

## Citrix Shifts Your SAP Solutions into High Gear

As a professional, you know that the increasingly advanced business processes required for competitive advantage, and the rich GUI experience users prefer, can place a significant burden on your infrastructure. In supporting these demands, SAP® applications must reach ever-growing user populations over wide area networks (WANs) and compete for network resources with the growing quantities of voice-over-IP (VoIP), e-mail, streaming media, general Internet access, and other application traffic for infrastructure resources.

**Reduces Network Wait Time for  
SAP Users by 50 to 99 Percent**

But, do you know the solution? Depending on network quality and the SAP transaction involved, Citrix Application Delivery solutions can reduce users' transaction response times by a staggering 50 to 99 percent—even within SAP's

Enterprise Service-Oriented Architecture (Enterprise SOA or ESOA).

SAP ESOA provides efficient, reusable, and open building blocks from the SAP suite of business solutions. To address the evolving needs of your enterprise, you can mix and match these services to build composite applications. ESOA lets you leverage and extend your data silos and legacy systems to achieve new levels of innovation while conserving costs.

To determine the performance strides it makes possible for customers of ESOA, Citrix—a member of SAP's collaborative, cross-industry, customer and vendor Enterprise Services Community (ESC) and the ESC's Network Services Advisory Group—was invited to conduct performance testing in the Enterprise Networking Lab (ENL) at SAP Labs' Palo Alto campus. Citrix and SAP proved that together their solutions can deliver remarkable benefits to SAP customers.

In today's service-oriented world, Citrix® solutions are more valuable than ever. No one but Citrix offers a complete application delivery suite of optimization, virtualization, security, and management tools designed to meet the LAN and WAN performance needs of all users of ESOA.

## Citrix and the Enterprise Networking Lab

Recognizing the importance of networks to end-user performance and the success of an ESOA implementation, the Enterprise Services Community created the ENL, a controlled lab environment for the testing of networking products in a production-like ESOA environment. The ENL is based on the SAP Discovery Server, a collection of common business scenarios in the form of composite applications. Mercury LoadRunner virtual user sessions executed the predefined workflows and a Shunra WAN Emulator allowed network quality to be varied for each test.

Invited to the Palo Alto laboratory for two weeks of private research sessions, Citrix executed the scripts that SAP provided, and measured the improvements in SAP user response times which its products made possible for the following four network quality configurations—each of which approximates a common enterprise scenario:

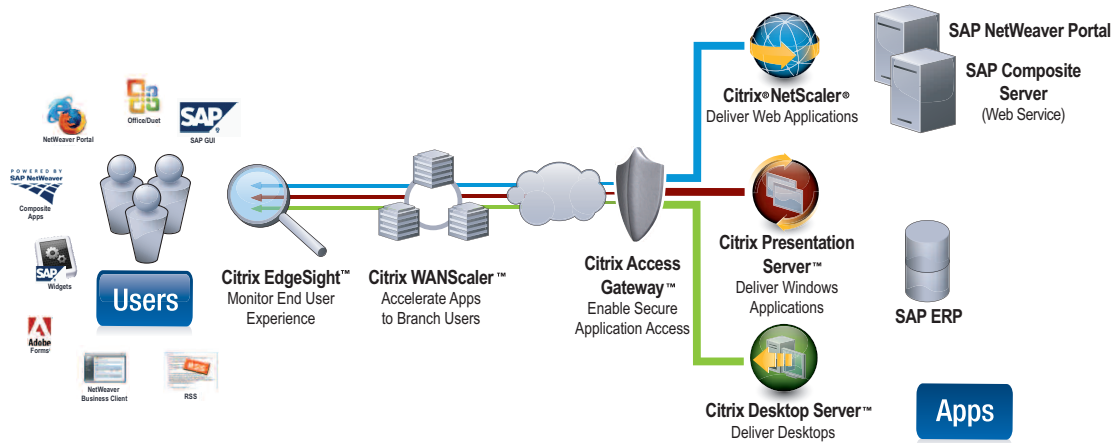
- LAN—100 Mbps, 0% packet loss, 4-ms latency
- High-quality WAN backbone—45 Mbps, 0% packet loss, 30-ms latency (one way)
- Moderate-quality WAN backbone—45 Mbps, 1% packet loss, 150-ms latency (one way)
- Remote worker or branch office—768 Kbps, 1% packet loss, 150-ms latency (one way)

