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Group Specification

Mobile Thin Client (MTC); Use Cases and Requirements

Reference
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Keywords

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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 defines a set of consistent and complete requirements for a future mobile thin client system. An important consideration is that the mobile thin client system should work with the current available Internet and wireless communication network infrastructure (including the access network, the aggregation network and the core network). Requirements with respect to this network partitions are defined. Besides the network itself, additional infrastructural components are important for the mobile thin client system. Their function and the rationale for constructing the system out of these building blocks are described in the deliverable and requirements of the components themselves are defined. Namely those basic building blocks are the thin client server, the application image server, the data storage server, the thin client mobile device and the service management framework. The defined requirements are categorised into mandatory and optional.

The present document is a requirement document only, and does not describe technical solutions.

Motivated by the fact that the issues of security, detailed AAA implementation, seamless handover and the optimization of external resources (like application image server or data storage server) are amply addressed in other standardisation effort; the present document does not address these issues.

1 Scope

The present document is intended to define a set of consistent and complete requirements. Nevertheless, during the ongoing discussion, new requirements can come up. Hence, from the start on, the requirements (as well as the initial architecture) are intended to be relevant and adequate for future mobile thin client systems, while exhibiting the necessary flexibility to cope with new requirements.

The basic idea considered in mobile thin client system concerns nomadic users and addresses remote application access. User terminals considered range from laptops to smart phones, and applications should be delivered transparently (i.e. without changing the application code itself). This basic setting is further developed in the present document into more specific scenarios.

The following issues are excluded from the present document:

- Security;
- detailed implementations of AAA including billing mechanism;
- seamless handover;
- optimization of external resources, like application image server or data storage server.

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.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

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

[1] DGS MTC 009: "Mobile Thin Client (MTC); Architecture".

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.

[i.1] Niraj Tolia, David G. Andersen, M. Satyanarayanan "Quantifying Interactive User Experience on Thin Clients", IEEE Computer, Volume 39 - 3, pages 46-52, March 2006.

[i.2] Niraj Tolia, David G. Andersen, M. Satyanarayanan: "The Seductive Appeal of Thin Clients", February 2005.

[i.3] Pantel, L.: "On The Impact of Delay on Real-Time Multiplayer Games. International Workshop on Network and Operating System Support for Digital Audio and Video", 2002.

[i.4] Dick, M.: "Analysis of Factors Affecting Players" Performance and Perception in Multiplayer Games", Proceedings of 4th ACM SIGCOMM workshop on Network and system support for games, 2005.

[i.5] Deboosere, L., De Wachter, J., Simoens, P., De Turck, F., Dhoedt, B., and Demeester, P.: "Thin Client Computing Solutions in Low- and High-Motion Scenarios", in Proceedings of the Third international Conference on Networking and Services (June 19 - 25, 2007). ICNS. IEEE Computer Society, Washington, DC, 38.

[i.6] ITU Recommendation Y.1541 (February 2006): "Network performance objectives for IP-based services".

[i.7] "VirtualGL - Background" [online].

[i.8] A.F. Wattimena, et al.: "Predicting the perceived quality of a First Person Shooter: the Quake IV-model", 5th Workshop on Network & System Support for Games, Netgames 2006.

[i.9] C. Gutwin: 'The Effects of Network Delays on Group Work in Real-Time Groupware', Proc. 7th European Conf. Computer-Supported Cooperative Workshop, Kluwer, 2001, pp. 299-318.

3 Definitions and abbreviations

3.1 Definitions

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

application image server (see note 2): repository for application images

NOTE 1: When a thin client server does not have a certain application installed locally, it gets it from an application server. This server does not run the applications but contains binary images and distributes these to thin client servers. However, the application image servers are external resources and not covered by the responsibility of the mobile thin client management framework.

NOTE 2: Distributed applications are supported as well. The client part is then transmitted to the thin client server when necessary. The thin client server runs the client part of the application and the server part would run on the original application server for that application.

application streaming: technology that virtualizes an application and splits it into blocks of executable code

NOTE: Only the required blocks of executable code are streamed from an application server to a client. This allows saving both disk space and time when executing a new application.

data storage server: repository for data a user uses (not for data about a user)

NOTE: Since the clients are to be thin, data storage is shifted into the network. This data will be accessed during mobile thin client sessions, or can be accessed independently: without the thin client provider. However, the application image servers are external resources and not covered by the responsibility of the mobile thin client management framework.

interaction delay or latency: in the present document, time between the generation of a user event (e.g. keystroke, pointer movement) and the resulting update, including presentation on the screen

NOTE: A substantial body of knowledge about the impact of interactive response times on user satisfaction and task productivity has been built up (see [i.1] and [i.2]). More information on delay can be found in Annex C of the present document.

mobile thin client session: dialogue or conversation between two or more entities

NOTE: Entities might be devices, software services or users. A session starts at a certain time, and ends at a later time. In terms of behavior, a session may be:

- a stateless session, meaning that the conversation consists of independent requests with responses.
- a stateful session, meaning that at least one of the end point parts should save information about the session history.

