

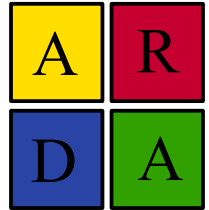
The AMGA Metada Service in gLite

*B. Koblitz, CERN-IT
with N. Santos and V.Pose*

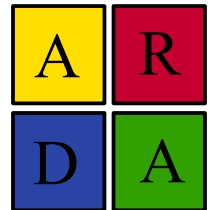
*CHEP 06, Mumbai, India
February 2006*

- **What is AMGA? What is Metadata on the Grid?**
- **Interface definition**
- **Implementation of AMGA**
- **Performance Comparison with File Catalogues**
- **Replication of Metadata with AMGA**

- **AMGA (ARDA Metadata Grid Application) is the Metadata catalogue of gLite 1.5**
- **AMGA started out as ARDA's tool to investigate metadata access on the GRID**
- **Metadata is relationally structured data for grid jobs (lives normally in databases)**
- **AMGA works in 2 modes:**
 - Side-by-Side a File Catalogue (LFC): File Metadata
 - Standalone: General relational data on Grid
- **AMGA has 2 front ends:**
 - SOAP with PTF standardised interface
 - Text-based TCP streaming protocol (proprietary, documented)
- <http://project-arda-dev.web.cern.ch/project-arda-dev/metadata/>



- **AMGA implements a common interface designed in close collaboration of gLite-DM and ARDA teams**
(P. Kunszt, R. Rocha, N. Santos, B.K.)
contains man ideas from UK GridPP Metadata group, LHCb (Bookkeeping, GANGA), HEP, PTF...
- **EGEE standard for metadata access (implemented)**
- **Design Ideas:**
 - Versatile: Performance (HEP), Security (BioMed)
 - Provides simple relational data manipulation interface
 - Modular: Interface for Entry manipulation, schemes, security
 - Few requirements on back end, can be SQL-DB, XML...
 - Allows stateless & statefull implementation
- **Description of WSDL at**
<https://edms.cern.ch/document/573725>



- **Schema (directory)**
 - Has hierarchical name and list of attributes /prod/events
- **Attributes**
 - Have name and storage type
 - Interface handles all types as strings
- **Entry**
 - Live in a schema, assign values to attributes
- **Query**
 - SELECT ... WHERE ... clause in SQL-like query language

Examples

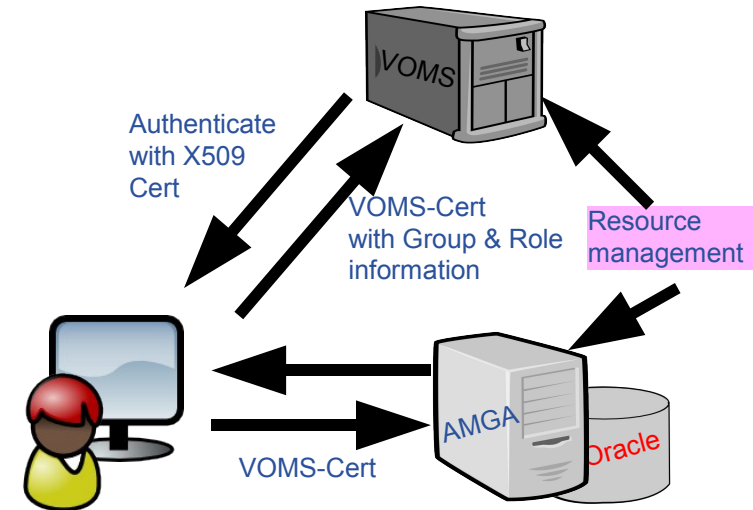
```
createdir /jobs
addattr /jobs jobStatus int
addentry /jobs/job1 jobStatus 0
updateattr /jobs jobStatus 1 jobID>100
selectattr /DLibrary:FileName /DLAudio:Author /DLAudio:Album
        '/DLibrary:FILE=/DLAudio:FILE and like(/DLibrary:FileName, "%.mp3") `
```

