

Choice of ISPs Over Broadband Cable A Technology Discussion



Choice of ISPs Over Broadband

- ≡ Technical Challenges to Support Multiple ISPs over Cable Facilities
- ≡ AT&T's Broadband Choice Trial
- ≡ The Economics of Open Access
- ≡ The Canadian Experience with Internet Regulation



Technical Challenges to Support Multiple ISPs in the Cable Environment

Cable is a Shared Architecture

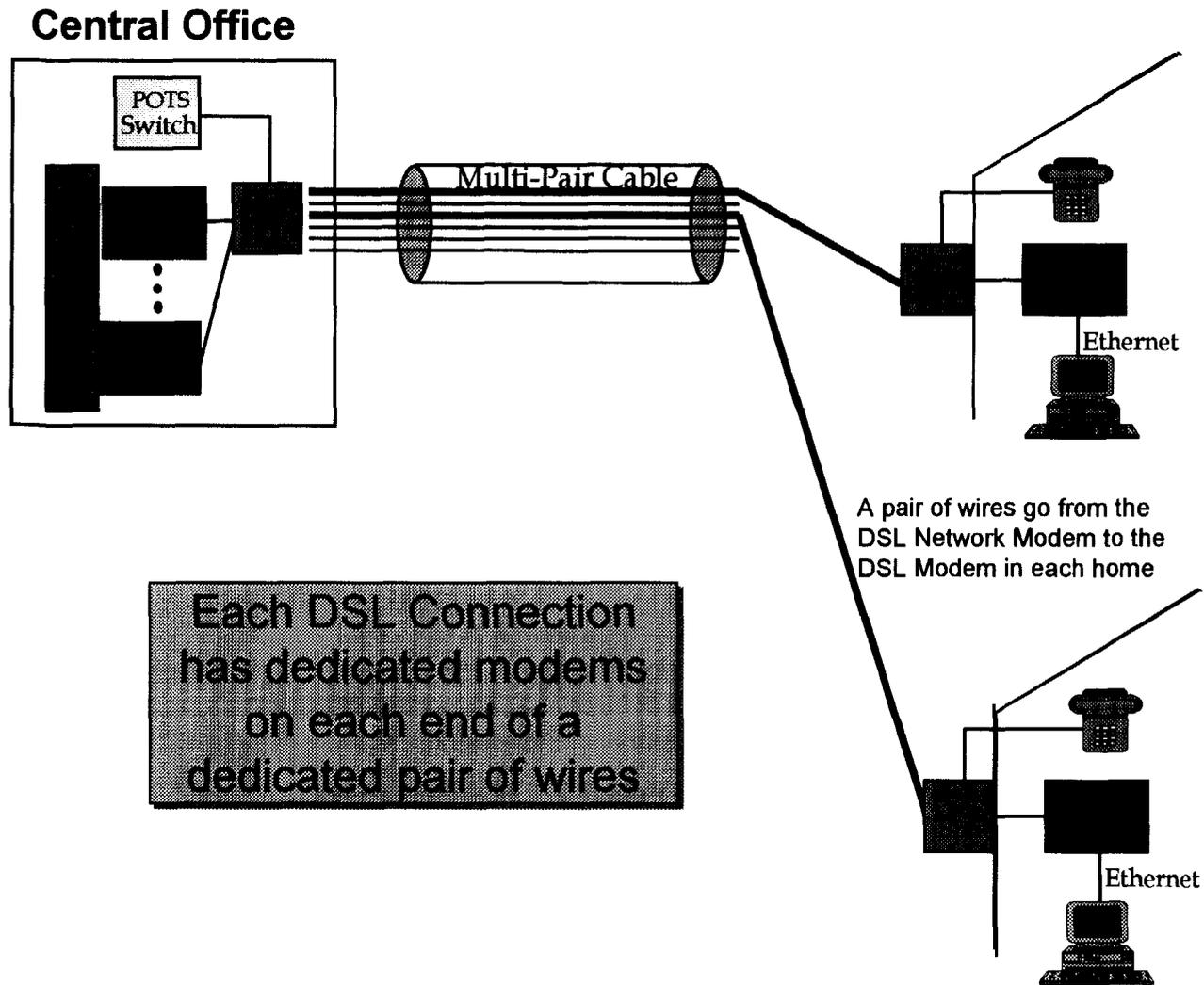
≡ Cable architecture designed for broadcast services:

- Legal requirements limit the bandwidth available for advanced services:
 - Must carry
 - Public Educational and Government (PEG)
 - Leased access
- No dedicated last mile exists, unlike with the Telco local loop
- IP over Ethernet is a shared application well suited for cable

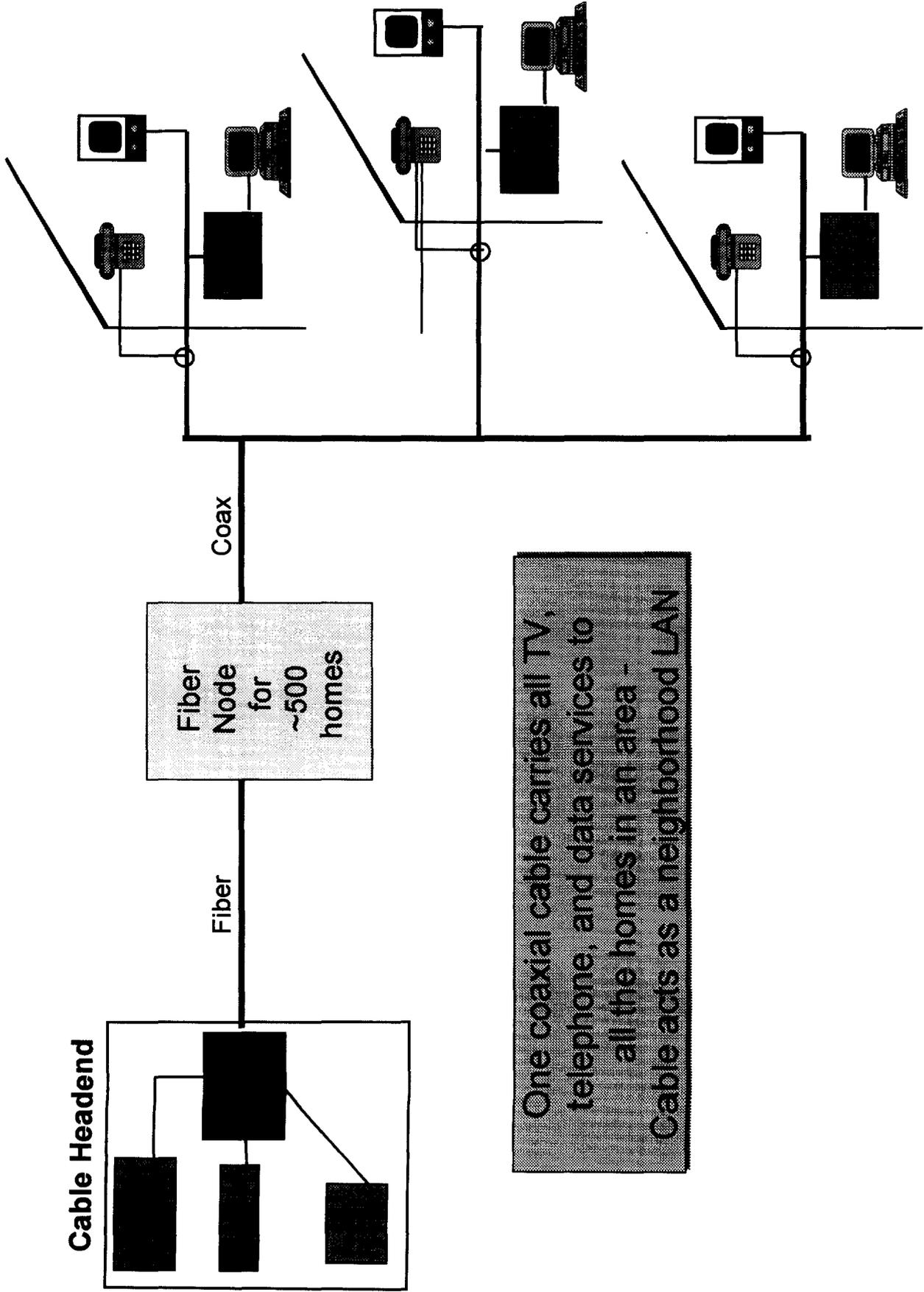
≡ Shared infrastructure must support:

- Multiple providers (ISPs)
- Simultaneous access to multiple services (voice, video, data)

DSL Architecture (Dedicated)



HFC Architecture (Shared Coax)



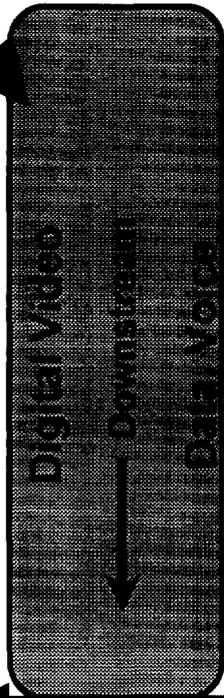
One coaxial cable carries all TV, telephone, and data services to all the homes in an area - Cable acts as a neighborhood LAN

Optical Cable Requirements Limit

• High power and amplification requirements make the highest frequencies only suited for digital video

Spectrum on Cable

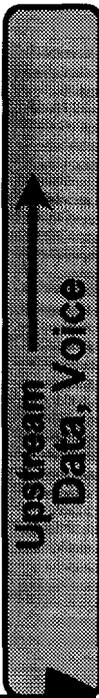
MHz
550 - 750



450



50



- Must Carry
- Leased Access
- PEG

• Lower power and amplification requirements make this frequency well suited for upstream voice and data
• Higher interference makes this undesirable for analog video

Key Challenges to Support Multi

- ≡ Any new cable application must address:
 - Services to be supported (point to point services, multicast services, etc)
 - Bandwidth management
 - Privacy, security and encryption
 - Back office issues:
 - Provisioning
 - Accounting
 - Billing
 - Customer care

- ≡ Multiple solutions are possible depending on architecture, technology, and economics

Broadband Choice Trials

- ≡ AOL TW commenced trial July 2000 in Columbus, Ohio
 - ISPs signed up as of October 19th:
 - RMI.net
 - Juno Online
 - Road Runner
 - AOL
 - Earthlink (not part of current trial, but recently struck an agreement)
- ≡ Comcast announced trial to start first quarter 2001 in the Philadelphia area
 - Juno, first announced ISP
- ≡ AT&T Broadband started trial November 2000 in Boulder, Colorado

AT&T Broadband Choice Trial Boulder, Colorado



BROADBAND

AT&T Broadband Choice Over Cable

≡ Proposal:

- Modify existing AT&T cable data network and architecture to support multiple ISPs and multiple services

≡ Technical Challenge:

- Data packets are sent using IP destination based routing today
- Bandwidth management issues

≡ Technical Alternatives:

- Change the way the data packets are routed
- Change the way the data packets are put on the cable
- Divide the spectrum, dedicating a portion to each ISP

Broadband Choice Trial Requirements

Proposal:

- Modify existing AT&T cable data network and architecture to support multiple ISPs and multiple services

Operational Requirements:

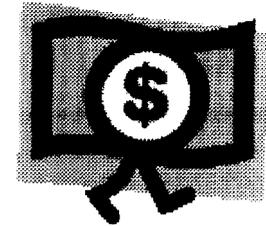
- Easy for customers to use
- Easy for customers to choose/change ISPs
- Provide the ISPs direct access to their customers
- Compatible with DOCSIS 1.0 and 1.1 which enables customers to have low cost modems that work on any compliant cable system
- Allow simultaneous access to multiple ISPs
- Scalable
- Reliable and secure
- Allow easy addition of future services such as IP telephony and interactive TV

Broadband Choice Trial Parameters

- ≡ Technical and operational trial
- ≡ Six months, starting 11/1/2000
- ≡ Operational tests: hardware, software, ISP coordination, scalability, reliability, interface to regional and national ISPs
- ≡ Technical test: changing how the data packets are routed
- ≡ Scope:
 - 500 users
 - 10 ISPs (current router limitation)
 - 9,000 homes passed
- ≡ No fees charged by AT&T to participating customers or ISPs
- ≡ Broader commercial and marketing trial to follow in up to three communities in Massachusetts, Fall 2001

AT&T Broadband Choice Trial

AT&T Broadband has spent \$20 Million to date



8 ISPs signed trial agreements:

- NATIONAL ISPs: EarthLink, Juno, WorldNet, Excite@Home
- SENIOR CITIZEN ISP: FriendlyWorks
- REGIONAL ISP: RMI.net
- DSL ISPs: Winfire, Flashcom

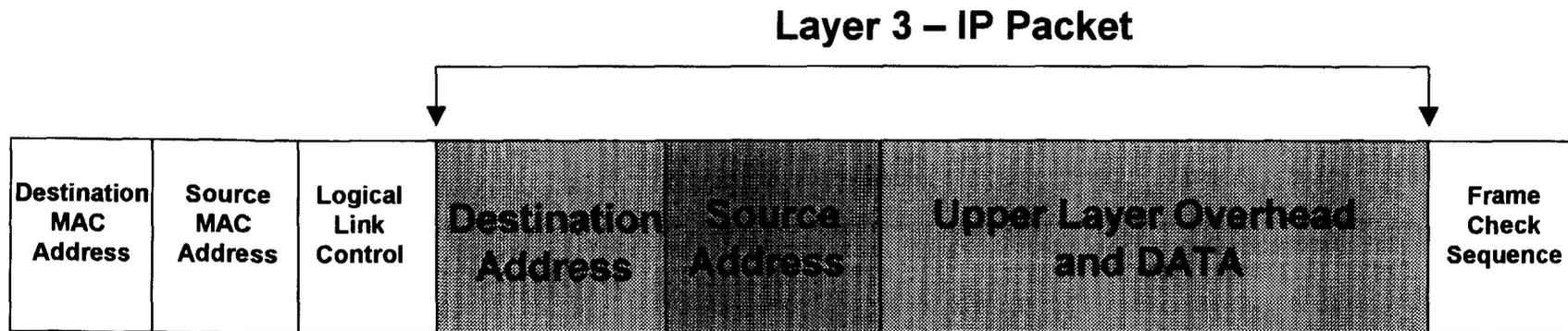
Trial commenced as scheduled on November 1st with first customer a Juno subscriber

180 customers as of 12/05/00

Up to 15 customers a day to be added over the next few weeks until reach 500 test accounts

Test: Changing How Packets

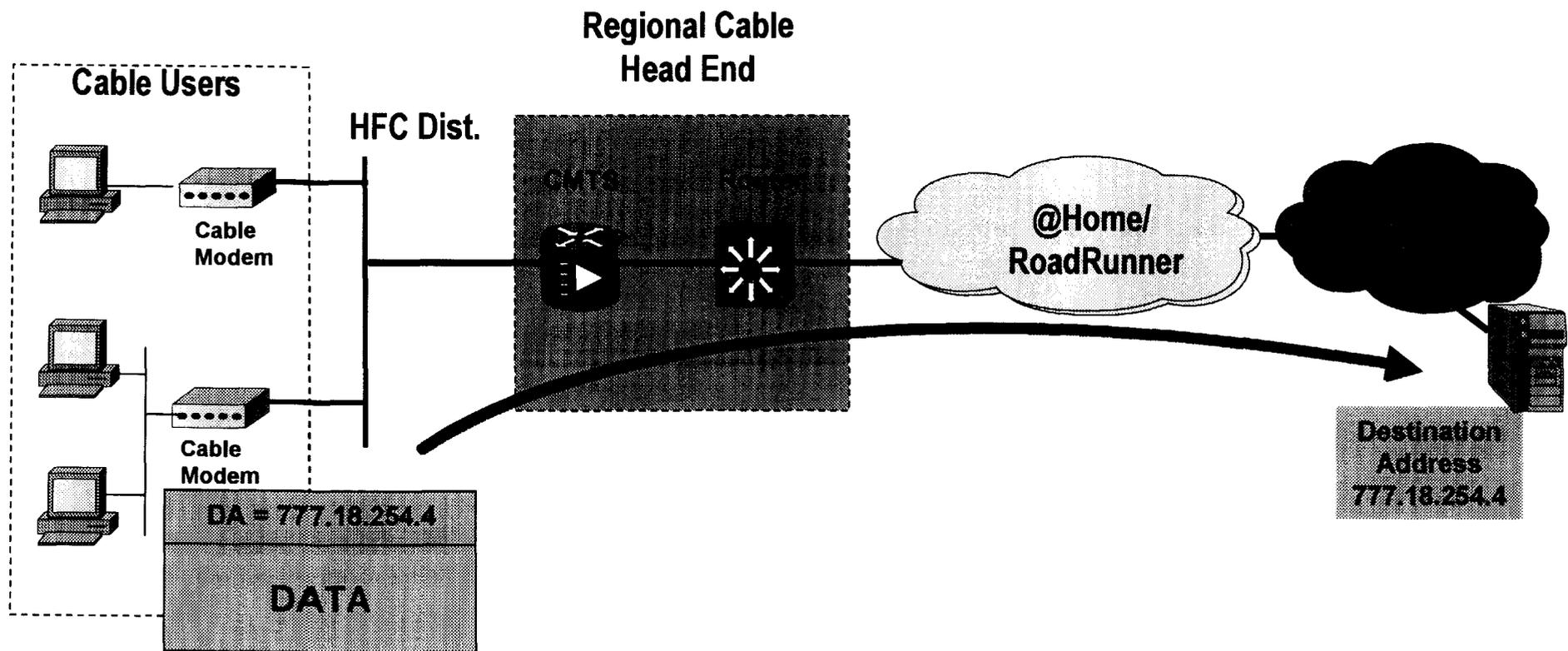
LAYER 3 – Network Layer – Internet Protocol



