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Service-Centric Networking

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Workshop – July 2017
Bern, Switzerland

Agenda

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- Service-Centric Networking requirements
- Session Support
  - Benefits of session support
  - Designed session support for SCN
  - Evaluation of the SCN session support mechanism
- IaDRA-SCN
  - Intra-domain routing architecture for Service-Centric Networking
- Session Support
  - Node failure recovery
- Conclusion

SCN Requirements

- **Session support**
- **Load balancing**
- **Node failure recovery**
- Service composition
- …

Benefits of session support

- Session use cases
- Service provider need to instantiate a virtual machine before processing incoming requests
  - Requires processing context
- Security-related applications
  - E.g., encryption/decryption services that require a key exchange
  - Requires processing context
- Sessions are beneficial for the processing of continuous service requests requiring an execution context

Session support – design and evaluation

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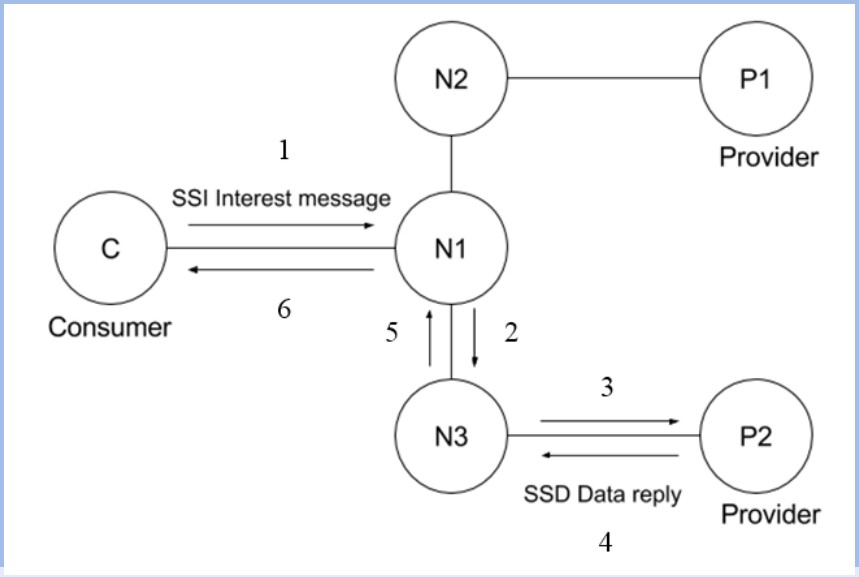
- The following slides will present the designed session support
  - Session establishment
  - Session usage
  - Session termination
- Our mechanism for SCN session support
  - NDN was extended to integrate the SCN session support
- To implement and evaluate our work
  - We used the ndnSIM framework
  - ndnSIM is a ns-3 based simulator integrating the NDN implementation of the CCN concept

Session establishment 1/3

- To establish a session two messages need to be sent
  - Session Start Interest (SSI)
  - Service Start Data (SSD)
- SSI is sent by the service consumer and SSD is the reply of the Producer to the incoming SSI Interest
- In the figure below consumer C establishes a session with producer P2



Session establishment 2/3

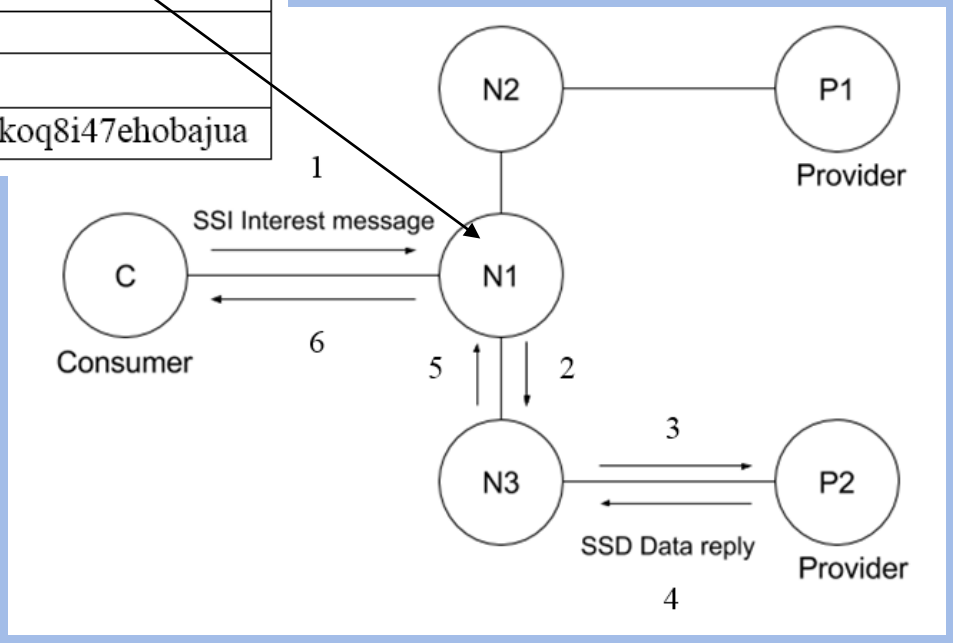
- SSI name contains three elements
  - Requested Service Identifier
  - Keyword indicating a request for a Session
  - Unique session ID generated by the service consumer
- SSD service producer data reply contains
  - Unique session ID generated by the service producer
- Intermediate nodes store in their FIB the session name
  - Which consists of the SSI name concatenated with unique ID generated by the producer
  - e.g., *service/getWeather/session/kdi32jd329j92rgqlkoq8i47ehobajua*

