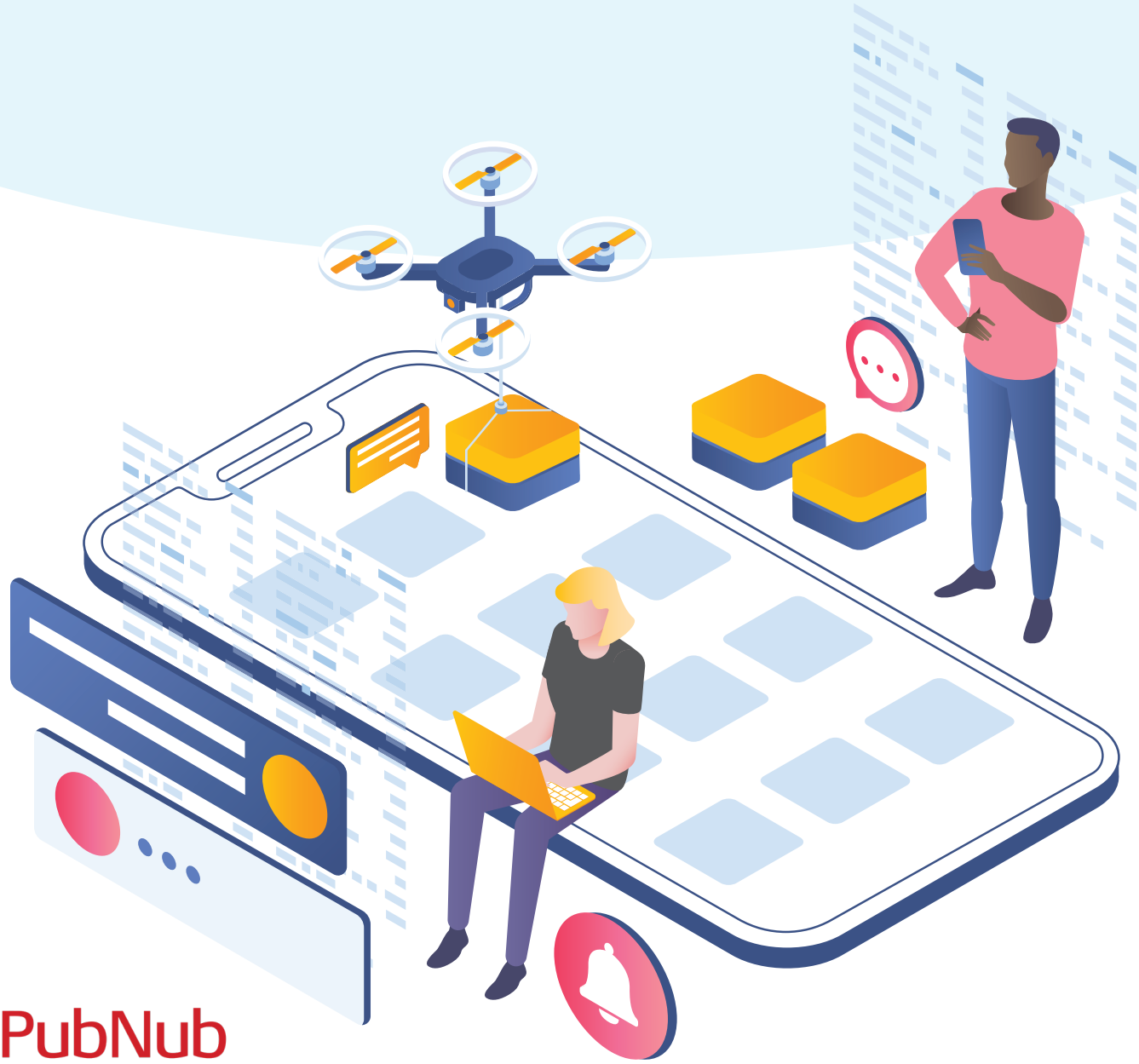


PubNub

Building Applications for the On-Demand Economy

Defining the on-demand economy, what's driving it, and the biggest challenge it faces.

