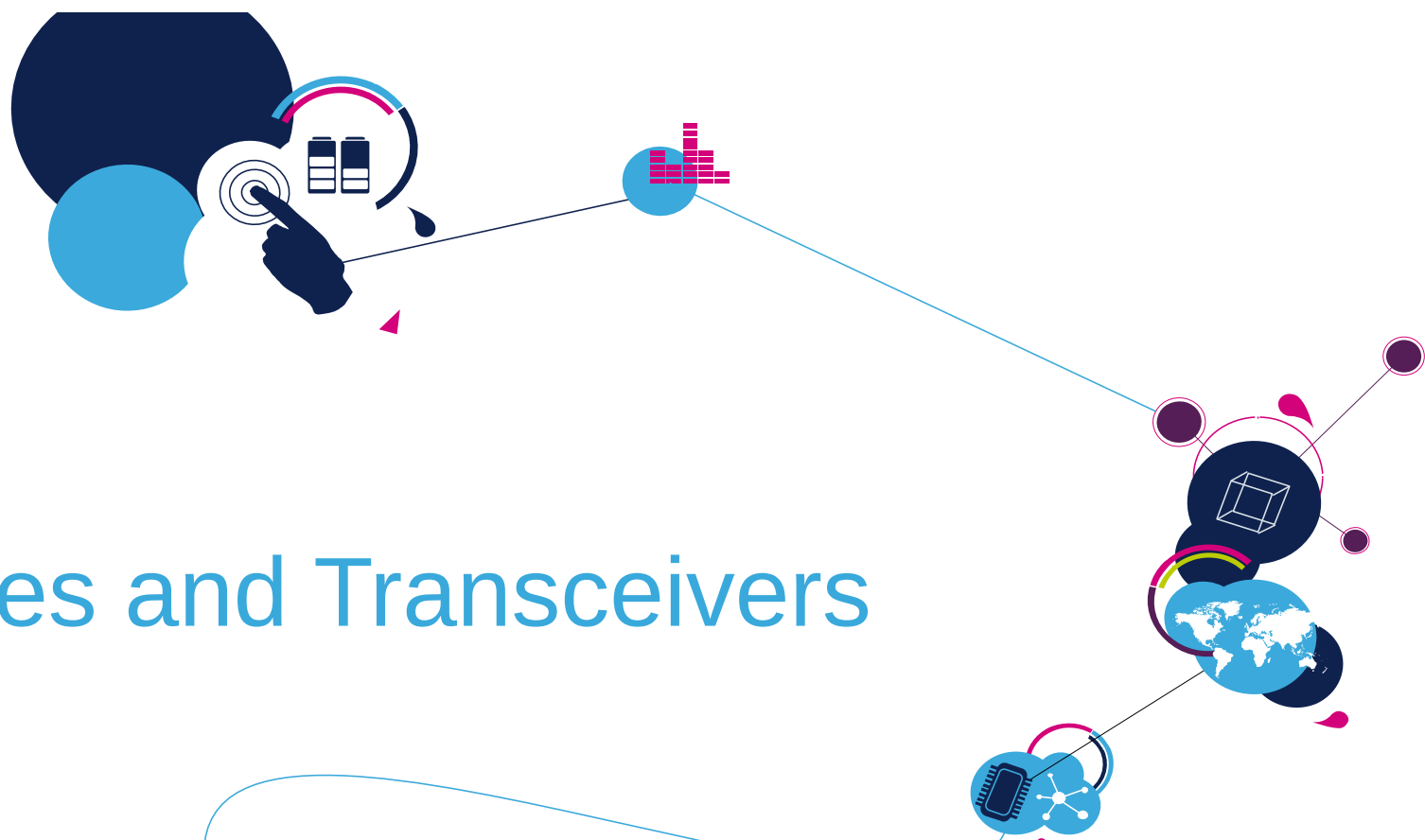




NFC Memories and Transceivers

Product presentation

January 2015



New market dynamics

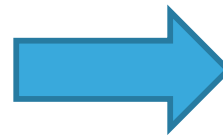
2

From RFID driven (2010)...



- Limited RFID adoption, no NFC
- High cost of infrastructure
- ROI [investment] driven

... to NFC driven (2014)



- NFC adoption confirmed, ramping
- “Free” infrastructure
- User experience [value] driven
- Multi-market

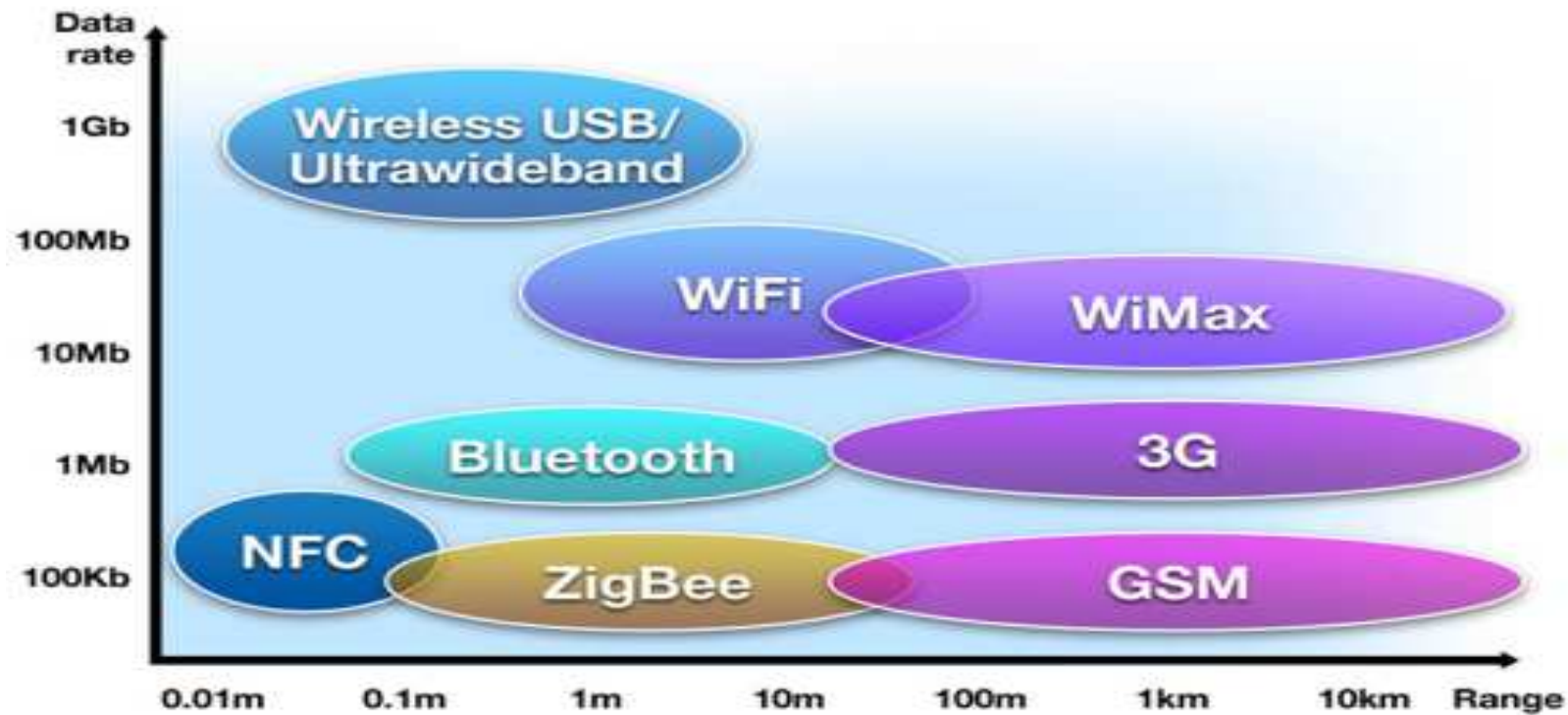
NFC technology 3

- Near Field Communication, a short range wireless technology operating at 13.56MHz
- Interactive and zero power, enabling convenient connection to the Internet of Things
- Enables contactless transactions, data exchange, and simplifies setup of more complex communications such as Bluetooth and Wi-Fi
- Fast growing deployment in Mobile
 - The number of NFC-enabled devices in use will exceed 500 million in 2014 (source ABIresearch)
 - By 2015, 50% of smartphones compatible with NFC (source Gartner)



NFC : Near Field Communication

- is a subset of 13.56 MHz RFID
- is short distance / low data rate
- is complementary to Wi-Fi or Bluetooth



Wide range of use cases 5



- Convenient wireless pairing

- **Tap & Pair!** Bluetooth or Wifi connection pairing / unpairing made convenient by just tapping the phone by the dynamic NFC tag.



- Remote programming

- **Tap & Set!** Take advantage of smartphones user interface to set appliances, home automation, healthcare and industrial equipments. Change default settings, cooking profile, activate warranty card ...



- Data download

- **Tap & Download!** Download your running data, your device user manual, the customer service contact information.



- Service maintenance

- **Tap & Diagnose!** Enable / disable a device, repurpose it, download its maintenance records, error codes, activate new functions.

