CLAIMS:

1. A communication network comprising at least one receiver system optically coupled to a plurality of transmitter systems for transmission of synchronization signals generated by the at least one receiver system to the plurality of transmitter systems over a unidirectional synchronization channel, said at least one receiver system configured to embed into the synchronization signals thereby generated additional data indicative of an internal time count thereof for synchronization of transmission of data/signals from each one of the plurality of transmitter systems to said at least one receiver system over a sparse data/signals unidirectional communication channel.

2. The communication network of claim 1 further comprising a bidirectional communication channel configured for classical data exchange between the at least one receiver system and the plurality of transmitter systems, for thereby carrying out QKD key generation procedures between the at least one receiver system and the plurality of transmitter systems based on the data/signals transmitted over the sparse data/signals communication channel.

3. The communication network of claim 1 or 2 wherein the synchronization signal comprises a PRBS.

4. The communication network of claim 3 wherein the additional data comprises: a time-tag indicative of a number of PRBS cycles of the synchronization signal; and/or an identifier of one of the plurality of transmitter systems and time-interval(s) during which said transmitter system is permitted to transmit data/signals over the sparse data/signals unidirectional communication channel.

5. The communication network of claim 1 configured for one of the following: determine by each one of the plurality of transmitter systems a time delay between transmission and reception of data/signal thereby transmitted over said sparse data/signals unidirectional communication channel using a portion of the data/signals, said portion selected based on the additional data embedded in the synchronization signals; determine by each one of the plurality of transmitter systems a time delay between transmission and reception of data/signal thereby transmitted over said sparse data/signals unidirectional communication channel based on a correlation between the selected portion of the data/signals and a pattern received by the at least one receiver system responsive to the data/signals thereby transmitted over the sparse data/signals unidirectional communication channel; transmit by each one of the plurality of

transmitter systems the selected portion of the data/signals to the at least one receiver system for thereby carrying out the correlation and accordingly determining the delay time.

6. The communication network of claim 1 wherein the at least one receiver system is configured to embed the additional data into the synchronization signals by flipping a number of bits thereof.

7. The communication network of claim 1 configured to achieve the optical coupling over one or more optical fibers and/or free space, and to realize the different channels therein by respective different wavelengths or wavelength ranges.

8. The communication network of claim 1 comprising a single receiver system and one or more passive splitters optically coupling between said single receiver system and the plurality of transmitter systems and configured to direct the data/signals transmitted from all of said plurality of transmitter systems over the sparse data/signals unidirectional communication channel for receipt by a single detector of said single receiver system.

9. The communication network claim 1 comprising a plurality of receiver systems each of which optically coupled to a respective plurality of transmitter systems by one or more passive splitters and backbone data/signal line configured to realize all of the communication channels between said plurality of receiver systems and said plurality of transmitter systems.

10. The communication network of claim 9 configured to assign to each one of the plurality of receiver systems a time-window during which it is permitted to communicate data/signals with all of the transmitter systems in said communication network, and/or to assign to each one of the plurality of receiver systems a plurality of non-overlapping sub-time-windows, within its time-window, each one of said plurality of non-overlapping sub-time-windows defining a time-interval during which transmitter systems of the respective plurality of transmitter systems are permitted to communicate data/signals with the receiver system to which said plurality of non-overlapping sub-time-windows are assigned.

11. The communication network of claim 1 configured as a ring network comprising a transmitter interface unit for coupling each one of the plurality of transmitter system to said ring network, and a receiver interfacing unit for coupling each one of the receiver systems to said ring network, each of said interfacing units configured for said transmitter and receiver systems to receive the communication over the communication channels, and transmit data/signal thereover, without interrupting said communication.

12. The communication network of claim 11 wherein the interfacing units are configured to controllably switch direction of signal communication along said ring network, and/or to controllably block the communication over said ring network at a selected one of the plurality

of transmitter systems and permit communication in a determined direction oriented respective to said selected one of the plurality of transmitter system.

13. The communication network of claim 11 configured to permit all of the receiver system to receive the communication from all of the transmitter systems in said communication network, and/or invert the determined direction of communication therein so as to improve the communication to at least one of the receiver systems.

14. The communication network of claim 11 wherein each transmitter interface unit comprises two imbalanced couplers configured for respectively coupling the communication to the transmitter system to the ring network from east and west sides thereof.

15. The communication network of claim 14 comprising: a shutter configured to controllably block the communication through the bypass communication line; and/or a bypass communication line connecting a pair of output ports of the imbalanced couplers, and splitter configured to optically couple another pair of output ports of said imbalanced couplers to the transmitter system.

16. The communication network of claim 15 comprising a west side shutter configured to controllably block west side communication to the splitter, and an east side shutter configured to controllably block east side communication to said splitter.

17. The communication network of claim 11 wherein each receiver interface unit comprises a west circulator configured to receive west side communication from the ring network via a first port thereof, an east circulator configured to receive east side communication from the ring network via a first port thereof, a west splitter optically coupling between to a second port of said west circulator, a third port of said east circulator, and the receiver system and between, and an east splitter optically coupling between to a second port of said east circulator, a third port of said west circulator, and said receiver system.

18. The communication system of claim 17 wherein the receiver system comprises a detection unit comprising a west circulator optically coupled to the west splitter via a first port thereof, an east circulator optically coupled to the east splitter via a first port thereof, an imbalanced interferometer optically coupled second ports of said circulators via its inputs ports, two detectors respectively optically coupled to third ports of said circulators, and two mirrors respectively coupled to output ports of said imbalanced interferometer.

19. The communication network of claim 1 wherein at least one of the receiver systems is configured to measure the data/signals transmitted over the sparse data/signals unidirectional communication channel and based thereon transmit instructions to at least one of the transmitter

systems to adjust a wavelength of its transmissions over said sparse data/signals unidirectional communication channel.

20. The communication network of claim 1 configured to determine length and/or changes therein based at least on one of a back-to-back and round-trip delay times.

5