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Insights 2024:

Rural Broadband Business Sustainability

ISPs Make Slow but Steady Progress
to Close the Digital Divide

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INTRODUCTION

Rural Broadband isn't just About Building Out Access—It's About Sustainable Business Growth

Progress is being made on closing the digital divide. Accelerated by funding from sources such as the Rural Digital Opportunity Fund (RDOF) and the Broadband Equity, Access, and Deployment (BEAD) program in the U.S. and the Infrastructure and Jobs Act, new investments are extending high-speed connectivity to more subscribers in more places than ever.

The provider landscape is changing rapidly as well, encompassing a diverse cast of co-ops, utilities, and municipalities alongside traditional internet service providers (ISPs). The access technologies they're using are equally diverse, including fiber-to-the-home (FTTH), wireline, fixed wireless, satellite, and 5G. The Covid pandemic saw inspiring stories of service providers stepping up to provide connectivity in schools, hospitals, and throughout the community to support remote work and learning at home for families.

Still, challenges remain. The pandemic has passed, but IDC reports that 63 percent of organizations worldwide believe that a recession is coming, with the highest levels of pessimism found in North America. Post-pandemic impacts and higher interest rates have increased construction costs considerably, leading some RDOF recipients to petition the FCC for relief. Providers want to grow, but they're understandably concerned about ROI.

The looming issue of IPv4 exhaustion remains a perennial concern. The cost volatility of IPv4 addresses on the market makes them a risky investment. Even with scarce supply, many U.S. ISPs haven't yet made plans to address the shortage with CGNAT and bridge the transition to IPv6. Meanwhile, IPv6 adoption lags, and ISPs must deal with the cost and complexity of IPv4/IPv6 coexistence.

This report, the second in an annual series by A10 Networks and Gatepoint Research, provides insight into the state of rural broadband. Incorporating the results of a broad-ranging survey of senior decision-makers at regional ISPs, the report examines how far we've come, how much further we need to go, and challenges to be addressed along the way to build sustainable rural broadband connectivity and business growth.
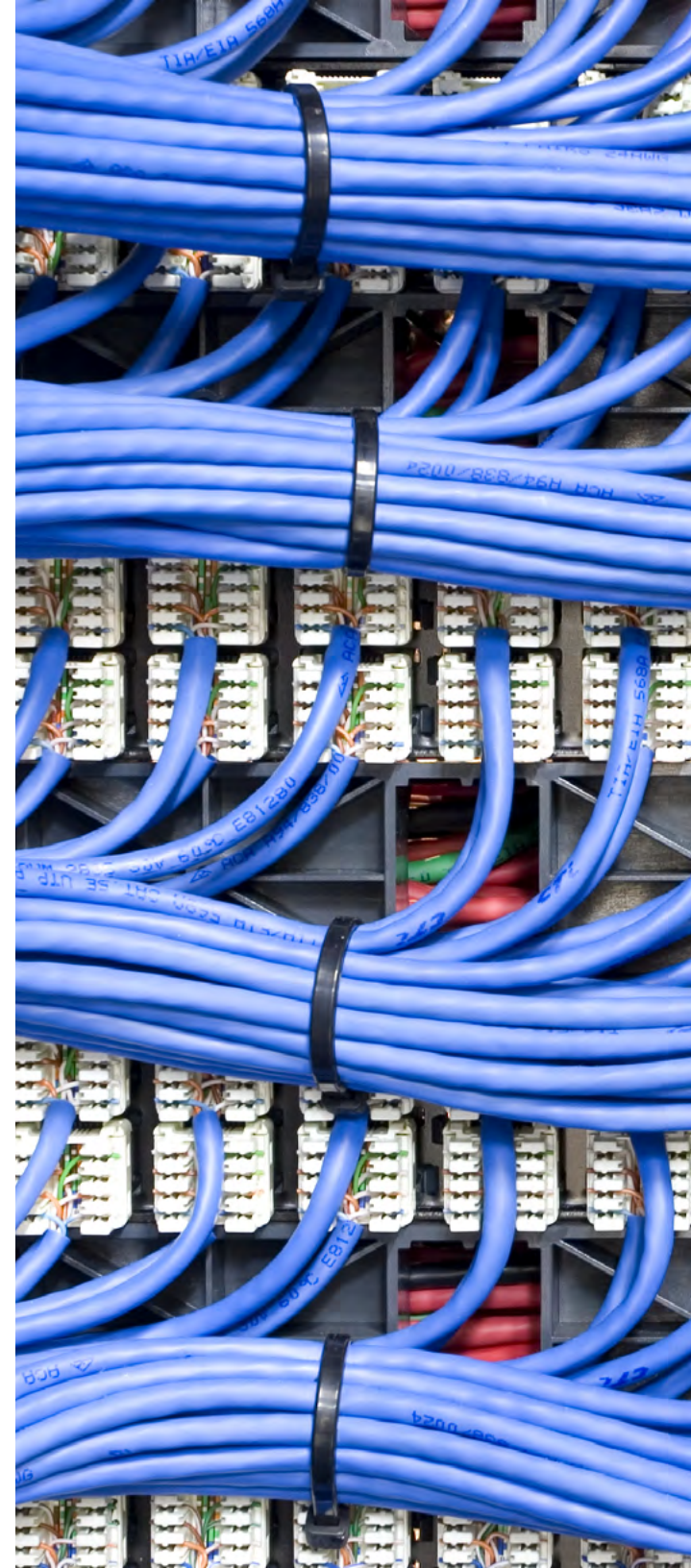
TOP BUSINESS OBJECTIVES AND CHALLENGES FOR RURAL ISPS
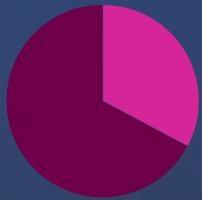
33% successful broadband buildout to new communities

