



let's build a smarter planet



Smart Telecom Infrastructure Management

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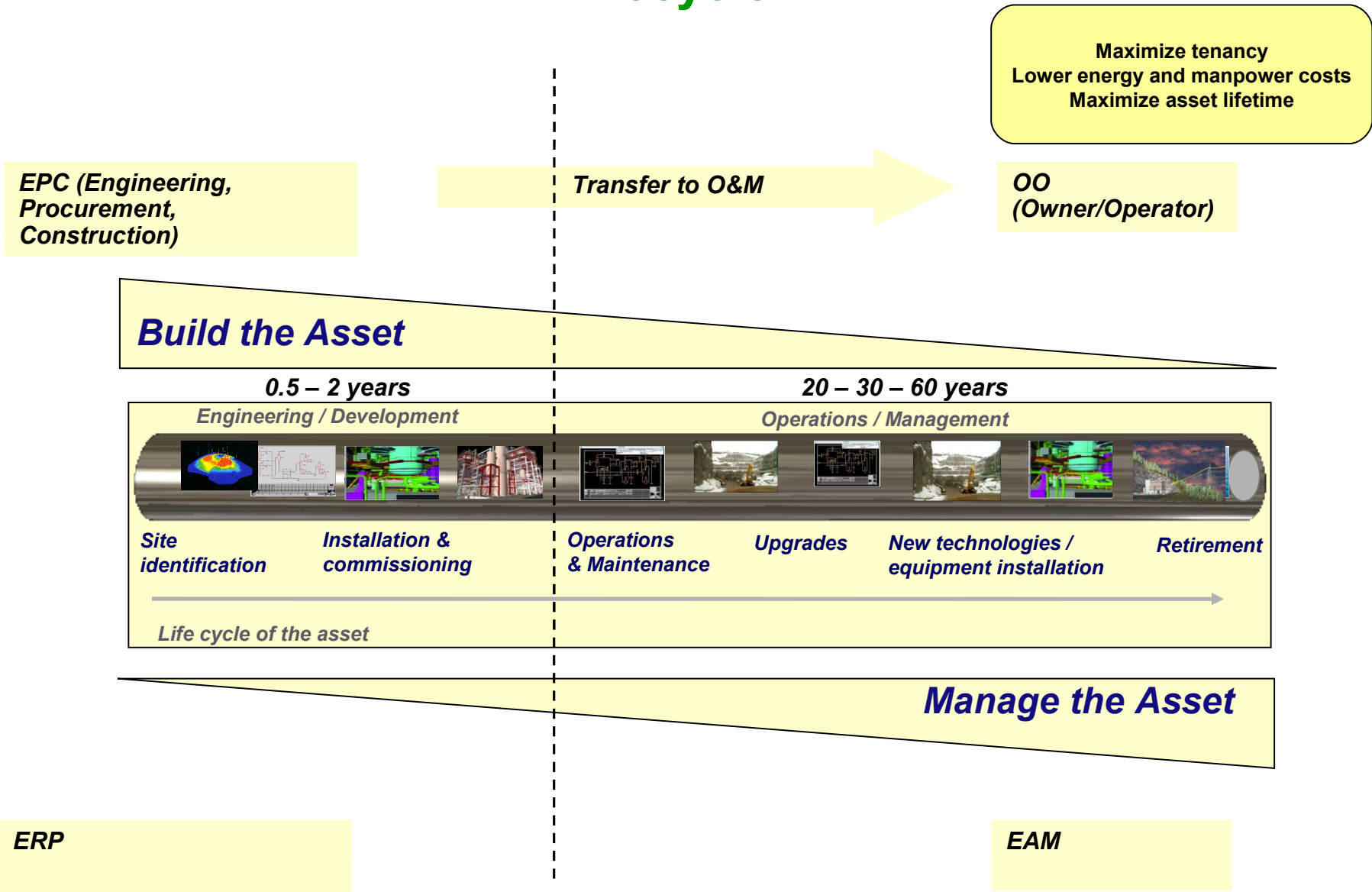
What's interesting about passive Telecom infra ?

- An important **energy / carbon** problem
 - Eats up about 1.8 billion liters of diesel a year !
- Perhaps the largest scale **distributed asset management** problem in business
 - Over \$10 billion of capex, spread across the length and breadth of the country
- Sector with the highest M&A, consolidation, and regulatory activity in recent times
- Arguably one of the most “interesting” enterprise IT scenarios in the industry
 - Even BAU processes require water-tight integration across enterprise systems
 - A unique, complex enterprise billing environment, not supported out-of-the-box by any ERP packages

Understanding the passive infra business

- Understanding the “Lifecycle”
- Understanding the operational environment
- Challenges and fundamental limits on efficiency
- Understanding the crucial role of technology
- Understanding the “endgame”

Lifecycle



Operational environment

- Large number of geographically distributed assets, housed in ground or roof-based setups
- On-site operations outsourced to vendors with local presence. Circle organizations exercise control and governance
- “In band” monitoring (e.g. OSS feeds) from active infrastructure available, but may or may not be available / utilized by tower operator
- May have arrangements with Tenant’s NOC / circle offices, to extend monitoring data/stations



