



# An African Internet Infrastructure Proposal for the G8

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# A proposal

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- The G8 just pledged to increase African aid by \$25 billion per year.
- A portion of that increase should be used for a high-speed Internet backbone to and a point of presence in every African village.
- There are 3 billion people in 3 million villages in developing nations



# Outline

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- Background
- Village applications and business models
- Backbone architecture and feasibility
- Project policies (lessons learned from NSFNet)
- Conclusion – G8



# Background

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# 1990s hypothesis

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- Computer networks can improve the quality of life in developing nations at a relatively low cost
- Marginal impact increased by a lack of alternative ICT and transportation
- Raising the quality of rural life will reduce pressure for urban migration



# This motivated 15 years work

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- ICT measurement and readiness studies
- Pilot applications and business models
- Training
- Conferences and workshops



# After 10-15 years work

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- We have evidence that the hypothesis is true
- The digital divide persists
- Capital is not available
- The Internet is on the “radar screen” – all governments recognize the communication-development link

# Generic Digital Divide

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# Internet subscribers, 2003

| <b>Income</b> | <b>Population</b> | <b>Subscribers</b> | <b>Per 100</b> |
|---------------|-------------------|--------------------|----------------|
| Low           | 2,413             | 5,424              | .22            |
| Lower middle  | 2,393             | 69,762             | 2.92           |
| Upper middle  | 331               | 12,150             | 3.68           |
| High          | 961               | 216,069            | 22.48          |
| World         | 6,097             | 303,405            | 4.98           |



