AGNSS-Packet Timing Hybrid

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Background

AGNSS

- Residential house : -10 ~ -20dB blockage by outer wall or roof
- Building : -20 ~ -30dB blockage by outer wall or roof
- Lack of link margin at indoor environment

Packet Timing (PTP / NTP)

- Dependent on PDV and delay asymmetry
- Dependent on the location of Grandmaster(Server) and its capacity

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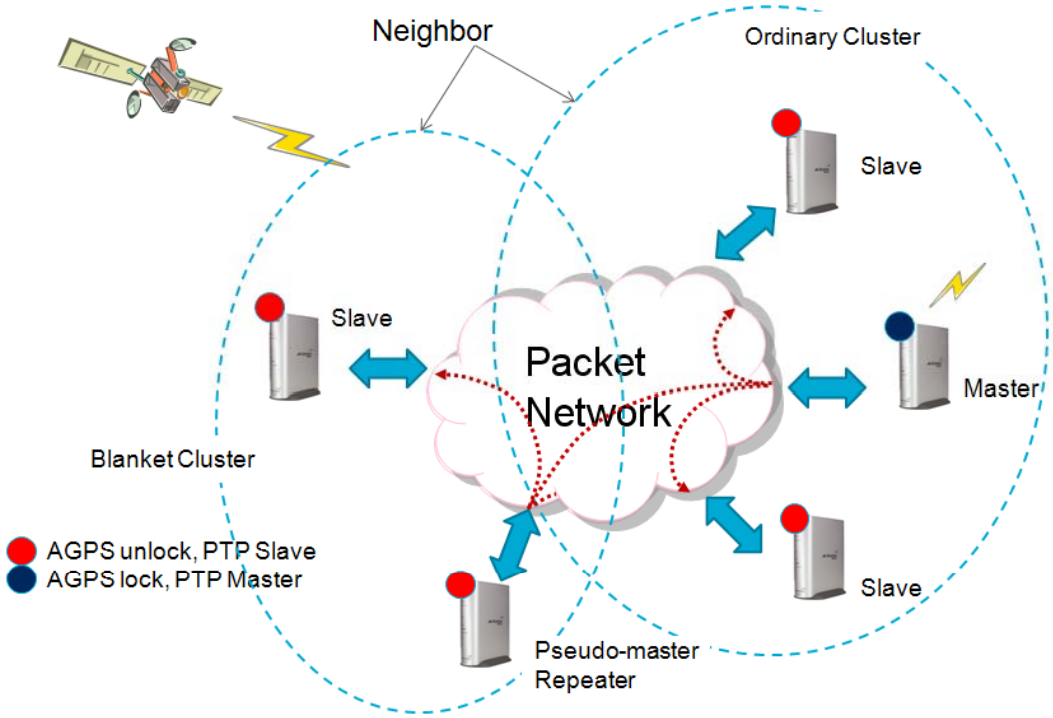
AGNSS-Packet Timing Concept

- ✓ AGNSS – Packet timing hybrid
- ✓ End to End synchronization
- ✓ Distributed network
- ✓ Clustering / NL distribution
- ✓ QL-based BMCA
- ✓ Dynamic PPS
- ✓ SyncH : AGPS-PTP hybrid



