

Parallel Data Transfer with Voice Calls for Energy-Efficient Mobile Services

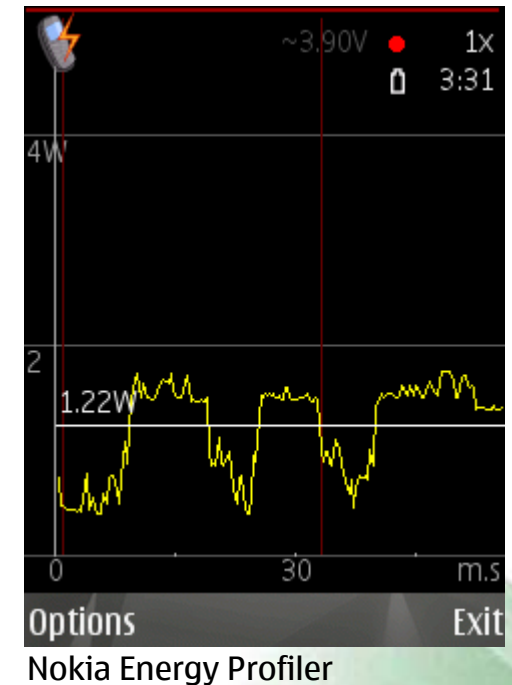
Mobilware 2009

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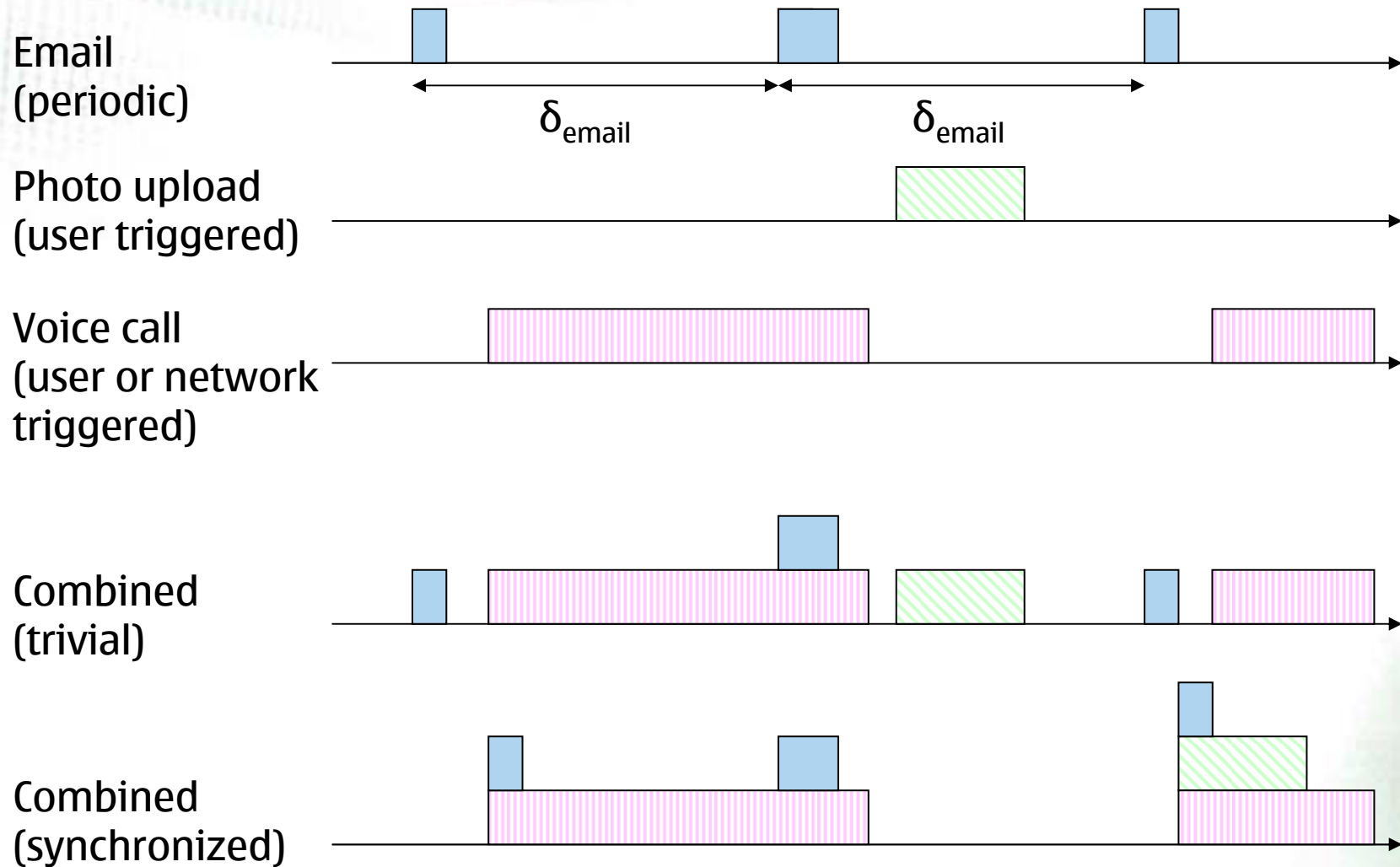
Nokia Research Center, Helsinki, Finland