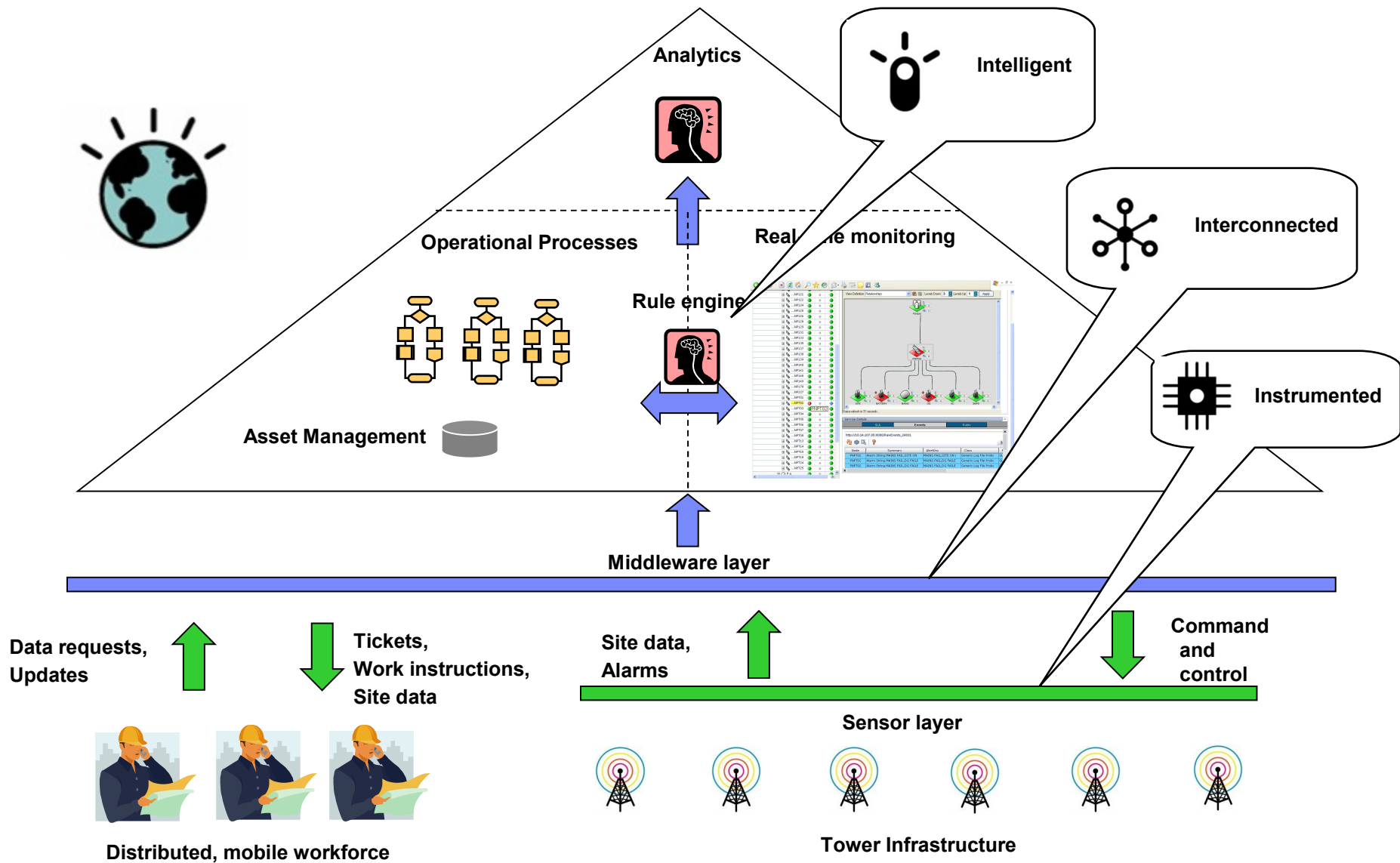
Fundamental limits to efficiency

- Poor quality of grid power supply, leading to dependence on diesel
- Inability to govern actions of vendors, especially in remote areas
- Frequent asset movement
 - Justified movement: to manage site outages quickly / locally
 - Undesirable movement: theft
- Scale
 - Every investment (e.g. site surveillance, instrumentation for monitoring) has to be multiplied at least 10,000 times
- Technology penetration
 - Ground personnel may not have access to enterprise applications / data

The crucial role of technology

- A substantial number of issues / operational challenges can be addressed effectively by technology
- Wide variety of monitoring / “sensing” (observe)
- “Smarts” to determine what is actionable (analyze)
- Remote process orchestration and tracking, workforce management (act/control)
- **Analytics** of asset performance, process/vendor performance, energy optimization opportunities, ... (analyze)
- Streamline asset lifecycle management – manage costs, maximize lifetime through maintenance

High-level solution architecture



Best of breed components

- All 20 of the world's top 20 service providers are IBM Netcool customers
- 1,000+ Service Provider Customers



- AOL
- AT&T*
- Bell Canada*
- BellSouth*
- Cablevision
- Comcast
- Cox Comm.
- Digex
- Earthlink
- MCI*
- SBC*
- Sprint (& Nextel)*
- Telmex*
- Triton PCS
- UUNET
- Verio
- Verizon*
- Qwest*

- Bharti
- China Mobile
- China Netcom
- China Telecom
- China Unicom
- China Rail

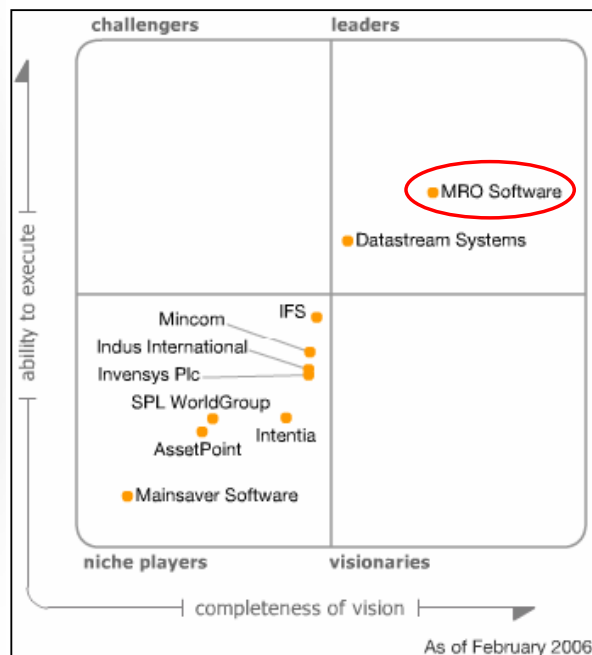
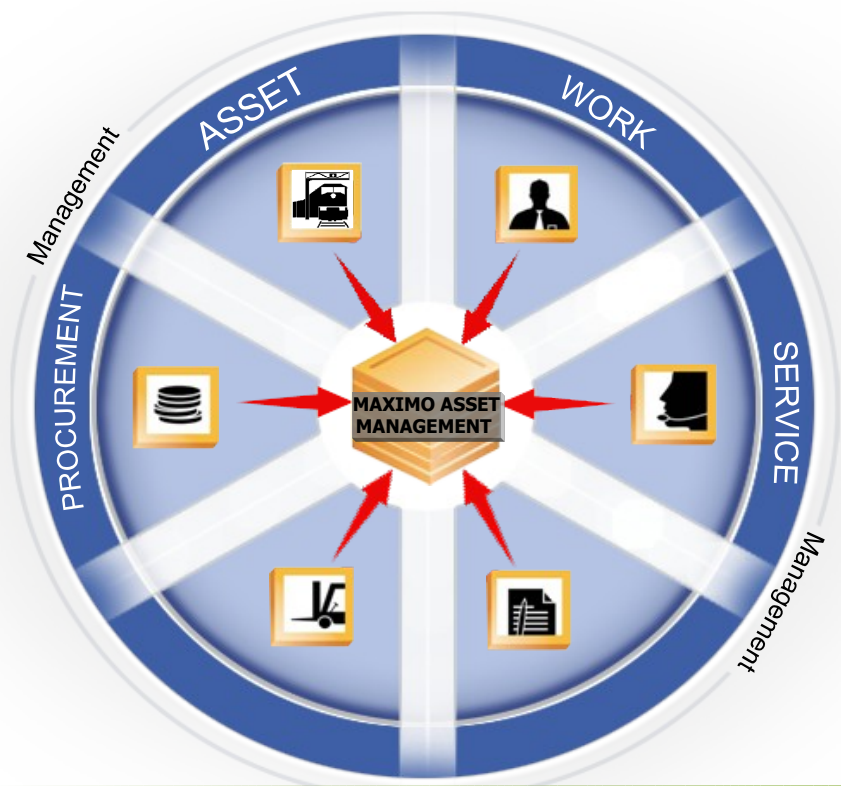
- CSL
- Ericsson
- ISTT Singapore
- Japan Telecom
- KDDI
- NTT

