Near Field Communication
Jointly developed by Philips and Sony, Near Field Communication (NFC) is a wireless connectivity technology that enables convenient short-range communication between electronic devices. NFC offers the ultimate in convenience for connecting all types of consumer devices and enables rapid and easy communications. It is the perfect solution for controlling data in our increasingly complex and connected world.

NFC is central to Philips’ vision of a world where everyone can always connect to information, entertainment and services – anytime and anywhere. Its intuitive operation makes it particularly easy for consumers to use, while its built-in security makes it ideal for payment and financial applications.
Near Field Communication

The advantages of NFC

Acting as a secure gateway to the connected world, tomorrow’s NFC-enabled mobile devices will allow consumers to store and access all kinds of personal data – at home or on the move. Simply by bringing two NFC-enabled devices close together, they automatically initiate network communications without requiring the user to configure the setup.

NFC-enhanced consumer devices can easily exchange and store your personal data – messages, pictures, MP3 files, etc. Delivering ease of use, instant natural connectivity, zero configuration and smart key access, NFC meets all the needs of today’s connected consumer as well as creating opportunities for new mobile services.

Natural connectivity

NFC provides a more natural method for connecting consumer devices, broadening the scope of networking applications. Just as you would walk across a room full of people to have a private conversation with someone, rather than shouting across it so that everyone could hear, NFC uses this principle to link two devices. By offering increased convenience for the user when interacting with multiple consumer devices, NFC helps to bring Philips’ vision of a connected world one step closer.

Zero configuration

With NFC, two devices that are close together can automatically initiate a ‘conversation’, allowing them to determine how they can interact. NFC delivers effortless interconnection of consumer devices, such as mobile phones, AV (Audio Visual) equipment, digital cameras, PDAs, set-top boxes and computers. With NFC there is no longer any need for users to navigate sometimes complex setup procedures when transferring data between consumer devices.
The advantages of NFC

Smart key access
NFC is fully compatible with both Philips’ MIFARE® and Sony’s Felica contactless smart card platforms. These proven systems provide a solid foundation for the introduction of NFC-enabled devices. This enables NFC devices, like your mobile phone or PDA, to act as an electronic key to access your home, office, or car, or to pay for – as well as to act as – your transport ticket.

Enabling mCommerce
Mobile eCommerce or mCommerce is a vast area of activity, covering any transactions involving monetary value conducted via an electronic device such as a mobile phone or PDA. Offering consumers the possibility to make any sort of electronic payment wirelessly, NFC-enabled mobile devices are well placed to become the heart of mCommerce.
Near Field Communication

Combining communications and identification

Evolving from a combination of contactless radio frequency identification (RFID) and networking technologies, NFC is a unique wireless connectivity technology that enables convenient short-range communication between electronic devices. It allows fast and automatic set-up of wireless networks, providing a virtual connector for existing cellular, Bluetooth and wireless 802.11 devices. This touch-and-go convenience enables rapid and easy communication between all types of consumer devices, making NFC the perfect solution for controlling data in our increasingly complex and connected world.

**Smart card security**

NFC combines connectivity with smart card security. NFC devices can read information from contactless cards. This makes smart cards the ideal solution for bringing information and electronic coupons into the NFC world. They can also operate like a contactless card – even when switched off – and are compatible with the huge installed infrastructure of Philips’ MIFARE and Sony’s Felica contactless card systems.

**Virtual connector**

NFC can be used as a virtual connector for quickly establishing other types of wireless communication between devices. By bringing two devices close together, it can automatically configure and initialize other wireless protocols such as WiFi and Bluetooth. This enables communications at longer ranges and higher data rates. In an environment rich with wireless-enabled devices, NFC is the easy way to set up connections without needing to go through complicated selection menus.
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Putting the user in control

NFC provides secure storage for your confidential personal data, such as credit card numbers, coupons, membership data or digital rights. And by providing a fast and easy connection between your PC and mobile phone or your TV and PDA, it allows you to easily update and align your appointments or any other data.

