

ITU Focus Group on Autonomous Networks

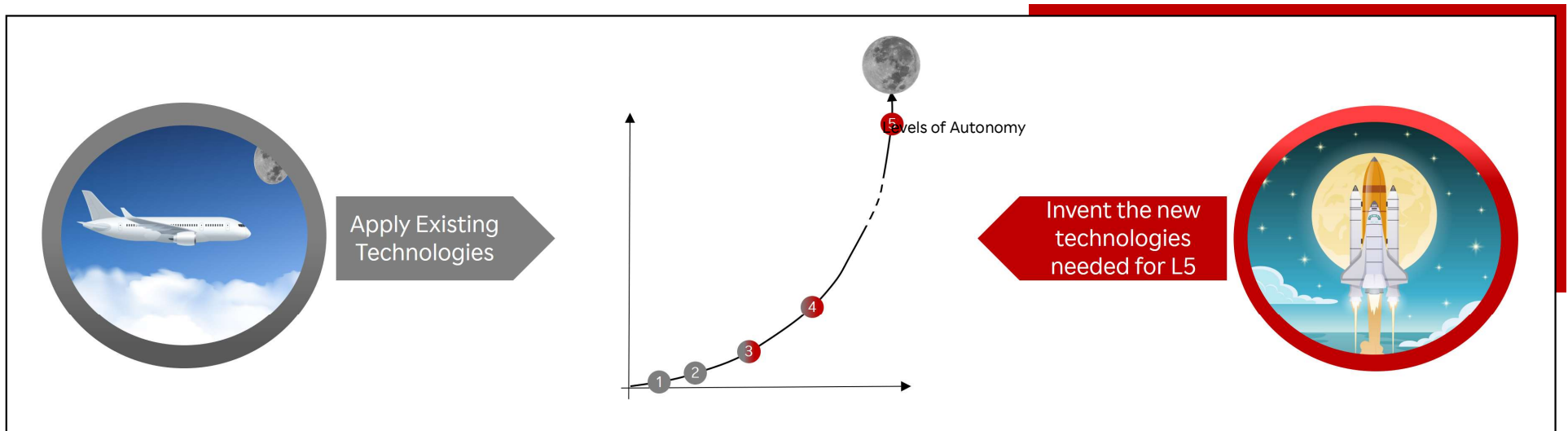
Feb 9, 2021 – IRTF COINRG Interim meeting