- Security very important for BioMed, not for HEP

Security ↔ Speed

- AMGA supports:

- SSL connections (Optional!)
- Authentication based on Password, X509 Cert, Grid Proxy
- Posix-ACLs and Unix permissions for entries and collections
- Built-in group-management like AFS or via VOMS

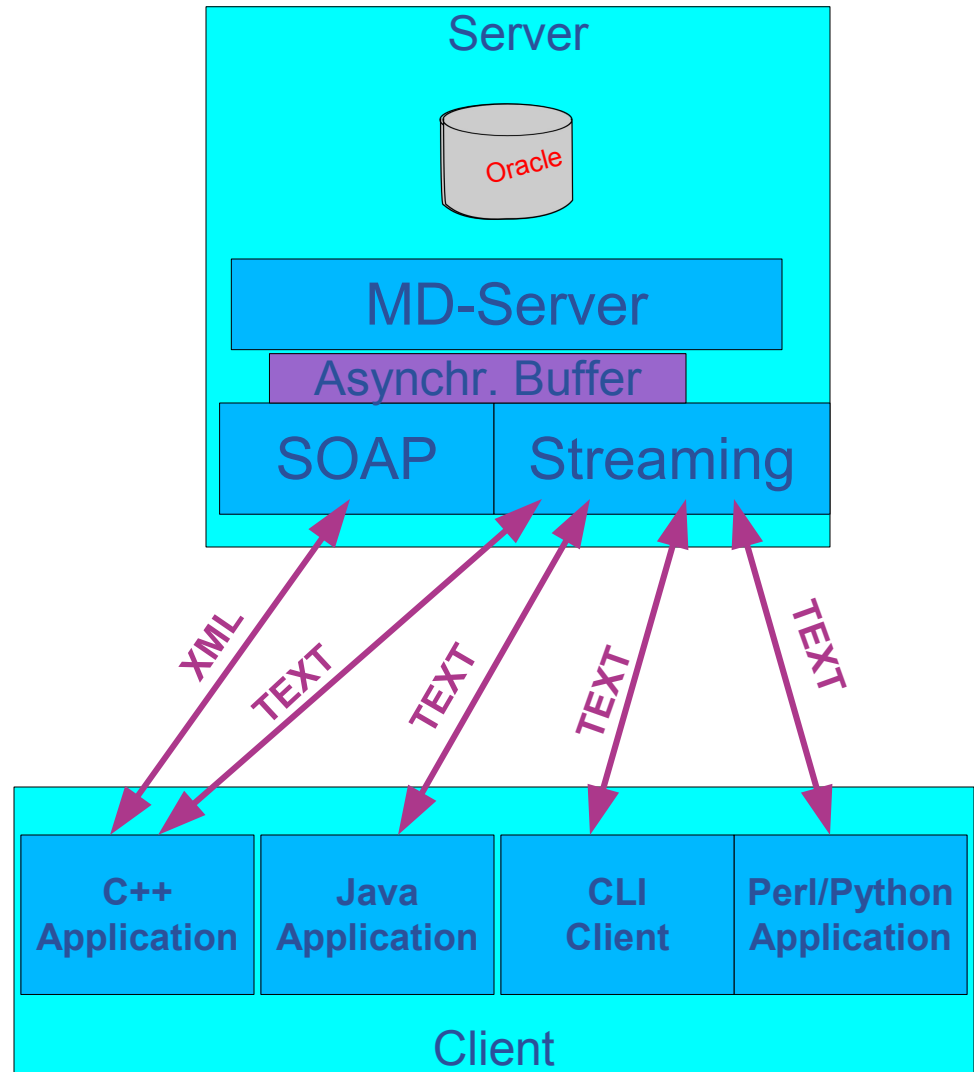


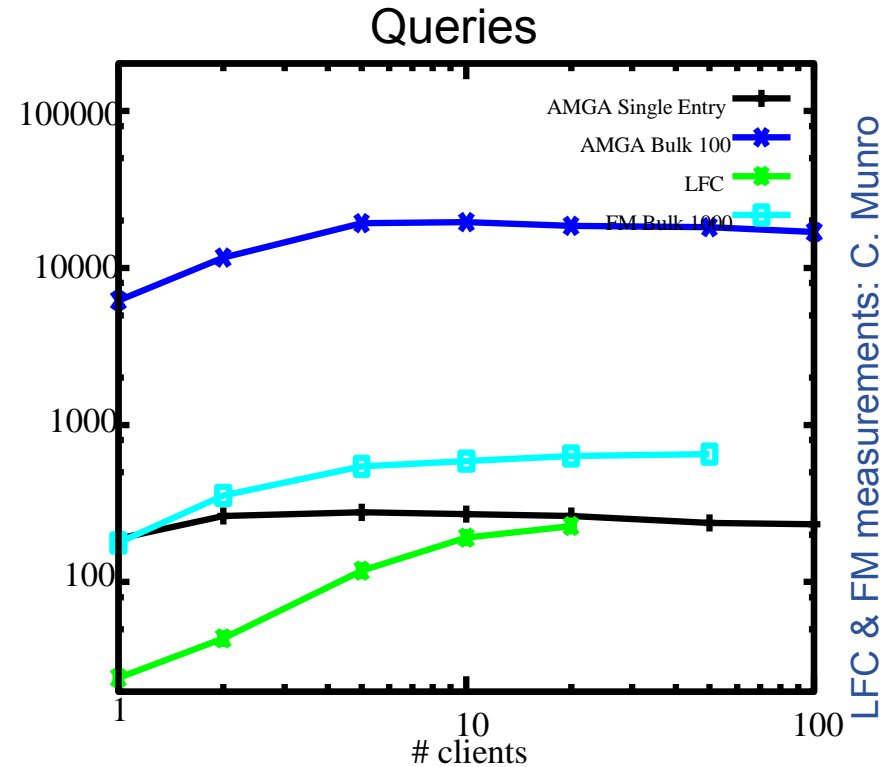
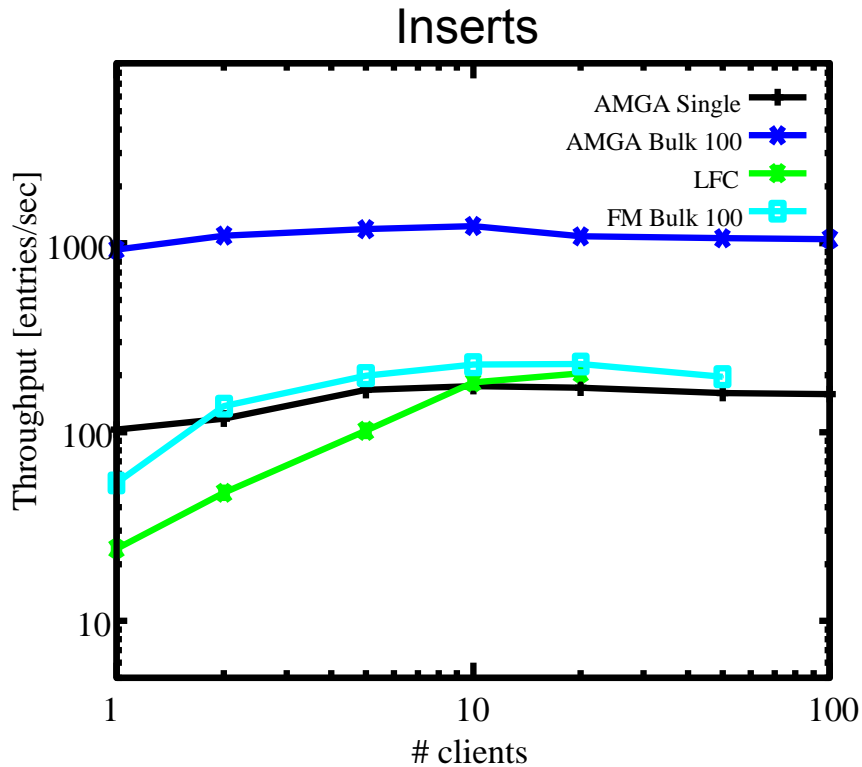
- Currently no security on attribute basis

