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Oracle E-Business Suite Field Service
Advanced Scheduler for Engineered Systems

Extreme Advantage –
Running Field Service Advanced Scheduler on Engineered Systems
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Executive Overview

This white paper illustrates how Oracle Engineered Systems (Exadata and Exalogic) are beneficial to service providers using Oracle Field Service Advanced Scheduler. This is achieved by significantly improving end user response to make Dispatchers more productive and by drastically reducing batch processing time to handle high volume of field service calls. Synergies provided by the Engineered Systems are extremely advantageous for customers handling a large numbers of service requests and tasks on a daily basis, by utilizing services of strategically deployed field workforce. The across-the-board improvement in performance, throughput and scalability achieved by deploying Advanced Scheduler on Engineered Systems will allow customers to maximize workforce utilization, minimize response times, drastically reduce SLA violations, and significantly improve customer satisfaction and retention. This paper explains how running Oracle Advanced Scheduler on an Engineered Systems helps achieve these objectives.

Introduction to Engineered Systems

Oracle’s Engineered Systems combine best-of-breed hardware and software components with game-changing technical innovations. Designed, engineered, and tested to work best together, Oracle’s Engineered Systems can power the cloud or streamline data center operations to make traditional deployments even more efficient. The components of Oracle’s Engineered Systems are preassembled for targeted functionality and then—as a complete system—optimized for extreme performance. By taking the guesswork out of these highly available, purpose-built solutions, Oracle delivers a solution that is integrated across every layer of the technology stack—a simplicity that translates into less risk and lower costs for your business. Only Oracle can innovate and optimize at every layer of the stack to simplify data center operations, drive down costs, and accelerate business innovation.

Oracle Exalogic

Oracle Exalogic is an Engineered System on which enterprises deploy Oracle business applications, Oracle Fusion Middleware or third-party software products. Exalogic comes pre-built with compute nodes, memory, flash storage and centralized storage, all connected using InfiniBand in a high redundancy architecture delivering five-nines availability, with fault tolerance and zero-down-time maintenance.

Exalogic dramatically improves performance of Oracle Applications, Fusion Middleware and 3rd party applications without requiring code changes and reduces costs across the application
lifecycle, from initial set-up to on-going maintenance, as compared to conventional hardware platforms. Oracle has made unique optimizations and enhancements in Exalogic firmware, Exalogic software, and in Oracle’s middleware and Oracle’s applications. These include on-chip network virtualization based on near zero latency Infiniband fabric, high-performance Remote Direct Memory Access, workload management in Oracle Weblogic server and optimizations in Oracle Coherence and Oracle Traffic Director. Exalogic includes support for a highly optimized version of the Oracle VM, which significantly outperforms comparable virtualization solutions and is an ideal consolidation platform for Oracle Applications. Templates to simplify install, deployment and configuration of Applications on Exalogic are available.

Oracle Exadata Database Machine

Oracle’s Exadata Database Machine is Oracle’s database platform delivering extreme performance for database applications including Online Transaction Processing, Data Warehousing, Reporting, Batch Processing, or Consolidation of mixed database workloads. Exadata is a pre-configured, pre-tuned, and pre-tested integrated system of servers, networking and storage all optimized around the Oracle database. Because Exadata is an integrated system, it offers superior price-performance, availability and supportability. Exadata frees users from the need to build, test and maintain systems and allows them to focus on higher value business problems.

Exadata uses a scale out architecture for database servers and storage. This architecture maintains an optimal storage hierarchy from memory to flash to disk. Smart Scan query offload has been added to the storage cells to offload database processing. Exadata implements Smart Flash Cache as part of the storage hierarchy. Exadata software determines how and when to use the Flash storage for reads and write as well as how best to incorporate Flash into the database as part of a coordinated data caching strategy. A high-bandwidth low-latency InfiniBand network running specialized database networking protocols connects all the components inside an Exadata Database Machine. In addition to a high performance architecture and design, Exadata offers the industry’s best data compression to provide a dramatic reduction in storage needs.
Oracle SPARC SuperCluster

Similar to Engineered Systems such as Exadata, Exalogic, Oracle E-Business Suite can be deployed on Oracle’s SPARC SuperCluster to achieve high availability, performance, scalability and environment consolidations. Here is a brief description of Oracle’s SPARC SuperCluster’s technical capabilities.

