WHAT IS CLAIMED IS:

1. A method for traffic engineering (TE) in a software defined network (SDN), the method comprising:

receiving, by a TE component, a first TE information from a core network component in a core network;

receiving, by the TE component, a second TE information from a radio access network (RAN) component in a RAN; and

transmitting, by the TE component, a TE decision to at least one node in the SDN,

wherein the TE decision is determined according to the first TE information and the second TE information, and the TE decision comprises at least one end-to-end path solutions based on a flow-path format or flow-link format.

2. The method of claim 1, wherein the flow-path format comprises at least one path between a source and destination for a plurality of source destination pairs in the SDN and a rate allocation over the at least one path for the plurality of source destination pairs; the flow-link format comprises per link resource allocation for a plurality of source destination pairs in the SDN.

3. The method of claim 1, further comprising:

receiving, by the TE component, a TE configuration selected by an network operator; and

determining, by the TE component, the TE decision based on the first TE information and the second TE information and the TE configuration.

4. The method of claim 3, wherein the TE configuration comprises a TE objective for controlling network resources assigned to different services.

5. The method of claim 3, further comprising:

receiving, by the TE component, a service requirement; and

determining, by the TE component, the TE decision based on the first TE information and the second TE information, the TE configuration and the service requirement.

6. The method of claim 5, wherein the service requirement comprises at least one of quality of experience requirements between sources and destinations and quality of service requirements between sources and destinations; or at least one of quality of experience feedback and quality of service feedback.

7. The method of claim 1, further comprising:

receiving, by the TE component, a TE triggering event comprising at least one of a one-time time out event, a periodic time out event, an input change event, and a service quality of experience (QoE) and quality of service (QoS) performance degradation event; and

determining, by the TE component, the TE decision in response to receiving the TE triggering event.

8. The method of claim 7, wherein the input change event comprises one of a network topology change, a network parameter change, a service requirement change, and a service quality of experience or quality of service performance degradation event.

9. The method of claim 1, wherein the first TE information and the second TE information comprise network topology information and network parameter.

10. The method of claim 9, wherein the network parameter in the second TE information further comprises spectral efficiency (SE) values for radio links.

11. The method of claim 1, further comprises:

determining, by the TE component, routing path candidate from a maximum number of candidate routing paths for each logical link.

12. The method of claim 1, further comprising:

transmitting, by the TE component, a feasibility result indicating whether a current TE problem defined by the TE information is feasible.

13. The method of claim 1, wherein the TE decision comprises at least one of an end-to-end path, a per route resource allocation, a per route rate allocation, links used for end-to-end routing, per link resource allocation, and per link rate allocation.

14. A traffic engineering (TE) component in a software defined network (SDN), comprising:

a first interface configured to receive a first TE information from a core network component in a core network and a second TE information from a radio access network (RAN) component in a RAN; and

a second interface configured to transmit a TE decision to at least one node in the SDN,

wherein the TE decision determined according to the first TE information and the second TE information, and the TE decision comprising at least one end-to-end path solutions according to a flow-path format or a flow-link format.

15. The TE component of claim 14, wherein the flow-path format comprises at least one path between a source and destination for a plurality of source destination pairs in the SDN and a rate allocation over the at least one path for the plurality of source destination pairs; the flow-link format comprises per link resource allocation for a plurality of source destination pairs in the SDN.

16. The TE component of claim 14, wherein the first interface is further configured to receive a TE configuration selected by a network operator, wherein the TE decision determined according to the first TE information and the second TE information and the TE configuration.

17. The TE component of claim 16, wherein the first interface is further configured to receive a service requirement, wherein the TE decision determined according to the first TE information and the second TE information, the TE configuration and the service requirement.

18. The TE component of claim 14, wherein the TE component further comprises a third interface, wherein the third interface configured to receive a TE triggering event, wherein TE triggering event comprises at least one of a one-time time out event, a periodic time out event, an input change event, and a service quality of experience (QoE) and a quality of service (QoS) performance degradation event.

19. The TE component of claim 14, wherein the second interface is further configured to transmit a feasibility result, wherein the feasibility result is used to indicate whether a current TE problem defined by the TE information is feasible.

20. A method for traffic engineering (TE) in a software defined network (SDN), the method comprising:

transmitting, by a radio access network (RAN) component in a RAN, a second TE information to a TE component; and

receiving, by the RAN component, a data packet from a source node; wherein the data packet carrying a data header generated based on a TE decision,

wherein the TE decision determined according to a first TE information generating from a core network component in a core network and the second TE information, and the TE decision comprising at least one end-to-end path solutions based on a flow-path format or flow-link format.

