

MNO Sharing Opportunities with Rail

Presented by: **Gerhard Fritze**
team GmbH / Frequentis AG
on behalf of Christian Veits - ÖBB

For: **ETSI Workshop “Developing the Future
Radio for Rail Transport”**

4-5 July 2018

Agenda

- ✓ Scope of the project “ProgMo” (Programm Mobilfunk)
- ✓ Setup of cooperation with MNOs
- ✓ Technical solutions
- ✓ Example for improvement
- ✓ Next steps

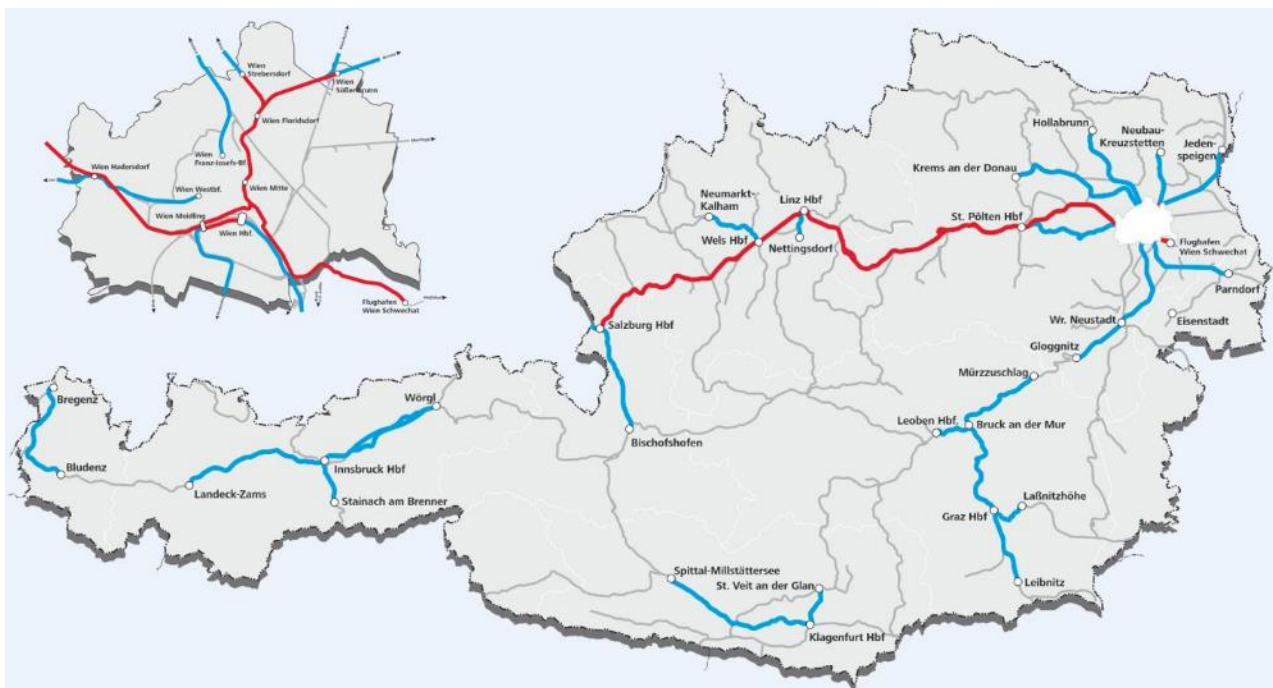


Background

- ✓ „It is easier to get WiFi on a space shuttle than on a high speed train“
(© CEO of ÖBB, April 17, 2015)
- ✓ Requirement to create a fall-back plane for GSM-R, a basis layer for future rail services AND improve the radio coverage for the rail customers
- ✓ Actually 3 projects
 - ✓ WiFi Access Points in selected HS trains
 - ✓ HF repeaters in selected HS trains (with high cabin attenuation)
 - ✓ Improvement of coverage along the tracks → focus of today's talk
- ✓ Project sponsor: Ministry of Transportation

Scope

- ✔ Improvement of 2G, 3G and 4G coverage along ~1.500 km tracks
- ✔ Split into **Phase 1** (until 2017) and **Phase 2** (until 2019)
- ✔ Reuse of existing infrastructure (e.g. GSM-R masts) as much as possible



~1.500 km out of a total of
~6.000 km tracks were select
based on the passenger volume




Necessity

- ✔ Tracks often lead through scarcely populated areas
 - ✔ No business case for a single operator to build coverage

