

On Name-oriented Publish/Subscribe in the Future Internet

Thomas C. Schmidt, Matthias Wählisch, Dominik Charousset, Sebastian Meiling
schmidt@informatik.haw-hamburg.de



Agenda

- 🕒 Publish/Subscribe at Internet Scale
- 🕒 Information-centric Networking –
the Problem of State Management
- 🕒 Name-oriented Multicast – H \forall Mcast
- 🕒 Future Directions



Publish/Subscribe at Internet Scale

- o Decouples Content Request from Response
 - In location, time, or in communication state
 - Names contribute the logical links

New Communication Paradigm for a Future Internet?

o Key Challenges

- Scalability
- Routing: transparent rendezvous
- Service design: meeting application needs
- Programming design: meeting developers



Current Pub/Sub Approaches

o Traditional: Multicast

- Simultaneous action of senders and receivers
- Technology-bound, lacks uniform naming

o Specific: The Web

- Bound to the application context of content access
- Built on top of endpoint-to-endpoint primitives

o Hot: Information-Centric Networking

- Gains from correlating receivers in space & time
- Built on data-driven in-network states



Recap: The Web

o Universal Naming

- URL addresses any resource (real or virtual)
- Technology-abstraction per namespace

o Simple Programming Access

- Easy handling of (meta-type) URL
- Facile coupling of request & response by http

o Successfully Rests on Internet Foundations

- TCP/IP, DNS, ...



Information-centric Networking

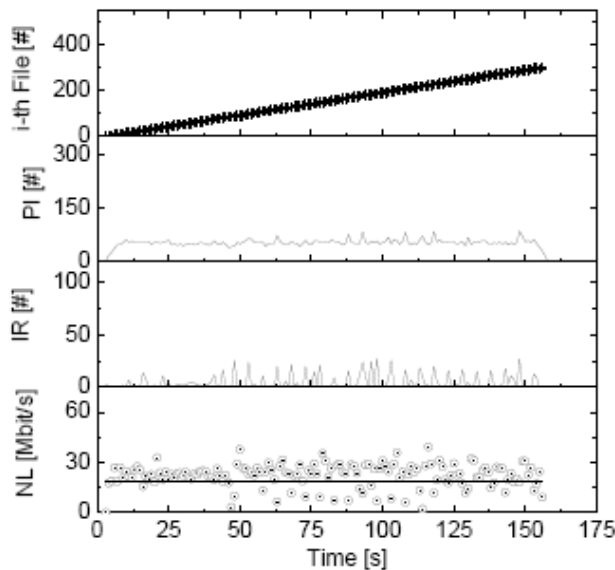
- o Universal Binding of Content to Names
- o Ubiquitous Caching
- o Essentially two Ways of Content Retrieval
 1. Mapping names to current locators
 - Requires state updates with content & replication
 2. Request routing on content names
 - Requires in-network request routing states