Oracle’s SPARC SuperCluster is the world’s most efficient multi-purpose engineered system, delivering extreme efficiency, cost savings, and performance for consolidating mission critical applications and rapidly deploying cloud services. Oracle’s SPARC SuperCluster represents a complete, pre-engineered, and pre-tested high-performance enterprise infrastructure solution that is faster and easier to deploy than a collection of individual database and application servers. The system combines innovative Oracle technology—the computing power of Oracle’s SPARC servers, the performance and scalability of Oracle Solaris, the Sun ZFS Storage Appliance, the optimized database performance of Oracle Database accelerated by Oracle Exadata Storage Servers, and a high-bandwidth, low-latency InfiniBand network fabric—into a scalable, engineered system that is optimized and tuned for consolidating mission-critical enterprise applications.

Oracle’s SPARC SuperCluster provides both the capacity for growth, as well as the fine-grained server virtualization needed to isolate individual application components. Deployment speed, application performance, and availability can all be optimized with the multiple layers of enterprise application infrastructure consolidated onto a high-performance, highly available SPARC SuperCluster system. Designed as a pre-configured, pre-tested, and ready-to-deploy SPARC SuperCluster engineered system, the solution provides a complete and optimized infrastructure solution for applications, built around robust compute, networking, storage, virtualization, and management resources. The result is a system that is orders of magnitude easier to manage, and up to five times faster to deploy than alternatives, all while occupying considerably less real estate requiring less power. Furthermore, the SPARC SuperCluster system provides full built-in redundancy resulting in a highly reliable infrastructure without single point of failure. An issue with one component will not impact other components of the system offering true isolation. Customers can consolidate multiple Oracle E-Business Suite environments with minimum disruption, without fear of performance degradation, and the ability to achieve required service levels.
Technical Benefits of Oracle’s Engineered Systems

Overview

Internal benchmarking indicates that Oracle E-Business Suite running on Oracle’s Engineered Systems performs 3 to 10 times faster for forms and self service applications depending upon the concurrency load profile. And linear scaling allows for very large deployments and multiple applications to run simultaneously while maintaining consistent response times. Oracle’s Engineered Systems are architected to deliver maximum availability, high performance, and scalability helping Oracle E-Business Suite customers to consolidate environments, and reduce server footprint resulting in an overall reduction in cost of application ownership.

Here are some of the technical benefits delivered by Engineered Systems:

- Oracle E-Business Suite applications consists of many batch processing programs that create large workloads. These workloads are highly CPU intensive. High concurrency of these workloads requires systems with large memory capacity with large Systems global area (SGA) and Program global area (PGA) capable of processing high speed disk input/output (I/O). Oracle’s Engineered Systems are architected to deliver these superior technical capabilities to manage such large workloads.

- Engineered systems can handle twice as many users per core compared to other servers delivering the scalability required to add more application users during growth and expansion.

- Linear Scaling easily supports very large deployments.

- Resource Manager can help consolidation of database and application environments by controlling CPU usage, managing CPU contention via instance caging, controlling disk I/O usage, and managing contention via IORM’s inter-database resource plans. Customers can achieve higher throughputs as more transactions can be processed using single Exadata core compared to other servers.

- Exalogic has been engineered to leverage a technique known as Single-Root I/O Virtualization to eliminate virtualization overhead and deliver maximum performance and scalability. Mission-critical server virtualization offers a whole new level of consolidation where multiple virtual machines are sharing a single physical server in order to maximize the utilization of server hardware, while minimizing associated cost.

- Oracle VM template for Exalogic reduces installation and configuration time and allows rapid deployment of Oracle E-Business Suite applications.
- Oracle E-Business Suite customers can load balance web and forms servers, configure parallel concurrent processing and configure Oracle RAC and Oracle Data Guard for high availability.
- Oracle Enterprise Manager Cloud Control (EM) helps with Exadata manageability and provides a composite view of all health indicators of a cell or cell group to diagnose and troubleshoot performance problems efficiently.

Oracle E-Business Suite customers will benefit from using following unique features of Exadata Database Machine:

**Exadata Smart Flash Cache**

Exadata Smart Flash Cache uses Flash memory to dramatically reduce the time to read and write database and log records. The intelligence in Smart Flash Cache transparently moves active database blocks from disk to flash in real time, thus ensuring that "hot" data is in Flash memory when the next access occurs. Blocks that should not be in Flash are similarly recognized, maximizing the amount of space in Flash for active data.

