itential®

# Itential Vendor Profile: Automation and Orchestration for Multi-Domain Networks

Mark Mortensen, Ph.D.

# About Itential

Itential has been named as one of the Top 6 suppliers of cross-domain orchestration in the telecom market. This is an independent report by ACG Research on Itential. It presents our views on Itential and its products and services for automation and multi-domain orchestration. We also interviewed an Itential customer and present the customer's views are they reported to us. Itential is a high-technology private software company that provides an intelligent network automation cross-domain orchestration software system for network and service provisioning for CSPs and enterprises. Its low-code solution can be configured by users or Itential to provide zero-touch provisioning across the entire network. Itential differentiates itself by the ease and speed of integration, the ability of nonexperts to create complex automation processes quickly, and extensive management of the resulting automation processes. It is built on the latest software technology and with its very dynamic paradigm for network data management, provides a foundation for the autonomous network operations of the future.

## Financials and Basics

| ITEM | ITENTIAL |
|---|---|
| **Year founded** | 2014 |
| **Headquarters** | Atlanta, GA, USA |
| **CEO** | Ian Bresnahan |
| **Employees** | 200+ |
| **URL** | www.itential.com |
| **Product segment** | Cross-domain orchestration system for automated provisioning of network infrastructure, network functions, and customer services. Can also provide direct domain control provisioning functions where needed. |
| **Geographic focus** | NA & EMEA with some exposure to LATAM and APAC |
| **Primary products for CSP market** | Itential Automation Platform |
| **Other markets** | Operations automation for private enterprise communications networks |
| **Key NF partners** | Is intrinsically multivendor with adapters to a wide variety of network functions, both physical and virtual |
| **Key OSS partners** | Integrates with multiple OSS systems, no strategic partners |

**Table 1. Itential Information (Source: Itential, ACG Research)**

The Itential Automation Platform system is in use in over 50 customers' operations, including large CSPs, primarily in the US and Europe, managed service providers, and Fortune 500 enterprises in the financial services, retail, transportation, and government sectors.

## Communications Software Products and Services

Itential is a product-focused very high-technology software company, incorporating patented techniques for modeling and automating the provisioning of CSPs' products, services, and resources and efficiently creating and instantiating new interfaces to other systems. It is designed to require few professional services, giving CSPs the ability to expand the footprint of the system with regards to the:

- Network resources (multivendor, both existing and new types) whose provisioning is orchestrated,
- Southbound systems, such as EMS/NMS and domain control systems, that may control the network resources,
- Northbound systems, such as order management systems, that determine what orchestration is necessary and provide the necessary description,
- Other OSS systems, such as inventory, service assurance, and design systems that may be involved in the orchestration processes.

Although its sweet spot is providing overall orchestration of multiple domains via others' domain control systems, Itential can also take the role of a domain control system, interfacing directly with the network resources.

