

***Excalibur* architecture: high-speed IP services to home PCs**

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IP Applications

Over Cable Network (IPACD) BOF

IETF Montreal, June 24, 1996

(Anonymous ftp at [twcable.com:/pub/EXCALIBUR/](ftp://twcable.com/pub/EXCALIBUR/)*)

General Service Properties

- ☐ **Connectionless access:** LAN-like service, no dial-up, permanently connected, automatic “BW-on-demand”.
- ☐ **High speed:** 8-25 Mb/s downstream, 1-3 Mb/s upstream, shared BW.
- ☐ **Standard datacom:** mainstream Internet technology (TCP/UDP/IP), leverage new multimedia extensions (IPng).
- ☐ **Client-server infrastructure:** enabling TWC environment, evolve to new services.

What is *Excalibur's* model?

***Excalibur* is an enabling networking and distributed computing environment.**

Deliver LineRunner™ information services.

- **Multivendor end-to-end solution, based on IP internetworking and related applications => open, extensible and manageable.**
- **Supports high-speed multimedia interactive PC applications - it is NOT an entertainment video environment.**
- **Leverages TWC's broadband HFC access network, and metropolitan fiber networks, to create regional broadband IP infrastructure ("intranet").**
- **Provides local and national services - and content - focused on residential customers, with national and global IP connectivity (Internet and "internets")**

How is *Excalibur* structured?

Networking:

- Access network: HFC broadband and cablemodems (Ethernet).
- Metropolitan fiber broadband backbone (ATM/ SONET, FDDI...)
- Global access: Internet, on-line services, enterprises, NOC, ...

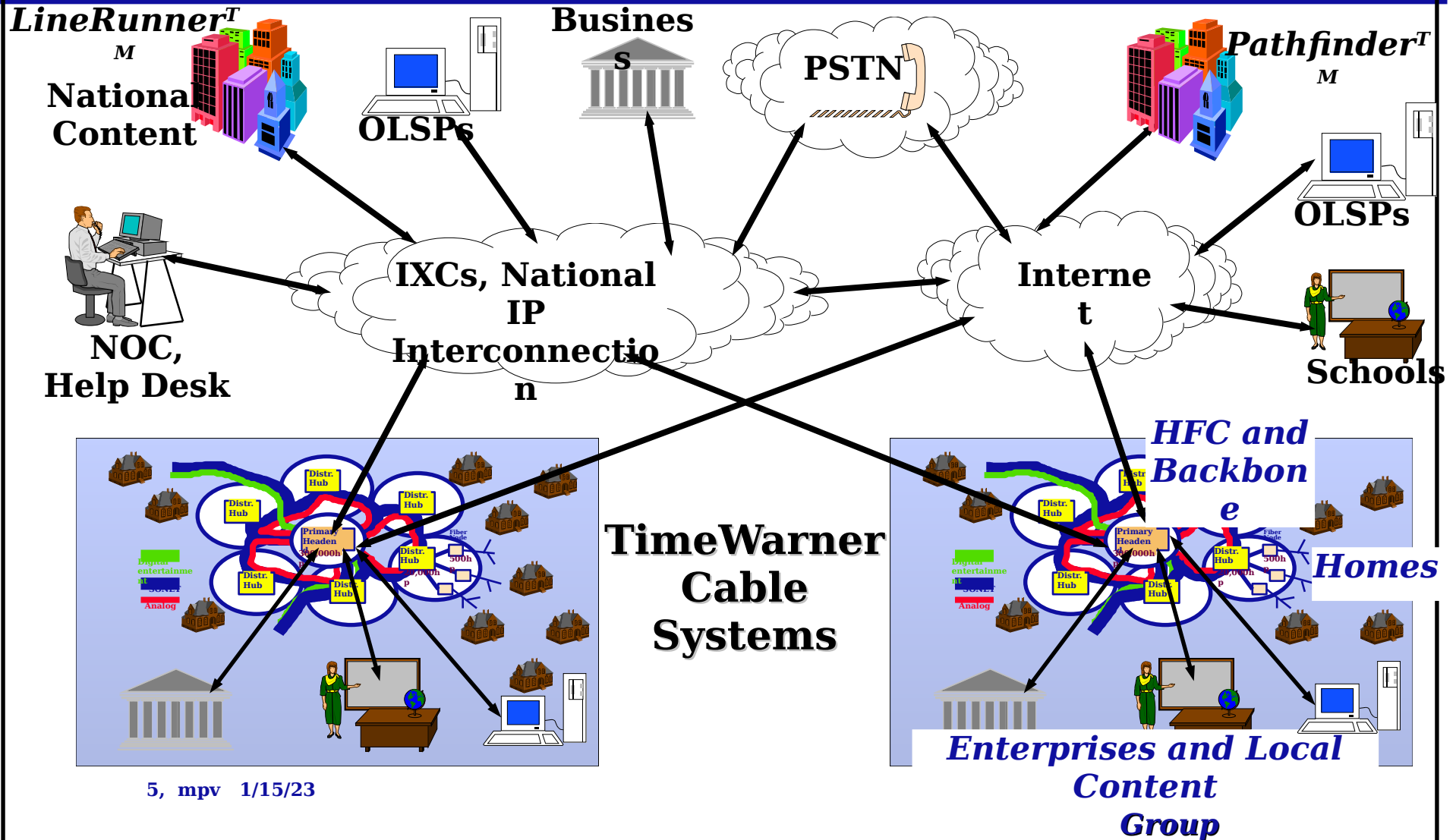
Client SW:

- Browser, e-mail, usenet, telnet, ftp...
- Install, log-in, account mgmt, SW download...

Server SW:

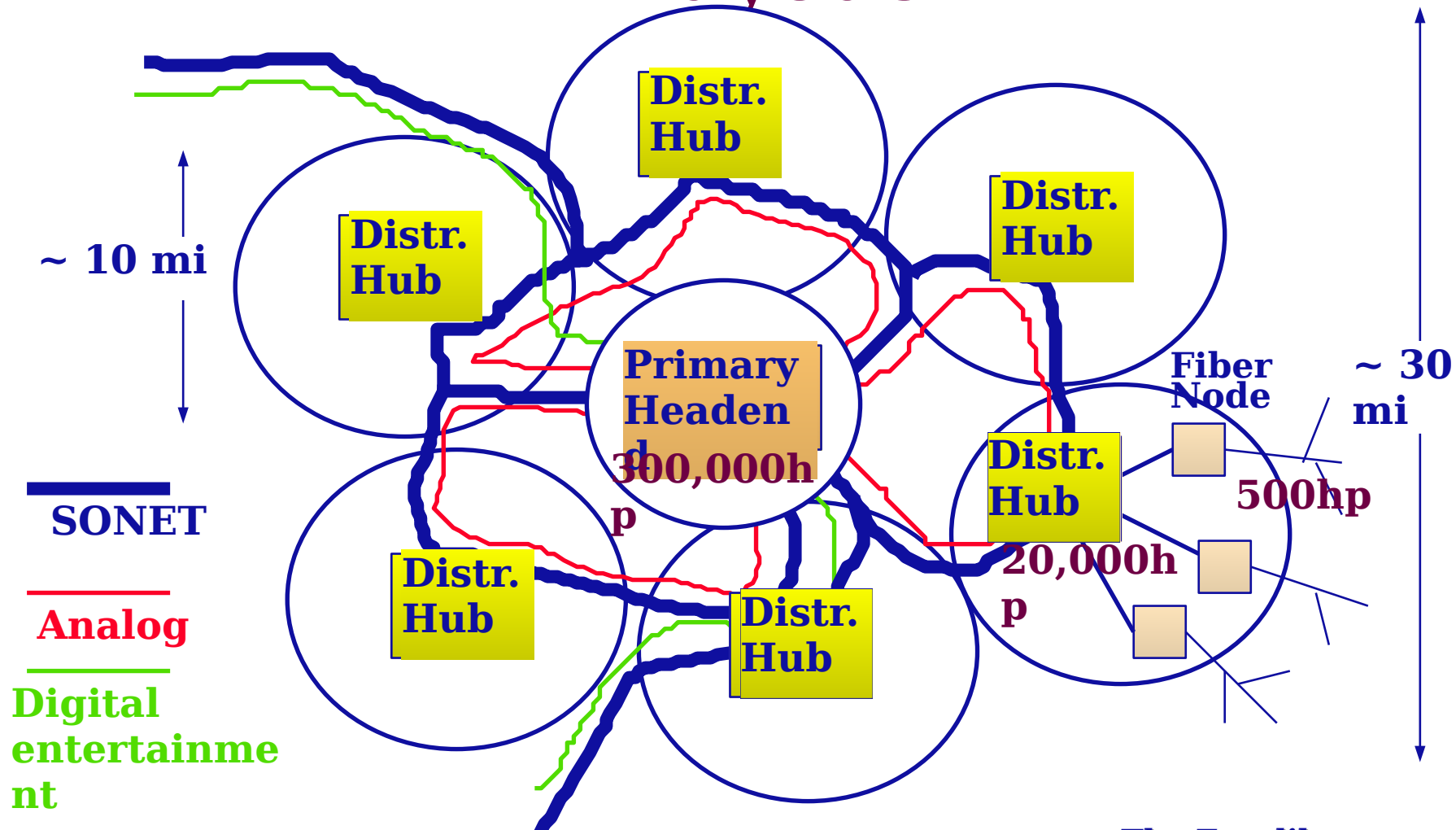
- Subscriber Mgmt, Session Mgmt, Content Mgmt, http, SMTP, NNTP, DNS, DHCP...
- Network Mgmt, System Admin, Billing, Events Logging, Security and Firewalls...

