PHILOG

Sagex™

Multi-Vendor Network Device Manager

WHITE PAPER

Supervise

Manage

Automate

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1. GOAL : OPTIMIZE THE PRODUCTIVITY OF THE NETWORK TEAM

Telecommunications networks are strategic elements for today's companies, government agencies or any other modern organization. The consequences of faults affect the quality of service rendered for the entire information system. The repercussions on productivity and the losses in earnings are often quite serious. To avoid these faults, it is necessary to set up a tool, which monitors the network as well as a way to detect and resolve problems quickly. To maximize the availability of each of the components of the network, optimize performances, and thus the productivity of the team supervising it, a few tools exist but the choice is difficult.

The different network management platforms on the market (HP OpenView, BULL OpenMaster, Netview, CA TNG …) bring to the network manager a basis on, which to start but, which is often insufficient to meet all of the needs. Being that these platforms only function in SNMP, it is natural to attach extra proprietary tools to them, which enable one to configure and supervise a given number of devices on a network. We can also add CiscoWorks for the management of Cisco routers, Optivity for the management of Nortel/BayNetworks, PNM for the management of CS Telecom devices…

As each tool requires specific knowledge, one can easily imagine the qualifications needed for the manager of a network composed of heterogeneous devices (Cisco, Motorola, CSTelecom)

When faced with a mono-vendor based network, the choice is relatively simple. In general each manufacturer has a proprietary tool, which offers a limited management solution for its devices. Furthermore, during sales negotiations, this tool is often given to the customer free of charge when the customer makes a large purchase of equipment.

However, the multiplication of those acting in the area of network inter-connection and the improvement of inter-product functioning have introduced heterogeneity, which is constantly increasing in company networks. The choice of equipment is no longer only dictated by the reputation of the manufacturer, but also by its know-how and technological advance in various areas: routing, LAN, Gigabit ATM switching,… Price is finally not the last consideration in the choice of equipment.

Thus, to maintain a certain level of freedom, companies opt very often for multi-vendor networks.

Moreover, even though SNMP is a standard, which manufacturers are tending towards today, the networks are still composed of many non-SNMP devices. As X25 is a very secure protocol and adapted to poor quality links, it was very much deployed for data transfers among banks and government agencies in the early 1980s. Today, the reliability of communication links and voice-data convergence tends to make this protocol disappear in favor of frame relay, ISDN and ATM. In this migration phase, it is important to have a network management tool, which can both manage older non-SNMP devices and new devices. This makes the choice of the network management tool a difficult one to make.

Thus, with full knowledge of this need Philog offers to assist network managers in their search to improve the quality of the transporting of data on long distance networks composed of heterogeneous devices.

For several years now, software has been developed in Unix and PC/NT thus guaranteeing the same level of functioning whatever the system. Today more than 500 customers put their trust in **SageX** software to manage their networks.

2. SAGEX : THE HETEROGENEOUS DEVICE MANAGEMENT TOOL
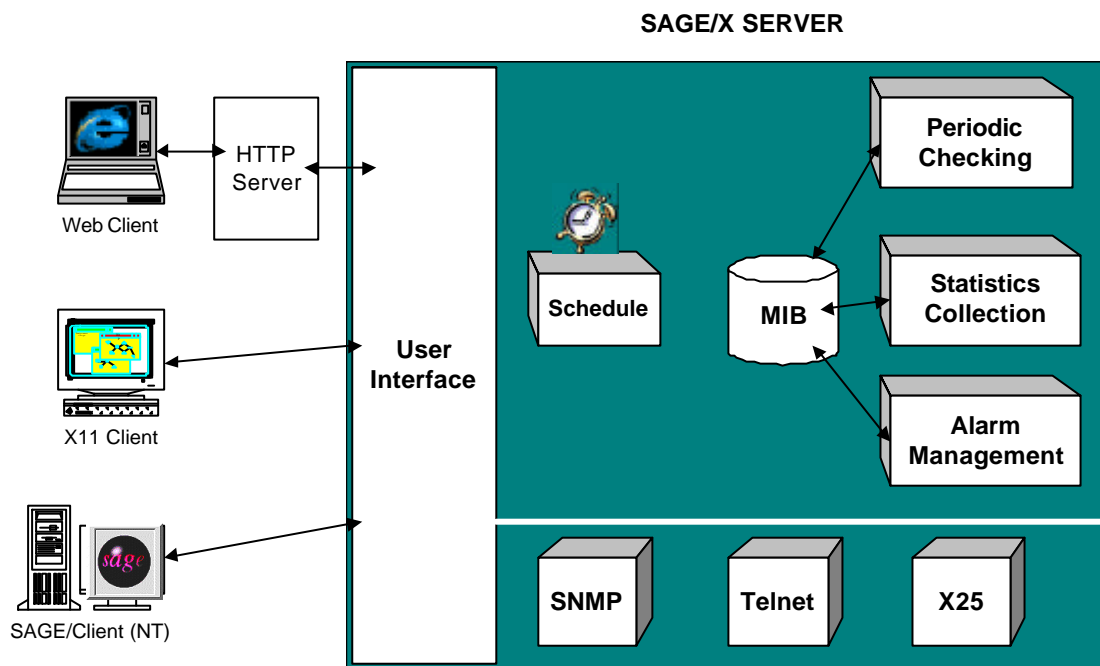
SAGE/X SERVER

SageX was developed, based on a multi-station, multi-user client-server architecture. Several versions exist, which enable it to meet a large array of needs. Versions of SageX under HP-UX, AIX, Solaris and Windows NT are available. SageX can run as standalone or integrated with a framework such as HP OpenView, OpenMaster, Netview, CA TNG, Spectrum. SageX does not just simply extend the range of devices supported by a framework, it also brings new advanced management features and improves the management of SNMP devices.

Whatever the environment, SageX is composed of two distinct parts, a device management part (dialog realized in SNMP, telnet, TFTP or X25) and an internal system part. The latter part takes charge of periodically checking devices, decoding all the alarms coming from the network and collecting statistics. The Scheduler module guarantees that all the tasks are run one after the other with a maximum delay of 5 minutes in case the system slows down (memory saturation problems, occasional network problems causing bursts of alarms,…) All the information gathered by SageX is stored in the MIB.

Three types of user interfaces exist today. The X Window and NT clients are very close to each other, they enable one to have exactly the same interface whether it is under Unix or NT. The web-based client, written in pure Java and using internet technologies, has become the most common SageX interface. This client enables one to connect to the SageX server through a web browser and to access all the features of the product.

SageX is based on a management model in , which the system simulates the behavior of several operators placed before one or several terminals. These "virtual" operators working in parallel automatically realize a great number of tasks, which thus allow network users to devote less time to device management. The goal of SageX is to optimize the productivity of the network team, that's why 95% of all SageX actions can be scheduled in the Scheduler so that they may be run automatically by the system.

This system manages a network composed of devices, which are themselves composed of various elements (ports, serial output…). The model is both simple and flexible. It enables SageX to offer services of the same nature on heterogeneous devices by their origin or function in the network.

SageX is written for a large part in EMUL. This language-oriented communication guarantees much flexibility in use. The EMUL language is object and multi-tasking oriented. SageX also offers a development workshop allowing network managers to create their own EMUL scripts.

SageX offers uniform visibility of different types of devices. The available operations (checking, downloading, statistics, etc.) are very often possible whatever the device. Nevertheless, the particularities of each element are conserved so as to offer the best management possible.

SageX is not a substitute for the operators in charge of managing the network. SageX automates tedious and repetitive operations and thus optimizes the work the work of the users by allowing them to concentrate on more essential tasks.
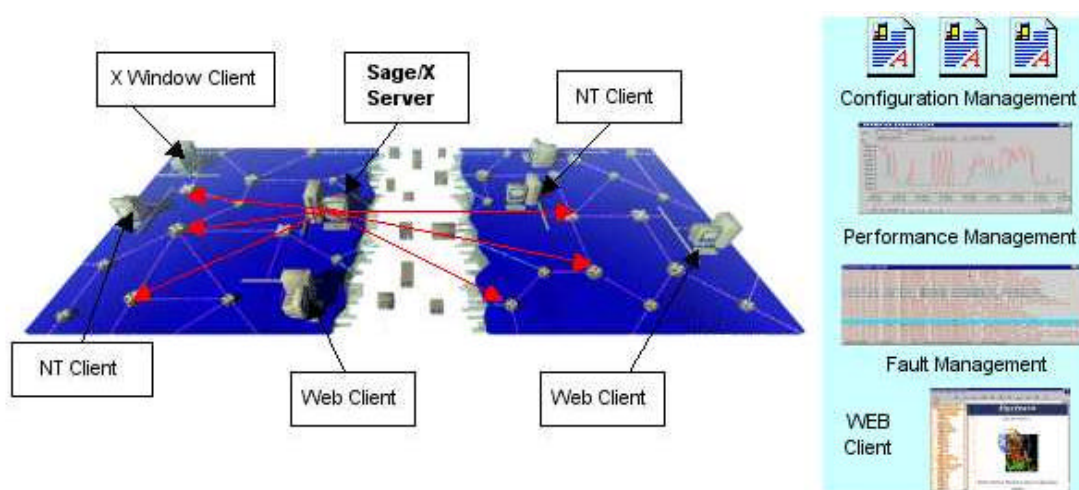
SageX disposes of different means of access (X Client, NT Client, Web Client) allowing one to act quickly in case of a problem. The Web Client is based on a three tiers architecture thus offering better distribution of the work load and optimization of response time. This module is written in pure Java, which makes it compatible with all work environments. Furthermore, Philog optimized the client server dialogs, which allows the use of this client with a low throughput access (e.g. PSTN).

3. PROBLEMS ADDRESSED

3.1 HETEROGENEITY MANAGEMENT

SageX is an open platform for the management of heterogeneous networks (X25, FR, IP, etc…). SageX covers an entire range of X25, FR and IP devices. The flexibility of the technologies used in the product enables rapid integration of new devices when they are accessible in terminal mode, PAD or X25.

SageX integrates CISCO routers (ranges 1000, 1600, 2000, 25**, 36**, 4*** et 7***), Catalyst switches 19**, 29** et 5***, a few NORTEL/BAY NETWORKS routers, MOTOROLA Vanguard FRADs and practically the X25 switches on the market (OST, SAT, CS TELECOM, SITINTEL, TELEMATICS …). The list of devices managed by SageX is continuously growing. To see the complete list of devices managed by the latest version of SageX, refer to: http://www.philog.com/sagex/uk/faqs/Sagex_devices.html.

Moreover, SageX supports any device with a standard MIB (MIB II).

To model a device, one only needs to choose a model and provide minimum access parameters (address, password or community). SageX automatically discovers its configuration and manages administrative views one after the other, which are very representative of the status of the device.

What is an integrated device?

