

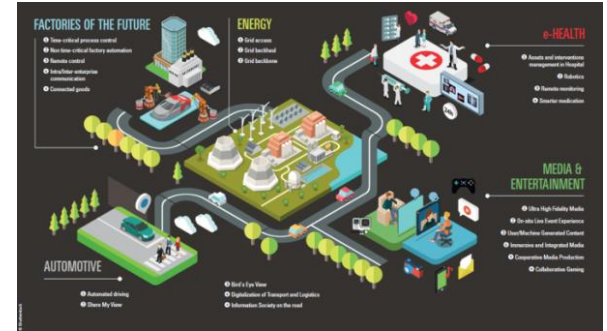
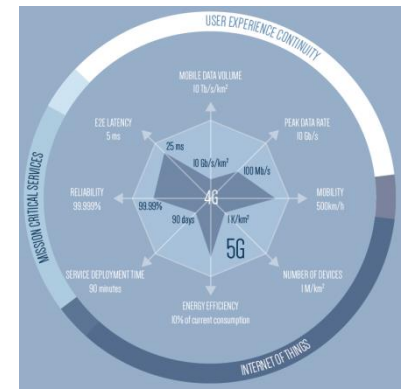


(Horizon 2020 ICT-17 project)

Pål Grønsund, Telenor Research
ICT-19 Info Day, Brussels, 14th Sept 2018

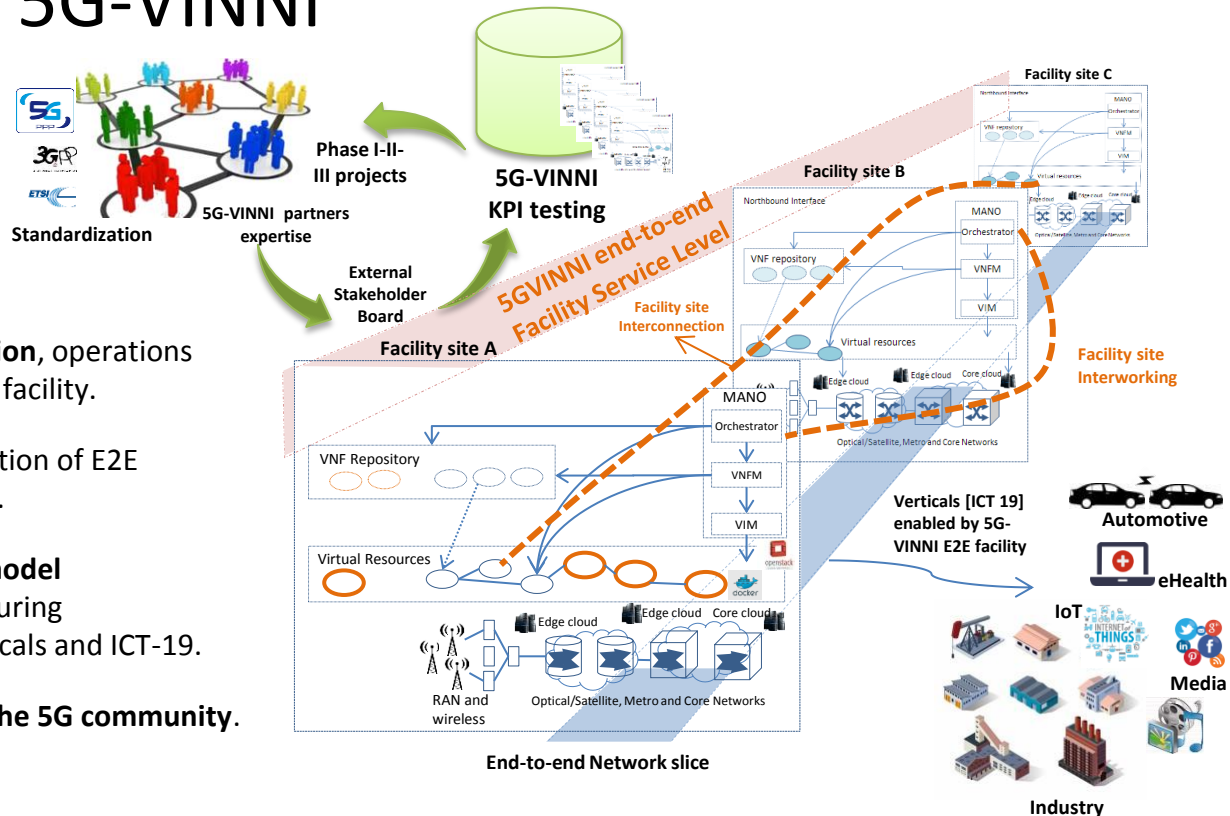
5G-VINNI (5G Verticals INNOvation Infrastructure)

