User focus in consumer terminals and conditionally guaranteed budgets

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HVE consumer terminals









HVE consumer terminals

- Focus on:
  - digital TV sets, digitally improved analogue TV sets, set-top boxes (STBs);
  - (i.e. *receivers* in a broad-cast environment);
  - providing *high-quality digital audio and video*.

QoS for HVE consumer terminals

- Is about:
  - media processing in *software*
  - (trading resources for quality at run-time)
  - using powerful *programmable* components
  - rather than dedicated *single function* components.

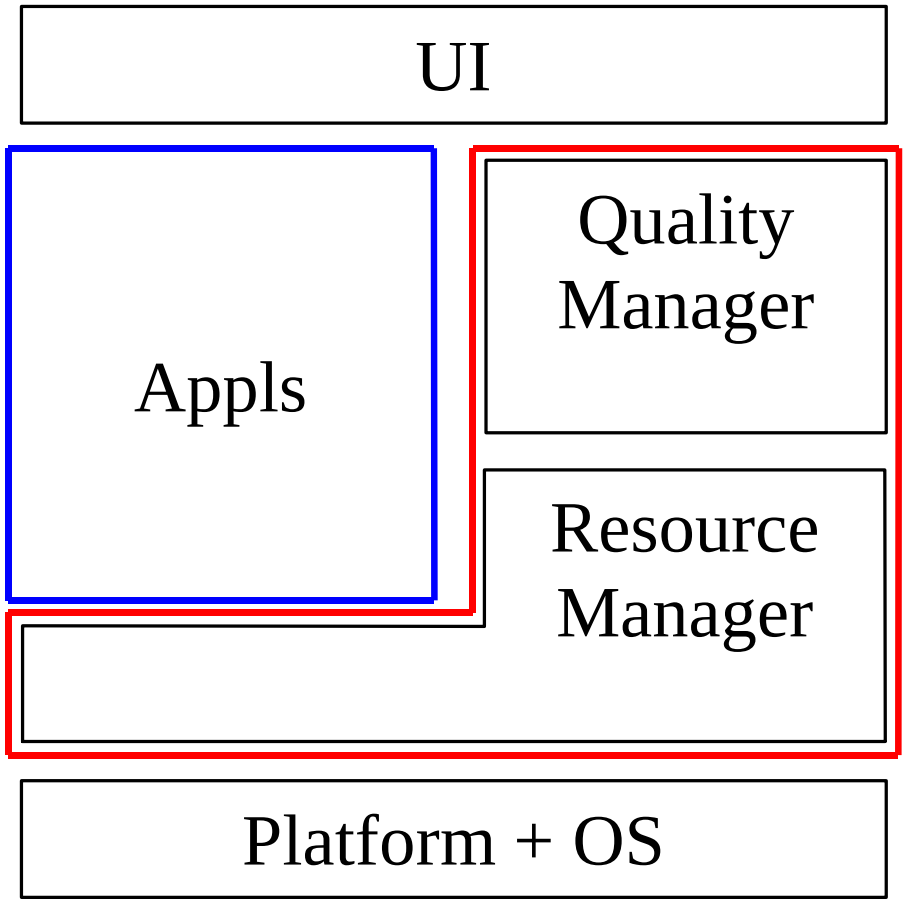
QoS for HVE consumer terminals

- Much alike QoS for mainstream multimedia
  - dynamically scalable applications;
  - maximisation of overall *perceptual* quality;
  - basic concepts: *quality levels* and *budgets*
- however:
  - ...

QoS for HVE consumer terminals

- Cost-effective media processing:
  - budget below worst-case
- User expectation:
  - robustness and stability;
  - guaranteed timing behaviour:
    - no tolerance for jitter;
    - low tolerance for frame-skips.

