Application areas of Scalable Adaptive Multicast

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What is SAM?

- Issues
  - Large Number of Groups
  - Group Membership Management
    - member = 3 ~ Huge
  - Network Topology
    - Mesh / Tree / DHT
  - Network Resource Constraints
    - Bandwidth, Latency, Error rate
  - Higher Level Requirements
    - Congestion Control, Reliability, Security

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Applications Areas

Application is KEY for deployment

- Kind of Networks
  - Adhoc Networks
  - Sensor Networks
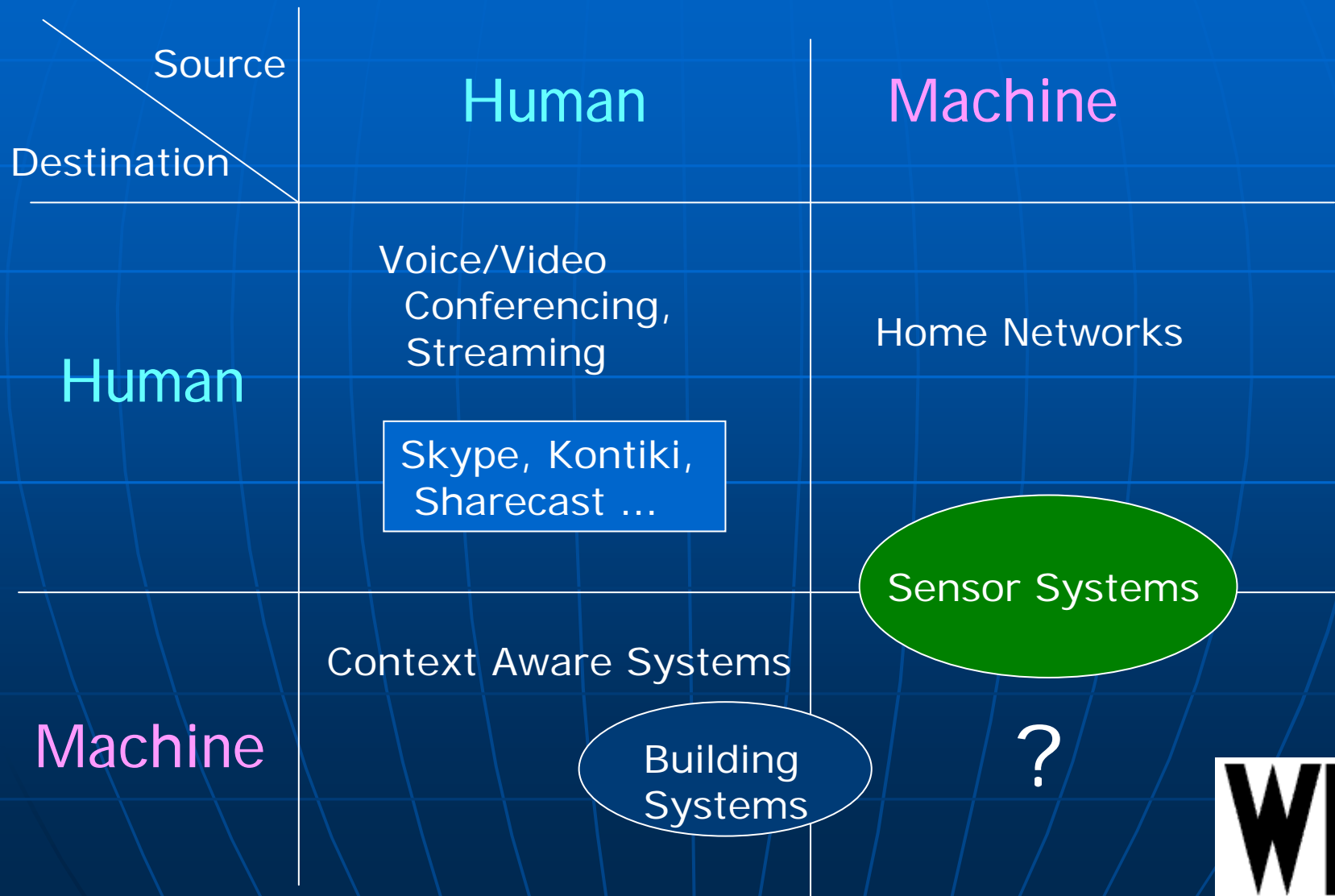 - Home Networks
  - Office/Building Networks

- Kind of Content
  - Video / Audio
  - Information Sharing (Whiteboard / Display)
  - Sensing data

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Who will be communicating?

