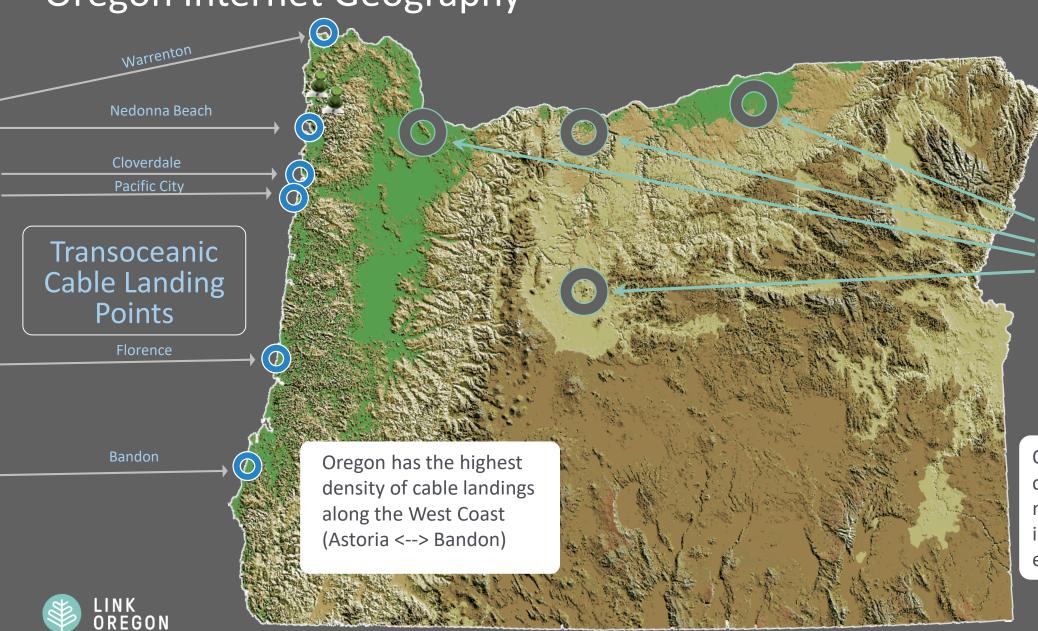# Update for the NITRD Joint Engineering Team (JET)

Steve Corbató, Executive Director

Remote Presentation – January 21, 2020
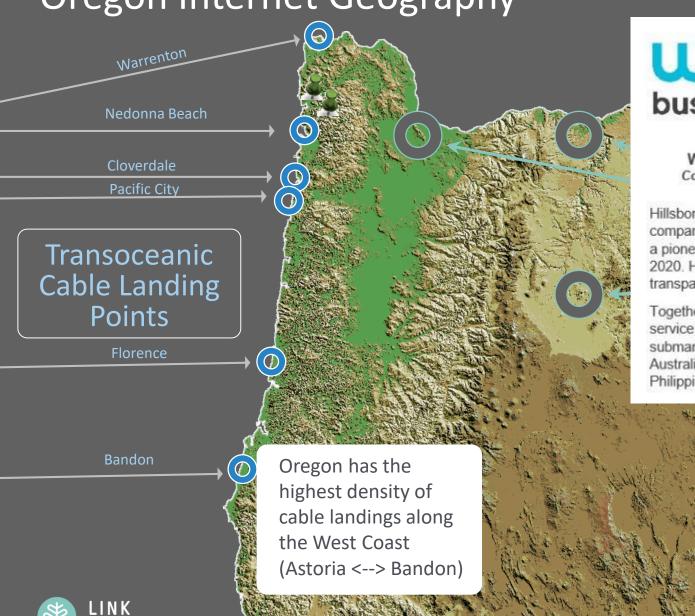
Oregon Internet Geography

Warrenton

Nedonna Beach

Cloverdale

Pacific City

Transoceanic Cable Landing Points

Florence

Bandon

Oregon has the highest density of cable landings along the West Coast (Astoria <--> Bandon)

Commercial Data Center Concentrations

Oregon supports key components of the national / global internet and cloud ecosystem

LINK OREGON

2

Oregon Internet Geography

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wave business

Wave Business Announces Construction of Hillsboro Data Center Ring II
Combined Fiber Rings to Connect Seven Submarine Cable Systems into Single Network

Hillsboro, OR! January 20, 2020! Wave Business, a leading fiber optic telecommunications company on the West Coast, today announced the construction of Hillsboro Data Center Ring II, a pioneering fiber optic network in Oregon scheduled to be completed in the second quarter of 2020. Hillsboro is already home to Wave's fiber Ring I, a cross-connect facility for several transpacific submarine cables that currently connects six data centers.