- AMGA allows to create views: Safer, faster, similar to RDBMS

Security tested by GILDA and BioMed teams: Very positive feedback for built-in group management & ACLs

- **AMGA Implementation:**
 - SOAP and Text frontends
 - Streamed Bulk Operations
 - Supports single calls, sessions & connections
 - SSL security with grid certs (negotiated by client)
 - Own User & Group management + VOMS
 - PostgreSQL, Oracle, MySQL, SQLite backends
 - Works alongside LFC
 - C++, Java, Perl, Python clients

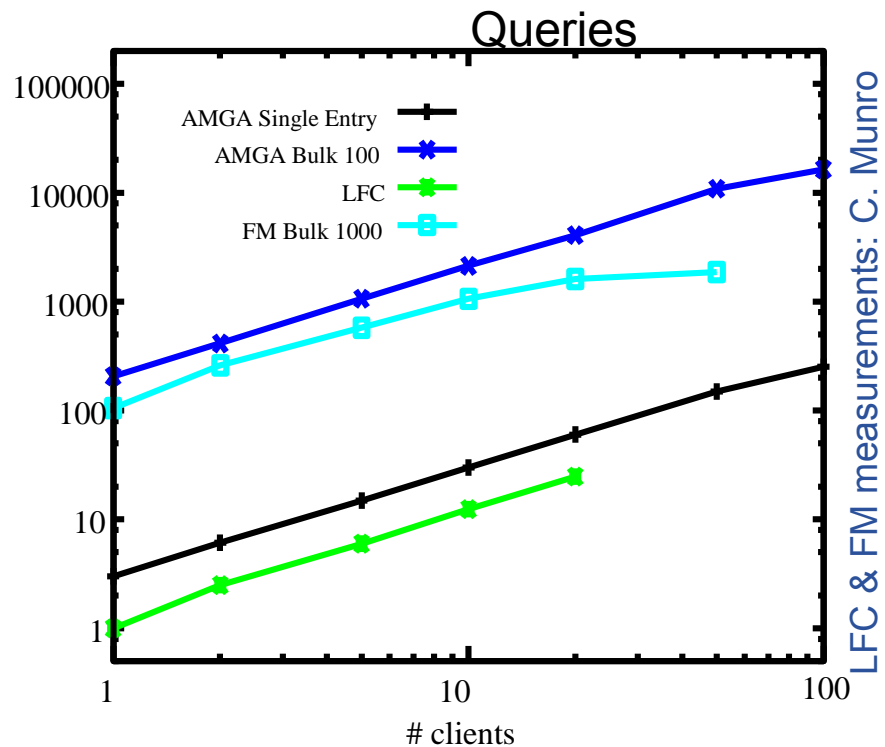
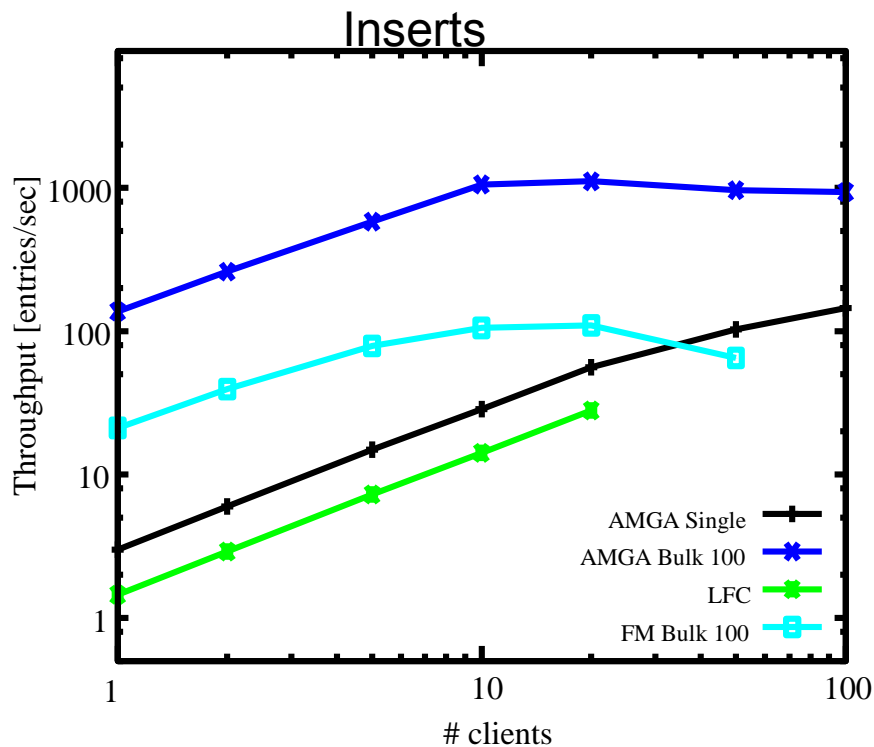




