Autonomous Networks: Beyond Automation

Scottish Autonomous Networked Systems 2022

December 13th, 2022

Philip Rodgers

Rakuten Mobile, Inc

Rakuten

Rakuten Mobile Innovation Studio

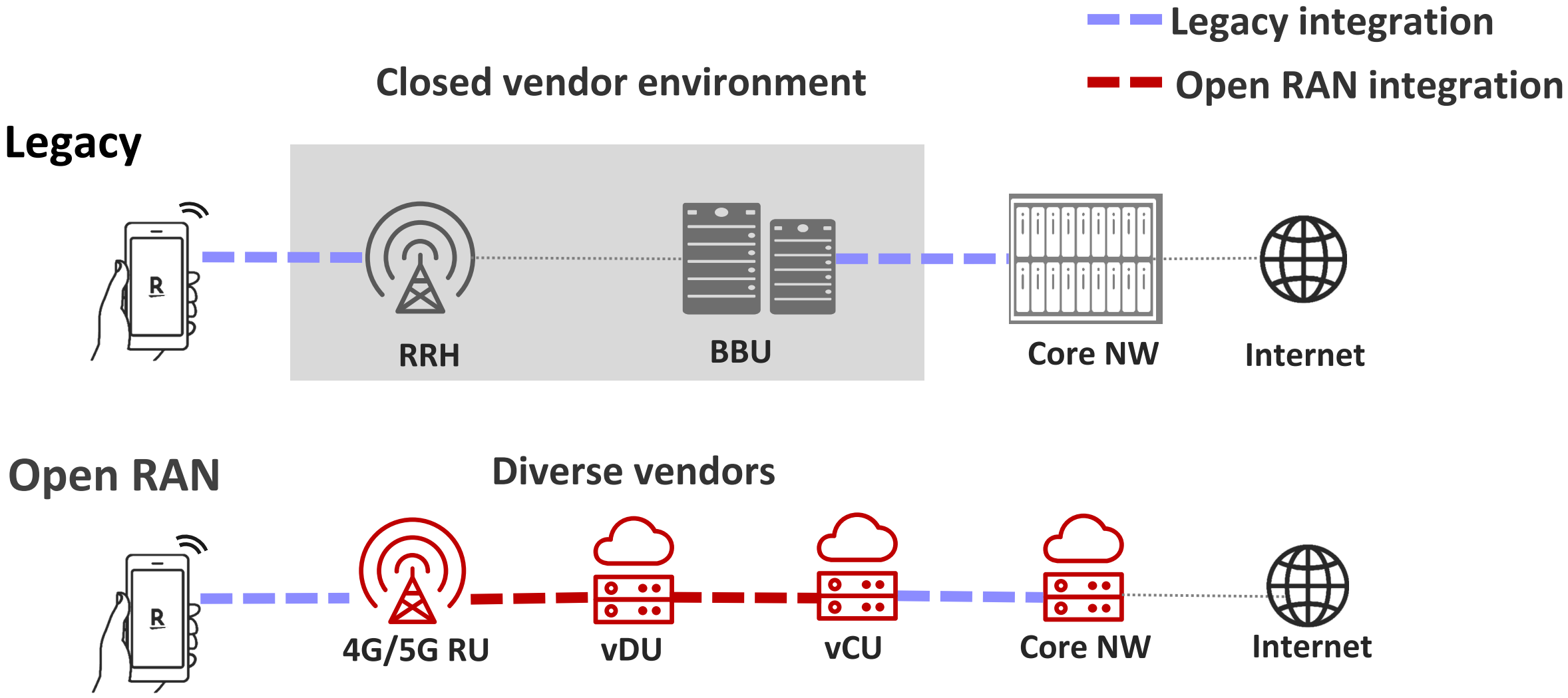
Rakuten Mobile Innovation Studio

Dedicated to making Autonomous Networks a reality

Team of PhD researchers, SW engineers & experienced Telco professionals

footprint on the moon Image creator Buzz Aldrin, 1969, Image credit © Corbis

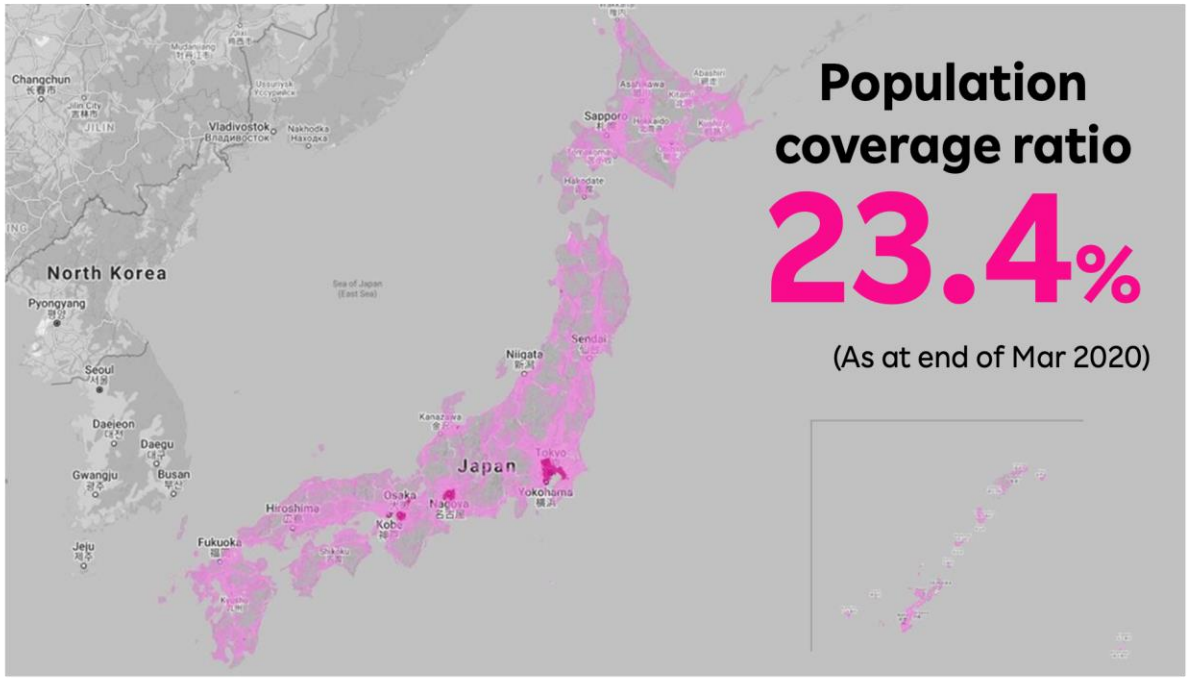
End-to-End Fully Virtualized Cloud Native Mobile Network



End-to-End Fully Virtualized Cloud Native Mobile Network

Rakuten network area
Roaming partner network area

At full scale commercial launch (Apr 8, 2020)

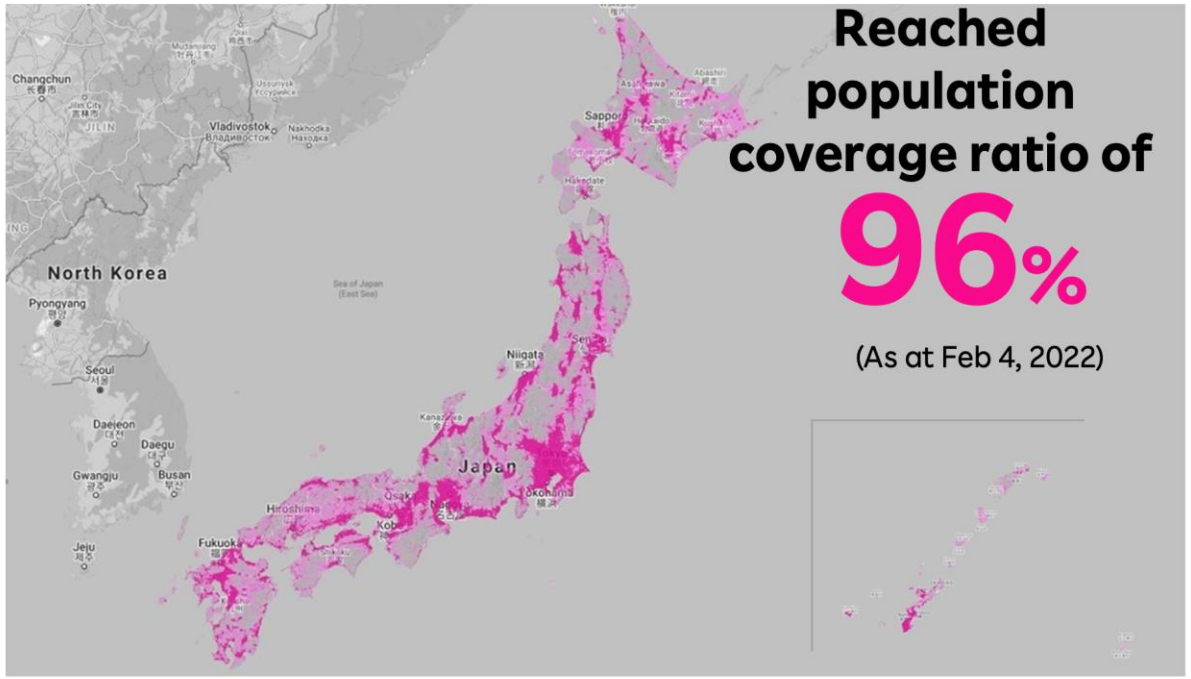


Population coverage ratio

23.4%

(As at end of Mar 2020)

Feb 4, 2022



Reached population coverage ratio of

96%

(As at Feb 4, 2022)

* Night-time population coverage ratio *Depending on the timing of calculation and other factors, there may be cases where the area map does not reflect actual coverage.

