

WHITE PAPER

Profitability and OSS Support: A Return on Investment Analysis of IBM Tivoli Netcool

Sponsored by: IBM

Randy Perry

Eric Hatcher

Elisabeth Rainge

February 2009

EXECUTIVE SUMMARY

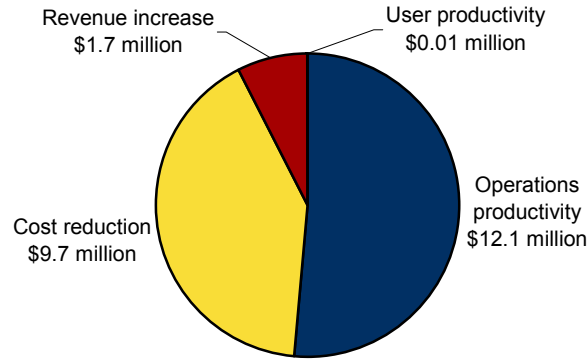
IDC studied telecommunications service providers, including mobile and fixed-line service providers, that have implemented Performance Management, Service Quality Management, and Network Fault Management from the IBM Tivoli Netcool suite of solutions. These firms found IBM Tivoli Netcool to be a robust services management package that matched their critical demands particularly well. IDC's research and analysis of these sites indicates a high level of business value return. Their purchase and implementation of IBM Tivoli Netcool (investment) delivered a return of 625% (ROI). The savings they achieved as a result of the implementation covered the original investment costs in less than six months (payback). Additionally, IBM Tivoli Netcool's capabilities enabled the 14 customers to achieve an annual average benefit of \$23.5 million, including:

- Saving on average \$9.5 million annually, including \$482,162 in operations staff costs through improved efficiency
- Increasing revenue by an average of \$1.7 million or \$0.54 per subscriber
- Saving \$0.36 per subscriber
- Improving mean time to repair (MTTR) a device or system by 54%
- Reducing capital expenditure (capex) by an average of \$1.3 million
- Consolidating network operations centers (NOCs) into fewer centers, reducing NOC expenses by 70% and resulting in \$293,801 average annual savings
- Shortening the time to deliver new services to market by 37%, leading to increased/earlier revenue

The average annual benefit from IBM Tivoli Netcool of \$23.5 million includes cost reductions, user productivity improvements, operations productivity improvements, and revenue increases in the proportions shown in Figure 1.

FIGURE 1

Benefits of IBM Tivoli Netcool



Total = \$23.5 million

Source: IDC, January 2009

SITUATION OVERVIEW

Leading service providers depend on key metrics to measure their continual process improvements and enhance the quality and attractiveness of their service offerings. Just to stay competitive, they must both measure *and* improve metrics as varied as MTTR; dispatch; call time resolution; time to revenue for new service concepts; churn (customer attrition or loss); and, ultimately, earnings before interest, taxes depreciation, and amortization (EBITDA). For operations management, the relentless focus on efficiency has prompted moves to automation and a variety of supplier partnership approaches, such as working with network equipment vendors to ease network management and/or outsourcing. To stay competitive today and to improve core customer relations competency, service providers must integrate cost-oriented measures of internal processes such as MTTR and call time resolution with customer-facing objectives, such as reduced churn and increased revenue per subscriber.

Today's market realities mean that there are ongoing projects to integrate and synthesize information, which stretch across multiple domains. They require the kind of system integration and synthesis that operational support systems (OSSs) enable. Infrastructure foundations for an integrated view include not only the network foundation but also the corporate knowledge base about that infrastructure, including links to IT systems. Typically, such network technology complexities and data reconciliation challenges can fuel spending independent of OSS priorities. But the foundational pieces of OSS, as described by those we interviewed in the research, can effect a notable, positive improvement on these sometimes far-reaching goals.

Looking at the top operational and business issues of service providers, IDC believes that three major business considerations guide today's OSS selection and commitment decisions: operational costs, quality, and revenue contribution.

Current Situation: Today's Headaches and Resolutions

Service providers' uniquely critical dependency on network infrastructures keeps network management teams busy and encumbered by a growing scope of responsibility. The network management teams with these increasing responsibilities face two particularly critical challenges: working to improve long-term service integrity and managing ongoing data reconciliation issues.

