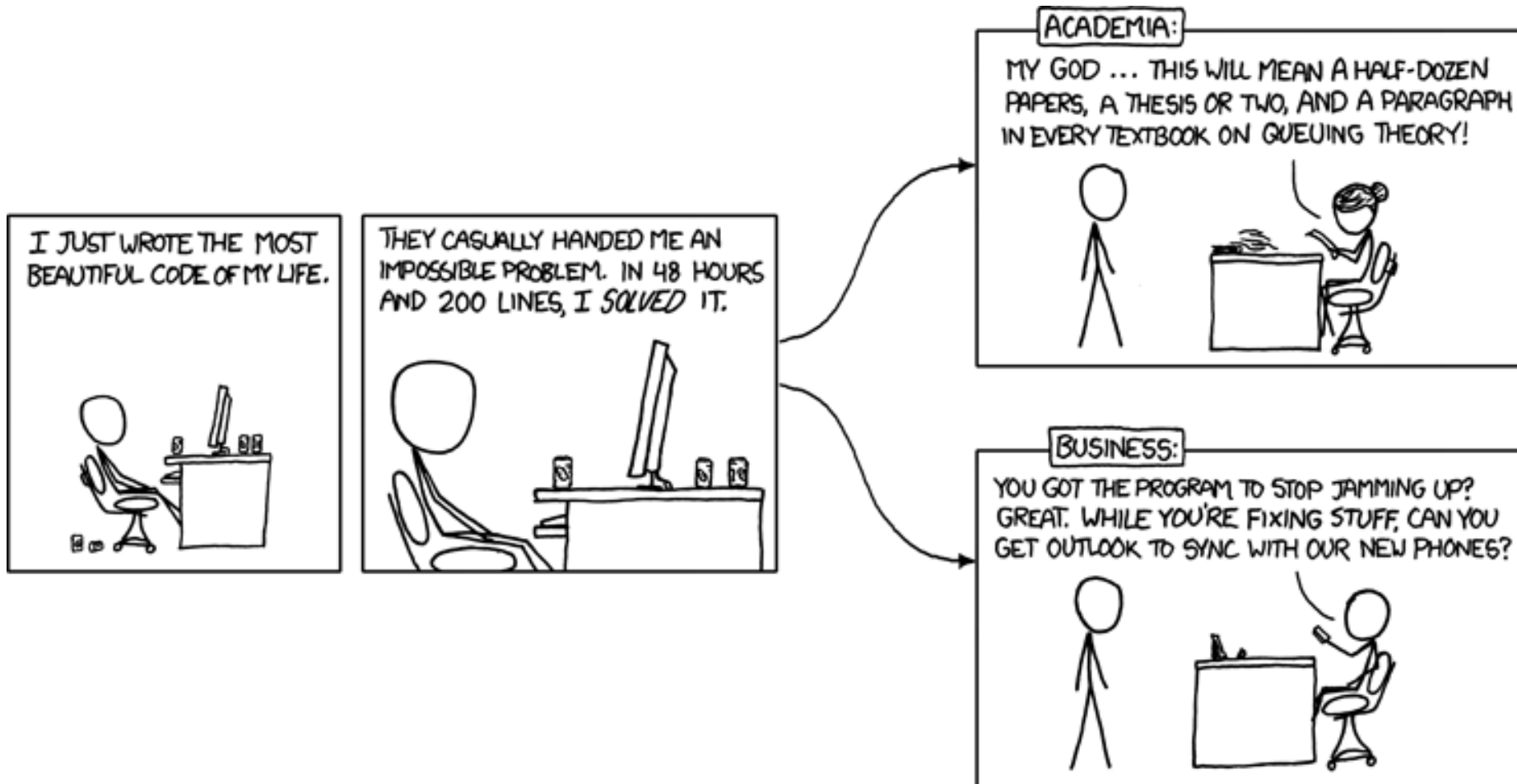# GemStone Update

Norm Green and:[James Foster]
ESUG 2023
Lyon, France
August 30, 2023

Academia vs Business…

Part 1

GemTalk: Who We Are

Our History

- ## 41 Years of Continuous Operation
  - Founded: 1982 (as Servio Logic Corporation)
  - First Version of GemStone Shipped: 1986
  - Name Changed from Servio to GemStone: 1995
  - Acquired by Brokat: July 2000
  - Management buyout: June 2001
  - Acquired by VMware: May 2010
  - Acquired by GemTalk Systems: May 2013

GemStone Powered Business

Financial and Trading Vertical

Kapital is the world leading derivatives trading and management system – since 1993

DBO is a very large precious metals trading and settlement system.

