Open Geospatial Consortium Inc.

Date: 2005-12-16

Reference number of this OGC® document: **OGC 05-101**

Version: 0.0.4

Category: OpenGIS® Discussion Paper

Editor: David S. Burggraf

OWS 3 GML Investigations—Performance Experiment

Copyright notice

Warning

This document is not an OGC Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an OGC Standard.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document type: OGC© Discussion Paper
Document stage: Approved
Document language: English

Contents

Figures Page

Tables

Preface

Suggested additions, changes, and comments on this draft report are welcome and encouraged. Such suggestions may be submitted by OGC portal message, email message, or by making suggested changes in an edited copy of this document.

The changes made in this document version, relative to the previous version, are tracked by Microsoft Word, and can be viewed if desired. If you choose to submit suggested changes by editing this document, please first accept all the current changes, and then make your suggested changes with change tracking on.

i. Submitting organizations

The following organizations submitted this document to the Open Geospatial Consortium Inc:

- Galdos Systems Inc.

ii. Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

Contact	Company
D. Burggraf	Galdos

iii. Revision history

Date	Release	Editor	Primary clauses modified	Description
Aug 25/05	1	D. Burggraf	All	First draft—Methodology and Test Environment
Oct 26/05	2	D. Burggraf	All	Second draft—Preliminary performance results included
Dec 11/05	3	D. Burggraf	9, Annex A	Final performance results, analysis and conclusions.

Dec 16/05	4	D. Burggraf	8, 9, Annex A	Summary charts and data tables refactored.

iv. Changes to the OpenGIS® Abstract Specification

The OpenGIS® Abstract Specification does not require changes to accommodate the technical contents of this document.

Foreword

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Introduction

Geography Markup Language is the ‘Lingua Franca’ for the description of geographic information. The current encoding format of GML is XML Schema (.xsd) and instances (.xml), which are relatively verbose and bulky, when compared to other GIS data formats. Developments such as XML hardware acceleration (DataPower, Tarari) and the widespread advances in memory and CPU clock speed have made GML handling less unwieldy since its adoption by the Open Geospatial Consortium in 1999. However, data compression and binary XML encoding formats are also expected to provide a significant boost in GML data transfer and processing performance in the web services environment.

In this experiment, the retrieval time of GML features from a Web Feature Service (WFS) to a WFS client will be studied by varying certain control parameters including methods of encoding and compression. Four different control parameters including encoding format, data set size, bandwidth, and feature type will be varied to test the relative performance in each case.

The methodology, test environments and details of the control parameters are described in Clause 6. The results of the performance experiment are summarized in Clause 8 and tabulated in Annex A. The analysis and conclusions are discussed in Clause 9.

OWS 3 GML Investigations—Performance Experiment

1 Scope

This OGC Interoperability Program Report investigates the retrieval time of GML features from a Web Feature Service (WFS) to a WFS client by varying certain control parameters including methods of encoding and compression. Four different control parameters including encoding format, data set size, bandwidth, and feature type will be varied to test the relative performance in each case.

2 Conformance

Not required for an IP IPR, DIPR, or Discussion Paper.

3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

OGC 03-105r1, OpenGIS® Geography Markup Language (GML) Implementation Specification, Version 3.1.1, April 2004.

OGC 05-008c1, OWS Common Implementation Specification, May 2005

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
BinXML™
Binary encoding format/system for XML data.

5 Conventions

5.1 Symbols (and abbreviated terms)

API Application Program Interface

COM	Component Object Model
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off The Shelf
DCE	Distributed Computing Environment
DCP	Distributed Computing Platform
DCOM	Distributed Component Object Model
GML	Geography Markup Language
ISO	International Organization for Standardization
OGC	Open GIS Consortium
UML	Unified Modeling Language
WFS	Web Feature Service
XML	eXtensible Markup Language
1D	One Dimensional
2D	Two Dimensional
3D	Three Dimensional

5.2 UML notation

Most diagrams that appear in this specification are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of the OGC Web Services Common Implementation Specification [OGC 04-016r2].

5.3 Document terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [OGC 04-016r2].

6 Methodology and Test Environment

The elapsed time for the retrieval of features via a *GetFeature* request from a transactional WFS to a WFS client will be measured. The Galdos Cartalinea WFS implementation that supports an X-Hive database will be used for this experiment. The description of the test environment is described in sub-clause 6.5. The GML test data consists of a subset of VMAP0 and a subset of MSD3. Four different control parameters will be varied to test the relative performance in each case. The parameters to be varied are listed as follows:

1. Encoding Formats
2. Feature Types
3. Dataset Size
4. Bandwidth

More details about the control parameters are given in sub-clauses 6.1 - 6.4.

6.1 Encoding Formats

6.1.1 Uncompressed GML

The performance results for uncompressed GML are to be used as the baseline in this experiment. This is currently the default output format of a WFS.

6.1.2 BinXML

BinXML™ is a tool which allows for encoding and decoding XML messages in a binary form. It provides compression and parsing efficiency to improve XML transmission and processing performances over a complete system. The software components provided by BinXML™ form a generic chain for parsing, validating, fragmenting, compressing, encoding and decoding XML documents. The BinXML™ software is composed of two main parts: an encoder and a decoder. Both parts share some common knowledge about the XML language to be encoded. A BinXML™ Schema Compiler supplied by Expway is used by Galdos that validates and compiles XML Schema. The Schema Compiler generates two representations of the schema, which are used respectively by the encoder and the decoder.

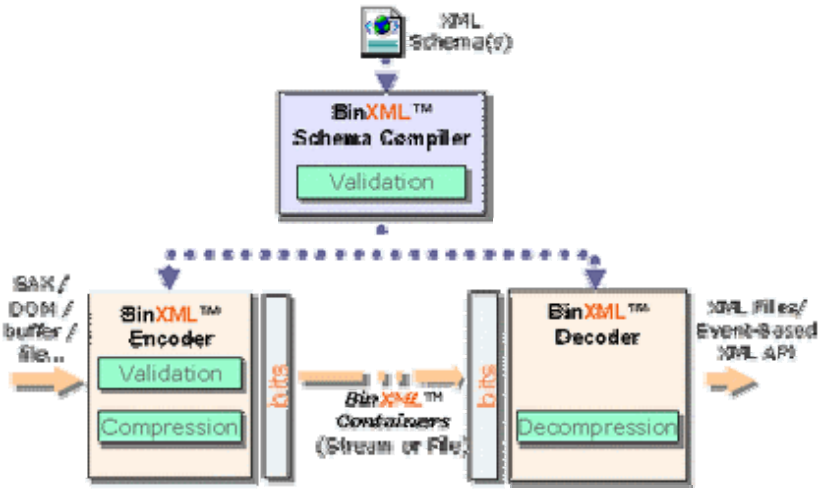

Figure 6.1.2-1 — BinXML Coder/Encoder Workflow.

6.1.3 gzip Compression

GNU zip or *gzip* [gzip] is a lossless compression utility that produces files with a .gz extension. Compression is always performed, even if the compressed file is slightly larger than the original. The worst case expansion is a few bytes for the gzip file header, plus 5 bytes every 32K block, or an expansion ratio of 0.015% for large files. GNU zip has been adopted by the GNU project and is now relatively popular on the Internet. The format of the .gz files generated by *gzip* is described in RFCs 1951 and 1952 in the files http://www.ietf.org/rfc/rfc1951.txt (deflate format) and http://www.ietf.org/rfc/rfc1952.txt (gzip format).

6.1.4 BinXML with GZIP Compression

It is expected that this combination of BinXML and GZIP compression will cost more in coding/decoding, but this may be offset by a slightly lower dataset payload in the low bandwidth case.

6.2 Feature Types

The feature types listed below are defined in two separate GML application schemas, VMAP0 and MSD3, which are both available on the OWS3 project page of the OGC Portal.

6.2.1 VMAP0

The VMAP0 feature types to be tested in this experiment are summarized in Table 6.2.1-1.

Table 6.2.1-1 — VMAP0 Feature Types.

SHORT NAME	GEOGRAPHIC REGION	FEATURE COUNT	FILE SIZE (MB)
builtupa	North America	8,346	6.3
inwatera	North America	153,358	120.4
elevp	North America	175,880	62.6
watrcrsl	North America	290,528	146.8
contourl	World	1,099,837	1,005.9

6.2.2 MSD3

The MSD3 data sets to be tested in this experiment are summarized in Table 6.2.2-1. The MSD3.gml data file is a concatenation of all the provided GML data files for this experiment.

Table 6.2.2-1 — MSD3 Data Sets.

FILENAME	FEATURE COUNT	FILE SIZE(MB)
AAL015.gml	857	1.8
LAP030.gml	1,444	1.6
PAL015.gml	2,888	5.4

MSD3.gml	7,448	13.0

6.3 Dataset Size

To measure the effect of dataset size on the retrieval rate, the feature count will be varied from 100 to 50000. For feature types with a sufficiently large number of feature instances, iterations will be performed with the *wfs:maxFeatures* attribute value set to the values: 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000. However, if the number of feature instances is not sufficiently large, e.g. in the case of built up areas, which has 8346 features then the *wfs:maxFeatures* attribute will not increase past 10000. A plot of the *GetFeature* transaction response time vs. *maxFeatures* will illustrate the relative performance. A sample plot is shown in Figure 6.3-1.

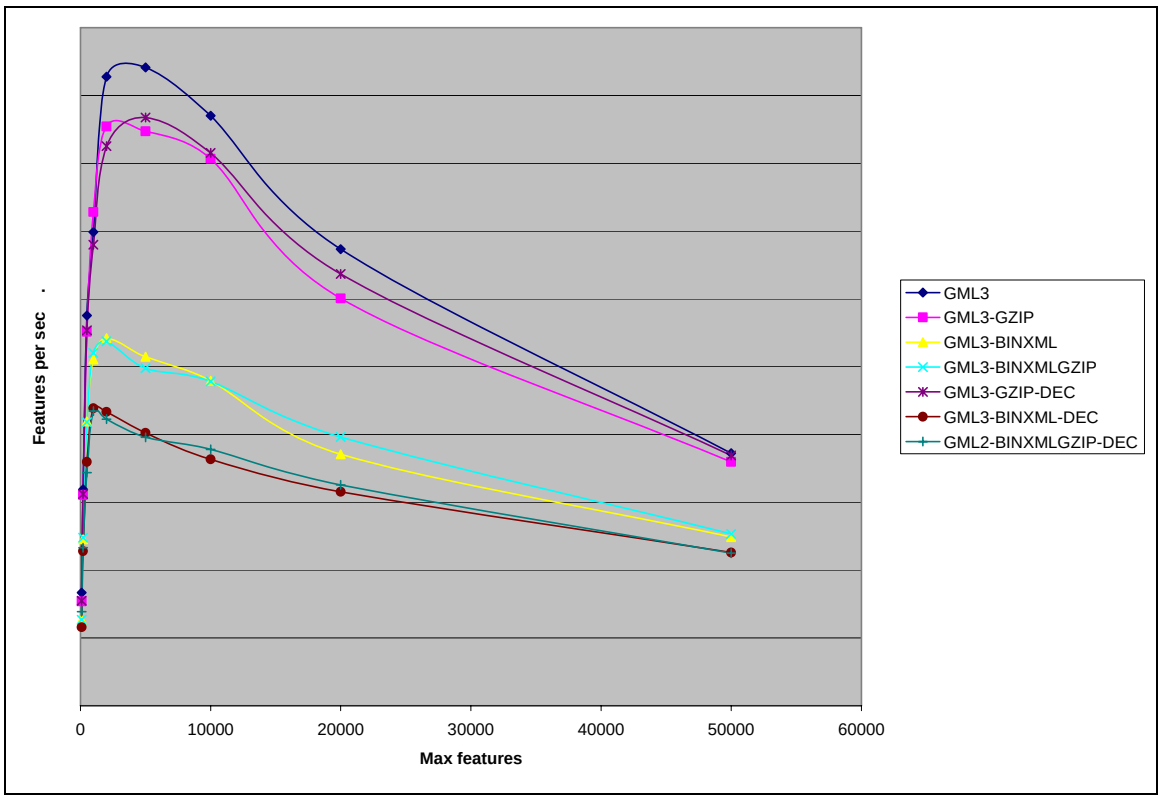

Figure 6.3-1 — Sample Plot of Feature Count Vs. Rate.

6.4 Bandwidth

The performance tests will be conducted in three different bandwidth environments:

1. Local Server
2. 100 MBS LAN
3. 10 MBS WAN

The local server environment will be used as a baseline comparison for the other environments. It is expected that relative performance will improve for binary encoded formats in the lower bandwidth environments.

6.5 Test Environment

Cartalinea version: GDS~DEV_V1_8_0_56_ALPHA with custom BinXML serializer.
Database version: X-Hive 5.1.3

6.5.1 Local Server

Machine name: ags0104
Processor clock: Intel 2 x 2.4GHz, both used
Machine memory: 2 GB
OS: Windows XP Professional
JRE 1.4.2_06

6.5.2 LAN client

Machine name: AGS00013
OS Windows 2000 Professional
Processor clock: 1 GHz.
Machine memory: 512MB
JRE 1.4.2_03

6.5.3 Low Bandwidth client

Machine name: AGS0046
OS: Windows 2000
Processor clock: Intel 1 GHz.
Machine memory: 1 GB
JRE 1.4.2_03

7 Hypothesis

The following table summarizes the file size for the various output formats of the sample dataset containing the VMAP0 *inwatera_hydro_1m* feature type.

Table 7-1 — Relative File Size for the Various Output Formats.

Feature Type: inwatera_hydro_1m			
Output Format	**File Name**	**Size (KB)**	**Size Relative to Uncompressed File (%)**
GML3	inwatera-GML3.xml	42129	100
GML3-GZIP	inwatera-GML3-GZIP.gzip	5640	13.387
GML3-BINXML	inwatera-GML3-BINXML.bix	7945	18.859
GML3-BINXMLGZIP	inwatera-GML3-BINXMLGZIP.gzip	7947	18.863

Upon inspection of the size relative to the uncompressed file for each output format, we can see that GZip offers the best compression of XML, but does not offer any further compression on the BinXML encoding. The BinXML encoding also offers a significant reduction in size comparable to that of GZip. The time to compress and decompress the GZip is very small; on the order of 1 second for compression and 0.5 seconds for decompression. The time to compress and decompress BinXML is longer than GZip but is still relatively small; on the order of 10 seconds for compression and 5 seconds for decompression. As a result we can expect that the total elapsed time for transfer of the data across a low bandwidth network will be significantly decreased if compression or binary encoding is used. Thus we would expect that the overall performance results in the low bandwidth case to significantly improve for the GZip and BinXML output formats. It is not easy to predict how the performance relative to raw GML will change in higher bandwidth case and when the feature volume is varied.

8 Results

Each result summary is illustrated with a colour coded plot of feature count versus feature retrieval rate (measured in features per second) for each feature type and bandwidth environment. The colour coded legend is provided in each plot. Each plotted point is compared and averaged over five iterations to reduce the probability of spurious results. The results are organized by bandwidth and feature type in the following sub-clauses.

8.1 Local Server

8.1.1 Feature Type: *builtupa_pop_1m*

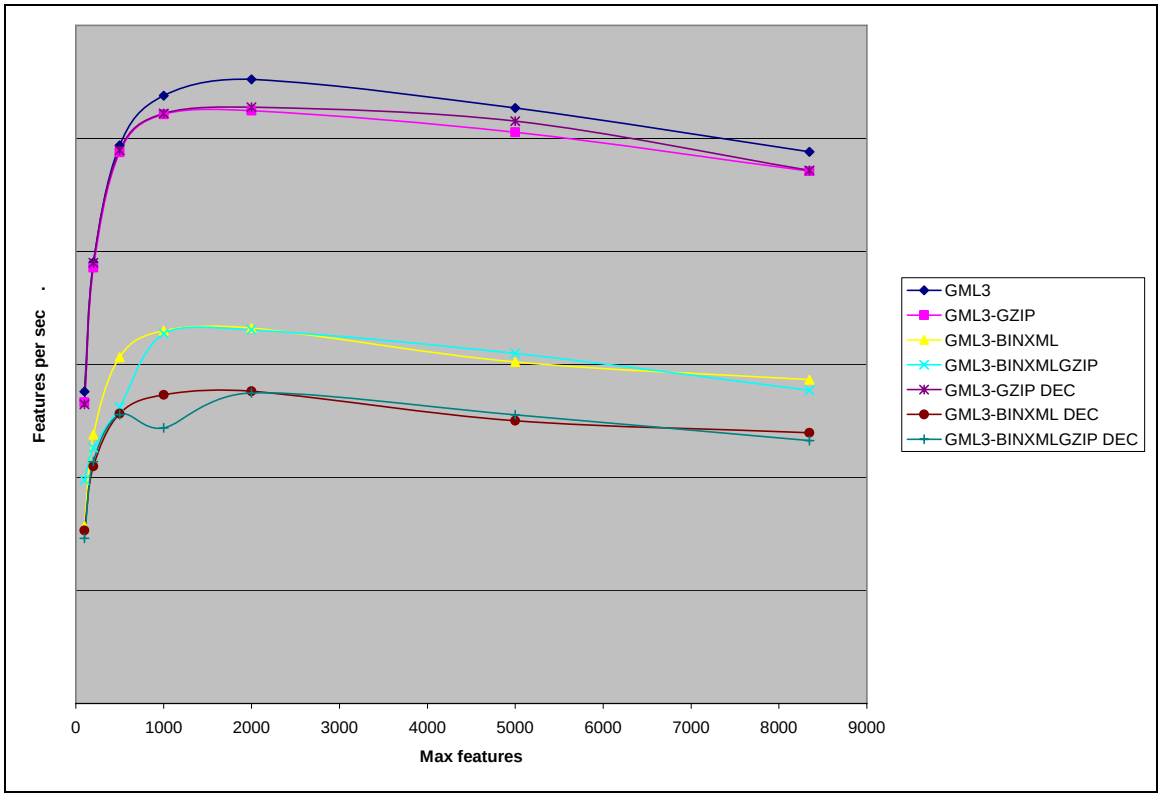

Figure 8.1.1-1 — Local Server *builtupa_pop_1m* Feature Count Vs. Rate.

8.1.2 Feature Type: *contourl_elev_1m*

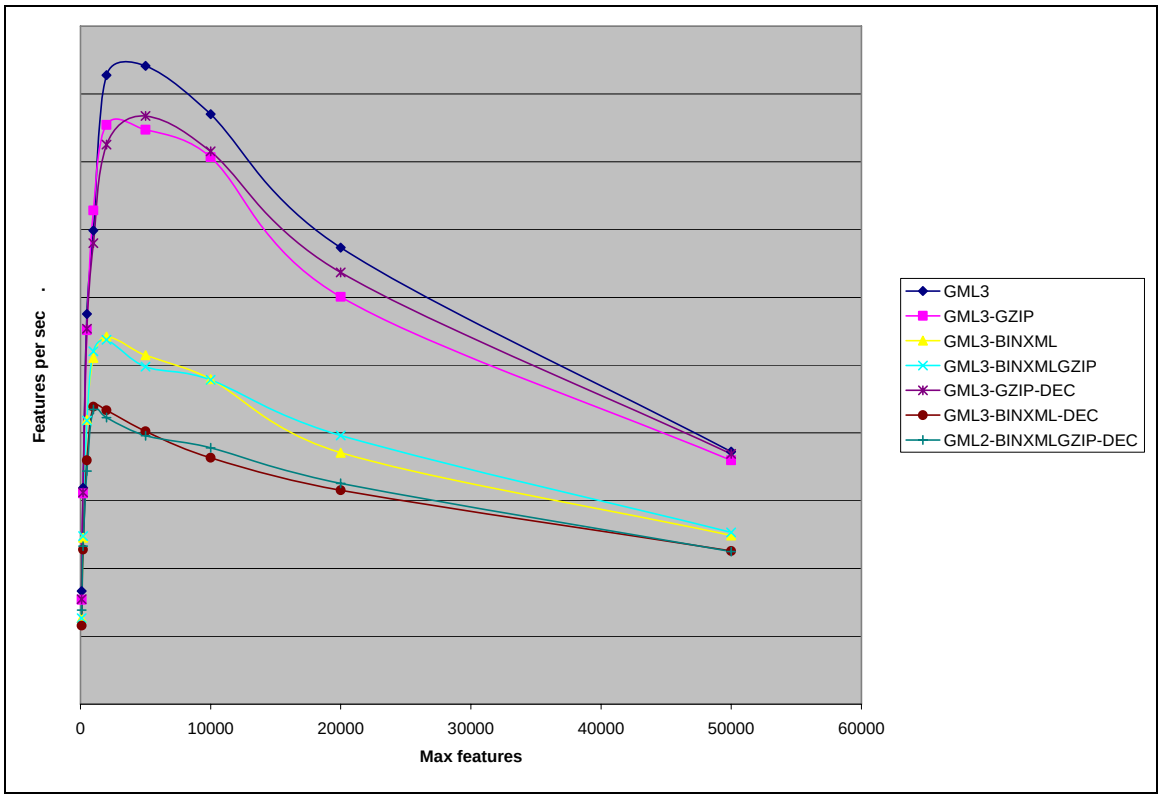

Figure 8.1.2-1 — Local Server *contourl_elev_1m* Feature Count Vs. Rate.

