TRIBAL BROADBAND BOOTCAMP 13

RANTANENTOWN RANCH (TEMECULA)
JUNE 2024

_____ **OWNS THIS BOOK**

@tribalbroadbandbootcamp on Instagram • @TribalBBCamp on Twitter (X)
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TribalBroadbandBootcamp.org

Everyone has something to learn and everyone has something to teach.

View the digital version of the latest TBB booklet on our webpage:
URL: **tribalbroadbandbootcamp.org/resources/**

Connect with the Tribal Broadband Bootcamp Community on Discord
URL: **discord.gg/RRU8q66Tz2**

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ABOUT US

WASKAWIWIN: Matt and Chris are working together to create Waskawiwin, a 501(c)3 nonprofit organization that will host and manage the Tribal Broadband Bootcamps as well as find other ways to assist building more Internet capacity in Indian Country.

THE INSTITUTE FOR LOCAL SELF-RELIANCE is a national research and advocacy organization that partners with allies across the country to build an American economy driven by local priorities and accountable to people and the planet. We build local power to fight corporate control in order to help build thriving, diverse, equitable communities. The **Community Broadband Networks Initiative** promotes locally rooted, democratically accountable broadband networks that provide fast, affordable and reliable Internet access to all Americans.

TRIBAL BROADBAND BOOTCAMP: Visit our website for more information at **tribalbroadbandbootcamp.com/**

CO-FOUNDERS

Matthew Rantanen and Christopher Mitchell established these bootcamps to convene Tribal communications teams and offer access to training, resources, and a deep network of Tribes working to connect their communities.

- **Matthew Rantanen**
  SCTCA/CREE
  matthew.rantanen@gmail.com
  Co-creator of the bootcamp
  Cyber Warrior for Tribal Broadband
  23 years in the Space, Director of Technology, SCTCA, TDVNetwork. Co-Chair, Tech and Telecom, National Congress of American Indians.
  LinkedIn: **linkedin.com/in/matthewrantanen/**

- **Christopher Mitchell**
  Institute for Local Self-Reliance
  christopher@ilsr.org
  Program Director
  Christopher Mitchell runs the Community Broadband Networks program at the Institute for Local Self Reliance and moonlights as a professional sports photographer. He thinks he is funny.
  LinkedIn: **linkedin.com/in/christopher-mitchell-79078b5/**

FUNDING SUPPORT

Tribal Broadband Bootcamp is brought to you by Waskawiwin. Support and sponsorship for TBB13 Advanced Fiber came from Institute for Local Self-Reliance, Tribal Resource Center, Democracy Fund, Calix, Michelson 20MM, Merit Network, Connect Anza, and Network Startup Resource Center. Ting Internet was an equipment sponsor.

SHARE ON SOCIAL MEDIA

Please post about your experience on social media and follow @tribalbroadbandbootcamp on Instagram @TribalBBCamp on Twitter and at facebook.com/Tribalbroadbandbootcamp/ on Facebook!
Use hashtags #Tribalbroadband #tribalbroadbandbootcamp #digitalequity

YOUTUBE

Watch content from previous and future events on youtube.
URL: **youtube.com/@TribalBroadbandBootcamp**

SHARED PHOTOS FILE

Feel free to share photos from the event here.
URL: **drive.google.com/drive/folders/1sgFxul4Vdhb7QAF5WUVTFySfvJ1v1KoJ**

AGENDA

DAY 0 - MONDAY, JUNE 17
- Welcome Dinner

DAY 1 - TUESDAY, JUNE 18
- Introductions
- Introduction to Fiber Optics
- Fiber Network Tour
- Aerial Fiber Building Demonstration
- Tribal Broadband Case Study

DAY 2 - WEDNESDAY, JUNE 19
- Fiber in the Field
- Software and Provisioning Demonstration
- Troubleshooting Fiber Networks
- Tribal Broadband Case Study

DAY 3 - THURSDAY, JUNE 20
- Fiber Q&A
- Basic and Advanced Wireless Demonstrations
- Wireless Discussion

*Agenda subject to change based on daily survey feedback.

TRIBAL BROADBAND RESOURCES

TRIBAL BROADBAND BOOTCAMP: Visit our website for more information at **tribalbroadbandbootcamp.com/**

TRIBAL RESOURCE CENTER: TRIBAL RESOURCE CENTER - HELP DESK AND RESOURCE HUB

Native American-led organization dedicated to offering trustworthy guidance for tribal communities seeking greater access and benefits of broadband. Check out TRC's website for an extensive hub of resources including technical guidance, legal and policy resources, case studies and business models, and much more. Get plugged into TRC's community of Indigenous Broadband practitioners and contact the Help Desk if you have any questions or would like to speak to a professional regarding your broadband project.
Help Desk URL: **tribalresourcecenter.net/help-desk/**
Resource Center URL: **tribalresourcecenter.net/**

JUNE 2024 BOOTCAMP NOTES FILE
URL: **docs.google.com/document/d/1jJYIPtkM1HqS1Qg3feVftBIpwYyG4yvM63CIZLbVkdU/edit**

BUSINESS OF TRIBAL BROADBAND WEBINAR SERIES:

A series of in-depth webinars hosted by Waskawiwin and ILSR focused on topics in the creation and sustainability of tribal ISPs. The first webinar offered a high-level view of a variety of business models used by certain networks, and the second dove into wireless infrastructure and licensing. Keep checking back for more in-depth events on other topics.
URL: **tribalbroadbandbootcamp.org/virtual-events/**

GOALS AND CULTURE

TBB GOALS

TBB's primary goal is to foster a network of Indigenous people working across Indian Country to build broadband networks and develop the best practices needed to ensure communities have high quality Internet access if they want it.

Additional Goals Include:

- Inspiring people to create and work at Tribal Internet Service Providers (ISPs) in their own communities
- Building confidence among Tribal ISP staff so they can tackle challenges
- Helping Tribes gain more control over their digital futures
- Demystifying technology, law, policy, and more – Indian Country needs more of their people working at all levels in this field.

TBB CULTURE

To achieve our goals, we strive to create a specific culture at our events through how we treat each other. First and foremost is that we respect each other. We all have something to learn, and we all have something to teach. We want everyone to feel comfortable enough to ask what they might be afraid is a "dumb question." In our experience, those questions often help to resolve some of the confusion others likely have and are opportunities for collective learning. The Bootcamps promote an inclusive environment that is conducive to building and establishing trust.

Respect for each other also means that we do not tolerate any derogatory inappropriate behavior. If you feel uncomfortable with the actions, behaviors, or words of any of the instructors or participants, please notify Matt or Chris, who will do their best to resolve the issue.

Finally, we try to keep the mood light. The Bootcamps provide a great opportunity to learn, share, and connect with each other, and we can have a good time doing that. This helps to build and strengthen trust among the group and create the culture we need to engage in this challenging work, for now and into the future.

BIOS

HANEEN ABU AL NEEL

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Democracy Fund

Haneen Abu Al Neel is the program associate at the Digital Democracy Portfolio within the Public Square team at Democracy Fund, an independent foundation working to ensure that the US political system is moving towards a multi-racial democracy, that is open and just, resilient and trust worthy.
Haneen brings in expertise from the international relations and democracy, diversity, equity, and inclusion, restorative justice, human rights research, narrative change, and movement building. Haneen earned her BA in leadership studies and women, gender, and sexuality studies from University of Richmond, and her MA in Ethics, Peace, and Human Rights from American University.

OLGA ARMENTA VEGA

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Tohono O'odham Utility Authority

JESSICA AUER

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ILSR

Jessica is a Tribal Broadband Policy Analyst with ILSR's Community Broadband Networks Initiative, recently joining the team on as a two-year Leading Edge Fellow. She supports he team's work in research, advocacy, and training to promote tribal broadband initiatives. Jessica has a background in 20th century U.S. labor history.

JORDAN CHINANA

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Jemez Pueblo Tribal Network

I have been with JNET since 2022. I am currently serving the role of Network Operations Technician and also server as Digital Navigator for our Digital Navigator Program.

KYLE DAY

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Karuk Tribe

I was at the last boot camp running out on the presentations to get hands on with trouble shooting fiber. I am hoping to get to do it again. Yootva (Thank you)

DAVIDA DELMAR

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AMERIND Critical Infrastructure and the National Digital Inclusion Alliance

I work to support Tribal communities to achieve digital equity through my work with digital navigators, the Indigenous Digital Inclusion Working Group, and adapting digital inclusion tools for Indigenous communities.

ANGELA DIAHKAH
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Jemez Pueblo Tribal Network
I have been with JNET since it first deployed in 2020. I am currently serving the role of Network Operations Supervisor and also the Program Manager for our Digital Navigator Program. I was raised in the Pueblo of Jemez and fluent in our towa language. The most powerful tool I use is my native language. It allows me to communicate effectively to our community members.

