

**Mobile Services Category Team (MSCT)**  
**Advanced Technology Academic Research Center**  
**(ATARC)**

**Mobile Backend as a Service (MBaaS)**  
Working Group Document



## Table of Contents

MBaaS General Definition.....	3
<i>MBaaS Technical Definition</i> .....	3
Mobile Application Delivery Platforms.....	3
MBaaS Features.....	5
Mobile Applications Tiers.....	6
<i>Tier 1 Mobile Applications – Static Content</i> .....	6
<i>Tier II Mobile Applications – Static &amp; Dynamic Content</i> .....	7
<i>Tier III Mobile Applications – Comprehensive MBaaS Solution</i> .....	8
Open source MBaaS Architecture.....	9
Connectivity.....	10
Challenges .....	11
Benefits of an MBaaS .....	11
MBaaS Sources of Supply.....	12

## **MBaaS General Definition**

MBaaS is an emerging technical capability that provides mobile app developers with a way to connect applications to backend cloud storage and processing, while also providing common features such as user management, push notifications, social networking integration, and other features that mobile users demand from their apps. MBaaS, has a lot of the same intent as PaaS, to speed up the application development process, however MBaaS is purely a backend, providing an infrastructure that automatically scales and optimizes, bundled with a set of essential resources developers require, like content, data, messaging tools and all the best 3rd party, API driven services they are used to like Facebook, Twitter and Dropbox.

## **MBaaS Technical Definition**

An MBaaS (Mobile Backend-as-a-Service) is the primary point of contact for end user applications for both mobile and web. The MBaaS hosts Node.js applications as REST API servers and/or Express.js based web apps. The primary purpose of the MBaaS is to allow users (developers) to deploy Node.js server side for their mobile apps. The MBaaS also provides functionality such as caching, persistence, data synchronization and a range of other mobile centric functionality for mobile app developers. Multiple MBaaS may be utilized for client segregation and/or lifecycle management (environments).

## **Mobile Application Delivery Platforms**

MBaaS is part of a broader set of technology solutions that enable the delivery of mobile applications. The three major mobile delivery platforms in the marketplace today are Content Management Systems (CMS), Mobile Application Development Platforms (MDAPs), and Mobile Back-end-as-a-Service (MBaaS). MBaaS is the newer category and represents an emerging set of technologies that interface and support other mobile delivery systems. The diagram below represents the three major types of mobile delivery platforms and their associated uses and benefits.



- |  |   |   |
|--|---|---|
| <ul style="list-style-type: none"> <li>▪ Supports creation/delivery of Tier 1-type* mobile applications;             <ul style="list-style-type: none"> <li>○ Delivers information to mobile devices</li> <li>○ Same system for delivering website and mobile content</li> <li>○ Efficient means for repurposing content</li> <li>○ Works with search engines to drive awareness and traffic</li> </ul> </li> <li>▪ Requires less technical skills</li> <li>▪ Significantly cheaper than building a native app</li> <li>▪ Less engaging user experience</li> </ul> | <ul style="list-style-type: none"> <li>▪ Supports creation/delivery of Tier 2-type* mobile applications, allowing;             <ul style="list-style-type: none"> <li>○ Development of native apps for iOS and Android devices</li> <li>○ Apps with faster performance, greater convenience, and “stickiness” with users</li> <li>○ Support of personalization and location-based services</li> <li>○ Delivery of contextually-relevant information</li> </ul> </li> <li>▪ Requires significant technical skills and investment</li> <li>▪ Moderate – High security posture</li> <li>▪ Works together with MDM/MAM solutions</li> </ul> | <ul style="list-style-type: none"> <li>▪ Supports creation/delivery of Tier 3-type* mobile applications;             <ul style="list-style-type: none"> <li>○ Facilitates building and maintaining complex native apps.</li> <li>○ Provides toolkits and libraries to speed development.</li> <li>○ Offers pre-built APIs for faster integration with external resources</li> <li>○ Resources can scale quickly and easily for high-demand situations</li> </ul> </li> <li>▪ Lowers CAPEX</li> <li>▪ Works together with an MADP/CMS to provide back-end infrastructure and services</li> </ul> |
|--|---|---|

