

Smart Card 101: Overview of Smart Card Technology



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APTA Fare Collection 101
Miami, FL
March 28, 2011***



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Overview Contactless Card

Physical Characteristics

- Credit card sized device
- Contains one or more integrated circuits
- Data stored in chip's memory

Advantages

- Decreased dwell time at farebox
- Speedy, convenient, easy to use
- Card may remain in wallet during high speed communication
- Vandalism proof with robust cards & reader
- Reduced maintenance costs & extended life-time of the system



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Contact vs Contactless

- Contact
 - Requires insertion into a reader
- Contactless
 - Must only be near proximity to the reader in order to exchange data



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Types of chip cards

- Memory only Integrated Circuit Chip Card
 - “electronic magnetic stripes”
 - Higher data capacity than a magnetic stripe
 - Simply store data
 - Contain hardwired memory that cannot be overwritten



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Types of chip cards – cont.

- Memory card with built-in logic
 - Provides authenticated access to the memory
 - Provides memory where one can read/write
 - Based on the access conditions, authentication needs to be performed before read/write
 - Example: MIFARE Classic 1K/4K



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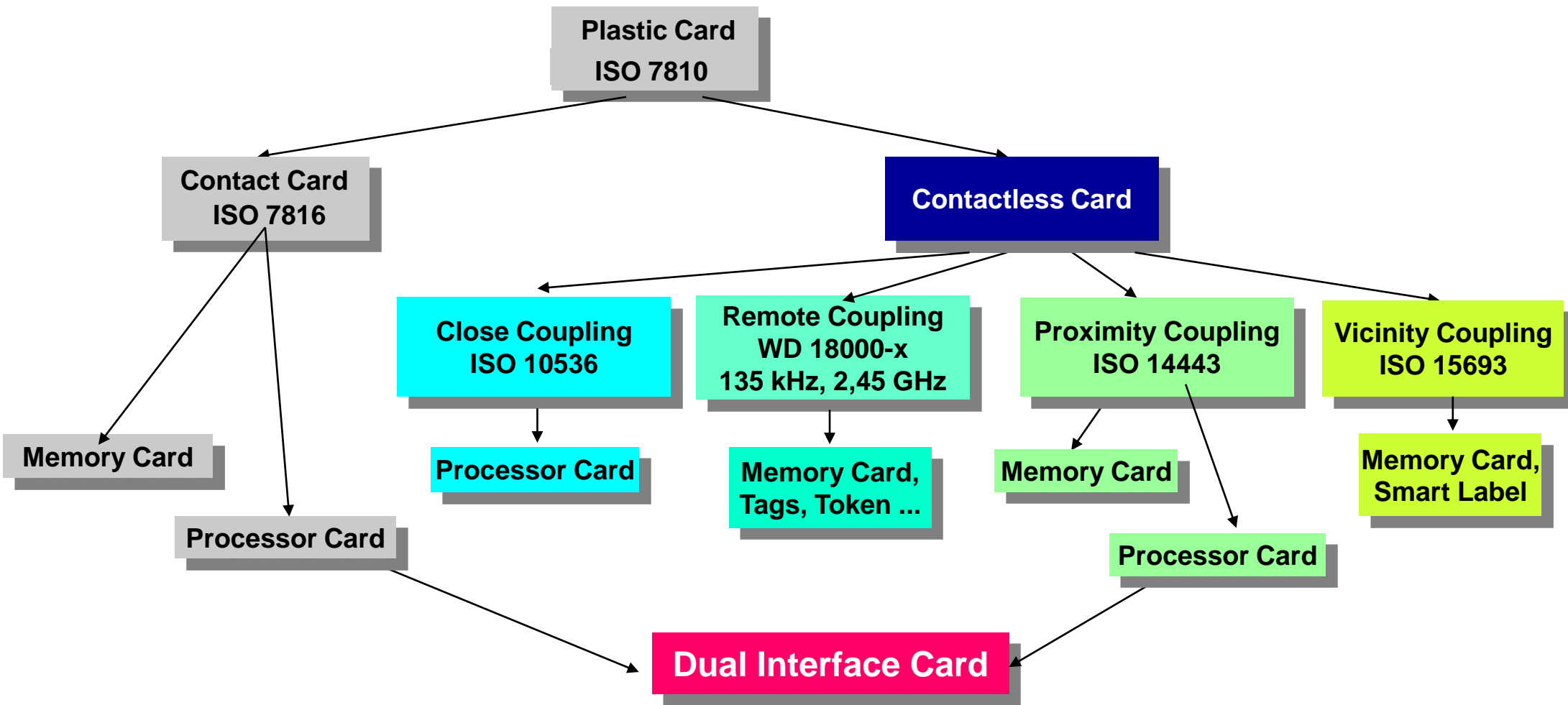
Types of chip cards - cont

