outshift by CISCO

Driving autonomous network operations

How Swisscom and Outshift by Cisco are redefining network reliability with AI agents

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Contents

Executive summary

The telecommunications industry stands at a pivotal moment where traditional network operations must evolve to meet the demands of an increasingly complex digital landscape. This complexity often leads to significant business impacts when network misconfigurations occur during change management workflows. According to Gartner, over 80% of network problems are due to improper configuration and change management issues, which results in unplanned downtime. Globally, Splunk and Oxford Economics estimate that downtime costs organizations over $400B annually in lost productivity, revenue, and recovery efforts.

Addressing this problem is the crux of the collaboration between Swisscom, Switzerland's largest telecom provider with over 6 million mobile customers and 10,000 antenna sites, and Outshift, Cisco's incubation engine. Together the teams worked to transform network change management from reactive to predictive, and to redefine customer experiences.

Through an intensive process, our teams demonstrated that the dream of autonomous network operations is not a distant vision but an achievable reality. By leveraging AI agents, knowledge graphs, and network digital twins (NDT), we successfully recreated and prevented a real-world network outage that had previously impacted Swisscom's customers.

The results prove that organizations can significantly reduce change-induced outages, accelerate service rollouts, and decrease operational costs while building more intelligent, resilient, and agile networks for the future.

Building the blueprint for autonomous networks: A real-world use case

A fully autonomous network that can predict failures and implement changes with minimal human intervention has long been the North Star goal for telecom and service providers. It's a vision that promises reliability, agility, and efficiency at unprecedented scale.

We're now excited to share a use case that demonstrates how this future is being built right now. Since we announced our partnership earlier this year, our engineering and product teams have collaborated to demonstrate a fundamental shift in how network operations can be managed to redefine the change management workflow.

Using a real-world network outage, **Swisscom**, in collaboration with Outshift by Cisco, created a blueprint for an autonomous future.

The vision and the challenge: Striving for perfection in a complex world

As one of the first providers in Europe to launch a nationwide 5G network, Swisscom has always been recognized for its forward-thinking approach to technology and innovation within telecommunications. So, it is no surprise that the leadership team has set a clear and ambitious vision to evolve their network operations from a reactive, human-centric model to an AI-assisted framework and, ultimately, achieve autonomous operations.

They recognize that in an increasingly complex digital landscape, relying solely on manual processes and traditional automation no longer meets the demands of the market – or

benefits their customers fully.

Like many things in life, however, this is easier said than done and bringing this vision to life comes with its own set of challenges.

The catalyst: Learning from failure

A recent Swisscom network service outage was the catalyst for our collaboration. Like any major service provider, Swisscom has a rigorous change management process, including a dedicated physical lab for pre-production testing. Yet, a seemingly routine configuration change, intended to optimize traffic routing, was pushed to production and resulted in an avoidable service disruption.

A post-mortem revealed two root causes that will be familiar to any senior network engineer:

1. **Incomplete test coverage**
   The test cases executed in the physical lab, while thorough by current standards, failed to account for a subtle, second order effect of the change on a dependent service.

2. **Misconfiguration**
   A discrepancy due to a missing copy of a redistribution route metric, resulted in a forwarding loop which created the perfect storm for failure that had an impact on customers.

This incident served as a reminder that, despite their value, physical labs are costly, slow to adapt, and can never perfectly replicate the complexity of a dynamic production environment. Swisscom realized that to achieve their autonomous vision, they needed a new approach that was predictive, comprehensive, and could operate at the speed and scale of their network. This is where the **Outshift Agentic Network Validator** entered the picture.

> "At first, I was skeptical about achieving tangible results due to the project's tight timeline and ambitious scope. However, my doubts were quickly dispelled. Outshift's Agentic Network Validator solution demonstrated its remarkable potential by analyzing real-world network changes, enabling it to predict and prevent errors before they occurred. This technology will change the way we operate networks, and the transformation will happen much more swiftly than I ever anticipated."
>
> — Martin Gysi, System Architect, Swisscom

The proof of concept: A bold proposal to turn hindsight into foresight

After a series of deep dive discussions where Swisscom shared their vision and the Outshift team detailed the architecture of the Agentic Network Validator, we charted a bold path forward. We proposed a four-month proof of concept designed to tackle the exact failure scenario Swisscom experienced. The goal was not just to simulate the problem, but to prove it could be systematically prevented.

Technical objectives

The technical objectives were clear and challenging:

1. **Create a true digital representation**
   The Outshift team would build a high-fidelity **network digital twin (NDT)** of Swisscom's production network. This involved creating a dynamic **network digital map (NDM)** built on a knowledge graph. The knowledge graph would be populated by ingesting real topology, state, and dependency data from Swisscom's production network data. We would then emulate the exact network state and configuration change that led to the original incident.

