



**Universal Mobile Telecommunications System (UMTS);  
LTE;  
Study on IMS based peer-to-peer content distribution services  
(3GPP TR 22.906 version 15.0.0 Release 15)**

*iTech STANDARD REVIEW  
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Full standards catalog: https://standards.iteh.ai/catalog/standards/sist/15.0.0-2019-07  
https://standards.iteh.ai/catalog/standards/sist/15.0.0-2019-07  
4c12-a0fe-801116794db/etsi-tr-122-906-v15.0.0-2019-07*



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**Reference**RTR/TSGS-0122906vf00

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**Keywords**LTE,UMTS

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**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

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Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
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# Foreword

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# Introduction

The development of fixed and mobile broadband technologies (e.g. G/E-PON allows about 100Mbps downlink and 100Mbps uplink, LTE allows the possibility of the speed up to 100Mbps downlink and 50 Mbps uplink) and more and more powerful mobile handsets have boosted popular usage of content distribution services (e.g. Live streaming and Content on Demand) on mobile handsets.

With the explosive growth of media content consumption, the number of media servers to provide streaming services is required to be increased almost linearly with the number of users. In addition, centralized streaming media servers require considerable demands towards the bandwidth of the backbone IP network. So it's required to deploy more and more edge servers close to UEs to guarantee service quality with the increasing number of users.

Peer-to-peer technology can be used between edge servers and UEs to relieve the above problem. Not only the edge servers handle the requests from its locally served UEs, but also they can handle the requests transferred from the neighbouring edge servers. Similarly, if the UE's capabilities permit, the UE can offer spare uplink bandwidth and storage space while obtaining data, and uploads data to other requested destinations. Content is transmitted in a segmented manner, and most of the traffic can be spread across the edge of the network, which helps reduce the storage and bandwidth demands of centralized servers. So the system capability is improved along with the increasing number of edge servers and UEs.

IMS, proposed by 3GPP, is viewed as a fixed and mobile convergence core network to provide multimedia services, and defines an infrastructure for user authentication, registration, service discovery, and multimedia session control and etc. So this Technical Report is aimed to study content distribution services in a Peer-to-Peer manner based on IMS from SA1's perspective and it is expected to identify the use cases and potential service requirements.

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# 1 Scope

This Technical Report presents the overview, use cases and other aspects (e.g. Mobility, Charging, Security and etc.) of IMS based Peer-to-Peer Content Distribution Services. And the potential service requirements will be identified. The objectives are to study IMS based content distribution services with the following aspects:

- Identifying the user cases to describe how users, operators and service providers will may benefit by using/deploying IMS based content distribution services in fixed and mobile convergence networks with Peer-to-Peer technology;
- Identifying service aspects where IMS network improvements are needed to cater for content distributed services for above accesses;
- Identifying mobility, charging and security related requirements in the case of content distribution services on IMS;
- Identifying potential copyright issues;

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
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- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 22.101: "Service Aspects; Service Principles".
- [3] 3GPP TS 22.105: "Services and Service Capabilities".
- [4] 3GPP TS 22.233: "Transparent end-to-end packet-switched streaming service; Stage 1".
- [5] 3GPP TS 22.246: "Multimedia Broadcast/Multicast Service (MBMS) user services; Stage 1".
- [6] 3GPP TS 22.115: "Service aspects; Charging and billing".
- [7] 3GPP TS 22.220: "Service requirements for Home NodeBs and Home eNodeBs".
- [8] 3GPP TS 21.201: "Technical Specifications and Technical Reports relating to an Evolved Packet System (EPS) based 3GPP system".
- [9] Open IPTV Forum release 2: "Functional Architecture".  
[http://www.openiptvforum.org/docs/OIPF-Functional\\_Architecture\\_v2\\_0-2009-09-08.pdf](http://www.openiptvforum.org/docs/OIPF-Functional_Architecture_v2_0-2009-09-08.pdf)
- [10] ETSI TS 182 019 release 3: "TISPAN - Content Delivery Network (CDN) architecture".
- [11] Draft ETSI RTS 182 027 release 3: "TISPAN - IPTV Architecture, IPTV functions supported by the IMS subsystem".
- [12] Draft ETSI TR 182 010: "Peer-to-peer for content delivery for IPTV services, analysis of mechanisms and NGN impacts".

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [x] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [x].

**Peer-to-Peer:** A concept related to A distributed network architecture composed of participants that make a portion of their resources (such as processing power, disk/cache storage or network bandwidth) directly available to other network participants.

**Peers:** The entities (e.g. UE, network entity) of both suppliers and consumers of resources, in contrast to the traditional client-server model where only servers supply, and clients consume.

