



Future Content Networks

COAST: Content-aware Searching, Retrieval and Streaming

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Who is “COAST”

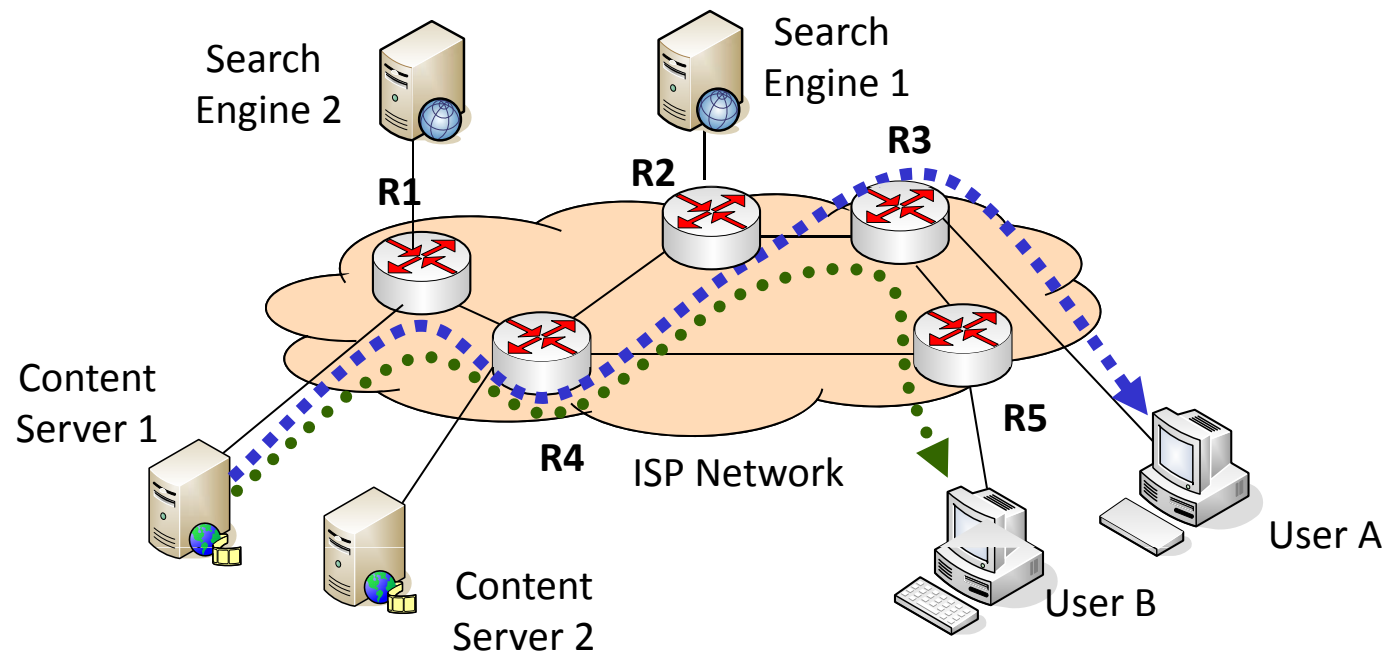
- ST Microelectronics (Italy)
- Synelixis Solutions Ltd (Greece)
- Yahoo! Iberia (Spain)
- NEC Europe Ltd (UK)
- Telefonica I+D (Spain)
- Fraunhofer HHI (Germany)
- Politecnico di Torino (Italy)
- Technische Universität Berlin (Germany)
- Fundacion Barcelona Media (Spain)
- University of California, Los Angeles (USA)
- Seoul National University (S. Korea)



9 Participants from 5 EU countries + 1 from USA and 1 from S. Korea
3 Industries, 1 Operator, 1 SME, 4 Research Institutes, 2 non-EU participants



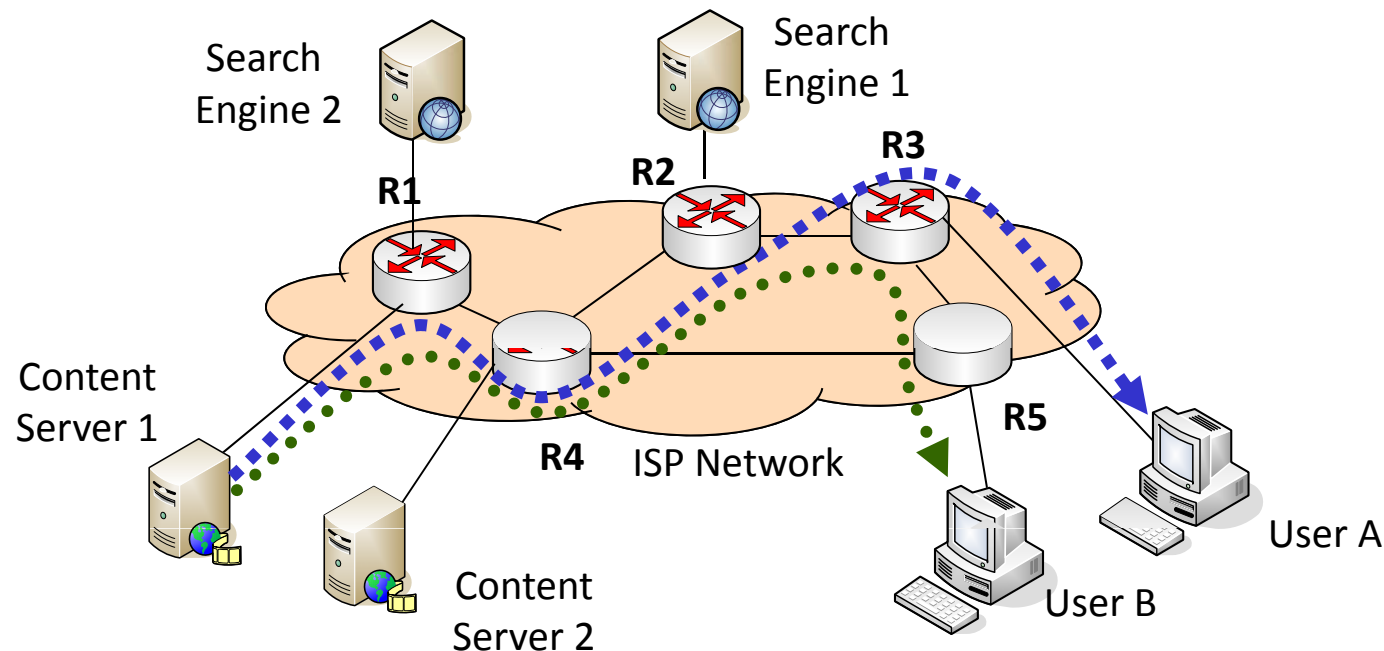
Limitations of today's Internet Architecture



