Broadband Carinthia - Gigabit for Everyone

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1 What is the goal of Carinthia?

Carinthia formulated the goal of "Gigabit for Everyone" long before the European Commission's "Digital Agenda 2030." Carinthia's goal was not triggered by its own "Agenda 2030," but rather by confidence in the technical superiority of fiber optics over all other communications infrastructures, on the one hand, and the political will to use the general availability of fiber optics as an effective tool for regional development, on the other. However, this will was only partly a reason for entrusting this tool to a state-owned company.

2 Why a federal state company?

The goal is area coverage ("for Everyone" means close to 100%). Area coverage entails high investment costs for infrastructure expansion in sparsely populated areas. These costs are usually not justifiable through private expansion. The usual solution is to contribute public funds in the form of a "lost subsidy," which, as the name suggests, is lost to the public budget through the awarding of the contract.

However, the loss from the budget can be avoided by investing the funds in the lasting value of a publicly owned (fiber optic) infrastructure, for example, through an infrastructure company. The goal of achieving an effective instrument for regional development is merely an additional benefit. This realization led to the establishment of state-owned companies for fiber optic expansion in almost all Austrian federal states at the end of the last decade. Their task to this day is to build (fiber optic) infrastructure in areas experiencing market failure.

This is also the case in Carinthia. The infrastructure company is called "BIK Breitbandinitiative Kärnten GmbH" (BIK for short), founded in 2017 by the state of Carinthia.

Since BIK's scope of activity is limited to passive infrastructure, the state initially faced the question of how to deal with this. The state did not want to mutate into a telecommunications operator, which would not have been legally possible anyway. The answer was to limit itself to the role of infrastructure owner (Passive Infrastructure Provider, PIP) and to lease the created infrastructure as an "open network" to all network operators under equal conditions. However, network operators are merely a means to an end, because the focus of a public administration is the citizens. A public administration is "supply-oriented." This means that Carinthia —unlike a self-financing expansion—can set area coverage as a priority in order to bring ultrafast internet with gigabit speeds to every corner of the state.

3 The 3LOM model: An innovative approach to network expansion

In order to offer citizens, businesses, and institutional facilities (in general: "users") more than just "bare" fiber optics, namely, primarily internet services, a suitable model is

required. The simplest is the dark fiber model, which does not yet offer a network, but only point-to-point connections. In Austria, an infrastructure owner must offer this model if they use public funds for network expansion. This means that Carinthia must also offer this model, although it is not the subject of the following discussion.

These models assume that users generally need more than just fiber optics, namely an active network on which internet services are offered. For such a network, the PIP would only need a single partner as operator and service provider. This model would be the "Passive Layer Open Model (PLOM)." This model is simple, but it offers users only limited choice between different service providers. The situation is similar to that in a copper network: A provider needs the line to the user along with the infrastructure behind it, i.e., the switching center (called the "Point of Presence, PoP " in fiber optics) along with the line to the nearest internet node. All of this creates costs and typically reduces the number of network operators to those who can afford this expense.

Carinthia favored a broad, competitive market for internet services. In fact, users in the Görtschitztal region, the first to be developed, can currently choose between 20 internet service providers (ISPs), thus proving Carinthia's approach to be realistic. This diversity of services in competition creates 3LOM, but not PLOM.

Carinthia has therefore opted for the "3-Layer Open Model (3LOM)" from the outset (→ Fig. 1). This continues to offer the functionality of PLOM, thus being open at the infrastructure level ("Layer 1"). Consequently, various network operators and professional users can also use the "bare" fiber optic cable under non-discriminatory conditions. In addition, 3LOM is open at the network operation level ("Layer 2"). Consequently, various Internet service providers (ISPs) can use the network and compete to reach any user on the network without having to worry about infrastructure and network operation themselves, unlike with PLOM.

