WHITE PAPER

THE FUTURE OF FINTECH: IMPLICATIONS OF 5G FOR FINANCIAL SERVICES

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Executive summary

5G is the next generation of wireless data networks that will form the bridge between our hyper-connected world and the future of digital transformation. 5G represents a vast expansion of the information superhighway, making new bandwidth available at two to 10x the rate of 4G. 5G expands cellular network capacity, transforming consumer experiences on mobile devices by making more broadband data available at home, in the car and virtually everywhere.

5G is critical infrastructure setting a new digital foundation for business. 5G is touted for familiar consumer benefits like powering virtual reality applications, but it delivers much more than faster video games. 5G offers enterprise-strength infrastructure for FIS® – and our competitors – to advance core business capabilities like high-frequency trading, real-time analysis of payment transactions for fraud and leveraging artificial intelligence to administer web chat bots.

5G delivers three leading benefits over 4G: more data bandwidth at higher speeds that are capable of supporting many more devices.

1. **More bandwidth to send and receive (much) more data.** 5G can handle up to 1 gigabit per second (Gbps), offering data throughput upwards of 10x the 4G maximum of 100 megabits per second (Mbps).

2. **Lower latency so data travels (much) faster.** 4G offers 100 millisecond response delay, or latency. 5G reaction time can be as low as a single millisecond for performance that exceeds customer expectations,

3. **High device density means 5G performs under heavy use.** 5G supports upwards of 10x the number of simultaneously device connections, delivering superior performance anywhere people gather in large numbers.

5G will help FIS and our customers leverage cloud investments, improve customer experiences and innovate to meet the future as it reaches for the present. Getting the most out of 5G requires a proactive commitment by company leadership to prioritize developments that utilize 5G to ensure the company maintains a competitive advantage.

"5G will improve mobile apps and remote banking with richer media communications and more instantaneous services. Faster throughput speeds and lower latency will accelerate credit approvals, improve customer service via chat or virtual assistants, and increase the security of mobile payments and transfers while reducing friction."

-eMarketer report, "5G and Financial Services," March 2021

Enterprise 5G overview

5G is fast becoming an anchor technology in digital transformation. Enterprise businesses are including 5G in their development roadmaps to reduce costs, boost operational efficiency and improve customer experiences. Leveraging 5G's capabilities will become increasingly necessary – and timely – as use of the technology becomes the norm with technology partners, financial service providers and customers.

The transformative power of 5G will benefit enterprise businesses that use 5G to leverage investments in cloud services, realize the potential of the Internet of Things (IoT), and utilize data at the scale and speed the future demands.

Leveraging investments in the cloud

The cloud is essential infrastructure for virtually all enterprise organizations. 5G's enhanced security, expanded bandwidth and cost effectiveness are optimized to leverage the cloud's existing value while overcoming latency challenges. 5G enables mobile edge computing (MEC) to position data where it's needed.

5G also enables network slicing, expanding bandwidth by simultaneously supporting multiple logical and virtualized networks over a common physical infrastructure. Using network slicing, software-defined networking (SDN) and network functions virtualization (NFV), 5G-leased lines are expandable to handle a variety of situations with a single network, allowing operators to provide integrated services that increase revenue.

Realizing the potential of IoT

Many IoT applications are hitting bandwidth limits of 4G wireless technology, including smart grid, smart building and location monitoring. 5G overcomes 4G's bandwidth limitations with network slicing and service-based architecture, while massive machine type communications (mMTC) allows the network to accommodate high-density IoT installations.

5G-based connectivity delivers comprehensive end-to-end security infrastructure to combat cyberattacks or manipulation. Creation of several 5G sub-networks can isolate and further strengthen network security.

Moving data at future scale

5G will deliver more with less, offering a more powerful and more efficient data transmission pipeline. 5G uses small cells, smaller versions of cellular towers that position data and computing resources closer to where they're needed. Though it carries more data faster, 5G doesn't carry data as far. It leverages tweaks to these small cells, like beamforming, to focus transmissions to their intended users rather than broadcast widely.

5G uses a higher band of radio frequencies that offer higher data rates, carrying more data with higher performance.

