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

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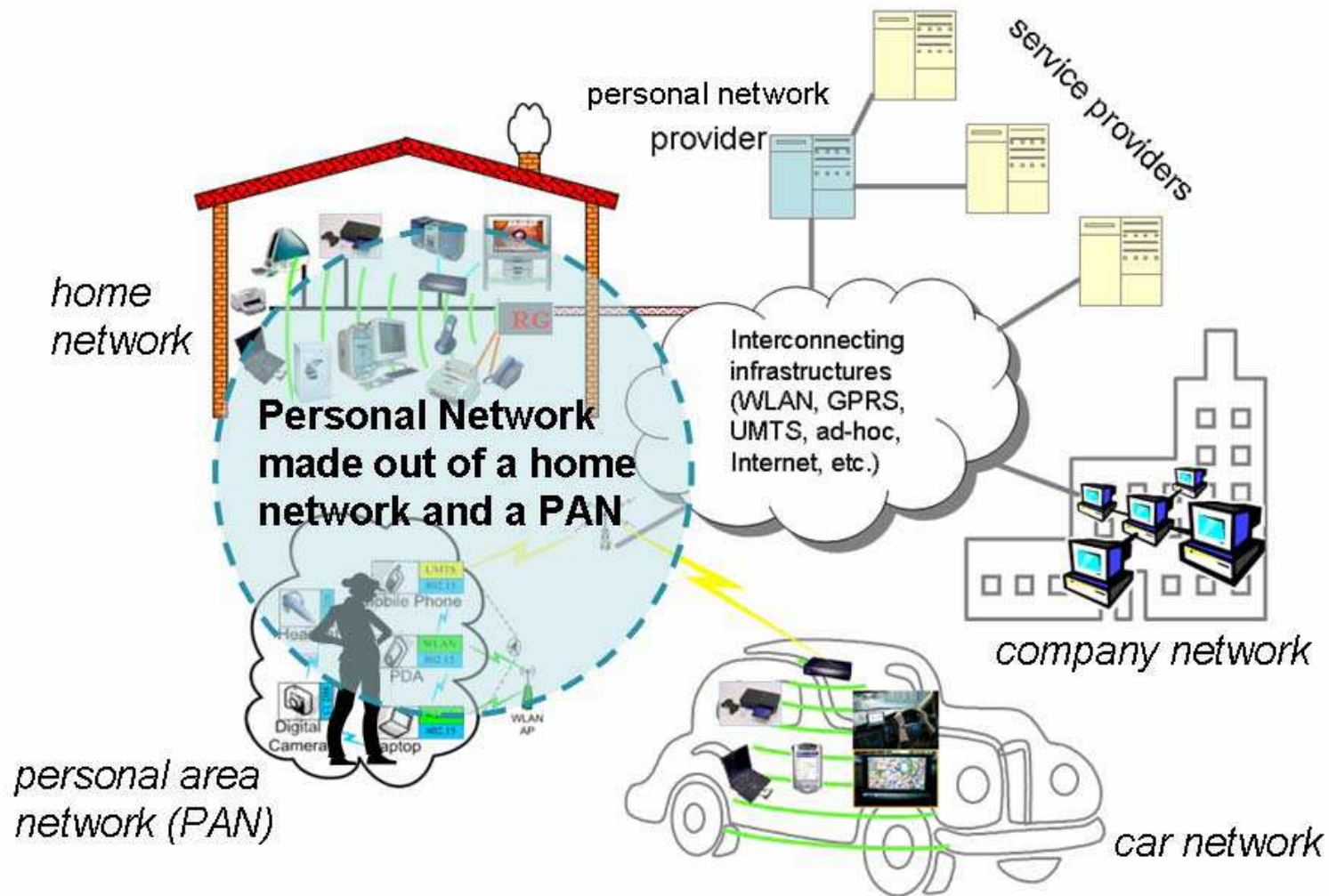
F. Selgert  
KPN



