# CAF2 Model Overview

CostQuest Associates

Introduction

USF Primer

- Modeling Background
- Modeling Attributes

Overview of CQBAT

- Design Questions
- What is it
- General Assumptions

USF Models

- History
- Advancements

Q/A

# DAY 1, SESSION 1

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Overview of Economic Underpinnings
- Cost
- Basic financial model
- Network Design
- Network Capability
- Annualization
- Greenfield and Brownfield

CQBAT Platform Overview
- Capturing Company and Geographic Specific attributes
- Classifying Service Areas
- Demand Development
- Network Capabilities
- Existing Broadband Coverage
- Data Sources
- The Guts

Q/A

# DAY 1, SESSION 2

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Input Review (and sources)
CQBAT Network Capex Overview
- Middle mile
  - Network routing
  - Assumptions
  - Testing
- Telecom Plant
  - Review Network Topology development
  - Fttd –vs- FTTp
  - Assumptions
  - What is in the CO

# DAY1, SESSION 3

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ACS

Q/A

# DAY 1, SESSION 4

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Network  Capex Overview: session 2

- Network Topologies within CQBAT
- Sizing Assumptions
- Interplay of User Inputs
- Shared cost allocation

Q/A

# DAY 1, SESSION 5

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Opex Overview

- Structure
- Development of Costs and Drivers

Treatment of areas outside the “mainland”

Online CQBAT

- Review of Run time parameters
- Overview Filter fields
- Reporting
- Review Data Dumps
- Review Audit Reports

Q/A

# DAY 2, SESSION 1

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Review of current results

- What runs were filed with the FCC
- Report Results
- Maps

Key issues of a refresh with logic “as-is”

- Use of 2010 Census
- Wire Center boundaries to use
- Customer data to use
- Extent of existing broadband coverage
- Regional Adjustment refresh
- Key Assumptions to review

Q/A

# DAY 2, SESSION 2: 11:00 – 12:30

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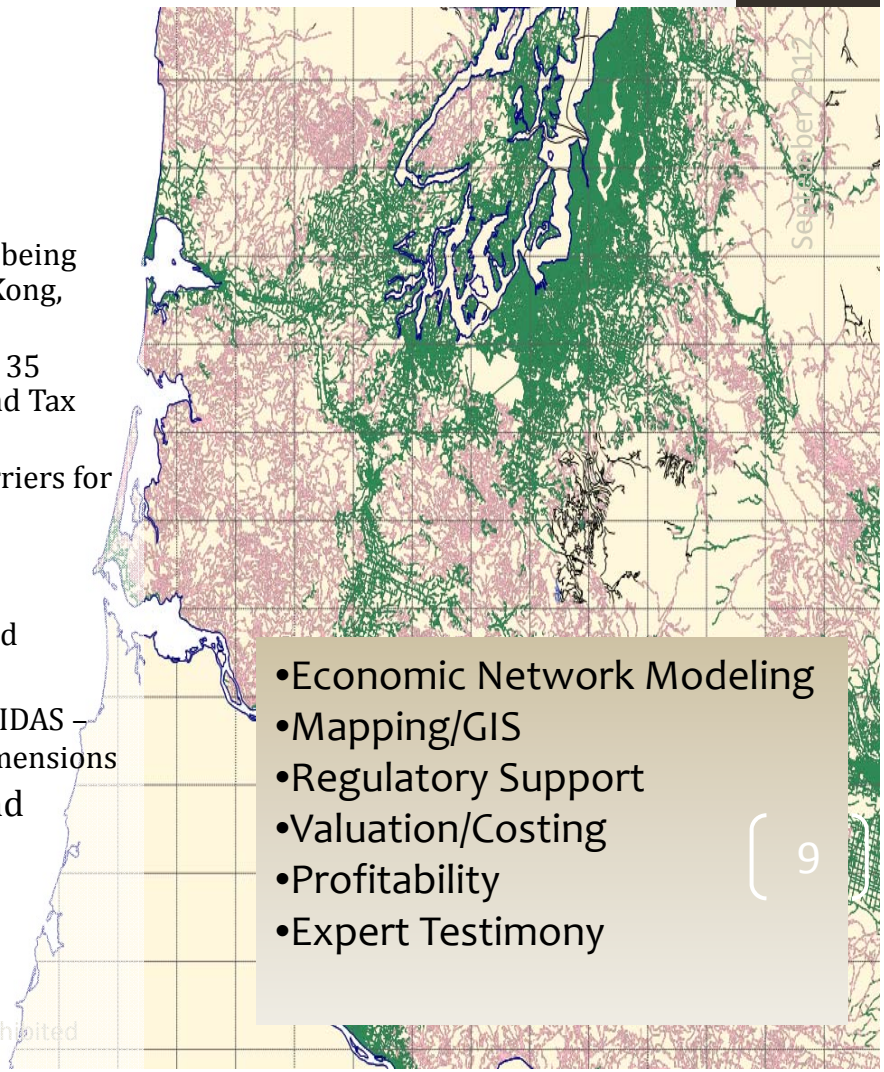
# Introduction

**CostQuest Associates**

- *Cincinnati – Seattle – Washington DC – Birmingham*
- *Formed in 1999*
- Internationally recognized as leading telecommunication network modeling, costing and profitability experts
  - Broadband and USF models: BAM used by FCC for NBP, CQBAT being considered as national USF model, CPM California, CPM Hong Kong, BCPM, NUSC Australia, CostPro-Core New Zealand
  - Loop model: CostPro in use by carriers with operations in over 35 states, adopted and well received by commissions in all UNE and Tax proceedings
  - Wireless Costing: State of Wyoming (Fixed), CTIA, Wireless Carriers for more than 20 states
  - Wireless Work: USAC Filings, Audits and Reviews, USAC/USF Workshops, GIS Analysis, Policy Support, CAF1 Auction Models
  - Interconnection model: CostPro-Core in use by the New Zealand Commerce Commission to set rates
  - Profitability models: COMPASS, MAPS, ProfitMap, CPMS, and MIDAS – economic based contribution models over various business dimensions
- Global experience in developing, supporting regulatory and competitive practices



- Economic Network Modeling
- Mapping/GIS
- Regulatory Support
- Valuation/Costing
- Profitability
- Expert Testimony



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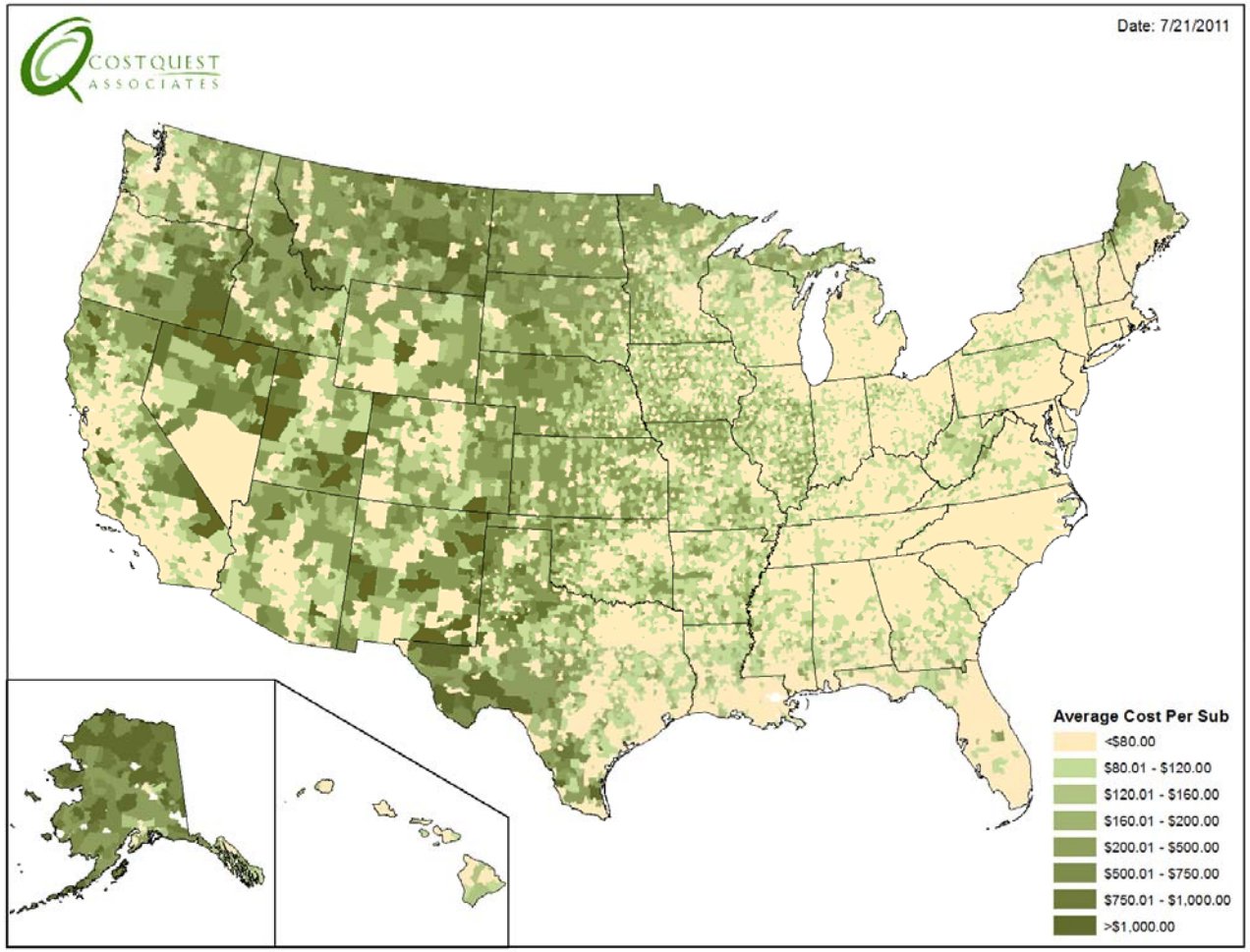
# The Goal

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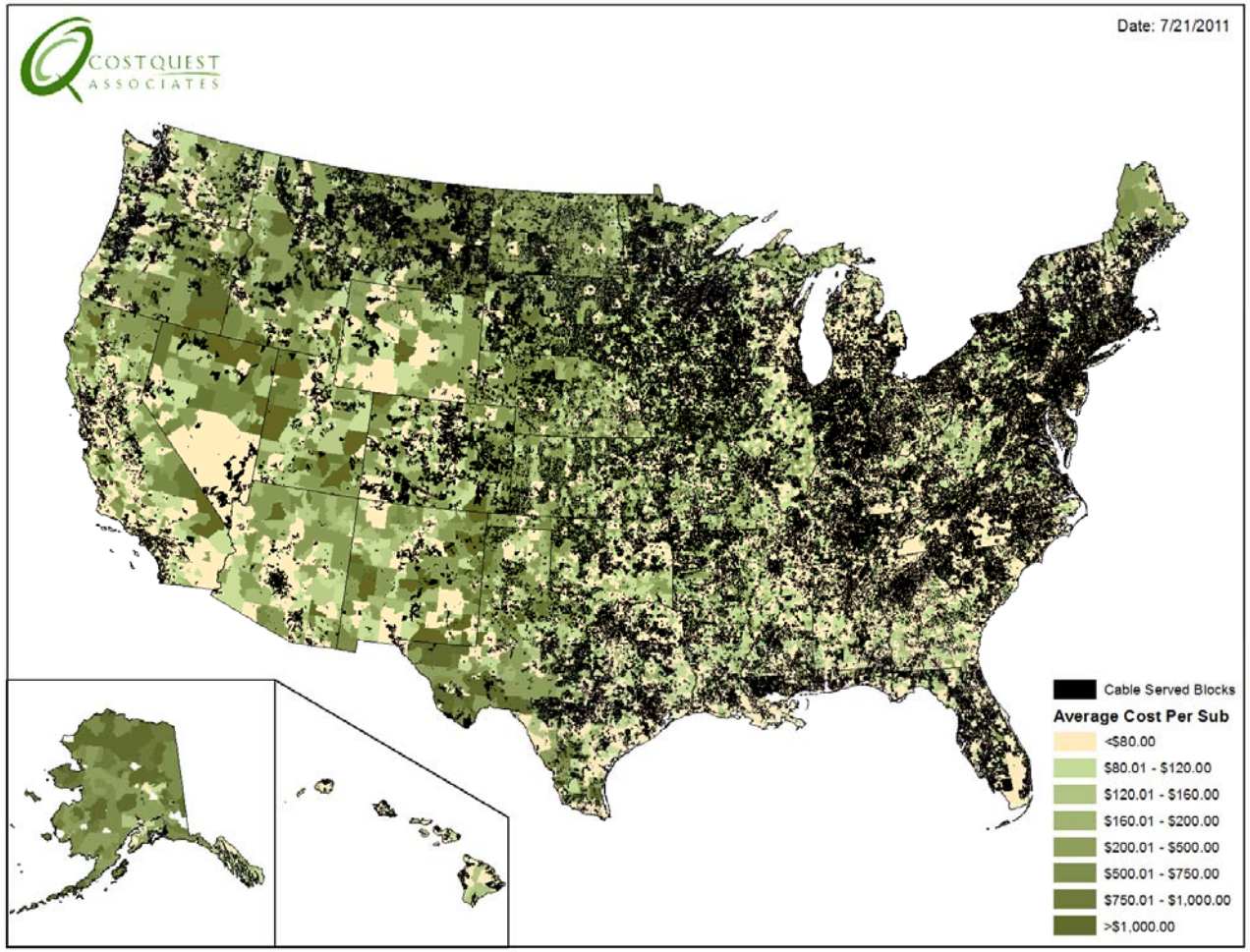
# The Goal

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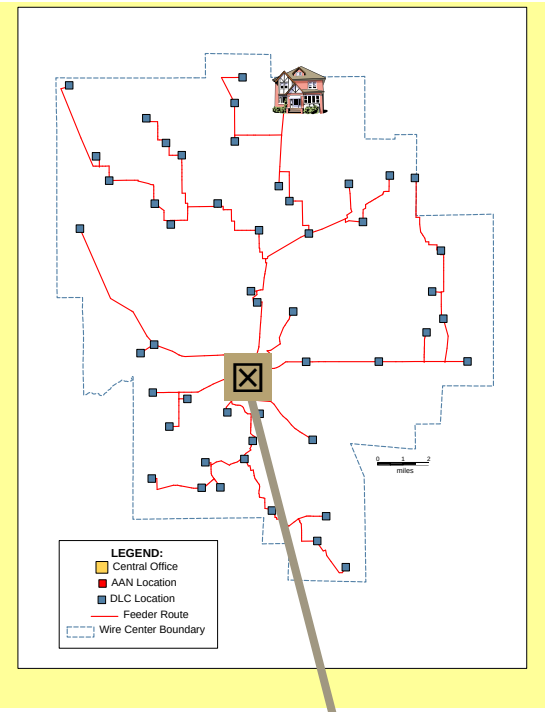
# Telco Network

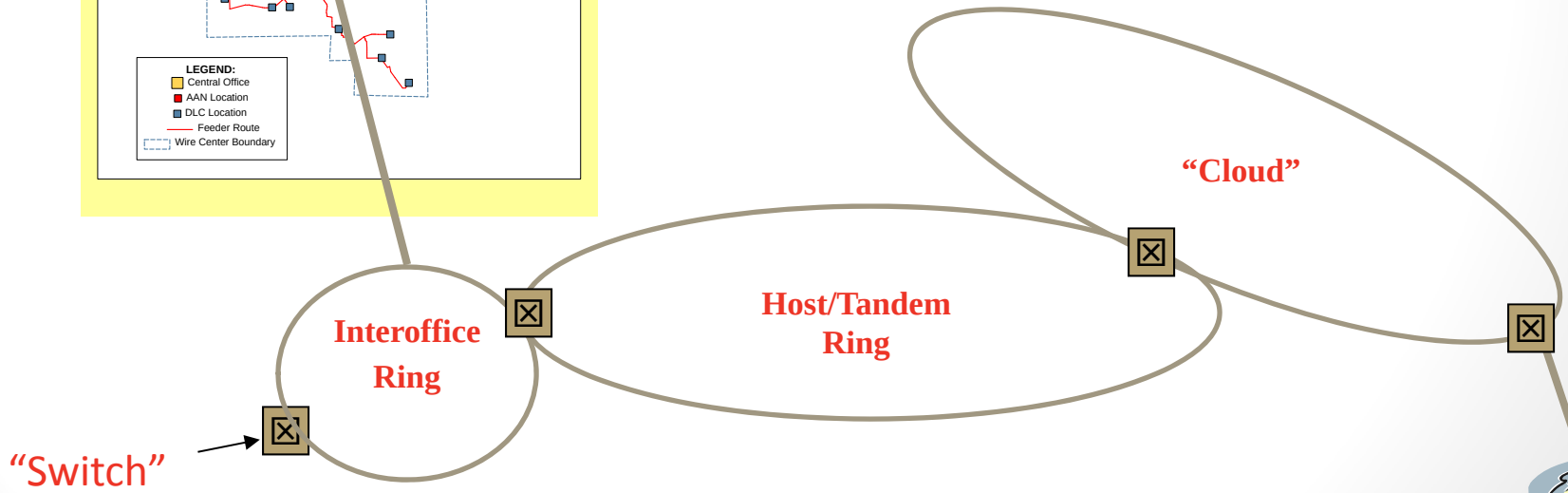



Red – Core network

- "Switch"
- Interoffice network

Yellow Box – Loop network

- DSLAMs
- Access network

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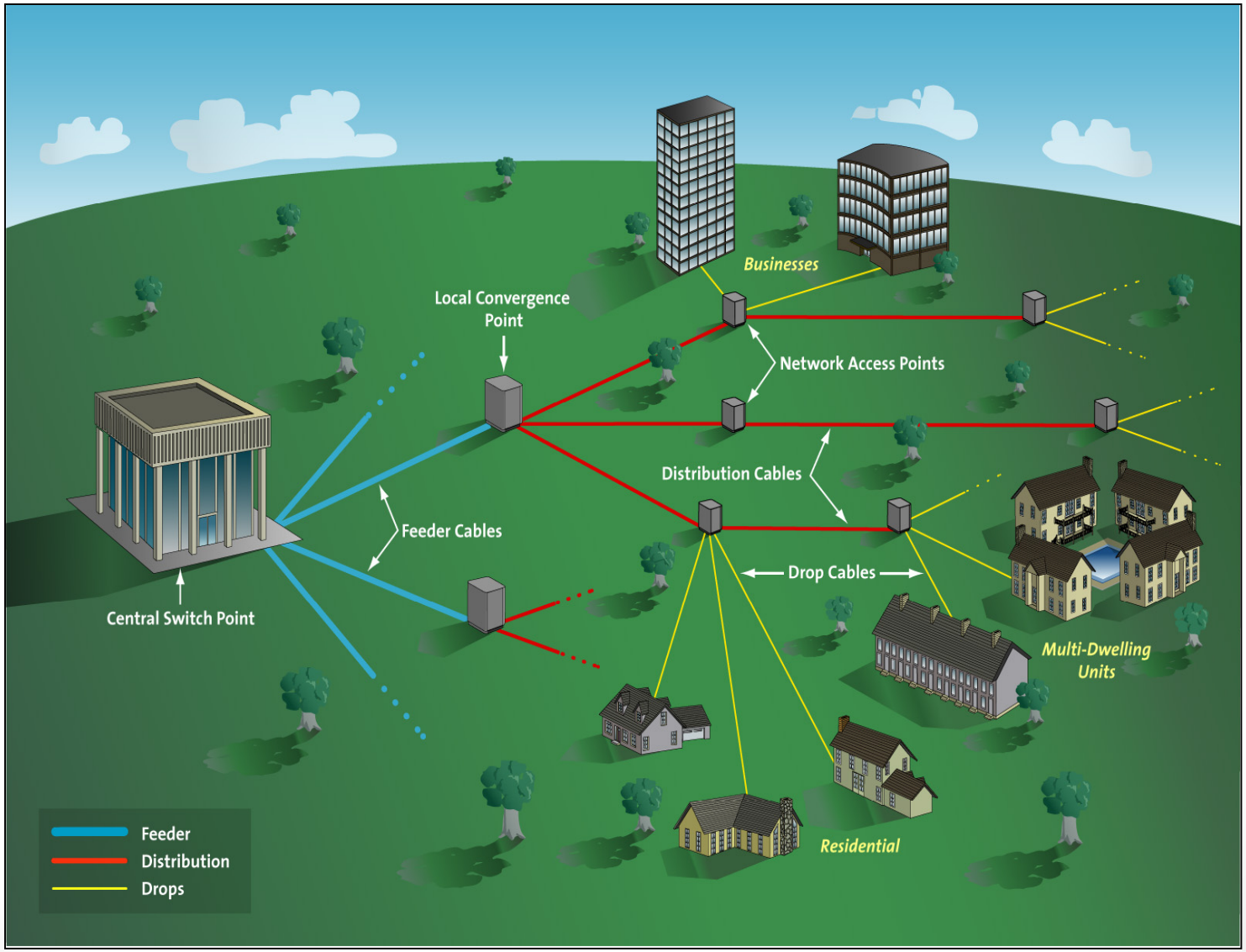
# Local Loop

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# USF MODELING BACKGROUND

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# USF Model Policy Decisions …an initial list

- What technologies will the model assume?
  - Will broadband be supported? At what speeds?
  - Is the network TDM or IP?
  - Is the network Fiber to the Prem or Fiber to a DSLAM?
- What percentage of customers purchase the service?
  - What is the take rate we assume?
  - Do we include POLR costs?
- What is the geographic unit of consideration?
  - ILEC wire centers, Study areas, or Census units?
- What is in and outside of the study?

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# USF Background

**Background**

- As most of you may be aware, the FCC's current universal service system was established over fourteen years ago, with very few updates since its inception
  - At the time, the FCC had just released the Synthesis model as a modern tool for calculating telecommunications costs for purposes of supporting universal service
  - However, the telecommunications landscape has changed dramatically and has left the funding mechanism outdated
  - With new technology, methodology, and data, we're poised to address these issues today

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# USF "Golden Rules"

CC Docket No. 96-45 (FCC 97-157), issued May 8, 1997, paragraph 250

*250. Criteria for Forward-Looking Economic Cost Determinations. Whether forward-looking economic cost is determined according to a state-conducted cost study or a Commission-determined methodology, we must prescribe certain criteria to ensure consistency in calculations of federal universal service support. Consistent with the eight criteria set out in the Joint Board recommendation, we agree* ***that all methodologies used to calculate the forward-looking economic cost of providing universal service in rural, insular, and high cost areas must meet the following criteria****:*

1. ***The technology assumed in the cost study or model must be the least-cost, most-efficient, and reasonable technology for providing the supported services that is currently being deployed.*** *A model, however, must include the ILECs' wire centers as the center of the loop network and the outside plant should terminate at ILECs' current wire centers.* ***The loop design incorporated into a forward-looking economic cost study or model should not impede the provision of advanced services****. For example, loading coils should not be used because they impede the provision of advanced services. We note that the use of loading coils is inconsistent with the Rural Utilities Services guidelines for network deployment by its borrowers. Wire center line counts should equal actual ILEC wire center line counts, and the study's or model's average loop length should reflect the incumbent carrier's actual average loop length.*
2. ***Any network function or element****, such as loop, switching, transport, or signaling, necessary to produce supported services* ***must have an associated cost****.*
3. ***Only long-run forward-looking economic cost may be included****. The long-run period used must be a period long enough that all costs may be treated as variable and avoidable****. The costs must not be the embedded cost of the facilities, functions, or elements.*** *The study or model, however, must be based upon an examination of the current cost of purchasing facilities and equipment, such as switches and digital loop carriers (rather than list prices).*

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# USF "Golden Rules"

4. ***The rate of return must be either the authorized federal rate of return on interstate services, currently 11.25 percent**, or the state's prescribed rate of return for intrastate services. We conclude that the current federal rate of return is a reasonable rate of return by which to determine forward looking costs. We realize that, with the passage of the 1996 Act, the level of local service competition may increase, and that this competition might increase the ILECs' cost of capital. There are other factors, however, that may mitigate or offset any potential increase in the cost of capital associated with additional competition. For example, until facilities-based competition occurs, the impact of competition on the ILEC's risks associated with the supported services will be minimal because the ILEC's facilities will still be used by competitors using either resale or purchasing access to the ILEC's unbundled network elements. In addition, the cost of debt has decreased since we last set the authorized rate of return. The reduction in the cost of borrowing caused the Common Carrier Bureau to institute a preliminary inquiry as to whether the currently authorized federal rate of return is too high, given the current marketplace cost of equity and debt. We will re-evaluate the cost of capital as needed to ensure that it accurately reflects the market situation for carriers.*
5. ***Economic lives and future net salvage percentages used in calculating depreciation expense must be within the FCC-authorized range**. We agree with those commenters that argue that currently authorized lives should be used because the assets used to provide universal service in rural, insular, and high cost areas are unlikely to face serious competitive threat in the near term. To the extent that competition in the local exchange market changes the economic lives of the plant required to provide universal service, we will re-evaluate our authorized depreciation schedules. We intend shortly to issue a notice of proposed rule making to further examine the Commission's depreciation rules.*
6. *The cost study or model must estimate **the cost of providing service for all businesses and households within a geographic region**. This includes the provision of multi-line business services, special access, private lines, and multiple residential lines. Such inclusion of multi-line business services and multiple residential lines will permit the cost study or model to reflect the economies of scale associated with the provision of these services.*


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# USF "Golden Rules"

7. ***A reasonable allocation of joint and common costs*** *must be assigned to the cost of supported services. This allocation will ensure that the forward-looking economic cost does not include an unreasonable share of the joint and common costs for non-supported services.*
8. *The cost study or model and all underlying data, formulae, computations, and software associated with the model must be available to all interested parties for review and comment.* ***All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible****.*
9. ***The cost study or model must include the capability to examine and modify the critical assumptions and engineering principles.*** *These assumptions and principles include, but are not limited to, the cost of capital, depreciation rates, fill factors, input costs, overhead adjustments, retail costs, structure sharing percentages, fiber-copper cross-over points, and terrain factors.*
10. ***The cost study or model must deaverage support calculations to the wire center serving area level*** *at least, and, if feasible, to even smaller areas such as a Census Block Group, Census Block, or grid cell.* ***We agree with the Joint Board's recommendation that support areas should be smaller than the carrier's service area in order to target efficiently universal service support****. Although we agree with the majority of the commenters that smaller support areas better target support, we are concerned that it becomes progressively more difficult to determine accurately where customers are located as the support areas grow smaller. As SBC notes, carriers currently keep records of the number of lines served at each wire center, but do not know which lines are associated with a particular CBG, CB, or grid cell. Carriers, however, would be required to provide verification of customer location when they request support funds from the administrator."*


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# Benefits of a FLEC

- The benefits of a properly developed forward looking economic cost (FLEC) model for universal service include:
  - Clarification of concepts of the least-cost provider
  - Normalization of participants
  - Metrics and analytics to examine issues such as targeting, reserve levels for auctions, service definitional changes, etc..
  - An avoidance of asymmetric embedded costs mechanisms
  - A less onerous process for stakeholders and policy makers
  - A clear link between defined service and costs developed
  - Superior incentives

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# USF MODELING ATTRIBUTES

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# Model Definitions

- Every current universal program relies upon both a "cost model" and a "support model"
- Definitions:
  - "Cost Model": A systematized collection of mathematical procedure that takes as inputs geographic and non-geographic data and that produces an estimate of the cost of providing a telecommunications service
  - "Support Model" : A mathematical procedure that takes cost and other factors as inputs and that produces a universal service support amount for a carrier or customer
    - This is sometimes called a "support mechanism"

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# Modeling Issues

- Cost modeling issues
  - Forward-looking -vs- embedded costs
  - Modeling object
  - Technology choice
  - Source of input data
  - Accuracy of results
  - Reflecting an efficient carrier
- Support modeling Issues
  - Participants
  - Averaging of costs
    - Statewide, Study Area
  - Benchmarks for support eligibility
  - State versus Federal portions

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# Cost Model Basics

- Model Basics
  - Cost = Investment * ACF + Direct Opex + Shared and Common
- Components of Costs
  - Investment Models: Loop, Switching, and Interoffice
    - Today's focus is on the Loop
      - History
      - Current approaches
      - Outputs
  - Annual Charge Factor Models (not covered)
    - Depreciation, Taxes, Cost of Money
  - Opex Models (not covered)
    - Operations, Shared, Common

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# Cost Model Policy Decisions

- What technologies will the model assume?
  - Will broadband be supported? At what speeds?
- Should any existing facts about carrier networks be recognized?
  - Carrier nodes?
- What assets lives for depreciation and cost of money should be used?
- Where facilities (such as poles) serve more than one utility, how should costs be allocated?
  - What geographic factors will be considered?
    - Soils? Climate? Land cover?
- What percentage of customers will decline to purchase the service?
  - What scale should the cost output take?
- What is the geographic unit of consideration?
  - Is the ILEC wire center the proper unit?
  - Or should it be Study areas? Census units? Etc..

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# Support Model

- With regard to Support, model allows the ability to adjust the design attributes to understand the impact and make informed policy recommendations
- Key Parameters for Support can include;
  - Identify participants in the funding
  - Establishing a geographic basis for averaging (wire center, carrier, county, census block etc…)
  - Establishing services included
  - Utilization of a cap
  - The benchmarks to be used for funding (revenue, cost, funding caps etc..)
    - And extent of the benchmark
  - Determination of the Federal-State portioning (what level of the fund is covered Federally and at the State level)

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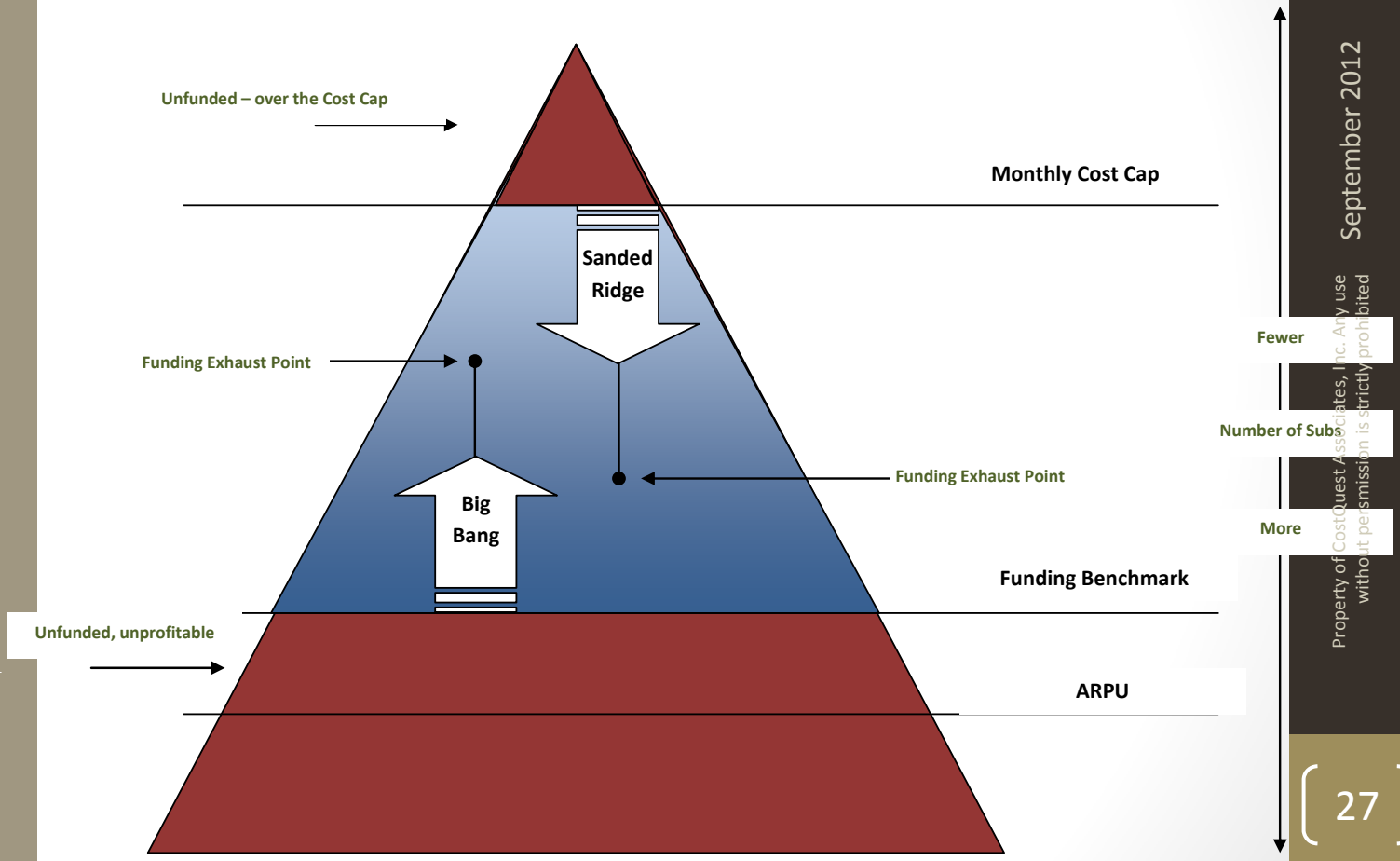
# Support Approach

## Funding Approach

- "Big Bang" starts at a benchmark – stretches limit funds to most subscribers, but may not help highest cost subscribers
- "Sanded Ridge" starts at a cost cap – impacts the highest cost subscribers but may not be financial secure for providers
- Funding limit impact: raise benchmark, drop cap, or both

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High Level overview

Review of General Assumptions

Overall Design

# OVERVIEW OF CQBAT

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# What is CQBAT

- The CostQuest Broadband Analysis Tool or CQBAT
  - Overall Design
    - Scorched node
    - Forward looking
    - New network built to all locations (POLR)
    - Active customers hooked up with broadband service
  - Contemporary / real-world wireline systems engineering standards are used for the modeling of the networks
    - More specifically, the use of industry standard engineering practices for landline deployments are used because they have been tested and confirmed against forward-looking standards in a wide array of regulatory proceedings and field tests

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# What is CQBAT

- The CostQuest Broadband Analysis Tool or CQBAT
  - The model employs long standing capacity costing techniques to estimate economically rational augmentation investments reflecting real world engineering capacity exhaust dynamics
    - Network build out will be based on deployment from known/existing LEC COs
    - The current service provider will continue to supply the service area
    - Smaller companies have the opportunity to join purchasing agreement with other small companies reducing scale economies
  - Coverage
    - Cable coverage based on SBDD
    - Wireless coverage based on SBDD
    - Telco coverage based on SBDD
  - Network
    - IP based network
    - Focus on cost of data "Pipe“
    - No Video gear (including STB) installed
    - No Voice Gateway installed

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# What is CQBAT

- The CostQuest Broadband Analysis Tool (CQBAT) helps to answer:
  - What new network facilities will need to be built to provide sustainable/affordable access?
  - What will it cost to deploy those networks?
  - What will it cost to operate those networks?
  - Where is support required to encourage and support build outs?
  - Will the resulting business opportunities make economic sense?

