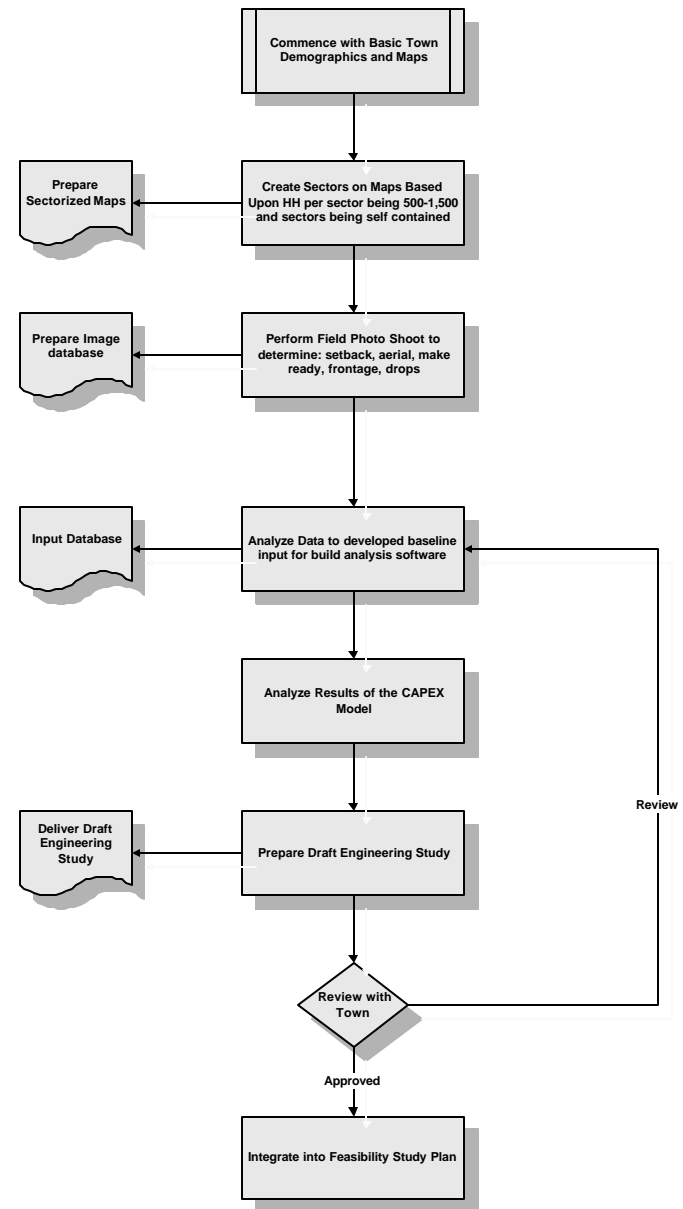


# THE MERTON GROUP

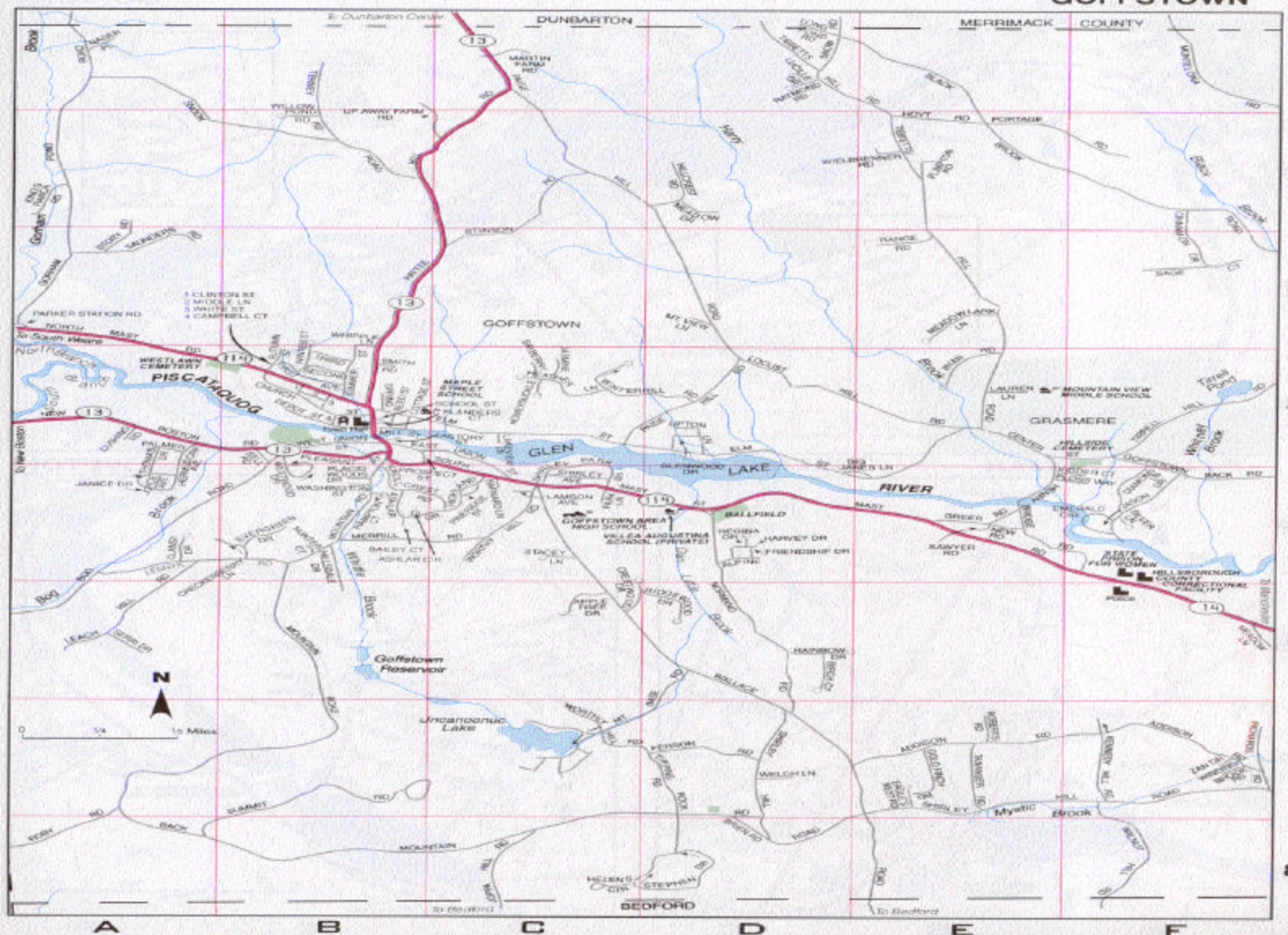
## *Municipal Broadband Networks Infrastructure Goffstown, NH*