5G capabilities

5G is exciting technology that benefits consumers and business alike, as shown in figure.[1]

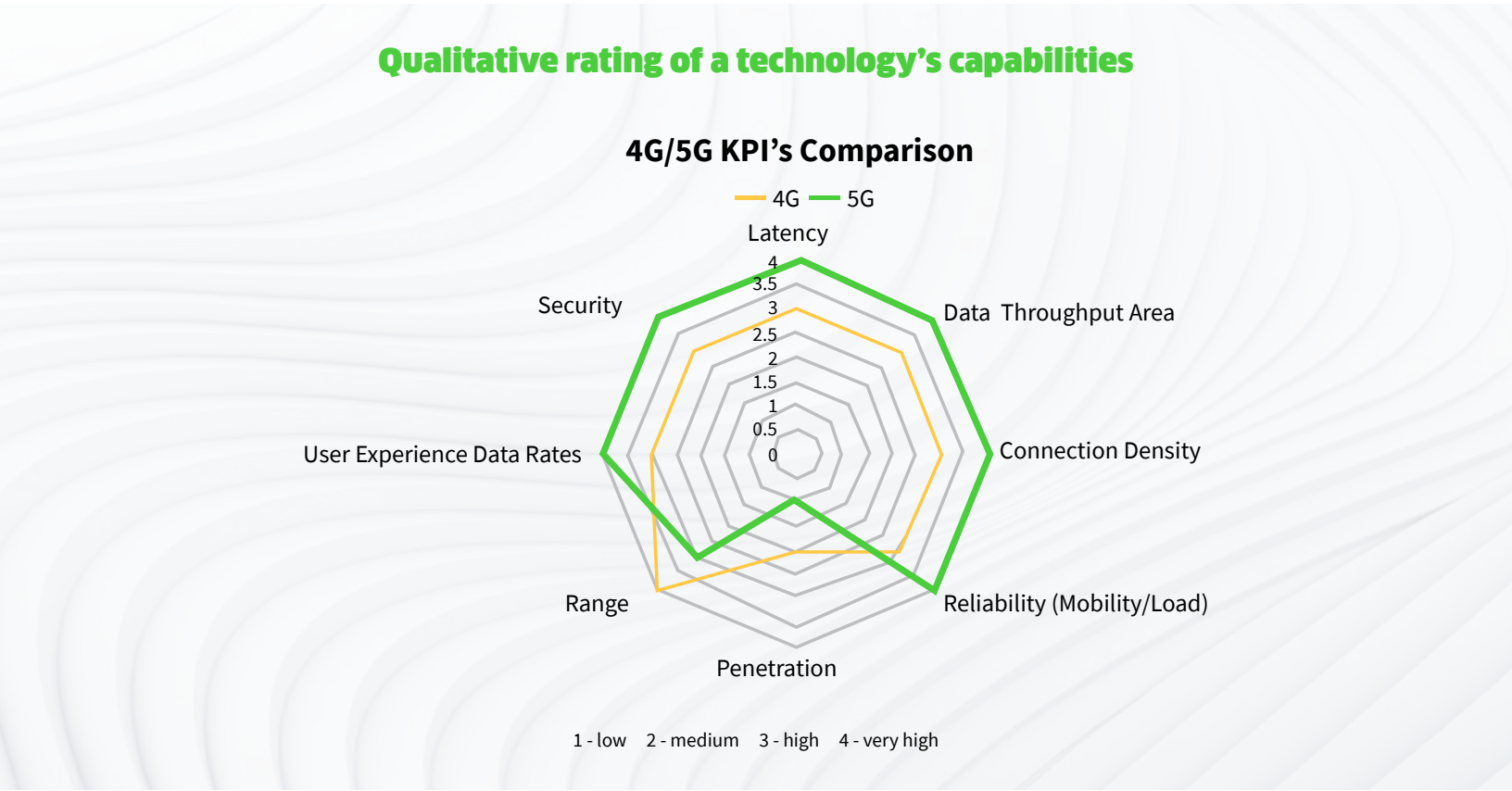


Figure 1: Qualitative rating of 5G

5G offers strong security, low latency and with lower power consumption. 5G's latency is around one millisecond, compared to the 50 milliseconds 4G offers. 5G's massive latency reduction is comparable to hardwired connections. That's great news for Internet of Things (IoT) devices. This IoT support will help enable the 4th industrial revolution in actual practice.

