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www.km4city.org

Exploiting Snap4City API, and Web/Mobile Applications SDK

January 2024, Course, Part 7 <u>https://www.snap4city.org/944</u> <u>https://www.snap4city.org/577</u>

DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISON SUPPORT SYSTEMS AND BUSINESS INTELLIGENCE



Paolo Nesi, <u>paolo.nesi@unifi.it</u> <u>https://www.Km4City.org</u> <u>https://www.disit.org</u>









Be smart in a SNAP!



SMARTCITY EXPO WORLD CONGRESS

7-9 November 2023, Barcelona, Spain

Visit Snap4City in Hall 1

Exploiting Snap4City API, and Web/Mobile Applications SDK

January 2024, Course, Part 7

https://www.snap4city.org/944 https://www.snap4city.org/577

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES



















https://www.snap4city.org/944

On Line Training Material (free of charge)









Snap4City (C), January 2024







Note on Training Material

- Course 2023: <u>https://www.snap4city.org/944</u>
 - Introductionary course to Snap4City technology
- Course https://www.snap4city.org/577
 - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology
- Documentation includes a deeper round of details
 - Snap4City Platform Overview:
 - <u>https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf</u>
 - Development Life Cycle:
 - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
 - Client Side Business Logic:
 - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- On line cases and documentation:
 - <u>https://www.snap4city.org/108</u>
 - <u>https://www.snap4city.org/78</u>
 - <u>https://www.snap4city.org/426</u>





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Snap4City Platform

Technical Overview

From: DINFO dept of University of Florence, with its DISIT Lab, Https://www.disit.org with its Snap4City solution

Snap4City:

- Web page: <u>Https://www.snap4city.org</u>
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city

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- Twitter: <u>https://twitter.com/paolonesi</u>
- FaceBook: <u>https://www.facebook.com/paolo.nesi2</u>



• https://www.snap4city.o

rg/drupal/sites/default/f

iles/files/Snap4City-

PlatformOverview.pdf







DIPARTIMENTO DI







UNIVERSITÀ DIGUI STUDI FIRENZE DINFO DISIT SNAP4city SNAP4Tech **Development Life-Cycle** https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle-v1-1.pdf From Snap4City: We suggest you to read the TECHNICAL OVERVIEW: https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf https://www.snap4city.org https://www.snap4solutions.org https://www.snap4industry.org https://twitter.com/snap4city https://www.facebook.com/snap4city https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg Coordinator: Paolo Nesi, Paolo.nesi@unifi.it DISIT Lab, https://www.disit.org DINFO dept of University of Florence, Via S. Marta 3, 50139, Firenze, Italy Phone: +39-335-5668674



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Development https://www.snap4city.org/d ownload/video/Snap4Tech-**Development-Life-Cycle.pdf**





- Register on <u>WWW.snap4city.org</u>
 - Subscribe on **DISIT Organization**
- You can:

UNIVERSITÀ Degli studi

FIRENZE

Access on basic Tools

INGEGNERIA DELL'INFORMAZIONE

- Access to a large volume of Data
- Create Dashboards
- Create IOT Applications
- Connect your IOT Devices
- Exploit Tutorials and Demonstrations









- Smart City API: Internal and External
- Concepts and tools for using Knowlege Base, ServiceMap, API
- Federated Knowledge Bases and Smart City APIs
- Advanced Smart City API
- Access to Protected data
- Forging and managing: Mobile and Web Apps, MicroApplications
- Web and Mobile App Development Kit
- Training Material

Living Lab Accelerating











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Development Life Cycle Smart Solutions





11/23



















- Smart Applications can be easily developed exploiting the cloud infrastructure by producing only:
 - Processing Logic / IoT App with almost no coding activities
 - Data Analytics in Python or Rstudio
 - Dashboards with almost no coding activities.
- → Orange parts of the previous figure slide are those usually developed,
 - all the rest, is part of the provided microservices and infrastructure.
- Third party applications can dialog with the solutions via
 - Smart City API, Swagger: <u>https://www.km4city.org/swagger/external/</u>
 - Brokers/IoT Brokers, for example for NGSI Orion Broker: <u>https://www.km4city.org/swagger/external/?urls.primaryName=Orion%20Broker%20K1-K2%20Authentication%20API</u>
 - Processing Logic / IoT App any protocols: https://www.snap4city.org/65 They can also expose some specific API, custom made

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES









Internal API







Internal and External Smart City API

Snap4City	Smart City A	PI Docs: Swagger		
User: roottooladmin1, Org: DISIT Role: RootAdmin, Level: 7	⊖ swagger	Select a spec Advanced Smart City API Advanced Smart City API Km4city Web App API		
LCCCUT LE External Services Data Set Manager: Data Gate	Advanced Smart City API (100 CNS) https://www.km4city.org/swagger/external/ascapi-openapiv3.json	Orion Broker K1-K2 Authentication API Heatmap API	ernal API Docs: Swagger	
 ✓ Resource Manager: Process Loader ✓ ✓	SMART CITY API WEB DOCUMENTATION		Select a spec	IoT device registration API IoT device registration API Notificator API
Web Scraping Tool (0n) Web Scraping Tool (6l) B Kstudio Development Studio Development 011	Servers https://servicemap.disit.org/WebAppGrafo/api/v1 v		rm of a JSON document shaped conforming to a well-defined schema fevice.	DISCES scheduler API Resource Manager API Sensors API
R Studio Development 0.116 R Studio Development TF R Studio Development GFF R Studio Development GFF R Studio Development Crol	Services	~		Event Logger API Ownership API Data Manager API
A Studio Severaginen Crisi MicroServices from DataAnalytic ETL Development ETL Development 1	GET / Service discovery and information Events	~		Device, Broker and Value Mgmt API Snap4City Application API Engager API
ETL Development 2 Knowledge Base Graphs Knowledge Base Queries	GET /events/ Event search			Wallet API User Profiler API
Smart City API Docs Swagger Internal API Docs Swagger Testing API by Postman Source Code Access	Locations GET /location/ Address and geometry search by GPS			Snap vs Openmaint API Device Groups API
& Management ▼ © Settings ▼	Public Transport	~		Sci-Hub Processing API
 User Management and Auditing Help and Contacts 	GET /tpl/agencies/ Agency list GET /tpl/bus-lines/ (Bus) Lines list			
 Documentation and Articles • My Profile • 	GET /tpl/bus-routes/ (Bus) Routes list			~

https://www.km4city.org/swagger/external/index.html

https://www.km4city.org/swagger/internal/index.html

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Internal Snap4City API

	Snap4City	Internal API Docs: Swagger	
	User: roottooladmin1, Org: DISIT	🕀 swagger Select a spec	IoT device registration API
	Role: RootAdmin, Level: 7		IoT device registration API
	LOGOUT		Notificator API
	🔰 Knowledge and Maps 🔻 💧	IoT Device Registration API 🏧 🊥	DISCES scheduler API
c	O IOT Applications 👻	https://www.km4city.org/swagger/internal/iotdeviceapi-openapiv3.json	Resource Manager API
Ŧ		The API accepts in input a description of an IoT device with its broker and attributes in the form of a JSON document shaped conforming to a well-defined schema	Sensors API
-	🕻 Resource Manager 🔻	operations on a graph database, also returning the URI of the inserted, updated or deleted device.	Event Logger API
्	Development Tools	Extended PDF documentation (313k)	Ownership API
	Web Scraping Tool		Data Manager API
	Jupyter Hub - Python		Device, Broker and Value Mgmt API
	Web Scraping Tool (0n)	Servers	Snap4City Application API
	Web Scraping Tool (6l)	Indy Jawww. Alsh. or gi Service and platfine in or	Engager API
	 R Studio Development 0.11 		Wallet API
	R Studio Development 0.116	Registry	User Profiler API
	R Studio Development TF	Toglouy	My KPI API
	R Studio Development GFF	POST /insert For registering or updating a device in the graph database.	Snap vs Openmaint API
	ETL Development		Device Groups API
	ETL Development 1	POST /delete For deleting a device from the graph database.	Sci-Hub Processing API
	ETL Development 2	POST /	
	Knowledge Base Graphs	/make-private i or maixing a device as a private device.	
	 Knowledge Base Queries Smart City API Docs: Swagger 	POST /make-public For marking a device as a public device.	
	Internal API Docs: Swagger		
	Testing API by Postman	Device Attributes	~
	Source Code Access		
	Management	POST /disable For disabling a device attribute.	
	Decision Support Systems 🔹	/enable For enabling a device attribute that had been disabled.	
•	📽 Settings 🔻		
4	User Management and Auditing 🔻	Models	\sim
	🕅 Help and Contacts 🔻		
	Documentation and Articles 💌	device >	
	My Profile 🔻		
https://ww	vw.km4city.c	org/swagger/internal/index.html	

Snap4City (C), January 2024





Internal Smart City AP

- IOT devices / Entities and tools API:
 - IoT device /entity registration API
 - API of the IoT / Entity Directory
 - Sensors API
 - API of the IoT / Entity Directory
 - Device, Broker and Value Mgmt API
 - API of the IoT / Entity Directory
- Mobile App management
 - User Profiler API
 - To manage the user profile for the Engager on Mobile Apps
 - Engager API
 - From the Engager to prepare engagements to the Mobile Apps
 - Wallet API
 - From the Engager to Wallet o the users of Mobile Apps and in general
 - Snap4City Application API





Internal Smart City AP

- Resources and entities (Partially usable also as External API)
 - Snap4City Application API
 - To manage IOT Apps, Proc.Logic
 - My KPI API
 - To manage MyKPI, MyPOI, POI, etc.
 - Data Manager API
 - Resource Manager API
 - To manage resources on the market place
 - Ownership API
 - To manage ownerships and delegations
 - Device Groups API
 - To manage ownerships and delegations
- Notificator API
- DISCES scheduler API (deprecated)
- Event Logger API (partially deprecated)
- Snap vs OpenMaint API
 - Integration with the workflow management and ticketing
- SCI-HUB Processing API
 - To activate data download and heatmap production from Copernicus satellite services





Snap4City External API



Snap4City (C), January 2024





Snap4City API families

- C1-C2 / H1-H2: ASCAPI, Advanced Smart City API + Data Managers
 - Mainly to access at data, pose query, etc.
- A1-A2: broker connections
 - Mainly access to send data, get data here is without storage !!!!
- E1-E2: Server Side Business Logic, Proc.Logic/IoT App, Node-red
 - Envent Driven data INPUT/OUTPUT, via WS
- **G1-G2:** Dedicated Connections with Data Analytics, Custom communications
- Internal API:
 - All the others









External Smart City API

Snap4City	Smart City API Docs: Swagger			
User: roottooladmin1, Org: DISIT	🕀 swagger	Select a spec	Advanced Smart City API	~
Role: RootAdmin, Level: 7			Advanced Smart City API Km4city Web App API Orion Broker K1-K2 Authentication API	
External Services 🔻	Advanced Smart City ADI 🚥 🚥		Heatmap API	
Data Set Manager: Data Gate	https://www.km4city.org/swagger/external/ascapi-openapiv3.json			
esource Manager: Process Loader 🔻	SMART CITY API WEB DOCUMENTATION			
evelopment Tools 🔺				
💩 Web Scraping Tool				
🙆 Web Scraping Tool (On)				
🙆 Web Scraping Tool (6l)	Servers			
🐻 R Studio Development	https://servicemap.disit.org/WebAppGrafo/api/v1 v			
🙆 R Studio Development 0.11				
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R Studio Development TF	Services			\sim
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R Studio Development Gral	GET / Service discovery and information			
MicroServices from DataAnalytic				
B ETL Development				
BTL Development 1	Events			\checkmark
💩 ETL Development 2				
🎽 Knowledge Base Graphs	GET /events/ Event search			
< Knowledge Base Queries				
Smart City API Docs: Swagger	Locations			\sim
 Internal API Docs: Swagger 				
Testing API by Postman	GET /location/ Address and geometry search by GPS			
Source Code Access)
Management ▼	Public Transport			\checkmark
Settings 🔻				
Iser Management and Auditing 🔻	GEI /tpl/agencies/ Agency list			
lelp and Contacts 🔻	GET /tpl/bus-lines/ (Bus) Lines list			
ocumentation and Articles 🔻				
ly Profile 🔻	GET /tpl/bus-routes/ (Bus) Routes list			

https://www.km4city.org/swagger/external/index.html





External Smart City API

- Advanced Smart City API, normal or Super
 - To access the Service Map resources and query
- Orion Broker K1-K2 Authentication, etc., SSO
 - To communicate with IOT Orion Brokers exploiting the Secure Filter of Snap4City.
- Heatmap
 - To save and access to HeatMaps of the Heatmap server
- Other: ODM, Traffic Flow, etc.
- Km4city Web App API
 - To exploit MicroApplications created as tools for Dashboards, totem, web Apps, etc.











POSTMAN		SCIAD	Public Public No environment
KM4CITY API Introduction Introduction Event, POI, Address Discovery Event, POI, Address Discovery	KM4City A An exhaustive set of reac here.	API d-only APIs that have been developed in the context of the Km4City Project can be found below	Language cURL ~
 Public Transport User Feedbacks Recommender DISCES Web App Control Room 	Service Dis Sample calls to APIs that them, including the Servi found in the Details about	COVERY allow to discover the available services, and retrieve some minimal information about each of ce URI, that can be leveraged for requesting further details through calls like those that can be <i>ut services</i> section (see below).	
	GET Search by cate, https://servicemap.km4city Search for an accommod See also par. 4.2 of the Si	gory in a radius .org/WebAppGrafo/api/v1/?selection=43.7909;11.2280&maxDists=0.5&categories=Accommodation⟨=en lation in a radius of 500 m from a given position, using English names & labels. mart City API Guidelines.	Example Request Search by category in a radius curllocationrequest GET "https://servicemap.km4city.org/WebAppGrafo/api/v1/?selection=43.7909;11.2280&maxDist <
	PARAMS		Example Response 200 – OK
	selection	43.7909;11.2280 WGS84 latitude and longitude, that could come from a GPS device, but also could be somewhat entered by the user for gathering information about a remote location.	<pre>{ "Services": { "fullCount": 16, "type": "FeatureCollection", "features": [(()] ()] ()]]]</pre>
	maxDists	0.5 Maximum distance from the given position of the services to be retrieved, expressed in kilometres. It defaults to 100 metres. If it is set to the special value "inside", services are returned whose WkT boundary contains the given position (it could be the case of a park).	<pre>"geometry": { "type": "Point", "coordinates": [11.22766494750977,</pre>
	categories	Accommodation The list of categories of the services to be retrieved separated by a semicolon. If omitted, all kinds of services are returned. It can contain macro categories or categories. If a macro category is specified, services are returned that belong to any of the categories in the macro category. The complete list of categories and macro categories can be retrieved on the Service Map that can be reached at https://servicemap.disit.org.	

https://documenter.getpostman.com/view/4177198/km4city-api/RW83QsX5?version=latest