- If the ***content could be stored/cached closer to the end users***, not only at the end-points as local proxies, but transparently in the network (routers, servers, nodes, data centres) then content delivery would have been much more efficient.



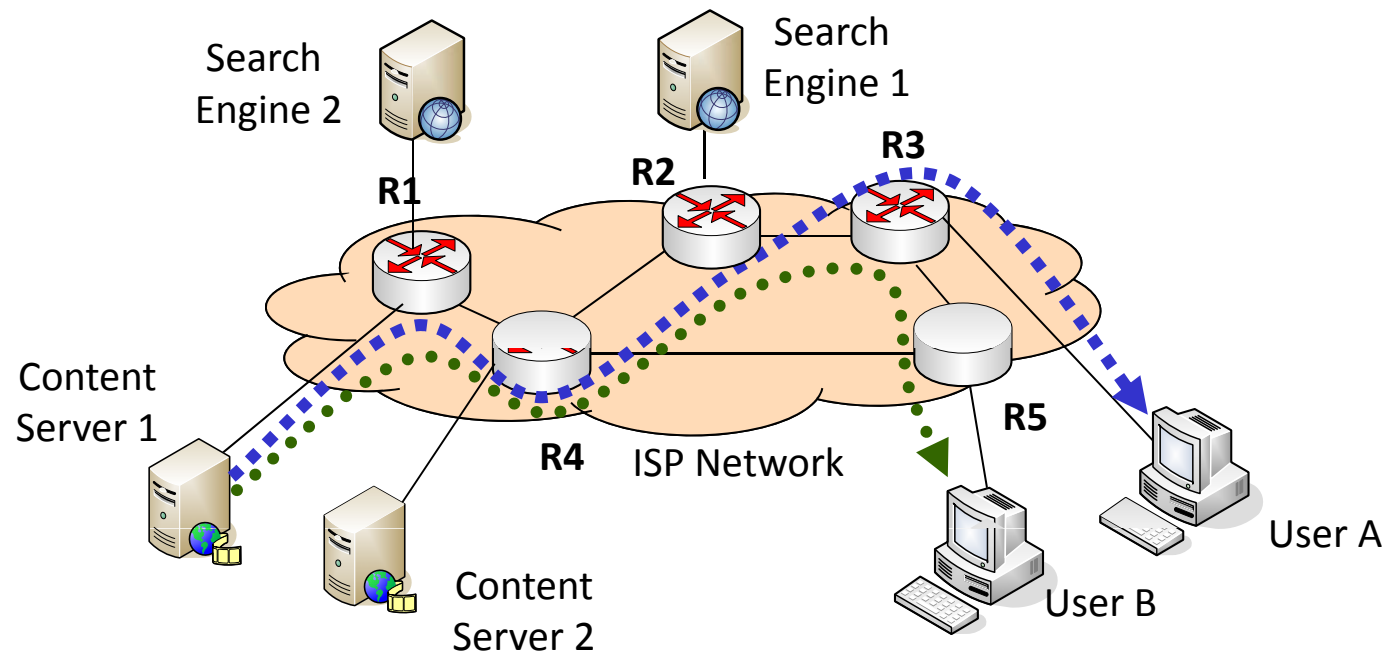
Limitations of today's Internet Architecture



- If the ***routers could identify/analyse what content is flowing through them***, the search engines would gain much better knowledge of content location and provide information even on “live” video streams.