The enhanced mobile broadband (eMBB) category led the market in 2020, with a market share of over 41%. The high percentage is due to 5G network operators' initial focus on offering better broadband capabilities for applications like high-speed cloud-based gaming, AR/VR, UHD video and continuous video conversations. For both home and business use, eMBB offers incredibly fast data speeds. As a result, eMBB is likely to serve a variety of use cases, including in-vehicle entertainment, 4K video access and virtual meetings.

Massive machine-type communications (mMTC) are envisioned as a way to meet the rising need for a well-developed digital environment. mMTC focuses on delivering services for applications that require a high level of connectivity, such as smart buildings and smart cities. The increasing necessity to maintain continuous connectivity for all IoT devices installed in a network is expected to contribute to the expansion of the mMTC sector.

5G fast facts

"The global 5G services market size is expected to grow from USD 53 billion in 2020 to USD 249.2 billion by 2026, at a CAGR of 29.4%"

– Yahoo Finance, March 2021

"IDC expects 5G smartphone shipments to account for more than 40% of global volume in 2021 and grow to 69% in 2025"

– IDC Media Center, March 2021

"The global 5G services market size was valued at USD 41.48 billion in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 46.2% from 2021 to 2028."

–Grand View Research, March 2021

eMBB
(Enhanced mobile broadband)

URLLC
(Ultrareliable and low latency communications)

mMTC
(Massive machine-type communications)

Opportunities for financial services

5G is poised to revolutionize businesses with 10x faster speed than 4G. 5G will enable more connected devices at lower latency, i.e. faster speed. 5G is destined to transform multiple business processes in the finance sector which has become an early adopter of digital technology from ATMs to mobile banking. Consumers are ready, if not eager, to engage this new generation of services.

Let's take a look at how 5G will power and influence the financial industries with wearable devices.

Consumer experience benefits

Consumers get excited about the speed of 5G, and rightfully so. 5G is up to 10x faster than 4G, allowing more devices to perform high-speed, low-latency operations backed by the processing power of the cloud. 5G will allow banking customers to engage with financial institutions over high-definition video conference and solve their queries in real time. ATMs can have a very supplicated biometric process, including the real-time video upload with transactions.

Enhanced analytical capabilities

5G will leverage ultra-low latency to transmit data to more powerful cloud platforms. Enterprises will be able to provide consumers with more insightful real-time recommendations. Demographic, geographic, psychographic and behavioral data will be segmented and processed much more efficiently.

