Architecting a Highly Resilient Global Communications Platform

OVERVIEW OF TWILIO'S SUPER NETWORK

twilio

INTRODUCTION

You know your company's customers want to interact through a variety of channels. To help them do so, let's say you decided to build your own global communications network. Reliably offering voice, messaging, and cellular connectivity for IoT services that's enterprise grade means you'd have to start by selecting, qualifying, onboarding, and managing at least one provider. To get global coverage, you'd probably need a lot more than one provider, however, forcing you to solve the problems of how to integrate them all and ensure you have consistent quality.

Today's world of cloud communications has eliminated much of this complexity with easy-to-use software APIs. Of course, not all communications APIs are created equal. In fact, to be truly robust, a communications API needs to be powered by an underlying network that is reliable and flexible, so it can support your business goals rather than hinder your business growth. That's why it's important to understand the architecture of a communications network before choosing—or trying to create—a communications platform for your business.

In the last 10 years, we've established partnerships with providers all over the globe to build Twilio's all-reaching Super Network. And by weaving together these different networks, we've achieved something greater than the sum of its parts. Our software measures voice quality on every route in real time, letting us choose how to route traffic to consistently deliver the highest quality. Instead of dealing with the outages and service disruptions that are surprisingly common in today's telecom world, you can depend on Twilio's Super Network for higher quality and reliability than a single provider network can deliver.

We run 2.2 million voice quality and connectivity tests per year to ensure everything works all the time

We believe that our customers trust their success on Twilio's ability to continuously innovate, improve, and expand our global communications network. Our mission is to build a highly reliant, low-latency network that connects you with anyone around the world. To deliver on this promise, our mission translates into two priorities: providing quality at scale while expanding coverage, capabilities, and choice for our customers. We achieve these goals by building deep relationships with our providers and investing in software innovation to ensure our network is redundant, resilient, and scalable.

Twilio isn't just your technology partner. We also strive to be your trusted advisor, managing the intricacies of multiple provider relationships so you don't have to and helping you navigate through complex compliance requirements and local or regional regulations when expanding globally. To support our global communications network, we have provider relationship managers in every region along with customer success managers and support engineers to proactively identify and resolve issues for you and answer any questions. In other words, we've put some of the brightest minds together with some of the most innovative technologies to solve your biggest communication problems—with software.

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WHAT MAKES TWILIO'S COMMUNICATIONS NETWORK SUPER?

Our strategy for providing the highest-quality communications network centers around taking a provider-agnostic approach to how we route traffic. We find the best providers to work with, continually test and evaluate all providers to determine their performance and capabilities, and route traffic to deliver the best quality for our customers.
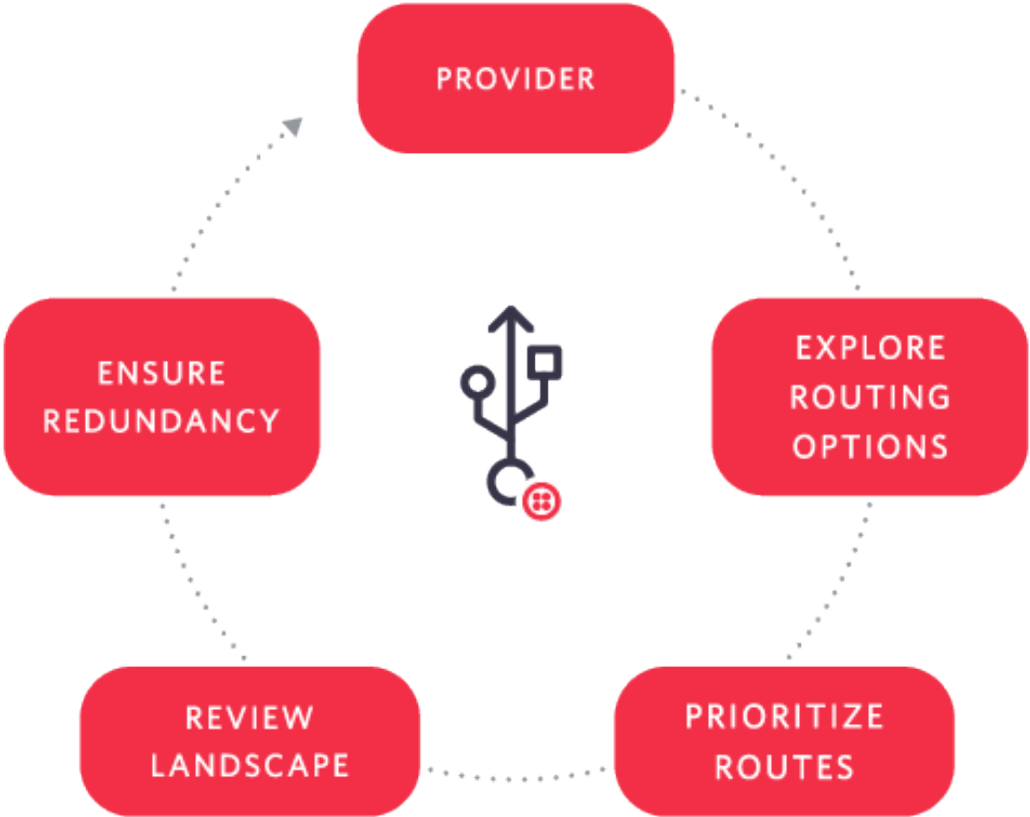
To build an exceptional global communications network, we follow a proven process to deliver the quality, reliability, and resiliency you need.

