



Automated Preliminary Planning and Cost Optimization in Fiber Rollouts

How Gurobi Accelerates Strategic Decisions

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Have you ever wondered what's behind your modem and where connectivity comes from?

From your living room to the global backbone: the hidden journey of every bit

- At home: Modem/Router + ONT, turning light into data and Wi-Fi/LAN connectivity.
- Access network (FTTH): Fiber drop to street cabinet, passive splitters, OLT at the central office.
- Transport: Metro rings, regional core, long-haul fiber interconnects.
- Edge & data centers: CDNs and cloud where content and services live.
- The hidden reality: planning routes, digging, permits, reusing ducts/fiber, materials, and costs.

Digital Lifelines



A1. Responsibility for Austria

10,000 m² space

one of the largest operators of datacenters in Austria

~16,000 Jobs

6.000 directly employed at A1 Austria

~500 mn euros per year

investments in infrastructure

~107,000 households

connected to the A1 Fiber Network in 2024

850,000 households

supplied with FTTH/B (Homes Passed)

~90% 5G coverage

end of 2024

~ 40 mn euros per year

investments in security

The largest fiber optic network in Austria

with a length of more than 76,500 km

Test victories 2024

- „SpeedChecker Netztest 2024“
- „ÖGVS Test: Bester Mobilfunkshop“
- „Chip Netztest 2024“
- „Employer Branding Awards 2024 DACH“
- „connect-Leserwahl 2024“
- „Bester Kundenservice“ (Smartphone Magazin)
- „Futurezone Netztests 2024: bestes Netz“
- „Connect Mobilfunkshop Testsieg“
- „Connect Service-Apps Testsieg“



A1 Fiber Optic Network in Austria



More than **76,500 km** of fiber optic cable: Austria's digital lifeline.



Ready for the future: A1 fiber access points in **95% of all municipalities.**



A1 Highspeed Internet for more than **4 million households.**



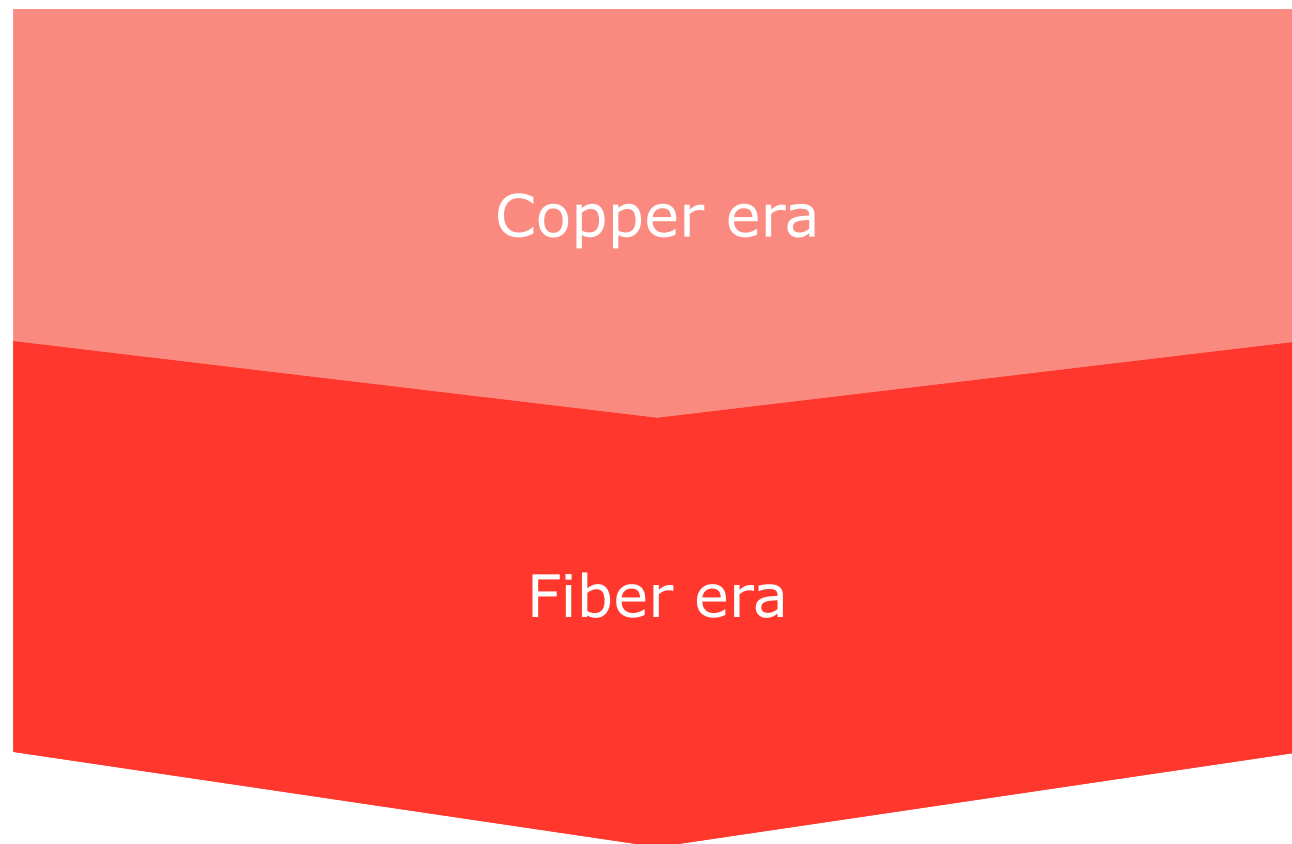
Superfast and stable bandwidths of up to **1,000 Mbit/s** for home connections.



