Use of facilities in an EBX 8000 PABX

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Summary

A survey is presented of traffic measurements made in the Telefonhus PABX of KTAS, Copenhagen. The use of several subscriber facilities, on which measurements were also made, is evaluated. Some services such as enquiry, automatic ring-back and follow-me are in great demand while others must still gain in popularity.

1 KTAS' telephone exchange

In July, 1976, a new processor controlled PABX of the type EBX 8000 was inaugurated in the offices of the Copenhagen Telephone Company. Direct dialling-in to the extensions was added to the exchange one year later.
KTAS provides telephone service on the Danish islands of Sealand, Lolland, Falster and Bornholm. There are now about 1.1 million subscribers in the area, and KTAS's main offices employ about 2000 persons, many of them in direct customer-related functions, such as receiving orders for new installations, etc.
The EBX 8000 [1] is of the processor-controlled type with reed contacts as switching elements. Processor control implies that a series of new PABX facilities can be im-

Fig. 1. Operators positions at the Telefonhus PABX

plemented as software routines, without the addition of hardware.
KTAS has standardized on this type of PABX, which could be offered at about the same price as conventional exchanges of the same capacity, which do not offer the new facilities.

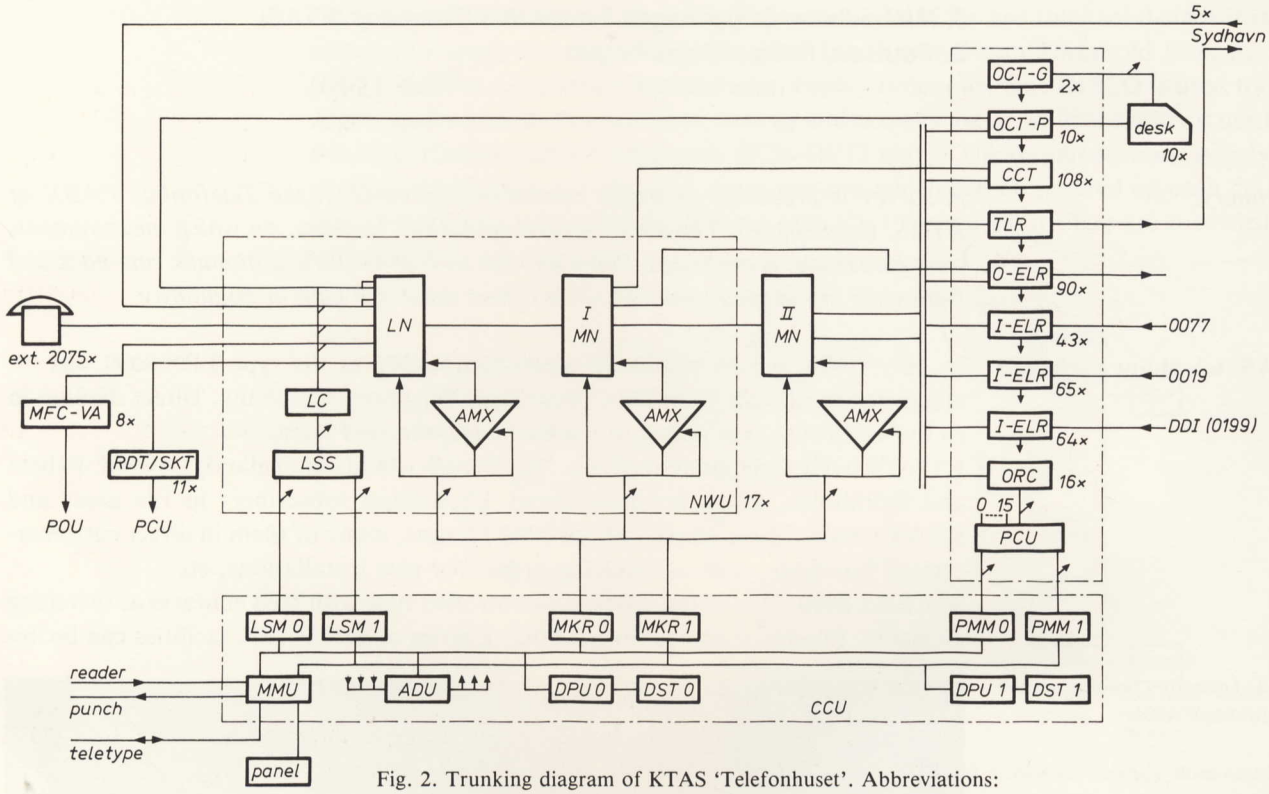


Fig. 2. Trunking diagram of KTAS 'Telefonhuset'. Abbreviations:

AMX = access matrix
CCT = connecting circuit
CCU = common control unit
DPU = data processing unit
DRC = digit receiver
DST = data store
ELR = exchange line circuit
I-ELR incoming; *O-* outgoing
LN = line network
LSM = line state memory
MFC = multifrequency code
MKR = marker
MMU = man-machine unit
MN = mixing network
NWU = network unit
OCT = operator's circuit
PCC = peripheral control unit
PMM = peripheral message multiplier
RDT = dial tone receiver
SKT = keytone sender
TLR = tie-line circuit

The trunking diagram is shown in Fig. 2 which indicates the number of traffic circuits.
On this diagram the 2075 extensions are shown on the left, where the operators (*OCT-P*), the MFC receivers for direct dialling in, the keytone senders (*RDT/SKT*) and the incoming tie-lines from the PABX in the subsidiary at Sydhavn are also connected.
On the right are shown 10 operator positions, 108 connecting circuits (*CCT*) for internal connections, 6 tie-lines (*TLR*) for outgoing connections to Sydhavn, 90 outgoing exchange lines (*O-ELR*), 172 incoming exchange lines (*I-ELR*) in three bundles and 16 digit receivers (*DRC*).
The incoming traffic is split up into the direct dialling-in bundle, called with (01)99*xxxx*, just as if the extensions were subscribers of a public exchange, and the

assisted bundles, called by dialling the special service numbers 0019 (for KTAS's administration) and 0077 (for the ordering offices).
It is characteristic for EBX 8000 that the switching network (*LN, IMN* and *IIMN*) is not only used for speech connections, but also for connections during call set-up, such as extension to *DRC, RDT/SKT* to *O-ELR, I-ELR* to *OCT-P* or to MFC-receiver, etc.

2 New facilities

1

In addition to the usual PABX functions such as enquiry and automatic transfer, EBX 8000 offers a series of new facilities as well as improvements of the older ones. The EBX 8000 installed in the KTAS offices features as a standard the following extension facilities:

- add-on conference (three-party conference)
- automatic call forwarding (in case of no answer) for 5% of the extensions
- automatic ring-back on internal calls (as soon as called party comes free) for a simultaneous number equal to 2% of the extensions
- follow-me for a simultaneous number equal to 5% of the extensions
- chief-secretary combinations for 5% of the extensions. This facility implies abbreviated dialling between chief and secretary, automatic call forwarding to secretary if chief is busy, absent marking of chief so all calls go to the secretary, and mutual priority
- analysis of outgoing calls for trunk barring
- abbreviated dialling to 50 external directions
- keytone equipment and translation of keytone to dial pulses and vice versa
- group hunting for 8% of the extensions, with 2% of directory numbers used as call number
- hot line for 1% of the extensions.

In the KTAS Telefonhus exchange, which now has 2075 directory numbers (2176 extension positions), the above facilities have been extended by:

- automatic call forwarding, 360 possible, 346 in use
- chief-secretary, 176 possible, 144 used
- group hunting: 128 call numbers, 96 used; 592 extensions, 500 used.

The staff has been instructed in the use of the new facilities through descriptions in the telephone directory, but no special training was implemented except for members of the larger group hunting groups.

3 Traffic measuring programs

A standard set of measuring programs is supplied with each PABX to be read in as required. The measuring programs comprise both traffic measurements and call state counts.
The traffic measurement program can scan up to 60 targets with various intervals. A target consists of a group of traffic circuits, individual operators, a switching module, single links and single extensions. The call state counting program can count the number of seizures of the traffic circuit groups and answers to incoming line traffic. In addition, a number of counters can register the use of those facilities programmed by the users. The use of the firmly programmed facilities cannot be measured (automatic call forwarding, abbreviated dialling, etc.).
KTAS runs traffic measurements at the Telefonhus exchange on a regular basis every four weeks. An example of an hourly printout from the EBX is shown in Fig. 3. There, the first lines show the call state counting. Target 0100 is incoming calls, where on route 0016 — the DDI route — a total of 2128 incoming calls have

Fig. 3. Printout by EBX 8000 of traffic metering programs

```
EBX 8000-0019
*CALL STATE AND FACILITY COUNTING*

1111100      0001   0078   0008   0021
0007  0000   0010   0001

TARG  ROUT   GRP    RESULT
```

