SAMTK: A Toolkit for Scalable Adaptive Multicast

Updates

samrg @ IETF71

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Why SAMTK?

- To fill the gap between researchers and real world application developers.
- Share the common technologies for multi-point communications.

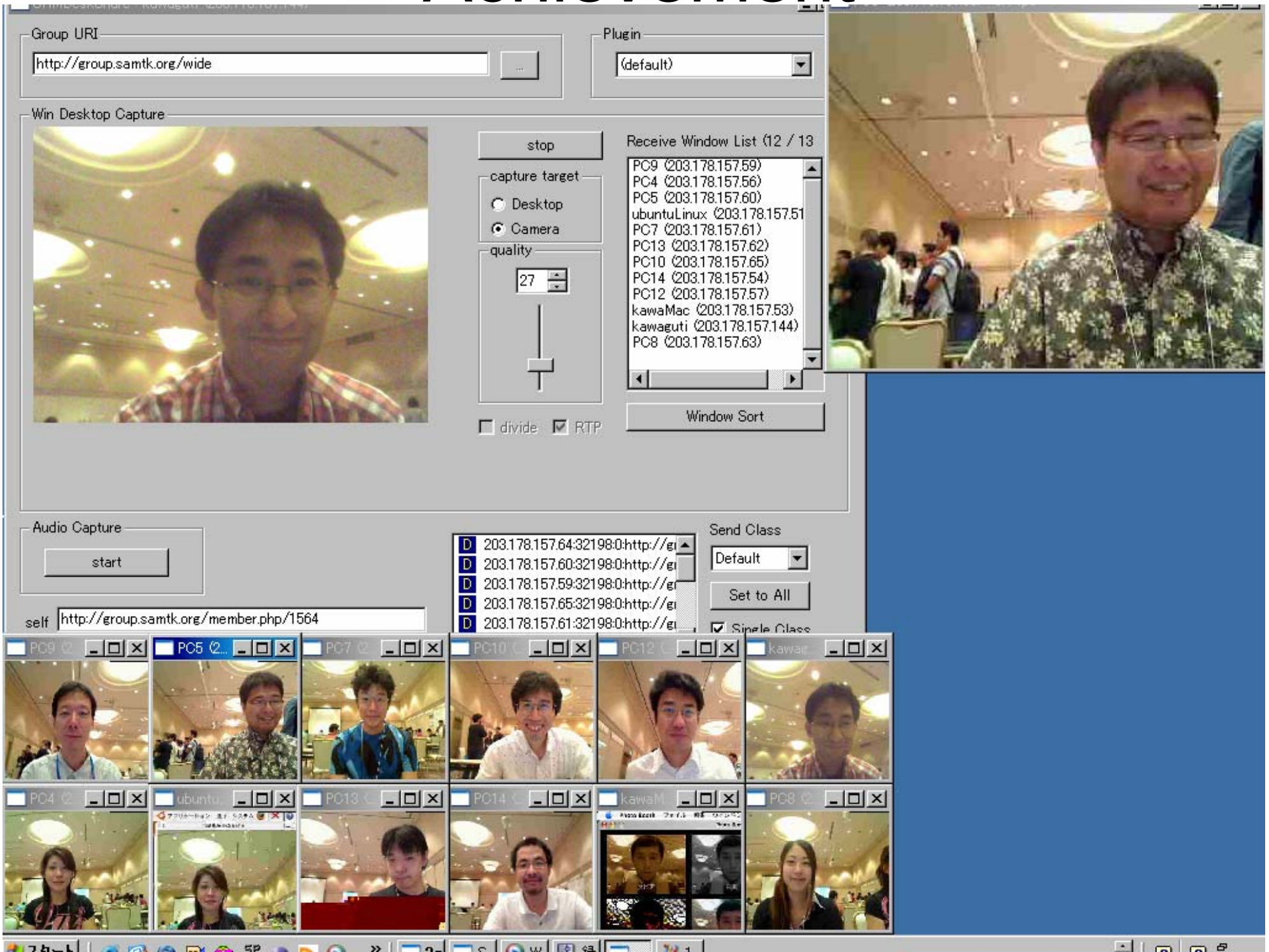
- Support Hybrid Configuration of multi-point communication protocols.
- Enable step-by-step deployment of hybrid ALM/XCAST/Multicast communication.