« Embedded NFC » use cases for IoT 6

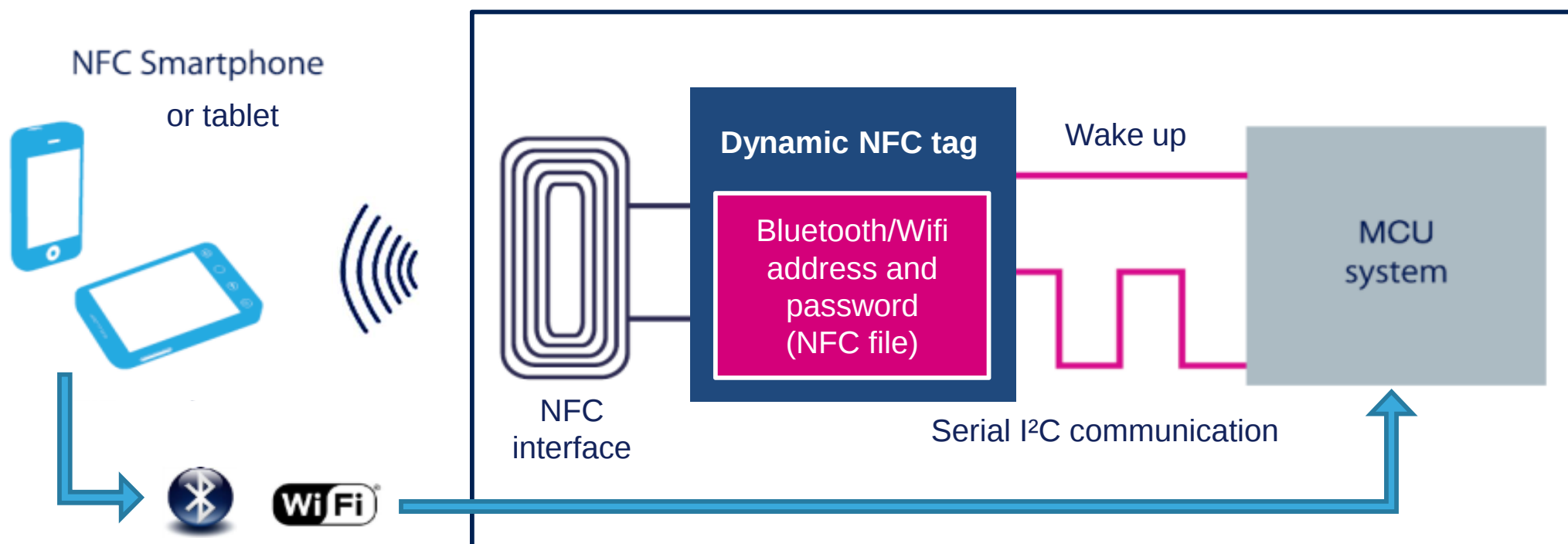
- ST's dynamic NFC tags and transceivers...
... a wide range of use cases, in an affordable and easy-to-use device



<http://youtu.be/Z-9HtyhoxT8>

Wireless pairing “Tap & pair”

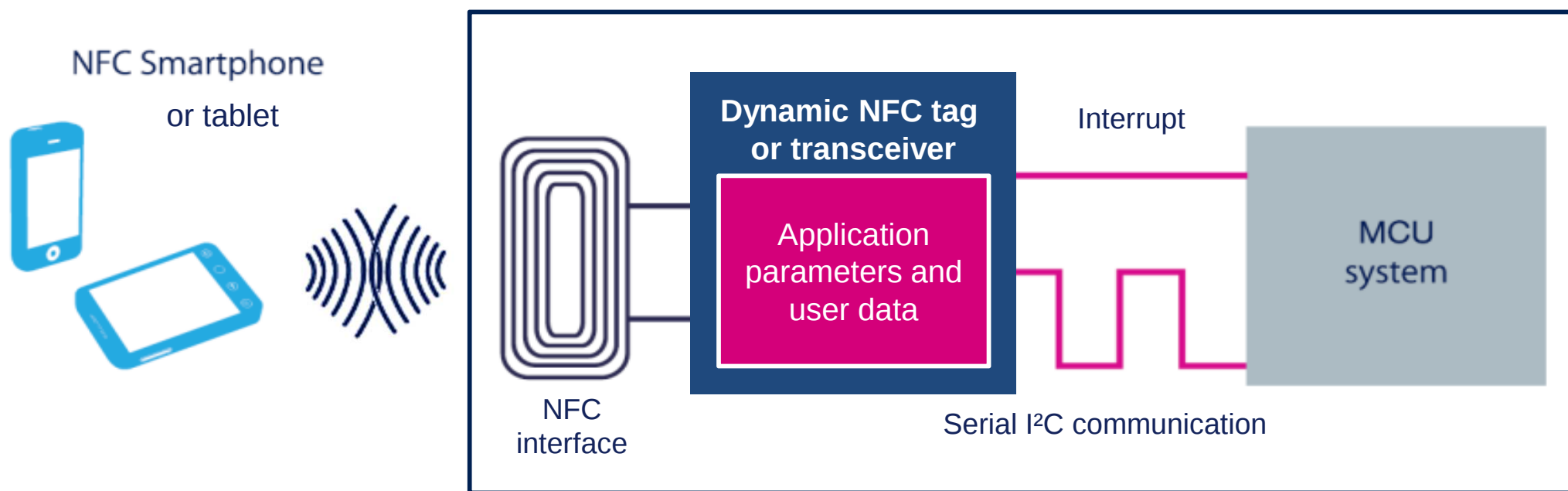
7



Use ST's NFC technology to enable seamless wireless pairing

Data download, remote programming, servicing “Tap & exchange”

8



Use ST's NFC technology to exchange data in an interactive and user-friendly way by leveraging smartphone or tablet display quality

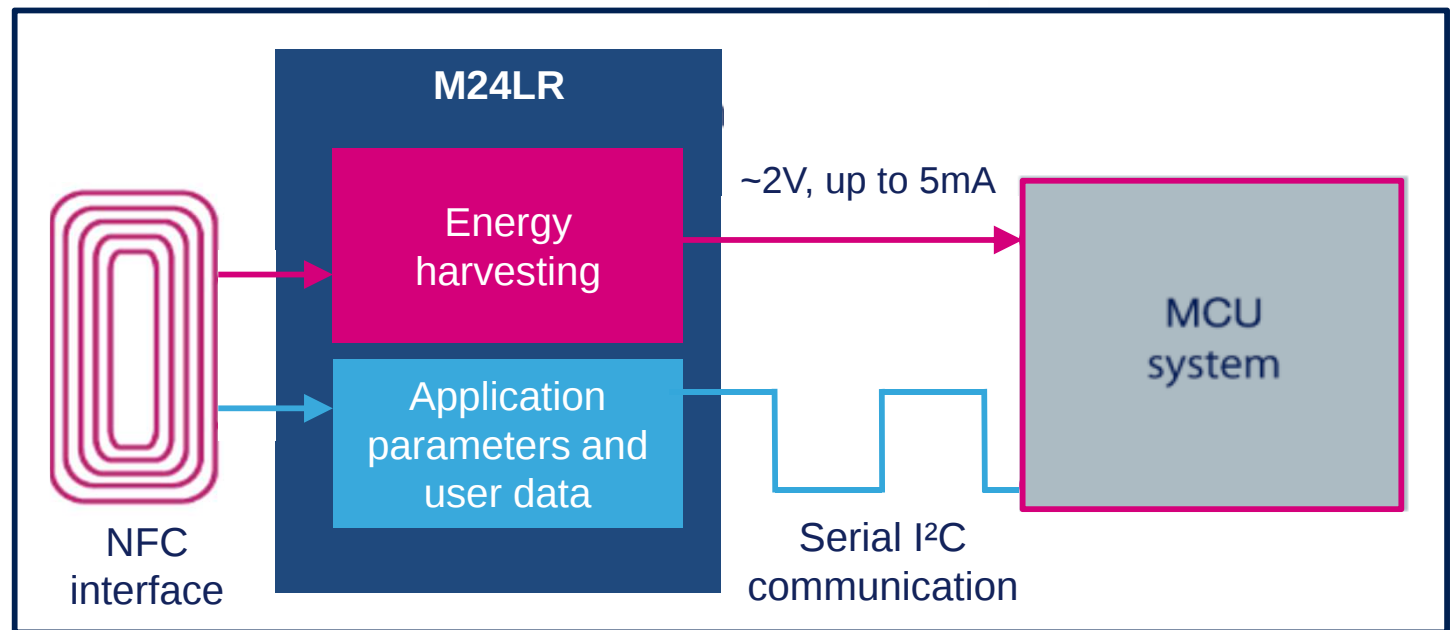
Beyond NFC... Energy harvesting with M24LR