- Philippine LDT
- Shanghai Cable
- Singtel
- SmarTone
- Telstra
- VSNL

- Belgacom
- British Telecom*
- BT Cellnet
- Cable & Wireless
- Cablecom
- Deutsche Telekom*
- France Telecom*
- KPN*
- NTL
- Swisscom*
- T-Mobile
- Telecom Italia*
- Telefonica*
- Telekom Austria
- Telenor
- TeliaSonera
- Telkom South Africa
- Vodafone

Best of breed components

- Maximo Enterprise Asset Management : Single, integrated platform for all asset classes (physical assets, IT assets)
- Market share leader across industry verticals
 - More than 80 customers in energy and utilities, 200 in oil and gas/chemicals, 110 in facilities and industrial, 500 in transportation, ...
- Placed in Gartner's leader quadrant for 11 years in a row

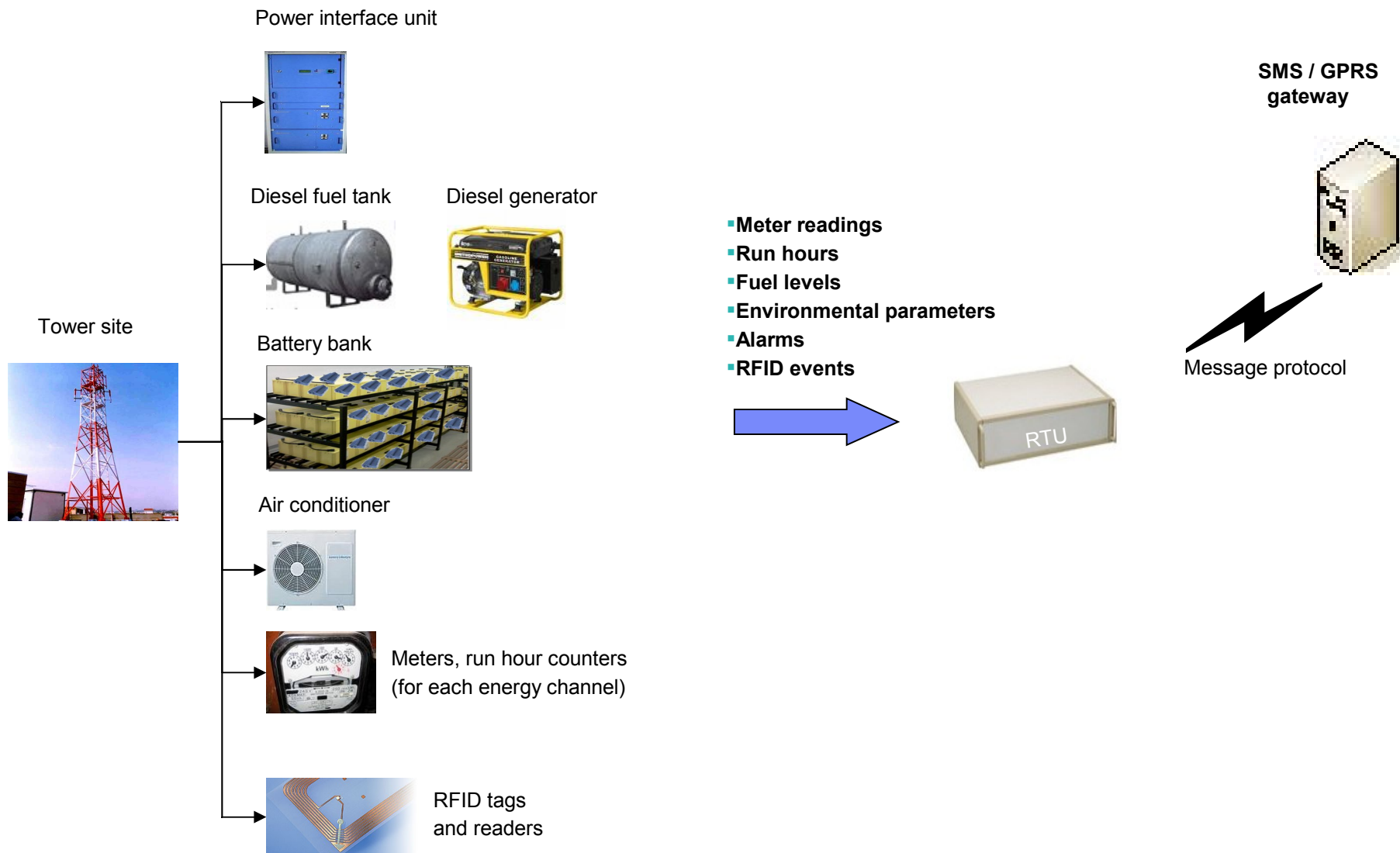


Gartner

MRO Software
is the only vendor to have been placed in the EAM Leader's Quadrant 10 times since 1998

