

**Application for  
The Northwest Academic Computing Consortium  
Joanne R. Hugj Excellence Award**

## Outdoor Campus Public Safety Camera System

Pacific Northwest National Laboratory  
IT Services Division

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### Abstract:

The Campus Camera and Emergency Call Station system enhances the safety and security of staff and visitors to the Pacific Northwest National Laboratory (PNNL). Our implementation leverages both state-of-the-art wireless mesh technology and commodity wireless technologies. Use of the wireless mesh for camera and access point interconnections reduced construction costs of the system by a factor of ten. The self-healing mesh provides redundancy within the Campus Camera infrastructure. As a bonus, the system provides continuous wireless coverage across the campus so that staff and visitors stay connected, even when moving from building to building. Furthermore, the broad coverage improves detection of unauthorized wireless access points that jeopardize PNNL network security.

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### Description of the Practice:

The need for safety and security on campuses is at an all-time high. At Pacific Northwest National Laboratory, one of 10 DOE Office of Science national laboratories, 4,200 staff conduct critical research in energy, environment, fundamental science and national security. The main campus includes over 35 buildings and facilities spread over approximately one square mile area north of Richland, Washington.

As part of an effort to improve campus safety, cyber security, physical security and emergency response, PNNL installed a comprehensive new safety system consisting of 81 cameras, 14 emergency call stations and campus-wide outdoor wireless mesh network. The project also included a major update of PNNL's Operations Center: relocation to a larger facility, plus six large wall monitors that display multiple images per panel.

The video cameras are mounted on light poles and send encrypted signals in real time to receivers on the rooftops of nearby buildings (see inset at right). The Operations Center receives the camera and emergency call station signals after they are routed through network security systems designed to detect and prevent unauthorized activities.

The Campus Public Safety Camera System uses Aironet Wireless Mesh technology from Cisco Systems. PNNL's IT Services group designed and manages the supporting wireless mesh network for the new system. The new mesh integrates well with extensive indoor wireless networks in use across our campuses.



## Responses to Evaluation Criteria:

### Innovation

Metropolitan and campus WiFi networks are becoming more common. However, these networks typically are used just for data services. PNNL is the first federal government organization in the country to implement the new Cisco product in a comprehensive large-scale video, voice and data application.

The implementation was the first for video cameras on this scale using Cisco's wireless mesh technology in addition to the emergency call stations that rely on wireless Voice over IP (VoIP).

The PNNL campus has many trees and line-of-sight obstacles. This, coupled with its size and the number of bandwidth-intensive video cameras, required an innovative engineering approach to prevent interference from such a dense outdoor network. The challenges presented led to a deployment team that included one of Cisco's foremost WiFi experts.

The new wireless system is now being integrated with the indoor wireless infrastructure to create a complete campus canopy of wireless services, including video, voice, data and location applications.

The Outdoor Campus Public Safety Camera System crosses all organizational boundaries at the Laboratory in terms of its deployment and subsequent use. The canopy network lays the groundwork for the Research Campus of the Future, a new initiative that includes cutting-edge facilities and an adjacent science and technology park.

### Benefits

Through its support of the video cameras and emergency call stations, the campus camera installation has spread a safety umbrella over the entire PNNL campus. This achievement satisfied the customer's primary requirement for video coverage, while increasing both cyber and physical security at the laboratory, as well as the capabilities of the Operations Center staff (inset below).

- The same architecture that supports the camera system provides an outdoor wireless network covering most of the PNNL campus.
- The system is uniquely capable of detecting and thwarting unauthorized wireless activities affecting the campus.
- With 81 cameras strategically placed throughout the campus, Operations Center staff can evaluate activities in parking lots, key pedestrian areas and facility perimeters.
- The wireless architecture significantly improved safety during the construction phase by eliminating the need for trenching to install buried cable.



PNNL has an extensive internal wireless infrastructure, and various auditors have noted it as a best-in-class implementation. Use of a standards-based outdoor product (Cisco Aironet) that is compatible with PNNL's internal wireless network enables integration of indoor and outdoor architectures for more efficient and effective operation. The infrastructure offers additional opportunities, including:

- quick deployments of secure point-to-point connections as a part of our Business Continuity plans to mitigate impacts caused by IT infrastructure damage on campus
- campus-wide wireless data network, allowing staff and visitors to stay connected as they move between and within buildings

- campus-wide infrastructure supporting radio frequency identification, leveraging PNNL-developed radio frequency identification technologies, offering considerable property tracking efficiencies
- campus-wide VoIP, which is particularly well suited to crafts and facilities support personnel who move throughout the campus daily.

A key benefit of the project was the use of new wireless technologies instead of cable and conduit to connect outdoor cameras on 30-foot light poles to the Operations Center. The wireless implementation not only offered a more redundant architecture than a conventional wired approach but also significant cost savings (see Cost Benefits).

### **Replicability**

The PNNL implementation is directly applicable to any research campus, whether commercial or university. The advanced physical and cyber security protections it offers render the system particularly applicable for areas with sensitive research.

We are leveraging our experience and relationship with the vendor to develop solutions for alternate scenarios that require quick setup and redundant architectures, such as regional disaster recovery scenarios (e.g., Hurricane Katrina), Homeland Security initiatives support and military deployments.

### **Costs**

The total cost of the new system was approximately \$2.8M. It is estimated that deploying wired network connections to each camera and call station distributed around the campus would have added nearly \$5M to the total cost. In similar outdoor deployments at PNNL, wireless has been about 10 times less costly to install than conduit and cable. Besides basic network connectivity, the new dual radio mesh access points also provide the multiple benefits described above, including the ability to interoperate with extensive indoor wireless networks that provide large productivity benefits to researchers. The large cost savings from using wireless for camera connections made the overall project possible.

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### **Links:**

None.

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