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Title: (Interim) Report from “Build-a-thon” for ITU AI/ML in 5G Challenge 2022

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Abstract: In 2021, [FGAN-I-170-R1] successfully initiated the “Build-a-thon” of ITU FG AN in collaboration with ITU AI/ML in 5G Challenge. Extending the participation of FG AN in ITU AI/ML in 5G Challenge, [FGAN-I-216-R1] proposed a 2022 edition of build-a-thon. This document gives a report on the ongoing Build-a-thon activities.

1 Introduction

As discussed in [FGAN-I-006] and [ITU Challenge URL], ITU AI/ML in 5G Challenge is an opportunity for students, professionals and industry from around the globe to work together and study the practical application of artificial intelligence (AI) and machine learning (ML) in emerging and future networks.

In the 2020 edition, the Challenge welcomed over 1300 participants from 62 countries, forming 911 teams. Among these were problem statements in the “enablers” track which included developing reference implementations based on FG specifications. The second edition took place in 2021, connecting more than 1600 participants from 82 countries. The Challenge culminated during the Grand Challenge Finale in December, where teams selected from each problem statement competes for prizes, global recognition and ITU certificates.

The collaboration between different organizations enabled a win-win situation for the participants and technologists aimed at overall technology development in the following manner:

- **Create a distributed eco-system:** ITU AI/ML in 5G Challenge enabled participants to connect with new partners in industry and academia — and new tools and data resources — to solve real-world problems based on the ITU specifications. This was supported by several webinars with leading researchers around the world, round-table discussions with participants and experts, and using open source and open data. Several activities accompanied the Challenge such as webinars, round-tables, and hands-on-session: (live & replay; <https://aiforgood.itu.int/ai-ml-in-5g-challenge/>).

NOTE- This enables FGAN to take advantage of the state of the art, discussions, code and Sandbox from this distributed eco-system of industry, academia and other experts to advance the work in WG3 PoC, specifically related to the key concepts in the [FG-AN ToR].

- **Diverse participation:** A mix of participants (not only data scientists) from various backgrounds came together to solve problems, and students were provided mentoring by experts. Prizes and certificates were offered, refer to [FGAN-I-006] for details. But the real value was the diverse points-of-view offered from across the world. The solutions from academia, students, researchers and industry resulted in published papers for 2020 Challenge: <https://www.itu.int/en/journal/j-fet/2021/005> and a paper based on Build-a-thon 2021, titled "Network resource allocation for emergency management based on closed-loop analysis" is pre-published on ITU Journal on Future and Evolving Technologies. It is a collaborative paper with 22 authors, distributed across 6 countries. It can be accessed free of cost from: <https://www.itu.int/pub/S-JNL-VOL3.ISSUE2-2022-A16>

NOTE- This enables FGAN to collaborate and work closely with other entities as mentioned in clause 5 of [FG-AN ToR].

- **Create practical implementations:** Challenge included problem statements which worked on creating reference implementations, using open source, demonstrating concepts from ITU specifications. Thus, the challenge was more than just predictions and inferences, but also about coding and proving the concepts in FG specifications.

Build-a-thon reports from FG AN teams are available in [FGAN-I-183], [FGAN-I-166], [FGAN-I-163-R2], [FGAN-I-187] and [FGAN-I-151-R1].

[FGAN-I-183] describes the design of closed loops using a declarative specification. This is achieved using using TOSCA a simple yet formal syntax, to express a closed-loop. The resulting YAML file is parsed and the resulting components are instantiated in a virtualized environment. [FGAN-I-166] describes a network testbed with a C-RAN architecture composed of remote radio units (RRUs), baseband unit (BBU) pool, and core network. [FGAN-I-151-R1] describes creating a simulation environment to generate data for model training and testing purposes and serve as a simulation underlay for testing. [FGAN-I-187] describes the various algorithms which can be integrated with an O-RAN based controller architecture to verify the resource allocation schemes. [FGAN-I-163-R2] describes the implementation of the above algorithms in an O-RAN near Real Time RAN Intelligence Controller (RIC) and its integration with the Acumos model repository. Finally, integration of these algorithms and closed loops into simulation branch in the 5G Berlin testbed [OSNL Testbed] was done.

NOTE- This enables FGAN to collaborate towards reference implementations as mentioned in [FG-AN ToR] and as demonstrated above.

Recognising the importance of such initiatives as an instrument for pre-standard research and spreading awareness and attracting diverse talent to the pool, [FGAN-I-216-R1] proposed to create a “build-a-thon” proposal aligned with WG3 of PoC and the key concepts defined in the [FG-AN ToR].

The build-a-thon is a problem statement in ITU AI/ML in 5G Challenge. It aims to demonstrate and validate important use cases for autonomous networks, creating proof of concept implementations and tools in the process. As an open platform, FG AN is well-poised to enable access to experts, students and industry, collaborate with other external events such as plugfests and hackathons and to set the stage for collaboration in open-source projects, other PoC (proof of concept) and standardization work.

2 Build-a-thon in Autonomous Networks

What is a build-a-thon?

In essence, a build-a-thon is a common, open platform for like-minded people to come together (remotely) and build something to prove a point. In the case of FG AN we define it as below:

1. Build-a-thon is a PoC development activity, to build upon a key concept in FG AN, especially intended to prove the concept practically with code, test setup and demo setup. It is open to anyone.
 2. Build-a-thon is not intended to create a product, nor would the code created as part of Build-a-thon be considered as product quality software.
 3. Build-a-thon would create well-documented artefacts and opensource code.
- NOTE- In case there are project specific restrictions on opening the code to open source, other forms of license may be applied based on discussions among participants.
4. It is done collaboratively in teams, may last for several months, especially intense towards the end, culminating in a demo or presentation. The primary output would be well-documented, working code. By-products could be use case documentation, design docs and test code.
 5. Completeness of the code is expected only to be judged by the definition of scope in the accompanying documentation. Correctness of the code is expected only to be judged by the definition of test scenarios in the accompanying documentation.