- Microprocessor based chip
 - Contains microprocessor, operating system, read/write memory
 - ISO 14443A 1-4 compliant
 - Secure, high speed command set
 - Flexible file structure
 - Open crypto algorithm in hardware such as DES/3DES Or AES
 - Example: MIFARE DESFire



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Contactless Card Types



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Contactless Card Types

	Memory	Microprocessor
Type A	Mifare [®] 1K Mifare UL	Mifare DESFire, SmartMX, micropass (Inside), Infineon
Type B		Micropass (Inside), Infineon
Other Types	Sony Felica	
	Cubic GO CARD [®]	



ISO Standard



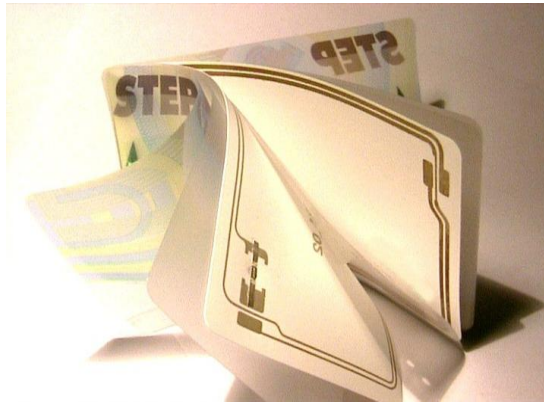
Not ISO Standard



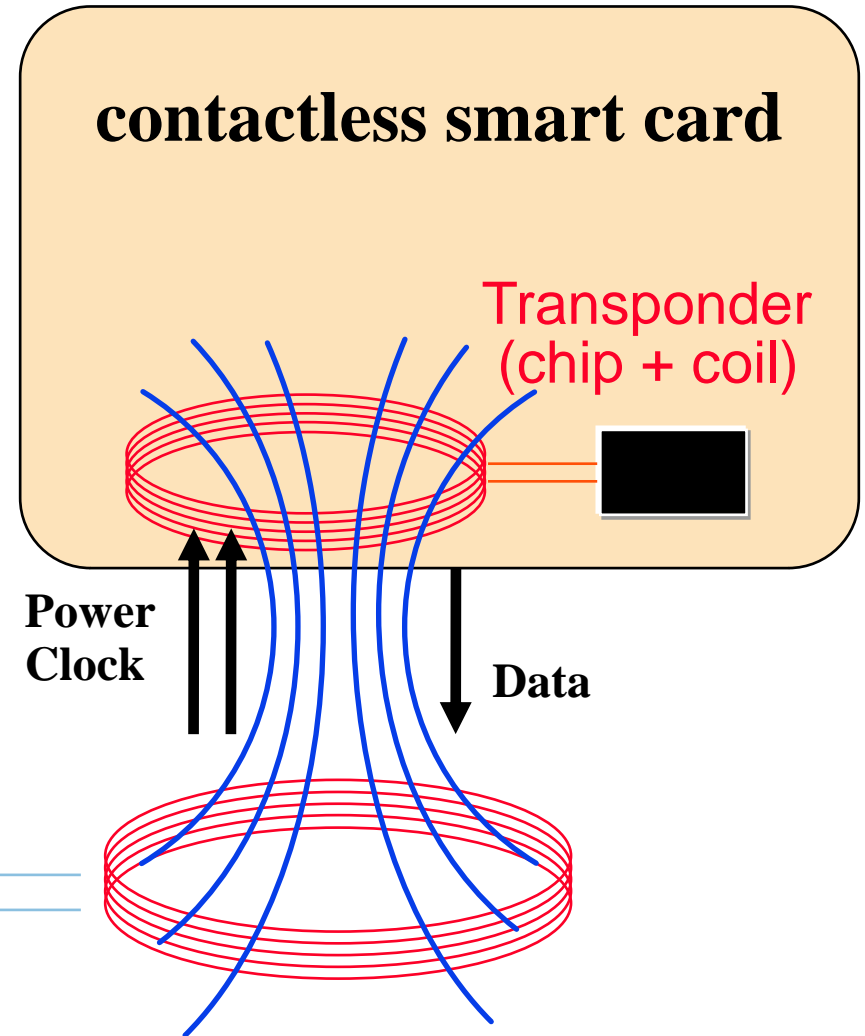
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Contactless Card Technology

