

Dave Gasdia
Maximo Strategy & Product Management



Maximo Scheduler 7.5.1

A Renewed Approach to Work Management

Pulse2012

Meet the Experts. Optimise your infrastructure.

May 31 - June 1

Sheraton on the Park Hotel, Sydney



Please Note:

Disclaimer

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion.

Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision.

The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.



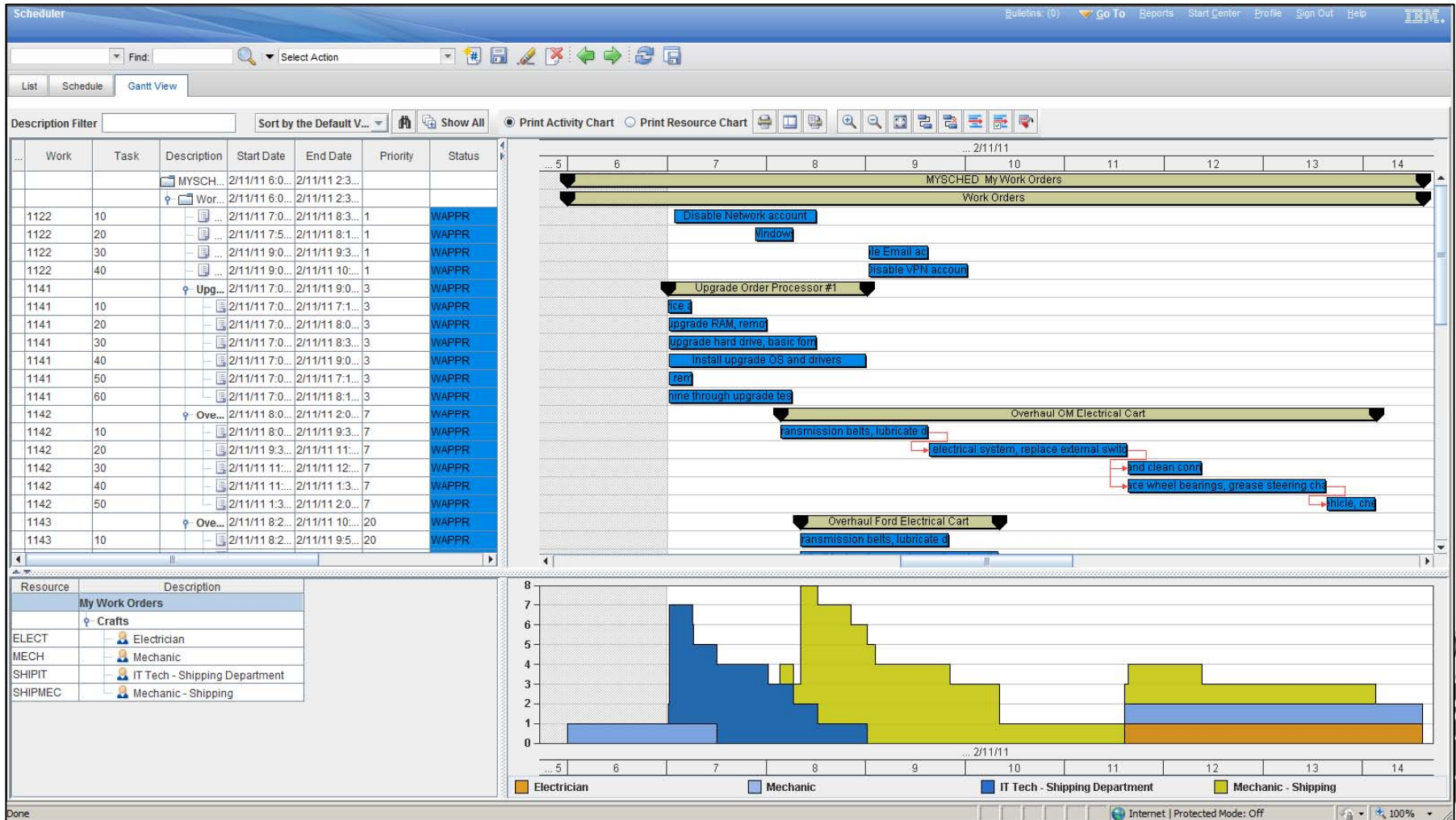
Agenda

- How has Maximo Scheduler evolved?
- Our Renewed approach toward Work Management
- New Features and Enhancements – Advanced Scheduling & Workforce Management:
 - Scheduler
 - The new Graphical Assignment application
 - Dispatching, Maps and Service Addresses
 - Maximo Everyplace templates
- Supporting Enhancements in Maximo fix-pack 7.5.0.3



What is Maximo Scheduler?

A Maximo add-on application that facilitates the scheduling of work orders, tasks, and PM forecasts graphically in a Gantt view



Maximo Scheduler to Date

Scheduler 7.1

Gantt View to visualize work orders and tasks

- Drag & drop work orders & tasks
- Manage dependencies
- Perform CPM
- View resource load and availability
- What If analysis

Work Orders

- Date constraints
- Task dependencies

Scheduler 7.1.1, 7.5

Gantt View to visualize PM forecasts

- View and manage future PMs and Work Orders
- View resource load and availability for both future PMs and Work Orders

Work Orders

- Bulk Reschedule
- Assignment Manager tab in Work Order application

3Q,2009

1Q,2010, 2Q 2011

Precedence Logic and Activity Constraints

- Precedence logic added between work orders/tasks that have the same parent
- SNE/FNL date constraints calculated automatically from JP/PM offsets

This WO is out of Compliance...

Compliance window for any work order or task

Predecessors: >> WO

Select Predecessors

Download

Site Relationship Lead/Lag Hours

Scheduling Information WO

Target Start: 01/03/12 10:08

Target Finish: 30/11/12 00:00

Scheduled Start: 01/03/12 10:08

... 2012

May June July August September October November

Project 1

First task

Edit Con

Preced

Prede

Suc

Con

OK Cancel



PM Forecasting

- Generate forecast dates, change/move dates and allow Maximo to use these forecast dates when generating PM based work orders.
- PM Forecast dates are graphically displayed in the same row on the Gantt chart.

The screenshot displays the Maximo PM Forecasting interface. On the left, a 'Generate Forecast' dialog box is open, providing instructions on how to generate forecasts. The main window shows the 'Preventive Maintenance' details for PM: IC-12400, 'Forklift #2 Quarterly Inspection and Certification' at the 'BEDFORD' site. The 'Forecast' tab is active, showing 'Forecast Dates Locked?' as unchecked and 'Reforecast Subsequent Dates?' as checked.

The 'Scheduler' view is shown in 'Gantt View' mode. The Gantt chart displays a timeline for November 2010, with columns for dates 11/1/10, 11/2/10, 11/3/10, 11/4/10, and 11/5/10. The chart shows bars for 'Work Order & Forecasts', 'Preventive Maintenance', and 'Work Orders'. The 'Preventive Maintenance' bar is expanded to show specific tasks with their start and end dates and times.