AGNSS-Packet Timing Architecture

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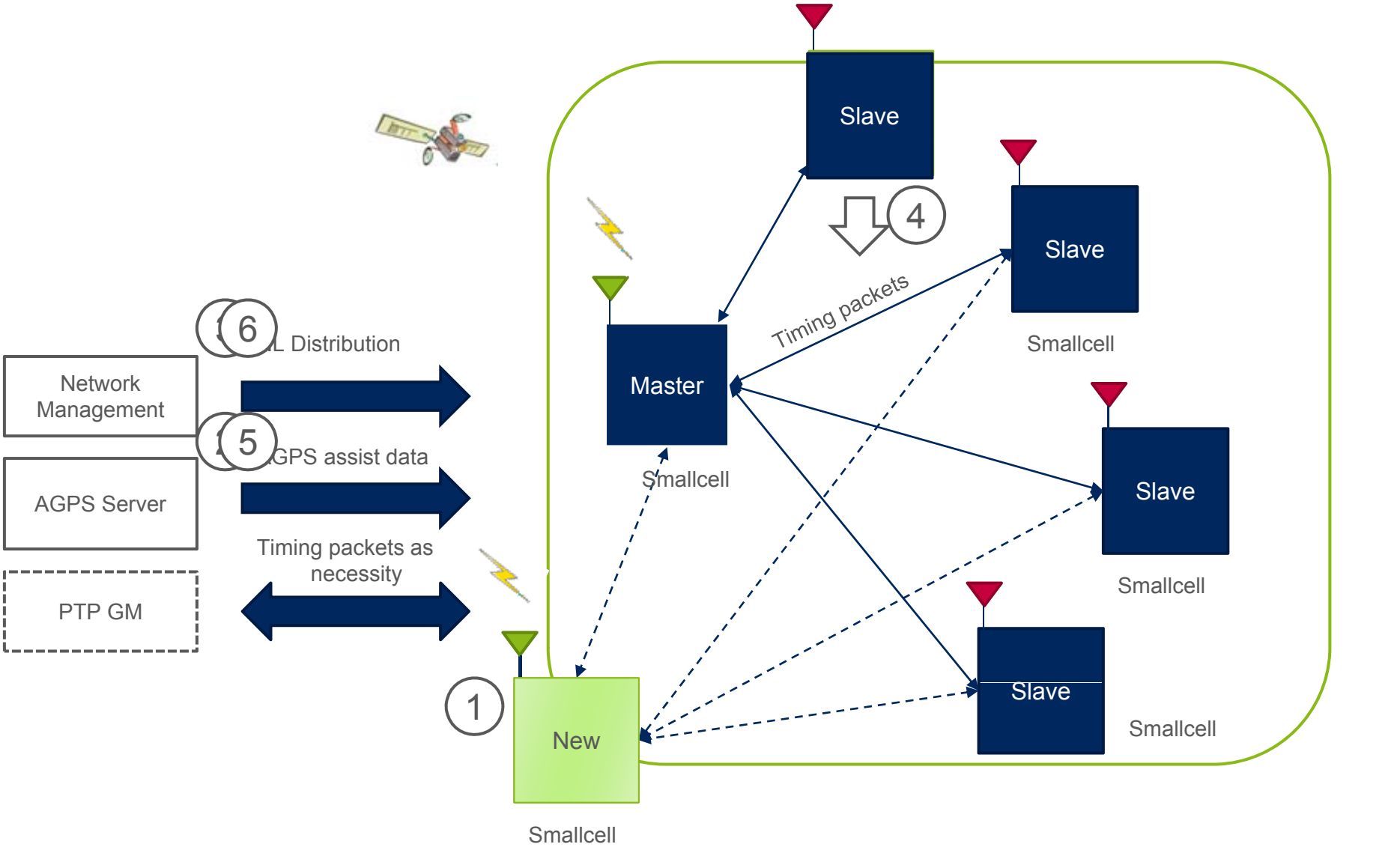
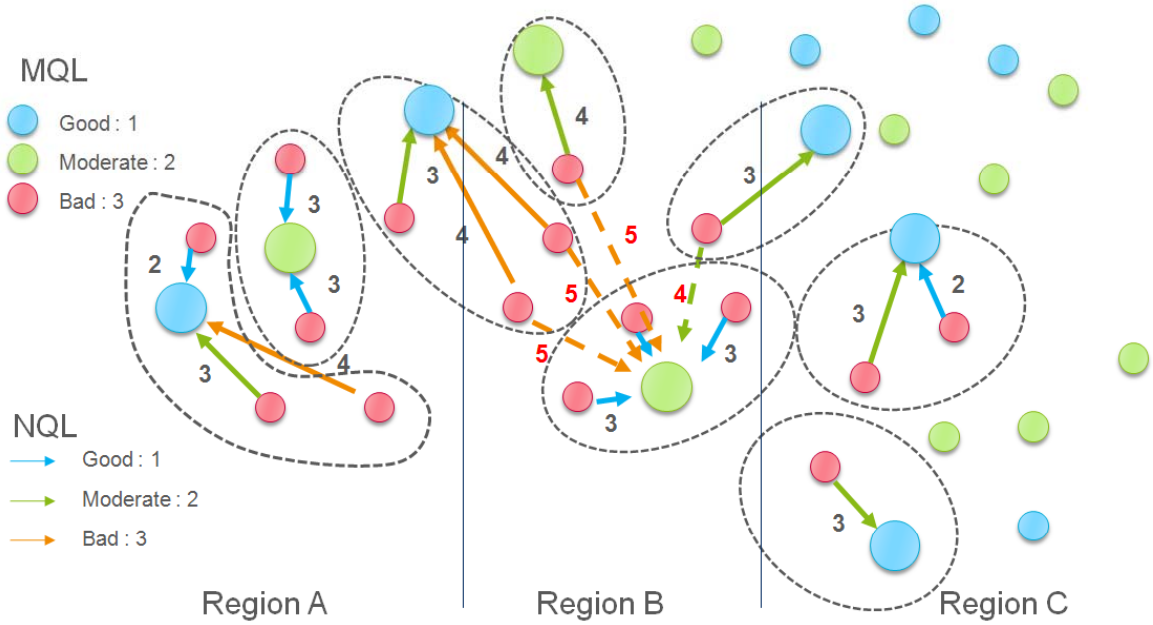
Hybrid Network

