Emails in Numbers

We thought of conducting a comparative performance study for three solutions that cover the four basic functions of electronic messaging: message receiving, their delivery to the user's mailboxes, message storage and user accessing stored emails. Two usage scenarios were considered: business and ISP.

The three tested solutions are:

- **Sendmail** (message receiving and delivery) **+ Dovecot** (message storage and access)
- **Postfix** (message receiving and delivery) **+ Cyrus** (message storage and access)
- **AXIGEN** (complete solution)

The tests consisted in sending messages with a predetermined size to the servers and checking their acceptance in the users' mailboxes.

The large number of spam messages from the total traffic of received email messages (estimated by Radicati, in 2007, at 72% of all traffic) generates frequent periods of intensive server usage. To verify the servers' ability to respond in overload conditions, their response time to requests on 1, 2, 4 and 8 parallel connections was tested.

Business type scenarios (medium/large companies)

Characteristics

Medium and large sized companies generally employ their own messaging solutions for security and efficiency reasons. Typically, messages sent in the business environment are medium sized (13.6kB) and the employees connect to an e-mail client (for example: MS Outlook, Mozilla Thunderbird etc.) trough the IMAP protocol.

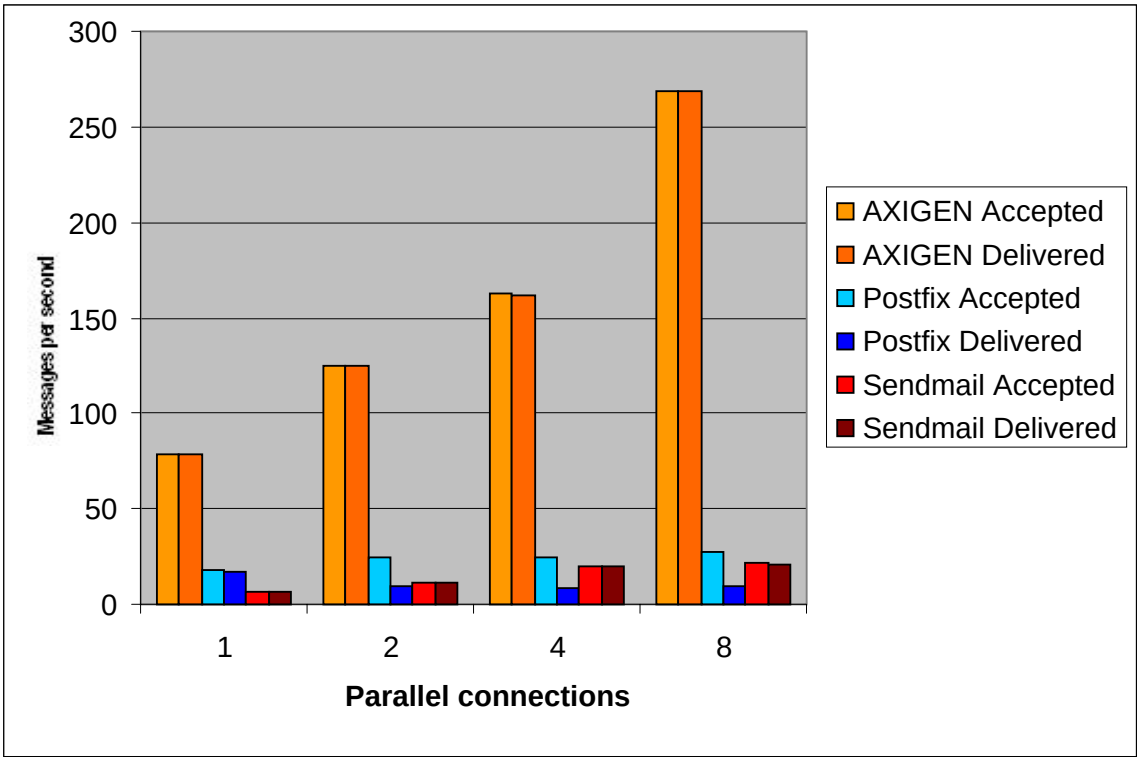
Testing results

The most relevant performance indicators of a messaging solution are the number of accepted messages by the server and the number of delivered messages to the user's mailbox within a time unit. Ideally, the two indicators are equal; therefore, the server is able to immediately deliver all received messages.