Excalibur Global View



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Typical TWC Division Layout



SONET

Analog

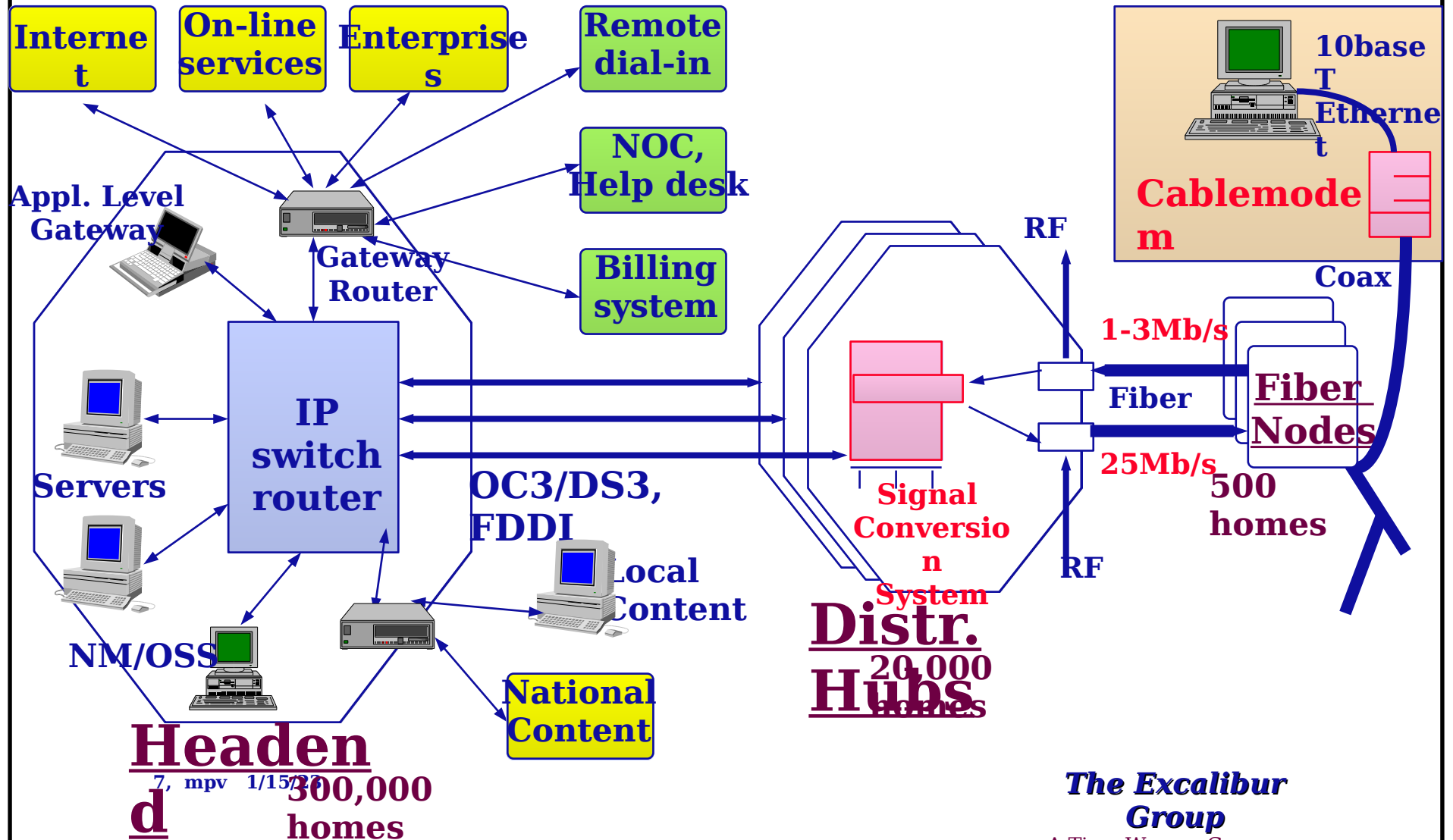
Digital entertainment