Aims of the build-a-thon in Autonomous Networks are as follows:

- To take advantage of the momentum and energy created by the “AI/ML in 5G Challenge”, create a “track” for autonomous networks. Bring the community of experts to the Challenge platform to fashion practical “proof of concept” problems from the **use cases** documented in [FGAN-O-013-R1].
- To build proof of concepts and demos which can prove the feasibility (or the lack of it) of **architecture concepts**, collaborate and study the gaps of existing prototypes and standards.
- To build opensource solutions and collaborate with existing opensource projects in this domain, aligned with other potential **PoC (proof of concept)** projects in FG-AN.

NOTE- If there are project specific restrictions on open source, other forms of license may be applied based on discussions among participants and classifying the problem statement as “restricted”.

- To consolidate the learnings from the exercises above, feed the learning to the deliverables of FG-AN.

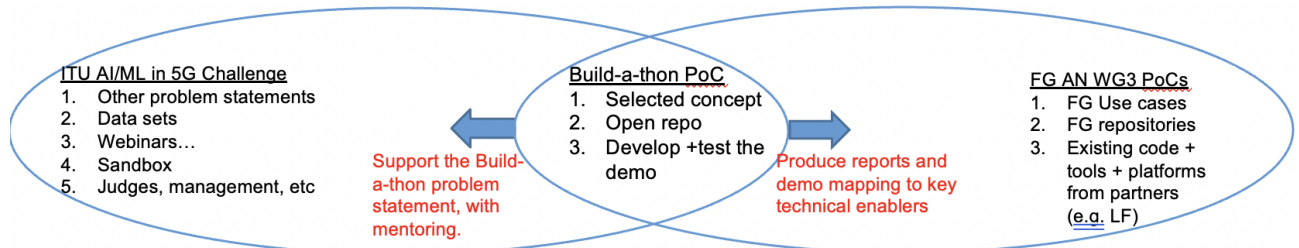


Figure 1: Relationship between ITU AI/ML in 5G Challenge with the agreed Build-a-thon and the FG AN.

As shown in figure 1 above, ITU AI/ML in 5G Challenge includes many problem statements, corresponding datasets, along with an ecosystem of webinars, sandbox, challenge management etc described in [ITU Challenge URL]. ITU-T FG AN working group 3 is discussing proof of concepts related to [FG-AN ToR]. Build-a-thon collaborates with the ITU AI/ML in 5G Challenge (see clause 2 above) to create PoC in areas of common interest, by triggering a “build-a-thon” track in the Challenge.

The Build-a-thon, reusing the challenge platform, will build PoC, based on selected use cases (described below). Build-a-thon problem statement will be an “open” problem statement under the Challenge where as FG AN may run other PoC which are unrelated to the Challenge.

2.a Outline of the Build-a-thon is as follows:

NOTE- timeline of the steps below will follow the timeline of the Challenge 2022 (announced in [ITU Challenge URL])

1. From the use case deliverable of FG-AN [FGAN-O-013-R1], and architecture contributions from partners of ITU, problem statement to demonstrate key concepts of AN (Autonomous networks) [FG-AN ToR] is fashioned.
2. Problem statement is submitted to ITU AI/ML in 5G Challenge 2022, as per instructions in [FGAN-I-006]. Problem statements propose FG-AN as the host, clearly state what needs to be built/implemented from the AN use cases, refer to any papers or other references, point out any tools or resources and suggest scoring mechanisms.
3. Judges, experts (from among FG AN participants) for mentoring and scoring of submissions to the build-a-thon will be nominated by the 8th meeting of FG AN.
NOTE- <https://www.itu.int/en/ITU-T/AI/challenge/Pages/2021.aspx> includes Judges for the 2021 ITU AI/ML in 5G Challenge from FG AN.
4. Round tables and periodic meetings with registered participants of the build-a-thon would be supported by FG AN.
NOTE- see Annex I for details of teams registered for 2022.
5. Submissions would be scored and publish results (winners) from the build-a-thon as per Challenge timeline.
NOTE- see <https://aiforgood.itu.int/event/itu-ai-ml-in-5g-challenge-grand-challenge-finale-2021-final-presentations-and-evaluation/>
6. FG AN intends to support the “Challenge Grand Finale” (refer [FGAN-I-006]), and felicitate the winners.

NOTE – the details of 2021 challenge are available in <https://aiforgood.itu.int/about-ai-for-good/aiml-in-5g-challenge/challenge-2021/> and <https://aiforgood.itu.int/meet-the-winning-teams-in-the-itu-ai-ml-in-5g-challenge/>

In addition to certificates from ITU, the top team from 2021 FG AN Build-a-thon was presented with a prize courtesy Rakuten Mobile.

7. Follow-up with discussions with open source and other partners (e.g. FGAN-I-233, FGAN-I-228-R1, FGAN-I-224) and inputs would be derived to FG-AN deliverables based on the learnings from the build-a-thon.
8. Collaboratively publish papers (e.g. conference papers, ITU journal etc), articles, technical reports and technical specifications integrating the results from the build-a-thon. NOTE- based on the call for papers in <https://www.itu.int/en/journal/jfet/2022/004/Pages/default.aspx> a paper based on Build-a-thon 2021, titled "Network resource allocation for emergency management based on closed-loop analysis" is pre-published on ITU Journal on Future and Evolving Technologies. It is a collaborative paper with 22 authors, distributed across 6 countries. It can be accessed free of cost from: <https://www.itu.int/pub/S-JNL-VOL3.ISSUE2-2022-A16>

NOTE: Build-a-thon will use 5G Berlin testbed [OSNL Testbed] as an testing and evaluation platform. Collaboration with other partners (like O-RAN) for a joint demo using the O-RAN components in the testbed will be explored.