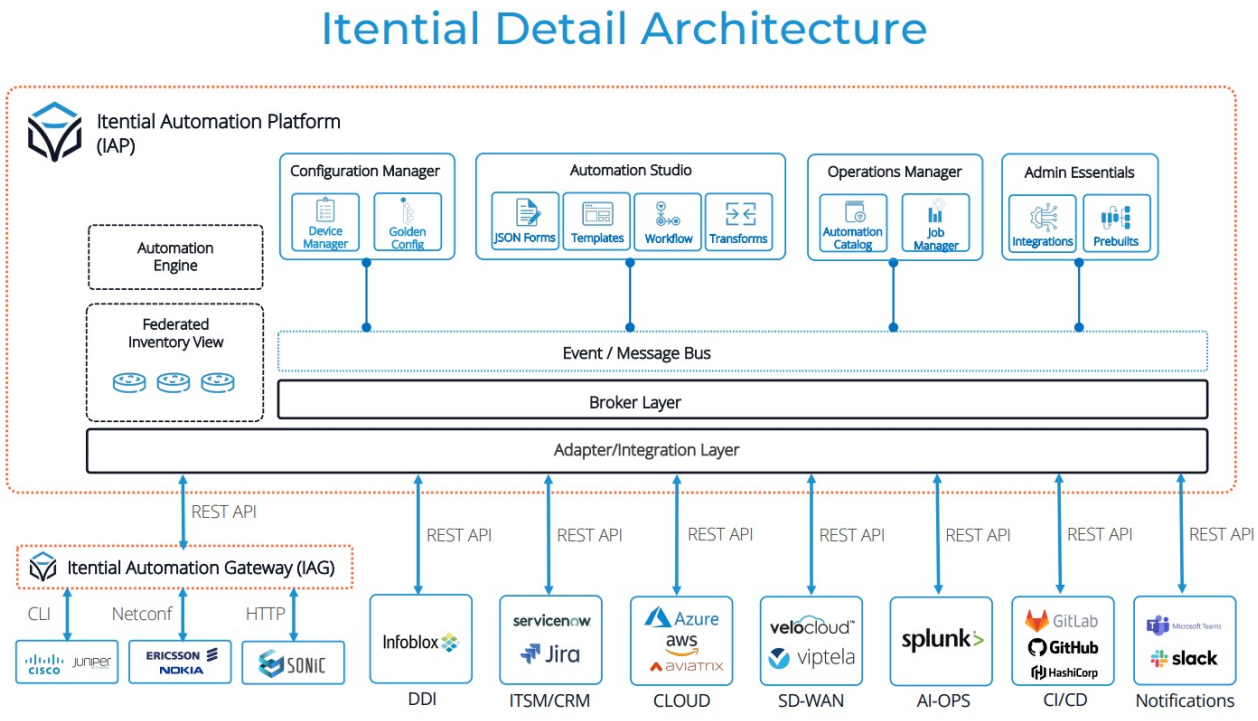


**Figure 1. Itential Architecture**

| Product | Description |
|---|---|
| **Itential Automation Platform (IAP)** | |
| **Configuration Manager** | Provides comprehensive device configuration and full life-cycle management for network functions (NF) and cloud infrastructure. Includes Day 0/1/2 activities, including NF deployment (Day 0), NF configuration management (Day1+), NF version and compliance management, upgrades, and decommissioning. |
| **Automation Studio** | A low-code, a drag-and-drop environment for the creation of end-to-end automated operations processes across multivendor and multidomain networks. Automation Studio enables non IT users to visually design, build, and edit orchestrations and automation scripts for operations, configuration, and service life-cycle management. It includes prebuilt integrations to popular systems and can import Swagger 2.0 or Open API 3.0 specifications to generate new integrations. |
| **Operations Manager** | Provides a single, unified dashboard view into the status and performance of the orchestrations running inside of the Itential Automation Platform. Allows network technicians to continuously manage, maximize, measure, and scale orchestrations across the organization. Includes: managing automation schedules, event triggers, and API access to automations; a dashboard showing summaries of automation job metrics; drill down into running automations to view performance metrics execution details. |
| **Administration Essentials** | Admin Essentials is an administrative interface to view, configure, and modify all admin-level properties across the Itential platform. Admin Essentials includes functionality to manage permissions/authorizations, create/manage profiles, manage applications, install/manage adapters, create and configure dynamic integrations, install/manage prebuilt components, and view/manage operational status of adapters and functions of the IAP. |
| **Federation/Broker Layer** | The Federation/Broker layer ensures consistency in data models between various adapters and creates a unified, abstracted, federated view of resources and data provided from connected systems, controllers, NFV, and network orchestrators, and other network management systems. It fundamentally |