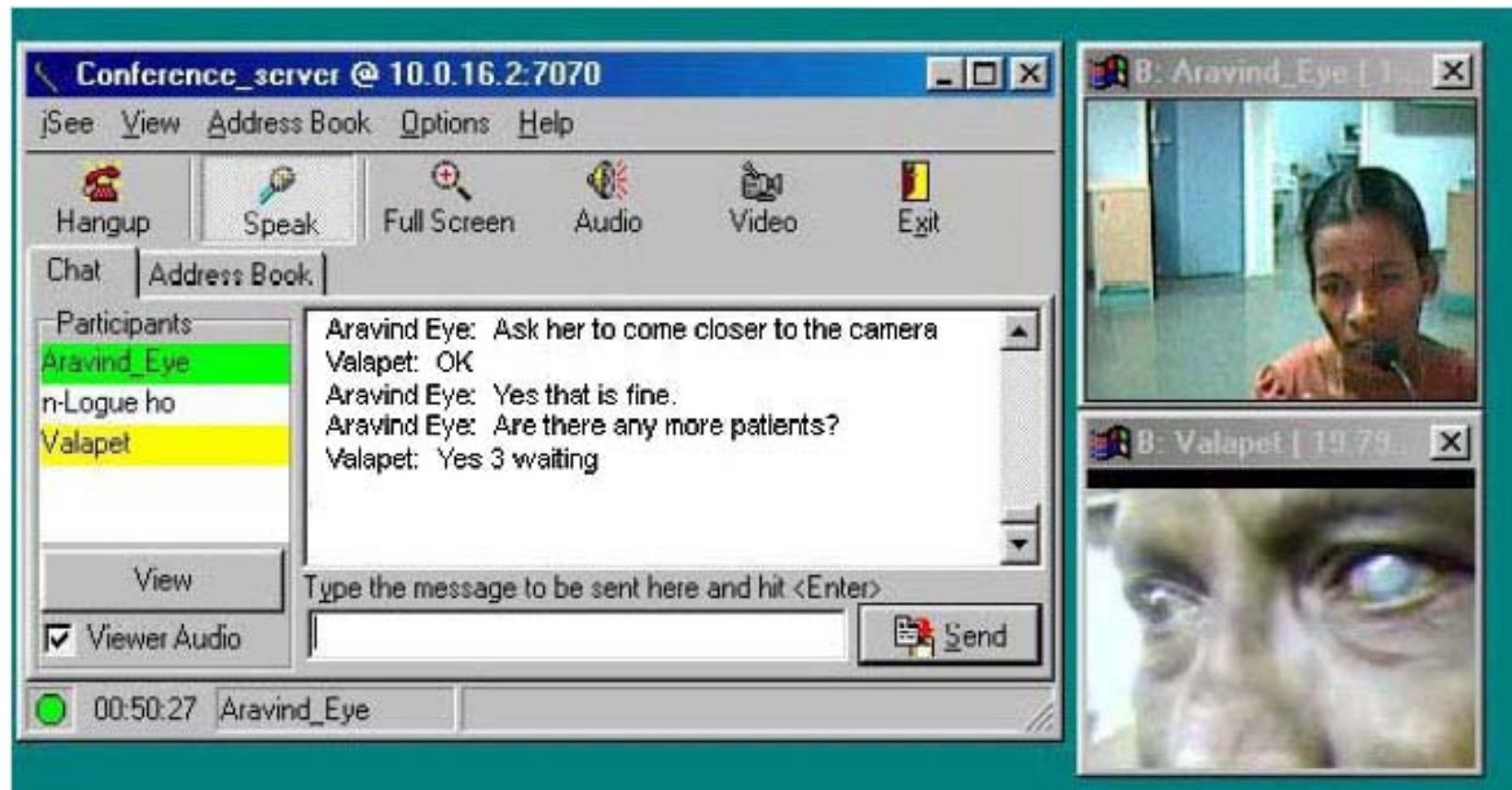
# Cannot attract private capital

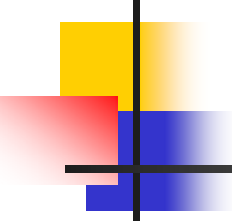
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- Cost of 20 hours access as percent of average monthly GNI per capita

|                     |       |
|---------------------|-------|
| Low income nations  | 246.4 |
| Lower middle income | 24.9  |
| Upper middle income | 8.6   |
| High income         | 1.6   |

# Pilot village applications and business models





# Sustainable approaches to village Internet centers

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- Corporate owner, single application
- “Franchise” centers
- State owned



# E-Chaupal

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- ITC, an Indian conglomerate (agribusiness, infotech, hotels, etc.)
- Remote centers at agricultural hub locations
- Savings in logistics and middlemen
- Payback time 8 months to 2 years
- Connecting via VSAT today

# E-choupal home page

07 अप्रैल मंडी का भाव (गेहूँ) प्रति क्विंटल - किरावली - 612-617 - अचनेरा - 610 -620 - मथुरा - 615-615 - 3



## ई-चौपाल

प्रति क्विंटल - किरावली - 612-617 - अचनेरा - 610 -620 - मथुरा - 615-615 - 3

फसल | धाव | बावरा | अरहर | उद | मेहूँ | चवे | मसूर |

किसानों के हित में, किसानों का अपना  
ई-चौपाल

किसान भाईयों

आप अपने  
बातों अपने  
चौपाल में उ  
से, खेती-बाड़ी के अच्छे तरीकों से, बीज, खाद, यह 04-04-04 अब 7000  
कीटनाशकों के उपयोग की जानकारियों से, फसल साल बाद  
कैसे अच्छी ली जाए और उसे कैसे सुरक्षित रखा  
जाए। भला एक-दूसरे की सलाह लेने और देने के  
लिए चौपाल से अच्छा कौन सा मंच होगा जहाँ सभी  
किसान भाई इकट्ठे होते हैं और आपस में चर्चा  
करते हैं।

समाचार

Transactions

वरीयता:

- ✦ मौसम संबंधी
- ✦ उत्तम कृषि तरीके
- ✦ बाजार संबंधी
- ✦ फसल संबंधी
- ✦ परिचर्चा
- ✦ मिट्टी परीक्षण
- ✦ सुझाव
- ✦ किसान परिचय
- ✦ सरकारी योजनाएँ
- ✦ समाचार



# E-choupal services

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- Login
- Weather
- Crop best practices
- Market related information
- Agricultural queries
- Suggestion box
- Farmer profile
- Government schemes
- News

# N-Logue rural Kiosk

- Remote medicine
- Remote veterinary
- Remote agricultural advice
- E-government
- E-mail
- digital photography
- desktop publishing
- Telephony
- Break even at \$75/mo.