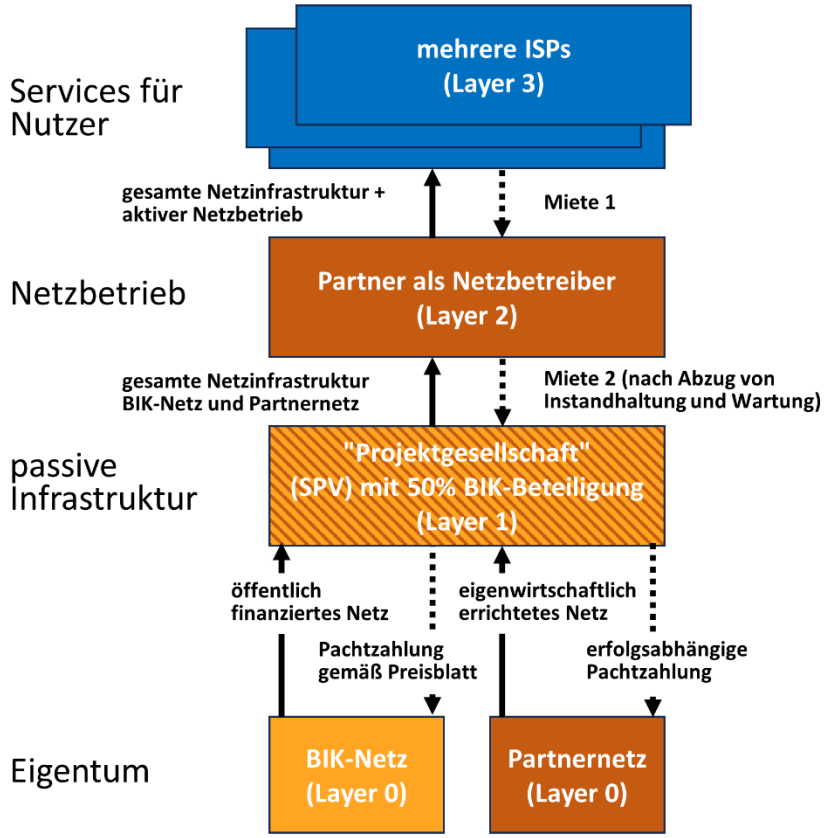

Fig. 1 The 3LOM model of Carinthia

The Carinthian 3LOM model is unique in its "Layer 0" architecture, with infrastructures owned by different parties. Layer 1 is a formal entity (a "Special Purpose Vehicle, SPV") for joint representation with third parties (Layer 2). Another unique feature is the "wholesale only " principle at Layer 2—a network operator is not permitted to act as an ISP (Internet Service Provider) with its own services.

In the 3LOM model, Carinthia (BIK) limits itself to the role of infrastructure owner. The remaining components of the model are transferred to a partner selected through a tender process. 3LOM creates a broad, open market for Internet service providers (ISPs), allowing every user to choose between their services. This choice is important because it encompasses parameters such as contract commitment, installation costs, service fees, and customer service or local proximity to the customer. Thus, differences in technical parameters are not the only factor that determines the selection.

4 Hurdles on the way to the goal

4.1 Hurdle municipalities

A key hurdle that had to be overcome was local support from the municipalities. While this is expressed in a pre-marketing quota, it also depends on whether the municipality supports

the fiber optic expansion. Therefore, in Carinthia, the municipalities were contractually involved in the network expansion process from the very beginning.

