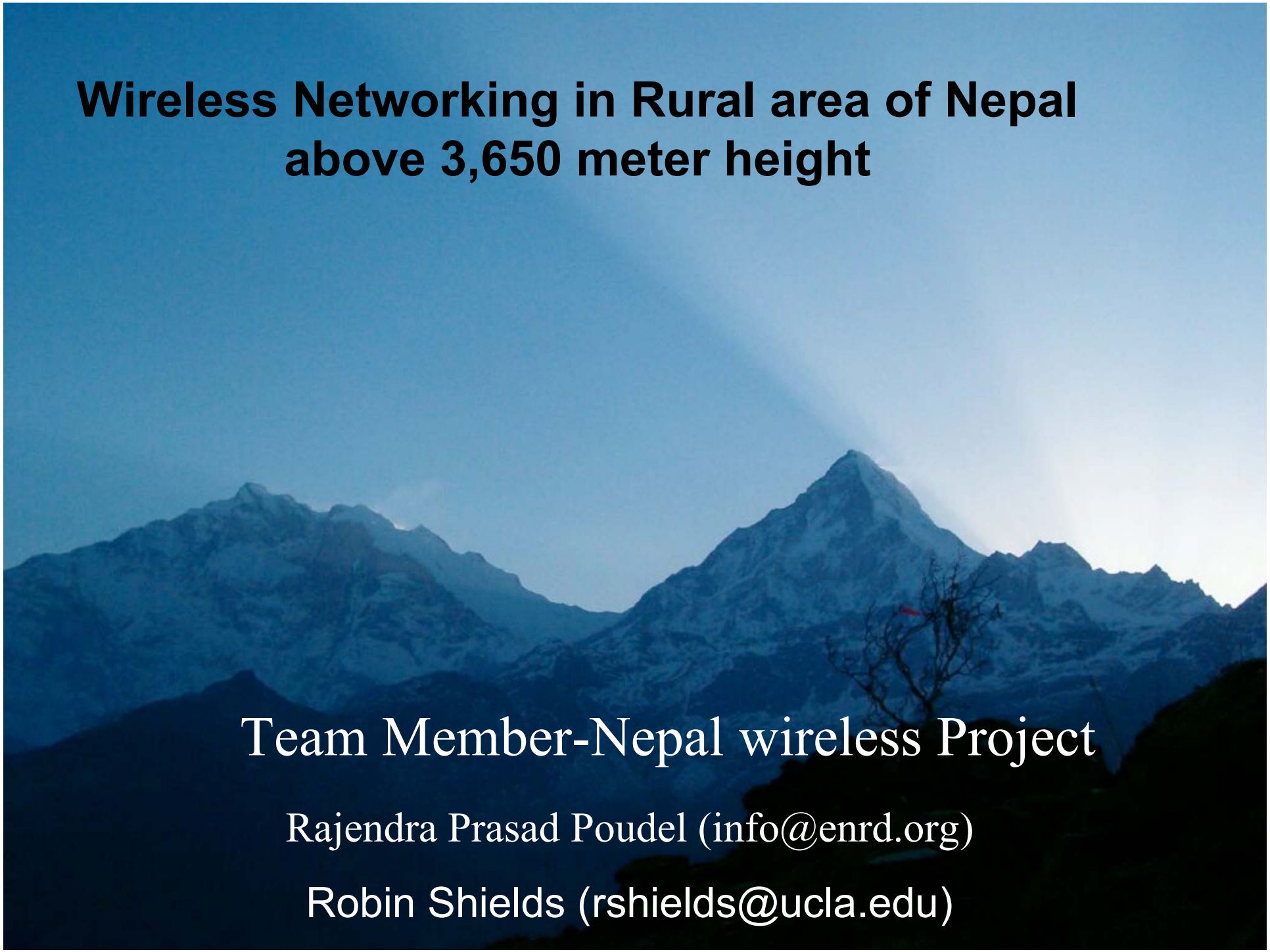

Wireless Networking in Rural area of Nepal above 3,650 meter height

Team Member-Nepal wireless Project

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Agenda

- Project Background and History
- Results to Date
- Technical Details
- Future Goals
- Challenges and Problems
- Conclusion

Who We Are

A team of volunteers from Nepal and abroad working to create ICT connectivity in rural areas of Nepal through license free wireless technology.

