云数据存储与管理

柴云鹏

IDC 的统计表明，2007 年一年的数据增量就达到了 281EB，最近几年的数据增长率在 60%左右，相当于每过 18 个月翻一番。在数据量如此迅速增长的背景下，传统的存储系统和数据管理系统在扩展性、效率和成本等方面遇到了巨大的挑战，无法满足需求。而云数据管理具有扩展性强、性价比高、容错性好等优势，可以承担起超大规模数据存储的重任。

我们目前在云数据管理系统方面与 IBM、NSN 等公司进行合作，研究和开发适合企业级应用的云数据管理系统。具体来说，在云数据库方面，我们基于 Map-Reduce 模型，并行实现 SQL 操作，并通过多维索引结构来优化系统的性能；在云存储系统方面，我们在云存储中引入了闪存缓存层，一方面能够提高系统的访问性能，另一方面通过合理的数据分布策略来减少整个系统的能耗。

Cloud Data Management (CDM)

Yunpeng Chai

Outline

- **Motivation of CDM**
- Survey of CDM
- IBM SUR Cloud DB Project
- NSN Cloud Project
- Future Research Work

Motivation of CDM

- Rapid Data Increase
  - 2007: 281EB (1EB = 1000PB)
  - IDC: 60% per year (double - 18month)
  - Facebook: 850 million photos
    & 8 million videos ONE day
  - Web pages, logs, media contents

Motivation of CDM

- Challenges
  - Scalability
    - Load Balance
    - Congestion / Delay
  - Efficiency
  - Cost
    - Fault Tolerance
    - Energy Conservation

Motivation of CDM

- Advantages of CDM
  - Scalability
  - Fault Tolerance
  - Performance/Efficiency
  - Performance-cost
  - Living and evolving

Motivation of CDM

- Comparison
  - Traditional Storage and DB
    - RAID/NAS/SAN
    - Hundreds of nodes
  - Cloud Data Management
    - Commodity Computers + SATA Disk
    - Tens of thousands of storage nodes

Motivation of CDM

- Cloud Data Management Systems
  - Scalability
    - 100 → 10,000 nodes
  - Efficiency
    - Application-driven
  - Cost
    - Commodity Computers + SATA Disks
    - Flash / Disk Energy Conservation

Motivation of CDM

- CDM Industry
  - Internet Service Cloud Platform
    - Google/Amazon
  - Cloud Products
    - IBM – Blue Cloud
    - MS - Azure
  - Enterprise-class Private Cloud
    - China Mobile
    - National Health Care

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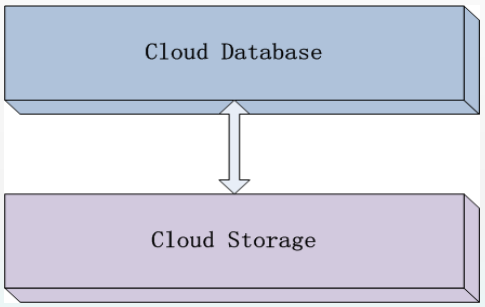
Survey of CDM

- CDM System Survey
  - Commercial Systems
    - Google- GFS + BigTable
    - MS- Azure
    - Yahoo!- PNUTS
    - Amazon- Dynamo
  - Open Source Systems
    - HDFS
    - KFS
    - Hbase
    - HyperTable
    - Cassandra
    - CouchDB
    - Voldemort



Survey of CDM

- Cloud Database:
  - Key-value data model
  - R/W performance / Parallelism
  - No/ Simple SQL operations

Survey of CDM

- Cloud Storage:
- Architecture:
  - Master-Slave
    - GFS, HDFS
    - Baidu Cloud
  - P2P
    - Cassandra