Ultra-fast internet **for businesses and industry.**



A few decades of fiber and a century of copper

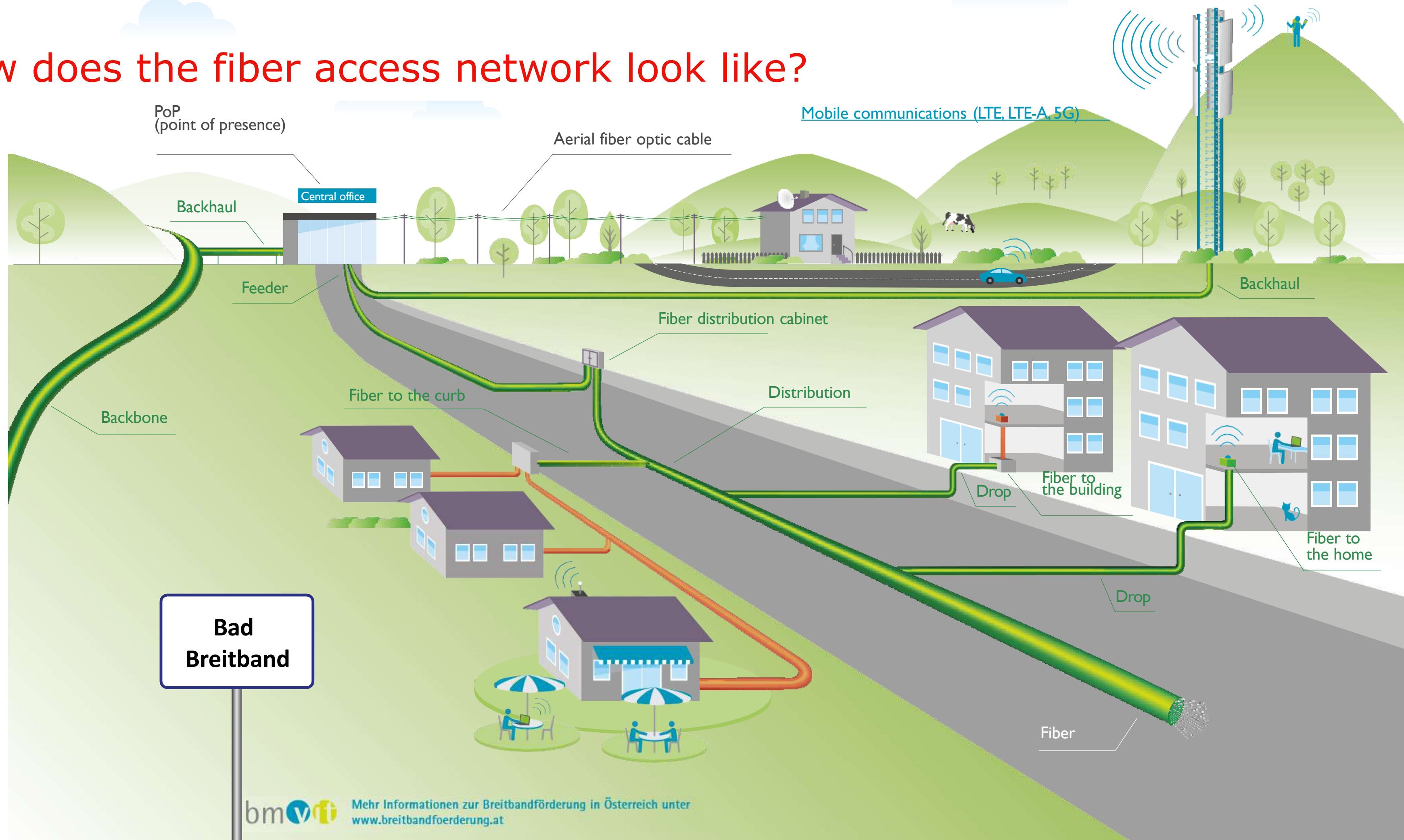


- PSTN (analog telephony): ~1920s–1980s
- ISDN: ~1990–2005; standardization late 1980s–early 1990s
- DSL/VDSL: ADSL, VDSL2; deployments ~1999–2020 (ITU-T)
- Core/backbone fiber: commercial deployments since late 1980s, widespread in the 1990s
- FTTH acceleration: ~2000s–2010s across JP/US/EU
- PON evolution: GPON: ITU-T G.984 (2003); deployments ~2006+
 - XGS-PON: ITU-T G.9807.1 (2016); deployments ~2017
 - 25GS-PON: Industry MSA spec (2020); deployments ~2021+
 - 50G-PON: ITU-T G.9804 (2021); deployments ~2023+

Strategic takeaways for 2020s:

- Fiber networks are the future, but we should use synergies with existing infrastructure
- Prioritize areas with high ROI
- Automate preliminary planning and cost estimation to accelerate strategic decisions

How does the fiber access network look like?



Who influences how fiber networks are built?



