ORIGINAL

AT&T

Suite 1000
1120 20th Street, N.W.
Washington, DC 20036
202 457-3810

RECEIVED
JAN 14 1998
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

January 13, 1998

EX PARTE OR LATE FILED

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M. St., NW, Room 222
Washington, D.C. 20554

RE: Ex Parte Presentation – Proxy Cost Models
CC Docket No. 96-45

Dear Ms. Salas:

On, January 13, 1998, AT&T and MCI (the Hatfield Model Sponsors or "HMS") met with Mike Riordan, Gary Biglaiser, Michael Kende, Patrick DeGraba, Lisa Gelb, Stagg Newman, Donald Stockdale, Robert Loube, Bill Sharkey, and Brad Wimmer of the Commission staff in regards to the staff's examination of cost models. The HMS were represented by Rich Clarke and Joel Lubin of AT&T, and Mark Bryant and Michael Pelcovits of MCI.

The purpose of this meeting was to provide the Commission staff with a description of how the Hatfield Model, v5.0 performs at counting, locating and clustering customers, and at engineering the local telecommunications network. Questions about how the Hatfield Model 5.0 performs these tasks relative to the BCPM3 and the HCPM were addressed as well. The attached presentation materials were used at this meeting.

Two copies of this Notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(a)(2) of the Commission's rules. Because of the late hour of this meeting, this notice is being filed the following business day.

Sincerely,

Richard N. Clarke

Attachments

cc: Mike Riordan, Gary Biglaiser, Michael Kende, Patrick DeGraba, Lisa Gelb, Stagg Newman, Donald Stockdale, Robert Loube, Natalie Wales, Brad Wimmer, Sheryl Todd, Chuck Keller, Brian Clopton, Richard Smith, Mark Kennet, Anthony Bush, Bill Sharkey, Abdel Eqab, Whitey Thayer

No. of Copies rec'd 0+1
List A B C D E

Hatfield Model v 5.0

NARUC Annual Convention
Boston, Massachusetts
November 7, 1997

What's New in 5.0?

- Dramatically improved accuracy in determining customer locations
- Improved engineering of distribution and feeder networks
- Enhanced switching, signaling, and interoffice transport network calculations
- Increased flexibility in assigning expenses, determining Universal Service support

Customer Location

- Data sources exist that permit geocoding of actual residence and business locations
- This permits plotting of customer locations within a wire center, and the engineering of distribution plant to serve the precise areas where customers are located
- Does not rely on arbitrary segmentation of customers into Census Bureau geographical boundaries or arbitrarily defined grid cells

3

Customer Location Data Sources

- Metromail Residential Data
  - File of deliverable postal addresses and telephone numbers
  - Contains roughly 100 million household records
  - Covers over 90% all U.S. households
  - Updated continuously
- Dun & Bradstreet Business Data
  - Information on roughly 11 million business establishments
  - Postal addresses
  - Telephone numbers
  - Counts of employees
  - Standard Industrial Classification (SIC) codes

4

Geocoding Process

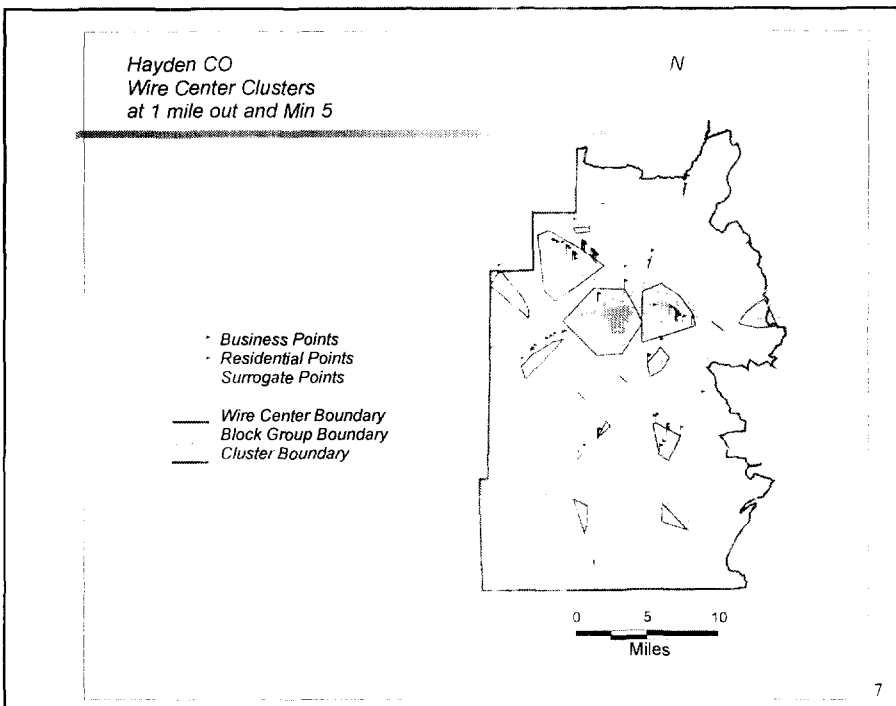
- These ~110 million customer records are assigned latitude and longitude coordinates (geocodes) accurate to within 50 feet
- Current coverage of about 75%
- "Unlocated" customers are assumed to be placed uniformly along the periphery of the CB and the geocodes implied by these placements are added to the dataset
- Assures that the dataset contains geocodes for 100% of the target number of customer locations by CB

