Performance Parameters And Special Features For Enterprise Intra Mail Management System

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Abstract— In this paper performance parameters and special features for enterprise intra mail management system is presented. The enterprise intra mail management system considered is a quasi-online and offline mail delivery, mail documentation and tracking system. Essentially, the system uses online software platform to enhance accessibility and ease of tracking mails. At the same time it uses offline hardcopy documentation to ensure compatibility with the legacy systems employed in the organisation. Specially, the various performance parameters considered in this paper are the arrival time, the arrival rate and the response time. The procedure for capturing the various data items that can be used to determine the parameter values are presented along with the analytical formulas and in some cases detailed algorithms for implementing the parameter value determination are presented. The special features discussed include management of timed-response mail such as query, request for explanation, committee report, call notice, timetable, panel meeting, board meeting, management of backup electronic file copy and backup hard copy file folder, management of closed file and closed file folders, management of retrieved mails, management of mail follow-up activities and lost mail management. Detail discussion of the procedure for special features and in some cases detailed implementation algorithms are presented for each of the special features.

Keywords— Response Time, Performance Parameters, Arrival Rate, Enterprise Intra Mail Management System, Lost Mail, Closed File Folder

1. Introduction

As the adoption of smart technologies increases across the globe, organisations are expected to upgrade their various operational procedures to align with the emerging technologies [1,2, 3,4, 5, 6, 7,8, 9,10]. One of such areas that require urgent attention in many organisation in the developing countries is their mail management system [11,12,13,14,15,16,17,18]. Although there are several off the shelf mail management systems, majority of the organisations in the developing countries are still adopting the manual method which affects productivity and causes much waste of man-hour. In some cases, the organisation adopts quasi automated mail management system whereby a parallel computerised online and manual offline versions of the mail management system are operated at the same time. The online computerised version helps in expediting mail delivery and tracking while the manual version help to synchronise with other legacy systems that are still adopted in the organisation [18,20,21,22,23,24].

Specifically, in the paper, the focus is on the development procedure and analytical models that can be used to determine some system performance parameter values. The procedure specifies the data items required and the approach that will be used to capture those data items as well as the mathematical expressions that will be used to determine the values of the parameters based on the data items captured from the system. The various performance parameters considered in this paper are the arrival time, the arrival rate and the response time.

In addition, another major focus of the paper is discussion of some special features of the quasi enterprise intra mail management system and development of mechanisms that can be used to implement those special features. The special features discussed include management of timed-response mail such as query, request for explanation, committee report, call notice, timetable, panel meeting, board meeting, management of backup electronic file copy and backup hard copy file folder, management of closed file and closed file folders, management of retrieved mails, management of mail follow-up activities and lost mail management. Detail discussion of the procedure for special features and in some cases detailed implementation algorithms are presented for each of the special features.

In all, the ideas presented in this paper are meant to help institutions that are adopting some forms of automated mail management system to include relevant performance parameters and special features that will make the system more robust and more relevant maximizing the productivity of the organisation.

2. Methodology

In this paper two major issues are considered, first some performance parameters are discussed and then some special features of the enterprise intra mail management system are also presented.

2.1 The Performance Parameters

In order to determine productivity and determine other performance measure in a system, certain data items need to be collected and certain formulas and procedures need to be used determine the values of certain parameters. In this paper, the various parameters considered are the arrival time, the arrival rate and the response time. Other parameters can be computed from the knowledge of these basic parameters.

