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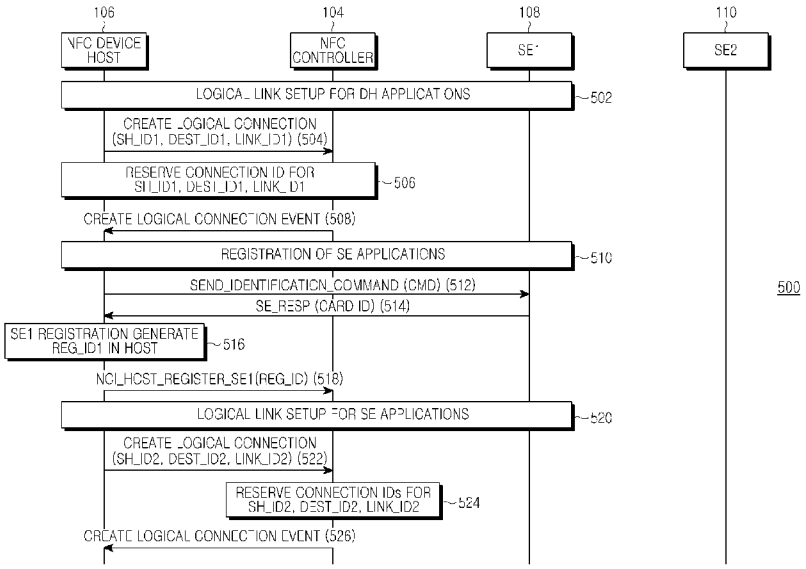
[Fig. 5]



(57) Abstract: A method and system for handling a plurality of applications in a Near Field Communication (NFC) device is provided. The method is performed at a NFC Controller (NFCC). The method includes storing a source host identity (ID), a destination host ID and a link ID associated with each application from one or more applications. The method also includes managing the one or more applications simultaneously based on the source host ID, the destination host ID and the link ID stored in the NFCC.

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Description

METHOD AND SYSTEM FOR MANAGING MULTIPLE APPLICATIONS IN NEAR FIELD COMMUNICATION

Technical Field

[1] The present invention, in general, relates to a field of managing data in short range wireless communication. More particularly, the present invention relates to a method and system for managing multiple applications in Near Field Communication(NFC).

Background Art

[2] Communication devices such as mobile phone, Personal Digital Assistance (PDA), Laptops are frequently used for communication, for example, communication over a telecommunication network and short range communication. The communication over the telecommunication network can be a wired network and/or a wireless network. An example of wired network includes a Public Switched Telecommunication Network (PSTN). Examples of wireless network include Global System for Mobile (GSM), Code Division Multiple Access (CDMA), and the like. The short range communication can be established when communication devices are in a close proximity to each other. Examples of short range communication network include, but are not limited to Bluetooth · infrared communication, Near Field Communication.

[3] Near Field Communication (NFC) is a short-range high frequency wireless communication technology. In NFC a communication link is established automatically as soon as two NFC enabled communication devices are placed close to each other. NFC enables exchange of data between devices that are within ~10 centimeter distance. NFC compatible communication devices adheres to ISO 18092 standards. Further, NFC compatible communication devices can operate in different operating modes, for example, reader/writer mode, peer-to-peer mode, and card emulation mode. The different operating modes are based on ISO/IEC 18092-NFCIP-1 and ISO/IEC 14443 contactless smart card standards. For the sake of clarity and for the purpose of this description, the NFC compatible communication devices will be referred as communication devices.

[4] In reader/writer mode, the communication device is capable of reading NFC forum mandated tag types. A tag in this mode is either active or passive. However, the tag is activated for communication when a reader communication device is at a close proximity to the tag. In Card Emulation mode, the communication device hosts a NFC tag that is used as a traditional contactless smart card. In the Peer to Peer mode of operation, a legacy NFC communication device works in a Half-Duplex mode of operation using protocols that enable Peer to Peer mode of operation.

[5] Hence, the NFC communication devices operate in three different modes. The main parts of a NFC communication device operation include NFC Controller (NFCC), Device Host (DH), and removable entities. An example of DH includes a processor. The removable entities include secure elements (SE) and/or non-secure elements. The NFCC interfaces and interacts with the DH and the removable entities directly through physical links. The interactions are managed by the protocols in the NFCC, DH and removable entities. Hence, the interaction among the NFCC, the DH and the removable entities results in transfer of application data over the NFC wireless link. In NFC communication devices, multiple applications can be deployed on DH and removable entities. Further the interaction of the multiple applications with other applications entities within the same NFC communication device and also with other NFC communication devices is managed by the NFCC.

Disclosure of Invention

Technical Problem

[6] In light of the above discussions there is a need for a method and system to efficiently manage operations associated with multiple applications in the NFCC.

Technical Solution

[7] In an embodiment, a method for handling a plurality of applications in a Near Field Communication (NFC) device is provided. The method is performed at a NFC Controller (NFCC). The method includes storing a source host identity (ID), a destination host ID and a link ID associated with each application from one or more applications. The method also includes managing the one or more applications simultaneously based on the source host ID, the destination host ID and the link ID stored in the NFCC.