Citrix demonstrated the resulting performance improvements:

- Individually, Citrix NetScaler® and Citrix WANScaler® optimization technologies reduced end-user response times for very data-intensive transactions between about 80 and 95 percent, depending on network conditions. When used in tandem (and with WANScaler's compression history in play), response times were reduced by as much as 99 percent. Citrix's benefits varied across tests and tended to be greatest when data load was heavy or network quality poor.
- Citrix Presentation Server™ provided more than just deployment, cost, and security benefits via its virtualization capabilities: it also reduced response times by 60 to 97 percent, depending on the transaction and network quality.
- For NetWeaver Enterprise Services transactions with small data payloads, WANScaler, NetScaler, and Presentation Server improved performance on congested networks by approximately 50 percent.
- NetScaler reduced SAP NetWeaver Portal CPU utilization by more than 60 percent, thereby slashing data center costs.
- Citrix Access Gateway™ Advanced Access Control and Citrix EdgeSight™ provided significant security and management benefits.

## Citrix Fine Tunes Network Quality

The Citrix Application Delivery Infrastructure enables today's Web applications to deliver a competitive level of performance even over low-quality WAN links while allaying security concerns in the process.



Citrix can provide a variety of performance-enhancing solutions, which can be used individually or in combination. While similar point solutions may exist, Citrix is unique in its exclusive focus on application delivery and in the breadth of its offerings of optimization, virtualization, management, and security solutions. ENL testing included the following:

### CITRIX NETSCALER

Citrix NetScaler is a multi-feature product that reduces SAP server workload and improves user performance. Deployed in front of the SAP NetWeaver Portal as a dedicated application delivery appliance, NetScaler is designed to efficiently handle basic tasks such as Secure Sockets Layer (SSL) encryption/decryption, TCP connection management, and data compression. With such CPU-intensive tasks offloaded, the SAP NetWeaver Portal can handle vastly greater numbers of simultaneous connections and users. NetScaler also effortlessly serves popular content directly from memory, further reducing SAP workload. And finally, NetScaler can intelligently distribute application traffic at multi-gigabit data rates among multiple backend servers. SAP administrators can reduce operating expenses by procuring and managing fewer servers.

### CITRIX WANSCALER

Citrix WANScaler complements NetScaler, delivering a WAN optimization solution to an enterprise's far-flung branch-office users. WANScaler automatically applies to each data flow a combination of performance-boosting techniques depending on the application, data, and network conditions—including Adaptive TCP Flow Control; multi-level compression (disk, L2 cache, and memory based); protocol acceleration, minimizing round trips across the WAN; and granular traffic management with Layer-4 service-class policies. Though servers may be deployed thousands of miles away, WANScaler can help deliver LAN-like performance across the enterprise.

## CITRIX PRESENTATION SERVER

Citrix's flagship application delivery system, Presentation Server moves client-side applications and Internet browsers from a user's computer to a secure, high-performance data center, and in the process reduces latency-ridden round trips across the WAN. It enables employees to access SAP and non-SAP applications from anywhere, using virtually any device. These apps appear to run locally on the client machine, but in reality execute on the server. Thus, local variables such as PC age, power, memory, and OS, etc. are no longer critical performance factors. And Presentation Server utilizes a proprietary network protocol for communications that provides a high-quality SAP user experience across a connection with as little as 10–25 Kbps of bandwidth per user.

### THE COMPONENTS OF CONGESTION

Most IT professionals are familiar with the effect network bandwidth has on performance. However, bandwidth is not the only, nor necessarily even the most important, factor in network quality. Two lesser-known factors—latency and packet loss—play a critical role.

Latency—the time it takes for a data packet to travel from transmitting to receiving system—leaves its mark on all applications, but particularly on those based on Web technologies like HTTP. The typical Web page is composed of dozens of separate objects—.jpg and .gif images, JavaScript code, cascading style sheets, and more. Each of these objects must be requested and retrieved separately, one after the other. Numerous round trips across the network are required; a NetWeaver Portal page, for example, might require dozens of HTTP requests and hundreds of TCP round trips. The inherent chattiness of these Web technologies can result in excessively long page-load times. And the further a user is from the SAP data center, the greater the typical latency.

