

Zebra MPact for Mobile Marketing and Location Analytics

MPact Location Tracking vs. Cisco Connected Mobile Experience (CMX)

EXECUTIVE SUMMARY

Today consumers and businesses rely on smartphones, tablets and other Wi-Fi enabled devices for a wide array of personal and commercial applications. All major players in retail, hospitality and airport verticals are using these devices to engage with visitors by using location based services. Businesses are increasingly deploying real-time Wi-Fi and Bluetooth Low Energy (BLE) based location services to offer better customer experience and engage with personalized promotions and in-venue coupons.

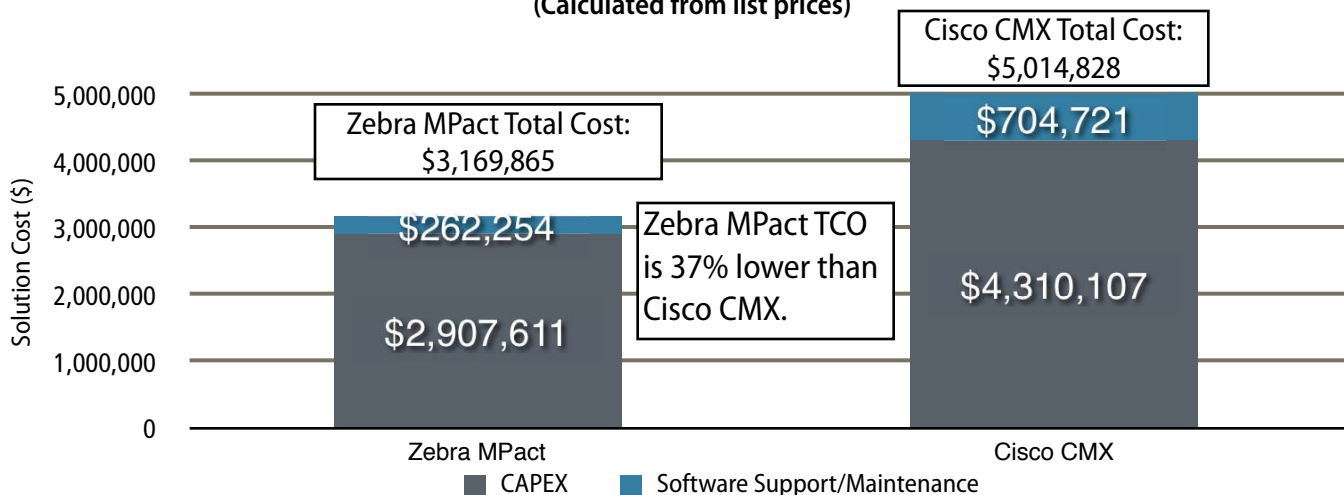
Zebra Technologies commissioned Tolly to evaluate its Zebra MPact for Mobile Marketing and Location Analytics platform and compare that with Cisco System's offering, Connected Mobile Experience (CMX). Tests evaluated a range of functionality and performance using AP7532 and AP2702i, which are mid-tier flagship 3-stream MIMO 802.11ac access point models from Zebra and Cisco, respectively. Tests included a detailed review of the tiered location offering for presence, zone, position along with the location analytics and reporting. Additionally, Tolly engineers evaluated Total Cost of Ownership (TCO) with respect to capital expense and software support costs of typical deployments for location-based services. ...<continued on next page>

THE BOTTOM LINE

- 1 Zebra MPact with AP7532 delivered 50% better location accuracy and around 40% lower TCO compared to Cisco CMX with AP 2702i model
- 2 MPact provides multi-RF locationing solution based on BLE and Wi-Fi technologies
- 3 MPact computes locations in real-time, while CMX latency was up to 5 mins for Apple device
- 4 Superior manageability to enable, disable and prioritize tracking for groups of clients
- 5 Multi-level presence detection for granular presence detection
- 6 Advanced location analytics for site ranking and category comparison across multiple sites

Wireless Locationing Solution Costs for 100 Sites

30 APs Per Site, 3-Year Software Support
(Calculated from list prices)



Notes: See details in main document text. Pricing sourced from various online resellers. These are complex solutions and users should source solutions according to their need. Furthermore, discounts may apply that are not reflected herein.