[8] In another embodiment, a Near Field Communication Controller (NFCC) is provided. The NFCC includes a memory to store a host identity (ID), an application ID and a link ID associated with each application from one or more applications. The NFCC also includes a processor to manage the one or more applications simultaneously, based on the host ID, the application ID and the link ID stored in the memory.

Advantageous Effects

[9] The features and advantages of the present invention will become more apparent from the ensuing detailed description of the invention taken in conjunction with the accompanying drawings.

Brief Description of Drawings

[10] FIG. 1 illustrates an exemplary environment, in accordance with one embodiment of the present invention;

[11] FIG. 2 illustrates a Near Field Communication Controller (NFCC), in accordance with one embodiment of the present invention;

[12] FIG. 3 illustrates representation of data stored in a memory in accordance with one embodiment of the present invention;

[13] FIG. 4 illustrates a method for handling operations associated with a plurality of applications in a Near Field Communication Controller (NFCC), in accordance with one embodiment of the present invention; and

[14] FIG. 5 illustrates a flow diagram for handling operations associated with plurality of applications in a Near Field Communication Controller (NFCC), in accordance with one embodiment of the present invention.

Mode for the Invention

[15] The accompanying figure, similar reference numerals may refer to identical or functionally similar elements. These reference numerals are used in the detailed description to illustrate various embodiments and to explain various aspects and advantages of the present disclosure.

[16] Persons skilled in the art will appreciate that elements in the figure is illustrated for simplicity and clarity and may have not been drawn to scale. For example, the dimensions of some of the elements in the figure may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present disclosure.

[17] The terms used to describe various embodiments are exemplary. It should be understood that these are provided to merely aid the understanding of the description, and that their use and definitions in no way limit the scope of the invention. Terms first, second, and the like are used to differentiate between objects having the same terminology and are no where intended to represent a chronological order, as and where stated otherwise. A set is defined as a non-empty set including at least one element.

[18] FIG. 1illustrates an exemplary environment 100 in accordance with one embodiment of the present invention. The environment 100 includes a NFC device 102. The NFC device 102 is shown to include a Near Field Communication Controller (NFCC) device 104, a Device Host (DH) 106, two secure elements (SE1 and SE2) 108 and 110. The DH is associated with three applications, for example an application 112 (DH-App1 112), an application 114 (DH-App2 114) and an application 116 (DH-App3 116). The two secure elements are also associated with one NFC applications each, for example an application 118 (SE1-App1) and an application 120 (SE1-App2). However, only two secure elements and one DH are shown in the environment 100, it will be apparent to the person ordinarily skilled in the art that the environment 100 includes more number of secure elements and DH. Further, the number of applications associated

with the DH and secure elements may also vary.

[19] For NFC communication, the applications in the DH 106 and the secure elements 108 and 110, interact and communicate initially with the NFCC 104 in the NFC device 102. For example, the DH 106 is connected to the NFCC 104 using a physical link 122. In an embodiment, the applications residing in the DH 106 and the SE s (108 and 110) interact with NFCC using one or more NFC Controller Interface, For example NFC Controller interface 124 and 126. The NFC communication can be internal communication and/or external communication. The internal communication includes interaction between one or more elements within the same NFC device. For example in the NFC device 102, the internal communication is when an application in the DH 106 communicates with an application in the secure element 108 and/or the secure element 110 and/or vice versa.

[20] The external communication is when applications residing in an element in one NFC device interact with an application residing in an element in another NFC device. For example in the environment 100, the external operation is when an application in the DH 106 and/or secure element 108 and/or 110 interacts with an application residing in an element in a remote NFC device. The applications residing in the DH 106 and Secure Element (SE) 108 and 110 communicates with applications residing in other NFC devices using the NFCC 104, the NFCC 104 in turns uses NFC air interface for communication. This results in application data transfer over the NFC wireless link.

[21] In an embodiment, the data transfer associated with a plurality of applications is managed by the protocols in the NFCC 104. The plurality of applications associated with the DH 106 and secure elements 108 and 110 are managed by the NFCC 104 by creating logical links. In an embodiment, a logical link is used to identify a communication path between the NFCC 104 and the applications residing in the DH, SE or with a remote NFC device. The interaction between the NFCC 104 and the DH 106 and the interaction between the NFCC 104 and the SE s 108 and 110 occurs inside an NFC device 102. Hence, the NFCC 104 manages operations associated with a plurality of applications residing in the DH 106, the SE 108 and the SE 110 by maintaining and storing a plurality of information associated with each application in the NFCC 104.

[22] In an embodiment, information associated with the plurality of applications are Source Host Identity (ID), Destination Host ID and a link ID associated with each of the applications associated with DH and SE, for example the DH 106 and the SE s 108 and 110. The Source Host Id is the identity of a source element in which an application that has requested communication is residing. The Destination Host ID is a identity of a destination element with which the application has requested to communicate. The logical link identity (ID) is a unique connection identity that is created when a link between an application and the NFC controller is established.

[23] For example, when DH-App1 interacts with SE1-App1, the Source Host ID is the ID of the DH 104, the destination Host ID is the ID of the SE 108 and link ID is a unique connection identity that will be generated when a link will be established between the DH 104 and the SE 108. Similarly, information associated with a plurality of application interactions is stored in the NFCC 104. Thereby, the NFCC 104 manages the plurality of operations associated with application in the NFC device.

