



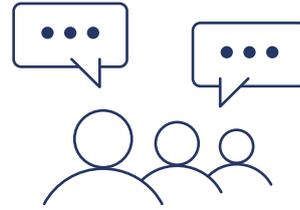
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## 1. Introduction

Calypso Networks Association (CNA) and OSPT Alliance have announced they are collaborating to drive the adoption of open standards in transport ticketing. The end goal of the partnership is to achieve convergence between their respective open standards – CALYPSO® and CIPURSE™ – and to simplify the choice and integration options for public transport operators (PTOs) while delivering time and cost efficiencies to the entire transport ticketing value chain.

Together, CNA and OSPT Alliance wanted to align stakeholders around the issue of evolving ticketing and open technologies. It organised two focus groups in order to gain better insight into market expectations.

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In April 2021, the first Focus Group was held with representatives of Users (mobility providers). To frame the session, the following questions were asked:

1. What functionality do you envision to advance your transport ticketing systems? (5/10 years+)
2. What are the barriers to achieving this vision? / Can you provide insight into current system frustrations?
3. How do we make transport ticketing systems adaptable to long term requirements within a reasonable budget?

In May 2021, a second Focus Group was held with representatives of Suppliers (solution providers). The questions asked to frame the session were:

1. What are your expectations of this collaboration?
2. What functionality do you believe to be crucial to the advancement of transport ticketing systems?
3. Can you share current ticketing system limitations?
4. What key elements are necessary to ensure sustainability and growth of the ecosystem?

This document presents a synthesis of the information collected during the two focus group sessions.

- ➔ **Section 2 - Details an overview of key learnings.**
- ➔ **Section 3 - Outlines the current state of the transport ticketing ecosystem today.**
- ➔ **Section 4 - Addresses the expectation of a future standard.**

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## 2. Key outcomes – What did we learn?

Current CALYPSO® and CIPURSE™ technologies address the need for contactless ticketing by PTA and PTO today. For the participants who have already deployed contactless solutions, there is no business case to change the technologies already in place. Nevertheless, **there is demand to continuously improve both traveller experience and the security of ticketing.**

Maintenance of both standards is expected to remain ongoing, as well as improvements migrate toward new versions of specifications, more efficient digitisation on mobile and better interoperability, particularly with private mobility providers.

**The trend toward Mobility-as-a-Service remains strong and integration between systems will become increasingly more important to provide travellers with frictionless journeys.** Standardisation must extend from fare media to all sub-systems, and from front-end devices to back-end systems. Additionally, Account Based Ticketing architecture, which fosters integration between systems, requires strong consideration for the management of the customer account and the right-to-travel, and the acceptance of different technologies (EMV, barcode, Bluetooth devices...) as fare media. Furthermore, the shift toward more integrated solutions must also comply with security and privacy regulations, such as GDPR.

**Standardisation through a certification programme would allow seamless and cost-effective integration, as well as more independence for PTAs and PTOs to procure solutions.** Open standards are expected to reduce vendor lock-in while simultaneously increasing the pace of innovation. In addition, nuanced specifications enable decision makers and experts to make choices that work within project constraints. When deploying new standards, education and strong technical support should be offered by experts and skilled consultants.

Successful, sustainable standardisation will occur if an effective collaborative environment is established by associations, with the participation of stakeholders, users, suppliers, as well as consultants. **A clear governance and funding framework, at the local and national level, should also be established to improve the ongoing evolution of transport ticketing systems.**

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**Whatever the deployment context, new standards should be designed and integrated as an ‘evolution’ rather than a ‘revolution’ of the existing systems.**

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## 3. Today's Opportunities

### 3.1 The business perspective

#### Transit market and technology

Networks around the world recorded a huge drop in ridership during the COVID-19 pandemic. Despite availability of vaccines and the return to “almost normal” business activity, ridership has not returned to pre-pandemic figures. Many passengers resumed the use of private vehicles, others switched to alternative modes of mobility, such as personal bike, micro-mobility services or carpooling. This is combined with a significant percentage of former passengers now working from home and commuting to the office infrequently or only a few days per week. This drastically impacted fare media shipments in 2020.