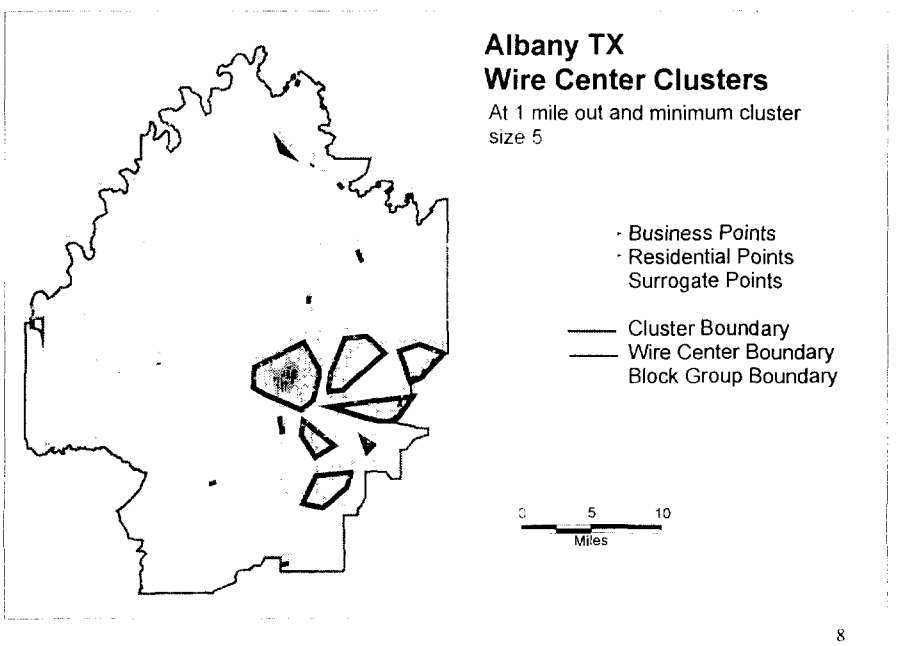
5

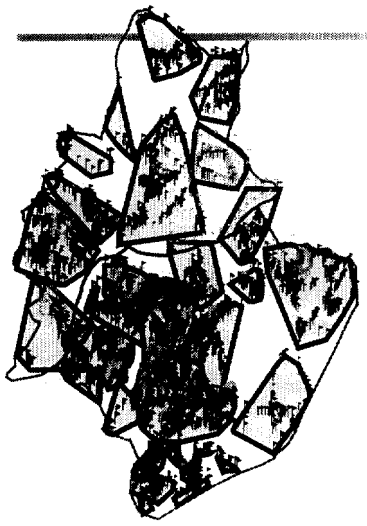
PNR Clustering Algorithm

- Determines the customer locations that are close enough together to be served by a single distribution area
- Engineering requirements for clusters:
  - No point in a cluster may be more than 18 kft. distant from the cluster's centroid
  - No cluster may exceed 1800 lines in size

6


Hayden CO
Wire Center Clusters
at 1 mile out and Min 5
N
Business Points
Residential Points
Surrogate Points
Wire Center Boundary
Block Group Boundary
Cluster Boundary
0 5 10
Miles
7


Albany TX
Wire Center Clusters
At 1 mile out and minimum cluster size 5
Business Points
Residential Points
Surrogate Points
Cluster Boundary
Wire Center Boundary
Block Group Boundary
0 5 10
Miles
8