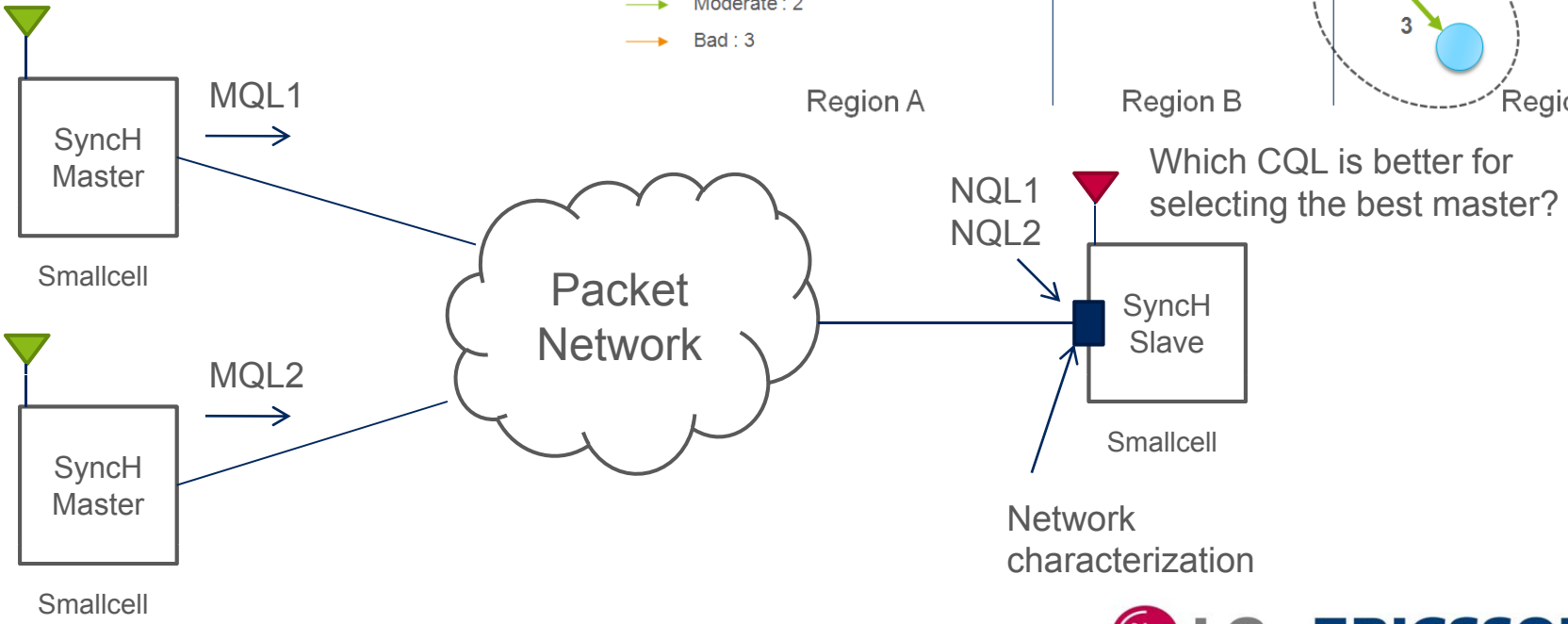


Hybrid Network & Clustering

QL based BMCA

- Master's Clock Quality (MQL)
- Network Quality (NQL)
- Composite QL(CQL)
  = α*MQL + β*NQL

