ConEx Concepts and Uses

draft-moncaster-conex-concepts-uses-02

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Draft status

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- Individual draft
- Intended charter milestone: use-cases
- Intended status: Informational
- Intended next step: WG item

Changes from previous version

- Updated document to take account of the new Abstract Mechanism draft
  - As the Abstract Mechanism draft develops, more material will be able to be removed from this document
- Updated the definitions section
- Removed sections on Requirements and Mechanism
- Moved section on Architectural Elements (monitors and policers) to new appendix
- Minor changes throughout

The Problem

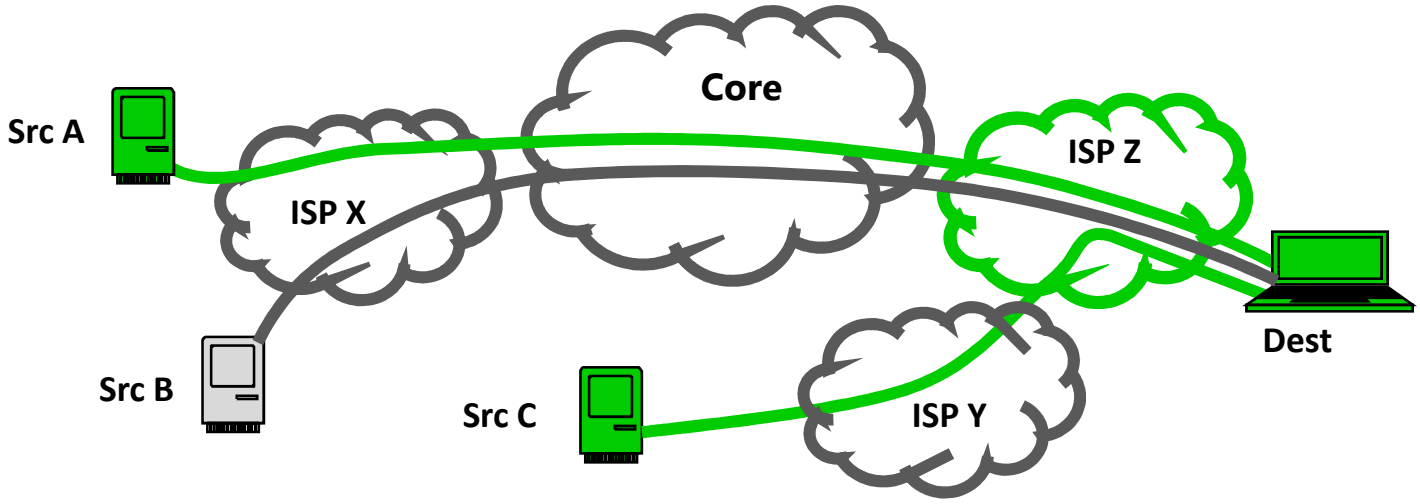
- The problem can be characterised in at least two ways:
  - Capacity Sharing – sharing limited resources between concurrent flows
  - Congestion Management – improving performance and delay for all
- Understanding congestion is definitely key
  - Too much traffic arriving too quickly = congestion
- Capacity sharing currently myopic:
  - In time (queues have no idea of past history of traffic)
  - In space (traffic may be causing problems elsewhere)
- Queues can only apply pressure by indicating congestion
  - Best signalled in forward direction (unlike Source Quench)
  - Requires honesty from receiver who wants the data as fast as possible
  - Needs sender to reduce rate, but it would rather send fast too
- Whole path congestion not visible at forwarding layer
  - Can't tell whether traffic is responsive to congestion

The Problem continued

- Capacity sharing suffers from a key problem – how to measure it
- Current approaches (rate and volume) are bad as they don't reflect actual network conditions
- Congestion is a good measure of impact on other users
- Congestion-volume is a better metric to measure this
  - Congestion-volume = volume x congestion (units of bytes)
  - Congestion-Rate = rate x congestion (units of bps)
  - For a 1Mbps flow, 0.1% congestion = 125 bytes congestion-volume in 1 second
- Congestion-volume is measure of how much excess traffic was in network over any sampling interval (millisec, minute, month, ...)
- Congestion-volume can be measured per-packet, per-flow, per-user, per-network, ...
- ConEx means congestion-volume can be measured as easily as volume