9



NFC Smartphone
or tablet

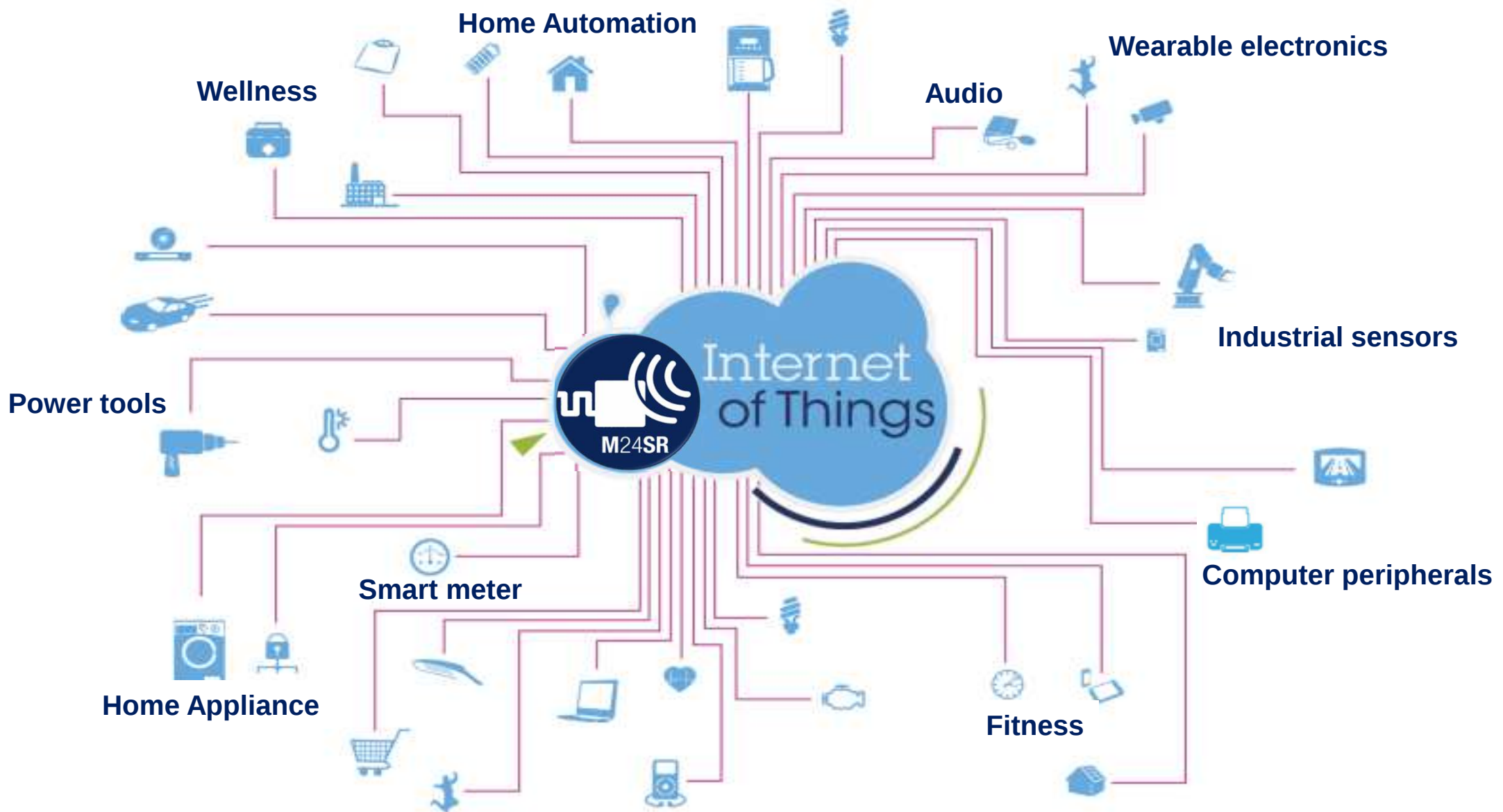
RFID reader

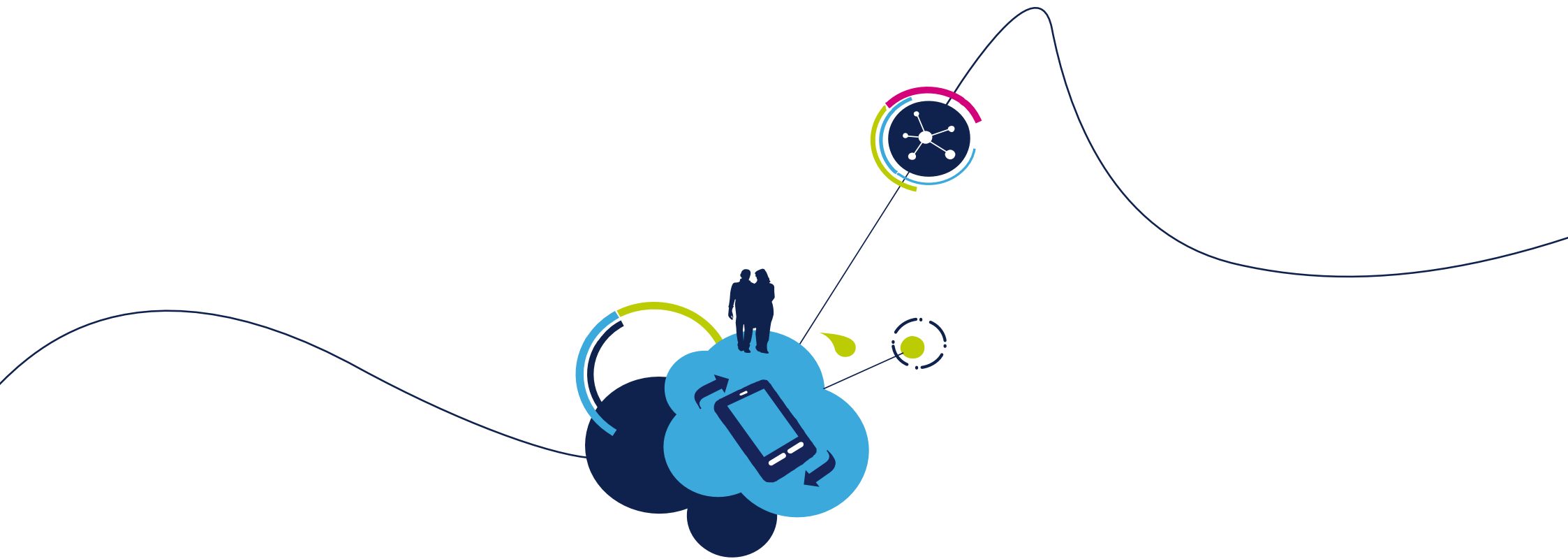


Use M24LR to enable battery-less applications such as
e-paper based electronic shelf labels