Future Proofing

The increasing complexities of network applications and the infrastructures they inhabit make the processes of monitoring services, deploying network-based applications, and implementing next-generation network infrastructure more difficult today than in the past. One interviewee highlighted the challenges posed by ring failures in metro Ethernet networks, saying that "Netcool has certainly helped us in being able to proactively restore services ... or take restoration measures." To manage such significant capital investments, such as metro Ethernet, and to handle the increasing complexity of service offerings, especially bundling, service providers need comprehensive views of the infrastructure.

As discussed later in the paper, many IBM Tivoli Netcool customers cited the ability to reduce trouble tickets and the comprehensiveness of the system view as key benefits. The broad purview of the infrastructure is helping service providers to establish OSS procedures and practices that they can easily adapt to future and planned investments that include WiMAX or LTE as well as more sophisticated voice, video, and data offerings.

The emergence of a new set of technologies — ranging from composite applications to new scripting languages — as well as an accompanying new market ecosystem referred to collectively as "Web 2.0" suggest many opportunities for network management and telecom OSS/BSS vendors. The next-generation telecommunications infrastructure integrates a myriad of applications and infrastructure and goes beyond supporting specific emerging technologies such as LTE, NGN, or IMS. Addressing the monitoring requirements involves offering a holistic view of that network and service — that is an end-to-end view or a "from the end-user" perspective or "process based" rather than "technology silo based."

Data Integration

Data and knowledge integration challenges drive OSS complexity. To be effective, the network management administrator not only must integrate network equipment element management system (EMS) data on specific nodes with data from other nodes but also must integrate that node data with a logical understanding of the network traffic flows. The service provider must regularly manage both the traffic node and the network node in the context of customers and services, which are geographically dispersed.

However, service providers interviewed for this study cited the breadth of IBM Tivoli Netcool support for telecommunications infrastructure as a means of coping with these data integration challenges. One interviewee commented, "We've had a reduction [in number of management platforms] especially across the IP network where we've done away with element managers and so forth." While reducing the sheer number of platforms does not minimize the data integration challenge, fewer systems does limit the complexity of data integration efforts for the operational infrastructure.

Automation of interfaces and information flows continues to prove a key enabler for this type of integration. As both the technologies and the practices of automation continue to mature, the IBM Tivoli Netcool solution is continuing to participate in and benefit from this process.

Top Business Considerations

A further priority and focus of current projects for many service providers involves the goal of aligning network operations more closely with business goals and priorities. New senior management within service providers (in some cases) bring more focus on financial metrics and on their stiffer competition. This is forcing shifts in corporate culture within some service provider organizations. As a result of the shift, key performance indicators such as churn and ARPU remain essential but share the spotlight with shorter-term profit and financial operations metrics. This in turn results in new priorities for network and operations staff, including the impetus to link enhanced profit performance to their normal network operations.

The Business Value of IBM Tivoli Netcool

IDC interviewed 14 telecommunications service providers that operate in Europe, New Zealand, and North America. These companies employ an average of 34,173 people and provide services including landline phone services and wireless and Internet access. Table 1 displays the demographics.

TABLE 1	
Demographics	
Category	Average
Average number of subscribers	26,542,857
Average number of employees	34,173
Average NOC staff size	212
Geography	North America, Europe, New Zealand

Source: IDC, January 2009

Note: The interviews for this white paper were conducted in October and November 2008, after the initial wave of concern for the economic outlook had set in. We believe that the interviews accurately reflect the service provider priorities and use of the IBM Tivoli Netcool solution within the business environment of late 2008.

Challenges

IBM Tivoli Netcool customers face a range of challenges. Some customers said that in the past, their greatest hurdle was keeping operating and maintenance costs in check while their business expanded. These costs include preventing trouble tickets, limiting repairs, reducing truck rolls, and performing network upgrades.

Poor communications and organizational bureaucracy also proved challenging for customers. Prior to the deployment, some customers' approval process for adding new services was lengthy and had several built-in layers. Managers from unrelated operations groups held separate powers of approval, and often they were not aware of the larger business initiative. This led to a disorganized network operations center (NOC).