Work	Task	Description	Start Date
		Work Order & Forecasts	11/1/10 12:00 AM
		Preventive Maintenance	11/1/10 12:00 AM
1010		Inspection - with Job Plan Sequence	11/1/10 12:00 AM
1011		Inspection - Has effect on Subsequ...	11/1/10 12:00 AM
1008		Daily Inspection - Forecast Dates L...	11/1/10 12:00 AM
1009		General Inspection - No effect on S...	11/1/10 12:00 AM
		Work Orders	11/1/10 10:08 AM

Our Continued Focus on Work Management

Maximo Scheduler 7.5.1

- Focus : Advanced Planning & Scheduling, Workforce and Resource Optimization

Scheduler 7.1

Gantt View to visualize work orders and tasks

- Drag & drop work orders & tasks
- Manage dependencies
- Perform CPM
- View resource load and availability

Work Orders

- Date constraints
- Task dependencies

Scheduler 7.1.1, 7.5

Gantt View to visualize PM forecasts

- View and manage future PMs and Work Orders
- View resource load and availability for both future PMs and Work Orders

Work Orders

- Bulk Reschedule
- Assignment Manager tab in Work Order application

Scheduler 7.5.1

Gantt View displays additional Resources

- Materials/Tools/Asset
- Graphical Labor Assignments
- Resource Leveling – CPM or Manual
- Perform Actions from Gantt

Work Orders

- Dispatching
- Public Map API

3Q,2009

1Q,2010, 2Q 2011

2Q,2012

Work Management Plan Forward

- Investing in the natural evolution of our current products in a direction desired by our customers
- Enhancements to Scheduler (Maximo Scheduler 7.5.1)
 - Graphical Assignment/Dispatching
 - Provision of standard Work Order actions
 - Additional Resources and their availability
 - Assets/Locations
 - Labor
 - Tools
 - Materials
 - Schedule Compliance
- Enhancements to Maximo (7.5.0.3 function in a fix pack)
 - Service Addresses
 - Public Map UI Control
 - Crews
- Maximo Everyplace role based templates
- Optimization (iLOG Optimization tools)

All functional capabilities enabled with Maximo Scheduler 7.5.1

Target avail. 1H 2013

Our Work Management Focus Areas

Capacity Planning

Forecast Work
Identify Resource Gaps

Resource Optimization

Availability:
• Assets
• Location
• Material
• Tools
• Labor/Crews
Resource Leveling

Assignment

Graphical UI
Labor and Crews
Automated

Dispatching

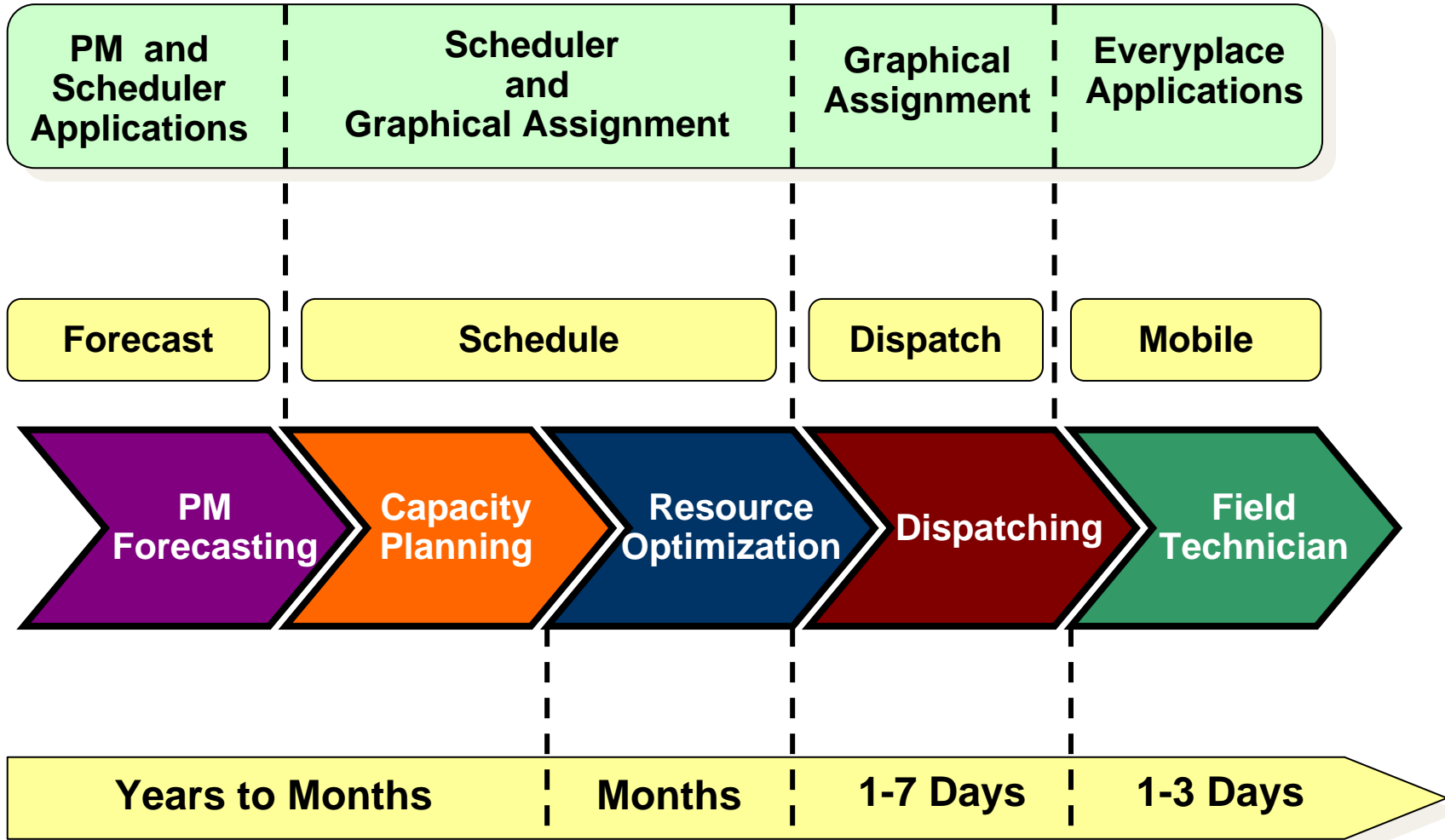
Graphical UI
Public Map Control
Route Optimization
Labor and Crews
Automated