How to make the battery last longer?

- Energy-efficiency of applications and services is a recurring theme
 - New applications and services create further needs
 - Battery consumption can be an obstacle for adoption of new services
- Solutions
 - Battery technology
 - Hardware development
 - Optimize applications
 - Cooperation
 - Between different devices
 - Between apps in a single device



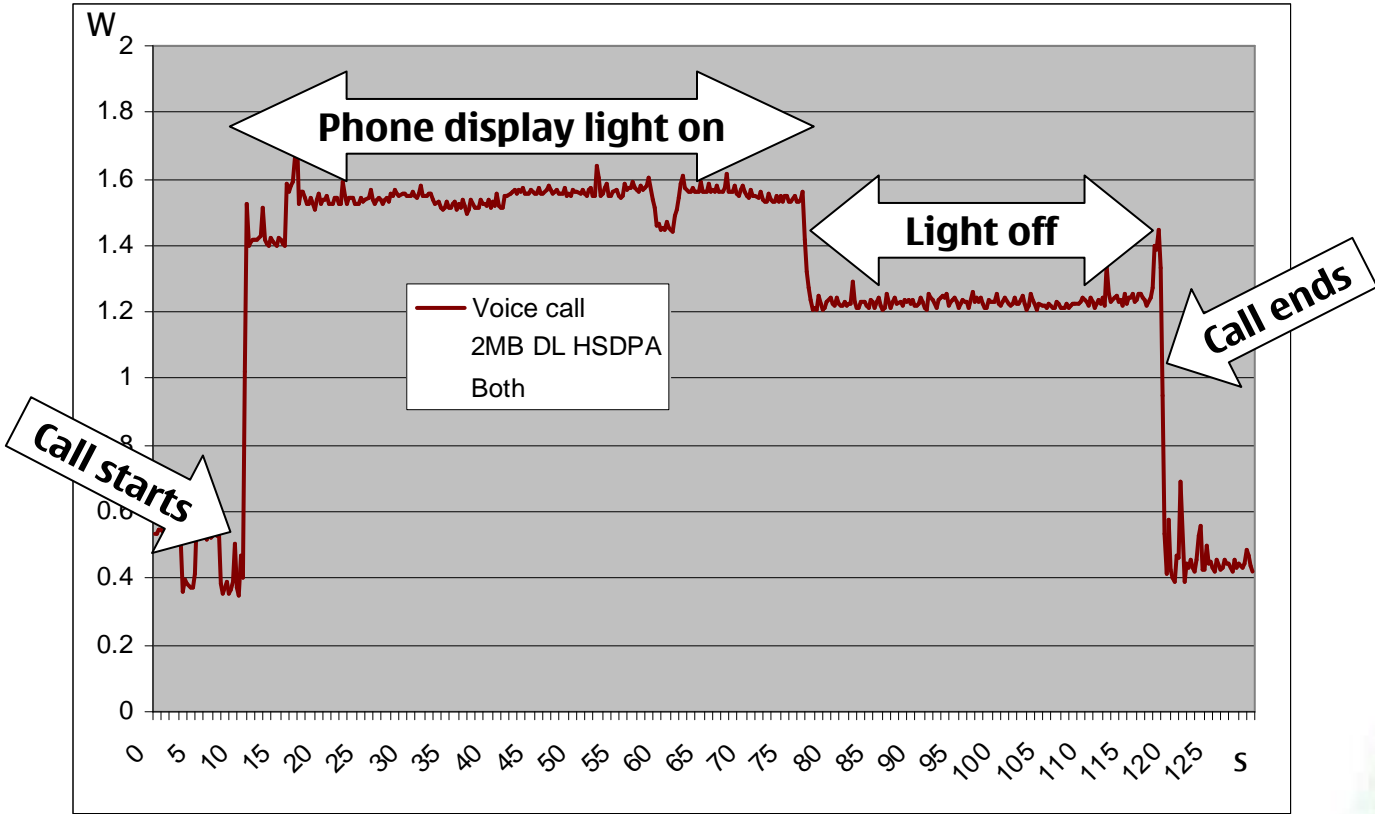
Application Cooperation