-   since 1990

ICE is the world's fastest growing electronic trading exchange – since 1994

MMI Holdings – Financial portfolio management system. – since 1995

Lifeware – Cloud-based insurance management solutions – since 2000

Guava – Financial & treasury Software – since 1998

GemStone Powered Business

Manufacturing Vertical

Texas Instruments — *Works* application for semiconductor manufacturing – since 1991

onto innovation — Semiconductor manufacturing software – since 1998

HTS — HVAC software – since 2012

H.B. Fuller — Adhesives Manufacturing – since 1997

GemStone Powered Business

Utilities Vertical

TCMS II- Trouble Call Management System V2

GemTalk provides remote administration and emergency on-call support to augment FPL staff

GemStone Powered Business

Telecommunications Vertical

CONDIS – Inventory and cable management – since 1993

Telecom Service Provisioning for Argentina – since 2004

Telecom Workflow Management – since 2013

GemStone Powered Business

Government Vertical

Border Security – since 1996

Visa Processing – since 2004

Dutch Agricultural Institute – agriculture data collection – since 1998

GemTalk Partners

FINWORKS
INFORMATION TECHNOLOGY SOLUTIONS

doxcelerate

instantiations

RUDOLPH
TECHNOLOGIES

The US Oncology
Network

SIEMENS

Pharo

CCK. Financial Solutions.

HTS

HPI Hasso
Plattner
Institut

computas

Lifeware

sophisticated simplicity

HOKUS

mercap

TUAUSTRIA
Austrian Universities of Technology

Yesplan
Let's make it happen

GemTalk In the Community…

- **Conferences and Groups**

  - Pharo Consortium (Industrial Member)

  - ESUG (Platinum Sponsor)
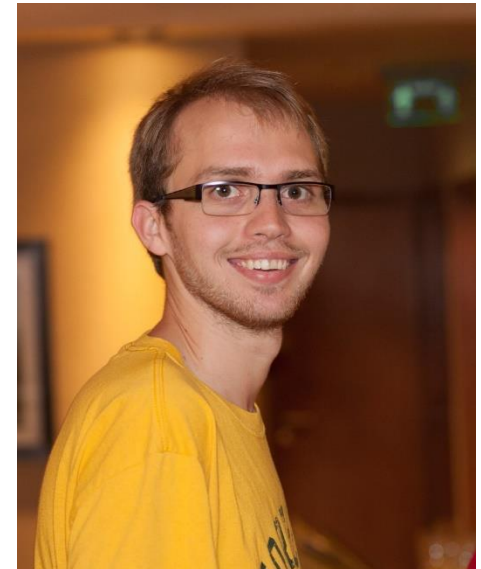
  - FAST (Platinum Sponsor)

The GemTalk Team

GemTalk – The Next Generation

- Welcome Kurt Kilpela!

- Joined GemTalk on May, 2019

- From Kurt's Cover Letter:

  Early in my education, I was introduced to Smalltalk. Prior to this, my training was in Java, C, and C++. Initially, it felt bizarre. In just a few days, I fell in love.

GemTalk – The Next Generation

- Welcome Andres Valloud!

- Joined GemTalk in June, 2022

- Projects

  - x86_64 native code generator improvements

  - ARM aarch64 native code generator

GemTalk – The Next Generation

- Welcome Alissa Friel!

- Joined GemTalk in August, 2023

- BSc. Computer Science,

  Portland State University

Part 2

GemStone Software:

A Lightning Tutorial

How Many Have A Good Feel For What GemStone Is?

How Many Have Actually Used GemStone ?

So What Is This GemStone Thing?

- A solution to the limitations of traditional Smalltalk:

    1. Object space limited to one VM.

    2. Object space limited to one host.

    3. Object space limited to available RAM.

    4. Object changes (since last image save) lost when VM exits.

Welcome To The World Of GemStone!

- Object space visible to thousands of VMs on thousands of machines.