| | |
|---|---|
| | establishes the set of available function calls to be implemented in adapters and typically has a one-to-many relationship with adapters. The Federation/Broker layer maintains a set of brokers for common object types, such as devices, services, topologies, AAA, and instances. This enables the automation engines and orchestration flows to interact with connected entities more easily by type. For example, there may be multiple southbound adapters that are connecting to systems or controllers that manage devices. The Broker layer identifies when multiple southbound connections can manage a common entity type (devices) and presents that entity information to the upper layers, so that an orchestration flow could request a list of all devices, regardless of the southbound path, for activities. |
| **Automation Engine** | Itential's automation engine provides a robust method for consuming the aggregated data from existing tools and applying the business logic involved in network automation. Itential does not create copies of data, allowing your systems of record and their data to serve as the source of truth, mitigating data quality issues and manual fallout errors. Automations can be published as micro-services that are available through an open API to northbound systems, enabling network-specific actions to be triggered and managed via the IAP. By extracting the complexity associated with managing multiple systems and data models, the Itential automation platform enables anyone to drive automation. Automation and orchestration flows can be initiated in multiple ways: they can be initiated manually by users, triggered by events for closed-loop operations, triggered by API calls or initiated by other orchestration flows in the system (or from external orchestration systems). |
| **Federated Inventory View** | The Federated Inventory View is maintained by the Federation/Broker layer and contains the working, real-time list of connected assets. This includes information about objects connected via adapters (such as network controllers, management systems, and orchestration systems) as well as about objects connected via IAG instances. |
| **Adapter/Integration Layer** | The Integration/Adapter layer provides integration with any API (REST, SOAP, RESTConf, NetConf, etc.) in an efficient and standardized manner. An adapter |

| | |
|---|---|
| | is a software module that can be created dynamically on the platform (usually referred to as a dynamic integration) or can be created offline by end-users through the Adapter Builder web application (https://www.itential.com/developer-tools/adapter-builder/). An adapter for the Itential platform differs from integrations on other orchestration platforms. When an adapter (or integration) is created, the system also dynamically designs objects associated with each of the API calls associated with the endpoint. These design objects are auto populated as objects in the Automation Studio so that no additional development or integration is required to incorporate those API calls into an orchestration flow. Additionally, the adapter creation process can create test stubs and test cases to simplify the process of unit testing the integration. The Itential Open Source site contains some of the most frequently requested adapters. |
| **Itential Automation Gateway** | Optional module that acts as a gateway to popular network automation tools such as Red Hat Ansible®, Nornir, Netmiko, Terraform, Custom Scripts, HTTP, and NetConf endpoints. Enables users to incorporate assets from any of those systems in larger orchestration/automation scenarios and eliminates many of the constraints normally associated with those tools (authentication, API exposure, etc.) by providing a simple REST API and a standardized inventory model. IAG extends the reach of the Itential Automation Platform and provides the ability to support a more diverse, wide range of systems while providing inventory of connected assets and secure access to those assets. |

**Table 2. Itential Product Information**

## Position in ACG Research Segmentation

Itential provides functions that transcend the traditional OSS models. ACG has a new market segmentation model that places its functions primarily in the Domain Control and Orchestration market, with some exposure to the network provisioning and configuration and service provisioning markets, Figure 1.

