

**USING FIBER TO INTERCONNECT DIFFERENT SYSTEMS,
REDUCE CASCADES AND CHANGEOUT
ADDRESSABLE CONVERTERS**

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ABSTRACT

Over the past five years, Cencom Cable Associates, Inc., has acquired three different cable systems in St. Louis County, Missouri. These systems have about 3000 miles of plant and serve over 100,000 subscribers today with five headends and three AML microwave receive sites.

This paper will discuss the plan that has been proposed and is being implemented to interconnect the systems using fiber optics with control from one headend, eliminating the microwave systems and reducing all trunk runs to less than nine amplifiers in cascade. Also involved in this plan is the changeout of addressable converters in one of the systems without adding channel capacity, but using AM fiber nodes to break up the trunk runs. After the plan is completed, within three years, the system will be served from one headend with three hubs fed by FM fiber links and 90 AM fiber nodes.

BACKGROUND

Cencom Cable Associates, Inc., is a MSO headquartered in St. Louis County, Missouri with cable systems in eleven states serving over 420,000 customers. CCA was founded in 1982 and by December 1984 had acquired systems in five states with around 40,000 subscribers. The next year saw Cencom grow from 40,000 subscribers to 150,000

subscribers largely due to the acquisition of three systems in St. Louis County. Each system uses different outside plant technology and different addressable converters.

The management and customer operations of the systems have been consolidated with all customer service and repair service functions being handled from one location. This plan will integrate the technical networks and allow the systems to be managed and operated as one system.

EXISTING

Existing Network

The existing systems and network configuration is shown in figure 1. Cencom I is the system acquired from Warner Amex. It is a 400 MHz system utilizing Qube two way interactive addressable converters and C-COR electronics. The headend is located in Olivette with three AML receive sites using Hughes high power AML microwave equipment. Cencom II is the system acquired from Group W. It is a 400 MHz system utilizing Zenith Z-Tac one way addressable converters and Jerrold electronics. Its territory is served with three separate headends. Cencom III is the system acquired from Storer. It is a dual 330 MHz system utilizing Tocom addressable converters and Texscan electronics served out of one headend.

