

# Hierarchical naming for scalable content distribution in large networks

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# Outline

- Motivation
  - Challenges of scalable content distribution in large networks
- Designs
  - Meta network and attribute wise networks
  - Data delivery and mobility handling
- Performance measurement
- Conclusion

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# Ever-growing content distribution

- Internet is a global media consuming platform
  - Growing rapidly and already dominate the overall media consumption if consider broader types of devices and media types
    - Computer, Smart phone, tablet, e-reader ...
    - Audio, video, gaming, e-book, data ...
- Large organizations all have own ad-hoc data distribution solutions
  - Largely based on CDN and Http transport
  - Almost have no inter-operability
    - Sharing data across providers/devices are hard
- There is a need for ubiquitous content distribution designs that work for all

# Challenges in large networks

- Diversity in demands and requirements
- Uncertainty and unreliability in system
- Low manageability
- High complexity
- As a tentative proposal, we present a content naming scheme that aims at addressing these problems
  - A deployment plan
  - Feasibility analysis

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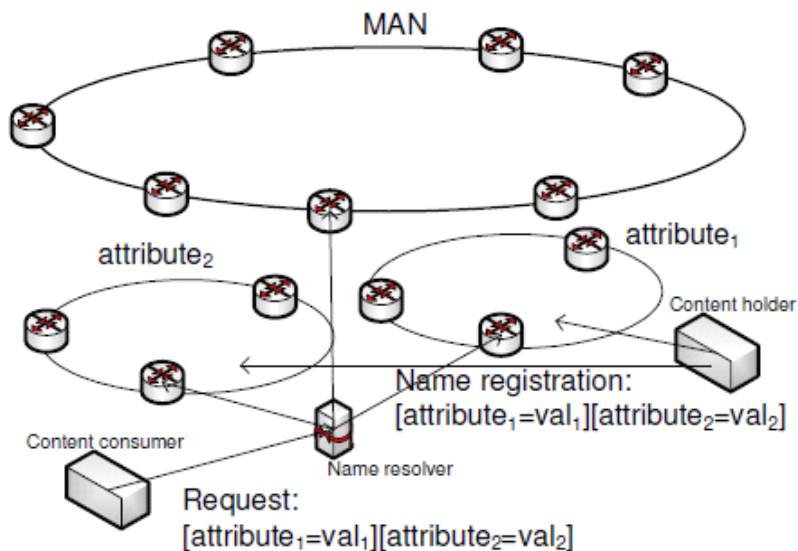
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# Attribute-value based naming

- Attribute-value vs. digital naming
  - Attribute-value pairs are universally understandable to human
  - Inter-operating with digital networking protocols is not super-efficient, but manageable
  - Ease application development with more flexibility and expressiveness
  - Some security problem could be addressed easier than digital naming
- Digital naming can be fast
  - Can be difficult to work across networks and organizations
  - Efficient but unfriendly to application development

# Overall architecture

- A hierarchical structure
  - A meta network at top that manages the mapping between attributes and attribute-wise networks
  - Attribute-wise networks at bottom to handling actually query load





# Use attribute-value

- Content is described by attribute-value pairs
- Indexing record based on the value of an attribute
  - Use Chord/DHT to organize records
- Content owners expose their identity and address information onto an attribute-wise network
  - A content description (attribute-value pairs), owner's ID and address form a content record
  - A content record is replicated onto multiple attribute-wise networks
    - For all its defined attributes
    - Eg: [name="wcnc"][organizer="IEEE"] needs to be replicated onto the attribute wise network for "name" and "organizer"

# Meta networks

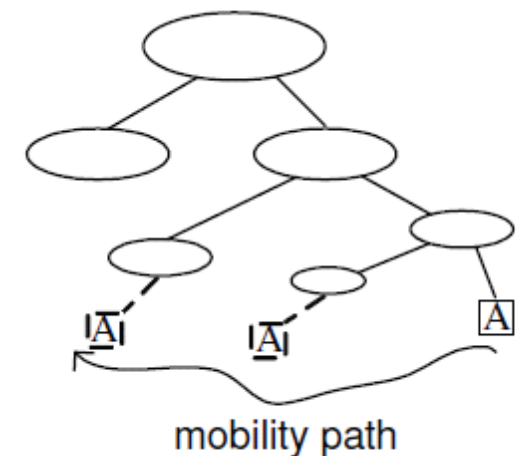
- Users search for contents for certain attribute-value criteria
- It needs to know an entry point into the attribute-wise network
  - If there is a cached valid one, use it
  - Otherwise, query meta network to get an entry point it interested in
  - Eg: looking for [name="wcnc"][organizer="IEEE"] but has not entry points to the "name" and "organizer" attribute wise network
    - Asking Meta network to find an entry point to those 2 networks