Internal bench marks for Oracle E-Business Suite have shown following results as a result of Smart Flash Cache:

- Average I/O latency reduced by 58% and no special tuning is required to achieve I/O performance improvement.
- Log file sync events improved by 5% and no special tuning is required to achieve log file sync event improvements

**Exadata Smart Scan**

Exadata Smart Scan speeds up data-intensive queries by leveraging the processing power of Exadata Storage Servers to scan and filter out results. By moving queries to storage instead of moving the data to the database servers, long-running reports often complete 10 times faster than conventional systems.

**InfiniBand**

The use of InfiniBand as the networking fabric within Exadata ensures the lowest latency for messages and the highest bandwidth for data transfers. High-speed transactions as well as data-intensive queries and reports reap the benefits from InfiniBand. Oracle E-Business Suite benefits resulting from InfiniBand are:
• 30-40% lower CPU utilization and 100% or more throughput compared to Gigabit Ethernet
• 20% improvement in online transactions response times
• Easier scaling of E-Business Suite online transactional processing through low latency

Exadata Scale-Out Storage

Exadata Scale-Out Storage enables the full performance of Exadata to be realized against large and growing databases, without fear of bottlenecks. As the database size grows and storage capacity is added to Exadata, storage performance and networking bandwidth scale in equal proportion. As a result,
• Backups and Clones can be executed at a rate of 20TB/hour
• Faster incremental backups can be performed

I/O Resource Manager (IORM)

IORM allocates I/O bandwidth across different applications and databases, based on a prioritized allocation plan, to ensure that the most important applications get the performance they need when they need it. As a result, customers can consolidate database and application environments without worrying about resource contention and performance degradation. Oracle E-Business Suite customers benefit from using following unique features of Exalogic:

Exalogic Exabus

Applications running on Exalogic utilize Exabus, the underlying Infiniband fabric, which provides low latency and high throughput eliminating I/O bottlenecks in every application layer. Applications components are typically deployed in more than one server and Exabus provides low latency for I/O across nodes on same Exalogic rack. Access to ZFS storage device over Exabus greatly reduces latency for log file writes and other file access operations. For applications running on Exalogic and accessing the database tier on Exadata, Exabus delivers faster I/O, reduces CPU usage on both the mid-tier and DB-tier and providing higher connection pooling efficiency.

Oracle VM for Exalogic

Exalogic Oracle VM can sub-divide a physical compute node into multiple virtual machines to increase application deployment efficiency while maintaining application performance. Oracle VM has been engineered for tight integration with Exalogic Exabus I/O backplane using a technique called Single Root I/O Virtualization (SR-IOV) ensuring Oracle VM significantly outperforms comparable hypervisors from other leading vendors. The benefit of this approach
is unmatched application performance. In an Exalogic configuration, the impact of virtualization on application throughput and latency is negligible.

Introduction

A part of the Oracle E-Business Suite, Oracle Field Service is an integrated suite of applications that enables highly effective field service delivery at many leading service organizations across the globe. It provides all of the basic field service functions including handling emergency break-fix and preventive maintenance jobs, scheduling and dispatch, diagnosis, debrief, and billing needed to run a profitable service operation. Oracle Field Service can be extended with Oracle Advanced Scheduler, Oracle Spares Management, and Oracle Mobile Field Service to provide a more advanced field service delivery solution. Oracle Field Service helps organizations of all sizes, industries, and geographies increase efficiency and reduce operational costs. It does so by employing standardized processes to enforce consistent business rules and by using automated processes and productivity tools to accelerate the task closure process.

Oracle Advanced Scheduler (OAS) helps leading field service providers book appointments and schedule field service technicians for all types of planned and reactive field service tasks including installations, moves, repairs (break/fix), preventive maintenance, inspections, field change orders and upgrades. It creates optimized schedules for field workforce that meet tough customer service objectives while minimizing travel and other key operational costs. OAS is highly scalable and considers a wide variety of configurable constraints, workforce availability, skills and spare part requirements, business rules, service objectives, and cost factors. It supports the complete spectrum of field service business models from decentralized technician self-scheduling and district office dispatching to the centralized, tightly controlled scheduling, dispatch, and work release. This allows OAS to be successfully deployed in large, sophisticated field service businesses in many industries including high tech, industrial manufacturing, office and medical equipment, local government, utilities, retail, security, and telecommunications.