\* Tier 1, 2, and 3 type mobile applications defined by ATARC MBaaS Working Group Members

## MBaaS Features

The following is a high-level set of features of an MBaaS platform:

MBaaS Features		
Features	Sub-Features	
<b>User Management</b>	User Listing User Property Management Enable/Disable Users Create New Users Social Logins Session Control	Multiple Logins Password Reset Relationships Data Validation Export/Import User Data
<b>Data Management</b>	Graphical Data Browser Complete Object Persistence Solution Rest Console Cross Platform APIs Relational Data	Built-in Paging Support Complex object hierarchy Schema management Data security Data to geo relationship
<b>Geolocation</b>	Geo metadata Location data Search in radius SQL driven search Security / Permissions Geo clustering	Client Code/App Generation Geopoint to data object relations Interactive geofencing design Geofencing manager Geofencing events and actions Geofencing monitor
<b>Media Streaming</b>	Cross platform streaming Ready to use media Publish live from iOS / Android Create video on demand	Powerful stream management Play video everywhere Instant on-demand media deployment Client code app generation
<b>Publish/Subscribe Messaging</b>	Cross platform message delivery Powerful data broadcast Conditional subscriptions Push vs Pull	Games Online message publishing Instant mobile chat Customizable business logic
<b>Push Notification</b>	Send notifications from server Cross platform push Scheduled notifications Badges, popups, sounds Group broadcast	Target specific users Customized business logic Online message publishing Device management
<b>Custom Business Logic</b>	Event handler API customization Timers	Server code debugging Integrated logging Manage custom code in production
<b>Analytics</b>	API filtering API consumption by client type Error analysis	Hosted services analytics New vs Returning users Rich media analytics
<b>Mobile Code Generation</b>	Multiple client types Generate starter code Registration / Login Data management code	Chat apps Geo browser Video broadcaster / player File management apps

## Mobile Applications Tiers

Mobile applications can be categorized into three tiers:

- Tier I – Static Content, simpler design, display functionality.
- Tier II – Static & Dynamic content.
- Tier III – Comprehensive MBaaS Solution – push, geo-location, storage, security, etc.

### Tier 1 Mobile Applications – Static Content

#### **Description:**

This type of mobile application retrieves and displays static content which is formatted to fit the navigational scheme and form factor of mobile devices, including tablets. A Tier 1 mobile application typically involves a user launching a web browser via their mobile device and accessing a resource (website) that contains static content or hyperlinks to other resources/websites. Information is pushed to the end-user via a web server(s). The Tier 1 app may interact with an external website (extranet), a closed environment (intranet), or some combination of the two.