IEEE 802 (Ethernet)

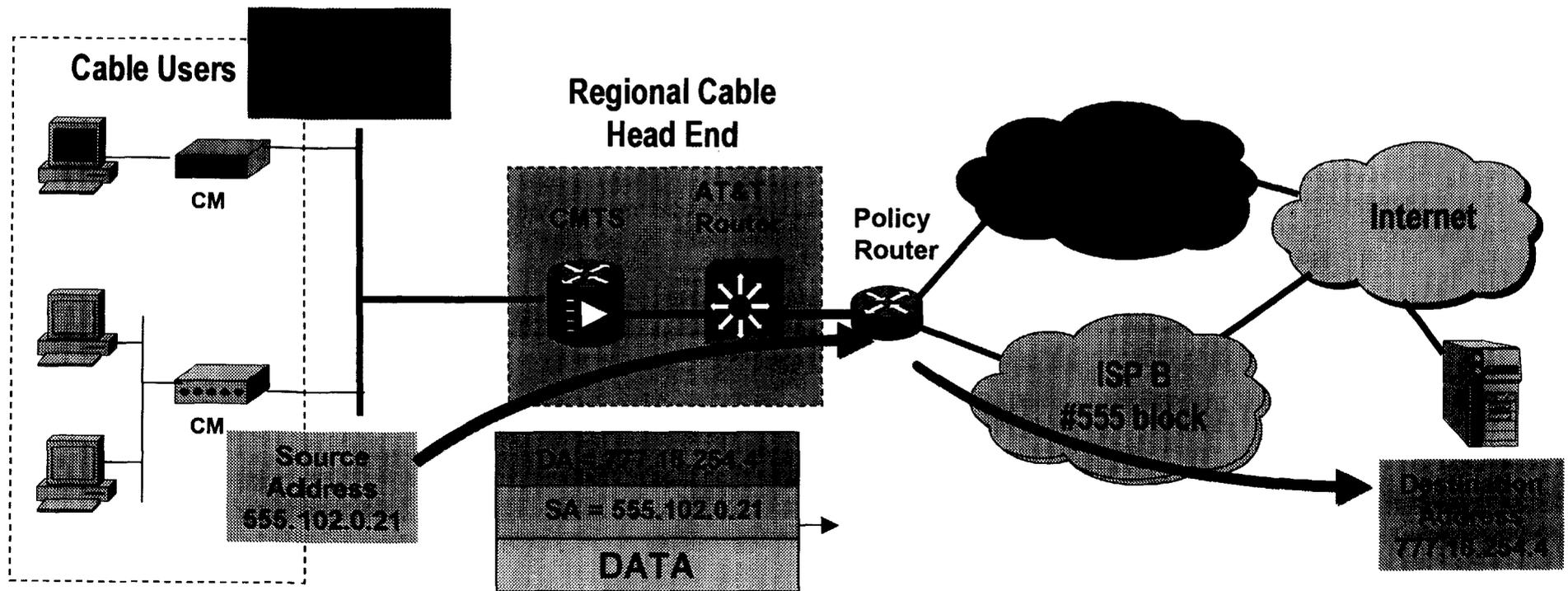
Destination Routing

- Outgoing packets are destination routed through @Home/Road Runner to the Internet



Source Address Based Policy Routing

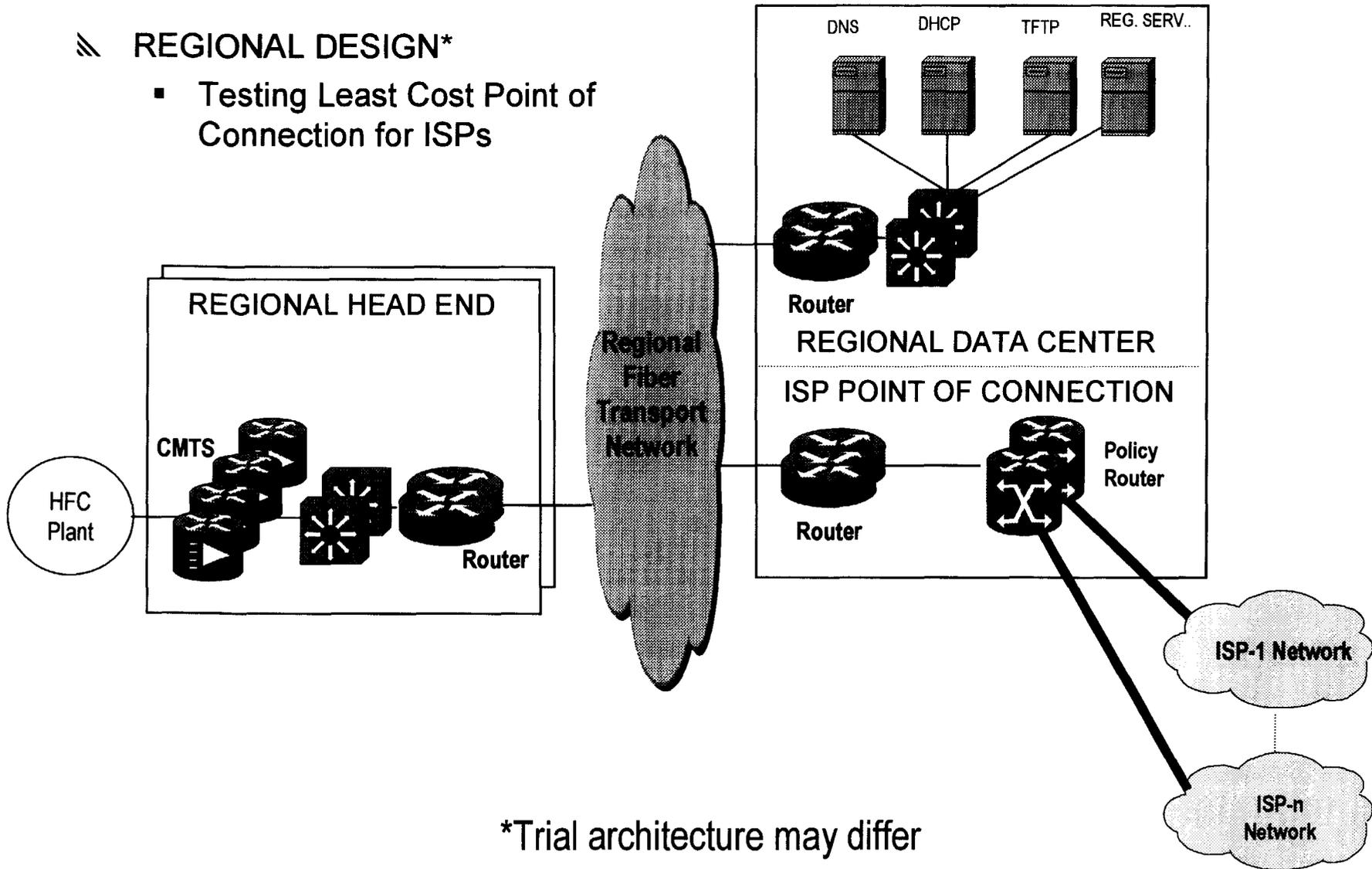
- ISP provides AT&T Broadband with a block of IP addresses
- AT&T Broadband dynamically assigns cable modem an IP address from the ISP block
- Outgoing packets are forwarded by the policy router to the ISP based on the source address of the cable modem
- ISP delivers the packet based on destination address



