

Connecting Sichuan Leverages IoE Capabilities to Improve Healthcare and Education



EXECUTIVE SUMMARY

Objective

- Build a connected community from the ruins of the 2008 earthquake
- Use technology to improve healthcare, education, and economic development
- Create scalable, replicable models for technological innovation

Strategy

- Working within a public-private partnership, incorporate ICT into the disaster rebuilding effort

Solution

- Connected ICT infrastructure encompassing cellular, satellite, and a variety of broadband technologies
- Healthcare initiatives include mobile device connectivity, Mobile Clinics, and networked medical facilities
- 21st Century Schools initiative uses digital technology for distance learning, shared content, multimedia instruction, and teacher development

Impact

- Improved access to medical care through Mobile Clinics, 32 new “smart” hospitals, 66 networked medical facilities, and streamlined medical administration
- Networked campuses and remote learning improve educational opportunities for students and teachers
- Technology in the classroom supports long-term economic growth

Background

In January 2014, Cisco released the results of an in-depth analysis of the economic benefits of the Internet of Everything (IoE) for the public sector. Cisco’s model revealed that some \$4.6 trillion in “Value at Stake” would result from the adoption of IoE capabilities across 40 key public sector use cases over the next 10 years, including smart water, smart buildings, smart energy, smart parking, and more (<http://bit.ly/1aSGIzn>).

As a next phase of its analysis, Cisco engaged Cicero Group, a leading data-driven strategy consulting and research firm, to undertake a global study of IoE capabilities across these 40 use cases – how the best public sector organizations are “connecting the unconnected,” as Cisco terms it. To that end, Cicero Group conducted interviews with dozens of leading public sector jurisdictions – federal, state, and local governments; healthcare organizations; educational institutions; and non-governmental organizations (NGOs) – to explore how these global leaders are leveraging IoE today.

The research examined real-world projects that are operational today, are being delivered at scale (or through pilots with obvious potential to scale), and that represent the cutting edge of public sector IoE readiness and maturity. The aim of the research was to understand what has changed in terms of the jurisdictions’ people, processes, data, and things, and how other public sector organizations can learn from (and replicate) the trail blazed by these global IoE leaders. In many cases, these jurisdictions are Cisco customers; in others, they are not. The focus of these jurisdictional profiles, therefore, is not to tout Cisco’s role in these organizations’ success, but rather to document IoE excellence, how public sector entities are putting IoE into practice today, and to inform a roadmap for change that will enable the public sector to address pressing challenges on multiple fronts by drawing on best practices from around the globe.

About Connecting Sichuan

A violent earthquake and series of aftershocks in 2008 devastated parts of Sichuan province in China, killing 80,000 and seriously injuring hundreds of thousands. The disaster left many homeless, while decimating schools and healthcare facilities. Connecting Sichuan – a public-private partnership that is unique in China – tackled technological rebuilding and revitalization of the area. The project was a three-year effort incorporating state-of-the-art information and communications technology (ICT) infrastructure throughout the rebuilding process. Its threefold approach addressed healthcare, education, and economic development by preparing youth to enter the future as a technologically progressive generation.

Qiang Liu is president of the Shifang Traditional Chinese Medicine Hospital within Sichuan's medical network. He also serves as director of the Shifang Health Bureau Information Center.

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Objective

The Connecting Sichuan project sought to build a uniquely connected community with state-of-the-art technological infrastructure designed to promote locally sustainable growth of healthcare and education. In addition to the structural rebuilding of the area, the project managers consciously incorporated technology into the rebuilding, with a particular focus on the outcome, rather than just product deployment. The rebuilding effort provided an ideal proving ground for technological innovation. Provincial and central Chinese government leaders were interested in seeing how rebuilding could be used to incubate solutions for replication in other parts of China.

Strategy

Connecting Sichuan is a public-private collaboration in which the government of China committed more than \$145 billion to the overall Sichuan earthquake rebuilding effort. In addition, a major global technology company provided infrastructure technology and services. The program's threefold strategy focused on applying technology to improve healthcare, education, and long-term economic development in the area.

Mr. Liu indicated that the Connecting Sichuan project involved local medical administrators from the early stages of development. "From the beginning, our designs for reconstruction after the earthquake were coordinated with the Connecting Sichuan project," he explained. "The network design was specifically reflected in the overall plans, ensuring that different medical facilities, patient rooms, and buildings were all connected."