# Cuban Youth Computer Clubs

- 350 YCCs
- Geographically dispersed
- Education
- Games
- Email
- News



# YCC mobile unit



# YCC mobile unit





# G8 goals for Africa

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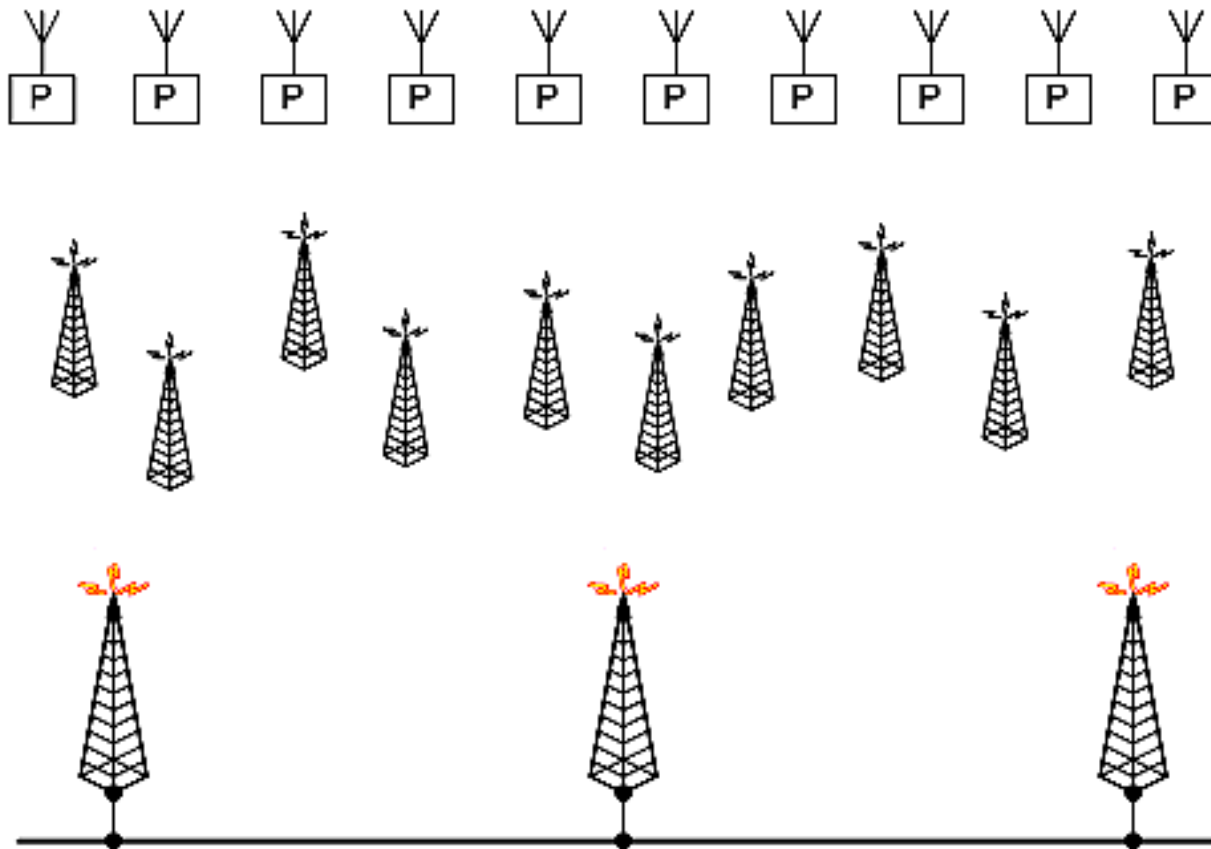
- Improve peacekeeping