MATTHEW DOUGLAS
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Hoopa Valley Public Utilities District
I am the Broadband Manager for the Hoopa Valley Public Utilities District. We started our broadband journey in 2020 and have built out a Wireless ISP for our tribe and have secured funding to transition to a Fiber ISP. We have learned a lot along the way and are learning more every day.

FRANK GORNICK
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Cal.net
Retired West Hills Community College Chancellor, former Project Manager for SJVRBC/CETF, currently Tribal Liaison for Cal.net., working with tribal communities in the San Joaquin Valley.

CODY HARRIS
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Seattle Community Network Regularly volunteer with Seattle Community Network. Occasionally involved with NYC Mesh. Software engineer by day.

PATRICK JACKSON
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Hoopa Valley Public Utilities District
Involved in Broadband since 2012 serving a variety of roles from serving on the Native Nations Broadband Task Force to performing fixed wireless home installations

ESTHER JANG
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Local Connectivity Lab / University of Washington
Esther Jang is a newly graduated PhD in Computer Science from the University of Washington in Seattle, and will be starting a postdoc there in the Fall. Her research focuses on both rural and urban community networks, and especially how communities of practice can build and sustain technical infrastructures. She has installed community networks in Tanzania, the Philippines, Mexico, and various states around the US. She founded and organizes the Seattle Community Network (SCN) project, which builds community-owned and maintained Internet access infrastructure to support digital equity in Seattle and Tacoma. She serves as a Director at the Local Connectivity Lab, a 501(c)(3) nonprofit focusing on technology research, deployment, and teaching in support of community networks around the world. She has been a technical networking instructor for the Tribal Broadband Bootcamps since 2019. In her free time, she is an avid jazz singer and plays often with the vibrant local swing community.

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Cyanna possesses a natural flair for technology and is an avid learner, always eager to explore new horizons. She approaches challenges with a positive attitude, never burdened by any sense of entitlement. Proficient in computer systems, networking, and software, she is now gearing up to venture into the realm of transport networks, expanding her expertise even further.

MARY ST. JOHN
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Calix
Instructor, Speaker, Freelance Writer, Author Advocate, and Life-Long Learner; with a variety of tech experience.

PAUL MIRANDA
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SCTCA
Pala Tribal Member. Involved in Southern California Tribal Chairmans Association wireless network spanning San Diego County

VIRGIL MOLINA
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TOUA - NOC Technician. Working as a NOC technician 1 year 6 months.

DAVID MURRAY
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Shingle Springs Band of Miwok Indians
David Murray is an enrolled member of the Shingle Springs Band of Miwok Indians. He grew up on the Rancheria in rural El Dorado County, California.
David has worked for his Tribe in various roles since 2020. Most recently, he explored the benefits of offering high speed internet to the Tribe's members, government, and businesses. Working closely with CAL.NET, the Tribe completed its broadband Infrastructure in December 2023. Today, there are 45 homes and 10 Tribal businesses connected to fiber service on our Rancheria.

JESSICA PABLO
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Tohono O'odham Utility Authority
I was born and raised and still reside on the Tohono O'odham Nation, I have been employed with T.O.U.A a little over 2 years as a Telephone Customer Representative.

ANGELINA PANIAGUA
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ILSR
Angelina Paniagua is Senior Project Manager for the Community Broadband Networks Initiative with ILSR. Her experience comes from nonprofit, private sector, and government work. She is bilingual in English/Spanish and is an advocate for diversity, equity, and inclusion.

JOSEPH PERALTA
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SCTCA
Currently working in TDV department of S.C.T.C.A. and going on 16 years. During my time with TDV I have gained the knowledge and tools to confidently setup remote communication sites that are off-grid. I understand the best practices for using wireless PtP and PtMP devices. Knowledge of computer networking.

MATT PETERSON
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SFMIX // Two P
Temporary network event addict - euro hacker camps, emeritus desert city, maker spaces.. and a few FTTH & WISP's too

JORDAN PITTMAN
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Institute for Local Self-Reliance
Jordan Pittman is a Digital Equity Coordinator with ILSR's Community Broadband Networks Initiative. He supports the team's work in promoting access to affordable, high-quality broadband service for all, with a focus on those who face systemic barriers to digital equity. Jordan received a B.S. in Rural Community Development from Abraham Baldwin Agricultural College and has been interested in ways that public policies affect rural places and structured access to resources.

MATTHEW PUGA
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Student
Matthew Puga, an enrolled member of the Chippewa-Cree Tribe, is currently pursuing a bachelor's degree in Cybersecurity at Stone Child College. He brings experience from his previous role as IT Support for the Chippewa-Cree Tribal Broadband project, showcasing his dedication to technology and community development.

TARAH SAMUELS
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Council of the Haida Nation
Elected representative with a portfolio of Nation building, finance, administration, personnel, and community & economic growth.

SPENCER SEVILLA
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University of Washington
Spencer Sevilla is a scientist at the University of Washington, co-founder of the Local Connectivity Lab, and owner of Treetop Network Services. He is proud to have worked with the Tribal Broadband Bootcamps since the very beginning, and has helped build several Indigenous networks across three continents over the past decade. He is most well known for having the best hair in the community networks scene.

CLAUDIA TARBELL
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I worked within the Akwesasne Mohawk Nation for 10+ years. For the past five years I was the Marketing and Sales Manager for the local internet service provider, owned and operated by the Saint Regis Mohawk Tribe. I fell in love with the telecommunication industry because it is constantly changing and witnessed the positive impact broadband can have on tribal and rural communities.
I am passionate about sharing my knowledge learned while working for a tribally owned ISP and assist other tribal nations in their broadband journey!

MICHAEL TERLEP
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SANDAG
My name is Michael Terlep and I'm Regional Planner working at the San Diego Association of Governments on various digital equity efforts.

LINDA THOMAS
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Cal.net
Linda Thomas is the Vice President of Community Outreach and Government Affairs for Cal.net. She comes to Cal.net from the CA Community College System where she was the Vice Chancellor at West Hills Community College District in Coalinga. Linda is passionate about helping unserved/underserved communities connect to the internet, achieve digital literacy, and receive workforce training.

PAUL WATERS
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Democracy Fund
Paul Waters is the Director of the Digital Democracy Portfolio at Democracy Fund, a foundation working toward an open and just democracy that is resilient in the face of change and worthy of the American people's trust. DDP's work is animated by the ideas of Reparations, building race-conscious equitable investment in our tech, telecom, and media systems; and Rights, securing civil and human rights in the digital environment. This portfolio includes funding to advance data policy innovation within a human rights framework, develop pathways for community governance of broadband services, and support media policy to fund equitable journalism.

SARAH WILKINSON
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Sarahwilkinsonart.com
Art has been really important to me for a very long time. Since drawing horses and high fashion in 3rd and 4th grade, to learning that it could possibly be a profession in high school, art and creativity has always made me feel alive. My art has grown with me as I go through stages of my life. My primary loves is working with companies on my favorite properties, but most importantly, creating art that is from my brain. Art that is meaningful and honest, speaks about mental health, and helps me get through tough times, and in turn hopefully helps others get through similar feelings and situations.

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COREY YEPA
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Jemez Pueblo Tribal Network
I have been with JNET since it first deployed in 2020. I am currently serving the role of Network Operations Technician and also the Data Manager for our Digital Navigator Program.

GENERAL RESOURCES: INTERNET BASICS

BROADBAND 101: The Basics of Broadband Infrastructure by the California Community Foundation. With a couple of helpful infrastructure definitions as well as current policy activities, this would be a good source for beginners or those with limited broadband experience to start with.
URL: **tinyurl.com/44vymy37**

Good for Beginners

PEW FACT SHEET ON HOW BROADBAND INFRASTRUCTURE GETS BUILT: A look at logistical, legal, and other requirements that govern deployment of internet equipment. Another great introductory resource, with a little more detail on the different behind-the-scenes permitting and logistical requirements for broadband builds.
URL: **tinyurl.com/4cjzfd7j**

Good for Beginners

IP ADDRESSING AND ROUTING: The 10,000 Foot View: A bit more technical, this short resource explains how to understand the parts of an IP address and how they get assigned.
URL: **tinyurl.com/4e6r7b7n**

SOFTWARE LICENSING FAQS FOR TRIBAL ENVIRONMENTAL PROFESSIONALS: This organization, primarily made up of Environmental Professions, produced a FAQ sheet with best practices and guidance for software licensing. Though centered mostly on grants with the EPA, the FAQ sheet offers good general advice for acquiring software with federal money and other software questions you might have.
URL: **epa.gov/system/files/documents/2022-12/tribal-software-faq.pdf**

TRIBAL EXCHANGE NETWORK GROUP: Tribal Partnership Group supported by the EPA and the Institute for Tribal Environmental Professionals (ITEP), whose purpose is to engage tribes in Exchange Network (EN) opportunities including grant funding, technical solutions, and collaborative partnerships. Though their work is focused on environmental issues, tribes may find it relevant in learning about data management practices or connecting with environmental experts in the planning process.
URL: **tribalexchangenetwork.org/**

ILSR FACTSHEET: A POCKET GUIDE TO 5G HYPE: Quick explainer dispelling some myths about 5G wireless.
URL: **tinyurl.com/235jaurb**

Good for Beginners

BROADBAND BASICS FACT SHEET: This two-page fact sheet explains commonly used terms related to Internet access, including broadband, wi-fi, fiber optic networks, and LTE. A helpful primer on Internet terminology for non-technical folks who want to follow policy or networking conversations.
URL: **communitynets.org/content/new-resource-fact-sheet-broadband-basics-center-digital-equity**

Good for Beginners

PEW FACT SHEET ON HOW THE INTERNET WORKS AND THE IMPLICATIONS FOR BROADBAND POLICY: A look at the infrastructure, operations, and organizations that deliver consumer service
URL: **tinyurl.com/bddwxbeb**

Good for Beginners

RECOMMENDED BOOKS

TUBES: A JOURNEY TO THE CENTER OF THE INTERNET (ANDREW BLUM): Journalist Andrew Blum goes inside the Internet's physical infrastructure and flips on the lights, revealing an utterly fresh look at the online world we think we know. (Goodreads).