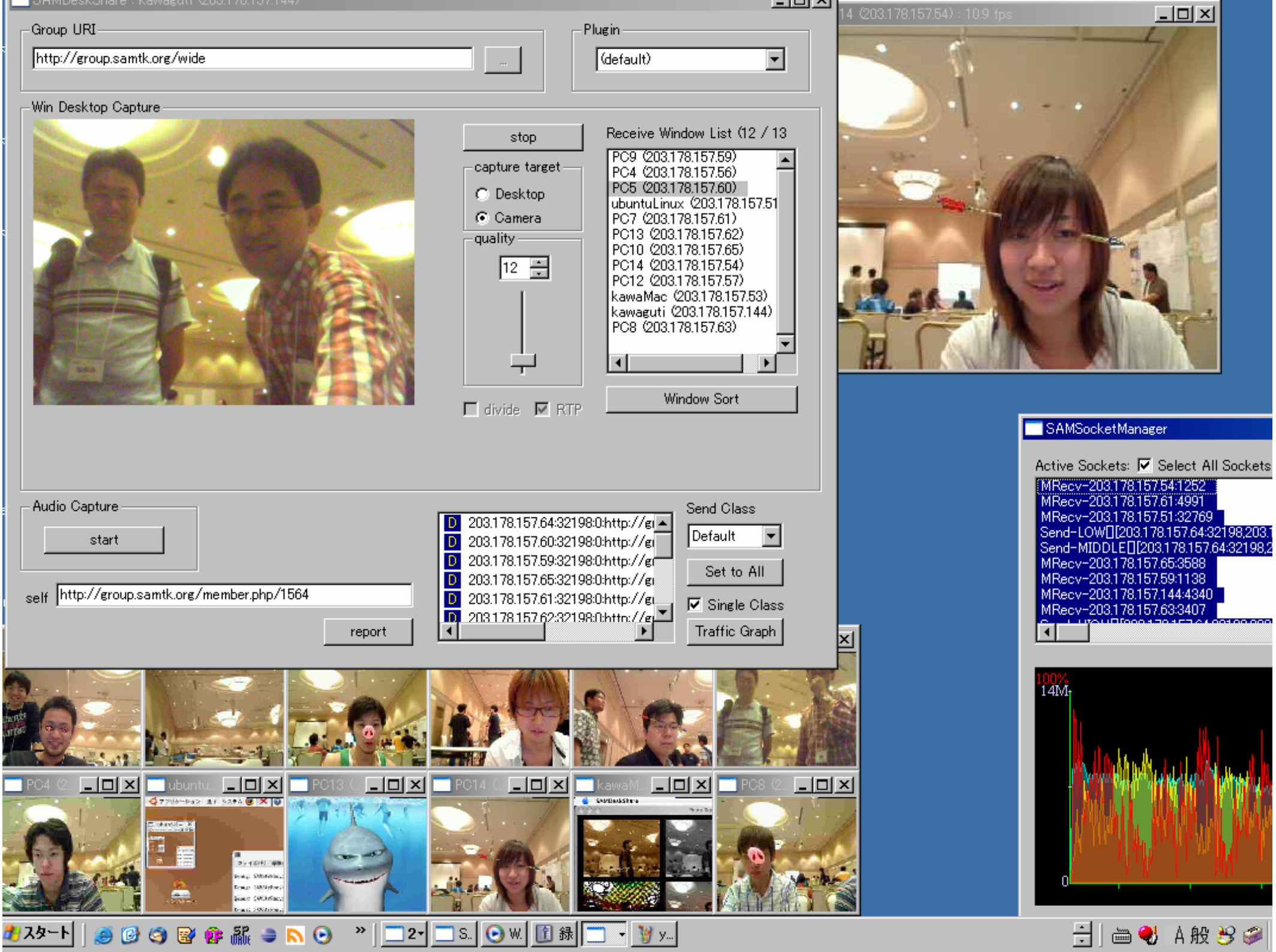
SAMTK

SAMTK : a Toolkit for SAM

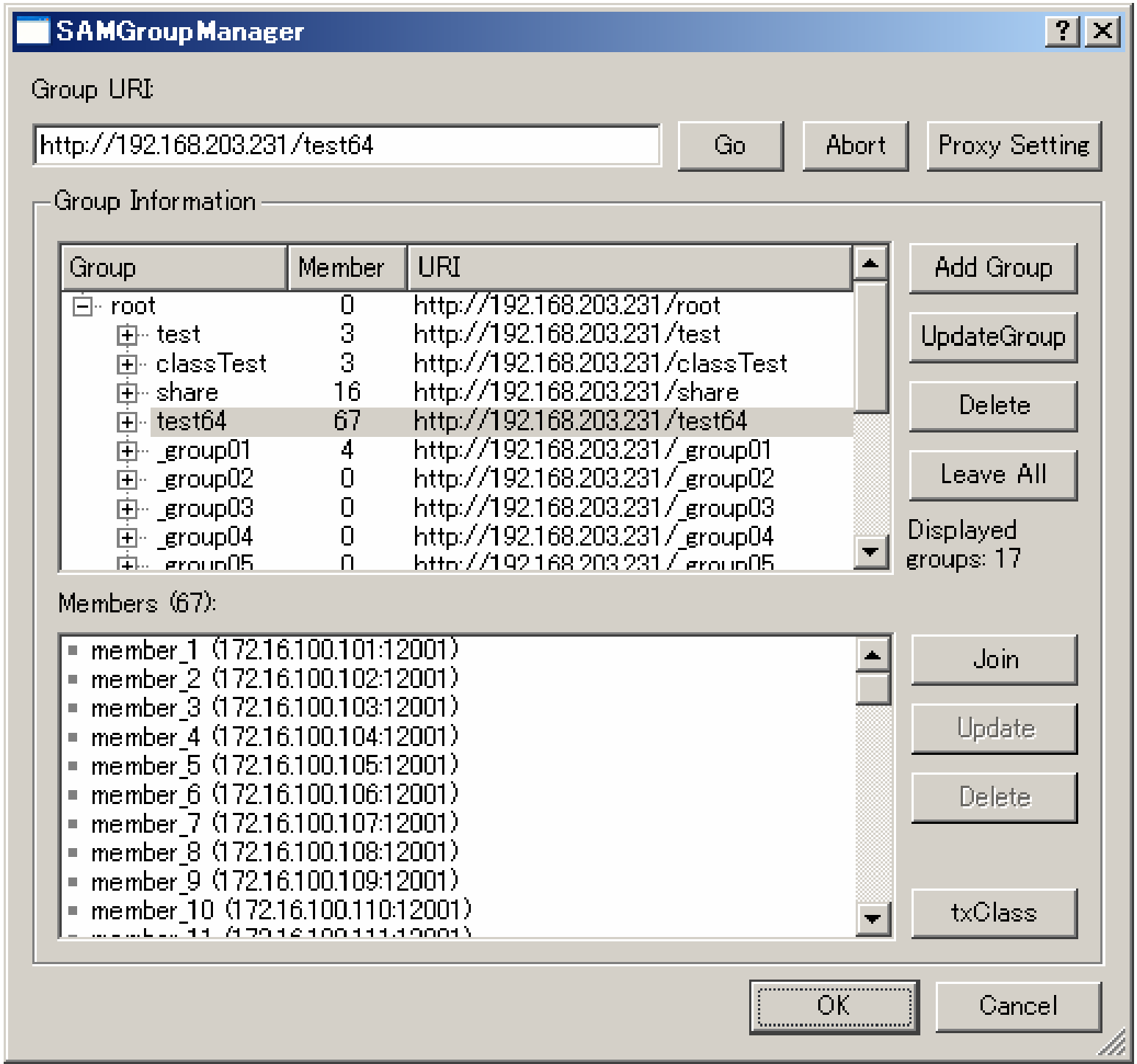
- Platform for both SAM researchers and application developers.
- Common API for SAM communication protocols.
  - Group management.
  - Multi-layered communication.
- Ease of application development.
- C++ , Qt, Multi-platform(Win /Mac /Linux/BSD)