Map data ©2022 Google, TMap Mobility

Innovations for the Telco Industry

Global Open RAN Leadership

Highly Advanced Edge Network

Efficient Operations through Automation

Innovations for the Telco Industry

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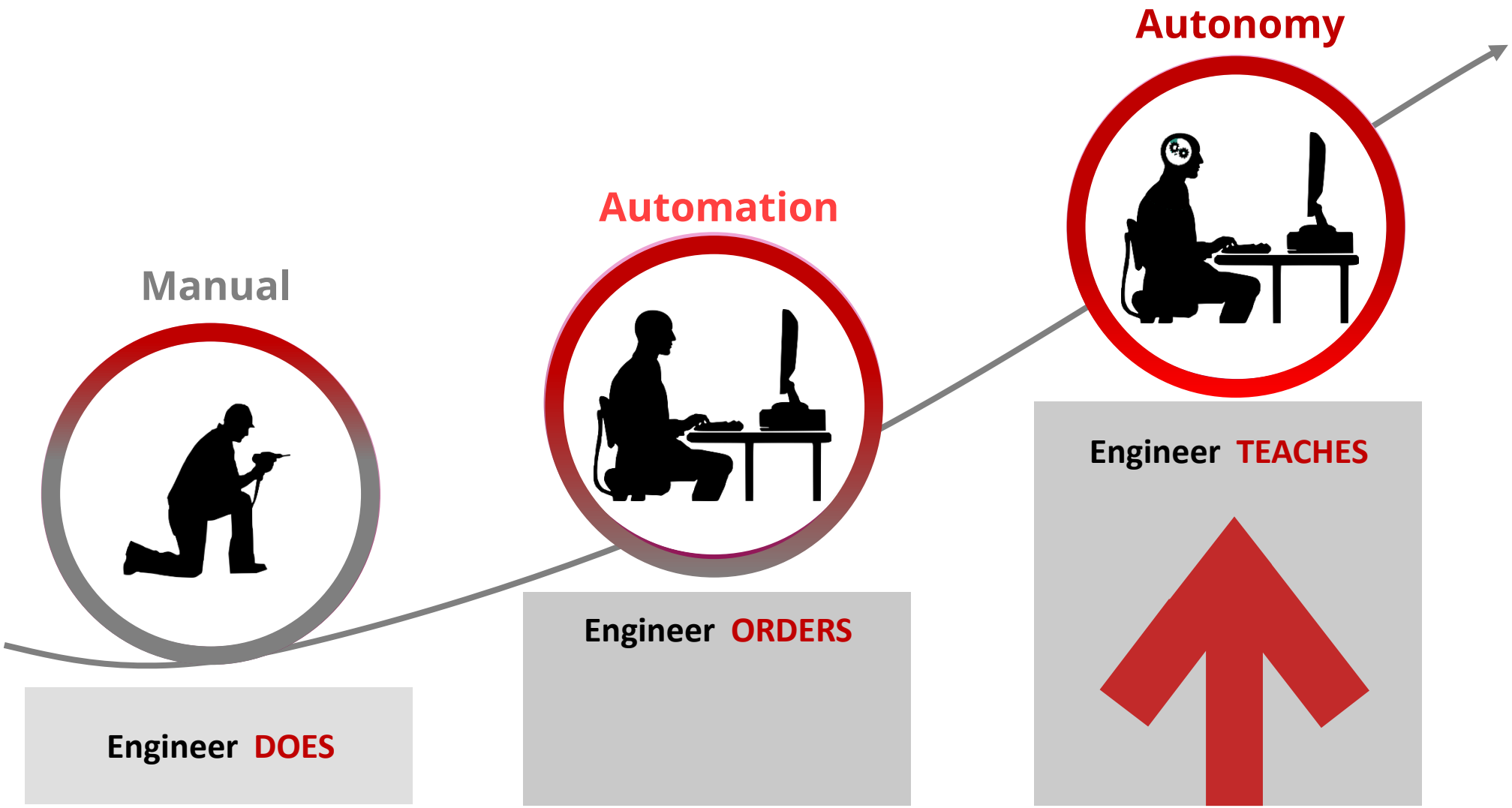
What's next?

Autonomous Networks?

Hypothesis: Autonomy is better than Automation



Autonomous Networks

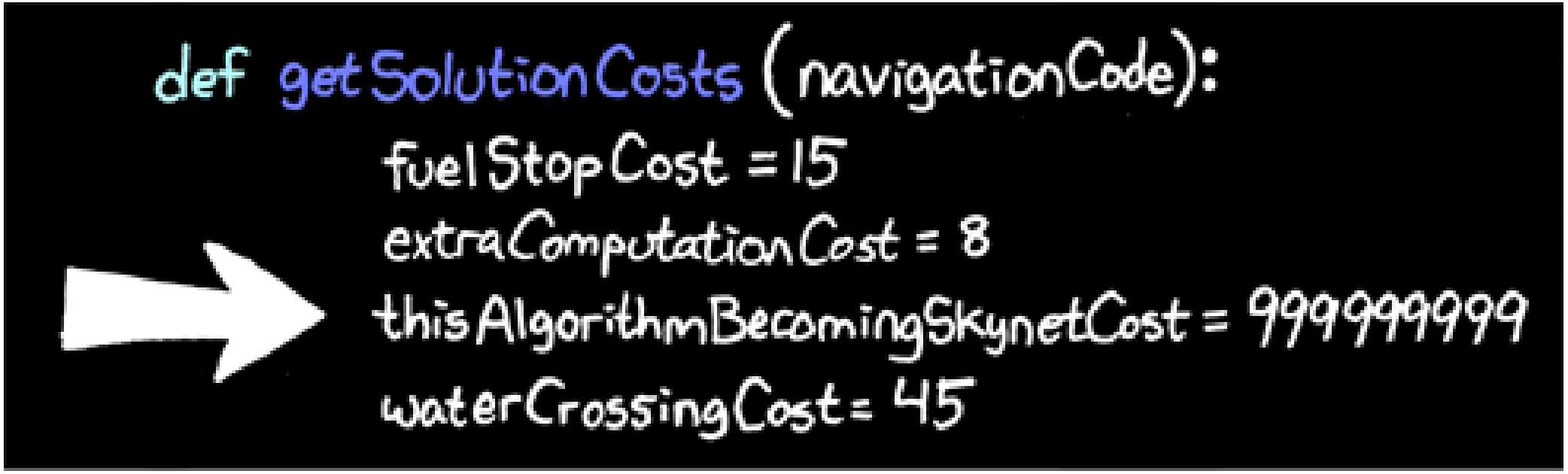
What does

“Autonomous Networks ”

mean to you?

MARKETWATCH PHOTO ILLUSTRATION/EVERETT COLLECTION

Obligatory XKCD Reference

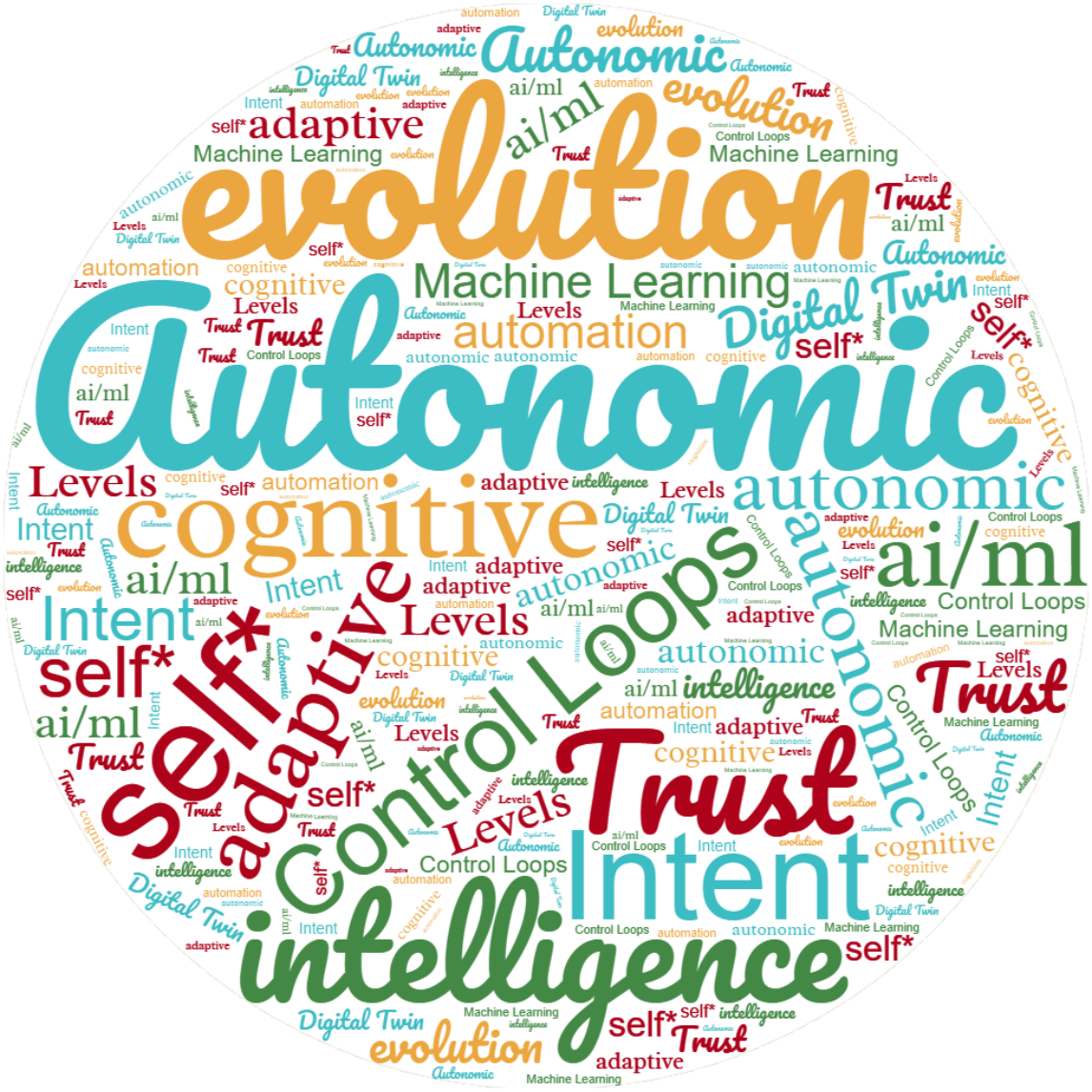


GENETIC ALGORITHMS TIP:
ALWAYS INCLUDE THIS IN YOUR FITNESS FUNCTION

(Just make sure you don't have it maximize instead of minimize)

https://xkcd.com/534/

What are “Autonomous Networks”?

