Automotive NFC Hands-On Workshop

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Digital Key & NFC | PL Secure Car Access | BL AAA

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NXP SECURE CONNECTIONS FOR A SMARTER WORLD

Agenda

- AUTOMOTIVE NFC/S32K INTRO

- Live Demo : S32K & NCx3340

- ANFC NCI STACK

- HANDS-ON ANFC NCI STACK

What Will we Learn Today?

- Understanding Automotive NFC Use Cases (GUI Demo)

- Working with ANFC NCI SW Stack for S32k and NCx3340

- Exchanging APDUs in order to interact with smart cards and smart phone:
  - What needs to be implemented on the car's NFC reader
  - What needs to be implemented on the NFC smart card and smart phone

- Exchange NDEF records between NCx3340 and smart phone

- Anything missing?

Automotive NFC / S32K Intro

NFC Versus Other Wireless Technologies

	WiFi	ZigBee (802.15.4)	Bluetooth	NFC
Network topology	Star	Mesh	Point-to-point	Point-to-point
Range	30-100 m	10-20 m	10 m	< 0.1 m
Discovery	Broadcast	Broadcast	Broadcast	Response to field
Power	High	Low	Classic: Mid / LE/Smart: Low	Tag: Zero / Reader: Very low
Privacy	Low	Mid	Mid	High

- **Ease of use**: NFC connects automatically in a fraction of a second, so fast it seems **instantaneous**

- **Ultra low-power**: NFC consumes much less power than Wi-Fi or BLE.

- **Security:** NFC solutions combining secure elements are very attractive for smartphone/smart card based car access and drive authorization

NFC Communication Modes
Full NFC Functionality For Interior Applications

Read/Write Mode

This is where NFC spends most of its time, with one NFC-enabled device interacting with another to get information or initiate an action. The initiating device can read data in from the second device or write data out to it.
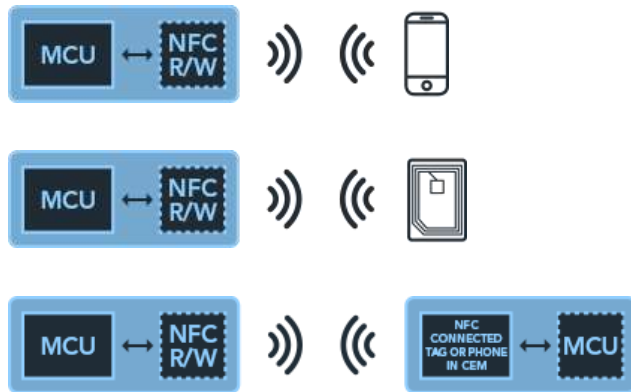
Peer-to-Peer Mode

Sometimes referred to as "P2P" mode, this is the one you can use to exchange files between smartphones, or receive loyalty points when making a purchase.