Real-time Communication

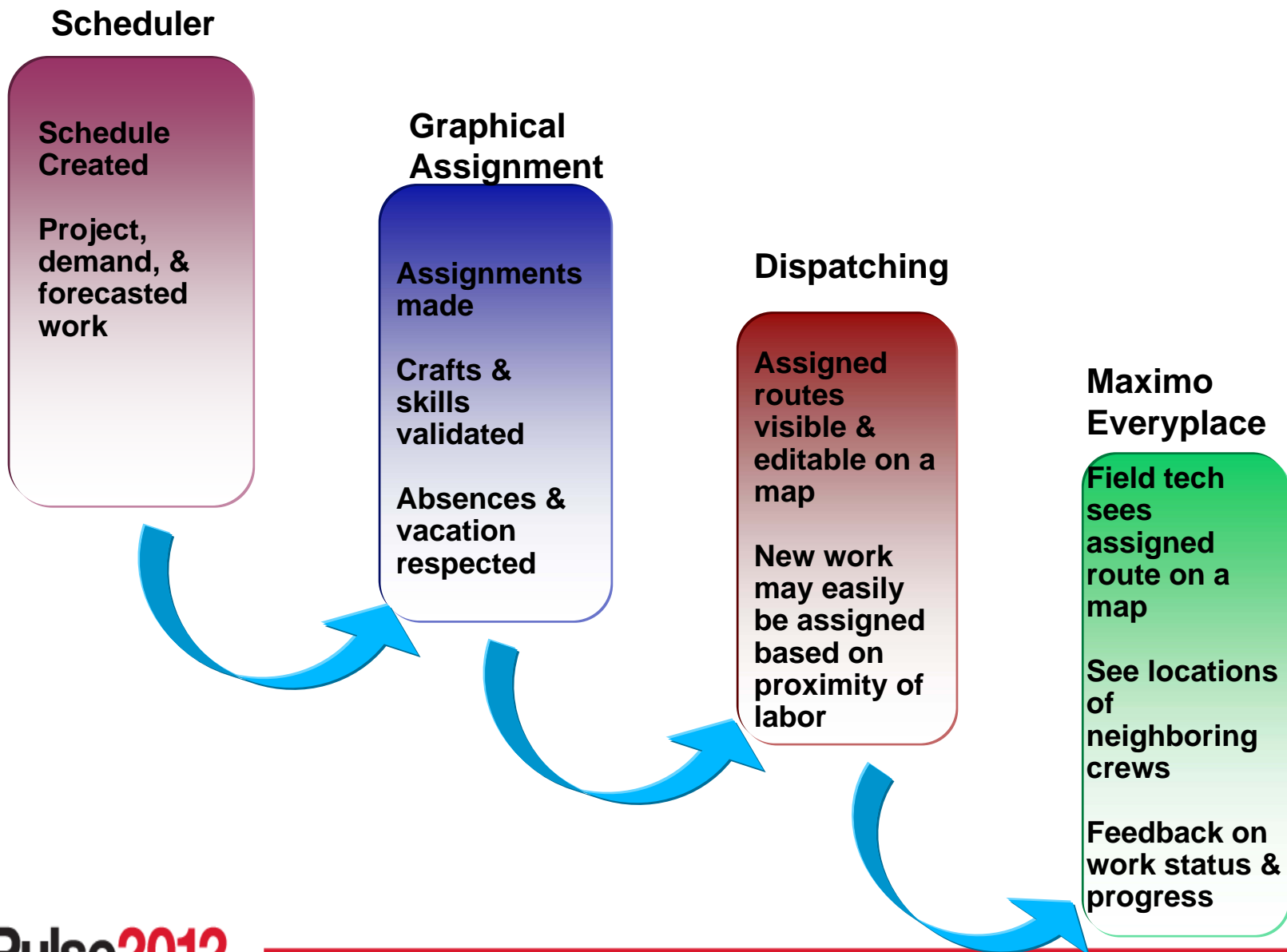
Assign
Emergency Work
Communication To Field Technicians

Schedule Compliance

Time Phased Functional Utilization



The logical work management hand-offs



Roles Involved in Managing the Schedule

Scheduler/Planner



- Defines and adjusts labor/crew availability along with resource leveling
- Capacity Planning
- Assigns work orders to resources
- Continuously optimizes the schedule as the operational environment changes
- Sequence and route work assignments based on geography

Dispatcher



- Monitor field resources and work order progress and status
- Monitor the location of field resources compared to open orders
- Enter status and complete work orders on behalf of technicians who don't have mobile devices
- Sequence and route ongoing work assignments based on geography and optimization

Field Technician



- Supervisor approves and assigns work on mobile devices
- Receive work orders in the field and provide real time status updates to dispatch
- Complete, edit and approve work orders on mobile devices along with viewing work on a map with optimal driving directions
- Notify dispatch of potentially dangerous situations, incomplete work



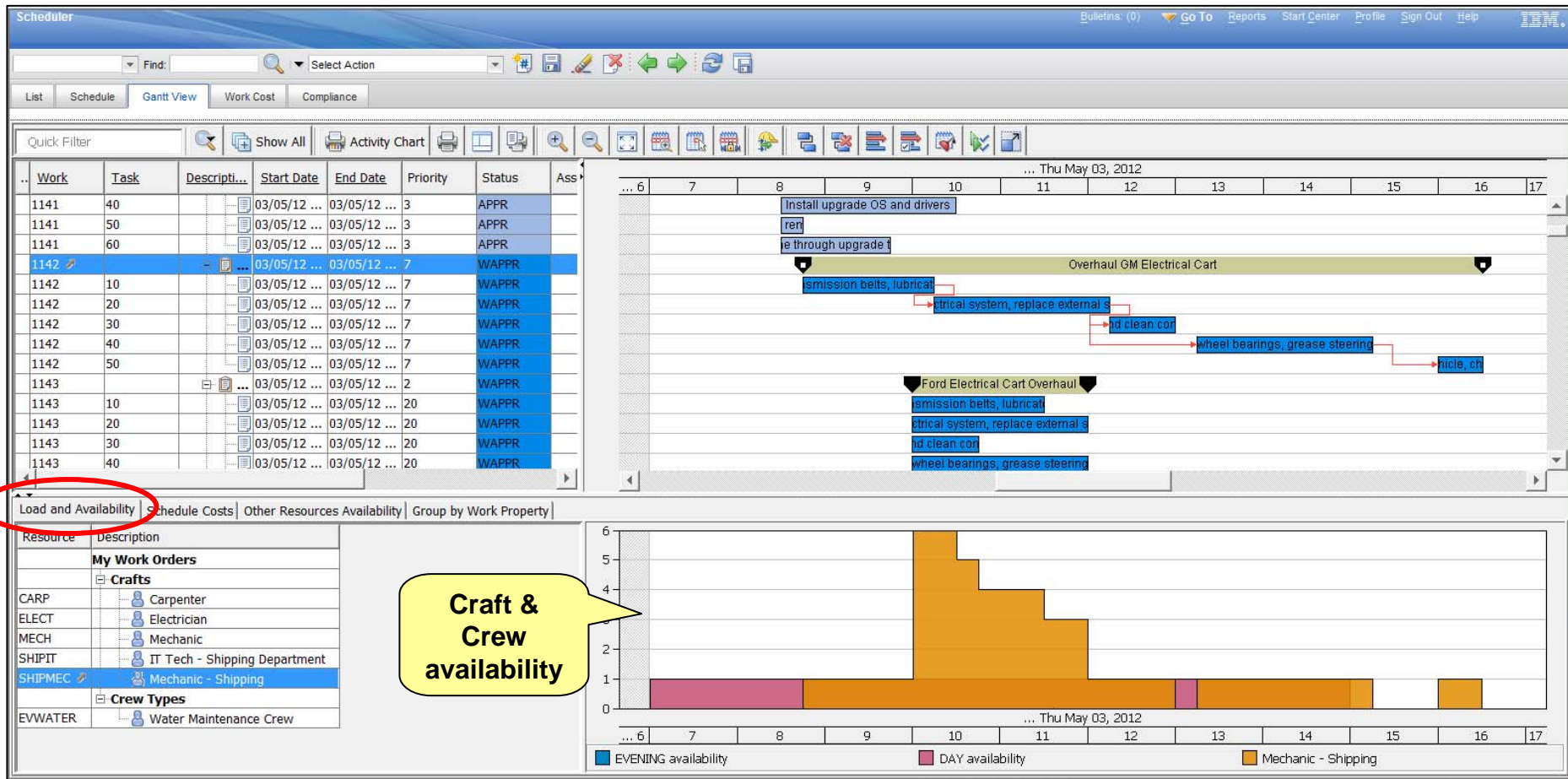
Contributors to our approach:

Maximo Scheduler

Load and Availability

Additional resource types provide a more complete and accurate vision of factors critical to proper planning & scheduling

- Can now see Labor/Crew, Asset/Location, Tool and Material availability

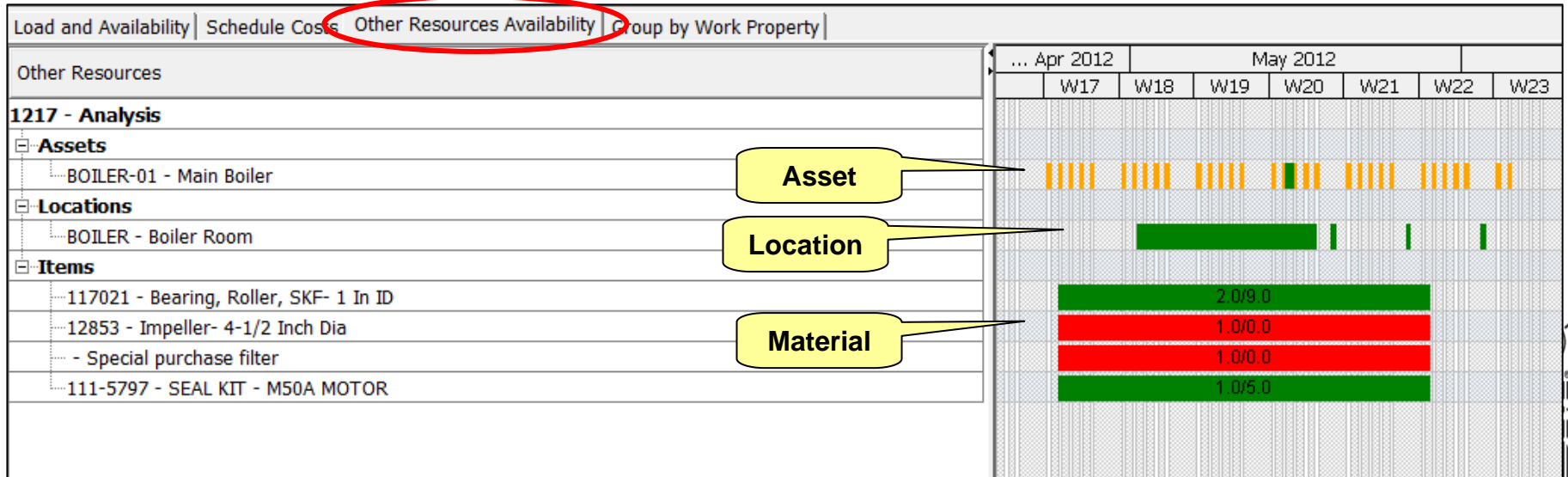


Asset, Location & Material Availability

Other Resource Availability tab shows:

- Maintenance/Operational/Calendar availability of Asset and Location
- Planner knows when an Asset or Location is (or is not) available for work
- Calendar may be imported from an external system (i.e. Production system)

- Material Availability for planned materials
 - Shows required quantity vs. available quantity
 - Eliminates planning work to be done when critical materials are unavailable
 - Trades can be advised via email to pick up materials from an alternate storeroom



Usability Improvements - Additional Actions and Tool Bar Buttons

Work Order Actions

- Keep the user from having to always navigate away from the Scheduler Gantt view

Additional Toolbar Buttons

- Make routine changes and adjustments simple for the planner



- Zoom to Week
- Go To Day
- Constrain horizontal scrolling to the date range containing work
- Filter resources based on selected work orders
- Show/Hide Compliance
- Full Screen

Work	Task	Description	Start Date	End Date
		MYSCHED My Work Orders	5/5/10 ...	3/4/12 ...
		Work Orders	5/5/10 ...	3/4/12 ...
1141		Lesson #1	2/11/11...	2/11/11...
1141		device and remove back cover	2/11/11...	2/11/11...
1141		Remove dust, remove dust	2/11/11...	2/11/11...
1141		Format drive, basic formatting	2/11/11...	2/11/11...
1141		Remove hard drives and drivers	2/11/11...	2/11/11...
1141		Remove and remove anti-static device	2/11/11...	2/11/11...
1141		High voltage upgrade testing cycle	2/11/11...	2/11/11...
1142		Physical Cart	2/11/11...	2/11/11...
1142		Remove belts, lubricate drive chain	2/11/11...	2/11/11...
1142		Remove belts, replace external switches	2/11/11...	2/11/11...
1142		Clean clean connecting terminals	2/11/11...	2/11/11...
1142		Remove belts, grease steering chassis	2/11/11...	2/11/11...
1142		Remove belts, check safety points	2/11/11...	2/11/11...
1143		Overhaul	2/11/11...	2/11/11...
1143		Remove belts, lubricate drive chain	2/11/11...	2/11/11...
1143		Remove belts, replace external switches	2/11/11...	2/11/11...
1143		Clean clean connecting terminals	2/11/11...	2/11/11...
1143		Remove belts, grease steering chassis	2/11/11...	2/11/11...
1143		Remove belts, check safety points	2/11/11...	2/11/11...
1150		12345	2/11/11...	2/11/11...
1157		15	2/11/11...	2/11/11...

Resource Leveling & Optimization



Support for various optimization models (target 1H 2013)

iLog CPLEX engine will be included with Maximo Scheduler

- Input
 - Flexible resource combinations
 - Priorities: Asset, Work , Location, Material, Tools
 - Resource availability
- Output
 - Optimal work schedule based on:
 - Resource availability
 - SLA's
 - Time constraint
 - And other user defined objectives such as minimize cost, schedule emergency work first, etc.

