ACM SIGACT News Distributed Computing Column 19

Sergio Rajsbaum*

Abstract

The Distributed Computing Column covers the theory of systems that are composed of a number of interacting computing elements. These include problems of communication and networking, databases, distributed shared memory, multiprocessor architectures, operating systems, verification, Internet, and the Web. This issue consists of:

- "A review of the SIROCCO 2005 conference," by Corentin Travers.

Many thanks to Corentin for his contribution to this issue.

Request for Collaborations: Please send me any suggestions for material I should be including in this column, including news and communications, open problems, and authors willing to write a guest column or to review an event related to theory of distributed computing.

A Review of the SIROCCO 2005 Conference

Corentin Travers [1]

Abstract

This is a review of the 12th Colloquium on Structural Information and Communication Complexity (SIROCCO), Mont Saint Michel, Normandie, France 23–26 May, 2005, with proceedings in Springer's Lecture Notes in Computer Science #3499. It includes a summary of the invited talks and the papers presented.

1 Introduction

This article is a review of SIROCCO 2005, the 12th Colloquium on Structural Information and Communication Complexity, that took place in Mont Saint Michel, France 23–26 May, 2005. The proceedings, edited by Andrzej Pelc and Michel Raynal, are published in Springer's Lecture Notes in Computer Science #3499. This article describes the conference, the two invited talks, and the papers presented. The web site of the conference is *http://sirocco.informatika.sk*.

SIROCCO offers an alternative to larger conferences, with a friendly atmosphere and a less packed program that gives more time to talk with the very serious researchers that attend this conference. It usually

*Instituto de Matemáticas, UNAM. Ciudad Universitaria, Mexico City, D.F. 04510 `rajsbaum@math.unam.mx`.

[1]IRISA, Campus de Beaulieu, 35042 Rennes Cedex, France. `corentin.travers@irisa.fr`

takes place in small, beautiful European towns with nice weather end of May, over two-and-a-half days that include an afternoon excursion. Previous SIROCCO colloquia took place in Ottawa (1994), Olympia (1995), Siena (1996), Ascona (1997), Amalfi (1998), Lacanau (1999), L'Aquila (2000), Val de Nuria (2001), Andros (2002), Umea (2003) and Smolenice Castle (2004). The submission deadline is usually beginning of January. About 25 papers are presented, out of about 50 submissions, on a wide variety of distributed computing subjects, some of them with a combinatorial flavor related to graphs and algorithms. Proceedings were published in the past in the Proceedings in Informatics series of Carleton Scientific press. This year for the second time the proceedings were published in Springer's LNCS series. For a review of SIROCCO'01 by Pierre Fraigniaud, see the Distributed Computing column in the December 2001 issue of SIGACT News.

Respecting the tradition of great locations, this year the colloquium took place in Mont Saint-Michel. Located in the French North coast, Mont Saint-Michel is a little rocky tidal island dominated by an impressive, well conserved Abbey. This last finds its origin in a small church built in the early eighth century. Mont Saint-Michel is famous for its tides, that shift as fast as galloping horses. When the tide is low the island is connected to main land, and when it is high it becomes an island. The dates of the conferences were chosen to coincide with the biggest tides!

Figure 1: Mont Saint Michel.

Figure 2: Tide session

SIROCCO 2005

Conference chair: David Peleg (Rehovot, Israel).

Program Committee co-chairs: Andrzej Pelc (Gatineau, Canada) and Michel Raynal (Rennes, France).

Program Committe: Carole Delporte-Gallet (Paris, France), Paola Flocchini (Ottawa, Canada), Leszek Gasieniec (Liverpool, UK), Rachid Guerraoui (Lausanne, Switzerland), Darius Kowalski (Warsaw, Poland), Rastislav Královič (Brastislava, Slovakia), Danny Krizanc (Middletown, CT, USA), Shay Kutten (Haifa, Israel), Bernard Mans (Macquarie, Australia), Toshimitzu Masuzawa (Osaka, Japan), Achour Mostefaoui (Rennes, France), Jaroslav Opatrny (Montreal, Canada), Sergio Rajsbaum (UNAM, Mexico), Alex Shvartsman (Storrs, CT, USA), Ugo Vaccaro (Salerno, Italy).

Organization (INRIA): Elisabeth Lebret (Chair), Lydie Mabil, Florence Santoro and Nadège Mallory.

Webmaster and Publication chair: Rastislav Královič (Brastislava, Slovakia).

