Embedded Flash Storage for Industrial IoT

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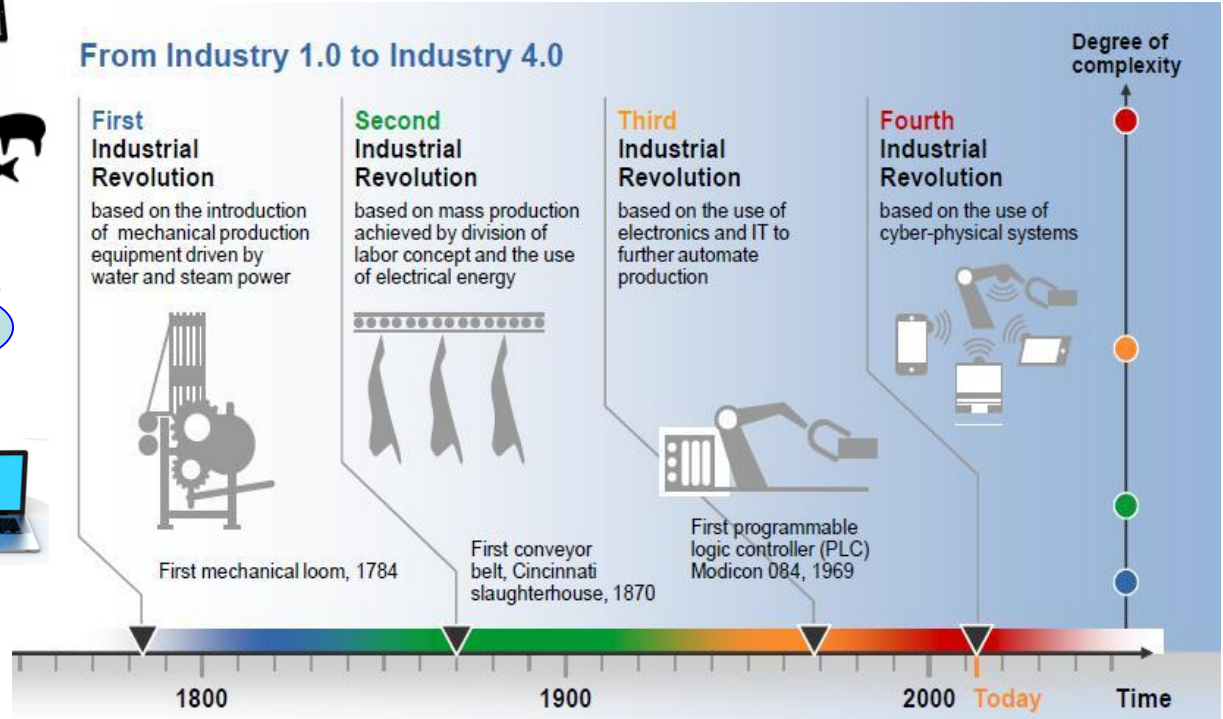
EmBestor Technology Inc.
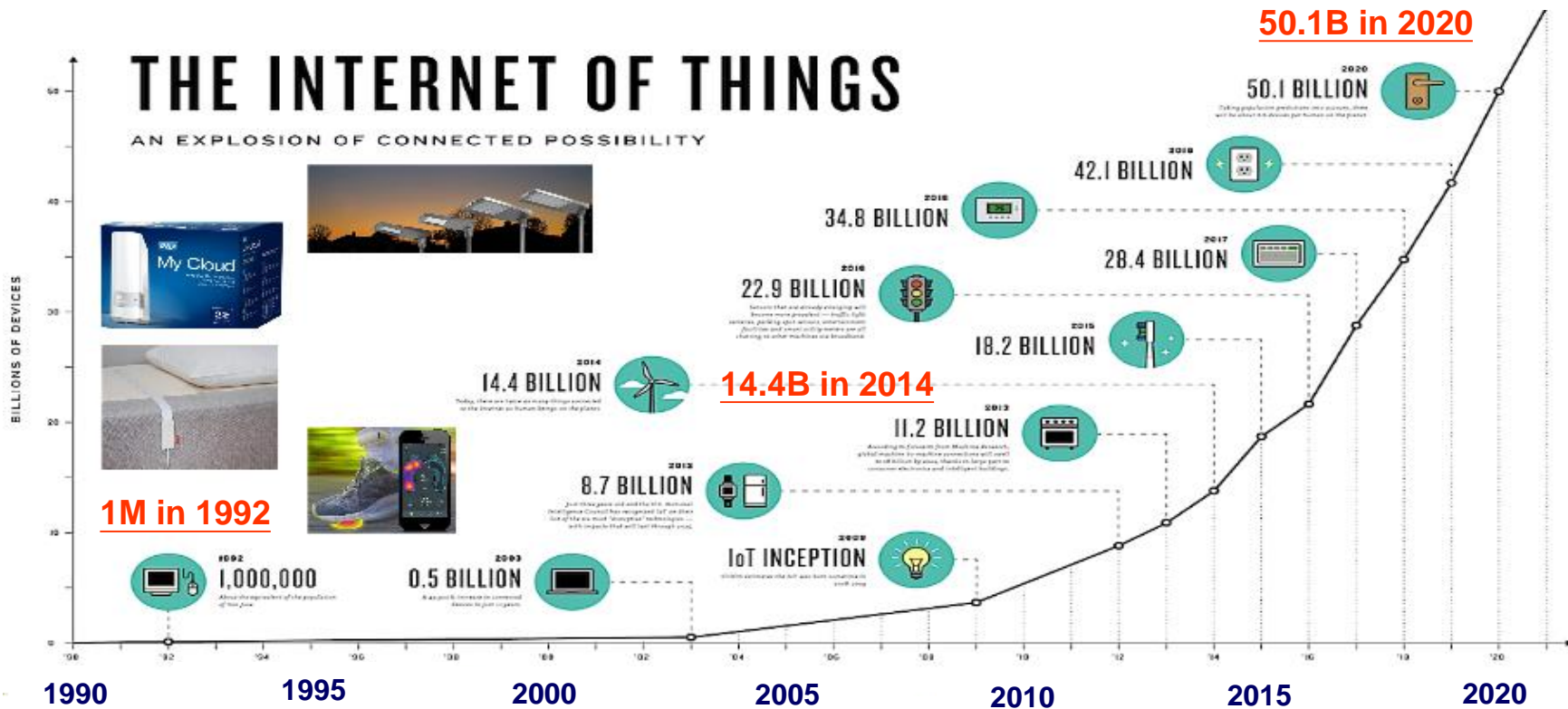**http://www.embestor.com**

