

What is **Network Inventory Management?**

The importance of adopting an agile approach to operations

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Introduction: Setting the boundaries

The term “network inventory management” (sometimes synonymous with “resource inventory management”) has become a widely used term even though it lacks a standard definition, despite the efforts of organizations such as the TeleManagement Forum.

For a variety of reasons network inventory management is becoming increasingly important – indeed, it’s fair to say it’s fundamental to the transformation of networks and the smooth introduction of the newest generations of technology for today’s and future networks. Driven by network evolution, operators of communications networks are focused on adopting an agile approach to operations that enables them to innovate, adapt their networks, deliver services faster, and become more proactive in how they manage their business, all while streamlining or reducing costs.

For these gains to be realized, all operators require an understanding of the resources over which their business is conducted, ranging from physical “in the ground” assets to the transit infrastructure that carries traffic and more beyond.

The services they provide are not only enabled by their network assets but are transported over the connections between them. Services, then, are delivered across chains of physical elements and are composed of logical and virtual resources. And, increasingly, they are also deployed from cloud-based infrastructure.

As a result, we’ll also consider cloud deployment models.

Defining the network inventory

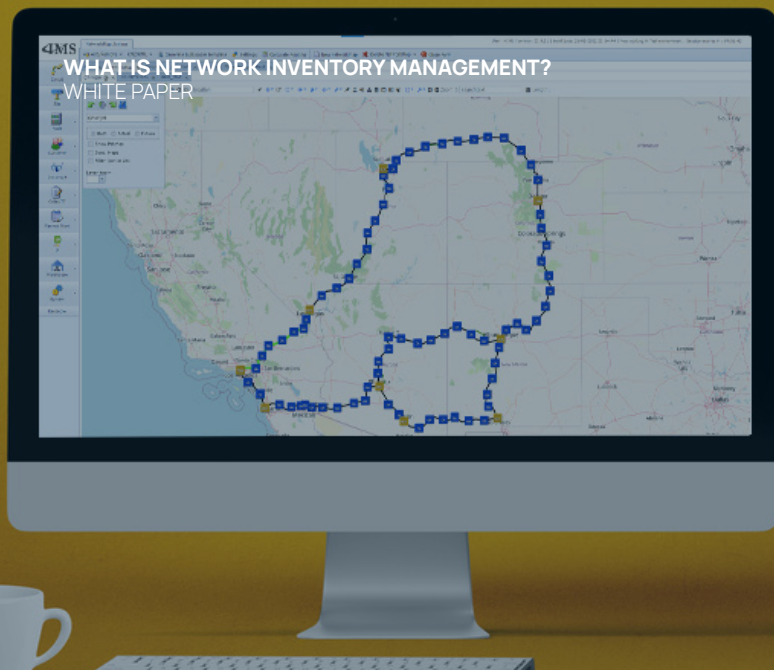
Only by understanding all the elements in these chains and correlating them with each other can operators manage, optimize, and evolve the performance of their assets and the delivery of their services to secure the desired agility and levels of operational performance.

This understanding requires a single view, available to all stakeholders and accessible to different business processes – the “complete picture” that we will refer to in this paper as the “Network Inventory”.

To deliver any service optimally the operator must have a comprehensive and immediate overview of how all the components deployed in the process of delivery perform.

This includes not only the physical base of which the network itself is comprised but also logical and virtual assets such as phone numbers and connections, and the interfaces between.

As an example, using a property with a fiber (GPON) connection, the relevant inventory to be managed should include all assets (and the related information they collect) linked to the physical and logical network resources used to deliver services.



“Operators must be able to automatically determine the effects of network faults on customers to meet expectations and reduce churn”

This encompasses the buildings, rooms, active and passive equipment, cable routes, duct segments, cable chambers (manholes), utility poles, trenches, fiber cables, and more in addition to the actual network elements that handle the service from the end user’s building back to the original optical line terminal in the operator’s facility. It also may include information related to logical connections and services such as details of how a service is routed over multiple connection layers (for example, VLANs, WDM frequencies, Ethernet layers, etc.) and other parameters.