Session establishment 3/3

- FIB table of node N1 after session establishment
  - Route to the session of N3 is added

TABLE III. FIB TABLE OF NODE N1

Forwarding Information Base	
Node	***Name***
N2, N3	service/getWeather
N3	service/getWeather/session/kdi32jd329j92rgqlkoq8i47ehobajua



Session usage

- The service consumer needs to send an Interest with the following naming convention
  - service/[*service-identifier*]/session/[*session-identifier*]
- The name contains two keywords and the service and *session identifiers*
- Intermediate nodes forward the Interest based on the standard NDN forwarding scheme
  - Routing based on the FIB table entries

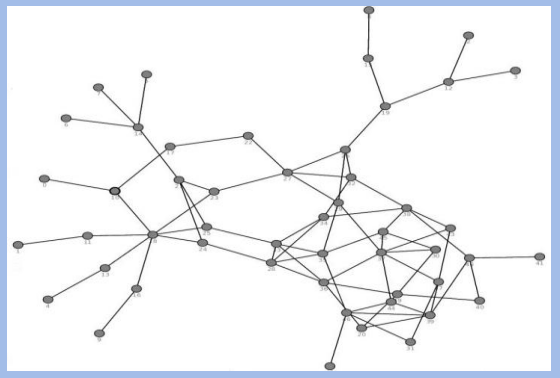
Session termination

- To termination a session the service consumer needs to send a session Interest request containing the keyword *terminate*
- The service provider will reply to this request to confirm the end of the session
- Intermediate nodes will delete the corresponding FIB entries
  - Upon forwarding the service provider confirmation

TABLE III. FIB TABLE OF NODE N1

Forwarding Information Base	
Node	***Name***
N2, N3	service/getWeather
~~***N3***~~	~~service/getWeather/session/kdi32jd329j92rgqlkoq8i47ehobajua~~

Evaluation scenario



- Topology composed of 50 nodes
  - 4 provider and 8 consumer nodes
- Service consumers send service request
  - Approximatively every second
  - Random variable of exponential distribution
- Service producers process incoming request
  - Based on a uniformly distributed random variable
  - Two different scenarios by varying the processing time (ms)
    - 1500-2000 and 2500-3000
  - Processing time
    - Time required by a node to process a request
- We compared the service delivery time
  - Time between the request sent and the response received by the consumer

Evaluation and results

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- We compared the three strategies present in ndnSIM and our session support strategy
- By varying the processing time the ranking of the strategies considered remains unchanged
  - 1500-2000 and 2500-3000 (uniform random distribution)
- Our session support mechanism outperforms the existing strategies
  - Because existing strategies are not efficient for service request load-balancing