# Contents

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

# Personal Network



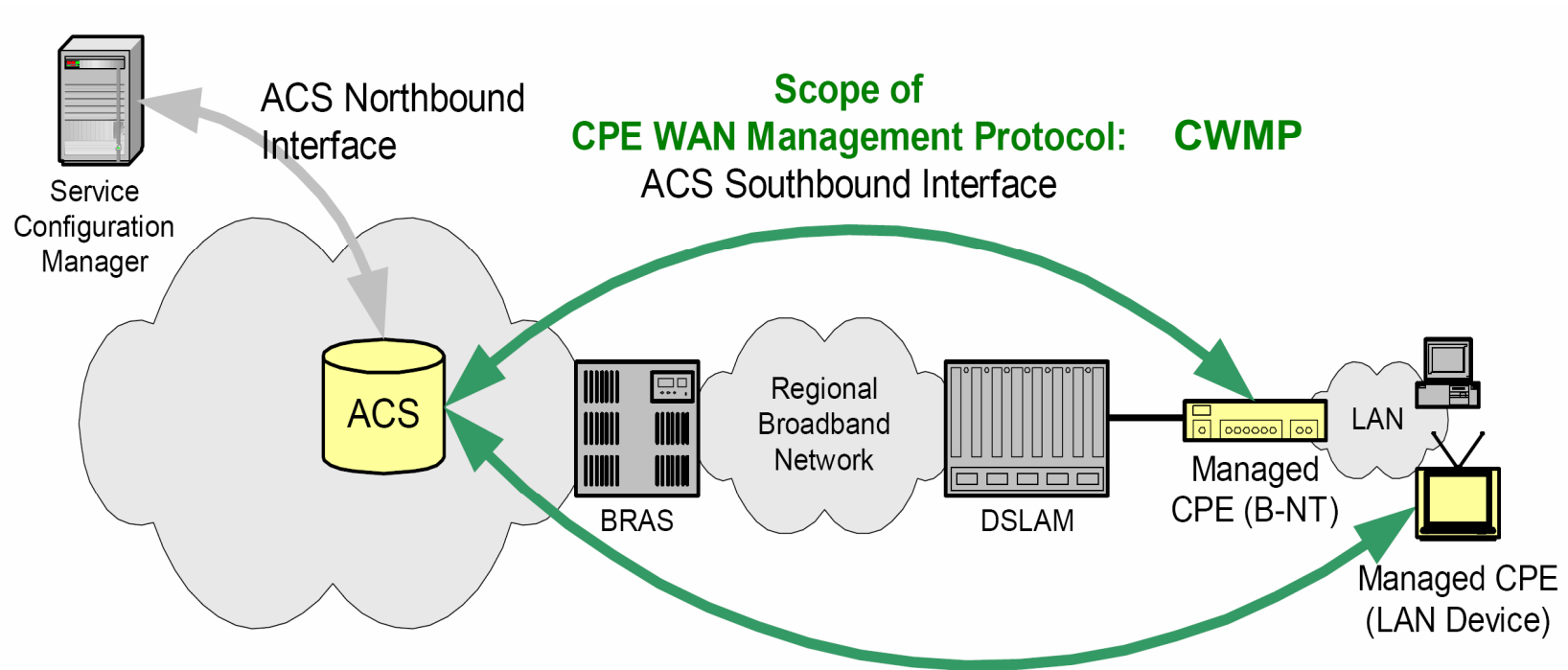
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## Remote Device Management in Personal Networks