21. The method of claim 20, wherein the data header comprises a path ID indicating at least one path between a source and destination for a plurality of source destination pairs in the SDN and a rate allocation over the at least one path for the plurality of source destination pairs; or the data header comprises a flow ID indicating per link resource allocation for a plurality of source destination pairs in the SDN.

22. The method of claim 20, wherein the TE decision is determined according to the first TE information, the second TE information and a TE configuration, wherein the TE configuration comprises a TE objective for controlling network resources assigned to different services.

23. The method of claim 22, wherein the TE decision is determined according to the first TE information, the second TE information , the TE configuration and a service requirement, wherein the service requirement comprises at least one of quality of experience requirements between sources and destinations and quality of service requirements between sources and destinations; or at least one of quality of experience feedback and quality of service feedback.

24. A radio access network (RAN) component in a RAN, comprising:

a transmitter configured to transmit a second TE information to a traffic engineering (TE) TE component in a software defined network (SDN); and

a receiver configured to receive a data packet from a source node; wherein the data packet carrying a data header generated based on a TE decision,

wherein the TE decision determined according to a first TE information generating from a core network component in a core network and the second TE information, and the TE decision comprising at least one end-to-end path solutions based on a flow-path format or a flow-link format.

25. The RAN component of claim 24, wherein the data header comprises a path ID indicating at least one path between a source and destination for a plurality of source destination pairs in the SDN and a rate allocation over the at least one path for the plurality of source destination pairs; or the data header comprises a flow ID indicating per link resource allocation for a plurality of source destination pairs in the SDN.

26. The RAN component of claim 25, wherein the TE decision is determined according to the first TE information, the second TE information, the TE configuration and a service requirement, wherein the service requirement comprises at least one of quality of experience requirements between sources and destinations and quality of service requirements between sources and destinations; or at least one of quality of experience feedback and quality of service feedback.

27. The RAN component of claim 24, wherein the TE decision is determined according to the first TE information, the second TE information and a TE configuration, wherein the TE configuration comprises a TE objective for controlling network resources assigned to different services.

CLAIMS:

1. A method in a network component for traffic engineering (TE) in a software defined network (SDN), the method comprising:

receiving, by a TE component, a first TE information from a first core network component in a core network;

receiving, by the TE component, a second TE information from a radio access network (RAN) component in a RAN; and

transmitting, by the TE component, a TE decision to a plurality of network components, wherein the TE decision is associated with a TE configuration, the first TE information, and the second TE information, wherein the TE configuration comprises a TE objective, and wherein the TE decision comprises information for a solution for multiple end-to-end paths between at least one user equipment (UE) and a second core network component in the core network, wherein a plurality of the multiple end-to-end paths are to be used by one of the UEs simultaneously, and wherein each of the multiple end-to-end paths traverses the core network and the RAN.

2. The method of claim 1, wherein the TE information comprises spectral efficiency (SE) values over radio links.

3. The method of claim 1, further comprising determining a feasibility result indicating whether a current TE problem defined by the TE information is feasible.

4. The method of claim 1, wherein the determining a TE decision between the at least one UE and a second core network component is performed in response to a triggering event.

5. The method of claim 4, wherein the triggering event comprises at least one of a network topology change, a network parameter change, a service requirement change, and a service quality of experience or quality of service performance degradation event.

6. The method of claim 5, wherein the network topology change comprises a node addition or removal.

7. The method of claim 5, wherein the network parameter change comprises at least one of a radio resource availability change, a link capacity change, a buffer size change, an operating cost change, and a link SE change.

8. The method of claim 5, wherein the service requirement change comprises at least one of a source addition, destination addition, a source removal, a destination removal, a logical link quality of experience requirement change, and a logical link quality of service requirement change.

9. The method of claim 1, wherein the TE decision comprises at least one of an end-to-end path, a per route resource allocation, a per route rate allocation, links used for end-to-end routing, per link resource allocation, and per link rate allocation.

10. The method of claim 1, further comprising adjusting a path computation algorithm according to a change in traffic engineering configuration parameter.

11. The method of claim 1, wherein the traffic engineering information comprise at least one of quality of experience requirements between sources and destinations and quality of service requirements between sources and destinations.

12. The method of claim 1, wherein the traffic engineering information comprise at least one of a rate requirement and a delay requirement.