#### Contactless smartcard and multichannel solutions

The CALYPSO® and CIPURSE™ contactless smartcard features field-proven technologies. The current systems will remain in place in order to optimise investments. Despite the emergence of new fare media, such as EMV, open payment and barcode, smartcards remain a viable option, albeit with a lower market share than before. In addition, the rise of the account based ticketing (ABT) system is expected to reduce the appetite for card based technologies (CBT), where contracts are written inside the fare media.

Stakeholders agree that **these technologies are complementary and can exist in parallel; they are committed to providing consumer choice.** For all networks, the existing contactless smartcard will not be replaced by a new generation, due to the “cost of change”, which is too high to migrate millions of cards. Regarding current CALYPSO® and CIPURSE™ open technologies, users are happy with them: they provide the required expectations in terms of performance, security and fare functionality. Both users and industry stakeholders want assurance that the current standard will be maintained in order to justify long-term investments and protect past decisions. Lastly, large quantities of ticketing media are in stock, implying a significant fall in card sales volumes.

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## Avoid vendor-lock in

Past experience demonstrates that deploying a fare ticketing solution is expensive and time consuming. Even with limited smartcard technologies available, implementations are often proprietary and the vendor-specific nature of the technology increases the difficulty of deploying interoperable services.

Participants agreed on the fact that PTA and PTO have the power to impose norms and to implement open solutions. Nevertheless, writing RFPs and determining the best course of action can be difficult. There is a lack of educational material to enable strategic and technical decisions. Technology selection and investment processes are complex and it's often difficult to understand and compare offers. To avoid proprietary solution implementation and to open the market, more and more tenders are split into several parts to procure, for example, front-end devices independently from the back-end system.

## Digital age and interoperability challenges

There is growing demand from passengers to use digital solutions and to increase the use of smartphones as the main entry point for a seamless and friendly user experience. Until recently, this kind of digital solution was often supplied by start-ups, especially for micro-mobility providers. These companies did not invest in contactless smartcard technologies and unlikely to do so in the future. The implementation of near field communication (NFC) features with smartphone is complex, especially when attempting to guarantee a wide reach on handsets. Barcode technology is often preferred to NFC in order to bypass some of the restrictions imposed by handset manufacturers. Lastly, deploying digitised options on top of legacy systems raises many difficulties as the historical system were not designed to be integrated with mobile technologies, and integration with incumbent provider and new supplier requires a dedicated integration.



## 3.2 Technical

### Reliability and efficiency

Participants acknowledged the robustness and security of CALYPSO® and CIPURSE™ offerings, which guarantee secured, consistent, and reliable transactions. In addition, the contactless smartcard delivers known advantages compared to some other technologies, such as the Bluetooth Low Energy (BLE), which is not precise enough; Host-based Card Emulation (HCE) in Android, which is not available on all handset or competitor platforms; or the barcode, which suffers from a degraded user experience and limited reading performance.

For participants that have already deployed smartcard solutions, new specifications would need to build on the legacy of the existing framework. The ability to easily co-existence with other technologies and standards is crucial in an environment where ticketing payment choice is key.



### Upgrade and migration difficulty

Stakeholders share the need to improve existing technical features (ex. counters or media identifier management), as well as the need to upgrade data structure (ex. file) after the first deployment. The upgrade of a whole system to a new version of fare media specification can be complex. PTOs/ PTAs could face delays and refusal from vendors to upgrade their systems due to cost, lack of technical expertise if the system is old, or divergence from the vendors' objectives for their next generation solutions. Even the migration towards an ABT system, transferring existing card-based fare rules into server centric solutions, remains complex. Some business operations are not explicitly addressed in the ABT architecture, such as the inspection management, which requires exact and immediate accessible data on travel and fare history.

