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Technical Report

3rd Generation Partnership Project;

Technical Specification Group Services and System Aspects;

Study on Enhancement of LTE for Efficient delivery of Streaming Service;

Stage 1

(Release 16)

** 

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# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

x the first digit:

1 presented to TSG for information;

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document describes the use cases and provides gap analysis for identifying potential requirements for optimization of both Over-The-Top and operator managed streaming service considering new business models and existing well-known technologies e.g. caching (UE caching, in-network caching, internet CDN caching), content-aware service delivery, hybrid broadcast and unicast delivery, delay tolerate delivery (using the spare resource and/or delivery in non-busy time/hour), enhanced network sharing which covers the case that the streaming content is provided by shared RAN.

# 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.

- For a specific reference, subsequent revisions do not apply.

- 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 TR 41.001: "GSM Release specifications".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply.   
An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

SHE service hosting environment

# 4 Overview

Mobile network operators are deciding to use LTE based system to support streaming services. A content provider can use content caching technology in the application in the UE to improve user experience by intelligent access technology selection (e.g. application update or content pre-download automatically in WLAN environment). At the same time, the network resources are not fully utilized in certain cases (e.g. night time). The key factor to enable “anywhere, anytime of streaming service” reachability is to optimize network resource usage of streaming services in an efficient manner to promote the consumption of content by the user. New technology e.g. local data center will help to streaming transmission more efficiently.

This technical report is to study potential service requirements for optimization of both Over-The-Top and operator managed streaming service considering possible use cases e.g. caching, content-aware service delivery, delay tolerate delivery, local streaming transmission etc. This study will provide gap analysis and identify these potential requirements.

# 5 Use Cases

## 5.1 Operator controlled Caching service delivery

### 5.1.1 Description

A user has a subscription with an operator and purchases the streaming service from operator. The user caching service delivery takes place at different times during the day (peak hour) and night (off-peak hour).

### 5.1.2 Pre-conditions

The operator provides information on how to use the caching service to the customer who has subscribed to this service.

Authorized content providers list and data volume are configured into UE.

### 5.1.3 Service Flows

The operator network provides an indication that subscription streaming services are supported.

The subscribed user uses his UE to select a show from the operator provided list.

The UE is able to cache the show for the user in different manner (at off-peak hour or indoor).

### 5.1.4 Post-conditions

The UE disconnects from operator’s streaming service.

The next origination attempt from the user’s UE goes through the normal session set up process. The UE may cache the unseen show or some other show for free during certain time. If the user watches the cached content in the UE, the user will be charged otherwise the cached content will be overwritten by new content.

### 5.1.5 Potential Impacts or Interactions with Existing Services/Features

None.

### 5.1.6 Potential Requirements

A 3GPP system shall support a mechanism to indicate to UEs that operator streaming services are available.

Based on operator policy, the 3GPP system shall support a mechanism to configure a list of authorized content providers and the maximum data volume cached in the UE for each of these content providers.

## 5.2 Delay tolerated streaming service delivery

### 5.2.1 Description

This use case describes the delay tolerated delivery of streaming service for a user. Some delay tolerated streaming service can be marked by user and delivered to the UE in off-peak time (e.g. night).

### 5.2.2 Pre-conditions

The user subscribes the video streaming service.

### 5.2.3 Service Flows

1. When commuting to office, the user watches the real-time video news and marks some non real-time videos that could be downloaded later.

2. The marked videos are automatically downloaded and cached at the UE at the off-peak hours.

3. The user watches the cached videos the next day.

### 5.2.4 Post-conditions

The network can setup session to transfer the delay tolerated streaming service delivery during the off-peak time and the user is billed in watching the video.

### 5.2.5 Potential Impacts or Interactions with Existing Services/Features

None.

### 5.2.6 Potential Requirements

The 3GPP system shall be able to deliver a streaming service to UE at the off-peak hours.

The 3GPP system shall be able to generate the charging data for this streaming service.

## 5.3 Periodic media streaming upload

### 5.3.1 Description

In industrial plants, CCTV equipment is used to observe parts of a process from a central control room, for example when the environment is not suitable for humans. In some case, for example in the oil field, the plant is far away from the central control room, the video data is stored in the local data center owned by the operator and is periodically upload to the central data center owned by the user.