Achievement



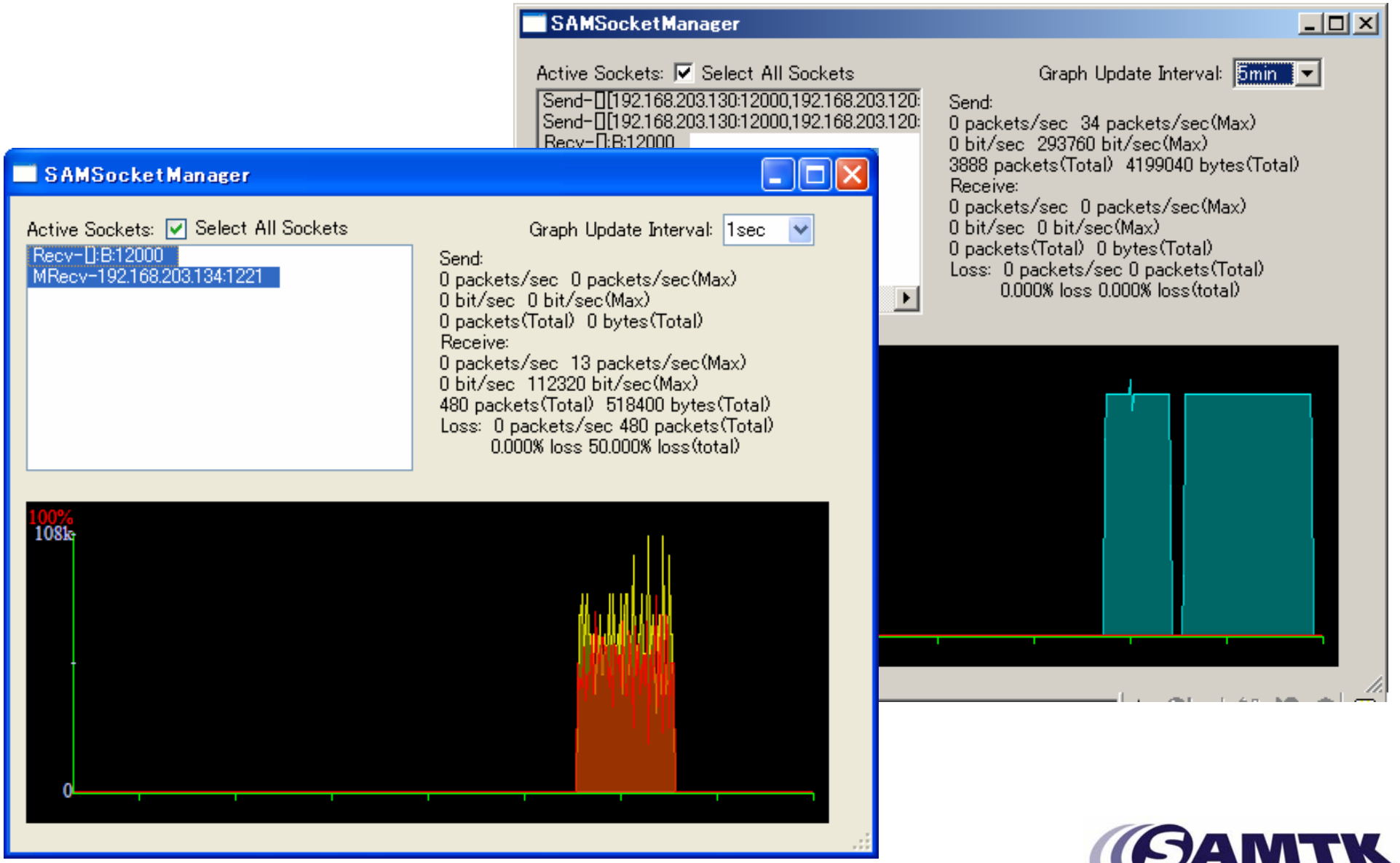

Group URI
http://group.samtk.org/wide
Plugin
(default)
Win Desktop Capture
stop
capture target
Desktop
Camera
quality
12
Receive Window List (12 / 13
PC9 (203.178.157.59)
PC4 (203.178.157.56)
PC5 (203.178.157.60)
ubuntuLinux (203.178.157.51
PC7 (203.178.157.61)
PC13 (203.178.157.62)
PC10 (203.178.157.65)
PC14 (203.178.157.54)
PC12 (203.178.157.57)
kawaMac (203.178.157.53)
kawaguti (203.178.157.144)
PC8 (203.178.157.63)
Window Sort
divide
RTP
Audio Capture
start
self
http://group.samtk.org/member.php/1564
report
Send Class
Default
Set to All
Single Class
Traffic Graph
SAMSocketManager
Active Sockets:
Select All Sockets
MRecv-203.178.157.54:1252
MRecv-203.178.157.61:4991
MRecv-203.178.157.51:32769
MRecv-203.178.157.65:3588
MRecv-203.178.157.59:1138
MRecv-203.178.157.144:4340
MRecv-203.178.157.63:3407
100%
14M
0
スタート

SAMTK Group Manager



Traffic Monitor

- Monitor the traffics over SAMTK



SAM Issues

- Group Management
  - Member Join/Leave, Scalability
- Traffic Management