Outline

- Internet of Things (IoT) and Industry 4.0

- Embedded Flash Storage (EFS) in IoT Structure

- Industrial IoT (IIoT) Examples

- EFS Features for IIoT

- Customized Function Examples

IoT and Industry 4.0

**Internet of Things**

From Industry 1.0 to Industry 4.0

Degree of complexity

First Industrial Revolution
based on the introduction of mechanical production equipment driven by water and steam power

Second Industrial Revolution
based on mass production achieved by division of labor concept and the use of electrical energy

Third Industrial Revolution
based on the use of electronics and IT to further automate production

Fourth Industrial Revolution
based on the use of cyber-physical systems

First mechanical loom, 1784

First conveyor belt, Cincinnati slaughterhouse, 1870

First programmable logic controller (PLC) Modicon 084, 1969

1800   1900   2000   Today   Time

Source: DFKI (2011)

Internet Connected Devices

50.1B in 2020

THE INTERNET OF THINGS

AN EXPLOSION OF CONNECTED POSSIBILITY

14.4B in 2014

1M in 1992

BILLIONS OF DEVICES

1990   1995   2000   2005   2010   2015   2020

Structure of IoT
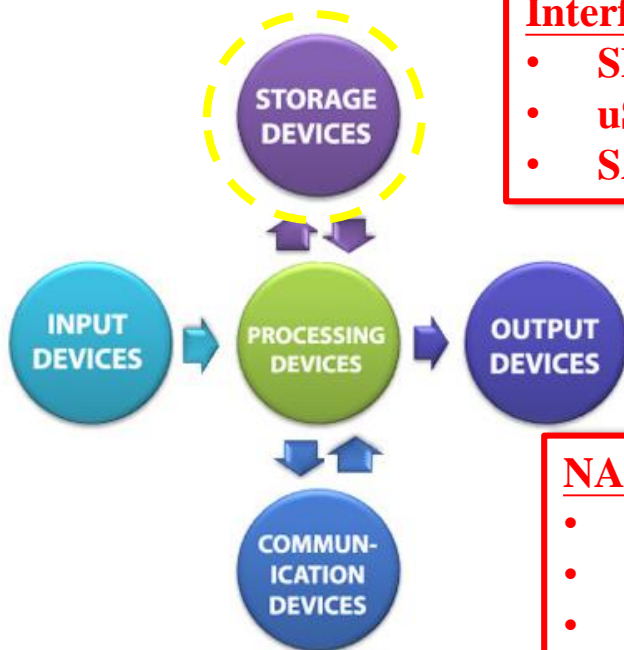
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Embedded Flash Storage:

- For the "Things": Sensors, Actuators, IP Cams, I/O Controllers. (Low density)

- For the Gateway: Controller Hub, Network Gateway. (Mid Density)

- For the Server: the Cloud, Data Center. (Large/Super Density)
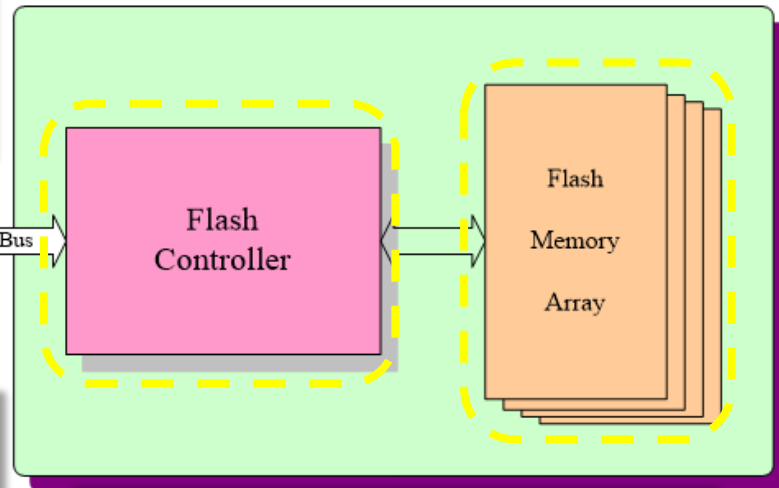