29 March 2006
© Gartner, Inc.
Kristian Steenstrup
William Maynard
ID: G00137606

Instrumentation



Real-time Operational Insight

TOC Portal - Microsoft Internet Explorer

Address: http://localhost:9080/TOCWeb/PerspectiveHandler

Links: IBM Business Transformation Homepage, IBM Standard Software Installer, IT Help Central, Join World Community Grid

Tower Operations Center

National Circle Site Analytics

SiteID: Find

Selected site is MP3961

Circle	Zone	Cluster	District	Address	CGI	GeoCodes
MP	Bhopal	Bhopal	Bhopal	Aasif naseer khan s/o n.a. khan,1,aman colony	404-93-39046-39612	(23.298,77.396)

Contacts	Name	Mobile No.	Email
ZTM	Ranjit Katoch	9816649835	null
Cluster Incharge	Rajjit Kumar	9816649834	null
Technician	Shashi Kumar	9805444665	null

Status Energy Process Opex Asset

Site	Power	Communication	Environment
Site State	Mains State	PIU Comm	Door State
BTS Opco-1	Manual Mode	IO Comm	Temperature
BTS Opco-2	Mains Low	DECM1 Comm	Fire and Smoke
BTS Opco-3	DG State	DECM2 Comm	A/C
BTS Opco-4	DG Fail Start	DECM3 Comm	Both A/C
	DG Fail Stop	DECM4 Comm	
	Fuel State	AECM1 Comm	
	DG Fault	AECM2 Comm	
	LLOP Fault		
	Rectifier State		
	Site on Battery		
	Battery Fuse		
	Load Fuse		
	Battery Voltage		
	Frequency		
	Voltage		
	LCU1 Voltage		
	Fuel Level		

start | Local intranet | 11:56 Wednesday 18/03/2009 | 66%

Real-time Operational Insight

Inventory loaded into TOC "service model" :
Hierarchy of circle, zone, cluster, site, asset

The screenshot displays the IBM Tivoli Netcool interface within a Microsoft Internet Explorer browser window. The interface is divided into several panes:

- Service Tree (Left):** A hierarchical tree view showing the organization structure. It includes levels for India, various states (Assam, Bihar, HP, Haryana, Karnataka, Rajasthan, UPE), and specific sites like Panipat, Rewari, and Rohtak. The 'Panipat' site is currently selected.
- Service Viewer (Middle):** A list of assets (assets) associated with the selected site. Each asset is represented by a small icon and a name (e.g., ...NP121, ...NP122, etc.). The status of each asset is indicated by a green circle.
- View Definition: Relationships (Right):** A graphical diagram showing the relationships between the selected site (PNPT02) and its various components. The components include SITE, BATTERY, MAINS, DG, AC, and SMPS. Each component has a status indicator (green or red) and a numerical value.
- Service Details (Bottom Right):** A table showing the event log for the selected site. The table has columns for Node, Summary, AlertKey, and Class. The events listed are related to 'MAINS FAIL' and 'SITE ON'.

Real-time asset status for a given site

From “data” to “action”, via Rule Engine

① Rule Engine computes need for actionable ticket, creates trigger event

Serial	Alert Key	Agent	Node	Manager	Summary	AssetName	Alert Group	AlarmCode	SiteType	Location
252307	MAINS FAIL	SMS	BHAAH01	RuleEngine	Alarm String: MAINS FAIL Status Str...	MAINS	RuleEngine_Alarm	ALMNSF02	Macro	

② Ticket automatically created

Service Requests

Find: [] Select Action []

Service Request: 2815 Owner: ARVOLD Owner Number: 9910030882 Owner Group: Status: RE-ASSIGN Attachments []

External ID: NCOMS 252307 Source: SMS? [] Phone? [] E mail? [] Notify? [] Created By: MXINTADM

Service Request Details

Summary: Alarm String: MAINS FAIL

Details: Alarm String: MAINS FAIL | Status String: 0000 | Command Status: DECM2 COMM FAILURE DECM4 COMM FAILURE | Room Temp: 26.4Deg C | Fuel Level: 023% | DG Running Hours: 000844.9Hrs | MAINS Running Hours: 0001072.0Hrs | BATTERY Running Hours: 0000190.9Hrs | Sys Status: MANUAL MODE | DG Fault Status: 00 | DG Energy: 00000102Kwh

Asset: [] Location: BHAAH01 | INASARHI

Configuration Item: [] Target Description: []

GL Account: [] Asset Site: BHAR Country: INDIA Circle: BHAR Zone: PATNA Cluster: GAYA Pool: BH001 District: NALANDA Town: TI AHABA

Site Type: Macro Alarm Type: MAINS FAL

Classification: [] Classification Path: [] Class Description: [] Reported Priority: 1 Impact: [] Urgency: [] Internal Priority: [] Service Group: [] Service: [] Vendor: [] Site: [] Site Visit Required? [] Calendar: BH CAL Shift: 24HRS Create WO Options: MULTI Technician Remarks: [] Vendor Required? [] Expert Required? [] Manual Remarks: []

From “data” to “action”, via Rule Engine

3 Ticket ID is reflected back in event

Manager	Summary	AssetName	Alert Group	AlarmCode	SiteType	Location	TicketID	EIFFdBk
RuleEngine	Alarm String: MAINS FAIL Status Str...	MAINS	RuleEngine_Alarm	ALMNSF02	Macro	BHAAH01	2815	Updated

4 Ticket is eventually resolved

Service Request: 2815
 Owner: JYOTIS
 Owner Number: 9810661480
 Status: RESOLVED
 External ID: NCOMS 252307
 Source: SMS?
 Created By: MXINTADM