Communication based grouping of Application Areas

Source / Destination	Human	Machine
Human	Voice/Video Conferencing, Streaming Skype, Kontiki, Sharecast ...	Home Networks Sensor Systems
Machine	Context Aware Systems Building Systems	?

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Current Applications

- Skype
  - P2P Audio/ Video Conferencing
  - SkypeCast
    - Audio Conferencing for 100 people

- p2pradio
  - P2P radio streaming
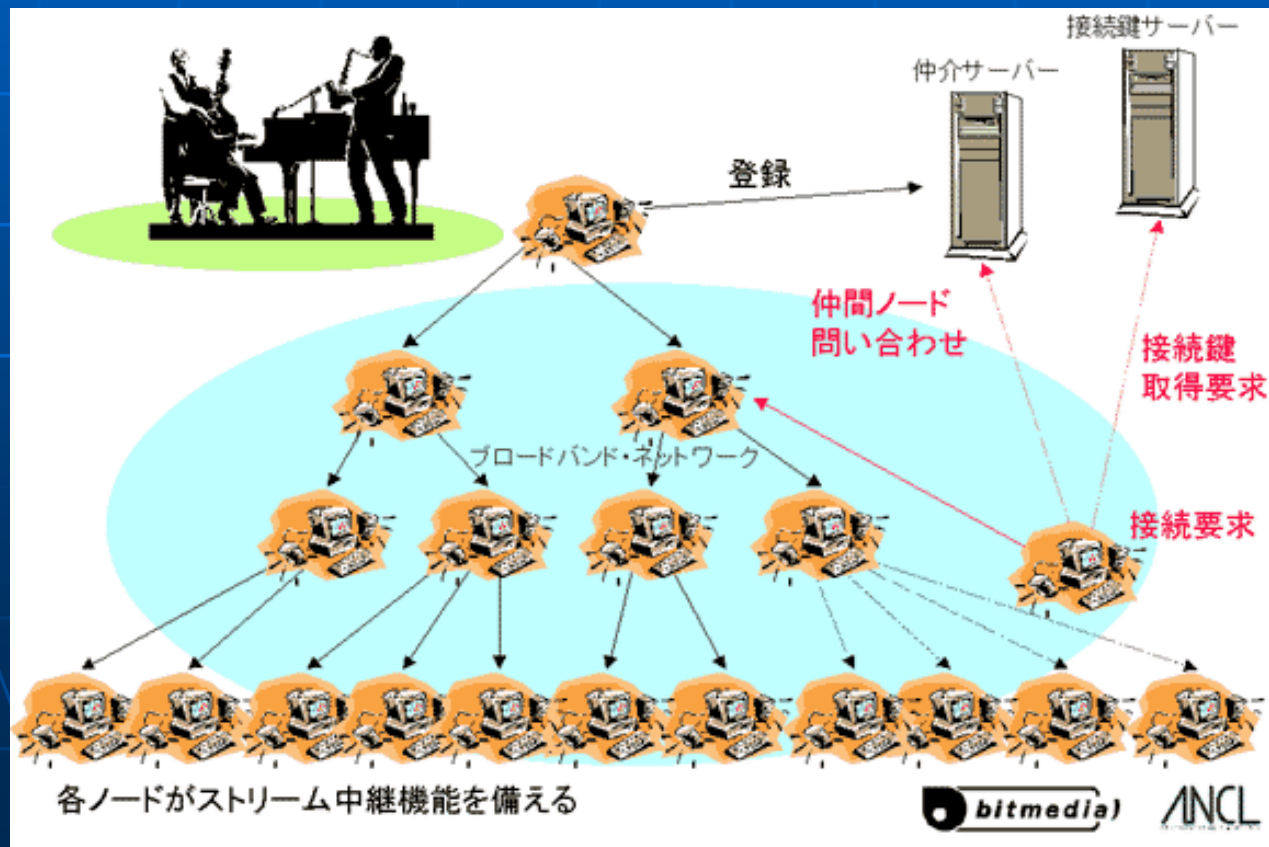 - http://www.streamerp2p.com/