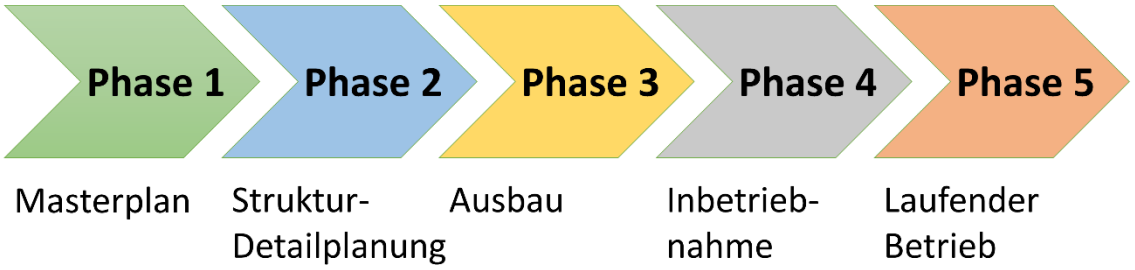

Fig. 2 Multi-phase plan for the development of a municipality

Currently (mid-2024), Phase 2 planning (P2 planning) has been completed for 103 municipalities, as has the expansion of 23 municipalities. 40 additional municipalities are to follow by April 2027. The network is already in operation in 9 municipalities (planning status→ Fig. 4).

In phase 1 of planning (→ Fig. 2), 121 of the 132 Carinthian municipalities prepared their master plans for municipal development at their own discretion. Despite all the diversity, a first step in raising awareness was achieved. The diversity of plans was leveled out in Phase 2 planning, which was led and largely financed by BIK. For Phase 2, 103 of the 132 Carinthian municipalities (78%) contractually committed themselves, each secured by a municipal council resolution.

- to a cost contribution to the Phase 2 plan in the amount of €5,000 net,
- to clean up the building and apartment data as a basis for precise planning,
- to assist in obtaining preliminary contracts with the future network operator,
- for the active communication of existing infrastructure, civil engineering projects and other synergy potentials, as well as for the introduction of the community development program,
- to not require additional services (such as sidewalk repairs).

Such an approach requires intensive cooperation with the municipalities throughout the entire project duration. The success of this cooperation is demonstrated by the fact that to date (after laying over 900 of the 3,065 km of duct), there has not been a single intervention by a municipality in connection with the network expansion. The municipalities' satisfaction is, of course, not only a result of the cooperation during the planning phase, but also of the tightly organized construction implementation under the supervision of BIK.

4.2 Hurdle area coverage

For convenience, the following discussion no longer refers to the development of a single municipality, but rather to entire regions, each of which encompasses several municipalities. This is useful because it creates expansion projects of a certain scale that can be implemented more efficiently than many small projects, yet are still manageable with limited resources.

Network expansion in sparsely populated areas is expensive. The dilemma is that, on the one hand, private expansion in such areas is not cost-effective, and, on the other hand, the use of public funds is limited to sparsely populated areas (areas of market failure). Both types of financing therefore only cover part of a region; neither achieves complete coverage.

In addition, the areas of market failure have become smaller and smaller over the years and are increasingly scattered across a region, significantly increasing the effort required to provide them with dedicated access routes. Finding an operator that limits its coverage to the areas of market failure (a geographical "patchwork") is virtually impossible. Leasing the infrastructure is simply becoming too expensive to offer products that are affordable to users.

From a broader perspective, it therefore only makes sense to consider regions as a whole. Consequently, the need arose to overcome this hurdle of area coverage through joint expansion by BIK and a self-financing partner. In the first two regions, the partner was sought and found through a (very complex) Europe-wide tendering process: The 3LOM model (→ Following Fig. 1), BIK specified to the partner:

- the self-financing expansion of the assigned portion of the region's passive infrastructure (Layer 1). The expansion is mandatory and subject to penalties. The remaining portion will be constructed simultaneously with public funds or by BIK.
- Provision of active network components (Layer 2)
- joint operation of both layers as well as the non-discriminatory offer of the entire network to service providers (ISPs) under the condition of "wholesale only " - the partner is therefore not allowed to offer its own Internet services.

The first tender (Görtschitztal) resulted in öGIG (the Austrian Fiber Optic Infrastructure Company) as a partner, one of Austria's currently largest "neutral network operators," offering Layer 1 and Layer 2 in combination or even just Layer 2. The second tender (Gailtal/Lavamünd) was won by KELAG (Kärntner Elektrizitäts-Aktiengesellschaft), the state energy supplier.