2.1.1 Arrival time

The arrival time is the mail received time as recorded on the mail receive log book and the online database. In this paper, the online database is used for the analysis. As such the offline logbook record is expected to the same with the online arrival time entry. In essence, the mail arrival time as captured on the online record is recorded on the offline logbook. Each day has a flag (Wf) to indicate if it is a working day or not. The format of the arrival time includes the date and time as follows;

Arrival Date (ARDat) format: Year, Month, Day, Wf

Arrival Time (ARTm) format: Hour using 0-23 hour and minute format

Table : The table indicating the detailed mail arrival date and time record

Mail Tracking Number	Year	Month	Day, Number (1 to 31)	Day Name [Monday to Sunday]	Wf flag (Wf = 1 for non-working day and Wf = 0 for working day)	Time: Hour (By 0 -23 hour)	Time : Minute (0 - 60 min)

2.1.2 Rate of arrival and visualization of arrival per hour, per day , per week, per month, per year

The rate of arrival of mails is given as the number of mails that arrived per unit time. The Number of mails is determined by first setting the range of time the mails are considered. That means, a beginning time (**BegTime**) and ending time (**EndTime**) are selected, then, the number of mails (NoMBTmETm) that arrived within this time are determined. Next the time unit is selected which can be Hour, Day, Week, Month or Year. The number of the selected time units (NoTuBTmETM) that occurred between the beginning time (**BegTime**) and ending time (**EndTime**) are determined. Hence, the arrival time (ArTBTmETM) is defined as;

$$ArTBTmETM = \frac{NoMBTmETm}{NoTuBTmETM} \quad (1)$$

The unit is mails/time unit selected. The beginning time (**BegTime**) and ending time (**EndTime**) are specified according to the format of the arrival time.

i. Number of mails received in hours, days, weeks, months, years , etc within a given time frame between BegTime to EndTime

ii. Number of hours, days, weeks, months , years in a given time frame between BegTime to EndTime

The procedure for computing the arrival rate requires that there is a table of all the mails log with the arrival date (ARDat) and arrival time (ARTm) of each mail. Then, the procedure for computing the arrival rate is as follows;

The procedure for computing the arrival rate

Algorithm 1 The procedure for computing the arrival rate

1: Set the value of BegTime and EndTime *// Set the period under consideration by specifying Beginning time (BegTime) and Ending time (EndTime)*

2: Set the value of TU *// Set the time unit (TU) which can be Hour, Day, Week, Month or Year;*

3: Determine NoMBTmETm *// Determine from the table the number of mails (NoMBTmETm) that arrived within BegTime and EndTime*

4: Determine NoTuBTmETM *// Determine from the table the number of the selected time units (NoTuBTmETM) that occurred between the beginning time (BegTime) and ending time (EndTime)*

5: Compute ArTBTmETM *// Compute the arrival time (ArTBTmETM) using Equation 1 with unit as mail/TU*

The sample table showing the data that is generated and used to compute the arrival rate in mails/hour is shown in Table 2. The content of Table 2 is the number of mails received in a given hour between BegTime to EndTime. Based on Table 2, the total number of mails received in hours between BegTime to EndTime and the total number of hours between BegTime to EndTime are determined from which the mail arrival rate in mails/hour is determined.

Table 2 : Number of mails received in a given hour between BegTime to EndTime

S/N	Mail Tracking Number	Year	Month	Day, Number	Day Name	Wf flag 0 or 1	Time: Hour (By 0 -23 hour)	Time : Minute (0 -60 min)
1								
2								
3								
n								
NMyr: No. of mails in the years between BegTime and EndTime	**Nyr: No. of years between BegTime and EndTime**		**Arrival Rate Yr = NMyr/ Nyr mails per year**					
NMmnt: No. of mails in the months between BegTime and EndTime	**Nmnt: No. of months between BegTime and EndTime**		**Arrival Rate Mnt = NMmnt / Nmnt mails per month**					
NMwk: No. of mails in the weeks between BegTime and EndTime	**Nwk: No. of weeks between BegTime and EndTime**		**Arrival Rate WK = NMwk / Nwk mails per week**					
NMdy: No. of mails in the days between BegTime and EndTime	**Ndy: No. of days between BegTime and EndTime**		**Arrival Rate day = NMdy / Ndy mails per day**					
NMhr: No. of mails in the hours between BegTime and EndTime	**Nhr: No. of hours between BegTime and EndTime**		**Arrival Rate hour = NMhr / Nhr mails per hour**					
NMdyx(X): No. of mails in the Xth (Mon,Tue, Wed, Thu, Fri,Sat,Sun) day in a week between BegTime and EndTime, where X =1,2,3,4,5,6,7	**Ndyx(X): No. of Xth day between BegTime and EndTime, where X =1,2,3,4,5,6,7**		**Arrival Rate day(x) = NMdy(x) / Ndy (x) mails per day (X)**					
NMhrk(K): No. of mails in the Kth hour between BegTime and EndTime, where k =0,1,2,…, 23	**Nhrk(K): No. of Kth hour between BegTime and EndTime, where k =0,1,2,…, 23**		**Arrival Rate hour (k) = NMhr(k) / Nhr(k) mails per hour(k)**					