  - How many packets can be sent
- Topology Management
  - How to route the traffic

SAMTK

SAM Issues

- Group Management
  - Member Join/Leave, Scalability
- Traffic Management
  - How many packets can be sent

← SAMTK manages here

- Topology Management
  - How to route the traffic

← Plug-in manages here

SAMTK

Design Choices of SAMTK

Lessons from XCAST6 deployment/development

- Keep it simple, stupid
  - Do not design Group Management
    - currently Web server (1000 line of php) based.
    - extensible design with XML.
    - P2P based could be introduced
- Multi-protocol support is important
  - not ideal IPv6 world
- Multi-platform & rich interface is important
  - to support many users.

Design Choices of SAMTK

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Scalability for Number of Groups

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Scalability for Number of Groups

ALM/ Overlay with Plugin

SAMTK

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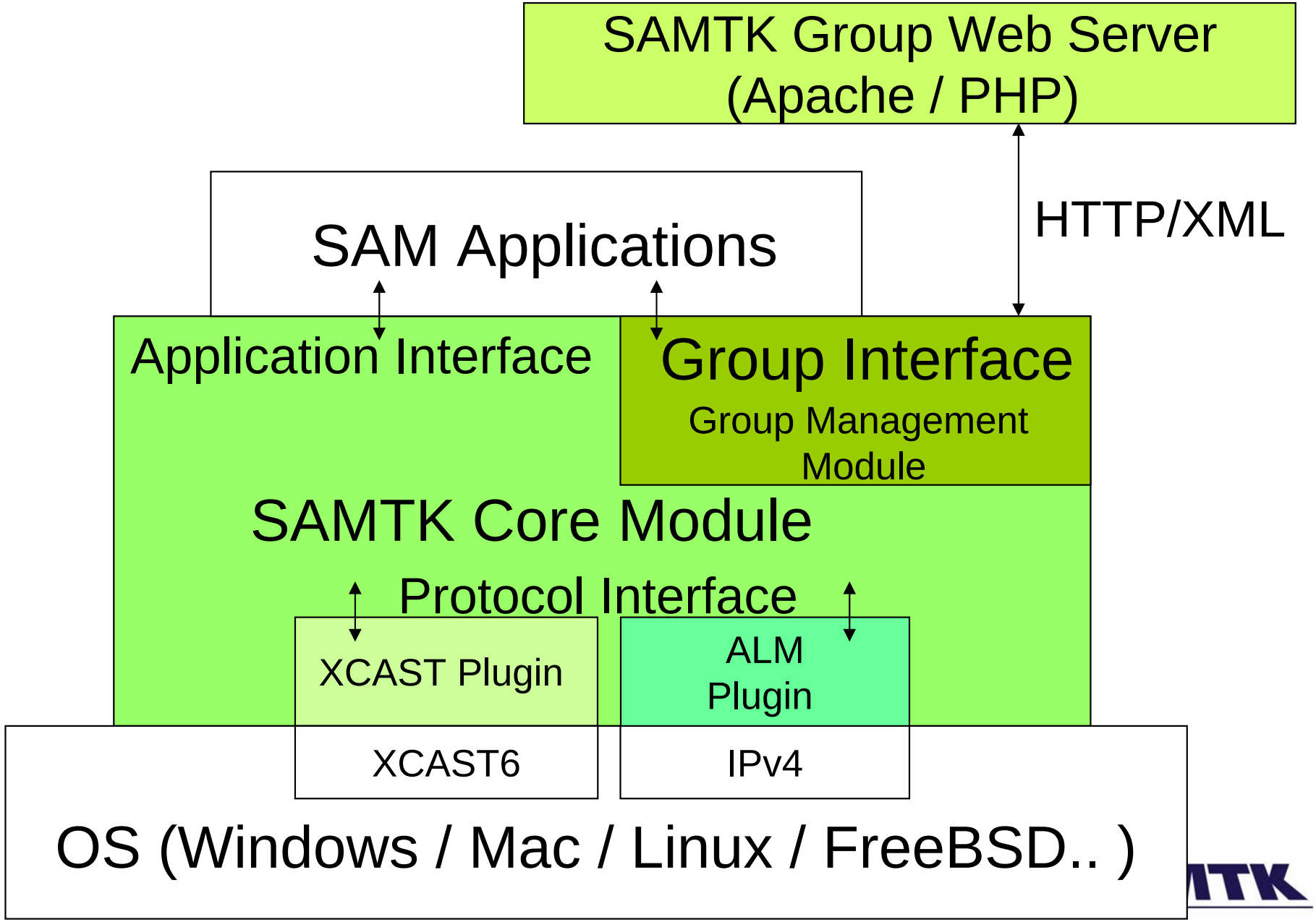
Scalability for Number of Groups

