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H O N G K O N G

Dynamic Self-Adaptive Replica Location Method in Data Grids

Offered by

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1. Problems

Finding the physical locations of ***multiple replicas*** of desired data ***efficiently*** in large-scale data grids

2. DSRL Method

A Dynamic Self-Adaptive Replica Location Method in Data Grids

2.1 DSRL Architecture : three-layer decentralized structure

– **Physical storage layer**: stores physical data

•composed of Storage Sites (SS)

–**Local location layer**: provides local replica information

•composed of Local Location Nodes (LLN)

•LLN stores all (LDN, PRN) mapping of data elements on the local SSs.

–**Global location layer**: maintains global location information

•composed of Global Home Nodes (GHN)

•GHNs store indices information (called home directory information) of all replicas, i.e. (LDN, LLN) mapping for each data element

–**Each data element selects one GHN as** its ***home node*** to store its home directory information.

2.2 Dynamic mapping technique

–Each data element has an 128-bit identifier GIDI

•For data element O, GIDI (O)=MD5(LDN(O))

–Each home node (GHN) has a unique binary GIHA address

•GIHA address is assigned dynamically

–Prefix-matching principle

•Each data element selects the GHN whose GIHA is a prefix of its GIDI as its home node

–Dynamic assignment of GHNs' GIHA addresses

•A dynamic balanced binary tree with GHN nodes as leaves (edges to left-child labeled 0, edges to right-child labeled 1)

•GIHA address is assigned with the label of the path from the root to the corresponding leaf

•When a GHN node joins or departs, the tree adapts to the variation and remains a balanced binary tree; and the home directory information should be migrated among GHNs.

2.3 Home directory cache and update

–Each LLN maintains a home directory cache

•Storing recently accessed home directory information

•Timeout mechanism and LRU replacement policy

–**Soft-state update strategy** to update information on LLNs and GHNs

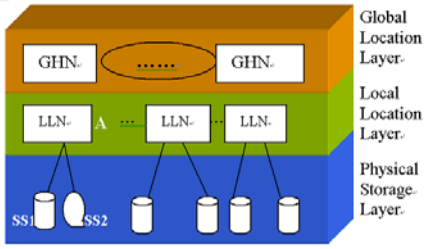

Figure 1: DSRL Architecture

Logical Data Name (LDN)	Physical Replica Name (PRN)
LDNxyz	PRNabc

Figure 2: Local replica information on LLNs

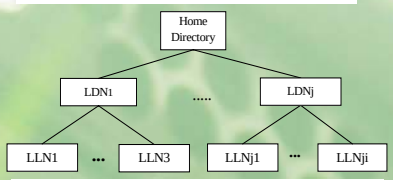

Figure 3: Home directory information on GHNs

3. DSRL Properties

–Good load balance of GHNs

–Self-adaptive

•Adapt to dynamic variation of nodes

–Low query latency

•2 hops for all replicas of one dataset

–Scalability

•Scalable in sites, dataset and replicas

–Reliability

•No single point of failure

•Failure of remote components does not affect local accesses

4. Related Work

– SRB (SDSC)
– Giggle
– Replica Catalog in Globus
– ……

5. Ongoing Work

– Integrated with the data grid engine **GridDaen**
•Developed in NUDT (Supported by the National 863 Program of China)
– Large-scale simulations
– Experiments in wide-area environments