WHITE PAPER

CROSS Inventory

A Single Unified Inventory Platform for Visibility, Control, and Automation

How next-generation inventory solutions are shaping the viability of network operations

Digital experiences are central to our modern lifestyle. Our most fundamental interactions – working, purchasing, entertainment, communicating and more – are supported and enriched by digital technologies. Communication service providers (CSPs) and network operators provide the fabric upon which all these digital experiences are carried.

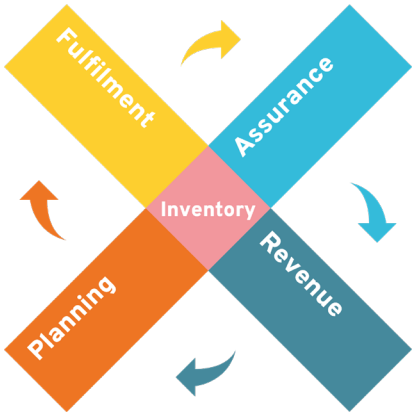
Most people are aware that comms networks are part of this digital experience fabric. Fewer are aware of the OSS (Operational Support Systems) and BSS (Business Support Systems) that keep it operational and optimized.

The digital experiences we all enjoy and rely upon need communication services to be offered, delivered, and maintained. In turn, these services are dependent upon reliable, efficient OSS and BSS solutions.

The commercial viability of each CSP is directly tied to:

- Its network
- The customer services that run over it
- The key OSS/BSS processes that manage the networks and services

The inventory solution is at the heart of OSS and BSS systems, supporting each of the other four fundamental network operations workflows shown in the diagram below.



Tradition Inventory is the same, but all too different

These same fundamentals have existed since the first OSS/BSS appeared. But make no mistake, there are fundamental changes underway today that significantly impact inventory fundamentals into the future.

We have already entered a new era and further changes are looming. Inventory will continue to support the four key scenarios but must adapt to the more modern, dynamic, automated, software-centric networks we manage today and tomorrow. It's incumbent on the Inventory solution to facilitate CSPs doing more, with less, in a faster time.

Many existing inventory platforms are struggling to keep pace across the primary considerations of next-generation inventory solutions:

Scalability	to adapt to increased virtualization, scalable consumption, dynamic re-sizing, and data needs
Utilization	for better / faster allocation of dynamically available capacity
Flexibility	efficiently cope with new offerings in physical, logical, virtual, service and product inventories
Reliability	of networks, systems, and data (in addition to the automations that depend on accurate data)
Insightful	operational and situational awareness of a more dynamically changing network environment, including service impact analysis, root-cause analysis and so much more
Security	of private and confidential information
Coherent	availability of all sources of data. Even if spread across many primary sources and domains, Inventory must provide a consistent, consolidated, cleansed, stitched view of data to support accurate, expedient decision making
Autonomy	is essential to managing increasingly complex networks and workflows. Inventories of the past were not designed to readily accommodate algorithmic operations or artificial intelligence / machine learning (AI/ML)
Enriched / Contextualized	data is the superpower of any OSS, where the ability to cross-link data from many sources can unlock multi-dimensional insights. This super-power is enabled by integration, typically via powerful Open APIs and subsequent linkage of data sets. It is then unleashed from a single model via advanced analytics and intelligent automations. Inventory solutions must provide insights that are commercially, contractually, or operationally aware
Cost Savings	should be achieved as an indicator of improved operational efficiency

Adaptation is a mandatory business requirement

The benefits of software-defined and dynamically optimized networks can only be attained with an advanced inventory solution.

Traditional solutions may accommodate some of these ten vectors, but business-changing efficiency can only be unlocked when all ten are implemented cohesively. Don't let your business be constrained, or worse, left to stagnate due to an inventory solution that can't keep up with the ambitions of your network.

These aren't just nice-to-have features. These features impact the efficiency of the four fundamental pillars that are critical to your business - Planning, Fulfilment, Assurance and Revenue / Billing.