AT&T Broadband Design Architecture

REGIONAL DESIGN*

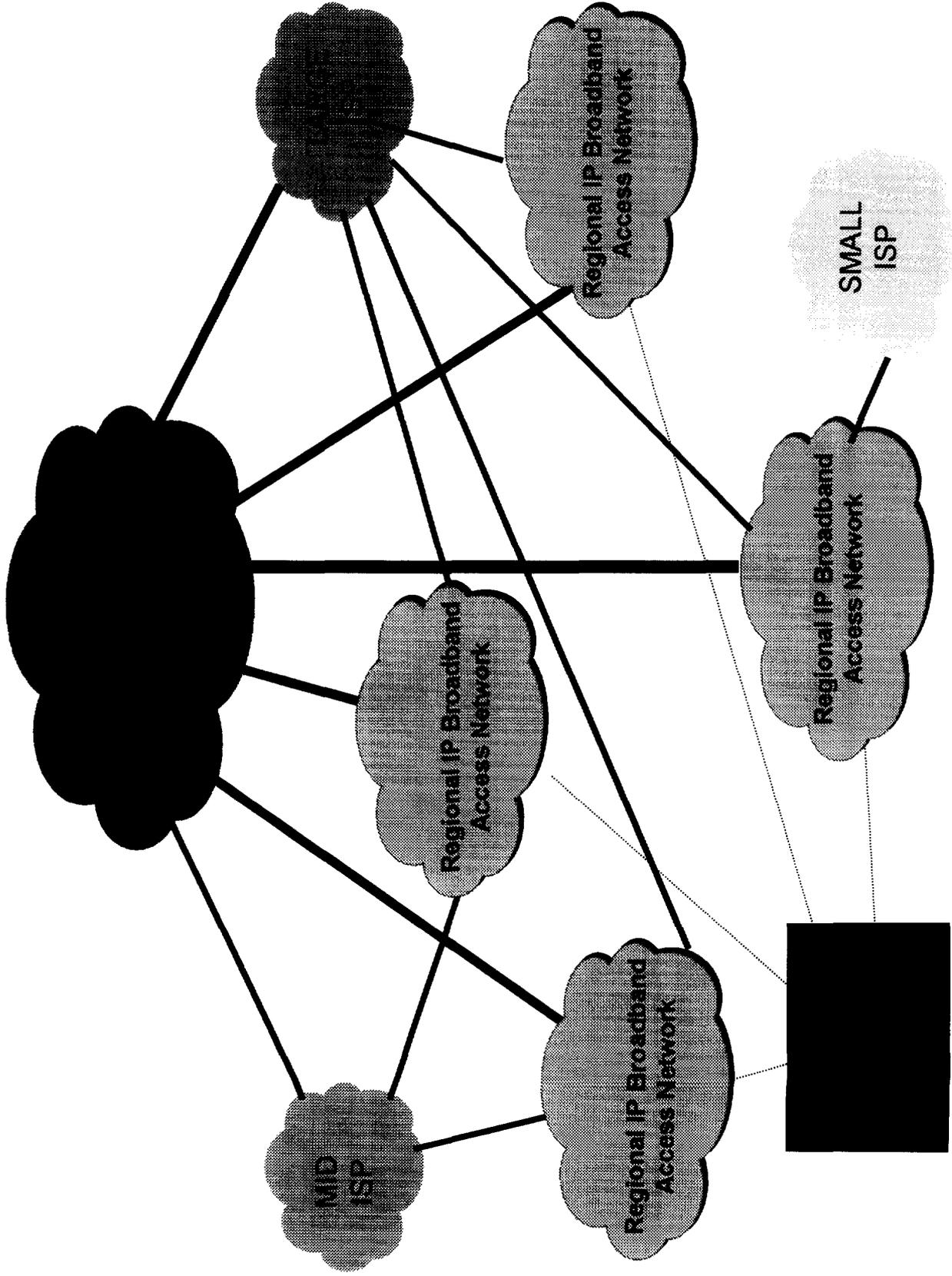
- Testing Least Cost Point of Connection for ISPs