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# CQBAT Assumptions

- What take rate should be used?
  - 90%
- Should a steady state be used for demand - or should a growth factor (or loss factor) in customer take rate be included over some mid-term time period - 5 to 10 years?
  - Keep it simple
    - Size the OSP network (e.g., Fiber, copper, terminal locations) to serve all potential customers
    - Size the Hardwired/Common equipment to serve the maximum expected demand, along with some engineering fill factor
    - Size success based capital (e.g., Line cards, modems, etc..) to the levelized demand (along with some spare capacity)
- What Cost of Money should be used?
  - 9%
- Should capital and operational cost inputs be varied by region?
  - Yes…see RegionalCostAdjustment table
- What gauge copper should be used for the distribution plant?
  - Use 24 gauge in all cases
- How should the cost be unitized?
  - By Active Customers
- How do we classify companies to size
  - Based on user controlled inputs…see OCNCoSize discussion

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# CQBAT Assumptions

- How should plant mix be determined?
  - Vary by density and network type…see PlantMix table
- Do we run Drops to all households or only Active customers?
  - Only to Working locations
- Should we adjust capex cost to capture purchasing power?
  - Provide functionality - but assume no difference
- What is the Busy Hour Bandwidth we should build to
  - Used levelized approach that covers basic data requirements …video and voice products are NOT being modeled
- How do we share the network cost with business services
  - Based on services demanded and capacity cost approach to apportionment
- What services should be modeled to businesses?
  - See "Service-Customer Creation" rules in later session
- What are the design Rules for copper and fiber designs
  - See "CopperDesign" and "FiberDesign" rules in later session
- What lives of assets should be used?
  - Use values used in BAM, which are within the FCC life range
- Where do we stop modeling the network
  - From Customer demarcation to Router on the “Cloud”





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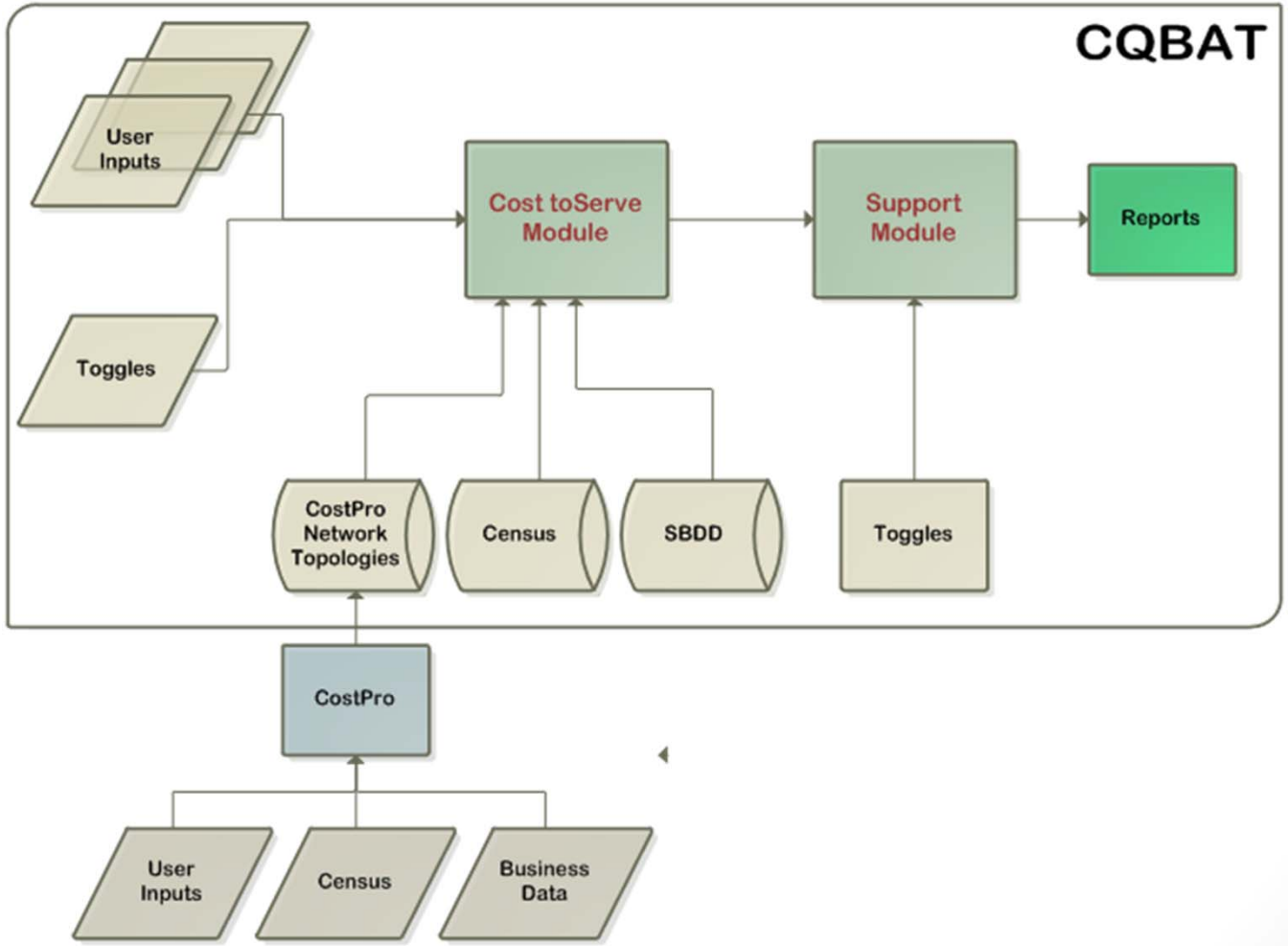
# CQBAT Design

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# COMPARISON TO PRIOR USF MODELING APPROACHES

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# Historical USF Models

- History
  - BCM
  - CPM
  - BCPM
  - Hatfield -- > HAI
  - Synthesis Model

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# The FCC's Current Model

- History
  - The FCC's "Synthesis Model" – Released and implemented in 1999
  - BCPM and HAI were reviewed as potential models
    - Are still used in a number of states
  - Synthesis model contained
    - New FCC developed loop model – HCPM
    - HAI switching and transport
    - Flavors of the BCPM
  - Blending and testing performed by FCC staff
  - In 2003, the models underlying code was changed from TurboPascal to Delphi


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# The FCC's Current Model

- Major Data Inputs
  - Customer locations
  - Line counts
    - Switched – residential and business
    - Special access
  - Other geographic data
    - Soils
    - Depth to bedrock
  - Cost tables for purchase and installation of equipment, operation of networks
  - ARMIS data used to derived operational costs

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# The FCC's Current Model

- Service provided:
  - From established central office locations
  - Using twisted pair wireline technology
  - Provides access to advanced services by limiting wire runs to about 18kft
    - Advanced services at the time of the model development was 28.8kbps modem service
    - Can support DSL deployment but not designed nor does it contain all the electronics for DSL
- Customers equally distributed along roadways
- Network Assumptions:
  - Feeder plant built along the four cardinal compass points, not roadways.
  - Assume that unit cost of business and residential switched lines has equal cost
  - Assume special access voice-equivalent channels have a uniform cost that bears a nationally uniform relationship to switched circuit cost

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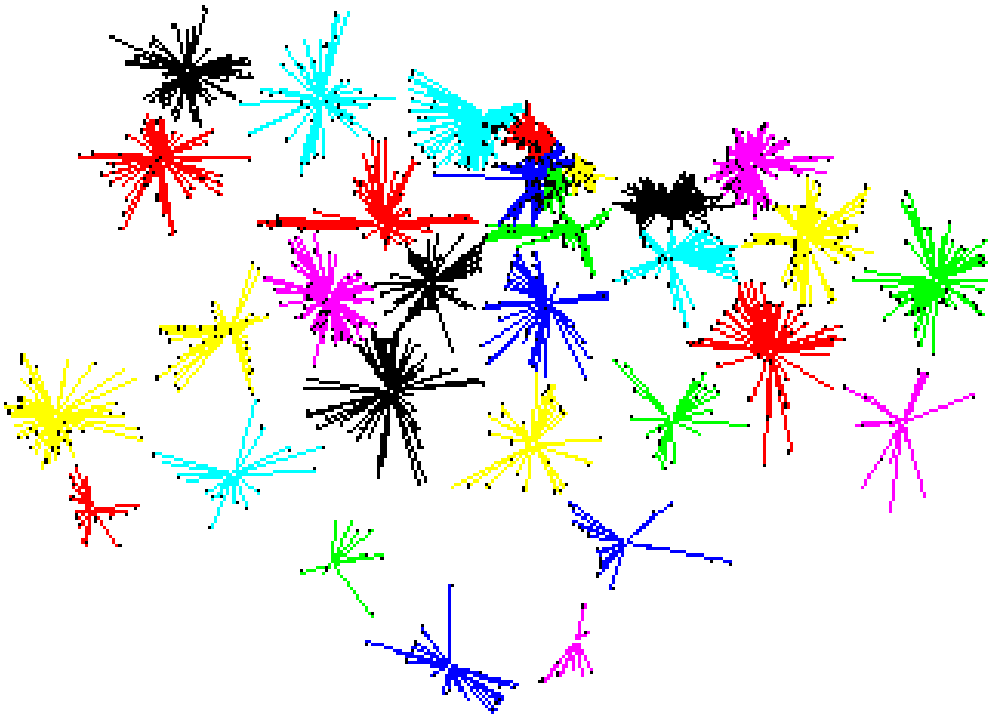
# SM: Clustering Customers to form Engineering Areas



*Material courtesy of William Sharkey (FCC)*

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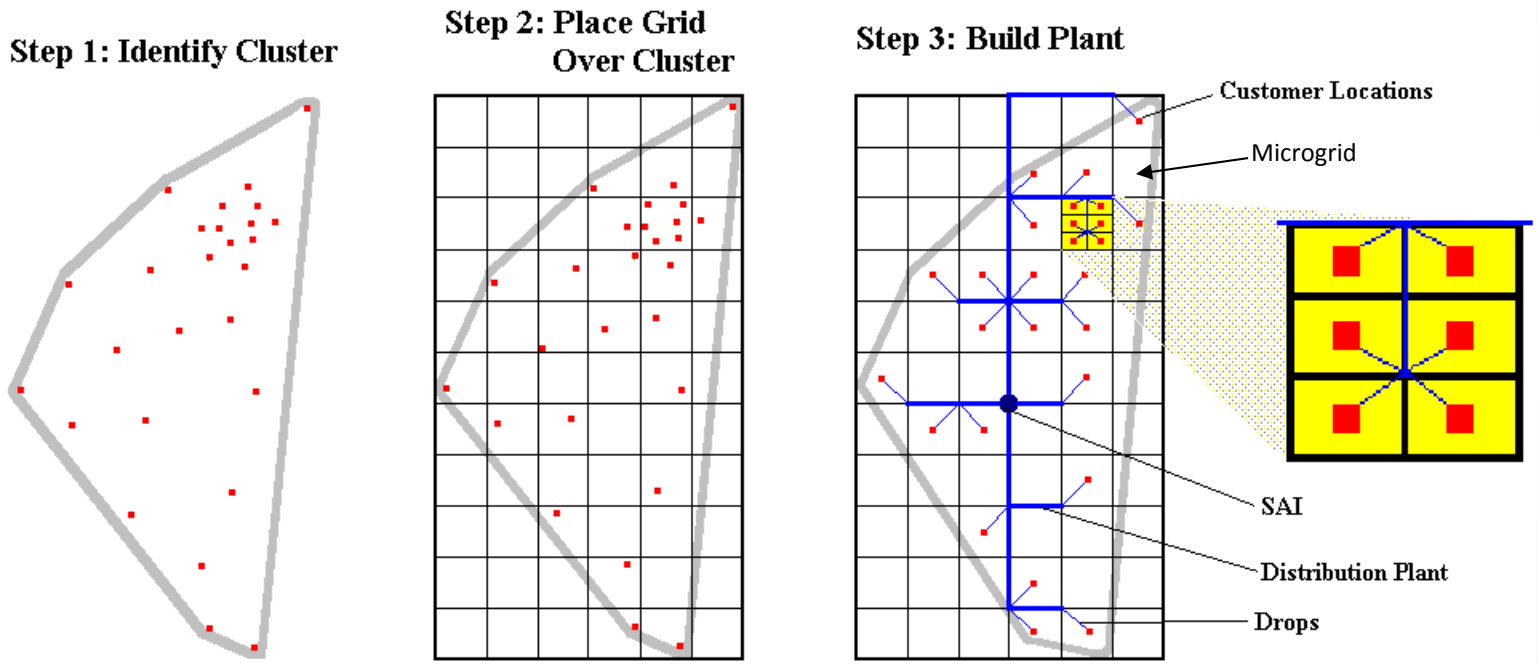
# SM: Grid Overlay for Every Serving Area (Cluster)

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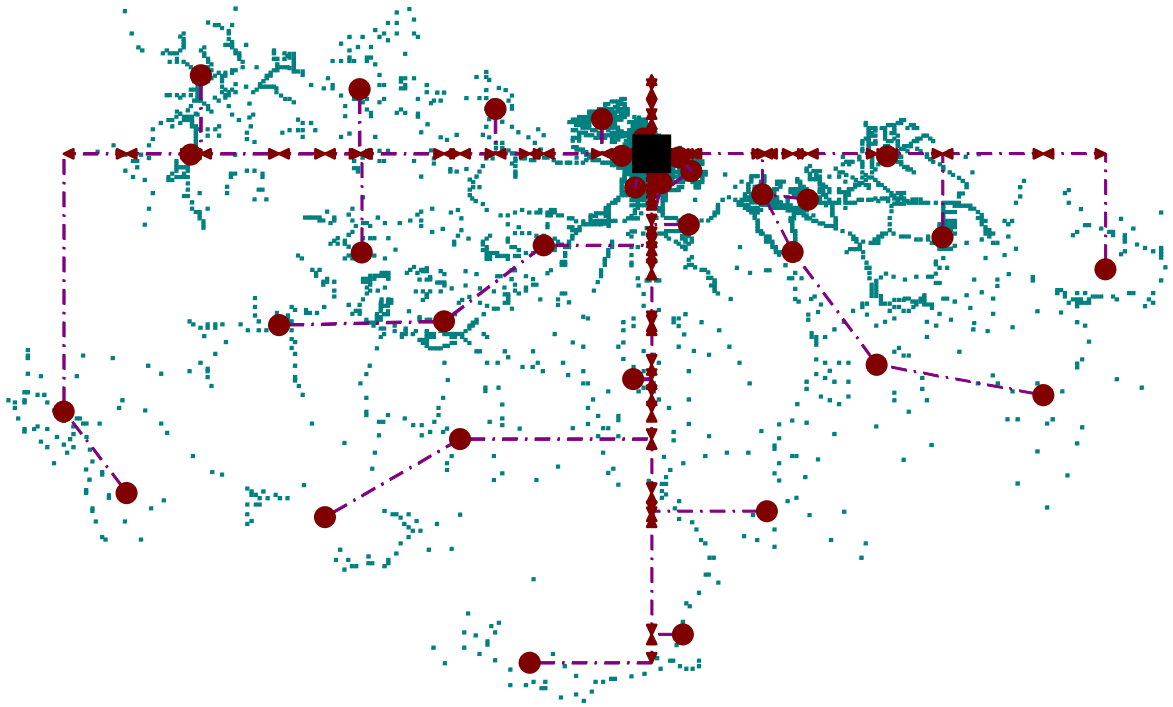
# SM: Feeder Network



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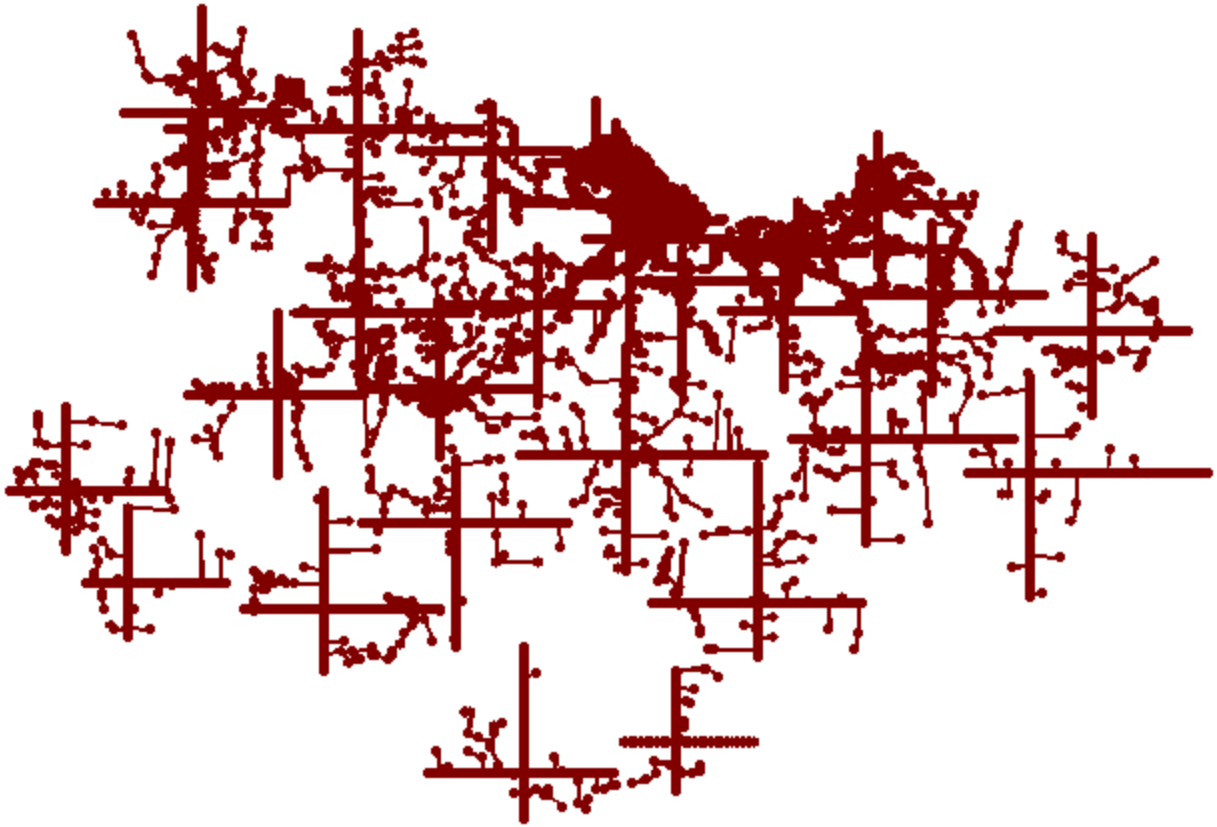
# SM: Distribution Network



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# The FCC's Current Model

- Cost Model Outputs
  - The Synthesis Cost Model produces a cost, per line, of providing universal service, averaged by wire center
    - Results are subsequently rolled up to a statewide average
  - Cost output details are shown for various kinds of investment and expenses
  - Alternative possible outputs are cost averaged by density zone
  - Today, the Synthesis Cost Model outputs are used primarily as inputs to the Support Model for non-rural carriers
    - Has been used in some UNE proceedings

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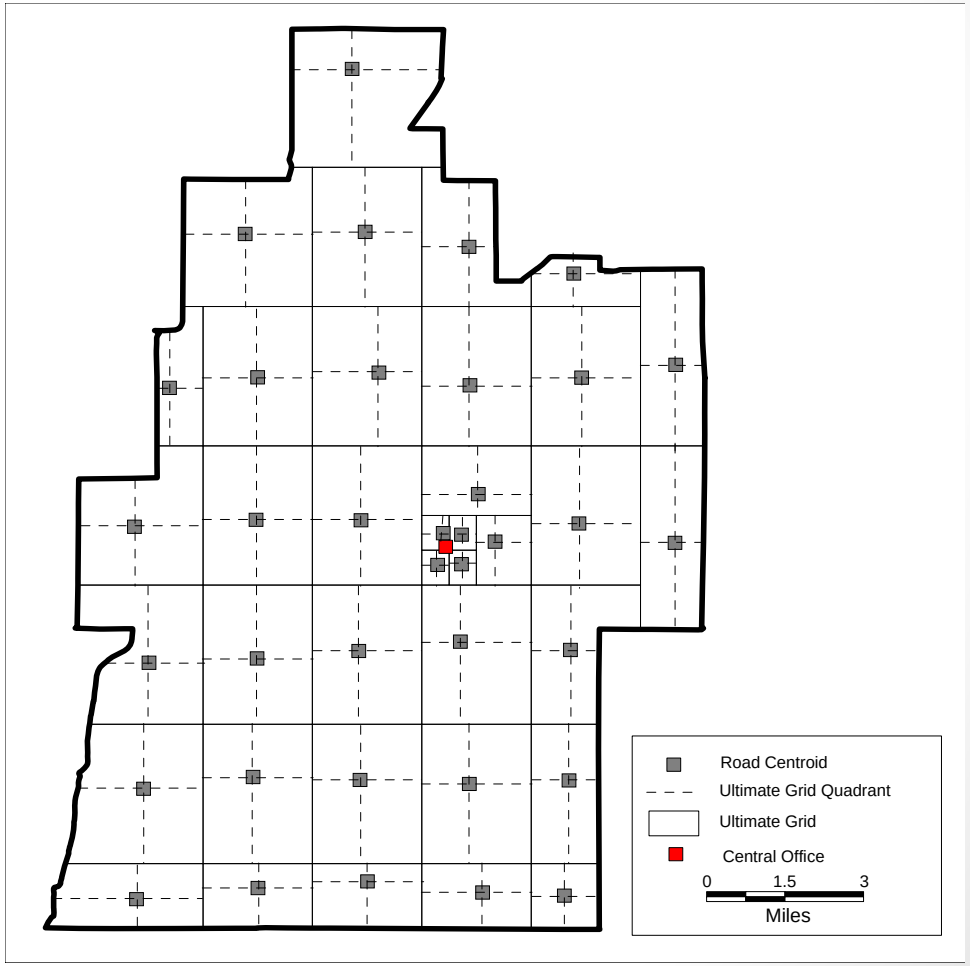
# BCPM: Grids, CSAs, and Quadrant Distribution Plant

**Road Centroids and Distribution Quadrants**
**Red Oak, IA**
**Wire Center**

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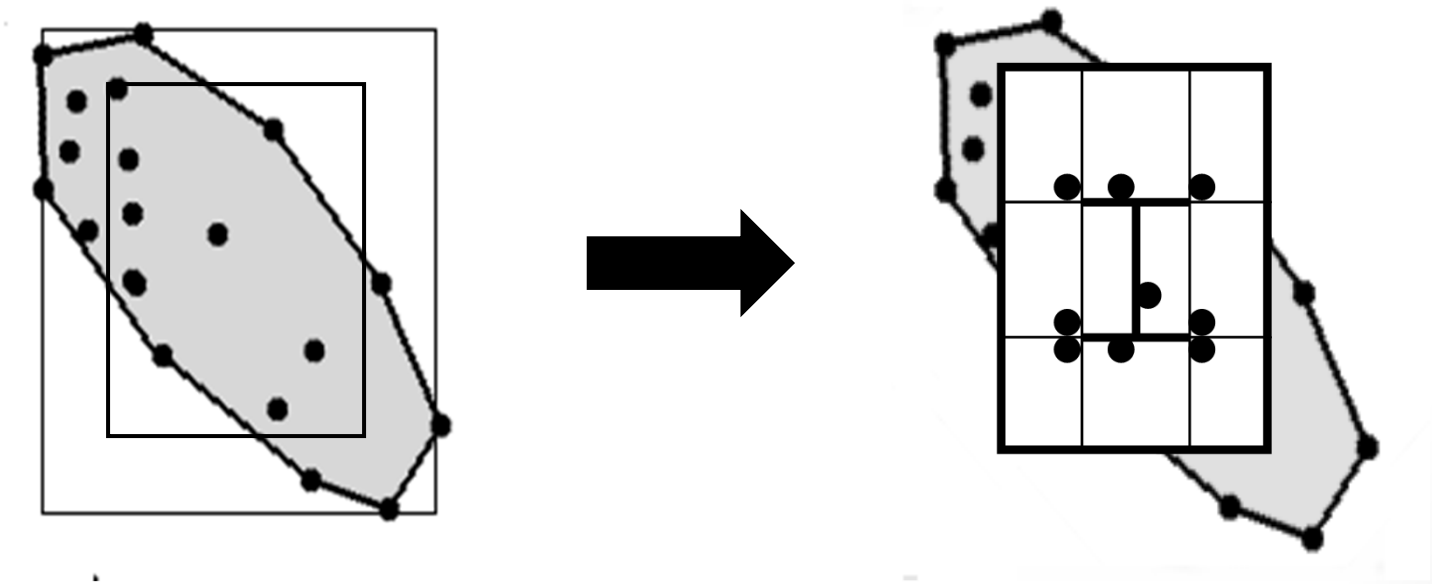
# HAI5.0: Distribution Routing

- HAI Distribution:



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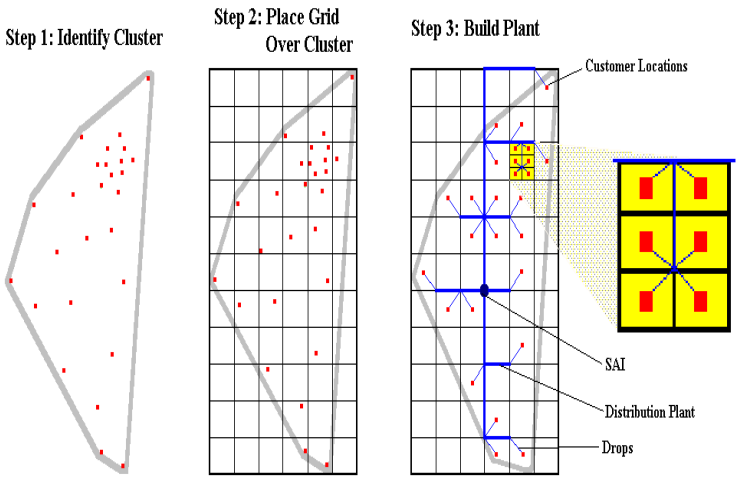
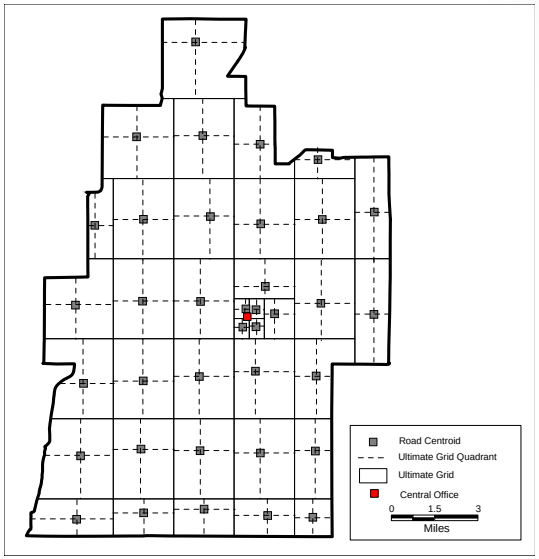
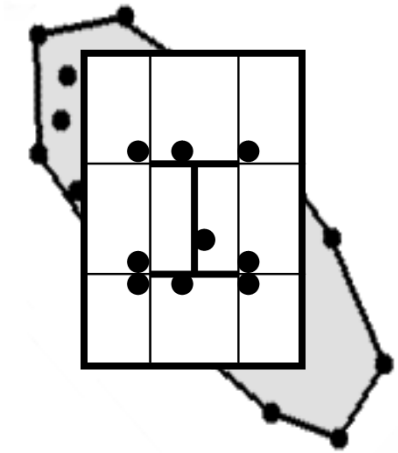
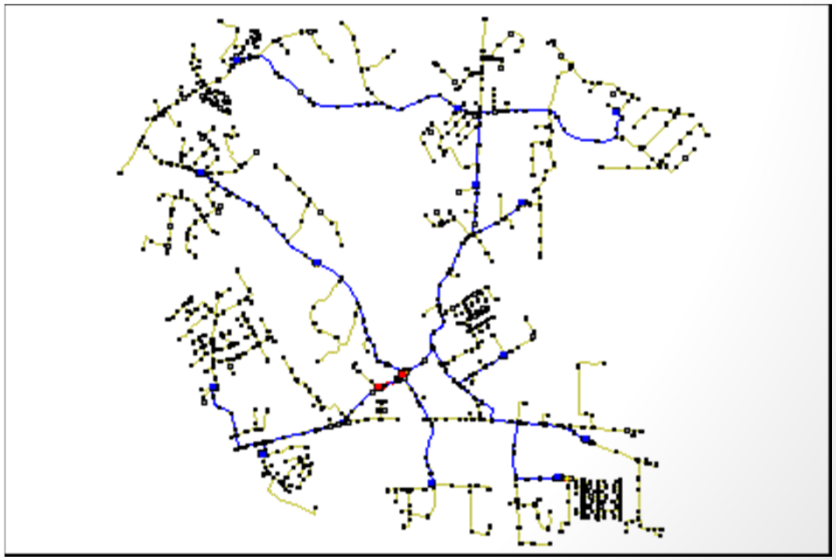
# Then and Now





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…Network Cost Models “Then” and “Now”

# ADVANCES IN NETWORK MODELING

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# Advancements in Network Modeling

- Improved customer locations
- Improved ability to match engineering designs and constraints
- Improved network routing
- Improved ability to vary the service delivered…broadband designs
- Ability to model multiple terrestrial networks

…In general, a more realistic, flexible network design resulting in more accurate cost estimates and improved information for decision makers

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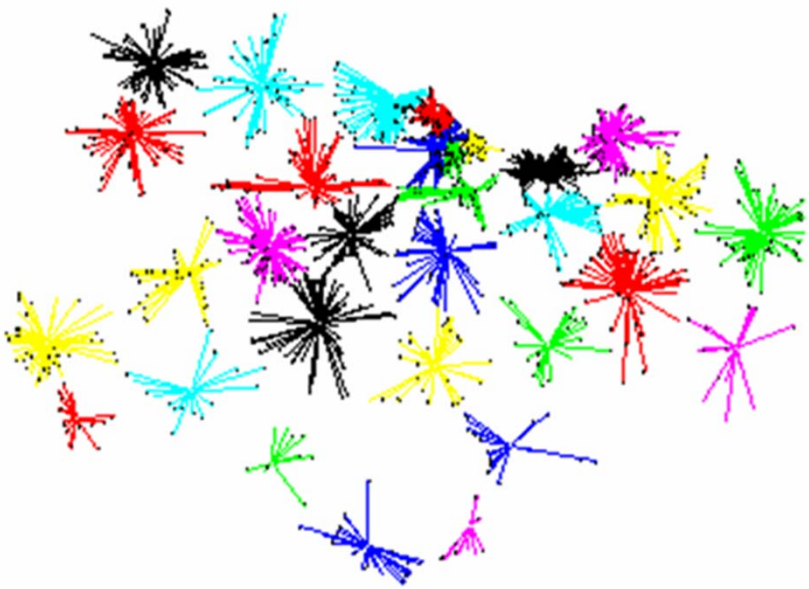
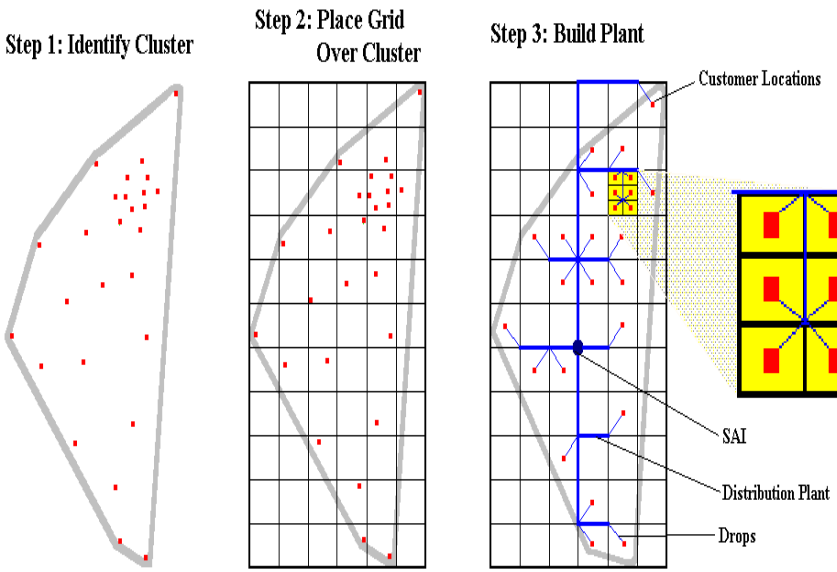
# THEN…FCC Model Methods for Customers and Engineering Design

Cluster formation



Customer locations and engineering design

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September 2012

# NOW…CQBAT Customer and Road Data

ILEC Wire Center service area with geocoded customer locations and roads

Geocoding success relies on the quality of the address data and the quality of the geocoding databases. On average we typically achieve 80-95% success rates to the street segment.