COVERAGE & CHOICE

Our rich diversity of global providers allows us to reach all of them through the best-quality routes.

TRUE GLOBAL COVERAGE

Our global network lets you reach billions of people worldwide via a single supplier: Twilio. We've established and manage thousands of interconnections with providers, enabling true global coverage that's supported by our "follow-the-sun" in-region operations teams for hands-on troubleshooting and ongoing local support. And we continue to deploy new interconnections to boost voice quality and messaging deliverability while expanding geographic coverage by continually adding new providers to the network.

Our operations teams respond within 5 minutes to all alerts, resolving 95% with no customer impact

INSTANT NUMBER PROVISIONING

Instant provisioning of numbers depends on reliable sourcing plus proactive inventory management. We carefully manage our phone number inventory to ensure we always have enough standing inventory in stock, available for purchase and instant provisioning, to meet all your needs. That means you can skip the months it takes most traditional phone companies to provision service or replenish their inventory because they're stocked out of numbers.

DEEP AND BROAD INVENTORY

Our depth of phone number coverage is better than all other providers, so you can choose the number within each country that's going to deliver a truly local and personal experience to your end customers. For example, we have over 150,000 phone numbers in the 415 area code alone, compared to another major provider that has only 77,000 phone numbers in the entire US. Likewise, we offer 500 unique UK localities compared to another leading provider that offers only 4 or 5.

People are 4 times more likely to pick up a call from a local area number versus a toll-free or out-of-area number

NUMBERS FOR EVERY USE CASE

We have the largest selection of phone numbers available for instant provisioning in over 100 countries and 50,000 specific localities to meet the unique needs of every customer, whether it's a one-way number for inbound calling or a dual-function landline for customer support voice and messaging. Our Phone Numbers API allows you to find the right numbers by searching our Global Phone Numbers Catalog based on your specific use case or filtering capabilities of the numbers. Before choosing numbers, you can review detailed information about each one's geodata,

regulatory requirements, configuration, and capabilities like one-way or two-way messaging and caller ID.

QUALITY & PERFORMANCE

We believe delivering reliable high performance depends on continuous optimization. That means we constantly analyze our current network to determine strengths and weaknesses. We only look for, onboard, and work with quality providers. And we review the market landscape frequently to ensure we're always able to offer the highest-quality connectivity at market rates. This continuous curation of available global telecom networks means customers can count on always getting the highest quality and best performance from the Twilio Super Network.

GLOBAL LOW LATENCY (GLL)

High latency on a call results in periods of silence, disturbance, and people talking over one another, each of which creates a bad call experience. Because our communications network is built in data centers in major regions around the world—from the US to Australia, Brazil, Germany, Ireland, and Japan to Singapore—we can ensure low latency in several ways. We automatically choose the nearest GLL region based on where an incoming call originates, then use the same region for the outbound leg of that call to ensure the lowest latency. Likewise, outbound API calls always use the GLL home region of the "to" participant's number. Conference calls will establish a GLL region where most of the participants are located.