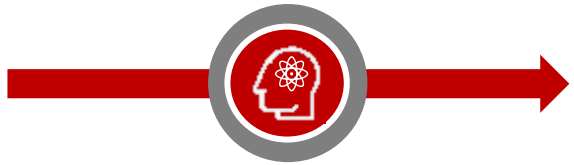


Beyond Automation towards Autonomy

Automation

Independent operation of a system:

- within well-defined parameters
- based on a limited set of predefined rules or constraints



Autonomy

Implies:

- large degree of adaptation,
- learning and decision making by the system itself.

01 Decide when to act ?

02 Deal with unknown situations ?

03 Invent a new approach ?

Research Approach: Key Concepts

01

CREATE

Evolutionary
Exploration

02

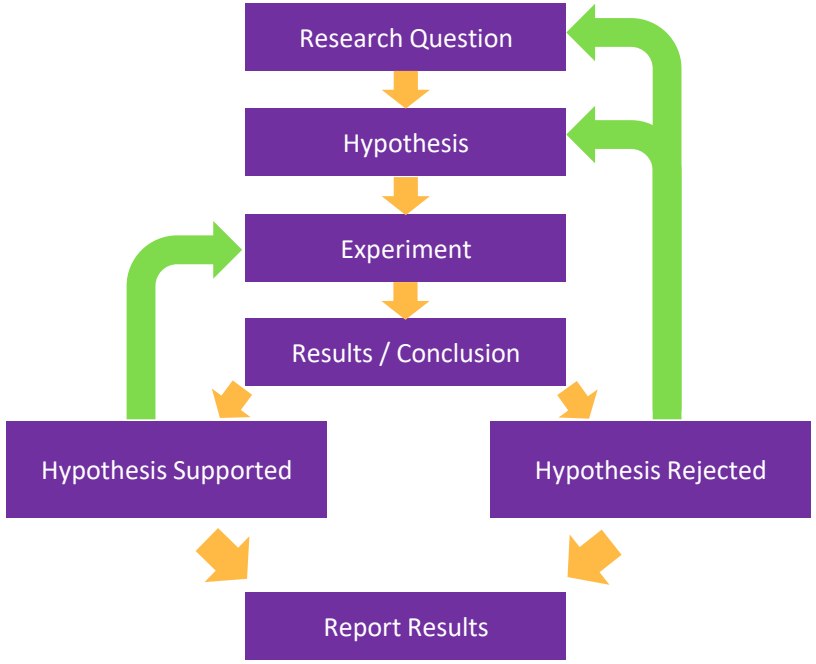
VALIDATE

Real-time
Responsive
Experimentation

03

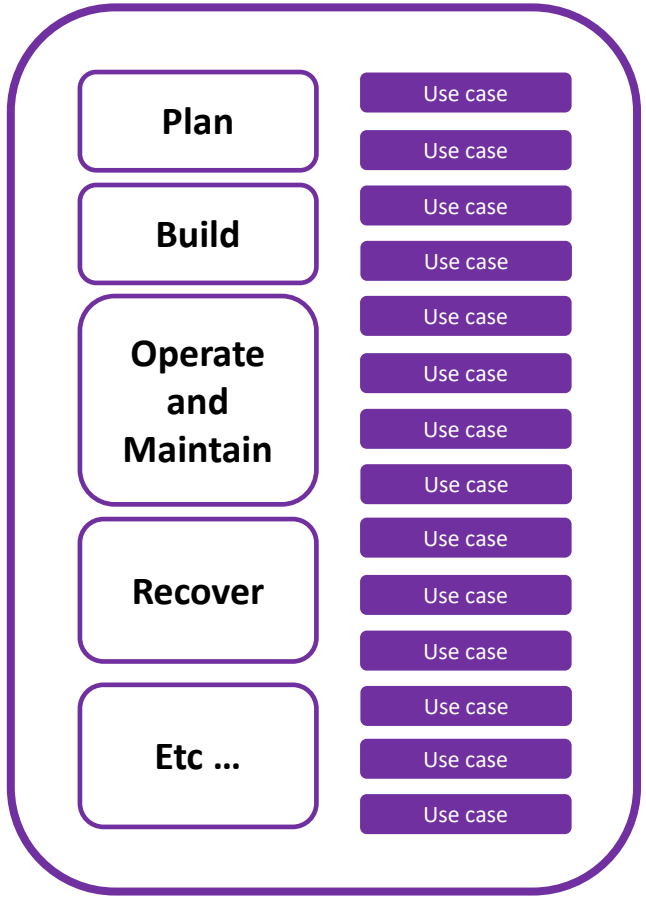
APPLY

Dynamic adaptation

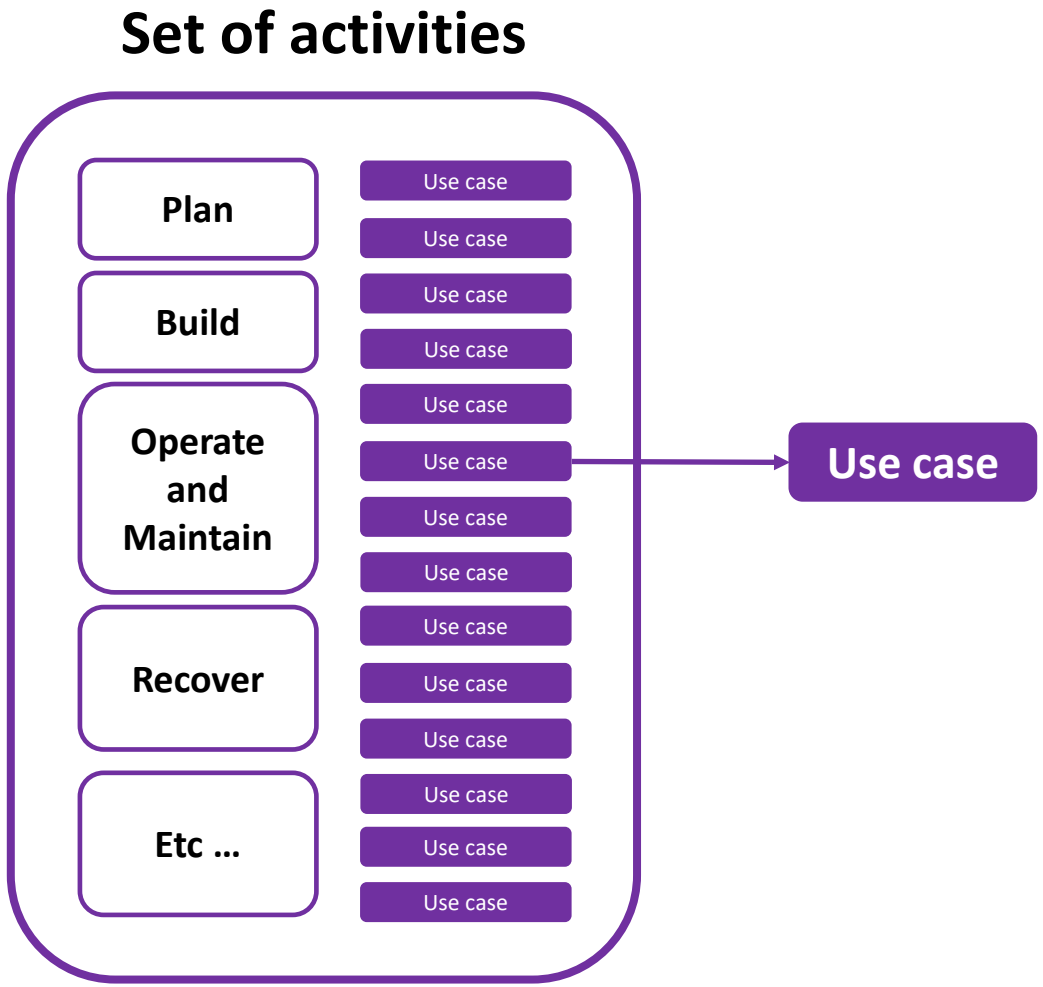


Operating a Network

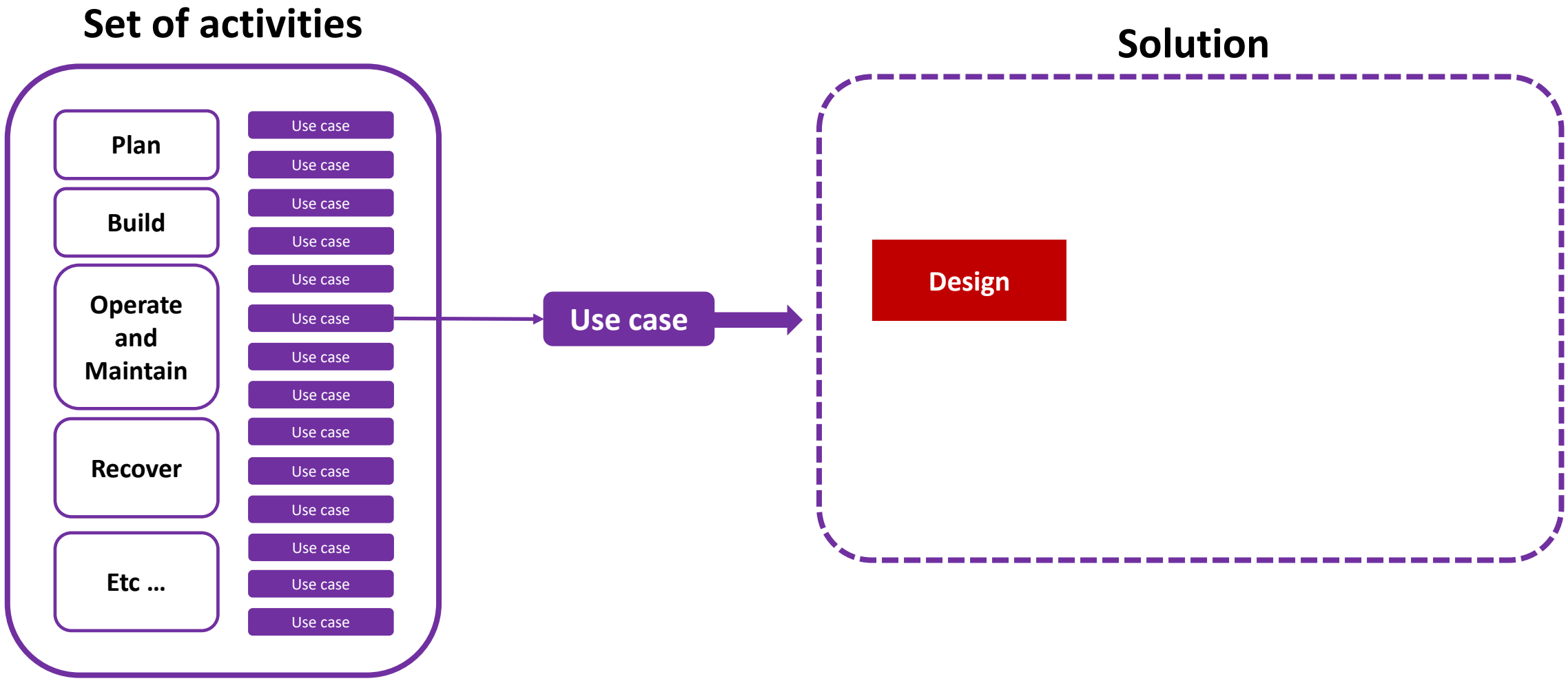
Set of activities



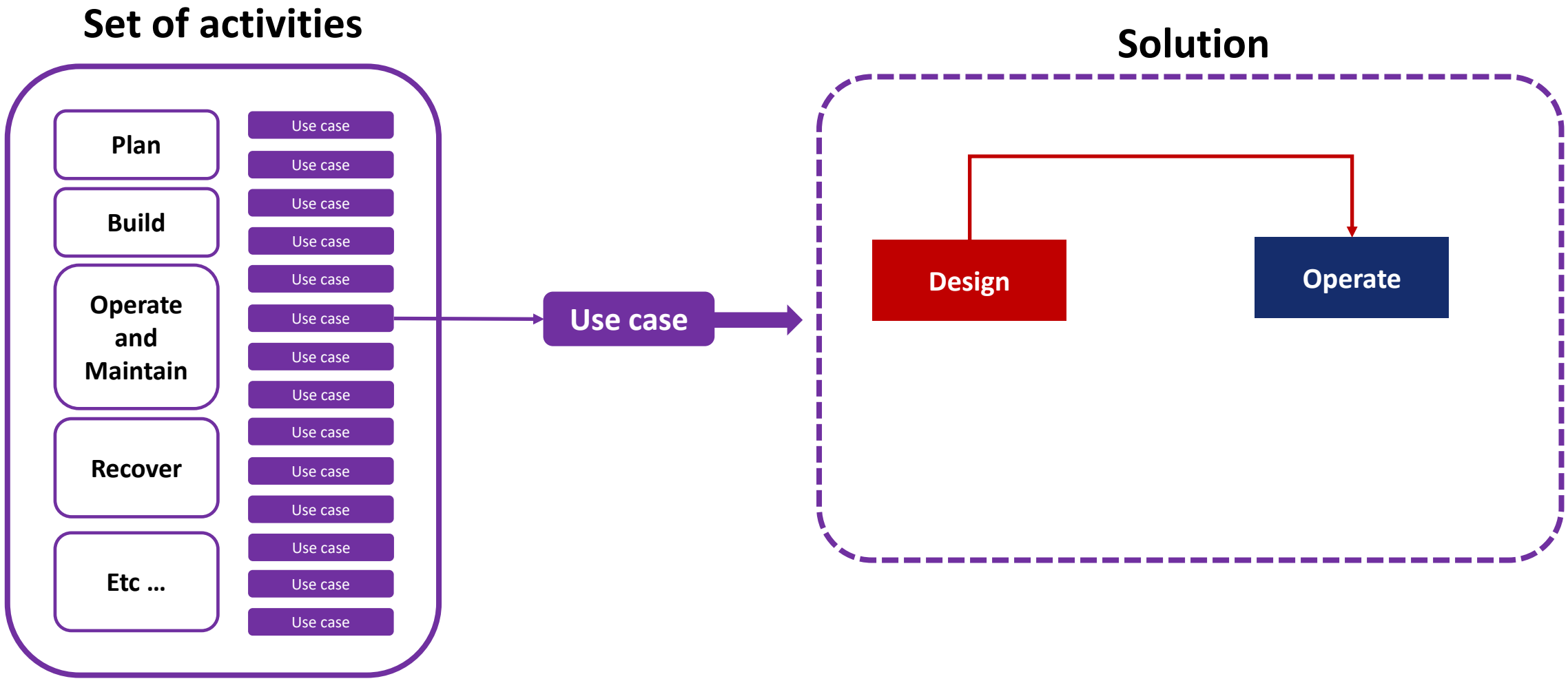
Operating a Network



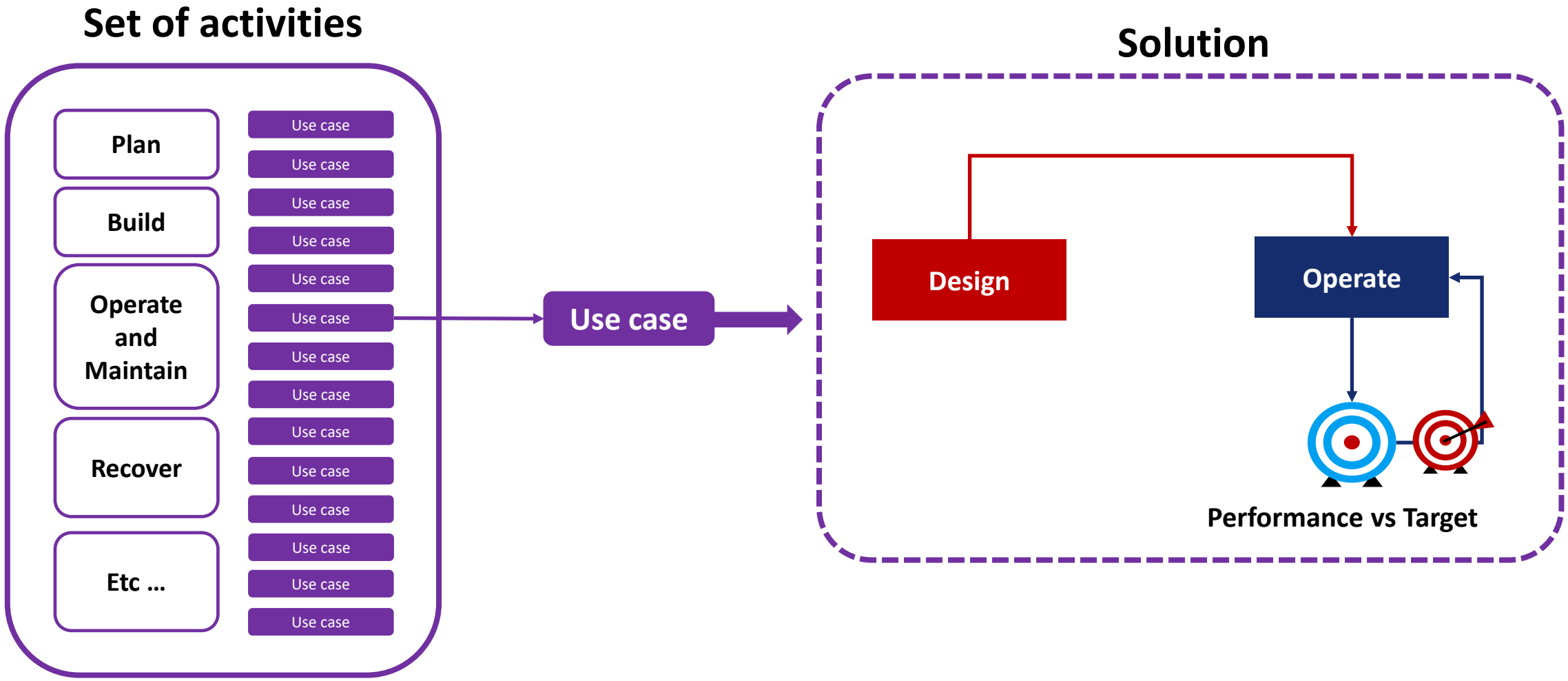
Operating a Network



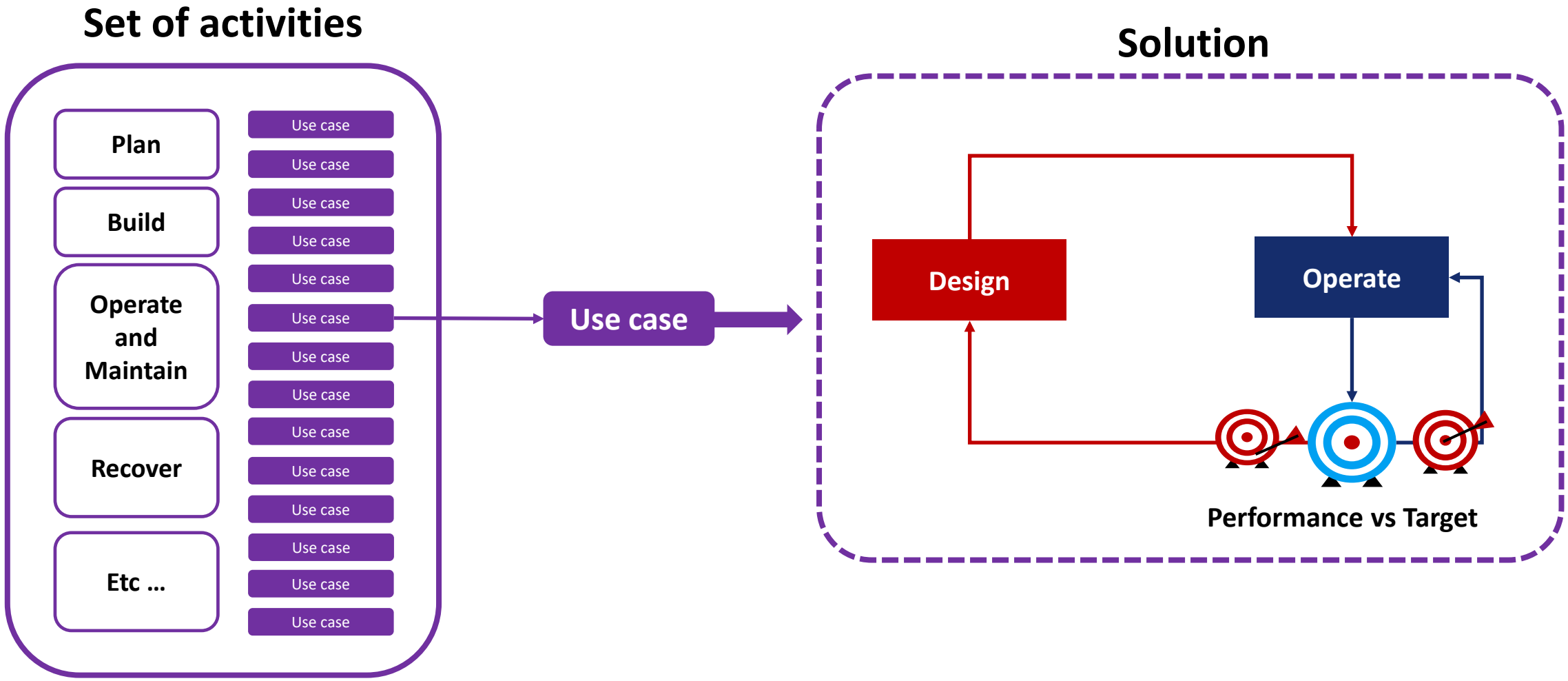
Operating a Network