Solution

Telecommunications Infrastructure

A connected ICT infrastructure was a key dependency for the other Connecting Sichuan initiatives. To reestablish communications as soon as possible following the earthquake, the government established multiple avenues of connectivity, including cellular, satellite, and a variety of broadband technologies.

The first thing the government established was the mobile or wireless network in the earthquake region, making Sichuan one of the first regions with pervasive 3G network availability. Along with a focus on road and building reconstruction, the project addressed the need for a robust ICT infrastructure, such as fiber optics along roads and ICT equipment in medical and educational institutions throughout the province. In Wenchuan County, the worst-hit region, the government established 150 endpoints using the local cable TV network's broadband. Together, these efforts connected Sichuanese communities to both internal resources and those outside the province, helping to stimulate economic growth.

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Healthcare Initiatives

Following the earthquake, a top priority was to bring medical care to the vast numbers of injured survivors, many in remote villages that were hours from the nearest hospital or clinic. While delivery of urgent medical services was the impetus for the program, it was designed around the community's longtime need to reduce the cost of healthcare delivery while increasing the quality of medical services. The new system made use of network telecommunications, cloud-based and centralized data management, and mobile technology to fundamentally change the delivery mechanism for healthcare.

In addition to stretching valuable medical resources, smart hospital technology uses the network to streamline administrative tasks and enable physical security, building management, energy utilization, and even air conditioning – all the different aspects of the hospital physical environment.

Mobile Device Connectivity

Immediately following the earthquake, medical field staff used mobile devices to map disease outbreaks, a common public health issue in disaster situations. With compromised transportation and communication systems, the key challenge was determining how to monitor for disease and intervene quickly. With widely deployed mobile devices, public health workers were able to capture disease information in the field and send it to the Centers for Disease Control and other public health agencies. The CDC could then use analytics to pinpoint the outbreak and respond appropriately.

Mobile Clinics

A fleet of Mobile Clinics was deployed to provide urgent care to areas that had been cut off by the earthquake. A Mobile Clinic is a four-wheel-drive vehicle capable of negotiating the rough terrain of hillside villages, and configured to provide basic medical services and consultations. The vehicle is equipped with radiology diagnosis equipment, an ultrasound unit, and laboratory capabilities, as well as a

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consultation room with telehealth capabilities, including video, audio, and data links. Multiple connectivity technologies – including a satellite-based communication gateway for remote areas – provided reliable connectivity during subsequent serious aftershocks. The vehicles also have microwave connectivity and a 3G gateway to allow voice and database connectivity.

When Mobile Clinics travel from village to village, they provide onsite examinations and testing, as well as video conferencing that allows city doctors to provide remote consultations to clinic visitors. The most widely used connectivity is between the Mobile Clinics and township medical centers, through which the Clinics connect with the centers' broadband services.

The vehicles were instrumental in restoring medical care and providing essential medical services in the aftermath of the quake. They have since become a permanent extension of Sichuan's hospitals, providing onsite care and linking rural villages with distant providers and other resources available at large medical centers.

Networked Medical Facilities

Thirty-two new "smart" hospitals were constructed or reconstructed as part of the project, extending ICT to all 66 medical facilities in the region. ICT has become the backbone of care delivery for the region, which does not have enough qualified doctors to adequately staff all of its medical facilities.

The telehealth technology built into the new smart hospitals allows for remote patient consultations, while collaborative events such as professional consultations are conducted via video conference. Patient data and other medical information are shared among these and 66 other provincial medical centers, which now have broadband network connectivity and video-conferencing equipment. A cloud-based data center connects them all together. For example, doctors in various locations work with each other on case studies, remote consultations, or remote radiology readings. Hospitals are no longer isolated, and previously underserved areas of the province now have access to all of these institutions.

Self-sustainability of the hospitals and clinics was important from the start. Mr. Liu noted that at present, roughly 90 percent of the ongoing technological support for the ICT infrastructure within his hospital is done internally, while the remaining support is contracted to partnering technology companies. Hardware and software support is all provided by local Chinese firms.