Video Streaming Systems

- Kontiki (http://www.kontiki.com)
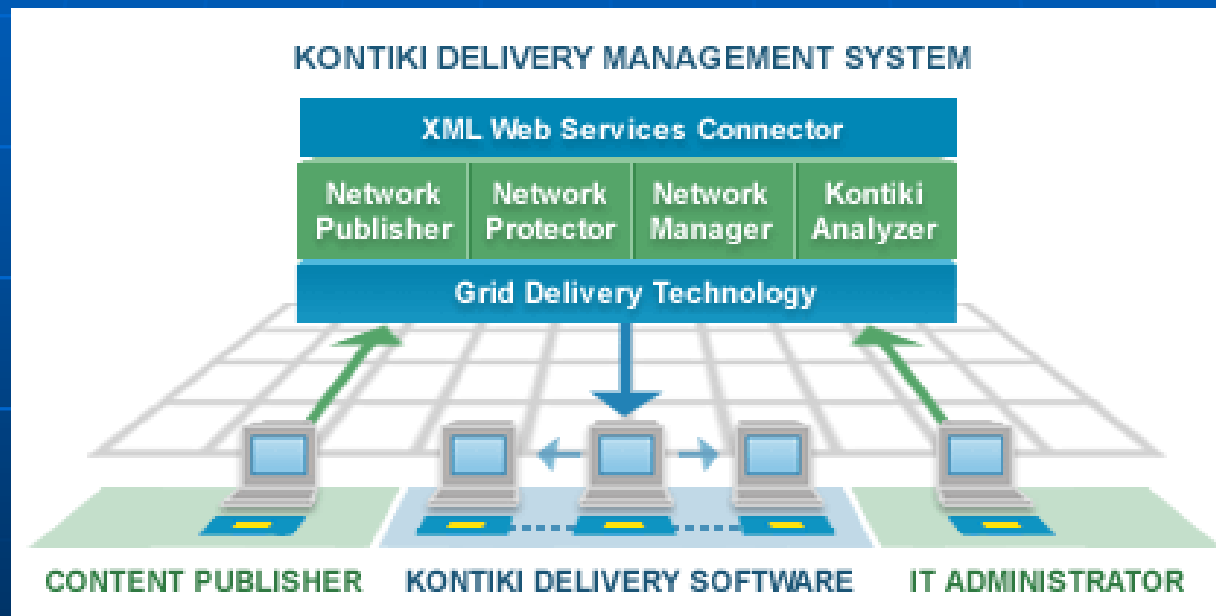
ShareCast

- P2P Video Streaming Service
  - http://www.scast.tv (Japanese)

XCAST

- eXplicit multi-Unicast
- VIC and RAT is currently used.
- Video: http://www.cogma.org/press/video/xcast_e_1000k.wmv