Note, Table 2 is prepared for the version that include the non-working hours, weekends and holidays while a second version is prepared for the version that exclude the non-working hours, weekends and holidays.

2.1.3 The response time

The response time is computed not with respect to the time action began on the mail but with respect to the time the mandatory entry on the online platform is made. So, the response time is the time between two consecutive entries on the online platform for a particular mail (with a particular mail tracking number). Hence, when the entry is not made on the online platform the response time increases indefinitely. Also, each mail has its response time and there is average response time computed with respect to mails with entries within a time range. In this wise, the response time of mails without a follow-up entry on the platform can make the response time to be very high unless the last entry is marked as terminal entry in which case the issue raised in the mail is considered to have been handled. In addition, apart from 'terminal point', a mail can also be marked 'keep in view', or 'under processing'. In such cases, the response time computation will stop at the point such entries are made for a mail on the online platform. In this wise a terminal point flag (TPF) is set to zero when the entry is not a 'terminal point', 'keep in view', or 'under processing' otherwise the TPF is set to 1 which stops further computation of response time for the mail after this point. When the mail resurfaces in the system, a fresh response time computation chart is started. This will circumvent response time running to infinity for already treated mails or discarded mails.

In any case, response time can be computed as absolute response time, denoted as Rta which includes non-working hours. The Rta includes weekend, holidays, night and all non-working hours in the computation of the response time. On the other hand, the response time can be factual, denoted as Rtf which does not include non-working hours. The Rtf does not include weekend, holidays, night and all non-working hours in the computation of the response time. Hence, for Rtf, all the holidays and non-working hours are noted and removed from the response time computation.

In this paper, each mail processing unit will have entry for the mail as in-coming mail and the next record as out-going or treated mail. In this case, if a mail is not out-going then it can be marked treated with any of the following captions 'terminal point', 'keep in view', or 'under processing'. If x is used to mark the entry point to a mail processing unit, then ẍ is used to indicate the corresponding out-going or treated point in the same mail processing unit. As noted, the response time is the time between two consecutive entries on the online platform for a particular mail (with a particular mail tracking number). Suppose that the last entry 'x' for mail with tracking number TrNum occurred on date and time (denoted as TrNum (x)DaTm. Then, at the out-going or treated point which is ẍ point for the same mail which occurred on date and time (denoted as TrNum(ẍ)DaTm, the response time is simply TrNum(ẍ)DaTm − $TrNum\ (x)DaTm$. Hence;

$$Rta(TrNum(x)) = TrNum\ (ẍ)DaTm\ -\ TrNum\ (x)DaTm \quad (2)$$

Rtf(TrNum(x)) = TrNum (TrNum(ẍ)DaTm)DaTm - TrNum (x)DaTm – sum of none working hours between TrNum (TrNum(ẍ)DaTm)DaTm and TrNum (x)DaTm (3)

AvgRta(TrNum(x)) = Sum of AvgRta(TrNum(x)) / xmax (4)

AvgRtf(TrNum(x)) = Sum of AvgRtf(TrNum(x)) / xmax (5)

Procedure for the response times per mail with mail tracking number, MTracNo are computed as follows;

The procedure for computing the response times per mail with mail tracking number, MTracNo