N96 Power measurements

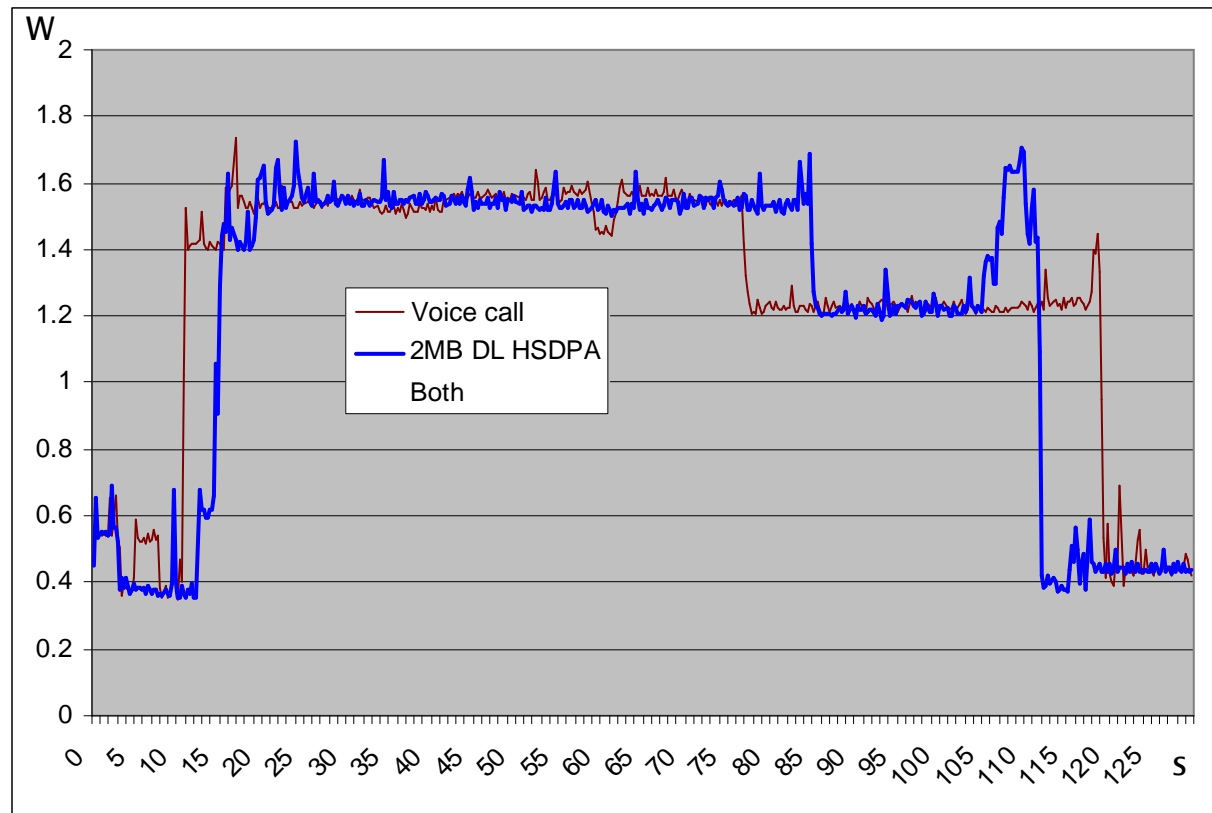


Normal voice call ~2 min



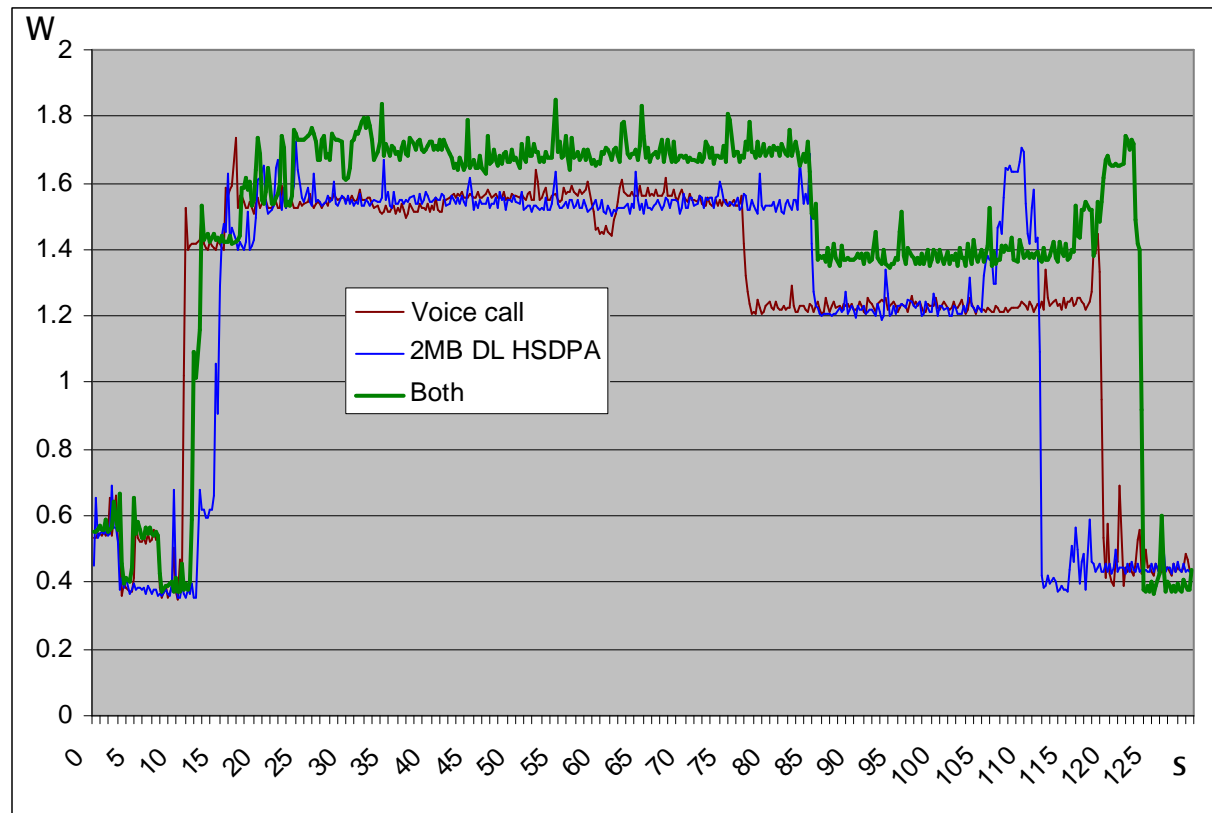
N96 Power measurements

2MB email attachment download with CDMA2100 HSDPA (3,5G)



