PCP Extension for Signaling Feedback Information from the End-User Application to the Application Server and to the Network
<draft-mou-pcp-application-network-feedback-00>

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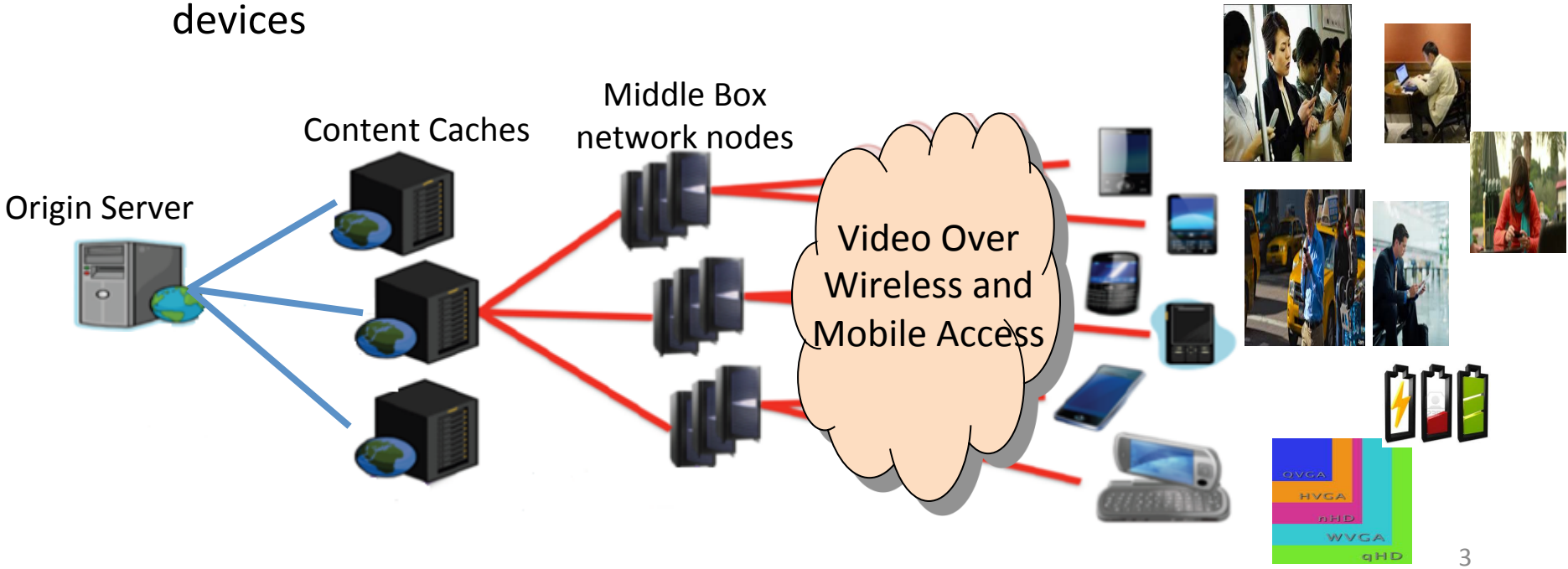
Outline

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

Motivation & Problem Statement 1/3

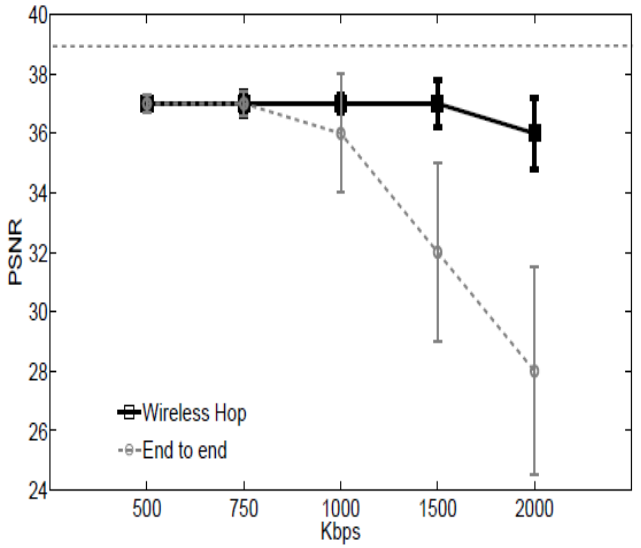
- Today's user's consumption style for video and multimedia applications is strongly changing.
  - Users are heavily counting on wireless and mobile devices for video streaming, interactive video and multimedia applications.
  - New demands for video services access: **anywhere, anytime** and from **any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



