Interaction with ICT17 projects
5G EVE Experience

5GPPP-TB Workshop

26-27 May 2020

Manuel Lorenzo (ERICSSON SPAIN - 5G EVE TM)

This Project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 815074

5G EVE

Agenda

1.	5G EVE Ecosystem	10’
2.	5G EVE Platform & Interfaces	10’
3.	Illustrative Cases of engaged ICT19 projects	15’
4.	Lessons Learnt	10’
5.	Key Resources & References	--'

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5G EVE

5G EVE - Consortium

Spain
Madrid

Telefónica, ERICSSON, NOKIA, ASTI, Telcaria, SEGITTUR

France
Paris, Rennes, Sophia Antipolis

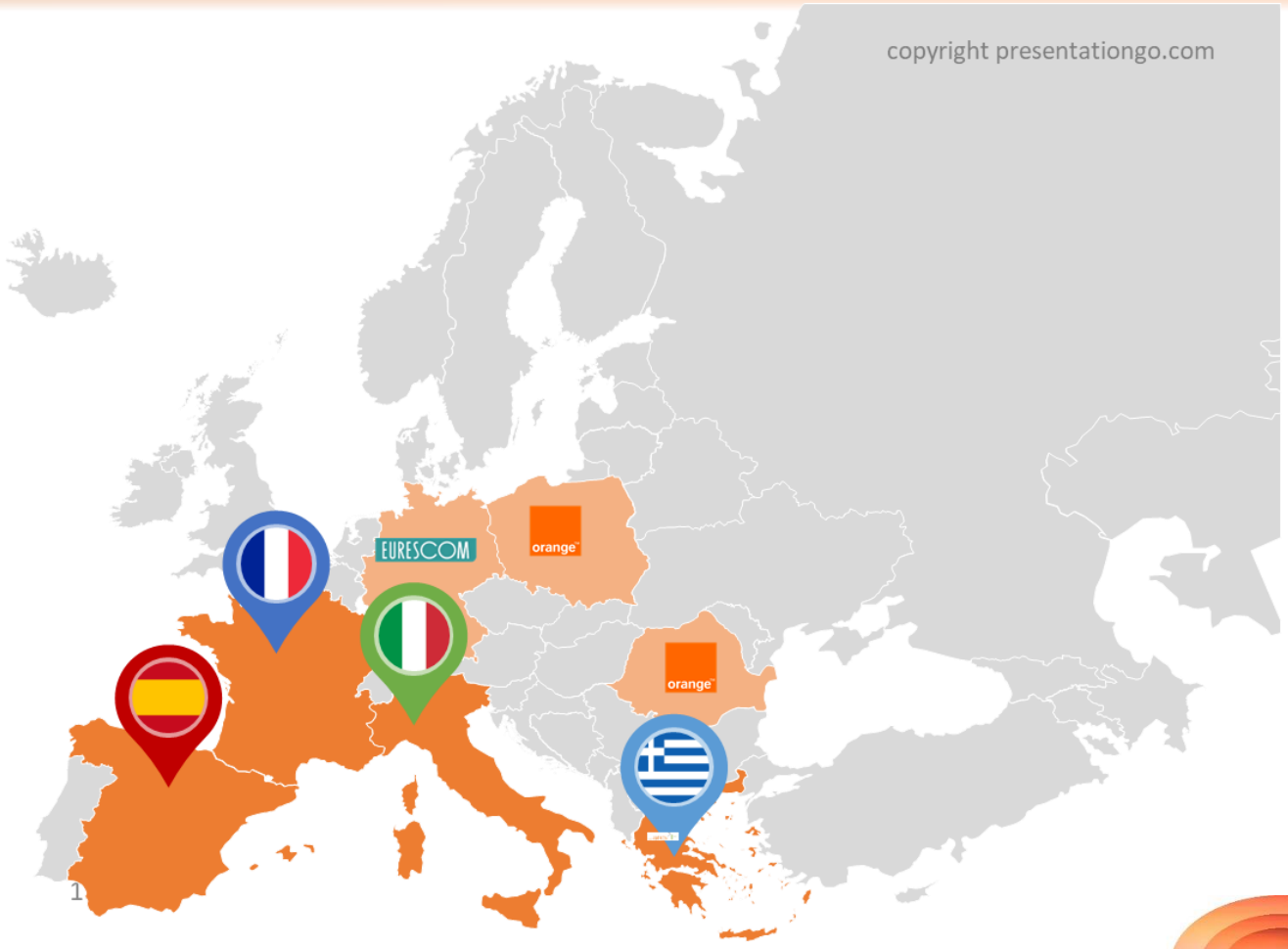
orange, NOKIA, b com, EURECOM, EDF

Italy
Turin

Città di Torino, IDC, PIIU, TIM, ERICSSON, NEXTWORKS, TRENITALIA, cnit, ...ares2t...