# *Methodology*

# Engineering Methodology



GOFFSTOWN

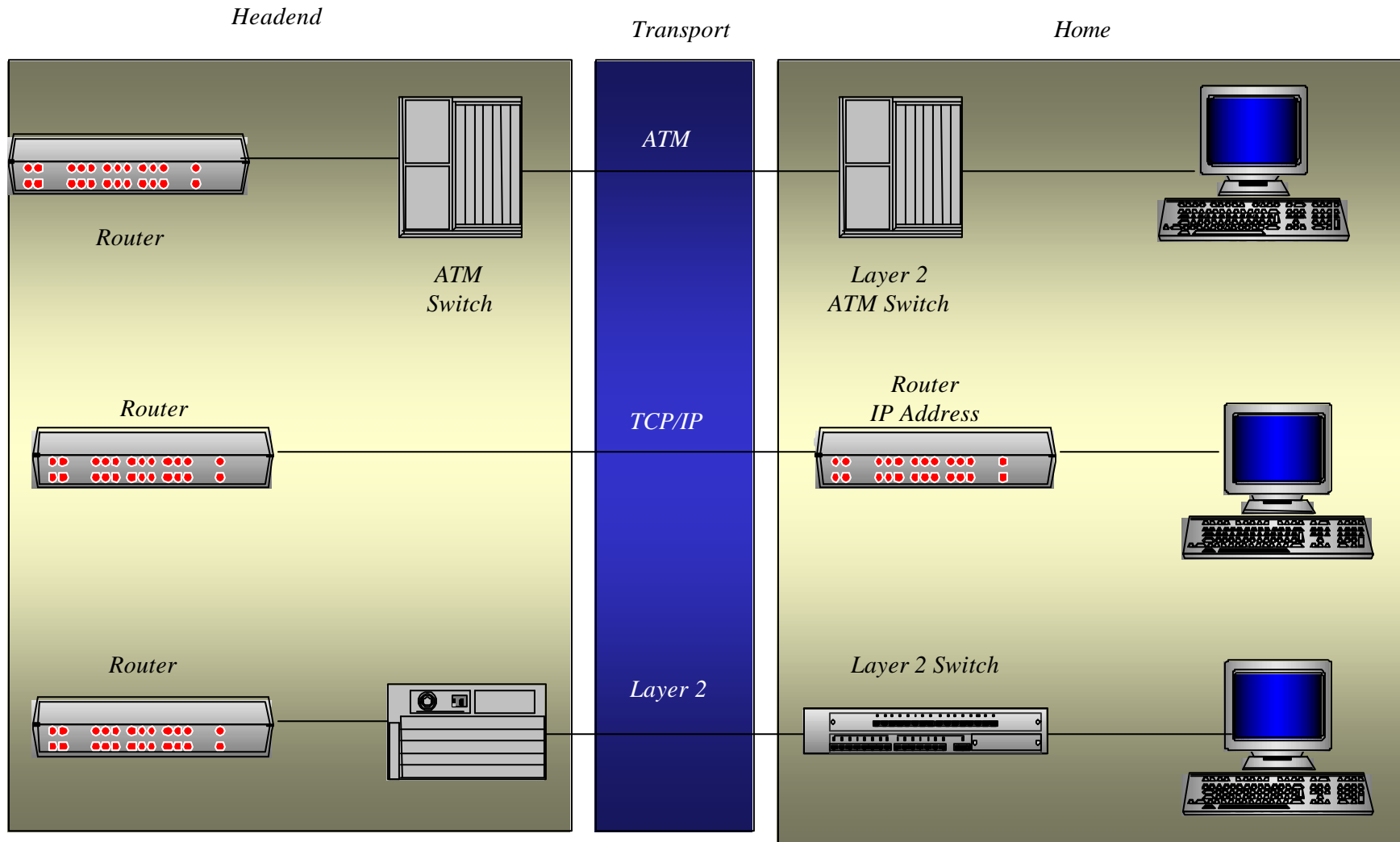


A B C D E F

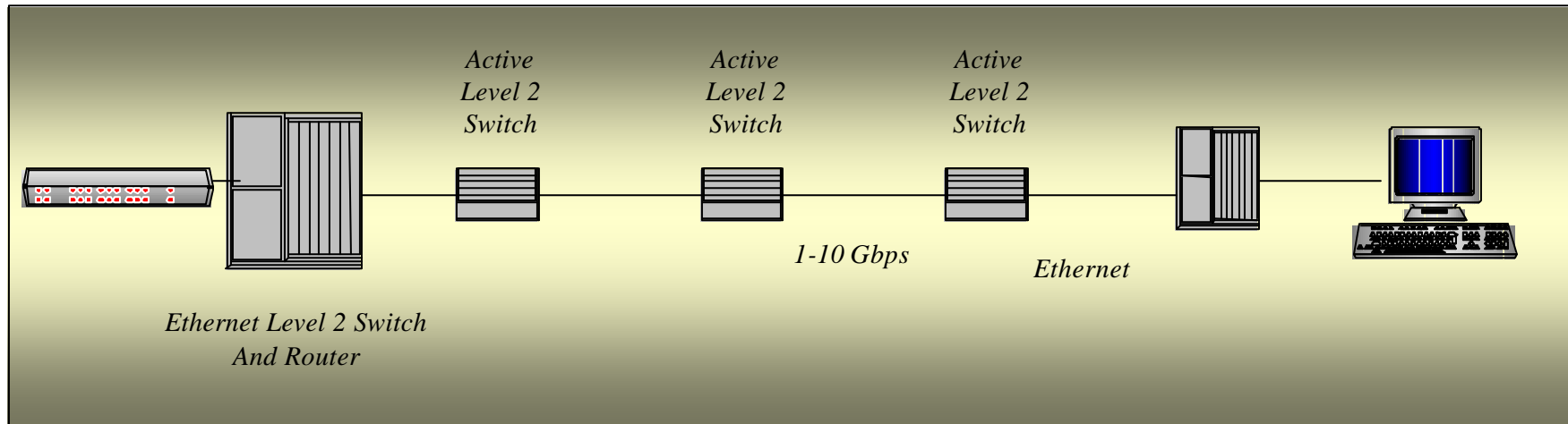
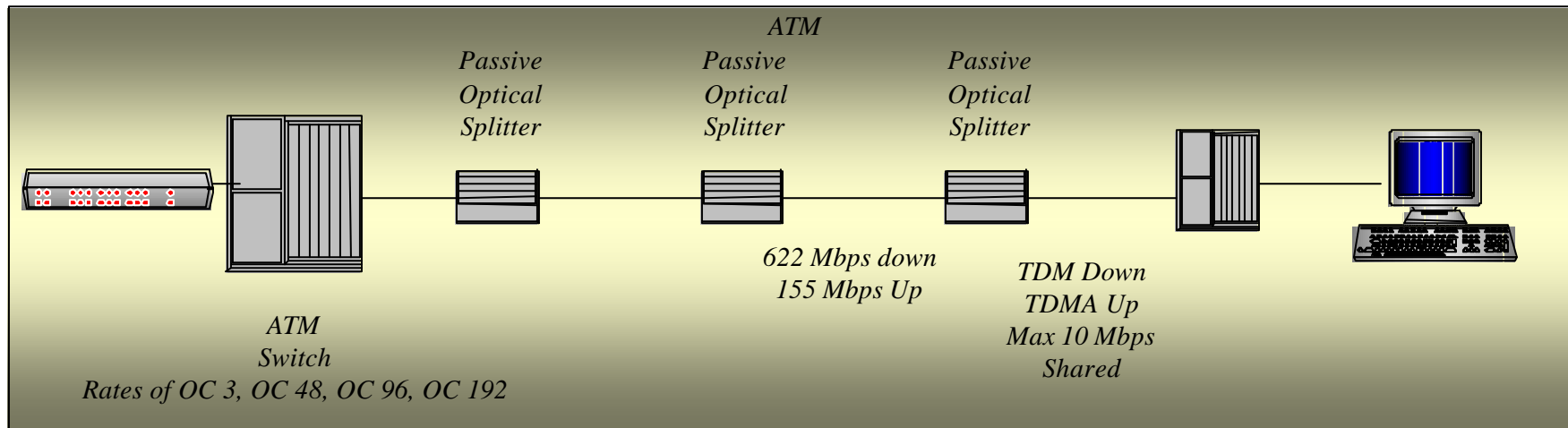
1  
2  
3  
4  
5  
6  
7  
8