0100	0010		00002593	0019 route
0100	0011		00000022	outgoing route
0100	0012		00000595	0077 route
0100	0016		00002128	DDI route
0100	0002		00000000	internal route
0101	0010		00000000	
0101	0011		00000010	
0101	0012		00000000	
0101	0016		00000000	
0101	0002		00000000	
0102	0010		00000000	outgoing exch. lines
0102	0011		00004755	
0102	0012		00000000	
0102	0016		00000000	
0102	0002		00002909	int. conn. circuits
0103	0010		00000000	
0103	0011		00000000	
0103	0012		00000000	
0103	0016		00000000	
0103	0002		00000000	
0104	0010		00000000	
0104	0011		00000000	
0104	0012		00000000	
0104	0016		00000000	
0104	0002		00000000	
0105	0010		00002036	
0105	0011		00000000	
0105	0012		00000470	
0105	0016		00001472	auto-transfer
0105	0002		00000000	add-on conference
0200			00000184	priority calls
0201			00000000	chief calls secretary
0202			00000062	secretary calls chief
0203			00000004	chief absent
0204			00000028	secretary absent
0205			00000006	automatic ring-back
0206			00000002	follow-me
0207			00000036	present in hunting group
0208			00000037	night extension absent
0209			00000230	common answering night
0210			00000000	hot-line call
0211			00000000	enquiry
0212			00000000	congestion in memory pools for dialled digits
0213			00000466	congestion in memory pools for aut. ring-back
0214			00000000	congestion in memory pools for follow-me
0215			00000000	
0216			00000000	

incoming calls

outgoing operator's calls (assisted calls)

seizures

congestions

outgoing answered calls (not counted, no answer signal)

incoming answered calls

```
EBX 8000-0019
*TRAFFIC DENSITY RECORDING*

1111100      0001   0002   0078   0008   0021
0007  0000   0010   0001   0500

TARG  TYPE   NUMB   BGIN   END    INS    RESULT
```

0001	0010				0068	00017091
0001	0011				0086	00017490
0001	0012				0040	00005353
0001	0013				0005	00000084
0001	0016				0064	00007387
0003	0002	0000			0024	00001697
0003	0002	0001			0024	00001772
0003	0002	0002			0024	00001374
0003	0002	0003			0026	00001438
0003	0002	0004			0010	00000124
0005	0003				0011	00000832
0002	0000				0016	00001644

0019 route
outgoing route
0077 route
tieline to Sydhavn
DDI route

internal traffic in 500-group 0 to 4

RDT/SKT, keytone senders
DRC, digit receivers

been counted. Target 0105 is answered calls, and it is seen for route 0016 that 1472 were answered. A substantial part of the difference is due to the rejection of calls to busy extensions.

Targets 0200 to 0213 are facilities. 0213 is e.g. enquiry calls, which took place 466 times.

At the bottom the traffic metering is shown. It is done by counting busy circuits at regular intervals, giving e.g. 7387 counts for route 16. In line 2, 0500 is the number of intervals, i.e. the average traffic was 14.8 Erlang on route 16. *'INS'* shows that 64 circuits were in service on this route.

The average conversation time — assuming it to be negligible for non-answered

Fig. 4. Printout of processed traffic data from EBX 8000 (as listed in Fig. 3)

