



INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Project-Team Scilab

*Equipe opérationnelle du consortium
Scilab*

Rocquencourt

THEME NUM

Activity
R *eport*

2005

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1. Team

Head of project team

Claude Gomez [DR, Inria]

Administrative assistant

Martine Verneuille [AI, Inria]

Staff member

Serge Steer [DR, Inria, part time]

Visiting technical staff

Hugues Perdereau

Technical staff

Farid Belahcene

Allan Cornet

Didier Halgand

Fabrice Leray

Pierre Maréchal

Jean-Baptiste Silvy [since 15 October 2005]

Research scientist

Robert Ehrlich

Jacques-Deric Rouault [since 1 September 2005]

Student intern

Florian Allie [ACET in july]

2. Overall Objectives

2.1. Overall Objectives

Scilab is a scientific software package providing a powerful open computing environment for engineering and scientific applications. Developed since 1990 by INRIA and ENPC, it is now maintained and developed by Scilab Consortium which was launched in May 2003.

Scilab project is not a “research project” but a “development project” at INRIA-Rocquencourt. It is the operational team of Scilab Consortium.

Scilab is distributed freely with the sources via the Internet since 1994. Scilab is currently being used in educational and industrial environments around the world.

Scilab includes hundreds of mathematical functions with the possibility to add interactively programs from various languages (Fortran, C, C++, Java...). It has sophisticated data structures (including lists, polynomials, rational functions, linear systems...), an interpreter and a high level programming language.

Scilab has been conceived to be an open system where the user can define new data types and operations on these data types by overloading operators.

A number of toolboxes are available with the system:

- 2-D and 3-D graphics, animation.
- Linear algebra, sparse matrices.
- Polynomials and rational functions.
- Interpolation, approximation.
- Simulation: explicit and implicit systems of differential equations solution.
- Scicos: hybrid dynamic systems (comparable to Simulink).

- Classic and robust control, LMI optimization.
- Differentiable and non-differentiable optimization.
- Signal processing.
- Graphs and networks.
- Parallel Scilab using PVM.
- Statistics.
- Interfaces with Computer Algebra (Maple, MuPAD).
- Interface with TCL/TK.

And a great number of contributions for various domains are available from Scilab Web site.

Scilab works on most UNIX systems including GNU/Linux and on Windows 9X/2000/XP. It comes with source code, on-line help and English user manuals. Binary versions are available.

Web Site

Newsgroup: `comp.soft-sys.math.scilab`

Contact: `Scilab@inria.fr`

3. Scientific Foundations

3.1. Scilab Consortium

Scilab Consortium was created in May 2003. Today there are 20 members: ANAGRAM TECHNOLOGIES, APPEDGE, AXS INGENIERIE, CRIL TECHNOLOGY, CEA, CNES, DASSAULT-AVIATION, ECOLE POLYTECHNIQUE, EADS, EDF, ENPC, ESTEREL TECHNOLOGIES, IFP, INRIA, KLIPPEL, PSA PEUGEOT CITROËN, RENAULT, STYREL TECHNOLOGIES, THALES and TNI.

There are also 8 contributor members: they are natural persons who made important contributions to Scilab and who were accepted by the steering committee of the consortium.

The purpose of Scilab Consortium is:

- To organize cooperation and exchange within the community of developers in order to make Scilab a platform which integrates the latest scientific advances in the field of numerical computation.
- To organize cooperation and exchange within the community of users in order to make Scilab a product that meets specifications required for use in industrial, educational and research environments.
- To obtain the resources necessary to maintain a team committed to editing new versions of the software which meets specified standards, encouraging the community of developers and ensuring first level support for users.

The Consortium is chaired by Doctor Maurice Robin.

The main parts of the Consortium are:

- The *Conference of Participants* elects the persons taking part to the Steering Committee and to the Scientific Board and decides any other matter proposed for the agenda by the Steering Committee. The participants can take part to working groups. The purpose of working groups is to help and prepare the decisions of the steering committee. Currently there is a working group for Scilab in Education.
- The *Steering Committee* is the decision-making body representing the Consortium's Conference of Participants.
- The *Scientific Board* analyses the scientific value of contributions and previews the scientific value of developments to be carried out.
- The *Operational Team* described below.