8.1.3 Feature Type: *elevp_elev_1m*

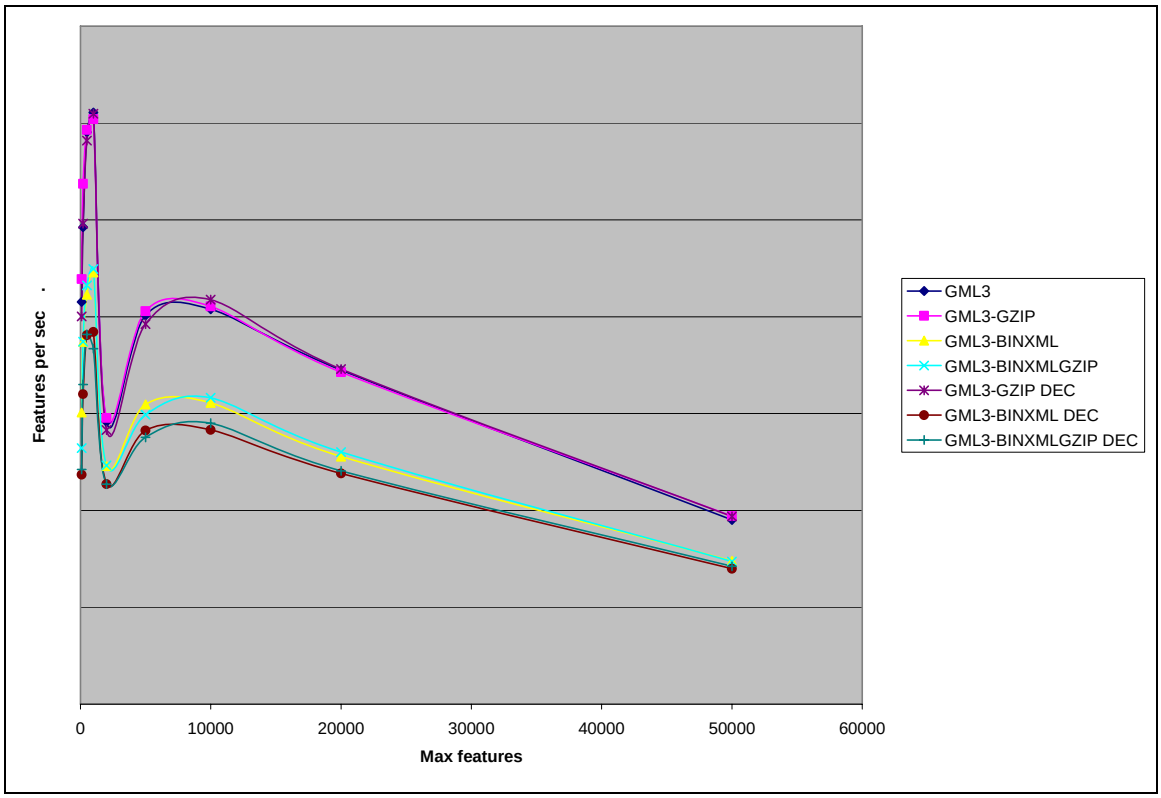

Figure 8.1.3-1 — Local Server *elevp_elev_1m* Feature Count Vs. Rate.

8.1.4 Feature Type: *inwatera_hydro_1m*

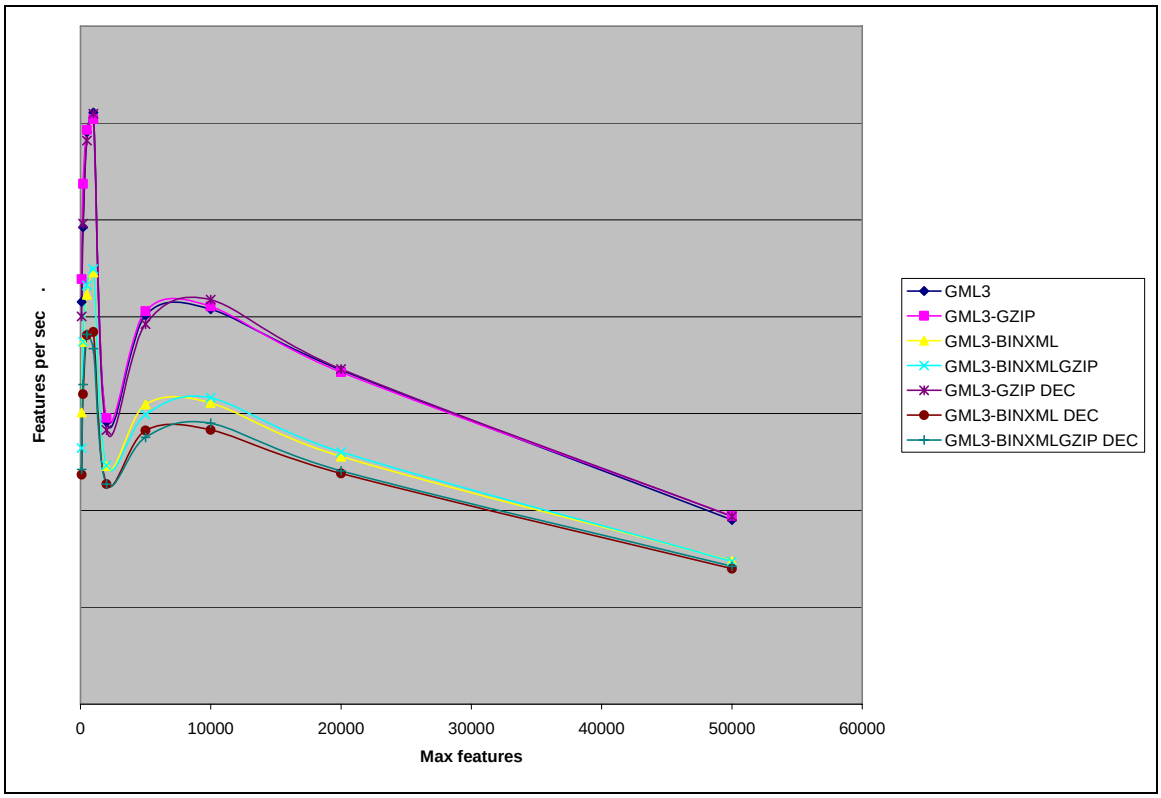

Figure 8.1.4-1 — Local Server *inwatera_hydro_1m* Feature Count Vs. Rate.

8.1.5 Feature Type: *watrcrsl_hydro_1m*

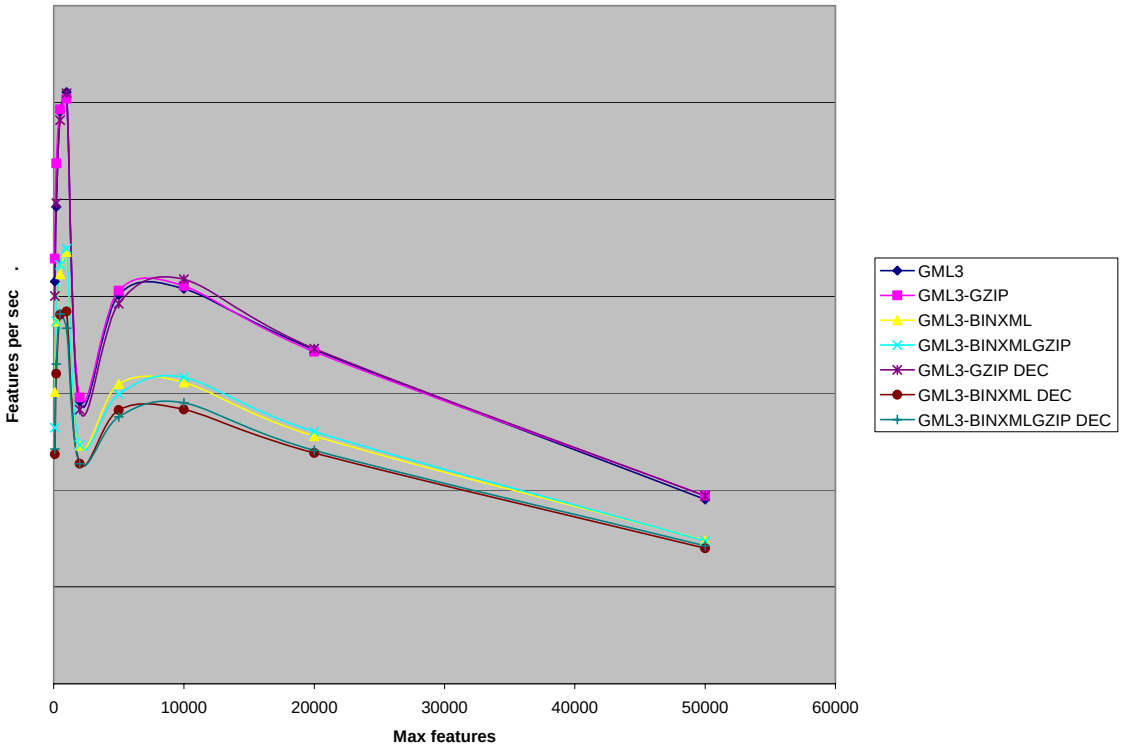

Figure 8.1.5-1 — Local Server *watrcrsl_hydro_1m* Feature Count Vs. Rate.

8.1.6 Feature Type: *AAL015*

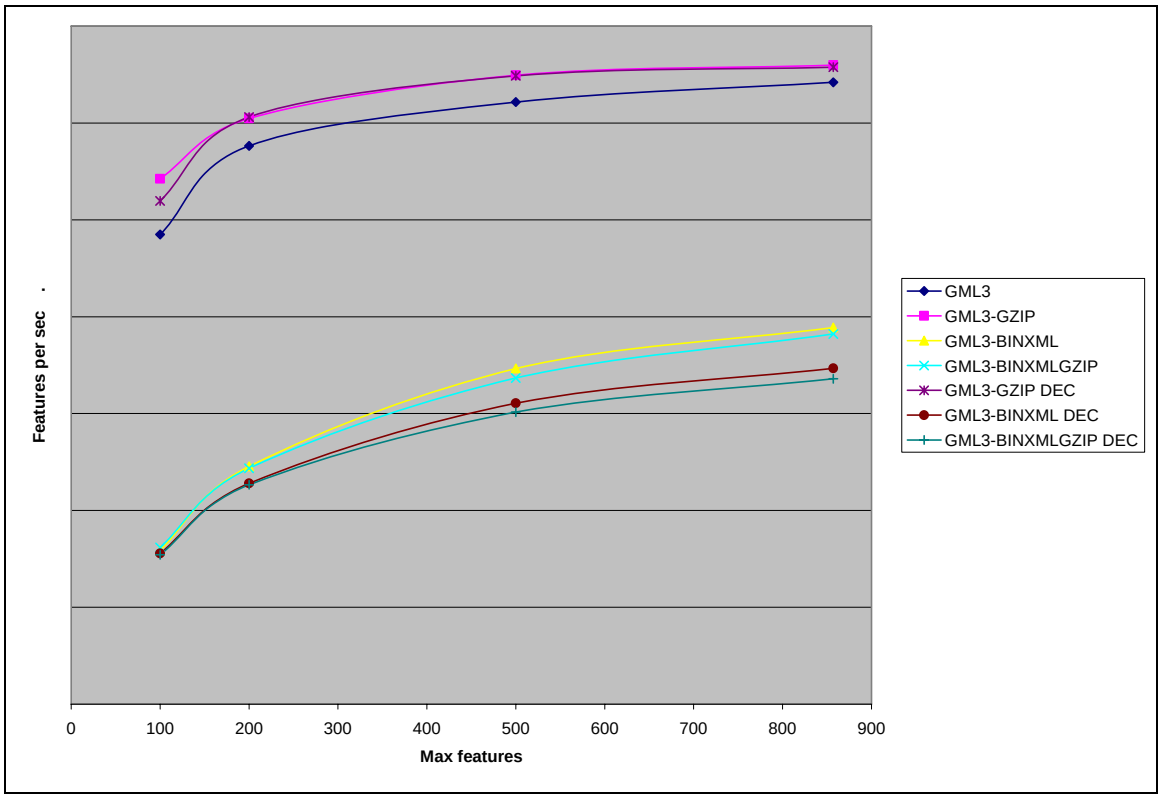

Figure 8.1.6-1 — Local Server *AAL015* Feature Count Vs. Rate.

8.1.7 Feature Type: *LAP030*

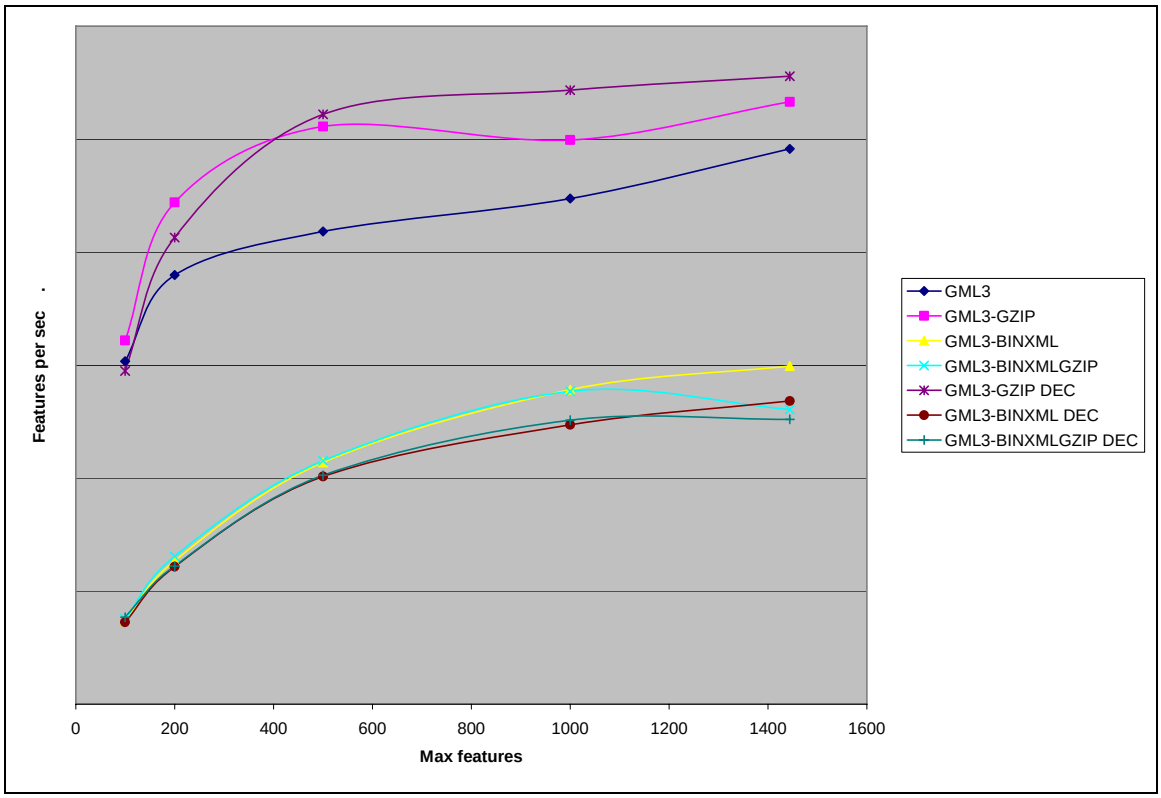

Figure 8.1.7-1 — Local Server *LAP030* Feature Count Vs. Rate.

8.1.8 Feature Type: *PAL015*

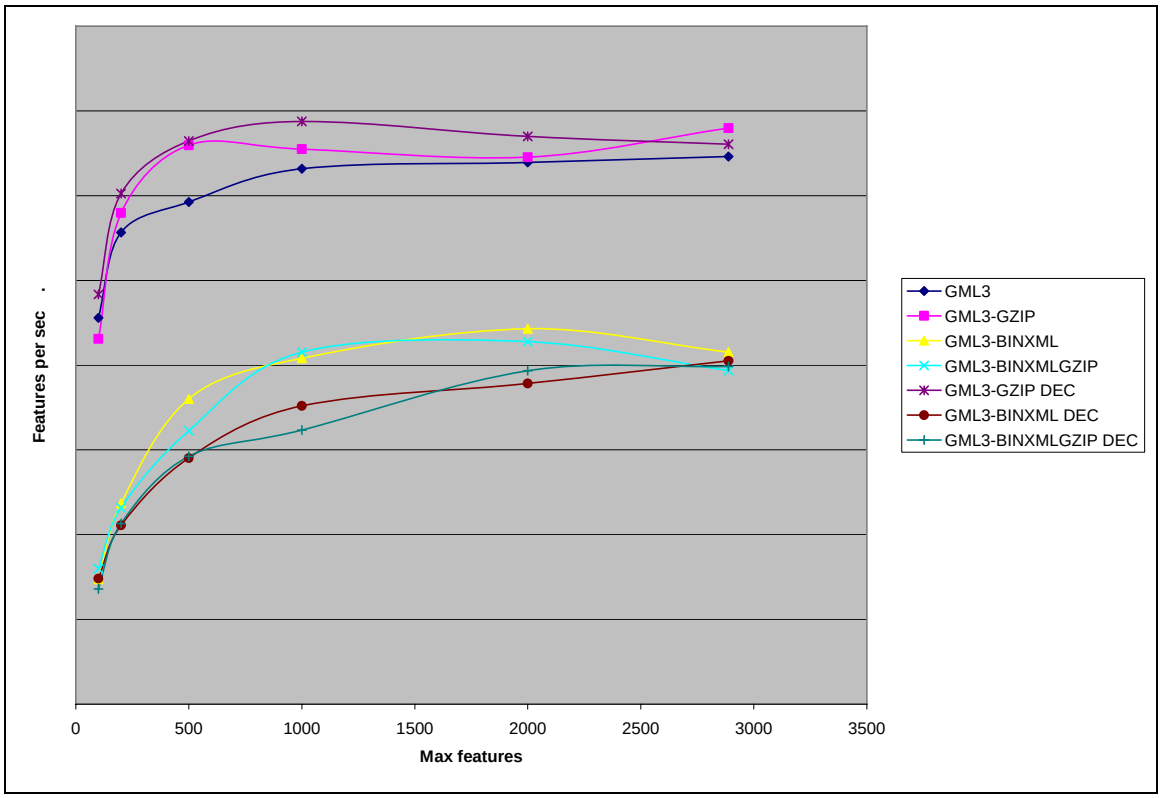

Figure 8.1.8-1 — Local Server *PAL015* Feature Count Vs. Rate.

8.1.9 Feature Type: *All MSD3 Features*

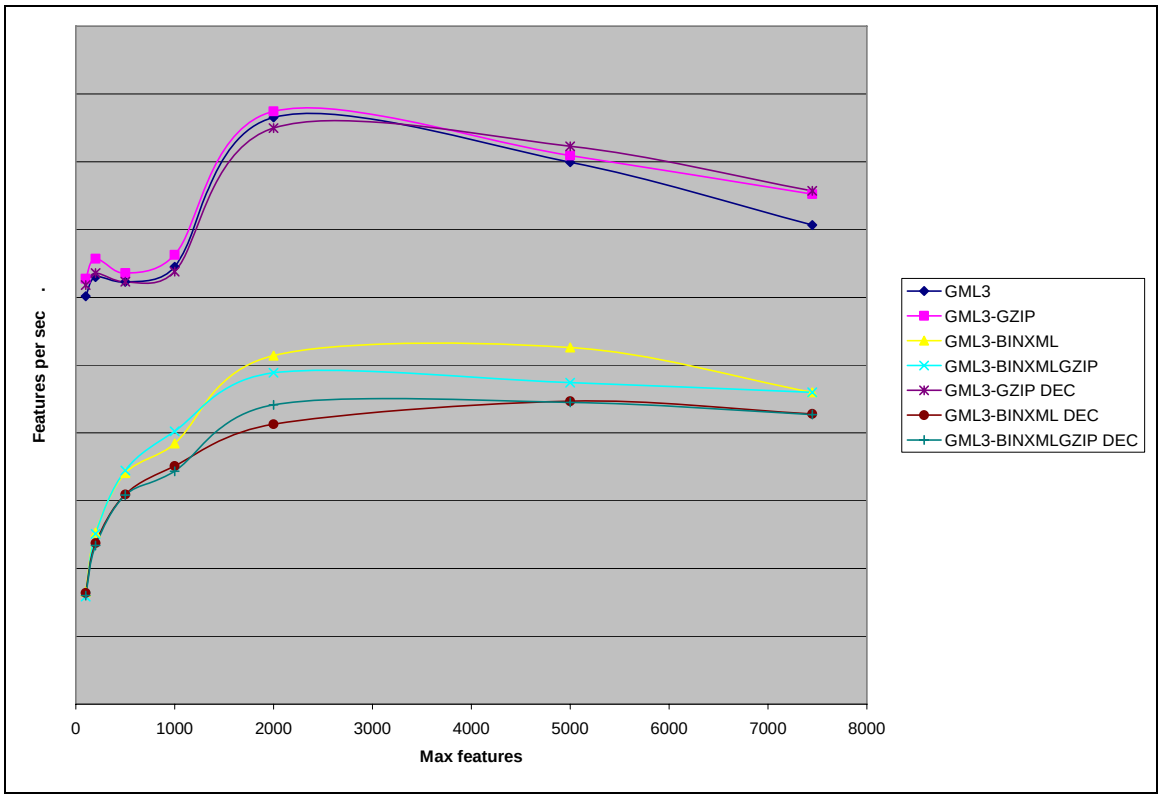

Figure 8.1.9-1 — Local Server *All MSD3* Feature Count Vs. Rate.