29% sustaining business growth

ORGANIC GROWTH RATE FOR RURAL ISPS

79% see 3-20% annual growth

35% see 10% or more annual growth

DESPITE ECONOMIC CONCERNS, EXTENDING BROADBAND IS STILL A PRIORITY FOR RURAL ISPS IN NORTH AMERICA AND FOR CSPS WORLDWIDE

Concerns about risk aside, ISPs remain committed to extending the reach of broadband. In one study of global communication service providers, 69 percent of respondents were expanding their networks to unserved or underserved communities.

This isn't a purely philanthropic effort, of course. The goal is to create sustainable business growth by expanding the subscriber base, complemented with the capacity needed to handle increased traffic. And many rural ISPs in North America are indeed seeing organic subscriber growth far beyond industry norms, with more than one in three growing by more than 10 percent annually.

Along the way, they'll need to deal with business challenges from supply chain struggles, increased security risks, and exposed APIs to the ongoing IPv4-IPv6 transition.

EXTENDING BROADBAND IS A GLOBAL PRIORITY

Jurassic Fibre

Jurassic Fibre is building out fiber-to-the-premises (FTTP) infrastructure to extend reliable high-speed connectivity to underserved homes and businesses in the southwestern U.K. A10 Networks Thunder® CGN helps the company meet both current and future needs with:

- ☑ A scale-out cluster design to accommodate a decade of customer and traffic growth
- ☑ A cost-effective solution to remediate IPv4 exhaustion
- ☑ DDoS resiliency that eliminates customer impact in the face of an attack

LEARN MORE

WITH MASSIVE GOVERNMENT INCENTIVES, NEW ENTRANTS FLOCK TO THE RURAL BROADBAND LANDSCAPE

As new federal funding flows into rural broadband, a diverse group of ISPs is rising to the challenge including regional and rural broadband providers, electric utilities and co-ops, satellite operators, and others. Many of the regional ISPs that have been awarded funding also have a personal incentive to help their communities advance, improving individual quality of life while attracting business investment and the jobs it brings.

Utilities and Electric Co-ops
Utilities and electric co-ops can leverage existing infrastructure and community relationships, and they have done well in recent Rural Digital Opportunity Fund (RDOF) auctions.

Municipal Broadband
While municipal broadband operations have historically faced restrictions that make such networks costly, difficult, and unsustainable, some states are in the process of contesting or changing these laws. Such efforts may pave the way to new opportunities for federally funded municipal broadband and public-private partnerships in underserved areas.