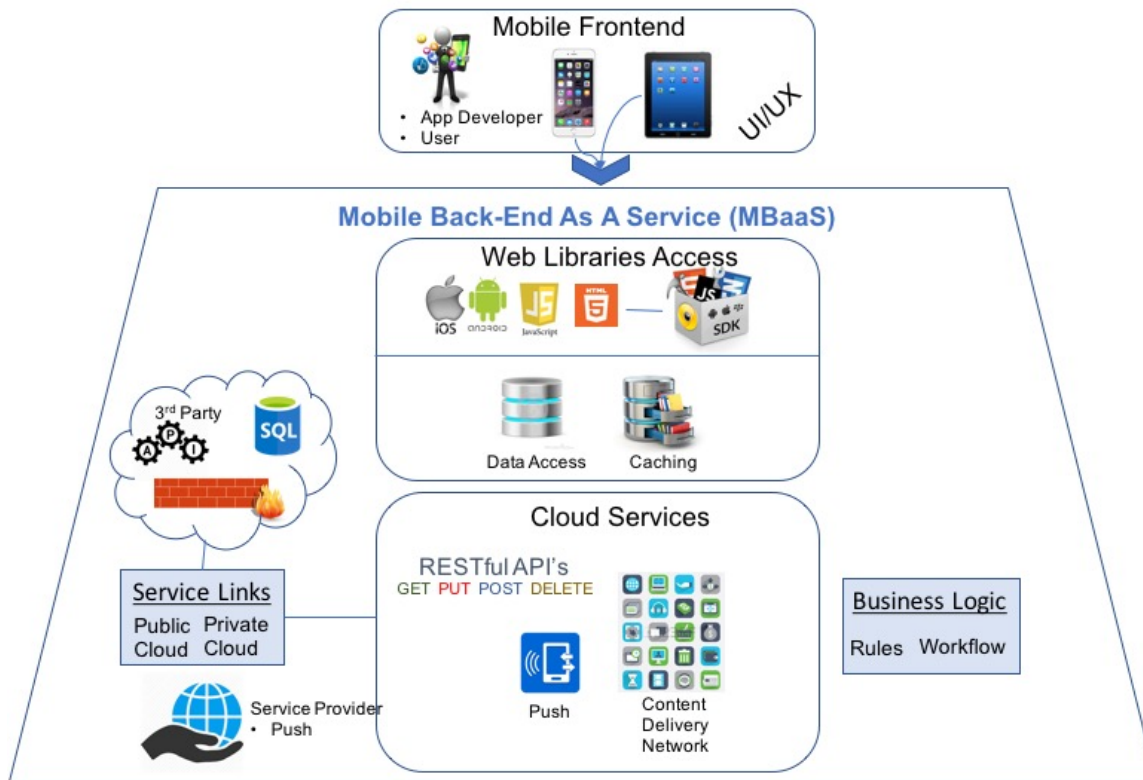
#### **Examples:**

In the government space, a secured, agency intranet site(s) or agency external-facing website (i.e. [www.omb.gov](http://www.omb.gov)).

#### **Backend Components Accessed:**

Technologies that support the development and delivery of Tier 1 applications include mobile Web Content Management systems with Mobile Content Management capabilities, Mobile Application Development software, and an MBaaS solution used in conjunction with a mobile frontend UI/UX. The following diagram depicts a Tier I Mobile Application MBaaS architecture.

## TIER I – MBaaS Architectural Diagram



## Tier II Mobile Applications – Static & Dynamic Content

### Description:

This type of mobile application retrieves and displays a combination of static and dynamic content formatted to fit the navigational scheme, OS(s), and form factors of various mobile devices. Tier II mobile applications requires orchestration of a variety of information sources to provide an enriched user experience. The Tier II application may be initiated through a commercial web browser or the native mobile device browser. Specific data elements may be tagged, rated, searched, and retrieved in context. Data access/retrieval is performed as an independent function. Information may be pushed or pulled to the end-user or to external databases depending on the requirements. Tier II mobile apps may interact with external websites (extranet), intranets, or invoke web services to enable communications among various applications.