⌘⌘⌘ ---Editor note: material from here on, will be discussed with the AI/ML in 5G Challenge management

3 Agreed problem statement

Id	ITU-ML5G-Build-a-thon-PS-2022-001
Title	BYOC: Build your own Closed loop
Description	<p>Aim of the project is to</p> <ul style="list-style-type: none">- collaboratively create a crowdsourced, baseline representation for AN closed loops (controllers), review and analyse them, and publish them in an open repository.- trigger technical discussions on the standard format for representing closed loops (controllers) with FG AN members and other stakeholders (e.g. IRTF NMRG, TOSCA, et al).- Collate the learnings from this exercise- Produce reference implementations of parser, “AN orchestrator” and “openCN” [FGAN-O-013-R1] and Evolution controller [FGAN-I-198].- This would pave the way for further downstream extensions on top of the baseline. <p>Introduction:</p> <p>From the list of use cases in [FGAN-O-013-R1], select cat 2 use cases. Consider also other closed loop use cases (e.g. from 3GPP TR 28.861 (R16), drafts from NMRG, et al). Create TOSCA YAML files corresponding to these Autonomous Networks use cases.</p> <p>Phase-1: Implement a reference TOSCA orchestrator which can demonstrate the parsing and validation of the format. Based on this reference implementation, FG AN will call for submissions which can satisfy the basic formats, while demonstrating closed loop representations using the format.</p>

	<p>NOTE- mechanisms described in cat 1 use cases can be used to manage the controllers.</p> <p>Phase-2: Based on phase-1, call for evolution/exploration mechanisms which can compose new closed loops based on existing ones.</p> <p>Steps:</p> <ol style="list-style-type: none"> 1. A basic repository will be hosted by FG AN, in collaboration with the Challenge, <ol style="list-style-type: none"> a. A repo will be used to store reference closed loops which can serve as a starting point for the participants. E.g. a br in a github repo may be used. <ol style="list-style-type: none"> i. This br should be pre-populated some YAML files and a reference ev controller, which presents a starting point for the participants. ii. The reference closed loops may be examples, parts of controllers (may not be complete, real life use cases) but representative enough for participants to understand how to build a closed loop. iii. Closed loop submissions may be related to 5G/4G/3G etc (networks in general), tagged/labelled (mapped to) with domain specific problems/use cases. b. Another repo will be used to store the submissions of closed loops by participants. e.g. a br in the github repo per submission. 2. Call for participants to submit other use case implementations in the same format. 3. Any participating team can submit any number of entries. 4. In Phase-1: FG will collect the submitted YAML files, and parse them using a (custom) TOSCA orchestrator (parser, similar to the one used by WINEST in 2021, see [FGAN-I-183] for details). 5. In Phase-2: FG will collect the Ev controllers, and given the entries in openCN from Phase-1, evaluate the Ev controllers by changing utilities, testing for levels of autonomy/adaptability. 6. Participant submissions may be in the form of <ol style="list-style-type: none"> a) Phase-1: Closed loops (any number of submissions are allowed), b) Phase-2: Closed loops + extensions of evolution controller (any number of submissions are allowed) <p>NOTE-</p> <ol style="list-style-type: none"> 1. The extensions may be automated (combining/reuse modules) and produce composite closed loops. 2. Use of specific techniques of AI/ML or NLP or any other tools is upto the participants, 3. Documentation of the closed loop is important and must accompany all submissions <p>FG will evaluate the submissions using pre-published criteria.</p>
Challenge Track	NA

Expected output and Evaluation criteria	<p>Phase-1: Evaluation may be based on:</p> <ol style="list-style-type: none"> 1. Is the closed loop submission well-documented? 2. Is the reference parser able to parse the file successfully? 3. Is the submission mapped to well-known references, standards (e.g. ITU FG AN deliverable FGAN-O-013-R1), industry bodies or academic references? To prove the utility or relevance to real life or the concept. 4. Are creative/advanced techniques or requirements met (as described in published references (e.g. ITU FG AN deliverable FGAN-O-013-R1), e.g. is the composition automated? If yes, how? 5. Is there a working demo? E.g. demo of file parsing, selection, chaining, or other forms of exploration. <p>Phase-2: Evaluation may be based on:</p> <ol style="list-style-type: none"> 1. Is there a working demo? E.g. demo of file parsing, selection, chaining, or other forms of exploration. 2. Is the controller submission well-documented? 3. Given the repo of closed loops from phase-1, can the ev controller prove “adaptability”: on the face of changing operational conditions, goals, utility, if presented with dynamic conditions, can the participant team demo the robustness by coming up with a new (valid, relevant) YAML file? <p>Bonus points:</p> <ol style="list-style-type: none"> 1) complete closed loop submissions (as against just modules) may receive bonus points. 2) reusing other teams’ modules to make composite/relevant closed loops may receive bonus points. <p>NOTE –Need quantitative criteria for the above metrics.</p>
Data source	<p>No data is required.</p> <p>However, use cases for closed loops are required which are openly published by many SDOs including ITU-T FG AN. These would be compiled and discussed in FG AN before launching the Challenge.</p> <p>See fig 2 and fig 3 below.</p> <p>Open question –</p> <p>(1) what is the role of domain knowledge? Can we provide enough mentoring/support to make sure there are good quality submissions?</p> <p>(2) Submissions may be reviewed/curated for semantic relevance (as against simple syntactic correctness). Some support in the form of a “semantic grammar” or dict or context may be provided by FG AN?.</p>
Resources	<p>[FGAN-O-013-R1] [3GPP TR 28.861] [NMRG IBN use cases] [ETSI ZSM 001]</p>
Any controls or restrictions	<p>The build-a-thon is open to all participants.</p>
Specification/Paper reference	<p>[FGAN-O-013-R1]</p>
Contact	<p>Editors</p>

