Mobility Support in Information Centric Networking (ICN)

Vasilios A. Siris

Mobile Multimedia Lab
Department of Informatics
School of Information Sciences and Technology
Athens University of Economics and Business
Contents

• Mobility support in ICN
  – Receiver mobility
  – Source mobility

• Conclusions
  – Location-dependent addresses are important/necessary for efficient mobility support
  – Old/new role of agents/proxies
Receiver mobility

Receiver mobility supported by design:

• Receiver-driven content request model
• No end-to-end session establishment such as TCP
• Individual chunks/packets are named hence can be requested individually
Receiver mobility and caching

• In-network caching can assist receiver mobility
• Caches along path followed by request can provide data
  – Possible with naming of content chunks/packets
• Further optimization: use caches proactively
Receiver mobility and proactive caching

- Transfer content requests to one-hop neighbors
  - Prefetch content at neighbors when mobile disconnects
- Wasted resources if we prefetch content to all neighbors
Receiver mobility and proactive caching

- Transfer content requests to one-hop neighbors
  - Prefetch content at neighbors when mobile disconnects
- Wasted resources if we prefetch content to all neighbors
- Select subset of neighbors based on transition probability ⇒ Selective Neighbor Caching (SNC)
Source/publisher mobility

• Not as straightforward as receiver mobility
  – Receiver-driven (pull) model helps receiver mobility
  – Requests need to be “matched” to sources
  – Requests contain location-independent names

• Two problems need to be addressed
  – Find source’s new location: to forward content requests
  – Achieve session continuity: reduce or avoid service disruption and data loss/delay
Source mobility approaches

- **Routing-based** approach
  - Routing tables updated when source moves
  - Only solution if no location-dependent addresses

- **Indirection** approach
  - Agents at home and visited network
  - Need location-dependent addresses

- **Resolution** approach
  - Requires separate resolution function
Source mobility: routing-based

- Requests forwarded using routing tables
- Routing tables populated based on content advertisements
- Source mobility would trigger new content advertisements. Issues:
  - Convergence time
  - Routing table scalability
  - Smaller problem in case of micro-mobility

![Diagram showing source mobility in a network with source at old location and new location, with a receiver indicated by n1.](image-url)
Source mobility: routing-based

- Requests forwarded using routing tables
- Routing tables populated based on content advertisements
- Source mobility would trigger new content advertisements. Issues:
  - Convergence time
  - Routing table scalability
  - Smaller problem in case of micro-mobility
- Optimization: Proactive content advertisements
- How data is forwarded from source to receiver depends on specific architecture
Subscriber/publisher mobility

• Subscriber mobility is supported by design:
  – Receiver-driven content request model
  – No end-to-end session establishment like TCP
  – Individual chunks/packets are named hence can be requested individually

• Content/Publisher mobility more complicated
  – requires updating of routing tables or resolution/rendezvous tables
Source mobility: indirection approach

• Home agent forwards requests to new source location
  – Requires location-dependent identifiers
  – Similarities with Mobile IP

Source old location
n1
Home agent
n1
Receiver
Source new location
n1
PoA
Source mobility: indirection approach

- Home agent forwards requests to new source location
  - Requires location-dependent identifiers
  - Similarities with Mobile IP

![Diagram of source mobility: indirection approach](image-url)
Source mobility: indirection approach

- Home agent forwards requests to new source location
  - Requires location-dependent identifiers
  - Similarities with Mobile IP
- Agents in visited network can help transparency
  - Automatically add location prefixes
- Disadvantages:
  - Communication goes through home agent
Source mobility: resolution approach

- Resolution function already exists in some ICN architectures
- Resolution table updated with current location ⇒ need location-dependent ids
Source mobility: resolution approach (2)

- Resolution function can be provided by
  - Independent resolution network
  - Home agent

![Diagram showing source mobility and resolution function](image-url)
Source mobility: resolution approach (2)

- Resolution function can be provided by:
  - Independent resolution network
  - Home agent
- Issue: Resolution overhead, only for first communication
- How data is forwarded from source to receiver depends on specific architecture
Source mobility: resolution approach based on home agent

- Home agent: binding between name and location
  - Location id: PoA prefix+name
  - Updated when source moves
Source mobility: resolution approach based on home agent

- Home agent: binding between name and location
  - Location id: PoA prefix+name
  - Updated when source moves
- Request for content n1 routed to home agent
Source mobility: resolution approach based on home agent

• Home agent: binding between name and location
  – Location id: PoA prefix+name
  – Updated when source moves
• Request for content n1 routed to home agent
• Home agent responds with PoA/n1
Source mobility: resolution approach based on home agent

- Home agent: binding between name and location
  - Location id: PoA prefix+name
  - Updated when source moves
- Request for content n1 routed to home agent
- Home agent responds with PoA/n1
- Receiver requests PoA/n1
Source mobility: session continuity

• Mechanisms at mobile nodes help
  – Moving node informs other side that it will move and possibly where it will move

• Home/visited agents can help achieve transparency
  – Automatically add PoA prefix
  – No changes to mobile nodes
Conclusions

- **Receiver mobility** supported by **design** in ICN
  - **Optimizations** are possible by exploiting **caches**
- **Source mobility is more difficult** in ICN
  - With location-independent names only routing-based approach is possible
    - Convergence time and routing table scalability issues
  - **Location-dependent identifiers** necessary to support efficient source mobility in the general case
- Both **location-independent names** and **location-dependent addresses** have a role in future networks
- **Flexible/dynamic mapping** and usage of **names and addresses** to find & transfer information is key
Old/new role of agents/proxies

- Helps to support mobility
  - Transparency
- Perform some functionality on behalf of mobiles
  - Intermittent connectivity of mobiles
  - Proactive caching
  - Security/privacy
- Interconnection of different technologies
  - HTTP/IP & ICN
  - Signaling aggregation to reduce contention on wireless/mobile/satellite MAC
Thank You

Mobility Support in Information Centric Networking (ICN)

Vasilios A. Siris

Mobile Multimedia Lab
Department of Informatics
School of Information Sciences and Technology
Athens University of Economics and Business