FIBER: THE COMING TECH REVOLUTION—AND WHY AMERICA MIGHT MISS IT (SUSAN CRAWFORD): An investigation of how giant corporations that control cable and internet access in the United States use their tremendous lobbying power to tilt the playing field against competition, holding back the infrastructure improvements necessary for the country to move forward (Goodreads).

NETWORK SOVEREIGNTY (MARISA ELENA DUARTE): By reframing how tribes and Native organizations harness these technologies as a means to overcome colonial disconnections, Network Sovereignty shifts the discussion of information and communication technologies in Native communities from one of exploitation to one of Indigenous possibility (Goodreads).

A DIGITAL BUNDLE: PROTECTING AND PROMOTING INDIGENOUS KNOWLEDGE ONLINE (JENNIFER WEMIGWANS): An exploration of the potential of online and digital technologies to serve Indigenous resurgence by contributing to the goals of Indigenous nation building (Goodreads).

FARM FRESH BROADBAND (CHRISTOPHER ALI): Christopher Ali analyzes the promise and the failure of national rural broadband policy in the United States and proposes a new national broadband plan (Goodreads).

GENERAL RESOURCES: TRIBAL BROADBAND AND CASE STUDIES

BUILDING INDIGENOUS FUTURE ZONES: FOUR TRIBAL BROADBAND CASE STUDIES: An ILSR report that delves into the experiences of four Native Nations as they constructed their own Internet service providers. Read the report to learn about the trajectory of four established Tribal ISPs and get lessons and themes from across the four case studies.
URL: **tinyurl.com/yc3t84u4**

Good for Beginners

TRIBAL TECHNOLOGY ASSESSMENT: This is an important piece of research establishing and outlining the digital divide on Tribal lands, based on a survey administered by the American Indian Policy Institute. Though the report was issued in 2019, readers will find that the insights remain extremely relevant. This is a useful as an overview of the unique barriers to internet access on Tribal lands.
URL: **papers.ssrn.com/sol3/papers.cfm?abstract_id=3427547**

BROADBAND IN INDIAN COUNTRY: Google doc with a brief overview of broadband issues in Indian Country, including estimates of need, challenges around access to capital and access to spectrum, and guides to funding opportunities.
URL: **tinyurl.com/mpsj3txx**

Good for Beginners

ARTICLE ON HOOPA VALLEY TRIBE AND STATE OF CALIFORNIA COLLABORATION: This article highlights an exciting collaboration between California and the Hoopa Valley Tribe to build and manage middle-mile infrastructure on Hoopa Valley's Reservation.
URL: **communitynets.org/content/hoopa-valley-tribe-and-state-california-embark-historic-collaboration**

VOGUE ARTICLE HIGHLIGHTING THE WORK OF BROADBAND ADVOCATE BRITTANY WOODS-ORRISON: Read this profile of Brittany Woods-Orrison (Koyukon Dené), a broadband specialist with Native Movement and Alaska Public Interest Research Group and advocate for digital equity. Share with us other profiles of Indigenous folks leading the way in broadband!
URL: **vogue.com/article/tokala-rampart-alaska**

ILSR PODCASTS FEATURING TRIBAL NETWORKS: ILSR produces a number of podcasts, and numerous episodes have featured Tribal networks or issues. Get inspired by their stories of success or hear Tribal broadband leaders talk about the lessons they've learned. To listen, search for "Community Broadband Bits" or "Building For Digital Equity" on Spotify, Apple Music, or wherever you get your podcasts, or go to **CommunityNets.org/broadbandbits** to subscribe and listen. See this running list for specific episodes on Tribal networks and issues: **tinyurl.com/y48hczjp**

NATION ARTICLE ON TRIBAL BROADBAND: This article in The Nation highlights the work of our friends at Hoopa Valley Public Utilities District to bring a tribally-owned Internet Service Provider to their community, and also features Matt Rantanen and Davida Delmar as well as mentions of the Tribal Broadband Bootcamp. The article tells a compelling story focused on Hoopa Valley that also offers helpful context for Tribal broadband more generally.
URL: **thenation.com/article/society/hoopa-acorn-wireless-native-internet/**

GENERAL RESOURCES: FURTHER LEARNING

NATIONAL BROADBAND RESOURCE HUB: Philanthropic initiative empowering government and community leaders to build a better broadband future; includes funding guides, policy analyses, and how-tos. This is a searchable repository of a huge number of materials, so it is a good source for looking for more in-depth information on any broadband-related topic.
URL: **broadbandhub.org/**

For In-Depth Learning

COMMUNITY NETWORKS BY THE INSTITUTE FOR LOCAL SELF-RELIANCE: Resources for those joining the movement to build broadband networks that are directly accountable to the communities they serve, including case studies, fact sheets, and video to help leaders make decisions about community owned networks.
URL: **communitynets.org/**

For In-Depth Learning

COMMUNITY BROADBAND BITS SHOW: Weekly podcast featuring interviews with people building community networks and shaping Internet policy; show focuses on the folks on the ground connecting their communities. Specific episodes focused on Tribal broadband are linked in the previous section.
URL: **communitynets.org/broadbandbits**

CONNECT THIS!: Live show featuring a diverse panel of broadband policy experts and ISP veterans that get together and talk about recent news, untangle regulations, demystify technology, dig into grant programs, and have a good time.
URL: **connectthisshow.com/**

UNDERSTANDING BROADBAND SERVICES FOR TRIBAL COMMUNITIES BY CALIX: A free introductory course walking participants through what it takes to build a broadband network and business in Tribal communities, with lessons on owning and operating a network, funding opportunities, permitting, and management.
URL: **calix.com/blog/2023/october/how-to-enroll-in-broadband-academys-course-for-tribal-communities.html**

Good for Beginners

PLANNING A NETWORK

17 STEPS BY THE INTERNET SOCIETY: Bill Murduch of ClearSky Communications breaks down 17 of the elements needed to build a network. This is a bare bones layout, best for folks with a knowledgeable background serious about deploying a new (or expanding) a network.
URL: **isoc.app.box.com/s/bdbaj1ugft6zc5cc5pa1z3quqfq4iih6**

Guide or Manual

SOFTWARE PROCUREMENT ROADMAP FOR TRIBES: Steps to Consider When Purchasing a Software License to Support Grant Workplan Activities
URL: **tinyurl.com/ky4tcxc9**

Good for Beginners

OPERATIONAL RATIOS*

1 Phone Support Technician per 1,500 subscribers
1 Field Technician per 600 subscribers
1 Customer Service Representative per 1,500 subscribers

*Ratios used by Vistabeam, an Internet Service Provider serving 8,500 subscribers and leveraging primarily wireless technology

CYBER SECURITY PRESENTATION: Recording from a presentation made on cybersecurity at TBB08 CRSTTA in October 2023 by Andy Deinert of Vantage Point and Rachael Wierson of Gila River Telecommunications, Inc. Topics included the importance of cybersecurity planning for federal grants, developing an incident response plan, best practices, and costs.
URL: **youtube.com/watch?v=hqaVxY3lmD0**

NEXT CENTURY CITIES BECOMING BROADBAND READY TOOLKIT is a compilation of good practices and a resource for any community seeking strategies and solutions to connect its residents.
URL: **nextcenturycities.org/broadband-toolkit/**

Guide or Manual

BUILDING BROADBAND COMMONS: TOOLS FOR PLANNERS AND COMMUNITIES: This resource offers government, private sector, and community representatives a guide to broadband planning at different scales, including walking through the different options for organizing a network and a description of the tools or steps you might adopt to make your network sustainable.
URL: **tinyurl.com/4f7sm76w**

Guide or Manual

CONNECT HUMANITY REPORT ON FINANCING MECHANISMS FOR LOCALLY-OWNED INTERNET INFRASTRUCTURE: This in-depth report (with executive summary) offers a review of the various financing and ownership models of community-based networks across the globe, as well as recommendations to policymakers and funders. You might use this to consider how to organize and finance your ISP or to help communicate to leadership and funders about your choices.
URL: **connecthumanity.fund/report-financing-ccps**

