

Monitoring and management of heterogeneous databases with Verax NMS

Whitepaper



Table of contents

Abstract	3
1. Common challenges	4
2. The Verax approach to database monitoring	5
2.1. Basic parameter monitoring	6
2.2. Advanced monitoring	7
2.3. Performance analysis and profiling	8
2.4. Configuration change tracking	9
2.5. IT automation	10
2.6. Service assurance approach	10
3. Summary	10

Abstract

This whitepaper provides an overview of challenges associated with monitoring and management of heterogeneous database environments. Relational database systems (RDBMS) are at the very heart of virtually every enterprise: they power CRM, ERP, e-commerce, billing and other systems. Efficient **monitoring, troubleshooting and database performance analysis** are essential for the business to stay up 24/7. On the other hand, automated DB diagnostics and management tasks can keep the IT costs under control.

The RDBMS run on various hardware and operating system combinations ranging from mainframes to PC-based Linux hosts. Database appliances (integrated hardware/storage/software solutions) are also appearing on the market – most notably the Oracle Exadata platform built as a combination of former Sun hardware and Oracle RDBMS software.

While a vast majority of RDBMS vendors supply excellent management, monitoring and query analysis tools (such as Oracle Enterprise Manager), these systems typically fall short in the following areas:

- They are difficult to use without an extensive training for an average systems administrator,
- They are specific for a single vendor/type of managed system.
- They focus on the DB performance, without analyzing the behavior of client applications and/or operating system problems.

Sometimes, the management tools come as a separately priced package (e.g. MySQL Query Analyzer tools). On the other hand, traditional application monitoring solutions are typically very simple and rely on SQL query response probing and simple counters such as the number of concurrent open sessions.

Verax NMS (<http://www.veraxsystems.com/en/products/nms>) allows for a **uniform, cross-platform and multi-vendor database management** with the following benefits:

- **Support for leading commercial and open-source databases** such as Oracle, IBM DB2, Microsoft SQL Server, MySQL, PostgreSQL and others.
- **Advanced monitoring capabilities** such as deadlocks and log file analysis.
- Functionality beyond simple monitoring and **providing advanced diagnostics & profiling** for top queries, sub-optimal queries, missing indices, insufficient sessions, etc.
- **Integrated end-to-end management solution** allowing database monitoring in the context of the entire IT service. For instance, a CRM may consist of hardware, a virtualization system, a native operating system, an application server and a database. In order to diagnose system performance, it is important to have the full system view.
- **Rules-driven IT automation:** for instance, rollback segment sizes may be automatically extended under administrator-defined conditions.
- **Excellent price/functionality** ratio.

Intended audience

The purpose of this paper is to highlight the most important issues of multi-vendor database monitoring to both business and IT personnel:

- **IT management** to determine correct operation of managed applications: identify bottlenecks, performance problems, sub-optimal SQL queries, etc.
- **Business owners** – ensure that client satisfaction and usability levels are high. For instance, the most critical factor for successful CRM implementation is the ability of your end-users to effectively execute business processes (e.g. quickly enter client data, proposal information, etc.).
- **Application designers** – monitor database performance and errors.

1. Common challenges

Databases have become an indispensable tool for modern enterprises. Containing business-critical information built over years, they require 24/7 uptimes. Managing a heterogeneous database environment has become a real IT challenge, as it is difficult to hire experts on all running platforms and keep costs under control at the same time. According to Forrester Research, the enterprise database market split looks as presented below:

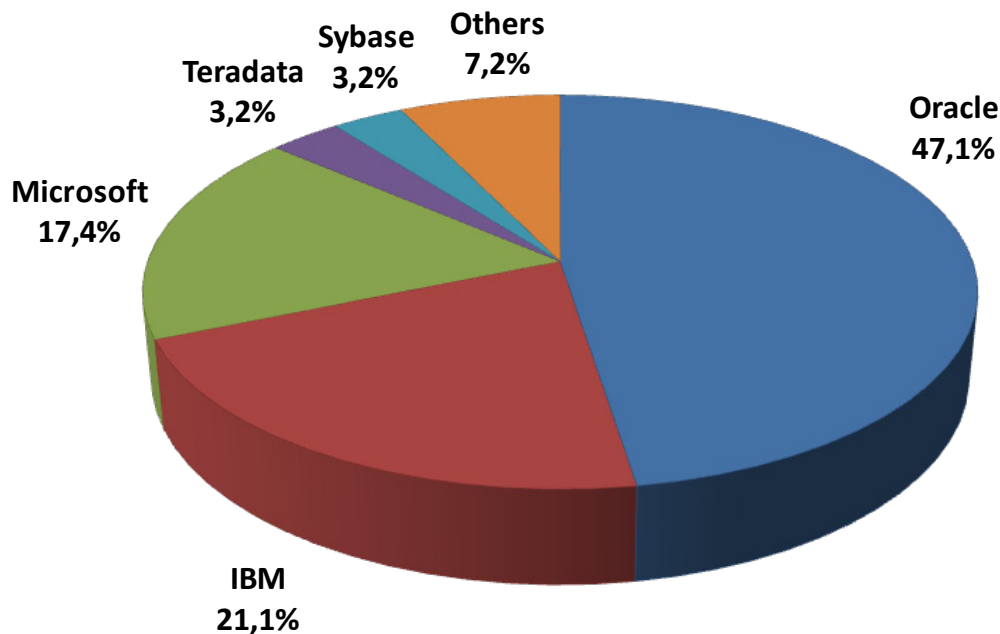


Figure 1: Enterprise database market split (source: Gartner Dataquest (June 2007)).

In addition, an internal Verax Systems research shows that a typical large enterprise runs a mix of three commercial database system types and one open source. This situation is usually a result of using 3rd party IT systems, which have their preferred database types. Open source is usually used for less important, in-house developed systems.

Oracle, Microsoft SQL Server and Informix are just a few examples among many commercially available database systems. They offer different implementation technologies, architectures and tools. They can also run on various hardware and operating system platforms including Windows, Linux or AS400. All these factors create a lot of challenges for DBAs and IT teams.

Verax NMS (<http://www.veraxsystems.com/en/products/nms>) allows for a **uniform, cross-platform and multi-vendor database management** enabling enterprises to simplify, reduce cost and provide efficient **monitoring, troubleshooting and multi-vendor database performance analysis**.

2. The Verax approach to database monitoring

Monitoring of databases from various vendors typically requires a mix of technologies such as SQL queries, SNMP, WMI and command line. Various databases also expose a different mix of parameters to monitor; therefore, it takes a lot of experience to determine which ones are important and what their acceptable levels are.

Verax NMS simplifies the management process, by encapsulating this knowledge in database management plugins. For instance, the Oracle plugin knows how to discover a server, database instances and what are the most important parameters to monitor. The plugin also contains information about default sensors, performance thresholds and associated alarm levels. All of these features allow for basic monitoring setup in a matter of a few minutes.

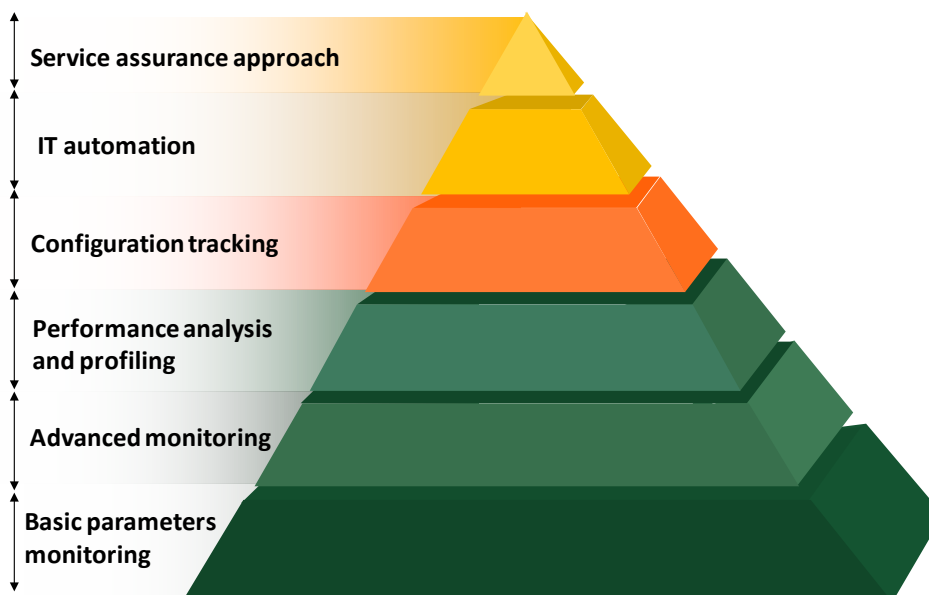


Figure 2: The Verax approach to database monitoring.