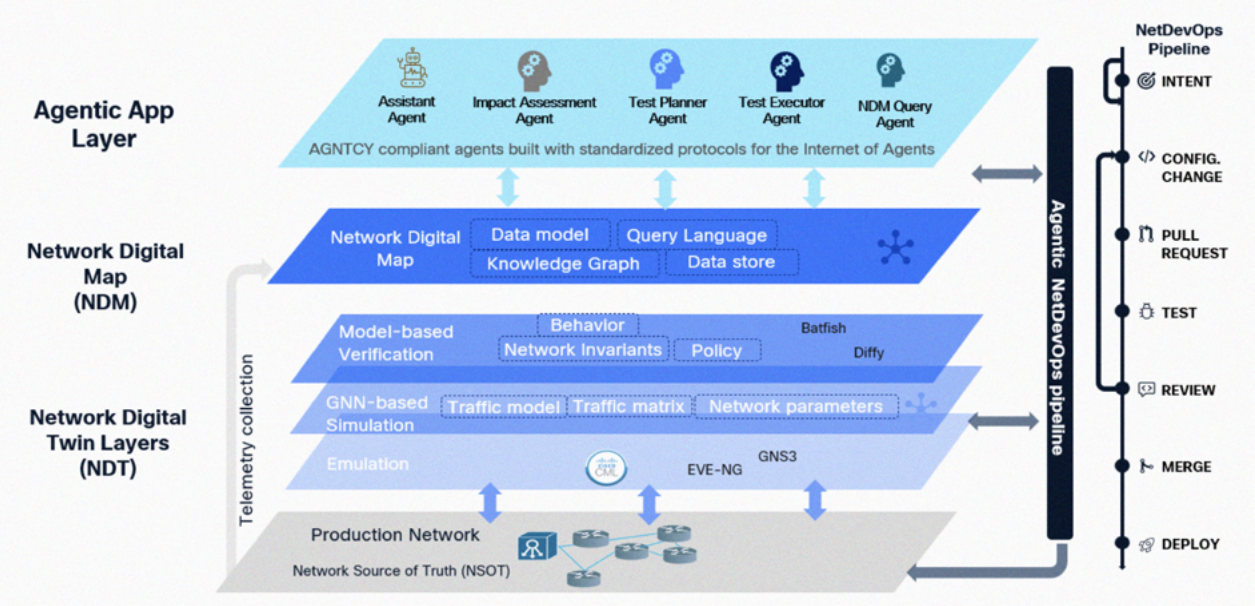
2. **Proactively detect the failure:**
   Using the NDT and NDM, the Outshift team had to prove that the system could detect the impending outage before it happened. This would validate that testing in a digital replica of the network, armed with formal verification tools, could prevent production failures.

3. **Showcase the power of a multi-agent system:**
   Following Outshift's established design principles for multi-agent interaction, we wanted to demonstrate how Swisscom's team could interact with the network through the Agentic Network Validator's natural language interface and its team of specialized AI agents. To do this, we had to show tangible outcomes across the entire change management lifecycle, from planning and assessment to execution and documentation. We also wanted to include standardized approaches for observability, using the observability components of the AGNTCY open source project, to capture the multi-agent system performance metrics.

Our Outshift engineering and product teams were energized by the challenge. In close partnership with Swisscom's experts, we embarked on the intensive sprint.