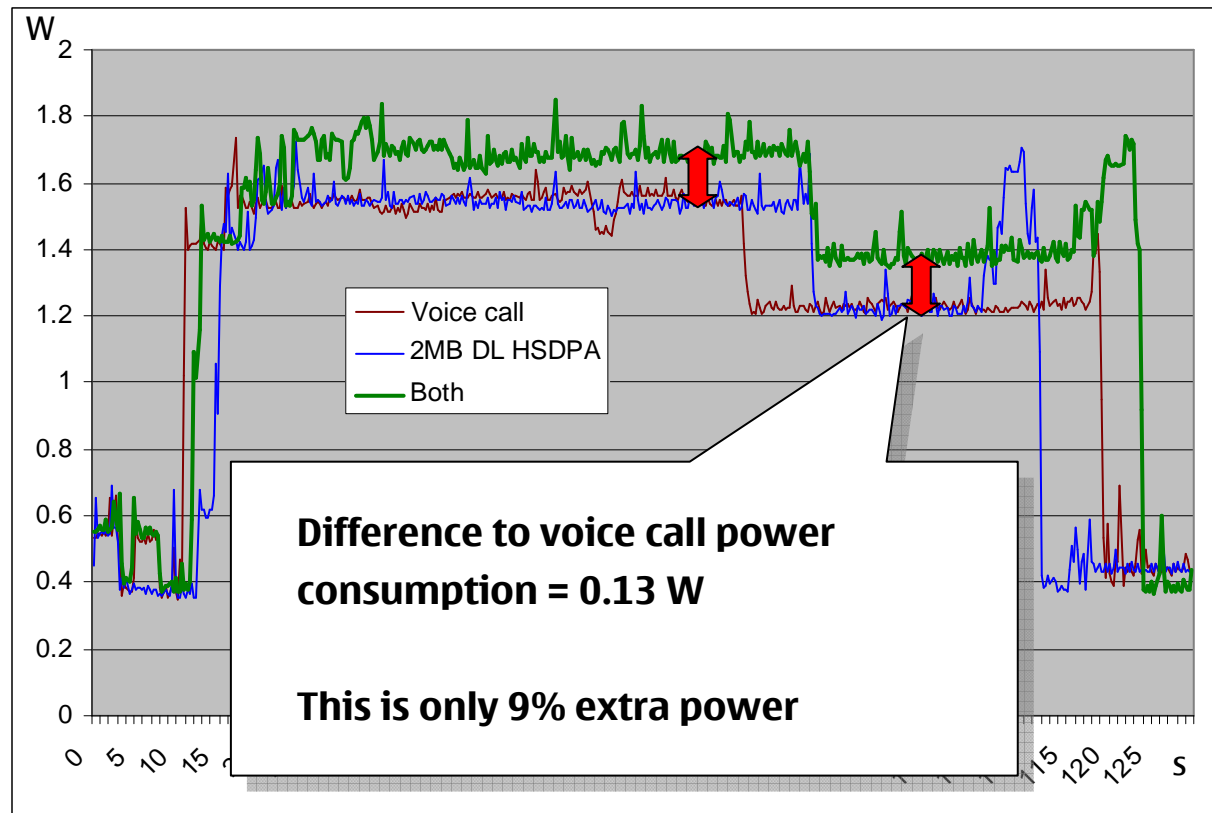
N96 Power measurements

Voice call and 2MB download with CDMA2100 HSDPA



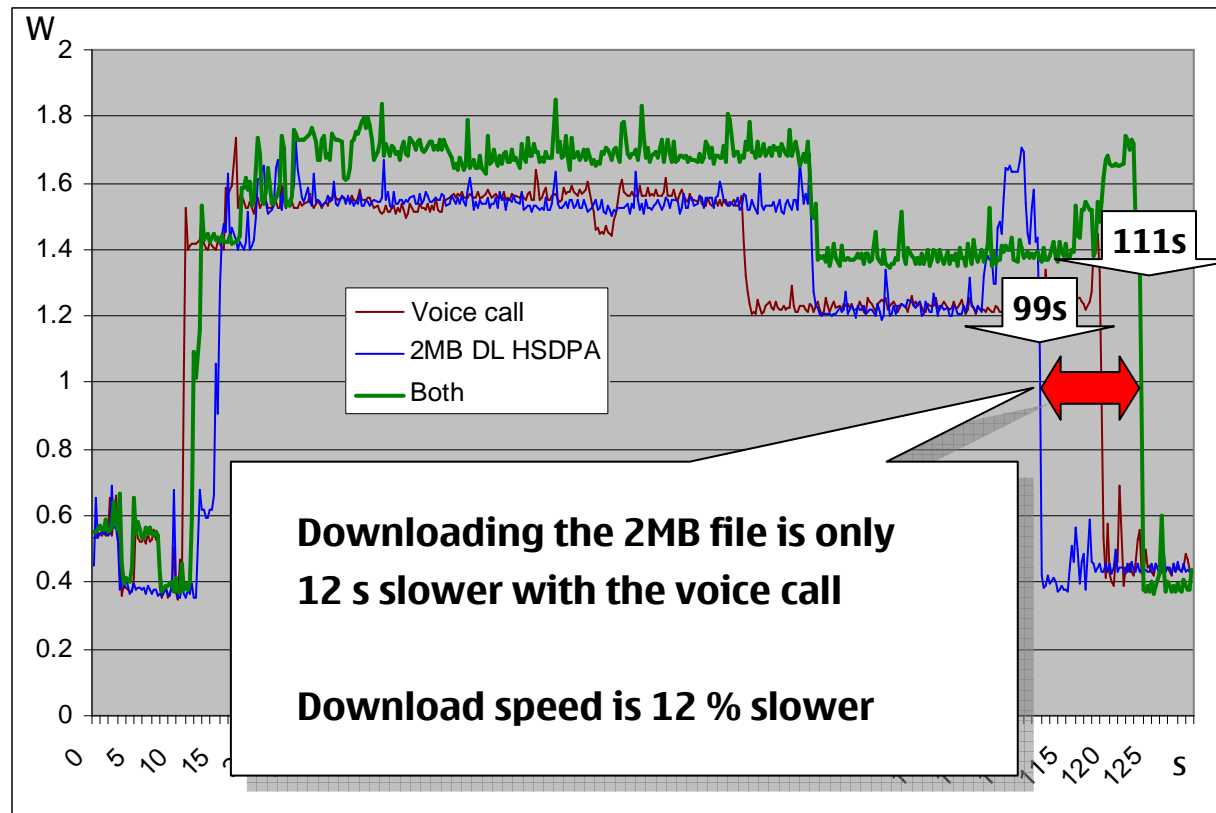
N96 Power measurements