Algorithm 2 The procedure for computing the response times per mail with mail tracking number, MTracNo
1: Read or get the mail tracking number, MTracNo.
2: Set initial entry count x =0
3: Set initial entry count x = x +1
4: Set maximum entry count xmax = x
5: Read the entry data and time for the xth entry as $TrNum\,(x)DaTm$
6: Read the corresponding out-going or treated point ẍ as $TrNum\,(ẍ)DaTm$
7: Compute $Rta(TrNum(x))$ where $$Rta(TrNum(x)) = TrNum\,(ẍ)DaTm\ -\ TrNum\,(x)DaTm$$
8: Compute Rtf(TrNum(x) where   Rtf(TrNum(x)) = TrNum (TrNum(ẍ)DaTm)DaTm - TrNum (x)DaTm – sum of none working hours between TrNum (TrNum(ẍ)DaTm)DaTm and TrNum (x)DaTm
9: If entry ẍ has TPF =0, then go to step 4 // that means entry x+1 if not 'terminal point', 'keep in view', or 'under processing'
10: Compute AvgRta(TrNum(x))   where   AvgRta(TrNum(x)) = Sum of AvgRta(TrNum(x)) / xmax
11: Compute AvgRta(TrNum(x))   where   AvgRtf(TrNum(x)) = Sum of AvgRtf(TrNum(x)) / xmax

Procedure for computing the response times for group of mails

The procedure for computing the response times for group of mails

Algorithm 3 The procedure for computing the response times for group of mails
1: Initialise mail counter z =0
2: Initialise AvgRta(TrNum(z)) = 0 // where AvgRta(TrNum(z)) is mail z average of absolute response time
3: Initialise AvgRtf(TrNum(z))= 0 // where AvgRta(TrNum(z)) is   mail z average of factual response time
4: Initialise GAvgRta(TrNum = 0 // where GAvgRta(TrNum(z)) is group mail average of absolute response time
5: Initialise GAvgRtf(TrNum = 0 // where GAvgRta(TrNum(z)) is group mail average of factual response time
6: Input Zmax   // maximum number of mails in the group
7: z = z +1
8: Read the mail tracking number, MTracNo.
9: Call up procedure for computing the response times per mail with mail tracking number, MTracNo
10: Read AvgRta(TrNum(z)) from the procedure called
11: Read AvgRtf(TrNum(z)) from the procedure called
12: GAvgRta(TrNum = GAvgRta(TrNum + AvgRta(TrNum(z))
13: GAvgRtf(TrNum = GAvgRtf(TrNum + AvgRtf(TrNum(z))
14: If z < zmax them go to step
15: GAvgRta(TrNum = GAvgRta(TrNum/ zmax
16: GAvgRtf(TrNum = GAvgRtf(TrNum / zmax

2.2 The special features of the enterprise intra mail management system

Some of the special features of the enterprise intra mail management system are presented in this section, The special features include management of timed-response mail such as query, request for explanation, committee report, call notice, timetable, panel meeting, board meeting, management of backup electronic file copy and backup hard copy file folder, management of closed file and closed file folders, management of retrieved mails, management of mail follow-up activities and lost mail management. Detail discussion and in some cases algorithms are presented for each of the special features.

2.2.1 Timed-response mail (query, request for explanation, committee report, call notice, timetable, panel meeting, board meeting, etc) mechanism (milestone, deadlines, notification, reminder)

Some mails require response and in some cases, the response is time bound. Such timed response

mails include query, request for explanation, committee report, call notice, input for timetable, board meeting reports, etc. In order to effectively handle such mails, some additional data items are required. Among the required data items are;

   i.   Mail tracking number
   ii.   Mail issue date
   iii.   Mail received or delivery date
   iv.   Required response date limit
   v.   Response flag ($mRF = 0$ if no response and $mRF = 1$ if there is response)
   vi.   Mail response date
   vii.   Mail response tracking number
   viii.   Follow-up activities ad dates