Regarding the OSI model, a session might be implemented as part of protocols and services at different layers:

- at the application layer, e.g. an interactive web session, a telnet remote login session.
- at the session layer, e.g. a Session Initiation Protocol (SIP) (Internet based phone calls).
- at the transport layer, e.g. a TCP connection or an established TCP socket.

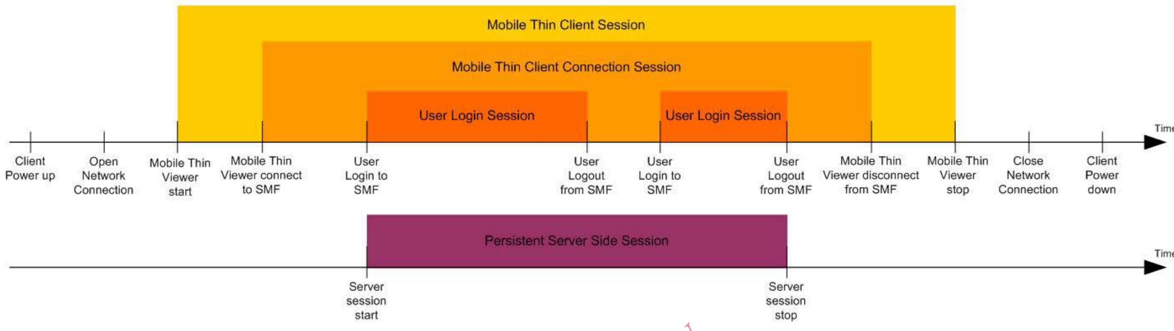


Figure 1: Visualisation of different definitions of "session" terms

packet delay: the delay a packet may experience on its transfer through the network

NOTE: This metric is particularly relevant for thin client environments, as every user input must be first transferred to the server before it can be processed. The packet delay has a huge impact on the user experience [i.6].

packet delay variation (jitter): the upper bound on the 1 - 103 quantile of the packet delay minus the minimum packet delay [i.6]

packet loss ratio: the upper bound on the packet loss probability

NOTE: In a thin client environment, packet losses might cause visual degradations or the loss of user events, leading to an unresponsive user interface [i.6].

session migration: situation or context when a given session shifts from one serve to another server

session mobility: situation or context when a given session shifts on a seamless way from device to device

throughput: the mean bit rate, averaged over some time interval, observed at the application level [i.6]

3.2 Abbreviations

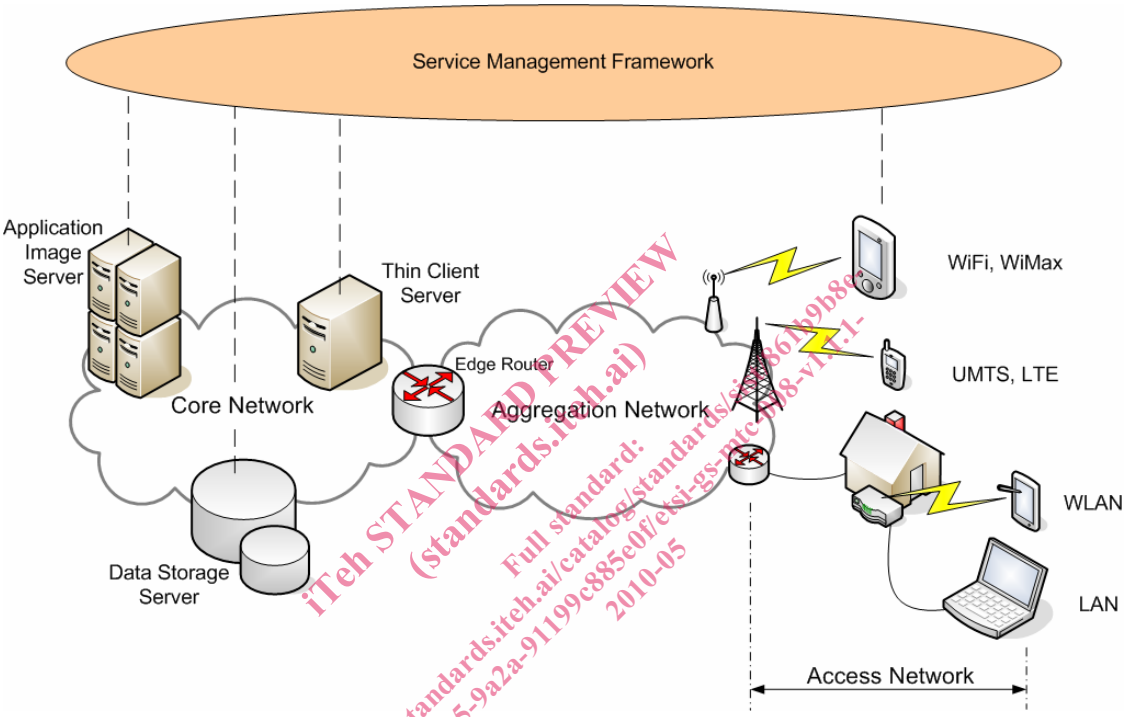
For the purposes of the present document, the following abbreviations apply:

AAA	Authentication, Authorization and Accounting
BER	Block Error Ratio
E2E	End to End
GPS	Global Positioning System
LTE	Long Term Evolution
MIBS	Management Iinformation Base
MTC	Mobil Thin Client
MTS	Mobil Thin Server
RDP	Remote Desktop Protocol
RFB	Remote Frame Buffer
SMF	Service Management Framework
SNMP	Simple Network Management Protocol

TC	Thin Client
TCS	Thin Client Service
UMTS	Universal Mobile Telecommunications System
VNC	Virtual Network Computing

4 System overview

The purpose of this clause is to provide a rough description of each component of the system in order to make the requirements comprehensive. This clause does not address a complete description of the system architecture. The system architecture will be treated in DGS MTC 009: "Mobile Thin Client (MTC), Architecture" [1].



NOTE: This figure only shows an example of a network configuration but is not intended to suggest allocation of infrastructure. There could be more than one instance of all types and some could be aggregated into the same physical machine or spread over multiple machines.

Figure 2: Network configuration

The Mobile Thin Client solution should work with the current available internet and wireless communication network infrastructure. This network basically consists of three main parts: the access network, the aggregation network and the core network. The thin client architecture uses this division as a basis too, as shown in Figure 2. The components shown are briefly explained below:

1) Core Network: the central part of the network, supporting high bandwidths. It is built and controlled for fast and efficient switching of data streams.

2) Access Network: the part of the network between client and base station

3) Aggregation Network: the network between base station and edge router, interconnecting the access network and the core network. It is an inter-working architecture bundling traffic of different users and handling the mobility of devices as they move from on access network to another. The aggregation network is potentially managed by another organization than the one of the core network. The aggregation network may also include roaming network infrastructures. Multiple aggregation networks exist simultaneously.

Besides the network itself, Figure 2 presents the infrastructural components that constitute the mobile thin client system. Their function and the rationale for constructing the system out of these building blocks are described in this clause, other sections in this clause elaborate on the requirements of the components themselves.

1) Thin client server: It is a physical machine that runs the applications of the user session. It receives user input and returns graphical output.

2) Application image server (see note 1): a repository for application images. When a thin client server does not have a certain application installed locally, it gets it from an application server. This server does not run the applications but contains them and distributes them to thin client servers.

NOTE 1: Distributed applications are supported as well. The client part is then transmitted to the thin client server when necessary. The thin client server runs the client part of the application and the server part would run on the original application server for that application.

3) Data storage server: a repository for data a user uses (not for data about a user). Since the clients are to be thin, data storage is shifted into the network. This data will be accessed during mobile thin client sessions, or can be accessed independently: without the thin client provider.

4) Thin client device: the mobile device through which users consume the thin client services.

5) Service management framework: this framework manages the network and the services. When a user logs in to consume thin client services, the framework searches an appropriate thin client server to connect to. Some functions of the service management framework are resource management, application management, load balancing, resilience, session management and business support such as billing and logging. The framework also provides hooks for security mechanisms. An important aspect that is also covered by the service management framework is Authentication, Authorization and Accounting (AAA).

NOTE 2: The application provider, data storage provider and thin client provider may be separate network elements as this is likely to improve manageability. The possibility exists, however, that these functions are merged in a practical setting. Also: multiple instances of these components could exist for scalability.

A small step-by-step example might provide better insight into the functions of the presented components:

- A user turns on his mobile thin client device. Access to the Internet is acquired. The user starts the thin client environment, which connects to the service management framework over the network.

- The service management framework checks the credentials of the user. If they are correct, the framework connects the thin client device to a well chosen thin client server (well chosen for load balancing, short network path, subscription information, etc.). Setting up this connection happens through the network provider.

- In the thin client environment, the user starts an application. If this application is already installed at the thin client server, it is simply started on that server machine. Otherwise, the thin client server connects to the service management framework to be connected through to an application image server. The desired application is transferred from the application image server to the thin client server, where it gets installed and executed.

- The user input is sent over the network to this thin client server, which executes the application and handles the user input, and eventually returns the graphical output.

- The user stores the documents that have been generated by thin client applications. Therefore, the thin client server requests a connection to a data storage server from the service management framework. The user documents get stored in his personal space reserved on the data storage server.

- The user shuts down the thin client environment (running on the mobile device). This causes a trigger to the service management framework to close the user session on the thin client server. As a final step the network connections between the user and the thin client server and service management framework are closed.