### 5.3.2 Pre-conditions

1. The CCTV equipments are deployed in the plant where is far away from the central control room.

2. The operator deploys the local data centre (e.g. MEC system) near the plant.

3. The user subscribes the local data centre and the traffic package from operator.

### 5.3.3 Service Flows

1. The CCTV equipments monitor the environment of the plant, and delivery the monitoring video to the local data center owned by the operator.

2. The administrator in the central control room can login the local data centre and observe the environment of the plant.

3. The video streaming is periodically uploaded to the central data centre according to the subscription and policy of the 3rd party (e.g. during the off peak time).

### 5.3.4 Post-conditions

The network can setup session to upload the streaming data stored in the local data centre deployed by the operator to the central data center of the 3rd party periodically according the subscription of the user.

### 5.3.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: text to be provided or section to be voided.

### 5.3.6 [Potential] Requirements

The 3GPP system shall be able to locally store streaming data.

The 3rd party shall be able to configure the time of periodic upload according to the subscription and policy of the 3rd party.

The 3GPP system shall be able to collect the charging information for the streaming service.

## 5.4 Local streaming service delivery

### 5.4.1 Description

This use case describes the local streaming service delivery which is mainly supplied in concert, stadium, music hall, public palace, etc. In these kinds of places, the users are almost in same location area and operator can deliver the streaming in the local area which will reduce resource consumption and achieve lower E2E latency.

### 5.4.2 Pre-conditions

Bob subscribed the local streaming service supplied by Operator A.

### 5.4.3 Service Flows

Bob is going to the stadium to watch football match.

The system of operator A identifies Bob’s UE is entering the stadium area.

The system of operator A notifies Bob that he can enjoy the football match through his streaming service during the match.

When the match begins, the streaming are real-time uploaded to the local streaming servers and the system of operator A can get the specific streaming from the local streaming servers and deliver them to users in the stadium area according to user’s requests. The streaming delivery can be real time or non-real time which is dependent on audience’s request. The real time streaming delivery means that once the user presses the request button in his smart phone, the specific streaming can be received in real time.

The interactions among users in the stadium are also supported by the system of operator A.

When Bob leaves the stadium, the system of operator A identifies and notifies Bob that the football match streaming service will be stop.

### 5.4.4 Post-conditions

During the match, when Bob is in the stadium area, he not only watches the match in the stadium, but also enjoyes it with his UE, e.g. through the streaming window focus on the goalkeeper action, through another streaming window focus on the whole picture of the matching, to interact with other audiences who are watching the match either.

### 5.4.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: text to be provided or section to be voided.

### 5.4.6 [Potential] Requirements

The 3GPP system shall be able to support local streaming service.

The 3GPP system shall be able to support local connection to local streaming servers according to operator’s policy.

The 3GPP system shall be able to configure local streaming service area according to operator’s policy.

The 3GPP system shall be able to identify a user is in the specific local streaming service area.

The 3GPP system shall be able to identify a user is not in the specific local streaming service area and stop the local streaming service.

The 3GPP system shall be able to deliver a real time or non real time local streaming service to user according to user’s preference.

The 3GPP system shall be able to generate the charging data for local streaming service.

## 5.5 Flexible route for streaming delivery

### 5.5.1 Description

For achieving better user experience for streaming service, local streaming service has been deployed. But the user does not always stay in one place. When he leaves the local streaming service area, the 3GPP system should be able to adaptively change video server and the route to continue supply streaming service, vice versa.

On the other hand, in some condition, multiple steaming servers and routes can be supplied to user. 3GPP network should be able to select one of them according to operator’s policy.

The use case describes one example of it.

### 5.5.2 Pre-conditions

Bob subscribed streaming service from operator A.

Operator A deploys service hosting environment (SHE) in metro and some applications run in the SHE.

### 5.5.3 Service Flows

Bob is in the metro to office.

Bob wants to watch video “news today” on line through his smart phone.

According to operator’s policy, the 3GPP system selects the metro local server and routes Bob’s smart phone to the metro local server to watch video.

Bob takes off the metro and get on shuttle toward his office. The 3GPP network identifies that Bob has left metro and the local server can’t be connected.

