

Future of Telco Lab



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Introduction

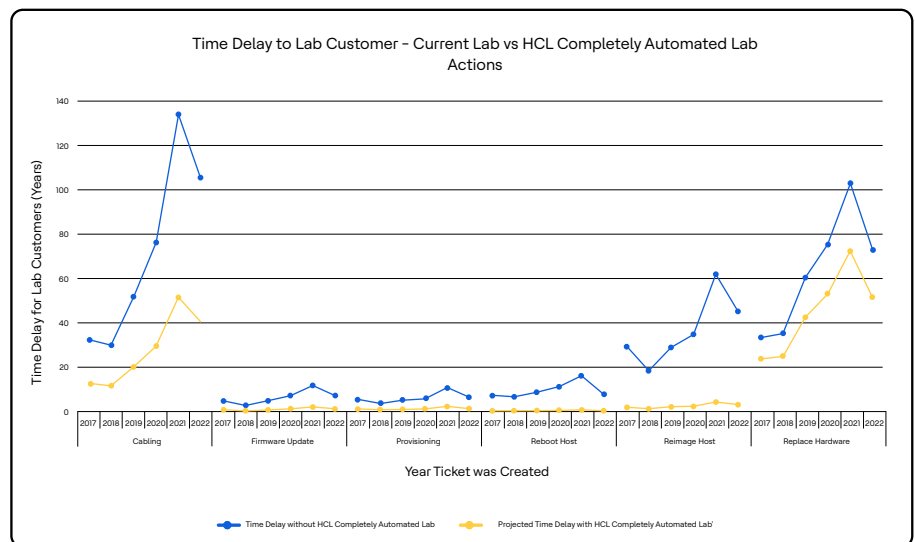
This paper has been authored to understand the need to modernize the Telco labs for future purposes.

The telecom industry sees rapid technological enhancements, especially in 5G, 6G, MEC, IoT, cybersecurity and enterprise communication domains, where new systems and solutions are being offered to the market at a high pace. Rapid advancements in technology and the needs of customers push the imperative for the telco labs to be ready to support new technologies and systems, facilitating lab resource reservations, timesharing of the resources and licenses for effective utilization and easy use of the resources by various customers.

As the Telco landscapes transform and new services are constantly demanded by end users, Telcos face challenges in delivering services with minimal Time to Market (TTM) and providing quality services to keep up with the competition. Telco labs have been major drivers in realizing telcos' goals for swift TTM.

There is a need to automate the lab's maintenance in terms of new image upgrades, firmware upgrades, deployment of new devices, ensuring security patches, provisioning of the lab devices, reimaging, etc. to emphasize the market demand for quicker launch of new services.

Telcos are continuously exploring options for completely automating routine tasks and enabling the telco labs for future demands, opening the labs for Proof of Concepts (POCs) and pre-production testing not only for the internal engineering teams but also for the other Telcos to use their lab as a service.



This drives us towards four key elements of the future lab management:

- Readiness of the lab for end-to-end automation
- Operational efficiency in the quick launch of service and change management
- Tools and processes to support the effective utilization of the labs
- Monetization capability

Readiness of the lab for end-end automation

Real-time inventory management

Fixing the inventory would be the first step in realizing the e2e automation. This process involves multiple parties engaged in utilizing various tools or devices. Inventory systems need to monitor usage and utilization accurately, ensuring the automation of assets in terms of reservation, connection management and effective resource utilization.

Network topology and planning

IP planning is among the crucial aspects of any Telco lab. Increasing solutions and demand for multiple use case validation would require dynamic and on-demand IP planning. However, without careful management, this can result in ad-hoc planning, causing network bottlenecks.

This severely impacts overall lab expansion and the ability to host multiple solutions with complex and dynamic network requirements, restricting overall lab capabilities.

Not only are lab expansions impacted, but this may also restrict the testing of complex network scenarios.

Operational efficiency

Lab outage and recovery time

A lab outage presents another critical issue. If not planned properly, the recovery time will be high, impacting ongoing projects. Inadequate business continuity planning will also cause longer downtimes.

