A Backward-Compatible Protocol for Inter-routing over Heterogeneous Overlay Networks

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Problem

Overlay networks co-operation

•Overlay networks currently can not co-operate due to the incompatibility in topologies, routing algorithms and types of queries

•Advantages of inter-overlay co-operation: increased search space in file sharing systems, simple localization of participating overlays, and easily achievable content redundancy.

Solution

A super overlay for enabling co-operation

A small number of peers from each of the standard overlay networks run Overlay Gateway Protocol (OGP), in addition to their native protocols. These peers form a super-overlay (the OGP overlay) equipped with efficient algorithms to perform unicast, broadcast, and multicast of messages from one standard overlay to others. Peers forming the OGP overlay play the role of gateways for other peers can reach across standard overlays they are not members of.

System model

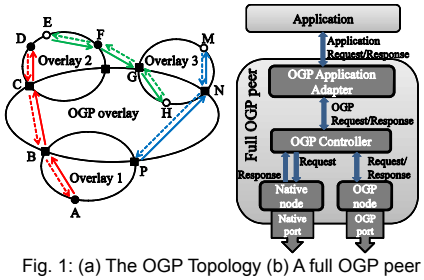

Fig. 1: (a) The OGP Topology (b) A full OGP peer

Peers classification

Blind peers: belong to only one standard overlay, are not aware of the existence of the OGP protocol

Full OGP peers: simultaneously belong to one standard overlay and the OGP overlay.

Lightweight OGP: belong only to one standard overlay but keep a list of full OGP peers

Inter-routing schemes

OGP Unicast: full OGP peers route requests into only one standard overlay different from the one the request originated from

OGP Multicast: full OGP peers route requests into multiple destination overlays different from the one the request originated from

OGP Broadcast: full OGP peers route requests into all overlays different from the one the request originated from

Evaluation setup

•A compete system is deployed on the French Grid5000 platform.

•Broadcast routing scheme are used

•The full and lightweight OGP peers periodically looked up a random piece of data on any of the standard overlays. The blind peers periodically look up data existing on their standard overlays

Three experimental scenarios

% of OGP peers	6, 10, 20, 30, 40	6, 10, 20, 30, 40
Lifetime mean (second)	900, 1800, 3600	900, 1800, 3600
Type of overlays	Chord	Chord, Kademlia, Gnutella

Table 1: Values of experimental parameters in scenario 1 (left column) and in scenario 2 (right column)

% of Light OGP peers	10, 20, 40, 60
% of OGP peers	10, 20
Lifetime mean (second)	1800
Type of overlays	Chord

Table 2: Values of experimental parameters in scenario 3

Results

Successful operation

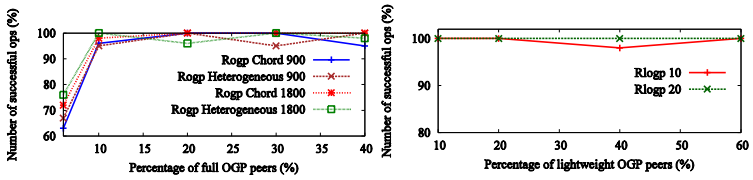

Fig. 2: Ratio of successful hops of a full OGP node (left) and a Light OGP node (right)

Generated traffic

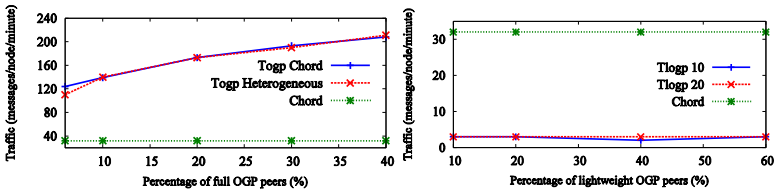

Fig. 3: Traffic of a full OGP node (left) and a Light OGP node (right) on the OGP overlay

Latency

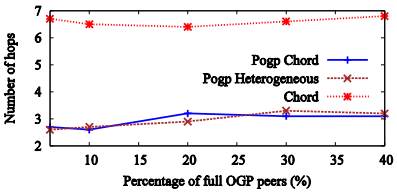

Fig. 4: Path length on the OGP overlay in a successful lookup performed by a full OGP node

Conclusions

•Having only 10% of peers as full OGP peers is sufficient for achieving a success ratio of round trip inter-overlay routing operations larger than 95%.

•Both full and lightweight OGP peers are proven to be efficient in terms of the path length needed for data lookup.

•A lightweight OGP peer generates the traffic nearly as same as that generated by a standard peer. The traffic generated by a full OGP peer on it is considerably larger than the traffic generated by a standard peer.

•Further works: thorough investi gation of the efficiency of the OGP protocol on much larger systems