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Migration Forum

EMV 101

EMV Migration Forum Webinar
March 6, 2014

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Introduction

Randy Vanderhoof
Director, EMV Migration Forum

About the EMV Migration Forum

Cross-industry body focused on supporting the EMV implementation steps required for global and regional payment networks, issuers, processors, merchants, and consumers to help ensure a successful introduction of more secure EMV chip technology in the United States.

Forum focus: address topics that require some level of industry cooperation and/or coordination to migrate successfully to EMV technology in the United States.

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Today’s Webinar Topics & Speakers

- **Introduction & EMV Implementation Status**: Randy Vanderhoof, Director, EMV Migration Forum

- **EMV 101**: Guy Berg, Senior Managing Consultant, MasterCard Advisors

- **Q&A**

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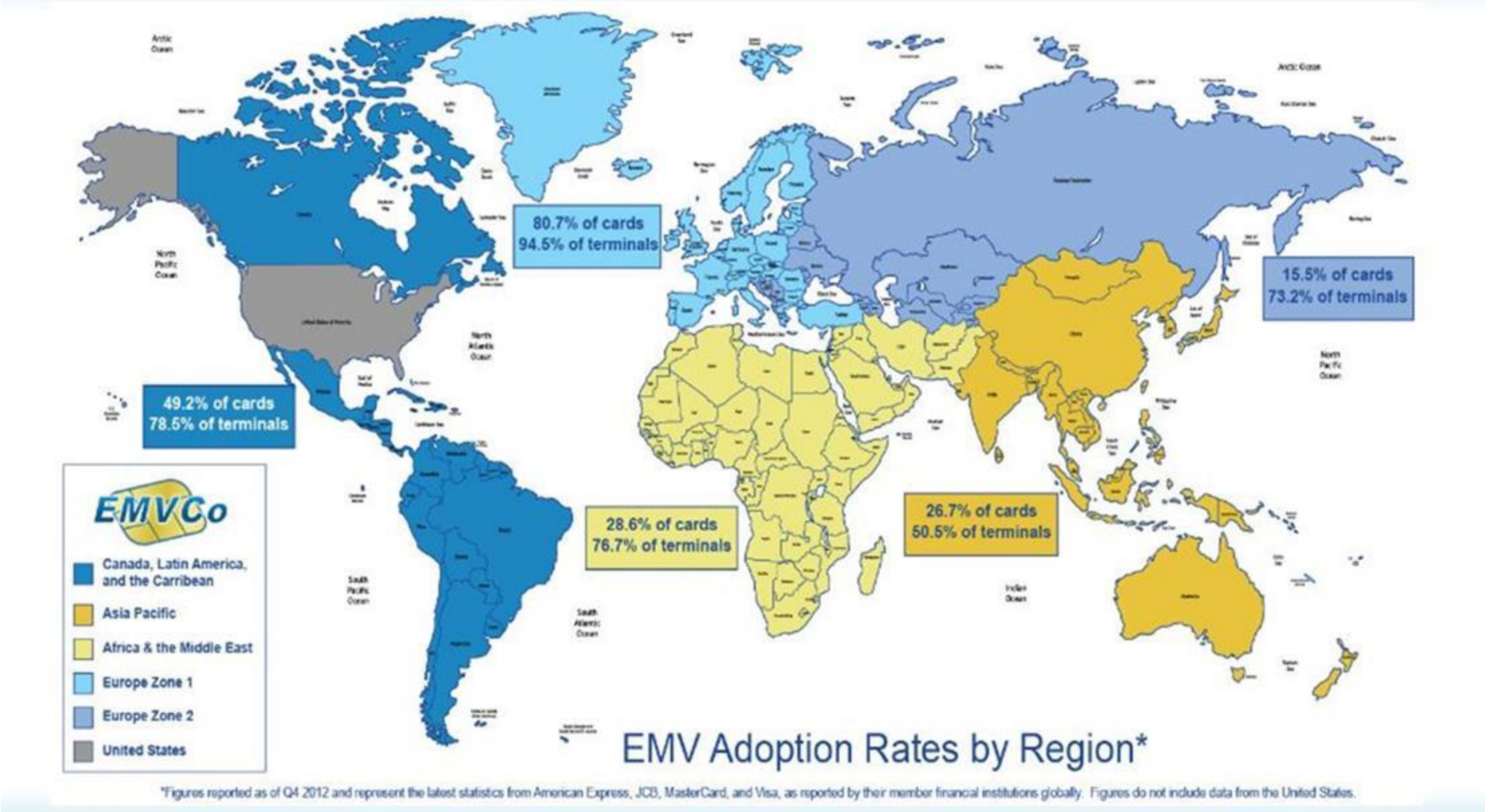
Global EMV Adoption



EMV Adoption Rates by Region*

*Figures reported as of Q4 2012 and represent the latest statistics from American Express, JCB, MasterCard, and Visa, as reported by their member financial institutions globally. Figures do not include data from the United States.

Source: EMVCo

U.S. Migration Progress

- Acquirers met 2013 readiness for EMV readiness and are deploying EMV to their merchants as part of the normal upgrade path
- Millions of EMV chip payment cards are in the marketplace from a broad set of issuers
- Merchants are investing in hardware upgrades to accept the payments
- ATM providers are actively deploying EMV-enabled ATMs
- EMV Migration Forum is active in working on issues requiring cooperation to help smooth the migration to EMV for the U.S. payments industry

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EMV Fundamentals Webinar

EMV Security Functions - Guy Berg, MasterCard Advisors

EMV Fundamentals

I. **EMV Payment Transaction Framework**

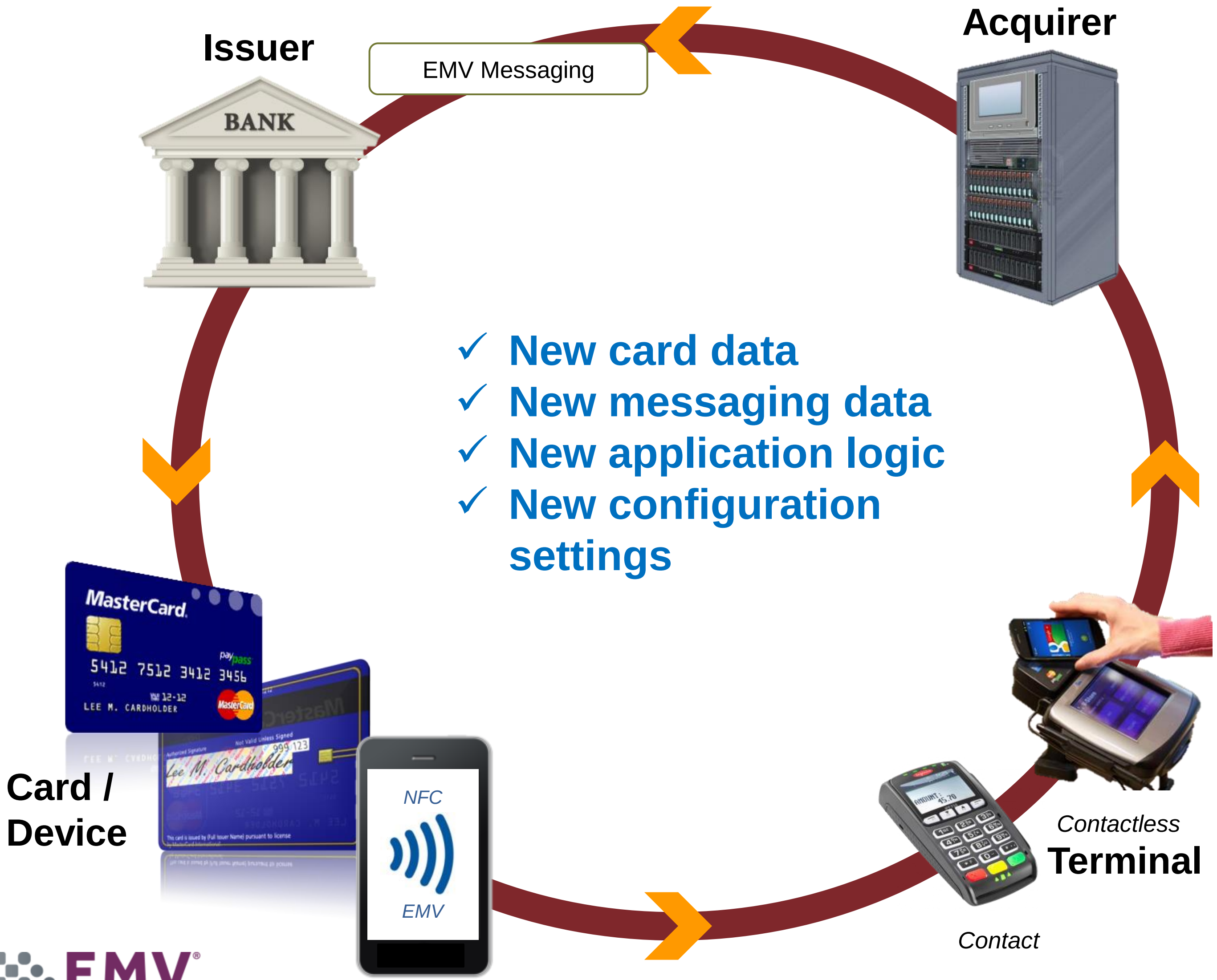
II. **Transaction Processing Comparison**

- Magnetic Stripe vs. EMV Transaction Security Points
- Data Breach and Skimming Protection Mechanisms

III. **EMV Application Fundamentals**

- On-line Card Authentication
- Off-line Card Authentication
- Offline Authorization
- Risk Management
- Cardholder Verification Method