Source: Tolly, October 2014

Figure 1



Based on Tolly's evaluation, the Zebra MPact solution demonstrated significant benefits over the competing Cisco CMX solution¹. The Cisco solution is significantly more expensive than the Zebra MPact and offers less functionality and lower location accuracy than Zebra MPact.

Total Cost of Ownership

Tolly engineers analyzed the capital costs to provide locationing services at 100 sites, each outfitted with 30 APs, and provide software maintenance for 3 years. The calculations were based on publicly available US list pricing information as of October 2014.

Where the Zebra MPact solution cost was \$3.2M, the cost for Cisco CMX was over \$1.8M greater at \$5.0M. Thus, Zebra MPact TCO or 37% lower than Cisco CMX. See Figure 1.

In terms of the initial capital outlay the Cisco solution is 48% more expensive than Zebra. When it comes to ongoing software support, however, the cost differences are dramatic. Where Zebra software support over 3 years costs \$262,254, Cisco support costs \$704,721 or 269% of the Zebra cost. As time goes on - and software support costs continue - the TCO becomes ever more favorable for Zebra. See Tables 7 and 8 for component details and cost source information.

Presence Tracking

From both a perspective of customer service and analytics, a more granular identification of presence that can identify customer location and behavior is beneficial. Not only can that information

allow the retailer to tailor a visit to a customer but analytics based on that information can be used to enhance the customer experience in the future.

Where the Cisco CMX solution can only identify that a customer is present, the Zebra MPact provides a multi-level, granular indication of presence through presence events.

Tolly engineers verified that Zebra MPact was able to send Presence Enter 1, Presence Enter 2, Presence Enter 3, and Exit events based on the proximity of the customer. Enter 1 event was triggered when the device was outside in a parking lot, Enter 2 was triggered when the device was at the entrance of the premises and Enter 3 was triggered when the device was inside the premises. Exit event was triggered when the device was no longer present in the premises.

These granular events from MPact help customers to quickly integrate and build tailored applications based on presence. The Cisco solution was only able to identify that a customer was present in the venue. See Table 1 for more details.

Location Accuracy

The critical and core feature of any location based mobility marketing solution is to provide accurate positioning information as a visitor navigates in the store or any venue. Accurate locationing provides both real-time contextual benefits to the customer experience as well as delivering more useful and relevant information for analytics after the fact. For example, indoor turn-by-turn navigation applications requires more reliable and accurate real-time location information.

Tolly engineers tested the locationing accuracy of each solution using two smartphones: 1) an Android-based LG

Zone Event	Use Case	Solution	
		Zebra MPact	Cisco CMX
Enter 1	Indicate outside visitors	✓	✗
Enter 2	Indicate visitors close to premises	✓	✗
Enter 3	Indicate inside visitors	✓	✗
Exit	Indicate that the visitor has left	✓	✗

Source: Tolly, October 2014 Table 1

¹ The costs are based on AP7532 and AP 2702i which are mid-tier flagship 3-stream MIMO 802.11ac access point models from Zebra and Cisco, respectively.



Nexus 5, and 2) an iOS-based Apple iPhone 5c. The smartphones were tested at 10 different locations in the simulated store and the positions reported by the solutions were compared to the actual smartphone location at each test point to determine accuracy. Across the test locations, the Zebra MPact solution provided greater accuracy than the Cisco solution with both

smartphones. With the Nexus phone, Zebra's accuracy was within an average of 3.6m compared to 4.4m for Cisco. With the iPhone, the accuracy was within an average of 2.7m compared to 6.7m for Cisco. This is because iOS based devices don't send probe request frames often once they are connected to the Wi-Fi network.