In addition, lower-quality WAN lines can cause occasional TCP/IP packet losses. As little as one-percent loss can have a drastic effect upon response time. This is because the TCP window size is reduced when packet loss happens. The window size is the amount of received data that can be buffered during a connection. The sending host can send only up to that amount of data before it must wait for an acknowledgment and window update from the receiving host. Therefore, reducing the window size increases the number of round trips, and therefore latency, often by a significant factor.

## CITRIX EDGESIGHT

Delivering visibility into performance, from the user perspective, across all applications and delivery methods, EdgeSight helps IT track and address critical issues—reducing support costs, improving business operations, and increasing customer satisfaction. Real-time alerts provide immediate notification when performance thresholds are crossed, as well as insight into the cause, location, and nature of application performance problems. This gets users back up and running faster and minimizes the IT resources required to make that happen. In addition, organizations can strategically manage their software license agreements by monitoring actual usage.

## CITRIX ACCESS GATEWAY

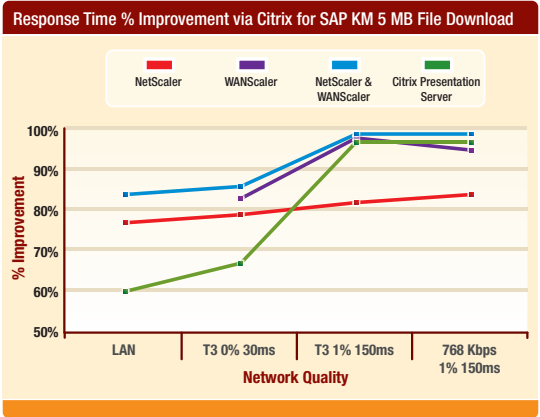
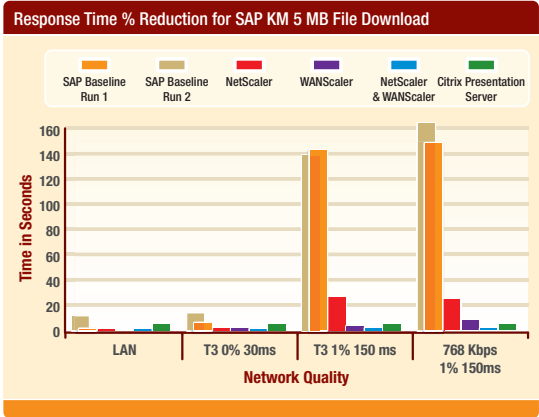
Citrix Access Gateway is a leading SSL VPN. Its Advanced Access Control enables administrators to establish a granular degree of control over applications, files, Web content, e-mail attachments, and printing. The Advanced Access Control option manages both what can be accessed and what actions are permitted—viewing, editing, or saving documents, for example—based on the user's role, location, type and configuration of device, and speed of connection.

# Citrix Boosts Performance for Data-Intensive Transactions

Whether users are accessing, for example, SAP NetWeaver Business Intelligence (BI) services from a branch office over a WAN or submitting complex purchase orders from a trading partner over the Internet, providing a secure, high-quality end-user experience for such large, data-intensive transactions can be tricky. There is so much information moving about in today's world that networks are encountering ever increasing burdens.

To simulate a user's-eye view of the effects data transfers can have across a variety of access scenarios, the ENL devised a test script around the SAP Knowledge Management services module. The key measurement for this test was the time it took users to download a 5 MB PowerPoint file stored on the SAP NetWeaver Knowledge Management module of the Portal Server.

SAP Baseline Run 1 (with no Citrix) was performed by the ENL prior to the arrival of Citrix. Baseline Run 2 was performed onsite by Citrix during Presentation Server testing. Some variability was observed, and both baseline runs are displayed below.



As you can see here, across the T3 network of LAN quality in terms of latency and packet loss (0%), there is very little degradation in net user response time. But once on a network that introduces real-world WAN packet loss and latency issues, response time skyrockets.

When the same test was run on the 768 Kbps network, 1/50th the size of the T3 line, the virtual SAP users experienced only a very mild increase in end-user response time. Clearly, bandwidth was not the key bottleneck: instead, the vast majority of the delay was a result of latency and packet loss.

As illustrated in the graphs above, when Citrix's optimization and virtualization products were added to the mix to combat the effects of a WAN network, they provided a 60- to 90-percent reduction in response time for SAP users.

