Professional Capacity Building for Communications

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Session G1: Professional Development Opportunities – Developing Your Skills and those of your Organization

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Abstract

Rural ITS deployments are becoming increasingly complex in order to adequately address the challenges that rural transportation presents. However, *even though rural communications engineering is a mission critical skill, many engineers have relatively little experience with the myriad of technologies that could be applied.* Furthermore, because technologies are changing and becoming obsolete very quickly, transportation professionals find it challenging to stay abreast of the latest technologies available on the market. *Transportation agencies are also faced with the challenges of finding qualified staff, increasing turnover, retention of existing staff with their experience, skill and leadership, and attracting new entrants to the transportation workforce.* A variety of training options for communications are available commercially, from academic institutions, trade organizations, and industry. However, *opportunities to gain training particular to rural transportation communications is limited*.

To build the professional capacity of rural ITS engineers, this project developed a comprehensive curriculum and conducted training for Rural ITS communications. Lead by subject matter experts, the training courses provided a hands-on, "nuts and bolts" learning experience. In this presentation, we will discuss the curriculum that was developed and the training courses that have been delivered. We will examine the lessons learned through two phases of the project, consider options for continued professional capacity building of ITS engineers, and discuss the potential applicability to other state Departments of Transportation.

Need

- Many engineers have relatively little experience with the many technologies that could be applied to rural ITS communications.
- Technologies are changing and becoming obsolete very quickly.
- Transportation agencies are facing challenges in hiring qualified staff, retaining experienced personnel, and attracting new entrants to the transportation workforce.
- Opportunities to gain training specific to rural transportation communications is limited or non-existent.
- Because available training is so diverse it is extremely difficult to gain sufficient, up-to-date, and practical skills to adequately address the challenges of rural ITS communications.

Problem

Rural ITS communications systems are compromised because of the lack of professional capacity.

- Rapidly changing technology
- Increasing competition for skilled workers
- High expectations for the level of service required of the transportation system
- Limited resources
- Increasing demand on the transportation system
- Overall smaller labor pool

Solution

To address the need for Professional Capacity Building in Rural ITS communications, this project has helped to develop a comprehensive curriculum and conduct training for Rural ITS engineers and technicians.

- Taught by subject matter experts
- Hands-on, “Nuts and bolts” learning experience
- Learning outcomes are centered on understanding the communication technologies, and selecting and implementing these technologies, particularly in a rural environment

Background/History (1)

In 2007, Caltrans proceeded with Phase 1 to build the professional capacity of Rural ITS engineers.

Phase 1

- Literature review
- Needs Assessment and Gap Analysis
- Curriculum Development
- Pilot Course: Plant Wireless – *Hands-On RF System Design*, October 4-7, 2010

Background/History (2)

Phase 2

- Literature review
- Curriculum Revision
- ~~Pilot Course: Plant Wired Core/Plant Wiring Basics, Serial Connectivity, xDSL , Scheduled April 2012~~ (Canceled)
- Pilot Course: Plant Wired – Mastering Fiber Optic Network Design and Installation, September 24-28, 2012
- Pilot Course: IP Networking Fundamentals and Usage – Hands-On Ethernet and TCP/IP Fundamentals, September 23-27, 2013

Background/History (3)

Phase 3

- Repeat Needs Assessment Survey and Gap Analysis
- Review and Revise Curriculum
- Pilot Course: Telco Wireless – Planned for March 2015

Curriculum Development (1)

- Curriculum Review Committee (CRC) – now called the Project Technical Advisory Panel (PTAP)
- Literature Review
  - Identified important topics in ITS communication technology
  - Documented available training opportunities in relevant subject areas

Curriculum Development (2)

- Needs Assessment
  - Surveyed Caltrans engineers and technicians working on ITS projects
  - Included demographic information, level of experience, importance of training, whether training was desired, how often the technology was used on the job
  - Addressed level of detail for training objectives for a sample course in each technology

Needs Assessment Survey Results (1)

- Close to 92 percent of the sample desired training in RF system basics, microwave, and network security.
- 88 percent were interested in training in xDSL technology as applied to ITS communications.
- 96 percent thought xDSL training was very important or important.
- 92 percent indicated training in RF system basics, microwave, and network security was of significant importance.

