

On Adapting HTTP Protocol to Content Centric Networking

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CFI 2012 Seoul, Korea

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Introduction

- Content Centric Networking (CCN)
 - One proposal of content/information/data oriented network architecture
 - A totally different using primitive for data transmission from current Socket-based primitive
- HTTP
 - Predominant protocol for deploying new services and applications
 - An application-level protocol
 - A content centric protocol to some extent
- How to stitch them semantically on their content-oriented features?

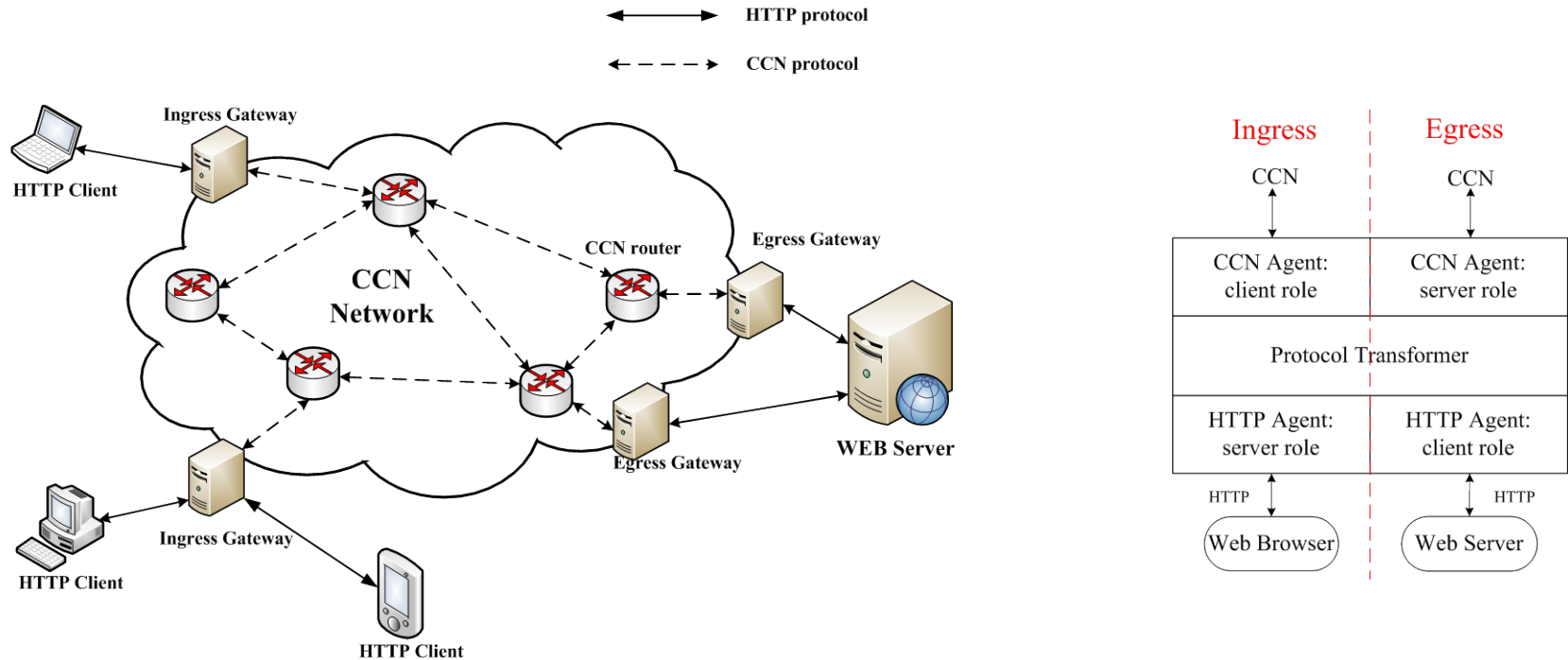
Motivation

- Build relatively large-scale test and generate real traffic to prove its feasibility and performance
- Combine the clean-slate design with the traditional Internet
 - Make an easy transition of CCN is still an open issue
- Figure out whether or how the content-oriented features of CCN could meet application needs and how the new architectural design interact with current system
 - Pre-existing content delivery infrastructure (e.g. CDN)
 - Content identification mechanism(e.g. HTTP content description).