ST NFC memories and transceivers at the heart of Internet of Things

10

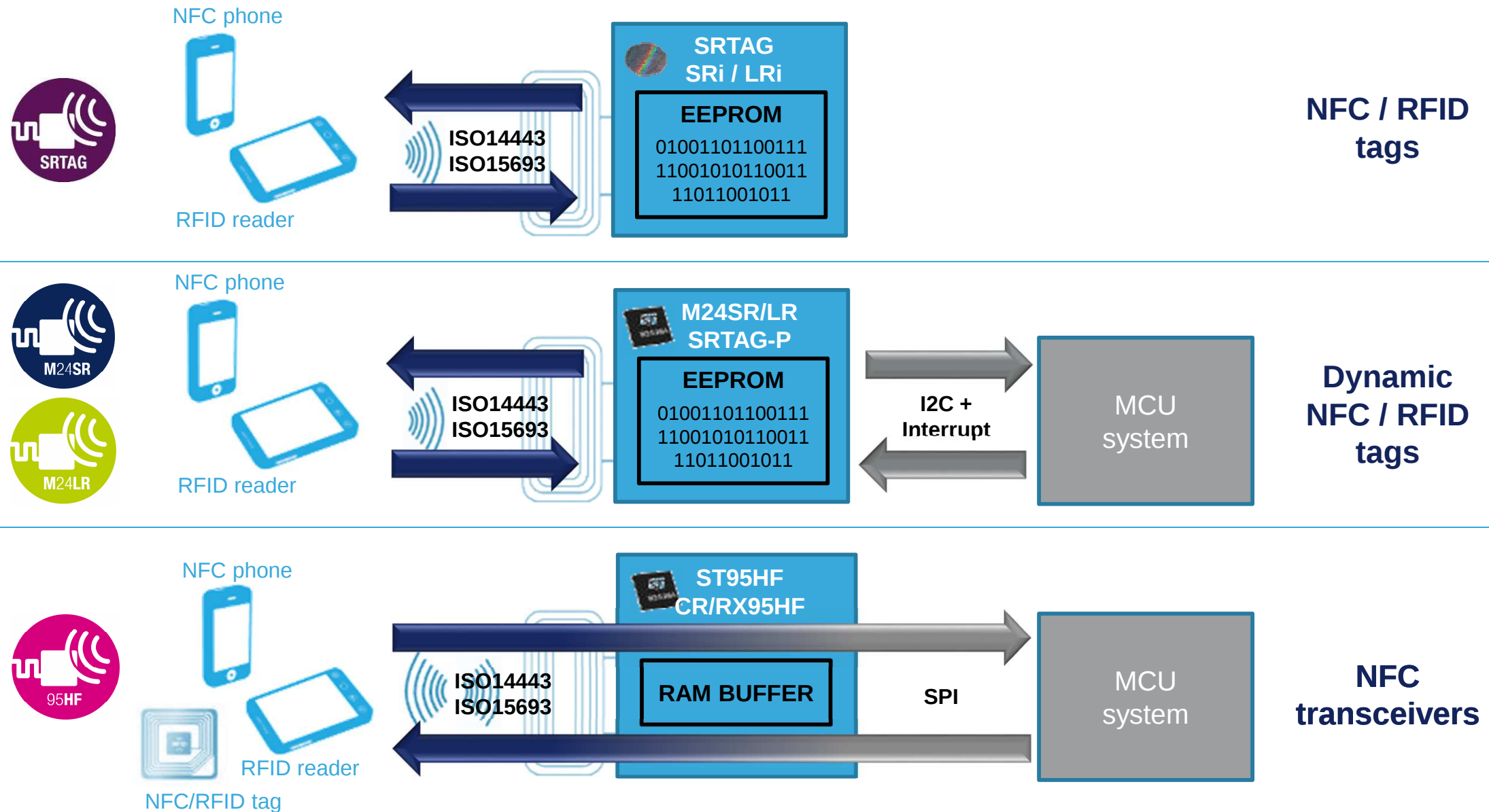


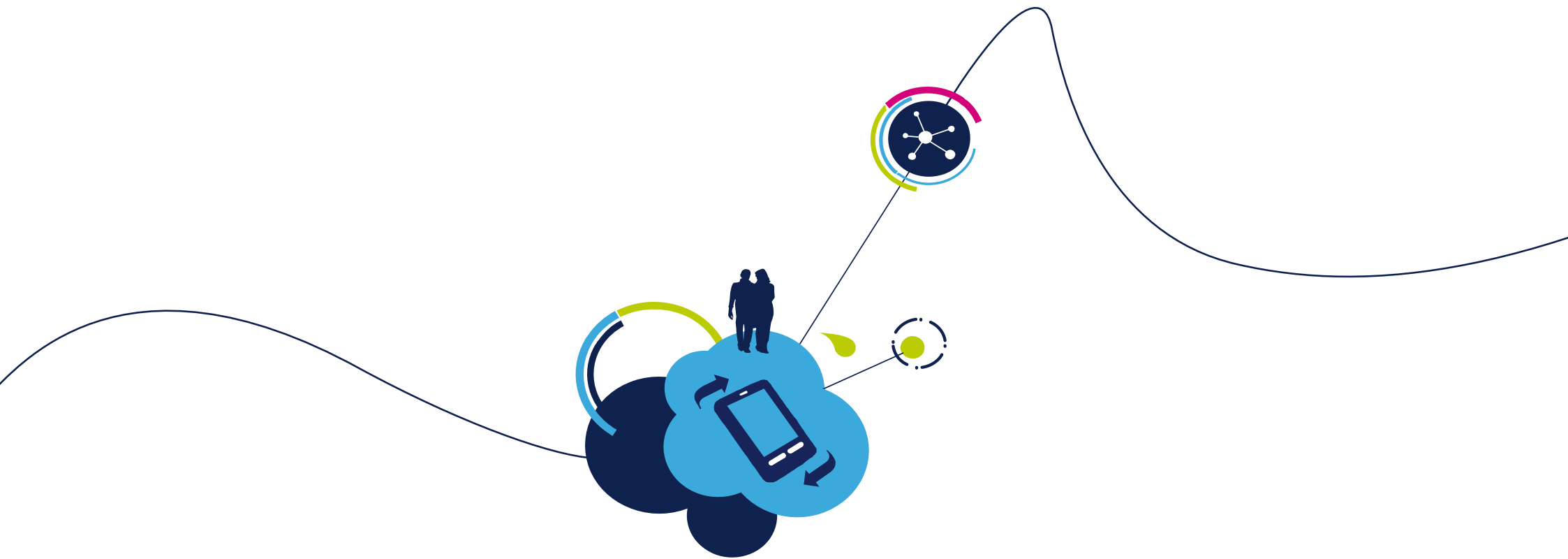


NFC / RFID Portfolio

ST solutions for NFC / RFID

12





NFC / RFID Tags



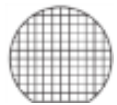
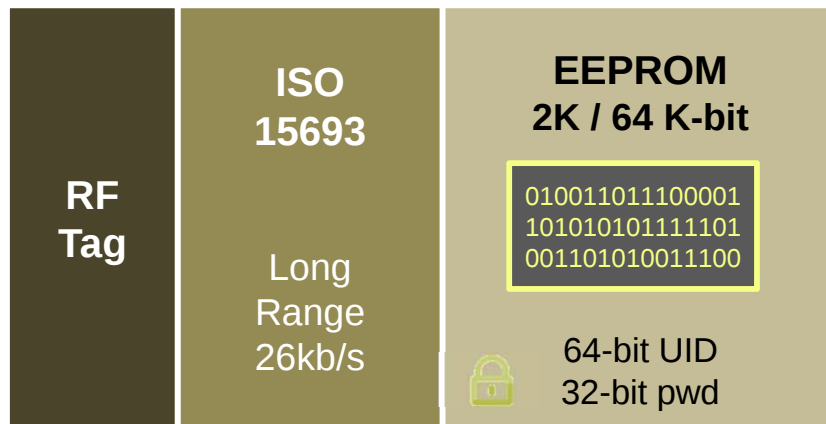
NFC / RFID tags 14

	LRI series	SRT / SRI series	SRTAGxxL series	SRTAG series
Contactless Interface	ISO15693 NFC Compatible	ISO14443B	ISO14443A NFC Type 4	
RF range	Long range Up to 100cm	Short range Up to 10cm		
RF speed	26kbps	128-bit 106kbps		
Memory format	EEPROM data	EEPROM data	NDEF file	
Memory size	2 / 64-kbit	512-bit & 2 / 4-kbit	512-bit / 2-kbit	16 / 64-kbit
Data protection	Password 32-bit	Counter 32-bit	Password 128-bit	
Counter	NA	Counter 32-bit	Counter 20-bit	NA
Package	SBN18	SBN18 ² moving to SBN12 *	SBN12 *	

² SBN18: Sawn and Bumped wafer, 180µm thickness

* SBN12: Sawn and Bumped wafer, 120µm thickness

LRI2K / LRIS64K

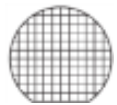


**SBN18: sawn and
bumped wafer,
180µm thickness**

- Use cases
 - Asset tracking
 - Gaming
 - Brand protection, identification
 - Maintenance, repair and operations
- Key benefits
 - ISO15693
 - Long range RFID
 - Antenna capacitance high value (up to 97pF)
- ST's competitive advantage
 - Data protection (32-bit password)
 - Largest available user memory (LRIS64K)

SRI512 / SRI2K / SRI4K

RF Tag	ISO 14443	EEPROM 512bit / 2K / 4Kbit
	Short Range 106kb/s	010011011100001 101010101111101 001101010011100  64-bit UID 32-bit counter



SBN18: sawn and
bumped wafer,
180µm thickness

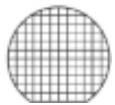
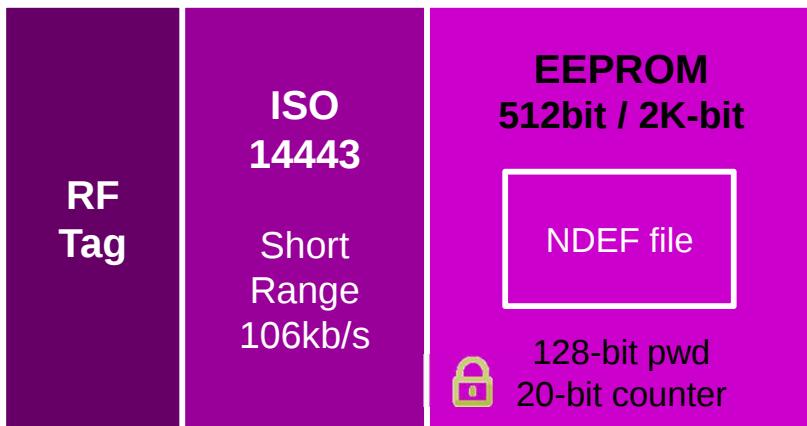
- Use cases
 - Mass transit and event ticketing
 - Asset tracking
 - Brand protection, identification
 - Maintenance, repair and operations
- Key benefits
 - Fast data transfer (ISO14443)
 - Large and flexible counting capability
 - SRT512 version for Transport
- ST's competitive advantage
 - Anti-tearing feature



SRTAGxxL NFC / RFID tags

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SRTAG512L / SRTAG2KL



SBN12: sawn and bumped wafer, 120µm thickness

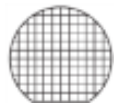
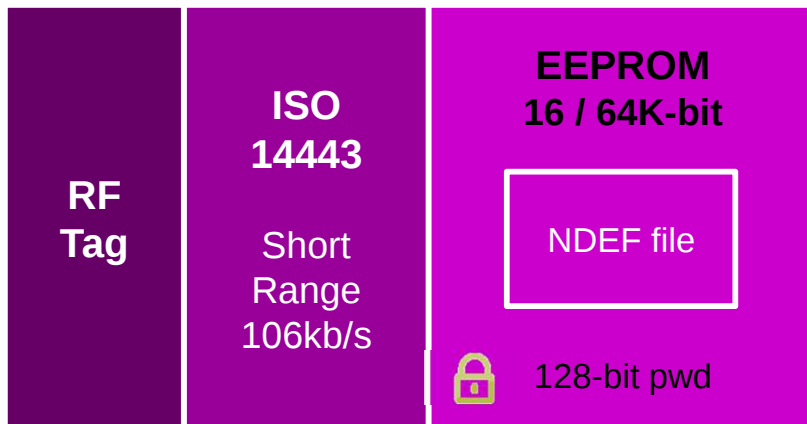
- Use cases
 - NFC token, NFC tag
 - Smart poster, Gaming
 - NFC business card (name card, vcard)
- Key benefits
 - NFC type 4 (ISO14443 Type A)
 - High speed operations (106kb/s)
 - NDEF memory format
 - Data protection (128-bit password)
 - Counter 20-bit
- ST's competitive advantage
 - Optimized PCB footprint
 - 50pF internal RF tuning capacitor allowing small antenna design



SRTAG NFC / RFID tags

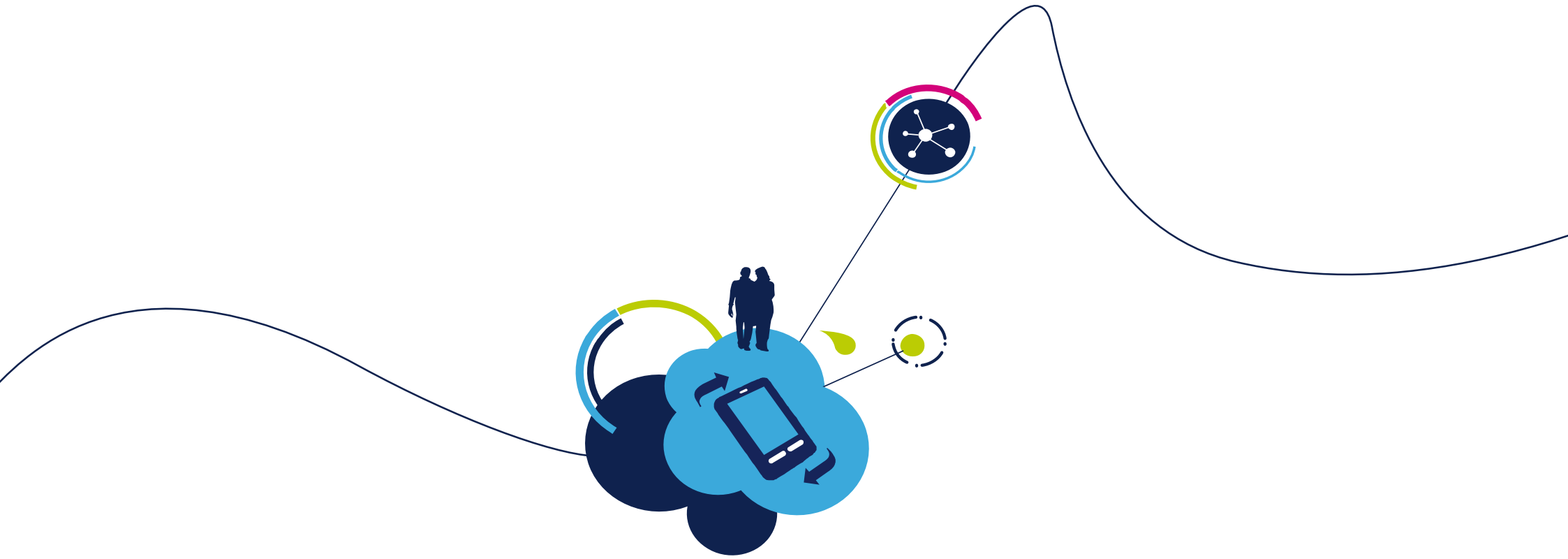
18

SRTAG16K / SRTAG64K



SBN12: sawn and bumped wafer, 120µm thickness

- Use cases
 - Smart poster, Gaming
 - NFC token
 - NFC business card (name card, vcard)
- Key benefits
 - NFC type 4 (ISO14443 Type A)
 - High speed operations (106kb/s)
 - NDEF memory format
- ST's competitive advantage
 - Large memory size (up to 64Kbit)
 - Data protection (128-bit password)
 - Same RF antenna design as M24SR product