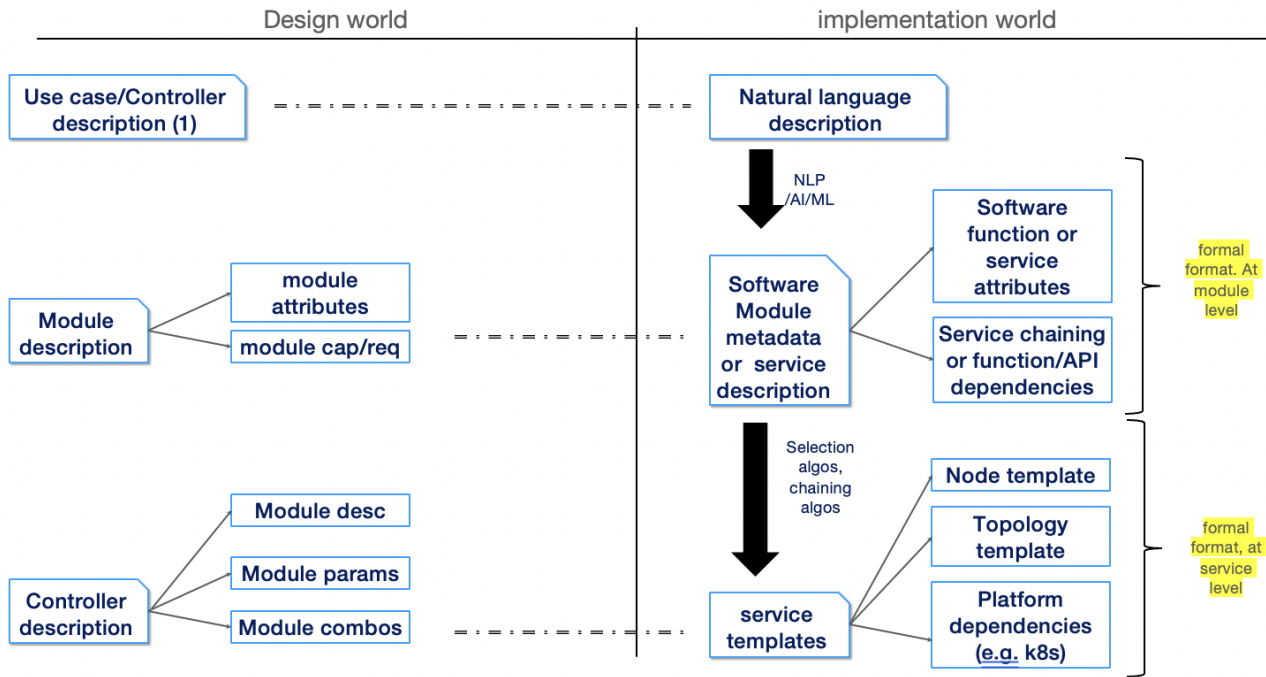


Figure 2: Design vs. implementation

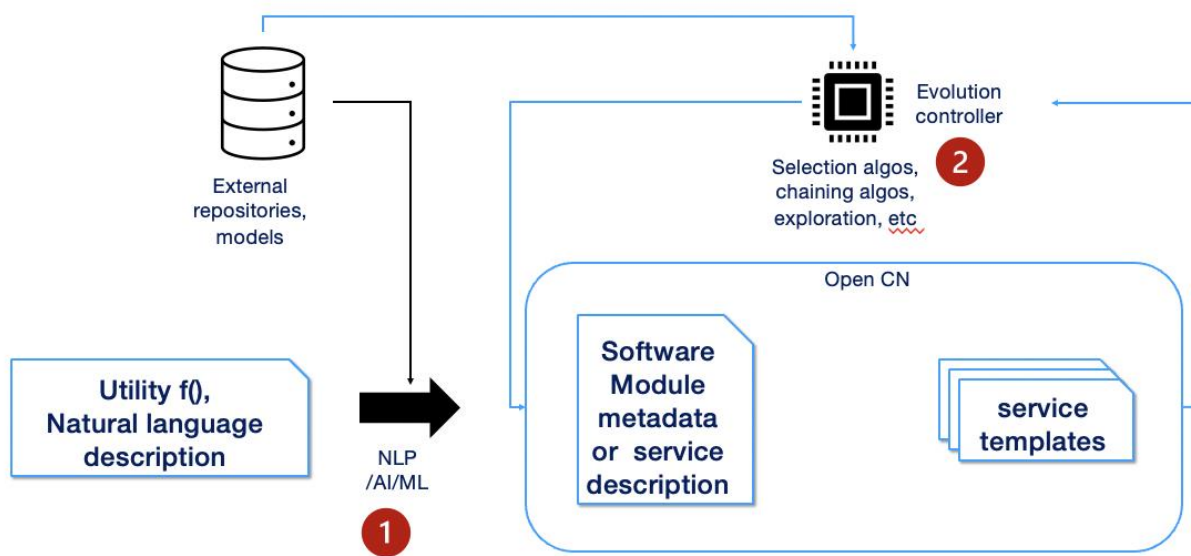
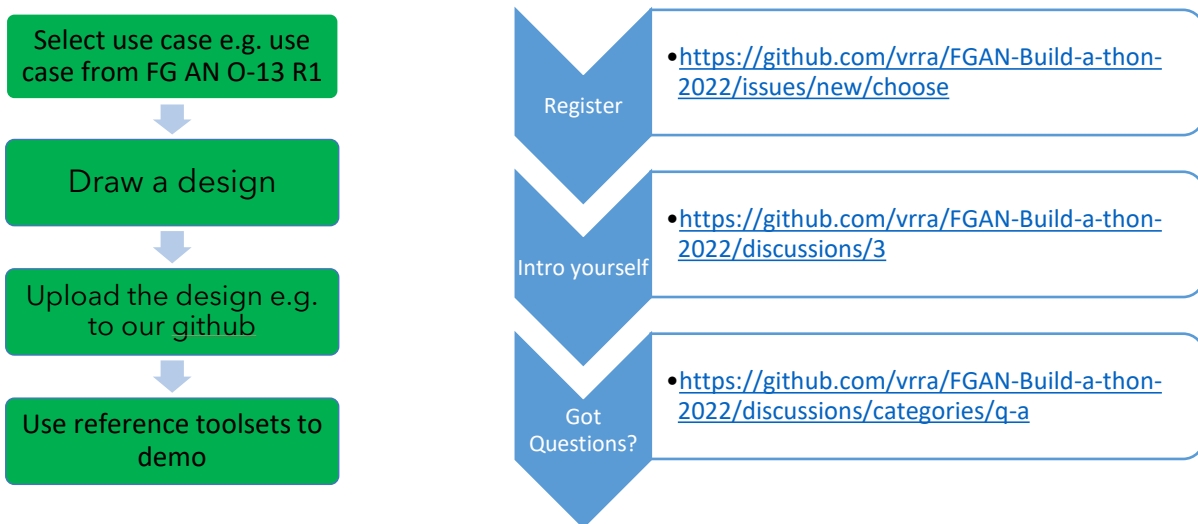


Figure 3: part 1 and part 2 of Build-a-thon

⌘⌘⌘ ---Editor note: end of discussion material with the AI/ML in 5G Challenge management

3.b) What are the tasks for participants?