Introducing the architecture of a next-generation inventory

CROSS Network Inventory enables service providers to deliver on the ten primary considerations using a novel architectural model. The CROSS approach uses a much lighter touch in terms of its data model, which also offers service providers greater architectural and transformation flexibility. Naturally, CROSS Inventory supports the following four primary workflows:

Planning – the process of network design and change, facilitated through the CROSS Inventory, allowing service operators to flexibly adapt to changing business strategies and capacity demands

Fulfilment – the process of accepting customer orders via the BSS, designing the corresponding services, and then activating them in the form of network changes. This provision of service initiates streams of revenue that are the lifeblood of service providers

Assurance – the process of monitoring the network for troubles, such as alarms, events, performance deterioration, SLA (Service Level Agreement) breaches and more. This is the ultimate insurance policy for the service provider's business model and revenue streams

Revenue / Billing – the process of collating customer service subscription and consumption data for the purpose of preparing a bill by the BSS, ensuring profitability for the service provider

Typical Usage Models for CROSS

The all-in-one approach to inventory-related workflows above allows service providers to design and maintain flexible, closed-loop control over their Service and Resource Inventory. This consolidated and coherent, yet lightweight and nimble model provides CROSS with a distinct advantage over other inventory solutions. It can be configured for service providers using traditional OSS/BSS models. However, CROSS Inventory can also be configured in novel ways to help service providers overcome entrenched challenges in ways the others can't.

CROSS as a Traditional OSS/BSS Model

CROSS Inventory can be coupled with BSS solutions to form a traditional OSS/BSS – all the way from a comprehensive form suited to service providers with complex services, networks, and process models; through to a lighter-touch form for efficient management of more modest network operating models.

The diagram below provides a deeper look into the functional modules that make up a full OSS/BSS, where CROSS Inventory functionality is encapsulated within the orange box. Planning, Fulfilment, Assurance and Billing are all clearly facilitated.