K.T.A.S.
TRAFIKVEJSKONTORET TT
26/ 9- 78

TRAFIKSTATISTIK PA TELEFONHUSCENTRALEN 0019
I PERIODEN 21/ 8-78 TIL 25/ 8-78

VIA NR.	VIA-NAVN	MANDAG KL. - KL.	LEDN.I DRIFT	MÅLT TRAFIK	ANKOMM. ELL.LOK. OPKALD	BESVARET AF LOK.NR.	AFGÆENDE OPKALD	AFG.OPK. FRA OB.	INTERN SPÆRRING	BELÆGN. TID
			ANTAL	ERLANG I	ANTAL					I--SEK.-I
10	0019 TLFHUS	7.00- 8.00	68	5.02	135	122	0	0	0	148.13
		8.00- 9.00	68	23.31	451	302	0	0	0	277.87
		9.00-10.00	68	48.58	685	524	0	0	0	333.76
		10.00-11.00	68	49.51	721	591	0	0	0	301.58
		11.00-12.00	68	44.49	601	497	0	0	0	322.26
		12.00-13.00	68	39.06	633	515	0	0	0	273.04
		13.00-14.00	68	41.96	647	543	0	0	0	278.19
		14.00-15.00	68	41.44	614	483	0	0	0	308.87
		15.00-16.00	68	33.44	515	435	0	0	0	276.74
		16.00-17.00	68	2.09	93	22	0	0	0	342.00
10	0019 TLFHUS	7.00-17.00	68	328.90	5095	4034	0	0	0	293.52
11	AFGÆENDE	7.00- 8.00	86	5.91	4	0	247	0	0	86.14
		8.00- 9.00	86	26.07	3	0	682	0	0	137.61
		9.00-10.00	86	47.74	3	0	1346	2	0	127.50
		10.00-11.00	86	47.95	6	0	1372	7	0	125.18
		11.00-12.00	86	47.23	6	0	1108	1	0	153.32
		12.00-13.00	86	42.60	1	0	1100	2	0	139.17
		13.00-14.00	86	43.07	3	0	1067	1	0	145.18
		14.00-15.00	86	43.84	3	0	1031	9	0	151.75
		15.00-16.00	86	42.18	3	0	1182	6	0	127.82
		16.00-17.00	86	12.29	3	0	332	4	0	131.68
11	AFGÆENDE	7.00-17.00	86	358.88	35	0	9467	32	0	136.47
12	0077 TLF.REST.	7.00- 8.00	40	0.	0	0	0	0	0	0.
		8.00- 9.00	40	4.50	78	57	0	0	0	284.21
		9.00-10.00	40	17.51	176	139	0	0	0	453.50
		10.00-11.00	40	16.83	178	143	0	0	0	423.69
		11.00-12.00	40	14.69	163	131	0	0	0	403.69
		12.00-13.00	40	15.49	156	141	0	0	0	395.49
		13.00-14.00	40	12.61	126	108	0	0	0	420.33
		14.00-15.00	40	11.08	117	91	0	0	0	438.33
		15.00-16.00	40	11.51	132	95	0	0	0	436.17
		16.00-17.00	40	0.24	0	0	0	0	0	864.00
12	0077 TLF.REST.	7.00-17.00	40	104.46	1126	905	0	0	0	415.53
16	0199 TLFHUS	7.00- 8.00	64	7.13	279	196	0	0	0	130.96
		8.00- 9.00	64	13.13	361	277	0	0	0	170.64
		9.00-10.00	64	19.95	586	394	0	0	0	182.28
		10.00-11.00	64	21.53	537	364	0	0	0	212.93
		11.00-12.00	64	12.13	365	241	0	0	0	181.20
		12.00-13.00	64	18.47	550	386	0	0	0	172.26
		13.00-14.00	64	17.26	461	346	0	0	0	179.58
		14.00-15.00	64	19.56	625	417	0	0	0	168.86
		15.00-16.00	64	17.37	535	377	0	0	0	165.87
		16.00-17.00	64	1.39	70	38	0	0	0	130.74
16	0199 TLFHUS	7.00-17.00	64	147.91	4369	3036	0	0	0	175.39
2	LOKAL	7.00- 8.00	108	1.82	0	0	77	0	0	85.09
		8.00- 9.00	108	8.60	0	0	487	0	0	63.57
		9.00-10.00	108	18.61	0	0	824	0	0	81.31
		10.00-11.00	108	18.84	0	0	760	0	0	89.24
		11.00-12.00	108	16.18	0	0	761	0	0	76.54
		12.00-13.00	108	14.55	0	0	627	0	0	83.54
		13.00-14.00	108	16.24	0	0	664	0	0	88.05
		14.00-15.00	108	19.32	0	0	749	0	0	92.86
		15.00-16.00	108	12.37	0	0	575	0	0	77.45
		16.00-17.00	108	1.28	0	0	84	0	0	54.86
2	LOKAL	7.00-17.00	108	127.81	0	0	5608	0	0	82.05

