Motorola (NYSE:MOT) is a Fortune 100 global communications leader that provides seamless mobility products and solutions across broadband, embedded systems and wireless networks. In your home, auto, workplace and all spaces in between, seamless mobility means you can reach the people, things and information you need, anywhere, anytime. Seamless mobility harnesses the power of technology convergence and enables smarter, faster, cost-effective and flexible communication.

The Mobile Devices business offers market-changing icons of personal technology – transforming the device formerly known as the cell phone into a universal remote control for life. A leader in multi-mode, multi-band communications products and technologies, Mobile Devices designs, manufactures, sells and services wireless subscriber and server equipment for cellular systems, portable energy storage products and systems, servers and software solutions and related software and accessory products. Motorola’s Integrated Digital Enhanced Network (iDEN™) brought to the market next generation wireless solutions designed for a variety of vertical market mobile business applications. iDEN technology is a highly innovative, cutting-edge system of technologies developed by Motorola to create an ideal, complete wireless communications system for today’s fast-paced, busy lifestyle. Advanced capabilities bring together the features of dispatch radio, full-duplex telephone interconnect, short messaging service and data transmission.

**Defining iDEN Mobile Device’s Challenges**

As a worldwide organization, Motorola continually strives for improvement in the quality of its products. In 2005, Motorola took quality initiatives a step further by mandating a corporate goal to reduce – by three times – the number of external software failures in their devices. One way Motorola measured the rate of reduction in failures was to track the amount of time and rework needed to address these failures by support staff.

Motorola’s goal was to remove as many defects as possible at the earliest possible stage. In order to illustrate how Motorola iDEN Mobile Devices would achieve this goal requires understanding some of the specific challenges facing Motorola’s global development teams:

**On-going increases in code size and complexity**

It is essential for iDEN Mobile Devices to address the challenges that come with an exponential increase in the code used in handheld devices as they define and create the world of seamless mobility. Games, Java applications and more complex user applications increase the complexity of the software itself. With new platforms, iDEN developers must adjust to multiple protocols.
Integrating external code
In addition to the growing code requirements of these applications, iDEN Mobile Devices has multiple suppliers who provide source code, libraries and binaries to build their mobile devices. Ensuring the support and quality of third-party applications, multiple platforms and multiple development languages (Linux, Java, Windows, C/C++) across the globe is a challenge.

Time to market pressure
In the global market, organizations are competing to have faster, better, smarter and cheaper devices. To meet these demands effectively while continuing to innovate creates added pressure on developers, and time to market is extremely important, especially in the quickly developing industrial nations. Klocwork® is able to aid these developers in creating quality source code so they can focus on innovation.

Shrinking development cycles
The cycle times for these initiatives can vary depending on the complexity of the software and the size of the project. While creation of new platforms can take up to a few years, development of derivative products can be done in weeks.

Improve and expand QA programs
iDEN Mobile Devices’ existing quality assurance programs were effective, but the costs associated with fixing defects discovered at that stage were significantly higher. The risk of defects “escaping” to the customer was also higher when defects were found later. The solution: reduce the number of defects in the code base – thereby reducing the number of software failures in the field.

Measure Software Quality
An additional requirement was to be able to track defects between product releases. This would give the development teams the ability to measure the quality of their product releases.

The Solution
To address these challenges iDEN Mobile Devices searched for a solution that could help developers and software programmers find defects within the organization’s code. When selecting the solution to implement, iDEN looked at which tool suite had the most accurate and efficient findings, as defined by functionality and coverage type. It was also critical that the solution be able to easily integrate into the development environment – spanning multiple teams in multiple geographies.

iDEN Mobile Devices turned to Klocwork’s development suite because other teams within the organization had already used it with much success. In addition to the proven performance, iDEN tested Klocwork’s tools in a “real-world” validation process. The test was based on an actual external problem that existed for iDEN Mobile Devices, and the tools were able to identify the problem with no difficulties.