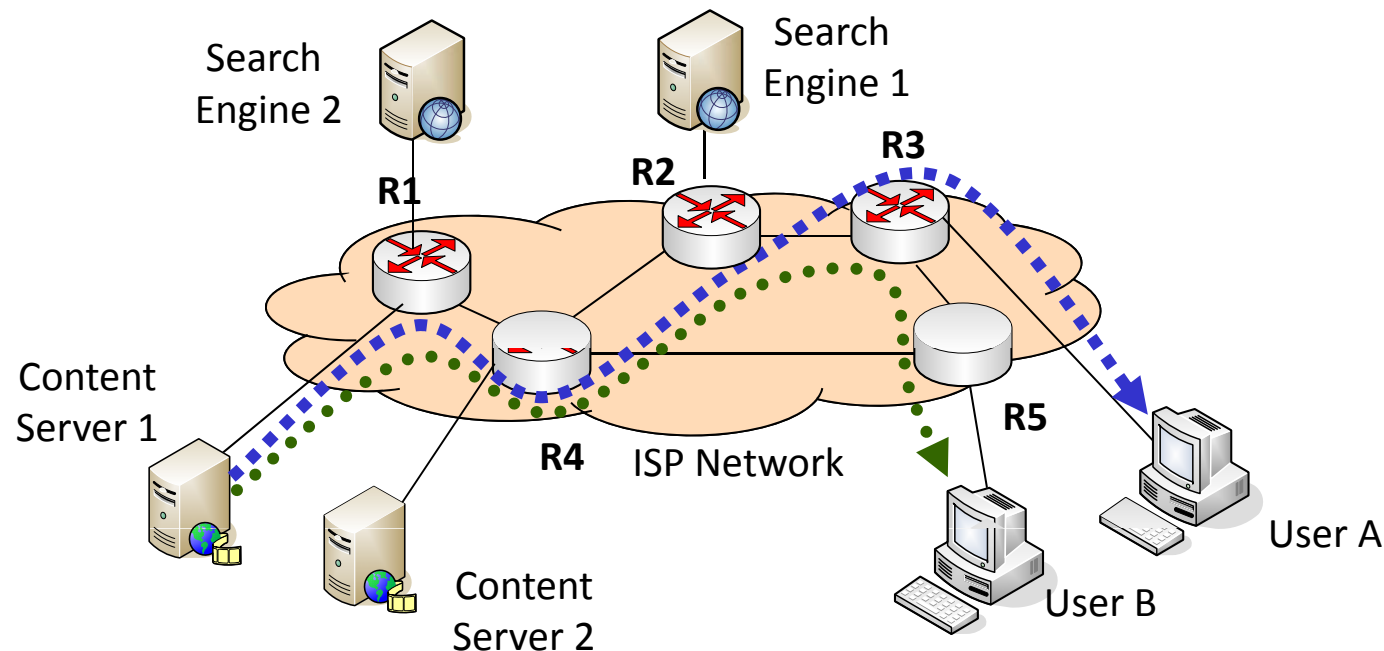


Limitations of today's Internet Architecture



- If the *network could dynamically identify what is the best end-to-end path* (less congestion, lower delay, more bandwidth), it would have provided a better way to deliver the data.

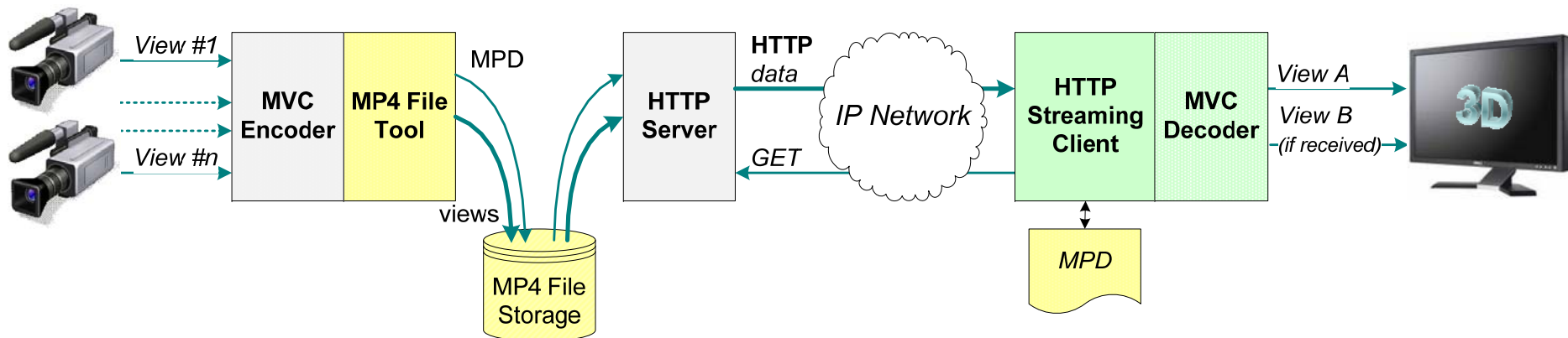
Limitations of today's Internet Architecture



- If the ***content could be interactively adapted***, not only statically based on the network and terminal capabilities, but also based on the interactive content selection by the user, the PQoS would be higher.