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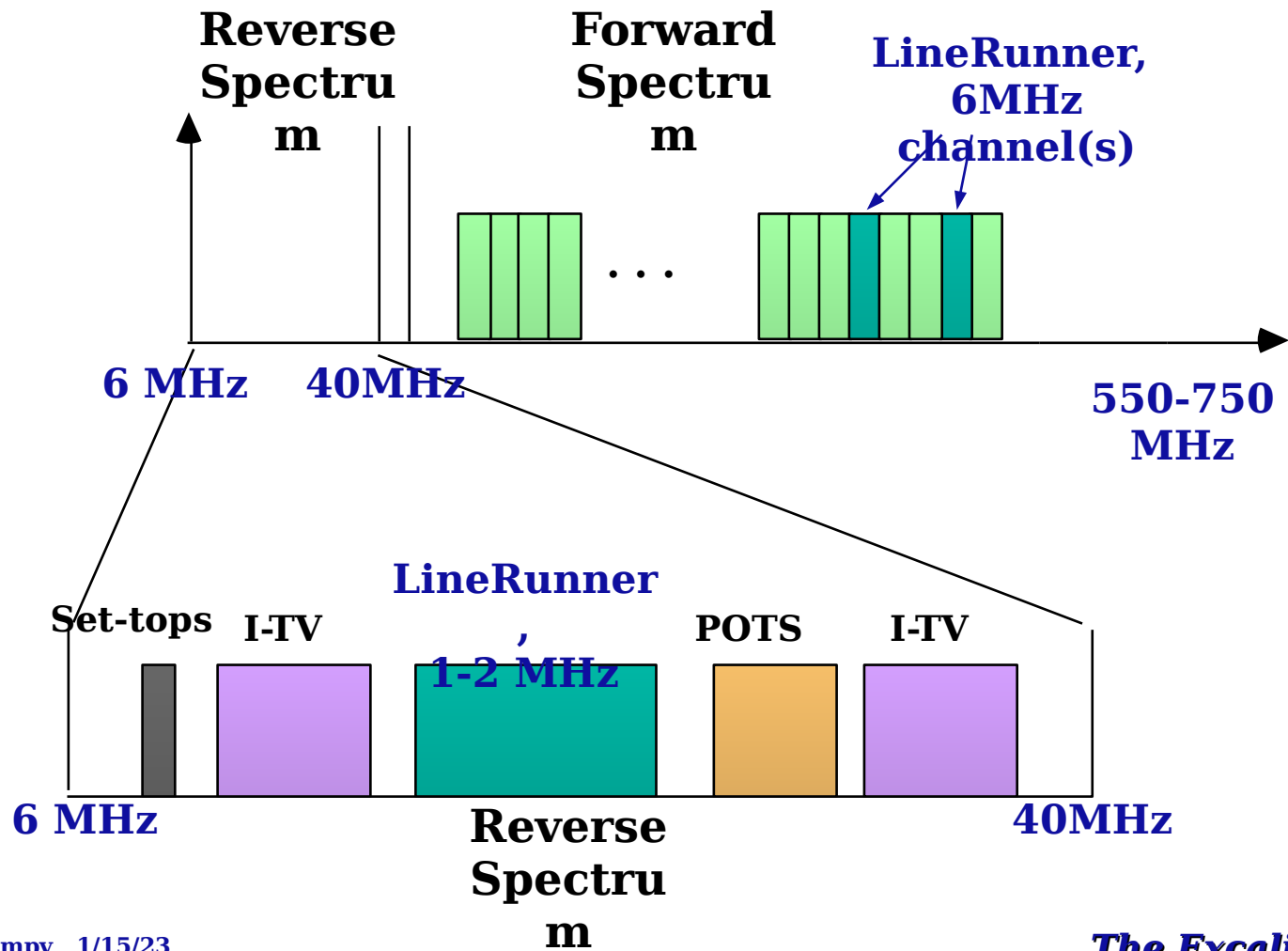
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Excalibur Reference Architecture



