




Smart Wi-Fi for Even Smarter Cities

It all starts with a **Connected City**



Smart cities are no longer a dream. Urbanization, demographic shifts, environmental changes, and new technologies are reshaping the way city leaders create and deliver public services –pushing them to use technology more effectively to enrich the quality of life for residents and visitors. The rise of Smart Cities is the response to these challenges.

What's a Smart City?

"Smart City" is a broad term used to describe the use of the latest information communications technology (ICT) to improve public infrastructure and services– fueling economic development and smarter management of natural resources and public services.

The emergence of smart cities today is largely driven by three common goals:

- 1) Improving the efficiency of city operations
- 2) driving a strong local economy and
- 3) increasing citizens' participation in local government.

Instrumental to achieving these goals is harnessing a new world of digital technology and communications infrastructure to first enable a connected city. Today, cities use a variety of infrastructure technologies to satisfy different connectivity requirements such as fiber for backbone connectivity and radio to connect to the users. Radio options include cellular (3G and LTE) for voice and high value data, Wi-Fi for high-capacity indoor and outdoor public access, and 900 MHz for ubiquitous, low bandwidth coverage, typically for sensors and meters.

Smart Wi-Fi: A Basic Building Block for Smart Cities

No single technology is a panacea for every use case and application, however, carrier grade smart Wi-Fi is at the forefront of smart city infrastructure. Given its cost efficiencies, the speed at which it can be deployed and the high bandwidth it delivers, as well as nearly universal support across mobile devices, Smart Wi-Fi is now viewed as a basic building block for enabling the smart city.

Smart Wi-Fi transforms traditional wireless connectivity within unlicensed radio frequencies through the use of advanced capabilities that extend the range, reliability and performance of 802.11 technologies. This allows the network to automatically adapt to environmental changes while optimizing client performance. For smart cities, this means strong wireless connectivity even when large trucks block an AP or crowds pack the street.

Combined with cloud computing, sophisticated analytics software, location-based services, embedded sensors, mobile device applications and new technologies such as Hotspot 2.0, Smart Wi-Fi has become an indispensable tool for helping municipalities achieve smart city status and do many things that were previously impossible or too expensive.

New Applications Driving the Smart City

Cities are leveraging smart Wi-Fi for many applications that go well beyond free public access to the Internet such as e-routing traffic, monitoring air pollution, conserving water, improving public safety and encouraging more direct participation, interaction and collaboration with local

government offered services.

Public Access

Wi-Fi access is an increasingly critical amenity for residents and visitors alike. It can be crucial for visitors, who may need ongoing access for navigation and sightseeing support, especially if they are traveling internationally and want to avoid outrageous roaming charges. But it is also important for residents. Nearly every city is seeking to ensure universal internet access, and Wi-Fi offers the most rapid and inexpensive option for this.

While Wi-Fi is typically a free amenity, it can still offer a number of direct benefits to the city. Ruckus's SPoT location services can provide rich footfall analytics to help plan and deploy public safety staff, as well as support city planning activities. In-browser messaging provides a new way to communicate with citizens and can serve as a platform to promote local activities and businesses as well as deliver information on location-relevant city services. Many cities will even offer a premium-tier of service for a small fee to help fund network operation and expansion.

Traffic control

Wi-Fi enabled video cameras mounted at intersections, sensors everywhere and cloud-based analytics software that cars and even people are using gives cities a more accurate picture of traffic flows and congestion at different times of the day and different days of the week. This data allows urban planners to detect shifts in traffic patterns and to make decisions concerning, among other things, where and when to plan activities or the traffic impact on fees that developers should be required to pay. Wi-Fi based traffic management systems can even dynamically adjust the timing of traffic lights at intersections to ease traffic jams.