Dynamic NFC / RFID tags



Dynamic NFC / RFID tags

20

	M24LR series	M24SR series	SRTAG-P series
Contactless Interface	ISO15693 NFC Compatible	ISO14443A NFC Type 4	
RF range	Long range Up to 100cm	Short range Up to 10cm	
RF speed	26kbps	106kbps	
Serial Interface	I2C @400kHz	I2C @1MHz	NA
Extra features	MCU wake-up & Energy Harvesting	MCU wake-up & RF Disable	MCU wake-up
Memory format	EEPROM data	NDEF file	
Memory size	4 / 16 / 64-kbit	2 / 4 / 16 / 64-kbit	2-kbit
Data protection	Password 32-bit	Password 128-bit	
Counter	NA	NA	Counter 20-bit
Package	SO8 / TSSOP8 / MLP8	SO8 / TSSOP8 / MLP8 / SBN12 *	DFN5 / SBN12 *

* SBN12: Sawn and Bumped wafer, 120µm thickness



M24LR dynamic NFC / RFID tags

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M24LR04E / 16E / 64E

RF Tag	ISO 15693	EEPROM 4 / 16 / 64 K-bit	I2C
	Long Range	01001101110000110 10101011111011010 01010011101010101 110100110	1.8/5.5V
	26kb/s	 32-bit pwd	400kHz
	Energy harvesting (~2V / 5mA)		
	Digital output (wake up)		



Full native support with
Samsung Galaxy S4,
LG Nexus 4...



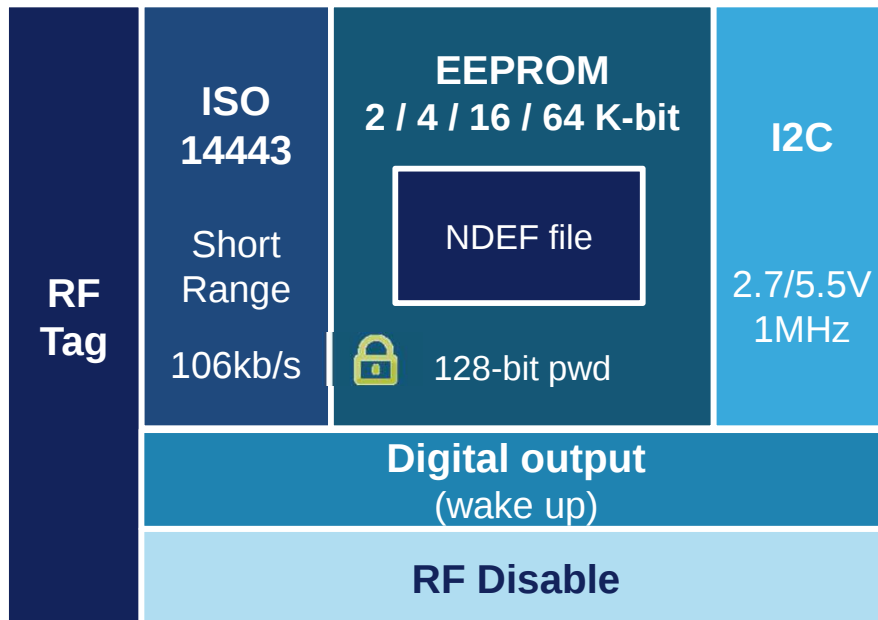
- Use cases
 - Dynamic data exchange with NFC phone
 - Battery-less applications
 - Parameter upgrade with RFID readers
- Key benefits
 - Energy harvesting through RF
 - ISO15693 long-range RFID (with high power RFID readers)
- ST's competitive advantage
 - Easy of use (limited BOM, 8-pin package)
 - Flexible interrupt pin
 - Sub \$20 discovery kit with Android Apps



M24SR dynamic NFC / RFID tags

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M24SR02 / 04 / 16 / 64



- Use cases
 - Convenient wireless pairing (Bluetooth, WiFi)
 - Dynamic data exchange with NFC phone
 - User settings update, information log download,...
- Key benefits
 - NFC Type 4 (ISO14443 Type A)
 - High speed operations (106kb/s)
 - NDEF memory format
 - Data protection (128-bit password)
- ST's competitive advantage
 - Easy of use (limited BOM, 8-pin package)
 - Flexible interrupt pin (configurable GPO)

M24LR / M24SR design compatibility

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ISO14443 interface

- NFC compliant (type 4)
- Short Range (up to 10cm)
- High speed 106kb/s
- Passive RF
- 25pF

High speed I2C

- 1MHz
- 2.7-5.5V
- NDEF data format

Enhanced EEPROM

- 200 years data retention
- 1 Million erase-write cycles
- 128-bit password protection

Compatible antenna
design

Same packages
and pinout

2K, 4K, 16K and 64Kbit
versions



ISO15693 RF interface

- NFC compatible
- Up to 1m with RFID readers
- 26kb/s data rate
- Energy Harvesting
- Passive RF
- 27.5pF

Low voltage I2C

- 400kHz
- 1.8-5.5V
- EEPROM data format
- NDEF by user

Standard EEPROM

- 40 years data retention
- 1 Million erase-write cycles
- 32-bit password protection

M24LR / M24SR tuning capacitance

24

	M24LR	M24SR
Standard	ISO15693	ISO14443
Main carrier frequency	13.56MHz	13.56MHz
Data sub-carrier frequency	+ 424kHz	+ 848kHz
Optimal frequency tuning	13.6MHz – 14MHz	14MHz – 14.4MHz
Internal capacitor (measured at 0.5V)	27.5pF	25pF
Recommended internal capacitor value for antenna design	29pF	27pF

- We decided to implement a lower internal capacitor value for M24SR product (25pF while 27.5pF for M24LR) in order to allow customers to use the same antenna design for both M24SR and M24LR products.

M24LR 40x20mm
rectangular antenna



M24SR 40x20mm
rectangular antenna

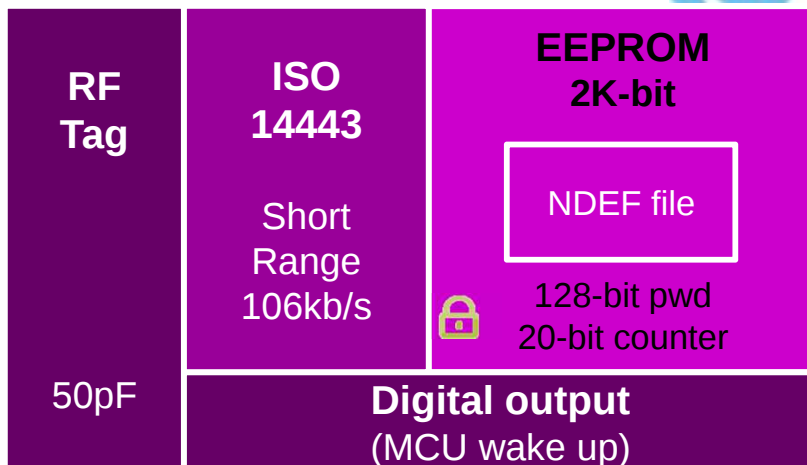




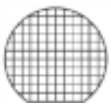
SRTAG2KL-P dynamic NFC / RFID tag

25

SRTAG2KL-P



DFN5



SBN12: sawn and bumped wafer, 120µm thickness

- Use cases

- Convenient wireless pairing

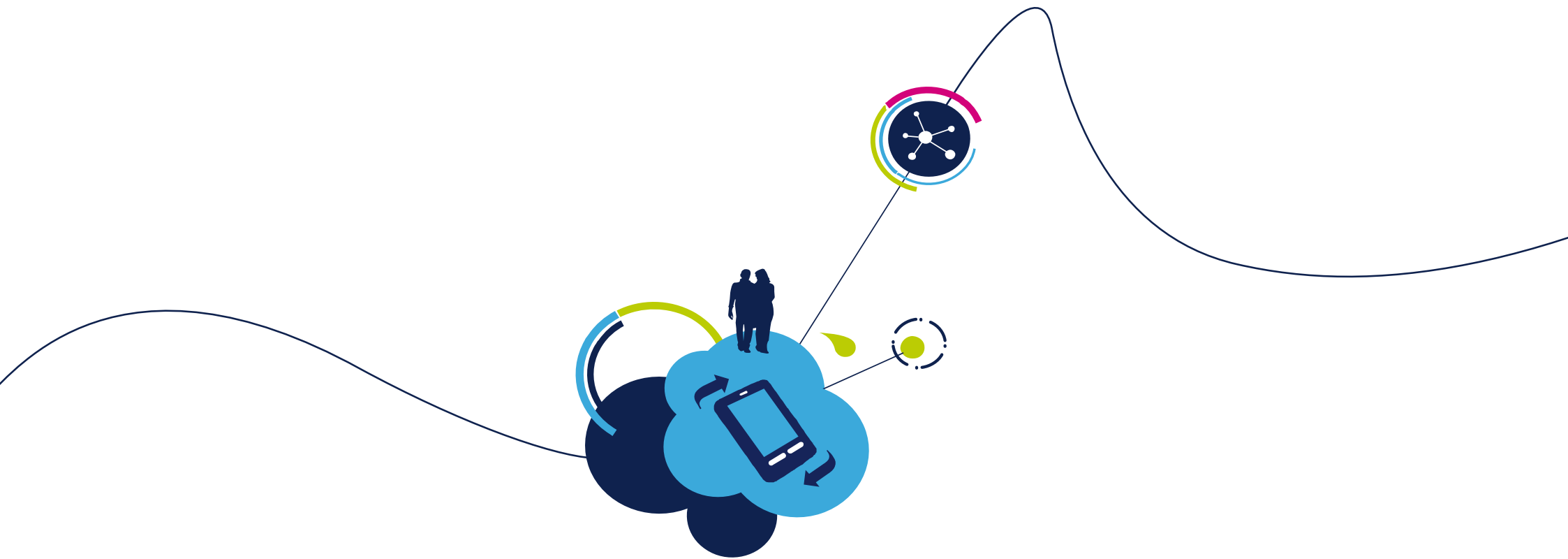
- Bluetooth pairing
 - Wifi static pairing