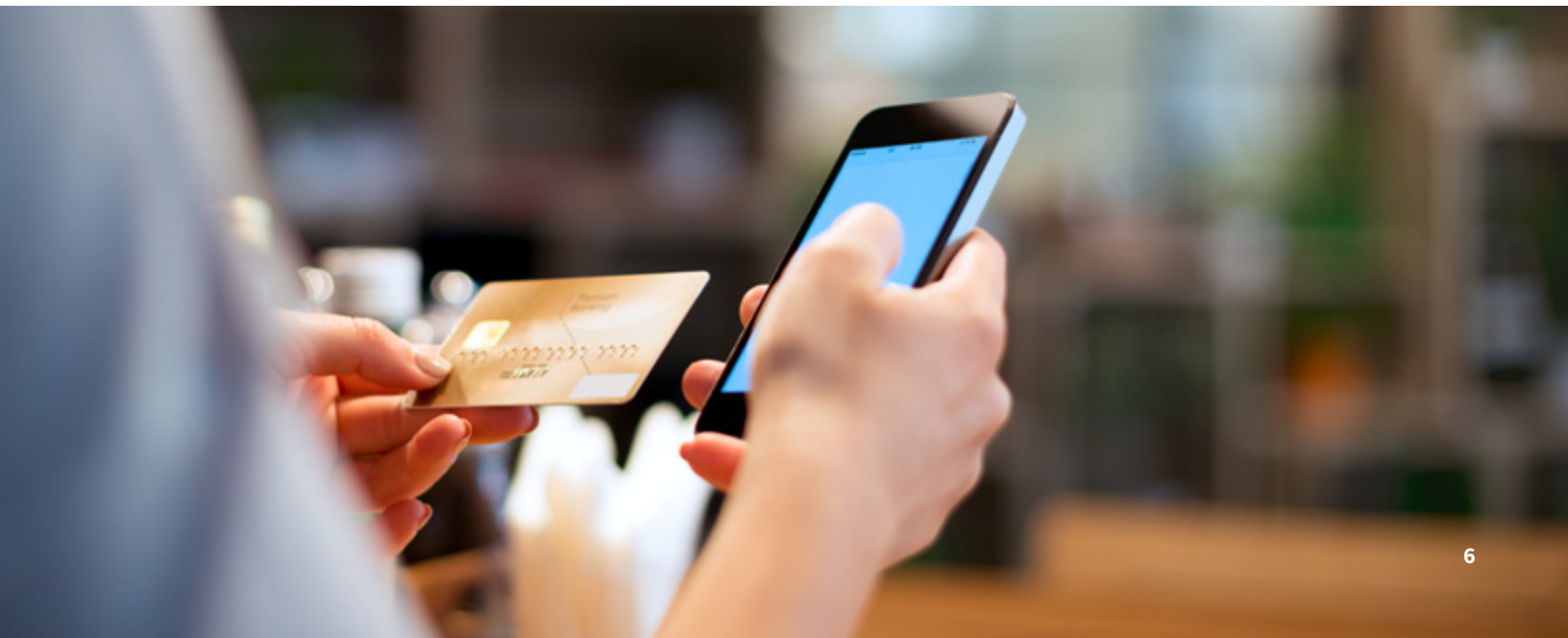
Upgraded multilingual support

Multi-language support services will see a vast expansion in capabilities and performance. Tellers now can interact more easily in real-time with customers who may speak any of dozens of languages. Customer service agents can now interact over 5G networks with near zero lag/latency communication, appearing in effectively real time.

For consumers it would be an overwhelming experience with the banks to be able to communicate faster, safer and more conveniently, while offering financial institutions greater ability to scale service provision even while downsizing branches.

High-frequency trading

Financial establishments commonly purchase real estate as near as viable to the exchange and trading workplaces. They do this to get the trading feeds near light speed. High-frequency trading (HFT). HFT is usually setup via high-speed fiber or terabit ethernet, however 5G can be a greater accessible technology for average consumers. This can be achieved by the using technologies like edge computing.



5G bank benefits

5G mobile phones will act as a thin client with unprecedented processing capabilities. Financial institutions and their partners can leverage powerful lightweight apps to deliver more exceptional user experiences via mobile devices. These new 5G-compatible applications can do the heavy processing in the cloud and get results on the device within milliseconds. With the rise of agile methodology and faster updates, applications can update in the backend or logs can be stored in real time for processing, which will reduce maintenance costs.

Financial institutions are likely to benefit from 5G by providing better consumer experience to grow retention and proportion of wallet. There are also several advantages that 5G can supply to banks that spark elevated performance or lower costs, including ATM networks and leased lines.

ATMs

ATMs offer greater convenience to clients, which plays an important role in retaining clients and providing them with greater satisfaction and comfort. Banks usually try to maintain uninterrupted high times 24x7 to satisfy clients; customers always demand up time or get frustrated, which may also cause revenue loss.
There are many areas where 5G can help institutions in far better ways then the old networking methods:

- **Coverage** – Wide coverage can be achieved by 5G without expensive setups for fiber or DSL.
- **Cost** – The overall cost of the 5G setups is much lower than legacy installations.
- **Maintenance** – 5G can be installed and configured quickly without waiting weeks for fiber line.
- **Secure** – 5G makes communication secure and reliable.

5G leased lines

5G provides fiber-like speed and latency but a far faster deployment period. With this benefit, 5G may be positioned as a fiber-like option for enterprise data networks, with substantially faster provisioning and serving as the principal business-grade option. 5G can also be utilized as a backup or hybrid to provide additional redundancy. 5G can potentially be the principal link in a company's branch network, especially if fiber expansion is difficult, notably in rural areas.

Some of the important technical specs to support 5G and edge infrastructure with cloud-based applications are mobile edge computing (MEC), network function virtualization (NFV) and software defined networking (SDN).