Together, Ring I and Ring II will connect up to 14 existing or planned data centers and will service 7 transpacific submarine cable systems. Transpacific destinations involving the submarine cable systems include China, Taiwan, Japan, Korea, Guam, Hawaii, New Zealand, Australia, and American Samoa. Additional destinations to be added in 2020 include the Philippines and Alaska, with New Caledonia being added in 2021.

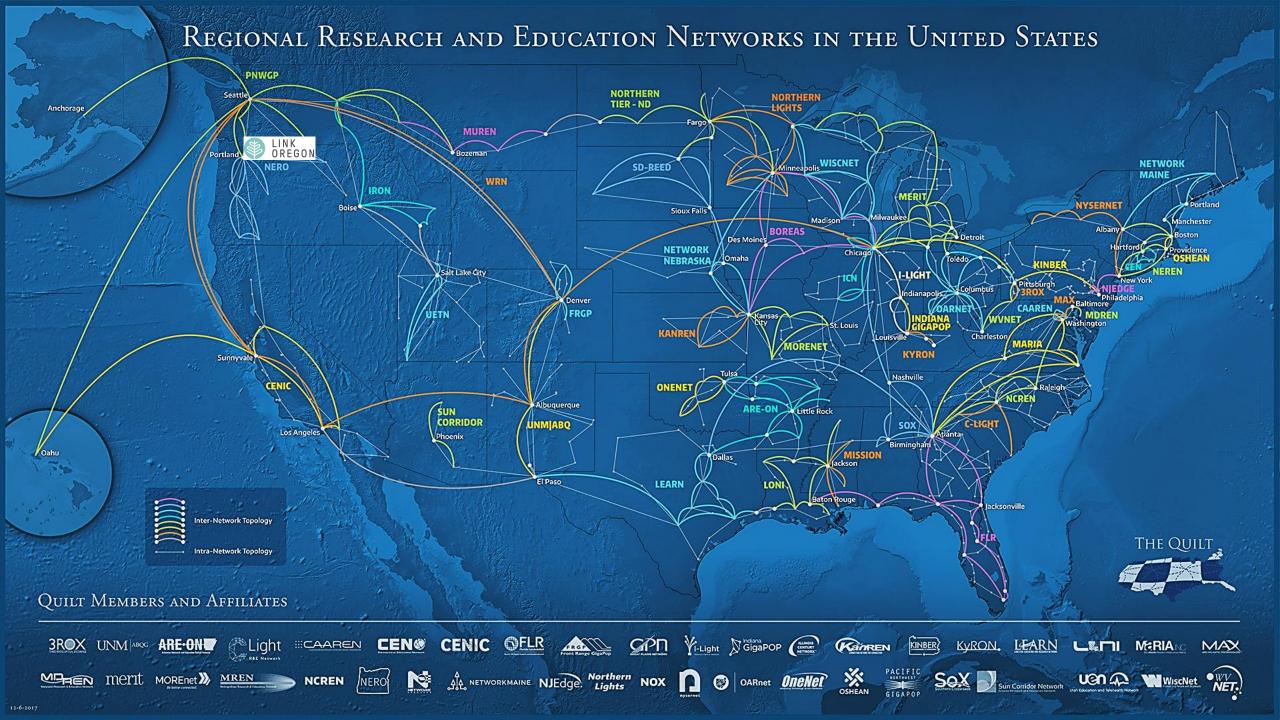Oregon supports key components of the national / global internet and cloud ecosystem