CLEAN PHONE NUMBERS

To efficiently measure and manage our active inventory of millions of phone numbers, we use an innovative system that intelligently analyzes inbound voice and messaging traffic of numbers that have been released or recently onboarded. Plus, we can automatically determine the likelihood of unwanted calls or messages on a given phone number and dynamically determine the monitoring period for each number, minimizing the likelihood of unwanted traffic. Released numbers go through automatic capability retesting before being added back into our general inventory for reuse, which means there are more numbers that you can count on to be "clean" numbers.

GUARANTEED CAPACITY

We manage our downstream capacity by targeting a 50 percent utilization level across our entire network. If we ever hit greater than 60 percent utilization, our team is automatically alerted and can quickly scale our capacity by tens of thousands of concurrent calls.

RESILIENCE

Because provider outages or degraded service are a sad fact of life, the telecom world can get very messy. Unlike other providers, we built our network on redundant routes, so it can gracefully failover in case of network issues, provider maintenance, or natural disasters before you ever feel the impact.

We designed our network from the ground up to be highly available, so you can be always on for your customers

DIRECT FIBER CONNECTIONS

We built out the Twilio Network Exchange (TNX) in data centers around the world to ensure we could connect to our providers in the most reliable way via redundant fiber connections. This approach improves quality by limited latency and jitter and shortens the time needed to troubleshoot issues. Certain leading providers also require direct connections, so TNX ensures we're building our communications network with the best-of-the-best to deliver the highest quality and reliability.

INTELLIGENT ROUTING

Our feedback API and conversion data give us the industry's best information on route reliability and deliverability. Other providers often rely on delivery receipts, which may be inaccurate and are easily manipulated. Thanks to our proprietary routing software, we can create different classes of routing based on use cases with different requirements, such as marketing messaging versus account verification, so we always use the right route for the right message. We continuously optimize routing using statistical analysis and conversion data to fine-tune our machine-learning algorithms to improve deliverability over time.

Our algorithm makes an average of 3,000 changes per day automatically to optimize message delivery

COST OPTIMIZATION

We secure cost savings through ongoing provider management and contractual negotiations when better prices become available. For example, we multi-source our provider relationships to ensure providers are giving us market rates for the traffic we send them even as market rates change, which means you'll continue to see prices decrease over time with no decrease in quality.

OPERATIONAL EXCELLENCE

We monitor millions of voice and messaging data points every day in real time, so we can quickly make changes or alert our teams to any fluctuations beyond the norm. Our operational strategy is mature, well-defined, and thoroughly tested because delivering the quality and reliability you need in a global communications network takes more than just managing providers (although we do that, too). It requires us to form true partnerships with providers based mutual trust and transparency. It inspires us to design new ways to ensure quality connections and detect fraud. And it compels us to keep up with the evolving regulatory environment by constantly strengthening our platform to protect your data.

END-TO-END PROVIDER RELATIONSHIP MANAGEMENT

We manage all the complexities of provider relationships, so you don't have to. That means we manage provider performance across quality, service, and features. We reward top-performing providers for good performance by sending them a greater percentage of our traffic. We continually raise the bar by adding new providers to increase the quality of our network and adding new products and feature sets for you to use to reach your customers. Overall, our goal is to provide the highest-quality services as quickly as possible.

Providers that perform well today may not be the ones that perform well tomorrow

PROVEN QUALIFICATION PROCESS

We use an established qualification process to select and onboard new providers quickly. Using this process, we can onboard a new termination provider for voice or messaging in a short amount of time, depending on the complexity of the agreement and any applicable legal requirements. Our team of industry experts uses repeatable, scalable processes to onboard new providers with the confidence that things will be done right the first time. We've automated the testing of both termination and phone numbers to ensure common use cases work for our customers. That means you don't need to

worry about the risks that typically come with onboarding a new provider like system downtime or integration problems.

