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FREEBAND

Remote Management of Mobile Devices with Broadband Forum's TR-069

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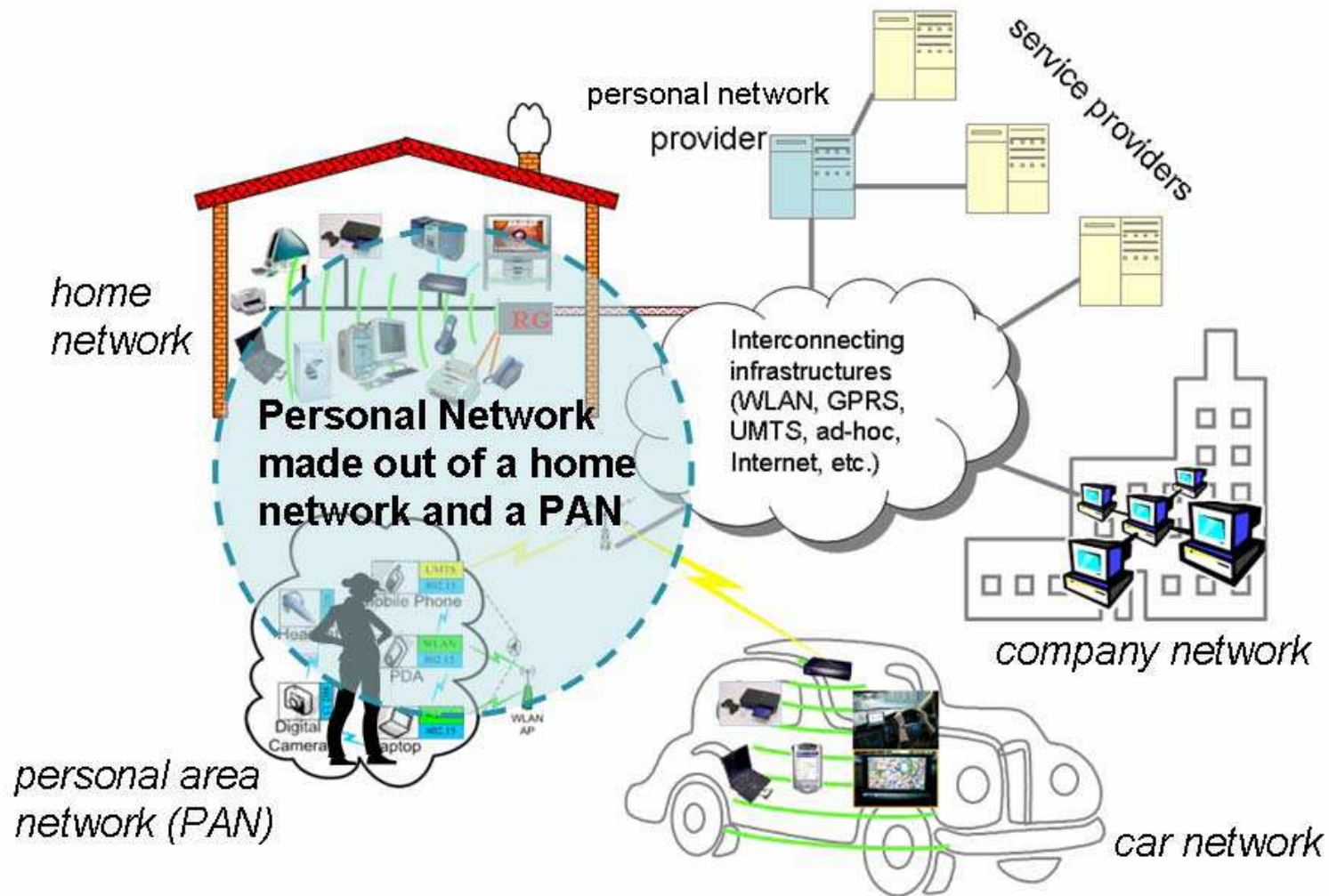
F. Selgert
KPN



Contents

- Introduction
- Benefits of TR-069 in heterogeneous networks
- Experimental validation
- Conclusions and future work