- Advanced Smart City API which can be confined into a single Smart City installation or Federated as well as for Super Service Map
 - <u>https://www.km4city.org/swagger/external/index.html</u>
- Federated Multiple Snap4City Knowledge Bases. This allows the creation of mobile applications that may move from multiple cities and area accessing data and making queries transparently. This solution is presently in place among the Knowledge Bases of: Antwerp/Helsinki, Tuscany/Firenze, Sardegna, etc. The resulting Service is called Super Service Map and it is integrated in the Smart City API. For example, via:
 - <u>https://www.disit.org/superservicemap/api/v1</u>
- Federated Open Data Portals via DataGate/CKAN that presently presents now more than 13800 data sets linked for the cities of Helsinki and Antwerp.
 - <u>https://datagate.snap4city.org/organization</u>
 - Federation, Harvesting interface is: <u>https://datagate.snap4city.org/harvest</u>
- WFS service of Snap4City on top of Federated Smart City API or simple Smart City API of a single ServiceMap (smart City installation). This solution permits to GIS applications and platforms (such as ArcGIS OnLine ESRI, ArcGIS Enterprise ESRI, ArcGIS Map/pro Desktop, QGIS, GeoServer, etc.) to access at Snap4City data. For Example, via:
 - <u>https://www.disit.org/superservicemap/api/v1/wfs</u>
 - https://www.disit.org/superservicemap/api/v1/wfs?service=WFS&request=GetCapabilities&version=2.0.0
- WMS service of Snap4City for publishing maps and heatmaps, provided by an installed GeoServer third party open source tool. For example, via:
 - <u>https://wmsserver.snap4city.org/geoserver/Snap4City/wms</u>
 - <u>https://www.km4city.org/swagger/external/index.html?urls.primaryName=Heatmap%20API</u>





Test the API





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SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES







Km4City: Knowledge Base











 How pass from ServiceMap to Linked Open Graph, Linked Data view tool





KM 4 CI



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Linked Open Graph LOG: https://log.disit.org

	Your data	Type of relations
VIA GIACOMO MATTEOTTI Bagno a ripoli Elorence thoose a class: Search for keyword eyword: ri: http:// Request	Sparg endpoint: (optional) http:// uri: http:// Request Requests: http://www.disit.dinfo.unifi.it/SiiMobility/MUSE +	Select all Deselect all Invert Hide all inverse belongTo coincideWith contains depiction ends forming has hasAccess hasExternalAccess hasRule hasProvince masRule hasStreetNumber isPartOf isPartOfProvince isPartOfRegion managingAuthority ownerAuthority sameAs seeAlso starts
TOSCANA Epitities:18 PISTOIA PISTOIA PISTOIA USPACE PISTOIA P	type isIn coincideWith hasStreetNumbeRI04901702380TO isIn isIn isPartOf isPa	type basExternalAcce USEC SALVATORE hasAccess placedIn



Some structures from Km4City model

ServiceMap: https://servicemap.km4city.org












http://www.km4city.org ¥ 🛱 🖹 📶 95% 🗎 12:52 Plaza 1* What do you want to do? KM 4 CITY Q KM 4 CITY KM 4 CITY σιπτε υ Q 10 COC UISCOVELI City Interest Search 10 > 🖸 📮 Cultural Activity ponte Q D > 🗹 📮 Education > 🖸 📮 Emergency Ponte > 🕑 🖳 Entertainment **Bus Ticket** Car Park Public transport > 🖸 🗣 Environment & A a Strega Nocciola - Gelateria Artigiana lecchi 4 A C C A C 4 ✓ ☑ I Financial Service FIRENZE XK Ponte * 🗊 📶 35% 🖬 12:57 **XK** EDC Choose Services C Bank /ecchi Suggestions Near You 🕞 📮 Financial Institu > 🖸 📮 Accommodation Events We Recommend Giardino Di Boboli \sim > 🛛 🖳 Advertising 0 . . . **♀ ≵** 4 45% ■ 00:56 🕅 🖶 🖂 in 🗖 J 30% ■ 18:56 . ÷Č (-) Tipo: Digital Location > 🖸 📮 Agriculture And Livestock Suggerimenti Q = > 🖸 📮 Civil And Edil Engineering Descrizione: The Prince s Way ends in the Giardino Weather Assistant Navigator di Boboli, near the Grotta del Buontalenti, that is a > 🛛 🗳 Cultural Activity Post very masterpiece of the Mannerist architecture and ᡅ D B Education And Research ₹+ X sculpture > O 📮 Emergency FIRENZE Favourites Chronology Latest Reviews Descrizione: Il Percorso del Principe termina nel > D 📮 Entertainment Giardino di Boboli, nei pressi della Grotta del Ö ß > D 😔 Environment Buontalenti, vero e proprio capolavoro dell ESERCITAZIONE MUGNONE 2016 M architettura e della scultura manierista > D 📮 Financial Service Alert Civil Prot. Settings Vote APP! 101 > 🖸 📮 Government Office > 🖸 📮 Health Care Ð D Annunziata 🏯 🕅 > 🛛 📮 Industry And Manufacturing Tipo: Squares Distanza O:1949 m Information About Us > 🖸 📮 Mining And Quarrying Indirizzo: 🏌 🚘 💂 D Shopping And Service > D 🛂 Tourism Service Piazza Santissima 🏦 Annunziata **> O I** Transfer Service And Renting Tipo: Squares Regione Toscana Distanza @:1949 m Tutta la posta in un unico Indirizzo: 🏌 🚘 🛱 餔 DISPONIBILE SU posto ETFLI Google play Calendario Posta R Cibo : prevede: Firenze (FI) (ZONA: A3) ALLERTA Sereno \odot RISCHIO TEMPI Dalle ore 13.00 Scarica da Trattoria Gozzi 2 di Venerdì 27 App Store IDROGEOLOGICO Tipo: Trattoria maggio 2016 IDRAULICO GIALLO Distanza @:1975 m alle ore 18.00 di RETICOLO MINORE Microsoft Edge Roma Venerdi 27 lostra Tutte le Categorie maggio 2016 Scarica da Dalle ore 18.00 di Venerdì 27 Windows Store IDROGEOLOGICO S maggio 2016 ARANCIONE IDRAULICO alle ore 12.00 di ETICOLO MINORE Anteprima Sk 39 Snap4City (C), January 2024

UNIVERSITÀ DEGLI STUDI FIRENZE DIPARTIMENTO DI INFORMAZIONE DISTRIBUTED SYSTEMS ACCOAPPICATIONS **CSNAP4city**















Advanced Devevelopment Kit features

- Exploiting Km4City Advanced Smart City API
 - Open Source: GitHub
 - Multiplatform: exploiting Apache Cordova Framework
 - Active since 2015
 - Adopted by a community of several Projects, Cities and SME
- Respecting user privacy:
 - Anonymous usage vs Authenticated usage (OAuth, email, ...)
- Modular & Dynamic:
 - Loading new modules from the WEB, and/or creating App by modular approach
- Personalization and Profiling:
 - Personalized menu, proposed POI for search
- Reaching City Users:
 - Alerting and notifications by location, by user behaviour





Swagger

Advanced SmartCity API

- Search data: by text, near, along, etc.
 - Resolving text to GPS and formal city nodes model
- Empowering city users: contributions, suggestions, forum discussions, etc.
- Events: Entertainment, critical and mobility
- Public and Private Mobility & Transport, and predictions
- POIs, Cultural and Touristic info
- Health services and predictions
- Environmental information, heatmaps; values
- Profiled Suggestions to City Users
- Traffic flow reconstruction
- Personal Assistant: PAVAL
- User Engagement: goal experiences, and assessment
- Sharing knowledge among cities -> see Knowledge base Management

Snap4City		Smart City	API Docs: Swagger		
r: roottooladmin1, Org: DISIT	\varTheta swag	ger	Select a spec	Advanced Smart City API	v
Role: RootAdmin, Level: 7				Advanced Smart City API Km4city Web App API	
nboards				Orion Broker K1-K2 Authentication API	
Dashboards	Advar	nced Smart City API 📟 📟			
ficator	https://www.km4cit	y, org/swagger/external/ascapi-openapiv3.json			
Innlications	SMART CITY A	PI WEB DOCUMENTATION			
Personal Data					
Directory and Devices 🔻					
wledge and Maps 🔻	Servers	aman dirit ara@dahAnnOrsfo/ani/ut			
o Applications	incips.//service				
mal Services 🔻					
Set Manager: Data Gate	Services	s			\sim
urce Manager: Process Loader 🔻	GET	/ Senire disroven and information			
opment Tools					
R Studio Development	 Servic 	ce search near GPS position - It allows to retrieve the set of services that are near a given	GPS position. The services can be filtered as belonging	to specific categories (e.g. Accommodation, I	Hotel,
TL Development	Restau	urant, etc.), or having specific words in any textual field. It can also be used to find services	hat have a WKT spatial description that contains a spe ice identified by its service! (i) The services can be filte	tific GPS position.	ccomodation
Knowledge Base Graphs	Hotel,	Restaurant, etc.), or having specific words in any textual field. It can also be used to find se	vices that have a WKT spatial description that contains	a specific GPS position.	
Knowledge Base Queries	• Servic etc.), c	or having specific words in any textual field.	ngular area. The services can be intered as belonging i	5 specific categories (e.g. Accomodation, Hote	si, Restaurant,
Smart City API Docs: Swagger	Servic	ce search within a WKT described area - It allows to retrieve the set of services that are in tion to specific categories (e.g. Accomposation, Hotel, Destaurant, etc.), or having specific within the second	side a geographic region described using the Well Kno ords in any textual field	vn Text (WKT) format. The services can be fille	ered as
nternal API Docs: Swagger	 Servic 	ce search within a stored WKT described area - It allows to retrieve the set of services th	it are inside a geographic region described using the W	ell Known Text (WKT) format, by referring to th	he WKT with an
Testing API by Postman	geome	ter provided when the wirk it is stored. The services can be intered as belonging to specific c etries can be retrived from the <u>Service Map</u> in the Search Area selection box (with Search A	ange specific area). New geometries can be provided u	sing the http://www.km4city.org/wkt web servic	e list of available te which can
Source Code Access	store a	a WKT from a shp file or providing directly the WKT string.	nicipality. The services can be filtered as belonging to s	pecific categories (e.g. Accomodation, Hotel, F	Restaurant. etc.).
agement 🔻	or hav	ing specific words in any textual field.	ed unless the Consiste Man upon interface		
ngs 🔻	Servic Full te restan	extended with a query solution of the the set of services associated with a query solution int search - It allows to retrieve the geolocated entities (not only services) that match with a units area or inside a MKT assessed area.	list of keywords. The results can be possibly filtered to	be within a specified distance from a GPS posi	ition, or within a
Management and Auditing 💌	Servic	period of a status of an entropy of the period of the service using its serviceUri, as an HTML (fr	rmat query parameter set to htm/) or a machine readab	le JSON document (format query parameter se	et to json).
and Contacts 💌					
mentation and Articles 🔻	Parameters			(Try it out
rofile 🔻	Mana				
4City portal	Name	Description			
City portal	selection	Through this parameter, the user indicates where the services have to be sea	rchod. It could be a houndary within which to cou	and an a point around which to an arch	
acity portai	string	Through the parameter, the user marcules interesting setting and	cried. It could be a boundary within which to see	rich, of a point around which to search.	

Snap4City (C), January 2024







(query)

Usages & Sample values:





Snap4City	Smart City API Docs: Swagger								
er: roottooladmin1, Org: DISIT	⊖ swagger	Select a spec Advanced Smart City API	~						
Role: RootAdmin, Level: 7		Advanced Smart City API							
poards		Orion Broker K1-K2 Authentication Al	PI						
ashboards	Advanced Smart City API 🏧 🏧								
cator	https://www.km4city.org/swagger/external/ascapi-openapiv3.json								
nlications	SMART CITY API WEB DOCUMENTATION								
irectory and Devices 👻	Servers								
/ledge and Maps 🔻	https://servicemap.disit.org/WebAppGrafo/api/v1 🗸								
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nal Services 🔻									
Set Manager: Data Gate	Services		\checkmark						
 urce Manager: Process Loader _▼									
anmant Taola	GEI / Service discovery and information								
	. Service courch near CDS nocition. It allows to retrieve the set of services that are near a	niven CDS position. The capilors can be filtered as belonging to specific categories (e.g. Accommon	lation Hotel						
	Restaurant, etc.), or having specific words in any textual field. It can also be used to find ser	vices that have a WKT spatial description that contains a specific GPS position.							
Knowledge Base Graphs	 Service search near a service - it allows to retrieve the set of services that are near a give Hotel, Restaurant, etc.), or having specific words in any textual field. It can also be used to f 	In service identified by its serviceUri. The services can be filtered as belonging to specific categories (find services that have a WKT spatial description that contains a specific GPS position.	e.g. Accomodation,						
Knowledge Base Oueries	 Service search within a GPS area - It allows to retrieve the set of services that are inside a otc.) or baying specific words in any textual field. 	a rectangular area. The services can be filtered as belonging to specific categories (e.g. Accomodatio	n, Hotel, Restaurant,						
Smart City API Docs: Swagger	 Service search within a WKT described area - It allows to retrieve the set of services that 	are inside a geographic region described using the Well Known Text (WKT) format. The services car	n be filtered as						
nternal API Docs: Swagger	 belonging to specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific categories (e.g. Accomodation, Hote	cific words in any textual field. .ces that are inside a geographic region described using the Well Known Text (WKT) format, by referri	ing to the WKT with an						
Festing API by Postman	identifier provided when the WKT is stored. The services can be filtered as belonging to spe	cific categories (e.g. Accomodation, Hotel, Restaurant, etc.), or having specific words in any textual f	ield. The list of available						
Source Code Access	store a WKT from a shp file or providing directly the WKT string.	arch Range specific area). New geometries can be provided using the <u>http://www.km4city.org/wki</u> web) service which can						
agement 🔻	 Service search by municipality - It allows to retrieve the set of services that are in a specific or baying specific words in any textual field 	fic municipality. The services can be filtered as belonging to specific categories (e.g. Accomodation, H	lotel, Restaurant, etc.),						
	 Service search by query id - It allows to retrieve the set of services associated with a quer Full text search - It allows to retrieve the geolocated entities (not only services) that match. 	y stored using the <u>Service Map</u> user interface. with a list of keywords. The results can be possibly filtered to be within a specified distance from a Gi	PS position or within a						
	rectangular area or inside a WKT geolocated area.	ML (format query parameter set to html) or a machine readable. ISON document (format query param	neter set to <i>ison</i>)						
Management and Auditing 🔻		the format query parameter set to minif of a machine readable soon document format query param	icici set to joonj.						
and Contacts 🔻									
nentation and Articles 🔻	Parameters		Try it out						
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4City portal	Name Description								
City portal	selection	a sparshod. It could be a boundary within which to sparsh, or a point around which to sp	arch						
iony portai	string Inflough this parameter, the user mulcales where the services have to be	a searched, it could be a boundary within which to search, or a point around which to see	arch.						

🖸 DISIT Lab portal





Thematic Data Domain Tuscany

- Street and geoinformation of the territory and details for routing, navigation, ...
- GeoResolution, Environmental data
- Mobility and Transport: public and private, public transport, parking status, fuel stations prices, traffic sensors, etc.
- **Culture and Tourism**: POI, churches, museum, schools, university, theatres, events in Florence
- Environmental: pollution real time, weather forecast, etc.
 - Environmental data geo resolution
- Social Media: twitter data
- **Health**: hospital, pharmacies, status of the first aid triage in major hospitals, ...
- Alarms: civil protection alerts, hot areas, ...