Zebra Technologies Corporation

MPact Mobile Marketing Platform

Features, Accuracy & TCO



Tested October 2014

As the Cisco CMX solution uses only probe requests for Locationing, it is not able to accurately update the location unlike MPact that uses both management and data frames from devices to provide real-time location update. See Table 2.

In addition, MPact triggers contextual region events like Enter, Proximity, Contained and Exit so that customers can build relevant applications easily.

- Enter – triggers when a visitor enter a predefined zone
- Proximity – triggers when a visitor is in the proximity of a zone
- Contained – triggers when a visitor stays in a zone for pre-configured interval
- Exit – triggers when a visitor exits from a region

For example, venue owners can build an application that use "Contained" event on "Reception" zone to notify an associate that a visitor is standing at the reception area.

Tolly engineers observed that Cisco CMX didn't support any of these important location based contextual events.

Zebra MPact vs Cisco CMX: Wi-Fi Position Tracking at 10 Locations - Accuracy Summary
Reported Position vs Actual Location of Client
 as reported by each solution

Summary

Smartphone "Customer"	Average Distance Discrepancy Across 10 Test Locations in meters (lower numbers are better)	
	Zebra	Cisco
LG Nexus 5	3.6	4.4
Apple iPhone 5c	2.7	6.7

By Location

Test Location	Reported Distance to Actual Location Delta (meters)			
	Nexus 5		iPhone 5c	
	Zebra	Cisco	Zebra	Cisco
1	4.7	2.3	2.7	6.7
2	2.4	2.9	1.8	2.7
3	2.7	3.8	1.7	8.7
4	7.2	6.9	7.0	5.4
5	2.9	3.0	3.0	9.2
6	0.9	4.6	3.4	6.3
7	0.8	4.8	1.0	13.2
8	4.4	8.2	3.2	3.1
9	8.1	5.4	2.3	5.7
10	1.5	1.6	1.3	5.5

Note: Both devices associated to Cisco SSID. Cisco will only calculate position from client probes. The iPhone was probing less frequently when connected, and therefore was less accurate.

Source: Tolly, October 2014

Table 2



Micro-Locationing Using MPact Beacons

According to Zebra Technologies: “MPact provides three tiers of locationing for customer engagement - presence, zone, and position. With Bluetooth® Smart beacons, MPact can not only detect the presence of the visitor, but also provides zone and exact location with 1-2m accuracy where the visit is located. MPact operates in various modes including iBeacon™. Beacons enable the next level of customer engagement by providing real-time location triggers and notifications, prompting visitors to access privileges offered by the retailer or venue owner.”

Tolly verified these Micro-locationing capabilities. This testing used Bluetooth Low Energy (BLE) beacon technology in conjunction with an application on a mobile device to determine the position of a user in an aisle of the store. Tolly engineers verified that the Zebra MPact solution could use this approach to determine location within less than 2m, more reliably and consistently. As a result, the BLE solution offers accuracy that is ideal for use cases like product-level analytics or promotions and turn by turn navigation in various hospitality and retail environments.

CMX does not provide BLE or any form of Microlocationing solution.

Manageability & Ease of Integration

The value and usefulness of any system is enhanced when it provides a rich set of management and integration features. Tolly evaluated several aspects of manageability and integration and found that Zebra MPact adds value in both areas

Manageability & Ease of Use

Area	Feature	Mobile Locationing Solution	
		Zebra MPact	Cisco CMX
Client Groups	Definition of Client Groups	✓	✓
	Enable/Disable LBS per Client Group	✓	✗
	Prioritized Tracking for Client Group	✓	✗
	Reporting based on Client Groups	✓	✗
Location Based Services API	Software Developer Kit	✓	✓
	Location Based Services Subscriber	✓	✓
	Multiple LBS Subscriber per site	✓	✗
	Event Filtering	✓	✗

Notes: See Test Methodology section for detailed descriptions of each feature. API and integration information derived from documentation only.