TARG NR.	ORGAN TYPE	MANDAG KL. - KL.	ANTAL ORGANER	MÅLT TRAFIK
2	DCR	7.00-17.00	16	32.27
3	CCT GR.0	7.00-17.00	24	32.08
3	CCT GR.1	7.00-17.00	24	36.49
3	CCT GR.2	7.00-17.00	24	25.85
3	CCT GR.3	7.00-17.00	26	29.81
3	CCT GR.4	7.00-17.00	10	3.58
5	RDT/SKT	7.00-17.00	11	16.39

calls — is 7387 : 1472 = 5 counting intervals. In line 1, 0002 indicates a counting interval of 36 seconds, i.e. 180 seconds average conversation time.
Similarly for route 10 (0019), one gets an average conversation time of (17091 : 2036) × 36 = 302 seconds.
The measuring results are accumulated and printed every hour (or every fifteen minutes). However, the traffic office of KTAS is interested in traffic values per hour and not accumulated values, and therefore it has written a calculation program, run via the KTAS time sharing service. The paper tape from EBX is read in and the traffic measurement's results are printed out in a summarizing format (Fig. 4).
The output is divided per route and per hour for each route. Then, traffic, call states and average conversation time are calculated in each line.
The sum of the traffic values over each day indicates the average traffic. With 10 hours measuring, these values are in deci-Erlangs. Likewise the small table shows the traffic in deci-Erlangs for digit receivers, local calls in the 5 groups of the exchange (4 of 500 extensions, 1 of 125 extensions) and on the senders for keytone signals to the external lines.
Similarly a program has been made for evaluating the use of the facilities for each hour. A typical output is shown in Fig. 5.

Fig. 5. Processed facility counting of EBX 8000 (as listed in Fig. 3)