For those records that do not geocode, we fall back to an accepted process of surrogation to the roads within a Census Block.

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# NOW…CQBAT Engineering Design / Clusters

Network Node locations are based upon user inputs and general network design principles

Picture captures network nodes with red dashed line representing **Road Based Clusters**

**Legend:**
- – Digital Loop Carrier
- – Copper fed X-Box
- – Pedestal

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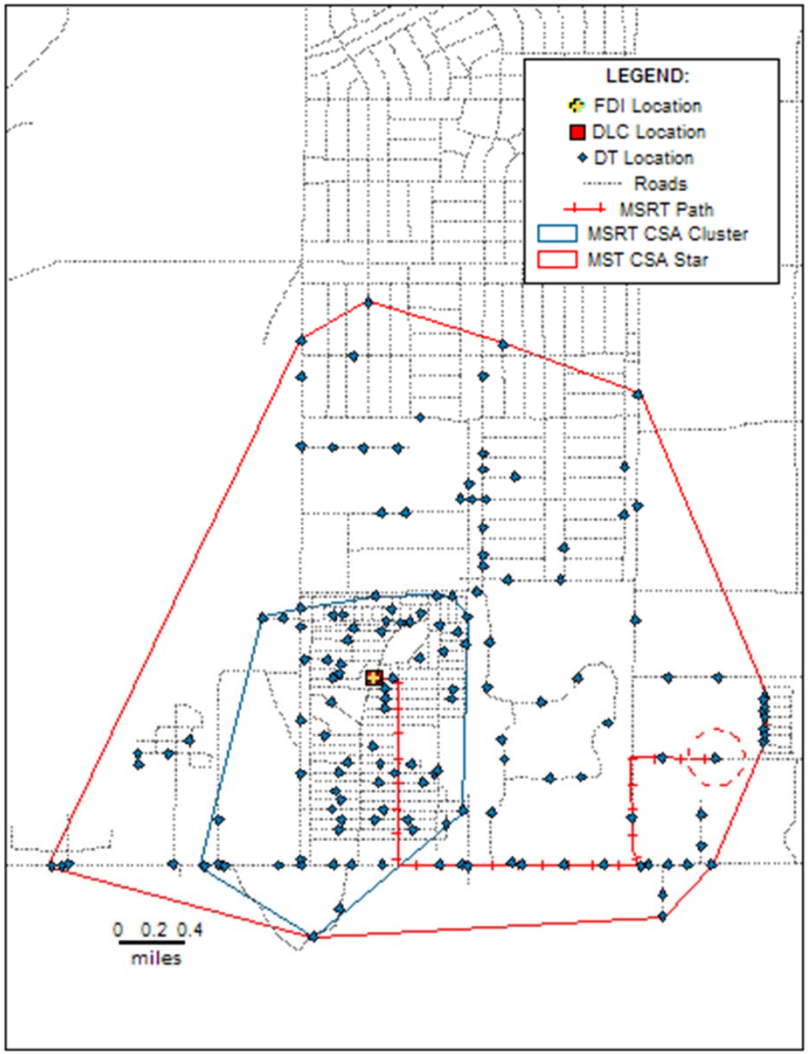
# Clustering – CQBAT Road based Cluster versus MST

FCC's SM used a Minimum Spanning Tree (MST)

CQBAT uses a Road Based Spanning Tree (MSRT)

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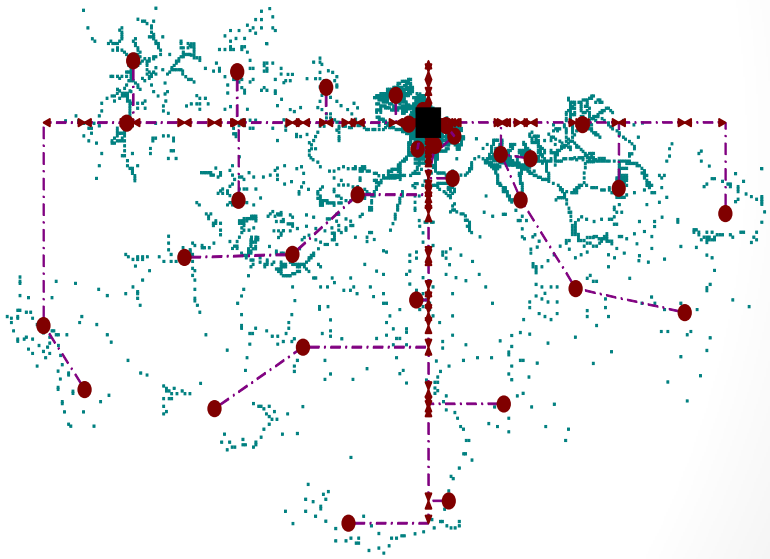
# THEN…FCC Model Network Routing

Rectilinear Distribution Design

Rectilinear Feeder Design



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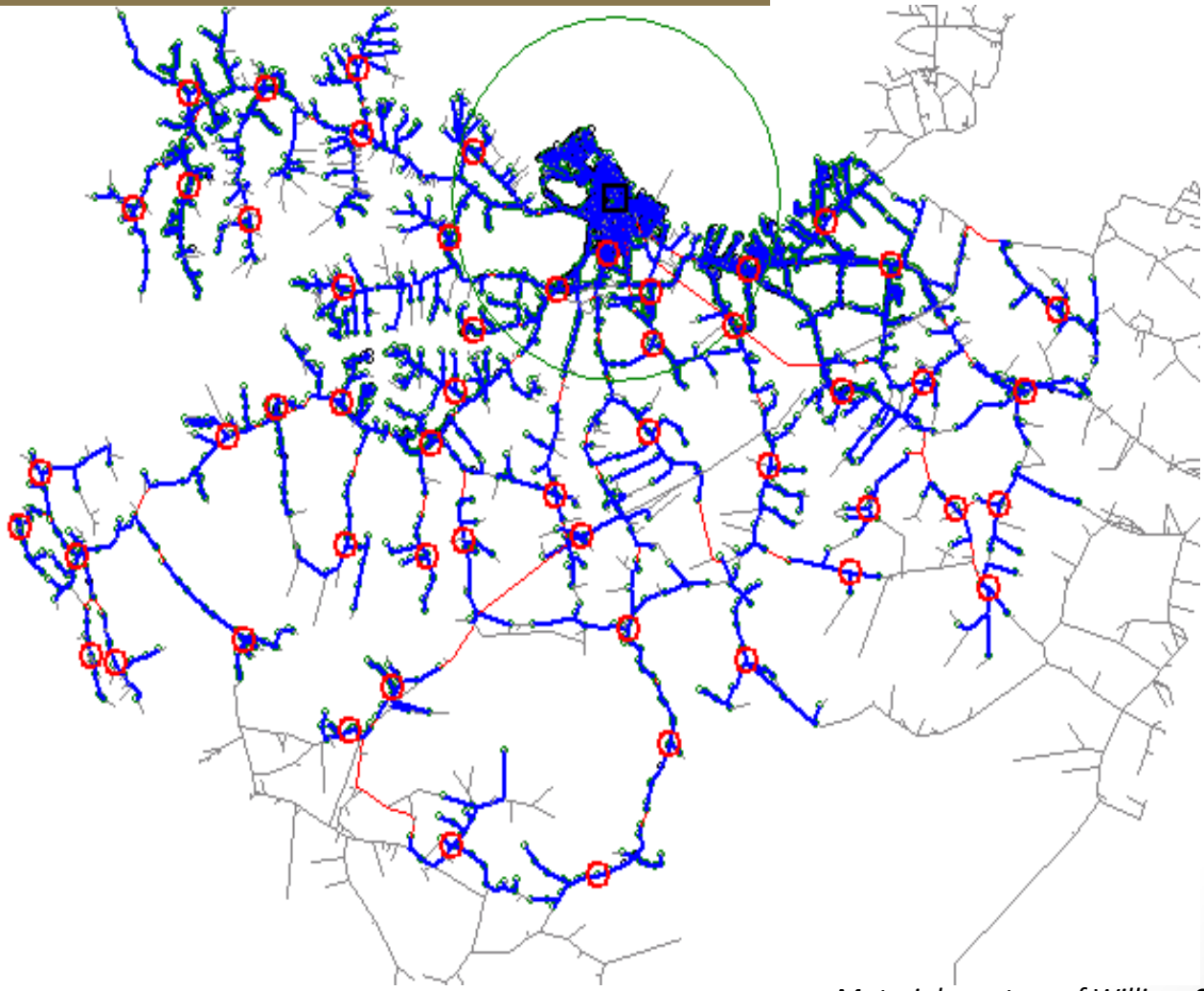
# NOW…Road Based Networks

Road based design of wire center on prior chart



*Material courtesy of William Sharkey (FCC) and Jeff Prisbrey*

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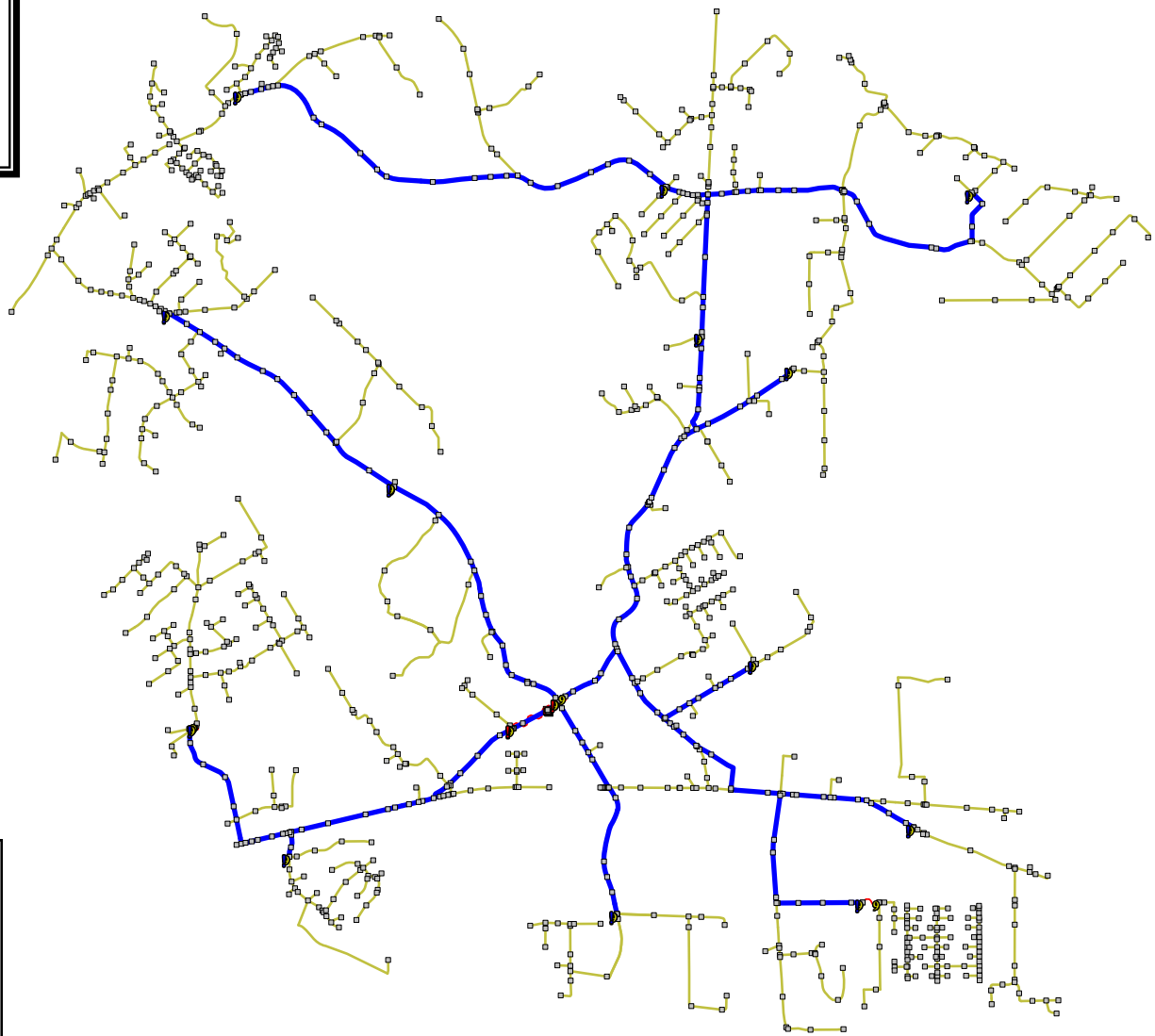
# NOW…CQBAT Road Based Network

Designed Network with overlaid cabling, no roads shown



**Legend:**
- – Digital loop carrier
- – Copper Fed X-Box
- – Pedestal
- – Fiber Feeder
- – Copper Feeder
- – Distribution

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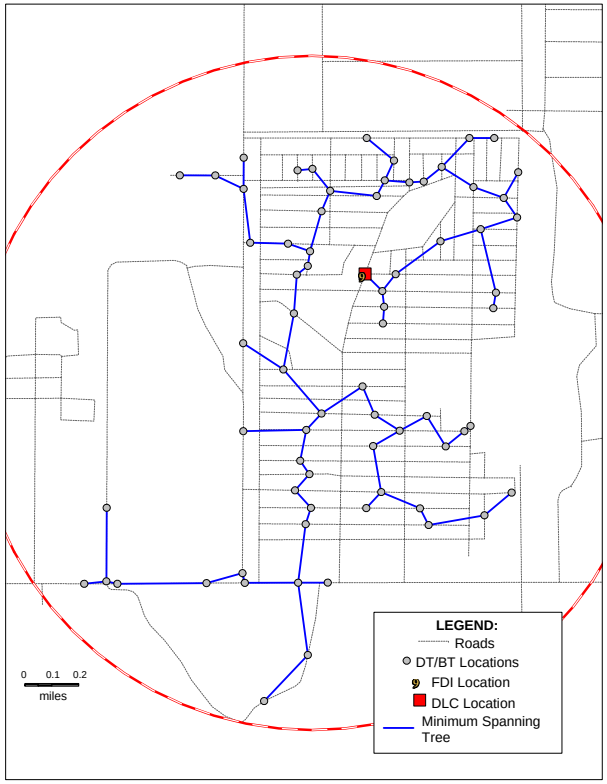
# Distribution Routing and Design

CQBAT

MST (similar to HCPM)

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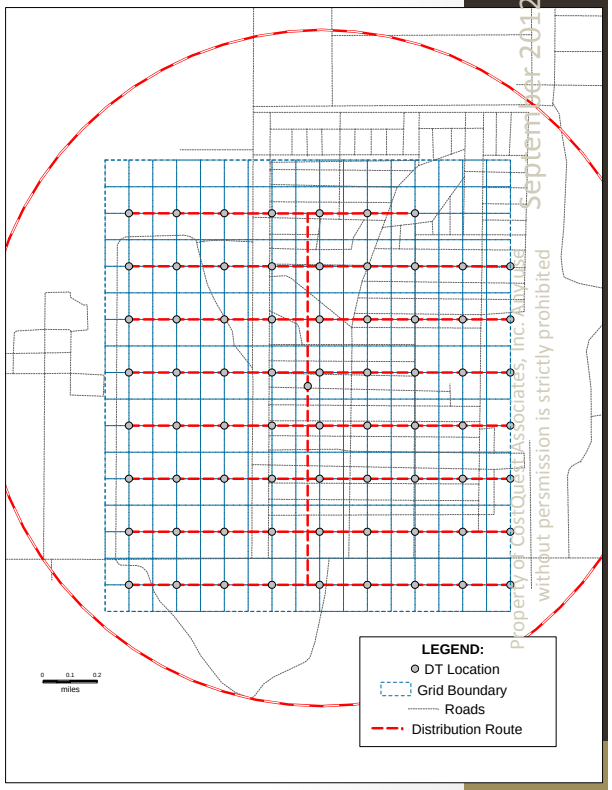


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# THEN…Broadband Network Design

…Advanced services at time of development - 28.8kbs modem service

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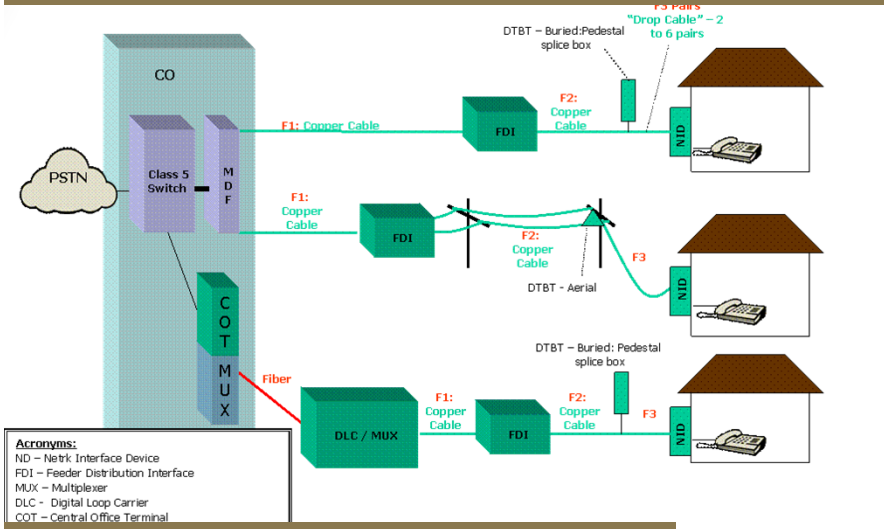
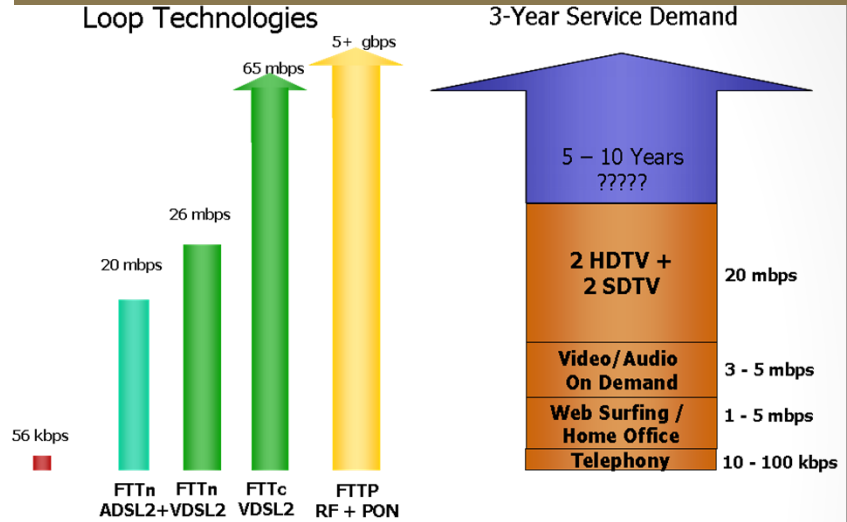
# Wireline Architecture

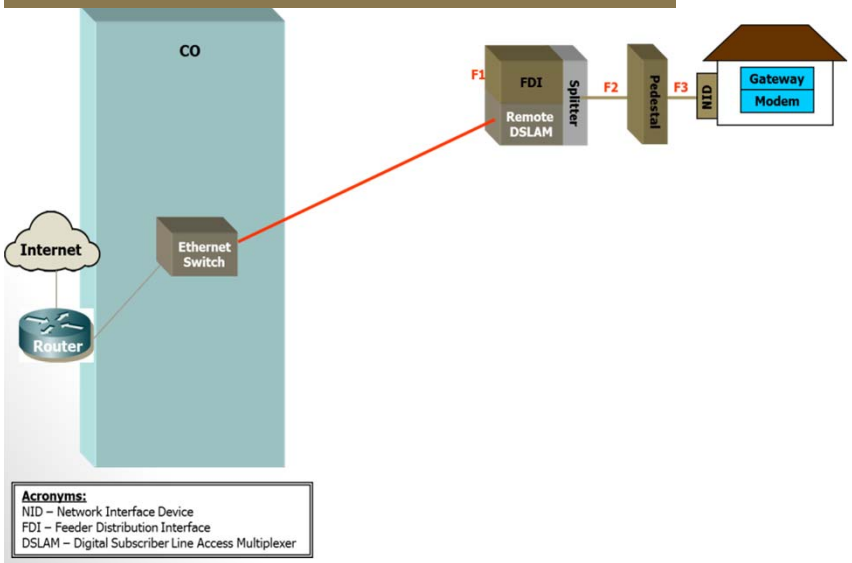
## THEN…Voice Network – Current USF model design



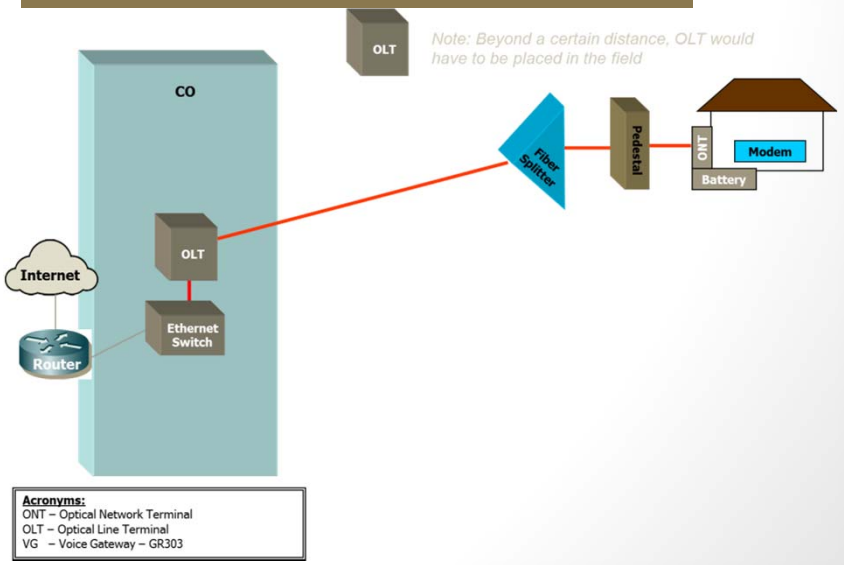

## The need for a fatter "pipe" to the customer




## NOW…FTTd/n Network




## NOW…FTTc/p Network

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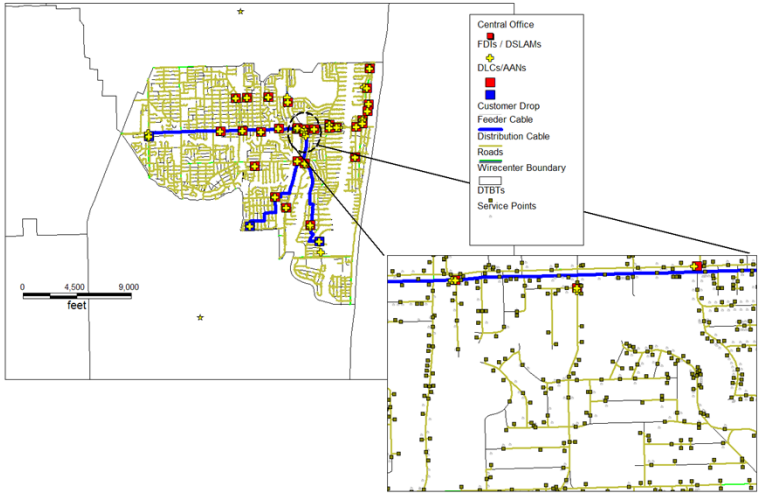
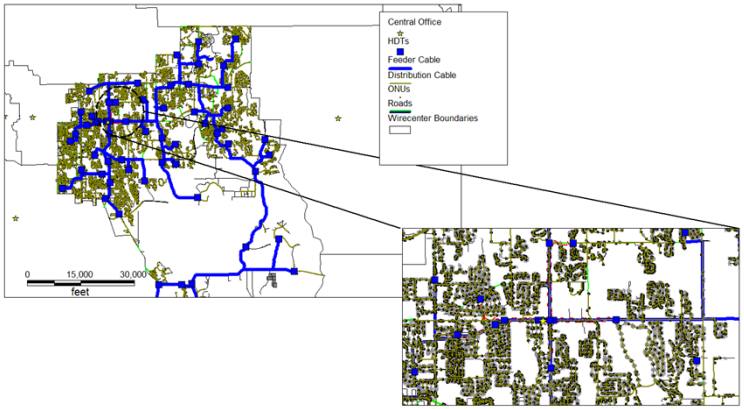
# NOW…CQBAT Broadband Network Designs

## FTTd/n Network




## FTTc/p Network

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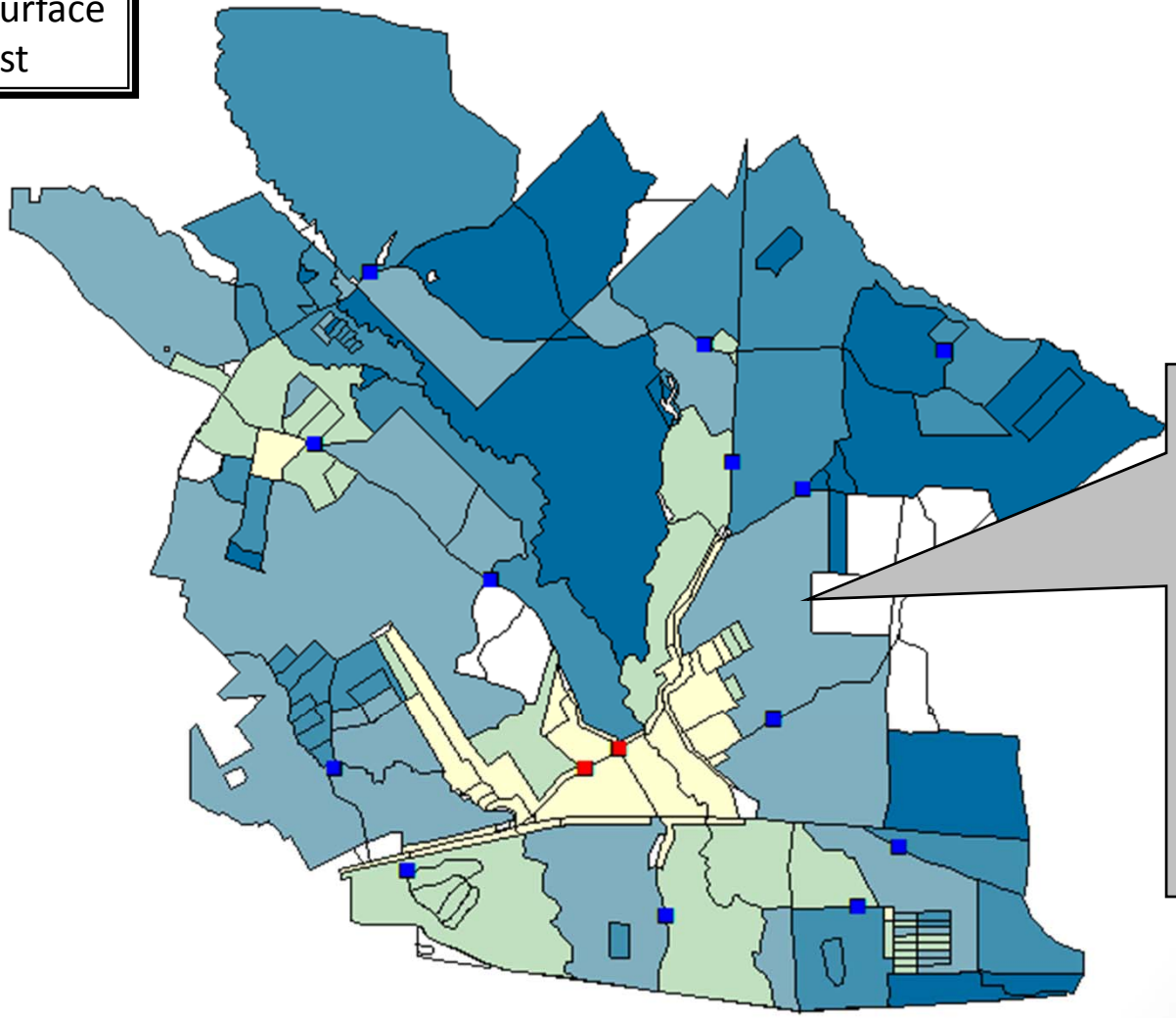
# Granularity – Sub Wire Center Detail

Census Block Cost Surface
- Darker = higher cost



With the ability to develop cost at any level within a wire center, cost surfaces can be developed that represent the average costs of customers within the selected geographic bands

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# FCC SM Versus CQBAT Summary

| General | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Estimate forward-looking investment supporting basic local service for USF | Y | Y |
| Estimate forward-looking investment supporting broadband for USF | Y | N |
| Model “existing node” wireline network | Y | N |
| Model “scorched node” wireline network | Y | Y |

| Customer Location | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Model designs network to service locations | Y | N |
| Model moves service locations to designed network | N | Y |
| Model locates census data uniformly in Census Block | N | Y |
| Model locates census data via random controlled placement on "livable" road segments | Y | N |

| Customer Aggregation - Clustering | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Customer serving areas based on minimum spanning road tree path distance rather than rectilinear distance | Y | N |

| Cable Routing | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Model assumes all cable routes explicitly follow actual roads in wire center | Y | N |
| Model determines shortest road path for all cable routes | Y | N |
| Model “lays” cable from central office to each service location | Y | N |


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# FCC SM Versus CQBAT Summary

| Engineering and Economics | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Model can engineer broadband service | Y | N |
| Dynamic DSLAM sizing | Y | N |
| Pedastals placed at the center of idealized lots to optimize locations to pedastal | N | Y |
| Pedastals placed along the road to serve customers within engineernig parameters | Y | N |
| Variable maximum copper loop distance | Y | Y |
| Central Office Terminal sharing | Y | N |
| All Fiber Feeder Network | Y | N |
| Use of copper T1 to feed small DLCs | N | Y |
| Copper gauge crossover | Y | Y |
| Fiber to the Prem (FTTp) option | Y | N |
| Service specific network design | Y | N |
| HiCap Network overlay | Y | N |
| Allocation of cost only on pair equivalents | N | Y |
| Allocation of cost based on best identified cost driver | Y | N |
| Capital Cost conversion to COM, Tax and DEPR | Y | Y |
| Use of levelized cost | Y | Y |

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# FCC SM Versus CQBAT Summary

| Geographic Detail | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Model can report cost by Wire Center | Y | Y |
| Model can report cost by County | Y | N |
| Model can report cost by CBG | Y | N |
| Model can report cost by CB | Y | N |
| Model can report cost by sub-CB | Y | N |

| Support | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Model provides variable Benchmark and Caps to develop Support | Y | N |
| Model provides ability to roll up on PC and RoR company level | Y | Y |
| Model provides ability to filter out "served" CBs | Y | N |
| Model can report cost by CB | Y | N |
| Model can report cost by sub-CB | Y | N |

| Model Distribuiton and Access | | |
|---|---|---|
| | CQBAT | FCC Synthesis Model |
| Access to service location data via Protective Order | Y | Y |
| Inspection of model and logic | Y | Y |
| Access to a test dataset for testing | Y | Y |
| PC based Model | N | Y |
| Online access | Y | N |

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# ISSUES WITH HISTORICAL MODELS – DO THEY STILL EXIST?