Typical Maximo Scheduler Use Case with Optimization

Maximo Scheduler is typically used to address:

- Capacity Planning
 - Identify craft and skill requirements for a set of work orders that need to be completed within certain constraints
 - Compare the requirements against availability - Asset, Location, Materials, Tools, as well as Resources (Labor and Crews) and identify the gaps
- Resource Leveling
 - Schedule work orders automatically based on current availability of crafts and skills.
 - Flexible resource combinations
- Assignment
 - Automatically assign work orders to individuals after taking into account skill requirements, the current labor load and the availability.
 - In the case of mobile crew, optimize the assignment based on customer defined parameters and priorities
 - Automate Route optimization
- Emergency Work Management
 - Dynamically assign emergency work to crew and reassign/reschedule affected work orders



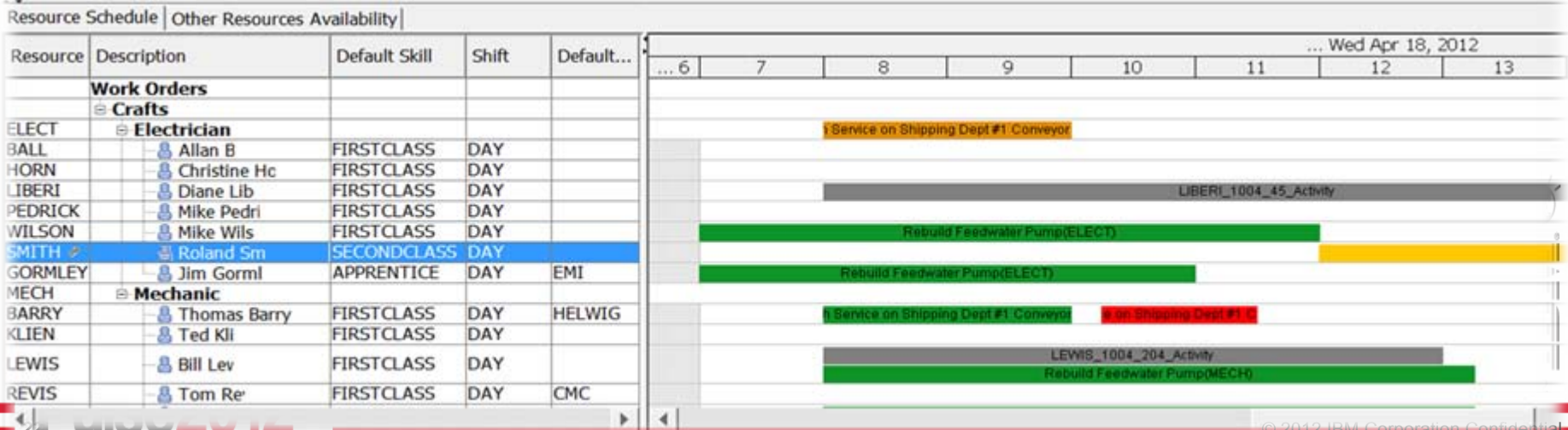
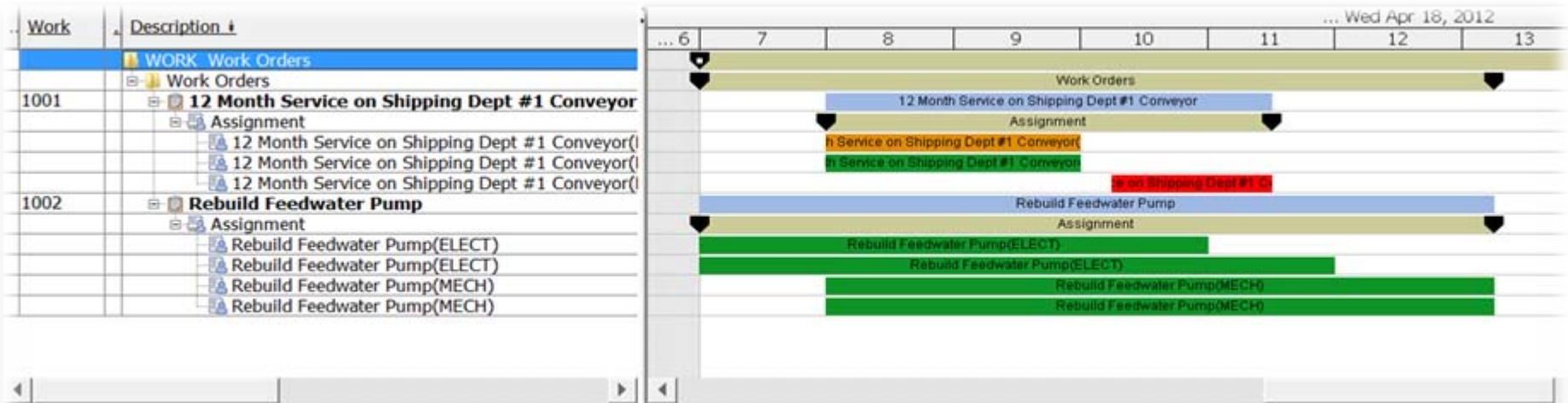


Contributors to our approach: Graphical Assignment


New Graphical Assignment Application

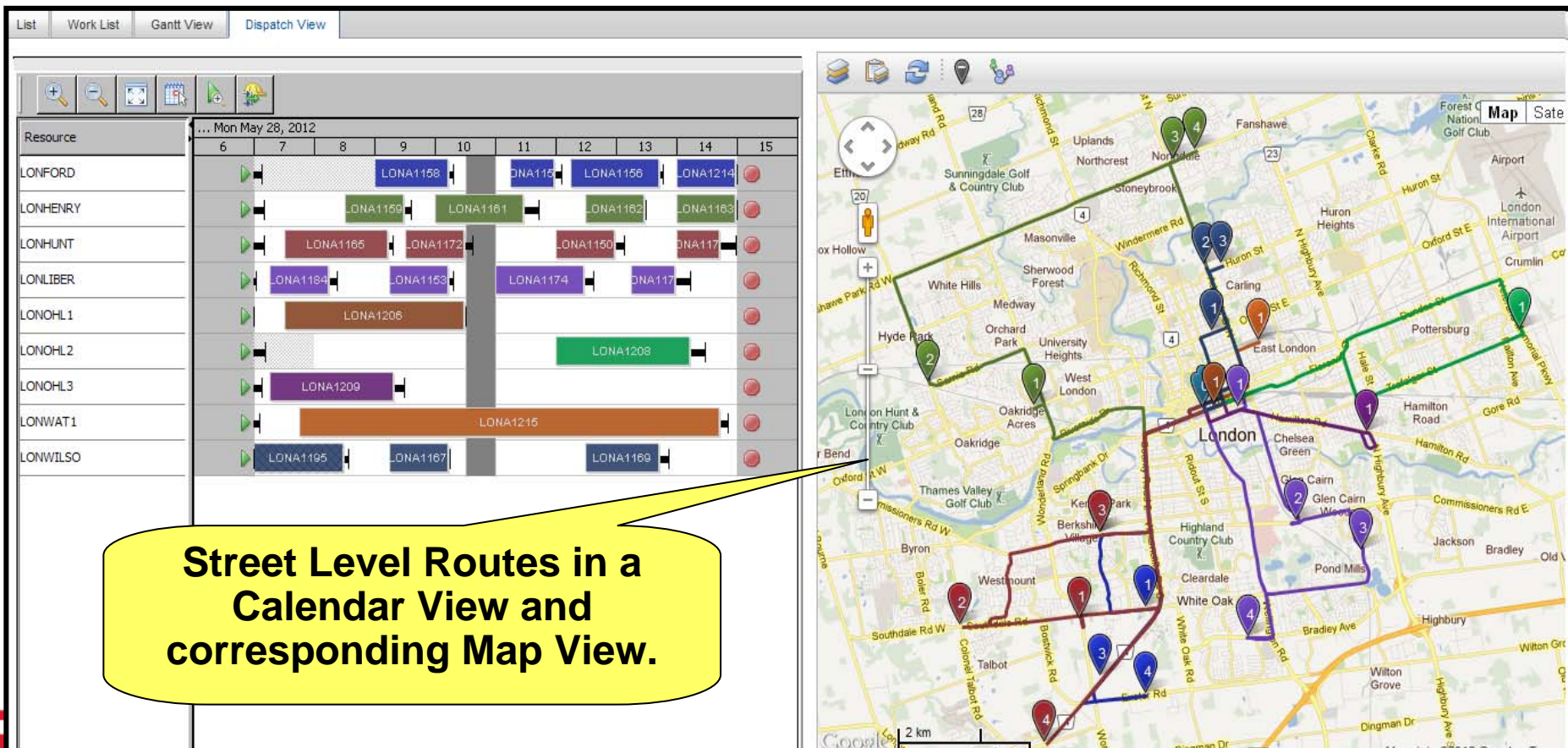
Application aimed at easing the process of assigning work to people

