A Unified Interface for Experimentation at the Edge

Initial Thoughts

Srikanth Sundaresan

ICSI

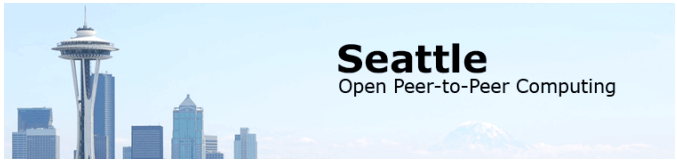
Measurements from the edge are critically important

- Broadband is a critical resource
  - Not a luxury anymore
- View from the outside just as important as the view from inside
- The edge is as complex as the core
  - If not more – problems are devilishly difficult to pinpoint, let alone solve

… Which explains why there are so many platforms

Project BISmark

DASU



Do we need so many platforms?

	BISmark	Ark	SamKnows	RIPE
Continuous active	Y	Y	Y	Y
Passive	Y	N	Y/N	N
Scope of experiments	High	Higher (better CPU/storage)	Medium(resource constraints)	Low (only use tools compiled in)
Heavy duty exp	?	Y	N	Y/N
Local storage	N	Y	N	N
Scale	~	~	Y	Y

Each platform is unique, valuable in its own right

As a researcher, what would one choose?

- Considering experiment that can potentially run on all platforms:
  - Scale
  - Ease of deployability
- Experiment deployability is important
  - Else platform will never be used outside of niche group

How easily are experiments deployable in current platforms?

- BISmark – not difficult (?)
  - Comfortable with openwrt
  - Ash, C, lua
  - Short turn-around times (weeks)
- Ark ?
- SamKnows
  - Ash, C
  - Long turn-around times (months)

Can we write experiments once and deploy everywhere?

- It's complicated
  - Technically possible
    - Standard cross-compilation techniques
    - A few hardware/other quirks (interface names, etc)
    - Some effort in integrating with existing experimentation method
  - More difficult in practice
    - Memory / CPU / bandwidth / time constraints
    - Need to make code general-purpose

Case study: Porting WtF to SamKnows

- Where's the Fault
  - Tool that localizes throughput bottlenecks to access link or wireless gateway
  - Collects passive pcaps
  - Proof-of-concept code in Ash + custom small C modules
  - Extensively tested on BISmark
    - 65+ homes, 2 months
  - FCC got interested in June 2013

Timeline of porting WtF to SamKnows

- Summer 2013
  - Realized that Netgear 3500 has Broadcom chipset, which reduces functionality
  - 2/3 of nodes which has Atheros chipset is deployed off-path
- Fall 2013
  - Proof-of-concept code that works flawlessly in BISmark but fails miserably in SamKnows
- Spring 2014
  - Ported WtF as a lightweight, predominantly C-based program
- Summer 2014
  - Early testing + adding features
  - Testing on 100 nodes (still larger than entire BISmark deployment)
- Late summer 2014
  - Initial deployment
  - … which got postponed due to FCC MBA measurements cycle
- Fall 2014
  - Deployment!
  - Wholesale crash of 30-40% of nodes within 36 hrs
  - Experiment pulled (we did get some really interesting data though!)

A unified experiment development platform

- Is there a standard development platform we can agree upon and enforce?
  - C/C++ with Shell/Lua
- Some “basic” constraints / good habits
  - Memory, CPU, storage, network utilization
  - Real people may be using the network!!

Can we impose tight constraints *and* maintain usefulness of platforms?

Keep management small and separate

- Experiment vetting
  - Does it meet ToS of platform?
  - Security (hard!)
  - Resource utilization (hard!)
  - But likely only needs to be done on one platform
- Constraints should be managed by experiment
  - Hardware
    - A wireless component that works on BISmark should fail gracefully on Ark
  - Keep resource utilization minimal

Basic assumptions

- Simple packaging system
  - Expecting users to figure out packaging for every single platform is expecting too much
    - Openwrt makefiles are not pretty
  - Give us a pointer to the code repo, we'll generate the package
- Package management system
  - Pick nodes
  - If the code repo updates, the deployments update

BISmark and Ark

- Probably easiest to integrate (externally, not internally)
  - Similar (yet different) vision, platform
- The researcher needs to provide
  - Code that is platform-agnostic
- The platform provider needs to provide
  - Platform-specific package management
  - Integration into experiment universe (crontab)
  - Nodes
  - Data pipeline

So what should the platforms provide?

- Maintain an open, easy-to-use development toolchain (easy)
  - Keep platform-specific build management separate from code
- Sync data
  - Can be offline
- Provide list of constraints (easy)
  - Memory, CPU, network usage, time
- Enforce constraints (hard)
  - Sandboxing: very difficult, if not impossible to vet experiments or deploy without losing sleep

Practical first step

- Run basic experiments on each others' platforms
  - Bismark-active: periodically measures latency, throughput, packet loss, jitter
  - Something light-ish from Ark?

BISmark → bismARK*

*** This might not happen**