[24] FIG. 2illustrates a Near Field Communication Controller (NFCC) 104 in accordance with one embodiment of the present invention. To explain the FIG. 2, references will be made to FIG. 1. However, it will be apparent to a person ordinarily skilled in the art that the present invention can be explained with the help of any other suitable embodiment of the present invention. The NFCC 104 includes a memory 202 and a processor 204. The memory 202 is capable of storing a source host identity (ID), a destination host ID and a link ID associated with each application from one or more applications.

[25] In the environment 100, the memory 202 is capable of storing information associated with the applications residing in the DH 106, the SE 108 and the SE 110, when the applications interact with each other or with applications residing at remote device. For example the memory 202 stores information associated with applications DH-App1, DH-App2, DH-App3, SE-App1 and SE-App2, when the applications interact with each other or applications residing at remote device. For example, when DH-App1 interacts with SE1-App1, the source host ID, the destination host ID and the link ID associated with the communication is stored in the memory 202.

[26] In an embodiment, a source Host ID, a destination host ID and a link ID, associated with one or more applications, is stored collectively and simultaneously when the one or more applications interacts with other applications. Further, the processor 204 manages operations associated with the one or more applications simultaneously based on the source host ID, the destination host ID and the link ID stored in the NFCC.

[27] FIG. 3 illustrates a representation of data stored in a memory in accordance with one embodiment of the present invention. To explain the FIG. 3, references will be made to FIG. 1 and FIG. 2. However, it will be apparent to a person ordinarily skilled in the art that the present invention can be explained with the help of any other suitable embodiment of the present invention.

[28] The environment 300 shows a memory 202 associated with the NFCC 104. In an embodiment, the memory 202 stores information associated with one or more applications when the one or more applications communicate with other applications. In an embodiment, the memory 202 stores a source host ID, a destination host ID and a link ID associated with each of the one or more application, when the one or more application is interacting with other applications. In another embodiment, the memory 202 stores

any of a source Host ID, a destination host ID, a link ID, an application ID, a protocol ID, or a registration ID associated with each of the one or more applications.

[29] Hence, when an application, for example a DH application 112 (the DH-App1) communicates with other applications, for example the SE-App1, a source host ID, a destination host ID, a link ID, an application ID or a protocol ID associated with the application DH-App1 is stored in the memory 202. For example, the source host ID is the identity of the DH 106, the destination host ID is the identity of the SE 108, the link ID will be a logical link ID that will be generated when a link is created with the NFCC 104.

[30] In an embodiment, the application ID identifies an application with a unique identifying mechanism. The application ID is a predefined identifier set by NFC standards or it can be defined as a new identifier for NFC applications. The Protocol ID identifies a protocol with a unique identifying mechanism. The protocol ID is a predefined identifier set by NFC standards or it can be defined as a new identifier for NFC protocols that are operating in the NFCC or using the NFC Controller Interface. The registration ID is required to securely identify a removable element such as a Secure Element or any other removable element. This ID is created when the secure element or a non-secure element is inserted in a NFC device for the first time after authentication a procedure occurs.

[31] In an embodiment, the information associated with the one or more applications that are communicating is stored in a tabular format 302 in the memory 202. The tabular format 302 shows five different fields, for example a Source Host ID field, a Destination Host ID field, a Link ID field, an Application ID field and a Protocol ID field. Though six fields are shown in FIG. 3, it no where limits the scope of the invention to six fields. Hence, a person ordinary skilled in the art can have more or less number of fields in the memory 202. Further, the method can also be performed with more or less number of fields.

[32] FIG. 4 illustrates a method for handling operations associated with plurality of applications in a Near Field Communication Controller (NFCC), in accordance with one embodiment of the present invention. To explain the method 400, references will be made to FIG. 1. However, it will be apparent to a person ordinarily skilled in the art that the present invention can be explained with the help of any other suitable embodiment of the present invention. The method 400 can also include more number of steps as depicted in FIG. 4. Further, the order of the steps may also vary. In an embodiment, the method is performed by the NFCC.

[33] At step 402 the method 400 is initiated. At step 404, the method 400 stores a source host identity (ID), a destination host ID and a link ID associated with each application from the one or more applications. In an embodiment, the source host ID, the des-

tination host ID and the link ID is stored in the memory 202 when an application residing in an element interacts with other applications. For example, when the DH-App1 communicates with the SE-App1 and DH-App2 communicates with the SE-App2, the information associated with the communication is stored in the memory 202 of the NFCC 104. In an embodiment, the information associated with the communication is a source host ID, a destination host ID and a link ID.

[34] In an embodiment, the source host ID is the ID of the entity where an initiating application resides. The initiating application is an application that initiates a communication. Hence, identity of the DH 106 is the source host ID when the DH-App1 initiates communication with other applications. In an embodiment, the destination host ID is the ID of the entity where a requested application resides. The requested application is an application which is requested by the initiating application for communication. For example, when the DH-App1 communicates with the SE-App1 then the destination host ID is the ID of the Secure Element 108.

