

Complete Rural Connectivity Solution

KODOFON Group

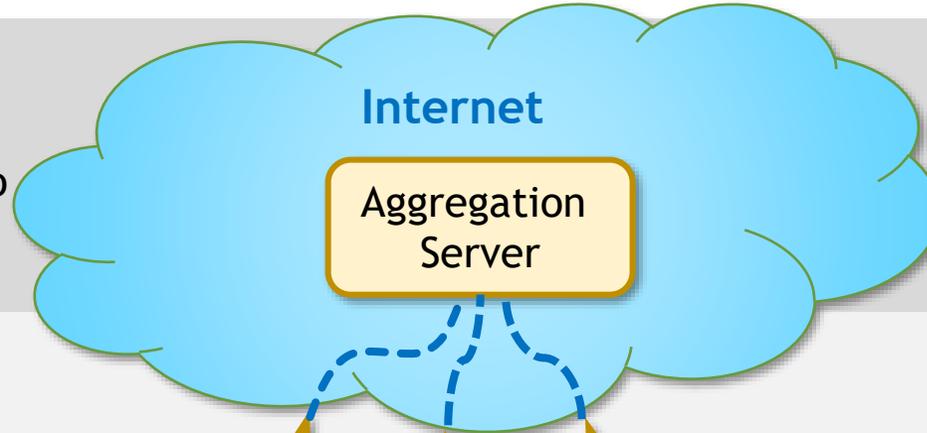
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Outline Communication Flowchart

The level of control and access of transport communication channels to the Internet

The aggregation server can be located anywhere the broadband Internet access is available



The level of backhaul channels (BH)

TCS technologies:

- Fiber-optic communication line;
- Point-to-point communication;
- Satellite;
- Tropospheric;
- Bonding of cellular channels;
- Any combination of the above communication technologies.

BH 1

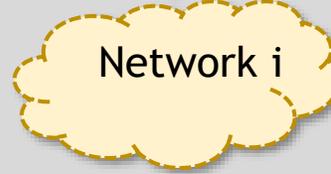
BH i

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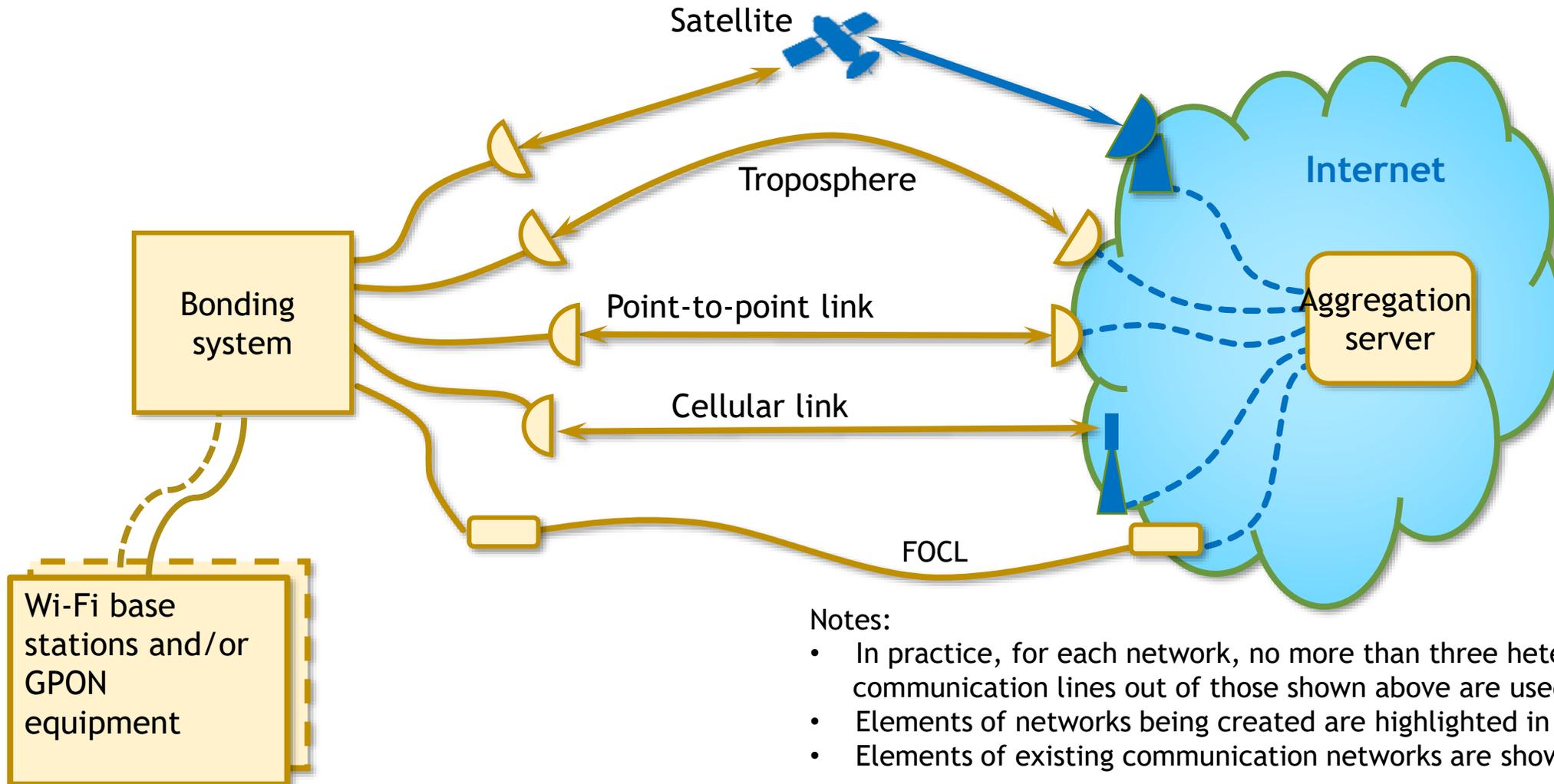
The level of subscribers broadband access networks to the Internet