EMV migration impacts all stakeholders involved in payment transaction processing



- ✓ New card data
- ✓ New messaging data
- ✓ New application logic
- ✓ New configuration settings

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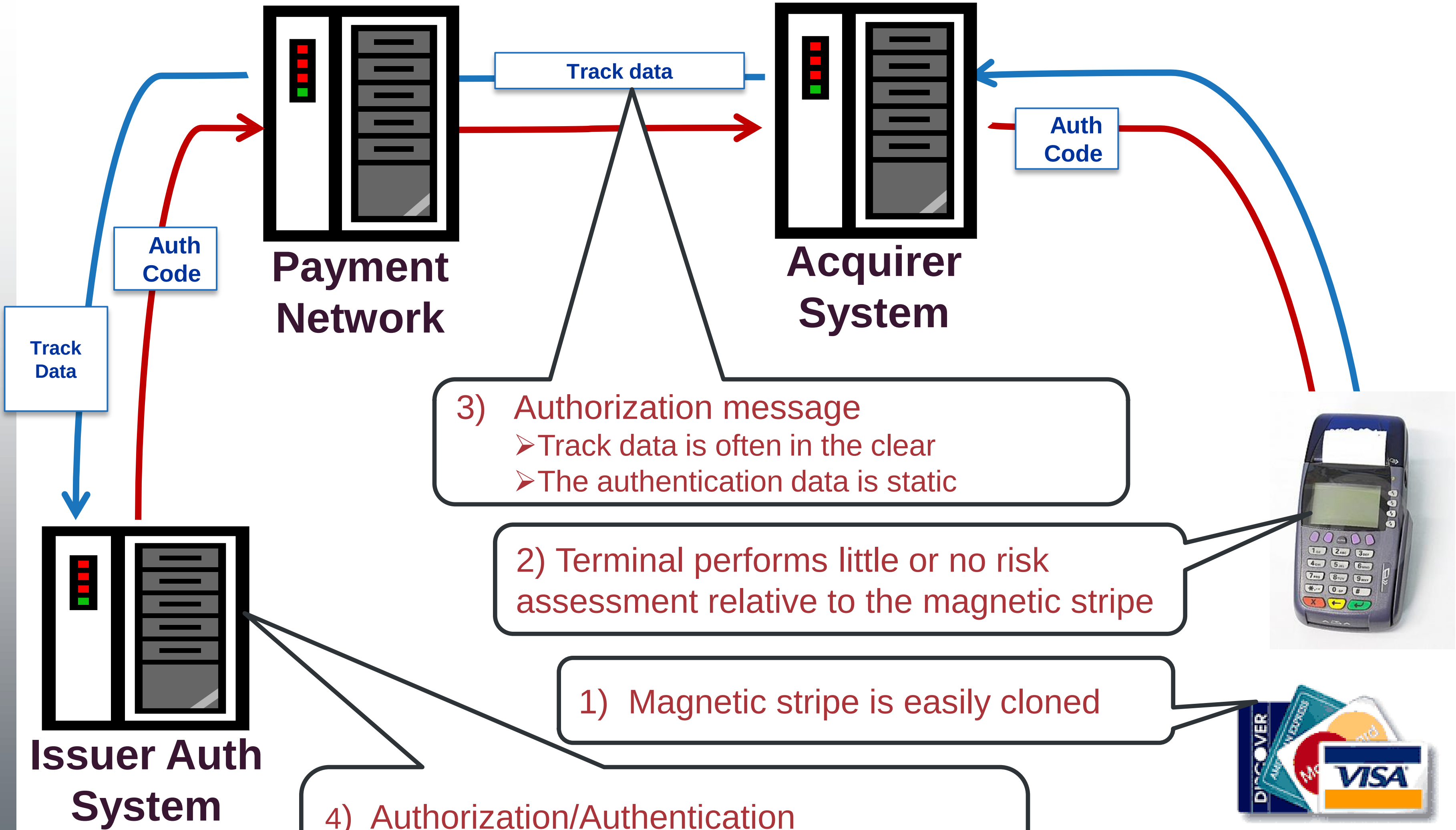
Magnetic Stripe Transaction uses static authentication data that can be skimmed



Track data

Auth Code

Track Data

Auth Code

Payment Network

Acquirer System

Issuer Auth System

3) Authorization message
- ➢Track data is often in the clear
- ➢The authentication data is static

2) Terminal performs little or no risk assessment relative to the magnetic stripe

1) Magnetic stripe is easily cloned

4) Authorization/Authentication
- ➢Risk assessment performed at the host
- ➢Host cannot recognized cloned cards

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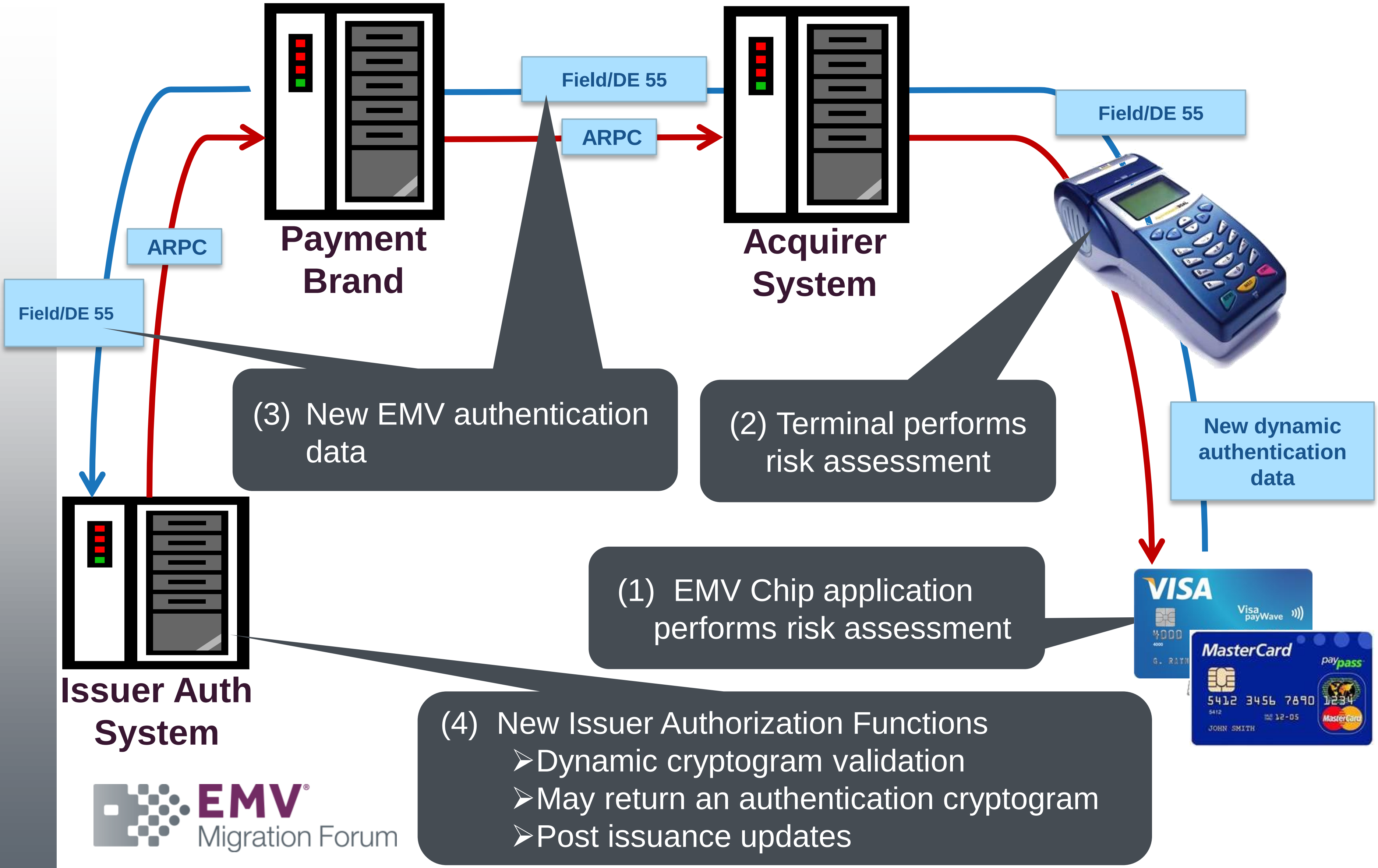
EMV Transaction Processing Introduces dynamic authentication that makes copied data useless at POS



(1) EMV Chip application performs risk assessment

(2) Terminal performs risk assessment

(3) New EMV authentication data

(4) New Issuer Authorization Functions
- Dynamic cryptogram validation
- May return an authentication cryptogram
- Post issuance updates

