

The Fine Art of Mobile Testing

Why most companies are behind the curve on mobile testing and how they can move into the lead



Business Critical Mobility

Mobile has become a game-changer across virtually all industries. Organizations around the world now drive significant value through providing continuous access to services, anytime and anywhere - to millions of customers and thousands of employees over an astonishing array of devices.

Companies, public bodies, and other organizations report that mobile entities, such as apps and responsive web sites, (those that optimize viewing and navigation across a wide range of devices) account for their fastest growth in terms of number of interactions and transactions. Many media companies report that their services are now accessed more frequently through mobile devices than through PCs. Similarly, travel companies report that ticket sales through apps and transactional-based websites are on an astonishingly rapid growth curve with sales through mobile apps accounting for an increasing proportion of their revenues every month.

In many respects, mobile solutions are following in the footsteps of the Web. It may be helpful for our current understanding of mobile solutions to compare how the two fields have developed.

In the early days of the Web, companies were experimenting and discovering. Quickly, static home pages became highly dynamic platforms for rich media and engaging experiences. The Web brought both core business processes and new business models online. Mobile solutions are taking a similar path: after a brief period of experimentation in a new business development channel they are becoming increasingly business critical.

Let's first take a look at how different aspects of the Web have developed over time (Figure 1)

As you can see, there are three phases through which web solution aspects have passed:

- **Discovery** – This is when the market is experimenting in and discovering the channel. Static home pages with addresses to physical office locations, simple marketing brochures and perhaps an e-mail address for contacts

were the norm. There was little or no IT-impact and few companies had a structured approach to quality assurance and testing online resources.

- **Support core business** – The Web grew in importance and began supporting companies' and organizations' core business processes. The solutions at first supported only a limited dynamic user interaction on both internal intranet sites and external sites. Sales and marketing teams were the primary business drivers, with IT support often consisting of inefficient and siloed system integration solutions. Quality assurance happened occasionally, if at all, and without a clear structure. Lack of experience, methods and tools were issues that kept quality on a typical "it works if we're lucky" level.
- **Drive new business** – Today, web solutions are not only business critical but core enablers of new business opportunities. Online experiences are engaging and transactional in nature. Community and social media elements are now included as integral, natural parts of solutions. Most successful companies in all sectors have already integrated online into their core products and services. Through the emerging Responsive Web Design (RWD) trend, the Web is quickly becoming "mobile first", which means that new online services created now are designed primarily for mobile users first. The entire organization is engaged in the planning and design of web solutions now, including Product Development, Service and HR. IT departments have learned to support new solutions using highly scalable, cloud-enabled and service-oriented architectures. Quality assurance measures have matured and are supported by a wealth of expertise, methods, experience and tooling. Common quality assurance challenges still include addressing distributed solutions, usability, different types of browsers and security.

The same phases and aspects are as relevant for mobile solutions as for web solutions (Figure 2):

- **Discovery** – For the past few years, the market has been discovering and experimenting in the mobile channel. Simple and narrowly scoped apps for branding purposes were initiated most often by marketing departments. The

Figure 1: Phase Progression of Web Solution Aspects

		Phases		
		Discovery	Support core business	Drive new business
Solution Aspects	Functional Scope	Static home pages	Limited dynamic support for user interaction	Engaging online experiences, internal and external, highly transactional, community building, social media integrated, mobile supported through responsive web design
	Organization	Marketing	Sales and Marketing	Sales, Marketing, Product Development, Service, HR and IT
	IT impact	N/A	Limited siloed system integration	Service-oriented architecture, Cloud-supported scalability, mature security implementations
	Quality Assurance	N/A	Occasional and unstructured, no tools	Integrated, structured and methodological, strong tooling
	Quality Assurance Issues	N/A	Lack of experience, methods and tools. Labor intensive manual testing	Complexities of componentized and distributed solutions, usability, browsers, and security