- Object space limited by disk, not RAM.

- Object changes managed by ACID transactions
  - Atomic
  - Consistent
  - Isolated
  - Durable

- Object changes guaranteed persistent once committed.

Key Features Of GemStone

- Scalability
  - Billions of objects
  - Thousands of users.
  - Thousands of machines.
  - Thousands of transactions per second.
  - Terabytes of data.

20

Key Features Of GemStone

- Concurrency
  - Multiple user sessions.
  - Built-in database transactions.
    - Commit
    - Abort
    - Continue
  - Optimistic Concurrency
    - Reduced Conflict Collections
  - Pessimistic Concurrency
    - Object-level read/write locks.
  - Namespaces
    - Shared and private.

Key Features Of GemStone

- Security
  - Object-level security.
    - User, group, world permissions.
  - Login Security
    - User-id / Password
    - Single-Sign-On (GSSAPI / Kerberos)
    - LDAP
    - PAM
    - X509 Certificate
  - Administrative Privileges
    - #GarbageCollection
    - #OtherPassword
    - #SystemControl

Key Features Of GemStone

- 100% Smalltalk (*"It's turtles, all the way down"*)
  - All objects, all the time.
  - Classes, methods, blocks, exceptions.
  - ANSI Smalltalk compliant

Key Features Of GemStone

- Very Large Collection Support
  - Collections of millions of objects.
  - Optimized searches using b-tree Indexes:
    - Equality Indexes (a = b)
      - *AllEmployees detect:{:each| each.lastName = 'Ducasse' }*
    - Identity Indexes (a == b)
      - *AllEmployees select:{:each| each.countryOfOrigin == #France }*

Key Features Of GemStone

- Interfaces to Other Smalltalks
  - VisualWorks® - GemBuilder for VisualWorks®
  - VA Smalltalk® - GemBuilder for VA Smalltalk®
  - Pharo – tODE, GsDevKit, Sparkle, gt4Gemstone
  - Jade / Jadeite (Dolphin, open source)
- Interfaces To Other Languages
  - C/C++ - GemBuilder for C
  - Java – GemBuilder for Java
- Interfaces to Relational Databases
  - Oracle – GemConnect for Oracle
  - Postgres – GemConnect for Postgres
  - Sybase – GemConnect for Sybase (open source)

GemStone/S 64 Platforms

- Object Server (Database)
  - Linux:
    - x86_64 (Intel / AMD)
    - aarch64 (ARM) ** NEW ** (non-production only)
  - Apple MacOS:
    - x86_64
    - M1, M2 (Apple Silicone)
  - Oracle Solaris: x86_64
  - IBM: AIX PowerPC 64 bit
  - Raspberry Pi aarch64