- Key benefits

- NFC type 4 (ISO14443 Type A)
 - High speed operations (106kb/s)
 - NDEF memory format
 - Data protection (128-bit password)
 - Digital output for host wake-up (polarity from low to high level, no external resistor)

- ST's competitive advantage

- Tiny DFN5 package (1.7x1.4mm)
 - 50pF internal RF tuning capacitor allowing small antenna design



NFC Transceivers



NFC transceivers

27

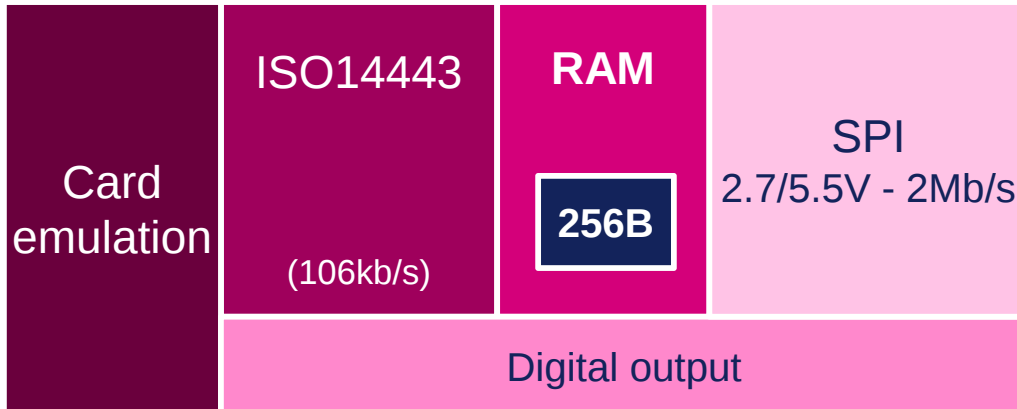
	RX95HF	CR95HF	ST95HF
Mode	Card emulation	Reader	Transceiver (Reader / Card / P2P)
Contactless Interface	ISO14443A	ISO14443A/B ISO15693 Felica	
RF speed	Up to 106kbps	Up to 848kbps	
Serial Interface	SPI @2MHz	SPI @2MHz UART @2MHz	SPI @2MHz
Extra features	MCU wake-up		
RAM buffer	256-Bytes	528-Bytes	
Package	QFN32 5x5		



RX95HF NFC receiver

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RX95HF NFC receiver (card emulation)



QFN32

- Use cases

- Data exchange between a NFC phone and a NFC device
 - User settings update, information log download,...
- Convenient wireless pairing (Bluetooth, Wifi)
- Identification & Authentication

- Key benefits

- ISO14443 standard supported
- RAM buffer of 256Bytes for fast data transfer

- ST's competitive advantage

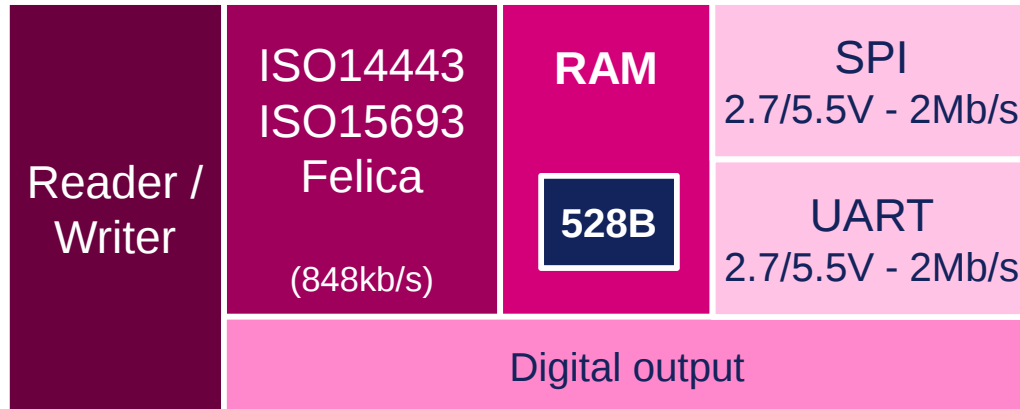
- Simple implementation / limited BOM
- Easy-to-use evaluation / development kits
- Reference designs, application notes



CR95HF NFC / RFID reader

29

CR95HF NFC reader



QFN32

- Use cases

- RFID / NFC reader

- Product identification or authentication
 - Product configuration (parameter settings)
 - Access Control, Digital Door Locks
 - Medical, industrial & production reader equipment

- Key benefits

- All NFC modes supported (ISO14443, ISO15693, Felica)
 - Fast data transfer (up to 848kb/s)
 - Low power modes

- ST's competitive advantage

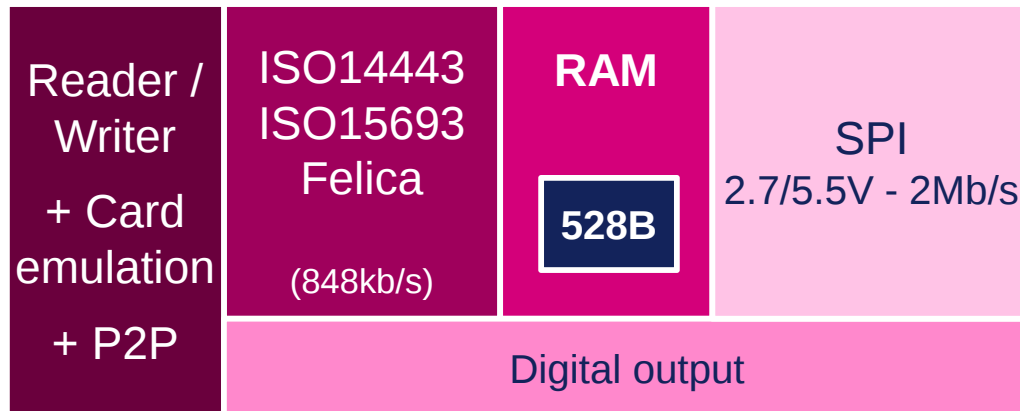
- Simple implementation / limited BOM
 - Easy-to-use evaluation / development kits
 - Reference designs, application notes



ST95HF NFC transceiver

30

ST95HF NFC transceiver



QFN32

- Use cases

- Dynamic data exchange between a NFC phone and a NFC device
 - User settings update, information log download,...
- Dynamic wireless pairing with hand-over

- Key benefits

- All NFC modes supported in reader mode (ISO14443, ISO15693, Felica)
- Different operating modes supported:
 - Reader-Writer (R&W) mode
 - Card Emulation (CE) mode
 - Peer to Peer (P2P) proprietary mode
- Fast data transfer (up to 848kb/s)

- ST's competitive advantage

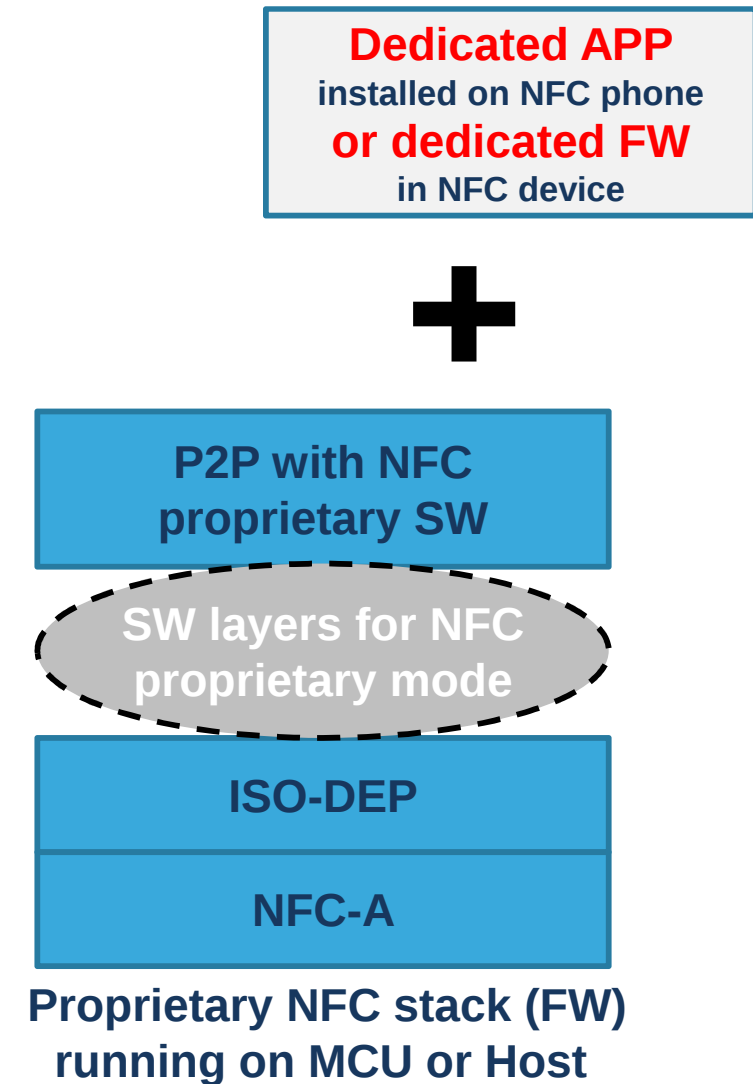
- Simple implementation / limited BOM
- Easy-to-use evaluation / development kits
- Reference designs, application notes



ST95HF transceiver mode

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- Three modes supported by ST95HF product:
 - Reader/Writer mode (like CR95HF)
 - Card Emulation mode (like RX95HF)
 - Peer to Peer proprietary mode for dynamic data exchange
- ST95HF product can be configured dynamically Reader / Writer or Card Emulation depending of the NFC product in front.
- The P2P proprietary mode means that a P2P communication is feasible between two devices if those two devices have a dedicated SW to manage properly the specific P2P commands:
 - In case of NFC phone, need a dedicated Android application installed in the NFC phone.
 - In case of device (like another ST95HF based device), need a dedicated SW in the device.



