What do YOU NEED

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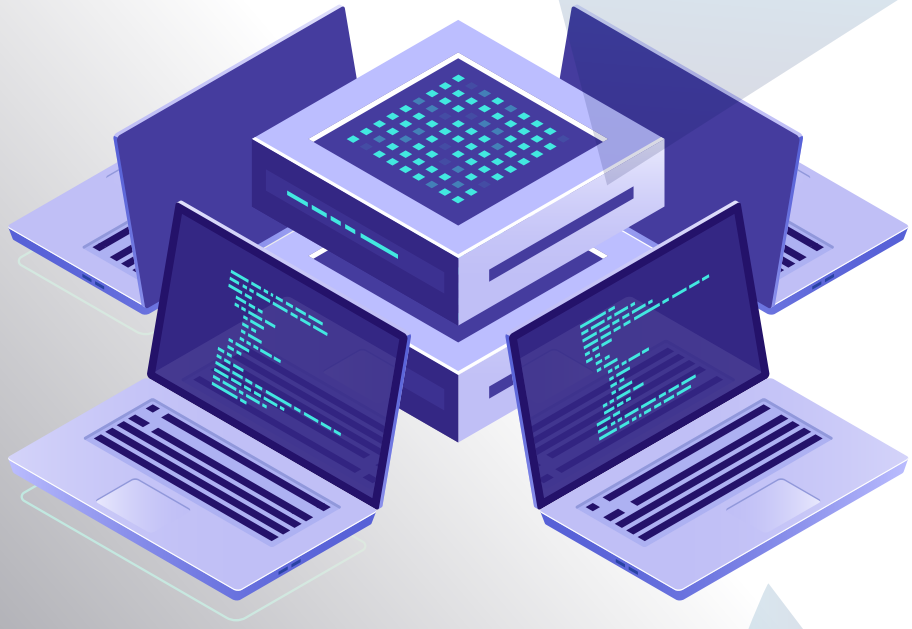

to build an Intent-Based Solution?

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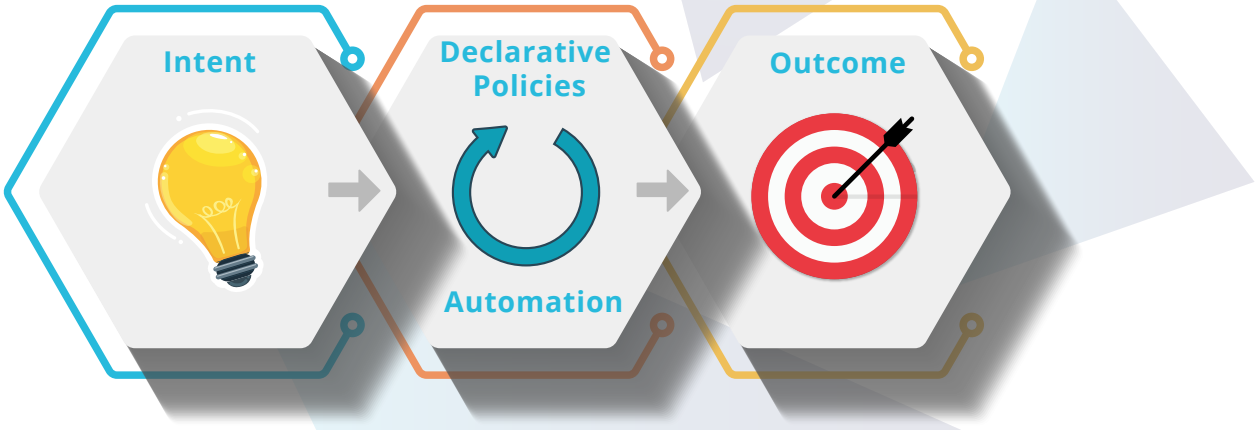
What is an Intent-Based Networking Solution?

Network automation is broken today. In the past, organizations have built numerous scripts and manual workflows to keep networks up, but with the imminent demand on the horizon from IoT, 5G, Edge Computing along with increasing cyber security threats, a new and radical approach to automating network operations is required.

Lately, the buzz about Intent-based networking or IBN is on the rise. A multitude of vendors are making claims regarding how Intent-based Networking will manifest itself. IBN is expected to make monitoring and management of existing complex IT networks simple as well as reduce human errors and self heal.. IBN should also accelerate the path to digital transformation and enhance customer experience.

IBN starts with an Intent. But what is an Intent? Simply put, intent can be defined as the benefit one expects to receive from the network. An example of Intent could be - “Payroll app should work without downtime.” IBNS will assess and evaluate the intent and, after multiple levels of translations, will break it down to the appropriate device command level and ascertain that the intent is never violated.

Initially, the intent definition will have to be granular and the example above may not be technologically feasible. However, as IBN matures and with the infusion of Artificial Intelligence (AI) and Machine Learning (ML) , defining intents will simplify considerably.