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 [*ISO/IEC JTC1/ SC29/WG11 N13468, Context, Objectives, Use Cases and Requirements for Green MPEG, April 2013*]

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



Source: R. Raghavendra, E. M. Belding, "Characterizing high-bandwidth real-time video traffic in residential broadband networks," WiOpt 2010: 597-602

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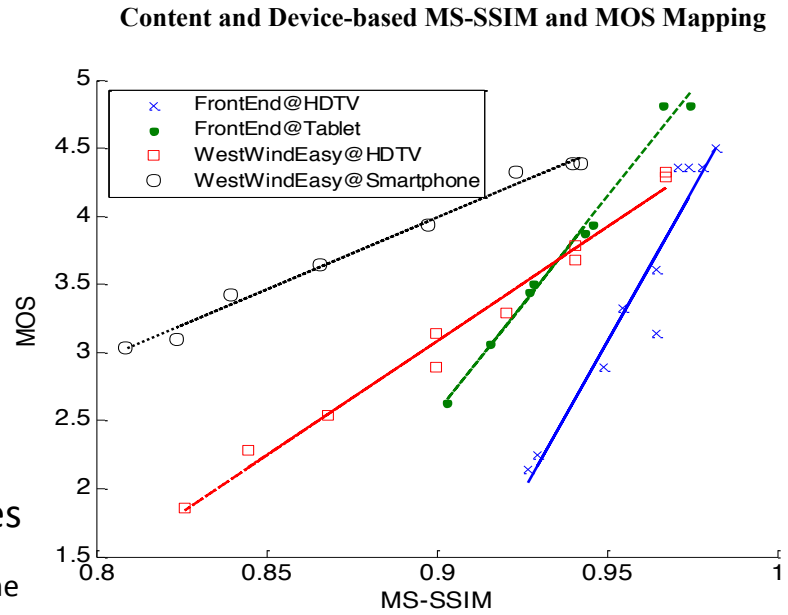

Source: Yiting Liao, Audrey Younkin, Jeffrey Foerster, Philip Corriveau "Achieving High QoE Across the Compute Continuum: How Compression Content and Devices Interact," 7th International Workshop on Video Processing and Quality Metrics for Consumer Electronics (VPQM), 2013.

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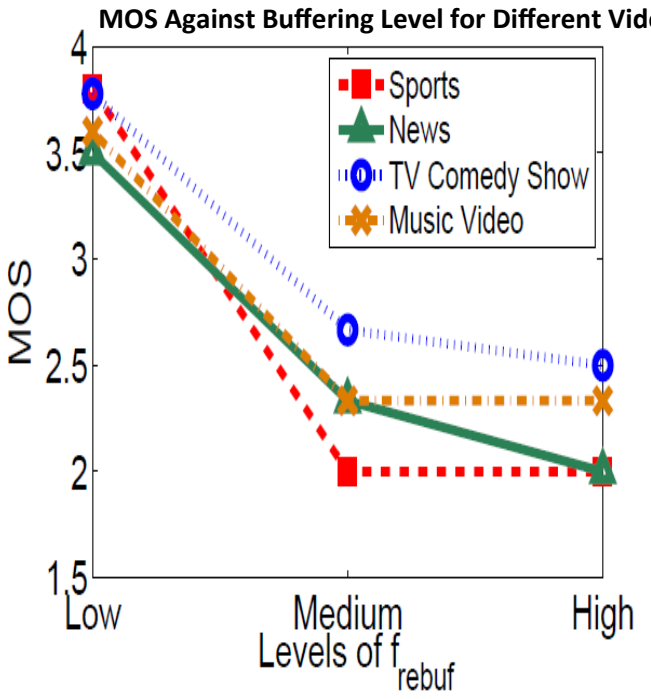