- Graphical Assignment UI is the same as Scheduler to further facilitate the logical “hand-off” of a schedule to where assignments are made
- Assignments are easily made via Drag & Drop with resulting color changes indicating a change of status from Waiting Assignment to Assigned



Dispatch Tab – Display Street Level Routes

-  Once Routes are created, click on the Dispatch Tab.
- Dispatch View - displays Routes in a Calendar and Map View
- Calendar View gives you the ability to Filter, Drag & Drop Assignments, Delete Assignments, Split Assignments
- Map View – View Nearby Labor & Crews, View Unassigned WOs, View WO markers based on status, priority or work type.



The screenshot displays the 'Dispatch View' interface, which is split into two main sections: a calendar view on the left and a map view on the right. The calendar view shows a grid for the week of Monday, May 28, 2012, with days 6 through 15. Resources are listed on the left, including LONFORD, LONHENRY, LONHUNT, LONLIBER, LONOHL1, LONOHL2, LONOHL3, LONWAT1, and LONWILSO. Each resource's schedule is represented by colored bars indicating assigned work orders (WOs) and their durations. The map view on the right shows a detailed street-level map of London, with various colored lines and markers representing the routes and assignments for each resource. A yellow callout box points to the map view, containing the text: "Street Level Routes in a Calendar View and corresponding Map View."

Resource	6	7	8	9	10	11	12	13	14	15
LONFORD				LONA1158		DNA115	LONA1156		LONA1214	
LONHENRY			LONA1159	LONA1161			LONA1162		LONA1163	
LONHUNT			LONA1185	LONA1172			LONA1160		DNA117	
LONLIBER			LONA1184	LONA1153			LONA1174		DNA117	
LONOHL1			LONA1206							
LONOHL2							LONA1208			
LONOHL3			LONA1209							
LONWAT1			LONA1215							
LONWILSO			LONA1195	LONA1167					LONA1169	

Dispatch View – Unassigned WOs

The screenshot shows a Google Maps interface with a dispatch software overlay. The map displays various neighborhoods in London, Ontario, with several unassigned work orders (WOs) marked by numbered pins. A callout box for work order LONB1173 is open, showing the following details:

- LONB1173**
- Work Order for London 120**
- Address:** 1400 Huron St, London, ON N5V 2E3, Canada
- Status:** APPR
- Asset:** LON120
- Location:** LON120
- More Information...** (dropdown menu)

The map shows several other unassigned WOs, each with a numbered pin (1, 2, or 3) and a grey location icon. A yellow callout bubble points to one of these pins, containing the text: "Unassigned Work Orders with Work Order Information on Map tips."

Unassigned Work Orders with Work Order Information on Map tips.

GPS Tracking

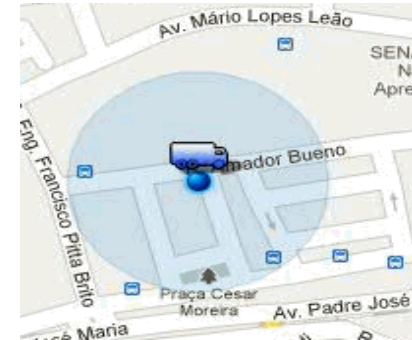
Identify a Location Based Service (LBS) Interval to capture

- Longitude, Latitude, Altitude, Accuracy, Altitude Accuracy, Heading, Speed

Labor:



Crews:



Markers are color coded to display how current the LBS is.



Blue within 30 mins of the LBS interval (configurable)

Red last location accuracy is over the limit (configurable).

Yellow outside 30 mins of the LBS interval

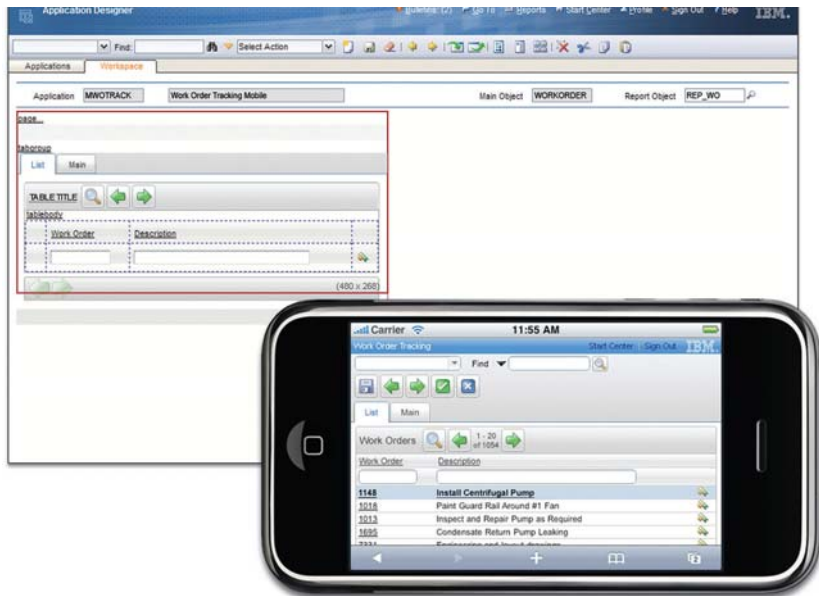


Contributors to our approach:

Maximo Everyplace

IBM Maximo Everyplace

Allows users to access any existing IBM Maximo application on an iPhone, iPad, iPod touch, Android, Blackberry, or other supported device without installing anything on those devices



Maximo Everyplace enables users to:

- Shorten the lag time between an event's occurrence and the recording of that event in the system. There's no need to wait until they get back to their desk to enter or retrieve data.
- Increase accuracy of data in the system by allowing them to enter information while it's fresh in their minds.
- Offer convenient, targeted access to Maximo for workers who don't regularly sit at a desk or use a desktop computer.