Parking

Studies have shown that as much as 30% of the traffic in some locations consists of drivers looking for a parking spot. New parking solutions can leverage IP video to identify available parking spots and share this information either via digital signage or a mobile app, thus providing a major benefit to drivers while also reducing traffic. On the enforcement side, these solutions can identify exactly when a car enters or leaves a space, enabling much more efficient enforcement and again, providing information that can be useful to drivers such as, for instance, reminding them that they have 10 minutes left on their meter.

Environmental protection and water conservation

Population growth and climate change have made water conservation a major issue for cities. Smart Wi-Fi technology; together with sensors and cloud-based software help cities to begin addressing these issues more proactively. The installation of wireless sensors in water pipes allows the city to establish a baseline for water flow rates. When the city detects an increase in the flow rate, it can send inspectors immediately to spot the water leak and repair it. Smart cities can also make use of air quality sensors that wirelessly transmit data to city servers, which allow urban planners to adjust zoning permits and impose regulations to achieve compliance with

federal and state air quality laws. These systems not only determine the type of pollutants in the air, but also where these pollutants predominate.

Public Safety

Wi-Fi has long been part of a city's public safety infrastructure. Wi-Fi-enabled video cameras already exist in many cities, not only at traffic intersections, but also in parks, near ATMs and schools, and in downtown areas. But with faster data transmission speeds, better video quality, improved facial recognition software, and cloud-based analytics much more is now possible. Cities are now using Wi-Fi not only to download video from police cars but are also trialing projects involving the use of wireless-enabled body-mounted cameras on police officers that enables video data to be automatically downloaded, stored and analyzed by cloud-based services.

An Explosion of New Data to Transport

Footfall video from IP-based cameras, transponders collecting highway tolls and thousands of sensors sprinkled all around the city are creating vast amounts of new data about city operations that must be transported back to the primary data center. Trenching streets to run more fiber cabling is not economically feasible for most cities. This has placed a spotlight on the use of carrier-class Wi-Fi products and technologies that deliver both the capacity and reliability needed to support these new requirements. Smart Wi-Fi infrastructure is considered an ideal solution for addressing this data explosion quickly and cost-effectively.

Ruckus Smart Wi-Fi for Smarter Cities

Beyond conventional Wi-Fi technology, originally conceived as a technology of convenience for consumers, Ruckus Smart Wi-Fi employs a range of new capabilities, not available in traditional Wi-Fi systems, that are essential to the development of smart cities. When coupled with cloud-based applications, analytics engines and the "Internet of Things", Smart Wi-Fi allows a city to more easily, efficiently and economically collect and analyze all kinds of data to make better decisions about urban planning, city property management and budgets.

Adaptive antenna switching

Advanced directional smart antenna arrays now allow for RF transmissions to be focused and automatically directed over the best signal paths to deliver the highest speeds with the least amount of interference and packet loss. This extends the coverage range of each access point and enables stronger signals, which is essential for smartphones with limited battery power.

Reliable wireless meshing

Smart wireless meshing creates adaptable, strong and reliable point-to-point or point-to-multipoint backhaul connections between access points. This eliminates the costly and cumbersome requirement to run copper or fiber to every access point, thereby radically

simplifying the deployment process while at the same time reducing the cost.

Smart access management

Cloud-based access management lets cities gather valuable user demographics while providing the ability to easily customize and control the client experience with sophisticated facilities to engage residents and visitors more proactively using messages, information or advertising that can be completely customized.

Highly scalable location services

Location-based Wi-Fi services now give cities access to a rich set of analytics about client location, density and usage patterns. This allows cities to better understand and analyze user behavior and footfall trends, particularly in locations where traditional location services or new beacon technology doesn't always work well or is cost-prohibitive.

SPoT Analytics



Seamless, secure Wi-Fi provisioning

Hotspot 2.0 automates the tedious provisioning of Wi-Fi connections, allowing Hotspot 2.0-capable smart mobile devices to automatically authenticate and securely connect to the Wi-Fi infrastructure with little or no human intervention.

With Smart Wi-Fi, the development of smart cities is no longer a question of how, what or why, but when.