# *General Architecture*

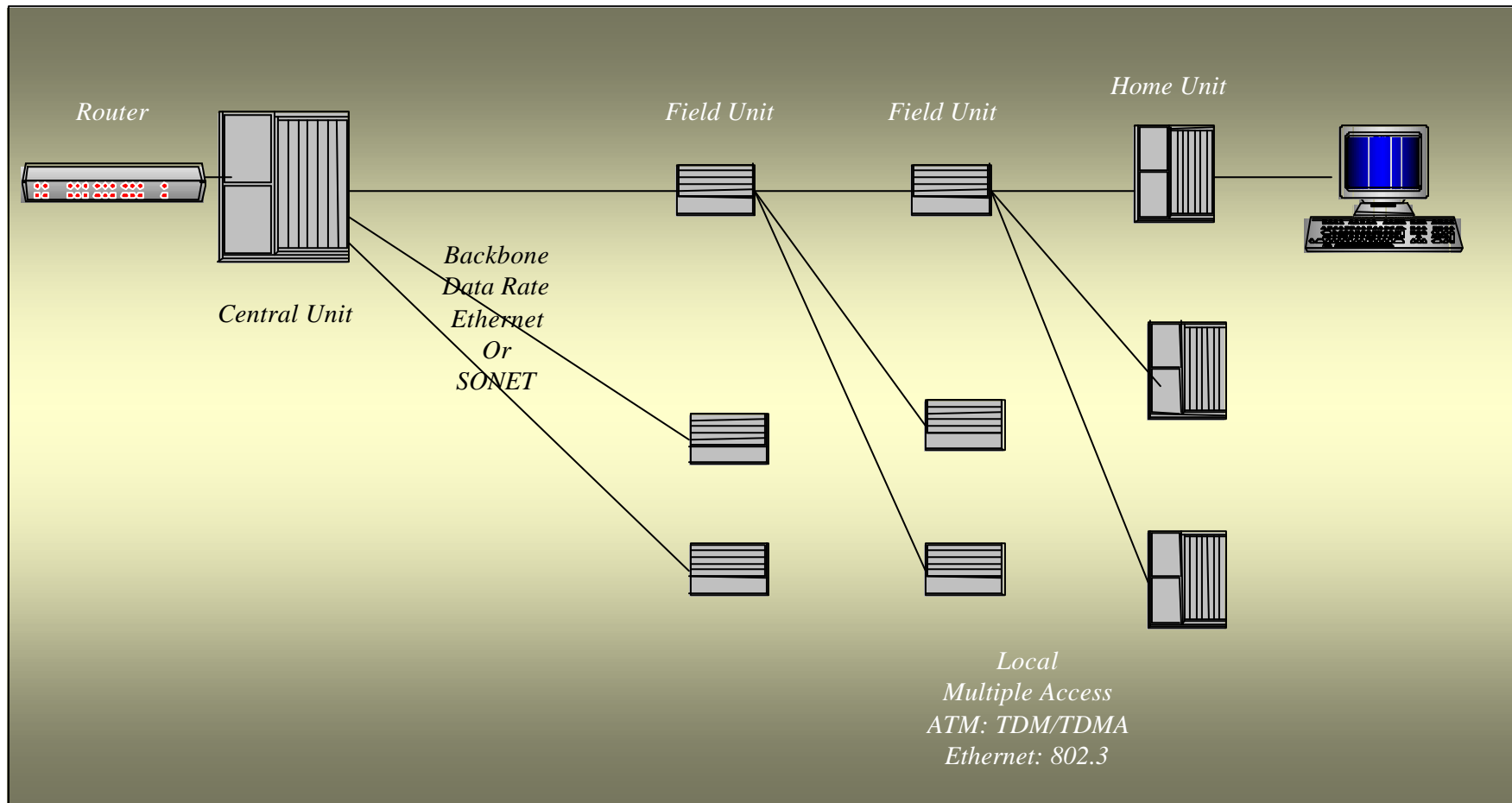
# Ethernet Layer 2, 3 and ATM



# Fiber Rates ATM v GigE

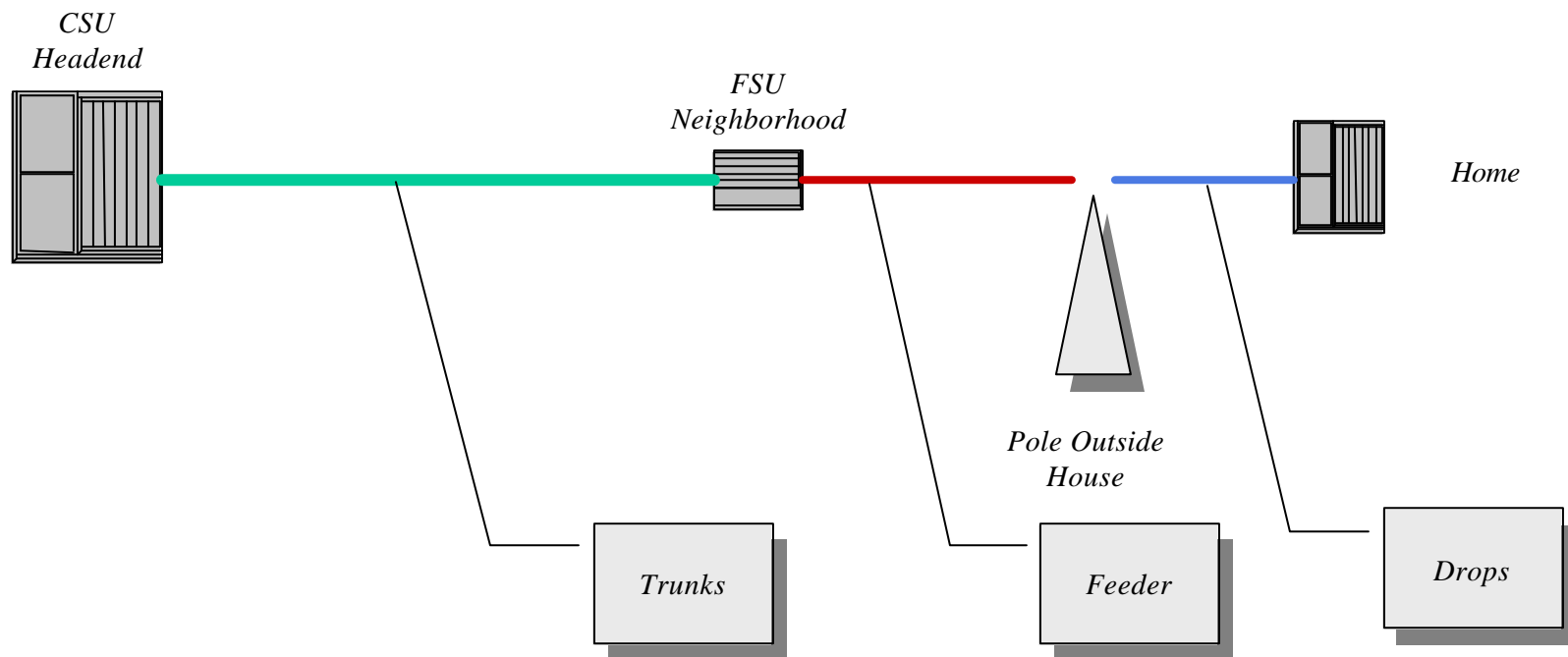


# Basic Architecture





# Generic Fiber Network Elements



# *Local Architecture*

## *Goffstown, NH Sectorization*

| Sector | Population | Percent | Street Miles | Percent |
|--------|------------|---------|--------------|---------|
| 1      | 1,410      | 25%     | 13           | 11%     |
| 2      | 1,410      | 25%     | 14           | 12%     |
| 3      | 1,015      | 18%     | 12           | 10%     |
| 4      | 395        | 7%      | 13           | 11%     |
| 5      | 451        | 8%      | 12           | 10%     |
| 6      | 451        | 8%      | 17           | 14%     |
| 7      | 226        | 4%      | 22           | 18%     |
| 8      | 282        | 5%      | 17           | 14%     |

5,641
100%
120
100%

Total HH: 5,641  
 Total Miles Streets: 120

# *Goffstown, NH Set Back*

| Sector | Street Miles | Average Set Back | Weighted Average Setback |
|--------|--------------|------------------|--------------------------|
| 1      | 13           | 102              | 25                       |
| 2      | 14           | 100              | 25                       |
| 3      | 12           | 200              | 36                       |
| 4      | 13           | 134              | 9                        |
| 5      | 12           | 200              | 16                       |
| 6      | 17           | 277              | 22                       |
| 7      | 22           | 200              | 8                        |
| 8      | 17           | 281              | 14                       |

120

Total Average Set  
Back

156

# *Goffstown, NH Frontage*

| Sector | Street Miles | Average Frontage | Weighted Average Frontage |
|--------|--------------|------------------|---------------------------|
| 1      | 13           | 150              | 38                        |
| 2      | 14           | 150              | 38                        |
| 3      | 12           | 400              | 72                        |
| 4      | 13           | 150              | 11                        |
| 5      | 12           | 200              | 16                        |
| 6      | 17           | 1,067            | 85                        |
| 7      | 22           | 500              | 20                        |
| 8      | 17           | 563              | 28                        |