ConEx Use Cases Introduction

- Lots of use cases for ConEx
- Charter focuses on use cases for following scenario:



Green elements ConEx-Enabled. Grey elements not Enabled

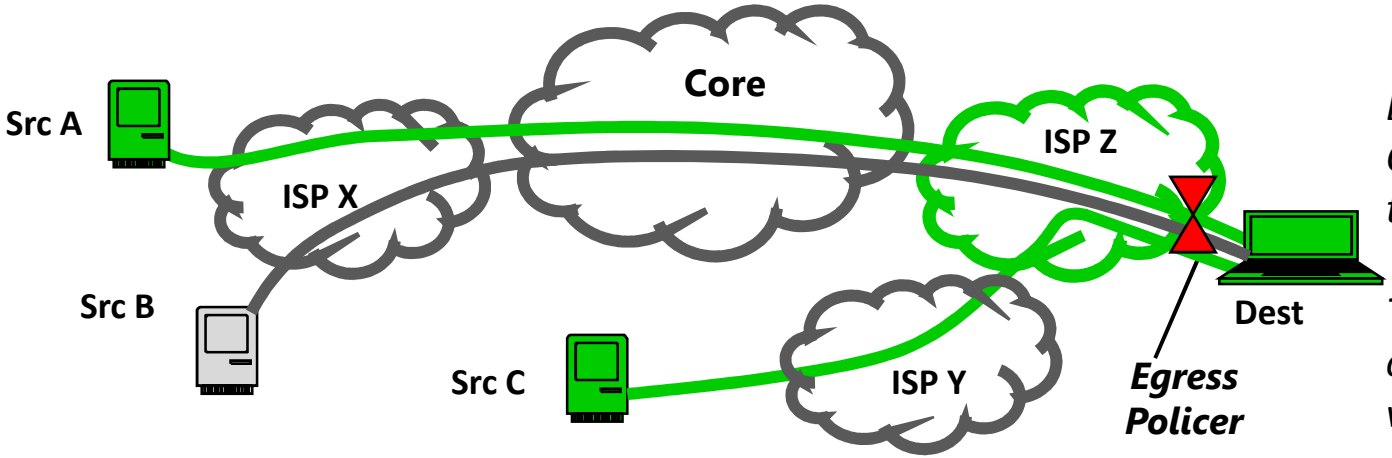
- NB: the symmetry of most networks implies that **ISP Z** can be a ConEx-Enabled ***source*** network for any traffic that **Dest** sends into the network

Summary of ConEx Use Cases

- Traffic management
  - Enable operator management according to congestion volume
- Encourage better congestion control
  - “Scavenger” services such as LEDBAT should generate little congestion volume and therefore benefit from ConEx traffic management
- Targeted capacity provisioning
  - ISP settlements based on congestion volume can allocate money to where upgrades are needed
- Enable differentiated QoS
  - Higher priority application can increase congestion volume, in order to increase packet drops for lower priority applications
- Mitigate DDOS attacks
  - Malicious traffic causing high congestion volumes can be identified and mitigated
  - (See later discussion about whether to keep this use case)

Traffic Management

- ISPs often perform traffic management:
  - Aim is to give majority of users an adequate service at peak times
  - Users targeted based on application, traffic rate, volume transferred, etc
- ConEx policers offer an alternative:
  - Each sender is declaring the congestion they expect to cause
  - This can be used to control the impact they have on others
- ConEx Egress policer identifies users with most congestion-volume.
  - Prioritise traffic depending on congestion it has declared
  - Penalise traffic that has caused excessive congestion



