



Overview of ticketing technologies for mass transit

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01. Preamble



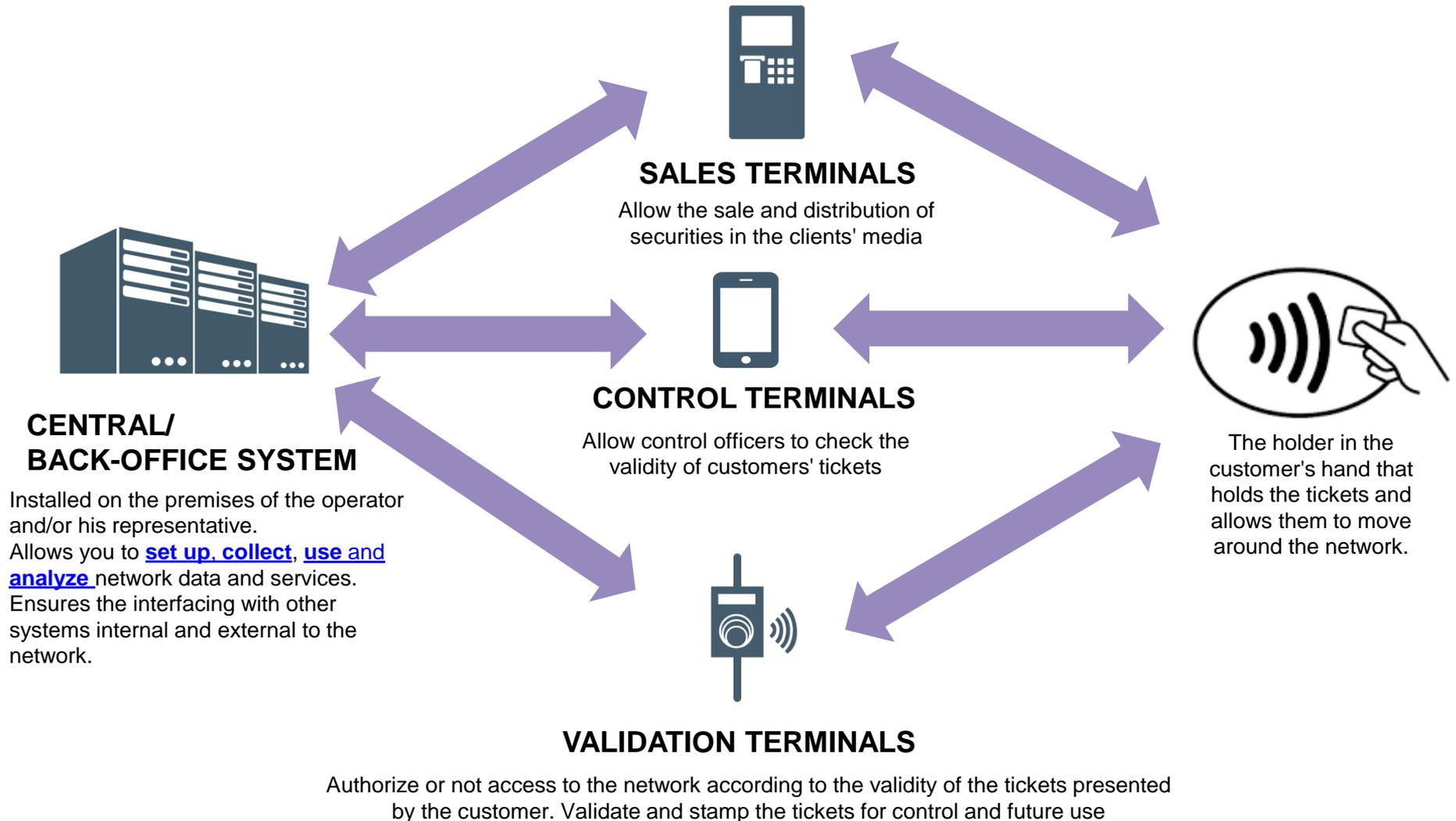
- **The ticketing system is at the service of a fare policy** that is composed of
 - A range of tickets associated with profiles
 - A price level
 - A geographical principle
 - A level of network integration
- A **small investment component** but is positioned at the heart of the war ie **customer relations 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

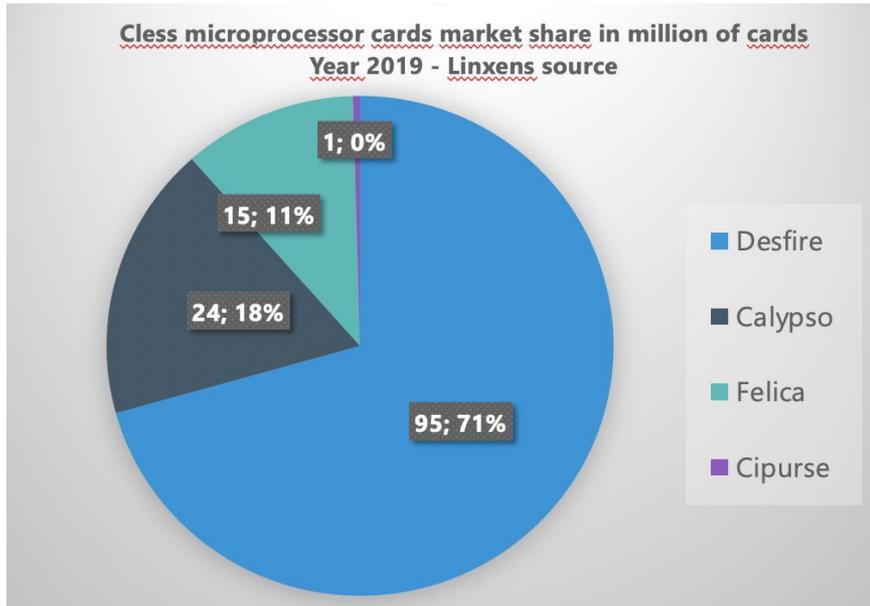


- To date, **card-based technologies** are **preferred for mass transit** to manage large flows and limit fraud.
- The basic trends:
 - the **contactless** has imposed itself as a standard solution: gain in maintenance, from mechanics to software!
 - From the **single card** to the **multiplicity of media** using NFC and light ticketing
 - **New players** (Banks, GAFA....) that are arriving in force

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



03. Overview of technologies



- **Mifare** (market leader) and **Felica** are **proprietary single-source technologies** ie hardware and software integrated with a single manufacturer (moreover Felica is not ISO)
- **Calypso non-proprietary** software communication protocol / separate hardware validation



Calypso®



03. A gradation of security levels (and cost!)

| |  | | |  | | |
|--|--|--|--|---|---|--|
| Cards  | Low range Mifare Ultralight | Middle range Mifare Classic | High range DESFIRE | Low range Calypso Basic | Middle range Calypso Light | High range Calypso Prime |
| Provider  | NXP single source for the component | Double source | NXP single source for the component | Multi source at all levels, including component | Multi source at all levels, including component | Multi source at all levels, including component |
| Security  |  Defrauded, low security |  Defrauded massively |  1 st generation defrauded. Uses the calypso patent |  Same security level as Calypso Prime |  Same security level as Calypso Prime |  Never defrauded |
| Interoperability  | not designed for interoperability | not designed for interoperability | not designed for interoperability | Designed for interoperability | Designed for interoperability | Designed for interoperability + Hoplink App dedicated to interoperability |
| Integration | - Software owned by the ticketing operators - SDK and API NSP owners | | | Open source SDK: Eclipse Keyple | | |

03. 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)