

Update on the Deployment of BATS Codes

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n-hop technologies
Hong Kong



Why BATS?

- Multi-hop is a longstanding problem in wireless communication
- Transmission can sustain no more than a few hops if data packets are treated as commodities
- The multi-hop curse
- **BATS** can sustain tens or even hundreds of hops, without relying on link-by-link retransmission (very bad for video transmission)
- Recoding is employed at the intermediate nodes



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BATS Codes

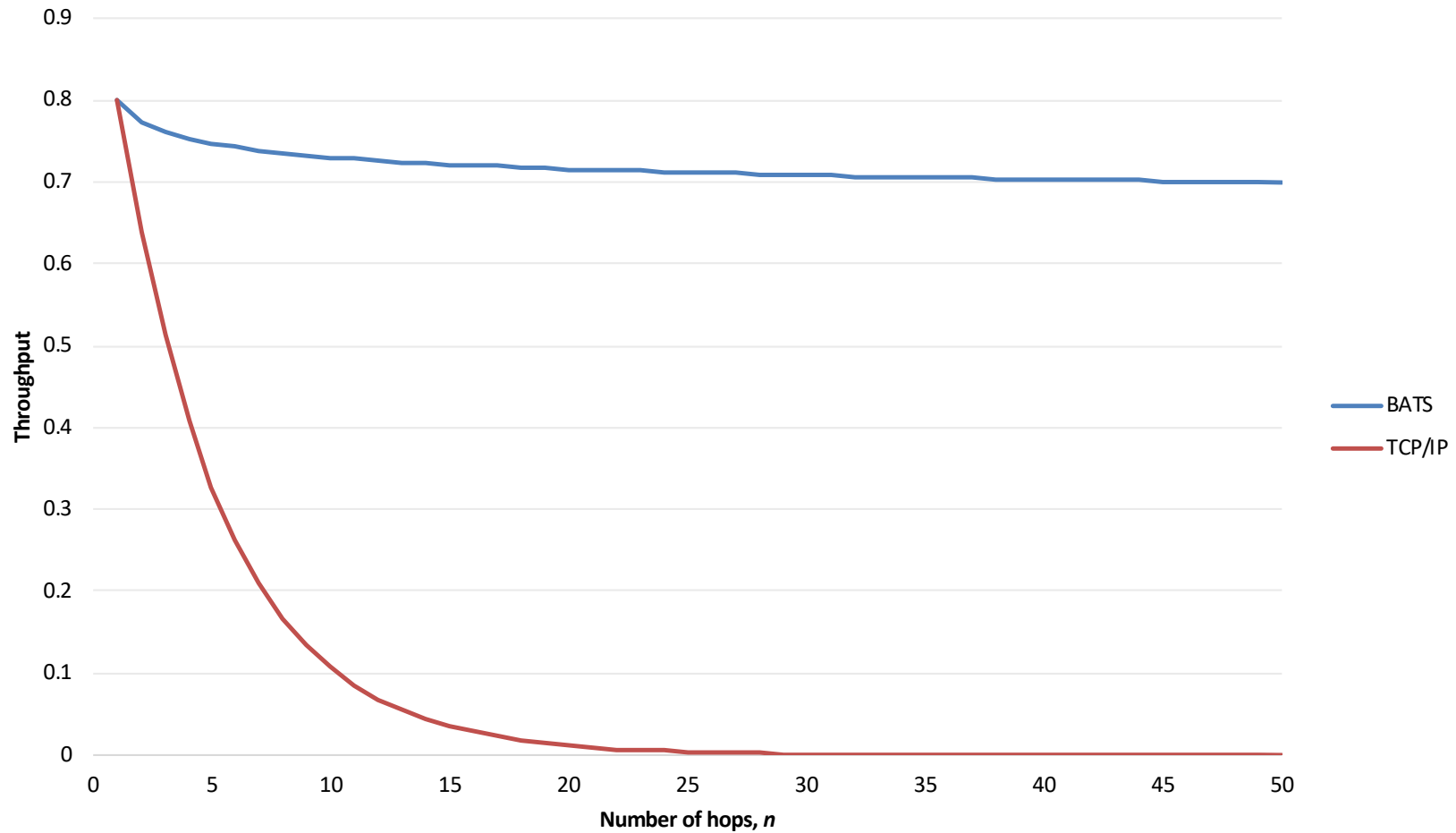
Theory and Practice

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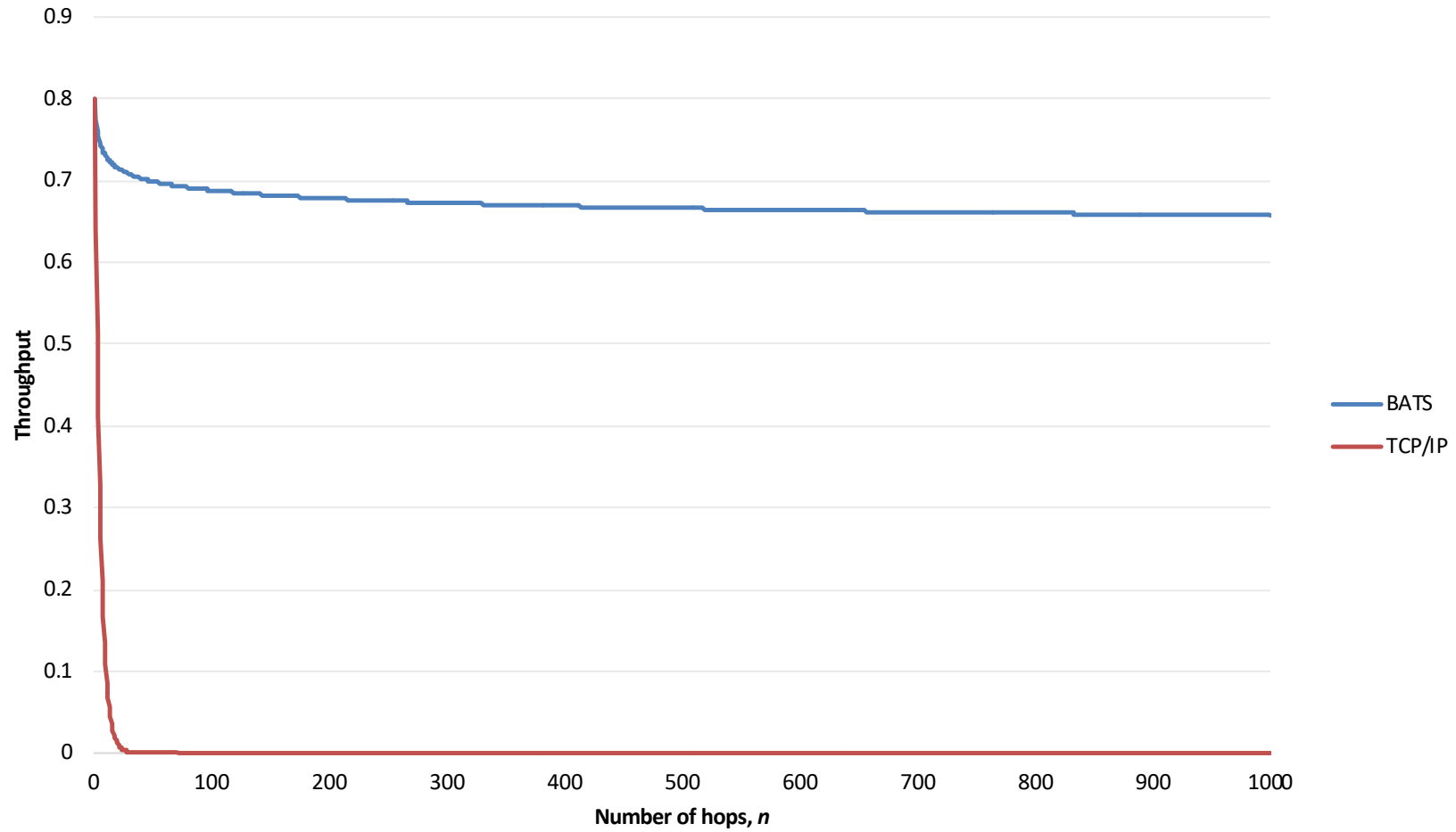
*SYNTHESIS LECTURES ON
COMMUNICATION NETWORKS*