[35] In an embodiment, the link ID is a logical link ID that is generated when the communication between the entities within the same electronic device is established. For example, when the DH-App1 communicates with the SE-App1 then the link ID is the logical link ID that is generated at run time. In another embodiment, when an application, for example the DH-App1 communicates with an application residing in other NFC device then the logical link ID is a predefined ID. Hence, the NFCC stores the predefined ID as the link ID when the application in the source host interacts with a destination host over a NFC air interface.

[36] At step 406, the method 400 manages the one or more applications simultaneously based on the source host ID, the destination host ID and the link ID stored in the NFCC. In an embodiment, the method manages communication associated with the one or more applications in the NFC device 102 simultaneously. In an embodiment, the one or more applications are stored in a Device Host (DH). In an embodiment, the one or more applications are stored in a removable elements associated with the NFC device. In an embodiment, the one or more applications are stored in DH and/or removable elements or both. The removable elements are secure element and/or a non-secure element.

[37] In an embodiment, the method 400 also stores a registration ID along with the source host ID, destination host ID and link ID. In an embodiment, the registration ID is stored when an application, that is initiating the communication, is residing in a removable element. The removable element is an entity that can be connected and disconnected from an NFC device. In an embodiment, an application in a removable element registers itself with the NFC device when the removable element is connected with the NFC device.

[38] Thereafter, a registration ID is generated when the device is successfully connected and identified by the NFCC. Hence, the method 400 then manages the one or more applications based on the registration ID along with the source host ID, destination host ID and link ID. In an embodiment, each of the one or more applications interacts with NFCC using a predefined dedicated link when the communication is within the NFC device. In this embodiment, the one or more applications are residing in one or more Secure Elements (SE) associated with the NFC device. The predefined link is used to transport the command, events or data of one or more applications to the Device Host. In an embodiment, the predefined dedicated link is created when the NFCC is initialized.

[39] The predefined dedicated link, for example a Routing_SE_Link or a Tunnel_SE_Link, can be pre-allocated in the NFCC 104 for the purpose of routing data from the one or more SE (108 and 110) to the DH 106. For example, a link ID OxFF can be pre-allocated in the NFCC 104 to handle routing of traffic from one or more SE (108 and 110) to the DH 106. This link can be pre-established between the NFCC 104 and DH 106 while the NFCC is initialized.

[40] In an embodiment, the applications that are residing in one or more SE can communicate to the NFCC and the peer device over NFC interface only. Hence, there can be message exchanges required between the SE and the DH. Therefore, the NFCC creates the dedicated link, for example the Routing_SE_Link or the Tunnel_SE_Link, that can be used to carry data frames or other information frame from one or more SE to the DH. In an embodiment, the frames carry necessary information like Application ID, SE_ID that is required by the DH to act on the data carried in the frame.

[41] In an embodiment, the method 400 stores a protocol ID along with the source host ID, destination host ID and link ID. The protocol ID is the ID associated with a protocol that is used by an application, for example DH-App1, to communicate with other application, for example the SE-App1. In this embodiment, the method manages the one or more applications simultaneously based on the source host ID, the destination host ID, the link ID and the protocol ID.

[42] In an embodiment, the method 400 stores an application ID along with the source host ID, destination host ID and link ID. The application ID is the ID that associated with an application when the NFCC identifies and initializes the application, for example DH-App1. In this embodiment, the method manages the one or more applications simultaneously based on the source host ID, the destination host ID, the link ID and the application ID.

[43] In an embodiment, the method stores at least one of a source host identity (ID), a destination host ID, a link ID, an application ID, a registration ID or a protocol ID associated with each application from one or more applications. For example, the method

400 can store only application ID and protocol ID associated with one or more applications. In another example, the method 400 can store only a link ID and source ID associated with one or more applications. Thereafter, the method manages the one or more applications simultaneously based on at least one of a source host ID, a destination host ID, a link ID, an application ID, a registration ID or a protocol ID stored in the NFCC.

[44] In an embodiment, the method manages one or more applications in the NFC device when the data associated with the one or more applications are sent to an applications residing in an elements in the same NFC device and/or to an application residing in a second NFC device. In another embodiment, the method manages one or more applications in the NFC device when the data associated with the one or more applications are being received from an applications residing in an elements in the same NFC device and/or to an application residing in a second NFC device. At step 408, the method 400 is terminated.

[45] FIG. 5 illustrates a flow diagram 500 for handling operations associated with plurality of applications in a Near Field Communication Controller (NFCC), in accordance with one embodiment of the present invention. To explain the flow diagram 500, references will be made to FIG. 1 and FIG. 2. However, it will be apparent to a person ordinarily skilled in the art that the present invention can be explained with the help of any other suitable embodiment of the present invention. The flow diagram 500 can also include more or less number of steps as depicted in FIG. 5. Further, the order of the steps may also vary. In an embodiment, the method is performed by the communication device.

[46] At step 502, an application residing at Device Host (DH), for example the DH 106, request the NFC Controller (NFCC) 104 to establish a communication session with other application, for example SE-App1. Hence, initiation of a logical link setup happens at step 502. At step 504, the NFCC creates a logical connection and updates one or more fields in the memory 202 of the NFCC 104 with information associated with a logical connection. Hence, information associated a source host ID, a destination host ID and a link ID is stored in the memory 202 of the NFCC 104. For example, ID of the DH 106 is stored as a source ID and ID of the SE 108 is stored as the destination ID when the DH-App1 communicates with the SE-App1.