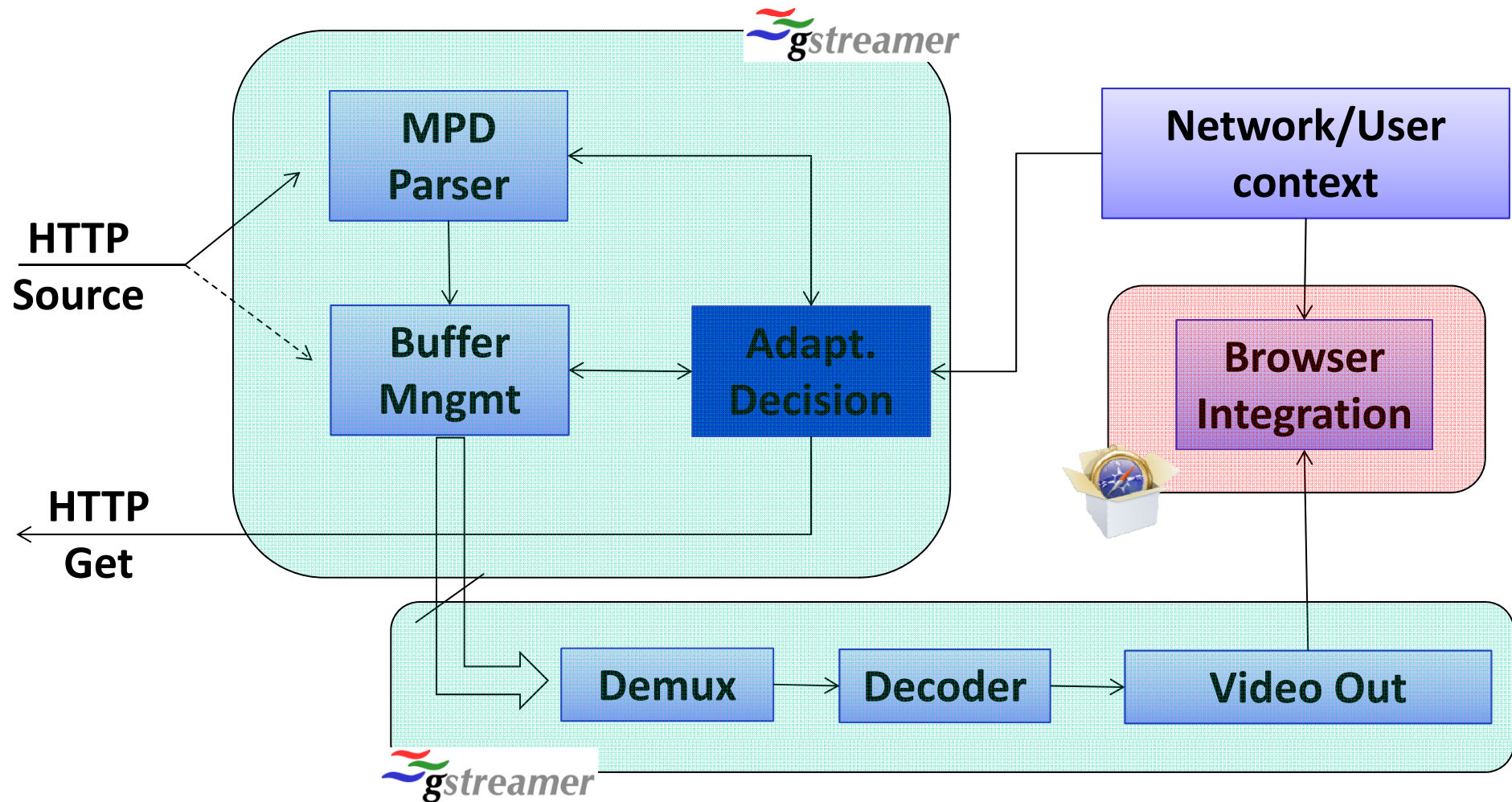
Step 1: Distribution of autonomous content



- Dynamic Adaptive Streaming over HTTP
- Streaming based on media segments (e.g. MP4FF)
- Media Presentation Description (MPD) indicates all options
- Client driven adaptation by dynamic selection of alternatives



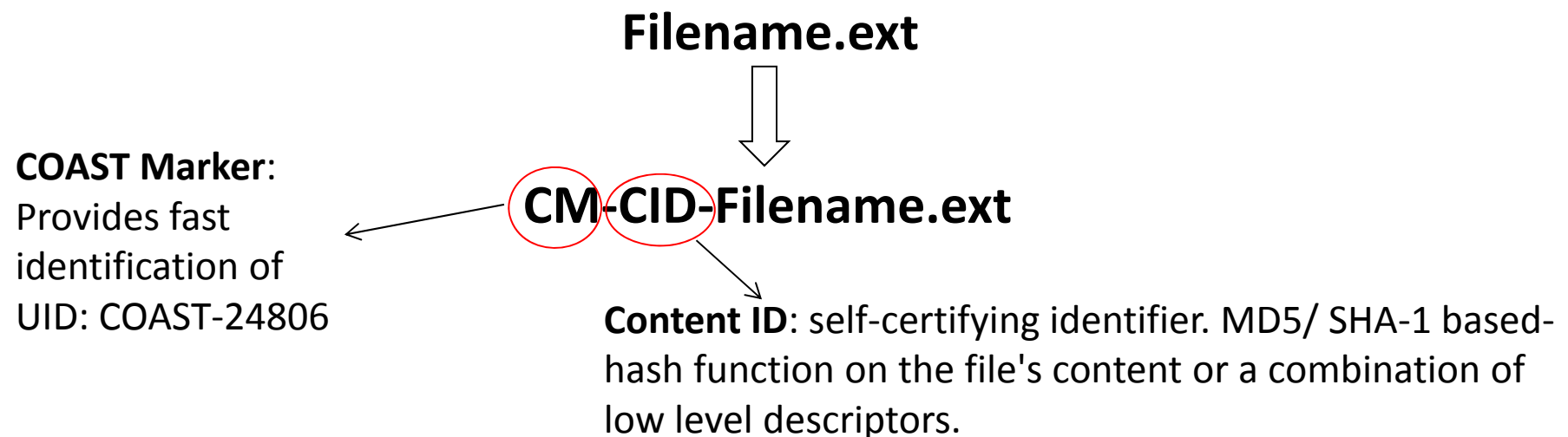
Step 1: DASH Client, functional blocks





Step 2: COAST URL (CURL)

- Unique Content Based identifier for COAST contents
 - Enable fast identification of the content within COAST overlay
 - Fast calculation (not calculated each time the content is requested)
 - Avoid data replication → Unique association with the object
 - Integrity of the object
 - Backward compatible with the content → No change of the content file format





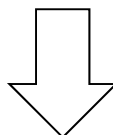
Step 2: COAST URL (CURL)

`http://www.abc.com/Filename.ext`



COAST

`http://www.abc.com/CM-CID-Filename.ext`



CURL

Trigger COAST related functionalities

Original URL can easily be extracted



Step 2: COAST URL (CURL)

`http://my.domain.net/dance.mp3`

`http://my.domain.net/COAST248036_37a8d10c39e921da187c6929adcb0bfa59cf2192_dance.mp3`

`http://my.domain.net/clip.avi`

`http://my.domain.net/COAST948036_37a8d10c39e921ff187c6929adcb0bfa60cf2352_clip.avi`

`http://my.domain.net/homepage.html`

`http://my.domain.net/COAST248036_84d53e26a9976fc3250ba5cc462e7bb5f7862780_homepage.html`

- Fast
- Efficient: Unique representation
- Backwards compatible
- User Unfriendly (?)



