NFC Tags Must Offer the Right Balance of Cost and Performance

With four NFC Forum-mandated tag types to choose from, designers need to consider the properties of each before committing to one type over another.

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According to a recently-launched white paper &#151 “Near Field Communication in the Real World &#151 using the right NFC tag type for the right NFC application” &#151 from Innovision Research & Technology Plc, NFC is ready for adoption across a range of applications. However, to ensure a mass market and create profitable opportunities around the technology, designers and manufacturers need to make the right

choices, especially when it comes to the NFC tag. Features and capabilities must match application needs, and the price must be right for mass-market deployment.

The initial mass-market applications of NFC are likely to build on existing payment and communications infrastructure and user behavior, where the user benefits are most compelling, the business case is strongest and the commercial risks are lowest. This implies a need for low-cost NFC integrated circuits (ICs) that can be applied to a broad range of uses cost effectively, in a way that is compatible with the broadest range of pre-existing devices and reader infrastructure.

Developers can choose from four NFC Forum mandated tag types. How do they ensure they choose the right tag for the job? First, let's look at the key mainstream applications for NFC in the next few years.

Initial NFC Applications

It's likely that the first mass-market applications for NFC will be in relatively low-financial value applications &#151 with low risk of fraud &#151 that do not require large investment in new back-end infrastructure. These fall into three main categories: peer-to-peer; payment & ticketing; and service initiation.

In peer-to-peer applications, NFC is used to set up local communication between two devices. When the content or payload to be transferred is relatively small (up to a few kilobytes), NFC can be used to transmit the data itself. For larger amounts of data, however, NFC is likely to be used to establish a separate wireless connection such as Bluetooth or WiFi &#151 to carry the content. A typical peer-to-peer application would be printing photos straight from a picture phone or digital camera.

One of the drivers for the creation of the NFC standard was to build payment and ticketing capabilities into mobile phones. For banks, NFC-enabled payments are much easier and less costly to handle than cash and other traditional payment methods. Initially, NFC-enabled devices are likely to be used for vending machines and parking meters.

In the service initiation case, the user touches an NFC-enabled device against an NFC tag, which then transfers a small amount of information to the NFC device. This could be plain text, a web address (URL), phone number or other simple piece of data.

So what types of NFC tags are available to serve these applications?

Mandated Tag Types

In June 2006, the NFC Forum announced the initial set of four tag formats that all NFC Forum-compliant devices must support. Tags compatible with these mandatory formats are available initially from Innovision, Philips and Sony. They were selected to cater for the broadest possible range of applications and device capabilities. They are:

&#149Type 1 – based on ISO 14443 A, this has a 96-byte memory capacity &#149Type 2 – also based on ISO 14443 A, this has half the memory capacity of Type 1 tags &#149Type 3 – based on FeliCa, this has a larger memory (currently 2 kbyte) and operates at a higher data rate (212 kbit/s), which means it is suitable for more complex applications &#149Type 4 – fully compatible with ISO 14443A/B, this offers large memory-addressing capability with read speeds of between 106kbit/s and 424kbit/s, making it suitable for multiple applications.

It is worth noting that Type 1 and 2 tags and Type 3 and 4 tags are two very different groups, with very different memory capacities. There is very little overlap in the types of applications they are likely to be used for. It is important, therefore, that designers consider the relative merits of each before committing to one type or another.

Horses for Courses

With initial mass-market deployments likely to be in low-financial value, low-risk applications, it is important that NFC tags meet the requirements with the right balance of cost and performance.

In 'smart poster' applications, users touch their mobile phones against a tag embedded in the poster itself, which triggers the transmission of a URL to the phone. This URL could, for example, direct users to a web site where they can find out further information or download a special coupon or token. The trade-off here is to have a tag that is small and low-cost enough for mass deployment, but with sufficient memory to contain a reasonably long URL and some additional security features.

A similar application is MMS or ringtone downloads, where users touch their phones to a product or promotional piece, for example, to obtain an associated picture message or ringtone. Once again, small size is important, but so are sufficient memory and security features. The larger the memory capacity on the tag, the more information that can be transferred directly to the phone. However, there are limitations arising from the short 'touch time' between the NFC device and the tag. In practice, this sets an upper limit for the amount of data exchanged to just a few kilobytes during the touch.

In shortcut applications, users can automatically send an SMS or phone number by touching their phone against a tag embedded in all kinds of objects. One possibility is the provision of 'tags in a box' with new mobile phones. Users would be able to save a phone number or text message on the tags, which are embedded in stickers. These could be affixed to photo frames, for example, and used to provide the phone number of the person in the picture, either as a fun application or as a very practical one for the elderly or disabled. In this case, small size and low cost are the main considerations, as the memory requirements are small.

Bluetooth pairing, for example, between a mobile phone and a hands-free headset, or a digital camera and a printer is made much more convenient by NFC. Generally, only a small amount of memory is required, and small size, low cost &#151 with low risk of 'tearing' the data transfer &#151 are the main requirements. Larger memory may be useful in applications that also involve the automatic transfer of some data between the two devices.

Features to Focus On

The read/write memory capacity offered by the NFC tag is key, particularly in mass-market applications, as larger memory comes at the expense of unit price and footprint. For example, in smart poster applications, larger memory translates into longer URLs and greater security options. The larger memory offered by Type 3 and 4 tags could be useful in certain applications, for example, for high data content downloads such as MMS or ringtones but is overkill for smart posters, Bluetooth pairing or low-data shortcut applications.

It is nonetheless important to balance cost with capability, especially when some

level of security is required. Smart posters need to be protected from fraudulent copying or tampering with the URL or phone number provided in public environments. Also, there needs to be sufficient memory to provide a full URL even when a digital signature is required. Type 1 tags offer 96 bytes of read/write memory, while the nearest comparable competitor product (Type 2 tag) offers 48 bytes.

After writing data to a tag, it can be irreversibly locked to read-only mode to prevent it being overwritten or altered in any way – no-one can modify the tag once it has been published. This is an important security and privacy feature offered by the Type 1 tag format.

The unit price of NFC tags is naturally a key factor in determining its suitability for certain applications. For example, if the IC is only to be used for Bluetooth pairing in a hands-free headset, which users only need to do occasionally, features like high read speed and large memory are irrelevant.

The die size area of the NFC tag is important, especially in applications that require unobtrusive positioning, or integration on to other chipsets. In smart poster applications, Type 1 and 2 can provide a much more appropriate balance of cost, size and memory capacity than Type 3 and 4 tags, for example.

The higher the read speed, the lower the chance of a read/write 'tear' occurring (where data is not fully or properly transferred). Read speed therefore has a direct impact on system reliability and user experience. The proprietary 'Read All' command in Type 1 tags enables the whole content of the tag to be read in one shot, rather than a block at a time &#151 which can improve read performance considerably.

The first mass-market applications for NFC are likely to build on existing infrastructure, initially in relatively simple shortcut, identification, service discovery/initiation or device pairing applications. For these, developers need a standardized tag format that is small, low-cost and flexible enough to be successfully integrated into existing form factors and integrated circuitry.

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