Figure 2: Phase Progression of Mobile Solution Aspects

		Phases		
		Discovery	Support core business	Drive new business
Solution Aspects	Functional Scope	Disconnected apps	Limited dynamic support for user interaction	Engaging mobile experiences, internal and external, highly transactional, community building, social media integrated, optimized for reach and platform
	Organization	Marketing	Sales and Marketing	Sales, Marketing, Product Development, Service, HR and IT
	IT impact	N/A	Limited dynamic support for user interaction	Service-oriented architecture, cloud-supported scalability, mature security implementations
	Quality Assurance	N/A	Occasional and unstructured, no tools	Integrated, structured and methodological, strong tooling
	Quality Assurance Issues	N/A	Lack of experience, methods and tools. Labor intensive manual testing	Complexities of componentized and distributed solutions, usability, platforms, screen sizes, and security

impact on IT was minor and few companies applied a structured approach to mobile testing.

- Support core business** – Just as with web solutions, mobile solutions has grown in importance and now supports companies’ and organizations’ core business processes. The simple, disconnected early apps evolved into transactional apps, which enable the user to sign in, manage accounts, and buy (and even sell) products and services. Internal apps for field service, sales support and decision support through various business intelligence solutions were and are being built to accelerate internal processes and reduce costs. While inefficient, siloed system integration solutions are still common, more often mobile solutions are being designed to reuse existing investments in service-oriented architectures that were first built to support web solutions. The latest research published in the World Quality Report, 2012-2013¹ indicates that quality assurance and mobile testing only happen occasionally and without a clear structure. We find that the primary reasons are lack of experience, lack of devices, and lack of tools.
- Drive new business** – As mobile solutions mature they are increasingly core enablers of new business opportunities. The most successful apps and responsive webs are engaging and highly transactional in nature. Just as with the Web, community and social media integration are natural solution elements. Some companies have developed a business-driven mobile strategy that involves all parts of the organization. Mobile testing is on its way to maturity as testing experts learn new methods and are enabled with more sophisticated devices and tools.

Mobile Testing Challenges

Just as mobility in general has followed in the footsteps of the Web, mobile testing is following along the same path as web testing. The two share many drivers but there are some areas of mobile testing that are distinctly more challenging and

require particular attention. They are:

- Platform Fragmentation
- The Mobile Device’s Physical Characteristics
- User Experience
- Performance
- Security
- System Integration
- Managing App Distribution.

Platform Fragmentation

The most pressing and obvious mobile testing challenge is ensuring quality across the ever-increasing range of device types.

Arguably, there are at least three relevant smartphone and tablet operating system platforms which mobile solutions need to support: Google’s Android (with the largest market share), Apple’s iOS (second largest and with the user base which is the most active in downloading, buying and using apps), and Microsoft’s Windows 8/Windows Phone.

Each platform has its own set of characteristics, from user experience and user interface to technology frameworks, app distribution, and execution models:

- Google Android** is a popular platform among many smartphone makers, which makes it an especially fragmented platform. Android has several major versions corresponding to even more Application Programming Interface (API) sets. There can be hundreds of different Android devices in an installed base at any given time and location.
- Apple iOS** runs in iPhones, iPod Touches, iPads and iPad Minis. There is a strong platform consistency across iOS devices, but there are significant differences in device sizes, screen resolutions, camera resolutions, and so on. The iOS user base is typically quick to adopt new versions of the operating system, which means no more than three versions of the operating system, including the latest, will likely need to be supported to address most target markets.

¹ World Quality Report 2012-13 contains analysis and commentary based on data collected from 1,553 in-depth interviews with organizations in 25 countries. The report can be downloaded in full at <http://www.capgemini.com/wqr2012>

- Microsoft Windows 8 and Windows Phone** are becoming increasingly popular and are standouts from the user experience and user interface perspectives. The platform looks and works differently than Apple's iOS and Google's Android, which look and feel more similar to each other. The platform is licensed to smartphone and tablet makers, such as Nokia just as Google licenses Android to Samsung and HTC. The fragmentation challenge is fortunately not as significant as with Android, due to Microsoft's stricter hardware design guidelines.

