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Connecting citizens: City-wide public Wi-Fi made simple

Nokia AirScale Wi-Fi Solution

Application note

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Abstract

As the world's most popular wireless connectivity technology, Wi-Fi holds huge potential to support smart cities. As well as connecting sensors and devices as part of Internet of Things (IoT) services, free public Wi-Fi access offers everyone better online experiences and closer engagement with the city. Nokia AirScale Wi-Fi supports city public Wi-Fi deployment and operation at minimized cost and delivering high-performance connectivity that enhances the urban experience and helps create the smart city.

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Connecting the smart city

Much has been written about smart cities. About how they will help to solve the issues of growing urbanization. How they can increase the efficiency of transportation, improve public safety, reduce a city's environmental impact and how they can attract visitors and businesses to drive up prosperity.

Connectivity is essential for realizing all these benefits. High-performance, ever-present connectivity will offer citizens compelling new digital services. It will also support the Internet of Things (IoT) that will connect sensors, machines and applications to help cities make the best use of their resources.

This connectivity will need to meet a wide variety of demands, from maximizing sensor battery life to ultra-high throughput speed to ultra-fast response times. The next generation mobile technology, 5G, holds the promise of meeting all these demands to help conventional cities become smart cities, but it will not happen overnight.

The opportunity to transform into a smart city exists today and can be achieved by using current wireless technologies. Deploying these technologies right now will also provide cities with the vital experience and strong foundation for future 5G connectivity.

Wi-Fi comes out into the open

Wi-Fi is the world's most-used wireless connectivity technology. Nokia Bell Labs predicts that, by 2020, Wi-Fi will satisfy two-thirds of global growth in wireless traffic demand. It's a proven, familiar technology that is available in nearly all mobile devices. It doesn't require a city to own spectrum, it's affordable and straightforward to deploy and operate.

Mostly used today to provide indoor connectivity, Wi-Fi holds huge potential for the burgeoning smart city to provide wireless access in the busiest public spaces. Streets, plazas, shopping malls, tourist areas, bus stops, public buildings – the list is long.

Free public Wi-Fi access for citizens and visitors offers everyone, regardless of their economic status and with equal opportunity, the chance to improve their online experiences and become engaged with the city in new ways. Ubiquitous Wi-Fi can also be used to connect sensors as a fast-track way to test and deploy new smart city IoT services.

Europe encourages Wi-Fi for municipalities

The European Commission recognizes the potential of Wi-Fi for public urban spaces. With its Wifi4EU project, funding of 120 million euros is available to around 8,000 municipalities across Europe to deploy free Wi-Fi services in their public venues.

Each selected municipality will receive a voucher to be spent on hardware installations, enabling it to offer free Wi-Fi for a minimum of three years. The infrastructure must use state-of-the-art equipment, be easy to access, appropriately secured, part of an authentication system and enable a high-quality internet experience.

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Providing connectivity exactly where it's needed

Municipalities face many challenges in providing public Wi-Fi.

Among the key challenges is the deployment model to be used. The municipality may want to own its Wi-Fi infrastructure. This brings the advantage of lower total cost of ownership, but brings the drawbacks of higher CAPEX and the need to provide skilled people to operate the service. The alternative is to pay for a service from a provider (ISP). This offers the advantage of no CAPEX, no resources needed and the fact it can be included as part of a package of other services. The drawback is higher OPEX.

Siting the actual Wi-Fi access points is another important consideration. The municipality will want to balance coverage against the number of sites to give the most cost-effective solution. Access points should be high power to provide wide coverage with the fewest possible sites.

The actual sites could be wholly based on the municipality's existing properties in the case of owning its own Wi-Fi infrastructure or making use of the sites owned by an ISP.

A further challenge facing deployment is the provision of backhaul to link the Wi-Fi access points to a centralized controller and the internet. Running Ethernet cables to every point of deployment is one possibility, particularly if such connectivity already exists or is easily accessible close to the access points. However, if this is not the case, such a solution may be considered as being too costly or impracticable.

However, in many instances the Wi-Fi access point can be deployed on the same site as an existing macrocellular network base station or small cell, simply sharing the existing backhaul network.

If Wi-Fi access points need to be installed where no cellular sites exist, or if collaboration between the municipality and mobile network operator is not feasible, then access point mesh networking can also be used. This simple, flexible approach involves individual Wi-Fi access points connecting with each other wirelessly to carry user traffic to a root access point with an Ethernet cable connection to the backhaul network.

They should also be small and unobtrusive to blend in with urban environments without any added costs for shrouds. And their installation must be easy and rapid without the need for costly on-site preparation.

Once installed, running the network becomes an issue. Resources will be needed to manage and protect the network, resources that municipalities, in particular smaller and medium sized cities, may not have.