Total Average  
Frontage

307

# *Goffstown, NH Make Ready*

| Sector | Street Miles | Average Make Ready | Weighted Make Ready |
|--------|--------------|--------------------|---------------------|
| 1      | 13           | 43%                | 11%                 |
| 2      | 14           | 50%                | 13%                 |
| 3      | 12           | 50%                | 9%                  |
| 4      | 13           | 0%                 | 0%                  |
| 5      | 12           | 50%                | 4%                  |
| 6      | 17           | 0%                 | 0%                  |
| 7      | 22           | 0%                 | 0%                  |
| 8      | 17           | 0%                 | 0%                  |

Total Average  
Make Ready

36%

# *Goffstown Aerial*

| Sector | Street Miles | Average Aerial | Weighted Average Aerial |
|--------|--------------|----------------|-------------------------|
| 1      | 13           | 100%           | 25%                     |
| 2      | 14           | 100%           | 25%                     |
| 3      | 12           | 100%           | 18%                     |
| 4      | 13           | 50%            | 4%                      |
| 5      | 12           | 50%            | 4%                      |
| 6      | 17           | 100%           | 8%                      |
| 7      | 22           | 100%           | 4%                      |
| 8      | 17           | 100%           | 5%                      |

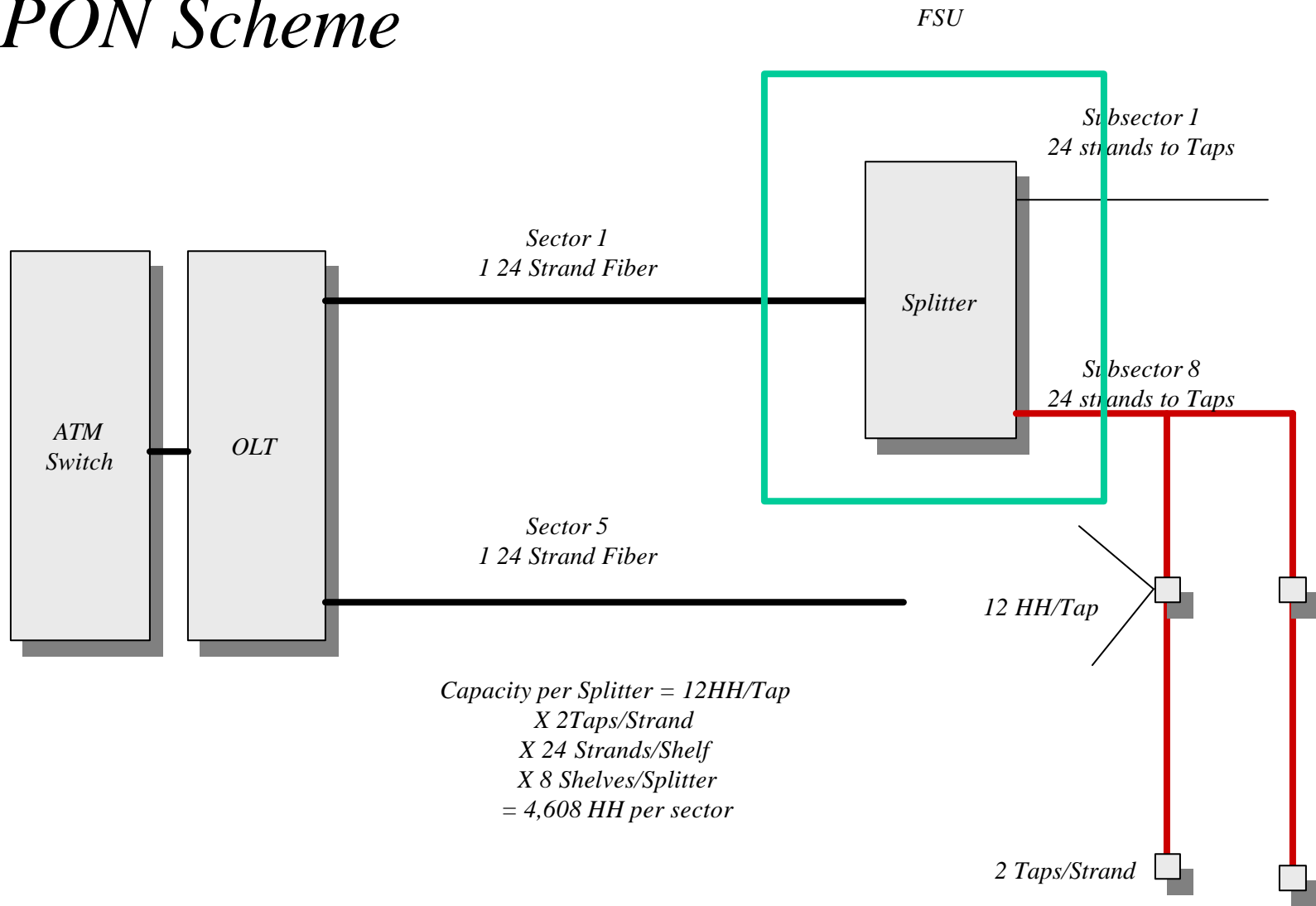
Total Average  
Aerial

93%

# *PON Architecture*



# PON Scheme

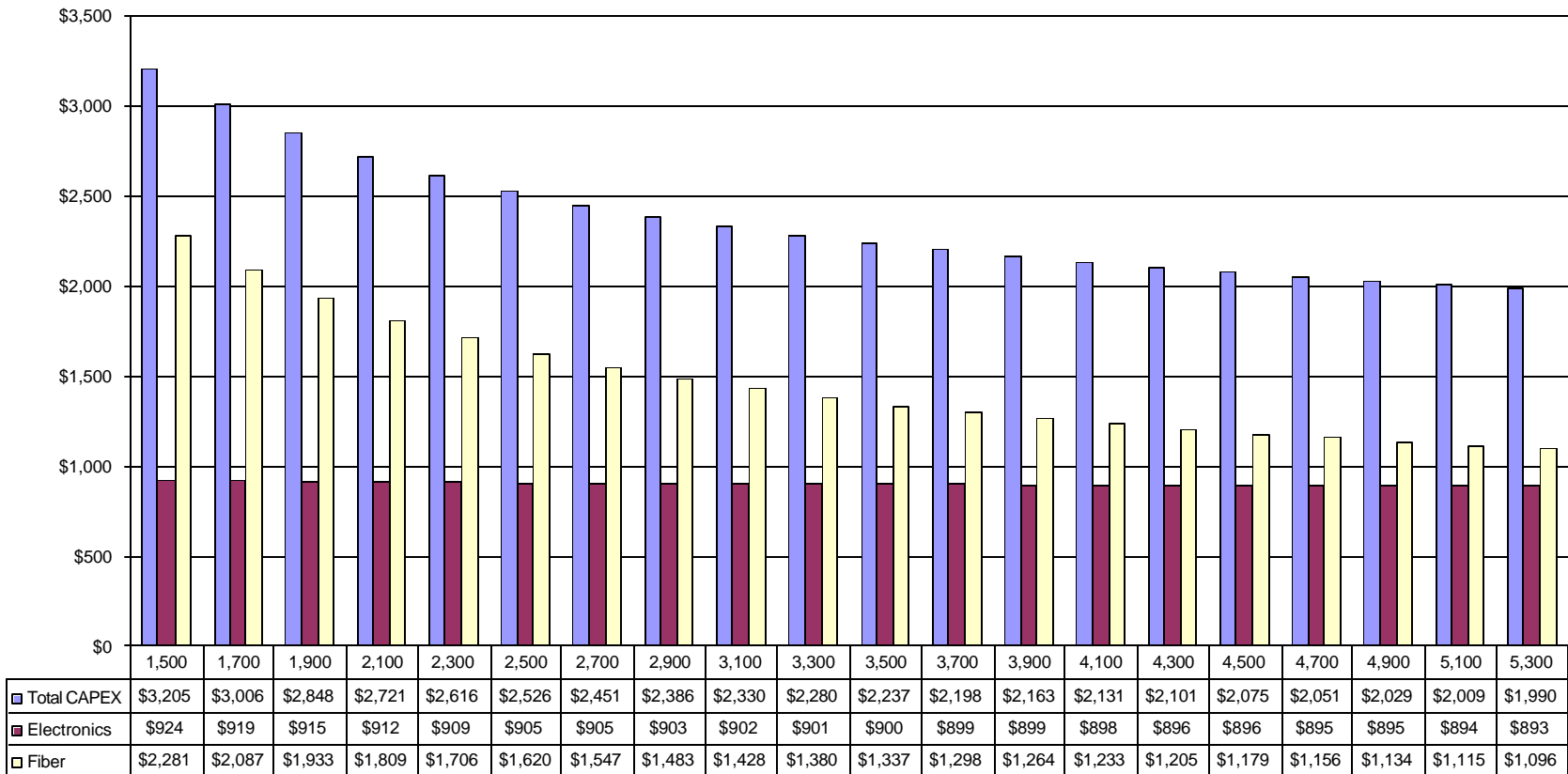


# PON Cost Analysis

| <i>Unit</i>             | <i>Fixed</i> | <i>Variable</i> | <i>Capacity</i>  | <i>Example for 1,000 HH</i> | <i>Per HH CAPEX</i> |
|-------------------------|--------------|-----------------|--|-----------------------------|---------------------|