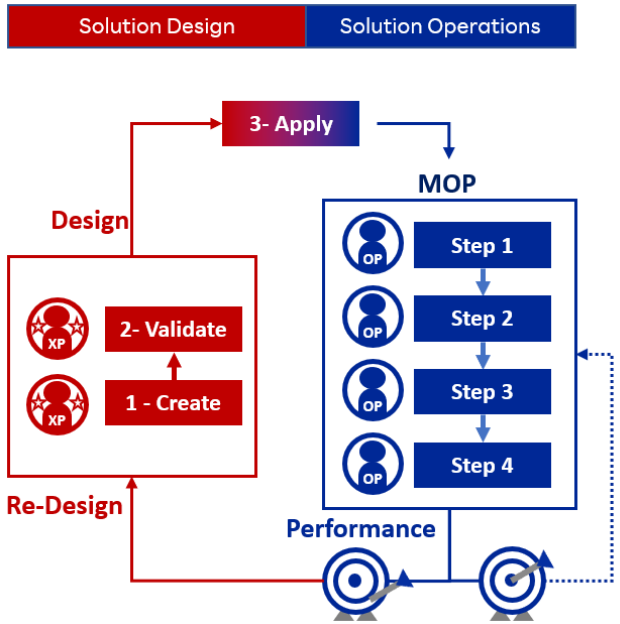
Operating a Network



Operating a Network



Transformation of Operations



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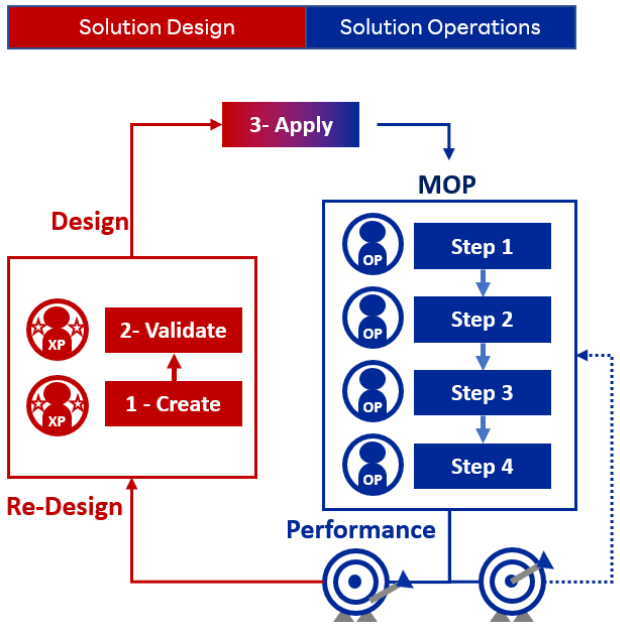

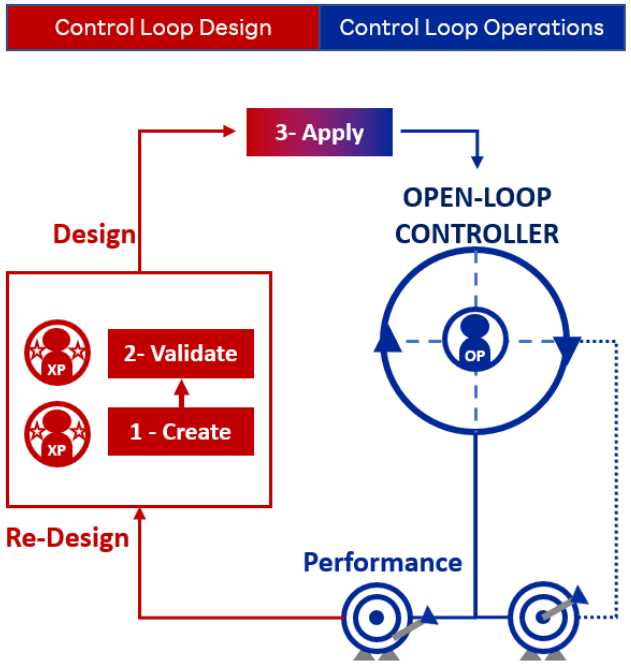

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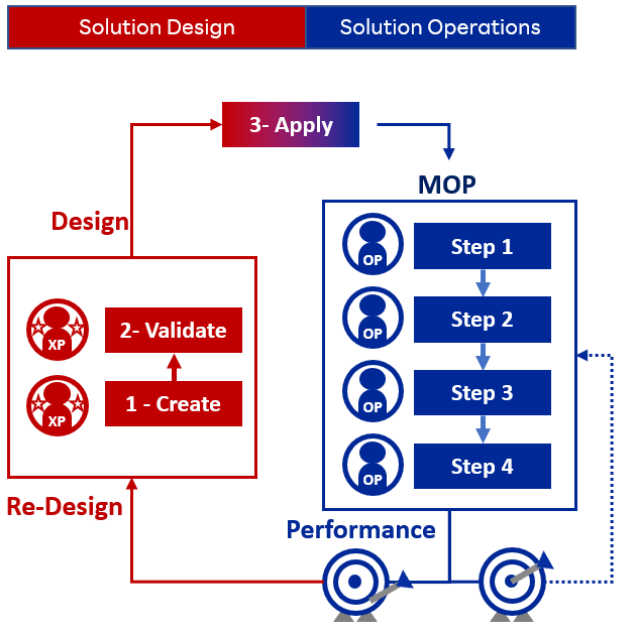
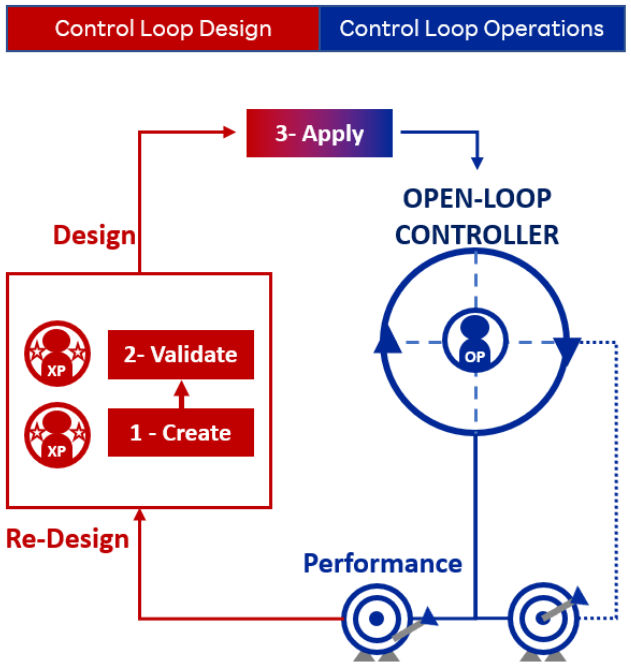
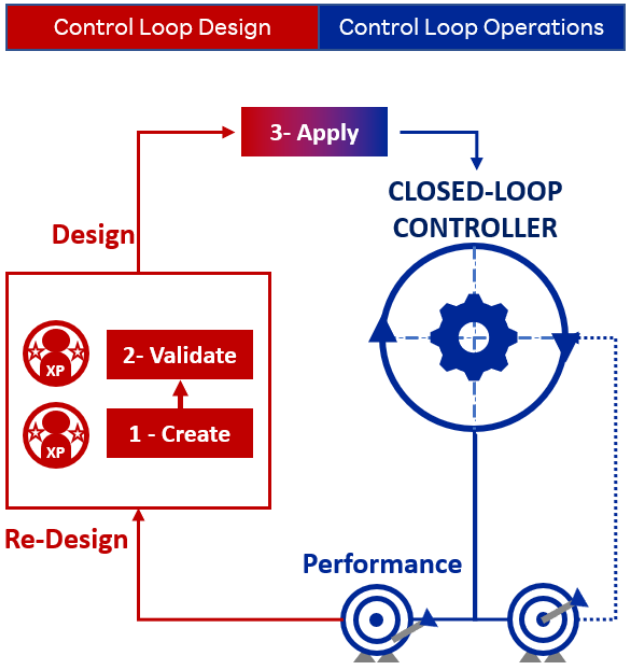
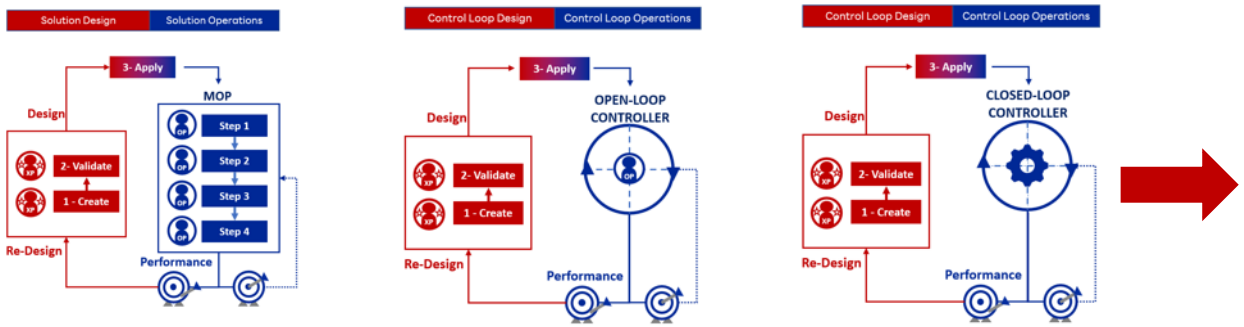