4 Progress Report

4.1 Background

4.1.1 The following reference materials are prepared for distribution:

- LS/o <https://extranet.itu.int/sites/itu-t/focusgroups/an/output/FGAN-O-018-LS.docx>
- FG AN <https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-216-R1.docx>
- FG AN <https://extranet.itu.int/sites/itu-t/focusgroups/an/output/FGAN-O-013-R1.docx>
- GitHub link <https://github.com/vrra/FGAN-Build-a-thon-2022>

NOTE- this is a public repo, with docs, code, discussion forum, and videos.

4.1.2 Request for mentor support:

- Pick your use case from FGAN-O-013-R1
- join the discussions,
 - introduce yourselves here: <https://github.com/vrra/FGAN-Build-a-thon-2022/discussions/3>
 - answer any questions here: <https://github.com/vrra/FGAN-Build-a-thon-2022/discussions/categories/q-a>
- “watch” the repo
- Support local teams (in local language).

4.1.3 Request to teams:

- introduce yourselves here: <https://github.com/vrra/FGAN-Build-a-thon-2022/discussions/3>
- ask any questions here: <https://github.com/vrra/FGAN-Build-a-thon-2022/discussions/categories/q-a>
- pick your favourite use case from FGAN-O-013-R1 (or other such references)
- draw a graph (see annex-II below)
- upload to neo4j (see annex-III below)
- create TOSCA representation (see annex-IV below)
- use reference parser (see annex-V below)
- aim for bonus points:
 - create an FG AN contribution, documenting the use case and demo
 - create a video of the demo, upload to the repo
 - extend the parser, submit it to the repo
 - map to standards (ITU or others)
 - automate, automate, automate (apply AI or NI)
 - Implement Ev Controller e.g. Create a "dating" service for controllers, for chaining, composition of controllers.
 - Reuse controllers from other teams' submissions [and give credit and cite them]
- publish notebooks

- j) contribute to (ITU journal) paper

4.1.4 Request for Judges panel

- a) introduce yourselves here: <https://github.com/vrra/FGAN-Build-a-thon-2022/discussions/3>
- b) “watch” the repo
- c) Attend all webinars/talks/meetings and carefully follow the progress of the teams
- d) See Clause 3 above and review the evaluation criteria
Hint: Keep your own personal “leaderboard” based on the evaluation criteria
- e) See “2022 Build-a-thon Judges Handbook” in annex VI below.

4.2 Timelines

Activity	Timeline	Notes
Problem statement description LS/o on the problem statement and call for collaboration.	Done	FGAN-O-018-LS
Registration opens	May 1	[accept teams via github] [https://challenge.aiforgood.itu.int/match/matchitem/68]
Dataset preparation	June 3	For each use case, identify actors, graphs, provide reference code 1. parse the use case doc [can use human hands or python] 2. generate graph (we have some seed code in the github already) 3. generate TOSCA (from the graph) 4. modify WINEST code from last year to parse TOSCA 5. publish 1,2,3,4 above.
2022 Build-a-thon kickoff workshop	June 3	VIP motivational speeches (5mn each). each use case owner to explain the use case to the teams (see annex II below). See Kickoff workshop plan below NOTE- Send a follow up LS/o, publishing the kick off and draft timelines.
Podcasts, webinars	May-June	regional language speakers (on each use case).
Registration closes	Oct 21	NOTE- may extend by a few days, if needed.
Mentoring support, round-tables with participants.	May-Sep	1. answer questions in github discussions . 2. provide reference toolsets. e.g. NLP tools, AI tools for text search, generation, classification, etc which may be useful for participants. 3. meet and engage with participating teams.

2022 Build-a-thon Workshop 2.0	02 Sep 2022	
Accept submissions by participants	28 Oct	Via github repo NOTE- Send a follow up LS/o on upcoming demo event
Judging and demo event	07 Nov	
Reports to FG AN and SG13 LS/o	Dec 2022	A deliverable will be produced by FG AN based on the Build-a-thon activity. NOTE- Send a follow up LS/o on Build-a-thon output
Grand Challenge Finale	Dec 2022	Overall Challenge finals.

NOTE- optionally, teams can contribute to ITU J-FET journal submissions in early 2023, based on the call for papers.

4.3 Kickoff workshop (3 June, 2022)

12noon-12.30 pm CEST	Intro by Chair VIP motivational speeches	Chair VIPs
12.30pm-1pm CEST	Background and descriptions	Vishnu
1pm -2pm CEST	FlexRIC as a platform for Build-a-thon 2022, Q&A	Navid, Alireza Eurecom
2pm-3pm CEST	Learning from the TOSCA data experience, discussion and Q&A.	Chinmaya Mobile & Cloud Lab, Institute of Computer Science, University of Tartu, Estonia.
15mn Yoga break		
3.15pm-4pm CEST	Presentation by use case mentors, Teams, discussion and Q&A	Use case mentors, Build-a-thon Teams, And Vishnu
4pm-4.30pm CEST	Extra time, New comer intros, other comments, presentations and Q&A	Welcome newcomers, Background tools, pointers, github, etc Questions, comments.

The kick-off workshop took place on the 3rd of June, 2022.

During this workshop, 118 participants registered and 74 participants attended the workshop.