- 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

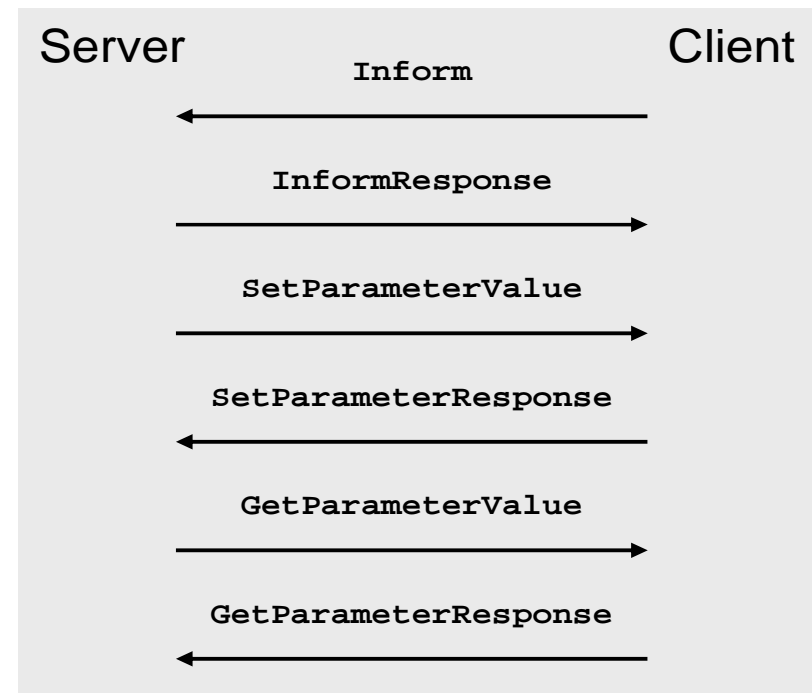


ACS: Automatic Configuration Server

# TR-069 protocol stack

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

## 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

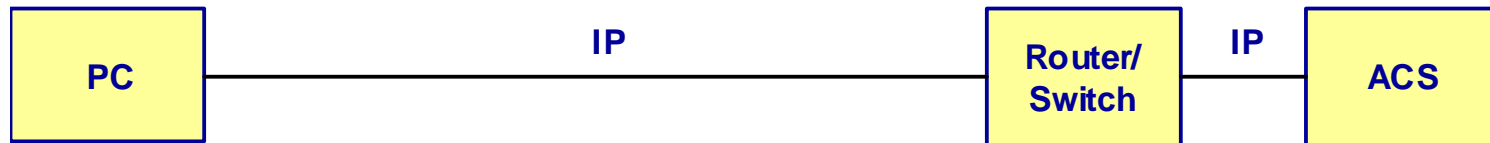
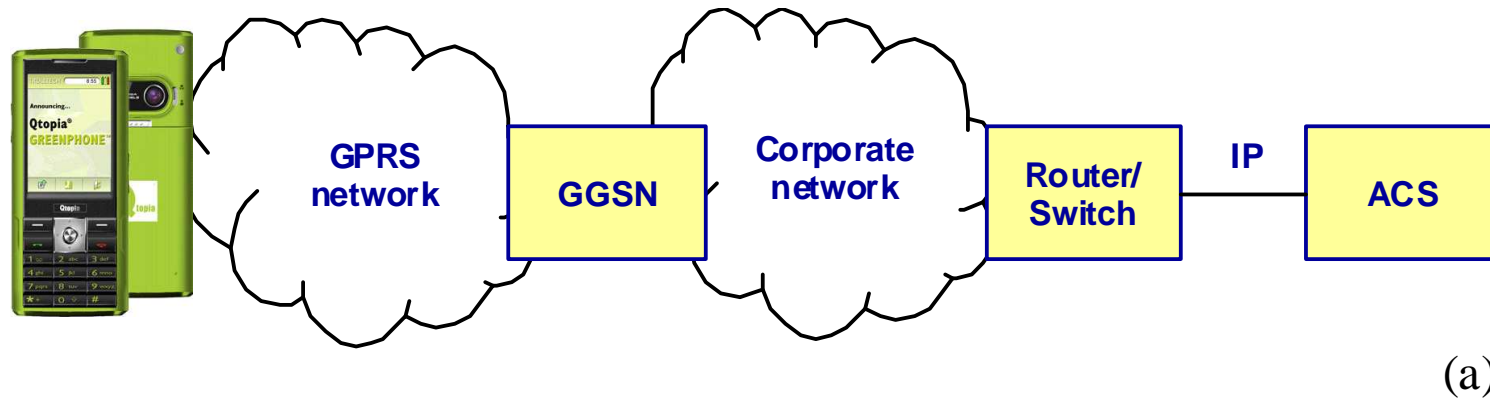
→ minimum required bit rate 15 kbps