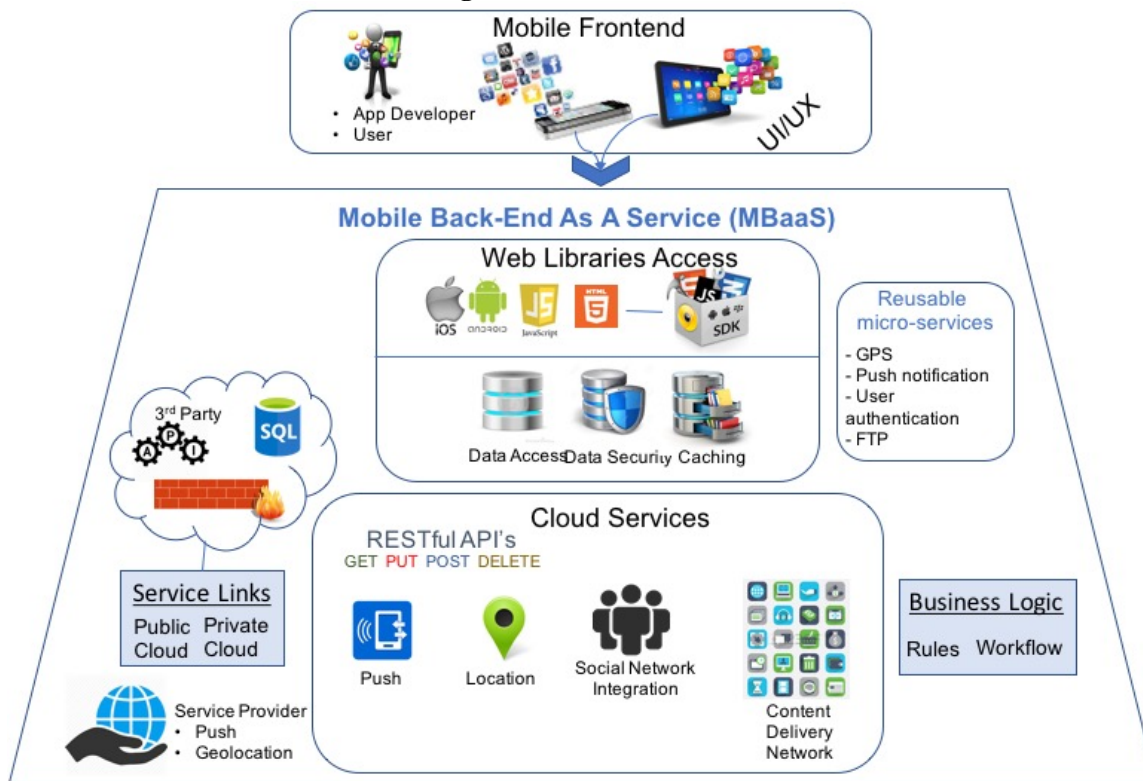
### Examples:

This type of application is used to access financial data from one source, general news from another source, passes your browsing history data to an advertising-server that displays from previously visited sites, and provides geo-located GPS data. In the commercial space, an electronics sales distributor may deploy a mobile app for its salesforce that optimizes pricing for hundreds of thousands of products by compiling, aggregating and structuring competitor pricing data in real-time. A government data analyst may require a mobile app that keeps up to date on new sanctions and regulations at international, federal and state levels to ensure compliance with terrorist financing.

### Backend Components Accessed:

Technologies that support the development and delivery of Tier II mobile applications include Content Management Systems with Content Integration capabilities, Mobile Application Development software, and an MBaaS solutions used in conjunction with frontend UI/UX software. Diagram below depicts a Tier II Mobile Application MBaaS architecture

### TIER II – MBaaS Architectural Diagram



### Tier III Mobile Applications – Comprehensive MBaaS Solution

#### Description:

These mobile applications are more sophisticated with integrated and related functions, that are complex to develop, maintain, and deploy. They share many of the technical functional characteristics of Tier II applications, but often integrate mission-critical information sources. The nature of Tier III mobile applications often require specialized work-flows and inter-dependent functions between data sources and business rules. Tier III mobile applications may be programmed to automatically activate/control other activities or processes. They are often used in advanced intel operations or sophisticated decision-making situations. Security requirements are of highest concern.