Of course, Wi-Fi is not the only available wireless connectivity, nor can it fulfil the comprehensive needs of all smart city applications. But it can provide a powerful, rapidly-deployable, complementary connectivity layer that delivers services alongside operators' 3G and 4G networks.

The latest developments even provide new ways to fit Wi-Fi and LTE together seamlessly. Licensed Assisted Access (LAA) and LTE / Wi-Fi Aggregation (LWA) aggregate LTE in licensed spectrum with either LTE or Wi-Fi on unlicensed technologies. Meanwhile, MulteFire combines the high performance of LTE with the simple deployment of Wi-Fi by allowing LTE to run on unlicensed spectrum to augment outdoor Wi-Fi.

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Nokia AirScale Wi-Fi makes it easy to deploy city-wide Wi-Fi

Nokia AirScale Wi-Fi is built around a complete portfolio of latest generation Wi-Fi access points for outdoor and indoor deployment. These solutions benefit from Nokia's extensive experience in wireless, offering superior coverage or capacity to a city's Wi-Fi network.

In terms of deployment, they simplify a city's Wi-Fi network needs, from installing Wi-Fi access points through to managing the network, solving the challenge of lack of resources.

Once an access point has been physically installed on a site, it only needs to be powered on and connected to the internet. The centralized Wi-Fi controller automatically configures and then manages the access point.

The controller is most often securely hosted in a Nokia data center, together with the authentication server. This arrangement minimizes the city's Total Cost of Ownership and ensures data is secured and handled accordance with local regulatory requirements.

Optimal total cost of ownership and predictable OPEX are achieved through the pay-as-you=grow model, allowing costs to be kept under control.

The components of a complete solution

Nokia AirScale Wi-Fi Access Points: indoor and outdoor access points implement the latest 802.11ac standard and support up to four-stream multiple input multiple output (MIMO) with up to 160 MHz channel bandwidth for high throughput. The result is ten-fold more bandwidth than most current Wi-Fi networks while simultaneously supporting older Wi-Fi devices. Hotspot 2.0 technology lets devices automatically discover and access the Wi-Fi network.

For the busiest locations, the access points use automatic channel assignment to ensure traffic is balanced across the network to give every device the best connection. Fast handover and client mobility support ensure service continuity as users or devices move from one access point to another.

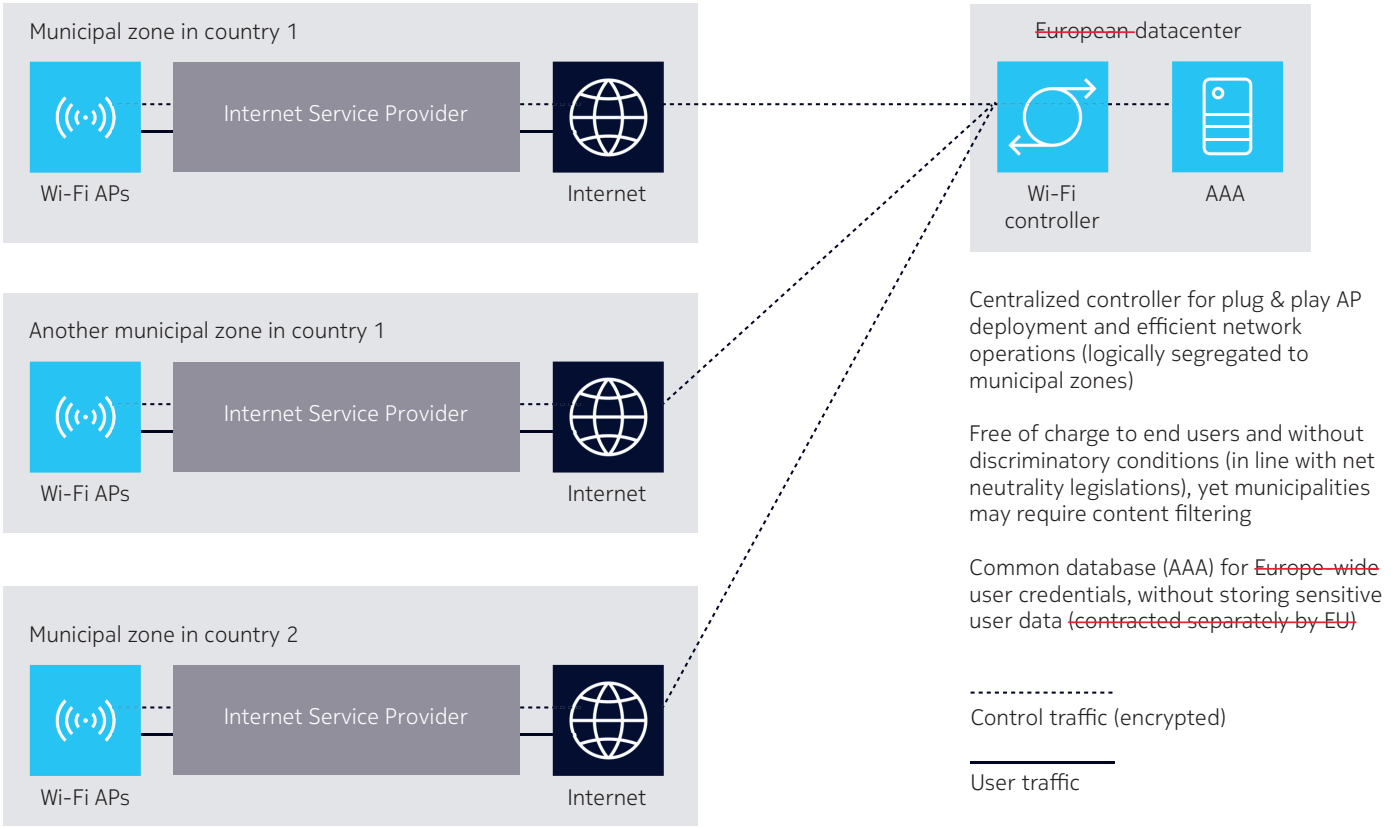
All the access points are compact and feature stylish designs, making them unobtrusive once installed. The outdoor units provide good capacity and coverage for open spaces such as city squares, streets and parks and can be integrated into street furniture such as advertising pillars, bus stops and equipment shelters. The access points can also be deployed inside 4G small cells, physically integrated, yet logically separated.

