



Improving TCP performance in mobile satellite IP communications

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Roadmap

- Background
 - mobile satellite communications
 - transmission control protocol (TCP)
- Motivation for TCP performance improvement
- Mobile satellite services
 - risks
 - uncertainties
 - ethics
- Possible scenarios
- Conclusion and References

Background

- Mobile satellite communications:
 - occurs between an earth station or mobile entities to another earth station via artificial satellites
- Seamless, ubiquitous system—based on integrated satellite/ground-based technology:
 - provides coverage for both land and maritime areas not reachable by cable
- Satellite link characteristics:
 - high bit error rate (BER)
 - long and varying propagation delay
 - varying bandwidth
 - asymmetric path (uplink and downlink bandwidth)





Background

- Transmission Control Protocol (TCP) and Internet Protocol (IP):
 - specify rules of communication between end-hosts on the Internet
 - used for most Internet applications such as Telnet, HTTP, and FTP
- TCP was originally designed for wired network:
 - random BER is negligible
- The Internet:
 - has witnessed tremendous growth in wireless IP communications

HTTP: hypertext transfer protocol
FTP: file transfer protocol
BER: bit error rate



Motivation

- Ubiquitous computing:
 - “everywhere computing: a human-centric system”
 - quality of service (QoS) is maintained for network services as in wired networks
- The problem:
 - packet losses occur in satellite networks due to link characteristics
 - TCP misinterprets packet losses as an indication of congestion
 - QoS is affected by long propagation delay and jitter
 - design issues arise in satellite transmission circuits using TCP as primary transport protocol



Risks

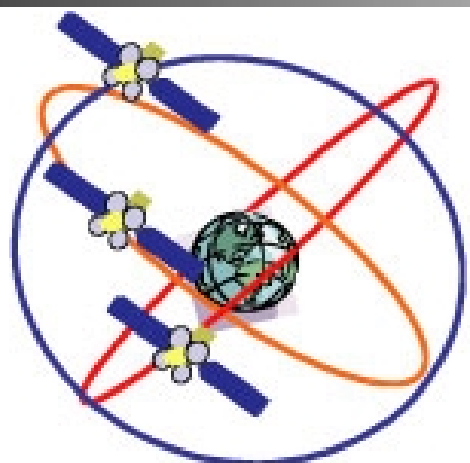
- Security concerns:
 - unlicensed operators/users
 - interfere with existing systems
 - hack into existing systems
 - license exempt frequencies
- Financial implications in providing affordable services:
 - remote areas in developed countries (aboriginal communities in Northern Canada)
 - developing nations



Uncertainties

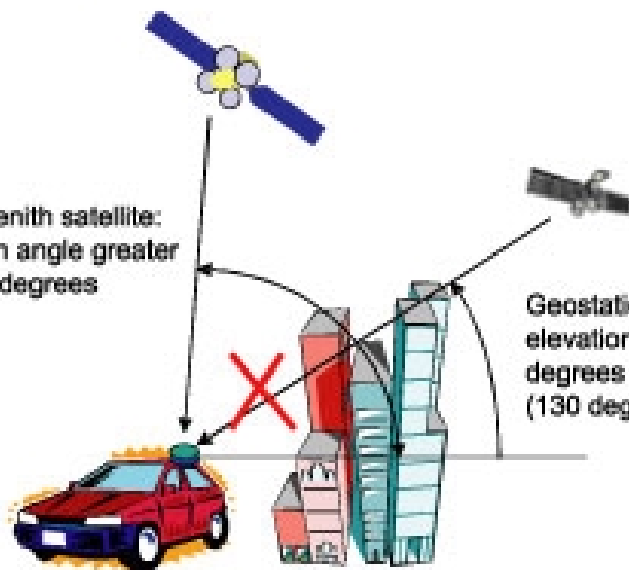
- Continuous proposals on frequency band allocation:
 - additional frequency bands being introduced
- Multiple stages from conception to actualization:
 - time-consuming
 - unpredictable outcomes
- Various types of artificial satellites still in developmental phases:
 - geostationary
 - non-geostationary
 - highly elliptical orbit, medium earth orbit, low earth orbit, and quasi-zenith (Japanese initiative)

Quasi-zenith satellite system



Satellites are placed on two to four orbital planes
⇒ two to four satellites pass over Japan,
with one satellite located near zenith
over Japan

Quasi-zenith satellite:
elevation angle greater
than 70 degrees



Geostationary satellite:
elevation angle of about 48
degrees from Tokyo
(130 degrees east longitude)