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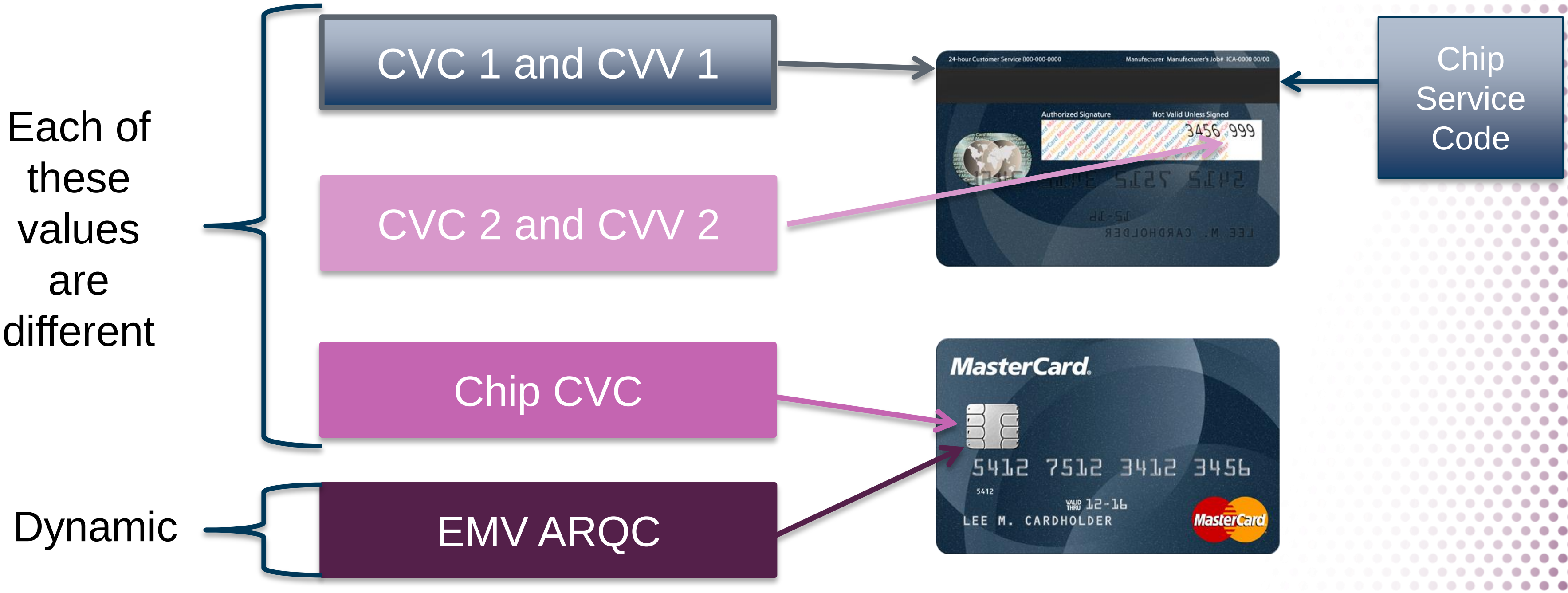
EMV and non EMV security mechanisms combine to provide skimming and data breach protection

Multiple protection mechanisms are used in concert to combat card skimming, counterfeit card production and data breach threats



Each of these values are different

CVC 1 and CVV 1

CVC 2 and CVV 2

Chip CVC

Dynamic

EMV ARQC

Chip Service Code

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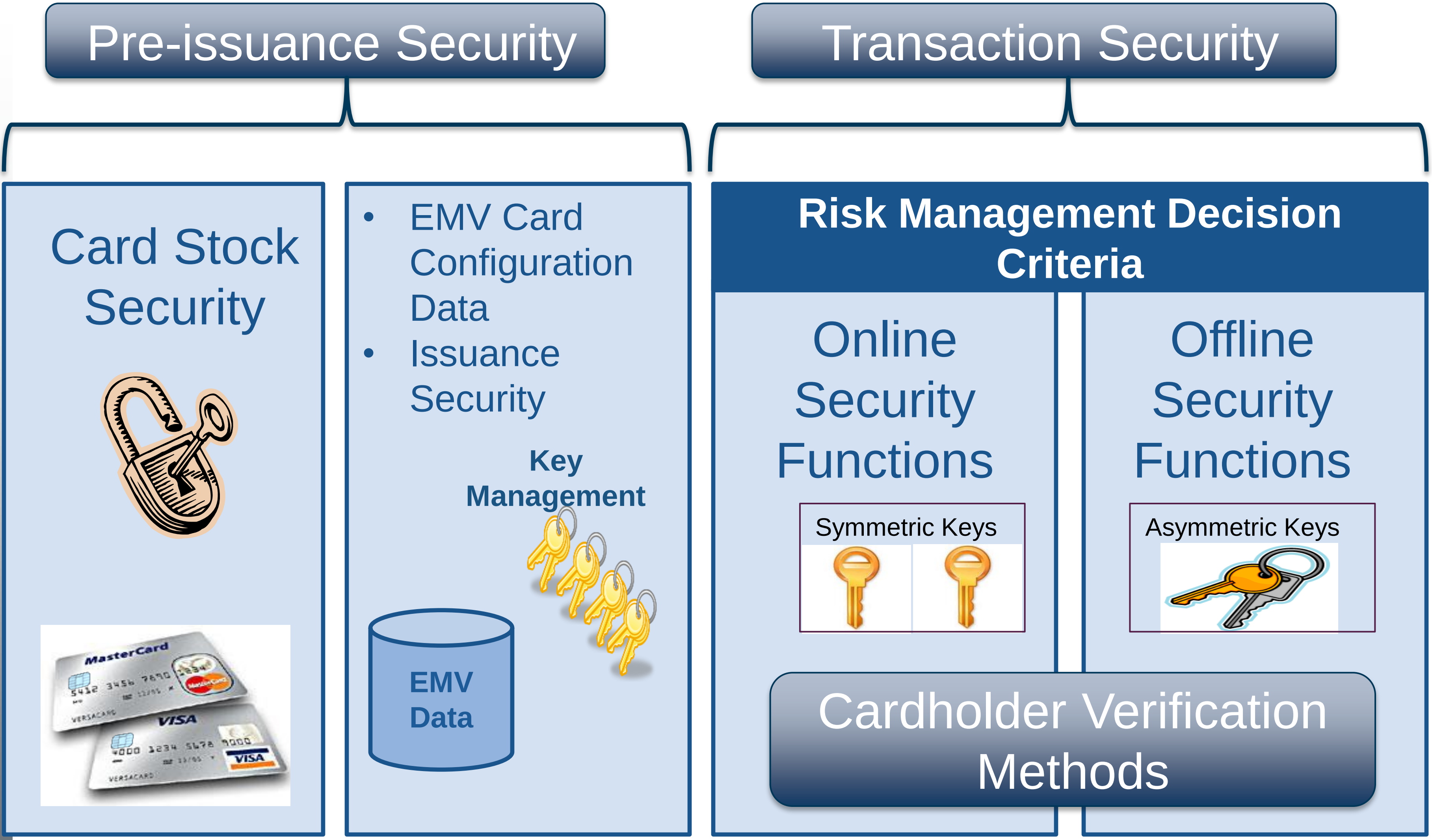
EMV introduces new data, cryptographic processes and security keys

M/Chip 4 Tags	Chip Data	VSDC Tags	Chip Data
D3	Additional Check Table	9F51	Application Currency Code
D5	Application Control (Contact)	9F52	Application Default Action
D7	Application Control (Contactless)	9F53	Cons Trx Counter International Limit (CTCIL)
D9	Application File Locator (Contactless)	9F54	Cum Total Transaction Amount Limit (CTTAL)
D8	Application Interchange Profile (Contactless)	9F55	Geography Indicator
C3	Card Issuer Action Code (CIAC) - Denial	9F56	Issuer Authentication Indicator
C4	Card Issuer Action Code (CIAC) - Default	9F57	Issuer Country Code
C5	Card Issuer Action Code (CIAC) – Online	9F58	Cons Trx Counter Limit (CTCL)
CD	Card Issuer Action Code – Default (Contactless)	9F59	Cons Trx Counter Upper Limit (CTCUL)
CE	Card Issuer Action Code – Online (Contactless)	9F5C	Cum Total Trx Amt Upper Limit (CTTAUL)
CF	Card Issuer Action Code – Denial (Contactless)	9F5D	Available Offline Spending Amount
C8	Card Risk Management (CRM) Country Code	9F5E	Cons Trx International Upper Limit (CTIUL)
C9	Card Risk Management (CRM) Currency Code	9F68	Card Additional Processes
D1	Currency Conversion Table	9F72	Cons Trx Counter International Country Limit (CTCICL)
D6	Default ARPC Response Code	9F73	Currency Conversion Parameters
9F 14	Lower Consecutive Offline Limit (LCOL)	9F77	VLP Funds Limit
CA	Lower Cum. Offline Transaction Amt (LCOTA)	9F78	VLP Single Transaction Limit
9F 23	Upper Consecutive Offline Limit (UCOL)	9F79	VLP Available Funds
CB	Upper Cum. Offline Transaction Amt (UCOTA)	9F7F	Card Production Life Cycle History (CPLC)
9F6C	Magstripe Application Version Number		
9F62	PCVC3 Track1 (Contactless)	Key	MDK$_{AC}$
9F63	PUNATC Track1 (Contactless)	Key	MDK$_{SMI}$
9F64	NATC Track1 (Contactless)	Key	MDK$_{SMC}$
9F65	PCVC3 Track2 (Contactless)	Key	MDK$_{IDN}$
9F66	PUNATC Track2 (Contactless)	Key	MDK$_{CVC3}$
9F67	NATC Track2 (Contactless)		
56	Track1 Data (Contactless)		
9F6B	Track2 Data (Contactless)		

