CostQuest’s Modeling Approach
USF and CACM/CAM Overview

CostQuest Associates

January 2014
Agenda

• Introduction: CostQuest’s Profile
• USF and Broadband Deployment
• US Broadband Landscape
• USF Models: Overview of CACM
• Business Case and Profitability Analysis
• Q&A
COSTQUEST INTRODUCTION
Introduction

CostQuest Associates
Corporate Profile

• Internationally recognized as leading telecommunication network modeling, costing and profitability experts

• Global experience in developing, supporting regulatory and competitive practices
Introduction

CostQuest Associates
Corporate Profile

*Cincinnati – Seattle – Washington D.C.*

Formed in 1999
Partners: 4
Employees: 16+

Core Competencies:
• Economic Network Modeling
• Mapping/GIS
• Regulatory Support
• Valuation/Costing
• Profitability
• Expert Testimony
Introduction

CostQuest Associates
Corporate Profile

Model Products/Services
- Wireline Models
  - CQ Landline (CQLL)
  - CQ Middle Mile (CQMM)
  - Connect America Cost Model (CACM)
  - CQUSF – State USF Model

- Wireless Models
  - CQ Wireless
  - CQ FixedWireless

- Valuation and Appraisal
  - CQ Landline RCN
  - CQ Wireless RCN

- Business case and Profitability
  - Gigabit Cities
  - COMPASS
Introduction

CostQuest Associates
Corporate Profile

Other Products/Services
• GIS/Mapping

• Online Tools
  • Bandwidth Assessment Tool
  • Mapping Analysis Tool

• Auction Toolset

• CostQuest’s Data Pantry
CostQuest Associates
Corporate Profile

Notable Projects

- Broadband and USF models: BAM used by FCC for NBP, CACM being used as national CAF/USF model, CPM California, CPM Hong Kong, BCPM, NUSC Australia, CostPro-Core New Zealand
- RCN and Loop models: CostPro in use by carriers with operations in all 50 states, well received by commissions in all Pricing efforts and in UNE and Tax proceedings
- Wireless Costing: Wireless Models NTIA, CTIA, Wireless Carriers
- Wireless Work: USAC Filings, Audits and Reviews, USAC/USF Workshops, GIS Analysis, Policy Support, USF Auctions
- 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
**Telecom/Broadband Clients**

- LARGE TELECOMS
  - AT&T
  - Verizon
  - Qwest/CenturyLink
  - Cincinnati Bell
  - Embarq/Sprint

- CABLE PROVIDERS
  - Comcast
  - Time Warner

- RURAL PROVIDERS
  - Frontier Communications
  - Consolidated
  - Windstream
  - Iowa Telecom

- AND OTHERS

**Client Mix**

**Government**

- Federal Government
  - Federal Communications Commission
  - USAC
  - U.S. Department of Commerce
  - NTIA

- State Government
  - State of Alabama
  - State of California
  - State of Idaho
  - State of Wisconsin
  - State of Wyoming

- International Government
  - New Zealand Commerce Commission
  - Australia Commerce Commission
  - Government of Hong Kong

**Wireless**

- LARGE MOBILE PROVIDERS
  - AT&T Mobility
  - Verizon
  - T-Mobile
  - U.S. Cellular

- RURAL WIRELESS PROVIDERS and Others
  - Alltel
  - ATNI
  - TWN
  - Western Wireless
  - Bluegrass Cellular
  - M3 Wireless
  - Commnet

- AND OTHERS

**Other Clients/Partners**

- McKinsey & Company
  - LR Kimball
  - Bernstein Research
  - Duff and Phelps
  - Parsons Applied Economics
  - University of Florida
  - University of Wisconsin
  - University of Alabama
  - University of Idaho
  - KeyTech/Bermuda
  - The Enterprise Group
  - VisionTech 360
  - The EdLab Group
  - City of Cincinnati

- AND MANY OTHERS
Network Experts

FTTIP Architecture

Acronyms:
ONT = Optical Network Terminal
OLT = Optical Line Terminal

Node 0 Node 1 Node 2 Node 3 Node 4

Note: Beyond a certain distance, OLT would have to be placed in the field.
USF AND BROADBAND DEPLOYMENT
The Broadband Challenge