13. The method of claim 1, wherein the traffic engineering information comprises at least one of quality of experience feedback and quality of service feedback.

14. The method of claim 1, wherein the traffic engineering information comprises network parameters.

15. The method of claim 14, wherein the network parameters comprise at least one of link capacity, buffer size, radio resources at RAN nodes, per node operating cost, and per link operating cost.

16. A network component configured for traffic engineering (TE) in a software defined network (SDN), the network component comprising:

a processor; and

a non-transitory computer readable storage medium storing programming for execution by the processor, the programming including instructions to:

receive a first TE information from a first core network component in a core network;

receive a second TE information from a radio access network (RAN) component in a RAN; and

transmit a TE decision to a plurality of network components, wherein the TE decision is associated with a TE configuration, the first TE information, and the second TE information, wherein

the TE configuration comprises a TE objective, and wherein the TE decision comprises information for a solution for multiple end-to-end paths between at least one user equipment (UE) and a second core network component in the core network, wherein a plurality of the multiple end-to-end paths are to be used by one of the UEs simultaneously, and wherein each of the multiple end-to-end paths traverses the core network and the RAN.

17. The network component of claim 16, wherein the TE information comprises spectral efficiency (SE) values over radio links.

18. The network component of claim 16, wherein the programming further comprises instructions to determine a feasibility result indicating whether a current TE problem defined by the TE information is feasible.

19. The network component of claim 16, wherein the instructions to determine a TE decision between the at least one UE and a second core network component is performed in response to a triggering event.

20. The network component of claim 19, wherein the triggering event comprises at least one of a network topology change, a network parameter change, a service requirement change, and a service quality of experience or quality of service performance degradation event.

21. The network component of claim 20, wherein the network topology change comprises a node addition or removal.

22. The network component of claim 20, wherein the network parameter change comprises at least one of a radio resource availability change, a link capacity change, a buffer size change, an operating cost change, and a link SE change.

23. The network component of claim 20, wherein the service requirement change comprises at least one of a source addition, destination addition, a source removal, a destination removal, a logical link quality of experience requirement change, and a logical link quality of service requirement change.

24. The network component of claim 16, wherein the TE decision comprises at least one of an end-to-end path, a per route resource allocation, a per route rate allocation, links used for end-to-end routing, per link resource allocation, and per link rate allocation.

25. The network component of claim 16, wherein the programming further comprises instructions to adjust a path computation algorithm according to a change in a traffic engineering configuration parameter.

26. The network component of claim 16, wherein the TE information comprise at least one of quality of experience requirements between sources and destinations and quality of service requirements between sources and destinations.

27. The network component of claim 16, wherein the TE information comprise at least one of a rate requirement and a delay requirement.

28. The network component of claim 16, wherein the TE information comprises at least one of quality of experience feedback and quality of service feedback.

29. The network component of claim 16, wherein the TE information comprises network parameters.

30. The network component of claim 29, wherein the network parameters comprise at least one of link capacity, buffer size, radio resources at RAN nodes, per node operating cost, and per link operating cost.

31. A traffic engineering (TE) component in a software defined network (SDN), comprising:

a first interface connected to at least one control/management component to receive a first TE information from a first core network component in a core network, to receive a second TE information from a radio access network (RAN) component in a RAN, and to receive TE configuration information;

a second interface configured to receive a triggering event from one of the core network and the RAN; and

a TE decision component, comprising a processor and non-transitory computer readable media, connected to the first and second interfaces that determines a unified TE decision in response to the triggering event according to the first TE information, the second TE information, and TE configuration information, wherein the TE configuration information comprises a TE objective, and wherein the unified TE decision comprises information for a solution for multiple end-to-end paths between at least one user equipment (UE) and a second core network component in the core network, wherein a plurality of the multiple end-to-end paths are to be used by one of the UEs simultaneously, and wherein each of the multiple paths traverses the core network and the RAN, and wherein the TE

decision component is further configured to determine a rate allocation over the multiple end-to-end paths.

32. The TE component of claim 31, wherein the first interface is further configured to receive service requirements, wherein the service requirements include quality of experience and quality of service requirements between sources and destinations.

33. The TE component of claim 32, wherein the first interface is further configured to receive quality of experience and quality of service feedback.

34. The TE component of claim 31, wherein the triggering event comprises at least one of a network topology change, a network parameter change, a service requirement change, and a service quality of experience or quality of service performance degradation event.