



New technology is required for today's network and application environments. **Badu Networks** has it, and your business might not survive without it



Dennis Vadura, CEO

Meet the leader behind the success of Badu Networks

CEO Dennis Vadura is an experienced entrepreneur, software architect and developer. Mr. Vadura started two companies prior to Badu Networks and served as CEO at both: publicly traded AccuPoll, and Web Tools Int. Mr. Vadura also held senior technical and management positions at 3M and EDS.

The lifeblood of virtually every business is its network. It's the delivery mechanism for applications, whether they're hosted on-premises or in the cloud, and the impact of poor performance can be devastating. If your network fails, your business fails.

The continued rapid adoption of cloud services, the proliferation of streaming applications and IoT-enabled devices, and the dramatic increase in remote work since the Covid-19 lockdowns have reduced the effectiveness of traditional QoS, WAN and TCP optimization solutions, as well as newer SD-WAN technologies. Implementing the right solution now to address these long-term trends will future-proof an enterprise to deliver sustainable profitability in the years to come.

There are many network optimization vendors that claim they can address these trends, but one that stands out from the rest is Badu Networks. The company's patented next-generation WarpEngine™ optimization

technology is specifically designed for today's network and application environments. WarpEngine delivers dramatic improvements in WAN, mobile, Wi-Fi and cloud network performance and throughput without costly and disruptive upgrades, enabling customers to maximize ROI from their existing network infrastructure. Badu Networks' innovative software and appliance solutions significantly reduce webpage load times, accelerate enterprise applications hosted on-premises and in the cloud, and speed traffic across the internet. Badu Networks was founded in 2012, and it is based in Irvine, California.

In conversation with Dennis Vadura, CEO of Badu Networks

Why does your unique approach to optimization succeed in today's network environments where other solutions fail?

There are two major reasons. First, many optimization tools assume you have control over both ends of the network. This isn't often the case anymore, since much of today's network traffic travels beyond the corporate firewall over broadband internet connections to the cloud. Secondly, networks are now subject to unprecedented levels of packet delay variation (PDV), more commonly referred to as jitter, and it's become the leading cause of throughput collapse. Today's streaming, IoT and web applications transmit data in unpredictable bursts. Cloud environments are subject to VM scheduling conflicts and random hypervisor delays. Last mile mobile and Wi-Fi networks suffer from fading, RF interference and other issues. All these factors combine to produce extraordinary levels of jitter.

TCP, still the most widely used protocol, treats jitter as a sign of congestion,

retransmitting packets and throttling traffic to prevent data loss until throughput collapses and applications stall, even when plenty of bandwidth is available. And not only TCP traffic is affected. For operational efficiency, applications using TCP generally share the same networks and compete for bandwidth with applications using UDP and other protocols. More bandwidth is often allocated to applications using TCP to compensate for its reaction to jitter. This means bandwidth that could be available for applications using UDP and other protocols is wasted, and the performance of all applications sharing a network suffers. The impact on employee productivity and revenue can be devastating.

TCP's reaction to jitter occurs in the transport layer (layer 4 of the OSI stack). But that's not where network upgrades, QoS and WAN optimization solutions operate, so they really don't do anything to address it. In some cases they even contribute to jitter.

TCP optimization solutions which do focus on the transport layer generally attempt to address TCP's response to jitter with techniques like congestion window management, selective ACKs, adjusting idle timeouts, and tweaking a few other parameters. At most they deliver a 10 to 15% boost in throughput by treating some of the symptoms, but don't eliminate the root cause of jitter-induced throughput collapse. Nor do they do anything to boost non-TCP traffic.

Jitter-induced throughput collapse can only be resolved by modifying or replacing TCP's transport layer congestion control algorithms to remove the bottleneck they create. But to be acceptable and scale in a production environment, a viable solution can't require changes to

the TCP stack itself, or any client or server applications. It must also work with ADCs, SD-WANs, VPNs and other existing network infrastructure to avoid expensive and disruptive rip and replace efforts.

WarpEngine is really the only solution that addresses all these requirements. WarpEngine is implemented as a single ended transparent proxy that can be installed at any point on a network as a hardware appliance, software module or VM in a public or private cloud – a major advantage over dual-ended solutions that require control over both network endpoints. WarpEngine's proprietary algorithms determine whether jitter is due to congestion in real-time, and prevent throughput collapse when it's not. WarpEngine doesn't need unencrypted payload access for compression and deduplication like traditional optimization tools, so throughput stays at consistently high levels for all types of traffic – encrypted, unencrypted, and compressed. WarpEngine builds on this with other performance enhancing features that give our customers anywhere from 2x to 10x or greater improvements in throughput for TCP, UDP and all other traffic on their existing WAN, Wi-Fi, mobile and cloud networks at far less than the cost of upgrades.

Don't jitter buffers prevent jitter-induced throughput collapse?

No, jitter buffers don't really address jitter-induced throughput collapse. Jitter buffers try to improve the user experience by ordering and evenly spacing packets to realign packet timing for consistency right before they're passed to the receiving application. Jitter buffers might succeed in that regard in some instances, but they can destroy performance for live video

and audio and other real-time applications. Moreover, the packet timing realignment process they use often creates random delays that lead to more jitter, compounding the problems we've been discussing.