K.T.A.S.
TRAFIKVEJSKONTORET TT
23/11- 78

TRAFIKSTATISTIK PA TELEFONHUSCENTRALEN 0019
I PERIODEN 23/10-78 TIL 27/10-78

TARGET: FACILITET:	200 TRANS-PORT	201 3-PART KONF.	202 PRÆFE-RENCE	203 CHEF I SEKR.	204 SEKR.I CHEF	205 CHEF FRAVÆR	206 SEKR. FRAVÆR	207 NOTE-RING	208 MED-FLYTN.	209 NÆRVÆR MARK.	210 NAT-KONC.	211 NAT-OMST.	212 HOT-LINE	213 TILB.K T.EXT.	214 SPÆR I CIFF.M	215 SPÆR I NOT.LG	216 SPÆR MFL.L
MANDAG KL.																	
7.00- 8.00	1	0	2	0	0	0	0	0	2	2	0	0	0	3	0	0	0
8.00- 9.00	32	0	21	0	2	1	0	5	8	73	0	0	0	75	0	0	0
9.00-10.00	42	0	14	1	1	4	0	10	8	51	0	0	0	113	0	0	0
10.00-11.00	50	0	13	1	7	1	1	15	3	78	0	0	0	140	0	0	0
11.00-12.00	38	0	10	0	3	0	0	11	20	77	0	0	0	150	0	0	0
12.00-13.00	52	0	5	1	1	4	0	9	12	72	0	0	0	124	0	0	0
13.00-14.00	58	0	3	1	11	1	0	9	17	64	0	0	0	142	0	0	0
14.00-15.00	50	0	18	0	4	1	0	10	7	62	0	0	0	127	0	0	0
15.00-16.00	38	0	22	1	6	2	0	4	6	47	0	0	0	127	0	0	0
16.00-17.00	0	0	0	0	0	2	0	0	2	2	0	0	0	3	0	0	0
7.00-17.00	361	0	108	5	35	16	1	73	85	528	0	0	0	1004	0	0	0
TIRSDAG KL.																	
7.00- 8.00	1	0	4	0	0	0	0	1	5	1	0	0	0	1	0	0	0
8.00- 9.00	42	0	2	0	3	2	0	8	6	85	0	0	0	70	0	0	0
9.00-10.00	55	0	4	0	3	1	0	11	7	64	0	0	0	124	0	0	0
10.00-11.00	51	0	25	0	4	1	1	10	10	59	0	0	0	122	0	0	0
11.00-12.00	30	0	16	0	2	2	1	8	21	57	0	0	0	112	0	0	0
12.00-13.00	34	0	23	0	3	1	0	7	8	64	0	0	0	117	0	0	0
13.00-14.00	53	0	24	1	8	0	0	13	12	62	0	0	0	131	0	0	0
14.00-15.00	46	0	12	0	3	2	0	9	6	48	0	0	0	138	0	0	0
15.00-16.00	46	0	18	0	7	2	0	11	5	51	0	0	0	123	0	0	0
16.00-17.00	2	0	1	0	3	0	0	3	3	3	0	0	0	4	0	0	0
7.00-17.00	360	0	129	1	36	11	2	81	83	494	0	0	0	942	0	0	0
ONSDAG KL.																	
7.00- 8.00	0	0	4	3	0	0	0	1	4	1	0	0	0	3	0	0	0
8.00- 9.00	29	0	32	1	5	2	0	7	5	69	0	0	0	55	0	0	0
9.00-10.00	44	2	13	4	0	1	1	12	12	48	0	0	0	123	0	0	0
10.00-11.00	56	0	25	1	6	0	0	14	8	52	0	0	0	189	0	0	0
11.00-12.00	40	0	16	1	3	3	1	9	12	60	0	0	0	121	0	0	0
12.00-13.00	50	0	7	1	6	2	0	5	19	71	0	0	0	104	0	0	0
13.00-14.00	54	0	9	0	13	1	0	8	17	56	0	0	0	125	0	0	0
14.00-15.00	47	1	14	2	4	1	0	13	7	49	0	0	0	113	0	0	0
15.00-16.00	44	0	15	1	5	2	0	17	6	33	0	0	0	110	0	0	0
16.00-17.00	4	0	1	0	0	0	0	2	0	0	0	0	0	5	0	0	0
7.00-17.00	368	3	136	14	42	12	2	88	90	439	0	0	0	948	0	0	0
TORSDAG KL.																	
7.00- 8.00	3	0	2	1	0	0	0	0	5	1	0	0	0	3	0	0	0
8.00- 9.00	29	0	2	0	8	2	0	3	8	72	0	0	0	45	0	0	0
9.00-10.00	39	0	8	1	8	0	0	13	16	42	0	0	0	86	0	0	0
10.00-11.00	45	0	32	1	5	0	0	10	6	47	0	0	0	128	0	0	0
11.00-12.00	50	0	17	0	3	1	1	4	10	56	0	0	0	108	0	0	0
12.00-13.00	43	0	18	0	3	1	0	13	2817	60	0	0	0	97	0	0	0
13.00-14.00	48	0	14	1	1	2	0	18	-2795	50	0	0	0	108	0	0	0
14.00-15.00	46	0	16	0	3	1	0	20	5	51	0	0	0	111	0	0	0
15.00-16.00	30	0	21	0	1	4	0	3	5	46	0	0	0	90	0	0	0
16.00-17.00	5	1	0	1	1	0	0	0	0	3	0	0	0	10	0	0	0
7.00-17.00	338	1	130	5	33	11	1	84	77	428	0	0	0	786	0	0	0
FREDAG KL.																	
7.00- 8.00	0	0	2	0	0	0	0	3	4	1	0	0	0	0	0	0	0
8.00- 9.00	22	0	5	0	0	0	0	3	9	60	0	0	0	39	0	0	0
9.00-10.00	46	0	9	0	2	4	0	9	14	47	0	0	0	96	0	0	0
10.00-11.00	38	0	13	1	0	0	0	8	11	44	0	0	0	105	0	0	0
11.00-12.00	39	1	13	1	5	3	0	6	18	45	0	0	0	104	0	0	0
12.00-13.00	37	0	23	0	4	1	0	5	14	55	0	0	0	106	0	0	0
13.00-14.00	53	0	14	2	5	0	0	8	9	69	0	0	0	114	0	0	0
14.00-15.00	37	0	6	0	5	1	0	13	9	46	0	0	0	99	0	0	0
15.00-16.00	30	0	6	1	2	0	0	14	3	32	0	0	0	76	0	0	0
16.00-17.00	1	0	3	0	0	0	0	0	2	2	0	0	0	7	0	0	0
7.00-17.00	303	1	94	5	23	9	0	69	93	401	0	0	0	746	0	0	0
MANDAG -FREDAG	1730	5	597	30	169	59	6	395	428	2290	0	0	0	4426	0	0	0

4 Traffic measuring results

In the following, results of measurements on Monday, August 21st to Friday 25th, 1978 are presented. However, comparison with measurements during other weeks show that these results are quite typical for the Telefonhuset exchange.
Fig. 6 depicts the traffic values for Monday, August 21st, 1978. Monday is the busiest day of the week as far as traffic is concerned.

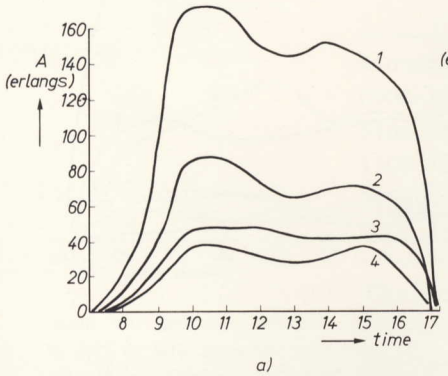


Fig. 6*a*. Traffic variation on Monday 21th of August, 1978. *1*: total traffic, *2*: incoming, *3*: outgoing, *4*: local traffic.