Basic architectural framework



Legend:

— : QoS RM

— : Applications

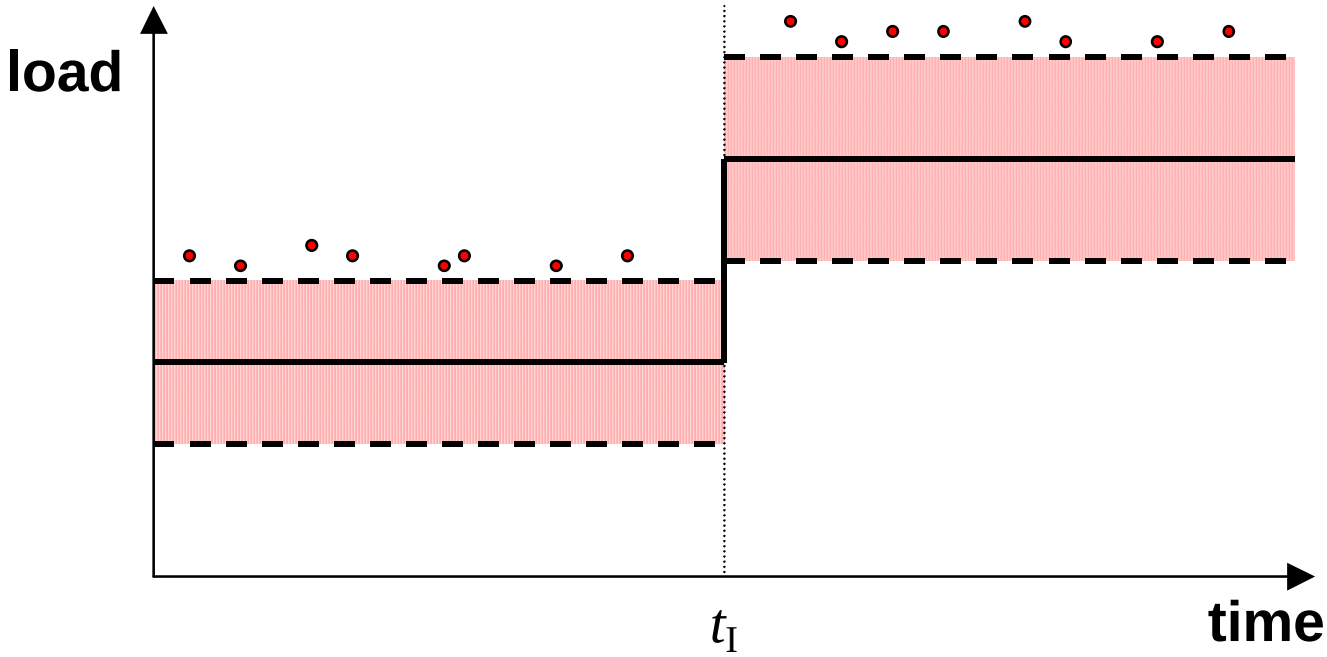
User focus

- TV set:
  - variable number of windows, e.g.
  - main window, PiP, videophone, web-browser
- User focus:
  - typically at one window at the time;
  - changes dynamically;
  - requires *stable* quality.

