Prioritisation and Flow Control in Messaging Middleware

Master’s thesis presentation
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Agenda

- Background for the thesis
- Messaging Gateway introduction
- Structure of the thesis
- Results of the analysis and measurements
- Conclusions
Messaging Gateway
Background

- Prioritisation one of the strong selling points of the Messaging Gateway product
- Demand for validation of the message prioritisation functionality
  - Internal results and improvement proposals
  - Results for the customers
  - Adherence to the system requirements
- Development of analysis and measurement methodology
Messaging Gateway
System introduction

Subscribers

Bearer Network

SMSC
MMSC
WAP GW
PPG

Messaging Gateway

Operator backend systems

Billing
Location
AAA
...
Messaging Gateway
Main functionality 1/2

- Full store-and-forward system
  - Message prioritisation
  - Message flow control
  - Load-balancing of both ingress and egress links
- Integrations to different mobile operator backend systems
- Message route selection using a scripting language
- Large set of supported SMSC and MMSC protocols
  - Protocol translations
  - Ideal for multi-vendor environment
- Message prioritisation based on DiffServ concepts
  - Messages divided into priority classes
  - Classes entitled to a relative share of system capacity

- Extensions to the DiffServ model
  - Grouping priority classes into priority class groups in order to create virtual parallel systems
  - Store-and-forward capabilities taken into account

- Message flow control
  - Dynamically adjusted link speeds according to the destination load conditions
  - Load-balancing between different ingress and egress links
Messaging Gateway
System architecture
Messaging Gateway
Structure of thesis

• Analysis and comparison
  • Introduction of service quality concepts and DiffServ router conceptual model
  • Analysis of Messaging Gateway requirements and design
  • Comparison of the functions of DiffServ router conceptual model and Messaging Gateway
• Measurements using message prioritisation
  • Black-box measurements for throughput, latency and their variances
  • Aimed at verifying the service level differentiation or illustrating deviations from the modelled system
• Results and validation
Messaging Gateway
Results of the analysis

• Design theoretically sound
  • Implements all functional blocks of the conceptual model of DiffServ router
  • Design solves common prioritisation system caveats such as priority inversion and low priority starvation

• All system requirements addressed

• Prioritisation may not be adhered to in all parts of the system
Messing GateWay
Measurements

Messing GateWay

Driver
SMSC emulator

Driver
SMSC emulator

Driver
SMSC emulator

Routing Engine

Adapter
Service

Adapter
Service

Adapter
Service

Storage Engine

Measurement point
Messaging Gateway
Measurement results 1/2

• Service levels clearly differentiated
  • Averages in both throughput and latency on appropriate level
  • Total system capacity not affected because of prioritisation functions
• System maintains the throughput and latencies well
• Priority inversion and low priority class starvation avoided under all conditions
Messaging Gateway
Measurement results 2/2

• Variances in throughput and latency are affected
  • Services connected to same adapter have effects on each other
  • Increase in variance can be as high as three-fold
• Messages with multiple segments reserve more than assigned share of system capacity
• Message flow control system, especially filtering function, not capable of full message stream separation
Messaging Gateway
Conclusions

• System fulfills the requirements
  • Provides clearly differentiated service levels
  • Implements the prioritisation and flow control functionality

• Enhancement proposals
  • Message stream separation improvements
  • Message latency and latency variance elimination
  • Flow control to operate on the right level of message streams

• Further work
  • Extend the work to MMS functionality of Messaging Gateway
  • Include load-balancing and messaging clusters to the measurements