Voice call and 2MB download with CDMA2100 HSDPA



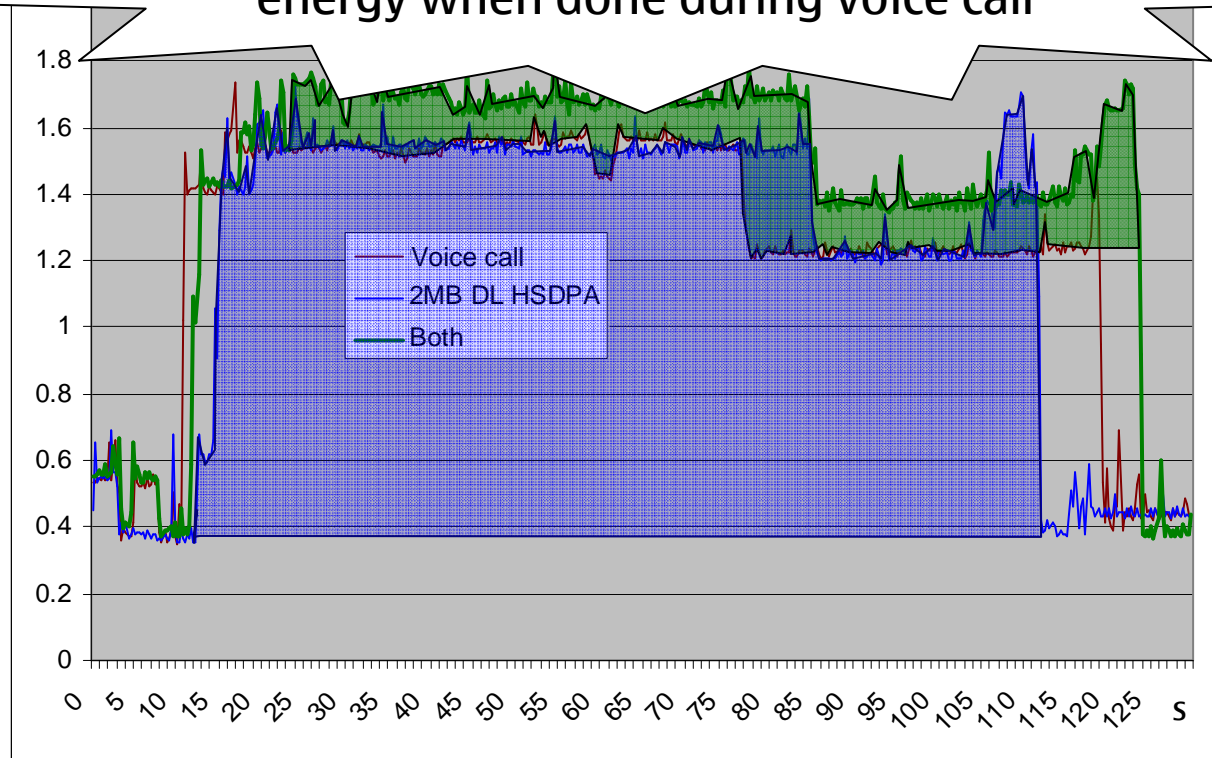
N96 Power measurements

Voice call and 2MB download with CDMA2100 HSDPA