A device integrated in SageX is a device, which Philog has invested in, in order to offer the user numerous features dedicated to this device. Among these features is an accurate graphical representation, decoding of proprietary alarms, collection of statistics specific to this device or access to specific elements of the device (e.g. traffic analyzer, routing table, configuration manager, etc…).

What is a supported device?

A device supported by SageX is a device, which is not in the list of integrated devices but, which could be created and managed minimally by SageX. For this type of device, SageX offers the user the following features :

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- discovery of the device and its interfaces,

- periodic polling,

- minimal alarm management,

- collection of standard MIB II statistics indicators,

- default graphical view.

One of the major advantages of SageX is this ability to communicate with practically any type of device. For many years SageX was specialized in X25 devices ; behind this protocol are in fact hidden numerous equipment suppliers, each necessitating specific development so as to be able to manage their range of devices. Today SNMP is a standardized protocol universally deployed and this why SageX is fully SNMP based. However, despite the label, "Simple Network Management Protocol ", each equipment supplier usually proposes particular management of its SNMP devices, and provides the user with a large number of specialized indicators in the MIBs, which are often proprietary. By closely analyzing private MIBs and standard MIBs, SageX acquires knowledge of the device (description of the basis and examination of the configuration), which allows it to offer to the user numerous advanced management features.

3.2 MONITORING DEVICES IN REAL TIME

Alarm processing

All the devices managed by SageX are automatically configured to forward their alarms (or SNMP traps) to it. Thus, as soon as a device generates an alarm, it is immediately processed by SageX, which logs the event and updates the objects in the graphical views.

Furthermore the checking of nodes allows it to test accessibility as well as the correct configuration of devices. Thus; when a device is seriously down and it is incapable of notifying the management tool, the check made by SageX will detect this anomaly. The checking of nodes is a periodic event for, which the user sets the period. To run a check on all the interfaces in a relatively short time, SageX runs these tasks in parallel; this part is explained more in detail later on.

3.3 MAXIMIZE THE AVAILABILITY OF DEVICES

SageX disposes of numerous features, which enable it to quickly diagnose problems (e.g. traffic analyzer, periodic analysis, etc…) These features are described more in detail in the part on "troubleshooting tools".

Moreover, the TRAITHIS module allows describing of the unavailability of the network, element by element, so as to deduce the average quality of the network during a given period.

TRAITHIS calculates :

- The physical unavailability of devices (lines, nodes, applications),

- PSTN usage(in normal mode / in backup mode),

- ISDN usage (in normal mode / in backup mode).

These results are produced in the form of ASCII files or tables, which can be used in EXCEL.
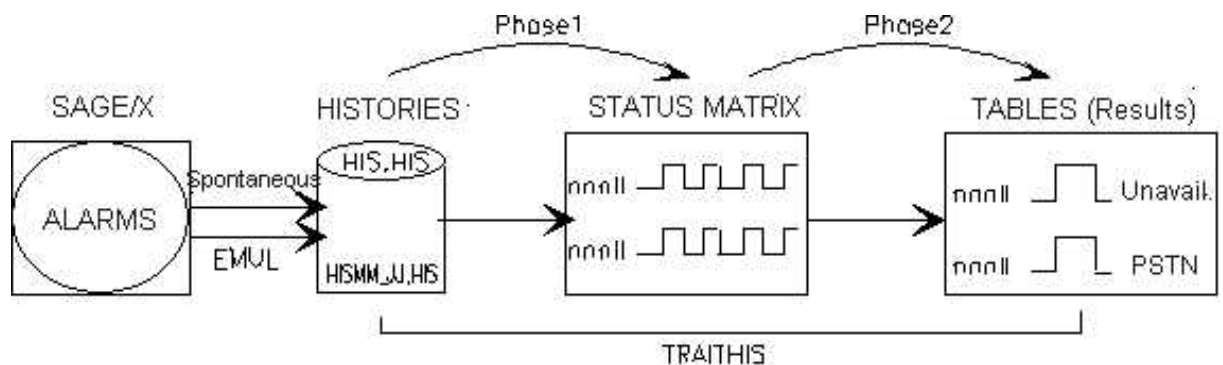
How TRAITHIS works

The graph above summarizes how the module works. TRAITHIS make calculations based on the history of alarms from the SageX application. These contain a header with the initial status of each device on the network, followed by the alarms concerning these devices. Spontaneous alarms are processed with the highest priority. The alarms generated by SageX allow the information to be completed. They must be interpreted with caution for the dates of the alarms are the dates of detection of the incidents and not of their appearance. From the history of the alarms, TRAITHIS generates a status matrix according to the Ok and Ko alarms encountered in the history. A second calculation phase is then run on this matrix so as to determine unavailability or ISDN or PSTN usage time for the node and line objects in SageX.

Example of results :

10 Devices the Most Unavailable from 11/1/99 to 11/14/99
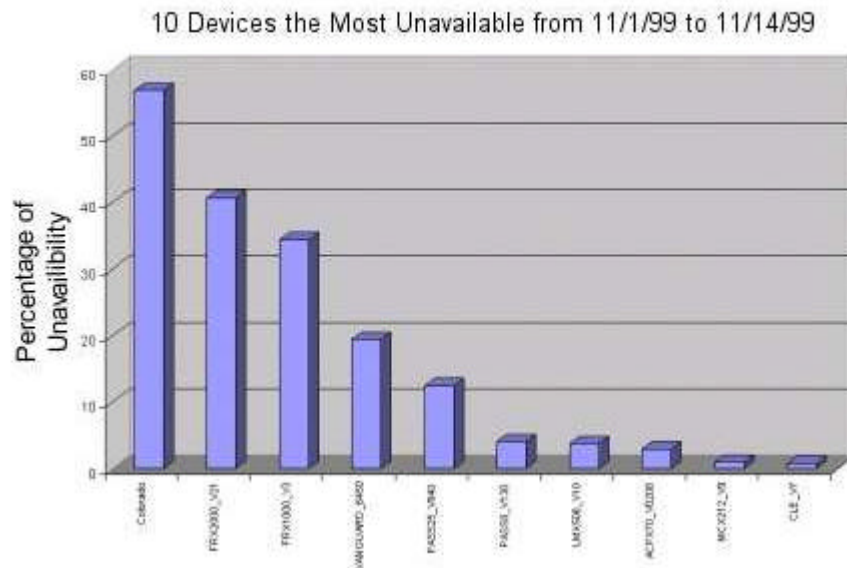
3.4 MONITORING CONFIGURATIONS AND SOFTWARE VERSIONS

Manufacturers are always seeking to improve their equipment ranges (more power, more features, new MIB, etc.) very often offer new software versions. The network manager is often obliged to follow these evolutions, for several reasons (e.g. correction of an anomaly, interesting new feature, etc.), and to update their equipments even though this sometimes requires costly equipment upgrades. Furthermore, the network manager must also accept that the proprietary management tool is not upgraded at the same time. The manufacturer's know-how is creating new devices, which are always more innovative as quickly as possible; the priority is therefore not placed on the development of management tools. Thus, often it is necessary to wait several weeks before receiving a corrective patch allowing one to manage the new device in its new software version.

Philog has signed partnership agreements with most of the manufacturers whose devices can be managed by its tools, thus SageX is able to quickly integrate the management of these new software versions.

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4. STRATEGIC FEATURES

4.1 POWERFUL AUTO-DISCOVERY

By simply indicating an IP address and a community list, SageX will discover, one after the other all the routers on the network by using information stored in their routing tables.

The algorithm used optimizes the speed of the discovery by running processes in parallel, all the while making sure not to disturb the performance of the network. A network of several hundred routers will be discovered in about fifteen minutes, saving precious time in documentation and data entering.

Non-SNMP devices are not discovered by this algorithm. To make up for this, SageX allows for the creation of devices one by one manually. In this case, the user specifies the device model and gives its address and password, then runs the exploration.

4.2 EXPLORATION WITH AUTOMATIC CREATION OF REAR VIEW

Simply by indicating an address and a password SageX will connect to the device and examine all the parameters so as to add to the information base stored in SageX for each object managed. SageX is thus able to automatically build a graphical view (front and back), which is very representative and very accurate for each device.

4.3 NETWORK MAPPING

SageX's powerful graphic editor in allows the user to represent quickly the network through tree views. SageX disposes of several graphic models (maps, representation of stations, complete list of the different device models managed, etc.) making the task of integrating data, which is usually long and tedious, much more pleasant and faster. Thus, the devices and their interconnections are drawn very quickly.

So that the user may act as fast as possible when an alarm is generated, SageX, through a mechanism of color propagation, brings the most degraded status up to the top level of the tree views. The navigation tree enables one to instantly view where the problem is located with a simple click, and the user accesses the right view immediately.