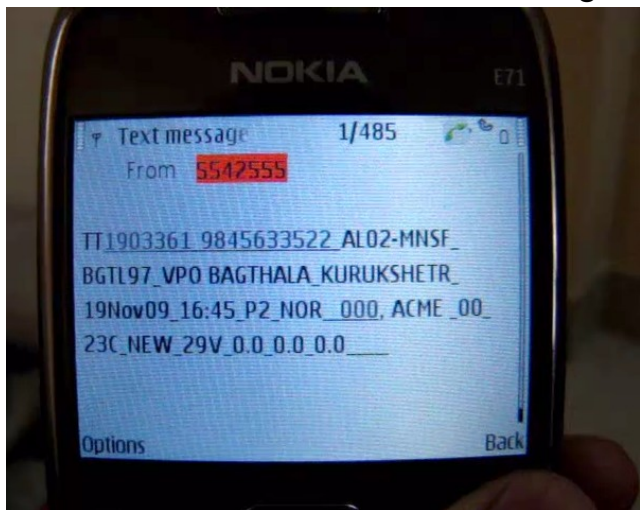
Service Request Details:
 Summary: Alarm String: MAINS FAIL
 Details: Alarm String: MAINS FAIL | Status String: 0000 | Command Status: DECM2 COMM FAILURE_DECM4 COMM FAILURE | Room Temp: 26.4Deg C | Fuel Level: 023% | DG Running Hours: 000844.9Hrs | MAINS Running Hours: 0001072.0Hrs | BATTERY Running Hours: 0000190.9Hrs | Sys Status: MANUAL MODE | DG Fault Status: 00 | DG Energy: 00000102Kwh

5 Resolved ticket is reflected back in event

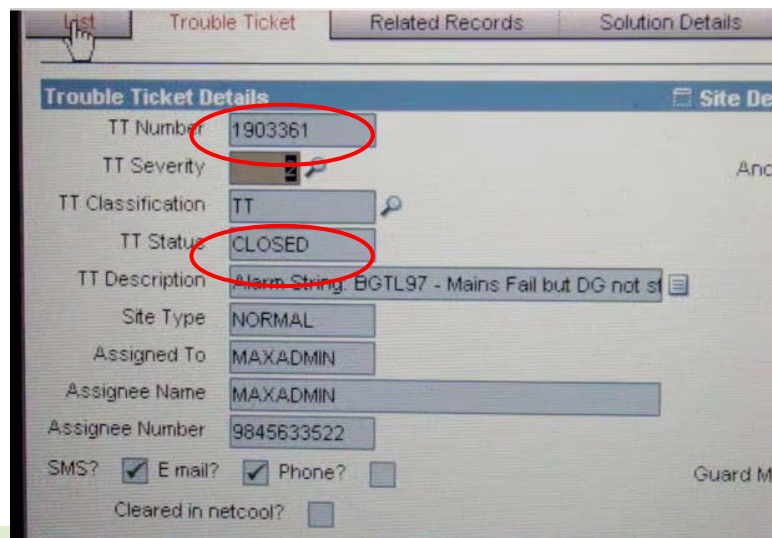
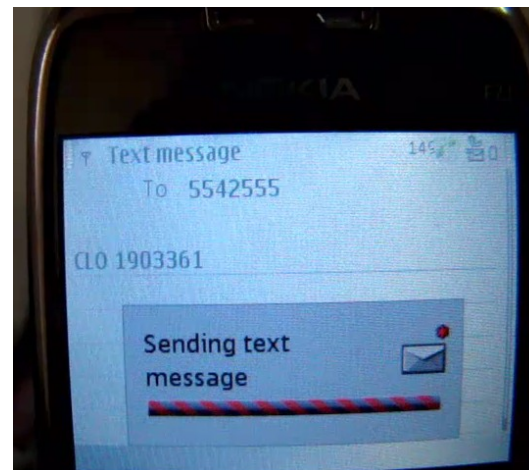
Serial	Alert Key	Agent	Node	Manager	Summary	AssetName	Alert Group	AlarmCode	SiteType	Location
252307	MAINS FAIL	SMS	BHAAH01	RuleEngine	Alarm String: MAINS FAIL Status Str...	MAINS	RuleEngine_Alarm	ALMNSF02	Macro	BHAAH01

SMS-based process management

User receives ticket as text message



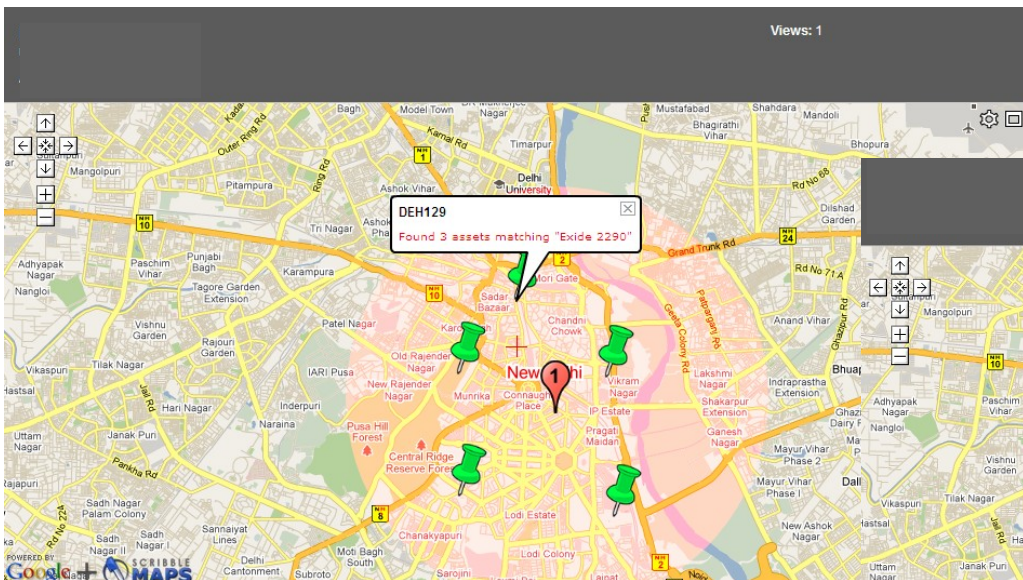
User manages ticket through text commands (in this example, he closes the ticket)