Nokia AirScale Wi-Fi controller: The Wi-Fi controller can be provided as a 24/7 service from a Nokia data center, with Nokia taking on the responsibility for monitoring, managing and troubleshooting the Wi-Fi network. Alternatively, the controller can be deployed on-premises to support up to 10,000 access points with the city requiring only a web browser and internet access for monitoring the network.

The controller-based architecture simplifies operations and maintenance of the Wi-Fi network because access points are centrally configured, monitored and upgraded with the latest software.

New access points can be added easily, reducing installation time and without the need for specialist skills. As the network grows to beyond 100 access points, the operational cost savings of the controller-based architecture increase with the size of the network.

The solution features advanced capabilities to detect and protect against malicious activities such as rogue access points that could compromise data security and damage network performance. The controller securely authenticates users for sensitive transactions and critical IoT applications, while Internet Protocol Security (IPSec) can be configured on the bearer plane between access points and a security gateway to securely tunnel traffic.



Captive Portal and Authentication, Authorization and Accounting (AAA): The cost-effective and feature-rich Captive Portal, AAA, policy engine and marketing engine manages user engagement on the network. As well as authenticating users and protecting against unwanted access, it provides a simple, user-friendly dashboard to enable a city to customize Wi-Fi log-in and other aspects of the user experience, as well as measure and analyze traffic and Wi-Fi use.

Captive Portal and Wi-Fi network analytics enable popular access points and data throughput to be identified to aid network expansion and optimization, as well as visitor behavior such as time on the network, location and data use to understand how the network is being used.

Multi-access edge computing (MEC): MEC deploys applications at the edge of the network, close to the location of users. The Nokia MEC platform delivers immersive digital experiences such as augmented reality (great for tourist guide applications), boosts the performance of internet high-definition video and web content and can host IoT applications with demanding latency and bandwidth performance requirements.

Real-time location of Wi-Fi devices is also possible. Users with devices connected to the Wi-Fi network could be sent locally-relevant information to help them find their way around the city or to inform them of local points of interest or even to display advertising to help generate revenue for the city authority.

In addition, teaming up with mobile network operators enables cities to simplify video surveillance based on the operator's LTE network with the city's MEC capabilities being used for real-time video analytics and other smart city use cases.

A more compelling urban experience

Studies have shown that cities investing in public Wi-Fi access gain substantial benefits. More than half of respondents to a European Cities Monitor survey stated that "quality of telecommunications" was a key factor in attracting people and business to cities and investment in this area will generate rewards.

Price Waterhouse Coopers has also determined that, for every euro spent on broadband infrastructure, 14 can be generated for the local economy.

Public Wi-Fi can be used to enhance tourism through augmented reality services, for example. Freely available Wi-Fi connectivity can improve people's experiences and safety in public spaces, such as stadiums, event venues, malls, airports and train stations. Remote monitoring of the condition of assets and city infrastructure, such as bridges, could be supported to reduce costs by minimizing the need for manual inspections.

The next step – connect the city

Nokia AirScale Wi-Fi is a complete solution to support city public Wi-Fi deployment and operation. It minimizes the city's costs and delivers high-performance Wi-Fi connectivity for citizens and visitors, enhancing the urban experience and laying the foundation for the future smart city.

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