Tier-3 ISPs
More than 1,200 tier-3 ISPs, operating FTTH projects across 1 – 4 states, provide roughly 18 percent of U.S. FTTH connectivity. Another 2,800 wireless ISPs (WISPs) averaging 1,200 customers each currently serve more than seven million customers across all 50 states

Tribal communities
The Department of Commerce's National Telecommunications and Information Administration (NTIA) recently announced grants totaling $3,998,000 as part of the Tribal Broadband Connectivity Program (TBCP), bringing total funding to date to nearly $2 billion.

REGIONAL ISPS GAIN ESSENTIAL SUPPORT FOR NEW INVESTMENT

Federal funding and industry partnerships are especially critical for regional providers who must face the same technology and business challenges as tier-1 operators, but on a smaller scale with more modest resources and fewer subscribers per investment dollar.

New Funding Flows to Rural Broadband . . . .

$65B **Infrastructure and Jobs Act**
- Broadband Equity, Access, and Deployment (BEAD) $42.5B
- Middle Mile Grants (MMG) $1B
- Grants available through states, tribes,and territories
- Enacted by Congress, administered by the National Telecommunications and Information Administration (NTIA)

$10B **American Rescue Plan of 2021**
- Capital projects fund
- Broadband infrastructure
- Flexibility for other assets to support work, education,and healthcare

$20.4B **Rural Digital Opportunity Fund (RDOF)**
- Unserved and underserved communities
- Est. 22M locations/5M+ census blocks
- FCC 904 Auction—184 winners in Nov. 2021
- $14B still remains—no clear path to how it will be spent
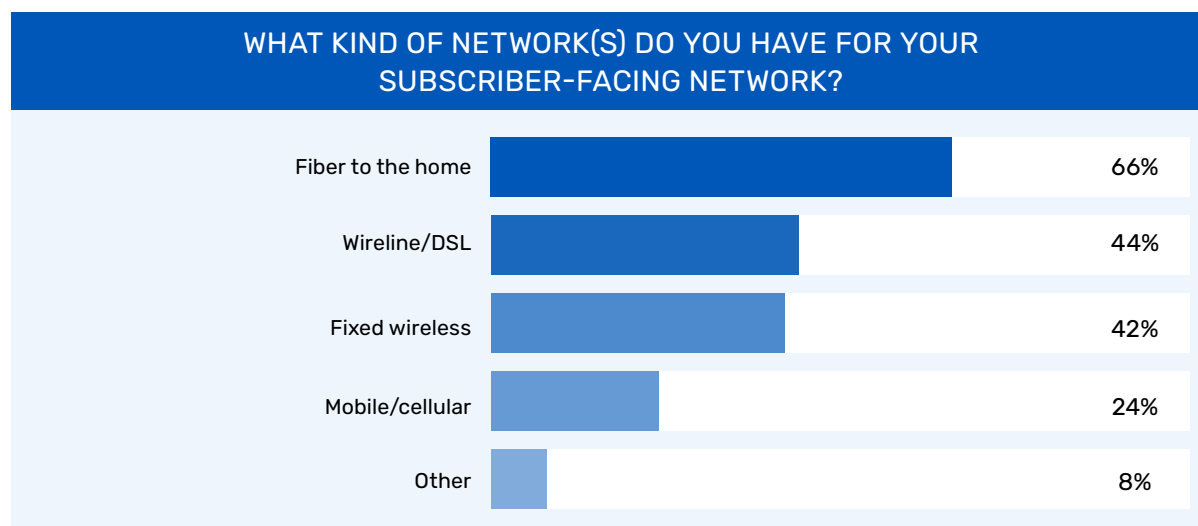
USDA **USDA ReConnect Program**
- Recent fourth round awarded $667M across 22 states
- $1.44B awarded to 74 projects to date
- 87,106 households in funded service areas

State-by-state funding levels, responsible agencies, and provider plans tracked by Fierce Telecom

BROADBAND PROVIDERS DEPLOY MULTIPLE TECHNOLOGIES TO EXTEND ACCESS AND MEET URGENT DEMAND FOR CONNECTIVITY

While the debate rages on among advocates of fiber and fixed wireless access technologies, most ISPs use a combination of both of these technologies as well as others. The combination of government funding, private-sector ambition, and creative approaches to problem-solving has yielded significant progress in closing the digital divide.