Duluth GA
Wire Center Cluster
At 1 mile out and minimum cluster size of 5

- Business Points
- Residential Points
- Surrogate Points

— Cluster Boundary
— Wire Center Boundary
Block Group Boundary

0 2 4
Miles

9

Customer Location

- All information currently contained in HM4 database is reported for each cluster
- Clusters replace the CBG as unit of analysis in HM5

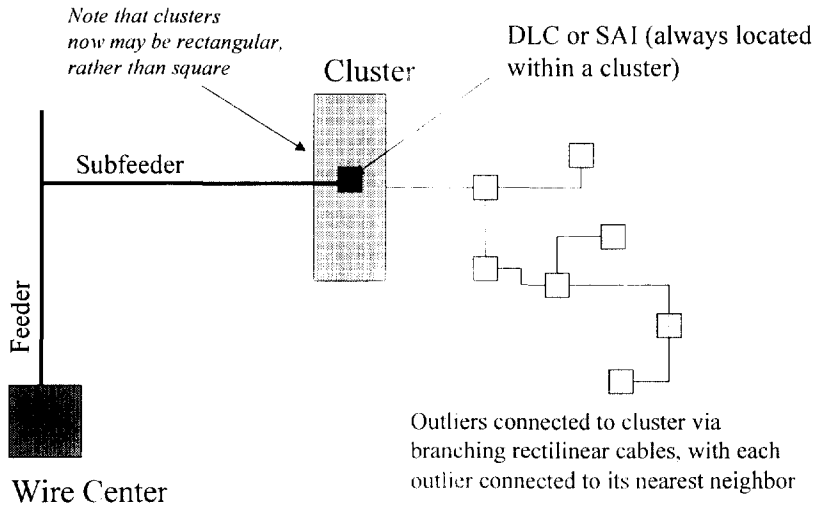
10

Distribution Module

- The HM5 Distribution Module takes as input for each wire center records describing the clusters within the wire center service area
  - Location of cluster centroids
  - Aspect ratio of lengths of major and minor axes
  - Line counts
- Engineering
  - Backbone and branch cables are engineered to "cover" the cluster
  - SAIs and DLCs are placed at cluster centroids
  - Distant outliers are served via digital copper T-1 cables

11

Loop Engineering Example



12

Optimization of Feeder Technology

- Feeder is always fiber if analog copper distance would exceed 18 kft.
- If total distance is less than 18 kft.
  - For each cable route cost of fiber feeder and copper feeder are evaluated separately
  - Choice of copper feeder and fiber feeder is made dynamically based on least cost technology
  - Accounts for total life-cycle cost of facility, including depreciation and maintenance

13

Optimization of Structure Type

- For each cable route, the costs of buried versus aerial cable are evaluated separately
- Default proportions of each plant type are considered, but a user-adjustable proportion of total plant can "swing" from one structure type to another
- Within the "swing" fraction, the amount of structure type substitution increases as relative cost differential between the structure types increases
- Underground plant is unaffected by this calculation

14

Optimization of Feeder Routing

- Feeder optionally will be routed more directly toward customer clusters - rather than rectilinearly

15

Switching Costs

- Model now determines costs separately for host, remote, and stand alone switches
- Investment in host/remote combinations distributed equally among all lines served by the combination
- Cost of umbilical trunks between remotes and hosts modeled explicitly

16

Interoffice Network Costs

- All wire centers may now (at the user's option) be located on SONET rings
  - In HM4, smaller offices were required to be trunked directly to the tandem on SONET fiber
- Interoffice route distances are now calculated explicitly
  - In HM4, interoffice distances were estimated based on distance across the exchange area

17

Expense Module Changes

- USF calculations now permit separate calculation of state and federal funds, using different benchmarks and selections of supported services for each
- Some categories of expenses can now be assigned either according to direct costs, or on a per-loop basis
  - General Support
  - Network Operations
  - Variable Overheads
- Output report showing results by Part 32 USOA account

18

Input Data Changes

- 1996 ARMIS data is now used for
  - calculation of expense/investment ratios
  - network usage (DEMs and call attempts)
- Alaska (Anchorage) and Puerto Rico are now included

19

Interface and Model Operation

- Model requires Microsoft Office Professional '97
- Model can now be run in "batch" mode -- select a group of study areas and the model will cycle through them sequentially
- Computing requirements are similar to those for HM4
  - Fast Pentium processor recommended
  - 32MB of RAM minimum, 64 MB recommended