Wearable devices

Wearable digital devices are booming in popularity and represent potential as a significant channel for mobile payments. Legacy wearable devices relied on local authentication, using biometric data like fingerprints to inspect against a new scan each time. 5G technology will authenticate in cloud with more reliability and lower latency than ever before.

Data management

5G's low latency bandwidth offers real-time information gathering and delivery of data including location payment information. 5G will opening doors for introducing more artificial intelligence into personal banking services. Automated financial assistant could remind customers that they are reaching a weekly budget limit. By leveraging high-speed low latency services financial institutions could provide advice that is more precise and matters a lot in getting more customers with 5G experts consider its benefits are expected to exceed beyond customers. By utilizing this technology financial professionals will be able to leverage them in order to create more efficient back up processes.

5G challenges

Enterprise technology readiness

The 5G standard is still comparatively new, having only been completed in 2018. 5G implementation is still restricted despite major network manufacturers such as Ericsson, Nokia and Huawei having solutions at the ready. Network coverage will also be restricted, since carriers typically roll out new technology in phases, taking two to three years to reach the whole country.

The fact that 5G employs a wide range of frequency bands, including the millimeter wave spectrum (mmWave), which encompasses spectrum over 24 GHz, further complicates matters. Because of the short range of this high frequency, which permits massive capacity, 5G networks would require a dense array of network sites employing small cells.

The FCC in the United States made a critical decision in September 2018, mandating that cities and towns approve or deny 5G cell site applications within 90 days. This is a departure from 4G, where local governments had more autonomy and authority. Securing the actual real estate needed to support this will be a challenge, and it is already the source of some controversy. Because of the low coverage, the implementation area will be constrained, affecting the total business outcome.

Uncertain ROI

Game-changing technologies are often misunderstood when launched, and the bulk of 5G vertical application cases are still in early stages of development. To drive deployments and adoptions, network manufacturers and service providers are primarily responsible for these use cases. While 5G will enable various commercial applications, its true value to consumers is unknown until more deployments are made and returns calculated.

Professional services

Professional services are critical to ensuring the effective adoption of 5G for businesses. 5G is more than simply a wireless network technology; it's also a critical enabler for a variety of vertical-specific solutions. 5G applications must be created and adapted to the demands of a certain sector or even an individual company. Service providers must be aware of the key problems and goals of businesses, as well as local regulations.

Security

5G will help address persistent challenge in financial services. The third generation partnership project (3GPP) maintains 5G security standards, including the physical layer in identity management. Because 5G will enable a wide range of industry applications, 3GPP improves 5G security using the Security Assurance Methodology (SECAM).

Standard security, on the other hand, may not be sufficient. The new advantages of 5G (for example, service-based and flexible) come at a price. SDN/NFV's adaptable and programmable characteristics makes 5G networks more vulnerable. The capacity to handle a larger number of devices, particularly in IoT deployments, as well as faster data rates, raises the risk of unwanted access and attacks such as bots and DDoS.

Conclusion: Enterprise recommendations for 5G

It pays to be first

Enterprise businesses should leverage 5G to acquire a first-mover competitive advantage. 5G improves client engagement, increases operational efficiency and saves money. Businesses may use 5G to provide new apps such as mixed reality on mobile devices now that it is available to the general public. This will provide a marketing and branding edge as well as attract new clients, particularly millennials and other tech-savvy consumers.

Platforms for managing network technology complexities

5G will be a critical component of corporate networks. It is employed as the underlying corporate network (such as SD-WAN and mobile branch) as well as a facilitator for new applications (e.g., AR/VR, omnichannel). Businesses should search for a sophisticated network management platform with AI capabilities to ensure maximum uptime, minimal downtime and effective resource utilization.

Leverage service-based architecture

5G expands possibilities for enterprise businesses to collaborate with a broader range of service providers, making it critical for businesses to seek outside established carriers for 5G suppliers. 5G facilitates service-based architecture, with native support for SDN/NFV, APIs and network slicing. Other non-telco providers will now be able to lease a piece of telecommunication providers' 5G networks, combine the capacity with their existing offers and provide 5G-based services to companies, changing the entire value chain of 5G.

Seek collaborative solutions with trusted partners

Collaborative partnerships are critical for ensuring successful deployments and unlocking new breakthroughs in 5G. Most 5G applications are industry-specific, have a strong relation to business outcomes and require professional services. Trusted partners will be essential for successful collaborative deployment of 5G-based solutions.