3.2. Operational Team

The Operational Team implements the decisions of the Consortium about Scilab development and promotion. It is the “Scilab development project” at INRIA-Rocquencourt.

The team is organized as follows:

- The Chief Technology Officer of Scilab Consortium who manages the operational team: Claude Gomez.
- The Promotion and Marketing Manager who is responsible for promoting the software, recruiting new Members, conducting communications and promotional activities and communicating the users’ needs: Didier Halgand.
- The Quality Assurance Manager who monitors and enhances quality assurance processes used in development and maintenance of Scilab: Hugues Perdereau.
- The Product Manager who is responsible for product policy for Scilab software: Claude Gomez.
- The Development Manager who coordinates the Development Team: Serge Steer.

The Development Team, tasked with developing or delegating the development of new functions or enhancement of existing features and to compile and distribute subsequent versions of the Scilab software. It does also maintenance and support. It is compound by:

- Allan Cornet.
- Farid Belahcene.
- Pierre Maréchal.
- Fabrice Leray.
- Jean-Baptiste Silvy.

3.3. Scilab Developers

They are people who can modify Scilab code directly, add functionalities and fix bugs. They work in accordance with Scilab team, under the management of the development manager.

There are currently 10 Scilab developers.

4. Software

4.1. New Scilab release

First of all, Scilab 3.1.1 was released in May 2005. This new Scilab release is a minor Scilab release. The main improvements of this new release are:

- The Windows port was completely rewritten for Scilab 3.0. The performances have been improved by using Atlas libraries optimized according to the processors.
- Scipad, the integrated editor, developed by Scilab developers, is now multilingual and has a debugger.
- The Object Oriented Graphics was introduced with Scilab 3.0. The interactive graphics editor has been dramatically improved. High level functions that mimic Matlab functions have been made such as “plot”, “surf”, “bar”, “pie” and “mesh”.
- Matlab to Scilab Conversion Tool: more functions are now translated and it is now able to translate a whole hierarchy of directories.

The first release candidate of Scilab 4.0 was issued in December 2005.

4.2. Scilab Development

The Scilab development is based on a management plan and a quality policy. We describe below :

- The management plan.
- The quality assurance plan.
- The bug tracking policy.
- The qualification procedure and the qualification environment.

The management plan A management plan has been written and diffused to the Steering Committee of the Consortium. This document gives the general rules that the operational team sets up for the realization of the development of Scilab software within Consortium framework.

- Operational organization and regular check (team organization, responsibilities, meetings, etc.)
- Road map proposal (calendar and dead-line).

The quality assurance plan This document gives the general rules that the operational team sets up for the management, the development, the qualification, the diffusion and the maintenance of Scilab software.

- Quality plan (organization and follow-up).
- Cross procedures to the Scilab activity (documentation management and configuration management).
- Qualification procedure (process, referential, non-regression and implementation).
- Management procedure of the technical requests (bugs management, means, etc.).

The bug tracking policy The chosen policy is to have a complete tracability of all the Scilab bugs and requests. In order to respect the policy, an open source tool (Bugzilla) has been modified and installed to manage and track the Scilab bugs and the Scilab requests (see below the description of the bug tracking system).

The qualification procedure and the qualification environment Scilab team has defined and installed a qualification procedure and related environment to ensure the internal acceptance of the scilab software.

This procedure is based upon a reference scale of qualification. Each step of this scale is composed of critical elements and information elements:

- critical elements generally correspond to tests which must be successfully passed to achieve acceptance,
- information elements corresponds to others tests, documentation checking, etc.

This provides not only criteria for classical acceptance but also thorough information on the final state of the scilab product version to be described in “released notes” document as well as known by support team prior to external delivery.

The used methodology should be an answer to the constraint of a software product:

- large diffusion
- heterogenous target machines
- regular delivery (major or minor releases)

4.3. Technical support

- Technical support daily activities
 - Answering emails coming from Scilab users and forwarding the emails to the Scilab experts in case of specialized problem.
 - Filtering and deleting spam emails by using procmail software.
 - Managing the bugzilla system and the database.
 - Administrating the CVS server, managing the users, and access.
- Automatic compilation chain

To test every day the compilation of Scilab sources provided by our CVS server, an automatic compilation chain has been installed. It starts every night on various platforms (GNU/Linux, Windows, Solaris and HP UX).