20

Counting, Locating, Clustering and Engineering Plant to Customers in the Hatfield Model, v5.0

PNR and Associates,
Jenkintown, PA
Hatfield Associates,
Boulder, CO

Sponsors: *AT&T*
MCI

Revised: January 1998

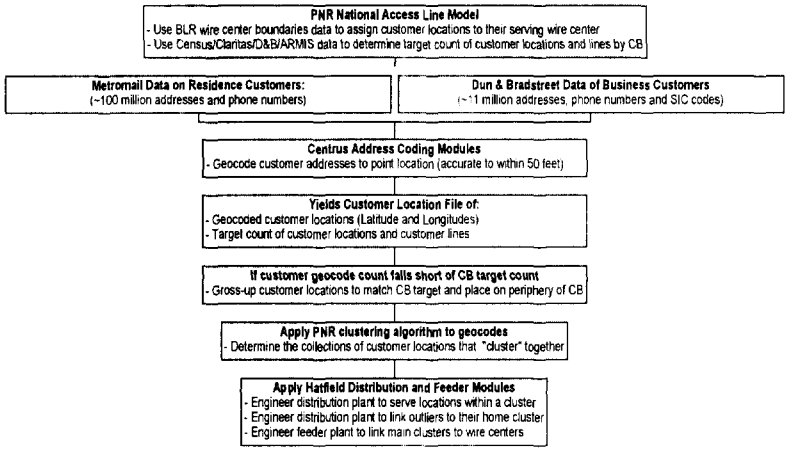
Overview

Process Stages

- Counting customers
  - PNR National Access Line Model (NALM)
- Locating customers
  - Geocoding actual customer location
  - Location gross-up process
- Clustering process
  - Grouping customers that can be served in a single distribution area into distribution areas
- Engineering distribution plant
  - Placing cables to serve located customer clusters

Overview

Process Overview



Counting Customers

PNR National Access Line Model

- PNR National Access Line Model (NALM) estimates number of:
  - Customer locations, and
  - Telephone lines

  by
  - Census Block (CB), and by
  - Wire Center (WC)

Counting Customers

PNR NALM - Residence

- Determine a target number of residence locations by CB
  - Metromail 1997 household counts provide the "floor" for these counts
  - If Claritas 1996 household count projections at the Census Block Group (CBG) level exceed Metromail counts, the residual is apportioned to the CB level based on 1990 U.S. Census distribution patterns and added to Metromail

Counting Customers

PNR NALM - Residence (continued)

- Determine a target number of residence telephone lines by CB based on:
  - Residence customer location counts
  - Telephone penetration estimates based on statewide U.S. Census data as adjusted due to CBG-specific demographic factors such as age and income
  - "Second" line penetration based on age and income
- Target counts of households and lines are then normalized to match study area residence line totals as reported in:
  - ARMIS, NECA, USTA, RUS, etc.

Counting Customers

PNR NALM - Business

- Determine a target number of business locations by CB based on:
  - Dun & Bradstreet (D&B) business establishment counts located to the CB level based on geocoded addresses
- Determine a target number of business telephone lines by CB based on:
  - Gross counts of business lines estimated from D&B business establishment counts, employee counts and SIC code information, and
  - Shares of lines that are single line business or multiline business based on employee counts and SIC codes

Counting Customers

PNR NALM - Business (continued)

- Target counts of business locations, employees and lines are then normalized to match study area business line totals as reported in:
  - ARMIS, NECA, USTA, RUS, etc.

Counting Customers

PNR NALM - WC Assignment

- BLR data on WC boundaries is primary basis for assigning customer locations and lines to WCs
  - BLR boundaries are conformed to CB boundaries
  - CBs are then assigned to WCs based on these boundaries
  - Customer telephone number NPA-NXX and Bellcore LERG WC associations are used to verify BLR accuracy and resolve data inconsistencies
- All customer locations located in CBs that are associated with a WC are then assigned to that WC

Locating Customers

Metromail Residential Data

- Large file of deliverable postal addresses and telephone numbers
  - Contains roughly 100 million household records
  - Covers over 90% all U.S. households
- Compiled from many information sources:
  - Telephone white pages, voter and automobile records, real estate transaction data, warranty cards, etc.
- Accuracy maintained
  - File is updated 65 times annually
  - Incorporates postal address standardization practices
  - National change of address processing