Chip security provides both card stock security and transaction security



Pre-issuance Security

Card Stock Security

- EMV Card Configuration Data
- Issuance Security

Key Management

EMV Data

Transaction Security

Risk Management Decision Criteria

Online Security Functions

Symmetric Keys

Offline Security Functions

Asymmetric Keys

Cardholder Verification Methods

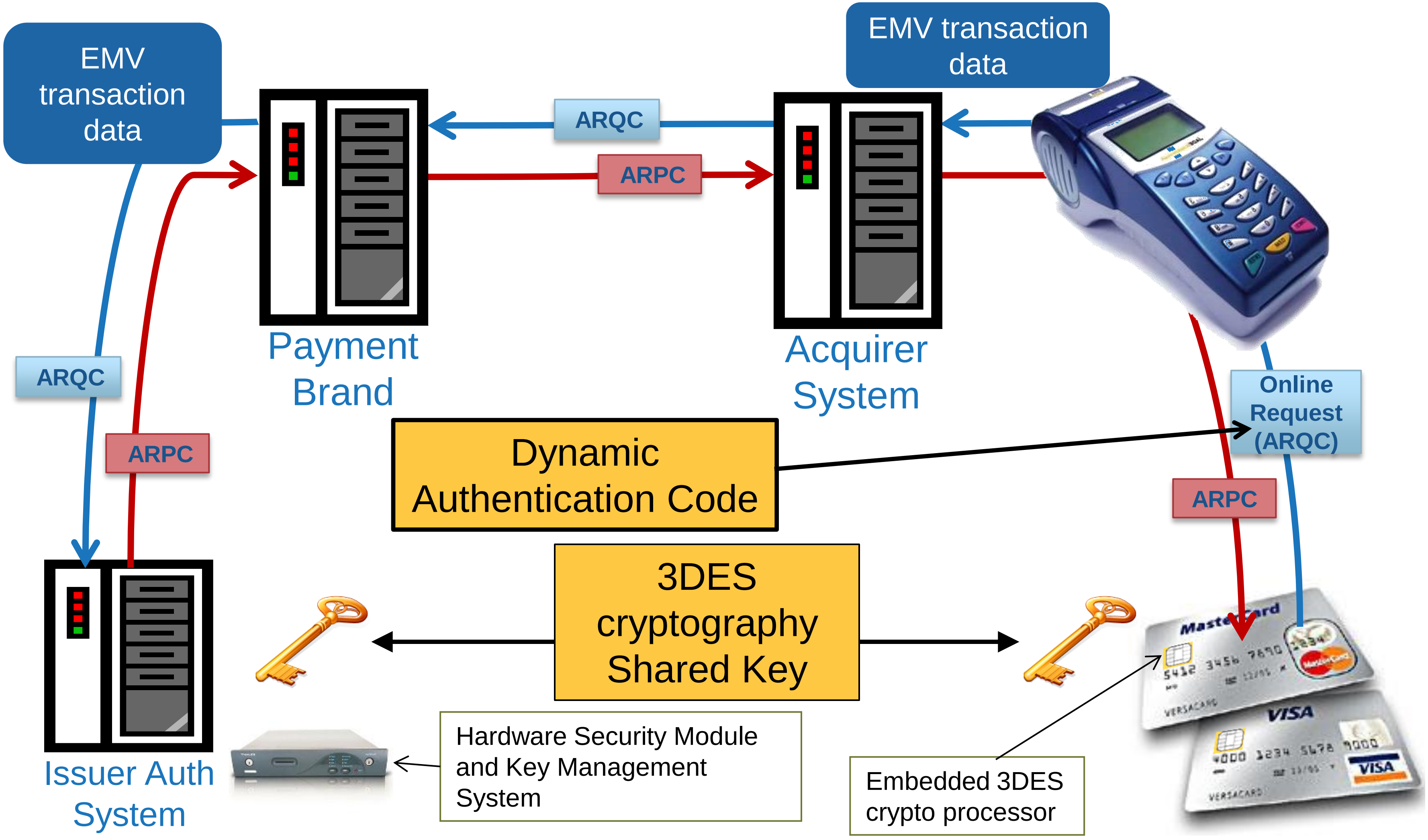
EMV security functions performed online

Online Transaction Security

1 Online Card Authentication
(Online CAM)

2 New Message Data for Authorization Assessment

On-line CAM (Card Authentication)



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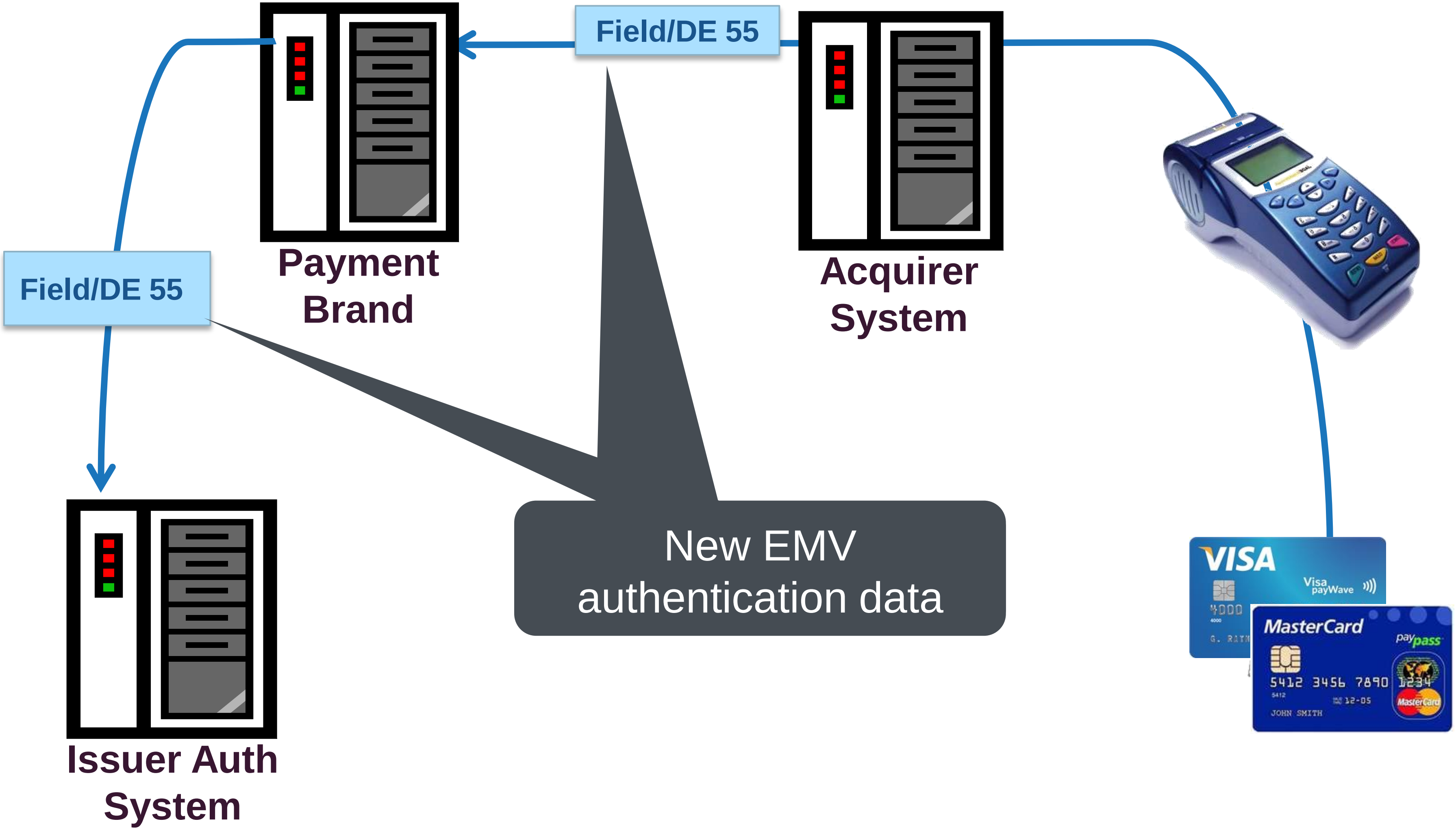
EMV message data also increases online fraud detection security



Field/DE 55

Payment Brand

Field/DE 55

Acquirer System

New EMV authentication data

Issuer Auth System

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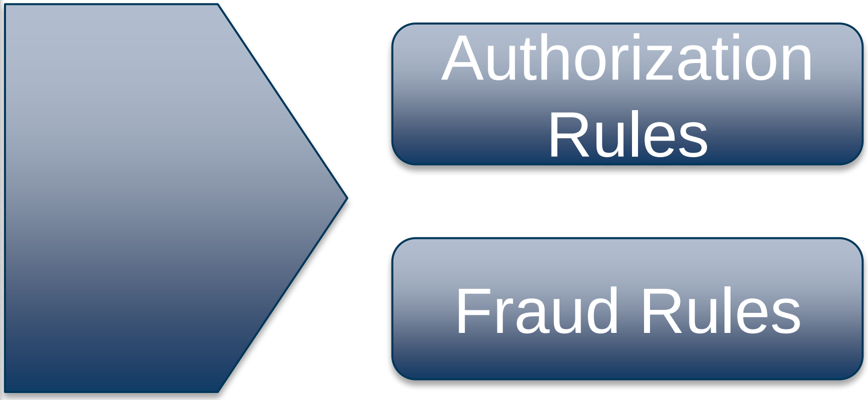
New EMV data in the authorization message enhances authorization decisioning

ISO 8583 – Field or DE 55

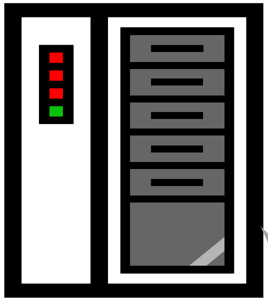
- Application Cryptogram
- Cryptogram Information Data
- Issuer Application Data
- Application Interchange Profile
- Terminal Verification Result
- Terminal Capabilities
- Cardholder Verification Method Results
- Unpredictable Number
- Application Transaction Counter
- Amount, Authorized (Numeric)
- Transaction Currency Code
- Transaction Date
- Transaction Type
- Transaction Currency Code
- Terminal Country Code