Autonomous Networks: Key Concepts



01

CREATE

Evolutionary Exploration

02

VALIDATE

Real-time Responsive Experimentation

03

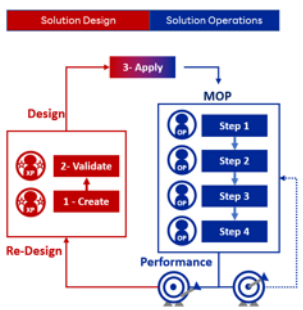
APPLY

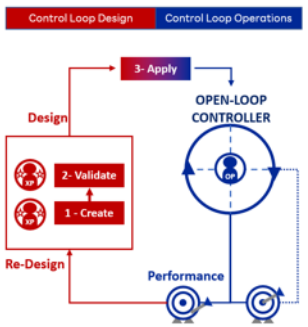
Dynamic adaptation

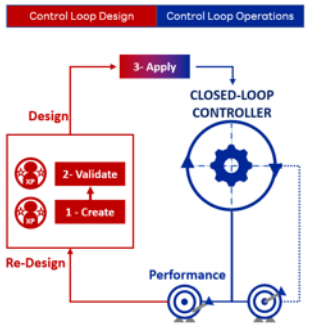
Autonomous Networks: Key Concepts

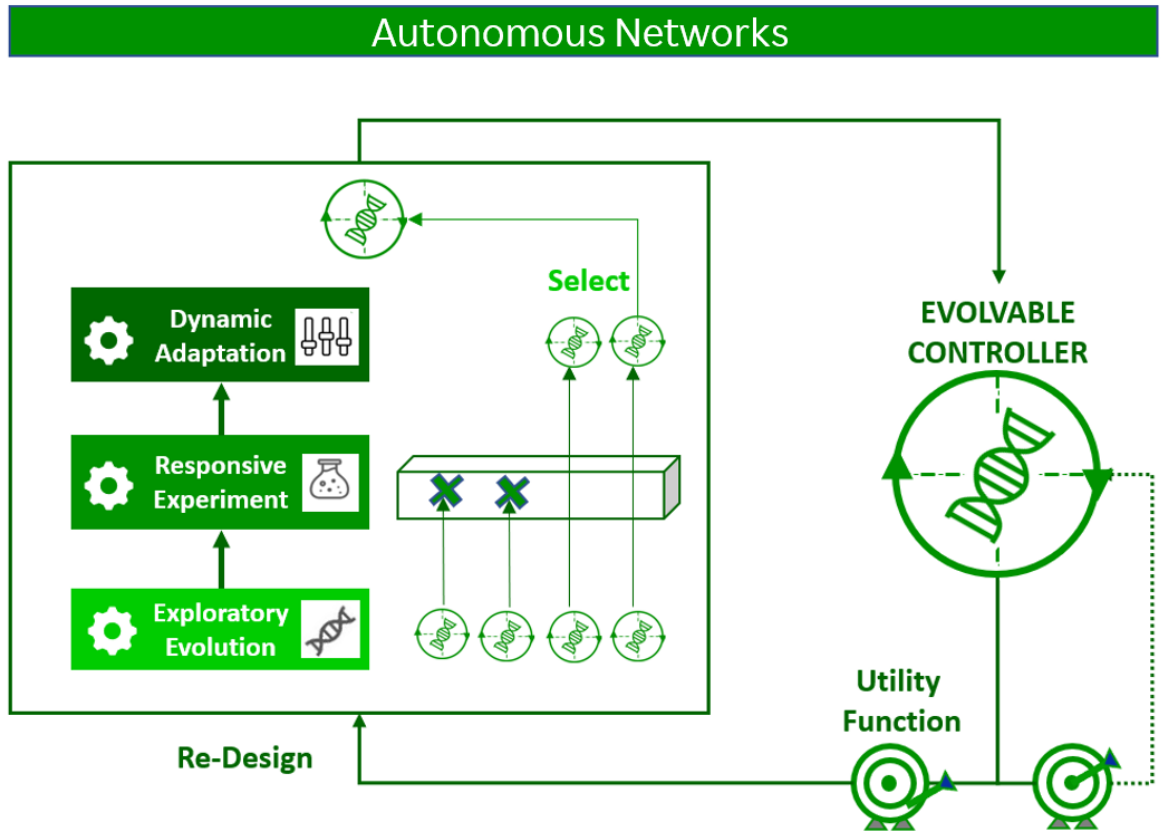
… To Machine Centric

From Human Centric …

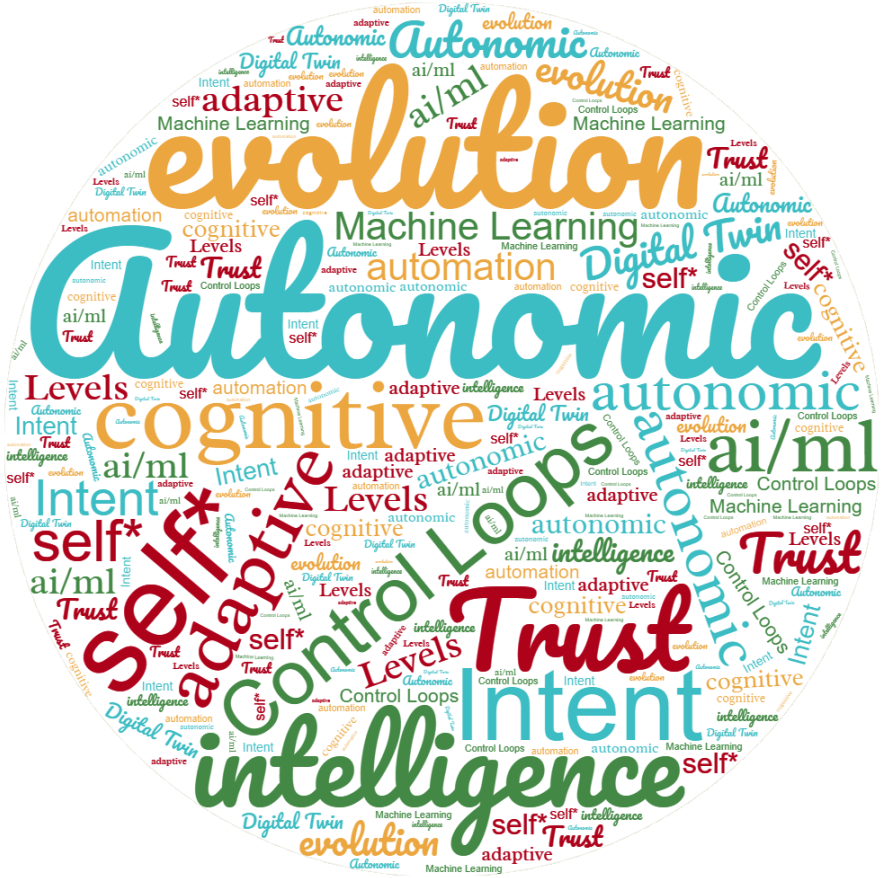






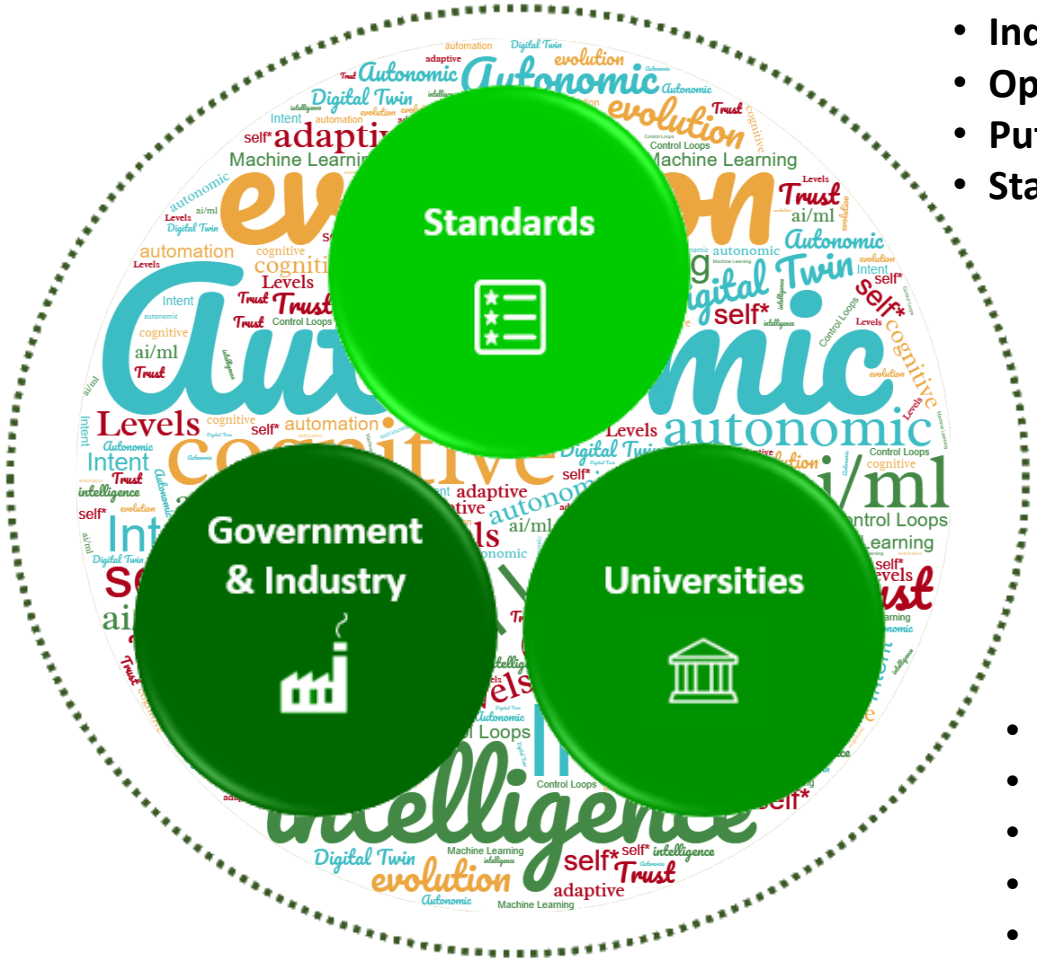


The magic ball of Autonomous Networks



Demystifying effort: Building the Ecosystem