| EUU, End User Unit      |              | \$1,067         | 1 per user   | \$1,067,000                 | \$1,067             |
| Taps                    |              | \$558           | 12 users per Tap   | \$46,500                    | \$47                |
| Splitter                | \$7,000      | \$1,380         | 8 splitter draws pre cabinet, 576 HH per splitter draw, maximum of 4,608 HH per Splitter cabinet. Typically 5 sectors so 5 splitters | \$41,900                    | \$42                |
| ATM Switch              | \$40,000     | \$4,000         | Max capacity 15 OC-3 Cards, incremental cost per OC-3 Card, user has 2 Mbps at 5% utilization is 100 Kbps per user.                  | \$44,000                    | \$44                |
| OLT PON Card            |              | \$6,000         | Maximum 18 Cards per shelf, capacity of 64 users per card  | \$93,750                    | \$94                |
| OLT Rack                |              | \$10,000        | Maximum of 3 Shelves per rack. 3,456 HH per Rack   | \$10,000                    | \$10                |
| Number HH               |              |                 |  | 1,000                       |                     |
| Total                   |              |                 |  | \$1,303,150                 |                     |
| Total per HH            |              |                 |  | \$1,303                     | \$1,303             |
| Total Fiber Miles       |              | \$25,000        | In town of 80 miles with 70% coverage  | \$1,400,000                 | \$1,400             |
| Drop Cost               |              | \$300           |  | 300,000                     | \$300               |
| Total per HH with Fiber |              |                 |  |                             | \$3,003             |

