

Cellular system solutions for NFC-enabled handsets

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Five years ago, handset manufacturers would introduce between five and 10 new cellphone models per year. Today, some launch up to 40 models annually, each targeting a specific market. Moreover, cellphones do a lot more and cost a lot less than they used to. At the forefront of this trend are cellular system solutions that enable manufacturers to deliver up-to-date models with new features to retain and grow the customer base.

By extending system solutions, it becomes easier for manufacturers to differentiate products and quickly incorporate new technologies into handsets that meet the operators' changing needs. With the variety of hardware/software IP and integration know-how, designers can customize a cellular system solution to create an enhanced multimedia mobile handset. Using a near field communication-enabled (NFC) system solution, secure connectivity now joins a long list of cellphone feature options such as MMS, MP3, Java, speech recognition, MPEG video and FM radio.

Philips' first NFC-enabled Nexpria system solution is for high-end cellphones and features a validated system solution with an embedded ARM9 processor core, EDGE system and other multimedia features.

Wireless whisper

NFC bridges today's connectivity gap and is compatible with established contactless smart-card technologies. Now an official standard backed by a growing number of leading players, it is also a short-range protocol that provides easy, secure, fast and automatic communication between various devices.

Acting as a virtual connector, NFC can also be used to quickly establish other types of wireless communication on

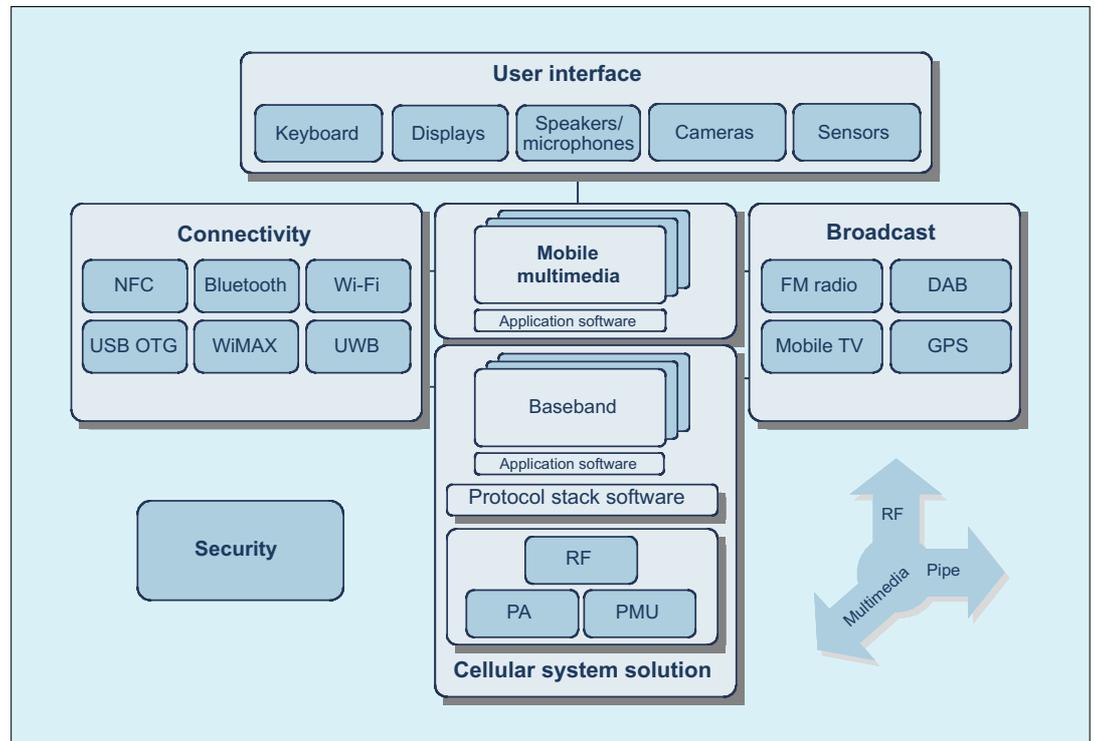


Figure 1: The Nexpria cellular system solution is a total approach to integrating new features.

devices. Bringing two NFC devices into close proximity, it can invisibly configure and initialize other wireless protocols such as Bluetooth and 802.11, enabling devices to communicate at longer ranges from then on, or transfer data at higher rates. NFC operates in the 13.56MHz frequency range over a distance of typically a few centimeters. It is also compatible to the broadly established contactless smart-card infrastructure.