[47] In an embodiment, an ID associated with a created logical link between the DH-App1 and SE-App1 is also stored in the NFCC 104. In an example, the ID of the DH 106 is SH_ID1, the ID of the SE 110 is DEST_ID1 and the logical link ID is a link_ID1. At step 506, a connection ID is reserved for the connection associated with the application, for example the connection ID is reserved for SH_ID1, DEST_ID1 and link_ID1. At step 508, a logical connection event is created. At step 510, SE ap-

plications are registered with the NFC device. In an embodiment, the SE applications are registered when a removable device is attached to the NFC device. At step 512, the DH 106 sends an identification command to the secure elements for identifying the secure elements. In an embodiment, the identification command is sent using a function Send_Identification_Command(CMD) as shown in FIG. 5.

[48] At step 514, the secure element responds to the DH 106 with the Secure Element card identity. For example, the secure element sends a response using a function SE_Resp (Card_ID). At step 516, the secure element gets registered. Further, a registration ID is generated in the DH 106. For example registration ID is Reg_ID1.

[49] At step 518, the NFC Controller Interface (NCI) registers the secure element SE1. In an embodiment, the NCI registers the secure element using function NCI_Host_Register_SE1(REG_ID1). At step 520, a logical link setup is initiated when an application residing in the secure element (SE1) communicates with other applications. At step 522, a logical connection is created. In an embodiment, the logical connection is created using the function Create Logical Connection (SH_ID2, DEST_ID2, link_ID2)). At step 524, a connection ID is reserved for the logical connection associated with SH_ID2, DEST_ID2 and link_ID2. At step 526, a logical connection event is created for the application residing at the SE1.

[50] In an embodiment, the source host ID, the destination host ID and the link ID associated with one or more applications in the NFC device are stored in the NFCC 104. This is done when the one or more applications interact with other applications residing in the same NFC device or with an application residing in other NFC device. Thereafter, the operations associated with the one or more applications are managed based on the information stored in the NFCC. In an embodiment, an application ID, a protocol ID or a registration ID is also stored in the NFCC.

[51] Various embodiments of the present invention described above provide the following advantages. The present invention provides a method for managing operations associated with multiple applications in a Near Field Communication (NFC) device. The method increases the efficiency of the NFC device as the information associated with a plurality of applications that are communicating with other applications are stored in the NFC Controller (NFCC). Hence, the NFCC can easily manage multiple applications simultaneously.

[52] The method enables the NFC device to perform lesser operations for managing multiple applications. This increases performance of the NFC device and also reduces power consumption considering NFC operations are power critical. The usage of Registration ID enhances the security features. Further, the discovery operations are also eased out by the usage of Protocol ID.

[53] While the embodiments of the present invention have been illustrated and described,

it will be clear that the present invention and its advantages are not limited to these embodiments only. Numerous modifications, changes, variations, substitutions and equivalents will be apparent to those skilled in the art without departing from the spirit and scope of the present invention as described in the claims.

Claims

[1] A method for handling operations associated with a plurality of applications in a Near Field Communication (NFC) device, the method at a NFC Controller (NFCC) comprising:
storing a source host identity (ID), a destination host ID and a link ID associated with each application from one or more applications; and
managing the one or more applications simultaneously based on the source host ID, the destination host ID and the link ID stored in the NFCC.

[2] The method of claim 1, wherein the one or more applications are stored in one or more hosts, wherein the one or more hosts is at least one of a Device Host (DH), a Secure Element (SE), and a non-secure element associated with the NFC device.

[3] The method of claim 1, wherein the link ID is a logical link ID associated with an application when a source host and a destination host is associated with the NFC device, wherein the source host is an entity that corresponds to the source host ID and the destination host is an entity that corresponds to the destination host ID.

[4] The method of claim 1, wherein the link ID is a predefined link ID when a source host interacts with a destination host over a NFC air interface, wherein the source host is an entity that corresponds to the source host ID and the destination host is an entity that corresponds to the destination host ID.

[5] The method of claim 1, wherein managing the one or more applications comprises creating a predefined dedicated link between the one of the one or more applications and the NFCC when the communication is within the NFC device, wherein the predefined dedicated link is used to transport at least one of a plurality of commands, a plurality of events and a plurality of data of the one or more applications.

[6] The method of claim 1 further comprising storing a registration ID associated with the one or more applications and managing the one or more applications simultaneously based on the source host ID, the destination host ID, the link ID and the registration ID.

[7] The method of claim 1 further comprising storing a protocol ID associated with the one or more applications and managing the one or more applications simultaneously based on the source host ID, the destination host ID, the link ID and the protocol ID.

[8] The method of claim 1 further comprising storing an application ID associated with the one or more applications and managing the one or more applications si-

multaneously based on the source host ID, the destination host ID, the link ID and the application ID.

[9] A method for handling operations associated with a plurality of applications in a Near Field Communication (NFC) device, the method at a NFC Controller (NFCC) comprising:

storing at least one of a source host identity (ID), a destination host ID, a link ID, an application ID, a registration ID and a protocol ID associated with each application from one or more applications; and

managing the one or more applications simultaneously based on the at least one of the source host ID, the destination host ID, the link ID, the application ID, the registration ID and the protocol ID stored in the NFCC.

