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## Position Paper

### Goldman Sachs JCP SE/EE Executive Committee Nomination

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Goldman Sachs is a financial services firm built on its global technology enterprise. Technology is not only the largest division at Goldman Sachs, representing more than a quarter of the firm, but over two-thirds of its 8,000 members are application developers. With more than 130 million lines of Java code under management, development at Goldman Sachs is overwhelmingly Java-based, and there are more than 3,000 developers in its Java user group implementing systems which are then leveraged by over 10,000 end-users.

The firm custom-builds most of its software because of the unique technological problems presented by the nature and scale of its businesses; the critical importance of state-of-the-art capacity, latency and resilience; and the need to respond rapidly to clients. Its historical reliance on open source components, as well its extensive multi-vendor relationships, also give it deep experience with problems of interoperability and systems/software integration. As a major consumer of Java, Goldman Sachs is thus deeply invested in its future, and seeks to contribute to Java standards. We remain committed to the continued evolution of Java, both through the innovation of the broad Java community, and the ongoing process of standardization.

Given the importance of technology at Goldman Sachs, the firm has sought to play a supporting and sustaining role through individual and corporate participation in a broad range of industry forums and leadership groups, including:

- Java One, presenting —Java on 40,000 desktops
- Mifos, an initiative of the Grameen Technology Center
- AMQP PMC committee
- Open Group, POSIX standardization
- OpenCompute project
- Great India Developer Summit
- Fedora Project Board
- Various open source projects, including
  - Fitnessse
  - Trove Collections Framework
  - OpenJDK
  - Zookeeper
  - Glibc
  - Elutils
  - Gcc

We believe in Java and the power of the community to evolve this mission critical development platform as such

- Goldman Sachs is an active participant in the JCP EC and several JSR Expert Groups
- The Hong Kong Java User Group, which is run by a member of the firm
- We have hosted Java User Group meet ups in London and New York and are looking to host more globally
- We have open sourced GS Collections, a Lambda-Ready Java Collections Framework
- Our design focus in the framework has been in 3 primary areas:
  - Rich Fluent API that maintains compatibility with the JDK versions 5 – 8
  - Reduced Memory Footprint
  - Increased performance
- GS Collections is hosted @ GitHub
  - <https://github.com/goldmansachs/gs-collections> (the framework)
  - <https://github.com/goldmansachs/gs-collections-kata> (our extensive hands-on training for the framework)
  - <https://github.com/goldmansachs/gs-collections-kata/tree/solutions-java8> (Lambda solutions branch)

As member of the JCP Executive Committee, Goldman Sachs would put particular focus on ways to advance the role of Java in the enterprise, and on furthering cross-vendor integration. Some specific areas of focus include:

**Management Features** – Goldman Sachs deploys thousands of Java-based systems globally. While Java provides facilities to manage single JVM instances, management at the aggregate level — whether for instrumentation, monitoring, alerting or log file management—continues to be a challenge. With run-time information dispersed across these various media, managing applications, diagnosing issues, and problem resolution come at a high cost. From a security perspective, managing the deployment of the Java runtime on the desktop is critical to managing operational risk, and continues to be a challenge for larger deployment bases. Any improvement in the management space would result in practical benefits and time-cost savings to any organization.

**Parallel Processing** – With the explosion of multi-core systems, our ability to take advantage of the compute power of modern hardware has become dependent on our ability as developers to write code effectively in a multi-threaded paradigm. The Java language is uniquely able to help developers exploit those capabilities through language constructs and libraries that allow developers to write efficient and testable parallel algorithms. While the existing language constructs go a long way in achieving these goals, there are still opportunities to build upon and extend these constructs.

**Serialization** – Goldman Sachs uses serialization of objects extensively to store historical state. Given the increasingly parallel nature of the CPU, serialization quickly becomes a limitation, due to its single-threaded nature. Improving the performance of serialization through compression, parallelization, and/or other techniques could represent a significant savings in compute, transport, and storage.

**Cloud / Dynamic Computing** – As enterprise computing moves away from static models of deployment and delivery into significantly more dynamic computing paradigms, we see that the distributed nature

of the cloud depends very much on fast, globally available metadata; flexible, well performing software; and the ability to abstract away from traditional infrastructure methodology. Java is in the unique position of being the —language of the cloud. Further extension in this direction will be of benefit to any large-scale infrastructure provider.

**Security** – Goldman Sachs maintains a keen focus on managing technology risk and protecting sensitive data. Areas of focus relevant to this discipline include authentication and authorization capabilities; cryptographic functionality; trust models and integrity of trust boundaries; and the ability to maintain security qualities in distributed/aggregated systems. Availability of standardized security protocol implementations and integration with Windows and \*nix infrastructures is essential to secure application development and enterprise integration.