



NetInf: An Information-centric Design for the Future Internet

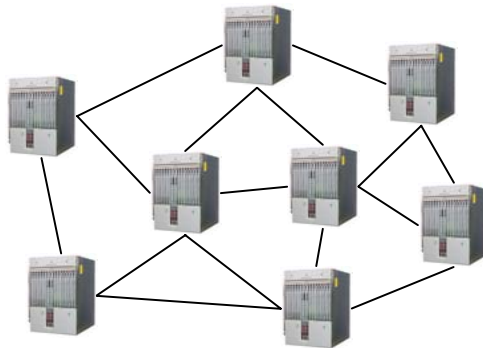
Christian Dannewitz
University of Paderborn

Colleagues
4WARD project

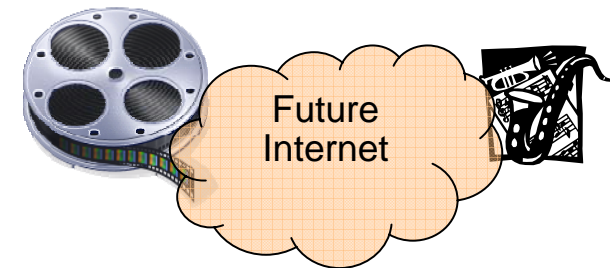


Network of Information

Today's Internet
Focus on *nodes*



Information-centric
Network
Focus on *information*



Build network architecture with
information at the center of all considerations

- ❖ Work in progress – focus on *problem space* and *overview*
 - Many details left out!
- ❖ Remix & extension of work presented at ReArch'08 & EU review



Presentation Outline

- ❖ Scenarios
- ❖ Problem and solution space
- ❖ Prototype
- ❖ Summary and conclusion



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Scenarios

- Content Distribution
 - *Common platform* for efficient large-scale content distribution
 - Server-less Web, Video on Demand,...
 - Retrieve local copies
- Augmented Internet
 - Integration of the *real world* and related Internet *information and services*
- Delay Tolerant and Mobile Networking





Presentation Outline

❖ Scenarios

❖ Problem and solution space

- Overview
- Information dissemination
- Naming and name resolution
- Information-centric security
- Information modeling

❖ Prototype

❖ Summary and conclusion



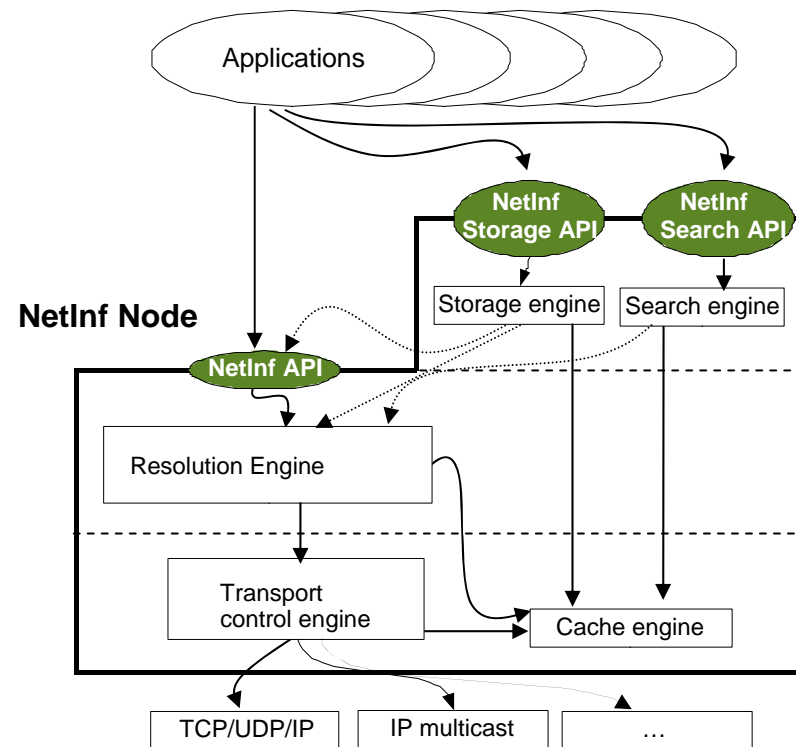
Towards an Information-centric Network Architecture

❖ Design architecture based on new paradigm

- Identify relevant concepts
- Identify existing partial solution
- Develop missing pieces

❖ Other main components

- Persistent naming
- Information-centric security
- Information modeling





Inefficient Information Dissemination

❖ Problems:

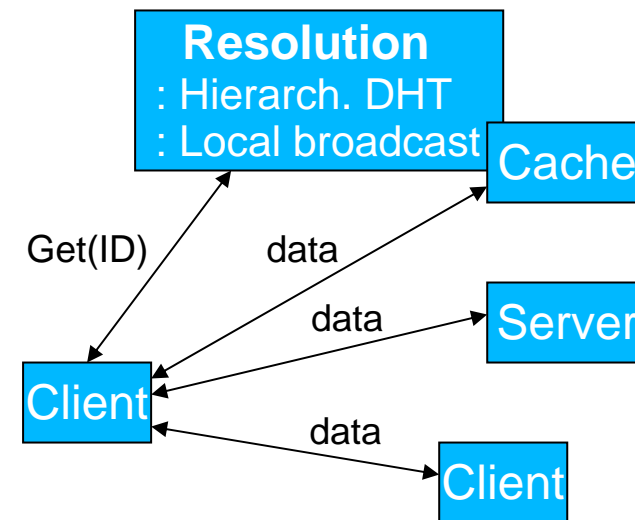
- Access to copies on clients
- Caching: Special *configuration* or *interception* of requests required
 - Redirects, proxies, deep packet inspection
- Anycast difficult
- *Flash-Crowd Effect (FCE)* and *Denial of Service (DoS)*