The prerequisite for the partnership approach was the joint P2 planning (→ Fig. 1), to which both partners were bound during implementation. This planning resulted in an innovative iterative process, resulting in two coordinated infrastructures characterized by "asymmetric" co-laying. This allows for significant cost savings by allowing the self-financing expansion to utilize more of the partner's routes than vice versa. This process is called the "Carinthian lever model" (→ Fig. 3):

- The non-partnership full expansion (100%) would cost €6.2 million.
- The self-supporting expansion would be able to supply 564 "Homes Passed " costing less than €2,000. This would result in area coverage of 38% at an investment cost of €2 million.
- cooperative expansion achieved 1,416 "Homes Passed ," significantly more than if the partner were operating independently. Both partners together achieved a "full coverage" of 97% and reduced the costs for the regionally coordinated "full expansion" from €6.2 million to €3.5 million (i.e., by approximately 44%). While the 97% coverage result is the best among all expanded municipalities, the target was only 80%, a figure that was generally achieved.

It should be noted that the failure to achieve 100% area coverage was more likely the result of deliberate restrictions at the outset of the planning process (e.g., "Alpine huts will not be developed") than a consequence of the planning itself. This restriction was always coordinated with regional policy and agreed upon with each individual municipality.

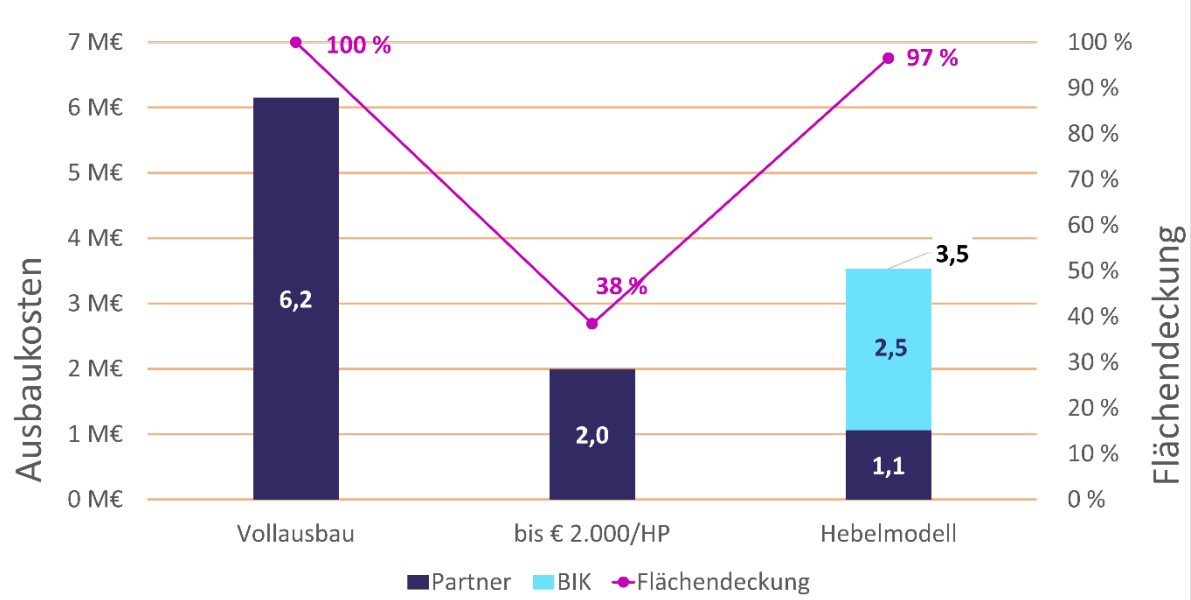

Fig. 3 The Carinthian lever model

The example shows the result for the municipality that achieved the greatest area coverage (97%). Other examples generally exceed 80%. In this example, by sacrificing 3% of area coverage (to 100%), BIK's collaboration with a self-employed partner can achieve cost savings of approximately 44%.
HP ... "Homes Passed "; M€ ... Mio €

4.3 Hurdle synergies

Exploiting synergies in fiber optic expansion has long been a requirement of the European Commission, most recently in the "Gigabit Infrastructure Act (GIA)." These synergies can be summarized under the terms "shared use" (of existing infrastructure) and "shared installation" (with other civil engineering projects). However, Carinthia did not have to wait for the European requirements, because, as mentioned at the beginning, the topic of synergies was already the subject of the initial agreements with the municipalities, the competent authority for local infrastructure.