R. Srikant, Series Editor

Performance Comparison

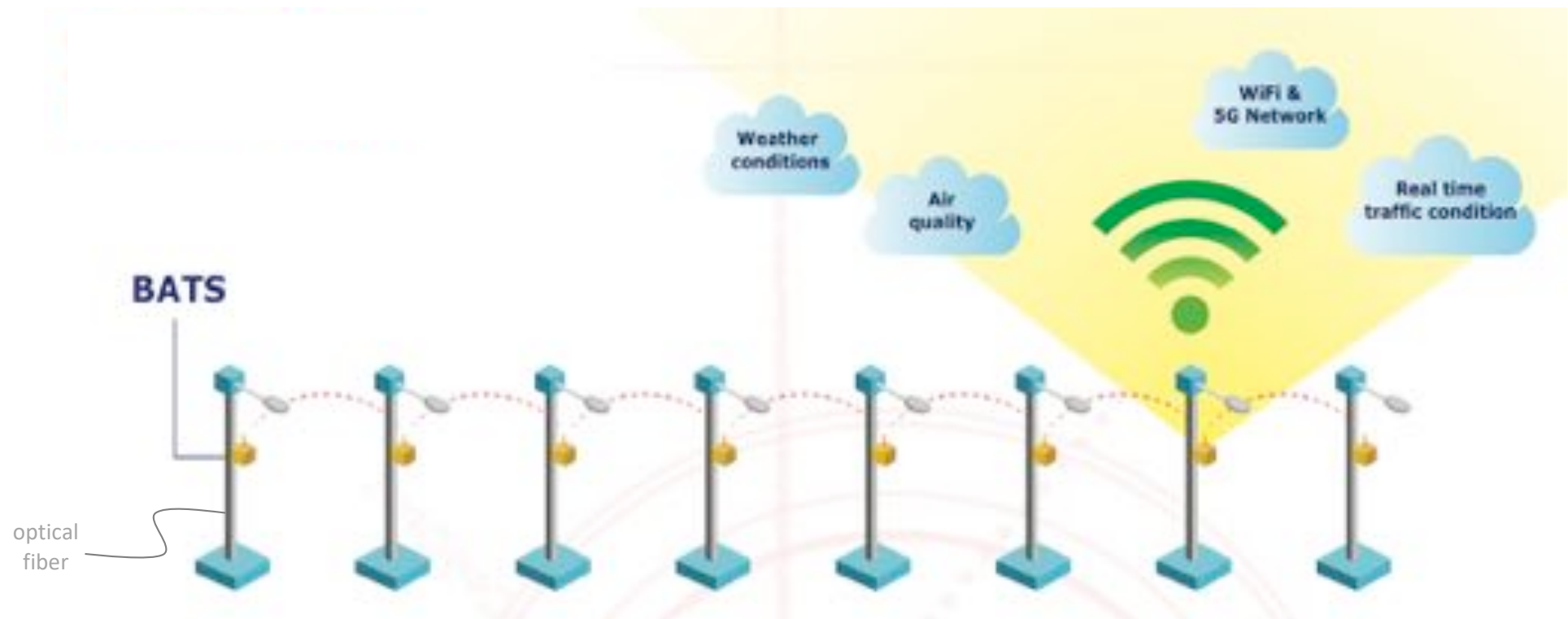


Performance Comparison



Hong Kong Smart Lamppost Project

Smart Lamppost Connectivity



Pilot Project

- Successfully deployed BATS in 36 smart lampposts
- The general public has concern about the installation of video cameras on the lampposts due to possible infringement of privacy
- Hopefully can resume by end of 2021, with video cameras replaced by LiDARs



