

Scalable Bandwidth:
**Give Your Network
an Easy Path for
Adding Throughput
When Needed**

Introduction

Rajant's Living Network™ Infrastructure Evolves and Adapts to Your Growing and Changing Connectivity Requirements

Chasing network speed and capacity. As wireless networks expand and applications are added, IT professionals are confronted with an explosion of data that can create bottlenecks. Mobility and bandwidth-intensive applications such as automation, video surveillance, and the “catch-all” category, Internet of Things (IoT), can increase bandwidth requirements dramatically. The result is that these increasing demands can outpace the network’s capacity if not carefully managed.

A major portion of Rajant's Living Network philosophy focuses on the constant innovation and evolution of our Kinetic Mesh® solutions to improve scalability and adaptability. We believe you shouldn't have to rip and replace your network every time you need additional bandwidth. Rajant's unique Automatic Protocol Tunneling (APT) allows your wireless network to transmit data to and from the wired network via multiple Ethernet connections. SlipStream nodes are specifically designed for APT performance. Together, APT and SlipStream can help you evolve your network to meet escalating application and data requirements on your Rajant or non-Rajant wireless network.

IT professionals are confronted with an explosion of application data, creating bottlenecks and increasing bandwidth needs dramatically. This white paper explores how Rajant enables operations to meet rising mobility, throughput, and capacity requirements.



**Rajant SlipStream
Wired Node**



**Rajant BreadCrumb®
LX5 APT Node**



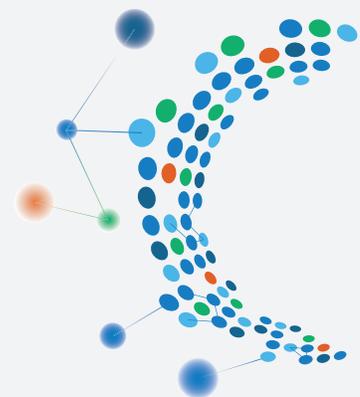
Scale and Adapt with APT and SlipStream

Our self-healing, peer-to-peer wireless mesh networks provide connectivity via a dynamic web of interconnected wireless BreadCrumb® nodes powered by our patented¹ InstaMesh® networking software. With any-node to any-node capabilities, InstaMesh routes traffic over the best available path with extremely low overhead. Kinetic Mesh nodes form a Living Network that offers the ability to easily expand the capacity of your mesh network by adding BreadCrumb nodes and APT connections. This level of adaptability allows you to provide continuous connectivity for the growing number of autonomous vehicles and equipment in industrial environments. SlipStream's high-speed APT gives you an added option in your Living Network toolbox.

- **APT Groups:** As applications are added to your mesh network, the variety of data types and mounting data volume can tax the capacity of your current network configuration. Adding BreadCrumbs utilized as APT nodes can eliminate bottlenecks by getting data off the wireless mesh network and onto the wired network quickly. In an APT group, two or more APT nodes combine to form ingress/egress points into your mesh backbone or wired network without introducing the possibility of a single point of failure. Each APT group elects a master node that encapsulates and decapsulates data, enabling reliable and fast data transfer to and from your wired Ethernet network.
- **Having multiple APT groups within a mesh network can:**
 - Avoid overwhelming a single APT master with multiple data streams
 - Enable more efficient load balancing
 - Allow faster re-routing should a failover occur
 - Greatly increase overall traffic throughput

APT groups can be placed wherever Ethernet access to your LAN is available. The number of APT Groups needed will be based on your network's physical layout and coverage area. To meet your throughput objectives, the placement of each APT group should reduce the number of hops from the wireless network to the wired network. Your authorized Rajant Kinetic Mesh® Partner can help you design and configure the best APT-SlipStream solution for your requirements.

- **SlipStream:** SlipStream is a wired BreadCrumb® node that provides a high-throughput interface between your wired and wireless networks. With SlipStream's high-speed processor devoted to Kinetic Mesh network encapsulation and decapsulation, data can traverse the wired/wireless boundary up to **seven times faster** than a BreadCrumb LX5 used as an APT master.