The recording of the session can be accessed here: [Build-a-thon Kick-off workshop recording](#)

4.4 Workshop 2.0 (2 Sep 2022)

2 September – Friday FG-AN Build-a-thon 2022 Workshop Remote Platform: Zoom Meeting (Register by clicking here)
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12:00 –16:30	10. Intro by Chair / VIP motivational speeches		
	11. Background and descriptions	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-282.pptx	Vice-Chair: Vishnu Ram
	12. How to use TOSCA YAML in Build-a-thon	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-281.pptx	Guda Blessed
	13. Build-a-thon Team Demo	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-280.pptx	Team Digital Twin
	14. Build-a-thon Team Demo	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-275.pptx	Team InnovNet
	Break		
	15. Research Methods and Paper Editing: A guide for Build-a-thon participants	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-283.pdf	Dr. Ibrahim Aliyu, Chonnam National University, Gwangju, South Korea
	16. Build-a-thon Team Demo	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-291.pptx	Team Costa Rica
	17. Extra time, Newcomer intros, other comments, presentations and Q&A		Use case mentors, Build-a-thon Teams, Vishnu
	18. Closure		

Workshop 2.0 took place on the 2 Sep, 2022. 73 participants registered and 42 participants attended the workshop.

The recording of the session can be accessed here: [Build-a-thon workshop 2.0 recording](#)

4.5 Workshop 3.0 (7 Nov 2022: judging and demo event)

Proposed abstract: “Workshop 3.0 will be the final event for FG AN Build-a-thon 2022. The workshop will bring all Build-a-thon participants who submitted a solution and enable presentations and exciting demos by the teams. Experts from the FG AN would set the stage for the team presentations and demos with an interesting exchange of views on the related use cases, architecture and proof of concepts. Team presentations will cover key concepts such as evolution, explain the graph based techniques and representation of AN use cases. The top teams selected from the Workshop 3.0 will represent the Build-a-thon in the final event of ITU AI/ML 5G Challenge.”.

Nominations for judges:

- **Stephen McQuistin:** Stephen McQuistin is a researcher in the School of Computing Science at the University of Glasgow. His research focus is on improving the Internet protocol standards process, and its outputs, by designing tools and interventions. As part of this, he regularly takes part in the IETF, to promote adoption of these techniques. Stephen also contributes to computing science outreach activities, which most recently involved holding a Python workshop for students in Nigeria.
- **Rodel Urani:** Rodel has extensive experience in various sectors. He has created a strong partnership with stakeholders in their technological enterprise in which initiatives was steered thoroughly and properly, affirming business success.

He advised business owners, boards, decision makers, industry veterans, and locally acknowledged pundits and experts in their technology plans including but not limited to best-in-class solutions, practicality and viability of allocated resources and facilities.

He finished his master's degree, was commissioned in Philippine Army, is certified to various technologies including job roles. He is a frequent participant to technology incubation, recommended practices, industry research and continuing education programs.

07 Nov 2022 – Monday FG-AN Build-a-thon 2022 Workshop 3.0 12noon – 16.30 Geneva (CET) Remote Platform: Zoom Meeting (Register by clicking here)			
12:00 – 16:30	1. Intro by Chair / VIP motivational speeches	12.00-12.15	Leon (FG AN Chair) and Wei Meng(Director of Standards in ZTE)
	2. “Fireside chat” – setting the stage for Build-a-thon.	12.15-12.45	Leon, Paul, Xiaojia, Vishnu.
	3. Intro to judges	12.45-12.50	Vishnu, Stephen McQuistin Rodel
	4. team-1: digital_twins	13.00-13.20	Cat 1
	5. team-2: InnovNet	13.20-13.40	Cat 1
	6. team-3: AI_ML_SSD	13.40-14.00	Cat 2
	7. team-4: Costa Rica (Oscar, Ericka and colleagues), 7am Alajuela time.	14.00-14.20	Cat 2
	8. team-5: Tech Rangers	14.20-14.40	Cat 1
	9. team-6: Morse coders	14.40-15.00	Cat 2
	10. team-7: Avengers	15.00-15.20	Cat 2
	11. team-8: Heartfiial Intelligems	15.20-15.40	Cat 2
	12. team-9: DMTelcomTeam	15.40-16.00	Cat 2
	13. team-10: Roger That	16.00-16.20	
	14. team-11: TCS SMART Machine	16.20-16.40	
	Closure		

64 participants registered and 44 participants attended the Build-a-thon 2022 workshop 3.0. The recording of the session can be accessed here: [Build-a-thon workshop 3.0 recording](#)

4.6 Podcasts and webinars

- India partner (IIT/D):
 - Landing website: https://bhartischool.iitd.ac.in/build_a_thon/index.html
 - Dataset: https://drive.google.com/file/d/19uaJjJY0-ItKJ35f_OI6Nb_A_3uAuKTc/view
- July 22, 2022, IIT/Delhi: India workshop-1 on “Build-a-thon: AI/ML driven Low Latency Closed Loop Control”
https://us06web.zoom.us/webinar/register/WN_nmKKI7k7RtacgZdVXVNI0w
Recording: <https://youtu.be/m-iWNfoBC8I>
- Aug 26, 2022: IIT/Delhi: India workshop-2 on “Build-a-thon: AI/ML driven Low Latency Closed Loop Control” https://us06web.zoom.us/webinar/register/WN_S-ExgHvPTQ2gNhvPE1q7xA
Recording: <https://youtu.be/pHqNHQxiBEo>
- Sep 12, 2022: IIT/Delhi: India round-table on “Build-a-thon: AI/ML driven Low Latency Closed Loop Control” ,
Recording: <https://youtu.be/UedZYsrTPQg>
- Sep 23, 2nd Round Table Session for Build-a-Thon on 23rd Sep, 2022 from 4:00-5:00 pm at IIT Delhi. <https://youtu.be/7sBZ1kLC6hs>
- Oct 14: Closing event (hybrid) in New Delhi - Please Register to attend online: https://us06web.zoom.us/webinar/register/WN_MJXF803zTAif55jaUKWQ5A
Recording: <https://www.youtube.com/watch?v=UedZYsrTPQg>

4.7 Demo SG13 hybrid workshop

International Telecommunication Union (ITU) is organizing a workshop on “**Advances in evolutionary autonomous networks: Use cases, architecture and PoC**” and **demo day** which will be held on Tuesday morning 15 November 2022 at ITU headquarters in Geneva, Switzerland.