Few operators possess the complete picture they really need – which creates friction for service delivery (e.g., when activating another connection to a property in the same neighborhood or planning a new extension in an adjacent neighborhood). As a result, consideration of network inventory management solutions has now come to the fore.

Components of the Network Inventory

With this in mind, we believe network inventory management (NIM) can be seen as the collection, monitoring, aggregation, presentation and evaluation of information related to all the resources used by an operator to implement its services and products. The NIM must deliver the ability to manage both physical resource inventory database systems as well as service application(s) or database(s).

Standardized information model

At its core, the NIM must provide a standardized information model via which the resources it encompasses (examples of which have been described in the preceding section) can be managed.

Typically, the attributes included in the model would be dependent on the resources and equipment deployed, as well as the technology and connectivity required.

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Functionality of the network inventory management solution

The purpose of the NIM solution is to accurately describe the state of resources (network elements and their components, IT systems and applications, plus related resources as defined within those systems) within the operational domain at any one time.

This requires the recording of what resources are being consumed by which service instances at the physical and technology layers of the infrastructure on a continuing basis – and ensuring that this record is updated regularly and regardless of the equipment deployed is thus an essential requirement.

At a minimum, the TeleManagement Forum's [Frameworkx model](#) suggests NIM functionality must therefore include:

- Visibility of the status of all resources
- A capacity management interface related to asset tracking
- Barcode/RFID tracking of all resources including spares
- Resource history tracking for all problems and returns
- Interaction/normalization with resource activation and resource provisioning
- Management of under-utilized or 'stranded' assets
- Resource inventory retrieval allowing the operator to retrieve part, or all of the resource inventory known to the target OSS
- Resource inventory update notifications
- Resource inventory update
- Resource inventory reconciliation

“The NIM must expose not only what physical equipment is in place to deliver a service but the unique aspects that define the service (for instance, 1Gb/s connectivity, with specified QoS comprised of minimum uplink and downlink requirements), the pathway via which it is delivered, how that service can be provisioned, and so on.”

NIM is about **processes** as well as **objects**

A comprehensive network inventory management solution is not only concerned with network elements and associated applications. The functional relationships between these “things” and the need to maintain accuracy through ongoing update and transactional processes (reconciliation) is, as we have mentioned, also a critical aspect of the domain. The NIM must expose not only what physical equipment is in place to deliver a service but the unique aspects that define the service (for instance, 1Gb/s connectivity, with specified QoS comprised of minimum uplink and downlink requirements), the pathway via which it is delivered, how that service can be provisioned, and so on.

Therefore, NIM must also take account of the applications which contain and maintain information about the instances of services in a telecom organization.

So, it is desirable that it stores and accounts for information related to:

- **Customer Facing Service (CFS)** instances, and their attributes
- **Resource Facing Service (RFS)** instances, and their attributes
- The **mapping of services** (RFSs or CFSs) to other services and/or service components

In addition, the NIM should include a Service Inventory Information Model as well as functionality for:

- **Service inventory retrieval**
- **Service inventory update notifications**
- **Service inventory updates**
- **Service supporting resource inventory**
- **Service inventory reconciliation / synchronization**

To summarize the diverse array of aspects it covers, the NIM solution should be able to account for:

1. The **physical components** in the network
2. The **logical resources** that span between those physical objects, which may or may not be physical in nature
3. **Virtual aspects** of a service delivered over a logical connection
4. The **service** itself and the **delivery** mechanisms that characterize its execution

Network inventory management **use cases**

There is a wide array of use cases that demonstrate how an effective NIM can help solve the common but often difficult challenges faced by operators. These include:



Fault impact analysis

Operators today must be able to automatically determine the effects of network faults on customers in order to meet expectations and help reduce churn. Being able to do so enables them to deliver increasingly complex services while minimizing the effect of unplanned outages. In this context, the ability to determine the full impacts beyond just those customers immediately affected is essential. NIM also enables the effective handling of repair activity according to business priorities as well as ensuring accurate customer notifications.