❖ Related solutions:

- *Content Distribution Networks* (e.g., Akamai)
 - No client copies, FCE, DoS
- P2P networks (e.g., BitTorrent)
 - No caching in the network
 - Topological embedding problematic
 - SmoothIT, P4P, IETF ALTO, ...
 - Stand-alone solutions, no common platform

❖ NetInf: Build consistent architecture

- Caching built-in from the beginning
- Any copy is good





Persistent Naming

- ❖ Problem: Persistent naming
 - URLs, IP addresses overloaded: Locator and identifier
 - Tussle for “good” domains

- ❖ Related solutions:
 - HTTP redirects
 - Requires cooperation of old domain
 - Permalink, Digital Object Identifier (DOI)
 - P2P networks: Use flat names

- ❖ NetInf:
 - Persistent naming framework
 - Information-centric security



Naming Framework

Naming of files

- ❖ 1st idea: Random number
 - + *Global uniqueness* statistically likely
 - + No central naming authority
 - No security
- ❖ 2nd idea: Hash of the content
 - + *Self-certification*
 - + Any copy is good and secure!
 - Not persistent for dynamic content
- ❖ 3rd idea: Hash public key of owner + metadata
 - + *Owner authentication* to improve *trust*
 - Persistence problem when owner changes

19574329834789248237

Hash(Content)

Hash(Public_Key) | Label

+

Metadata:
...
Sign_{SK}(Hash(Content))
...

Naming of services, real-world objects, streams

- ❖ No content for self-certification



Information Model

❖ Problems:

- No consistent, copy-independent representation of information
- Keeping track of *identical copies*
- Handle different *encodings* (e.g., mp3, wav)
- Benefit from metadata and semantics

❖ Related solutions:

- BitTorrent tracker
- Semantic Web

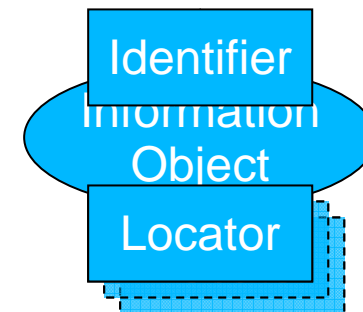


Identifier and Information Modeling

- ❖ 1st step: *Identifier/locator split*
 - Persistent, location-independent identifiers
 - Represent *multiple copies*

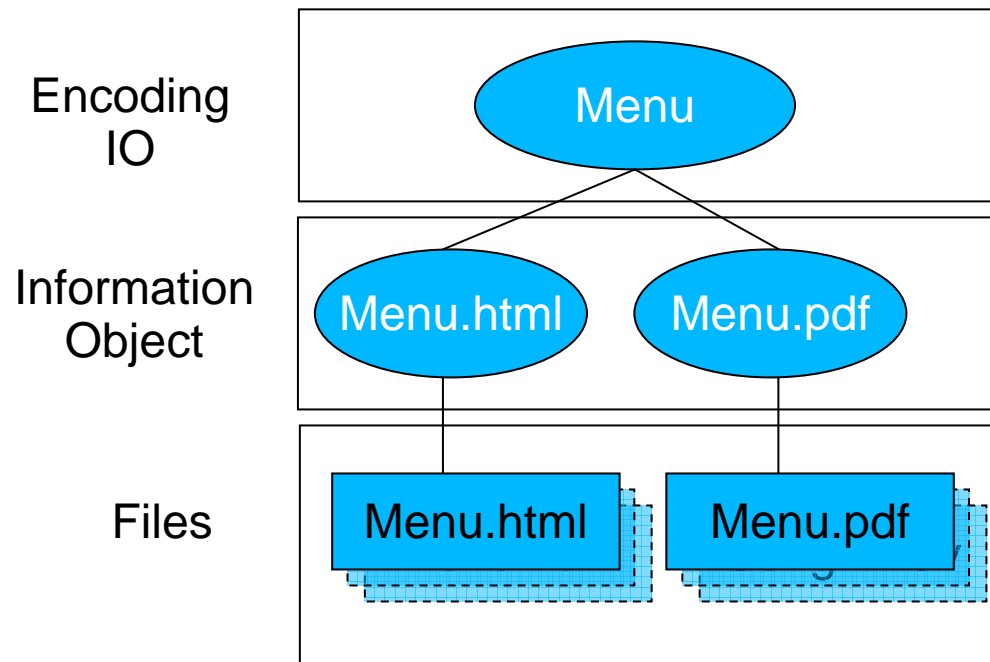
- ❖ 2nd step: *Information Objects (IOs)*
 - Representation of information
 - Independent of *specific copy and encoding*
 - E.g., a text, a song
 - Contains *information-specific* metadata
 - E.g., signature, attributes

- ❖ Information Objects can do more:
 - Represent streams, services, real-world objects
 - Organize information





Organize Information



- ❖ Enables efficient information dissemination
 - Automatically choose encoding and copy
 - User can navigate information



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Summary and Conclusion

- ❖ Architecture based on *information-centric* paradigm
 - Rather than *host-centric* paradigm

- ❖ Main focus:
 - Efficient *information dissemination*
 - Benefit from *available copies, anycast, solve Flash-Crowd Effect, ...*
 - *Secure and persistent* naming framework
 - *Name Resolution*
 - Information modeling via *Information Objects*

- ❖ Status:
 - Evaluation of core architecture
 - Still open issues, e.g. caching
 - Prototyping



Thank you for your attention

