Xbits: Software Defined Internet Services at an IXP

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Xbits

- An upcoming effort to introduce programmable services at internet exchange points

- Makes possible/easier tasks such as:
  - Domain based or application specific peering.
  - Remote control peering
  - Enforceable inter-domain routing policies
  - Time of day routing
  - Dynamic traffic engineering for peering policy compliance
Xbits and TouSIX: Complementing Architectures

- Control Plane Manager
- Route Server/Prefix Handling
- Network Functions Auctions
- Financials/Charging
- Service Level Agreements
- Application Specific Peering
- Analytics Engine
- IXP Manager
- Support

TouSIX Umbrella Fabric
Architecture of IXP Application Interface
Possible Use Cases
Network Security

• Enhanced network security

• Provision of security services at line speeds such as:
  – Real-time attack detection
  – Flow diversion
Network Security: Attack Detection

- Behavioural flow analysis

- Monitor behaviour of protected traffic against requested class of service

- Builds peacetime (normal) traffic baselines

- Set flow entries for selected network flows to read traffic statistics for each of the Autonomous Systems
  - aggregating statistics collected for a given autonomous system from multiple locations
Network Security: Flow Diversion

- If the anomaly detector detects variation from the baseline traffic
  - Invokes redirection service to redirect only the suspicious traffic towards the scrubbing centre
  - After attacks, restores network to original configuration
  - First line of defence for ISPs
Brokerage: Pricing and Selling of Network Functions

Network functions auctioning with following major components:

• Resource advertising
• Resource auctioning mechanism
• Resource allocation mechanism
• Tracking of resource utilization
• Billing and charging functions
Brokerage: Example scenario

• A multimedia content provider intends to livecast a game event to selected set of customers a distinct autonomous system
  – e.g. in a specific state

• Customers have subscribed for distinct quality of service requirements

• Reach ability to end customers via multiple autonomous systems
Brokerage: Example scenario (contd.)

- Transit autonomous systems advertise their QoS with a base priceline

- Content provider bids for the resource, transit autonomous system accept or reject request

- Brokerage provides platform for matching buyers and sellers of network functions

- At the end of session, charges are settled from accounts of respective providers
Application Specific Peering

- Two users in distinct autonomous systems peering at the IX require temporary expansion of bandwidth for offering specific application
- The originating AS place the request at the IX brokerage with its acceptance criterion
- The destination and transit AS broadcast charges
- An automated/assisted best match is established at the brokerage
- Relationship terminates on conclusion of the session
Analytics Engine

- Aggregation of statistics at the controller

- Provision of decision feedback to individual clients on peering agreements
  - Quality
  - Time of day
  - Load balancing

- Steering of traffic through middleboxes based on
  - intelligent collection of statistics
  - participant policy
Customer Controlled and Configurable Services

- Basic SDN paradigm follows a principal: SDN interfaces should be extensible and abstract.
- In the designs of IXP applications, customers should be able to specify their peering criterion.
- In Xbits, customer given access to their own specific AS space and the services that are available from other AS.
- Based on these, customers would be able to develop their own custom applications.
Consumer Specific Dynamic Delivery of Applications

• Differential consumer specific traffic handling and treatment is another feature that maybe desired by individual IXPs.

• An example is popular web destinations (e.g. facebook) and video streaming services (e.g. youtube)
  – may require dynamic servicing through multiple AS based on QoS demands from end use customers.

• ISPs can advertise these demands to the IXP, bid and obtain resources that meet these application demands.
Consumer Specific Dynamic Delivery of Applications

- e.g. Broadcast services can also monetize ISP (and IXP) to allocate better resources to their services.

- This feature can be implemented as a dynamic policy framework in the designed application interface.
Selling and Pricing of Network Functions

• With the proposed architecture, network functions could be offered at a price to other network owners.

• Network owners will open up selected programmatic interfaces to their networks to third party independent software vendors

• Creates an ecosystem of network application developers using network intelligence
  – Enrich existing network applications
  – Possibly new network applications
Selling and Pricing of Network Functions

- Application developers jointly with backing of their network owners
  - can assign pricing functions to their services

- IXP can act as a facilitator to reach an agreement between the two autonomous systems
  - a) completely automated
  - b) with minimal human intervention.
Selling and Pricing of Network Functions: Example Scenario

• Offloading of an AS traffic to another AS during peak hours
  – paying the transit fee based on the pricing introduced for forwarding.

• The pricing function can also make use of embedded analytics to create new services
  – enrich existing applications through programmatic interfaces.
Charging

- Base set of IXP peering / interconnect services offered at no charge

- Charging based on value added services offered
## Possible Charging Mechanism

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<tr>
<th>Product Details</th>
<th>CPU Requirements</th>
<th>Memory Requested</th>
<th>Ports Requested (1G/10G/100G)</th>
<th>Number of Peering Transactions</th>
<th>Traffic Volume</th>
<th>Managed/Unmanaged</th>
<th>Application Agnostic (Yes/No)</th>
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Conclusion

- Xbits offers a promising interconnect mechanism with added flexibility to offer differentiated services

- Opens up L2 IXP interfaces for innovation for a robust SD-WAN