Educational Initiatives

The primary goal of the Connecting Sichuan educational initiative was replacing schools lost in the earthquake with "21st Century Schools" incorporating state-of-the-art ICT and digital technology in the classroom. Objectives for the structures included a networked educational community with shared instructional content; increased learning options through remote classroom activities; curricula supported with multimedia presentations; and teleconferencing events to provide teachers with opportunities for professional development.

The first step in the educational portion of the Connecting Sichuan initiative was providing ICT to create a connected campus. Connectivity is critical to a 21st-

century classroom, in which curricula and teaching strategies are shared using a cloud-based approach. In this system, master teachers provide smaller schools with access to a variety of classes and professional support. For example, a teacher in the capital city of the province can teach a class that is broadcast to other schools in the earthquake zone, and the students can participate in back-and-forth interaction with the teacher. Additional course options, improved curriculum, and wider access to the most highly skilled teachers are particularly valuable in rural villages.

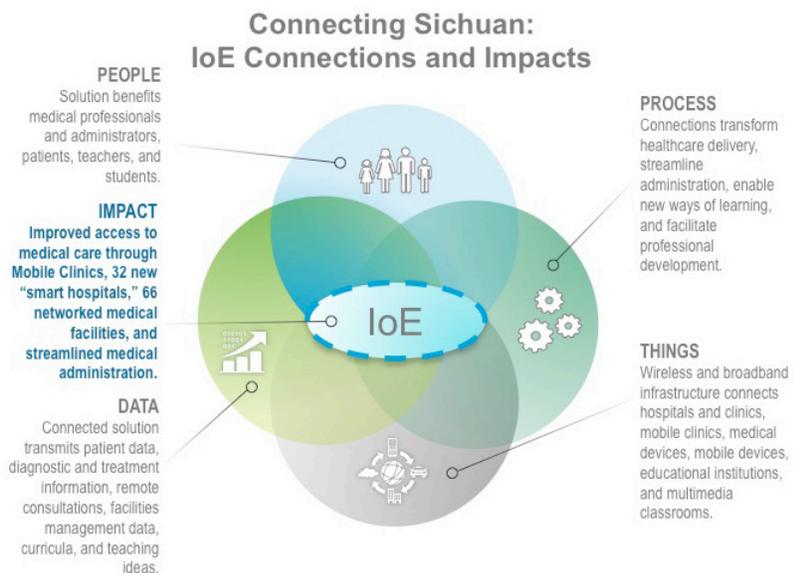
Smart classroom installations occurred primarily in quake-ravaged areas, but audio-visual connectivity was extended to areas beyond the quake zone as well, providing additional educational opportunities and professional support in remote school systems. ICT equipment and use vary by the needs of each class, ranging from voice- or portal-based connections, to telepresence capabilities, to more immersive environments. Digital whiteboards have also replaced traditional chalkboards.

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To a certain extent, the program is a greenfield initiative and serves as a valuable test site for educational models. It provides the opportunity to experiment and capture the impacts of policy or process change, as well as of technology deployment.

Figure 1. Connecting Sichuan: New and Better Connections.



Source: Cisco Consulting Services, 2014

Impact

The Connecting Sichuan program has been widely recognized as a model of both disaster response and smart community design.

Healthcare Initiatives

One of the primary goals of the Connecting Sichuan program was to provide long-term and sustainable change in healthcare delivery, addressing the shortages of trained medical professionals and limited access to quality care in remote communities. Building or rebuilding 32 smart hospitals, networking 66 medical facilities, and providing mobile delivery of healthcare services have made these objectives a reality for millions of Sichuan residents and medical providers.

Mobile Clinics and Telehealth

The Mobile Clinics have proven a highly effective tool within the Sichuan medical community, and the program has grown well beyond the initial deployment. Additional Mobile Clinics have been put into use not for disaster response, but as an extension of hospital services to remote areas such as the ethnic Tibetan region of the province. The Mobile Clinics are providing health screenings and bringing patients to hospitals for treatment.

In addition, the proliferation of mobile devices and telecommunication technology assists with identification and management of disease outbreaks, providing real-time support for field personnel from the Centers for Disease Control.

Smart Hospital Networking

Connecting scores of hospitals and medical centers has promoted consistency and quality of service. Access to common cloud-based medical and patient data, professional development training materials, remote specialist support, and quick consultations with distant colleagues creates an environment of collaborative patient care. It encourages ongoing treatment of chronic conditions and results in improved patient outcomes. These contributions are particularly important in rural communities.