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Benefits of IBN over traditional solutions

IBN promises to eliminate all of the hassles of traditional solutions such as script upkeep, scale limitations, version incompatibilities, long lead times for learning, as well as islands of automation. Also, IBN ensures the following benefits:

1. **Deploy services with speed & agility -** One of the critical features of IBNS is how it translates the abstract language from NetOps into vendor specific commands. It helps to accelerate network fulfillment timelines by a huge margin through design & operational agility of the NetOps teams by eliminating manual intervention.

2. **Take control -** Based on the NetOps defined intent, a network aware IBNS determines the best way to implement the intent across the network, maximizing NetOps ability to control the network.

3. **Improve consistency -** IBN makes network management more predictable. Unlike manual interpretation, which varies over time, IBN acts on behalf of the network consistently each time intent is realized.

4. **Reduce operating expenses –** Realize significant improvement in operational efficiency & reduction in OpEx. NetOps will also experience efficiencies in time spent on design, implementation, testing, and troubleshooting.

5. **Enhance employee productivity & morale -** Reduction in time and effort required to manage a network translates into more time for employees to focus on value-added innovations that bring improved agility and productivity to their lines of businesses.

6. **Continuous compliance & service assurance -** Round-the-clock compliance and automated service assurance are realized that result in a reduction in errors, faster threat detection, less time spent on troubleshooting, and thus improved network uptime.

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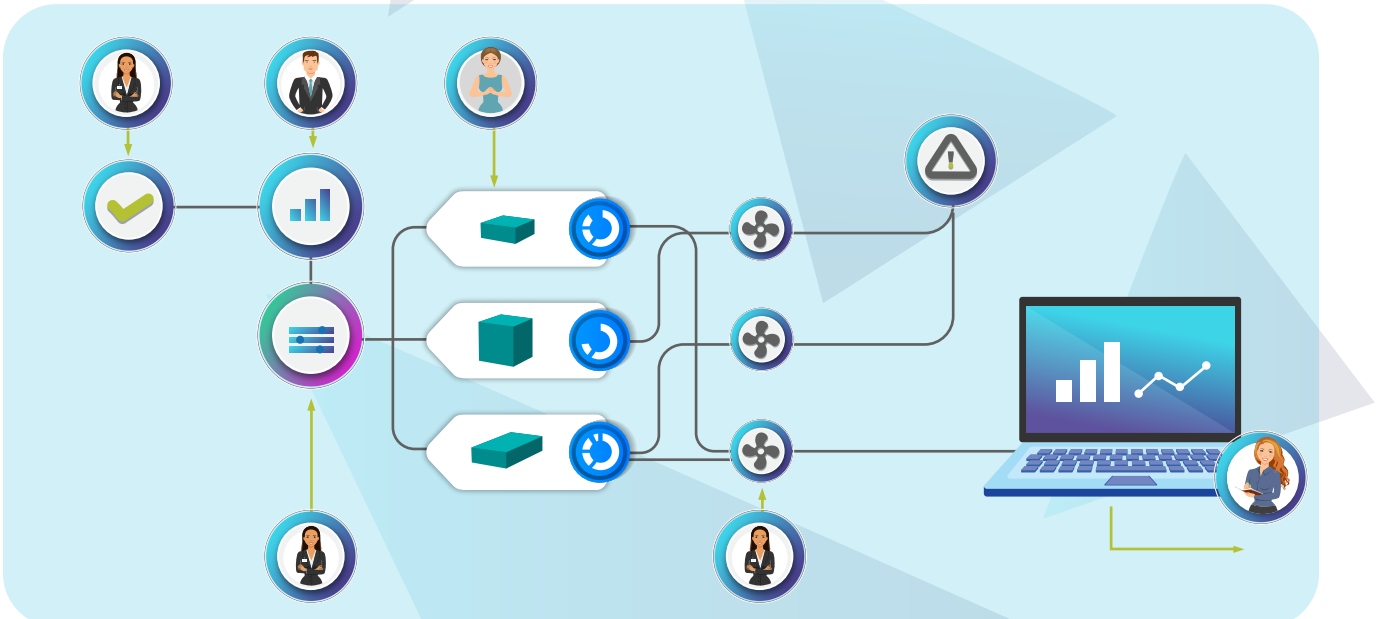
Essential Elements of an IBN solution

Low code designer and **Workflow utility**

Low code automation is a programming environment for application software creation using graphical user interface (GUI) and configuration tools instead of computer programming. The intent Based solution starts by defining an Intent. An intuitive graphical user interface to design, deploy and execute simple or complicated network operations is also imperative to an optimized IBN solution. The low-code or even a no-code design allows administrators to configure pre-checks, post-checks and approval flow to express the intent.



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A solid IBN solution is not limited to device and service automation. It must also automate the entire method of procedures (MOPs). MOPs include not only network operations but also business processes such as approval flows, operation sequence, and time of day executions. A low code designer utility should also enable. administrators and architects to incorporate all these various features and result in an end-to-end business policy.