The tender for the second region (Gailtal/Lavamünd) resulted in the state energy supplier as a partner. This partnership significantly increased the synergy potential, as KELAG was able to contribute its own existing infrastructure, especially empty conduits.

The partnership was so successful that the construction tenders for subsequent projects were based on this partnership. These tenders continued to be based on a single plan coordinated between the partners, but in separate and carefully coordinated procedures.

The aim is to further increase the synergy potential in future tenders. BIK and KELAG are now joined by KNG-Kärnten Netz GmbH (KNG for short), a subsidiary of KELAG, which has sovereignty over the power grid. The current synergy potential includes the possibility of burying overhead power lines "underground" in conjunction with fiber optic expansion. "Co-installation" can now run both ways – fiber optic installations can be carried out by others, and a third party can be involved in fiber optic expansion. It is estimated that this type of co-installation will be possible for 40% of the routes. This type of co-installation alone will save 50% of the installation costs in 40% of cases. A win-win situation. The latest construction tender is therefore a joint one for the three partners.

Such a partnership is uncharted territory, and not only in Austria. It is the latest step in the long history of fiber optic expansion in Carinthia. It cannot be engineered; it has evolved over time. It is now attracting positive interest from construction companies and municipalities (e.g., "just digging it up once").

Beyond the construction phase, the new partnership brings the 3LOM model to life by providing a concrete framework (planning, "wholesale only ," technical and commercial parameters). Even the offer to users is binding: a maximum one-time connection fee of €300 gross, and at least one end-customer product below €40 gross per month. These specifications ensure that Breitband Kärnten becomes a "single-source" network.

5 Status and outlook

The hurdles have been overcome. Carinthia's overcoming of them on its way to the goal of "Gigabit for Everyone" is perhaps unique. The following achievements have been achieved:

- **Maximizing area coverage while reducing costs:** The Carinthian lever model promises over 80% area coverage while simultaneously reducing investment costs by around 40%.
- **Maximum use of synergies:** The partnership between BIK, KELAG and KNG offers extraordinary synergy potential.
- **Optimal coordination:** The interests of the region (regional development) harmonize with the economic interests of the owners.
- **Efficient processes:** Uniform interfaces and processes throughout Carinthia ensure smooth operations.
- **Fast construction:** Through joint planning, construction tendering and construction supervision, construction can be carried out quickly (principle: "only dig once").
- **Innovative construction models:** In the competition between construction companies for the most efficient construction execution, innovative construction models can be used while adhering to the specified quality standards, reducing construction costs and shortening construction times.

Currently the path to the goal has reached the following point (→ Fig. 4):

- **Görtschitztal** region is developed and operational. Partners are BIK and öGIG. 380 km of routes serve 11,000 users ("Homes Passed ").

- **Gailtal/Lavamünd** region is under completion and is scheduled to go into operation in 2024. The partners are BIK and KELAG. 440 km of routes serve 14,000 users ("Homes Passed ").
- Contracts for the **Lieser-Malta-Tal** and **Hochstuhl regions** have been awarded, and construction is already underway there. A total of 770 km of line will serve 20,700 users ("Homes Passed ").
- **Hochobir** , **Gurktal** and **La vanttal** regions are still outstanding and are scheduled to be awarded in early 2025. Financing is secured and 23,000 users ("Homes Passed ") are to be served.
- Further regions are being prepared based on the existing P2 planning (financing is still to be secured).