- Build an open large scale 5G End-to-End facility that can
 - demonstrate that key 5G network KPIs can be met
 - be validated, accessed and used by vertical industries (e.g. in ICT-19 projects) to test use cases and validate 5G KPIs.
- Duration: 3 years, budget: 19,998 M€
- Consortium: 23 partners (operators, vendors, academics, SMEs)
- External Stakeholder Board: Vertical industry



Key objectives of 5G-VINNI

1. Design an advanced and accessible 5G end to end facility for verticals and ICT-19.
2. Build several **interworking** sites of the 5G-VINNI end to end facility.
3. Provide user friendly **zero-touch orchestration**, operations and management systems for the 5G-VINNI facility.
4. **Validate the 5G KPIs** and support the execution of E2E trial of vertical use cases for ICT-19 projects.
5. Develop a viable **business and ecosystem model** to support the life of the 5G-VINNI facility during and beyond the span of the project for verticals and ICT-19.
6. **Demonstrate the value of 5G solutions to the 5G community.**



5G-VINNI Facility Sites

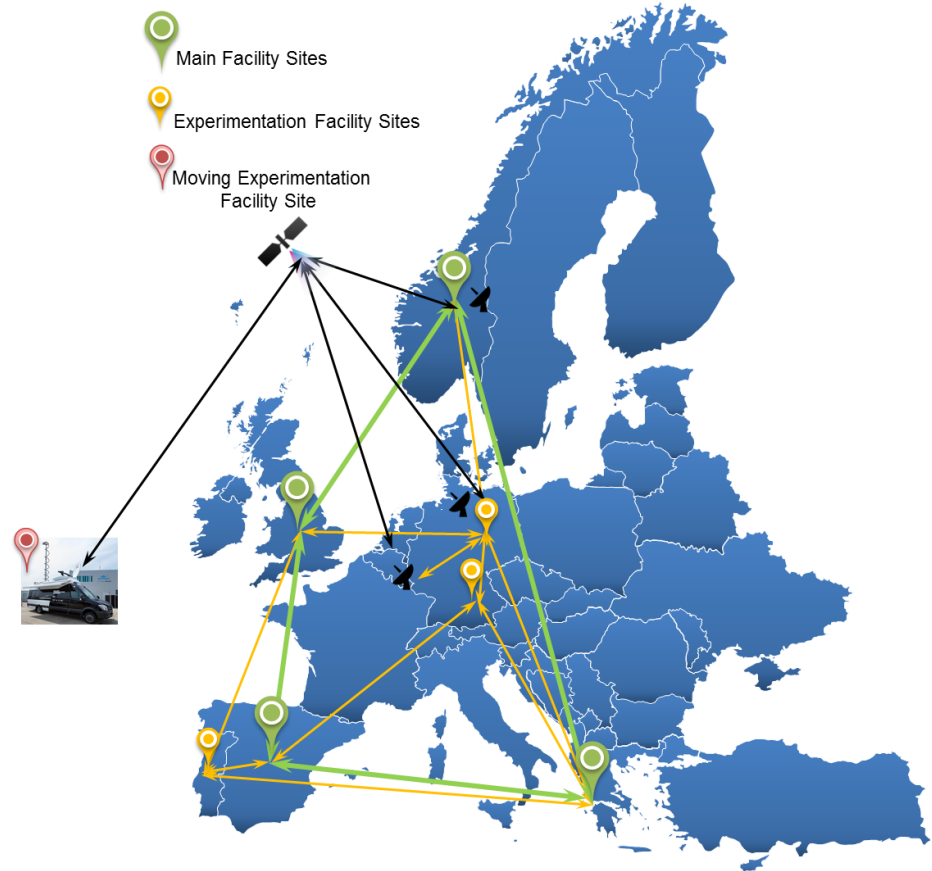
Main Facility sites: E2E 5G-VINNI facility that offers services to ICT-18-19-22 projects with well-defined Service Level Agreements.