Step 2: COAST URL (CURL) in MPD

```
<MPD type="OnDemand" minBufferTime="0.96S">
  <Title>MPD Example</Title>
  <Source>COAST</Source>
  <Copyright>COAST, All rights reserved</Copyright>
</ProgramInformation>

<Period segmentAlignmentFlag="True">
  <Representation bandwidth="642348" width="640" height="480" mimeType="video/mp4" startWithRAP="False">

    <SegmentInfo duration="0.96S">
      <!--InitialisationSegmentURL sourceURL="MPD_Example.3gp"/-->
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_000.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_001.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_002.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_003.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_004.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_005.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_006.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_007.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_008.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_009.mp4" />
      <Url sourceURL="http://coast.media.net/COAST248036_ccihashvalue_video_seg_010.mp4" />
    </SegmentInfo>

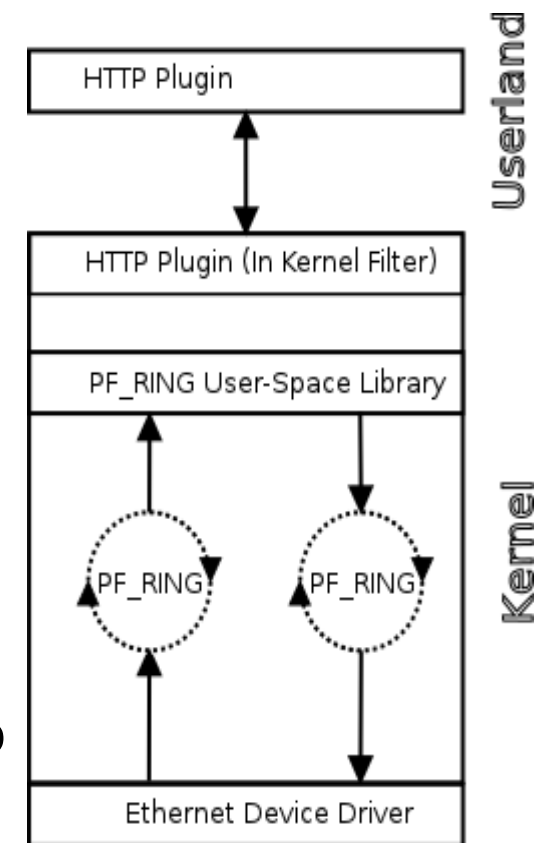
  </Representation>
</Period>

</MPD>
```