N96 Power measurements

Download requires only
14%
energy when done during voice call



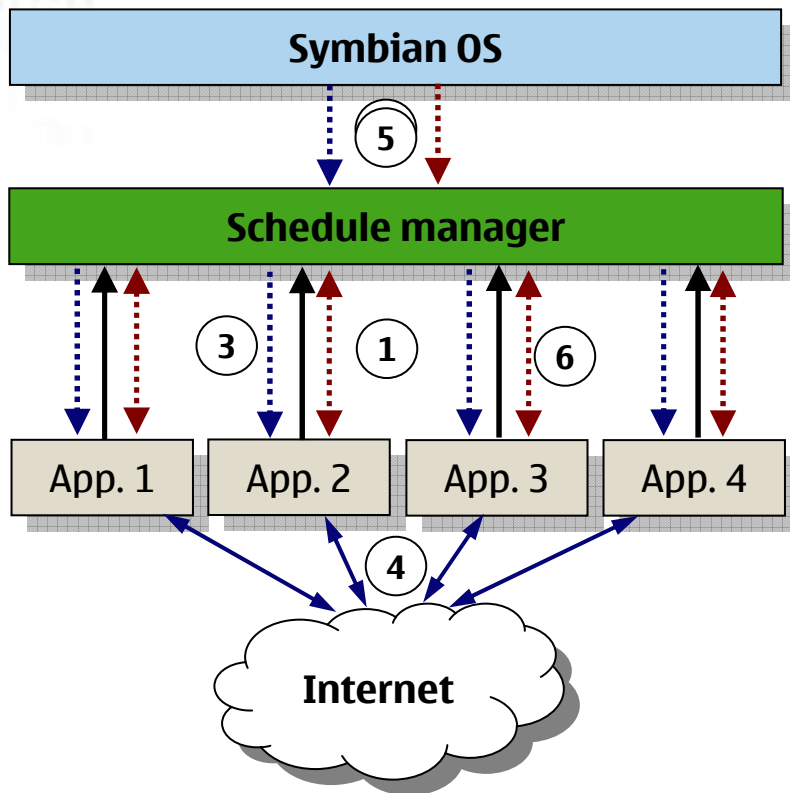
“Energy free” data transfer for a typical user