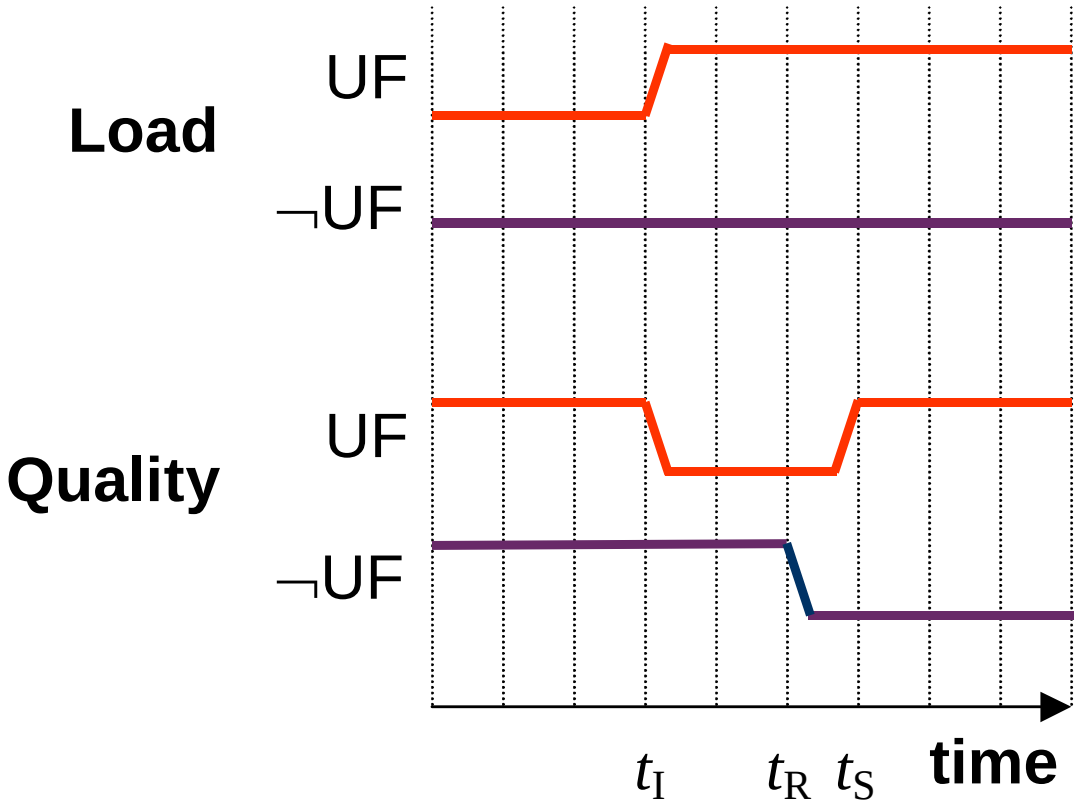
Dynamic load

time scale	*change*	*cause*
minutes	movie ⇒ commercial	service provider
seconds	scene change	data
10 msec	load of media processing	function specific