Card Emulation Mode

This mode, used almost exclusively by NFC smartphones, lets the system behave as an ISO/IEC 14443-compliant contactless smartcard. That means your phone can be used in the existing contactless infrastructure, for things like ticketing, access control and payments. The mode can work even when the phone is off.
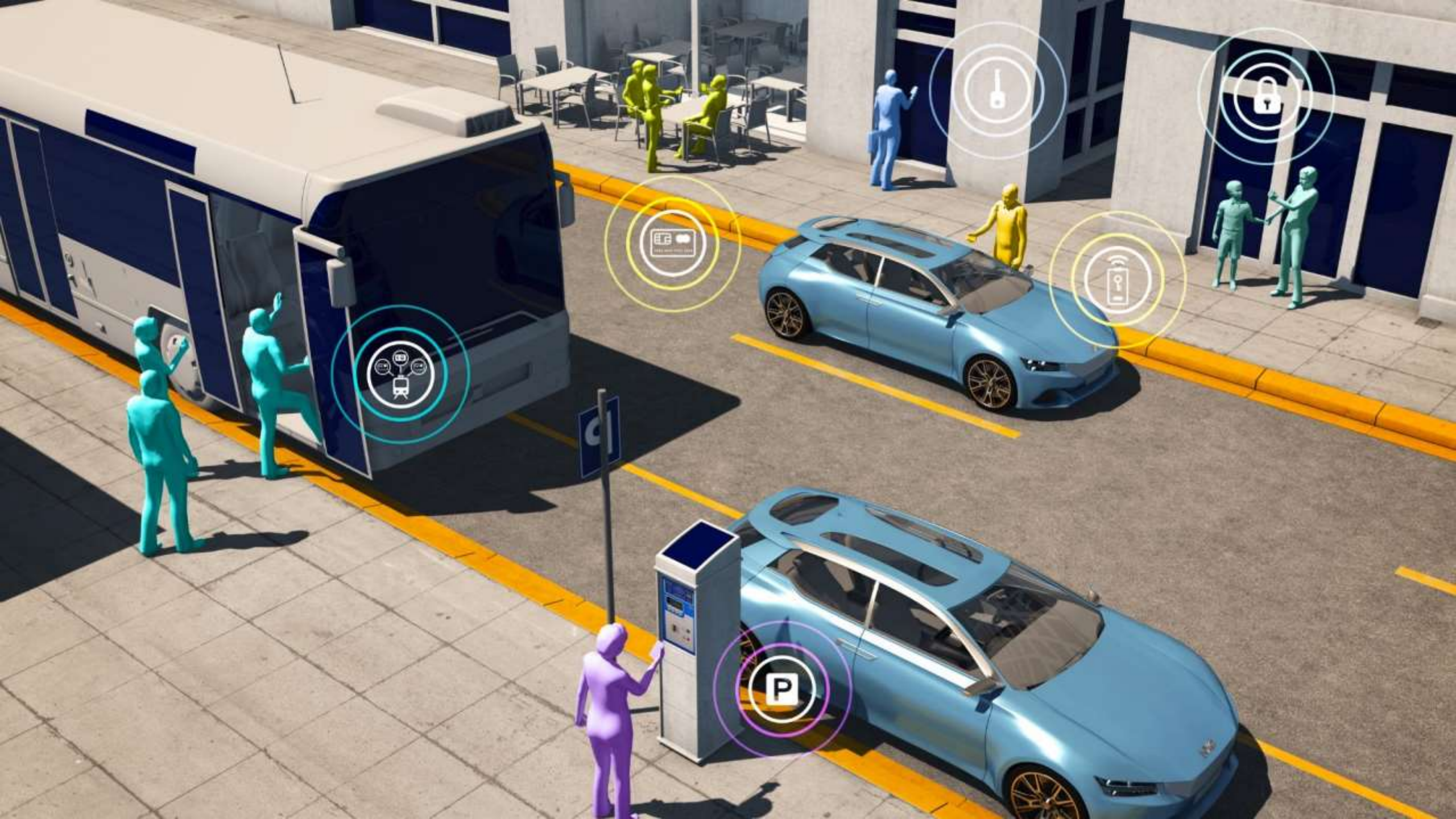
- Smart phone car access
- Car sharing
- Fleet management

- Bluetooth®/Wi-Fi® pairing
- Driver authorization for engine start
- Personalization (air conditioning, seat and mirror settings)
- Card protection
- In-car payment

Live Demo: NFC Use Cases

NCx3340 - Flagship NFC Controller
Full NFC Functionality for Interior Applications

AVAILABLE

Features:

- NFC controller combining NFC frontend with an advanced 32-bit microcontroller → system solution with lower BOM

- Separate RF driver supply 2,3 V - 5,5 V → High TX output power

- Integrated firmware with easy and standardized NCI interface → convenient software integration