Greece
Athens

OTE, ERICSSON, NOKIA, WINGS ICT SOLUTIONS



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5G EVE

5G EVE - ICT19 Ecosystem

Projects	Web site	Industry 4.0	Agriculture & Agri-Food	Automotive	Transport & Logistics	Smart Cities & utilities	Public Safety	Smart (air)ports	Energy	Ehealth & wellness	Multimedia & entertainment
5G EVE	https://www.5g-eve.eu/	√		√		√			√		√
5G Drive	https://5g-drive.eu/			√							
5G Solutions	https://www.5gsolutionsproject.eu/	√				√		√	√		√
5G TOURS	http://5gtours.eu									√	√
5G!Drones	https://5gdrones.eu/				√		√				√
5G HEART	http://5gheart.org/		√		√					√	
5GROWTH	http://5growth.eu/	√			√				√		
5G VICTORI	https://www.5g-victori-project.eu				√				√		√

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5G EVE - ICT19 Ecosystem (Cases for today)

Projects	Web site	Industry 4.0	Agriculture & Agri-Food	Automotive	Transport & Logistics	Smart Cities & utilities	Public Safety	Smart (air)ports	Energy	Ehealth & wellness	Multimedia & entertainment
5G EVE	https://www.5g-eve.eu/	√		√		√			√		√
5G Drive	https://5g-drive.eu/			√							
5G Solutions	https://www.5gsolutionsproject.eu/	√				√		√	√		√
5G TOURS	http://5gtours.eu									√	√
5G!Drones	https://5gdrones.eu/				√		√				√
5G HEART	http://5gheart.org/		√		√					√	
5GROWTH	http://5growth.eu/	√			√				√		
5G VICTORI	https://www.5g-victori-project.eu				√				√		√

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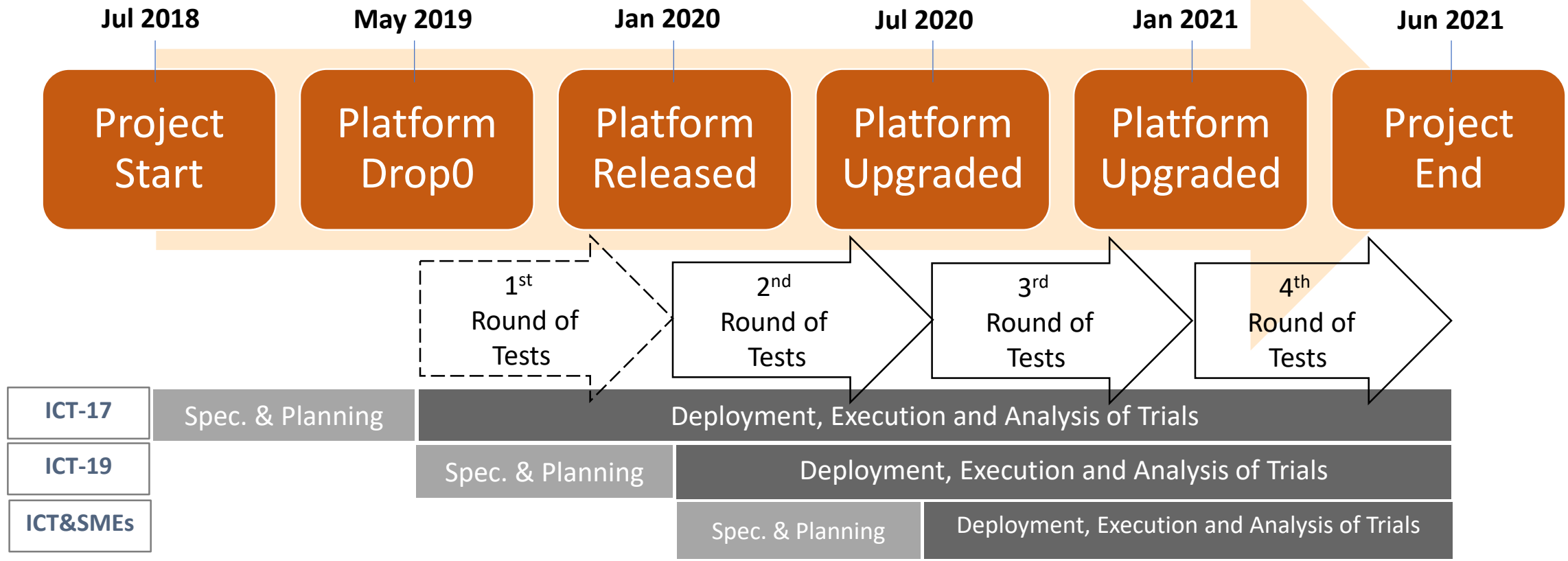
5G EVE