Locating Customers

Dun & Bradstreet Business Data

- Information on 11 million business establishments (over 90% coverage)
  - Postal addresses
  - Telephone numbers
  - Counts of employees
  - Standard Industrial Classification (SIC) codes
- Compiled from many information sources:
  - Gov't. and trade orgs., financial institutions, etc.
- Accuracy maintained via:
  - Daily updates
  - Annual management interviews

Locating Customers

Geocoding Process

- Centrus Address Coding Modules used to assign geocodes to business and residence customer addresses
- Process:
  - Standardize addresses to USPS specifications
  - Determine latitude and longitude coordinates (geocodes) of each address
  - Retain geocodes that are precise to six decimal places of accuracy (50 feet or less)
  - Discard less accurate geocodes *(e.g.,* CB/CBG/ZIP+4*)*

Locating Customers

Geocoding Process (continued)

- Quality measures
  - Nationally, about 75% of all addresses successfully geocode to the six decimal place point level
  - Ungeocoded locations due to:
    - Faulty address records
    - Faulty road location (TIGER) files
    - P.O. Boxes, rural routes, etc.
- Geocoding success is improving rapidly due to:
  - Tightened postal requirements
  - Needs of non-postal shippers (e.g., UPS, Fedex)
  - E911 expansions

Locating Customers

Geocoding Process (continued)

Note the difference in Census Ids. Those with A SX codes are 12 digit while ZXnX codes are only 10

STREET	CITY	ZIP	LONG	LAT	CENSUS_ID	MATCH CODE	LOC CODE
42 HUMMINGBIRD LN	ALMONT	81210	-106.486424	38.781180	08051963600110	S80	AS0
213 RAINBOW RD	ALMONT	81210	-106.488218	38.788311	08051963600110	S80	AS0
954 COUNTY ROAD 744	ALMONT	81210	-106.767130	38.749458	08051963800124	S80	AS1
2809 COUNTY ROAD 38	GUNNISON	81230	-106.940758	38.470850	08051963600288	S80	AS1
18806 COUNTY ROAD 765	ALMONT	81210	-106.480000	38.723500	080519636001	S80	ZB9E
5866 COUNTY ROAD 62	GUNNISON	81230	-106.617400	38.439800	080519636001	S80	ZB9E
299 ZUNI TRL	GUNNISON	81230	-106.936300	38.504200	080519636002	S80	ZC7K
146 CACTUS HILL DR	GUNNISON	81230	-106.643400	38.467800	080519636001	S88	ZC7K
200 INDUSTRIAL PARK RD	GUNNISON	81230	-106.559900	38.504100	080519636001	S89	ZC7K
34 SLATE VIEW LN	CRESTED BUTTE	81224	-106.882500	38.807100	080519638001	S88	ZT7J
17300N N STATE HIGHWAY 1	ALMONT	81210	-106.846000	38.664600	080519636002	S82	ZT9F

Note the difference in Lat / Long assignments. Point geocodes go to the 6th decimal place

Address information is provided courtesy of Metromail, Inc.

Locating Customers

Geocoding Process (continued)

- Location Codes
  - Location codes indicate the accuracy of the assigned geocode

Code	Description
AS0	Indicates a house range address geocode. This is the most accurate geocode available. *Best Location - offset 50'.*
AS1	Indicates a house range address geocode. Street side is unknown. *CB to the left of the intersection is assigned and location is in middle of street.*
AS3	Indicates address was interpolated onto a TIGER segment that did not originally contain address ranges. *CB to the left of intersection is assigned and location is in middle of street.*
ZXnX	Indicates location based on ZIP code data. This is NOT a *point* geocode and therefore is not used in Customer Location

Locating Customers

Geocoding Process (continued)

Levels of geocoding in our example

- 100 Residential points
  - 77 records to AS0
  - 9 records to AS1
  - 14 records to a ZIP level
- Leaves customer location file with 86 usable locations

- 100 Business Points
  - 60 records to AS0
  - 8 records to AS1
  - 3 records to AS3
  - 11 records to a ZIP level
  - 18 records could not be geocoded
- Leaves customer location file with 71 usable locations