Personal Network



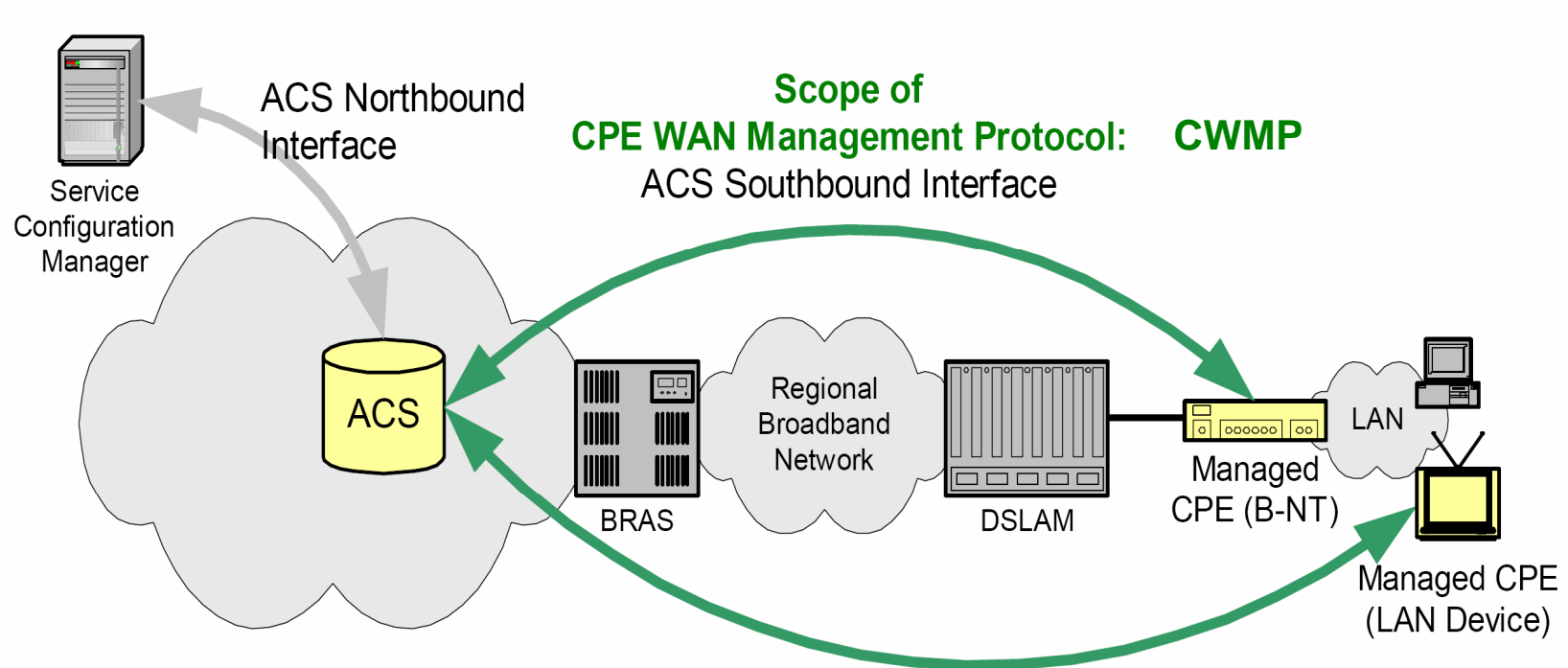
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Remote Device Management in Personal Networks

- Service providers will offer new services to many similar devices in a PN, irrespective of their access technology (including GPRS)
- Provisioning of these services requires proper configuration of all devices involved in a coherent way.
- Service providers prefer to use a single remote management system for the configuration of fixed as well as mobile devices to reduce operational costs.
- The OMA recently developed the OMA-DM protocol for remote management of mobile devices.
- Broadband Forum has standardized the CWMP (TR-069) for remote management of devices in the home network.