New Field Technicians Everyplace Templates



Developed new mobile applications for the field technician

- Leverage existing Maximo Everyplace product
 - Ability to tailor the application with Application Designer tool
- New templates designed for the field technician
 - View current and sequenced assignments for themselves or their crew
 - Obtain directions where required
- View and feedback on work order details
 - Configurable content
- Dynamic updates of sequenced work reflecting newer higher priority work, reassignments, emergencies
- Application for Supervisor, and Technician (Lite, Phone and Tablet versions)



MX Everyplace Field Technician Application – Tablet

- Create a Work Order Query that will capture the WOs assigned to labor/crew for the day.
- Map is based

The screenshot displays the 'Work Orders' application interface. At the top, there is a search bar and a navigation indicator '1 - 3 of 3'. Below this is a table with the following data:

Work Order	Description	Asset	Status
EV1227	Craigs House	EV105	APPR
EV1228	Reuben Hoar Library	EV106	APPR
EV1230	British Beer Co	EV104	APPR

Below the table is a 'Select Records' checkbox and another '1 - 3 of 3' indicator. The 'Map View' section below shows a map of the area with a blue route connecting three points labeled 0, 1, and 2. A yellow callout bubble points to the route with the text 'Field Technician's Work Order Route'.

Field Technician's
Work Order Route

Field Technician Application – My Work

The screenshot shows the 'Everyplace Technician (Tablet)' application interface. At the top, there are navigation options: 'Start Center' and 'Sign Out'. Below that is a search bar with 'Find:' and a magnifying glass icon. A toolbar contains various icons for navigation and actions. The main section is titled 'My Work' and includes tabs for 'Details', 'Resources', and 'Results'. There are also options for 'Advanced Search', 'Save Query', and 'Bookmarks'. The 'Work Orders' section is circled in red and shows a table with columns 'Work Order', 'Description', 'Asset', and 'Status'. Below it, the 'Required Materials' section is circled in red and shows a table with columns 'Item', 'Description', 'Storeroom', and 'Quantity'. At the bottom, the 'Required Tools' section is circled in red and shows a table with columns 'Tool', 'Description', 'Storeroom', and 'Quantity'. A yellow callout bubble points from the 'Work Orders' section to the text 'Street Level Route of Work Orders for the day.' Another yellow callout bubble points from the 'Required Materials' section to the text 'List of Required Material and Tools to do the work for the day.'

Work Order	Description	Asset	Status
LON51161	Work Order for London 105	LON105	APPR
LON51162	Work Order for London 106	LON106	APPR
LON51163	Work Order for London 107	LON107	APPR
LON51164	Work Order for London 122	LON122	APPR
LON51165	Work Order for London 108	LON108	APPR
LON51167	Work Order for London 117	LON117	APPR
LON51169	Work Order for London 118	LON118	APPR

Item	Description	Storeroom	Quantity
1002	5 ft. X 6 ft. window pane		1.00
11406	AC Spark Plug	CENTRAL	8.00
11453	Seal, Mechanical, Self Aligning- 1 In ID	CENTRAL	1.00
117084	Shaft- 1 Inch Dia	CENTRAL	1.00

Tool	Description	Storeroom	Quantity
ARROW BOARD	Arrow Board Traffic Control Trailer		4.00

Street Level Route of Work Orders for the day.

List of Required Material and Tools to do the work for the day.

Field Technician Application – Details

Everyplace Technician (Tablet) Start Center

Find: [Search Icon]

My Work Details Resources Results

Work Order LON5116
Work Order for London 105

Work Type [Search Icon]

Priority [Input]

Status APPR

Service Address LON105 [Search Icon]

Formatted Address 1100 Hyde Park Rd, London, ON N6H 5K5

Street Address 1100 Hyde Park Rd

City LONDON

State/Province ON [Search Icon]

Location LON105 [Arrow]

1100 Hyde Park Rd, London, ON N6H 5K5 [Add Icon]

Asset LON105 [Arrow]

Asset for London 105 [Add Icon]

Classification [Arrow]

[Search Icon]

Start Date / Finish Date

Scheduled 3/5/12 10:00 AM [Calendar Icon] 3/5/12 11:30 AM [Calendar Icon]

Actual [Calendar Icon] [Calendar Icon]

Toolbar Actions:

- Query Tools
- New / Follow-up Work Order
- Status Change
- Stop / Start Timers
- Attach Documents

Field Technician Application – Time Reporting

Mobile Worker LH - Mozilla Firefox: IBM Edition

File Edit View History Bookmarks Tools Help

http://maxdevp7b.swg.usma. Google

Most Visited IBM My Yahoo! Comcast RTC: Maximo Plans IBM

Mobile Worker LH

Confirm Timer

The Timer is going to record the time you have spent managing your

Ticket Class

Record Key

Review the information below before submitting.
You may update the values and click 'OK' to submit.
Click 'Cancel' to return to the record; the Timer will continue to run.

Start Date

Start Time

Finish Date

Finish Time

Hours

Complete Workorder?

	11430	O-PRESSU	
	11430	RUNHOURS	

1 - 2 of 2

Transferring data from maxdevp7b.swg.usma.ibm.com...

New functions in Maximo 7.5.0.3

Maximo 7.5.0.3 - Service Address Application

- Available in Locations, Assets, Service Requests, Incidents, Problems, Work Order Tracking, Activities and Tasks, Changes and Releases.
- **Service Addresses moved from Service Provider and Utilities to core Maximo**

Note: Service Addresses are important for the usage of maps. Mapping utilizes the Latitude (y) and Longitude (x) coordinates.

Maximo 7.5.0.3 – Crew Types/Crew Applications

- Crew Types and Crews moved from Utilities to core Maximo
 - Crews have required craft/skill, qualifications and tools (defined as crew type attributes)
 - Assign labor to crew positions and assign tools to meet the crew requirements
 - A crew history of labor/tool assignments and the work performed is maintained
 - Schedule Crews in Maximo Scheduler, Assign Crews in Graphical Assignment, WOT, Job Plans

Rate is the summation of all the labor and tool rates assigned to the crew. Override rate if required.

Position	Craft	Skill Level	Description	Vendor	Remarks
DRIVER	DRIVER	SECONDCLAS	Class B license		
HELPER	ELECT	APPRENTICE	Electrician Apprentice		
LEADER	ELECT	FIRSTCLASS	Electrician - 1st Class		

Tool Sequence	Tool Number	Description	Remarks
TS1	LONBTRUCK	Bucket Truck	

Map Tabs

Available in Service Address, Locations, Assets, Service Requests, Incidents, Problems, Work Order Tracking, Activities and Tasks, Changes and Releases.