Each management plugin has an embedded GUI allowing easy basic administration and execution of common actions (e.g. restart) in a few minutes. The NMS plugins are not designed to exploit the full potential of DB management to the extent of what vendor-provided tools (such as Oracle Enterprise Manager) do. Instead, they provide a “dashboard” oriented to provide the most important information in a single place (some options are very difficult to find in the vendor tools).

Of course, Verax NMS database management plugins provide much more functionality than reading and presenting database server information. At Verax Systems, we have identified six key elements to successful database monitoring:

- Basic parameter monitoring (i.e. availability & query response times),
- Advanced monitoring (i.e. database internals such as rollback segments, logs, etc.),
- Performance analysis and profiling,
- Configuration tracking,
- IT automation,
- Service assurance approach.

It is also important that NMS plugins are not only passive. In fact, they can take configuration actions against the database or an instance (e.g. increase the size of a rollback segment). The list of actions for a particular database type is also embedded in the plugin. Actions can be invoked from the GUI, or used to provide IT automation (described in detail in section 2.5).

2.1. Basic parameter monitoring

Basic monitoring checks rudimentary metrics such as:

- Database availability,
- Query response times,
- Resource usage (e.g. CPU load or a number of concurrent sessions, number of queries and others),
- Storage usage.

Verax NMS database management plugins provide a set of such basic metrics and default alarming thresholds. These metrics are good enough to check basic system availability (in fact, such a simple monitoring can be achieved using open source packages or even in-house shell scripting), however it does not have any **diagnostic capabilities**.

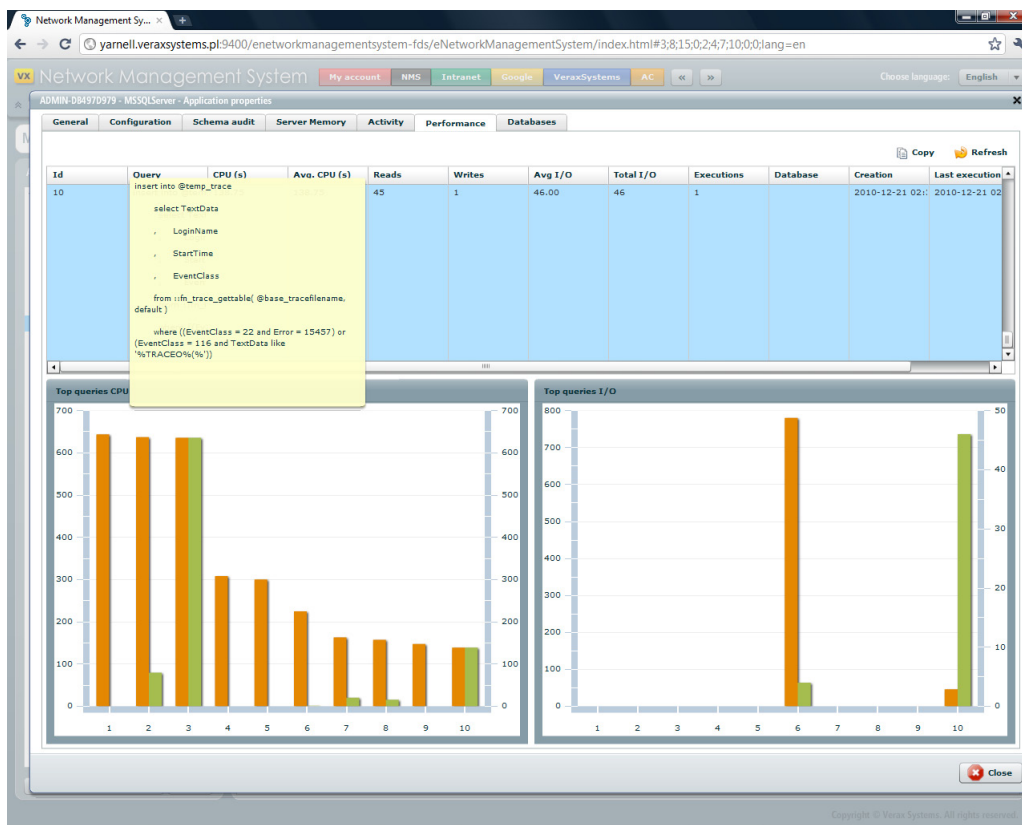


Figure 3: Verax NMS top query analysis for Microsoft SQL Server.

