5G-VINNI (5G Verticals INNovation Infrastructure)

H2020 ICT-17 project accepted for grant

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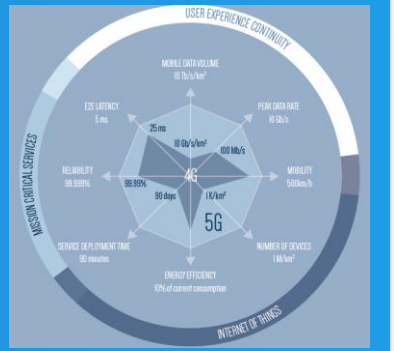
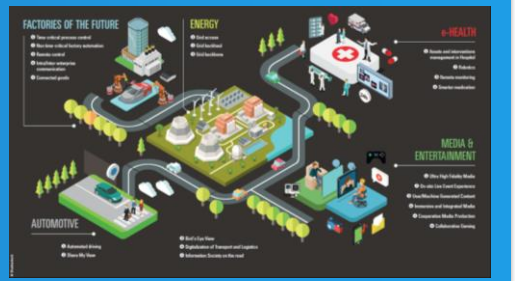
5G-VINNI (**5G V**erticals **INN**ovation **I**nfrastructure)

a project accepted for grant in ICT-17

- Build an open large scale 5G End-to-End facility that can
  - demonstrate that key 5G network KPIs can be met KPIs (capacity, ubiquity, speed, latency, reliability, density of users, location accuracy, energy efficiency, service creation time, network management capex/opex)
  - be validated, accessed and used by vertical industries (e.g. in ICT-19 projects) to test use cases and validate 5G KPIs.





Project Budget: 19,998 million €
Project Duration ~36 months (start July 2018)

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
	Engineering	Italy
Academia	AUEB	Greece
	UC3M	Spain
	Simula	Norway
	Uni. Patras	Greece
	Fraunhofer FOKUS	Germany
SME	EANTC	Germany
	Limemicro	UK
	SRS	IR
Admin	Eurescom	Germany

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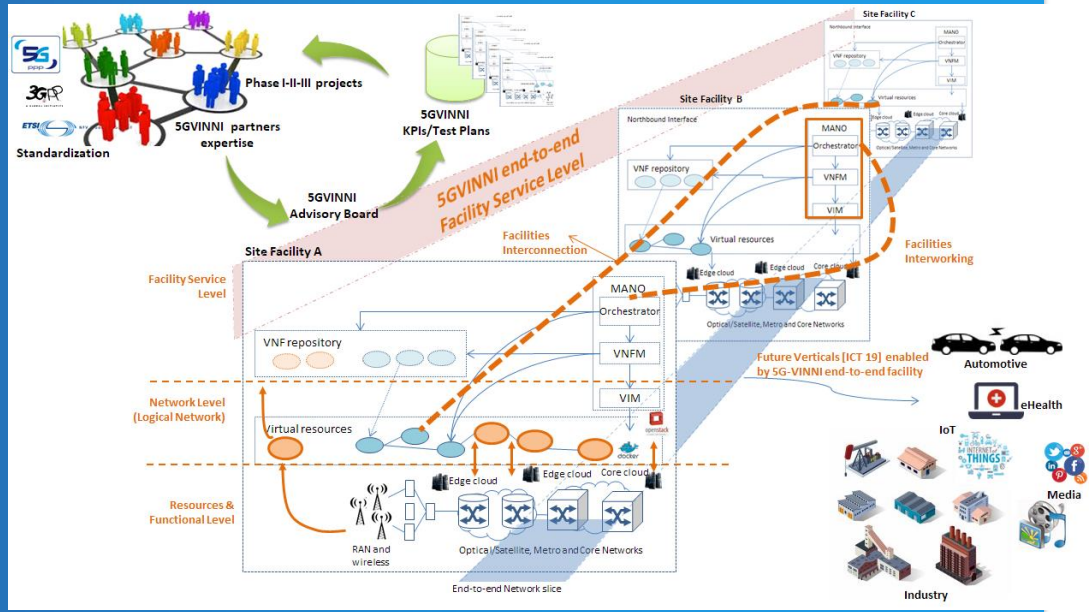
Key objectives of 5G-VINNI

1. Design an advanced and accessible 5G end to end facility.
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 to prove the 5G-VINNI capabilities.
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.



6. **Demonstrate the value of 5G solutions to the 5G community** particularly to relevant standards and open source communities with a view to securing widespread adoption of these solutions.