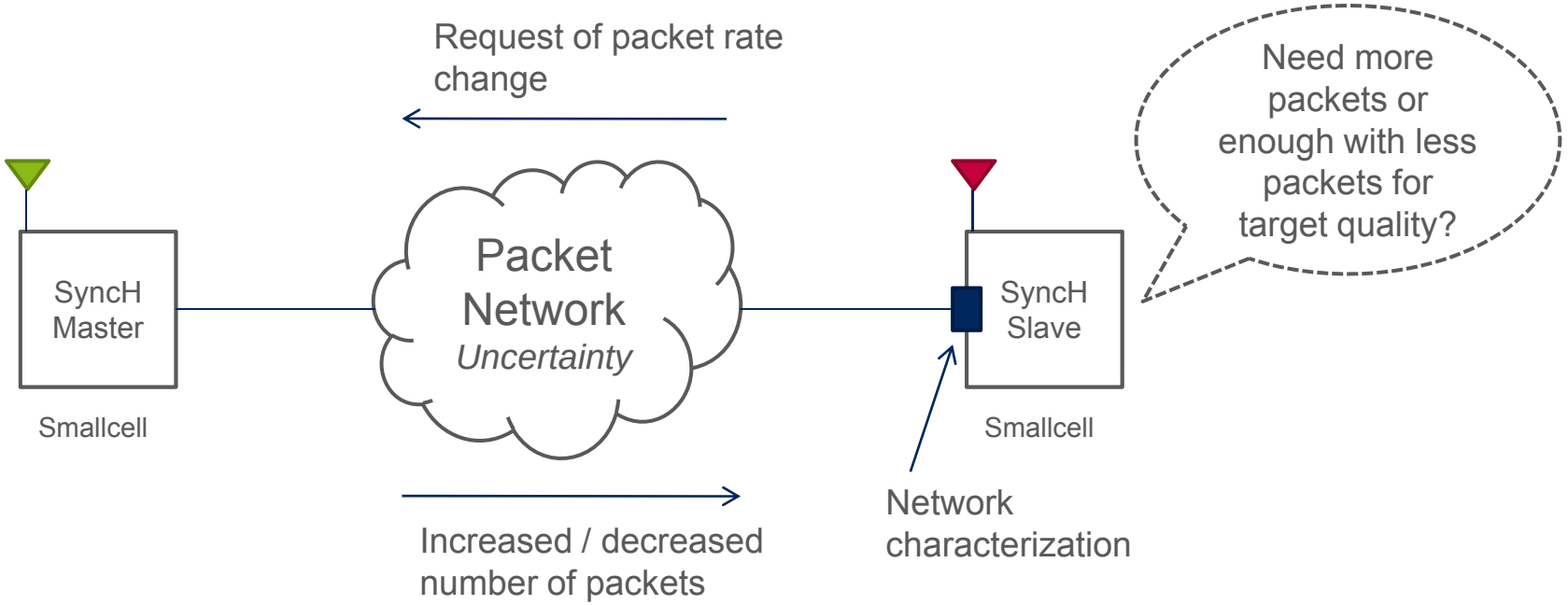




Hybrid Network & Clustering

Dynamic PPS

- Packet rate control by estimating network quality
- Optimize packet rate in order to reduce network load



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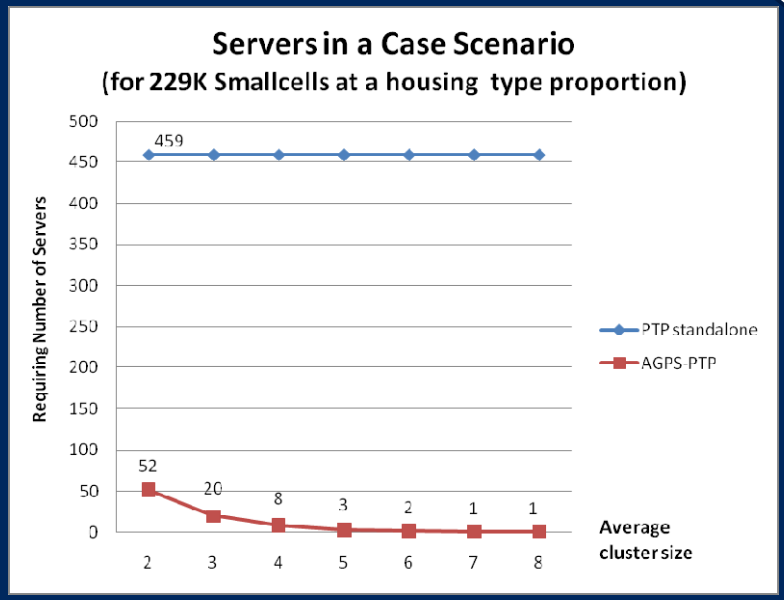
Effect on Servers

- Estimated based on the fix probability from SigNAV's study
  - Good efficiency of the required number of server in most cases of rural and urban areas except for 'dense urban concrete office with higher attenuation tinted windows'
- Servers in a case scenario – *Conservatively low fix probability applied*

