Programmable Network Solutions

Business and Operational Challenges

Service providers and large enterprises are faced with three increasingly difficult challenges as they deploy new internetworking services and infrastructures.

The first challenge deals with the logistics of new service deployment. New service deployment is a process that begins at order entry and ends with a fully validated and operational network service. In between are device procurement, configuration staging, onsite delivery and installation, service testing, and more. The time delta between order entry and a validated, billable service is called *time to deployment;* this parameter is a critical metric that impacts both customer satisfaction and overall profitability. The cost of each deployment, often a labor-intensive process, is often as or more expensive as the network device itself and is a significant factor in calculating return on investment. Although some companies are forced to accept suboptimal deployment times and costs, they must meet certain overall deployment goals in order to stay in business. For service providers, these goals are a direct representation of market penetration. Unless they can meet these goals, there is no business case to proceed.

The second challenge deals with what is sometimes called "intellectual scarcity," the inability to hire or train enough skilled workers to run a business. Because these resources are so scarce, network deployment and management processes that rely heavily on manual processes cannot be scaled to meet the business requirements—there simply are not enough skilled workers to manage the job. Because these resources are so scarce, companies must carefully consider not only the direct costs but also the opportunity costs of applying workers to a task. In order to remain competitive, companies are forced to find ways to make these resources more productive. This is a classic yield-management problem.

The final challenge deals with the architectural aspects of the problem. Companies rely heavily on their operational and business support systems (OSS/BSS) to run their business. Each new internetworking service must be integrated into these existing systems. The time and expense of that integration can be a significant factor when considering the profitability of potential new service offerings. In addition, new internetworking service offerings are becoming increasingly complex. Not only does that complexity make them more difficult to integrate into older systems, it also increases the risk of failure—especially when manual processes are employed.

Driving Intelligence into the Network

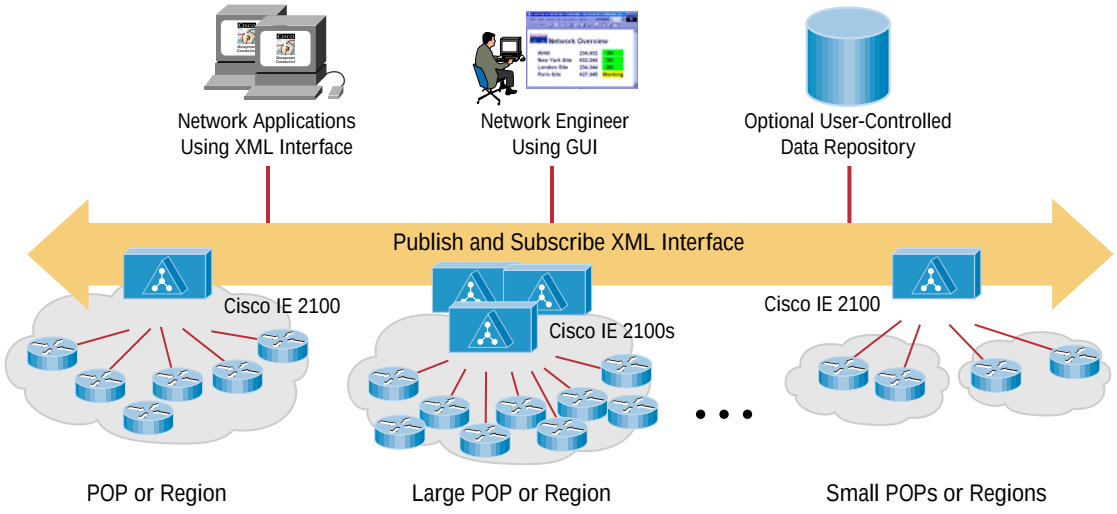
Meeting these business and operation challenges is not easy. According to the Yankee Group, service providers invest 38 percent of their budget in operational staff and systems. The intelligence needed to run their business is trapped in these people and applications. As people leave, this intelligence leaves the company. As new applications are written, they duplicate that of other applications. Because skilled workers are a scarce resource and intelligent applications cannot be written fast enough, this 38-to-62-percent ratio limits the extent to which service providers can expand their services offerings and their business.

Cisco's response to this challenge is to push intelligence down into the network itself. An intelligent network reduces the need for human intervention, thus reducing the number of skilled workers required to deploy and maintain a network service. An intelligent network frees customer and independent software vendor (ISV) programmers to build lighter applications focused completely on the service offering rather than duplicating investment on replicated infrastructure.

By reducing the operations-to-equipment ratio, Cisco enables customers to invest their resources on new revenue-producing service offerings rather than maintaining existing ones.