OAS comes with a set of powerful batch processing engines and highly interactive and intuitive user interfaces. Batch processes include core Scheduler engine for scheduling technicians in the field, Optimization engine for continuous optimization of technicians’ trips, and job release process for drip feeding technicians with tasks in a timely manner. Interactive
user interfaces include Dispatch Center dashboard for monitoring tasks, technicians and jeopardy management, and Scheduler UI for interactive scheduling.

Tuning IT systems and applications for performance demands skills in networking, server configuration, operating system, storage, database, middleware and application domains. IT organizations spend significant time and money identifying the right mix of these components to run their demanding applications. Oracle Engineered Systems – Exalogic and Exadata deliver a balanced configuration out of the box, with the right combination of networking, storage and server components paired with Oracle engineered software optimizations for deploying Oracle applications such as Oracle Field Service and Oracle Advanced Scheduler.

Oracle Advanced Scheduler Delivers Business Value

Comply with service level agreements and contractual obligations

Oracle Advanced Scheduler (OAS) finds opportunities to load balance high volume of field jobs, increases daily throughput, and ensures quality of service to increase on time service delivery and compliance to committed SLAs. Scheduler significantly minimizes the possibility of service tasks slipping into jeopardy by automating task rescheduling and release, while achieving continuous optimization of trips across available technicians in a service organization.

Increase Field Technician Productivity

OAS significantly improves the productivity of field workforce by reducing the idle time, travel time, and overtime, and increasing their utilization (more tasks per day). OAS ensures that the technicians do not make multiple trips to the same customer site. Sophisticated scheduler geo-clustering and optimization algorithms further optimize technicians’ travel by reducing lengthy and overlapping trips. Service providers are provided greater flexibility by drastically reducing field technician travel time and thereby increasing the customer facing time. OAS further provides a mobile interface to empower technicians to reschedule their existing tasks or any follow up task, while they are still at the customer site.

Increase Customer Satisfaction and Retention

It is a known fact that each additional field visit to a customer site costs $250 (industry average). OAS reduces scheduling errors due to skills mismatch or missing parts and ensures that the technician is scheduled during the access hours specified by customer. This drives the
first-time-fix-rate to be significantly higher, which is an important measure in achieving customer satisfaction and retention.

Lower Field Service Operation Costs

Advanced Scheduler’s powerful algorithms and optimization logic utilize geo-spatial data for travel calculations and route optimization, enforce cost based business rules and constraints to arrive at the most optimized schedules for field workforce. It eliminates idle times, minimize overtime costs, reduce vehicle fuel and brings down the overall operational costs.

Scheduling Challenges in a Field Service Organization

Field service organizations face significant challenges in order to be profitable and at the same time, being able to stay agile and at the forefront of the competition. Scheduling the field resources with the appropriate skills, right parts, at the opportune time within customer stipulated access hours, complying to contractual obligations and honoring promised SLAs, and keeping the operating costs as low as possible and staying profitable, is daunting and overwhelmingly complex. Field Service organizations often face conflicting challenges and priorities, as depicted in Figure.2.
Setting aside the business practices and operational deficiencies, the IT Infrastructure in general and conventional hardware in particular, multiplies the complexity and poses additional challenges to an already burdened field service organization:

- The performance of conventional hardware is a bottleneck and the Advanced Scheduler Optimizer cannot be run in many situations because there is not enough time when dealing with shorter response times, like 2 hour and 4 hour service level agreements.
- End user response is significantly impacted by the limiting system’s memory capacity and IO throughput of conventional hardware, which further impacts the decision making ability of dispatchers due to lack of visibility into the minute-by-minute schedule changes and exceptions that occur in every field service operation.

Benefits of Deploying Oracle Advanced Scheduler on Engineered Systems

End User Response Time

Proactive Task and Resource Management using Highly Interactive Dispatch Center

The Dispatch Center dashboard provides real-time GPS-based location tracking and mapping capabilities. An intuitive graphical user interface provides memory intensive mapping, trip tracing, color coded status monitoring, and decision making capabilities while responding to emergency tasks. Rendering maps using geo-spatial map tiles demands allocation of sizeable system memory. With the ability to support memory up to 3TB, Engineered Systems meet this demand very effectively, and provide up to 5x faster responses to user operations on map, like zooming, panning, resizing and clicking on markers.