What about SD-WAN solutions? Don't they take care of many of today's network performance issues?

Yes and no. SD-WAN solutions were introduced mostly within the last ten years to offload growing branch office internet and cloud-bound traffic from leased line and MPLS links to less expensive broadband. SD-WAN offers obvious architectural and cost advantages. However, there's a common misconception that SD-WAN can optimize performance by choosing the best available path among broadband, LTE, 5G, MPLS, Wi-Fi, or any other available link. The problem is SD-WAN makes decisions based on measurements at the edge, but it has no control beyond that. What if all the available network paths are bad? Some SD-WAN vendors bundle in WAN and TCP optimization, and many WAN optimization vendors now offer SD-WAN solutions, but they come with all the drawbacks mentioned earlier. The good news is that WarpEngine can easily be deployed with SD-WANs to overcome these drawbacks.

Security is a huge concern with any network technology. How does WarpEngine address security in comparison to other optimization solutions?

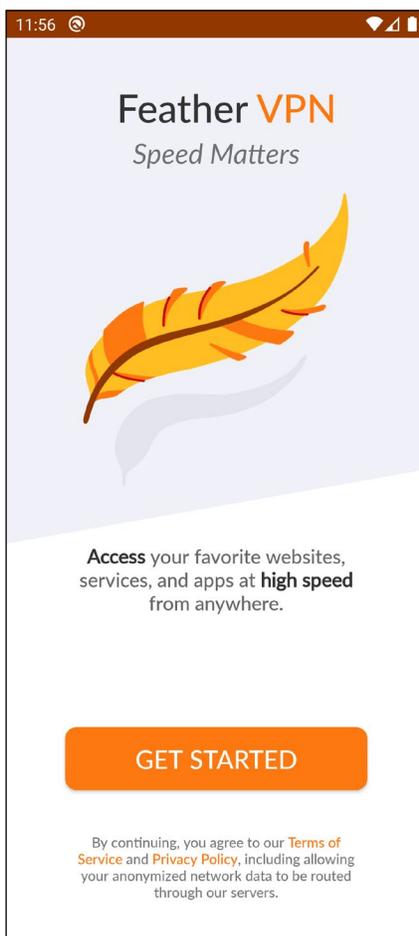
As I've mentioned, WarpEngine is a single-ended transparent proxy that uses an algorithmic approach to optimization. It doesn't need the unencrypted payload, and

therefore encryption key access for compression and deduplication that traditional dual-ended optimization tools do. This means WarpEngine eliminates the security risk and maintenance overhead of exposing sensitive encryption keys to a third-party vendor solution, as well as the performance penalties that result from random encryption/decryption delays at each endpoint that contribute to jitter. These are massive advantages now that over 80% of network traffic is encrypted. Another problem with dual-ended tools that rely on unencrypted payload access is they assume you have control of both ends of the network – an increasingly unlikely scenario. Public web sites will never share their encryption keys.

We've also introduced a new VPN product line that leverages WarpEngine's unique carrier-grade optimization as a major differentiator. In addition to WarpEngine and the latest encryption technology, our new VPN aggregates available LTE and Wi-Fi links to take advantage of their combined bandwidth, and seamlessly transitions between them as mobile device users move around. We have versions

available for: consumers; MNOs and MVNOs looking to optimize their LTE bandwidth and offload as much traffic as possible from LTE to Wi-Fi; and businesses of any size that want secure access and fast network

WarpEngine technology. In addition to the new VPN product line I just mentioned, Badu Networks is extremely well-positioned to become a significant player in 5G as it rolls out over the next five years. 5G networks will require at least ten times the number of cells as LTE because of their shorter range. This means in addition to 5G's high rollout cost, jitter is likely to be far worse than we've seen with LTE, due to fading, RF interference, and other factors becoming more of an issue, despite 5G's dramatic increase in bandwidth. The MNOs we're working with realize this and test our technology on both their existing LTE and new 5G networks. Their results typically show WarpEngine improving their LTE network throughput by up to 3x or more, with similar improvements for 5G. That's why MNOs see us as a bridge to 5G that can help them control the timing and cost of their rollouts by (1) dramatically boosting the performance of existing LTE networks that will still be in place as the backup for 5G for many years to come; and (2) significantly reducing the number of 5G cells they need to deploy – their most significant cost factor.



performance for employees working from any location.

What can you tell us about your company's future direction?

We plan to move forward on two major fronts leveraging our

We'll also be targeting the VM version of WarpEngine, branded as WarpVM™, at Microsoft Office 365. Our testing shows WarpVM can resolve Office 365's widely reported performance issues that kill productivity, because they're largely due to the impact of application behavior and virtualization on cloud network throughput. WarpVM will deliver the LAN-like experience employees were used to before Microsoft Office products moved to the cloud.

[Contact Badu Networks to learn more or request a free trial of WarpEngine or WarpVM](#)

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Our technology stands out because it's the only one that overcomes the obstacles to achieving maximum throughput caused by the transport layer's response to today's network traffic. The result is dramatically improved performance for WAN, Wi-Fi, mobile, broadband and cloud networks, and the applications that use them.”