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Introduction

Service providers looking to grow their revenues are increasing their network footprint and adding new services. Operations, administration and management systems facilitate the deployment of the solutions designed to support these efforts.

EXECUTIVE SUMMARY

In today's marketplace of unbridled competition and price erosion, service providers looking to grow their revenues and protect their profits are expanding their network footprints and offering new value-added services. Both types of initiative usually require the installation of new equipment, something that has historically been prone to issues during deployment and maintenance. Keeping these challenges in mind, **TelcoBridges™** has designed *Toolpack OAMP*, an operations, administration, maintenance, and provisioning (OAM&P) system that enables service providers to maintain their reputations for reliability and responsiveness during the integration, operation, and maintenance of new equipment. Packaged in an intuitive yet powerful user environment featuring one-click installation, *Toolpack OAMP* features support for fault tolerance, redundancy and active system monitoring.

INTRODUCTION

In today's marketplace, a telecommunications service provider looking to grow its revenues and protect its profits faces the twin threats of unbridled competition and price erosion. Meeting this challenge effectively can require increasing the number of subscribers or increasing the average monthly revenues per subscriber or both. Growth in subscribers is achieved by increasing the penetration of the existing network footprint—capturing new customers and competitors' customers—and by expanding it to previously non-serviced areas. Increasing monthly revenues per subscriber is achieved by introducing new value-added services such as conferencing, IVR, ring-back tones, voicemail, and pre-paid / post-paid service.

Both types of growth usually require the installation of new equipment on the service provider's premises, something that has historically been prone to issues during deployment and maintenance. For expanded network footprints and new valued-added services to contribute positively to revenue and profitability targets, the service provider must maintain its reputation for uptime and availability during the introduction, operation, and maintenance of new solutions. To support the deployment and ongoing use of their products, while meeting the reliability and responsiveness needs of service providers, telecommunications equipment providers have developed solutions known as 'operations, administration, maintenance, and provisioning' (OAM&P) systems, though these have not been without their challenges.

An OAM&P system is a customer premise-based tool that enables the service provider to perform the initial set-up and any subsequent maintenance and provisioning operations on its telephony systems. Maintenance operations range from the simple, such as the collection of statistics and alarms, to the more complex, such as system configuration changes, the addition of new hardware or software components, and the application of software patches or software upgrades. Provisioning activities included the activation of new customers or the addition of new services to a given account. The OAM&P system helps the service provider enhance its system capabilities through changes to capacity or capabilities, without causing service disruption. The design of the OAM&P system is thus very important, as it has a direct impact on the quality of service provided to customers, and thus on customer satisfaction, long-term revenues and profitability.

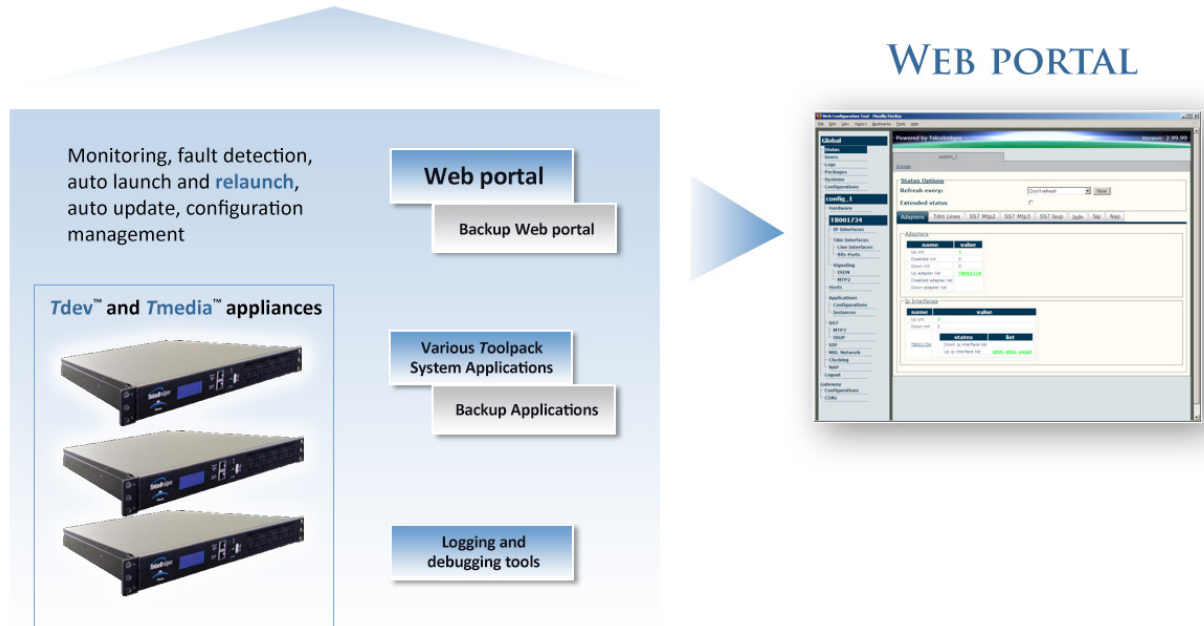
To support the deployment of its industry-leading family of *Tdev™* multi-service application platforms and *Tmedia™* media gateway platforms, **TelcoBridges** has designed an OAM&P solution known as *Toolpack OAMP*. (See Figure 1.)