Source: UNISVR

EFS in Computer Systems
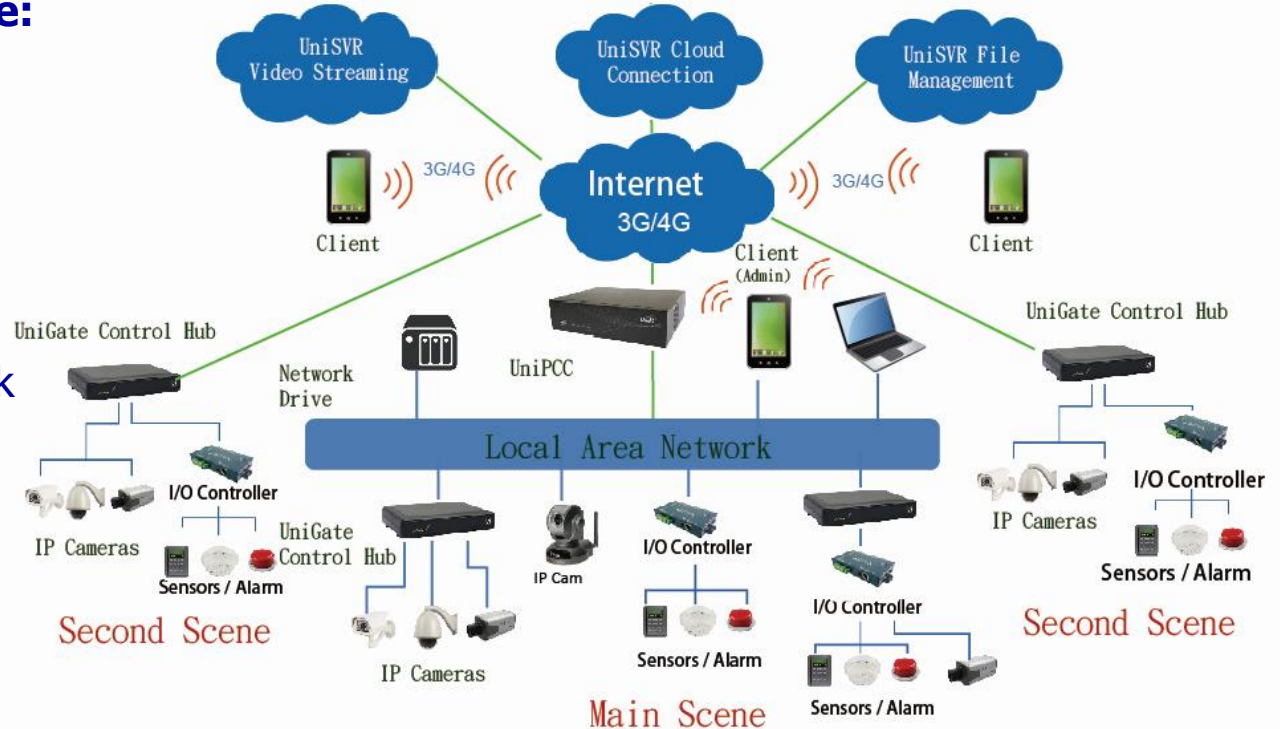
Interface Controller
- **SD, UFD**
- **uSD, eMMC, UFS**
- **SATA, PCIe/NVMe**

The Flash Storage System

Interface Bus — Flash Controller ↔ Flash Memory Array

NAND Controller
- **VLSI**
- **ECC**
- **DMA & Buffer**
- **Flash Sequencer**
- **Algorithms**
- **MCU & F/W**

NAND Flash	SLC	MLC
WT (-40~85ºC)	★★★	★★
CT (0~70ºC)	★★	★

INPUT DEVICES → PROCESSING DEVICES → OUTPUT DEVICES
STORAGE DEVICES
COMMUN-ICATION DEVICES

What is "For Industrial"?

	Industrial	Consumer
Users	Enterprise/Group	Personal
Customize	YES	NO
Life Cycle	> 5~20 years	[1~5] years
Quality	High	Satisfactory
Design-In	Long-term	Timing, Cost
Environment	Versatile, Severe	General
	… … … …	… … … …

IIoT Example: Factory Automation

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IIoT in Factory Automation:

- "Things": Sensors, IP Cams, Actuators.

- Goal: Automation, Optimization, Flexibility.

- Performance Index: Efficiency, Productivity, Flexibility.

- Technology: Robotics, All Sensors Automation, Data Collection and Analysis, Optimal Simulation, Cloud Computing.