Technologies of broadband access of subscribers to the Internet:

- Wi-Fi;
- and/or GPON



Flowchart of Backhaul Channel Organization



Notes:

- In practice, for each network, no more than three heterogeneous communication lines out of those shown above are used.
- Elements of networks being created are highlighted in yellow
- Elements of existing communication networks are shown in blue

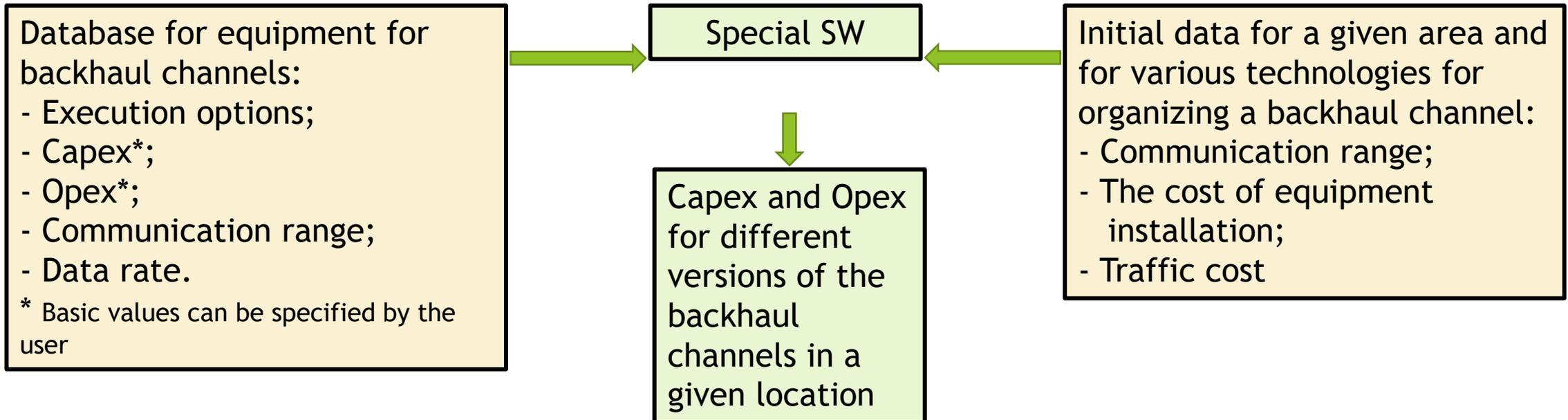


Key Technologies Covered by the Complete Solution

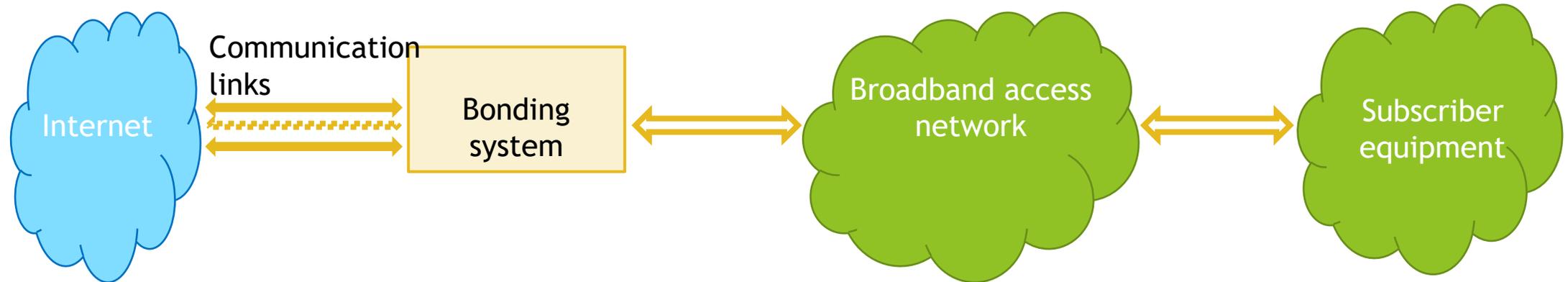
1. Technology for the optimal choice of communication equipment according to the quality/price ratio;
2. Technology for bonding heterogeneous communication channels in any combination;
3. Communication network planning technology;
4. Technology for monitoring and managing a hybrid communication network



Technology for the optimal choice of communication equipment for the backhaul channel



Technology for Bonding Heterogeneous Communication Channels



Bonding system operation algorithm:

- A bonding system always uses a communication link that is optimal in terms of quality/price;
- In case of insufficient throughput of this communication link, the second communication link in terms of quality/price ratio is used. Subscribers with a lower rate plan are connect to it. And so on, if there are more than 2 communication links.