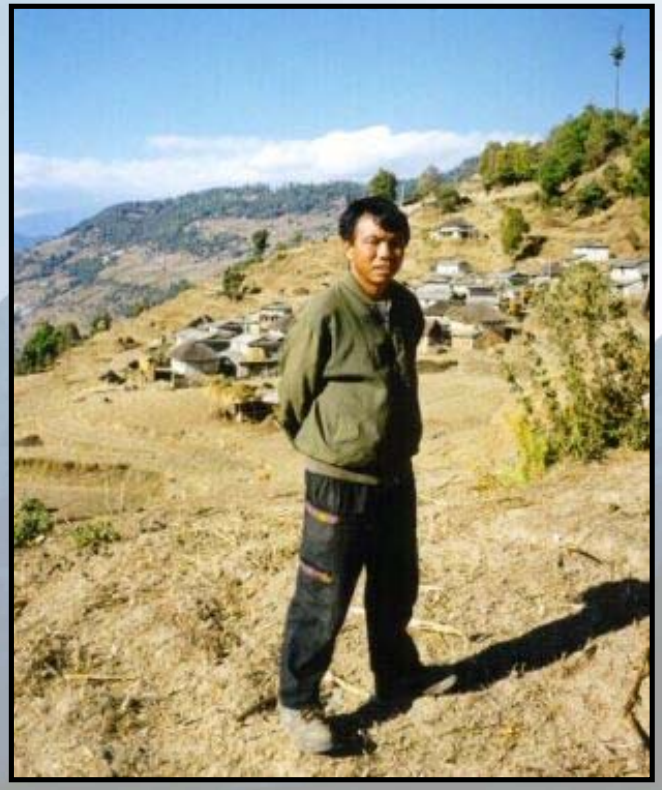
Background: Why Wi-Fi in Rural Nepal?

- Area with no roads, few schools and hospitals, no tele-communication and unreliable electricity.
- Why would such a community need a wireless network, and how could they use it?

Mahabir Pun's Vision

In 1997 Mahabir first dreamed of connecting his village, Nangi, to the the internet in order to communicate with friends abroad. After learning of emerging wireless ethernet technologies, Mahabir saw a way to address many of the areas problems, including:

- **Teacher Shortages**
- **Lack of doctors/hopitals**
- **Local trade problems**
- **No emergency communication**



Project History

2002 (Testing Phase-1)

- First testing of wireless equipment in Nangi Village
- Two villages approximately 3 km apart are connected using Cisco Aironet PC cards and homemade antennas.

Project History

Early – 2003 (Testing Phase-2)

- Test wireless connection created to Pokhara.
- Pokhara and Nangi village are connected using D-Link access points and television satellite dishes. Signal is relayed over 3,200 meter peak.