Additionally, data integrity and backup are emerging challenges for Telco labs, with the continuously increasing demand for new solution testing.

More and more solutions are being considered, such as Hub and Satellite lab models, where the lab operations are executed with minimal disruptions.

High operational cost

Operational cost is always a big obstacle from the initial setup to the maintenance and expansion of telco labs. Lab expenditures (CAPEX and OPEX) vs. ROI is a key consideration and a prime factor of concern when establishing such labs. The expectation is to minimize CAPEX needs and optimize OPEX.

Following are the major heads to be monitored and analyzed for OPEX against lab ROI –

- Overall human resource cost for lab operations
- Tool licensing cost
- Time wasted on the automatable tasks
- Waiting time for the testing to set up the lab and topologies

HCLTech has its homegrown completely automated lab for automating the day two maintenance tasks, which ensures smooth lab operations.

Security and regulatory requirements

Security is a top critical requirement for ever-expanding Telco labs. Security requirements need to be evaluated and periodically checked at the following levels –

- Infrastructure and physical security
- Network security
- Application-level security
- Patch management

GEO-specific regulatory requirements are also critical and challenging to upkeep while dealing with lab expansions and introducing new customers and projects.

Many Telcos are exploring the need to consolidate lab assets for better management, which also increases security exposures.

Autonomous operations

Telcos are under growing pressure to reduce the overall OPEX and lab maintenance, including the target area for optimization. This could be approached in two different dimensions. One dimension involves automating the day-to-day operations of lab management in terms of the provision of new hardware, reimaging, patching and firmware upgrades. The second dimension is in terms of auto ticketing issues, performing root-cause analysis and moving towards the auto resolution of the tickets, considering some of the typical lab needs for testing the failure scenarios.

Self-care portal

Ease of use has been the theme and a recurring demand from many customers across various verticals. Lab as a service also requires an intuitive portal to facilitate the consumption of services. This will improve the adoption rate for leveraging new services. Through this portal, end users can reserve the required platforms, devices, traffic equipment, ports and topologies for their requirements. The availability of the lab resources is kept transparent and live. Additionally, users can monitor the usage of testbeds, enhancing their ability to manage and optimize their testing environment.

Smart energy management

Sustainability has become a key customer demand, driven by industry forums, standards and regulatory bodies. Effective lab management now requires the observability of the testbed parameters in terms of the power, Heating, Ventilation and Air Conditioning (HVAC) and real estate utilization. Often, unused devices and support devices remain powered on without being monitored to manage these utilities effectively. This not only impacts the bottom line but also aligns with broader sustainability goals. HCLTech's observability platform provides insights into network energy usage and utilization of lab resources.

Tools and process for lab management

Dynamic resources and connectivity management

The dynamic provisioning of resources and reservation of resources and ports on demand are critical aspects of lab transformation. This capabilities facilitate the effective usage of the lab assets, significantly reducing the manual effort required for provisioning and de-provisioning resources and establishing connectivity across various physical assets. Furthermore, there is a growing need for virtual resources to dynamically scale up and scale down based on specific requirements.

Harmonized process

Multiple labs across the Geo's often follow varied processes for procuring and managing test/lab resources, localized to their needs. This brings inefficiency for the Telcos in terms of usage of the resources and longer waiting period for some of the resource availability, which is available in other lab or other geos. Resources may be overutilized or duplicated across multiple, further exacerbating inefficiencies. This brings in the need for common processes to measure the utilization, harmonized procurement process and standardized process for reservation of the resources.

License management

In labs utilized by multiple engineering teams, lab licenses are often purchased individually based on specific needs, with inconsistent monitoring of license usage or purchase and retirement processes. This lack of oversight leads to inefficient utilization of lab licenses and tools.