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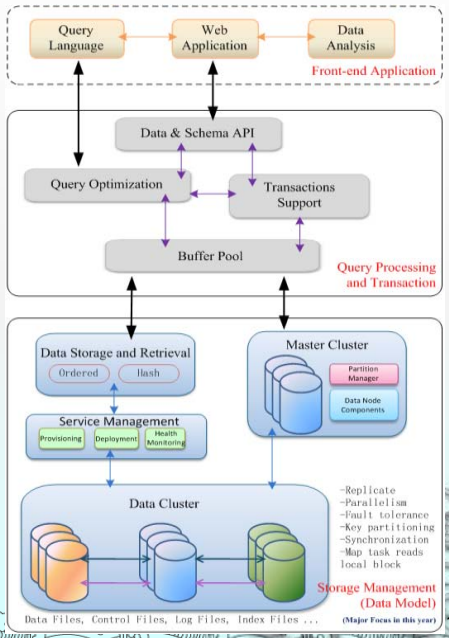
IBM SUR Cloud DB Project

- Cloud Data Management Systems
  - Based on Cassandra (Facebook)



Outline

- Motivation of CDM
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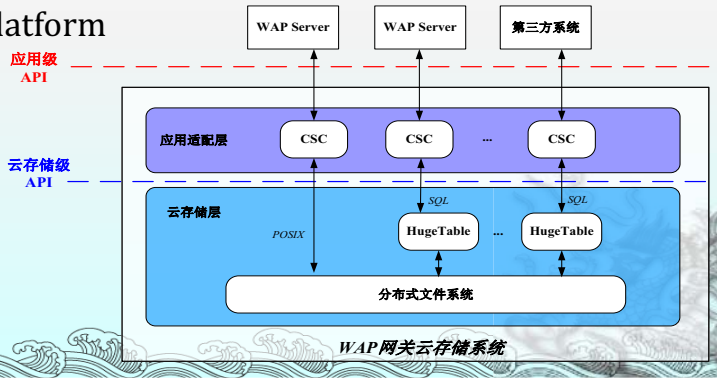
- **NSN Cloud Project**
- Future Research Work

NSN Cloud Project

- Background
  - Telecom Cloud
    - Scalability
    - Cut costs
    - Unified platform