Authorization Rules

Fraud Rules

The new EMV information in the authorization message increases the issuers security tools



Issuer Auth System

Issuer Authorization Tools

- ➢ Increased use of authentication security keys
  - ✓ EMV ARQC dynamic cryptogram validation
- ➢ Enhanced Authorization assessment rules
  - ✓ Cross check terminal and card results
- ➢ Offline PIN Optional for cardholder verification
- ➢ Online PIN Optional for cardholder verification
- ➢ Post issuance card updates
- ➢ ARPC

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EMV Security Functions Performed Offline

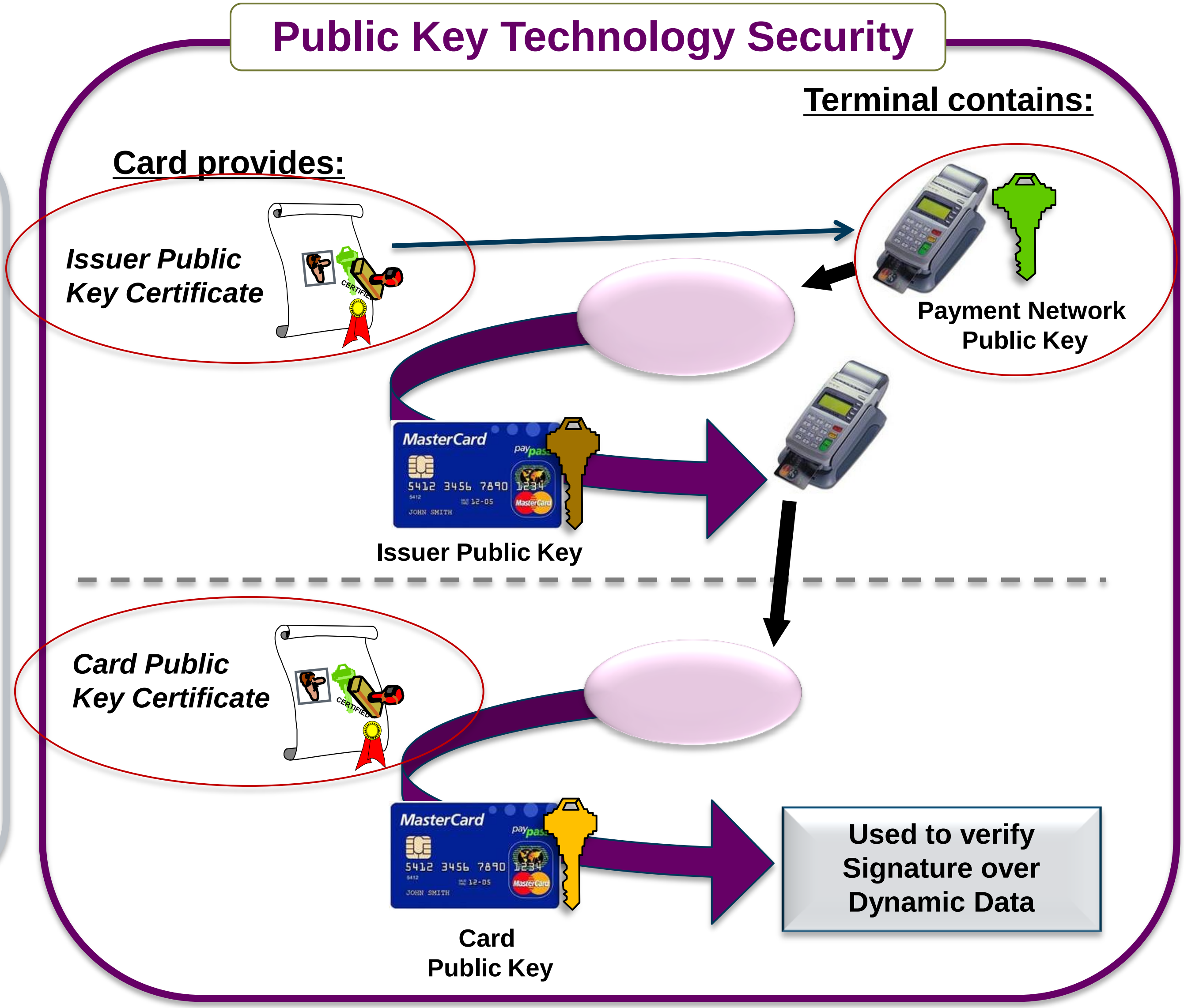
Offline Security Functions

Asymmetric Keys

1. Offline Card Authentication (Offline CAM)
2. Offline Authorization (Offline Transaction)
3. Offline PIN (Cardholder Verification Option)

EMV Offline security functions require asymmetric keys and certificates

DDA/CDA
Card Authentication



Public Key Technology Security

Terminal contains:

Card provides:

Issuer Public Key Certificate

Payment Network Public Key

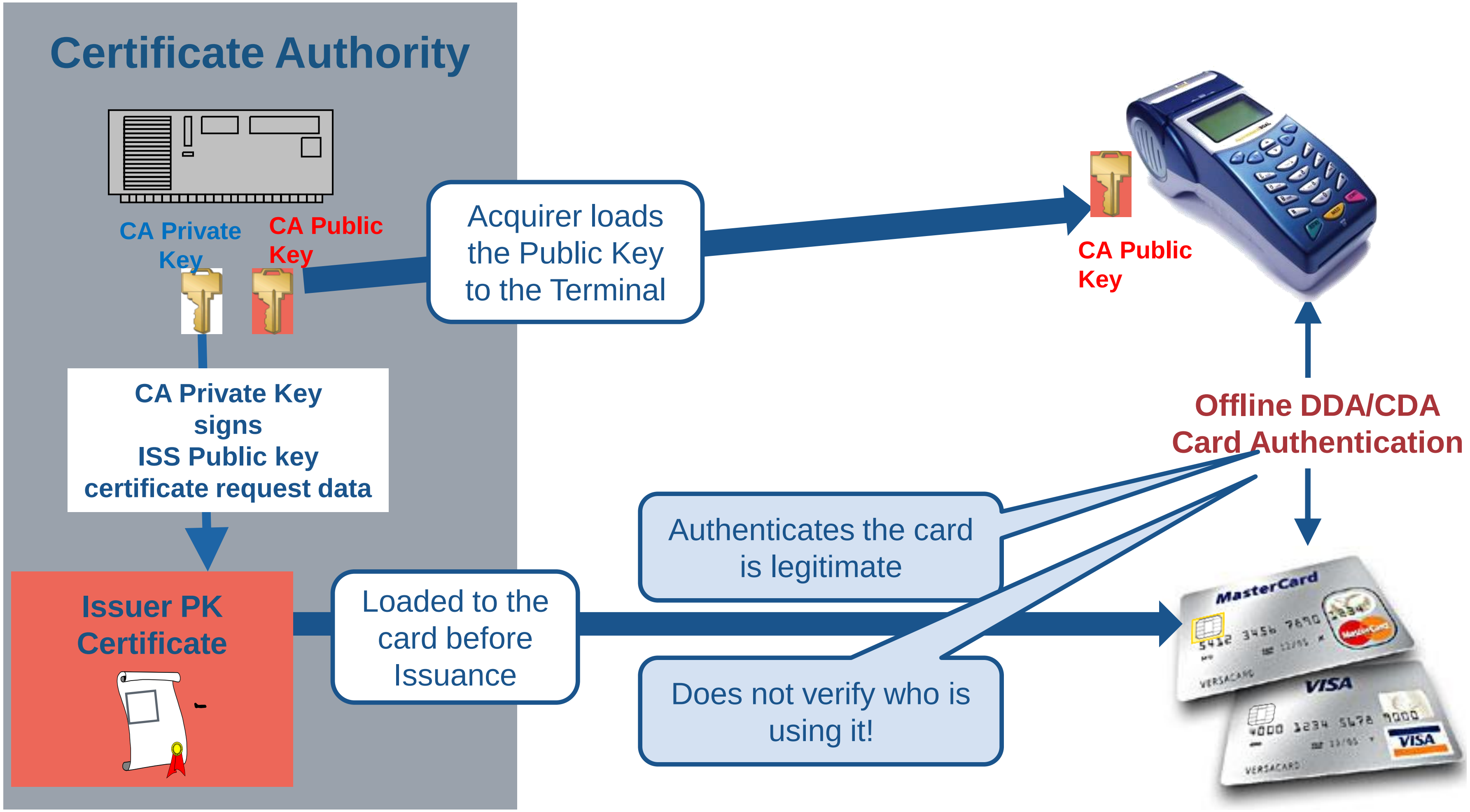
Issuer Public Key

Card Public Key Certificate

Card Public Key

Used to verify Signature over Dynamic Data

Offline Card Authentication (Simple Example)



Certificate Authority

CA Private Key

CA Public Key

Acquirer loads the Public Key to the Terminal

CA Public Key

CA Private Key signs ISS Public key certificate request data

Offline DDA/CDA Card Authentication

Authenticates the card is legitimate

Issuer PK Certificate

Loaded to the card before Issuance

Does not verify who is using it!