The seamless wireless networking and identification that NFC offers allow access to content and services intuitively by simply touching NFC-enabled smart objects or bringing NFC-enabled devices close to each other. Not surprisingly, NFC offers a host of opportunities for cellphones to interact with the world. By integrating NFC into cellphone system solutions, the usefulness, versatility and added value of the cellphone is greatly enhanced.

The NFC-enabled cellular system solution has been implemented in the Nexpria Sy.Sol 6100 platform. The solution was demonstrated in early 2004

and prototypes are now in pilot production for trial with a leading handset manufacturer and network operator.

Implementing hardware

Hardware NFC functionality is realized with two chips: Philips' SmartMX and PN531

NFC controller with embedded firmware. SmartMX is a smart-card dual-interface security controller fully supplied and controlled by the PN531 via a two-wire S²C (signal-in/signal-out communication) interface. The PN531 is controlled by the baseband processor via the I²C

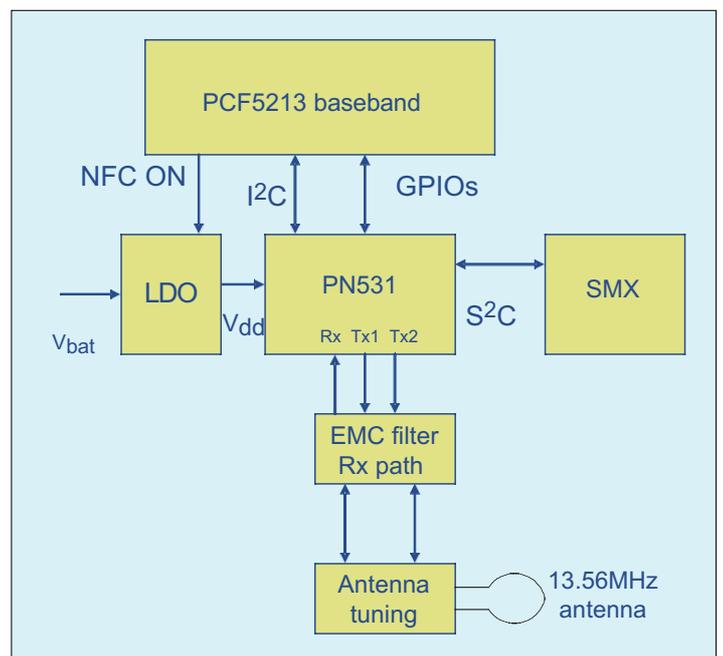


Figure 2: The hardware combines Philips' PN531 NFC and SmartMX security controller.

bus, plus two GPIOs for hand-shaking. The antenna circuitry is split into two parts—EMC filtering + RX path and antenna tuning—thus allowing freedom in the location of the contactless operating antenna (currently in a special battery pack). Another GPIO controls the dedicated low-dropout linear regulator for the NFC power supply.

In smart-card emulation mode, the RF transceiver is fully under the control of the SmartMX, and the PN531 is not aware of the data exchange. This guarantees the required security level for transport or payment applications. The SmartMX sends a signal when the transaction with the external reader is completed, and then PN531 can read the result in the SmartMX.

Software implementation

Specific modules have been added to Sy.Sol 6100 software. These modules are compatible with many possible data flows out to fit harmoniously with the current Nexperia software stacks:

- Hardware abstraction layer with its adaptation layers to I²C driver and to the application.
- Java device layer to interface with the J2ME stack and allow interactions with the SIM.