SMTP and IMAP, 100 mailboxes, medium sized messages

Description
- Number of mailboxes per system: 100
- Number of parallel connections: 1, 2, 4, 8 (four different test sets)
- Storage and queue are recreated before each test set, to prevent one test from influencing the next one
- Total time for each set: 900 seconds
- Transfer distribution for each set:
    - 10% 2k messages sent trough SMTP
    - 50% 6k messages sent trough SMTP
    - 20% 20k messages sent trough SMTP
    - 10% 50k messages sent trough SMTP
    - 10% messages read trough POP3
- SMTP transfer = message sent trough SMTP to one recipient (randomly picked from the 100)
- POP3 transfer = login, retrieve all, delete all for one mail box (randomly picked from the 100)

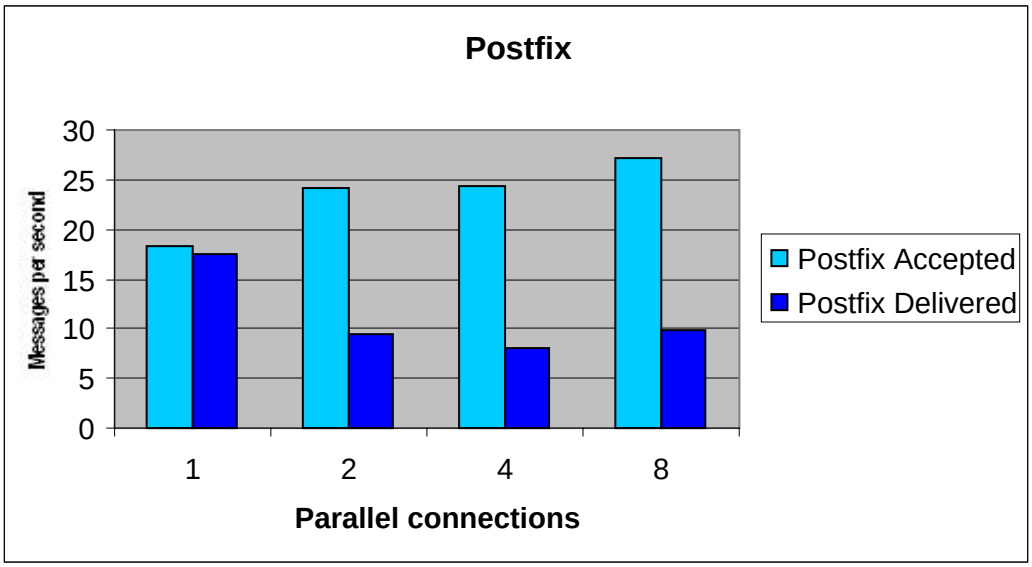
After running these tests, we obtained the following results:



Parallel connections	Axigen		Postfix		Sendmail	
	Accepted	Delivered	Accepted	Delivered	Accepted	Delivered
1	78.73	78.23	18.35	17.47	7.08	6.53
2	124.96	124.62	24.15	9.52	11.44	10.99
4	162.39	162.02	24.46	8.15	19.97	19.64
8	269.20	268.81	27.17	9.81	21.46	21.11

We noticed that, in the case of Sendmail, the accepted number of messages is almost equal to the delivered number of messages witch ensures the server's reliability; also, the number of these messages increases when the number of parallel connections is increased. However, from 4 to 8 parallel connections, there's only a minor increase of the received/delivered message number, leading us to conclude that the maximum performance level is archived; no matter how many parallel connections are added, the total performance doesn't increase anymore.

The following graphic details the results for the Postfix solution (at a corresponding scale to observe the evolution of the examined indicator):



We notice that, for Postfix, once we increase the number of parallel connections, the difference between the number of accepted and delivered messages is significantly greater, the latter being much smaller. It can be concluded that a big part of the processing power is used to accept messages; sadly, the delivery is affected by this behavior, the immediate effect being the constant message queue increase, which finally causes a server blockage. Compared to Sendmail, Postfix works a little better in the case of a single connection, but the performance balance switches in favor of Sendmail as the number of parallel connections is increased.

Unlike the first two solutions, AXIGEN maintains a balance between the number of received and delivered messages and its performance highly increases when new parallel connections are being added, working almost 13 times better than Sendmail and Postfix at 8 parallel connections.

To conclude, even if in normal traffic situations a 7-20 messages/second performance is satisfactory and the Sendmail or Postfix solutions behave acceptably, during peak traffic periods, such as virus outbreak situations, spam attacks, when sending large numbers of messages (e.g emails to large distribution lists) or in case of server attacks, AXIGEN proves to be much more reliable.

