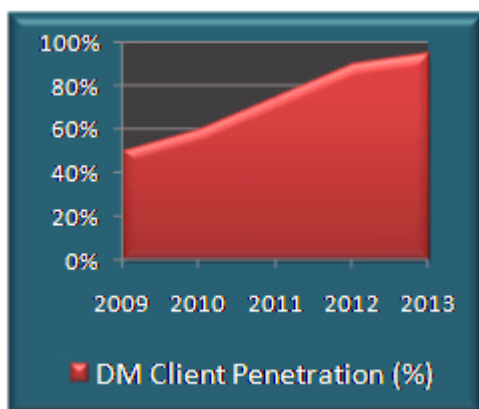


The Critical Role of Interoperability Standards for Mobile Device Management

Executive Summary

As the growth and complexity of mobile devices and services that run on them continue to increase, mobile operators and device manufacturers are struggling to keep up. Doing anything to more than 50 million mobile phones at the same time is hard enough, doing so without standards in place to help ensure interoperability is a feat akin to herding feral cats. Fortunately, the welcome appearance of the Open Mobile Alliance (OMA) in 2002 created a single entity responsible for coordinating the development, testing, and publication of interoperability standards for mobile devices.

Mobile Device Management (MDM) has quickly grown to serve a critical need within the industry, with clear benefits for mobile operators and device manufacturers, including: increased adoption of new services to drive revenue, reduced operational and support costs, and improved customer satisfaction and loyalty. OMA device management standards (OMA-DM) continue to evolve. Diagnostics and Software Management have become relatively stable, but new applications like Lock & Wipe and Device Capabilities Management are still under development as of the beginning of 2009. While OMA standards provide for interoperability, device manufacturers and/or carriers still must build device-specific clients to support the standards. Fortunately the future is bright, with half of new handsets shipping in 2008 OMA-DM compliant with more than half of handsets deployed in the field being OMA-DM compliant by sometime in 2009.



The nice thing about standards is that there are so many of them to choose from.

Andres S. Tannenbaum

As a founding member of OMA, InnoPath Software serves in a variety of key roles in the development and adoption of technology standards. InnoPath is an innovator and leader in OMA – with almost 200 OMA submissions and donations of proprietary source code – and will continue to contribute to future standards initiatives. Unlike many vendors, InnoPath supports all mandatory and optional OMA features as specified.

In a series of OMA-sponsored “test fests” InnoPath successfully demonstrated interoperability between the company’s OMA/MDM server and client, and OMA DM 1.2 compliant clients and servers from multiple vendors. To date, the company has certified more than 200 mobile handset models from leading manufacturers worldwide, including Alcatel, LG, Motorola, Nokia, Sony Ericsson, Samsung, Sanyo, and Siemens. InnoPath’s ActiveCare Solutions Suites leverage OMA standards where available, but also provide added functionality to deliver fully integrated, end-to-end MDM solutions for carriers and device manufacturers.

Importance of Mobile Device Management (MDM) Standards

Mobile operators and device manufacturers alike are delighted to see the increase in the sale and use of mobile devices around the globe. The other side of this two-edged sword, however, is the increasing variety and complexity of mobile devices and services that are becoming available. The challenge of managing billions of complicated devices, while maintaining customer satisfaction, looms as one of the more fundamental problems facing wireless operators and device manufacturers today – and into the foreseeable future.

For the past several years, communications providers and equipment makers have been working – unfortunately, sometimes independently and at cross purposes – to develop practical and solid specifications for standardized over-the-air (OTA) device management technology.

Standards allow the players in the mobile phone industry to focus their knowledge and capabilities on core competencies, and to collectively ensure interoperability of their respective components. In turn, this supports the rollout of new services, provides new revenue streams, enables effective maintenance and repair of existing mobile devices, and improves customer satisfaction.

With a standards-based OTA device management (DM) protocol in place, companies are free to provision, upgrade, diagnose, and repair mobile phones without requiring the customer to visit a storefront.