Access to Point of Interest information, POI

- POI: point of interest
- type: macro and subcategories
- **Position**: GPS, address, telephone, fax, email, URL, ...
- Description: textual, multilingual, with images, ...
- Link to dbPedia, Linked Open Data
- Links to other services
- Real time data if any: sensors data, timeline, events, prices, opening time, rules of access, status of services, status of queue, etc..
- See transversal services on ServiceMap
 - Regular and in test platform

	- Hide Menu
L,	Regular Services Transversal Services Services Categories De/Select All Image: Service Services Area + Image: DigitalLocation +
	HappeningNow + Path + Fresh Place Public Transport Line Road Sensors
nts,	
	Smart_irrigator
	search text into service
	N. results for each: 100 Search Range 100 mt Q Q

Via La riguret



46

Concepts of Services: Macro and subcathegory

A SKOS area into the Km4Clty Ontology and Knowledge base for modeling POI and any element On map

UNIVERSITÀ

DEGLI STUDI

FIRENZE

INGEGNERIA DELL'INFORMAZIONE AND INTERNET TECHNOLOGIES LAB







Service Information: different kinds of services

×

Direction

Piazzale Verdi

Piazzale Verdi

Piazzale Verdi

Piazzale Verdi

Piazzale Verdi

Piezzele Ve

1

			A COMPANY AND A COMPANY		
	AURORA Firenz		TPL STOP : Piazza St	tazione	(Fr. Cc)
	LINKED OPEN GRAPH	11	Vaibus		
A LA LA	Tipology: Accommodation - Hotel Email: info@hotelaurora.info Website: www.hotelaurora.info Phone: 055210283 Address: VIA L. ALAMANNI, 5		LINKED OPEN GRAPH Lines: FI-LU FI-VG No available routes		
Ę	Cap: 50100		Display 50 🗸 Bus per	r page	
20	City: FIRENZE		Search:		
1 A	Prov.: Fl		Time	Line	Dire
			06:46:00 2017-03-20	FI-LU	Piazza
	E H		08:16:00 2017-03-20	FI-LU	Piazza
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10		RAGO IN			

Loggia San Paolo
LINKED OPEN GRAPH
Tipology: CulturalActivity - Monument_location
Digital Location
Address: VIA DELLA SCALA, 3
Cap: 50123
City: FIRENZE
Prov.: FI
Photos:

×



Description: The rounded arches, the stone skeleton and the glazed terracotta medallions recall the model of the Loggiato degli Innocenti. The medallions in glazed terracotta by Andrea della Robbia and his sons Marco and Luca contain seven polychrome figures of Santi Francescani and two works of mercy Cristo conforta un Giovane and Cristo conforta un Anziano. Beneath the portico can be admired the expressive embrace between San Domenico Guzman and San Francesco d Assisi by Andrea della Robbia







General Text Search Features

Snap4City (C), January 2024

Search by text for POIs via:

- Full text: description, title, macro and category name
- Filtering by macro-cat and subcategory
- Filtering on distance and geometric shape

Search by text with assisted suggestion to get:

- Streets and civic numbers, or POI, locations
- Geo resolution, from point to street; from civic to GPS, etc.

- Hide	Menu
Florence Bus Tuscan Municipalities Text Search Events	
Search by Text:	
Max number of results: 100 ~	
Quick address/location search	
exclude POI: AND mode:	
Via romagnosi 3,firenze	
VIA GIANDOMENICO ROMAGNOSI, 3, FIRENZE	
A PROGRESSO 3 - S.R.L FIRENZE	
C OPERA 3 S.R.L FIRENZE	
A 🚭 Ex 3 Gavinana - FIRENZE	F
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VIA GIAN DOMENICO ROMAGNOSI, 3, ROSIGNANO MARITTIMO	
🕫 🕼 VIA GIAN DOMENICO ROMAGNOSI, 3, PRATO	
VIA GIAN DOMENICO ROMAGNOSI, 3, SESTO FIORENTINO	
ROMAGNOLI PALMIRO - FIRENZE	
Romagnoli - FIRENZE	
💴 💟 VIA MARIO ROMAGNOLI, 3, PISTOIA	
PELLETTERIA EVA DI ROMAGNOLI LORENZO - FIRENZE	4
Campo di calcio "Romagnoli - FIRENZE	20
STEFANO DI ROMAGNOLI STEFANO - FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 34, FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 35, FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 36, FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 19, FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 23, FIRENZE	
VIA GIANDOMENICO ROMAGNOSI, 18, FIRENZE	









Around a point or POI



Search by Shape (WKT) or Distance

Each request or search in the Km4City model can be referred to a point and a ray, to an area, to a polyline Inside a closed polyline





Along a polyline









Empowering City Users

- Allow city users to
 - provide comments, images and scores associated with a certain Service (or place, via GPS), discussions on forums, etc.
 - Get list of last contributions of the same kind provided by other users
 - Save favorites
 - Share trajectories,
 - Save and Manage their own data, IOT data, etc.
- Contributions can be:
 - used as feedbacks
 - moderated by a back-office personnel
- Connection with powerful servers based on 311 standard it also possible





Access to Event information

- Getting Traffic Events: ESB, etc.
- Getting Critical Events: CAP standard
- Getting Police events
- Getting Entertainment Events in the city
 - Theater, museum, show, sport, etc.
 - Getting Event details
 - Event kind, and thus ordering
 - in the day, week, and month
 - Location, and thus ordering, or selecting events per area, per residence
 - General information
 - Opening and cost (if any)
 - Etc.







Conto to

RITIȘH SCHOOL

VEN 29/04/2016

C2 C3 and and and an

12:53



Supporting City Users in using Public Mobility

Public Transportation, PT

Getting tickets

degli studi FIRENZE

- Getting bus stops, lines, and timennes for bus, train and tramline (GTFS, ETL, ...)
- Getting Tunnel and Ferry Status
- Searching Services along a Pub. Transport line or closer to a stop
- Searching the closest bus stops
- searching for BUS stops via name
- real time delays of busses
- Modal/multimodal routing for Pub. Transport
- Tracking fleets, trajectories, etc.
- Get connected drive data







Parcheggio Stazione

Firenze

Più vicini ④ Più vicini � Posti liber

Parcheggio Stazione Firenze S.M.N.

27 08-06 20:0

Parcheggio Stazione Firenze S.M.N

Parcheggio auto

+ Parcheggi

PARKING





Supporting City Users using Private Mobility

Private Transport

- Parking status (DATEX II, ...)
- Saving car park
- Getting closer parking
- OBD2 data from your engine or fleet
- Getting parking forecast: short and long term
- Getting closer free space on parking
- Getting fuel stations location and fuel product prices
- Getting bike sharing rack status
- Searching Services along a **path** or closer to a point or Service as Hotel, Restaurants, square, etc.
- Getting closer cycling paths
- Recharging stations: location and status
- Getting traffic information
- Heatmap where is safer to bike









Private Mobility: routing and navigation paths

To get the path from two points/POIs:

- Shortest for pedestrian
- Quietest for pedestrian
- Shortest for private vehicles
- Multimodal with Public Transportation
- Constrained routing
- Search for POIs along the identified Path! <u>http://www.disit.org/ServiceMap</u>

Image: Control of Cont			
Florence Bus Tuscan Municipalities Text Search Events Select an agency: Select an agency: Select a noute - Select a noute - Select a noute - Select a stop:		- Hide Menu	
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New Experience to access at Cultural and Touristic info

- Getting location and description of Point of Interests, POIs: culture and tourism first
 - Location, images, phone, URL, etc.
 - Get image, video, audio, ...
- Search for POIs in areas and closer
- Get routing to reach location or POI by walking downtown
 - searching Services along the path
- Search for location, full text assisted
- Leave a score, take a picture, etc.





New way to access at health services

TECHNOLOGIES LAB

 Searching for pharmacies and hospitals

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degli studi FIRENZE

- Getting the closest hospital first aid locations and status
- Getting real time updated information about the first aid status of major hospitals (triage)





Access at Environmental information

- Getting weather forecast for the next hours and days
- Getting alert information from Civil protection
- Getting air quality status

degli studi FIRENZE

- Getting Air quality via heatmaps, heatmap animation
- Computing Air quality indexes
- Computing Air quality predictions
- Getting pollination status
- getting actual weather status: temperature, humidity, pressure, rain level,
- etc.



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11-20

21-30

31-40

51-60

61-70 71-80

>100

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Profiled Suggestions to City Users

Personalized suggestions

- The server provide suggestions in the user context (location and time) arranged in a number of categories
 - Culture, mobility, food and drink, etc.
 - Alerts: civil protection, city council, twitter data, etc.
- The city user may reject some of them, thus the suggestion engine learns about preferred topics and category











Profiled Engagements to City Users

- The user are profiled to learn habits:
 - Personal POI and paths
 - Mobility habits
- Information and engagements sent to the city users are programmed according to the user evolution to:
 - Stimulate virtuous habits
 - More sustainable habits
 - More healthy habits, etc.
 - Get feedbacks
 - Provide bonus and prices, ...
 - Send alerts, ...

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Developing Web and Mobile Apps, MicroApps,..

Mobile Apps

Monitoring

Θ



Web App HTML5, MicroApplications

Embed into Web pages





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Snap4City (C), January 2024

http://www.disit.org/6873





- based on Km4City engine on the back
- documented: <u>https://www.snap4city.org/404</u>
- ServiceMap tool to generate visually calls to exploit the Smart City API in web and mobile applications
- Documentation and examples:
 - TC5.15 Snap4City Smart City API Collection and overview, real time
 - <u>ServiceMap and ServiceMap3D, Knowledge Model, Km4City Ontology</u>
 - Knowledge Base Graphs and Queries: browsing and queries into the KB
- The Alternatives:
 - just Dashboards directly exploiting data on graphics and/or
 - IOT Applications via Node-RED exploiting MicroServices also using the Smart City APIs



SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES



Federation of Smart City Services



- Km4City Semantic Reasoner
- ServiceMap interoperability
- Seamless for multiple Mobile Apps
- Smart City API

Super:

- distributed access and sharing services
- Each city control its own data
- Final user can pass from one city / area to another in seamless manner: without changing the mobile Apps





Federation of Snap4City vs ORION Broker







SUPER



- Super, Nodes and SSM2ORION presents the same Smart City APIs.
- The **network of Super** can be reconfigured dynamically
 - Multiple networks of Super can be realized as well
 - Distributed Searches via the Federation of Super are performed with o(1) complexity
 - Results from an API rest calls are provided in real time also when the size of the network is large
 - Dashboard widgets and Mobile Apps are enabled to use the Super
 - Clients can pass from one Super to another transparently: moving devices
- Nodes
 - do not need to permanently share data
 - data can be of any size, the data shared is typically public since users of different KB are different and not refer to the same LDAP/KeyCloak authentication/authorization service.
 - may have different number of services
 - Services can be based on KB as well as on Brokers
 - Services managed as HLT of: Sensors, Sensor-Actuators, POI.
 - Data of other HLTs are managed independently from the other SmartCity API such as: MyKPI, External Services, WFS GIS, Heatmaps, special tools, etc. etc.
- The solution support disjoined nodes, federation and independent services





Federated ServiceMap and Smart City API

To improve scalability, fault tolerance and federation among cities:

- One entry point Smart City API for all zones
- Multiple Knowledge base See performance assessment

At different levels:

- Among cities/regions
- Among data providers, Operators

By Means of:

- − Smart City API → Apps
- Smart City Ontology
- Dashboards/data analytics
- Organization independent
- CKAN via harvesting

Snap4City (C), January 2024

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES













1

Development https://www.snap4city.org/d ownload/video/Snap4Tech-**Development-Life-Cycle.pdf**







Selection on Smart City API Organization Attribute Values Conditions Device Model Combining different filters for selecting Device List entities from Smart **Attribute Strings** City APIs Time Constraints Geo Constraint Nature/Subnature Limit on number • Be care: filtering too much may lead to Categories empty set 🙂





How to Get the «Query» used in More Options (2a)

- REST CALL by category → JSON (Options in RED), they are REST ASCAPI calls
 - Requesting a category, so that to see all Services of the same category (subNature)
 - <u>http://svealand.snap4city.org/ServiceMap/api/v1/?selection=59.581458578537955;16.71183586120606;59.62</u>
 <u>875017053684;16.875171661376957&categories=Street_light&maxResults=100&format=json</u>
 - Please note that in the MoreOption dashboard the GPS area is neglected
 - <u>https://servicemap.disit.org/WebAppGrafo/api/v1/?selection=43.64471;11.005751;43.89471;11.505751&categories=Green_areas&maxResults=200&format=json</u>
 - Please note that in the MoreOption dashboard the GPS area is neglected
 - Custom PINS note: "selection" coordinates are used for collecting attributes in custom PINS. Other options such as "maxDists" cannot be used in custom PIN. All parameters can be used in other cases.
 - Requests to SuperServiceMap for the network of Federated KBs by using /api/.....

Without prefixed KB to obtain merged results from more KBs. For example as:

- /api/v1/?categories=Air_quality_monitoring_station&format=json
- Please note that the direct links to the superservicemap can be of the form:
 - <u>https://www.disit.org/superservicemap/api/v1/</u>?




How to Get the «Query» used in More Options (2b)

- REST CALL by ServiceURI → JSON (ServiceURI in RED), they are ASCAPI calls
 - Requesting single Service
 - https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT _QA_FI-BOBOLI&format=json
 - <u>https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT</u>
 <u>QA_FI-MOSSE_SV&format=json</u>
 - Different KBs links are identified by their ASCAPI links: svealand.snap4city.org, servicemap.disit.org,
 - Requesting all IoT Devices that have been produced by the same Model
 - https://www.disit.org/superservicemap/api/v1?selection=59.36535064975547;13.457822799682619;59.39031474260852
 ;13.566999435424806&model=SmartLightCapelon&format=json
 - Please note that in this case the call is performed on the superservicemap, you can change to go directly on the right KB
 - You can specific both category and model to be more precise and focused.
 - <u>https://www.disit.org/superservicemap/api/v1/?selection=36.8092847020594;12.216796875000002;42.71473218539458</u> ;32.03613281250001&categories=Travel_information&format=json&fullCount=false&maxResults=500&model=DOMESTIC <u>MOVEMENTS2013-2018_1620304406</u>
 - In this case, we have a double filtering for model and for categories, plus other constraints
 - Please note that in the MoreOption dashboard the GPS area is neglected





How to Get the «Query» used in More Options (2c)

- Requesting get data single device (view on map, if format HTML and not JSON)
 - **Request to see the single device:**
 - <u>https://svealand.snap4city.org/ServiceMap/api/v1/?serviceUri=http://www.disit</u> .org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7&format=json&fromTime=3-day
 - With ServerURI: <u>http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7</u>
 - From KB: <u>https://svealand.snap4city.org</u>





https://svealand.snap4city.org/ServiceMap/api/v1/?serviceUri=http://www.disit.org/km4city/resource/iot/orionCAPE LON-UNIFI/CAPELON/5C0272FFFE894AF7&format=json&fromTime=3-day

```
{ "Service":
{"type": "FeatureCollection",
"features": [
       "geometry": { "type": "Point", "coordinates": [13.46701, 59.37458]},
       "type": "Feature",
       "properties": { "serviceUri": "http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFE894AF7",
         "serviceType": "Environment_Smart_street_light",
         "name": "5C0272FFFE894AF7",
         "typeLabel": "Smart street light",
         "protocol": "ngsi",
        "format": "ison",
         "model": "SmartLightCapelon2",
         "producer": "Capelon",
         "macaddress": "",
        "brokerName": "orionCAPELON-UNIFI",
         "ownership": "public",
         "organization": "CAPELON",
         "description": "",
         "website": "",
         "maintenanceUrl": "",
         "maxCapacity": "",
         "minCapacity": "",
         "isMobile": "",
         "nature": "Environment",
       ....
```