The architecture in action: A team of AI agents at work

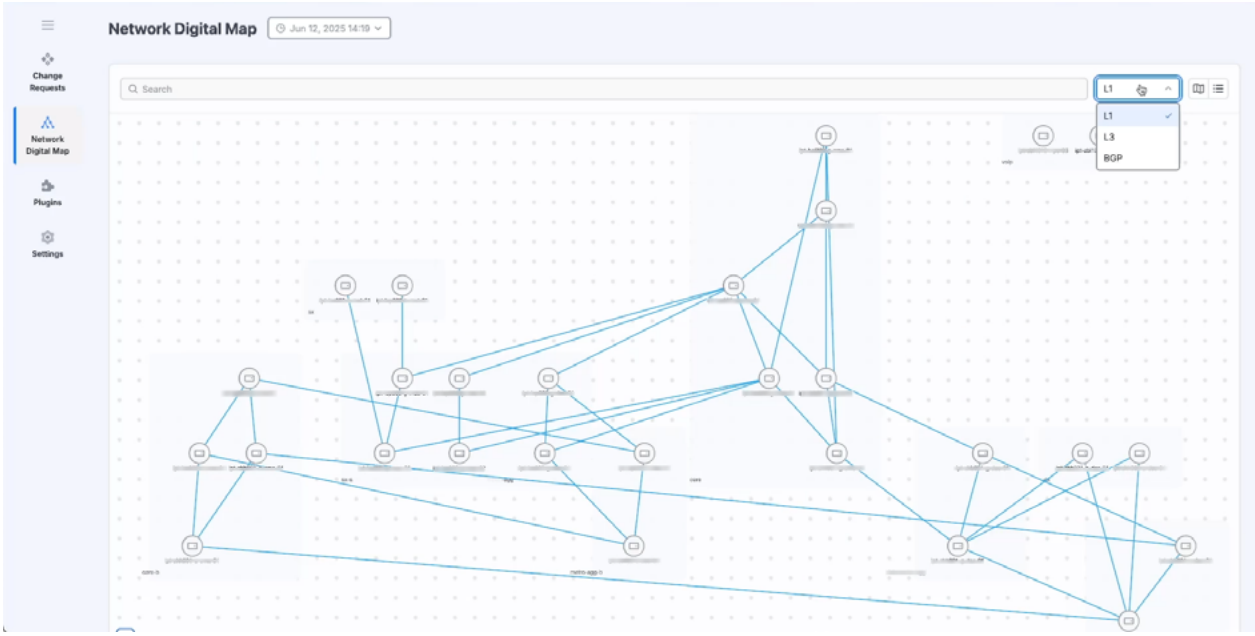
To understand how we achieved our goals, it's essential to look under the hood of the Outshift Agentic Network Validator architecture. This is a multi-agent system built with standardized AGNTCY protocols for the Internet of Agents (IoA). Through this architecture, different AI agents collaborate to solve complex change management and network update requests by using the Network Digital Twin to perform network change validation and testing.



Let's walk through the journey of the recent Swisscom change request, this time handled by the Agentic Network Validator.

The foundation: The knowledge graph and digital twin

First, we ingested data from Swisscom's inventory systems, configuration databases, and telemetry platforms, i.e. via the Network Service Orchestrator (NSO), into the Agentic Network Validator's knowledge graph. This created the network digital map (NDM) which captures not just devices and links, but also service dependencies, customer circuits, and a historical state. This NDM became the single source of truth and the foundation for the network digital twin.

