Government Digital ID (2023), ID docs, Digital ID, digital driver licences and wallets, September 25 2023, Available at: https://www.digitalidentity.gov.au/news/id-docs-digital-id-digital-driver-licences-and-wallets-0
13 The Parliament of Australia, Digital ID Bill 2023 Progress. Available at: https://www.aph.gov.au/Parliamentary_Business/Bills_LEGislation/Bills_Search_Results/Result?bId=s1404
14 MitID, About MitID , , Available at: https://www.mitid.dk/en-gb/about-mitid/
15 United Nations Development Programme, Digital Public Infrastructure. Available at: https://www.undp.org/digital/digital-public-infrastructure

The future of customer experience

Research indicates that there is a link between customer satisfaction with government interactions and trust in government, as well as compliance with government processes. According to a 2022 survey by the Australian Public Service Commission, 91% of people who trusted government services were also satisfied with them.[16] To improve customer satisfaction and build more satisfying experiences, governments should aim to create streamlined, personalised, and proactive interactions that align with customer experiences in the private sector.

There are several strategies that governments can use to improve the customer experience:

01 **Data matching:** By leveraging data and embedding the principle of 'tell us once' with consent, governments can streamline the customer experience by bringing together information that has already been provided by citizens but is stored in disparate government systems. This reduces the need for citizens to re-enter information and reduces administrative burdens. For example, the UK's 'tell us once' system for bereavement has saved customers time and emotional burden, as well as saving the government £20 million annually through improved technology infrastructure and efficiencies.[17]

02 **Process cleansing:** Simplifying and removing unnecessary process steps can deliver benefits to both citizens and the government. For instance, the Australian Capital Territory's Better Regulation Taskforce reduced previous interactions with 17 areas and up to 30 applications down to one, resulting in an estimated 20,000 cumulative hours of time savings for the sector.[18]

03 **Personalisation through data:** Governments can leverage data to provide more personalised experiences to users based on their individual circumstances. This ensures that citizens have access to the right information and services at the right time. Currently, personalisation of government services in Australia is relatively limited. For example, the Australian Taxation Office personalises tax returns by pre-filling information based on data from previous tax returns and institutions connected to an individual's tax file number.[19]

DPI plays a significant role in integrating experiences across government services and driving increased personalisation. DPI consists of reusable digital data and payment components, along with digital ID capabilities. Denmark's national portal, My Overview, is an example of how DPI can be used to provide citizens with a comprehensive view of relevant services tailored to their needs.[20]

To deliver best-in-class government experiences, it is essential to use data and personalisation intelligently. By understanding a citizen's needs and expectations based on life events or interactions, governments can anticipate the services or information that individuals may need. For instance, when families register the birth of a child using Singapore's LifeSG app, they are automatically prompted to apply for a 'baby bonus'.[21] This concept can also be applied to R&L processes. For example, if a citizen receives a roadworthy certificate from a licensed provider, an email could be sent providing them with information they need to prepare for selling their car — creating a connected experience from task to task.

16 Australian Public Service Commission (2023), Trust in Australian Public Services 2023 Annual Report. Available at: https://www.apsreform.gov.au/sites/default/files/resource/download/20231128_TAPS%20-%20Annual%20Report%202023_accessible.pdf
17 Deloitte Insights, How government can deliver streamlined life event experiences. Accessed: https://www.deloitte.com/global/en/our-thinking/insights/industry/government-public-services/citizen-centric-government.html
18 Chief Minister, Treasury and Economic Development Directorate, Better Regulation Report 2022,
19 Australian Taxation Office, ATO and myGov communications. Available: https://www.ato.gov.au/online-services/online-services-for-individuals-and-sole-traders/ato-online-services-and-mygov/ato-and-mygov-communications
20 Denmark Agency for Digital Government, National Citizen Portal, My Overview. Available at: https://en.digst.dk/digital-services/borgerdk-national-citizen-portal/my-overview/
21 Deloitte Insights, How government can deliver streamlined life event experiences. Accessed: https://www.deloitte.com/global/en/our-thinking/insights/industry/government-public-services/citizen-centric-government.html

2.0 Technology challenges facing transport registration and licensing

2.1 Major technology challenges for transport regulators seeking to modernise

Most regulatory IT systems were developed long before the internet, mobile, and cloud existed. Over time, the systems have been adapted and new components built to keep up with changing regulatory needs. However, the core foundations have missed out on key technology developments that have occurred since the early 2000s. This is creating substantial risks and challenges to meet existing regulatory requirements and to support the future of mobility.

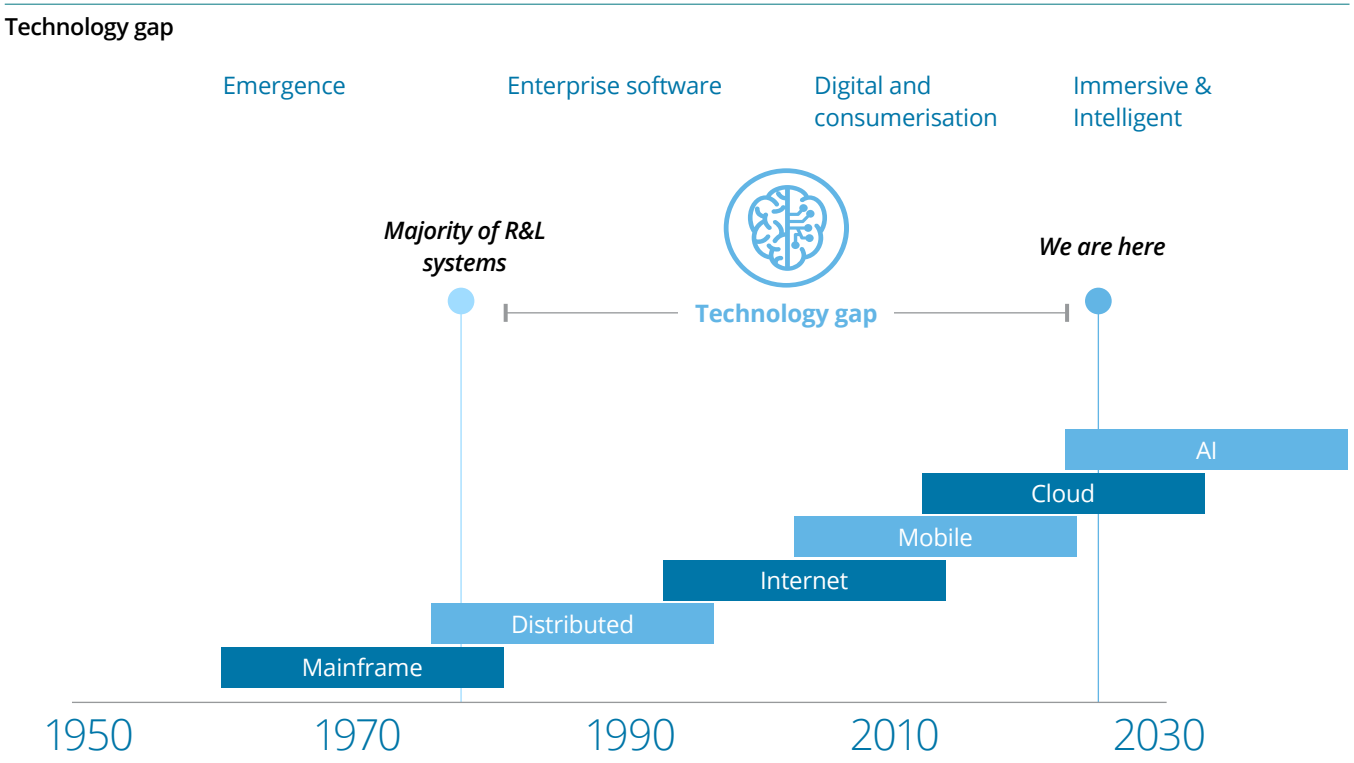


Figure 4: Technology gap | Source: Deloitte 2024

2.0 Technology challenges facing transport registration and licensing

We are now facing a future that will be dominated by innovations and threats coming from AI.