- Develop democracy and effective governance
- Improve health
- Improve education
- Increase economic growth



# Architecture and feasibility

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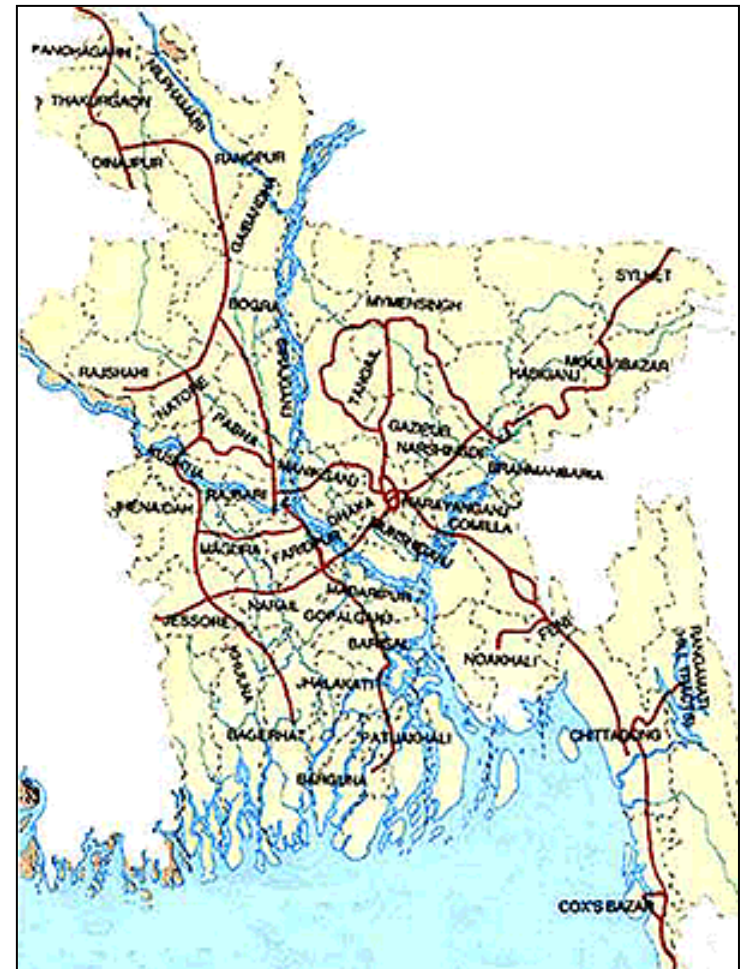
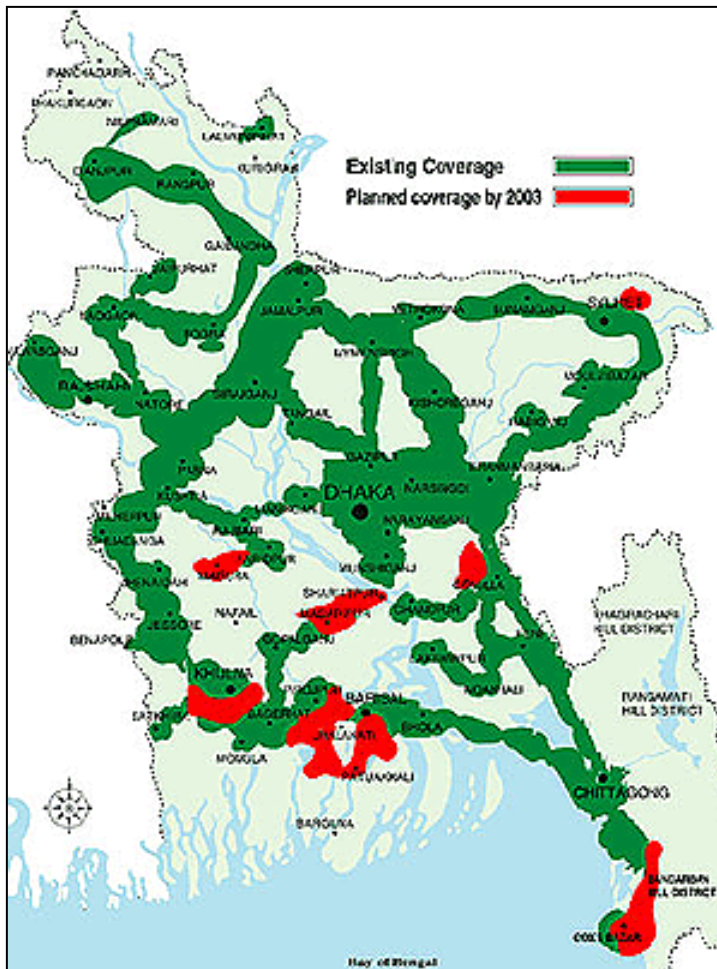
# Fiber Backbone, Mesh, POPs