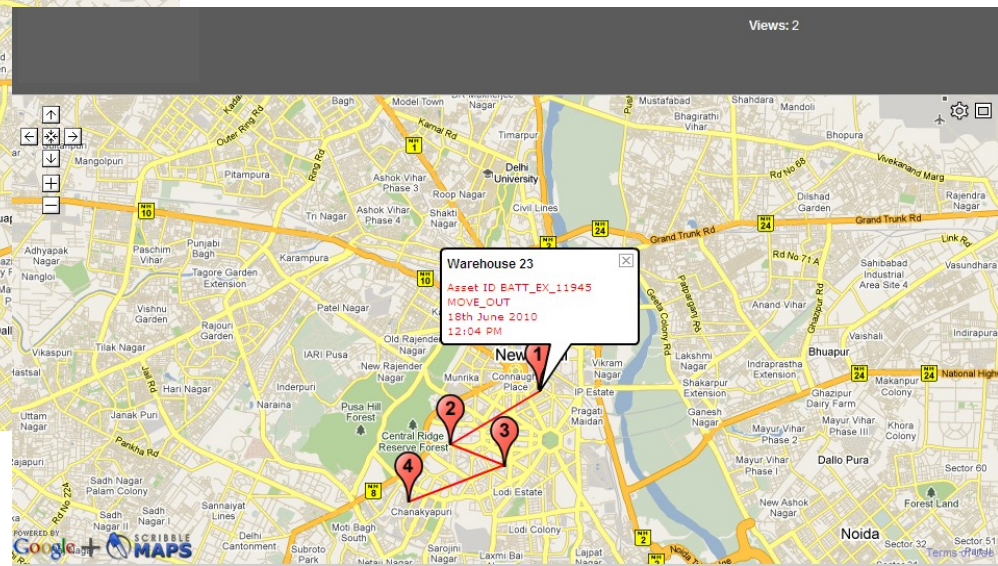
Back-end service desk system always reflects and tracks the process state

Asset tracking and management

Spatial search



Track and Trace / movement history



Auditing

AssetID	Asset Description	Last Audit Date	Delta
BATT_EX_189	Exide Battery Model XYZ 12V	18th June 2009	LOCATION=DEL123, LOCATION=DEL776
AC_BLU_1034	Bluestar Air Conditioner Model A23	18th June 2009	LOCATION=DEL123, LOCATION=UNDEF
AC_BLU_1096	Bluestar Air Conditioner Model A23	18th June 2009	STATE=ONSITE, STATE=MOVE_OUT
CAB_CAT5_10267	CAT5 Cable 10ft	18th June 2009	null
BATT_SUK_104	Su-Kam Battery Model ABC 12V	18th June 2009	STATE=ONSITE, STATE=RETIRED
BATT_SUK_109	Su-Kam Battery Model ABC 12V	18th June 2009	STATE=ONSITE, STATE=RETIRED
BATT_SUK_110	Su-Kam Battery Model ABC 12V	18th June 2009	STATE=ONSITE, STATE=RETIRED

The “EndGame”

*A tower management solution starts out as a means to provide
visibility, control and automation*

*But eventually becomes the key source of continuous “**insights**” into
operations and business –*

*exposing **trends, issues and optimization opportunities***

What's creating work ? Why ?

Start Center - LRI Internet Explorer

Address: http://10.14.166.22:8080/maximo/ui/login?uisessionid=1241754691017

Welcome, NOCUPW

Update Start Center

Favorite Applications

- Trouble Tickets
- Assignment / Reassignment Matrix
- Escalation Matrix
- Tower Sites
- Clusters
- Zones
- Circles
- Countries
- Tower Site - Employee
- People

TT's Generated for the past 24 Hrs.

Chart Type: [Pie](#)

Tickets generated in the past 24 Hrs (By Alarm type)

Alarm type	Value	Percent (%)
AC FAULTY	3	0.48
AECM1 COMM FAILURE	46	7.34
AECM2 COMM FAILURE	32	5.1
BATTERY FUSE FAIL	10	1.59
DECM1 COMM FAILURE	14	2.23
DECM2 COMM FAILURE	17	2.71
DECM3 COMM FAILURE	3	0.48
DG FAILED TO START	50	7.97
DG FAILED TO STOP	7	1.12
DG FAULT	60	9.57
DG FUEL LEVEL LOW	20	3.19
DG ON	7	1.12
DOOR ALARM	34	5.42
FIRE AND SMOKE	10	1.59
HIGH TEMPERATURE	81	12.92
LOAD FUSE FAIL	4	0.64
LOW BATTERY VOLTAGE	91	14.51
MAINS FAIL	32	5.1
MANUAL MODE	29	4.63
PIU COMM FAILURE	5	0.8
RECTIFIER FAIL	62	9.89
SITE ON BATTERY	10	1.59

[List View](#)

Tickets generated from the past 1 month

Chart Type: [BAR](#)

Tickets generated for the past month (By Asset Type)

Asset Type	Value	Percent (%)
AC	422	17.52
BATTERY	446	18.51
COMMUNICATION	343	14.24
DG	537	22.29
MAINS	182	7.56

What's the “right” level of EB/DG consumption ?

- Example :
 - Compares a measure of site EB+DG consumption to group average
 - Higher than 1 indicates opportunity to improve energy performance : could be due to equipment, poor preventive maintenance, or energy theft
 - Sample set of 1700 sites

Ratio (r)	% of sites (x)	Severity
Below - 0.5	9%	Grey
0.6 - 1.7	53%	Green
1.8 - 3.0	24%	White
3.0 - 4.5	8%	Red
4.5 - above	6%	Red

How's my asset performance ?

- 25% of the tickets are for DGs
 - 60% of these are due to DG faults
 - 20% of these are due to low fuel level
 - **Fix / replace / improve PM of DGs**

- 17% of the tickets are for batteries
 - 60% of these are due to low voltage level
 - **Improve PM of batteries**

- High incidence of AC faults (and high temperature alarms) in Circle1 (11%) and Circle2 (17%) circles
 - **Audit and address root cause**

How's my energy performance ?

- Only 9% of sites report daily metering
 - Audit and address root cause
- In Circle1, 5% of sites have DG+mains energy consumption 20% higher than normal
 - Audit and address root cause
- In Circle2, 12% of sites show battery runtime lower than expected
 - Audit and address root cause
- In Circle3, more than 30% of sites show DG+mains consumption > twice the circle average
 - Audit and address root cause

How's my process / vendor performance ?

