Feb 2nd, 9:30 AM - 3:30 PM

Research poster: HTSMA: a hybrid temporal-spatial multi-channel assignment scheme in heterogeneous wireless mesh networks

Yan Jin  
University of Nevada, Las Vegas

Ju-Yeon Jo  
University of Nevada, Las Vegas, juyeon.jo@unlv.edu

Mei Yang  
University of Nevada, Las Vegas, mei.yang@unlv.edu

Yoohwan Kim  
University of Nevada, Las Vegas, yoohwan.kim@unlv.edu

Yingtao Jiang  
University of Nevada, Las Vegas, yingtao@egr.unlv.edu

See next page for additional authors

Repository Citation

https://digitalscholarship.unlv.edu/epscor/2010/feb02/24

This Event is brought to you for free and open access by the Conferences/Meetings (NNE) at Digital Scholarship@UNLV. It has been accepted for inclusion in 2010 Annual Nevada NSF EPSCoR Climate Change Conference by an authorized administrator of Digital Scholarship@UNLV. For more information, please contact digitalscholarship@unlv.edu.
Presenters
Yan Jin, Ju-Yeon Jo, Mei Yang, Yoo-hwan Kim, Yingtao Jiang, and John Gowens

This event is available at Digital Scholarship@UNLV: https://digitalscholarship.unlv.edu/epscor/2010/feb02/24
**Overview of WMNs**

**Home Networking in Climate Change**

**Ubiquitous Sensor Network (USN) based Infrastructure in Climate Change**

**HTSMA: a Hybrid Temporal-Spatial Multi-Channel Assignment Scheme in Heterogeneous Wireless Mesh Networks**

Authors: Yan Jin, Ju-Yeon Jo, Mei Yang, Yohwan Kim, Tingting Zeng, John Gowens

**Overview of HTSMA**

- **Increases network capacity**
- **Problem:** Channel Assignment (CA)
- **Centralized**
  - Graph Based
  - Network Partitioning
  - Gateway Centered
  - Peer Channeled
- **Distributed**

**Existing problems**

- Utilization of a dedicated channel for the transmission of necessary control messages—waste of limited bandwidth resource
  - Utilization of time synchronization across all the nodes—excessive system overhead
  - Routing==CA is still a NPC problem
  - A distributed heuristic algorithm is feasible

**Proposed Algorithm-HTSMA**

- **Centralized Temporal-Spatial Multi-channel Assignment (HTSMA) scheme**
  - Neither a dedicated channel nor time synchronization is needed
  - Each host is equipped with a single radio interface—feasible for small and low-cost devices
  - The gateway utilizes available channels fairly by switching channels in a round-robin fashion to collect the packets from other nodes—temporal property of HTSMA
  - Other nodes simultaneously utilize different orthogonal channels within their neighborhoods—spatial property of HTSMA

**Initialization of HTSMA**

- **Phase I:** Initialization
  1. Switch to a predefined, common channel for each $e_i \in G(W)$
  2. Set the hop count of gateway $T(G(W))=0$
  3. Set $S_{i}^{0}=\Phi$ for each $e_i \in G(W)$
  4. Set $S_{i}^{0}=\Phi$ and initialize $-\infty$ for each $e_i \in G(W)$
  5. Gateway broadcasts a hello message with its radio range $r_0$ and $D(W)$

- **Phase II:** Main Processing (ac: host id) $a_i \in G(W)$
  1. While (initialized $=1$ and current clock time $\geq$ previous time)
  2. Host receives a hello messages from host $j$
  3. If $t_{i}^{0} = t_{j}^{0}$
  4. Estimate $d_{i} = \frac{s_{i}^{0}}{|S_{i}^{0}|}$ based on the receiving signal intensity
  5. Set $S_{i}^{0} = t_{i}^{0} = t_{j}^{0}$
  6. $T(G(W)) = T(G(W)) + 1$
  7. $S_{i}^{0}$ initialized $=0$
  8. Initialize a back-off system timer $t$
  9. Else:
  10. Update $t_{i}^{0}$
  11. Broadcasts a hello message, piggybacking its radio range $r_0$ and $D(W)$

**Performance Evaluation**

- **Three MAC CA schemes:**
  1. conventional single-channel IEEE 802.11
  2. multi-channel synchronization-based MAC protocol MMAC [So et al. 2004]
  3. HTSMA

- **Three performance metrics:**
  1. Aggregate network throughput
  2. Saturation network throughput-maximal throughput that a network can accommodate
  3. Collision ratio

**Metric I:** Aggregate network throughput in a 500m500m area

**Metric II:** Saturation network throughput in a 500m500m area

**Metric III:** Collision ratio in a 500m500m area

**USN is a conceptual network built over existing physical networks which make use of sensed data and provide knowledge services to anyone, anywhere and at anytime, and where the information is generated by using context awareness.**