PART ONE:

What is the On-Demand Economy?

We often refer to the term on-demand economy as the *gig economy, shared economy, crowdsourcing,* or i*t's like Uber, but for X*. But the on-demand economy is an umbrella term for all those things in one way or another. Those terms talk about who or what is fulfilling the service, while on-demand includes it all.

The on-demand economy is a business, service, or product built on letting users request a physical object, a piece of data, a service and have that request fulfilled. It's built on the concept of instant gratification, the psychological feeling consumers get when they can instantaneously make a transaction, and possibly follow the path of it all the way to fulfillment.

In short, you want something, and you want it now, and the on-demand economy fulfills it.

SHARING ECONOMY VS. ON-DEMAND ECONOMY VS. CROWDSOURCED ECONOMY

The *sharing economy* is commonly built on top of the concepts of the on-demand economy, but not vice-versa. In the sharing economy, resources are shared. If I'm not using my garage, my bicycle, my golf clubs, or my cabin in the woods, someone can rent it. Airbnb, GetAround, Rent The Runway, and Lending Club are all examples of the sharing economy. With the crowdsourced economy, it's similar to the sharing economy, only we're talking about the labor rather than the resources.

The *crowdsourced economy* utilizes the talents, skills, and tangible resources of a group of persons to deliver a service or product. Sometimes used synonymously with the *gig economy*, the crowdsourced economy is driven by large numbers of independent workers in temporary positions, who can work as little or as much as they want. Uber, Upwork, Instacart, and TaskRabbit are all examples of the crowdsourced economy.

These companies are built as on-demand companies, where users can easily and quickly request a service, a product, anything, and it's handled start to finish through the on-demand business. Ease of

use, realtime alerts and notifications, and security and compliance are paramount in the on-demand economy, to deliver the instant gratification that users not only require, but crave.

ON-DEMAND ECONOMY VS. SHARED ECONOMY VS. CROWDSOURCED ECONOMY

Just because it's on-demand, doesn't mean it's 'shared' or 'crowdsourced'.

CORE TENETS OF THE ON-DEMAND ECONOMY

PROVIDE AN INSTANTANEOUS EXPERIENCE

In the on-demand economy, nobody wants to wait. Whether you're calling a car or ordering a meal, you want confirmations, updates as status changes, live maps, and the product or service itself as quickly as possible. The instantaneous experience is essential - so on-demand services need to have a tight, reliable realtime layer. It needs to be fast, lightweight, available in unreliable environments, and in most cases, mobile-first.

CONNECTED SHARED EXPERIENCE

As we previously covered in our explanation of the crowdsourced economy, in many on-demand services, there's more than one human involved. As a result, the entire transaction experience is really a connected shared experience, one person requesting the good or service, and the other person or persons fulfilling it. As a result, everyone needs to be synchronized in their instantaneous experience. When a person does one thing, it needs to be reflected across every other connected user as it happens. Whether it's a chat message with an update or monitoring location on a live map, that connected shared experience is what drives the user satisfaction and success of the service.

MOBILE, MOBILE, MOBILE

The chances are good that somebody involved in an on-demand transaction will use a mobile device in one way or another. That means that mobile needs to be top of mind for any on-demand business. You have people and services constantly in a state of motion, so ensuring a reliable experience even on the go is a must. It's not just the fulfillment of the service or product, but all the updates that come in between that provide the connected shared experience users love.