TR-069 in Broadband Forum Auto-configuration Architecture

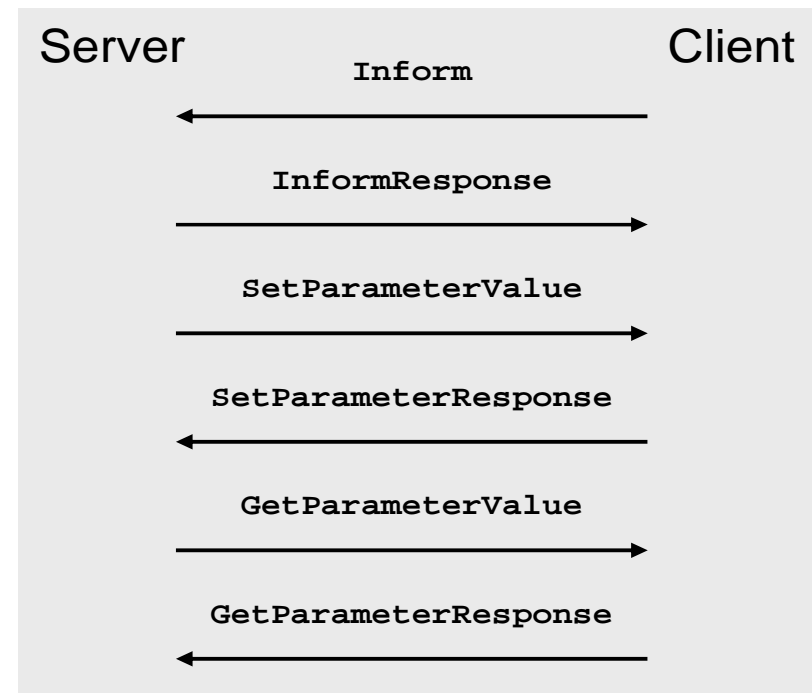


ACS: Automatic Configuration Server

TR-069 protocol stack

CPE/ACS management application
RPC methods
SOAP
HTTP
SSL/TLS
TCP/IP

Session example



TR-069 vs OMA-DM

	TR-069	OMA-DM
Technology	webservices	webservices
Number of datamodels	6 standardized	many proprietary
Deployment	Worldwide for high-end residential gateways	Developed for mobile devices, but not commercially deployed yet



Key issue of this paper

- Remote Device Management systems for heterogeneous networks such as Personal Networks do not exist
- We therefore investigated the suitability of Broadband Forum's TR-069 for Remote Management of mobile devices
- In this paper we focus on the performance of TR-069's Customer premises equipment – Wide area network Management Protocol (CWMP) over mobile connections



Typical example

Provisioning VoIP equipment with TR-069

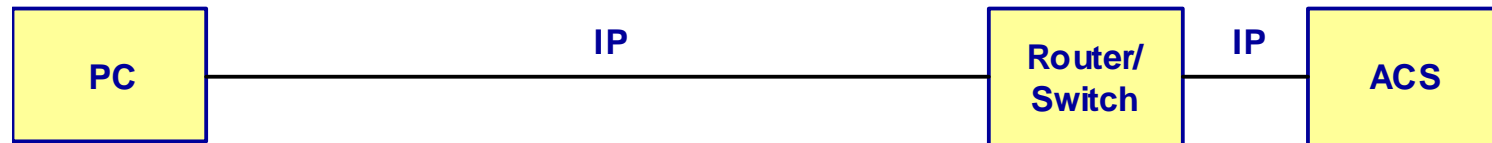
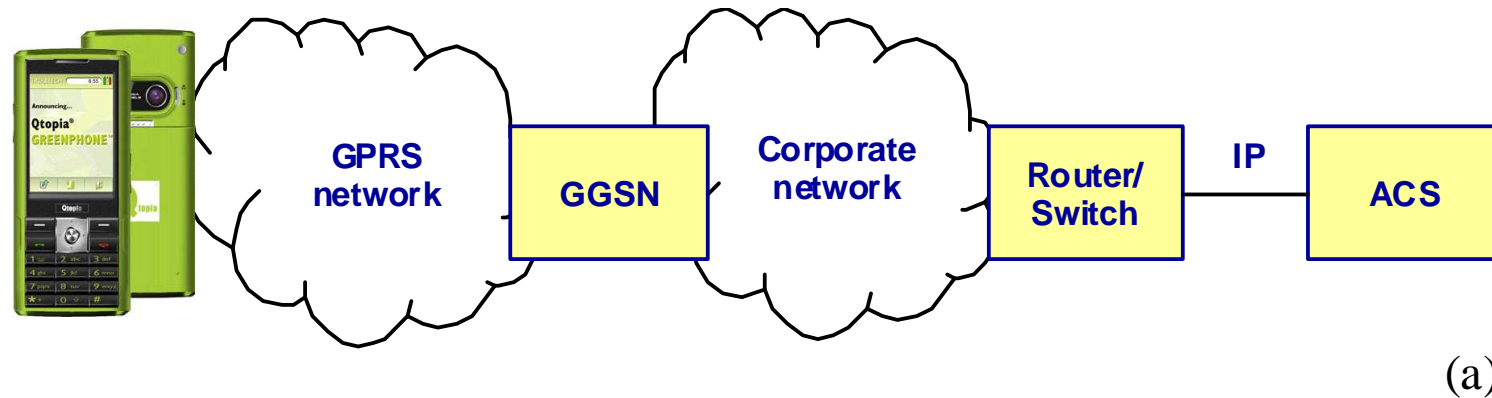
- configuration file
 - 2000 parameter lines of 50 one-byte characters
- file size 100kB
- allowed download time: 60 seconds
- minimum required bit rate 15 kbps