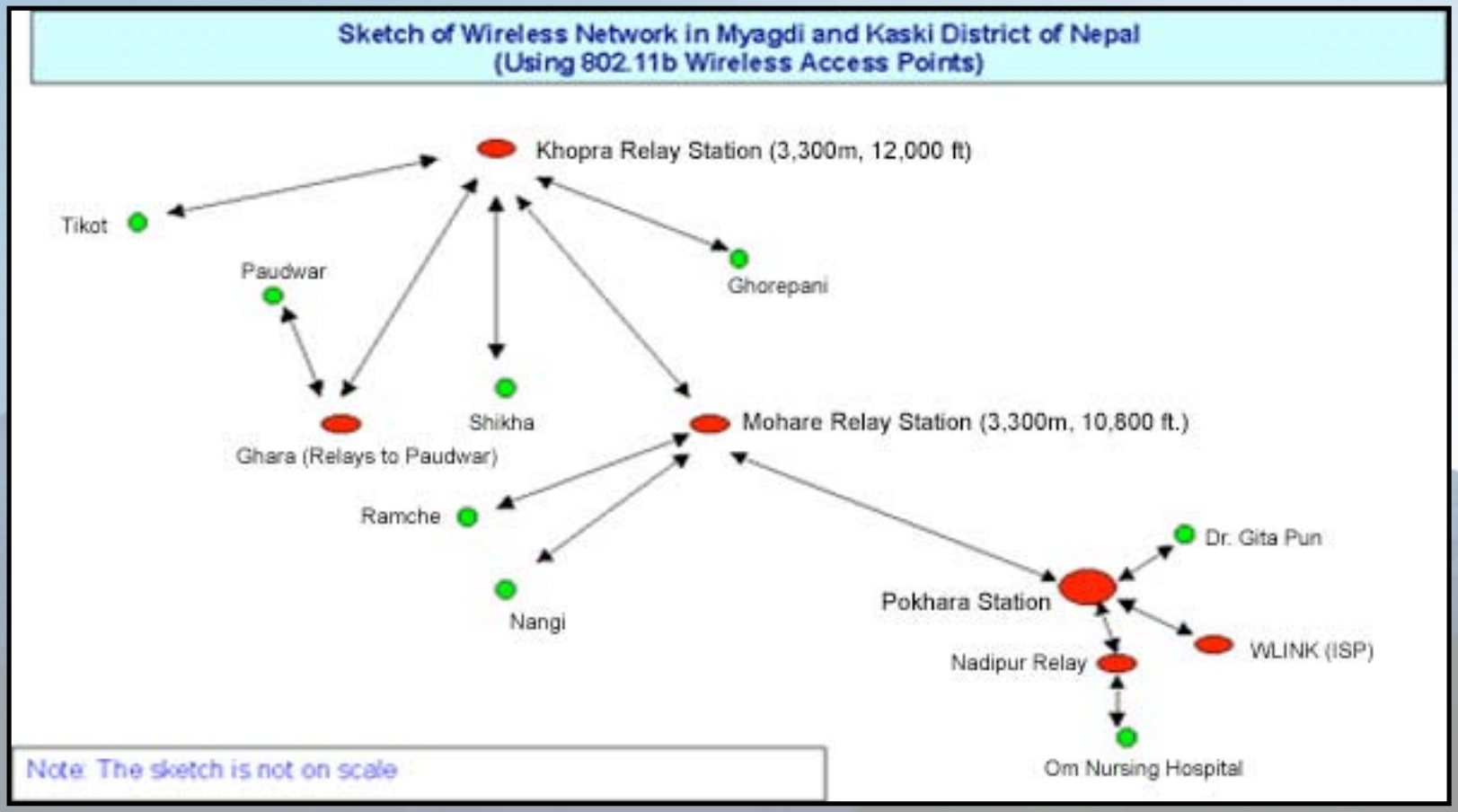
Project History

Mid – 2003 (Phase I)

- Wireless network created among five villages using smartBridges access points and 24 dB antennas.
- Two relay solar/wind powered relay stations are created to carry to signal over high passes.
- Internet connectivity is provided by a dial-up proxy server in Pokhara.

Project History

Mid – 2003 (Phase I)



Project History

2004 (Phase 2)

- 64/64 Kbps wireless service is provided by World Link.
- Improves bandwidth and reliability, provides “always on” connection with no waiting.

WORLDLINK COMMUNICATIONS PVT. LTD.

Project History

2005 (Phase 2)

- Pokhara network extended to include Om nursing home and Nadipur.
- Network extended to 3 secondary school.