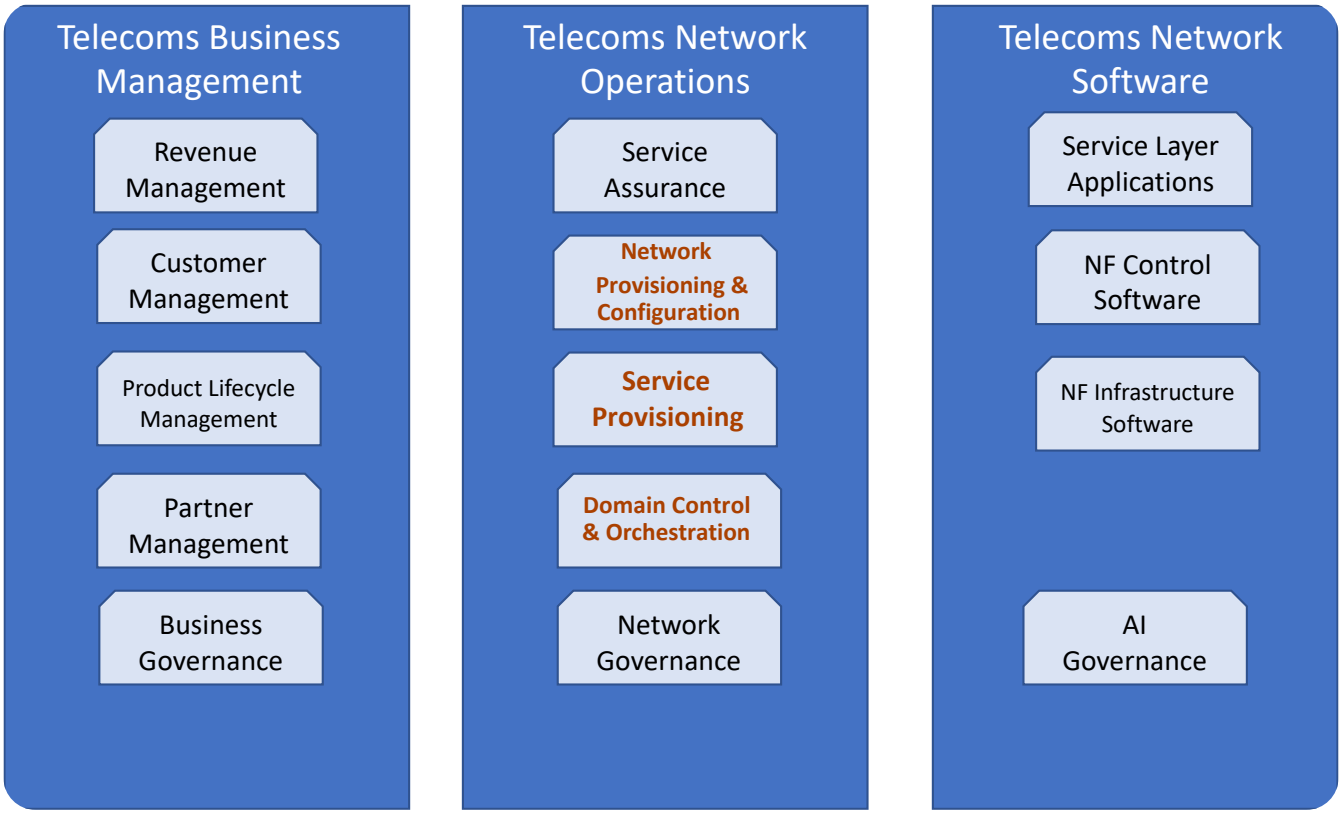


**Figure 2. Domain Control and Orchestration Market**

The cross-domain orchestration part of the Domain Control and Orchestration (DCO) segment is a new and evolving market. We differentiate in the DCO model between modules that work on domain-specific functions and others that do cross-domain control and orchestration. We refer to them as domain control (DC) and cross-domain orchestration (CDO) software systems, respectively.

Domain controllers are generally being implemented as a **suite** of cloud-native, model-based, API-driven modules that support the full **life cycle** of operations needed within and across an operator's domains. Increasingly, the suites include the domain-level provisioning and service assurance, along with a dynamic inventory cache that serves both. For slicing management, the slice design function is also often being added to these other functions.

CDOs sit above the individual domains, linking northbound to higher-level service and business management systems. They provide a logically tiered arrangement of software that streamlines and enhances the operation of multivendor, multilayer, and multidomain network infrastructures. They often interface with other cross-domain service assurance and inventory functions provided by specialist systems.

