SWITCHED FIBER ACCESS NETWORK

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Tree structured access networks with automatic service restoration. Full mesh logical backbone implemented with circuit switches. Regional node provides packet switching and traffic aggregation.
SWITCHED FIBER ACCESS

- Lower fiber cost
  Greater traffic concentration, therefore less fiber required.
- Greater flexibility
  More degrees of freedom for topology of fiber plant.
- Better security
  Switched service provisioning discourages fraud.
- Automatic service restoration
  Commercial quality service, 50 msec restoration, everywhere.
- Reduced delay
  No initial delay when sending a packet.
- Mechanized maintenance
  Intelligence and means of monitoring at every network node.
ROOT is where the access network terminates in a regional node.
Edge node (E) is a community switch to which homes have direct connection.
Distribution node (D) is a switched interior node of the access network.

All user traffic passes through at least one root.
Virtual path switching provides each home with a protected path to the root.
The topology is a “fat tree” - a tree structure with extra links for redundancy.
PROTOTYPE EDGE NODE

Current Generation Access Node

1.2 Gb/sec throughput
8 ports at 155 Mb/sec
8K virtual circuits
Basis for system experiment

Next Generation Node Design

10 Gb/sec throughput
Fast restoration
Flow control
Cell grouping
Switched multicast

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AUTOMATIC SERVICE RESTORATION

Algorithms
Detect and classify failures
Discover available facilities
Identify additional and removed nodes
Choose a new tree
Instantiate tree in forwarding tables

Restoration time based on height of tree rather than number of nodes
A single multi-fiber cable in the street is necessary for fiber access and is sufficient for automatically restored broadband service.

Marginal cost of extra fibers in a cable is small. Networks have been designed for cities of 10,000 to 100,000 households.

Additional cost to support service restoration is less than 10% based on publicly available cost data for overlashed aerial cable.

Restoration can probably be completed in 50 msec.
Large regions are economical
- Fiber back-haul (aided by WDM) reduces transmission cost.
- Operating costs for switching centers are an increasing burden.

Backbone can be simplified
- Reduced number of regions simplifies routing.
- Substantial traffic aggregation simplifies flow control.

Reduced complexity enables competition
- Technology independence among regional operators.
- Independent evolution of regional and backbone networks.
• Telephone and cable operators have hybrid networks in operation today. Evolution to switched access is natural.

• Homes are clustered:
  80% of central office customers are within 3 miles.

• Region with 100 mile radius looks plausible.
  Distribution nodes with fiber back-haul for local communities.