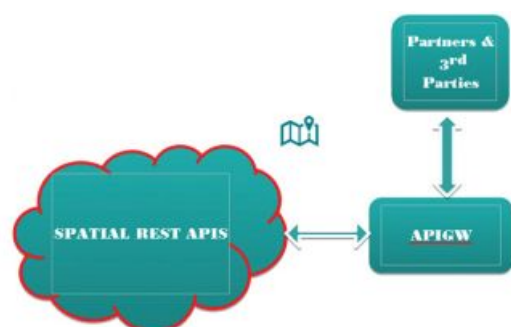# The Importance of REST APIs for 5G Network Technology

The use of technology to communicate fulfils an innate human need to connect with loved ones across geographies. Since the first telephone was invented in 1877, the demand for communication has been ever-growing.

141 years on from this achievement, Information and Communications Technology (ICT) is a very dynamic and fast-moving field and one which is becoming more and more intertwined with the geospatial industry, with geospatial, telecommunications, and Big Data industries beginning to converge in a significant way.

End users and businesses are constantly seeking more from the telecommunications industry and, interestingly enough, vice-versa. On the one hand, end users request personalised services, better performance and user experience; on the other hand, businesses need to get more information about their consumers in easier and secure ways.

According to International Telecommunication Union (ITU), 2018; the emerging trends within the ICT sector, which the geospatial industry has already established a presence, are; 5G, Artificial Intelligence (AI), Cloud, Internet of Things (IoT), Big Data, Smart Cities, VR/AR and Open Source. These services bring together people along with components such as data, applications, transport systems and cities in a smart networked communications environment.

This article focuses specifically on 5G, which refers to the fifth-generation mobile network. 5G is an IP based model designed for wireless and mobile networks which offers more reliable, ultrafast and low latency mobile connections. Facilitated by the use of mapping technology, 5G expected to be rolled out across many developed countries in 2020's.

In the United States, for example, organisations such as AT&T and Verizon have tested 5G delivery methods for the primary purpose of improving speed and capacity for mobile broadband. Meanwhile, in the UK, Ofcom, the UK's communications regulator, predicts that 5G will help innovation and improve productivity for a variety of sectors such as manufacturing, healthcare and transport.

With 5G offering greater possibilities for more accurate and timely data, more devices to collect the data across a broad range of sectors (energy, health, agriculture etc.), and faster response to meet the needs of the people, society appears to be entering a new paradigm. Aryaputra (2011) calls this 5G world the Wireless World Wide Web Applications (WWWW), wherein uninterrupted access to the internet means that space and time are no longer the constraints they once were. According to Fuetsch, A. President and CTO of AT&T Labs "the world is eager to see what 5G can do. And, all we can do is make sure we have networks that are ready for whatever developers, businesses and consumers want to throw at us."

What are Application Programming Interfaces?

The rollout of 5G networks will, however, not be an easy process - not just from a physical, infrastructural point of view, but from an interoperable angle also. The ITU Focus Group, for example, emphasises the importance of Application Programming Interfaces (APIs) to the 5G ecosystem - something which will allow applications and services to program network functions.

In layperson's terms, APIs (Open or Private) are technologies that allow applications to talk to one another, and they are critical

to powering complex apps as they give organisations the ability to connect systems and share data. Meanwhile, Oracle, the developer behind an integrated stack of cloud applications and platform services, stresses that APIs make it possible for organisations to open their backend data and functionality for providing interoperability, fostering software reuse and reducing programming effort.

APIs in GIS World

So, what does all of this have to do with the GIS world? Well, as an emerging trend in GIS, APIs have become very important, particularly across governments which require integration of vast amounts of information. Government-centric organisations, such as Scotland's Environment, Spatial Northern Ireland's Land and Property Services and Britain's Ordnance Survey have, as examples, implemented APIs (Restful style) for their maps and data services which can be used (consumed) by the public sector and the citizens.

The maps and data services which have been developed by these bodies at the local, regional and national levels form the basis of each countries National Spatial Data Infrastructure (NSDI). The APIs, which have been integrated with web services/microservices, cloud computing, geo-browsers, mash-ups and other web technologies, meanwhile, increase the required flexibility of sharing information.

In case you think that APIs and NSDIs can exist independently of one another, then it is perhaps worth quoting Jack Dangermond, founder and President of Esri, who in 2009, stressed the technical philosophy of NSDI. "The architectural answer for an integrated geospatial framework is creating a network of distributed geospatial services that can be dynamically integrated using open standards and free APIs that can visualise, query, and support advanced applications on the web."

