TECHNICAL SPECIFICATION

ISO/IEC TS 22924

Identification cards — Transport layer topologies — Configuration for HCI/HCP interchange

Cartes d'identification — Topologies de la couche transport — Configuration pour les échanges HCI/HCP

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Contents

Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and security devices for personal identification*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national -committees.

Introduction

This document is laid on the ground of ISO/IEC 7816 (all parts) specifying integrated circuit cards and the use of such cards for interchange, and on ETSI TS 102 622 defining the HCI core that is an application independent logical interface.

ETSI TS 102 622 is referenced in this document as a well-known HCI specification, however it should be noted ETSI TS 102 622 describes another host network with the host controller implemented by the CLF/NFC controller and with hosts residing on UICCs/SEs all connected to the host controller. ETSI TS 102 622 allows for other interfaces than SWP for data link layer of HCI, and does not mandate using the SWP but just describes the condition if the SWP is used.

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Identification cards — Transport layer topologies — Configuration for HCI/HCP interchange

1 Scope

This document specifies the requirements for a protocol derived from HCI/HCP (see ETSI TS 102 622) enabling communication for devices regardless of data link and physical layers. This document covers the following:

a) outline of a system comprised of one or more hosts and one controller;

b) extension of connection topology between hosts and host controller (i.e. star topology and additional other topologies);

c) segregation between existing system using ETSI TS 102 613 and new system compliant to this document (this document refers ETSI TS 102 613, but does not change its specification and does not use RFU).

For ETSI TS 102 622, data link layer and physical layer like SWP specified in ETSI TS 102 613 is out of the scope.

Albeit questioned in this document, the duplication of OSI transport layer by e.g. enforcing encapsulation of HCP into T=1 or the reverse, is out of the scope.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 7816-3, *Identification cards — Integrated circuit cards — Part 3: Cards with contacts — Electrical interface and transmission protocols*

ISO/IEC 7816-4, *Identification cards — Integrated circuit cards — Part 4: Organization, security and commands for interchange*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
APDU gate
entry point to a service processing command APDU inside a *host* (3.6) or returning response APDU

3.2
APDU application gate
entry point to a service sending command APDU and retrieving correspondent response APDU

3.3
gate
entry point to a service that is operated inside a *host* (3.6)

[SOURCE: ETSI TS 102 622]

3.4
HCI network
star-topology network comprised of a *host network* (3.8) where *hosts* (3.6) are interconnected with a *host controller* (3.7) through HCI

3.5
HCP stack
layout comprised of a routing layer, a messaging layer and a collection of *gates* (3.3)

3.6
host
logical entity that operates one or more service(s)

[SOURCE: ETSI TS 102 622]

3.7
host controller
host (3.6) that is also responsible for managing a *host network* (3.8)

[SOURCE: ETSI TS 102 622]

3.8
host network
network of two or more *hosts* (3.6)

[SOURCE: ETSI TS 102 622]

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3.9
managing host
host (3.6) which is in charge of resolving conflicts and interoperability issues between different contactless applications provided by different hosts

[SOURCE: ETSI TS 102 622]

3.10
pipe
logical communication channel between two *gates* (3.3) from different *hosts* (3.6)

[SOURCE: ETSI TS 102 622]

3.11
terminal host
host (3.6) allocated a static identifier HID '01'

4   Symbols and abbreviated terms

ADM_x   arbitrary command for administration gate, see ETSI TS 102 622 clause 6.1, e.g. ADM_CRE-ATE_PIPE

APDU   application protocol data unit

API   application programming interface

ANY_x   arbitrary command for all gates, see ETSI TS 102 622 clause 6.1, e.g. ANY_OPEN_PIPE

