Introduction

The QED Workshop II, held in Warsaw on 20–22 July 1995, was the second meeting devoted to the inchoate QED project. Robert Boyer and Andrzej Trybulec were responsible for the scientific programme, with Roman Matuszewski being the active chair.

The overall idea of QED is best described by the preamble to the *QED Manifesto* - an anonymously authored document that discusses the desirability and feasibility of organizing a proof-checked encyclopedia of mathematics:

> "QED is the very tentative title of a project to build a computer system that effectively represents all important mathematical knowledge and techniques. The QED system will conform to the highest standards of mathematical rigor, including the use of strict formality in the internal representation of knowledge and the use of mechanical methods to check proofs of the correctness of all entries in the system.
>
> The QED project will be a major scientific undertaking requiring the cooperation and effort of hundreds of deep mathematical minds, considerable ingenuity by many computer scientists, and broad support and leadership from research agencies."

The first QED Workshop was held at Argonne National Laboratory, on May 18–20, 1994. The most important conclusion of that workshop was that QED was an idea worthy pursuing. The majority of participants of the Warsaw workshop subscribed to that conclusion entirely.

The purpose of the workshop was to assemble a group of researchers to further pursue the idea of building a mechanically proof-checked encyclopedia of mathematics. The workshop was run as a sequence of one hour long discussions each devoted to a specific QED-related topic. The topics, which were suggested earlier by the participants and accepted for presentation, varied from very general issues of sociological and political nature to specific technical questions. A short summary of each of the presentations and discussions is attached.

Therefore, the workshop took on the form of a discussion meeting rather than that of a conventional conference. In the numerous discussions a distinction was made between:

(i) the software that organizes and administers the database of mathematical knowledge, and

(ii) the system or systems that are used to demonstrate the correctness of the results in the first place.

A clear short term goal was identified: we should attempt making the results of various systems publicly available, preferably on the World Wide Web. Then, over the course of time, we can investigate more sophisticated ways of integrating the diverse range of the already accumulated, machine readable mathematical knowledge.

The workshop was attended by 28 researchers, from 9 countries, representing ongoing worldwide efforts in theorem proving and mathematics. 11 of the participants attended the QED Workshop I at Argonne in 1994. The list of participants is given below:

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The participants of the workshop shared the opinion that the final shape of QED will be achieved through a long sequence of small evolutionary steps. The starting point of this evolution is formed by existing theorem provers and proof-checkers, especially the ones that have already accumulated sizable data-bases of machine checked mathematics.

We would like to mention an initiative of John McCarthy who presented a talk on "Heavy Duty Set Theory" in which he gave examples of inferences which he felt should be regarded as (mathematically) "obvious" to a practical proof checker. He challenged the participants to replicate his solution of the mutilated checkerboard[1] in various systems and then compare how far the solutions are from his expectations. As far as I know two systems met the challenge. One of these is published in this Report[2]. For another mutilated checkerboard mechanical checking please see `ftp://ftp.cli.com/pub/nqthm/nqthm-1992/examples/subramanian/mutilated-checkerboard.ps` .

[1] In this Report see: *The Mutilated Checkerboard in Set Theory.*
[2] *The Mutilated Chessboard Problem* by Grzegorz Bancerek.

There were two general discussions. The first, a panel discussion led by Piotr Rudnicki, considered general aspects, as seen by the 8 panelists (G. Bancerek, M. Korolkiewicz, B. McCune, B. Pase, R. Prank, S. Spież, H. Stoyan, and A. Tarlecki). The panelists expressed both their enthusiasm about specialized QED subsystems and reservations about being too optimistic too soon. In particular, there was some discussion about how to attract mathematicians to the initial steps of building QED. There were no doubts that when QED is sufficiently developed, mathematicians will be glad to use it.

The second general discussion, led by Deepak Kapur, concerned general views on the future of the QED Project (the next workshop, the need of common meta logic, short term goals, what should be the administrative structure managing the QED data base, and how to achieve a steady flow of contributions to the QED mailing list). The participants expressed their hope that the next QED Workshop will happen in 1996.

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