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5G-VINNI Facility sites

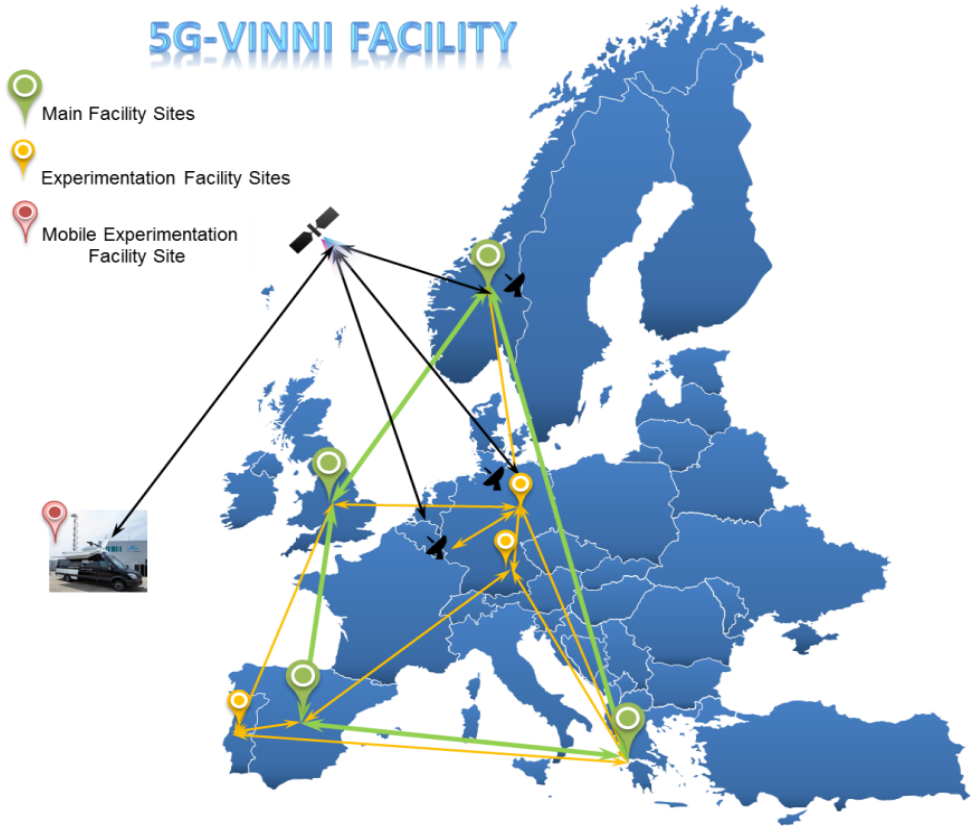
Main Facility sites: E2E 5G-VINNI facility that offers services to ICT-18-19-22 projects with well-defined Service Level Agreements.

- 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)

Mobile Experimentation Facility site: moving satellite terminals.



5G-VINNI Facility sites – Key Features

Orchestration and Softwarization features

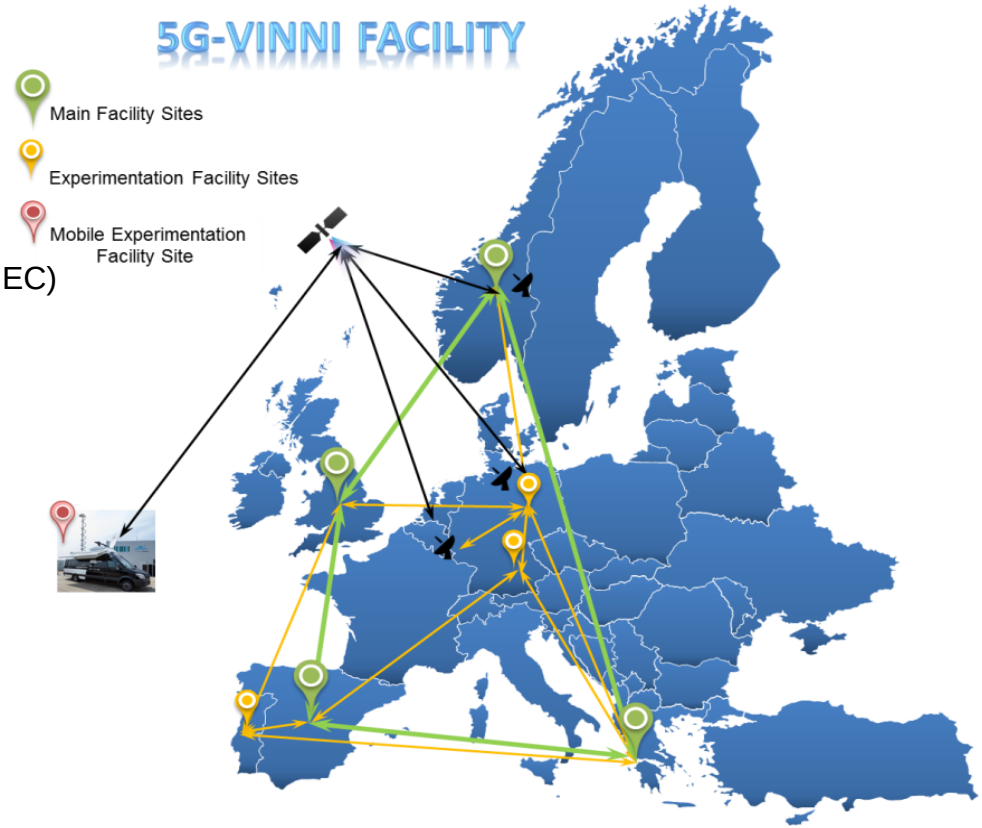
- Network Slicing and E2E Service Orchestration
- Slice Federation/Interworking across facility sites
- NFV MANO, NFVI and SDN
- Distributed Cloud with Multi-access Edge Computing (MEC)