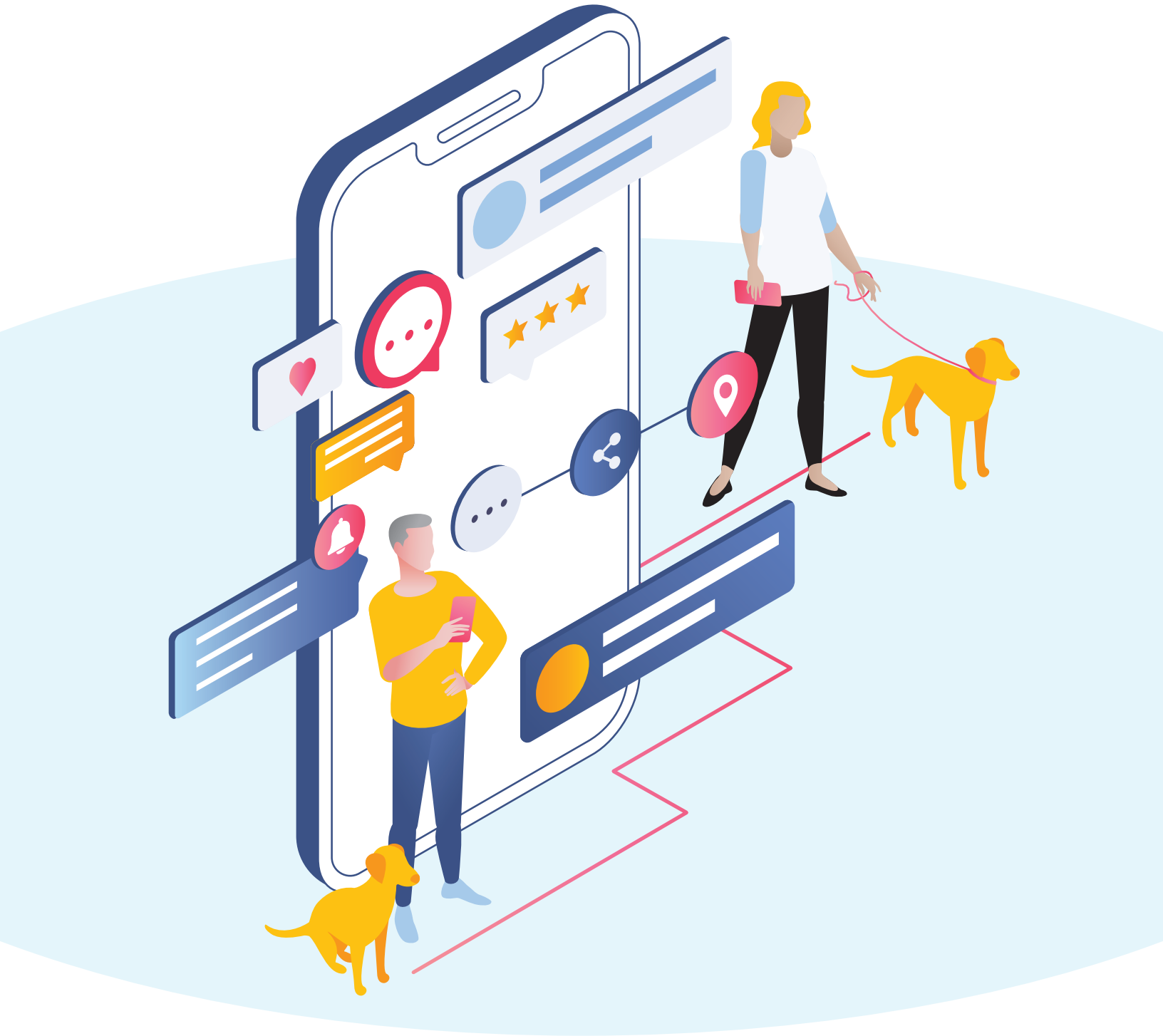
SO HOW DO YOU STAND OUT AMONGST THE REST?

In Part Two, we'll look at the economics of the on-demand economy, and dive deep into the guiding principle of providing world-class on-demand experiences.

PART TWO:

The Economics of On-Demand Services

An on-demand service is, typically, one in which technology connects a buyer and a seller seamlessly and frictionlessly - one person who needs a ride to the airport with another who wants to drive them; one person who wants food from a restaurant and another happy to deliver it; one person who wants their dog walked and another available to provide that walk.



The transformation of human interactions driven by ubiquitous Internet access is nowhere more evident than in the rise of on-demand services.

IT'S ALL ABOUT OPTIMIZATION

In principle, the success of on-demand services relies upon a simple economic principle: optimization. If a restaurant, for instance, can produce more meals than a full dining room can consume, then it makes sense to find a way to use the excess capacity to sell meals to those who are not physically present. Similarly, individuals with free time can tap that leisure to earn more money - the much-vaunted 'side hustle' that maximizes the earning capacity of each person in the marketplace.

