Global liner shipping is a competitive industry, requiring liner carriers to carefully deploy their vessels efficiently to construct a cost competitive network. This paper presents a novel compact formulation of the liner shipping network design problem (LSNDP) based on service flows. The formulation alleviates issues faced by arc flow formulations with regards to handling multiple calls to the same port. A problem which has not been fully dealt with earlier by LSNDP formulations. Multiple calls are handled by introducing service nodes, together with port nodes in a graph representation of the problem, and by introducing numbered arcs between a port and a novel service node. An arc from a port node to a service node indicate whether a service is calling the port or not. This representation allows recurrent calls of a service to a port, which previously could not be handled by LSNDP models. The model ensures strictly weekly frequencies of services, ensures that port-vessel draft capabilities are not violated, respects vessel capacities and the number of vessels available. The profit of the generated network is maximized, i.e. the revenue of flowed cargo subtracted operational costs of the network and a penalty for not flowed cargo. The model can be used to design liner shipping networks to utilize a container carrier’s assets efficiently and to investigate possible scenarios of changed market conditions. The model is solved as a Mixed Integer Program. Results are presented for the two smallest instances of the benchmark suite LINER-LIB-2012 presented in Brouer, Alvarez, Plum, Pisinger, and Sigurd (2013).