*Egress Policer can use ConEx info to prioritise traffic from **Srcs A & C**.*

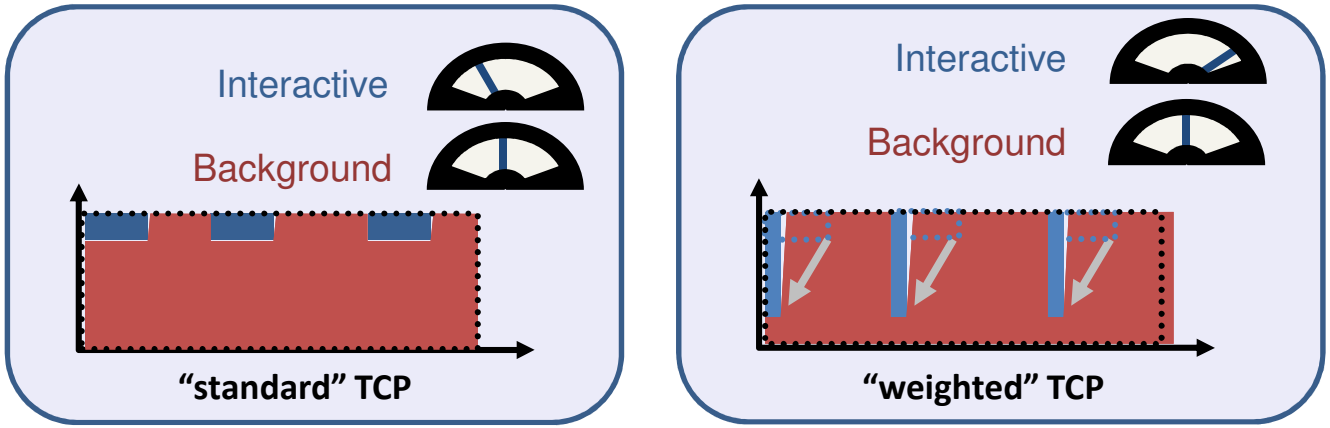
*Traffic from **Src B** can only be prioritised by volume/rate/app*

Managing the Right Traffic

- Lots of debate about traffic management
  - Current approaches tend to be relatively unfocused
  - Assumptions made about when “peak time” happens
  - Often targets specific applications - big problem for Net Neutrality camp
- ConEx approach is better
  - Only targets traffic that contributes most to congestion
  - Because it monitors actual congestion it always knows when peak time is
  - Wholly application-agnostic – only cares about impact of traffic on the network
- Overall this is better for ISP and its users
  - Less damaging to customer relationships
  - Allows some bandwidth differentiation without QoS in the net
  - No need for expensive flow-aware kit in backhaul or access

Encouraging Better CC

- Lots of current work looking at better congestion control
- LEDBAT introduced idea of highly reactive congestion control
  - Designed for bulk data transfers which don't care about instantaneous rate
  - Backs off as soon as it detects queue building - reacts to congestion before other transports need to
- MulTCP and related work introduced weighted congestion control
  - Application chooses how much to react to congestion by assigning a weight
  - High priority apps don't back off much, low priority back off more
  - Logical extension is fully weighted congestion control



Encouraging Better CC continued

- Current traffic management disincentivises use of LEDBAT
  - LEDBAT still transfers high volumes, so is still targeted
  - LEDBAT used for applications like P2P, so is still targeted
  - LEDBAT can still reach high data rates, so is still targeted
- ConEx encourages LEDBAT-like transports
  - ConEx based traffic management brings correct incentives
  - Traffic is controlled based on congestion it causes
  - LEDBAT causes less congestion so gets less control
- ConEx encourages use of more adaptable congestion controls
  - Applications choose how reactive they want to be
  - Interactive applications can react less to maintain their quality
  - Background applications can back off more and recover at quieter times
  - All that matters is overall Congestion-volume...

Targeted Capacity Provisioning

- Better traffic management means:
  - Users stop causing unnecessary congestion
  - Protocol designers avoid unnecessary congestion
- So any congestion remaining reflects real demand
- Congestion-volume can be used to measure this demand
  - Can measure at each physical interface
  - Can measure over investment timescales
  - Can identify precise capacity demand
- Without ConEx you can't tell if demand is real
  - Investments may be "wasted"
  - Users may not see real benefit
- More on this in next revision...

