HostView:
Annotating end-host performance measurements with user feedback

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Network performance disruptions are frustrating

Video/Audio interruptions

Congested path

Long term goal:
Automatic troubleshooting tool at end-host
1. Automatic detection of performance disruptions
2. Root cause analysis
3. Fix
The first step

Automatic detection of network performance disruptions as perceived by end-users

Only performance disruptions that affect end-users

Performance of any networked application
Challenges

- Hard to model user perception
  - Users have different tolerance levels
  - Applications may mask some problems

- Hard to measure network performance with user feedback
  - Users may not be willing to provide data
    - Privacy concerns
    - Data collection may overload end-host
Road map

- **Measure**
  - Network performance annotated with user feedback

  => Design of HostView

- **Model**
  - Good/bad network performance according to users

- **Design**
  - Tool to detect network performance degradation
HostView design

- User privacy concerns and willingness
  - Understand users’ concerns with a survey [CCR-2010]

- End-host data collection
  - More data is better
  - But, may overload user’s machine

- Extract meaningful user feedback
  - More feedback is better
  - But, cannot annoy users
End-host data collection

- **Network performance**
  - Passive traffic analysis to infer network performance
  - Small overhead (less than 5%)

- **User environment and system performance**

- **Application-level context**
  - Associate internet connections to applications
    - Application executable
    - Application protocol
Application context

- Application executable
  - Use gt to sample process table

- Application protocol
  - Make L7 run online
  - Offline port inspection

- Trade off: coverage vs. overhead
  - Evaluation with 7 LIP6 students for two weeks
Evaluation summary

- **Coverage**
  - App protocol of port = l7 for 86.43% of the bytes
  - gt labels 88.63% of the bytes with app executable

- **Overhead**
  - l7: CPU spikes correlate with traffic bursts
  - gt: 5% CPU load with 1 s polling interval

- gt incorporated in HostView
- port inspection is done offline
User feedback

- Which questions to ask?
  - Easy to fill, not to annoy users
  - Enough information to interpret results
  - HostView questions: 4 multiple choice and 1 free text

- When to ask the questions?
  - User triggered: “I am annoyed” button
  - System triggered: Experience sampling mechanism
  - HostView combines both techniques
Example question

4. Did you experience any of the following problems, in the last five minutes? (Click all that apply)

- [ ] Can’t connect to some sites or services
- [ ] Poor voice or audio quality
- [ ] Slow download or upload
- [ ] Slow browser
- [ ] Poor video quality
- [ ] Any other problem(s):

- [ ] None
Experience sampling algorithm

- **Goal:** feedback at different performance levels
  - Assume performance correlates with network load

- **Solution:** weighted random sampling
  - Load thresholds based on distribution of throughput
    - Low: throughput ≤ 85<sup>th</sup> percentile
    - Medium: 85<sup>th</sup> percentile ≤ throughput ≤ 95<sup>th</sup> percentile
    - High: throughput ≥ 95<sup>th</sup> percentile
  - Pop-up a questionnaire if
    - Machine not idle
    - \( \text{Rand}() < P\{ \text{sample} | \text{load\_state} \} \)
How often to sampling?

- **Requirement from users**
  - Maximum of 3 questionnaires per day
  - Questionnaires cannot be too close
  - Need mechanism to stop questionnaires

- **Challenge: don’t know how long users are up**
  - Small polling intervals: too frequent questionnaires
  - Large polling intervals: not enough answers

- **Options**
  - Fixed polling interval
  - Adaptive: Predict active time based on previous activity
Preliminary takeaways

- Pilot with four LIP6 students for two weeks
- Not all the samples are complete
  - Question times out
  - User checks ‘Ask me later’ option
- Daily activity varies
  - Can double from one day to the next
- Traffic load varies
  - Distribution of load varies significantly across users
Next steps

- Large scale deployment of HostView
  - Need a big dataset with various user profiles
  - At least two weeks per user
  - Performance problems are rare events!

- Correlation of network performance with user feedback

- Build models of good and bad performance
We need your help!

- Please download HostView at
  http://cmon.lip6.fr/EMD

THANK YOU!