Steering Committee Chair: David Peleg (Rehovot, Israel) .

2 The Program

The conference organization was very effective. A special shuttle to get from Rennes to Mont St. Michel and back was provided Monday 23rd and at the end of the conference, Thursday May 26. Upon arrival on Monday, a welcome cocktail at the ”Mère Poulard” restaurant was arranged. Here is were participants enjoyed the splendid food provided every day. The registration fees included everything, meals, hotel rooms, proceedings and other conference costs.

Amotz Bar-Noy (CUNY, New York) opened the conference on Tuesday with his talk “Cellular Networks: Where are the Mobile Users?” After a full day of talks, at 7PM, the attendees enjoyed a private visit of the Mount Saint-Michel Abbey. Wednesday started with the invited talk by Cyril Gavoille (LABRI, Bordeaux), titled “Distributed Data Structures: a Survey,” followed by talks, then lunch, and then an afternoon excursion to Cancale and Saint-Malo. Picture 4 shows “La pointe du Grouin,” one of the beautiful places seen during that afternoon of perfect weather. Surrounded by rampart, Saint Malo is a coastal city with a strong maritime history. It was almost destroyed during the second world war and later rebuilt with careful efforts to mimic its original looking. Everyone seemed to be happy there. This great atmosphere favors interesting scientific discussions and strong emulation between the participants. Delicious food was enjoyed at the conference banquet that same day, at the restaurant “Tirel-Guérin.” The conference ended Thursday after lunch.

Figure 3: From left to right: Ralf Klasing, Sergio Rajsbaum, Michel Raynal, Shmuel Zaks, Andrzej Pelc, and Leszek Gasieniec in Saint Malo.

3 The Talks

Here the talks are summarized, included the two invited talks.

3.1 Invited Talks

In addition to the regular papers sessions, the conference featured two invited talks by Amotz Bar-Noy and Cyril Gavoille.

- Cellular Networks: Where are the mobile users? (Amotz Bar-Noy, City University, New York, USA)

  Before establishing a communication channel between some mobile users, it is first required to locate them. The roaming area is partitioned in cells. Due to the cost of up-link communications, mobiles report only their location when crossing boundaries of a zone. Consequently, at each time and for a particular mobile, the system knows only a set of cells containing the one which is the location of this mobile. Moreover, for a given zone and a particular mobile, the system maintains a profile that predicts the location of the mobile by associating a probability with each cell. The only allowed operation is paging: the system can ask if a particular user is present in a particular cell. Several cells can be paged at the same time. The main question addressed in this talk is "*How to search inside a zone while minimizing the number of paged cells and the search time?*". This model gives rise to many optimization problems. The talk surveyed algorithmic solutions and challenges related to some of them.

- Distributed Data Structures: A survey (Cyrille Gavoille, Bordeaux, France)

  Given an arbitrary graph and a local graph property (i.e., a property defined on subsets of nodes), the main question addressed in this talk is how to associate a (preferably short) label with each node such that one can check the property by inspecting only the labels of the related nodes. More precisely, for a given property and a graph family, the goals are to find lower bounds on the label size together with efficient algorithms to compute the labels and to directly compute the property from nodes' labels. A collection of lower bounds and open challenges in this area were presented. The author concluded by emphasizing the large amount of research available in this area.

3.2 A Brief Survey of SIROCCO Scientific Contributions

Papers presented at the colloquium were subject to a thorough refereeing process. Among the 48 contributions submitted to SIROCCO 2005, 22 high-quality submissions were selected according to scientific criteria that are standard in the community of distributed computing as well as in the community of theoretical computer science.

One topic at the kernel of the SIROCCO community is to study the computational power of a distributed set of entities that have partial knowledge on their environment. This is more or less the underlying question addressed in the following set of papers. S. Das, P. Flocchini, A. Nayak and N. Santoro investigate in "Distributed Exploration of an Unknown Graph" the problem of exploring and mapping an unknown environment. The environment is modeled as a simple undirected connected graph of n anonymous nodes. In particular, they consider a group of k identical anonymous and asynchronous agents initially located at different nodes of a graph. The goal of the agents is to construct a labeled map of the graph (Labeled Map Construction, LMC). At each node of the graph, incident edges are arbitrary labeled. This implies that the

Figure 4: La pointe du Grouin.

anonymous agent may not be able to distinguish between two nodes with the same degree. On the other hand, an agent can access at each node a whiteboard on which it can read and write. It is worth noticing that although this model is weak, they give an efficient algorithm that solves the LMC problem, providing that n and k are co-prime and that the agents know k or n. Their algorithm is split in two parts: First, each agent builds a labeling map of a sub-tree of the unknown input graph. Then, an ad-hoc algorithm is applied to merge the distinct maps.