- Norway (Oslo, Kongsberg)
- UK (Martlesham)
- Spain (Madrid)
- Greece (Patras)

Experimentation Facility sites: provide environments for advanced focused experimentation and testing possibilities on elements and combinations of elements of the E2E model.

- Portugal (Aveiro)
- Germany (Berlin)
- Germany (Munich)

Moving Experimentation Facility site: satellite connected vehicle.



Capabilities in the Facility Sites

Capabilities	Main Facility sites	Experimentation Facility sites
5G NR	X	X
5G Core	X	X
NFV Infrastructure and Orchestration	X	X
Multi-Access Edge Computing (MEC)	X	X
Network Slicing	X	X
E2E Service Orchestration	X	
Interworking and interconnection among facility sites	X	
Testing framework	X	
Distributed Data Fabric Service	X	

Note: the experimentation facility sites will have advanced capabilities not specified in the table, please refer to the facility site summary slide.

Services offered to ICT-19 projects by the Main Facility sites

Service offered by Main Facility sites
Device Connection (eMBB, mMTC)
Network Slice as a Service for eMBB
Network Slice as a Service for URLLC
Network Slice as a Service for mMTC
Customized Network Slice*
Hosting of third party VNF as part of Slice
Distributed Data Fabric Service as part of Slice
Integration of new non-5G-VINNI gNB to 5G-VINNI facility
Integration of new non-5G-VINNI MEC node to 5G-VINNI facility
Interworking with non-5G-VINNI Facility sites**
Testing services (KPI testing, Use Case testing) ***

* Can be advanced features (e.g. SFC, security, enhanced Cloud access) and be a mix of eMBB, URLLC and mMTC.

** This is subject to terms and conditions to be defined with non-5G-VINNI facility sites (e.g. from ICT-17 or ICT-19 projects)

*** Scope of testing services provided in each main facility site to be defined.

5G-VINNI Facility Sites – Summary

Main
Facility sites

Norway (Oslo, Kongsberg)

- Slicing (eMMB, URLLC, mMTC)
- E2E Service Orchestration (Nokia)
- NFVI (OpenStack) and MANO (Nokia)
- MEC (Nokia)
- Four 5G gNBs (Ericsson, Huawei)
 - 3.5GHz, 90MHz BW
 - 26GHz, 800MHz BW
- 5G Core (Ericsson)
- 3GPP compliance
 - Rel'15 in 2019, Rel'16 in 2021
 - NSA in 2019, SA in 2021
- Satellite backhaul option (GEO)

UK (Martlesham)

- Slicing (eMMB, URLLC, mMTC)
- Service Orchestration (Nokia)
- NFV MANO, NFVI and vEMS (Samsung)
- MEC
- 5G RAN incl. 3.5 and 26GHz (Samsung)
- 5G Core (Samsung)
- 3GPP compliance
 - Rel'15 in 2019, Rel'16 in 2021
 - NSA in 2019, SA in 2021

Spain (Leganes)

- Slicing (OSM extension)
- Service Orchestration (OSM NBI)
- NFV MANO (OSM) and NFVI (OpenStack)
- SDN (ODL/ONOS)
- Support for micro-VNFs
- 5G RAN (SDR), low frequencies and 30-300GHz
- Advanced monitoring and data-driven management
- Edge computing (MEC and non-MEC)
- 5G Core (possibly SBA-based)

Greece (Patras)

- Slicing (eMMB, URLLC, mMTC, via OSM)
- Service Orchestration (via OSM NBI services)
- NFV MANO (OSM) and NFVI (OpenStack)+DPDK
- 5G RAN open source radio (Lime, SRS)-700-800MHz, 3.5.-3.8GHz
- 5G Core (Open5GCore)
- NB-IoT, LTE-M (FhG NB-IOT core)
- mmWave backhaul (Intracom)
- GEANT connectivity
- MEC

Portugal (Aveiro)

- Service Orchestration (AlticeLabs)
- NG-PON2-based 5G front/backhaul (AlticeLabs)
- NFVI (OpenStack)
- SDN (ODL)
- Cloud RAN
- MEC

Germany (Berlin)

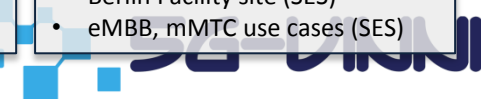
- 5G RAN prototype(s)
- 5G Core (Open5GCore)
- Edge cloud/e2e Orchestration (OpenBaton)
- mmWave backhaul
- Interconnection with remote islands in Betzdorf and Tokyo
- Large scale events, Nomadic networks, Disaster Relief