ALM/ Overlay with Plugin

Qt / C++ implementation

SAMTK Architecture



Application Interface

Interface from applications

- SAMSocket : Multipoint socket class
  - Separation of send socket and receive socket
  - Underlined protocol can be choose through plugin interface
- GroupAddress : Multipoint address class
  - Composed from member information
  - Currently identified through group URI

SAMSocket subclasses

- SAMSendSocket
  - UDP based interface
  - Socket for Multipoint send
- SAMReceiveSocket
  - Socket for Multipoint reception
    - management of several streams from different sources
  - Qt Slot/Signal based handling

Group Interface

- Several concepts of "Group" in SAM
  - Multicast group
  - Small group
  - Hybrid group... (Multicast - Unicast)
- We currently employ simple server-based group management.
  - will implement p2p group management.
- Every group/member is identified through GroupURI / MemberURI

SAMTK

Group Management Methods

- getSAMGroupMemberList(GroupURI)
- getSAMGroupMember(MemebrURI)
- getSAMGroupInfo(GroupURI)
- getSAMGroupAddress(GroupURI)
- addGroup(newGroupURI, path)
- deleteGroup(GroupURI)
- addMember(GroupURI)
- joinGroup(GroupURI, properties)
- deleteMember(MemberURI)
- setProperty(MemberURI, Key, Value)
- deleteProperty(MemberURI, Key, Value)

Sample Group URI

http://group.samtk.org/ietf71


```
<?xml version="1.0"?>
  <response>
    <request type="get"><result status="success"/></request>
    <group><group-ref id="159" uri="http://group.samtk.org/ietf71" member-num="2"/>
    <path>ietf71</path>
    <parent-group><group-ref id="1" uri="http://group.samtk.org/root" member-num="0"/>
    </parent-group><properties/>
    <subgroups/><members>
      <member><member-ref id="2212" uri="http://group.samtk.org/member.php/2212"/>
        <group><group-ref id="159" uri="http://group.samtk.org/ietf71"/></group><ttl/>
        <properties>
          <property key="Application">SAMVideoConf</property>
          <property key="port">32198</property>
          <property key="address">192.168.3.100</property>
          <property key="name">kawaguti</property></properties>
      </member>
      <member><member-ref id="2213" uri="http://group.samtk.org/member.php/2213"/>
        <group><group-ref id="159" uri="http://group.samtk.org/ietf71"/></group><ttl/>
        <properties>… </properties></member>  </members>
    </group>
  </response>
```

Protocol Interface

- Interface for protocol plugins
- Overlapping socket interface to Multi- Destination
- Multi-destination is passed by SAMGroupAddress

SAMTK

Protocol API (= Plug-in Interface)

- setGroup(GroupAddress)
- writeDatagram(char * , int, GroupAddress)
- readDatagram(char *, int, HostAddress)

- bool hasPendingDatagrams()
- bind(port)

Currently, very simple style.