CB   chaining bit

CLF   contactless front end

COS   card operating system

CPU   central processing unit

CRC   cyclic redundancy code

DF   dedicated file

EVT_x   arbitrary event, see ETSI TS 102 622 clause 6.3, e.g. EVT_HOT_PLUG

GID   gate identifier

HCI   host controller interface

HCP   host controller protocol

HID   host identifier

I^2C inter-integrated circuit

ICC   integrated circuit card

IFD   interface device

IRQ   interrupt request

LRC   longitudinal redundancy code

NAD   node address

NFC   near field communication

N(S)   send sequence number

OSI   Open System Interconnection

PCB   protocol control byte

PID   pipe identifier

PPS   protocol and parameter selection

RF   radio frequency

RFU   reserved for future use

SCL   smart secure platform common layer

SE   secure element

SS   SPI slave select wire

SSP   smart secure platform

SWP   single wired protocol

    3

TPDU   transmission protocol data unit

UART   universal asynchronous receiver and transmitter

UICC   Universal Integrated Circuit Card

USB   universal serial bus

eSE   (embedded) secure element

5   Architecture

5.1   System architecture view

5.1.1   General

This subclause describes the reference use case architecture where APDU gate fits. This architecture is based on a star topology where one or more hosts (e.g. secure element, ICC-managed device) physically connect to a component (e.g. IFD, device controller, contactless frontend) acting as a host controller. In this topology, the HCI defines the interface between hosts.
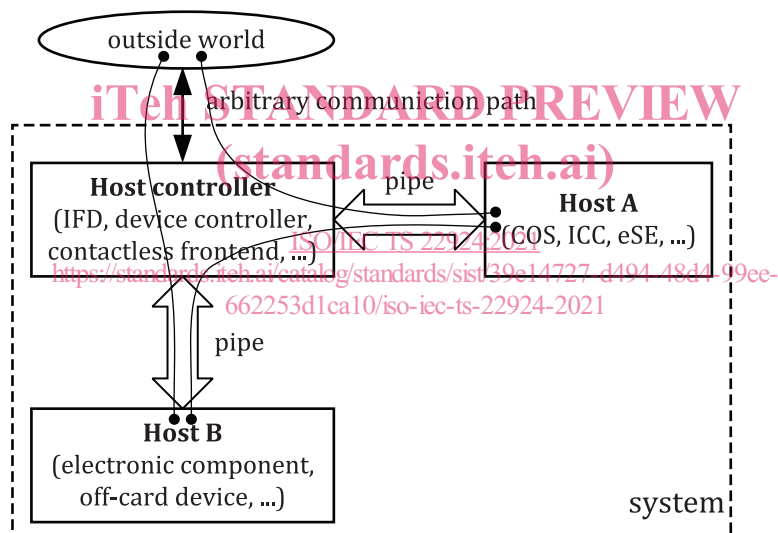

Figure 1 — System architecture for reference use case

ICC-managed devices may also make use of off-card devices (see ISO/IEC 18328-1 for use cases and ISO/IEC 18328-3:2016, Clause 7, for architecture description). The usage of ICC-managed off-card devices needs a communication with an ICC (or a secure element) through an IFD. The prerequisite for such communication is a COS or application which can handle additional devices and a host controller providing the suitable bi-directional communication means. Figure 1 describes this architecture.

NOTE   For simplification, drivers and interfaces are not represented on Figure 1.

The reference use case on Figure 1 is deployed on Figure 2 over a general HCP stack. The route conveying instructions over a pipe created between the two gates is represented.
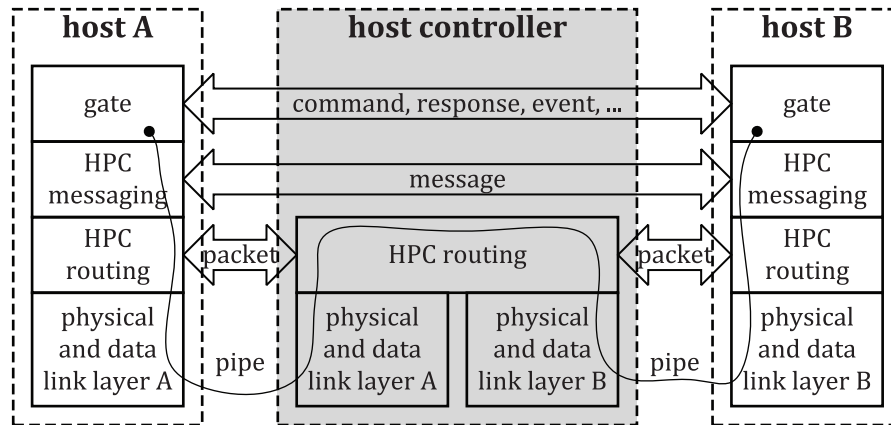
Figure 2 — HCI general stack representation