  In reality more than 30peoples can join the same group
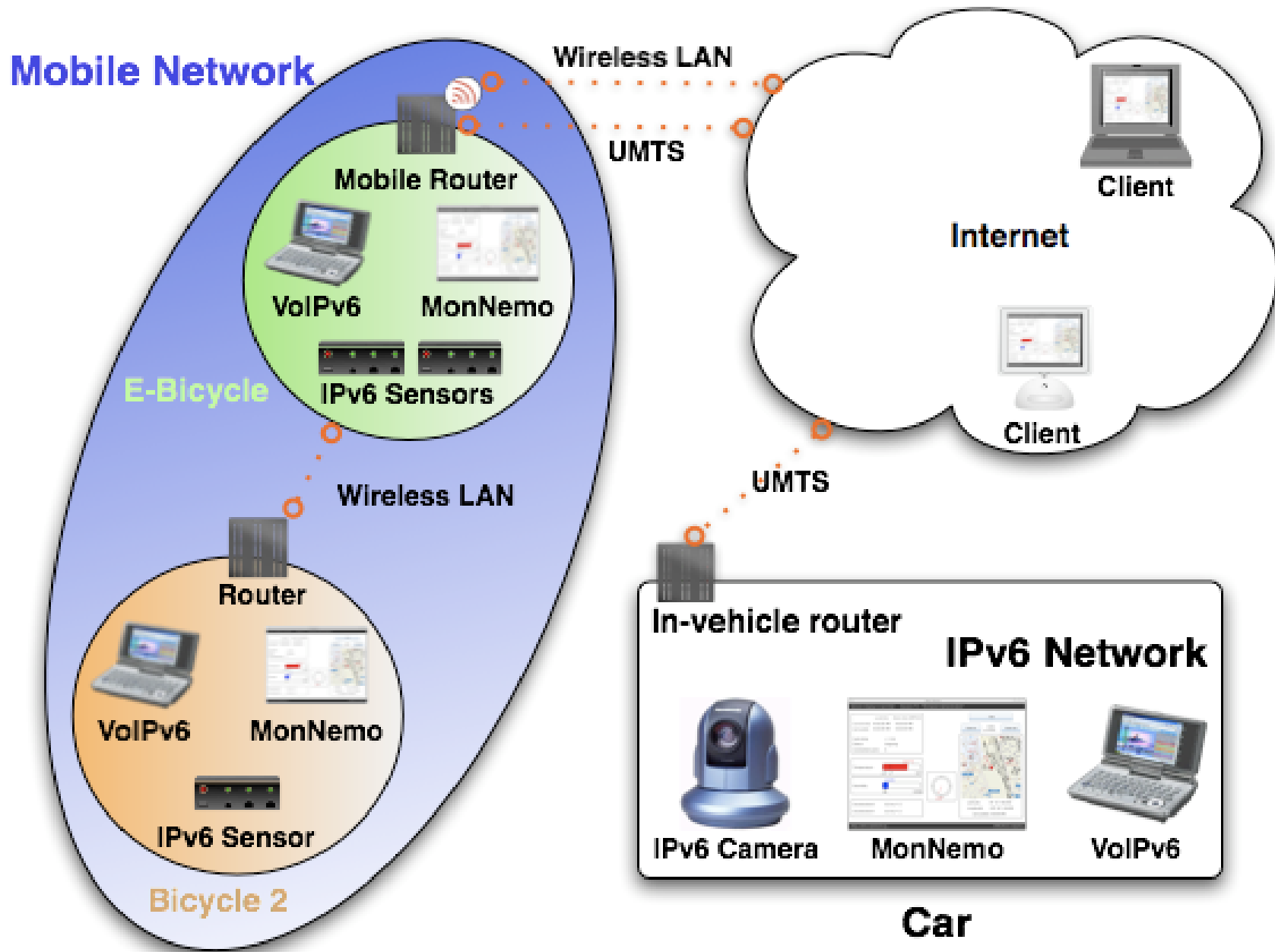
Tour de France E-bicycle Demonstration

- Tour de France:
  - July 1st ,Strasbourg ~ July 23rd ,Paris
- http://demo.nautilus6.org/demos/200607-tourdefrance.php
- Communication between

  Bicycles   Crew   Supporter

- XCAST6 is used for audio/video communication among the rider/crews.

- XCAST6 is working with NEMO (Network Mobility)

E-Bicycle with NEMO

The Demonstration Scenario

Future Application Areas

Adhoc Networks

- Multicast in the Ad-hoc Environment
  - Several researches...
  - Apparently SAM is required in Adhoc but not yet solved.