- Supports Low Power Card Detection mode

- Multiple GPIO's

- IRQ pin → Improved host communication / host task scheduling

- SMD package HVQFN40

- Temperature range: NCF: - 40 .. +85°, NCJ: ..+105°

Supported protocols:
Reader/Writer mode
- ISO/IEC 14443 A&B R/W support
- FeliCa R/W support
- R/W support for MIFARE 1K, 4K
- R/W support for ISO15693/18000-3

Peer to Peer mode
- Passive Target & Initiator
- Active Target & Initiator

Card emulation
- ISO/IEC 14443 A&B
- FeliCa

Supported host interfaces:
- SPI 7 Mbit/s
- I²C

Application diagram

NCF3340 incl. Firmware | NCI | NFC NCI Stack / Host uC

NXP

S32K1 Family – Accelerating Automotive Software Design

Automotive-grade SW
Future proof designs

- ARM Cortex M4F and M0+ cores
- ISO CAN-FD, CSEc hardware security, ISO26262 ASIL-B functional safety
- Ultra low power

Performance & Integration
Minimized complexity

Broad Portfolio
Maximised reuse

- S32K design, 32 to 176 pins
- Automotive-grade Software Development Kit (SDK)
- AEC-Q100 grade 1 qualified (125°C), 15 year longevity
- Autosar, MCAL & OS, 3rd party ecosystem

S32K1 Family Overview

| Sampling | Production |

S32K11x

S32K116	S32K118
Arm Cortex-M0+ @ 48MHz	
128KB Flash	256KB Flash
16KB SRAM	24KB SRAM
up to 42 I/O	up to 58 I/O
DMA	
1x FlexCAN with 1x FD	
QFN-32	LQFP-64
LQFP-48	

Common Features

- AEC-Q100, 125°C, 5V
- CSEc Security Module
- Low Power Operating Modes & Peripherals
- 16ch 12-bit ADCs, Comparator
- LPUART, LPSPI, LPIIC, FlexIO
- ASIL-B Capable: (ECC, MPU, CRC, W'DOGs)
- FlexTimers, LP Timers, Prog. Delay Block
- 8-40MHz Ext. Osc, 8/48MHz Osc., 128KHz LPO
- JTAG
- S32 DS IDE, SDK
- Autosar MCAL / OS

S32K14x

| S32K142	S32K144	S32K146	S32K148
Arm Cortex-M4F @ 112MHz			
256KB Flash	512KB Flash	1MB Flash	2MB Flash
32KB SRAM	64KB SRAM	128KB SRAM	256KB SRAM
up to 89 I/O		up to 128 I/O	up to 156 I/O
DMA			
2x FlexCAN with 1x FD	3x FlexCAN with 1x FD	3x FlexCAN with 2x FD	3x FlexCAN with 3x FD
LQFP-64		LQFP-144	
LQFP-100		LQFP-176	
MAPBGA-100			
			ENET
			Quad SPI
			ETM Trace