The 3GPP system changes the video route to the general video server.

### 5.5.4 Post-conditions

Bob can continue watching the video in the shuttle without aware of the change of the route.

### 5.5.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: text to be provided or section to be voided.

### 5.5.6 [Potential] Requirements

According to operator’s policy, the 3GPP system shall be able to automatically change streaming service route, e.g. from local route to more general route, vice versa.

According to operator’s policy, the 3GPP system shall be able to configure which context information is related with streaming route.

The 3GPP system shall be able to collect context information related to update streaming route according to operator’s policy.

## 5.6 Authorization for streaming delivery

### 5.6.1 Description

Today more children watch the videos on their smart phone, but some videos are not suitable for kids. It is necessary for parent to control the content and duration of streaming watched by kids.

This use case describes the authorization for streaming delivery.

### 5.6.2 Pre-conditions

Bob is an eight year old boy and he often watches the videos through his smart phone.

Bob’s farther subscribes the streaming service for kids that specifies corresponding content classification of streaming service and duration of watching video, for example Bob can only watch the video one hour and do not watch the violent video.

Note：The content classification may be specific countries and may depend on local regulation.

### 5.6.3 Service Flows

Bob wants to watch video online through his smart phone.

In the connection set up phase, 3GPP system should check the subscription of Bob. If the watched video fits the subscribed grade, then the 3GPP system set up the connection for Bob. If the video don't fit the subscription, the 3GPP system shall reject to set up the connection for Bob.

The 3GPP system shall disconnect the session for Bob after subscribed duration.

### 5.6.4 Post-conditions

Bob can watch video of suitable grade through his smart phone during subscribed duration.

### 5.6.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: The relationship between this use case and what is provided by OMA BCAST is FFS.

### 5.6.6 [Potential] Requirements

The 3GPP system shall be able to support the authorization for the streaming delivery based on subscription and on policy defined by the third party.

## 5.7 Application user profile support for streaming delivery

### 5.7.1 Description

Today, some application server supplies one kind of pay video service. Once user buys the pay video e.g. 9.99 USD per month for video provider’s server, he has higher priority to see the most popular and most fresh videos from the application server.

When user watches these videos through smart phone, the 3GPP system also need to support the application layer user priority from end to end aspect although this kind of user profile is defined from one application server not 3GPP system.

### 5.7.2 Pre-conditions

Bob is one premium user of “OuyTube”, a video sharing web site.

Bob and Tom subscribed with operator A.

“OuyTube” and Operator A have agreement to supply high quality video service to “OuyTube” premium users.

### 5.7.3 Service Flows

Bob and Tom want to watch “OuyTube” video online through their smart phones.

In the connection set up phase, the application server of “OuyTube” notifies 3GPP system that Bob’s is in premium class.

According to agreement between “OuyTube” and Operator A, the 3GPP system sets up high priority radio connection for Bob. But for Tom, the 3GPP system set up normal radio connection.

In some cases, the video application server may be hosted in local, with the help of local service hosting environment, the 3GPP system also can be notified the application user’s priority.

### 5.7.4 Post-conditions

Bob can watch “OuyTube” video through his smart phone with high quality.

Tom can watch “OuyTube” video through his smart phone with normal quality.

### 5.7.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: text to be provided or section to be voided.

### 5.7.6 [Potential] Requirements

According to agreement between application server and Operator, the 3GPP system shall support the operator or the 3rd party to configure which user profile information belonging to the application server should be shared with the 3GPP system.

## 5.8 Network assistant application optimization for streaming delivery

### 5.8.1 Description

For achieving better user experience for streaming service, local streaming service has been deployed. Some popular streaming content in the local streaming server is distributed from one same cloud video application server. But when the streaming content in the local streaming server is continuously delivered to the end user through 3GPP system, it has to face different radio environment in different local area which will greatly impact the streaming delivery quality.

So, it is suggested that different radio condition and local traffic context should be considered in the local streaming server to adjust application layer transmission to help to achieve better user experience. That means when the local streaming server gets the radio environment information e.g. radio condition, local traffic context, etc. it can decide whether the application level video optimization function should be utilized to achieve better user experience.

### 5.8.2 Pre-conditions

Bob and Tom subscribed streaming service with 4K quality in default from operator A.

