6. Fachgespräch der GI/ITG-Fachgruppe KuVS «Future Internet»

Service-Centric Networking

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Overview

> Content-Centric Networking
> Service-Centric Networking
  — Advantages
  — Uniform Naming for Services and Content
  — Object Types
  — Addressing Multiple Objects for Composed Services
  — Optimization of Service Execution
  — Examples: Video Rendering and Real-time Audio Conferencing
> Conclusions and Outlook
Content-Centric Networking (CCN)

> [Jacobson et al., ACM Conext 2009]
> Combination of content lookup and routing
> Messages (using XML encoding)
>    — Interest: content name, selector
>    — Data: content name, signature (info), data
> Hierarchical content names
>    — Example: /unibe.ch/braun/lecture/20100405

> Processing of Interest message
>    — Longest prefix match on content name in Content Store: returning data and discarding Interest
>    — Pending Interest Table (PIT) match: adding request to PIT and discarding Interest
>    — Forwarding Information Base (FIB, population by announcements of content availability) match: forwarding of Interest towards data
Service-Centric Networking (SCN)

- CCN is content-centric and encodes a few operations on content as extensions of names.
- Proposal: Service-Centric Networking
  - Extension of content-centric networking to support services, possibly operating on content.
  - Description of a service using content naming scheme, e.g., /google.com/file-service
  - Service request to invoke a service in Interest message
  - Service response in Data message
- Services
  - Infrastructure services, e.g., cloud computing services
  - Client-oriented services, e.g., web services
  - Continuous content retrieval and streaming services
Advantages of SCN

> No service lookup and service registry

> Caching of service data; extended caching of multimedia data

> Location-based services

> Optimized service selection
Uniform Naming for Services (Functions) and Content (Data)

- Services perform (data) processing and are represented by \textit{functions} to be invoked. Content stores for \textit{data}.
- Service-centric networking should support both data and functions.
- Object-orientated programming paradigm integrates both functions and data into objects. Method calls among objects to invoke functions.
- Proposal: Object names for both services (functions) and content (data), e.g.,
  - /youtube.com/rendering
  - /unibe.ch/braun/lecture/20100405
- Advantages of object-oriented approach
  - Uniform naming
  - Services can be implemented as a set of cooperating objects
SCN Object Types

1: Content Object
- read
- content data

2: Service Object
- function1
- function2
- function3

3: Content/Service Object
- read
- function1
- function2
- content data

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Addressing Multiple Objects for Composed Services

<table>
<thead>
<tr>
<th>Objectname1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectname2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>ObjectnameN</td>
</tr>
<tr>
<td>Parameter1</td>
</tr>
<tr>
<td>Parameter2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>ParameterM</td>
</tr>
</tbody>
</table>

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Optimization of Service Execution

Interest

(service-name (data1, data2))
Example: Video Rendering I

- client
  - read
  - write
  - video-file1

- render
  - read
  - write
  - video-file2

  - read
  - write
  - video-file3
Example: Video Rendering II

- Client
- Render
- Video-file1
- Read
- Write
- Video-file2
- Read
- Render
- Write
- Video-file3
- Read
- Render
Example: Real-time Audio Conferencing

Sent audio data → Echo cancellation → Trans-coding → Mixing

Received audio data
Real-Time Audio Conferencing Service

/main/echocancel
/main/transcode
/main/mix/todaysconf
/main/john/audiostream_original
/main/mix/todaysconf/audiostream
/main/john/audiostream_original
/main/john/audiostream_trans
/main/mix/todaysconf
/main/mix/todaysconf
/main/mix/todaysconf
/main/main
/main/write
/main/read
/main/generated
/main/generated/audiostream
/main/echo-cancelled
/main/echo-cancelled/audiostream
/main/transcoded
/main/transcoded/audiostream
/main/mixed
/main/mixed/audiostream

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Conclusions and Outlook

- Service-Centric Networking as a new paradigm extending content-centric networking using an object-oriented naming concept

- Open Issues
  - Implementation architectures
  - Service management
  - Service composition
  - Routing
  - Parameter support
  - Charging
  - Security