Source: Tolly, October 2014

Table 3

Reporting & Advanced Analytics

Reporting & Analytics Feature	Mobile Locationing Solution		
	Zebra MPact	Cisco CMX	Notes
Total Visitors	✓	✓	
Repeat Visitors	✓	✓	
Site Ranking	✓	✗	
Dwell Time vs Devices	✓	✓	Cisco: Bar or line chart Zebra: Breaks down by region/site
Inside vs Outside	✓	✗	
Customer Conversion	✓	✓	Cisco: Can view report for conversion Rate (In Tolly test was 100% static)
Bounces	✓	✗	
Engaged Visitors	✓	✓	
Devices Per Region	✓	✓	
Device Density Heatmap	✓	✓	
Shopper Path Analysis	✓	✓	

Notes: See Test Methodology section for detailed descriptions of each feature.

Source: Tolly, October 2014

Table 4



compared to Cisco CMX.

Grouping Clients

An ability to define groups and enable location tracking on specific groups is very important for any location based solution, given that retailers and venue owners are experiencing thousands of visitors every day. So, it is imperative that businesses may want to enable and prioritize location tracking on certain high-value customer segments like loyalty customers, but not on every visitor.

Where Cisco only supports definition of client groups, Zebra not only provides that function but offers prioritized tracking for client groups as well as reporting based on client groups. See Table 3.

Application Programming Interface & Location Services

Tight integration between systems can typically be accomplished only at the programming level. Thus, the availability of an application programming interface (API) along with a software developer kit are essential enablers of this integration. Both Zebra MPact and Cisco CMX offer an API and SDK for partners and customers. But MPact provides a rich set of location data filtering capabilities.

Tolly engineers have found no filtering capabilities in CMX based on client groups (employee devices, or guest Wi-Fi users etc), while MPact provides a rich set of filters so that customers can receive

relevant location data. This saves a lot of WAN bandwidth.

In addition, MPact offers multiple subscribers per site so that different departments like marketing or operations, can receive data independently to build different applications. CMX doesn't provide this capability.

Reporting & Advanced Analytics

The Zebra MPact solution not only provides the same core reporting and analytics features as the Cisco CMX but contains additional reporting features such as site ranking, "inside vs. outside" and bounce reports. See Table 4.

Wireless Mobility Platforms Under Test

Vendor	Function	Model	Description	Version	Configuration Notes
Zebra Technologies	Wireless Controller	NX7500	WING5 Wireless Controller	WING 5.5	
	Access Point	AP7532	Wireless Access Point		
	Location Services	SP-SWSV-P-1	AirDefense Services Platform	9.1.2-07	Implemented as a virtual machine
	MPact	AD-PROX-P-1	Wi-Fi Proximity Awareness and Analytics	5,247	Implemented as a virtual machine
Cisco Systems	Wireless Controller	AIR-CT5508	Cisco 5508 Wireless LAN Controller	7.6.120.0	
	Access Point	AP2702i	Wireless Access Point		
	Location Services	AIR-MSE-VA-K9:V01	Cisco Mobility Services Engine - Virtual Appliance	7.6.120.0	Implemented as a virtual machine
	Reporting Console	PRIME-NCS-VAPL	Cisco Prime Infrastructure	N/A	Implemented as a virtual machine

Common configuration: All APs configured on 2.4GHz Ch 1, 5GHz Ch 40. Security set to WPA2-PSK. Maximum transmit power. Firmware used was latest available as of October 13, 2014.

Source: Tolly, October 2014

Table 5



Test Setup & Methodology

Objective

The objective of the evaluation was to quantify the locationing aspects of the solutions under test across a number of specific areas. Engineers quantified specific capabilities of each system in a simulated retail environment as well as generated a cost model for one site scenario.