This compilation chain has three main tasks:

 - Compile Scilab CVS sources.
 - Produce a daily unstable version of scilab on differents platforms.
 - Launch various test batteries.

This process is very important for debugging Scilab when source code is modified. Moreover it allows the team to release such called “unstable versions” about every month: these version are not fully qualified but they allow the users to benefit from the last developments and bugs fixing.
- Scilab Website
 - Scilab website <http://www.scilab.org> is updated regularly. This web site is also a good pathway to be in contact and get feed back from scilab users. So, a guestbook and a form permit internet surfers to make requests.
- Bugzilla: a bug tracking system for Scilab

In addition to the Scilab newsgroup, providing a wealthy Scilab software knowledge database, the Scilab development team proposes on Scilab website the Scilab bugs tracking system, a bugzilla-based system. It is a centralized web-database tracking system for Scilab bugs and Scilab requests. This tool allows to share and take advantage of the experiment of the Scilab community (developers and users). Now, each user, after creating an account, can:

 - create a new bug report or a new request,
 - give an attached file reproducing the defect and/or advising a workaround,
 - make a search in the bugs database or requests database,
 - find an existing patch for a registered bug.

+ Scilab developers

CVS source code and Bugzilla management has been open to the Scilab Developers. Decicaded Web pages have been made for them with all the information needed for coordinating the development. In addition to these Web pages, we have installed some tools about CVS management (ViewCVS, Bonsaï, ...) to make easier scilab development.

4.4. Scilab step by step

Concerning Scilab, there already exists a documentation integrated in the language environment or directly loadable on web site, with introduction and presentation texts. Here, the purpose is not to do again in a better or worse way what is elsewhere done, but to present a different and original approach, which is qualified as step-by-step. This approach is directed as well to the beginner in computer sciences, to the beginner in Scilab as well as to confirmed programmers who are looking for a piece of information about syntax or a feature of the language.

This documentation is bilingual: English and French languages.

For each notion or element of syntax, this document presents one or several complete and runnable Scilab programs, completed by several images of the result at screen.

The programs are tested under both operating systems Windows and GNU/Linux.

Scilab step-by-step is structured into 6 volumes with a number of chapters for Scilab 3.0, 3.1 and future 4.0:

Volume 0 Generalities.

Volume 1 Instructions and elementary types.

Volume 2 Structured elementary types.

Volume 3 Procedures and functions.

Volume 4 Graphism.

Volume 5 Mathematics.

The actual documentation represents about 2300 files (160 HTML files, 1840 JPEG figures, much more than 342 Scilab files).

In the new 4.0 version dedicated to Scilab 4.0, the accent is firstly put on the downloading/installation/test processes (Volume 0 – achieved) and on the functionalities and use of the new graphics (Volume 4 – in process).

This documentation is available at the websites:

- [HTML and ZIP formats](#)
- [HTML and ZIP formats](#)
- [ZIP format](#)

4.5. Windows Version

The Windows Scilab 3.0 release has been completely rewritten and has now the following improvements:

- Transcription of all the Visual C++ Makefile's towards the Visual Studio .NET environment:
 - Improvement of the integration of Visual Studio Compiler to the dynamic links.
 - Improvement of the stability.
 - Dramatic improvement of the speed of Scilab.
 - Optimization for various processors (Atlas Libraries).
- Integration of the Scilab software to the Windows environment by modification of the GUI to have the Windows look and feel:
 - Files association with Scilab.
 - Rewriting of dialogues boxes and adding toolbar.
 - Management of the menus (French and English).
 - Command Window for interactive exploration and development.
- Possibility to use external C compilers with Scilab to generate code C: lcc or Visual Studio Express.
- DDE (Dynamic Data Exchange) client functions have been added to the Windows version. It allows communication with other Windows application supporting this communication (Word, Excel, ...).

4.6. New Object Oriented Graphics

Even if Scilab 2.7 graphics was quite powerful, users complained in particular about the graphics functions syntax and the poor customization tools available. The conception of this graphics does not allow to make it evolve enough. A new entity oriented graphics has been built. To ensure backward compatibility the old graphic has been maintained.