## 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	✓



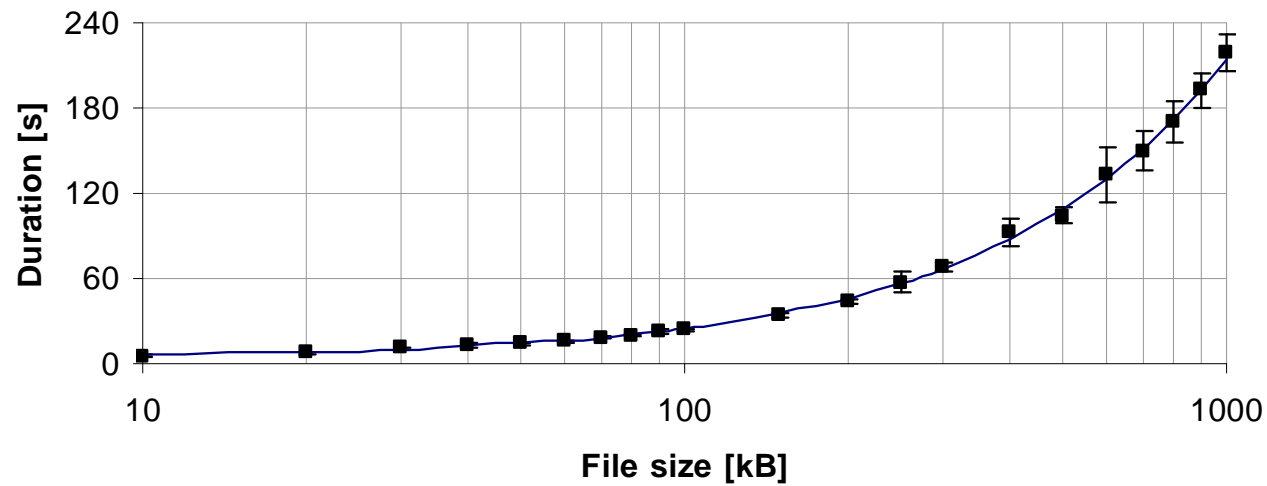
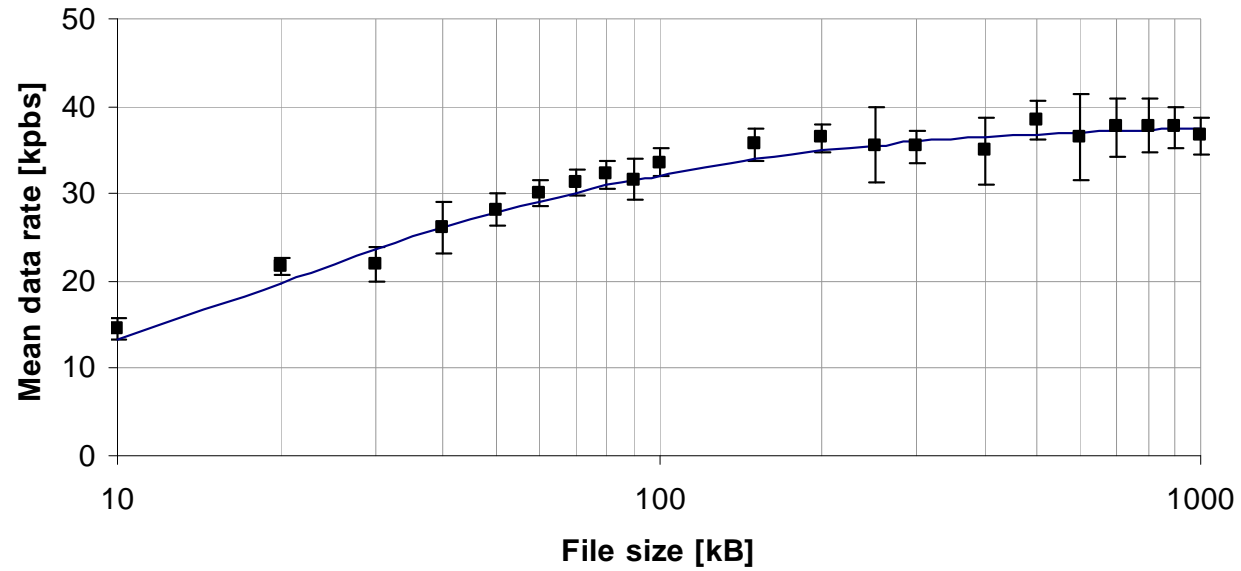
## Performance measurements: test setup