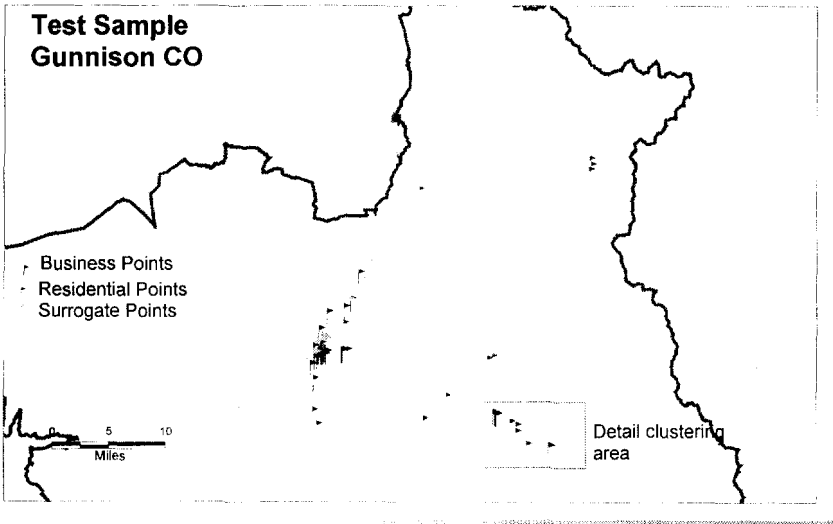
Locating Customers

Customer Location Positioning

- Counts of geocoded customer locations in each CB are compared with NALM target count of customer locations for that CB
  - Count of customer locations that are "unlocated" within the CB is determined
  - "Unlocated" customers are then assumed to be placed uniformly along the periphery of the CB and the geocodes implied by these placements are added to the customer location file (CLF)
  - Assures that the CLF contains geocodes for 100% of the target number of customer locations by CB

Locating Customers

Customer Location Positioning



Clustering Customers

Clustering Customer Locations

- CLF contains a list of customer geocodes for 100% of the target location count for each WC
- To determine efficient engineering of telephone plant, all customer locations associated with a WC are analyzed to determine what cluster patterns exist
  - No artificial CB/CBG or "grid" boundaries are permitted to limit the identification of clusters
- Algorithm must ensure that identified cluster configurations comport with telephone plant engineering specifications

Clustering Customers

PNR Clustering Algorithm

- Algorithm is based on the "nearest neighbor" methodology with added engineering rules
  - All distances measured based on rectilinear (right angle) routing
  - No point in a cluster may be more than XX kft. distant from the cluster's centroid
  - No cluster may exceed XXXX lines in size
  - No point in a cluster may be farther than X miles from its nearest neighbor in the cluster

Red parameters are input values to the clustering process

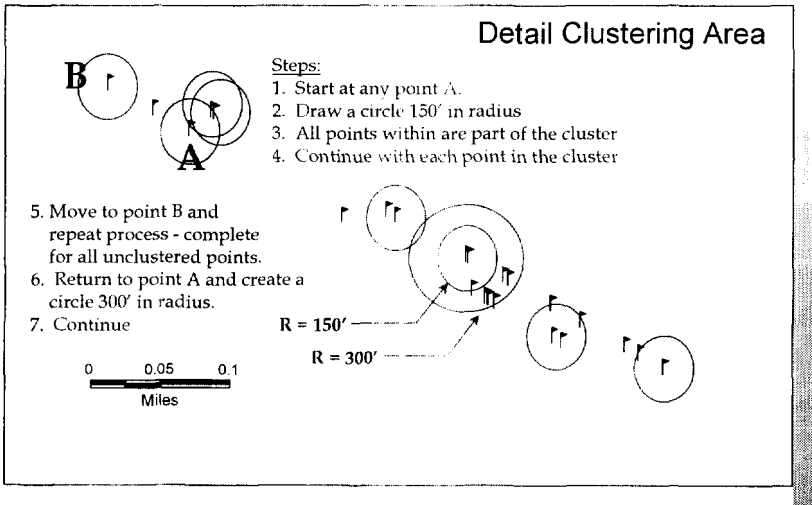
Clustering Customers

PNR Clustering Algorithm (continued)

- Algorithm allows telephone plant engineering restrictions to be incorporated as an integral part of the clustering process
- Algorithms that require engineering restrictions to be post-applied to clusters are not efficient
  - Efficiency is essential if ~111 million customer locations are to be analyzed for clusters