Leon Wong

Rakuten Mobile

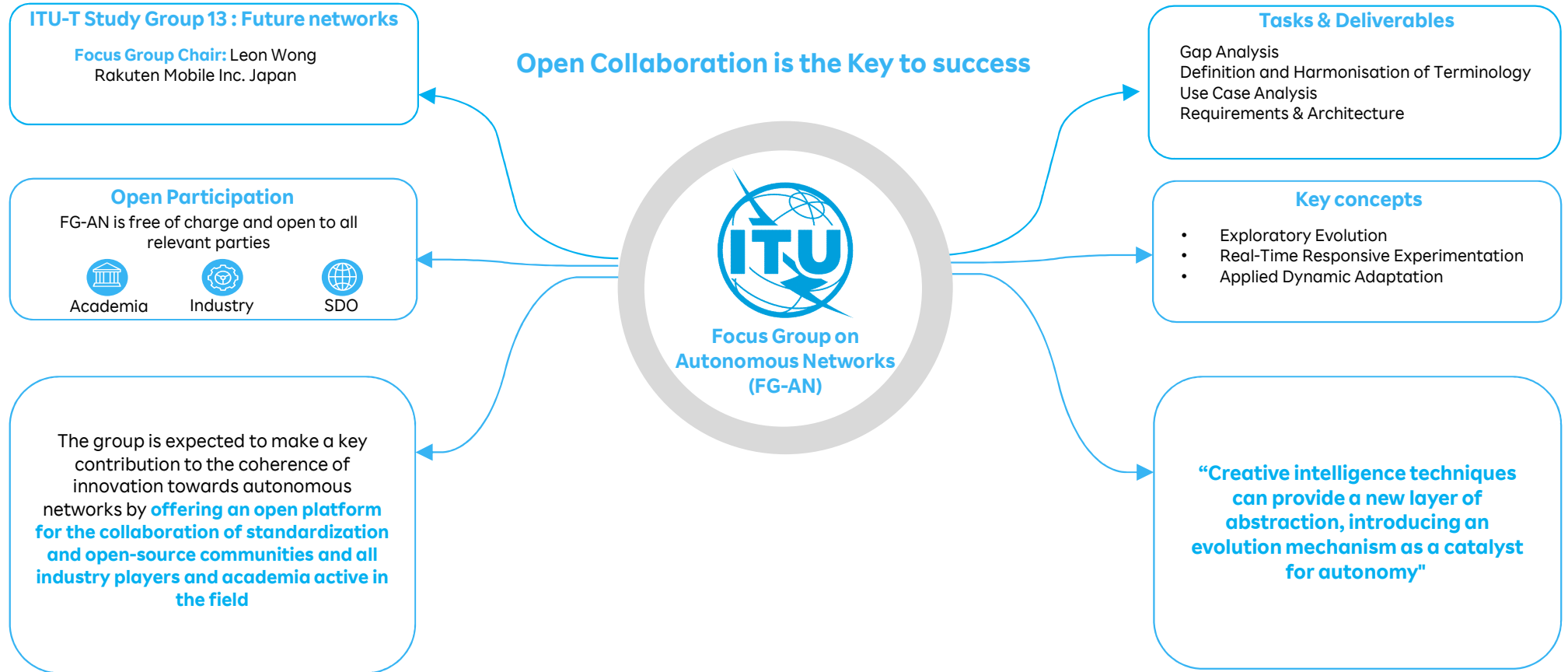


Some perspectives



“You will not reach the moon by trying to flight your plane higher...”

ITU Focus Group on Autonomous Networks



Key Concepts



Focus Group on
Autonomous Networks
(FG-AN)

01

**Exploratory
Evolution**



02

**Real Time
Responsive
Experimentation**



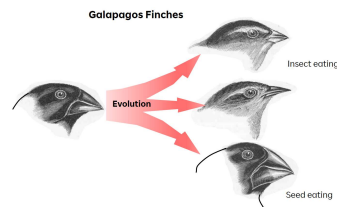
03

**Dynamic
Adaptation**

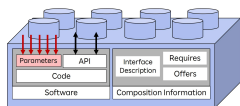


Exploratory Evolution in Future Networks : Making Logic

“Codify-able process of creativity.”



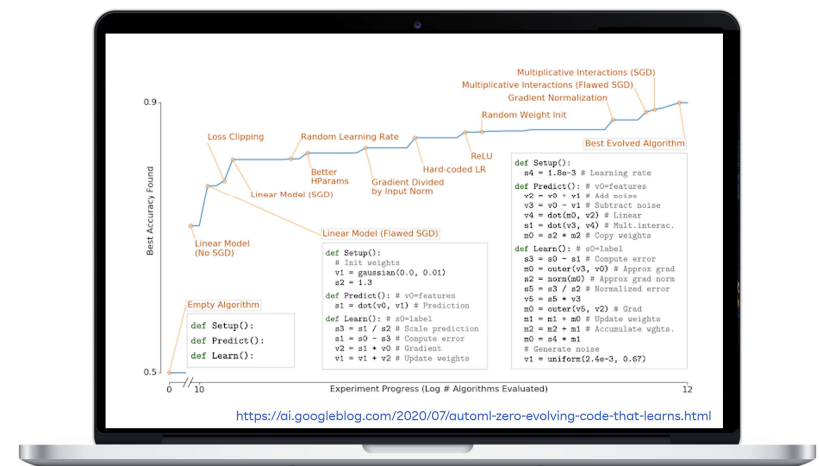
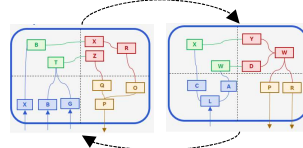
Parameters of a module



Choice of module



Topology of a controller



AutoML-Zero: Evolving Code that Learns



State space

How to reduce the number of possible choices?



Convergence Problem

How can we make the right choices in a reasonable time?

