

A DISTRIBUTED CLOUD & RADIO PLATFORM FOR 5G NEUTRAL HOSTS

5GCity: Use Cases for Smart Cities to improve the 5G ecosystem using a strong partnership between industrial and research area





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5GCity Project





Media (Industry Vertical)

5GCity consortium includes different media-related partners, a television channel, a national broadcaster, and a SME focused on content acquisition and production in the Cloud or an association of media companies. Three different media use cases will be deployed and evaluated (mobile real-time transmission, UHD video distribution, and real-time video acquisition and production in the Edge & Cloud).



The city of Lucca holds some yearly events that are highly disproportionate to the city size, resulting in a number of issues including illegal waste dumping. 5GCity will use the cities' surveillance cameras and deploy (multiple instances of) a virtualized service that can process video streams near cameras automatically to identify illegal dumping.





Neutral host (Telecom Use Case)

GCity will leverage its virtualization platform in order to enable the cities to create dynamic end-to-end slices containing both virtualized edge and network resources and lease it to third-party operators.

5GCity project and Use Cases



5GCity: a distributed cloud & radio platform for 5G Neutral Hosts.

• The main goal is to turn a city into a distributed, third party, and multitenant edge infrastructure, extending the cloud model all the way to the edge while enabling dynamic, fast and interoperable provisioning

5GCity Use Case: a specific application paradigm and describes how the proposed technology can be used to satisfy specific needs.

- For each Use Case, we are going to consider the following aspects:
 - Overall description
 - Actors involved
 - Deployment topology
 - Evaluation
 - Requirements
 - Expected impact



Use Cases: selected scenarios

All the use cases can be clustered in 3 scenarios:

- Scenario 1 Telecom Use Case: 5GCity leverages its virtualization platform in order to enable the cities (or any infrastructure provider) to create dynamic end-to-end slices containing both virtualized edge and network resources and lease it to third-party operators.
- Scenario 2 Industry vertical: is strictly related to different aspects of the media and entertainment industry. Video acquisition, editing and delivery.
- Scenario 3 City Services: is tailored to the specific needs of the city of Lucca
 - which holds some yearly events that are highly disproportionate to the city size, resulting in a number of issues including illegal waste dumping.





5GCity architecture





5GCity Architecture and physical resources can be described as a set of functional blocks grouped in functional areas, the boundaries of each functional area are logical and not tied to specific geographical position of the resources implementing the single functionality.



The 5G architecture is expected to accommodate a wide range of Use Cases with advanced requirements, especially in terms of latency, resilience, coverage, and bandwidth.

pioneer

Use Cases distribution



ID	Lico Coco Nomo	City			
	Use Case Name	Barcelona	Bristol	Lucca	
UC1	Unauthorized Waste Dumping Prevention			Yes	
UC2	Neutral Host	Yes	Yes	Yes	
UC3	Video Acquisition and Production Community media engagement in live events	Yes	Yes		
UC4	UHD Video Distribution Immersive Services		Yes	Yes	
UC5	Mobile Backpack Unit for Real-time Transmission	Yes			
UC6	Cooperative, Connected and Automated Mobility	Yes			

5GCity Use Cases and 5G Groups



5G Groups						5GCity Use Cases		
eMBB - Broadband access everywhere					All			
mMTC - Massive internet of things					UC4, UC5, UC6			
Extreme real time communication					UC2, UC4, UC5,			
						UC6		
URLLC/ uMT	C - Ultra reli	iable con	nmunication	and Low la	atency Commu	inication	All	
						Enh	eMBB anced mobile broadband	
							Gigabytes in a second	
5G Traffic Requirement	UC 1	UC 2	UC 3	UC 4	UC 5	UC 6		3D video, UHD screens
Device Density	Low	High	Medium	Medium	Medium	High	Smart home/building	Augmented reality
Mobility	Static/Low	High	Medium	Medium	Medium	High		
Infrastructure	Medium	Medium	Medium	Medium	Medium	Medium	Voice	Mission critical application
Traffic Type	Period/ Event driven	All types	Continuous/ Event Driven	Continuous/E vent Driven	Continuous/ Event Driven	Continuous/ Event Driven	Smart city	Future IMT
User Data Rate	Low	High	Low	High	Medium	Medium	mMTC	
Latency	Low	Low	Low	Low	Low	Low	Massive machine type	Ultra-reliable and low latency
Reliability	High	High	High	High	High	High	communications	communications
Availability	High	High	High	High	High	High		