Communication Network Planning Technology

The communication network planning technology is based on unmanned aerial vehicles equipped with a system for bonding communication channels of cellular networks, Wi-Fi equipment and a video camera.

Option 1. Depending on the level of signals received by the drone from cellular base stations (BS), the height (H) at which the bonding system antennas and/or PtP station antenna will be installed is determined at the place where Wi-Fi base stations and/or bonding equipment is supposed to be installed.

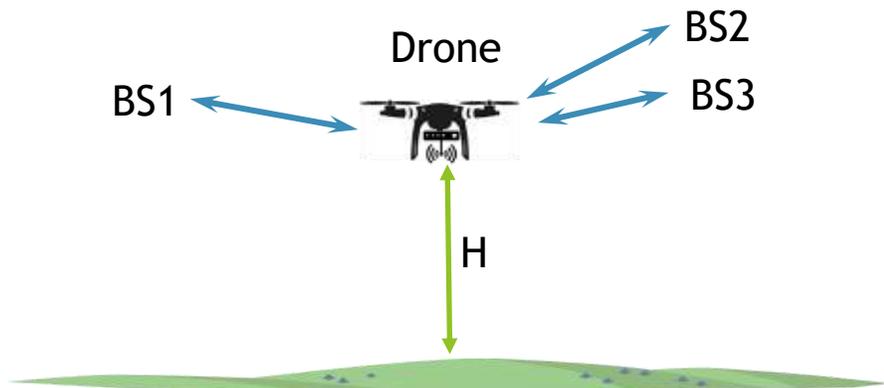


Fig. 1

Option 2. Drone2 rises to the height (H2) of the assumed installation site of a half-set of the PtP station with broadband Internet access. Drone1 determines the height (H1) at which another PtP station half-set should be installed depending on the level of the signal received from Drone2. At the same time, the roofs of most houses to be connected to the Internet should be visible from the Drone1's video camera.

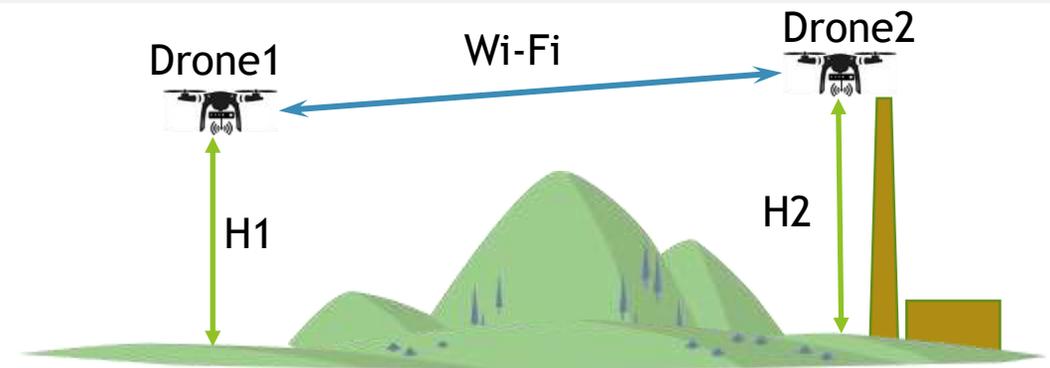


Fig. 2



Hybrid Communication Network Monitoring and Control Technology

This technology was designed to automate and control the main activities of an Internet provider of wireless communication networks.

In particular, it supports the following functions:

1. Remote control of equipment with the possibility of software update;
2. Remote monitoring of equipment to confirm its operation;
3. Monitoring of the condition and real throughput of communication links;
4. Integration with billing systems:
 - ▶ uploading the subscriber base;
 - ▶ uploading the rate plans;
 - ▶ creation of subscribers;
 - ▶ activation/deactivation of subscribers' rate plans;
5. Monitoring and management of the client base.



Examples of Equipment Used

P2P equipment	Wi-Fi base stations	Cellular bonding systems	Telecommunication cabinets
			
<ul style="list-style-type: none">• 10 design options;• bandwidths: 2,4 GHz, 5 GHz and 6 GHz;• Communication range up to 30 km	<ul style="list-style-type: none">• 8 design options;• bandwidths: 2,4 GHz and 5 GHz;• Communication range up to 10 km	<ul style="list-style-type: none">• 6 design options;• 2 or 4 bonded cellular channels;• Communication range up to 10 km	<ul style="list-style-type: none">• 4 design options;• uninterruptible power supply;• lightning protection;• switching;• routing;• bonding



THANK YOU!

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