Queries can be complex by geo-area, by cathegory, by IoT Device Model, a list of ServiceURI (all the same kind), with filters by value on specific Variables (numeric, and textual in AND), QUERY:

- https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=700.2&model=CarPark
- https://www.snap4city.org/superservicemap/api/v1/iotsearch/?selection=42.014990;10.217347;43.7768;11.2515&model=metrotrafficsensor&valueFilters=vehicleFlow>0.5;vehicleFlow
 300
- https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=200.2&model=metrotrafficsensor&valueFilters=vehicleFlow>10;vehicleFlow<400&serviceUri=http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO1;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO1;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO10;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO11;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO13;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO14;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO16;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO16;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO16;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO16;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO18;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO18;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO20;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO20;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO20;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO22;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO22;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO24;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO24;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO24;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO26





How to Get the «Query» used in More Options (3)

- ServiceMap (specific KB) and Query service
 - The Query performed is saved and can be recalled with a QueryID, valid for that specific KB, and not accessible via SuperServiceMap / Federated KB
 - The QueryID is communicated via email
 - Specific REST Call with HTML is also provided to change the Query in server associated with the QueryID received
- Query ID (only Read and Read/Write of the query)
 - <u>https://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=1c8111893d40a2bb0</u>
 <u>7a2078ffe299ced&format=json</u>
 - Cannot be used for Custom PINs.
 - Cannot be used to get data via ServiceMap since the Query ID is KB based





Special Commands in «Query» of More Options (4)

- Commands for Special Tool:
 - Traffic Flow tool: <u>https://firenzetraffic.km4city.org/trafficRTDetails/roads/read.php</u>
 - Scenario tool: /scenario/
 - Whatif tool: /whatif/
- Heatmaps, see Data Analytic part of the training for the several versions which can be used:
 - <u>https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&laye</u>
 <u>rs=PM2_5Average24HourFlorence</u>
 - <u>https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&laye</u>
 <u>rs=denseNO2_Firenze_IDW</u>
 - WMSServer that is a GeoServer may be different for different installations of Snap4City





Time Series Data Access

- Time Series are attached to Devices which are identified by ServiceURI
- To Access at the Time Series (also called real time data) you can:
 - 1. From IoT App use the block «service info dev» In this case, you automatically access to your private and delegated data. You do not need to perform the authentication since it is performed directly from the microservice IoT App context, both on cloud and on edge
 - 2. From Python/Rstudio, Web and Mobile App, you can call Smart City API, see in this section and in *Part 7 of the course*.
 - 3. Retrieve data from IoT App and pass them to Python/Rstudio as presented in other sections. This approach is viable for small amount of data, such as some thousands. For larger amount of data or to be more efficient we suggest to use case (2) which is a direct access to the Smart City API.





IoT Search API (Search Entities)

- These API allows to find «IoT devices» matching a specific query on the dynamic data
 - On the last values
 - On a temporal range
- For example:

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- Find all weather sensors with a last temperature value greater than 35
- Find all weather sensors that last week had a temperature greater than 38
- The API over a temporal range can return the list of matching devices or a list of dynamic data records matching the query
 - the list of times when temperature was greater than 38
- These APIs for performance reason query only the OpenSearch index and have some limitations





- The base url is https://www.snap4city.org/superservicemap/api/v1/iot-search/?...
- Query params are similar to other apis:
 - selection=...
 - A GPS point <latitude>;<longitude>
 - A GPS rectangular area <lat1>;<long1>;<lat2>;<long2>
 - A service uri (uses its lat;lon position)
 - More complex geographic filters are not supported
 - maxDists=..
 - Maximum distance in km from the GPS point (default 0.1 km)
 - categories=...
 - A list of categories as nature and subnature separated by ";"
 - model=...
 - Search for devices of a specific model (only one allowed)
 - serviceUri=<suri1>;<suri2>...
 - Filters on specific service uris
 - text=...
 - Filters using keywords and phrases to be searched in any string value of the device (phrases are delimited by "...")
 - valueFilters=<cond1>;<cond2>;...
 - A set of conditions in AND on specific values (the verification of equal condition is «=» or «:» depending on the data type)

IOTSearch APIs

- value name>:<string> (ex. Status:Active)







Other query params:

- fromResult=...
 - Start from a result at a given position (starting from 0)
- maxResults=...
 - Maximum number of results returned (default 100)
- values=...
 - Report data of only specific fields, separated by «;» (e.g. temperature; humidity) if omitted all fields are reported
- sortOnValues=...
 - Allow to sort results on a specific field, if omitted are sorted by distance from the GPS point, adding «:asc» or «:desc» sort direction can be provided (e.g. temperature:asc)
- notHealthy=true
 - Reports only sensors that are now considered unhealthy as have not provided data in the expected next time
- For more details see the documentation: <u>https://www.km4city.org/swagger/external/#/IOT_Search/get_iot_search</u>





IoTSearch Example

- Find all weather sensors with last values of temperature in [25,30] and humidity greater than 50
- GET https://www.snap4city.org/superservicemap/api/v1/iot-search/? categories=Weather_sensor& valueFilters=temperature>=25;temperature<=30;humidity>50
- Only GeoJSON response
- https://www.snap4city.org/superservicemap/api/v1/iotsearch/?categories=Weather_sensor&valueFilters=temperature>=25;temperature<=3 0;humidity>50



Snap4City (C), January 2024



},







```
"fullCount": 49.
"type": "FeatureCollection"
"features": [ {
        "type": "Feature"
        "geometry": { "type": "Point", "coordinates": [10.5224,43.794] },
        "properties": {
            "date time": "2023-07-26T07:00:00.000Z",
            "deviceModel": "SirSensors",
            "deviceName": "SIRSensor TOS11000512",
            "expected next date time": "2023-07-26T07:15Z",
            "nature": "Environment",
            "organization": "DISIT",
            "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/SIRSensor_TOS11000512",
            "subnature": "Weather sensor",
            "values": {
                "dateObserved": "2023-07-26T07:00:00.000Z",
                "humidity": 59,
                "rainDelta15": 0,
                "temperature": 27,
                "windDirection": 340,
                "windGust": 2.2,
                "windSpeed": 1.3
```



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Results pagination

Results can be paginated using

- fromResult=... (first result to be returned starting with 0)
- maxResults=... (page size)

• The total results is reported in the fullCount field of the results.

To get page *p* (1..n) of results (with page size 50) _ ...?...&fromResult=(p-1)*50&maxResults=50



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IoTSearch over time Example

Find all instants where a weather sensor has temperature in [25,30] and humidity greater than 50 in the last 7 days

GET <u>https://www.snap4city.org/superservicemap/api/v1/iot-search/time-range/</u>? fromTime=7-day& categories=Weather_sensor& valueFilters=temperature>=25;temperature<=30;humidity>50

Only GeoJSON response

https://www.snap4city.org/superservicemap/api/v1/iot-search/timerange/?fromTime=7day&categories=Weather_sensor&valueFilters=temperature%3E=25;temperature%3 C=30;humidity%3E50







```
"fullCount": 122339,
"type": "FeatureCollection"
"features": [ {
        "type": "Feature",
        "geometry": { "coordinates": [ 9.23375, 45.47745 ], "type": "Point" },
        "properties": {
            "deviceModel": "Arduino Uno",
            "deviceName": "station01",
            "nature": "Environment",
            "organization": "DISIT",
            "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/station01",
            "subnature": "Weather sensor",
            "values": {
                "date time": "2023-07-26T08:44:56.791Z",
                "expected_next_date_time": "2023-07-26T08:45:06.791Z",
                "humidity": 86,
                "temperature": 30
        },
```



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IoTSearch over time Example

Find all weather sensor with at least one time with temperature in [25,30] and humidity greater than 50 in the last 7 days

GET https://www.snap4city.org/superservicemap/api/v1/iot-search/time-range/?
fromTime=7-day&
aggregate=true&
categories=Weather_sensor&
valueFilters=temperature>=25;temperature<=30;humidity>50

Only GeoJSON response







```
"sumOtherDocs": 10771,
"type": "FeatureCollection"
"features": [
        "geometry": { "coordinates": [9.23375, 45.47745], "type": "Point"},
        "properties": {
            "aggregationCount": 44870,
            "deviceModel": "Arduino Uno",
            "deviceName": "station03",
            "nature": "Environment",
            "organization": "DISIT",
            "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/station03",
            "subnature": "Weather sensor"
        },
        "type": "Feature"
    },
```

- Returns the first 100 devices matching the request, «sumOtherDocs» is the number of matching
 records that are left out in the aggregation process, meaning that there are more than 100 device,
 adding maxResults=200 in the request the sumOtherDocs become 0 meaning that all matching data is
 aggregated in the results.
- No pagination is possible for aggregated results.





IoTSearch Limitations

- Report only limited static data of matching devices (model, nature, subnature, geographic position)
- Limited geographic queries (no polygon or line search)
- In case of private data, the owner and the delegated users can access the data but if the owner or the delegations change these applies only to newely submitted data (old data can be accessed only by old owner or old delegations)





Legenda on REST Call 1/2

- the **black continuous line** (push) will be used to send some data on the platform broker with a REST call which has to be Authenticated and Authorized according to the OpenId Connect as explained later, and would be in the form of:
 - <u>https://<platformdomain>:8443/orionbrokerfilter/v1/updateContext</u>
 - Or in the form for non TSL protected interaction:
 - <u>http://iot-app.snap4city.org:80/orion-broker/v1/updateContext?elementid=**ELEMENTID**&k1=**K1**&k2=**K2**</u>
- the **black dashed line** (pull) will be used to request some data from the platform by using a REST call to smart city API (Authenticated and Authorized according to the OpenId Connect as explained later), in the forms:
 - via regular Smart city API by category, etc.
 - <u>http://svealand.snap4city.org/ServiceMap/api/v1/?selection=59.581458578537955;16.71183586120606;59.62875017053684;16.</u>
 <u>875171661376957&categories=Street_light&maxResults=100&format=json</u>
 - Via Super
 - <u>https://www.disit.org/superservicemap/api/v1/</u>?.....
 - Via Super by values
 - o <u>https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=700.2&model=CarPark</u>
 - <u>https://www.snap4city.org/superservicemap/api/v1/iot-</u>
 <u>search/?selection=42.014990;10.217347;43.7768;11.2515&model=metrotrafficsensor&valueFilters=vehicleFlow>0.5;vehicleFlow<300</u>





Legenda on REST Call 2/2

- the red dashed line (push) will be used to send some data from the platform (from an Orion broker) to some stable IP client or other machine for machine-to-machine communication
 - As a first step the client has to subscribe to some entity on the Orion Broker passing its IP where the broker will have to send the data in push
 - The POST will be in the form of <u>/v1/subscribeContext passing as parameters</u>: elementid (the device ID, and K1, K2) or TSL approach
 - o
 curl
 -X
 POST
 "https://broker1.snap4city.org:8080/v1/subscribeContext?elementid=mypersonaldatatesterdevice&k1=4e0924a8-fdd6-49cf-8d4a-f49cb5710d8b&k2=240567da-64a4-43b3-8ac9-1265178f3cbe"
 -H
 "accept:

 application/json"
 -H
 "Content-Type:
 application/json"
 -d

 "{\"entities\":[{\"type\":\"Ambiental\",\"isPattern\":false,\"id\":\"mypersonaldatatesterdevice\"}],\"attributes\":[\"temperature\"],\"reference\":\"http://prova/\",\"duration\":\"P1M\",\"notifyConditions\":[{\" type\":\"ONCHANGE\",\"condValues\":\"temperature\"}],\"throttling\":\"PT10S\"}"
 - Then the broker will send the messages to the subscribed client
 - it could be possible to have this kind of push also by using Kafka and/or WebSocket, but this is possible with simple and direct exposed API to all Snap4City platforms.
- The external APIs of Snap4City are documented in Swagger
 - <u>https://www.km4city.org/swagger/external/index.html</u>

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES









Why and How to use **Delegations to READ/WRITE**







Delegations Rules

- Each entity in Snap4City is created as private and can be only visible/editable only for its owner, the so-called Creator.
 - The Owner/creator can pass the ownership to some other user of the same Organization.
 - Each entity in Snap4City provide a specific graphic user interface to change the ownership for: IoT Device Models, Dashboards, IoT Apps, etc.
- Once the Ownerships is passed, the former Owner/creator loses the possibility of editing and view the entity.
- The Owner of an IoT Device/Entity Instance can provide grant rights
- to other users.
 - READ_ACCESSS: means to be capable to read data messages of a device/Entity Instance even if you
 are not the Owner. This grant allows you to create devices/entities which can read from one or
 several users.
 - READ_WRITE: means to be capable to send new messages on that device/Entity, and also to read the data provided. This grant allows you to create devices/entities which can receive messages / data from one or several users.
 - MODIFY: means to have the right to modify the device/entity structure. This grant is quite strong and should be carefully used and in general the Owner should be conceptually the only one authorized to change the device / entity structure.





Example of Delegation Patterns

- A user **A creates a device**, and post data for it, and it is interested to communicate the data to many users at which the user A provide READ_ACCESS.
 - To this end, A has to know the UserName of the platform to create the delegations.
- A user A creates a device to receive messages notifications from many users. A sort of mailbox for receiving some event notifications.
 - To this end, user A provide READ_WRITE grant to each of them. They are going to write their messages on the same mailbox, with the hope to avoid them to send messages at the same time stamp.
 - A can read the message notification and can overwrite them to confirm their reception.
- If all the IoT Devices/EntityInstances produce by a given Device Model are for instance userprofiles of some application, they can be searched and listed by all users having at least the READ_ACCESS to those devices.
 - The platform provides a Search block in IoT App / Proc.Logic, as well as Smart City API as query by model.
 - In both cases, the user performing the query will receive back only the device he/she created and those that have been delegated to him.



TOP



Develop: Provide Data and Access to Protected Data







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Approaches

- authenticate
- Second
 - use the services to provide and/or get data







Two Possible Approaches for Authentication

Authentication Code Flow Protocol (confidential application)

• For Web Application with Server Side functionalities or native applications, including services towards mobile applications

Single Page App

 For Web Application without Server Side functionalities

Implicit Flow Protocol referred to as Direct Grant with username/password

(public applications)

- Less secure: It's not recommended to use this flow unless you absolutely need to
- For Front-End Web Application that do not have Server Side functionalities.
- JavaScript can do only this kind of applications





Authentication Flow Protocol

(confidential application, Web Server Application)

Step1 The Web Server Application provides a way to securely store information, and provide service to your users via HTML pages

- In particular: client_id and client_secret are secured on the WSA
 - They have to be requested to the snap4City platform organization
 - Snap4City has to know the redirect uri of your Application Server to complete the round and provide back the information
- This approach is valid for application servers which provide html pages to your users, while this information is saved into the Applications Server which also interact with the Snap4City Platform
 - It in practice the same approch used by the Dashboard manager to provice access to the dashboard at the users.