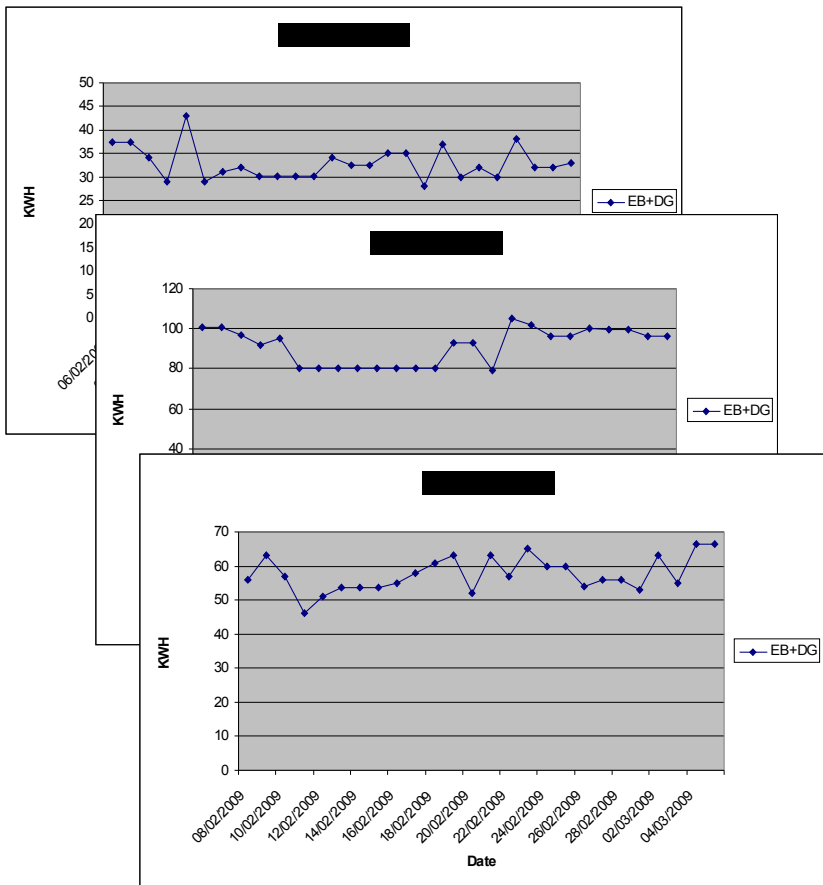
- Every circle has 55% or higher ticket reassignment
 - Skill issues with 'First line of defense' ?

- Average time to acknowledge too high in Circle1
 - Over 30 hours, with sample set of 21,000 tickets !
 - 84% of tickets across all circles not acknowledged within SLA
 - Process adoption issue ?

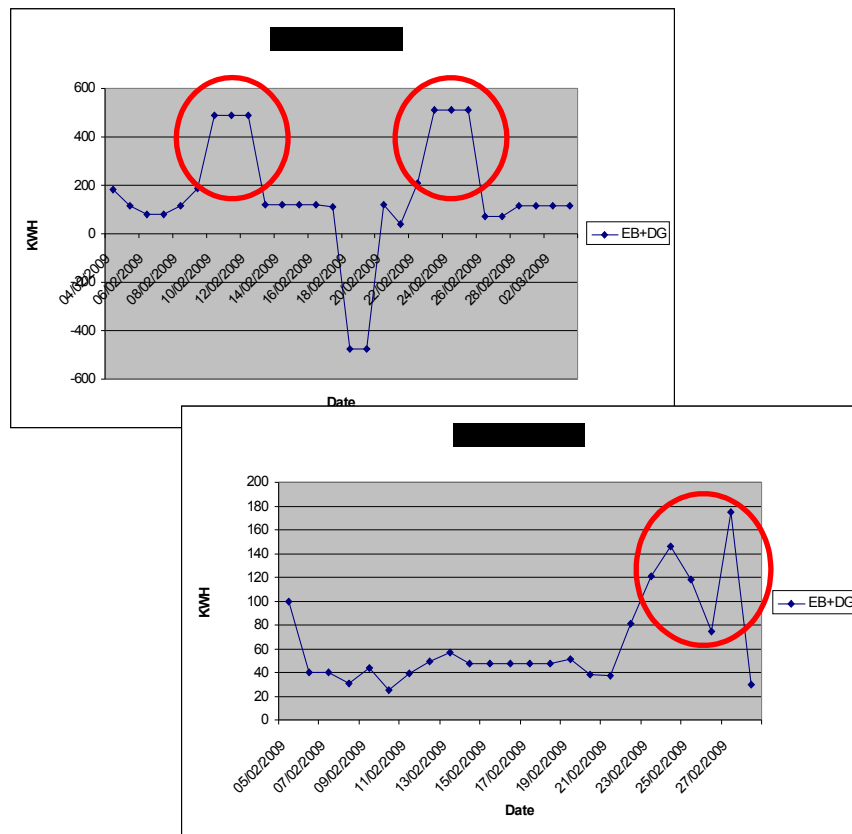
- Average time to resolve too high in Circle1, Circle2, Circle3, Circle4
 - Skill issue ? Spares issue ?