Operator A deploys multiple local service hosting environments (SHE) in different area e.g. airport, CBD etc. And “News Today” which is one popular video application runs in these SHEs.

### 5.8.3 Service Flows

Bob is in the airport waiting for board.

Bob wants to watch video “News today” on line through his smart phone.

According to operator’s policy, the 3GPP system selects the airport local server and routes Bob’s smart phone to the airport local server to watch video.

The airport local server requests the 3GPP system to share the airport radio environment information and decides to utilize its most efficient video compress function in application layer to help the 4K video successfully to be delivered over airport radio environment.

At the same time, Tom is in CBD and also wants to watch video “News today” on line through his smart phone.

According to operator’s policy, the 3GPP system selects the CBD local server and routes Tom’s smart phone to the CBD local server to watch video.

The CBD local server requests the 3GPP system to share the information of CBD radio environment and decides that the radio environment is good and there is no need to invoke the most efficient video compress function.

### 5.8.4 Post-conditions

Bob receives the 4K format streaming in the airport.

Tom receives the 4K format streaming in the CBD.

### 5.8.5 Potential Impacts or Interactions with Existing Services/Features

Editor’s Note: text to be provided or section to be voided.

### 5.8.6 [Potential] Requirements

According to operator’s policy, the 3GPP system shall support the SHE which is deployed in different local area (no matter belongs to operator or the 3rd party) to configure which radio environment information can be shared to the application layer which is hosted in the SHE.

According to operator’s policy, the 3GPP system shall support the SHE which is deployed in different local area (no matter belongs to operator or the 3rd party) to get radio environment information based on the configuration.

# 6 Considerations

## 6.1 Considerations on security

Security measures shall be provided to protect access to streaming service via different RATs or operators, e.g. with RAN sharing.

The 3GPP system shall be able to authorize the streaming delivery based on subscription and on policy defined by a third party.

Editor’s note: additional security considerations are for further study.

## 6.2 Considerations on charging

Charging information shall identify whether the streaming service was provided in real time or using delay tolerant delivery.

If the cached content on the UE is viewed by the user, the charging information for that content needs to be generated.

The 3GPP system shall be able to generate the charging data (e.g. the duration of streaming service, the amount of data transferred) for local streaming service.

# 7 Potential Requirements

A 3GPP system shall support a mechanism to indicate to UEs that operator streaming services are available.

The 3GPP system shall be able to schedule deliver a download-and-play service to UE at the off-peak hours.

The 3GPP system shall be able to support local connection to local streaming servers according to operator’s policy.

The 3GPP system shall be able to configure local streaming service area according to operator’s policy.

The 3GPP system shall be able to identify a user is in the specific local streaming service area.

The 3GPP system shall be able to identify a user is not in the specific local streaming service area and stop the local streaming service.

The 3GPP system shall be able to deliver video content via local service delivery immediately or postponed according to user’s preference.

According to operator’s policy, the 3GPP system may be able to automatically change streaming service route, e.g. from local route to more general route, vice versa.

According to operator’s policy, the 3GPP system shall be able to configure which context information is related with streaming route.

The 3GPP system shall be able to collect context information related to update streaming route according to operator’s policy.

According to agreement between application server and Operator, the 3GPP system shall support the operator or the 3rd party to configure which user profile information belonging to the application server should be shared with the 3GPP system.

According to operator’s policy, the 3GPP system shall support the SHE which is deployed in different local area (no matter belongs to operator or the 3rd party) to configure which radio environment information can be shared to the application layer which is hosted in the SHE.

According to operator’s policy, the 3GPP system shall support the SHE which is deployed in different local area (no matter belongs to operator or the 3rd party) to get radio environment information based on the configuration.

# 8 Conclusion and Recommendations

The Feasibility Study on Enhancement of LTE for Efficient delivery of Streaming Service Technical Report analyses several use cases of eLESTR. The use cases address three key aspects of eLESTR:

- operator controlled Caching service delivery

- service delivery via an optimized path, and

- authorization and security

Taking into consideration the Use Cases and Scenarios defined in Clause 5, new considerations related to security and charging for eLESTR have been identified in Clauses 6 with additional potential requirements in Clauses 7.