Fiber where possible – follow the roads



# Use fiber wherever possible







# Wireless technology

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- Today
  - VSAT
  - Proprietary terrestrial technologies
- Soon
  - WiMAX – may unify terrestrial wireless
- Worth watching
  - High altitude platforms
  - Constellations of LEO satellites

# VSAT



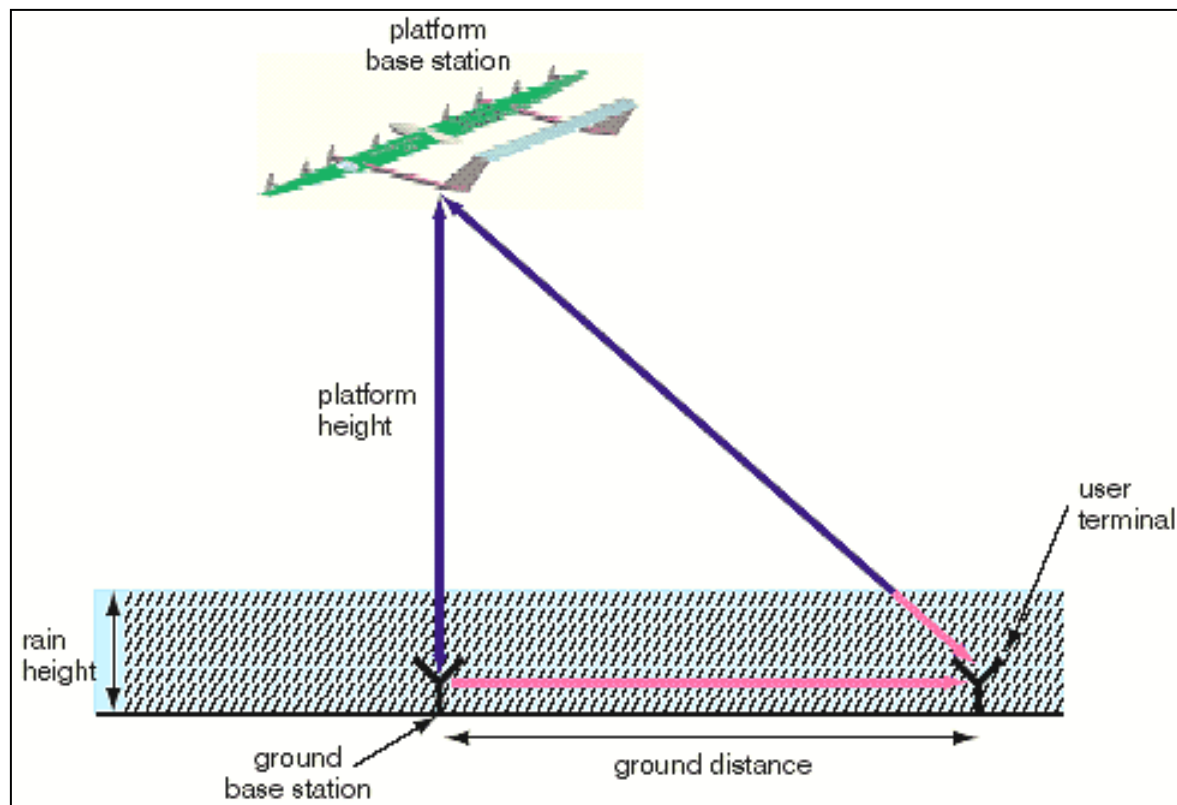


# WiMAX may unify wide-area terrestrial wireless

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- License free market innovation
- Mass production (carrier and user)
- ? Global regulatory conformity
- ? “Competition” from next generation Wi-Fi
- ? “Competition” from 3<sup>rd</sup> generation cellular
- ? “Competition” from new license-free bands

# High-Altitude Platform



# Sanswire HAP





# Sanswire HAP

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- 245 x 145 x 87 feet
- Proprietary lifting gas technology
- Outer envelope covered in film solar panels
- Solar powered electric motors
- Held in position using 6 onboard GPS units
- Desired altitude: 65,000 feet
- Line-of-sight to a 300,000 square mile area
- Controlled by earth stations on the ground
- Flight time: 18 months

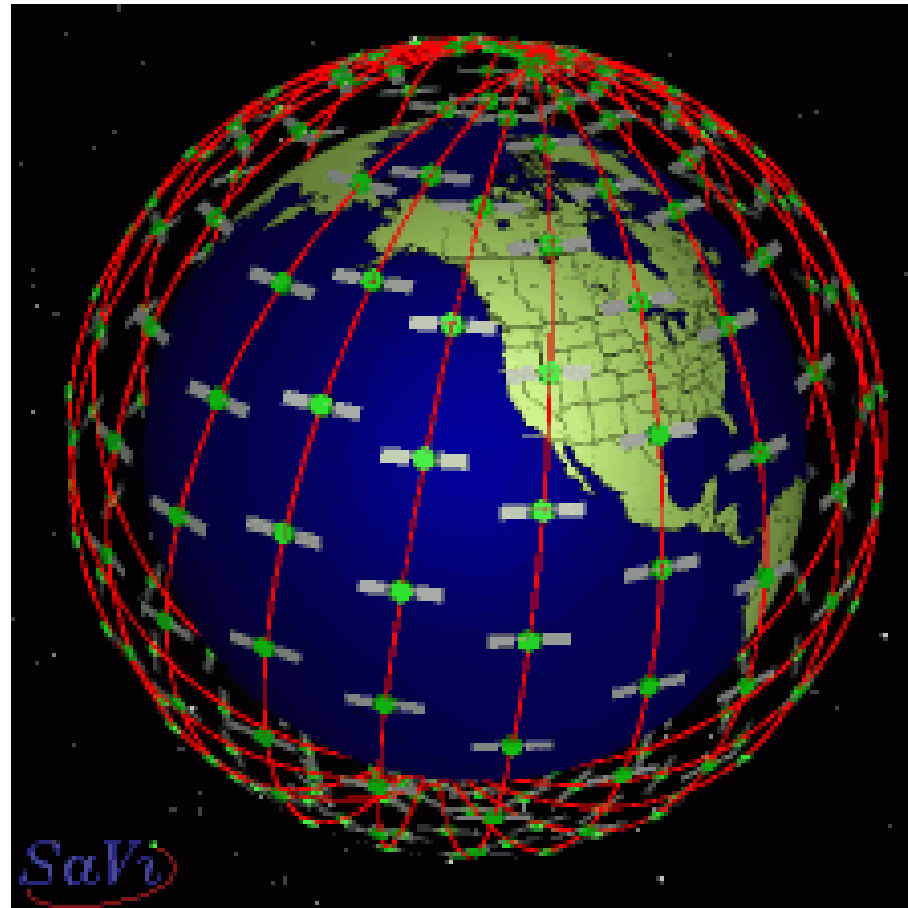


# Sanswire progress

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- May 2005: floating tests
- July 2005: joint venture to deploy five platforms in Colombia

