GP-020526
TruePosition Presentation to GERAN #9: U-TDOA Feasibility Study for GPRS and GSM

15-19 April 2002

Seattle, Washington

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Objective

- Demonstrate the feasibility of an uplink time difference of arrival (U-TDOA) positioning procedure within GSM and GPRS
- Propose an approach that minimizes the impact on existing GSM and GPRS functionality

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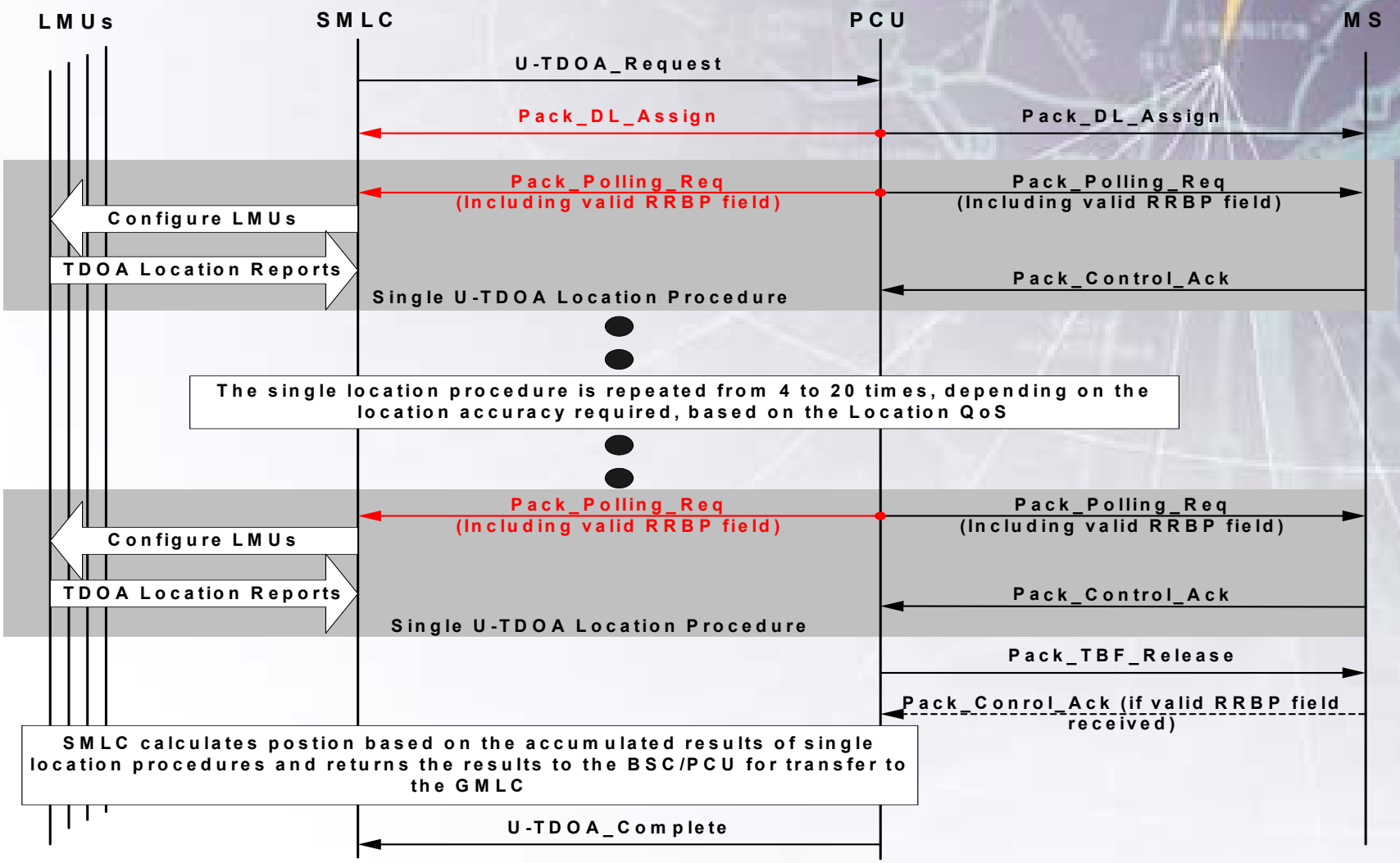
Uplink TDOA in GPRS