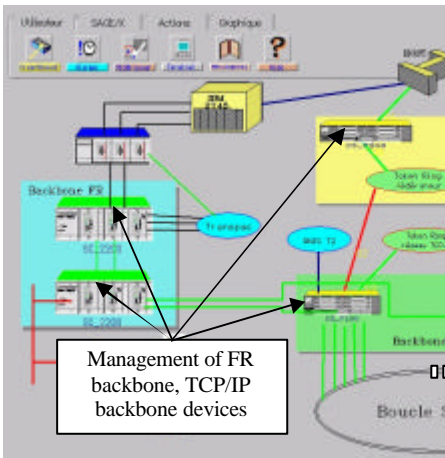> Propagation of Ko status up to the top of the tree
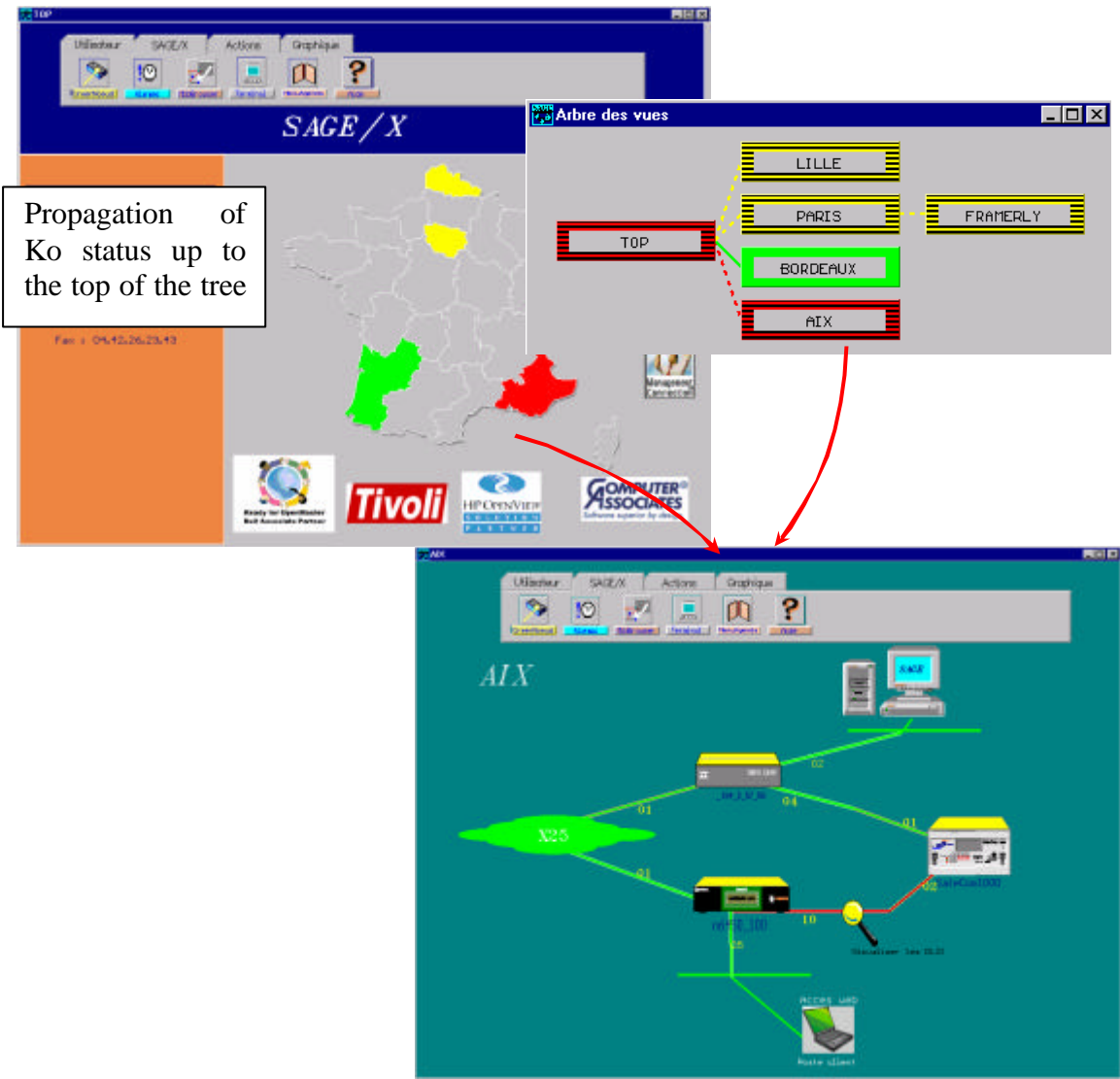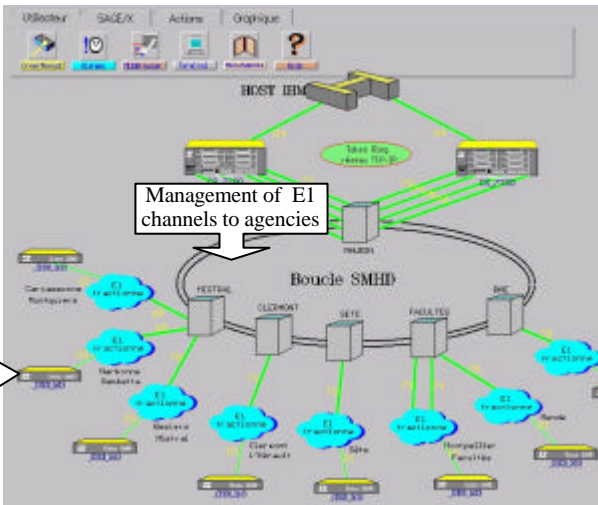
Other Examples of Topological Views :
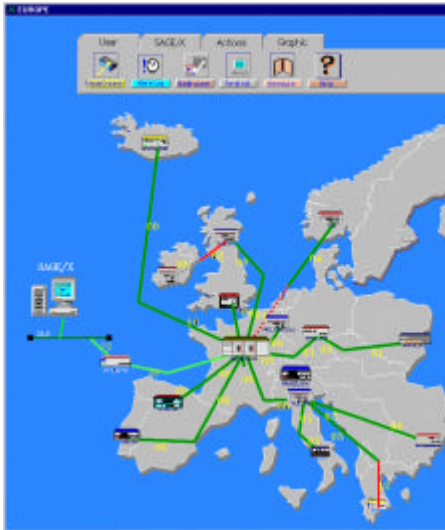
European Network
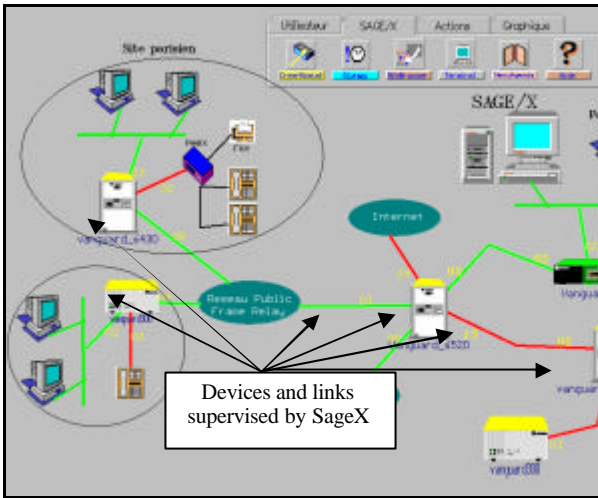
Several sites interconnected by a Frame Relay network

Enterprise network based on an SMHD loop

Agencies connected to the loop via fractioned E1 links

These topological views allow the user to go quickly to the view containing the problem. Once this first step has been reached, it is necessary to examine the devices and their ports to determine the source of the problem. To help the user in this second step, SageX has rear views. These graphic views can contain various administrative information :

- Localization of the device,

- Name and telephone number of the person in charge,

- Name telephone number of the manufacturer,

- Physical characteristics of the lines, cables, clocks, throughput, type of modem, etc.

- Number of Leased Line and telephone number of the person to contact,

- Free comments.....

All the information in the device is read and brought back to SageX during exploration then stored in the base.

Examples of Rear Views :

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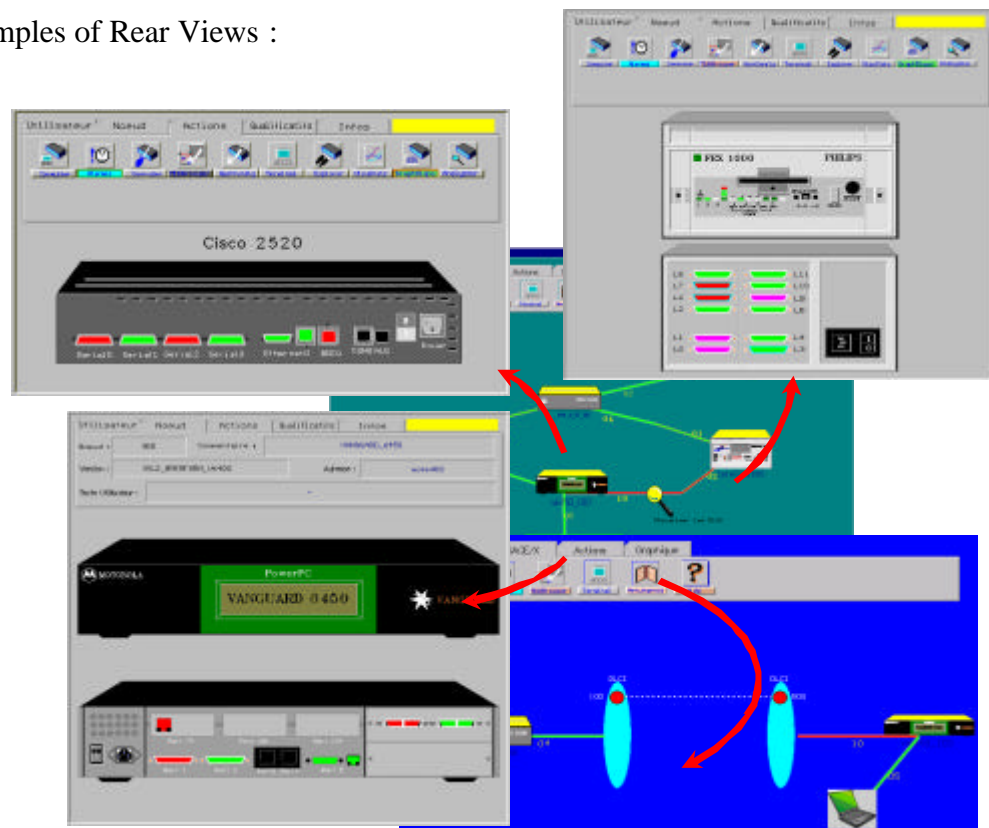
4.4 OPTIMIZED PERIODIC CHECKING AND COLLECTION OF STATISTICS

SageX monitors several hundred devices, which is several thousand interfaces. To accomplish this, SageX automatically runs numerous tasks in parallel. So as to optimize the use of bandwidth and to avoid congesting the network with heavy traffic during these periodic actions, SageX judiciously divides up the repetitive tasks in time based on weighting factors and a base period. An example is given below for a SageX managing 200 devices (nodes).

The mechanism consists of dividing up the periodic checking over several base periods. During each base period, periodic checking is done on a certain number of network objects.

The assigning of an object to a base period is managed automatically by SageX so as to have an equal distribution. The number of base periods is defined indirectly by the definition of the weighting factor parameter. This critical factor makes the number of objects vary that SageX assigns to each base period.
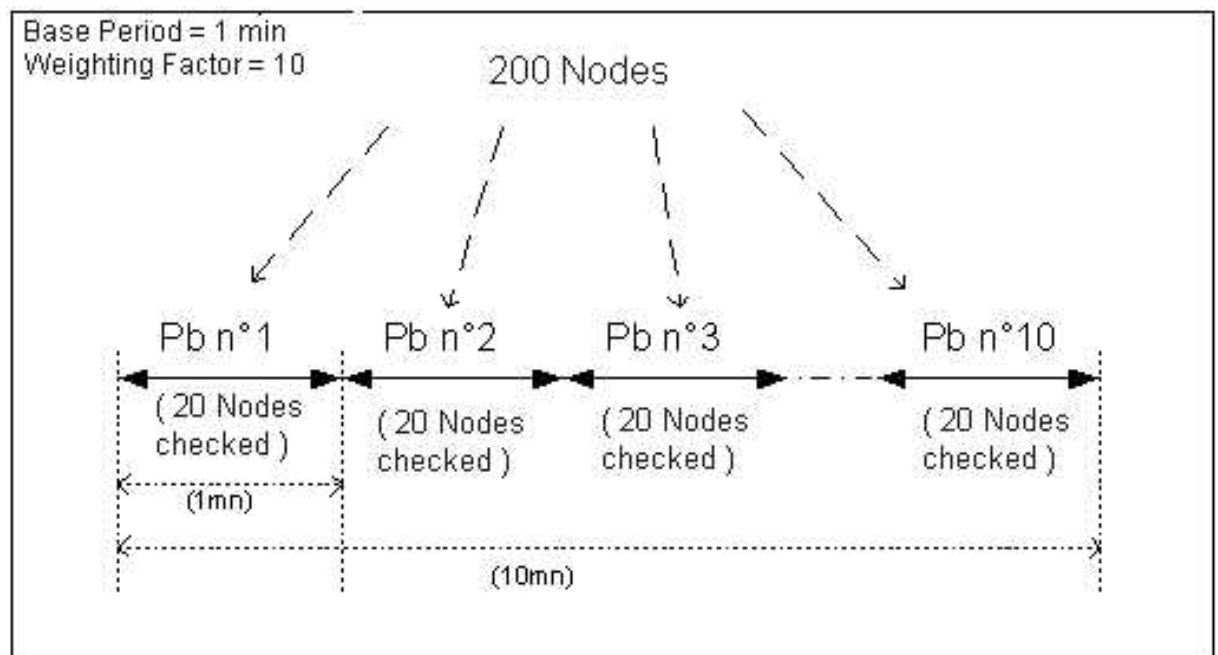
Distribution in time of nodes to check

4.4.1 THE TASK PROCESS

SageX is multi-thread; this enables it to run several tasks in parallel and to do actions very quickly. Moreover, even though SageX manages a great number of devices (500 nodes), there is no congesting of the network because of the periodic checking or collection of statistics. These different actions are blended in time.