Low code frameworks must integrate with northbound entities such as ticketing, billing, and ITSM solutions like Service Now, BMC Remedy, Jira, etc. and southbound entities such as devices, SDN/SD WAN controllers and cloud technologies such as AWS, GCP. An optimal low-code framework leverages exhaustive open APIs to integrate with any north or southbound elements. The framework should also be bi-directional so that it can be triggered by the operator or via the alerts from the infrastructure.

Configuration & Compliance **Management**

The first step to a successful IBN implementation starts with taking an inventory of the existing network infrastructure. The automation plan should capture the latest configuration and operational metrics of the devices. Without valid real-time configuration information, all policies and intent will be ineffective and could be dangerous to overall network operations. Unfortunately, today's networks involve devices from multiple vendors, each with their own syntax, CLI, or API. Therefore, the first challenge for any IBN system is to unify the configuration from various devices and present a consolidated view to the administrator. Furthermore, it should facilitate the comparison of multiple versions of the configuration for auditing and backup purposes. Version control, Abstraction, Config Diff, Config Export, and Archival are some of the essential requirements of any IBN system.

Software Configuration Management

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Beyond the initial configuration, an IBN must ensure device configuration matches the intended policy on a continuous basis. All device configurations must be reconciled with corporate standards, and any violations need to be flagged for visibility purposes. For example, if a router has a weak password, or if someone opened a questionable port in a firewall rule or if some device has an incorrect NTP server, the IBN should immediately flag the violation. Furthermore, it should be simple to remediate the violation. Without such compliance validations, the IBN solution cannot guarantee that the original intent will always be enforced.

Collection & Monitoring **framework**

Network Automation is comprised of multiple layers. On the surface, configuration management seems to be enough but a strong collection and monitoring framework is mandatory. Operational and performance data from multiple data sources such as SNMP, Streaming telemetry, SNMP traps, and syslog also provide deep insights into network behavior.

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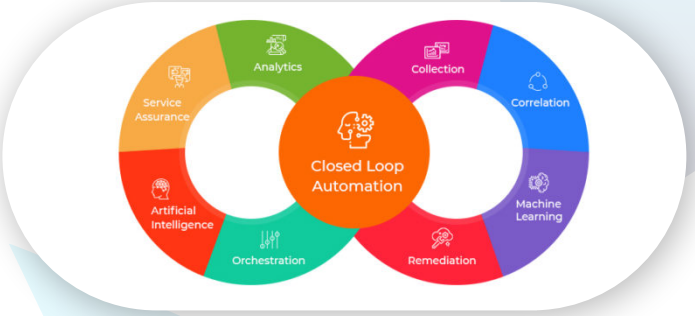
An effective collection engine ingests multiple data sets to provide a foundation for an effective monitoring framework. It allows NetOps teams to choose the right data source based on the network requirements such as latency and throughput. A modern stack with a provision to queue messages to meet any number of contingencies also helps to maintain high availability and ensures NetOps teams do not miss vital information.

The presentation of collected information is vital as well. A unified view of alarms, performance related data derived from multiple data sources offers NetOps teams with a single-pane-of-glass to meet all their monitoring requirements. An intuitive and customizable user interface with the dashboards providing insightful data at a region, network, device, and interface level details also offers NetOps an opportunity for initial triage to in-depth troubleshooting and remediation.

Closed-loop **Automation**

Enforcement of policies and ensuring a network's desired state is enabled by a closed-loop automation (CLA) framework. Traditional automation solutions act on only initial inputs and do not consider network feedback. The administrator may have specialized tools to monitor the network and receive issue alerts. However, the typical response to alerting is manual, which not only causes delays in action but also introduces human error.



MULTI-VENDOR NETWORK INFRASTRUCTURE

Datacenter | Enterprise | Cloud | Branch/Campus | Service Provider

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Closed-loop automation bridges this gap. CLA continuously receives feedback from the network and takes appropriate remediation actions automatically. CLA works in conjunction with the collection and monitoring framework. The monitoring framework provides real time metrics indicating the state of the network to CLA. CLA compares the current state to the desired state and takes the appropriate action automatically.

E.g., say a policy is defined which prescribes that CPU of any device should not exceed 70%. CLA will continuously receive feedback from the collection and monitoring framework on current CPU utilization of all devices. If any device exceeds the set baseline behavior, CLA will trigger remediation actions – such as blocking a particular port or redirecting traffic to another network - automatically.

CLA is an essential component of intent-based networking. To continually enforce the policy defined by the intent, any viable IBN solution must have a powerful CLA at its core.

