

**INTERNATIONAL SEMINAR
ON TELETRAFFIC ANALYSIS
AND COMPUTER PERFORMANCE
EVALUATION**

JUNE 2-6, 1986

AMSTERDAM, THE NETHERLANDS



Centrum voor Wiskunde en Informatica
Centre for Mathematics and Computer Science

ABOUT THE CENTRE FOR MATHEMATICS AND COMPUTER SCIENCE (CWI)

The Centre for Mathematics and Computer Science (CWI) is the research institute of the Foundation Mathematical Centre.

At CWI fundamental research in mathematics and computer science is carried out by about 100 scientists, supported by a staff of administrative personnel and programmers. The main interest of CWI is fundamental scientific research, but part of its activities are devoted to development, as a rule in cooperation with industry. CWI also accepts specific commissions from government institutions and industry, which in turn often lead to interesting new research projects. This interaction of fundamental research and real-world problems leads to mutual benefit and enrichment.

The CWI is by its nature especially adapted to the dynamic interdisciplinary character of present-day research. Its closely collaborating research units are at the moment organized in 8 scientific departments, supported by excellent computer facilities.

Moreover, CWI stimulates national and international contacts by organizing courses, colloquia, lectures, conferences and workshops.

ABOUT THE SEMINAR

Subject area

Teletraffic analysis and computer performance evaluation are concerned with the prediction of the behaviour of computer and communication systems under varying load conditions. These disciplines entail modeling of the relevant systems, model analysis by mathematical and experimental techniques, evaluation of the results so obtained, and, finally, their implementation in system design, routing and flow control.

The identification of the key parameters characterizing the global behaviour of the systems and the dependence of these parameters on system structure and operation, have led to a large variety of performance models, about which there exists an extensive literature. The key parameters entering into the studies are message throughputs, response times, utilization of devices, waiting times, and other objective functions which characterize optimal operational behaviour of programming and processing procedures and of resource allocation and sharing. The techniques used in model analysis stem from probability and queueing theory, from scheduling and control theory, from simulation and optimization analysis.

The field shows a rapid development in breadth as well as in depth, a development which is reflected by the large number of recent international conferences and symposia.

Goals of the Seminar

- . Reviewing the state of the art
- . reviewing trends in new developments and unsolved problems
- . exposition and discussion of models, analytical and experimental techniques, and measurements

Main topics

The seminar will be concentrated around seven main topics, each addressed by a keynote speaker, who will present an overall view of that topic. The topics and the keynote speakers are:

- | | | |
|----|--|----------------------------|
| 1. | Performance Models for Distributed Systems | - <i>L. Kleinrock</i> |
| 2. | Performance Models for Telecommunication Systems | - <i>P.J. Kühn</i> |
| 3. | Performance Models for Computer Systems | - <i>S.S. Lavenberg</i> |
| 4. | Storage Allocation Models | - <i>E.G. Coffman, Jr.</i> |
| 5. | Measurements and Simulation | - <i>H. Beilner</i> |
| 6. | Multiplexing and Ring Systems | - <i>A.G. Konheim</i> |
| 7. | Queueing and Network Analysis | - <i>O.J. Boxma</i> |

Proceedings

The proceedings of the seminar will be published by North-Holland Publishing Company. A preprint will be available at the seminar.

Participation

Because of the nature of the Seminar, participation is on invitation only. Due to limited facilities no further invitations can be made.

Sponsorship/Auspices

The seminar is sponsored by the Dutch government through the Ministry of Science and Education, and by the Centre for Mathematics and Computer Science, and will be held under the auspices of the International Teletraffic Council for the Organization of Teletraffic Congresses, and of the Working Group 7.3 of IFIP.