For In-Depth Learning

Aerial Hardware list: A brief listing of some common hardware needs for building an aerial fiber network. This list will continue to be updated with new recommendations. It is intended to give you a first introduction and does not include a full description of the element. We are happy to connect you with someone who can give you more information. Please free to comment or add to this list - it can be collaborative.
URL: **tinyurl.com/347stzw5**

TRIBAL BROADBAND HANDBOOK FROM THE NATIVE NATIONS LAW & POLICY CENTER: A publication by UCLA's Native Nations Law & Policy Center aimed at tribal in-house counsel and tribal leadership, designed as a broad overview of common broadband technologies and planning considerations. You might use this while getting community and leadership buy-in or answering questions from Tribal government departments.
URL: **law.ucla.edu/sites/default/files/PDFs/Native_Nations/245939%20UCLA%20Law%20publications%20broadband_R4.pdf**

Good for Beginners

BROADBAND FRAMEWORK FROM THE MICHIGAN MOONSHOT TEAM AT MERIT NETWORKS:
This community network roadmap and primer offers comprehensive guidance for planning a community network, including overviews of policy and technology. Most folks will want to skip the information specific to Michigan, but the toolkit also contains templates and planning resources that many will find extremely useful.
URL: **merit.edu/community/moonshot/framework/**

Guide or Manual | Sample Legal/Technical

HANDBOOK ON INFRASTRUCTURE DEPLOYMENT ON TRIBAL LANDS FROM NATIVE NATIONS COMMUNICATIONS TASK FORCE
The helpful handbook issued by members of the Native Nations Communications Task Force offers a survey of common considerations when planning an infrastructure deployment, including guidance for identifying and evaluating different options as well as the pros and cons of each. It also outlines some of the regulatory considerations and authority Tribes may wield.
URL: **fcc.gov/sites/default/files/nnctf_infrastructure_handbook_adopted_05.16.22.pdf**

Good for Reference | Good for Beginners

TRIBAL RESOURCE CENTER VIDEO SERIES ON PLANNING A TRIBAL ISP: Check out this series for an introduction to common questions as you plan an ISP, covering the value of Internet for your community, tools for assessing your Tribe's needs, developing partners, feasibility studies, funding, and sustainability. These videos are produced by a Native organization so bring a Tribal framework and briefly walk you through the considerations and options you will confront.
URL:**youtube.com/channel/UCUvDKhwtXoEia_GuO83ur5A/videos**

Good for Beginners | Guide or Manual

BACKHAUL ACQUISITION RESOURCES FROM TRIBAL RESOURCE CENTER: Acquiring backhaul will be an essential element for planning or extending your network. This webpage links to a number of resources, including key definitions, capacity planning estimates, and maps that may help you locate backhaul providers.
URL: **tribalresourcecenter.net/building-networks/backhaul-acquisition/backhaul-acquisition/**

PATHWAYS TO SUCCESS: AN NTTA BROADBAND REFERENCE GUIDE: This is a great guide from established ISPs at National Tribal Telecommunications Association giving you a roadmap for planning and carrying out a project to get your community connected.
URL: **connect.nm.gov/uploads/1/4/1/9/141989814/pathways_to_success_an_ntta_broadband_reference_guide.pdf**

Guide or Manual

DATA, POLICY, AND FUNDING RESOURCES

GEOSPATIAL RESOURCES FOR TRIBES: The Branch of Geospatial Support under BIA offers free geospatial software, geospatial training, and geospatial technical assistance to BIA staff and Tribal personnel.
URL: **bia.gov/bia/ots/dris/bogs**

FEDERAL BROADBAND FUNDING OPPORTUNITIES BY COMMON SENSE MEDIA: Comprehensive breakdown of federal broadband funding opportunities, including recipients, timeline, and uses for each grant program.
URL: **tinyurl.com/3pk9yfmb**

Good for Reference

INDIGENOUS CONNECTIVITY SUMMIT CALLS TO ACTION: A set of recommendations that, if adopted by governments and other stakeholders, could help advance connectivity in Indigenous communities in Canada and the United States.
URL: **connecthumanity.fund/2023-indigenous-connectivity-summit-calls-to-action/**

DIGITAL RESERVATIONS ACT: This is an introduction to a piece of legislation proposed a few years ago to establish the principles of spectrum sovereignty. This legislation was not enacted, so it is not law, but represents the vision of spectrum sovereignty policy advocates and can offer some language and learnings for continued advocacy.
URL: **warren.senate.gov/imo/media/doc/OnePager_DigitalReservations_07142020.pdf**

FIRST NATIONS INFORMATION GOVERNANCE CENTRE: Indigenous and Native-led organization providing education and training to a variety of external learners, including presentations, workshops, and their flagship course, The Fundamentals of OCAP®: Ownership, Control, Access, Possession. The principles of OCAP promote Indigenous data sovereignty; exercising and enacting these principles are directly tied to Indigenous self-determination, and to the preservation and development of their cultures. The interpretation of OCAP is unique to each Indigenous/Tribal community or region – it is NOT a doctrine or prescriptive, but a set of guiding principles. Ultimately, FNIGC is a tool that rightsholding Indigenous communities can use, via their governance model, to help assert sovereignty of their data and information.

Since 1996, the FNIGC's mission has been to uphold the values of OCAP. OCAP is a set of principles designed to protect First Nations (Indigenous/Tribal) ownership and jurisdiction over their data, ensuring that Indigenous people are the stewards of their own information.

- **Ownership:** individually and collectively as a community
- **Control:** deciding how and it's used and by whom, and under what conditions
- **Access:** the right to determine and define access regardless of where information/data is held
- **Possession:** ensuring they have the power to use their information for the benefit of their own communities.

URL: **fnigc.ca/**

BOTTLENECKS IN THE AFFORDABLE CONNECTIVITY PROGRAM: Episode 522 of the Community Broadband Bits Podcast. This episode of the Community Broadband Bits Podcast focuses on the Affordable Connectivity Program on Tribal lands and the complexity it poses for Tribal ISPs.
URL: **tinyurl.com/5n8m7hrd**

DARRAH BLACKWATER'S ARTICLE ON SPECTRUM SOVEREIGNTY FOR TRIBES: Darrah Blackwater has written extensively on the principle of spectrum sovereignty. Here she introduces the concept of spectrum sovereignty and the enormous sums raised by the federal government in auctioning spectrum licenses, including over Tribal lands.
URL: **ictnews.org/opinion/fcc-owes-tribes-billions-for-tribal-spectrum-sales**

ILSR'S GUIDE TO CHALLENGES TO FCC'S BROADBAND MAP: Though changes to the FCC's Broadband Map can no longer affect BEAD funding amounts, the map is regularly being updated and it remains important to have high-quality data on broadband availability. This guide to submitting challenges to the FCC map primarily focuses on individual-level challenges, but also links to bulk challenge resources useful for ISPs or Tribal governments.
URL: **communitynets.org/sites/default/files/2023-02/FCC%20Challenge%20Guide.pdf**

Good for Reference

ARTICLE ON DATA CHALLENGES FOR BROADBAND IN INDIAN COUNTRY: H. Trostle's article reviews some of the inaccuracies in federal broadband data that hinder the ability to fully understand and confront the digital divide on Tribal lands, including the overstatement of broadband availability, incorrect or missing address data, and even incorrect Tribal boundaries. It gives a useful big picture view of common challenges among Tribes and can help inform collaboration or public comment.
URL: **minneapolisfed.org/article/2023/inaccurate-data-could-hinder-broadband-access-in-indian-country**

Good for Beginners

FEDERAL WEBSITE HOSTING STATE BEAD PLANS: This site, which should be regularly updated, includes links to the state BEAD proposals, outlining each state's plans for distributing millions of dollars in broadband funding. Follow your state's progress to keep up-to-date on how your Tribe can engage with the BEAD program and potentially win broadband funding.
URL: **broadbandusa.ntia.doc.gov/public-notice-posting-state-and-territory-bead-digital-equity**

Good for Reference

ACCESS TO CAPITAL CLEARINGHOUSE - FEDERAL LISTING OF FUNDING FOR TRIBES: Launched at a 2023 White House Tribal Nations Summit, this resource is a database of all federal sources (across departments) of funding for Tribal governments, Tribal enterprises, Native entrepreneurs, and Native Community Development Financial Institutions. Though not all are specific to broadband, this list of funding programs may introduce you to some new potential funding sources.
URL: **bia.gov/atc**

Good for Reference

DEPARTMENT OF THE INTERIOR'S NATIONAL TRIBAL BROADBAND STRATEGY: This is a "proposed roadmap" for federal engagement with Tribal broadband needs. Though it is a couple of years old and many of their recommendations were not implemented, this document can be a helpful window into the sorts of policies federal agencies are or should be considering to advance a cohesive National Tribal Broadband Survey.
URL: **bia.gov/sites/default/files/dup/assets/as-ia/doc/2020.%20December.%20National%20Tribal%20Broadband%20Strategy%20FINAL-cover%20change.pdf**