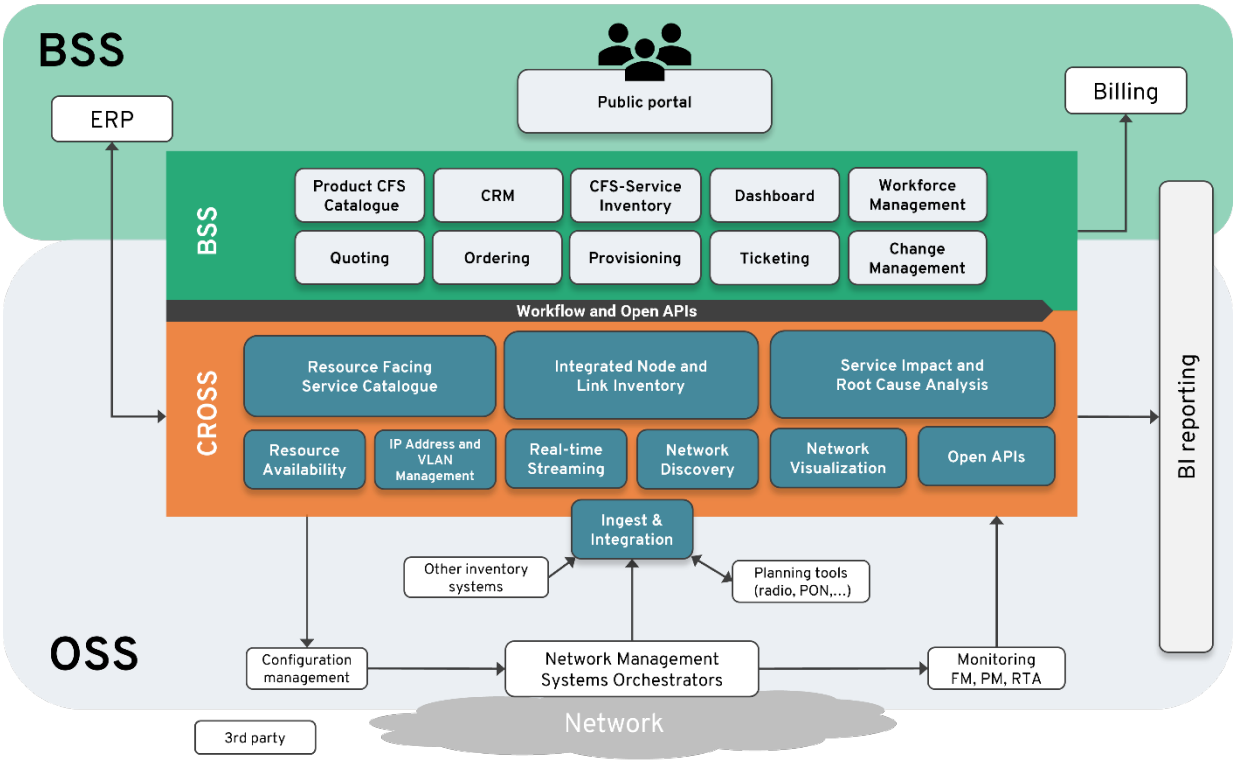


Figure 1. CROSS integration across OSS/BSS domains

Additionally, CROSS's ability to integrate inventory and network data with the wider OSS/BSS environment, made possible through its REST-based Open API and library of probes, enables it to support end-to-end workflow automation, such as order and service management.

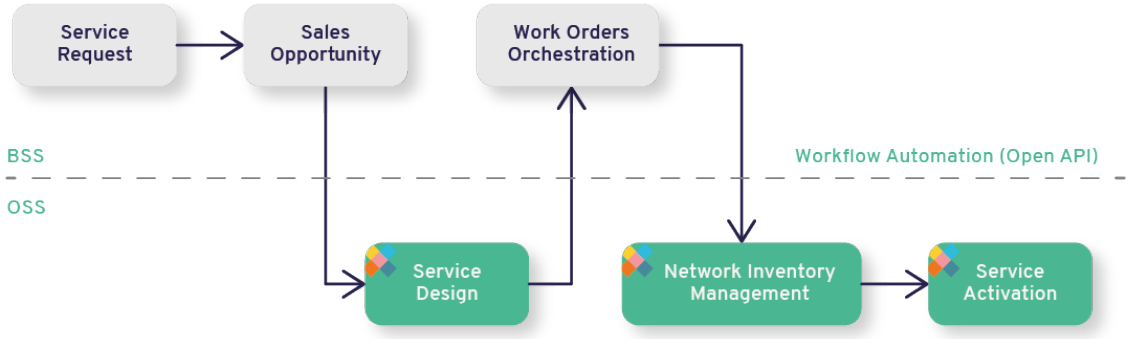


Figure 2. Supporting end-to-end provisioning workflows, from service request to activation

CROSS as an Active Inventory Model

Modern, virtualized networks present an increased prevalence of dynamic behaviors, resource allocation and usage patterns. Intent-based networking (IBN), policy management, software defined private networks / slices, iterative service models, self-optimization, dynamic re-routing, and other automations mean these networks are changing far more dynamically than the networks of the past.

This requires a more modern, active inventory model to be able to keep track of the current state of the network to support workflows for fulfilment (e.g., for resource allocation) and assurance (e.g., to understand current operational states and performance within the network). The daily network discovery cycles of the past are simply not regular enough to maintain an accurate account of the network's service or resource inventory.

The CROSS Inventory database consists of two main modelling / stitching rules and five core tables as well as TM Forum Open APIs for data sharing. This architecture provides flexibility, easier data integration / modelling and future-proofing as it supports any future device, topology, or technology without customization.

CROSS as a Data Bridge Model

The lightweight data model described previously, combined with comprehensive user functionality, allows CROSS Inventory to act as a "Data Bridge." It not only becomes the single source of truth for network inventory (and the other workflows that rely upon it) but it provides a tool-kit to collect and visualize information. From there, it also facilitates decision making and initiation of key processes.