5G EVE Roadmap – General Time-line



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5G EVE

5G EVE Roadmap
Highlights

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For a detailed roadmap of 5G EVE platform please visit:
https://www.5g-eve.eu/event/webinar-the-5g-eve-end-to-end-facility-for-vertical-industry-trials/

5G EVE

5G EVE 5G Capabilities Roadmap (1 of 2)

Capabilities	Features	2019/MAY	2020/JAN	2020/JUL	2021/JAN
Allocated Spectrum	Low Bands (800 MHz)	Y (10MHz)	Y (10MHz)	Y (10MHz)	Y (10MHz)
	Mid Bands (2.6 GHz, 3.4-3.8 GHz)	Y (20 MHz)	Y (40MHz)	Y (40 MHz)	Y (100MHz)
	High Bands (26 GHz)			(optional)	(optional)
5G Services	Enhanced MBB (eMBB)	Y	Y	Y	Y
	URLLC (URLLC)	(Pre-sched)	Y(Rel-15)	Y(Rel15)	Y(Rel-16)
	Massive IoT (mMTC)	Y (LTE-M+NB-IoT)	Y (LTE-M+NB-IoT)	Y (LTE-M+NB-IoT)	Y(Rel-16)
5G Architecture Options	Option-1 (Legacy)	Y	Y	Y	Y
	Rel15-5GNR + EPC in NSA mode		Y	Y	Y
	Rel15-5GNR + Rel15-5GC in SA mode			Y	Y
	Rel16-5GNR + Rel16-5GCore (in NSA & SA modes)				Y
5G Access Features	Flexible Numerology		Y	Y	Y
	Massive MIMO	Y	Y	Y	Y
	Multi-User MIMO		Y	Y	Y
	RAN Virtualization			Y	Y
	Latency Reduction	Y (pre-scheduling)	Y(Rel-15)	Y(Rel15)	Y(Rel-16)
	Optional(Multi-RAT Spectrum Aggregation, New		optional	optional	optional

5G EVE 5G Capabilities Roadmap (2 of 2)

Capabilities	Features	2019/MAY	2020/JAN	2020/JUL	2021/JAN
Core Network	vEPC supporting 5G	Y	Y	Y	Y
	5GC			Y	Y
	CUPS	Y	Y	Y	Y
	SBA			Y	Y
	Interworking with LTE			Y	Y
Slicing	Network Slicing (std 5G Services: eMBB, URLLC, mMTC)		Y	Y	Y
	Service Slicing (cloud orchestration level)			Y	Y
	Multi-site Slicing			Y	Y
Virtualization	NFVi support	Y	Y	Y	Y
	SDN control			Y	Y
	Vertical Virtualized Application deployment support	Y	Y	Y	Y
Edge Computing	3GPP Edge Computing		Y	Y	Y
	ETSI MEC		(optional)	(optional)	(optional)
Interconnection	Interconnection among 5G EVE Sites		Y (*)	Y	Y
	Interconnection with other ICT17 platforms			TBD	TBD
	Interconnection with other ICT19 projects' infra			TBD	TBD

5G EVE

5G EVE KPI Roadmap

5G-EVE KPIs (D1.1)	ITU-R M.2410-0 (11/2017)	2019/MAY	2020/JAN	2020/JUL	2021/JAN
User Data Rate	• DL User Experienced Data Rate (Mbps): 100 Mbps • UL User Experienced Data Rate (Mbps): 50 Mbps	• Y • Y	• Y • Y	• Y • Y	• Y • Y
Peak Data Rate	• DL Peak Data Rate (Gbps): 20 Gbps • UL Peak Data Rate (Gbps): 10 Gbps			• Y (mmW) • Y (mmW)	• Y (mmW) • Y (mmW)
Capacity	• Area Traffic Capacity (Mbit/s/m2): 10 Mbit/s/m2				• Y
Latency	• UP Latency (ms): 1ms (URLLC), 4 ms (eMBB) • CP Latency (ms): <20 ms	• Y(LTE)	• Y(4 ms)	• Y(4 ms)	• Y(1ms) • Y
Device Density	• Connection Density: 1 M devices/km2 (mMTC)				• Y
Mobility	• Stationary: 0 km/h • Pedestrian: 0 km/h to 10 km/h • Vehicular: 10 km/h to 120 km/h • High speed vehicular: 120 km/h to 500 km/h	• Y • Y	• Y • Y	• Y • Y	• Y • Y • Y • TBD
Reliability	• Reliability (%)		• Y	• Y	• Y
Availability	• Availability (%)			• Y	• Y