RAN and Core features (varies across facility sites)

- New Radio in 3.5 and 26 GHz bands, Massive MIMO
- Cloud RAN
- 5G SA and NSA
- IoT
- Satellite (GEO, MEO) integration with 5G (and MEC)

Innovative features

- Distributed IoT Data Fabric service
- Experiment and Test Executor



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5G-VINNI Facility sites – Solutions Details

Main Facility sites

Norway (Oslo, Kongsberg)

- Service Orchestration (Nokia)
- Slicing (eMMB, URLLC)
- NFV MANO and NFVI (Nokia)
- MEC
- SDN (Nuage)
- 5G RAN 3.5 and 26GHz (E///, Huawei)
- 5G Core (E///)
- vEMS (E///, Huawei)
- Satellite (GEO, Telenor)

UK (Martlesham)

- Service Orchestration (Nokia)
- Slicing (eMMB, URLLC, mMTC)
- NFV MANO, NFVI and vEMS (Samsung)
- MEC
- 5G RAN incl. mmWave 3.5 and 26/28GHz (Samsung)
- 5G Core (Samsung)

Spain (Madrid)

- Service Orchestration
- Slicing
- NFV MANO (OSM) and NFVI (OpenStack)
- SDN (ODL)
- 5G RAN (SDR), low frequencies and 30-300GHz
- 5G Core

Greece (Patras)

- Slicing (eMMB, URLLC, mMTC)
- Service Orchestration
- NFV MANO (OSM) and NFVI (OpenStack)
- 5G RAN open source radio (Lime, SRS)
- 5G Core (Open5GCore)
- IoT (FhG NB-IOT)
- mmWave backhaul (Intracom)
- Planned GEANT connectivity

Experimental Facility sites

Portugal (Aveiro)

- Service Orchestration (Alticelabs)
- NFVI (OpenStack)
- SDN (ODL)
- Cloud RAN
- NG-PON2-based 5G front/backhaul (Alticelabs)
- Smart city

Germany (Berlin)

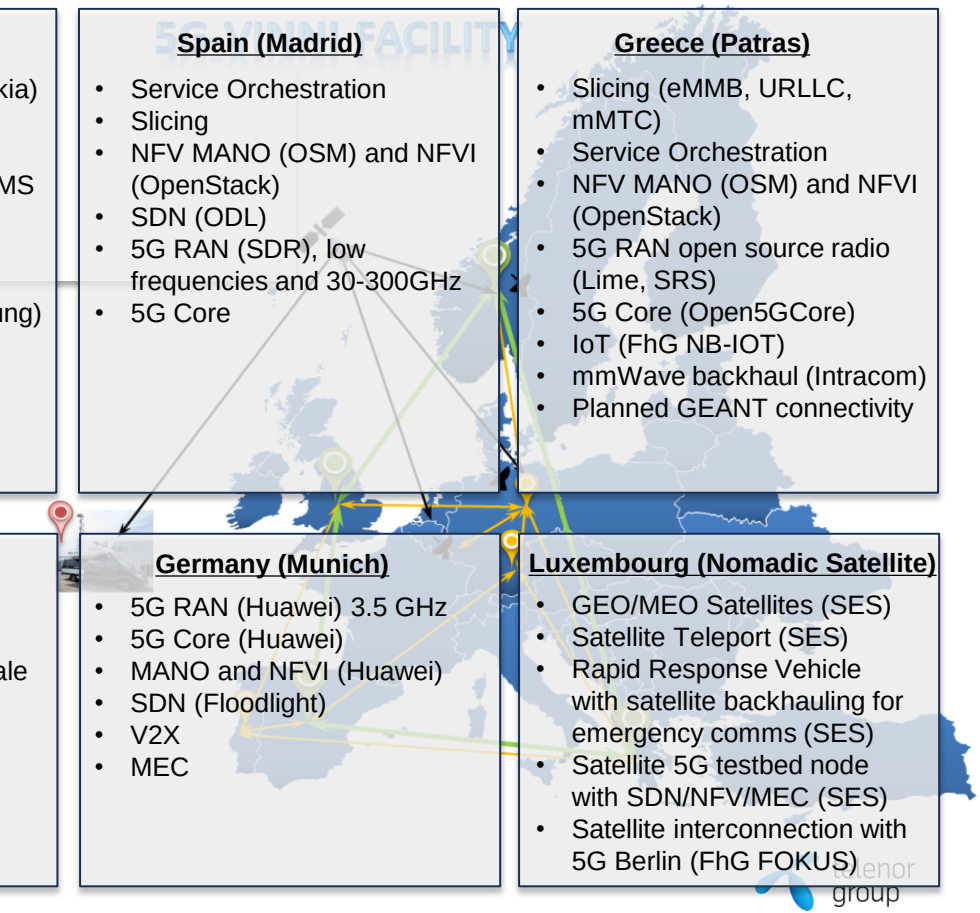
- 5G RAN prototype
- 5G Core (Open5GCore)
- 5G edge network large scale events and conferences.
- mmWawe backhaul
- Satellite interconnection (Betzdorf, 5G!Pagoda)
- Public Safety, Emergency Response, Disaster Relief