Other Use Cases

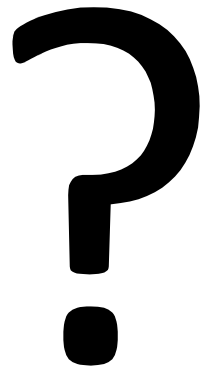
- Charter focused on ConEx-enabled destination network
  - CDN distributing e.g. Movies; User watching VoD;
- Can add ingress policing for traffic heading in other direction
  - End user transferring P2P; Live video chat with remote user via relay server;
- 3 other use cases already discussed in draft:
  - ConEx for DDoS mitigation – network can identify and track excess congestion and block it before it causes problems. This could be a big incentive to deploy
  - ConEx "QoS" (builds on weighted CC) – user can prioritise traffic with no network involvement. Makes sense with ingress policing.
  - Congestion accounting: works best with full deployment. But even simple deployment at sender allows operators to monitor congestion-causing traffic
- Other use cases discussed on mailing list. Intend to add more use cases to draft

Questions for the Working Group

- How to manage the remaining ConEx mechanism material?
  - Determine fate of ConEx Architectural Elements in appendix
  - Align draft terminology with Abstract Mechanism
- Should the DDOS use case be retained?
  - Incomplete resolution on mailing list: http://www.ietf.org/mail-archive/web/conex/current/threads.html#00094
  - If retained, use case clarifications may be needed
- How to clarify the differential QoS use case?
  - Discussion on mailing list: http://www.ietf.org/mail-archive/web/conex/current/threads.html#00127
- What use cases should be added?
  - E.g. from draft-mcdysan-conex-other-usecases-00

Questions

- Did we pick a reasonable set of use cases?
- Should we add a non-commercial use case like campus, corporate, etc?



Conclusions

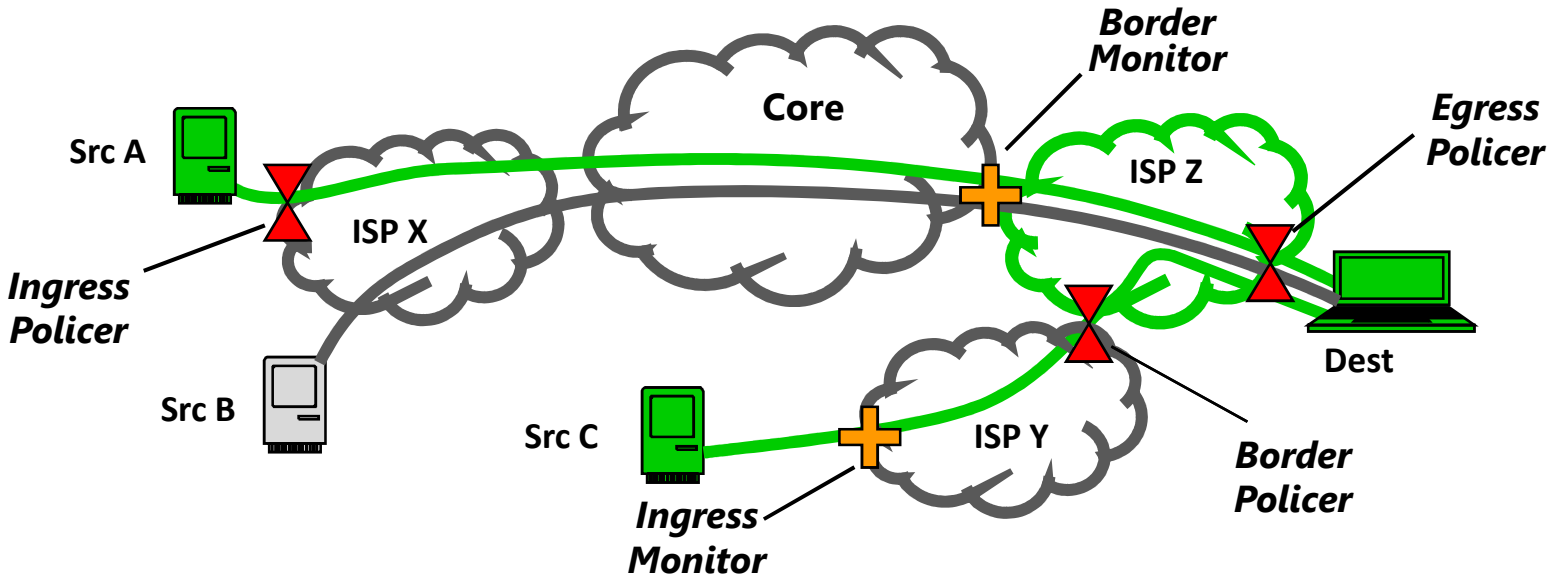
- This draft describes some of the use cases for ConEx
- By no means exhaustive – this is a radical idea that will generate some truly innovative uses
- Congestion-volume is the key metric for controlling capacity sharing