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5G EVE

5G EVE Ecosystem

Key Activities - Now (H1-2020) and Going Forward (H2-2020)

Platform Validation

- Experimentation by 5G EVE Vertical Partners
- 5G KPIs Validation

Cooperation with ICT-19 Projects

- Hands-on Training on 5G EVE Platform
- Spec, Planning and Integration Support
- Integration and Experimentation by ICT-19 Verticals

Continued Platform Development

Evolution of current 5G EVE platform towards:

- Jul 2020 upgrade (full set of platform services)
- Jan2021 release (Rel16 capabilities supported)

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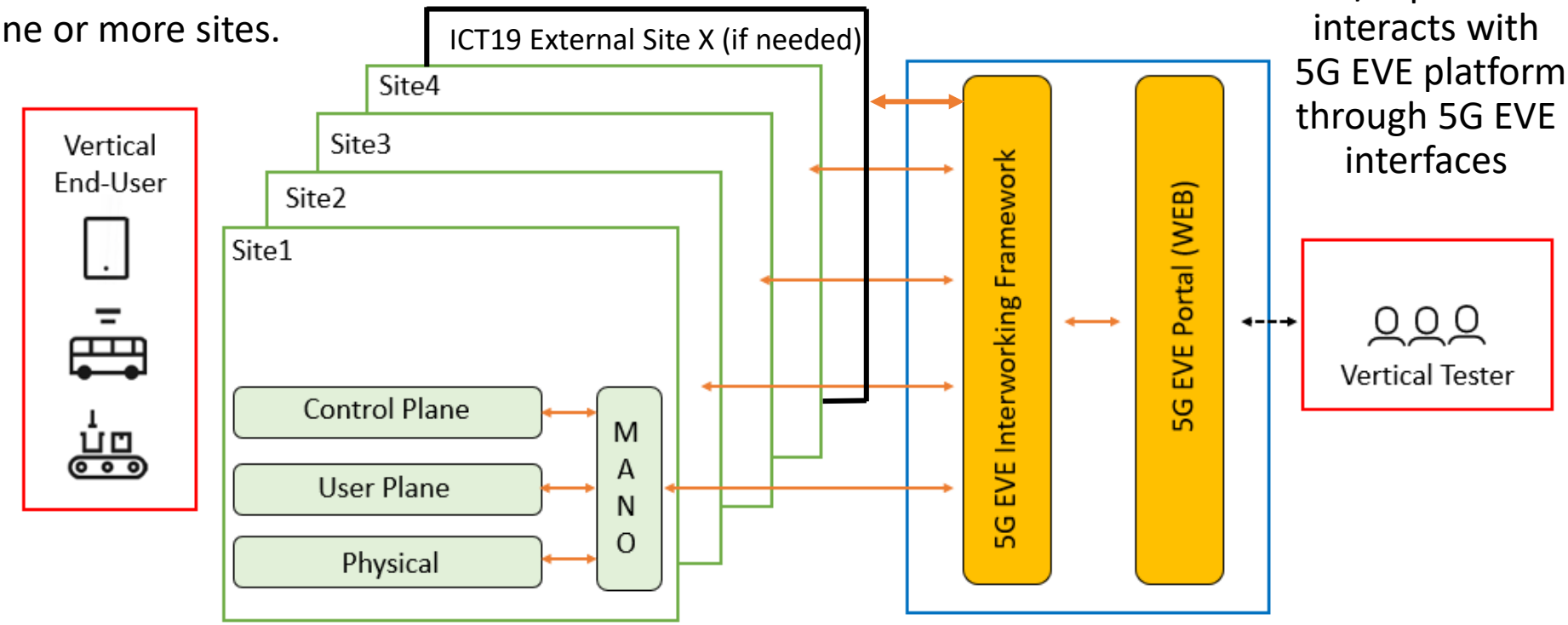
5G EVE

5G EVE Platform – Verticals' View 30k Feet

Vertical End-User Service is delivered at one or more sites.



Vertical Tester/Experimenter interacts with 5G EVE platform through 5G EVE interfaces