Stakeholders

State/regulators and us (operator) — often jointly



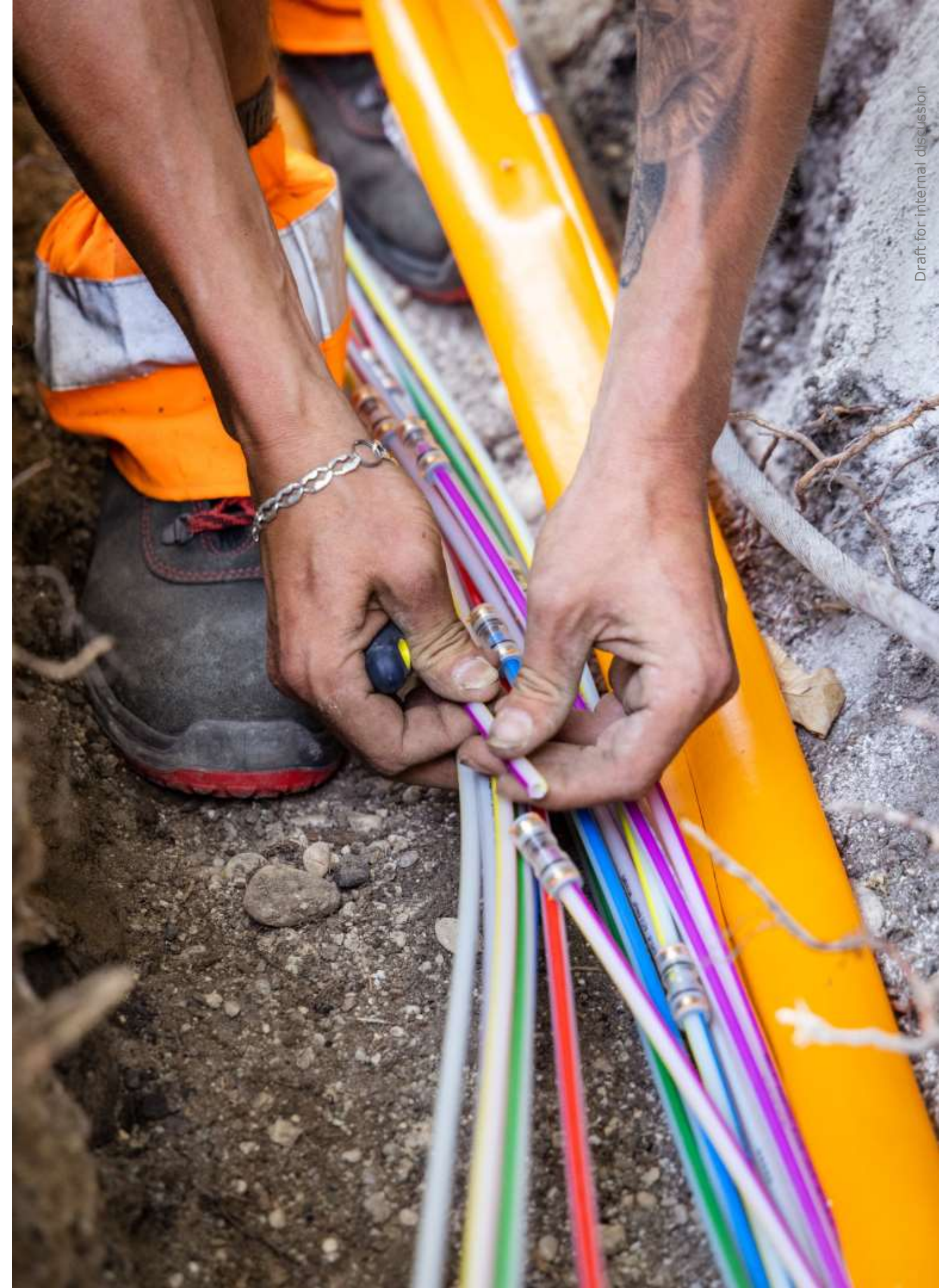
Constraints

funding/budget; competitor builds



Decision per area

state-led, operator-led, or joint



Draft for internal discussion

How can we ensure an optimal network rollout?

Without solver and automation

- Disparate data (GIS, cadastral, address lists) handled manually → error-prone
- Non-targeted outputs: unclear cost ranges for executives; engineers get too many options and details
- Reliable strategic budget planning is tough: cost uncertainty, shifting permits/funding, competitive builds
- Calculation of a scenario per network takes hours to days and is still risky

Without optimization, time, cost, and risk are difficult to quantify.