LINK OREGON

3

Link Oregon: Introduction

- A new consortium of the four research universities and state government
- Facilities-based optical network
  - Statewide fiber footprint
  - Individual statewide WANs to converge on this platform
- Can serve public and non-profit sectors
- Incorporating NERO/OGIG networks (UO)
- Two core services
  - Ethernet based transport
  - Enhanced Internet service
- Non-profit organization established
  - Asset vessel and operational entity
  - Vehicle for collaborative IT projects
- Local peering and broadband partnership

Oregon's Four Research Universities
- *Oregon Health & Science University (OHSU), Portland*
- *Oregon State University, Corvallis*
- *Portland State University, Portland*
- *University of Oregon, Eugene*

REGIONAL RESEARCH AND EDUCATION NETWORKS IN THE UNITED STATES

LINK OREGON

PNWGP — Seattle, Portland

Anchorage

NERO

IRON — Boise

MUREN — Bozeman

NORTHERN TIER - ND — Fargo

NORTHERN LIGHTS

WISCNET — Minneapolis, Madison, Milwaukee

WRN

SD-REED — Sioux Falls

MERIT — Detroit, Toledo

NETWORK MAINE — Portland, Manchester, Boston

NYSERNET — Albany, Hartford, Providence

OSHEAN

NEREN

CEN

UETN — Salt Lake City

NETWORK NEBRASKA — Des Moines, Omaha

BOREAS

ICN

I-LIGHT — Chicago, Indianapolis, Columbus

KINBER — Pittsburgh, 3ROX

OARNET

NJEDGE — New York, Philadelphia

MAX — Baltimore

CAAREN

WVNET — Charleston

MDREN — Washington

Denver FRGP

KANREN — Kansas City, St. Louis

INDIANA GIGAPOP — Louisville

KYRON

MARIA

Sunnyvale

CENIC — Los Angeles

MORENET

ONENET — Tulsa

Nashville

NCREN — Raleigh

Oahu

SUN CORRIDOR — Phoenix

UNM|ABQ — Albuquerque

ARE-ON — Little Rock

SOX — Birmingham

C-LIGHT — Atlanta

El Paso

MISSION — Jackson

Dallas

LEARN

LONI — Baton Rouge

Jacksonville

FLR

Legend

- Inter-Network Topology
- Intra-Network Topology

THE QUILT

12-6-2017

Link Oregon: Strategic Governance

- Board of Directors
  - State government
    - Terrence Woods, State CIO (vice chair – FY20)
    - Brendan Finn, Governor's Office
    - Peter Tamayo, Dept. of Education
    - Kurtis Danka, State CTO
  - Research universities
    - Kirk Kelly, PSU (chair – FY20)
    - Bridget Barnes, OHSU
    - Andrea Ballinger, OSU
    - Jessie Minton, UO
  - Ninth board member
    - Steve Corbató (executive director)

Link Oregon: Building the Organization

- Non-profit organization formed
  - 501c3 application submitted to IRS
  - Naming and branding
    - Oregon Fiber Partnership (corporate)
    - Link Oregon (service)
  - Web & social media presences
    - www.linkoregon.org
- Staffing (now 6 FTE and 1 consultant)
  - Business Manager (hired)
  - Senior Network Engineer/Architect (hired)
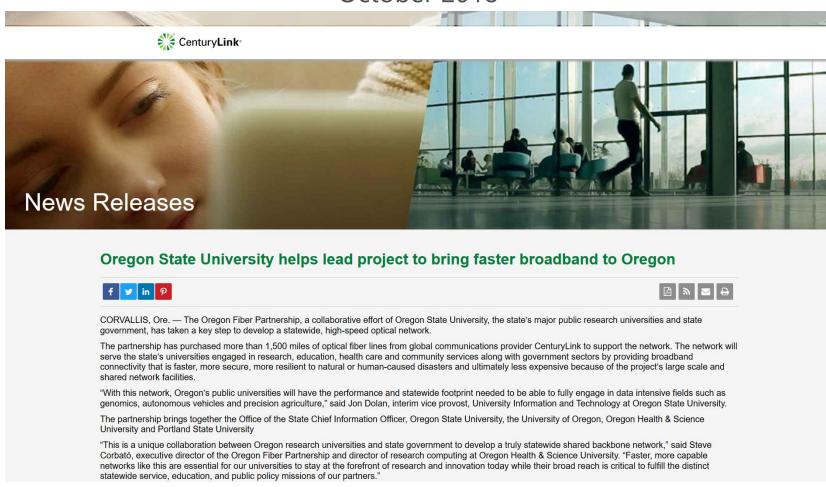 - Project Manager (contracted)