This scenario also avoids the costs of preprogramming handsets and advanced technical training for retail employees. Routine tasks such as changing phone numbers and activating new customers are simplified when handled over the air – and customers continue to enjoy mobile communications with no required trips to the vendor’s or carrier’s site.

Overview of OMA Standards



Since its formation in 2002 by more than 200 industry leaders – including InnoPath – the Open Mobile Alliance (OMA) has functioned as the key entity that creates, tests, and approves standards for emerging mobile technologies. With the goal of total interoperability, OMA’s several working groups are dedicated to creating “products and services based on open, global standards, protocols and interfaces and...not locked to proprietary technologies.” More specifically, the goals of the OMA are as follows:

- “Deliver high quality, open technical specifications based upon market requirements that drive modularity, extensibility, and consistency amongst enablers to reduce industry implementation efforts.”
- “Ensure OMA service enabler specifications provide interoperability across different devices, geographies, service providers, operators, and networks; facilitate interoperability of the resulting product implementations.”
- “Be the catalyst for the consolidation of standards activity within the mobile data service industry; working in conjunction with other existing standards organizations and industry forums to improve interoperability and decrease operational costs for all involved.”

- “Provide value and benefits to members in OMA from all parts of the value chain including content and service providers, information technology providers, mobile operators and wireless vendors such that they elect to actively participate in the organization.”

The Device Management (DM) group – one of the most active and prolific of the OMA groups – consolidated prior device management activities in order to focus on the following implementation areas:

- Initial device configuration settings Installation and updates of persistent information
- Retrieval of management information
- Management of device diagnostics, events and alarms
- Software installation and lifecycle management
- Software and firmware updates
- Application settings
- User preferences

The value of the OMA DM group’s standards has eclipsed all others, when compared to any other device management technologies, based on the following criteria:

- **Enabler Platform.** The OMA DM protocol suite provides a generic framework that allows manufacturers and carriers to easily build DM applications. Unlike OMA CP, IP-Over-the-Air (IOTA) or the Wireless Application Protocol (WAP), the OMA DM platform can be applied to virtually any kind of device management application.
- **Broad Participation.** Industry insiders consider OMA the de facto standards organization for the entire mobile industry, with current active participation from over 400 companies around the world.
- **Global Standard.** OMA standards are technology neutral; they are built on HTTP and SMS technologies, which are already found in most 2G, 2.5G, and 3G networks. The standards can also be applied over other transport protocols, such as WAP and Infrared Object Exchange (OBEX).
- **Interoperability.** Since its inception, OMA has identified interoperability as a crucial area for success. Most DM specifications include detailed sections on compliance and test requirements. A separate OMA working group named IOP (for Interoperability) works continuously to develop interoperability test cases and execute them among disparate implementations.
- **Maturity.** Although the initial set of DM specifications were released only a few years ago, many of the OMA DM specifications have incorporated prior standards from the WAP forum and SyncML initiatives which have been used successfully for years in commercial implementations.

How OMA Standards Are Developed

OMA standards travel a somewhat complex path to become fully accepted, published specifications standards. Figure 1 illustrates the status of some noteworthy specifications developed in the OMA DM working group and their stage of approval as of early 2007. The steps include the following:

1. **Work Item Document (WID).** First, OMA must approve a new item as a viable work item before any development activities begin.
2. **Requirement Definition (RD) and Architecture Definition (AD).** High level definitions of the requirement (use cases) and architecture are defined next.
3. **Draft Specification.** Based on the RD and AD, the group creates a draft specification. Once available, OMA posts the draft on its Web portal, soliciting industry contributions on changes that might enhance the specification.
4. **Candidate Enabler Specification.** When the specification enters into a stable stage, OMA publishes the candidate standard specification. At this stage, many vendors begin to test implementations of the candidate standard in OMA-sanctioned “test fest” events, with the understanding that further minor improvements may be incorporated later.

5. Approved Enabler Specification. After several IOP tests based on the Candidate Enabler Specifications are conducted among disparate implementations and any specification issues and ambiguities are resolved, the approved specification becomes the de jure standard.