*Trial architecture may differ

Trial parameters and proposed solutions subject to change during the trial

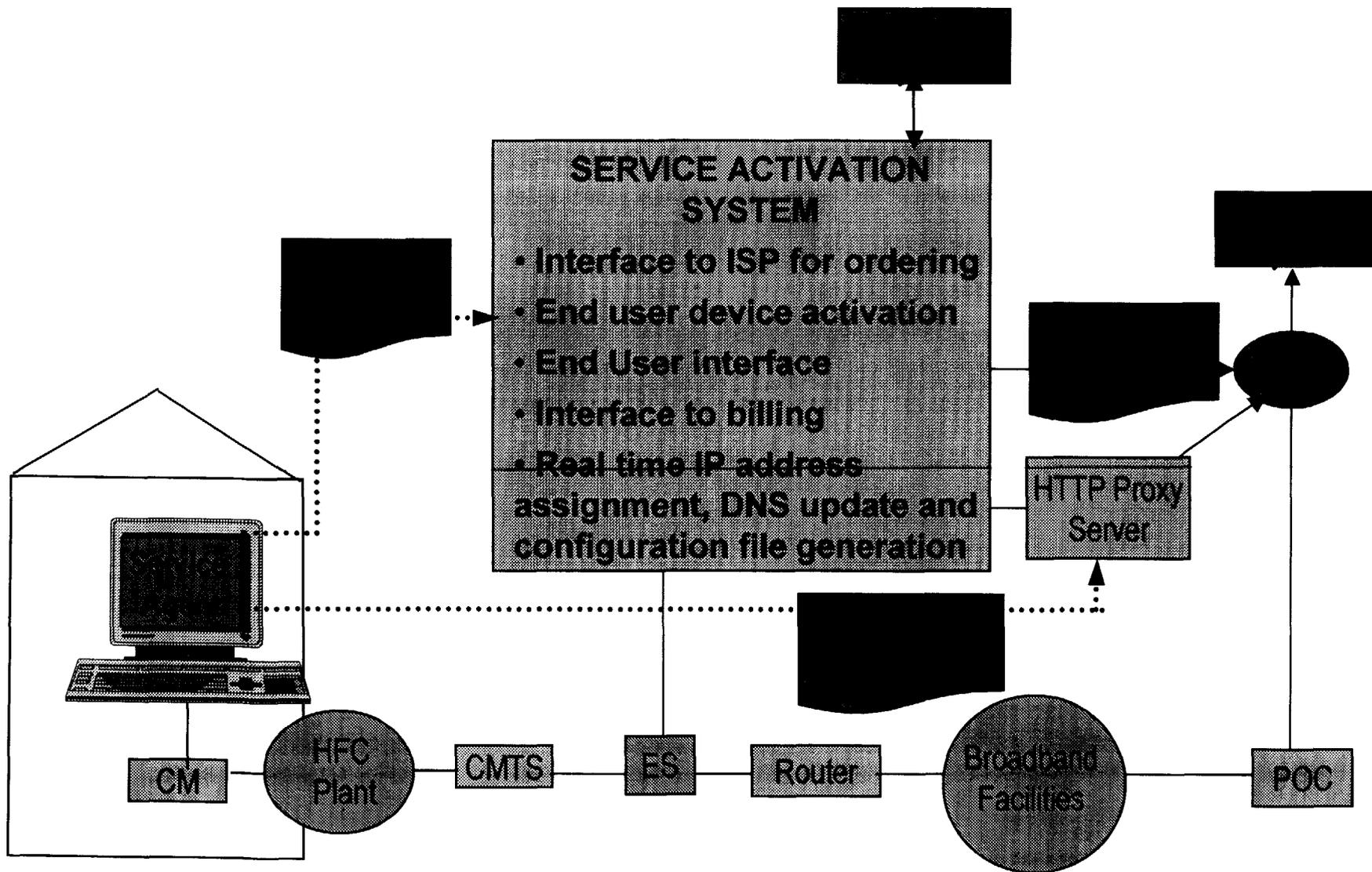
AT&T Broadband Design Architecture



Trial parameters and proposed solutions subject to change during the trial

Service Activation System – 28 New

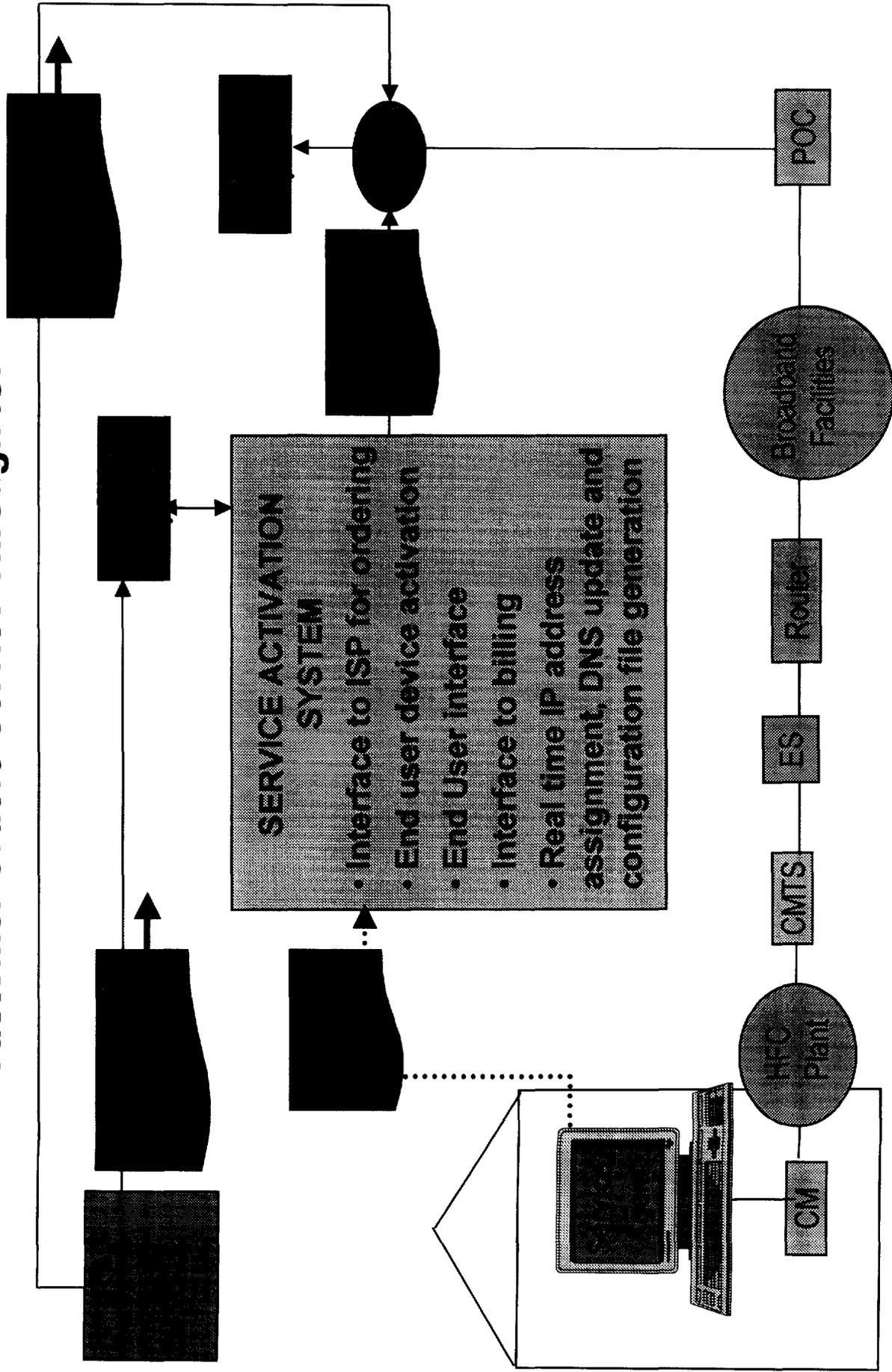
Customer chooses an ISP through AT&T Broadband via their PC



