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One Stop For Your RF and Wireless Need

What is NFC?

This NFC tutorial covers following sub topics:

How NFC Works | NFC Modulation and coding | NFC Tag vs NFC Reader | NFC Tag Types | NFC-A,NFC-B,NFC-F | difference between bluetooth,wifi,RFID and NFC | NFC Tools and Equipments

Near Field Communication is referred as NFC. The technology is similar to RFID standard. As we know there are two types of fields around the RF Antenna

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viz. near field and far field. Near field refers to the electromagnetic radiation near to the antenna(i.e. region upto $2D^2/\lambda$) and far field refers to EM radiation away from the antenna. NFC has become very popular as short distance communication(few millimeters) with very low data rate (few kbits/sec). NFC protocols are based on RFID standards published and outlined in ISO/IEC 18092.

NFC is used for wide variety of contactless applications which include access control in railways and in offices, healthcare, information exchange, payments as well as consumer electronics. NFC is basically a point to point way of communication. It always need initiator and target. There are two types of communication based on power. In active communication , initiator and target will generate the EM fields alternately and will communicate with each other. In passive mode, target will draw the power from NFC reader. In passive mode it is easy to make the NFC target with the use of sticker and no battery is neeeded.

NFC devices work based on inductive coupling. Induction is the production of electric current by passing a wire through a magnetic field(H). As we

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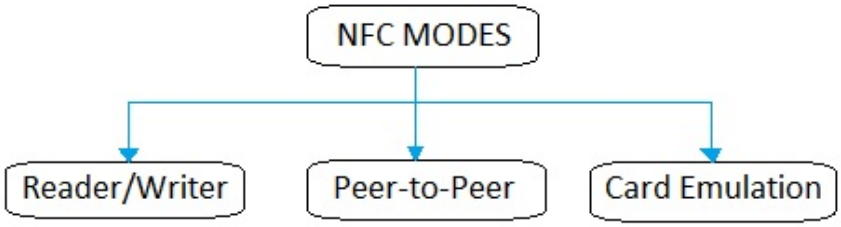
know NFC devices have coils built into them. A magnetic field from a NFC device generates power in these coils, which initiates the transmission of data over the radio waves. Both devices (target and initiator) share this power.

NFC Operating modes



There are three operating **modes** in the NFC technology. They are reader/writer, peer to peer and card emulation.

The reader/writer mode is compliant to ISO/IEC 14443 as well as FeliCa specifications. In this mode, NFC device can read the tag. The tag here usually is integrated in the smart poster or sticker.

The peer to peer mode is compliant to ISO/IEC 18092 standard specifications. In this mode, devices are self powered. Here both the devices communicate with each other and share the information. Users of this mode can exchange bluetooth or WLAN link

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establishment parameters as well as exchange data for example, digital photos or virtual business cards.

In card emulation mode, the data stored on the card is read by NFC reader. The card having this mode is referred as smart card and is used for various applications such as ticketing, payments, purchases, transit access control mechanism etc. In this mode, NFC compliant device communicates with the reader just like a smart card. This mode is a two way communication.

NFC Frequency and data rates

NFC operates in unlicensed ISM **frequency band** of about 13.56 MHz. It supports **data rate** of 106 Kbps , 212 kbps and 424 Kbps. NFC uses bandwidth of 14KHz to map data on the RF carrier. Sidebands of NFC RF modulated spectrum may extend upto +/- 1.8MHz.

NFC Applications

FTTH | KNX | WAP | Mobile IP

NFC has wide variety of applications. Few of them are summarized below. Following can be served with the use of NFC mobile phone and NFC smart cards.

- It is used at airport and railways for pass gate, to get information from smart poster, to get information from information kiosk, to pay bus or taxi fare.
- It is used in the vehicle to adjust the seat position, to open the door, pay parking fees etc.

- It is used in the office for entry and exit locations, exchange business cards, log in to the PC, print using copier machines etc.
- It is used in the restaurant to pay using credit card, get loyalty points, get and use coupon, share information and coupon among NFC users etc. Figure-2 depicts NFC compliant USIM.
- It is used at theater stadium at pass entrance, get event information and more.
- It is used for download and personalize the applications, check usage history, lock phone remotely and more.

All the products compliant to NFC use N-Mark. It is the global symbol for recognition as well as acceptance of NFC compatible short range wireless communication devices.

NFC Tag Types

There are four **NFC tag types** viz. Tag 1 type, tag 2 type, tag 3 type and tag 4 type.

Type 1 tag : It is based on ISO/IEC 14443A standard specifications. Ihis tag type-1 is read as well as read/Write capable. The size of the memory is between 96bytes to 2kbytes. The memory can be

write protected. The data rate supported with this type 1 tag is 106 kbps. One such example manufactured is Innovision Topaz.

Type 2 tag : It is based on ISO/IEC 14443A standard. This tag also is read/write protected and is write protectable. The memory size available is between 48 bytes to 2 Kbytes. The data communication speed supported is about 106 kbps. The NFC tag type-2 is manufactured by NXP and are available as NXP Mifate ultralight.

Type 3 tag : It is based on JIS X 6319-4 standard and is popular in Japan. The tag can be either read & re-writable or read only. This mode is pre-configured during the manufacturing. Memory size of upto 1Mbyte is available. The data rate supported is 212 kbps. The example of this type 3 tag is sony Felica.

Type 4 tag : This tag type is ISO/IEC 14443 (A or/and B) standard compliant. This tag also is pre-configured at the time of manufacturing. This tag also can either be read & rewritable or it can be read only. The memory size max. supported is 32 Kbytes. The data communication speed supported is 106 Kbps. For

communication, APDU as per ISO 7816-4 need to be used.

NFC Signalling types

There are three **signalling** types used in NFC communication technology standard. Any one of these signalling type is used for communication between initiator and target or between reader and tag. The types are NFC-A, NFC-B and NFC-F. Refer NFC-A vs NFC-B vs NFC-F for more which describes difference between these signalling types.

NFC technology related links

NFC basics NFC-A,NFC-B,NFC-F types NFC vs RFID difference between bluetooth,wifi,RFID and NFC What is NFC on phone Difference between NFC tag types NFC Tag vs NFC Reader

Zigbee,WiFi,RFID related links

- RFID Tutorial
- MIFI vs WIFI
- what is zigbee
- Zigbee network architecture basics

IoT Wireless Technologies

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RF and Wireless Terminologies

SATELLITE RF Antenna Avionics Wireless LiFi vs WiFi MiFi vs WiFi BPSK vs QPSK BJT vs FET PDH vs SDH CS vs PS MS vs PS

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