Assumed,
- 500 clients as a PTP GM capacity
- 10% of households have Smallcells

	Rural standalone house	Dense urban concrete apartment	Rural brick apartment	Total
The number of households	455,857 (20%)	1,258,658 (55%)	577,379 (25%)	2,291,894
Fix probability assumed	90%	60%	70%	

2005 Housing in Seoul, KOSIS



Required number of Servers Compared to PTP standalone

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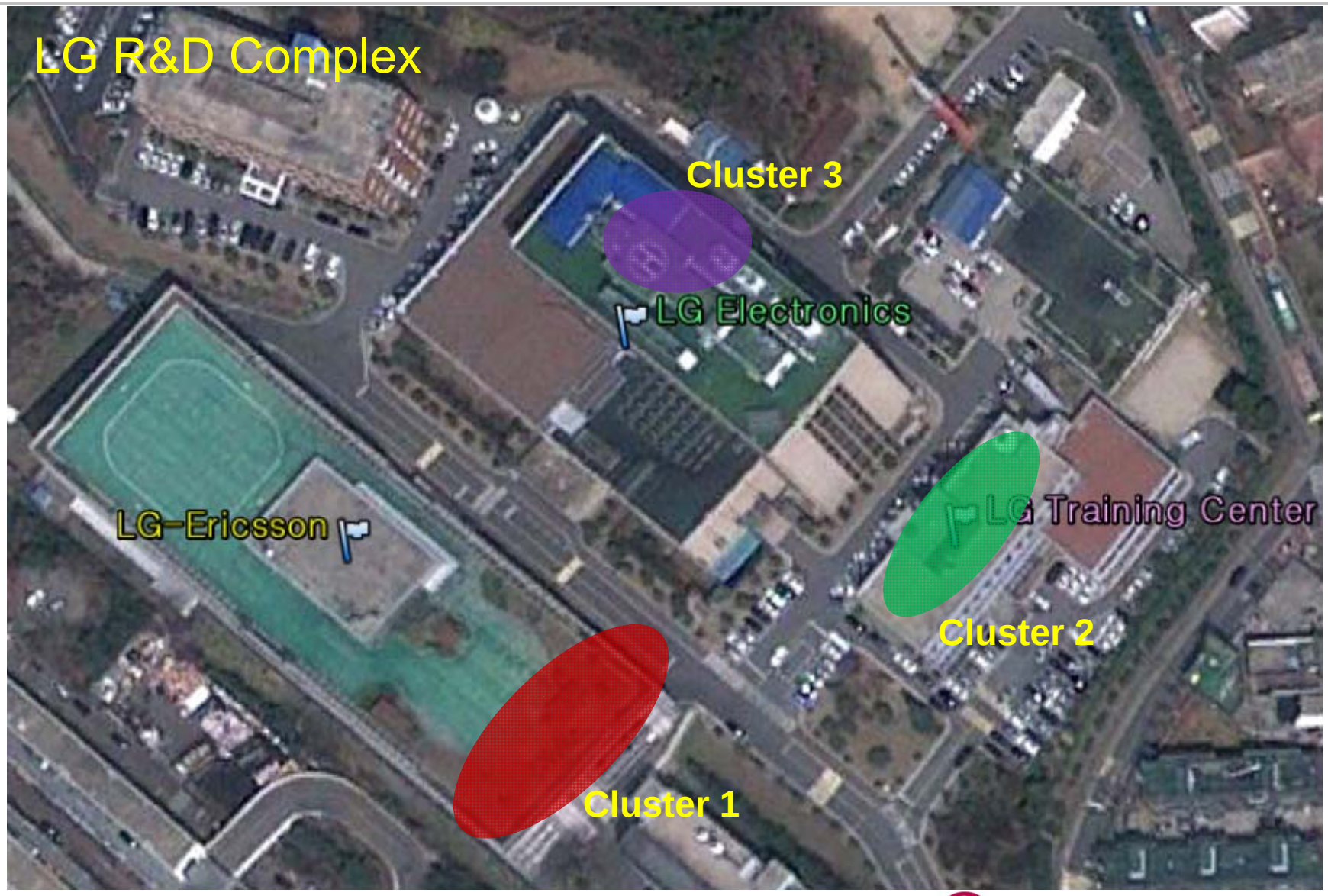
Performance – Private Network