ANFC NCI Stack

System Architecture With NFC Controller
Full NFC Functionality Without Any Compromises for Interior Applications
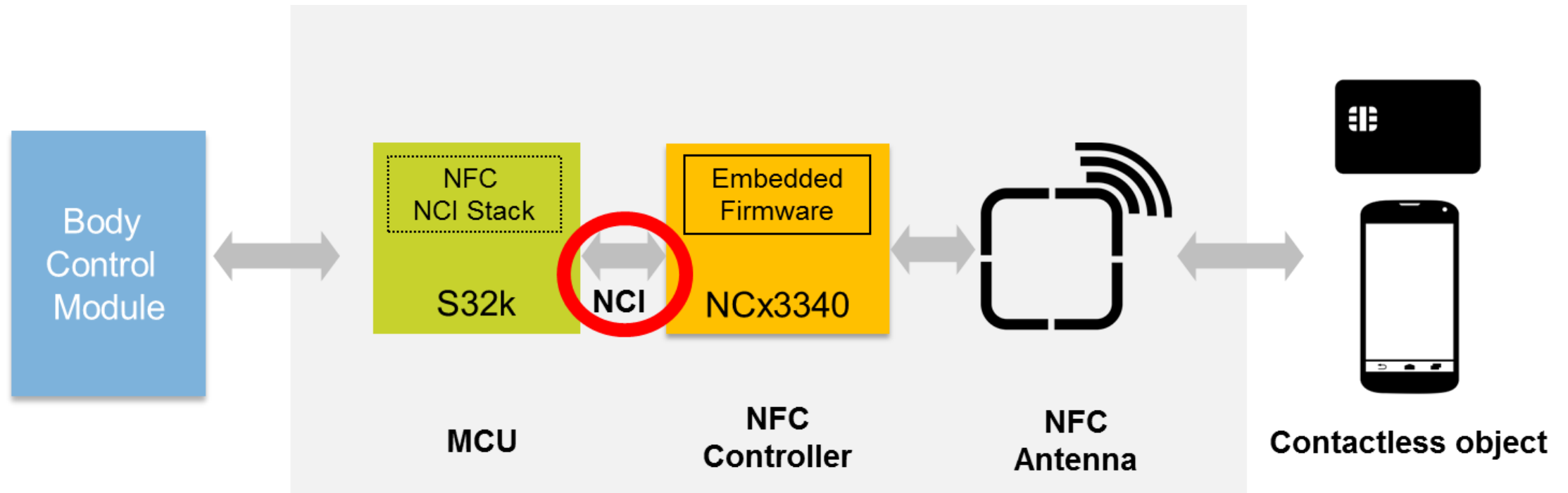
NFC Controller Interface (NCI) Specifications
Standardizing Communication Between Host and NFC Controllers

- **Standard interface** between host application controller and NFC controller

- Specified by NFC Forum

- Common level of interoperability and functionality

- **Eases integration** of NFC controllers into various platforms (e.g. mobile phones, wireless chargers etc.)

- Same logical interface for different physical transports (e.g. SPI, I2C etc.)

- Specifications: http://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/
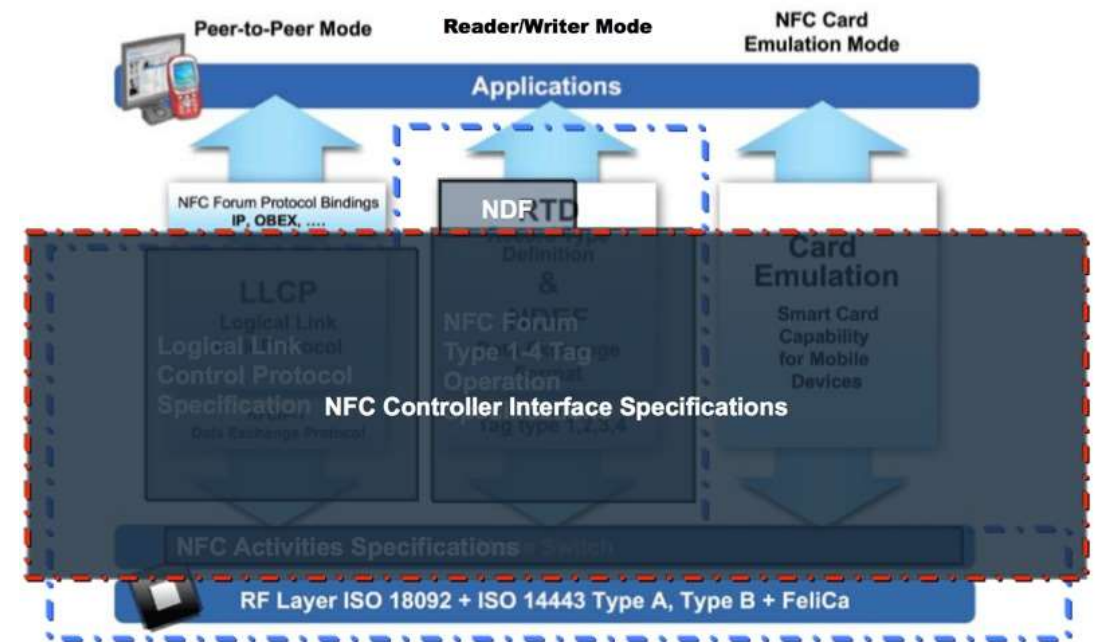