Authentication Flow Protocol, step 2



Step2

- the user login is redirected to the identity provider
- 2) Given the client_id of the application and the client_secret (in the diagram called code)
- 5) The Service get the AccessToken
- Then the Service can pose any API rest call to get data for the User





Access Token of CaropenID®

- The access token is in the format of JSON Web Tokens
- https://jwt.io/

• The access token was:

eyJhbGciOiJSU2I1NiIsInR5cClgOiAiSldUliwia2lkliA6lCJOZVBpSFRvREtibWZzbl9hREtETGpGTHFKQXluTXNNWjZjS1lMeGRoS29zIn0.eyJqdGkiOilyZGQ xYmVkZC1jODImLTRjY2QtODM3MS1mN2Y2OWY5OTU2YjIiLCJIeHAiOjE2NzE1NTMxMjgsIm5iZil6MCwiaWF0IjoxNjcxNTUxNjl4LCJpc3MiOiJodHRw czovL3d3dy5zbmFwNGNpdHkub3JnL2F1dGgvcmVhbG1zL21hc3RlcIIsImF1ZCl6Imp1cHl0ZXJodWltcG9udGR12ZFyZCIsInN1Yil6ImQzZmMyNml3LW Q1MTktNGJmYy04OGExLWU10WMwNDRmNjcxNCIsInR5cCl6IkJIYXJlcIIsImF6cCl6Imp1cHl0ZXJodWltcG9udGR12ZFyZCIsImF1dGhfdGltZSI6MCwic 2Vzc2lvbl9zdGF0ZSI6IjI0ODJIZTNiLTBkYTUtNDNkZS04MzMwLTBiMzJmNjQ0ZmlyZSIsImFjciI6IjEiLCJhbGxvd2VkLW9yaWdpbnMiOltdLCJyZWFsbV9h Y2NIc3MiOnsicm9sZXMiOlsiQXJIYU1hbmFnZXIILCJ1bWFfYXV0aG9yaXphdGlvbiJdfSwicmVzb3VyY2VfYWNjZXNzJjp7lmFjY291bnQiOnsicm9sZXMiO IsibWFuYWdILWFjY291bnQiLCJtYW5hZ2UtYWNjb3VudC1saW5rcyIsInZpZXctcHJvZmIsZSJdfX0sInJvbGVzJjpblkFyZWFNYW5hZ2VyliwidW1hX2F1d Ghvcml6YXRpb24iLCJvZmZsaW5lX2FjY2VzcyJdLCJuYW1lljoic3VybmFtZSIsInByZWZIcnJIZF91c2VybmFtZSI6InRlc3R3YXN0ZSIsImZhbWlseV9uYW1llj oic3VybmFtZSIsImVtYWIsIjoidGVzdHdhc3RlQGdtYWIsLmNvbSJ9.RE7whLSrXRpf3uXFV32rVb90YHY4GW0g087OS_k-p79Q84twdQswu-80aAT0bV1RKep0qpRKZpWAsBWcHwrWEeDDNadUbv6n-GmUT0qfZRTpRzn2N8JfpqHGa12sC4-ThstKxgH99fkI6e_9ubZ0z4G9zWHQRrIHTcEmReYfazOnutdmgSX0F-ErM8eO9vRPmUmWBn5y7ZUm8re7CH6UPZNb15P4dXUnfR_zZK3gw8tyUyXdkHSSYTZrtj3fFbVjq3zxzV1Do2al-BpqS7quiCyHMG0qInYriWZKSARUyzjuL1QqBoSS6_xTe25wyizvwZ1BwHoeak400Rc0IqAgw



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T M L	Debugger Libraries Introduction Ask	Crafted by Crafted by Cotta
Encoded	Algorithm RS256 V	
"eyJhbGci0iJSUzI1NiIsInR5cCIg0iAis wia2lkIiA6ICJ0ZVBpSFRvREtibWZzb19h	HEADER: ALGORITHM & TOKEN TYPE HEADER: "RS256",	
dGkiOiIyZGQxYmVkZC1jODlmLTRjY2QtOD mN2Y2OWY5OTU2YjIiLCJleHAiOjE2NzE1N gsIm5iZiI6MCwiaWF0IjoxNjcxNTUxNjI4 3MiOiJodHRwczovL3d3dy5zbmEwNGNpdHk	"typ": "JWT", M3MS1 "kid": "NePiHToDKbmfsn_aDKDLjFLqJAynMsMZ6 JTM×Mj LCJpc PAYLOAD: DATA	cKYLxdhKos"
L2F1dGgvcmVhbG1zL21hc3RlciIsImF1ZC 1cH10ZXJodWItcG9udGR1Z2FyZCIsInN1N QzZmMyNmI3LWQ1MTktNGJmYy040GExLWU1 DRmNjcxNCIsInR5cCI6IkJ1YXJ1ciIsImF	I6Imp { iI6Im "jti": "2dd1bedd-c89f-4ccd-8371-f7f69f995 "exp": 1671553128, OWMwN "nbf": 0, iat": 1671551628, "iss":	6b2",
Imp1cH10ZXJodWItcG9udGR1Z2FyZCIsIn fdG1tZSI6MCwic2Vzc21vb19zdGF0ZSI6J JiZTNiLTBkYTUtNDNkZS04MzMwLTBiMzJn mIyZSIsImFjciI6IjEiLCJhbGxvd2VkLW9 bnMi01tdLCJvZWFsbV9bY2N1c3Mi0nsicn	F1dGh"https://www.snap4city.org/auth/realms/mast.jI00D"aud": "jupyterhub-pontdugard",.NjQ0Z"sub": "d3fc26b7-d519-4bfc-88a1-e59c044f6".'yaWdp"azp": "jupyterhub-pontdugard",.'yaWdp"azp": "jupyterhub-pontdugard",.'yaXM"auth_time": 0,	er", 714",
iOlsiQXJlYU1hbmFnZXIiLCJ1bWFfYXV0a phdGlvbiJdfSwicmVzb3VyY2VfYWNjZXNz mFjY291bnQiOnsicm9sZXMiOlsibWFuYWo Y291bnQiLCJtYW5hZ2UtYWNjb3VudC1saV	"session_state": "2482be3b-0da5-43de-8330" 0b32f644fb2e", "acr": "1", "allowed-origins": [], "realm_access": { "roles": ["Accementation"	

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Single Page App

- The Single Page has no secure way to store information on client side
- All the secret information is maintained on the Identity Provider side



- The Single Page has to bring the login on the Identify Provider, which redirect on the applications
- The process follow the above presented approach
- Given the client_id of the application, the users can get the accessToken to make requests.





Two Simpler Cases

Public Applications



Implicit Flow Protocol







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Public Applications

https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token

	 https://www.snap4city.org/auth/realms/master /protocol/ope 	enid-connect/token			Send
Params	Authorization Headers (8) Body • Pre-request Script Te	ests Settings			Cookie
non	e 🌑 form-data 📧 x-www-form-urlencoded 🌑 raw 🌑 binary 🌑	GraphQL			
	KEY	VALUE		DESCRIPTION	••• Bulk E
~	client_id				
~	grant_type	password			
2	username		client id, username,		
	password		nassword grant type		
	Key	Value	passwora, grant_type	Description	
				_	
y (Cookies Headers (6) Test Results			Status: 200 OK Time: 44 ms Size: 2.87 K	B Save Response
dy (Pretty	Cookies Headers (6) Test Results			🛱 Status: 200 OK Time: 44 ms Size: 2.87 K	B Save Response
Pretty 1 2 3 4 5	Cookies Headers (6) Test Results Raw Preview Visualize JSON ~ ~ "access_token": "eyJhbGci0iJSUzI1NiIsInR5cCI eyJqd6ki0iIyZGQxYmVkZC1j001mLTRjY2Qt0DM3 IsImF1ZCI6Imp1cH102XJodWItcG9udGR12ZFyZC c21vb19zdGF02SI6IjI00DJiZTNiLTBkYTUtNDNk JdfSwicmVzb3VyY2VfYWNjZXNzIjp7ImFjY291bn b24i1CJvZmZsaW61X2FjY2VzcyJdLCJuYW1IIj0i RE7whLSrXRpf3uXFV32rVb90YHY4GW0g0870S_k- e09vRPmUmWBn5y7ZUm8re7CH6UPZNb15P4dXUnfR "expires_in": 1500, "refresh_expires_in": 2073600, "refresh_expires_in": 2073600,	gOiAiSldU: MSImN2Y200 ISInN1YiL ZS04MZMLL c3VybmFtZ: p79Q84twd0 _zZK3gw8ty	gOiAiSldUIiwia2lkIiA6ICJOZVBpSFRvREtibWZzbJ MS1mN2Y20WY50TU2YjIiLCJleHAi0jE2NzE1NTMxMjj IsInN1YiI6ImQzZMMyNmI3LWQ1MTktNGJmYy040GExi QiOnsicm9sZXMi0lsibWFuYWdlLWFjY291bnQiLCJtv c3VybmFt2SIsInByZWZlcJlZF91c2VybmFt2SI6Inf p79Q84twdQswu-80aAT0bV1RKep0qpRKZpWAsBWcHw _zZK3gw8tyUyXdkHSSYTZrtj3fFbVjq3zxzV1Do2aI-	gOiAiSldUIiwia2lkIiA6ICJ0ZVBpSFRvREtibWZzbl9hREtETGpGTHFKQXluTXNNWjZjS1lMeGRoS29zI MS1mN2Y20WY50TU2YjIiLCJleHAi0jE2NzE1NTMxMjgsIm5iZiI6MCwiaWF0IjoxNJcxNTUXNJI4LCJpc3 ISInN1YiI6ImQzZMMyMmI3LWQ1MTktNGJmYy040GExLWU10WMwNDRmkjcxNCIsInR6cCI6IkJ1YXJlciIs ZS04MzMwLTBiMzJmNjQ0ZmIyZSISImFjciI6IjEiLCJhbGxvd2VkLW9yaWdpbnMi0ltdLCJyZWFsbV9hY2 QiOnsicm9sZXMi0lsibWFuYWdLLWFjY291bnQiLCJtYWbJbZUtYWNjb3VudC1saW5rcyIsInZpZXctcHJv c3VybmFtZSISInByZWZlcn1lZF91c2VybmFtZSI6InR1c3R3YXN0ZSISImZhbWlseV9uYW11Ijoic3Vybm p79Q84twdQswu-80aAT0bV1RKep0qpRKZpWAsBWcHwrWEeDDNadUbv6n-GmUT0qfZRTpRzn2N8JfpqHGaI _zZK3gw8tyUyXdkHSSYTZrtj3fFbVjq3zxzV1Do2aI-BpqS7quiCyHMG0qInYriWZKSARUyzjuLlQqBoS	Status: 200 OK Time: 44 ms Size: 2.87 K g0iAiSldUIiwia2lkIiA6ICJ0ZVBpSFRvREtibWZzbl9hREtETGpGTHFKQXluTXNNWjZjS1lMeGRoS29zIn0. MSim02Y20WYS0TUZYjIiLCJ1eHA10jEZNzEINTTMxHjgsIm5iZiif6MCwiaWF0joxNjcxNTUxNjI4LCJpc3M10iJodHRwczovL3d3dy5zbmFwNGNpdHkub3JnL2F1dGgvcr IsInN1YII6Im0zzMMyNmI3LWQ1MTktNGJmYy040GExLWU10WNNNmNjcxNCISInR5cC16IkJ1YXJ1cIIsImF6cC16Imp1cH10ZXJodWItc69udGR1Z2FyZCISImF1dGh1 2504HzMuLTB1MzJmNjQ0ZmIyZSISImFjci16IjEiLCJh6GxvdZvkLW9yaWdpbnMi0ltdLCJyZWFsbV9hY2NL3Mi0nsicm9sZXMi0lsiQXJ1YU1hbmFnZXILLCJhbWFfY2 Qionsicm9sZXMi0lsibWFuYWd1LWFjY291bnQiLCJtYW6hZ2UtYWNjb3VudC1saW5rcyIsInZpZXctcHJvZmlsZSIdfX0sInJv6VzIjpbIkFyZWFNYW6hZ2VyIiwidW1W c3VybmFtZSISInByZWZ1cnJ1ZF91c2VybmFtZSIGInR1c3R3YXN0ZSISImZhbWlseV9uYW111joia3VybmFtZSISImVtYWIsIjoidGvzdHdhc3R1QGdtYWlsLmNvbS39. p79Q84twdQswu-80aAT0bV1RKep0qpRKzpWAsBWcHwrWEeDDNadUbv6n-GmUT0qfZRTpRzn2N8JfpqHGaI2sC4-ThstKxgH99fkI6e_9ubZ0z4G9zWHQRIHTcEmReYfaz _zZK3gw8tyUyXdkHSSYTZrtj3fFbVjq3zxzV1Do2aI-BpqS7quiCyHMG0qInYriWZKSARUyzjulL1QqBoSS6_xTe25wyizvwZ1BwHoeak400Rc0IqAgw",




Implicit Flow Protocol

For some client_id the client_secret are needed

ST v nttps://www.snap4city.org/auth/reaims/master/protocol/ope	enia-connect/token		Send V
ms Authorization Headers (9) Body • Pre-request Script *	Tests Settings	L3	Cookies
KEY	VALUE	DESCRIPTION	••• Bulk Edit
client_id			
grant_type	password		
client_secret			
username			
password			
Key	Value	Description	
y Cookles Headers (6) Test Results retty Raw Preview Visualize JSON ~ => 1 2 "eccess_token": "eyJhbGci0iJSUzIINIIsInR5cCIg0iAiSIdUIiwia	21kIiA6ICJOZVBpSFRvREtibWZzb19hREtETGpGTHFKQX1uTXNM	Status: 200 OK Time: 109 jZjS11MeGRoS29zIn0.eyJqdGkiOiI1Y2Y3OWYzYy1hMGE1LTRiZGUtOwR1Ny11NjE4	ms Size: 2.73 KB Save Response ~
<pre>s cxpire_in : 1990, "refresh_expires_in": 2073600, "refresh_token": "eyJhbGci0iJSUzIINiIsInR5cCIgOiAiSIdUIiwin" token_type": "bearer", "not-before-policy": 0, session_state": "f0e85878-bbdb-4fd0-aa44-da450c9a6af7"</pre>	a21kIiA6ICJOZVBpSFRvREtibWZzb19hREtETGpGTHFKQX1uTXW	WjZj511MeGRo529zIn0.eyJqdGki0iJmMjczYmJkNS0yNmYxLTRjMTUtOGM5Zi040Dc	3ZDJhZWYzYjQiLCJleHAi

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Access Token & Refresh Token

- Access tokens have typically of short duration
 - Once the access token is expired,
 - The refresh token can be used to request another fresh access token and this can be done at the endpoint
- <u>https://www.snap4city.org/auth/realms/master/protocol/openid-</u> <u>connect/token/</u>
- With the parameters reported in the next slide







Param	ns Authorization Headers (8) Body • Pre-request Script Te	sts Settings			
	na farm data a u unum farm urlanandad a raw. A bianau a b	CrankOl			
nor	ne lorm-data la x-www-torm-unencoded la raw lobinary	GraphyL			
	KEY	VALUE	DESCRIPTION	000	
\checkmark	client_id	I have strong to react the second			
\checkmark	grant_type	refresh_token			
	scope	openid profile			
	refresh_token	eyJhbGciOiJSUzI1NiIsInR5cClgOiAiSIdUIiwia2lkliA6ICJOZVBpSFRvREtibWZ			
	Key	Value	Description		
Body	Cookies Headers (5) Test Results		Ca Status: 200 OK Time: 11 ms Size: 2.75 KB	Save R	es
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Develop: How Cloud Containers may Access to Protected Data (example of Python)







Private Device Data Retrieval

- We'll use the cloud installation of jupyterhub
- https://www.snap4city.org/650



Not All The Device in Snap4City are public...