Organizing Committees

International Organizing Committee:

| | |
|-------------------|---|
| H. Beilner | University of Dortmund |
| E.G. Coffman, Jr. | Bell Laboratories, Murray Hill |
| J.W. Cohen | University of Utrecht |
| L. Kleinrock | University of California, Los Angeles |
| H. Kobayashi | IBM Japan, Tokyo |
| A.G. Konheim | University of California, Santa Barbara |
| P.J. Kühn | University of Stuttgart |
| S.S. Lavenberg | IBM Thomas J. Watson Research Center, Yorktown Heights |
| T.J. Ott | Bell Communications Research, Morris Township |

National Advisory Board:

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| L. Kosten | Professor Emeritus, University of Technology, Delft |
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| J.H.A. de Smit | Twente University of Technology, Enschede |
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Local Organizing Committee:

| | |
|-----------------------|---|
| J.W. Cohen (chairman) | University of Utrecht |
| O.J. Boxma | Centre for Mathematics and Computer Science, Amsterdam |
| H.C. Tijms | Free University, Amsterdam |

PROGRAM (preliminary)

Monday, June 2

- 9.00 - 10.00 Registration
- 10.00 - 10.10 Opening address by J.W. COHEN, Chairman
- 10.10 - 10.30 Welcome address by P.C. BAAYEN, scientific director CWI

PERFORMANCE MODELS FOR DISTRIBUTED SYSTEMS

- 10.30 - 11.15 Performance models for distributed systems
L. KLEINROCK (UCLA, USA)
- 11.15 - 11.30 Coffee break
- 11.30 - 12.00 General resource sharing systems
G. PUJOLLE, S. FDIDA (Univ. Pierre et Marie Curie, France)
- 12.00 - 12.30 Flexible networks of tightly and loosely coupled processors
U. HERZOG (Univ. of Erlangen-Nürnberg, FRG)
- 12.30 - 13.45 Lunch

PERFORMANCE MODELS FOR TELECOMMUNICATION SYSTEMS (I)

- 13.45 - 14.30 Modelling of communication systems and services, and performance evaluation techniques
P.J. KÜHN (Univ. Stuttgart, FRG)
- 14.30 - 15.00 Trunk reservation models in telecommunications systems
K. KAWASHIMA (NTT, Japan)
- 15.00 - 15.30 Tea break
- 15.30 - 16.00 Blocking and routing in circuit-switched networks
F.P. KELLY (Univ. of Cambridge, UK)
- 16.00 - 16.30 Some results from an asymptotic analysis of a class of simple, circuit-switched networks
D. MITRA (AT&T Bell Labs, USA)
- 16.30 - 17.00 An approximation method for analyzing a virtual circuit switch based LAN - solving the simultaneous resource possession problem
A.A. FREDERICKS (AT&T Bell Labs, USA)
- 17.30 Reception at the Centre for Mathematics and Computer Science

Tuesday, June 3

QUEUEING AND NETWORK ANALYSIS (I)

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|---------------|--|
| 9.00 - 9.45 | Models of two queues - a few new views O.J. BOXMA (CWI, Neth.) |
| 10.00 - 10.30 | An efficient algorithm for the cycle time distribution in two-stages cyclic queues with a non-exponential server S. CARBINI, L. DONATIello (Univ. of Pisa, Italy) G. IAZEOLLA (2nd Univ. of Rome, Italy) |
| 10.30 - 11.00 | Coffee break |
| 11.00 - 11.30 | title unknown P.-J. COURTOIS (Philips Res. Lab., Belgium) |
| 11.30 - 12.00 | title unknown M.I. REIMAN (AT&T Bell Labs, USA) |
| 12.00 - 12.30 | Approximate analysis of priority queueing networks J. VAN DOREMALEN, J. WESSELS and R. WIJBRANDS (Techn. Univ. Eindhoven, Neth.) |
| 12.30 - 13.45 | Lunch |

MEASUREMENTS AND SIMULATION

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|---------------|--|
| 13.45 - 14.30 | Measurements and simulation H. BEILNER |
| 14.30 - 15.00 | On inference and transient response for M/G/1 models D.P. GAVAR, P.A. JACOBS (Naval Postgraduate School Monterey, USA) |
| 15.00 - 15.30 | Tea break |
| 15.30 - 16.00 | Equivalent network, load dependent servers, and perturbation analysis - an experimental study Y.-C. HO (Harvard Univ., USA), P.Q. YANG (Jiaotong Univ., China) |
| 16.00 - 16.30 | Unix process behaviour and load balancing among loosely-coupled computers W.E. LELAND, T.J. OTT (Bell Comm. Research, USA) |