Source: R. Mok, E. Chan, R. Chang, " Measuring the quality of experience of HTTP video streaming ," IEEE International Symposium on Integrated Network Management 2011

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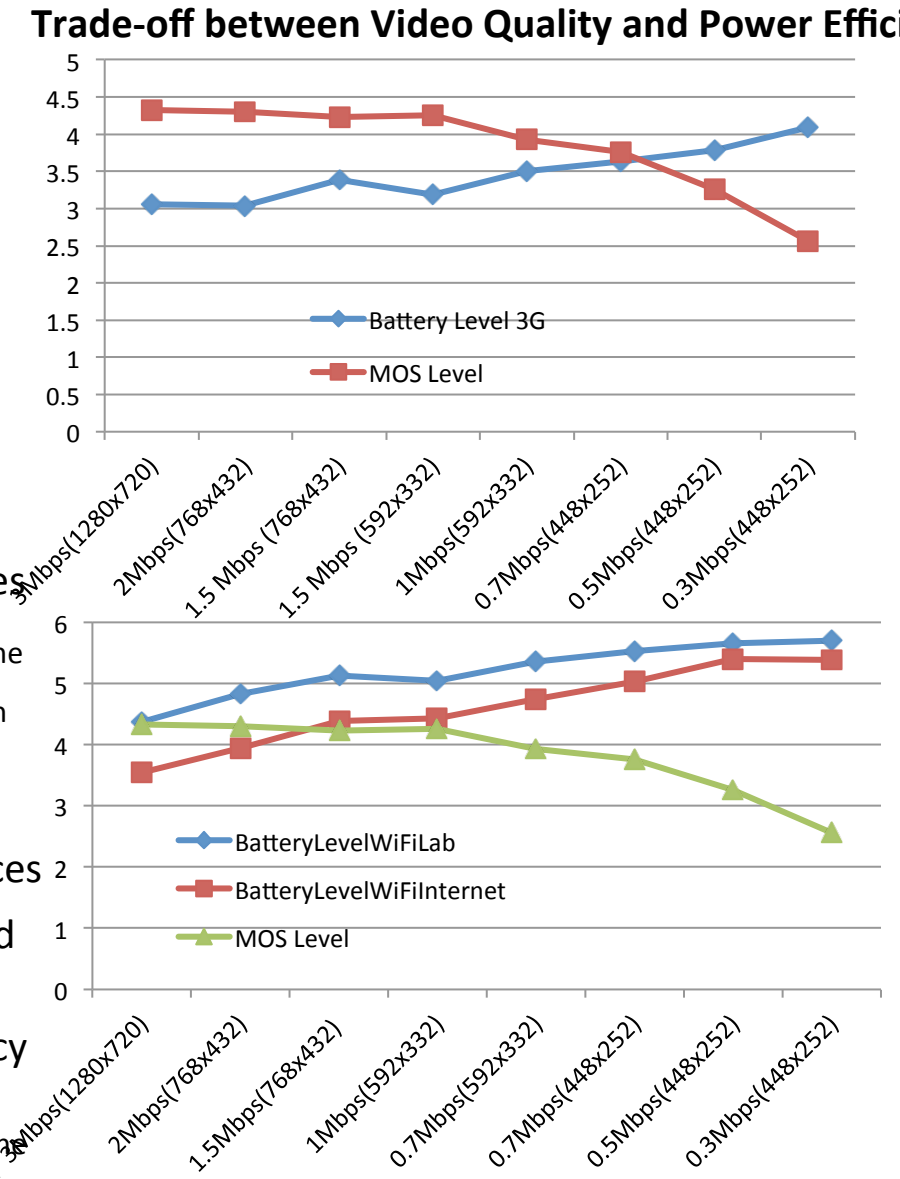


Experiments on Smartphone: Trade-off between Video Quality and Power Efficiency

Motivation & Problem Statement 3/3

- 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 ? 1/2

- 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.