Performance of TR-069 over GPRS: hypothesis

	Specification GPRS	Requirement TR-069	Pass
Data rate	24-36 kbps down 16-24 kbps up	15 kbps down (less up)	✓
Latency	seconds	anything TCP can cover	✓
Connection quality	freezes during handover TCP/IP session	anything that TR-069's retry mechanism can handle	✓



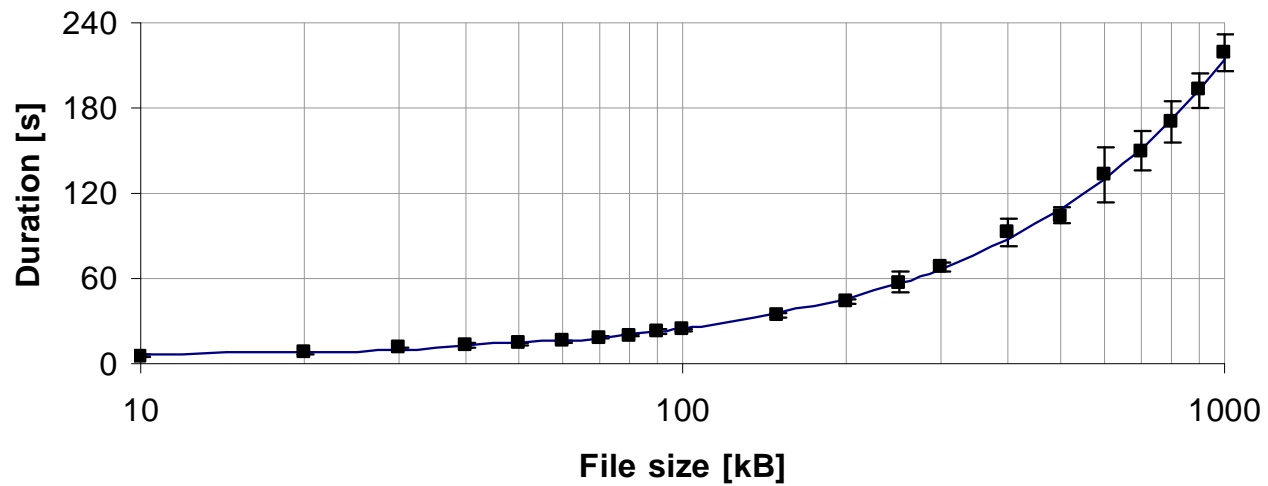
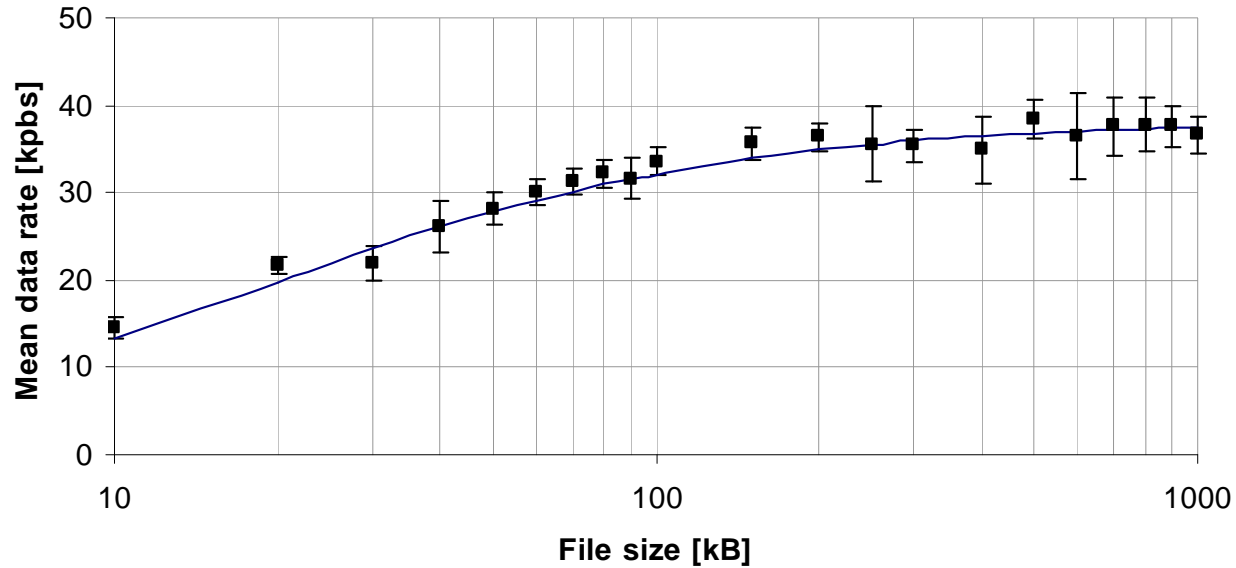
Performance measurements: test setup