When used with the **TelcoBridges'** family of products, *Toolpack OAMP* enables the service provider to configure, monitor, and upgrade an entire production system, running on multiple *Tdev* or *Tmedia* units and multiple host servers.

> Figure 1

Toolpack™ OAMP Application

Backup Toolpack OAMP Application



SOLUTION OVERVIEW

Because the underlying platforms to be managed are so complex, OAM&P systems are often hard to design and even harder to implement. In fact many, if not most, OAM&P systems suffer from one or more issues. We will explore those issues and see how Toolpack OAMP uniquely addresses them to give service providers the peace of mind they need to deploy new network capacity and enhanced services using the TelcoBridges family of products.

Statistics and alarms

The complexity of telecommunications systems requires an OAM solution that can make sense of all the data is generated.

Statistics and alarms

As a result of the addition of VoIP, video and data traffic, and other value-added services, the complexity of telecommunications systems has now reached new heights. Timely access to statistics, alarms and event logs is very important for rapidly identifying and fixing service issues. However, many OAM&P systems do not offer sufficiently detailed information (logs, statistics on system components, etc.) to properly diagnose a problem or its root causes in a timely manner.

Toolpack OAMP provides immediate, detailed states of and statistics on all components configured in the system. This information is displayed in a user-friendly manner in the Toolpack web-based portal. It is also available through shell commands, or through a C++ based application-programming interface (API). It is therefore easy to obtain an overview of the system's states or to integrate the querying of this information with other parts of the system through the shell or C++ APIs.

Debugging tools

In lieu of having expert users on-staff, an OAM solution should provide information that service providers and their system integrators can use to remotely debug any issues.

Debugging tools

For cost reasons, the average service provider often does not maintain the expertise on staff to perform deep analysis of the many types of issues that occur with telecom systems (e.g., configuration errors, interoperability problems, hardware failure, or bugs). These problems

generally need to be investigated by the engineers that designed the system. However, for operational or security reasons, these engineers—frequently external personnel employed by a system integrator—generally don't have direct access to the system once it is in production. It is therefore very important that the OAM&P system provide an easy means for non-expert users of the system to capture all required system logs, statistics, system states, and other information, so that they can be sent to the solution developer or hardware manufacturer for debugging purposes. The lack of proper tools for debugging at an appropriate level of detail greatly increases the turn-around time for identifying and resolving an issue.

Designed to support the successful and timely deployment of new network capacity and enhanced services, Toolpack OAMP provides the means to quickly capture the system activity for a given period. It includes the collection of statistics, logs, and system states for the given period, allowing TelcoBridges-certified system engineers to analyze call flows, and rapidly identify and resolve any issues. Toolpack OAMP also provides complete logging of events through the system, including low-level, highly detailed traces about the signalling states of each call. The level of traces can be customized per module in order to provide very precise analysis of call flow without generating excessive amounts of logging. Such logging of the entire system (including systems that run on multiple host servers) can be gathered in a centralized manner. Control over the level of traces is also managed centrally through the web portal interface. Log files are automatically compressed to save disk space, while maximum disk space usage can be configured so that older logs are automatically erased.