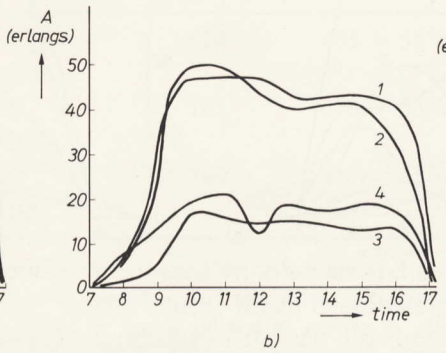


Fig. 6*b*. External traffic on same day. *1*: outgoing traffic, *2*: 0019 route (incoming), *3*: 0077 route, *4*: 01-99 route traffic (incoming DDI).

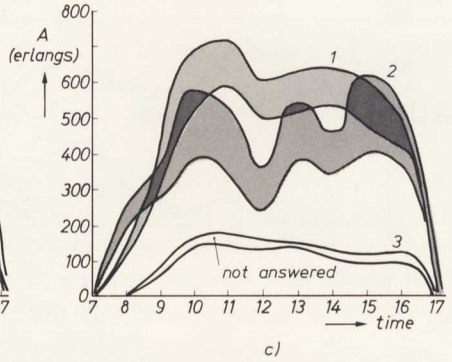


Fig. 6*c*. Incoming calls on same day. *1*: 0019 route, *2*: 01-99 route, *3*: 0077 route traffic. Shaded areas: unanswered calls.

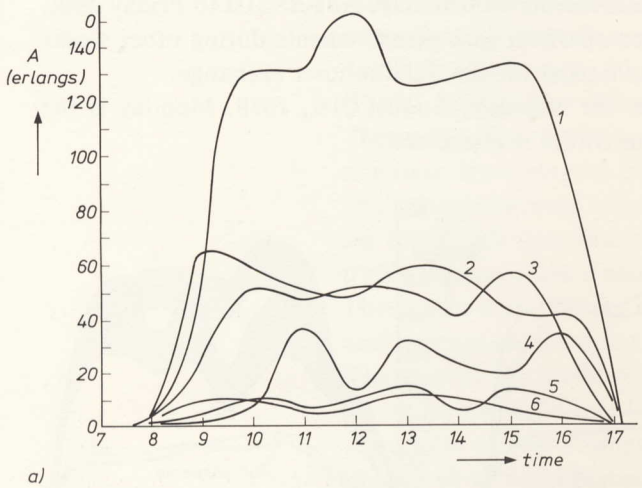
Table 1 Telefonhus traffic in Erlangs per 100 extensions

traffic type	measured 78-08-21
internal traffic	1.8
incoming	4.2
outgoing	2.3
total	8.3

The traffic capacity of the exchange is 14E per 100 extensions, so there is ample spare capacity.
Fig. 6*b* shows the external traffic separately. The direct-dialling-in traffic (DDI)amounts to only 22% of the total incoming traffic, but in terms of the number of calls (Fig. 6*c*) it amounts to 42%.
The explanation for this is presumably that the facility is mainly used by KTAS staff calling the main office with rather short messages. Another important factor is that the DDI traffic does not include waiting time for busy extensions (camp-on-busy condition), as such calls are mostly disconnected right away.
Another indication for DDI being used mainly by KTAS employees is that the percentage of DDI calls between 0700 and 0800 hours is as high as 61%. The pronounced decrease for the lunch break is also indicative in this respect.

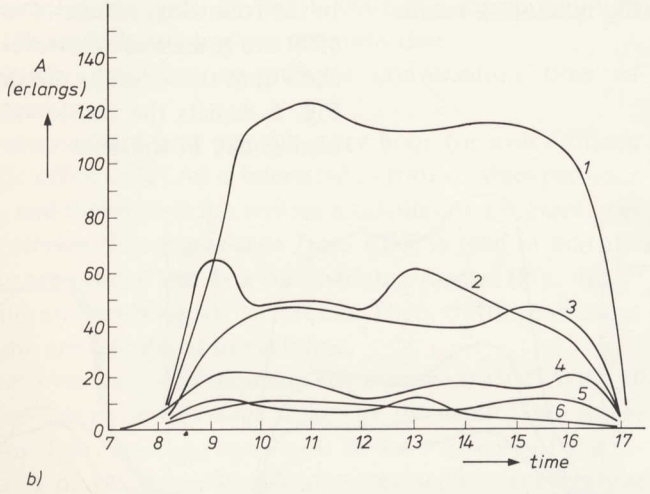
5 Use of facilities

Fig. 7 shows the use of the different facilities. The facilities which are read in more permanently are not measured. Another restriction is that several facilities can only be used via keytone telephone sets. These comprise 1155 sets of the total complement of 2075, or 55%.