Needs Assessment Survey Results (2)

- Less than 10 percent of respondents indicated substantial experience in all four topics.
- Only 8 percent of the sample said they possessed substantial experience with RF system basics, microwave, or xDSL technologies as applied to ITS communications.
- The portion with substantial experience in network security was 4 percent.
- Roughly half of the sample used these technologies on a regular basis, which indicated that ITS engineers were utilizing the technologies and therefore adequate training was needed.

Curriculum Development (3)

- Gap Analysis
  - Needs (needs assessment survey)
  - Available training opportunities (literature review)
  - Compared recognized needs with available training opportunities and identified gaps.
- Clear need for professional capacity building in ITS communications; rural focus with applicability to urban transportation.
- Communications training was available, but not geared toward transportation technology applications, let alone rural transportation communications. Some providers allowed some customization of content.

Curriculum Development (4)

- Four topics that could be considered a higher priority for training:
  - Plant Wireless – RF System Basics
  - Plant Wireless – Microwave
  - Plant Wired – xDSL Technology
  - IP Fundamentals – Network Security

Subject Areas and Topics

Plant Wireless

- RF system basics
- 802.11 (WiFi) and related
- Microwave
- Short haul radio
- Privately owned WiMax

Plant Wired

- Plant wiring basics
- Serial connectivity
- xDSL
- Optical fiber

IP Fundamentals

- Understanding IP networks
- Local area networks
- Wide area networks
- Network security
- Vendor specific equipment

Telco Wireless

- Cellular/PCS basics
- GSM data, 3G and beyond
- CDMA data, 3G and beyond
- LTE, 4G and Next Generations
- Telco owned WiMax

Telco Wired

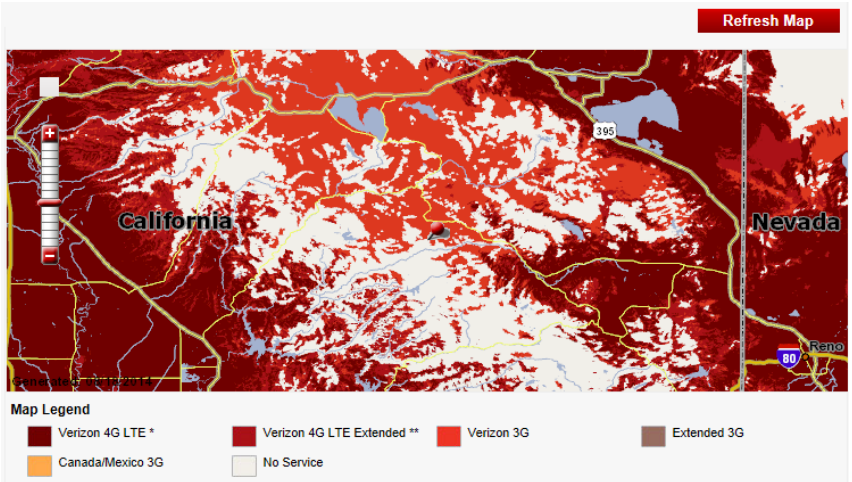
- POTS
- ISDN
- xDSL
- DS1/T1
- Fractional DS1/T1
- Frame relay
- Analog data circuits