Trial parameters and proposed solutions subject to change during the trial

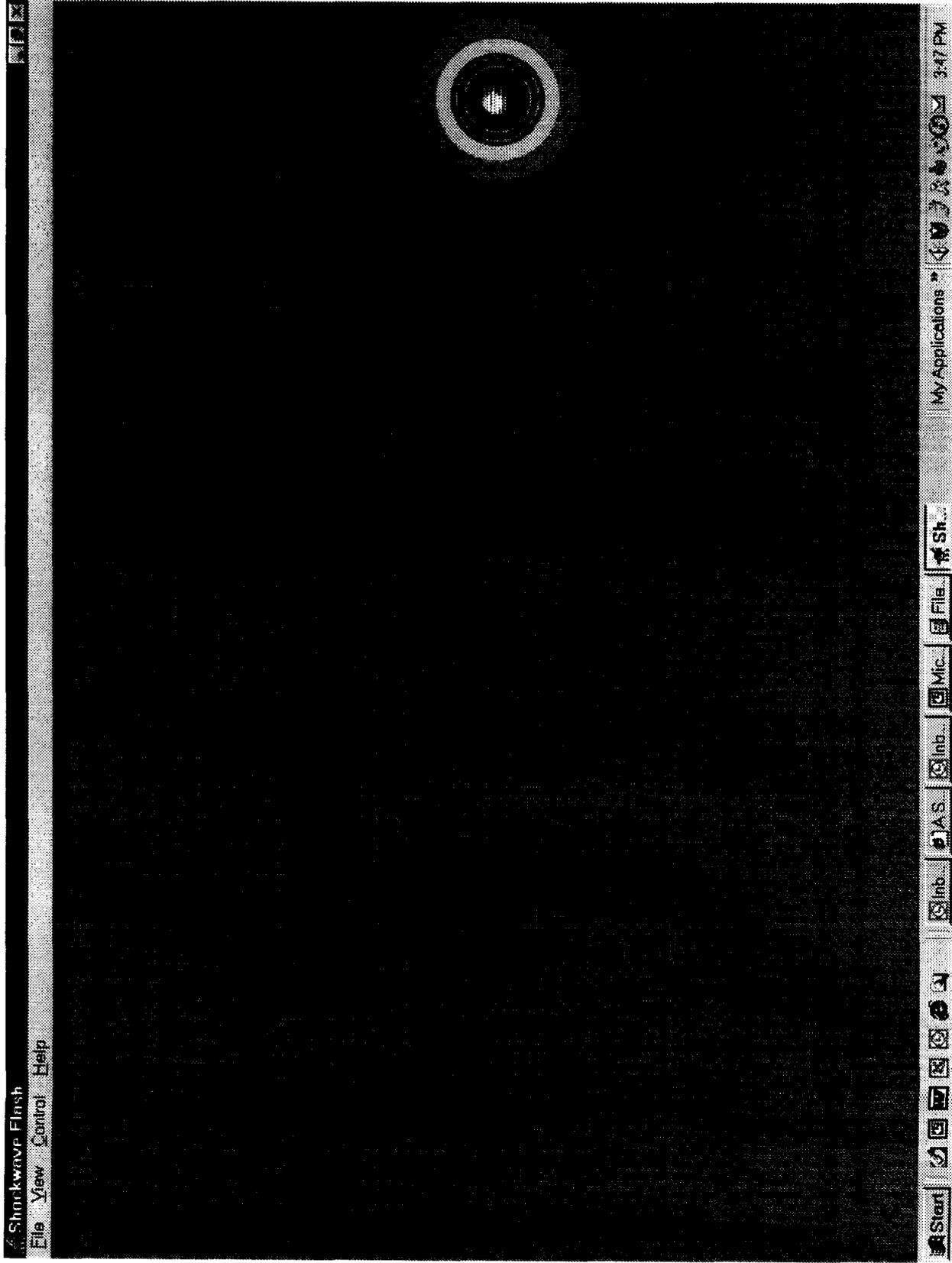
Service Activation System – 28 New

Customer Orders Service Through ISP



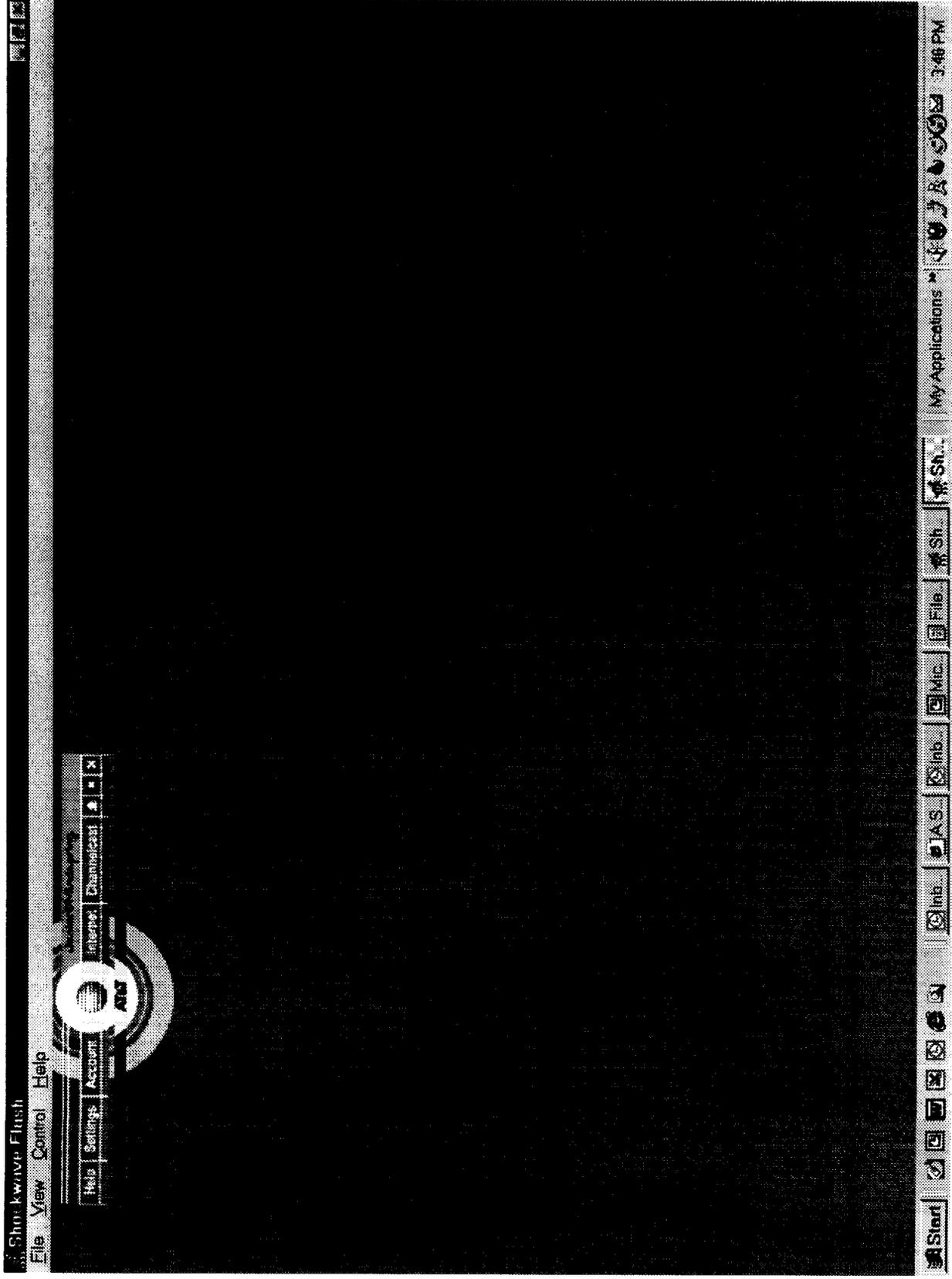
Trial parameters and proposed solutions subject to change during the trial

Service Agent Mock-up : Pulsafix



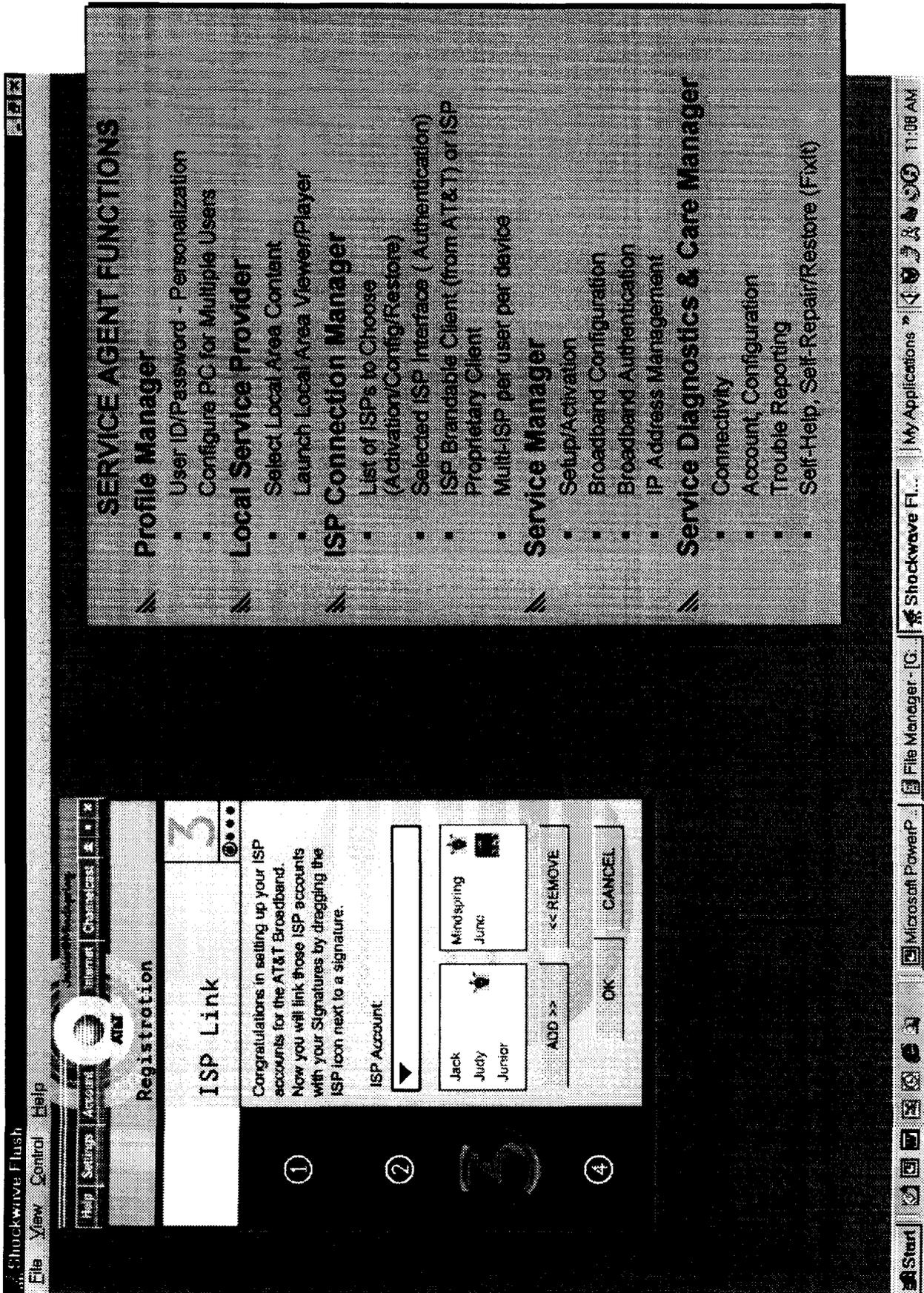
Trial parameters and proposed solutions subject to change during the trial

PC Service Agent Mock-up : Tool



Trial parameters and proposed solutions subject to change during the trial

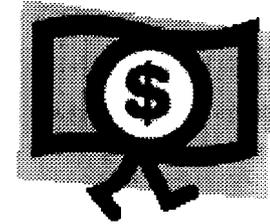
Service Agent Mock-up : ISP Registration



Trial parameters and proposed solutions subject to change during the trial

AT&T Broadband Choice Trial

Supporting multiple ISPs is costly and complex:



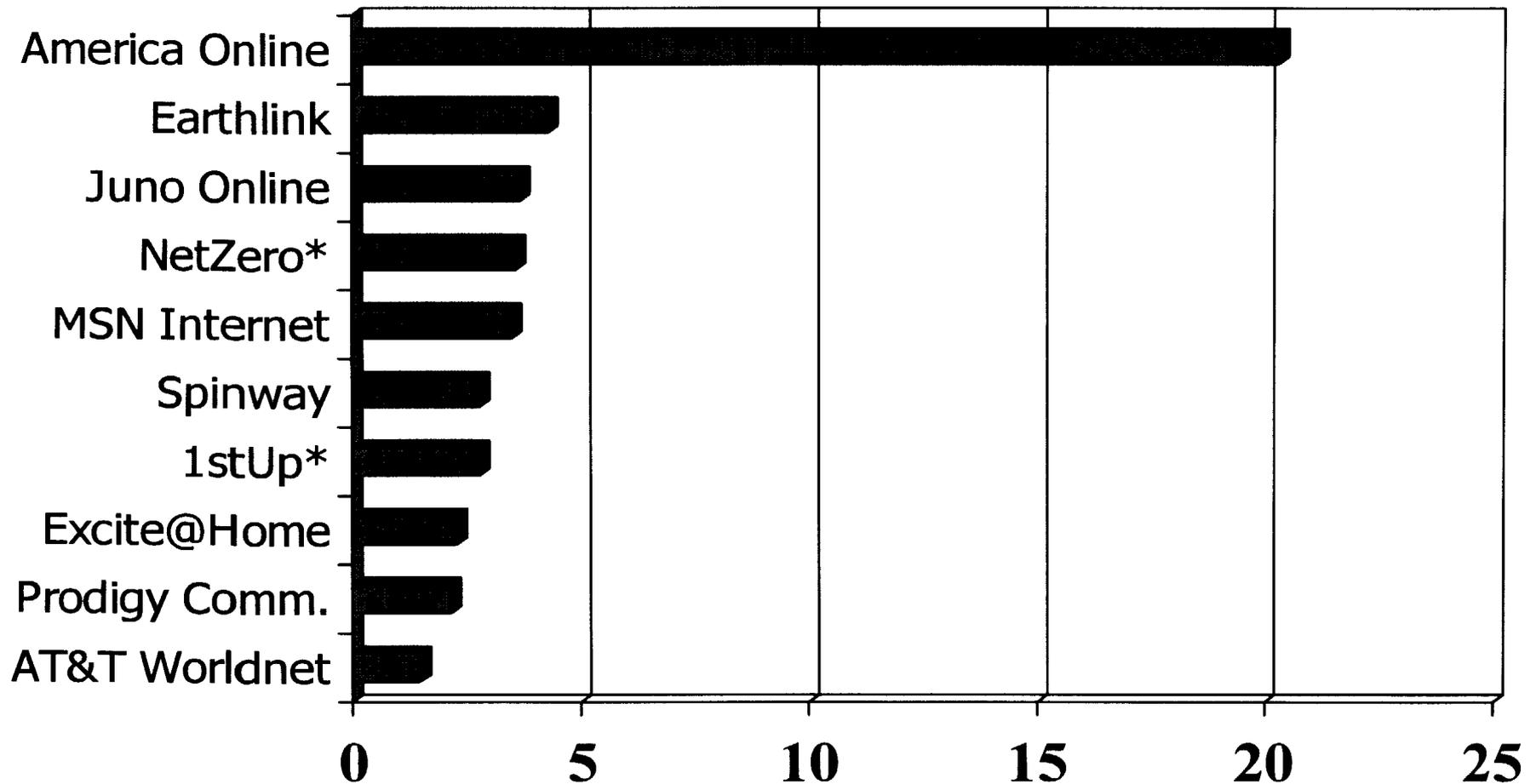
- ≡ Reconfiguration of the cable system
- ≡ Deployment of current hardware to support multiple ISPs and development of future requirements
- ≡ Development of systems and software to manage 3rd party bandwidth demand
- ≡ Development of operational support systems to provide 3rd party access
 - ordering
 - provisioning
 - maintenance
 - customer care