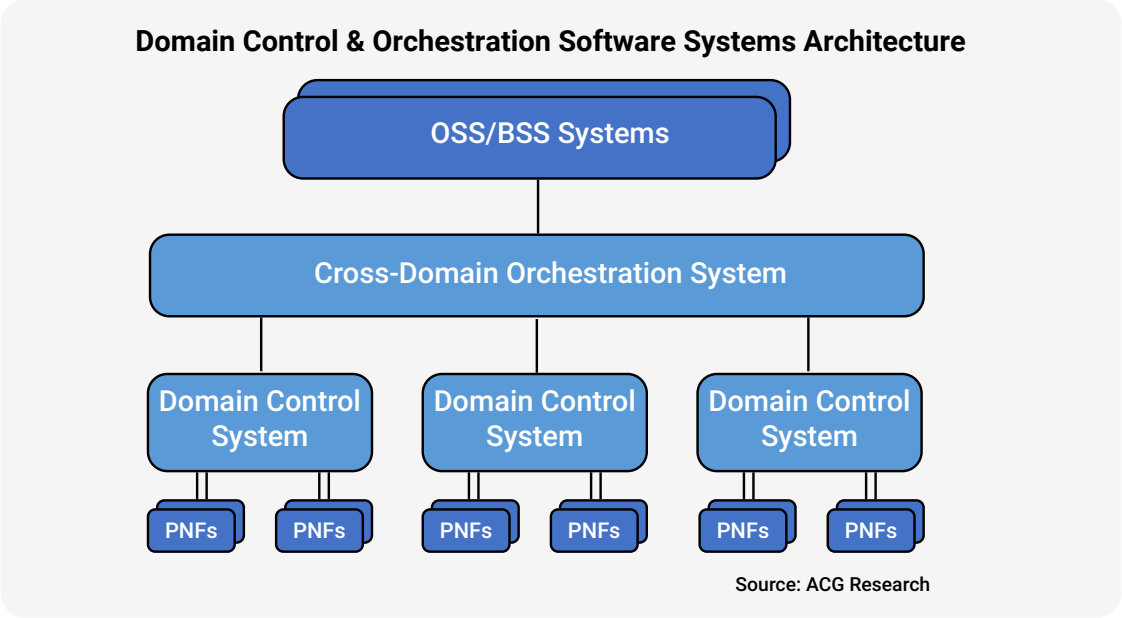


**Figure 3. DCO System Functions Overview (Source: ACG Research, 2022)**

## Domain Control Functions

At base, DCO functions include resource provisioning (adding network capacity and functionality and allocating resources to customers' services) and service assurance supported by analytics, along with an inventory of the network resources and implemented services. Together, these enable both human-assisted optimizations as well as closed-loop automation within the purview of the domain controllers for automatic resource management and control to maintain the quality of service needed for the services supported by the domain[1] . If the required functions cannot be performed at the domain control level and within this domain, then they need the involvement of a cross-domain orchestrator to complete the task/s[2] . Similarly, a cross-domain orchestrator may recognize that actions are necessary within the context of a domain and call on one or more domain controllers to implement the actions.

## Cross-Domain Orchestration Functions

Above the domain controllers are one or more CDOs. They take actions whose scope of effect stretches across two or more underlying network domains and which are related to a function that needs either alignment or continuity across a combination of elements that must work together in support of an end-to-end service. They take input from the DCs, analyze and take actions within their purview, take inputs from and respond to requests from higher-layer systems. In some cases, the CDOs themselves may exist in multiple layers.

[1] The services provided by the domain may be end-user services or services provided to more comprehensive end- user services that cross domains but require involvement of this domain.

[2] The exception is the case of NFV infrastructure, where a direct message may be sent to a domain controller for that area or sent to a higher-level cross-domain orchestrator.

| CROSS-DOMAIN ORCHESTRATION FUNCTION | DESCRIPTION |
|---|---|
| **Cross-Domain Service Provisioning** | Communicating with one or more domain controllers to provision network services in a single domain or that cross domain boundaries. May include cross-domain path computation. |
| **Network Resource Optimization** | Analyzing the configuration and usage of the network infrastructure across multiple domains and taking autonomous or directed actions to optimize the equipment utilization or quality of service. |
| **Network Resource Provisioning and Adjustment** | Initiating installation, configuration or adjustment (expansion, contraction or change) of a network resource (either virtual or physical) triggered either from upstream BSS/OSS or autonomously within the purview of the CDO. |

**Table 3. Orchestration Functions**

## Competitors

ACG Research places Itential in the top 10 suppliers of Cross Domain Orchestration Systems. Other players that Itential competes against in the cross-domain orchestration market include Amdocs, Ciena Blue Planet, Cisco (Sedona), Ericsson, FRINX, HPE, IBM, Juniper, NEC/Netcracker, Nokia, Oracle, and ZTE. ACG Research's interviews with CSPs have found that about two-thirds of the CSPs look to independent software vendors for their CDO functions.