Installation

Several customers commented on the ease of the solution installation and the flexibility of IBM Tivoli Netcool, which is deployed smoothly given the automated process by which network elements are added. IBM Tivoli Netcool includes responsive probes that connect and retrieve data during the deployment. Also, customers noted that they had the freedom to customize the solution according to their organization's needs while still benefiting from full IBM support. In the past, customizing the company's solutions was prohibited by strict service agreements with the vendors. If a customer tuned software specifically for its site, the vendor would cease to support the new solution.

Specific Benefits of IBM Tivoli Netcool Solutions

The impact on business operations that these service providers derived from the deployment of IBM Tivoli Netcool solutions can be placed in three groups:

1. **Improve operational cost efficiency.** By automating network performance monitoring and fault management, the service providers were able to increase their customer base without adding infrastructure or operations staff. In some cases, they were able to consolidate infrastructure. Overall they reduced their annual cost per subscriber by \$0.36.
2. **Improve quality.** By automating network management functions and monitoring service quality, the companies were able to increase their operational productivity. All the service providers in the study were able to improve the quality of their services:
 - Events requiring intervention were reduced by 27%.
 - MTTR was reduced by 54%.
 - Network downtime was almost eliminated as it was reduced by 98%.
3. **Increase revenue through faster time to market.** By providing an integrated and consistent management environment, IBM Tivoli Netcool solutions reduced complexity and created a stable services platform. On average companies reduced the time required to develop and launch new services by 37%, which improved annual revenue by as much as \$0.54 per customer.

Operations Productivity

Automating many procedures has reduced the amount of time the operations staff spends performing manual tasks. In addition, the single IBM Tivoli Netcool interface allows the service providers to automate procedures faster compared with automating several applications individually. As one manager said, "We have fewer events because we can take them in and filter them and do more automation. So that takes out a number of manual interfaces. We don't have to look at screens and watch alarms. Before, we would have to look at all of the thousands of alarms, validate them, and clear them manually." Because so many events are handled automatically, operations staff can focus on issues that impact the customer, providing faster repairs and better service.

IBM customers are now proactive, examining data input and output for critical errors that would disrupt the operations environment. The IBM Tivoli Netcool solutions allow customers to conduct root cause analysis. In the past, customers were forced to confront one alarm at a time, but with IBM Tivoli Netcool, they are able to determine if many alarms have the same core problem. Once the core problem is resolved, several alarms are terminated in one step.

Customers are better able to integrate their systems after the deployment of IBM Tivoli Netcool. In the past, when adding new components to the environment, technicians were required to write new scripts and new decision rules for each addition. IBM Tivoli Netcool has reduced the new installation time because it uses a common format for new software.

IBM Tivoli Netcool has helped customers detect network events faster, leading to a reduction in the number of trouble tickets. Many tickets are now processed automatically, and as one customer said, "Mean time to repair is greatly reduced. We have already identified the problem; we caught it faster than before. When a repair is in progress and someone does call in, we can now tell them, for example, 'We're aware of that issue, and it will be repaired in 30 minutes.'" This customer estimated that the number of help desk calls had been cut in half since the deployment.

The average annual productivity increase is \$12,062,369.

Cost Reduction

Six of the 14 service providers interviewed were able to leverage their increased management capabilities to consolidate their NOC operations and reduce NOC infrastructure costs by an average of 70%. One customer was able to reduce the total number of NOCs. A manager mentioned in the interview, "We now only have one NOC. We went from nine NOCs to one. Prior to the deployment, we had nine NOCs in a decentralized situation — now we have only a central one."

The most significant savings came from increasing operational efficiency. Much of this was created by the NOC consolidations, but IBM Tivoli Netcool has helped its customers reduce operational staff costs in a number of ways. Customers avoid hiring new technicians because current staff productivity levels have increased since the deployment. One manager stated, "Netcool is helping these people be more productive. The number of employees is increasing very slowly because we have Netcool and other tools. They are helping us avoid hiring." The time required for

Savings from NOC consolidation, capital expenses, and tool and platform consolidation averaged \$1.9 million annually across all respondents. These reductions in equipment, facility, and personnel requirements translate to carbon emission reductions of over 200 metric tons annually.