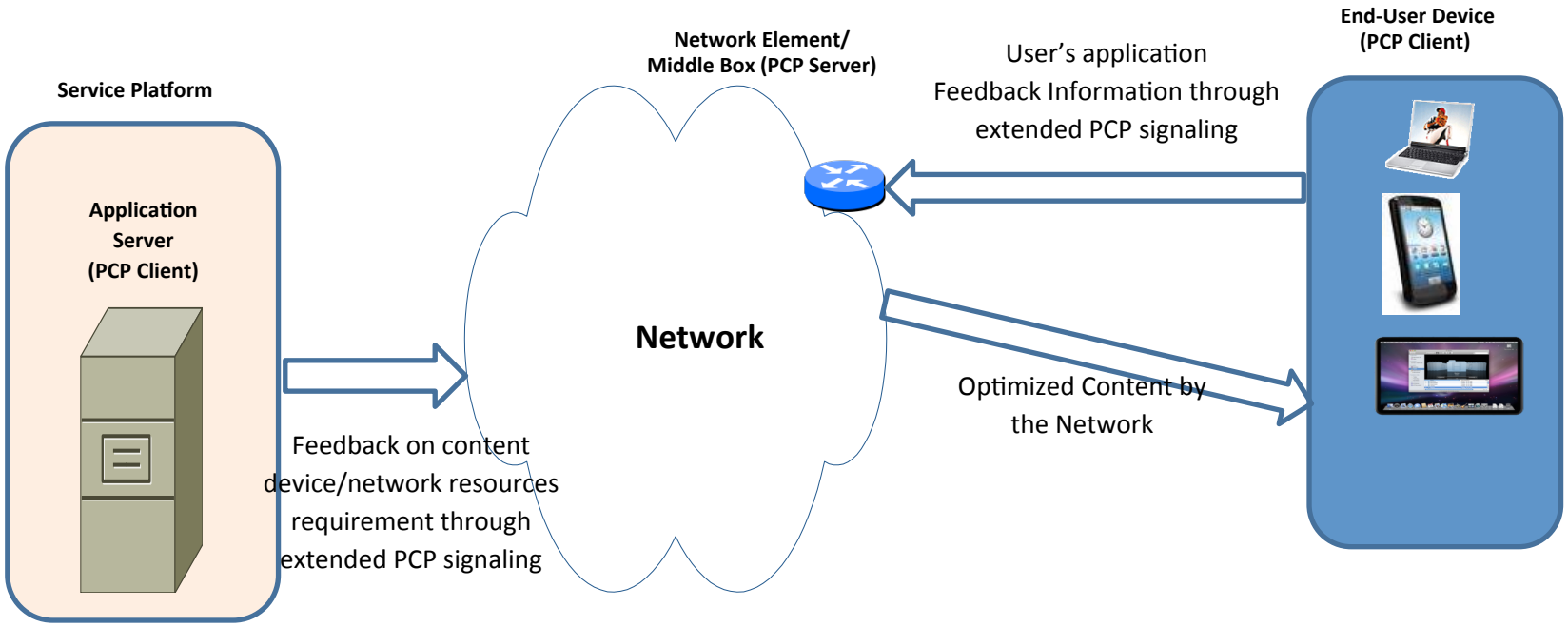
Why PCP ? 2/2

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.