8.2 100 MBPS LAN

8.2.1 Feature Type: *builtupa_pop_1m*

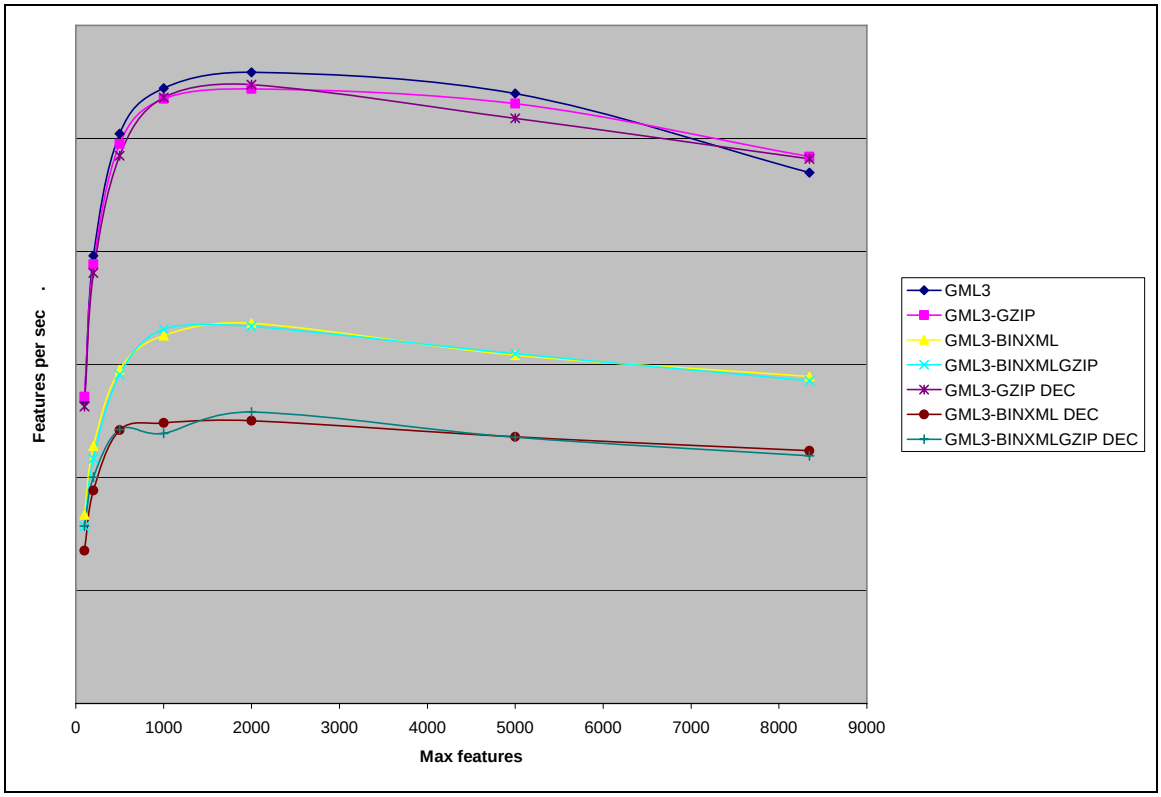

Figure 8.2.1-1 — 100 MBPS LAN *builtupa_pop_1m* Feature Count Vs. Rate.

8.2.2 Feature Type: *contourl_elev_1m*

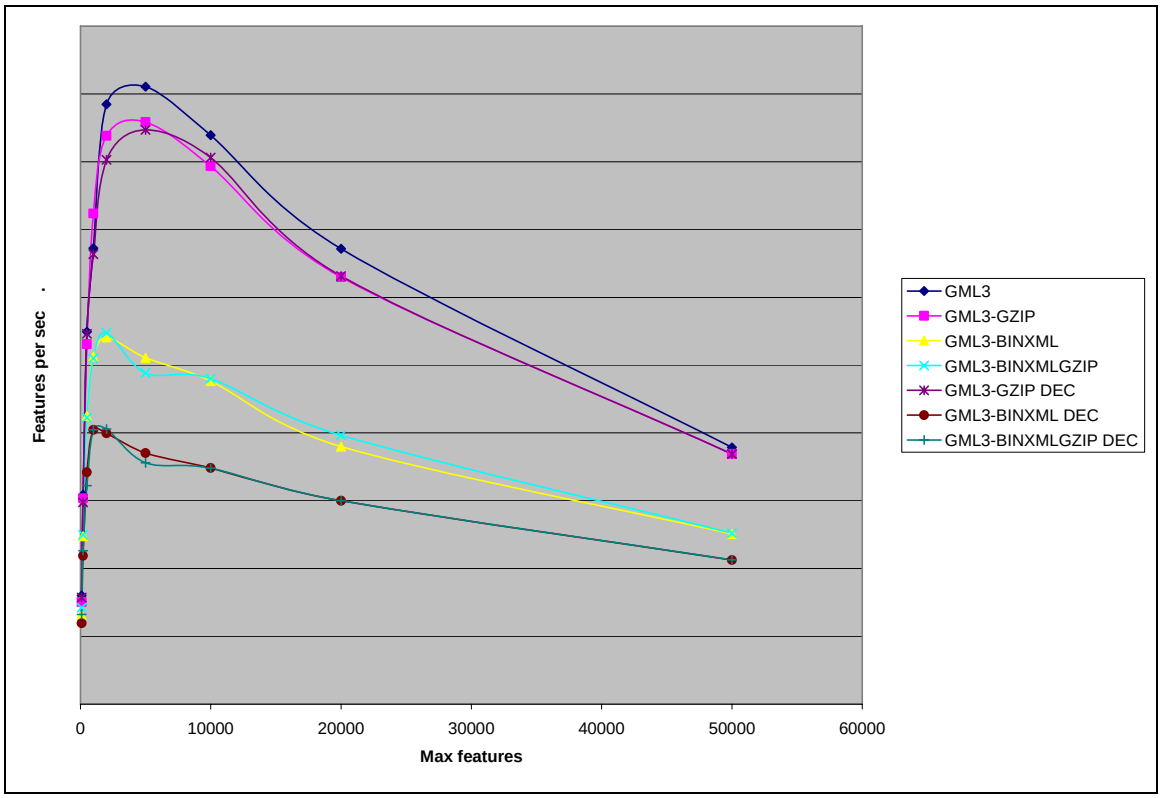

Figure 8.2.2-1 — 100 MBPS LAN *contourl_elev_1m* Feature Count Vs. Rate

8.2.3 Feature Type: *elevp_elev_1m*

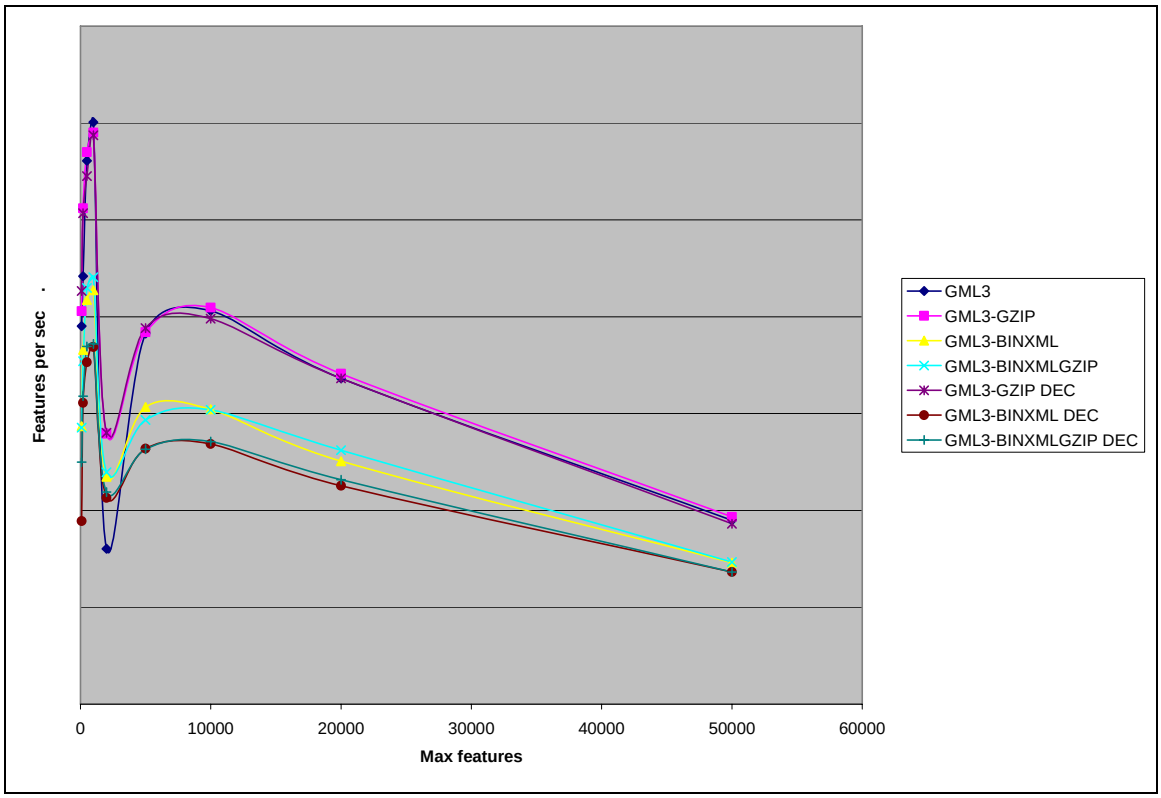

Figure 8.2.3-1 — 100 MBPS LAN *elevp_elev_1m* Feature Count Vs. Rate

8.2.4 Feature Type: *inwatera_hydro_1m*

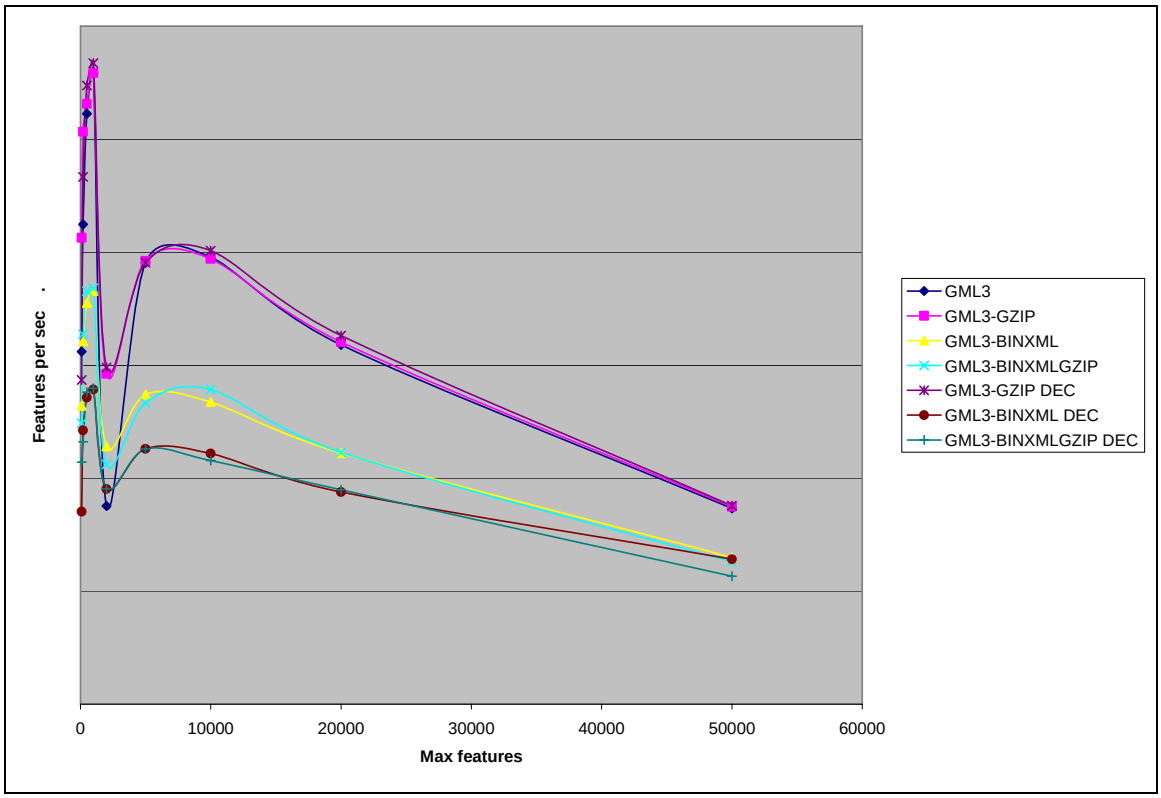

Figure 8.2.4-1 — 100 MBPS LAN *inwatera_hydro_1m* Feature Count Vs. Rate.

8.2.5 Feature Type: *watrcrsl_hydro_1m*

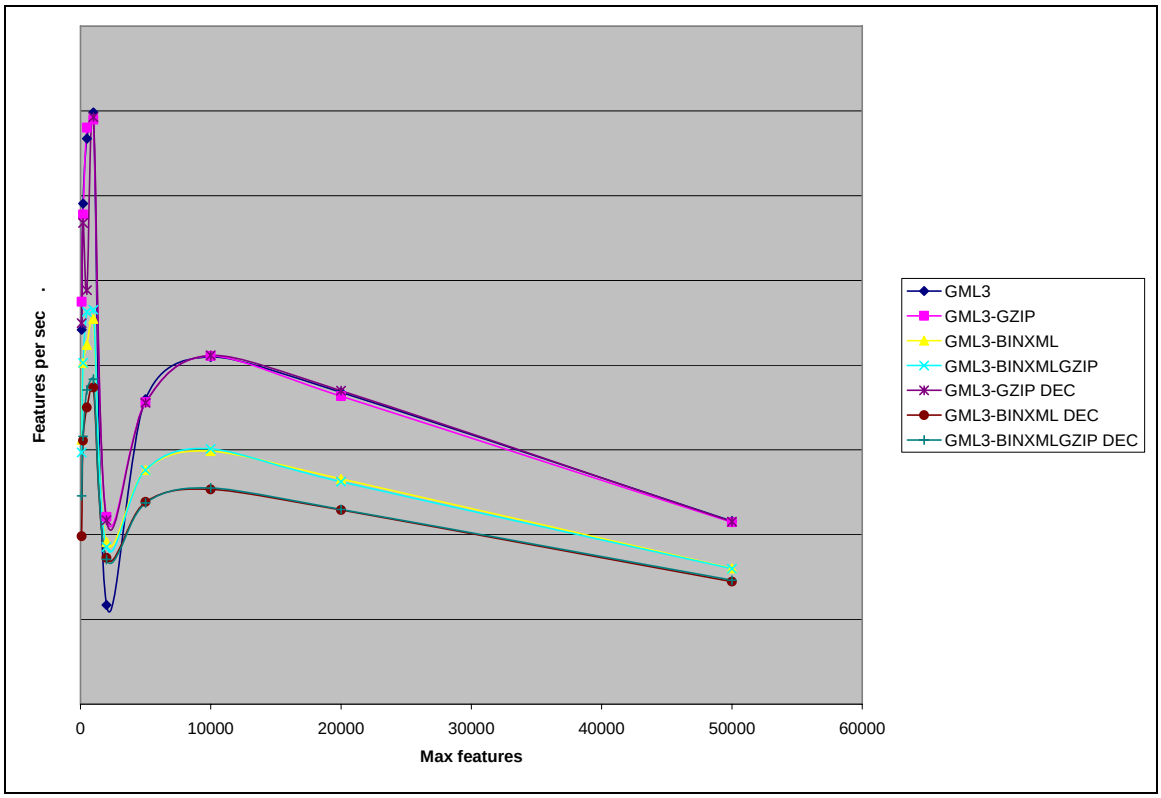

Figure 8.2.5-1 — 100 MBPS LAN *watrcrsl_hydro_1m* Feature Count Vs. Rate.

8.2.6 Feature Type: *AAL015*

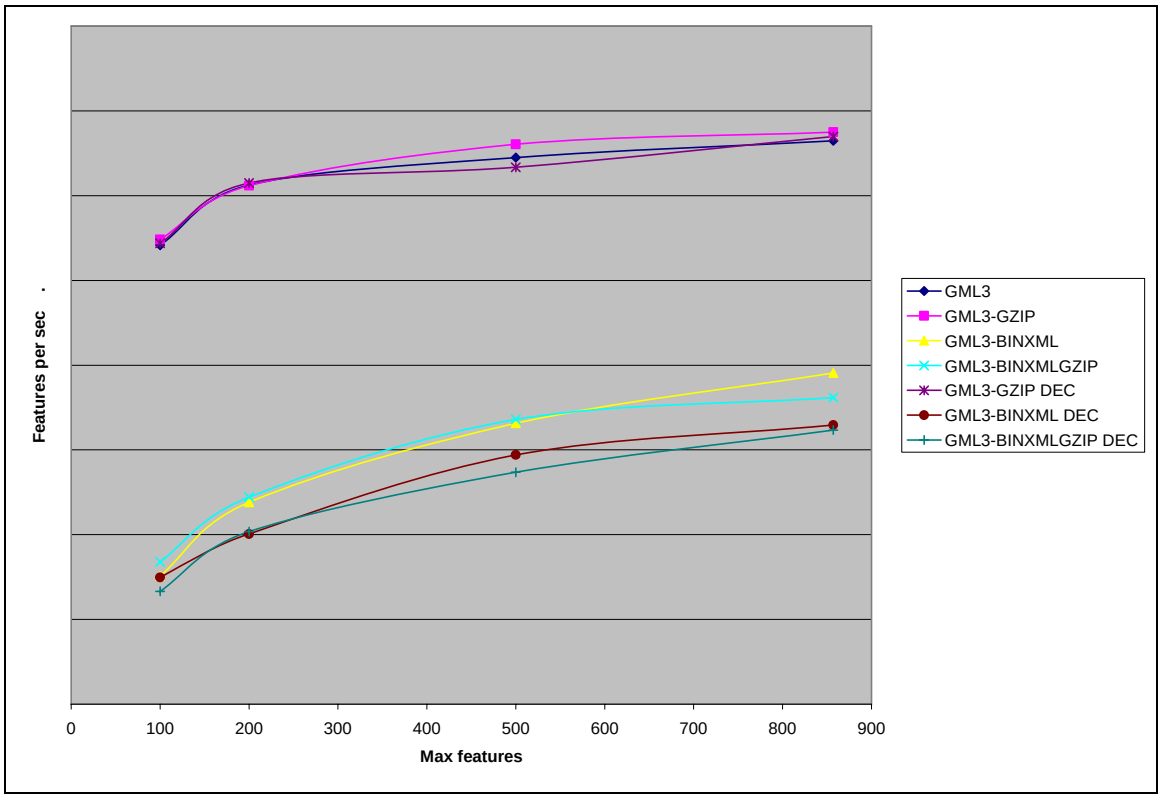

Figure 8.2.6-1 — 100 MBPS LAN *AAL015* Feature Count Vs. Rate.

8.2.7 Feature Type: *LAP030*

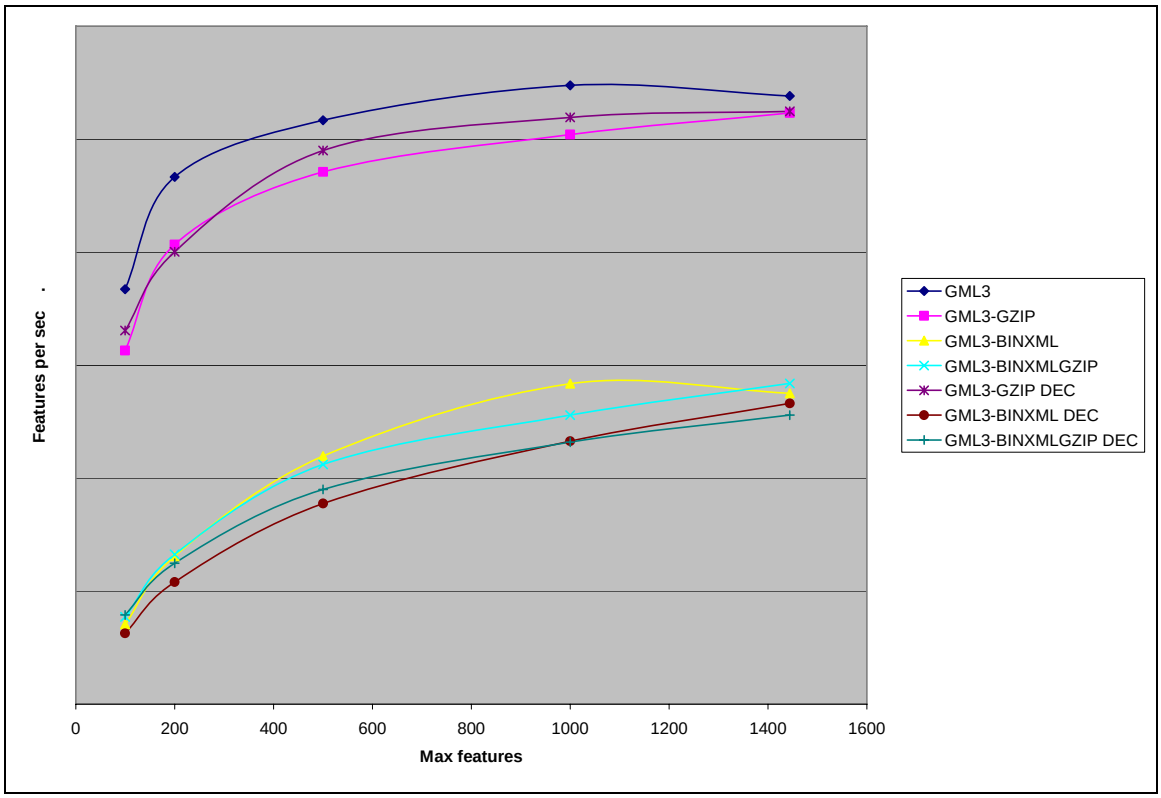

Figure 8.2.7-1 — 100 MBPS LAN *LAP030* Feature Count Vs. Rate.

