WHAT IS CLAIMED IS:

1. A communication management system comprising:

a measuring unit that measures, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

an assigning unit that assigns, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured by the measuring unit; and

a distribution controller that performs control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning unit has assigned the clients,

wherein the assigning unit determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel.

2. The communication management system according to Claim 1,

wherein the distribution controller includes a switch controller that performs switch control in which, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel, an excess portion of the distribution data is deleted from the communication channel, and a distribution path for the excess portion is switched to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

3. The communication management system according to Claim 2,

wherein the switch controller selects, as the other one or more of the plurality of communication channels having an available communication-path capacity, a communication channel whose communication-path capacity is larger than an amount of communication traffic at the certain time point indicated by a total pattern as a sum of the traffic patterns of the clients assigned to the communication channel, among the plurality of communication channels.

4. The communication management system according to Claim 2 or 3,

wherein the distribution controller includes a shift unit that, if a total amount at a certain time point of distribution data to be distributed to clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifts a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point, the distribution guarantee time being determined in accordance with importance of the distribution data, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel even if the shift unit shifts the entire distribution data to the distribution guarantee time of the distribution data, the switch controller deletes an excess portion of the distribution data from the communication channel and switches a distribution path for the excess portion to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

5. The communication management system according to any one of Claims 1 to 3, further comprising:

a schedule registering unit that accepts registration of a schedule item from each of the clients and accepts registration of distribution data to be distributed to the client in association with the schedule item registered by the client,

wherein the distribution controller regards an estimated time associated with the schedule item registered by the schedule registering unit as a specified distribution time for the distribution data registered in association with the schedule item, and performs control to distribute the distribution data at the specified distribution time.

6. The communication management system according to Claim 5, further comprising:

a distribution guarantee time obtaining unit that obtains a distribution guarantee time which is calculated by adding the specified distribution time for the distribution data registered in association with the schedule item and an allowable delay time which is determined in accordance with importance of the distribution data,

wherein, if a total amount at a certain time point of distribution data to be distributed to

the clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, the distribution controller shifts a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point.

7. The communication management system according to any one of Claims 1 to 6, wherein the assigning unit includes

a feature vector obtaining unit that obtains feature vectors representing features of pattern forms of the traffic patterns of the clients,

a clustering unit that groups the clients into a plurality of clusters in accordance with similarity among the feature vectors,

a cluster range information memory that stores, for each cluster generated through clustering performed by the clustering unit, a range of feature vectors belonging to the cluster, and

a combination information memory that stores, for each of the plurality of communication channels, a combination of clients in which a total pattern as a sum of the traffic patterns of one or more clients assigned to the communication channel is within a communication-path capacity of the communication channel, the combination being expressed by a combination of clusters to which the clients belong, and the combination being stored as a combination of clusters assignable to the communication channel, and

wherein the assigning unit obtains clusters to which the feature vectors of the traffic patterns of the clients belong from information stored in the cluster range information memory, and obtains, in accordance with the obtained clusters corresponding to the clients, a combination of clients to be assigned to the communication channel from among combinations of clients that satisfy a combination of clusters assignable to the communication channel stored in the combination information memory.

8. The communication management system according to any one of Claims 1 to 7, further comprising:

a capacity pattern measuring unit that measures a pattern of temporal changes in an effective communication-path capacity of a best-effort-type communication channel among the plurality of communication channels,

wherein the assigning unit determines one or more clients to be assigned to the best-

effort-type communication channel so that a total pattern as a sum of the traffic patterns of one or more clients assigned to the best-effort-type communication channel is within the pattern measured by the capacity pattern measuring unit.

9. A communication management method comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring; and

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel.

10. A program causing a computer to execute a process, the process comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring; and

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel.