Evaluation and results

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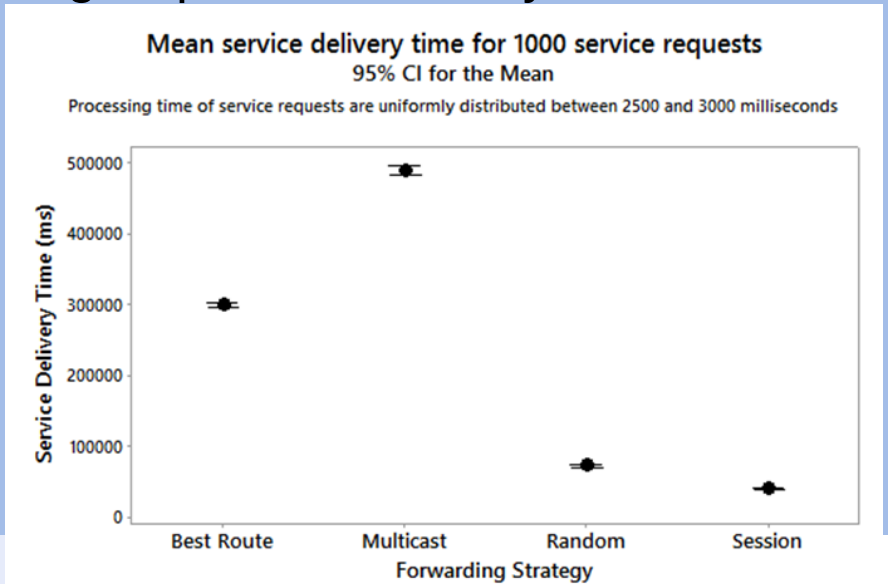
- Chart shows results for mean service delivery time
  - For 1000 service requests
  - For service processing time of 2500-3000 (ms)
    - Processing time distribution of 1500-2000 (ms) does not affect the performance rank
- Random strategy is second best behind our session support
  - Effect of forwarding requests randomly to different service providers



IaDRA-SCN

- IaDRA-SCN
  - Intra-domain routing architecture for Service-Centric Networking
  - First SCN routing architecture based on NLSR
- Nodes propagate to the network
  - Prefix
    - Allows to distribute registered prefixes
    - Name prefix reachability
  - Adjacency
    - Contains active links to neighbours and their cost
    - Allows to build the network topology and compute path cost
  - Resource Availability
    - Service providers propagate periodically Resource Availability information
    - Allows load-balancing for service requests requiring processing

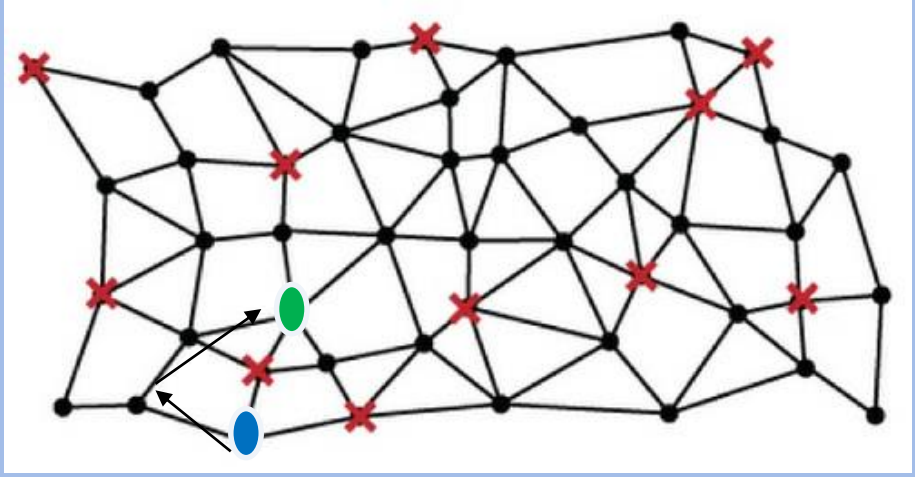
IaDRA-SCN

- With the Adjacencies, nodes can:
  - Built the network topology
  - Identify which node is associated with which prefixes
  - Rank outgoing faces for future service request forwarding decisions
- Nodes have a significant knowledge of the entire network

- Based on NLSR
  - Intra-domain
  - Protocol overhead

Session Support - Node failure recovery

- Find alternative path in case of node failure
- Service provider propagates periodically BF containing session identifiers
  - Alternatively it can broadcast its node identifier
    - Less protocol overhead
- The service requester will broadcast a request to find an alternative path/face to reach the service provider



Conclusion

- Session Support Paper presented at Networking-Comet
- Ongoing research to integrate node failure recovery
  - Session information propagation
  - Node failure recovery by propagating session/node identifiers
- IaDRA-SCN
  - First NLSR based Service-Centric Networking routing architecture
  - NLSR was extended to propagate resource availability information

Questions

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Thank you for your attention!