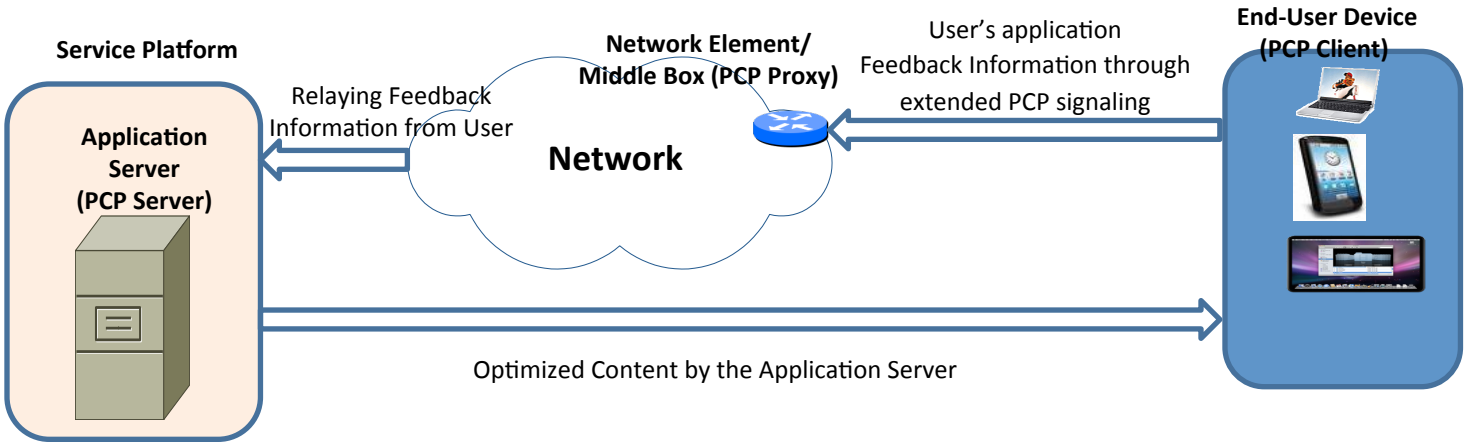
Use-Cases 1/4

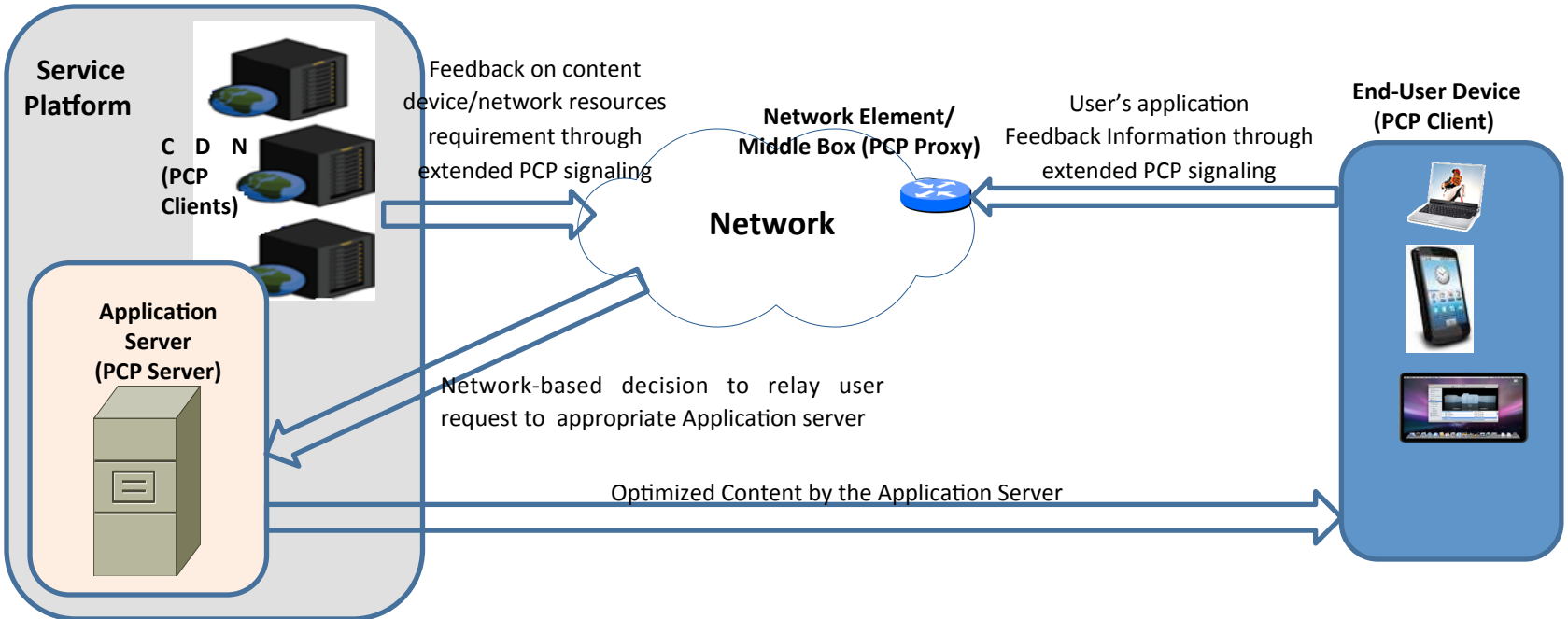
Optimized Content Delivery by the Network