8.2.8 Feature Type: *PAL015*

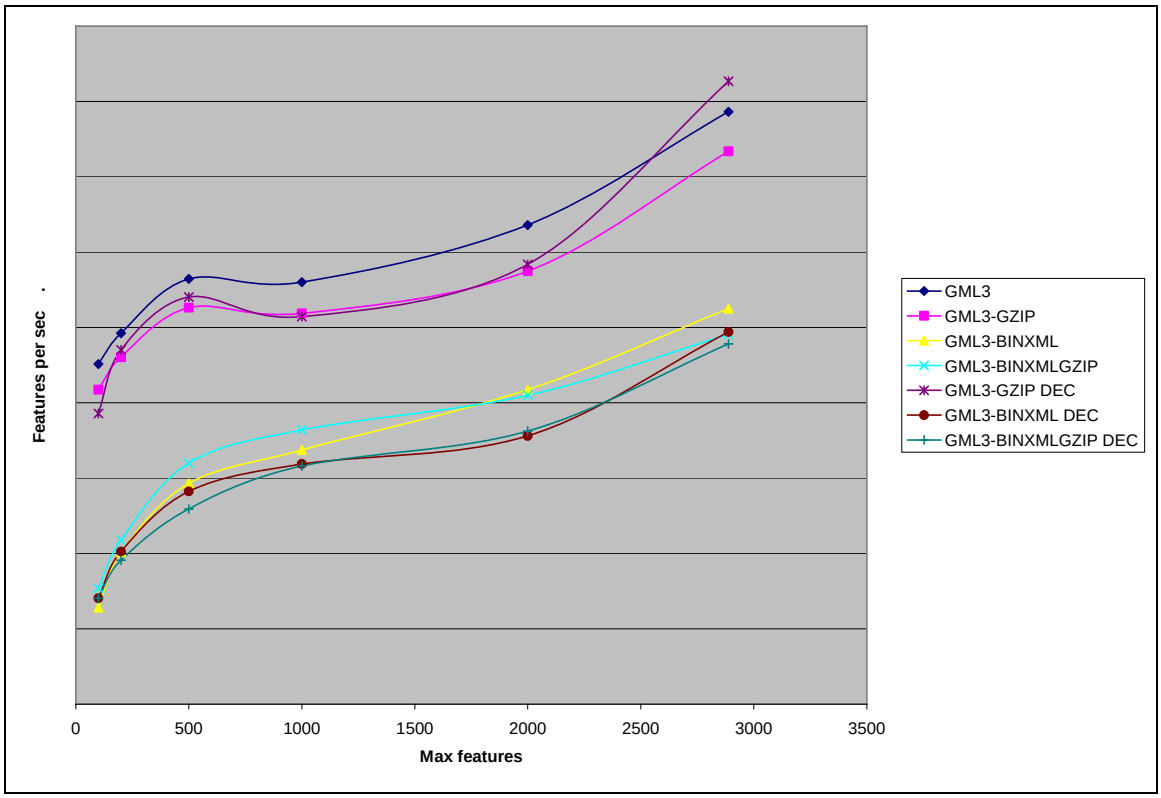

Figure 8.2.8-1 — 100 MBPS LAN *PAL015* Feature Count Vs. Rate.

8.2.9 Feature Type: *All MSD3 Features*

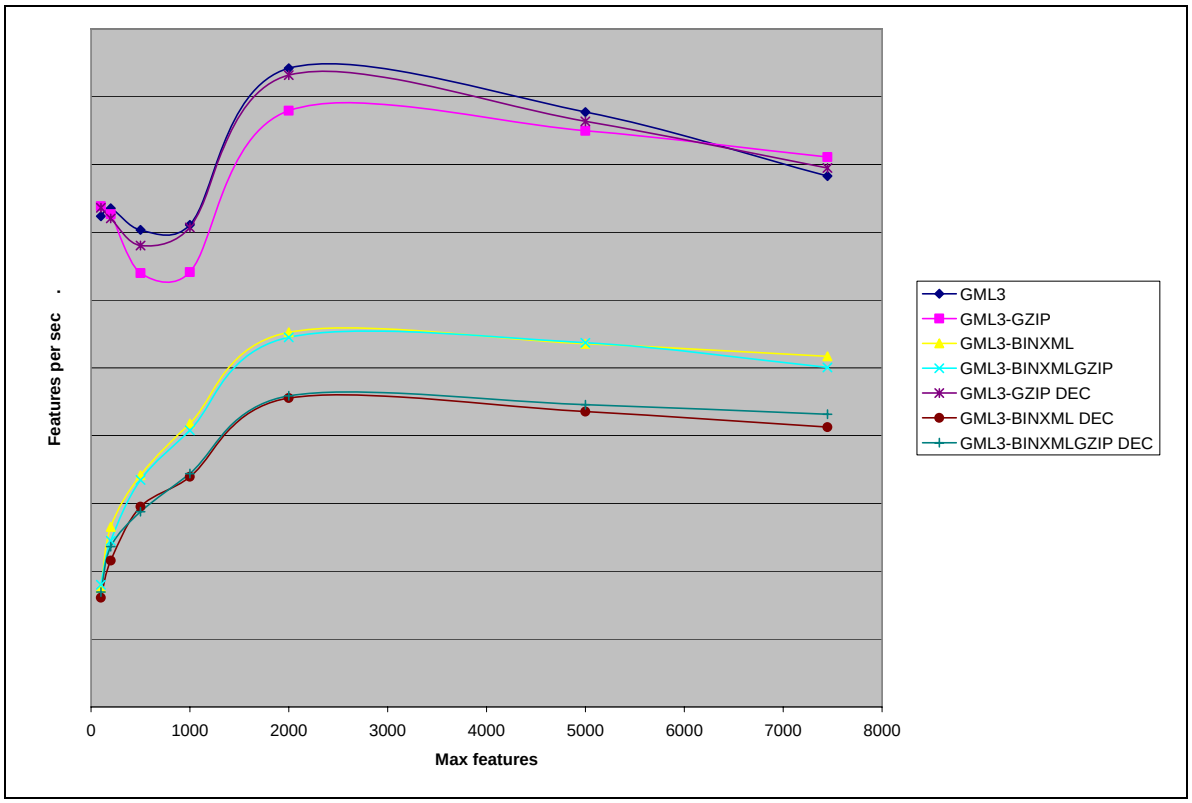

Figure 8.2.9-1 — 100 MBPS LAN *All MSD3* Feature Count Vs. Rate.

8.3 10 MBPS WAN

8.3.1 Feature Type: *builtupa_pop_1m*

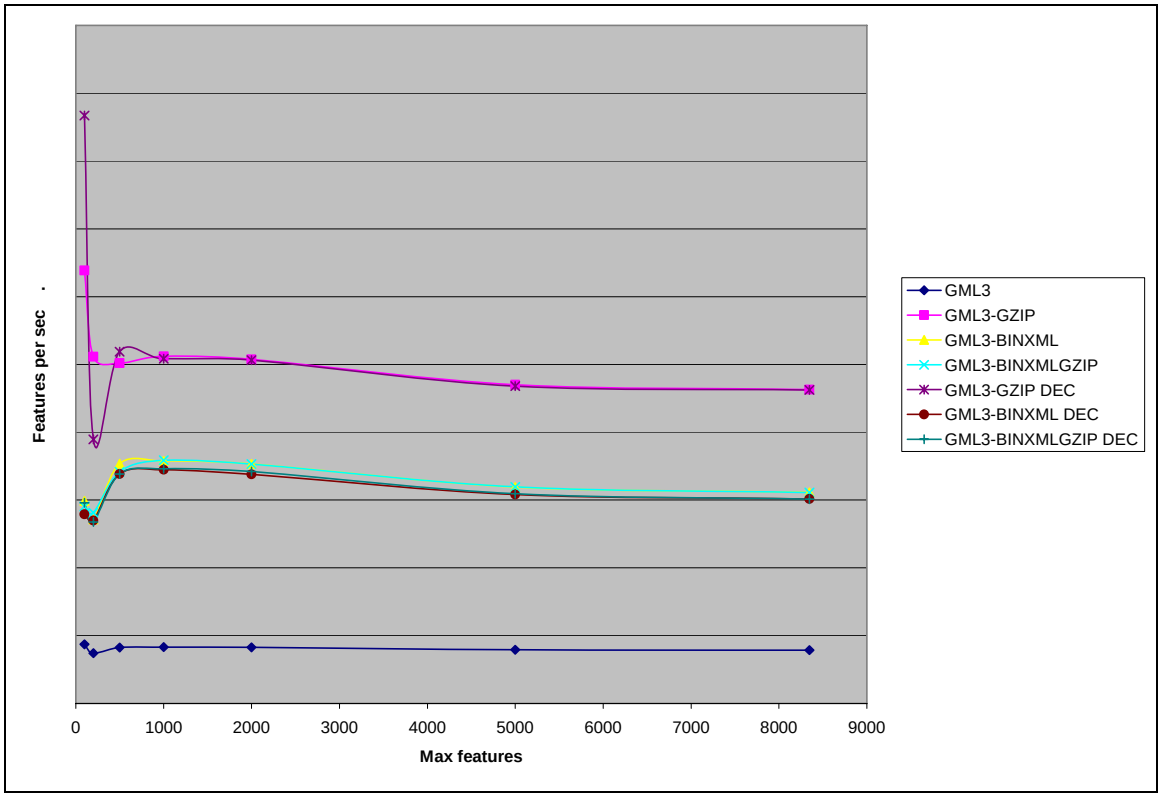

Figure 8.3.1-1 — 10 MBPS WAN *builtupa_pop_1m* Feature Count Vs. Rate.

8.3.2 Feature Type: *contourl_elev_1m*

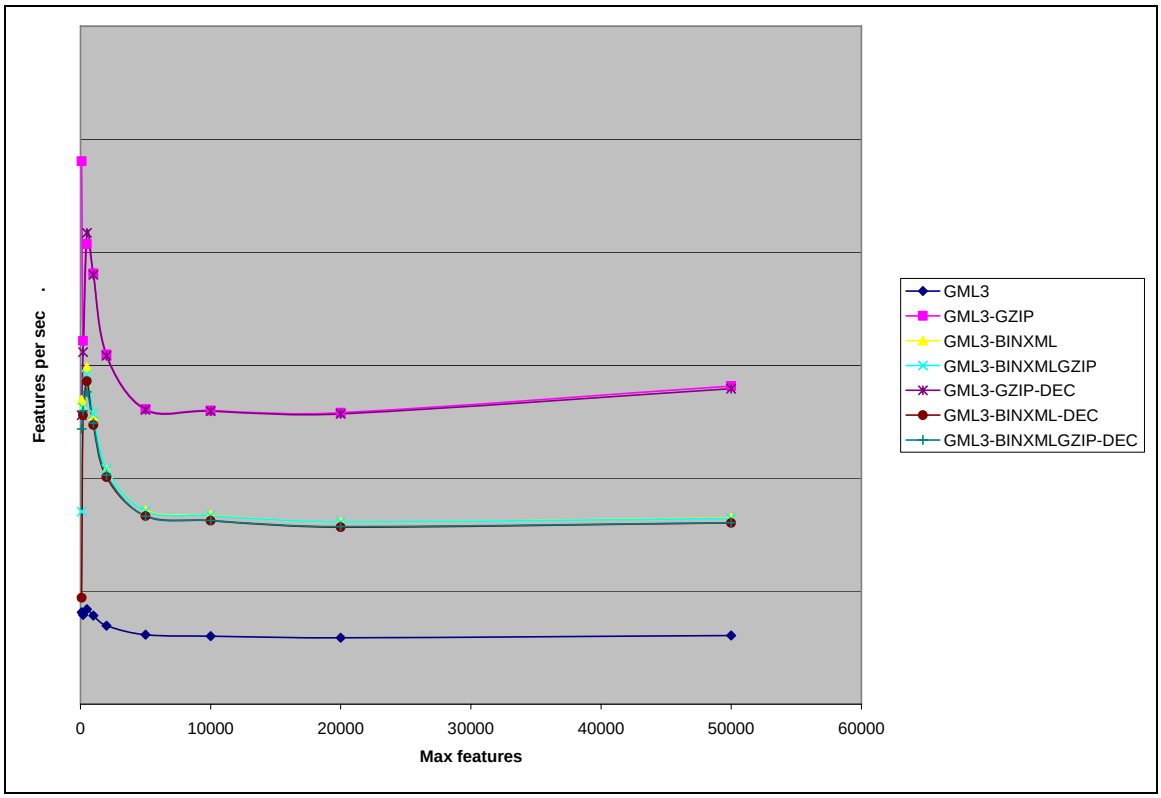

Figure 8.3.2-1 — 10 MBPS WAN *contourl_elev_1m* Feature Count Vs. Rate.

8.3.3 Feature Type: *elevp_elev_1m*

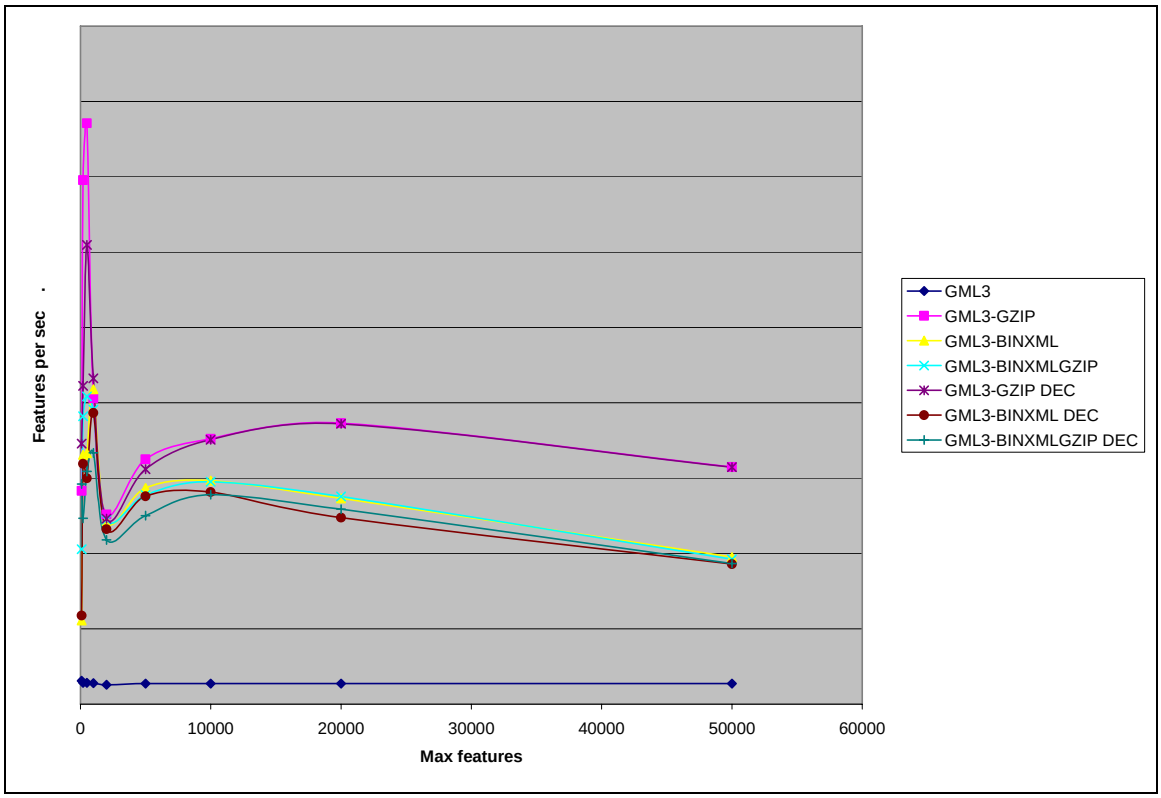

Figure 8.3.3-1 — 10 MBPS WAN *elevp_elev_1m* Feature Count Vs. Rate.

8.3.4 Feature Type: *inwatera_hydro_1m*

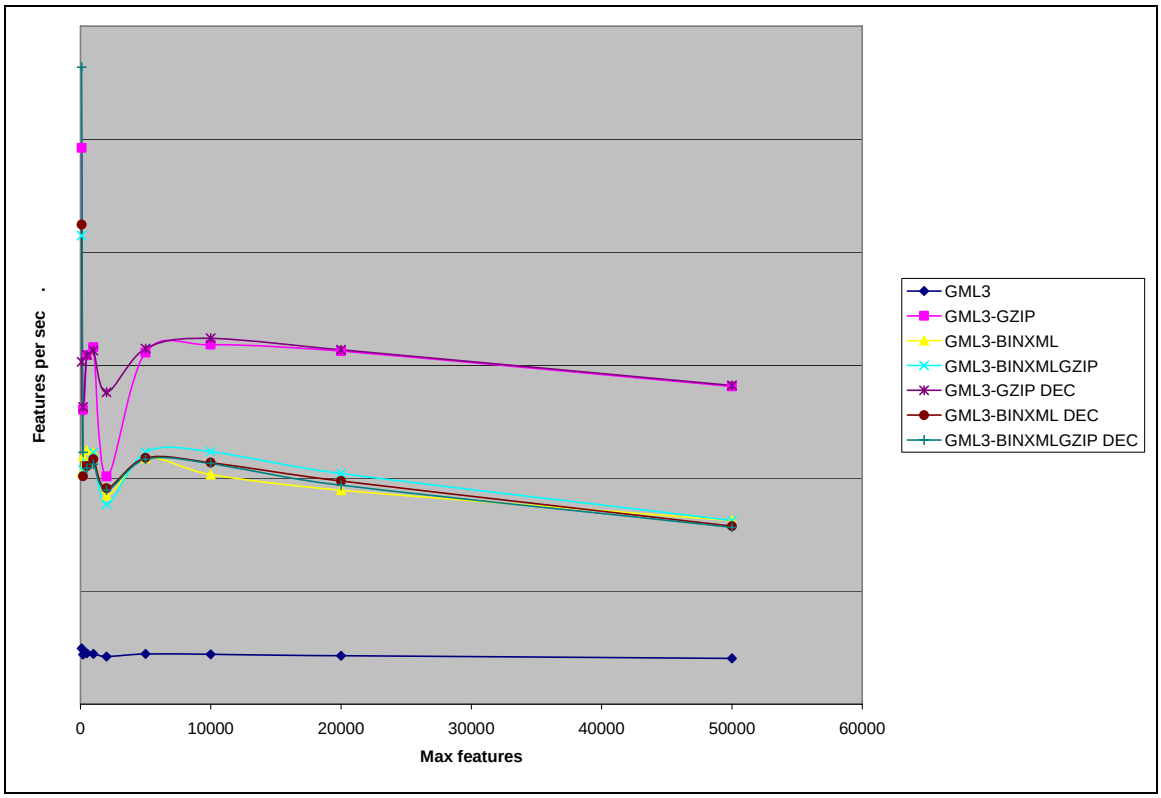

Figure 8.3.4-1 — 10 MBPS WAN *inwatera_hydro_1m* Feature Count Vs. Rate.

8.3.5 Feature Type: *watrcrsl_hydro_1m*

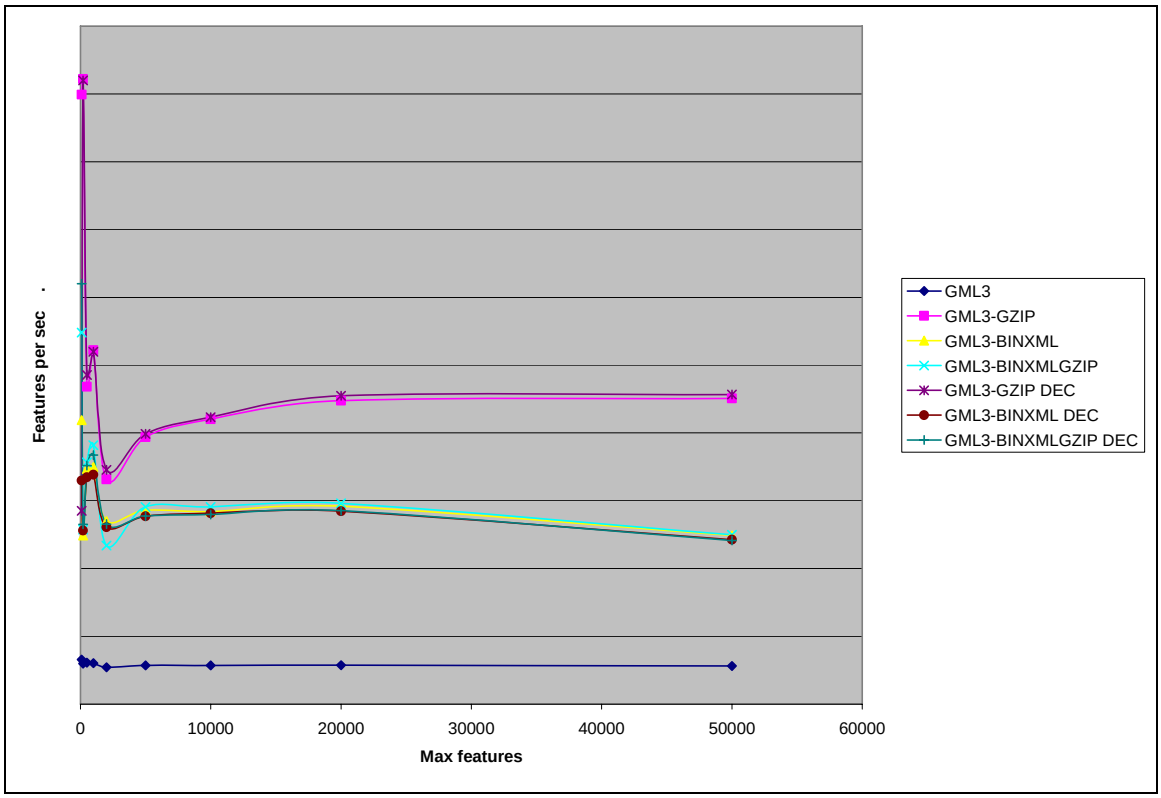

Figure 8.3.5-1 — 10 MBPS WAN *watrcrsl_hydro_1m* Feature Count Vs. Rate.