Comprehensive NFC / RFID portfolio

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NFC / RFID tags

ISO14443A (NFC)



SRTAG512L
SRTAG2KL
SRTAG16K
SRTAG64K



ISO14443B (RFID)



SRI512 / SRT512
SRI2K / SRI4K

ISO15693 (RFID)



LRI2K / LRIS64K

Dynamic NFC / RFID tags

ISO14443A & I2C



M24SR02
M24SR04
M24SR16
M24SR64



ISO15693 & I2C



M24LR04E
M24LR16E
M24LR64E



ISO14443A & INT



SRTAG2KL-P



NFC transceivers



RX95HF
Card emulation

CR95HF
Reader

ST95HF
Transceiver



Gaming, Consumer, Peripherals, Wellness, Smart poster

Product part numbers 33

M24SR	Package	2Kbit	4Kbit	16Kbit	64Kbit
Dynamic NFC/RFID tag RF ISO14443A + I2C IF + GPO + RF disable	SO8 TSSOP8 MLP 2x3 SBN12	M24SR02-YMN6T/2 M24SR02-YDW6T/2 M24SR02-YMC6T/2 M24SR02-YSB12I/2	M24SR04-YMN6T/2 M24SR04-YDW6T/2 M24SR04-YMC6T/2	M24SR16-YMN6T/2 M24SR16-YDW6T/2 M24SR16-YMC6T/2	M24SR64-YMN6T/2 M24SR64-YDW6T/2 M24SR64-YMC6T/2 M24SR64-YSB12I/2

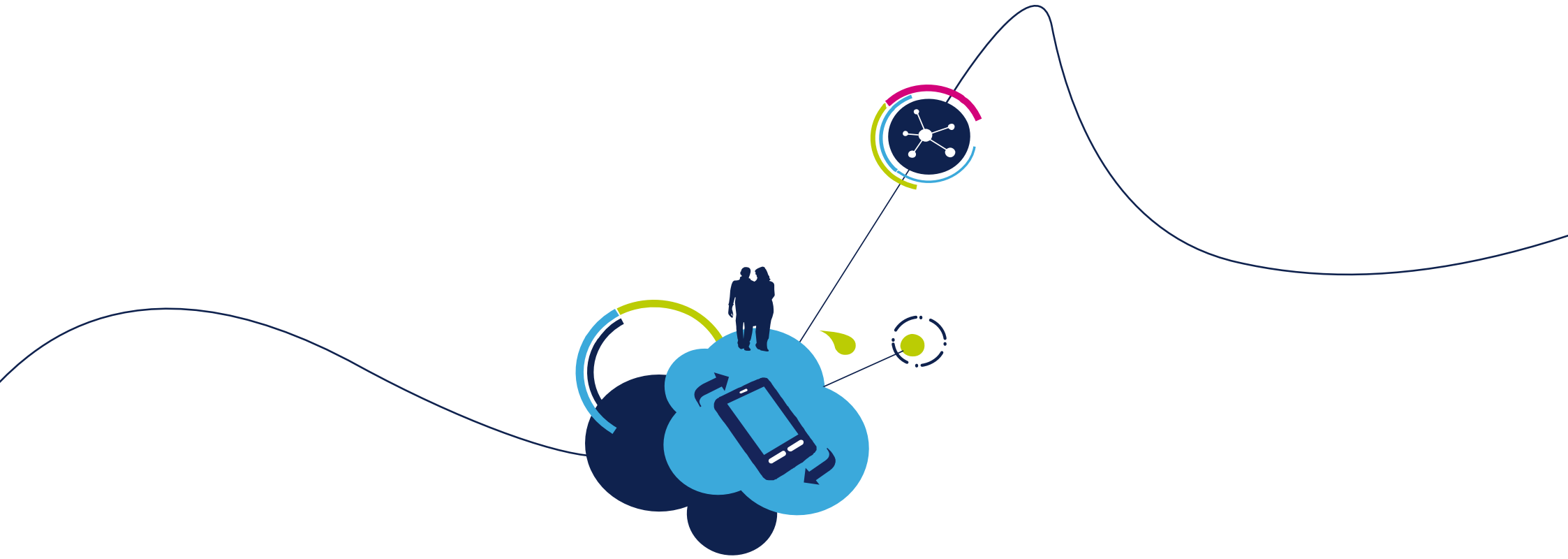
SRTAG	Package	512bit	2Kbit	16Kbit	64Kbit
NFC/RFID tag RF ISO14443A	SBN12	SRTAG512L-SB12I/5	SRTAG2KL-SB12I/5	SRTAG16K-SB12I/2	SRTAG64K-SB12I/2

M24LR	Package	4Kbit	16Kbit	64Kbit
Dynamic NFC/RFID tag RF ISO15693 + I2C IF + GPO + Energy harvesting	SO8 TSSOP8 MLP 2x3	M24LR04E-RMN6T/2 M24LR04E-RDW6T/2 M24LR04E-RMC6T/2	M24LR16E-RMN6T/2 M24LR16E-RDW6T/2 M24LR16E-RMC6T/2	M24LR64E-RMN6T/2 M24LR64E-RDW6T/2 M24LR64E-RMC6T/2

95HF	Package	Card emulation	Reader	Transceiver
NFC transceivers NFC + SPI IF	QFN32	RX95HF-VMD5T	CR95HF-VMD5T	ST95HF-VMD5T

SRTAG-P	Package	2Kbit
Dynamic NFC/RFID tag RF ISO14443A + GPO	DFN5 SBN12	SRTAG2KL-PMH6T/5 SRTAG2KL-PSB12I/5





Support eco-system and kits

Multi-market approach

35

Visibility / awareness at customers

Comprehensive portfolio

Competitive pricing

Technical support



Availability

Visible product launch

Ease of design

Best-in-class website

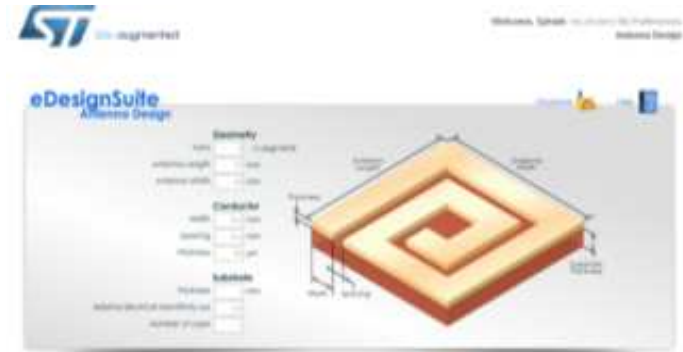
NFC Android App



Evaluation board



Antenna Design Suite



e2e community



M24SR
support
eco-system

Nucleo shield



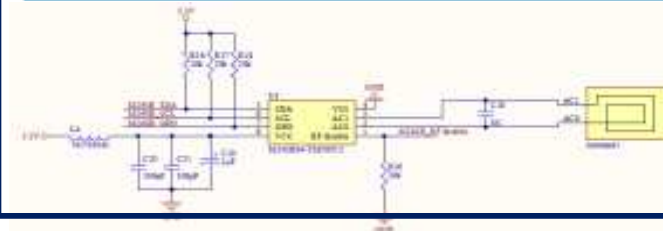
MCU drivers

```

/*****
int main(void)
{
    /* Wait till HSE is ready */
    HSEStartUpStatus = RCC_WaitForHSEStartUp();
    if(HSEStartUpStatus == SUCCESS)
    {
        /* Enable Prefetch Buffer */
        FLASH_PrefetchBufferCmd(FetchBuffer_Enable);
    }
}

```

Technical documentation



IBIS model

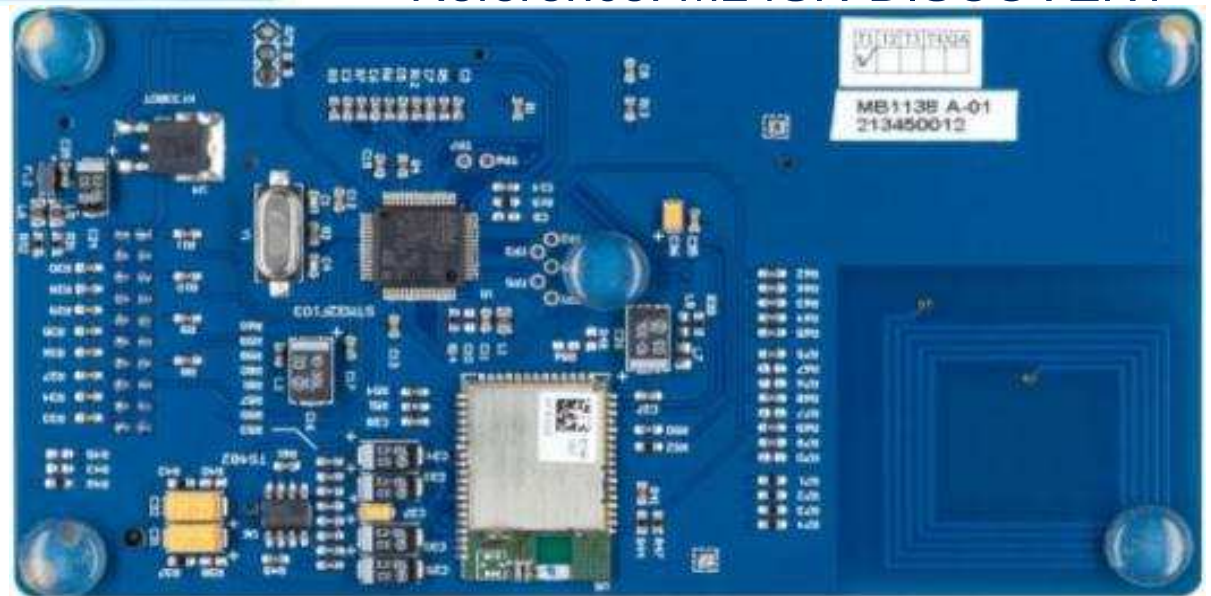


M24SR Discovery Kit

37



- M24SR evaluation board
 - M24SR64 dynamic NFC tag with 30x30mm antenna
 - STM32F1 micro-controller
 - Color display
 - USB & JTAG connectors
 - BT / audio module (premium)
 - Audio headset (premium)
- Reference: M24SR-DISCOVERY