4.4.2 BANDWIDTH USED BY SAGEX

The table below shows the results obtained following a measurement campaign done on a network composed of heterogeneous SNMP devices. The goal of this campaign was to measure the number of objects emitted/received as part of the periodic checking and the collection of statistics.

Manufacturers	**Check** Number of bytes emitted + received per interface	**Collection of Stats** Number of bytes emitted + received per interface
Motorola	255	624
Cisco	220	796
CS Telecom	287	482
Bay Networks	267	803
General Average	**257**	**676**

By taking the previous example describing the checking of 200 nodes (10 interfaces per node) and basing this on an average of 30 seconds to check 2000 interfaces, we can deduce an average of 13.3 Kbit/sec to check a network of 200 nodes. The same goes for the collection of statistics, where we can deduce an average rate of 35.2 Kbit/sec to collect the statistics for 2000 interfaces.

On the whole, we get an average rate of around 50 Kbit/sec for the checking and collecting of statistics for 200 SNMP nodes. This rate could be higher in the case where the user programmed extra actions in the scheduler (e.g. retrieval or downloading of configurations) or in the case of the management of X25 devices (dialog between SageX and Sage/Engine buffering alarms); however these different measurement campaigns realized show that SageX always has a consumption rate of less than 10% of the bandwidth.

4.5 COLLECTING INDICATORS

Performance management is based on the use of statistics data made available by the devices to understand the status of systems when performance faults appear.

SageX is able to collect any statistics counter in raw form at the level of nodes, lines or logical components (ISDN channels, E1 channels, FR DLCIs). The nature and quality of the data available varies enormously according to the type of devices. The statistics information provided could be quite various. However, to give the user a summarized and meaningful view of performances of the network, SageX collects indicators describing the behavior of devices, then indicators describing the behavior of their interfaces. The list of indicators collected is divided into three categories described below :

Indicator Category	Non SNMP Devices (ex : X25)	SNMP Devices
LOAD INDICATORS	Number of virtual circuits switched RX/TX packets switched RX/TX call and confirmation packets RX throughput, TX throughput	Workload IP packets received IP packets emitted RxThroughput, TxThroughput
Resource Management Indicators	Switch Buffers (bufMin, bufMax)	Non-routed packets Memory occupied Processor load
Transmission Quality Indicators	Errors (bad CRC, Aborts, Overruns, ErrParity) Number of frames lost by lack of memory	Reception errors Emission errors Packets lost by lack of memory Resets

Collections are done in periods defined by the user. A uniform vision of the results is proposed with the graphic statistics viewer. All the values gathered are recorded in the log file and can be consulted later or exported to other application such as Excel. A very large statistics file could take a long time to load and would affect the performance of SageX. Thus, to optimize system performance, SageX allows one to schedule periodic automatic archiving of the statistics history. The statistics can be re-opened at any time (graphically or in text form).

4.5.1 LOAD INDICATORS
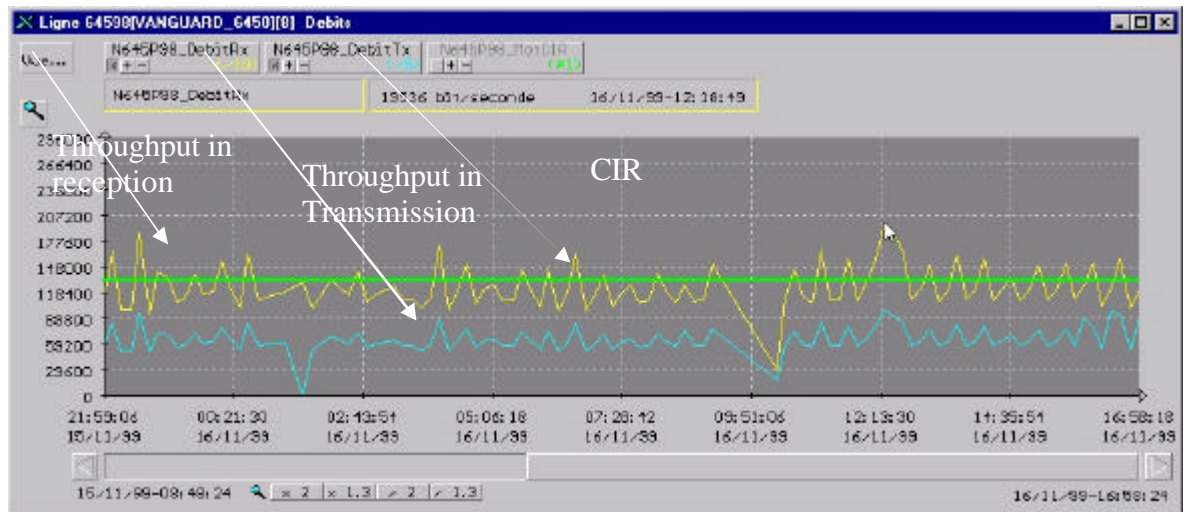
Graphic representation of emission and reception throughput on a Frame Relay DLCI.

Graphic representation of the CIR.

4.5.2 RESOURCE MANAGEMENT INDICATORS

These indicators diagnose the correct use of internal resources for nodes on the network: buffer problems, memory load, processor load. Monitoring all the metrics related to the performance of the network is essential for proactive action (capacity planning) or reactive (corrections).
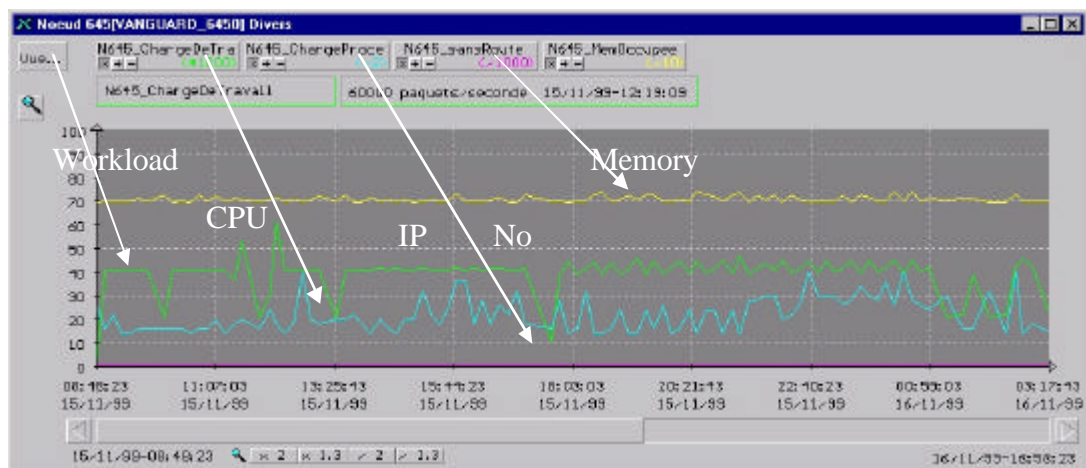
4.5.3 TRANSMISSION QUALITY INDICATORS

These indicators are composed mainly of error indicators allowing one to judge the quality of the physical infrastructure (NICs, physical cables, etc.)

4.6 CONFIGURATION MANAGEMENT

The management of configurations is done starting from a node and may be divided into three distinct parts:

- total configurations: concerning all the information on the configuration of the node,

- partial configurations: concerning information related to an element of the node (line, access-list, dialer-list),

- profiles : models for partial configurations.

Configuration management for a node enables the user to have an overall view of the total or partial configurations of the node in descending order of the last download date.

4.6.1 TOTAL CONFIGURATIONS

The function, "Configuration Validation" does a complete dump of a device's configuration. We thus obtain total configurations.

All of the archived configurations are presented in descending order (according to the last download date, or dump if no download has been done). A marker (*) is placed before the last configuration extracted for the node. Above this are displayed all the partial configurations related to this node.

After selecting the desired configuration, it is possible to modify this configuration, to upload it to a device or prepare a "N+1" configuration. This feature enables the programmer to upload a new configuration through the scheduler. This "future" configuration is created from a copy of the reference configuration, then by modifying this copy so as to obtain the next configuration to upload to this device; this configuration is simply called configuration N+1.

4.6.2 COHERENCY CHECKING

To be sure that the configuration archived by SageX is identical to the operational configuration of the device, it is possible to check the coherency. This feature compares the configuration present on the node with the last one dumped. If a difference is noticed, SageX gives notification of this, and in this case, depending on what the user wishes to do, the configuration can be re-validated to update SageX in relation to the operational configuration or the configuration archived by SageX can be uploaded to restore coherency at the device level. In the first case a new dump is done (taking into account the latest modifications) and the partial configurations are deleted.

4.6.3 PARTIAL CONFIGURATIONS - PROFILES

This feature allows one to create a subset of the device configuration selected. Depending on the devices, the partial configuration could be the configuration of an interface, of an access list or a dialer-list.

After selecting the desired partial configuration, it is possible to consult or modify this configuration, or to make a profile out of it. This latter possibility helps the user to configure very quickly a new set of devices. When installing new devices on the network, some lines may require the same basic configuration. In this way, SageX configuration management has been specified to allow the creation of a configuration, which can be used as a basic model for all the elements of the network. SageX takes this configuration and makes a profile out of it, which can then be uploaded to other nodes. When creating a profile, the user can very easily choose the information to put in the profile (flip-flop yes/no before each line present in the partial configuration).