Additionally, the procurement of tools and licenses frequently occurs in silos across the Geos and labs, furthering exacerbating the problem of underutilized licenses. There is a pressing need to implement a system that allows for time shared usage of the same license across various testbeds. Many of HCLTech's ecosystem partners in test tools support the approach, enabling licenses to be shared across different test tools and test beds. Licenses could be transferred through the network or they could be maintained in a centralized repository and managed effectively on a time-shared basis.

Test management

There is a need for a test cases repository that can be reused by various customers, leveraging industry standards such as Request for Comments (RFCs), 3rd Generation Partnership Project (3GPP), etc. There should be supported by an Integrated Development Environment (IDE) that allows for the dynamic creation of test cases based on specific requirements, a process referred to as Intent-based test case generation. HCLTech has a rich set of test case repositories and has proven GenAI-driven test case generation models to address the space of test management requirements.

Continuous Integration/ Continuous Testing / Continuous Deployment (CI/CT/CD)

With the increasing virtualization and containerization of components, lab must evolve to meet the real time needs of CI/CT/CD. Labs should be equipped to onboard Cloud-Native Network Function or Virtual Network Function (CNF's and VNF's), allowing for their testing, certification and preparation for real time deployment. HCLTech provides platforms that facilitates the onboarding the VNFs and CNFs, enabling comprehensive testing using HCLTech's Test management solutions. These platforms also support necessary security checks through open-source tools, ensuring that the functions are thoroughly certified before moving into production environments.

Lab monetization

There are requirements for testing POC on new technologies, solution testing, ad hoc pre-deployment testing and requirements for various/hybrid technologies from various Tier 2/Tier 3 Telcos.

The emergence of IoT and other advanced technologies has expanded the need for testing across various verticals, including supply chains, automobile and medical. Additionally, organization like the Federal Mobility Group (FMG) plays a crucial role in testing pre-deployment of solutions and POCs.

All these dimensions of challenges push the telco labs to modernize their labs to ensure efficient management and operations.

Futuristic services

With rapid innovations and the increasing need for prototyping, there is a growing demand for testing concepts across various domains. New use cases and requirements necessitate that testing infrastructure is ready for immediate consumption. HCLTech has identified several areas of focus, such as terrestrial-to non-terrestrial requirements handover testing and continuous monitoring of parameters such as temperature humidity for verticals such as food, pharma, defense, etc., there has been growing demand for autonomous operations testing for various TMF recommended use cases, growing usage of AI/ML across the spectrum demands testing of models with real-time equipment. There has been traction and need in areas such as quantum computing needs. This demands the labs be equipped with the lab infra or test infra and a ready-to-use scenario for future needs.

View on cross-vertical needs

Recent trends that the need for lab usage is expanding beyond Telcos to include other verticals such as supply chain, automobile and more. However, these industries are often reluctant to invest in lab investments. Similarly, Tier 2 and Tier 3 Telco players are hesitant to invest in lab for POC purposes.

This creates the opportunity for the Telcos to expand the lab services to third parties for consumption and maximize the ROI on the lab investments.

