

Mobile Thin Client (MTC); Architecture

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Mobile Thin client Computing (MTC).

Introduction

The present document is intended to define a technical framework of the mobile thin client system architecture. This includes basic building blocks, components detailed at different levels and appropriate interfaces between them.

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1 Scope

The present document presents the architecture for a mobile thin client system, consistent with the requirements articulated in the work item "Mobile thin client system requirements" of the MTC ISG. The deliverable first describes a high-level architecture, in order to position the approach taken, and subsequently details the functional architecture at three different levels. Components and their interactions are identified, together with their interfaces. Non-normative scenarios indicating a possible implementation of the required functionality, are included as annex to the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] ETSI MTC 008: " Mobile Thin Client (MTC); Use Cases and Requirements".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Service Management Framework (SMF): to manage the thin client service, a whole range of management components are required (such as authentication and authorization, network management, business management, session management, server management, monitoring, etc.). The collection of these management components is called the Service Management Framework (SMF). It should be noted that for scalability and efficiency reasons, the components of the SMF will be distributed. Some of the management components will run on the client, some on the server hosting the thin client session and some on dedicated management servers

thin client protocol: is responsible for delivering user input (such as keystrokes, mouse events but also data from for example webcams, etc.) to the server and sending audiovisual output from the server to the client

thin client service: is a service offering remote execution of applications. While the application logic is actually running on a remote server, output is transmitted to the terminal the user interacts with. Likewise, the user input is captured at the terminal, and transmitted to the remote server for proper handling. This basic service can be supplemented with additional functionalities, such as authentication, remote data storage and management, automatic application installation, etc.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ADS	Application Delivery Service
DSS	Data Storage Service
E2E	End to End
E2EAUTHN	End to End authentication
E2EAUTHZ	End to End authorization
E2ECONN	End to End connection
E2ELOGISTICS	End to End logistics
ENV	ENVironment
ESS	Entity Subscription Service
I	Interface
MTC	Mobile Thin Client (implementing the client part of the service)
MTH	Mobile client Hosting environment
MTS	Mobile Thin Server (implementing the server part of the service)
NET	NETwork
NETC	NETwork Control
QOS	Quality of Service
SDM	Self Data Manager
SLM	Self Logistics Manager
SMF	Service Management Framework
TCS	Thin Client Service
TCSC	Thin client service core
TCSCC	Thin client service core core (i.e. the core of the TCSC)

4 High-level architecture

4.1 Overview

In Figure 1, the high-level software architecture is illustrated. Six basic building blocks can be distinguished: the Mobile Thin Client, the Mobile Thin Server, the Service Management Framework, the Network Control, the Data Storage Service and the Application Delivery Service.

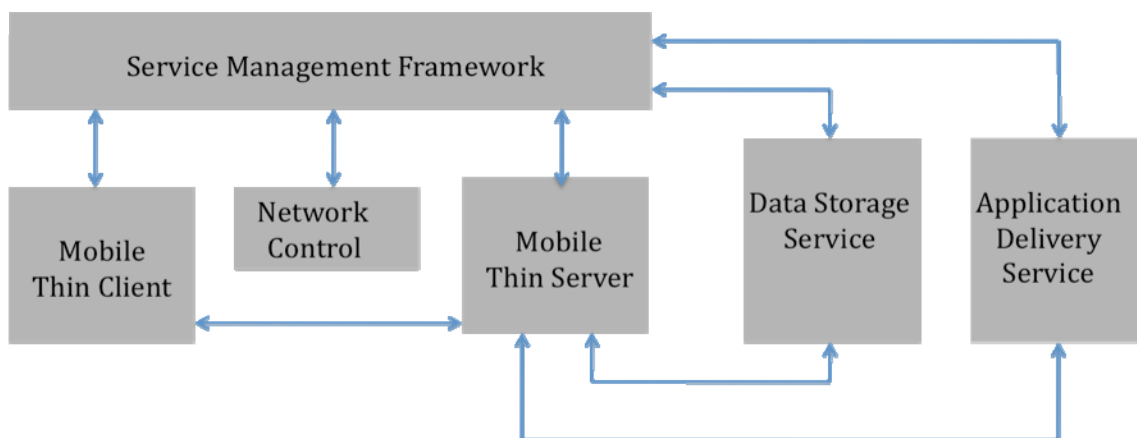


Figure 1: High-level software architecture

In Figure 1, only one client (i.e. Mobile Thin Client) and one server (i.e. Mobile Thin Server) are visualized. The multi-user aspect of the architecture is shown in Figure 2. Multiple clients can be connected to the same physical Thin Client Server running a separate User Session for each connected user. To monitor and manage the Thin Client Server, a part of the Service Management Framework (i.e. the Thin Client Server Management component) is installed at every Thin Client Server. The Mobile Thin Server runs on top of the Thin Client Server Operating System.