This technology gap has many implications:

- Core transport R&L systems are complex, customised legacy applications. Limited end-to-end knowledge and varied business rules across states exacerbate operational and maintenance risks, potentially inflating IT operational and security costs over time.
- The absence of standardised data formats and communication protocols within and across state transport agencies hampers data fluency and analytics capabilities. This fragmentation limits the potential for operational insights and informed decision-making.
- While new SaaS solutions are being implemented, numerous highly customised legacy systems built on diverse platforms like .NET, Java, and Delphi remain operational. This increases the complexities of the technology stack, increases demand for specialised IT skills to maintain and support the system, and increases risks associated with non-vendor-supported or end-of-life systems.
- Many third-party partners interact directly or indirectly with R&L systems. However, the reliance on incompatible application programming interfaces (APIs) and point-to-point integrations leads to inefficiencies and poor end-user experiences.

The reliance on ageing legacy platforms and the need to continuously bolt on new components has resulted in a 'spaghetti ecosystem' for R&L, as shown in the following figure.

Spaghetti ecosystem - complex siloed current state technology environment (illustrative model)

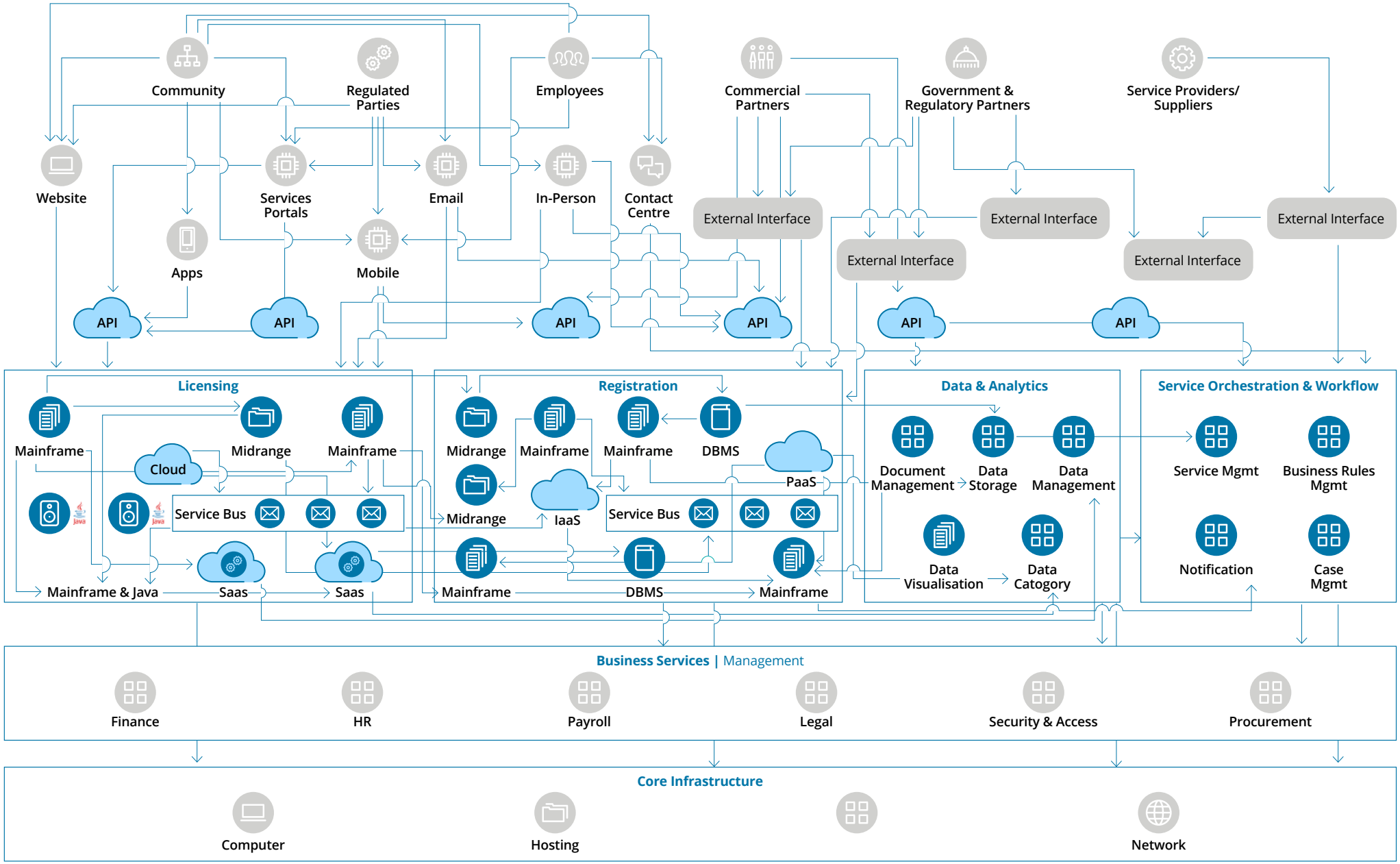


Figure 5: Spaghetti ecosystem - complex siloed current state technology environment (illustrative model) | Source: Deloitte 2024

Challenges caused by the technology gap and spaghetti ecosystem include:

- **System rigidity:** R&L systems are typically built on monolithic architectures in contrast to the modular designs of more modern systems. This makes the systems 'rigid' in that changes are not easily implemented, resulting in increased cost and time to implement changes. This is a significant constraint on an authority's ability to react to changing regulatory needs from evolving societal needs and advances in technology.
- **Interoperability challenges with modern systems:** R&L systems operate within a broader ecosystem that spans technology that supports government services and the private sector. The ability to interoperate is critical to the success of the regulation framework. The broader technology ecosystems are often built on more modern design standards and conventions, which may not be compatible with the legacy R&L systems that were designed in an era when system integration was far less mature.
- **Lack of documentation and scarce skill sets:** Systems that have been developed and modified over multiple decades are invariably impacted by varying levels of system and process documentation. This, coupled with reduced access to people with the skills to understand the original code, means that modifications to the system becomes more difficult over time. The longer these systems are maintained in their original form, the more expensive and risky the roll-out of changes becomes.
- **Missed opportunities:** The monolithic and rigid nature of legacy R&L systems makes it difficult to take advantage of modern developments in digital, data, cloud, and AI. Data is difficult to extract and new sources of external data are difficult to ingest. Analytic capabilities are minimal resulting in high costs and significant time and effort to extract and analyse data in a meaningful way. This often results in missed opportunities to leverage data analytics. Cloud computing significantly reduces infrastructure costs and improves system performance. There are missed opportunities where systems are either still managed in ageing physical infrastructure and/or where they have been transitioned to the cloud and their rigid architectures make it difficult to leverage the full benefits of cloud computing.
- **Security overhead:** The spaghetti ecosystem of many R&L systems alongside varying levels of documentation and scarce skill sets increases the challenge of maintaining adequate security levels. Due to the highly sensitive nature of R&L information, most systems have appropriate security in place; however, this is only achieved through significant cost and effort. The security controls required also contribute to a highly conservative and administrative approach to system changes, which further restricts the ability to change and adapt the technology to new requirements. While the extra security administrative overhead is necessary, it could be reduced in more modern platforms that use increased levels of security automation.

2.2 Transport regulatory systems at a crossroads in technology transformation

Many transport agencies across Australia are thinking about, or have commenced, a shift off legacy technology systems. This is a complex and substantial undertaking, and there is a history of costly, failed attempts.

Modernisation programs are complex, costly, and often deliver limited value or benefits against a significant cost base. At the same time, the current system landscape is ageing, complex, and costly to maintain — not to mention the significant challenges with supporting and enabling future changes across transport and the increased sophistication of cyber threats. There is a clear need to modernise and transform but the investment and risks are significant. Transport agencies must find a future path that works within current investment capacity but also reduces the risk of technical debt and delivers sustainable, adaptable, and secure technology platforms that will enable R&L transformation.