Each of these vendors also compete against Itential in the domain control market. In addition, all network element vendors (whether physical or virtual) provide domain controllers that work with their own equipment, as well as being able to be adapted to control other vendors' equipment. ACG Research's interviews with CSPs have determined that about two-thirds of the CSPs look to the developer of their network functions (whether virtual or physical) for the associated DC functions, often choosing to operationally define major vendors' equipment as separate domains and using the CDO functions for coordination among them.

# Itential's Key Differentiators

Itential is a company built from the ground up to provide a modern, cloud-native, full-functionality cross-domain orchestration software product that can be used by CSPs that want to implement these functions with limited involvement of the software vendor or systems integrator. Its forward-looking architecture positions it well as both a near-term way of automating current network operations as well as being a fundamental part of a CSP's long-term journey toward implementing autonomous networks.

### Rich Data Model

Itential uses the industry standard JSON format to create a flexible model for internal representation of the network resources and services. This rich model can then be mapped to a wide variety of models in the CSP and enterprise spaces, including physical and virtual network resources, complex services, and cloud resources and services.

### Extensive Interface, Workflow, and Equipment Model Libraries

CSPs have referenced how Itential provides an extensive library of interfaces to existing domain control systems, network elements, and other OSS and BSS systems. It also has a sophisticated methodology for managing version control as these all evolve.

### Dynamic Creation of Orchestration Workflows

Itential has extended beyond the well-accepted concept of catalog-driven workflows. The system utilizes a set of modules that constitute composite objects of tasks, forms, and templates that are dynamically combined at run time to create the end-to-end cross-domain workflow.

### Easy-to-Use Interface for Workflow Component Creation

The system provides a drag-and-drop interface for creating workflows, tasks, forms, and templates that can be used by an IT-trained network engineer, not requiring personnel from the IT organization. This allows the democratization of the automation projects, spreading it throughout the organization, which has been found to be a key to success of these projects.

### Customer-Extensible Interfaces to Other Systems

A CSP's IT organization can use the capabilities of the Itential Automation Gateway and other tools to create new or modify existing interfaces to other systems without involving Itential.

### Real-Time Federated View of Available Network Resources

Key to effective end-to-end orchestration is the ability to know the current state of the network and the resources available. Most systems require a shadow inventory function that can easily get out of synch with the true state of the network. Itential takes the approach to dynamically federate the available information from other systems. This will become increasingly important as the network becomes more dynamic and services are optimized in real time to maintain their required QoS characteristics.

### Modern Software Architecture

As a recently developed system, Itential exhibits the very latest cloud-native software architecture, DevOps processes, and CI/CD implementation. This speeds the process of evolving and optimizing the software.

## Customers and Markets

Itential started in the CSP space in the US but has also had considerable success in the enterprise market where its ease of use has made it popular for network automation. As a product-focused company with strong features to allow its customers to configure and extend its use, as well as an extensive library, Itential has a small professional services footprint.