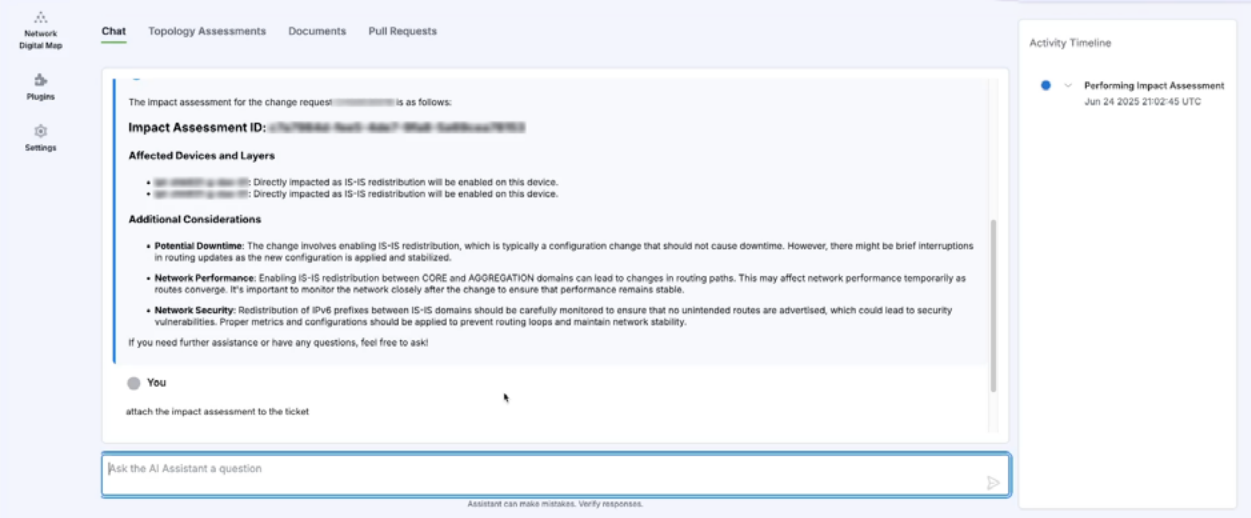


The workflow: A change request's journey to safety

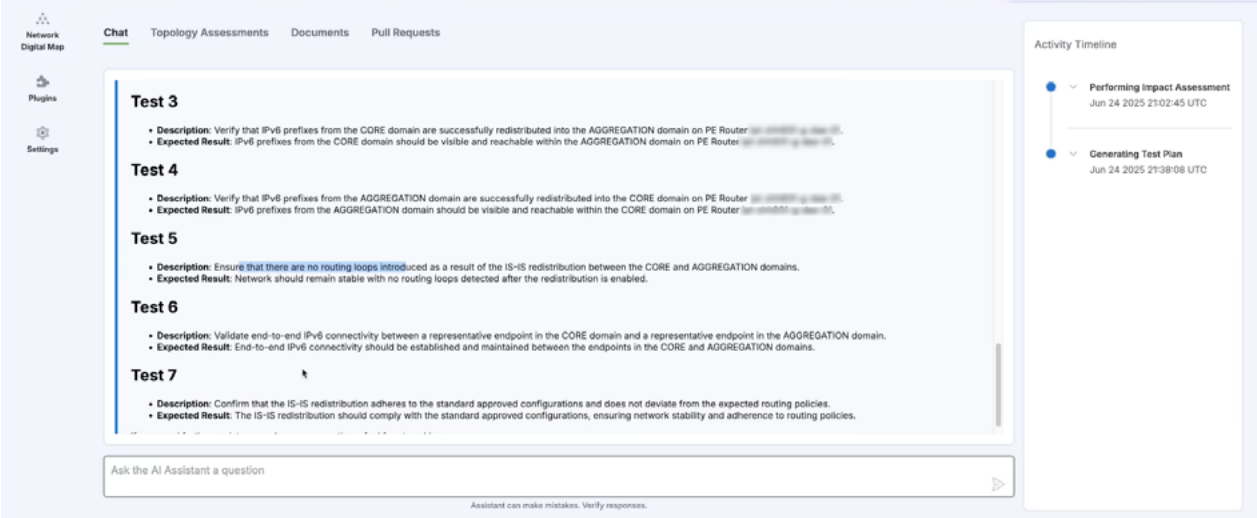
1. ### Workflow initiation
   The assistant agent/IT service management (ITSM) integration, enables a Swisscom engineer to initiate the process via a simple, natural language description in the ITSM tool that prompts the validator's assistant agent: "Submit a change to enable IS-IS redistribution between CORE and AGG domains on PE routers R1 and R2 as part of the approved network migration plan. Ticket: ITSM-CHG0030018." Note that this workflow initiation can also be done via a Git commit versus an ITSM tool.

2. ### Intent interpretation and orchestration
   The assistant agent, the system's orchestrator, immediately parses this request, understands the intent and links actions to the ITSM ticket for tracking and execution. It does this through a conversational chat interface which the user can also use to explore the network in addition to serving as a co-pilot for workflow tasks.

3. ### Impact assessment agent
   This agent doesn't just look at the two specified routers. It queries the NDM to understand every dependency connected to them to predict the blast radius, including non-obvious, second order effects such as affected devices, potential downtime, and network performance changes.



4. ### Generating Smarter tests: Test planner agent.
   This agent now creates a far more intelligent test plan. It doesn't just generate standard verification checks. It designs specific tests to validate the very risks identified by the impact assessor, with test descriptions and associated expected results.

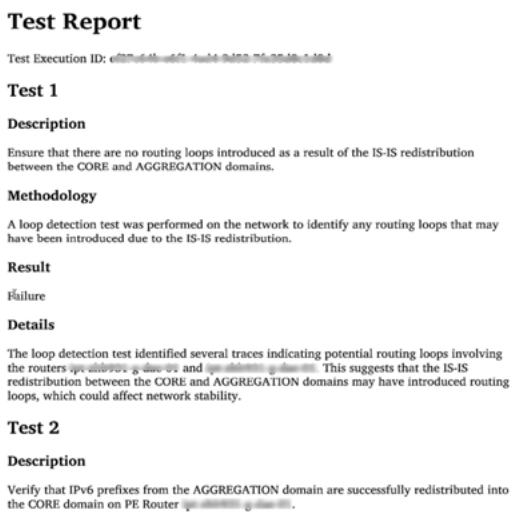


5. ## Smart execution in the digital twin

The test executor agent takes the test plan and recognizes that some tests require state verification while others might require performance simulation. It intelligently calls the right tools within the **NDT** to execute the test cases. It first analyzes the test plan and then forks a snapshot of the most recent version of the production network from the NDM. It then pulls in the configuration candidate from the specified location and computes the network snapshot with this configuration candidate in the NDT. By going through all the test cases recommended by the test planner agent, it uses a formal verification tool to prove the ISIS configuration is logically sound or otherwise show that a misconfiguration might result in a network failure. The execution steps are communicated transparently to the user via our agent activity feed, just like other prior workflow steps. At the end of the run, the agent formats a test report and attaches it to the ITSM ticket.