Restful Style APIs

Even the API innovation itself has changed. The term REST API finds its origins in American computer scientist Roy Fielding's PhD dissertation, which was published in 2000. REST, which stands for Representational State Transfer is, contrary to common belief, not an architecture, but rather a set of constraints that, when applied to the design of a system, creates a software architectural style. A RESTful system has main constraints of being a client-server system and stateless. In addition to these constraints; a RESTful system has to support a caching system and be uniformly accessible and layered. It uses a standard URI (Uniform Resource Identifier) that makes a call (Request URL) to a web server like http:// or a specific API domain.

Bringing this back to the above-mentioned geospatial systems, Spatial NI is a web-based portal (client-server system) that facilitates sharing, using and developing geographic information. Its purpose is to allow ease of access to Land & Property Services' (LPS) mapping and geographic information and this is achieved by implementing Restful APIs, wherein their specific URIs are accessible by public services and citizens who demand base maps, land and property information.

Why REST APIs are Important in Telecom (Especially 5G)

The importance of REST APIs to programmers and developers has grown significantly as the geographic web of customers (the public), businesses and government has grown. From a telecoms perspective, 5G is not only about the development of a new radio interface, but also of an end-to-end system, one which includes the "integration and convergence of all network segments with heterogeneous wireless and optical technologies, together with massive cloud computing and storage infrastructures" (Alliance, 2015).

While most traditional distributed, networks and web services which are used for building web applications are unable to cope with and meet current networking requirements of 5G; REST, can cope with 5G's future networking requirements like WWWW. Firstly, for cooperation and sharing information; RESTful Web services not only use the web as a transport medium, but also integrate into it. Secondly, they are lighter and more simple than traditional methods in terms of computation requirements, bandwidth and memory. Thirdly, since HTTP is on charge, they can go through firewalls or proxy web servers (Mayoral et al., 2016 & Mayer, 2018).

Since 5G is about society interconnection; REST is the right software architecture style for ease of programming, ease of collaboration between many parties, and for flexibility supporting multiple vendors and adopting multiple operators.

Usage of REST APIs in Telecom (Mobile Industry)

In terms of the usage of REST APIs by the Telecom (Mobile Industry), they will be critical to the implementation and deployment of new 5G services. According to Ofcom, mobile network operators are going to be the first to implement and deploy 5G and services on their existing websites in order to meet the growing demand for data.

For example, EE Mobile Network Operator's Coverage Checker Application (used for identifying areas with the best 4G Network in the UK) uses REST APIs that let consumers use locator web services (geo-coding) to integrate their current location or point of interest with coverage checker services.

Coverage Checker Application is a customer faced application which is based on REST APIs such as Geo-coding and Coverage Checker Spatial REST APIs. Geo-coding REST API is an Analytical Service in which physical addresses are converted into geographical coordinates and obtained response type as GeoJSON format. However, the integration between REST APIs and geospatial services goes much deeper. The Coverage Checker REST API, for example, serves as a Data Visualisation Service used to request images/tiles via OGC's Web Map Service (WMS) Standards. In this spatial web service;

maps produced by WMS are rendered in a pictorial format (png) in different coverage layers (2G, 3G, 4G, 4G double speed and 4G+) for different geographic extents. The coverage tiles are delivered by Geoserver & Geowebcache by adding up SLDs & Projections and supported by Java EE (Backend) and invoked by Javascript files (Frontend).

These Spatial REST APIs are exposed to 3rd party applications and partners (e.g. BT Mobile) via API Gateway which is the single entry point and responsible for request routing, composition, and protocol translation. By using API Gateway, EE allows her partners to build and maintain their own tools e.g. User interfaces (UI) by just consuming these APIs.

Conclusion

It is predicted that 5G technology will allow flexible, reliable and secure wireless networks to connect people with all applications, services, and "things". With the advent of 5G, new technologies continue to emerge to which we will need to adapt. While adapting these new technologies, there is a need for cooperation and sharing information.

REST APIs are central to this process. They can maximise technology innovation and optimise the efficiency of sharing information to deliver value-added services. In this context; for sharing location and addressing data; Geospatial Rest APIs play an important role for the organisations and industries who manage Geographical Information Systems via web-based portals that allow sharing, using and developing geographic information.

In the Telecom industry, for instance, mobile network operators have developed GIS management strategies to prepare for 5G. For achieving this; they have improved their infrastructures by providing Geospatial REST APIs and they let consumers use these location-based web services.

The availability of these REST APIs has allowed the geospatial, telecommunications, and Big Data industries to implement software and services. By embracing REST APIs, these industries will provide smart networked communications environments such as 5G roll out.

With the rollout of 5G, the future is going to be even greater for the GIS industries who want to use GIS and maps by building their own creative maps and sharing them on the web or on mobile devices.

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https://www.gim-international.com/content/article/the-importance-of-rest-apis-for-5g-network-technology