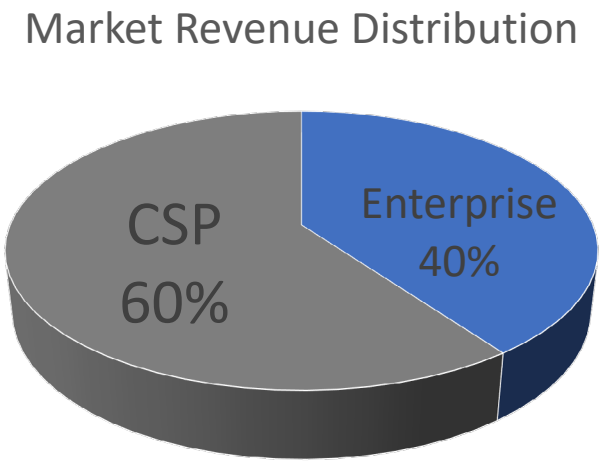


**Figure 4. Market Served Percentage Distribution**

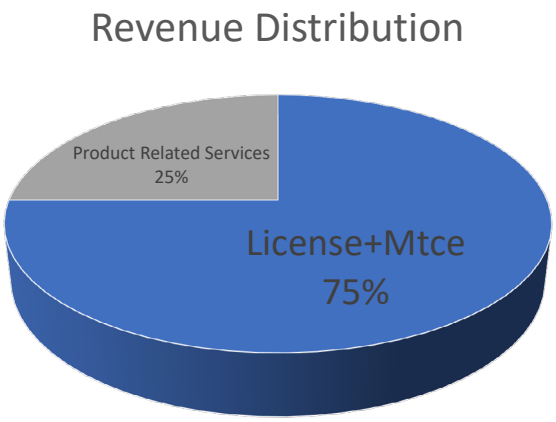


**Figure 5. Percentage of Revenue Types**

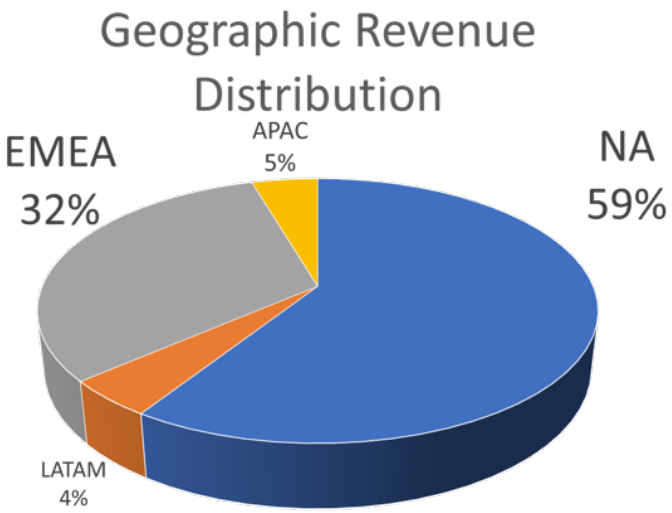


**Figure 6. Position in Geographic Markets**

## Key CSP Customers

Unlike most specialist software companies in the telecoms market that start with Tier2 CSPs as their main customers until they develop the strength to serve the Tier1 market, Itential is already serving the most demanding customers. Its major customers include:

- Deutsche Telecom
- Liberty Global
- Lumen
- Telecom Italia
- TPx Communications
- Verizon Wireless

# CSP Interview

I interviewed a senior manager of core network engineering of a Tier 1 US wireless carrier who has been using Itential since 2017. The company has implemented over 300 complex network engineering workflows using Itential, with many more being added. The use of Itential is also being expanded dramatically as a key element in the CSP's overall network engineering automation platform.

## Interview: Key Use-Cases

The current main workflow use cases are the orchestration of complex multistep workflows for:

- Deploying new optical and packet data networking infrastructure, both the box-ready-for-use and the network-ready-for-use processes,
- Automating network element software updates,
- Automating network configuration updates,
- Provisioning new service instances.

Key to effective implementation of these use-cases was the ability of the network engineering team to use the graphical interface for creating new workflows without the involvement of its IT organization by having several IT trained members who work with subject matter expert network engineers. These members also create new tasks and adapters to other OSS/BSS systems without the involvement of Itential. In the future, workflow creation will be further spread throughout the engineering team, with the more IT trained members focusing on the integrations, adapters to new network elements, and administering the growing number of increasingly complex workflows.

The CSP also has plans to expand the use of Itential into the core 5G wireless network to automatically orchestrate the implementation of virtualized core network functions in concert with the underlying cloud infrastructure.

## Interview: Key Component of the Network Engineering Automation Platform

Itential is a central component of the CSP's overall automation platform for the network engineering department. Northbound, it interfaces to the homegrown user portal that allows network engineers to create, administer, and evaluate the efficacy of workflows. The portal also acts as a gateway to other OSS/BSS systems, such as inventory and service assurance, which are also parts of the overall network engineering automation platform. Southbound, it integrates primarily with packet and optical domain controllers from the network element vendors. The availability of the prebuilt interfaces to key domain control systems was a major selling point for Itential.

The manager expressed great pleasure in the availability of APIs for all the major functions that Itential supports, making integration into the overall automation platform much easier.