HFC Spectrum Usage



Cablemodem

Self-installing and adaptive: key operational requirements for large-scale deployment.

☐ **Asymmetrical, yes, but *high-speed both ways*:**

☐ **64QAM, 24 Mb/s in 6 MHz down (QPSK initially?)**

☐ **QPSK, 1-3 Mb/s in 1-2 MHz up**

☐ **Ethernet 10baseT to PC:**

☐ **Multiple PCs in the home/small business.**

☐ **Filter network traffic on MAC address.**

☐ **Vendor-specific MAC protocol, future standard.**

TW part of industry effort to define interoperable cablemodem.

☐ **Link-level encryption required over HFC**

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Signal Conversion System

SCS at the Distribution Hub, aggregates traffic from about 20,000 hp (40 fiber nodes):

- Terminate cablemodems: physical and link levels.
- Connect to Headend router: deliver IP datagrams (over ATM/SONET, FDDI, ...).

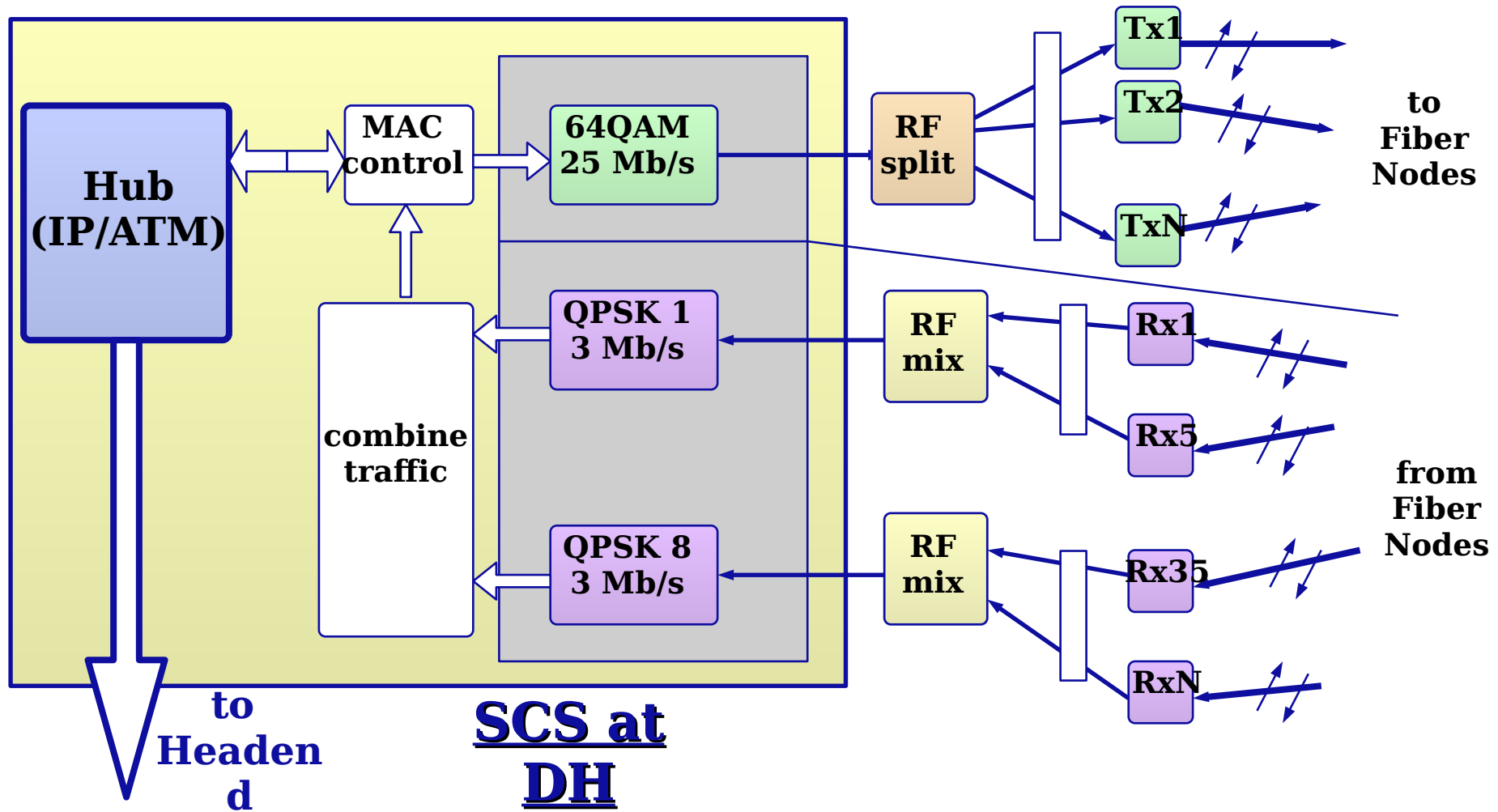
Decouple up streams from down streams, scale from low-penetration:

Forward: start one mod for all users, install additional cards as needed.

Reverse: RF clusters of fiber nodes, add additional demods as needed.

Support multicasting/broadcasting.

Illustrative example: SCS Modular Growth



*LineRunner*TM Applications

- Client SW on customer's PC: open IP apps.
- Broadband multimedia environment, html/http extending to Java, vrml, etc..
- Compelling GUI, launch other apps.
- Three levels of apps for *LineRunner*TM:
 - **Basic:** browser, email, ftp, telnet. Content: national and local, newspapers, schools, business, government, weather, sports, etc.
 - **Enhanced:** add unrestricted Internet access.
 - **Premium:** all other third-party (OLSP, work-at-home, shopping, etc.)
- User tools: install, login/logout, account/subaccount management, network download, etc.

***LineRunner™* account management**

■ Login validates account and cablemodem:

■ Activate link-level encryption.

■ Assign IP addresses (DHCP), enable TCP/IP stack.

■ Master account holder, multiple subaccounts:

■ Manage subaccounts, passwords, access levels, etc.

■ “Parental control” features.

■ Enable user mobility, “guest” subaccount type.

*LineRunner*TM Basic services

*LineRunner*TM information services:

 Local news, weather, sports, bulletins, etc.

Global Internet email service:

 SMTP gateway, email client using POP protocol.

Launchers for third-party applications (OLSPs, enterprise connection, schools, games, etc.)

Selectively authorized URLs for *LineRunner*TM basic customers.

Access to OLSP

- Provide launching from *LineRunner*TM interface.
- Each OLSP deals directly with customers, for both client software and account/billing.
- OLSP can have local servers at Headend, outside our firewall.
- Connect through gateway/IP filtering.
- NM information shared across subnetworks, as feasible.

Access to Internet

“Access to Internet” has multiple functions.

- **For users:** the Internet is an open, global information service.
- User will have **LineRunnerTM** client apps (or theirs):
 - Our TCP/IP stack, when needed.
 - Browser in open mode.
 - telnet, ftp, gopher, whois, finger, etc.
- **Access to any site on worldwide Internet.**
Restricted access from the outside to our servers and clients.

(cont.)

Access to Internet (cont.)