This paper focuses on potential technology approaches and capabilities to modernise R&L systems. We acknowledge the important role culture, workforce skills and capabilities and change management will play in helping transport agencies successfully navigate through these challenges – these building blocks are fundamental to drive efficient, effective, and long-lasting changes to R&L schemes.

3.0 Technology capabilities needed to underpin the regulator of the future

3.1 A reference architecture for R&L

The modernisation path for R&L legacy systems is complex. Having a bird's eye view of the business functions and technology landscape is an essential tool for planning any future investment in the technology.

Based on our global experience in R&L transformations, we have prepared a comprehensive architecture view of R&L systems that shows the commonality across R&L jurisdictions. As well as being a valuable tool to support R&L transformation and modernisation strategies, it is also a common framework that could support interagency and cross-jurisdiction collaboration.

The R&L Reference Architecture combines business functions and underlying technology to help strategic planning.

3.0 Technology capabilities needed to underpin the regulator of the future

Future transport R&L Common Architecture & Technology Capability Model — key components

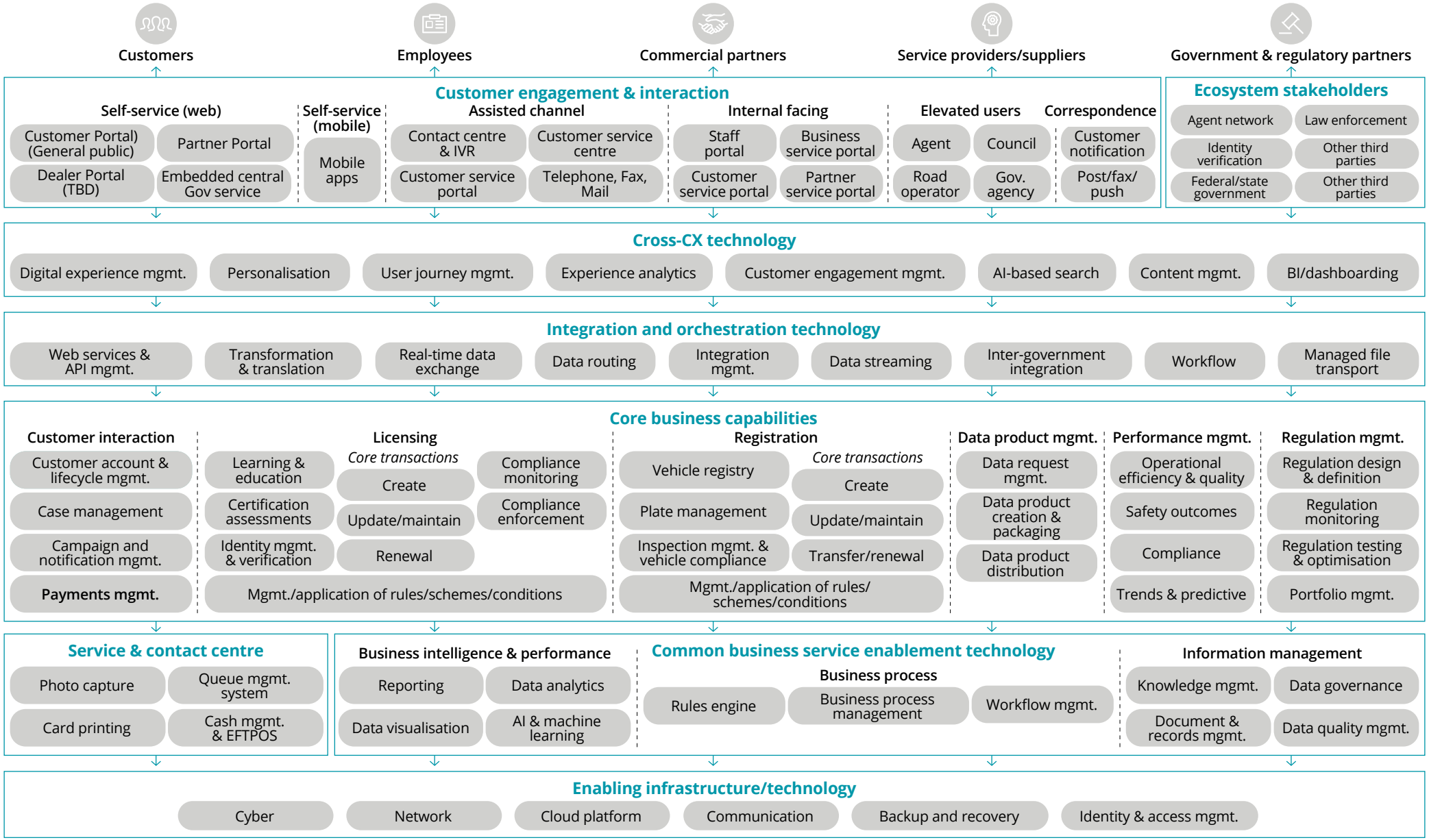


Figure 6: Future transport R&L Common Architecture & Technology Capability Model — key components | Source: Deloitte 2024

A description of the core components follows:

Customer engagement and interaction

The point of interaction is at the core of the transport R&L system, serving as the launchpad for user journeys. Built with human-centred design principles, this multi-channel hub fosters robust stakeholder engagement through website, social media, and seamless integrations with other partners.

From our global observations, many R&L platforms have transitioned to more modern software platforms in this space. Some of the key vendors include Adobe, Optimisely, Acquia, Sitecore and Bloomreach.

Integration & orchestration layer

The integration and orchestration (I&O) layer is the 'central nervous system' of transport R&L systems. It operates as a high performance data and process hub that efficiently processes massive R&L data streams in real-time. This enables actionable insights using event-driven APIs and intelligent reporting, empowering data-driven decision-making and proactive issue resolution. The layer promotes seamless interoperability with internal and external stakeholders via bi-directional data exchange, streamlining processes and improving communication.

Given the age and the organic growth of R&L systems, many environments lack a modern approach to integration and orchestration that works seamlessly across the system landscape. This is often hampered by the obscure interfacing requirements of core legacy systems. These challenges often greatly affect the cost of maintaining and improving systems.

Some of the leading vendors in this space include Informatica, Oracle, SAP, IBM, Mulesoft, Boomi, and Workato as well as the leading cloud platform providers AWS, Azure, and Google.[22]

Core business system layer

The R&L business system layer is what is often thought of as 'the system' or in some cases 'the mainframe'. This is the heart and soul of the R&L system and is typically ageing, heavily customised and built on outdated or obsolete coding languages. Documentation, or lack thereof, is a significant problem, compounded by limited access to people with the skills to interpret the underlying code. This has made modernisation costly and risky.

This is where the modernisation conversation is normally focused. We have observed many approaches to modernising this layer — ranging from containing the legacy system in cloud platforms through to full system replacement. There are many choices and many technology components that need to be considered in this layer, each with their own benefits, challenges, and risks when it comes to modernisation.

One of the first steps to modernising the core system involves solving the documentation problem. This typically involves using modernisation platforms that are able to interpret the code and system architecture to create visibility and a deeper understanding of how the underlying components interact and what functions they perform.

Jurisdictions that have taken a system replacement path have favoured CRM (customer relationship management) and BPM (business process management) platforms as the central system to deliver R&L core functionality. According to Gartner, some of the leading vendors in this space include Salesforce, Microsoft, Oracle, Pegasystems, and ServiceNow.[23]

3.2 Potential future impacts on R&L

With the three futures trends (mobility, identity, and customer) in mind, the reference architecture is a useful tool to visualise how key R&L components will be impacted. It starts to break down the challenge of designing technology to meet future demands.

We have mapped each of these three future trends to show where significant change is likely to occur against the R&L Reference Architecture, illustrated on the following page.