Germany (Munich)

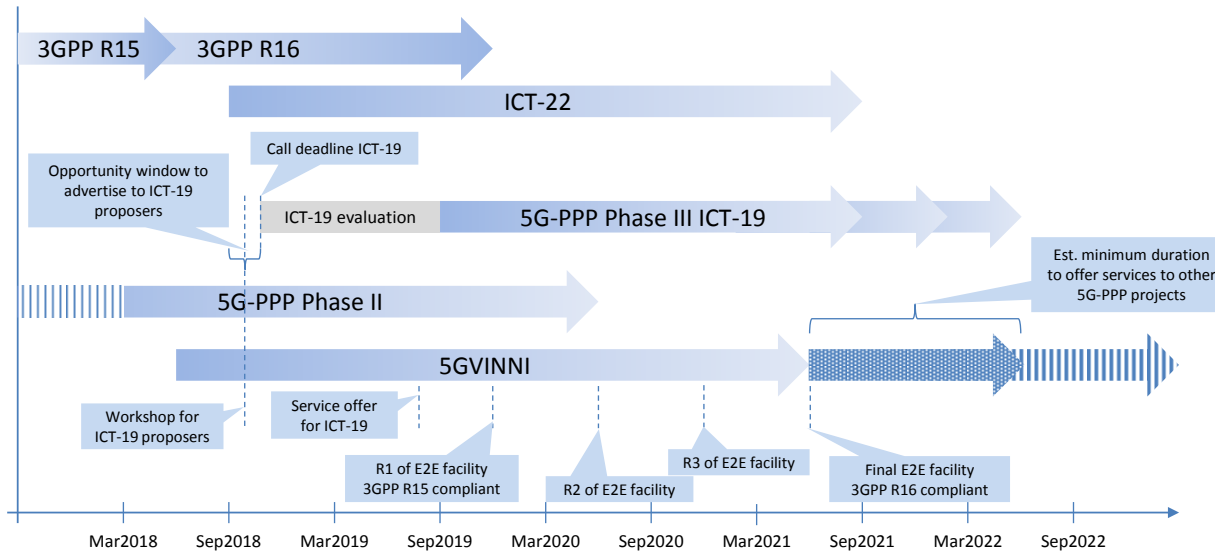
- 5G NR SA RAN (Huawei) 3.5 GHz
- 5G Core (Huawei)
- MANO and NFVI (Huawei)
- SDN (Floodlight)
- V2I, V2P
- MEC, Edge Computing
- URLLC targeting Rel16/17
- Sensor fusion enabled by 5G

Luxembourg (Satellite Connected Vehicle)

- GEO/MEO satellites (SES)
- C/X/Ku/Ka-band (SES)
- Satellite teleport (SES)
- Satellite backhauling (SES)
- Satellite 5G testbed node with SDN/NFV/MEC (SES)
- Satellite interconnection with Berlin Facility site (SES)
- eMBB, mMTC use cases (SES)



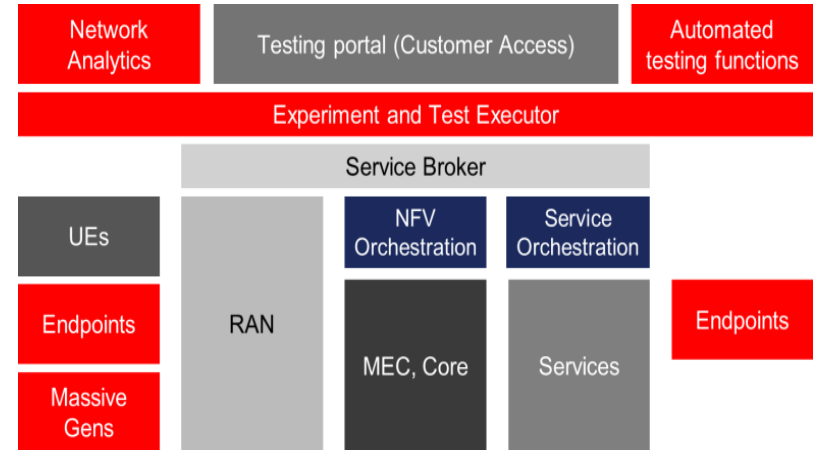
Global Timing



- Detailed service offer with SLA and onboarding-roadmap to be provided on 1st July 2019.
- 5G-VINNI Facility is ready for ICT-19 project experimentation on 1st Jan 2020.
- 5G-VINNI Facility will be available until 1st July 2022
Terms and conditions will be announced for use after 5G-VINNI project ends 1st July 2021.