CENCOM CABLE TELEVISION ST. LOUIS AREA SYSTEMS

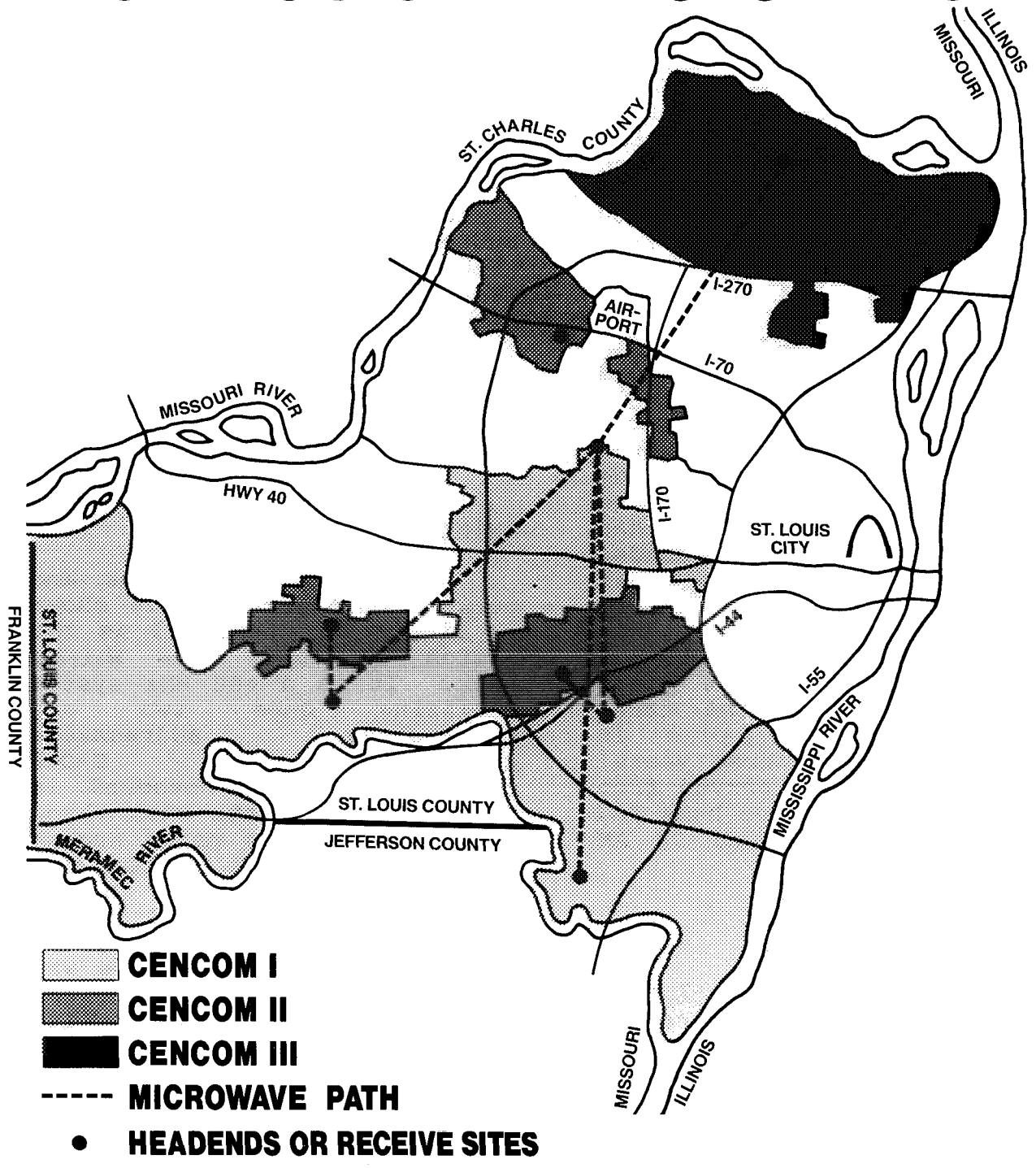


Figure 1

The systems' five headends have been interconnected on a limited channel basis utilizing AML, AML line extenders and FM over coax. These links are used to deliver Pay Per View channels, barker channels, and local access channels.

Qube converters

As stated earlier, the system acquired from Warner Amex, Cencom I, uses the Qube two-way interactive converters. These converters have not been manufactured in six years and additional Qube converters that would work in this system are not available. The system was running out of converters! Attempts to find a satisfactory Qube compatible converter or decoder were unsuccessful. The decision was made to change out the converters using Jerrold IPPV converters retaining the RF return path over the cable system.

There are six encoded channels on the system. In order to change out the converters, the Qube and Jerrold encoding schemes needed to exist simultaneously. There was not excess channel capacity and no plan to increase the channel capacity of the system. Replacing six existing channels with the Jerrold encoded channels for the length of time it would take to replace 38,000 converters is not acceptable from a customer or political standpoint. If however this period of time is reduced to a few weeks, the time to replace 1500 or so converters, it would be acceptable. The use of AM fiber nodes is an excellent way to break up the system with each node capable of having a separate channel lineup feeding

a unique group of customers.

Local Origination, PPV, Ad Insertion

Each of the three systems in St. Louis County is addressable and offers three channels of Pay Per View programming. Two of these channels are locally originated. In addition there is a county wide Cooperative School District program that delivers programming over the cable systems to local schools.

In order to deliver this programming, two of the three Missouri II headends receive limited channels utilizing Hughes AML line extender equipment from two of the AML receive sites in Missouri I. The third headend is connected using a FM over coax link. The Missouri III headend is connected using an AML path.

Local ad insertion is currently being done on four channels being inserted at each headend. Inserting local advertizing on any additional channels will require additional equipment at all five headends.

Plant Extensions

The western section of St. Louis County is the current growth area. A significant portion of this area is not currently being served by cable. Most of this area could not receive satisfactory service by extending the existing plant. The longest length of the existing plant has 38 feed forward amplifiers in cascade after an AML receive site. A different means to

service this area is required before plant can be extended.

PROPOSED PLAN

In addition to the above specific situations that needed solutions, there existed the desire to improve the overall performance and the reliability of service provided to our customers. The result is the Cencom Cable Television Missouri Fiber Optic Plan as shown in figure 2. The following will discuss the plan and how we made our decisions.

Backbone Architecture

There has been much written over the past two years regarding the fiber optic backbone architecture proposed by ATC and the different variations that have been proposed and utilized since then by different cable operators. Most of these alternatives were considered.

One of the first decisions to be made was if we would turn around amplifiers. Route diversity for the fiber optic cable was not feasible for most of the area. Since the fiber cable would be overlashed to the existing coaxial cable, a redundant backup switch would provide backup only in the case of optical failure. A loss of continuity, fiber break, pole knockdown, etc., would affect the coax as well as the fiber. Not turning around amplifiers would require about 40% more AM fiber nodes. We decided that this additional cost could not be justified to just provide backup in the case of optical failure.

Another major decision is

the number of amplifiers that will be left in cascade behind the fiber nodes. A fiber backbone plan was first designed for four amps in cascade. Then we looked at a design with nine amps in cascade. The nine amp design required only about one third as many nodes as the four amp design. Since the systems are 400 MHz with HRC headends, the performance with nine amplifiers in cascade will meet all performance requirements. Each node will serve less than 2000 customers which will work well with the addressable converter changeout process.

Hubs

As mentioned earlier, a main objective of the plan is to be able to control all the systems in St. Louis County from one location. This location is in Olivette where all customer and repair service representatives are located, where the studio and pay per view insertion equipment is, and where the billing computer is located.