**User Peer:** The UE type of participants in the Peer-to-Peer network both providing services to other participants and requesting services from other participants, e.g. PC terminals.

**Network Peer:** The participants in the Peer-to-Peer network deployed and controlled by operators/service providers both providing services to other participants (e.g. User Peer or Network Peer) and requesting services from other participants, e.g. the cache server deployed by operators/service providers.

**Content Source Server:** An entity, which stores the source content and provisions interface for other entities to fetch content.

**Content Cache Server:** An entity, which caches partial/entire source content to be distributed to end users. The data on Content Cache Server is obtained from the Content Source Server or other Content Cache Servers via pre-distribution of the source content or upon users' request. The Content Cache Servers usually are deployed at the edge of the network to accelerate content distribution.

**Content Control Server:** An entity, which performs the management of content indexing and control content distribution (e.g. how the source content is distributed from the Content Source Server to the Content Cache Servers).

### 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [x] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [x].

P2P	Peer-to-Peer
CDS	Content Distribution Service
CoD	Content on Demand
CDN	Content Delivery Network
G-PON	Gigabit Passive Optical Network
E-PON	Ethernet Passive Optical Network
WLAN	Wireless Local Area Network
H(e)NB	Home NodeB and Home eNodeB

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## 4 General Description

### 4.1 Overview

The following figure explains the network elements involved in IMS based Peer-to-Peer Content Distribution service and how they interact with each other.

IMS UEs initiate the content distribution service via fixed or mobile access network to IMS CN Subsystem. IMS UE will be redirected to the portal, which offers content indexing, browsing and searching functionalities. The content is

usually stored on content source servers (e.g. Network entities or UEs) and content cache servers are deployed close to the users to accelerate content distribution.

User profile is stored in IMS and the terminal capabilities (e.g. processing capabilities, screen size) are stored in Peer-to-Peer application service, when available. After IMS UEs request content distribution services, User Profile will provide the P2P application service with the user's preferences and terminal capabilities will be used to decide whether or not the client is capable of receiving the requested content. Content control is used to control how the content is distributed in the network and where IMS UEs can get the requested content.

