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(54) OPTIMIZING PATH SELECTION FOR MULTIPLE SERVICE CLASSES IN A NETWORK

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(57) **ABSTRACT**

A method for routing traffic in a network includes determining topology information for the network and determining traffic demands for multiple service classes. The method further includes determining an objective function for an optimization problem using the topology information and demands, and determining a solution to that specifies a network path for each demand.

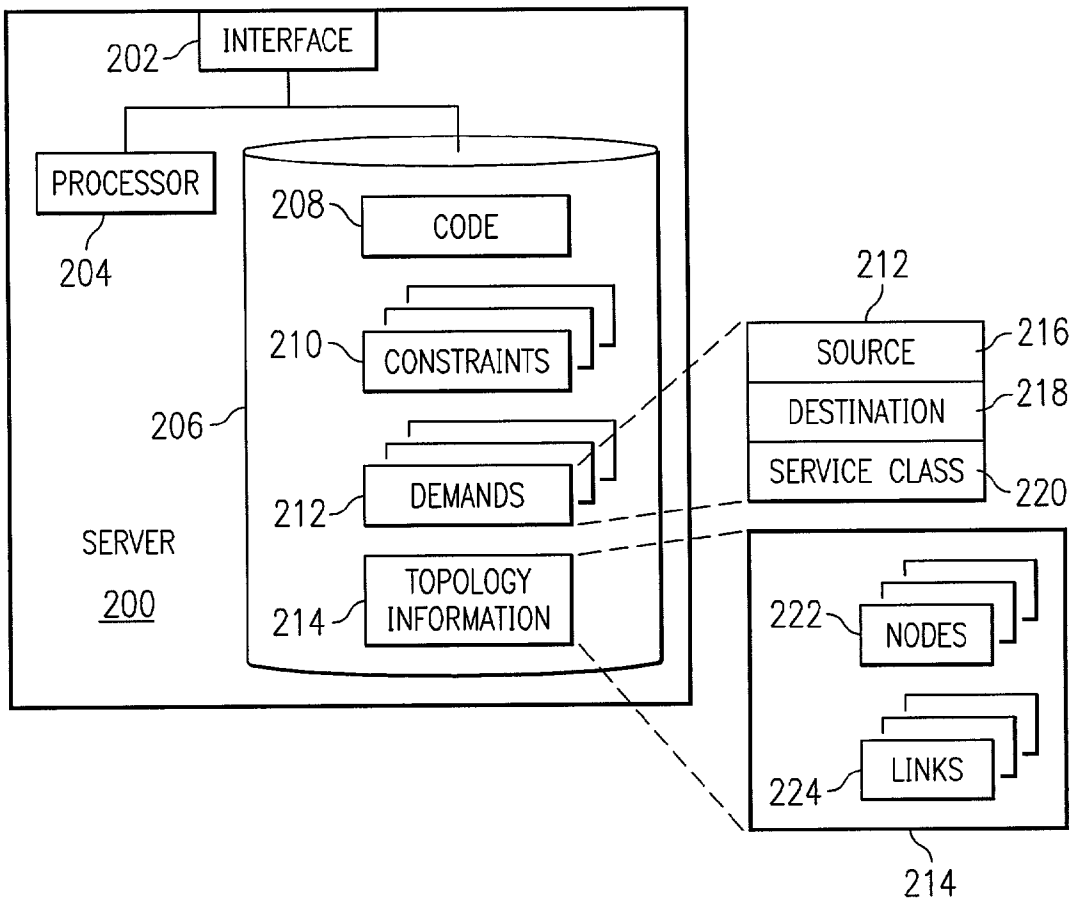


FIG. 1

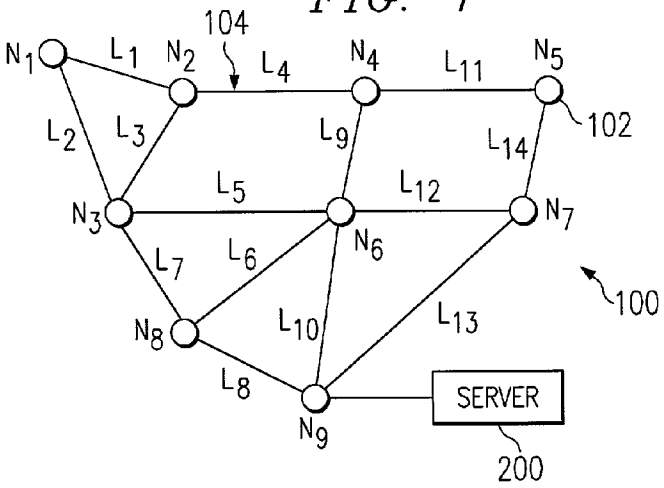


FIG. 2

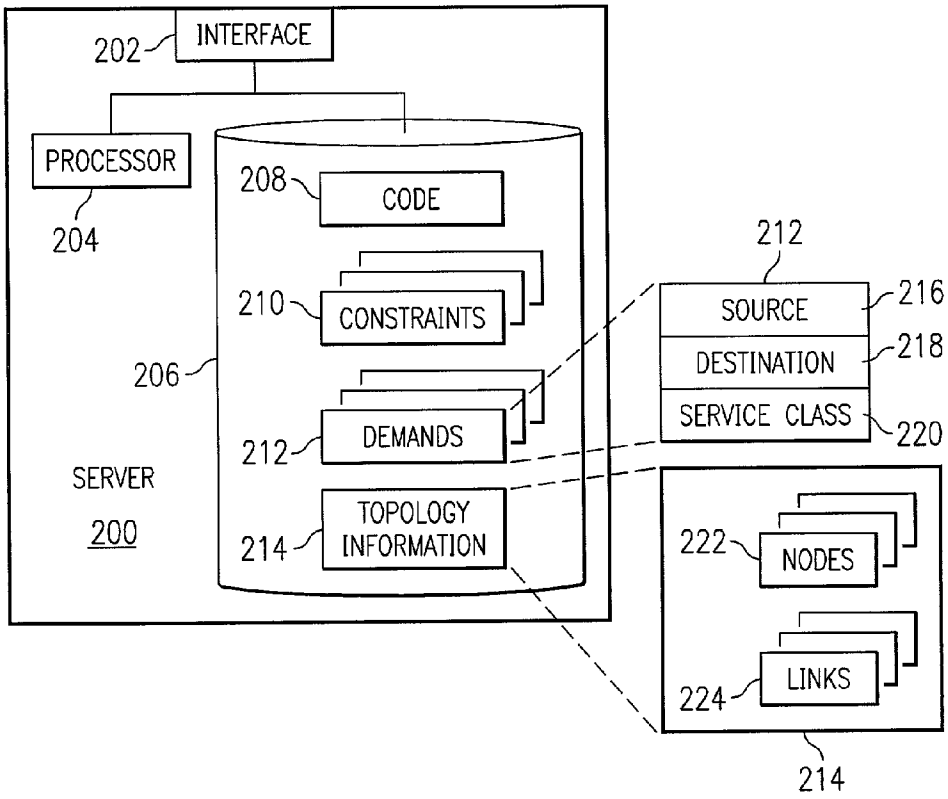
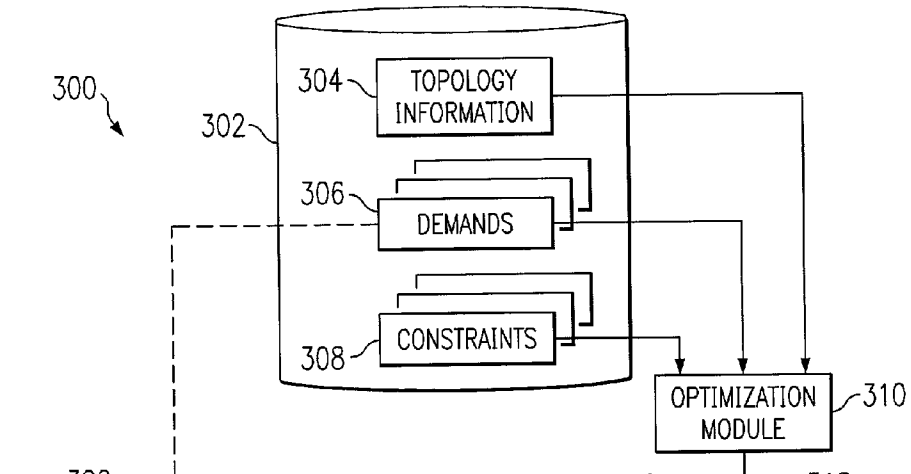