Link Oregon: Network development

- Pilot ring lit - Newport/Corvallis (12/2018)
- Optical line/Ethernet transport RFP (OSU)
  - Fujitsu 1FINITY optical system
- Procured additional fiber segments
  - Southern Oregon ring (Hunter)
- Building public partnerships
  - City of Portland
  - Clackamas County
  - City of John Day
- NERO integration
  - Technical staff joined Link Oregon
- CENIC connection (100 Gbps - Eugene)
  - Retain Internet2 (100 Gbps – Portland)
- Resiliency is a key design factor
  - Cascadia Subduction Event

Link Oregon in the News
October 2018

CenturyLink

News Releases

Oregon State University helps lead project to bring faster broadband to Oregon

CORVALLIS, Ore. — The Oregon Fiber Partnership, a collaborative effort of Oregon State University, the state's major public research universities and state government, has taken a key step to develop a statewide, high-speed optical network.

The partnership has purchased more than 1,500 miles of optical fiber lines from global communications provider CenturyLink to support the network. The network will serve the state's universities engaged in research, education, health care and community services along with government sectors by providing broadband connectivity that is faster, more secure, more resilient to natural or human-caused disasters and ultimately less expensive because of the project's large scale and shared network facilities.

"With this network, Oregon's public universities will have the performance and statewide footprint needed to be able to fully engage in data intensive fields such as genomics, autonomous vehicles and precision agriculture," said Jon Dolan, interim vice provost, University Information and Technology at Oregon State University.

The partnership brings together the Office of the State Chief Information Officer, Oregon State University, the University of Oregon, Oregon Health & Science University and Portland State University

"This is a unique collaboration between Oregon research universities and state government to develop a truly statewide shared backbone network," said Steve Corbató, executive director of the Oregon Fiber Partnership and director of research computing at Oregon Health & Science University. "Faster, more capable networks like this are essential for our universities to stay at the forefront of research and innovation today while their broad reach is critical to fulfill the distinct statewide service, education, and public policy missions of our partners."

http://news.centurylink.com/2018-10-10-Oregon-State-University-helps-lead-project-to-bring-faster-broadband-to-Oregon

https://today.oregonstate.edu/news/oregon-state-university-helps-lead-project-bring-faster-broadband-oregon

LINK OREGON
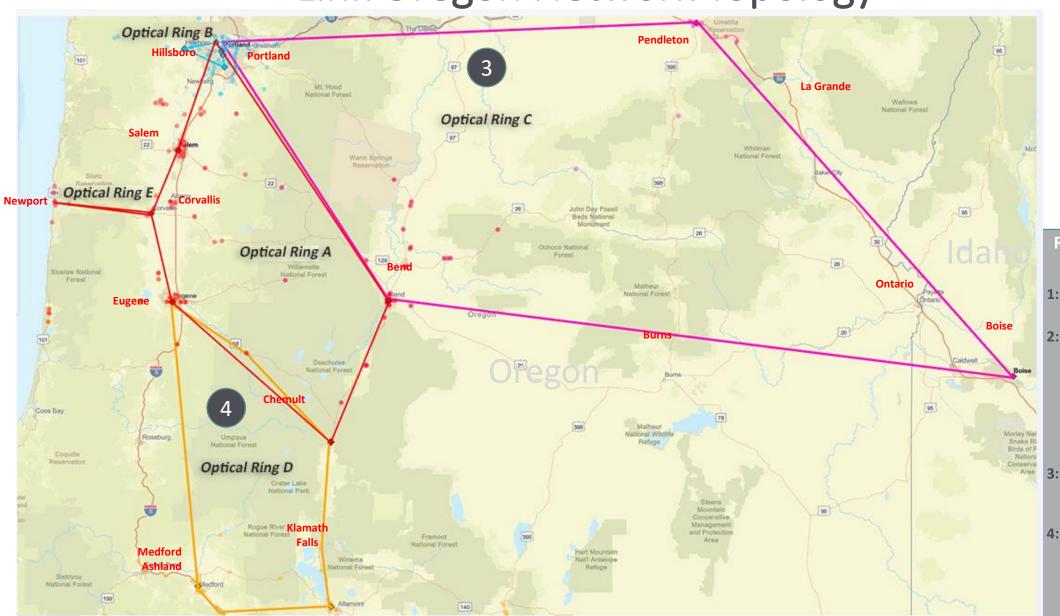
PLANNED NETWORK CONECTION SITES