- Smart card transfers data using radio frequency technology via a transmitter and receiver

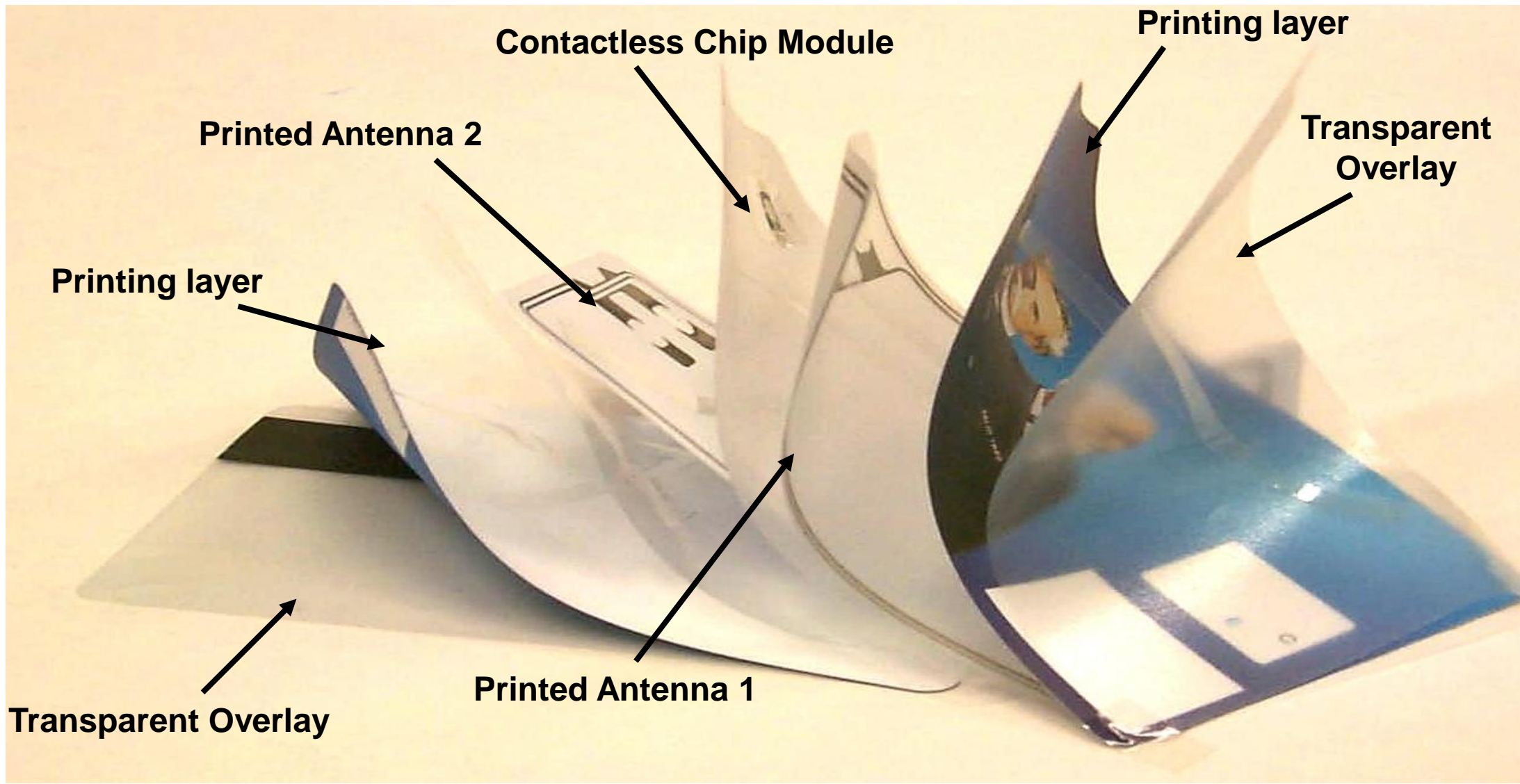


**contactless
smart card
reader**



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Contactless Cardbody Construction