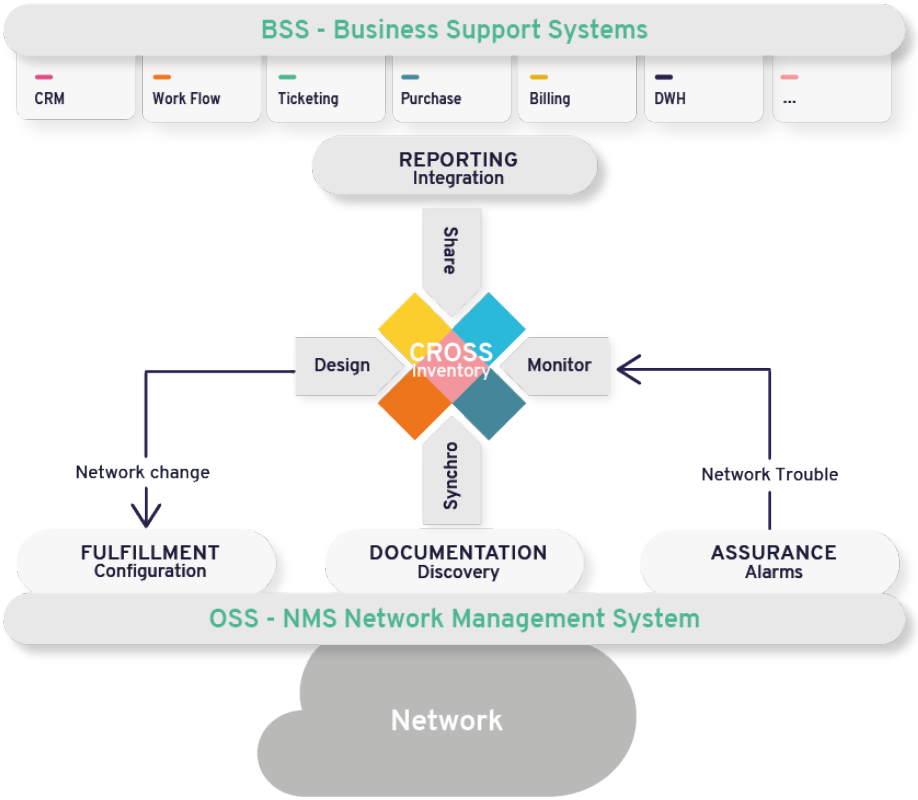


Figure 3. CROSS as an OSS/BSS data bridge

In a simple-to-use, browser interface, CROSS Inventory provides:

A common network model – discovering, consolidating, and stitching data from many sources to create a coherent, multi-domain data set that is easily worked with (e.g., actions, queries, visualization / presentation of data, etc.)

Single pane of glass – correlating technical, operational, and financial / commercial data in a single place to ensure easy access to all the metrics and levers that are important to a network operator

OSS/BSS toolkit – integrating functionality across planning, fulfillment, assurance, and revenue workflows to monitor, command and control network operations from a single console

The data bridge model lays the foundations for sophisticated next steps to be taken. It creates the platform for more advanced analytics practices to be established because the linkage between data and comprehensive query / visualization / presentation tools has already been established. This data bridge mode can also be particularly useful if operators are finding it challenging to plot a way forward with a complicated OSS / inventory transformation.

CROSS Inventory can operate harmoniously with other data sources, connecting and stitching data from existing probes and APIs. It can either continue to operate in this overseer role or can also take on more of a data master role, allowing other systems / sources to be more easily decommissioned.

CROSS as a data consolidation and reconciliation platform

CROSS's unique value add is that it fully integrates network layers to provide a true single source of truth. It achieves this through a process called cross-domain mapping whereby objects in different layers are connected in a fully coherent data model. What this means in practice is that the circuit schema, for example, shows a fully connected diagram with all the layers and elements involved in supporting that.