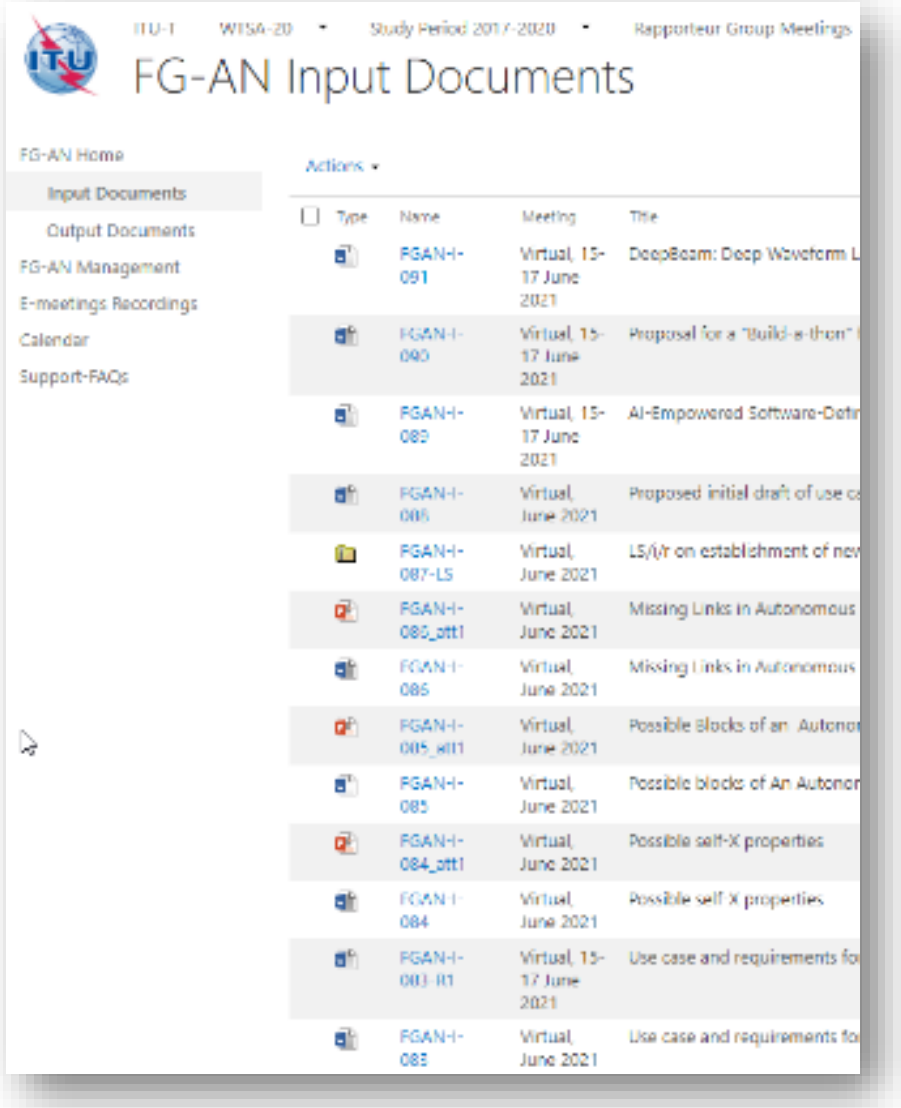
- Government Momentum
- Industry Collaborations
- Fundings



- Industry Momentum
- Open Collaboration platform
- Put the approach to the test
- Standardization

- Academic Momentum
- Academic Collaborations
- Research capacity
- Research skills
- Talent pipeline

Open Collaboration: Focus Group on Autonomous Networks



For more info:

ITU-T Focus Group on Autonomous Networks (FG-AN)

https://www.itu.int/en/ITU-T/focusgroups/an

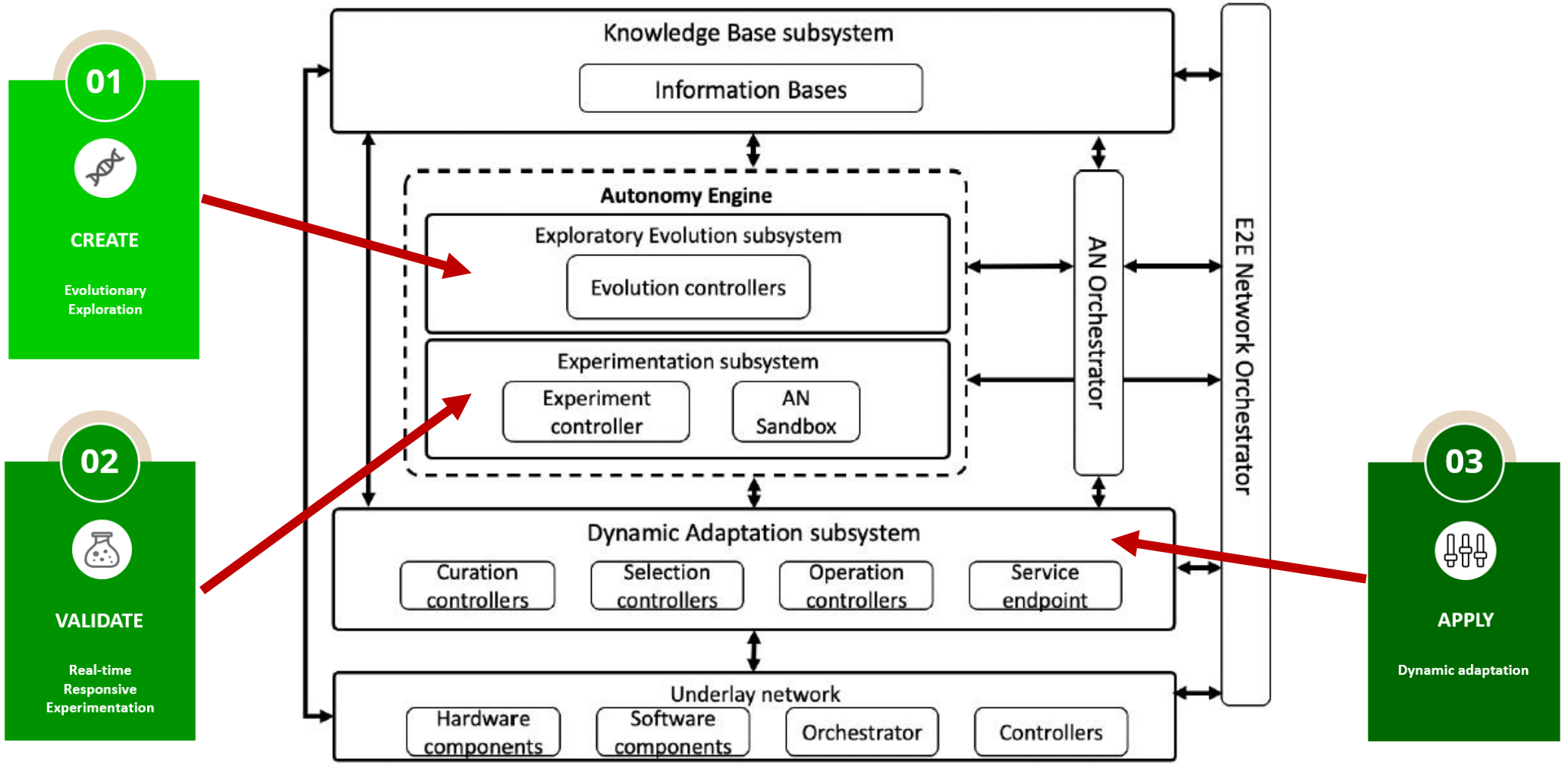
Mailing List: fgan@lists.itu.int

Japan TTC's ITU-T FG-AN Ad Hoc Group (AN-AH)