5.1.2 Hosts

This subclause contains a subset of information from ETSI TS 102 622 about hosts.

The identity of a host is coded in a byte named HID. Table 1 lists the reserved values for the HID.

Table 1 — Host identifiers

host	HID
host controller	'00'
terminal host	'01'
RFU	'02' to '7F'^a
dynamically allocated	'80' to 'BF'
proprietary	'C0' to 'FE'
not allowed	'FF'^b

[a]   In this table the value '02' is RFU whereas in ETSI TS 102 622 it is used for UICC host.

[b]   In this table the value 'FF' is not allowed whereas in ETSI TS 102 622 it is proprietary.

The generic term "host" is used to refer to any host (e.g. terminal host, UICC host) excluding the host controller.

The dynamically allocated range of values shall be used by the host controller to assign a HID to any host not identified in Table 1. The host controller shall always assign the same HID to a given host throughout different sessions as long as there is no modification in the hardware configuration of the device.

NOTE 1   In ETSI TS 102 622, there is no statement that a HID has to be unique.

NOTE 2   ETSI TS 102 622 does not describe how a host controller assigns an HID to a host.

5.1.3 Gates

This subclause contains a subset of information from ETSI TS 102 622 about gates.

A gate provides an entry point to a service that is operated inside a host. The HCP enables gates from different hosts to exchange messages. There are two types of gates:

— management gates that are needed for the management of the host network;

— generic gates that are not related to the management of the host network.

The type of a gate is identified by a GID. GIDs are listed in Table 2 and are either unique within the scope of a host ('10' to 'FF'), or their values refer to the same gate type for every host ('00' to '0F').

Table 2 — Gate identifiers

gate	GID
reserved for proprietary use	'00' to '03'
loop back gate	'04'
identity management gate	'05'
RFU	'06' to '0F'
host specific	'10' to 'EF'
reserved for proprietary use	'F0' to 'FF'

The GID for the application gates are dynamically assigned by the host running the application gate.

The following rules apply to hosts and gates.

a)   All hosts and the host controller shall have one administration gate.

b)   All hosts may have one link management gate and the host controller shall have one link management gate.

c)   All hosts and the host controller shall have one identity management gate.

d)   All hosts and the host controller shall have one loop back gate.

e)   All hosts and the host controller may have one or more generic gates.

5.1.4   Pipes

This subclause contains a subset of information from ETSI TS 102 622 about pipes.

A pipe is a logical communication channel between two gates. There are two types of pipes:

—   static pipes that are always available, i.e. they do not need to be created and cannot be deleted;

—   dynamic pipes that can be created and deleted.

The state of a pipe is either open or closed. The state shall remain persistent if the hosts are powered down and up again. It shall also remain persistent if a host is temporarily removed from the host network and is not replaced by a different device in the meantime. The state of a dynamic pipe after creation and the initial state of a static pipe shall be closed.

The PID is 7 bits long. The value of PID is used in the header of HCP packets as routing information (see B.6). For static pipes the PIDs are predefined with values as defined in Table 3. For dynamic pipes, PIDs are dynamically allocated by the host controller.

Table 3 — Pipe identifiers

PID	pipe ending at:	pipe type
'00'	link management gate	static
'01'	administration gate	
'02' to '6F'	other gate	dynamic
'70' to '7F'	RFU	

The following rules apply to gates and pipes.

a)   A static pipe always connects a gate of a host to a gate of the host controller.