Dispatch Center dashboard comes with highly interactive Gantt view that provides drag and drop scheduling capabilities, auto refresh for status monitoring, informative icons, and dynamic tool tips. These Gantt features are significantly enriched by the throughput and IO capacities of the Engineered Systems and exhibit 2x to 5x performance as compared to conventional hardware.
Dispatch Plan Board provides a day view of all tasks and technicians under the Dispatcher’s radar scope. Context sensitive information is fetched and rendered in real-time for continuous status monitoring and exception handling. As the Dispatch Center dashboard displays the aggregate information from all other technician facing applications and mobile devices in real-time, its performance is enhanced by the Engineered Systems to the tune of 5x, as observed in other user interfaces with similar behavior.

Increased user performance in the Dispatch Center benefits the Dispatcher through improved visibility into the minute-by-minute schedule changes and exceptions that occur in every field service operation. By being able to visualize schedule changes and exceptions quickly, Dispatchers have an increased ability to react to exception conditions and prevent missed service level agreements. This directly leads to increased customer satisfaction and reduced costs.

Faster and more accurate appointment booking

When Dispatchers or call center agents schedule field service tasks interactively using Dispatch Center Dashboard, they would get faster scheduling/appointment booking using Engineered Systems. With the high processing power of Engineered Systems, they can resort to complex, but more accurate street level routing based scheduling, instead of less accurate estimate based scheduling. As the travel time is calculated more precisely, this will significantly enhance their ability to promise more accurate technician arrival time to the customers.

Enhanced Decision Making capabilities using Interactive Scheduler UI

OAS processes a vast amount of data related to geo-spatial attributes, territories, technician calendar and shifts, spare parts availability, and scheduler rules and presents this information in an intuitive format in the Scheduler user interface (UI). It also supports several scheduling modes like intelligent, window-to-promise, and assisted. Scheduler fetches technician availability information, enforces business rules, computes distance and travel, sources spare parts, applies weighted costs, and renders schedule options, presorted by the cost. As the Dispatcher schedules the task interactively, these operations have to be handled at lightening speed and with utmost accuracy. Compared to any system deployed on traditional hardware, Oracle Engineered Systems provide significant performance advantage in the range of 2x to 5x. Dispatchers realize significant usability improvements from the lightening processing speed, enhanced throughput, faster database retrieval, efficient I/O activities and much needed memory capacity provided by Oracle Engineered Systems.

Batch Processing Performance Improvements
High Performance Scheduler Algorithms

Oracle Advanced Scheduler (OAS) uses the most sophisticated, high performance algorithms to determine the fastest route between two addresses, to geographically cluster tasks, to insert a task into the schedule, and to optimize the schedule once all tasks have been initially scheduled. Scheduler has to process a significant number of permutations and combinations of scheduling options for available technicians at lightning speed, usually a few milliseconds. These calculations become further complicated if the task requires spare parts, which may be sourced from several dispersed geographically warehouses, as the cost of making the spare part available will have to be taken into account for computing the scheduling options.

Processing abilities of scheduler algorithms significantly enhanced up to a factor of 6x, with the Exalogic based middle tier application components combined with in-memory processing capabilities demanded by the scheduler algorithms.

Cost-based Business Rules Enforcement

Oracle Advanced Scheduler provides a highly configurable Rules model to drive important scheduling decisions. Configurability of these cost factor weightings allows service providers to tailor OAS to meet their unique business objectives and at the same time, makes OAS one of the complex data and hardware resource intensive processes in EBS applications. OAS being a hardware resource intensive application, substantially benefits from the higher memory and processing power of Oracle Engineered Systems.

Timely Release of Tasks to the Field Technicians

OAS provides the capability to automatically release batches of tasks to the field for execution. Service providers would like to 'drip feed' their technicians based on the number of tasks at hand and the rate of work closure. Depending on operating priorities, this process is used by field service providers to release several weeks of work or just the work due to start in the next few hours. This complex task release process can gain 5x or more in performance advantage in an environment deployed on Oracle Engineered System.