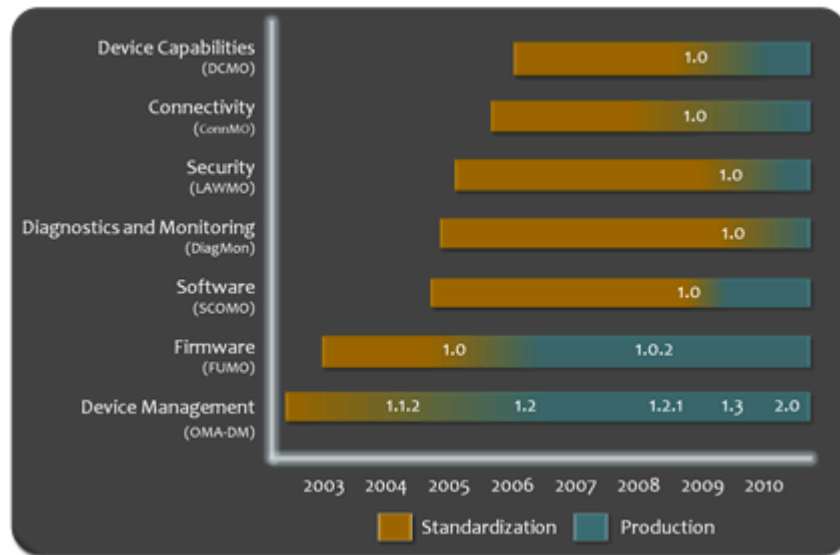


Figure 1: OMA-DM Enabler Status

The latest status of all in-progress and approved enablers are at:

http://www.innopath.com/pdf/oma_update.pdf

InnoPath's Standards FAQ is at: http://www.innopath.com/solutions/mdm_and_oma_faq.shtml

Adoption and Implementation of OMA Standards

Many leading global carriers and device manufacturers now implement new, powerful OMA DM technologies, replacing competing technologies based on WAP, IS-683/ IOTA, and other proprietary protocols. Many mobile devices in the marketplace already include the DM client, and the DM protocol stack now joins SMS, IP/HTTP, and WAP as a default feature integrated into a number of new mobile devices (see Figure 2). Not only have the 3rd Generation Partnership Projects (3GPP and 3GPP2) allies embraced OMA DM, but their respective groups have also chosen to incorporate and reference OMA DM standards in their work.

The Firmware Update Management Object (FUMO) is the flagship application that DM enables for Firmware Update Over The Air (FOTA). FOTA updates the firmware of mobile devices in the field, even while subscribers are using them. This application attracts attention from both service providers and device manufacturers because it can improve customer satisfaction, avoid expensive handset recalls, and help OEMs release new, advanced phones more quickly.

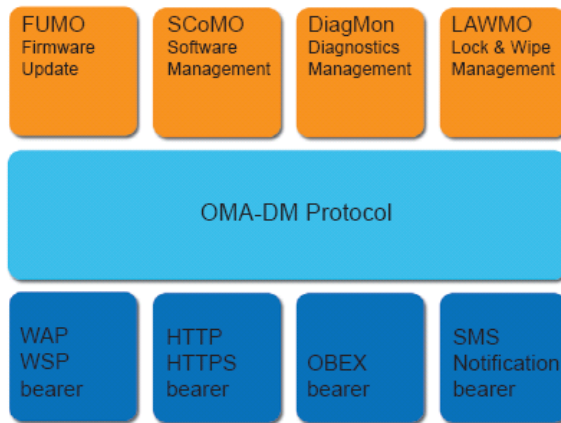


Figure 2: DM Protocol Stack Development

InnoPath Contributions to OMA Standards

As a founding member of OMA, InnoPath serves in a variety of key roles in the development and adoption of technology standards. Within the DM working group for example, InnoPath works with partners to define DM specifications, including Firmware Update Management Object (FUMO), Software Component Management (SCOMO), Device Diagnostics and Monitoring (DiagMon), Device Configuration Management Object (DCMO), Client Provisioning (CP), Connectivity Management Object (ConnMO), and scheduling of device activities and planning of interoperability testing.