WHAT KIND OF NETWORK(S) DO YOU HAVE FOR YOUR SUBSCRIBER-FACING NETWORK?

Network Type	Percentage
Fiber to the home	66%
Wireline/DSL	44%
Fixed wireless	42%
Mobile/cellular	24%
Other	8%

According to IDC, 86 percent of U.S. households had a fixed broadband connection at the end of 2021. IDC also predicts that fixed wireless (FWA) will play a crucial role in closing the digital divide by connecting "unreachable" customers. In fact, fixed wireless FWA accounted for a full 90 percent of new broadband subscriptions in 2022.

Fiber-to-the-home also is progressing. The Dell'Oro Group reports that 72 million U.S. households and businesses have already been passed by fiber, with the total expected to reach 113 million by 2030, including 27 million served by rural operators, municipalities, and utilities. The Fiber Broadband Association reports 7.9 million new FTTH homes were added in 2022. Another study recently found that 43 percent of U.S. households now have access to fiber, with tier-3 ISPs accounting for 17 – 18 percent of total FTTH build.
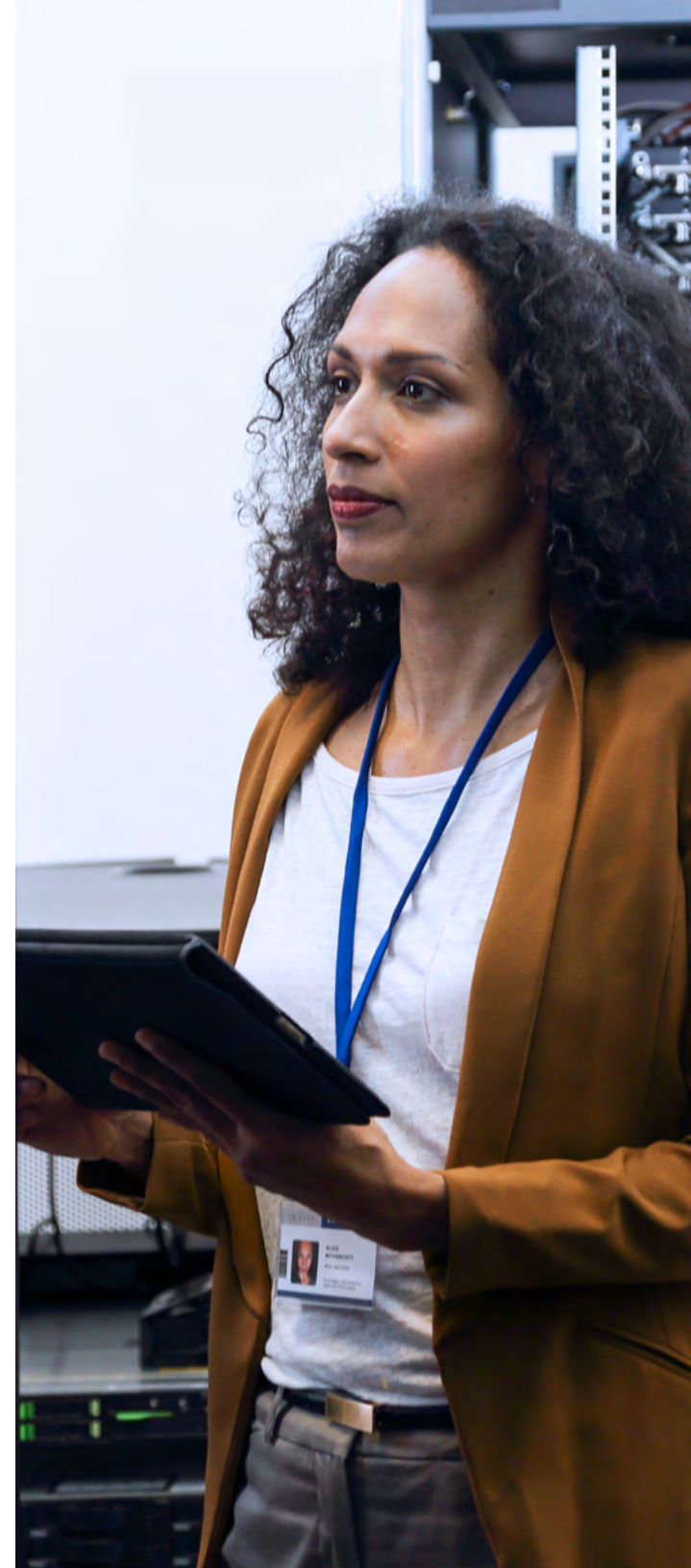
U.S. REGIONAL ISPS SHOW LAGGING RESPONSE TO CRITICAL IPV4 ISSUE