LFC & FM measurements: C. Munro

- Protocol comparison with LFC and FiReMan catalogues:**

- Authentication with X509 Certs, SSL connections
- LFN/GUID pairs inserted, query for GUID of LFN, Oracle DB
- AMGA **scales** very well up to 100 concurrent client (DB Limit)
- Streamed bulk inserts/queries are very fast!



LFC & FM measurements: C. Munro

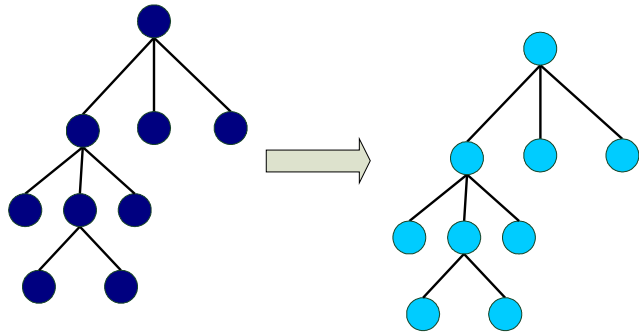
- **Comparison with FC protocols, connection from Taiwan:**
 - 300ms latency dominates performance
 - Reduce round-trips with sessions or holding connections
 - (Streamed) bulk operations vital for WAN performance

- **AMGA in (pre-)production within several projects:**
- **LHCb and ATLAS: GANGA**
 - Highly dynamic relational data for tracking jobs
 - AMGA used for communication between user clients
- **LHCb Logging and Bookkeeping**
 - 15 Million log entries of jobs
- **EGEE BioMed applications**
 - Highly secure access to medical images metadata
 - Many different security roles, uses VOMS
- **Generic applications:**
 - Metadata for EGEE-GILDA DigitalLibrary
 - UNOSAT project: Satellite images metadata, GIS

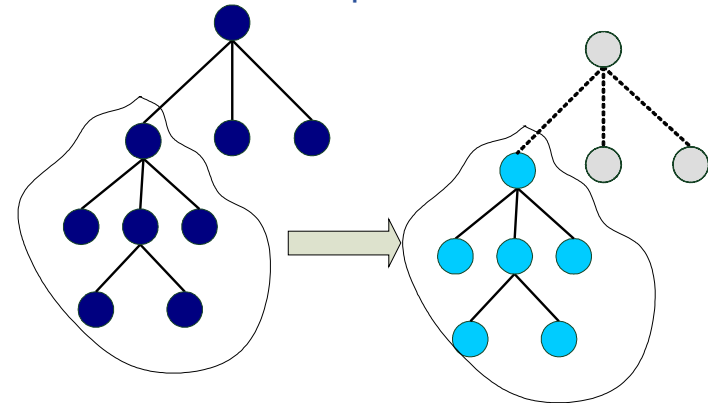
- **Replication of metadata on Grid necessary:**
 - **Scalability:** more connections, smaller latencies
 - **Reliability:** Avoid single point of failures
 - **Administration:** Less DBA time central management possible
- **AMGA DB can also be replicated using LCG-3D project's Oracle streams replication, however**
 - **Does not scale to size of Grid (intended for Tier 1 only!):**
 - DBA access to change replication schemas on all sites
 - Replication works only if all sites up, no failover
 - **Not cross-vendor replication:** Oracle only
- **AMGA implements replication & federation itself:**
 - Asynchronous log-shipping of Metadata commands: **cross-vendor**
 - **Users can changes replication and federation setup**
- **Initial implementation currently tested**