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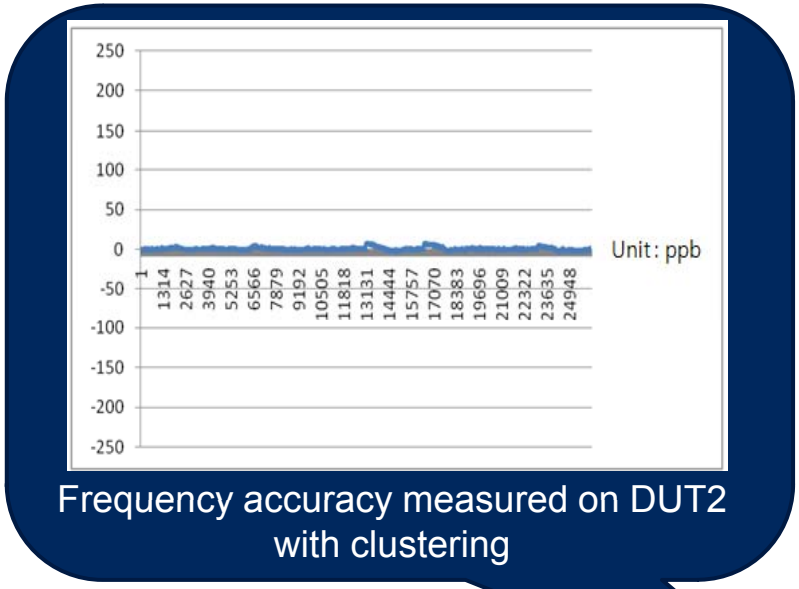
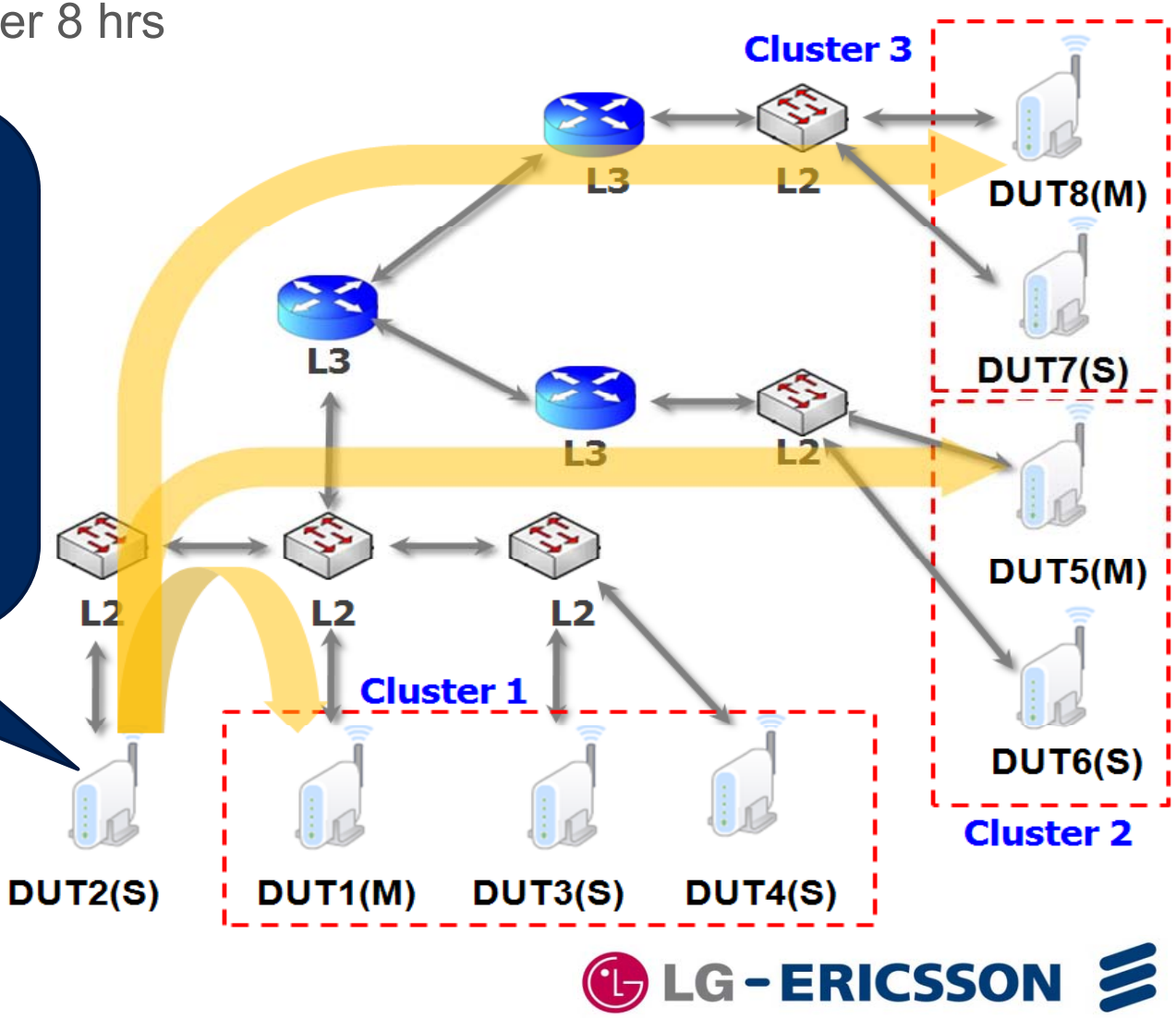
Performance – Private Network

