



Trends in Global & Regional Networks: How to Win

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Overview

- ◆ Fables and Trends
- ◆ How to Win
- ◆ About NWAX

Fable: The Internet Boom Ended in 2000

- ◆ Variant 1: The Internet is grossly overbuilt
- ◆ Variant 2: Internet predictions were all hype
- ◆ Trends: the backbone networks were overbuilt, but:
 - Major networks reduced capacity in some cases and
 - Bandwidth demand doubles ~ annually
 - Rapid growth of “broadband” likely to push demand

What's Happening to Transit Prices?



So What if Internet Prices Drop?

- ◆ “Every age defines itself by the resource it wastes. Our agrarian forefathers wasted human time. The Victorians wasted coal and iron, the twentieth century wasted electricity. Over the past decade, the world had to learn to waste transistors. Now it needs to learn how to waste bandwidth, and begin rebuilding the world again.” — George Gilder
- ◆ Substitute bandwidth for other resources because the cost of bandwidth is dropping rapidly

Disruptive Technologies

- ◆ Internet is following a very similar pricing pattern to the PC – Moore's Law
- ◆ Related disruptive technologies to watch
 - Dark Fiber
 - Metro Ethernet
 - Data Centers
 - Wireless
 - VOIP

Dark Fiber

- ◆ Customer-operated fiber optic networks
- ◆ Typically long lease; can be hard to get
- ◆ Add/upgrade the electronics as desired
- ◆ Customer responsible for maintenance

Metro Ethernet

- ◆ With or without dark fiber
- ◆ “LANs” become “MANs” (metro)
 - Gigabit Ethernet extends 20 miles +
 - LAN engineers able to support metro networks
 - Equipment can be a tenth the cost of SONET
 - Quality of service, convergence/recovery of loop outages are being addressed by vendors
- ◆ Can save big money whether you buy Ethernet services or do it yourself

Data Centers

- ◆ Access multiple services with few circuits
- ◆ Potential method to access multiple transit networks, individually or via local ISP
- ◆ Make sure its well-connected and has a variety of services/providers

Wireless

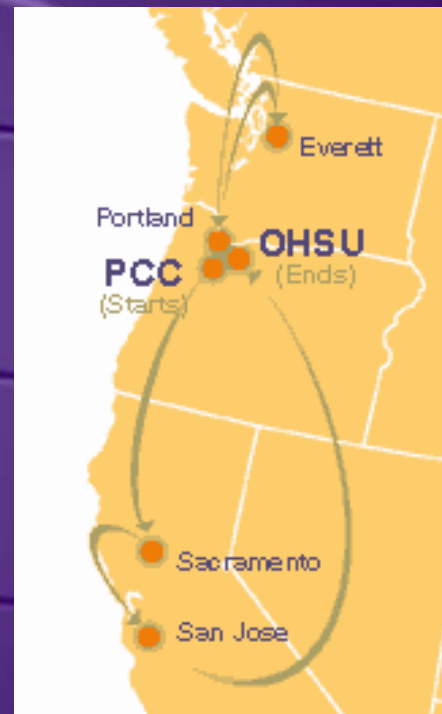
- ◆ 802.11 stimulated tremendous investment
- ◆ New very fast fixed wireless evolving
- ◆ Potentially the cheapest option, especially for short distances
- ◆ Very fast deployment

Fable: location doesn't matter

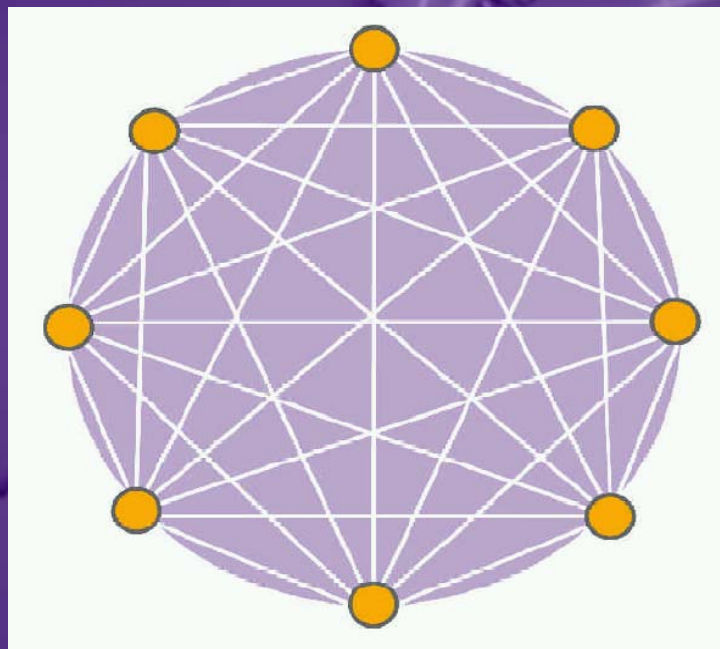
- ◆ Variant 1: no applications need high quality of service
- ◆ Variant 2: your phone company will take care of you
- ◆ Trends:
 - Quality of service does matter for some applications
 - There are no quality guarantees between networks
 - You are less likely to get good quality with local connections, such as for healthcare, school or work where you need it most
 - Telcos are under severe business pressure