INDIGENOUS CONNECTIVITY AND TECHNOLOGY DIVISION, BIA: This is a new division of BIA announced in April 2024 to assist federally recognized Tribal nations on issues related to broadband, technology, and digital sovereignty and to coordinate with other federal agencies on Tribal broadband policy. It is led by Danae Wilson, who previously led the Nez Perce Tribe's broadband initiative and worked at the White House. Though new, this division could end up being a powerful resource for Tribes. Read about the division and its services on their website. You might see especially their page dedicated to streamlining rights-of-way and permitting policies:
URL: **bia.gov/service/broadband-access**
URL: **bia.gov/bia/ots/ict**

For In-Depth Learning | Good for Reference

ILSR ARTICLES ON TRIBAL BROADBAND POLICIES: Check out ILSR's **communitynets.org** for coverage of broadband policies relevant to Tribes. Recent articles include a discussion of opportunities offered by ReConnect, and hurdles that Tribes have to overcome in challenging existing funding that did not obtain Tribal consent in order to unlock BEAD dollars. Reach out if you have questions or ideas about other policy angles we should highlight. URL:
URL: **communitynets.org/content/tribes-likely-have-challenge-rdof-and-other-enforceable-commitments-state-bead-maps**
URL: **communitynets.org/content/usda-reconnect-amps-broadband-funding-tribal-nations**

BROADBAND NEWSLETTERS

Good for Beginners

Keep up to date with broadband news by subscribing to the following newsletters.

BENTON DAILY DIGEST: Free, reliable, and non-partisan daily digest or weekly analysis of media and communications news.
URL: **benton.org/user/register**

BEYOND TELECOM LAW BLOG: Blog hosted by a team of telecommunications attorneys with a focus on wireless and wireline services, related services (content delivery and cloud computing), and equipment, as well as network security and data privacy.
URL: **beyondtelecomlawblog.com/**

COMMUNITY BROADBAND NETWORKS BY ILSR: Weekly newsletter featuring information about municipal broadband, cooperative networks, Tribal networks, and other local Internet solutions.
URL: **communitynets.org/content/sign-newsletters**

KELLER & HECKMAN: Email list offers multiple broadband and telecom news digests per week
URL: **tinyurl.com/3wwfcwft**

WIRELESS: WIRELESS BASICS

ISOC INDIGENOUS CONNECTIVITY SUMMIT CRIMPING WORKSHOP (October 2021): Slides by Esther, Jillian, Grant, & Matt J. This slideshow has some good diagrams and will be a helpful crimping refresher.
URL: **tinyurl.com/yw8he8d5**

Good for Beginners

CRIMPING VIDEO: If you want to refresh your crimping skills, this is a great video for a quick review.
URL: **tinyurl.com/68mzuzss**

Good for Beginners

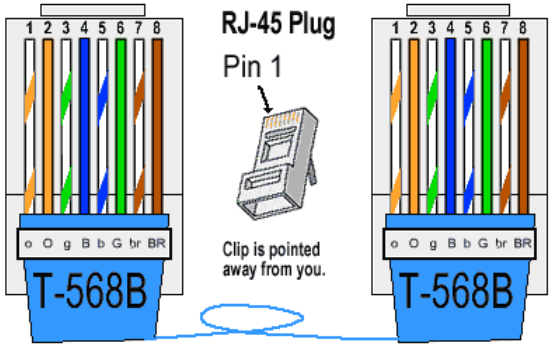
CABLE TESTING VIDEO (first 7 min only for basics): This video walks you through how to test the ethernet connections in your network.
URL: **tinyurl.com/mr3p2xes**

Good for Beginners

ILSR FACTSHEET: WIRELESS INTERNET 101: A brief, handy introduction to the terminology and basic questions of wireless networks.
URL: **tinyurl.com/mryy9nmj**

Good for Beginners

T-568B STRAIGHT-THROUGH ETHERNET CABLE



Both the T-568A and the T-568B standard Straight-Through cables are used most often as patch cords for your Ethernet connections. If you require a cable to connect two Ethernet devices directly together without a hub or when you connect two hubs together, you will need to use a Crossover cable instead.

Good for Beginners

WIRELESS: BUILDING AND MAINTAINING A NETWORK

WIRELESS BEST PRACTICES AND OPEN SOURCE LTE SLIDES: This is a pretty detailed slideshow on wireless best practices. These are slides from a presentation, so they are best used as a reference or refresher and may be a bit harder to follow for beginners without any background.
URL: **tinyurl.com/mr2ufh84**

Good for Reference

START YOUR OWN ISP: This guide is focused on the very earliest stages of starting a WISP - determining feasibility up through connecting the first few customers.
URL: **startyourownisp.com/**

Guide or Manual

WIRELESS NETWORKING IN THE DEVELOPING WORLD is a free book about designing, implementing, and maintaining low-cost wireless networks.
URL: **wndw.net/index.html**

Guide or Manual

VIDEO TRAINING ON USING GOOGLE EARTH TO DESIGN YOUR WIRELESS NETWORK: A thirty-minute walk through of how to use google earth to design your wireless network, including for identifying potential obstacles. This is a practical resource that will be especially useful for those just planning their networks and are exploring their mapping software options or need to keep their costs down.
URL: **youtube.com/watch?v=ad7bMGPDwcw&list=PLZ1cQ-u1XTA7nkhdE5XfUFLCEBfUbkt0x&index=5**

For In-Depth Learning

FIBER: BASICS

FIBER OPTICS NETWORK PRIMER: Fiber Optic Networks Presentation by NSRC. This is a pretty detailed slideshow on fiber networks by NSRC. These are slides from a presentation, so they are best used as a reference or refresher. The first few slides offer a very good primer on fiber, but the end of the presentation might be a bit harder to follow for beginners.
URL: **tinyurl.com/mwumj7yr**

Good for Beginners

ILSR VIDEO ON CONDUIT, FIBER OPTICS & THE LAST MILE | BUILDING A FIBER-TO-THE-HOME NETWORK: Animated video by ILSR that breaks down conduit, the central office, and the last mile to give you a birds-eye-view of a typical fiber optic network. This short video provides a quick overview of what the last-mile is, and what it takes to build a subterranean fiber optic network.
URL: **youtube.com/watch?v=qr9zjtfHR-w**

Good for Beginners

FIBER: BUILDING AND MANAGING A NETWORK

NETWORK STARTUP RESOURCE CENTER (NSRC): Cultivates collaboration among a community of peers to build and improve a global Internet that benefits all parties. They facilitate the growth of sustainable Internet infrastructure via technical training and engineering assistance to enrich the network of networks. You might find their video series on technical network topics particularly useful for in-depth learning.
URL: **learn.nsrc.org/bgp/**

For In-Depth Learning Good for Reference

TERMS & CONDITIONS FROM MERIT NETWORK: A sample terms and conditions for working with contractors constructing a fiber network based on the MERIT research and education network in Michigan.
URL: **tinyurl.com/yc58ve6w**

Sample Legal/Technical

CAD DRAWING REQUIREMENTS: When building a network, you will likely be working with vendors and will want to make sure they send you key network information and drawings. These are the requirements you should require them to include.
URL: **tinyurl.com/mu2zssza**

Sample Legal/Technical

GILA RIVER TELECOMMUNICATIONS HOME INSTALL PHOTOS: This is a brief presentation with photos walking you through how GRTI installs fiber to the home. It demonstrates one of several ways that the final install in the home can be achieved. This (or something of your own modeled after it) would be a great resource for helping folks in your community understand what a FTTH network would look like before or as you begin installation. Thanks to GRTI for sharing and captioning the photos.
URL: **tinyurl.com/454jz3kn**

ENVIRONMENTAL ASSESSMENT EXAMPLE: A sample environmental assessment commissioned by Merit Network for an extensive build in Michigan. Documents include the full environmental assessment (including cover page, table of contents, final text, maps, and photographs) and the finding of no significant impact.