<https://www.itu.int/md/T22-TSB-CIR-0033/en>

<https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2022/20221115/Pages/default.aspx>

4.8 Grand Challenge Finale

14 Dec 2022, <https://aiforgood.itu.int/about-ai-for-good/aiml-in-5g-challenge/>

4.9 Lessons Learnt

General

- 1) Local partners “hub” is important
- 2) Mentoring is super important
- 3) Regular progress and monitoring of progress drives up submissions and quality
- 4) well-defined, automated workflow and submission process is needed.
- 5) Simulators and software component availability matters.
- 6) Since our problem statement is domain specific (networks and automation related), ramp up of teams matter, unless their research is already focussed on this area.
- 7) better engagement tools are needed via social media.
- 8) Reference solution helps teams to quickly build submissions.

Specific

- 1) The use of various tools and techniques are seen
 - JSON vs. YAML,
 - xOpera,

- NLP,
 - prediction methods, Graph datascience.
- 2) use of cat 1 and cat 2 use cases.
 - 3) closed loops covering a large scope were presented (e.g. du)
 - 4) Lack of specific CL frameworks (e.g. ZSM, ENI, ONAP)

4.a Next steps

The following next steps are proposed:

- 1) Analyse for new use cases based on the submissions.
- 2) Edit a paper based on the submissions.
- 3) Propose options for Build-a-thon 2023

5 Conclusion

This contribution reports on the build-a-thon 2022 (aligned with the ITU AI/ML in 5G Challenge). We call for support for this activity and request participants in FG-AN for resources and pointers for the build-a-thon.

6 References

- [ETSI GS ZSM 001] Zero-touch network and Service Management (ZSM); Requirements based on documented scenarios
- [FG-AN ToR] Terms of Reference: ITU-T Focus Group on “Autonomous Networks” (FG-AN) https://www.itu.int/en/ITU-T/focusgroups/an/Documents/FG-AN_Terms_of_Reference.pdf
- [FGAN-I-006] ITU AI/ML in 5G Challenge (second edition, 2021)
- [FGAN-I-072] O-RAN SC architecture and collaborative use cases deep dive
- [FGAN-O-013-R1] ITU-T FG AN “Use cases for Autonomous Networks”
- [ITU Challenge URL] <https://aiforgood.itu.int/ai-ml-in-5g-challenge/>
- [OSNL Testbed] S. Sultana and A. Mittermaier. (2022, 03/12). *Updates on the 5G test network, Plans on intent based-network slicing*. Available: <https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-197.zip>
- [ONAP CL] <https://wiki.onap.org/display/DW/Defining+Control+Loops+in+TOSCA+for+CLAMP>

Annex I: Team details for 2022

Number	Team	Report	Github	Presentation slot in the agenda of Nov meeting [check the meeting agenda for latest slot]
1	digital_twins	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-303.docx	TBD	Álvaro Pendas Recondo, engineer intern at Rakuten Mobile Inc. in Tokyo. Jaime Fúster de la Fuente, engineer intern at Rakuten Mobile Inc. in Tokyo.
2	CR-Insight	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-302.docx	TBD	Ericka (TeamLeader) Amanda, Nicolle Alberto Oscar (Mentor) CostaRica.
3	CR-Analytics			Abigail (TeamLeader) Jackeline Melanie Oscar (Mentor) CostaRica.
4	InnovNet	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-304.docx	TBD	Tarek Mohamed Abdullah Egypt
5	Easy System	TBD	TBD	Amr Elsayed, Ahmed Murad Mostafa Mohamed, Mahmoud Mohamed Karim Rabie (mentor)
6	Ritpantaram	TBD	TBD	name-vaibhav Kumar, designation-MTech student, affiliation-Indian Institute of technology Delhi, country-India
7	AI_ML_SSD	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-296-R1.docx	TBD	Debanka Giri, Project Scientist, IIT Delhi Sudev Kumar Padhi, PHD, IIT Bhilai, India Nitin kumar Choudhary, M.Tech, IIT Bhilai, India Mohit kumar, B.Tech, IIT Bhilai, India

8	Acute Triangle	TBD	TBD	Sunday Agabaidu Abraham, Federal University of Technology Minna, Nigeria Akinseli Yemisi Esther, Federal University of Technology Minna, Nigeria Godswill, Federal University of Technology Minna, Nigeria
9	unknown warriors	TBD	TBD	Akash Sadhwani, Engineer ,civil, India
10	ILLUMINATI	TBD	TBD	Tanishq
11	Build-a-tron	TBD	TBD	Shaurya Mohan, Student, IIT Delhi, India Shravan Nawandar, Student, IIT Delhi, India Aarushi Gupta, Student, IIT Delhi, India Apar Ahuja, Student, IIT Delhi, India
12	Team Prime	TBD	TBD	Rahman Alam,Masters Student,IIT Delhi, India Yogesh Mathpati,Masters Student,IIT Delhi, India Mahadev,Masters Student,IIT Delhi, India Kalpesh More,Masters Student,IIT Delhi, India
13	The Step-Dads	TBD	TBD	Tanishq Panwar, student, IIT Delhi, India Aditya Mathur, student, IIT Delhi, India Hitarth Agarwal, student, RGIPT, India
14	Infinity	TBD	TBD	Mansi, 3rd year undergraduate at IIT-DELHI, India
15	Tech Rangers	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-298-R2.docx	TBD	Frank C. Ebeledike - Student - FUT Minna - Nigeria Emmanuel Othniel Eggah - Student - FUT Minna - Nigeria Abel Oche Moses - Student - FUT Minna - Nigeria Dr James Agajo - Associate Professor, PhD (Telecommunication