SlipStream nodes run InstaMesh®, integrate seamlessly with current BreadCrumb models, and are backward compatible with prior BreadCrumb models. The devices are non-radio mesh nodes designed to be placed in a Network Operations Center (NOC) or other controlled indoor environment. A SlipStream can process the output of multiple APT nodes which are operating at full capacity. When deployed as part of an APT group, SlipStream becomes the APT master. Although you can choose to deploy one SlipStream, it is highly recommended that you deploy them in pairs to eliminate a potential point of failure and to provide failover.

¹U.S. Patent 8341289B2

SlipStream Consideration Factors

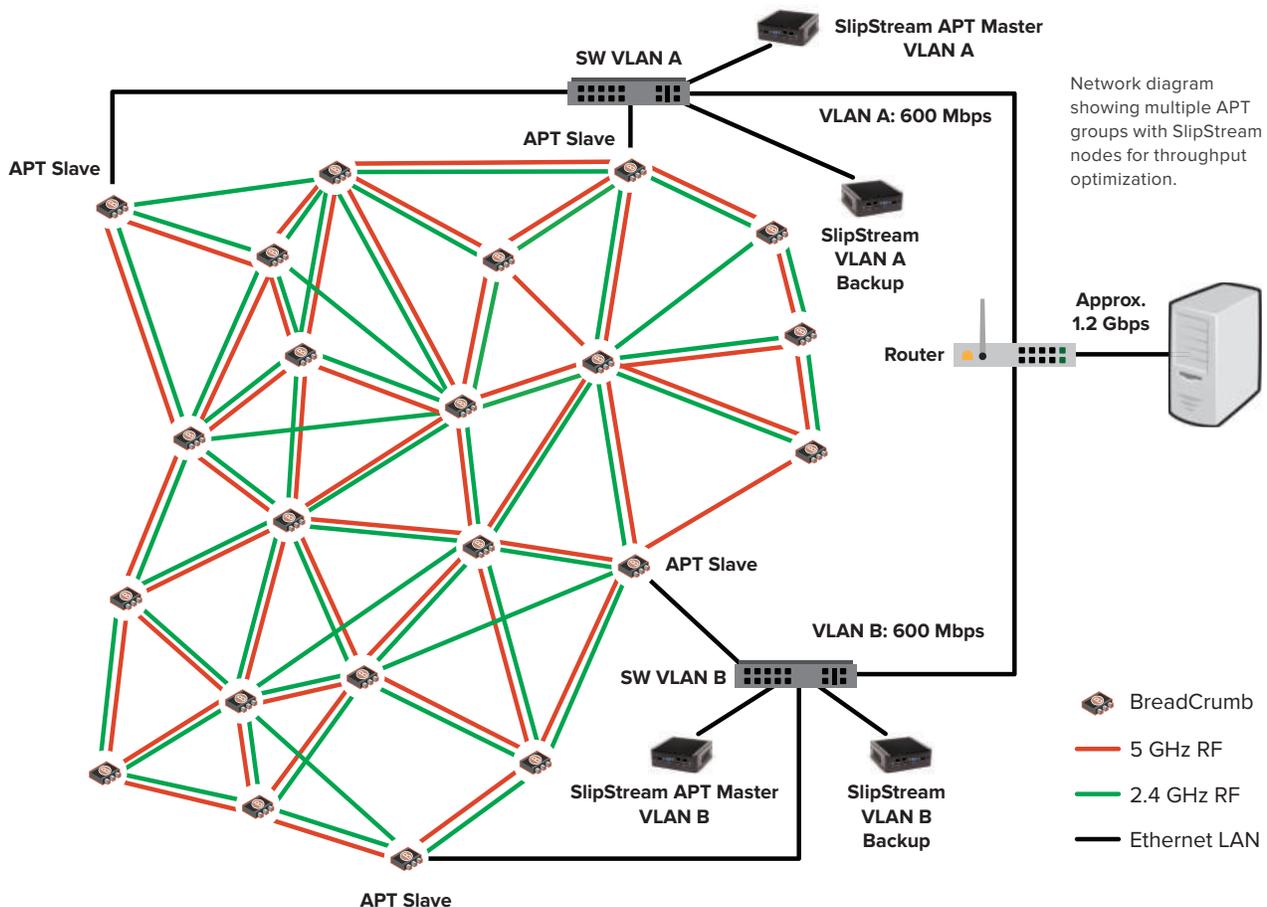
Can your wireless network benefit from SlipStream? To answer that question, you need to evaluate the types and volumes of data that are or will be traversing your Kinetic Mesh network or non-Rajant wireless network.