M24SR Nucleo shield

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- M24SR Nucleo board
 - M24SR64 dynamic NFC tag with 31x30mm antenna
 - Compatible with STM32 Nucleo boards
 - Equipped with Arduino UNO R3 connector
 - Powered through the Arduino UNO R3 connector
 - 3 color LEDs for general purpose
- Reference: X-NUCLEO-NFC01A1



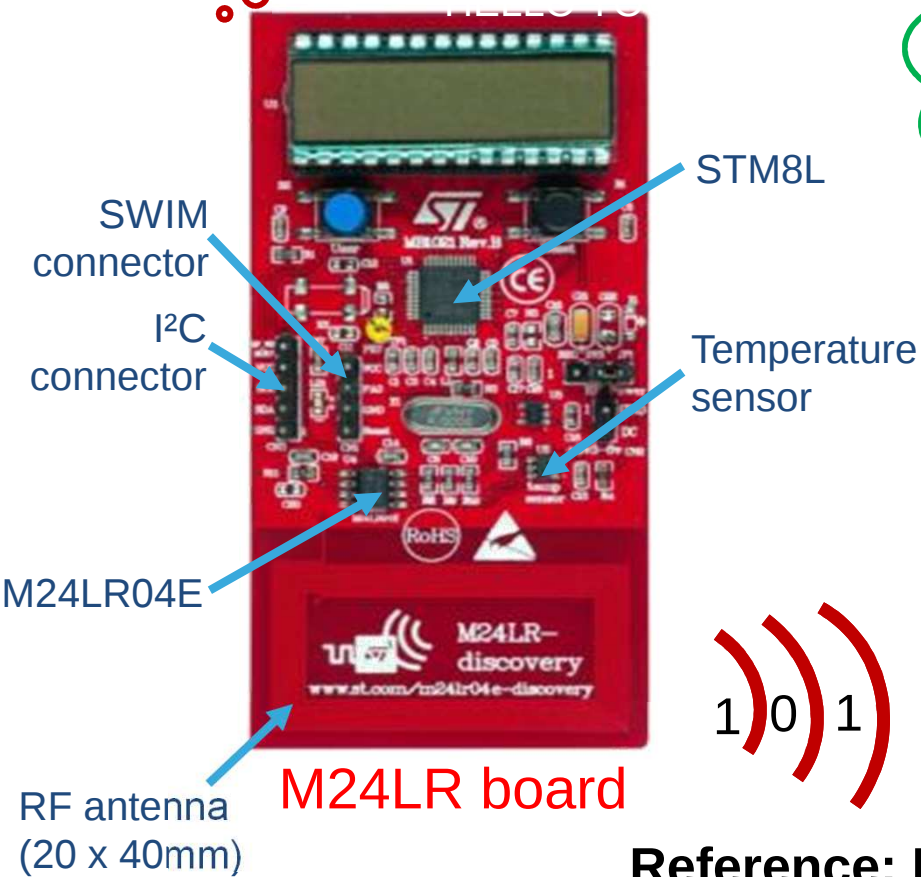
<http://www.st.com/web/en/catalog/tools/PF260759>

M24LR Discovery Kit

39

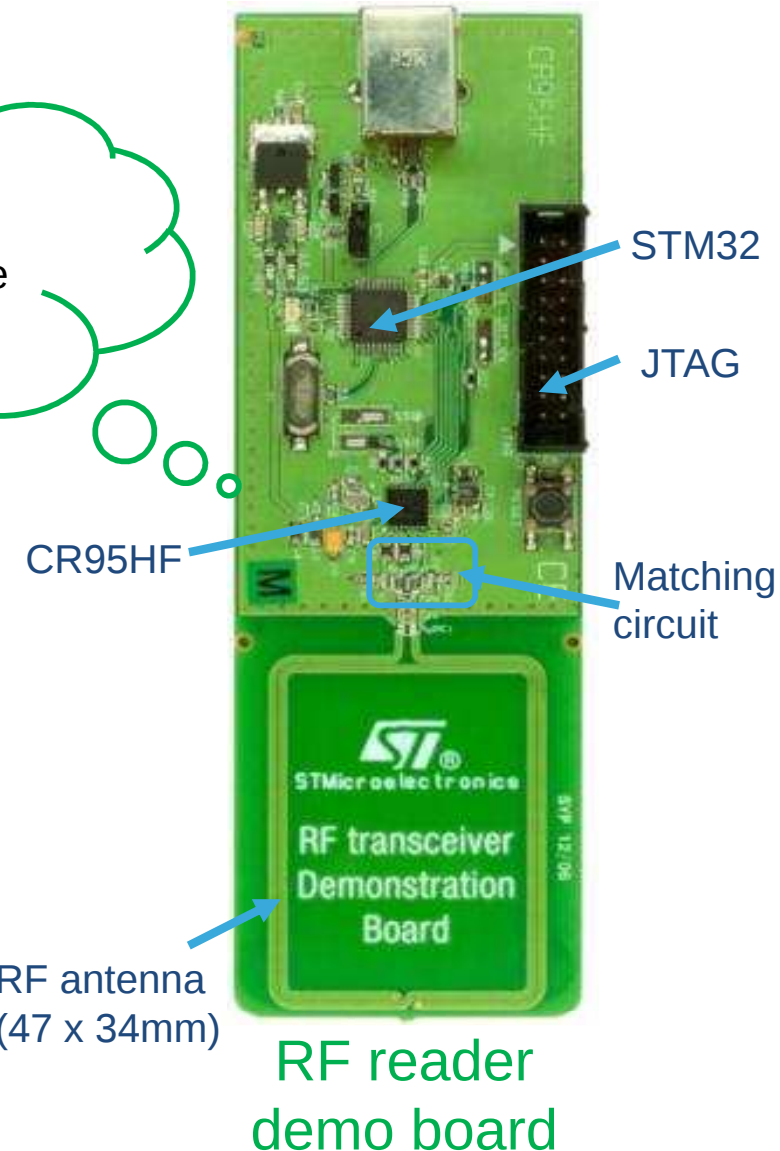
For example I can display the text message stored in the Dynamic NFC/RFID Tag

I allow to power and exchange data with the M24LR04E but I am not the only one.



Reference: M24LR-DISCOVERY

<http://www.st.com/web/en/catalog/tools/PF253360>



CR95HF Discovery Kit

40

- CR95HF evaluation board is part of the M24LR discovery kit



<http://www.st.com/web/en/catalog/tools/PF253360>



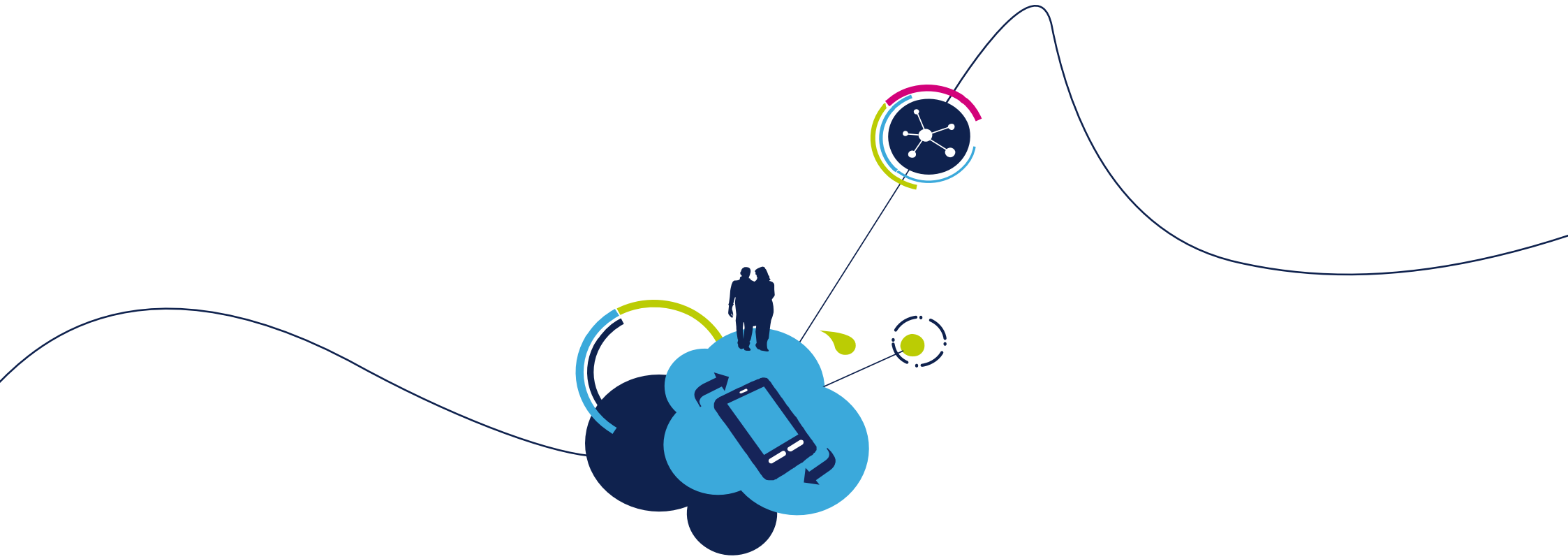
ST95HF discovery kit

41

- ST95HF evaluation board (reference: EVAL-ST95HF)
 - ST95HF NFC transceiver with 47x34mm antenna
 - STM32F1 micro-controller
 - LCD color display
 - USB & JTAG connectors
 - LEDs & Joystick



<http://www.st.com/web/en/catalog/tools/PF259751>



One slide summary

Dynamic NFC / RFID tags and transceivers

43

Dynamic NFC / RFID tags and NFC transceivers



Enabling NFC connectivity for a wide range of applications in an affordable and easy-to-use device

Tape & Pair

Tape &
Exchange

Tape &
Pay

#1 in EEPROM and strong expertise in RF → reliable supplier (best-in-class quality and service)

Strong and long term commitment to a comprehensive NFC portfolio

Addressing wide range of applications:

- Consumer / Home appliance
- ESL / OTP card
- Healthcare / Wellness
- Industrial / Smart meter

Comprehensive NFC / RFID portfolio



Thank You !