WHITE PAPER

Enterprise Imaging

Why Java ?

AGFA HealthCare

Technical foundation for the Enterprise Imaging platform

1. Introduction

When building a pioneering healthcare application for the 21st century, choosing the ideal technical foundation for the system is a major architectural decision. This white paper describes the motivations and rationales for building the Enterprise Imaging solution on the Java platform.

2. Java's position in the software industry

The monthly *TIOBE Programming Community Index* is a frequently quoted source indicating the popularity of various programming languages. Survey results from August 2011 are found in Table 1. In terms of the index rankings published over the last decade, the success of the Java platform in the software industry is striking: Java has continuously maintained the top position since 2006; looking over the past 10 years, it has always been in the top two.

Table 1: TIOBE Programming Community Index – survey results August 2011

Position Aug 2011	Position Aug 2010	Change in position	Programming Language	Ratings Aug 2011	Change from Aug 2010
1	1	+0	Java	19.409%	+1.42%
2	2	+0	C	17.390%	-0.48%
3	3	+0	C++	8.433%	-1.23%
4	4	+0	PHP	6.134%	-3.05%
5	6	+1	C#	6.042%	+1.06%
6	9	+3	Objective-C	5.494%	+2.34%
7	5	-2	(Visual) Basic	5.013%	-0.40%
8	7	-1	Python	3.415%	-0.81%
9	8	-1	Perl	2.315%	-1.11%
10	11	+1	JavaScript	1.557%	-0.84%

These statistics highlight Java's position as the most adopted programming platform in the software industry. For the R&D team, it was therefore a logical decision to build the new global healthcare solution on this remarkable, strongly performing platform.

3. Intrinsic technical features of Java

Java was officially introduced in 1995, and has evolved from a groundbreaking programming environment into a mature software ecosystem that encompasses support for nearly all domains and aspects of modern software development. The Enterprise Imaging platform has benefitted from this broad platform foundation on all levels.
Java technology provides all the features necessary to tackle the extensive and complex challenges of realizing modern healthcare applications. On the one hand, the intrinsic language features and the superior platform concepts make it a very productive environment. Its object-oriented nature, its automatic memory management by Garbage Collection, its sophisticated support for multi-threading, etc., all boost development efficiency. Overall, it seems unlikely that Enterprise Imaging platform could have been built in the same timeframe using a native language like C++.

At the same time, the Java platform provides technical answers to critical non-functional requirements. The use of managed code and the Checked-Exceptions mechanism both contribute to the high reliability required by Agfa HealthCare. These techniques also improve general system stability and robustness.

Ever since Java was introduced, its platform independence has been the most highlighted technical argument for using it. The practical advantages of this become obvious when comparing it to other platforms - for example Microsoft's .NET platform - which have since adopted the same concept. Still, Java remains unique in the number and diversity of execution environments that it is able to run in. When we compare Java and .NET, we see that Java runs on a variety of operating systems, including Microsoft Windows, The Open Group's UNIX derivatives, Google Android, etc., while .NET is primarily bound to Microsoft Windows.

As new categories of computing devices increase operating system fragmentation, the significance of this independence will increase further. This is especially the case for the market of mobile devices - smartphones, tablets, etc. - which represent interesting future target platforms for the Enterprise Imaging solution. The same holds true for heterogeneous server-side environments that will be introduced mainly through new virtualization concepts and cloud computing in the near future. In all these cases, Java will be the key enabler for conquering new platforms at the minimized cost required for adaptation.

At one time, Java suffered from a reputation for slow execution times compared to natively compiled languages like C. Just-In-Time compilation and other advanced runtime techniques now found in all Java Virtual Machines make this claim obsolete. Figure 1 displays the results from a performance study done at the University of

Copenhagen, showing that Java can match the speed of C# for common use cases. Of course, the definitive evidence comes from the high performance of the Enterprise Imaging platform on both the server-side and the client-side.