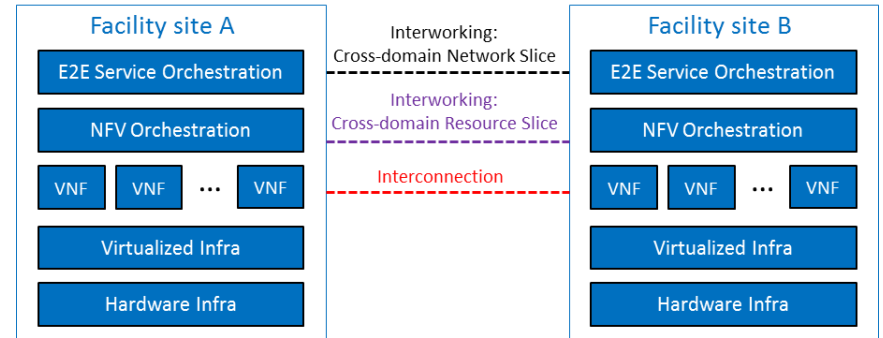
5G-VINNI Test Framework

- Availability of a corpus of test cases to be used as is or as templates for customization
- Availability of a testing portal that allows:
 - Creation and customization of individual test cases
 - Management of testing campaigns (including overnight testing)
 - Results processing and analytics (analytics expected by 2020/2021)
- Easy integration of third parties components and systems under test via open SDK
- Consulting services for testing and experimentation

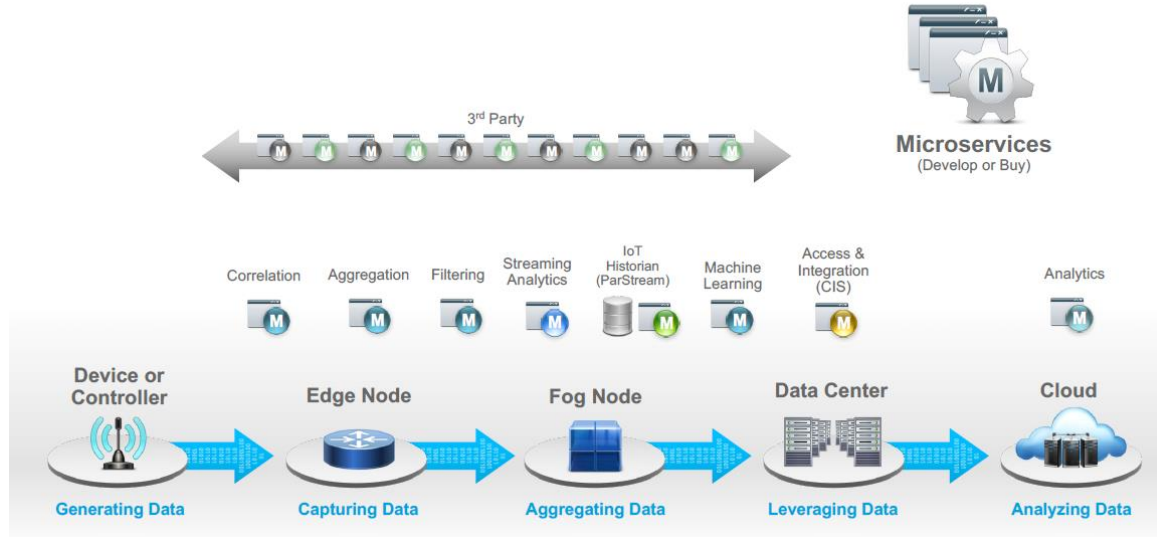


Interworking and Interconnection among Main Facility sites

- Interconnection among facility sites:
 - Connectivity between facility sites.
- Interworking among facility sites:
 - Network Slice crossing different facility sites (domains)
 - Potentially also Resource Slice crossing different facility sites (domains)
- Interworking implies interconnection.
- Management and Orchestration of cross-domain services, resources and SLAs will enable and support interconnection and interworking.
- 5G-VINNI is open to interwork and interconnect with other non-5G-VINNI facilities.
- Detailed specification and SLAs will be defined.
- (some facility sites are connected to GÉANT)



Distributed Data Fabric Service



- Service to extract, compute/transform and move data across the distributed network facility (edge, core, ...).
- Micro-services that make up the data fabric service are distributed throughout the infrastructure.
- Orchestrated and provided as a service, particular relevance for IoT type vertical industry use cases.

