Group Communication based on Standard Interfaces

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Overview

• Group Communication
• Why standard interfaces?
• Standardisation goals
• What interfaces?
• What standards?
• Example
Group communication

- Handles group as one entity
- Used for
  - Replication
  - Fault-tolerance
- Strong primitives
  - Reliable broadcast
  - Total order broadcast
  - View synchronous broadcast
Group communication example

- **Total Order Broadcast**
  - Delivers a message in the same order everywhere
Group communication current state

• Not used much
  ❑ Isis was commercial product ➔ not success…

• Many academic prototypes

• Related system: Message queues
  ❑ Widely used
  ❑ Weak properties (not really specified)
Group communication problems

- **Complex:**
  - Many different models
  - Application issues not considered
  - No standardised interface

▷ need standards
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Why standard interfaces?

• From the application's point of view:
  ❑ Different toolkits
  ❑ Different interfaces
  ❑ Different services

• From the group communication point of view:
  ❑ Each toolkit re-invents the wheel
  ❑ Cannot use standard low level services
  ❑ Cannot interoperate with the world
The big picture

We need interoperability...

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Standardisation goals

- **Things to avoid:**
  - Defining a new standard
  - Defining a new toolkit
  - Monolithic system

- **Goals:**
  - Inter-operable system
  - Reusable services (internally & externally)
  - Existing & open standards
Modularity

• Want modular system
  ❑ What granularity?

• Service approach
  ❑ Medium granularity
  ❑ Corresponds to proposals in literature
    • Failure detection, group membership
  ❑ Larger than micro-protocols

• Make it possible to integrate existing systems
  ❑ Infrastructure (message queues)
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What Interfaces?

- Failure detection service
- Messaging service
- Multicast service
- Group Membership service
- View Synchronous Broadcast
- Total Order Broadcast

low level services

high level services
Interface overview

Application

Standard Interface
Group Membership

Standard Interface
View Sync. Multicast

Standard Interface
Total Order Multicast

Standard Interface
Failure Detection

Standard Interface
Unicast

Standard Interface
Multicast

Standard Interface
Operating System

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What standards to use?

- **Desirable standards**
  - Open
  - Accepted  Used by existing applications
  - Appropriate  Can be used for group communication

- **Standard domains:**
  - Messaging  Unicast, multicast, total order broadcast
  - Network management  Failure detection
  - Directory access  Group membership
Applicable standards

- **Unicast, Multicast** *Application Exchange Protocol*
  - APEX (IETF) ➔ BEEP (IETF)

- **Failure detection**
  - SNMP (IETF) *Simple Network Management Protocol*

- **Group Membership**
  - LDAP (IETF) *Lightweight Directory Access Protocol*

- **Total order, view synchronous broadcast**
  - APEX (IETF)
Group Communication based on Standard Interfaces
The big picture

LDAP
SNMP

APEX
LDAP
SNMP

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Exemple – group membership

- Service to identify member of a group
- Exists in one form or another in group communication
- Set of groups
- Processes are part of one or more groups
Group membership – LDAP structure

• Groups are name-spaces
• Processes are leaves
• Process informations are attributes

Group Communication based on Standard Interfaces
Group membership operations

- LDAP queries

- Find if p1 is member of group a:
  - search(group=a,pid=1)

- Find all processes in group b:
  - search(group=b,pid=*)

- Add process p3 in group c:
  - add(group=c,pid=3)
Conclusion

• Standards help:
  ❑ Structure group communication
  ❑ Reuse existing infrastructure
  ❑ Permit interaction with existing services & tools

• Future work:
  ❑ Show how different services can be implemented
  ❑ Propose implementations
Questions?

Thank you very much!