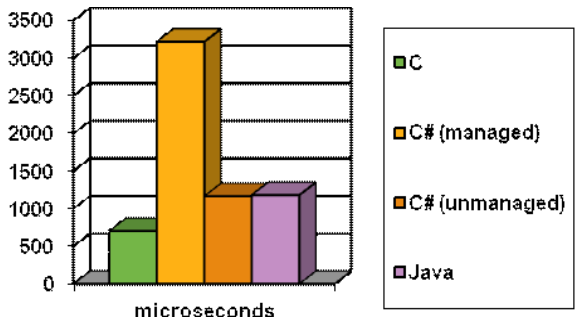

Figure 1: Results from a performance study at the University of Copenhagen

4. The mature Java ecosystem

The availability of numerous third-party Java modules and libraries from other vendors and community projects has enabled Agfa HealthCare to build the system architecture on industry-proven, standardized components. Furthermore, the reliance on widespread and robust third-party components enhances the system stability and significantly reduced development time and budget. By embedding community software components, the core solution is based on a cost-effective software stack. This allows Agfa HealthCare to offer customers attractive Enterprise Imaging licensing options.

The Enterprise Imaging core of the client is built on top of the Eclipse™ OSGi[1] plug-in framework. OSGi defines the frame for building an extendable architecture that can be tailored to specific market and customer needs. The sophisticated integration possibilities are particularly important in the face of the lack of a single provider that can fulfill all the requirements of a global healthcare market. The OSGi core of Enterprise Imaging enables first-class, seamless integration scenarios with other vendors. Currently, there is no plug-in framework outside the Java world that can match the strengths of the Eclipse OSGi implementation.

In addition to the integration of existing components, the Enterprise Imaging platform takes advantage of advanced Java technologies for various project levels and development aspects. Here are just a few examples highlighting some important

[1] OSGi = Open Services Gateway initiative

applications used within the project: the Eclipse integrated development environment (IDE) represents a fully Java-based tool-chain that covers all software development steps, thereby allowing development workflow to occur in a highly integrated and flexible manner. Furthermore, the deployed build system, the solution-testing framework and many other critical Application Lifecycle Management applications are Java-powered. This strong foundation allowed Agfa HealthCare to implement an efficient, seamless and cost-effective process that plays a key role in the successful development of an advanced global healthcare solution.

5. Java's favorable future

The continuing development and evolution of the Java platform is officially accompanied by the Java Community Process (JCP), a steering process that controls the development of standards for new Java technologies. This open initiative aims at achieving a broad technical consensus that is backed by important corporate players. The joint nature of the process ensures that various stakeholders can contribute, while efficiently preventing domination by a single company. The acknowledged structure and role of the JCP strengthens the future stability of Java for three main reasons:

Firstly, a solo technical effort by a major company is unlikely, minimizing the risk of vendor-lock in when using the Java platform.

Secondly, the participation of many stakeholders drives the incorporation of new technologies and scientific progress from all domains of software engineering, in a timely manner.

Thirdly, technological backward-compatibility can be safely assumed for the long term, as many stakeholders have built long-lived solutions and products based on Java. The significant investments made by many companies turn the assumption that Java will be a dynamic and relevant software platform in the foreseeable future into a safe bet.

6. Strategic arguments for using Java

The adoption of Java offers numerous key benefits for the Enterprise Imaging on the project level, and for Agfa HealthCare from a corporate strategy perspective. The fact that Java is an established standard in the software industry, as well as in the domains of academic education and research, opens up clear possibilities for human resource hiring. Java developers and experts with all levels of professionalism and expertise can be found globally. This available pool of talent ensures as well that the future evolution of the Enterprise Imaging platform will be driven by highly talented individuals with excellent experience in the field of Java development.

Related readings

- TIOBE Programming Community Index: www.tiobe.com/content/paperinfo/tpci/index.html
- Java SE Performance White Paper: http://java.sun.com/performance/reference/whitepapers/6_performance.html
- Java Performance: www.dina.kvl.dk/~sestoft/papers/performance.pdf
- About the OSGi Service Platform – Technical White Paper : www.osgi.org/wiki/uploads/Links/OSGiTechnicalWhitePaper.pdf
- Java Community Process: http://jcp.org

Agfa HealthCare, a member of the Agfa-Gevaert Group, is a leading global provider of diagnostic imaging and healthcare IT solutions. The company has nearly a century of healthcare experience and has been a pioneer on the healthcare IT market since the early 1990's. Today Agfa HealthCare designs, develops and delivers state-of-the-art systems for capturing, managing and processing diagnostic images and clinical/administrative information for hospitals and healthcare facilities, as well as contrast media solutions to enable effective medical imaging results.

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