If you want to accommodate a majority of users in any given market, you will need to support hundreds of different types of smartphone and tablets, running on several different versions of the operating systems. Since developers have no control over when new operating system versions are made available to users or whether users will upgrade, it is common for new releases to supplant existing applications.

To perform mobile testing across a wide range of device types and platforms means executing both automated and non-automated tests on emulators and on physical devices, both those directly available and those running in the Cloud. There are several firms that provide software tools for mobile device testing in the market today, including Perfecto Mobile, Keynote DeviceAnywhere, and Bitbar TestDroid, that enable mobile testing for devices hosted in private and public clouds.

Test automation is seen by those in the mobile testing field as either the panacea for everything or not even worth the effort. Test automation is a very valuable tool in mobile testing and in solving the problem of platform fragmentation, but always as an addition to manual testing. Test execution automation has a more prominent role in mobile testing than in other fields of testing because an automated regression test set for mobile can be used much more frequently.

In a non-mobile testing project, testing automation starts with an investment in tooling, in devices, in time spent setting up test script architecture and, of course, in automating of the test scripts themselves. This investment is returned in subsequent releases through shorter test times and/or higher product quality. With each release, more of the investment is recouped until the full return on investment is reached (Figure 3).

In mobile testing, however, the test set is used more frequently since a number of different devices are involved. It's mainly used to check if all things that used to work in the past on the different devices are still working in the present (Figure 4).

Because the test set has a greater use, the return on investment of a mobile test set increases much faster (Figure 5).

But even greater use does not make automated testing a replacement for manual testing. Test automation is mostly used for regression testing – for instance, a test that runs overnight on all devices to make sure all the changes that have been made in the software haven't caused any regression errors. Automating the regression test frees testers from these often repetitious and tedious tasks to work on more complicated test cases, like those that have to do with Mobile Device Physical Characteristics (see below). In most cases, this leads to higher product quality because time is

Figure 3: ROI of test automation is earned back over subsequent releases

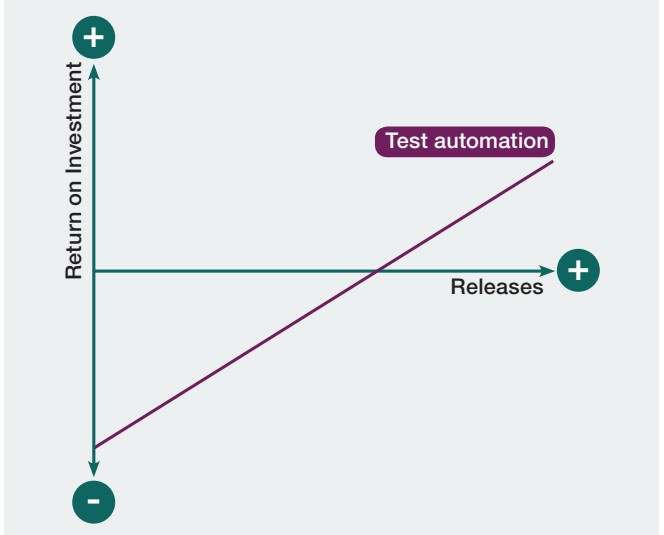


Figure 4: In mobile test projects there is another axis – devices on which the test set is used