Real-time Organization wide Trip Optimization

Oracle Advanced Scheduler's powerful Optimization batch process computes the most optimized trips for field technicians in real time, and hence, utilizes the advanced capabilities of both hardware and software like in-memory processing, multi-threading and parallel processing. The increased performance of an Engineered Systems up to a factor of 2x to 5x lets customers perform more runs of the Scheduler Optimizer. As more travel time is squeezed out of each daily schedule, this leads to direct cost savings in fuel and in vehicle
maintenance. Further, this leads to an increase in the number of tasks completed per day and an increase in the number of service level agreements met (and hence, increased customer satisfaction).

In a high technology industry, where equipment embedded intelligence and machine-to-machine communication are becoming the industry standard, equipment malfunction, remote diagnostics and creation of defect repair service request are automated. Service providers prefer to automate the entire end-to-end process of service request and task creation, scheduling, part ordering and task release to the technician. This entire process has to be handled within a few seconds to a couple of minutes. OAS performs this task at lightning speed. As the dispatchers are also expected to schedule tasks and handle exceptions interactively, the schedules become less optimal quickly. Service providers resort to Advanced Scheduler Optimization process to keep the schedules of field workforce constantly optimized. OAS deployed on Engineered Systems stands up to this challenge.

Improved Scalability

Oracle Advanced Scheduler Architected for Global Field Service Operations

Oracle Advanced Scheduler (OAS) is being used by several service providers to support their global field service operation. Several service providers adapt an expansion growth strategy. This entails expanding their footprint, geographical reach and strategic resource deployment. The main strength of OAS application is its capability to scale up to the increasing volumes of field service tasks, and at the same time, handle significant increase in the number of application users in a rapidly expanding global service business organization. The OAS application is architected to support these data, hardware and infrastructure intensive processes in real time. Because OAS is designed to support an agile field service organization, it will benefit further from the synergies provided by the Oracle Engineered Systems built to support scalability, as the businesses grow over a period of time.

Reducing the Total Cost of Ownership

Field Service organizations operate 24x7x365. Deploying OAS on an Engineered Systems significantly reduces maintenance time of their IT infrastructure, which translates to high availability of IT resources for field operations.

Service providers operating in high call volume environments will accumulate millions of data records (service requests, tasks, task assignments and technician debrief) in fairly short periods of time. Engineered Systems are specifically designed to deal with these storage
challenges. Additional business benefits include less frequent archiving and longer access to historical data.

OAS also benefits from faster and easier deployment on Engineered Systems. Some service providers prefer to have their custom home grown or third party call center application hosted on a separate system and have OAS deployed on a different instance for handling the scheduling and dispatching needs. This ensures that operations will continue even if communications to the data center are lost, and at the same time, lowers the cost of operations significantly by not requiring to replace their existing systems. In distributed deployment mode or in a heterogeneous system environment, OAS can run ‘stand alone’ in a separate database instance and can be fully leveraged for scheduling via SOA architecture compliant web services. OAS deployed using Engineered Systems foster this approach due to the possibility of fast and easy deployment.

Conclusion

Service providers can expect to get their ROI and remain competitive and profitable only if they achieve significant operational advantage. Leveraging Oracle Advanced Scheduler’s sophisticated scheduling algorithms, architecture, configurability, automation, and performance can significantly enhance their operational efficiencies. The benefits derived from Oracle Advanced Scheduler are numerous, but many of these advanced scheduling and optimization features are complex and place significant demands on the hardware platform. In order to take full advantage of the sophistication of Oracle Advanced Scheduler in a timely fashion, hardware should not become a limiting factor.

Deploying Advanced Scheduler on an Engineered System provides significant immediate operational benefits.

Increased user performance in the Dispatch Center benefits the Dispatcher through improved visibility into the minute-by-minute schedule changes and exceptions that occur in every field service operation. By being able to visualize schedule changes and exceptions quickly, Dispatchers have an increased ability to react to exception conditions and prevent missed service level agreements. This directly leads to increased customer satisfaction and reduced costs.

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daily schedule, this will lead to direct cost savings in fuel and in vehicle maintenance. Further, this leads to an increase in the number of jobs done per day and an increase in the number of service level agreements met (and hence, increased customer satisfaction).

Oracle Engineered Systems provide the extreme advantage: the power, optimization, sophistication, reliability, convenience and economy to transform the field service organization into a customer oriented profit center.