PROACTIVE SELECTIVE NEIGHBOR CACHING
FOR ENHANCING MOBILITY SUPPORT
IN INFORMATION-CENTRIC NETWORKS

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Reduce delay experienced after handing off to another location

- Mobile Users (MUs) in an ICN architecture
- Running applications with strict delay requirements
Receiver-Driven model in ICN

Domain A
Publisher

Domain B
Publisher

✓ MU just re-subscribes after completing the handoff
ICN is mobile-ready

- **What about delay after handoff?**
  - Resend request, wait for resolution and path formation
  - Wait to get data from (another?) publisher

- **Delay-sensitive applications:**
  - Realtime/emergency notifications,
  - Teleconferencing, online gaming, etc..

- **Sensitive to delay jittering**
  - Multimedia Streaming services
• Proactive Caching
• SNC: Selective Neighbor Caching
• Evaluation
• Future Work and Conclusion
Proactive Caching

• **Use proxies**
  – Handle requests
  – Proactively Cache IOs

• **Neighboring proxies**
  – One hope ahead
Proactive Caching

• **Full caching**
  – Proactively fetching and caching requests and IOs to all neighbors

• **Blind approach**
  – *Wastes* buffer space
  – *Infeasible* to cache all IOs for all mobiles
  – Increases delay for other mobiles
• Proactive Caching
• **SNC: Selective Neighbor Caching**
• Evaluation
• Future Work and Conclusion
Selective Neighbor Caching (SNC)

- **SNC selects only an optimal subset of neighbors**
- **GOAL:** Minimize total costs

\[ S: \text{Subset of neighbor proxies} \]

Current Proxy: \( i \)

Mobile User

\( j \)
Selective Neighbor Caching (SNC)

\[ a) \text{ Chit: Delay cost from a selected proxy} \]
Selective Neighbor Caching (SNC)

\(a\) \(Chit\): Delay cost from a selected proxy

\(b\) \(Cmiss\): Delay cost from a non selected proxy
Selective Neighbor Caching (SNC)

a) $C_{hit}$: Delay cost from a selected proxy

b) $C_{miss}$: Delay cost from a non selected proxy

c) $C_{cache}$: The cost for allocating buffer space
Selective Neighbor Caching (SNC)

**a)** $C_{hit}$: Delay cost for getting IOs from a selected proxy

**b)** $C_{miss}$: Delay cost in case next proxy was not selected

**c)** $C_{cache}$: The cost for allocating buffer space

**d)** $P_{ij}$: The probability for the MU to move from $i$ and attach to $j$
What is the optimal subset $S^*$?

Discover $S \subseteq J$ which **minimizes** the total cost:

$$P_{hit}(S) \times C_{hit} + (1 - P_{hit}(S)) \times C_{miss} + N(S) \times C_{cache}$$

- **Average delay**
- **Cache cost**
Each Proxy decides autonomously

Pre-fetching in neighbor $j$ if and only if:

$$p_{ij} \geq \frac{C_{cache}}{C_{miss} - C_{hit}}$$

- SNC is fully distributed and decentralized
• Proactive Caching
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Simulation Delay gains over Full Caching
Simulation delay gains over No Caching

- No Caching, \(|J|=8\)
- No Caching, \(|J|=5\)
• Proactive Caching
• SNC: Selective Neighbor Caching
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• Future work and Conclusion
Future work

- Network topology, multiple levels of proxies
- Traffic demand, IO size, disconnection period
- The influence of in-network caching
- Online cache cost evaluation
- Consider extensions as discussed in the paper
Conclusion

• SNC trades-off delay with cache cost
  – Selects the appropriate subset of proxies which minimizes cost

• Simulation investigations quantify cost gains
