Research Methodology

NSFCloud breakout session

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Participants

- 21+ people
- Many doing systems research
- A few applications research
- NSFCloud builders
Research Experiment Phases

• Prepare
• Execute
• Monitor and measure
• Data storage & analysis
• Traces & workloads
• Sharing
Prepare Experiments

• A lot of work to prepare an experiment
  – Evolve an environment
  – Scale the environment
  – Prepare the real experiment

• Make this process as convenient as possible
  – On-demand access to small-scale resources
    • Longer wait times are acceptable for larger experiments
  – Easy and quick access to resources (e.g. virtual machines)
  – Easily transition from virtual to physical
    • VM image -> node image?
    • Encourage use of ansible/puppet/chef or similar
    • Container technologies?
Execute Experiments - Describe Environment

• Level of detail?
  – From a class of resources
  – Detailed characteristics
  – Exact nodes

• Detailed information is important
  – E.g. hardware changes
Execute Experiments - Verify Environment

• Much more interest from testbed builders than from users!
  – Users interested in the end (the environment they ask for)

• Level of detail to verify
  – Tradeoff thoroughness vs time to execute
  – Verify what the user asked for, at least (# cores, memory, disk, etc.)
  – Could verify much deeper (e.g. performance benchmarks)

• Standardize benchmarks/tests?
Execute Experiments - Modify Environment

• Load injection, fault injection
• Users have their own tools
• (very brief discussion)
Monitor and Measure

• Important to do this throughout the systems
  – Include tools in standard OS images
  – Access to data gathered outside of the OS
    • Network, power, heat

• Availability of data?
  – To the user of the relevant components
  – To other users and publicly?
    • Useful data
    • Potential concerns about making data public before the user can publish
      – Mitigated by some amount of anonymity (public won’t know who was using what components when)
Data Storage and Analysis

• Store experimental data for analysis
• Users plan to use their own scripts/tools & experts to analyze
  – Interest in sharing
• (brief discussion)
Traces and Workloads

• Traces and workloads from production environments would be very useful
  – Use to drive experiments
  – Must describe in detail the configuration of the system they were gathered from
  – Such workloads from non-production environments can be misleading

• Traces from the NSFCloud testbeds also useful
  – Provide detailed information about experiments
  – Compare extended or related work
Sharing

• Lots of interest in being able to share information and collaborate
• Repeatability, extensibility
  – Experiment configurations
  – Experimental data
• Publishing results
  – Refer to config/data in paper
• Community building
  – Publications & project information
  – Tips and tricks
  – Data analysis tools