- **Tdoc GP-020525 presents an U-TDOA solution for the GPRS environment**
- **For an MS in Packet Idle Mode, Multiple execution of the Packet Polling Request interrogation are used to cause the MS to transmit**
  - The number of executions varies from 4 to 20 depending on the LCS QoS and the MS transmit power level
- **For an MS in Dedicated Mode, the transmit energy associated with the ongoing uplink data transfer will be used to locate the MS**
- **For an MS operating in CS mode:**
  - The false handover technique previously specified in 03.71 is reasonable for idle MS
  - For MS in dedicated mode, the existing transmit energy will be used
  - In either case, flexibility exists to utilize control channel (SDCCH) and/or traffic channel (TCH) resources

PS, Standby State



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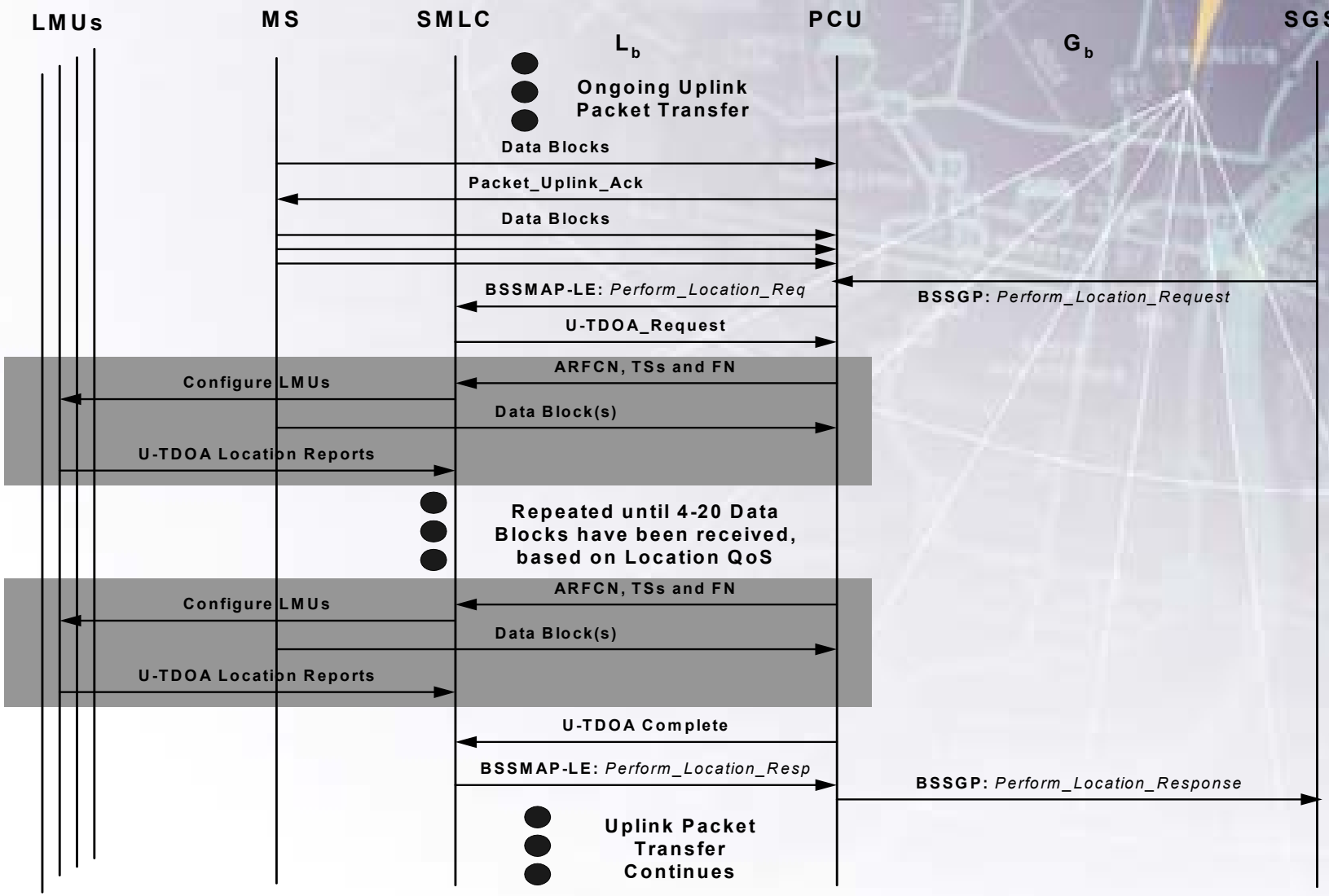
PS, Ready State, active data transfer