The reality, of course, is a little more complex. Ironically for those who lived through the first wave of Internet growth and its inexorable dismantlement of disintermediation (eliminating travel agents, phone operators, and stenographers by the boatload), on-demand services introduce a level of intermediation that is core to its success. A service, accessed generally either by browser or by a smartphone app, provides (generally speaking) three core support structures:

- **Listing:** the ability to make oneself available as a provider, or to find a provider as a consumer
- **Communication:** the ability to connect consumer and provider and book a service
- **Payment:** the service will generally set at least the parameters of the economic agreement (and often prices themselves), collect the consumer's money, and disburse it to the provider after deducting a fee

At the beginning of the consumer-provider relationship, neither knows exactly who the other is, and the on-demand platform will erect barriers to prevent them from communicating outside the platform: if they were to do so, they could make side deals that would cut the on-demand provider out of the cash flow.

And that's the most fascinating element of the economics of on-demand services: the company from whom the consumer ostensibly buys their service - whether a ride to the airport, a tasty hot meal, or a walk for their pup - in general employs exactly zero of the individuals who will actually do the work.

The essence of a successful on-demand business is to be nothing more nor less than an intermediary. While Uber may look and feel like a direct analog to a taxi service, it bears more organizational and financial resemblance to a travel agency or even a retail outlet: it markets, brokers the sale of, and collects a commission for the successful completion of, transactions between consumers and independent providers.

THE BUSINESS FOUNDATION

Understanding this business foundation explains some of the fascinating ways in which on-demand providers traverse a variety of different businesses. Lyft and Uber, for instance, now offer meal delivery services, and are starting to make a push into scooter services. Go-Jek, the first Indonesian 'unicorn' (billion-dollar valuation company) started life connecting riders to ojek (moped) drivers, and now offers services from fuel-delivery to in-home massages to the nation's fourth-largest e-wallet. None of these are truly 'ride-for-hire' enterprises, but rather complex logistics organizations, whose core focus is connecting providers to consumers in return for a commission.

What this means is that no on-demand service is truly what it 'is': there is always a gap between the market presence (how the company presents itself) and the organizational raison d'etre. As an example, Wag, a service that offers dog walking services on demand, recently raised $300 million in venture capital from Softbank, resulting in a $1.4 billion valuation. Is this because investors see the company earning hundreds of millions of dollars a year in dog walking commissions? Likely not - but they do give each of their users a lockbox for a front door key, and track its usage so the resident can have confidence their

home is protected. Over the long haul, the economic value of Wag is almost certainly less the value of dog walks, and more the value of access to that lockbox, which can be licensed to other service providers (house cleaners, handymen, electricians - you name it), providing a near-infinite range of potential future revenue streams to Wag.

THE CONSUMER

As a consumer, it is worthwhile to remember that the on-demand service itself is merely the go-between: its value is determined by its efficiency, its effectiveness, and its ability to source excellent independent providers. Realtime connections are the most evident element of this: on-demand only works when connections between consumer and provider are instantaneous, and when necessary information ”where is my ride?”, “where is my dog?” can be accessed right as it happens.

THE SERVICE PROVIDER

For the services themselves, the defining element of success will be consumer perception that nobody else can do a better job of finding the right provider at the right time. Almost by definition, no on-demand service can fully monopolize a provider community (when was the last time you saw a US rideshare vehicle that didn’t have both Lyft and Uber stickers in the rear windshield?), and so they must continually ensure they outperform their own competition. While pricing will enter the frame, today’s reality is that the defining competitive advantages lie in convenience and immediacy: consumers will pick the solution that most swiftly solves their need....and providers will flock to the service that is likeliest to deliver a steady flow of consumers.

It’s a symbiotic relationship, ultimately, between all participants in the chain - and one that is strengthened primarily by being the quickest to connect everyone who wants to do business. Keyword there is **quickest**. And there’s a technological trend shaping the way on-demand businesses deliver it.