Ethics



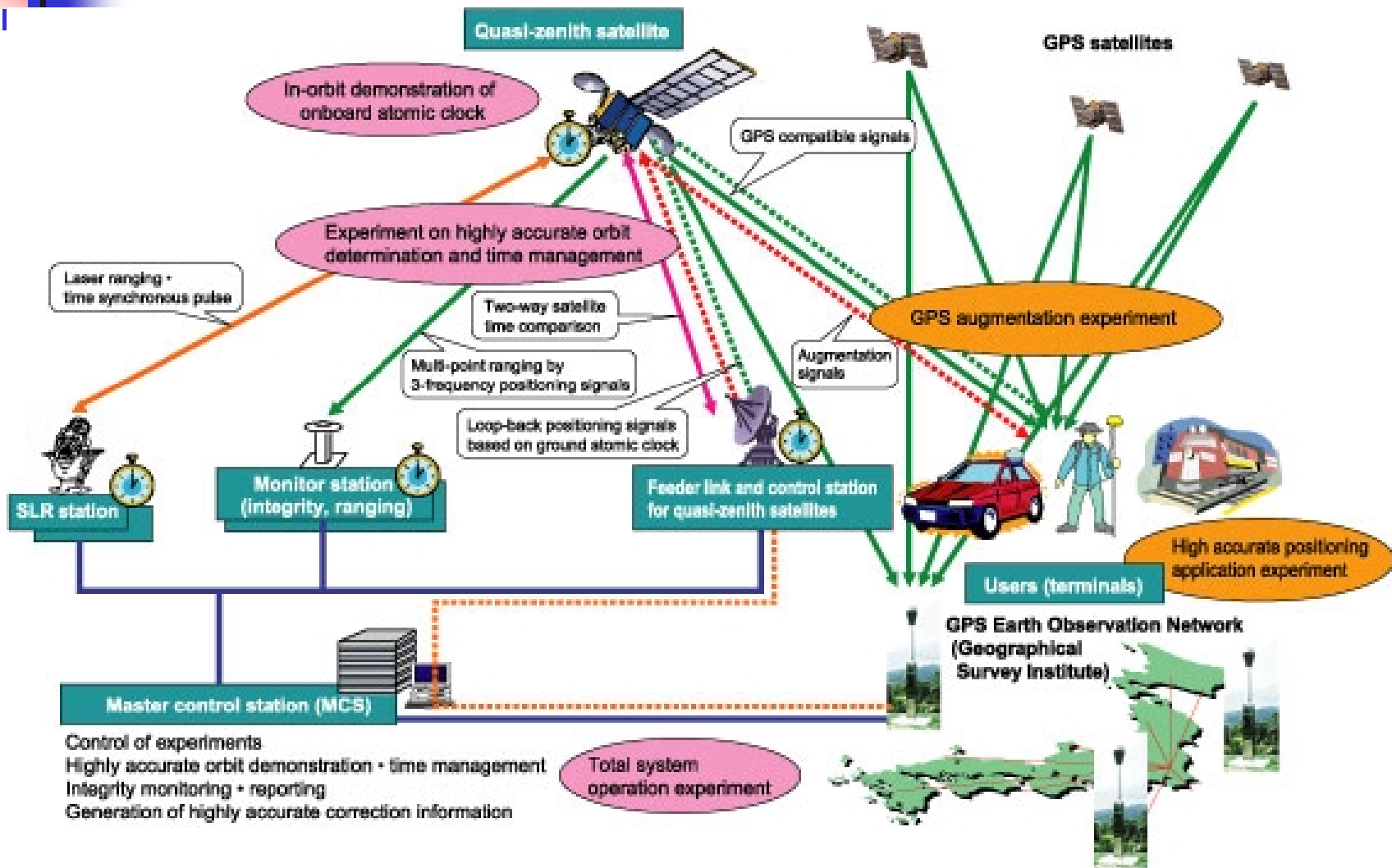
- Public vs. commercial needs:
 - true technological partnerships to improve quality of daily life for communities with the greatest need
- Standardization of domestic, national, and international policies
 - fairness in capacity allocation and sharing:
 - primary vs. secondary services
 - incumbent vs. future services
 - developed vs. developing countries
 - have issues of wasted bandwidth due to excessive spam (Nigeria, Nepal)



The art

- Examine all risks exhaustively and ensure that they can be mitigated
- Identify all uncertainties, conceptualize and experiment to get predictable outcomes
- Address issues government versus commercial influence on policies and fair representation of nations both developing and developed
- Create a workable framework

Application of art to quasi-zenith satellite development





Possible scenario

- Mobile services on aircraft vs. airborne service for disaster recovery site (Indonesia)
 - risk: finance, short-term or long-term, topography
 - uncertainty: frequency to be allocated
 - ethics: necessity or commercial gain
 - art:
 - examine the risks
 - certify outcomes of concepts and experiments
 - ensure fairness in policies formulated



Conclusion

- Efficient satellite transport:
 - can provide mobile communications even to the most remote and unreachable areas
 - possesses horizons of opportunities that are boundless
 - has social and economic implications

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