Source: Axiomtek

IIoT Example: Logistics & Transport
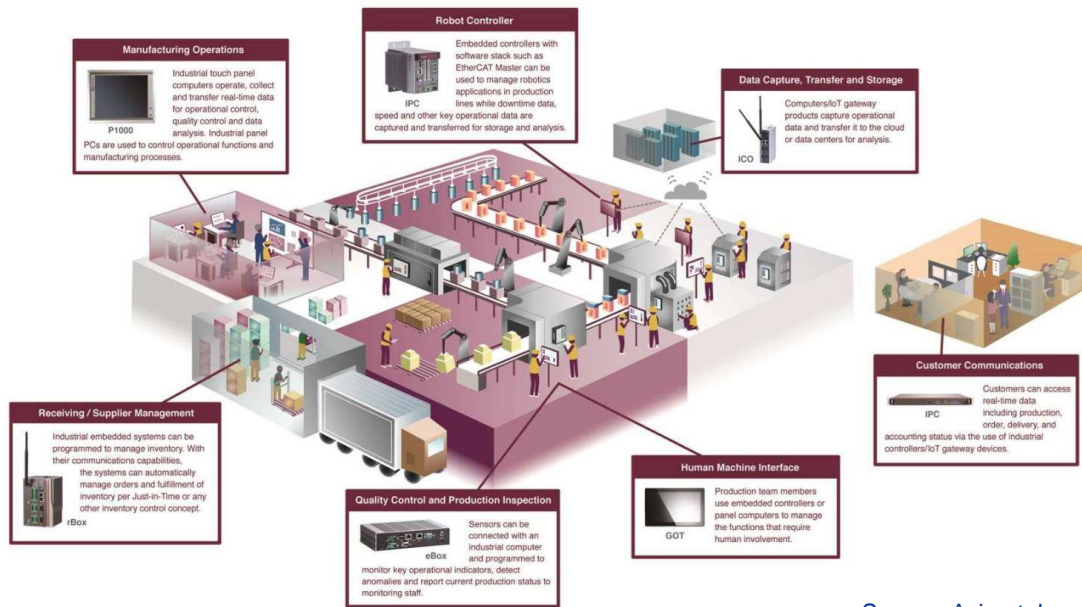
IIoT in Logistic & Transport:

- "Things": Sensors, IP Cams, IO Controllers.

- Goal: Security, Safety, Optimization, Flexibility, Inventory Control, Environment Control.

- Performance Index: Efficiency, Productivity, Flexibility.

- Technology: Sensors, Automation, Data Collection and Analysis, Optimal Control.

Source: CISCO

EFS Features for IIoT

Environmental Extremes:

- Wide Temperature Range: Several Grades: (0~70), (-25~85), (-40~85), (-40~125), (-55~125)

- Dusty, Humid and Chemical: Waterproof and Dustproof.

- Electro-Magnetic: EMI, EMC.

- Mechanical: Anti-Vibration, Anti-Shock.

Performance:

- Data Integrity: Data Retention, Power-fails Protection, Data Robustness.

- Data Security and Privacy.

- Access Speed: Throughput (Sequential), Latency (Random).

- Energy Saving: Low Power and Power Management.

Functions:

- Programmable and Configurable

- Flexibility and Extensibility.

- Customizations and Platform Support.

Industrial EFS Features

Features:

- Industrial Grade: microSD / SD Card / UFD / SSD.
- Density: 256MB ~ 64GB(SLC); 8GB ~ 128GB(MLC);
- Interfaces: SD, USB, SATAT, PATA, PCIe/NVMe.
- High Random IOPS performance.
- High Endurance.
- Fixed BOM 3 years.
- -40°C ~ + 85°C wide temperature range support.
- Real-time, informative, S.M.A.R.T. function.
- Read/Program Disturbance Management.
- Adaptive Static Wear Leveling.
- Management of Sudden Power-fails.
- Low-power and Power management.

Real-time Remote S.M.A.R.T.
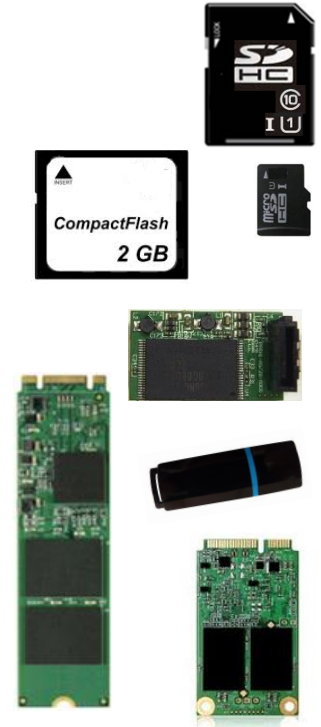
- Host can get more of device's SMART Information easily.
- Support Customized Windows AP, the normal reader could get the SMART Info.
- Support SDK for several Linux OS versions

SMART Info.