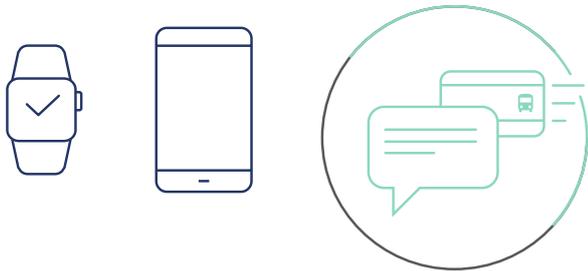
Some participants shared that a better trade-off would be to extend interoperability with advanced digital solutions. This would result in the upgrade front-end equipment with more configurability capability. This is one of the major workarounds to avoid NFC integration issues between smartphones and terminal vendors.

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## Increasing technical complexity

In the last decade, a growing number of vendors entered the market to promote different technologies such as HCE, phone SIM based integration, BLE, contactless EMV, and barcode. Those technologies focus mainly on better digitisation, but vendors of front-end equipment or handsets do not support them at the same pace, which cause technical interoperability issues.

As micro-mobility gained traction, the number of technical implementations increased with the number of service providers, as well as their mobile applications and their own back-end solutions. Providing a seamless travel experience across transport modes becomes a complex mission, requiring a nightmarish integration of APIs between systems that are specific to each solution. The user is identified in several manners, with several payment means, with several media and ways to interact with the transport offer.



## Market Status Today – Summary

The market is fragmented and lacks standards to foster integration and facilitate public transit in close cooperation with the private sector.

**The large choice in technologies, from smartcards, EMV open payment, barcode and mobile ticketing, means that there is increasing opportunities and challenges in how to ensure interoperability across the mobility network, and a consensus that the future may favour ABT. To this end, several questions emerge:**

- What will be the suitable mean to identify the passenger and the right to travel?
- How to ensure interoperability between different terminals and back-ends and also between different back-ends?
- What could be the distributed architecture to interconnect systems in the future?
- How to deal with usage with Smartphone owners and non-owners?
- How will the contactless smartcard compete with the growth in EMV® in transit?
- How will the contactless smartcard foster the ABT deployment?
- How open technologies can help involve start-ups & micro-mobility service providers?

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**The market today suffers from a lack of standardisation at several levels of the ticketing architecture, from the fare media data up to the back-end APIs, including front-end equipment with their specific interfaces. In addition, accepting both closed and open loop fare media requires complex integration at all levels.**

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## 4. Future Expectations

### 4.1 Business

#### Customer experience & inclusion

Providing a consistent traveller experience is a major concern for participants in the focus groups. Frictionless and seamless journeys across all modes of transport is paramount in a context where public mass transit connects to private sector services such as micro-mobility, ride hailing, taxis, and even privately owned car or bike services. The challenge comes in dealing with different types of end-users and figuring out how to design services and related systems that not only address commuters, but also occasional or tourist travellers, and digital natives that request full dematerialisation? This last type of user is made up of autonomous adults; technology to serve these customers cannot be deployed if it excludes passengers such as children, elderly or unbanked people.

Access to the transport services, could be conceptualised as a – paid – access control approach. This approach would use the technologies to integrate a large set of services, including public event, municipal services, cultural institutions, workplaces, libraries, food services, or for paying fines and fees. Integration of such services can foster loyalty towards local services and users could be rewarded with loyalty programs.

#### Foster fast-paced innovation

Exposed to digital services from other industries that are available through smartphones, travellers expect more innovation from the transportation sector. Focus Group participants all agreed on the need for fast-paced innovation to ensure the following:

- Agility and time-to-market;
- Technical flexibility: solutions must evolve and remain compatible to several data exchange format, not only NFC;
- Cost-efficient solutions must be affordable with low cost of ownership;
- Facilitate the fight against ticketing fraud;
- Ease of provisioning with multiple suppliers;
- Compatibility with legacy system to avoid technical big-bang;
- Quick and frequent deployment; avoiding months for full rollout;
- Business performance, such as fast throughput for mass transit (high passengers per minutes).

These criteria indicate that the future of ticketing must be driven by open standards managed through a framework that addresses market pain points with a holistic approach to the entire ecosystem.

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## Governance

Establishing standardised ticketing solutions in a large area, across a country or a region, is a challenge where transport operators, authorities, and ministries must agree on governance and solutions.