Poor Access Degrades Quality

- ◆ Problem: the lack of local connections between networks is a barrier to applications that need high quality within the region
- ◆ Example: historically, connections from OHSU to Portland Community College (PCC) via Sacramento, San Jose, Seattle, 20-30 'hops'
- ◆ Poor quality even across town



The “N-Squared” Network Problem



- ◆ In the past, if you needed a high quality connection you needed a dedicated circuit
- ◆ This, in theory leads to “N-squared” connections among partners
- ◆ The reality, however is that this is usually unaffordable and so eliminates potential opportunities

Can you rely on a single transit network?

- ◆ Internet “overbuilt” in 2000
- ◆ Level3, XO, Global Crossing, Worldcom go chapter 11; re-emerge to new price war?
- ◆ Incumbent phone companies heavily in debt
 - Cable companies & VOIP pose major challenge
- ◆ “Cable & Wireless Gives Customers 60 Day Notice” that it is discontinuing service
- ◆ All networks experience periodic problems, congestion
- ◆ Usual solution: use two or more transit networks with adequate capacity from either

Fable: the Internet isn't for serious work

- ◆ Trends :
 - Critical applications moving to the Internet
 - “Cheap,” high-speed Internet access enabling remote access, telecommuting, outsourcing, telemedicine, mainframe access, remote storage – fraction of the cost of dedicated circuits
 - Remote relationships are increasingly critical to save money, develop new products and compete
 - Performance generally good, but not guaranteed

Why VOIP (Voice over IP)

- ◆ Data traffic has already surpassed voice
- ◆ Voice, however historically the most critical:
 - Most critical uses
 - Most critical performance
 - Most money: Internet access totals \$30B/Yr; telephone service is \$300B/Yr
 - Most local

Making Sense of VOIP

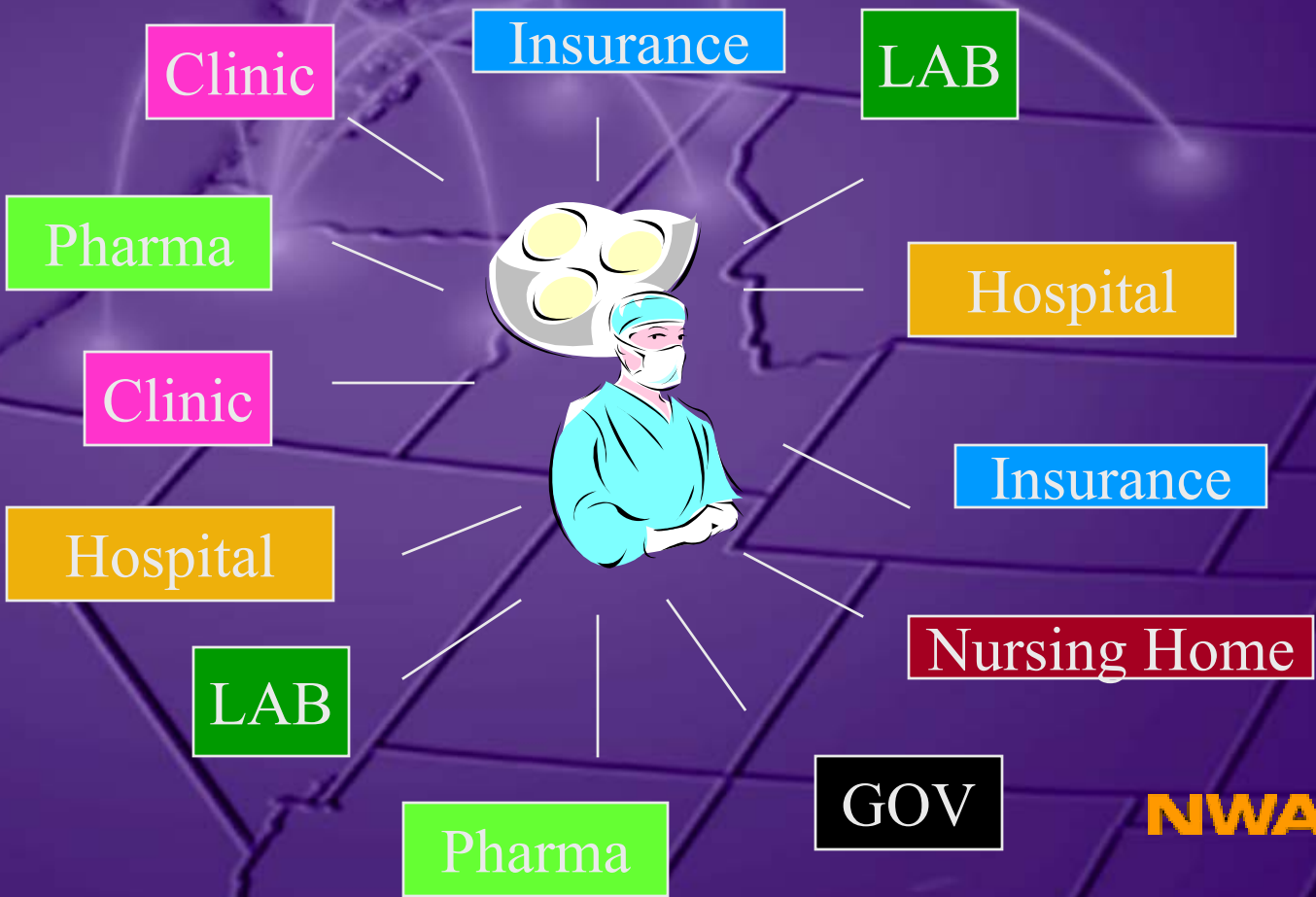
- ◆ Rapidly moving target – many potential applications, business models, savings
 - Long distance
 - Innovative applications
 - IP “Centrex” (outsourced PBX)
 - Eliminate/reduce trunk lines
- ◆ Tax-preferred medium? FCC evaluating now
- ◆ Security and quality engineering critical