PART THREE:

The Technological Trend Shaping the On-demand Economy

In tandem with our ever-increasing reliance on on-demand services, the economy is growing bigger, faster, more efficient, and more connected. We're seeing more and more types of services and products delivered, more resources shared, and the new gig economy transforming jobs for the next generation.

The technological trend shaping that growth is realtime. Driven by low-latency, high-reliability connectivity, it's the glue that holds it all together. Delivering the instant gratification, the feeling we all crave of instantaneous updates from order to fulfillment and getting what we want as quickly as possible is what it's all about. Like on-demand video and SaaS products, the on-demand economy is built on the concept of not waiting; getting it when you want it. And realtime is what ensures that.

So how is realtime shaping the on-demand economy? It continues to improve the experience of using on-demand applications - faster updates and more interactive features.

Beyond simply requesting a service and getting live updates, it allows you to add other interactive features as well. Realtime chat with the person fulfilling your service or support when you need help. Connecting the on-demand application to 3rd party applications to enhance the experience, like Uber allowing you to DJ your ride or order food through Uber Eats on your way home.

It's the core of delivering a seamless and reliable on-demand experience from start to finish.

THE TECHNOLOGICAL CONCEPT OF REALTIME

The technological concept of realtime is something that functions in what is perceived as immediate or in the moment. Obviously in the on-demand economy, there's a good chance the service itself won't be fulfilled in realtime, however, every step of the way - updates, tracking geolocation on a map, payment - is all delivered in realtime.

Now, back to the technology: what makes realtime, realtime? You need a network (infrastructure) to deliver the data in realtime, and you need protocols and APIs to build the functionality. There's a ton of ways to do this.

You can go the open-source route, spinning up your own infrastructure, utilizing open source protocols like websockets or HTTP long polling. Or you can utilize a realtime service provider, who handles all the infrastructure and provides you the realtime APIs and SDKs to do it. Scale is a major factor in this technology decision. It's an important decision that needs to be made when building an on-demand feature or app.

SHAPING THE ON-DEMAND ECONOMY AND THE HUMAN EXPERIENCE

The on-demand economy's transformation is shaped in part by the impact that realtime technology has on the human experience in general. To understand what this is, let's think about what virtual and technological on-demand experiences used to be. You had one, maybe two channels of interaction.

- You'd call a taxi company and maybe the driver calls you and confirms they're on their way.
- You'd find a 2nd hand item online, haggle a bit over email or in-person, and purchase the item.
- You'd order food through an online portal, receive a confirmation, and at some point the item would show up at your door.

That experience is what has changed. The on-demand economy takes advantage of the massive amounts of data and interactive sources today. Connected shared on-demand experiences bring all these together for a period of time and make it as immersive an experience as possible.

It's why you get updates not just from your delivery person or driver picking you up, but also the status of your food in the kitchen or your car's geolocation. On-demand companies are adding as many interactive sources of data and streaming them to the end user to satisfy their thirst for instant gratification.

BUT IT'S NOT THAT EASY...

The on-demand experience will continue to grow as a defining value for businesses, products, and apps across every industry. People now expect to get something, whether it be updates, or the service itself, in near realtime, so look for the on-demand features to differentiate industry leaders and define new disruptors establishing new ways of delivering goods and services.

But can't every company simply roll out on-demand features in their apps and products? There's a massive challenge - scale. See why scaling is the biggest challenge in building realtime, on-demand applications.

PART FOUR:

Why Scaling is the Biggest Challenge for the On-Demand Economy

As the on-demand economy continues to boom, user expectations continue to grow. We don't just want the service or product as quickly as possible: we want all the updates, alerts, notifications, and communication in-between, from start to finish.

It's a stream of constant updates and conversation, and the expectation (or, really, the requirement) is that everything happens in realtime.

The growth in user expectations means that on-demand applications are growing exponentially more data-intensive. Location tracking, chat messages, live updates, and more: on-demand services are creating, sending, and consuming massive amounts of data around the clock. And that creates a significant challenge for on-demand businesses: scaling.