In the new mode (enabled by default since version 3.0), each graphics window and the drawing it contains are represented by hierarchical entities. The hierarchy top level is the "Figure". Each Figure defines at least one child of type "Axes". Each Axes entity contains a set of leaf entities which are the basic graphics objects like Polylines, Rectangles, Arcs, Segs, ... It can also contain "Compound" entities which are recursive sets of entities.

Graphics entities are associated to Scilab variables of type "handle". The handle is a unique identifier which is associated to an instance of an entity. Using this handle, it is possible to control the properties of the entities using the "set" and "get" functions. The handles are also used to manipulate graphics objects, to move them, to make copies or delete them. The main interest of the new graphics mode is to make property change easier and to avoid cumbersome list of arguments in the graphics function calling sequence to set the properties.

This year, work was devoted to finalize this new graphics mode (talking about the objects' definition). Some missing object (surfaces, polylines...) properties have been completed. At the same time, another useful tool was improved : the graphics editor. This development, made in TCL/TK, allows us to change object properties without passing by the scilab console. 3-D plots merge were reviewed and fixed and deal with 2-D objects too. Zoom 3-D has been re-enabled and major bugs fixed. Finally the axes structure was totally rebuilt to allow more editable properties. Five high level graphics functions were implemented to help Matlab users migrating to Scilab and ease Matlab compatibility. Therefore, a combined work has been done with the Translator developer (see next section about "Matlab To Scilab Conversion Toolbox").

4.7. The Solids toolbox

A toolbox was made to represent objects under the form of transparent or opaque polyhedrons in a transparent 3-D space. The Scilab interpreter offers the very interesting possibility to run a program which builds different figures in 3-D space, then, once the running is achieved, to manually turn this space in an interactive way. The toolbox integrates the representations of polyhedrons with a variable number (up to 8) of edges per face. Simple transformations such as translation, 3-D rotation and 3-D homothety are implemented in the description of the solid.

4.8. Matlab To Scilab Conversion Toolbox

The objective of this work is to provide a tool to ease the translation of Matlab toolboxes for Scilab. Due to their common origin, Scilab and Matlab have a lot of similarities, but Scilab and Matlab have evolved separately making the translation from one language to the other difficult. In particular variable properties inference is mandatory to be able to produce a readable and efficient code.

A prototype was available in Scilab 2.7. The kernel of the translator had to be completely rewritten for Scilab 3.0 based on a generator of a Matlab code formal tree and a tree converter. In Scilab 3.0 basic data types and main Matlab computational builtins were handled. Scilab 3.1 introduced the high level "struct" and "cell" types and a huge set of automatic tests to verify Matlab compatibility.

Jointly to this work, a dictionary of Matlab and Scilab equivalents is written based on our precise knowledge of both tools. This document is available on Scilab Web site.

During this year we have worked on:

- the extension of the set of Matlab function handled, in particular with the more commonly used graphic functions (plot, surf, bar, pie,...)
- the improvement of the toolbox translation tool to allow inter-function variable properties inference,

- the generation of report files giving help on the encountered difficulties during the translation (unhandled Matlab functions, advice to improve the generated code, ...)
- the extension of Scilab to take into account some Matlab syntax like the try catch construct and some basic function specific semantics (sum, prod, ...)
- the documentation and the test set have been extended and with the help of some Scilab Consortium members, real size tests have also been made.

4.9. Other Developments and Support

- Command History for recording the running history of interactive Scilab sessions.
- Better integration of Scipad editor.
- The diary (used to rule the generation of session traces) and history tools, have been improved and rewritten in C.
- Small syntax adaptations have been made to make the Matlab to Scilab translator work easier.
- Creation and Improvement of the Java <-> Scilab Interface. In particular this allows the use of Scilab as a computational engine in a Java environment.
- TCL interface has been totally rewritten (for better error detection and better data transfert).

Beyond its activity of development, the team brings its supports to the users. These relations with the users are a good way to improve the quality and the usability of the software.

4.10. Marketing

In 2005, a marketing function was added to the Operational Team structure of the Scilab Consortium. This step meets the need to better organize the software publishing activity of the Consortium in line with market expectations. Among others, the Marketing function is in charge to:

- Define and implement the relevant marketing policies.
- Increase Scilab visibility and notoriety both locally and internationally.
- Increase both Scilab memberships and Scilab users numbers.
- Identify and formalize the useful partnership agreements.
- Position Scilab as the privileged numerical calculation platform for National and European significant projects which have recourse to this type of software.
- Propose an operating plan for the implementation of the phase 2 of the Consortium (foreseen in January 2007).