A new standard should address the whole range of fare or pricing definitions, as well as combined service offers. **The collaboration and ticketing integration between public and private sector, between mass transit and individual offer providers, has now become unavoidable.** To that end, regulation rules and mandates must be clear as mutual trust is the necessary foundation.

Standards must be clearly documented and capable of facilitating simplified decision-making processes for stakeholders, whether strategic or technical. Adding new functionality to an interoperable system is complex due to the different stakeholder's agendas and constraints, and would be difficult to agree to every change.

Consulting is recognised as an efficient way to support organisations in implementing and optimising investments while avoiding losses due to bad choices. Nevertheless, consultants and the two associations should promote open and future-proof solutions, especially for national schemes required to last a long time.

The Covid-19 pandemic demonstrated that revenue earning stability is now compromised and the business case for new investments must be demonstrated to gradually implement new specifications or updates to existing ones.

## Collaboration and engagement for a new open standard

Nowadays, establishing new standards should be addressed as a technological market push, driven by feature. Open standards need market stakeholders to be aligned, which can take a significant amount of time to achieve.

**Strong collaboration should be the cornerstone for joint ventures,** and both CNA and OSPT Alliance associations can create an environment that fosters dialogue and trust in the context of meaningful cooperation.

Additionally, maintaining engagement and relevant communication should be the end result of the deep teamwork and cooperation between the Marketing and Communication working group and Technical working groups.

Materials and resources should be issued to improve market education, avoid existing misconceptions, and facilitate industry understanding regarding the goal of a new standard. Responsive support is expected from standardisation organisations, as well as associated and trained consultants.

User group participants raised the point that PTA and PTO should be independent from vendor implementations ("de-facto" standards) and be able to choose without funding a particular industry initiative. Stopping the development of bespoke solutions is now essential. **Standards should also allow complete flexibility and modularity between hardware and software to foster common use and a platform approach,** as well as technological versatility in a sustainable approach. Open standards should be addressed in an ecosystem perspective to harmonise implementation and avoid different interpretation that results in a clear architecture breakdown.

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## 4.2 Technical

### Interoperability

Interoperability is a key concern for guaranteeing the scalability of the mobility offer, especially in a MaaS ecosystem with a complex value chain. Interoperability must no longer be addressed only at the media level. Instead, data portability is required between accounts and service providers.

Furthermore, interoperability is increasingly required between regions and between systems run by public and private transport modes, up to central clearing systems. As the smartcard is not accepted by all mobility providers, MaaS requires full digital solutions to secure account identifiers, especially within the context of mobile use. Nevertheless, even with a standard, large scale interoperability remains a huge challenge.

In a context where digitisation is king, the need for dual credentials, physical and virtual, remains a topic more pressing than ever to address, with the additional constraints of different types of use cases, and the possibility to manage back-up alternative in case of a fare media failure.



### Certification programme

It is imperative to deliver efficient and qualitative solutions to avoid end-users' trouble and operational issues, such as loss of revenue in case of system unavailability.

**A certification programme is recognised as one of the major enablers to reduce technical and deployment risks.** This was one of the drivers of deploying EMV worldwide. Certification should rely on clear specification framework to assess the compliance against requirements. This is a compulsory approach that avoids different interpretation between industrial providers, especially for an open standard. Moreover, certification on a technical sub-system does not always prevent downstream issues on field. The framework must evolve and be accompanied by a complementary testing strategy in order to address all parts of the system in the context of a MaaS integration.

The certification programme must also be supported by marketing collaterals to clearly demonstrate the benefit, robustness, and value of such a programme.

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## Security

It is important to **ensure mutual trust between scheme participants** and end-to-end security for data exchange. Nevertheless, security measures shall not be a barrier or a constraint for deployment and operations. From the existing solution, improvements are expected for better convenience:

- Avoid the use of printed identifiers to track electronically the fare media. Accessing a media identifier too easily could badly impact GDPR compliance. Tokenisation solutions are mature enough to allow diversified and secured identification of a fare media, as well as exchange of identifiers that rely on a single account;
- Avoid physical Secure Access Module (SAM) within a terminal, which is a real issue of management for transport operators, and develop alternatives thanks to remote SAM or other solutions based on asymmetric cryptography;
- Establish trusted frameworks to allow data and media acceptance based on a technical chain of trust;

- Protect data exchange at all levels of the system with trusted services or API;
- Ensure anonymisation and GDPR compliance, to not associate directly an identifier to a user;
- Enable auditability with privacy protection;
- Ensure that potential logic of validation by the user, such as manual check-in or check-out on a smartphone, does not enable fraudulent cases.