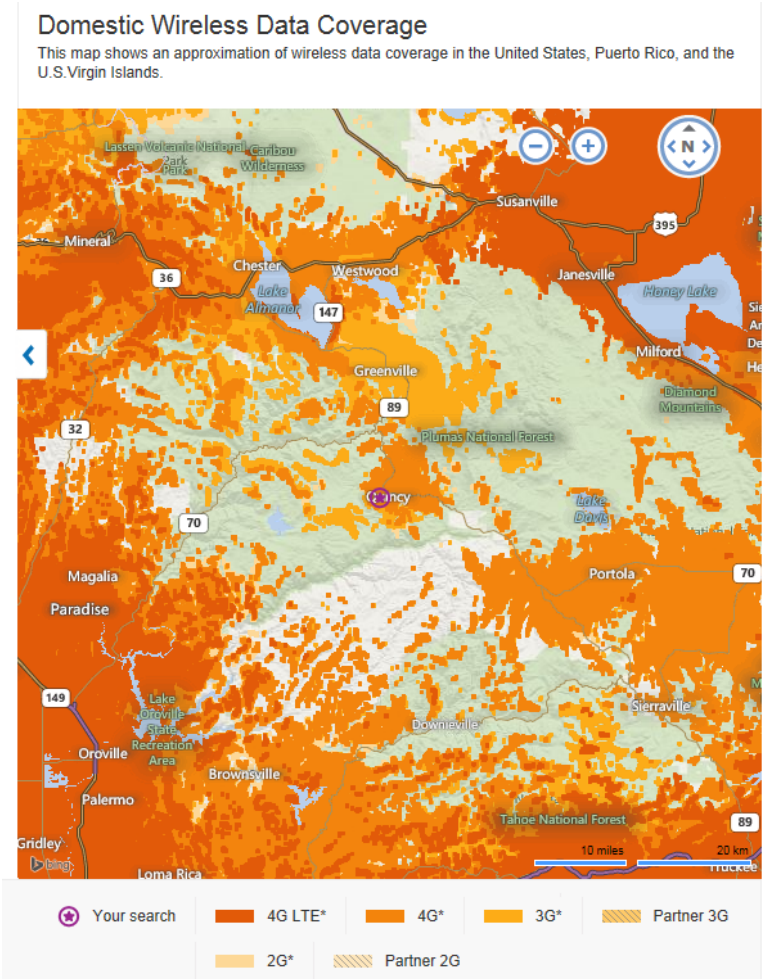
Plant Wireless

- Plant Wireless Core and RF System Design
- 802.11 (WiFi) and Related
- Microwave
- Short Haul Radio
- Privately Owned WiMAX

Telco Wireless

- Telco Wireless Core and Cellular/PCS Basics
- GSM Data, 3G and Next Generations
- CSMA Data, 3G and Next Generations
- LTE (Long Term Evolution), 4G and Next Generations
- Telco Owned WiMAX





Plant Wired

- Plant Wired Core/Plant Wiring Basics
- Serial Connectivity
- xDSL
- Optical Fiber

Telco Wired

- POTS
- ISDN
- xDSL
- DS1/T1
- Fractional DS1/T1
- Frame Relay
- Analog Data Circuits

IP Fundamentals

- Understanding IP Networks / IP Networking Core
- Local Area Networks (LANs)
- Wide Area Networks (WANs)
- Network Security
- Vendor Specific Equipment Training (e.g., Cisco, Juniper, other)

Subject Matter Expert List

- One of the core tenets for this project is to develop training that would be presented by experts in their field.
- CRC recommendations, word of mouth, recommendations from instructors, extensive web search.
- Those submitting bids were evaluated based on an approved limited solicitation scoring rubric. Selected providers were further vetted throughout course development.
- Currently there are 82 training providers on the list.
- More added when identified.

Phase 1 - Pilot Course, Plant Wireless

Hands-On RF System Design

October 4-7, 2010

Course taught by Neil Hollingum through Break-Thru Training Solutions (BTS)

Phase 2 - Plant Wired (Attempt #1)

Plant Wired Core/Plant Wiring Basics, Serial Connectivity, xDSL

Scheduled April 2012

Canceled …

Phase 2 - Plant Wired (Attempt #2)