#### Example:

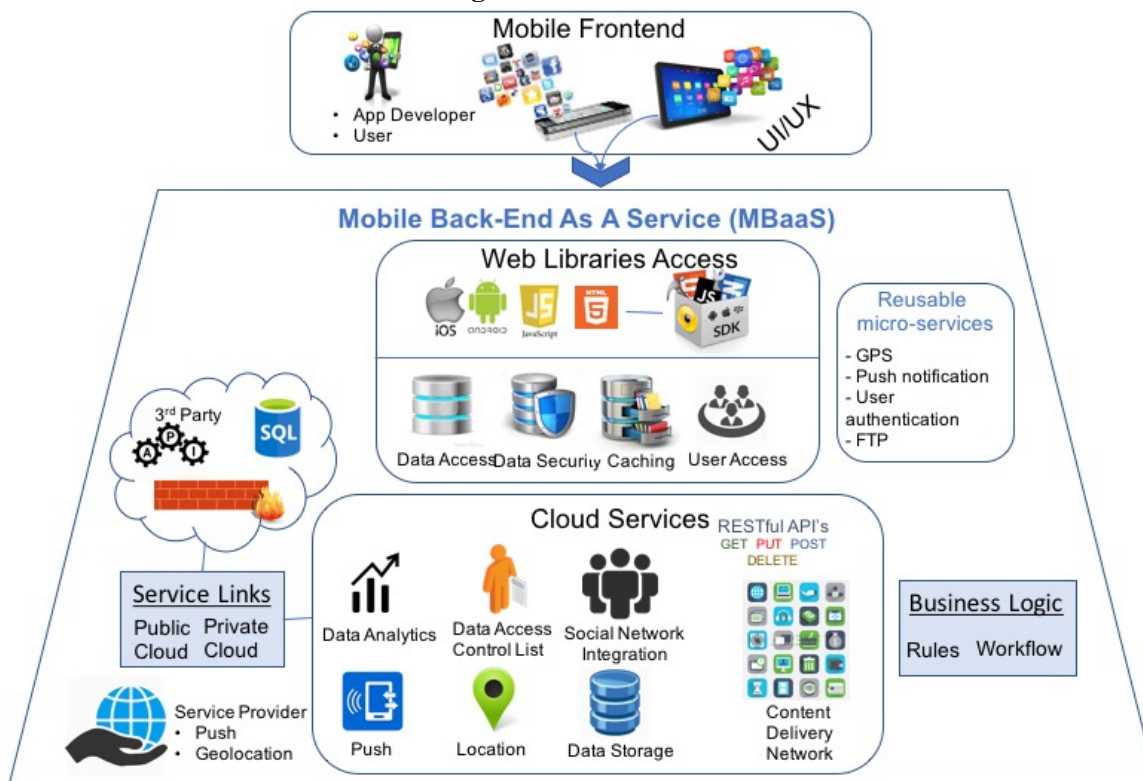
A USDA field inspector, using an app on his tablet, confirms his assignments for the day which cover a 100-mile radius over three counties. The app tracks his route and findings at each facility visited, along with his location, using the device GPS. The app is tied to a weather forecasting

site that predicts dangerous weather at the time of his third visit. The app sends an alert to the tablet looking up an alternative USDA field office nearest his current location. The app launches WAZE commercial site and presents the fastest route to the USDA field office nearest him. In addition, the app presents alternative USPS offices that are open and closer. The consumer example would be the UBER driving service.

**Backend Components Accessed:**

A Tier III mobile application will access a full suite of backend integrated services including data access, security, user management/control, analytics, social networking, geo-location, storage, push services, business logic, and cloud services. The diagram below highlights the comprehensive MBaaS architecture needed to support a Tier III mobile application.

**TIER III – MBaaS Architectural Diagram**



**Open source MBaaS Architecture**

An open source MBaaS Architecture should include -the following services, which are deployed during product installation on an open source PaaS:

- mbaas: management of configuration of MBaaS
- messaging: analytics messages interface, recording of raw data
- metrics : generate stats and aggregations recorded through messaging
- statsd: store stats in memory
- mongodb: storage with 3 replicas recommended
- nagios: events monitoring
- redis: caching

- docker containers: for management and app hosting
- kubernetes pods: orchestration of containers

To estimate the infrastructure configuration there are several variables to be considered, for example, the number of apps, number of app users, functionality in the apps, the number of services, and the number of transactions to/from devices and to/from backend integrations.