- Object Clients
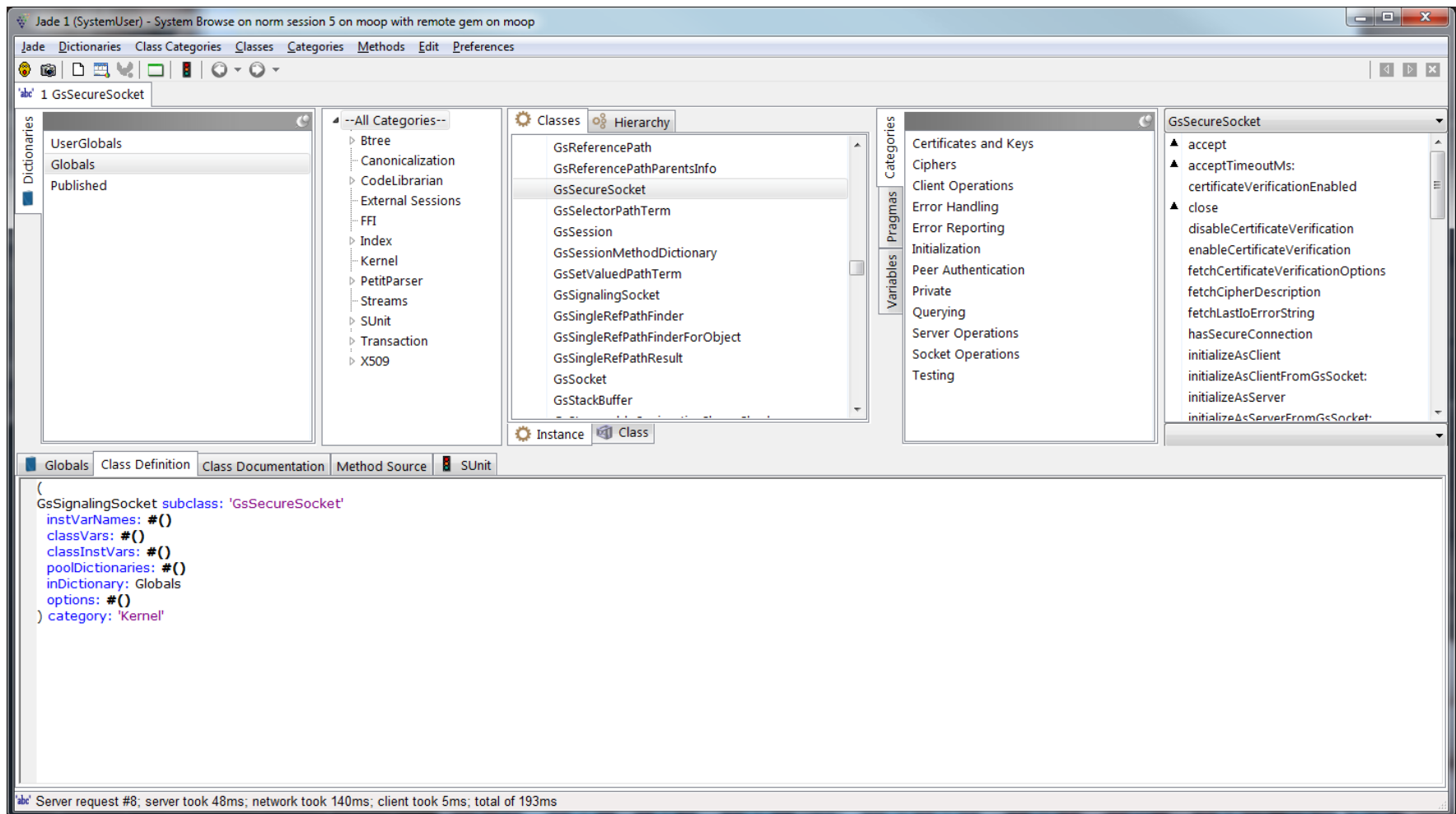 - All of the above, and:
    - Microsoft Windows 10,11

GemBuilder for Smalltalk (GBS) Platforms

- Cincom® VisualWorks® 9.1.1
  - MS Windows 10/11
  - Linux 32/64 bit

- Instantiations VA Smalltalk™ 11.0.1, 10.0.2, 8.6.3
  - MS Windows 10/11

Jade IDE

- Open source IDE for all versions of GemStone
- Written in Dolphin Smalltalk by James Foster
- MS Windows only
- Supports all versions of GemStone
- Free of charge
- Rich set of tools
  - Browsers
  - Inspectors
  - Debuggers
- https://github.com/jgfoster/Jade

Jade System Browser

Jadeite IDE

- Fork of the Jade project
- Currently in development at GemTalk for a customer in Europe
- Support for source code control with Rowan and Git
- Support for Tonal file format
- Migration tools from other SCM systems

GemStone/S Licensing Models

- Community Editions
  - Free (as in beer) for <u>any</u> use (including commercial)
- Perpetual
  - Buy once, own it forever
- Annual Subscription
  - Pay annually, cancel any time.
- Value Added Reseller (VAR)
  - Percentage of royalties

GemStone Community Edition

	Starter	Limited	Full	Extended SPC	Extended CPU	Extended Full
License Kind	Perpetual	Subscription	Subscription	Subscription	Subscription	Subscription
Cores	2	2	2	2	4	4
SPC	1 G	2 G	2G	4G	2G	4G
Gems	10	20	Unlimited	Unlimited	Unlimited	Unlimited
Disk	10G	50G	Unlimited	Unlimited	Unlimited	Unlimited
Development DB	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Production DB	1	2	Unlimited	Unlimited	Unlimited	Unlimited
Tech Support	Community	Community	5 tickets	10 tickets	10 tickets	20 tickets
Price	Free	Free	$1500/yr	$3000/yr	$3000/yr	$6000/yr
Distribution	With Product	Email addr	Sales	Sales	Sales	Sales