[10] The method of claim 9, wherein managing the one or more applications comprises sending data frames from the NFC device to a second NFC device based on the at least one of the source host identity (ID), the destination host ID, the link ID, the application ID, the registration ID and the protocol ID stored in the NFCC.

[11] The method of claim 9, wherein managing the one or more applications comprises receiving data frames from a second NFC device and routing data frames in the NFC device based on the at least one of the source host identity (ID), the destination host ID, the link ID, the application ID, the registration ID and the protocol ID stored in the NFCC.

[12] A system for performing method described in one or more of the above claims.

[13] A Near Field Communication Controller (NFC) device comprising:

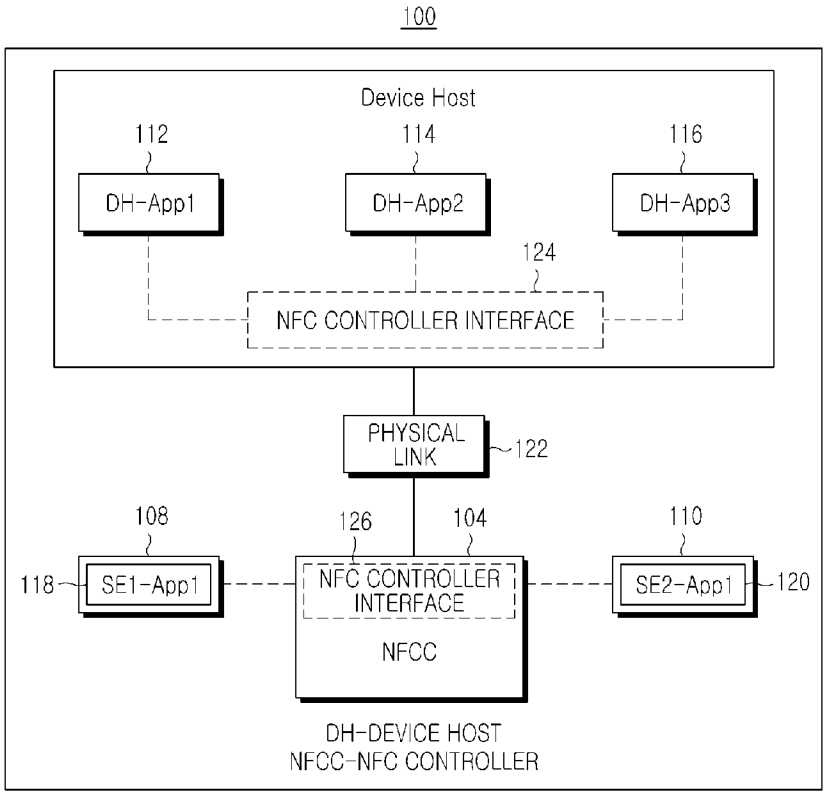
a memory to store a source host identity (ID), a destination host ID, a link ID, an application ID, a registration ID and a protocol ID associated with each application from one or more applications; and

a processor to manage the one or more applications simultaneously based on the source host identity (ID), the destination host ID, the link ID, the application ID, the registration ID and the protocol ID stored in the memory.

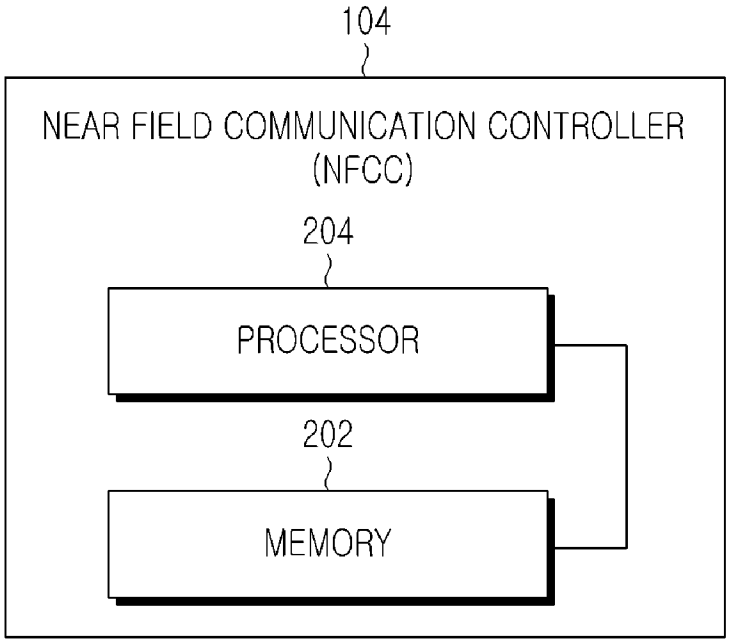
[14] A method for handling operations associated with a plurality of applications in a Near Field Communication (NFC) device as described and explained with reference to the drawings.

[15] A Near Field Communication (NFC) controller substantially described and explained with reference to the drawings.