ISP type scenarios

Characteristics

In the case of Internet Service Providers (ISP), the average message size is usually small and users connect trough the POP3 protocol. The extremely high number of users significantly increases the traffic load a messaging solution has to handle; moreover the contractual relationship between the service provider and email users imposes a high standard of service continuity and availability to the supplier.

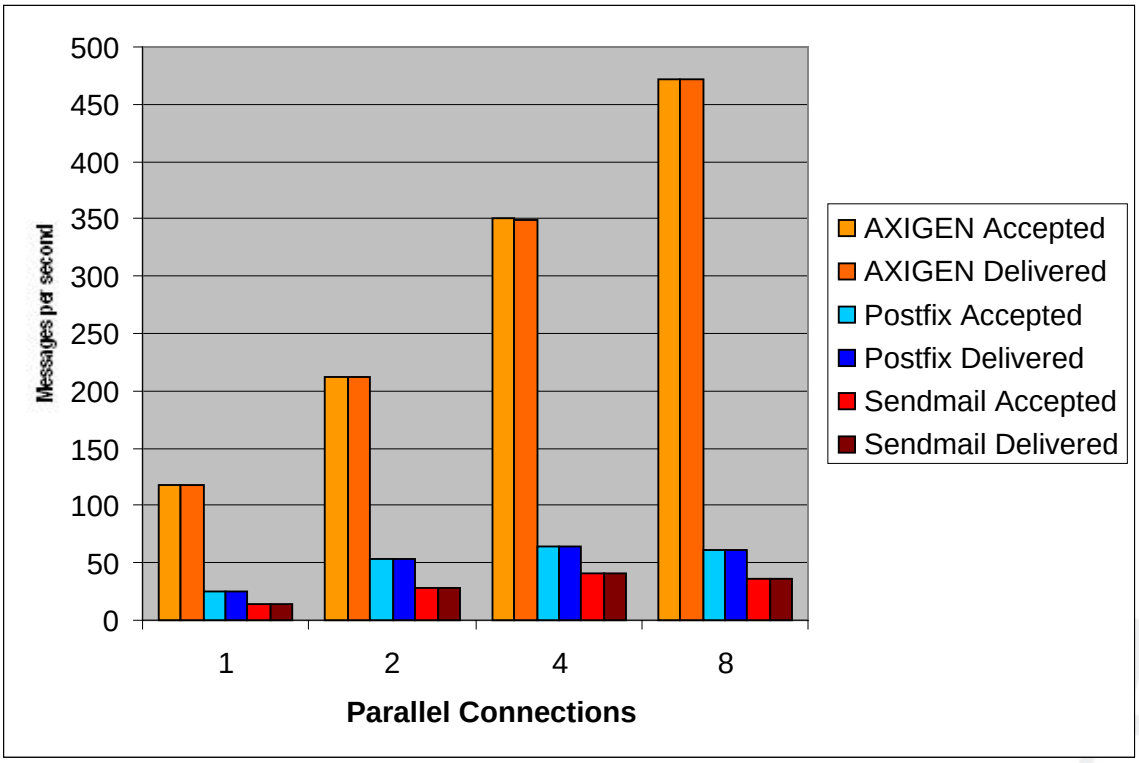
SMTP and POP3, 100 mail boxes, small size messages

Description

- Number of mail boxes per system: 100
- Number of parallel connections: 1, 2, 4, 8 (four different test sets)
- Storage and queue recreated before each test set, preventing one test from influencing the next
- Total time length for each set: 900 seconds
- Transfer distribution for each set:
  - 90% 2k message sent trough SMTP
  - 10% message read trough POP3 (login, retrieve all, delete all)
- SMTP transfer = message sent trough SMTP to one recipient (randomly picked from the 100)
- POP3 transfer = login, retrieve all, delete all for one mail box (randomly picked from the 100)

Testing results

We observed the same indicators as in the previous scenario in order to take notice of the total effect of server overload that is perceivable by the end user.

