RESEARCH BRIEF

AUTOMATED MONITORING AND MANAGEMENT OF HYBRID BROADBAND NETWORKS

The potential

Managing hybrid networks is crucial for commercial network existence and operation and is also critical as a market differentiator. The difficult system problem of security and information assurance also has become a critical component of monitoring and management for communication networks. In addition, schemes for efficient storage and aggregation of massive network monitoring data are key to modern network management.

The increasing heterogeneity and speed of hybrid networks calls for management automation and non-conventional ideas.

At NASA, autonomous intelligent network management and control systems for complex spacecraft, including micro-satellite constellations, are key to its exploration mission. As NASA moves towards using commercial satellite networks and the Internet, intelligent fault and performance management are becoming vital.

The challenge

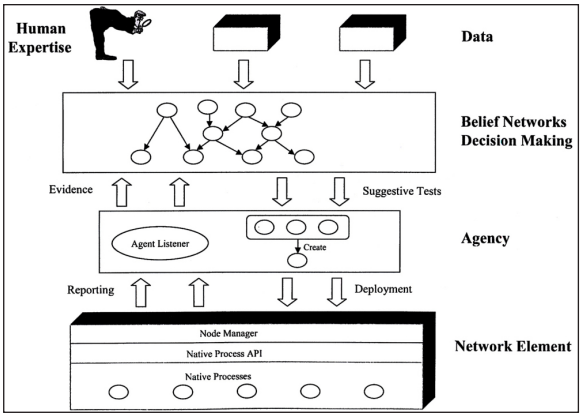
Intelligent monitoring systems are needed for satellite and hybrid network fault and performance management for millions of users.

Researchers need to develop schemes for efficient storage and aggregation of massive network data, network management systems for NASA networks and space communication systems using commercial satellites, autonomous intelligent network management and control systems for complex and distributed spacecraft, and integrated security schemes for satellite networks.

The research

Researchers at ISR's Center for Satellite and Hybrid Communication Networks (CSHCN) have developed large-scale distributed systems for fault management belief networks, Markov decision processes, and intelligent agents. They also have initiated the development of automated management of formation flying and satellite constellations.

Performance management. CSHCN researchers have proposed a novel hierarchical scheduling discipline that provisions rate, delay and jitter bounds to connections. They also have proposed and analyzed a new delay bounding scheduler called the Highest Relative Delay First (HRDF), which they have implemented in a prototype ATM switch.



The integrated system

Network management data. The researchers have developed efficient ways to compute, store and manipulate the spacial and temporal aggregates of monitored network statistical data in large satellite networks. This includes new flexible tools for defining and using hierarchies.

Reliable multicast protocol. To solve the problems of high loss rates, long propagation delays and limited and shared return channels, the researchers have proposed a framework for a lightweight reliable multicast protocol, boosted up packet protection with proactive packet level forward-error-correction coding, and reducing the volume of feedback from users.

Security and information assurance. Here, the researchers have extended the strand model, embedded propositional logic in the strand transition function, and expanded the formulas joined with propositional logic connectives.

In the future the researchers plan to complete the design and evaluation of efficient, secure, and reliable multicasting over "mesh" satellite networks,

and develop an automated symbolic tester for routing protocols.

Support

Industry: Hughes Network Systems, Lockheed Martin, Telcordia

Industry interest: Verizon, IBM

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Research Team

John Baras
Professor, Electrical and Computer Engineering and the Institute for Systems Research
Director, Center for Hybrid and Satellite Communication Networks

Nicholas Roussopoulos
Professor, Computer Science

ISR-affiliated faculty

Majid Raissi-Dehkordi
ISR Postdoctoral Research Associate

Research staff: S-A. Yang and V. Bharadwaj

Graduate students: A. Arora, A. Labrinidis, N. Sismanis, G. Akkor, A. Roy-Chowdhury

Contacts

John S. Baras
Professor, Electrical and Computer Engineering Department and the Institute for Systems Research
2249 A.V. Williams Bldg.
University of Maryland
College Park, MD 20742

Phone: 301.405.6606
Email: baras@isr.umd.edu
Web: *www.isr.umd.edu/~baras/*

Nicholas Roussopoulos
Professor, Electrical and Computer Engineering Department and the Institute for Systems Research
3235 A.V. Williams Bldg.
University of Maryland
College Park, MD 20742

Phone: 301.405.2687
Email: nick@cs.umd.edu
Web: *www.cs.umd.edu/~nick/*

Link

Maryland Hybrid Networks Center
www.hynet.umd.edu