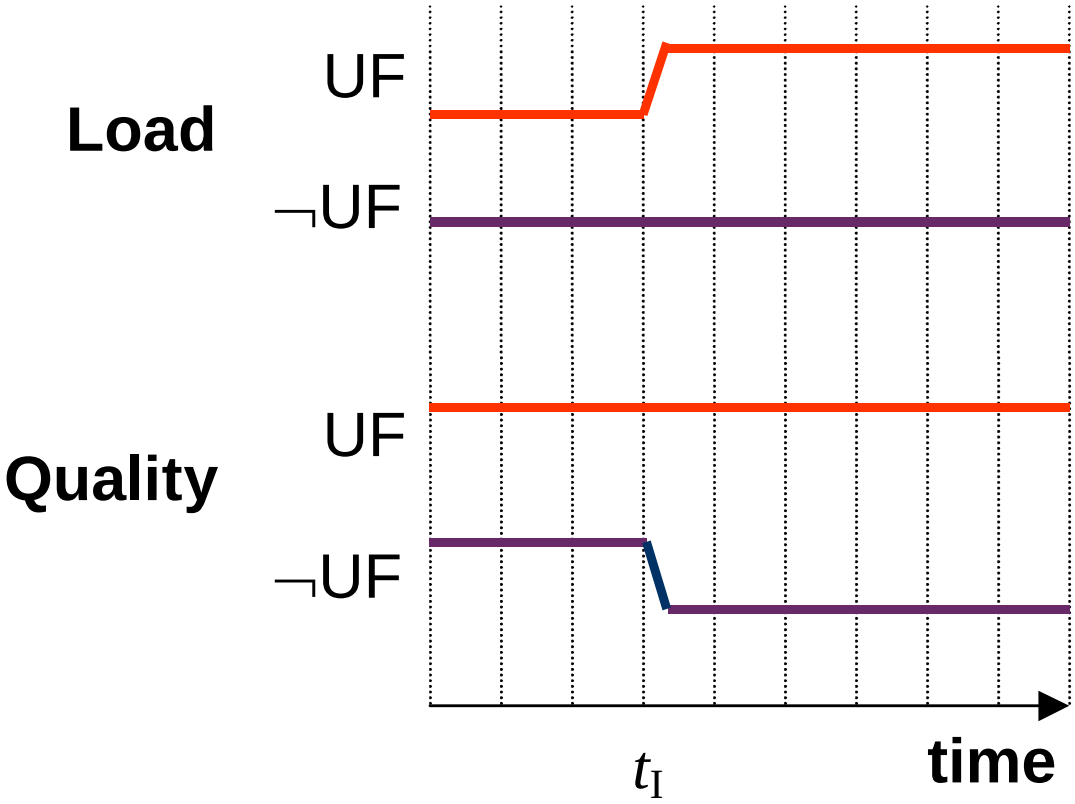
Dynamic load



User focus: problematic behaviour



User focus: desired behaviour



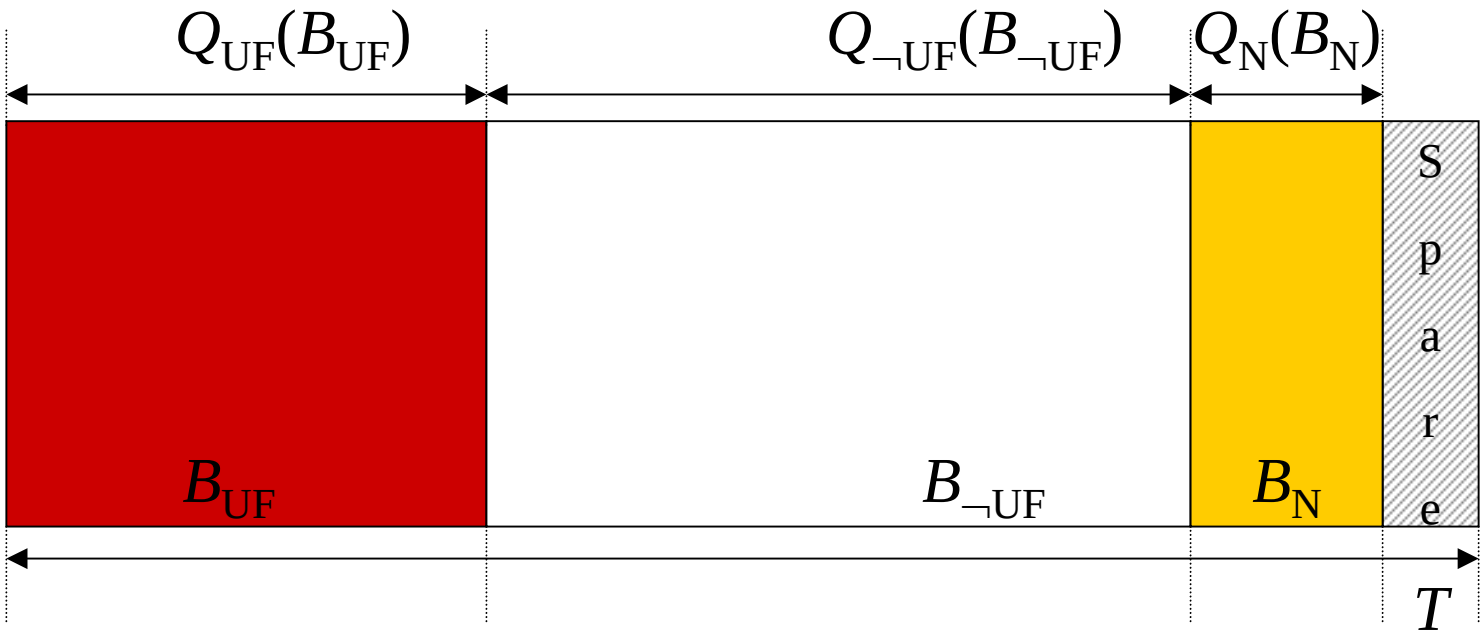
User focus: problem cause

- Dynamic load:
  - intrinsic
- Budgets allocation below worst-case:
  - cost-effectiveness
- Long reaction time:
  - stability: distinguish *structural* from *transient* load change