Single point of failure

Operators need to determine where they have problems in the network and address them before an outage results, often by identifying potential single points of failure (SPOF) that usually result from a flaw in the design, implementation or configuration of a link or system. A SPOF in a data center or other IT environment can compromise the availability of workloads or the entire data center, depending on the location and interdependencies involved in the failure, as can one in the field. Understanding where these can be found is essential.



Fiber and FTTx rollout

Fiber rollout presents numerous challenges, not least the difficulty of pursuing successful deployment and operation while relying on a myriad of generic IT solutions to give an overview of the network. Integrating these (ERP, CRM, ticketing tools, etc.) via an Enterprise Service Bus leads to enormous integration costs and complexity in the long term due to lack of domain functionality and costly integration work, a problem that can be removed or minimized with a comprehensive NIM.



Network optimization

Network optimization, dependent on inventory management, positively impacts both costs and revenues. Faster and better understood data analytics and insight into usage, network logs, hardware maintenance, marketing efficiency, peak load analysis, and near real time granular levels of analysis that were previously impossible to perform at scale can reduce costs. Combining disparate customer data silos into one source of truth (our complete picture) can deliver insights that increase revenues.



Dynamic service orchestration

Until now, services have typically been delivered on demand, but not in real-time. Different levels of automation have been implemented and realized to accelerate these processes, but lags or delays remain common. The new network architecture, originally designed for 5G but also applicable to all other core telecoms networks, opens the possibility for dynamic, real-time service orchestration and activation. As such, inventory management is a critical enabler, providing the accurate repository of all resource availability and capacity that will be required to ensure that a given service is delivered, at the required velocity, with the desired capabilities and QoS. The integration of network inventory systems with the real-time orchestration platforms that will unlock dynamic, real-time services, including slice creation and management, is thus essential.



Financial asset management

Operators must be able to understand and account for their network assets, including their location and financial classification. This is critical for financial reporting, new service introduction, service trend analysis and regulatory reporting. It requires maintaining an accurate view of fixed assets, tracking assets in multiple networks/territories and ensuring Fixed Asset Register compliance. This, too, can be addressed via an NIM solution.



Security

Different files (for example, AutoCAD drawings, excel sheets, simple tools) that are not secured can easily be sent to external sources by mistake. Compared to a secured database environment (e.g., 2FA within secured LAN) this can lead to problems – so protecting such sensitive data via a complete NIM solution with the appropriate security procedures to restrict access reduces the risk of data leakage.

Similarly, routers can present points of vulnerability, particularly if they are not configured correctly. On the other hand, a NIM solution that can automatically check router configurations and adherence to the policies in place can identify such weaknesses – and provide recommendations for the correct configuration, in line with the security design rules in place. It can also help other tasks, such as:

- Network hardening
- Monitoring and identifying unplanned changes
- Checking firewalls
- Discovering unwanted devices on ports

In fact, the NIM can be a key tool in supporting and enforcing security at multiple levels.

Risk of inadequate approaches to network inventory management

As networks have grown and technologies have evolved at an increasing pace, so too has the range of assets and functions that must be managed. To deliver against expectations and perform optimally, operators must have an accurate picture of their inventory at all times.

Despite this, many operators have only a fragmented view of their assets and this is a serious problem. It means that while they can grow their businesses quickly in theory (particularly when expansion comes through mergers and acquisitions), consolidating and integrating any new infrastructure can be complex.

Worse, some operators not only have an incomplete picture of their inventory but also rely on paper-based systems alongside outdated software solutions. Both seriously constrain an operator's ability to activate and deploy the services they sell, let alone to define their capabilities. This can also lead to a gap in unrealized future capabilities.

Without a NIM system in place, even the simple step of activating a fiber connection can sometimes take days despite the required assets already being in place. With a NIM, the processes that provision and activate the service can obtain the information they need via automated processes, removing friction and accelerating service delivery.

Deploying network inventory management in the cloud

Today, telco infrastructure is increasingly shifting to deployment in the cloud to take advantage of the agility, elasticity, and scalability it affords. Among other things, the Cloud enables telcos to:

- Reduce OPEX
- Virtualize networks
- Adopt software-defined networking
- Migrate to zero-touch operations
- Improve business continuity

For telcos, cloud deployment is also particularly suited to supporting both a new generation of network architecture, realized through software-defined networking and network function virtualization, as well as a more agile mode of operations.

