Internet exchange point and internet routing essay

These relations are one of two types: customariness (hierarchical) or peering (flat). Recent studies of intra-AS relations indicate the gradual transition of the Internet ecosystem from the hierarchical structure to a flatter peering architecture [1]. This infrastructure level flattening is characterized by the constant growth, rewiring and deaths of inter-AS links. Primary driving forces behind these changes are economic; especially the meteoric rise in popularity of organizations such as Backbone, Google, Yahoo and Microsoft, who have lately deployed large, private WAN infrastructures [1].

The transition from the hierarchical Internet has also accelerated with the deployment of multiple Internet exchange Points (Sips) worldwide, the facilitator of peering. Numerous peering links (between Eases) at these Sips have recently been uncovered but their effects on Internet topology and intermediation routing performance not yet examined. Exchange points (shown in fig 1) provide an infrastructure for Eases to set up mutually agreeable peering agreements at a common location and enable the quick exchange of traffic without requiring higher tier transit providers.

They also facilitate dynamic hanging of peering agreements between Internet Service Providers (Sips) providing transit to customer Eases. These customer Eases obtain better network performance (lesser delays, more reliability) while the Sips save substantially on transit costs. A. Motivation Two key issues which arise with the growth of Sips and an increase in peering relations are: the effect inter-AS peering links have on the Internet topology and on inter-domain routing performance. Topology evolution.

Internet topology modeling and analysis has attracted substantial attention ([2], [3]) over the years in the quest for designing more accurate topology enumerators and emulation environments. These applications are used in design and implementation of new/improved Internet protocols and require high levels of accuracy; levels which can only be reached by the discovery of most (if not all) AS-links present. Links not yet discovered are termed the missing links [4] 978-1-4577-1394-1/11/$26. O 02011 IEEE Fig. 1. A set of Eases peering at an XP.

A and B set up a BGP session to exchange data while E and F use the Internet cloud to transmit data to each other. Any AS peering at the XP may initiate BGP session with a peering AS. ND uncovering these missing links is the primary focus of topology research. A comprehensive study of peering links at these Sips by Augustan et al. In [5] revealed almost ASK links previously not visible in any other study. These hitherto unseen links have a definite impact on Internet topology and its evolution, an impact not studied in past work.

Routing performance. Internet topology affects the intermediation routing performance with upper-tier providers being bypassed due to lower-tier peering through Sips. This change in traffic flow creates newer BGP routes traversing these Sips (termed XP tats); the behavior of which we measure and use to finally evaluate the effectiveness of XP peering. There has been little past studies measuring the impact Sips have on topology evolution and routing performance, which is where we aim to fill the gap. B.

Importance of BGP BGP is the routing protocol of the Internet. All Eases configure their routers with BGP sessions for routing within their AS and BGP (or simply BGP) for communicating with external Eases. The router configuration depends on the interns routing policies followed by the organization which in turn is dictated by its economic guidelines and traceries. The creation/breaking of a peering link are largely subject to these policies and their presence or absence is disseminated throughout the network via the BGP routing tables.

By advertising the presence of a peering link which bypasses a transit ISP, an AS and its customers not only save significant amounts of money (via reduced transit costs) but also (theoretically) extract better routing performance. Thus BGP holds the key in determining if peering at Sips is indeed effective or not. C. Contributions 292 The key contributions of this work thus are: Topology evolution. We first generate a comprehensive view of the current Internet topology from various datasets to study the macroscopic effects of peering links on the observed Internet topology.

We then show the major role these links play in impacting overall topological characteristics and conclude that the key to solving the missing links problem indeed lies at the Sips; a result future topology modeling/analysis techniques cannot ignore. Routing performance. We evaluate the routing performance of XP paths in comparison with available alternate routes to determine the technical benefit of erring (economic benefits aside). From our extensive Placental measurements we observe bottleneck creation at the XP hops along a path while about 10% of default XP paths are the best available path between arbitrary hosts on the Internet.

Economics. With economics playing a major part in the underlying dynamics of the AS ecosystem, coming up with an effective mathematical model describing the interactions and transition between AS relationships is an area we are currently exploring. Using available tools such as evolutionary game theory we propose to study how peering could be seed effectively to enable a system with big transit providers coexisting with smaller customer networks. Application to routing overlays.

Peering is also a definite source for delay based Triangle Inequality Violations (Tips) across Internet routes. We use available outermost based measurements to identify Tips on a large scale with the aim of designing overlay networks along these XP paths. With the sheer number of routes and gigabytes of outermost data available, identifying these global Tips are a painstakingly laborious process. We employ a parallel programming paradigm with General Purpose Graphics Processor Units (Eggcups) to come up with a faster and more efficient system implementation.

A macroscopic graph analysis is carried out in comparison with the ACADIA and REVIEWS graphs (we omit DIMES here due to space constraints). We carry out a complete graph analysis based on various metrics such as node degree distribution, Joint degree distributions, clustering coefficient, node soreness, distance, eccentricity and node/edge centrality. We present two important characteristic results here: the average neighbor connections and node betterments centrality. Figure 2(a) presents a comparison of the average neighbor connectivity, a metric