COMPREHENSIVE MARKET RESEARCH

Failure to comply with regulations and telco laws is an expensive mistake to make, but fortunately, we've got you covered. Before entering a country, we conduct a thorough regulatory and legal scan that reviews provider viability and number marketability based on relevant laws along with a market scan that includes a review of available providers and routes to ensure we choose the most relevant provider for that market.

CONTINUAL NETWORK EXPANSION

We continue to add direct reach, higher-quality connections, and reach with improved pricing around the world. We consistently assess your needs to determine geographic coverage and product requirements. Based on changing demand, we prioritize onboarding providers in the necessary geographies to provide broader phone number coverage and more feature coverage such as two-way numbers or the ability to ensure caller ID preservation.

QUALITY COMMUNICATIONS DELIVERY

We handle the ongoing management of our entire communications network, monitoring provider performance and managing quality. For example, we've established outbound voice call quality metrics covering the top 80 percent of international destinations by volume. We've also created real-time voice dashboards to track provider performance in a region or country.

We've connected with hundreds of providers to ensure we have the correct route depth to meet customers' communications needs. In fact, if our providers should go down, we have enough capacity to route your calls reliably and consistently with enterprise-grade voice quality.

We run over 100,000 test calls to our numbers in 100+ countries each month to ensure stability and quickly detect outages

CAPABILITY VERIFICATION

We perform extensive capability and regular cleanliness testing on all phone numbers to ensure quality. We conduct a technical evaluation, interconnecting testing, and a suite of 25 capability and performance tests to ensure you know exactly what features and capabilities a Twilio number comes with when you buy it.

After a number passes our internal tests, we monitor real-world traffic on it before releasing it for purchase. When the number works as expected, we make it available to you for instant purchase via our Console and API.

SOPHISTICATED FRAUD DETECTION

We use complementary internal and external fraud systems that can detect voice traffic fraud in real time. We also closely monitor for anomalies in account activity, account pre-signup, and payment activity. And we constantly explore new ways to add fraud protection to our platform and services to stay one step ahead of fraudsters. Until the fraudsters stop, neither will we.

We continue to create new detection systems to keep up with new attempts to circumvent existing safeguards

GLOBAL & LOCAL REGULATORY EXPERTISE

Business is regulated differently around the world, which means we're constantly tracking changes in existing regulations as well as the development of new regulations that affect our products and services. Our extensive provider partnerships help ensure regulatory due diligence by enabling us to understand applicable regulations and local laws in every geography.

REGULATORY COMPLIANCE

We see the EU's General Data Protection Regulation (GDPR) as an opportunity to build a stronger data protection foundation for the benefit of all. Twilio is committed to ensuring that our platform is GDPR-compliant when the regulation becomes enforceable on May 25, 2018. In addition, Twilio currently adheres to the EU-US Privacy Shield Framework by complying with EU restrictions on

personal data stored or processed outside the EU. We also make EU Model Clauses available, when necessary. These are standardized contractual clauses used in agreements between service suppliers (like Twilio) and their customers to ensure that any personal data leaving the EU will be transferred in compliance with EU data-protection law.

INTEGRATED PROCESSES

We've designed automated processes to ensure compliance with existing regulations, and our self-service processes help meet the requirements of emerging regulations.

Our B2B knowledge extends across borders, especially when it comes to regulatory issues. For example, mainly due to terrorist threats, Germany now requires an address to be on file for any new phone number, so we've automated that process in our API and customer Console; the process typically takes only 2-3 days.

New regulations are always emerging. For instance, countries like Belgium, Germany, Italy, and others now require ID verification for mobiles, so we've made this a self-service process in our API to ensure provisioning new numbers remains quick and easy for you.

THE FUTURE OF COMMUNICATIONS

Agile communications can help you innovate faster than your competition. You can't afford to be slowed down by the long provisioning timelines and glacial pace of legacy communications providers. That's where Twilio can help: with on-demand phone numbers and services available immediately through an API. We believe a resilient, always-on communications network should be the norm, and we use the power of the cloud and automation to route around provider outages or service disruptions before they ever impact you. The result is ubiquitous global connectivity—no matter when, where, or how you (and your customers) need it.