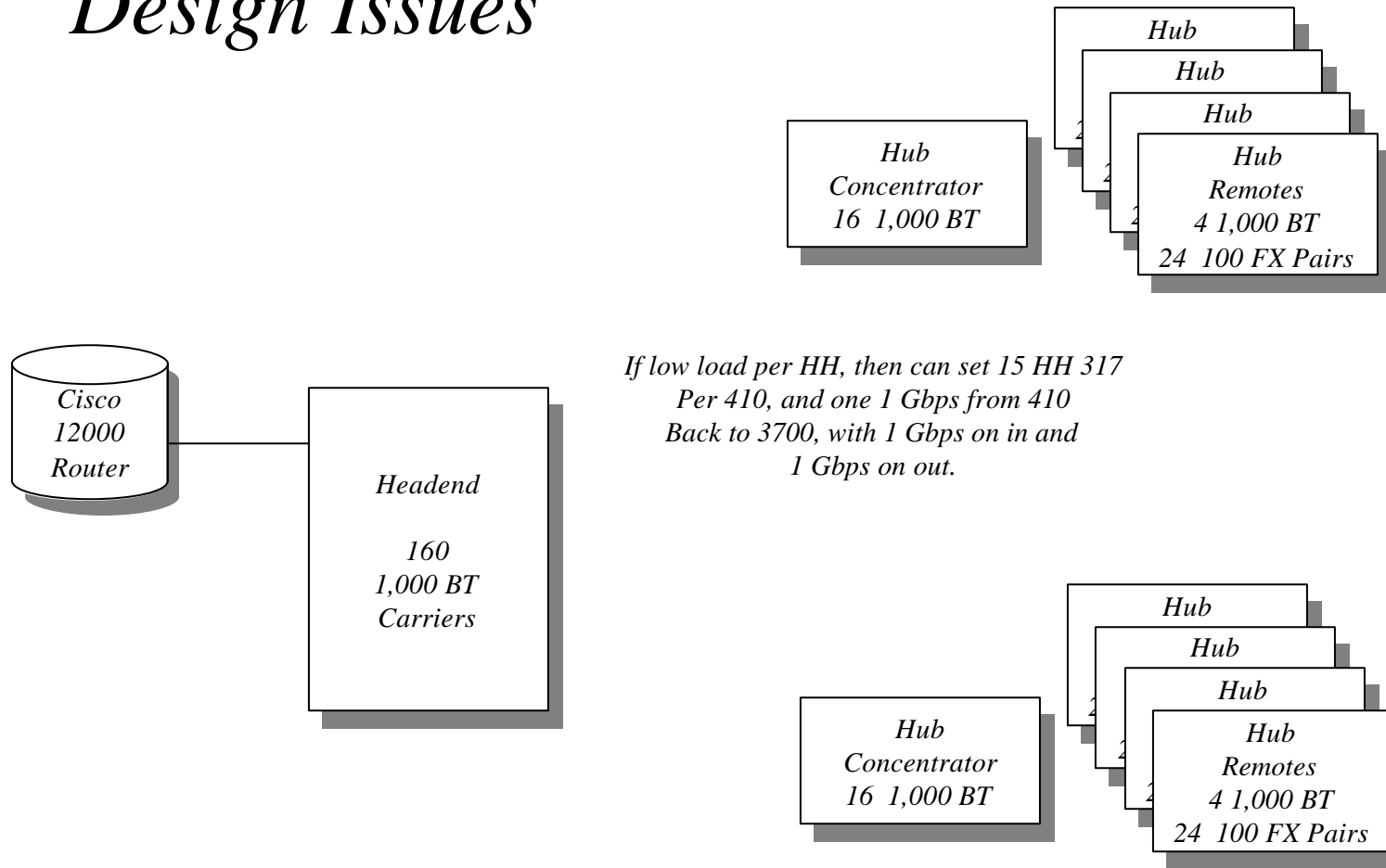
# CAPEX, PON

CAPEX per HH vs Number HH (PON)