ConEx Concepts and Uses

spare slides

ConEx Components

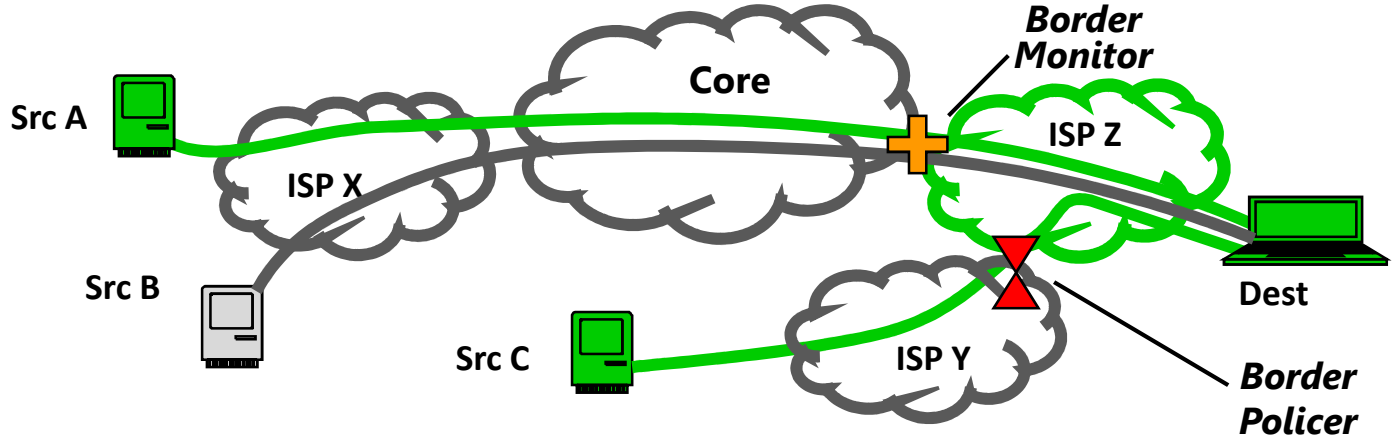
- Two new network components defined:
  - **ConEx Monitor** –uses ConEx to measure/report Congestion-volume
  - **ConEx Policer** –uses ConEx to actively control traffic (delay, expedite or drop)
- Policers and Monitors can be at Ingress, Egress or Border:



- Border can do policer or monitor functions
  - policing can mitigate serious congestion
  - Monitoring can see (and deter) congestion

Raising the DDoS Bar

- DDoS is a serious problem – currently no robust solution
- ConEx Border Policers can help raise the bar
  - ConEx Policers limit traffic rate towards congestion hot-spots
  - Policers can rate-limit non-ConEx traffic routing towards same hot-spot
- ConEx Border Monitors can help raise the bar too
  - DDoS traffic shows ultra-high congestion, so shows up at border



- DDoS protection grows as ConEx deployment increases
- Details are important but way beyond scope of use cases document