Compared to most communications service providers (CSPs) across the globe, regional ISPs in the U.S. have been slower to adopt CGNAT as a solution to their shortages of IPv4 addresses. Also, many don't yet have a viable plan for full transition to IPv6, an unavoidable requirement in coming years representing potentially vast cost and complexity.

This slow pace may largely be due to the fact that the U.S. had a larger IPv4 address pool to begin with—45 percent of the world's total allocation—which has prolonged the time available to confront IPv4 exhaustion. Unlike providers in the rest of the world, most regional ISPs have been able to get by with their existing IPv4 allocation to date, but it's only a matter of time until the urgency increases. Many current broadband growth plans will outstrip existing supply and force rural ISPs to rethink their approach for providing IP connectivity.

The Financial Risks of Additional IPv4 Investment to Sustain Subscriber Growth

The limited availability of IPv4 address space poses a critical challenge for rural ISP subscriber growth. "Free" IPv4 addresses are virtually non-existent; officially, these have been fully allocated by the American Registry for Internet Numbers (ARIN) and other regional RIRs, though there are limited quantities available from time to time. More often, additional address space can be acquired only by leasing it on the open market through a broker or another ISP.

In addition, hyperscalers have recently begun acquiring massive IPv4 space on the open market, including over 100 million addresses by AWS alone. This further limits the available supply of IPv4 addresses while increasing cost pressure.

The price volatility of IPv4 addresses is particularly concerning for ISPs. In 2021 – 2022, IPv4 addresses were available at roughly $50 – 60 each. At up to $600,000 per 10,000 subscribers, this represented a major expense for small ISPs that hadn't had to deal with the IPv4 shortage prior to their current growth plans. Then in early 2023, the price dropped—raising doubt about whether this considerable investment would hold its value over time.

MANY RURAL ISPS HAVE NO IPV6 TRANSITION PLAN AT ALL

The tail of IPv6 adoption is long, but the eventual replacement of IPv4 is inevitable. While tier-1 mobile network operators have moved quickly to lead the transition, most websites and many endpoint devices around the world are not IPv6 compatible.

As a result, IPv4 and IPv6 will continue to coexist for years—and operators will have to continue supporting both standards.

THE CRAWL TO IPV6

Tier-1 mobile providers lead IPv6 adoption

T··Mobile·   **92.5%**

verizon✓   **83.9%**

AT&T   **74.4%**

BUT U.S. providers as a whole: . . . .

39%
have no plans to transition to IPv6

27%
plan to transition within two years

U.S. ISPs Hesitate to Emulate Widely Successful Global CGNAT and IPv6 Strategies

CGNAT has been widely adopted and successfully deployed worldwide, but many regional ISPs in the U.S. have been reluctant to move beyond their legacy IPv4 infrastructure and create a larger plan for IPv6 migration. Globally, ISPs are increasingly using CGNAT to address the IPv4 shortage—but 26 percent of U.S. providers aren't using CGNAT, and 75 percent are still depending on their existing allocation of IPv4 addresses. Nearly half of providers are focusing on acquiring more IPv4 blocks through another service provider or on the common market. Concerns of resource limitations, service disruption and cost impede the faster use of IPv6.

Top IPv6 Migration Concerns of Rural ISPs

44%
Lack of resources or expertise

43%
Service disruptions to subscribers

37%
Costly equipment replacements

As a result, many of these operators end up using non-enterprise-class approaches for IPv4/IPv6 coexistence and migration and aren't fully carrier grade. Meanwhile, unexpected IPv4 costs can add 10 percent or more to annual operating expenses, further calling into question the viability of ambitious growth plans.