# LEO satellite constellation

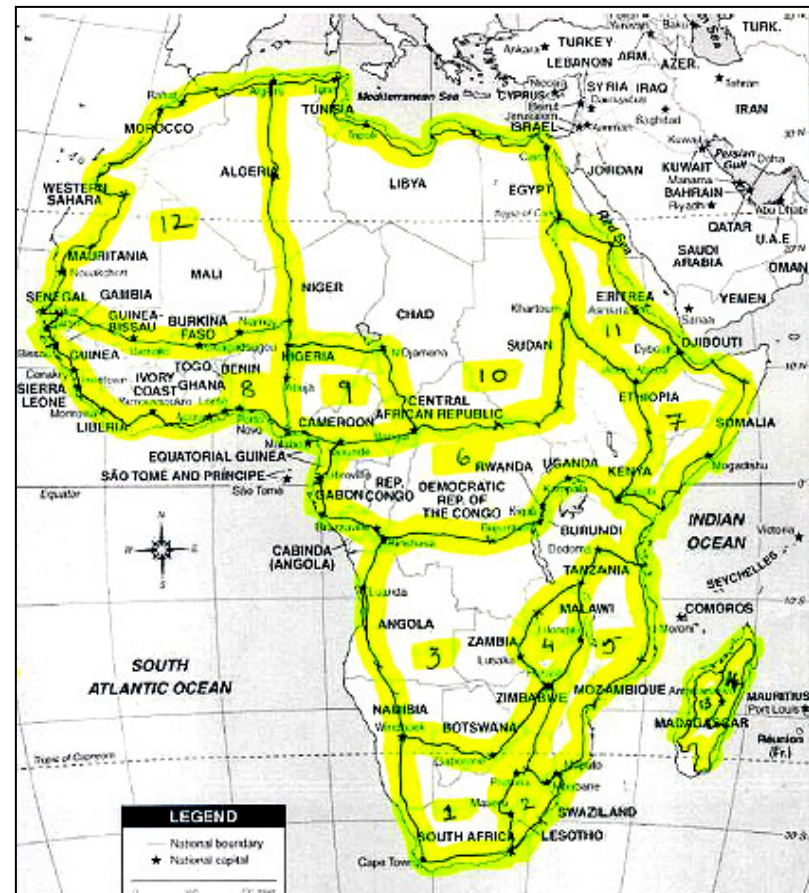




# FiberAfrica

- 70,000 Km fiber core
- 30,000 Km fiber spurs
- Wireless to fiber
- Reach 400 million
- Walking/bicycling distance
- 1 billion dollars

Daunting, but with precedents





# Cost context, \$billion

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- Manhattan project: 1.889
- US Interstate Highway system: 128.9
- Apollo program: 25.4
- GPS: 8.3 through 1995, 21.8 to complete
- Baseball stadium: .581
- B2 bomber: 2.2
- US pet food: 10 per year
- G8 African pledge: 25 per year (new)

# Project policies – lessons learned from NSFNet



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# An unconnected nation

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- No national backbone network
- No residential connectivity
- No commercial application
- Character-oriented email and news primary applications
- Connectivity only in a few universities
- The US in 1989



# The NSFNet Approach

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- **NSFNet challenge:** Provide a high-speed Internet link and a point of presence in every university in the United States.
- **Developing nations challenge:** Provide a high-speed Internet link and a point of presence in every village in every low and lower-middle income nation.