While the familiar IT cloud delivered virtual services to meet enterprise requirements, the emerging telco cloud embraces public, private and hybrid cloud environments, often depending on the country in which services are delivered.

So, there may be different adoption models, but the direction of travel is clear: cloud migration is inevitable for telcos and Communications Service Providers (CSPs).

Early attention has largely been focused on the migration of network services and functional components to cloud environments, such as 4G and 5G core network functions, or IPTV offers, for example. But, as this trend accelerates, the OSS – and also the NIM – is sure to follow, bringing the question of its migration path to the fore.

How can operators address this?

VC4-IMS: network inventory management-as-a-service

VC4-IMS is a complete network inventory management solution, available as-a-service, from the cloud, based on the same cloud infrastructure and architecture used by operators globally. Public or private, the choice is yours.

VC4-IMS shows operators how to bring clarity to their assets and provides a foundation for ensuring that investments in agile network evolution deliver the ROI desired. It eliminates scattered data silos, unlocking a single, consolidated view and, importantly, it can now shift solving the long-standing OSS data problem into the emergent cloud landscape.

VC4-IMS as-a-service delivers many direct benefits including:

- Advanced network inventory management functionality via a **complete, cloud-based solution**
- **Flexible managed service options**, with tiers of service and SLAs to meet your needs and budgets
- Ready to support your **NGN fiber, FTTH/GPON, WDM/OTN, MPLS, SDN/SD-WAN and 5G** and legacy network registration in the cloud
- Changes the balance from CAPEX to OPEX to ensure **efficient network evolution** and that you target investments where they matter
 - **Freeing CAPEX** for fiber build, for example
 - Enhancing automation and assurance
- **Enhanced security** including a secured database with 2FA within a secured LAN, the ability to check router configurations to ensure that they comply to equipment standard policies, configuration recommendations and company design rules, and the ability to check ports for unwanted devices

With the availability of VC4-IMS - network inventory as-a-service - based on hyper-scale, Tier 1 cloud infrastructure providers, telcos, operators and CSPs can choose the deployment model and SLAs that meet their own specific needs and plans. The OSS is evolving to support your cloud investments and strategy, with the agility and flexibility you need.

As part of this evolution, VC4 is now bringing comprehensive network inventory as-a-service to any operator, regardless of size, as well as enterprises that operate their own communications networks.



“VC4 understands our needs and gives us the required support. They bring passion and experience in their work, they are open for new ideas and challenges. We highly recommend VC4.”

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Summary

For operators today, having access to a consolidated repository of all the data associated with each network asset and service is a critical component of commercial success. Awareness of asset location, performance, capability, usage, status, and more, is vital for optimal performance. The sum of this information is the basis for improving both operations and customer experience. And improved performance in those areas is the foundation of long-term commercial success.

This means that the ability to access the right inventory platform is key to unlocking the potential of myriad advances in the network itself. Effective network asset management tools have become intrinsic components of the next generation operator's go-to-market planning. The importance of a single source of data for all operations and processes from planning to deployment to revenue cannot be overlooked.

VC4-IMS, the leading NIM solution, brings clarity to your assets and provides you with the foundation you need to ensure that your investments in agile network evolution deliver the ROI that you're targeting. Available for operators of any size, with cloud-based or on-premise options, offering the flexibility you need to transform your business and operations.

VC4-IMS eliminates scattered data silos, unlocking a single, consolidated view. Based on the experience of decades of working with leading operators, it solves the OSS data problem.

It eliminates operational friction and boosts efficiency. Starting with network planning, on to build and then infrastructure management, VC4-IMS supports the full-service lifecycle, helping you to manage complex networks and plan investments more effectively for future evolution and the discovery of new insights and opportunities. It can help any network operator – fiber, broadband, mobile – across different sectors, such as telecoms, utilities, education, and rail, as well as large enterprises manage their infrastructure, connections, and customer relationships – from the cloud, as-a-service, or on-premise.

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