Expectations to ICT-19 projects

- Provision resources and effort for integration of use cases
- Funding in case additional gNB is required, including transmission cost if not present
- Funding in case additional MEC site is required to be integrated
- Funding in case a customized slice template is required
- Funding in case of use of capacity beyond basic offering (to be defined)
- Field support will be given for test implementation, but funding is required in case of experiment execution
- High capacity interconnection needs to be budgeted (to be defined)
- Provisioning of budget after 3rd year of 5G-VINNI (i.e. from 1.July 2021- 1.July 2022)
- Interconnection among non-5G-VINNI facility sites is subject to agreement between the stakeholders.

Please contact 5G-VINNI for further information and discussion

- Web page: <http://www.5g-vinni.eu/>
- Twitter: [@5gVinni](https://twitter.com/5gVinni)
- E-mail: 5G-VINNI-Contact@5g-ppp.eu



Supplementary

Partners of 5G-VINNI

Partners are carefully selected to fulfil the objectives of 5G-VINNI for the ICT-17 call

External Stakeholder Board for vertical industry and other institutions important for vertical use cases is established, e.g.

- Logistics
- Shipping
- Transportation
- Media & entertainment
- AR / VR
- Automotive
- Public safety / PPDR



Partners		
Operators	Telenor ASA (TnResearch, TnNorway, TnSatellite)	Norway
	BT	UK
	Telefonica	Spain
	SES	Luxembourg
Industry	Huawei	Norway & Germany
	Ericsson	Norway
	Nokia	Finland / Norway
	Samsung	UK
	Intracom	Greece
	Keysight	Denmark
	Cisco	Norway
	Alticelabs	Portugal
Academia	Engineering	Italy
	AUEB	Greece
	UC3M	Spain
	Simula	Norway
	Uni. Patras	Greece
SME	Fraunhofer FOKUS	Germany
	EANTC	Germany
	Limemicro	UK
Ad min	SRS	IR
	Eurescom	Germany

Service descriptions

Service	Description
Network Slice as a Service (eMBB, URLLC, mMTC)	Network slice based on slice template implemented in the 5G-VINNI Facility. Certain attributes can be configured in the slice template.
Device connection	Connecting UE or device to a vertical slice. The Network Slice as a Service is a pre-requisite of this service
Custom Network Slice	Custom slice template that is different than the pre-implemented eMBB, URLLC and mMTC slice types. Since implementation is required there will be need for technology consultancy and the customer must finance this.
Hosting of third party VNF as part of Slice	Custom VNF as part of a network slice (i.e. Network Slice as a Service for eMBB, URLLC or mMTC). Onboarding of and modelling of the third party VNF as part of the Network Service and Network Slice is required.
Distributed Data Fabric Service as part of Slice	Custom distributed data fabric service to be instantiated and activated as part of a network slice (i.e. Network Slice as a Service for eMBB, URLLC or mMTC). The specific distribution and configuration of the data fabric service is required per customer demand.
Integration of new non-5G-VINNI gNB to 5G-VINNI facility	Custom integration of additional eNB to 5G-VINNI facility. Customer must then finance the eNB cost, eNB installation costs and integration cost in the case of new gNB not integrated before. Transport must also be financed in case transport network is non-existing or not owned by 5G-VINNI facility site owner, or in the case of high capacity requirements.
Integration of new non-5G-VINNI MEC node to 5G-VINNI facility	Custom integration of additional MEC to 5G-VINNI facility. Customer must then finance the MEC node cost, MEC node installation costs and integration cost in the case of new MEC node not integrated before. Transport must also be financed in case transport network is non-existing or not owned by 5G-VINNI facility site owner, or in the case of high capacity requirements.
Interworking with non-5G-VINNI Facility sites*	Custom interworking and interconnection between 5G-VINNI facility site and non-5G-VINNI facility site. Integration costs and interconnection costs must be financed by customer.
Testing services (KPI testing, Use Case testing)	Customer can request testing services to test KPIs and to test Use Cases.