2.2. Advanced monitoring

Advanced monitoring goes beyond counters and simple metrics and takes a deeper dive into the database internals. Advanced monitoring aspects may (depending on the monitored DBMS type), include elements such as:

- Deadlocks with raising alarms when they appear,
- Excessive job time detection,
- Excessive query time detection,
- Predictive analyses (“when is my rollback segment about to be exhausted?”) on basic metrics, especially those that may lead to system lock-ups.
- Security problems (e.g. unsuccessful logins, insufficient privileges),
- Transaction rates and abnormal resource consumption levels.

Verax NMS monitors not only database “internal” parameters such as transaction rate, cache hit ratio, etc., but also detailed resource consumption characteristics, such as typical memory consumption levels, volume of occupied disk storage, number of transactions, number of connections used and others.

It is also worth noting that Verax NMS can be also used for **database capacity planning**, i.e. an administrator can see when a database utilization will exceed server hardware capacity, is there enough power to host additional applications on a database, etc.

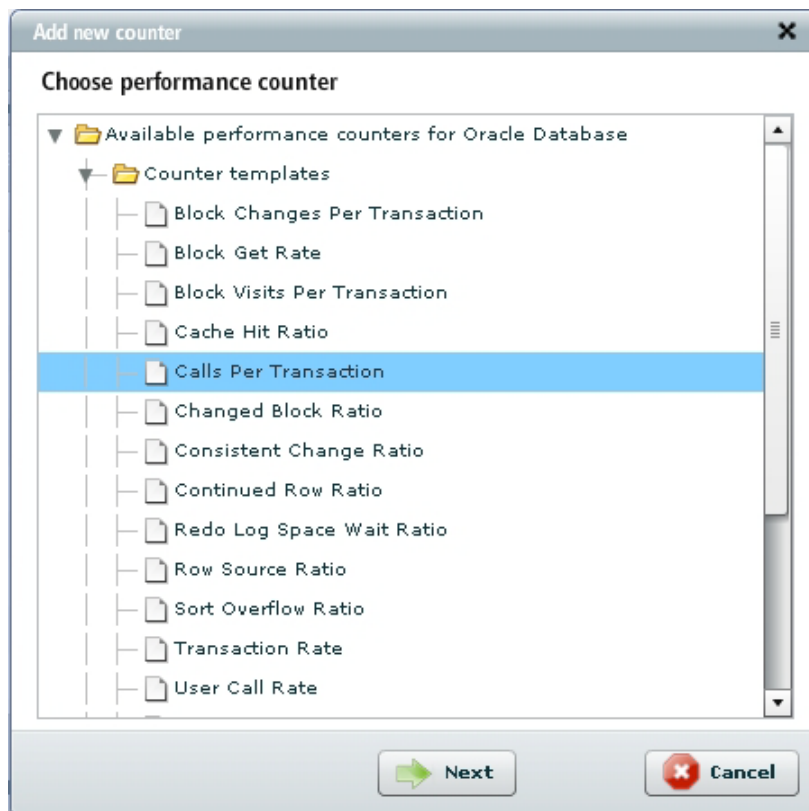


Figure 4: Defining performance counters for Oracle database in Verax NMS.

Advanced performance counters are fully supported by Verax NMS plugins. Manual fine-tuning may be involved to meet particular requirements.

2.3. Performance analysis and profiling

Whereas basic and advanced monitoring techniques serve the purpose to detect problems, they are not much aid in finding problems with applications using the database systems. This role is performed by performance analysis and profiling.

Verax NMS helps to monitor databases from the application point of view, providing a large set of analytical reports for exploring usage patterns and trends by users and applications. Metrics collected by the system such as:

- Top queries (i.e. queries consuming most resources),
- Suboptimal queries (e.g. joins that can be improved, by using an index or alteration of the SQL query itself),
- Unusual excessive queries (e.g. an analyst report may create high load on the database and block the ERP system from performing – such situations should be detected),
- Excessive users,
- Excessive job times,
- Identification of resource consumption by applications and users:
 - Users with most sessions,
 - Top query users,
 - Most active users.