FIG. 3



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	k=1	k=2	k=3	k=1	k=2	k=3
$t1_j^k$	0	0	0			
$p1_j^k$	0	0	0			
$t2_j^k$				0	0	0
$p2_j^k$				0	0	0
$t3_j^k$						
$p3_j^k$						
	$N_i \rightarrow N_1$			$N_i \rightarrow N_2$		

314 316 318 320

SOURCE	DESTINATION	SERVICE CLASS	PATH
N_1	N_2	1	L_1
N_1	N_2	2	L_2
N_1	N_3	1	L_2
N_1	N_3	2	L_2, L_3, L_4
N_1	N_4	1	L_2, L_5, L_9
N_1	N_4	2	L_2, L_7
N_1	N_8	1	⋮
N_1	N_8	2	

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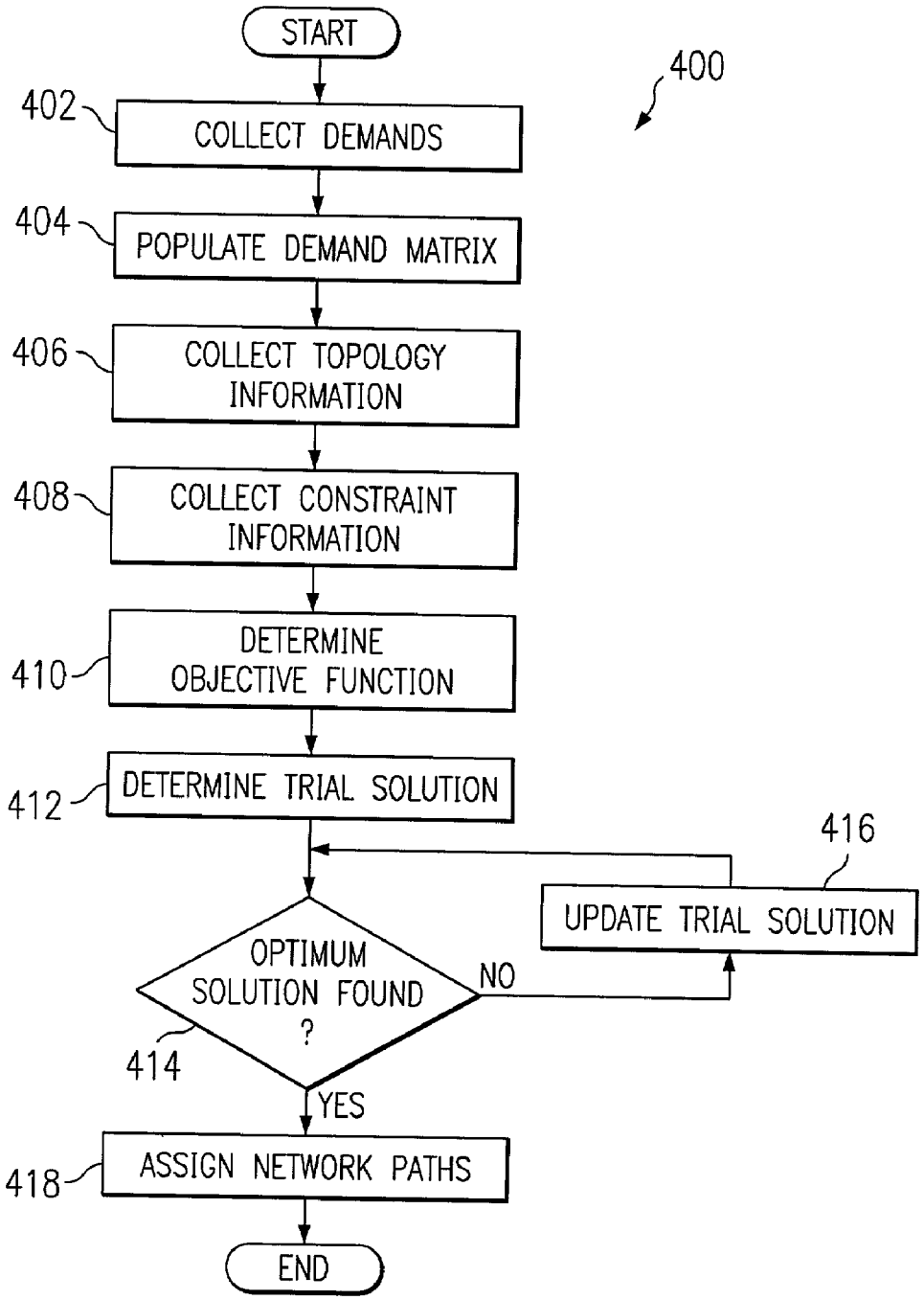
FIG. 4



OPTIMIZING PATH SELECTION FOR MULTIPLE SERVICE CLASSES IN A NETWORK

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates in general to telecommunications, and more particularly to a method and system for optimizing path selection for multiple service classes in a network.