⇒ **State Management by Data-driven Events**

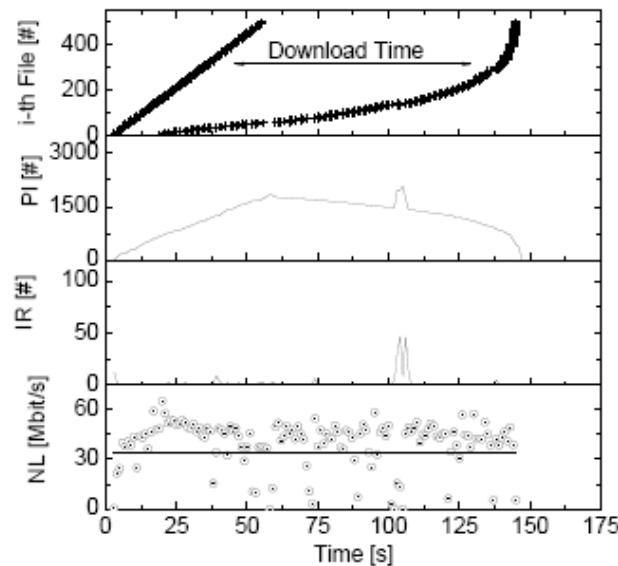


The Problem of Data-driven States

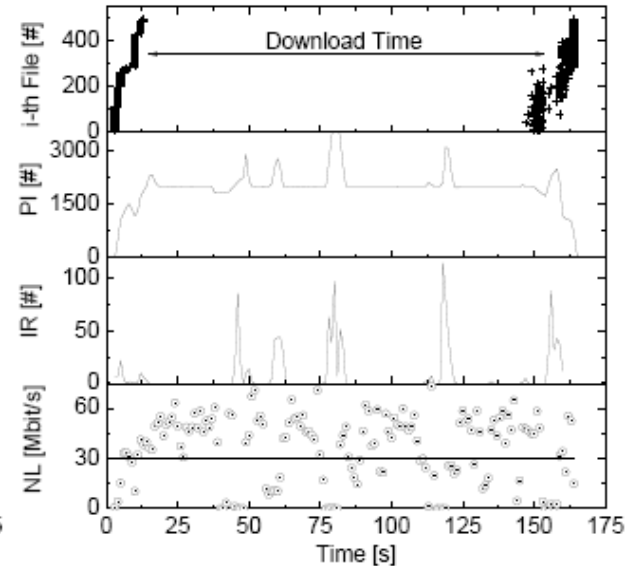
Example: Experimental Analysis for CCNx



(a) 2 files per second



(b) 10 files per second



(c) 100 files per second

Bulk of Interest: Performance Measurement of Content-Centric Routing
In: *Proc. of ACM SIGCOMM Poster, 2012*



Name-oriented Multicast: H \forall Mcast

o Universal Service Abstraction for Multicast

- Technology integration by system-centric intelligence
- Middleware layer as a service enabler

o Name-oriented Service Access

- Universal naming with stateless mapping option
- Common API in final IRTF review

`draft-irtf-samrg-common-api`

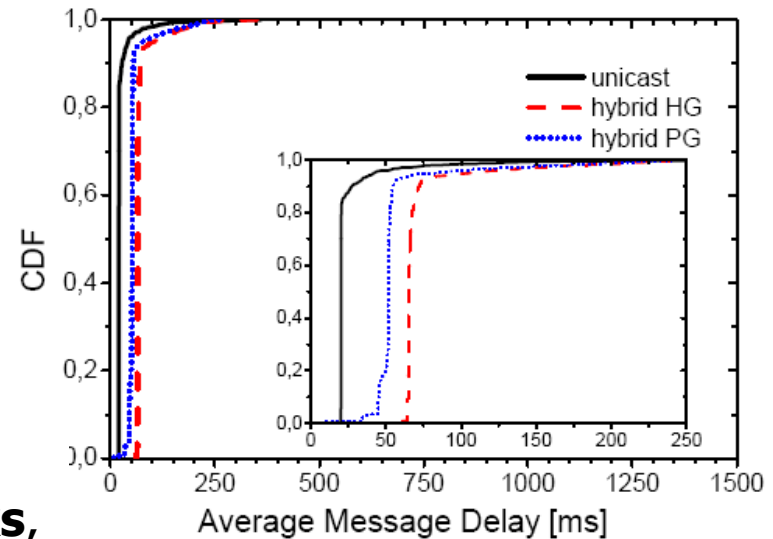
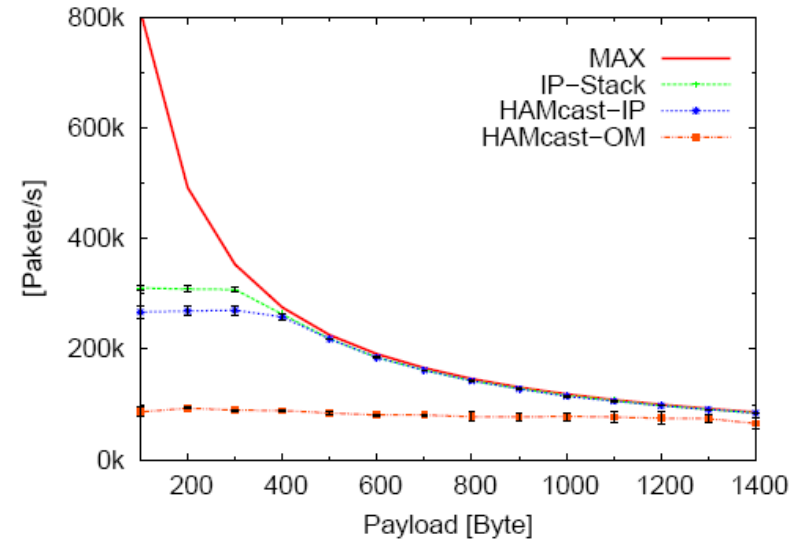
- `Source Register/Join` establish name caching

o States per channel ... but **not data-driven** ...