Source: http://gemtalksystems.com/index.php/lc-licensing/

Support Models

- Web Support (24 x 7)
  - https://techsupport.gemtalksystems.com
  - Help requests processed 8 am – 5 pm Pacific Time

- Emergency 24 x 7 Support
  - Available for a premium
  - GemTalk provides an emergency phone number
  - Call back to the customer within 15 minutes

- Mailing Lists
  - GLASS – Open source projects: Seaside / GLASS / tODE
  - GemStone Smalltalk – GemStone-specific
  - Sign up at:
    - https://lists.gemtalksystems.com/mailman/listinfo/

Part 3

Roadmap

On Agile Programming…

© Scott Adams, Inc./Dist. by UFS, Inc.

Recent GS/64 Server Releases

- Version 3.7.0
  - ~~August 2023~~ September 2023
- Version 3.7.1
  - February 2024
- Version 3.6.x
  - 3.6.6: May 2023
  - 3.6.7: December 2023

New In Version 3.6

- Support for DARE (Data At Rest Encryption)
  - Optional encryption of database extents and tranlogs
  - Encryption done at the database page level
    - Each page is encrypted individually
  - Encryption Mode: XTS-AES
    - XTS == *XEX-based tweaked-codebook mode with ciphertext stealing*
    - Support for 128 and 256 bit XTS keys
    - XTS is supported by: *BestCrypt, TrueCrypt, VeraCrypt, DiskCryptor, MS Bitlocker, wolfCrypt.*
  - Private key (and passphrase) required to start encrypted GemStone database.

New In Version 3.6

- Support for DARE (Data At Rest Encryption)
  - Encrypt / decrypt via copydbf utility
    - Creating an encrypted database extent:
    ```
    $GEMSTONE/bin/copydbf -e dbCert.pem -s 128 \
    -K /home/normg/certs \
    $GEMSTONE/data/extent0.dbf $GEMSTONE/data/extent0.sdbf
    ```
    - Starting an encrypted database:
    ```
    $GEMSTONE/bin/startstone -D dbPrivateKey.pem \
    -J ~/secrets/passphrase.txt -K /home/normg/keys
    -z $GEMSTONE/data/system.conf normstone
    ```

New In Version 3.6

- Restricted *System >>performOnServer:*
  - If enabled, each UserProfile has a whitelist of permited *performOnServer:* commands.
  - Only commands on the whitelist may be executed.
  - Default whitelist is empty.
  - Example of adding a permitted command (git)

```
|up|
up := AllUsers userWithId: 'normg'.
up addPrivilege: 'NoPerformOnServer' ;
   addPerformOnServerCommands: (Array with: '/usr/bin/git') .
```

New In Version 3.6

- 4 New Special Classes
  - Also known as *immediate objects*
  - Value encoded in the object ID
  - Never occupy disk space
    - SmallDate
    - SmallDateAndTime
    - SmallScaledDecimal
    - SmallTime

New In Version 3.6

- gslist output as JSON:

```
normg@moop>gslist -j
{"GemStoneServers":[
        {
        "Name":"norm",
        "Host":"moop",
        "HostId":"b6f9ea8dee7eca73",
        "Ip":"10.94.141.31",
        "Status":"Exists",
        "Type":"Stone",
        "Version":"3.6.0",
        "Creator":"normg",
        "Started":"2020-09-21T12:44:59.000-07:00",
        "Pid": 7733,
        "Port": 38423, ….
```