- ✔ Very spiky traffic pattern
 - ✔ Long periods of no traffic
 - ✔ Short periods with very high traffic (when a train passes by)



Challenges

- ✓ Three MNOs in Austria
 - ✓ Telekom Austria 
 - ✓ T-Mobile Austria 
 - ✓ Hutchison Austria 
- ✓ ProgMo shall enhance coverage and fill gaps of MNOs networks, but
- ✓ MNO networks look differently (different frequency allocations, different usage of frequencies and technologies, different suppliers, different sites)
- ✓ Hence, different MNOs have different needs
- ✓ Avoid IM3 problems



Basis for cooperation

- ✔ Separate but identical contracts with each operator
- ✔ All MNOs in Austria have signed the contract
- ✔ It took more than 1 year to agree on the contractual terms



July 2016: CEO TMA, Minister of Transportation, CEO TA, CEO ÖBB, CEO H3A

Process

- ✔ Perform measurements along designated lines per
 - ✔ MNO
 - ✔ Frequency
 - ✔ Technology
- ✔ Identify coverage gaps in each network
- ✔ Identify sites which would improve the networks of at least 2 MNOs (no sites are built just for a single MNO)
- ✔ Discuss and agree together with the MNOs on the sites which should be built
- ✔ Build

Technical solution 1

✓ Macro sites

- ✓ BTS/NodeB/eNodeB from each MNO
- ✓ 2 antennas back-to-back directed along the tracks (12 port antennas)
- ✓ Coupling matrix to connect all MNOs and frequencies to the 2 antennas

✓ Issues:

- ✓ Not possible to use RRUs (remote radio units) since then the coupling matrix would need to be next to the antenna on top of the mast
- ✓ Coupling matrix inserts loss into the antenna path and thus reduces the cell size, resulting in the need of more sites