https://www.ttc.or.jp/topics/20210422

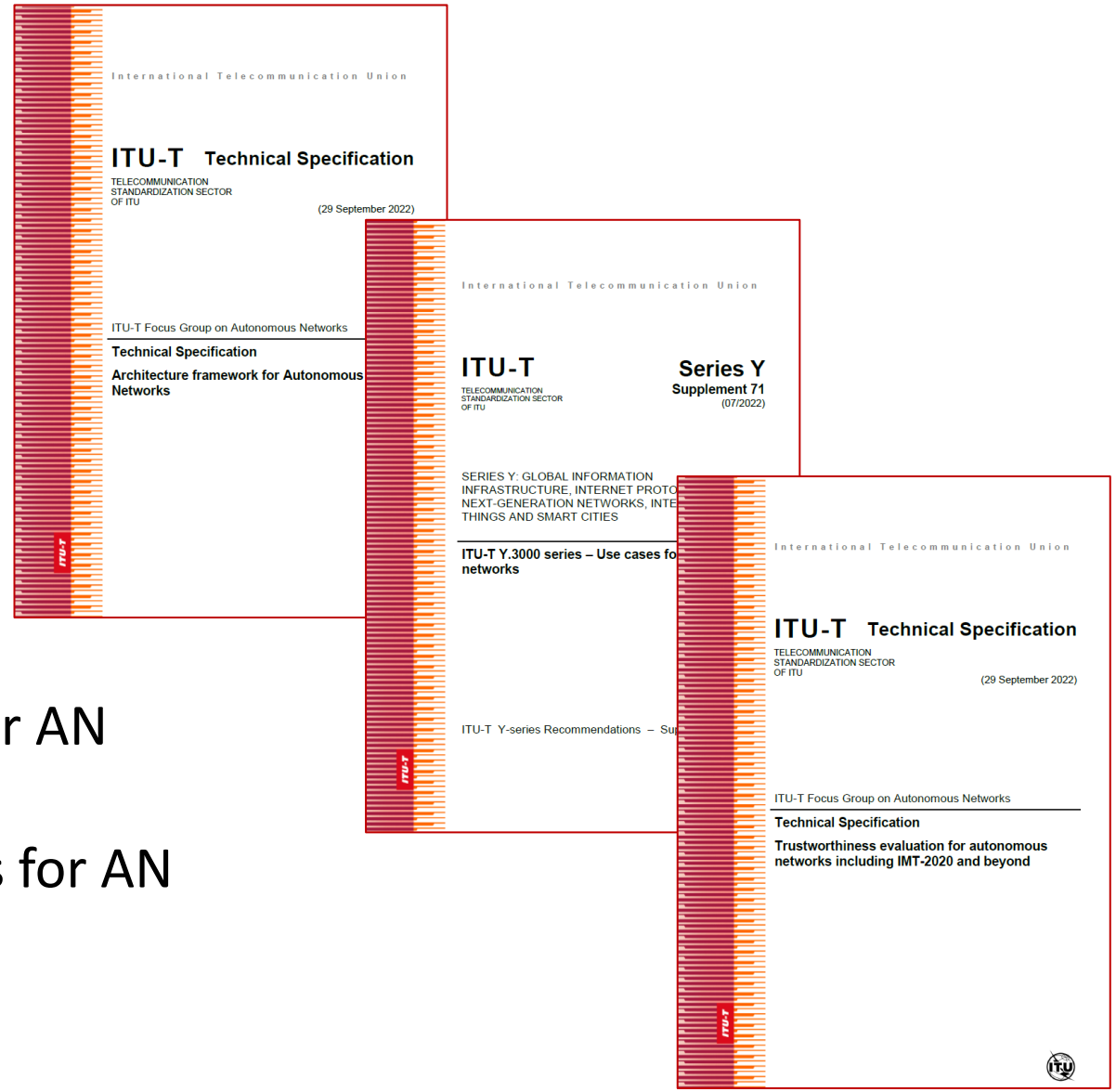
TTC Telecommunication Technology Committee

Open Collaboration: Focus Group on Autonomous Networks

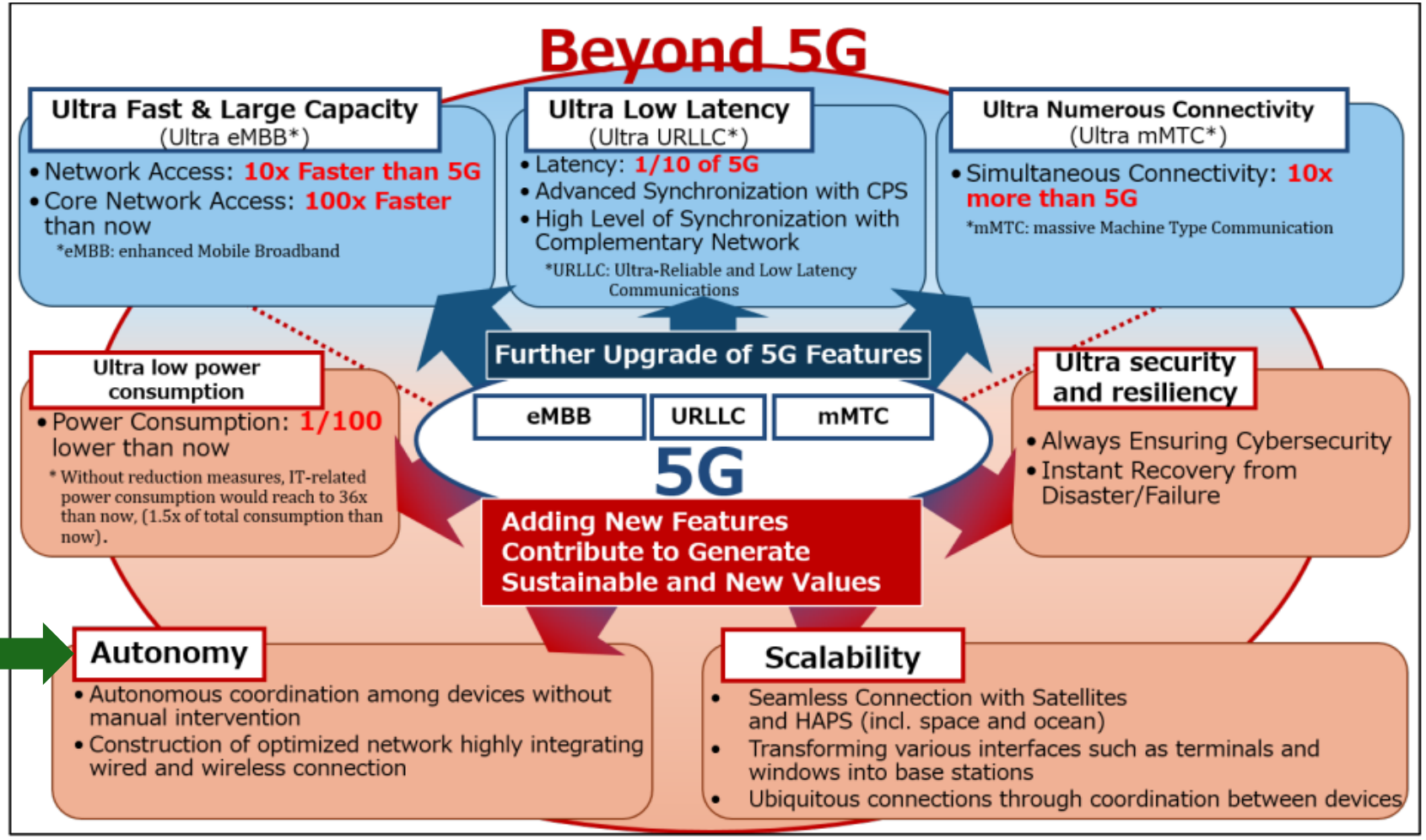


Open Collaboration: Focus Group on Autonomous Networks

- Proofs of Concept
- Build-a-thons
- Gap Analysis
- Technical Specifications
  - High-Level framework architecture for AN
  - Evaluation of Trustworthiness in AN
- YY.Sup71 : ITU-T Y.3000 series - Use cases for AN



Japan: Beyond 5G Promotion Strategy



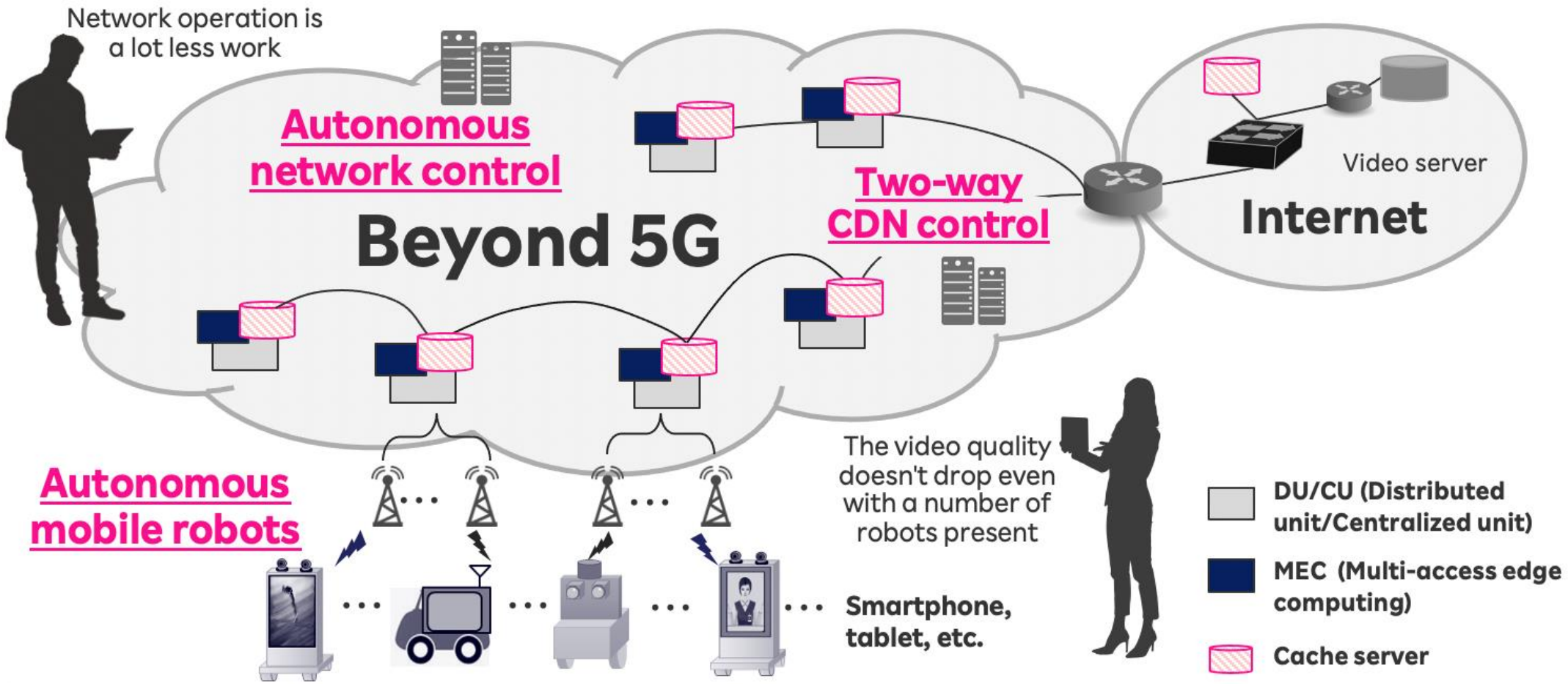
Functions Required for Beyond 5G

Source: https://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/Beyond_5G_Promotion_Strategy_Roundtable_Recommendations.pdf

Joint Research: RM, Nagoya University, OKI

National Institute of Information and Communications Technology

Coordinated-type Autonomous Networks



https://corp.mobile.rakuten.co.jp/news/press/2021/1108_01/

Academic Collaborations

Building the Ecosystem Together

Rakuten Mobile Innovation Studio

https://netlab.mobile.rakuten.co.jp

email: rmi-research-contact@mail.rakuten.com

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