Clustering Customers

PNR Clustering Algorithm



Clustering Customers

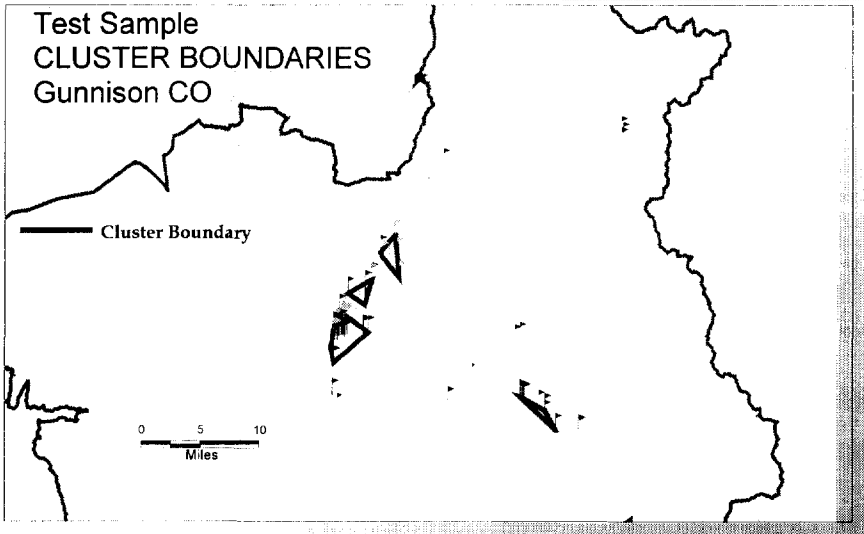
PNR Clustering Algorithm (continued)

- Engineering requirements for "main" clusters:
  - No point in a main cluster may be more than 18 kft. distant from the main cluster's centroid
  - No main cluster may exceed 1800 lines in size
  - No point in a main cluster may be farther than 2 miles from its nearest neighbor in the main cluster
  - A main cluster must contain at least 5 points
- "Outlier" clusters meet all main cluster requirements, except they contain fewer than 5 points
  - Identity of nearest other cluster established as well

Red parameters are currently used values

Clustering Customers

PNR Clustering Algorithm



Engineering Plant

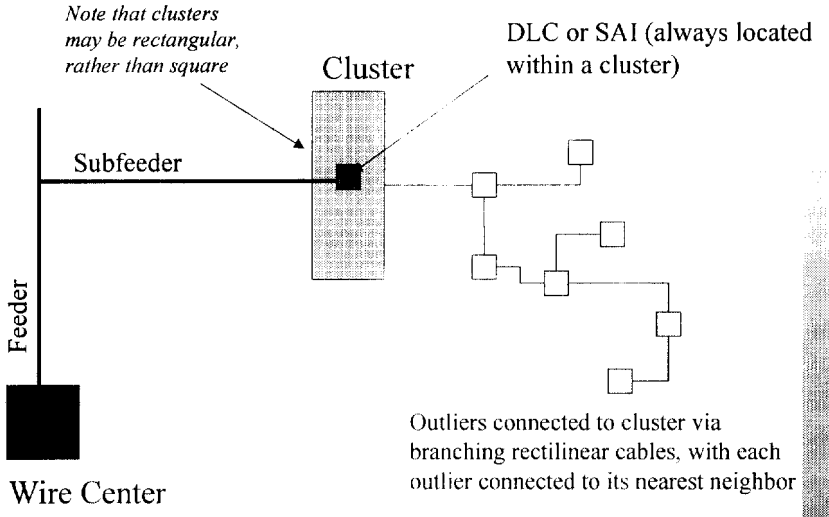
Distribution and Feeder Modules

- The HM 5.0 Distribution Module takes as input for each WC a list of records describing the main and outlier clusters within the WC's service area
  - Location of cluster centroids
  - Aspect ratio of lengths of major and minor axes
  - Line counts
  - For outlier clusters, the identity of the nearest other cluster
- For main clusters
  - Backbone and branch cables are engineered to "cover" the cluster
  - SAIs and DLCs are placed at cluster centroids

Engineering Plant

Dist'n and Feeder Modules (continued)

- For outlier clusters
  - Analog or T1 copper cables are constructed from the nearest other cluster to the centroid of this cluster
  - Analog or T1 copper cables are constructed along a "road" array of customer locations within this cluster
- Feeders are engineered from main cluster centroids to their WC
  - Feeder is digital fiber-optic if analog copper distance would exceed 18 kft., or if
  - Fiber is more economical than copper on the route

Engineering Plant

Loop Engineering Schematic