22 Gartner (2023), Gartner Magic Quadrant for the CRM Customer Engagement Center, upper right quadrant, 1 November 2023, Available at: https://www.gartner.com/en/documents/4899431, and Gartner (2024), Gartner Magic Quadrant for Integration Platform as a Service, 9 February 2024, Available at: https://www.gartner.com/en/documents/5198963

23 Gartner (2023), Gartner Magic Quadrant for the CRM Customer Engagement Center, upper right quadrant, 1 November 2023, Available at: https://www.gartner.com/en/documents/4899431

3.0 Technology capabilities needed to underpin the regulator of the future

Future transport R&L Common Architecture & Technology Capability Model — key components impacted by future trends

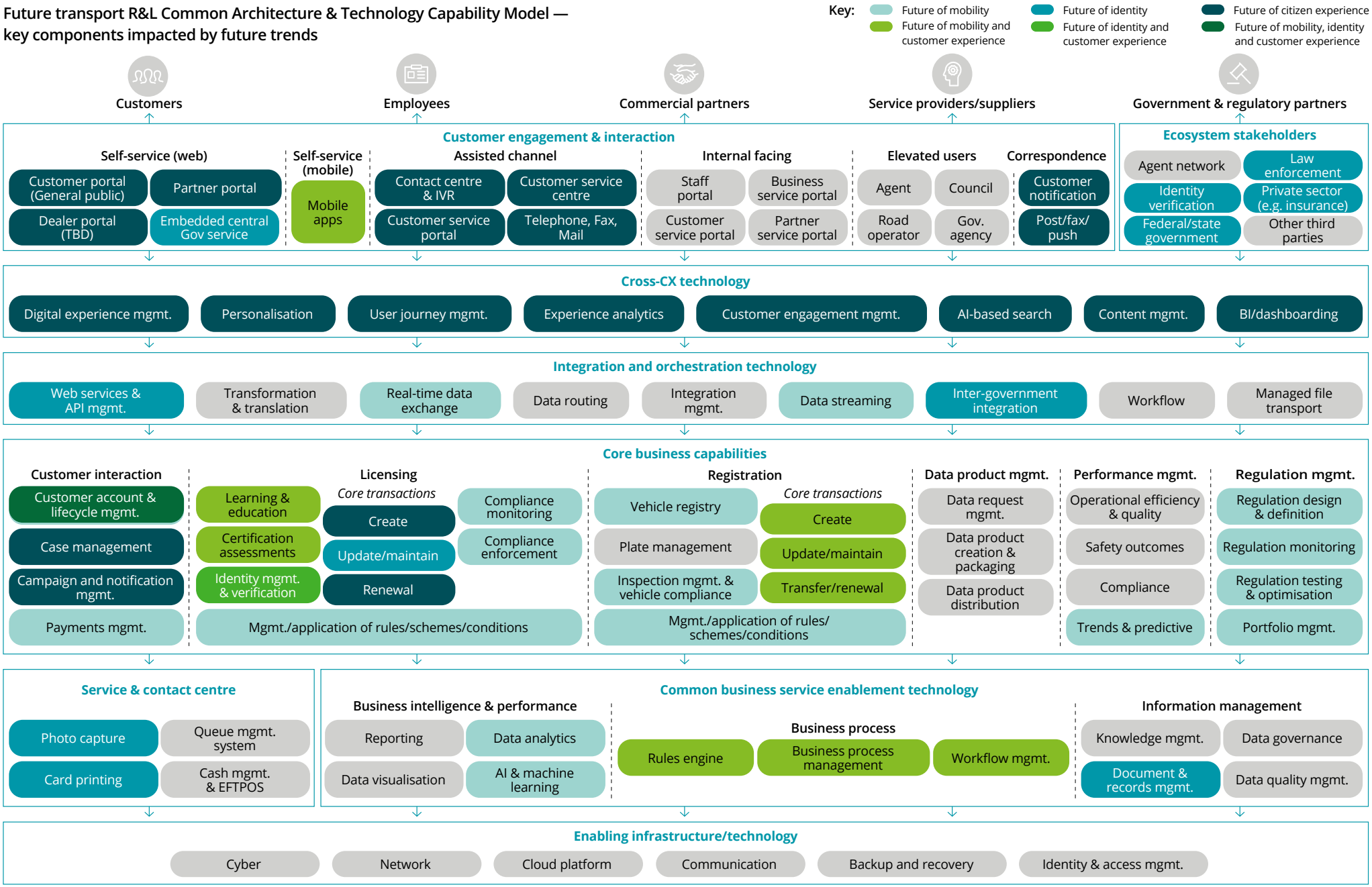


Figure 7: Future transport R&L Common Architecture & Technology Capability Model — key components impacted by future trends | Source: Deloitte 2024

The impacts are future looking, and each jurisdiction may have its own interpretation of the future and most likely scenarios. We have summarised the primary impacts from each of the three future trends below.

Implications of the future of mobility

The future of mobility will have significant implications on how R&L products and services are designed, and how customers will interact with government. The future of mobility implications are indicated in light teal on the R&L Reference Architecture model. Some of the key points that were considered include:

- **Connected vehicles and infrastructure:** With increased data from connected vehicles and transport infrastructure, there will be new opportunities to monitor the effectiveness of regulations and simulate and design new ones. This will require advanced capabilities in **Regulation Management** and **Real-Time Data/ Streaming**. We may also see changes in **Inspection Management and Vehicle Compliance** — vehicles may be able to continuously stream data about their condition with compliance monitoring becoming more dynamic. This concept flows more broadly into **Compliance Monitoring** and **Enforcement**. We have already seen some of the possibilities with mobile apps that monitor driver behaviour (e.g. Life360 and DriveScore), which are being used by parents keeping an eye on their children through to corporates and fleet management. Applying this to a government and regulator level raises privacy considerations. One possible path is that compliance takes on some elements of 'nudge behaviour' as opposed to just a punitive, reactive approach.
- **Shared mobility:** The growth of shared mobility services and mobility as a service may create the need for a more dynamic association between licence holder and vehicle registration. This becomes particularly relevant if vehicle registration fees are replaced by some form of road use charge. This will drive changes to how the **Customer Record (Customer Account and Lifecycle Management)** and the Vehicle Registry interact. There will also be increased pressure on developing new business rules and processes **(Rules Engine, Business Process Management, Workflow).**
- **Electrification of powertrains:** The roll-out of electric vehicles at its core is just a change of powertrain and as such would not directly change regulations. However, there are several potential flow-on implications. One is the issue of declining fuel tax revenue, which creates a future need for alternative approaches to how vehicle use is taxed. Changes in the approach to road user charging allow for more personalised use of the transport network and is a path many countries are embarking, including Singapore.

  If we combine the 'shared mobility' perspective into this we also set up conditions for a road-usage charge that is linked to the driver, as opposed to the vehicle (which may flow through to broader MaaS strategies). The roll-out of electric vehicles (EVs) is also bringing with it new EV-charging infrastructure, which could create a situation where driver identities are linked to the vehicle to support account-based charging. Other implications could include changes to road access. For example, only zero emission delivery vehicles have access in the CBD in the Hague.

  Another implication could emerge from recent findings that suggest there are some safety risks with EVs, which are most likely linked to the technology being new, with drivers (and pedestrians) adapting to the new driving characteristics of EVs. Vehicle safety issues include reduced noise, regenerative braking, and increased acceleration. As such, regulatory change may be required.

  The resulting impacts on the R&L Reference Architecture could affect **Payments Management, Vehicle Registry, Customer Account and Lifecycle Management, Regulation Management, and Inspection Management and Vehicle Compliance**.
- **New and changed transport modes:** One of the exciting trends of the future of mobility is how transport options may change. We are already witnessing the regulatory pressure resulting from the introduction of micro mobility, such as e-scooters and e-bikes. These require changes to regulations that need to be encoded into the underlying systems — something that is time consuming and high cost in the current legacy systems. This will require access to easy-to-use, powerful **Business Rules**, **Business Process Management**, and **Workflow** technologies to drive rapid roll-out (at low cost) of regulatory changes. The gradual emergence of more autonomous vehicle capabilities will also drive regulatory changes. There is another potential future here if we consider combining the impacts of connected and autonomous vehicles with dynamic authorisation of autonomous modes on different road corridors such as passing a gantry to a freeway, which enables autonomous mode.