Germany (Munich)

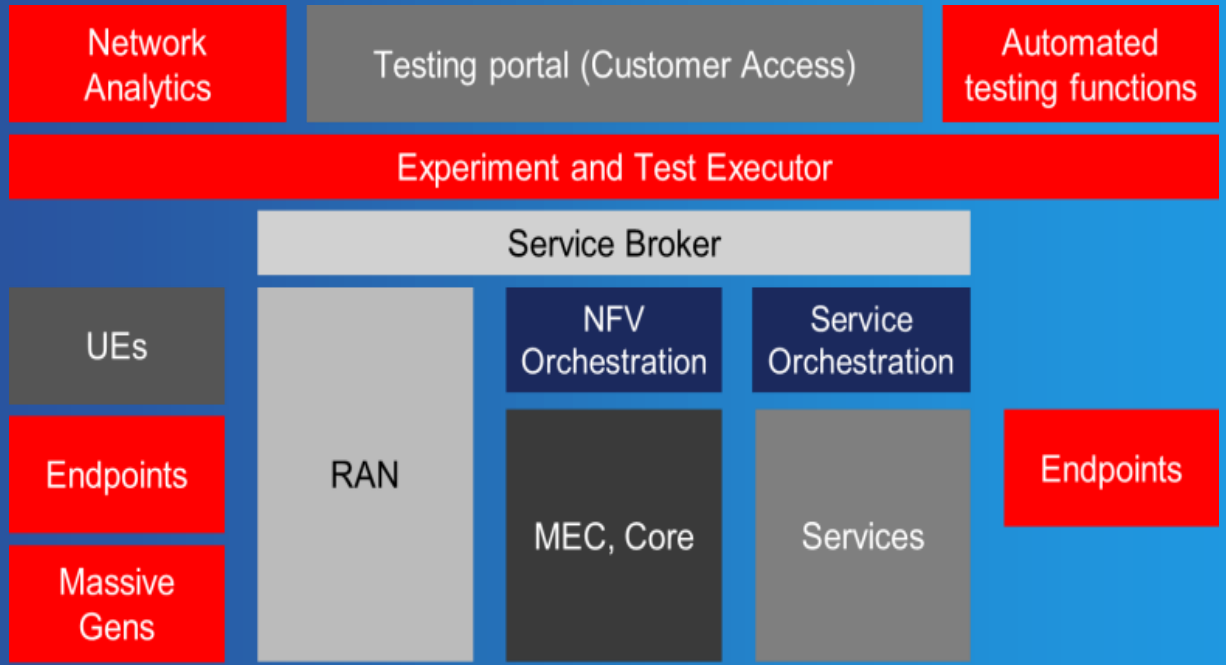
- 5G RAN (Huawei) 3.5 GHz
- 5G Core (Huawei)
- MANO and NFVI (Huawei)
- SDN (Floodlight)
- V2X
- MEC

Luxembourg (Nomadic Satellite)

- GEO/MEO Satellites (SES)
- Satellite Teleport (SES)
- Rapid Response Vehicle with satellite backhauling for emergency comms (SES)
- Satellite 5G testbed node with SDN/NFV/MEC (SES)
- Satellite interconnection with 5G Berlin (FhG FOKUS)