- **For system:** the Internet is a global network to find and carry information, when appropriate.
- Some **LineRunner™** content may be distributed using the Internet.
- Other premium www sites will be accessed over the Internet.
- New services and applications as well: electronic commerce, MBONE, I-phone, etc.

Remote dial-in access

- Provide phone access to **LineRunner™** service.
- Low-speed (28kb/s) or ISDN access for traveling customers, and for homes beyond cable franchise.
- Aggregate PSTN calls at terminal server, provide TCP/IP traffic to *Excalibur* edge router.
- Client SW first provides login to PPP, then user is presented to usual to **LineRunner™** login process.

Security capabilities





- **Link level: encryption over HFC: RSA plus DES, or similar.**
- **Network level: application gateways plus IP filtering:**
- **Session level, for some client applications:**
 - **Kerberos?**
 - **User login with passwords.**
- **Logging and audits to monitor any attacks.**

Enterprise connectivity

A class of third-party premium information services:

-  Launched from **LineRunner™** basic interface.
-  Provided and billed separately.

Important service for business, academic and governmental campuses:

-  Work at home, telecommuting.
-  CSCW including residential customers.
-  Education, K-12 to universities.
-  Remote medicine, patient-doctor consultation.

Other evolving services

■ Excalibur is an enabling platform, many new apps will be supported:

■ Virtual CD-ROM.

■ Interactive, multiuser games.

■ Home shopping.

■ etc.

■ Some key technologies for future:

Multimedia apps (Java, Macromedia,...)

Secure NFS services.

Real-time RSVP enhancements.

Electronic commerce protocols.

Operations support services

- **Subscription management and billing: interface to existing cable systems.**
- **“It’s another cable product” paradigm.**
- **Generate work order and trigger *LineRunner*TM system configuration.**
- **Usage monitoring and event logging:**
 - **Collect sessions information, not packet traffic.**
 - **Log premium services sessions.**

System administration

- ❑ **System Administration (UNIX, NT): key aspect for success of business.**
- ❑ **Manage: e-mail, www, DNS, DHCP, IP filtering, appl. gateway, file storage, etc.**
- ❑ **Local staff to cover routine tasks and respond to hard failures.**
- ❑ **Remote administration, complement local expertise.**

Network management services

- ❑ Use SNMP standard platforms to build NM applications.
- ❑ Element Managers for all key components:
 - ❑ At Headend: servers, switches, routers.
 - ❑ At DH: SCS, routers.
 - ❑ At home: cablemodem, user PC?
- ❑ Provide single point of entry for NM operator, integrated solution for multivendor roll-out.
- ❑ Cablemodem and SCS must support TWC's csmi MIB (Spectrum Management Application).

Customer support services

- Provide complete coverage of user's requests over single 800-number access.**
- Resolve all issues regarding client apps, account management, cablemodem, LAN card.**
- Remote, centralized customer support, coverage 12x7 minimum, 24x7 preferable.**
- Local staff for network plant and hard failures only.**

Content management

- NUL LineRunner™** national content created in NYC, distributed to regional systems.
- NUL Local content creation: *customizing and branding*** from basic content templates.
- NUL Heavy use of html/http technology. Caching http servers.**
- NUL Third-party services and applications responsible for their content and local servers.**

Elmira, NY trial (Southern Tier On-Line

Market test of **LineRunner™** concept: content, operations, customer support, etc.

Started early June '95, it has 250 users:

about 75 free to community (schools, libraries, etc.)

about 175 paying customers: \$14.95/mo Basic, \$9.95/mo Enhanced, no time or usage charges.

Client-server system, (almost) full **LineRunner™** functionality: Hewlett-Packard implementation.

Cablemodem: interim product for trial, Zenith Homeworks, 4 Mb/s symmetric.