Configuration management & validation

The ability to building, test, deploying, and even roll-back system configurations, without taking the system offline is a key consideration when evaluating an OAM solution.

Configuration management and validation

Modifications to the configuration of a production system are inherently risky. An erroneous configuration can create a host of problems that are sometimes hard to identify and resolve. It is therefore very important that the OAM&P system provide a convenient means of creating, validating, and activating configurations, without causing interruption to existing services. Notwithstanding that need, most OAM&P systems do not provide adequate tools for managing multiple configuration sets, and then validating those configurations before activating them. In fact, some systems do not actually permit changing the configuration without requiring a reboot, and may not allow an easy rollback to the previous configuration in case of a fault or incompatibility.

Toolpack OAMP enables the creation of multiple configurations, their validation and the ability to switch between any of them at any time. Validating or activating a configuration is done "live", without service interruption, and without any lost calls¹. Configurations are again managed centrally through the web portal interface, independent of the number of Tmedia units or host servers used, providing a convenient approach to managing multiple system configurations.

Scalability

An OAM solution should support the ability to gracefully scale the system as service uptake increases.

Scalability

When initially rolling out new capacity or new value-added services, it is often convenient to set up a smaller production system in order to minimize the cost of entry. Over time, system usage generally increases and the production system is scaled up accordingly. It is therefore very important that an OAM&P system allow the production system to scale gracefully. However, some OAM&P solutions require a complete system shutdown in order to add more hardware and software, leading to disruption of service. This prevents timely incremental capacity increases or service additions, affecting the service provider's competitiveness, since this type of operation must be performed as rarely as possible to avoid service interruption.

¹ Unless changing core parameters, such as removing or changing variant of an ISUP/ISDN stack, for example. This would of course affect calls currently active on the stack instance. However, it would not affect any other part of the system.

Toolpack OAMP can be scaled gracefully from 1 to 16 Tmedia units (representing more than 30,000 TDM and 30,000 VOIP call legs, non-blocking, with IVR), using multiple hosts for load sharing. Scaling the system up or down—adding or removing new servers, Tmedia units or stack variants—can be done “live”, without any service interruption, through the addition of appropriate configuration items in the web portal interface. Toolpack OAMP automatically manages the launch and monitoring of applications across multiple host servers. Redundant instances of applications can also be added or removed live to improve the system’s resiliency.

Software upgrades

An OAM solution should support the version management process, enabling system updates with as little disruption as possible to operations.

Software upgrades

Change is a fact of life, even for telecom systems, as new features are released, bugs are fixed, and interoperability across solutions from different vendors is introduced and improved. However, version management of systems comprised of multiple software and hardware components can rapidly become a nightmare. It is therefore important that an OAM&P system allow graceful upgrading of the system and do so, where possible, without service interruption. However, many OAM&P systems do not enable such smooth version management. They often require manual updating of many components, often one by one, and they often do not permit different software versions to coexist, requiring shutdown of the entire production system for the duration of the update. Finally, they often over-write older software versions with newer ones, making a rollback to a previous version painful, or even impossible. This can lead to service interruptions, increase the overall risk of the upgrade process, and potentially delay the introduction of new features or other enhancements that can benefit customers.

The Toolpack OAMP solution can be upgraded or downgraded from one system version to another gracefully, while the system is “live”, without service interruption², and with a minimum of lost calls. Once a new software package has been installed on the main host server, Toolpack OAMP automatically replicates the package on all other hosts, automatically re-launches all running applications³, and updates the software on all relevant Tdev/Tmedia units, while the system is running. The update is performed a single application or Tdev/Tmedia component at a time in order to avoid service interruption. Installation of a new software version does not uninstall previous software versions. It is therefore possible, to switch between any version of the software at any time.

User interface

Considering that it will often need to be used by non-experts, an OAM solution should be intuitive and easy to use, providing a straightforward means of accomplishing tasks.