Host

Internet

Device 1

Device 2

Device 3

Device 4

Data Privacy: Proprietary Use
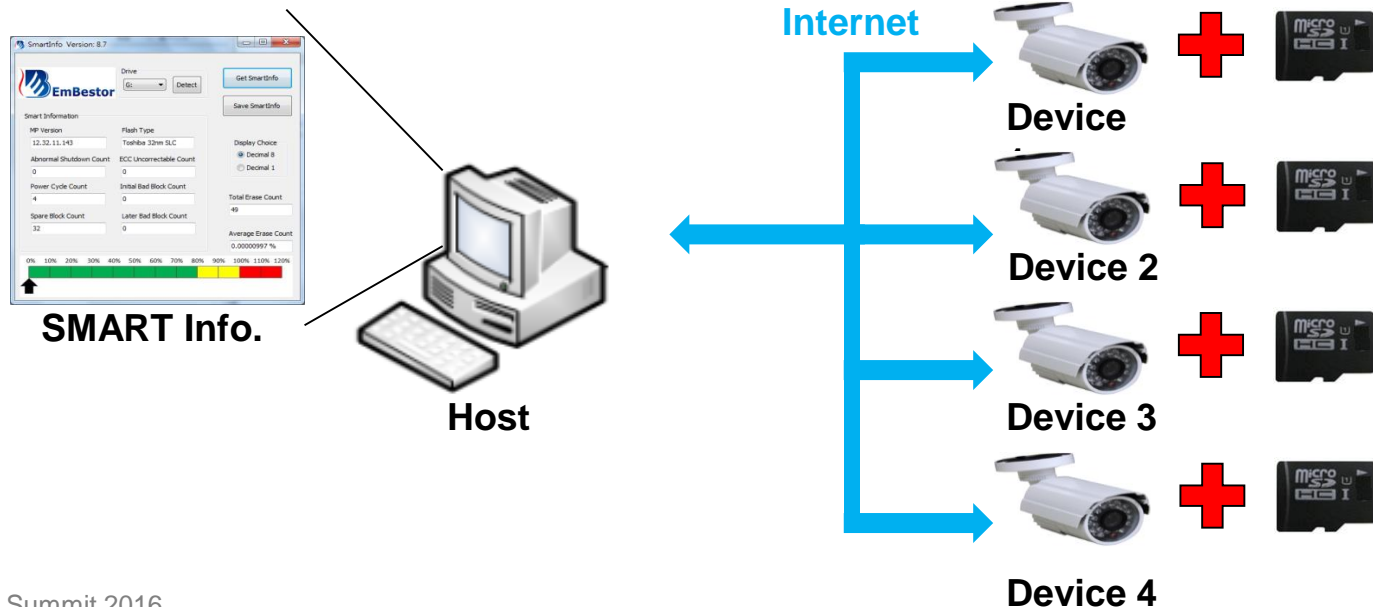
- The EmBestor EFS Devices provide Hidden Data mechanism. Customer Host device need follow the Hidden Data specifications.
- This mechanism can provide the data privacy and enhance the data security level.