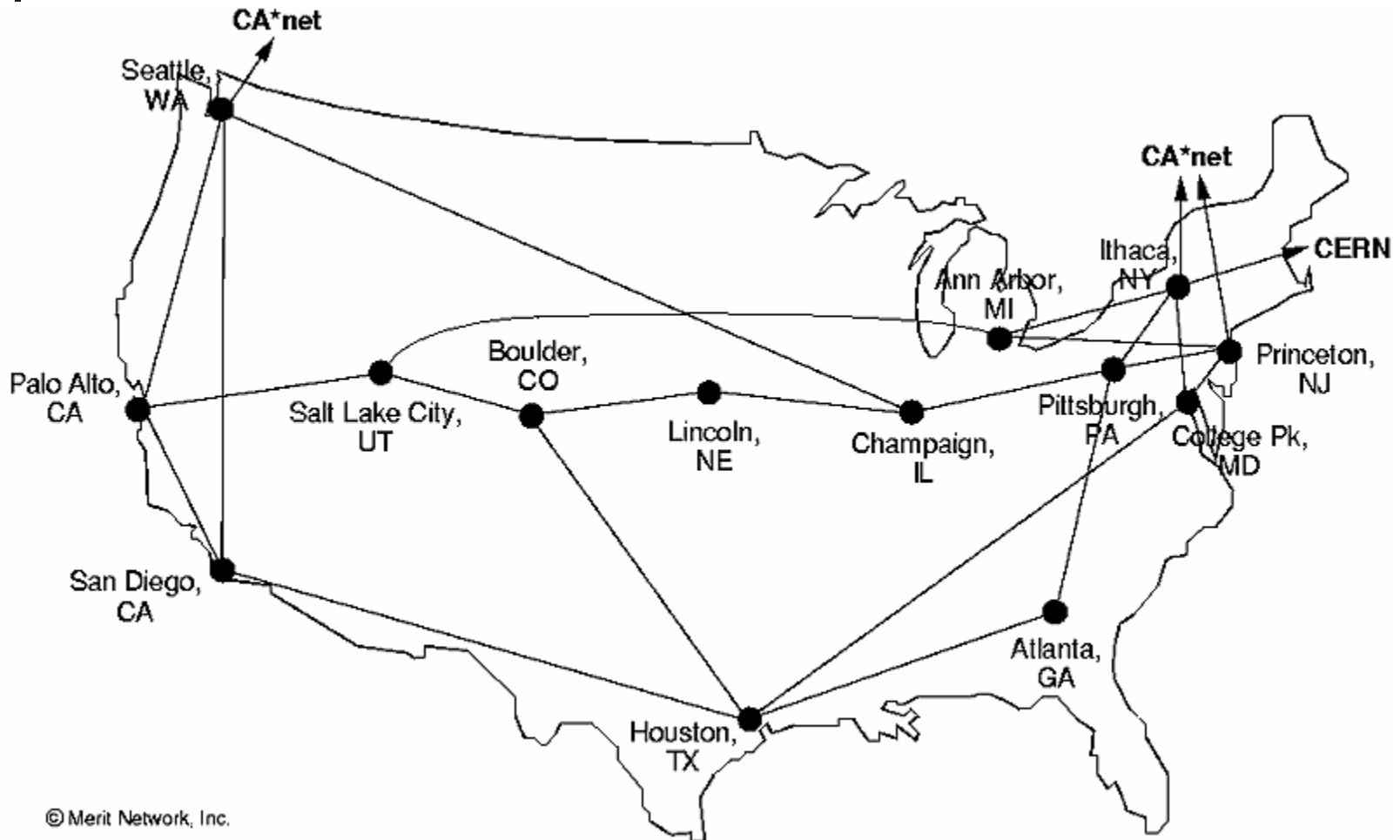


# NSFNet – seeding the Internet

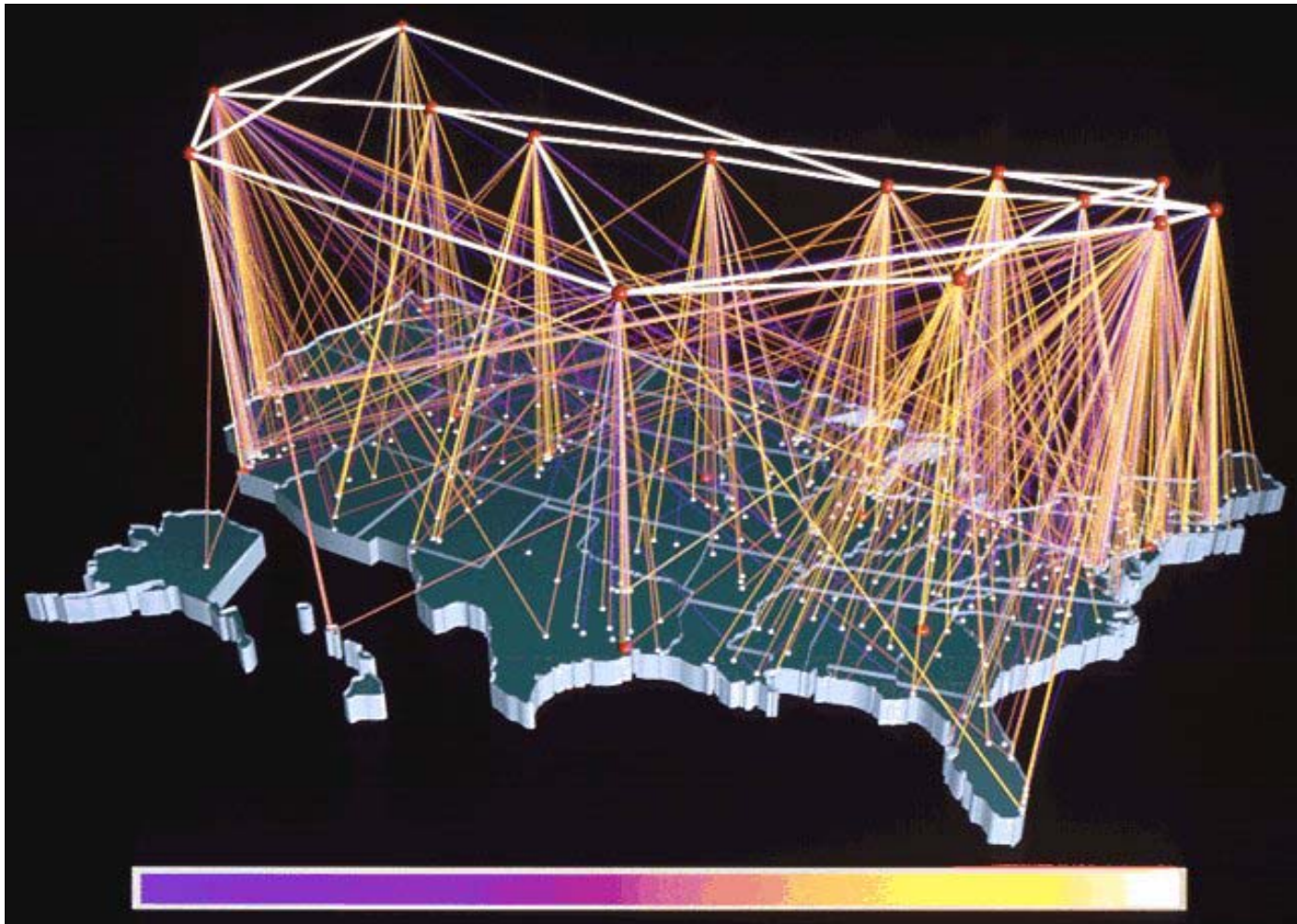
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- Build backbone connecting key sites
- Fund connectivity and POP (router and a link)
- Connect
  - US higher education networks
  - International research and education networks
- First IP backbone – seeded the Internet