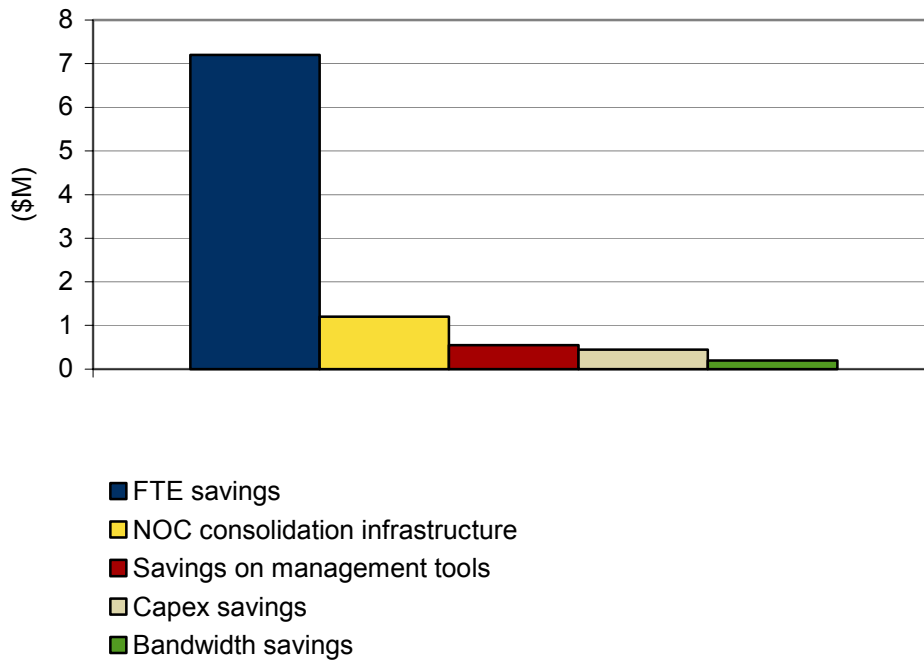
analysis has been reduced. One customer mentioned that, in the past, the majority of its analysis was outsourced — requiring 50 people. But since the deployment of IBM Tivoli Netcool, the customer can accomplish this with seven analysts.

The IBM solutions' broad functionality allows customers to eliminate or consolidate many of their old toolsets into one system. One customer said, "By reducing the number of tools, I think we're saving about \$2 to \$3 million a year."

In addition to the other savings, those service providers purchasing bandwidth from other service providers were able to reduce their costs. Figure 2 shows the areas where interviewees were able to reduce costs.

FIGURE 2

Annual Cost Reduction



Source: IDC, January 2009

Some customers were able to reduce travel costs as a result of integrating remote testing tools with IBM Tivoli Netcool. In the past, a home office would send technicians into the field to test a system and gather data. After the data was processed, the technicians were required to return to the site to customize the system and perform maintenance. Since the deployment, the operations staff can conduct some of the first phase of tests remotely and travel to the service site only once. As one customer said, "We have fewer dispatches to the field, so that equals less labor. With reduced truck rolls and travel in general, it has saved maybe 4,000 people a trip per year."

Reduction in truck rolls eliminated, on average, 12,000 miles of truck travel, \$78,270 in expense, and 327 metric tons in carbon emissions annually per telecommunications service provider.

On average, customers saved \$9,666,559 annually in combined reduced costs.

Revenue Increase

Since the deployment of the IBM Tivoli Netcool solutions, customers are able to roll out new products and services with greater speed, which decreases the time to market. The development cycle has been shortened by eliminating multiple iterations of interfaces and standardizing alarm profiling. One customer estimated the time saved reduces the average four-month project by 25%. As one customer said, "It has decreased our time to market by having fewer systems. We're getting a benefit already. We can release products faster because we've got a consolidated single view; we only have one "code set" to change. There is less development, less testing, less training, less general support."

The IDC analysis showed that, on average, the service providers experienced a bottom-line revenue increase of \$1,718,750 as a result of the deployment.