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Off-line CAM (Card Authentication Method) Options

Offline Card Authentication Options

DDA

- Dynamic Data Authentication
- Issuer Public Key Certificate
- ICC Public Key Certificate

CDA

- Combined Data Authentication
- Issuer Public Key Certificate
- ICC Public Key Certificate
- Application Cryptogram (Transaction Certificate)

Card (Chip) Level Certificate

Dynamic offline card authentication is unique per transaction

Offline authorization risk parameters are loaded at personalization and updated with post issuance scripts

2

Offline Authorization

(Offline Transaction)

Offline Risk Management on the Chip

Consecutive Transaction Counter
Last Online Application Transaction Counter

Lower Consecutive Offline Limit
Upper Consecutive Offline Limit

Lower Consecutive Offline Amount
Upper Consecutive Offline Amount

Offline Authorization Parameters

PIN
PIN Try Limit
PIN Try Counter

Issuer Action Codes
Card Issuer Action Codes

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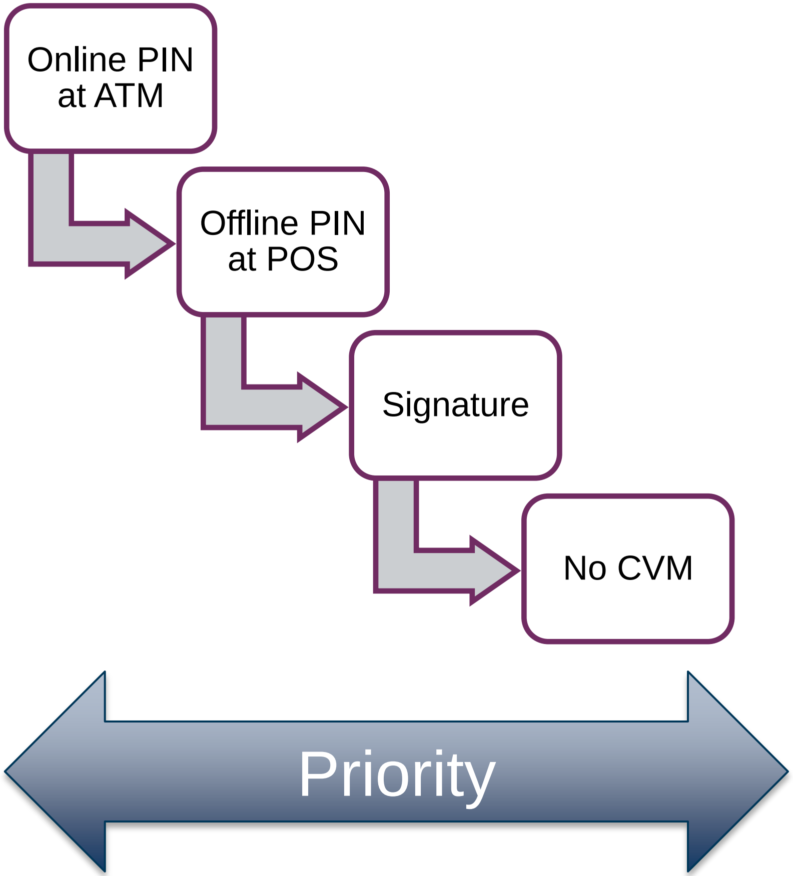
EMV Cardholder Verification Settings

CVM Options

- No CVM
- Signature
- On-line PIN at ATM
- On-line PIN at POS
- Off-line PIN plain texted
- Off-line PIN enciphered

Example: CVM List Selected



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Card profiles and terminal profiles work together to determine the method of cardholder verification

