



The Role of Public Wi-Fi in Enabling Smart Cities

Business Models and Use Cases for Maximum Impact

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Municipalities Digitally Transforming into Smart Cities

The Smart City Mission: Accelerate the digital transformation of an urban ecosystem to meet environmental, financial and social outcomes

Smart City solutions help address many of the key challenges cities face today, including:

- Economic development
- Sustainably managing strained infrastructure like roads and water
- Reducing the digital divide
- Meeting increasing resident, visitor, and business expectations for a fully connected mobile experience



The Foundation of Smart Cities

Connectivity is a foundational layer to Smart Cities, both for Internet access and new digital services, such as IoT applications

Public Wi-Fi helps achieve
3 Smart City objectives:

1. Provide an amenity for residents, students, visitors, and tourists
2. To bridge the digital divide
3. Enable IoT-based city services



What is Public Wi-Fi?

Public Wi-Fi is wireless connectivity provided by a city, public institution like a library or airport or service provider, to the general public

Public Wi-Fi can be:

- Free or paid for by users
- Indoor or outdoor
- Used by the public (residents, tourists, visitors), businesses, and/or by the city



More than
50%
of all mobile data traffic
is carried by Wi-Fi



Some Wi-Fi First mobile services achieve over 90% offload to Wi-Fi

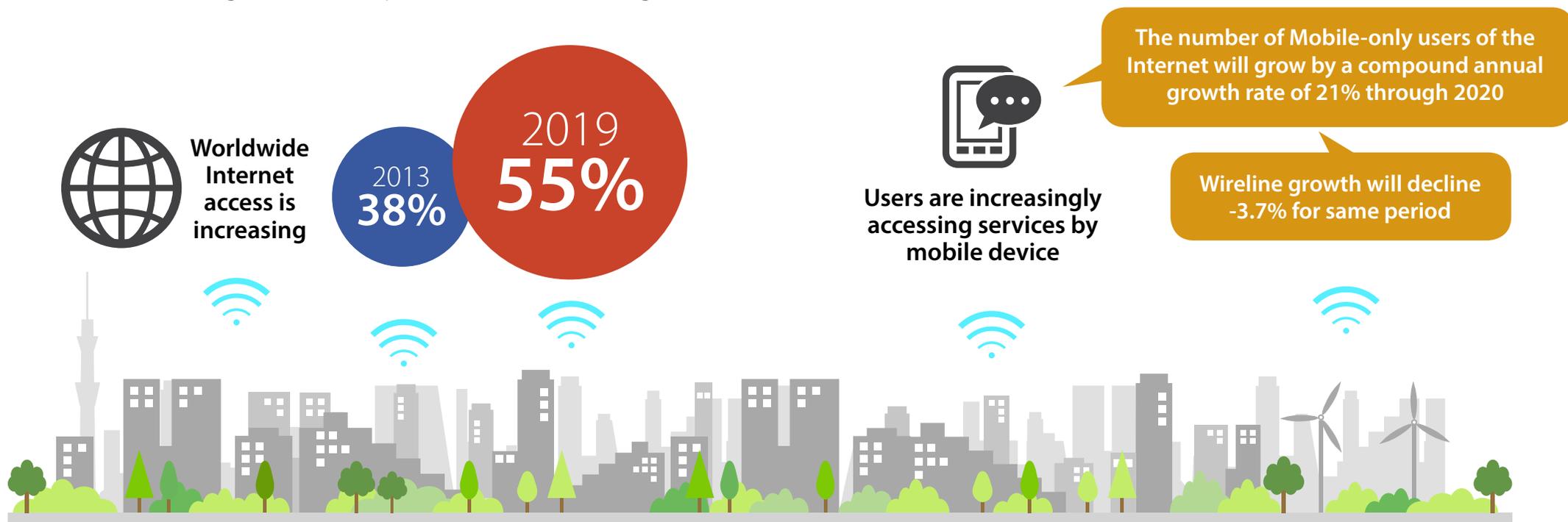


Public Wi-Fi is the most widely deployed Smart City use case

More Services Being Accessed and Provided Online

Current and future digital services trends necessitate Internet connectivity

Lack of Internet access has implications for addressing digital equity. Even in developed markets, 20-30% can't afford broadband access. Internet infrastructure is essential for municipal business investment, and meeting resident expectations/ attracting residents.