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# Rural Task Force Issues with FCC's SM/HCPM

- The Rural Task force evaluated the Synthesis Model based on the FCC's own 10 criteria and additional criteria
- Using these criteria, the Rural Task Force found major issues with the FCC's Synthesis Model and recommended that it not be used
- Their summarized concerns with the FCC's platform are as follows:
  - Modeled lines differed significantly from actual lines
  - Modeled route miles varied significantly from actual route miles
  - Modeled plant installed did not line up with actuals
  - Wire Center Areas and boundaries in the model did not match up to actuals
  - Model underestimated Switching investment
  - Modeled General Support investment varied significantly compared to actual
  - Model underestimated Network Operations costs
  - The use of a Statewide Average cost was inappropriate

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# Q/A

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Basic financial model

- Levelization
- Annualization

# OVERVIEW OF CQBAT ECONOMIC UNDERPINNINGS

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# What is Cost?

- "Cost" is a word used in many ways –
- In economics, all costs are opportunity costs
  - Costs are caused by the contemplation of a decision, the action implementing the decision, and the consequences of that decision
  - When a business takes an action, resources are either used up, or committed to one use rather than another
  - It is the value of that "other use" that is cost

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# Economic Definition

- Cost:

  The value of resources that will be either: 1) used up; or 2) committed to (or a portion of the capacity of the resource is committed to) a use (for a period of time)

  … because of my decision and consequent action

- By its nature,
  - Forward-looking
  - Focus on cost causation
  - Opportunity cost-based

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# Capacity Costing: The Basics

From client study

| | | | |
|---|---|---|---|
| DSX-1 Panel material price | | | $12,600 |
| Number of DS1 ports available | (physical capacity) | / 840 | |
| Material price per DS1 per port | | | $ 15.00 |
| Number of DS0 ports available per DS1 (phys cap) | | / 24 | |
| Material price per DS0 per port | | | $ .625 |
| Utilization Factor | (usable capacity) | | / .85 |
| Utilized Material Price per DS0 Port | (at capacity) | | $ .735 |
| Circuit Annualization Factor | | | x 0.18 |
| Annual Cost | | | 0.13 |
| Monthly Cost | | | 0.011 |

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# Working Cost: The Basics

For TELRIC and TSLRIC studies, we may utilize working units to unitize rather than total available capacity

| | | |
|---|---|---|
| DSX-1 Panel material price | | $12,600 |
| Number of DS1 ports used | (used capacity) | / 420 |
| Material price per DS1 per port | | $ 30.00 |
| Average number of DS0 working | / 15 | |
| Material price per working DS0 per port | | $ 2.00 |
| Circuit Annualization Factor | | x 0.18 |
| Annual Cost | | 0.36 |
| Monthly Cost | | 0.03 |

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# CQBAT – Economic Underpinnings

- Basic Financial Model
  - Forward Looking Economic Cost (FLEC) model
  - Consistent with Total Element Long Run Incremental Cost methods – UNE Proceedings
    - Scorched node
      - Only the Central office locations and the association of customer locations to the CO remain
    - Long Run Incremental Analysis
      - Greenfield and Brownfield Options
      - Includes Shared and Common Costs
    - Cost Attribution based on TELRIC methods

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# CQBAT – Economic Underpinnings

- Basic Financial Model
  - Model develops Investments and Associated Annual Capital Costs and Operating Expenses
    - Capital Costs – Depreciation, Cost of Money, Income Taxes
      - Equal Life Group Depreciation / Survivor Curves
      - Economic lives based on FCC proposed ranges established in 1999
    - Operating Expenses – Plant Specific, Non-Plant Specific, Customer Operations, G&A, Uncollectibles
    - Levelized, Annualized Cost approach
      - Levelized over a planning period
        - Uses annual charge factors for Depreciation, Cost of Money and Taxes
      - Comparable to a business case, but stated as the average across the periods – the "Steady State"

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# "Steady State" model reduces number of explicit assumptions and simplifies modeling

**Simplified cash-flow statement**
*Discounted to a single column*

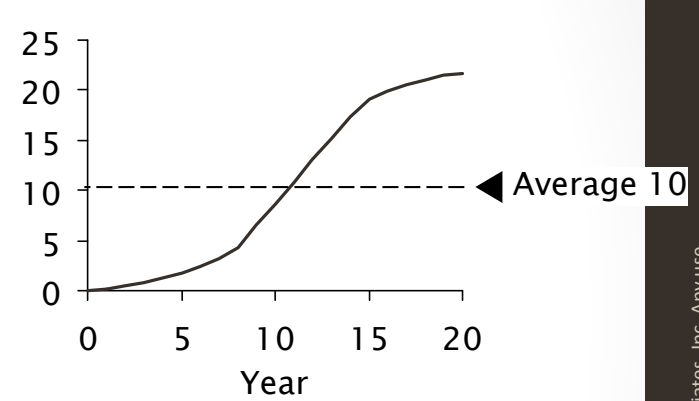
| | |
|---|---|
| Revenue | $100 |
| - | |
| Network ops | $50 |
| = | |
| Contribution | $50 |
| - | |
| Overhead | $25 |
| = | |
| EBITDA | $25 |
| - | |
| Capex | $15 |
| - | |
| Int & tax | $10 |
| = | |
| Cash flow | $5 |

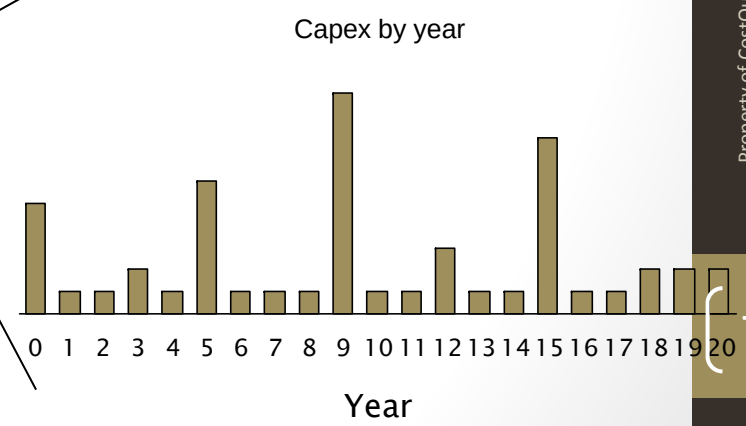
Captures Earnings and Taxes related to Equity

**Explicit assumptions**

| | |
|---|---|
| Average ARPU | $10 |
| Average subs | 10 |
| Total discounted capex | 15 |

**Implicit assumptions**

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# Levelized Costs

- Levelized Unit Costs
  - Has its roots in pricing
  - Capital costs are levelized to produce a constant annual cost throughout the life of each asset
    - Depreciation – with ELG, each account's depreciation expense gradually declines over time as short-lived assets are depreciated and longer-lived assets remain
    - Cost of Money (Return) gradually declines over time as the investment is depreciation
    - Income Tax is estimated as a return on the equity portion of return so it declines also
  - Levelization is a "smoothing" method using time value of money principles to develop a constant annual cost to set price or for comparison to revenues

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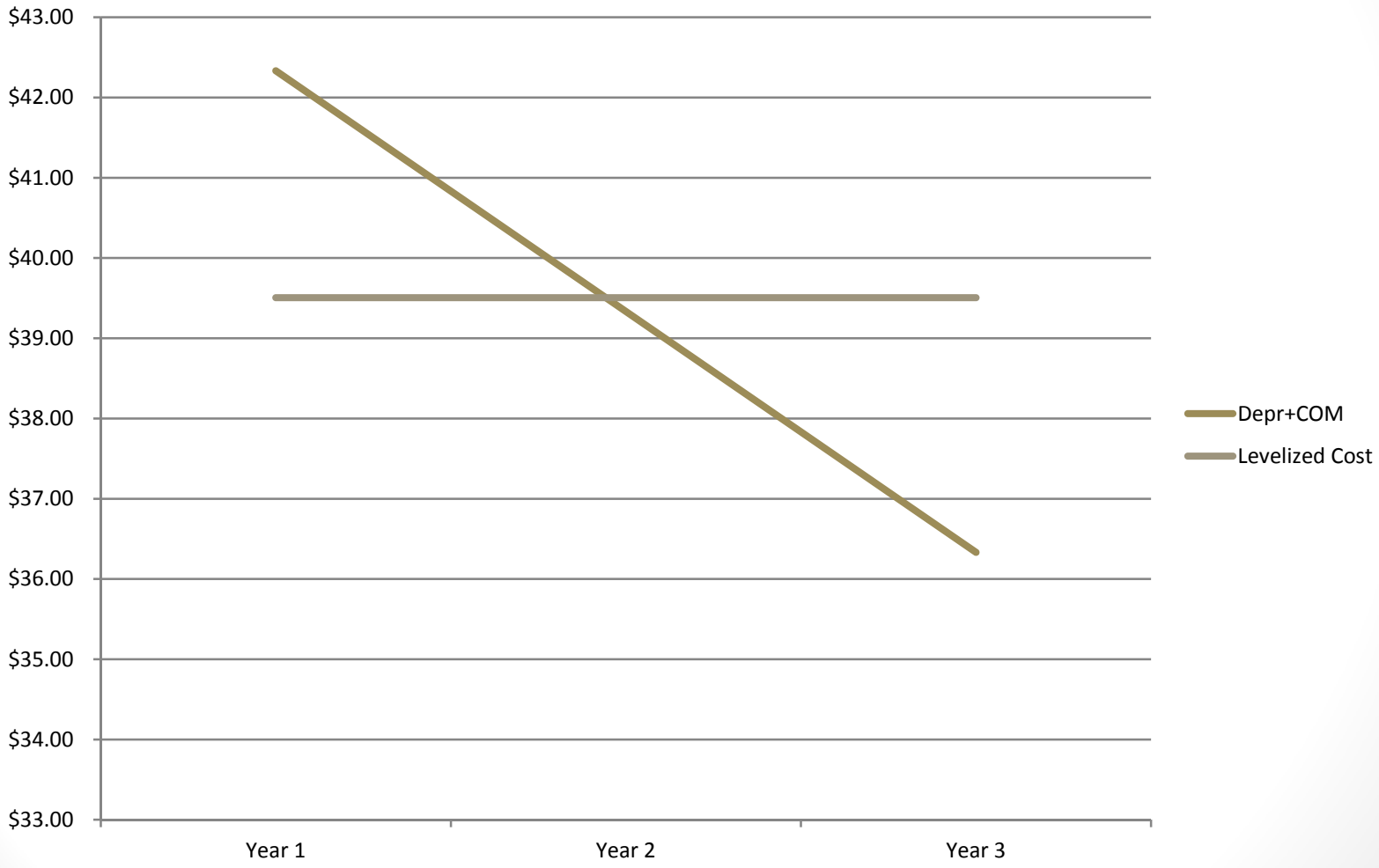
# Impact of Levelization

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# Levelization Example

| | | |
|---|---|---|
| Upfront Investment | 100,000.00 | |
| COM | 11.25% | |
| Simple annual depreciation - Frame | 10.00% | |
| Simple annual depreciation - Plugs | 20.00% | |
| Taxes | 0 | *simplifying assumption* |

**Approach used in CQBAT: Upfront capital asset that requires 11.25% return. Value of asset degrades over time (as represented by Depr). Asset degradation is captured back in price of service and paid back to Lendor (much like a car loan)**

| | | Year 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | NPV | Levelized | ACF |
| New System | GrossCapital | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | | | |
| - Frame last 10 years | Depr | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $29,140.01 | $5,000.00 | 5.00% |
| | Net Capital | 50,000 | 45,000 | 40,000 | 35,000 | 30,000 | 25,000 | 20,000 | 15,000 | 10,000 | 5,000 | | | |
| | COM | 5,625 | 5,063 | 4,500 | 3,938 | 3,375 | 2,813 | 2,250 | 1,688 | 1,125 | 563 | $20,859.99 | $3,579.27 | 3.58% |
| - Plugs last 5 | GrossCapital | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | | | |
| | Depr | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | $58,280.02 | $10,000.00 | 10.00% |
| | Net Capital | 50,000 | 40,000 | 30,000 | 20,000 | 10,000 | 50,000 | 40,000 | 30,000 | 20,000 | 10,000 | | | |
| | COM | 5,625 | 4,500 | 3,375 | 2,250 | 1,125 | 5,625 | 4,500 | 3,375 | 2,250 | 1,125 | $21,060.64 | $3,613.70 | 3.61% |
| TOTAL | GrossCapital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | | | |
| | Depr | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | $87,420.03 | $15,000.00 | 15.00% |
| | Net Capital | 100,000 | 85,000 | 70,000 | 55,000 | 40,000 | 75,000 | 60,000 | 45,000 | 30,000 | 15,000 | | | |
| | COM | 11,250 | 9,563 | 7,875 | 6,188 | 4,500 | 8,438 | 6,750 | 5,063 | 3,375 | 1,688 | $41,920.63 | $7,192.97 | 7.19% |
| | Annual cost | 26,250 | 24,563 | 22,875 | 21,188 | 19,500 | 23,438 | 21,750 | 20,063 | 18,375 | 16,688 | $129,340.66 | $22,192.97 | 22.19% |

**Alternative approach: Money borrowed from Lender -balloon payment at the end. Loan requires 11.25% return.**

| | | Year 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | NPV | Levelized | ACF |
| | GrossCapital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | | | |
| | Depr | | | | | | | | | | | | | |
| | Net Capital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | | | |
| | COM | 11,250 | 11,250 | 11,250 | 11,250 | 11,250 | 16,875 | 16,875 | 16,875 | 16,875 | 16,875 | $77,688.20 | $13,330.16 | 13.33% |
| | Capital Repay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150000 | $51,652.47 | $8,862.81 | 8.86% |
| | Annual cost | 11,250 | 11,250 | 11,250 | 11,250 | 11,250 | 16,875 | 16,875 | 16,875 | 16,875 | 166,875 | $129,340.66 | $22,192.97 | 22.19% |



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# Levelized Costs vs Business Case

- Similarities
  - Both identify Capital and Expenses
  - Both use Time Value of Money Concepts in presenting results
    - CQBAT captures the onetime capital expenditures (Greenfield or Brownfield) and associated expenses and uses levelization to develop a single levelized cost that is constant over the study period for easy comparison to revenues, or to a benchmark
      - Capital expenditures are converted to annual costs using levelized annual cost factors using time vale of money concepts (NPV)
    - Business case captures yearly variations in revenues, capital expenditures and expenses over the study period and typically concentrate on cash flows
      - Business cases typically produce annual results (income statement format) but also use time value of money to produce outputs for the study such as Internal Rate of Return (IRR) and NPV using discounted cash flows (annual outflows vs inflows discounted by a discount rate)

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# Derivation of Taxes

Taxes in the model represent the income taxes associated with the return on equity -- earnings

| | Capital (For Project) | Rate | 1st Year Interest | Ist Year Depr | Tax Requirement | |
|---|---|---|---|---|---|---|
| Debt | 500 | 6.0% | 30 | 50 | 0 | |
| Equity | 500 | 16.5% | 82.5 | 50 | 52.75 | <<<This is how we calculate tax requirement |
| | | | **112.5** | **100** | **52.75** | |

| | | |
|---|---|---|
| Project | **Revenue + Subsidy** | 465.25 |
| | **Opex (made up)** | 200.00 |
| | **Depr** | 100.00 |
| | **EBIT** | 165.25 |
| | **Interest** | 30.00 |
| | **EBT** | 135.25 |
| | **Taxes** | 52.75 |
| | **income** | 82.50 |

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# Deferred Taxes

With the difference between book and tax depreciation, there is a need to capture the impact of deferred taxes

**Capital Calculations**

| | |
|---|---|
| **Econ Life=** | 10 |
| **FNS=** | 0% |
| **FedTaxRate** | 35% |
| **Tax Life=** | 5 |
| **Rate of Return** | 0.1125 |
| **Convention** | Mid-Year |

| Year | Beginning of Period Capital | Book Depreciation | Tax Depreciation | Deferred Tax | End of Period Capital | Rate of Return |
|---|---|---|---|---|---|---|
| Total | | 1.0000 | 1.0000 | 0.0000 | | 0.0568 |
| 1 | 1.0000 | 0.0500 | 0.2000 | 0.0525 | 0.8975 | 0.1067 |
| 2 | 0.8975 | 0.1000 | 0.2000 | 0.0350 | 0.7625 | 0.0934 |
| 3 | 0.7625 | 0.1000 | 0.2000 | 0.0350 | 0.6275 | 0.0782 |
| 4 | 0.6275 | 0.1000 | 0.2000 | 0.0350 | 0.4925 | 0.0630 |
| 5 | 0.4925 | 0.1000 | 0.2000 | 0.0350 | 0.3575 | 0.0478 |
| 6 | 0.3575 | 0.1000 | 0.0000 | -0.0350 | 0.2925 | 0.0366 |
| 7 | 0.2925 | 0.1000 | 0.0000 | -0.0350 | 0.2275 | 0.0293 |
| 8 | 0.2275 | 0.1000 | 0.0000 | -0.0350 | 0.1625 | 0.0219 |
| 9 | 0.1625 | 0.1000 | 0.0000 | -0.0350 | 0.0975 | 0.0146 |
| 10 | 0.0975 | 0.1000 | 0.0000 | -0.0350 | 0.0325 | 0.0073 |
| 11 | 0.0325 | 0.0500 | 0.0000 | -0.0175 | 0.0000 | 0.0018 |

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# Annualization

- Annual Capital Costs
  - Depreciation, Cost of Money and Income Tax parameters are user adjustable in CQBAT
  - Depreciation
    - Economic lives from the range of lives established by the FCC in 1999 (CC Docket 98-137)
    - Equal Life Group (ELG) –depicts fact that not all equipment will live exactly the account average life; use of Gompertz-Makeham survivor curves to split each account into groups of equal lives for depreciation purposes
    - Annual Depreciation expense for each account is levelized to develop constant depreciation rate over the account life
  - ROR (or Cost of Money) – the weighted average cost of capital applied to the investment and levelized over the life of the account
  - Income Taxes –federal and state income taxes applied to equity portion of the ROR, adjusted for deferred taxes and levelized over the life of the account
  - Accomplished by producing Levelized Annual Capital Cost Factors and applying to forward-looking investments to produce levelized annual capital costs


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# Annualization

- Annualized Costs
  - Levelized annual costs are easy to compare to a benchmark; Business case cash flows are not comparable to a benchmark
  - Levelized annual costs provide for a constant cost over time and, thus, a constant funding need when compared to a benchmark

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# ACF Example

| | | |
|---|---|---|
| Upfront Investment | 100,000.00 | |
| COM | 11.25% | |
| Simple annual depreciation - Frame | 10.00% | |
| Simple annual depreciation - Plugs | 20.00% | |
| Taxes | 0 | *simplifying assumption* |

**Approach used in CQBAT: Upfront capital asset that requires 11.25% return. Value of asset degrades over time (as represented by Depr). Asset degradation is captured back in price of service and paid back to Lendor (much like a car loan)**

| | | Year 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | NPV | Levelized | ACF |
| New System | GrossCapital | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | | | |
| - Frame last 10 years | Depr | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | $29,140.01 | $5,000.00 | 5.00% |
| | Net Capital | 50,000 | 45,000 | 40,000 | 35,000 | 30,000 | 25,000 | 20,000 | 15,000 | 10,000 | 5,000 | | | |
| | COM | 5,625 | 5,063 | 4,500 | 3,938 | 3,375 | 2,813 | 2,250 | 1,688 | 1,125 | 563 | $20,859.99 | $3,579.27 | 3.58% |
| - Plugs last 5 | GrossCapital | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | | | |
| | Depr | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | $58,280.02 | $10,000.00 | 10.00% |
| | Net Capital | 50,000 | 40,000 | 30,000 | 20,000 | 10,000 | 50,000 | 40,000 | 30,000 | 20,000 | 10,000 | | | |
| | COM | 5,625 | 4,500 | 3,375 | 2,250 | 1,125 | 5,625 | 4,500 | 3,375 | 2,250 | 1,125 | $21,060.64 | $3,613.70 | 3.61% |
| TOTAL | GrossCapital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | | | |
| | Depr | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | $87,420.03 | $15,000.00 | 15.00% |
| | Net Capital | 100,000 | 85,000 | 70,000 | 55,000 | 40,000 | 75,000 | 60,000 | 45,000 | 30,000 | 15,000 | | | |
| | COM | 11,250 | 9,563 | 7,875 | 6,188 | 4,500 | 8,438 | 6,750 | 5,063 | 3,375 | 1,688 | $41,920.63 | $7,192.97 | 7.19% |
| | Annual cost | 26,250 | 24,563 | 22,875 | 21,188 | 19,500 | 23,438 | 21,750 | 20,063 | 18,375 | 16,688 | $129,340.66 | $22,192.97 | 22.19% |

**Alternative approach: Money borrowed from Lender -balloon payment at the end. Loan requires 11.25% return.**

| | | Year 1 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | NPV | Levelized | ACF |
| | GrossCapital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | | | |
| | Depr | | | | | | | | | | | | | |
| | Net Capital | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 150,000 | 150,000 | 150,000 | 150,000 | 150,000 | | | |
| | COM | 11,250 | 11,250 | 11,250 | 11,250 | 11,250 | 16,875 | 16,875 | 16,875 | 16,875 | 16,875 | $77,688.20 | $13,330.16 | 13.33% |
| | Capital Repay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150000 | $51,652.47 | $8,862.81 | 8.86% |
| | Annual cost | 11,250 | 11,250 | 11,250 | 11,250 | 11,250 | 16,875 | 16,875 | 16,875 | 16,875 | 166,875 | $129,340.66 | $22,192.97 | 22.19% |

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September 2012
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# Annualization

- CQBAT Costs (Summary)
  - Depr = Investment X Levelized Depreciation Factor
  - COM = Investment X Levelized COM Factor
  - IncomeTax = Investment X Levelized Income Tax Factor
  - Plant Specific Expenses = Investment X Plt Spec Factor
  - Non-Plant Specific Expenses = Investment X Non-Plt Spec Factor
  - Customer Operations Expenses = Expense/Customer X # Customers
  - Corporate Operations = Investment X Corporate Ops Factor

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# Greenfield/Brownfield

- Options in CQBAT:
  - Current User Toggle approach:
    - Greenfield = "No"
    - Tied to CAPEX inputs that indicate whether a Capex item is Greenfield, Brownfield, All
    - The current Greenfield toggle simply excludes the capex items listed as "Greenfield"
      - For example, copper distribution is listed as Greenfield, as such it will be left out
    - Issues:
      - While Greenfield items are removed, it also removes any associated
        - Operational costs
        - Replacement capital
  - Current alternative approach: Modified ACF inputs
    - Under this approach, Greenfield ="Yes"
      - Captures the capital and operational cost
    - ACF table sets DEPR, COM, and TAX to 0 for those items that are typically "Greenfield"
    - Issues:
      - Excludes all capex cost (including replacement) if the ACF values are set to 0
      - Some categories may be mixed (Greenfield and Brownfield): e.g., Conduit
  - If needed, alternative approaches can be developed

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# Greenfield/Brownfield

**The following Support Q/A may help clarify some questions about the Greenfield/Brownfield approach**

Q: When the model is set to brownfield FTTD, can you confirm whether it does the following:

A. Models the costs for the addition of DSLAMs where DSLAMs are not present within 12,000 feet of locations not served by an unsubsidized competitor

R: Correct: DSLAMS are added as needed to support the broadband requirements of the model. The investment for these new DSLAMs is captured in the brownfield view.

B. Models the costs for the building of fiber to these new DSLAM

R: The fiber is sized to support these new DSLAMs; only the portion of the fiber which supports the unserved area is captured in the brownfield investment. The structure (poles and conduit) are assumed to exist so their investment isn't captured.

C. Models the costs for the building of fiber to COs where fiber is currently assumed not to exist

R: The fiber investment which supports the new DSLAMs is retained

D. Models the costs of additional switches, routers and ADMs necessary to provision increased bandwidth demand

R: The investment to grow routers (there are no switches in the model) placed in unserved areas is included.



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# Greenfield/Brownfield

**…continued**

Q: If there are other significant costs that brownfield FTTD models (other than conditioning and CPE), can you please address them?

R: The model doesn't really model brownfield differently than greenfield. What it does is segregate investment differently. In the greenfield view all the investment calculated by the network is included. In the brownfield view, all of the investment is not reported out.

Q: When the model is set to brownfield, does it only affect the CapEx input sheet? If it affects other input sets, please specify.. Specifically, does it affect operating expenses?

R: Again the brownfield/greenfield isn't impacting inputs. It is segregating investment. When the opex inputs were calculated by the coalition, they were calculated on a greenfield bases.