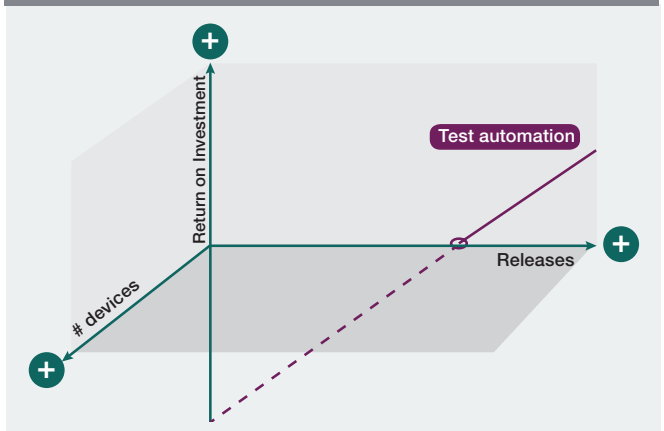
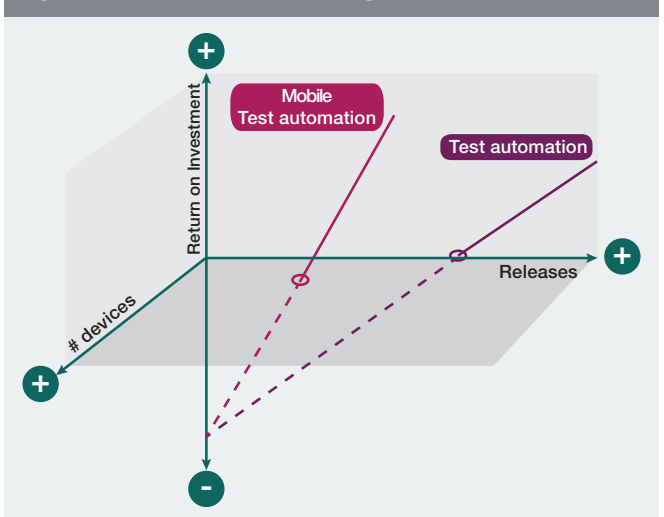


Figure 5: More frequent usage means quicker ROI



spend more efficiently. Test automation applied in this way leads to project flexibility as well – since regression testing can be performed so regularly it becomes less risky to make changes in the software. This works especially well in agile projects where it helps to increase the project velocity.

The Mobile Device's Physical Characteristics

The number of device types running multiple operating systems is growing at an incredible rate. With every new generation of smartphones we see an increasing number of physical sensors and abilities, each adding more complexity to mobile testing.

The following characteristics need to be addressed:

- **Means of communication** – Smartphones use a wide range of communication channels. In addition to the GSM standard there are Wi-Fi, Bluetooth, NFC, USB, and others. The capability to handle these different channels is impacted by communication technology, context of use, and device features. Since mobile solutions often require connectivity, deep verification of the mobile solution against each means of communication is strongly recommended.
- **Different screen sizes** – Smartphones come in many sizes and the line between them and tablets is blurring. The smallest tablets are now the same size as the largest smartphones. Making sure that applications run on all relevant screen sizes and resolutions is an important aspect of mobile testing.
- **Touch and gestures** – Designing for touch is central to most mobile applications. Testing for different types of touch and gestures, such as swiping and pinching, and even touching with two and more fingers at the same time are relevant test scenarios.
- **Orientation** – Many mobile applications provide different types of user interfaces depending on whether the device is held in portrait/vertical or in landscape/horizontal. Verifying application behavior as orientation changes is important.
- **Camera** – The majority of mobile devices now have built-in cameras. Photo-related features are common, even in what are considered to be enterprise types of applications. Since camera integration often works differently across devices, how the camera works with the mobile solution that is being tested is an important consideration.
- **Location** – Most mobile devices have built-in GPS and many applications are designed to take advantage of location information. Some features may only be available when the user is near a certain place or object, an especially difficult challenge for mobile testers who are not able to physically be at that location. To ensure relevant mobile results requires testing the GPS integration and being able to simulate locations and location changes.

While many of these physical characteristics can be tested in automated frameworks (even location can be simulated), some features, like multi-touch and the synchronization of gestures and sounds, can be more challenging. It is important to identify the most relevant target platforms early in the testing effort and plan for extensive manual testing where this is the only option.

User Experience

With the increasing popularity of mobile applications comes an increased importance of usability. User experience and user interface experts are key to any mobile development and testing effort. The most efficient way to handle usability testing is to start it early in the process, with application sketching and prototyping.