The following main results were reached:

- Increase the number of the Consortium members from 14 to 20.
- Participation in several shows (see below).
- Organization of a press conference at the time of the European announcement of the creation of the Consortium for the standardization of Numerical Calculation (November 2005). The immediate repercussions were: 4 articles in the print media (Electronique, Electronique Int'l, Industrie & Technologies (double page), l'Usine Nouvelle) and a significant coverage on the Net (EETimes, Yvelines Compétences...).
- Submission of 2 European projects and 2 national projects (see below).

- Support for the current promotional activities and creation of new promotional tools (posters, flyers, presentations, ...).
- Initialization of the operating plan necessary to the deployment of the phase 2 of the Consortium envisaged in 2007.
- Anticipation of a new approach with regards to product marketing (licensing, pricing, toolboxes external development processes).
- Realization of a product positioning and impact study: estimation of the number of installed seats (+ 250,000 units), geographic and sector-based deployments, ...
- Add a questionnaire for downloaders on the Scilab Web site.

5. Contracts and Grants with Industry

5.1. Scilab Consortium

After INRIA funding, the main funding of Scilab project comes from the dues given by the members who subscribe to Scilab Consortium.

The team has also a funding from the French Embassy in Beijing for the promotion of Scilab in China.

6. Other Grants and Activities

6.1. Consortium

- Claude Gomez: steering committee, 11 May 2005.
- Claude Gomez: assembly of Consortium participants, 27 June 2005.
- Claude Gomez: steering committee, 8 December 2005.

6.2. National Actions

- Stand at the Salon Solutions Linux 2005, Paris, 1–3 February 2005.
- Stand at the “LabVIEW and Simulation Tools” day, Versailles, 17 November 2005.
- Scilab is used now in high schools in BCPST classes. With INRIA Rocquencourt we made a Scilab CDROM for French high school with dedicated documents and Web page: see [CDROM](#).

We participated to 2 proposals that were submitted to ANR. One of them, OMD, about multidisciplinary optimization, has been accepted by the RNTL: this project is based on Scilab platform.

6.3. European Actions

We participated to 2 proposals submitted to the European program FP6 Call 5, a SSA proposal and an IP proposal.

6.4. Numerical Mathematics Consortium

The creation of the “Numerical Mathematics Consortium” or NMC was announced In August 2005 in Austin (USA): **NMC**. INRIA, hosting Scilab Consortium, is one of the founding members with Maplesoft, Mathsoft and National Instruments. The purpose of this consortium, open to everybody and working in the same way as the W3C, is the definition of the semantics of a set of mathematical functions for making numerical algorithms, mainly for matrix computations. The implementation of the algorithms is not taken into account and the syntax of the functions, only used for examples, is not imposed. The standardization should allow the interoperability of the software and the easy re-use of numerical algorithms. Standardization is one of the missions of INRIA who is strongly involved in the consortium: **Standardization**.

We made the European announcement of the NMC in France in November 2005 during a press conference.

We also participate to the writing of the technical document. The first version should be released at the beginning of 2006.

6.5. International Actions

- At the LIAMA in Beijing, the Scilab On Site Project for Scilab promotion and the Scilab Seed Project for Scilab development have been created. In particular, one of the purposes of the Seed Project is to make the localization of Scilab, allowing Scilab to use internally various languages such as Chinese.
- The 2006 Scilab Toolbox Contest in Japan has been announced. This event is organized by INRIA and the Japanese National Institute of Informatics (NII). It is open to Japanese and no Japanese students living in Japan. See **NII**.
- Claude Gomez, Serge Steer: 2005 Scilab Contest Awards Ceremony, XiaMen, China, 28 October 2005.
- Stand at the 44th IEEE Conference on Decision & Control and European Control Conferenc (CDC-ECC’05), Sevilla (Spain), 12–15 December 2005.

6.6. Visiting Scientists

Winners of 2005 Scilab Contest: 4 Chinese professors and 5 Chinese students, 6–9 December 2005.