• Consumers desire for high quality, low cost, high speed broadband services
• Telecoms need to cover cost, provide a return to shareowners, compete effectively and on a fair basis
• Governments desire to provide for the well being of its citizens, provide an environment that supports economic development, and spend limited public funds in a fair and effective manner
Our Experience

• CostProCORE for TSO in New Zealand
  • Model based
  • Annual funding cost in high cost areas
• NUSC Australia
  • Model based
  • Annual funding in high cost areas
• CPM HongKong
  • Model based
  • Annual funding to high cost customers
• BCPM, BAM, CQBAT, CACM in USA
  • Model based
  • Annual funding for high cost areas
  • Initial investment funding
  • Auction Support
Model Benefits

The benefits of a properly developed forward looking economic cost model for universal service and broadband deployment include:

- Clarification of concepts of the efficient provider
- Normalization of participants
- A less onerous process for stakeholders and policy makers
- An avoidance of asymmetric embedded costs mechanisms
- A tool to look at various scenarios in a quick and accurate manner
- Metrics and analytics to examine issues such as
  - Benchmarks, targeting, reserve levels for auctions, service definitional changes, etc.
  - Loan and grant requests
  - Monitoring and measuring
  - Product/Service profitability
- A clear link between defined service and costs developed and the impact of the current and/or future environment (e.g., line loss)
- A tool to inform the dispersal of limited public funds to achieve government desires
- Support for various cost concepts -- LRIC, TSLRIC, Marginal Costs, etc. -- for various uses – funding, pricing, reserve prices, benchmarks, etc.
Broadband Coverage
Cable Providers

National Broadband Map - Round 6, June 2012

Cable Service

>0 to <3 Mb DL
>=3 to <6 Mb DL
>=6 to <10 Mb DL
>10 Mb DL

Source: NationalBroadbandMap.gov
Broadband Coverage
Fixed Wireless Providers

Fixed Wireless Service

Source: NationalBroadbandMap.gov
Broadband Coverage
Wireless Providers

Wireless Service

National Broadband Map - Round 6, June 2012

Source: NationalBroadbandMap.gov

Key:
- >0 to <3 Mb DL
- >=3 to <6 Mb DL
- >=6 to <10 Mb DL
- >10 Mb DL
The Challenge

Full U.S. FTTp Deployment - RCN

- % of Network Investment
- Average Monthly Cost per HomePassed

Graph showing the increase in % of Network Investment and Average Monthly Cost per HomePassed as the deployment progresses from 0% to 100%.
National Broadband Plan
State Efforts
FCC Mobile Subsidization (CAF)
FCC Landline Subsidization (CAF)
BTOP/ARRA Update
RUS Loans
NTIA’s FirstNet

US GOVERNMENT RESPONSE
National Broadband Plan
“Connecting America”

- National Broadband Plan
  - Goals
    - At least 100 million homes having affordable access at 100 megabits per second download and 50 megabits per second upload
    - US should lead world in mobile innovation
    - Every American should have affordable access to robust broadband service
    - Every American community should have affordable access to 1 gigabit per second broadband service to schools, hospitals, and government buildings
    - To ensure the safety the safety of the American people, every first responder should have access to a nationwide wireless broadband public safety network
    - Ensure America leads in in the clean energy economy
  - Key Objectives
    - Move money from the Universal Service Fund to a new Connect American Fund to help support the National Broadband Plan in unserved areas
    - Create a Mobility Fund to ensure the wireless network nationwide 3G coverage
    - Develop plans to give access to broadband for low income Americans
    - Launch a National Digital Literacy Corps to train youth and adults digital literacy skills
- The impact of the National Broadband Plan is to make the United States a world leader in providing internet communications nationwide
Government Developments

• FCC
  • Revisions to the universal service
    • Connect America Fund – Focus is on Broadband deployment in high cost areas via landline and wireless technologies -- $45B over 10 years
  • Broadband Acceleration Initiative
    • Lowers the cost of stringing new fiber on utility poles and reducing the wait times for cell tower approval
  • Spectrum expansion (wireless and wifi)
    • 35% increase in unlicensed 5 Ghz band for Wifi
    • Broadcaster incentive auctions for white space (120Mhz in the 600Mhz band, estimate of $22B)
    • Allowance of DISH to use S band for terrestrial service
    • First Responders network
Government Developments