- AMGA replication makes use of **hierarchical concept**:

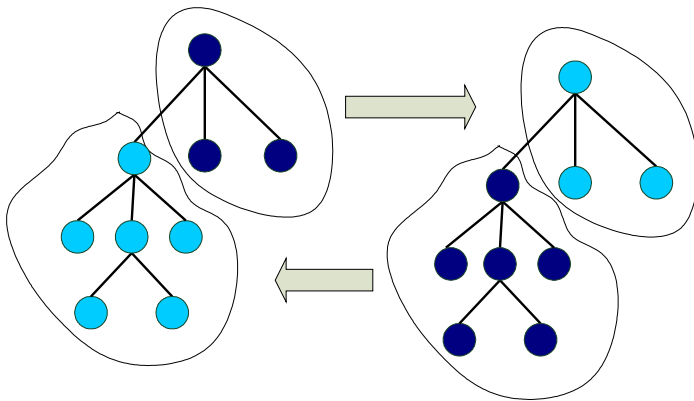
Full replication



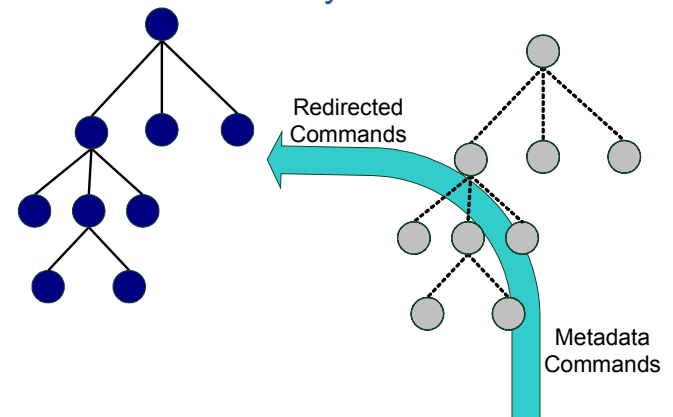
Partial replication



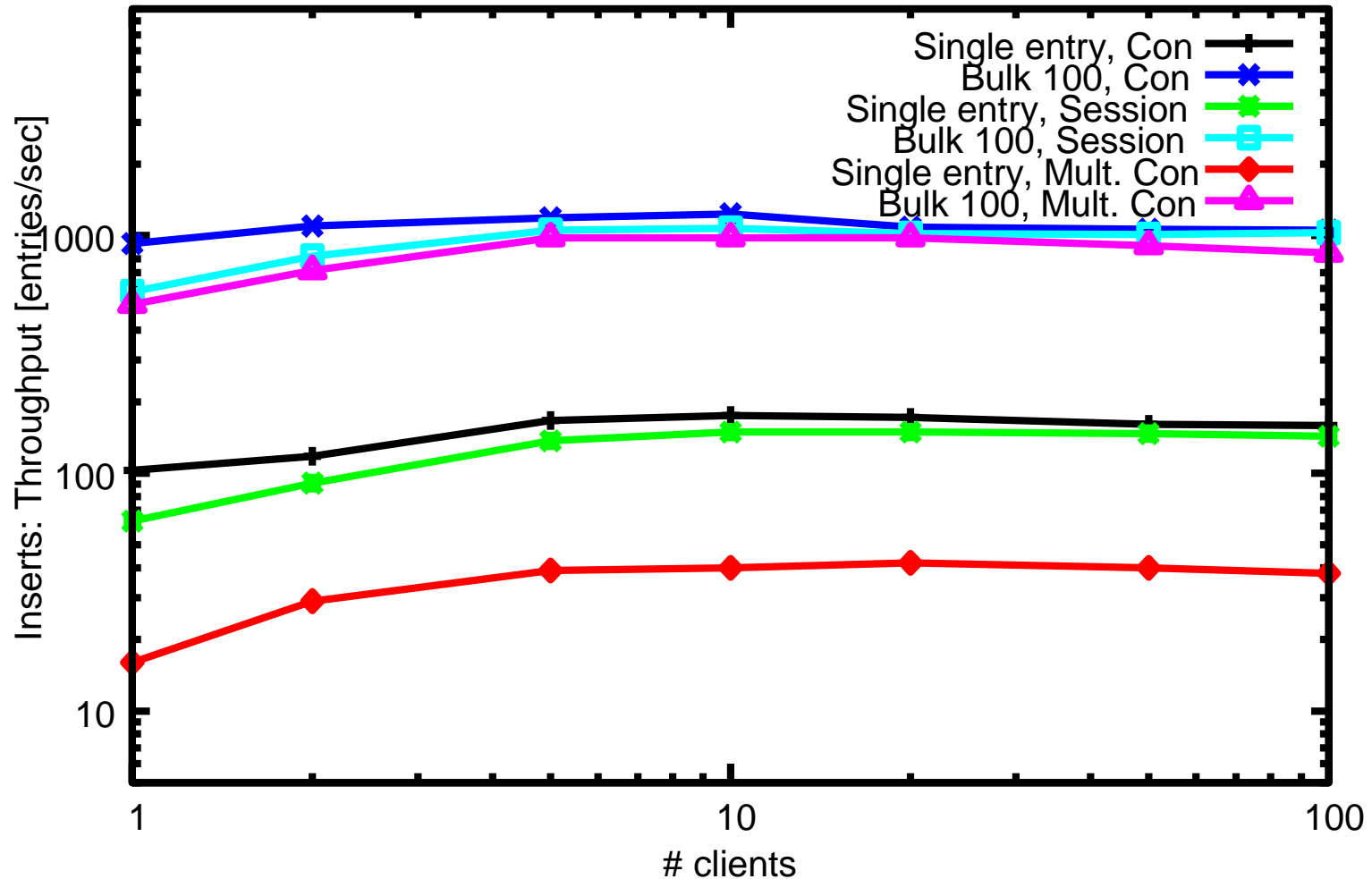
Federation



Proxy

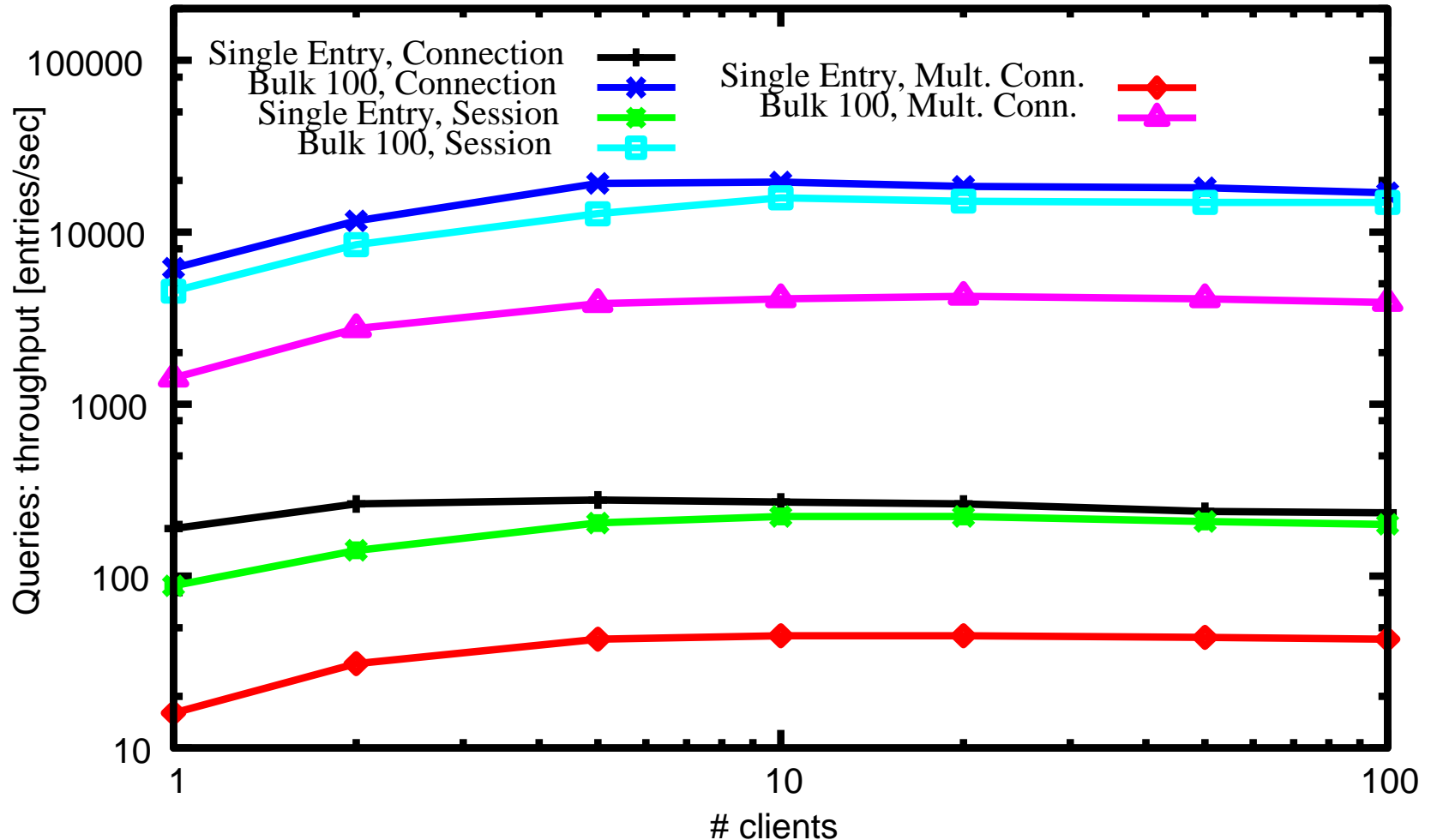


- ARDA metadata server **AMGA** now in **gLite 1.5**
- Implements most of **PTF Metadata Interface**
- **AMGA** has seen **heavy performance/stability testing**
 - AMGA's protocol throughput 10 times higher than LFC's or FiReMan's due to combination of sessions and bulk streaming
- **AMGA** includes very **flexible** (and optional) **security** features
- **AMGA** currently evaluated / in preproduction for LHCb(GANGA, bookkeeping), MDM, DigitalLibrary, UnoSat...
- **Replication features now available in AMGA (beta)**
- **AMGA Web Site**
<http://project-arda-dev.web.cern.ch/project-arda-dev/metadata/>



Inserting entries (GUID+LFN) into a AMGA already filled with 1 million entries. The limit of the Oracle database is about 1000 entries/sec which can be reached with bulk operations of 100 entries in all of the 3 connection modes of AMGA: Multiple individually authenticated TCP connections, a single SSL session spanning multiple TCP connections and a single TCP connection. The SSL session is nearly as fast as the single connection.

All measurements with an Oracle backend.



Retrieving GUIDS from AMGA for a given LFN where the catalogue holds 1 million entries. Using an SSL session spanning several TCP connections is about 10 times faster than having several TCP connections where the client authenticates in each. A single connection is only slightly faster than a session. A bulk operation with 100 entries is able to increase the speed over the single entry operation in all cases by about another factor of 10.