Wednesday, June 4

PERFORMANCE MODELS FOR TELECOMMUNICATION SYSTEMS (II)

- 9.00 - 9.30 Overload control for switches of communication systems -
a two-phase model for call request processing
R.K. BOEL (Univ. of Gent, Belgium),
J.H. VAN SCHUPPEN (CWI, Neth.)
- 9.45 - 10.15 An M/G/1 queue with class dependent balking (reneging)
B.T. DOSHI, D.L. JAGERMAN (AT&T Bell Labs, USA)
- 10.15 - 10.45 Coffee break
- 10.45 - 11.15 Load testing packet switches (tentative)
L.J. FORYS (Bell Comm. Research, USA)
- 11.15 - 11.45 A simple telephone exchange with delayed feedbacks
G. FAYOLLE (INRIA, France)
- 12.00 - 12.30 Sharp approximate analysis of adaptive routing in mesh
networks
A.G. GREENBERG (AT&T Bell Labs, USA)
- 12.30 - 13.45 Lunch

PERFORMANCE MODELS FOR COMPUTER SYSTEMS

- 13.45 - 14.30 Performance models for computer systems
S.S. LAVENBERG (IBM, USA)
- 14.30 - 15.00 Server sharing in symmetric queues
B. AVI-ITZHAK (Technion, Israel),
S. HALFIN (Bell Comm. Research, USA)
- 15.00 - 15.30 Tea break
- 15.30 - 16.00 Expert system applications in system modeling
Y. BARD (IBM, USA)
- 16.00 - 16.30 title unknown
P.P. SPIES (Univ. of Bonn, FRG)
- 18.00 Reception at the "Amsterdam Historisch
Museum", Kalverstraat 92.

Thursday, June 5

STORAGE ALLOCATION MODELS

- 9.00 - 9.45 Stochastic analysis of storage fragmentation
E.G. COFFMAN, Jr., T.T. KADOTA, L. SHEPP (AT&T
Bell Labs, USA), F.T. LEIGHTON (MIT, USA)
- 10.00 - 10.30 Physical design for a random-access file with
random insertions and deletions
H. MENDELSON (Univ. of Rochester, USA),
U. YECHIALI (Tel Aviv Univ., Israel)
- 10.30 - 11.00 Coffee break

MARKOV PROCESSES

- 11.00 - 11.30 Some transformed Markov processes
J. GANI (UCSB, USA)
- 11.30 - 12.00 Markovian functionals in teletraffic analysis
R. SYSKI (Univ. of Maryland, USA)
- 12.00 - 12.30 Perturbation series expansions for nearly
completely-decomposable Markov chains
P.J. SCHWEITZER (Univ. of Rochester, USA)
- 12.30 - 14.00 Lunch

QUEUEING AND NETWORK ANALYSIS (II)

- 14.00 - 14.30 Stochastic inequalities for queueing networks
A. HORDIJK, A.N.N. RIDDER (Univ. of Leiden, Neth.)
- 14.30 - 15.00 Insensitivity in two-node blocking models with applications
N.M. VAN DIJK, H.C. TIJMS (Free Univ. Amsterdam, Neth.)
- 15.00 - 15.30 Tea break
- 15.30 - 16.00 Discrete-time analysis for the interdeparture distribution of
GI/G/1 queues
P. TRAN-GIA (Univ. of Stuttgart, FRG)
- 16.00 - 16.30 Queues with locking: the multiclass problem
F. BACCELLI (INRIA, France)