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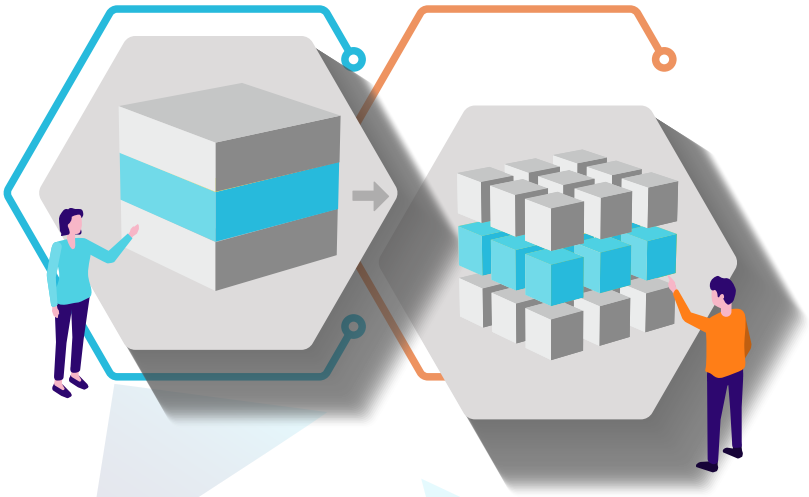
Horizontally **Scalability**

Networks today are challenged by the latest breaking technologies such as 5G and IoT that are poised to accelerate digital transformation. Organizations are also wanting to improve service velocity but are struggling to do so due to the scale and the cost of manual changes to implement service offerings, from installing & provisioning of new network equipment to upgrading existing ones.



To keep up with the demand, networks must scale faster. Monolithic network automation software fails to meet this growing demand from the network based on its inherent architectural challenges. An IBNS platform therefore should have the capability to scale horizontally to match the breadth of any network.

A modern software stack packed into a microservices architecture allows each feature within the IBNS to have its own lifecycle so that it can be upgraded without affecting other functions and can scale independently. A distributed architecture leveraging cloud-native technologies also helps in the placement of IBNS modules closer to the target networks addressing remote site use cases without latency issues.

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Multi-vendor and multi-entity **Communications**

Whether intentional or accidental, the typical network infrastructure is a multi-vendor environment. While some organizations try to standardize on one vendor, they often end up with at least 3 or 4 vendors due to business or technical needs. Multi-vendor also avoids vendor lock-in and results in Capex savings. However, multi-vendor networks can kill network automation aspirations unless a robust IBN solution is implemented that can support various attributes such as CLI, NETCONF, API, REST CONF, and YANG models.

Besides efficient provisioning, IBN must be proficient at collecting operational metrics using other formats such as SNMP, SNMP Traps, Syslog, sFlow, NetFlow as well as Streaming Telemetry. Many homegrown automation tools support a subset of vendors and formats, resulting in islands of automation that are difficult to sustain. Subsequently, a robust IBN solution must support legacy vendors as well as new vendors to support agility and improved productivity.

Devops/Netops **Culture**

IBN solution is big and complicated. Organizations will have to leverage open source solutions and may even need to custom build a few elements in-house. They may also need to procure third party tools and libraries. Integrating all these varied components into a single seamless, scalable solution coupled with periodic maintenance and upgrades, require significant devops activities.

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IBN use cases change over time as the products and markets mature. Use cases developed during inception will soon be outdated. New protocols, procedures, and interfaces require regular upkeep and constant code modifications. A more practical solution is to build models and templates that can be enhanced and extended to suit business requirements as and when they change.

Organizations with a strong devops culture are bound to have an edge. A rich devops culture is essential to respond quickly to ever-changing market dynamics.

How much time will it take to build an **IBN SOLUTION?**

An IBN solution must harmonize overall network functionality.. The amount of time it takes to develop a fully functional IBN solution is also dependent on an organizations comfort with automation, business interests, and DevOps culture. The profiles below offer some guidance on possible scenarios based on an enterprise's automation journey.

Beginner

A network has minimal automation - either because there are very few devices to manage or there is a strong team of network engineers and established predefined methods of procedures. There may also be just a few siloed automation instances, which might be comprised of Ansible, Chef or Puppet aimed at automating simple tasks such as configuration management. Typically in this environment, the existence of automation is primarily designed to eliminate tedious command-line configurations.

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If a customer is at this stage, IBN is a long journey. The first step is to build a good DevOps team with diverse skill sets. Building an IBN solution also requires expertise in scripting on various platforms, database management, performance monitoring, and troubleshooting.. The initial goal should be to develop a centralized interface to locate and view all networks and resources within the organization. The centralized interface can subsequently be enhanced to display essential device alerts and notifications.. The next steps are to add analytics engine for monitoring, assurance engine for compliance, workflow engine, closed-loop automation engine and finally the IBN engine. This long path to an IBN solution typically takes 2-3 years to deploy.

Intermediate

At this stage, a slightly sophisticated automation environment might be in place.

