SIP and Transport Protocols

Tekelec

9/1/11

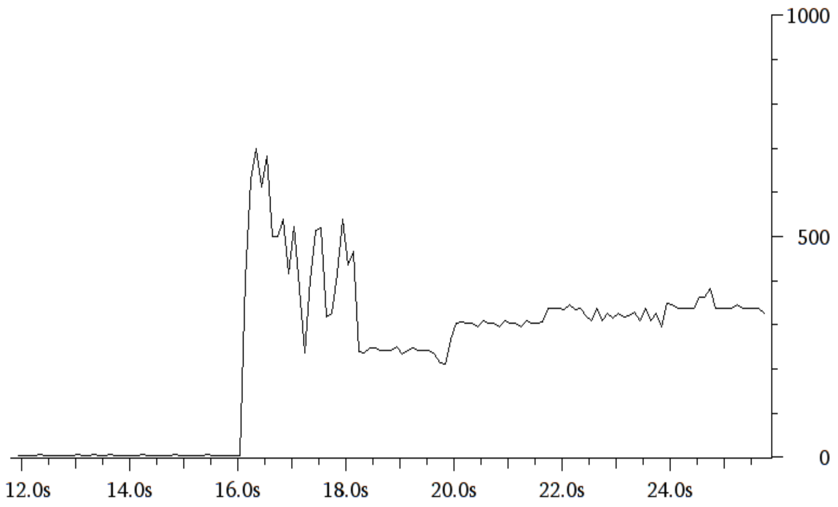
Cristian Constantin
cco@iptel.org
Andrei Pelinescu-Onciul
andrei@iptel.org

SIP / User Datagram Protocol (UDP)

- Fast and simple (best effort)
- Application level: atomic reads/writes on the sockets
- High throughput at a cost: congestion
- Congestion: infrastructure cannot support the amount of traffic; two types: application congestion / network congestion
- No explicit congestion control & avoidance mechanism in SIP/UDP; application has to take care of it

SIP / User Datagram Protocol (UDP) – cont.

- Application congestion in an Active/Stand-by failover
- traffic rate during failover is close to the engineered cps
- newly active server is experiencing congestion for several seconds due to retransmission spikes



SIP / Transmission Control Protocol (TCP)

- TCP offers a lot more than UDP: congestion control, retransmission, error control
- However TCP is a stream oriented protocol used for reliable transfer of chunks of data from host A to host B; TCP was not meant for real-time signalling
- Disadvantages for SIP: continous flow of data (no message boundaries), application layer synchronization/serialization of reads/writes, usually no fine grain configuration of internal timers

SIP / Stream Control Transmission Protocol (SCTP)

- SCTP is the Swiss army knife of transport protocols
- UDP-like features: message boundary preservation, unordered message delivery, one-to-many sockets at the application level.
- TCP-like features: positive (selective) acknowledgment, retransmission of lost data, windowed flow control, congestion control, one-to-one sockets at the application level

SIP / Stream Control Transmission Protocol (SCTP) – cont.

- SCTP unique features:
  - multihoming
  - multiple streams per connection
  - built-in heartbeats
  - most of the protocol parameters configurable per system and per socket (association)
  - exposes asynchronously its internal states/events to the application level through the use of notifications
- Useful for SIP:
  - message boundary preservation
  - fine tuning of the timer values
  - Multipath / transport layer failure detection per path
  - asynchronous notifications of socket events

SIP / Stream Control Transmission Protocol (SCTP) - cont.

- Pitfalls
  - the SCTP socket API is a moving target still under development,
  - due to novelty, the level of complexity of some of the SCTP stack implementations is inversely proportional with the time spent on testing them
  - sometimes their performance in terms of throughput is not on a par with the one offered by TCP.

UDP vs TCP vs SCTP

- Configuration:
  - Hardware: Intel XEON, 16 way, 2.53 GHz, 24 GB memory (8 GB used by SER), Gb network cards
  - SER / Linux CentOS
  - The test bed is emulating proxy to proxy signalling
  - small number of sip nodes, small number of tcp connections/sctp associations
  - a lot of calls coming from/going to the same node
  - SER is just routing the calls using prefix based routing (max. 30 prefixes)
- Tested call scenarios:
  - Transaction replied by SER directly: INVITE / 404
  - End to end transaction: INVITE / 100 / 180 / 200
  - Call consists of: INVITE / 100 / 180 / 200 / ACK / BYE / 200; it is both initiated and terminated by UAC, ringing time: 12s, call duration: 120s in average (35s – 205s)

UDP vs TCP vs SCTP – cont.

- Max throughput: UDP, directly replied transaction: 27K tps
- Calls on UDP (using raw sockets for send): 8K cps; active-standby failover produces much higher spikes (around 20K)
- Calls on TCP: 10K cps
- Calls on SCTP: 2.5K cps; most reliable active-standby failover (no call loss)

UDP vs TCP vs SCTP – issues

- Timer process congestion
  - there are: multiple udp/tcp/sctp processes, only two timer processes
  - at high call rate the timer processes cannot cope with all the events generated by traffic processed in the udp/tcp/sctp processes
- SCTP relatively poor throughput
  - Linux kernel issue
  - One-to-many sockets do not scale properly with the number of readers/writers (synchronization bottleneck)
- Active/standby failover with TCP
  - Depends on how quickly the peers detect the failure and reconnect
  - Worse than SCTP