The AM fiber technology is limited in the distance it can serve. Our first design anticipated AM nodes leaving six headends, Olivette and five fiber hubs. Each hub had to receive "headend quality" and is connected back to Olivette using FM over fiber. As the quality of AM fiber products has improved, we feel confident that excellent quality can be achieved on links up to 23KM in length using single laser transmitters. Because of the lengths possible with the AM technology, all of Cencoms St. Louis county systems, including currently unserved areas, can now be served by four hubs, the

CENCOM CABLE TELEVISION FIBER OPTICS PLAN

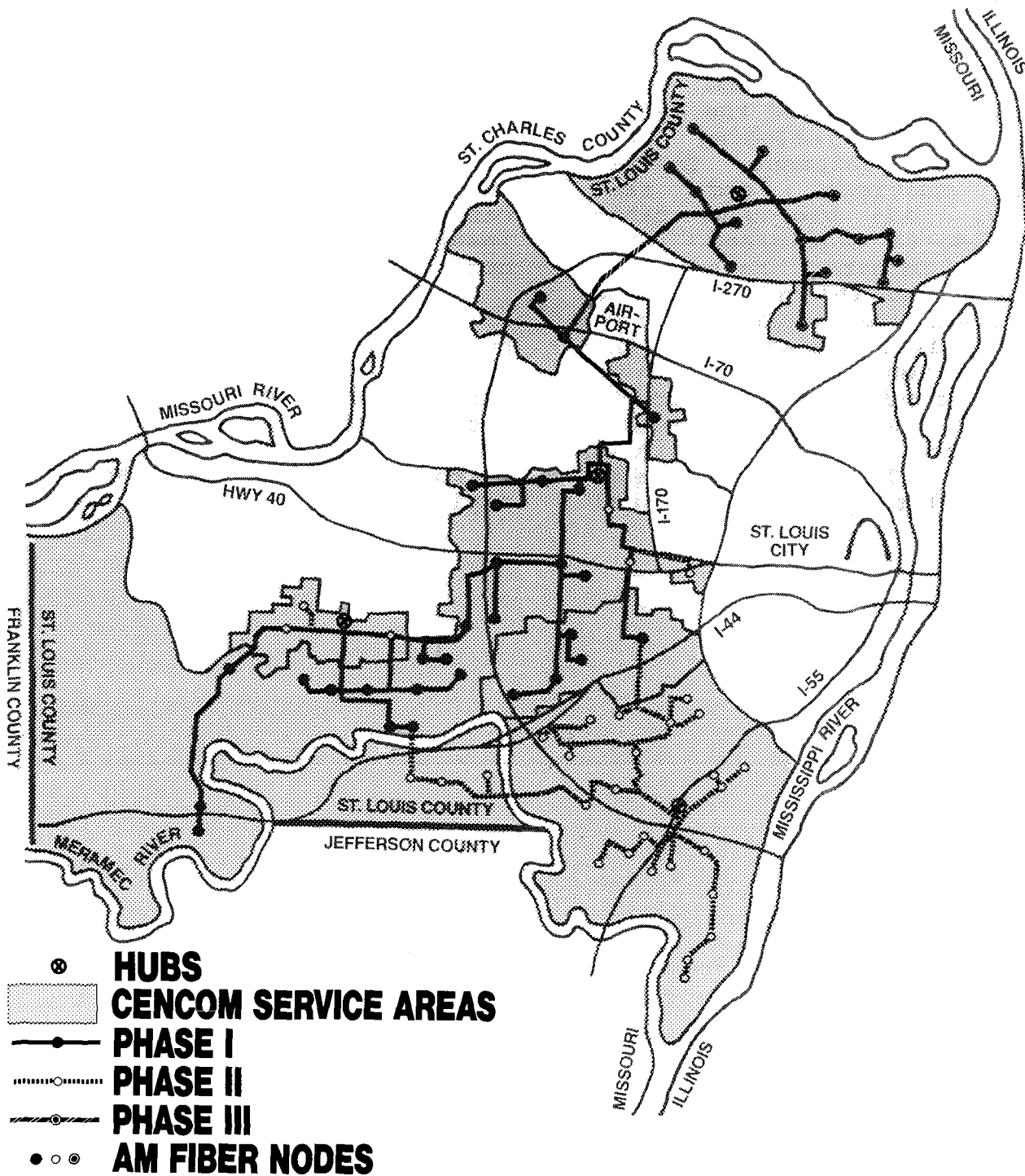


Figure 2

three fiber hubs served by FM over fiber from Olivette and the Olivette headend.

All programming sources, addressable security encoding and commercial ad insertion can now be done at Olivette. This design will enable us to eliminate two of the three headends that served the Cencom II system including the buildings, equipment, towers, earth stations, and real estate. All microwave paths will also be eliminated. This will eliminate rain fade problems and the need for the towers and real estate at each receive site. In addition, the ad insertion equipment now in each headend can be moved to Olivette and used to insert advertizing on additional channels. The required number of satellite receivers and

VideoCipher decoders is also reduced dramatically.

CONCLUSION

When completed by the end of 1992, the Cencom Cable Television Missouri Fiber Optic Plan will have placed around 200 miles of fiber optic cable containing around 2400 miles of fiber. There will be 90 AM fiber nodes each serving less than nine amplifiers in cascade. All programming and insertions can now be done and controlled from one location.

All customers, including potential customers currently unreachable, will receive improved picture quality and much better reliability with the elimination of the microwave and no more than nine amplifiers in cascade.