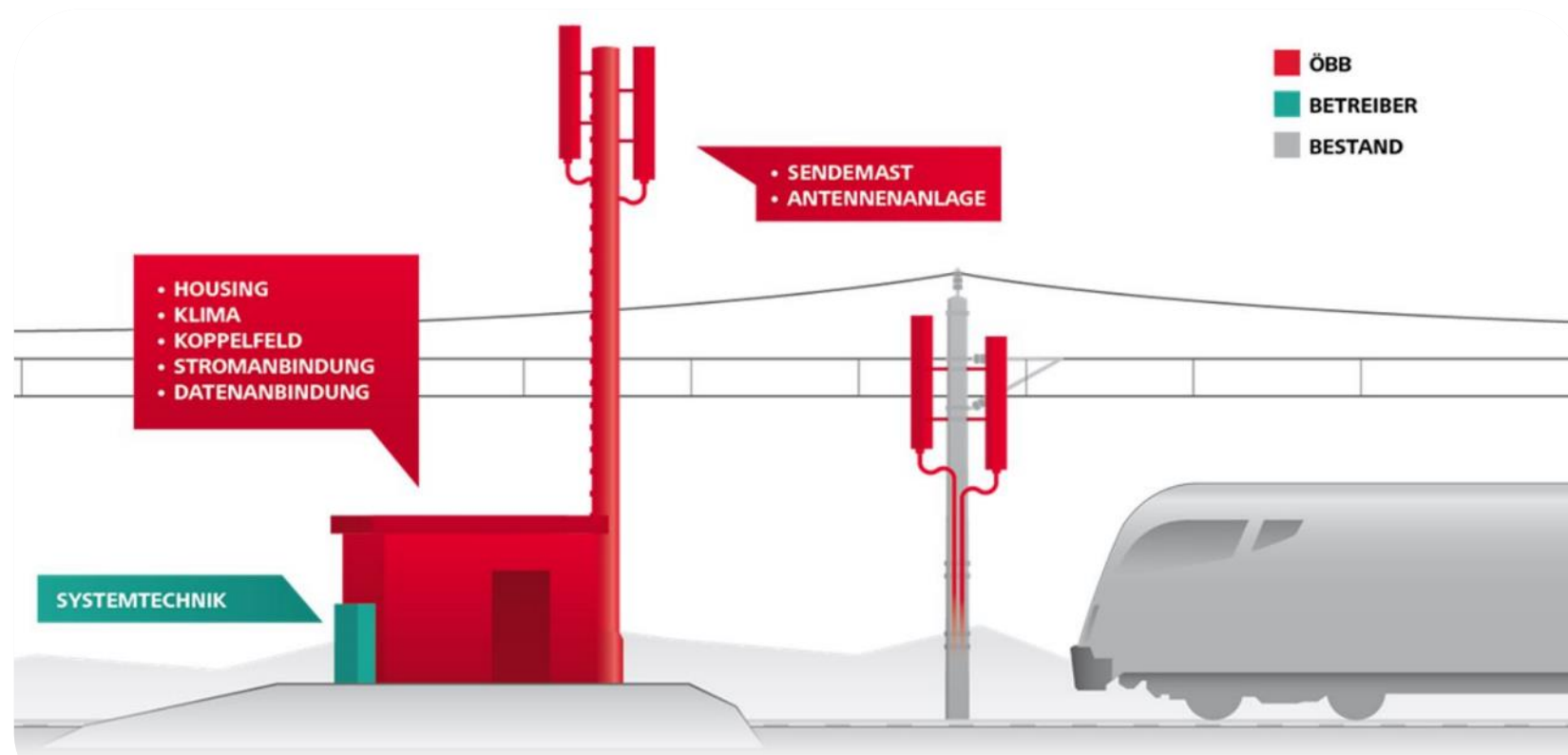
Split of responsibility

✓ ÖBB provides

- ✓ Masts
- ✓ Antenna system
- ✓ Housing
- ✓ Electricity
- ✓ Fibre optics

✓ MNOs provide

- ✓ BTS/NodeB/eNodeB



Site types



BS equipment



Coupling matrices



Antennas



Technical solution 2

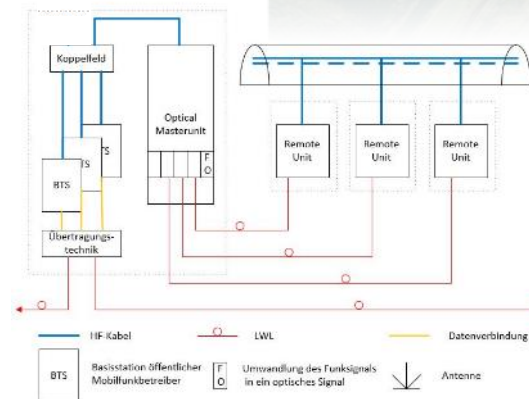
- ✓ Main-Remote concept, applied in
 - ✓ Tunnels
 - ✓ Areas where it is not possible to build a macro site (e.g. tracks running through remote forest areas)

Solution:

- ✓ Optical Master Unit at the macro site
- ✓ Remote Units along the tracks on catenary masts or in the tunnels

Issues:

- ✓ OMU/RU cause runtime problems
- ✓ Very tricky tuning of parameters in the BTS/NodeB/eNodeB vs. OMU/RU (e.g. noise insertion due to amplification)



Remote technology

- ✔ Ideal to use catenary mast
- ✔ Less power consumption
- ✔ Less space than tower sites with BS housing
- ✔ Less base, also screw-foundations are possible in difficult terrain
- ✔ In case of static issues with the catenary mast, steel masts are used



Challenges in building

- ✔ The construction work takes place during ongoing track operation
- ✔ Many night shifts (crane release, catenary shutdown, etc)



Example for improvement

Line between Vienna center and Vienna airport

before coverage improvement (June 2015)

after coverage improvement (Jan 2016)



The improvements were already positively noted by many passengers!

Next steps

- ✓ Not yet decided (we are busy to keep the project running)
- ✓ Possible areas for further discussions are
 - ✓ Additional lines (HS lines? ETCS lines? TEN lines? Local lines for commuters?)
 - ✓ Additional technologies - new lines with 5G? upgrade of ProgMo lines with 5G?
 - ✓ Additional MNOs - new frequency auctions for 5G might bring new MNOs?
 - ✓ Future need for national roaming for operational tasks?
 - ✓ Possible synergies of MNO migration to 5G and rail migration to FRMCS?
 - ✓ Possible new models for rail ↔ MNO cooperation
- ✓ Issues:
 - ✓ Lead time in track building business: > 10 years tunnel opens 2026, building has already started
 - ✓ Lead time in mobile communications: <3 years impossible to say what solution should be built now to fit for the needs in 2026

Additional information

Further reading:

Signal und Draht 12/2016

Ausbau mobiler Breitbandversorgung in österreichischen Zügen und Bahnhöfen

Providing mobile broadband services
in Austrian trains and railway stations

Christian Sagmeister | Christian Veits



Thank You