In short, Klocwork won over competing software quality assurance tools because of proven success within other Motorola groups, the ability to report the most effective findings – as defined by functionality, the type of defects found, and demonstrated value – Klocwork’s tools correctly identified known defects in validation process. An additional benefit was the ability to simultaneously identify both software quality and software security issues.

The iDEN Mobile Devices group initiated usage of Klocwork’s toolset in September 2004. The immediate area addressed was the implementation of automated defect detection prior to code inspections, and verification prior to ship acceptance. The Process and Tools team implemented software process changes and deployed the Klocwork application into the software build environment so the tool was easy to use for end-users and developers.
All software engineers were trained on-site by Klocwork and Motorola trainers in both the tool and process changes. This expedited the learning curve by having hands-on lab exercises of the engineer’s environment and questions on usage and tools answered by knowledgeable resources.

The deployment of the defect detection was expanded to iDEN’s remote development sites in Asia, Australia and Israel in early 2005. Remote servers were set up to provide capacity and faster access. Local administrators in the remote sites were identified and trained. This distributed environment around the globe included more than 1,000 engineers.

A team was formed to define the use model prior to the implementation of the Klocwork toolset. This team remained active to assist during the global deployment to resolve any user issues. Klocwork’s defect detection is currently used on 100% of all products developed by iDEN. There are strict requirements for code inspections and shipping acceptance criteria that must be met, prior to signoff for all products – including maintenance releases.

**Results**

In Motorola’s continuous process improvement paradigm, the iDEN Mobile Devices software team implemented several process and tools in 2005 – the combination of which has led to significant cost reductions and quality improvements. The Klocwork tool suite was a major contributor to achieving the quality results identified in this case study.

At the end of 2005 the iDEN Mobile Devices software community realized the following quality benefits:

- **2X improvement** in customer reported defects at alpha-beta
- **3X improvement** in Customer Reported Unique Defects (CRUD, an external metric)
- **1.2X reduction** in Non-traditional Software CoPQ

These results earned the iDEN Mobile Devices group the highest achievement in quality performance award for 2005, the Motorola CEO Quality Award, because of the significant and sustainable performance improvements that directly and positively affect our customers as well as our bottom line.

Using tools like Klocwork’s directly improves software quality, allowing our software developers to spend more time creating applications versus fixing application defects. This has proven to be highly beneficial to Motorola iDEN because it helps us focus on the strategic value of our products to our customers.

By utilizing the Klocwork application early in the software development lifecycle, at the time the code is created and prior to any code inspection, potential software errors are more easily detected and the cost associated with fixing the errors is significantly reduced.

Further drill down of the data highlighted that there was a 1.6 fold improvement in Defect Leakage for Coding phase of the software development lifecycle, while experiencing a 3X growth in the delta KAELOC code size. This directly correlates to the impact of implementing Klocwork tools and process changes.

The number of defects found at System Test was reduced by 2 fold in the first year that Klocwork’s tools were implemented.
Future Work with Klocwork

iDEN Mobile Devices continues to monitor and fine-tune the implementation of Klocwork tools to provide quality software products to Motorola’s customers.

Motorola as a corporation has recognized the value of Klocwork’s static code analysis and has purchased an enterprise license agreement with the company, naming Klocwork a Motorola Preferred Supplier. Motorola is actively working to share best practices across development organizations through the use of multi-division teams.

“The process definition and executive support from the Klocwork partnership was key to the success of iDEN’s quality initiative,” said Farideh Gozleveli, Motorola.

“Klocwork was an essential part of the solution. Klocwork came onsite and helped with the entire implementation process. The relationship is a partnership - Klocwork understood the environment and challenges we were facing. If that didn’t happen, this initiative wouldn’t have been successful,” said Soili Lehrer, Motorola.

About Klocwork

Klocwork® helps developers create more secure and reliable software. Our tools analyze source code on-the-fly, simplify peer code reviews and extend the life of complex software. Over 1000 customers, including the biggest brands in the mobile device, consumer electronics, medical technologies, telecom, automotive, military and aerospace sectors, have made Klocwork part of their software development process. Tens of thousands of software developers, architects and development managers rely on our tools everyday to improve their productivity while creating better software.