- Newport
- Portland/Hillsboro
- Salem
- Corvallis
- Eugene
- Roseburg
- Grants Pass
- Medford/Central Point
- Ashland
- The Dalles
- Bend
- Klamath Falls
- Pendleton
- La Grande
- Ontario
- Burns
- Boise, Idaho
- Florence - possible
- Coos Bay - possible

2,300 route-mile network
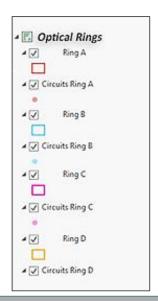
Legend

Fiber_Routes_1mi_Broadband

Current POPs

IMPLEMENTATION
- Over 3-5 years
- State of Oregon and University funding
- Partnerships with private and public telecommunications companies

LINK OREGON

PLANNED NETWORK CONECTION SITES
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IMPLEMENTATION
- Over 3-5 years
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Long-term planned topology

Legend
Fiber_Routes_1mi_Broadband

Current POPs

Link Oregon Network Topology

Optical Rings
- Ring A
  - Circuits Ring A
- Ring B
  - Circuits Ring B
- Ring C
  - Circuits Ring C
- Ring D
  - Circuits Ring D

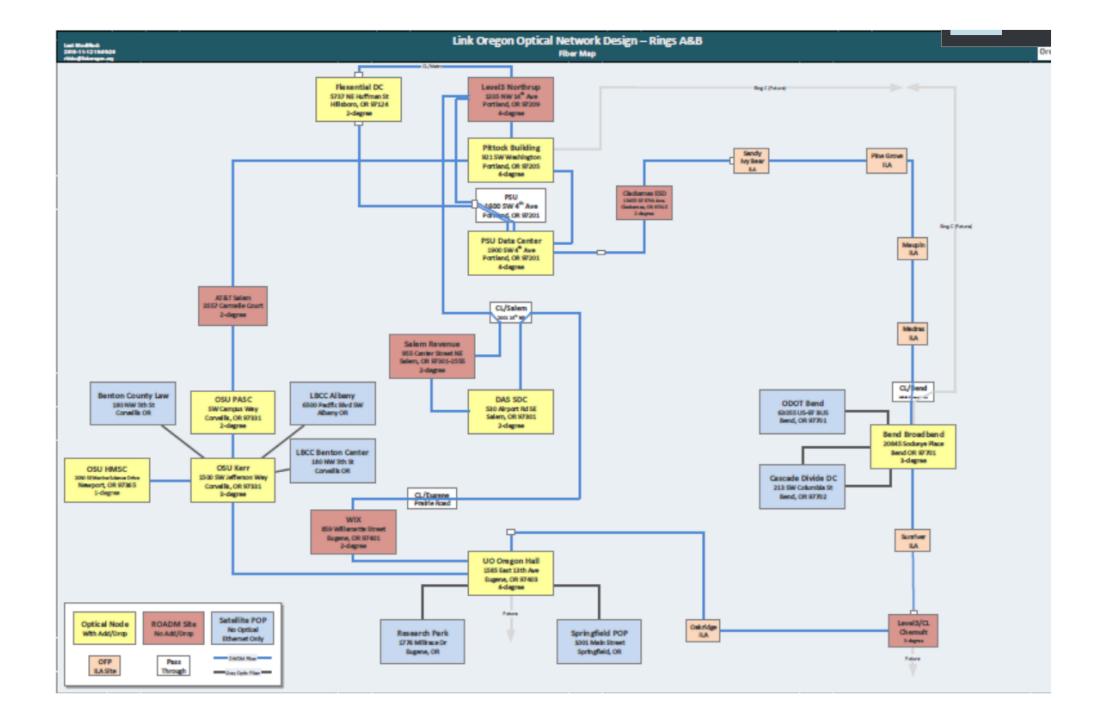**RELEASE PLAN** (Tentative) **by Optical Rings**