Synchronized to local masters with down to < 10ppb frequency accuracy over 8 hrs



Frequency accuracy measured on DUT2 with clustering



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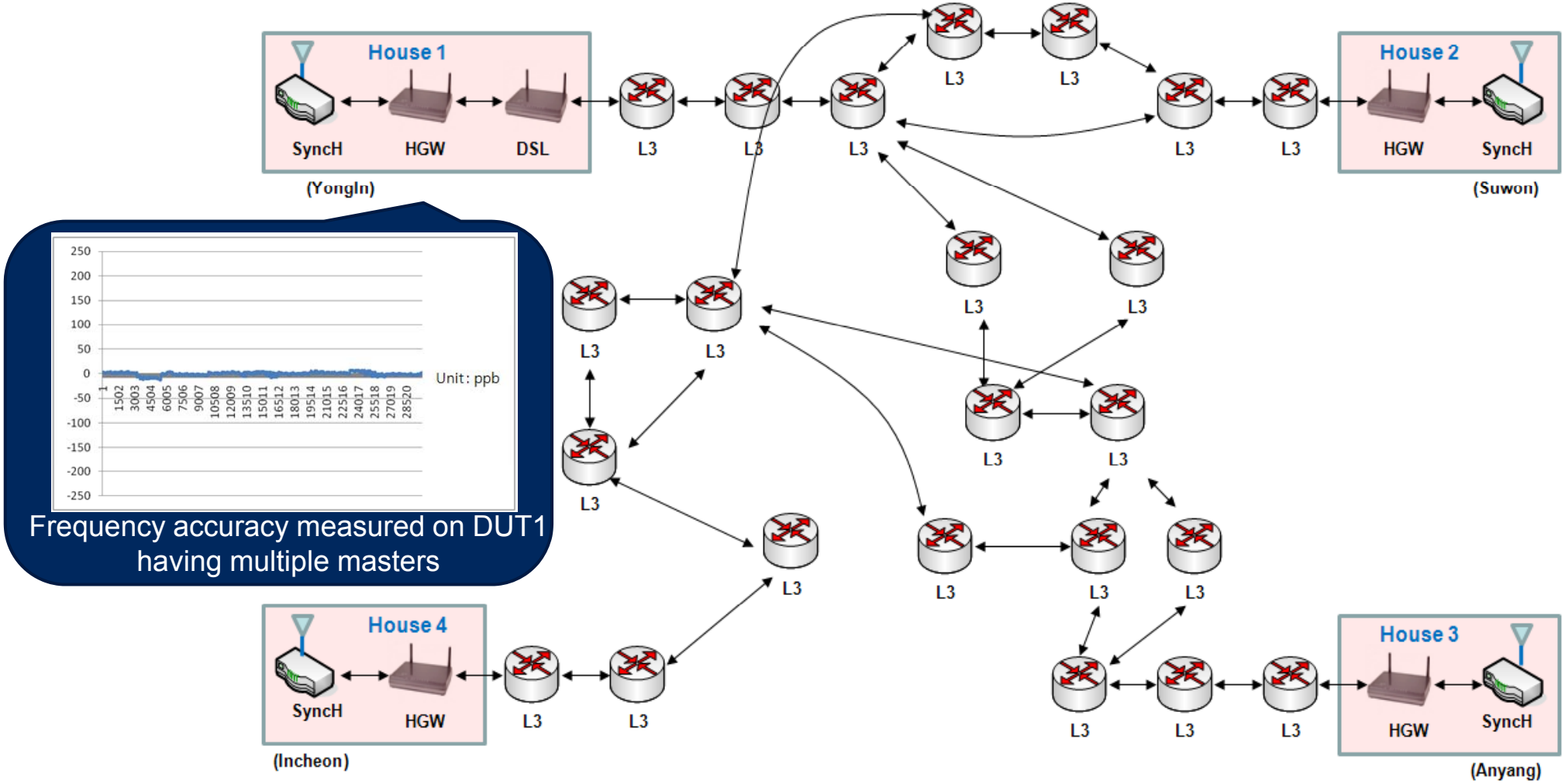
Performance – Public Network