Platforms/Systems Under Test

The Zebra MPact solution consisted of an NX7500 wireless controller, AirDefense Services Platform, AP7532 Access Point, MPact server and Zebra BLE tags.

The Cisco solution consisted of a 5508 WLAN Controller, Cisco Mobility Services Engine and Cisco Prime Infrastructure. Please see Table 5.

Environment & Setup

Testing was conducted in a lab environment that was mapped to simulate a retail environment, in an area of approximately 4,000 square feet.

All testing was conducted using an array of four wireless LAN (WLAN) access points (AP) from each vendor under test. Both solutions were deployed using the same floor map and configured similarly for retail locations. At each location Zebra and Cisco APs were placed about 1 foot apart so that setup for both solutions was the same.

The test clients were defined as the systems to be targeted for locationing. These consisted of an LG Nexus 5, and Apple iPhone 5c, and an Apple iPad 3. Each client was identified by its unique MAC address.

To test the micro-locationing using Bluetooth Low Energy (BLE), the Apple iPad was used in conjunction with a Zebra-supplied test application.

Test Methodology

Architecture

Using publicly available pricing documents, Tolly engineers created a cost model based on the architectural requirements of each solution. This aspect of the evaluation did not include testing.

Cost models were constructed for a scenario of 100 deployed sites with 30 APs per site.

Models included one time costs of: wireless controller and APs, Location services, analysis and reporting consoles and ongoing costs, consisting mainly of support for the various solution components.

Presence

The goal of these tests was to determine the level of granularity that each SUT could provide. For this test, engineers enabled only one AP for each solution. For each solution, an RSSI threshold was created which would identify the devices as "present".

Wireless Access Point & Beacon Systems

Device Type	Vendor	Model	Description	Quantity
Wireless Access Point	Zebra Technologies	AP 7532	3x3 MIMO 802.11ac AP	4
Wireless Access Point	Cisco Systems	2702i	3x3 MIMO 802.11ac AP	4
Bluetooth Beacon	Zebra Technologies	Bluetooth Smart Beacon	Bluetooth Tag	18

Source: Tolly, October 2014

Table 6



**Comparison of 3-Year Projected Total Cost of Ownership: 100 Sites, 30 APs Per Site
Capital and Operational Costs - Details
Zebra Technologies vs Cisco Systems**

Category	Item	SKU	List Pricing	Qty	Subtotal by Configuration 30 APs per site
Zebra MPact Solution					
CAPEX	NX9500 Integrated Services Controller	NX-9500-100R0-WR	\$24,267.00	2	\$48,534.00
	NX 9000 1024 AP License	NX-9000-1024LIC-WR	\$56,007.00	3	\$168,021.00
	AP 7532 802.11ac AP	AP-7532-67030-US	\$795.00	3000	\$2,385,000.00
	AirDefense ADSP	SP-SWSV-P-1	\$4,528.00	2	\$9,056.00
	Wi-Fi Proximity Awareness and Analytics License	AD-PROX-P-1	\$99.00	3,000	\$297,000.00
CAPEX Costs					\$2,907,611.00
Support	NX9500 - 3 Yr Support	SAEX-NX9500-30	\$6,083.00	2	\$12,166.00
	1024 AP License 3 Yr Support	SWS-1024APS-LIC-30	\$36,864.00	3	\$110,592.00
	Proximity and Analytics - 3 Yr Support	SWS-AD-PROX-30	\$45.00	3000	\$135,000.00
	AirDefense ADSP 3 Yr Support	SWS-SP-SWSV-30	\$2,248.00	2	\$4,496.00
Support Costs					\$262,254.00
Solution Cost					\$3,169,865.00
Cisco CMX Solution					
CAPEX	Cisco 8500 Series WLC with 3000 AP support	AIR-CT8510-3K-K9	\$525,000.00	1	\$525,000.00
	Cisco 8500 Series WLC for High Availability	AIR-CT8510-HA-K9	\$25,136.99	1	\$25,136.99
	Virtual MSE platform with 5000 AP Location License	L-MSE-7.0-K9	\$4,995.00	2	\$9,990.00
	Cisco Aironet 2702i 802.11ac AP	AIR-CAP2702I-N-K9	\$1,095.00	3000	\$3,285,000.00
	CMX License- 1000 AP	L-AD-LS-1000AP	\$149,995.00	3	\$449,985.00
	Cisco Prime Network Control System	PRIME-NCS-APL-K9	\$14,995.00	1	\$14,995.00
CAPEX Costs					\$4,310,106.99
Support	Cisco 8500 Series WLC - 3 Yr Support	CON-3SNT-AIRCT85K	\$204,750.00	1	\$204,750.00
	Cisco 8500 Series WLC for High Availability - 3 Yr Support	CON-3SNT-AIRCT85	\$15,600.00	1	\$15,600.00
	Virtual MSE platform with 5000 AP Location License - 3 Yr support	CON-SAU-LMSE7K	\$4,497.00	3	\$13,491.00
	Cisco Aironet 2702i 802.11ac AP - 3 Yr Support	CON-3SNT-AIRCINK9	\$155.76	3000	\$467,280.00
	Cisco Prime Network Control System 3 Yr Support	CON-SNT-NCSAPL9	\$1,200.00	3	\$3,600.00
Support Costs					\$704,721.00
Solution Cost					\$5,014,827.99