HTTP-CCN Gateway

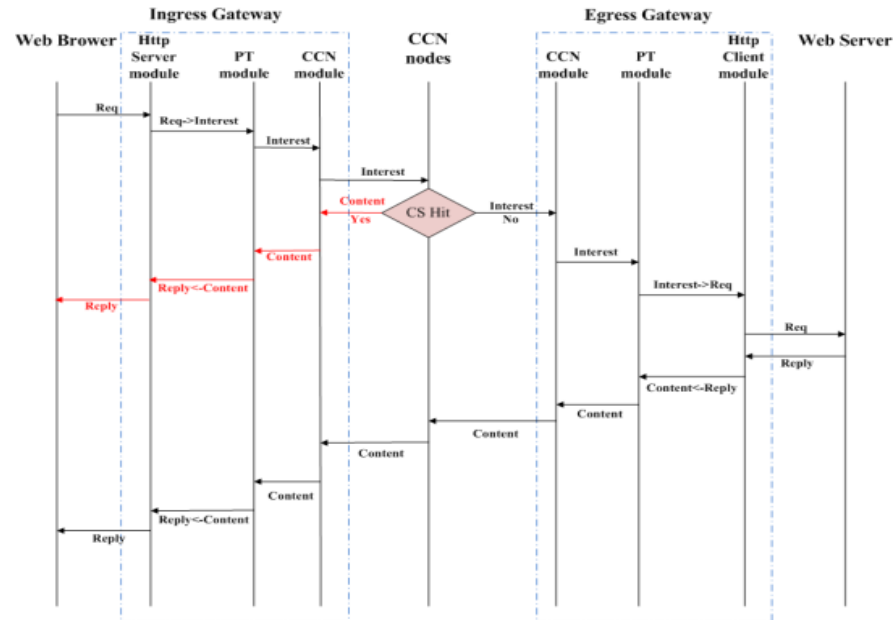
- Designed and implemented a HTTP-CCN gateway
 - To convert http request and http response to CCN Interest and Data.
- Combine HTTP and CCN by stitching their semantically on their content-oriented features
 - Such as content caching

HTTP-NDN Gateway Overview



- The HTTP-CCN gateway consists of two parts
 - Ingress gateway and Egress gateway (IG and EG for short)
- Implementation
 - Modified and extended an open source WAP and SMS gateway named kannel

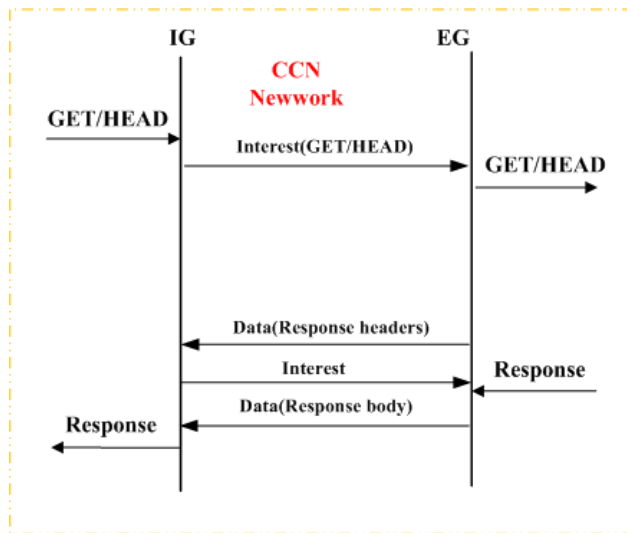
Protocol Transformation



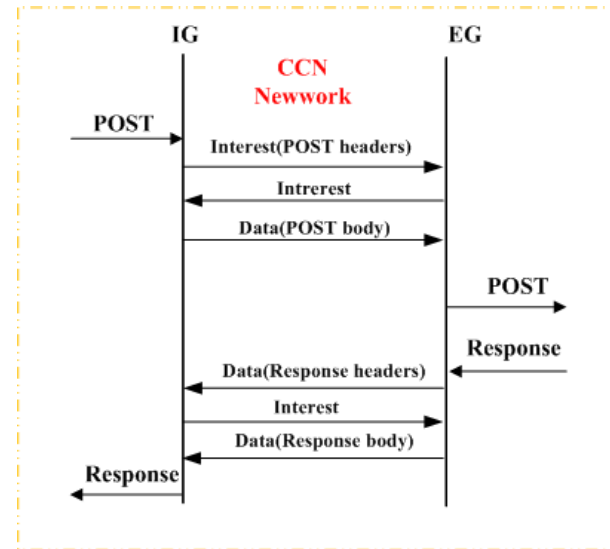
- CCN Naming convention
 - Combine the URL with a prefix which indicates the routing information needed by CCN router