1: **Pilot Lighting** -> **Ring E** (Corvallis – Newport)
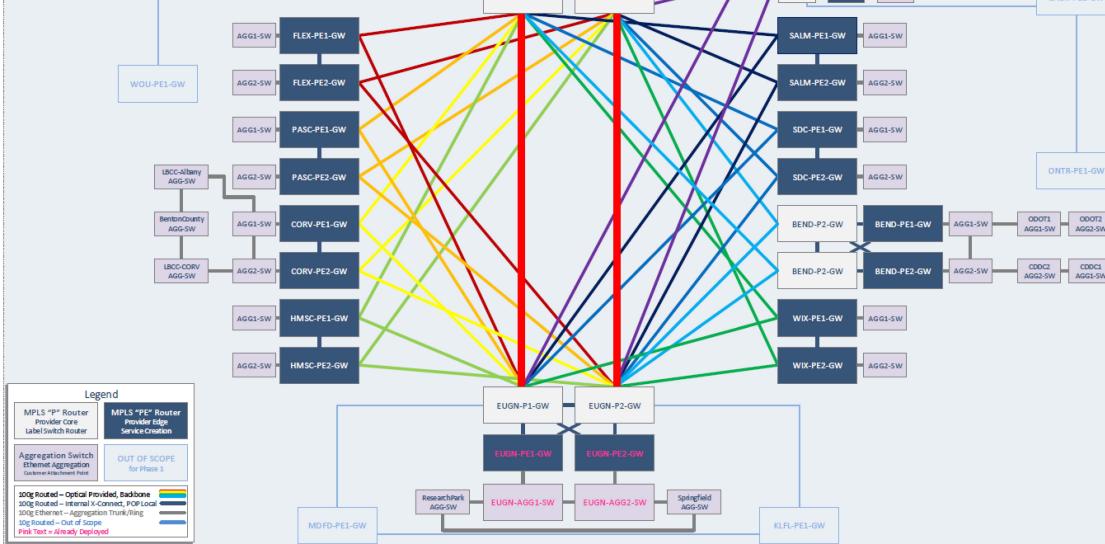
2: **Willamette Valley + Central Oregon** ->

Ring A (Portland – Salem – Corvallis – Eugene – Chemult – Bend – Portland)
+
Ring B (Portland – Hillsboro)

3: **Eastern Oregon** -> **Ring C** (Portland – Pendleton – Boise – Bend – Portland)

4: **Southern Oregon** ->

Ring D (Eugene - Oakridge - Chemult - Chiloquin - Klamath Falls - Medford - Ashland – Roseburg)

Link Oregon Optical Network Design – Rings A&B
Fiber Map

Link Oregon Underlay Network Design
Centralized P Routers

LINK OREGON

Legend

MPLS "P" Router Provider Core Label Switch Router	MPLS "PE" Router Provider Edge Service Creation
Aggregation Switch Ethernet Aggregation Customer Attachment Point	OUT OF SCOPE for Phase 1

100g Routed – Optical Provided, Backbone
100g Routed – Internal X-Connect, POP Local
100g Ethernet – Aggregation Trunk/Ring
10g Routed – Out of Scope
Pink Text = Already Deployed