URL: **tinyurl.com/y6mbsk5v**

Sample Legal/Technical

DIGITAL INCLUSION RESOURCES

Good for Beginners

ILSR DIGITAL EQUITY FACT SHEETS WITH AARP AND NDIA

WHAT IS BROADBAND? explains the basics of Internet access, defining key terms, technologies, and use. It explores who uses the Internet, how, and why the way we define broadband has such an impact on the quality of connections available to households today.
URL: **tinyurl.com/mrxd4f3z**

BROADBAND ACCESS CHALLENGES tackles infrastructure, affordability, and adoption issues. It addresses how mapping challenges have stymied funding programs, what has been done to lower monthly costs, and what is needed to improve adoption rates nationwide.
URL: **tinyurl.com/4bfpajfz**

BROADBAND AFFORDABILITY CHALLENGES explores the financial obstacles facing unconnected households. It reviews state and federal attempts to reduce those barriers with subsidies and the mandating of low-cost plans, and the models available today which can promote competition and lower prices.
URL: **tinyurl.com/2ww2sh9d**

BROADBAND AVAILABILITY CHALLENGES dives into why some households have access to the fastest Internet infrastructure while others languish on slower connections, and millions of households still lack basic connections at all. It also highlights community-driven efforts to improve local connectivity, and assesses the likely impact of an unprecedented level of federal investment in broadband funding for the future.
URL: **tinyurl.com/yf9c8ssp**

KEY DIGITAL SKILLS FOR BROADBAND examines the challenges in making sure that everyone who wants to take full advantage of everything the Internet has to offer has the skills to do so. It catalogs the high barriers to entry faced by New Americans, older adults, and other populations, and documents the host of national and local programs that are successfully breaking those barriers down.
URL: **tinyurl.com/yckrnkh6**

EXPANDING DEVICE AVAILABILITY FOR BROADBAND charts the connection between broadband adoption, access, and device use. It offers solutions for a myriad of local contexts, considers the advantages and disadvantages of different models for expanding device ownership and use, and profiles programs that stand able and willing to help communities meet their goals.
URL: **tinyurl.com/4new7as6**

NATIONAL DIGITAL NAVIGATOR CORPS: Read here about the 18 Digital Navigators funded through NDIA's National Digital Navigator Corps program launched in 2022. Seven of these projects are Tribal-led projects, and an additional three serve Tribal communities. Learn about their work, hear their stories, and consider reaching out to learn about what a Digital Navigator could do in your community.
URL: **digitalinclusion.org/digital-navigator-corps/**

DIGITAL INCLUSION RESOURCES

DIGITAL EQUITY LEADERSHIP LAB REPORT
Read a case study about the 'Digital Equity Leadership Lab', a five week program in 2021 during which twenty-five leaders from across Baltimore came together with national experts in areas related to network engineering, federal policymaking, community broadband networking, and grassroots organizing. The case study helps clarify the role of community-based leadership development to promote digital equity and justice.
URL: **tinyurl.com/ysn72vy7**
For In-Depth Learning

A FOUNDATION FOR THE FUTURE OF DIGITAL EQUITY WORK: Episode 520 of the Community Broadband Bits Podcast focused on the digital inclusion work of the National Digital Inclusion Alliance, with a specific focus on work in Tribal communities.
URL: **tinyurl.com/39bsnkb6**
Good for Beginners

BUILDING FOR DIGITAL EQUITY SHOW: Educational series including podcasts and live stream events to inform and debate digital inclusion efforts.
URL: **tinyurl.com/mry5c2hk**
Good for Beginners

NATIONAL DIGITAL INCLUSION ALLIANCE:
This is the website for one of the nation's leading digital equity organizations, focusing on bringing together and supporting local digital equity and inclusion efforts. Join in on calls and gain access to their resources here.
URL: **digitalinclusion.org/**

NDIA STARTUP MANUAL: Guidance to organizations looking to increase access and use of technology in disadvantaged communities through digital literacy training, affordable home broadband, affordable devices and tech support.
URL: **startup.digitalinclusion.org/**
Guide or Manual

DIGITAL INCLUSION COALITION GUIDEBOOK: An in-depth look at successful models and recurring themes across coalitions, accompanied by best practices, lessons learned, and specific recommendations from the field.
URL: **tinyurl.com/ehftd5hj**
Guide or Manual

NDIA'S DIGITAL INCLUSION GUIDE FOR STATES:
This guide provides state and territory leaders with simple, tactical steps to prepare now for planning and eventual implementation of digital equity strategies.
URL: **tinyurl.com/5dd3z39s**
Guide or Manual

NDIA'S MONTHLY DIGITAL INCLUSION 101S: NDIA holds monthly 101 Webinars to engage and connect new digital inclusion practitioners and advocates.
URL: **tinyurl.com/c23e25yv**
Good for Beginners

DIGITAL INCLUSION ECOSYSTEM

A Digital Inclusion Ecosystem is a combination of programs and policies that meet a geographic community's unique and diverse needs. Coordinating entities work together in an ecosystem to address all aspects of the digital divide, including affordable broadband, devices, and skills.

INDICATORS OF A STRONG DIGITAL INCLUSION ECOSYSTEM:

- Existence of programs and policies addressing all aspects of the digital divide:
    - Affordable and subsidized broadband service options that meet the community's needs
    - Multilingual digital literacy and digital skill trainings that meet the community's needs
    - Hardware and software technical support
    - Digital navigation services to guide residents to the above services
- Collaboration: Entities providing local digital inclusion services, policymakers, advocates, social service providers and community leaders co-create solutions in partnership with the community.

For citations, definitions are at **digitalinclusion.org/definitions/**

DIGITAL INCLUSION DEFINITIONS

DIGITAL EQUITY:

A condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy and economy.

Digital divide is the issue.
Digital inclusion is the work.
Digital equity is the goal.

Digital equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services.

DIGITAL INCLUSION:

The activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of information and communication technologies.

THIS INCLUDES FIVE ELEMENTS:

Affordable, robust broadband internet service;
Internet-enabled devices that meet the needs of the user;
Access to digital literacy training;
Quality technical support; and
Applications and online content designed to enable and encourage self-sufficiency, participation and collaboration.

DIGITAL DIVIDE:

The gap between those who have affordable access, skills and support to effectively engage online and those who do not.

DIGITAL NAVIGATORS:

Digital Navigators are trusted guides who assist community members in internet adoption and the use of computing devices. Digital Navigation services include ongoing assistance with affordable internet access, device acquisition, technical skills, and application support.

DIGITAL INCLUSION 101 RESOURCES, tinyurl.com/4cnbreun

DIGITAL INCLUSION CONVERSATION QUESTIONS

1. What prevents people in your community from consistently connecting to the internet and using it effectively?

2. What resources already exist in your community for people facing these barriers?

3. What doesn't already exist, but would be useful for people in your community who are facing these barriers?

NDIA
NATIONAL DIGITAL INCLUSION ALLIANCE

PROFESSIONAL DEVELOPMENT OPPORTUNITIES (TRAININGS, CERTIFICATIONS, SCHOLARSHIPS)

CALIX UNIVERSITY: Calix University offers a range of in-depth courses on technical topics, broadband fundamentals, and how to launch and grow a broadband service provider. There are even more intensive, instructor-led courses. On Calix University, you are able to pick and choose the courses that are right for you and your Tribal ISP now and for your future development. While Calix also offers a free introductory course on Tribal Broadband (described in General Resources: Further Learning section), they are making the entire Calix University available for free to bootcamp participants! To get access, please email Claudia Tarbell at claudia.tarbell@calix.com.
URL: **calix.com/services/education.html#university**

For In-Depth Learning

FIBER OPTIC ASSOCIATION REFERENCE GUIDE: The FOA has developed a guidebook on Fiber Optics & Premises Cabling that has a lot of helpful material. The Guide is intended to be used as reference material for those working in the industry, studying for FOA Certifications, teaching fiber optic training classes or giving refresher tutorials for FOA CFOTs.
URL: **foa.org/tech/ref/contents.html**

For In-Depth Learning

Below we have gathered information about some of the training/certification programs focused on broadband jobs. This is not an exhaustive list, nor is it an endorsement of any of the below programs.

For In-Depth Learning

LIGHTBRIGADE
This is a decades-old fiber optic training company. They offer in-person and online trainings ranging from foundational to intermediate to advanced, on a variety of topics related to fiber optics including technician training and fiber optic application to a host of fields. Their offerings include a special broadband-focused catalog called Broadband Academy, with tracks like technician, specialist, and professional. Many of their classes offer certification through established third-party organizations, as well as BICSI Continuing Education Credits. Several participants at TBB have gone through one of their training programs. Cost can be in the thousands of dollars.
URL: **lightbrigade.com/certifications**

OKLAHOMA STATE UNIVERSITY INSTITUTE OF TECHNOLOGY: OSUIT and NTIA recently announced the launch of a new fiber optic technician training program. This program is strictly for underrepresented groups and offers free enrollment for Tribal citizens. The program includes a series of progressively advanced courses, with options to obtain FOI certification. There is also a course on aerial construction. Read about the program in this article **mvskokemedia.com/osuit-fiber-optic-program-offers-free-training-for-tribal-citizens/**
Or visit their website.
osuit.edu/workforce/fiber-optic-training.php

ETA, INC.: This is another trade association that offers technical certifications, including Fiber Optics Technician, Fiber Optics Installer, Electronics Technician, and as well as others in Fiber Optics and Information Technology. These are not courses, just the certification tests, though they also sell study materials online. Exams can cost several hundred dollars. Some require some number of years experience.
URL: **etai.org/index.html**