Using Netbox and other apt tools, one can manage to a single source of truth and realize some degree of device configuration management, enforcement of some compliance policies, and simplification of device onboarding within an automation framework. One might also realize some partially automated software image device upgradability.

DevOps may be in an implementation phase, and an administrative team might be well versed with scripting technologies. However, moving to IBN solution would still require a considerable effort. These challenges will only get tougher. Enhancing the platform and maintaining an IBN solution requires significantly more human and monetary resources, and . management has to be highly committed to this activity.

These monitoring and provisioning frameworks need to be advanced enough to enable faster monitoring with better data retention and analysis capabilities. The framework also needs to be upgraded with low code automation to define network baseline behavior easily. Closed-loop automation has to be incorporated to take remediation actions based on feedback from the network. The final required element is to overlay the IBN engine.

The process can realistically require 15 to 18 months to deploy.

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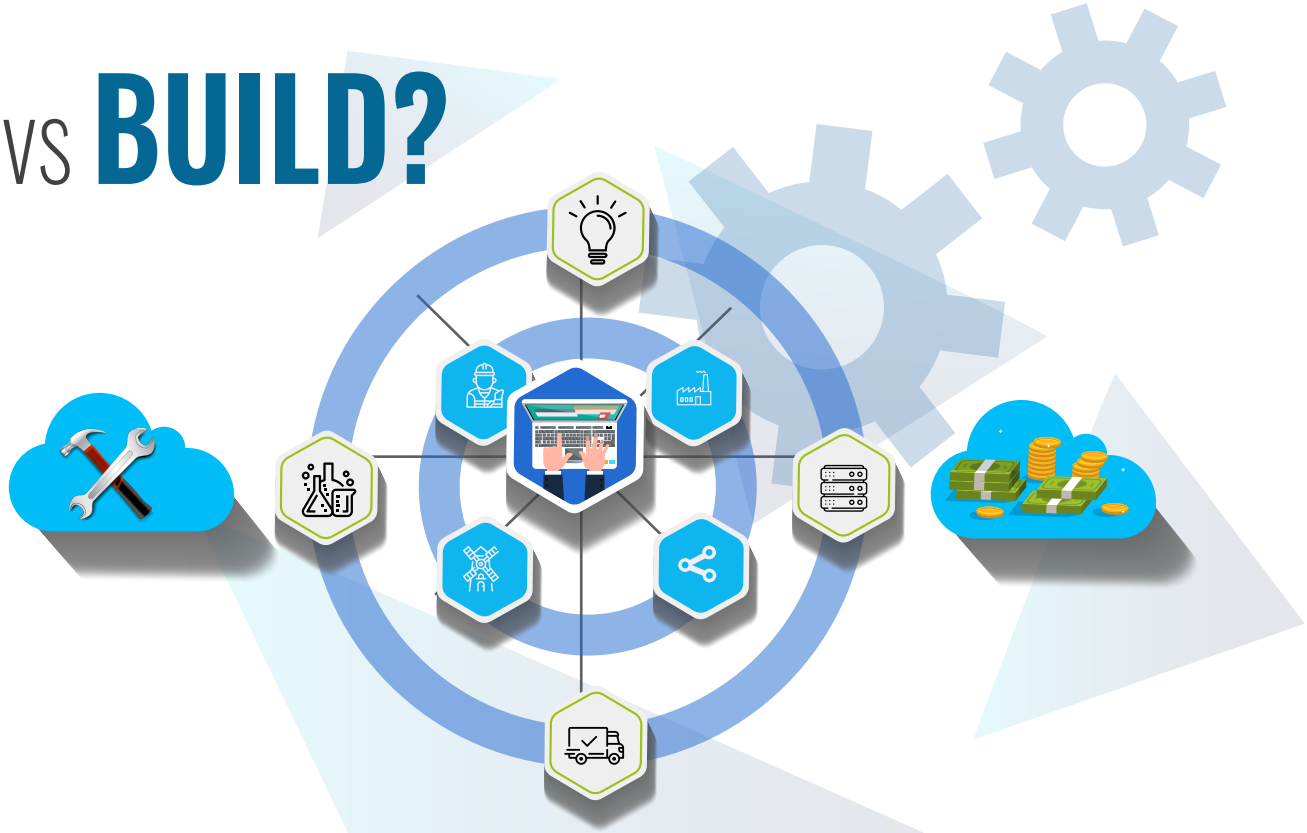
Expert

The typical framework- which already has the capability to monitor and collect tens and hundreds of devices – is now hardened enough to display device information, as well as alert and notify issues. The entire automation platform at this stage is typically is customizable through APIs and extensible through SDKs. One can now integrate the platform with any ticketing/billing/ITSM solutions such as ServiceNow, Jira, or BMC ready.

An automation platform of this scale demonstrates the commitment of an organization towards realizing the development and maintenance of an advanced platform.