Key aspects of mobile usability testing include:

- **User interaction** – How features are presented and used must have an intuitive and natural flow, allowing the user to complete tasks with as few taps and gestures as possible.
- **Navigation** – Features need to be easy to find and navigation should adhere to platform guidelines and be designed following best practices for each platform.
- **Signup and login** – The first impression is the most important. Design of signup and login is critical. A failed design will lead to lost usage and lost users.
- **Layout and user interface design** – Validating look and feel is as important as precision in layout and user interface design. With tens of thousands of new apps introduced every week, it's no longer enough to address functional needs. Aesthetics must be addressed as well.
- **Exception handling** – Errors do occur in solutions, especially when so many components need to work together and be integrated. It is important that the user be kept informed of issues in a timely, accurate, and friendly manner.

Mobile solutions, both apps and responsive webs have to deliver a high level of quality user experience. Most users have a different, more intimate relationship with their mobile devices than they do with their computer. The mobile device is always with them, they show it and the apps they like to their friends. This can even be described as an “emotional” attachment.

Usability testing has elements of both subjective and objective analysis. This means there needs to be a flexible and dynamic approach to managing defect reports. Being up to date on platform rules and guidelines, market best practices and being open-minded about new ways to design are all important elements. It is important to know what leaders like Josh Clark, author of the book “Tapworthy” and Luke Wroblewski, author of several books, including “Mobile First”, are saying about usability, user experience, and user interface design.

Performance

A natural consequence of being able to access mobile solutions from everywhere at any time is that people are using them more often. For example, bank customers used to receive their statements monthly. Now, people are using mobile apps to check their bank accounts much more often, even several times a day. This translates into an increased workload on the solution's back end. Also, cellular networks rarely perform as well as fixed networks. This is not just a matter of bandwidth, which varies significantly depending on network generation (2G, 3G, 3.5G, 4G), but also of latency and frequent data communication errors. These network

issues are putting additional loads on IT systems in ways for which they were not designed and it often impacts their overall performance. A very small change in server balance can drastically degrade performance, not just for the mobile users, but for all users.

Performance testing is an end-to-end proposition that can be divided into three main areas:

- **Network capabilities** – Cellular networks are nondeterministic and exhibit wide variations in bandwidth and jitter. This means that users in different locations accessing services through different operators can experience vastly different application performance. All users of a solution, including non-mobile users, are at risk of poor performance as the rate of mobile usage increases because the average transaction life span is increased, which puts the back end under more pressure. Identifying relevant test scenarios and being able to execute these tests are important in order to appropriately measure and optimize situations.
- **System integration and back end layers** – Regardless of the mobile component, it's important to carry out performance and scalability testing through all system integration and back end layers. Performance bottlenecks are often identified in these layers and any capabilities and resources a test organization already has acquired there will be crucial in validating mobile solution end-to-end performance.
- **The app itself** – App installation, first time launch, subsequent launches, population of data, integration performance between apps and sensors, including camera and GPS, and overall responsiveness of the user interface are all relevant app performance indicators.

Most performance, load, and stress test tools that work for testing back end systems on web solutions are also relevant for mobile testing. However, for simulating a number of users on any type of network, you'll need to add more tools to your testing toolbox. Shunra and Neotys are two such highly relevant tools.

If your mobile solution is distributed through an app store, you should keep in mind that one of the most common reasons why apps are rated poorly is because of performance issues. If your app doesn't meet the most basic criteria - the right function running at the right performance – you risk losing usage and users.

Security

Mobility has opened up new security challenges for IT and Risk Management/Compliance departments. Increased access to systems and increased openness always need to be balanced against the right levels of security. Also, since mobile devices are small, they are more easily forgotten, lost or stolen, which makes it even more important to protect stored information and functionality. But instead of making security a show stopper for mobility, it is essential to assess the risks and available solutions rationally.

In some cases, your own employees can be a part of the challenge. Workers are incorporating both personal mobile

devices (Bring Your Own Devices policy) and corporate ones (fleet policy) into the workplace. Given this scenario, how do you ensure that enterprise mobile apps will not be impacted by apps installed by end-users? How do you deploy security policies with devices that belong to employees and not to the enterprise? How can you be sure applications will not be compromised by other installed applications? How can you be sure that mobile solutions and devices are not opening a security breach in your IT managed environment?