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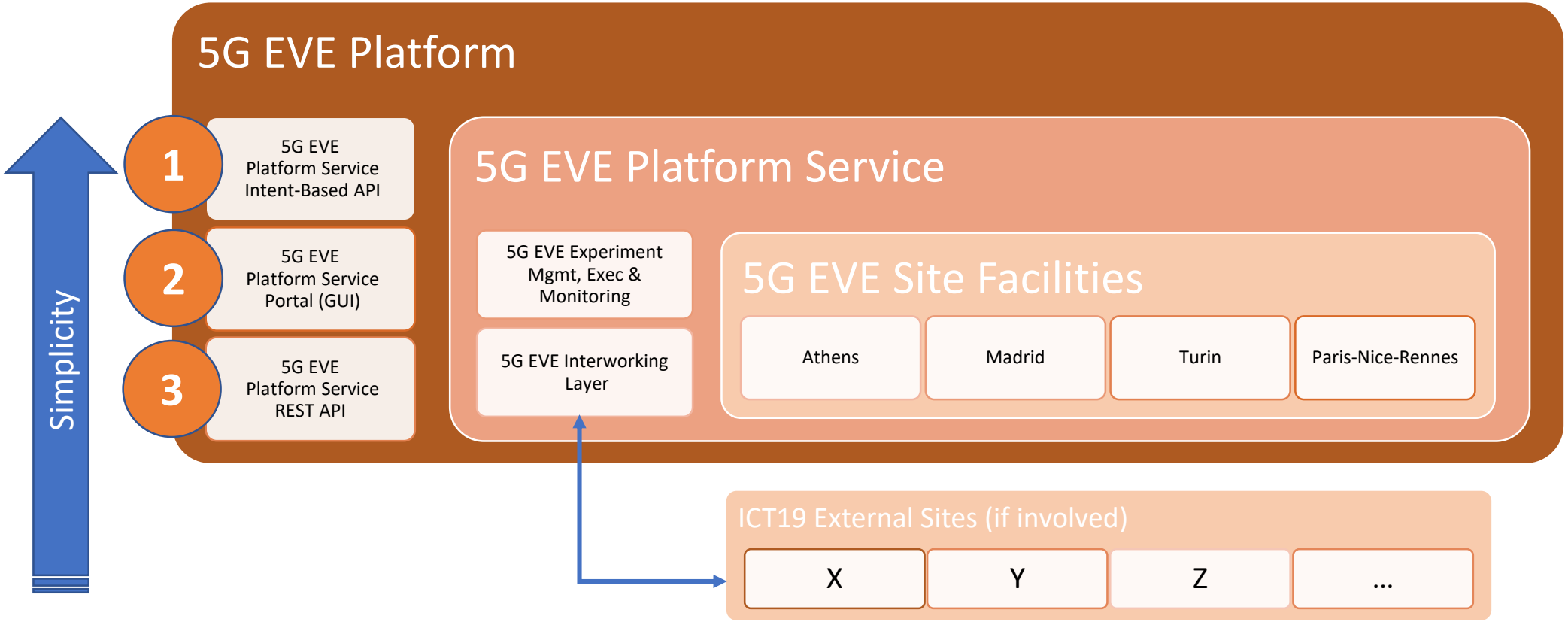
5G EVE

5G EVE Platform – Interfacing Models



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5G EVE

5G EVE Platform – Vertical's Checklist

WHY	Motivation for validation activities is clear: validate app behaviour/performance, assess solution architecture, analyze influence of 5G KPIs,, …)
WHAT	Vertical Use Case is specified, and app developed and ready for play-out in a cloud
HOW	Environment conditions, test cases to be executed, and measurements to be collected for validation are clear
WHERE	Site selected for validation campaigns: either a 5G EVE native site or external site
WHEN	Time plan (over the calendar) decided for execution of the validation campaigns
WHO	Teams in charge are trained in 5G EVE platform and their contact details known to 5G EVE team for enabling access to the platform

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5G EVE

5G EVE Workflow

Test design → Test preparation → Test execution & monitoring → Test PE and Analysis

Design your experiment
- Select a target 5G environment
- Browse a **wide portfolio of tools** and service components to build your experiment
- Bring **your own applications**
- Create new **blueprints** to easily reproduce your tests with different operational conditions

Vertical's VNF provider

Experiment developer

Customize your experiment
- Configure your **experiment settings** using a wizard or an Intent-based Interface

Schedule your experiment
- Select a time slot to run the experiment and wait for the **environment preparation**

Experimenter

5G EVE Site Manager

Execute your experiment
- Build your own **virtual** environment and execute the tests
- **Monitor** the experiment **progress** and visualize monitoring graphs for your **metrics, logs and KPIs**

Experimenter

Assess service performance
- Check **statistics** about experiment results
- **Compare** KPIs from different experiment settings and **tune your service** configuration
- Use **diagnostics** for troubleshooting

Experimenter

5G EVE Portal (WEB)

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5G EVE

5G EVE Workflow and 5G EVE portal

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5G EVE

5G EVE Experimentation: Basic jargon

- **Experiment blueprint:** high-level representation of an experiment **template**, built by an experiment developer. Includes:
  - **Vertical Service blueprint**: defines service components, their interconnectivity, service-level parameters, application metrics, configurable parameters.
  - **Context blueprints:** defines the operation context and/or experimental conditions to run the experiment (e.g. artificial background traffic, artificial delay, etc.).
  - **Test Case blueprints:** defines the scripts to run the experiment and their configuration.
  - **Network Service Descriptor** associated to vertical service and experiment. Defines how to deploy the service and the experiment in the virtual infrastructure. If needed, service-specific VNF packages can be also provided for vertical applications.
  - Target site(s), infrastructure metrics to be measured and KPIs to be validated.
- **Experiment descriptor:** defines the characteristics of an experiment **instance**, customizing the specific target values for the service parameters defined in the experiment blueprint. Defined by the Experimenter.
  - Internally, it is composed of vertical service descriptor, context descriptors and test case descriptors.