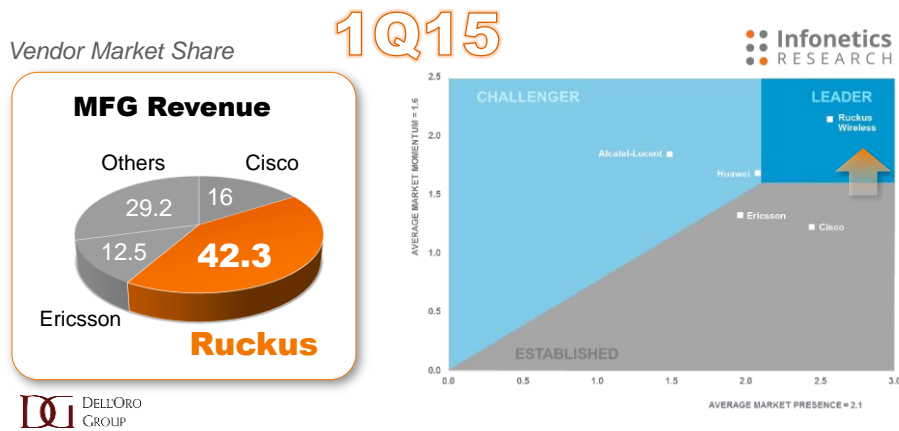
Leader in Carrier Class Wi-Fi solutions

As large service providers (SPs), including both mobile network operators (MNOs) and cable multiple system operators (MSOs) turn to Wi-Fi to offload 3G/4G traffic and to provide a valuable amenity to attract subscribers and reduce churn, they apply an entirely new level of due

diligence to Wi-Fi infrastructure. Accustomed to deploying network infrastructure with 20-30 year lifespans, SPs perform rigorous performance, management and reliability testing to all network gear.

Ruckus is the clear leader for SP and outdoor Wi-Fi deployments.

THE Leader in Carrier Wi-Fi

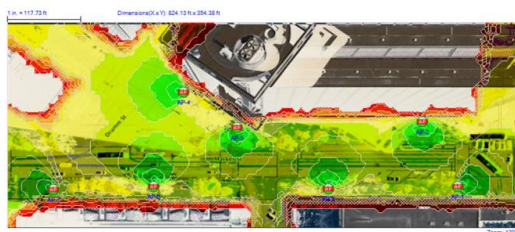


Focused Wi-Fi Expertise

Ruckus is purely focused on Wi-Fi. All of our R&D, engineering, development, testing, professional services, channel partners are Wi-Fi oriented, as well as 100% of our revenue. We help customer solve the most challenging, mission critical wireless connectivity challenges and continuously improve our knowledgebase for how to successfully deploy, manage and monetize Wi-Fi networks.

For cities, this means expertise in where to target deployments and how to design and plan network installs. Most of the time this means selecting specific areas or zones for Wi-Fi

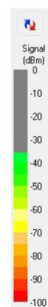
Location #1 Embarcadero to Drum Predictive Design



Location #1 Embarcadero to Drum Predictive Channel Plan



coverage, and conducting site surveys to understand the RF environment and what is needed to ensure strong, pervasive Wi-Fi connectivity.



Scalable Wi-Fi Management

Ruckus has worked with cities and service providers to deploy networks with over 100,000 access points. Strong management is critical to ensure high service quality and minimize ongoing operational costs. The Ruckus SmartZone software platform provides a tremendous level of flexibility: scaling up to 300,000 devices, offering single and multi-tenancy, as well as ‘WiFi-as-you-grow’ — the capability for your network to expand with and adapt to the changing needs of your business.

Ruckus Wi-Fi offers an ideal platform for immediate city services, as well as a robust platform for future opportunities and applications. That is why it is the preferred solution for cities of all sizes around the world. For more information, please go to <https://www.ruckuswireless.com/>.