Fable: do not connect to your competition

◆ Trends:

- Telecom and transportation have always connected competitors – no phone system or Internet without
- New services often require new standards
- Lack of quality via the Internet dictates “direct” connections – connect together as a community can lower effective cost
- Regional “communities” are good for business and community

Notional Regional Health Community



Healthcare Community

- ◆ Institute of Medicine: As many as 98,000 die annually from medical errors
 - Many preventable with greater adoption of appropriate health information systems
- ◆ US healthcare administrative costs ~25%
- ◆ Vision: a seamless web of services and information so that patients can get the best available care

Communities of Interest Benefits

- ◆ Reduced operating costs for the industry improves bottom line relative to other regions
- ◆ New/improved services and applications
- ◆ Area becomes noted for the industry – industry “clusters”
- ◆ Attract and retain talent and investment
- ◆ Example: regional bioscience clusters

How to Win

- ◆ Maximize your use of the net
- ◆ Make sure you get the best quality and price
- ◆ Access two or more backbone nets via a local data center or ISP
- ◆ Use Ethernet, dark fiber, wireless in any combination
- ◆ Connect network communities of interest: 'coopetition'

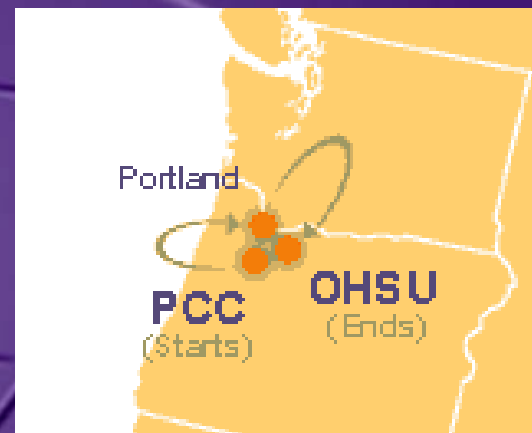
Make the trends your friends

About NWAX

- ◆ OHSU, Portland State University (PSU) and Oregon Graduate Institute (OGI) partner to connect to Internet2, the Next Generation Internet in 2000
- ◆ Highly successful, Internet2 gave the universities exceptional capabilities like high quality two-way video but only with other members
- ◆ In a perfect world we could use the Internet for video conferences and telemedicine with the region however poor regional connections between networks prevents