8.3.6 Feature Type: *AAL015*

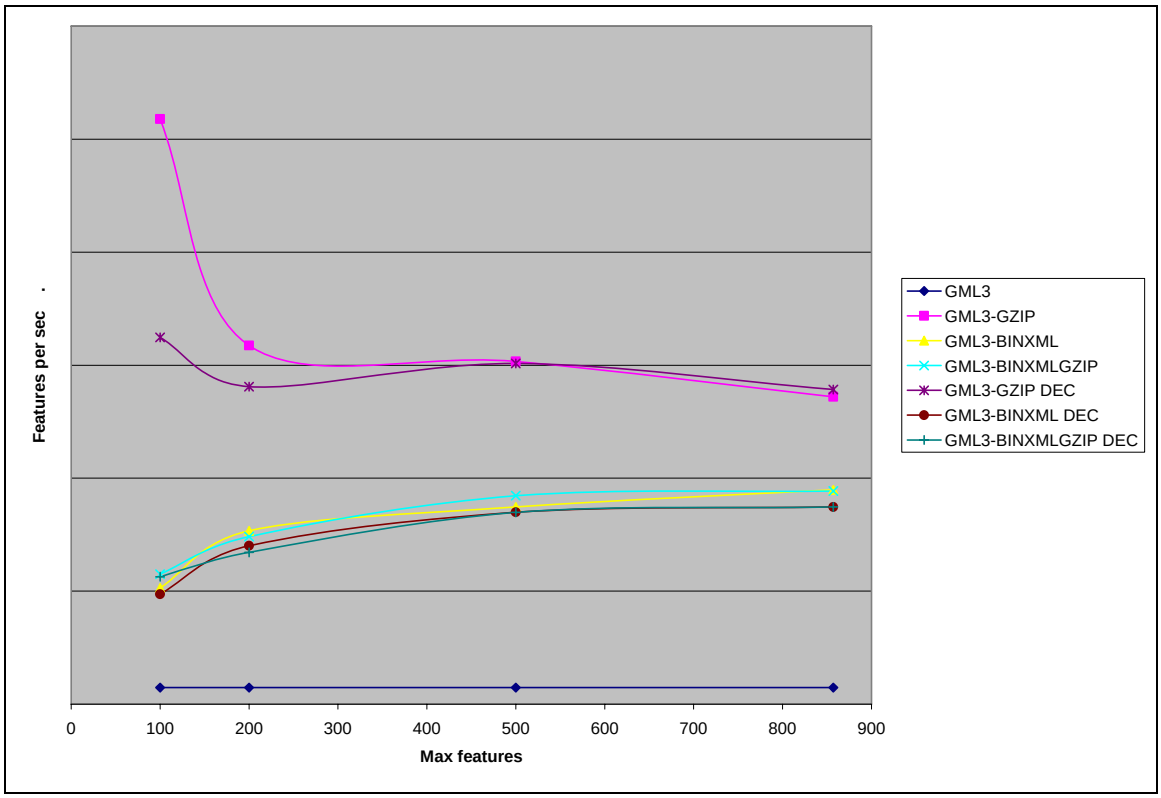

Figure 8.3.6-1 — 10 MBPS WAN *AAL015* Feature Count Vs. Rate

8.3.7 Feature Type: *LAP030*

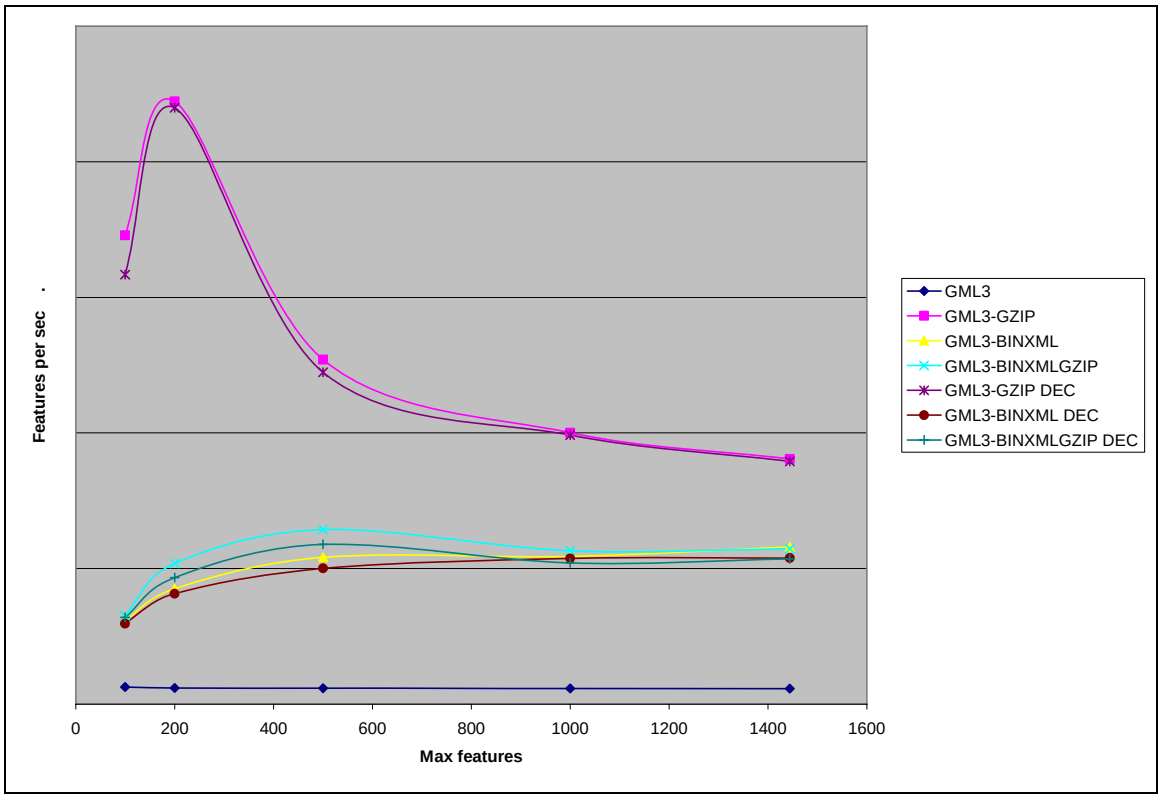

Figure 8.3.7-1 — 10 MBPS WAN *LAP030* Feature Count Vs. Rate.

8.3.8 Feature Type: *PAL015*

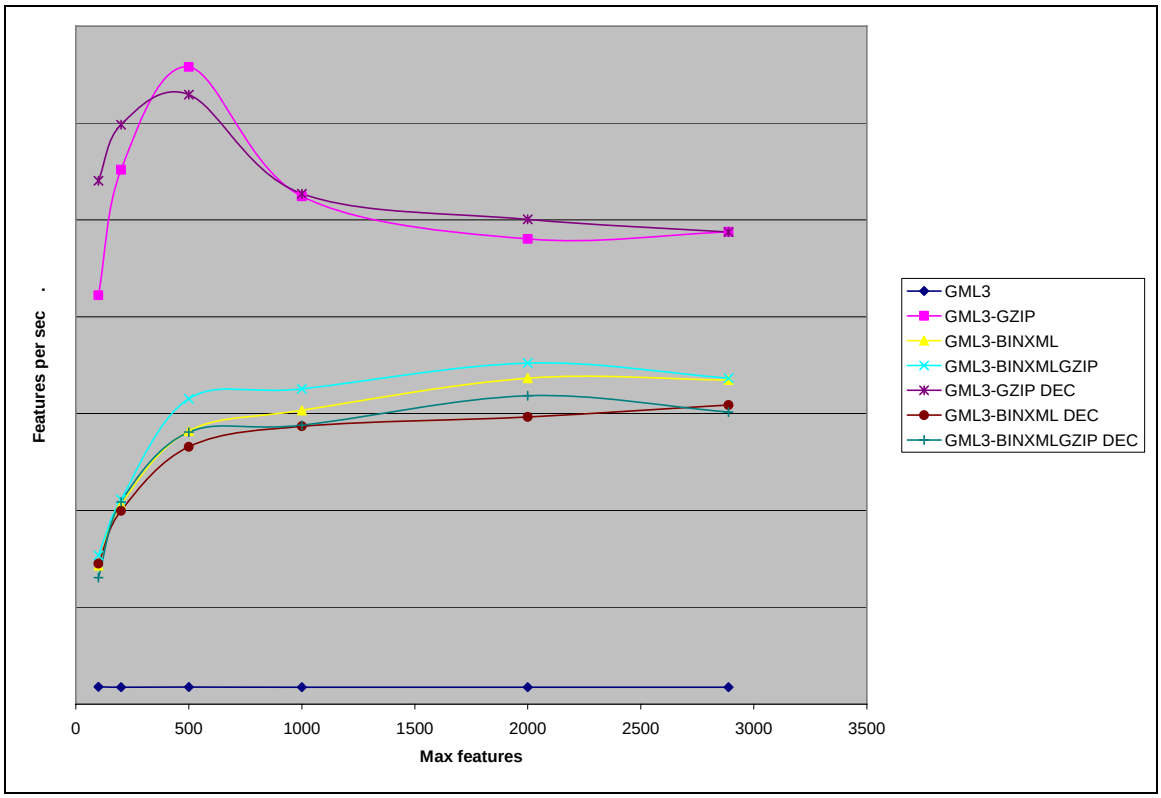

Figure 8.3.8-1 — 10 MBPS WAN *PAL015* Feature Count Vs. Rate.

8.3.9 Feature Type: All *MSD3* Features

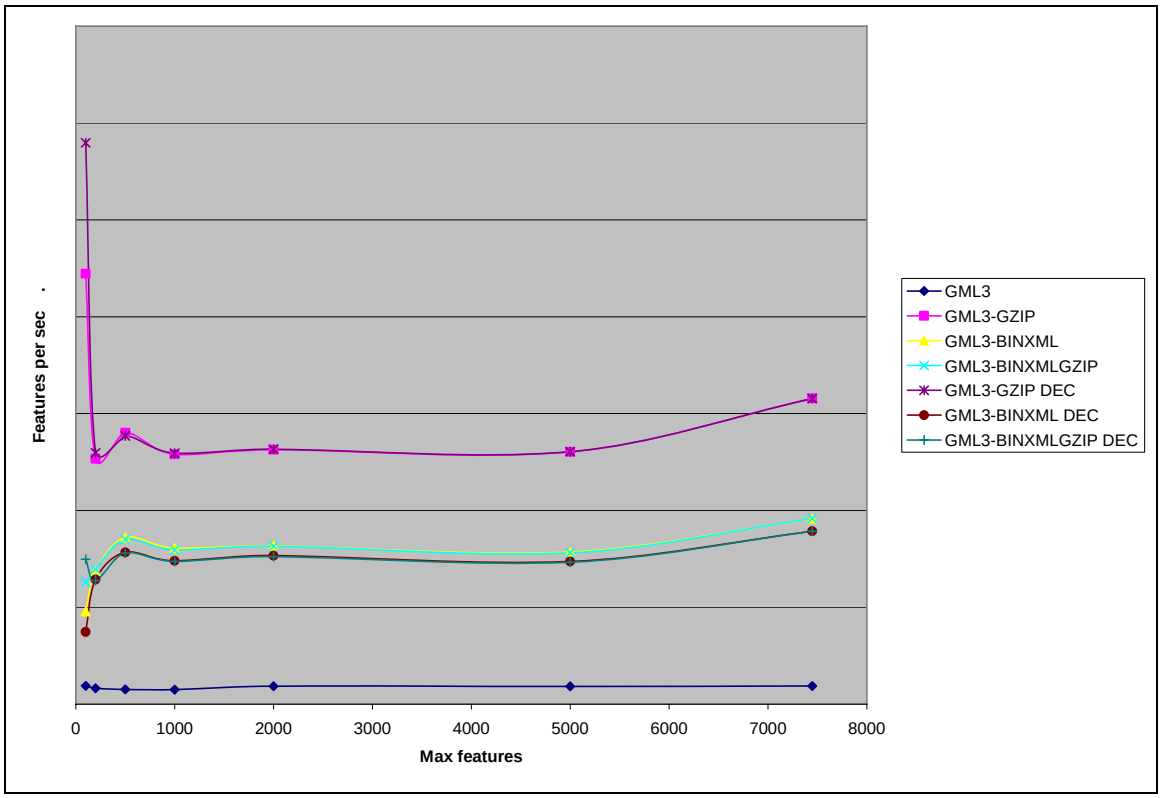

Figure 8.3.9-1 — 10 MBPS WAN All *MSD3* Feature Count Vs. Rate.

9 Analysis

The relative performance between the various compressed/binary encodings and raw GML is quantified in this Clause. The relative performance is determined by taking the feature retrieval rate (in features per second) for a given choice of parameters and dividing by the feature retrieval rate for raw GML. For example if the feature retrieval rate for a given choice of parameters is 550 features per sec and the corresponding feature retrieval rate for raw GML is 500 features per sec, then the relative performance is calculated as 550/500 = 1.1×

9.1 Local Server

9.1.1 Feature Type: *builtupa_pop_1m*

Table 9.1.1-1 — Local Server *builtupa_pop_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.969255×
GML3-BINXML	0.596292×
GML3-BINXMLGZIP	0.598414×
GML3-GZIP-decode	0.974262×

GML3-BINXML-decode	0.512188×
GML3-BINXMLGZIP-decode	0.514105×

9.1.2 Feature Type: contourl_elev_1m

Table 9.1.2-1 — Local Server *contourl_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.944717×
GML3-BINXML	0.654497×
GML3-BINXMLGZIP	0.659669×
GML3-GZIP-decode	0.947578×
GML3-BINXML-decode	0.561185×
GML3-BINXMLGZIP-decode	0.575704×

9.1.3 Feature Type: *elevp_elev_1m*

Table 9.1.3-1 — Local Server *elevp_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.020806×
GML3-BINXML	0.758537×
GML3-BINXMLGZIP	0.75121×
GML3-GZIP-decode	0.994385×
GML3-BINXML-decode	0.677514×
GML3-BINXMLGZIP-decode	0.680499×

9.1.4 Feature Type: *inwatera_hydro_1m*

Table 9.1.4-1 — Local Server *inwatera_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.260005×
GML3-BINXML	0.875758×
GML3-BINXMLGZIP	0.883632×
GML3-GZIP-decode	1.214638×
GML3-BINXML-decode	0.750563×
GML3-BINXMLGZIP-decode	0.762126×

9.1.5 Feature Type: *watrcrsl_hydro_1m*

Table 9.1.5-1 — Local Server *watrcrsl_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.117608×
GML3-BINXML	0.826477×
GML3-BINXMLGZIP	0.822976×

GML3-GZIP-decode	1.055948×
GML3-BINXML-decode	0.732393×
GML3-BINXMLGZIP-decode	0.717683×

9.1.6 Feature Type: *AAL015*

Table 9.1.6-1 — Local Server *AAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.060086×
GML3-BINXML	0.479259×
GML3-BINXMLGZIP	0.473254×
GML3-GZIP-decode	1.047762×
GML3-BINXML-decode	0.439202×
GML3-BINXMLGZIP-decode	0.429844×

9.1.7 Feature Type: *LAP030*

Table 9.1.7-1 — Local Server *LAP030* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.130517×
GML3-BINXML	0.464322×
GML3-BINXMLGZIP	0.451561×
GML3-GZIP-decode	1.130508×
GML3-BINXML-decode	0.427873×
GML3-BINXMLGZIP-decode	0.426832×

9.1.8 Feature Type: *PAL015*

Table 9.1.8-1 — Local Server *PAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.029298×
GML3-BINXML	0.539128×
GML3-BINXMLGZIP	0.527558×
GML3-GZIP-decode	1.080033×
GML3-BINXML-decode	0.468659×
GML3-BINXMLGZIP-decode	0.460339×

9.1.9 Feature Type: All *MSD3* Features

Table 9.1.9-1 — Local Server All *MSD3* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.028895×

GML3-BINXML	0.482883×
GML3-BINXMLGZIP	0.480886×
GML3-GZIP-decode	1.0015×
GML3-BINXML-decode	0.4336×
GML3-BINXMLGZIP-decode	0.43498×

9.2 100 MBPS LAN

9.2.1 Feature Type: *builtupa_pop_1m*

Table 9.2.1-1 — 100 MBPS LAN *builtupa_pop_1m* Relative Performance

Output Format	Performance Relative to GML
GML3-GZIP	0.992703×
GML3-BINXML	0.596326×
GML3-BINXMLGZIP	0.585201×
GML3-GZIP-decode	0.97956×
GML3-BINXML-decode	0.468365×
GML3-BINXMLGZIP-decode	0.487115×

9.2.2 Feature Type: contourl_elev_1m

Table 9.2.2-1 — 100 MBPS LAN *contourl_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.968325×
GML3-BINXML	0.680787×
GML3-BINXMLGZIP	0.690007×
GML3-GZIP-decode	0.959899×
GML3-BINXML-decode	0.551136×
GML3-BINXMLGZIP-decode	0.557868×

9.2.3 Feature Type: *elevp_elev_1m*

Table 9.2.3-1 — 100 MBPS LAN *elevp_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.10916×
GML3-BINXML	0.838761×
GML3-BINXMLGZIP	0.843452×
GML3-GZIP-decode	1.101304×
GML3-BINXML-decode	0.722142×
GML3-BINXMLGZIP-decode	0.7517×

9.2.4 Feature Type: *inwatera_hydro_1m*

Table 9.2.4-1 — 100 MBPS LAN *inwatera_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.135056×
GML3-BINXML	0.784785×
GML3-BINXMLGZIP	0.771978×
GML3-GZIP-decode	1.092541×
GML3-BINXML-decode	0.632063×
GML3-BINXMLGZIP-decode	0.63584×

9.2.5 Feature Type: *watrcrsl_hydro_1m*

Table 9.2.5-1 — 100 MBPS LAN *watrcrsl_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.10282×
GML3-BINXML	0.808138×
GML3-BINXMLGZIP	0.806747×
GML3-GZIP-decode	1.061778×
GML3-BINXML-decode	0.676359×
GML3-BINXMLGZIP-decode	0.693665×

9.2.6 Feature Type: *AAL015*

Table 9.2.6-1 — 100 MBPS LAN *AAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	1.012849×
GML3-BINXML	0.442557×
GML3-BINXMLGZIP	0.443566×
GML3-GZIP-decode	0.99943×
GML3-BINXML-decode	0.388859×
GML3-BINXMLGZIP-decode	0.372233×

9.2.7 Feature Type: *LAP030*

Table 9.2.7-1 — 100 MBPS LAN *LAP030* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.905539×
GML3-BINXML	0.385329×
GML3-BINXMLGZIP	0.379877×
GML3-GZIP-decode	0.925826×
GML3-BINXML-decode	0.333025×

GML3-BINXMLGZIP-decode	0.349629×

9.2.8 Feature Type: *PAL015*

Table 9.2.8-1 — 100 MBPS LAN *PAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.924384×
GML3-BINXML	0.494194×
GML3-BINXMLGZIP	0.528938×
GML3-GZIP-decode	0.920513×
GML3-BINXML-decode	0.47049×
GML3-BINXMLGZIP-decode	0.458528×

9.2.9 Feature Type: All *MSD3* Features

Table 9.2.9-1 — 100 MBPS LAN All *MSD3* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	0.950732×
GML3-BINXML	0.452729×
GML3-BINXMLGZIP	0.441951×
GML3-GZIP-decode	0.989735×
GML3-BINXML-decode	0.379367×
GML3-BINXMLGZIP-decode	0.387134×

9.3 10 MBPS WAN

9.3.1 Feature Type: *builtupa_pop_1m*

Table 9.3.1-1 — 10 MBPS WAN *builtupa_pop_1m* Relative Performance

Output Format	Performance Relative to GML
GML3-GZIP	6.345467×
GML3-BINXML	3.991054×
GML3-BINXMLGZIP	3.976316×
GML3-GZIP-decode	6.502024×
GML3-BINXML-decode	3.842125×
GML3-BINXMLGZIP-decode	3.877097×

9.3.2 Feature Type: contourl_elev_1m

Table 9.3.2-1 — 10 MBPS WAN *contourl_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	4.639472×

GML3-BINXML	3.052896×
GML3-BINXMLGZIP	2.909064×
GML3-GZIP-decode	4.319207×
GML3-BINXML-decode	2.729589×
GML3-BINXMLGZIP-decode	2.933222×

9.3.3 Feature Type: *elevp_elev_1m*

Table 9.3.3-1 — 10 MBPS WAN *elevp_elev_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	14.98334×
GML3-BINXML	9.977715×
GML3-BINXMLGZIP	10.66263×
GML3-GZIP-decode	13.52966×
GML3-BINXML-decode	9.404018×
GML3-BINXMLGZIP-decode	9.438008×

9.3.4 Feature Type: *inwatera_hydro_1m*

Table 9.3.4-1 — 10 MBPS WAN *inwatera_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	7.00394×
GML3-BINXML	4.603579×
GML3-BINXMLGZIP	5.098485×
GML3-GZIP-decode	6.801949×
GML3-BINXML-decode	5.054926×
GML3-BINXMLGZIP-decode	5.384063×

9.3.5 Feature Type: *watrcrsl_hydro_1m*

Table 9.3.5-1 — 10 MBPS WAN *watrcrsl_hydro_1m* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	9.056448×
GML3-BINXML	5.155978×
GML3-BINXMLGZIP	5.426664×
GML3-GZIP-decode	8.108499×
GML3-BINXML-decode	4.908847×
GML3-BINXMLGZIP-decode	5.506799×

9.3.6 Feature Type: *AAL015*

Table 9.3.6-1 — 10 MBPS WAN *AAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	24.13289×
GML3-BINXML	10.61816×
GML3-BINXMLGZIP	10.89263×
GML3-GZIP-decode	20.28349×
GML3-BINXML-decode	9.961032×
GML3-BINXMLGZIP-decode	10.11944×

9.3.7 Feature Type: *LAP030*

Table 9.3.7-1 — 10 MBPS WAN *LAP030* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	23.88523×
GML3-BINXML	8.150692×
GML3-BINXMLGZIP	8.919548×
GML3-GZIP-decode	23.12089×
GML3-BINXML-decode	7.745573×
GML3-BINXMLGZIP-decode	8.249207×

9.3.8 Feature Type: *PAL015*

Table 9.3.8-1 — 10 MBPS WAN *PAL015* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	29.91504×
GML3-BINXML	14.4442×
GML3-BINXMLGZIP	15.4289×
GML3-GZIP-decode	31.699×
GML3-BINXML-decode	13.56125×
GML3-BINXMLGZIP-decode	13.94139×

9.3.9 Feature Type: All *MSD3* Features

Table 9.3.9-1 — 10 MBPS WAN All *MSD3* Relative Performance Summary

Output Format	Performance Relative to GML
GML3-GZIP	17.69827×
GML3-BINXML	8.84055×
GML3-BINXMLGZIP	9.125346×
GML3-GZIP-decode	19.16697×
GML3-BINXML-decode	8.030035×
GML3-BINXMLGZIP-decode	8.776436×

10 Conclusions

10.1 Bandwidth

In the local server environment, GZIP compression offered a very small performance increase (if any) for each feature type and the average relative performance over all the VMAP0 feature types was roughly 1.06× and over all the MSD3 feature types was about 1.07×. Thus, the performance gained by handling a smaller file size had about an equal trade-off with the performance hit taken by the compression process. Factoring in the decompression process at the end did not make a significant difference as the average relative performance results for GML3-GZIP-decode indicates in Table 10-1. The binary encoding with and without GZIP compression resulted in a performance loss in the local server environment as the binary encoding process was too costly.