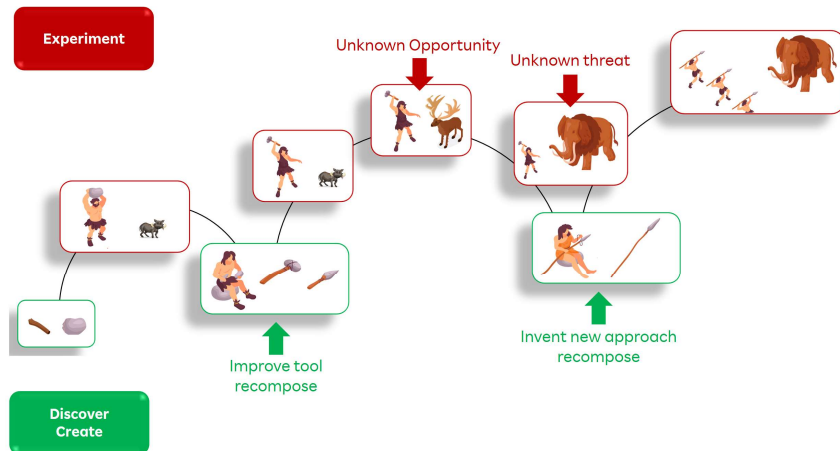


Exploitation vs Exploration

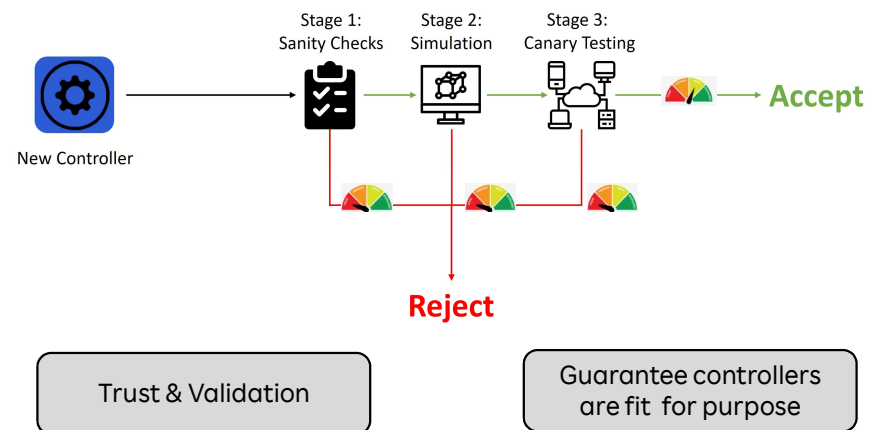
When is the right time to try something new?

Real-Time Responsive Experimentation: Validating Logic

"Humans test their ideas..."



...so should machines."



How to recreate an **effective environment** per use case automatically?

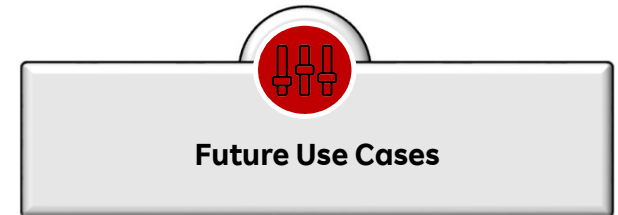
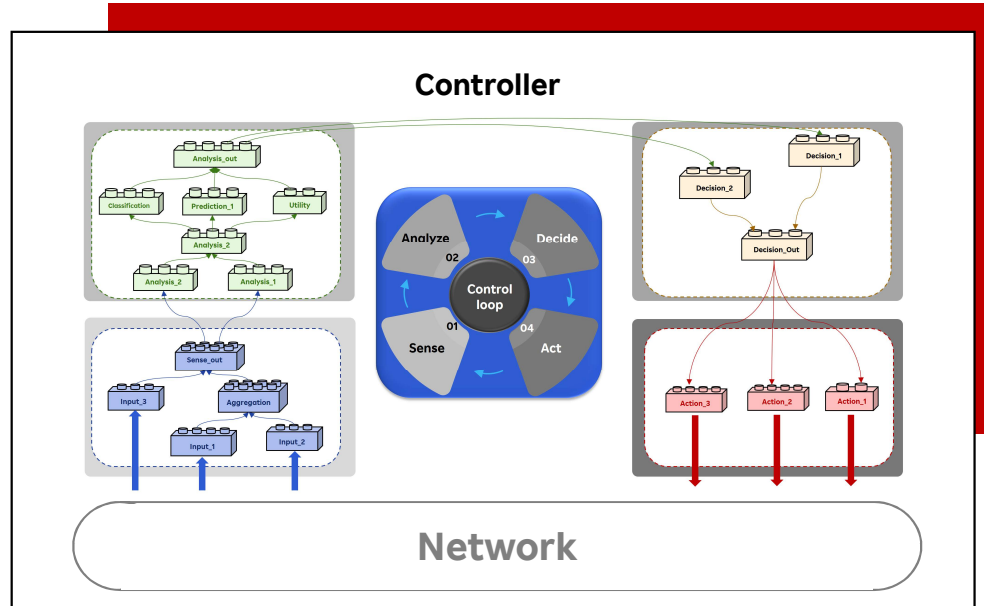
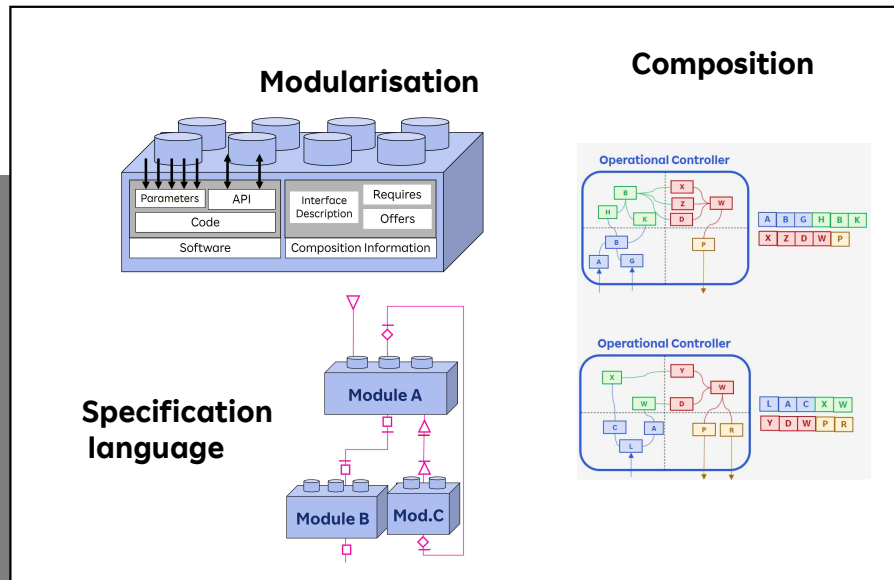