The data items will enable effective follow-up of such timed-response mails to ensure that the required response is obtained within the time limit specified. The required response date limit and the response flag can be used to set reminder alerts to the officers concerned with follow-up and the ones concerned with responding to the mail. The follow-up activities performed are recorded so that in case the response is not submitted within the time limit, the follow-up officers will have evidence to show that the fault is not from him. The procedure for utilizing the timed-response mail mechanism is presented as follows:

The procedure for utilizing the timed-response mail mechanism

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Algorithm 4 The procedure for utilizing the timed-response mail mechanism

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1: Get the mail tracking number
2: Get the mail issue date
3: Get the mail received or delivery date
4: Get the mail required response date limit
5: Get the mail response flag ($mRF = 0$ if no response and $mRF = 1$ if there is response)
6: Set the reminder alert schedule (time table for series of follow-up reminder alert)
7: While $mRF = 0$ do // Reminder while loop
8: If reminder alert schedule time is reached then send reminder alert and save same on the follow-up activity chart
9: If the response time limit is exceeded then send limit exceeded alert and abort the reminder while loop
10: Repeat while loop // repeat reminder while loop

2.2.2   File copy option and notifications

File copy ensures that a copy of the mail retained in softcopy and in hard copy or in any one of the two options. The ensures that a mail document can be recovered and reproduced and can also be reference and attached in other mails. The electronic file copy (e-copy) is a scanned copy of the entire mail document while the hard copy (h-copy) is a photocopy or duplicate copy of the entire mail document.

For each mail the e-copy flag (denoted as eCF) and h-copy flag (denoted as hCF) are **used** to indicate is such file copy is present or absent.

In each mail processing unit a file copy is expected to be kept. The **following** data items are required to manage the file copy which can be e-copy or h-copy or both.

The procedure for generating and managing the mail file copies (both e-copy and h-copy)

Algorithm 5 The procedure for generating and managing the mail file copies (both e-copy or h-copy)

1: Set the file e-copy flags eCF is set to 0 if there is no e-copy and 1 if there is e-copy and eCF
2: Set the file h-copy flags hCF is set to 0 if there is no h-copy and 1 if there is h-copy and hCF
3: Input the file copy (e-copy or h-copy) Index Name (which is the folder name where the file is stored)
4: Input the file copy (e-copy or h-copy) number (the unique folder number in the mail management system)
5: Input the file copy (e-copy or h-copy) date
6: Input the file copy (e-copy or h-copy) time
7: Put the e-copy or h-copy on the respective files

2.2.3   Closed file folder mechanism

At some point, some hardcopy file folders are closed. In a similar way some e-copy file folders may be archived or removed from the online database to an offline backup storage. In such cases, the file folders are considered to be closed.

The procedure for generating and managing the closed file folders requires that the mails that are included in the closed file folders are properly documented and the name of the closed file folders and their contents are also properly documented.

The procedure for generating and managing the closed file folders

Algorithm 6 The procedure for generating and managing the closed file folders
1: The cut-off date for closed file folder entry is selected
2: Eligible mails for closed file folder are evaluated by their date of last activity including latest submission date, latest citation of mail by other mails, latest date of filing in the e-copy or h-copy or both)
3: The eligible mails for the closed file folder will have their closed file flag (cFF) set to 1 for closed file otherwise the cFF is set to 0.
4: The closed file folder tracking data items are created and it include name and number
5: The eligible mails for the closed file folder with cFF =1 are extracted from the database and the closed file folder tracking data items are included on the mails closed fil folder details
6: The closed files are withdrawn and put in the created closed file folder and put away to closed file folder archive (both the hardcopy and the e-copy file folders)

2.2.4   Retrieval of mail

Sometimes, mail that is submitted is withdrawn (after it has MTrackNum). If the mail does not have MTrackNum, it can be withdrawn without any trace in the system. However, if a mail already has a tracking number only the admin of the online platform can retrieve the mail. When a mail is retrieved, every record about the mail is archived and the online record for the mail will read 'retracted'. However, if the university management so wishes, the entire record about the mail can be completely deleted from the system. Such permanent and total removal of mail records require the approval of the university management.