5G-VINNI Test Framework



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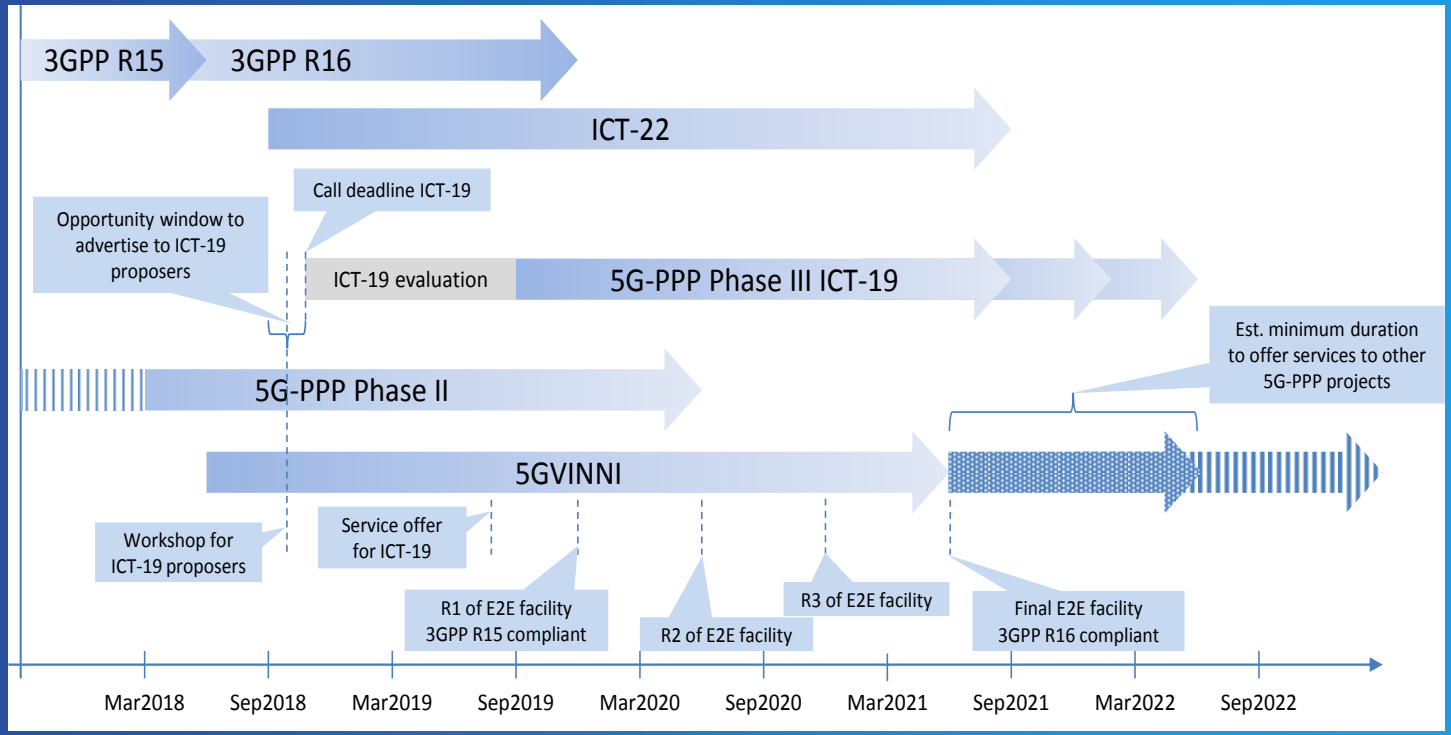
Global timing alignment with 3GPP and 5G PPP



6 months release cycle of 5G-VINNI facility

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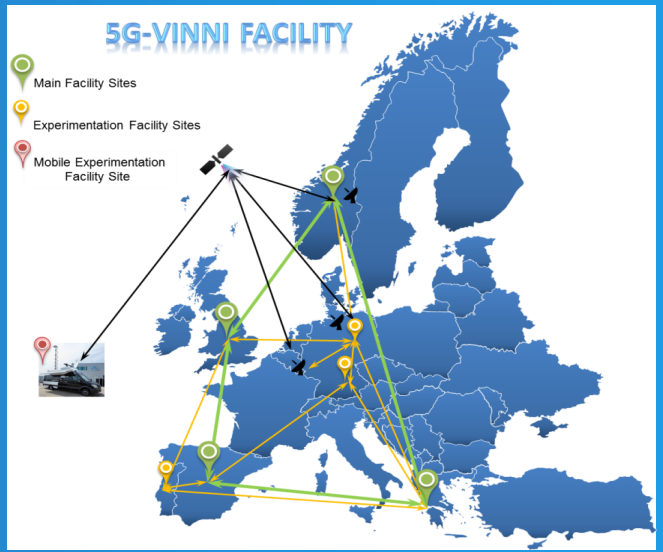
In summary, 5G-VINNI will build an open large scale 5G End-to-End facility to be used by vertical industries to test use cases and validate 5G KPIs

5G-VINNI Facility sites

- **Main Facility sites**: E2E 5G-VINNI facility that offers services to ICT-18-19-22 projects with well-defined SLAs;
  Norway (Oslo, Kongsberg), UK, Spain (Madrid), Greece (Patras)
- **Experimentation Facility sites**: provide environments for advanced focused experimentation and testing possibilities;
  Portugal (Aveiro), Germany (Berlin), Germany (Munich).
- **Mobile Experimentation Facility site**: moving satellite terminals.