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# Q/A

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Capturing Company and Geographic Specific attributes

Classifying Service Areas

Demand Development

Network Capabilities

Existing Broadband Coverage

Data Sources

The Guts

# CQBAT PLATFORM OVERVIEW

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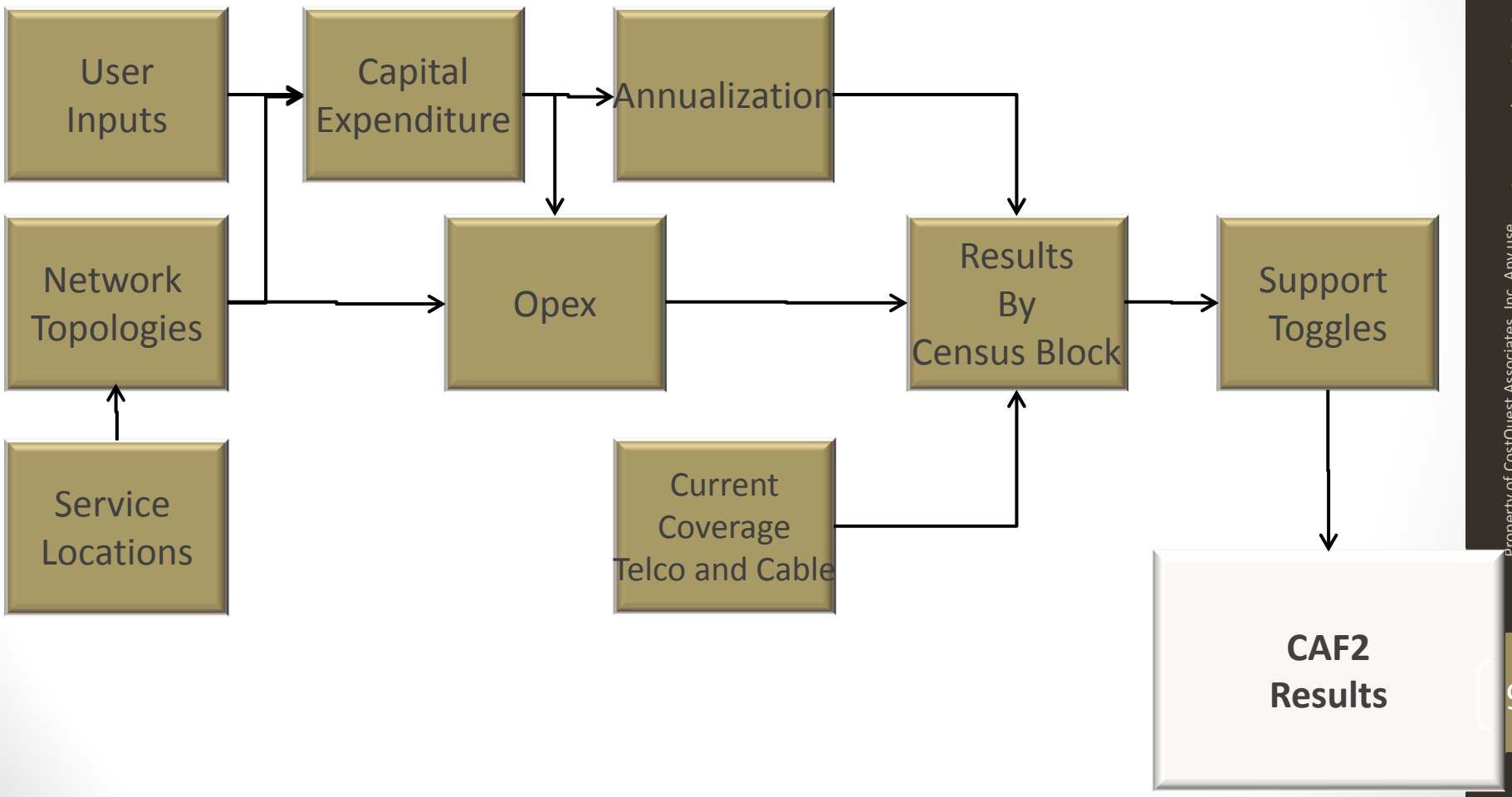
# High Level Flow of CQBAT

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# Capturing Company and Geographic Differences

- CQBAT models the cost of an efficient provider, but recognizes the specifics of an operating area (and even a Census Block)
  - Plant mix captures variation in
    - State
    - Density
    - Distribution, feeder, interoffice
  - Company size impacts
    - Operation cost
    - Capex purchasing power
  - Terrain and density impacts
    - Construction and plant specific costs
  - Regional Cost Adjustment
    - Applied to capex to capture regional cost differences in construction costs – both material and labor
      - Impacts those operational costs that are a factor of capex
  - Sales Tax
    - Captures state by state differences
  - Loop design
    - Captures the specifics of the network build all the way down to a customer

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# Mapping of Service Areas

- TeleAtlas provides a mapping from CLLI (service area) to SAC
  - Provides initial mapping
- Using files of FCC and prior efforts
  - SAC mapped to OCN
- Coalition reviewed their CLLI to SAC to OCN mapping, updates made
- Within CQBAT
  - Internal TelcoMaster table controls
    - Mapping of CLLI to OCN/SAC
    - Mapping of CLLI to ShortName
    - Mapping of RoR/PC
  - OCNCoSize table controls
    - Company size

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# Classifying Service Areas

- Determining the Size and Type for each company
  - USAC reports were used as the basis to initially assign and map companies
    - HC05, HC12, HC9 Provides:
      - Reported Line Counts
      - Rural/Non-rural flag
      - PriceCap / RoR basis
  - Company ownership based in part on initial file from FCC that was tuned for CAF1 regression model and CQBAT
    - ABC coalition reviewed and provided updates to OCN/SAC to company mappings
  - Company Size Categories (chosen in part to distribute Small companies into equal groups)
    - XXSmall: 0 – 1000 lines
    - Xsmall: 1000 – 4000 lines
    - Small: 4000 – 100,000 lines
    - Medium: 100,000 – 1M lines
    - Large: > 1M lines
  - Company size drives
    - Opex, Capex differentiation





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# TelcoMaster

| SAKey | ServiceArea | State | OCN | CompanyName | LATA | DomSwitch | SAArea | ShortName | SAC | StudyAreaName | SourceKey | SourceMetaKey | Rural | Type | RORorPC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AAPKOKXA | OK | 1980 | CHICKASAW TELEPHONE CO. | 536 | AAPKOKXADS0 | 105665565.6 | SML | 431980 | CHICKASAW TEL CO | 1 | 1 | R | C | RoR |
| 2 | ABBGNCXA | NC | 502 | STAR TELEPHONE MEMBERSHIP CORP. | 949 | ABBGNCXA648 | 402813280.5 | SML | 230502 | STAR MEMBERSHIP CORP | 2 | 1 | R | C | RoR |
| 3 | ABDLFLXA | FL | 328 | VERIZON FLORIDA INC. | 952 | ABDLFLXA96H | 79761673.3 | VZN | 210328 | VERIZON FLORIDA | 3 | 1 | N | C | PC |
| 4 | ABDLWIXA | WI | 859 | CENTRAL STATE TELEPHONE CO. | 350 | ABDLWIXARS0 | 254909411.2 | TDS | 330859 | CENTRAL STATE TEL CO | 4 | 1 | R | C | RoR |
| 5 | ABHGMIMN | MI | 9323 | AMERITECH MICHIGAN | 340 | ABHGMIMNDS0 | 70193483.78 | ATT | 315090 | MICHIGAN BELL TEL CO | 5 | 1 | N | C | PC |
| 8 | ABLNKSCD | KS | 9533 | SOUTHWESTERN BELL | 534 | ABLNKSCDDS0 | 170515903.7 | ATT | 415214 | SOUTHWESTERN BELL-KS | 8 | 1 | N | C | PC |
| 9 | ABLNTXOR | TX | 9533 | SOUTHWESTERN BELL | 550 | ABLNTXORCG0 | 281105925.8 | ATT | 445216 | SOUTHWESTERN BELL-TX | 9 | 1 | N | C | PC |
| 10 | ABLNTXOW | TX | 9533 | SOUTHWESTERN BELL | 550 | ABLNTXOWDS0 | 552705465.9 | ATT | 445216 | SOUTHWESTERN BELL-TX | 10 | 1 | N | C | PC |
| 11 | ABNGILXD | IL | 1183 | CITIZENS TELECOM CO ILLINOIS-FRONTIER CITIZENS -IL | 977 | ABNGILXDRS0 | 201675516.9 | Fron | 341183 | CITIZENS-FRONTIER-IL | 11 | 1 | R | C | PC |
| 12 | ABNGVAXA | VA | 4511 | UNITED TELEPHONE - SOUTHEAST - VA | 956 | ABNGVAXADS0 | 496631098.9 | Cent | 190567 | UNITED INTER-MT-VA | 12 | 1 | R | C | PC |
| 13 | ABRCNDXA | ND | 1631 | RED RIVER RURAL TEL ASSN - ND | 636 | ABRCNDXADS1 | 283072356.9 | SML | 381631 | RED RIVER RURAL TEL | 13 | 1 | R | A | RoR |
| 14 | ABRDIDXC | ID | 4427 | CITIZENS TELECOM IDAHO-FRONTIER COMM OF IDAHO | 652 | ABRDIDXCDS0 | 367287858.7 | Fron | 474427 | CITIZENS-FRONTIER-ID | 14 | 1 | R | C | PC |
| 15 | ABRDMDAB | MD | 9212 | VERIZON MARYLAND, INC. | 238 | ABRDMDABDS0 | 193624914.5 | VZN | 185030 | VERIZON MARYLAND INC | 15 | 1 | N | C | PC |
| 16 | ABRDMSES | MS | 9419 | BELLSOUTH TELECOMM INC DBA SOUTH CENTRAL BELL TEL | 482 | ABRDMSESRS9 | 839910644.2 | ATT | 285184 | SO CENTRAL BELL-MS | 16 | 1 | N | C | PC |
| 17 | ABRDNCXA | NC | 476 | WINDSTREAM NORTH CAROLINA, INC. | 949 | ABRDNCXADS0 | 64259134.59 | Wind | 230476 | WINDSTREAM NC | 17 | 1 | R | F | PC |
| 18 | ABRDOH79 | OH | 9321 | AMERITECH OHIO | 328 | ABRDOH79RS1 | 19394818.04 | ATT | 305150 | OHIO BELL TEL CO | 18 | 1 | N | C | PC |
| 19 | ABRDSDCO | SD | 9631 | QWEST CORPORATION | 640 | ABRDSDCODS0 | 1493003227 | Cent | 395145 | QWEST CORP-SD | 19 | 1 | N | C | PC |
| 21 | ABRMWIXA | WI | 925 | BAYLAND TELEPHONE, INC. | 350 | ABRMWIXADS0 | 225191239.8 | SML | 330925 | BAYLAND TEL CO | 21 | 1 | R | A | RoR |
| 22 | ABRNTXXA | TX | 1163 | VALOR TELECOMM TX, LP-TX #1 DBA WINDSTREAM COMM SW | 544 | ABRNTXXADS0 | 66322125.95 | Wind | 441163 | WINDSTREAM SW-TX#1 | 22 | 1 | R | C | PC |
| 23 | ABRYTXGI | TX | 9533 | SOUTHWESTERN BELL | 552 | ABRYTXGIRS0 | 190791038.1 | ATT | 445216 | SOUTHWESTERN BELL-TX | 23 | 1 | N | C | PC |
| 25 | ABSRMTXC | MT | 2250 | PROJECT TELEPHONE CO., INC. | 650 | ABSRMTXCDS0 | 1586091755 | SML | 482250 | PROJECT TEL CO | 25 | 1 | R | C | RoR |
| 26 | ABSRNDXA | ND | 1601 | ABSARAKA COOPERATIVE TELEPHONE CO. | 636 | ABSRNDXADS0 | 54640954.71 | SML | 381601 | ABSARAKA COOP TEL CO | 26 | 1 | R | A | RoR |
| 27 | ABVLALXA | AL | 9788 | CENTURYTEL TEL OF ALABAMA, LLC (SOUTHERN) | 478 | ABVLALXADS0 | 1013610557 | Cent | 259788 | CENTURYTEL-AL-SOUTH | 27 | 1 | N | C | PC |
| 29 | ABVLKSXA | KS | 1810 | UNITED TELEPHONE OF EASTERN KANSAS | 532 | ABVLKSXARS0 | 379154246.6 | Cent | 411317 | UNITED OF EASTERN KS | 29 | 1 | R | C | PC |
| 31 | ABVLPAES | PA | 9208 | VERIZON PENNSYLVANIA, INC. | 232 | ABVLPAESRS1 | 139893321.3 | VZN | 175000 | VERIZON PENNSYLVANIA | 31 | 1 | N | C | PC |
| 32 | ABVLSCXA | SC | 4335 | VERIZON SOUTH INC.-SC | 430 | ABVLSCXADS0 | 38681581.72 | Fron | 240479 | FRONTIER CAROLINAS - SC | 32 | 1 | N | C | PC |
| 33 | ACCYTXXA | TX | 332 | BRAZOS TELECOMMUNICATIONS, INC. | 548 | ACCYTXXARS0 | 325883460.5 | SML | 442041 | BRAZOS TEL COOP INC | 33 | 1 | R | C | RoR |
| 34 | ACDMSDXA | SD | 1670 | MIDSTATE COMMUNICATIONS, INC. | 640 | ACDMSDXADS1 | 1073977995 | SML | 391670 | MIDSTATE COMM., INC. | 34 | 1 | R | C | RoR |
| 35 | ACFFTXXA | TX | 2143 | SOUTH PLAINS TELEPHONE COOPERATIVE, INC. | 544 | ACFFTXXADS0 | 296908509.2 | SML | 442143 | SOUTH PLAINS TEL | 35 | 1 | R | C | RoR |
| 36 | ACHLOKXA | OK | 1979 | CHEROKEE TELEPHONE CO. | 536 | ACHLOKXARS1 | 65732090.24 | SML | 431979 | CHEROKEE TEL CO | 36 | 1 | R | C | RoR |
| 37 | ACHLTNMT | TN | 9419 | BELLSOUTH TELECOMM INC DBA SOUTH CENTRAL BELL TEL | 470 | ACHLTNMTRS0 | 268781729.9 | ATT | 295185 | SO. CENTRAL BELL -TN | 37 | 1 | N | C | PC |
| 38 | ACKLIACO | IA | 9631 | QWEST CORPORATION | 632 | ACKLIACORS8 | 304493371.3 | Cent | 355141 | QWEST CORP-IA | 38 | 1 | N | C | PC |
| 39 | ACKRMSXA | MS | 452 | DELTA TELEPHONE CO., INC. | 482 | ACKRMSXADS3 | 287868396.5 | SML | 280452 | DELTA TEL CO | 39 | 1 | R | C | RoR |
| 40 | ACLKILXA | IL | 1036 | VERIZON NORTH INC.-IL (CONTEL) | 360 | ACLKILXARS0 | 41706024.14 | Fron | 341036 | FRONTIER N - IL | 40 | 1 | N | C | PC |
| 41 | ACMEMIMN | MI | 9323 | AMERITECH MICHIGAN | 348 | ACMEMIMNDS0 | 44464942.5 | ATT | 315090 | MICHIGAN BELL TEL CO | 41 | 1 | N | C | PC |
| 42 | ACMENCMA | NC | 9417 | BELLSOUTH TELECOMM INC DBA SOUTHERN BELL TEL & TEL | 428 | ACMENCMA65F | 745738772.9 | ATT | 235193 | SOUTHERN BELL-NC | 42 | 1 | N | C | PC |
| 43 | ACMEWAXA | WA | 4423 | VERIZON NORTHWEST INC.-WA (CONTEL) | 674 | ACMEWAXARS1 | 248879014 | Fron | 522449 | FRONTIER NW - WA | 43 | 1 | N | C | PC |
| 44 | ACSHMAPL | MA | 9102 | VERIZON NEW ENGLAND INC. | 128 | ACSHMAPLDS1 | 93691243.37 | VZN | 115112 | VERIZON MASS. | 44 | 1 | N | C | PC |
| 46 | ACTNIN01 | IN | 9325 | AMERITECH INDIANA | 336 | ACTNIN01DS0 | 123064183 | ATT | 325080 | INDIANA BELL TEL CO | 46 | 1 | N | C | PC |
| 47 | ACTNMAMA | MA | 9102 | VERIZON NEW ENGLAND INC. | 128 | ACTNMAMADS1 | 76872647.66 | VZN | 115112 | VERIZON MASS. | 47 | 1 | N | C | PC |
| 48 | ACTNTXXA | TX | 2153 | TEXAS WINDSTREAM, INC. | 552 | ACTNTXXADS0 | 158752283.9 | Wind | 442153 | TEXAS WINDSTREAM | 48 | 1 | R | F | PC |



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# OCNCoSize

| COSize | ECHoldingCompanyName | OCN | ShortName | SAC | Sta | USACStudyAreaName | ALternateStudyAreaName |
|---|---|---|---|---|---|---|---|
| S | Oxford Telephone and Telegraph | 3314 | SML | 100002 | ME | OXFORD WEST TEL CO | OXFORD WEST TELEPHONE COMPANY |
| S | Lincolnville Telecom Company | 0003 | SML | 100003 | ME | Lincolnville Telecom Company | Lincolnville Telecom Company |
| S | TIDEWATER TELECOM, INC. | 3311 | SML | 100003 | ME | TIDEWATER TELECOM, INC. | TIDEWATER TELECOM, INC. |
| M | FairPoint Communications, Inc. | 0004 | Fair | 100004 | ME | CHINA TEL CO. | CHINA TELEPHONE CO. |
| M | Telephone and Data Systems, Inc. | 0005 | TDS | 100005 | ME | COBBOSSEECONTEE TEL | COBBOSSEECONTEE TELEPHONE COMPANY |
| M | Telephone and Data Systems, Inc. | 0007 | TDS | 100007 | ME | ISLAND TEL CO | ISLAND TELEPHONE CO. |
| M | Telephone and Data Systems, Inc. | 0010 | TDS | 100010 | ME | HAMPDEN TEL CO | HAMPDEN TELEPHONE CO. |
| M | Telephone and Data Systems, Inc. | 0011 | TDS | 100011 | ME | HARTLAND & ST ALBANS | HARTLAND & ST. ALBANS TELEPHONE CO. |
| M | FairPoint Communications, Inc. | 0015 | Fair | 100015 | ME | COMMUNITY SERVICE | COMMUNITY SERVICE TELEPHONE CO. |
| S | Oxford Telephone and Telegraph | 0019 | SML | 100019 | ME | OXFORD COUNTY TEL | OXFORD COUNTY TELEPHONE & TELEGRAPH CO. |
| S | Otelco Inc. | 0020 | SML | 100020 | ME | PINE TREE TEL & TEL | PINE TREE TELEPHONE & TELEGRAPH CO. |
| S | Otelco Inc. | 0022 | SML | 100022 | ME | SACO RIVER TEL & TEL | SACO RIVER TELEPHONE & TELEGRAPH CO. |
| M | Telephone and Data Systems, Inc. | 0024 | TDS | 100024 | ME | SOMERSET TEL CO | SOMERSET TELEPHONE CO. |
| M | FairPoint Communications, Inc. | 0025 | Fair | 100025 | ME | STANDISH TEL CO | STANDISH TELEPHONE CO. |
| Y | Union River Telephone Company | 0027 | SML | 100027 | ME | UNION RIVER TEL CO | UNION RIVER TELEPHONE CO. |
| S | UniTek, Inc. | 0029 | SML | 100029 | ME | UNITY TEL CO., INC. | UNITY TELEPHONE CO., INC. |
| M | Telephone and Data Systems, Inc. | 0031 | TDS | 100031 | ME | WARREN TEL CO | WARREN TELEPHONE CO. |
| M | Telephone and Data Systems, Inc. | 0034 | TDS | 100034 | ME | WEST PENOBSCOT TEL | WEST PENOBSCOT TELEPHONE & TELEGRAPH CO. |

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# Changes in Service Area Mapping

- Summary of TelcoMaster Updates Since Filing
  - February 2012 Miscellaneous corrections
    - Changes were applied January 2012 prior to the February Public runs
    - These changes revised the company (Short Name) that some Service Areas report under and also changed some to Rate of Return type of carriers
      - Changed all Service Areas for SAC 100015 Community Service in ME from Price Cap to Rate of Return
      - Changed all Service Areas for SAC 210291 GTC , Inc. in FL from Shortname 'SML' to 'Fair', Fairpoint
      - Changed all Service Areas for SAC 371536 Curtis Tel Co from ShortName 'Cons' to 'SML' in NE
      - Changed all Service Areas for SAC 381131 Citizens-Frontier ND from Price Cap to Rate of Return
      - Changed all Service Areas for SAC 431981 Chouteau Tel Co in OK from ShortName 'SML' to 'Fair', Fairpoint
      - Changed all Service Areas for SAC 462187 The El Paso Cnty Tel in CO from ShortName 'SML' to 'Cent' Century Link
      - Changed all Service Areas for SAC 613027 in AK from ShortName 'ATT' to 'SML' and updated to Rate Of Return. This was previously AT&T Alascom
    - Created input table CQAOCNCoSize_V5 which was made available for use
  - May 2012 changes to Price Cap and change of ownership
    - Changed definition from Rate of Return to Price Cap for several Fairpoint, Windstream and Consolidated SACs
    - 3 West Virginia Service Areas changed ownership to Frontier
    - 1 New Mexico Service Area changed ownership to Qwest and Price Cap


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# CQBAT Demand/Services

- For CQBAT, the following overviews the Demand/Service creation:
  - For residential data, Census Block-based estimates were used
    - The census based, residential data were randomly placed along the roads in a Census Block, to arrive at an unbiased estimate of residential locations to drive the network build
  - For business data, a multi-step process was used:
    - A count of business locations by Census Block was obtained from Geolytics
    - To estimate the type and size of the firms, business data from the Economic Census (2007) were utilized which is at ZIP code level
    - ZIP Code boundaries were overlaid on top of Census Block boundaries to create an association between Census Blocks and ZIP Codes
    - The Economic Census business data were allocated into Census Blocks based on the prevalence of ZIP data points
    - Within each Census Block, the Economic Census count of firms was then compared to the Baseline count of business firms -- difference assumed to be Single Office or Home Office ("SoHo") business locations
    - Once all the firms' locations in Census Block were classified by type and size, the firm points were randomly assigned to eligible road segments within the blocks
    - As a final step, wireless towers were added to the business demand point data set
  - The services assigned to residential and business customers follow on the next slide





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# CQBAT Demand/Services

**Service Creation**

**Res** *Based on Census HH counts in CBs*

| | |
|---|---|
| DSL | # |
| Customer | # |

**Basic Bus** *Based on GeoResults Firm counts in CBs - Not accounted for by Economic Census Counts, Anchors or Government data*

| | |
|---|---|
| DSL | B |
| Customer | { |

**Economic Census** *Based on Economic Census data - sample data shown*

**Sample Economic Census Data**

| Zip | NAICS | Est | N1_4 | N5_9 | N10_19 | N20_49 | N50_99 | N100_249 | N250_499 | N500_999 | N1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 501 | ------ | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 501 | 72---- | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 501 | 722212 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 501 | 81---- | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 501 | 813110 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1001 | ------ | 477 | 214 | 88 | 78 | 53 | 23 | 18 | 2 | 0 | 1 |
| 1001 | 22---- | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1001 | 221119 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1001 | 221310 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1001 | 221320 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1001 | 23---- | 60 | 36 | 12 | 6 | 5 | 0 | 1 | 0 | 0 | 0 |
| 1001 | 236116 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1001 | 236117 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Left(NAICS,2) >=50** — Counts of Services

| | | Est | N1_4 | N5_9 | N10_19 | N20_49 | N50_99 | N100_249 | N250_499 | N500_999 | N1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DSL | B | | 1 | 1 | | | | | | | |
| NSW | N | | | | | | | | | | |
| FO | F | | | | 1 | 1 | 1 | 2 | 2 | 4 | 4 |
| Customer | { | 1 | | | | | | | | | |

**Left(NAICS,2) <50** — Counts of Services

| | | Est | N1_4 | N5_9 | N10_19 | N20_49 | N50_99 | N100_249 | N250_499 | N500_999 | N1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DSL | B | | 1 | 1 | 1 | 1 | | | | | |
| NSW | N | | | | 1 | 2 | | | | | |
| FO | F | | | | | | 1 | 2 | 2 | 4 | 4 |
| Customer | { | 1 | | | | | | | | | |

**Government Locatic** *...portions captured in Anchor data*

**Towers** *...tbd*

| | |
|---|---|
| FO | W |
| Customer | { |

**Anchor Institutions** *SBDD*

| | | |
|---|---|---|
| FO | 1,2,3,4,5,6,7 | Code to match type |
| Customer | { | |

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# Network Capabilities

- Extent of Network
  - Runs from customer demarcation point (e.g., NID) to Router on the “Cloud”
- Design of network
  - IP based network
  - Focus on cost of data "Pipe“
    - No Video gear (including STB) installed
    - No Voice Gateway installed
  - Voice, Data, Video are considered services that ride the bits on the pipe
  - Network should be built to pass and ready to serve all locations (whether working or not)
    - Consistent with many state level POLR/COLR requirements

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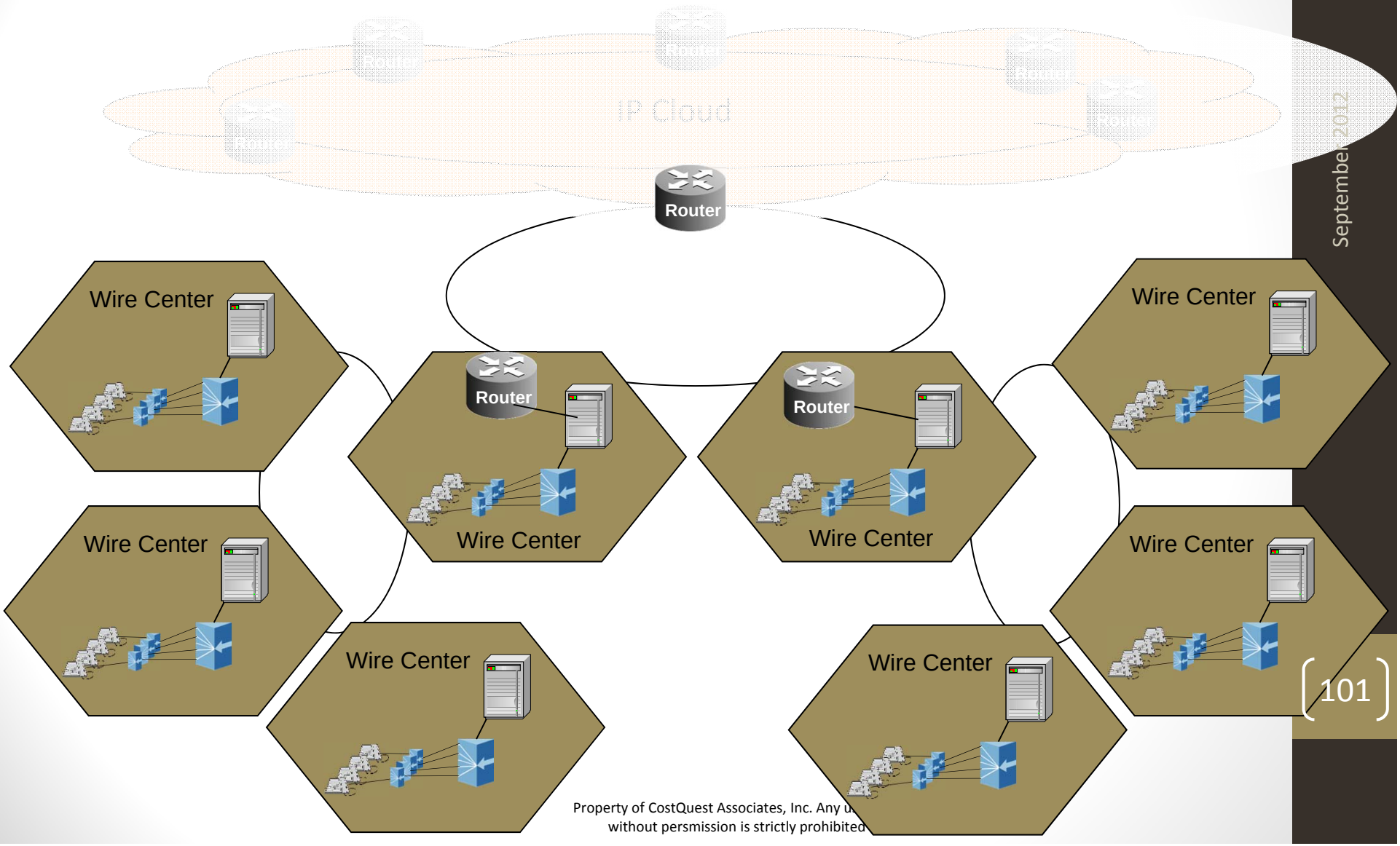
# Network Overview

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# EXISTING BROADBAND COVERAGE

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# Broadband Coverage Data Load

- Broadband coverage was derived from National Broadband Map
- Data Downloaded March 2011
  - First Public National Map Release (Feb 2011)
  - NBM Round 2 (Fall 2010 Ground Date)
  - Coverage data downloaded as CSV
  - Census 2000 format

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# Broadband Coverage Processing

- Coverage was segregated into three technology groups
  - A technology group is defined by a Transtech (Transmission Technology)
  - "Telco"=NTIA xDSL, SDSL, OtherCU, Optical Carrier
    - (Transtech 10,20,30,50)
  - "Cable"=NTIA DOCSIS 3.0, DOCSIS Other
    - (Transtech 40,41)
  - "Wireless"=NTIA Mobile Wirless, Fixed Wireless
    - (Transtech 70,71,80)





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# Broadband Coverage Speed "Winner"

- Within these technology groups (telco, cable, wireless) top speed category was calculated based upon the top speed in each technology category
  - Example: If there are multiple "Cable" providers in a block, the fastest speed will be attributed to that block for that technology group
- This categorization was made block by block without regard to serving area, operating company or neighboring blocks

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# Broadband Coverage Speed Tier

- National Broadband Map data is reported in upstream and downstream speed tiers
  - Tier 3=.768 to 1.5 Mbps, Tier 4=1.5 to 3.0 Mbps
- The block speed value was assigned based upon the bottom value in the NTIA downstream tier
  - Tier 3 assigned .768 Mbps
  - Tier 4 assigned 1.5 Mbps

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# Data Processing Exceptions

- Most of the data source issues we found have been corrected in supplemental releases

1. We only included blocks that had a valid Transtech
2. If the speed categories were below FCC threshold (MaxAdDown < Category 3) block ignored
3. If there were no speed categories on the block, speed was assumed to be .768 Mbps

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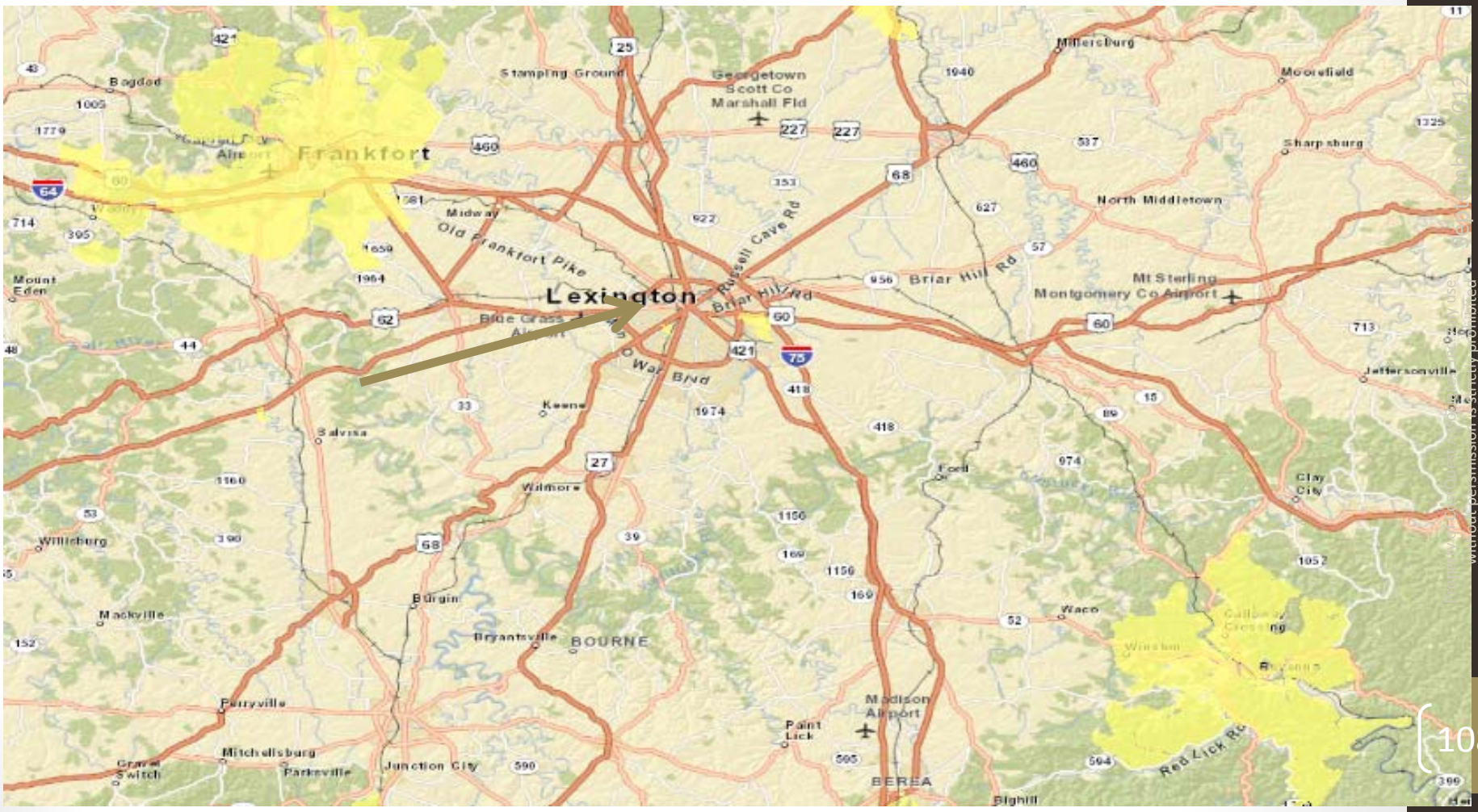
# SBDD Round 2 Cable Coverage




SBDD Cable in Yellow

# Broadband Coverage Supplementation

- In this early release of NBM data, there was concerned that the cable coverage footprint may be too small.
- Carriers analyzed a number of third party data sources versus the existing NBM coverage
  - Difficult to overcome the licensing issues in third party data
  - Indeterminate what the 'most accurate' source was
- Selected Warren Media as alternate source
  - NTIA/Warren Media Blend is a combination of cable coverage data from both the National Broadband Map and Warren Media