An Open source MBaaS can be deployed as a series of containers and pods on a dedicated PaaS.

The initial recommended deployment includes one MBaaS, however, two or more MBaaS will ensure network separation from other VMs (containers and pods) running on application nodes. For example, if the enterprise decides to have the development environment on a different data center.

Multiple environments such as Development, Testing, Pre-production and Production are defined in these MBaaS. Default configuration can have all these environments in a single MBaaS or separate MBaaS.

Open Source MBaaS overall architecture includes:

- Master Nodes
  - Minimum 2 VMs to assure resiliency and at least one VM always operating PaaS. In this definition etcd hosts are included in the VMs for master nodes.
- Infrastructure Nodes
  - Routers and docker registry separated from services in the master
- MBaaS Infrastructure
  - MBaaS components including: mbaas, messaging, metrics, statsd and Nagios and MongoDB replica sets (minimum 3)
- Cloud Application Nodes
  - For your mobile app cloud code and MBaaS services. Depending on the subscription level (SKU) these nodes can be deployed in shared or separate VMs.

## Connectivity

In order to allow MBaaS connectivity with MAP, and for apps deployed on mobile devices to communicate with the MBaaS, a permanent connection to the public Internet is required either directly or via an accessible web proxy. The following outbound access is required:

- TCP/80 (HTTP) / TCP/443 (HTTPS)

To support communication with apps deployed on mobile devices, the MBaaS requires a dedicated IP address used in the PaaS router. Depending on the type of mobile devices used and the nature of their connectivity, a public IP address may be required (e.g. for telephony devices using a Public APN) whereas other configurations may only require a private IP address (e.g. Private APN or Internal WiFi). MAP sends a small volume of email (e.g. user registration,

password reset, monitoring). For on premises installations, a locally accessible mail server/relay operated by the customer is required.

## Challenges

Although MBaaS offerings provide developers with increased efficiencies and ease of use, they are not perfect. There are challenges to consider while evaluating whether an MBaaS meets your needs. Some of those hurdles include:

- **Security:** Companies often perceive that data kept or accessed on the cloud will never be as secure as when it is stored on premise or behind their firewall. This manifests into a reluctance to allow outside vendors to either store or access their data in the cloud. There are security considerations to keep in mind while deploying MBaaS solutions:
  - Control and secure how apps connect to the enterprise – Best Practice
  - Do not directly expose your enterprise systems
  - PKI/Derived Credentials
  - Integrate with Active Directory and other Identity Management systems
  - Add keys, token, encryption to your mobile apps, no restrictions or extra charges
  - Secured development environments (dev, test, pre-production, live)
  - VPN connectivity
  - MTD/App Vetting
  - NAIOP/NIST Change responsiveness
- **Performance:** Latency and performance issues are sometimes a concern when an app accesses data, security, push messaging, and offline capabilities from the cloud. If latency is a concern then an on premise capability may be a better way to go.
- **Mobile Network Communications:** By performing data retrieval and business logic and computation in the cloud through MBaaS, you are making yourself susceptible to carrier network availability and performance.
- **Enterprise Integration:** While most MBaaS provides claim to integrate to any backend system, however this is not always true. A good MBaaS provider should be able to use all customizations, not have to replicate data or use a middleware.

## Benefits of an MBaaS

Some of the advantages of deploying an MBaaS solution include the following:

- Faster deployment of front end applications
- Ease of Use – MBaaS platforms offer self-service interfaces, which are easy to use, and get off the ground.
- More time to focus on the frontend user interface.
- Flexibility: - With RESTful API's MBaaS offers an open stack platform for developers who are not restricted to one set of tools for designing, engineering, and managing apps. This lets the developer choose a backend solution independent of the design tools, libraries, studios, and toolsets to build the frontend.