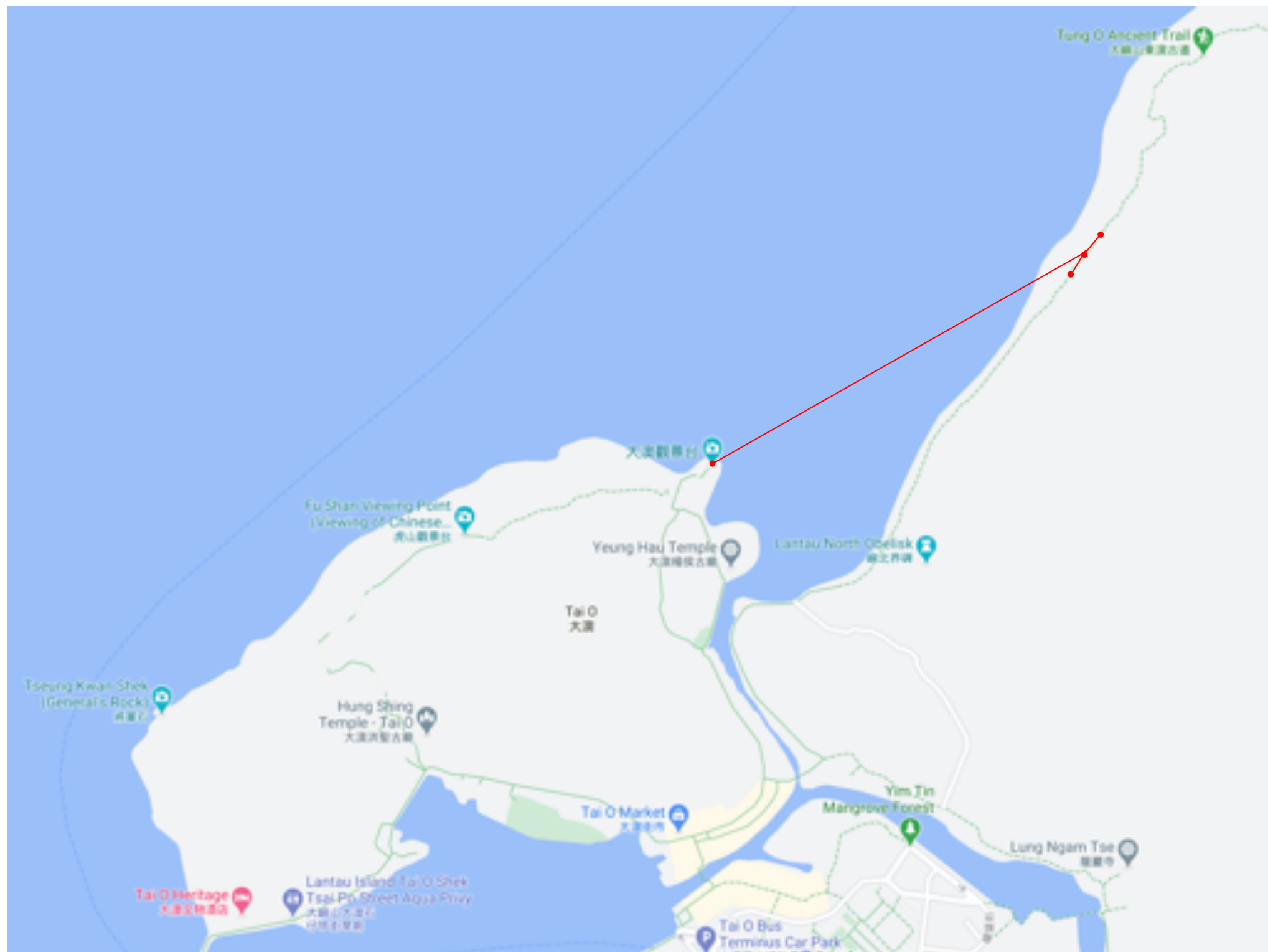
Smart Lamppost Testbed on CUHK Campus

BATS + Fog Computing

- BATS is inherently a fog computing application because the computation must be done at the edge
- Installing 20 fog computing based smart lampposts on the CUHK campus, with BATS being provided as a service
- Services to be provided
 - WiFi access
 - Lamppost-assisted autonomous driving
 - Real-time traffic monitoring with AI applications

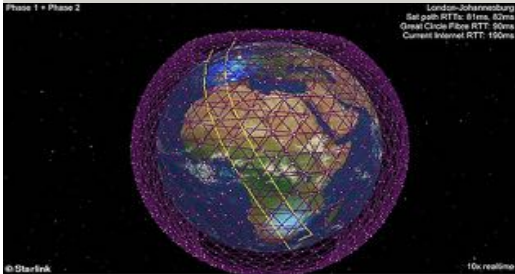


Hong Kong Country Park Pilot Trial





Addressable Markets



Satellite communications



Rural communications



Private networks



Rapid response



Smart cities



V2X



Safety & surveillance



Internet of Things



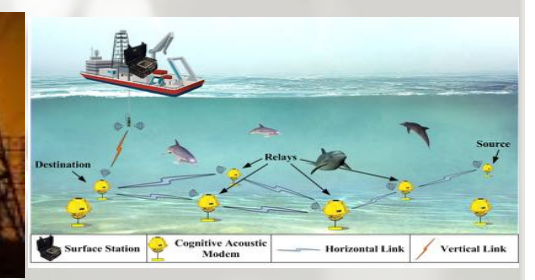
Confined space



5G



Powerline communications



Underwater communications



Field Programmable Gate Array (FPGA) for Mass Market



In-house
development and
implementation in
progress.



Supported by
Intel FPGA
development
team

Address mass
equipment market
for cost and
performance.



Facilitated and
supported by
Arrow
Electronics on
logistics and
market
development.



Internet Draft Submitted

BATS Coding Scheme for Multi-hop Data Transport
draft-irtf-nwcrg-bats-00 (Feb 02, 2021)

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Main Contents of the Draft

- Basic data delivery procedures using a BATS code
- A baseline BATS code specification
- Related research issues (new)
 - Coding design issues
 - Protocol design issues
 - Application related issues
- Security Considerations

Thanks to

- NWCRG Chairs Marie-Jose and Vincent
 - suggestion to add discussions on related research Issues
- Dave Oran
 - pointer to Byers and Luby's recent work on "Liquid Data Networking"

BATS IPs

- 3 US Patents
 - US Patent No. 8693501
 - US Patent Application No. US10425192
 - US Patent No. US10237782
- 5 EU Patents
 - DE validation of EP Patent No. 2644004
 - FI validation of EP Patent No. 2644004
 - FR validation of EP Patent No. 2644004
 - GB validation of EP Patent No. 2644004
 - SE validation of EP Patent No. 2644004
- 3 China Patents
 - CN Patent No. ZL 201180055775.3
 - CN Patent No. ZL 201610857698.8
 - CN Patent No. ZL 201811256029.0
- 1 MO Application
 - MO Patent Application No. J/004408

Thank you