However, the next challenge is to stitch together the various components and create a closed-loop automation framework. An advanced CLA framework coupled with the low-code designer will form a steppingstone to an IBN solution. At this level, one should be able to develop and deploy a functional l IBN solution in 6 to 9 months.

Buy vs **BUILD?**



Should You Build or Buy A Network Automation Solution?

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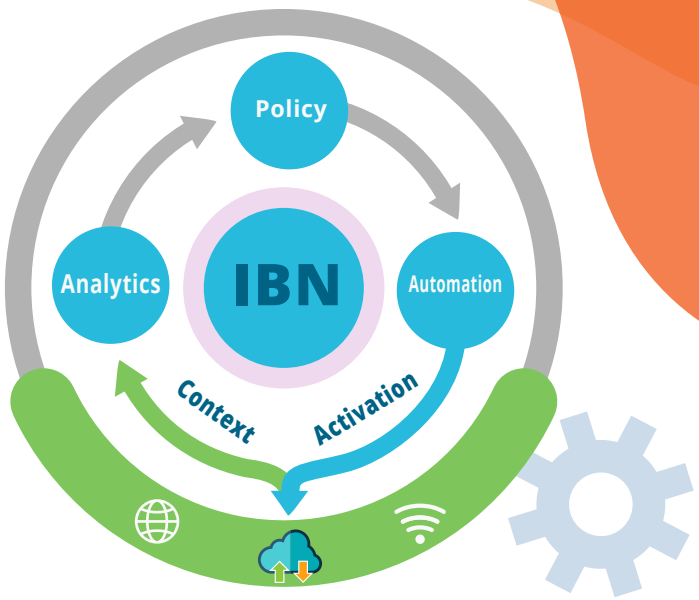
IBN solutions are quite complex. Planning, designing, developing, and maintaining such a solution requires significant investments in time and resources. It also requires a team with expertise in a wide variety of skills and technologies. Although the initial path to automation is easy, it's much more complicated to enhance and maintain an automation framework.

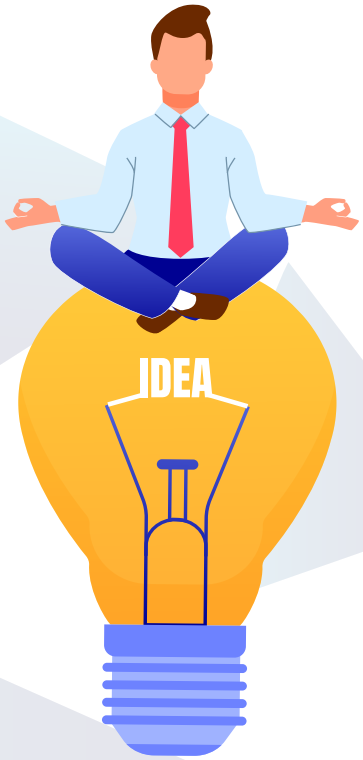


When is developing an IBN SOLUTION BETTER?

There are a few scenarios to consider in developing a solution in-house versus a purchase from a vendor.

Presence of an advanced automation framework.

If one already has an advanced automation framework at the aforementioned expert level with a considerable amount of resources invested, then it likely makes more sense to add incremental resources to advance the platform to an IBN solution.



Small Single vendor network

If one is not very advanced in the automation journey, but the network is relatively small (50 or less devices) and single vendor then it might make sense to develop an IBN solution organically.

Organizational Policy

Some organizations managing highly sensitive information may not want to install any solutions from external vendors. In this case, there may be no other alternatives than to develop an IBN solution in-house regardless of complexity level.

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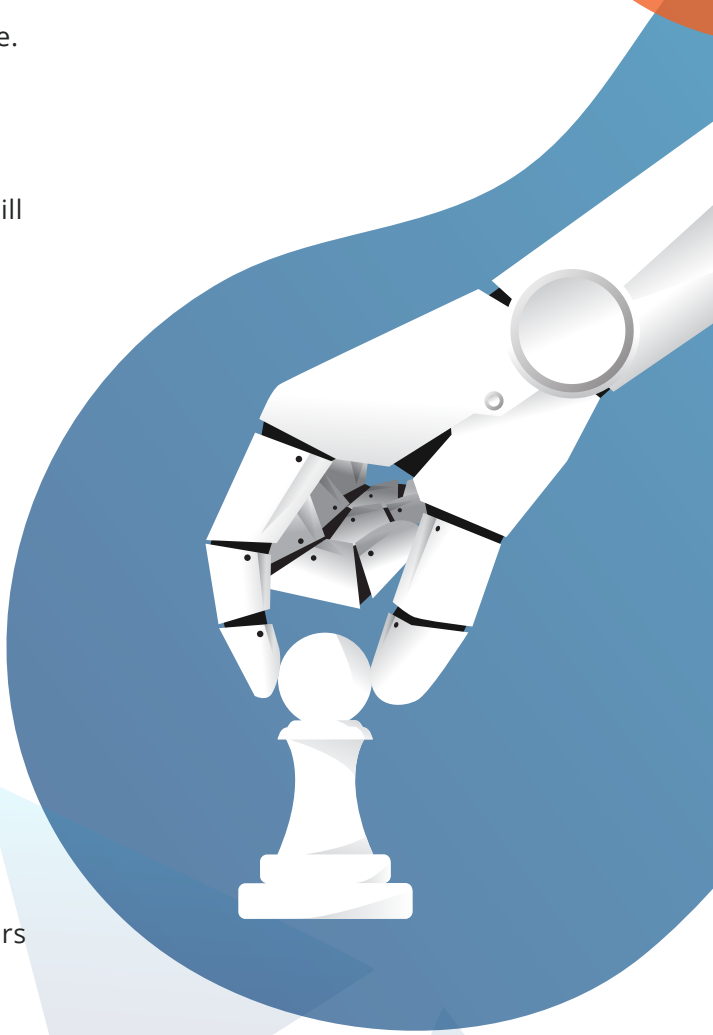
When is procuring an IBN SOLUTION BETTER?