WHAT IS SCALING?

Scaling means ensuring that your app, service, or product maintains and ensures reliable performance even as your user base grows, including audience size, geographical location, and usage patterns. Apps that scale poorly are forced to deal with constant outages, slow updates, security issues, and inconsistent connectivity - which, together, lead to disappointed, angry, and soon-to-be-ex customers. Because on-demand apps rely heavily on a fast, realtime experience, a failure to scale is very apparent and meaningful in the user experience. Fluctuations in efficiency and performance are easy to spot and incredibly frustrating to users.

IT COMES DOWN TO THE INFRASTRUCTURE

When building an on-demand business, scale is not normally on the "Minimum Viable Product" (MVP) list. You're focused on getting live quickly, acquiring users, figuring out your resource sharing strategy, thinking about the live features you'll deliver throughout your application, and all the other features that make your offering stand out in a crowd. But as your application grows in adoption, and, as a result, usage, the phrase "what works in the lab is not guaranteed to work in the wild," becomes a reality. That's because a massive amount of planning and engineering goes into building realtime, interactive, and data-intensive features that can operate flawlessly at scale.

As with so many technology decisions, on-demand businesses find themselves making a build vs. buy decision, which is actually more of a spectrum than a black-and-white decision. How much of that infrastructure do you want to build and manage yourself, and how much do you want to outsource to hosted-services and vendors?

To get an idea of what it takes, let's walk through a laundry list of things to build and consider for deploying a scalable infrastructure for on-demand applications.

- Coordinating and deploying multiple testing, staging, and production environments.
- Handling provisioning for those multiple environments (eg. straight-up rack-and-stack in a data center, Kubernetes containers, etc.).
- Deploying your application code to the environments.
- Data replication for multiple points of presence and automatic failover to ensure that messages are delivered 100% of the time (and actually in realtime).
- Message "catch-up" in case of connection dropout (if a delivery person is in a tunnel, for example, the customer must receive the message when they come out the other side).
- Setting up service management, system monitoring, and ops alerting.
- Creating a load balancing scheme (like Nginx or HAProxy).
- Implementing a scheme to segment data by channels or topics.
- Finding a store-and-forward solution for signal recovery, like in-memory caching.
- Implementing a method to connect individual clients to the ideal data center and port (eg. intelligent traffic management and global server load balancing).

- Computing which channels/topics to send/receive for a given client.
- Building orchestration between data centers and cloud regions to ensure data reliability between endpoints.
- Deciding which platforms and languages to support. (Do you have to reinvent the wheel to launch the Android version of your app?)
- Creating universal data serialization.
- Customizing code to detect a data uplink that works across device types.
- Determining Quality of Service and level of loss boundaries, and developing a data recovery scheme.
- A load testing service that can simulate a real audience (likely custom-built).
- Creating an update protocol and continuously modifying your network to support new products/services.
- Paying for Socket server costs, QA systems, and hot failovers.
- Headcount for ongoing Ops monitoring and innovation.
- Building a load distribution system.
- Identifying error messages.
- Building a log system with event-driven alerting.
- Knowing when faults occur and developing a playbook of responses.
- Building service management (like PagerDuty).
- Developing multi-datacenter deployment.

The length of that list says one thing: there's a lot to do. A ton of engineering and expertise goes into designing, deploying, and orchestrating a scalable on-demand app. This is why it's such a challenge to do it from scratch, especially with thousands and thousands of concurrent users. To do it well, expertise in DevOps,

server-side technologies, and more, is essential. A beautiful front-end can only get you so far.

Not to say it's impossible, but for teams both small and large, hosted services provide reliable and scalable infrastructure, relieving you of the stress, and responsibility, of delivering the seamless, reliable on-demand experience your end users will demand in order to remain loyal customers.

WRAPPING UP

On-demand apps will get more and more data-intensive as more and more sources of data stream updates, and new ways of communicating are launched. So choosing the right technologies and infrastructure to handle that is mission critical. But those that utilize and deliver the right data at the right time will have a leg up in providing an industry-winning user experience.

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