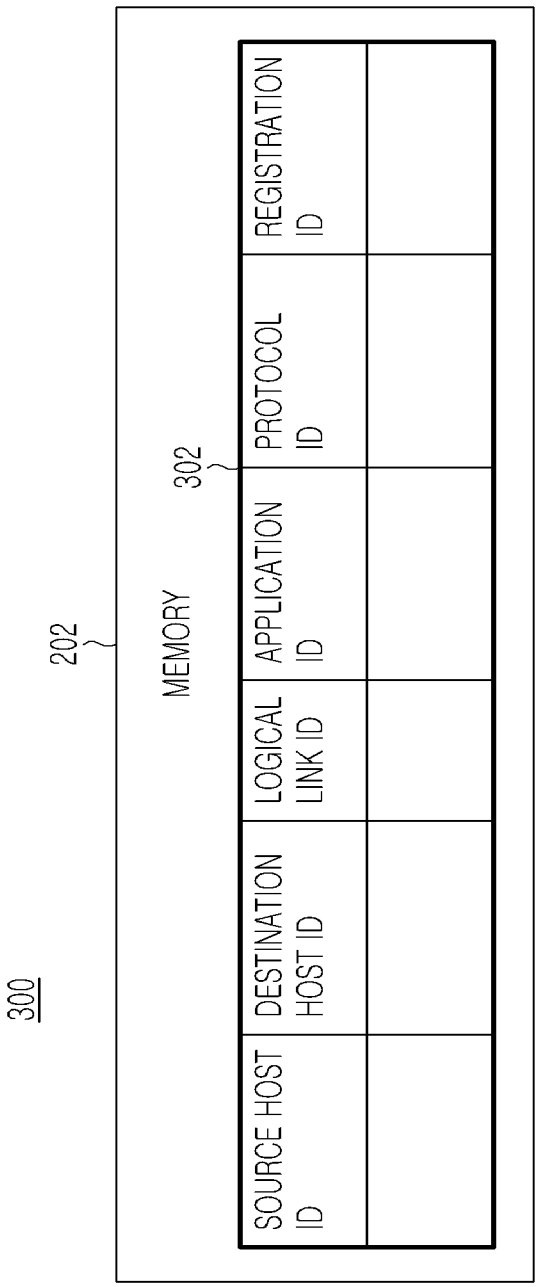
[Fig. 1]


100
Device Host
112
114
116
DH-App1
DH-App2
DH-App3
124
NFC CONTROLLER INTERFACE
PHYSICAL LINK
122
108
126
104
110
118
SE1-App1
NFC CONTROLLER INTERFACE
NFCC
SE2-App1
120
DH-DEVICE HOST
NFCC-NFC CONTROLLER

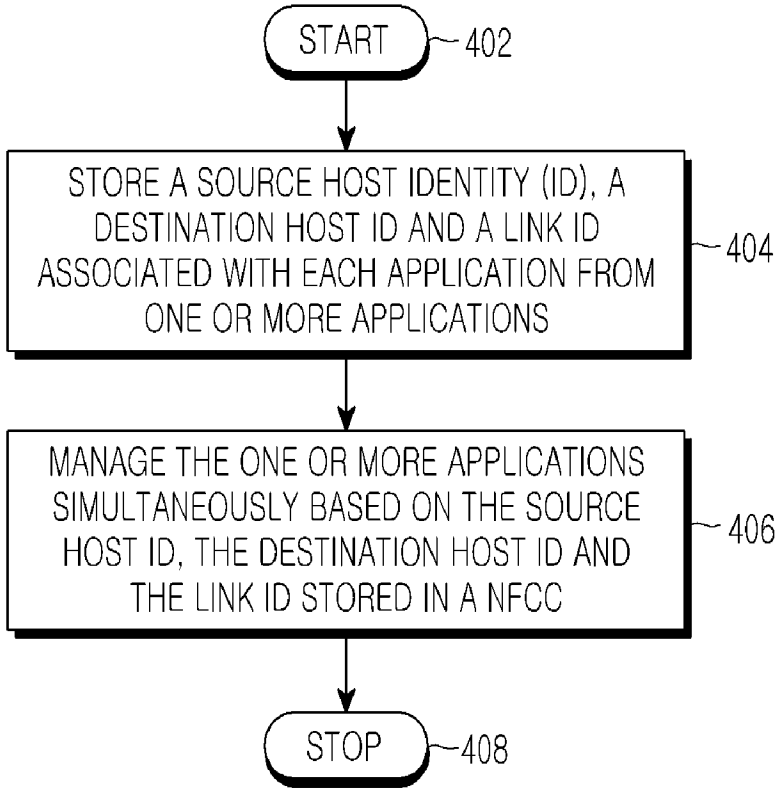
[Fig. 2]