Customer Host Device → **Can use the Card**

Other Host Device → **Cannot use the Card**

Security: Digital Signature
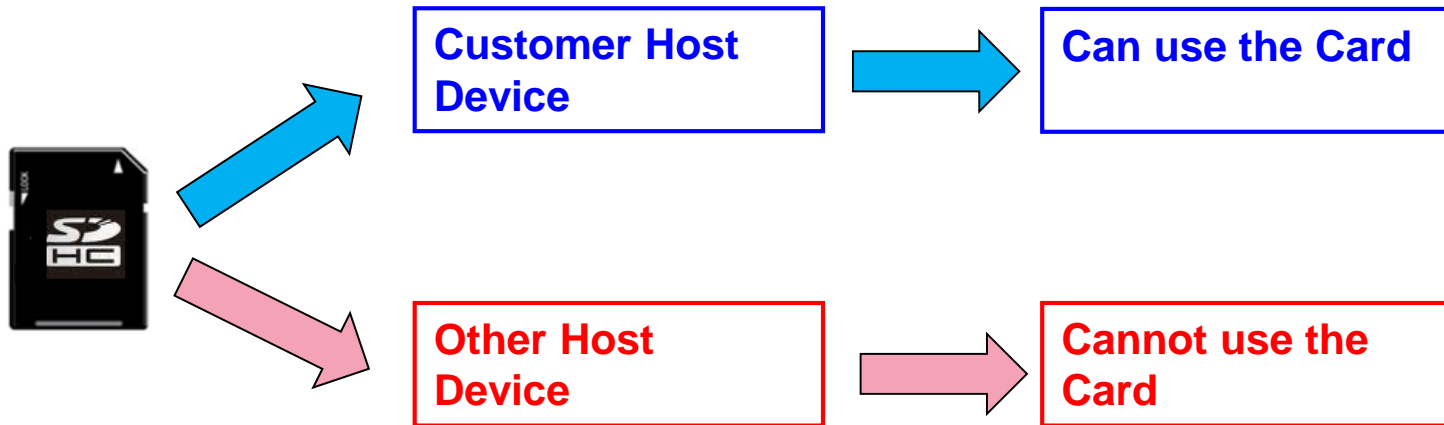
- Support data encryption