Table 10-1 — Local Server Overall Relative Performance

Output Format	*VMAP0* Average Performance Relative to GML	*MSD3* Average Performance Relative to GML
GML3-GZIP	1.062478×	1.0733×
GML3-BINXML	0.742312×	0.494236×
GML3-BINXMLGZIP	0.74318×	0.484124×
GML3-GZIP-decode	1.037362×	1.086101×
GML3-BINXML-decode	0.646769×	0.445245×
GML3-BINXMLGZIP-decode	0.650023×	0.429844×

In the 100 MBS LAN environment, GZIP compression offered again a very small performance increase (if any) for each feature type. As in the local server environment, the performance gained in transferring a smaller file size across the 100 MPS network had about an equal trade-off with the performance hit taken by the compression process. Factoring in the decompression process at the end did not make a significant difference as the average relative performance results for GML3-GZIP-decode indicates in Table 10-2. As in the local server case, the binary encoding with and without GZIP compression resulted in a performance loss in the 100 MBS LAN environment.

Table 10-2 — 100 MPS LAN Overall Relative Performance

Output Format	*VMAP0* Average Performance Relative to GML	*MSD3* Average Performance Relative to GML
GML3-GZIP	1.061613×	0.914961×
GML3-BINXML	0.741759×	0.439761×
GML3-BINXMLGZIP	0.739477×	0.454408×
GML3-GZIP-decode	1.039016×	0.923169×
GML3-BINXML-decode	0.610013×	0.401758×
GML3-BINXMLGZIP-decode	0.625238×	0.429844×

In the 10 MBS WAN environment, GZIP compression offered a large performance increase for each feature type and the average relative performance over all the VMAP0 feature types was roughly 8.41× and over all the MSD3 feature types was even better at 25.98×. Note that the MSD3 data sets were much smaller than the VMAP0 data sets. Thus, the performance gained by transferring a smaller file size across the 10MBS network greatly outweighed the performance hit taken by the compression process. Factoring in the decompression process made a small difference as the average relative performance results indicates in Table 10-3. The binary encoding with and without GZIP compression resulted in a significant relative performance increase in the 10 MBS network environment even when the decompression process was factored in.

Table 10-3 — 10 MPS WAN Overall Relative Performance

Output Format	*VMAP0* Average Performance Relative to GML	*MSD3* Average Performance Relative to GML
GML3-GZIP	8.405734×	25.97772×
GML3-BINXML	5.356244×	11.07102×
GML3-BINXMLGZIP	5.614631×	11.74702×
GML3-GZIP-decode	7.852267×	25.03446×
GML3-BINXML-decode	5.187901×	10.42262×
GML3-BINXMLGZIP-decode	5.427838×	10.77001×

The results and conclusions obtained in this sub-clause are in general agreement with the hypothesis of clause 7.

10.2 Dataset Size

Many of the summary charts in clause 8, reveal three trends in the performance results as the feature volume was increased. The first trend was an increase in performance as feature volume is slightly increased when starting with very low feature volume. This is reasonable as there is some overhead for processing, i.e. it takes very little additional time to retrieve 2 features, than it does to retrieve 1 feature. Hence the retrieval rate in features per second is expected to increase when comparing the retrieval of two features with the retrieval of one feature. The second trend is that there is a characteristic dip in performance as illustrated in Figure 8.1.3-1 when the feature volume (maxFeatures) is set at 2000. This dip is thought to be due to a slight delay caused by the Windows operating system when switching from physical memory to virtual disk memory. The third trend is that the overall feature retrieval rate decreases (and eventually levels out) as the feature volume is increased for high feature volume.

The results and conclusions obtained in this sub-clause were not predicted in the hypothesis of clause 7.

Annex A
(normative)

Relative Performance Data

The relative performance between the various compressed/binary encodings and raw GML is given in this Annex. The relative performance is determined by taking the feature retrieval rate (in features per second) for a given choice of parameters and dividing by the feature retrieval rate for raw GML. For example if the feature retrieval rate for a given choice of parameters is 550 features per sec and the corresponding feature retrieval rate for raw GML is 500 features per sec, then the relative performance is calculated as 550/500 = 1.1×

A.1.1 Local Server

A.1.1.1 Feature Type: *builtupa_pop_1m*

Table A.1.1.1-1 — Local Server *builtupa_pop_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	0.965885
GML3-GZIP	200	0.988045
GML3-GZIP	500	0.987705
GML3-GZIP	1000	0.969138
GML3-GZIP	2000	0.95005
GML3-GZIP	5000	0.95926
GML3-GZIP	8346	0.964704
GML3-BINXML	100	0.56856
GML3-BINXML	200	0.609565
GML3-BINXML	500	0.620601
GML3-BINXML	1000	0.61341
GML3-BINXML	2000	0.601521
GML3-BINXML	5000	0.57345
GML3-BINXML	8346	0.586939
GML3-BINXMLGZIP	100	0.716206
GML3-BINXMLGZIP	200	0.579376
GML3-BINXMLGZIP	500	0.53106
GML3-BINXMLGZIP	1000	0.608391
GML3-BINXMLGZIP	2000	0.598697
GML3-BINXMLGZIP	5000	0.587773
GML3-BINXMLGZIP	8346	0.567394
GML3-GZIP-decode	100	0.959238
GML3-GZIP-decode	200	0.99922
GML3-GZIP-decode	500	0.990993
GML3-GZIP-decode	1000	0.970656
GML3-GZIP-decode	2000	0.955565
GML3-GZIP-decode	5000	0.978106
GML3-GZIP-decode	8346	0.966056

GML3-BINXML-decode	100	0.554977
GML3-BINXML-decode	200	0.537671
GML3-BINXML-decode	500	0.519237
GML3-BINXML-decode	1000	0.507646
GML3-BINXML-decode	2000	0.500249
GML3-BINXML-decode	5000	0.475053
GML3-BINXML-decode	8346	0.490482
GML3-BINXMLGZIP-decode	100	0.52967
GML3-BINXMLGZIP-decode	200	0.555009
GML3-BINXMLGZIP-decode	500	0.52398
GML3-BINXMLGZIP-decode	1000	0.46758
GML3-BINXMLGZIP-decode	2000	0.523613
GML3-BINXMLGZIP-decode	5000	0.505194
GML3-BINXMLGZIP-decode	8346	0.493689

A.1.1.2 Feature Type: *contourl_elev_1m*

Table A.1.1.2-1 — Local Server *contourl_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	0.923077
GML3-GZIP	200	0.973435
GML3-GZIP	500	0.958513
GML3-GZIP	1000	1.042234
GML3-GZIP	2000	0.92122
GML3-GZIP	5000	0.899907
GML3-GZIP	10000	0.927021
GML3-GZIP	20000	0.892066
GML3-GZIP	50000	0.964979
GML3-BINXML	100	0.760456
GML3-BINXML	200	0.769684
GML3-BINXML	500	0.728653
GML3-BINXML	1000	0.731038
GML3-BINXML	2000	0.584537
GML3-BINXML	5000	0.54662
GML3-BINXML	10000	0.550929
GML3-BINXML	20000	0.550859
GML3-BINXML	50000	0.667695
GML3-BINXMLGZIP	100	0.761808
GML3-BINXMLGZIP	200	0.777226
GML3-BINXMLGZIP	500	0.726702
GML3-BINXMLGZIP	1000	0.744732
GML3-BINXMLGZIP	2000	0.579355
GML3-BINXMLGZIP	5000	0.528685
GML3-BINXMLGZIP	10000	0.549859
GML3-BINXMLGZIP	20000	0.588533
GML3-BINXMLGZIP	50000	0.68012
GML3-GZIP-decode	100	0.929656
GML3-GZIP-decode	200	0.977993
GML3-GZIP-decode	500	0.961909

GML3-GZIP-decode	1000	0.973409
GML3-GZIP-decode	2000	0.88982
GML3-GZIP-decode	5000	0.921598
GML3-GZIP-decode	10000	0.937167
GML3-GZIP-decode	20000	0.945489
GML3-GZIP-decode	50000	0.991159
GML3-BINXML-decode	100	0.695652
GML3-BINXML-decode	200	0.714889
GML3-BINXML-decode	500	0.624605
GML3-BINXML-decode	1000	0.627873
GML3-BINXML-decode	2000	0.467328
GML3-BINXML-decode	5000	0.427645
GML3-BINXML-decode	10000	0.417825
GML3-BINXML-decode	20000	0.468571
GML3-BINXML-decode	50000	0.606278
GML3-BINXMLGZIP-decode	100	0.832871
GML3-BINXMLGZIP-decode	200	0.730473
GML3-BINXMLGZIP-decode	500	0.597168
GML3-BINXMLGZIP-decode	1000	0.622277
GML3-BINXMLGZIP-decode	2000	0.455916
GML3-BINXMLGZIP-decode	5000	0.420448
GML3-BINXMLGZIP-decode	10000	0.434561
GML3-BINXMLGZIP-decode	20000	0.483876
GML3-BINXMLGZIP-decode	50000	0.603746

A.1.1.3 Feature Type: *elevp_elev_1m*

Table A.1.1.3-1 — Local Server *elevp_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.057068
GML3-GZIP	200	1.091349
GML3-GZIP	500	1.004032
GML3-GZIP	1000	0.988768
GML3-GZIP	2000	1.013801
GML3-GZIP	5000	1.011136
GML3-GZIP	10000	1.00695
GML3-GZIP	20000	0.993786
GML3-GZIP	50000	1.020361
GML3-BINXML	100	0.725301
GML3-BINXML	200	0.759536
GML3-BINXML	500	0.71588
GML3-BINXML	1000	0.729874
GML3-BINXML	2000	0.843438
GML3-BINXML	5000	0.770962
GML3-BINXML	10000	0.762996
GML3-BINXML	20000	0.741122
GML3-BINXML	50000	0.77772
GML3-BINXMLGZIP	100	0.637037
GML3-BINXMLGZIP	200	0.760105

GML3-BINXMLGZIP	500	0.732226
GML3-BINXMLGZIP	1000	0.735844
GML3-BINXMLGZIP	2000	0.845746
GML3-BINXMLGZIP	5000	0.744798
GML3-BINXMLGZIP	10000	0.775689
GML3-BINXMLGZIP	20000	0.754864
GML3-BINXMLGZIP	50000	0.774578
GML3-GZIP-decode	100	0.963971
GML3-GZIP-decode	200	1.00794
GML3-GZIP-decode	500	0.985335
GML3-GZIP-decode	1000	0.997928
GML3-GZIP-decode	2000	0.970741
GML3-GZIP-decode	5000	0.977864
GML3-GZIP-decode	10000	1.023984
GML3-GZIP-decode	20000	1.003093
GML3-GZIP-decode	50000	1.018612
GML3-BINXML-decode	100	0.570616
GML3-BINXML-decode	200	0.64992
GML3-BINXML-decode	500	0.645078
GML3-BINXML-decode	1000	0.62914
GML3-BINXML-decode	2000	0.779469
GML3-BINXML-decode	5000	0.703884
GML3-BINXML-decode	10000	0.69445
GML3-BINXML-decode	20000	0.690493
GML3-BINXML-decode	50000	0.734579
GML3-BINXMLGZIP-decode	100	0.583616
GML3-BINXMLGZIP-decode	200	0.670518
GML3-BINXMLGZIP-decode	500	0.646556
GML3-BINXMLGZIP-decode	1000	0.600925
GML3-BINXMLGZIP-decode	2000	0.778974
GML3-BINXMLGZIP-decode	5000	0.686445
GML3-BINXMLGZIP-decode	10000	0.711253
GML3-BINXMLGZIP-decode	20000	0.698425
GML3-BINXMLGZIP-decode	50000	0.747782

A.1.1.4 Feature Type: *inwatera_hydro_1m*

Table A.1.1.4-1 — Local Server *inwatera_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.19032
GML3-GZIP	200	2.635257
GML3-GZIP	500	0.972355
GML3-GZIP	1000	0.988034
GML3-GZIP	2000	1.614583
GML3-GZIP	5000	0.975311
GML3-GZIP	10000	0.986221
GML3-GZIP	20000	0.978663
GML3-GZIP	50000	0.999299

GML3-BINXML	100	0.649508
GML3-BINXML	200	1.832863
GML3-BINXML	500	0.628358
GML3-BINXML	1000	0.6683
GML3-BINXML	2000	1.279724
GML3-BINXML	5000	0.695458
GML3-BINXML	10000	0.68529
GML3-BINXML	20000	0.692739
GML3-BINXML	50000	0.749584
GML3-BINXMLGZIP	100	0.768131
GML3-BINXMLGZIP	200	1.780926
GML3-BINXMLGZIP	500	0.655755
GML3-BINXMLGZIP	1000	0.65751
GML3-BINXMLGZIP	2000	1.298982
GML3-BINXMLGZIP	5000	0.662428
GML3-BINXMLGZIP	10000	0.701005
GML3-BINXMLGZIP	20000	0.70416
GML3-BINXMLGZIP	50000	0.723794
GML3-GZIP-decode	100	0.919518
GML3-GZIP-decode	200	2.444584
GML3-GZIP-decode	500	0.96898
GML3-GZIP-decode	1000	0.993268
GML3-GZIP-decode	2000	1.649701
GML3-GZIP-decode	5000	0.997835
GML3-GZIP-decode	10000	0.999765
GML3-GZIP-decode	20000	0.956882
GML3-GZIP-decode	50000	1.001209
GML3-BINXML-decode	100	0.591521
GML3-BINXML-decode	200	1.514641
GML3-BINXML-decode	500	0.50877
GML3-BINXML-decode	1000	0.526562
GML3-BINXML-decode	2000	1.123721
GML3-BINXML-decode	5000	0.603813
GML3-BINXML-decode	10000	0.583919
GML3-BINXML-decode	20000	0.61339
GML3-BINXML-decode	50000	0.688735
GML3-BINXMLGZIP-decode	100	0.607113
GML3-BINXMLGZIP-decode	200	1.57845
GML3-BINXMLGZIP-decode	500	0.519781
GML3-BINXMLGZIP-decode	1000	0.544498
GML3-BINXMLGZIP-decode	2000	1.13389
GML3-BINXMLGZIP-decode	5000	0.59162
GML3-BINXMLGZIP-decode	10000	0.592351
GML3-BINXMLGZIP-decode	20000	0.619585
GML3-BINXMLGZIP-decode	50000	0.671843

A.1.1.5 Feature Type: *watrcrsl_hydro_1m*

Table A.1.1.5-1 — Local Server *watrcrsl_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.1
GML3-GZIP	200	1.110782
GML3-GZIP	500	0.9917
GML3-GZIP	1000	0.972294
GML3-GZIP	2000	1.910554
GML3-GZIP	5000	0.987872
GML3-GZIP	10000	0.997559
GML3-GZIP	20000	0.991931
GML3-GZIP	50000	0.995784
GML3-BINXML	100	0.704626
GML3-BINXML	200	0.76437
GML3-BINXML	500	0.675296
GML3-BINXML	1000	0.65508
GML3-BINXML	2000	1.655405
GML3-BINXML	5000	0.774001
GML3-BINXML	10000	0.729742
GML3-BINXML	20000	0.72857
GML3-BINXML	50000	0.751201
GML3-BINXMLGZIP	100	0.739266
GML3-BINXMLGZIP	200	0.718391
GML3-BINXMLGZIP	500	0.673332
GML3-BINXMLGZIP	1000	0.68055
GML3-BINXMLGZIP	2000	1.634807
GML3-BINXMLGZIP	5000	0.773185
GML3-BINXMLGZIP	10000	0.725242
GML3-BINXMLGZIP	20000	0.711003
GML3-BINXMLGZIP	50000	0.751003
GML3-GZIP-decode	100	0.558796
GML3-GZIP-decode	200	1.121411
GML3-GZIP-decode	500	0.98747
GML3-GZIP-decode	1000	0.893964
GML3-GZIP-decode	2000	1.921158
GML3-GZIP-decode	5000	0.99647
GML3-GZIP-decode	10000	1.011205
GML3-GZIP-decode	20000	1.009719
GML3-GZIP-decode	50000	1.003334
GML3-BINXML-decode	100	0.571704
GML3-BINXML-decode	200	0.638189
GML3-BINXML-decode	500	0.58102
GML3-BINXML-decode	1000	0.567785
GML3-BINXML-decode	2000	1.518286
GML3-BINXML-decode	5000	0.697318
GML3-BINXML-decode	10000	0.65658
GML3-BINXML-decode	20000	0.659162
GML3-BINXML-decode	50000	0.701495
GML3-BINXMLGZIP-decode	100	0.417575

GML3-BINXMLGZIP-decode	200	0.648565
GML3-BINXMLGZIP-decode	500	0.588217
GML3-BINXMLGZIP-decode	1000	0.578575
GML3-BINXMLGZIP-decode	2000	1.519088
GML3-BINXMLGZIP-decode	5000	0.701048
GML3-BINXMLGZIP-decode	10000	0.648636
GML3-BINXMLGZIP-decode	20000	0.655548
GML3-BINXMLGZIP-decode	50000	0.701897

A.1.1.6 Feature Type: *AAL015*

Table A.1.1.6-1 — Local Server *AAL015* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.118681
GML3-GZIP	200	1.049111
GML3-GZIP	500	1.044678
GML3-GZIP	857	1.027873
GML3-BINXML	100	0.328011
GML3-BINXML	200	0.425669
GML3-BINXML	500	0.557592
GML3-BINXML	857	0.605765
GML3-BINXMLGZIP	100	0.333657
GML3-BINXMLGZIP	200	0.422393
GML3-BINXMLGZIP	500	0.541671
GML3-BINXMLGZIP	857	0.595295
GML3-GZIP-decode	100	1.071488
GML3-GZIP-decode	200	1.0514
GML3-GZIP-decode	500	1.043756
GML3-GZIP-decode	857	1.024402
GML3-BINXML-decode	100	0.320986
GML3-BINXML-decode	200	0.39563
GML3-BINXML-decode	500	0.500012
GML3-BINXML-decode	857	0.540181
GML3-BINXMLGZIP-decode	100	0.318232
GML3-BINXMLGZIP-decode	200	0.392799
GML3-BINXMLGZIP-decode	500	0.485104
GML3-BINXMLGZIP-decode	857	0.523243

A.1.1.7 Feature Type: *LAP030*

Table A.1.1.7-1 — Local Server *LAP030* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.06083
GML3-GZIP	200	1.169443

GML3-GZIP	500	1.222063
GML3-GZIP	1000	1.115465
GML3-GZIP	1444	1.084782
GML3-BINXML	100	0.245001
GML3-BINXML	200	0.33401
GML3-BINXML	500	0.511687
GML3-BINXML	1000	0.621783
GML3-BINXML	1444	0.609132
GML3-BINXMLGZIP	100	0.249319
GML3-BINXMLGZIP	200	0.344251
GML3-BINXMLGZIP	500	0.514816
GML3-BINXMLGZIP	1000	0.61853
GML3-BINXMLGZIP	1444	0.530889
GML3-GZIP-decode	100	0.971985
GML3-GZIP-decode	200	1.087567
GML3-GZIP-decode	500	1.247964
GML3-GZIP-decode	1000	1.214072
GML3-GZIP-decode	1444	1.13095
GML3-BINXML-decode	100	0.23891
GML3-BINXML-decode	200	0.320375
GML3-BINXML-decode	500	0.481723
GML3-BINXML-decode	1000	0.552369
GML3-BINXML-decode	1444	0.545988
GML3-BINXMLGZIP-decode	100	0.253538
GML3-BINXMLGZIP-decode	200	0.321902
GML3-BINXMLGZIP-decode	500	0.484182
GML3-BINXMLGZIP-decode	1000	0.56146
GML3-BINXMLGZIP-decode	1444	0.513076