What is CGNAT and How Does it Work?

Globally, CSPs have used CGNAT technology to extend their limited pools of IPv4 addresses. By mapping multiple internal addresses to a single global public address and vice versa, CGNAT makes it possible to share each existing IPv4 address across 64 or more subscribers.

With this approach, 10,000 new subscribers could be connected using only 300 or fewer IPv4 addresses.

By reducing IPv4 acquisition costs up to 80 percent, CGNAT allows ISPs to redirect funds to business growth, and even sell unused IPv4 addresses to capture additional revenue.

FRENCH BROAD EMC CONNECTS RURAL CUSTOMERS WITH A10 THUNDER® CGN
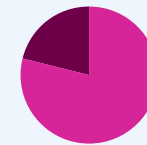
79%
CAPEX Savings

The French Broad Electric Membership Corporation (EMC) electric cooperative has used CGNAT to pursue ambitious goals for growth without being constrained by its limited IPv4 allocation.

The co-op supports up to 20 – 60 customers with a single IPv4 address while achieving up to 79 percent in CAPEX savings.

BUILDING FOR SUSTAINABLE GROWTH

To build long-term success, rural ISPs and other providers working to close the digital divide must resolve the dilemma of IPv4/IPv6 coexistence. Even as they contemplate the eventual migration to IPv6, the lack of backward compatibility between IPv6 and IPv4 will require operators to invest in expanded IPv4 capacity to meet the demands of their growing subscriber base while maintaining secure, high-quality service standards. Adding this capacity through the acquisition of additional IPv4 address space is a costly and risky approach with only limited impact.

CGNAT offers a more viable way forward. CGNAT is often discussed in terms of technology pros/cons — but when considered in financial terms, CGNAT helps minimize the investment risk of IPv4. In fact, providers can even release and monetize the excess pools of IPv4 rendered unnecessary by sharing each address across dozens of subscribers.

In the near term, CGNAT solves IPv4 exhaustion without the need to buy more price volatile IPv4 addresses with questionable long-term value. When combined with IPv4-IPv6 transition technologies provided in Thunder CGN, the ISP can buy time for more gradual IPv6 adoption side-by-side with continued support for IPv4.

CLOSING THE DIVIDE—AND KEEPING IT CLOSED

Rural ISPs have come a long way in their work to extend broadband connectivity to customers everywhere. As they leverage rich government funding, a full portfolio of access technologies, and new collaborative business models to complete the last mile of their effort, it's essential not to let issues around IPv4 exhaustion and IPv6 adoption undermine their growth plans. By adopting the same CGNAT approach already proven by ISPs around the world, they can resolve these operational concerns, stabilize OPEX, and minimize investment risk to ensure sustainable success for their business and reliable high-speed experiences for their customers.

METHODOLOGY

Between November 2022 and June 2023, Gatepoint Research invited selected executives from regional service providers to participate in a survey themed Approaches to Managing IPv4 Exhaustion & IPv6 Migration.

Candidates from regional service providers participated to date, including senior decision-makers at regional ISPs, electrical co-ops, municipalities, mobile network companies, FTTH providers, regional telcos, and web and cloud hosting companies.

This is the second A10 Networks survey of regional service providers, and expands on the previous study, which was conducted in 2021.

LEARN MORE ABOUT A10 NETWORKS

A10 Networks Thunder CGN provides CGNAT technology that enables service providers and other organizations to extend depleted IPv4 address pools and infrastructure, build a seamless transition path for IPv6 migration, and secure growing volumes of vulnerable IPv6 addresses.

Global Communication Service Providers: Market Growth Fuels Security Investments

Critical Core Network Technology for Rural Broadband Buildout

ABOUT A10 NETWORKS

A10 Networks (NYSE: ATEN) provides security and infrastructure solutions for on-premises, hybrid cloud, and

edge-cloud environments. Our 7000+ customers span global large enterprises and communications, cloud and web

service providers who must provide business-critical applications and networks that are secure, available, and efficient.

Founded in 2004, A10 Networks is based in San Jose, Calif. and serves customers globally.

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