Simulation & Canary Testing
How to balance simulation and Canary testing?



Digital Twin
How to experiment without breaking the real network?

Dynamic Adaptation: Applying Logic



1st Meeting in a Nutshell

225 registrations
~110 participants / day
34 Contributions

Including...

ROA : Recognized Operating Agency	19
SIO: Scientific or Industrial Organization	23
Industry Others	5
Universities/Research Org	37
Admin / State /Ministry/Reg.	27

Document	Title	Members
FGAN-I-004	LS//r on the establishment of a new Focus Group on Autonomous Networks [from ETSI ISG ZSM]	ETSI ISG ZSM
FGAN-I-005_att	ETSI ZSM and Autonomous Network	ETSI ZSM
FGAN-I-006	ITU AI/ML in 5G Challenge (second edition, 2021)	ITU/TSB
FGAN-I-007	Integration of network simulators in Closed-Loop Automation for Future Networks: work done and ways forward	Centre Tecnològic de Telecomunicacions de Catalunya (CTTC)
FGAN-I-008	Proposal of two use cases for FG AN	China Telecom
FGAN-I-009	Proposal to create a WG to discuss use cases of service systems and autonomous network	OKI, KDDI
FGAN-I-010	Network operator's trust in autonomous networks	China Mobile, Vishnu Ram OV- India, Rakuten Mobile
FGAN-I-011	Use case of autonomous complaint handling for future networks including IMT-2020	China Mobile, Vishnu Ram OV- India, Rakuten Mobile
FGAN-I-012-R1	Study of use cases for Autonomous Networks	Telecommunication Engineering Centre (TEC), Ministry of Communications, India
FGAN-I-013	Proposed draft Liaison statement (LS/o) on "Call for use cases for autonomous networks"	Vishnu Ram OV
FGAN-I-014	Machine Learning for Network Automation: Some Ideas on the topic	University Carlos III of Madrid
FGAN-I-015-R1_att	Toward Open, Programmable, and Virtualized 5G Networks	Institute for the Wireless Internet of Things, Northeastern University, Boston, MA, USA
FGAN-I-016	Autonomic/Autonomous Networking: Multi-Layer Autonomics in ETSI GANA and Federated Knowledge Planes for Autonomics	ETSI TC INT AFI WG
FGAN-I-017_att	Use Cases on RAN Intelligence	China Mobile Research Institute
FGAN-I-018_att	Toward effective Network Traffic Classification via Deep Learning	DIETI, University of Naples, Federico II
FGAN-I-019	Autonomous CDNs	Varnish Software, Sweden
FGAN-I-020	Real-time Responsiveness and Dynamic Adaptation in Edge Computing Systems	Queen's University Belfast, United Kingdom
FGAN-I-021_att	A brief retrospective of Autonomic Networking	IRTF Network Management Research Group (NMRG)
FGAN-I-022	Use case and requirements for autonomous networks based on hierarchical closed loops	Fraunhofer HHI
FGAN-I-023	Acumos/DCAE Integration, ML/AI aided ONAP-DCAE	Highstreet Technologies GmbH
FGAN-I-024	TM Forum Autonomous Networks Initiatives	TM Forum
FGAN-I-026	An Autonomous Leap	Rakuten Mobile
FGAN-I-027_R1_att	E2E Network Slicing use case: Overview, Closed Loop Automation & Intelligent Operation	Wipro, China Mobile, Huawei
FGAN-I-028	Autonomous Network Management for 5G and Beyond Services and Vertical Applications	University of the West of Scotland
FGAN-I-029_att	Communication-efficient and distributed ML for 5G and beyond	University of Oulu
FGAN-I-030	Proposal to add an Use case of autonomous network - Autonomous Massive MIMO	ZTE
FGAN-I-031	Proposal for a "Build-a-thon" aligned with ITU AI/ML in 5G Challenge (second edition, 2021)	Vishnu Ram O.V, Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), China Mobile, Rakuten Mobile, ZTE