function, according to communicate with AES chip
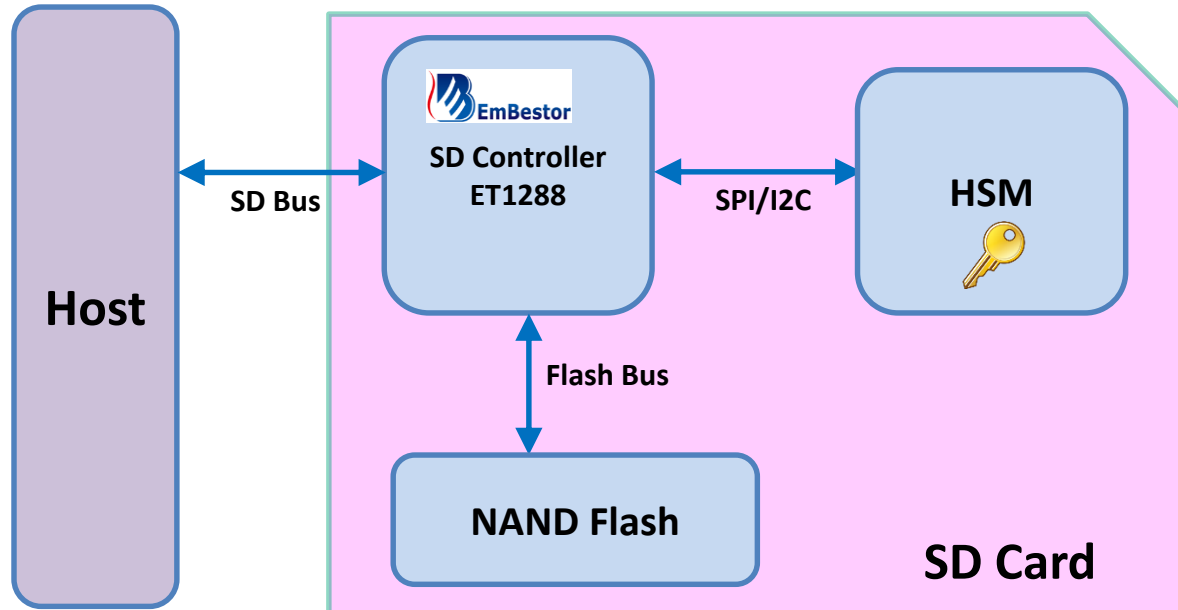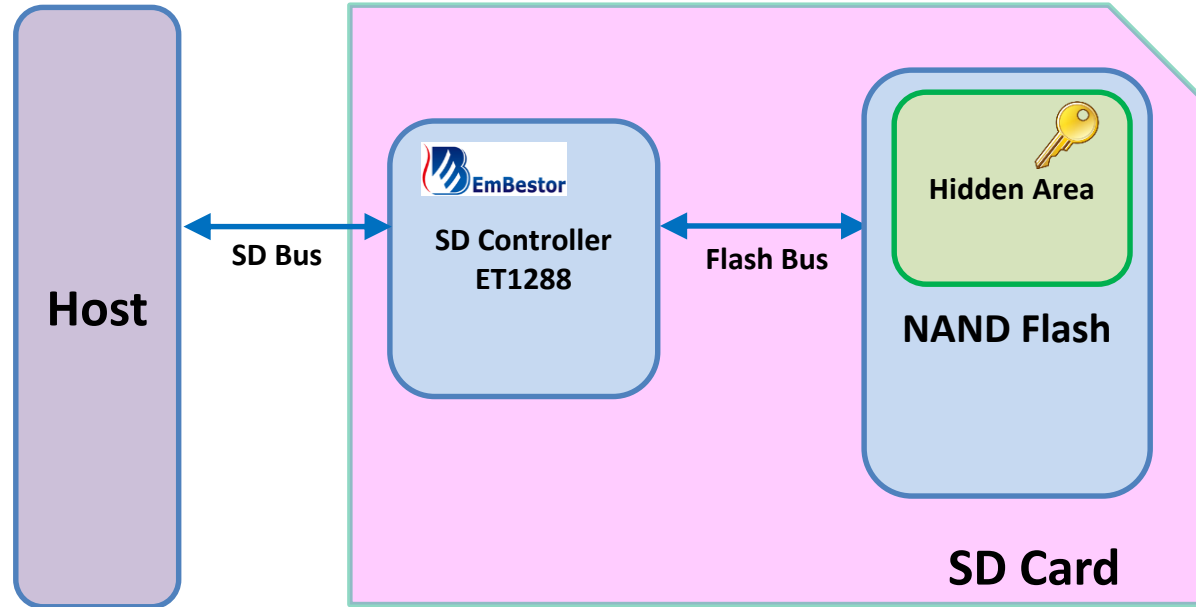- EmBestor support security customization based on customer requirement.