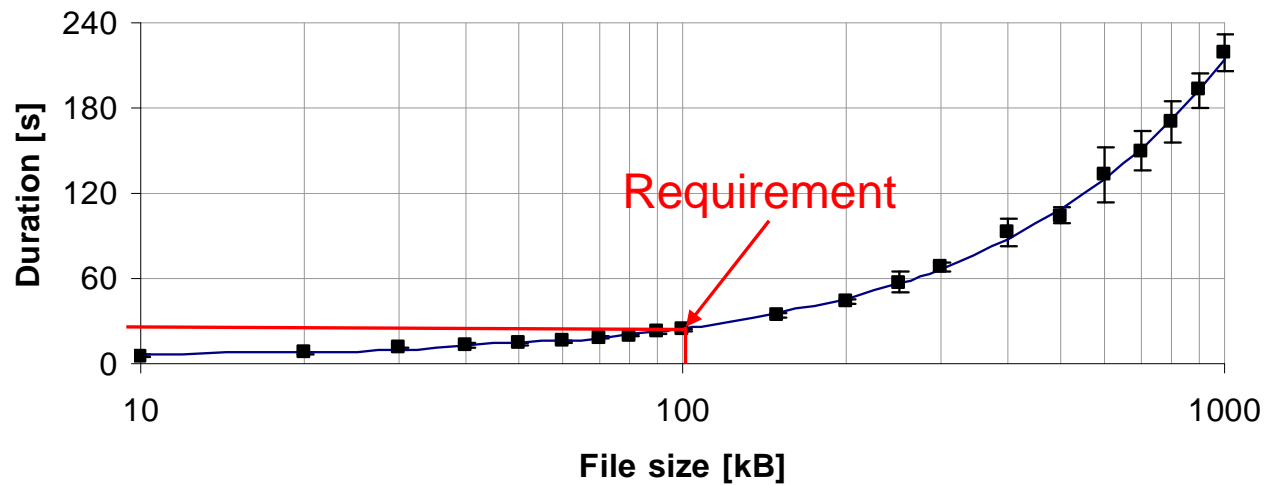
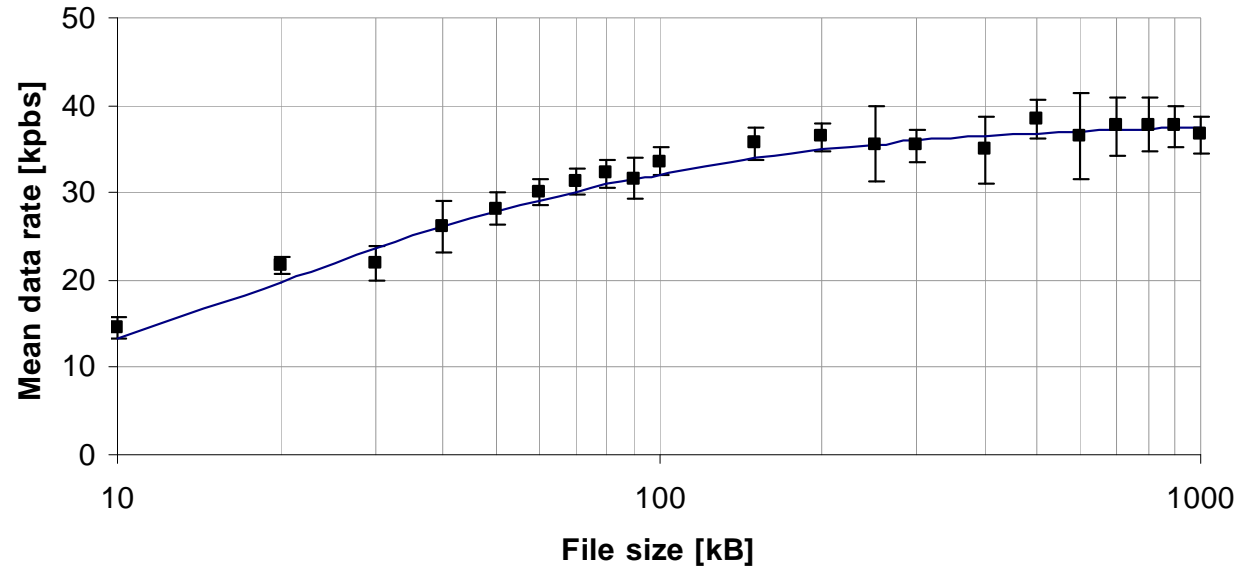
- time measurement of CPU speed and memory usage: Linux OS functions
- data transport time measurement: WireShark (formerly Ethereal)
- HTTP traffic and SOAP/XML tracking : TCP monitor (Dimark)
- we did not register: multi-slot class; coding scheme; delay/jitter



# 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<sup>\*)</sup> on a mobile client and on a fixed client

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

<sup>\*)</sup> 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