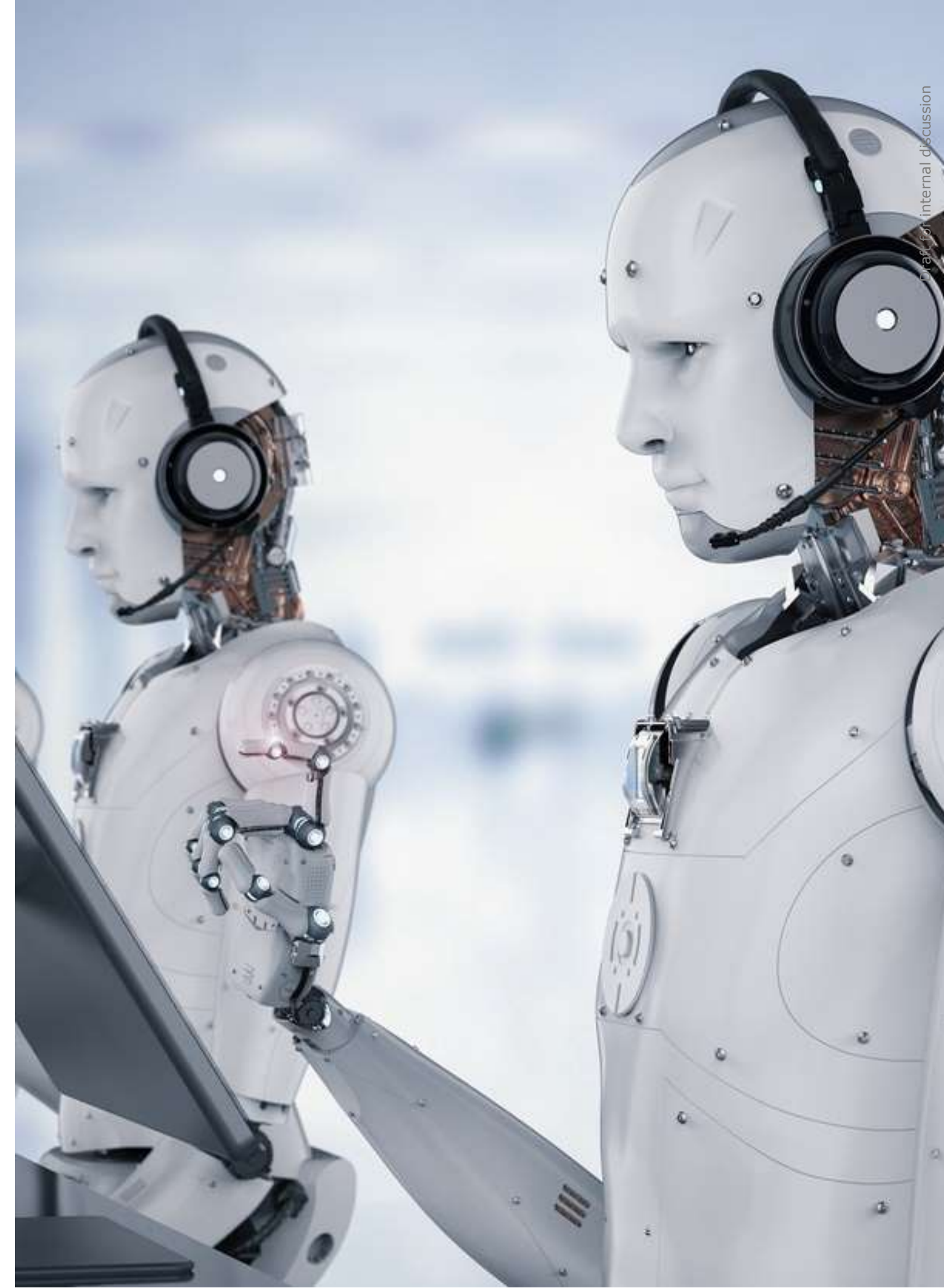


Automation as a Gamechanger

Automated preliminary planning should support transparency, speed, and provide certainty—for both decision-makers and technicians:

- Which area offers the highest ROI?
- Where can we reuse our existing ducts/fiber?
- Which scenarios are worth pursuing?

One click: scenario analyzed; clear, decision-ready outputs



Environmental limitations require clear planning

Automated preliminary planning and cost optimization

- Disparate sources: GIS, cadastral data, address lists—handled manually, high error risk.
- Our solution unifies GIS, cadastral, and customer data and auto-detects key factors: who needs a connection, what exists, where digging is required.
- Output is delivered directly in GIS with a detailed cost report.
- The lever that makes this possible in minutes—Gurobi-based optimization with the University of Applied Sciences Carinthia