It is recommended to proceed with normative work.

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 2017-02 | SA1#77 | [S1-171410](file:///E:\3GPP\SA1%20Jeju%202017\docs\S1-171410.zip) |  | 1 | FS\_eLESTR-Skeleton | 0.0.0 | 0.1.1 |
| 2017-02 | SA1#77 | [S1-171410](file:///E:\3GPP\SA1%20Jeju%202017\docs\S1-171410.zip) |  | 1 | FS\_eLESTR- Scope | 0.0.0 | 0.1.1 |
| 2017-02 | SA1#77 | [S1-171456](file:///E:\3GPP\SA1%20Jeju%202017\docs\S1-171410.zip) |  | 2 | FS\_eLESTR- Operator controlled Caching service delivery | 0.0.0 | 0.1.1 |
| 2017-02 | SA1#77 | [S1-171413](file:///E:\3GPP\SA1%20Jeju%202017\docs\S1-171410.zip) |  | 1 | FS\_eLESTR : Delay tolerated streaming service delivery | 0.0.0 | 0.1.1 |
| 2017-02 | SA1#77 | [S1-171414](file:///E:\3GPP\SA1%20Jeju%202017\docs\S1-171410.zip) |  | 1 | FS\_eLESTR- Charging & Security Considerations | 0.0.0 | 0.1.1 |
| 2017-05 | SA1#78 | [S1-172358](file:///D:\3GPP\SA1%20Porto%202017\docs\S1-172358.zip) |  | 1 | FS\_eLESTR-Periodic media streaming upload | 0.1.1 | 0.2.0 |
| 2017-05 | SA1#78 | [S1-172359](file:///D:\3GPP\SA1%20Porto%202017\docs\S1-172359.zip) |  | 1 | FS\_eLESTR- Location based streaming service delivery | 0.1.1 | 0.2.0 |
| 2017-05 | SA1#78 | [S1-172369](file:///D:\3GPP\SA1%20Porto%202017\docs\S1-172369.zip) |  | 2 | FS\_eLESTR- Flexible route for streaming delivery | 0.1.1 | 0.2.0 |
| 2017-08 | SA1#79 | S1-173413 |  | 2 | Authorization for streaming delivery | 0.2.0 | 0.3.0 |
| 2017-08 | SA1#79 | S1-173497 |  | 2 | Application user profile support for streaming delivery | 0.2.0 | 0.3.0 |
| 2017-08 | SA1#79 | S1-173079 |  | 1 | Network assistant application optimization for streaming delivery | 0.2.0 | 0.3.0 |
| 2017-11 | SA1#80 | S1-174501 |  | 2 | Security requirement for streaming delivery | 0.3.0 | 0.4.0 |
| 2018-02 | SA1#81 | [S1-180300](file:///D:\3GPP\SA1%20Fukuoka%202018\docs\S1-180300.zip) |  | 2 | eLESTR Overview Section | 0.4.0 | 0.5.0 |
| 2018-02 | SA1#81 | [S1-180016](file:///D:\3GPP\SA1%20Fukuoka%202018\Docs\S1-180016.zip) |  | 1 | eLESTR Section 3 and editorial revision | 0.4.0 | 0.5.0 |
| 2018-02 | SA1#81 | [S1-180301](file:///D:\3GPP\SA1%20Fukuoka%202018\docs\S1-180301.zip) |  | 2 | The requirements for eLESTR | 0.4.0 | 0.5.0 |
| 2018-02 | SA1#81 | [S1-180302](file:///D:\3GPP\SA1%20Fukuoka%202018\docs\S1-180302.zip) |  | 2 | The charging requirements for eLESTR | 0.4.0 | 0.5.0 |
| 2018-02 | SA1#81 | S1-180303 |  | 2 | The conclusion and recommendations for eLESTR | 0.4.0 | 0.5.0 |
| 2018-03 | SA#79 | SP-180165 |  |  | Clean-up performed by MCC for presentation for one-step approval to SA#79, including correction on the TR number | 0.5.0 | 1.0.0 |
| 2018-03 | SA#79 | - |  |  | Raised to v.16.0.0 following SA's one-step approval.  "Rel-15" changed into "Rel-16" on the cover page | 1.0.0 | 16.0.0 |