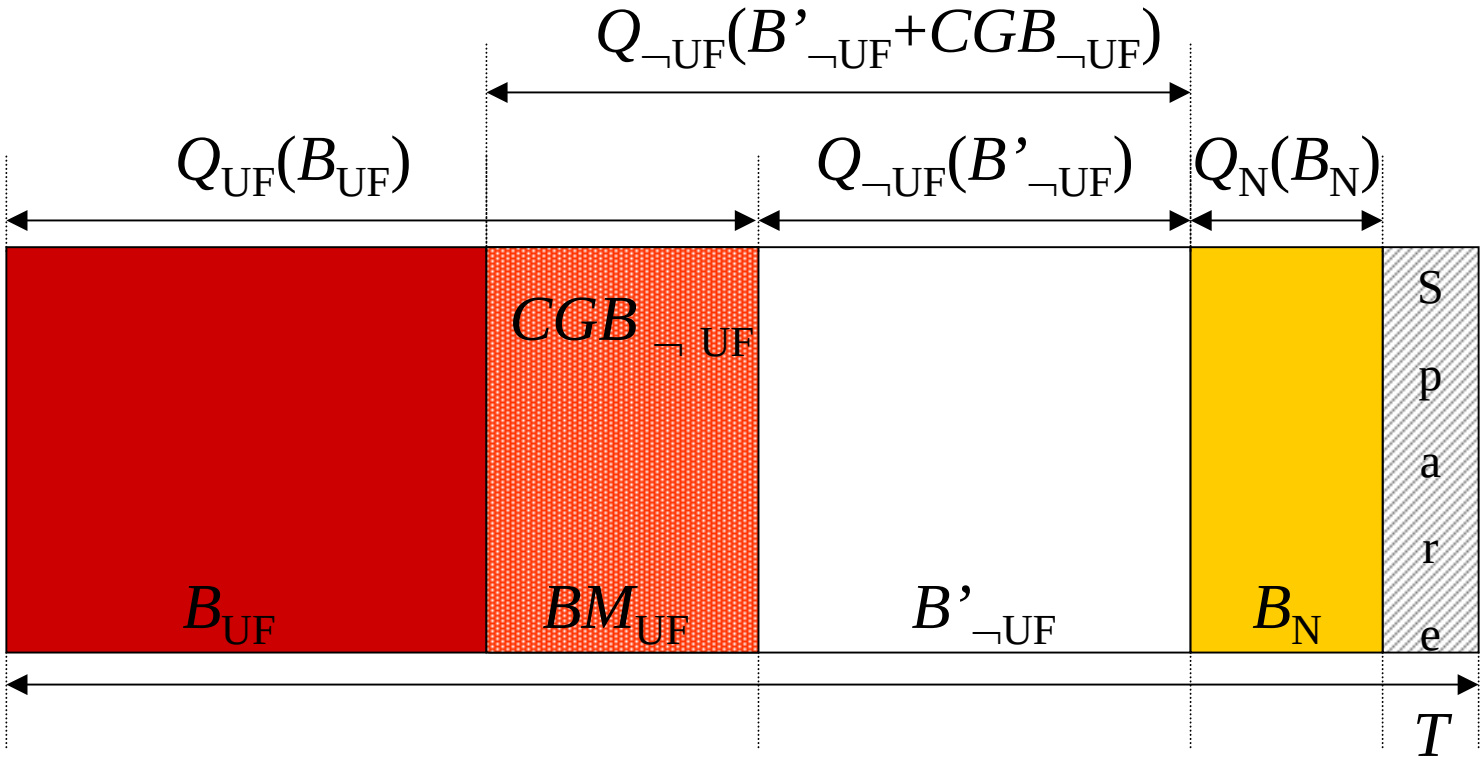
Conditionally Guaranteed Budget

- Load increase anticipation:
  - additional *budget margin* for UF;
  - lower budget for ¬UF;
  - slack generation by UF before load increase
- Unused resource capacity allocation:
  - *conditionally guaranteed budget* for ¬UF;
  - two quality levels for ¬UF

Degenerated example



Degenerated example



Conditionally Guaranteed Budget

- CGB withdrawal anticipation:
  - ¬UF confronted with UF's load increase;
  - (including peak loads of UF);
  - best-effort approach of UF.
- Hence:
  - problem moved to a less critical place

Related work

- User focus and budgets (AGBs) are known;
- CGBs are novel:
  - CGBs versus AGBs:
    - CGBs are inherently *conditional*
  - CGBs versus slack allocation algorithms:
    - CGBs are *budgets*, i.e.
    - have an admission test and are enforced.

Conclusions

- User focus problem:
  - *caused by*: dynamic load, budgets below worst-case, and stability requirement;
  - *results in*: quality dip of UF upon load increase.
- Novel notion of CGBs
  - solves user focus problem;
  - at the cost of quality of ¬UF.

Future work

- Applications: validate approach;
- Resource manager: support multiple UFs
- Quality manager: exploit CGBs

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