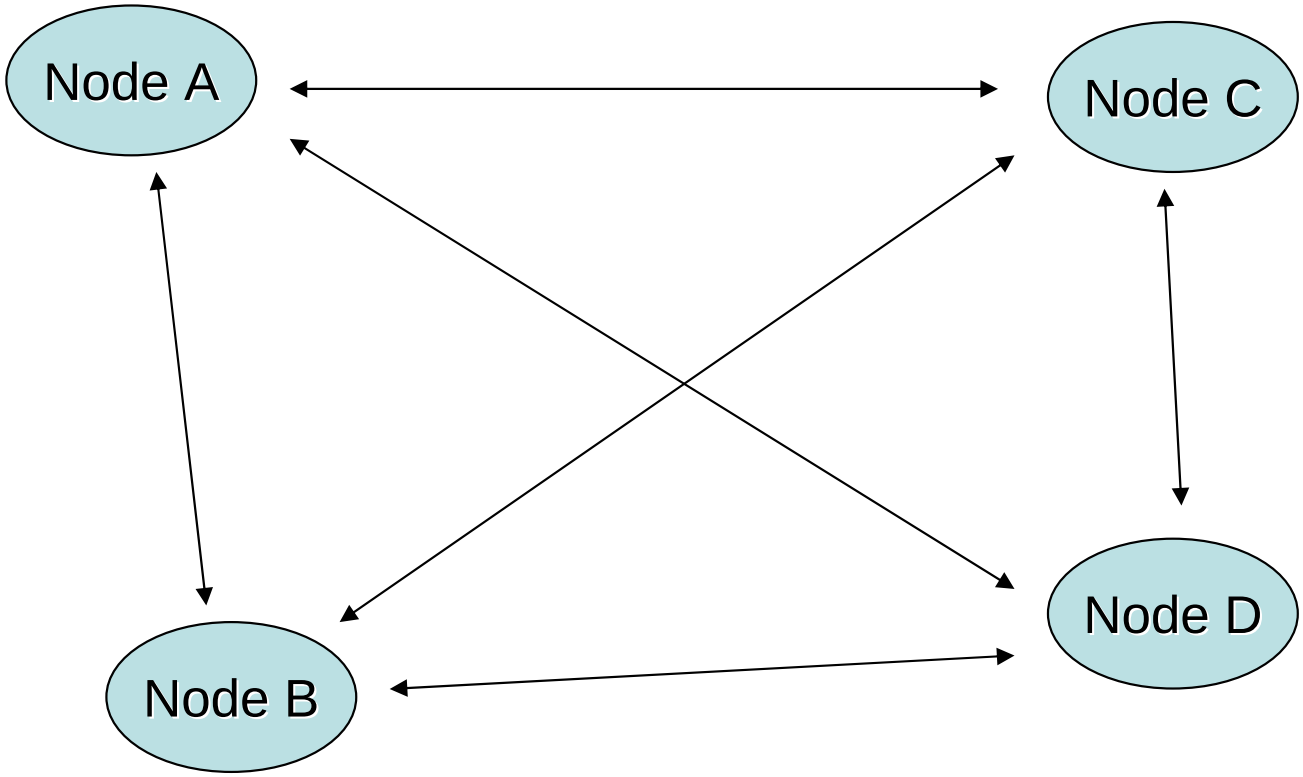
SAMTK

How to handle "Protocol Specific Information"

- Use Group Server extension field.
- Group Server has XML extension capability.
  - Attribute – Value Pair is currently used

- So if we utilize the group server information, we can deploy hybrid SAM network.