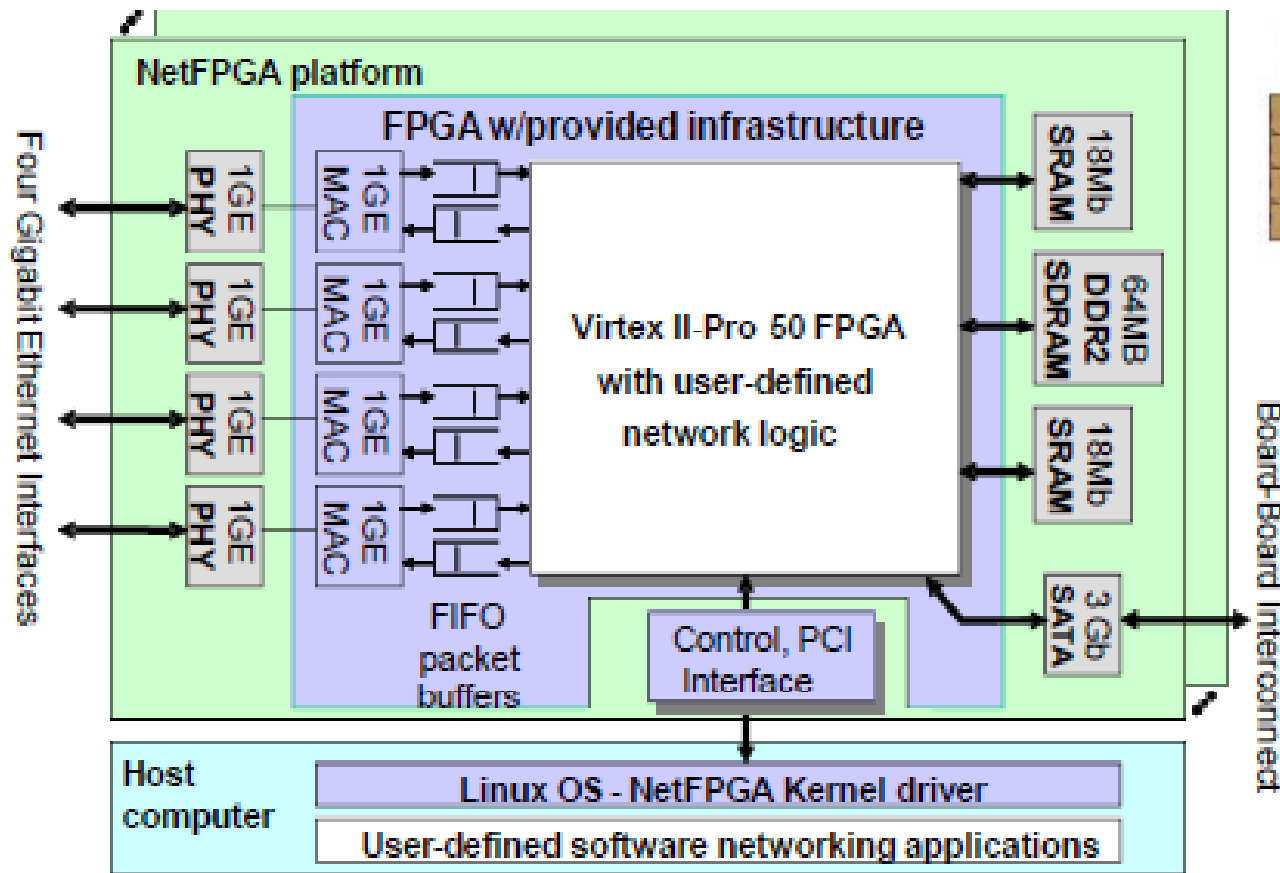
Step 3: DPI/Content identification

- DPI: PF_RING based implementation
- Simple interface to ring PKT capture
- High-performance
- Mature and tested code base
- Compatible with linux 2.6.x kernels up to .36. Easy to port to newer kernels.





Step 3: DPI/Content identification



- Four gigabit Ethernet Ports
- Standard PCI host Interface
- Gigabit serial I/O

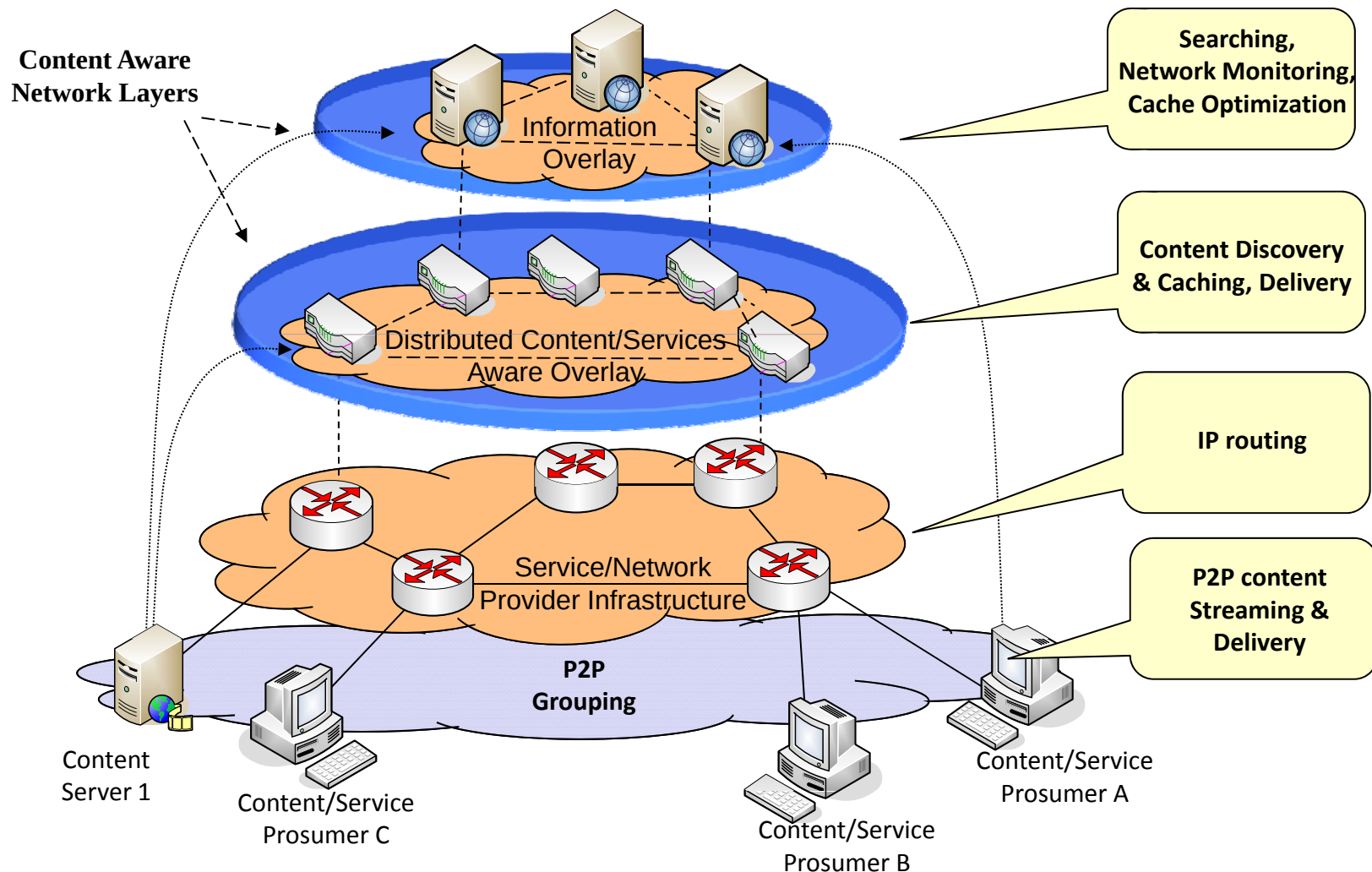


Step 4: Overlay Support

- Heterogeneity in the network nodes capabilities
 - Heterogeneity in topology/bandwidth capabilities
 - Heterogeneity in processing & storage capabilities
 - Heterogeneity in the delivery/streaming requirements
 - Heterogeneity in the security requirements
 - Heterogeneity in the network/domain administration
-
- We need an **abstract universal representation of nodes and virtual grouping of collaborating nodes** to create homogeneous sub-networks.