for some you'll need an access token to the private IoT Device of that authenticated user 1

so let's get the username and password

```
[1]: ### in the config.py file that i've created are stored the user and password for the snap4city authentication
# snap4cityauth = dict(
# user = 'user name of snap4city',
# psw = 'the password of the user',
# clid= '<client id depending on the App kind>' has to be obtained from Snap4City organization by sending an email to snap4city@disit.org.
# )
import config
utente = config.snap4cityauth['user']
password = config.snap4cityauth['psw']
client_id = config.snap4cityauth['clid']
```





Private Device Data Retrieval

next let's get the auth token 1

```
2]: import requests
import json
url = "https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/"
data = {"client_id": client_id,"grant_type":"password","username":utente,"password":password}
r=requests.post(url, data)
print(r.status_code, r.reason)
responseToken=json.loads(r.text)
refreshToken = responseToken["refresh_token"]
print("access_token : {}... expires in {}s, token_type: {}".format(responseToken['access_token'][:20],responseToken['expires_in'],responseToken['token_type'] ))
```

```
#to update the token using the refresh_token
url = "https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/"
data = {"client_id": client_id,"grant_type":"refresh_token","scope":"openid profile","refresh_token":refreshToken}
r=requests.post(url, data)
print("updating token using the refresh token ",r.status_code, r.reason)
responseToken=json.loads(r.text)
```

200 OK

access_token : eyJhbGciOiJSUzI1NiIs... expires in 1500s, token_type: bearer updating token using the refresh token 200 OK





Private Device Data Retrieval

so now you can access the private iot device data...

```
]: auth_token=responseToken['access_token']
hed = {'Authorization': 'Bearer ' + auth_token}
```

url = "https://www.snap4city.org/superservicemap/api/v1?serviceUri=http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/118907.682_485819.390-Plastic&accessToke

```
response = requests.get(url, headers=hed)
if response.status_code == 200: # ok
    print(json.loads(response.text))
```

{'Service': {'features': [{'geometry': {'coordinates': [4.857379, 52.359085], 'type': 'Point'}, 'properties': {'address': '', 'avgStars': 0, 'brokerName': 'orionUNIF
I', 'cap': '', 'city': '', 'civic': '', 'comments': [], 'description': 'Plastic', 'email': '', 'fax': '', 'format': 'json', 'frequencySec': '600', 'isMobile': '', 'li
nkDBpedia': [], 'macaddress': '', 'maintenanceUrl': '', 'maxCapacity': '5', 'minCapacity': '', 'model': 'AmsterdamPlasticContainer', 'multimedia': '', 'name': '11890
7.682_485819.390-Plastic', 'nature': 'Environment', 'organization': 'DISIT', 'ownership': '', 'phone': '', 'photoOrigs': [], 'photoThumbs': [], 'photos': [], 'produce
r': 'Amsterdam city', 'protocol': 'ngsi', 'province': '', 'realtimeAttributes': {'dateObserved': {'attr_type': 'DeviceAttribute', 'data_type': 'string', 'different_va
lues': '0', 'value_bounds': 'unspecified', 'value_refresh_rate': '300', 'value_type': 'timestamp', 'value_unit': 'timestamp'}, 'weight': {'attr_type': 'DeviceAttribut
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ype': 'Environment_Waste_container', 'serviceUri': 'http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/118907.682_485819.390-Plastic', 'starsCount': 0, 'subna
ture': 'Waste_container', 'typeLabel': 'Waste container', 'website': '', 'wktGeometry': ''}, 'type': 'Feature'}], 'type': 'FeatureCollection'}, 'realtime': {'head':
{'vars': ['measuredTime', 'dateObserved', 'weight']}, 'results': {'bindings': [{'dateObserved': {'value': '2022-01-14T09:52:09.000Z'}, 'measuredTime': {'value': '2022
-01-14T10:52:09.000+01:00'}, 'weight': {'value': '120'}]}}}

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES





Basic version for MaaS mobile App: missing payments: a small version is on GITHUB, a wider version will be Published soon

Snap4City (C), January 2024







Developing Web and Mobile Apps, MicroApps,..

Mobile Apps



**

Θ

Mobile Application

Monitoring

Administrator

strag and Topotories Co (they Profix Disatled)

Web App HTML5, MicroApplications

Embed into Web pages









Advanced SmartCity API

- Search data: by text, near, along, etc.
 - Resolving text to GPS and formal city nodes model
- Empowering city users: contributions, suggestions, forum discussions, etc.
- Events: Entertainment, critical and mobility
- Public and Private Mobility & Transport, and predictions
- POIs, Cultural and Touristic info
- Health services and predictions
- Environmental information, heatmaps; values
- Profiled Suggestions to City Users
- Traffic flow reconstruction
- Personal Assistant: PAVAL
- User Engagement: goal experiences, and assessment
- Sharing knowledge among cities -> see Knowledge base Management

Smart City API Docs: Swagger 💮 swagger Advanced Smart City A imin1. Ora: DISI Irion Broker K1 K2 Authenticatio Advanced Smart City API 📟 📟 ART CITY ARI WER DOCUMENTATIC https://servicemap.disit.org/WebAppGrafo/api/v1 Services T / Service discovery and inform Service search near GPS position - It allows to retrieve the set of services that are near a given r having specific words in any textual field. It can also be used to find services that have a WKT spatial description that contains a Try it out Through this parameter the user indicates where the services have to be searched. It could be a boundary within which to

Swagger



DIPARTMENTO DI DIPARTMENTO DI DISTRIBUTED SYSTEMS DISTRIBUTED SYSTEMS TECHNOLOGIES LAB IODDIE Apps exploiting our tech/Smart City API

- Firenze Dove Cosa, Km4City: ٠
 - Android: https://play.google.com/store/apps/details?id=org.disit.siiMobile&hl=en&gl=US
 - Apple iOS: https://apps.apple.com/it/app/firenze-dove-cosa-km4city/id1028356115
- Toscana dove cosa, Km4City
 - Android: https://play.google.com/store/apps/details?id=org.disit.toscana&hl=en&gl=US
 - Apple iOS: https://apps.apple.com/it/app/toscana-dove-cosa-km4city/id1064554200
- Antwerp in a Snap
 - Android: https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.antwerp&hl=en&gl=US ٠
 - Apple iOS: https://apps.apple.com/it/app/antwerp-in-a-snap/id1467737363
- Helsinki in a Snap
 - Android: https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.helsinki&hl=en&gl=US ٠
 - Apple iOS: https://apps.apple.com/it/app/helsinki-in-a-snap/id1466970280
- **Tuscany in a Snap**
 - Android: https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.tuscany&hl=en&gl=US
 - Apple iOS: https://apps.apple.com/us/app/toscana-in-a-snap/id1471094480
- Snap4Pisa: Pisa in a Snap:
 - Android: https://snap4city.aedit.it/drupal//sites/default/files/snap.apk
- Weee Life Mobile App:
 - Android: https://play.google.com/store/apps/details?id=org.disit.lifeweee&hl=en&gl=US
 - Apple iOS: https://apps.apple.com/it/app/life-weee/id1470224854
- **Comune Facile Android:**
 - Android: https://www.e015.regione.lombardia.it/site/app-detail?id=131
 - Comune Facile IOS: https://www.e015.regione.lombardia.it/site/app-detail?id=130
- POS by EPSON: https://www.e015.regione.lombardia.it/site/app-detail?id=58
- SnapBot: https://www.snap4city.org/684











SnapBot



https://www.snap4city.org/dashboardSmartC ity/view/index.php?iddasboard=MzAwNA==





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Parterre

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03-20-2021 22:41 Prediction

03-20-2021 23:45

03-21-2021 00:00

03-21-2021 00:15

03-21-2021 00:30

Around Here Real time

Daily Trend

0

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Web and Mobile App with Open Development Kit





134

Km4City APP, features

- **5 languages:** IT, EN, SP, DE, FR
- **Profiles** city users: citizens, commuter, student, tourist, operator, etc.
- Profiled Menu per POI
 - adaptive
- Main Menu: dynamic, and personalized
- Search Text
- Search per POI
 - Near to you, near to a point, a line, ...
- Other search
 - Close to you, events green areas, public transport, tickets , Cycling, parking, ...
 - Etc.
- POI
 - Preferred, Social icon
 - Ranking, Comments, Images





Snap4City (C), January 2024



Km4City APP

cover i City

Public transpo

36

Events

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Weather

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Favourites

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Alert Civil Prot

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Points Of Interest

Bus Ticket

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Suggestions Near You

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Search City

Siena

Search Stops By A

- Smart Parking, in Tuscany
- **Smart First Aid in Tuscany** ٠
- **Smart Public Transportation** in Tuscany
- **Smart Fuel pricing in Tuscany** ٠
- **Bike Sharing in Pisa** ٠
- Weather condition in Tuscany ٠
- **Environmental data** ٠
- Pollution and Pollination in Tuscany
- **Traffic Sensors in Tuscany** ٠
- **Smart Routing in Tuscany** ٠
- **Smart Transportation in** Florence
 - Events, traffic, ...
- **Entertainment Events in** ٠ Florence





OSCANA

Type: Teatro

Type: Theatre

Date: 08-18-2016



IRENZE

Services: 300 on 300 available



FIRENZE

ices: 362 on 540 available

Petrol Petro

1.514 € 1.344 €

Served Self

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Km4City APP, features 3/3 CSNAP4city

- **Navigation 3D**
- Ticketing for busses
- App used are tool for city assessment
 - Wi-Fi status
 - iBeacon status
 - User behavior analysis
 - GPS movements kinds
 - OD matrix
 - International flows







Pisa

Livorno

Piomhing

Crea SMS

Crea SMS

Crea SMS









Mobile App Features



- **Discovery** POI/services
- Search: POI, streets, suggestions
- **Mobility and transport**: Pub/priv, routing, car position, time table, park, sharing, tickets, etc.
- Environment and Weather: values, sensors, heatmaps, notifications
- Assistant, Forum, Developer Assistant
- Goal Experiences (Engagement)
- Personal data, activities, POI, tracking, IOT App, Dashboards, etc.
- Events: entertainment, critical
- Sharing position and trajectories with friends
- Monitoring city and personal Dashboards
- Personalized for Operators and Developers full control of their applications on cloud



MicroApplications









Understanding how City Users are using the City Services







The App is a Bidirectional Device

- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications

Users

• ..

Produced information

• Accepted ?

...

• Performed ?



Snap4City (C), January 2024

Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- Cumulated Scores from Actions
- Requested information
- Routing performed
-

Produced information

-System

- Suggestions
- Engagements
- Notifications



UNIVERSITÀ DEGLI STUDI FIRENZE DIPARTIMENTO DI DESTRIBUTERNO DI DISTRIBUTERNO DI INTERNET DELL'INFORMAZIONE DISTRIBUTERNET DISTRIBUTERNET







Preferred Users' Cathegories



User Behavior Analyser for Collective



Profiling

UNIVERSITÀ DEGLI STUDI FIRENZE DIPARTMENTO DI INGEGNERIA DISTRIBUTED SYSTEMS ADMINISTRA DISTRIBUTED SYSTEMS ADMINISTRA TECHNOLOGIES LAB







Real Time Traking: User Behaviour Analysis



Firenze - Monday November 7 2016 23:20:15

Sii-Mobili



User Behaviour Analyser









Understanding City User Behaviour

- Mobile Applications can send data via Advanced Smart City API to collect data about the city usage by the city users via a signed consent
 - See Mobile and Web App: Toscana in a Snap, Helsinki in a Snap, Antwerp in a Snap.
- City User behavior analysis includes production of:
 - suggestions, trajectories, hot places/heatmaps, etc.
 - origin destination matrices
 - data for the city user engagement
 - Etc.



https://www.snap4city.org/drupal/node/489





Engaging City Users Towards Virtuous Participated Attitude







Profiled Engagements to City Users

- The users are profiled to learn habits:
 - Personal POI, paths, Mobility habits
- Information and engagements sent to the users are programmed according to the context and user behavior to:
 - Stimulate virtuous habits
 - More sustainable habits
 - More healthy habits, etc.
 - Get feedbacks

UNIVERSITÀ Degli studi

FIRENZE

- Provide bonus and prices,
- Send alerts,

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Citizen Engagement via Mobile Apps



GPS Positions

- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images

....

...

Subscriptions to notifications

Produced information

- Viewed ?
- Accepted ?
- Performed ?

Users



Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- Cumulated Scores from Actions
- Requested information
- Routing performed

• • • • •

Produced information

- Suggestions
- Engagements
- Notifications





① Engagement Sent (4 hours)



Closer Latest Expiring

Can You Contribute With A Review Of "RASPINI RAR

You Parked In A Residential Zone

Closer Latest Expiring

Gustav Klimt Experience A Incore 1 SANTO STEFANO AL PONTE (Until 2017-04-02)

Help us to provide a better service

Can confirm that you LIVE around VIA TRIPOLI?

"Gustav Klimt Experience" At MUSEO DIOCESANO DI

Expiry: 2017-02-20 12:19:59

HELP US

ALERT

Assistant

EVENT today

Distance: O 3336 m Expiry: 2017-02-21 11:32:5

Type: Exibition

Personalize Your Point-Of-Interes Expiry: 2017-02-20 19:35:39

Type: Poo Expiry: 2017-02-20 11:55:00

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G Assistant

Closer Latest

1. * Have you been at Giardino di piazzale

Donatello^{*}

Yes No

2. How Much Did You Like?

1 2 3 4 5

0

Help for a better ser

Expiry: 2017-02-23 16:00:00

Have You Been Here?

 \triangleleft

俞

P 🛈 💎 🖊 📋 11:39

×



📊 K-Market Jätkäsaari

Early Education Paivakoti Ruo

→ Ticket sale

Lastentalo

→ Pre-primary education

@1521 m @ 47 m

⊙1520 m ♀71 n

Cancel

User

context

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Users' Engagement

Rule name	Туре	#sent	#viewed	#v #s
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
<u>daily event en</u>	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.0
	- commuter	5 (0.29%)	0 (0%)	0 (
	- student	14 (0.81%)	0 (0%)	0 (
	- tourist	1462 (85%)	25 (35.71%)	25

Inform

Air Quality forecast is not very nice You have parked out of your residential parking zone

The Road cleaning is this night The waste in S.Andreas Road is full

Engage

Provide a comment, a score, etc. Stimulate / recommend

Events in the city, services you may be interested, etc..

Provide Bonus, rewards if needed

you get a bonus since you parked here We suggest: leave the car out of the city, this bonus can be used to by a bus ticket



4 min 1 Engagemen... 4 min

Rules

City

context





Engaging City Users

- Mobile Applications can use Advanced Smart City API to collect data about the city usage by the city users via a signed consent
- It can be used for sending engagements to them such as to:
 - Inform
 - You have parked out of your residential parking zone
 - The Road cleaning is this night
 - The waste in S.Andreas Road is full
 - Engage
 - Please Provide a comment, a score, etc.
 - Stimulate / recommend
 - Events in the city, services you may be interested, etc..
 - Provide Bonus
 - Since you have parked here you can get 1 Bonus
 - We suggest you to leave the car out of the city, this bonus can be used to buy a bus ticket





Engagement Manager

- Definition of Rules for campaigns
- Monitoring and follow-up for each City

62.4

Segmented for user kind and interest



· •

T 00
Sii smart. Sii-Mobility!