Use-Cases 2/4

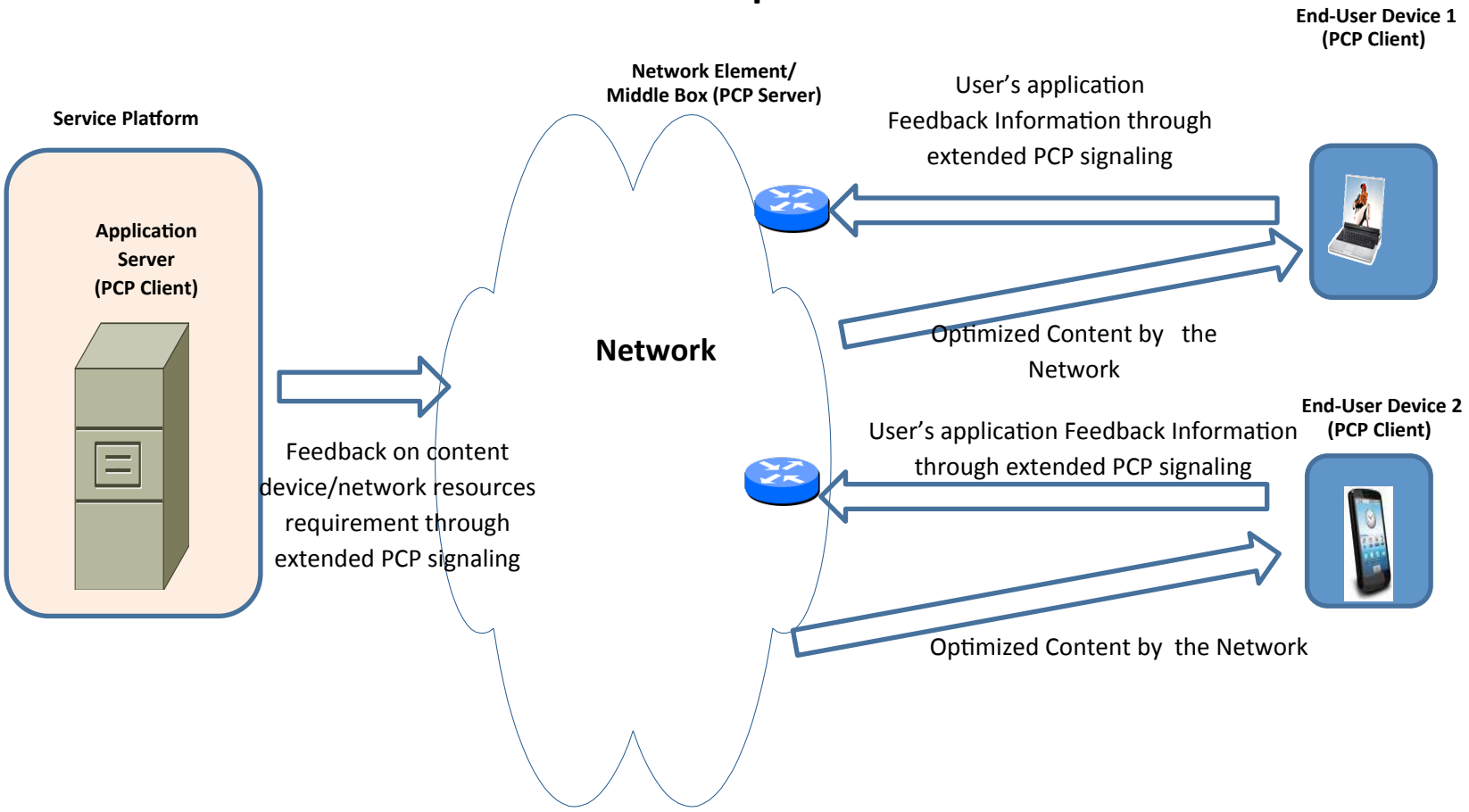
Optimized Content Delivery by the Service Platform