New in Version 3.6

- Amazon AWS Customer Master Key (CMK) Support
    - Encrypted data stored in GemStone.
    - Encryption keys managed by AWS.
    - Cloud user controls if/when data is unlocked and accessed.
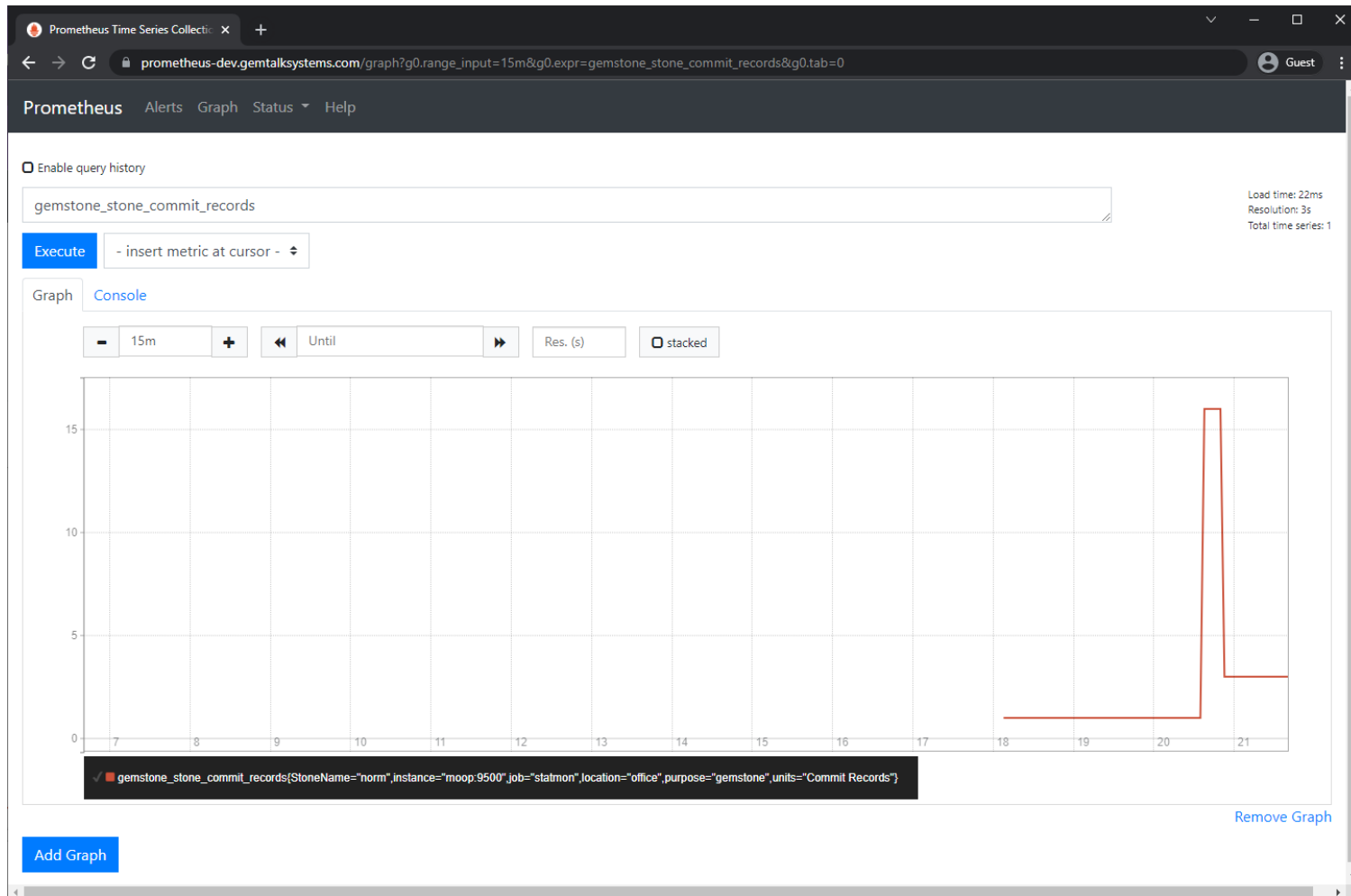
Version 3.7

- Performance, performance, performance!
  - We've made everything faster
    - startstone
    - stopstone
    - markForCollection
    - Backup
    - Restore
    - page reclaim
    - Smalltalk VM (thanks Andres!)

Version 3.7

- Support Monitoring GemStone with Prometheus
  - *"Prometheus is an open-source systems monitoring and alerting toolkit originally built at SoundCloud. Since its inception in 2012, many companies and organizations have adopted Prometheus, and the project has a very active developer and user community. It is now a standalone open source project and maintained independently of any company."* - https://prometheus.io

Prometheus Monitoring Sample

Version 3.7

- Faster Smalltalk VM on x86_64
  - Native code generator optimized by Andres Valloud
  - Reduce number of instructions and number of branches
  - Better branch prediction
  - Average ~35% improvement

Version 3.7

- Microsoft Azure Customer Master Key (CMK) Support
  - Encrypted data stored in GemStone.
  - Encryption keys managed by Azure.