Solution: Regional Internet Exchange

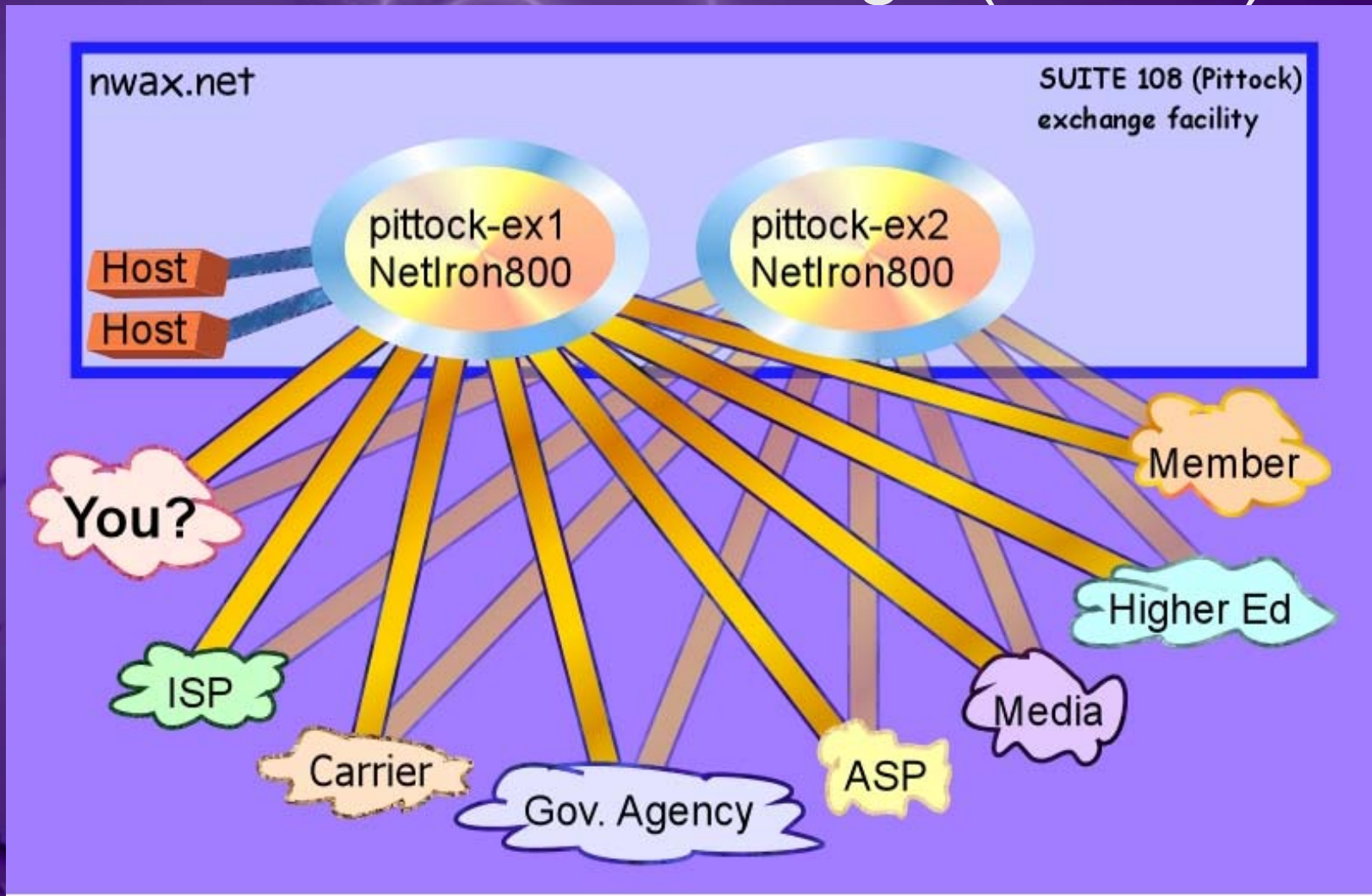
- ◆ Internet Exchanges Began as five Network Access Points to interconnect the global Internet
- ◆ Currently hundreds of exchanges worldwide in a variety of models
- ◆ Reduce “hops,” making next generation capabilities possible
- ◆ Create regional critical mass



What's the Critical Mass Issue?