2.2.5   Mail follow-up activity management

Mail Follow-up activities (personal visit, calls, reminder, whatsapp, email, SMS,)
Tracking mail follow-up activities can be very useful.
 While a response is awaited in respect of a mail, some follow-up activities can be carried out. The system presented in this paper requires that such follow-up activities should be captured and stored I the system using some data attributes associated with the mail, the follow-up activities and the persons involved in the follow-up activities. Notably, the follow-up activities can include but not limited to;

    i.   Follow-up visit
    ii.   Phone call
    iii.   Email message
    iv.   WhatsApp message
    v.   Twitter message
    vi.   Reminder mails

Each follow-up activity the following data items are recorded

    i.   Mail tracking number, MTrackNum the follow-up is associated with
    ii.   Follow-up activity name
    iii.   Follow-up activity number
    iv.   Follow-up activity date and time
    v.   Follow-up activity source or contact person name, phone number, email
    vi.   Follow-up activity respondent or contacted person name, phone number, email
    vii.   Follow-up activity content detail
    viii.   Follow-up activity response detail

2.2.6   Lost mail management mechanism

In order to avoid lost mail, each mail processing point is expected to get delivery acknowledgement for every mail it dispatches to anther mail processing point. Getting the mail delivery acknowledgement is the responsibility of the mail processing point which delivered the mail. As such, unacknowledged mail is traced to the mail processing point the last handled the mail without any further delivery acknowledgement of the mail from any other mail processing point.

In order to implement the lost mail management mechanism, every Mail Processing Point (Mail_Proc_Pnt) has Mail Processing Point Source Code (Mail_Proc_Pnt_SourCode) and Mail Processing Point Destination Code (Mail_Proc_Pnt_DestCode). There is also the mail delivery flag (mDF) and mail received flag (mRF) where the mRF is the acknowledgement flag. So, upon delivery of a mail with Mail Processing Point Source Code (Mail_Proc_Pnt_SourCode) and Mail Processing Point Destination Code (Mail_Proc_Pnt_DestCode), the source of the mail sets the mDF to '1' and this flag appears on the Mail Processing Destination point dashboard as incoming mail. The Mail Processing Destination Point (Mail_Proc_Dest_Pnt) must acknowledge or query the flag within a specified time frame otherwise it will be taken that the Mail_Proc_Dest_Pnt received the mail but refused to acknowledge it. Also, if the Mail Processing Source Point (Mail_Proc_Sour_Pnt) did not get acknowledgement of the delivered mail within the specified time frame, the Mail_Proc_Sour_Pnt should send a reminder for acknowledgement and then wait for a specified time frame. If the mail is not acknowledged at the end of the reminder time period, then the Mail_Proc_Sour_Pnt can notify the system admin of the failure of the Mail_Proc_Dest_Pnt to acknowledge receipt of certain mail delivered to it.

3. Conclusion

Some metrics for assessment of the activities and performance of the stakeholders for enterprise intra mail management system is presented. In addition some special features are discussed. The key metrics discussed are mail arrival time, mail arrival rate and response time. The specific definition of each of the metrics is presented as it applies to the enterprise intra mail management system. Also, the formula and procedure for determining the value of each of the metric are presented.

In addition, management of timed-response mail such as query, request for explanation, committee report, call notice, timetable, panel meeting, board meeting, management of backup electronic file copy and backup hard copy file folder, management of closed file and closed file folders, management of retrieved mails, management of mail follow-up activities and lost mail management. Detail discussion and in some cases algorithms are presented for each of the special features. The objective achieved in this paper is therefore the presentation of useful ideas can be used in measuring and evaluating activities and performances in enterprise intra mail management system as well as presentation of mechanism that can be used to handle some special issues that are prevalent in many enterprise intra mail management system.

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