CLAIMS

1. A communication management system comprising:

a measuring unit that measures, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

an assigning unit that assigns, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured by the measuring unit; and

a distribution controller that performs control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning unit has assigned the clients,

wherein the assigning unit determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel

wherein the distribution controller includes a switch controller that performs switch control in which, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel, an excess portion of the distribution data is deleted from the communication channel, and a distribution path for the excess portion is switched to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point, and

wherein the distribution controller includes a shift unit that, if a total amount at a certain time point of distribution data to be distributed to clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifts a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point, the distribution guarantee time being determined in accordance with importance of the distribution data, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel even if the shift unit shifts the entire distribution data to the distribution guarantee time of the distribution data, the switch controller deletes an excess portion of the distribution data from the communication channel and switches a distribution path for the excess portion to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

2. A communication management system comprising:

a measuring unit that measures, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

an assigning unit that assigns, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured by the measuring unit;

a distribution controller that performs control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning unit has assigned the clients,

wherein the assigning unit determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel;

a schedule registering unit that accepts registration of a schedule item from each of the clients and accepts registration of distribution data to be distributed to the client in association with the schedule item registered by the client,

wherein the distribution controller regards an estimated time associated with the schedule item registered by the schedule registering unit as a specified distribution time for the distribution data registered in association with the schedule item, and performs control to distribute the distribution data at the specified distribution time; and

a distribution guarantee time obtaining unit that obtains a distribution guarantee time which is calculated by adding the specified distribution time for the distribution data registered in association with the schedule item and an allowable delay time which is determined in accordance with importance of the distribution data,

wherein, if a total amount at a certain time point of distribution data to be distributed to the clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, the distribution controller shifts a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point.

3. The communication management system according to claim 2, wherein the distribution controller includes a switch controller that performs switch control in which, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel, an excess portion of the distribution data is deleted from the

communication channel, and a distribution path for the excess portion is switched to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

4. The communication management system according to claim 3, wherein the switch controller selects, as the other one or more of the plurality of communication channels having an available communication-path capacity, a communication channel whose communication-path capacity is larger than an amount of communication traffic at the certain time point indicated by a total pattern as a sum of the traffic patterns of the clients assigned to the communication channel, among the plurality of communication channels.

5. The communication management system according to Claim 1,

wherein the switch controller selects, as the other one or more of the plurality of communication channels having an available communication-path capacity, a communication channel whose communication-path capacity is larger than an amount of communication traffic at the certain time point indicated by a total pattern as a sum of the traffic patterns of the clients assigned to the communication channel, among the plurality of communication channels.

6. The communication management system according to claim 1 or 5, further comprising:

a schedule registering unit that accepts registration of a schedule item from each of the clients and accepts registration of distribution data to be distributed to the client in association with the schedule item registered by the client,

wherein the distribution controller regards an estimated time associated with the schedule item registered by the schedule registering unit as a specified distribution time for the distribution data registered in association with the schedule item, and performs control to distribute the distribution data at the specified distribution time.

7. The communication management system according to Claim 6, further comprising:

a distribution guarantee time obtaining unit that obtains a distribution guarantee time which is calculated by adding the specified distribution time for the distribution data registered in association with the schedule item and an allowable delay time which is determined in accordance with importance of the distribution data,

wherein, if a total amount at a certain time point of distribution data to be distributed to the clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, the distribution controller shifts a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point.

8. The communication management system according to any one of Claims 1 to 7, wherein the assigning unit includes

a feature vector obtaining unit that obtains feature vectors representing features of pattern forms of the traffic patterns of the clients,

a clustering unit that groups the clients into a plurality of clusters in accordance with similarity among the feature vectors,

a cluster range information memory that stores, for each cluster generated through clustering performed by the clustering unit, a range of feature vectors belonging to the cluster, and

a combination information memory that stores, for each of the plurality of communication channels, a combination of clients in which a total pattern as a sum of the traffic patterns of one or more clients assigned to the communication channel is within a communication-path capacity of the communication channel, the combination being expressed by a combination of clusters to which the clients belong, and the combination being stored as a combination of clusters assignable to the communication channel, and

wherein the assigning unit obtains clusters to which the feature vectors of the traffic patterns of the clients belong from information stored in the cluster range information memory, and obtains, in accordance with the obtained clusters corresponding to the clients, a combination of clients to be assigned to the communication channel from among combinations of clients that satisfy a combination of clusters assignable to the communication channel stored in the combination information memory.