The Programmable Network

Figure 1 Intelligence into the Network



So how do you make a network more intelligent?

The first step is to make the devices themselves smarter. Cisco has begun to enhance its network devices by embedding intelligent agents in them. The first embedded agent is an event agent that allows a Cisco device to be a peer in a publish-and-subscribe messaging environment (see Figure 1). Pub/sub messaging has quickly become a core component of most customer OSS/BSS systems and ISV service management products. Pub/sub provides one-to-many and many-to-many communications rather than the simple point-to-point interfaces network devices traditionally expose.

The next step is to use this new device intelligence to advantage by introducing a single external interface to multiple network devices rather than one per device. This requires one or more devices that focus on the task of pub/sub messaging and can serve as a proxy or controller for multiple devices. The Cisco Intelligence Engine 2100 Series provides this functionality and exposes a single Extended Markup Language application programming interface (XML API) regardless of the number of underlying devices.

The final step is to embed additional task-oriented agents in the devices. The first such agent is a configuration agent that makes full use of the event agent, which provides the following unique functionality:

"Plug-and-Play" Deployment

- Devices can now automatically identify themselves to the network, automatically configure themselves, and publish the results.
- Consumers of these registration and configuration events—network operators, provisioning tools, and workflow engines—can take special action based upon the success or failure of these devices.
- This new functionality is the core enabler of the Cisco end-to-end deployment solution.

Policy-Based Configuration

- Users and programmers can now change a service-affecting parameter or policy and notify the appropriate device group.
- Each device automatically stages its appropriate configuration to implement the policy change.
- Prior to committing the change, the devices validate the change required and publish the results.
- Users and programmers commit this entire network service change as a single synchronized transaction.

Cisco Intelligence Engine 2100 Series

Figure 2 Cisco Intelligence Engine 2100

The Cisco Intelligence Engine 2100 Series is a new form of network device that provides an intelligent network interface to applications and users (see Figure 2). Fully integrated with the Cisco Manufacturing Configuration Express ordering solution and Cisco's new embedded agent technology, the Cisco IE 2100 Series provides an end-to-end hands-free deployment solution for Cisco customer premises equipment (CPE)-based network services.

The Cisco IE 2100 Series is designed to deliver immediate productivity. It is a self-contained one-rack-unit (RU) rack-mountable unit that requires minimal configuration and can be installed within minutes of opening the box. Because the Cisco IE 2100 provides an intuitive, task-oriented user interface, network engineers can immediately begin automating routine deployment and configuration tasks with minimal training or learning curve.

Finally, the Cisco IE 2100 provides an open pub/sub XML interface for easy integration into existing OSS/BSS or workflow systems. This allows customers to immediately begin creating new service offerings or enhancing existing service offerings with new functionality such as plug-and-play deployment.

Cisco Configuration Express Service

Configuration Express is a no-charge service that streamlines the ordering and delivery of managed services CPE, enabling service providers to "turn on" billable service more quickly. Configuration Express utilizes a Web-based ordering process that is scalable and easy to use by nontechnical personnel, allowing a service provider's network engineers to focus on value-added tasks.

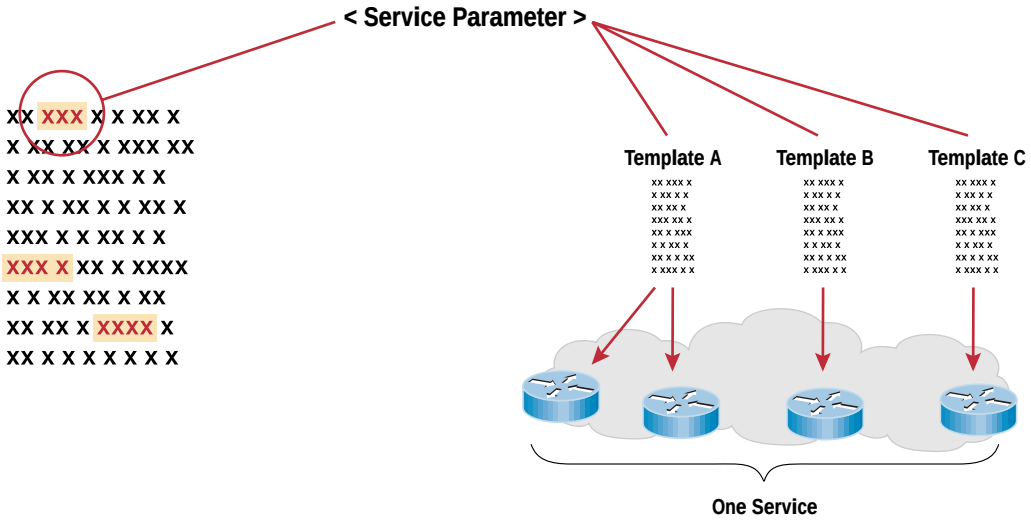
Using Configuration Express, service providers can specify a bootstrap configuration and ship-to address for each device on the order. Cisco then configures, tests, and ships the device according to these instructions. Subscriber shipments can be tracked on line.