Image source: www.nfc-forum.com

NCI Stack Solutions For NCF3340
Three Entry Levels For NCI Communication

	ANFC STACK	ANDROID (LibNFC)	NCI EXAMPLE
Features	Fully automotive, AUTOSAR, SPICE, MISRA, DTA, error handling, Full NFC	Full NFC, support for Kitkat till Oreo, error handling, DTA	Simple examples for all modes, limited quality and error handling
Cost	Cost adder	Free (Apache 2.0)	Free
Target projects	WPC+NFC applications using S32 and WCT family	Linux/Android based, infotainment	Demo purpose only
Footprint (config dependent)	~ 60kb flash / 5kb RAM	> 150 kb flash / 10kb RAM	~ 10kb flash / 5kb RAM
Availability	Available on request	Available via github	Available via nxp.com

Integration Into an Autosar Environment
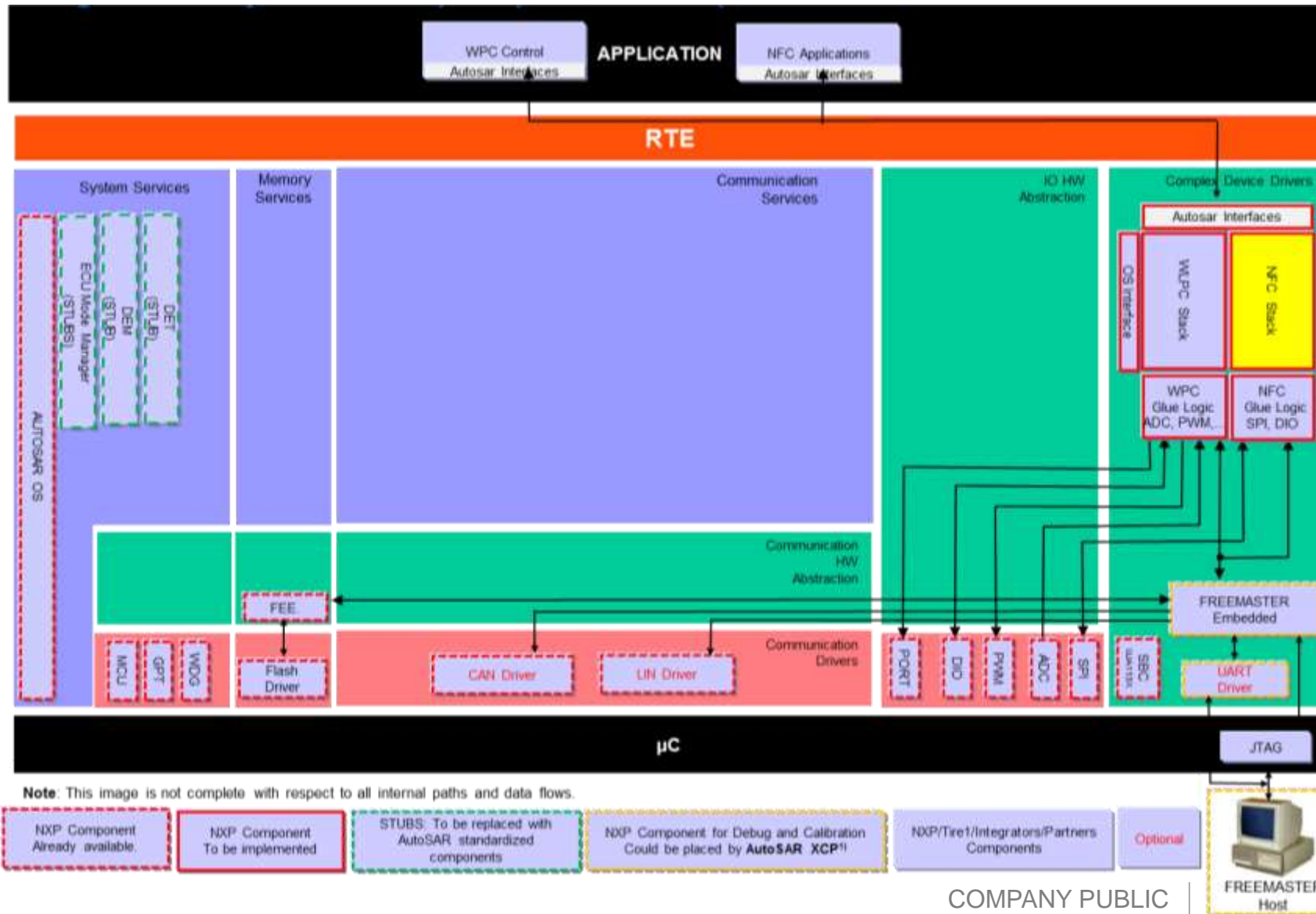
Availability