Operators may download over-the-air Java applications for supporting new use cases when they occur.

The high-security, dual-interface, smart-card controller IC SmartMX, with its Java card open-platform OS, is initially being delivered with the contactless Philips Mifare protocol, allowing the emulation of a Mifare card. The operator may then put additional cardlets securely. These cardlets may be downloaded over-the-air, either via the telecom network or contactless link from the infrastructure. The download is under the control of secure keys. Each cardlet has its own application identifier, which allows the cardlet manager to select the right application and to answer the external reader with the correct information. This identifier is also used to start

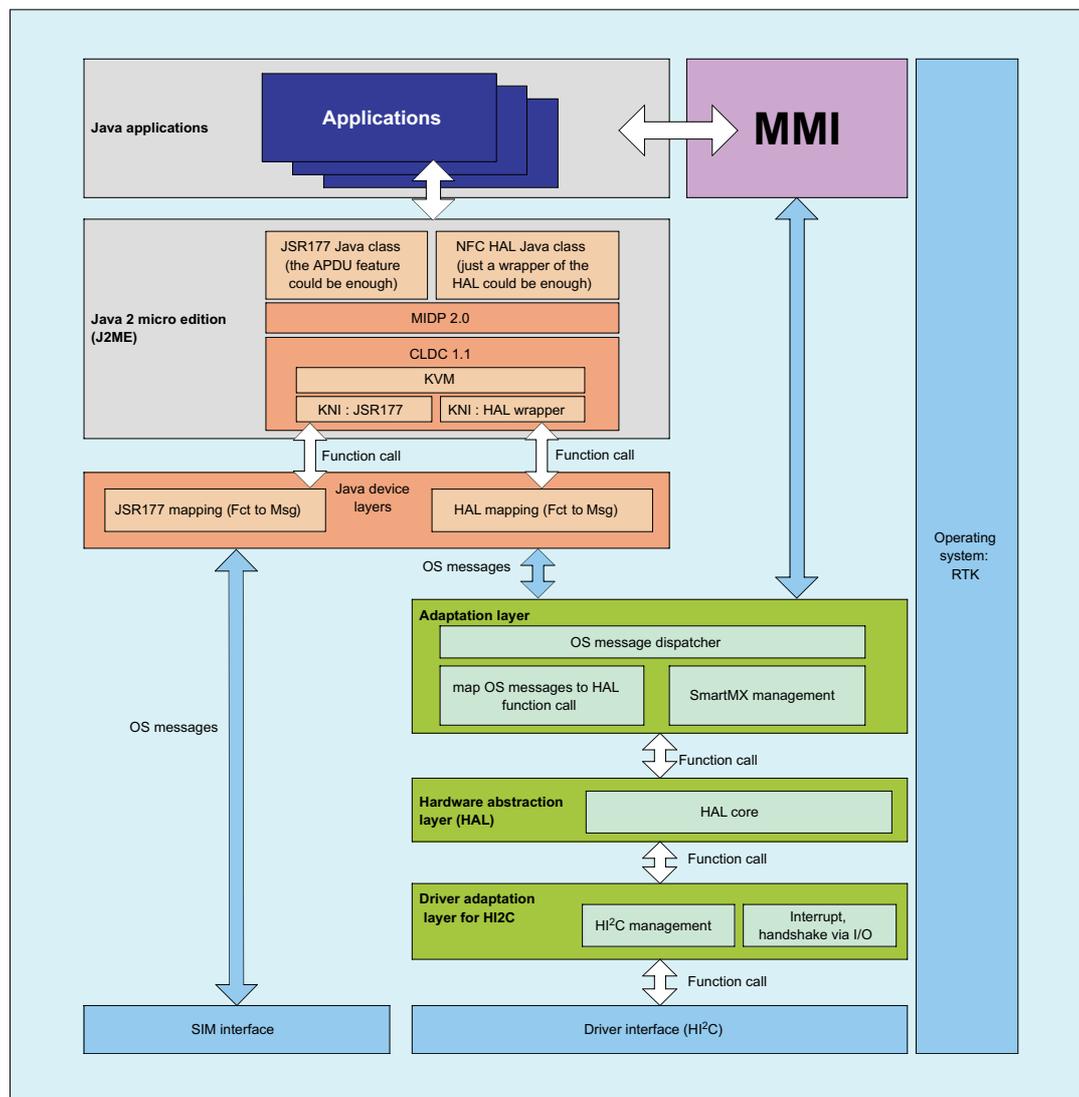


Figure 3: A hardware abstraction and Java device layer have been developed to be compatible with many possible data flows out of different use cases, and fit with Nexperia software stacks.

the right midlet on the mobile at the end of the transaction.

The implementation of NFC functionality in Nexperia mobile platforms is flexible, allowing the operators to remotely add new NFC Java applications securely. The hardware configuration, with the embedded firmware, fully supports three main operating

modes of NFC (reader/writer, peer-to-peer and card emulation) with few implications for the baseband processor. The relevant security level of each application can be chosen by the operators.

By default, the cellphone will be in NFC target mode with only the RF-level detector active and ready to answer an ex-

ternal reader request. In this mode, the power consumption is very low, but other modes can be initiated by Java actions at any time.

Bright future

