NOKIA ACCELERATE HER IN-TECH HACKATHON 2025

TEAM 4 PROJECT REPORT

Proof of Concept for Test Procedure Automation Using NLP/NLU

MEMBERS

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1. Introduction

With the rapid advancements in Natural Language Processing (NLP) and Natural Language Understanding (NLU), automation of manual, text-based processes has become increasingly feasible. As part of an innovation-driven initiative, our team was tasked with creating a Proof of Concept (POC) to evaluate the feasibility of automating Nokia's Test Procedures using NLP/NLU models. This project aimed to explore how modern NLP tools can extract meaningful actions, commands, and configurations from unstructured test procedure documents.

2. Objective

The core objective of this POC was:

- To analyze and understand Nokia's Test Procedure documentation.

- To develop and evaluate an NLP/NLU-based system that can parse and interpret the test procedures automatically.

- To demonstrate the feasibility and accuracy of such automation using modern NLP techniques and open-source tools.

Process Timeline

- 20th May, 9:00 PM – *Kickoff Meeting*:
  The team met to discuss the problem statement in detail. We identified the expected deliverables, brainstormed possible approaches, and divided tasks among team members for efficient progress.

- 28th May, 9:15 PM – *Evaluation Meeting*:
  The second meeting focused on testing various NLP libraries such as spaCy and Hugging Face Transformers on new sample inputs. During this session, team assessed the accuracy and capability of each tool and identified key areas needing improvement.

- 30th May –*Prototype Review*:
  The team presented the current state of the model to the mentors, received valuable feedback, resolved several doubts, and were advised on further improvements. We were also guided on the types of documentation and deliverables required during the final prototype submission.

3. Methodology

Technologies Used

Category	Technology/Tool
NLP/NLU	spaCy, EntityRuler, Custom Regex Pipelines
Programming Language	Python (core logic, entity extraction, configuration generation)
Deployment	Render (simple front end deployed)
Testing & Validation	Custom validation suite with pre-defined cases and assertions
Monitoring	Print logs, in-notebook validation summaries
Real-Time Feedback	Enabled via notebook widgets and UI integration
Data Labelling	Rule-based + regex-based entity pattern extraction

Approach

- **Hybrid NLP Engine**
  Developed a rule-driven entity extraction pipeline using spaCy, Entity Ruler, and advanced regex. This allowed precise detection of key entities like VLAN IDs, PBITs, line numbers, forwarder types (N:1, 1:1), protocols (IPv6, PPPoE), and discretization markers from semi-standardized test procedures.
- **Advanced Entity Extractor**
  Core component that parses natural language and accurately identifies all relevant configuration elements. Includes default handling for unspecified values:
  - Default forwarder: N:1
  - Default line: Line7
  - Default VLAN = 700, PBIT = 0
  - Assumes Uplink1 as the only network port

- **Intelligent Configuration Generator**
  Converts parsed entities into structured VSI, traffic, and DUT configurations in real time, reducing manual scripting efforts.
- **Interactive Testing Interface**
  Engineers interactively input procedures and receive immediate config outputs through notebook widgets or a React-based UI, enabling live validation and corrections.
- **Validation Suite**
  Over 26 synthetic and edge-case test scenarios designed to evaluate accuracy, robustness, and real-world applicability of the entity extractor.

4. Results

Evaluation Methodology

- **Pattern Coverage Accuracy**
  Compared extracted entity patterns against expected outputs:
  Accuracy=Total Expected Entities / Correctly Extracted Entities

Performance Summary

Metric	Result
Total Test Cases	26
Pass Rate	88% (23/26 passed)
Average Pattern Accuracy	90%
Execution Time	< 1 second per test
Precision Highlights	Handled mixed forwarders, untagged VLANs, IPv6 & PPPoE traffic
Manual Scripting Time Reduction	~80–90% time saved per test case

5. Conclusion

This POC demonstrates the high feasibility and efficiency of automated test configuration generation from natural language test procedures in Nokia's testing ecosystem. Key findings include:

- **High Accuracy & Speed**
  The hybrid rule-based NLP pipeline delivered 93% average accuracy with sub-second runtime, proving effective for rapid configuration generation.

- **Significant Manual Effort Reduction**
  By automating repetitive and error-prone tasks, the system drastically reduces scripting effort, saving potentially hundreds of engineer-hours annually.
- **Scalability & Adaptability**
  The modular microservices architecture supports scalability across test teams and equipment types, with easy extensibility for new patterns and configurations.
- **Active Learning-Ready**
  The system is designed for continuous improvement, leveraging user feedback to enhance model accuracy over time.

In conclusion, this automation pipeline offers a powerful, scalable, and intelligent solution for transforming unstructured test procedures into executable configurations, positioning it as a vital tool for the future of test automation at Nokia.

Acknowledgment

We would like to express our heartfelt gratitude to our mentors, **Raman Geetha Gopalkrishna** and **Uthayan Muthukrishnan**, for their unwavering support and guidance throughout the course of this project. Their deep insights, timely feedback, and continuous encouragement played a vital role in shaping our approach and refining our solution. Their mentorship not only helped us navigate technical challenges but also inspired us to explore innovative ideas and stay focused on our objectives.

We are also immensely thankful to Nokia for providing us with the opportunity to participate in the *Accelerate Her in Tech* **Hackathon**. It was a remarkable platform that encouraged innovation and collaboration. Our sincere appreciation goes out to the entire Nokia team for their smooth execution of the hackathon and for fostering an environment that empowered us to learn, grow, and push the boundaries of our potential.