The problem of graph exploration receives also attention from P. Fraigniaud, D. Ilcinkas, S. Rajsbaum and S. Tixeuil in "An $\Omega(\log n)$ Space Lower Bound for Graph Exploration with Stop" they concentrate on the memory requirements for exploration by a set of non cooperative deterministic agents. For a set of q non cooperative K-states agents, they build traps of size $O(qK)$; that is, a graph that cannot be explored by the robots. This improves the previous $O(K^{O(q)})$ lower bound. Moreover, they derive from their impossibility result lower bound on the memory requirement for exploration with stop by an agent equipped with a pebble.

The approach chosen in the paper by S. Dobrev, J. Jansson, K. Sadakane and W. Sung in "Finding Short Right-Hand-on-the-Wall Walks in Undirected Graphs" is rather original. Roughly speaking, it consists of starting from an exploration algorithm and then to investigate how to label arbitrary graphs for achieving efficient exploration. More precisely, they consider the problem of the perpetual traversal by a single agent of an unknown graph (differently said, exploration without stop). The simple algorithm used is the following "*Start by taking the edge with the smallest label. Afterward, whenever you come to a node, continue by taking the successor edge (in the local orientation) to the edge via which you arrive*". This is the basic right hand on the wall strategy. They ask whether it is possible, for every undirected graph, to find the local orientations of the nodes in such a way that the resulting perpetual traversal visits all the node in $O(n)$ moves. They answer affirmatively this question.

Another problem related to graph exploration is investigated by R. Klasing, E. Markou, T. Radzik and F. Sarracco in "Hardness and Approximation Results for Black Hole Search in Arbitrary Graphs." The question addressed in their paper is localizing a black hole in an unknown arbitrary graph. A black hole is an harmful node in the network that destroys all agents visiting this node. The model assumes a semi-synchronous network and two agents that collaborate for finding the black hole. Indeed, the problem is unsolvable if there is no bound on the time used by an agent for an edge traversal. They are interested in finding optimal black hole search, measured in the number of edge traversals performed by the agents. They first prove that this problem is NP-hard for arbitrary graphs and then turn their effort towards the design of approximation algorithms. They end up with a $7/2$-approximation scheme based on the construction of a spanning tree, improving the previously know approximation algorithms.

Two papers deal with the formation of geometric patterns by a set of robots freely moving on an euclidean plan. These studies also ask under which assumptions on the capabilities of the robots, formation of non-trivial geometric patterns is achievable. In the paper "On the Feasibility of Gathering by Autonomous Mobile Robots" by G. Prencipe, the robots are anonymous, oblivious and run asynchronously. They can take snapshots of the environment but they do not have multiplicity detection capabilities. Under these conditions, the author shows that the simple gathering task (i.e., the robots are required to meet in a single point not a priori known) is impossible. The proof technique uses some kind of bivalency arguments. By taking advantage of the asynchrony of the robots, he establishes that any algorithm that solves the gathering problem cannot prevent the robots from reaching one of two particular geometric configurations. Then, a schedule that leaves the robots looping between these two configurations completes the impossibility proof.

Another paper, "Biangular circle formation by asynchronous mobile robots" by B. Katreniak, addresses the problem of forming fully symmetric geometric pattern. Interestingly, the proposed solution uses geometric invariants, namely, the smallest enclosing circle (SEC). As long as robots are moving towards the SEC, it stays invariant. Then, robots move in a pseudo synchronous way along the circle, trying to form a fully symmetric pattern.

Two papers are concerned with a somewhat dual question. Dealing with security issues, it may be of primary importance to prevent the processing nodes from inferring unauthorized information from the messages exchanged during the computation. A typical example is electronic vote: it is desirable that after the vote each participant knows the result of the election but is unable to learn the vote of a particular participant. A. Beimel in "On Private Computation in Incomplete Networks" studies the functions that can be computed privately in incomplete networks. More precisely, a set of nodes is connected by an incomplete network of private and reliable channels. After the computation, a subset of t *curious* nodes collude and try to infer information from what they heard. A function is said to be computed t-privately if any coalition of at most t curious nodes does not learn any information that is not implied by their input and the output of the function. He gives a complete characterization of functions that can be computed 1-privately in simple networks with one separating vertex and two 2-connected components. He then addresses the more general question of 1-private computation in arbitrary networks. He shows that this can be reduced to 1-private computation of a related function in a tree and provides necessary and sufficient conditions for 1-private computation in trees, leaving open the exact characterization.