Friday, June 6

MULTIPLEXING AND RING MODELS

- 9.00 - 9.45 The moveable-boundary multiplexor - stability and decomposability
A.G. KONHEIM (UCSB, USA), M. REISER (IBM, Switzerland)
- 10.00 - 10.30 title unknown
A. DESCLOUX (Bell Comm. Research, USA)
- 10.30 - 11.00 Coffee break
- 11.00 - 11.30 Mean waiting times in nonpreemptive priority M/G/1 queues with server switchover times
M. MURATA, H. TAKAGI (IBM, Japan)
- 11.30 - 12.00 Two queues and one server with threshold switching
M. HOFRI (Technion, Israel)
- 12.00 - 12.30 A modelling study of the Orwell ring protocol
I. MITRANI (Univ. of Newcastle upon Tyne, UK),
J.L. ADAMS, R.M. FALCONER (British Telecom, UK)
- 12.30 - 13.45 Lunch

GENERAL INFORMATION

Location of the Seminar

Centre for Mathematics and Computer Science
Room Z011
Kruislaan 413
1098 SJ AMSTERDAM (The Netherlands)
(see attached map)

Transportation facilities

To reach CWI from the Central Station, take tram 9 to the stop "Kruislaan", turn East (=left) and after about 15 minutes walk (which includes a railway underpass) you will see the CWI complex on your left. From Amstel Station take bus 8 to stop "Kruislaan" and proceed as mentioned above.

Registration fee

The registration fee for the Seminar is Dutch Guilders (Hfl.) 200,-- when paid before 15 April, 1986 (which at current exchange rate is approx. \$ 75). After 15 April the registration fee will be Hfl. 275,--. Payment should be made to the account 43.60.53.705 of "Stichting Mathematisch Centrum" at AMRO-Bank, Sarphatistraat, Amsterdam (mention Seminar 3830 IST). The registration fee covers attendance to the Seminar, invitation to two receptions, coffee and tea breaks, luncheons, and a preprint of the proceedings published by North-Holland Publishing Company.

Social events

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| Monday, June 2 | A reception for participants and accompanying person(s) offered by the Centre for Mathematics and Computer Science at the CWI |
| Wednesday, June 4 | A reception offered by the Minister of Education and Science and the Burgomaster and Aldermen of Amsterdam, at the "Amsterdam Historisch Museum", Kalverstraat 92. |

Lecture Facilities

Two overhead projectors, a dia projector (standard format) and ample black-board space are available. If you intend to use the dia projector, you are kindly requested to notify the secretariat before the Seminar.

Secretariat and Information

Mrs. C.E. Both
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During the Seminar messages may be left for participants at telephone
31(20)5924171

SELECTION OF CWI TRACTS AND MONOGRAPHS

TRACTS:

- A. VAN WIJNGAARDEN et al. Revised report on the algorithmic language ALGOL 68.
- A. HORDIJK. Dynamic programming and Markov potential theory.
- F. GÖBEL. Queueing models involving buffers.
- J.K. LENSTRA. Sequencing by enumerative methods.
- A. FEDERGRUEN. Markovian control problems; functional equations and algorithms.
- J.K. LENSTRA, A.H.G. RINNOOY KAN, P. EMDE BOAS (eds). Interfaces between computer science and operations research. Proceedings of a symposium held at the Mathematisch Centrum, Amsterdam, September 7-10, 1976.
- H.C.P. BERBEE. Random walks with stationary increments and renewal theory.
- P.J.M. KALLENBERG. Branching processes with continuous state space.
- J.P.C. BLANC. Application of the theory of boundary value problems in the analysis of a queueing model with paired services.
- P.M.G. APERS. Query processing and data allocation in distributed database systems.
- F.A. VAN DER DUYN SCHOUTEN. Markov decision processes with continuous time parameter.
- J. KOENE. Minimal cost flow in processing networks, a primal approach.
- A.P.W. BÖHM. Dataflow computation.
- M.H. VAN HOORN. Algorithms and approximations for queueing systems.
- N.M. VAN DIJK. Controlled Markov processes; time-discretization.

MONOGRAPHS:

1. J.W. DE BAKKER, M. HAZEWINKEL, J.K. LENSTRA (eds.). Proceedings of the CWI Symposium on mathematics and computer science.
2. K. DEKKER, J.G. VERWER. Stability of Runge-Kutta methods for stiff nonlinear differential equations.
3. H. BRUNNER, P.J. VAN DER HOUWEN. Numerical solutions of Volterra equations.