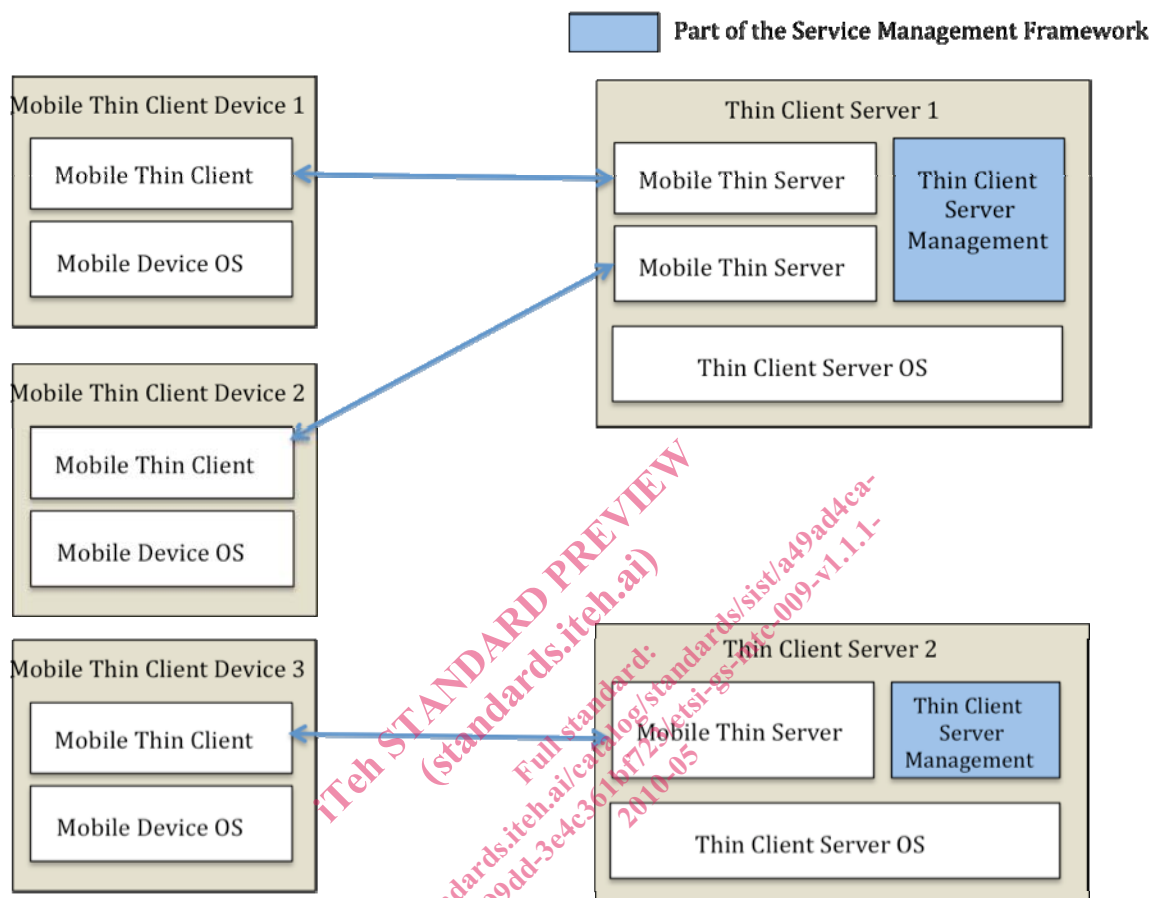


Figure 2: Multi-user aspect of the system Architecture

4.2 Basic Building Blocks

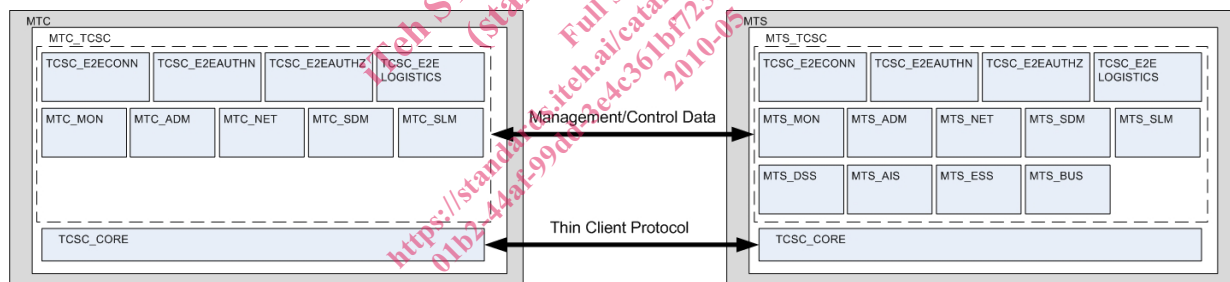
From a high-level perspective, the functionality of the 6 basic blocks is summarized Table 1. In clause 5, an exhaustive description of the functionality of all basic blocks will be discussed.

Table 1: Basic building blocks of architecture

Basic Building Block	Description
Mobile Thin Client	This is the software running on the mobile client device. When a user wants to start the thin client service, he starts this client on his thin client device.
Service Management Framework (SMF)	When a user logs in, he has to identify himself to the SMF, which is responsible for managing the complete thin client service and guaranteeing the desired QoS to the users. The components of the SMF are distributed over the different building blocks.
Mobile Thin Server	This is the software running on the Thin Client Server selected by the SMF. All applications of the users are executed in their Mobile Thin Server. Audiovisual output from a user's applications is transported over the network to the user's device. Input from the user is transported in the opposite direction.
Network Control	This is the service of the network operator. The SMF will interact with the Network Control block to set the appropriate QoS classes for the traffic between the Mobile Thin Client and the Mobile Thin Server.
Data Storage Service	This service maintains the personal data of the users.
Application Delivery Service	For scalability reasons (not every application should be installed in every Mobile Thin Server), applications are delivered by an application delivery service to the Mobile Thin Server.

4.3 Philosophy of the architecture

A first introduction of the system architecture is shown in Figure 3. Details on the functional aspects of the system architecture will be given in clause 5. Two major components can be distinguished: the Mobile Thin Client (MTC) and the Mobile Thin Server (MTS). Both entities communicate with each other over the network and exchange thin client protocol messages and management data. The architecture is quite symmetric, with some additional components on the MTS side to support specific services (e.g. data storage service).