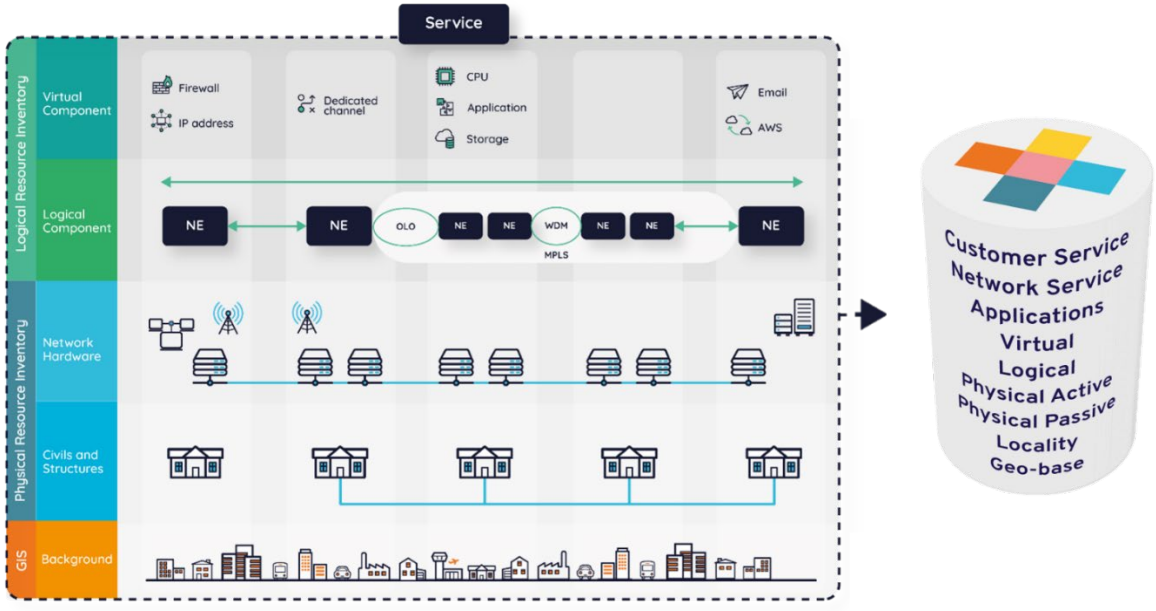


Figure 4. Consolidating network and service layers into a single source of truth

As the fulcrum around which all other OSS/BSS workflows pivot, inventory data integrity is essential. Yet this is a major cause of concern for most network operators around the world. CROSS Inventory has been designed to help solve this inventory data governance conundrum. Several novel techniques have been incorporated into CROSS Inventory for the express purpose of improving data integrity.

CROSS Inventory starts from a position of expecting that source data quality could be impaired – incorrect, incomplete, mismatched, stranded and more. Therefore, it ingests data as is, but provides confidence rankings of these data points. By flagging areas of concerns, it allows network operators to pinpoint actions such as audit, reconcile and remediate to ensure data quality is continually improving. Data quality monitoring and governance is not just a process or an algorithmic fix. It's built directly into CROSS Inventory.