FGAN-I-032_att2	Leveraging the NGMN E2E Architecture Framework on Autonomic Networking for 5G and beyond	NGMN Alliance
FGAN-I-033	Introduction to the core concepts in AN	FG AN Chairman
FGAN-I-034	ITU-T SG11 Highlights - Study Period (2017-2020)	ITU-T SG11
FGAN-I-036	Self-organization in future cellular networks: ongoing efforts and research plans in 6GNC	North Carolina State University
FGAN-I-037-R1_att	Innovative Application of Autonomous Network of China Unicom	China Unicom
FGAN-I-038	Network from Open-source Perspective	ZTE
FGAN-I-040	Proposed draft Liaison statement (LS/o) to TM Forum	Vishnu Ram OV

Work Group Structure

Working Group	Work Items (under discussion)	Deliverables
WG1: Use Cases and Requirements Analysis	<ul style="list-style-type: none"> · Use cases collection, analysis - including non-functional aspects · General requirements of Autonomous Networks based on use case analysis 	Report and specifications for use cases requirements and analysis
WG2: Core Technical enablers and Architecture	<p>Exploratory Evolution</p> <ul style="list-style-type: none"> · Study the different drivers and mechanisms of evolution · Produce guidelines for application of the evolutionary concept to various use cases · Study the application of evolutionary mechanisms and which of them need interoperability and openness <p>Real-time Responsive Experimentation</p> <ul style="list-style-type: none"> · Study mechanisms which will enable automating experimentation and analyse the need for new experiments. · Report on the specification languages/representations required to document such experimentation · Produce guidelines for the application of such experimentation that <ul style="list-style-type: none"> o Accept the “explorations” of exploratory evolution o Construct new real-time responsive experimentation to suitably verify these “explorations” o Validate the “explorations” <p>Dynamic Adaptation</p> <ul style="list-style-type: none"> · Unifying generic architectural models and reference architecture for an autonomous abstraction layer based on exploratory evolution and real-time experimentation. · Study mechanisms which will enable creating autonomous interoperable interfaces to achieve new use cases without human intervention. · Define/document the taxonomies, ontologies, or specification languages necessary to describe the architectures or sub-elements thereof, for the purpose of autonomous dynamic adaption 	<p>Technical reports and specifications for Architecture and core concepts</p> <p>Note: All items to be in symbiosis with the use cases and orientated by the 3 key concepts</p>
WG3: Proof of Concepts	<ul style="list-style-type: none"> · To create demonstrable PoC aligned with use cases and architecture · To engage other groups and initiate active collaboration regarding existing prototypes, open sources, plugfest, hackathons and other events 	Technical reports and supporting demonstrations

For more collaboration



**Synergise Efforts,
Accelerate Adoption**



**Open Collaborative
Platform**



**Study & Advance
Approaches**



**Focus Group on
Autonomous Networks
(FG-AN)**

Visit **[FG-AN homepage](https://www.itu.int/en/ITU-T/focusgroups/an)** for more info
<https://www.itu.int/en/ITU-T/focusgroups/an>

Rakuten