NFC has a huge number of potential applications and the technology becoming widespread at point-of-sale terminals, ticketing applications, downloading music etc.

Currently, 10-15 percent of mobile operators' revenues comes from downloading of ringtones and Java-based games. As MP3 music becomes common in cellphones, NFC-enabled devices would guarantee easy access. NFC will enable people to exchange many types of content—music, messages, photos, video clips, home movies etc.

NFC applications can be split into four basic categories:

- Touch and go—Applications such as access control or

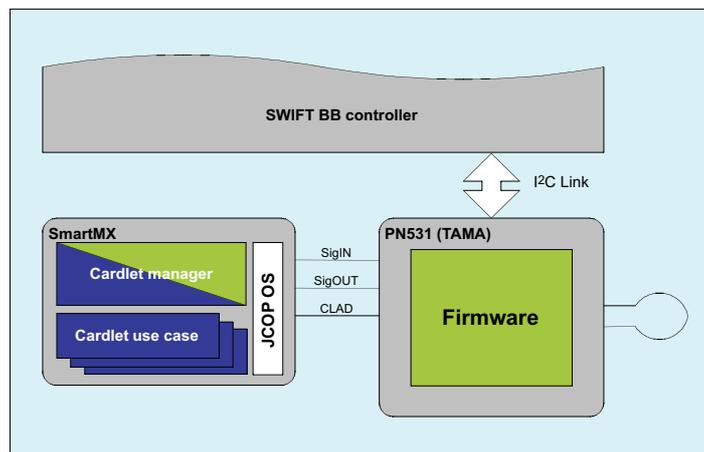


Figure 4: Aside from the SmartMX, operators may put additional cardlets securely for supporting other contactless protocols within the network.

transport/event ticketing, where the user only needs to bring the device storing the ticket or access code close to the reader.

- Touch and confirm—Applications such as mobile payment, where the user has to confirm the interaction by entering a password or just

accepting the transaction.

- Touch and connect—Linking two NFC-enabled devices to enable peer-to-peer transfer of data such as downloading music, exchanging images or synchronizing address books.
- Touch and explore—NFC devices may offer more than one possible function. The con-

sumer will be able to explore a device's capabilities to find out which functions and services are offered.

NFC creates new opportunities for mobile commerce and has the potential to change consumer behavior and spending habits. Its unique intuitive op-

eration makes it particularly easy for consumers to use, while its built-in security makes it ideal for payment and financial applications. NFC meets all the needs of today's connected consumer. Bringing it into everyone's mobile phone is the first step in guaranteeing its success. □