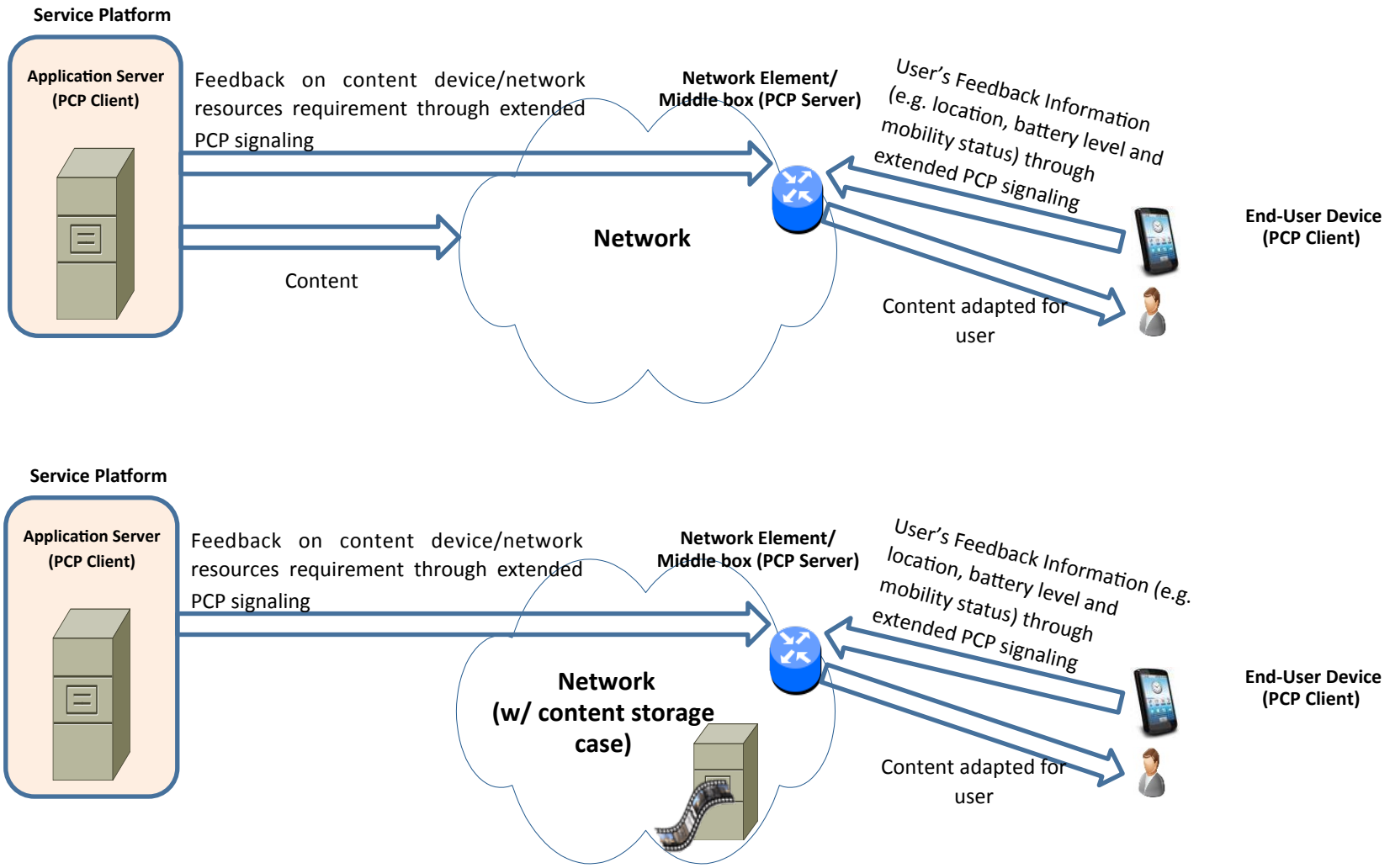
Use-Cases 3/4

Network-based Video Session Seamless Experience Across Devices



Use-Cases 4/4

Network-based User-Centric Content Adaptation



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.