### **OPTIMIZATION VIA NETSCALER AND WANSCALER**

Sending one transaction with 5 MB of data across the network can amount to hundreds or thousands of packets at the TCP/IP level. The optimization technologies Citrix provides are specifically engineered to make IP packets more efficient. In fact, test results proved conclusively that adding only a single, centrally located NetScaler appliance sitting in front of the SAP NetWeaver Portal Server can improve largefile download times across a global user base by about 80 percent. Even across the near-perfect conditions of a company LAN, response time improved. Across the lowestquality 768 Kbps network, one NetScaler took more than two minutes off the time required to download the file.

WANScaler was able to further reduce response time over this network—down to about 8 seconds. And in combination, NetScaler and WANScaler shaved WAN response times until they were virtually indistinguishable from response times on a LAN.

As mentioned earlier, WANScaler makes decisions about how to best handle data crossing the WAN cloud to optimize transmission time (TCP flow control). Subsequent views of similar data were aided by WANScaler's ability to find repetitive patterns within data. Whether across town or halfway around the world, users often share a lot of common information: they may be running the same transaction screens, for example, or processing similar reports on the same business data. WANScaler sends a token that tells the appliance on the other side of the cloud to insert the repetitive data from its local cache—thereby limiting congestion on the network—instead of sending this data numerous times across the WAN.

### **VIRTUALIZATION VIA PRESENTATION SERVER**

In a Presentation Server landscape, the application and data are stored centrally; the file does not need to be downloaded to be viewed. Instead, a highly optimized image is streamed to the user of any page he chooses to view.

For the 5 MB file test, Presentation Server reduced response times from 60 percent on the LAN to 97 percent on the 768 Kbps network line. As seen in the bar graph above, Presentation Server achieved LAN-like performance across all tested WAN qualities.

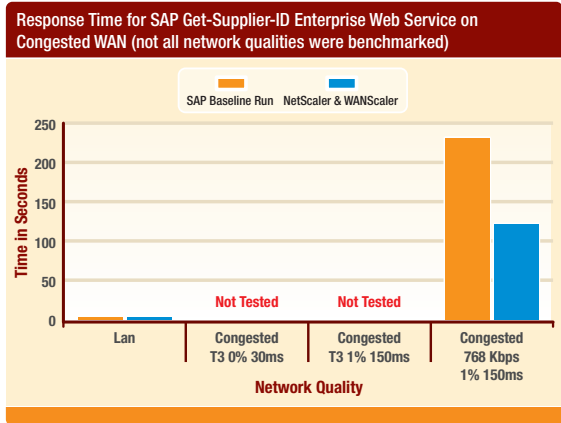
## Citrix Boosts Performance for Small Data Transactions

Not every transaction involves a 5 MB file, of course. Of an SAP customer's thousands of daily transactions, many may contain very small amounts of data. Web service calls, for example, can be quite small.

To represent these smaller data transactions, the ENL selected an SAP Enterprise Service from the Procurement module, Get-Supplier-ID, for testing. The key measurement was time required to return a list of five approved vendors for a product from the SAP Composite Server.

When this test was run on an empty network, network round trips, and resulting performance reductions, were driven by application code logic, not data payload. Thus, the baseline for Get-Supplier-ID was one second on a LAN and dropped only to eight seconds on a 768 Kbps network. However, even this seemingly small drop represents about an 800-percent reduction in user performance.

In addition, these small data transactions typically come in high numbers and must also inevitably compete for bandwidth with all other traffic on the network. To simulate a typical, busy WAN, a network load generator was added and the network was saturated with 750 Kbps of competing traffic (97 percent of rated capacity). End-user response time skyrocketed to more than 200 seconds. While this was an extreme test, it demonstrates that even a small transaction suffers from network congestion. Time constraints prevented the testing of multiple congestion levels but other, lower congestion levels can also be expected to cause performance degradation.



### ENTERPRISE SOA AND THE FUTURE OF BUSINESS

A Web service is a self-contained, discoverable piece of application functionality. For example, "Create order" is one that adds a sales order to a particular system. The full process of creating an order, however, involves myriad Web services offered from different systems. For example, sending confirmation to the customer, adding the order to the production plan, allocating materials to the order, and notifying the invoicing department are all Web services employed in this action.