9. The communication management system according to any one of Claims 1 to 8, further comprising:

a capacity pattern measuring unit that measures a pattern of temporal changes in an effective communication-path capacity of a best-effort-type communication channel among the plurality of communication channels,

wherein the assigning unit determines one or more clients to be assigned to the best-effort-type communication channel so that a total pattern as a sum of the traffic patterns of one

or more clients assigned to the best-effort-type communication channel is within the pattern measured by the capacity pattern measuring unit.

10. A communication management method comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring; and

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel, and

performing switch control in which, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel, an excess portion of the distribution data is deleted from the communication channel, and a distribution path for the excess portion is switched to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifting a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point, the distribution guarantee time being determined in accordance with importance of the distribution data, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel even if shifting the entire distribution data to the distribution guarantee time of the distribution data, deleting an excess portion of the distribution data from the communication channel and switching a distribution path for the excess portion to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

11. A program causing a computer to execute a process, the process comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring; and

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel, and

performing switch control in which, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel, an excess portion of the distribution data is deleted from the communication channel, and a distribution path for the excess portion is switched to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifting a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point, the distribution guarantee time being determined in accordance with importance of the distribution data, and

wherein, if a total amount at a certain time point of distribution data to be distributed to clients assigned to at least one of the plurality of communication channels exceeds the communication-path capacity of the communication channel even if shifting the entire distribution data to the distribution guarantee time of the distribution data, deleting an excess portion of the distribution data from the communication channel and switching a distribution path for the excess portion to another one or more of the plurality of communication channels having an available communication-path capacity at the certain time point.

12. A communication management method comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring;

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein, the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel;

accepting registration of a schedule item from each of the clients and accepting registration of distribution data to be distributed to the client in association with the schedule item registered by the client,

wherein an estimated time associated with the registered schedule item is regarded as a specified distribution time for the distribution data registered in association with the schedule item, and performing control to distribute the distribution data at the specified distribution time; and

obtaining a distribution guarantee time which is calculated by adding the specified distribution time for the distribution data registered in association with the schedule item and an allowable delay time which is determined in accordance with importance of the distribution data,

wherein, if a total amount at a certain time point of distribution data to be distributed to the clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifting a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point.

13. A program causing a computer to execute a process, the process comprising:

measuring, for each of clients, a traffic pattern representing a pattern of temporal changes in an amount of communication traffic regarding the client;

assigning, to each of a plurality of communication channels, one or more clients that use the communication channel, on the basis of the traffic patterns of the clients measured in the measuring; and

performing control of selecting, as a communication channel with which distribution data is to be distributed to one or more of the clients, at least one of the plurality of communication channels to which the assigning has assigned the clients,

wherein the assigning determines one or more clients to be assigned to each of the plurality of communication channels so that a total pattern as a sum of the traffic patterns of the one or more clients to be assigned to the communication channel is within a communication-path capacity of the communication channel;

accepting registration of a schedule item from each of the clients and accepting registration of distribution data to be distributed to the client in association with the schedule item registered by the client,

wherein an estimated time associated with the registered schedule item is regarded as a specified distribution time for the distribution data registered in association with the schedule item, and performing control to distribute the distribution data at the specified distribution time; and

obtaining a distribution guarantee time which is calculated by adding the specified distribution time for the distribution data registered in association with the schedule item and an allowable delay time which is determined in accordance with importance of the distribution data,

wherein, if a total amount at a certain time point of distribution data to be distributed to the clients assigned to the communication channel exceeds the communication-path capacity of the communication channel, shifting a portion of the distribution data at the certain time point to a subsequent time point, the portion having a distribution guarantee time that is later than the certain time point.