User interface

Telecommunication systems are composed of multiple components where each component has a high number of configuration parameters, statistics, and complex inter-dependencies with other components. The installation, upgrade and management of these components are not trivial tasks. An OAM&P system should therefore present configuration parameters, system states and statistics in a user-friendly and intuitive manner and complex tasks such as software upgrades should be automated. Unfortunately, due to their complexity and lack of intuitive user interfaces, a significant percentage of OAM&P systems can only be configured and managed by experts.

Toolpack OAMP addresses these usability challenges by providing a user-friendly interface: the Toolpack web portal. Running in a standard web browser, it enables configuration of the entire system, as well as the viewing of states, statistics, and logs. The Toolpack web portal hides the underlying complexity of configuration management and validation, while providing the user with an intuitive way of building configurations, and providing appropriate default values for most configuration parameters. Since it is developed using dynamic web pages, the Toolpack portal

² Of course, this requires having a minimum of two active Tmedia units since the Toolpack OAM system will upgrade/downgrade each one individually, one at the time.

³ Including OAM application itself, and the Web Portal interface

interface can be customized to meet specific requirements of service providers, including restricting access to specific users.

Fault tolerance, high-availability (HA)

An OAM solution is a key component in a strategy to maximize service reliability and availability and should provide facilities for monitoring and rapidly restoring service.

Fault tolerance, high-availability (HA)

In order to maintain customer satisfaction and perceived quality of service, telecommunication systems must be reliable. In practical terms, this means they must be fault tolerant and highly available. This is achieved through the redundancy of hardware and software components, paired with robust fault detection and recovery mechanisms. It is therefore very important that an OAM&P system be able to monitor and reboot any component of the system and, if possible, that each component be able to re-synchronize any active calls immediately following a failure. Nonetheless, many OAM&P systems lack the appropriate fault detection mechanisms, and are unable to automatically recover from the failure of a component, resulting in dropped calls and unhappy customers.

Toolpack OAMP monitors all running applications, automatically re-launching any crashed or deadlocked applications. In addition, it leverages the hardware watchdog on *Tdev* and *Tmedia* units in order to protect against hardware or software failures that would normally require manual rebooting of the units in case of a fault. Toolpack OAMP also enables redundant applications to be launched on redundant host servers, in order to avoid loss of service in case of host failure. Upon such a failure, active calls and associated media resources will be re-synchronized rapidly⁴ by the back-up applications, enabling them to remain active⁵. Using the same fault-tolerant mechanism, all Toolpack OAMP software subsystems are protected in a 1+1 fashion. As a result, redundancy is built-in from the base of the system up to the very user application. Communications between Toolpack OAMP, other applications and *Tmedia* hardware are managed through redundant Ethernet connections, so that a local network failure does not result in a loss of communication and has no impact on the overall telephony system (no loss of calls).

SUMMARY

Faced with the need to grow their revenues and protect their profits in the face of strong competition and continuing price erosion, service providers are expanding their network footprints and adding new valued-added services. In the process, they are integrating new equipment into their production telephony systems, an exercise prone to cost and configuration issues during deployment and service disruption during maintenance. To help service providers address these challenges head-on, and achieve their goals of revenue and profit growth, **TelcoBridges** has developed Toolpack™ OAMP, an 'operations, administration, maintenance, and provisioning' system that enables service providers to maintain their reputations for reliability and responsiveness as they expand their footprints and roll out new services. With support for fault tolerance, redundancy and active system monitoring, packaged in an intuitive yet powerful user environment, **TelcoBridges'** Toolpack OAMP is an innovative and effective solution to each of the OAM&P requirements discussed earlier. Accessed through a web-based portal, it also addresses many of the shortcomings found in existing OAM&P solutions.

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ABOUT TELCOBRIDGES

TelcoBridges is clearly defining the future of communications technologies. By supplying the industry's best telecom platform, **TelcoBridges** is helping telecom developers and integrators of VoIP and TDM solutions realize their bright ideas. **TelcoBridges'** customers develop and deploy carrier-grade telecom solutions for some of the world's largest operators in over 45 countries. These solutions include: mobile value-added services, location-based services, video calling applications, network monitoring, media gateways, switching, IVR, unified communications solutions, and more. For additional information, please visit www.telcobridges.com.

⁴ Typical resynchronization time is a few seconds.

⁵ Transient (not yet answered) calls that cannot be successfully resynchronized will be dropped in a graceful manner.