• States/Cities
  • ID, AL, WY, WI, etc...
    • States are looking at economic development plans and the cost to deploy
  • Cities are encouraging fiber deployment
    • Chattanooga and Kansas City have built out fiber networks that have gained attention
    • Other cities have plans: Cleveland, Lafayette, LA, Chicago, New York, Seattle to name a few
    • In all, 42 communities in 14 states have access to “ultra-high-speed” fiber providers that reach a gigabit
  • Various states are looking at revamping their state specific USF programs
Connect America Fund: Mobile

• Connect America Fund (CAF): $6,400,000,000 for deployment and operations of Mobile Broadband over the next 10 years

• Phased approach
  • Phase 1: $300mil one time deployment fund through reverse auction
  • Phase 2: $500mil per year for ongoing support
  • Plus: $100mil - Tribal lands deployment and $100mil/year ongoing
Connect America Fund: Fixed

- Connect America Fund - Landline
  - CAF1 was to distribute $300M in one time support to Price Cap carriers to spur immediate 4/1 buildout
    - Disbursement based on CostQuest regression model of cost
    - Carriers will receive $775 for each unserved location deployed
    - Only a portion was accepted by carriers
    - Continued discussion at the FCC to encourage providers to accept funding
  - CAF2 will distribute up to 4B annually to landline providers
    - Up to $1.8b annually to high cost areas served by Price Cap Carriers
    - Up to $100m for remote very high cost areas
    - Up to $2b annually to high cost areas served by Rate of Return carriers
CostQuest and CAF2

- CostQuest was retained by USAC to develop and deploy the model to guide disbursement of CAF2’s $1.8B in annual funds for Price Cap Carriers
  - Model is referred to as CACM >> Connect America Cost Model
- CACM
  - Based on prior work:
    - BAM and CQBAT
  - Models every wire center and every customer in the U.S.
    - Includes AK, PR, VI, HI, MP
    - Over 20,000 service areas
    - Over 160M customer locations
  - Current efforts focused on Price Cap areas
  - Forward looking network deployment: FTTp
  - Funding to high cost census blocks
  - Excludes areas already served by an unsubsidized competitor (e.g., cable)
Broadband Technology Opportunities Program – NTIA

- BTOP: NTIA invested approximately $4 billion in 233 BTOP projects benefitting every state. The portfolio of projects initially included:
  - Infrastructure projects totaling $3.5 billion in Federal grant
  - Public Computer Center (PCC) projects totaling $201 million
  - Sustainable Broadband Adoption (SBA) projects totaling nearly $251 million
  - State Broadband Initiative (SBI), NTIA granted approximately $293 million to states

- Source: NTIA, January 2012
RUS Loan Program Update

RUS 2012 - $173 million in telecommunications loans and grants

- RUS 2009-2011 - Broadband Initiatives Program (ARRA) - Completed
  - 320 awards obligated a total of $3.529 billion
    - 285 last-mile projects that totaled over $3 billion,
    - 12 middle-mile awards total $172.6 million,
    - 4 satellite awards for $100 million, and
    - 19 technical assistance awards for over $3.4 million

Source: RUS, January, 2012
USF MODELS

OVERVIEW OF CACM
CQUSF

The Forward Looking Economic Model Financial Template
What is CACM

• The Connect America Cost Model - CACM
  • Overall Design
    • Scorched node
    • Forward looking
    • New network built to all locations (POLR)
    • Active customers hooked up with broadband pipe capable of voice and data service
  • Contemporary / real-world wireline systems engineering standards are used for the modeling of the networks
    • More specifically, the model uses current engineering practices for landline deployments that have been reviewed against forward-looking standards in a wide array of regulatory proceedings and field tests
Basic Model Definitions

• CACM, like every 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 a network that is capable of providing one or more specified services
  • “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”
CACM