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5G EVE - Steps to run an experiment

1. Select the Target Site
2. Select the Experiment Blueprint
3. Provide the Values to customize your Experiment Descriptor
4. Select a Desired Time-slot, wait for the site configuration (offline procedure) and instantiate your experiment
5. Your environment is ready to run your **Experiment Execution**

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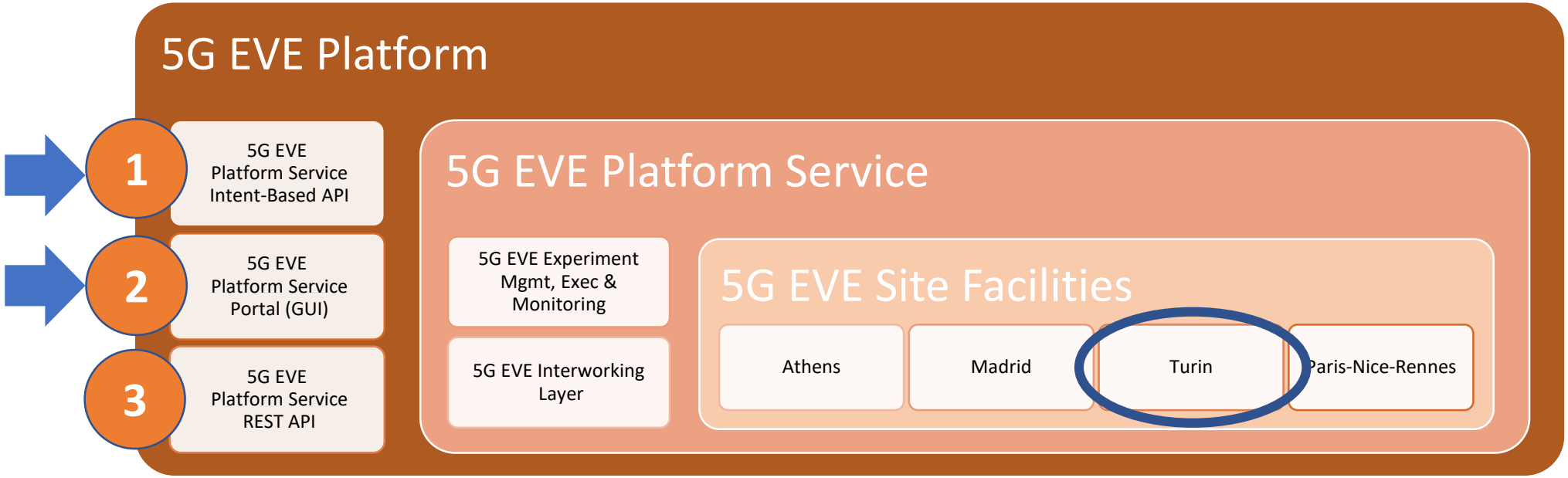
5G EVE

5G-SOLUTIONS



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5G EVE

5G-SOLUTIONS

- Assessments for collaboration performed at the very early stage of the project
  - As a result, 5G EVE identified the need of -and decided to develop- an Open API (besides the portal GUI) for enabling programmatic actions of Experiment Execution Management, without human intervention at some points of the workflow.
  - This project was pioneer in planning for the usage of 5G EVE portal even ahead of availability of the beta.
- 5G-SOLUTIONS relies on
  - 5G EVE Portal GUI for managing experiments
  - 5G EVE Rest APIs for controlling the execution (programmatically)
- Ongoing design of blueprints over 5G EVE portal (beta), thus enjoying the advantages of being pioneers