## MBaaS Sources of Supply

Given that MBaaS is an emerging sector, there are a limited set of vendors that truly qualify as MBaaS vendors. There are many vendors that have emerged from Platform-as-a-Service (PaaS) and Backend-as-a-Service (BaaS) spaces. The intent of this vendor list is to arm federal agencies with some basic knowledge on MBaaS vendors to get started with. Further evaluation is needed to evaluate individual needs.

The following is a list of sources of supply to consider while selecting an MBaaS vendor:

MBaaS – Sources of Supply		
Sources of Supply	Platform	Product
<b>Amazon Web Services</b>	AWS Mobile Services	<ul style="list-style-type: none"> <li>Amazon Cognito, Amazon Mobile Analytics, AWS Device Farm, AWS Mobile Hub, AWS Mobile SDK</li> <li>Comprehensive solution.</li> <li>Best fit for companies willing to support mobile initiatives with a set of services, instead of a single, managed product.</li> </ul>
<b>AnyPresence</b>	AnyPresence Enterprise Platform	<ul style="list-style-type: none"> <li>New entrant.</li> <li>Suited for customers that need flexibility in deployment.</li> </ul>
<b>IBM</b>	IBM MobileFirst Platform Foundation v.8.0	<ul style="list-style-type: none"> <li>IBM Bluemix</li> <li>Best fit for customers that focus on data integration, especially complex integration scenarios.</li> </ul>
<b>Kinvey</b>	Kinvey Platform	<ul style="list-style-type: none"> <li>Easy for customer that focus on using the platform and not managing it.</li> </ul>
<b>Microsoft</b>	Comprised of product set	<ul style="list-style-type: none"> <li>Azure App Service, CodePush, HockeyApp, Intune, PowerApps, Visual Studio 2015, Visual Studio Code, Visual Studio Team Services, Xamarin Studio, Xamarin Test Cloud.</li> <li>Focused more on front-end.</li> <li>Well suited for existing Microsoft customers.</li> </ul>
<b>Oracle</b>	Oracle Mobile Cloud Service v.2.0	<ul style="list-style-type: none"> <li>Oracle Developer Cloud Service, Oracle JavaScript Extension Toolkit, Oracle Mobile Application Accelerator, Oracle Mobile Application Framework</li> </ul>
<b>Red Hat</b>	Red Hat Mobile Application Platform	<ul style="list-style-type: none"> <li>Open Source Focused - Red Hat enterprise linux, Openshift, NPM community, Raincatcher, Feed Henry open source, 3Scale, BPMS</li> </ul>
<b>Salesforce</b>	App Cloud	<ul style="list-style-type: none"> <li>Force.com, Heroku Enterprise, Lightning, Mobile SDK, Salesforce1</li> </ul>

<b>SAP</b>	SAP Mobile Platform 3.0 SP11	<ul style="list-style-type: none"> <li>• SAP Hana Cloud Platform, mobile service; SAP Web IDE</li> </ul>
<b>Telerik</b>	<u>Telerik Platform</u>	<ul style="list-style-type: none"> <li>• Offers a full suite of web content management, MADP, and MBaaS solutions at various subscription rates. No on-premise solution available (analytics only).</li> </ul>

MADP

<b>Mobile Application Development Platforms – Sources of Supply</b>		
<b>Sources of Supply</b>	<b>Platform</b>	<b>Product</b>
<b>Appcelerator</b>	Appcelerator Platform	<ul style="list-style-type: none"> <li>• Best fit for customers that need to build cross-platform solutions.</li> </ul>
<b>Kony</b>	Kony Mobility Platform	<ul style="list-style-type: none"> <li>• Front-end tool (Visualizer) and back-end (MobileFabric).</li> <li>• Best fit for customers that need mobile support in multiple areas of their SDLC's.</li> </ul>
<b>OutSystems</b>	OutSystems Platform	<ul style="list-style-type: none"> <li>• Platform for developing mobile apps and integrating them with Cloud-based providers Azure, SAP, AWS.</li> </ul>