BACKGROUND OF THE INVENTION

[0002] Telecommunication systems continue to carry more and different kinds of traffic over their networks. Certain types of traffic require a high degree of reliability, so that few or no packets are lost in transit. Other types of traffic may be sensitive to timing, so that some packets may be lost, but the packets that are received need to arrive on time. Furthermore, some traffic may be order sensitive, while other traffic may be communicated asynchronously. As demand increases, telecommunication systems must adapt to handle increasing amounts and types of traffic.

SUMMARY OF THE INVENTION

[0003] In accordance with the present invention, a method and system for optimizing network path selection for multiple service classes in a network is disclosed. In accordance with the present invention, the disadvantages and problems associated with previous methods of optimization have been substantially reduced or eliminated. In particular, certain embodiments of the present invention have the advantage of allowing simultaneous optimization for several service classes.

[0004] In accordance with one embodiment of the present invention, a method for routing traffic in a network includes determining topology information for a network and determining demands for multiple service classes. The method further includes determining an objective function using the topology information and the demands, and determining a solution that specifies a network path for each demand using the objective function.

[0005] In accordance with another embodiment of the present invention, a server includes a memory and a processor. The memory stores topology information of a network along with traffic demands for multiple service classes. The processor determines an objective function for an optimization problem using the topology information and the demands, determines a solution to the optimization problem, and determines a network path for each demand using the solution.

[0006] Technical advantages of certain embodiments of the present invention include load balancing. The objective function may include a load balancing term so that the optimization accounts for load balancing among many links. This results in a more uniform distribution of traffic among links, thus providing more efficient use of network resources.

[0007] Other technical advantages of certain embodiments of the present invention include less dependency on individual links. Unlike previous systems that always direct traffic to the shortest available path, certain embodiments of the present invention allow more flexible path determination including multiple alternative routes. Thus, when a link fails, the traffic can often be redirected more easily, and less traffic overall is disrupted by the link failure.

[0008] Additional technical advantages of certain embodiments of the present invention include automatic fail-over path determination. Certain embodiments of the present invention include detection of component failure in the network and automatic recalculation of network paths in response to the failure. This allows quick recovery from component failure. Particular embodiments of the invention may include some, all or none of the enumerated technical advantages. These and other technical advantages of certain embodiments of the present invention will be apparent from the following figures, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For a more complete understanding of the present invention and its advantages, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

[0010] **FIG. 1** illustrates a network including nodes, links, and an optimization server;

[0011] **FIG. 2** illustrates the optimization server of **FIG. 1** in more detail;

[0012] **FIG. 3** illustrates conceptually a method in accordance with the present invention for providing optimum path selection in a network; and

[0013] **FIG. 4** is a flow chart illustrating the steps of a method for optimizing path selection in a network.

DETAILED DESCRIPTION OF THE INVENTION

[0014] **FIG. 1** illustrates a network **100** that includes nodes **102**, links **104**, and an optimization server **200** that assigns paths between nodes **102** in network **100**. "Nodes" refer to any hardware and/or software that sends and/or receives information in network. Nodes **102** may include switches, endpoints, routers, servers, clients, or any other suitable network component. Nodes **102** are denoted by "N", and numbered by subscripts. A "circuit" refers to any connection between a node **102** that is the source of information and a node **102** that is the final destination of the information. A "path" refers to the series of links **104** in a circuit.

[0015] Links **104** represent any physical and/or logical connection between nodes **102**. Links **104** may include cables, fiber optics, wireless links, or any other suitable method for communicating information between nodes **102**. A single logical link **104** may represent more than one physical link, in which case the logical link **104** is known as an "aggregated link." Links are denoted by "L", and numbered with subscripts.

[0016] Optimization server **200** performs various provisioning tasks including assigning circuits between nodes **102**. Server **200** represents any hardware and/or software configured to process information and perform tasks such as selecting circuits between nodes **102**, and communicating instructions to nodes **102** to send traffic to particular links **104**. Server **200** may communicate with one or all of nodes **102** using network **100**. Alternatively, server **200** may be an out-of-network server **200** that determines an optimal path

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