Key consideration factors include:

- Number of nodes in the wireless network
- Placement of the nodes and the geographic area covered
- Types and volumes of data uploaded to and downloaded from the wired network
- Number and types of applications supported

For an existing Kinetic Mesh network, BCICommander® Network Management and BCIEnterprise Network Monitoring Software can provide you the historical and real-time information needed to evaluate these factors. Check the volume of data traversing each APT master and compare that information to what you determine your requirements to be. If you see that video packets are dropping, an APT master is at 90+ percent processor utilization, or there is evidence of a bottleneck, adding SlipStream nodes can provide the additional throughput you need. If you are **designing a new Rajant wireless network** for a future deployment, you can analyze the same criteria and project APT-SlipStream requirements based on the RFP.

To add mobility, extend coverage, or relieve data bottlenecks for an **existing non-Rajant network**, the same criteria should be evaluated based on historical and real-time information available for your specific network. Our wireless networks can seamlessly integrate with non-Rajant devices and technologies via Ethernet, including satellite, fiber, copper, cellular, point-to-point (PTP) wireless, point-to-multipoint (PMP) wireless, LTE, 3G/4G, and CCTV. With Kinetic Mesh infrastructure and an APT-SlipStream solution, you can upgrade your non-Rajant network while leveraging your existing infrastructure investment.



Network diagram showing multiple APT groups with SlipStream nodes for throughput optimization.



Cost-Effectively Update a Mining Network for Automation Control

Open-pit mines span large geographic areas where fleets of high-cost, high-tech vehicles and equipment operate 24/7. Our Kinetic Mesh® networks are helping mine operators support a variety of applications such as vehicle and equipment health monitoring, miner tracking, drilling and blasting management, dispatch, and production control. An increasing number of automated and semi-automated vehicles and equipment are providing real productivity benefits to mine operations. Such vehicles and equipment are monitored and controlled using sophisticated hardware and software systems, and all have one thing in common: They employ sensors for a variety of uses, including GPS, gyroscopes, radar, temperature, speed, video, and lasers. It is not unusual for a haul truck to have 1,000 to 2,000 different sensors.

Sensors produce a tsunami of data that travel between vehicles, equipment, networks, and application servers. The huge volumes of sensor and application data can create severe bottlenecks. To control automated equipment, constant communications must be maintained between the automated equipment and your wired and wireless networks. Upgrading your new or existing Kinetic Mesh network or non-Rajant network with an APT-SlipStream solution can provide the added speed, capacity, and redundancy needed to eliminate bottlenecks and maintain continuous connectivity.

As an example, one Rajant mining customer was experiencing a maximum of 85 Mbps throughput on their Kinetic Mesh network. Rajant engineers helped them nearly double their capacity by adding a second APT group to the network. With two APT groups, their aggregate capacity was measured between 140-160 Mbps. As they increase the number of video cameras, they plan to add a third and fourth APT group. In addition, they plan to upgrade the wireless LX5 BreadCrumbs® acting as APT masters to SlipStreams. With these upgrades, real throughput is projected to reach 300+ Mbps³ across their Rajant network.

Almost three quarters (71%) of IT leaders are now gathering data for IoT initiatives, according to 451 Research.

Analyst IDC expects global IoT spending to reach almost \$1.29 trillion during the next three years.²

² ZDNet Tech Today, "Internet of Things: CIOs are getting ready for the next big revolution," February 2017

³ In order for your network to increase throughput and/or reduce bottlenecks between your wireless and wired networks, both your wireless and wired networks must be properly designed to optimize bandwidth and support additional capacity.