NFC provides access to information, anywhere and at any time. You can load the departure times of the bus into your mobile device by simply holding it close to the NFC-enabled timetable, or access the latest film news and reviews at the cinema by walking up to an NFC-enabled poster. More than just a wireless connection, it’s a basic tool that allows you to interact intuitively with our increasingly electronic environment.
Near Field Communication

NFC enables connected consumer applications

Connecting electronic devices simply and automatically, NFC offers a world of opportunities for interacting with your electronic environment. Its seamless blending of wireless connectivity and RF identification provides a framework for a limitless range of applications. Here are some examples of how NFC can be used:

- Event and transport ticketing
- Personal mobility
- Mobile music
- Mobile entertainment
- Smart posters
- Virtual connector
Near Field Communication

**NFC makes eTicketing easy**

An eTicket is an electronically issued access right, purchased by consumers for use on public transportation or to gain admission to an entertainment/sports venue. Using NFC, the eTicket purchasing process takes just a matter of seconds and is extremely simple and convenient for consumers. Once the consumer’s payment information is collected and approved, the eTicket is automatically transferred to the consumer’s mobile phone or smart card.

**View animation**

**User experience**

- User holds mobile phone close to the payment terminal to initiate a transaction
  The user types in credit card PIN at the terminal or on phone to confirm the transaction and complete the purchase
- User simply brings mobile phone close to another user’s phone to transfer a ticket
- Arriving at the concert hall, both users simply hold their mobile phones close to a reader fitted to the entrance turnstile, which allows access after checking the eTickets
- Whilst at the concert the user may also be able to take advantage of any loyalty offers linked to the eTicket such as price reductions on concert merchandise
NFC makes eTicketing easy

How it works
The user orders tickets using their mobile phone and a terminal interface, with payment being handled by the network operator. The network operator sends the transaction information to the service provider who issues an authorization code back to the network operator. This code is then forwarded to the user, effectively issuing them with an eTicket. The user can then simply swipe his phone over a reading device in a gate or turnstile. The reader verifies the code and allows access.

Other examples
• Cinema tickets – order eTicket online and get the review.
• Museum tickets – order eTicket online and receive a tour guide.
• Sports tickets – order eTicket and receive a free public transport pass to the stadium.
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NFC enhances personal mobility

Turning your mobile phone or PDA into an electronic wallet, NFC eases the stress of traveling by ensuring you always have the right cards and documents at hand.

View animation

User experience

• User books travel tickets from home, storing the tickets on his NFC-enabled mobile phone.

• User checks in automatically at the airport; the check-in terminal issues a boarding pass for the plane.

• Arriving at the destination, the user checks into the hotel using his credit card and stores the room access code on his mobile phone.

• User enters his room using the code stored on his mobile phone.

• User checks out from the hotel using his mobile phone to pay the bill.

• Back home, the user can check his travel expense overview stored on the mobile phone.
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Personal mobility

How it works
Online reservation systems already exist that work with a booking code or form that the user needs to print or receive through the mail. With NFC, the codes can be stored on the user’s phone, PDA or credit card. The user can also conveniently access on-line banking sites for billing and credit balance information by bringing their NFC-enabled device up to a similarly enabled computer – providing instant and secure access to important information whenever and wherever it is needed. In addition, NFC does away with login and password controls, freeing the user from having to memorize a host of user names and passwords.
NFC gives you access to your favourite music

With NFC, you can listen to your music whenever and wherever you want. You no longer need to copy your CDs or wait for tracks to download from the Internet. Just download the digital rights to a track to stream the music directly to your music system.

**View animation**

**User experience**

- User selects a track from a music distributing website and downloads the digital rights to mobile phone
- User moves phone into proximity with Internet enabled stereo system, such as a Philips’ Streamium, which automatically streams the selected track.

**How it works**

The digital rights to music tracks are stored as a code that can be transferred between devices. When you select a track it is streamed over the Internet via GPRS or a cable connection.
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NFC connects you to a world of entertainment and information

Your mobile phone is a gateway to a whole community, offering mobile games and access to a huge amount of news and information. mEntertainment is flourishing, driven by the availability and connectivity of mobile devices. You can use your NFC-enabled mobile phone or PDA for online-multiplayer and offline gaming or just for checking out the latest news headlines whilst on the move.

User experience

- User wants to play a mobile game
- User holds game card or customer loyalty card close to the mobile phone
- User is automatically connected to the game server via GPRS
- From a menu, user chooses the game to play
- The online game can be started
- User pays for the rights to the game with his monthly phone bill
- The game can be stopped and continued wherever the user left off
- The rights to the game can be transferred to other devices

How it works

When the user holds the phone close to a contactless smart card (gaming card, loyalty card, etc) it retrieves a URL from the card and stores it in memory. The application software then automatically connects to a website over GPRS. After authentication the game is enabled for online play. Furthermore, the digital rights for the game can be transferred to any NFC-equipped device, so it can be played at home or whilst out and about.
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NFC turns posters into smart posters

What do you do if you see a poster for a product, movie or concert and want to know more? With NFC you can automatically link to the website to find out show times or even buy a ticket then and there.