User Productivity

IBM Tivoli Netcool enhances productivity by allowing customers to reduce problems associated with bandwidth and maximize available resources. Customers have been able to improve operations user productivity by reducing the time required to fix errors associated with system and network downtime. On average, there was a 77% decrease in error repair time — a change from a mean of 1.3 hours per repair to just 20 minutes.

IBM Tivoli Netcool customers saved an average of \$10,312 annually on user productivity costs.

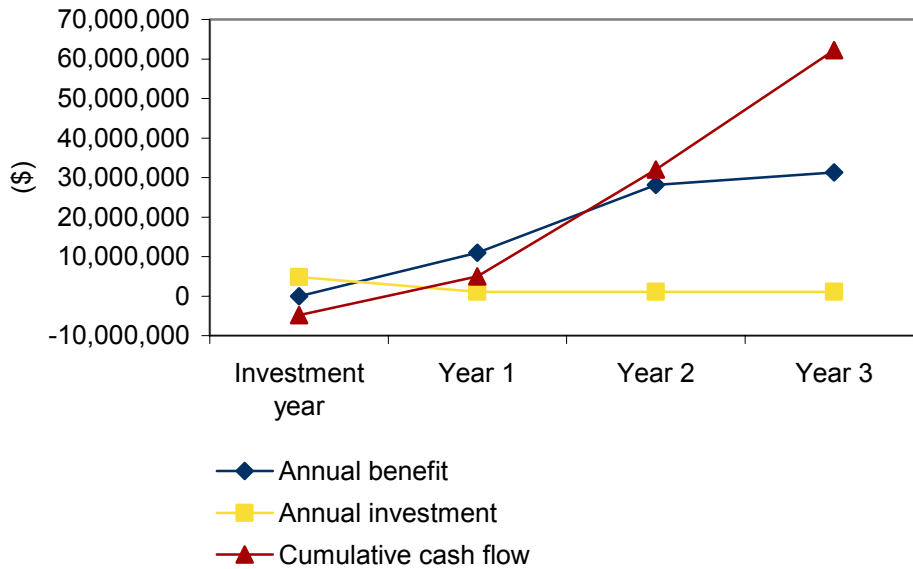
Business Value Analysis

Figure 3 shows the cost, benefit, and investment from the time IBM Tivoli Netcool solutions are purchased through three years. The total cash flow exceeds \$60 million three years after full deployment. Annual benefits increase in each year of the analysis. Benefits tend to increase in the years after the deployment as operators become more proficient with the solutions and as the technologies gain traction and increase their scope of use in the environment.

Investments in IBM Tivoli Netcool are highest in the year they are purchased and include hardware costs, software costs, operations installation time, training, and consulting. Investments decline and remain fairly consistent over the following three years. Annual costs include staff time for scheduled maintenance, application licensing fees, annual training, and hardware turnover.

FIGURE 3

Investment, Benefit, and Cash Flow over Time



Source: IDC, January 2009

IBM TIVOLI NETCOOL CASE STUDIES

IDC Business Value Case Study: Service Provider Headquartered in New Zealand

A New Zealand-based telecommunications service provider deployed Performance Management, Service Quality Management, and Network Fault Management from the IBM Tivoli Netcool suite of solutions. The deployment required approximately six months in 2001. The IBM solutions are used to manage the company's wireline and wireless services, which include 10,000 to 20,000 devices, for business customers. Now fully deployed, IBM Tivoli Netcool supports the NOC primarily through event management and system surveillance as IBM Tivoli Netcool has visibility into 95% of the service network and manages all switches, routers, and transmission equipment. The IBM Tivoli Netcool deployment has enabled the company to consolidate NOCs, improve operations staff support, reduce costs, and increase revenue.

Cost Efficiencies from Consolidation

IBM Tivoli Netcool has enabled the company to reduce the number of NOCs from two to one — saving over \$100,000 annually in operating costs. As one manager said, "If we didn't have Netcool, we would need more people. We have reduced those two NOCs and consolidated and avoided hiring new people. Because of the additional resources we avoided, the reduction has helped us save 50% of the old cost."