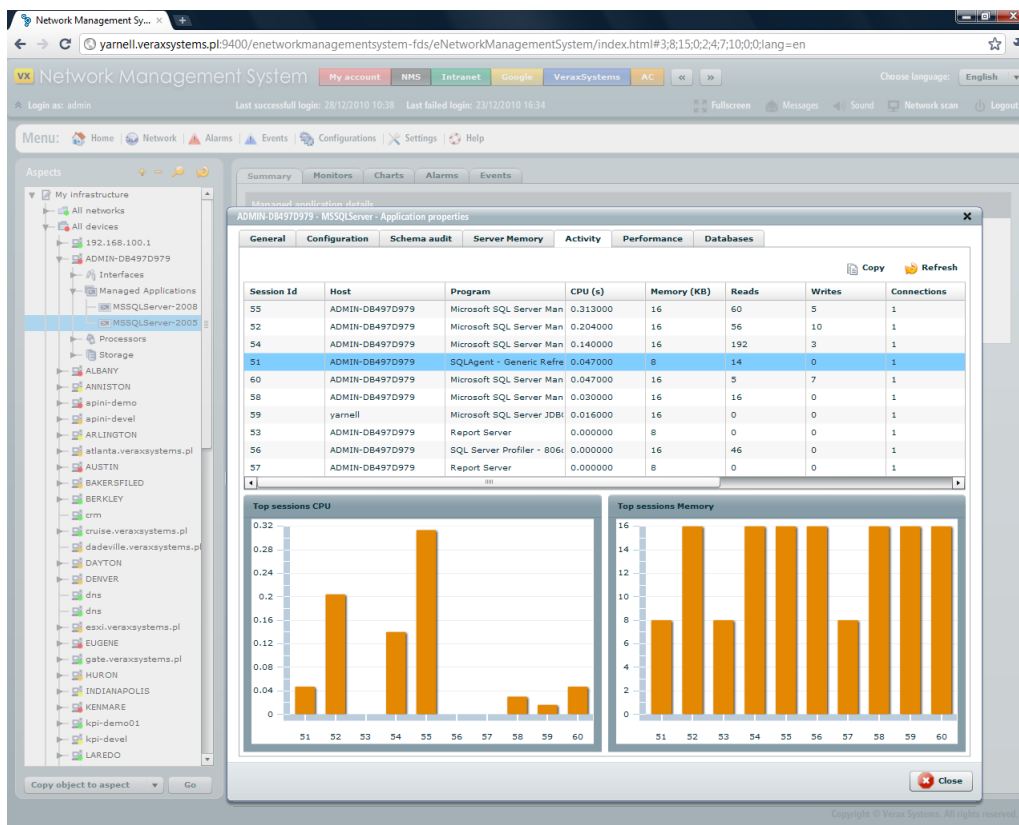


Figure 5: Top sessions view for Microsoft SQL Server.

2.4. Configuration change tracking

Verax NMS allows tracking of configuration changes both in global system parameters as well as individual schemas (the latter feature depends on RDBMS type). Sometimes, even small configuration changes have a great impact on the entire service provided. Verax NMS can track both internal logs saved as virtual SQL tables (this method is used for Microsoft SQL server) or by screening system logs.