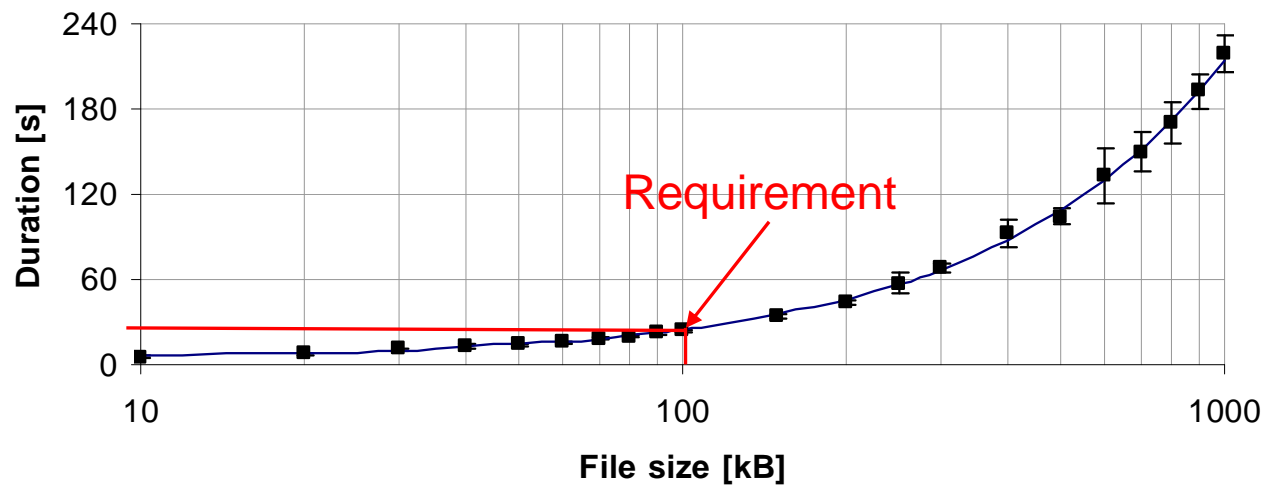
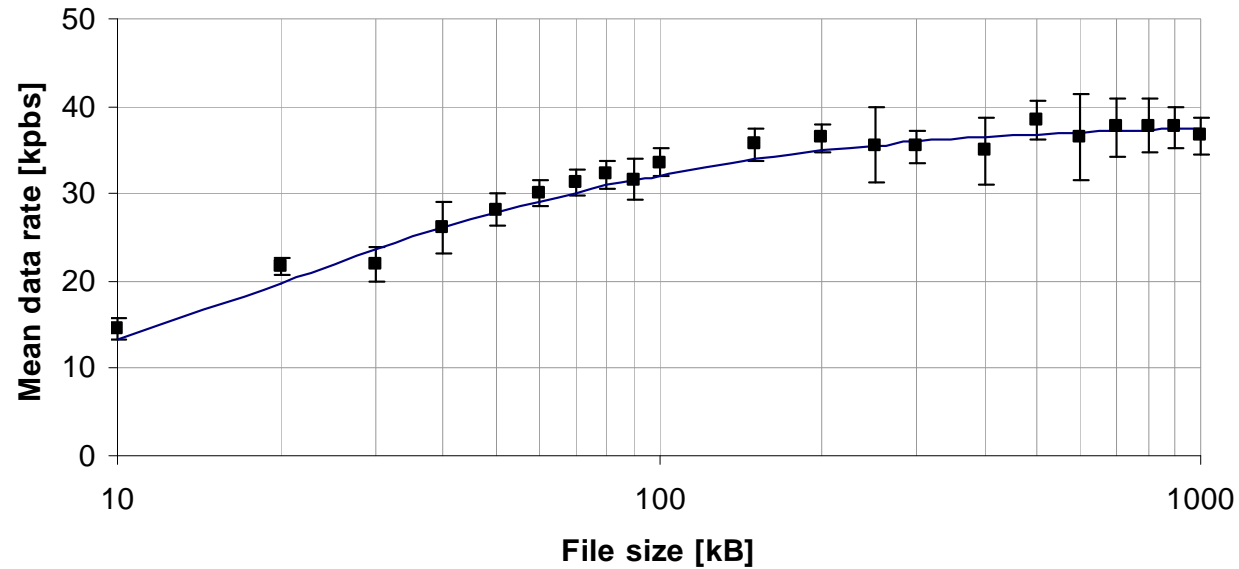
- time measurement of CPU speed and memory usage: Linux OS functions
- data transport time measurement: WireShark (formerly Ethereal)
- HTTP traffic and SOAP/XML tracking : TCP monitor (Dimark)
- we did not register: multi-slot class; coding scheme; delay/jitter