The complex end-to-end solution to create the order is a very powerful enterprise-level business service. With SAP's Enterprise SOA, you can create, combine, and rearrange such Enterprise Services to compose new business processes or change the steps in an existing one. With your applications and infrastructure powered by SAP NetWeaver, you can implement creative, flexible business strategies while leveraging existing investments to contain costs. And you can easily extend the reach of those processes to new communities inside and outside of your organization.

### OPTIMIZATION VIA NETSCALER AND WANSCALER

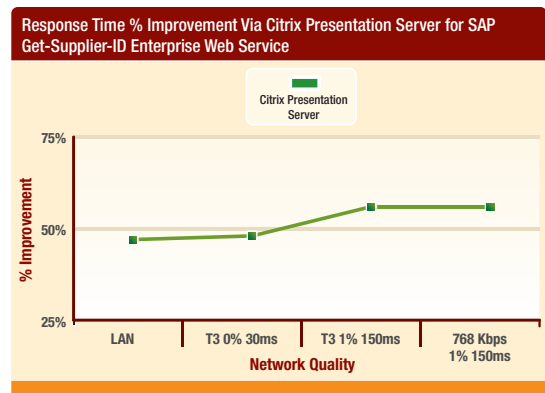
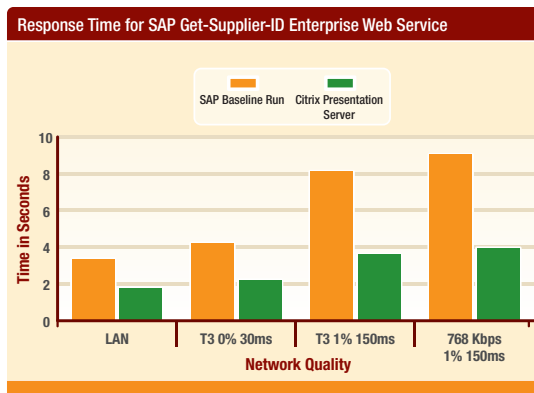
WANScaler flow control optimizations were able to reduce SAP response time by approximately fifty percent. A particular advantage of WANScaler in this instance is that it is able to control how much data any one IP packet transmits. It can package and send like data together, allowing the network to perform at or near its maximum potential. On the congested network, WANScaler was able to put this ability to excellent use, while NetScaler continued providing workload improvements for the SAP servers in the data center. While your network may not reflect performance as limited as this test scenario, WANScaler can still apply these same flow optimizations and provide benefit.

### VIRTUALIZATION VIA PRESENTATION SERVER

The test of Presentation Server and Get-Supplier-ID demonstrated that under virtually any network

conditions Presentation Server provides value for

Enterprise Services. With the browser in the central data center, round trips did not need to cross the WAN on their way to and from the NetWeaver server, and response time was reduced by 48 to 56 percent.

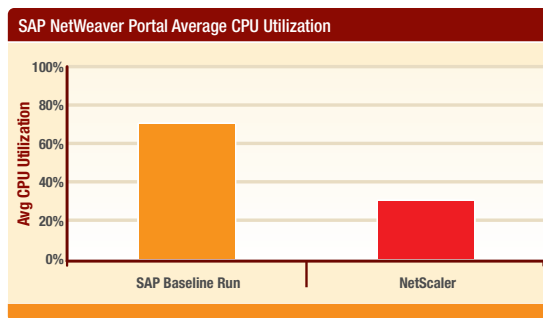




## Citrix Cuts Costs Appreciably

In the fourth and final test of Citrix products in the ENL, Citrix used a LoadRunner system to simulate 500 concurrent users. These virtual users logged on to the SAP NetWeaver Portal, viewed the homepage, logged off after approximately 100 seconds, logged back on again, and so on—during the course of an entire evening. The test measured the portal's ability to maintain connections to these users and to handle handshakes related to SSL encryption and other basic housekeeping tasks required just to keep a user's connection alive. The portal homepage is also the most commonly displayed page and contains a significant amount of content. Citrix measured the baseline for SAP's utilization when its products were and were not active.