Ccnx:/Egress-1/http/Get/www.baidu.com/s?wd=yi&rsv_bp=0&rsv_spt=3&inputT=1488

Deal with different HTTP methods



(a) GET/HEAD



(b) POST

- Semantically, GET is similar to CCN interest
- POST is partly similar to CCN data
 - A poster is both a data producer and a consumer.

Adapt HTTP Caching into CCN

- Caching is considered as one of the most important features of CCN
 - May be the main incentive for ISP to deploy CCN
- The IG and EG are designed to leverage this feature to support the HTTP application running over CCN.

Adapt HTTP Caching into CCN(cont.)

- For CCN
 - Consumer:
 - Control how interest could be satisfied by cached content
 - Attribute of Interest: AnswerOriginKind
 - Producer:
 - Control the content expiration
 - Attribute of Content: FreshnessSeconds
 - A timestamp denoting the time of its generation
- For Http
 - More complicated specification for regulating caching behavior
 - Some functions can not be mapped into CCN
 - “validation” mechanism for cached content to reduce network bandwidth requirements

Discussion about Transparent Caching

- Using HTTP to delivery videos prevails due to
 - Extensive availability
 - Enormous Infrastructure already existing in Internet
- Transparent caching
 - Intelligently and dynamically identify content and adapt to shifting content access patterns
 - CCN can be used to provide an ideal foundation of transparent caching for carrier network
 - With the great incentive of transparent caching, it can be a promising way for CCN to roll out

Obstacles of transparent caching with CCN(cont.)

- Application of HTML rewriting-based CDN service makes it inefficient to cache transparently in CCN.
 - Same content objects have different names.
 - Different IP addresses are included in the names.
 - Some random string is embedded in name to prevent clients from caching.

<http://118.228.18.32/youku/6975350854E3482E8FCDBE6E0E/03000201004F759257B7F300946C19B8D94FF0-563F-4D8D-A687-35BEBCA497B4.flv>

Obstacles of transparent caching with CCN

- Customized content make transparent caching difficult
 - The parameters indicating the client features can be encoded in the URL of a HTTP request or appears in the cookie header.
 - Content provider tagged video chunks as “private” to ban any caching outside requesting client.

<http://tc.v3.cache7.c.youtube.com/videoplayback?algorithm=throttle-factor&sparams=algorithm%2Cburst%2Ccp%2Cfactor%2Cid%2Cip%2Cipbits%2Citag%2Csource%2Cexpire&key=yt1&sver=3&expire=1332882801&signature=9453CF40D01B5DB92E27CC810DF7846F27498572.1B350162E6B7853438641E68D2BF807FFA0B51F7&source=youtube&id=5ec151f036d24501&cp=U0hSR1hTUF9FS0NOMI9QTVRJOkJZTFM2UktNdjM3&itag=34&ipbits=48&burst=40&ip=2402%3Af000%3A1%3A%3A&factor=1.25&fexp=913700%2C905024&ptchn=RussiaToday&ptk=russiatoday&playretry=1&cm2=1>

Conclusions

- We design and implement a HTTP-CCN gateway to transform HTTP request and HTTP response into CCN Interest and Data respectively
 - To stitch them semantically on their content-oriented features
- Constrained by the caching functionality CCN provided, it is difficult to completely map the HTTP caching requirements into CCN caching functionality naturally and effectively
 - Whether or how the content-oriented functionality provided in network layer could meet the needs of upper-level application?
- For transparent caching with CCN, we found that:
 - 1) Application of HTML rewriting-based CDN service makes it inefficient to cache transparently with CCN
 - 2) Customized content make transparent caching difficult. Achieving

Thanks!