Large Scale Distributed Database Systems Based on Semantic P2P Networks

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Outline

- Motivations
- Semantic P2P network - VIRTUAL HIERARCHICAL TREE GRID ORGANIZATIONS (VIRGO)
- Framework of VIRGO_DDBMS
- Implementation of Prototype
- Summary
Motivations

- Large project involved with scientific researchers from different organizations with different domains.
- These organizations have their own database systems.
- The researchers hope to share related information cross organizations.
- To connect individual DBMS into huge virtual DDBMS
Semantic P2P Network----VIRGO (unstructured, structured VS Semantic P2P -- unstructured )

- Unstructured P2P network: overlay links are established arbitrarily.

Disadvantages:

- Query by flooded way, traffic heavy load
- no guarantee to a peer that has the desired data.

Node’s ID is unnecessary. Because of flooded query and every queried node matches its stored information.
Semantic P2P Network----VIRGO
(unstructured, structured VS Semantic P2P -- Structured )

- put(GUID, data)
- remove(GUID)
- value = get(GUID)

GUID = DHT(contents)
Node’s ID is same format to GUID, without semantic meaning.
VIRTUAL HIERARCHICAL TREE GRID ORGANIZATIONS (VIRGO)

VIRGO - two_tuple Virtual Hierarchical Overlay Network-1 (L Huang, 2005)
VIRGO - two_tuple Virtual Hierarchical Overlay Network-1 (L Huang, 2005)

Node ID
nodeid@Domain name

**Semantic P2P Network. Node’s ID with semantic meaning**
VIRGO - two_tuple Virtual Hierarchical Overlay Network-2

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<td><strong>route node</strong></td>
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<tr>
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<td>A13(3), B3(3), Net2(1)</td>
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<td>MinD</td>
<td>A1(2)</td>
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VIRGO Lookup

Root layer

Science

Second layer

BT2, BT3, BI1, BI2, ...

Science, Biology

BT1, BI2, BT3

Science, Biology, Botany

Third layer

BI1, BI2, BI3, BI4, ...

Science, Biology, Bioinformatics

A11, A12, A13, A14, ...

Science, Computer, AI

Net1, Net2, Net3

Science, Computer, Network

node BT3

client

node BT1

node A13

node Net1

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One_tuple Virtual Hierarchical Overlay Network—Music Example

- Music Catalogue
  - music.popular
  - music.classic
- There are 3 nodes--Node A, B, C
- A node can join more than one group
New VIRGO Network Creation

(1) Node A (IP address 10.31.21.5) Set up new VIRGO network

Node A is the provider of Song of Britney, so it is classified as the group of music.popular.Britney

music

popular

Britney

A

music.popular.Britney.A

(1)

10.31.21.5
Node C (IP address 78.2.127.45) joins VIRGO network

Node C is the provider of Song of Beethoven, so it is classified as the group of music.classic.Beethoven

Domains of Node A and C share the prefix--music


music.classic.Beethoven.C (1) 78.2.127.45
Node Join-2


Node B is the provider of Song of Britney and Madanna, so it is classified as the groups of music.popular.Britney and music.popular.Madonna

Domain of node B shares the prefix—music.popular.Britney with node A, the prefix—music with node C.

music.classic.Beethoven.C (1)
78.2.127.45

music.popular.Britney.A(1)
10.31.21.5

music.popular.Madonna.B(2)
Music.popular.Britney.B(3)
210.12.56.125
Implementation-Package
Framework of VIRGO_DDBMS

- **TableSet**: all table space in DBMSs of all organizations with all Domains.
- **Tables in DBMS** are classified into hierarchical Domains.
- **Domains of tables** are classified into Tree.
Framework of VIRGO_DDBMS

- Every Database Server has several different domains of tables and join VIRGO network according to these classified domains of tables.
Framework of VIRGO_DDBMS SQL-like Statement

query ::= SELECT {*|expr[AS]c_alias} {,expr[AS]c_alias}...}} FROM table@domainref [WHERE search_condition];
Framework of VIRGO_DDBMS SQL-like Statement

- Query all software about bioinformatics developed after 2007.

```sql
SELECT * FROM software@bioinformatics.biology.science WHERE releaseYear >= 2007;
```
Framework of VIRGO_DDBMS

1. a_source.send(DSQL, a ∈ mintheoryhop(a_source));
2. do {
   a.send(DSQL, b ∈ mintheoryhop(a));
   set a = b;
} while ! samegroup(a.domain, group(DSQL.domain));
3. a.sendgroup(DSQL, c_i ∈ servergroup (group(DSQL.domain)));
4. ∀ c_i ∈ servergroup(DSQL.domain)
   if c_i.matchup( DSQL.search_condition) (execute DSQL.localSQL; return result to a_source);
5. a_source.RouteTableAdd(c_i) ;
6. a_source.integrateResults;
Implementation of Prototype of VIRGO_DDBMS

Besides VIRGO implementation,

```java
public class DDBMSagent {
    public String ParseDomainName(String DSQL) ;
    public String ParseLocalSQL(String DSQL);
    public String translatesFields(String tableField, String GlobalFieldsURL);
    public String makeupExecLocalSQL(String LocalSQL, String GlobalFieldsURL);
    public Vector cmdSQLExec(String ExecLocalSQL);
    public Vector integrateResults(Vector[] ddatasets);
}
```
Implementation of Prototype of VIRGO_DDBMS
Summary

1. VIRGO semantic P2P Network
   Node’s ID ---userID@ domain name (semantic meaning), domains of tables are classified into virtual tree topology.

3. SQL-like statement to complete complex query

4. Framework of VIRGO_DDBMS

5. Implementation of prototype of VIRGO_DDBMS.
The Networking and Distributed Technologies are the most vital parts of IT technologies in the current days and the future. When the next generation of Internet comes true and mobile systems go to 3G or even 4G in the future, there are trends to transform legacy software into Internet applications. To bring together industrial and academic researchers to discuss hot topics and trends on Networking and Distributed Computing, we will organize the First International Conference on Networking and Distributed Computing (ICNDC2010) on Oct, 21-24, 2010 in Hangzhou, P.R.China. ICNDC2010 will focus on (1) distributed computing and distributed systems track including Clusters and Grids, SOA, SAAS, IAAS, Service Composition and Orchestration, Peer-to-Peer Systems, Cloud Computing, etc. (2) Networking track including IP networks, Next generation Internet, wireless network, wireless mesh networks, 4G mobile communications and beyond, etc. (3) Distributed Applications track including application systems such as e-business, e-Science as well as application systems in the fields of Management Science and Economics and Education Science, etc.

The conference site, Hangzhou, is one of China's most significant tourism cities.
For further information, please contact

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