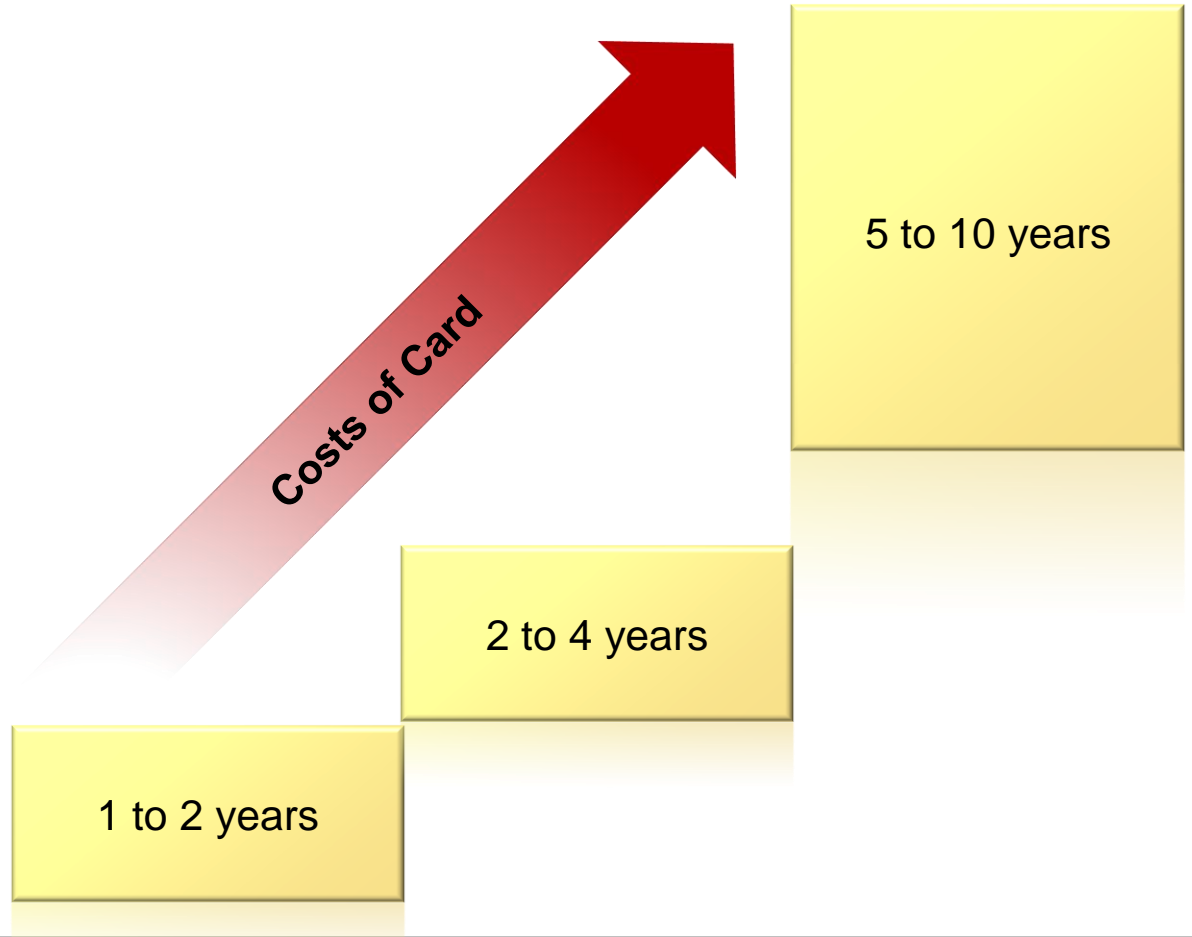


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Cost vs. Complexity and Durability

COMPLEXITY

- National eID
eDriving License
eHealth
- Financial Cards
Chip & PIN
- GSM SIM
Pay TV
- ID Badging
Access Control
- Transport Cards
- Loyalty Cards
Gift Cards



DURABILITY



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Cost vs. Technology

	Contact-based	Contact-less	Dual Interface	Hybrid (2 chips)
Cost	A = 100%	A x 130 – 150 %	A x 150 – 170 %	A x 180 – 220 %

Cost of a smart card depends on various factors as the microprocessor, operating system, inlay and manufacturing costs vary case by case.