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# Request and response

- Content is queried first to obtain the address of the content owner
- Data is requested afterwards using appropriate protocols
- Handling mobility by introducing gate keeper that recording a moving host's address



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# Feasibility

- A publicly maintained meta network
  - Analog to root DNS
- Many organization-owned attribute wise networks
  - Analog to Autonomous Systems' DNS servers
- Cost analysis and technical feasibility
  - Please refer to the paper

# Proof of concept study

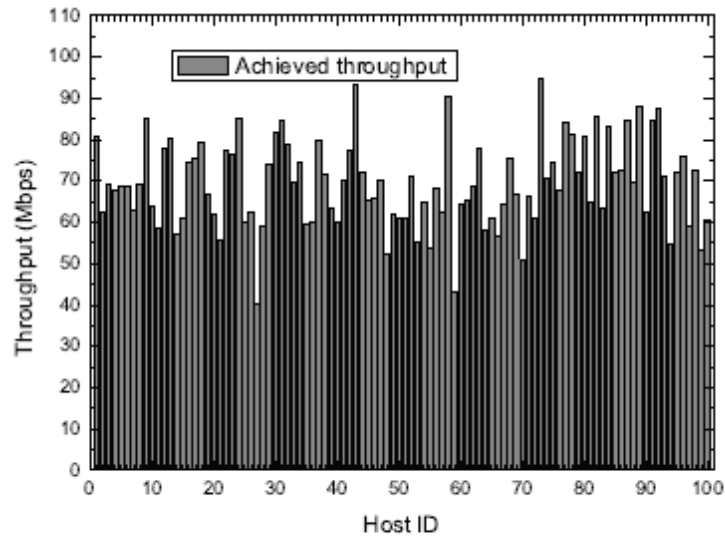
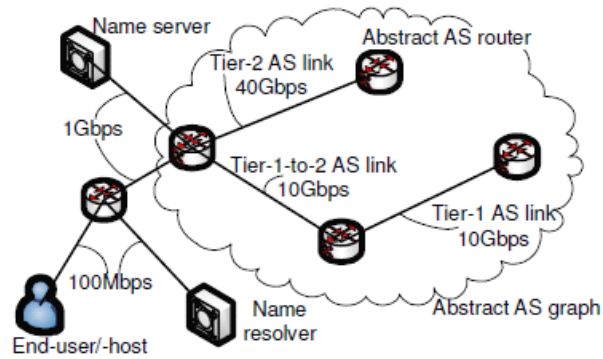


Fig. 5. The achieved throughput of all hosts.

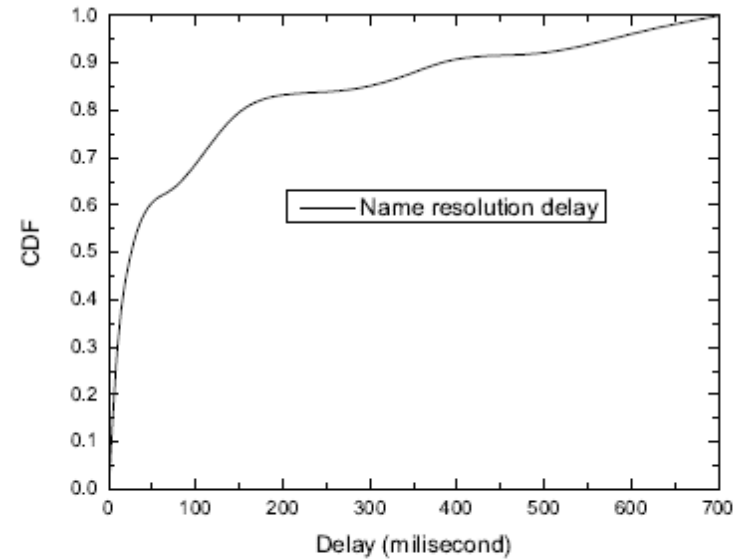


Fig. 4. The CDF of the name resolution delay.

Delay of query  
Throughput of content delivery

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# Conclusion

- A novel hierarchical name resolution network, which achieves fast name resolution through name record replication and provides a simple and flexible interface to application developers
- It's feasible and highly economical
- Proof of concept performance study is presented