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Impacts to Protocols

Note: The proposed solution minimizes impact on existing functionality. A solution that utilizes SMLC-BSC/PCU signaling resources more efficiently is possible (and desirable), but requires additional modifications of the BSC/PCU.

- **BSSGP**
  - Perform_Location_Request message must be extended
    - New value for U-TDOA in Location Type IE
- **BSSAP-LE**
  - Perform_Location_Request message must be extended
    - New value for U-TDOA in Location Type IE
- **BSSLAP**
  - New messages
    - U-TDOA Request and U-TDOA Response
      - *Similar to TA Request/Response message*
    - New "containers" to support transparent information transfer
- **RRLP**
  - New messages supporting transparent transfer of information between the SMLC and the LMU

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Impacts to Existing Nodes

- **BTS**
  - No additional changes, assuming LCS baseline
- **PCU**
  - Logical and messaging changes to implement Timing Advance Polling method
- **BSC**
  - Logic and messaging changes to implement “False Handover” method
- **MSC/VLR**
  - None
- **SGSN**
  - Logic and messaging changes for U-TDOA
- **SMLC and LMU**
  - Implement U-TDOA functionality as well as corresponding logic and messaging changes
- **MS**
  - None

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Impact on Specifications

- **43.059 LCS, Stage 2**
  - U-TDOA as a location method must be added
- **48.018 BSSGP**
  - Perform Location Request message extended to include U-TDOA in Location Type IE
- **49.031 BSSAP-LE**
  - Perform Location Request message extended to include U-TDOA in Location Type IE
- **48.071 BSSLAP**
  - Implement U-TDOA Request/Response message
  - Implement transparent information transfer between SMLC and PCU
- **44.071 LLP**
  - Implement transparent information transfer messaging between the SMLC and the LMUs

Expected Performance

Environment	Predicted Performance		
	67% error	95% error	Location Success Rate
Urban	45 - 70 m	110 - 150 m	99.9%
Suburban	40 - 65 m	125 - 165 m	99.9%
Rural	65 - 95 m	175 - 215 m	99.9%

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Benefits of U-TDOA

- **Radio Resource Efficiency**
  - Uses existing RF energy to locate active MS
  - For idle MS, uses uplink resources which is the available resource
    - Provision of assistance data in other methods utilizes downlink resources
- **Provides LCS to legacy and roaming MS**
  - Does not require modification of MS
- **Excellent performance in urban and indoor environments complements A-GPS and E-OTD**
  - Processing gain allows more LMUs to participate in location determination
  - Multipath mitigation increases accuracy
- **Protection from obsolescence**
  - New functionality through LMU and SMLC upgrades
  - No MS upgrades required
- **Proven Technology**
  - Over 1000 sites deployed and six years of operating experience
- **Scalable accuracy and cost**
  - Implemented in a phased approach with less than 1:1 cell site:LMU ratio

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Next Steps

- Request the approval of this feasibility study
- Propose proceeding with a Work Item Request to be submitted at GERAN #10

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