				and Computer Engineering), Head of Department, Computer Engineering - FUT Minna – Nigeria
16	Autonomers	TBD	TBD	Boutouchent Akram, Master Student @ Higher School of Computer Science Algiers & Intern @ La Rochelle University, France Kardjadja Youcef, Ph.D student @ La Rochelle University / Carleton University, France Adyson Maia, Ph.D @ La Rochelle University / Federal University of Ceara Meridja Abdellah Nassim, Master Student @ Higher School of Computer Science Algiers & Intern @ La Rochelle University, France
17	Morse coders	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-299.docx		Kodandram Ranganath, Technical Specialist, NOKIA Networks, Bengaluru, India Ayushi Khandal, SW Engineer, NOKIA Networks, Bengaluru, India Rakshesh P Bhatt, Senior Security Standardization Specialist, NOKIA Networks, Bengaluru, India Kunal Mahajan, Student, RVCE, Bengaluru, India Priksht CS, Student, RVCE, Bengaluru, India
18	Avengers	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-295-R1a.docx		Ashok Kamaraj, Technical Specialist, NOKIA Networks, Bengaluru, India Srinwaynti Samaddar, SW Engineer, NOKIA Networks, Bengaluru, India Sivaramakrishnan Swaminathan, Senior Standardization Specialist, NOKIA Networks, Bengaluru, India M SRI BHUVAN, Student, DSCE, Bengaluru, India NAGASWAROOP S N, Student, DSCE, Bengaluru, India
19	Heartifiial Intelligems	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-297-R1.docx		Sathish Venkateswaran, Technical Specialist, NOKIA Networks, India, Bengaluru Sarvasuddi Balaganesh, SW Engineer, NOKIA Networks, India, Bengaluru Rajat Duggal, System Specification Engineer, NOKIA Networks, India, Bengaluru

				Sree Ganesh Lalitaditya Divakarla, Student, PES College, India, Bengaluru Vaibhava Krishna Devulapali, Student, PES College, India, Bengaluru
20	Procoders			Mentor : Satya Kumar Vankayala, Staff Engineer, SRI-B, India Kuldeep Sharma-1, Engineer-1, SRI-B-1, India-1 Bharat Jain-2, Engineer-2, SRI-B-2, India-2 Ankita Jain-3, Engineer-3, SRI-B-3, India-3
21	DMTelcomTeam	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-301.zip		Wael Alron, Du Fathi
22	Roger That	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-305.docx		Musaib Amin Khuroo, Diploma CSE, JKSBOTE, India Suhaib Ajaz, BTech CSE, University of Kashmir, India
23	Team-bharti-IITD			Shashvat Sanadhya, Sr.project scientist, IITDelhi, India Priyal Thakkar, MS scholar, IITDelhi, India
24	Frontiers			name-Gautam Tiwari, designation- Student, affiliation-IIT Delhi, country-India name-Vinti Nayar, designation- Student, affiliation-IIT Delhi, country-India name-Pimmy Gandotra, designation-Research Associate, affiliation-IIT Delhi, country-India
25	TCS SMART Machine	https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-300.docx		Chandan Singh, Researcher, TCS, India Ayush Kumar, Researcher, TCS, India Vipul Sanap, Researcher, TCS, India

Annex-II: Results for 2022

Position	Team
1	digital_twins
2	Innovnet
3	AI_ML_SSD, Tech Rangers

Annex-III: Reference graphs

Reference code to produce the graph is available from
<https://github.com/vrra/FGAN-Build-a-thon-2022>

Please see att1 to this doc
https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-267-R2_att1.pptx

Annex IV: how to use neo4j (for controllers)

See the tutorial from WINEST

<https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-253.pdf>

Annex V: TOSCA representations (for controllers)

See the tutorial from WINEST

<https://extranet.itu.int/sites/itu-t/focusgroups/an/input/FGAN-I-253.pdf>

Annex VI: 2022 Build-a-thon Judges' Handbook

- Teams present their solution reports summaries during the Workshop 3.0 (see above) on 07 Nov 2022
- Judges score the Build-a-thon teams (which present during Workshop 3.0) for the 2022 Challenge.

Score metric	Max score
1. Is the report complete and ready? a) is the closed loop concept and use case well documented? b) is there a mapping to FG AN output?	10
2. Is the github available with code? a) is there a link between the report and the code? b) how is the code designing/implementing certain closed loop use case?	10
3. Is the demo of the task available via online/video? a) screenshots are provided OR b) video is provided	10
4. Is the team able to explain the design considerations? a) are there specific learnings from the experience of the team?	10
5. Is the team bringing out relation with FG AN tasks like use cases, other PoC, architecture, or gap analysis? a) clear references are provided to link the output with the tasks achieved by the team.	10
6. Feedback from mentors - Participation and engagement with mentors, regular and timely progress. a) has the team presented before in FG AN workshops or otherwise? b) was the report submitted on time?	10
7. Bonus points: for providing feedback and links to requirements/gaps: what are the impacts to existing reference points for enabling the AN key concepts? a) from the problem statement, which part is achieved by the team? b) are they able to articulate/explain well the links with other parts?	10

Do's and Don'ts for judges

- Do: give +ve feedback. Call out what the team did well.
- Do: call out opportunities for improvement.

3. Do: feel free to ask general technical questions on the domain, give technical comments – may be unrelated to “judging” aspect.
4. Don’t: link these general questions to judging activity, unless it is directly related to the task. At the bottom of your heart, you are an expert, and we @ ITU are glad that the participants may learn from you.
5. Do: Check again the task given to the team
6. Don’t: evaluate against your own idea of the task.
7. Do: try to understand the intent of the team, direction, context and approach and result.
8. Don’t: judge their English or language skills– this is not a language test. However, scope the team based on clear communication of tasks, learnings and output.
9. Do: when in doubt, feel free to call upon the mentors for any clarifications
10. Do: look for the team’s understanding of implementation
11. Do: take notes during the presentation of teams
12. Don’t: look for integrated E2E demo – we aren’t there yet.
13. Don’t: look for “accuracy” of “ML” models. That’s not the focus – unless mentioned in the task.

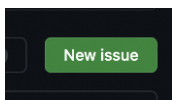
Sample questions to ask participants

1. “Show and tell” the report
2. “Show and tell” the github repo
3. “Show and tell” the video/demo
4. How is this related to FG AN work (i.e use cases, architecture or gaps?)
5. What are your key learnings?
6. How did you pace your work? i.e. how much work was done when? E.g. lit survey during April, design during Sep, coding testing during Oct, etc.

Annex VII: how to register for Build-a-thon 2022

Step-1: <https://github.com/vrra/FGAN-Build-a-thon-2022/issues>

Step-2: click “new issue”



Step-3: click “register for Build-a-thon 2022” [get started]



Step-4: Fill out the form

Step-5: Click “submit new issue”