  This would require advanced capabilities to handle **Data Streaming and Real-Time Data**, as well as integration into operational control technology across the transport network.

3.0 Technology capabilities needed to underpin the regulator of the future

Implications of the future of identity

The future of identity will potentially drive changes to how and where identity data is stored in R&L systems, and the processes across government for managing identity and verifiable credentials. There is also movement towards digital ID and digital wallets. The future of identity implications are indicated in teal on the R&L Reference Architecture model. The key points include:

- **Shift away from driver licences as master identity record:** If governments (state or federal) move towards centralising the management of identities like Singapore and Estonia, then the current practice of maintaining identity records in the R&L systems will need to change. In this scenario, the R&L system is focused more on providing a verifiable credential associated with an identity rather than maintaining the identity itself. This has implications on the components — **Identity Management and Verification, Document and Records Management**, as well as the customer/licence registry labelled as **Customer Account and Lifecycle Management** in the model. Equally, there will be changes required in the interaction and engagement with customers and ecosystem stakeholders such as federal and state governments, and law enforcement.

- **Move to digital IDs:** The shift to digital IDs will have implications on any current functions associated with managing physical identities. These are highlighted in the model under **Photo Capture**, and **Card Printing**. Some of these areas may become redundant in the future; however, it is also worth noting that there will be a period where parallel processes across physical and digital will need to be maintained. The key consideration is how to design the technology to support the parallel worlds in an efficient, secure, and low-cost manner.

Implications of the future of customer experience

The future of customer experience is already upon us with digitisation of government services happening across most jurisdictions. The future of customer experience implications are indicated in dark teal on the R&L Reference Architecture model. The key points include:

- **Single view of customer:** Transport operators are increasingly looking towards establishing a single view of the customer to support more personalised journey planning, dynamic fares, and ultimately, mobility as a service (MaaS). There is a possible future where the customer from the payment and ticketing domain is merged with licensing customers to represent a single customer (which is, after all, what we all are). This will enable a number of future possibilities around integrated transport (including driver owned vehicles), personalised journey planning, and even transport demand management such as platoon routing around congestion. Given this potential future, the R&L Reference Architecture has defined the core customer register as a separate function from licensing. This is illustrated in the architecture where there is no specific customer record under licensing; instead it is represented by **Customer Account and Lifecycle Management**. This could be maintained in a separate system outside R&L where licensing data is linked through to the central customer account database.

- **Unified customer portal:** We are witnessing changes to consolidate government services into a single, unified portal. A notable example is the progress that has been made with Service NSW. In this scenario, there could be a single, user-friendly platform for registration, licensing, permits, payments, and general information access with personalised dashboards and proactive notification. These changes are represented in the model under S**elf Service (Web), Self-Service (Mobile), Assisted Channel,** and **Correspondence**.

- **Mobile-first approach:** Future service delivery will also prioritise mobile app development for convenient R&L services, including digital licence downloads, vehicle tracking, and personalised journey planning. This is represented under **Self Service (Mobile)** in the model.

- **Digital experience uplift:** More broadly, there will likely be change across the wide range of digital channels for R&L. Given this, we would expect changes and enhancements to extend to the **Cross-CX technology** layer as well as **Learning and Education** and **Core Transactions** for both **Licensing** and **Registration**.

- **Biometric authentication and secure identity management:** Future advancements in biometric technology and identity management will likely use multi-factor authentication (MFA) with biometric options for secure access and identity verification, protecting customer data privacy. These changes are represented under **Identity Management and Verification** in the model.

Our analysis has just touched on some of the likely changes. How each component is impacted, when, and what business and technical implications will follow are beyond the scope of this paper. If we zoom out, we also get a macro view of the three futures, which suggests that almost no stone remains unturned across the R&L system landscape. The case for modernisation is clear when we understand how much change will be required. But this is more than just replacing old with new. Some areas will become obsolete. Some will need transformation. And some have not been thought of before. Successfully navigating the modernisation journey will require making the right strategic decisions about where to invest, how to invest, and when to invest.

3.3 Approaches to transitioning away from legacy technology

R&L modernisation is complex and the change implications on internal stakeholders, customers, and government and private sector stakeholders are significant. No single solution or approach can meet all needs. Success will require effective planning and navigation of multiple paths, timelines, and pro-gram phases.

Our perspective is that R&L system modernisation can be delivered through four key technology plays. Recognising that the legacy systems are large and complex and have been built and extended over time, it is unlikely that a single approach (e.g. Replace) would apply to every component of the architecture. We think there are many strategic choices for each technology and functional component. These strategic choices can then be bundled together to form a series of phases that represent evolving stages of the technology transformation.

3.0 Technology capabilities needed to underpin the regulator of the future

The four key plays that can be applied across R&L are:

Four key plays for R&L modernisation

Re-Build	Maintain and Contain	Modernise	Replace
A solution that would be considered if no cost-effective alternatives exist	*An interim solution where there is limited return on investment from modernizing or replacing*	*An interim or longer term solution that enables modern interactions*	*An longer term solution that is suitable for high value/cost areas and where COTS software exists*
Key Actions • Select a modern cloud platform-as-a-service (PaaS) and re-build functions on the platform	**Key Actions** • Transition to containerised cloud • Secure support contracts for legacy code • Security?	**Key Actions** • Run code discovery across • Convert to modern code base and legacy database (e.g. Java) leveraging modernisation platforms • Deploy on modern cloud • Selectively optimise application components	**Key Actions** • Select established market offering that provides a fully managed Software-as-a-Service (SaaS) platform, and align to broader architecture vision • Implement software components, configuration and integration into the ecosystem
When to use • High-value function with limited options in the software market • Access to strong development capability	**When to use** • Future functional obsolescence and/or uncertainty around how it will be used in the future • Future needs are unlikely to significantly change or impact the function • Technical support/access to skills are widely available in the market for at least the short-mid term for this function • Costs to maintain are manageable when compared to the alternatives	**When to use** • The function is not on a path to obsolescence and is likely to undergo change in the future • Some uncertainty around how the function will be used in the future requiring flexibility in the technology • No clear software market offering available and/or cost to transition is too high • Unknown level of complexity built into legacy system and lack of quality documentation • High risks associated with business change in the short-medium term	**When to use** • The function is not on a path to obsolescence and will require future enhancements that align with a market offering • There is low uncertainty about how the function will be used and/or the software market roadmap is aligned to this future • Software market is well aligned to the need and supports an aligned future roadmap • Ability to effectively manage change across the organisation

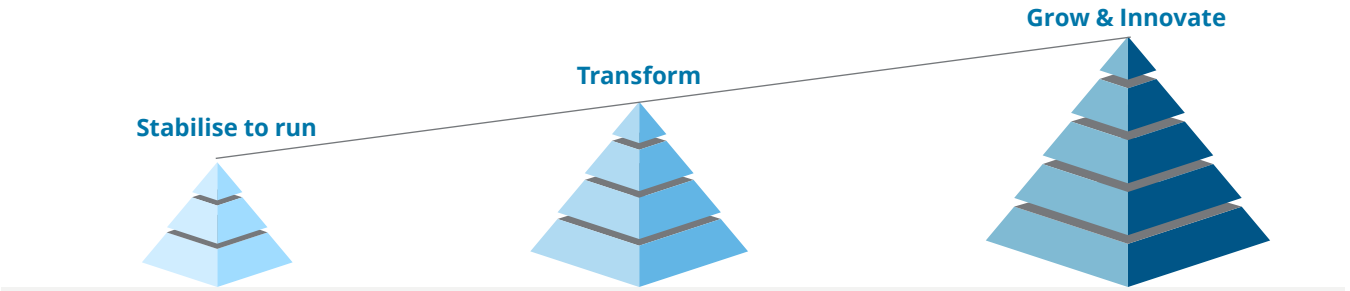
Figure 8: Four key plays for R&L modernisation | Source: Deloitte 2024

3.0 Technology capabilities needed to underpin the regulator of the future

Each of these four plays can be applied to a range of components across the R&L technology landscape in various stages and across varying timelines — this creates a mosaic across the reference architecture. Think of these options as a palette of colours that can be painted across the system architecture for a given point in time or phase. In other words, any transformation program is aligned with more than one approach; there are always many options. This should not, however, be interpreted as a confused mix of transformations happening at the same time. Instead, we suggest constructing transformation phases that focus on a specific goal, to minimise change in low priority (or overly complex, costly, and risky) areas at first, and to plan a series of phases that build upon the previous phase to drive more value and more significant and impactful change.