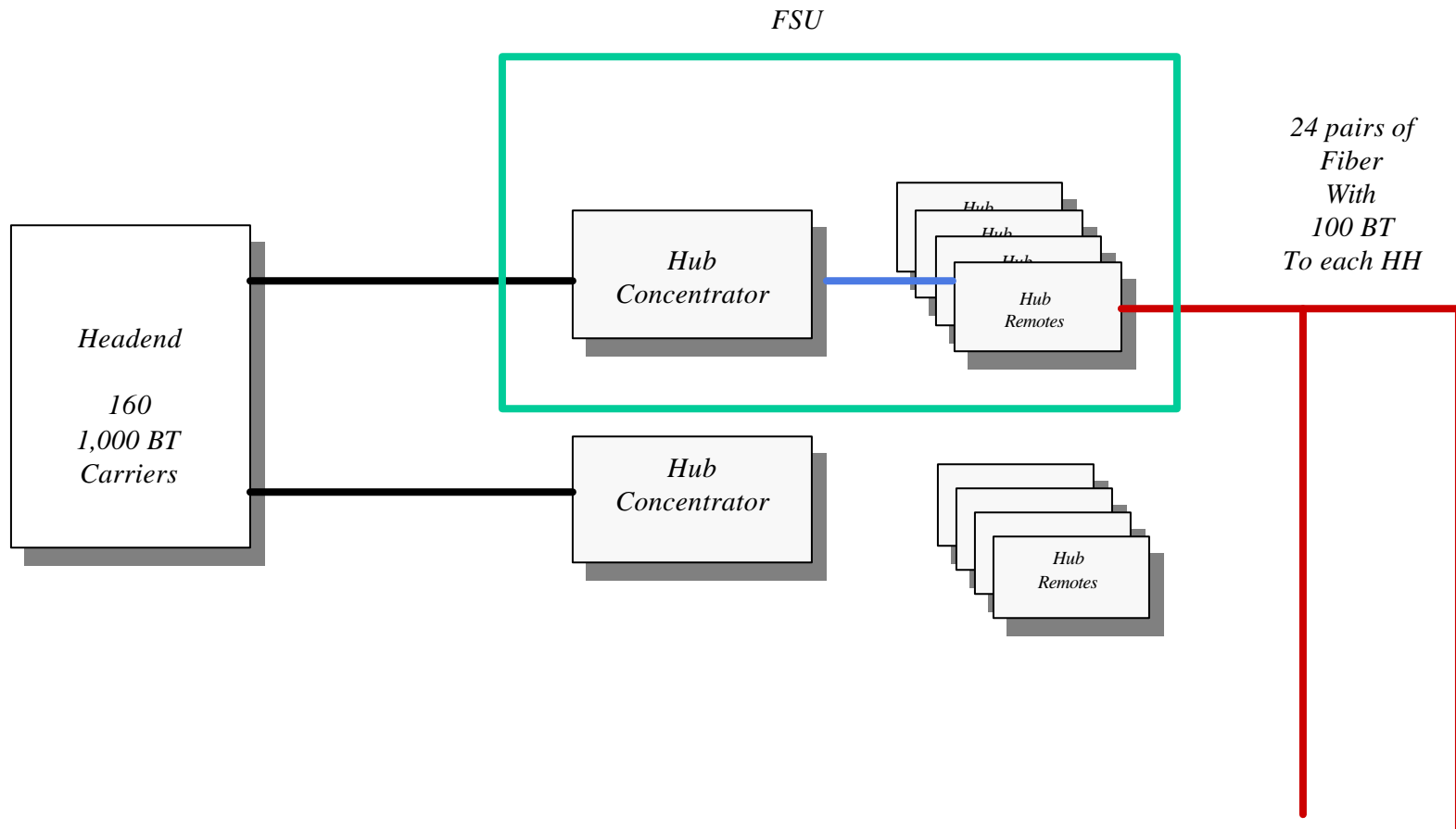


# *GigE Architecture*

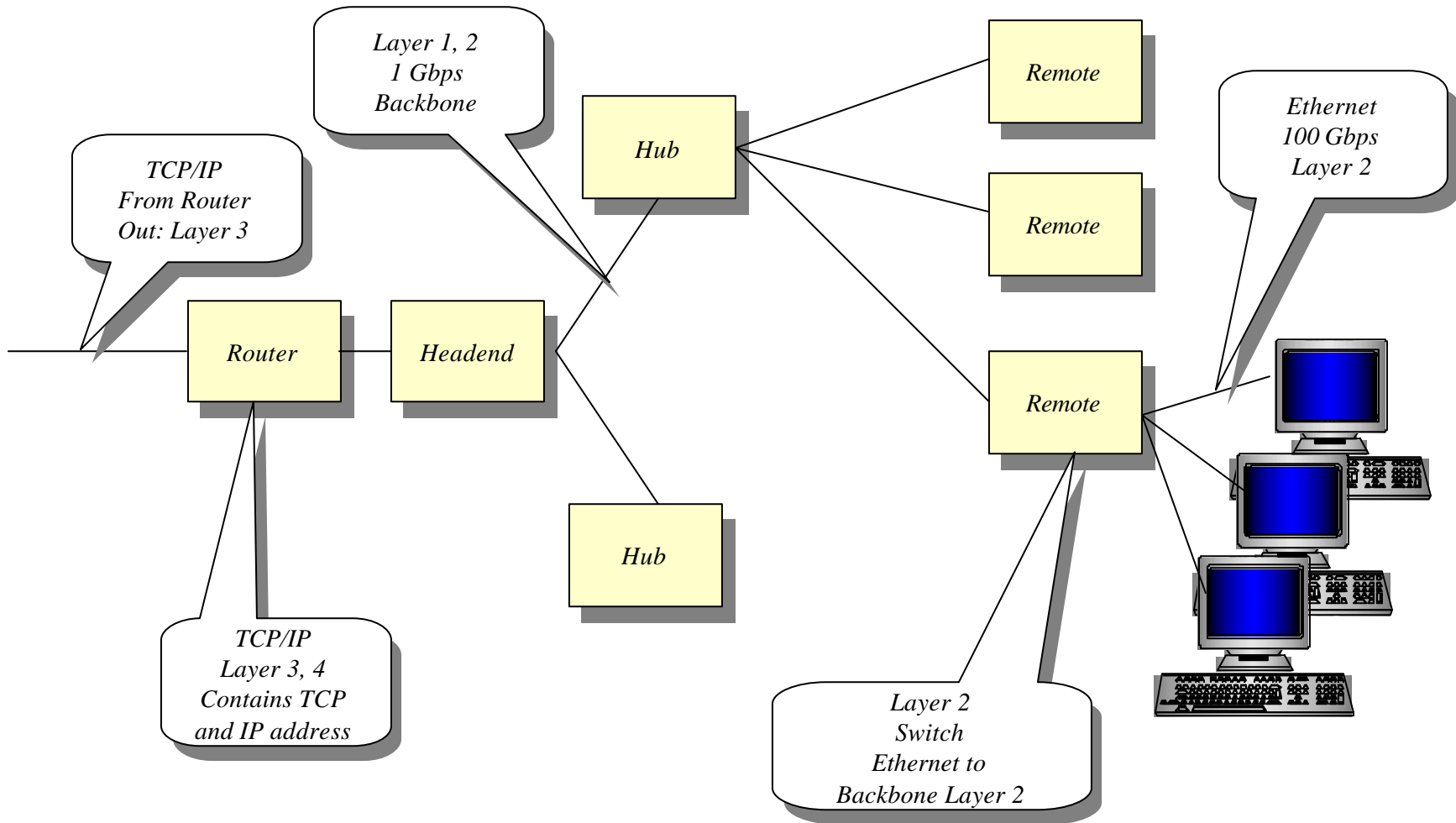
# Design Issues



# System Elements GigE



# GigE Architecture



# CAPEX

| <i>Unit</i>             | <i>Fixed</i> | <i>Variable</i> | <i>Capacity</i>  | <i>Example for 1,000 HH</i> | <i>Per HH CAPEX</i> |
|-------------------------|--------------|-----------------|--|-----------------------------|---------------------|
| EUU, End User Unit      |              | \$1,165         | 1 per user   | \$1,165,000                 | \$1,165             |
| Remote                  |              | \$7,695         | Supports 4 1 Gbps BT and<br>24 100 Mbps port pairs<br>with 10 km range | \$320,625                   | \$321               |
| Concentrator            |              | \$6,995         | Supports 16 1 Gbps BT<br>connections at 10 km range                    | \$34,975                    | \$35                |
| Headend                 | \$190,000    | \$12,000        | Supports 160 1 Gbps BT<br>connections                                  | \$202,000                   | \$202               |
| Number HH               |              |                 |  | 1,000                       |                     |
| Total                   |              |                 |  | \$1,722,600                 |                     |
| Total per HH            |              |                 |  | \$1,723                     | \$1,723             |
| Total Fiber Miles       |              | \$25,000        | In town of 80 miles with<br>70% coverage                               | \$1,400,000                 | \$1,400             |
| Drop Cost               |              | \$300           |  | 300,000                     | \$300               |
| Total per HH with Fiber |              |                 |  |                             | \$3,423             |



# CAPEX per HH

CAPEX per HH vs No HH (GigE)