Note: Pricing sourced from various online resellers. These are complex solutions and users should source solutions according to their need. Furthermore, discounts may apply that are not available via the websites used for pricing information. Prepare your own cost model.

Table 7

Zebra MPact vs. Cisco CMX: Component Cost Sourcing Information

Category	Item	SKU	Pricing Source
Zebra MPact Solution			
CAPEX	NX9500 Integrated Services Controller	NX-9500-100R0-WR	http://www.senetic.com/product/NX-9500-100R0-WR
	NX 9000 1024 AP License	NX-9000-1024LIC-WR	http://www.senetic.com/product/NX-9000-1024LIC-WR
	AP 7532 802.11ac AP	AP-7532-67030-US	http://www.provantage.com/motorola-ap-7532-67030~7MOTO37L.htm
	AirDefense ADSP	SP-SWSV-P-1	http://www.senetic.com/product/SP-SWSV-P-1
	Wi-Fi Proximity Awareness and Analytics License	AD-PROX-P-1	http://www.compsource.com/pn/ADPROXP1/Motorola-Symbol-3387/
Support	NX9500 - 3 Yr Support	SAEX-NX9500-30	https://support.ocr.ca/stock/Default.aspx/Motorola-Symbol/Service/Service-Contract/Motorola/SAEX-NX9500-30
	1024 AP License 3 Yr Support	SWS-1024APS-LIC-30	http://versatilemobile.net/catalog.php?p=SWS-1024APS-LIC-30&search=SWS-
	Proximity and Analytics - 3 Yr Support	SWS-AD-PROX-30	http://www.antaespro.com/8307155-item-MOTOROLA-SWS-AD-PROX-30.aspx
	AirDefense ADSP 3 Yr Support	SWS-SP-SWSV-30	http://www.uniquepos.com/MOTOROLA-SWS-SP-SWSV-30-p/sws-sp-swsv-30.htm
Cisco CMX Solution			
CAPEX	Cisco 8500 Series WLC for High Availability	AIR-CT8510-HA-K9	http://www.provantage.com/scripts/search.dll?QUERY=AIR-CT8510-HA-K9&Submit.x=6&Submit.y=12
	Virtual MSE platform with 5000 AP Location License	L-MSE-7.0-K9	http://www.senetic.com/product/L-MSE-7.0-K9
	Cisco Aironet 2702i 802.11ac AP	AIR-CAP2702I-N-K9	http://www.ithsc.com/ciscohardwaremaintenance/Cisco-Wireless-LAN-Products-AIR-CAP2702I-N-K9-155_2589-p-547517.html
	CMX License- 1000 AP	L-AD-LS-1000AP	http://www.senetic.com/product/L-AD-LS-1000AP
	Cisco Prime Network Control System	PRIME-NCS-APL-K9	http://www.senetic.com/product/PRIME-NCS-APL-K9
Support	Cisco 8500 Series WLC - 3 Yr Support	CON-3SNT-AIRCT85K	http://www.antaespro.com/8707570-item-CISCO-CON-3SNT-AIRCT85K.aspx
	Cisco 8500 Series WLC for High Availability - 3 Yr Support	CON-3SNT-AIRCT85	http://us.directdial.com/CON-3SNT-AIRCT85.html
	Virtual MSE platform with 5000 AP Location License - 3 Yr support	CON-SAU-LMSE7K	http://www.pcrush.com/product/Services-Warranties-Support/841141/Cisco-Software-Application-Support-Plus-Upgrades-SASU-1-Year
	Cisco Aironet 2702i 802.11ac AP - 3 Yr Support	CON-3SNT-AIRCINK9	http://www.directdial.com/CON-3SNT-AIRCINK9.html
	Cisco Prime Network Control System 3 Yr Support	CON-SNT-NCSAPL9	http://www.pcrush.com/product/Services-Warranties-Support/764605/Cisco-Cisco-SMARTnet-Extended-Service