In palio per te Carnet multicorsa Cap e

voucher per:

Scaricq

Dal 15 aprile al 1. trasporto pubblico Scarica l'app "Tos guadagna punti vi autobus e vinci tar Per maggiori infor il sito <u>info.sii-mobil</u>

Sii smart. Sii-Mobility! Scarica, viaggia, vinci!

Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "*Toscana dove, cosa",* guadagna punti viaggiando in autobus e vinci tanti fantastici premi! Per maggiori informazioni visita il sito <u>info.sii-mobility@org</u>



Campaing on Sustainable

Mobility



In palio per te

Carnet multicorsa Cpt e voucher per:



TEATRO DI PISA

SII smart. SII-Mobility! Scarica, viaggia, vinci!



Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi. Per maggiori informazioni visita il sito info.sii-mobility.org



CRUPPO FERROVIE DELLO STATO ITALIARE DI U CO

Snap4City (C), Janua





Rules for Rewards

<u>ASSISTANCE</u>

- If public transport is detected after bus line suggestion on trajectory usually made on private transport → 10points
 - Why don't you take the bus line 4 in Piazza Marconi to reach your workplace? You save money, you respect the environment and you will be stress free for not worry about parking!
- Once a day, if public transport is detected after suggestion on an alternative bus line availability →3points
 - Why don't you take the bus line 4 that stop just 50 meters far from you? You save money, you respect the environment and you will be stress free for the traffic jam!
- If public transport is detected for at least 30(?)
 minutes a day → 1point

- ENGAGEMENT
- Survey on commuter and their preferred way of mobility → 1point
 - How many minutes you usually commute to go to work?
 How do you rate the service?
- Feedback on public transport \rightarrow 1point
 - Which current public transport are you using? Are the service in line with your expectation?
- Comments/Photo/Rate or survey on POI (public transport) →1point
- Survey on use of the App after N days or for tourist coming home → 1point
- Feedback on PPOI or mobility \rightarrow 1point



Validation of user Engagement

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Months	Msg Sent	Msg Viewed	Msg Executed
1-January	3888	380	12
2-February	4319	489	22
3-March	4739	450	25
4-April	6567	918	67
5-May	7594	972	61
6-June	6437	695	55
7-July	9432	697	69
8-August	6988	429	73
9-September	5885	345	49
Total	55849	5375	433

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User Behaviour Analysis VALIDATION

- During the PILOT new rules has been added (30 on a total of 80) and mostly all of them are still online
- COMMENT_POI: requires more user interaction and not very contextualized (POI proximity) → higher rate of sent, lower rate on execution
- MOBILITY_FEEDBACK: requires less user iteration and very contextualized (user in MOBILITY) → normal rate of sent, high rate on execution

	Msg Sent	Msg Viewed	Msg Executed
COMMENT_POI	21632	804	15
MOBILITY_FEEDBACK	5378	371	94



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https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc2OQ==

Dashboard created to monitor in real time the answers to the survey provided on the Mobile App directly by the Engagement tool







https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc1OQ==

- Dashboard monitoring the Mobile App:
- Collecting the clicks
- Describing the ۲ community of users in terms of the profile aspects
- Measuring the time spend, and topics of interest of the users, etc.









Connected Drive







Main Concept of Connected Drive

- Different kinds of communications may arrive on the vehicles on board devices
- Mobile Phones can be a possible facilities

- Geolocated Real time Information as:
 - Alerting, dynamic digital signage (may not present physically on the road)
 - Supporting autonomous driving vehicles

V2V

V21





Experimentation on «Toscana Dove Cosa»

- Mobile App supporting connected Drive V2I connections:
 - <u>https://play.google.com/store/apps/details?id=org.disit.toscana&hl=it</u>
 - <u>https://apps.apple.com/it/app/toscana-where-what-km4city/id1064554200</u>
 - For the MOSAIC project and pilot in Tuscany
- The mobile App has a Navigator which includes now the acquisition of connected drive messages







Scenario



droid [C:\Users\badii.DISIT\Lavoro\workspace\toscana\platforms\android] - ...\app\src\main\AndroidManifest.xml [app] - Android Studio



SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES





SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES









- Apache Cordova is a set of JavaScript APIs that enable the devices to the application developer to access native features of the device such as the camera or accelerometer, storage, network, gps
- Combined with a user interface framework such as Dojo Mobile or jQuery Mobile or Sencha Touch, allows the development of smartphone applications using only HTML, CSS and JavaScript.
- When using the Cordova API, an application can be built without any native code (Java, Objective-C, C# etc.). The web technologies used are hosted in the same application at the local level (usually not on a remote http server).
- These JavaScript API are consistent and valid for the different platforms of mobile devices, in this way the application built on the Web standard, should be portable with a minimum of changes.





Mustache JS

- The library is **independent** from specific framework but there are plugins for the integration with jQuery, Dojo, and YUI.
- Possibility to work with javascript objects and then exploit the communication of data in JSON format from a REST call via AJAX.
- The **templates** for Mustache may be assigned or loaded as a string to a variable and the placeholder are identified by two braces, for example: {{miopplaceholder}}.
- One of the most interesting of the library feature is support in **enumerable values**
- Documentation and downloads are available on the official website: <u>http://mustache.github.io</u>





Mustache JS

Template

JSON

<h1>{{titolo}}</h1> {{descrizione}} {{#risultato}} //solo se risultato è true {{#citta}} {{nome}} ({{sigla}}) {{/citta}} {{/risultato}} {{risultato}} //altrimenti... Nessuna città trovata! {{/risultato}}

var data = {
 risultato: true,
 titolo: Città italiane,
 descrizione: Lista delle città italiane,
 citta: [
 {nome: Milano, sigla: MI},
 {nome: Roma, sigla: RM}
]



};



Mustache JS

	1	
lem	p	late

JSON

<h1>{{titolo}}</h1
{{descrizione}}
<pre>{{#risultato}} //solo se risultato è true</pre>
{{#citta}}
 {{nome}} ({{sigla}})
{{/citta}}
{{/risultato}}
{{^risultato}} //altrimenti
Nessuna città trovata!
{{/risultato}}

var data = { risultato: true, titolo: Città italiane, descrizione: Lista delle città italiane, citta: [{nome: Milano, sigla: MI}, {nome: Roma, sigla: RM}]

Template + JSON + Mustache

Città italiane

Lista delle città italiane

- Milano (MI)
- Roma (RM)



- OpenLayers is an open source JavaScript library for displaying map data in web browsers and can be used with a hybrid application developed with Cordova
- In the early versions of the app, the map was managed by Leaflet.js library. This was
 replaced because it didn't support the rotation, which is required to insert navigation
 functions within the app
- In addition, OpenLayers 3.0 builds the map and objects added to it with a canvas renderer, which is very efficient when objects are numerous and small as the markers displayed for each search done with the app
- Documentation and downloads are available on the official website: http://openlayers.org



OpenLayers 3.0

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General architecture of Mobile / Web App

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In the slides following there is an **example** of how to **add a module** to the app.

The goal of this example is to create a **new module** that in addition to viewing the list of car parks as is already the case for the button named "Parking" will **show directly** the **number of free parking lots** for each car park found





• Files required for creating a new module are as follows



ExampleModule.js Tipo: File JavaScript

-		-	
			Г
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	11		

exampleModule.labels. * .json Tipo: JSON File

exampleModule.principalMenu.json Tipo: JSON File A Javascript file containing the logic

5 JSON files (**ita**, **eng**, **esp**, **deu**, **fra**) containing **labels** to be included in the new interface

A JSON file that contains one or more **buttons** to be added to **principal menu** to allow the user to interact with the newly created module





 Copy these files to a new folder that will have the name of the new module (i.e., ParkingSearcher): the names of the files copied have to be changed to get the module name as a prefix

ro > workspace > siiMobilityAppKit > www > js > modules > parkingSearcher

ParkingSearcher.js Tipo: File JavaScript	
parkingSearcher.labels.deu.json Tipo: JSON File	
parkingSearcher.labels.eng.json Tipo: JSON File	
parkingSearcher.labels.fra.json Tipo: JSON File	
parkingSearcher.labels.ita.json Tipo: JSON File	
parkingSearcher.labels.spa.json Tipo: JSON File	
parkingSearcher.principalMenu.json Tipo: JSON File	





• Field descriptions for creating buttons in the main menu

{	
<pre>"callback": "PrincipalMenu.hide(); MapManager.centerMapOnGp</pre>	ıs();",
"iconId": "",	
"iconClass": "icon ion-android-bus",	
"iconFontSize": "41px",	
"iconColor": "#CC0000",	
"imgSrc": "img/ticketmenu.png",	
"imgHeight": "37px",	
"text": "P",	
"textFontSize": "38px",	
"textColor": "#CC0000",	
"captionId": "principalMenuParkingSearcher",	
"captionTextId": "moduleParkingSearcher",	
"step": true,	
"stepId": "eventsBadge",	
"ribbon": true,	
"ribbonId": "",	
"ribbonStyle": "background: #336633;background: linear-grad	ient(#33FF33 0%, #
"ribbonText": "Beta",	
"removed": false,	
"index": 0	

This field contains the **callback** for the new module.

The present callbacks should be left, because they serves to close the main menu and to center the map on the GPS





• Field descriptions for creating buttons in the main menu

"iconId": "", "iconClass": "icon ion-android-bus" "iconFontSize": "41px", "iconColor": "#CC0000" "imgSrc": "img/ticketmenu.png", "imgHeight": "37px", 'text": "P", "textFontSize": "38px" "textColor": "#CC0000" captionid : "principalMenuParkingSearcher", "captionTextId": "moduleParkingSearcher", "step": true, "stepId": "eventsBadge", "ribbon": true, "ribbonId": "", "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%); "ribbonText": "Beta", "removed": false, "index": 0

These blocks of fields are **mutually exclusive**. Allow you to choose the icon that will identify the button that you are creating. This icon can be chosen as an **image**, a **text**, a **glyphicon** (Bootstrap) or **ionicons** (ionicons.com).

N.B. Field **iconId** can be useful if you plan to edit the selected icon **dynamically**





• Field descriptions for creating buttons in the main menu



These blocks of fields are **mutually exclusive**. Allow you to choose the icon that will identify the button that you are creating. This icon can be chosen as an **image**, a **text**, a **glyphicon** (Bootstrap) or **ionicons** (ionicons.com).

N.B. Field **iconId** can be useful if you plan to edit the selected icon **dynamically**





• Field descriptions for creating buttons in the main menu

"callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();", "iconId": "", "iconClass": "icon ion-android-bus", "iconFontSize": "41px", "iconColor": "#CC0000", "imgSrc": "img/ticketmenu.png", "imgHeight": "37px", "text": "P", "textFontSize": "38px", "textColor": "#CC0000", "captionId": "principalMenuParkingSearcher", "captionTextId": "moduleParkingSearcher", "step": true, "stepId": "eventsBadge", "ribbon": true, "ribbonId": "", "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%); "ribbonText": "Beta", "removed": false, "index": 0

captionId serves to indicate the **container tag** of the text that is located at the bottom of each button.

captionTextId indicates the name of the field in labels.*.json whose value is the text to be inserted in the previous container.





• Field descriptions for creating buttons in the main menu

"callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();", "iconId": "", "iconClass": "icon ion-android-bus", "iconFontSize": "41px", "iconColor": "#CC0000", "imgSrc": "img/ticketmenu.png", "imgHeight": "37px", "text": "P", "textFontSize": "38px", "textColor": "#CC0000", "captionId": "principalMenuParkingSearcher", "captionTextId": "moduleParkingSearcher", "step": true, "stepId": "eventsBadge", 'ribbon": true, "ribbonId": "", "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%); "ribbonText": "Beta", "removed": false, "index": 0

These blocks of fields are used to show the user **badges containing information** related to the button on which are located





• Field descriptions for creating buttons in the main menu

{	<pre>"callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();", "iconId": "", "iconClass": "icon ion-android-bus", "iconFontSize": "41px", "iconColor": "#CC0000", "imgSrc": "img/ticketmenu.png", "i with the sector."</pre>
	<pre>"imgHeight": "37px", "text": "P", "textFontSize": "38px", "textColor": "#CC0000", "captionId": "principalMenuParkingSearcher", "captionTextId": "moduleParkingSearcher", "step": true, "stepId": "eventsBadge",</pre>
	"ribbon": true,
	"ribbonid": ", "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%); "ribbonText": "Beta",
}	"removed": false, "index": 0

These blocks of fields are used to show the user **badges containing information** related to the button on which are located





• Field descriptions for creating buttons in the main menu

"callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();", "iconId": "", "iconClass": "icon ion-android-bus", "iconFontSize": "41px", "iconColor": "#CC0000", "imgSrc": "img/ticketmenu.png", "imgHeight": "37px", "text": "P", "textFontSize": "38px", "textColor": "#CC0000", "captionId": "principalMenuParkingSearcher", "captionTextId": "moduleParkingSearcher", "step": true, "stepId": "eventsBadge", "ribbon": true, "ribbonId": "", "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%); "ribbonText": "Beta", "removed": false, "index": 0

removed field is useful to allow the removal and the insertion of the buttons in the main menu by the user.

index field is useful for rendering the buttons in the order chosen by the user.





• Field descriptions for creating buttons in the main menu

"collback", "DeincipolMony bido(), MonManagon contorManOnGes(),"		
"iconId": ""		APPKIT MILL GO YOU WAIL TO GO.
"iconClass": "icon ion-android-bus"	Touch and move Touch and move	
"iconFontSize": "41px".	Points Of	Map Search Points Of Interest
"iconColor": "#CC0000".	Map Search Interest Hide Hide Hide	
"imgSrc": "img/ticketmenu.png".	Touch and move Touch and move Touch and move	Events Settings About Us
"imgHeight": "37px",	🛗 🔅 р 🎧 т	Events Settings About os
"text": "P",	Events Settings About Us	
"textFontSize": "38px",	Hide Hide Hide	
"textColor": "#CC0000",		
"captionId": "principalMenuParkingSearcher",	example madule	
"captionTextId": "moduleParkingSearcher",	Show Show	
"step": true,		
"stepId": "eventsBadge",		
"ribbon": true,		
"ribbonId": "",		
"ribbonStyle": "background: #336622,Jackground: linear-gradient(#33FF33 0%, #336633 100%);"		
"ribbonText": "Beta",		
"removed": false,		
"index": 0	C H	





- Loading new buttons modules within the main menu, takes place by comparing the captionId field.
- If the menu already has a button with the same captionId, the first is replaced with the new one.
- To remove a button from the main menu (field removed hides it) add a delete field with value equal to true.





