



Measuring networks for enhancing user experience (Muse)

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Can we infer QoE from typical QoS metrics?

Muse's approach to infer user QoE

- HostView: end-host data collection tool
 - Measure network activity and performance annotated with user feedback
- Predicting user dissatisfaction with application performance
 - Train predictors from HostView dataset
- Ethnographic study within UCN project
 - Ground truth on user context
 - Guidelines to design new HostView

HostView data collection

- Network performance
 - Packet headers (anonymized IP source)
- User environment and system performance
 - CPU load, OS, time zone, country
- Application-level context
 - Content-type for HTTP responses
 - Application (process names)
- User feedback
 - System-triggered questionnaires (3 times a day)
 - I'm annoyed button

Deployment

- Recruiting volunteers
 - Leaflets at IMC 2010 and CS Mailing lists
 - 50 USD Amazon gift cards
 - Real-time feedback about network connection
- Data: 40 users
 - Nov 2010 – Feb 2011
 - 26 Mac OS and 14 Linux
 - 14 countries
 - Most users ran tool for one month

Lessons from training predictors using HostView data

- Few labeled samples, even fewer dissatisfied
 - Need long-term experiment per user
 - Better mechanism to trigger questionnaires
- Must identify user activity and context
 - Dissatisfaction with application user interacts with
 - But, it is hard to extract user activity/context
 - How to separate traffic of user activity from the rest?
 - How to identify activities running on the browser?
 - Is user alone or with someone? Is she in a hurry?

UCN user study: Approach

- Start small: in-depth study of few users
 - Gather ground truth on user activity/context
 - Collect an initial dataset to guide data collection
- Then, scale up progressively

Data collection

- System logging
 - OpenVPN, Moves, HostView
- Ethnographic material to get ground truth
 - Diaries
 - Interviews using visualization tool of logged data
 - Get users to explicate their online practices to a third party (us)
 - Get users to assign tags to certain kinds of online activity
 - Home visits to get surrounding context of everyday routine and practice

Deployment

- 12 participants in France
 - Mostly Paris area
 - Age ranging from Late Teens to Late 30s
 - Half students, others working in office, sales, creative and professional occupations, 1 unemployed
 - Living in mixture of housing from small apartments to large houses
 - Include people living alone, as couples, with families, sharing with friends etc., or lodging
- Mostly single device (2 registered with 2 devices)
 - Devices: 7 laptops, 1 tablet, 6 phones
 - OS: 2 Mac OS, 5 Windows, 4 iOS, 2 Android

Early observations

- Some routine per individual
 - Order of access
 - Particular kinds of content at certain times of day
- Difficult to get context
 - Logging doesn't get daily routine explicitly
 - Location info not always available
 - No logging whether users are alone or with someone
- Difficult to get usage
 - Many windows opened at the same time
 - Users may leave device open

New HostView

- Windows version (maybe Android)
- Better capture user activity and context
 - Tracking all I/O
 - Plugins for popular browsers
- Improved questionnaires
 - Simpler questionnaires
 - Less intrusive
- Better incentives
 - Visualization of data
 - Incrementally introduce diagnosis tools

Next steps

- HostView
 - New user study in UK
 - Better visualization of collected data
 - What will be good incentives for larger deployment?
- Open questions
 - Can we infer user activity from network traffic?
 - How to get coverage (user feedback across applications, context)?
 - How does application-agnostic approach compare with application-specific QoE inference?

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