InnoPath also works within the OMA IOP Protocol and Content (PRC) group, which is responsible for defining interoperability specifications for the technical specs produced by OMA DM; InnoPath representatives have served in the roles of vice-chairman, co-champion, and editor of various OMA standards activities. In addition, InnoPath serves as the Gatekeeper for managing contributions to SyncML Conformance Testing Suite (SCTS), the OMA DM open-source testing tool, has contributed proprietary source code to SCTS to support testing of the latest version of the DM protocol, and has co-hosted an OMA DM working group at a meeting facility near the company's headquarters in Sunnyvale, California.

What about OMA-CP?

OMA Client Provisioning (OMA-CP), originally specified in the WAP Forum, provides one-way information transfer between the MDM server and the handset. It may therefore be used for basic provisioning (i.e., email, MMS), but is incapable of retrieving information from the device such as that required for diagnosis. Since it is one-way, delivery is not guaranteed, and the MDM server will have no way to ensure that the message was received by the handset and acted upon. In contrast, OMA-DM, based on SyncML, provides two-way communications. The MDM server may poll the device for data, such as the configuration, and may compare the response against expected values. It is therefore quite suited for troubleshooting. Since OMA-DM provides acknowledgement that the message was received, it also supports mass operations.

Here, the MDM server sends a request or update to multiple handsets, and based on the acknowledgements can determine if the action resulted in success or failure. For example, as part of a mass FOTA operation, the server will attempt to update the firmware on tens of thousands of devices. The majority will report success, but the server will also know where updates have failed and why. Other mass update services that use OMA-DM such as SCoMO-based anti-virus definition updates also rely on this bi-directional connectivity to report on success.

OMA-DM also offers additional versatility in network connectivity, since it is adaptable to IP in addition to existing cellular deployments. WiMAX OTA provisioning uses OMADM in this way, since WiMAX devices have no IMEI. In contrast, OMA-CP is limited to connectivity via SMS.

Since OMA's inception, InnoPath has worked tirelessly to provide ground-breaking contributions to the standards group on many technology fronts. Following are a brief sampling of major InnoPath contributions to wireless device standards innovation:

- **Core DM protocol:** InnoPath has contributed to the core DM protocol in the areas of security and message correlation, provided SCTS test tool evaluations and improvements to the DM working group, and is actively involved in preparing protocol enhancing contributions for DM 1.3 and 2.0.
- **FUMO:** InnoPath acquired Openwave's MDM team and technology, which contributed one of the early proposals on FUMO/FOTA in 2003. InnoPath has remained actively involved in the development of the FUMO 1.0 enabler and will continue to work on enhancements and improvements for any future releases.
- **DiagMon:** As a co-champion for DiagMon, InnoPath has led the development of DiagMon technical specifications.
- **SCoMO:** InnoPath is currently serving as the Convener of SCoMO Adhoc WG in OMA. InnoPath is leading the development of SCoMO technical specifications which are expected to be completed in Q2 of 2008.
- **Scheduling:** InnoPath is actively collaborating on development of specifications for the scheduling of device activities, and planning for early interoperability testing in this area.
- **IOP:** In addition to contributing to the open-source management and continued improvement of SCTS tools, InnoPath continues to play a lead role in the development of IOP test specifications for OMA-DM and FUMO.

InnoPath's commitment to strong involvement across all of these areas will ensure that the OMA DM technical specifications serve customer and partner needs.

Interoperability Testing

InnoPath's industry leading Port to Production (P2P) program is designed to deliver broad industry interoperability certification for the company's ActiveCare Solution Suites. As part of the IOT program, InnoPath tests handsets from leading worldwide manufacturers on multiple versions of its commercially deployed servers, demonstrating "real life" conformance to standards set by industry bodies such as OMA.