Leveraging APT to its full capabilities and adding SlipStream can help your operations realize substantial ROI through:

- **Increased Productivity:** Having high-throughput, reliable, and failsafe mobile communications allows personnel to maintain control of autonomous equipment, keep equipment functioning at peak performance, and greatly reduce production outages.
- **Minimized Risks:** Continuous equipment monitoring and control can greatly reduce the risk of collisions as well as the lost productivity and repair/replacement costs resulting from out-of-service equipment.
- **Interoperability:** Because our BreadCrumb wireless nodes and SlipStream wired nodes can communicate with Wi-Fi or Ethernet-connected devices, you can achieve a “living” mesh solution that evolves with and adapts to your connectivity requirements without disrupting operations.
- **Obsolescence Avoidance:** Since we released our first product, all subsequent products have communicated with the devices they replaced. This is a significant differentiator between Rajant and most other wireless network manufacturers.
- **Support for New Applications:** When you deployed your current network, chances are it was virtually impossible to predict the types and number of applications you would be running today. Network scalability and adaptability are vital to support application growth. Our network expansion solutions allow your network to evolve and scale to meet ongoing application growth. Deploying SlipStream and APT in additional industries such as ports, transportation, oil and gas, military, agriculture, and civil government can provide the same or similar benefits.



Supply reliable, High-Speed Streaming Video for Public Safety

Municipal leaders know that having a safe community is a make-or-break criterion to keep and attract residents and businesses. As a result, expanding and upgrading public safety systems are top of mind for many city officials, and video surveillance is the nucleus of any successful public safety program.

As the number of IP-based surveillance cameras and associated video traffic increase, many public safety networks require added capacity and throughput to efficiently transmit video streams to a wired network within the command center. While many competing network technologies, such as public LTE, 3G, and 4G can download data, voice, and video fast, the upload speed is only a fraction of the download speed. And, this scenario can cripple video surveillance communications. A Rajant mesh network with SlipStream can dramatically improve the performance of an LTE or cellular network and increase aggregate throughput. Adding an APT-SlipStream solution to an overloaded public safety network can give you the reliable, high-speed throughput needed to increase video capacity and enable efficient video uploading and downloading.

The global video surveillance market is projected to grow steadily at a CAGR of over 22% during the forecast period 2016-2020.⁴

THE RESULTING ROI CAN BE SIGNIFICANT:

- **Mitigated Risks:** With high-bandwidth, reliable video connectivity, you can gather and disseminate evidence quickly, reduce pay-outs from fraudulent claims, and deter crime.
- **Scalable Video Connectivity:** Video, and especially high-definition video, is vital for nearly all public safety activities. However, video transmissions require high-bandwidth connectivity. Our APT and SlipStream solutions can provide the added bandwidth and capacity needed to efficiently deliver video streams to personnel and help your network scale to meet future surveillance growth.
- **Increased Productivity:** Having fast access to video streams allows you to utilize personnel and resources more efficiently, improve incident response time, and put more “eyes on-the-street.”
- **Improved Situational Awareness:** With mobile access to video, voice, and data, first responders can get real-time information in route to an incident, allowing them to plan and coordinate on-scene actions more effectively.

Summary:

Upgrade Your Wireless Network without Rip-and-Replace

Rajant Kinetic Mesh® solutions offer a great number of cost-effective wireless migration options to help you meet increasing mobility, throughput, and capacity requirements. Based on your network's size and configuration, upgrading your Rajant network or non-Rajant wireless network with an APT-SlipStream solution can help you cost-effectively:

- Increase the speed of data traversing the wired/wireless mesh boundary seven-fold
- Eliminate ingress/egress bottlenecks
- Increase usable bandwidth and deliver data to client devices faster
- Use radio frequency (RF) transmission space more efficiently
- Achieve more effective load balancing for your mesh network
- Have faster data re-routing in case of a failover

For more than a dozen years, our customers have depended on our wireless networks to help them enhance business strategies and maintain a competitive edge. **With a Living Network,™ you can adapt and expand your network to take advantage of the exciting business-enhancing technologies coming during the next dozen years.**

⁴ "Global Video Surveillance Market 2016-2020," TechNavio



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Learn why utilities, ports, mines, agriculture, and more industries rely on Rajant Kinetic Mesh networks for the continuous, fully mobile connectivity required to power today's data-driven operations. Visit www.rajant.com or contact a representative to learn more.