Most organizations may not have the skill or resources to develop an IBN solution in-house. In this case, procuring one from an external vendor is a more logical choice.

Current Automation is too basic

For organizations that did not have automation as a priority will have a very basic automation framework in place. Most activities are still executed manually. For such Organizations, developing an advanced IBN solution is an uphill task. Procuring the solution and services from an external vendor is a saner choice.



Multi-vendor large network

Defining policies and managing a large network (100+ devices) with a multi-vendor configuration is a complicated exercise. Developing and maintaining an IBN solution in this scenario will more than likely overburden network administrators. Subsequently, outsourcing network automation to a third-party vendor will allow network operators to focus on more value-added activities.

Frequently changing use cases

Use cases often change due to the market pressures and varying organizational focus. Resulting frequent modifications tend to burden network administrators. An IBN solution managed by external vendor will likely alleviate these pressures.

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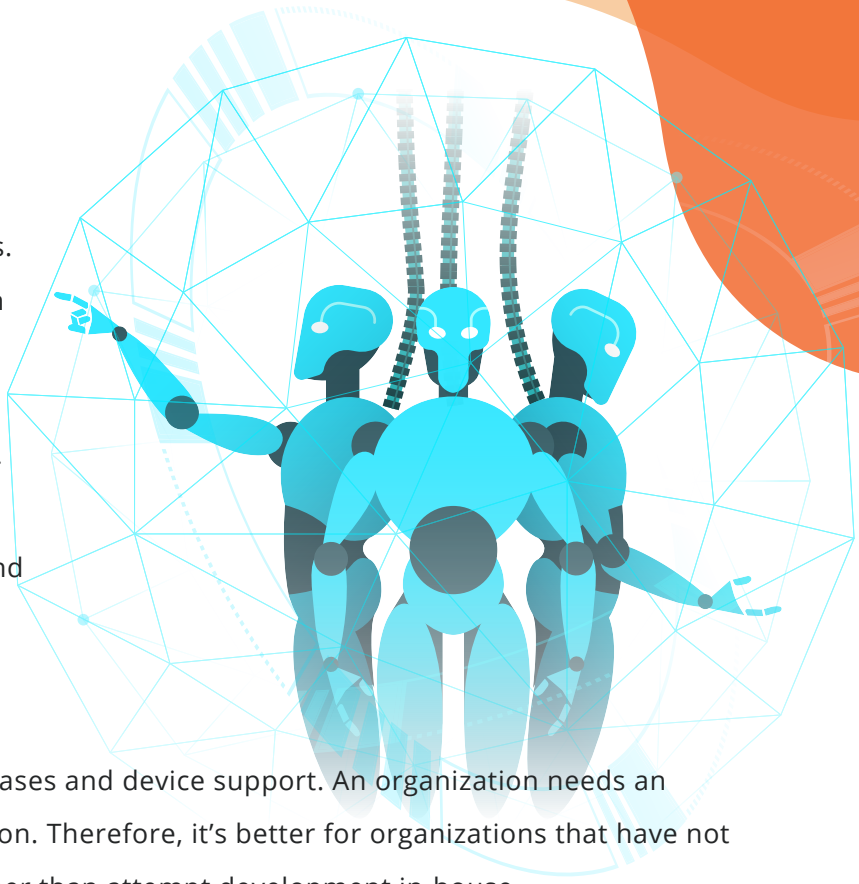
Strict Compliance requirements

Some industries such as finance and healthcare have to adhere to stringent compliance regulations. Any violation could potentially put the organization in jeopardy. IBN solutions play a valuable role in monitoring, alerting and remediating non-compliance. Organizations with strict compliance requirements are better off engaging an external vendor with the required skills and expertise to develop and maintain an IBN solution.