5G KPIs and 5GCity - 1/2



5G-PPP KPI	Relevance for 5GCity
P1	5GCity will highlight the requirements of the Smart City context
P2	Saving up to 90% of energy per service provided.
Р3	A VNF catalogue to create services in minutes / hours.
P4	The trusted, scalable applications will be deployed thanks also to solutions based on edge network equipment.
P5	5GCity solution will increase reliability and minimize latency; scalability will be increased and we will minimize latency
S2	Tasks offloading to edge components will enable significantly lower energy consumption.
S3	The 5G core functionalities, including uMTC and mMTC will be implemented as VNFs and VNF chains deployed on generic edge network equipment developed in Europe.
S4	5GCity will stimulate of new economically viable services of high societal value like U-HDTV and M2M applications
B1	5GCity will increase European competitiveness for industry addressing the 5G communication issues to eliminate risks that hinder investment in services.
B2	5GCity will increase European competitiveness for industry above all the SME

5G KPIs and 5GCity - 2/2



Consolidated Projects KPI\UCs	Crowded Venues	Smart Cities	Performance equipment	50+ Mbps everywhere	Mobile BB in vehicles
Device Density	1000– 10000 devices per km2 for UC3, UC4, UC5	< 1000 devices per km2 for UC1 ≥ 10000 devices per km2 for UC6	3 days batteries (smart phones) and more than 10 days (less performing devices): for all UCs	Far remote rural: 500 Mbps/km ² Rural: 5 Gbps/km ² Suburban: 25 Gbps/km ² for all UCs	Urban:1000-3000 veh/km² for UC6
Mobility	0-3 Km/s:for UC1, UC2, UC3, UC4, UC5 3-50 Km/s :for UC1, UC2, UC3, UC4, UC5 >50 Km/s:for UC6	0-3 Km/s: for UC1, UC2, UC3, UC4, UC5 3-50 Km/s ; for UC1, UC2, UC3, UC4, UC5 >50 Km/s: for UC6	3 days batteries (smart phones) and more than 10 days (less performing devices): for all UCs		>50 Km/s for UC6
Infrastructure	Medium (macro and limited small cell) for all UCs	Medium (macro and limited small cell) for all UCs		Medium (macro and limited small cell) for all UCs	Medium (macro and limited small cell) for all UCs
Traffic Type					
User Data Rate	100Mbps–1Gbps: for UC2, UC4 50–100Mbps:for UC3, UC5, UC6 < 50 Mbps UC1			DL: 50 Mbps (100 Mbps, if possible) UL: 25 Mbps	
Latency	<= 10 ms: for all UCs	<= 10 ms: all UCs			< 10 ms for UC6
Flexibility/versatility/re-configurability					
Resilience and continuity	For all UCs 95-99% expected: for UC2 and UC6:>99 %	> 99 % for all UCs			For all UCs 95-99% expected: for UC2 and UC6:>99 % > 99 % for UC6

5GCity lesson



Wide variety of vertical markets that originate extremely different use cases and, consequently, extremely different requirements.

- Wide range of requirements
- Different network setting

Reference Architecture

- The current network solutions are based on a relatively static and closed architecture; on the contrary, for the 5G solutions, decoupling the two levels of hardware and software will be the pillars to offer a new networking flexibility
- Network slicing as a key element of 5G Network to compose and manage *dedicated end-to-end logical networks* with specific functions, without loosing the economies of scale of a common physical infrastructure
- Neutral Host model has to be explored to offer innovative Smart City services to the final customers according to the heterogeneous characteristics; the proposed solution offer a better flexibility realizing the requirements coming from the new services and maintaining also the compatibility with the previous ones dealing correctly with the scalability.

Use cases

- Use cases have suitably designed for each city in accordance with all the partners and the public administrations interests
- Use cases allow to demonstrate the capability of dynamically reshaping and reassigning the resources dedicated to the different functionalities to allow the acceleration of the "Time to Market" for the insertion of new functionalities into the network
- The relation among the different 5G KPIs and the 5GCity KPIs will be explored

Mise project: "Città 5G"



Open Fiber and Wind Tre offer technical solutions for 5G access in the range 3.7 – 3.8 GHz

- Several other companies, utilities, research centers and public administrationsare involved as partners
- Among these, ZTE provides NR access, core network and transport technologies

The goal is to test newly deployed technologies as well as the capability of 5G to create a new digital economy with a ubiquitous network that will connect people, things, and services

Two cities involved: L'Aquila and Prato

4 years (September 2017 – 2021)

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