Two Approaches for Aggregation of Peer Group Topology in Hierarchical PNNI Networks

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Abstract

We propose two methods for aggregation of peer group topology in hierarchical ATM networks. In our proposed schemes, aggregation is performed in two steps: First, we transform the original peer group topology into a complete graph on border nodes. Then, we compute a compact representation of this complete graph. The final representations generated are terse, yet preserve the critical information of peer group structure that is needed for efficient call setup and routing. The first scheme is compatible with the current PNNI, while the second scheme extends the interpretation of these standards.

Both proposed aggregation methods transform a given peer group into a star graph representation. Our first approach optimally preserves, in a least square sense, the original costs of routing through the peer group. Our second approach assigns a weighted vector to the nucleus of the Logical Group Node, which quantifies the error in the compact representation. The two schemes are dual, in the sense that the first is best suited for peergroups where traffic patterns are unpredictable, and the second is suited for peergroups where traffic patterns can be characterized. Both the proposed schemes are practical: For peer groups with nodes V, links E, and n border nodes $B \subset V$, the approaches run in $O(n|V|\log|V| + n|E| + poly(n))$ time. The size of the final representation is small (linear in the number of border nodes) and can be computed efficiently. The scalability of the proposed algorithms makes them well-suited for use in practice. We also present a general method for measuring the degree of confidence in an aggregation scheme and give examples that illustrates the proposed techniques.

1 Introduction

As the advantages of ATM technologies are recognized, we anticipate the size of operational ATM clouds to grow at a rapid pace. In order to insure scalable operation of these networks, the PNNI standards for routing have been recently adopted. PNNI defines a set of protocols for a *hierarchic* network that provide the basis for efficient routing.

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Here P_2 shows the degree of match between d_{ij} and d^*_{ij} for all pairs i, j $(i \neq j)$.

Now assuming a degree of importance for each transit as specified in the vector C, and using the vector P_2, we compute that performance of this approach is 0.95 according to our formulation in section 5.3.

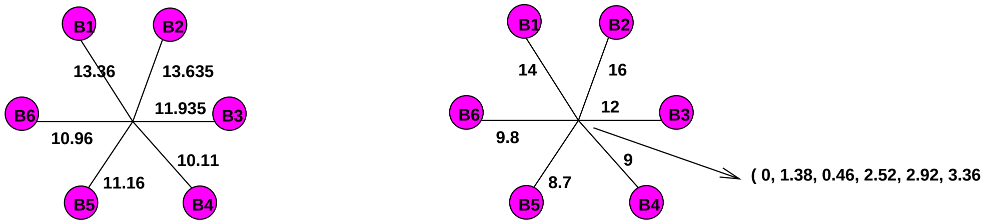

Figure 3: Compact representation using approaches 1 (left) and 2 (right)

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