Key Features

- **Orchestration and Softwarization;** Network Slicing, E2E Service Orchestration; Slice Federation, NFV MANO, SDN, MEC
- **RAN and Core (varies across facility sites);** NR in 3.5 and 26 GHz, Massive MIMO; Cloud RAN; LTE interworking; IoT, satellite integration, 5G SA and NSA Core.
- **Innovative Service;** Experiment and Test Executor, Distributed IoT Data Fabric service

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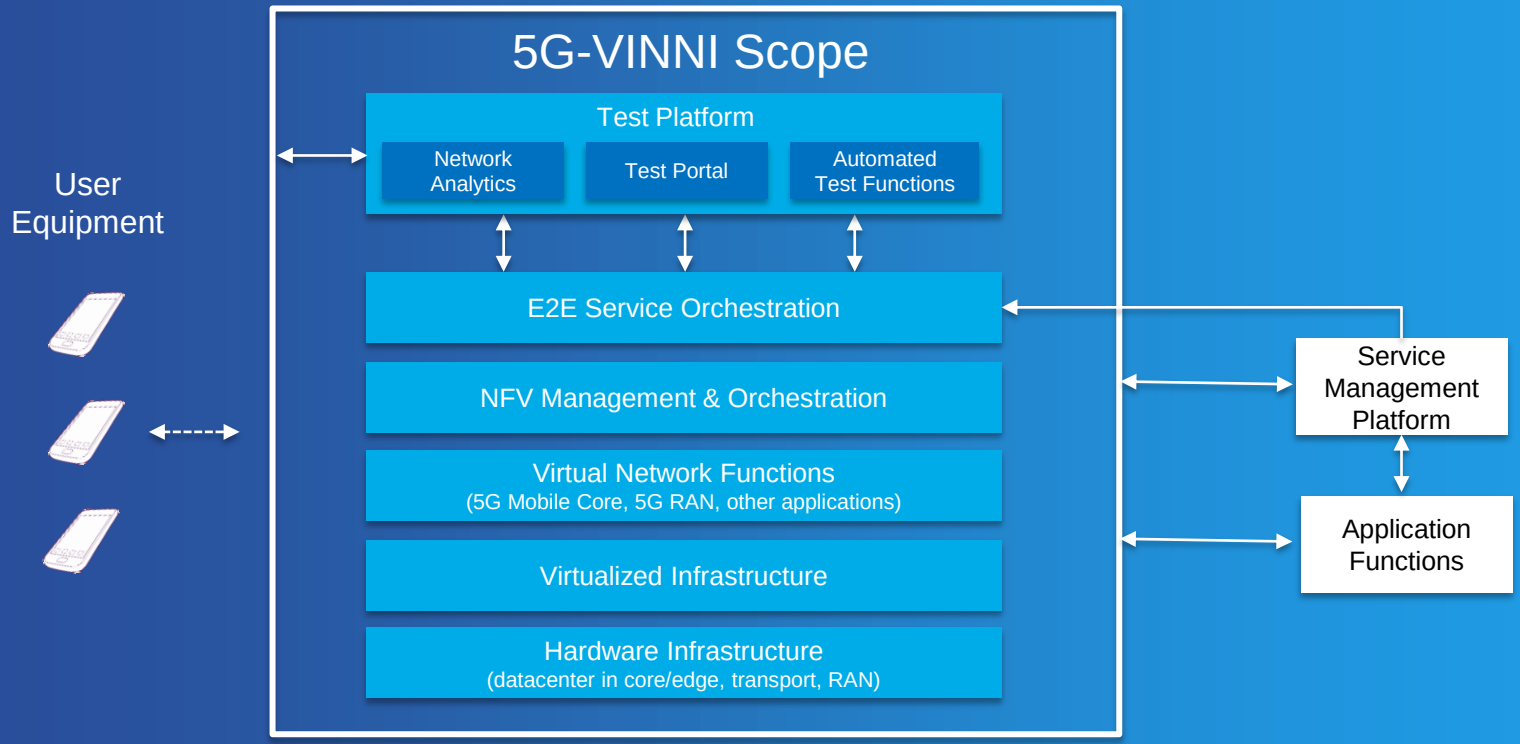
Backup

Basic separation of responsibilities between 5G-VINNI and verticals / ICT-19 projects