Synchronized to local masters on live networks ISPs provide (8~10 hops)



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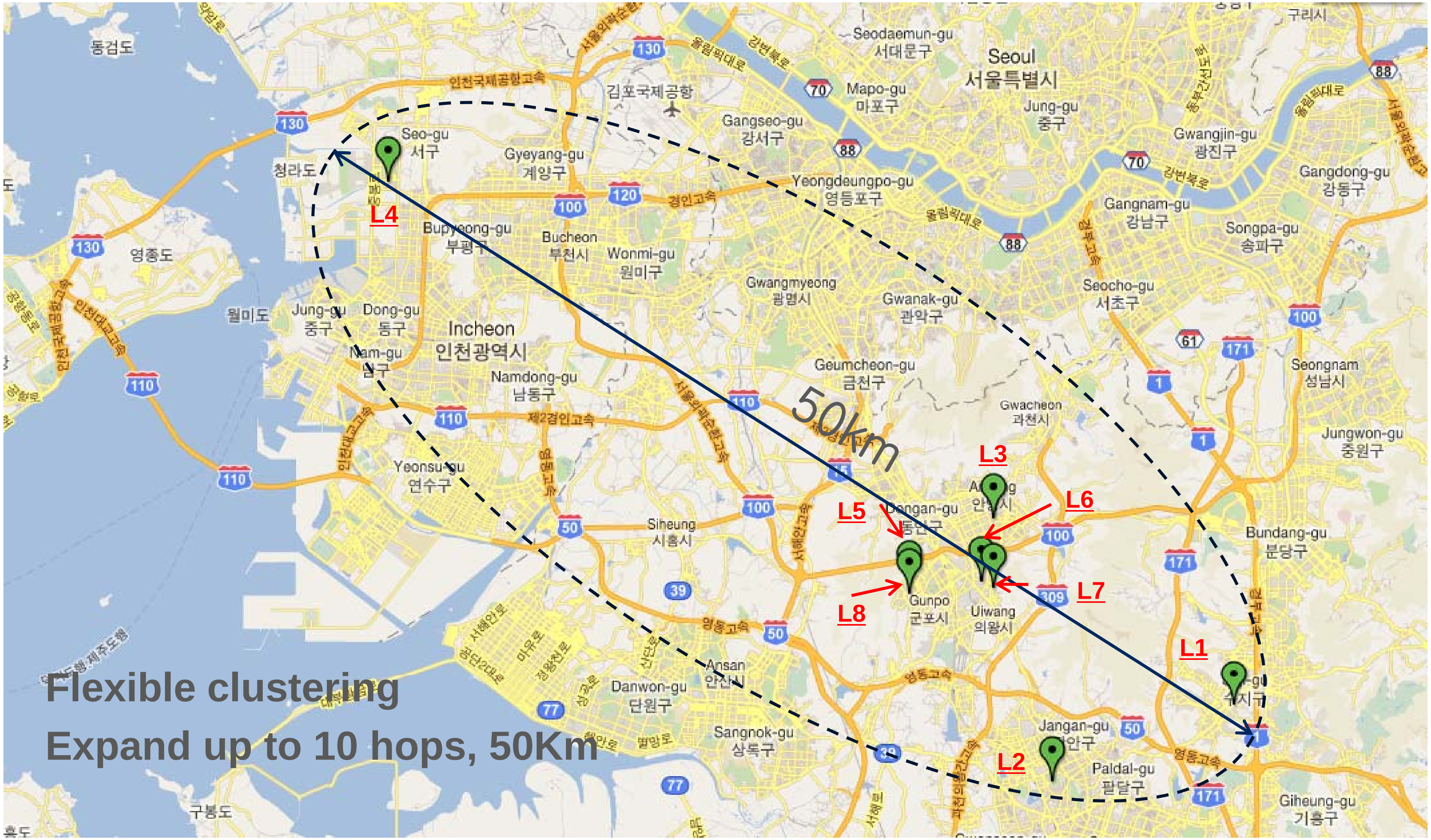
Performance – Clustering Range Tested



Flexible clustering

Expand up to 10 hops, 50Km

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Summary

- ✓ Complementary cooperation of AGPS and PTP
- ✓ Reliability from redundant masters
- ✓ Flexible clustering
- ✓ Server reduction
- ✓ Location from GPS

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