- ## What do I need?

  1. Order the S32k144 Evaluation Board at nxp.com

  2. Order the NCx3340 Add-On board at nxp.com

  3. Download the evaluation version ANFC NCI Stack at nxp.com

- ## For more details please contact:

  - Marc Manninger, Technical Marketing Manager Automotive NFC

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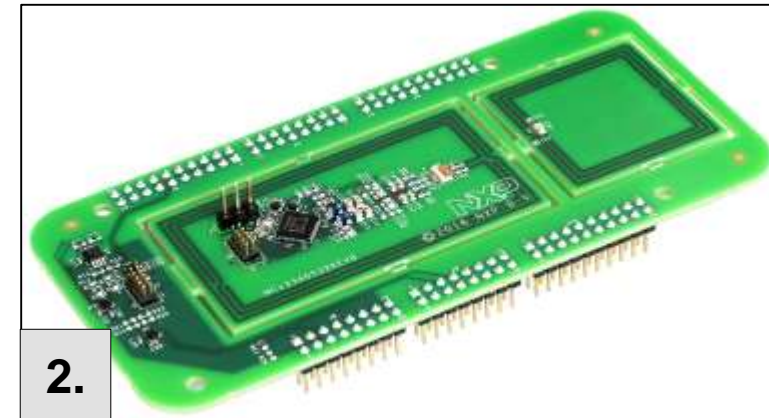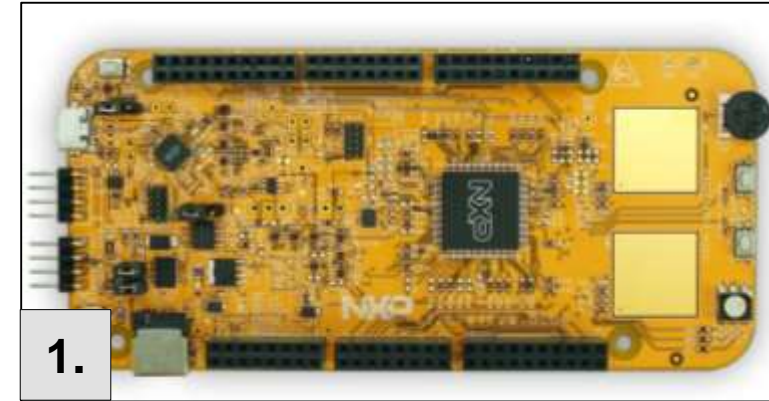
HANDS-ON: ANFC STACK

SECURE CONNECTIONS
FOR A SMARTER WORLD