Course taught by Eric Pearson of Pearson Technologies

Mastering Fiber Optic Network Design and Installation

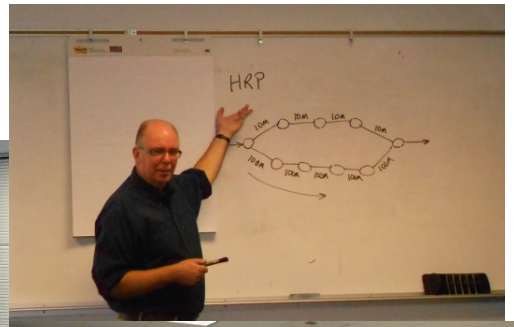
September 24-28, 2012

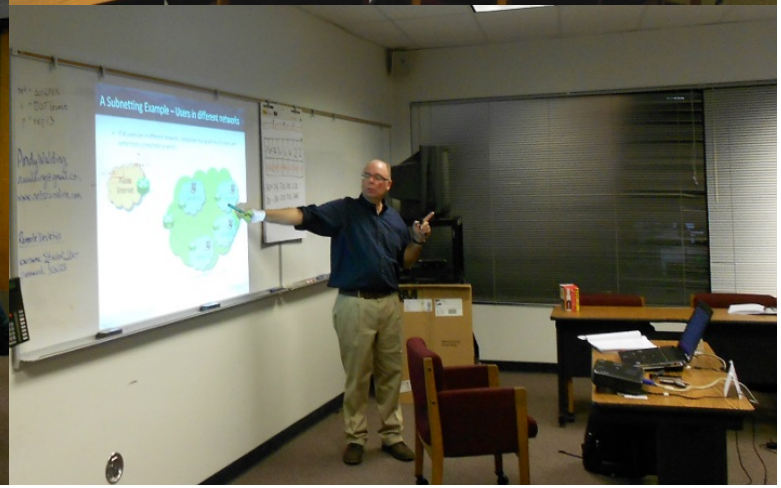
Phase 2 – IP Networking Fundamentals and Usage

Course taught by Andy Walding, CellStream, Inc.

Hands-On Ethernet and TCP/IP Fundamentals

September 23-27, 2013





Phase 3

- Telco Wireless
  - Telco Wireless Core and Cellular/PCS Basics
  - GSM Data, 3G and Next Generations
  - CSMA Data, 3G and Next Generations
  - LTE (Long Term Evolution), 4G and Next Generations
  - Telco Owned WiMAX
- Release Request for Bids (RFB) in Fall 2014.
- Course tentatively scheduled for early March.

Lessons Learned (1)

- 40 hours of training
- Late September or early March
- Location – training room, proximity to ITS operations, nearby lodging and dining options.
- Class size should be 10 – 15 students.
- Develop clear expectations and standards, and a formal Request for Bids. Include timeline and deadlines for various steps of course development and delivery.
- Start with an established course and customize.

Lessons Learned (2)

- Course instructors must be thoroughly vetted.
- Course instructors must be included in course curriculum development.
  - Clear expectations for relevancy and lab exercises.
  - Confirmation of actual hands-on activities.
  - One hour “dry run” presentation.
- Have direct means of communication with the instructor.
- Project team and CRC members should attend the training courses.

Lessons Learned (3)

- Chose to present a large amount of information within the courses and provide sufficient resources and references to review and learn after the course is completed.
- Minimum of 25% class time devoted to hands-on activities / practical applications.
- Clearly communicate course expectations, including attendance, skill level, relevancy.
- Have course materials and equipment set up at least one day prior to course start.

Lessons Learned (4)

- Maintain high standards for content and delivery:
  - *"That high quality technical content be delivered in a challenging environment by an expert in the field."*
  - The curriculum and presentation should not be "dumbed down" but instead students should be "brought up" to a higher level of expertise.
  - Students come out challenged, but with a good understanding of the material and different options available for solving a communications problem.
  - Instructor must have practical, hands-on experience for the length of time necessary to be considered an expert.
  - Instructor must be a quality teacher of adult learners.

Applicability to other DOTs?

- Needs assessment
- Available training opportunities
- Gap analysis
- Develop Request for Bids (or similar). Set clear standards / expectations and selection criteria
- True Subject Matter Expert, quality instructor
- Develop course content. Customize an established course
- Communicate
- Deliver training
- Evaluate

Possible Future Research

- Different options for course presentation.
- Engaging a DOT engineer to develop and present PCB courses in ITS communications.
- Consider conducting an assessment of student learning.
- Opportunities to facilitate student certification.
- Conduct another needs assessment and gap analysis.

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