Optimization & Performance — What Gurobi brings us

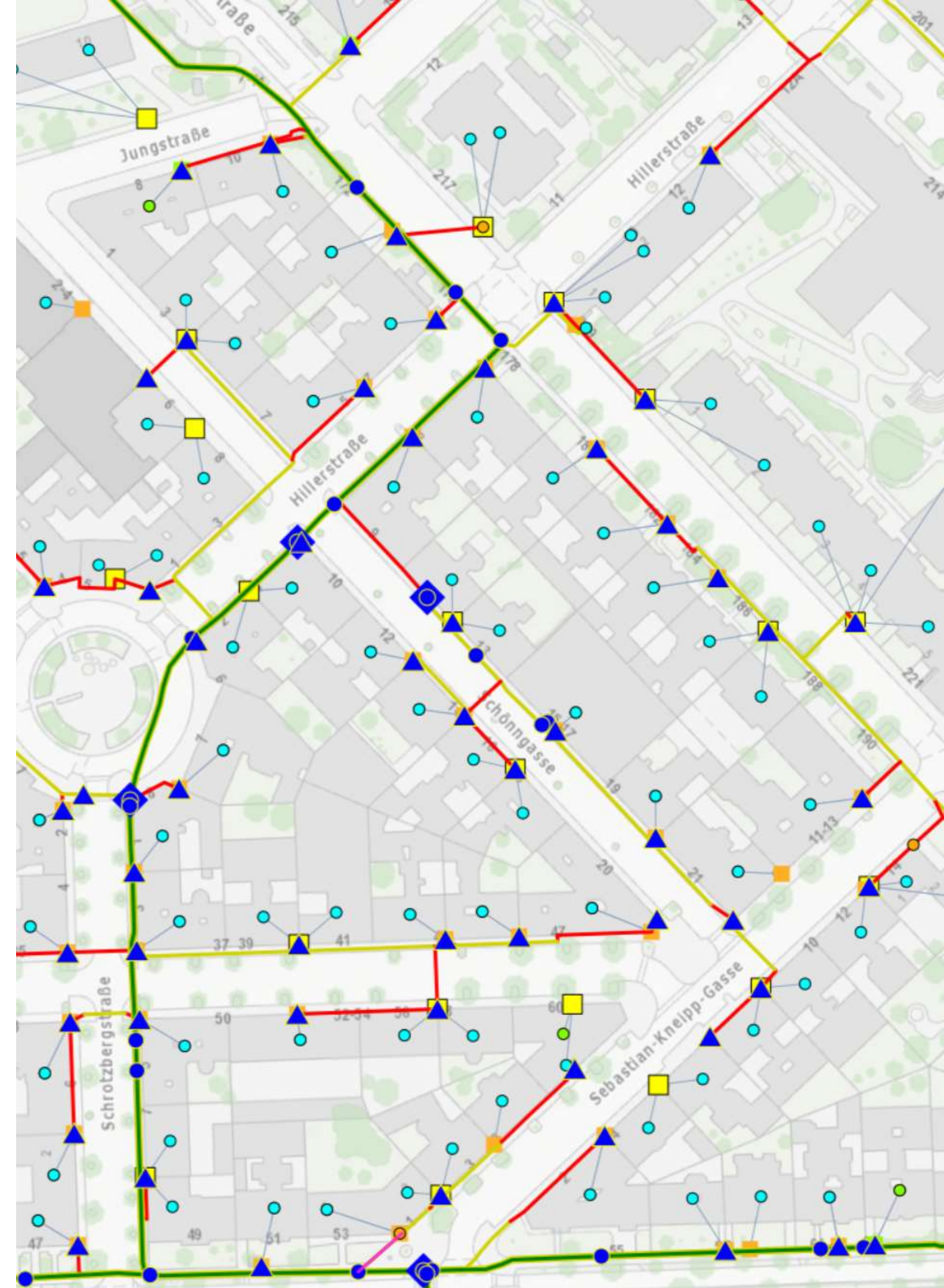
- Millions of possibilities → Gurobi (with University of Applied Sciences Carinthia) finds lowest-cost routes
- Optimized designs: routes, costs, and reuse of existing ducts/fiber
- multi-server cluster + automated scheduling → parallel runs of 10/100/1,000 variants
- Previously: hours per network → today: minutes (~10× faster)
- Scale enables broad scenario testing across coverage, budget, and ROI targets
- Decision-ready outputs: ROI-ranked plans and detailed cost/material reports in GIS
- Impact: faster investment cycles, lower risk, better capital allocation



From resource constraints to scenario-driven decisions

Computation is no longer the bottleneck—plan what you need, when you need it

- Unlimited compute: run as many scenarios as needed
- Scenario dimensions: area, budget, constraints, funding; target coverage (x-100%)
- Mixed demand: connect key sites (e.g., supermarket) while covering the village in one optimized run
- Compare and iterate: choose the design with best ROI, fastest delivery, lowest risk



From Vision to Reality

From GIS selection to ROI-ranked plans in minutes

- Draw the service area in GIS → ~15 minutes → detailed cost and materials report; scenarios ranked by ROI
- Save time, reduce errors, and steer strategy with data—planners and decision-makers aligned
- Scales from single municipalities to nationwide rollout strategies.

This is automated preliminary planning and cost optimization in practice.



What This Means for the Industry

Turning rollout into a predictable, data-driven discipline

- Information for a network rollout becomes calculable, plannable, and manageable
- Automation + performance + decision support → unprecedented transparency for engineers, executives and investors
- Better decisions: faster decision cycles, ROI-first prioritization, improved investments, lower risk



A1

Thank
you

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