View animation

User experience
- User sees a poster of a product
- User touches the label on the poster with mobile phone
- User is automatically connected to the manufacturer’s website
- User can download detailed information about the product or even buy it in the online store.

How it works
The user simply holds the phone close to the RF tag in the poster to read the URL address via NFC. The application software in the phone automatically connects to the website over GPRS.

Other examples
- Music poster – ring tone, concert ticket or fan community information is offered.
- Restaurant poster – sends directions and menu, enables instant reservation.
- Cinema poster – downloads latest schedules, enables online ticket booking.
- Holiday poster – click “YES” and they post you the latest brochure.
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Digital camera and TV

NFC delivers effortless connection of AV (Audio Visual) equipment, digital cameras, PDAs, set-top boxes, computers and mobile phones, and enables the simple transfer of everything from phone numbers to pictures, MP3 files or electronic cash. Offering limitless possibilities for increasing user convenience, NFC brings the vision of the connected world a step closer.

View animation

User experience

• User takes a picture with NFC enabled digital camera
• User brings camera close to an NFC-enabled TV
• The phone and camera automatically establish an NFC connection and start to communicate
• NFC automatically sets up a Bluetooth connection and downloads the pictures from the camera’s memory to the TV
• User selects picture to be displayed using TV remote control.

How it works

When the camera comes within NFC range, the TV detects it and a dialogue is established automatically. The devices determine that the camera can transfer photos to the TV, and because the images require a fast connection, the devices switch to Bluetooth to transfer the images.
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NFC technology

NFC is a short-range wireless technology for distances measured in centimeters. It is optimized for intuitive, easy and secure communications between various devices without requiring user configuration. To make two devices communicate, users simply bring them close together. The devices’ NFC interfaces will automatically connect and configure themselves to form a peer-to-peer network. NFC can also bootstrap other wireless protocols like Bluetooth or Wireless Ethernet (WiFi) by exchanging configuration and session data.

**Wireless short-range communication technology**
- Based on RFID technology operating at 13.56 MHz
- Typical operating distance of 10 cm
- Compatible with today’s field proven contactless MIFARE and FeliCa smart cards
- Data exchange rate today up to 424 kbit/s.

**NFC communication modes**

NFC-enabled devices can operate in active or passive modes. Mobile devices operating primarily in passive mode can achieve significant power savings, extending precious battery time. Active NFC devices can supply all the power needed for communication with passive devices through their internally generated RF field. This is exactly the same way that contactless smart cards are powered and ensures that data remains accessible even when the mobile device is switched off.
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NFC technology
Philips Smart Card & RF-ID Technology & NFC
Near Field Communication

**Standardization**

NFC is an open platform technology standardized in ECMA 340 as well as ETSI TS 102 190 V1.1.1 and ISO/IEC 18092. These standards specify the modulation schemes, coding, transfer speeds, and frame format of the RF interface of NFC devices. They also cover initialization schemes and conditions required for data collision-control during initialization – for both passive and active NFC modes. Furthermore, they define the transport protocol, including protocol activation and data exchange methods.
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NFC and others wireless technologies

NFC is complementary with existing wireless standards. It can be used to initiate WLAN, Bluetooth and other wireless connections without going through configuration menus. These connections are established simply by holding the two NFC products close together, or by configuring a device with contactless smart media.

<table>
<thead>
<tr>
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<th>NFC</th>
<th>Bluetooth</th>
<th>IrDA</th>
<th>ZigBee</th>
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<td>Point to multipoint</td>
<td>Peer to peer</td>
<td>Point to multipoint</td>
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<td>Up to 10 m</td>
<td>Up to 1 m</td>
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<td>~ 6 s</td>
<td>~ 0.5 s</td>
<td>&gt; 1 s</td>
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<td>Yes (protocol level)</td>
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NFC Products

Philips currently has two NFC products available, the highly integrated PN511 transmission module and the PN531 smart transmission module, which fully supports ISO 18092, MIFARE® and FeliCa™ read/write modes enabling it to act as a smart card in combination with a security controller chip.