6. ## The verdict

The test results are definitive. The test executor reports back: "**FAILURE**."



Test Report

Test Execution ID:

Test 1

Description

Ensure that there are no routing loops introduced as a result of the IS-IS redistribution between the CORE and AGGREGATION domains.

Methodology

A loop detection test was performed on the network to identify any routing loops that may have been introduced due to the IS-IS redistribution.

Result

Failure

Details

The loop detection test identified several traces indicating potential routing loops involving the routers and . This suggests that the IS-IS redistribution between the CORE and AGGREGATION domains may have introduced routing loops, which could affect network stability.

Test 2

Description

Verify that IPv6 prefixes from the AGGREGATION domain are successfully redistributed into the CORE domain on PE Router .

7. ## Closing the loop

Due to the reported failure of the first test run the change candidate is fixed using the details provided in the test report as a guide and a rerun shows that all tests passed. The entire process from the initial query to the impact assessment analysis, the generated test plan, the execution logs, and the final failure/pass verdict is meticulously documented and linked to the ITSM ticket by the assistant agent. The stakeholders receive a clear, evidence backed implementation recommendation, and the outage is thus prevented using the Agentic Network Validator multi-agent and NDT solution.

The results: Proof of tangible business value

At the conclusion of the proof of concept, the results were clear. We had not only met all the technical objectives but had also provided proof points that aligned directly with Swisscom's strategic business goals.

We successfully demonstrated how the Outshift Agentic Network Validator multi-agent system could:

- **Enable real-time interaction:** Engineers can query network state and intent in natural language.
- **Integrate with existing tools:** The system seamlessly linked its workflow to Swisscom's ITSM.
- **Deliver comprehensive planning:** The assistant agent is able to break down complex intent into a clear, auditable set of tasks.
- **Generate higher quality test cases:** The system created context relevant tests that caught the failure condition missed by the previous manual process.
- **Accurately assess blast radius:** The impact assessment agent correctly identified potential hidden dependencies.
- **Use the right tool for the right job:** The executor agent intelligently selected between formal verification tools.
- **Provide a complete audit trail:** Every action and decision was automatically documented in the ITSM tool for compliance and analysis.

Business outcomes: Reducing outages, costs, and time to market

Most importantly, we translated these technical wins into tangible business outcomes. The proof of concept proved that the Agentic Network Validator can directly enable:

1. ### A meaningful reduction in change induced outages
   By identifying potential failures in the digital twin before they reach production, the platform provides a powerful safety net, directly protecting revenue and customer experience.

2. ### Accelerated service rollout
   An agentic approach with a human-in-the-loop (HITL) design provides NetOps oversight and a trusted, automated validation pipeline. Engineers can implement changes with higher confidence and speed. The bottleneck of limited physical lab time is eliminated, shortening the entire change lifecycle.

3. ### Decreased operational costs
   Automation reduces the hours of manual effort required for change planning and testing. Furthermore, by preventing outages, the solution helps avoid massive downstream costs associated with service level agreement penalties, customer churn, and reputational damage.

The journey to autonomy has begun

Outshift's collaboration with Swisscom was more than just a successful proof of concept. It was a powerful demonstration of what's possible when a forward-thinking vision is paired with transformative technology. The exceptional work and rapid execution by the Outshift engineering and product teams, in tight collaboration with the experts at Swisscom, have laid a powerful foundation.

The journey to a fully autonomous network is an evolution, and Swisscom is now at the forefront of that movement. By leveraging AI agents, knowledge graphs, and network digital twins, they are not just preventing future outages; they are building a more intelligent, resilient, and agile network for the future. This proof of concept was the first step, and we are incredibly proud to be partners on this exciting journey.

The implications of this work extend far beyond Swisscom. As network complexity continues to grow and customer expectations for reliability reach new heights, the need for autonomous network operations becomes not just desirable but essential. Organizations that embrace this transformation today will define the competitive landscape of tomorrow. To help our customers achieve this transformation, the Outshift team is actively engaged with Cisco business units to build the features of **Outshift's Agentic Network Change Validator** into existing Cisco product portfolio.

Interested in learning more?

Explore how the Outshift team is building the Internet of Agents to facilitate similar use cases beyond agentic network operations at

outshift.cisco.com/the-internet-of-agents

Want to stay updated on next steps? Sign up for our newsletter. There will be more opportunities to get involved coming soon.

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