4.7 MANAGING BY OBJECT DOMAINS

This notion was created in SageX to allow the manager to gain time. An object domain is a set of objects managed by SageX. This management by domains brings a considerable gain in time in measurement where it enables the manager to launch an action on a set of objects instead of having to launch it one by one for each of the objects in the domain.

To upload a configuration on N nodes for example, all one need do is create a domain containing these N nodes and to launch the action "upload configuration"; this action can be run immediately or in differed mode.

Examples of object domains :

"N000 N010 N200" : nodes 000, 010 and 200

N000-N300 : all the nodes from 000 to 300

N000 N000/1 : node 000 and all its ports (components of level 1)

Network/1 : Network object and all the nodes it is composed of

4.8 USER MANAGEMENT

SageX offers advanced user management. In general, management tools offer a few pre-defined profiles. SageX goes further and allows the manager to create his own user profiles.

A user profile defines all access privileges to devices and to the different actions in SageX. Thus, it is possible to define :

- the list of objects accessible to the user (creation of object domains)

- the list of actions authorized for the user (multi-selection in a list of actions proposed).

A user is part of a group to, which is associated a list of profiles as well as graphical view displayed as soon as a user of this group connects to SageX.

User management gives one a more or less wide view of the objects on the network to a group of users and to grant actions to a user depending on his/her qualifications.

4.9 TROUBLESHOOTING TOOLS

Beyond their basic switching / routing functions, network devices often propose a variety of functions such as traffic analysis, line connection status, logging of remarkable events, which help the user in the day-to-day maintenance of the network.

4.9.1 TRAFFIC ANALYZER

Traffic analyzers or probes are expensive devices, which should be placed in the hands of experts. SageX offers as part of its standard features, on all the switches implementing this feature, access to the traffic analyzer. This software analyzer is simple to use and allows one to observe easily the traffic on an X25 line. The parameters of this analyzer can be set, so as not to be "polluted" with uninteresting traffic; it is possible create filters, profiles or to specify the type of packets and the number of the logical channel one wishes to analyze.
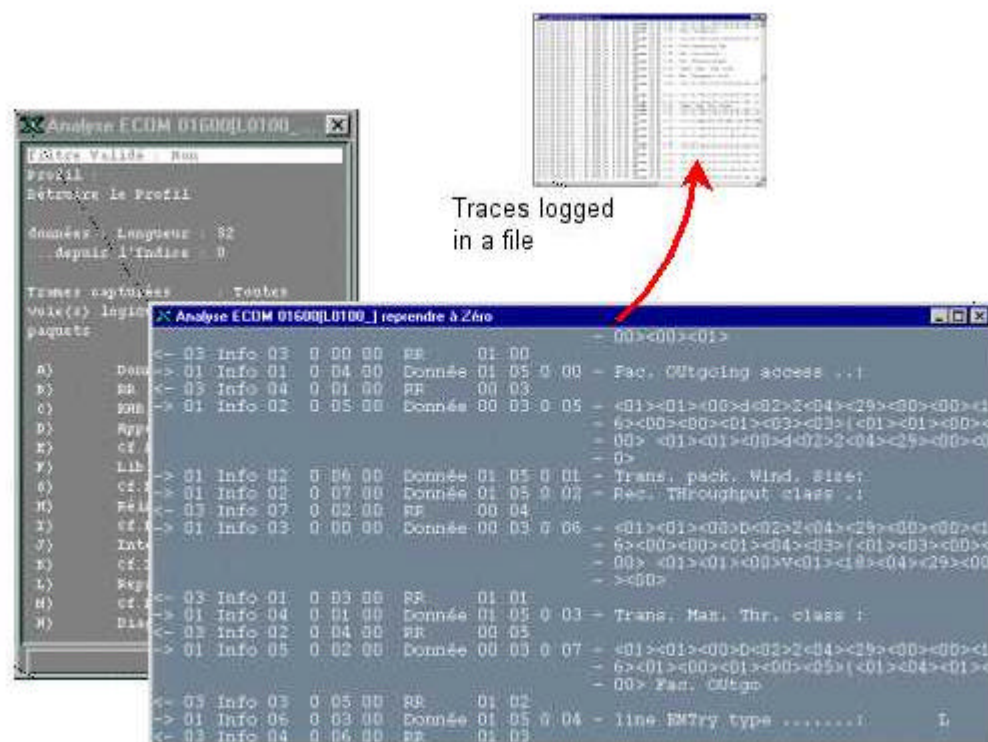
Traffic Analyzer on line 00 of an OST device

4.9.2 PERIODIC ANALYSIS

Periodic analysis allows the user to select counters he/she wishes to collect and to specify a collection period. The counters collected are recorded in a table file, which can be used in another application.
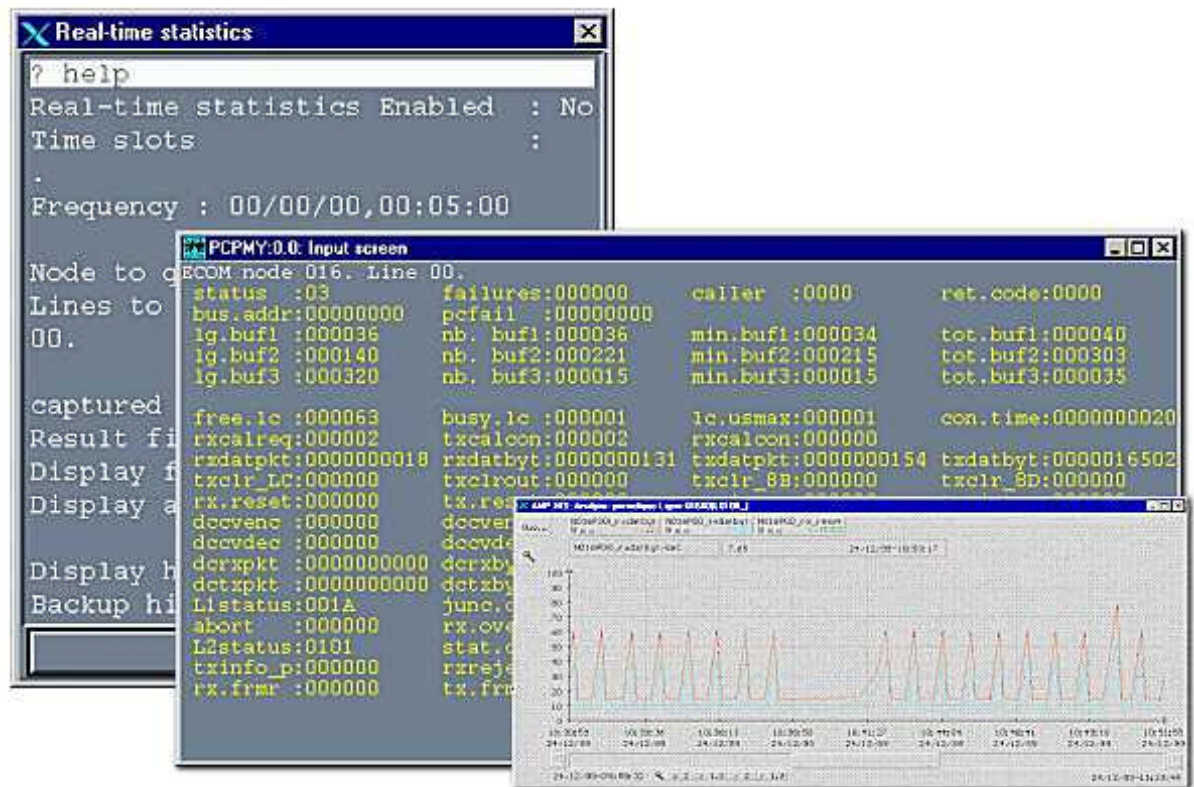

4.9.3 ASSISTED CONFIGURATION

The configuration of devices is complex and cannot be done with a generic tool for all devices are different and require specific knowledge to be able to configure them.

Experts who have very precise knowledge in the configuration of devices dispose, in SageX, of tools such as terminal emulation to connect quickly and without assistance to devices. To facilitate this task and make it accessible to non-experts, SageX allows one to connect to any device managed in assisted consultation. This consultation mode gives read or write access to the device configurations. This feature enables one to access internal configurations or to other services in a user-friendly way through menus.

