guities in the technical specification, reducing costs as there wouldn't need to be as great a buffer for unknown contingencies. A more comprehensive and well documented design would also make the project more enticing to a higher tier of integrator and give the village a sense of security, in that there would be someone on the team who had done this before. "And it was nice not to have to do this all on our own," adds Schaak.

Following is an inside account of how the consultant, integrator and end user have smoothly coordinated the project thus far.

Designing the System

The village took the work it had done to date on a system design and incorporated it into a Request for Qualifications (RFQ) for consulting services. Thirteen respons-

Proper Network Design Keeps Cameras From Phoning Home

There has been a lot of attention paid to cameras from certain manufacturers being able to "phone home" and potentially report sensitive information back to their manufacturer and potentially a government entity that may be affiliated with said manufacturer. While the theoretical danger is understandable, with a properly designed system this is simply not an issue.

One way to do this is to build two separate LANs, either with discreet network switches or by setting up a VPN. Consulting firm R. Grossman and Associates advocates doing this with separate switches as it makes servicing the system easier, but either way only the Client LAN is exposed to the outside world; cameras are on their own network with no Internet access. To view a camera, you need to go through the system firewall and the VMS software, as the servers bridge the two LANs. Cameras cannot phone home, regardless of manufacturer or country of origin, and a hacker cannot disable a camera without first going through the server and proprietary client software that they are likely unfamiliar with.

es were received, with R. Grossman and Associates (RG&A) ultimately selected to design, bid and project manage the years-long enterprise. Having clearly defined requirements from the client was tremendously helpful and using its RFQ as a starting point for the system design, an extensive information gathering effort was undertaken to create a design that, when complete, will connect and centrally monitor in excess of 200 cameras in 30 locations throughout the village. These include the Village Hall, performing arts center, public safety building, senior center, municipal airport, commuter rail station, engineering and public works building, five fire stations and 12 water infrastructure facilities (towers and tanks).

The system was designed with a distributed architecture to minimize the bandwidth requirements while maintaining image quality (frame rate, resolution and compression). For the most part, cameras would be recorded on a server at each location, with the exception of a few spots that were already connected via fiber and had dark fiber strands available. Servers installed in conditioned space (or open interior space where temperature was not an issue) utilized 1RU Razberi servers with four data drives that can be put into a RAID-5 configuration, and a solid-state drive (SSD) for the operating system and VMS software. Locations that did not have any sort of temperature control (such as water towers) utilized hardened servers rated for an operating environment ranging from -13° F to 140° F with 10% to 90% noncondensing relative humidity, to be on the safe side.

All servers were integrated boxes, incorporating integrated PoE+ network switches for the associated cameras, and were sized for the implementation of all phases. For example, if there were two adjacent buildings that were covered in different phases, the server was sized to handle the total camera count, reducing costs in later phases. Reliability was important as well; all patchable cabling utilized pass-through keystone jacks rather than 110-style punch-down blocks to simplify troubleshooting later. SSDs were used exclusively on the hardened servers for both the operating sys-

tem and VMS software, and a separate SSD was used for data. Surge protection and UPS systems were implemented throughout.
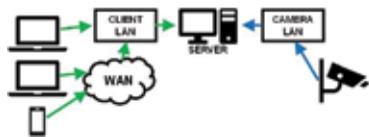
Selecting the Integrator

The RFP was released October 2016 and was designed to be scalable. There was a base bid that included certain elements common to all phases of the project (i.e. operator workstations) and four additional phases that could, for the most part, be implemented in any order — all required the base bid, but only Phase 5 had other dependencies. The 11 responses were generally excellent and included a good cross section of national, regional and local integrators. Pricing was varied — the high bidder was almost three times as much as the low bidder — but fell into roughly three pricing bands, once bidders that lacked credibility were disqualified. Choice of a VMS impacted pricing, so some time was spent on that to narrow the field (*see Deploying a Modular System Design sidebar*).

After careful consideration, Addison, Ill.-based Pentegra Systems was selected as the integrator believed to best serve the village and this project. Founded in 2000, Pentegra has won several awards and was extremely responsive throughout the evaluation process. Its team, including CEO Ed Karl, President Greg Augspurger, Security Engineering Manager Gene Brierton and Sales Engineer Jim Lichter, impressed with their knowledge, experience and collaborative approach, and their references echoed those sentiments. Their solution included Antaira Technologies hardened network switches, Axis cameras, EnGenius EnStation AC wireless links and Razberi servers (both hardened and rack mounted). Once the final submittals were received and approved and contracts were in place, work commenced on Phase 1 of the installation, which included six locations and roughly 70 cameras.

Installing the Solution

The on-the-ground task of managing the installation fell to Chris Westgor, technical services manager for Schaumburg, and Brierton at Pentegra, with remote support and site visits at key milestones from RG&A. Almost immediately, West-