Configuration Express supports the bootstrap integration with the Cisco IE 2100. Through this integration the entire service configuration, regardless of complexity, can be automatically deployed and validated on the CPE device the moment it is plugged in—and within moments of opening the shipping carton.

Cisco is working to extend the Configuration Express service to support additional Cisco platforms.

Immediate Productivity

Figure 3 Template-Based Automation



Most service providers and large enterprises create and test standard configurations for the network services and equipment they deploy. Some even build provisioning tools based upon templates and data repositories. Network engineers, who spend much of their time configuring network devices, also apply standard configurations and policies to their work. The Cisco IE 2100 provides significant value in all of these environments by providing embedded network infrastructure to automate deployment and configuration by extending the processes that customers are already familiar with.

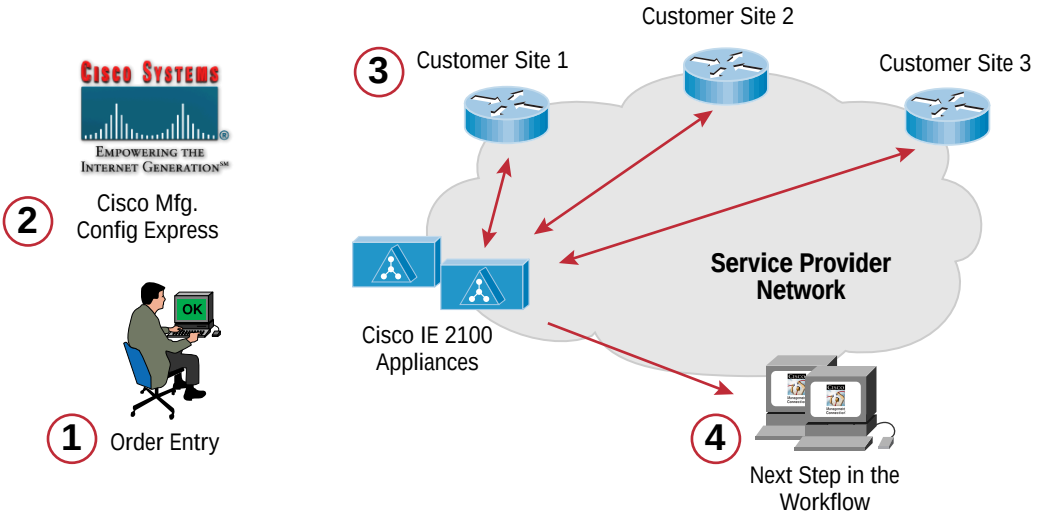
The first step in using the Cisco IE 2100 is to provide any existing device-configuration file that represents a standard service or service modification.

The second step is simply to identify which portions of the configuration represent a variable service parameter. Variable service parameters can be stored in the Cisco IE 2100 or a user-provided external repository (see Figure 3).

A single service parameter can apply to any number of different service templates. This setup is useful when some devices that make up a service perform different functions. Each device may need access to the same shared parameter; however, they may consume that information very differently. Sharing parameters allows the user or application to make a single service or policy change that affects an entire group of network devices. It is the embedded device agents that allow all required changes to be committed as a single, synchronized transaction.

End-to-End Hands-Free Deployment

Figure 4 Plug-and-Play Deployment



In this example we examine the end-to-end hands-free automation of a new service deployment (see Figure 4). The scenario also illustrates the power of integrating the ordering/manufacturing processes with embedded device intelligence.

The deployment process begins at order entry when a customer representative creates a service order. At this time it is necessary to procure the required equipment from Cisco and identify which standard service templates apply.

Cisco Configuration Express service allows customers to order devices preinstalled with standard bootstrap configurations and with delivery directly to the deployment site.