Missing Devops Culture

IBN solutions require frequent alignment to use cases and device support. An organization needs an established DevOps team to manage its IBN solution. Therefore, it's better for organizations that have not invested in DevOps to procure an IBN solution rather than attempt development in-house.

What to look for while buying IBN SOLUTION

If procuring an IBN solution from an external vendor appears to be a better option , then one should consider a solution that has the below features.

Integration with multi-vendor and many types of entities.

When a network grows , it typically consists of many multi-vendor and multi-domain devices. Devices will vary in features and capabilities. An IBN solution works effectively only if it can encompass all devices on the network. Subsequently, it should leverage APIs to integrate with any type of network element - ITSM, OSS/BSS, or traditional switches routers and firewalls.

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Diverse data collection capabilities

Monitoring and collection is an essential feature of any IBN solution. Therefore, any IBN solution must have network drivers to ingest data from a variety of sources such as SNMP, SNMP trap, Syslog, or Telemetry. The resulting IBN solution should be able to normalize and correlate the massive amount of data to provide appropriate feedback to the closed-loop automation framework.

Easy Intent development interface

The first step of an IBN solution is defining an intent. The usefulness and efficacy of any IBN solution depends on the ease of developing intent. A graphical low-code framework helps users to fine-tune intent definitions to the organization's requirements.

Rich support of programming languages

Out of the box, IBN solutions are not one size fits all. Organizations must develop various expressions and conditions as well as define actions to tie together multiple data and network entities . Subsequently, an IBN should be flexible enough to integrate with existing Java, Python, Perl, and Ansible scripts.

A framework to audit intent

An IBN is expected to perform many tasks automatically. An essential logging and reporting framework should exist to better comprehend the system and maintenance requirements.

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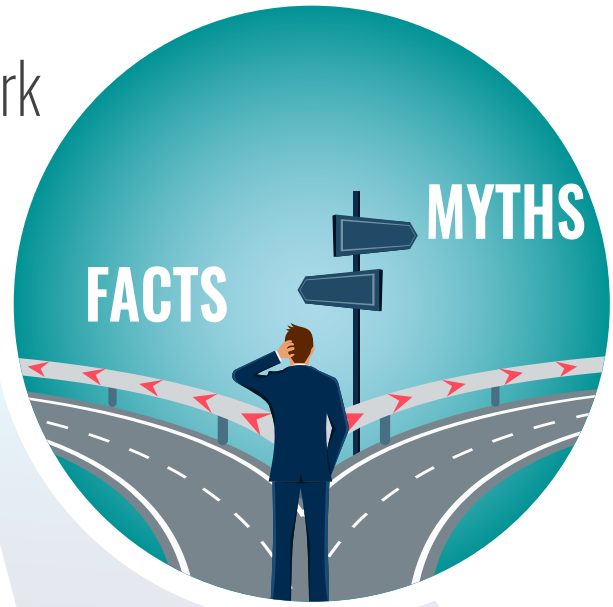
Horizontally scalable platform

An IBN should encompass the entire network and enable a single source of truth. Siloed networks will lead to fragmentation and fragmentedpolicy definitions. Thus, any IBN solution must be scalable to cover all devices on the network and enforce uniform policies.

Common **IBN MYTHS**

IBN can only work in a single vendor network

IBN can be implemented in a single or a multi-vendor network. The development of IBN could potentially start by deploying on a single vendor and then spread to the entire network with multi-vendor devices. The better the scalability,, the more effective an IBN solution.



IBN will eliminate many network operator jobs

IBN, like many automation solutions, actually elevates the importance of network operators. Instead of focusing on day to day troubleshooting activities, administrators now have the opportunity to spend time on more meaningful higher-level tasks such as defining policies or application support.

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IBN won't happen for another ten years

IBN is already here!. IBN based products are available and although t. immature, it's only a matter of time before IBN is widely accepted as an industry standard.

IBN is analogous to AI/ML

AI/ML complements IBN. AI/ML can play a crucial role at every stage as the business intent is translated to device level constructs. However, even in the absence of AI/ML,IBN solutions deliver valuable ROI to business by eliminating tedious, manual processes and automating troubleshooting.

IBN is very difficult to implement in large-scale networks

On the contrary, IBN is optimized for large networks. Uniform policies across all devices in large-scale networks can absolutely be achieved using IBN.

IBN creates a single point of failure in the network

In scenarios where IBN solutions don't support high availability and disaster recovery this could be the case. However, most production ready IBN solutions contain HA/DR features, and therefore failure is not a concern.

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Start planning your **NETWORK TODAY!**

A comprehensive IBN solution can be a significant undertaking.

If one is early in the automation journey, they will have to comprehend many of the advanced concepts and technologies that IBN requires for a successful deployment. Subsequently, a considerable amount of time in executing PoCs and dry runs with external vendors will be required. Planning requirements and evaluating vendors that suit an organization's particular needs will take significant effort. Starting early will put one in a proactive position.