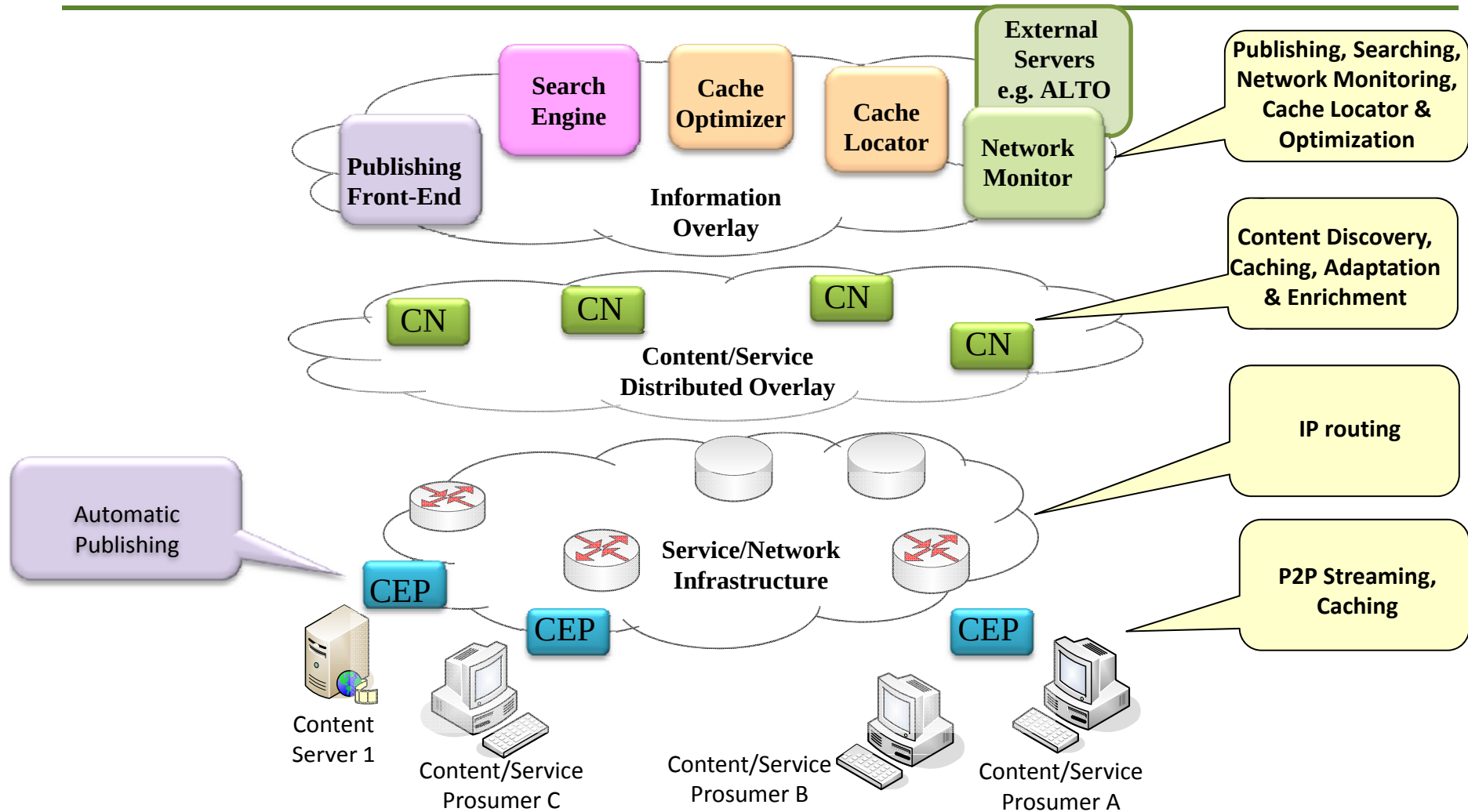


Step 4: Overlay Support



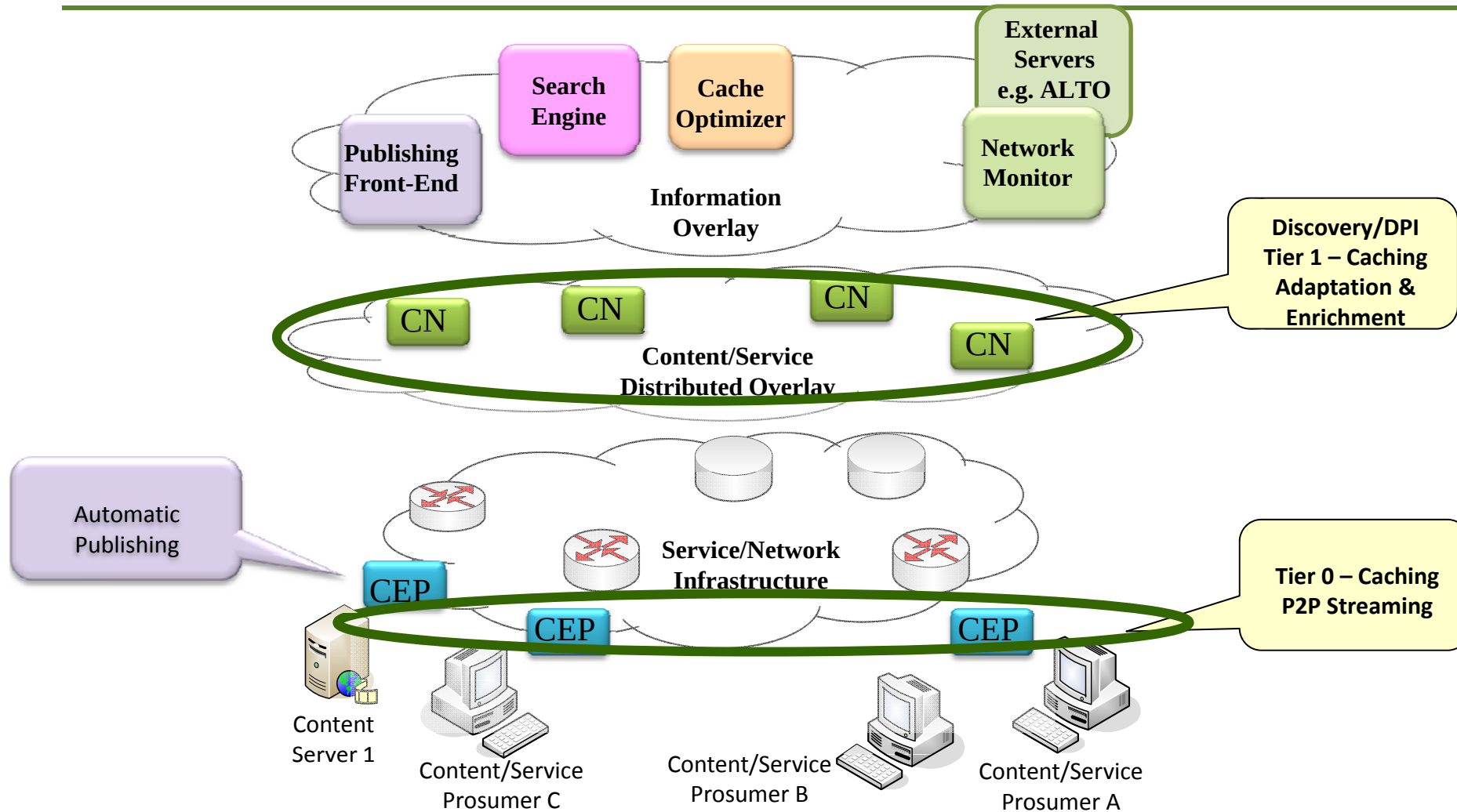


Step 4: Overlay Support