The following IT security aspects need to be taken into consideration in a mobile testing effort:

- **Mobile Device Management (MDM)** – For internal solutions, are you using market-leading MDM solutions?
- **Confidentiality** – Does the app keep your user data private?
- **Integrity** – Can the data coming to and from the app be trusted and verified?
- **Authentication** – Does the app verify the user's identity to an appropriate degree of certainty?
- **Authorization** – Does the app properly limit user privileges?
- **Availability** – Can an attacker compromise the solution in any way?
- **Non-Repudiation** – Does your app keep records of events?

This is a simple but thorough checklist. In test planning both problems and test measures need to be clearly defined. For internal solutions SAP Afaria, MobileIron, and AirWatch all provide a set of tools and platforms relevant to mobile security.

System Integration

Before mobility was commonplace, IT could more easily protect its enterprise's computing assets within a well-protected environment. The IT department controlled who could access what information by using secured software executed on controlled and identified computers.

The era of this closed IT environment is over.

To design a successful and integrated mobile solution, organizations need to make information available that, up until now, has been locked inside their back end applications. Think, as examples, of travel booking companies sharing travel information through a mobile application or banks enabling their clients to access their account information through an app. These are new kinds of challenges for many companies. Is the back end set up for this? Will the legacy processes interfere with the mobile-related ones that need to be developed?

Today's ERP solutions consist of complex end-to-end processes supported by a wide range of technologies. Mobile solutions are considered a must-have part of the overall process, especially in terms of how enterprises communicate with employees and customers. Legacy systems should be tested along with the mobile solutions to ensure that they have the capacity to deliver services as usual. In some cases, an unintended consequence of mobile solutions integration could mean degradation of service response time and service performance.

Planning and executing system integration testing as part of mobile testing efforts often consume the largest share of resources. It's important to plan accordingly.

Managing App Distribution

Most app distribution is managed through open and public app stores. Each app store, including Apple's App Store, Google's Play and Microsoft's Store, has its own set of guidelines that apps need to adhere to before they can be accepted into the store.

Reasons for rejection may include the following:

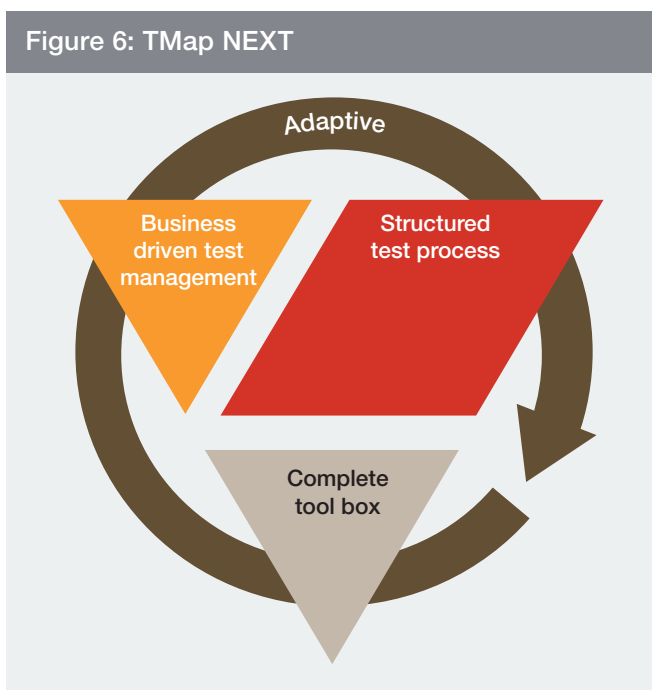
- If the app crashes
- If the app contains hidden functionality
- If the app duplicates apps already in the app store
- If the app collects location information or uses push notifications without the user's consent
- If the app does not comply with terms and conditions explained in the interface guidelines provided by the platform maker.