7. Dissemination

7.1. Scientific Committee Activities

- Claude Gomez: RNTL evaluator.
- Claude Gomez: co-organizer of the 2005 International Workshop on Scilab and Open Source Software Engineering, Wuhan (China), October 27–29, 2005.

7.2. University Teaching

- Claude Gomez
 - Ecole Centrale de Paris, third year: Dynamical Systems.
 - Chaire X-THALES “Ingénierie des Systèmes Industriels Complexes”: Dynamical Systems.
- Serge Steer
 - Chaire X-THALES “Ingénierie des Systèmes Industriels Complexes”: Dynamical Systems.

7.3. Examination

- Claude Gomez: member of the board of examiners of “Agrégation de mathématiques” in Morocco organized with the help of French Ministry of Education and French Foreign Affairs.
- Claude Gomez: member of the board of examiners of “Olympiades de mathématiques de l’Académie de Versailles”

7.4. Conference and workshop committees, invited conferences

- Serge Steer: “Présentation de Scicos et Scicos Implicite”, Journées Scilab/Scicos SNECMA, April 2005.
- Serge Steer: “Eléments de comparaison de Scilab/Scicos et Matlab/Simulink”, Journées Scilab/Scicos SNECMA, April 2005.
- Serge Steer: “Scilab : un enjeu pour le calcul scientifique”, Journée ingénieurs de développement, INRIA, April 2005.
- Serge Steer: “Présentation de Scicos et Scicos Implicite”, Siemens VDO, April 2005.
- Claude Gomez: “Scilab présent et futur”, Café logiciel InTech’Sophia, Sophia Antipolis, 17 May 2005.
- Serge Steer: “Eléments de comparaison de Scilab/Scicos et Matlab/Simulink”, Journées Scilab IFP, June 2005.
- Serge Steer: “Scicos : modélisation et simulation de systèmes dynamiques”, Journées Scilab IFP, June 2005.
- Didier Halgand: “Logiciel libre pour la modélisation et simulation des systèmes mécatroniques.”, 3rd European Mechatronics Meeting 2005, Annecy, June 2005.
- Claude Gomez: “Scilab logiciel libre pour le calcul scientifique”, Les Causeries d’Intech’Sophia, Sophia Antipolis, 30 June 2005.
- Claude Gomez: “Scilab : un logiciel libre de calcul scientifique”, Journée logiciels libres et industrie organisée par ISA-France et la SEE, Paris, 10 May 2005.
- Serge Steer: “Le logiciel Scilab”, Journée Scilab Renault, September 2005.
- Serge Steer: “Eléments de comparaison de Scilab/Scicos et Matlab/Simulink”, Journées Scilab Renault, September 2005.
- Claude Gomez: “Scilab: a Free Scientific Software Package”, Hong Kong Chinese University, November 3, 2005.
- Claude Gomez: “Mathematics and Scientific Software Packages”, Hong Kong Chinese University, Hong Kong, November 4, 2005.
- Claude Gomez: “Scilab : Une alternative open source européenne pour le calcul numérique”, LabVIEW and Simulation Tools, Versailles, 17 November 2005.
- Claude Gomez: “Scilab: software libre de cálculo científico”, Universidad de Sevilla, 14 December 2005.

8. Bibliography

Books and Monographs

- [1] C. GOMEZ (editor). *International Workshop on Scilab and Open Source Software Engineering proceedings*, Tsinghua University Press and Springer, 2005.

Articles in refereed journals and book chapters

- [2] C. GOMEZ. *Scilab : un logiciel libre de calcul scientifique*, in "Revue Techniques de l'ingénieur, Recherche et Innovation", vol. IN 31, April 2005.

Publications in Conferences and Workshops

- [3] S. STEER, F. BELHACENE, V. COUVERT. *How to migrate from Matlab to Scilab*, in "International Workshop on Scilab and Open Source Software Engineering, Wuhan, China", October 2005.

Miscellaneous

- [4] C. GOMEZ. *Familiarisation "Scilab pour le lycée" and Exemples d'utilisation de Scilab en classes de mathématiques du secondaire*, October 2005, <http://www.scilab.org/lycee>, Cours.

- [5] C. GOMEZ. *Systèmes dynamiques*, January 2005, <http://www-rocq.inria.fr/scilab/gomez>, Cours.