Standards & Interoperability

- ISO 7810/11 → *Standard for ID cards and features*
 - ISO 7816 → *Standard for contact based smart cards*
 - ISO 14443 → *Standard for Type A & Type B contactless smart cards*
-
- Universal Transit Farecard Standards (UTFS)
 - Contactless Fare Media Standard (CFMS)



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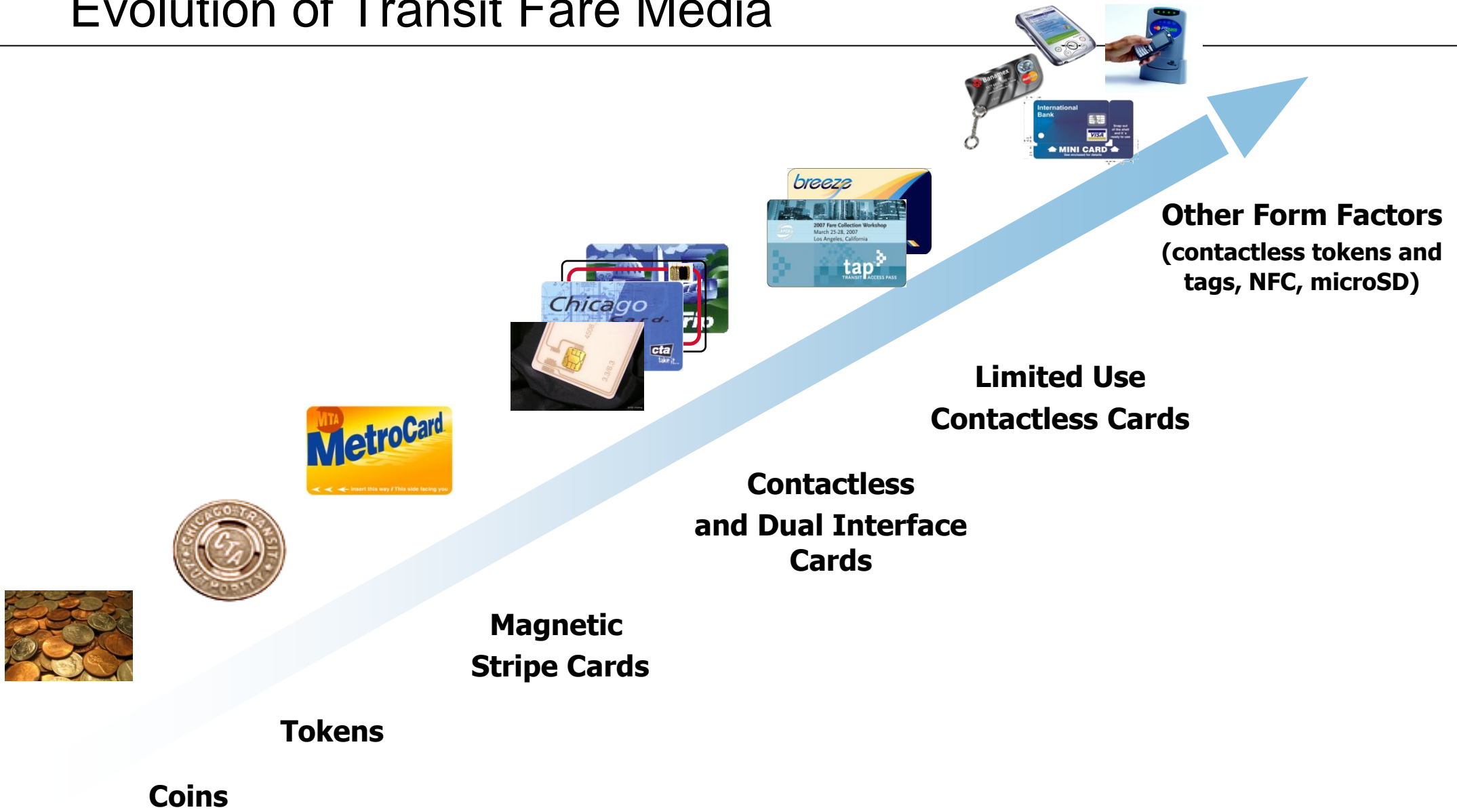
Benefits of Contactless Card Systems

- **Vandalism proof bus or station equipment**
 - Less maintenance cost
 - More equipment availability
- **Same reader processes contactless cards and Limited Use tickets**
 - Less capital equipment cost
- **Convenient and easy to use**
 - **Customer satisfaction**
- **Secure**
 - More revenue
- **Modern Image**
- **Upgradable**



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Evolution of Transit Fare Media



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Types of Fare Media

- Magnetic stripe cards
- Contact only cards
- Contactless cards
- Dual Interface cards
- Limited Use tickets
- Other form factors (contactless credit cards, NFC phones, microSD, mobile stickers, etc.)