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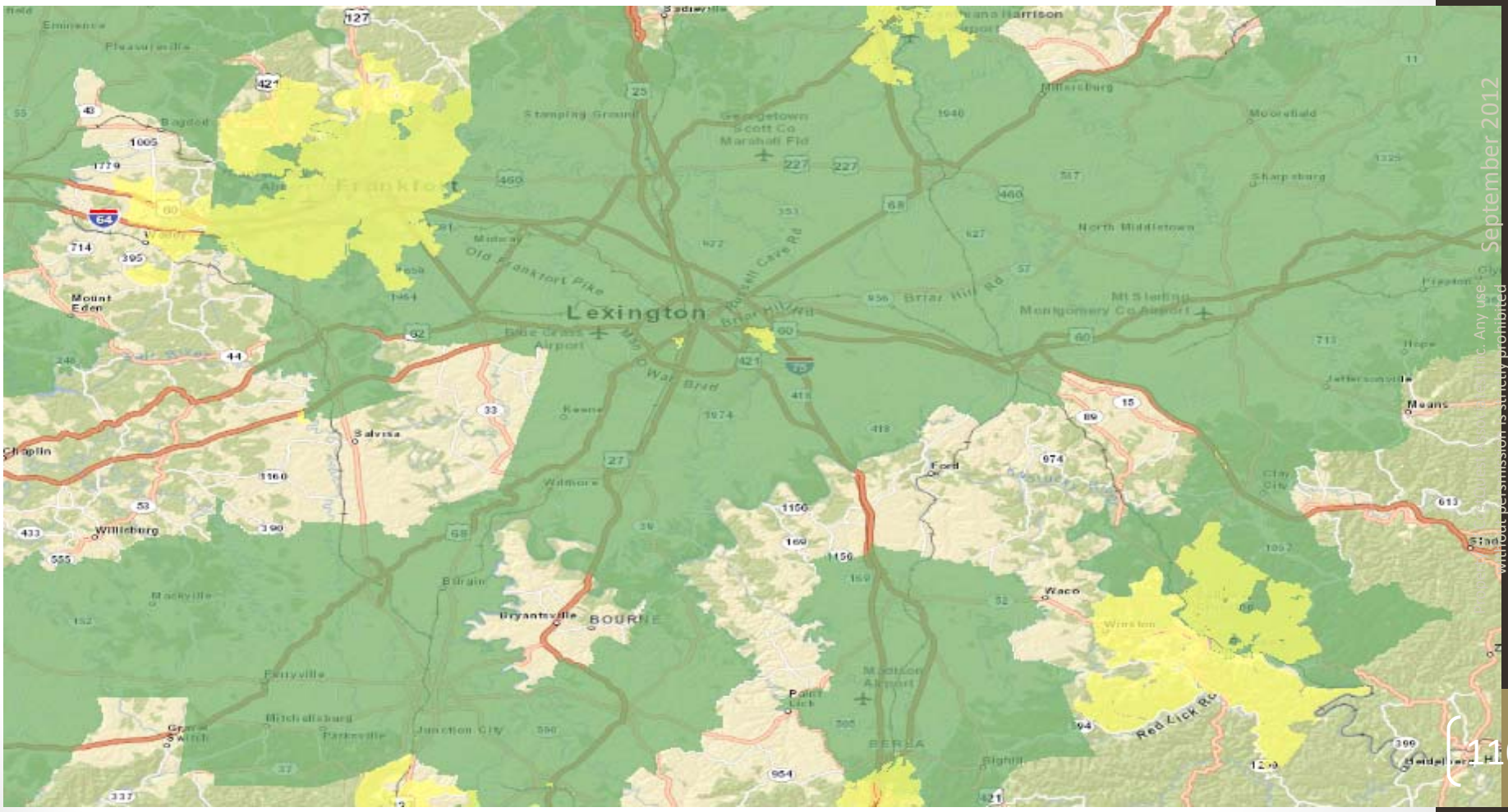
# Warren Media Coverage




SBDD Cable in Yellow
Warren Media Green

September 2012
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# Broadband Coverage Supplementation

- The blended Cable coverage is accomplished by augmenting the NBM Cable data with Warren based Census Designated Places
  - In Warren Media covered areas
    - Remove any Warren CDP that contains SBDD coverage
    - Remove any Warren CDP that have linear density < 35 service locations per road mile


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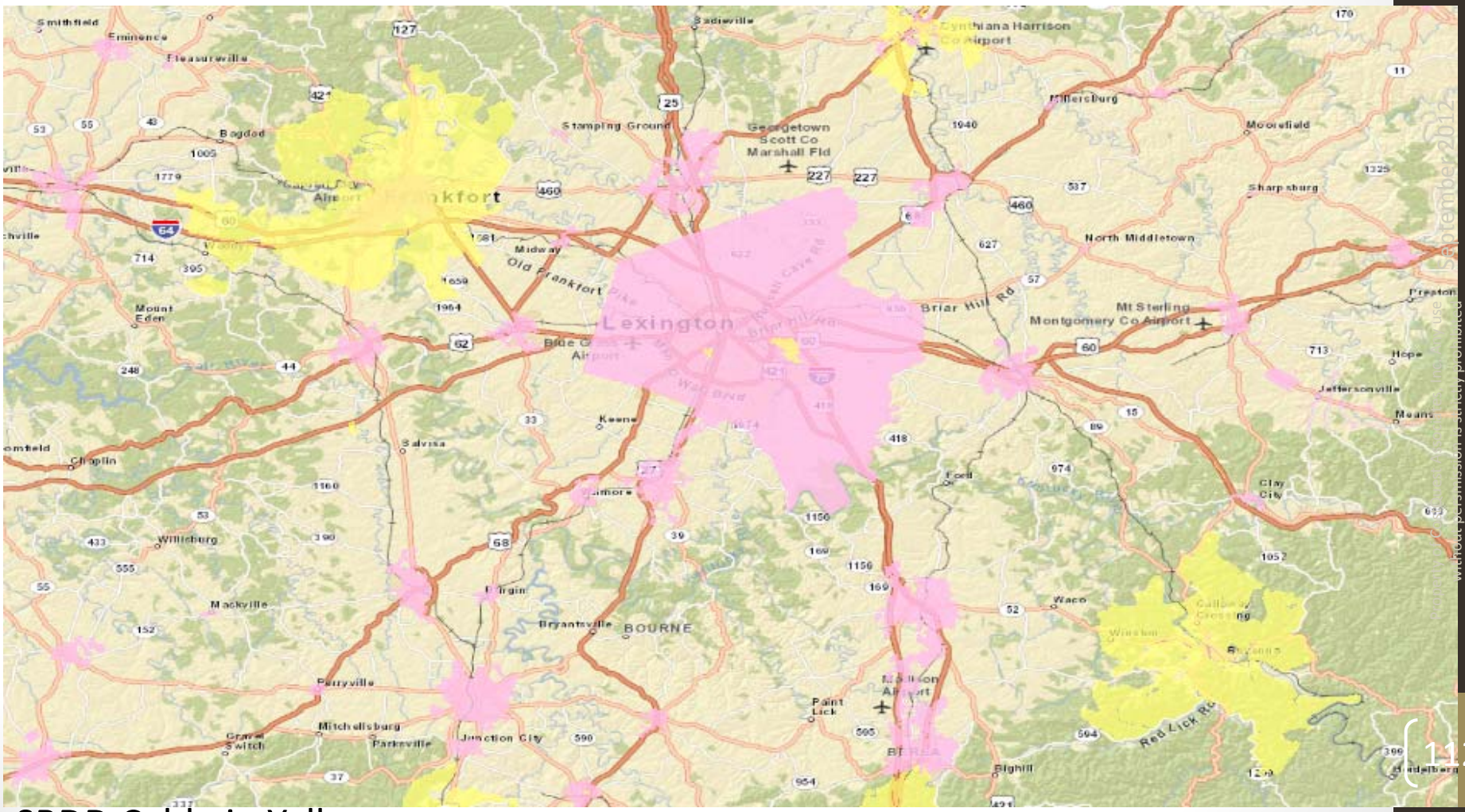
# Warren Media Blend




SBDD Cable in Yellow

Warren Served CDP in Pink

# DATA SOURCES

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# CQBAT Current Data Sources

| Data Category | Model Variables | Data Source | Wireline Coverage | Capex | Opex |
|---|---|---|---|---|---|
| Census Boundaries | Full census block; full census block group; full census tract; full census county; census state | 2009 TIGER | x | x | x |
| Wire center boundaries | Wire center code; wire center area | TeleAtlas 2010 | x | x | |
| Geographic characteristics | Land area, total road length; x and y coordinates by fragment. | Tiger Roads 2009; | x | X | |
| Terrain | Terrain Characteristics | USGS-Statsgo | x | x | |
| Population size | Population by block Population density by block and road length. | 2010 Geolytics and 2000 Census | x | x | |
| Housing units | Occupies housing units, total housing units, total households by block | 2010 Geolytics | x | x | |
| Provider size and organizational structure | Corporate ownership, size of parent company, number of wire centers operated by carrier. | Coalition Members | x | x | x |
| Company opex financial data | A wide array of company specific financial information (and underlying business volumes) from public and subscription service sources. Data centers on operating expense by category (e.g., maintenance, sales, interconnection, sales and marketing, G&A, bad debt, taxes, etc.) | See Appx. 4 for a comprehensive list of opex data sources | | | x |
| High Capacity locations | High Capacity locations will be used to represent high demand business points and will be used to improve Business location points for sizing the network. | Economic Census http://www.census.gov/econ/cbp/ | x | x | |
| Wireless tower location | Wireless tower locations will be used to represent locations requiring fiber service and will be used to supplement Business and Residential customer points for sizing the network. | To be determined | x | x | |
| Wireline carrier service | Telco broadband speed for wireline area coverage within a block | February 2011 National State Broadband Data NBM 6/30 deliverable download 3/22/11 | | | |
| Cable carrier service | Cable broadband speed for cable area coverage within a block | NBM 6/30 deliverable download 3/22/11 | | | |

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# THE GUTS

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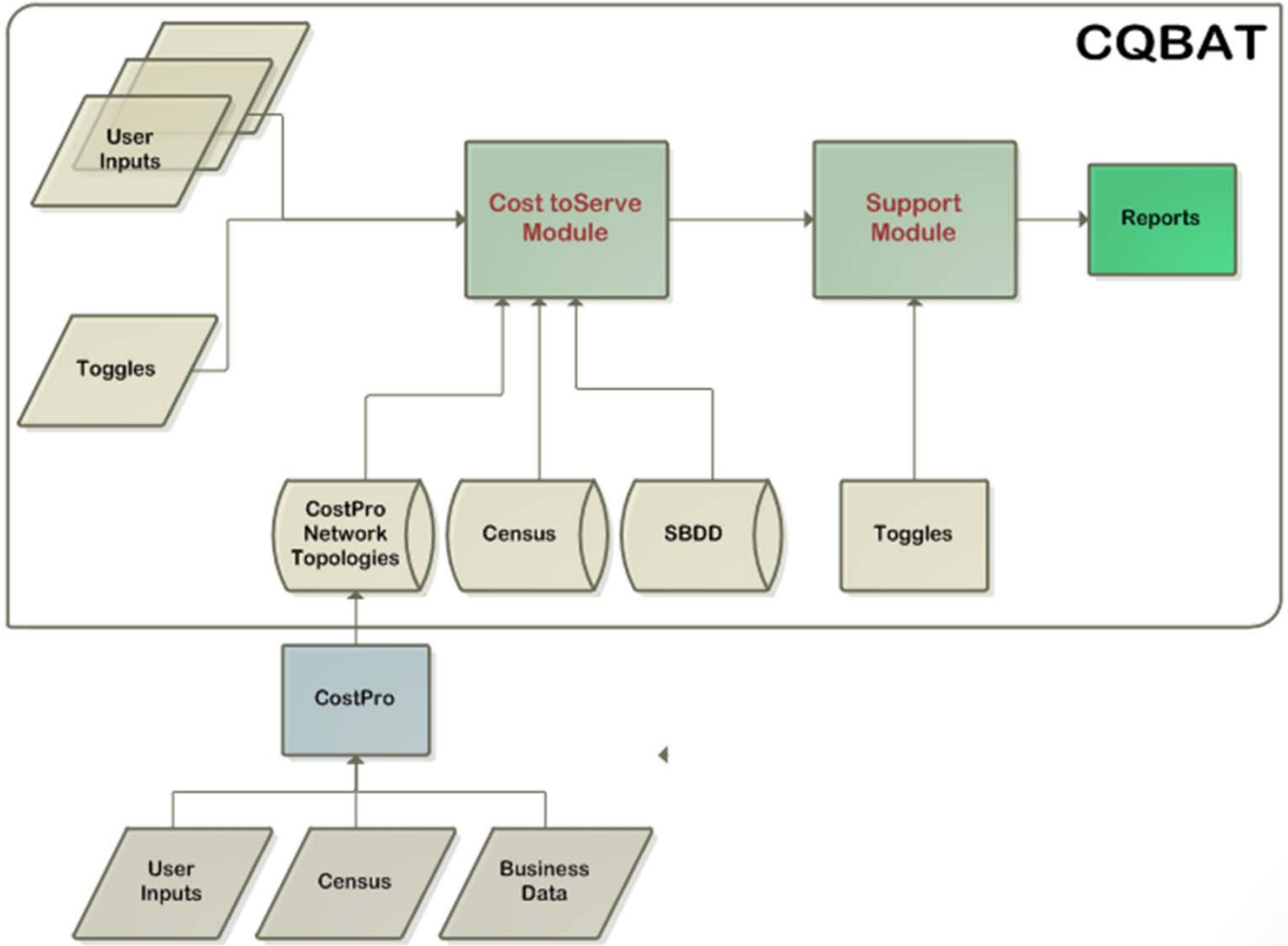
# CQBAT Schematic

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# Processing Steps

- Step1 Telco Create Sol Set
- Step 2 Initialize Solution Set
- Step 2b Update CTDensity
- Step 3a Feeder
- Step 3b  Delete From SS
- Step 4a Determine Take Rate
- Step 4b Determine Take Rate
- Step 5 Determine bandwidth
- Step 6 Determine ARPU
- Step 7  Determine Node2
- Step 8a Delete SysCapex
- Step8b Create SysCapex
- Step8c Adjust MM
- Step8d Update SysCapex.
- Step 9a - Index before 9
- ** Step 9b Start State Loop 9b
- Step 9c Start Loop Load Capex Dist
- Setp 9d Delete TEMPSS_CapexDist Table
- Step 9e Insert TEMPSS_CapexDist
- Step9f Update SS with CapexDist
- Step 9g End of State Loop 9
- ** Step 9h End of State Loop 9
- Step 9i Drop Index After 9
- Step 10a -Create Index before 10
- ** Step 10b  Start State Loop 10
- Step 10c  Delete SysCapex_Fdr
- Step 10d Delete from TEMPSysCapex_Fdr
- Step 10e Insert TEMPSysCapex_Fdr
- Step 10f Insert SysCapexFdr
- Step 10g Load Capex Fdr
- Step 10h Truncate before TEMPSysCapex_MM
- Step 10i Truncate before SysCapexMM
- Step 10j Insert TEMPSysCapexMM
- Step10k Insert SysCapex MM
- Step10l Update CapexMM
- ** Step 10m End State Loop
- Step 11a Delete SysOpex
- Step 11b Drop Index
- Step 11c Create SysOpex
- Step 12a Create Index Step 12
- ** Step 12b Start State Loop 12
- Step 12c Load Opex
- Step12d Delete TEMPSS_Opex
- Step12e Insert TEMPSS_Opex
- Step12f Update SS Opex
- Step 12g End SQL Loop
- ** Step 12h End of State Loop 12
- Step 13 Total Investment
- Step 14 Final Updates
- Step 15 Version Logging
- Step 16 - Index SSMaster for Reporting

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# Processing Steps – in Quasi-English

- Create entries in Solution Set table
  - Entries are driven by the Network Design Distribution table
  - A record is created for each CB/ServiceArea/Node2ID that meets the criteria
  - The record contains Census data, coverage data in terms of speed for Telco, Wireless and Cable and Distribution information (Node 3 Structure and Density, Node3 Length) and Node4 working lines
- Processing continues to update various fields of the Solution Set as described in the following steps
  - Update Node 2 and Node 0 fields based on Feeder data per the Node2ID
  - Apply  Residence Take Rate
  - Apply Business Take Rate
  - Apply CB Bandwidth
  - Apply Node2 Bandwidth
- Prepare intermediate table SYS CAPEX using the Capex user input combined with other user inputs
  - For each State and Network design type being used (FTTd or FTTp), the SYS CAPEX includes Material Amounts, COM, Depreciation, Tax and Operating Expense by Density and Terrain

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# Processing Steps – in Quasi-English

- Apply Capex Distribution
  - Loop through each state, using the SYS CAPEX table update the Solution Set fields Deprecation, COM, Tax and Opex fields (such as NetworkOperationsPSOpex)
- Apply Capex Feeder
  - Loop through each state, update the Solution Set fields Deprecation, COM, Tax and Opex fields
- Apply middle mile adjustments to these same Solution Set fields
- Create intermediate table SYS OPEX using the user input for Opex which varies by the CO Size and Density
- Apply Opex
  - Loop through each state, update the Solution Set fields Deprecation, COM, Tax and Opex fields
- Calculate Total Investment and Total Cost

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# Solution Sets

- Output structure
  - What is the solution set?
    - A Solution Set is a collection of output data processed by the model based on user defined settings and Input Collections
    - Specifically, Solution Set output is a function of the user specifying the States to be included in the scenario, the toggle settings that best fit user requirements and the underlying Input Collection consistent with user needs
  - The Solution Set is developed based upon two types of data feeds:
    - The first feed is the Input Collection
      - The Input Collection represents a specifically formatted series of OpenXML (.xlsx) files
      - The second feed to the Solution Set is a network topology which captures the selection of FTTd or FTTp

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# Solution Set Fields (page 1)

| Column | Datatype | Description |
|---|---|---|
| SSKey | Int | ID of Record in Solution Set |
| CB | VarChar (16) | Census Block ID |
| ServiceArea | VarChar (15) | Service area ID |
| Tech1 | VarChar (10) | Provider Type |
| Tech2 | VarChar (10) | Technology |
| Tech3 | VarChar (10) | Architecture |
| Tech4 | VarChar (15) | Distance to major node (DSLAM, Fiber node, Splitter, Tower) or Type of Wireless Run |
| State | Char (2) | State |
| Zip3 | VarChar (3) | 3 Digit Zip Code |
| HU | Float | Housing Units |
| Pop | Float | Population |
| BusinessEmployees | Float | Number of Business employees |
| SSRecordsPerCB | Float | This field would be used in some reporting by CB. It is a ratio of the Node4WorkingCust to RES and BUS census block data. |
| AreaSqMi | Float | Area: (mi^2), from CBMaster (converted) |
| CoSize | Char (1) | Company Size (S, M, L, Y, Z) |
| SASize | VarChar (2) | FIELD IS NOT USED |
| TelcoBBSpeed | Float | Speed for Telco delivered Broadband |
| CableBBSpeed | Float | Speed for Cable delivered Broadband |
| WirelessBBSpeed | Float | Speed for Wireless delivered Broadband |
| TelcoBBServed | Bit | Indication if telco broadband exceeds threshhold |
| CableBBServed | Bit | Indication if wireless broadband exceeds threshhold |
| WirelessBBServed | Bit | Indication if cable broadband exceeds threshhold |
| TowerCount | Float | FIELD IS NOT USED |
| GorB | VarChar (1) | Greenfield or Brownfield build |
| Competitors | SmallInt | Represents number of competitors for costing model run. This value may be entered by the user, in which case all records in the Solution Set will have the same value or it may be specific to the solution set record,representing the actual number of provider types serving this CB (example, 0, 1, or 2 , 2 meaning both wireless and cable serve the area) |

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# Solution Set Fields (page 2)

| Column | Datatype | Description |
|---|---|---|
| Node4WorkingCust | Float | Number of potential customers in CB,populated based on CostPro Distribution |
| Node4WorkingCustBus | Float | Potential Business customers in CB, populated based on CostPro Distribution |
| Node4WorkingCustRes | Float | Potential Residential customers in CB,populated based on CostPro Distribution |
| Node4Cable | Float | Distance: (ft), from Distribution |
| Node3WorkingLines | Float | Number of potential customers at Node3 |
| Node3Length | Float | Distance: (ft), from Distribution |
| Node3Cable | Float | Length of 25 pair capacity (in feet) triggered by CB |
| Node3CableSpliceSU | Float | Portion of splice set ups (count) triggered by CB |
| Node3CableSplice | Float | Portion of splices (count) triggered by CB |
| Node3StructureSharedHard | Float | Amount of Node3 structure that is shared with Node2 routes |
| Node3StructureSharedMedium | Float | Amount of Node3 structure that is shared with Node2 routes |
| Node3StructureSharedNormal | Float | Amount of Node3 structure that is shared with Node2 routes |
| Node3StructureNormal | Float | Portion of structure in normal terrain triggered by CB |
| Node3StructureMedium | Float | Portion of structure in medium terrain triggered by CB |
| Node3StructureHard | Float | Portion of structure in hard terrain triggered by CB |
| Node3EquipQty | Float | Number of Node3/Pedastals in CB |
| Node3Density | Char (1) | Density of distribution area |
| Node2ID | VarChar (15) | ID of serving Node2 |
| Node1ID | VarChar (15) | ID of serving Node1 |
| Node0ID | VarChar (15) | ID of serving Node0 |
| CBRoadLength | Float | Distance: (ft), from Distribution |
| CBHWCRRoadLength | Float | Distance: (ft), from Distribution |
| Node2Length | Float | Distance: (ft), from Feeder |
| Node2WorkingLines | Float | Number of customers passed by Node2 |
| Node2TowerExists | Bit | Does tower exist in Node2 area |
| Node22gExists | Float | Percentage of 2G in Node2 area |
| Node2Terrain | Char (1) | Average terrain in Node2 area |
| Node2Density | Char (1) | Average density in Node2 area |
| Node0WorkingLines | Float | Number of total customers in service area |
| Node0Node2Counts | Float | Number of Node2 locations in service area |

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# Solution Set Fields (page 3)

| Column | Datatype | Description |
|---|---|---|
| CTDensity | Float | Node4WorkingCustRes density (per Area Sq Mi) at a Census Track |
| VoiceTake | Float | Estimated Voice take in CB |
| DataLowTake | Float | Estimated DataLow take in CB |
| DataHighTake | Float | Estimated DataHigh take in CB |
| VideoLowTake | Float | Estimated VidoeLow take in CB |
| VideoHighTake | Float | Estimated VideoHigh take in CB |
| BundleLowTake | Float | Estimated BundleLow take in CB |
| BundleHighTake | Float | Estimated BundleHigh take in CB |
| DataTake | Float | Estimated total Data take in CB |
| VideoTake | Float | Estimated total Video take in CB |
| TotalVoiceTake | Float | Estimated total voice take in CB |
| DataLowRevenue | Float | Estimated DataLow Revenue in CB |
| DataHighRevenue | Float | Estimated DataHigh Revenue in CB |
| VideoLowRevenue | Float | Estimated VideoLow Revenue in CB |
| VideoHighRevenue | Float | Estimated VideoHigh Revenue in CB |
| VoiceRevenue | Float | Estimated Voice Revenue in CB |
| BundleLowRevenue | Float | Estimated BundleLow Revenue in CB |
| BundleHighRevenue | Float | Estimated BundleHigh Revenue in CB |
| AverageAnnualGrowth | Float | Based on Gompertz curve, this is the average annual growth in demand |
| AverageAnnualGrowthVideo | Float | Based on Gompertz curve, this is the average annual growth in video demand |
| CBBandwidth | Float | Estimated bandwidth in busy hour for CB |
| DataRevenue | Float | Estimated total Data Revenue in CB |
| TotalRevenue | Float | Estimated Total Revenue in CB |
| TotalVoiceRevenue | Float | Estimated total Voice Revenue in CB |
| VideoRevenue | Float | Estimated total Vidoe Revenue in CB |
| Node2Take | Float | Total take at the serving Node2 |
| Node2Bandwidth | Float | Total bandwidth in busy hour at serving Node2 |

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# Solution Set Fields (page 4)

| Column | Datatype | Description |
|---|---|---|
| Node0CloudEletronicsInvS | Float | Investment for Node0 cloud electronics (driven by subscribers) |
| Node0ElectronicsInv2 | Float | Node0Routers - Investment for Node0 termination electronics (driven by node 2 counts) |
| Node0ElectronicsInvB | Float | Investment for Node0 termination electronics (driven by bandwidth) |
| Node0ElectronicsInvC | Float | Node0Regen - Investment for Node0 termination electronics (driven by customers) |
| Node0VideoEletronicsInvC | Float | Investment for Node0 video termination electronics (driven by customers) |
| Node0VideoEletronicsInvS | Float | Investment for Node0 video termination electronics (driven by subscribers) |
| Node2AFStructureInv2 | Float | Node2PolesFDR - Investment for Node2 to Node0 Aerial Fiber Structure (Poles) |
| Node2BFStructureInv2 | Float | Node2BuriedTrenchFDR - Investment for Node2 to Node0 Buried Fiber Structure (trench) |
| Node2CCableInv2 | Float | Node2FDIFDR - Investment for Node2 to Node0 copper cable, including termination gear (FDI) |
| Node2ElectronicsInv2 | Float | Node2DSLAMFixedFDR - Investment for Node2 electronics (typically driven by placement of node2: Represents DSLAM Frame for Wireline, Microwave for Wireless ) |
| Node2ElectronicsInvB | Float | Investment for Node2 electronics (typically driven by bandwidth: Represents Radio for Wireless) |
| Node2ElectronicsInvS | Float | Node2DSLAMVariableFDR - Investment for Node2 electronics (typicall driven by subscribers or structure: DSLAM cards for wireline, and Tower/hut and fiber electronics for wireless) |
| Node2FCableInv2 | Float | Node2FiberAndSplitterFDR - Investment for Node2 to Node0 fiber cable, including termination gear (driven by node2 placement) |
| Node2FCableInvL | Float | Node2SplitterCardsFDR - Investment for Node2 to Node0 fiber cable, including termination gear (driven by locations) |
| Node2UFStructureInv2 | Float | Node2ConduitFDR - Investment for Node2 to Node0 Underground Fiber Structure (conduit systems) |
| Node3ACStructureInvL | Float | Node3PolesCUDIST - Investment for Node3 to Node2 Aerial Copper Structure (pole) |
| Node3AFStructureInvL | Float | Node3PolesFODIST - Investment for Node3 to Node2 Aerial Fiber Structure (pole) |
| Node3BCStructureInvL | Float | Node3BuriedTrenchCUDIST - Investment for Node3 to Node2 Buried Copper Structure (trench) |
| Node3BFStructureInvL | Float | Node3BuriedTrenchFODIST - Investment for Node3 to Node2 Buried Fiber Structure (trench) |

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# Solution Set Fields (page 5)

| Column | Datatype | Description |
|---|---|---|
| Node3CCableInvL | Float | Node3CopperAndPedastalAndFSTDIST - Investment for Node3 to Node2 Copper Cable |
| Node3FCableInvL | Float | Node3FiberDIST - Investment for Node3 to Node2 Fiber Cable |
| Node3UCStructureInvL | Float | Node3ConduitCUDIST - Investment for Node3 to Node2 Underground Copper Structure (conduit systems) |
| Node3UFStructureInvL | Float | Node3ConduitFODIST - Investment for Node3 to Node2 Underground Fiber Structure (conduit systems) |
| Node4CCableInvL | Float | Node4DropNIDAndONT - Investment in drop |
| Node4CPEInvS | Float | Node4Modem - Investment in customer premise gear |
| Node4CPEVideoInvS | Float | Investment in customer premise video gear |
| Node0FcableInv0 | Float | Node0FiberIOF - Middle Mile Fiber cable investment |
| Node0AFStructureInv0 | Float | Node0PolesIOF - Middle Mile Aerial structure |
| Node0BFStructureInv0 | Float | Node0BuriedTrenchIOF - Middle Mile Buried structure |
| Node0UFStructureInv0 | Float | Node0ConduitIOF - Middle Mile Underground structure |
| Node0ElectronicsInv0 | Float | Middle Mile electronics |
| Node0LandBuildingOther0 | Float | Node0LandBuilding - Investment for Node0 items not specific to the network. |
| NetworkOperationsPSOpex | Float | Opex for Plant Specific Network Operations |
| NetworkOperationsNPSOpex | Float | Opex for Non Plant Specific Network Operations |
| CustomerOperationsMktOpex | Float | Opex for Customer Marketing Operations |
| ServiceDeliveryOpex | Float | Opex for Customer Service Delivery Operations |
| GenAdminOpex | Float | Opex for General Administration Operations |
| BadDebtOpex | Float | Opex for Bad Debt |
| COGSOpex | Float | Opex for the Cost of Good Sold (e.g., Content) |
| FranchiseFeeOpex | Float | Opex for Franchise Fee |
| SpectrumOpex | Float | Opex for Spectrum |
| DEPR | Float | Monthly Depreciation Expense related to Investment |
| COM | Float | Monthly Cost of Money related to Investment |
| TAX | Float | Monthly Income Tax related to Investment |
| TotalInvestment | Float | Total Incremental investment attributed to CB |
| PopDensity | Float | Density: (People per mi^2), from CBMaster (converted) |
| TotalOpexCost | Float | Computed field that adds NetworkOperationsPSOpex,NetworkOperationsNPSOpex,CustomerOperationsMktOpex,Service DeliveryOpex, GenAdminOpex,BadDebtOpex,COGSOpex,FranchiseFeeOpex and SpectrumOpex |
| CapitalCost | Float | Computed field that adds DEPR, COM and TAX |



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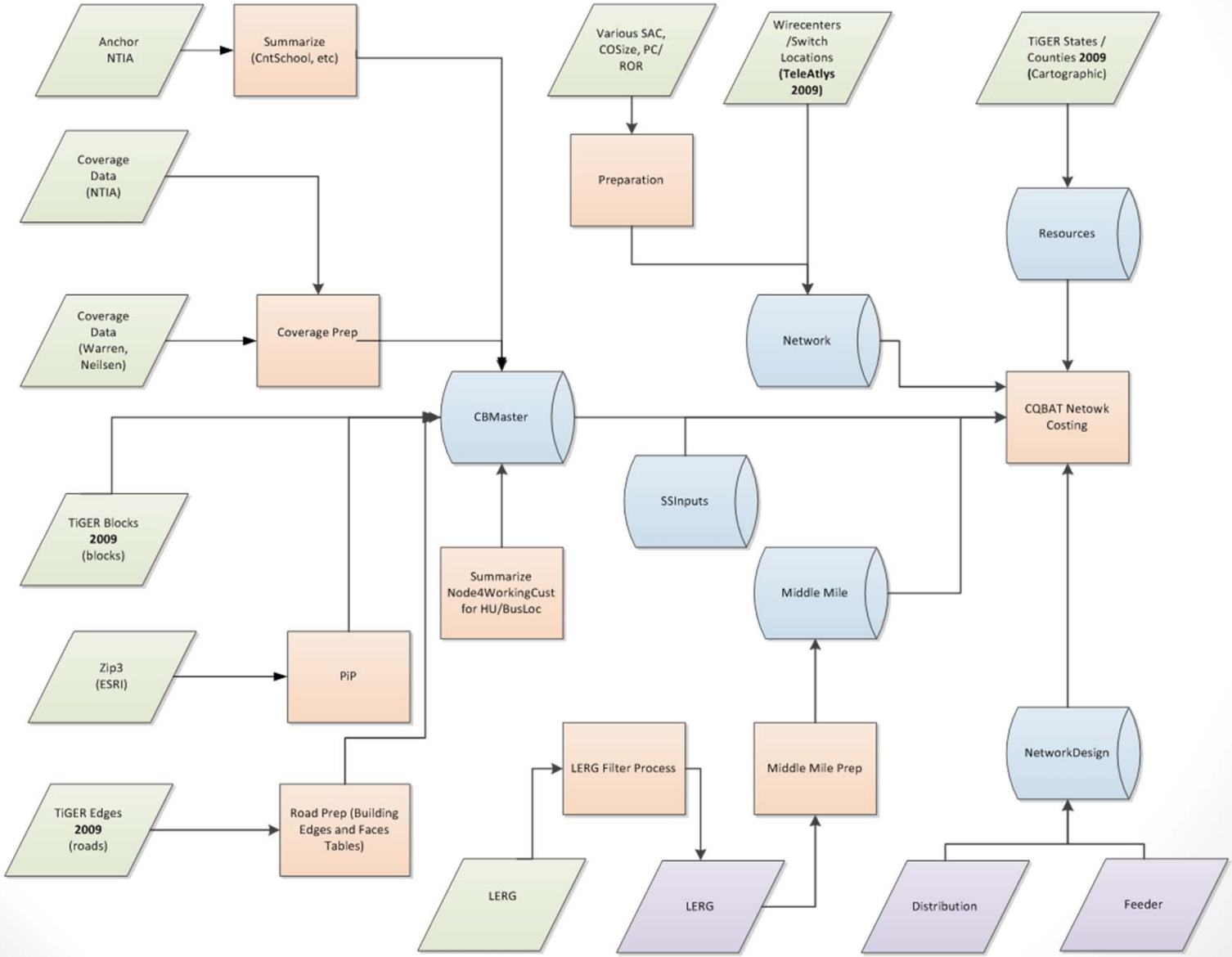
# CQBAT Schematic: Expanded