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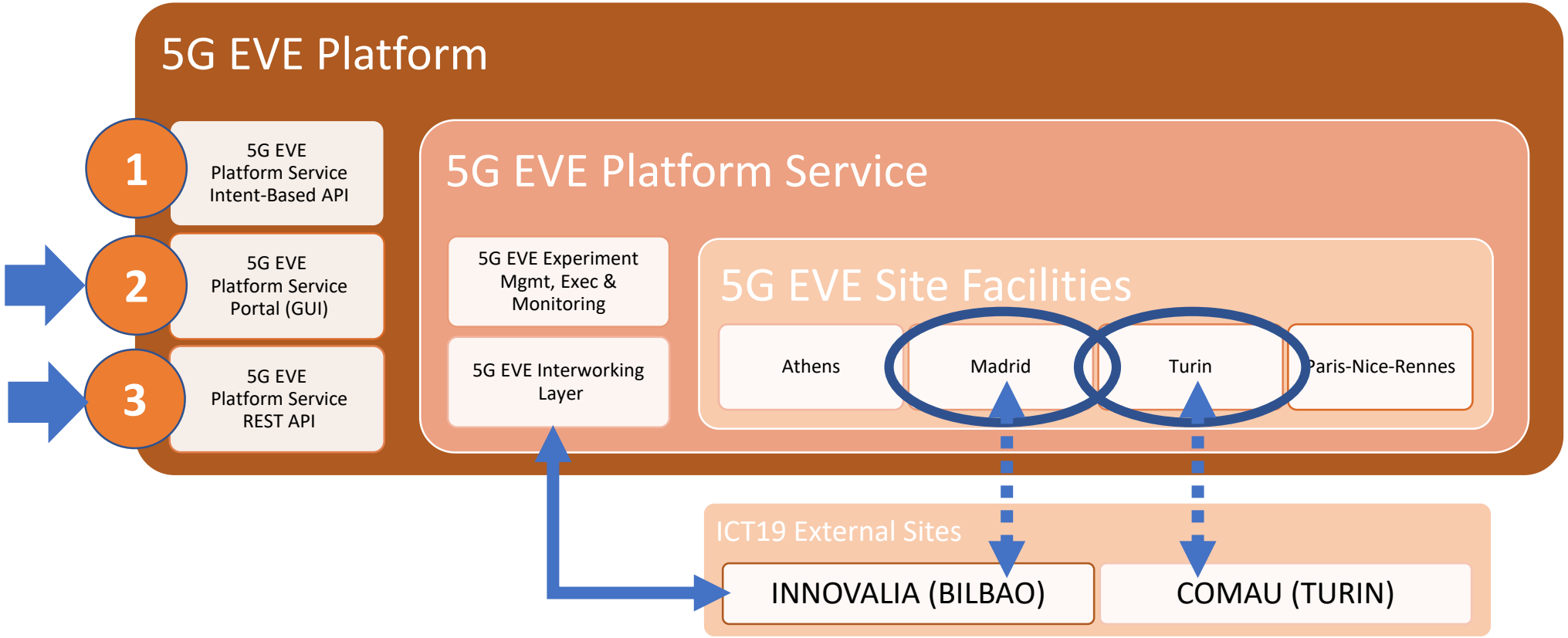
5GROWTH



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5G EVE

5GROWTH

- Assessments for collaboration performed.
  - Special case of integration of platforms vs interworking of sites
  - The analysis reinforced the need for extending the role of 5G EVE interworking layer to support onboarding of external trusted facilities in the same ecosystem.
- 5GROWTH relies on
  - 5G EVE Portal GUI for managing experiments
  - 5G EVE Rest APIs for controlling the execution (programmatically)
  - 5G EVE interworking layer for enabling technical validation campaigns at 5G EVE site (Madrid/5TONIC) as well as smooth migration to business validations campaigns on-prem at an external site (Bilbao/INNOVALIA)
- Ongoing design of blueprints over 5G EVE portal (beta), thus enjoying the advantages of being pioneers