**Figure 3: Overview of the System Architecture**

A short description of the components of Figure 3 is given in Table 2. Note that the functionality or implementation might differ between the MTC and MTS side. This rather high-level description can help the reader to understand the composition of the overall system architecture.

Table 2: Components of the System Architecture

TCSC_E2ECONN	Starts a connection between MTC and MTS, and thus acts as a portal to the system.
TCSC_E2EAUTHN	Authentication of MTS and MTC.
TCSC_E2EAUTHZ	Authorization of MTS and MTC.
TCSC_E2ELOGISTICS	Negotiates session settings, reserves resources, ...
MTS_MON	Monitors the state of the MTS.
MTS_ADM	Handles administration tasks.
MTS_NET	(De)packetizes data, sends and receives network packets (general network functionality), including network control functionality.
MTS_SDM	Contains data about the system, and provides a means for interacting with it.
MTS_SLM	Handles self management tasks such as resilience.
MTS_DSS	Endpoint to deal with data storage service.
MTS_ADS	Handles application delivery from application delivery service.
MTS_ESS	Handles access to the entity subscription service.
MTS_BUS	Provides required information for external business systems.
TCSCC	Handles the core communication between MTC and MTS. This basically means the thin client protocol communication, functionally equivalent to e.g. VNC, RDP, NX, ...

5 Functional Architecture

5.1 General Overview

As already stated in the requirement document [1], the mobile thin client service as an entity would operate within the following three main environments:

The **Terminal Device environment** is composed of the terminal hardware and software. This is the environment where the Mobile Thin Client will operate.

The **Hosting environment** is the environment, where the Mobile Thin Server will operate. This environment is supposed to provide components that are not included in the system scope but that are necessary for the Mobile Thin Server to communicate with the external world. For instance, components needed for configuring routers are not in the scope of the system. Another example is that the service should provide billing data to external billing systems but should not include a billing system. So if a billing system is needed it should be considered as part of the environment of the system.