CORNING FIBER TRAINING: Among other things, Corning is a manufacturer of fiber optic cable. They also offer a range of training courses in the installation, design, and troubleshooting of fiber optic networks. Some trainings are available online, while others are offered as multi-day hands-on training. Corning says that students "receive a certificate for the course and are eligible for third-party industry continuing education credits," but see the schedule of classes and contact them directly for details on the certification. Costs vary based on the length and format of the class, with multi-day, in-person trainings in the range of $1500.
URL: **corning.com/optical-communications/worldwide/en/home/training-and-events/training-programs.html**

CISCO: Cisco is a communications technology company that produces software and hardware. They offer a large variety of training courses that can be online, instructor-led, or private group training, with many focusing on the Cisco suite of products. These trainings are less focused on outside plant (fiber installation and maintenance) and more on a broader IT environment, preparing you for roles from network engineer to cybersecurity analyst to customer success manager. Costs vary for the programs, and many offer 3-year Cisco certifications with a passing score on a test.
URL: **cisco.com/c/en/us/training-events/training-certifications/training.html**

FIBER BROADBAND ASSOCIATION: FBA is a trade association for fiber broadband providers, and they offer a range of certification programs for network operators and technicians. Certifications usually last three years. In some cases, you may take the exam for a fee without enrolling in a course. Most courses are offered in-person, and FBA will soon be launching a new training program in partnership with community colleges across the country. Courses usually cost several thousand dollars and the exams several hundred.
URL: **fiberbroadband.org/education-and-certification/**

FIBER OPTIC ASSOCIATION, INC.: This is one of the premier training bodies for fiber optic education. They offer a free "Fiber U" platform of self-study courses with introductions to fiber optic skills, tools, and design. After completing a course, you can take a test (minimal cost) to get a Fiber U Certificate of Completion, but this is not to be confused with the more rigorous FOA Certification process. These courses are designed to help study for FOA certifications, which often require a combination of enrolling in an FOA-approved school and/or several years of experience. FOA Certification options include fiber optic network design, premises cabling, splicing, testing, fiber to the home, fiber for wireless, and many others. Certification tests usually cost several hundred dollars.
URL: **thefoa.org/**

BICSI: Bicsi is another major player in the telecom training and certification field. They offer virtual and in-person trainings as well as widely recognized certifications. Exams cost several hundred dollars, which does not include the costs of the handbook and training materials. Courses range in cost from several hundred to several thousand dollars. Some include hands-on training and others do not.
URL: **bicsi.org/education-certification/education-@-bicsi-learning-academy#gsc.tab=0**

FIBER INSTRUMENT SALES: This training program was recommended by a TBB attendee and NOC Supervisor, who attended an in-person training at their location in upstate New York. They also offer online trainings and hands-on in cities across the US. This does not offer a certification, but you can receive BICSI continuing education credits. In-person trainings cost around $500. URL: **fiberinstrumentsales.com/fiber-optic-training**

GLOSSARY

4G AND 5G: fourth generation and fifth generation - Terms for new advancements in wireless communication technology. See the fact sheet on the 5G Hype in this booklet for more information.

ACP: Affordable Connectivity Program - a program administered by the Universal Service Administrative Company that covers $75 of subscriber's internet bills on Tribal lands ($30 off Tribal lands). Income qualifications apply.

AP: ACCESS POINT: a device that transmits data over a wireless local area network

ASN: Autonomous System Number: - a unique 16 digit number assigned to networks and systems that allows for the routing of information

ASYMMETRICAL: Upload and Download speeds are different

ATTENUATION: The loss of signal power as light travels through a fiber optic cable or wireless signal travels through a network. A certain level of attenuation is inevitable, but it can be exasperated by external factors and lead to the degradation of the connection.

BACKHAUL: A general term for the segment of a network between the core and the edge. An example: the connection from a community network hub in a small town to a carrier hotel where it connects to the Internet backbone.

BANDWIDTH (RADIO FREQUENCY): all the radio frequencies within a given band (often measured in hertz)

BANDWIDTH (NETWORK SPEED): how much data you can transfer over a network over a certain period of time (often measured in data/second, ie. Megabits per second)

BEAD: Broadband Equity, Access, and Deployment Program - a $42B program administered by the National Telecommunications and Information Administration (NTIA) giving states each a designated amount of funding to distribute to broadband deployment projects.

BEAM WIDTH (ANTENNAS): In wireless networking, the region of three-dimensional space where most signal strength will fall based on transmission power and other antenna characteristics.

BIT: The base unit of information in computing. Network speeds tend to be measured by bits per second - using kilo, mega and giga. A bit is a part of byte, they are not synonyms. Bit is generally abbreviated with a lower case b.

BSL: Broadband Serviceable Location - This is a term that the federal government uses to designate locations (homes, businesses, etc) that should get an internet connection.

BTOP: Broadband Technology Opportunities Program - a federal funding program through the US Department of Commerce established by the 2009 stimulus legislation that distributed about $4B for broadband infrastructure deployment, and use and adoption programs.

BYTE: The base unit for file storage. Comprised of 8 bits. Byte is generally abbreviated with a capital B.

CBRS: Citizens Broadband Radio Service - refers to the unlicensed or "lightly-licensed" spectrum that has been designated for shared use by the FCC. General authorized access (GAA) users get lowest priority.

CONDUIT: A reinforced tube through which cabling runs. Useful to protect fiber-optic cables in the ground and because one can place the conduit underground when convenient and later "blow" or "pull" the fiber cabling through the conduit.

COOPERATIVE (CO-OP): A non-profit, member-owned organization that provides a needed service. Members pay a small fee to join and have voting rights.

CPE: Customer Premises Equipment - describes the box on the side of the house that receives and sends the signal from the network, connecting the subscriber.

CPI: Certified Professional Installer - a certification that people who are deploying CBRS equipment need to obtain.

DARK FIBER: Unused fiber infrastructure that has not been "lit" with Internet service. When building a network, the cost of adding more fiber than immediately required is negligible. Fibers can be leased to others or held in reserve for future need.

DDOS: Distributed Denial of System - Cyberattack that attempts to interrupt the normal Internet traffic at a server by flooding it with traffic

DEA: Digital Equity Act - A program that will be unfolding over 2024-2026 to promote digital inclusion work. Likely to be distributed through combination of state-level competitive grants and a federal competitive process.

DHCP: Dynamic Host Configuration Protocol - a process that assigns ISPs to each device in a network automatically

DIGITAL EQUITY: the state of all members of a community having equal access and sufficient digital literacy to use communications technologies.

DIGITAL INCLUSION: the actions required in order to achieve digital equity.

DNS: Domain Name Service - the phone book for the internet

DOCSIS: This is a technical specification that allows modern cable networks to offer broadband.

DIGITAL SUBSCRIBER LINE (DSL): Internet access over phone lines. Uses frequencies not used by human voices that degrade quickly over distance, meaning customers must live within a mile of the central office to get the fastest speeds.

DUCT: Ducts (or conduits) offer a highly protective environment for fiber-optic cables. They are typically buried, and then the cables are air-blown, jetted, pulled or pushed into the duct.

ENB: eNodeB -this is basically the brains of an LTE wireless network that manages the connections between the radios and registered users and the broader Internet

ETC: Eligible Telecom Carrier - a designation offered by states and the FCC for Internet Service Providers that makes them eligible for Universal Service Fund money.

FIBER-OPTIC: A system that uses glass to carry light which is used to transmit information. each side of the fiber is attached to a laser that send the light signals.

FIXED WIRELESS: A connectivity model that uses stationary wireless technology to bridge the "last mile" between the Internet backbone and the subscriber.
Fiber-to-the-home (FTTH): networks that use fiber to connect the subscriber.
FIBER-TO-THE-HOME (FTTH): networks that use fiber to connect the subscriber.

GAIN/LOSS (FOR ANTENNAS OR LINKS): The real-world performance of a wired or wireless networking system as compared to a perfect theoretical system

GBPS: Gigabits per second - or one billion bits per second. 8 Gbps means that 8 billion bits are transferred each second. Using an 8 Gbps connection, it would take 1 second to transfer a 1 GB (Gigabit) file - a compressed 90 min movie, for instance. 1 Kbps (Kilobits)<1 Mbps (Megabits)<1 Gbps

GIG: Shorthand for 1 gbps (1,000 mbps) download speeds. a speed fast enough that any number of applications can use the network minimizing congestion.

GIS: Geographic Information System - a platform used to create, manage, analyze, and map data. Can be used to connect data to geographic places.

GPON: Gigabit Passive Optical Network - a type of passive optical (fiber) network that is capable of implementing gigabit service

GREENFIELD: A plot of land that will soon become a residential development. Building a broadband network is cheap in greenfields because roads, sidewalks, lawns, and buildings are not yet impediments to running the necessary wires.

HERTZ (FREQUENCY), MEGAHERTZ, GIGAHERTZ: units used to measure frequency ⇨ 1 megahertz = 1 million hertz, 1 gigahertz = 1 billion hertz

HFC: Hybrid Fiber-Coax - a network that combines some fiber-optic elements (typically from the head end to a node in the field) and coaxial cable (typically the loop that connects the node to subscribers).