Reference design for PN511/PN531

The following block diagram shows how you would typically integrate the PN511/PN531 into an application.
PN511 transmission module

The PN511 is a highly integrated transmission module for contactless communication at 13.56 MHz. This transmission module utilizes an outstanding modulation and demodulation concept completely integrated for a variety of passive contactless communication methods and protocols at 13.56 MHz. It also supports ISO 18092, MIFARE® and FeliCa™ reader/writer modes and can act as a contactless smart card in combination with a security controller IC.

Key features

- Supports ECMA 340 with transfer speeds up to 424 kbit/s
- Supports ISO 14443A and FeliCa reader/writer mode can act as a smart card in combination with a secure card IC
- Hard reset with low-power function, software power down mode
- Host interfaces:
  - SPI interface up to 5 Mbit/s
  - I²C interface up to 400 kbit/s
  - serial UART interface to 1.2 Mbit/s, framing according to the RS232 interface
  - 8-bit parallel interface with Address Latch Enable
- 2.5-3.3 V power supply.

Near Field Communication

NFC enables connected consumer applications

NFC technology

- Standardization
- NFC and others wireless technologies
- Products
- PN511 Transmission Module
- PN531 Smart Transmission Module

Press releases

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PN511 transmission module

**PN511 simplified block diagram**

- ANALOG INTERFACE
- RF LEVEL DETECTOR
- DATA MODE DETECTOR
- CONTACTLESS UART
- REGISTER BANK
- HOST
- I²C 8-bit PARALLEL INTERFACE
- UART SPI
- FIFO

View datasheet
PN531 smart transmission module

The PN531 IC uses an 80C51 processor with 32 Kbytes ROM and 1 Kbytes RAM. It fully supports ISO 18092, MIFARE® and FeliCa™ read/write modes. The PN531 can act as a smart card in combination with a security controller IC. Furthermore the embedded firmware and internal hardware support the handling and the host protocols for the following interfaces: USB 2.0, I²C, SPI and serial UART.

Key features
- 80C51 microcontroller core with 32 Kbytes ROM and 1 Kbytes RAM
- Highly integrated analog circuitry to demodulate and decode card response
- Buffered output drivers to connect an antenna with minimum number of external components
- Integrated RF level detector
- Integrated card mode detector
- Integrated hardware and embedded firmware support for:
  - ISO 14443A reader/writer mode
  - MIFARE Classic encryption and MIFARE higher baud rate communication up to 424 kbit/s
  - Contactless communication according to the FeliCa™ scheme at 212 kbit/s and 424 kbit/s
  - NFC standard ECMA 340: NFC IP-1 interface and protocol
- Supported host interfaces
  - USB 2.0 full speed device
  - SPI interface
  - I²C interface
- 2.5 - 3.3 V power supply.
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PN531 smart transmission module

PN531 simplified block diagram

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Press releases

Philips and Sony Announce Strategic Cooperation to Define Next Generation Near Field Radio-Frequency Communications
September 5, 2002

Philips and Visa form major alliance to promote the application of contactless payment technology
May 28, 2003

Philips and Visa International showcase the potential of contactless payment and connectivity at the Consumer Electronics Show
January 8, 2004

Philips Accelerates Realization of Connected Planet Vision with Near Field Communication (NFC) Technology
March 17, 2004

Nokia, Philips and Sony establish the Near Field Communication (NFC) forum
March 18, 2004
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NFC Forum

The NFC Forum is a global group dedicated to promoting the use of NFC and the development of standards for the interoperability of devices to provide electronic services. It is a non-profit organization with the objective of supporting the broad adoption of NFC. It provides a platform for interested companies to achieve interoperability of their NFC devices.

Mission & Objectives

- Direct the future development of NFC Technology by proposing technical specifications for data structures, protocols, etc
- Provide technical recommendations and reference designs to form the basis for interoperability between devices and interoperability with services
- Establish conformity testing and issue conformance certificates
- Propose applications and use cases of NFC technology
- Drive market adoption of NFC by initiating promotional activities such as a website, press releases, educational workshops, support for members on tradeshows.

Visit the NFC Forum at: www.nfc-forum.org
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Contact us

For more information, please visit our website www.semiconductors.philips.com/markets/identification or you can contact us by e-mail: info.bli@philips.com.

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