Thus, SageX is a network management tool, which is good for all levels of expertise.
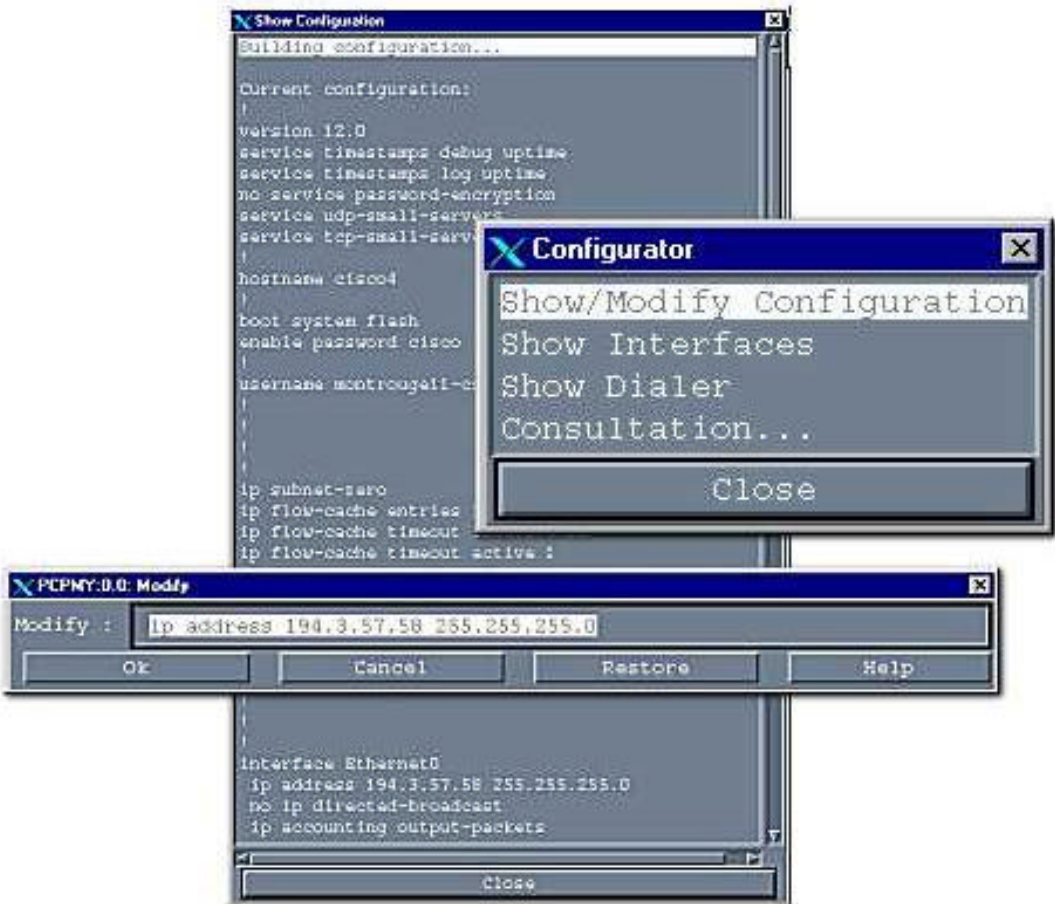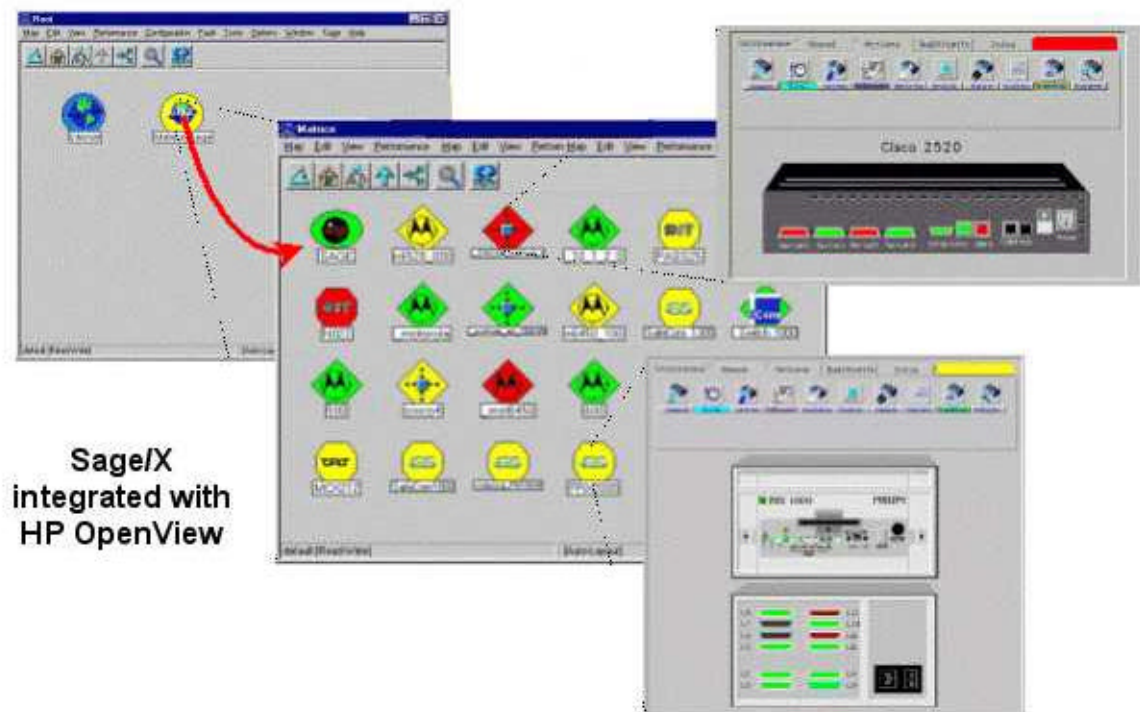
4.9.4 REMARKABLE EVENTS
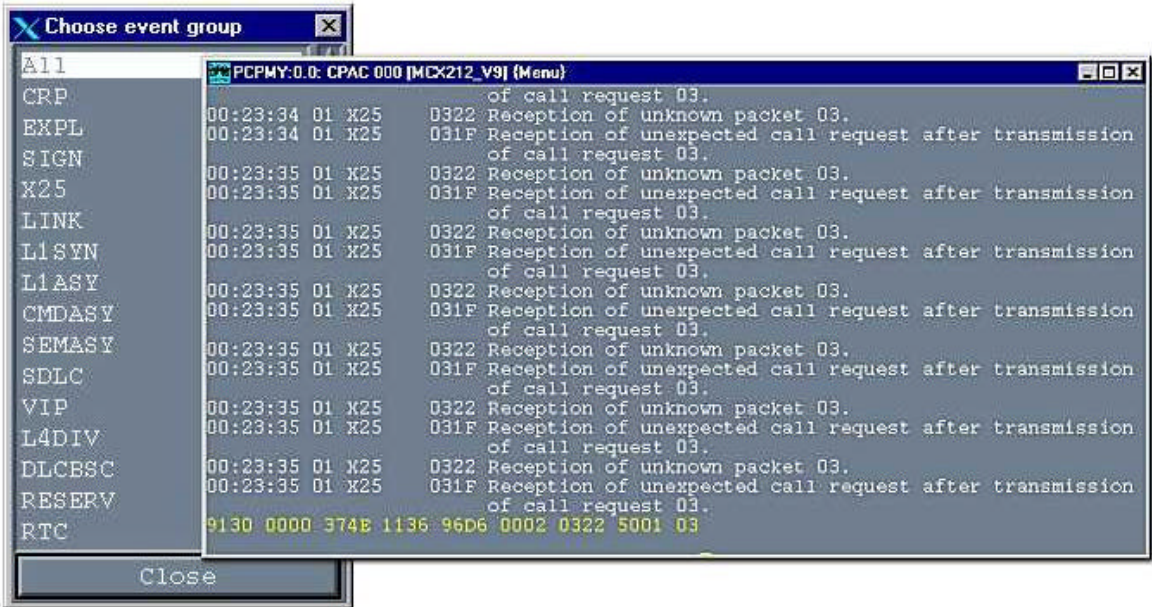
5. OPEN TO FRAMEWORKS

5.1 WHAT DOES SAGEX BRING TO A FRAMEWORK ?

SageX can be integrated with a framework such as HP OpenView, OpenMaster, Netview, CA TNG or operate as a standalone.

Sage/X integrated with HP OpenView

1. The management of devices unsupported by the framework

    SageX extends the functions of the framework to the management of X25 switches, PADS, modems, X400 messaging systems or to other devices with an internal proprietary agent.

2. Configuration management tools

The terminal mode in SageX or the assisted configuration manager enables one to connect to a device and to modify its configuration on-line.

Moreover, SageX has a configuration management module enabling one to archive several configurations by device (total or partial configurations). These configurations may be re-uploaded at any time to the device. From a given configuration, the manager can create an uploadable profile for a set of devices. This feature brings a considerable gain in time for the configuration of devices when installing and setting up devices.

3. Enhanced with statistics data collected

Without any additional setting of parameters on the framework, SageX brings additional statistics information. SageX automatically and seamlessly retrieves indicators in devices' proprietary MIBs . With many devices implementing MIB II and this often incompletely, it is necessary to get extra information in proprietary MIBs (Cisco, Codex, PCE MIBs, etc.) to have a precise description of the device or access advanced and complete statistics.

4. Three different levels of graphic views

-   Node views

-   Line views

-   Logical component views (ISDN channels or Frame Relay DLCI)
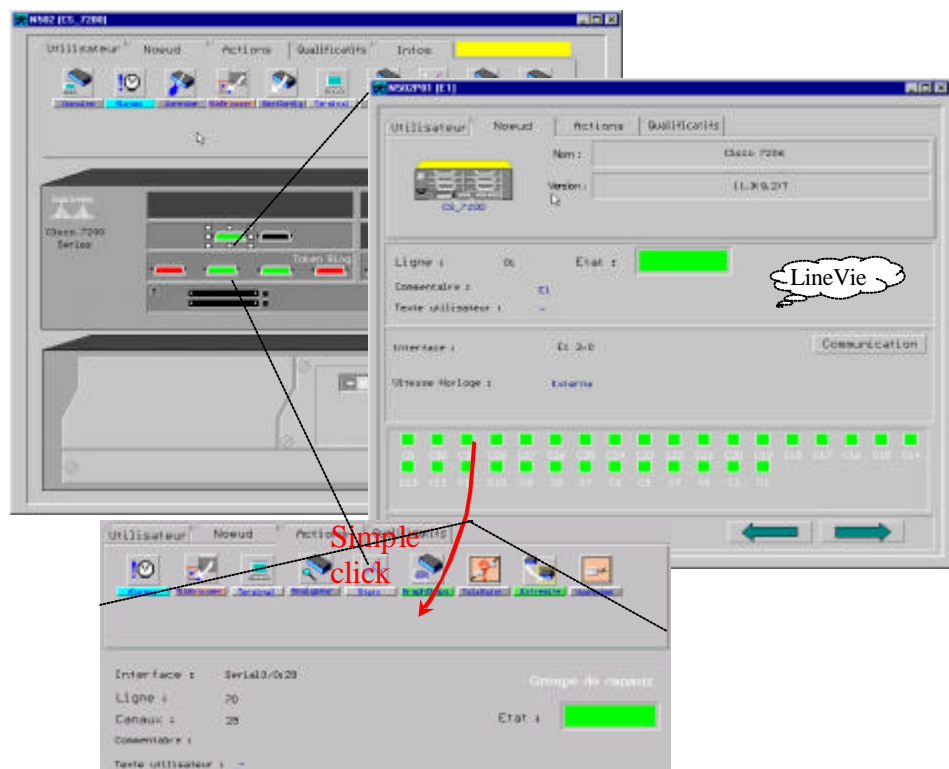
5.2 HOW DOES SAGEX INTEGRATE WITH A FRAMEWORK?