Nodes:
PSU-AGG1-SW, PSU-AGG2-SW, PSU-PE1-GW, PSU-PE2-GW, PSU-P1-GW, PSU-P2-GW
PTCK-P1-GW, PTCK-PE1-GW, PTCK-AGG1-SW, PTCK-P2-GW, PTCK-PE2-GW, PTCK-AGG2-SW
HERM-PE1-GW, PDTN-PE1-GW, LAGR-PE1-GW, ONTR-PE1-GW
WOU-PE1-GW
FLEX-PE1-GW, AGG1-SW, FLEX-PE2-GW, AGG2-SW
PASC-PE1-GW, AGG1-SW, PASC-PE2-GW, AGG2-SW
LBCC-Albany AGG-SW, BentonCounty AGG-SW, LBCC-CORV AGG-SW
CORV-PE1-GW, AGG1-SW, CORV-PE2-GW, AGG2-SW
HMSC-PE1-GW, AGG1-SW, HMSC-PE2-GW, AGG2-SW
SALM-PE1-GW, AGG1-SW, SALM-PE2-GW, AGG2-SW
SDC-PE1-GW, AGG1-SW, SDC-PE2-GW, AGG2-SW
BEND-P2-GW, BEND-PE1-GW, AGG1-SW, ODOT1 AGG1-SW, ODOT2 AGG2-SW
BEND-P2-GW, BEND-PE2-GW, AGG2-SW, CDDC2 AGG2-SW, CDDC1 AGG1-SW
WIX-PE1-GW, AGG1-SW, WIX-PE2-GW, AGG2-SW
EUGN-P1-GW, EUGN-P2-GW, EUGN-PE1-GW, EUGN-PE2-GW, EUGN-AGG1-SW, EUGN-AGG2-SW
ResearchPark AGG-SW, Springfield AGG-SW
MDFD-PE1-GW, KLFL-PE1-GW

Link Oregon: Target Sectors for Expansion

- Higher education
  - Other public colleges connected
  - Private baccalaureate institutions (e.g, Reed, Lewis & Clark, U Portland)
  - Community colleges
- K-12 education
  - NERO already supports ~30% of school districts - mostly through ESDs
- Public libraries
- Healthcare (public and non-profit)
- Local governments
- Federally recognized Tribes (9 in Oregon)
- Other community anchor institutions

Collaborating with the four research universities on an NSF CC planning grant proposal (due **today**!)*

Oregon: Federal research presences

- NOAA N-Wave
  - **Western fleet based in Newport (adjacent to OSU Marine Sciences)**
  - Additional Fisheries locations in Warrenton and Portland
- USDA Agricultural Research Service (ARS)
  - **Corvallis (OSU main campus)**
  - **Adams (Columbia Basin ARC)**
  - **Burns (Eastern Oregon ARC)**
- U.S. DOE
  - NETL-Albany (Fossil Energy)
  - *Waldport (OSU Wave Energy project)*
- NIH
  - *Portland - CryoEM center (OHSU/PNNL)*

Working with Oregon's Tribes

- Oregon's nine recognized Tribes face challenges in education, healthcare, cultural preservation and environmental protection.

- University of Oregon has established strong relations with Oregon's Tribal Leaders through the President Michael Schill's Native American Advisory Council.

- Link Oregon will work with Oregon's Tribes, wherever possible, to advance their educational, healthcare, research, and general government objectives.

- As an example, the Klamath Tribes provide network support for early childhood development, tribal courts, a community center, planning and maintenance, and the Aquatics Research Station located on the Sprague River.
- The Aquatics Research Station is currently working to protect two endangered fish species on the edge of extinction: Lost River (*C'waam*) and shortnose sucker fish (*Koptu*).
- This facility could benefit from additional bandwidth to support more in-depth academic research collaboration & to raise public awareness of the plight of these species and the Tribes' significant efforts.

Link Oregon Organizing Team

Research Universities

- **OHSU**: *Bridget Barnes (CIO),* Don Westlight, Andy Payne, Joe Voje, Danna Blattmann
- **OSU**: *Andrea Ballinger (CIO),* Jon Dolan, David Barber, Suzanne Lucke, Johan Reinalda, Terry Meehan, Ben Baggett
- **PSU**: *Kirk Kelly (CIO),* Ryan Bass
- **UO**: *Jessie Minton (CIO),* Matt Riley (CTO), Steve Huter (NSRC), Cindy Hetrick

State Government

- **OSCIO:** *Terrence Woods (CIO)*, Jennifer Bjerke (Deputy CIO), Ann Andrews, Paul Deike, Mike Gromek, Sandy Wheeler, Jeremy Lyon, Kris Walker

Link Oregon Staff

- Kevin Bohan, Steve Corbató, Stephen Fromm, Rick Hicks, Tina Kirk, Molly Thurston
- Consultants: Ann Marcus (communications)

Steve Corbató

Executive Director

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"Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Networking and Information Technology Research and Development Program."

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