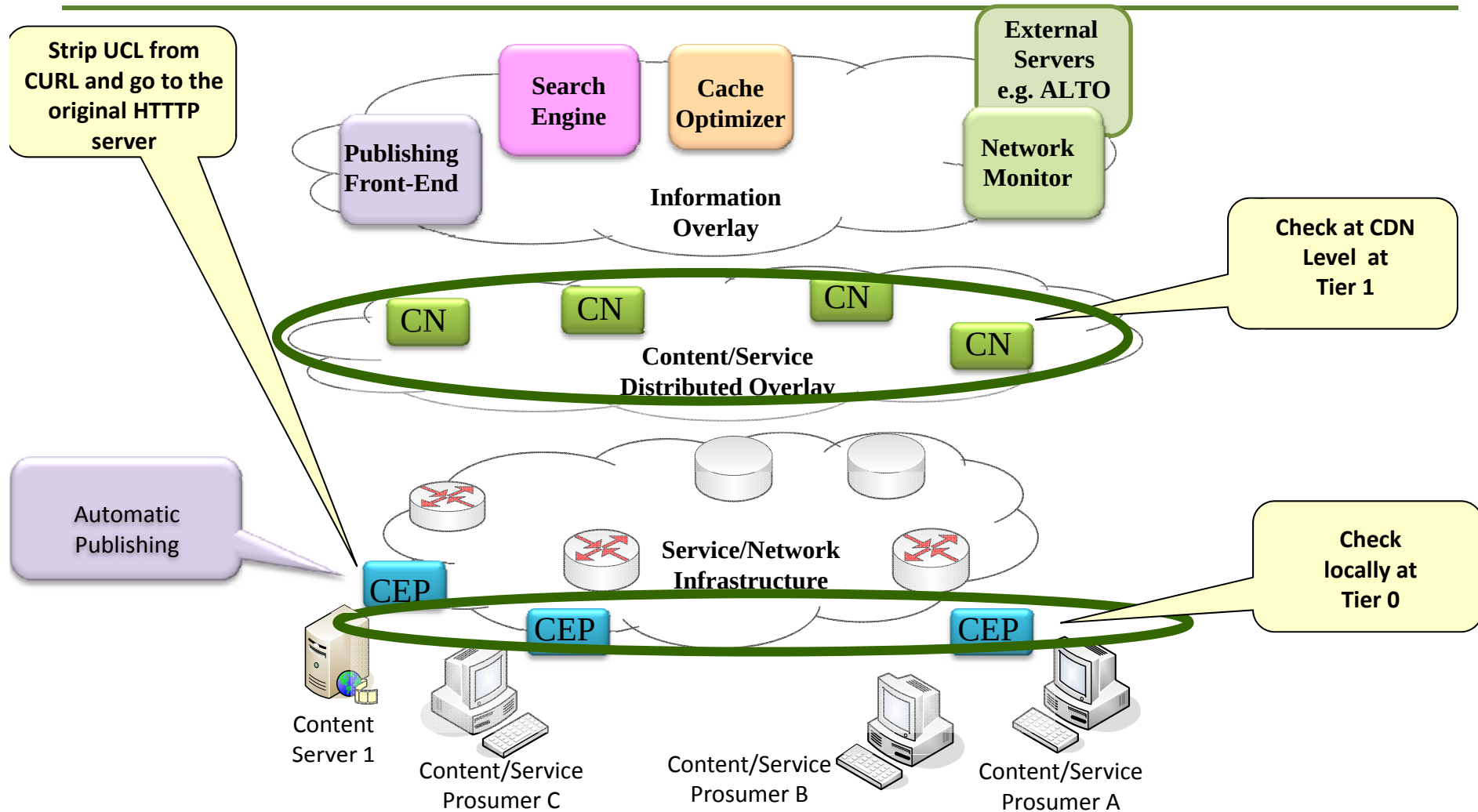


Step 5: Content Caching





Step 5: Content Caching



Thank You!

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