Operations Staff Productivity

The network operators have more flexibility since the deployment of IBM Tivoli Netcool. The staff is able to design customized views of the environment specifically for each operator's needs. Operators are now more proactive and gather critical system information faster, resulting in a network staff productivity increase of 29%. One manager said, "For example, a transmission engineer only wants to look at the transmission gear in his area. So now, he can take a sliced view — and he's also able to look across the entire network. We're able to provide all of the engineers very specific, relevant information in real time."

Business Benefits

The company has been able to reduce the number of service-level agreement (SLA) penalties and customer-related fines since the deployment of IBM Tivoli Netcool. The company's enterprise-level customer accounts are subject to the most stringent SLAs. Given this level of importance, the company manages these accounts closely using IBM Tivoli Netcool. The network operations staff built custom views specifically designed for enterprise customers, which allows the company to give direct attention to its highest-value customers. As one manager said, "Our vendor negotiations about infrastructure replacements and SLAs have been much improved. We are saving between \$50,000 and \$200,000 per year as a result of Netcool."

IDC Business Value Case Study: Service Provider in the United Kingdom

A telecommunications service provider based in the United Kingdom deployed Network Fault and Event Management from the IBM Tivoli Netcool suite in 2007. The company employs over 72,000 people and reported revenue exceeding \$70 billion in 2008. Reducing operational costs as well as consolidating and automating system management tasks were the primary reasons for the deployment. This IBM customer required a solution that had an integration capability powerful enough to cover its international network elements that span 13 countries. The company uses IBM Tivoli Netcool to integrate its IP network operations across all of its geographies.

Increasing Cost Efficiency

Since the deployment of IBM Tivoli Netcool, this customer has reduced its annual software and licensing fees because several network monitoring systems have been replaced by one. As one manager said, "Each network node must be licensed. A typical license is about \$300,000, so when we remove licenses from the local tools, because we have consolidated to the central office, that calculation is a considerable discount."

The company has also been able to avoid new hires because much of the system management work has been centralized. The satellite offices have had a reduction in the number of tasks the technicians must perform, and they are able to roll back the projected number of needed technicians. Despite nearly doubling its subscriber base, the company estimates that it has avoided at least six new hires in the past year.

Operations Staff Efficiency

The operations staff is now more efficient because there has been a reduction in duplicated efforts with respect to tasks within systems management and problem resolution. This company has made several acquisitions in the past few years, resulting in the added IP network teams working independently, without knowledge of other teams' functions. But since the deployment of IBM Tivoli Netcool, supervisors have centralized control of tasks and eliminated redundant projects. IDC estimates that this company has saved \$92,273 per year because of the increase in operations efficiency.

The company has reduced the time required for system integrations. In the past, an integration project, including creating node naming conventions and definitions and updating all of the necessary databases, took approximately 20 business days to complete. However, since the deployment, operations has reduced integration time to about three days. The company estimates that it is saving \$75,000 per country, per integration project.

Improving Service Quality

This IBM customer is concentrating event management from several different country networks into a single tool. IBM Tivoli Netcool allows the organization to correlate the events with root causes. Since the deployment, local management teams can access correlations that were previously constructed within the IBM Tivoli Netcool system. This increases operations staff productivity because technicians no longer write new code for each event they manage. One manager said, "Integration impacts people in the regions because they don't have to always rely on their local system. When they had problems connecting to the local system before, the techs in each country would start troubleshooting on their own. Now there is a centralized management. We are using a single tool, and this is saving a lot of time."

ROI Results

Over three years, IBM Tivoli Netcool customers have enjoyed a total of over \$54 million in discounted benefit. When this benefit is compared with a three-year discounted investment of \$7.5 million, the return is 625% with a payback period of 5.9 months. The ROI results are displayed in Table 2.