ICT: Information and communication technologies cover all advanced technologies in manipulating and communicating information, including telecommunication technologies such as the satellite, the cable, mobile telephony, and radio and TV, as well as digital technologies such as computers and the internet, among others.

INSTITUTIONAL NETWORK (I-NET): the network a municipal government requires to carry out its duties. I-Net frequently refers specifically to a network built for city uses (connecting schools, for instance) by the cable company as part of the franchise agreement with the city.

INTERNET: A worldwide network

INTERNET OF THINGS/IOT: Reference to Internet-connected devices — anything from laptops and smartphones to "smart" streetlights or thermostats.

IP ADDRESS: The Internet is like a big mailing system that's routing data in between machines, and every computer on the Internet must have an unique string of characters that serves as an address so that data can be delivered to it.

IRU: Indefeasible Right of Use - an agreement between a fiber owner and an entity contracting to use that fiber that establishes a right to use the fiber that cannot be annulled or voided

KBPS: Kilobits per second - a measure of speed. 8 Kbps means that 8 thousand bits are transferred each second. 1 Kbps<1 Mbps (Megabits)<1 Gbps (Gigabits)<1 Tbps (Terabit)

LAN: Local Area Network - a network of connected devices, like a home network, university network, or business network

LAST MILE: final leg of a connection between a Distribution Point or Point of Presence (PoP) and the customer.

LATENCY: The amount of time it takes for a bit to get from point A to point B. No matter how small the amount of data, for any network device there's always a minimum time that you can never beat. That's called the latency of the device."

A LATERAL: When a single fiber (or pair of fiber or multiple fibers in a single conduit) is pulled into a building

LEO: Low Earth Orbit - a more recent innovation in satellite technology that involves a network of satellites orbiting closer to earth, cutting down on latency and increasing speeds

LICENSED VS UNLICENSED FREQUENCIES: Licensed frequencies are overseen and allocated by the FCC for use in wireless systems. Unlicensed frequencies are unreserved. The former costs more but offers opportunities for more robust systems, whereas the latter removes barriers to experimentation and cost for deployments

LIT FIBER: Fiber infrastructure that is being used to provide Internet service.

LOI: Letter of Intent - a policy termed used by funding agencies, referring to what is usually the first step in an application process

LOS: Line of Sight - required in most wireless internet cases, where the antenna or radio transmitting the signal must have line of sight to the device receiving the signal

LTE: Long-Term Evolution - a wireless standard used in 4G wireless networks

MACROCELL: A cell used to provide cell network coverage to a large area (compared to small cells, which cover a smaller area). Often mounted on towers.

MBPS: Megabits per second - a measure of speed. 8 Mbps means 8 million bits are transferred each second - for ex. a photo. 1 Kbps <1 Mbps<1 Gbps (Gigabits)

MDU: Multiple dwelling unit - most frequently apartment buildings. MDUs can offer a challenge when building a ftth network due to the need to negotiate with building owners and rewiring that may be necessary to bring fast speeds to each unit.

MIDDLE MILE: the network connection between the last mile and greater Internet. For instance, in a rural area, the middle mile would likely connect the town's network to a larger metropolitan area where it interconnects with major carriers.

MOU: Memorandum of Understanding - a nonbinding agreement to work towards a stated project or goal

MTU: Max Transfer Unit

MUNICIPAL NETWORK: A broadband network owned by a local government. These networks take many forms, from modest networks serving a few businesses to networks that are available at every address across a community. Some are run by the municipality and others are managed by an ISP under contract.

NDA: Non-Disclosure Agreement - an agreement by one or two parties to a relationship not to disclose information, often with financial penalties. These are often abused.

NDIA: National Digital Inclusion Alliance - leading national organization focused on supporting local digital inclusion activities

NOC: Network Operations Center - usually a central location where network operators monitor the network and handle any interruptions or service needs

NTIA: National Telecommunications and Information Administration - a division of the Department of Commerce in Washington, DC. This agency administers certain broadband funding programs, including the Tribal Broadband Connectivity Program and BEAD

OLT: Optical Line Terminal - device usually at the central office of a fiber network that connects to the fiber backbone

ONT: Optical Network Terminal - device installed at the subscriber's home on a fiber network (like a modem)

OPEN ACCESS: An arrangement where the network is open to independent service providers to offer services. In many cases, the network owner only sells wholesale access to the service providers who offer all retail services (ie: triple play of Internet, phone, tv). Open access provides more competition for subscribers.

OSI: Open Systems Interconnection

OTDR: Optical Time Domain Reflectometer - a device used to identify the location of a break or interruption on a fiber network

OVERBUILD: To create a network that goes into competition with an incumbent provider (definition is specific to fiber).

PASSED: Residences or businesses that have access to the network. As a network is constructed, it will be built through a neighborhood before houses or businesses are connected. When a house or businesses is"passed,"it means they are eligible to sign up for services, which may require a technician to hook up the drop cable).

PEER-TO-PEER (P2P): type of network that allows computers to connect directly to each other rather than organizing them via hierarchical connections. Peer to peer technologies, such as BitTorrent, can greatly reduce the cost of distributing content but also have been used to exchange copyrighted materials without permission.

POE: Power over Ethernet - a system that delivers power as well as connectivity over ethernet cords, which allows for internet connectivity in places with no other power access

POP: A Point of Presence is an access point that provides a connection from one location to the rest of the Internet. ISPs have multiple PoPs.

PTMP (POINT TO MULTIPOINT): Communication that stems from one single point but serves multiple end-user devices

PtP - POINT TO POINT: a point-to-point connection refers to a communications connection between two communication endpoints or nodes.

RDOF: Rural Digital Opportunity Fund - a program administered by FCC to distribute $20B in funds for infrastructure deployment through a reverse auction system, where providers bid to provide service to locations in designated census blocks with less than 25/3 speeds

RFP: Request for Proposal - a call for proposals that opens a bidding process for a project

ROUTER: A device that passes information from one network to another

RUS: Rural Utilities Service - a branch of the US Department of Agriculture. RUS offers loans to entities deploying broadband in rural areas. The ReConnect grant program is among those administered by RUS.

ROT: Rise Over Thermal - a measurement in wireless networks that describes the congestion on the network

RURAL TRIBAL PRIORITY WINDOW: In 2020, before the FCC auctioned 2.5 GHz spectrum, they opened a priority window for Tribes with a rural land base to claim the license for unused spectrum over their lands. Possible precedent for any future spectrum auction.

SATURATION (WIRELESS): When enough data is being transferred that a network deployment's bandwidth is maximized: i.e. when a user device cannot sustain any more input.

SAS: Spectrum Access System - system to allocate access to spectrum dynamically in the CBRS range

SCADA: Supervisory Control and Data Acquisition - software to monitor and control major infrastructure processes

SECTOR: Similar to beam width, the formal designation for the three-dimensional space that a wireless radio distributes a signal to.

SFP: Small Form-Factor Pluggable - a compact, hot-pluggable network interface module

SLA: Service Level Agreement - a contract that sets the expectations between a service provider and customer (this can be with your vendors as well as with your customers)

SMALL CELL: Small cells provide wireless service via a connection to fiber optic networks. These units are much smaller and exist closer to the user — often attached to telephone poles and light posts — than macro cells ("cell towers"). Small cells already exist in many cities to provide 4G service.

SPECTRUM SOVEREIGNTY: A growing movement to recognize the sovereign right of Native Nations to control the spectrum over their lands

SWITCH: A device that passes information from one networking device to another

SYMMETRICAL: Internet connections have two components - a downstream and upstream. When the two speeds are the same, the connection is termed symmetric. Fiber-optic networks more readily offer symmetrical connections than DSL and cable, which are inherently asymmetrical.

TAKE RATE: The number of subscribers to a service - typically expressed in a percentage of those taking the service divided by the total number of people who could take the service. If a community fiber network passes 10,000 people and 6,000 people subscribe, it has a take rate of 60%.

THROUGHPUT: how much information a given channel can process in a certain amount of time (often measured in data/second, ie. Megabits per second)

UPS: Uninterruptible Power Supply - a system that offers automatic backup electrical power when power source fails

USAC: Universal Service Administrative Company - the non-profit organization tasked with overseeing the University Service Fund (not a government entity but administers a government program of federal funds)

USF: Universal Service Fund - a federal program with four programs: high cost (subsidizes the high cost of services in rural areas), low income (includes Lifeline or Affordable Connectivity Program), rural health care (reduced rates to rural health care providers to ensure they have access to similar services as urban counterparts), and schools and libraries (E-Rate subsidizes telecommunication services to schools and libraries).

WAN: Wide Area Network - an interconnected network that spans beyond a smaller geographic area

WI-FI: suite of protocols that allow wireless devices to exchange information using unlicensed frequencies. Equipment carrying the Wi-Fi brand is interoperable.

WISP: Wireless Internet Service Provider - refers to an entity that provides Internet exclusively over wireless networks

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