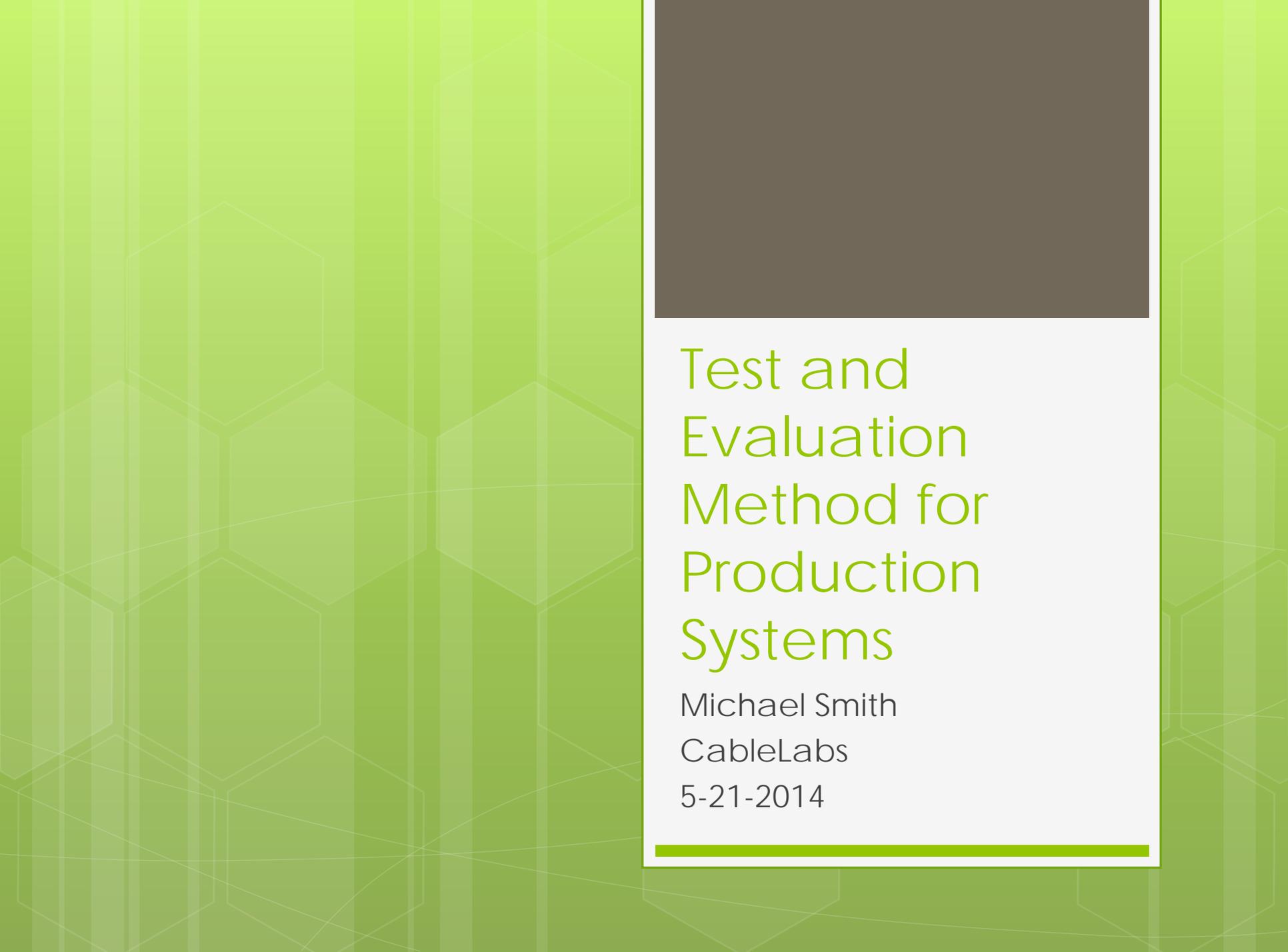| Invention Title:	Test and Evaluation Method for Production Systems
Invention Summary:	Evaluate changes to production computer systems in real time without impacting users by directing cloned inputs to a sandbox platform and comparing performance metrics with the production system.
Invention Description:	The production computer system receives inputs from potentially many sources. For example, a system way host a library of web services (API's), or be an interactive web site, or be a financial processing engine applying computational models to input parameters. In this invention, the system inputs are replicated, then these replicated inputs are redirected to a test, or sandbox platform. The test system's performance can then be directly compared to the production system. If the test system is running the same version of software as the production system, the outputs of the two systems will be the same. But if the test systems' software is updated with, as an example, a performance enhancement designed to reduce processing time, the new system's performance can be directly compared to the production system. The team designing the performance enhancement gets immediate feedback on what their changes would do to the production system. In this way, new ideas, algorithms, logic structures, even hardware enhancements can be evaluated as though they were already in production. Quickly evaluating new ideas and enhancements supports rapid development saves development costs by only deploying the best solutions and eliminating re-work caused by incomplete test coverage.
Invention Commercial Value/Customers:	Making changes to production computer systems has historically required building simulation environments and crafting test inputs to verify that the proposed changes will deliver the intended enhanced functionality and performance without introducing errors or latency. Once verified, these changes are then deployed to the production system and evaluated there. Often the deployed changes demonstrate unintended behaviors when subject to the actual production inputs. This can result in outages, lost business, poor customer satisfaction and additional development costs as the solution is rolled back and re-worked. In addition to these benefits, the invention provides system developers with a method to make changes quickly and get meaningful feedback without impacting users. This opens the possibility to try new ideas, innovative algorithms, logic enhancements, etc. which can have dramatic impact on the bottom line with new business, more efficient processes and improved customer interactions.
Invention Differences:	This technique can be applied broadly to hardware and software development in many industries. It is not restricted to particular operating systems, languages, or development paradigms. The invention is not focused on what performance enhancements could be made, but rather on the method used to evaluate many potential enhancements to arrive at the best.