TABLE 2

Three-Year ROI

Three-year benefit (discounted)	\$54,477,420
Three-year investment (discounted)	\$7,513,146
Net present value	\$46,964,274
Return on investment	625%
Payback (months)	5.9
Discount	12%

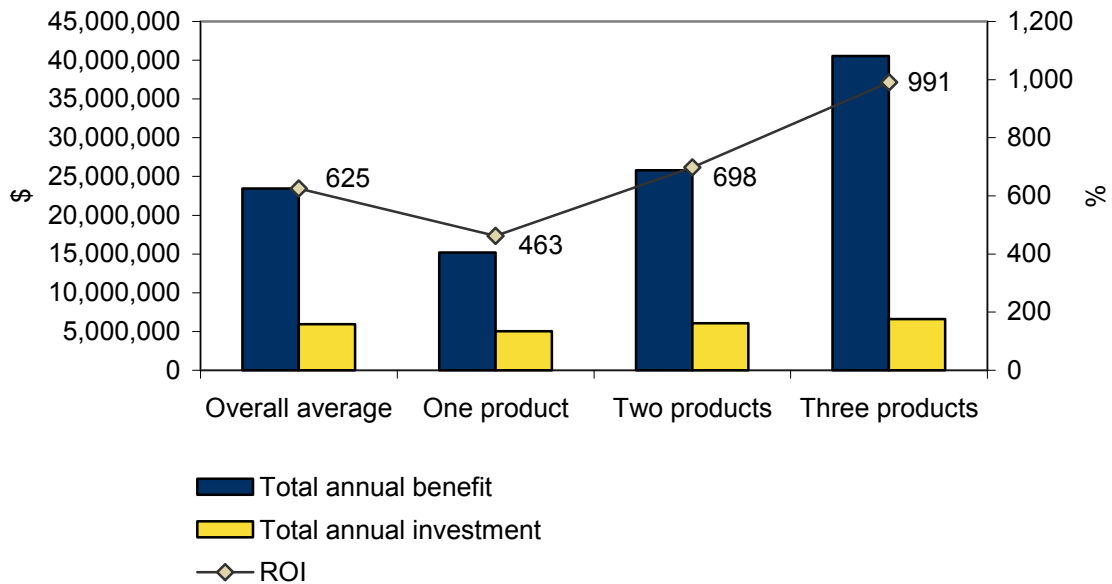
Source: IDC, January 2009

The Benefits of Integrated Solutions

The service providers in this study had deployed a combination of three IBM Tivoli Netcool solutions: Performance Management, Service Quality Management, and Network Fault and Event Management. Four of the 14 companies had all three solutions, six companies had two solutions, and four had only one solution. The ROI analysis revealed that a greater number of solutions deployed led to a higher ROI. The majority of the return is generated by the Network Fault and Event Management module, which had been deployed by all but one company. When customers combined Network Fault Management with the Performance Management and Service Quality Management packages, benefits increased by over \$10 million per year, while costs increased by only roughly \$1 million per year or less. Figure 4 shows the ROI results for the overall model and one, two, and three IBM solution combinations.

FIGURE 4

ROI with Increasing Number of Solutions



Source: IDC, January 2009

CHALLENGES/OPPORTUNITIES

Challenges

Many users interviewed for this study cited the role of the systems integrator. As with many OSS investments, the role of the systems integrator is critical and, in practice, ongoing. The need for ongoing support for the OSS itself continues to drive dependency on the systems integrator. For service providers looking for a software-only product solution to OSS requirements and seeking to avoid or minimize engagements with custom integration, the commitment required for systems integration expertise is potentially challenging.

The telecom services delivered by the service providers interviewed are still relatively young. For some interviewees, the relatively smaller and simpler infrastructure that was in place at the time of investment in IBM Tivoli Netcool has already changed. Operational networks will only continue to grow in complexity and size. For mobile operators, especially, while the challenges of LTE or WiMAX are consistent with IBM Tivoli's ongoing efforts to support new technology, the challenges of managing networks with 20,000 cell sites may be significantly changed by the prospects of managing 1 or 20 million femtocells. The challenge will lie in the next stage of maturity in the operational infrastructures and processes, which may or may not continue to play to Netcool's strengths, as shown in this study.

Opportunities

Service providers reported that operational processes remain complex and costly. Managing operations to drive not just revenue growth but also profitability is a top priority for service providers. Consolidation and back-office integration of OSSs require partners with breadth and telecom industry expertise. Telecom industry requirements, especially for TDM and intelligent network (IN) infrastructures, remain significantly specialized despite the consistent long-term vision of all IP networks. The reality of business risks and technology life cycles means that the support for legacy voice and mobile network infrastructures offered by platforms such as IBM Tivoli Netcool can open up opportunities. For service providers that are transforming from a network-centric business model to a service/customer-centric business model, effectively managing and consolidating network element management through a system such as IBM Tivoli Netcool can free up resources for more sophisticated service management efforts. This OSS domain will continue to be a site of information management optimization for service providers.