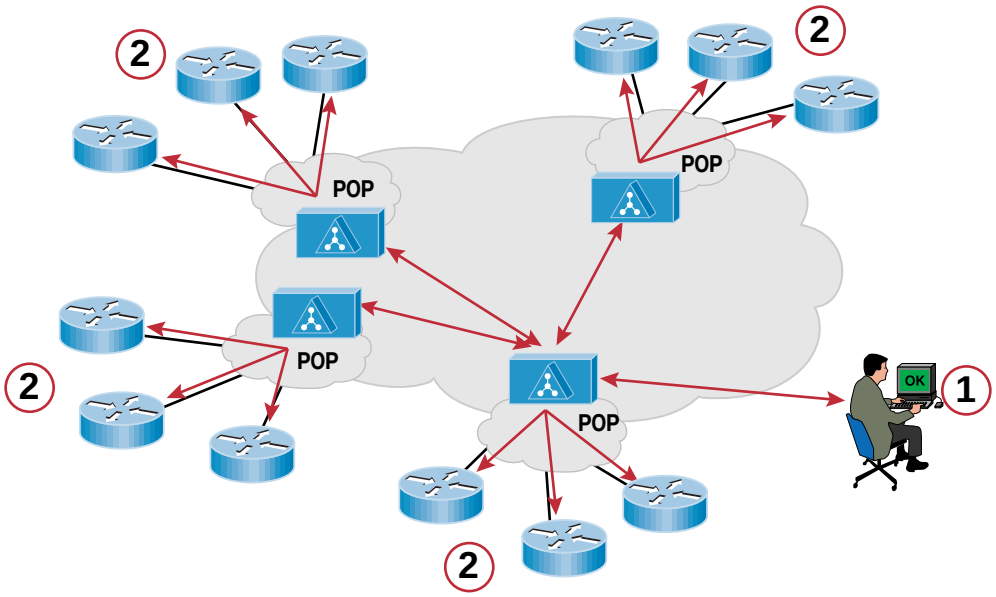
When these devices are unpacked and plugged in, they use their bootstrap configurations to locate their nearest Cisco IE 2100, register themselves with the network, and request their service configuration. The Cisco IE 2100 uses a predefined service template to dynamically generate the appropriate service configuration. The devices automatically apply these configurations, validate the change, and publish their success or failure. Instead of using service templates, the Cisco IE 2100 can also deliver configurations generated by other tools.

Operators or applications can monitor these configuration events to determine the next appropriate step. In an OSS environment, a workflow engine can monitor the events in order to automatically trigger the next appropriate step in the workflow, such as turning on monitoring or billing. This method can be used to automate existing service offerings by adding plug-and-play.

Note that this scenario illustrates the complete hands-free automation of service deployment from the point of order entry, including the triggering of post-deployment processes.

Managed Configuration

Figure 5 Mass Reconfiguration



In this example we examine a managed, policy-based configuration scenario. The scenario illustrates the power of a network-level interface versus individual device-level interfaces (see Figure 5).

We begin with a network operator, network application, or customer self-care system modifying one or more service parameters. These changes will result in different configurations for different devices based upon their location and purpose.

The Cisco IE 2100 broadcasts a single, lightweight event to the entire device group delivering the affected service. As with plug-and-play, each device requests its appropriate configuration change from the nearest Cisco IE 2100. After receiving the configuration, the device validates the change and publishes the result.

Optionally the Cisco IE 2100 can provide transactional support. In this case, the devices do not apply the change immediately but publish their status and wait. The operator or application can monitor these status events and, if all is well, publish a second lightweight commit event that commits the change across all affected devices in a synchronized manner.

Note that this scenario illustrates the ability to modify a complex network service across multiple devices as a single transaction, versus individually configuring numerous network devices.

Meeting the Challenges

The Cisco end-to-end deployment and configuration solution clearly addresses the business and operational challenges to deploying CPE-based network services. Cisco ships CPE devices directly to the subscriber site, where they provision themselves. This reduces time to deployment by days or even weeks, thereby increasing customer satisfaction and decreasing the time from hardware investment to service billing. Direct shipment and plug-and-play automation also reduces the cost to deploy by eliminating manual processes, including one or more truck rolls—typically $400 each. Finally, reducing the need for human intervention enables customers to attain the Internet-scale deployment rates required to satisfy competitive market penetration requirements.

The Cisco solution also addresses the problem of "intellectual scarcity," not just by automating manual processes, but by enabling existing workers to be more productive—even without additional training. Manual process automation also allows customers to invest their scarce human resources in the production of new revenue-generating services rather than the maintenance of old ones.

Finally, the Cisco solution integrates from order entry through service validation, the scope required to build a complete end-to-end integrated solution. In addition, the Cisco IE 2100 employs well-known OSS/BSS programming paradigms such as publish/subscribe and XML. This scenario ensures both the technical compatibility and the ready availability of programming talent needed to quickly and easily integrate with Cisco products, and into existing OSS/BSS systems.

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