1. Automatic creation of SageX objects in framework views.

   Specific symbols and menus are added to the graphic views offered by the framework so as to represent objects managed by SageX and to access the actions available with a simple mouse click. These symbols match the corresponding symbols managed by the framework and the running of SageX actions is seamless to the user.
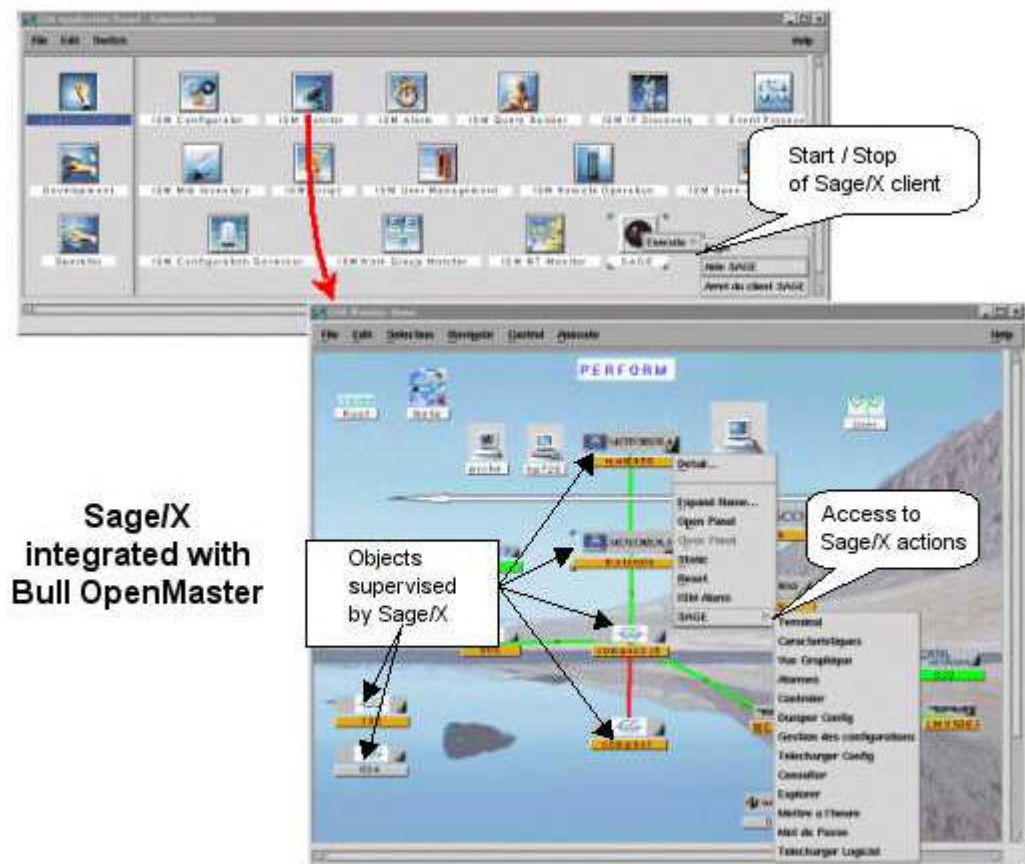

2. X25 Device Management

   SageX is the best solution for managing a heterogeneous set of X25 devices. By integrating with frameworks, SageX gives access to X25 to these SNMP managers. X25 devices are widely used in banks and large organizations.

3. Recording of SageX alarms in the alarm log of the framework.

   Alarms generated by devices managed by SageX are at first decoded then analyzed by SageX. After this, SageX may notify the framework of a change in status by sending a specific SNMP trap.
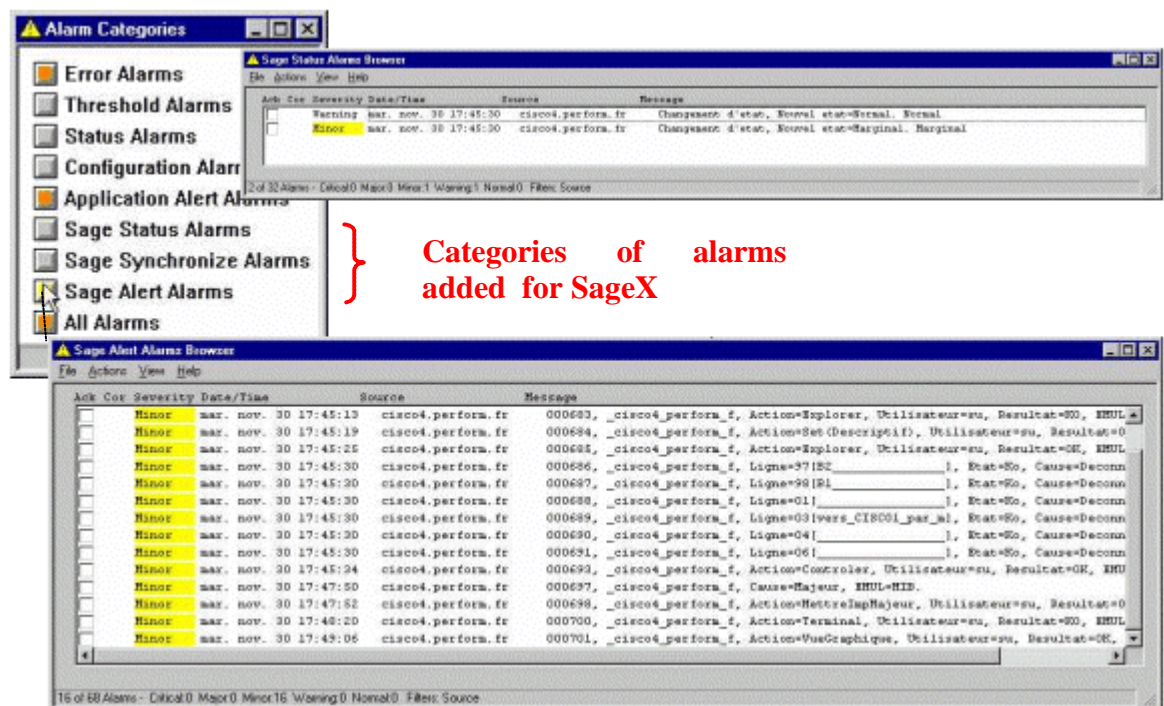
SageX Alarms in HPOV

4. Mapping of IP objects auto-discovered on SageX objects

    To offer more features on devices discovered through IP auto-discovery of frameworks, it is possible to map these objects on SageX objects. Thus, with no extra configuration of the framework, it is possible the more advanced features concerning these objects (e.g. configuration, statistics, etc.)

6. WEB BASED MANAGEMENT : THE NEW APPROACH

Until now the management of networks was restricted to Unix stations and X11 terminals. The complexity of Unix and the cost of terminals made the information concerning the health of the network useable only by the network team. Today, the concept of Web-based management enables the sharing and transmitting of this information to various users through a simple web browser.

Sage Web-Based, (the Web interface of SageX) is a simple product built for the purpose of simplifying network management operations. SageX utilizes the flexibility of internet technologies to offer the user a network management tool that's simple and easy to use.

With Web-based management, Sage Web-based offers all the flexibility and extensibility required to meet and evolve rapidly with the needs of the market.

6.1 ARCHITECTURE

Sage Web Based , written in pure Java, is based on a 3-tier architecture :
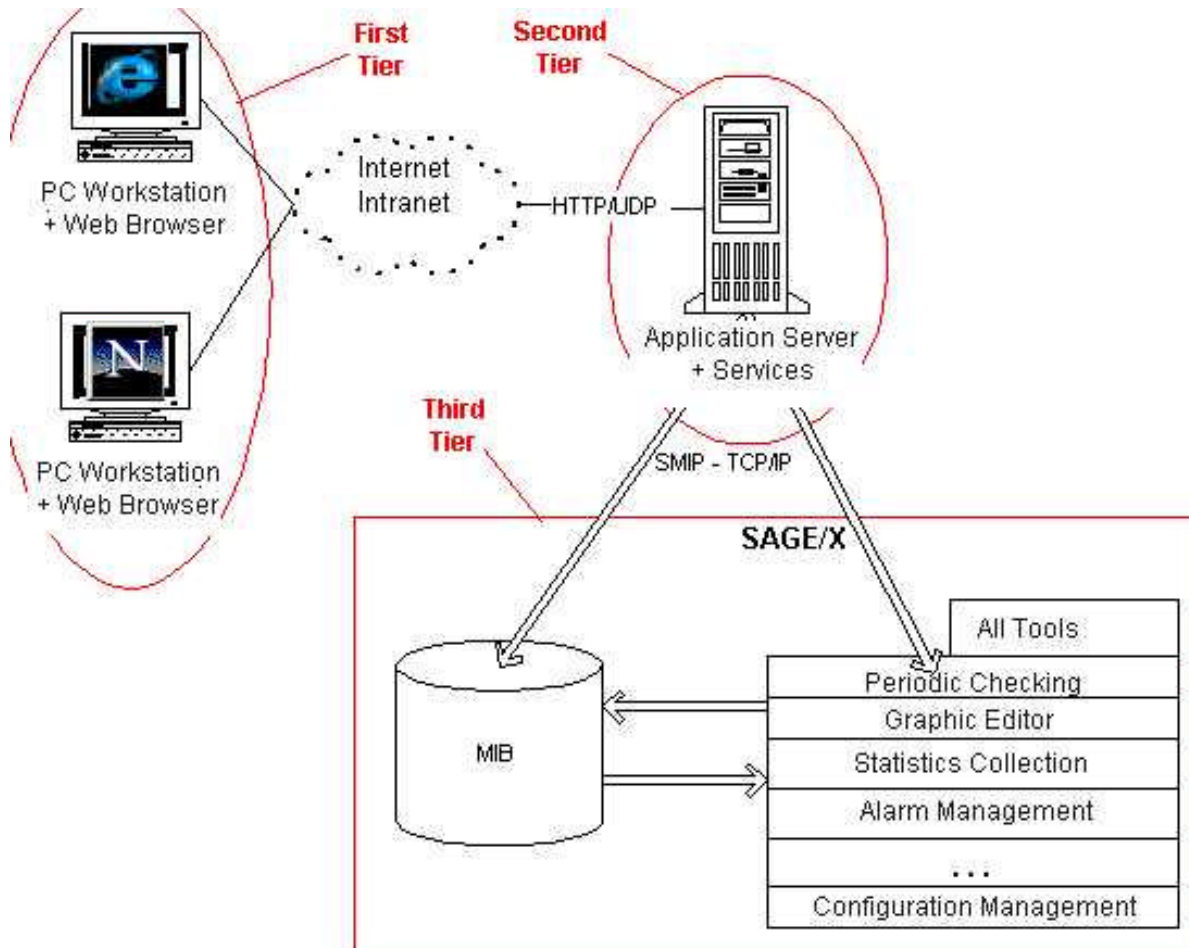
6.2 FEATURES

6.2.1 A SUMMARIZED VISION OF THE NETWORK

Through the tree node, the user can see all the objects in the MIB and visualize any relations that exist. A small icon placed before the name of the node allows one to determine the type of device.