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Magnetic Stripe Cards

- The classic machine readable media
- Magnetic stripe can be encoded with fare data; expiry date, value, etc.
- Magnetic stripe is reuseable

Advantages

- No cash handling
- Provide improved ridership data
- Inexpensive for single or occasional use

Disadvantages

- Susceptible to fraudulent use
- Extensive reader maintenance required
- Dirt, grime or chemicals can interfere with the reader heads and degrade card and reader performance and reliability



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Contact Cards

- Smart card with an embedded memory or microprocessor and contact interface
- Contact points for power and data transfer
- Can be either memory or microprocessor
- Used as SIM cards, ID card (logical access), bank cards, loyalty cards, etc.

Advantages

- Reduced maintenance costs and extended life of system
- Easy handling and convenient
- Offers a step up in security from magnetic cards

Disadvantages

- Limited transaction speed unsuitable for high transaction volumes
- Physical contact between cards and readers reduce lifetime of cards and readers



Contactless Cards

- Card has one chip with contactless interface
- Most desirable smart card available today
- Widely used in transit and banking applications

Advantages

- Versatile
- Multi-application
- Cost effective
- Easy, fast and convenient to use

Disadvantages

- No identified disadvantage for transit
- Expensive for contactless credit or debit card applications



Dual Interface Cards

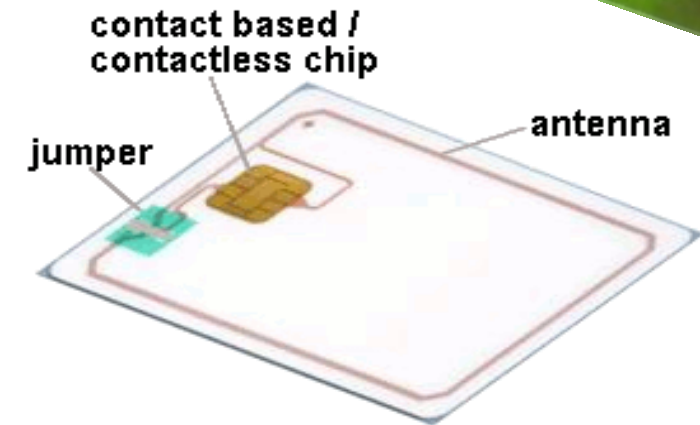
- Card has one chip that can be addressed by two interfaces
 - ISO 7816 for contact
 - ISO 14443 for contactless (13.56 MHz)
- Most versatile IC cards available
- Widely used in banking, retail and e-commerce

Advantages

- Versatile
- Multi-application
- Easy and convenient to use

Disadvantages

- Expensive
- Less reliable than other card types due to manufacturing complexity
- Contact applications may be uncertain or irrelevant for transit



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Limited Use Ticket

- Similar to contactless cards, it has one chip with contactless interface
 - Small memory
 - Basic but sufficient security
 - Same ISO standard as other contactless cards (ISO 14443)
- Used mainly for single use rides, specific ticketing event, etc.

Advantages

- Low cost of ticket, and the reader
- Uses the same infrastructure as contactless cards (i.e., installation of an additional reader is not needed)
- Quick, seamless travel between bus and rail
- Lower maintenance cost than magnetic stripe tickets
- Serialized; fraudulent activities can be tracked



Disadvantage

- More expensive than magnetic stripe cards



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Emerging Technologies and Trends

- Near Field Communications (NFC)
 - Phone is both card and terminal
- microSD with integrated antenna
 - Can change any mobile phone to an NFC phone
- Mobile phone sticker
 - Allows to use mobile devices for payment
- Open Payment
 - Bank cards can be used to pay transit fare
- Open Standard for Public Transport (OSTP)
 - Alternative transit contactless card technology



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Thank You



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