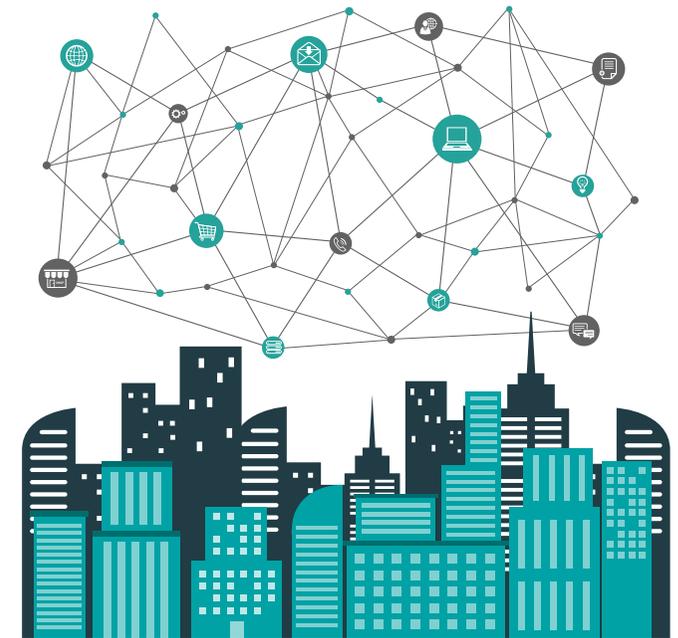


Security and Privacy Are Important Concerns for Municipalities

Attention must be paid to secure networking from device to application

Early public Wi-Fi had little, or no security, poor user experience, and limited coverage. New solutions, and deployments by service providers, cities, and other large operators can deliver:

- Seamless user experience
- Complete end to end encryption
- Much larger Wi-Fi footprint
- User-defined roaming and connection rules
- Higher Wi-Fi network utilization



A single Wi-Fi network becomes a viable option for supporting multiple applications (e.g., IP Video and IoT applications) and private, secure networks for municipal staff, each with its own distinct security and policies

New Services Supported by Wi-Fi Access Points

IP Video: Wi-Fi provides low cost, easy-to-deploy backhaul for IP video applications including surveillance, parking management and traffic control

IoT Gateways: Wi-Fi access points can provide low cost, secure connectivity for IoT applications such as weather and noise sensors, smart buildings and water / waste management.

Bridge for Digital Divide: Wi-Fi is the most cost-effective solution for delivering broadband access to low-income housing.

Networked LED Street Lighting



25-50% reduction in operations and energy costs

Connected Trash Bins



>50% reduction in garbage collection costs

Smart Parking



20-30% cost reductions

Smart Buildings



Payback in less than 6 months

Smart Water



40% clean water loss due to leaks, pipe bursts

Major Smart Cities Projects Facilitate Public Wi-Fi Deployment

Many new city services enable and reduce or offset the cost of public Wi-Fi

Wi-Fi can be deployed with or in LED streetlights to enable low-cost deployments over large areas. Smart trash bins can provide power (solar) and unique siting opportunities to extend Wi-Fi coverage areas.

Digital kiosks and signs can enable Wi-Fi using their existing network connections, and can provide funding to support larger Wi-Fi deployments.



Benefits from Public Wi-Fi

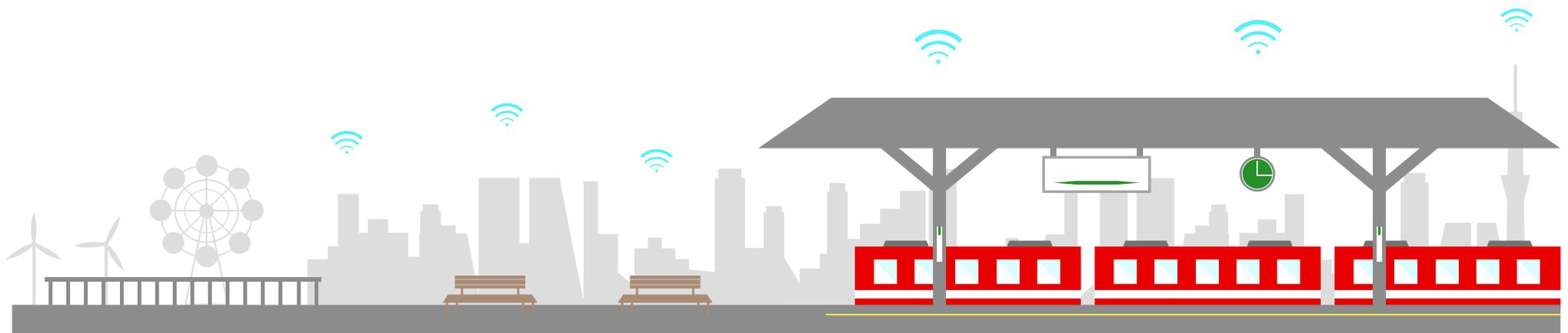
Public Wi-Fi is a sought after service and delivers many hard and soft benefits

Hard benefits:

- Public Wi-Fi networks can reduce the cost of deploying additional new services like
 - » IP Video solutions
 - » IoT solutions
 - » Broadband access in low-income areas

Soft benefits:

- Bridge digital divide
- Improve city/town image
- Improve visitor/resident satisfaction
- Spur economic development



How Can Cities or Service Providers Pay for Public Wi-Fi?

Several proven revenue-generation opportunities can fund or offset cost of Wi-Fi

Advertising

- Cities with a minimum deployment of at least 250 access points (APs) in high-traffic areas can offset some or all of network deployment costs.
- Smaller cities can work with an aggregator to develop critical mass to enable an advertising model

Fee-based premium services

- Offer ad-free or higher bandwidth service for a small daily or monthly fee

Wholesale offload (Boingo, iPass, 3G/4G offload)

- Offer secure roaming via Wi-Fi network aggregators
- As mobile operators return to unlimited data plans, will be more interest in offloading traffic, especially in areas that won't get initial 5G deployments.