Call minutes per day (min)	30
Average data transfer speed during call (kB/s)	30
"Energy free" data transfer potential for an average user (MB/day)	54
~ MP3 songs (#) [4MB/song]	14
~ video clip (min) [2.5 MB/min Reuters News]	22
~ email messages (#) [10kB/message]	5530

Implementation

- Requires at least GPRS class A or more capable device
- Two approaches:
 - Application specific implementation
 - Public API for developers
- In both cases implementation requires that application developers are aware of the mechanism

Download scheduler



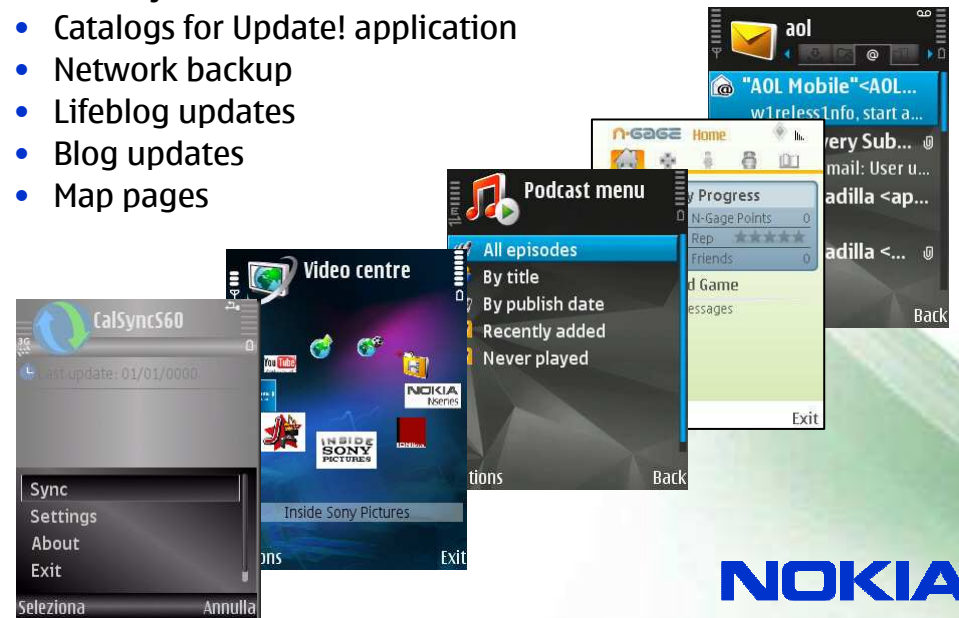
- 1) Applications will register to scheduler with a deadline value (max. time for the download to start)
- 2) Incoming/outgoing call is triggered (or deadline reached)
- 3) Scheduler gives the permission to applications to start downloads
- 4) Applications start download/upload
- 5) Call ended trigger
- 6) Scheduler tells the applications to finish their downloads. Applications can respond new deadline or deregister the service

Mobile services with up to 90% less energy

- Data transfer during voice call is almost free from energy point of view
- Many applications can postpone updates until a voice call takes place
- User experience does not change for apps that have periodic needs to transfer data
- Notifications of updated items immediately after calls => less interruptions for the user

- Video Center
- Podcasting
- Image sharing applications
- Email client
- Calendar client
- RSS feed readers (news etc.)
- Widset update
- Software upgrades for phone application
- Firmware upgrades
- P2P downloads
- Address book updates
- Advertisements

- Currency rates update for converter application
- Preloading frequently used content for browser
- Clock synchronization
- Catalogs for Update! application
- Network backup
- Lifelog updates
- Blog updates
- Map pages





Thank You!