NAND Flash — **ET1288 Controller** — **SD Interface** — **HSM Chip**
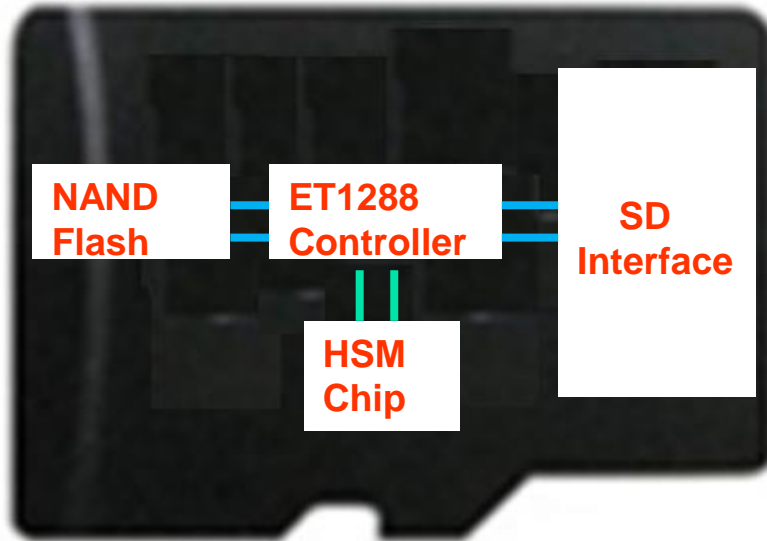
Mobile Payment

Mobile Identity

Cloud Security

Key Protect

SD/uSD with Digital Signature

Solution 1: Co-processing with external HSM

SD/uSD with Digital Signature

Solution 2: The Keys Stored in the Hidden Area

Thank You!

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