Simple SAMTK group



Group-0
- Node A
- Node B
- Node C
- Node D

Full Mesh Network by Multi-Unicast

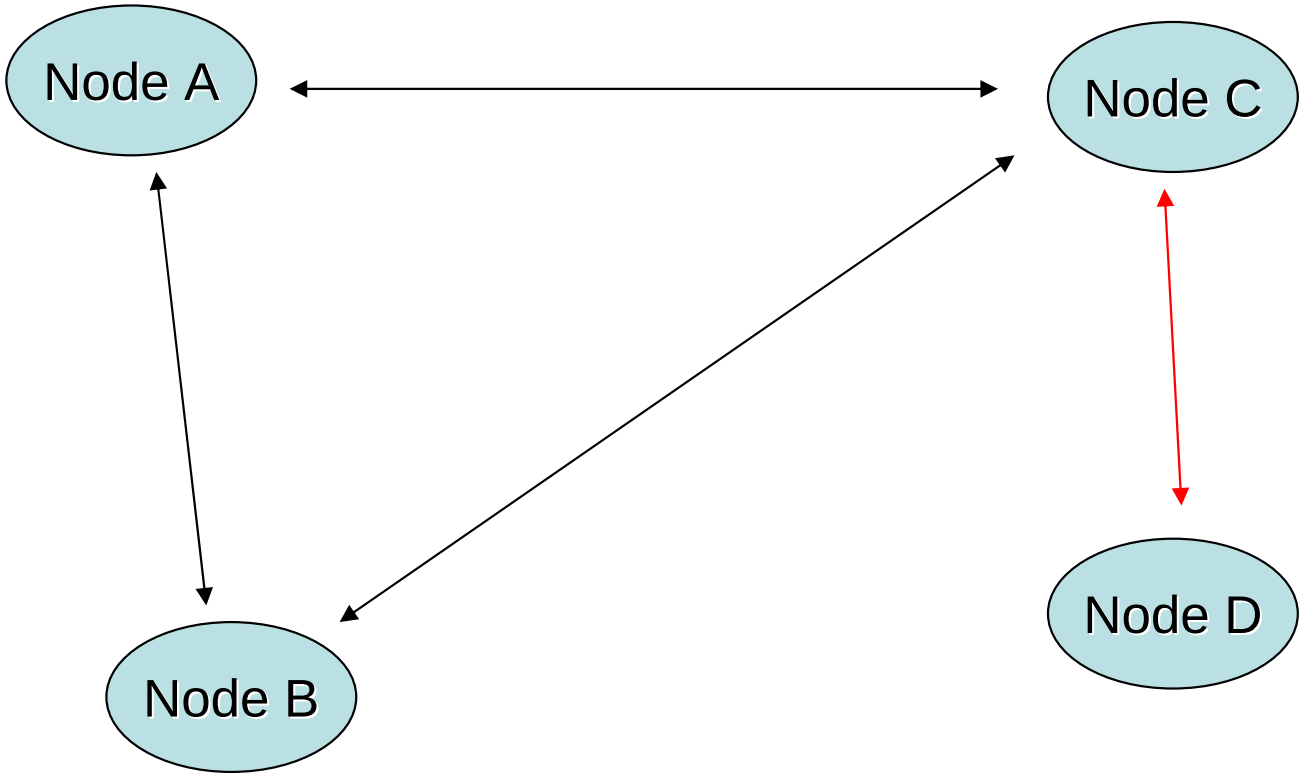
Relay Node on SAMTK

- Transfer a packets between different Group / different Transport

- May transform media into different type
  - Bitrate convertion
  - Video composition / division
  - Audio composition

Multi-hop SAMTK group

Introduce “Relay Node”



Group-0
- Node A
- Node B
- Node C

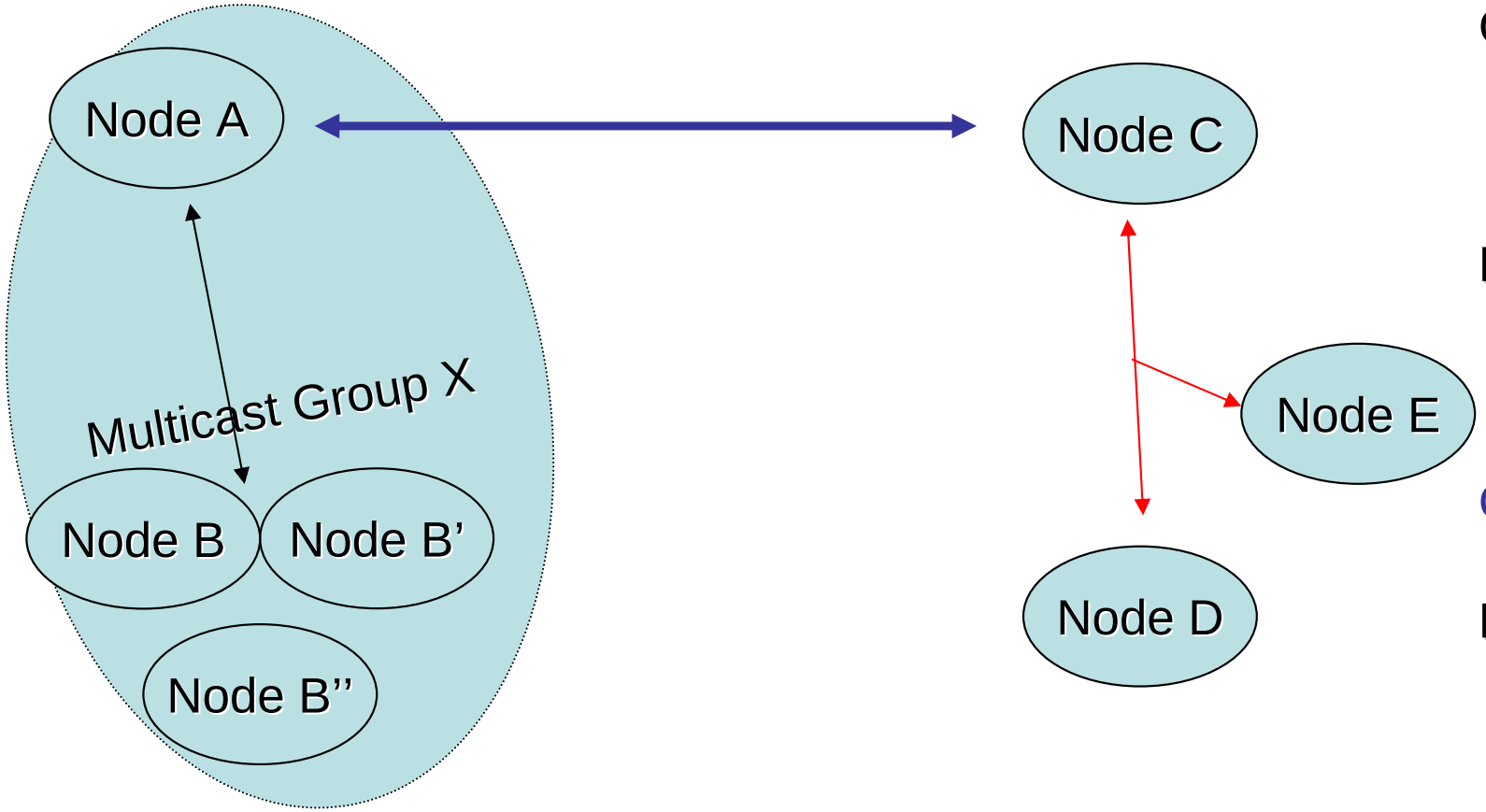
Node-C Relays
- Group-0
- Group-1

Group-1
- Node-C
- Node-D

Inter-Group Network by SAMTK

Hybrid SAMTK group

Introduction of Relay Node



Group-0(Multicast)
Node A
Multicast-group X

Node-A Relays
Group-0
Group-1

Group-1 (Unicast)