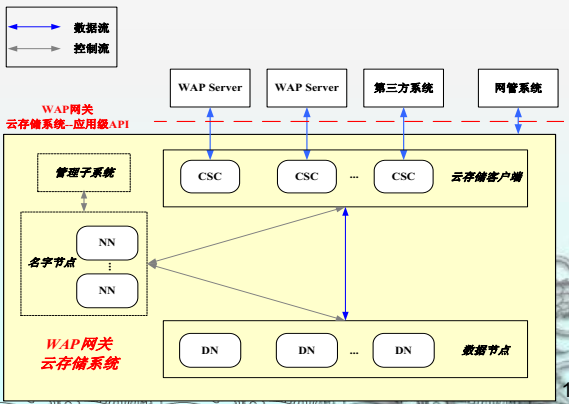


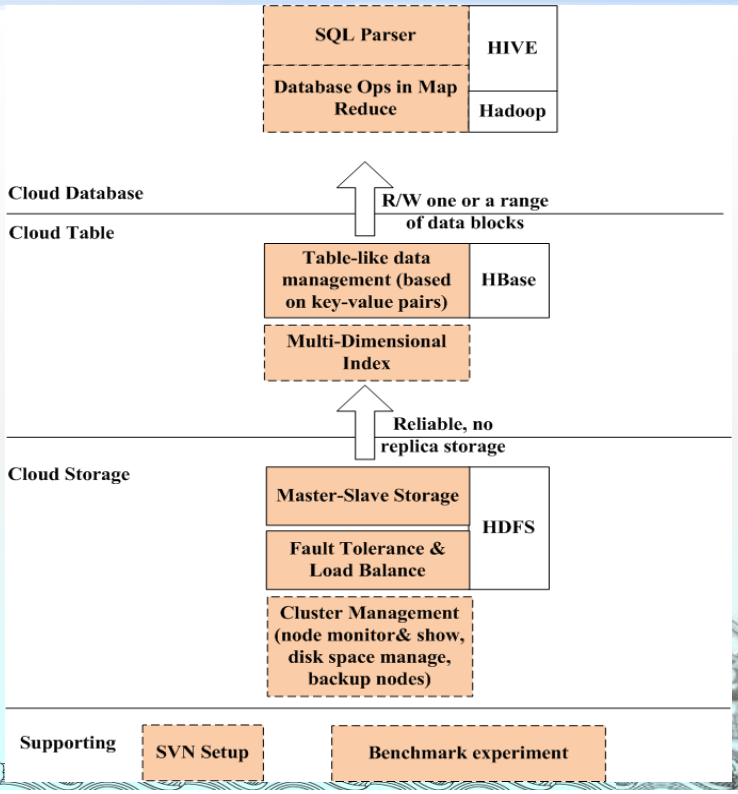
NSN Cloud Project

- Deliverables
  - Package of source code for CDM
    - CMRI WAP specification as input
    - Based on open source cloud project
    - Suit telecom app/workload
  - Demo of CDM*
    - Integrated with NSN WAP Server
  - Relevant investigation report and technical documentation

NSN Cloud Project

- Solution
  - Cloud Storage
    - Based on HDFS (Java, M-S arch)
    - Data dist strategy
  - Cloud Database
    - Hbase (Java)
    - Data type
    - DB Func
    - SQL support
    - Performance opt





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- **Future Research Work**

Future Research Work

- Cloud Database
  - Data model
  - DB operation extension
  - Efficiency
    - Multi steps
    - Distributed operations

Future Research Work

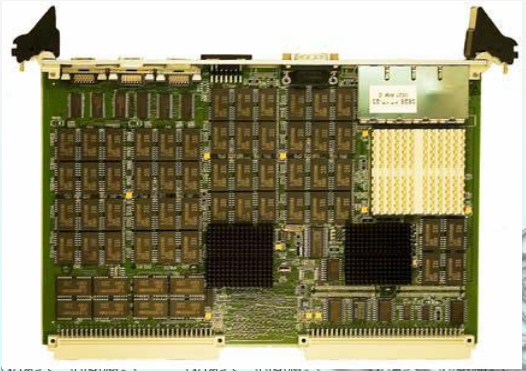
- Cloud Storage
  - Architecture: Master-Slave vs P2P
  - Flash
  - Energy Conservation

Future Research Work

- Architecture: Master-Slave vs P2P
  - P2P
    - Easy to manage, scalable
    - Fault tolerant
  - Master-Slave
    - High efficiency

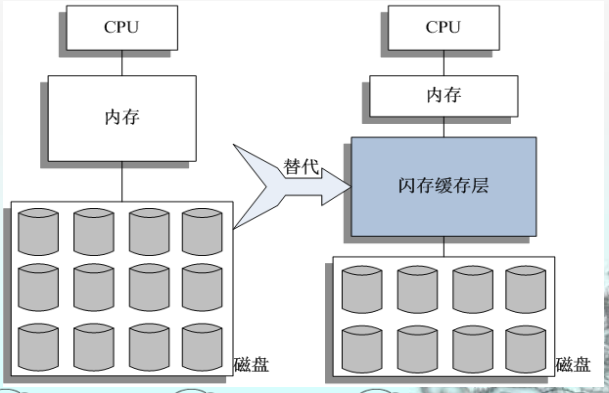
Future Research Work

- Mixed Storage (Flash + Disk)
  - Flash Database
    - Commercial SSD based optimization
    - Flash storage board



Future Research Work

- Mixed Storage (Flash + Disk)
  - Flash's Drawbacks:
    - Costs
    - Erase



Future Research Work

- Energy Conservation
  - More Energy-Efficient SSD
  - Dynamic data distribution