Figure 9 is an example of a transformation approach for R&L technology programs. This example is built around establishing a modernised core platform to enable future enhancements across the R&L landscape without initially causing major disruptions to core business processes and customer experience channels — this can be likened to an 'inside-out' approach to transformation. Other strategies could emerge that instead focus on the front-end first, and then working backwards into the centre (or 'outside-in'). Each approach has its merits and drawbacks. The inside-out approach illustrates how the reference architecture combined with the four plays can be applied to start building out a comprehensive transformation program for R&L. However, this is not a specific recommendation on how to transform R&L; each jurisdiction will have its own circumstances and trade-offs to consider.

Illustrative transformation approach that could be considered for R&L technology programs



Solidify the core licensing and registration functions to enable a more stable, modernised platform to build on

- Legacy code discovery and business rule definition
- Modernise core licensing and registration systems and enable modern API layer to support future interactions and data exchange
- Apply security improvements across all components in a maintain and contain strategy

Transform the customer and employee experience and commence data analytics enhancements. Enable automation across internal processes to drive operational efficiency

- Implement and replace current data analytics platform
- Implement and replce customer experience front-end
- Augment current modernised licensing and registration system with new technology to manage and maintain business rules/BOM/ workflow capabilities
- Modify identify services to reflect the new approach to digital identify management

Continued user experience optimisation whilist driving improvements to regulatory decision making based on data, simulations and AI capabilities

- Implement AI capability to support monitoring of regulatory effectiveness and modelling of future regulation changes
- Adopt enhanced user experience features

Figure 9: Illustrative transformation approach that could be considered for R&L technology programs | Source: Deloitte 2024

3.0 Technology capabilities needed to underpin the regulator of the future

This approach starts by modernising the core business capabilities that generate and maintain the customer and registration record in **Horizon 1**. All other components would be managed in a maintain and contain mode until after Horizon 1.

More impactful changes can be rolled out when a modernised and stabilised core system supported by modern system interfaces is in place. In **Horizon 2**, cumbersome business rules and workflows that are currently managed in the core system can be replaced with modern systems designed to drive business process improvement. Front-end user experience can be enhanced with a number of best-of-breed digital platforms alongside a CRM system to support customer interaction, case management, and notifications.

In **Horizon 3**, there is an opportunity to start delivering more advanced capabilities that enhance the design and effectiveness of regulatory changes as well as the speed and responsibility of new regulation deployment. AI and data analytics will play a role in driving significant capability uplift in **Horizon 3**.

This approach is not a specific recommendation for R&L transformation. It is one path — each regulator will need to consider its own challenges and demands.

Our core recommendation, however, is to apply this framework, leverage a comprehensive reference architecture, identify areas that are likely to change, and drive value across the future of R&L. Then, make strategic choices across each of the system components that can be grouped into a set of horizons.

This could play out like this:

Applying the four plays within the context of **Horizon 1** (Stabilise to Run) results in a reference architecture model that drives modernisation of the core while taking on a maintain and contain strategy for the rest of the R&L components.

3.0 Technology capabilities needed to underpin the regulator of the future

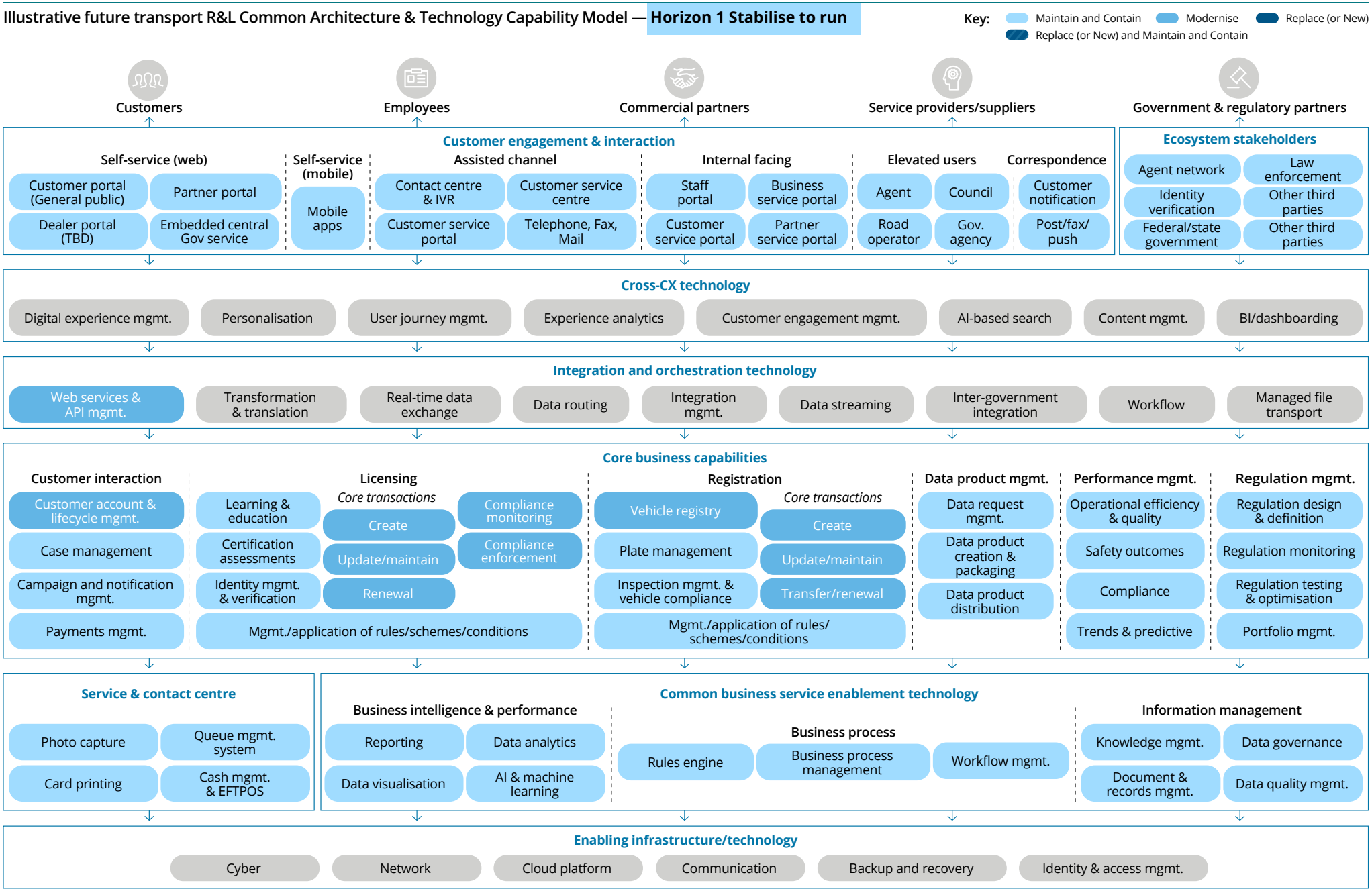


Figure 10: Illustrative future transport R&L Common Architecture & Technology Capability Model — Horizon 1 | Source: Deloitte 2024