Customer Locations
- GeoResults based
- Trued to Census

Roads
- Tiger

Wirecenter Boundaries
- GeoResults

Engineering Rules
- FTTp

Tandem Locations

High Level Design

CACM

User Inputs
- Capex
- Take Rates
- Opex
- ...more

Network Topology
- Dist
- FDR
- Middle Mile

Solution Set

Support Toggles
- Solution Set
- Benchmark
- Alt Tech Cap
- Geography
- ...more

Reports
CQLL Network Topology
CQLL Network Topology

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:
- Node
- Fiber fed Splitter
- Pedestal
CQLL Network Topology

Legend:
- / ■ - Node2
- □ - Pedestal
- -- - Feeder
- --- - Distribution

Designed Network with overlaid cabling, no roads
CQLL Network Topology

Census Block Cost Surface
- Darker = higher cost
CACM Cost Calculation

• Basic Formula
  • Cost = Investment * Annual Charge Factors ("ACF") + Direct Opex + Shared and Common Opex Costs

• Components of Costs
  • Investment Models: Loop, Central Office, and Interoffice
  • Annual Charge Factor Models
    • Depreciation, Taxes, Cost of Money
  • Opex Models
    • Operations, Shared, Common

Note: Annual Charge Factors convert investments into Depreciation, Cost of Money, and Tax costs
Support Model

• With regard to Support, CACM allows the ability to adjust the design attributes to understand the impact

• Key Parameters for Support include:
  • Participants in the funding
  • Utilization of a cap
  • The benchmarks to be used for funding
  • Exclusion of competitively served areas
Support Approach

**Funding Approach**

- “Big Bang” starts at a benchmark – stretches limited funds to most locations, but may not fund high cost locations like the “Sanded Ridge”
- “Sanded Ridge” starts at a cost cap – impacts the highest cost locations, but may not fund as many locations as “Big Bang”
MODEL RESULTS
(PRELIMINARY RESULTS)
Illustrative Results – Compared to Existing Coverage

"Hockey Stick": FTTp Cost per Subscriber across the U.S.

Preliminary results – for discussion purposes only
Illustrative Results

Cost Breakout for FTTp Service

- COM 18%
- DEPR 21%
- GenAdminOpex 13%
- BadDebtOpex 3%
- CustomerOperationsMktOpex 20%
- NetworkOperationsNPSOpex 12%
- NetworkOperationsPSOpex 6%
- TAX 7%

Preliminary results – for discussion purposes only
Illustrative Results

Investment Breakout for FTTP Service

- Copper Cable, Pedastal (DIST) -- FST: 7%
- Buried Trench (DIST): 16%
- Poles (DIST): 3%
- Fiber Cable (FDR): 3%
- Splitter: 7%
- Conduit (FDR): 5%
- Fiber (FDR): 3%
- Buried Trench (FDR): 6%
- Poles (FDR): 2%
- Regen: 0%
- OLT: 3%
- cVoip: 3%
- E-Switch, Routers: 2%
- Land, Building, Other: 9%
- Conduit (ICF): 0%
- Pole (ICF): 1%
- Fiber (ICF): 1%
- Undersea: 0%

Preliminary results – for discussion purposes only
Illustrative Results

FTTp Network

FTTp Cost versus Company Size

Preliminary results – for discussion purposes only
Nationwide Cost at CB level

Preliminary results – for discussion purposes only
PRODUCT AND SERVICE PROFITABILITY
OVERVIEW OF COMPASS
COMPASS
Product Economic Profitability System

• The approach
  • Focused on governance needs
    • Internal / decision support / coordination focus
  • Grounded in economics
    • Uses impact attribution approach
  • Activity based logic
    • Uses widely-held / practical approach to costing
  • N-dimensional mapping of costs and revenues
    • Products, markets / customers, channels, etc.
  • Can accommodate / coordinate both cost perspectives
    • Historical and forward look (via cost functions)
A Simple Concept

Cost Studies → Mapping → Revenue Database

Cost Database

Billing System

Cost, Revenue Analysis, Metrics, Profit Profiles
### Report: P&L Report (TotalCost_Cap)

**View:** Market Area=ABC, Bundle Area=Platinum  
**Period:** Aug-02

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<th>Video</th>
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<td>Invoice and Collect Revenue</td>
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<td>TOTAL VOLUME SENSITIVE COSTS</td>
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| CONTRIBUTION TO FIXED COSTS | 156,130 | 115,610 | (2,781) | 353,663 | 306,361 |
Q&A/Open Discussion