The knowledge available to nodes at the end of a computation is also the underlying topic of the paper "Communications in Unknown Networks: Preserving the Secret of Topology" by M. Hinkelmann and A. Jakoby. They advocate that, when security is concerned, the network topology has to be part of the secret. Their work focuses on building all-to-all communication primitives in which the topology of the whole network cannot be inferred from the messages heard (or routed) by a node. The networks considered are synchronous. Note that, in this setting, information may be inferred from the transfer delay of messages. They first observe that for achieving any routing scheme, nodes must have some partial knowledge on the network topology. So, they revisit Shannon entropy theory to precisely formalize the notion of information gain. I.e., the information that a node may deduce from its initial partial knowledge and the flow of message it routes. An all-to-all communication protocol for static networks that prevent node from gaining information is presented. Finally, the authors investigate the case of dynamic networks.

A collection of papers are motivated by the design of wireless networks. Difficulties arise from the fact that collisions can occur between neighbored nodes. Moreover, it is often assumed that nodes are

Figure 5: Pierre Fraignaud, Amotz Bar-Noy, Shay Kutten in the Abbey.

subject to failure. To cope with these difficulties, one direction is to build reliable logical communication infrastructures. This leads to solving difficult problems taken from the field of graph theory.

D. Bilò and G. Proietti give in "Range Augmentation Problems in Static Ad-Hoc Wireless Networks" inapproximability bounds and approximation algorithms for the range augmentation problem in static ad-hoc wireless networks. They assume that the set of nodes that can be directly reached by a node is a function of the transmission power of that node. So, given an initial transmission power assignment they ask for the minimum power augmentation that allows a connectivity property to be satisfied. This issue is closely related to network survivability: to increase the resiliency of some network, one may want to increase the network connectivity.

A. Clementi, M. Di Ianni, A. Monti, M. Lauria, G. Rossi and R. Silvestri study in "Divide et Impera is Almost Optimal for the Bounded-Hop MST Problem on Random Euclidean Instances" the bounded-hop MST problem on random euclidean instances. Given a positive integer h and an euclidean graph, the goal is to build a minimum spanning tree of height h with respect to some cost function. Such a construction yields good broadcast protocols, since a constraint on the number of hops is sometimes required as far as reliability and performances are concerned. As the problem is NP-hard in even weaker settings, their work focuses on approximation algorithm, keeping in mind the design of practical solution. They first establish a lower bound on the cost of an h-hop spanning tree that holds with high probability on d-euclidean graphs. Thereafter, a simple yet efficient heuristic within a constant approximation factor is presented. The proposed algorithm is based on the divide and conquer basic strategy and is better than previously existing solutions, not only considering practical efficiency but also considering approximation ratio.

When dealing with radio networks, a question which has received a lot of attention is frequencies assignment. Indeed, if two neighbored nodes are assigned with the same frequency, collisions may occur while they are communicating. In graph terms, this can be re-stated as a coloring problem. In the paper "On the Approximability of the $L(h, k)$-Labeling," T. Callamoneri and P. Vocca study $L(h, k)$-labeling. The goal is to compute a numbering (coloring) of the nodes of the input graph such that some constraints are satisfied on the difference between the numbers assigned to nodes according to the distance between them. More precisely, for any two adjacent nodes (i, j), $|c_i - c_j| \geq k$ and if i, j are at distance two, then $|c_i - c_j| \leq l$.

Since the problem is NP-complete in general, they explore different labeling techniques for a restricted class of graphs, namely, bi-partite graphs, and state a collection of approximability results.

In the paper "A Tight Bound for Online Coloring of Disk Graphs" I. Caragiannis, A. Fishkin, C. Kaklamanis and E. Papaioannou investigate the minimum coloring problem in the context of disk graphs. (I.e, graph-representations of a set of disks in the euclidean plane). They consider the online case, where the disk graph is revealed in steps. A naive algorithm to solve that problem is the First-Fit, that is: to each node is assigned the smallest color not assigned to its already examined neighbors. Rather surprisingly, the authors point out two main results concerning this simple algorithm: i) it is $O(\log \sigma)-$competitive when applied to $\sigma-$bounded disks graphs; ii) First-Fit algorithm achieves the best possible competitive ratio (within constant factor) among all deterministic online coloring algorithms for disk graphs not using disk representation.