The Economics of Open Access

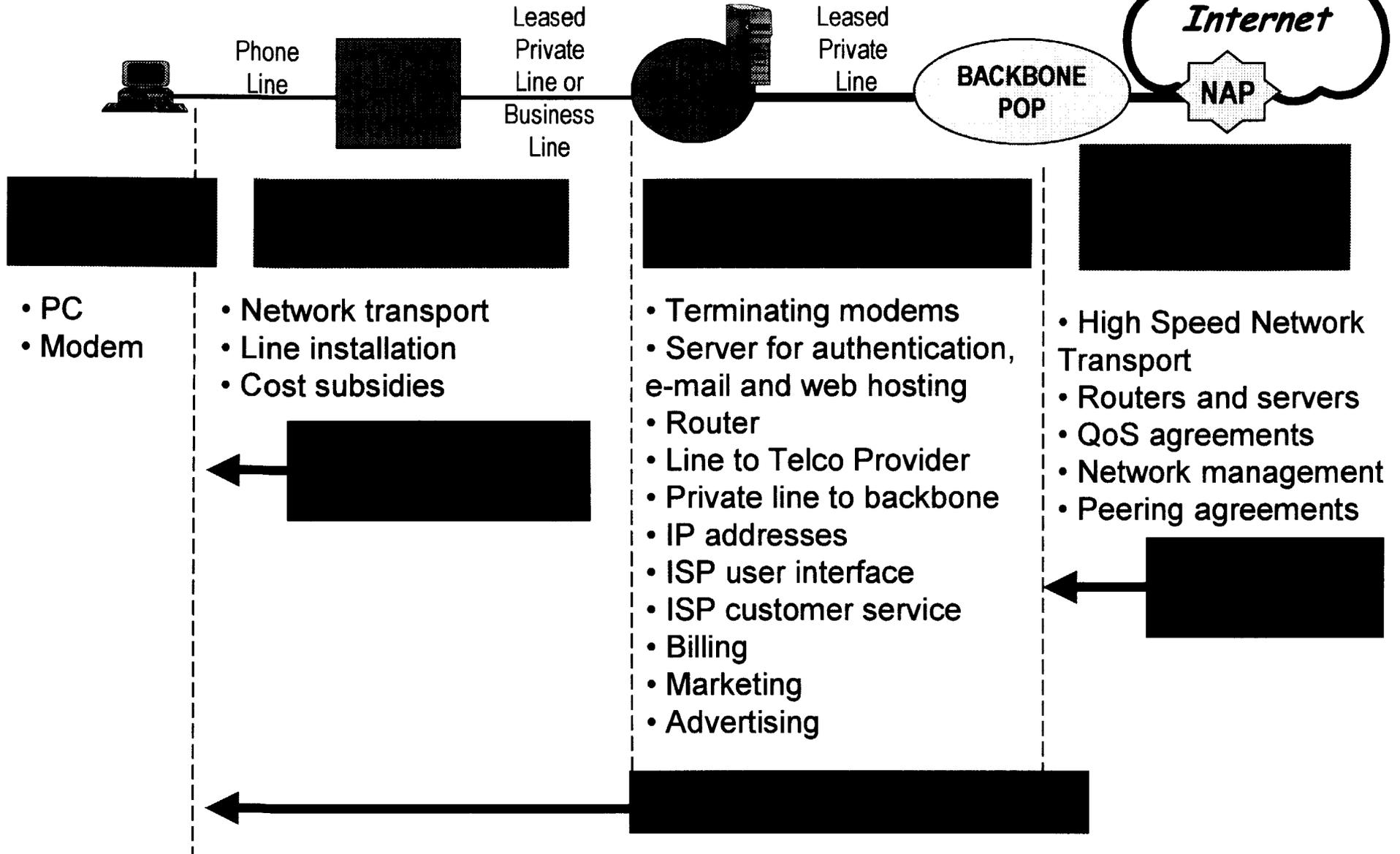
Top 7000 US Internet Service Providers

But...only a handful with more than 1M+ subscribers



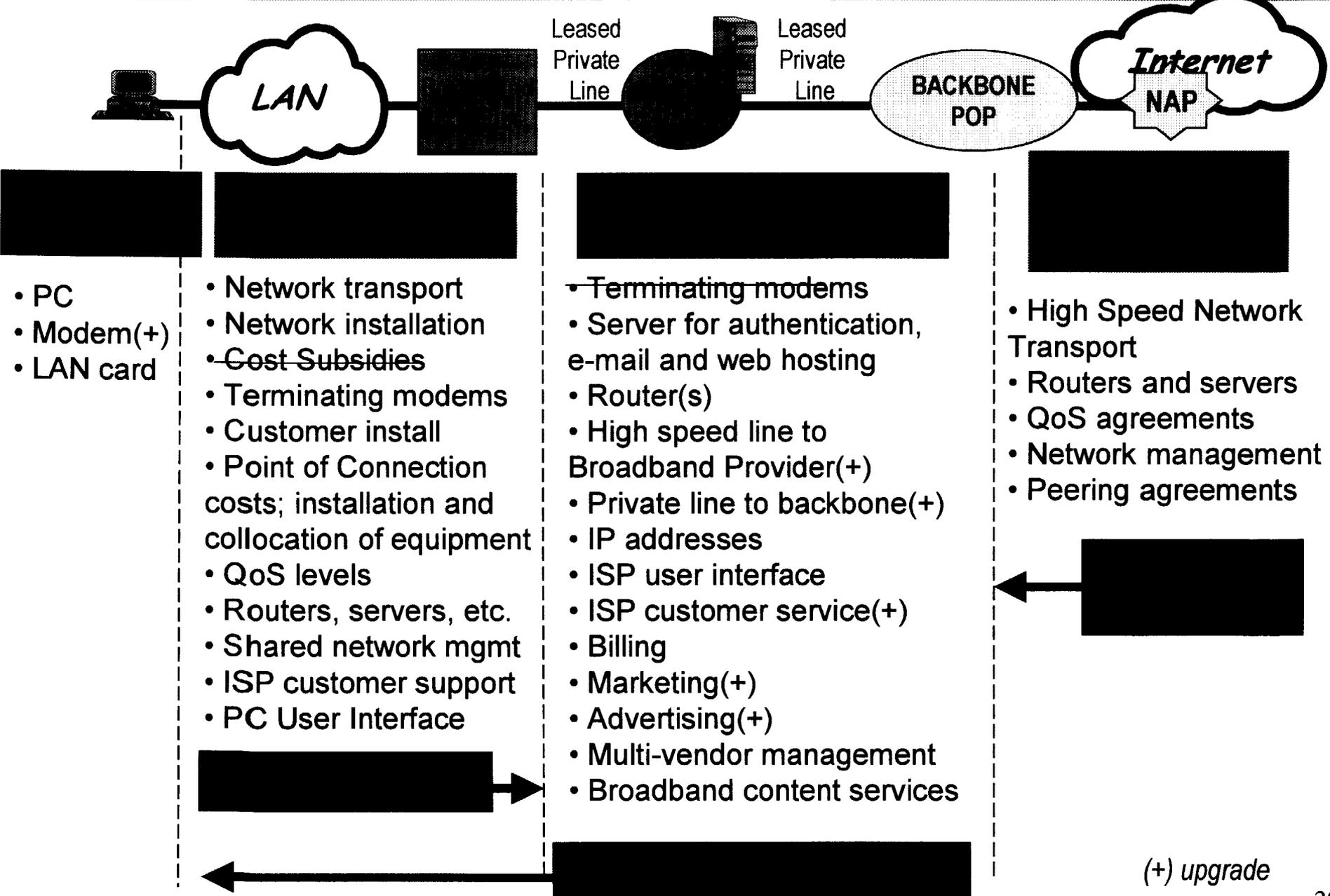
** Free ISP – Subscriber ranking based on industry average of 50% of subscribers logging on to free ISPs each month
Source: ISP Planet*

Broadband (Dial-Up) Economic Model



LOW BARRIER TO ENTRY

Broadband Economic Model (Cable, FTTN)



Economics Underlying DSL

MONTHLY COST	Monthly Cost
⌘ Upfront \$115K CO cost capitalized over 48 months	\$2,500
⌘ Backhaul DS3 from NSP to NPNT	1,600
⌘ Facilities, rent, power	1,700
TOTAL NETWORK COST	\$5,800
END USER CONTRIBUTION	
⌘ Average revenue per user	\$120
⌘ Additional revenue streams	15
⌘ Less Unbundled Loop Cost	(21)
⌘ Less DS3 Capacity Use	(5)
⌘ Less Success Based Capital	(7)
TOTAL REVENUE PER SUBSCRIBER	\$102

Notes: **One CO holds approximately 35,000 access lines**

Equipment was depreciated over 4 years; a 5 year depreciation would lower subs to 52

Additional revenue streams include assumed allocation of aggregated revenues

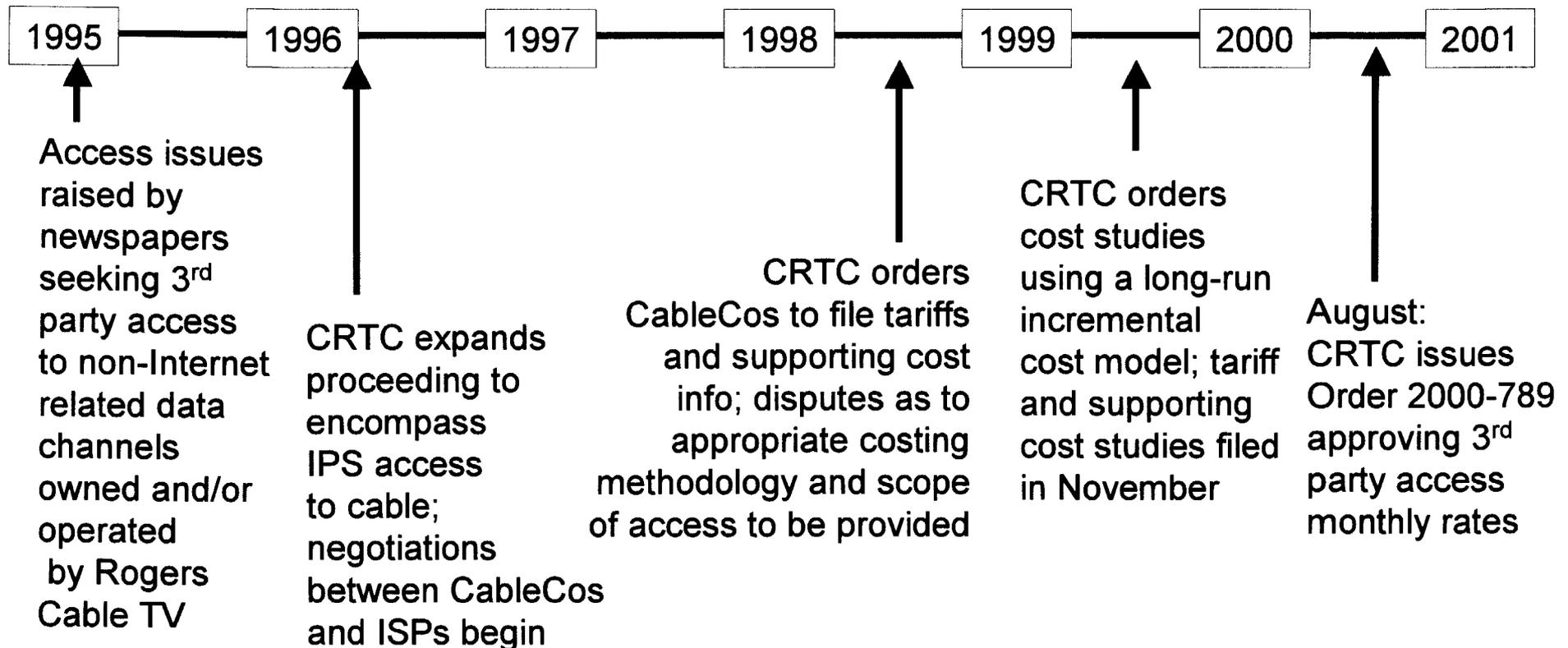
Source: Goldman Sachs using NorthPoint reports and Goldman Sachs estimates



The Canadian Experience

History of 3rd Party Access in Canada

TIMELINE



ISP Choice is still not a reality

CRTC Costing Methodology

Costing Methodology for transport service only took the following into account:

- Long-run causal costs
- Direct and indirect operating and capital costs
- A 25% mark-up to recover fixed and common costs
- A discount equal to weighted average cost of money

Disputed Issues
Traffic sensitive capacity charges
Cost of Equity
Study life
Segmentation costs
Bi-directional costs
IP layer costs
Service life
Productivity
Trouble reporting and repair costs
Bad debt costs

Monthly End-User Rate

- ≡ Rate ranges from \$19 to \$21.50 per month
- ≡ Covers transport service ONLY
 - Costs from CableCo router through distribution network to port on network side of cable modem in the customer's premises
 - ISP must provide the modem
 - ISP must provide installation
 - ISP must provide the interconnecting circuit at the CableCo router
 - ISP must provide customer service, marketing and interface

Canadian Experience

- ≡ Supporting multiple ISPs is costly and complex:
 - Requires changes to technology, standards and business models
- ≡ Five years of regulatory review has resulted in no scalable or commercial resolution:
 - Unclear whether tariff transport prices will support ISP entry
 - ISPs may have too many interconnection points when forced to the cable head end
- ≡ Multiple cost proceedings are still underway:
 - **Interconnection Rates**
 - Network protocols still an issue
 - Points of interconnection still an issue
 - Virtual and physical collocation costs to be determined
 - Router line-card costs to be determined
 - **Installation Rates**
 - Retail versus wholesale issues