# NSFNet T1 Backbone, 1991



# NSFNet with regional links







# The NSFNet Strategy

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- Highly leveraged – ARPA and NSF \$125 million
- Users in control – IP protocol implies decentralized funding and innovation
- R&D project – expert designers on temporary assignment, not government staff



# Highly leveraged: Government funding (\$million)

| <b>Project</b>                | <b>Cost</b> |
|-------------------------------|-------------|
| Morse telegraph               | .03         |
| ARPANet                       | 25          |
| CSNet                         | 5           |
| NSFNet backbone               | 57.9        |
| NSF higher ed connections     | 30          |
| NSF international connections | 6           |



# User control

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- Universities designed their LANs
  - Universities funded their LANs
  - Universities trained their users
  - Users invented applications – innovation at the edges of the network
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- A “dumb,” end-to-end network – IP is a design philosophy as well as a protocol.



# Areas of expertise

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Geographic Information Systems

Local Geography

Terrestrial wireless design and practice

Fiber optic design and installation

Network operation center design

Network modeling and optimization

Satellite research and practice

High altitude platform research and practice

Village POP configuration design

Training for POP operation

Design of solar and other power systems

Spectrum politics and policy

Mechanical design for radio towers

Village telecommunication centers and applications



# Conclusion

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# Okinawa G8 summit, July 2000

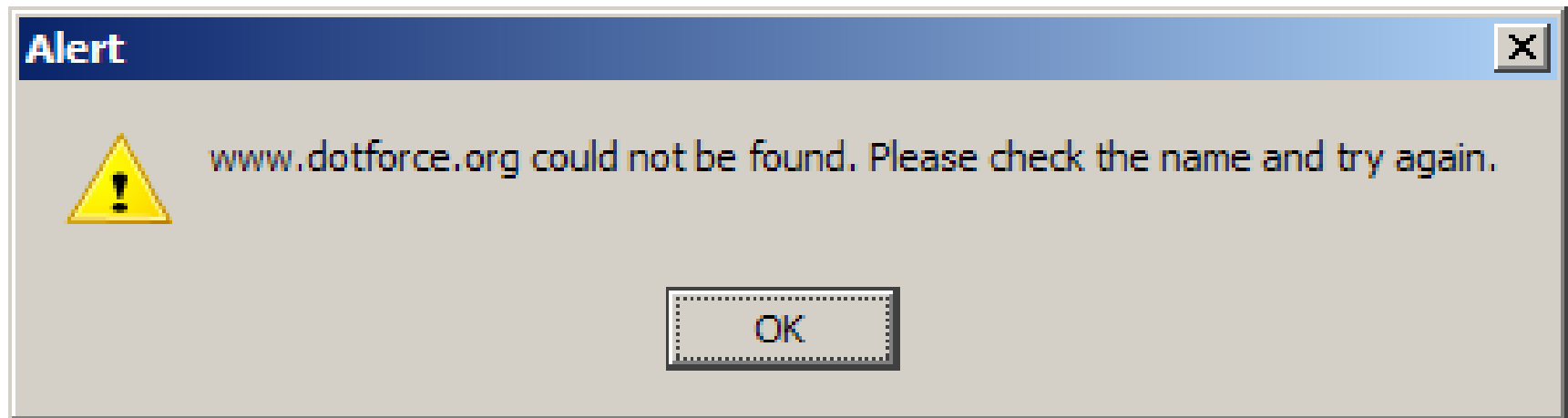
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- Focused on information and communication technology
- Billions of dollars were pledged (Japan alone promised \$15 billion)
- Digital Opportunity Task Force was formed "to identify ways in which the digital revolution can benefit all the world's people, especially the poorest and most marginalized groups."



# A few reports and no action

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# To continue the conversation

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