a)

Fig. 7*a*. Facility counting on Monday 21th of August, 1978. *1*: enquiry calls, *2*: present in hunting group, *3*: auto-transfer, *4*: priority, *5*: automatic ring-back, *6*: follow-me.



b)

Fig. 7*b*. Facility counting per hour, averaged over the week 21st to 25th of August, 1979. For indications see Fig. 7*a*.

Enquiry and auto transfer

Table 2 gives a survey of the use of enquiry (code 213) and auto transfer (200), related to the answered incoming traffic.

Table 2 Use of enquiry and autotransfer

time	incoming calls		enquiry		auto transfer	
	total	answered	number	%	number	%
Monday 21/8 0900–1000	1447	1057	133	12	53	5
Monday 21/8 1100–1200	1129	869	148	17	53	6
Monday to Friday	48720	37384	4400	11.7	1740	4.6

These are very high percentages which may not be generally valid. Percentages of 4 and 2 have been mentioned in corresponding investigations.
However, during a traffic measurement on the EBX 8000 exchange at the Philips offices in Copenhagen in late September, 1978, there were 19% enquiries and 6,3% auto transfers respectively, related to the answered incoming calls.
Enquiry is also possible on outgoing calls, but it is believed to be used very little on these calls.
It may be noted that the use of these facilities is higher during the lunch break ('I will see if he is present').

Add-on conference

The add-on facility (201) was not often used: only 9 cases throughout the week.

Chief-secretary combination

The absent marking facility (205, 206) is used, as expected, mainly between 0900 and 1000 hours for rerouting of calls to the secretary. The chiefs used it 74 times during the week and secretaries marked themselves absent 8 times.

Automatic ring-back

Automatic ring-back (207) is one of the most popular facilities. It can, however, only be used from keytone telephones.

Table 3 Automatic ring-back counts

time	internal calls	est. internal calls from KT	internal calls from KT to busy exch.	ring-back
Monday 0900–1000	824	455 = 55%	38 = 8.3%	11 = 30%
Monday 1100–1200	761	418 = 55%	30 = 7.2%	11 = 37%
Monday 1400–1500	749	411 = 55%	28 = 6.9%	14 = 50%
			during the whole week: 425	

The result in % is based on averages and also on the assumption that all use their telephones equally much, which is definitely not the case. However, there are no measurements available of the call distribution related to extensions.

Follow-me

During the Monday the follow-me facility (208) was used 69 times, and during the whole week 348 times, mainly before meetings in the morning and the afternoon. Whether the facility was used as a real follow-me or for rerouting to an answering position cannot be ascertained, but in both cases there is a better chance that a call to the number will be served.

Present marking

The present marking (209), which is applicable to extensions in hunting groups, was used 438 times during the day of observation.
The facility is especially often used in the order department of KTAS where the

Fig. 8. Modern equipment in an old building.

telephone sales staff go in and out of the hunting groups for service of the public. This department comprises 10 large hunting groups with cyclic start of test and a total of about 150 extensions in these groups. They are reached via the special service number 0077.

6 Conclusion

Based on the measurements of one week, the following conclusions can be drawn:

- the PABX is more than adequately dimensioned
- the DDI ratio is 42% over the whole week for all incoming calls and 47% for calls to the administration only.
- enquiry and auto transfers are used very much, with 11.7% and 4.6%, respectively, of the incoming calls during the week.
- automatic ring-back, present in group hunting, secretary-calls-chief and follow-me are all often used.
- more specific advertising of the other facilities might increase their use and improve service to the callers.

Further, the large allocations of permanently assigned facilities such as call forwarding, group hunting and chief-secretary combinations also seem to indicate a high interest for the facilities. About 50% of the extensions use one or more of the facilities.

7 References

1 R. T. VAN DER SCHAAF: EBX 8000, a stored program controlled PABX system, *Philips Telecommunication Review,* Vol. 33, 1975, 113–124 (No. 3)