Test and Evaluation Method for Production Systems

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Evaluating Production Modifications

Without User Impact

- **Problem:**
  - How to evaluate changes to live production systems without impacting users? For example
    - New web site layouts
    - New processing logic
    - Recommendation engine tweaks
    - Software maintenance

- **Historical Solution**:
  - Built non-production platforms to simulate production
  - Create test cases to simulate production inputs
    - Expensive, difficult and error prone
    - Do cases represent actuals well?
    - Must update cases as user scenarios evolve
  - Compare test platform results to production
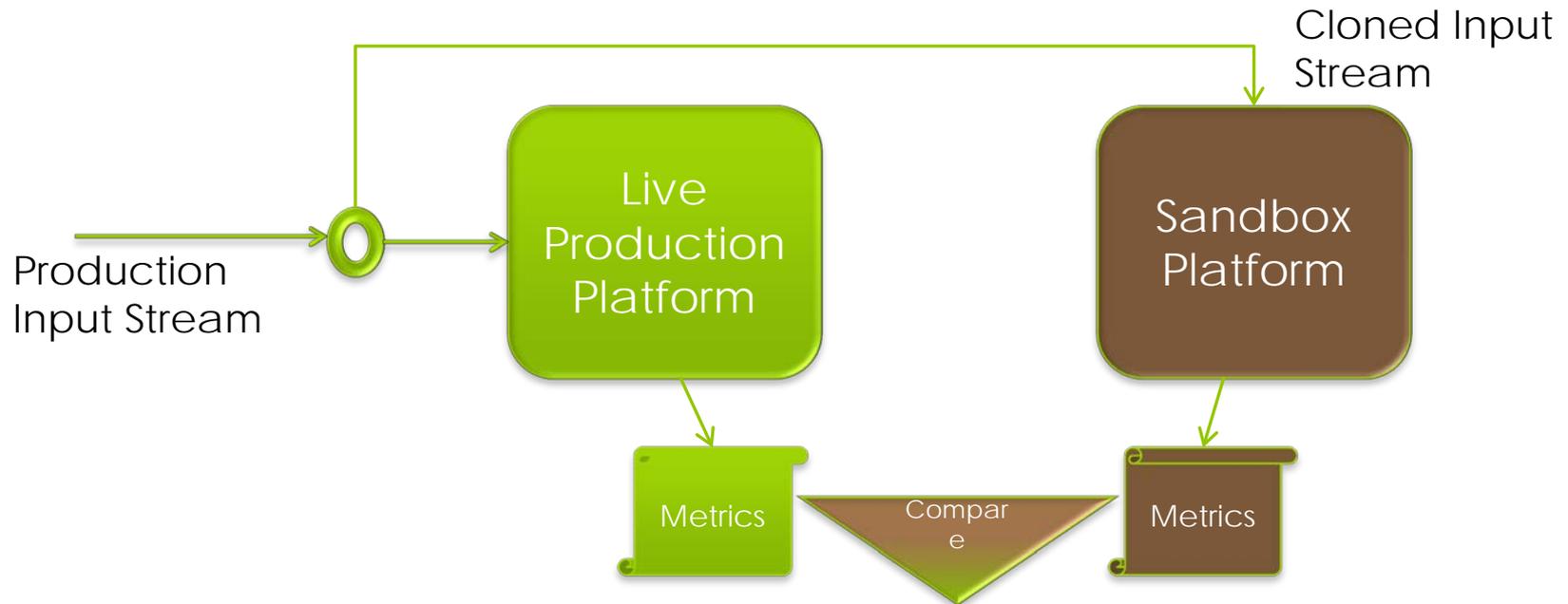   - Metrics from asynchronous results difficult to evaluate

Evaluating Production Modifications

Synchronously In Real Time

- **New Feedback Solution**
  - Clone real time production inputs
  - Direct cloned inputs to instrumented sandbox platform
  - Apply experimental logic, configuration parameters, etc. to sandbox platform
  - Continuously compare & monitor sandbox results to production results in real time.
  - Make changes to sandbox implementation and see the results immediately as compared to production
  - Optimizes system development and tuning
  - Confidently deploy successful changes into production

Production Performance Monitor & Development Sandbox

Cloned Input Stream

Production Input Stream

Live Production Platform

Sandbox Platform

Metrics

Compare

Metrics

Metric Examples	Production	Sandbox
Timing		
Page Load	4.2 ms	5.0 ms
Processing	3.0 ms	2.7 ms
Response	168 ms	47 ms
Errors		
Overall Rate	14%	11%
Code 107	4%	2%
Time out	9%	4%
Upsell Prompts		
Level 1	38%	62%
Level 2	12%	16%