Streamlined Medical Administration

Mr. Liu also stressed that the new technological infrastructure vastly improves the efficiency of hospital processes. It streamlines patient intake and management, and decreases wait times by bringing centrally stored information to the right person at the right time. For example, patient test results are now available online, instead of doctors or patients having to retrieve hard copies or evaluation. The information flow also allows for easy calculation of doctors' performance reviews and workloads. Additionally, the system easily tracks and analyzes consumption of medical supplies and other materials.

While the infrastructure upgrades incur up-front and maintenance costs, they do not directly increase revenue. However, it is believed that reduced patient wait times and other efficiencies may indirectly affect revenue.

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Another goal of the Connecting Sichuan program was to create a model for future community development programs. A group of academic researchers from Peking University, led by top health economics professor Gordon Liu, conducted a household-based, data-driven evaluation of the impact of Connecting Sichuan's healthcare initiatives. The peer-reviewed study, "Transforming Rural Healthcare Through Information Technology: an Interventional Study in China," appeared in the journal *Health Policy and Planning*, published by Oxford University Press. The study identified a number of successes in the program, and provided the following conclusion:

Connecting Sichuan was designed to systematically transform healthcare, education, and the workforce through networking technology. The Connecting Sichuan partnership has been a springboard for innovation and an incubator for the development of sustainable, replicable, and scalable technology models in Sichuan and beyond.

Technology-based classroom interactions also fulfill one of the objectives of Connecting Sichuan: educating a technology-savvy generation to assist in the area's long-term economic recovery.

Educational Initiatives

The educational environment of the 21st Century School includes advantages for both teachers and students. Networked campuses promote anytime, anywhere interactions among students, teachers, and senior educators, supporting engagement by all campus participants. Remote learning opportunities, shared instructional tools, and multimedia content in the classroom provide additional resources for teachers and a richer learning experience for students.

Technology-based classroom interactions also fulfill one of the objectives of Connecting Sichuan: educating a technology-savvy generation to assist in the area's long-term economic recovery. The early exposure to technology not only helps students learn the content, but also helps encourage critical thinking and the ongoing study of technological fields.

Lessons Learned / Next Steps

Mr. Liu described some early resistance to Connecting Sichuan programs within the medical community, saying that initially, "a lot of people weren't familiar with the system, and opposed it." He explained that some opposition originated with the staffs of newly built medical centers, but that "the opposition phase has already passed. These people have seen the benefit, and now very few people are against it." Among the few holdouts are some senior physicians who struggle with any kind of technology. To address the problem, Mr. Liu engages staff to assist the physicians with tasks such as ordering online prescriptions.

To help overcome objections and train users in the new technologies, Mr. Liu relied heavily on the Information Center, a service center organized as part of the Connecting Sichuan strategy. He described the center as an invaluable resource during implementation and training phases. "Its goal was to provide information support to medical organizations in our area, as well as strategic planning," he explained.

The Connecting Sichuan initiative offers a model that can be replicated elsewhere – not just within China, but wherever access to healthcare and educational resources needs to be more efficient and widespread.

Mr. Liu's biggest challenge going forward is maintenance support. "After all," he said, "this equipment will depreciate and run into problems, and it requires staff to maintain." However, Mr. Liu is hopeful for the long-term success of the program. He continues to adjust systems to optimize usage of the technology and increase efficiency. "Our plan right now is to enrich our application systems," he said. "We will develop numerous applications based on our medical organizations' business or management needs in Shifang city. We hope to make management easier, improve efficiency, and have the general public enjoy the benefits of the system."

Local sustainability is also an issue requiring policy changes, particularly regarding reimbursement for some procedures. For example, if a doctor provides remote support and is not reimbursed, then the system is not sustainable. Local governments and rural health insurance entities will need to adjust policies and processes to support the change-management process.

While the project began as a public-private partnership, it is now in the hands of local authorities who are continuing to manage and expand the program. The Connecting Sichuan initiative offers a model that can be replicated elsewhere – not just within China, but wherever access to healthcare and educational resources needs to be more efficient and widespread. While there have been other successes in telehealth and distance learning, the timing of the Sichuan deployments – coinciding with an increased governmental focus on health reform – bodes well for the long-lasting impact of the Connected Sichuan initiative.



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