

HiveStar™, SpaceCloud™

And the Edgeless Enterprise

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Lockheed Martin Corporation

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5G wireless networks offer two primary advantages over earlier generations: high bandwidth availability and low latency. 5G provides enhanced communications to a wide host of end user devices ranging from mobile user devices to the Internet of Things (IoT) devices in vehicles, appliances, and sensors.

In general, 5G significantly extends current 4G capabilities but at much higher speeds. When we consider the opportunities of 5G, they include:

- Better geographic coverage for many populations including rural users where there is historically low-geographical user density and bandwidth challenges, mobile platforms for example, on airplanes and cruise ships where bandwidth is generally low, and extending terrestrial networks to these locations.
- Continuity for wartime, emergency and disaster recovery scenarios where communication is necessary.
- Scalable content distribution for delivering multicast/broadcast of common content.
- Security and independence from Terrestrial Networks where bypassing vulnerable terrestrial networks is essential in protecting assets.

One area of interest for our customers is how private 5G networking and edge-computing can enable distribution, processing, and execution of software—and the gathering and delivery of data from the core of the enterprise to the very edges of the world and back again. Such a paradigm enables the future of the intelligent factory and the continuous integration of products from inception to deployment, from our engineers to our customers as they utilize our products in the field—whether on the ground, the ocean, in the air, or in orbit.

We're enhancing the security of this effort by developing an on-board Zero Trust Network (ZTN) Implementation as well as leveraging Quantum Key Distribution (QKD). ZTN is a security concept centered on the belief that organizations should not automatically trust anything outside or even inside its perimeters and instead must verify anything and everything trying to connect to its systems before granting access. QKD is a secure communication method which implements cryptographic

protocols utilizing aspects of quantum mechanics. It enables two parties to produce a shared secret key guaranteed to be known only to them, which can then be used to encrypt and decrypt messages.

This secure foundation provides a trusted platform for the delivery of critical mission applications executed by HiveStar™ and provided using our SpaceCloud™ Pipeline’s DevSecOps facilities providing a consistent, secure, and reliable mechanism for the just-in-time delivery of applications from “Keyboard to Orbit”. Applications delivered correctly the first time, and every time.

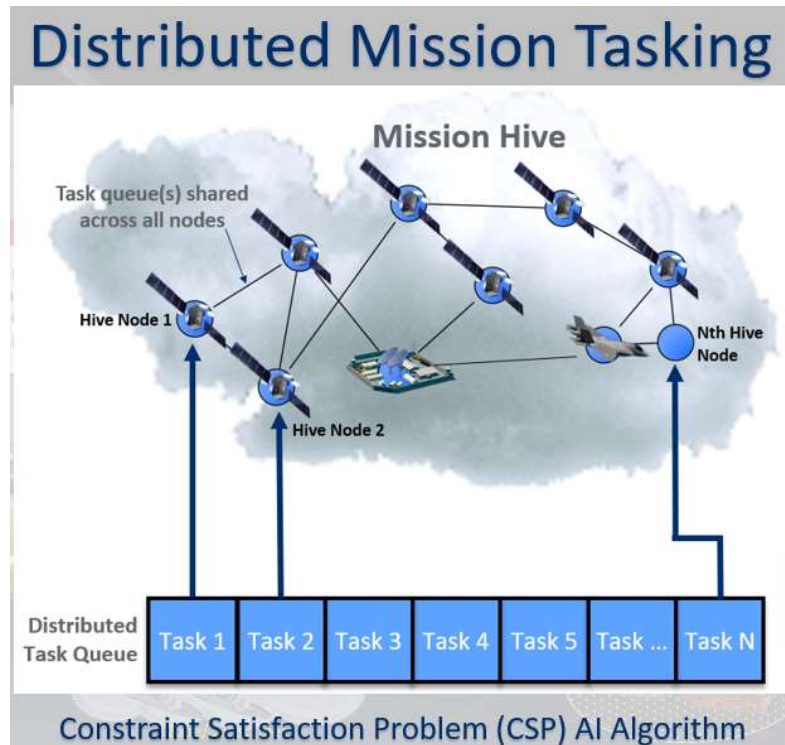
SpaceCloud™: From Keyboard to Orbit



Map data ©2020 Google

HiveStar™ technologies drive the execution of next generation sensing capabilities like a Ranging and Timing System (which provides sub-centimeter radio ranging accuracy) enabling the creation of advanced new technologies like the Coherent Integration of Federated Arrays (CIFA) which uses this base technology to demonstrate radio sensing used in mapping applications.

HiveStar™ and its sophisticated auctioneering system enables the distribution of application tasks across a constellation of resources with no human intervention required. This automatic optimization of resource use allows the effective distribution of mission tasks across disparate assets based on who can perform what tasks at what times. It answers critical needs for just-in-time scheduling optimization in a robust and reliable manner increasing mission agility and resiliency in



complicated situations. This is the future of task scheduling and execution where automated local knowledge drives reliable decision-making and effectivity consistent with higher level goals and priorities.

These capabilities further form the reliable foundation for a distributed and fractionated application ecosystem providing for the composition of applications as autonomous agents continuously monitoring data streams and taking appropriate actions based on higher level instructions and automatically utilizing the most appropriate algorithms for the mission task at hand. This is the basis for an autonomous world view which is controllable by mission directives and enabling the arbitrary minimization of the Observe, Orient, Decide, Act (OODA) loop to that needed to perform *any* mission on-demand.

We view these technologies as key to the future of the enterprise where the core and the edge become one. The entire enterprise becomes part of the hive whether it is about scheduling 3D print jobs on the factory

floor, scheduling an ISR collect from orbit, or chaining these elements together to provide a coherent product integration—offering bespoke capabilities at off-the-rack cost profiles. These are the capabilities our customers want in a way that is affordable, repeatable, and reliable. And they want it yesterday.

Many of these capabilities are built using open source software like Linux, Kubernetes, Istio, Linkerd, and Kafka enabling us to better approach the possible using state of the art technologies from the core of the enterprise out to the edge of computing.