• First version of the button







Labels of ParkingSearcher

• Description of **label.*.json** files



label.fra.json

"principalMenu": {
 "moduleParkingSearcher": "Liste parkings"

label.esp.json

"principalMenu": { "moduleParkingSearcher": "Lista de Aparcamiento"

Three important things to check:

- Languages shall be indicated by 3 characters: ita, deu, esp, fra, eng
- The label for the button must be contained within the object "principalMenu"
- The name of the field inside "principalMenu" must be the same of "captionTextId" seen before





Labels of ParkingSearcher

• Description of **label.*.json** files







Labels of ParkingSearcher

• Description of **label.*.json** files







• It is seen as fill most of the files in the folder of new module ParkingSearcher that is developed in this presentation

ParkingSearcher.js Tipo: File JavaScript	TODO
parkingSearcher.labels.deu.json Tipo: JSON File	\checkmark
parkingSearcher.labels.eng.json Tipo: JSON File	\checkmark
parkingSearcher.labels.fra.json Tipo: JSON File	\checkmark
parkingSearcher.labels.ita.json Tipo: JSON File	\checkmark
parkingSearcher.labels.spa.json Tipo: JSON File	\checkmark
parkingSearcher.principalMenu.json	\checkmark

workspace > siiMobilityAppKit > www > is > modules > parkingSearcher




• Functions contained in ParkingSearcher.js

show: function () {

application.resetInterface();

MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu); \$("#" + ParkingSearcher.idMenu + "Collapse").hide(); ParkingSearcher.open = true; InfoManager.addingMenuToManage(ParkingSearcher.varName);

application.addingMenuToCheck(ParkingSearcher.varName); application.setBackButtonListener();

},

hide: function () {

\$("#" + ParkingSearcher.idMenu).css({ 'z-index': '1001' });
MapManager.reduceMenuShowMap("#" + ParkingSearcher.idMenu);
InfoManager.removingMenuToManage(ParkingSearcher.varName);
application.removingMenuToCheck(ParkingSearcher.varName);
ParkingSearcher.open = false;

Closes any previously **opened menu**, **shrinks the map** to display the menu, **hides** the **button** to reduce the menu, since it will open already reduced.

Recording to other variables to get notifications when:

- users press the back button
- users change the **device orientation**
- must be closed the menu opened by this module





• Functions contained in ParkingSearcher.js

show: function () {

application.resetInterface();

application.setBackButtonListener();

```
MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu);
$("#" + ParkingSearcher.idMenu + "Collapse").hide();
ParkingSearcher.open = true;
InfoManager.addingMenuToManage(ParkingSearcher.varName);
application.addingMenuToCheck(ParkingSearcher.varName);
```

ı.

hide: function () {

\$("#" + ParkingSearcher.idMenu).css({ 'z-index': '1001' });
MapManager.reduceMenuShowMap("#" + ParkingSearcher.idMenu);
InfoManager.removingMenuToManage(ParkingSearcher.varName);
application.removingMenuToCheck(ParkingSearcher.varName);
ParkingSearcher.open = false;

Does the **opposite functions** to those performed by the **function show**, also reset the z-indexof the menu





• Functions contained in ParkingSearcher.js

```
checkForBackButton: function () {
    if (ParkingSearcher.open) {
        ParkingSearcher.hide();
},
refreshMenuPosition: function () {
    if (ParkingSearcher.open) {
        MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu);
        Utility.checkAxisToDrag("#" + ParkingSearcher.idMenu);
        if (ParkingSearcher.expanded) {
            ParkingSearcher.expandBusRoutesMenu();
closeAll: function () {
    if (ParkingSearcher.open) {
        ParkingSearcher.hide();
```

These are the **callbacks** called to **notify** the occurrence of an event among those described previously (see show function) and for which we recorded the module

- users press the back button
- users change the device orientation
- must be closed the menu opened by this module





• Functions contained in ParkingSearcher.js



- Checks if there is the element that will contain the html code created through the use of Mustache library.
- It is generated the html code with template ParkingMenu.mst.html and JSON ParkingSearcher.results and added to the element container.
- Finally, the feature that allows the users to widen the menu by dragging the handler is added to it





• Functions contained in ParkingSearcher.js



- Checks if there is the element that will contain the html code created through the use of Mustache library.
- It is generated the html code with template ParkingMenu.mst.html and JSON ParkingSearcher.results and added to the element container.
- Finally, the feature that allows the users to widen the menu by dragging the handler is added to it



},



ParkingSearcher Module Functions

• Functions contained in ParkingSearcher.js

successQuery: function (response) {
 ParkingSearcher.results = responseObject["Results"];
 ParkingSearcher.refreshMenu();
 ParkingSearcher.show();
 MapManager.addGeoJSONLayer(responseObject);
 ParkingSearcher.resetSearch();

```
errorQuery: function(error) {
    navigator.notification.alert(
    Globalization.alerts.servicesServerError.message,
    function () { },
    Globalization.alerts.servicesServerError.title);
```

These are the callbacks that should be called once the JSON, containing the data to be displayed to the user, is created. The success callback:

- will locally save the response
- will create the menu
- will show it.

If the menu will contain **elements** that it is possible to **show on the map** they will be added to the map by last function





ParkingSearcher Module Template

• Before adding the logic of the new module, we create the template to be filled with the correct JSON.



This default template will **simply show a menu** with a header and body empty. **Must have the same name as the string entered as the third parameter in the call**

ViewManager.render (ParkingSearcher.results, "#" + ParkingSearcher.idMenu, "ParkingMenu");

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ParkingSearcher Module Template

• Before adding the logic of the new module, we create the template to be filled with the correct JSON.







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ParkingSearcher Module Template

• Before adding the logic of the new module, we create the template to be filled with the correct JSON.







Create ParkingSearcher Module

The goal of this example is to create a **new module** that in addition to viewing the list of car parks as is already the case for the button named "Car Park" will **show directly** the **number of free parking lots** for each car park found

In ParkingSearcher.js must be made the logic that **retrieves data** from API describer in previous presentations and creates the **JSON** to fill the **template** and generate the new menu





• The following API returns **the list of parking** that are located at a maximum distance of 300 meters from the location sent. The list is limited to 100 items.

http://www.disit.org/ServiceMap/api/v1/? selection=43.7778;11.2481& categories=Car_park& maxResults=100& maxDists=0.3& format=json& lang=it& geometry=true





• The returned data are not sufficient to create the final JSON, because these **data are lacking** on the realtime information

▼ object {1}	-
▼ Services {3}	
fullCount: 5	
type : FeatureCollection	
▼ features [5]	There are data from all car
 ▼ 0 {4} ▼ geometry {2} 	parks nearby, but there are
type : Point	four properties that are
▶ coordinates [2]	rew properties that are
type : Feature	received
name : Garage La Stazione Spa	
tipo : Parcheggio_auto	
typeLabel : Parcheggio auto	
serviceType : TransferServiceAndRenting_Car_park	
hasGeometry : 🗌 false	
<pre>serviceUri : http://www.disit.org/km4city/resource/RT04801702315P0</pre>	
multimedia : value	
id : 1	
▶ 1 {4}	





• The following API which returns all information relating to a single service

http://www.disit.org/ServiceMap/api/v1/? serviceUri=http://www.disit.org/km4city/resource/RT04801702315PO& format=json& lang=it





• The returned data are not sufficient to create the final JSON, because these data are **relative to only one car park**

▼ object {2}	
▼ Service {2}	
type : FeatureCollection	
▼ features [1]	
▼ 0 {4}	The
▶ geometry {2}	
type : Feature	nea
▶ properties {26}	ma
id : 1	
▼ realtµme {2}	
▶ head {2}	
▼ results {1}	
<pre>v bindings [1]</pre>	
▼ 0 {6}	
▶ capacity {1}	
freeParkingLots {1}	
value : 282	
occupiedParkingLots {1}	
▶ occupancy {1}	
▶ status {1}	
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There are data from **one car parks nearby**, but there are **many properties** that are received





 The idea is to call the first API that returns the complete list of nearby car park, and for each car park in the list call the second API that returns detailed information with the number of free parking lots





• The first API can be call in the app with the following functions

search: function(){

var parkingQuery = QueryManager.createCategoriesQuery(['Car_park'], SearchManager.searchCenter, "user"); APIClient.executeQuery(parkingQuery,ParkingSearcher.searchInformationForEachFeature,ParkingSearcher.errorQuery);

http://www.disit.org/ServiceMap/api/v1/? selection=43.7778;11.2481& categories=Car_park& maxResults=100& maxDists=0.3& format=json& lang=it& geometry=true

The **first function** creates the string that contains the **parameters** from "?" to the end.

The **second function** adds the URL of the API and makes the call. When the data has been received calls the error or success callback.





• The second API can be call in the app with the following functions



For each car park listed is called the API that returns details.

If there is **no car park** in the list is called a function which **doubles the radius** of the search area **until at least one car park is in the list** or the radius is greater than 200 km





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ParkingSearcher Module Logic

• The number of free parking lots is copied **from realtime object in the properties** to make writing the template easier. Is also added as a property a string that identifies the **text color** based on the number of free parking lots







```
successQuery: function (response) {
   var responseObject = response;
   if (SearchManager.typeOfSearchCenter == "selectedServiceMarker") {
       MapManager.searchOnSelectedServiceMarker = true;
   for (var i = 0; i < responseObject["Results"].features.length; i++) {</pre>
       responseObject["Results"].features[i].id = i;
       Utility.enrichService(responseObject["Results"].features[i], i);
   if (responseObject["Results"].features[0].properties.distanceFromSearchCenter != null) {
       responseObject["Results"].features.sort(function (a, b) {
            return a.properties.distanceFromSearchCenter - b.properties.distanceFromSearchCenter
       });
   } else {
       responseObject["Results"].features.sort(function (a, b) {
            return a.properties.distanceFromGPS - b.properties.distanceFromGPS
       });
   ParkingSearcher.results = responseObject["Results"];
   ParkingSearcher.refreshMenu();
   ParkingSearcher.show();
   MapManager.addGeoJSONLayer(responseObject);
   ParkingSearcher.resetSearch();
```

This is the **function** that receives the **end JSON** and shows it to the user, by creating the marker on the map and **populating** the **list** through the **template**.

The JSON is enriched with additional information such as distance from GPS or from a manual search and list is sorted according to these values.

```
},
```





ParkingSearcher Module Template

 This is the final template that allows you to show the user a list of car parks in its vicinity with an indication of the number of free parking lots







ParkingSearcher in main menu

• Final version of the button with call to module logic



The search function of the variable SearchManager **asks the user where want search** (GPS, Manual or Last Service) and then call the **search function** of the variable which is passed as string

parkingSearcher.principalMenu.json





ParkingSearcher Module Finished











For the creation of the app through the modules it is necessary to compile it with grunt before doing it with Cordova







Inside the root folder of the Sii Mobility App Kit there is a gruntfile.js which will merge the js and json files as described inside it. Inside the root there is also a node_modules directory within which there must necessarily be these folders containing the plugins useful for merging files.

Gruntfile









To compile the files, the grunt command must be launched on the open terminal in the project root If everything works properly the screen that should appear is as follows. If some package is missing it can be installed with the npm i packagename command. If disit-json-merger is missing download it from <u>https://github.com/disit/siiMobilityAppKit/tree/master/node_modules/disit-</u>

json-merger

nning "concat:dist" (concat) task

Running "concat:allTogether" (concat) task

tunning "clean:0" (clean) task
> 1 path cleaned.

Running "disit-json-merger:singleTemplate" (disit-json-merger) task File "www/js/build/singleTemplate.json" created.

Running "json-merger:ita" (json-merger) task File "www/js/build/labels.ita.json" created.

Running "ison-merger:eng" (ison-merger) task File "www/js/build/labels.eng.json" created.

Running "ison-merger:deu" (ison-merger) task File "www/js/build/labels.deu.json" created.

Running "json-merger:esp" (json-merger) task File "www/js/build/labels.esp.json" created.

tunning "json-merger:fra" (json-merger) task ile "www/js/build/labels.fra.json" created.







Gruntfile

If the grunt command was successful as in the image of the previous slide then the command Cordova build android can be launched and if all goes well you will have a screen like the following one

> :compileDebugSources :transformClassesWithDexBuilderForDebug :transformDexArchiveWithExternalLibsDexMergerForDebug :transformDexArchiveWithDexMergerForDebug :transformNativeLibsWithMergeJniLibsForDebug :transformResourcesWithMergeJavaResForDebug :packageDebug :assembleDebug :cdvBuildDebug

BUILD SUCCESSFUL in 1m 54s 44 actionable tasks: 44 executed Built the following apk(s): C:/Users/badii.DISIT/Lavoro/workspace/siiMobilityAppKit/ apk





Further readings

- <u>TC5.16</u>. Exploiting Smart City API for developing Mobile and Web Apps
- TC5.15. Snap4City Smart City API Collection and overview, real time
- <u>TC5.17.</u> Search on Services via Smart City API: MicroApplication, <u>Exploiting Micro Applications in HTML5 based on Advanced Smart City</u> <u>API</u>
- <u>TC5.18</u>. <u>Snap4City API are documented in Swagger, and tested in</u> <u>Postman</u>
- <u>TC5.19</u>. Using ServiceMap as a Tools for Developing web and mobile apps and micro applications

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What is missing here and you can find in the former course <u>https://www.snap4city.org/577</u>

- Data Streams from partecipatory, Mobile App
- Data streams from Mobile vehicles
 and smart phones Devices
- Data Ingestion via Web Scraping
- Data stream from TV Cameras, TV Cam Manager
- Social Media interoperability

- Another Complete Example
- BlockChain models and devices in Snap4City (new feature)
 - **Orion Broker:**
 - Services/SrvPath and Multitenant
- External and Internal Brokers,
 - External Broker harvesting
- Managing Node-RED on edge from cloud
- More on: Security of Snap4City Stack from device to dashboards
- VM based installation of Snap4City
- ETL: Penthao Kettle interoperability

https://www.snap4city.org/944

On Line Training Material (free of charge)









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Note on Training Material

- Course 2023: <u>https://www.snap4city.org/944</u>
 - Introductionary course to Snap4City technology
- Course https://www.snap4city.org/577
 - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology
- Documentation includes a deeper round of details
 - Snap4City Platform Overview:
 - <u>https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf</u>
 - Development Life Cycle:
 - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
 - Client Side Business Logic:
 - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- On line cases and documentation:
 - <u>https://www.snap4city.org/108</u>
 - <u>https://www.snap4city.org/78</u>
 - <u>https://www.snap4city.org/426</u>

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- 📜 Knowledge and Maps 💌
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- Entity Directory and Devices
- Resource Manager
- Development Tools
- 🚳 Management 🔻
- Decision Support Systems
- Deploy and Installation
- Help and Contacts 💌
- Documentation and Articles
- 💧 My Profile 🔻
- Km4City portal
- DISIT Lab portal

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2023 booklets

• Smart City





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• Artificial Intelligence





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 https://www.snap4city. org/drupal/sites/default /files/files/Snap4City-PlatformOverview.pdf



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Development https://www.snap4city.org/d ownload/video/Snap4Tech-**Development-Life-Cycle.pdf**









<u>Client Side Business Logic</u>

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Client-Side Business Logic Widget Manual

From Snap4City:

- We suggest you read <u>https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf</u>
- We suggest you read the TECHNICAL OVERVIEW:
 bttps://www.apaptoity.org/doupload/uidao/S
 - https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- slides go to https://www.snap4city.org/577
- https://www.snap4city.org
- <u>https://www.snap4solutions.org</u>
- <u>https://www.snap4industry.org</u>
- <u>https://twitter.com/snap4city</u>
- <u>https://www.facebook.com/snap4city</u>
- https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg

Coordinator: Paolo Nesi, <u>Paolo.nesi@unifi.it</u> DISIT Lab, <u>https://www.disit.org</u> DINFO dept of University of Florence, Via S. Marta 3, 50139, Firenze, Italy Phone: +39-335-5668674



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SMART CITIES AND SMART INDUSTRY

Snap4City: FIWARE powered smart app builder for sentient cities



Commercial Overview



<u>https://fiware-</u>
 <u>foundation.medium.com/snap4</u>
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 <u>builder-for-sentient-cities-</u>
 <u>acfe24df49d5</u>

 <u>https://www.snap4city.org/drup</u> <u>al/sites/default/files/files/FF_Im</u>
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