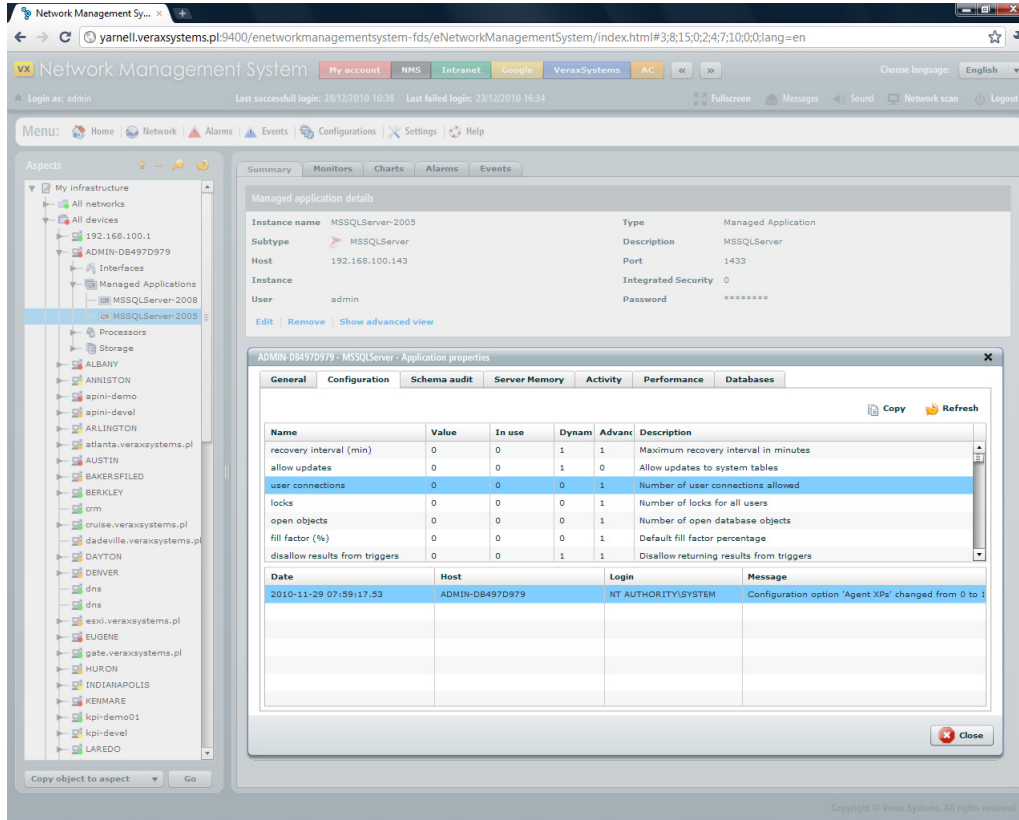


Figure 6: Server configuration change log display for Microsoft SQL Server.

In case of detected configuration changes, NMS can raise alarms to database administrators.

2.5. IT automation

IT automation is the ability to automate and execute tasks without involvement of personnel. Examples of automation in database field may include actions such as extending rollback segments, purging temporary files, restarting databases, etc.

A majority of existing monitoring solutions do not provide automation capabilities. As a result, organizations typically build their own automation scripts and tools. Such in-house solutions are costly to develop and maintain, are usually not consistently used and cause security problems.

Verax NMS provides a consistent, reliable and secure framework for automating IT tasks. The system contains an embedded jRuby scripting engine, allowing users to provide automaton scripts. These scripts can be triggered by predefined schedules or by various events in the system, allowing administrators to create a wide range of automated scenarios for repeatable tasks.

Verax NMS can execute management actions against a particular element (in this respect it is a real management rather than a monitoring system). These actions can range from simple ones ("restart") to more elaborate scenarios (such as "increase rollback segment size" on an Oracle database).

It also allows DBAs to shift from reactive to a more proactive mode and actually discover problems before they affect service operations.

2.6. Service assurance approach

In the traditional approach to database monitoring, databases are treated as another set of IT infrastructure components. Any dependencies (e.g. a SAP system requires a healthy Oracle database, etc.) are ignored. Distribution among a number of physical hosts creates another challenge here (e.g. Oracle RAC configurations, MySQL master-slave). A popular configuration for large Internet sites is to use MySQL as a "caching" database with a master copy persistent in an enterprise-grade DBMS like Oracle. Those complex dependencies require a new approach to monitoring. Service assurance is a new paradigm of systems monitoring focused on monitoring services across the silos rather than groups of elements. The idea behind the service assurance approach is to proactively alert of a problem, understand its impact on the business, prioritize IT resources based on the business impact, and quickly identify the component at issue. In other words, to get an overview of the database health and to highlight predictable problems before they appear. Verax NMS fully supports the service assurance approach via user-defined business aspects, which group monitored elements that constitute a single service (e.g. back-office, e-commerce, production, , etc.). Each business aspect has its own status, alarms and SLAs associated.

3. Summary

The paradigm of database monitoring is shifting from traditional reactive approach to a more proactive one - enabling IT staff to detect potential failures before they can affect services. IT Service assurance solutions such as Verax NMS provide administration teams with the ability to see a full spectrum view of their IT environment.

Verax NMS supports administrators by gathering advanced performance statistics and providing them with a number of comprehensive reports for proactive monitoring and effective capacity planning.

For more information, please visit our website www.veraxsystems.com/en/products/nms.