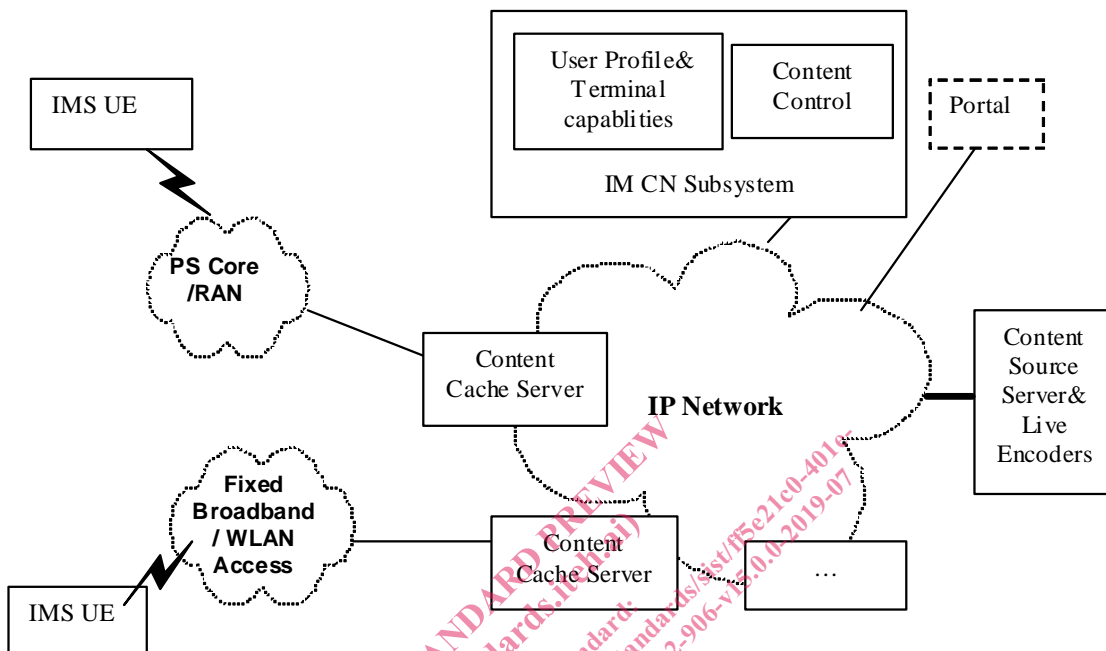


Figure 4.1 Overview of IMS based Peer-to-Peer Content Distribution System

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## 5 Use Cases

### 5.1 Content-on-Demand Service for Large numbers of Online Users

#### 5.1.1 Service Description

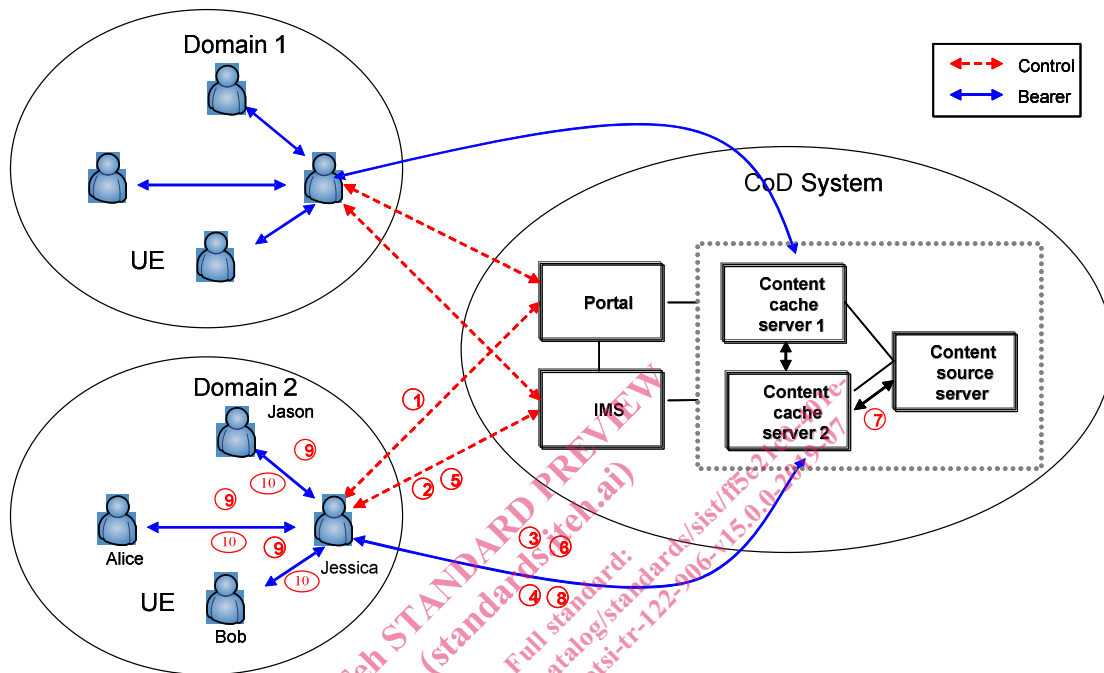


Figure 5.1 CoD for large numbers of online users

Jessica is an IMS subscriber of operator A, and she wants to view the popular movie "Transformer", but for some reason she doesn't want to watch it in cinema. She notices from a pushed advertisement on her IMS client that *IMS online movie theatre* can provide "Transformer" on demand with a discounted price. So she decides to watch it from online movie theatre.

(1) Jessica starts her IMS P2P application client and begins IMS registration process. After Jessica finishes her registration, the IMS P2P application (e.g. a Portal) delivers the program information to the P2P client. Jessica searches and selects the "Transformer" in the program list of the Portal to tell the P2P application that "I want to watch Transformer";

(2) After receiving Jessica's request, the P2P application queries the locations of film storage resources of "Transformer", and then sends back the list of resource locations to Jessica. At the beginning the content cache server 2 has some initial parts of "Transformer" (e.g. Part 1 and 2) and the content source server has all parts of it. So the P2P application tells Jessica "the content cache server 2 has "Transformer", you may download from it";

Note: "Transformer" is segmented into 10 parts beforehand(named in order as Part 1, Part 2, Part 3 and so on). Only part 1 and part 2 of "Transformer" are downloaded to the cache server 1 since they are the most frequently viewed parts. And then the cache server 2 can obtain part 1 and part 2 from the cache server 1 rather than the content source server.

(3) Jessica's UE asks the content cache server 2 "Which parts of "Transformer" do you have? Can I download them?";

(4) Upon receiving "yes", Jessica's UE downloads the first two parts of "Transformer" from the content cache server 2 and begins to watch "Transformer" and the rest of parts of "Transformer" will be retrieved from the content source server.

(5) Jessica's UE updates the information (e.g. which parts Jessica currently have) to the P2P application service and retrieves the latest information of where the "Transformer" parts are distributed from the P2P application service periodically, e.g. every 2 minutes;