- Multi-layerd multicast
  - Multicast over AODV (MAODV)

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Adhoc Emergency Networks

- In the disaster situation(Earthquake) there is no Infrastructure.
- Adhoc network can be a solution for this.
- People want to communicate for Information sharing..

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Military Adhoc Networks

- Several tanks/troops moves together.

- Muliti-hop communication is required for low-power RF communication.

Sensor Networks

- Distributed sensors with wired/wireless networks.

- Currently usual adhoc-routing is applied to sensor networks.

- Several sensors should communicate each other.

- SAM can be used in this area.

Ubiquitous Computing

- MIT House_n project
  - http://architecture.mit.edu/house_n/
  - Sensor networks for Home environment
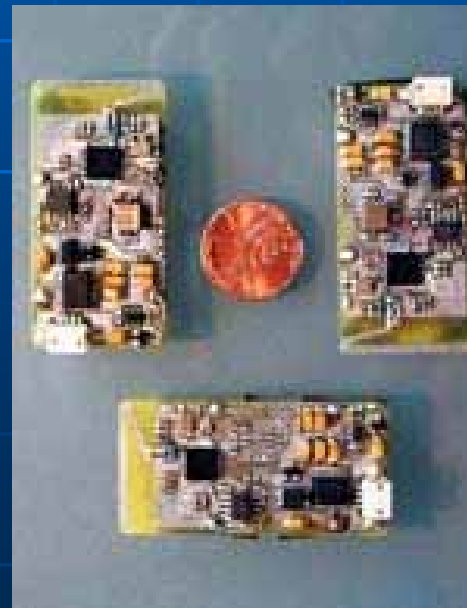
How about current Research?

- A lot of studies / proposals have been done. But not yet stabilized.

- How can we "Research and Develop" and finally "Deploy" the fruit of Scalable Adaptive Multicast Systems?

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Taxonomy of SAM related studies

Under Construction....

	Type of Network	Central Server	Number of Members	...
ALMI	Mesh	Yes	Small	
XCAST	Tree	No	Small	
Narada	Mesh	No	Small	
RelayCast	Tree	No	Middle	
Peercast	Tree	No	Middle	
Scribe	DHT (Pastry)	No	Large	
Bayeux	DHT (Tapestry)	No	Large	
CAN-mcast	DHT (CAN)	No	Large	
Overcast	Mesh	No	Large	
Scattercast	Mesh	No	Large	
OMNI	Tree	No	Large	
...				

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Proposal: Standardization of Application Program Interface for SAM

- Too many algorithm/protocols for creating standard.

- For the real world deployment, rich, and high-quality application is truly required.

- But it should not depend on the specific protocol.

Define the API for SAM applications

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Example Levels of API

- Routing Level
  - Scribe (Pastry based P2P mcast)
    - create(credentials, groupId)
    - join(credentials, groupId, messageHandler)
    - leave(credentials, groupId)
    - multicast(credentials, groupId, message)
- Application Level
  - RalayCast
    - Using Proxy based API (Using kind of port forwarding)
   - Not requiring changes for Applications

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Several Studies for API and Middleware for SAM

- Dabek, F., Zhao, B., Druschel, P., Kubiatowicz, J. and Stoica, I.: Towards a Common API for Structured Peer-to-Peer Overlays, *Proc. IPTPS'03* (2003).

- Y. Nakamura, H. Yamaguchi, A. Hiromori, K. Yasumoto, T. Higashino and K. Taniguchi, "On Designing End-user Multicast for Multiple Video Sources," ICME2003.

- N. Mimura, K. Nakauchi, H. Morikawa, and T. Aoyama: "Functional Unit Oriented Middleware for Application-Level Multicast Services," IEICE Transactions on Communications, IEICE/IEEE Joint Special Section on Autonomous Decentralized Systems, vol. E88-B, no. 12, pp. 4442-4450, December 2005.

