Overview of ticketing technologies for mass transit

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The ticketing system is at the service of a fare policy that is composed of:
- A range of tickets associated with profiles
- A price level
- A geographical principle
- A level of network integration

A small investment component but is positioned at the heart of the war, i.e., customer relations and revenue collection, therefore primarily a governance issue.

Distinction between ticketing:
- **Card-based** - Media Based Ticketing (MBT)
- **Server-based** / account-based ticketing
02. The direction of history towards contactless

- To date, **card-based technologies** are preferred for mass transit to manage large flows and limit fraud.

- The basic trends:
  - **contactless** has imposed itself as a standard solution: gain in maintenance, from mechanics to software!
  - From the **single card** to the **multiplicity of media** using NFC and light ticketing
  - **New players** (Banks, GAFA....) that are arriving in force

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02. The ticketing system is part of an architecture with several components

- **Sales Terminals**
  - Allow the sale and distribution of securities in the clients’ media

- **Control Terminals**
  - Allow control officers to check the validity of customers' tickets

- **Validation Terminals**
  - Authorize or not access to the network according to the validity of the tickets presented by the customer. Validate and stamp the tickets for control and future use

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**Central/Back-Office System**

- Installed on the premises of the operator and/or his representative.
- Allows you to set up, collect, use and analyze network data and services.
- Ensures the interfacing with other systems internal and external to the network.

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**The holder in the customer’s hand that holds the tickets and allows them to move around the network.**
03. Overview of technologies

- **Mifare** (market leader) and **Felica** are proprietary single-source technologies, i.e., hardware and software integrated with a single manufacturer (moreover, Felica is not ISO).

- **Calypso** non-proprietary software communication protocol / separate hardware validation.
### 03. A gradation of security levels (and cost!)

<table>
<thead>
<tr>
<th></th>
<th>MIFARE DESFire</th>
<th>MiFare Classic</th>
<th>Calypso Basic</th>
<th>Calypso Light</th>
<th>Calypso Prime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cards</strong></td>
<td>Low range</td>
<td>Middle range</td>
<td>High range</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MiFare Ultralight</td>
<td>MiFare Classic</td>
<td>DESFire</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Provider</strong></td>
<td>NXP single source for the component</td>
<td>Double source</td>
<td>NXP single source for the component</td>
<td>Multi source at all levels, including component</td>
<td>Multi source at all levels, including component</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Defrauded, low security</td>
<td>Defrauded massively</td>
<td>1st generation defrauded. Uses the calypso patent</td>
<td>Same security level as Calypso Prime</td>
<td>Same security level as Calypso Prime</td>
</tr>
<tr>
<td><strong>Interoperability</strong></td>
<td>Not designed for interoperability</td>
<td>Not designed for interoperability</td>
<td>Not designed for interoperability</td>
<td>Designed for interoperability</td>
<td>Designed for interoperability + Hoplink App dedicated to interoperability</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>- Software owned by the ticketing operators - SDK and API NSP owners</td>
<td></td>
<td></td>
<td>Open source SDK: Eclipse Keyple</td>
<td></td>
</tr>
</tbody>
</table>
Points to watch out for

- **Ensure system scalability**
  - Possibility of competitive bidding
  - Evolutionary capacity and openness of the system

- **Ensure a high level of security in the face of evolving threats**

- **Ensure adaptability to changes in pricing policy**

- **Controlling the total cost of ownership**
  - A specific topic in developing countries on the overrepresentation of single tickets compared to subscriptions

- **Ensure interoperability between networks**
  - (and even better, fare integration)