3.0 Technology capabilities needed to underpin the regulator of the future

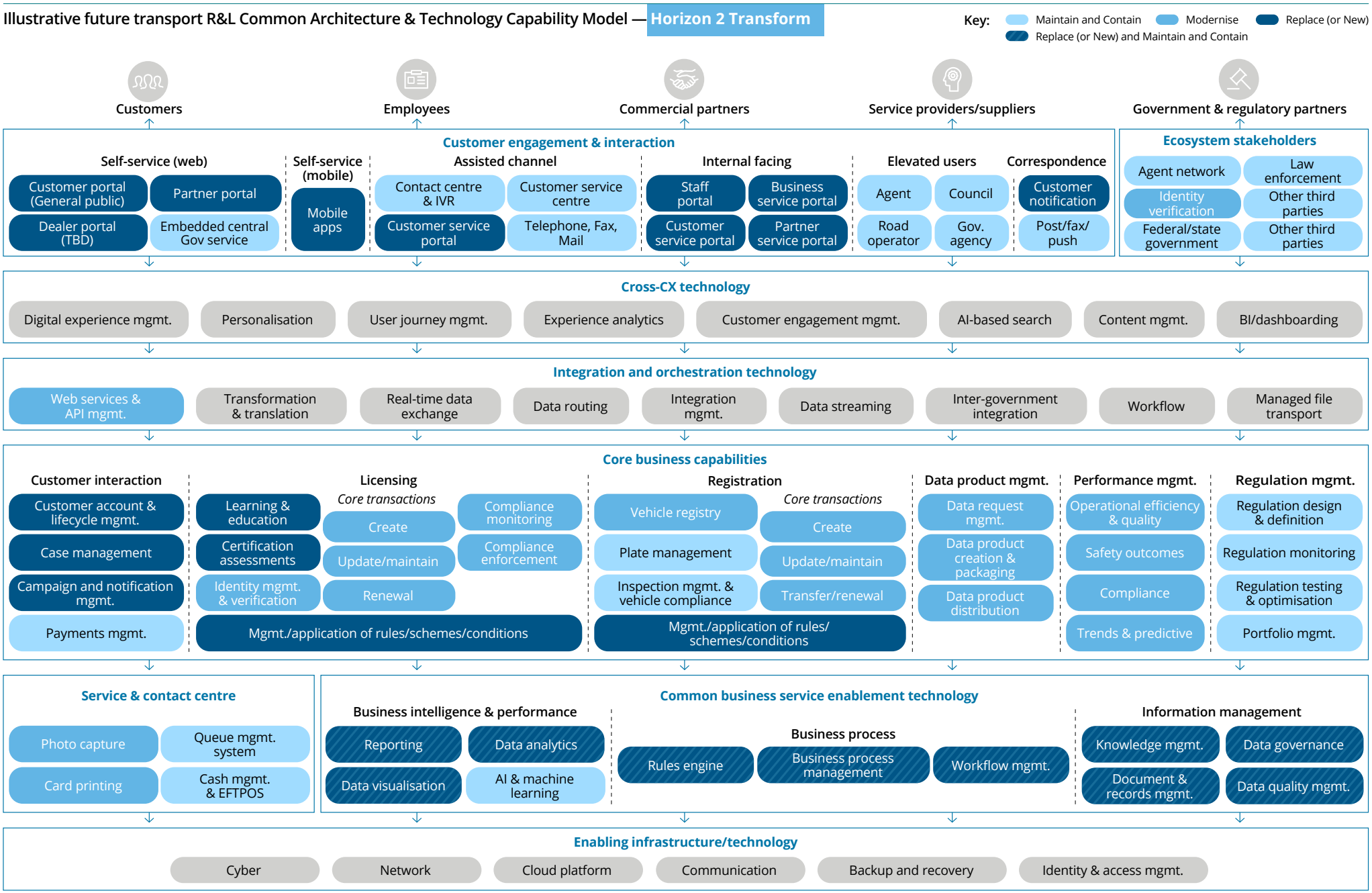


Figure 11: Illustrative future transport R&L Common Architecture & Technology Capability Model — Horizon 2 | Source: Deloitte 2024

3.0 Technology capabilities needed to underpin the regulator of the future

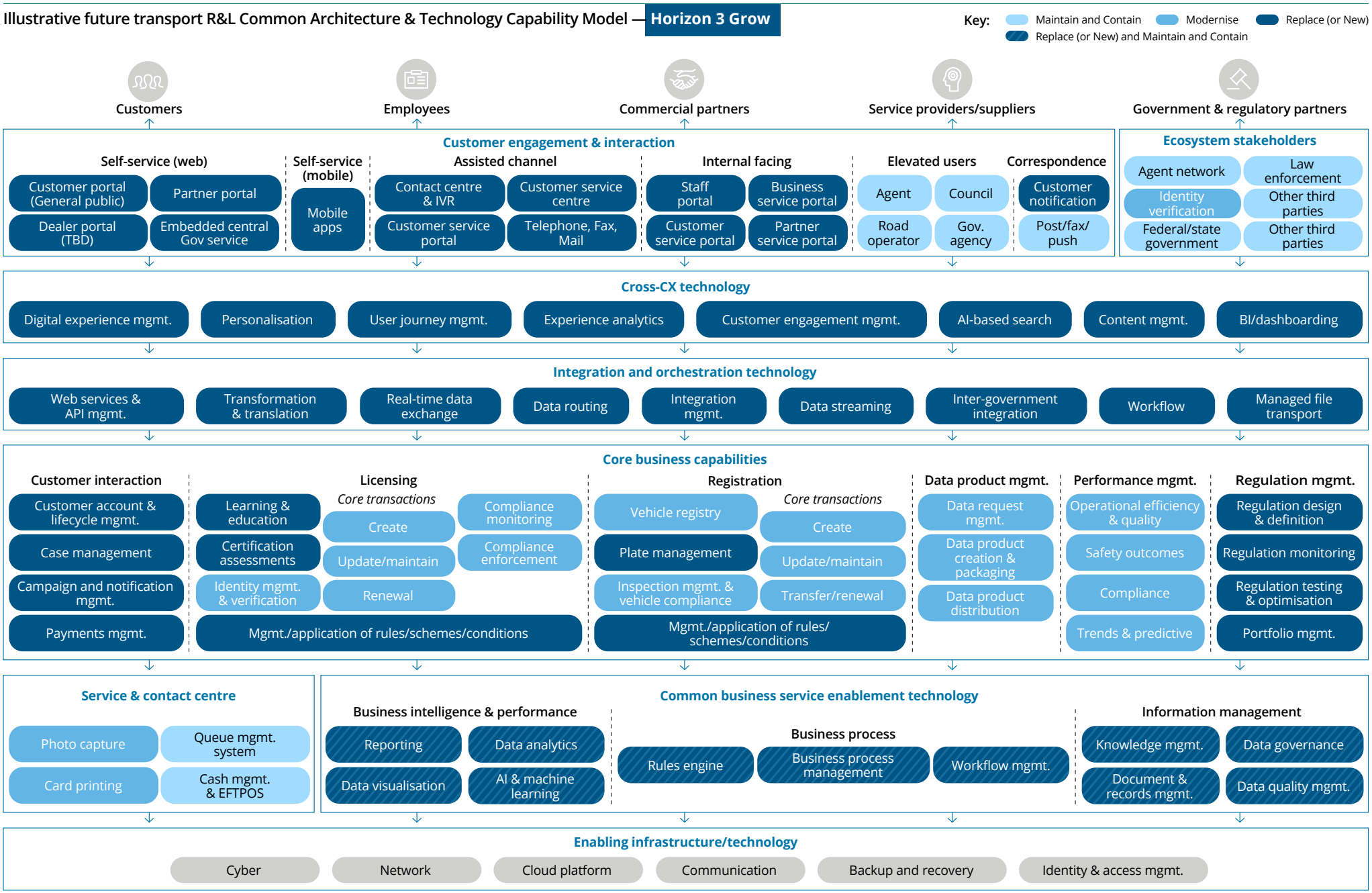


Figure12: Illustrative future transport R&L Common Architecture & Technology Capability Model — Horizon 3 | Source: Deloitte 2024

4.0 Next steps to modernise transport regulatory systems

As governments are considering their R&L technology transformation options, the approach we described in part three is a key step in breaking down what is a complex transformation challenge. This approach is a modular approach to modernisation and transformation that considers current state challenges, cost of transformation, and future strategic relevance for each component. It is suitable for early-stage planning, and can also be applied part way through a transformation to support strategic planning of the technology platform over time.