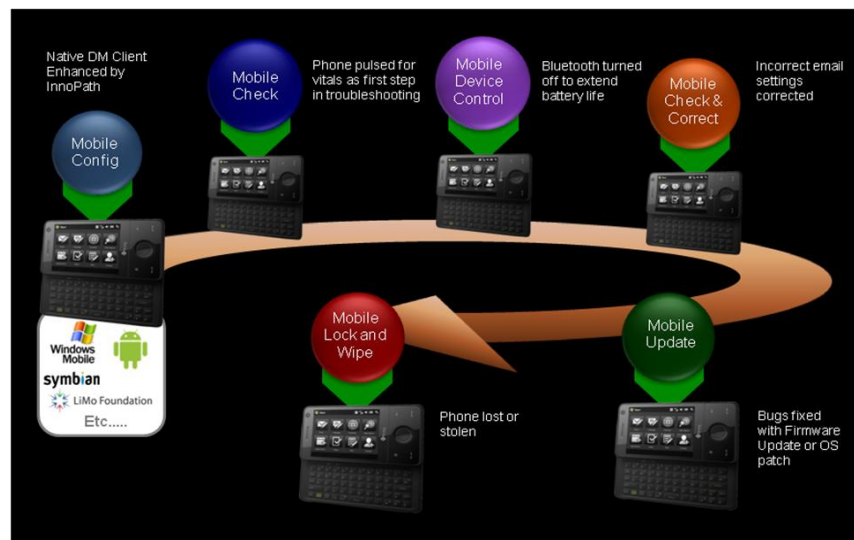


Figure 3: InnoPath standards based ActiveCare lifecycle device management

Device manufacturers use the P2P program to subject early release samples of mobile devices to a series of interoperability and configuration tests with InnoPath's ActiveCare Integrated Solutions. Since InnoPath's server is the most widely deployed in the mobile industry, the IOT Service is of significant value to device manufacturers, and offers the following benefits:

- An opportunity for OEM customers to validate their handset implementations against “in-production” servers
- Faster validation of handsets by leveraging InnoPath's expertise in performing interoperability testing and debugging issues.
- An opportunity for the OEM to discover interoperability testing issues in a “safe” environment, rather than with the mobile operator during a lab trial
- A broad set of “pre-tested” mobile phones that operators are more willing to rapidly deploy on their networks.

With multiple test locations in the U.S., Japan and China and around-the-clock online access to InnoPath's testing servers, handset manufacturers obtain quick feedback on the compliance of their handsets with commercially deployed InnoPath servers prior to formal lab testing with carriers.

InnoPath has demonstrated interoperability between the company's OMA compliant MDM server and client, and OMA-DM V1.2 compliant clients and servers from multiple other vendors. InnoPath successfully passed all mandatory test cases, as well as all optional test cases. To date, the company has certified more than 200 mobile handset models on its MDM solutions from leading manufacturers worldwide, including Alcatel, HTC, LG, Motorola, Nokia, Sony Ericsson, Sanyo, Samsung, Siemens and UTStarcom. InnoPath will continue to participate in all future OMA test fests.

Are Standards Enough?

OMA standards are far from complete, and their scope does not encompass the complete span of MDM applications. In addition, ambiguities in the specifications leave room for different interpretations which often result in different implementations. While OMA standards provide for interoperability, device manufacturers and/or network operators still must build device specific clients to support the standards.

InnoPath's Solutions Suites (see Figure 3) leverage OMA standards for interoperability where available, but also provide value-add cutting edge capabilities for customers. InnoPath offers both carrier and handset manufacturer solution suites, which when deployed together, result in the only integrated, end-to-end solution for MDM in the industry.

Summary and Conclusion

In summary, interoperability standards are essential to the successful growth of the mobile industry. The Open Mobile Alliance (OMA) plays a critical role in coordinating the development, testing and publication of standards, and mobile operators should consider a phased approach for adoption and deployment that reflects the maturity of the specifications and supporting technologies. InnoPath is a founding member of OMA and is committed to maintaining a leadership role to ensure the timely evolution and implementation of standards across the industry.