Measured mean data rate and duration when sending data files over GPRS



Measured mean data rate and duration when sending data files over GPRS



Measured duration for typical setting and getting one TR-069 parameter^{*)} on a mobile client and on a fixed client

	Mobile CWMP client	Fixed CWMP client
Connection setup time	3 s	0.1 s
Data exchange time	10 s	1 s
Mean data rate	5 kbps	61 kbps

^{*)} parameter value: 1952 characters \approx 2kB

Memory and CPU usage of the mobile device

- on the condition:
CWMP client running, GPRS ON, ACS OPEN
memory usage: 1400 kB
- during file transfer of 100kB files:
CPU usage 30 ms
i.e. 1% of the total time needed for data processing
- → memory and CPU usage of current mid-end mobile devices will not be a bottleneck for applying CWMP over GPRS



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Conclusions

- a single management protocol for both mobile as fixed private networks can be attractive from a service operational point of view
- our measurements give a strong indication that TR-069 can safely be used for remote management of mobile devices

Future work

- low bandwidth of GPRS may result in longer connection times and may require more capacity for concurrently connected devices
- TR-069 performance may be improved with a factor of up to 20 by data compression of XML files
- the effect of interrupted management sessions
- study of provisioning processes and bootstrap actions
- study of OMA-DM applicability over fixed networks