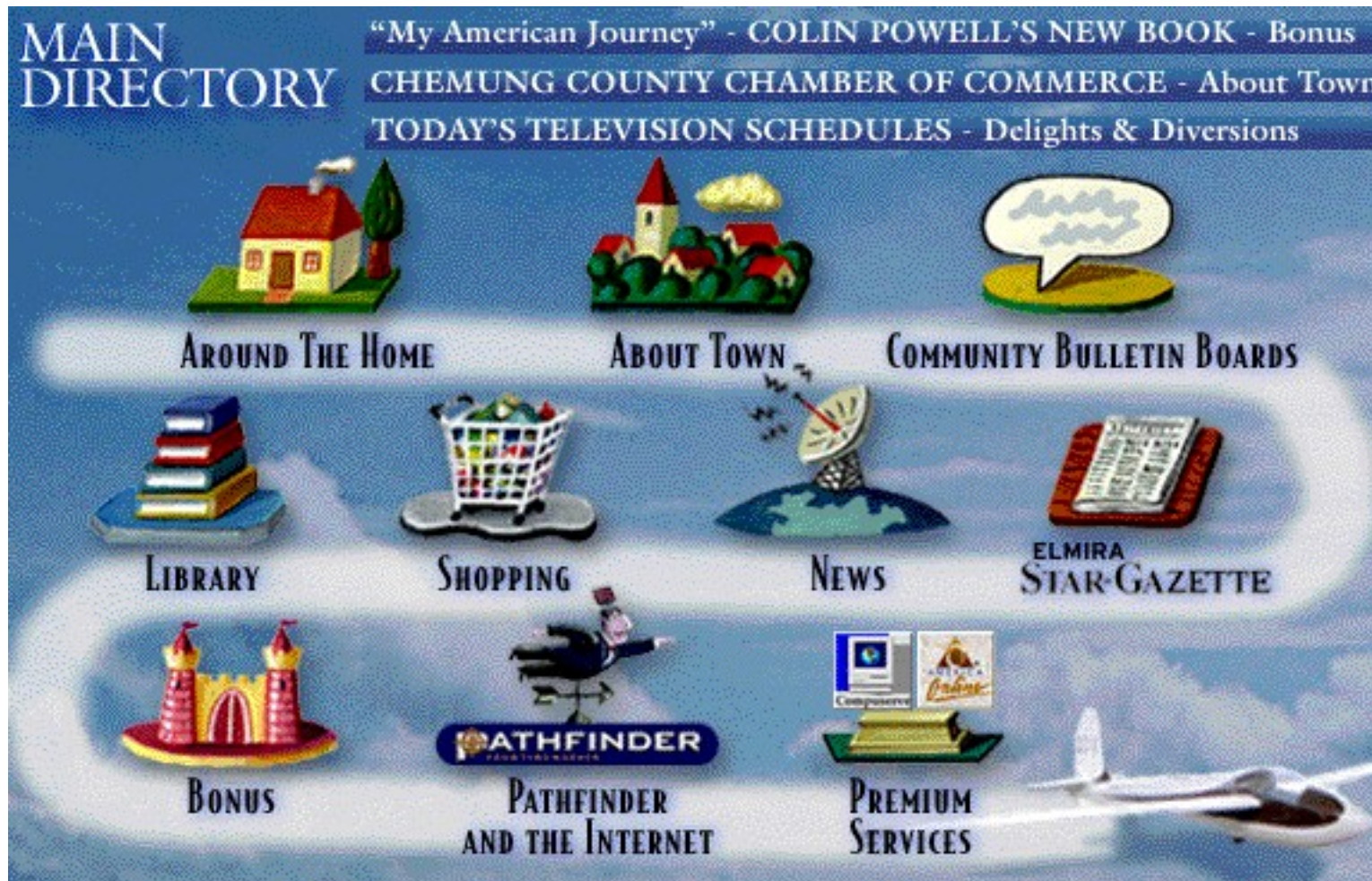
Binghamton/Elmira/Corning will be a 1996 commercial deployment, conclude Elmira test phase.

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Elmira trial



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Commercial Deployment Plans

- **LineRunner™** commercial deployment in several metropolitan systems in 1996.
 - TW Cable continues multibillion investment to upgrade HFC plant for 11+ million homes.
 - Over past 2 years developed multivendor end-to-end solutions, built to *Excalibur* specs:
 - **Hewlett-Packard** (Cisco, Netscape, Cabletron...)
 - **Toshiba** (Sun, Cisco, Netscape...)
 - Cablemodem purchases from **Motorola** and **Toshiba**.
 - Client SW collaboration agreement with **Microsoft**.
- Other deployment/vendor announcements to follow.**