Node-C Relays
Group-1
Group-2

Group-2(Xcast)
Node-C
Node-D
Node-E

Hybrid Network by SAMTK

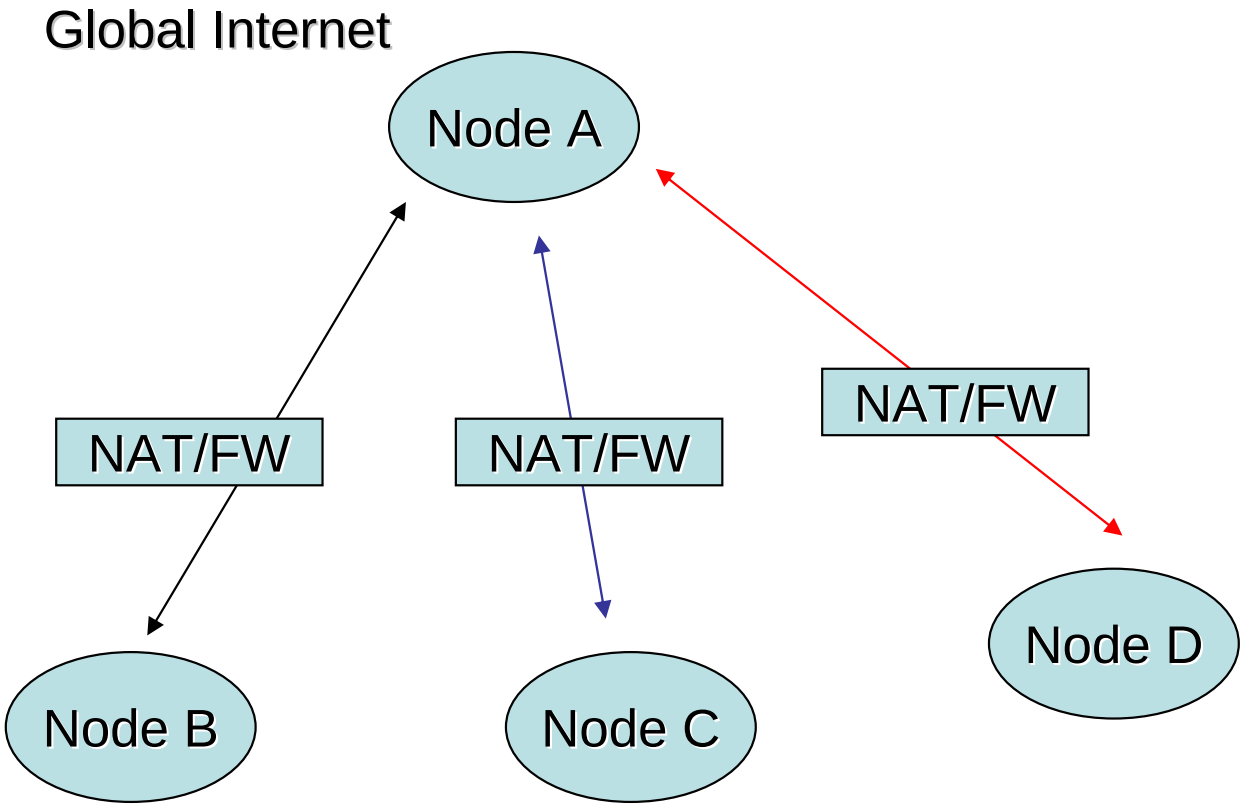
Hand-made Hybrid SAM Network

- User can add each hybrid network via SAMTK Group Server.

- Might be a step for automatic hybrid network.

SAM Network through NAT/FW

Utilization of "Relay Node"



Node A relays
- Group -0
- Group -1
- Group -2

Group-0
- Node-A
- Node-B

Group-1
- Node-A
- Node-C

Group-2
- Node-C
- Node-D

Automatic configuration of these groups is desired

Summary

- SAMTK enables quick test/deployment of a new multipoint communication protocols.
- Researchers take a benefit of real-world application based on SAMTK.
  - easy to compare with other protocols.
- Application developer take a benefit of multi-protocol implementation.
- We can deploy “Hybrid SAM Network” by introducing “Relay Node”.

Comments!

- Please send comments to
  kawaguti @ nagoya-u.jp

- http://sourceforge.net/projects/samtk
- Documentation
  - http://samtk.org

Towards a P2P Group Management

- We can use P2P Network for Group management.
- But it is still in early stage to consider about Group Management Protocols.