Network environment is the pipe that links the two previous environments. This environment is composed of one or many networks. This environment is taken into account because the Mobile Thin Client and Server will need to interact with it, for instance to ask for specific network QoS support. A goal of the service is to allow end-to-end network adaptation in order to provide the best possible end user experience combined with the best possible energy economy.

5.2 Elaboration of the architecture

5.2.1 Introduction to the Architecture

To elaborate on the architecture, we proceed using an approach that will consist of:

- Elaborating the top level (level 0) architecture layer.
- Recursively building detailed layers (level 1 up to level 3): to achieve this, each functional block in a previous layer will be split into deeper sub-blocks, according to the sub-functionality they provide. This will be done only when it is appropriate. For instance, at some level, some blocks will not need to be more detailed, so they will appear in a layer as they are in less detailed layer.

In the present document, the top level layer will be considered as the layer level zero. The immediately underlying layer will be considered as the layer level one, etc.

5.2.2 Top level architecture description (level 0)

For the sake of simplicity, the architecture is conceived as a traditional client server architecture where the client is a piece of software running in its own environment and the server is also a piece of software running in its environment. The two pieces communicate with each other through the network. This is illustrated in Figure 4.

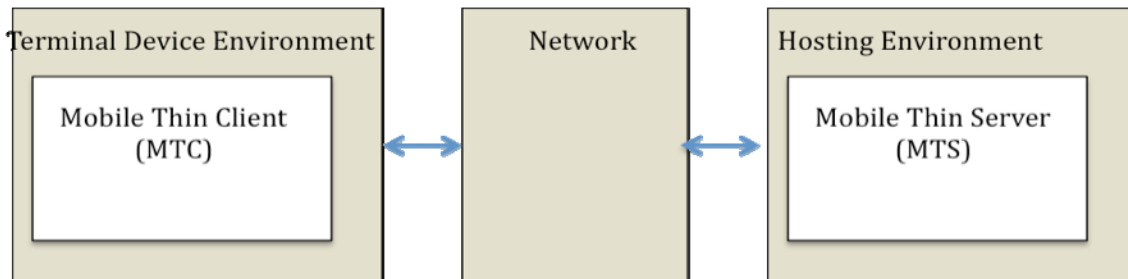


Figure 4: Top Level Architecture

5.2.2.1 Network considerations

As far as the network is concerned, the Mobile Thin Client and the Mobile Thin Server will provide two high level types of data:

- Control Data: the destination of this data is the network itself, meant to be interpreted by the network.
- End-to-end data: for this type of data, the network will transmit the data unmodified between the two end points.

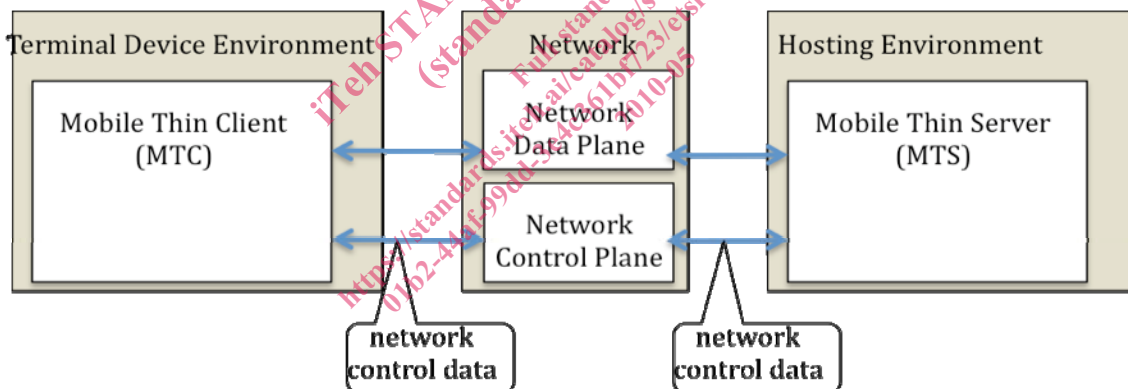


Figure 5: Types of data

For network control data, it is the responsibility of the network to provide the needed interfaces for the system to be able to set the adequate parameters. The Mobile Thin Client and Mobile Thin Server will include components that will ensure providing data for network control.

According to Figure 5, two interface categories are expected to be provided by the network:

- The interface needed for end-to-end communication: this interface will be named I_NET_E2E.
- The interface needed for network control: this interface will be named I_NET_NETC.