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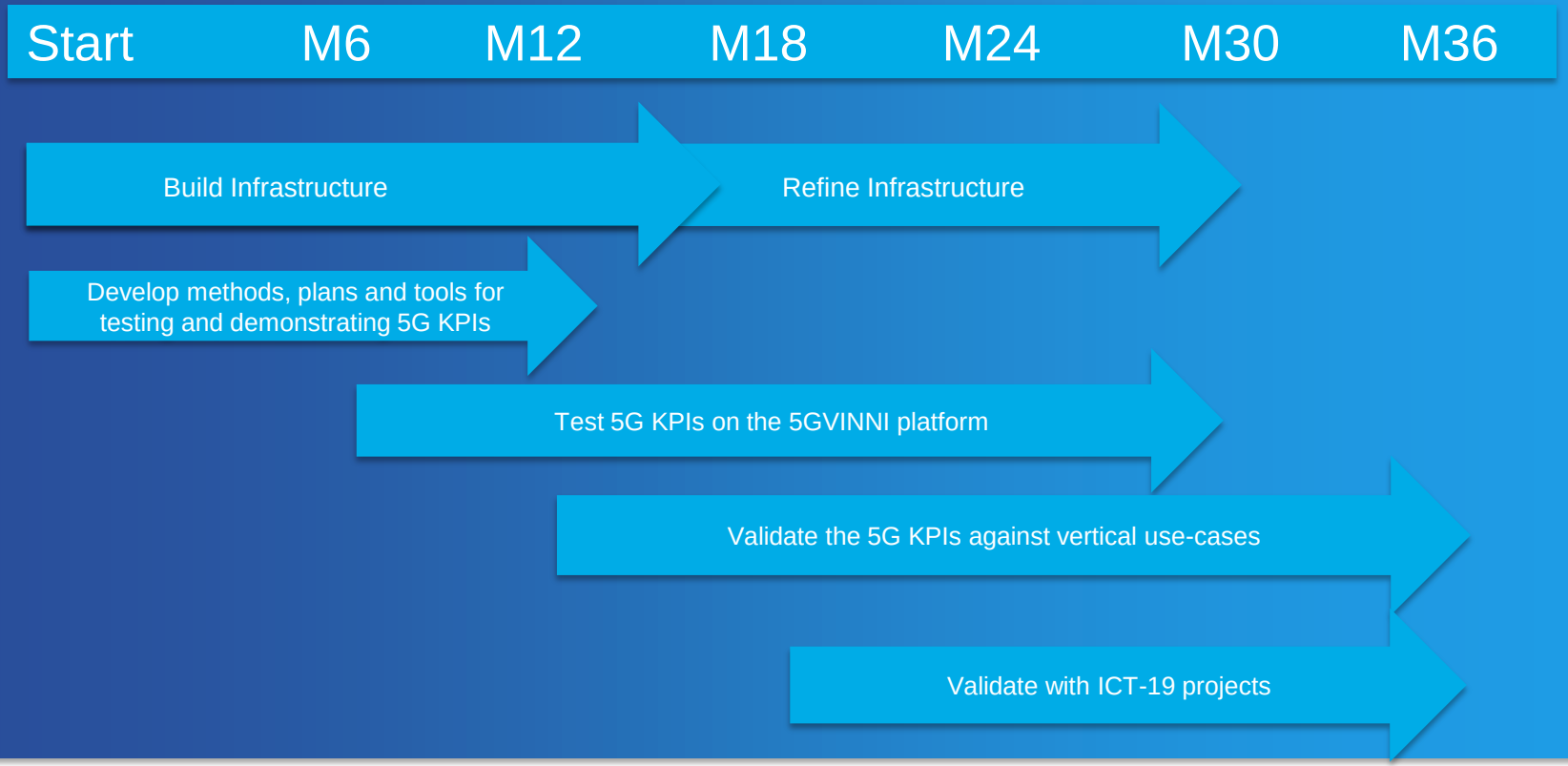
5G-VINNI activities at high level