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Simulators/Tools for SAM(p2p)

- p2psim
  - Supports Chord, Accordion, Koorde, Kelips, Tapestry, and Kademlia.
  - http://pdos.csail.mit.edu/p2psim/
- MACE
  - A domain-specific C++ like language to describe a distributed system's.
  - http://mace.ucsd.edu/
- Overlay Weaver
  - Java based imp. of Chord, Tapestry, Kademlia
  - Visualizer of P2P network
  - http://overlayweaver.sourceforge.net/
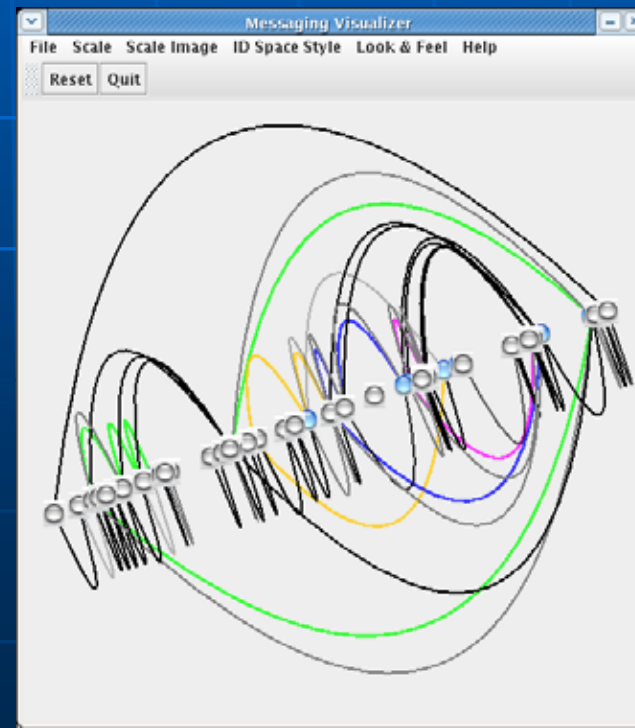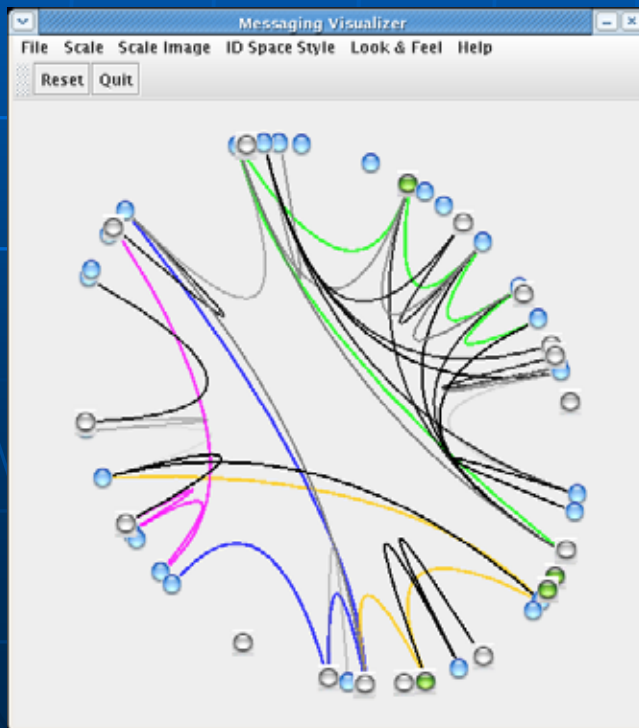
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Overlay Weaver (Shudo et al.)