Results to Date

Infrastructure

- **Two solar/wind powered relay stations established on high mountain passes.**
- **Seven villages connected to LAN and internet.**

Results to Date

Communications

- **Mail and web server established at http://NepalWireless.net**
- **Voice over internet "capability" established for calls on the NTC PSTN and abroad.**

Results to Date

Education

- **Computer labs established in 2 villages. Single computers set up in others.**
- **Local content development underway with ENRD.**
- **Tele-teaching program piloted from Nagi Higher secondary school to 3 other secondary schools in other villages.**
- **Many villagers of all educational backgrounds are using the network.**

Results to Date

Telemedicine

Pilot telemedicine program set up in Nangi village. Roughly 200 villagers treated to date in consultation with Dr. Gita Pun, who have been working voluntarily for NWP from here Nursing home in Pokhara.

Technical Details

Radio Telemetry

- **All radios are 2.4 GHz (802.11b) from smartBridges (100 mW), Senao (100 mW), and Deliberant (250 mW).**
- **Majority of connections are point to point using highly focused 24 dBi antennas. A 15 dB omni directional antenna is used in Pokhara and two Deliberant radios have 15 dB internal antennas.**
- **Point-to-Multipoint connections are operating at Pokhara, RS1, RS2.**

Technical Details

IP Management

- **All network devices are assigned static, local, IP addresses (192.168.1.X).**
- **Bandwidth varies between 8 Mbps on short point to point links to 1 Mbps on long links.**

Technical Details

Power Management

- **RS1 and RS 2 have a combination of solar panels and wind generators with deep cycle batteries.**
- **Combined solar output is about 150W at RS1 and 75W at RS2. Wind generators have a theoretical 400W output but are rarely used. Batteries have a combined capacity of 70 amp hours (12V).**

Future Goals

(Running phase 3- up to end of 2005)

Infrastructure

- **Improve uptime and reliability, particularly along the network. We are considering using 5.2 GHz equipment to increase bandwidth and reduce interference.**
- **Expand connection to more 14 villages to the end of this year.**
- **Establish communication centers (at least 2 computers) in all villages.**
- **Setup cyber cafes in Ghorepani and Ghaandruk, and Totopani to raise revenues from tourists.**

Future Goals

(Running phase 3- up to end of 2005)

Programming, exposing project

- **Train villagers to use the network and various services available (ENRD).**
- **Continue local content development (ENRD).**
- **Establish local web server and mail server in local language for saving international bandwidth.**
- **Create reliable and high quality teleteaching between two villages (Nangi and Paudwar) to address teacher shortages.**
- **Setup full VoIP gateway capability in Pokhara.**

Challenges and Problems

Radio Telemetry

- **Radio reliability has been a problem. Several radios have broken for unknown reasons, although precautions have been taken for lightning.**
- **Point to point connections require more equipment and power. We would like to increase point to multipoint connections. This requires antennas with a broader beam angle, but differences in altitude make this task challenging.**
- **Backbone (Pokhara – RS1 – RS2) reliability should be increased as much as possible.**
- **Reliable earthing for lightning arrestors is also required.**

Challenges and Problems

IP Management

- **Subnetting should be used to ensure bandwidth is used effectively.**
- **Some form of dynamic addressing should be introduced for network computers. DDNS could also be used so computers can be reliably addressed.**
- **Network monitoring and analysis is required for bandwidth and uptime. This will help to identify troublesome links and bottlenecks.**
- **Maximum bandwidth is desirable, even on long links. 5.2 GHz equipment may help with this.**
- **Routing local traffic and emails appropriately will conserve internet bandwidth.**
- **A high quality video conferencing solution is needed for teleteaching. Our pilot program had limited success in this area.**

Challenges and Problems

Power Management

- **Few radios should be used at each Relay Station. We are looking at using a single board computer (SBC) with multiple wireless interfaces or 5.2 GHz equipment with back-to-back antenna connections to improve efficiency.**
- **Monitoring voltage levels and possibly programming on/off timing over ethernet is desirable. Various microcontrollers and built-in HTTP servers provide this capability.**

Conclusion

- **Wi-Fi is a feasible option for rural areas, but requires careful planning and attention.**
- **World Link (an ISP) has been a valuable partner in this effort, and we hope to continue cooperation in the future.**
- **ENRD is acting as an ambassador role for lunching this NWP in rural area.**

Thanks for your time.