Last but not least, in "On Semi-Perfect 1-Factorizations" R. Královič and R. Královič tackle an important but difficult conjecture in graph theory, namely, the existence of a 1-factorization of a complete graph K_{2n} in which any two 1-factors induce an Hamiltonian cycle. A 1-factor of a graph G is a spanning subgraph in which every vertex has degree one. A 1-factorization of G is a partition of the set of edges of G into distinct 1-factors. Apart from its theoretical interest on its own, a 1-factorization of a graph can be used to build bandwidth efficient wireless network topologies. Instead of attempting to give a direct answer to the conjecture, they relax the problem in some way. More precisely, given a decomposition into 1-factors $F_1, \ldots, F_k$ of some graph, it is only required that every $F_1 \cup F_i, 1 < i \leq k$ forms a Hamiltonian cycle. Such a 1-factorization is called *semi-perfect.* They show that complete graph K_{2n}, hypercubes Q_{2n+1} and Tori $T_{2n\times 2n}$ admit a semi-perfect 1-factorization.

A few papers consider design issues in optical fiber networks. Whereas the assignment of wavelengths to a given set of light-paths has received a lot of attention, the number of add-drop multiplexers (ADM) seems to be the dominant cost factor. Even if the problem is restricted by considering simple topologies or static predefined routing request, the problem remains quite hard. J.C. Bermond, L. Braud and D. Coudert address in "Traffic Grooming on the Path" the grooming problem in a WDM network where nodes are path connected. Routing a request consists of assigning it a route in the physical network and a wavelength. If each request uses at most a constant fraction $1/C$ of the bandwidth of the wavelength, it is possible to group (or *groom*) at each edge of the network at most C requests in the same wavelength. While minimizing the number of wavelengths is an easy problem in a network formed by nodes connected on a path, finding the minimal number of ADMs is NP-complete for a general sets of requests. Consequently, the authors investigate this problem in a restricted setting, namely static uniform all-to all traffic and completely solve the case $C = 2$. Interestingly, they model the problem as a graph partition problem and they design their solution using tools borrowed from design theory.

The work "Minimizing the Number of ADMs in SONET Rings with Maximum Throughput" of M. Shalom and S. Zaks concentrates on minimizing the number of ADMs in a SONET ring while making a full use of the bandwidth. They develop an architecture based on nested polygons and provide necessary and sufficient feasibility conditions. Their work shed a new light on the trade-off between the number of ADMs and the number of wavelength in SONETs.

In certain cases, a central entity faces nodes which may lie by reporting false information about their local state, while the central entity tries to minimize the cost of a task distributed among the lying nodes. For instance, V. Auletta, R. De Prisco, P. Penna and G. Persiano consider in "On Designing Truthful Mechanisms for Online Scheduling" the online scheduling of jobs among selfish agents. Jobs must be scheduled on a set of parallel machines, each of them owned by an agent that may not report its truth capability to handle jobs. However, the central entity pays agents for handling jobs. Therefore, the goal of an agent is to minimize its job assignment (by reporting low capability) while maximizing its payment. A solution to this problem consists of designing a scheduling algorithm A together with a payment function P. The pair (A, P) is called a *mechanism*. Interestingly, it is possible to design truthful mechanisms, for which the best strategy for every agent is reporting his true capability, whatever the reports of other agents is. The paper focuses on the loss of optimality due to the combination of the online setting with selfish agents.

The design of mechanisms is also the main concern of the paper "Free-Riders in Steiner Tree Cost-Sharing Games" by P. Penna and C. Carmine. Roughly speaking, they consider the problem of distributing a service from a source node to some clients. More precisely, a source node and a set of clients are connected by some underlying graph. Moreover, delivering the service has some cost that depends on the underlying graph and the set of clients that access the service. Each client reports its willingness to be served. Then, the provider builds a distribution tree for serving the client and charges the clients in order to balance the distribution cost. They give polynomial time mechanisms for this cost-sharing game, improving their previous results by taking into account free-riders (i.e., clients that access the service for free).