App store guidelines are frequently updated and it's important to stay current on any changes in terms and conditions so that relevant mobile testing can validate adherence to the rules.

How we can help overcome the challenges

Capgemini and Sogeti offer mobile testing methodologies and solutions to ensure that the intended business value is delivered by the appropriate mobile solution. We offer five fine-tuned mobile testing services supported by our proven and industry-recognized testing approach, TMap NEXT®, and our adaptation for mobile testing, TMap NEXT for Mobile, as well as special services for mobile testing.

TMap NEXT for Mobile



While TMap was around before mobile phones, its principles directly apply to mobile testing. The four essentials of TMap NEXT still offer the same or more value (Figure 6):

- TMap is an adaptive test method.
- TMap is based on a business-driven test management (BDTM) approach.
- TMap describes a structured test process and life cycle model.
- TMap contains a complete tool box.

The adaptivity of TMap NEXT is the reason that we can still apply its many methods and tools.

A mistake often made is that in today's rapidly changing, agile development process, a structured testing approach is not required. The contrary is true: these kinds of development processes require even more structure. The misunderstanding is that people often confuse structure with extensive documentation. Nowadays, structure is more often provided by Kanban boards, daily stand ups and regression sets.

In a mobile testing project, a risk-based test strategy is key. The aim is to find the issues with the most impact as early in the project as possible. Therefore, the testing approach needs to be focused on the biggest risks for the app. The TMap NEXT BDTM process applies here – only the risks have changed, aligned as they are to the mobile testing key drivers.

Also, the phases of the life cycle model are completely relevant to mobile testing, only with shorter cycles to accommodate a more iterative process.

And of course the toolbox of TMap NEXT applies to mobile testing. We still need tools and test design techniques that can be used to execute our mobile testing services.

We offer the following mobile services based on TMap NEXT:

- Mobile Functionality Testing
- Mobile Compatibility Testing
- Mobile Usability Testing
- Mobile Performance Testing
- Mobile Security Testing.

We can deliver these mobile testing capabilities to your organization through our Mobile Testing Center of Excellence, through which we also partner with the world's leading mobile testing tools providers.

Scan the QR code to access our TMap checklists or go to www.tmap.net



About Capgemini and Sogeti

With more than 120,000 people in 40 countries, Capgemini is one of the world's foremost providers of consulting, technology and outsourcing services. The Group reported 2011 global revenues of EUR 9.7 billion. Together with its clients, Capgemini creates and delivers business and technology solutions that fit their needs and drive the results they want. A deeply multicultural organization, Capgemini has developed its own way of working, the Collaborative Business Experience™, and draws on Rightshore®, its worldwide delivery model.

Sogeti, its wholly-owned subsidiary, is a leading provider of local professional services, bringing together more than 20,000 professionals in 15 countries and is present in over 100 locations in Europe, the US and India.

Together, Capgemini and Sogeti have innovative, business-driven quality assurance (QA) and testing services, combining best-in-breed testing methodologies (TMap® and TPI®) and the global delivery model, Rightshore. The Capgemini Group has created one of the largest dedicated testing practices in the world, with over 11,000 test professionals and a further 14,500 application specialists.

Capgemini and Sogeti also offer end-to-end Mobile Solutions for mobile strategy and services as an Enterprise Mobility Orchestrator. Deploying a framework of harmonized methods, accelerators and industrialized services, the Enterprise Mobility Orchestrator services can help create, implement and support an organization's mobile strategy.

Rightshore is a trademark belonging to Capgemini. TMap, TMap NEXT, TPI and TPI NEXT are registered trademarks of Sogeti, part of the Capgemini Group.

**For more information,
please contact:**

Jean-Pascal Duniau
Mobile Testing Leader
jean-pascal.duniau@sogeti.com

Mark Buenen
Global Service Line Testing,
Vice President
mark.buenen@sogeti.com

Andreas Sjöström
Mobile Solutions Global Service Line
andreas.sjostrom@sogeti.com