PCP Extension for Signaling Feedback Information from the End-User Application to the Application Server and to the Network

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Outline

- Motivation & Problem Statement
- Why PCP?
- Use-Cases
- Proposed Extension
- Next Step
Motivation & Problem Statement 1/3

• Today’s user’s consumption style for video and multimedia applications is strongly changing.
  – Users are heavily counting on wireless and mobile devices for video streaming, interactive video and multimedia applications.
  – New demands for video services access: anywhere, anytime and from any device based on users’ profiles
  – Popularity of content sharing among different users and different devices

[Diagram of video over wireless and mobile access]
Motivation & Problem Statement 2/3

- The network and service infrastructure are not enough optimized:
  - Huge amount of video content consumption w/o sufficient QoE consideration, services differentiation and resources optimization
  - No correlation between the content requirement and available devices resources
    - ITU-T G1070 for video conferencing QoE considers the devices characteristics and ambient light information
  - No correlation between the content requirement and available network resources
  - No correlation between the user context and the available network and devices resources
  - No sufficient information for power-efficiency
    - PCP minimizes the keepalive overhead
    - MPEG Green standard discusses in its requirement the need for green and power efficient video

Available bandwidth on wired and wireless links and resulting video PSNR when streaming Videos from 0.5 to 2 Mbps

Motivation & Problem Statement 2/3

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More intelligence is required in the network and the service infrastructure, through:

- Knowledge in the network and service platform about the available device and network conditions for the end-user
- Knowledge in the network about the content requirements in terms of devices and network resources for content stored either in the network or in the application server

How to obtain such knowledge in a cost-effective way with no need for changing the current infrastructure and in a generalized way to all applications

- Feedback/notification mechanisms between the end-user application, the network and the service platform is needed to provide information helping the content delivery and adaptation decisions
- PCP is a strong candidate
Why PCP?

- PCP [RFC6887] is viewed as a request/response protocol and also as a hint/notification protocol between a PCP client and a PCP server.
- PCP can be extended to carry more mapping information than the IP internal versus external addresses.
- Draft [Flowdata] is an example of the use of PCP for signaling by the client the flow characteristics to the network and signaling by the network its ability to accommodate that flow back to the client.
- PCP allows learning and influencing the mapping lifetime, which helps reducing network bandwidth, overload on application servers and middle boxes and battery resources for wireless and mobile devices.
Further advantages for PCP motivating its use are as follows:

- PCP can be used to install state in upstream devices such as NAT, firewalls or other flow-aware devices.
- PCP can be used to notify a failure that may occur at an upstream PCP-controlled device, and therefore the PCP client can react accordingly.
- PCP allows learning the lifetime of installed mappings and would therefore avoid overloading the network and service platform with keepalive messages. This also saves the battery resources for wireless and mobile end-user devices.
- PCP can be used to notify the network with the flow characteristics so as to enforce policies at the access segment.
- PCP can be used to receive informative information from the network so that client may use them to select the interface to use to place a session.
- PCP can be extended easily to allow reporting capabilities to a remote server.
- Extending PCP with the FEEDBACK feature avoids making assumptions on how media streams are exchanged (e.g., RTP, IAX mini-frames, etc.).
- PCP extension does not require an OS support. The feature can be managed at the application level.
Use-Cases

Optimized Content Delivery by the Network

- **Service Platform**
  - Application Server (PCP Client)

- **Network Element/Middle Box (PCP Server)**
  - User’s application feedback information through extended PCP signaling

- **Network**
  - Feedback on content device/network resource requirement through extended PCP signaling
  - Optimized Content by the Network

- **End-User Device (PCP Client)**
Use-Cases 2/4

Optimized Content Delivery by the Service Platform

Service Platform
Application Server (PCP Server)

Network Element/Middle Box (PCP Proxy)

Relaying Feedback Information from User

Network

User’s application Feedback Information through extended PCP signaling

End-User Device (PCP Client)

Optimized Content by the Application Server

Feedback on content device/network resources requirement through extended PCP signaling

Network-based decision to relay user request to appropriate Application server

Optimized Content by the Application Server
Use-Cases 3/4

Network-based Video Session Seamless Experience Across Devices

Service Platform

Application Server (PCP Client)

Feedback on content device/network resources requirement through extended PCP signaling

Network Element/ Middle Box (PCP Server)

User’s application Feedback Information through extended PCP signaling

Optimized Content by the Network

Network

User’s application Feedback Information through extended PCP signaling

Optimized Content by the Network

End-User Device 1 (PCP Client)

End-User Device 2 (PCP Client)
Network-based User-Centric Content Adaptation

User’s Feedback Information (e.g., location, battery level and mobility status) through extended PCP signaling

Feedback on content device/network resources requirement through extended PCP signaling

Content adapted for user

Application Server (PCP Client)

Service Platform

Network (w/ content storage case)

Content

Application Server (PCP Client)

Service Platform

User's Feedback Information (e.g., location, battery level and mobility status) through extended PCP signaling

Content adapted for user

Network Element/Middle-box (PCP Server)

End-User Device (PCP Client)
Proposed Extension

• This document defines an extension to the Port Control Protocol (PCP) RFC 6887 [RFC6887] allowing:
  – The end-user application to signal in real-time to the network and application server information about its available device capabilities and network resources (mainly device characteristics, buffering status as an indication of the network conditions as well as other useful context information (e.g., location, environment light/noise, mobility status)
  – The application server to signal in real-time to the network the requirement of the content it stores in terms of devices and network resources.

• The extension defines a new PCP option for the existing PEER and MAP OpCodes
  – FEEDBACK Option for signaling information between the end-users application, the network and the application server
Next Step

• WG Comments.
• A next version of the draft after comments.