- ◆ You'd think Oregon would be an Internet leader
 - Consistently “most connected” region; most telework in US
 - High concentration of technology companies/employees
- ◆ Straddles major fiber routes, but few local onramps
- ◆ Potential business opportunities migrate elsewhere
 - Research opportunities developed by Intel, Tek, others
 - Web sites and e-business move to be close to the backbone
 - Poor local quality dampens demand
- ◆ Cause: history and proximity to Seattle & Bay area

Northwest Access Exchange (NWAX)



Current Membership

- ◆ Oregon Health & Science University
- ◆ Oregon Graduate Institute
- ◆ Portland State University
- ◆ Portland Research and Education Network
- ◆ Saw Net
- ◆ Northwest Open Access Network
- ◆ PDX Net (Includes DSL Only and DSL Northwest)
- ◆ Comotiv Systems
- ◆ Portland General Broadband
- ◆ Fortix
- ◆ NERO (Oregon Public K-20)
- ◆ Universal Telecom/US POPS
- ◆ University of Washington (Washington Gov, K-20)
- ◆ Portland Trail Blazers (several media and sports-related sites)
- ◆ Integra Telecom
- ◆ Peak Internet Services
- ◆ Portland Community College
- ◆ Pacifier Online Services
- ◆ Oregon DAS (State Government)
- ◆ Easystreet

Why OHSU Backs NWAX

- ◆ OHSU Oregon Opportunity program needs quality access:
 - Research & Healthcare, telemedicine statewide
 - Dedicated high speed circuits would be prohibitively expensive
 - NWAX enables shared access; should offset the cost over time
 - Dec 2001: Child psychologist uses NWAX for video to Pendleton, a first for a public exchange point



Distributed Exchange Architecture

- ◆ Partnership with Portland General Broadband, Easystreet & Fortix
- ◆ Dual redundant Gigabit Ethernet links
- ◆ Enables highly diverse, reliable transit
- ◆ Create local critical mass

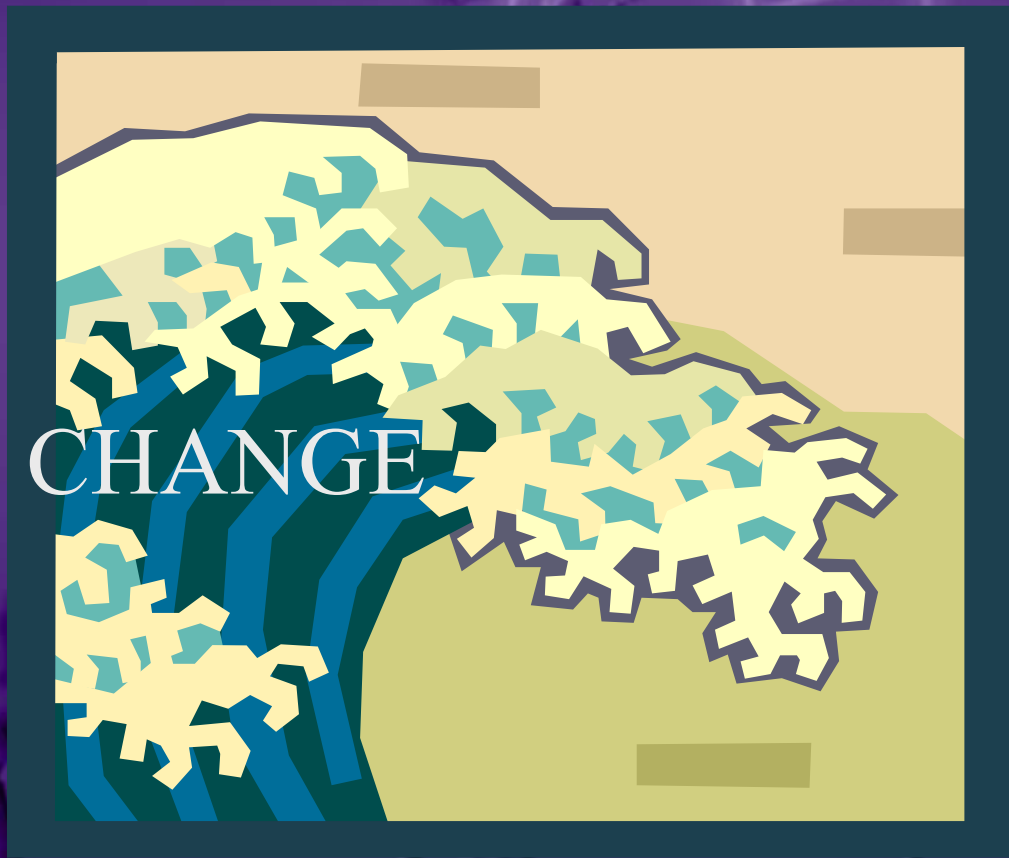


Benefits for Regional Partners

NWAX benefits for business and service providers:

- ◆ Reduce transit costs via peering
- ◆ Access broad regional market – high quality, low cost
- ◆ Enable regional uses that need high quality of service
- ◆ Access high quality, highly reliable transit
- ◆ Reduce/eliminate the need for “N-Squared” networks

Responses to Disruptive Technology



Duck or Go
Surfing