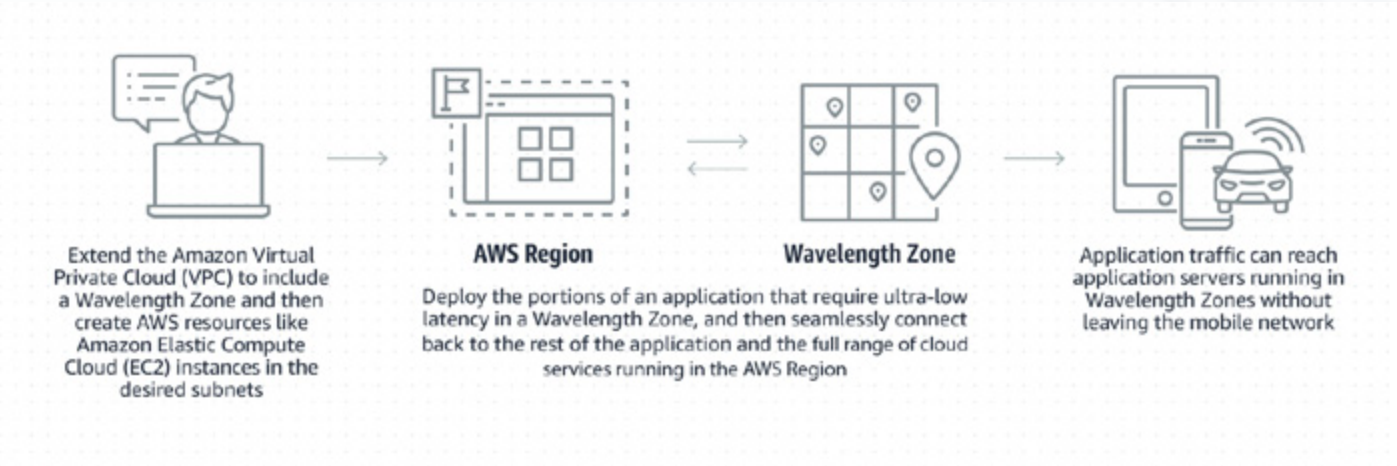
FIS works with enterprise partners to transcend legacy customer-supplier relationships to collaboratively co-develop solutions from inception through deployment. From business case creation through solution development, implementation and service management, FIS helps you achieve your foundational business goals.

Conclusion: Enterprise recommendations for 5G

Appendix: AWS Wavelength

AWS Wavelength combines the high bandwidth and ultra-low latency of 5G networks with AWS compute-and-storage services to enable developers to innovate and build a new class of applications. Wavelength is accessible in the U.S., Japan, South Korea and—soon—Europe.

Wavelength allows AWS cloud applications to access Wavelength Zones. Creating an Amazon virtual private cloud (VPC) to include a Wavelength Zone, a subnet can route traffic through 5G networks.



4 steps to use Wavelength

1. Create a VPC using the Amazon Virtual Private Cloud Console.

2. Create a carrier gateway and a subnet associated with the Wavelength Zone

3. Create and a public subnet in an Availability Zone in the Region

4. Launch an instance for your Wavelength application

1. Use `allocate-address` to allocate a Carrier IP address. For more information, see allocate-address in the *AWS CLI Command Reference*.

Example

```
aws ec2 allocate-address --region us-east-1 --domain vpc --network-border-group us-east-1-wl1-bos-wlz-1
```

Output

```
{
    "AllocationId": "eipalloc-05807b62acEXAMPLE",
    "PublicIpv4Pool": "amazon",
    "NetworkBorderGroup": "us-east-1-wl1-bos-wlz-1",
    "Domain": "vpc",
    "CarrierIp": "155.146.10.111"

}
```

About FIS

FIS is a leading provider of technology solutions for merchants, banks and capital markets firms globally. Our more than 55,000 people are dedicated to advancing the way the world pays, banks and invests by applying our scale, deep expertise and data-driven insights. We help our clients use technology in innovative ways to solve business-critical challenges and deliver superior experiences for their customers. Headquartered in Jacksonville, Florida, FIS is a Fortune 500® company and is a member of Standard & Poor's 500® Index.

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