Security measures should be addressed at any level of a ticketing solution and the ecosystem, not only at the fare media level, with a global consistency and standardisation to easily integrate systems. In addition, complementary protection measure such as biometrics features, personal identification numbers (PIN) or two-factor authentication are not considered as valuable by the end user, and could create more friction when used daily.



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## Account management as the bedrock

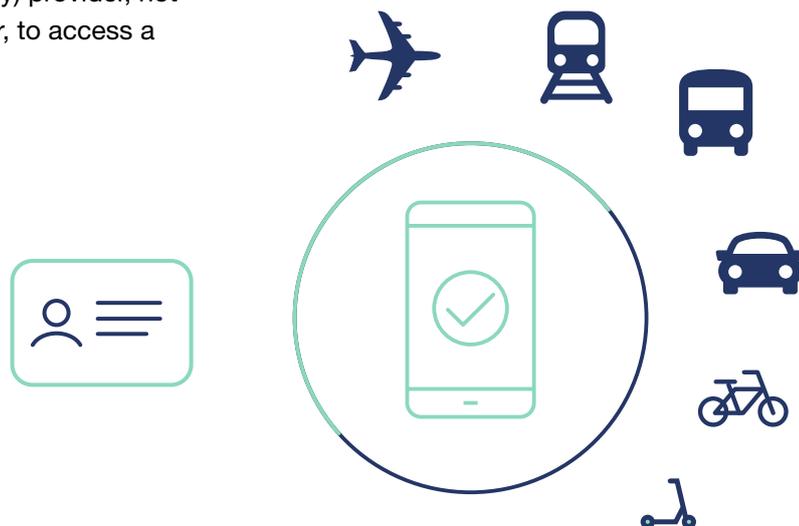
In contrast to the past, the contactless smartcard should not be seen as the only means to interact with the ticketing system. The challenge remains to **identify the traveller against his mobility account**. Ideally, it would be singular and unique, but objectively there remains the necessity to aggregate several account or travel rights at a single and chosen provider.

The mobility account should be considered as a single point of entry to multiple different services without friction for users. As in the case of Single Sign-On (SSO) capability between computer applications, account information and related credentials should be shared between service providers, public or private, in a trusted, secured and automatic manner. The traveller is registered towards a single service (identity) provider, not necessarily a transport operator, to access a complete/large set of services.

This raises questions:

- How to share relevant data, as it is acknowledged that proprietary customer relationships are important in terms of business?
- How to manage liability and service level between service providers?
- How to verify the authenticity of the account holder and the eligibility and solvency to travel with a service provider?

Some participants compare this approach with phone roaming, which is something to investigate further.



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## 5. Conclusion

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The ultimate technology still does not exist. Due to the diversity of use cases and needs, it's necessary to address with confidence the integration of technologies in an open and structured manner. Moreover, past choices should not be jeopardised by future technology.

**And implementing a new standard, should be an 'evolution' rather than a 'revolution'.**

It should not be synonymous with complex migration. Considering legacy deployment against the capability to implement innovation as an "add-on" and seamlessly managing the phase out of former solutions should always be the goal.

The market must continue to increase integration maturity for a **better modularity and flexibility**. If standardisation can address the end-to-end integration and compatibility, it should also enable seamless integration and cost-efficient deployment for a good market up-take.

Ultimately, the top goal is to provide greater user experience and to guarantee sustainability of transport ticketing.

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Calypso Networks Association and OSPT Alliance warmly thank the participants for openly sharing their points of view and the fruitful exchanges.

The two associations are now working actively to define future steps for the ticketing open standards journey and will be glad to on-board new companies and organisations for this initiative.



**Want to know more?**

**Visit <https://ticketingopenstandards.org>**