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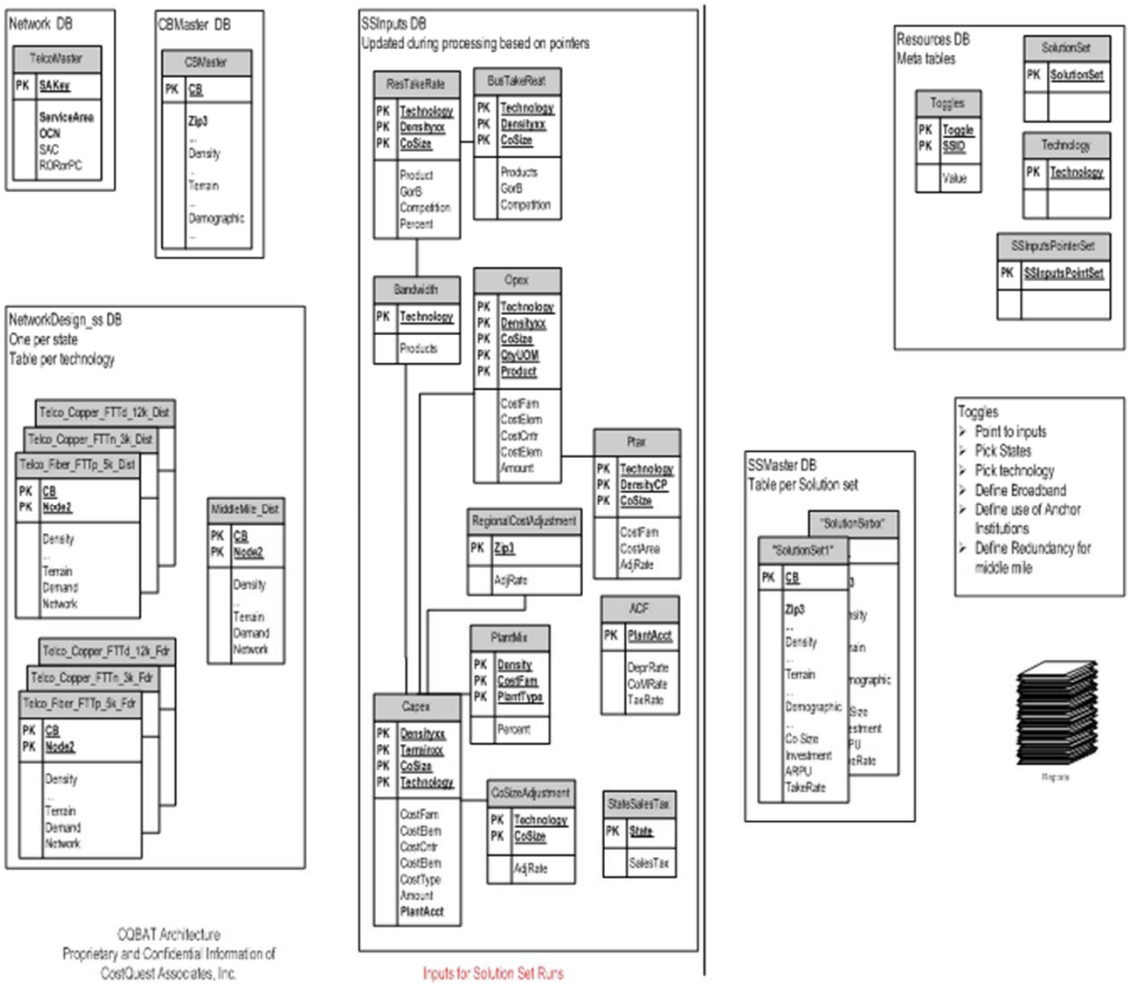
# CQBAT Schematic: Another View

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# Q/A

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# INPUT REVIEW (AND SOURCES)

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# Coverage and Network Topologies

- The following have been developed externally and loaded into databases within CQBAT:
  - Current Broadband coverage pulled from NTIA's National Broadband Map is captured in the CBMaster database
  - The various network topologies as produced by CostQuest are captured in the Topology databases (one for each state)
    - These topologies capture the size and type of plant required
    - These are then converted into investments (i.e., capex) applying costs for material and labor provided in user input tables
    - Included in these databases are topology tables for
      - Distribution
      - Feeder
      - Middle Mile

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# CQBAT Dist

| CB | ServiceArea | Node4 Working Cust | Node4 Cable | Node4 Working CustRes | Node4 Working CustBus | Node3 Working Lines | Node3 Length | Node3 Cable | Node3 CableSpliceSU | Node3 CableSplice | Node3 Structure Normal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10010201001000 | PRVLALMA | 2 | 100.00 | 2 | 0 | 2 | 10,333 | 1,622.24 | 0.31 | 29.26 | - |
| 10010201001000 | PRVLALMA | 1 | 362.00 | 1 | 0 | 4 | 2,474 | 343.35 | 0.04 | 3.10 | - |
| 10010201001000 | PRVLALMA | 5 | 260.00 | 3 | 2 | 6 | 6,416 | 1,532.36 | 0.04 | 5.89 | 798.66 |
| 10010201001001 | PRVLALMA | 1 | 50.50 | 1 | 0 | 2 | 9,505 | 708.57 | 0.08 | 10.79 | - |
| 10010201001001 | PRVLALMA | 11 | 2,457.33 | 11 | 0 | 19 | 8,150 | 6,211.74 | 0.99 | 56.79 | 1,714.57 |
| 10010201001002 | PRVLALMA | 48 | 6,297.92 | 44 | 4 | 81 | 11,743 | 36,713.44 | 9.52 | 899.86 | 6,375.92 |
| 10010201001002 | PRVLALMA | 53 | 8,495.69 | 48 | 5 | 74 | 9,529 | 28,664.68 | 4.17 | 379.70 | 6,738.29 |
| 10010201001003 | PRVLALMA | 18 | 1,627.64 | 15 | 3 | 30 | 9,308 | 12,122.24 | 2.66 | 184.25 | 1,995.07 |
| 10010201001004 | PRVLALMA | 9 | 970.17 | 8 | 1 | 20 | 8,863 | 6,118.35 | 1.11 | 82.34 | 935.87 |
| 10010201001005 | PRVLALMA | 7 | 786.08 | 7 | 0 | 20 | 11,464 | 5,416.78 | 1.45 | 137.22 | 712.02 |
| 10010201001005 | PRVLALMA | 21 | 3,340.33 | 20 | 1 | 27 | 9,534 | 14,503.78 | 3.88 | 220.01 | 3,496.54 |
| 10010201001006 | PRVLALMA | 14 | 1,368.14 | 12 | 2 | 24 | 10,834 | 10,098.71 | 2.10 | 239.83 | 844.52 |
| 10010201001007 | PRVLALMA | 48 | 2,578.02 | 47 | 1 | 65 | 10,544 | 32,100.42 | 8.56 | 797.88 | 728.15 |
| 10010201001008 | PRVLALMA | 4 | 200.00 | 4 | 0 | 8 | 9,961 | 2,788.27 | 0.89 | 71.18 | - |
| 10010201001010 | PRVLALMA | 41 | 4,886.95 | 37 | 4 | 69 | 9,612 | 23,659.06 | 4.22 | 434.60 | - |
| 10010201001011 | PRVLALMA | 78 | 8,871.76 | 74 | 4 | 124 | 10,614 | 42,596.84 | 7.61 | 824.27 | 2,544.04 |
| 10010201001012 | PRVLALMA | 10 | 1,144.20 | 10 | 0 | 21 | 7,442 | 4,862.88 | 1.05 | 99.53 | 511.53 |
| 10010201001013 | PRVLALMA | 6 | 959.00 | 5 | 1 | 17 | 6 | | | | |
| 10010201001014 | PRVLALMA | 6 | 787.17 | 4 | 2 | 16 | 8 | | | | |
| 10010201001015 | PRVLALMA | 3 | 150.50 | 3 | 0 | 4 | 9 | | | | |
| 10010201001016 | PRVLALMA | 12 | 1,112.00 | 11 | 1 | 13 | 11 | | | | |
| 10010201001017 | PRVLALMA | 1 | 50.00 | 1 | 0 | 2 | 11 | | | | |
| 10010201001017 | PRVLALMA | 3 | 1,086.00 | 3 | 0 | 4 | 2 | | | | |
| 10010201001018 | PRVLALMA | 16 | 1,764.67 | 15 | 1 | 26 | 11 | | | | |
| 10010201001019 | PRVLALMA | 11 | 1,183.67 | 10 | 1 | 22 | 10 | | | | |
| 10010201002000 | PRVLALMA | 21 | 1,869.11 | 20 | 1 | 35 | 6 | | | | |
| 10010201002001 | PRVLALMA | 3 | 199.00 | 2 | 1 | 3 | 6 | | | | |
| 10010201002002 | PRVLALMA | 21 | 2,516.50 | 18 | 3 | 34 | 6 | | | | |
| 10010201002003 | PRVLALMA | 3 | 159.50 | 3 | 0 | 5 | 5 | | | | |
| 10010201002004 | PRVLALMA | 10 | 2,022.92 | 10 | 0 | 25 | 9 | | | | |

| Node3 Structure Medium | Node3 Structure Hard | Node3 Structure Shared Hard | Node3 Structure Shared Medium | Node3 Structure Shared Normal | Node3 EquipQty | Node3 Density | Node2ID | Node1ID | Node0ID |
|---|---|---|---|---|---|---|---|---|---|
| - | 420.98 | 420.98 | - | - | 1.00 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 246.92 | 246.92 | - | - | 0.25 | R | PRVLALMA5651 | PRVLALMA5437 | PRVLALMA5417 |
| - | - | - | - | 23.92 | 4.50 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | 141.23 | 141.23 | - | - | 0.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | - | - | - | 111.39 | 4.00 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | 1,300.90 | 368.81 | - | - | 13.18 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | - | - | - | 676.20 | 16.39 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | - | - | - | 212.65 | 4.69 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | - | - | - | 121.51 | 1.33 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | 309.71 | 147.75 | - | - | 1.63 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | - | - | - | 212.65 | 5.92 | R | PRVLALMA5677 | PRVLALMA5572 | PRVLALMA5417 |
| - | 619.42 | 295.50 | - | - | 4.43 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 2,892.33 | 1,013.14 | - | - | 7.40 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 429.62 | 84.43 | - | - | 0.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 3,184.22 | 1,670.28 | - | - | 10.07 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 3,258.49 | 907.77 | - | - | 22.68 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 194.15 | 20.89 | - | - | 1.90 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 233.73 | 12.53 | - | - | 1.62 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 389.02 | 389.02 | - | - | 1.17 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 359.18 | 359.18 | - | - | 2.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 3,862.54 | 2,964.83 | - | - | 5.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 747.99 | 563.28 | - | - | 0.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 740.76 | 740.76 | - | - | 0.75 | R | PRVLALMA5651 | PRVLALMA5437 | PRVLALMA5417 |
| - | 323.59 | 34.81 | - | - | 3.83 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 220.04 | 23.67 | - | - | 3.67 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 1,327.67 | 255.43 | - | - | 6.10 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 73.43 | 72.28 | - | - | 2.00 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 1,080.17 | 435.67 | - | - | 5.43 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 87.12 | 53.62 | - | - | 1.50 | S | PRVLALMA5594 | PRVLALMA5419 | PRVLALMA5417 |
| - | 850.35 | 19.10 | - | - | 1.70 | S | PRVLALMA5595 | PRVLALMA5420 | PRVLALMA5417 |



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# CQBAT FDR

| Service Area | Node2 Cable | Node2 Length | Node2 Cable Splice | Node2 Cable SpliceSU | Node2 Structure Normal Rural | Node2 Structure Normal Suburban | Node2 Structure Normal Urban | Node2 Structure Medium Rural | Node2 Structure Medium Suburban | Node2StructureMediumUrban | Node2 Structure Hard Rural | Node2 Structure Hard Suburban | Node2 Structure Hard Urban | Node2 Structure Shared Hard Rural | Node2 Structure Shared Hard Suburban | Node2 Structure Shared Hard Urban | Node2 Structure Shared Medium Rural |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ABVLALXA | 1.19 | 16.00 | - | - | 0.89 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 18,193.94 | 77,521.00 | 8.00 | 0.79 | 17,618.08 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 18,538.77 | 81,257.00 | 9.17 | 1.37 | 17,962.91 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 24,751.92 | 54,943.00 | 7.65 | 0.61 | 24,176.06 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 10,913.77 | 73,632.00 | 9.17 | 1.37 | 10,337.91 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 9,857.27 | 69,657.00 | 9.17 | 1.37 | 9,281.41 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 14,380.94 | 74,002.00 | 8.50 | 1.04 | 13,805.08 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 17,082.13 | 63,503.00 | 8.78 | 0.53 | 16,798.52 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 11,510.74 | 63,017.00 | 7.60 | 0.59 | 10,934.88 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 5,438.40 | 54,873.00 | 7.27 | 0.42 | 4,862.55 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 15,425.38 | 54,069.00 | 7.02 | 0.30 | 14,849.53 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 1,347.85 | 20,264.00 | 7.89 | 0.09 | 1,064.25 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 11,741.13 | 62,330.00 | 9.78 | 1.03 | 11,457.52 | - | - | - | - | - | - | - | - | - | - | - | - |
| ABVLALXA | 18,340.13 | 68,929.00 | 9.78 | 1.03 | 10,572.52 | - | - | - | - | - | 7,484.00 | - | - | 3,438.96 | - | - | - |

| Node2 Structure Shared Medium Suburban | Node2 Structure Shared Medium Urban | Node2 Structure Shared Normal Rural | Node2 Structure Shared Normal Suburban | Node2 Structure Shared Normal Urban | Node2 Working Lines | Node2 Tower Exists | Node2 2gExists | Node2 Road Length | Node2 HWCR Road Length | Node2 Microwave Hops | Node2 Terrain | Node2 Density | Node0 Road Length | Node0 HWCR Road Length | Node0 Working Lines | Node0 Node2 Counts | Node2ID | Node1ID | Node0ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | - | - | - | - | 1,278.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2232 | ABVLALXA2114 | ABVLALXA2113 |
| - | - | 12,797.37 | - | - | 46.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2233 | ABVLALXA2229 | ABVLALXA2113 |
| - | - | 14,306.36 | - | - | 16.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2234 | ABVLALXA2227 | ABVLALXA2113 |
| - | - | 14,194.60 | - | - | 7.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2235 | ABVLALXA2211 | ABVLALXA2113 |
| - | - | 9,273.86 | - | - | 63.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2236 | ABVLALXA2226 | ABVLALXA2113 |
| - | - | 8,100.10 | - | - | 26.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2237 | ABVLALXA2228 | ABVLALXA2113 |
| - | - | 12,833.05 | - | - | 41.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2238 | ABVLALXA2224 | ABVLALXA2113 |
| - | - | 6,194.78 | - | - | 29.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2239 | ABVLALXA2138 | ABVLALXA2113 |
| - | - | 9,509.58 | - | - | 18.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2240 | ABVLALXA2230 | ABVLALXA2113 |
| - | - | 4,399.11 | - | - | 45.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2241 | ABVLALXA2220 | ABVLALXA2113 |
| - | - | 13,265.60 | - | - | 9.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2242 | ABVLALXA2218 | ABVLALXA2113 |
| - | - | 978.57 | - | - | 22.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2243 | ABVLALXA2119 | ABVLALXA2113 |
| - | - | 7,287.66 | - | - | 42.00 | - | - | - | - | - | N | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2244 | ABVLALXA2141 | ABVLALXA2113 |
| - | - | 6,410.66 | - | - | 39.00 | - | - | - | - | - | W | R | 0 | 0 | 5,487.00 | 77.00 | ABVLALXA2245 | ABVLALXA2140 | ABVLALXA2113 |

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# ACF

- ACF:
  - Supplied by CostQuest based on input from the Coalition
  - This table captures the Annual Charge Factors that covert Investment into its monthly costs
  - The current values loaded into CQBAT are produced by CostQuest's CapCost model
    - The basis of the model is the economic determination of the depreciation, cost of money and income taxes associated with various plant categories
    - The calculation incorporates industry standard procedures, including: Equal Life Group methods, inclusion of future net salvage, Impact of deferred taxes, mid-year conventions, etc.
    - Currently assumes
      - 9% Cost of Money
      - Depreciation lives consistent with those prescribed by the FCC's Wireline Bureau latest general depreciation order
  - Used to convert Investment into monthly values of Depreciation (DEPR), Cost of Money (COM), and Income Taxes (TAX)



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# ACF

| Account | Economic Life (years) | Tax Life (years) | Future Net Salvage (percent) |
|---|---|---|---|
| Land | 0 | 0 | 0% |
| Motor Vehicle | 7.5 | 3 | 10% |
| Tower | 25 | 3 | 0% |
| Radio | 9 | 5 | 0% |
| Microwave | 9 | 5 | 0% |
| Building | 40 | 31.5 | 0% |
| Furniture | 15 | 5 | 10% |
| Office Support | 10 | 5 | 0% |
| General Purpose Computers | 6 | 5 | 0% |
| Switching | 12 | 5 | 0% |
| Circuit/DLC | 11 | 5 | 0% |
| Pole | 25 | 15 | -75% |
| Aerial Copper | 20 | 15 | -35% |
| Aerial Fiber | 25 | 15 | -25% |
| Underground Copper | 25 | 15 | -30% |
| Underground Fiber | 25 | 15 | -20% |
| Buried Copper | 20 | 15 | -10% |
| Buried Fiber | 25 | 15 | -10% |
| Conduit | 50 | 15 | -10% |

| Financial Data | | |
|---|---|---|
| ReturnOnEquity | 9.7% | Return on Equity |
| DebtRate | 7.0% | Debt Rate |
| DebtRatio | 25.0% | Debt Ratio |
| DiscountRate | 9.00% | Discount Rate |
| **Tax Data** | | |
| FederalTaxRate | 34.0% | Federal Tax Rate |
| StateTaxRate | 5.3% | State Tax Rate |

CostQuest CapCost Model

| PlantAcct | COM | DEPR | FedTAX | StateTAX | OthTAX |
|---|---|---|---|---|---|
| AerialCU | 0.0042 | 0.0059 | 0.0018 | 0.0003 | 0.0000 |
| AerialFO | 0.0043 | 0.0045 | 0.0018 | 0.0003 | 0.0000 |
| Building | 0.0052 | 0.0023 | 0.0022 | 0.0004 | 0.0000 |
| BuriedCU | 0.0043 | 0.0047 | 0.0018 | 0.0003 | 0.0000 |
| BuriedFO | 0.0044 | 0.0038 | 0.0018 | 0.0003 | 0.0000 |
| Circuit | 0.0033 | 0.0076 | 0.0014 | 0.0002 | 0.0000 |
| Conduit | 0.0049 | 0.0019 | 0.0020 | 0.0003 | 0.0000 |
| DSLAM | 0.0033 | 0.0076 | 0.0014 | 0.0002 | 0.0000 |
| Furniture | 0.0032 | 0.0052 | 0.0013 | 0.0002 | 0.0000 |
| Computers | 0.0035 | 0.0136 | 0.0015 | 0.0002 | 0.0000 |
| Land | 0.0075 | 0.0000 | 0.0031 | 0.0005 | 0.0000 |
| Microwave | 0.0034 | 0.0092 | 0.0014 | 0.0002 | 0.0000 |
| MotorVehicles | 0.0033 | 0.0097 | 0.0014 | 0.0002 | 0.0000 |
| OfficeSupport | 0.0029 | 0.0085 | 0.0012 | 0.0002 | 0.0000 |
| Pole | 0.0043 | 0.0061 | 0.0018 | 0.0003 | 0.0000 |
| Radio | 0.0034 | 0.0092 | 0.0014 | 0.0002 | 0.0000 |
| Switching | 0.0034 | 0.0069 | 0.0014 | 0.0002 | 0.0000 |
| Tower | 0.0034 | 0.0035 | 0.0014 | 0.0002 | 0.0000 |
| UgdCU | 0.0043 | 0.0046 | 0.0018 | 0.0003 | 0.0000 |
| UgdFO | 0.0043 | 0.0043 | 0.0018 | 0.0003 | 0.0000 |



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# Bandwidth

- Bandwidth:
  - Supplied by the Coalition and consistent with the National Broadband Plan
  - Provides the busy hour bandwidth
  - Used to size the appropriate network components

| Tech3 | VoiceBandwidth | DataLowBandwidth | DataHighBandwidth |
|---|---|---|---|
| FTTn | 0.00 | 0.440 | 0.440 |
| FTTd | 0.00 | 0.440 | 0.440 |
| FTTp | 0.00 | 0.440 | 0.440 |

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# Business Take

- Business Take
  - Supplied by the Coalition, currently set at 90% of potential customers
  - Provides the take rate for business customers by density and level of competition
    - Can be supplied at the Census Track level

| Tech1 | LowerCTDensity | UpperCTDensity | CT | Tech3 | GorB | Competitors | DataLowTakeRate | DataHighTakeRate |
|---|---|---|---|---|---|---|---|---|
| *Telco* | *Lower Census Track HH Density* | *Upper Census Track HH Density* | *Census track* | *Type of network: FTTd, FTTn, FTTp* | *Represents take for Greenfield (G) build or Brownfield (B) augmentation or ALL* | *Broadband Competitors (0, 1, 2)* | *% of Active customers with Broadband Voice only* | *% of Active customers taking Broadband data service* |
| Telco | 0 | 10000000 | @ | @ | A | 0 | 0% | 90% |
| Telco | 0 | 10000000 | @ | @ | A | 1 | 0% | 45% |
| Telco | 0 | 10000000 | @ | @ | A | 2 | 0% | 30% |

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# Capex

- Capex
  - Supplied by CostQuest based on inputs provided by the Coalition
    - Most inputs represent an average value from across coalition members
  - Provides the material and installation costs for the plant build
  - Data is applied against the network topology data to derive total build out investment levels
  - Inputs capture technology, network node, network function and plant sharing

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# Capex

| COSize | Tech2 | Tech3 | PlantMix | Terrain | Density | PlantAcct | Cost Fam | CostArea | Units | GorB | Min Capacity | Max Capacity | Unit Capacity | Material Amount | Non Material Amount | Total Amount | NodeDemand | Multiplier | OutputField |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALL | Copper | FTTD | NA | NA | % | Circuit | Dist | CPE | 1 | A | 0 | 10000000 | 1 | 35.44 | 13.99 | 0.00 | T1.DataTake | None | Node4_CPEInv_S |
| ALL | Copper | FTTD | NA | NA | % | Circuit | Dist | CPE | 1 | A | 0 | 10000000 | 1 | 0.00 | 0.00 | 0.00 | T1.VideoTake | None | Node4_CPEVideoInv_S |
| ALL | Copper | FTTD | NA | NA | % | BuriedCU | Dist | NID | 1 | G | 0 | 10000000 | 1 | 8.33 | 49.76 | 0.00 | T1.DataTake | None | Node4_CCableInv_L |
| ALL | Copper | FTTD | NA | NA | % | BuriedCU | Dist | Drop | 1 | G | 0 | 10000000 | 1 | 0.10 | 1.17 | 0.00 | T1.Node4Cable | DataTakeRate | Node4_CCableInv_L |
| ALL | Copper | FTTD | NA | NA | % | BuriedCU | Dist | DTBT | 1 | G | 0 | 10000000 | 1 | 136.11 | 130.18 | 0.00 | T1.Node3EquipQty | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Buried | NA | % | BuriedCU | Dist | Conditioning | 1 | B | 0 | 10000000 | 1 | 0.00 | 100.00 | 0.00 | T1.Node4WorkingCust | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Aerial | NA | % | AerialCU | Dist | AerialCU | 1 | G | 0 | 10000000 | 1 | 0.72 | 0.15 | 0.00 | T1.Node3Cable | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Buried | NA | % | BuriedCU | Dist | BuriedCU | 1 | G | 0 | 10000000 | 1 | 0.55 | 0.11 | 0.00 | T1.Node3Cable | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Ugd | NA | % | UgdCU | Dist | UgdCU | 1 | G | 0 | 10000000 | 1 | 0.56 | 0.12 | 0.00 | T1.Node3Cable | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Aerial | NA | % | AerialCU | Dist | AerialCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 1.39 | 0.00 | T1.Node3Cable | DistPlacing | Node3_CCableInv_L |
| ALL | Copper | FTTD | Buried | NA | % | BuriedCU | Dist | BuriedCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 0.01 | 0.00 | T1.Node3Cable | DistPlacing | Node3_CCableInv_L |
| ALL | Copper | FTTD | Ugd | NA | % | UgdCU | Dist | UgdCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 1.67 | 0.00 | T1.Node3Cable | DistPlacing | Node3_CCableInv_L |
| ALL | Copper | FTTD | Aerial | NA | % | AerialCU | Dist | AerialCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 1.73 | 0.00 | T1.Node3CableSplice | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Buried | NA | % | BuriedCU | Dist | BuriedCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 1.71 | 0.00 | T1.Node3CableSplice | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Ugd | NA | % | UgdCU | Dist | UgdCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 2.11 | 0.00 | T1.Node3CableSplice | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Aerial | NA | % | AerialCU | Dist | AerialCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 63.54 | 0.00 | T1.Node3CableSpliceSU | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Buried | NA | % | BuriedCU | Dist | BuriedCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 84.04 | 0.00 | T1.Node3CableSpliceSU | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Ugd | NA | % | UgdCU | Dist | UgdCU | 1 | G | 0 | 10000000 | 1 | 0.00 | 149.83 | 0.00 | T1.Node3CableSpliceSU | None | Node3_CCableInv_L |
| ALL | Copper | FTTD | Aerial | Normal | Rural | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Normal | Rural | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 5.34 | 14.49 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Normal | Rural | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 3.40 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Medium | Rural | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Medium | Rural | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 5.34 | 15.05 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Medium | Rural | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 4.13 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Hard | Rural | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureHard | StructureH | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Hard | Rural | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 5.34 | 18.51 | 0.00 | T1.Node3StructureHard | StructureH | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Hard | Rural | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 5.68 | 0.00 | T1.Node3StructureHard | StructureH | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Normal | Suburban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Normal | Suburban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.78 | 16.07 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Normal | Suburban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 6.16 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Medium | Suburban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Medium | Suburban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.78 | 16.09 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Medium | Suburban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 6.24 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Hard | Suburban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureHard | StructureH | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Hard | Suburban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.78 | 19.95 | 0.00 | T1.Node3StructureHard | StructureH | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Hard | Suburban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 7.22 | 0.00 | T1.Node3StructureHard | StructureH | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Normal | Urban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Normal | Urban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.65 | 19.37 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Normal | Urban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 7.42 | 0.00 | T1.Node3StructureNormal | StructureN | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Medium | Urban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Medium | Urban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.65 | 19.37 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Medium | Urban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 7.42 | 0.00 | T1.Node3StructureMedium | StructureM | Node3_BCStructureInv_L |
| ALL | Copper | FTTD | Aerial | Hard | Urban | Pole | Dist | Pole | 0.78 | G | 0 | 10000000 | 1 | 0.64 | 1.55 | 0.00 | T1.Node3StructureHard | StructureH | Node3_ACStructureInv_L |
| ALL | Copper | FTTD | Ugd | Hard | Urban | Conduit | Dist | Conduit | 0.67 | G | 0 | 10000000 | 1 | 4.65 | 23.73 | 0.00 | T1.Node3StructureHard | StructureH | Node3_UCStructureInv_L |
| ALL | Copper | FTTD | Buried | Hard | Urban | BuriedCU | Dist | BuriedTrenchCU | 0.41 | G | 0 | 10000000 | 1 | 0.00 | 7.42 | 0.00 | T1.Node3StructureHard | StructureH | Node3_BCStructureInv_L |

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# Capex

| CostFam | CostArea | Solution set OutputField | Audit Report Output Field |
|---|---|---|---|
| CO | | | |
| | Eswitch | Node0_ElectronicsInv_2 | TotalNode0Investment_Electronics |
| | Router | Node0_ElectronicsInv_2 | TotalNode0Investment_Electronics |
| Dist | | | |
| | CPE | Node4_CPEInv_S | TotalNode4Investment |
| | CPE | Node4_CPEVideoInv_S | TotalNode4Investment |
| | ONT | Node4_CCableInv_L | TotalNode4Investment |
| | NID | Node4_CCableInv_L | TotalNode4Investment |
| | Drop | Node4_CCableInv_L | TotalNode4Investment |
| | AerialCU | Node3_CCableInv_L | TotalNode3Investment |
| | AerialFO | Node3_FCableInv_L | TotalNode3Investment |
| | BuriedCU | Node3_CCableInv_L | TotalNode3Investment |
| | BuriedFO | Node3_FCableInv_L | TotalNode3Investment |
| | BuriedTrenchCU | Node3_BCStructureInv_L | TotalNode3Investment |
| | BuriedTrenchFO | Node3_BFStructureInv_L | TotalNode3Investment |
| | Conditioning | Node3_CCableInv_L | TotalNode3Investment |
| | Conduit | Node3_UCStructureInv_L | TotalNode3Investment |
| | Conduit | Node3_UFStructureInv_L | TotalNode3Investment |
| | DTBT | Node3_CCableInv_L | TotalNode3Investment |
| | FDT | Node3_CCableInv_L | TotalNode3Investment |
| | Pole | Node3_ACStructureInv_L | TotalNode3Investment |
| | Pole | Node3_AFStructureInv_L | TotalNode3Investment |
| | UgdCU | Node3_CCableInv_L | TotalNode3Investment |
| | UgdFO | Node3_FCableInv_L | TotalNode3Investment |
| | | | |
| | HubAgg | Node0_ElectronicsInv_2 | TotalNode0Investment_Electronics |
| | Building | Node0_LandBuildingOther_0 | TotalNode0Investment_LandBuilding |
| | Land | Node0_LandBuildingOther_0 | TotalNode0Investment_LandBuilding |
| | OLT | Node0_ElectronicsInv_2 | TotalNode0Investment_Electronics |



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# Capex

| CostFam | CostArea | Solution set OutputField | Audit Report Output Field |
|---|---|---|---|
| Fdr | | | |
| | AerialFO | Node2_FCableInv_2 | TotalNode2Investment_Facilities |
| | BuriedFO | Node2_FCableInv_2 | TotalNode2Investment_Facilities |
| | BuriedTrenchFO | Node2_BFStructureInv_2 | TotalNode2Investment_Facilities |
| | Conduit | Node2_UFStructureInv_2 | TotalNode2Investment_Facilities |
| | COTFiberTerm | Node2_FCableInv_2 | TotalNode2Investment_Facilities |
| | DSLAM | Node2_ElectronicsInv_2 | TotalNode2Investment_Electronics |
| | DSLAM | Node2_ElectronicsInv_S | TotalNode2Investment_Electronics |
| | FDI | Node2_CCableInv_2 | TotalNode2Investment_Facilities |
| | FST | Node2_FCableInv_2 | TotalNode2Investment_Facilities |
| | FST | Node2_FCableInv_L | TotalNode2Investment_Facilities |
| | Pole | Node2_AFStructureInv_2 | TotalNode2Investment_Facilities |
| | UgdFO | Node2_FCableInv_2 | TotalNode2Investment_Facilities |
| MM | | | |
| | AerialFO | Node0_FCableInv_0 | TotalNode0Investment_Facilities |
| | BuriedFO | Node0_FCableInv_0 | TotalNode0Investment_Facilities |
| | BuriedTrenchFO | Node0_BFStructureInv_0 | TotalNode0Investment_Facilities |
| | Cloud | Node0_CloudEletronicsInv_S | TotalNode0Investment_Electronics |
| | Conduit | Node0_UFStructureInv_0 | TotalNode0Investment_Facilities |
| | Pole | Node0_AFStructureInv_0 | TotalNode0Investment_Facilities |
| | ROADM | Node0_ElectronicsInv_C | TotalNode0Investment_Electronics |
| | Router | Node0_ElectronicsInv_2 | TotalNode0Investment_Electronics |
| | UgdFO | Node0_FCableInv_0 | TotalNode0Investment_Facilities |