The R&L Reference Architecture is a common framework to support collaboration between jurisdictions as they work through how to transition off legacy systems. There is an opportunity to leverage strategies, market insights, and share concepts around approach that we believe would be beneficial for all State and Territory Governments.

4.1 What should you do next?

Here are four key steps to take:

Step 1: Create a reference architecture for your R&L systems

We welcome re-use of the R&L Reference Architecture in this report but note there could be some regional differences that may call for adjustments. Alternatively, government authorities may already have their own view and/or be interested in developing their own. It is important to start with a common point of reference and to consider the future of transport and regulation more broadly — including capabilities that may be required and/or understand how current capabilities are likely to change.

With a common reference architecture in place, the 'big challenge' is broken into 'bite-sized chunks' that can support strategic analysis and decision making.

Step 2: Consider the three future trends — mobility, identity, and customer

As we outlined in part three, consider the key future challenges, developments, and opportunities facing your organisation and work through how this will affect components of the reference architecture. Ask:

- Will it be relevant (obsolete) in the future?
- Will it increase (decrease) in importance in the future?
- Will it be likely to change (remain stable) in the future?

This will result in a strategic view of where and how future developments will play out over time.

Step 3: Determine which plays make sense, where, and when

This will involve getting a better understanding of the current state of each component including understanding what technology supports the component and the costs, risks, and challenges to maintain the current component.

A more technical review will help to understand how the architecture in the underlying legacy systems is grouped together. This may be achievable using the organisation's understanding and documentation of its systems but, in most cases, the ageing nature of the R&L systems makes this difficult. Where this is the case, undertaking a legacy code review using available modernisation platforms will analyse how the systems are constructed and the functions they perform.

This step also includes a review of market offerings to identify which components of the reference architecture are supported by enterprise software packages. This will help to determine where replacement strategies may be feasible versus areas that may continue to require customer development (technology improvements over time reducing the degree of customisation required).

The current state review including the costs, risks and challenges (including non-technology enablers such as culture, skills and change management), combined with a view of the technology landscape and market offerings, can now be contrasted against the future strategies to drive strategic decision making around the four plays.

The result will be a heat map against the reference architecture showing how the transformation will be conducted.

Step 4: Construct a roadmap

A short-, medium-, and longer-term perspective can now be applied to the transformation. This should lead to the creation of distinct phases for the transformation. Early phases would typically emphasise constraints such as budget, change customer and employee impact, and burning platforms such as cyber. Later phases feature opportunities and focus on delivering bigger changes that take advantage of future trends.

The roadmap will help you to determine how the four plays can be run within each phase of the plan. As such, budget constraints and appetite for change may limit change to a transformation in earlier phases. A full replacement might make sense over the longer term. The strategy for investment and change can be tailored to meet key step changes over time.

Conclusion

The future of registration and licensing is data-driven. As the R&L landscape evolves, efforts to modernise systems must be strategic. Governments are already exploring ways to navigate this complex change, considering current state challenges, transformation costs, and the future relevance of each component.

This paper explores a strategic four-step approach: developing a reference architecture, assessing future variables — mobility, identity, and customer — evaluating the current state of each architectural component and market offerings, and, ultimately, creating a phased roadmap for system transformation.

A major focus of these steps is that R&L systems can adapt to the conditions during implementation. We propose prioritising modernising core business capabilities, with less critical areas following a 'maintain and contain' approach until later phases.

This paper also emphasises leveraging strategies, market insights, and shared concepts, which can be beneficial across jurisdictions. The R&L Reference Architecture is a critical framework for collaboration among different governments as they transition from legacy technology systems.

Enabling interoperability and integration, adopting citizen-centric design, ensuring security and privacy, emphasising adaptability and scalability, and incorporating artificial intelligence and automation will be essential for future transformation.

Our approach towards transforming R&L systems provides structured yet flexible ways to tackle future challenges. It ensures the stability of current systems while paving the way for modernisation driven by efficiencies gained through advanced technologies.

Contact us

Susan Brown
—
Partner
Technology & Transformation
susbrown@deloitte.com.au

Sarah Close
—
Partner
Strategy, Risk & Transactions
sclose@deloitte.com.au

Blye Decker
—
Director
Technology & Transformation
bdecker@deloitte.com.au

Eyal Genende
—
Director
Technology & Transformation
egenende@deloitte.com.au

Appendix A: Glossary

Term	Definition
Application programming interfaces (APIs)	Sets of protocols, tools, and definitions that enable different software applications to communicate and share data with each other.
Authority	An administrative body or agency designated by the government to manage and oversee the registration, licensing, and regulation of certain entities (such as vehicles, drivers, vessels, businesses, or other regulated activities) within a specific jurisdiction.
Autonomous vehicles (AV)	Autonomous vehicles are self-driving transport systems that navigate without human control, using sensors and AI for decision-making. They can be classified based on the level of automation and the driving task being performed: **Level 1 –** Driver assistance: Basic driver aids, needs continuous human supervision. **Level 2 –** Partial automation: Assisted steering and acceleration, driver's continuous monitoring. **Level 3 –** Conditional automation: Mostly autonomous driving, occasional human intervention. **Level 4 –** High automation: Operates independently in specific areas, potential human control. **Level 5 –** Full automation: Completely autonomous in all scenarios, no human intervention.
Connected and automated vehicles (CAV)	Vehicles equipped with a wide collection of technologies that deliver communication between vehicles and infrastructure.
Commercial-off-the-shelf (COTS)	Software that can be bought from a provider and adapted after-the-fact.
Digital public infrastructure (DPI)	DPI is a set of shared systems for the public sector that are built on open standards and are secure and interoperable — the three core components of DPI are digital identity, electronic payment, and data exchange systems. The aim of DPI is to drive access, innovation and digital economies. Source: United Nations Development Programme

Appendix A: Glossary

Term	Definition
Electric vehicles (EV)	An umbrella term related to three types of electric powered vehicles: • Battery electric vehicles (BEV): Run entirely on electricity stored in high-capacity rechargeable batteries. • Plug-in hybrid electric vehicles (PHEVs): Equipped with both an electric motor and an internal combustion engine. Can be plugged-in for charging or fuel run. • Hybrid electric vehicles (HEVs): Powered by both an internal combustion engine and an electric motor. Cannot be plugged in to charge the battery; instead, the battery is charged through regenerative braking and the internal combustion engine.
Gross vehicle mass (GVM)	The maximum loaded mass of a vehicle.
Heavy vehicle (HV)	A vehicle with a gross vehicle mass of more than 4.5 tonnes.
Information technology business-as-usual (IT BAU)	Denotes the regular ongoing operations and maintenance activities within an IT environment.
Light vehicle (LV)	A vehicle other than a heavy vehicle.
Micro mobility	Lightweight, usually electric, transportation modes that are designed for short trips such as electric scooters, electric bicycles, electric skateboards.[1]
Mobility-as-a-service (MaaS)	Shift away from personally-owned modes of transportation, towards aggregated mobility solutions that are consumed as a service.
Point-to-point integrations	Direct connections between specific applications or systems for sharing data without a central hub.
Registration	Is the registration of an entitlement or ownership.
Shared mobility	The concept of shared transportation services where individuals or groups access and utilise vehicles or transportation modes on a short-term or temporary basis such as Uber Pool, Go Get and Lime Scooters.
Software-as-a-service (SaaS)	Software accessed via the internet on a subscription basis, eliminating the need for installation or maintenance on individual devices.
Technical architecture	The form and structure of systems and technologies.
Platform-as-a-service (PaaS)	Cloud operated platform for hosting custom-built software. The underlying hardware and operating systems are managed by the cloud platform.

Deloitte.

Deloitte Services Pty Ltd
ABN 61 649 157 201

Deloitte is Australia's pre-eminent economics advisory practice and a member of Deloitte's global economics group. For more information, please visit our website: www.deloitte.com/au/en/services/economics.html

Created by CoRe Creative Services. RITM1819180