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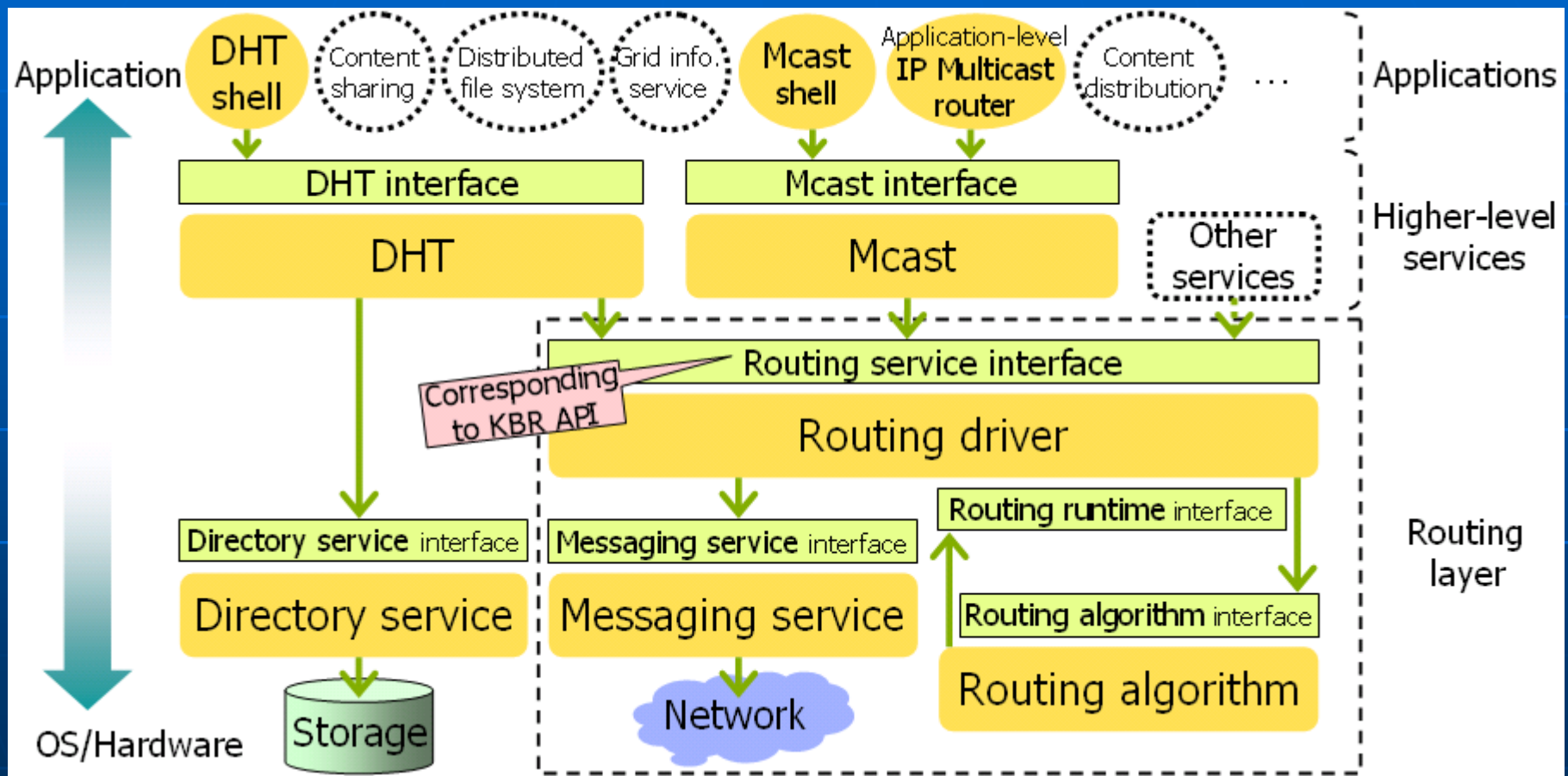
Simple API and Messaging Visualizer of Overlay Weaver

Sample of API

McastConfiguration config = McastFactory.getDefaultConfiguration();

Mcast mcast = McastFactory.getMcast(config);

mcast.joinOverlay(String hostAndPort);

mcast.joinGroup(ID groupID);

mcast.multicast(ID groupID, Serializable content);

Summary

- SAM has a lot of Application Areas

- API Standardization is one of the KEY
  - Several examples. (Routing, Application level)
- There are several tools we can use.
  - p2psim, MACE , Overlay Weaver
- Sharing Information is Important
  - Too many researches are working...
  - Building a taxonomy is a good work for RG.

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