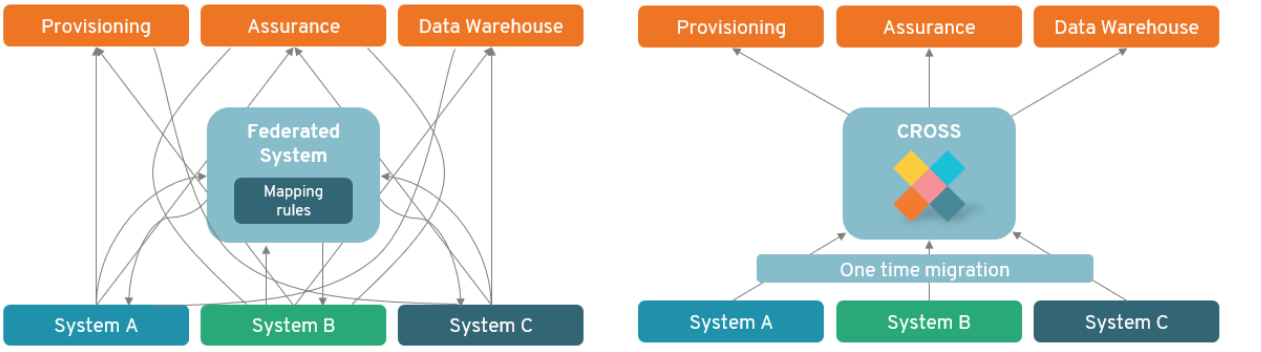
Federated vs Integrated Inventory

Each of the typical usage models described above has a dependency on a consistent set of data that can be relied upon by all inventory data consumers. CROSS Inventory uses a unique approach to facilitating coherent data when compared with other Inventory solutions. Other solutions seek to ***federate*** data – providing links to and correlations between primary data sources. This means data can be cached and fetched from other sources, often with any data errors in the underlying systems.

By comparison, CROSS Inventory seeks to ***integrate*** data – ingesting and connecting all data whilst also providing a data governance layer as described in the previous section. The integration / governance approach seeks to highlight

and detect any errors / omissions whilst synchronizing data with primary sources. These inconsistencies can then be used to improve the quality of data in the originating solutions.

It does so by providing a platform for more sophisticated transformations to proceed, because CROSS Inventory untangles integration complexity, as seen in the following diagram.



All systems stay as a master database, including data quality and cost.

Each system can be read once and decommissioned or stay as a master database and be used to regularly incrementally update CROSS.

Figure 5. CROSS integration vs federation

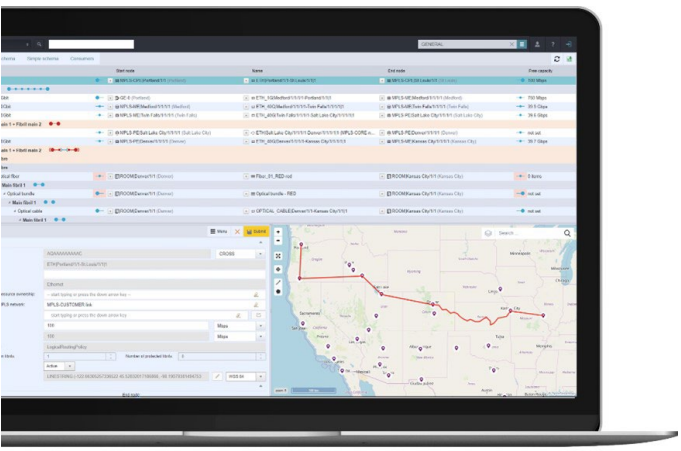
Proceeding from a position of confidence

Service providers are faced with many challenges stemming from their inventory solutions today:

- Complex architectures and data dependencies make the thought of transformation to the future-state inventory they know they need an absolute nightmare
- Keeping data quality levels high enough for the whole solution to be relied upon is a constant struggle
- Network technologies are evolving at a seemingly exponential pace, so the next iteration of inventory solution must be adaptable and scalable enough to last well into the future
- The competition is constantly striving to deliver better, faster, more reliable offerings to market to steal away market share. Complex and inflexible OSS/BSS models, with inventory at their core, slow down the time to market and stymie efficient, profitable operations

CROSS Inventory is designed to specifically overcome these challenges. Not only does it incorporate the ten primary considerations of next-generation inventory solutions below, but it also becomes a cornerstone for unlocking more advanced OSS/BSS transformation objectives:

1. Scalability
2. Utilisation
3. Flexibility
4. Reliability
5. Insightful
6. Security
7. Coherent
8. Autonomy
9. Enriched / Contextualized
10. Cost Saving



CROSS Inventory provides the foundation from which telecoms can proceed to a future state that delivers:

- A shorter time to plan
- A shorter time to deliver
- A shorter time to fix
- A shorter time to reliable revenue turn-on
- And a seamless insight-generation pipeline that helps to continually improve planning, delivery, fixes, and revenue / profitability

To find out more about how CROSS Inventory can improve your operations, please visit www.cross-ni.com or contact us at info@cross-ni.com to book an initial consultation.