The matrix view summarizes all the nodes managed by SageX. A simple click in a box in this view brings up the parameters concerning the node clicked on.
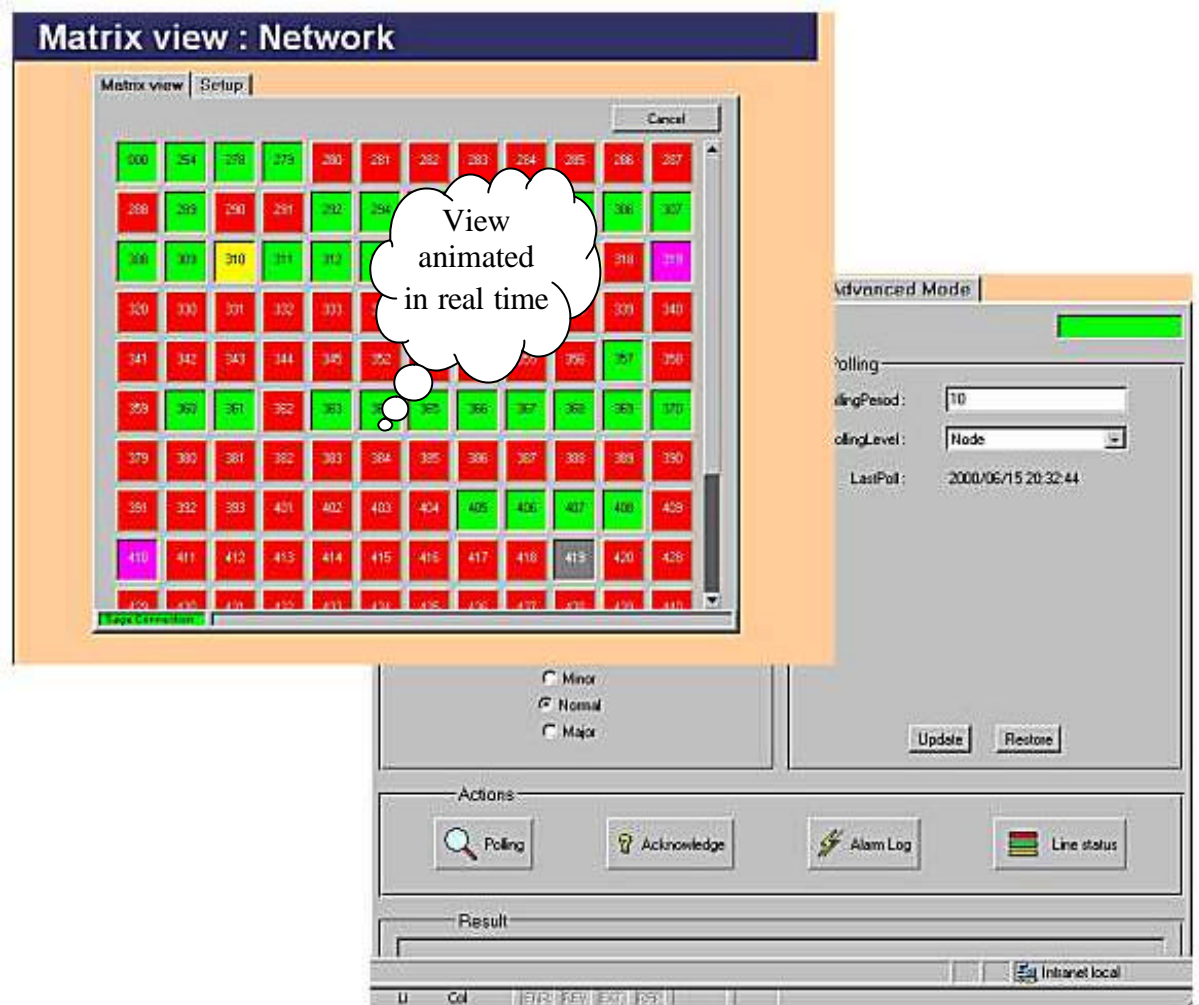
Sage Web Based offers the user the possibility of quickly visualizing and in a friendly way the device's attributes. Actions authorized depend on the user's access privileges in SageX. To summarize and clearly present all the information provided by SageX, the attributes and actions are grouped together in three categories:

- Fault Management

- Configuration Management

- Performance Management

acknowledgement, alarm visualization and line status visualization.
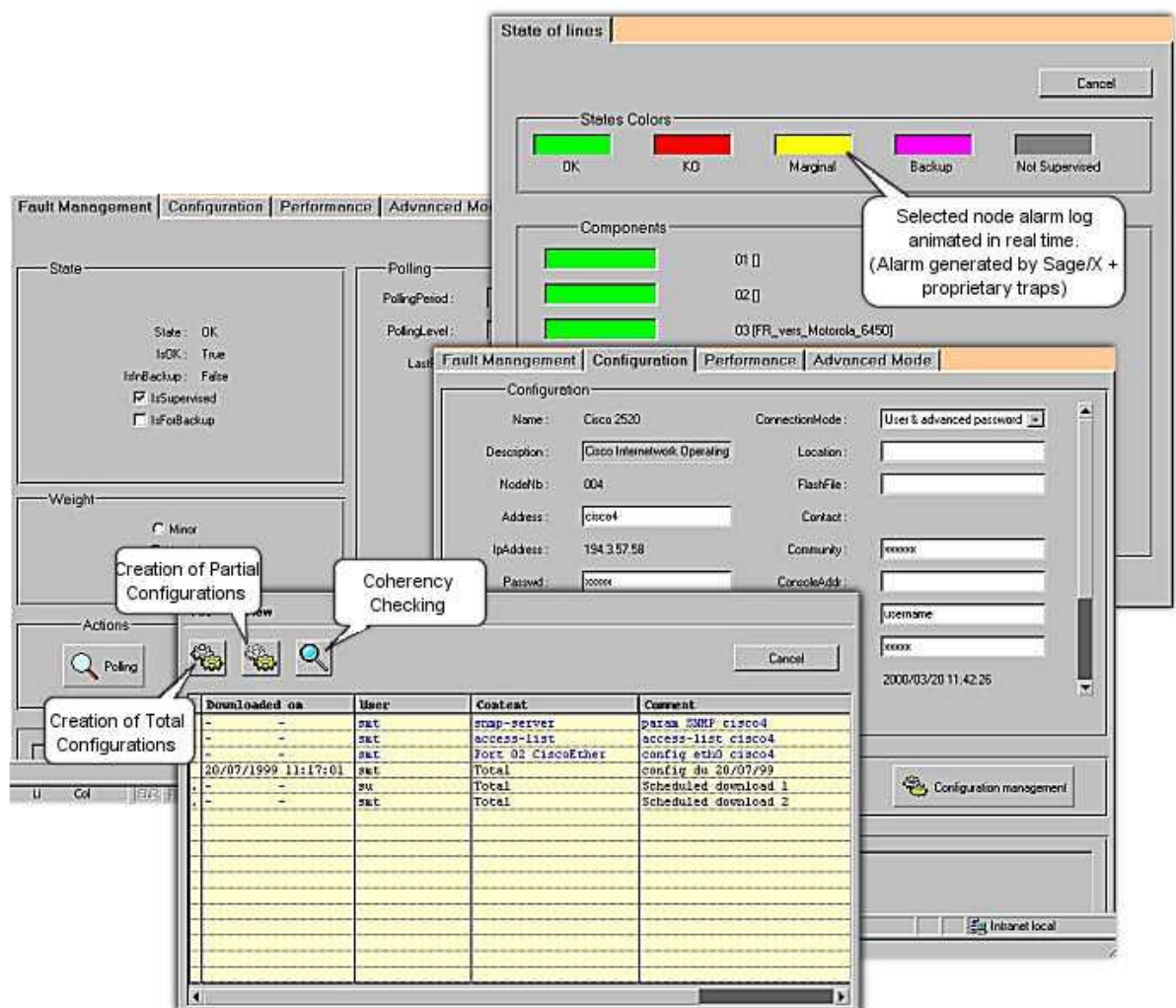
6.2.2 FAULT MANAGEMENT

Fault management is composed of status attributes, checking, polling actions, acknowledgement, alarm visualization and line status visualization.

6.2.3 CONFIGURATION MANAGEMENT

Configuration management is composed of configuration attributes and exploration, deletion, time setting and configuration management actions

6.2.4 PERFORMANCE MANAGEMENT

Sage Web Based presents in a summarized and friendly way all the statistics collected by SageX. SageX is able to collect statistics at the level of nodes, lines, and their logical components. With a simple click on the desired object in the tree node, the user can access all the statistics. Performance management is composed of statistics attributes, availability attributes calculated by TRAITHIS and graphic visualization of statistics.
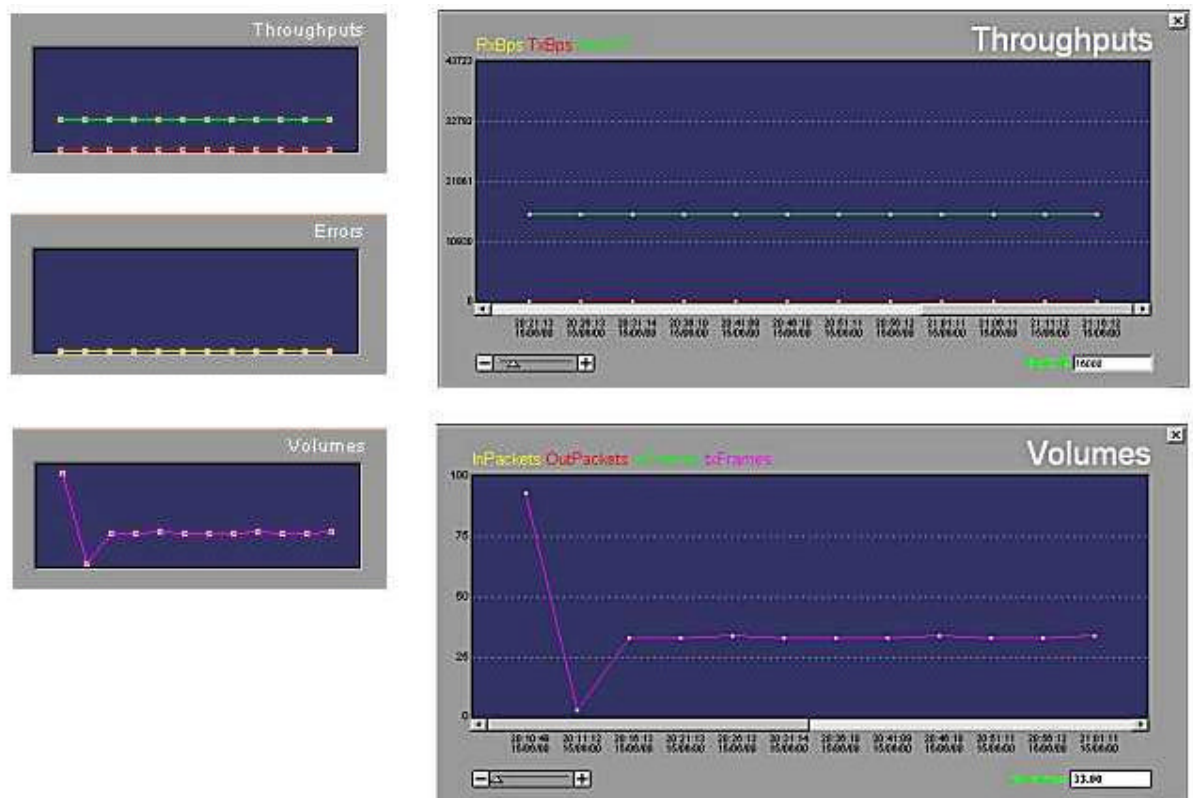
Statistics available at the node level