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# COSize Adjustment

- COSize Adjustment
  - Defaulted to 1s
  - Provides the user the capability to adjust the assumed purchasing power of small, medium and large providers
  - Currently, the inputs assume that all providers can achieve the same purchasing power (either as a result of their size or their ability to buy as a consortium)

| Tech2 | CoSize | AdjRate |
|---|---|---|
| Copper | S | 1 |
| Copper | M | 1 |
| Copper | L | 1 |
| Copper | Y | 1 |
| Copper | Z | 1 |
| Fiber | S | 1 |
| Fiber | M | 1 |
| Fiber | L | 1 |
| Fiber | Y | 1 |
| Fiber | Z | 1 |

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# Opex

- Opex
  - Supplied by CostQuest
    - based upon NECA, ARMIS, public reports, and information provided by Coalition members
  - Provides the estimated operation costs to run and maintain a Broadband network, by technology type, by company size, by density, by function

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# Opex

| Cost Face | | | | | Driver/CostType | UOM Driver | DENSITY | | | SIZE ADJUSTMENT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P&L Format | CostFam | CostArea | CostCntr | CostElem | QtyUOM (Driver) | | Large Urban | Large Suburban | Large Rural | Code Source | Medium size Company (100,000 to 1,000,000 Loops) | Small Company (4,000 to 99,999 Loops) | XSmall Company (1,000 to 3,999 Loops) | XXSmall Company (< 100,000 Loops) |
| | | | | | | | | | | | -17.49% | 26.16% | 22.05% | 52.24% |
| **Cost of Sales:** | | | | | | | | | | | | | | |
| Network Operations Expense | Network | Plant Specific | Cable & Wire Expense | CU Aerial Expense | Investment | CU Aerial Cable Investment | 0.1863917 | 0.1863917 | 0.1233417 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | FO Aerial Expense | Investment | FO Aerial Cable Investment | 0.0375600 | 0.0375600 | 0.0494765 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | CU Buried Expense | Investment | CU Buried Cable Investment | 0.0540978 | 0.0540978 | 0.0374454 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | FO Aerial Expense | Investment | FO Buried Cable Investment | 0.0053131 | 0.0053131 | 0.0121196 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | CU Underground Expense | Investment | CU Underground Investment | 0.1001540 | 0.1001540 | 0.0656569 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | FO Underground Expense | Investment | FO Underground Investment | 0.0414877 | 0.0414877 | 0.0368124 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | Poles expense | Investment | Poles Investment | 0.0255119 | 0.0255119 | 0.0191459 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | Conduit Systems expense | Investment | Conduit Investment | 0.0037020 | 0.0037020 | 0.0027929 | | -26.96% | 29.59% | 47.82% | 64.33% |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | ######## | ######## | ######## | ######## |
| | | | Circuit Equipment / Transport | | Investment | Circuit / Transport Investmen | 0.0279932 | 0.0279932 | 0.0248874 | | 0.01% | 36.29% | 40.66% | 132.71% |
| | | | | | | | | | | | ######## | ######## | ######## | ######## |
| | | | Switching | | Investment | Switch Investment | 0.0847925 | 0.0847925 | 0.1194936 | | 0.01% | 36.29% | 40.66% | 132.71% |
| | | | | | | | | | | | | | | |
| | | Plant Non-Specific | Network Operating Expense | | Investment | Total Plant Investment | 0.0209635 | 0.0209635 | 0.0138417 | | -5.34% | 13.76% | -8.86% | 7.62% |
| | | | | | | | | | | | | | | |
| | | Backhaul | Fast-E lease Per Month | Backhaul | Aggregation Point (Wirece | | $ - | $ - | $ - | | 0 | 0 | 0 | 0 |
| | | | Gig-E lease Per Month | Backhaul | Aggregation Point (Wirece | | $ - | $ - | $ - | | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | |
| | | | General Support & Network Support Expense | | Investment | Total Plant Investment | 0.0158211 | 0.0158211 | 0.0104291 | | -28.55% | 14.73% | -5.88% | 23.08% |
| | | | | | | | | | | | | | | |
| Customer Operations Marketing | Customer Operations | Sales & Marketing | n/a | n/a | Customer | Customer | 3.62 | 3.62 | 3.62 | | 0 | -7.00% | 24.01% | 67.80% |
| Customer Operations Marketing | Customer Operations | Sales & Marketing | n/a | n/a | Investment | Total Investment | - | - | - | | 4.70% | -41.22% | -67.35% | -112.88% |
| | | Advertising | n/a | n/a | TotalRevenue | Total Revenue | | | | | | | | |
| | | | | | | | | | | | | | | |
| G&A and Misc. | General & Administration | G&A | n/a | n/a | Customer | Customer | - | - | - | | 20.37% | 81.46% | 223.31% | 526.47% |
| G&A and Misc. | General & Administration | G&A | n/a | n/a | Investment | Total Investment | 0.028023 | 0.028023 | 0.018842 | | 18.08% | 28.45% | 102.56% | 205.84% |
| | | | | | | | | | | | | | | |
| G&A and Misc. | Uncollectible revenue | Bad Debt | n/a | n/a | Customer | Customer | 0.92 | 0.92 | 0.92 | | 0 | 0 | 0 | 0 |
| G&A and Misc. | Uncollectible revenue | Bad Debt | n/a | n/a | Investment | Alternative: Total Investment | 0.29% | 0.0028617 | 0.29% | | | | | |

COSTQUEST ASSOCIATES
September 2012
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# Plant Mix

- PlantMix
  - Supplied by CostQuest based on input from the Coalition
    - Inputs provided by State and Density
  - Provides the estimated mix of cable by type: aerial, buried and underground
  - Used in drive determine the type of cable required on a route

| | CostFam>> | Dist | | | FDR | | | IOF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| State | Density | Aerial | Buried | Underground | Aerial | Buried | Underground | Aerial | Buried | Underground |
| @ | Rural | 27.10% | 69.17% | 3.73% | 25.35% | 60.66% | 13.99% | 27.57% | 58.49% | 13.94% |
| @ | Suburban | 30.37% | 64.01% | 5.62% | 23.74% | 48.57% | 27.70% | 24.00% | 47.65% | 28.34% |
| @ | Urban | 38.11% | 54.60% | 7.30% | 19.45% | 40.24% | 40.31% | 19.51% | 39.96% | 40.52% |
| AL | Rural | 29.29% | 70.43% | 0.28% | 29.33% | 65.82% | 4.85% | 29.33% | 65.82% | 4.85% |
| AK | Rural | 27.10% | 69.17% | 3.73% | 25.35% | 60.66% | 13.99% | 27.57% | 58.49% | 13.94% |
| AZ | Rural | 27.10% | 69.17% | 3.73% | 25.35% | 60.66% | 13.99% | 27.57% | 58.49% | 13.94% |
| AR | Rural | 14.00% | 85.40% | 0.61% | 4.74% | 88.94% | 6.32% | 4.74% | 88.94% | 6.32% |
| CA | Rural | 26.73% | 63.23% | 10.04% | 21.53% | 55.69% | 22.78% | 21.43% | 57.22% | 21.35% |
| CO | Rural | 4.35% | 95.52% | 0.13% | 2.40% | 95.44% | 2.16% | 2.40% | 95.44% | 2.16% |
| CT | Rural | 77.97% | 17.56% | 4.47% | 61.53% | 33.13% | 5.34% | 61.53% | 33.13% | 5.34% |
| DC | Rural | 87.80% | 6.10% | 6.10% | 9.40% | 0.00% | 90.60% | 10.40% | 0.00% | 89.60% |
| DE | Rural | 28.20% | 71.70% | 0.10% | 32.20% | 64.50% | 3.30% | 58.50% | 37.10% | 4.40% |
| FL | Rural | 16.46% | 83.10% | 0.44% | 13.94% | 78.27% | 7.79% | 18.81% | 73.30% | 7.89% |


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# PTax

- PTax
  - Supplied by CostQuest
  - Sourced from property tax rates in each state
  - Provides the impact of property tax to various operating costs
  - Used to capture the impact of property tax in the operation costs

| State | AdjRate |
|---|---|
| AK | 1.0514 |
| AL | 0.9029 |
| AR | 0.9664 |
| AZ | 0.9804 |
| CA | 0.9745 |
| CO | 0.9649 |
| CT | 1.0318 |
| DC | 0.9979 |
| DE | 0.9880 |
| FL | 0.9871 |
| GA | 1.0378 |
| HI | 0.9874 |

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# RegionalCostAdjustment

- RegionalCostAdjustment
  - Supplied by CostQuest
  - Sourced from third party source - RSMeans
  - Provides the estimated difference in the cost to build and operate in each part of the county
  - Captures material and labor costs difference
  - Captured at the Zip3 level
  - Used in drive differences in CAPEX and OPEX costs due to labor and material cost differences across the country.
  - Applied to All CAPEX and indirectly to OPEX components

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# RegionalCostAdjustment

| State | Zip3 | City | AdjRate |
|---|---|---|---|
| NA | 000 | NA | 0.93 |
| NA | 001 | NA | 0.93 |
| NA | 002 | NA | 0.93 |
| NA | 003 | NA | 0.93 |
| NA | 004 | NA | 0.93 |
| NY | 005 | MID-ISLAND | 0.99 |
| PR | 006 | SAN JUAN | 0.78 |
| PR | 007 | SAN JUAN | 0.78 |
| PR | 008 | SAN JUAN | 0.78 |
| PR | 009 | SAN JUAN | 0.78 |
| MA | 010 | SPRINGFIELD | 1.04 |
| MA | 011 | SPRINGFIELD | 1.04 |
| MA | 012 | PITTSFIELD | 1.02 |
| MA | 013 | SPRINGFIELD | 1.02 |
| MA | 014 | CENTRAL | 1.07 |
| MA | 015 | CENTRAL | 1.10 |
| MA | 016 | WORCESTER | 1.10 |
| MA | 017 | CENTRAL | 1.11 |
| MA | 018 | MIDDLESEX-ESX | 1.13 |
| MA | 019 | MIDDLESEX-ESX | 1.13 |
| MA | 020 | BROCKTON | 1.18 |
| MA | 021 | BOSTON | 1.18 |
| MA | 022 | BOSTON | 1.18 |
| MA | 023 | BROCKTON | 1.12 |
| MA | 024 | NORTHWEST BOS | 1.18 |
| MA | 025 | CAPE COD | 1.07 |
| MA | 026 | CAPE COD | 1.09 |
| RI | 027 | PROVIDENCE | 1.10 |
| RI | 028 | PROVIDENCE | 1.05 |
| RI | 029 | PROVIDENCE | 1.05 |

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# StateSalesTax

- StateSalesTax
  - Supplied by CostQuest
  - Sourced from appropriate tax rates in each state
  - Used in CAPEX derivation

| State | SalesTax |
|---|---|
| AL | 0.0715 |
| AK | 0.0086 |
| AZ | 0.0777 |
| AR | 0.0736 |
| CA | 0.0796 |
| CO | 0.0475 |
| CT | 0.06 |
| DC | 0.0575 |
| DE | 0 |
| FL | 0.0663 |
| GA | 0.0676 |
| HI | 0.0438 |

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# Residential TakeRate

- Residential TakeRate
  - Supplied by the Coalition, currently set at 90% of potential customers
  - Provides the take rate for residential customers by density and level of competition
    - Can be supplied at the Census Track level

| Tech1 | LowerCTDensity | UpperCTDensity | CT | Tech3 | GorB | Competitors | DataLowTakeRate | DataHighTakeRate |
|---|---|---|---|---|---|---|---|---|
| *Telco* | *Lower Census Track HH Density* | *Upper Census Track HH Density* | *Census track* | *Type of network: FTTd, FTTn, FTTp* | *Represents take for Greenfield (G) build or Brownfield (B) augmentation or ALL* | *Broadband Competitors (0, 1, 2)* | *% of Active customers with Broadband Voice only* | *% of Active customers taking Broadband data service* |
| Telco | 0 | 10000000 | @ | @ | A | 0 | 0% | 90% |
| Telco | 0 | 10000000 | @ | @ | A | 1 | 0% | 45% |
| Telco | 0 | 10000000 | @ | @ | A | 2 | 0% | 30% |

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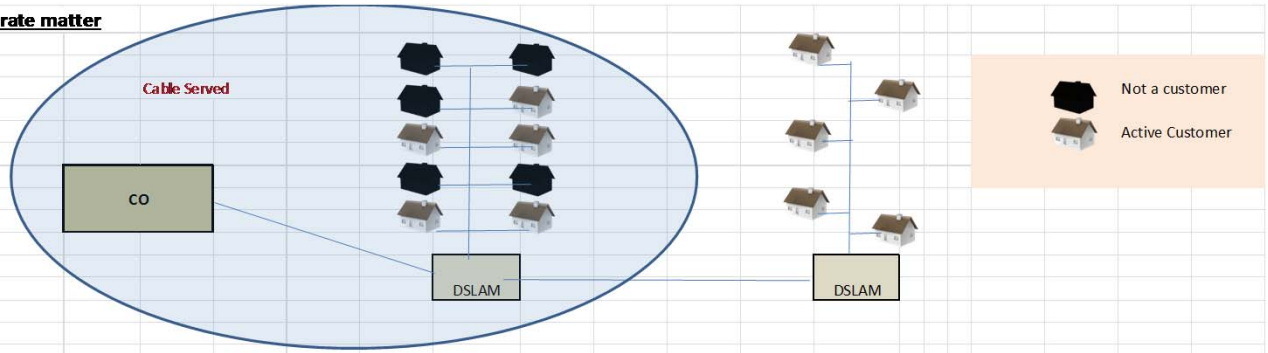
# Take Rate

**Does take rate matter**




**With Take**

| | | | | | |
|---|---|---|---|---|---|
| **Cost** | 100,000 | 10,000 | 10,000 | 20,000 | 10,000 |
| **CostDriver** | Active Customers | DSLAMS | Active Customers | DSLAMS | Active Customers |
| **Count of Driver** | 10 | 2 | 5 | 1 | 5 |
| **Cost Per** | 10000 | 5000 | 2000 | 20000 | 2000 |

**Cost Per Customer**

| **Cable Served** | |
|---|---|
| CO | 10,000 |
| Fiber | 1,000 |
| DSLAM | 2,000 |
| **TOTAL** | **13,000** |

| **Cable UN-Served** | |
|---|---|
| CO | 10,000 |
| Fiber | 5,000 |
| DSLAM | 2,000 |
| **TOTAL** | **17,000** |

**Without Take**

| | | | | | |
|---|---|---|---|---|---|
| **Cost** | 100,000 | 10,000 | 10,000 | 20,000 | 10,000 |
| **CostDriver** | All Locations | DSLAMS | All Locations | DSLAMS | All Locations |
| **Count of Driver** | 15 | 2 | 10 | 1 | 5 |
| **Cost Per** | 6666.67 | 5000 | 1000 | 20000 | 2000 |

**Cost Per Customer**

| **Cable Served** | |
|---|---|
| CO | 6,667 |
| Fiber | 500 |
| DSLAM | 1,000 |
| **TOTAL** | **8,167** |

| **Cable UN-Served** | |
|---|---|
| CO | 6,667 |
| Fiber | 5,000 |
| DSLAM | 2,000 |
| **TOTAL** | **13,667** |

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Middle mile

- Network routing
- Assumptions
- Testing

# CQBAT NETWORK CAPEX OVERVIEW

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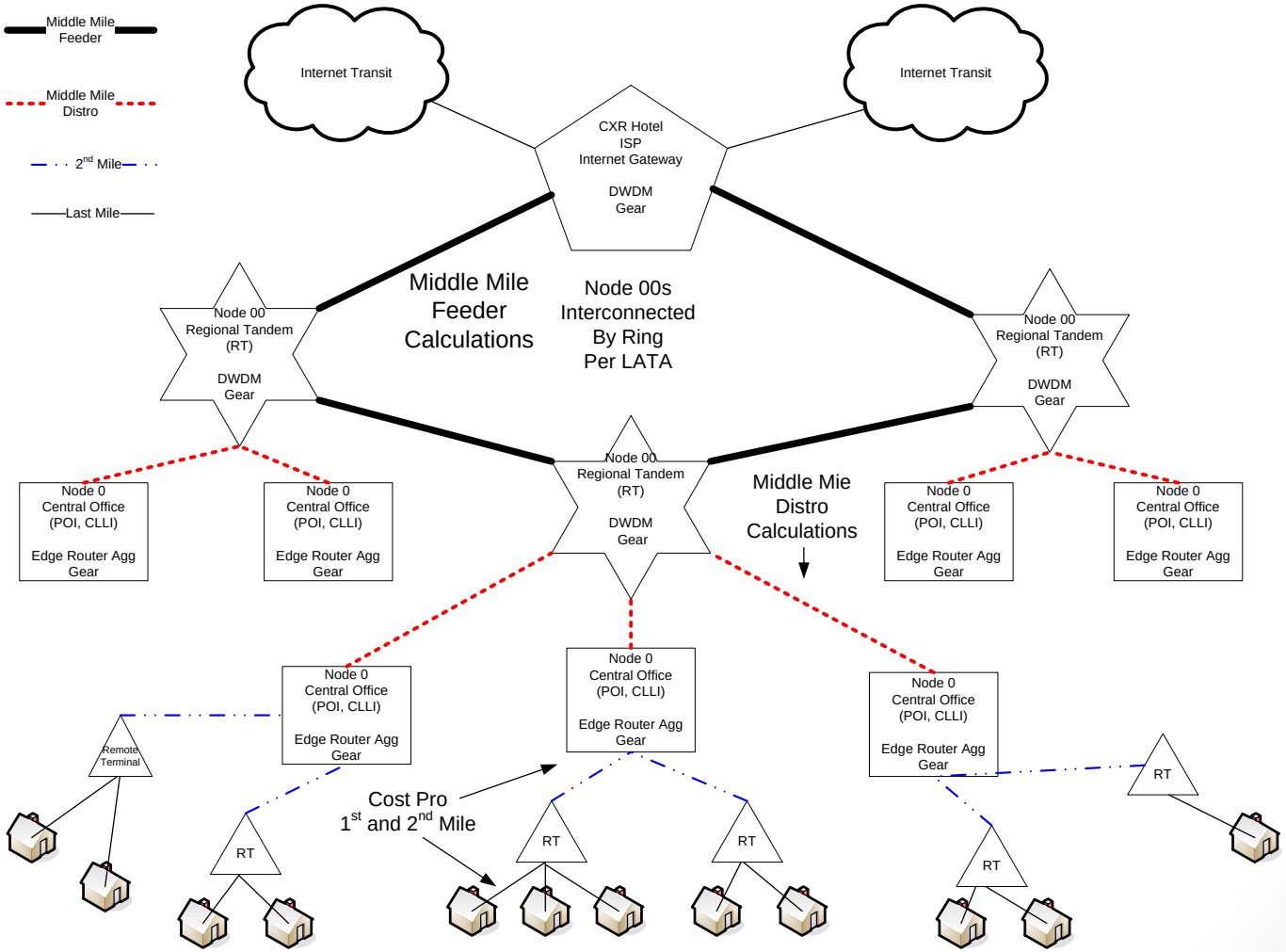
# Network Overview

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# Middle Mile

- Middle mile connects central offices with "the cloud" (Internet gateways) via connection to point of interconnection at a tandem within the LATA
- Method:
  - Start with identifying the nearest access to a Tier 3 Internet gateway for each CO (Node0/POI)
    - A surrogate for such access is assumed to be on a regional access tandem ring within the LATA
  - Regional tandem ("RT") locations were obtained from the LERG database
    - Each tandem identified as providing Feature Group D access in LERG 9 is designated an RT
  - The underlying logic (and the process) of developing middle mile investment requirements are grounded in the assumption that the Internet Gateway peering point is located on the RT ring – meaning that if the modeled design ensures each central office is connected to an RT ring, the corresponding Node0 customers all have access to the Internet

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# Middle Mile

- The middle mile processing logic proceeds as follows:
  - The Middle Mile process is run state by state
    - All CLLIs in a state are homed to the closest RT in that same state
    - The RT location is assumed to be where the Internet Gateway is located
  - CLLI locations are then routed to other CLLI locations with the same RT parent using a spanning tree approach based on the shortest distance routing back to their parent RT location
  - For cases where multiple RTs exist within a LATA, all the RTs within the same LATA are routed together in a ring
    - To ensure an efficient design the shortest ring distance is used

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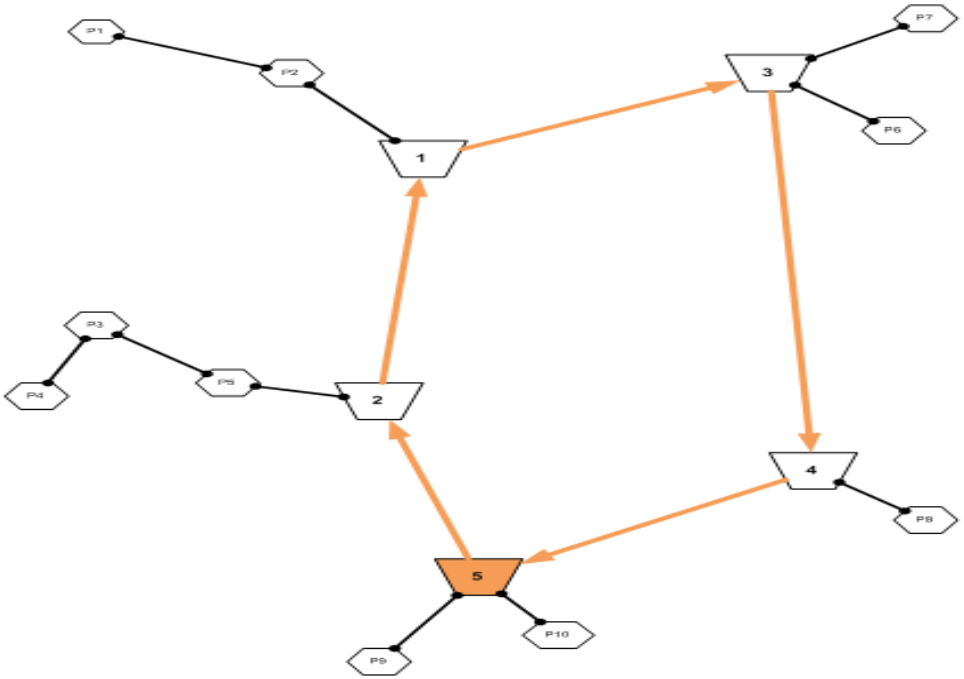
# Node0 to Node00, Node00 Rings

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# Middle Mile

- With the routing information in hand, CQBAT develops middle mile costs:
  - The distance of the RT rings is attributed to each CLLI on the ring in proportion to the number of service locations at each CLLI as compared to the total service locations for all the CLLIs attached to the RT Ring
  - The distance/cost from the CLLI back to the RT is attributed to each CLLI based on the cumulative service locations that can use the route
  - For electronics, CQBAT places an Ethernet switch in each CLLI
    - This Ethernet switch is connected to a router that may serve one CLLI or multiple
    - If the distance to the RT exceeds a user-specified distance, a regeneration unit is placed to extend the distance
      - This router/regenerator is then assumed to be the last piece of costed equipment in the broadband costs that are developed
  - For the fiber placement, CQBAT assumes a percentage of conduit and poles are included in the Loop plant
  - For the route-related costs, CQBAT assigns only a portion to the broadband network (current value set at ½) based on the assumption that the transport network is built for multiple purposes
    - CQBAT broadband services and leased dedicated data services

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# Middle Mile

| Node0ID | Node00ID | LATA | State | Node0Length | Node0Cable | Node0 Structure Normal Suburban | Node0 Terrain | Node0 Density | Node0 WorkingLines | Node00 WorkingLines | LATA WorkingLines | Node00 Node0Counts | LATA Node0 Counts | LATA Node00 Counts |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHWMALXA | ANTNALMT0GT | 476 | AL | 683,007 | 62,817 | 62,817 | N | R | 1,126 | 139,353 | 968,557 | 30 | 140 | 4 |
| LNDLALXA | ANTNALMT0GT | 476 | AL | 667,696 | 209,518 | 209,518 | N | R | 4,966 | 139,353 | 968,557 | 30 | 140 | 4 |
| HGLYALXA | ANTNALMT0GT | 476 | AL | 636,984 | 104,723 | 104,723 | N | R | 2,819 | 139,353 | 968,557 | 30 | 140 | 4 |
| LFYTALRS | ANTNALMT0GT | 476 | AL | 578,181 | 111,599 | 111,599 | N | R | 3,653 | 139,353 | 968,557 | 30 | 140 | 4 |
| FRDNALXA | ANTNALMT0GT | 476 | AL | 520,421 | 7,811 | 7,811 | N | R | 301 | 139,353 | 968,557 | 30 | 140 | 4 |
| RCMLALXA | ANTNALMT0GT | 476 | AL | 443,736 | 17,193 | 17,193 | N | R | 860 | 139,353 | 968,557 | 30 | 140 | 4 |
| RONKALXA | ANTNALMT0GT | 476 | AL | 415,893 | 88,776 | 88,776 | N | R | 4,942 | 139,353 | 968,557 | 30 | 140 | 4 |
| GDWRALMA | ANTNALMT0GT | 476 | AL | 352,511 | 161,641 | 161,641 | N | R | 2,114 | 139,353 | 968,557 | 30 | 140 | 4 |
| WDLYALXA | ANTNALMT0GT | 476 | AL | 340,452 | 19,505 | 19,505 | N | R | 1,401 | 139,353 | 968,557 | 30 | 140 | 4 |
| WDLDALXA | ANTNALMT0GT | 476 | AL | 245,748 | 54,730 | 54,730 | N | R | 1,680 | 139,353 | 968,557 | 30 | 140 | 4 |
| WEDWALXA | ANTNALMT0GT | 476 | AL | 254,826 | 19,561 | 19,561 | N | R | 2,026 | 139,353 | 968,557 | 30 | 140 | 4 |
| ASLDALXA | ANTNALMT0GT | 476 | AL | 228,141 | 67,050 | 67,050 | N | R | 3,803 | 139,353 | 968,557 | 30 | 140 | 4 |
| TLDGALRF | ANTNALMT0GT | 476 | AL | 191,559 | 77,599 | 77,599 | N | R | 4,294 | 139,353 | 968,557 | 30 | 140 | 4 |
| PLCYALXA | ANTNALMT0GT | 476 | AL | 211,688 | 154,481 | 154,481 | N | R | 13,848 | 139,353 | 968,557 | 30 | 140 | 4 |
| MRCRALXA | ANTNALMT0GT | 476 | AL | 203,322 | 7,815 | 7,815 | N | R | 1,067 | 139,353 | 968,557 | 30 | 140 | 4 |
| LNVLALXA | ANTNALMT0GT | 476 | AL | 195,031 | 28,414 | 28,414 | N | R | 2,361 | 139,353 | 968,557 | 30 | 140 | 4 |
| LECTALXA | ANTNALMT0GT | 476 | AL | 195,799 | 85,399 | 85,399 | N | R | 1,557 | 139,353 | 968,557 | 30 | 140 | 4 |
| PDMTALMA | ANTNALMT0GT | 476 | AL | 146,673 | 100,850 | 100,850 | N | R | 4,751 | 139,353 | 968,557 | 30 | 140 | 4 |
| TLDGALMA | ANTNALMT0GT | 476 | AL | 143,078 | 83,423 | 83,423 | N | R | 12,302 | 139,353 | 968,557 | 30 | 140 | 4 |
| RGLDALXA | ANTNALMT0GT | 476 | AL | 203,208 | 71,469 | 71,469 | N | R | 2,254 | 139,353 | 968,557 | 30 | 140 | 4 |
| DELTALXA | ANTNALMT0GT | 476 | AL | 132,401 | 4,549 | 4,549 | N | R | 1,018 | 139,353 | 968,557 | 30 | 140 | 4 |
| LNCLALXA | ANTNALMT0GT | 476 | AL | 146,228 | 19,285 | 19,285 | N | R | 3,000 | 139,353 | 968,557 | 30 | 140 | 4 |
| HFLNALXA | ANTNALMT0GT | 476 | AL | 133,370 | 40,289 | 40,289 | N | R | 2,731 | 139,353 | 968,557 | 30 | 140 | 4 |
| CHLFALXA | ANTNALMT0GT | 476 | AL | 83,078 | 4,137 | 4,137 | N | R | 1,368 | 139,353 | 968,557 | 30 | 140 | 4 |
| MNFDALMA | ANTNALMT0GT | 476 | AL | 77,574 | 4,696 | 4,696 | N | R | 1,657 | 139,353 | 968,557 | 30 | 140 | 4 |
| JCVLALMA | ANTNALMT0GT | 476 | AL | 73,606 | 45,537 | 45,537 | N | R | 7,787 | 139,353 | 968,557 | 30 | 140 | 4 |
| OHTCALMA | ANTNALMT0GT | 476 | AL | 70,334 | 74,075 | 74,075 | N | R | 3,994 | 139,353 | 968,557 | 30 | 140 | 4 |
| ANTNALLE | ANTNALMT0GT | 476 | AL | 29,346 | 20,188 | 20,188 | N | R | 8,710 | 139,353 | 968,557 | 30 | 140 | 4 |
| ANTNALOX | ANTNALMT0GT | 476 | AL | 23,535 | 20,571 | 20,571 | N | R | 14,824 | 139,353 | 968,557 | 30 | 140 | 4 |
| ANTNALMT | ANTNALMT0GT | 476 | AL | - | 20,736 | 20,736 | N | R | 22,139 | 139,353 | 968,557 | 30 | | |
| YORKALMA | BRHMALHW0GT | 476 | AL | 808,598 | 216,257 | 216,257 | N | R | 3,181 | 273,606 | 968,557 | 29 | | |
| LVTNALLA | BRHMALHW0GT | 476 | AL | 747,586 | 184,967 | 184,967 | N | R | 3,790 | 273,606 | 968,557 | 29 | | |
| EUTWALBO | BRHMALHW0GT | 476 | AL | 601,842 | 29,961 | 29,961 | N | R | 1,074 | 273,606 | 968,557 | 29 | | |
| EUTWALMA | BRHMALHW0GT | 476 | AL | 590,507 | 144,332 | 144,332 | N | R | 5,449 | 273,606 | 968,557 | 29 | | |

Sample File of Network Topology in CQBAT

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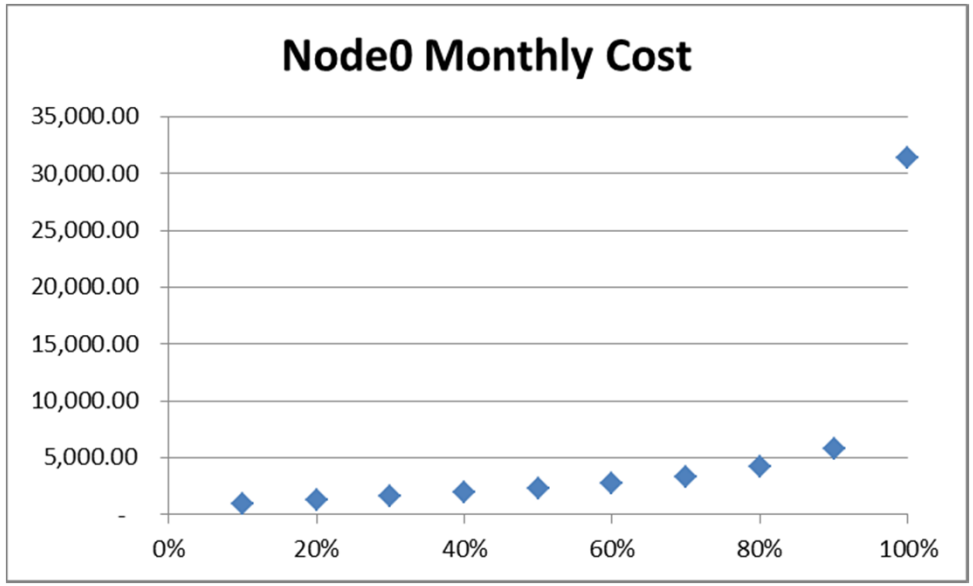
# Middle Mile Cost

- In BAM effort, monthly costs were tested against tariffed rates and found be reasonable by the FCC
- In CQBAT
  - Average Monthly cost for Node0 components is $3,000

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# Q/A

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