The screenshot displays a web application interface for a map. At the top, there are tabs for 'List', 'Address', and 'Map'. Below the tabs, the 'Formatted Address' is '300 Commissioners Rd W, London, ON N6J 1Y3, Canada', and the 'Address Code' is 'LON100'. A 'Find Location' button is present. The main area is a map showing a street grid in London, Ontario, with a blue location pin at the intersection of Commissioners Rd W and Southcrest Estates. A popup window is open over the pin, displaying the following information:

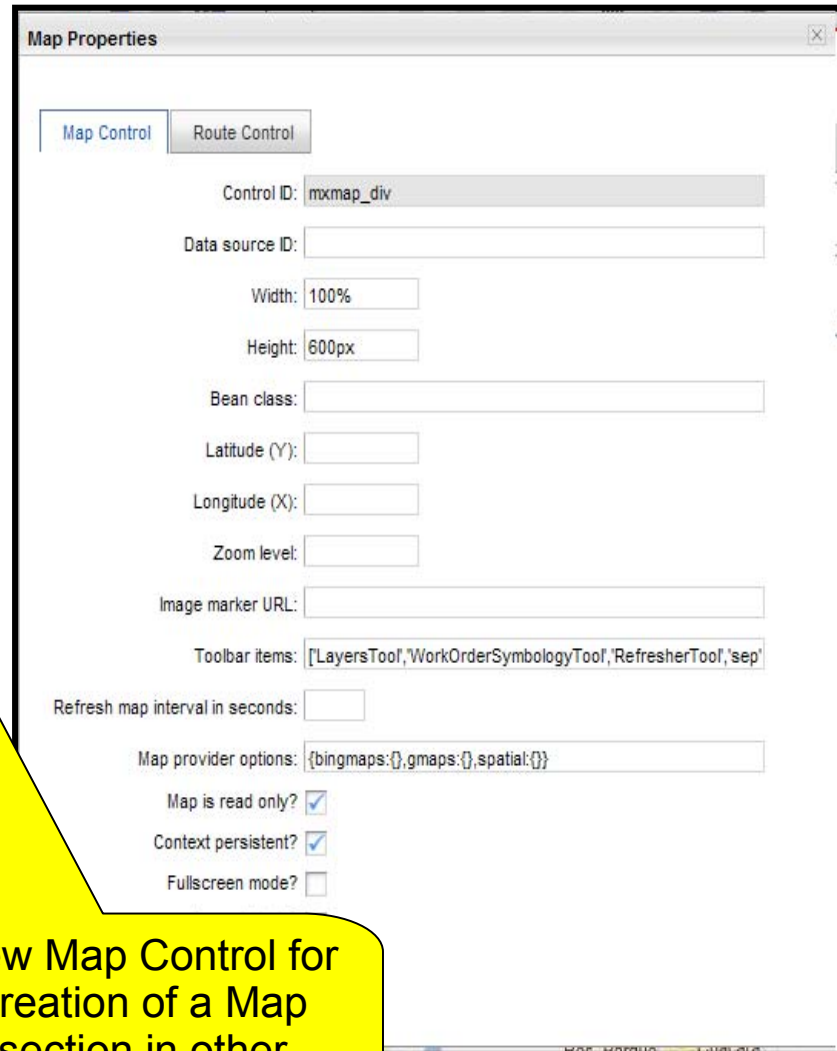
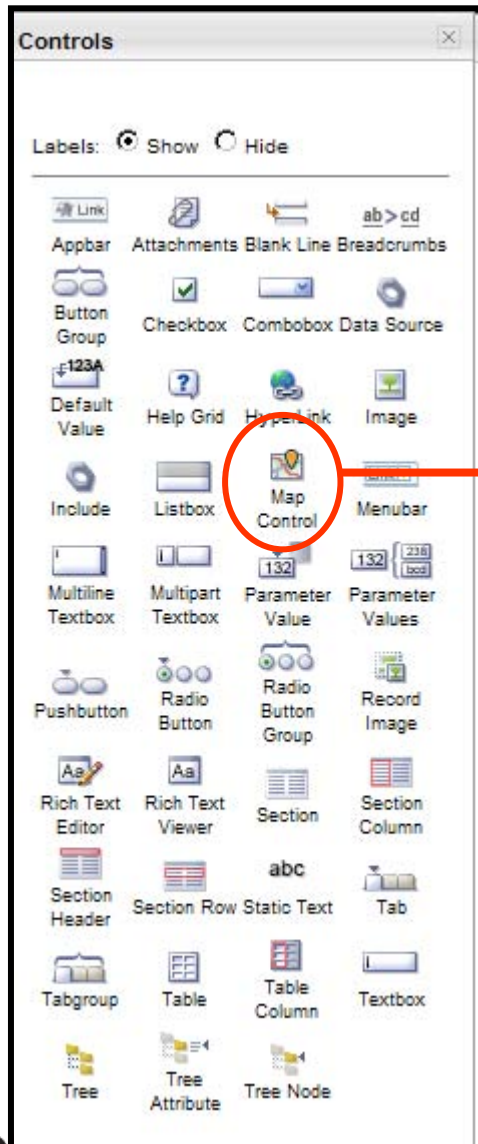
LON100
300 Commissioners Rd W, London, ON N6J 1Y3, Canada

Address: 300 Commissioners Rd W 300 Commissioners Rd W, London, ON N6J 1Y3, Canada

More Information...

The map includes various street names such as Gainsborough Rd, Oxford St W, Commissioners Rd W, and Southcrest Estates. Landmarks like the Thames Valley Golf Club and Springbank Park are also visible. The interface includes navigation controls like a compass and a person icon for location services.

Application Designer – Map Control



New Map Control for creation of a Map section in other applications

The Summarized Advanced Scheduling and Workforce Management Vision

- Use Maximo Scheduler to:
 - Find the optimal time to schedule upcoming work by balancing:
 - Work order and Task relationships and constraints
 - Labor, Asset, Location, Craft, and Material availability
 - Have visibility into schedule compliance
 - Drag and drop labor assignments (or automate)
- Increase the visibility of resources and crews by:
 - Leverage map UI control for dispatching of incoming work
 - Monitor progress of existing work
 - Manipulate crew and resource routes
- Improve efficiency of field technicians
 - Leveraging map UI control for viewing of route stops
 - Dynamic work list based on dispatched work and automated optimization
 - Communication with neighboring resources
 - Intuitive feedback from mobile applications



Questions



Trademarks and disclaimers

© Copyright IBM Australia Limited 2012 ABN 79 000 024 733 © Copyright IBM Corporation 2012 All Rights Reserved. TRADEMARKS: IBM, the IBM logos, ibm.com, Smarter Planet and the planet icon are trademarks of IBM Corp registered in many jurisdictions worldwide. Other company, product and services marks may be trademarks or services marks of others. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at www.ibm.com/legal/copytrade.shtml

The customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics may vary by customer.

Information concerning non-IBM products was obtained from a supplier of these products, published announcement material, or other publicly available sources and does not constitute an endorsement of such products by IBM. Sources for non-IBM list prices and performance numbers are taken from publicly available information, including vendor announcements and vendor worldwide homepages. IBM has not tested these products and cannot confirm the accuracy of performance, capability, or any other claims related to non-IBM products. Questions on the capability of non-IBM products should be addressed to the supplier of those products.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. Some information addresses anticipated future capabilities. Such information is not intended as a definitive statement of a commitment to specific levels of performance, function or delivery schedules with respect to any future products. Such commitments are only made in IBM product announcements. The information is presented here to communicate IBM's current investment and development activities as a good faith effort to help with our customers' future planning.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Prices are suggested U.S. list prices and are subject to change without notice. Starting price may not include a hard drive, operating system or other features. Contact your IBM representative or Business Partner for the most current pricing in your geography.

Photographs shown may be engineering prototypes. Changes may be incorporated in production models.