Version 3.7

- Fast Instance Migration
  - Migrate and commit all instances of up to 2000 classes in a single operation.
  - Multi-threaded: uses multiple C threads for speed.
  - Typical Use Case: Add a new instance variable.

Version 3.7

- OpenSSL upgraded from v1.1.1x to version v3.0.x
- ssh Support
  - New Class: GsSshSocket
  - Execute remote commands via ssh
- sftp Support
  - New Classes: GsSftpSocket, GsSftpRemoteFile
  - Upload and download files via sftp

Version 3.7

- Faster Read Streams on Strings
  - New Class: ReadByteStream
  - Optimized for reading String and byte objects.

- String Auto Promotion to Unicode16
  - When a code point greater than 255 is added to a String, it is promoted to Unicode16.

Version 3.7

- New Cryptographic Hash Methods (to play nicer with Pharo…)
  - We can now a hash result as any of:
    - LargeInteger
    - String
    - ByteArray (new)

```
'abc' perform: #sha256Sum
```

-Answers a String of hex digits

```
'abc' perform: #sha256SumBytes
```

-Answers a ByteArray

Version 3.7

- Native Support for *FileSystem*
  - *FileSystem* is now included in the GemStone base image
  - Code ported from Pharo
  - Major Classes
    - *FileReference*
    - *FileSystem*
    - *FileLocator*
    - *FsFileDescriptor*

Version 3.7

- New GsSecureSocket features:
  - GsSecureSocket == GemStone's TLS Socket Interface
  - Pre-shared keys (PSK)
    - Connect using a secret known to both the client and server.
  - Anonymous TLS
    - Encrypted connection with no authentication

Version 3.7

- Customer-defined Special (Immediate) Objects
  - 16 new Immediate classes for use by customers
  - Each instance stores up to 56 bits of customer-defined data
  - Example: Money
    - Currency (4 bits):
      - Euro
      - US$
      - CAN$
      - Yen
    - Amount (52 bits)
      - Answers a Scaled Decimal
    - Example code shipped in:
      - $GEMSTONE/examples/smalltalk/Money.gs

Version 3.7

- ## One-time Passwords
  - Create a temporary password valid for a single login.
  - Password lifetime specified in seconds.
  - Example:

```
GsCurrentSession currentSession
  createOneTimePasswordForUserId: 'NormG'
  validForSeconds: 60
```

Version 3.7

- Rowan – GemStone's New Package Manager
  - Preview Version Only.
  - Talk to Dale

Version 3.7.1

- Native Code Support on Linux ARM64
  - 3.7.0 supports only interpreted mode
- Still More VM improvements on Linux x86_64
  - Thanks Again Andres!
- Bug fixes

Version 3.8 and Beyond…

- Native ROWAN support
  - ROWAN is a new package manager that supports FileTree and Tonel repositories.
  - https://github.com/GemTalk/Rowan

- Pharo Support (Sparkle)
  - *Not* GBS for Pharo
  - Inspectors and debuggers
  - Work In progress.
  - https://github.com/GemTalk/Sparkle
  - No GA date yet.
  - Martin's UK Smalltalk talk: https://vimeo.com/676889959
  - ~~More in Martin McClure's talk Thursday @ 9 am~~

New Open-Source Projects

- Jadite For Pharo
  - Pharo IDE for GemStone Code Development Using Rowan
  - Work in progress, NOT ready for prime-time
  - Talk to Dale
    - **https://github.com/GemTalk/JadeiteForPharo**

New Open-Source Projects

- GemConnect for Postgres
  - 100% Smalltalk code via FFI
  - Requires GemStone/64 v3.6.2 or later
  - Available as open source on github:
    - **https://github.com/GemTalk/GemConnect-for-Postgres**

- GemConnect for RabbitMQ
  - 100% Smalltalk code via FFI
  - Requires GemStone/64 v3.6.4 or later
  - Available as open source on github:
    - **https://github.com/GemTalk/GemConnectForRabbitMQ**

Questions?

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