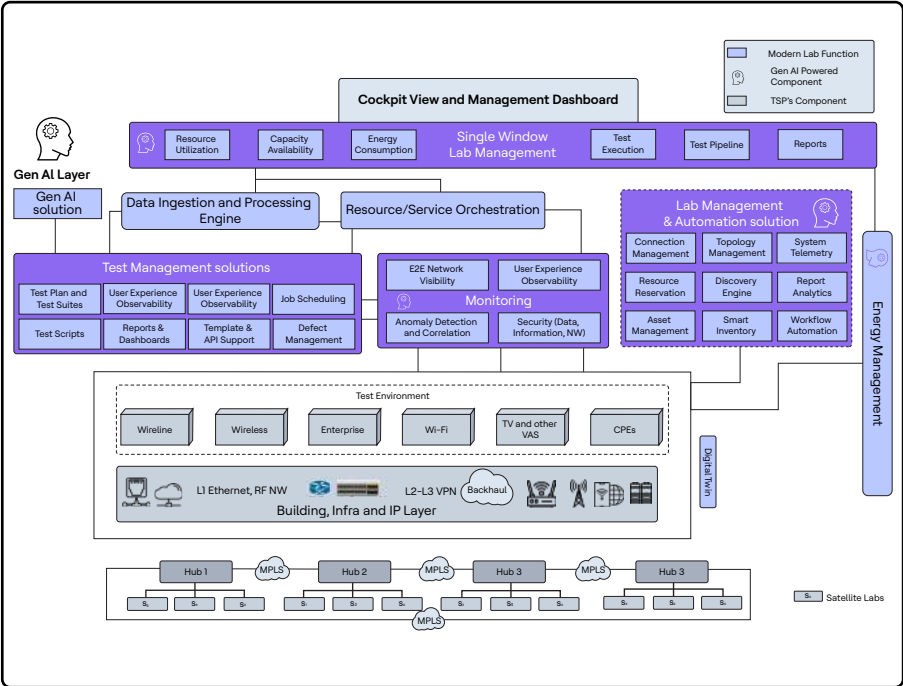
Multipurpose and multi-vendor labs

There is a growing demand from customers to eliminate vendor lock-in in both production and lab environments. Customers increasingly prefer best-of-breed solutions from various vendors, which necessitates the need for interfaces to the underlay networks that are compliant with industry standards. Lab management and test management solutions must be capable of interfacing to underlay networks that are compliant with the industry standards, irrespective of the vendor. Interoperability testing needs to be fulfilled by the lab infra, considering the growing heterogeneous lab environments.

HCLTech unique propositions

HCLTech recognizes the importance of future-ready lab requirements and offers comprehensive solutions tailored to customer needs. With proprietary IP in lab management, test management and fully automated lab solution to automate the routine operational tasks, observability platforms, reusable assets for the self-care portal and southbound interfaces to realize the need for the customer. HCLTech, as part of the various industry forums, including TM Forum and CAMARA, understands the landscape of the upcoming requirements and future needs of the lab and continues to work on enriching the platforms and also works with the partner ecosystem to provide comprehensive solutions for the Telco customer.

HCLTech POV on Future Telco Lab



HCLTech offers consulting services for lab modernization and exposes the wide range of HCLTech's own IP of tools, products and processes for the modernization of the Telco labs. Furthermore, it partnered with rich capabilities from ecosystem partners, enabling the customers to achieve the aspirations of transforming the labs for future requirements and for monetization of the labs. HCLTech views below as some of the key success factors of modernizations of the labs:

Vodafone's Lab of Future

Here is how we envisage Vodafone's Lab of Future to be



Conclusion

HCLTech's extensive experience with platform, tools and mature process will be instrumental in consulting, consolidating, modernizing and enabling the Telco labs for monetization. Our platforms, including Integrated Lab management systems, Observability, Test Management System, CNF/VNF on boarding Platforms and GenAI enabled solutions are designed to help the Telco's in achieving the desired outcomes of fully automated, sustainable and intelligent labs. These solutions not only support operational automation but also enable the validation of hypothesis on the Next Gen technologies with faster turnaround time.

Please connect us for further discussions around your lab modernization journey.

Author information



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Sathiyarayanan has been in Telecom industry for the past 25 years and driving solution across TSP's and OEM's . he has rich experience in building solutions across various domains such as Network testing , OSS , Lab services , Private 5G and GenAI . he has strong understanding of the Telco needs and integrating the solution tenants to meet the customer expectation .



Abhishek Narayan Saxena:

Abhishek has been in IT industry for more than 22 years, managing R&D and Professional Services projects in telecom domains (wired and wireless communication) including Network Management, Unified communication, Telco core and cloud for telecom OEM customers. He has extensive experience of setting up large telco labs and field deployment of telco clouds for 4G and 5G networks for Tier-1 TSP customers. He has also led projects for 4G / 5G Network Functions (VNFs and CNFs) certifications on various NFVi (Network Function Virtualization Infrastructure) platforms including OpenStack and Containerized clouds.

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