Business Model Options: No One Formula

3 main options to fund a public Wi-Fi: All can be used for ubiquitous wireless coverage



City-Funded

City funds the build out of Wi-Fi network by adding new budget line item, being part of a larger infrastructure bond, getting state, federal or non-profit grant money (usually some combination of all of these).

- Approach pursued by many smaller towns and larger cities with specific use cases or needs
- Examples: San Jose, CA, Lincoln, NE, Council Bluff, IA

Offered through Public Private Partnership (PPP)

Formal, contractual relationship, where the city provides defined assets and a private entity deploys and operates the Public Wi-Fi (i.e. Access and streamlined permitting to deploy fiber in return for Public Wi-Fi)

- Examples: LinkNYC, LinkUK

Operator-delivered

Service providers deploy W-Fi, with city approval, and earn back their investment via their own business model, typically using advertising, charges for premium access, and business services

- MSOs can use public Wi-Fi as a churn-reduction method
- Examples: Pinacl in York UK, WiFiLib in France, Boingo in airports. Manhattan's Downtown Alliance offers free Wi-fi funded via advertising on an app promoting local merchants, and provides useful tourist and visitor information.

Questions to Ask to Determine Best Model for Your City

- What is the deployment scope and density?
- What existing infrastructure can be leveraged?

What are the primary objectives of the Wi-Fi network?

- Is it used for public access or city services? Which city services and use cases will it be used for? Future growth / innovation?
 - What wireless backhaul options are required? Fiber, wireless, Wi-Fi mesh...
 - What forms of funding, or maintenance will sustain the system over time? Is charging fees and/ or advertising acceptable?
 - Can you calculate avoided costs, or operational savings for the business case? For example, using Wi-Fi for IP video or using Wi-Fi for secure city staff connectivity cameras avoids cost of running cable.
- Do you want to control the public Wi-Fi asset to ensure it can be used for future city use cases, or are you comfortable allowing a 3rd party to own this infrastructure?
 - Using a 3rd party means the operator may then have first rights to critical city infrastructure and the city can't leverage the Wi-Fi for new services or pilots
 - Can you calculate the benefits accrued by other city agencies?



Case Study: Vail Colorado and York UK

York UK: Deployed and operated by Pinacl Solutions

- For-profit network under city concession
 - Generates revenue via advertising, sponsorships, and footfall analytics
- Can support IP Video backhaul and digital displays
- Using Wi-Fi location based services to generate analytics for the city and local merchants
- Have retained rights for 3G/4G offload

Vail Colorado: City Funded

- Helps meet resident and visitor expectations for a world class town and ski resort
- Supports peak usage for major sporting and cultural events
 - Greater than 60,000 concurrent users
 - Also delivering HD video backhaul
- Improves city workforce efficiency and timeliness via secure network access
- Enables critical IoT applications such as traffic monitoring, snow and river level reporting, and parking management

Case Study: LinkNYC

- **Public Private Partnership to "...promote seamless user experience across public networks to create high-speed access across the boroughs."**
 - City provided assets, right of way and support, in addition to advertising rights
 - CityBridge consortium provided the kiosks, networking and ongoing operations
- **Provides free Gigabit-speed Wi-Fi across all 5 boroughs, as well as**
 - Free domestic phone calls and emergency calls
 - Touchscreen tablets for directory service
 - Public and city service announcements
 - Charging stations for mobile devices
- **Digital kiosks can withstand heat, cold, rain, snow as well as potential vandalism**
 - Can be a platform for several additional services
- **Fully funded by advertising**
 - And will return an additional \$500 million to the City of New York over 12 years

Leveraging Wi-Fi for New Use Cases: Access Points Are Key

Once access points (APs) are mounted, they represent valuable municipal real estate

Location, location, location

- Can provide power and backhaul for new services and pilots

APs as IoT gateway

- Adding BLE, ZigBee, even LoRa to Wi-Fi will position APs as an IoT gateway for many city services and use cases
- Reduce latency, provide redundancy - reduces deployment costs
- Becomes a platform for rapid, low cost deployments

Case in point: IP Video

- Video cameras are not just for surveillance, they can be used for parking spot locations, traffic monitoring and management, foot traffic analytics, etc.
- The most expensive part of IP video installations for outdoor deployment is running cable for backhaul – Wi-Fi is the solution



APs have lots of capacity for video with full security

Essential Guidance: 5 Steps to Take Toward Public Wi-Fi

1. Determine your key goals and desired outcomes from increased connectivity and Internet access
2. Learn from other successful, and failed, initiatives to tap into best practices
3. Set up key priorities as a framework for deciding on funding model
 - Funding options
 - Existing infrastructure
 - Competencies for contract governance or internal expertise
4. Develop the business case: costs incurred, measurable outcomes—including cost avoidance, social benefits, operational efficiencies
5. Research funding sources, from PPPs to grants