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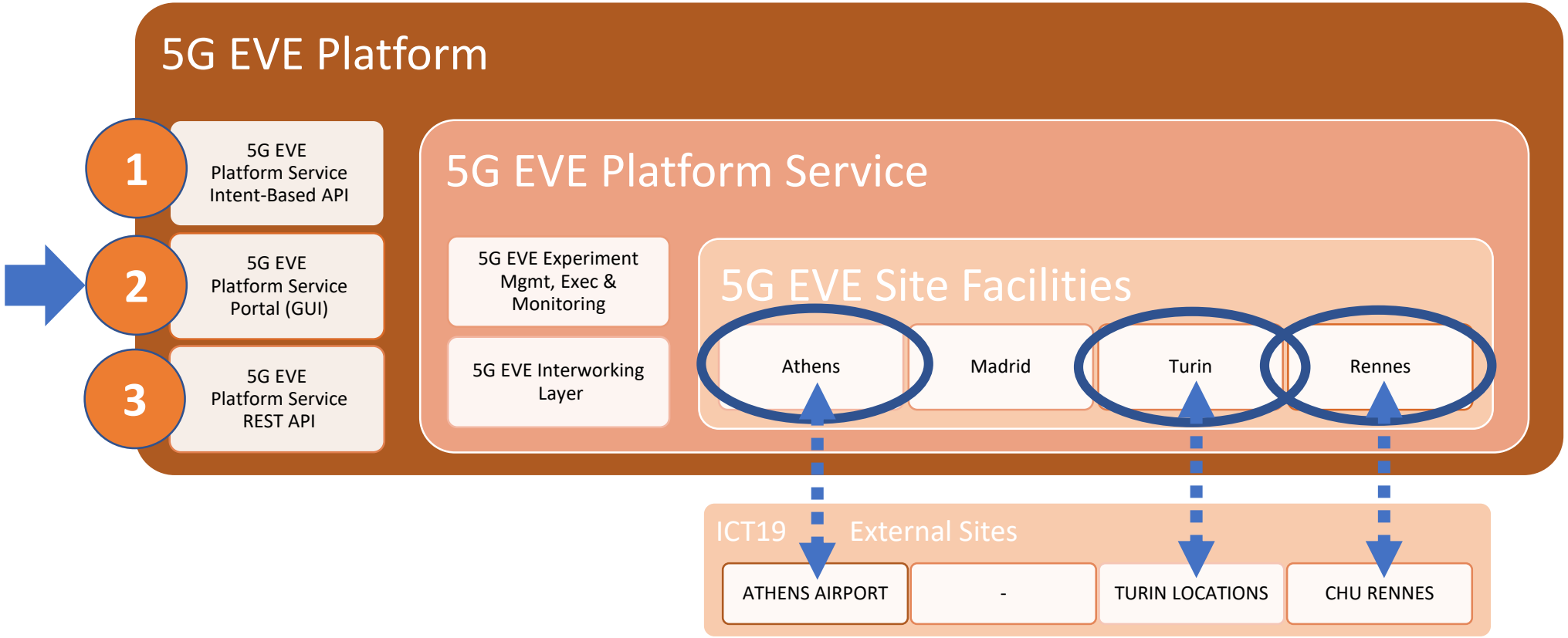
5G-TOURS



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5G EVE

5G-TOURS

- Assessments for collaboration performed
  - Raised the relevant point of support after 5G EVE (ICT17 indeed) finishes end of June 2021, and alternative models for minimizing impact. See 5GPPP whitepaper about On Board procedures to 5GPPP projects.

- 5G-TOURS relies on
  - 5G EVE Portal GUI for managing experiments in Turin, Rennes and Athens sites.
  - 5G EVE Rennes site and ONAP por incorporating CHU Rennes to 5G EVE ecosystem

- 5G-TOURS involved in experiment blueprint design over 5G EVE portal (beta), also enjoying the advantages of being pioneers ☺

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5G EVE

Lessons Learnt

- Flexibility and Versatility is a gift with two sides
  - 5G EVE platform provides ICT19 projects with the possibility to design, deploy execute extremely customised and varied experiment / test cases over a full-chain 5G set-up
  - 5G EVE platform usage requires that users
    - carefully assess all the variables involved when designing your experiments, and of the possible strategies to deploy your vertical application, bring your own metrics, reuse 5G KPI metrics and KPIs, …
    - Master 5G EVE “language” and tools, through both training and hands-on experience

- Staged Knowledge Sharing, Training and Collaboration is key
  - With projects running in parallel, the elaboration and commitment of 5G EVE to a public roadmap allows ICT19 projects for planning validation campaigns with minimized risks
  - Open discussions at the early stage of ICT19 projects paves the way for leveraging 5G EVE platform potential.
  - Experience also shows that common partners to 5G EVE and ICT19 projects play a key role in catalyzing mutual projects’ leverage and progress
  - 5G EVE+ 5GROWTH+ 5G-TOURS are taking the underlying model to the joint ETSI ENI (Experiential Networked Intelligence) PoC#9 for "Autonomous Network Slice Management for 5G Vertical Services“, thus extending influence to broader communites.

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5G EVE

Key Resources/References

- 5GPPP whitepapers – On Board Procedure to 5GPPP infrastructure projects:
  - https://5g-ppp.eu/wp-content/uploads/2020/04/On-Board-Procedure-to-5G-PPP-Infrastructure-Projects-1.pdf
- 5G EVE general Info & Training:
  - May 2019: https://www.5g-eve.eu/event/webinar-the-5g-eve-end-to-end-facility-for-vertical-industry-trials/
  - Feb 2020: https://www.5g-eve.eu/event/webinar-5g-eve-portal-and-validation-framework/
  - June 2020: Upcoming training. Registration at https://www.5g-eve.eu/
- Specific requests:
  - https://www.5g-eve.eu/contact/
  - mailto:support@5g-eve.eu

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5G EVE

Thank you!

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