The test revealed that, despite the fact that the virtual users were largely inactive, simply providing many concurrent TCP/IP connections via a Web-based architecture consumed 70 percent of SAP NetWeaver Portal's available CPU resources. This server was a modern, dual-CPU system with dual-core Intel Xeon processors, so clearly Web-based application delivery can represent a significant workload. With Citrix NetScaler turned on, CPU utilization dropped to a mere 30 percent—a 60-percent decrease over the baseline run and a considerable savings opportunity, not only for server procurement but for ongoing maintenance and support. Fewer servers and less electrical consumption also help organizations in their efforts to conserve resources.



As mentioned earlier, NetScaler can offload TCP/IP connection management, data compression, and SSL encryption/decryption from the SAP NetWeaver Portal onto its own specialized systems. NetScaler solutions also use advanced local and global load-balancing algorithms to ensure that user requests get to the SAP servers that can most efficiently handle them.

## Citrix Protects Your Confidential Data

Given industry standard browser caching functions, simply viewing a document posted on a Web page, including SAP Knowledge Management, can result in that file being stored on an end-user's hard drive in a local cache. In the event that a laptop were lost, stolen, or otherwise abused, highly sensitive data could "leak" out of the data center and into unauthorized hands. Citrix Presentation Server brings the browser for the application into your data center and off of PCs. In so doing, it not only improves performance, simplifies your management responsibilities, and lowers costs, but also grants you complete control over what data, reports, etc. can be cached or saved outside your protected network—and thereby eliminates the chance of inadvertent data "leakage."

In addition, Citrix's Independent Computing Architecture (ICA) network protocol offers built-in 128-bit Rivest Cipher (RC5) encryption so network traffic between users and servers cannot be intercepted. And as mentioned earlier, by adding Citrix Access Gateway Advanced Access Control, you can also protect data by controlling access to applications on a role-based, case-by-case basis. That is, you can specify which access methods each authorized user must employ to access each type of data in your system. You can also configure profiles to look for a properly locked-down endpoint machine with all the appropriate safeguards in place, and can appropriately and quickly shut that machine's access down if a security issue is encountered.

While at the ENL, Citrix demonstrated Advanced Access Control for an SAP employee. Citrix employees remotely examined an end-user device, validated that it had an appropriate antivirus application, checked for undesirable processes running in memory, and cleared the device for connection to the SAP environment. Upon connecting, they then launched a prohibited application. Advanced Access Control pinpointed the security risk and immediately reduced the level of access to SAP.

NetScaler also offers security solutions that stand up to today's toughest challenges:

- An integrated application firewall and SSL VPN enable users to enjoy a high-performance, continuous, and secure connection to your network—regardless of their connection speed.
- Deep-stream inspection technology analyzes bidirectional traffic, enabling you to apply sophisticated application security rules.
- Defined-object protection enables you to identify and lock down information that requires failsafe security.
- An encryption accelerator delivers end-to-end security without sacrificing network performance.

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## Visibility Ensures Swift End-User Performance

While most companies have sophisticated system management tools that provide an enterprise view of their servers, many lack a similar view of application performance and availability as experienced by the end user. As a result, they lack the real-time visibility and tools needed to ensure that service-level agreements (SLAs) are being met.

EdgeSight reflects the entire spectrum of IT resource performance from the end-user perspective, enabling IT professionals to quickly identify, source, resolve, and intercept problems so they can maximize performance and availability throughout the enterprise. Citrix tools can help to deliver on your SLA; EdgeSight can help you prove that you did just that.

## Conclusion

SAP's Enterprise SOA opens the doors to increasing adaptability and ongoing innovation. Providing a reliable, high-quality SAP user experience over WAN connections poses some specific challenges, however. To get the most from your investment, you need a delivery infrastructure that ensures the secure, speedy, and cost-effective delivery of Web-based resources. A Citrix Application Delivery System is uniquely qualified to help you meet this need.

The right combination of Citrix solutions for any SAP customer is determined by a number of factors. Presentation Server not only provides performance benefits, but also completely solves end-user computing device and environmental issues that must be addressed during SAP deployment and support. NetScaler not only provides performance benefits, but also reduces SAP NetWeaver Portal server costs. WANScaler not only provides performance benefits, but allows you to transmit more data across a given network capacity—thereby allowing you to wring efficiencies from your monthly investment in network capacity.

Citrix application delivery solutions can be combined to provide the maximum benefit that most closely matches your organization's needs.

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