CONCLUSION

The business value of the IBM Tivoli Netcool customers interviewed for this study was significant. The reported experiences from the 14 service providers in multiple regions and countries demonstrate that internal processes, technologies, and suppliers can drive significant complexities but that effective management can minimize the costs and risks involved.

Coping with the dynamics of the operational infrastructure requires service providers to do more with the same or fewer resources. Through the broad scope of the IBM Tivoli Netcool solution in the telecommunications infrastructure capabilities — from legacy voice through datacenter strategies — service providers reported the ability to optimize MTTR, front-end resolution rates, reduced truck rolls, and, especially, trouble ticket levels, as well as deal with customers and business partners. One interviewee summed it up by saying, "It's helping us save on capital. It better be," before going on to note the details of the points of operational payback.

In this study, some key service provider operational trends were highlighted: centralization, consolidation, and maximization. A few service providers noted that their OSS efforts were evolving as corporate mandates meant centralizing the OSS platform at the expense of regionalized operations teams. Likewise, integration of assets, especially as sporadic large infusions of new network operations as a part of acquisition activity but also consolidation of data based on automation of interfaces, prompted significant explicit and implicit benefits of using this solution. Finally, in many discussions, we saw that service providers are clearly working to maximize both the utility of the operational network through service bundling and the potential value of the customers through business intelligence efforts.

In the course of the study we spoke with service providers whose philosophy could be described as aggressively innovative to cautiously conservative and from relatively small but high-value customer bases to high-volume and mixed-value customer bases. Across this broad array of customers the business benefits remain linked to issues that are top priority for customers within markets such as the telecommunications industry. Industry specificity is a top buying criterion and a top benefit of the IBM solution.

For service providers evaluating OSS investments, the ROI results and case studies presented in this study provide important context. From differentiations among customer bases to service bundles to regulatory environments, virtually no two telecommunications service providers face the same set of challenges. However, the 14 service providers in this study represent a cross-section of the telecommunications industry.

APPENDIX

IDC's ROI Methodology

This methodology is based on gathering data from current users of the technology as the foundation for the model. Based on these interviews, IDC performs a three-step process to calculate the ROI and payback period:

1. Measure the savings from reduced operations costs (consolidation of hardware and software, avoided staff hired), increased operations efficiency, increased revenue, and improved user productivity.
2. Ascertain the investment made in deploying the solution and the associated training and support costs.
3. Project the costs and savings over a three-year period and calculate the ROI and payback for the deployed solution.

Because IBM customers in this study had deployed a combination of solutions, IDC was able to calculate four independent ROIs — an overall ROI as well as ROIs for having one product deployed, two products deployed, and three products deployed.

IDC uses the net present value (NPV) of the savings over three years in calculating the ROI and payback period for the deployment. The NPV of the savings is determined by subtracting the discounted three-year investments from the discounted three-year benefits. IDC uses a 12% discount factor to allow for the missed opportunity cost that could have been realized using that capital.

IDC uses the following assumptions in its calculations:

1. To quantify savings from IT efficiency, IDC multiplies time values by burdened salary (salary + 40% for benefits and overhead).
2. Because the full benefits of the solution are not available during the deployment period, IDC prorates the benefits on a monthly basis and subtracts the appropriate amount for the deployment time from the first-year savings.

Carbon Emission Reduction Calculation Assumptions

Savings from NOC consolidation (capital expenses and tool and platform consolidation) averaged \$1,919,960. This consolidation translated into a reduction in power utilization. Carbon emission reductions for NOCs factor the average reduction in NOC space times a standard energy usage figure per NOC square foot.

\$78,270 in travel (truck roll) savings equates to a reduction of 37,271 gallons of gas at \$2.10 per gallon. Each gallon of gas burned emits 19.36 pounds of carbon. Reduction in miles reduces carbon combustion by 721,575 pounds or 327 metric tons.

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