Classical fault tolerant distributed computing receives also attention from the SIROCCO community. In "Majority and Unanimity in Synchronous Networks with Ubiquitous Dynamic Faults" N. Santoro and P. Wildmayer study agreement problems in synchronous distributed system prone to *dynamic faults*. In this model, during each clock cycle, at most t communication links may suffer transient failures. This means that the set of links that are faulty may change at every clock cycle. In contrast, in the traditional component failure model, a link that experiments failure during a round is considered faulty forever after. They establish a collection of (im)possibilities result for various kinds of link failures, namely, omission, addition, corruption and any combination of these faults. Theses results hold for any arbitrary network, thus generalizing the existing knowledge. However, more investigation is required for closing the gap between lower bounds and upper bounds on the number of dynamic faults for agreement solvability in a large class of networks topologies, namely, those in which the maximal node degree differs from the graph connectivity.

T. Izumi and T. Masuzawa improve the time complexity for solving condition based consensus in crash prone synchronous systems. The condition based approach aims at circumventing impossible results in fault prone distributed systems by restricting the set of allowed inputs. In the synchronous setting, where consensus is always solvable whatever the number of faulty processes, the condition based approach allows to break some time complexity lower bounds. The authors present an improved (i.e., that achieves better time complexity) adaptive condition based protocol for solving consensus. The more restricted is the set to which the actual vector of input values belongs, the faster their algorithm converges towards a common decision. Interestingly, when the set of inputs does not belong to any condition, the time complexity achieved matches the canonical lower bound of $\min(f + 2, t + 1)$.

To conclude this survey, it is worth noticing that three papers are concerned with topics which have a long tradition in SIROCCO. The first two papers are dealing with establishing exact complexity bounds for fundamental distributed problems and the third with routing.

In their work "Two Absolute Bounds for Distributed Bit Complexity," Y. Dinitz and N. Solomon struggle with some very fine aspects of distributed computation, namely, distributed bit complexity. In this area, the main question is given a failure free synchronous network and a distributed task, what is the exact amount of bits that need to be exchanged by processes to solve the task. They provided to absolute bounds for leader election by two linked processes and by a chain of even length, closing the gap left open in previous works. Moreover, their proof shows that the algorithms presented are the only ones that match the lower bounds.

In "Optimal Gossiping in Square Meshes in All-Port Mode and with Short Packets" R. Wang and F. Lau design efficient gossiping algorithms, proving that existing lowers bound are tight. More precisely they consider the gossiping problem in an all port mode for square meshes. The result is carefully crafting gossiping schemes along the shortest paths.

Figure 6: The SIROCCO crowd walking at the edge of the Mont with high tide.

The work "Geometric Routing without Geometry" of M. Wattenhofer, R. Wattenhofer and P. Widmayer revisit the well known geometric routing paradigm. In this scheme, each node knows its own coordinates and the coordinates of its neighbors in the euclidean plane. Routing is then performed according to the following idea: when a node receives a message that contains the coordinates of its destination, it forwards it to the neighbor node that is geometrically closest to the destination. As pointed out by the authors, giving each node its real coordinates may be impractical or may require expensive hardware. To cope with this difficulty, they propose to use pseudo-coordinates computing as the distance from a subset of giving nodes called anchors. I.e., the coordinates of a node v is a vector $(d1, \dots dk)$ where di is the number of hops between v and the anchor a. To demonstrate the utility of this routing paradigm, they explore its application to different classical networks topologies. For each of these topologies, they provide lower and upper bounds on the number of anchors required to guarantee that any node has unique coordinates and study the efficiency of the (pseudo)-geometric routing scheme. Finally, the authors advocate that dynamic radio networks may benefit from pseudo-geometric routing schemes. More work has to be done in this direction.

4 Future SIROCCO's

This year's SIROCCO "placed the bar very high" in terms of location, food, scientific program, and in general of a very enjoyable and well organized conference. The 13th will be organized by Leszek Gasieniec in Liverpool, UK. We do hope that whoever is interested in this topics will join SIROCCO community and attend the next edition of the colloquium. Looking forward to see you next year in England!

Acknowledgments

Many thanks to E. Lebret and N. Mallory for their very nice work during the conference. Thanks also to A. Milani, S. Rajsbaum and M. Raynal that provide nice comments on earlier version of this report. The author is also grateful to N. Mallory, S. Tixeuil, S. Zaks who kindly give the pictures that illustrate this report.