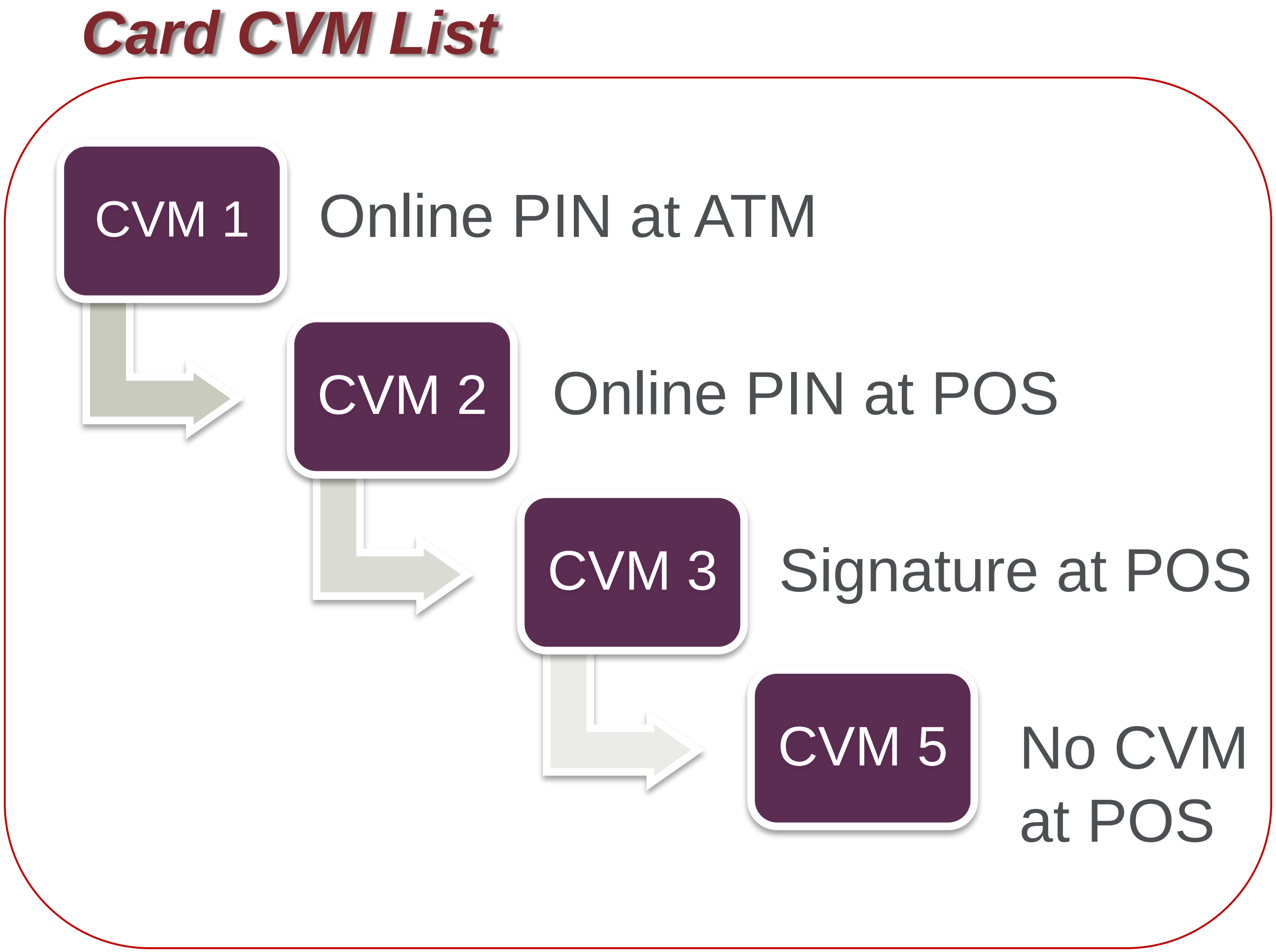
Terminal Capability Profile

POS Terminal

Signature

No “Offline PIN” support

No “Online PIN” support



Card CVM List

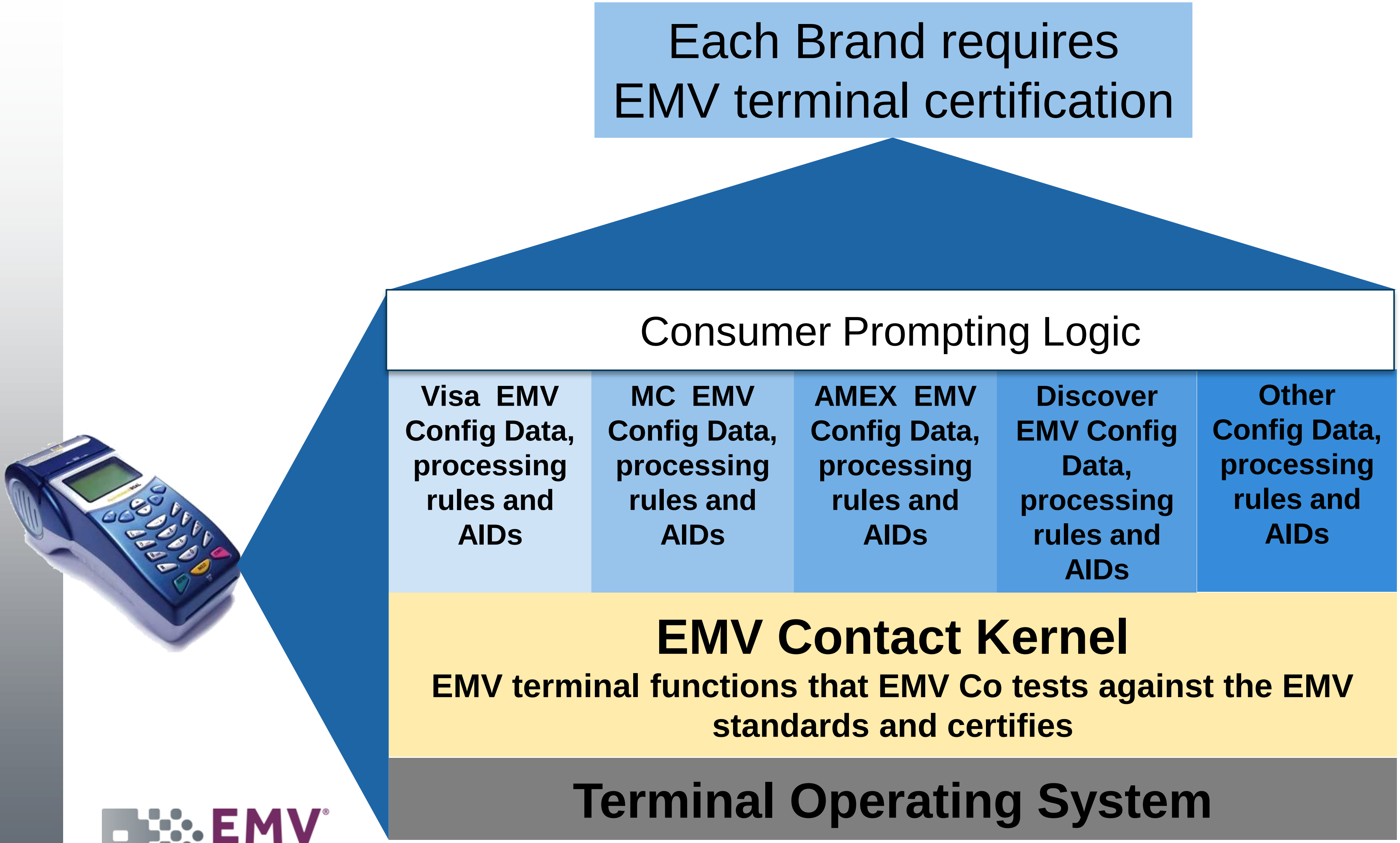
CVM 1 Online PIN at ATM

CVM 2 Online PIN at POS

CVM 3 Signature at POS

CVM 5 No CVM at POS

Terminal Perspective – EMV Logic Impact



Each Brand requires EMV terminal certification

Consumer Prompting Logic

Visa EMV Config Data, processing rules and AIDs

MC EMV Config Data, processing rules and AIDs

AMEX EMV Config Data, processing rules and AIDs

Discover EMV Config Data, processing rules and AIDs

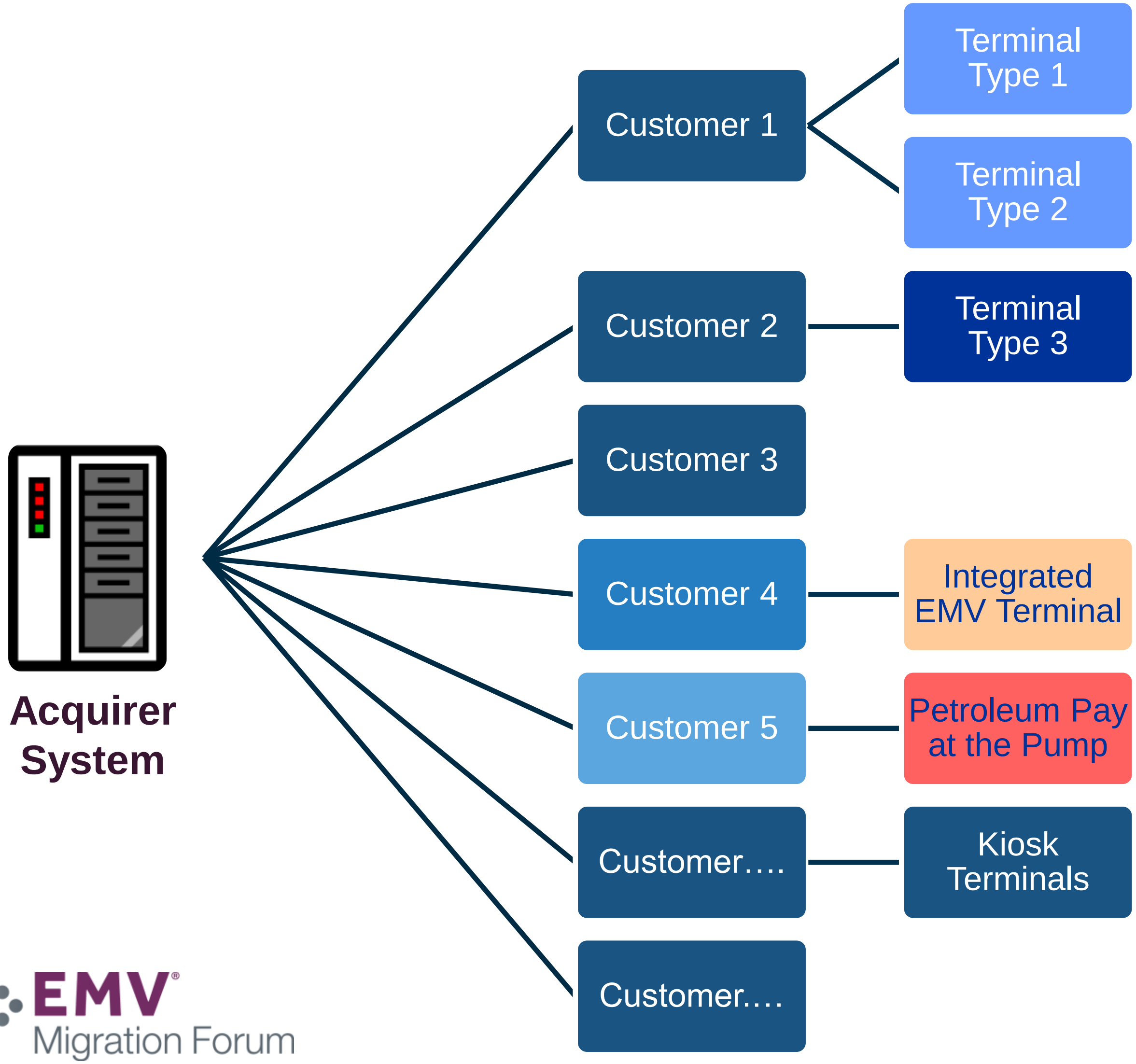
Other Config Data, processing rules and AIDs

EMV Contact Kernel

EMV terminal functions that EMV Co tests against the EMV standards and certifies

Terminal Operating System

Acquirers are required to Brand Certify each terminal type that they deploy



Acquirer System

Customer 1

Terminal Type 1

Terminal Type 2

Customer 2

Terminal Type 3

Customer 3

Customer 4

Integrated EMV Terminal

Customer 5

Petroleum Pay at the Pump

Customer….

Kiosk Terminals

Customer….

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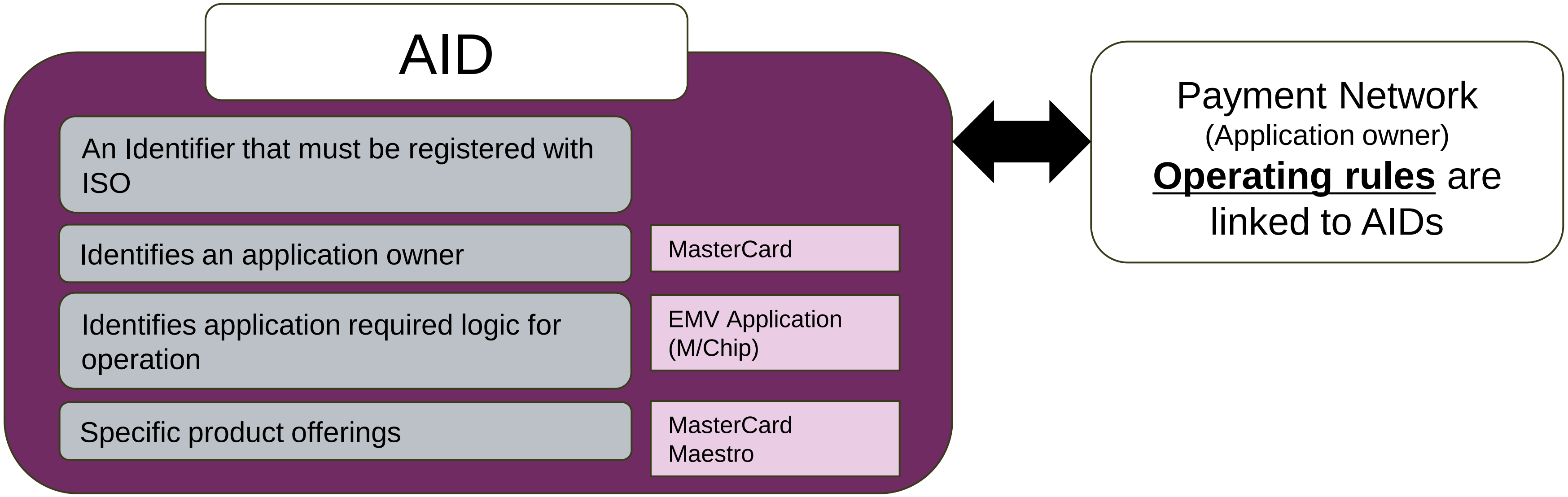
The AID provides a method for the terminal to recognize what applications exist on a chip card

So what is an AID?