A.1.1.8 Feature Type: *PAL015*

Table A.1.1.8-1 — Local Server *PAL015* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	0.945843
GML3-GZIP	200	1.041507
GML3-GZIP	500	1.113016
GML3-GZIP	1000	1.03644
GML3-GZIP	2000	1.009683
GML3-GZIP	2888	1.05207
GML3-BINXML	100	0.323178
GML3-BINXML	200	0.425856
GML3-BINXML	500	0.607592
GML3-BINXML	1000	0.646085
GML3-BINXML	2000	0.692929
GML3-BINXML	2888	0.642726
GML3-BINXMLGZIP	100	0.350572
GML3-BINXMLGZIP	200	0.416323

GML3-BINXMLGZIP	500	0.544387
GML3-BINXMLGZIP	1000	0.657477
GML3-BINXMLGZIP	2000	0.669034
GML3-BINXMLGZIP	2888	0.609267
GML3-GZIP-decode	100	1.06053
GML3-GZIP-decode	200	1.08242
GML3-GZIP-decode	500	1.121359
GML3-GZIP-decode	1000	1.088121
GML3-GZIP-decode	2000	1.047735
GML3-GZIP-decode	2888	1.022428
GML3-BINXML-decode	100	0.324978
GML3-BINXML-decode	200	0.379222
GML3-BINXML-decode	500	0.490046
GML3-BINXML-decode	1000	0.557225
GML3-BINXML-decode	2000	0.591822
GML3-BINXML-decode	2888	0.627053
GML3-BINXMLGZIP-decode	100	0.298173
GML3-BINXMLGZIP-decode	200	0.382777
GML3-BINXMLGZIP-decode	500	0.493623
GML3-BINXMLGZIP-decode	1000	0.511732
GML3-BINXMLGZIP-decode	2000	0.615392
GML3-BINXMLGZIP-decode	2888	0.616617

A.1.1.9 Feature Type: All *MSD3* Features

Table A.1.1.9-1 — Local Server All *MSD3* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.042922
GML3-GZIP	200	1.043107
GML3-GZIP	500	1.020705
GML3-GZIP	1000	1.027387
GML3-GZIP	2000	1.010352
GML3-GZIP	5000	1.01215
GML3-GZIP	7448	1.064323
GML3-BINXML	100	0.275257
GML3-BINXML	200	0.401589
GML3-BINXML	500	0.54712
GML3-BINXML	1000	0.596288
GML3-BINXML	2000	0.594161
GML3-BINXML	5000	0.65788
GML3-BINXML	7448	0.65098
GML3-BINXMLGZIP	100	0.263542
GML3-BINXMLGZIP	200	0.398724
GML3-BINXMLGZIP	500	0.553245
GML3-BINXMLGZIP	1000	0.623919
GML3-BINXMLGZIP	2000	0.565001
GML3-BINXMLGZIP	5000	0.593223

GML3-BINXMLGZIP	7448	0.650953
GML3-GZIP-decode	100	1.02694
GML3-GZIP-decode	200	1.009668
GML3-GZIP-decode	500	1.0001
GML3-GZIP-decode	1000	0.988874
GML3-GZIP-decode	2000	0.981919
GML3-GZIP-decode	5000	1.029429
GML3-GZIP-decode	7448	1.071082
GML3-BINXML-decode	100	0.272459
GML3-BINXML-decode	200	0.377108
GML3-BINXML-decode	500	0.496572
GML3-BINXML-decode	1000	0.544707
GML3-BINXML-decode	2000	0.477154
GML3-BINXML-decode	5000	0.558929
GML3-BINXML-decode	7448	0.60577
GML3-BINXMLGZIP-decode	100	0.266176
GML3-BINXMLGZIP-decode	200	0.371322
GML3-BINXMLGZIP-decode	500	0.495028
GML3-BINXMLGZIP-decode	1000	0.532309
GML3-BINXMLGZIP-decode	2000	0.510068
GML3-BINXMLGZIP-decode	5000	0.556566
GML3-BINXMLGZIP-decode	7448	0.604662

A.1.2 100 MBPS LAN

A.1.2.1 Feature Type: *builtupa_pop_1m*

Table A.1.2.1-1 — 100 MBPS LAN *builtupa_pop_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.016287
GML3-GZIP	200	0.980956
GML3-GZIP	500	0.981779
GML3-GZIP	1000	0.982982
GML3-GZIP	2000	0.973733
GML3-GZIP	5000	0.983206
GML3-GZIP	8346	1.029979
GML3-BINXML	100	0.625251
GML3-BINXML	200	0.575467
GML3-BINXML	500	0.585726
GML3-BINXML	1000	0.598228
GML3-BINXML	2000	0.602558
GML3-BINXML	5000	0.571082
GML3-BINXML	8346	0.615971
GML3-BINXMLGZIP	100	0.586099
GML3-BINXMLGZIP	200	0.546675
GML3-BINXMLGZIP	500	0.576798
GML3-BINXMLGZIP	1000	0.608172

GML3-BINXMLGZIP	2000	0.59755
GML3-BINXMLGZIP	5000	0.573408
GML3-BINXMLGZIP	8346	0.607702
GML3-GZIP-decode	100	0.98371
GML3-GZIP-decode	200	0.961524
GML3-GZIP-decode	500	0.961218
GML3-GZIP-decode	1000	0.985091
GML3-GZIP-decode	2000	0.980666
GML3-GZIP-decode	5000	0.959136
GML3-GZIP-decode	8346	1.025578
GML3-BINXML-decode	100	0.506494
GML3-BINXML-decode	200	0.475509
GML3-BINXML-decode	500	0.479586
GML3-BINXML-decode	1000	0.456031
GML3-BINXML-decode	2000	0.448196
GML3-BINXML-decode	5000	0.436935
GML3-BINXML-decode	8346	0.475803
GML3-BINXMLGZIP-decode	100	0.587755
GML3-BINXMLGZIP-decode	200	0.515012
GML3-BINXMLGZIP-decode	500	0.489434
GML3-BINXMLGZIP-decode	1000	0.446585
GML3-BINXMLGZIP-decode	2000	0.474443
GML3-BINXMLGZIP-decode	5000	0.443854
GML3-BINXMLGZIP-decode	8346	0.452725

A.1.2.2 Feature Type: *contourl_elev_1m*

Table A.1.2.2-1 — 100 MBPS LAN *contourl_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	0.939759
GML3-GZIP	200	0.983457
GML3-GZIP	500	0.966968
GML3-GZIP	1000	1.076205
GML3-GZIP	2000	0.947516
GML3-GZIP	5000	0.942877
GML3-GZIP	10000	0.945403
GML3-GZIP	20000	0.937924
GML3-GZIP	50000	0.974812
GML3-BINXML	100	0.818683
GML3-BINXML	200	0.802974
GML3-BINXML	500	0.774215
GML3-BINXML	1000	0.76199
GML3-BINXML	2000	0.61147
GML3-BINXML	5000	0.560984
GML3-BINXML	10000	0.567999
GML3-BINXML	20000	0.565628
GML3-BINXML	50000	0.663138
GML3-BINXMLGZIP	100	0.888889

GML3-BINXMLGZIP	200	0.809696
GML3-BINXMLGZIP	500	0.769829
GML3-BINXMLGZIP	1000	0.758376
GML3-BINXMLGZIP	2000	0.618853
GML3-BINXMLGZIP	5000	0.53639
GML3-BINXMLGZIP	10000	0.572069
GML3-BINXMLGZIP	20000	0.590335
GML3-BINXMLGZIP	50000	0.665624
GML3-GZIP-decode	100	0.98175
GML3-GZIP-decode	200	0.964142
GML3-GZIP-decode	500	0.994538
GML3-GZIP-decode	1000	0.986664
GML3-GZIP-decode	2000	0.907496
GML3-GZIP-decode	5000	0.930082
GML3-GZIP-decode	10000	0.960309
GML3-GZIP-decode	20000	0.940139
GML3-GZIP-decode	50000	0.973971
GML3-BINXML-decode	100	0.745342
GML3-BINXML-decode	200	0.708661
GML3-BINXML-decode	500	0.62305
GML3-BINXML-decode	1000	0.601456
GML3-BINXML-decode	2000	0.451599
GML3-BINXML-decode	5000	0.406789
GML3-BINXML-decode	10000	0.415077
GML3-BINXML-decode	20000	0.446952
GML3-BINXML-decode	50000	0.5613
GML3-BINXMLGZIP-decode	100	0.826381
GML3-BINXMLGZIP-decode	200	0.7327
GML3-BINXMLGZIP-decode	500	0.587279
GML3-BINXMLGZIP-decode	1000	0.601699
GML3-BINXMLGZIP-decode	2000	0.458646
GML3-BINXMLGZIP-decode	5000	0.390921
GML3-BINXMLGZIP-decode	10000	0.414485
GML3-BINXMLGZIP-decode	20000	0.446858
GML3-BINXMLGZIP-decode	50000	0.561843

A.1.2.3 Feature Type: *elevp_elev_1m*

Table A.1.2.3-1 — 100 MBPS LAN *elevp_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.039773
GML3-GZIP	200	1.15873
GML3-GZIP	500	1.016188
GML3-GZIP	1000	0.982179
GML3-GZIP	2000	1.739806
GML3-GZIP	5000	1.004011
GML3-GZIP	10000	1.008297
GML3-GZIP	20000	1.014692

GML3-GZIP	50000	1.018765
GML3-BINXML	100	0.735362
GML3-BINXML	200	0.827725
GML3-BINXML	500	0.744073
GML3-BINXML	1000	0.711525
GML3-BINXML	2000	1.462837
GML3-BINXML	5000	0.801583
GML3-BINXML	10000	0.749801
GML3-BINXML	20000	0.74631
GML3-BINXML	50000	0.769629
GML3-BINXMLGZIP	100	0.731582
GML3-BINXMLGZIP	200	0.801062
GML3-BINXMLGZIP	500	0.765939
GML3-BINXMLGZIP	1000	0.733474
GML3-BINXMLGZIP	2000	1.491202
GML3-BINXMLGZIP	5000	0.766731
GML3-BINXMLGZIP	10000	0.747933
GML3-BINXMLGZIP	20000	0.779579
GML3-BINXMLGZIP	50000	0.773568
GML3-GZIP-decode	100	1.093003
GML3-GZIP-decode	200	1.146984
GML3-GZIP-decode	500	0.971871
GML3-GZIP-decode	1000	0.977449
GML3-GZIP-decode	2000	1.745705
GML3-GZIP-decode	5000	1.014786
GML3-GZIP-decode	10000	0.980066
GML3-GZIP-decode	20000	1.000202
GML3-GZIP-decode	50000	0.981672
GML3-BINXML-decode	100	0.484493
GML3-BINXML-decode	200	0.704107
GML3-BINXML-decode	500	0.629431
GML3-BINXML-decode	1000	0.613717
GML3-BINXML-decode	2000	1.326265
GML3-BINXML-decode	5000	0.68942
GML3-BINXML-decode	10000	0.661622
GML3-BINXML-decode	20000	0.670769
GML3-BINXML-decode	50000	0.719458
GML3-BINXMLGZIP-decode	100	0.64018
GML3-BINXMLGZIP-decode	200	0.719555
GML3-BINXMLGZIP-decode	500	0.658346
GML3-BINXMLGZIP-decode	1000	0.619196
GML3-BINXMLGZIP-decode	2000	1.364317
GML3-BINXMLGZIP-decode	5000	0.68783
GML3-BINXMLGZIP-decode	10000	0.667697
GML3-BINXMLGZIP-decode	20000	0.689136
GML3-BINXMLGZIP-decode	50000	0.719045

A.1.2.4 Feature Type: *inwatera_hydro_1m*

Table A.1.2.4-1 — 100 MBPS LAN *inwatera_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.322874
GML3-GZIP	200	1.193009
GML3-GZIP	500	1.016787
GML3-GZIP	1000	0.99933
GML3-GZIP	2000	1.667408
GML3-GZIP	5000	1.003923
GML3-GZIP	10000	0.99628
GML3-GZIP	20000	1.007503
GML3-GZIP	50000	1.008389
GML3-BINXML	100	0.846723
GML3-BINXML	200	0.756019
GML3-BINXML	500	0.679688
GML3-BINXML	1000	0.654378
GML3-BINXML	2000	1.300961
GML3-BINXML	5000	0.701468
GML3-BINXML	10000	0.676227
GML3-BINXML	20000	0.698768
GML3-BINXML	50000	0.748836
GML3-BINXMLGZIP	100	0.796619
GML3-BINXMLGZIP	200	0.770867
GML3-BINXMLGZIP	500	0.699561
GML3-BINXMLGZIP	1000	0.658714
GML3-BINXMLGZIP	2000	1.209752
GML3-BINXMLGZIP	5000	0.68162
GML3-BINXMLGZIP	10000	0.703987
GML3-BINXMLGZIP	20000	0.700391
GML3-BINXMLGZIP	50000	0.726294
GML3-GZIP-decode	100	0.919105
GML3-GZIP-decode	200	1.098927
GML3-GZIP-decode	500	1.047963
GML3-GZIP-decode	1000	1.015091
GML3-GZIP-decode	2000	1.698353
GML3-GZIP-decode	5000	0.999828
GML3-GZIP-decode	10000	1.014861
GML3-GZIP-decode	20000	1.025805
GML3-GZIP-decode	50000	1.012935
GML3-BINXML-decode	100	0.545826
GML3-BINXML-decode	200	0.570771
GML3-BINXML-decode	500	0.519318
GML3-BINXML-decode	1000	0.49819
GML3-BINXML-decode	2000	1.085199
GML3-BINXML-decode	5000	0.578498
GML3-BINXML-decode	10000	0.56072
GML3-BINXML-decode	20000	0.590262
GML3-BINXML-decode	50000	0.739788
GML3-BINXMLGZIP-decode	100	0.686375

GML3-BINXMLGZIP-decode	200	0.546911
GML3-BINXMLGZIP-decode	500	0.528554
GML3-BINXMLGZIP-decode	1000	0.50014
GML3-BINXMLGZIP-decode	2000	1.087704
GML3-BINXMLGZIP-decode	5000	0.577766
GML3-BINXMLGZIP-decode	10000	0.545153
GML3-BINXMLGZIP-decode	20000	0.596524
GML3-BINXMLGZIP-decode	50000	0.65343

A.1.2.5 Feature Type: *watrcrsl_hydro_1m*

Table A.1.2.5-1 — 100 MBPS LAN *watrcrsl_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.075024
GML3-GZIP	200	0.978047
GML3-GZIP	500	1.019042
GML3-GZIP	1000	0.987586
GML3-GZIP	2000	1.891708
GML3-GZIP	5000	0.989869
GML3-GZIP	10000	1.002892
GML3-GZIP	20000	0.987697
GML3-GZIP	50000	0.993512
GML3-BINXML	100	0.706176
GML3-BINXML	200	0.681562
GML3-BINXML	500	0.635131
GML3-BINXML	1000	0.651146
GML3-BINXML	2000	1.637668
GML3-BINXML	5000	0.767528
GML3-BINXML	10000	0.728763
GML3-BINXML	20000	0.722452
GML3-BINXML	50000	0.742819
GML3-BINXMLGZIP	100	0.672608
GML3-BINXMLGZIP	200	0.681836
GML3-BINXMLGZIP	500	0.693832
GML3-BINXMLGZIP	1000	0.666356
GML3-BINXMLGZIP	2000	1.588671
GML3-BINXMLGZIP	5000	0.767697
GML3-BINXMLGZIP	10000	0.735579
GML3-BINXMLGZIP	20000	0.713567
GML3-BINXMLGZIP	50000	0.740577
GML3-GZIP-decode	100	1.017986
GML3-GZIP-decode	200	0.961386
GML3-GZIP-decode	500	0.731784
GML3-GZIP-decode	1000	0.99169
GML3-GZIP-decode	2000	1.857996
GML3-GZIP-decode	5000	0.988025
GML3-GZIP-decode	10000	1.00437
GML3-GZIP-decode	20000	1.005411
GML3-GZIP-decode	50000	0.997352
GML3-BINXML-decode	100	0.448494

GML3-BINXML-decode	200	0.526594
GML3-BINXML-decode	500	0.52465
GML3-BINXML-decode	1000	0.535127
GML3-BINXML-decode	2000	1.478214
GML3-BINXML-decode	5000	0.662932
GML3-BINXML-decode	10000	0.618478
GML3-BINXML-decode	20000	0.622697
GML3-BINXML-decode	50000	0.670046
GML3-BINXMLGZIP-decode	100	0.556539
GML3-BINXMLGZIP-decode	200	0.534913
GML3-BINXMLGZIP-decode	500	0.555786
GML3-BINXMLGZIP-decode	1000	0.54908
GML3-BINXMLGZIP-decode	2000	1.46228
GML3-BINXMLGZIP-decode	5000	0.65991
GML3-BINXMLGZIP-decode	10000	0.622582
GML3-BINXMLGZIP-decode	20000	0.624936
GML3-BINXMLGZIP-decode	50000	0.676962

A.1.2.6 Feature Type: *AAL015*

Table A.1.2.6-1 — 100 MBPS LAN *AAL015* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.012722
GML3-GZIP	200	0.998899
GML3-GZIP	500	1.024368
GML3-GZIP	857	1.015408
GML3-BINXML	100	0.279243
GML3-BINXML	200	0.389186
GML3-BINXML	500	0.51395
GML3-BINXML	857	0.587851
GML3-BINXMLGZIP	100	0.31022
GML3-BINXMLGZIP	200	0.398749
GML3-BINXMLGZIP	500	0.521011
GML3-BINXMLGZIP	857	0.544285
GML3-GZIP-decode	100	1.004132
GML3-GZIP-decode	200	1.003936
GML3-GZIP-decode	500	0.98221
GML3-GZIP-decode	857	1.00744
GML3-BINXML-decode	100	0.276219
GML3-BINXML-decode	200	0.327568
GML3-BINXML-decode	500	0.456062
GML3-BINXML-decode	857	0.495586
GML3-BINXMLGZIP-decode	100	0.245755
GML3-BINXMLGZIP-decode	200	0.332519
GML3-BINXMLGZIP-decode	500	0.424067
GML3-BINXMLGZIP-decode	857	0.486592

A.1.2.7 Feature Type: *LAP030*

Table A.1.2.7-1 — 100 MBPS LAN *LAP030* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	0.852269
GML3-GZIP	200	0.871873
GML3-GZIP	500	0.911266
GML3-GZIP	1000	0.920258
GML3-GZIP	1444	0.97203
GML3-BINXML	100	0.192004
GML3-BINXML	200	0.28071
GML3-BINXML	500	0.424801
GML3-BINXML	1000	0.517885
GML3-BINXML	1444	0.511243
GML3-BINXMLGZIP	100	0.210124
GML3-BINXMLGZIP	200	0.284246
GML3-BINXMLGZIP	500	0.410698
GML3-BINXMLGZIP	1000	0.466955
GML3-BINXMLGZIP	1444	0.527362
GML3-GZIP-decode	100	0.900463
GML3-GZIP-decode	200	0.857915
GML3-GZIP-decode	500	0.947874
GML3-GZIP-decode	1000	0.948022
GML3-GZIP-decode	1444	0.974856
GML3-BINXML-decode	100	0.170571
GML3-BINXML-decode	200	0.23178
GML3-BINXML-decode	500	0.343403
GML3-BINXML-decode	1000	0.424838
GML3-BINXML-decode	1444	0.494535
GML3-BINXMLGZIP-decode	100	0.214951
GML3-BINXMLGZIP-decode	200	0.267203
GML3-BINXMLGZIP-decode	500	0.367567
GML3-BINXMLGZIP-decode	1000	0.423272
GML3-BINXMLGZIP-decode	1444	0.475152

A.1.2.8 Feature Type: *PAL015*

Table A.1.2.8-1 — 100 MBPS LAN *PAL015* Relative Performance Data

Output Format	Max Features	Features per second
GML3-GZIP	100	0.925004
GML3-GZIP	200	0.935255
GML3-GZIP	500	0.932138
GML3-GZIP	1000	0.926004
GML3-GZIP	2000	0.903517
GML3-GZIP	2888	0.933045
GML3-BINXML	100	0.283593

GML3-BINXML	200	0.40936
GML3-BINXML	500	0.519241
GML3-BINXML	1000	0.602639
GML3-BINXML	2000	0.656137
GML3-BINXML	2888	0.667678
GML3-BINXMLGZIP	100	0.340716
GML3-BINXMLGZIP	200	0.442599
GML3-BINXMLGZIP	500	0.566901
GML3-BINXMLGZIP	1000	0.650023
GML3-BINXMLGZIP	2000	0.644451
GML3-BINXMLGZIP	2888	0.624287
GML3-GZIP-decode	100	0.85463
GML3-GZIP-decode	200	0.954866
GML3-GZIP-decode	500	0.957078
GML3-GZIP-decode	1000	0.918212
GML3-GZIP-decode	2000	0.917781
GML3-GZIP-decode	2888	1.051277
GML3-BINXML-decode	100	0.311701
GML3-BINXML-decode	200	0.411367
GML3-BINXML-decode	500	0.500328
GML3-BINXML-decode	1000	0.569158
GML3-BINXML-decode	2000	0.559896
GML3-BINXML-decode	2888	0.628144
GML3-BINXMLGZIP-decode	100	0.311526
GML3-BINXMLGZIP-decode	200	0.387758
GML3-BINXMLGZIP-decode	500	0.459082
GML3-BINXMLGZIP-decode	1000	0.564343
GML3-BINXMLGZIP-decode	2000	0.569929
GML3-BINXMLGZIP-decode	2888	0.608187

A.1.2.9 Feature Type: All *MSD3* Features

Table A.1.2.9-1 — 100 MBPS LAN All *MSD3* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	1.020679
GML3-GZIP	200	0.988228
GML3-GZIP	500	0.909254
GML3-GZIP	1000	0.901867
GML3-GZIP	2000	0.93363
GML3-GZIP	5000	0.968476
GML3-GZIP	7448	1.035681
GML3-BINXML	100	0.242439
GML3-BINXML	200	0.361164
GML3-BINXML	500	0.485608
GML3-BINXML	1000	0.587895
GML3-BINXML	2000	0.586541
GML3-BINXML	5000	0.610455
GML3-BINXML	7448	0.66055
GML3-BINXMLGZIP	100	0.24874