Who's walking away with my cheese ? 😊

"Well behaved" profiles of EB+DG consumption

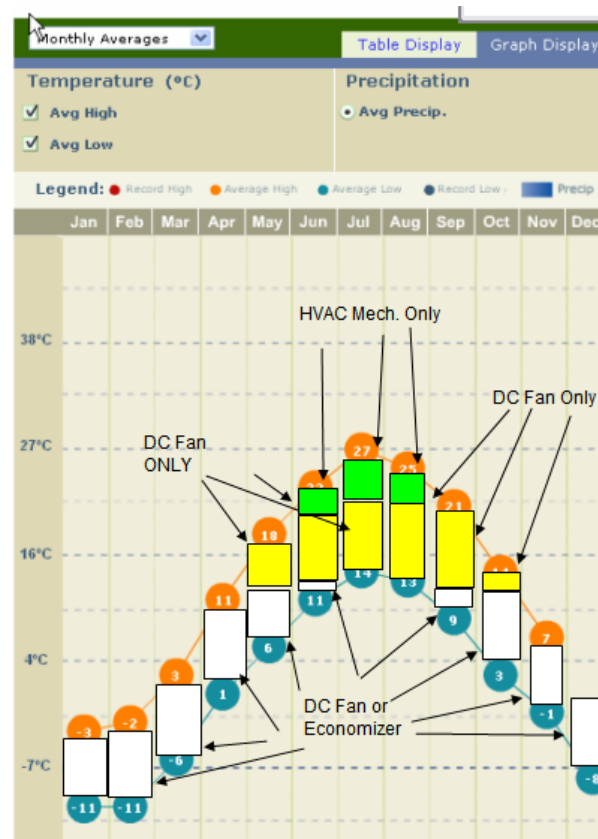
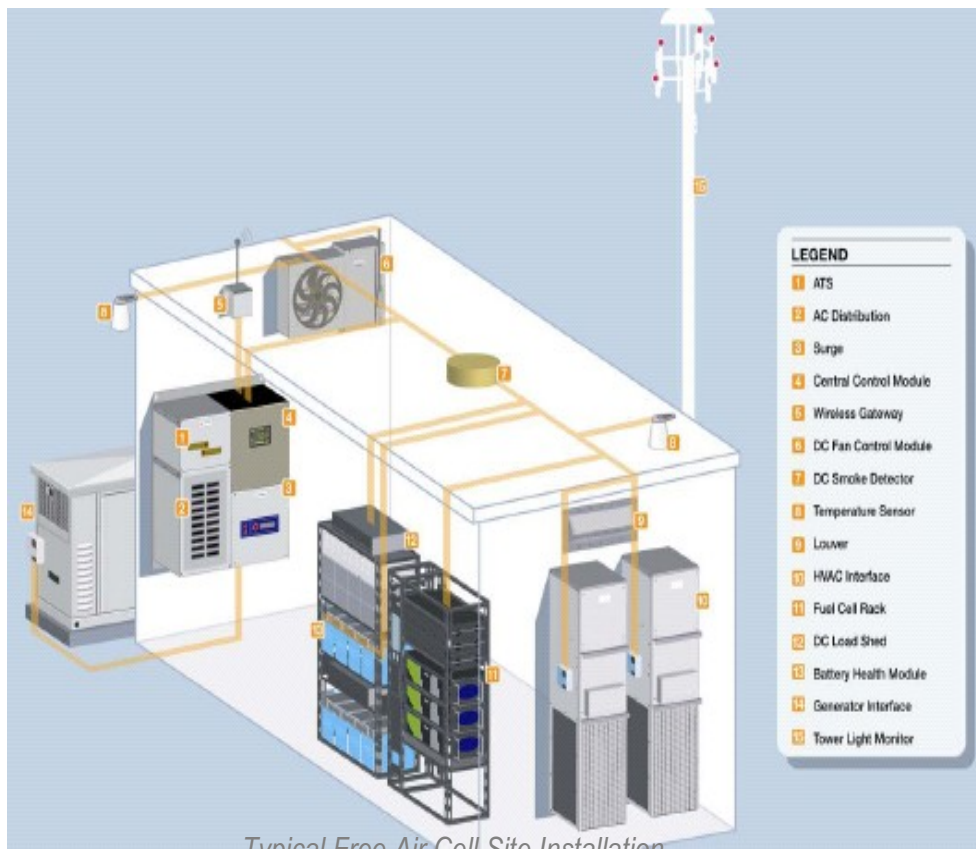


Profiles indicating theft / fraud



Are there opportunities for cutting my energy need ?

Example : Free Air Cooling



Projected “free air” savings calculation

Towers	Hydro Payments from 1 Jan 08 - 31 May 08	Montly Payment	Annual Payment	Projected Annual savings	Projected Monthly savings
47	\$179,000	\$35,800	\$429,600	\$115,992	\$9,666
500	\$1,790,000	\$358,000	\$4,296,000	\$1,159,920	\$96,660
1000	\$3,580,000	\$716,000	\$8,592,000	\$2,319,840	\$193,320
2000	\$7,160,000	\$1,432,000	\$17,184,000	\$4,639,680	\$386,640

Assumptions for Calculation

Run Times
 HVAC only 10-12%
 DC Only 30%
 DC Fan or Economizer 60%

Power Consumption Average
 HVAC Mech. 24amps @240VDC or 5.76KW
 HVAC Economizer 5amps@240VAC or 1.2KW
 DC Fan 6amps at 24VDC (3 @ -48V) or aprox .150KW*

Projected savings are based on information provided by operator and results from proof of concepts and installations with similar customers

Savings are based on current dollar value of commodity

IBM Green Sigma™

Continuous energy measurement and improvement methodology

- Leverages concepts from Lean Six Sigma to establish a continuous energy monitoring and optimization framework – spanning all parts of the organization
- ▶ Spans solutions for Energy, Water, and Waste Management
- ▶ Provided significant cost savings and environmental benefits for IBM and clients

Green Sigma™ Carbon Console
IBM Innovation Centre Dublin

GHG Protocol Scope 2 Emissions - Electricity
Line chart showing electricity usage in kWh over time. Report: Electricity Usage, Location: All DUB.

GHG Protocol Scope 1 Emissions - Gas
Line chart showing gas usage in kWh over time. Report: Gas Usage, Location: Server 1&2.

GHG Protocol Scope 3 Emissions - Business Travel
Bar chart showing business travel emissions in kg CO2 by date. Legend: Car, Taxi, Rail, Air. Report: Per Project, ID: CCCE, Type: All.

GHG Protocol Scope 2 Emissions - Electricity
Pie chart showing electricity usage by power source (Power 3, Power 4, Power 5, Power 6). Report: Pie Usage, Location: Bld 6 DUB.

GHG Protocol Scope 2 Emissions - Electricity
Line chart showing electricity usage in kWh over time. Report: Electricity Usage, Location: Srv 3 DUB.

Carbon Emissions Run Rate
Donut chart showing carbon emissions run rate. Values: 15,121,215, 22,681,823, 30,242,431, 37,803,039, 7,560,607, 0. Status: Decreased.

Banner
Line chart showing inbound CO2e over time. Report: Inbound CO2e, Location: POK.

Alert Log
Table of alerts:

Date	Time	Usage	Alert Type
29-08-2008	23:00	445.0	Profile Alert
29-08-2008	23:00	331.0	Profile Alert
29-08-2008	22:00	91.0	Profile Alert
29-08-2008	21:00	559.0	Profile Alert
29-08-2008	21:00	342.0	Profile Alert

GHG Protocol Scope 3 Emissions - Outbound LOGX
Line chart showing outbound CO2e in tonnes over time. Report: Outbound CO2e, Location: Dublin.

Epilogue

- Passive Telecom infrastructure business has unique challenges and scale
- Many of the issues / challenges in this business can be very effectively addressed with technology
 - These solutions have significant benefits for the business, as well as the environment
- IBM is uniquely positioned to deliver these benefits through
 - A deep understanding of the passive telecom infrastructure business
 - A comprehensive suite of pre-built solution assets
 - Hands-on experience in delivering these solutions



let's build a smarter planet