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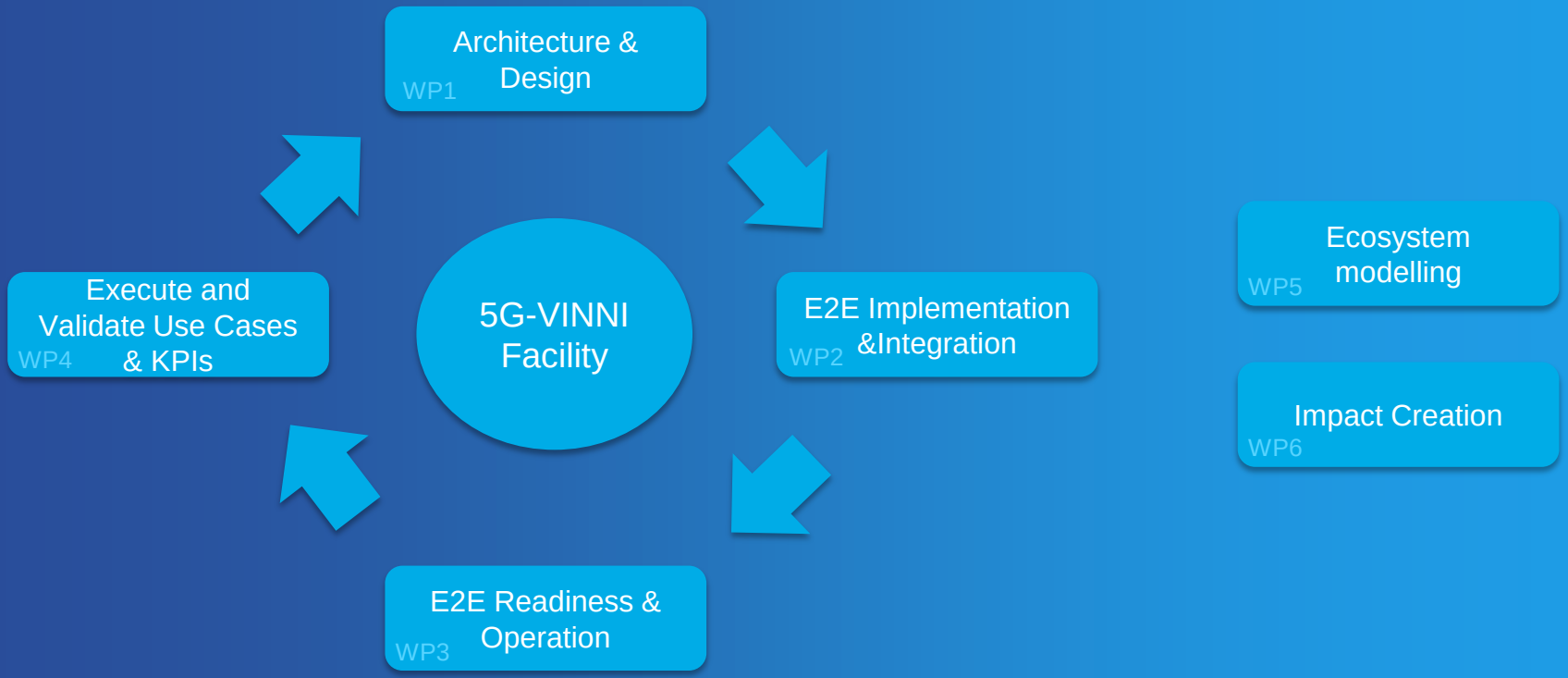
5G-VINNI Project Implementation and Methodology



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5G-VINNI Milestones

Milestone	Due date	Means of verification
Workshop for ICT-19 proposers	Sept 2018	• Workshop event
Release 0 of E2E facility	July 2019	• For 5G-VINNI project internal validation of KPIs and specific use cases for E2E facility validation. • Facility will consist of Non Stand Alone (NSA) 5G New Radio (NR) and 5G Core. • Virtualization infrastructure, NFV Orchestration and Service Orchestration will be implemented. E2E slicing is implemented supporting basic life-cycle events.
Service offer and on-boarding roadmap for ICT-18-19-22 projects	Nov 2019	• Including initial results of KPI validation on Release 0
Release 1 of E2E facility	Feb 2020	• Ready for use by ICT-18-19-22 projects and other external use cases. • The main facility sites (Norway, UK, Spain and Greece) will be 3GPP Rel15 compliant. • Minimum one of the facility sites will include Stand Alone (SA) 5G NR and 5G Core. • E2E slicing is implemented supporting all planned life-cycle events. Service orchestration across two interconnected main facility sites.
Release 2 of E2E facility	June 2020	• Backward compatible with Release 1. • Two main facility sites will include Stand Alone (SA) 5G NR and 5G Core. • Service Orchestration across 3 interconnected main facility sites. • Minimum 2 vertical use cases from ICT-18-19-22 project(s) and 3 use cases from other external verticals "customers" of the 5G-VINNI facilities are on-boarded.
Release 3 of E2E facility	Nov 2020	• Backward compatible with Release 2. • All main facility sites will include Stand Alone (SA) 5G NR and 5G Core. • Service Orchestration across all interconnected main facility sites. Initial results from vertical use cases and KPIs validation and testing.
Release FINAL of E2E facility	June 2018	• 3GPP R16 compliant. • Ambition to be backward compatible with Release 3, depending on standard compliance. • Minimum 4 vertical use cases from ICT-18-19-22 project(s) and 6 use cases from other external verticals "customers" of the 5G-VINNI facilities are on-boarded.