Front line Signal unit manages boom growth

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The 307th Expeditionary Signal Battalion faced a tough challenge in its communications mission when it deployed to Afghanistan as a part of the 2010 force package two troop uplift, in support of the expansion of the Regional Command – North area of operations.

Since the start of Task Force Dragon's deployment, requirements for the RC-N's U.S. contingent exploded from less than 100 to more than 8,000 customers. As the network ballooned many hurdles had to be overcome to provide warfighters with the high quality service expected from the U.S. Army Signal Corps.

One of the first and largest hurdles was the lack of infrastructure throughout the RC-N area of operations. Not just the infrastructure between forward operating bases and contingency operation posts but the infrastructure on the bases as well. At the time, many of the bases were still under construction. This meant construction teams were still clearing mines, building HESCO barriers, tents and work places. At most sites planning communications was very difficult because the layouts changed weekly. This level of non-predictability combined with the slow supply chains of Afghanistan left TF Dragon scrambling to develop a plan to extend services to the ever growing number of customers.

The first solution was to provide customers tactical communications via SIPR, NIPR Access Points, command post nodes, and joint network nodes. These nodes provide a relatively basic level of services through either a shared mesh of seven, five mega symbol time division multiple access carries; or through a dedicated three or four Mbps frequency division multiple access link (JNNs only). This solution was logical and appropriate for the expansion, because by doctrine, that is how an expeditionary Signal battalion fights.

However, with continuously growing customer requirements and lack of base infrastructure, it was becoming common to require multiple tactical terminals on the same base in order to cover all the customer requirements. Not necessarily because of the number of customers but because of their location. Previously Army customers settled in around the source of the communications. In today's changing battle field, customers are forced to setup their locations wherever possible, which means the communications have to come to the customer. Because of this we find multiple tactical nodes being used to support customers with much fewer requirements than the node is capable of supporting.

This wasn't just a waste of the potential of that node; it also had an ill effect on the shared TDMA network. Because of the increasing number of tactical nodes in the TDMA mesh, the network began reaching a constant state of 95% saturation which was causing network instability and poor quality customer service.

Reducing dependency on the TDMA network was TF Dragon's second big hurdle to overcome. The question was how to reduce the demand on the TDMA mesh network but still provide high quality customer service to sites with even the smallest requirements.

TF Dragon's network engineers were able to work out a couple of courses of action to combat this taxing of the TDMA network and increase customer quality of service. The first action was to interconnect the TDMA dependant nodes with the nodes capable of using FDMA or connecting the nodes to the Microwave Line of Site links to the RC-N headquarters at Camp Marmal. This interconnection virtually took the TDMA nodes out of the timeslot requesting cycle for the TDMA mesh but left the satellite link in place in case the interconnected FDMA/MLoS link failed. This type of interconnection is not too uncommon since it's been designed into the WIN-T architecture with the HCLoS system and tactical fiber optic cable assembly runs. However due to the limited land and material available and the layout of the FOBs and COPs; the laying of tactical fiber or the emplacement of the large WIN-T HCLoS shelters was not always an option. So the interconnection was accomplished using a newer IP radio system.

The Harris 7800W IP Radio system has been used throughout theater in a point-to-point configuration for quite some time with a high rate of reliability. Because of its small size and efficiency, up to 108Mbps through put in PtP mode, it has become a staple for LOS communications in the theater, up to 54Km. However, in the North we were able to use it in its more versatile mode, point to multi-point. When using the PtMP configuration and the sixty degree sector panel antenna we were able to build a robust base infrastructure networks with just a few radio sets. In PtMP configuration the Harris 7800W IP Radio is capable of a maximum through put of 54 Mbps at distances up to 24 KM. In this configuration the sector controller radio can control up to 20 sector subscriber radios. For example, on FOB Dehdadi II, by utilizing a setup of both a PtP and a PtMP radio network the tactical node footprint has been reduced from nine tactical nodes down to two, providing communications to over 500 customers on NIPR, SIPR and CX-I.

Besides just utilizing the standard tactical node interconnect TF Dragon's network engineers needed to find a way to extend service to customers without having to emplace an entire tactical node in order to interconnect. The solution was to build area distribution nodes. These ADNs come in two forms tactical and strategic.

The original tactical ADN consisted of an AES256 capable router and switch for NIPR connected to a set with a TACLANE, router and switch for both SIPR and CX-I. But due to a shortage of networking equipment we found a way

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to reduce the equipment requirements of this ADN but removing the SIPR and CX-I routers and terminating the GRE Tunnel on the Layer 3 enable switch. This worked for all tactical sites because the number of users was low so it wouldn't over tax the switch's CPU.

The original strategic ADN looked very similar but with one difference. Strategic uses a Black Core transport network that consists of an open switched network to allow any end to end encrypted traffic to flow to any point that it was needed. So the strategic ADN stack consisted of a Black Core switch; NIPR router and switch; SIPR & CX-I TACLANE and switch. Or because of the Black Core infrastructure if a site just required one of the services all that was required was the Black Core switch and the appropriate switch/router/TACLANE combination to provide the required service. A prime example of this combination of ADN and 7800W radio network infrastructure is on Camp Marmal. By utilizing a two SC Radios setup with overlapping fans TF Dragon was able to support the entire FOB with 18 current SS radios ADNs at customer sites offering full strategic services from the strategic point of presence; with the expansion capability to support up to 40 ADN sites.

By utilizing both of these solution sets TF Dragon was able to reduce its TDMA footprint from a peak of 72 tactical terminals to the current 50, with the current 50 having 12 interconnects--8 from TDMA nodes to an FDMA capable node and the remainder connected to the MLoS back to Camp Marmal.

This reduced the TDMA network burst time plan from a constant 95% utilization to an ideal 60% utilization over a seven carrier TDMA mesh. This in turn left room for the ever increasing customer base which from the start of implementation increased by over 50%. By implementing these creative architectural changes to the RC-N network infrastructure, TF Dragon and its network engineers have ensured a manageable and stable network for the future expansion of customer service throughout the North.

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Signal Soldiers operating in Afghanistan.