Sources as noted. Reference only. Pricing can change and/or vary by region. Prepare your own cost model.

Table 8



Multi-level Presence Detection

For Zebra MPact engineers configured the thresholds for the three tiers of presence, referred to as: Parking lot, Outside Entrance, and In-store. Cisco does not have a similar configuration.

Engineers then took the test device out of range of the APs, and re-entered the coverage zone, verifying that events were generated from each solution.

Granular Enter/Exit Events

Cisco does not offer events associated with tracking data in the same way that MPact does. Engineers verified that enter and exit events were received when clients transitioned between zones.

Zone Tracking

For this test, two identical regions were defined in each solution's management interface, and all four configured APs were powered on. Engineers then placed a client in each region and verified that the solutions properly identified the locations.

Position Tracking

For this test, engineers used two smartphone client devices, placed at ten different locations in the test environment. Both phones were associated to a Cisco-broadcasted SSID.

MPact's interface allows administrators to determine client coordinates in an embedded map, this was used to gather data points for both solutions.

The initial position of each test was determined using MPact as described above. The systems were given roughly one minute to stabilize, then two position readings were taken over the next minute to determine the distance. For Cisco, client

location was determined from Cisco Prime Infrastructure. Tolly engineers then approximated that location in MPact to obtain the x,y coordinates for the calculations.

It is worth noting that Cisco's positioning of the iPhone updated very infrequently, and for the last five test points, the reported location for the iPhone did not change.

Micro-locationing (BLE Tracking)

This test evaluated micro-locationing use Bluetooth Low Energy (BLE) tracking. For this test, only the Apple iPad 3 was used, in conjunction with a sample app (supplied by Zebra). A separate retail area was set up, and consisted of actual product shelves and product categories. Zebra bluetooth beacons were deployed roughly every two meters on the shelves and surrounding wall.

Using the application, engineers verified that the beacons correctly identified the location in the aisle with <2 meter accuracy.



About Tolly

The Tolly Group companies have been delivering world-class IT services for more than 25 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.

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Interaction with Competitors

In accordance with Tolly's Fair Testing Charter, Tolly personnel invited representatives from Cisco Systems, Inc. to participate in the testing. Cisco Systems did not respond to the invitation.

For more information on the Tolly Fair Testing Charter, visit:

<http://www.tolly.com/FTC.aspx>



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