HAMcast Performance

- o Generic High-performance Middleware
 - Modular software open for future services (C++, Java)
 - Near IP performance
- o Large Scale G-LAB Deployment
 - One-way delay measurements on European scale (incl. PlanetLab)



Large-Scale Measurement and Analysis of One-Way Delay in Hybrid Multicast Networks,
In: *Proc. of IEEE LCN 2012*



Future Directions: Scaling Pub/Sub in Time & State

Current approaches either scale for
separation in time *or* in state

But: Abstract Channel Access allows to

- Subscribe to stream (aka multicast push)
- Collect chunks/files (asynchronous pull)

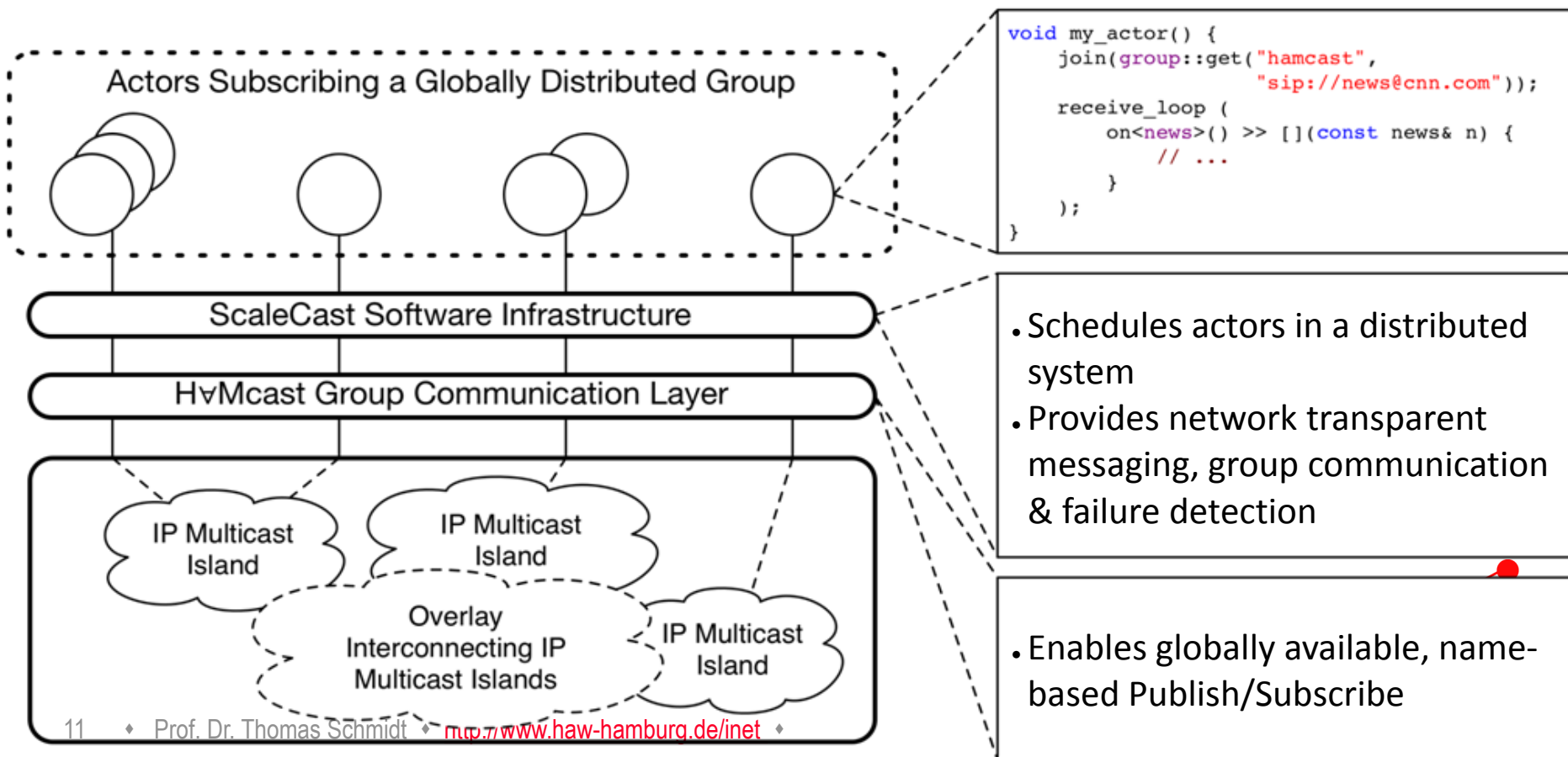
o Technology-abstraction May Serve Both

- Supported by selective naming
- H Δ Mcast middleware prepared for integration



Future Directions: Scalable Distributed Programming

Globally Distributed Actors Using Publish/Subscribe



Thank You!



Contact:

HAW Hamburg

t.schmidt@ieee.org

<http://www.haw-hamburg.de/inet>



Further Information:

<http://hamcast.realmv6.org>



SPONSORED BY THE



Federal Ministry of
Education
and Research