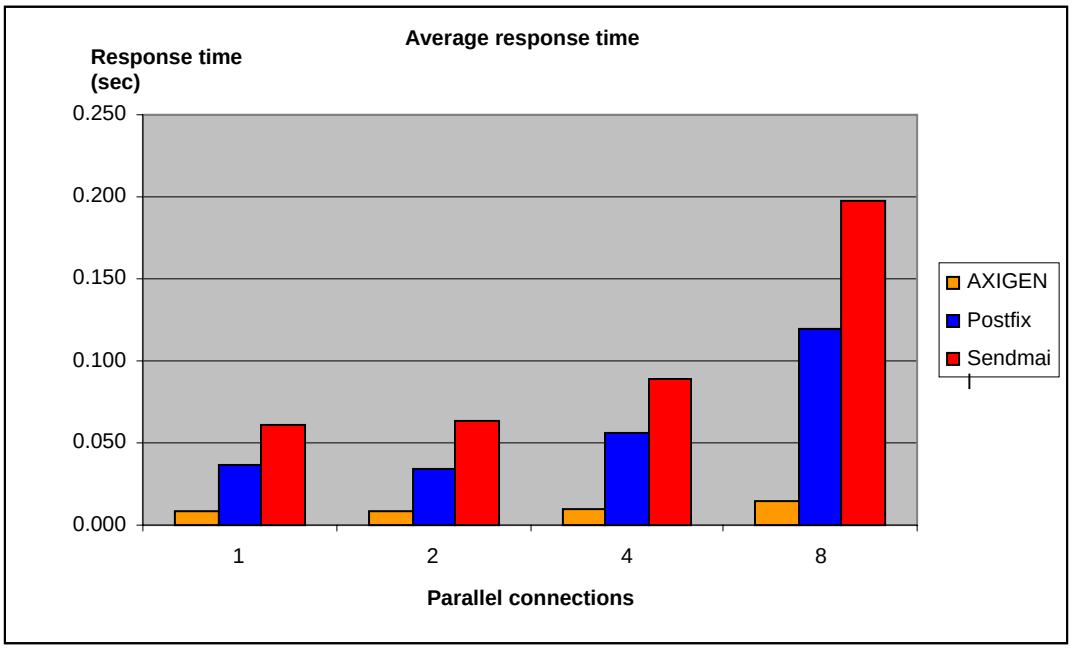


Parallel connections	Axigen		Postfix		Sendmail	
	Accepted	Delivered	Accepted	Delivered	Accepted	Delivered
1	117.32	117.21	24.97	25.01	14.81	14.33
2	212.24	212.21	53.57	53.59	28.15	27.91
4	349.85	349.79	64.44	64.45	40.59	40.43
8	472.22	472.14	60.58	60.59	36.42	36.26

Unlike the previous scenario, all three tested solutions maintain a very good balance between the accepted and delivered number of messages, not causing queue overload issues. We see that, Sendmail as well as Postfix, although their performance increases proportionally with the number of parallel connections, reach a maximum performance level between 4 and 8 parallel connections and even show a slight decrease (probably caused by the server overload).

The performance of Postfix is two times better than Sendmail's. However, AXIGEN's performance is far superior reaching in this scenario a level 7 times better than Postfix and 13 times better than Sendmail. If in the first scenario the processing speed is a critical factor only in peak traffic moments, in the case of Internet Service Providers mail server performance is a critical factor. Solution performance translates into efficient usage of hardware resources; thus, double the performance means half the number of necessary servers.

We further analyzed the average response time for the three solutions in the same scenario.



The server response time can employed to efficiently measure the overload for the server the solution runs on. Our results show that the response time increases when the number of parallel connections is higher in the case of all three solutions; AXIGEN reports a rather small response time increase, while Sendmail and Postfix show dramatic growth, especially when switching from 4 to 8 parallel connections. This phenomenon also affects the overall solutions performance (the number of processed messages per second), as previously shown in the above graphic analysis.

Testing Platforms

Hardware		
	CPU	Intel Xeon (Dual Core) 1.86 GHz, 2Mb cache
	Mem	2 GB RAM
	IO	SATA2 7200RPM 16Mb cache
Operating system		
	Kernel	2.6.9-42.EL SMP i686
	Distribution	CentOS 4.4
	Configuration	Default
Software		
	All used packages are from the standard distribution	
	AXIGEN	AXIGEN 5.0.0, I/O disabled sync, default configuration (with disabled TCP limitations)
	Sendmail	Sendmail 8.13.1-3.RHEL4.5, Dovecot 0.99.11-8.EL4, default configuration
	Postfix	Postfix 2.2.10-1.1.el4, Cyrus 2.2.12-8.1.RHEL4, default configuration

Conclusions

When choosing a messaging solution, it's critically important to take into account the average estimated traffic, the maximum load and the expected response time. Even though open source solutions (Postfix and Sendmail) ensure a reasonable performance for a low traffic level, an integrated (commercial) solution features a much higher performance when handling extreme requests, while optimizing hardware resources usage and diminishing peak traffic downtime.

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