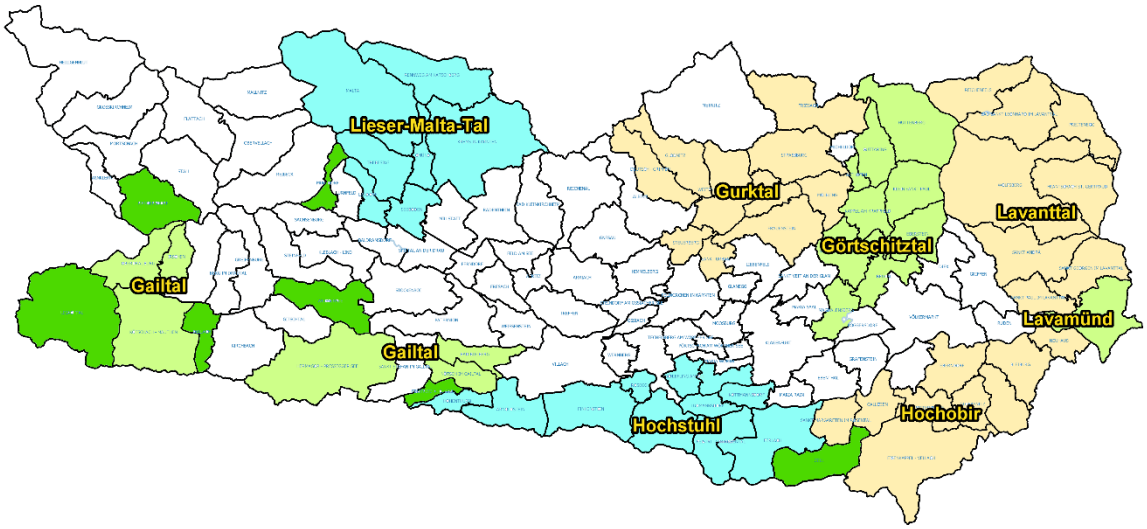

Fig. 4 Status of broadband expansion in Carinthia (June 2024)

Light green - Görtschitztal, Gailtal, and Lavamünd regions; blue - Lieser-Maltatal and Hochstuhl regions; ochre - Hochobir, Gurktal, and Lavanttal regions; dark green - existing expansion by third parties. P2 - 78% of the municipalities are planned - as the map shows, there is still potential for future expansion among these.

The long-term goal is to provide Carinthia with comprehensive gigabit internet ("Gigabit for Everyone"). This goal has now become a requirement of the "Digital Agenda 2030" to strengthen Europe's digital infrastructure. Since Carinthia has been pursuing this goal for some time, it is conceivable that Carinthia will achieve it sooner.

It should be noted that Breitband Kärnten is not intended as a monopoly, but also offers space for other network operators and their networks. As mentioned at the beginning, a public administration is "supply-oriented." Supply-oriented means that Carinthia—unlike its own expansion—may set area coverage as its priority in order to bring ultrafast internet with gigabit speeds to every corner of the country. It is not important to reach everything with its own network. There is also room for other network providers. However, the way Breitband Kärnten is designed, it will have a strong presence in the country.

Broadband Carinthia is a flagship project for Austria. It demonstrates how the nationwide expansion of a fiber optic network can be successfully implemented, even in rural areas, using an innovative model and targeted collaboration with partners. Carinthia sees itself as a role model for other regions in Austria and Europe.

Authors:

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Dr. Harald Hoffmann first discovered the world of (open) fiber optic networks during a trip to Sweden in 2008. The knowledge he gained provided an important foundation for his work as a consultant for fiber optic network design. He has been a long-time partner of BIK in developing Carinthia with broadband, not just fiber optic.

Peter Schark

Since 2004, Peter Schark has been Carinthia's Broadband Coordinator, working to raise awareness of the central role of digital infrastructure. Since its founding in 2017, he has served as the managing director of the state-owned company "BIK Breitbandinfrastruktur Kärnten GmbH." He is currently responsible for fiber optic expansion projects worth several hundred million euros in Carinthia.