### Interview: Key Learnings

- Itential performs as promised, automating complex network engineering workflows.
- Itential allows the CSP to use the tool to create new workflows with no involvement from Itential or the CSP's central IT team.
- Itential's prebuilt interfaces speed implementation, and its ability to integrate easily with other systems makes it a key component in the network engineering automation platform,
- Automating simpler tasks that require only a simple, prerecorded response are best automated using less complicated tools (such as Ansible). These can be used by Itential as components in more complex workflows.
- In embarking on the journey to automate the engineering workflows, it was necessary to assess, and, in many cases, upgrade the IT skills of the engineering team.
- The use of Itential was successful in this organization and is being expanded to orchestrate the 5G mobile core engineering tasks, especially in the instantiation of the virtualized mobile core functions that need to be automatically implemented on the right cloud infrastructure.

## ACG Research SWOT Analysis

Itential is a specialist in cross-domain orchestration, providing a strong software product that requires minimal professional services to implement effectively in CSPs' organization. It has considerable competition but seems well entrenched in the market with its current customer base strongly supportive of the company and the product.

### Strengths

- Top 6 vendor in the Telecoms market of cross domain orchestration software.
- Excellent Tier 1 reference customers with strong support.
- Modern software technology, fully cloud native, with DevOps development methodology and CI/CD delivery abilities.
- Patented technologies for modeling CSPs' products, services, and resources.
- Strong use-cases in the transport and other domains with proven benefits.
- Proven product scalability, including methodology for planning, storing, modifying, and updating the automation specifications.
- Clear marketing messages and value propositions.

## Weaknesses

- Still a relatively small company, competing against many vendors, including Ericsson, NEC/Netcracker, and Nokia.
- Penetration of the T2/T3 market usually requires more professional services, not a current strength nor current a priority for Itential.
- Limited penetration of the mobile domain, so far, where over half of the investment is going.

## Threats

- The market for cross-domain orchestration is immature with unknown potential profitability.
- The benefits of cross-domain orchestration can only be fully realized with strong domain control functions in place and presenting comprehensive northbound interfaces. Such interfaces are still in the minority. This has required that Itential build up its capabilities to interface directly with the network elements.
- The benefits for CDO as well as DC functions also depend upon the ability of the equipment to be software controlled. Such control is growing but, in general, is only available in about half of the embedded equipment at present.
- Market for domain controllers is dominated by the equipment vendors, most of whom bundle the DC functions with their equipment.
- All-in-one slicing managers, including provisioning, assurance, inventory, and design, have been introduced by over a dozen vendors. These compete with cross-domain orchestrator specialists, such as Itential, which include only provisioning and inventory with limited design and service assurance capabilities.

## Opportunities

- The need for ubiquitous cross-domain orchestration is becoming recognized as essential to move toward autonomous network operations. Itential's highly abstracted and dynamic approach provides a smooth evolution path to autonomous networks.
- As network slicing is implemented in 5G (and other) networks, the need for cross-domain orchestration will increase dramatically.
- The domain control function for unified control of disaggregated network elements represents a new market area that equipment vendors would be unlikely to dominate; Itential is well positioned to take advantage of this.
- Itential may represent an excellent strategic partner for a major player in the order management or service assurance markets that want to play in the market for overall slicing managers or that want to expand into the provisioning market, which is becoming increasingly integrated with the assurance market.

## About the Author

### Dr. Mark H Mortensen

Dr. Mark H Mortensen (mmortensen@acgcc.com, @DrMarkHM) is an acknowledged industry expert in communications software for the TMT sector, with over 40 years of experience in OSS and BSS specifications, software architecture, product marketing, and sales enablement. His work has spanned the gamut of technical work at Bell Labs, strategic product evolution at Telcordia, CMO positions at several software vendors, and as a research director at Analysys Mason. Most recently, Mark has focused on the technology and processes of digital transformation for Communications Service Providers and the growing automation and orchestration of network and business processes. He joined ACG Research in 2018 where he has been responsible for Communications Software research and consulting. His research program, Domain Control and Orchestration, characterizes the state of network automation in the industry, profiles vendor solutions, and provides market shares and forecasts for this evolving market.