AID

An Identifier that must be registered with ISO

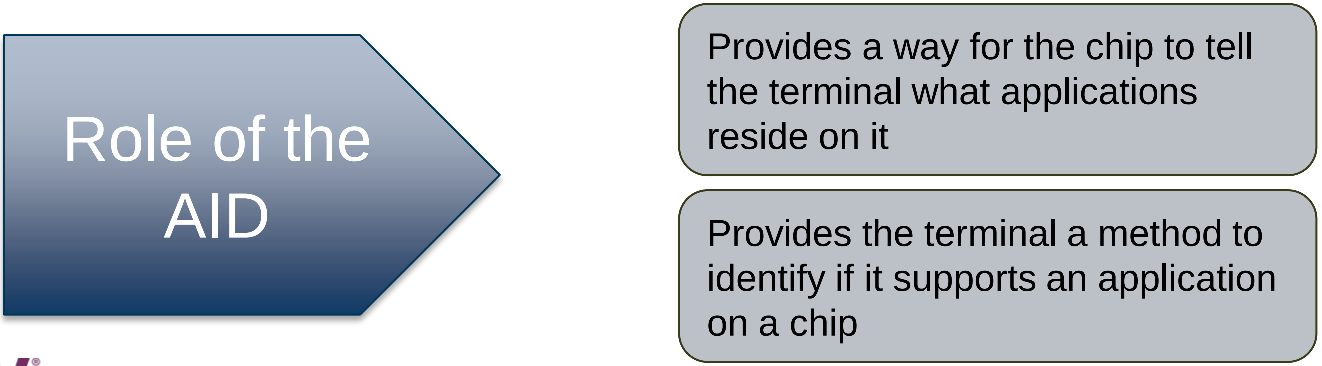
Identifies an application owner — MasterCard

Identifies application required logic for operation — EMV Application (M/Chip)

Specific product offerings — MasterCard Maestro

Payment Network (Application owner)

Operating rules are linked to AIDs



Role of the AID

Provides a way for the chip to tell the terminal what applications reside on it

Provides the terminal a method to identify if it supports an application on a chip

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The terminals maintain a list of AIDs that it supports

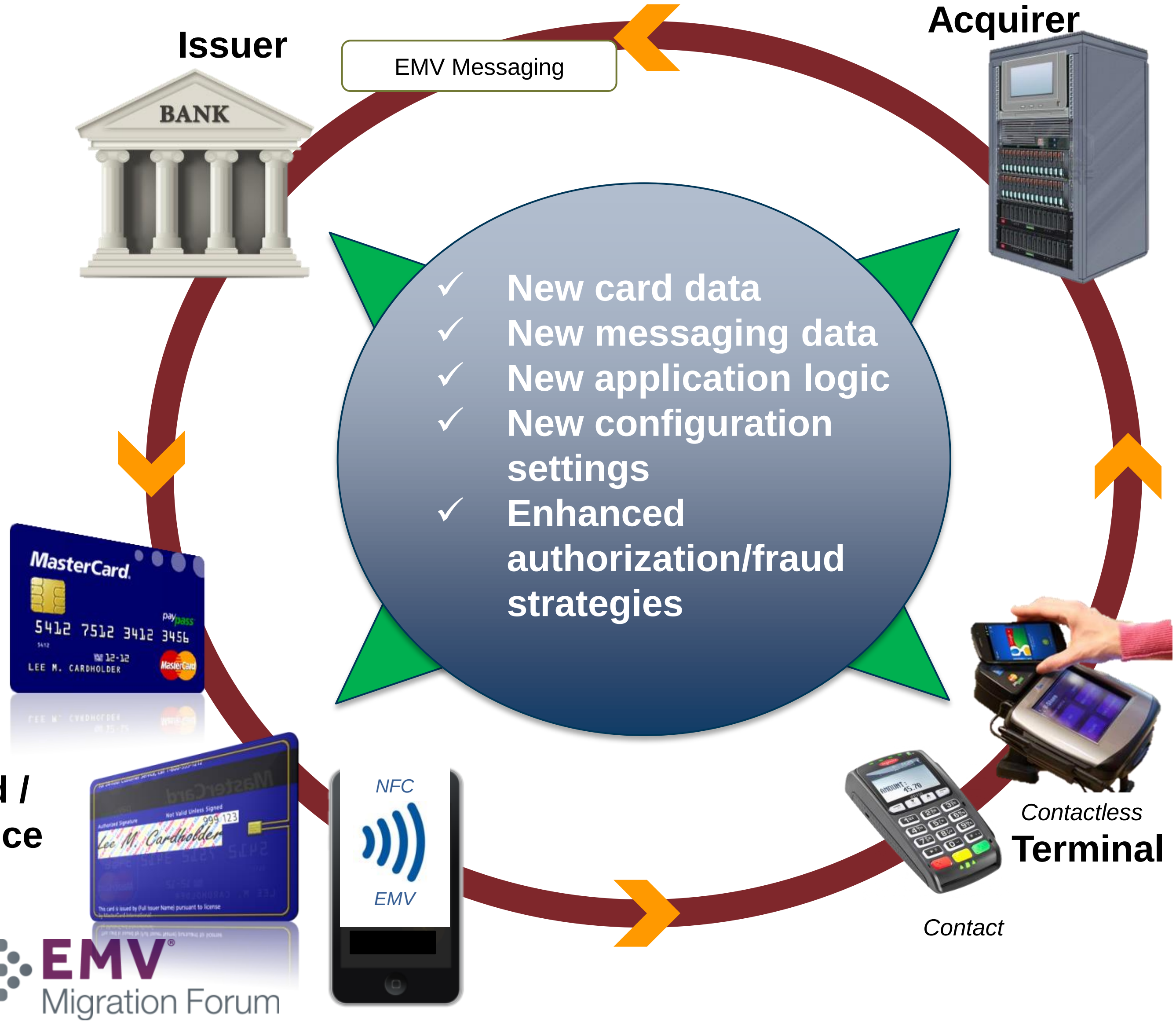
The terminal keeps a list of AIDs that it can support

An Issuer loads applications and corresponding AIDs to the chip

List of AIDs supported by the terminal	
MC Debit/Credit AID	A0000000041010
MC U.S. Maestro Common AID	A0000000042203
Visa	A0000000031010
Visa U.S. Common AID	A0000000980840
Discover AID	A0000003241010

Logic and configuration data specific to each AID must be added to the terminal

All stakeholders need to migrate to receive the full benefit of EMV



- ✓ New card data
- ✓ New messaging data
- ✓ New application logic
- ✓ New configuration settings
- ✓ Enhanced authorization/fraud strategies

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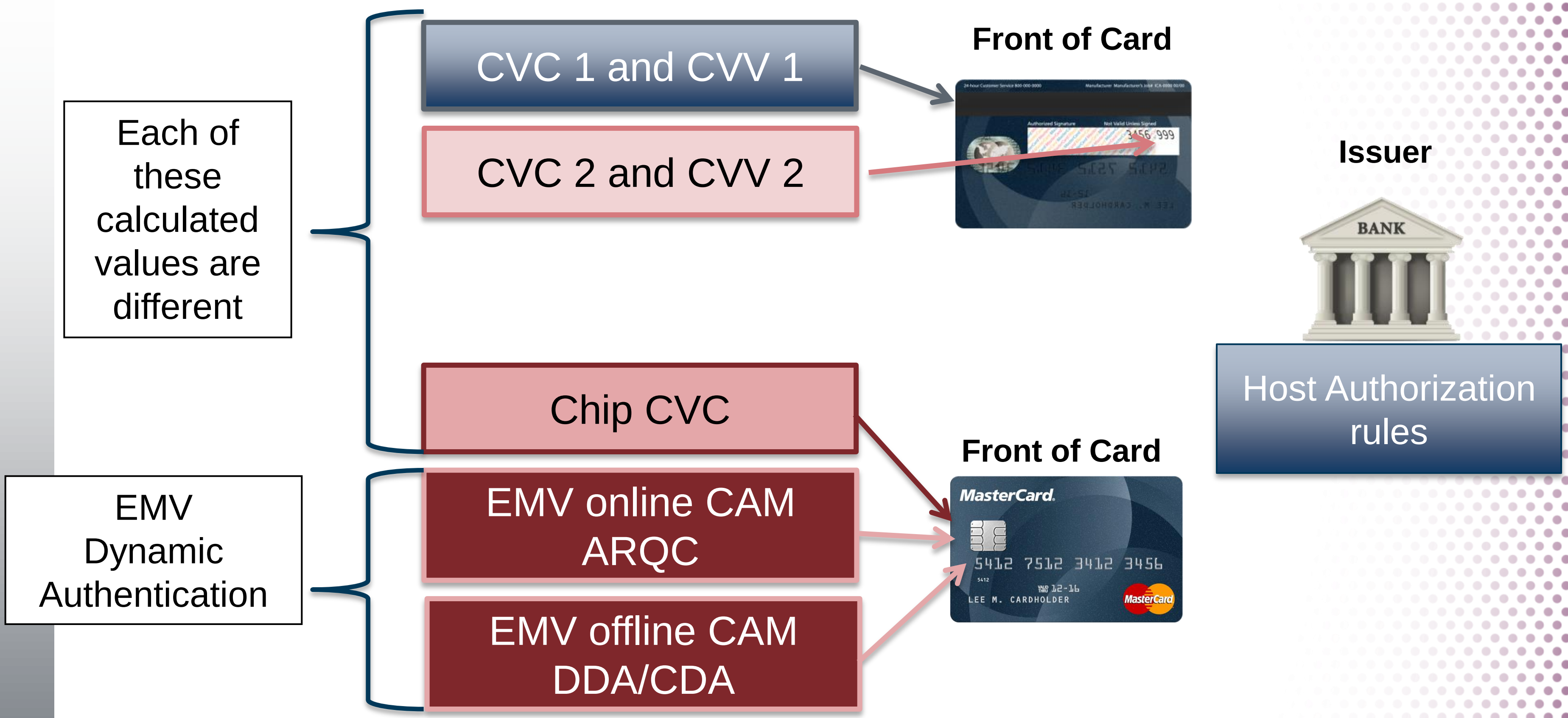
EMV leverages card, terminal, messaging and host system security technology to protect against counterfeit fraud



Each of these calculated values are different

CVC 1 and CVV 1

CVC 2 and CVV 2

Chip CVC

EMV Dynamic Authentication

EMV online CAM ARQC

EMV offline CAM DDA/CDA

Front of Card

Front of Card

Issuer

Host Authorization rules

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Q&A

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- Guy Berg, guy_berg@mastercard.com

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