Welcome to the last issue of the year 2011. In this issue, we bring to you three research papers. We are also pleased to introduce Research Essay section in this issue. The idea behind this initiative is to invite academic/industry experts to write a short essay on the emerging technology, business and policy trends in the area of data communications and networking. We hope that this will provide our readers a look-ahead and synergistic view of this rapidly evolving field.

The first paper is on security aspects of Mobile Adhoc Networks (MANETs). The MANETs are open to a wide range of attacks due to their unique characteristics such as dynamic topology, shared medium, absence of infrastructure, multi-hop scenario and resource constraints. Data packets sent by a source node may reach destination through a number of intermediate nodes. In the absence of security mechanism, it is easy for an intermediate node to intercept or modify the messages, thus attacking the normal operation of MANET. One such attack is the Black Hole attack, in which, a malicious node called Black Hole node attracts all the traffic of the network towards itself, and discards all the packets without forwarding them to the intended recipients. This paper evaluates the performance of Adhoc On-demand Distance Vector (AODV) and its multi-path variant Adhoc On-demand Multi-path Distance Vector (AOMDV) routing protocols under black hole attack. Non-cryptographic solutions such as Secure Blackhole AODV (SBAODV) and Secure Blackhole AOMDV (SBAOMDV) have been proposed to mitigate the effect of black hole attack with video streaming. The authors provide simulation results of their proposed algorithms and benchmark their results. The results show that, the proposed solutions provide better performance than the conventional AODV and AOMDV in terms of metrics such as packet delivery ratio, average throughput, average end to end delay, average jitter and Peak Signal to Noise Ratio of received video.

The second paper is on wireless sensor networks with energy heterogeneity. Clustering is always an important issue in this type of network, and the paper discusses how to enhance clustering subject to energy heterogeneity constraint. We have talked about M2M systems earlier that, with the advent of MEMS based sensor devices, wireless sensor networks are being increasingly deployed in large numbers in the industry and in our daily life – starting from monitoring production systems to keeping a vigil on social environments. Commensurately, there is a growing need for the efficient management of these sensor networks where battery-operated nodes have to handle complex functions in data acquisition and processing. Energy is traditionally a big bottleneck in these networks, and so energy saving solutions have always been in great demand. A major requirement for these battery-powered sensor nodes is to optimize between cooperation and competition. Another important issue with these
networks, which is usually ignored in most of
the works, is the non-uniformity among the
nodes in terms of energy content. Energy, be-
ing a crucial resource, imparts dominance to
the nodes, which may result in an interesting
behavioral pattern among the players. To ad-
dress this constraint in this paper, the authors
propose to use a heterogeneous three-tier node
setting in their clustering algorithm. Nodes
elect themselves as cluster heads based on their
energy levels, therefore retaining a more-or-
less uniform distribution of energy left with
sensor nodes. Their result shows that the new
protocol, proposed by them as SEP-E, is more
robust in terms of network life time and resource
sharing. The stability period offered by SEP-E
shows significant improvement over ‘de-facto’
standard protocol LEACH typically when the
degree of energy heterogeneity is high within
the network.

The third paper of the issue looks back at
one of the classical network algorithms which
most of us have learnt about during our under-
graduate days. The authors have considered
Kruskal’s algorithm in a multicast routing
environment keeping obviously recent multi-
media applications in mind. The Internet and
cellular networks are full of such applications
that demand guaranteed end-to-end quality of
service (QoS), and accordingly the underlying
delivery networks are characterized by stringent
constraints on delay, jitter, bandwidth, cost etc.
The problem of multicasting is now almost
synonymous with finding a minimum spanning
sub tree of a given connected network. More
than five decades ago, this problem was first
solved by Kruskal, soon to be followed by
Prim and Dijkstra who suggested better algo-
rithms. However, Kruskal’s algorithm remains
computationally more efficient in a number of
interesting cases, in particular when the network
under consideration is sparse. The authors of
this paper worked with the original algorithm
in a somewhat different setting as they have
considered the problem of determining multi-
cast trees that guarantee certain bounds on the overall
cost, and end-to-end delays from the source to
each of the destination nodes. They propose
to organize the priority queue of the original
Kruskal’s algorithm into multiple classes, which
are formed by the edge containing the source
node, the edges containing destination nodes and
the edges containing relay nodes respectively.
Then, they introduce a new strategy in edge
selection, giving priority to edges containing
one or two destination nodes to be selected.
Finally, based on these two strategies, they
address the problem of constructing the delay
constrained multicast tree using a fast and simple
heuristic algorithm named the Extended Krus-
kal’s (EKRUS) algorithm. Further, they have
developed two important strategies. The first
one deals with the organization of the priority
queue in Kruskal’s algorithm, and the second
one concerns edge priority aggregation.

In the Research Essay at the end of the
issue, Saha and Sridhar explore the emerging
technologies, market evolution, business mod-
els and regulatory interventions and indicate
possible research directions in the area of data
communications and networking in the coming
days. We hope that this will provide our readers
a look-ahead of the future issues of IJBDCN.

We hope that you enjoy reading this issue
as much as we do in compiling the interesting
articles in it.

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Debashis Saha is a professor with the MIS Group, Indian Institute of Management (IIM)-Calcutta. Previously, he was with CSE Department at Jadavpur University (Kolkata, India). He received his BE (Hons) degree from Jadavpur University (Kolkata, India), and the MTech and PhD degrees from the Indian Institute of Technology (IIT-Kharagpur, India) all in electronics and telecommunications engineering. His research interests include pervasive communication and computing, network operations, management and security, wireless networking and mobile computing, ICT for development, and network economics. He has supervised thirteen doctoral theses, published about 230 research papers in various conferences and journals, and directed four funded research projects on networking. He has co-authored several book chapters, a monograph, and five books including Networking Infrastructure for Pervasive Computing: Enabling Technologies and Systems (Norwell, MA: Kluwer, 2002) and Location Management and Routing in Mobile Wireless Networks (Boston, MA: Artech House, 2003). Dr. Saha is the recipient of the prestigious career award for Young Teachers from AICTE, Government of India, and is a SERC Visiting Fellow with the Department of Science and Technology (DST), Government of India. He is a Fellow of West Bengal Academy of Science and Technology (DST), Senior Life Member of Computer Society of India, Senior Member of IEEE, member of ACM, member of AIS, and member of the International Federation of Information Processing Working Group’s 6.8 and 6.10. He was the founding Chair of Calcutta Chapter of IEEE Communications Society (2003-2008).

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