104
NEAR FIELD COMMUNICATION CONTROLLER (NFCC)
204
PROCESSOR
202
MEMORY

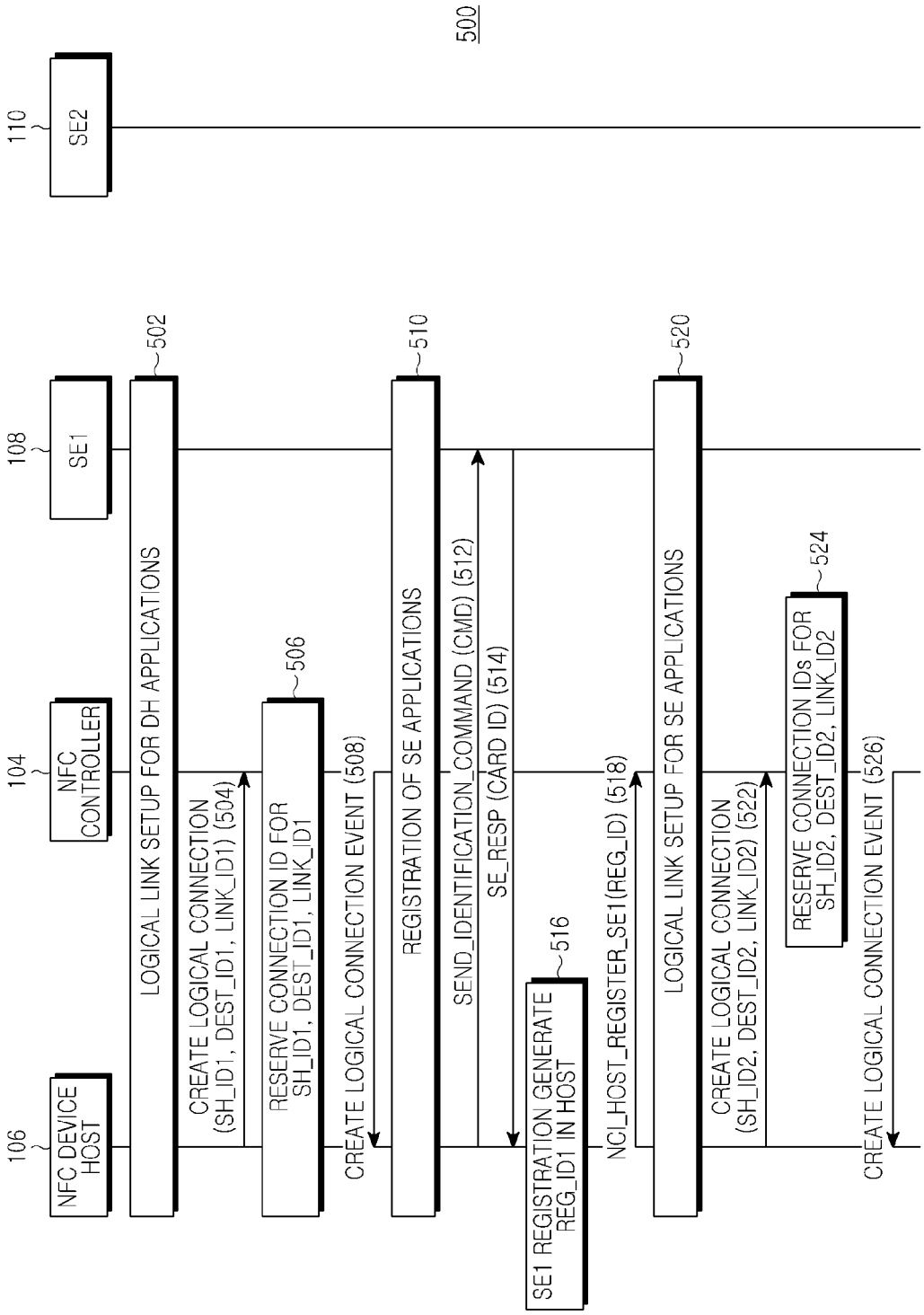
[Fig. 3]


300
202
MEMORY
302
SOURCE HOST ID
DESTINATION HOST ID
LOGICAL LINK ID
APPLICATION ID
PROTOCOL ID
REGISTRATION ID

[Fig. 4]


START
402
STORE A SOURCE HOST IDENTITY (ID), A DESTINATION HOST ID AND A LINK ID ASSOCIATED WITH EACH APPLICATION FROM ONE OR MORE APPLICATIONS
404
MANAGE THE ONE OR MORE APPLICATIONS SIMULTANEOUSLY BASED ON THE SOURCE HOST ID, THE DESTINATION HOST ID AND THE LINK ID STORED IN A NFCC
406
STOP
408

[Fig. 5]


500
110
SE2
108
SE1
104
NFC CONTROLLER
106
NFC DEVICE HOST
502
LOGICAL LINK SETUP FOR DH APPLICATIONS
CREATE LOGICAL CONNECTION (SH_ID1, DEST_ID1, LINK_ID1) (504)
506
RESERVE CONNECTION ID FOR SH_ID1, DEST_ID1, LINK_ID1
CREATE LOGICAL CONNECTION EVENT (508)
510
REGISTRATION OF SE APPLICATIONS
SEND_IDENTIFICATION_COMMAND (CMD) (512)
SE_RESP (CARD ID) (514)
516
SE1 REGISTRATION GENERATE REG_ID1 IN HOST
NCI_HOST_REGISTER_SE1(REG_ID) (518)
520
LOGICAL LINK SETUP FOR SE APPLICATIONS
CREATE LOGICAL CONNECTION (SH_ID2, DEST_ID2, LINK_ID2) (522)
524
RESERVE CONNECTION IDs FOR SH_ID2, DEST_ID2, LINK_ID2
CREATE LOGICAL CONNECTION EVENT (526)