GML3-BINXMLGZIP	200	0.333154
GML3-BINXMLGZIP	500	0.475712
GML3-BINXMLGZIP	1000	0.573502
GML3-BINXMLGZIP	2000	0.578646
GML3-BINXMLGZIP	5000	0.612247
GML3-BINXMLGZIP	7448	0.639623
GML3-GZIP-decode	100	1.017673
GML3-GZIP-decode	200	0.979827
GML3-GZIP-decode	500	0.967171
GML3-GZIP-decode	1000	0.994625
GML3-GZIP-decode	2000	0.989377
GML3-GZIP-decode	5000	0.984366
GML3-GZIP-decode	7448	1.015128
GML3-BINXML-decode	100	0.222745
GML3-BINXML-decode	200	0.293546
GML3-BINXML-decode	500	0.419659
GML3-BINXML-decode	1000	0.477161
GML3-BINXML-decode	2000	0.483722
GML3-BINXML-decode	5000	0.496337
GML3-BINXML-decode	7448	0.526985
GML3-BINXMLGZIP-decode	100	0.233904
GML3-BINXMLGZIP-decode	200	0.321498
GML3-BINXMLGZIP-decode	500	0.409106
GML3-BINXMLGZIP-decode	1000	0.484212
GML3-BINXMLGZIP-decode	2000	0.486952
GML3-BINXMLGZIP-decode	5000	0.508053
GML3-BINXMLGZIP-decode	7448	0.551449

A.1.2 10 MBPS WAN

A.1.3.1 Feature Type: *builtupa_pop_1m*

Table A.1.3.1-1 — 10 MBPS WAN *builtupa_pop_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	7.326734
GML3-GZIP	200	6.898864
GML3-GZIP	500	6.086007
GML3-GZIP	1000	6.163071
GML3-GZIP	2000	6.12957
GML3-GZIP	5000	5.924659
GML3-GZIP	8346	5.889368
GML3-BINXML	100	3.424537
GML3-BINXML	200	3.663452
GML3-BINXML	500	4.288479
GML3-BINXML	1000	4.30819
GML3-BINXML	2000	4.264659
GML3-BINXML	5000	4.024491

GML3-BINXML	8346	3.963571
GML3-BINXMLGZIP	100	3.33436
GML3-BINXMLGZIP	200	3.792222
GML3-BINXMLGZIP	500	4.141142
GML3-BINXMLGZIP	1000	4.317368
GML3-BINXMLGZIP	2000	4.263243
GML3-BINXMLGZIP	5000	4.02803
GML3-BINXMLGZIP	8346	3.957845
GML3-GZIP-decode	100	9.94987
GML3-GZIP-decode	200	5.253155
GML3-GZIP-decode	500	6.293212
GML3-GZIP-decode	1000	6.120889
GML3-GZIP-decode	2000	6.115039
GML3-GZIP-decode	5000	5.899361
GML3-GZIP-decode	8346	5.88264
GML3-BINXML-decode	100	3.200591
GML3-BINXML-decode	200	3.63874
GML3-BINXML-decode	500	4.103417
GML3-BINXML-decode	1000	4.151294
GML3-BINXML-decode	2000	4.080413
GML3-BINXML-decode	5000	3.884071
GML3-BINXML-decode	8346	3.836347
GML3-BINXMLGZIP-decode	100	3.396152
GML3-BINXMLGZIP-decode	200	3.608268
GML3-BINXMLGZIP-decode	500	4.105139
GML3-BINXMLGZIP-decode	1000	4.168805
GML3-BINXMLGZIP-decode	2000	4.131028
GML3-BINXMLGZIP-decode	5000	3.898789
GML3-BINXMLGZIP-decode	8346	3.831502

A.1.3.2 Feature Type: *contourl_elev_1m*

Table A.1.3.2-1 — 10 MBPS WAN *contourl_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	5.909292
GML3-GZIP	200	4.06995
GML3-GZIP	500	4.853966
GML3-GZIP	1000	4.866356
GML3-GZIP	2000	4.454168
GML3-GZIP	5000	4.253472
GML3-GZIP	10000	4.318491
GML3-GZIP	20000	4.392823
GML3-GZIP	50000	4.636734
GML3-BINXML	100	3.313113
GML3-BINXML	200	3.324965
GML3-BINXML	500	3.554544
GML3-BINXML	1000	3.257184
GML3-BINXML	2000	2.988713
GML3-BINXML	5000	2.793823
GML3-BINXML	10000	2.782844

GML3-BINXML	20000	2.745051
GML3-BINXML	50000	2.715829
GML3-BINXMLGZIP	100	2.095761
GML3-BINXMLGZIP	200	3.323743
GML3-BINXMLGZIP	500	3.475588
GML3-BINXMLGZIP	1000	3.281754
GML3-BINXMLGZIP	2000	2.994918
GML3-BINXMLGZIP	5000	2.786033
GML3-BINXMLGZIP	10000	2.771676
GML3-BINXMLGZIP	20000	2.746064
GML3-BINXMLGZIP	50000	2.706044
GML3-GZIP-decode	100	3.143748
GML3-GZIP-decode	200	3.943069
GML3-GZIP-decode	500	4.970502
GML3-GZIP-decode	1000	4.849568
GML3-GZIP-decode	2000	4.439376
GML3-GZIP-decode	5000	4.242113
GML3-GZIP-decode	10000	4.309815
GML3-GZIP-decode	20000	4.375403
GML3-GZIP-decode	50000	4.599266
GML3-BINXML-decode	100	1.157631
GML3-BINXML-decode	200	3.237394
GML3-BINXML-decode	500	3.405349
GML3-BINXML-decode	1000	3.154289
GML3-BINXML-decode	2000	2.89355
GML3-BINXML-decode	5000	2.71104
GML3-BINXML-decode	10000	2.698671
GML3-BINXML-decode	20000	2.666958
GML3-BINXML-decode	50000	2.641418
GML3-BINXMLGZIP-decode	100	2.995373
GML3-BINXMLGZIP-decode	200	3.285959
GML3-BINXMLGZIP-decode	500	3.291937
GML3-BINXMLGZIP-decode	1000	3.175112
GML3-BINXMLGZIP-decode	2000	2.917646
GML3-BINXMLGZIP-decode	5000	2.709404
GML3-BINXMLGZIP-decode	10000	2.700152
GML3-BINXMLGZIP-decode	20000	2.677979
GML3-BINXMLGZIP-decode	50000	2.645435

A.1.3.3 Feature Type: *elevp_elev_1m*

Table A.1.3.3-1 — 10 MBPS WAN *elevp_elev_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	9.113598
GML3-GZIP	200	24.44
GML3-GZIP	500	27.04241
GML3-GZIP	1000	14.57033
GML3-GZIP	2000	9.751987
GML3-GZIP	5000	11.9201
GML3-GZIP	10000	12.85285

GML3-GZIP	20000	13.6336
GML3-GZIP	50000	11.52518
GML3-BINXML	100	3.580523
GML3-BINXML	200	11.62173
GML3-BINXML	500	11.67863
GML3-BINXML	1000	14.99787
GML3-BINXML	2000	9.419929
GML3-BINXML	5000	10.52531
GML3-BINXML	10000	10.83091
GML3-BINXML	20000	9.990614
GML3-BINXML	50000	7.153908
GML3-BINXMLGZIP	100	6.619547
GML3-BINXMLGZIP	200	13.42729
GML3-BINXMLGZIP	500	14.33126
GML3-BINXMLGZIP	1000	14.03681
GML3-BINXMLGZIP	2000	9.481058
GML3-BINXMLGZIP	5000	10.18014
GML3-BINXMLGZIP	10000	10.76654
GML3-BINXMLGZIP	20000	10.07728
GML3-BINXMLGZIP	50000	7.0437
GML3-GZIP-decode	100	11.12798
GML3-GZIP-decode	200	14.84576
GML3-GZIP-decode	500	21.37547
GML3-GZIP-decode	1000	15.51539
GML3-GZIP-decode	2000	9.530536
GML3-GZIP-decode	5000	11.44149
GML3-GZIP-decode	10000	12.79715
GML3-GZIP-decode	20000	13.60942
GML3-GZIP-decode	50000	11.52371
GML3-BINXML-decode	100	3.784824
GML3-BINXML-decode	200	11.21548
GML3-BINXML-decode	500	10.51721
GML3-BINXML-decode	1000	13.87506
GML3-BINXML-decode	2000	8.990851
GML3-BINXML-decode	5000	10.11797
GML3-BINXML-decode	10000	10.26767
GML3-BINXML-decode	20000	9.054942
GML3-BINXML-decode	50000	6.81215
GML3-BINXMLGZIP-decode	100	9.403975
GML3-BINXMLGZIP-decode	200	8.666132
GML3-BINXMLGZIP-decode	500	10.83167
GML3-BINXMLGZIP-decode	1000	11.96668
GML3-BINXMLGZIP-decode	2000	8.442677
GML3-BINXMLGZIP-decode	5000	9.182328
GML3-BINXMLGZIP-decode	10000	10.14719
GML3-BINXMLGZIP-decode	20000	9.464625
GML3-BINXMLGZIP-decode	50000	6.83679

A.1.3.4 Feature Type: *inwatera_hydro_1m*

Table A.1.3.4-1 — 10 MBPS WAN *inwatera_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	9.979524
GML3-GZIP	200	5.930109
GML3-GZIP	500	6.865326
GML3-GZIP	1000	7.090726
GML3-GZIP	2000	4.784604
GML3-GZIP	5000	6.989763
GML3-GZIP	10000	7.201807
GML3-GZIP	20000	7.27347
GML3-GZIP	50000	6.92013
GML3-BINXML	100	4.153569
GML3-BINXML	200	5.001582
GML3-BINXML	500	4.993278
GML3-BINXML	1000	4.997845
GML3-BINXML	2000	4.381448
GML3-BINXML	5000	4.891586
GML3-BINXML	10000	4.602087
GML3-BINXML	20000	4.407607
GML3-BINXML	50000	4.003209
GML3-BINXMLGZIP	100	8.404245
GML3-BINXMLGZIP	200	4.716506
GML3-BINXMLGZIP	500	4.741544
GML3-BINXMLGZIP	1000	4.999225
GML3-BINXMLGZIP	2000	4.199811
GML3-BINXMLGZIP	5000	5.009366
GML3-BINXMLGZIP	10000	5.063321
GML3-BINXMLGZIP	20000	4.752629
GML3-BINXMLGZIP	50000	3.999714
GML3-GZIP-decode	100	6.143013
GML3-GZIP-decode	200	5.98375
GML3-GZIP-decode	500	6.862612
GML3-GZIP-decode	1000	7.025566
GML3-GZIP-decode	2000	6.551943
GML3-GZIP-decode	5000	7.072833
GML3-GZIP-decode	10000	7.333475
GML3-GZIP-decode	20000	7.302399
GML3-GZIP-decode	50000	6.941952
GML3-BINXML-decode	100	8.603972
GML3-BINXML-decode	200	4.588869
GML3-BINXML-decode	500	4.683039
GML3-BINXML-decode	1000	4.865798
GML3-BINXML-decode	2000	4.538257
GML3-BINXML-decode	5000	4.894784
GML3-BINXML-decode	10000	4.841027
GML3-BINXML-decode	20000	4.601152
GML3-BINXML-decode	50000	3.877433
GML3-BINXMLGZIP-decode	100	11.42864

GML3-BINXMLGZIP-decode	200	5.070906
GML3-BINXMLGZIP-decode	500	4.64134
GML3-BINXMLGZIP-decode	1000	4.766319
GML3-BINXMLGZIP-decode	2000	4.494984
GML3-BINXMLGZIP-decode	5000	4.866952
GML3-BINXMLGZIP-decode	10000	4.822917
GML3-BINXMLGZIP-decode	20000	4.513891
GML3-BINXMLGZIP-decode	50000	3.850617

A.1.3.5 Feature Type: *watrcrsl_hydro_1m*

Table A.1.3.5-1 — 10 MBPS WAN *watrcrsl_hydro_1m* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	13.69184
GML3-GZIP	200	15.41158
GML3-GZIP	500	7.653427
GML3-GZIP	1000	8.631081
GML3-GZIP	2000	6.077109
GML3-GZIP	5000	6.882504
GML3-GZIP	10000	7.357939
GML3-GZIP	20000	7.799924
GML3-GZIP	50000	8.002629
GML3-BINXML	100	6.379125
GML3-BINXML	200	4.162408
GML3-BINXML	500	5.668804
GML3-BINXML	1000	5.780658
GML3-BINXML	2000	4.946128
GML3-BINXML	5000	4.995847
GML3-BINXML	10000	4.970305
GML3-BINXML	20000	5.086576
GML3-BINXML	50000	4.413952
GML3-BINXMLGZIP	100	8.348389
GML3-BINXMLGZIP	200	4.306539
GML3-BINXMLGZIP	500	5.825476
GML3-BINXMLGZIP	1000	6.313029
GML3-BINXMLGZIP	2000	4.285343
GML3-BINXMLGZIP	5000	5.079015
GML3-BINXMLGZIP	10000	5.092817
GML3-BINXMLGZIP	20000	5.161185
GML3-BINXMLGZIP	50000	4.42818
GML3-GZIP-decode	100	4.343219
GML3-GZIP-decode	200	15.37472
GML3-GZIP-decode	500	7.935929
GML3-GZIP-decode	1000	8.589278
GML3-GZIP-decode	2000	6.333126
GML3-GZIP-decode	5000	6.965494
GML3-GZIP-decode	10000	7.411532
GML3-GZIP-decode	20000	7.922524
GML3-GZIP-decode	50000	8.100663
GML3-BINXML-decode	100	5.024014

GML3-BINXML-decode	200	4.279416
GML3-BINXML-decode	500	5.467143
GML3-BINXML-decode	1000	5.592348
GML3-BINXML-decode	2000	4.781203
GML3-BINXML-decode	5000	4.841306
GML3-BINXML-decode	10000	4.929434
GML3-BINXML-decode	20000	4.958524
GML3-BINXML-decode	50000	4.306232
GML3-BINXMLGZIP-decode	100	9.4437
GML3-BINXMLGZIP-decode	200	4.431912
GML3-BINXMLGZIP-decode	500	5.751007
GML3-BINXMLGZIP-decode	1000	6.072554
GML3-BINXMLGZIP-decode	2000	4.863287
GML3-BINXMLGZIP-decode	5000	4.845335
GML3-BINXMLGZIP-decode	10000	4.898815
GML3-BINXMLGZIP-decode	20000	4.972373
GML3-BINXMLGZIP-decode	50000	4.282205

A.1.3.6 Feature Type: *AAL015*

Table A.1.3.6-1 — 10 MBPS WAN *AAL015* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	35.43703
GML3-GZIP	200	21.59863
GML3-GZIP	500	20.82287
GML3-GZIP	857	18.67301
GML3-BINXML	100	7.037555
GML3-BINXML	200	10.4375
GML3-BINXML	500	11.97774
GML3-BINXML	857	13.01985
GML3-BINXMLGZIP	100	7.87236
GML3-BINXMLGZIP	200	10.08448
GML3-BINXMLGZIP	500	12.66549
GML3-BINXMLGZIP	857	12.94818
GML3-GZIP-decode	100	22.21083
GML3-GZIP-decode	200	19.11666
GML3-GZIP-decode	500	20.69733
GML3-GZIP-decode	857	19.10915
GML3-BINXML-decode	100	6.656421
GML3-BINXML-decode	200	9.545455
GML3-BINXML-decode	500	11.66486
GML3-BINXML-decode	857	11.97739
GML3-BINXMLGZIP-decode	100	7.717185
GML3-BINXMLGZIP-decode	200	9.140738
GML3-BINXMLGZIP-decode	500	11.65013
GML3-BINXMLGZIP-decode	857	11.96969

A.1.3.7 Feature Type: *LAP030*

Table A.1.3.7-1 — 10 MBPS WAN *LAP030* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	27.44675
GML3-GZIP	200	37.35897
GML3-GZIP	500	21.65079
GML3-GZIP	1000	17.25674
GML3-GZIP	1444	15.71289
GML3-BINXML	100	4.908844
GML3-BINXML	200	7.161703
GML3-BINXML	500	9.227983
GML3-BINXML	1000	9.387562
GML3-BINXML	1444	10.06737
GML3-BINXMLGZIP	100	5.188991
GML3-BINXMLGZIP	200	8.724526
GML3-BINXMLGZIP	500	10.97434
GML3-BINXMLGZIP	1000	9.751061
GML3-BINXMLGZIP	1444	9.958826
GML3-GZIP-decode	100	25.14286
GML3-GZIP-decode	200	36.96459
GML3-GZIP-decode	500	20.8404
GML3-GZIP-decode	1000	17.10195
GML3-GZIP-decode	1444	15.55467
GML3-BINXML-decode	100	4.712979
GML3-BINXML-decode	200	6.842452
GML3-BINXML-decode	500	8.537331
GML3-BINXML-decode	1000	9.267823
GML3-BINXML-decode	1444	9.367277
GML3-BINXMLGZIP-decode	100	5.074867
GML3-BINXMLGZIP-decode	200	7.84019
GML3-BINXMLGZIP-decode	500	10.03667
GML3-BINXMLGZIP-decode	1000	8.982457
GML3-BINXMLGZIP-decode	1444	9.311854

A.1.3.8 Feature Type: *PAL015*

Table A.1.3.8-1 — 10 MBPS WAN *PAL015* Relative Performance Data

Output Format	Max Features	Features per second
GML3-GZIP	100	23.45829
GML3-GZIP	200	31.50315
GML3-GZIP	500	37.31886
GML3-GZIP	1000	29.90882
GML3-GZIP	2000	27.38606
GML3-GZIP	2888	27.84844
GML3-BINXML	100	7.960119
GML3-BINXML	200	11.77065
GML3-BINXML	500	15.99777
GML3-BINXML	1000	17.30759

GML3-BINXML	2000	19.18486
GML3-BINXML	2888	19.1185
GML3-BINXMLGZIP	100	8.532121
GML3-BINXMLGZIP	200	12.06671
GML3-BINXMLGZIP	500	17.88933
GML3-BINXMLGZIP	1000	18.57194
GML3-BINXMLGZIP	2000	20.08438
GML3-BINXMLGZIP	2888	19.22305
GML3-GZIP-decode	100	30.03026
GML3-GZIP-decode	200	34.15699
GML3-GZIP-decode	500	35.7066
GML3-GZIP-decode	1000	30.06708
GML3-GZIP-decode	2000	28.53408
GML3-GZIP-decode	2888	27.8366
GML3-BINXML-decode	100	8.06081
GML3-BINXML-decode	200	11.39657
GML3-BINXML-decode	500	15.06838
GML3-BINXML-decode	1000	16.37315
GML3-BINXML-decode	2000	16.90735
GML3-BINXML-decode	2888	17.64108
GML3-BINXMLGZIP-decode	100	7.264171
GML3-BINXMLGZIP-decode	200	11.91709
GML3-BINXMLGZIP-decode	500	15.93629
GML3-BINXMLGZIP-decode	1000	16.432
GML3-BINXMLGZIP-decode	2000	18.15742
GML3-BINXMLGZIP-decode	2888	17.21975

A.1.3.9 Feature Type: All *MSD3* Features

Table A.1.3.9-1 — 10 MBPS WAN All *MSD3* Relative Performance Data

Output Format	Max Features	Performance Relative to GML
GML3-GZIP	100	23.37589
GML3-GZIP	200	15.35401
GML3-GZIP	500	18.34662
GML3-GZIP	1000	17.19347
GML3-GZIP	2000	14.22136
GML3-GZIP	5000	14.2104
GML3-GZIP	7448	16.74823
GML3-BINXML	100	5.029111
GML3-BINXML	200	8.340564
GML3-BINXML	500	11.26297
GML3-BINXML	1000	10.72997
GML3-BINXML	2000	8.84013
GML3-BINXML	5000	8.565388
GML3-BINXML	7448	10.16451
GML3-BINXMLGZIP	100	6.614974
GML3-BINXMLGZIP	200	8.453186
GML3-BINXMLGZIP	500	11.13346
GML3-BINXMLGZIP	1000	10.61154
GML3-BINXMLGZIP	2000	8.813572

GML3-BINXMLGZIP	5000	8.522057
GML3-BINXMLGZIP	7448	10.17251
GML3-GZIP-decode	100	30.48134
GML3-GZIP-decode	200	15.7278
GML3-GZIP-decode	500	18.13113
GML3-GZIP-decode	1000	17.26044
GML3-GZIP-decode	2000	14.23416
GML3-GZIP-decode	5000	14.21965
GML3-GZIP-decode	7448	16.74553
GML3-BINXML-decode	100	3.919094
GML3-BINXML-decode	200	7.809578
GML3-BINXML-decode	500	10.26269
GML3-BINXML-decode	1000	9.859051
GML3-BINXML-decode	2000	8.299769
GML3-BINXML-decode	5000	8.030656
GML3-BINXML-decode	7448	9.479375
GML3-BINXMLGZIP-decode	100	7.871273
GML3-BINXMLGZIP-decode	200	7.747475
GML3-BINXMLGZIP-decode	500	10.19885
GML3-BINXMLGZIP-decode	1000	9.824461
GML3-BINXMLGZIP-decode	2000	8.240124
GML3-BINXMLGZIP-decode	5000	7.986263
GML3-BINXMLGZIP-decode	7448	9.480803

Bibliography

[1] OGC 03-105r1, OpenGIS® Geography Markup Language (GML) Implementation Specification, Version 3.1.1, April 2004.