Pintail Technologies, Inc.

Meeting the New Challenges of Test

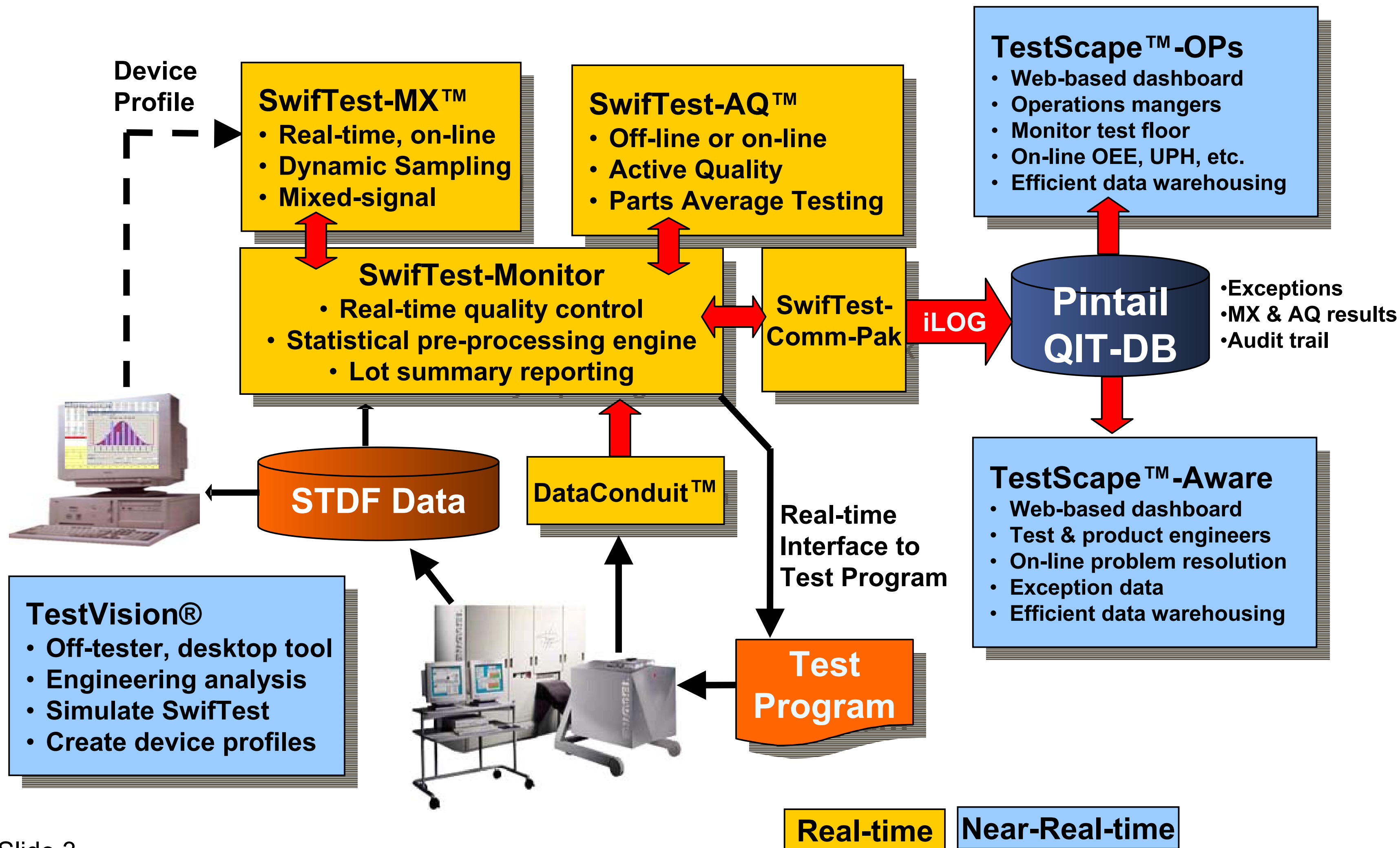
Southwest Test Workshop
June 8, 2005
www.pintail.com

Micky Ray
Program Manager
micky.ray@pintail.com

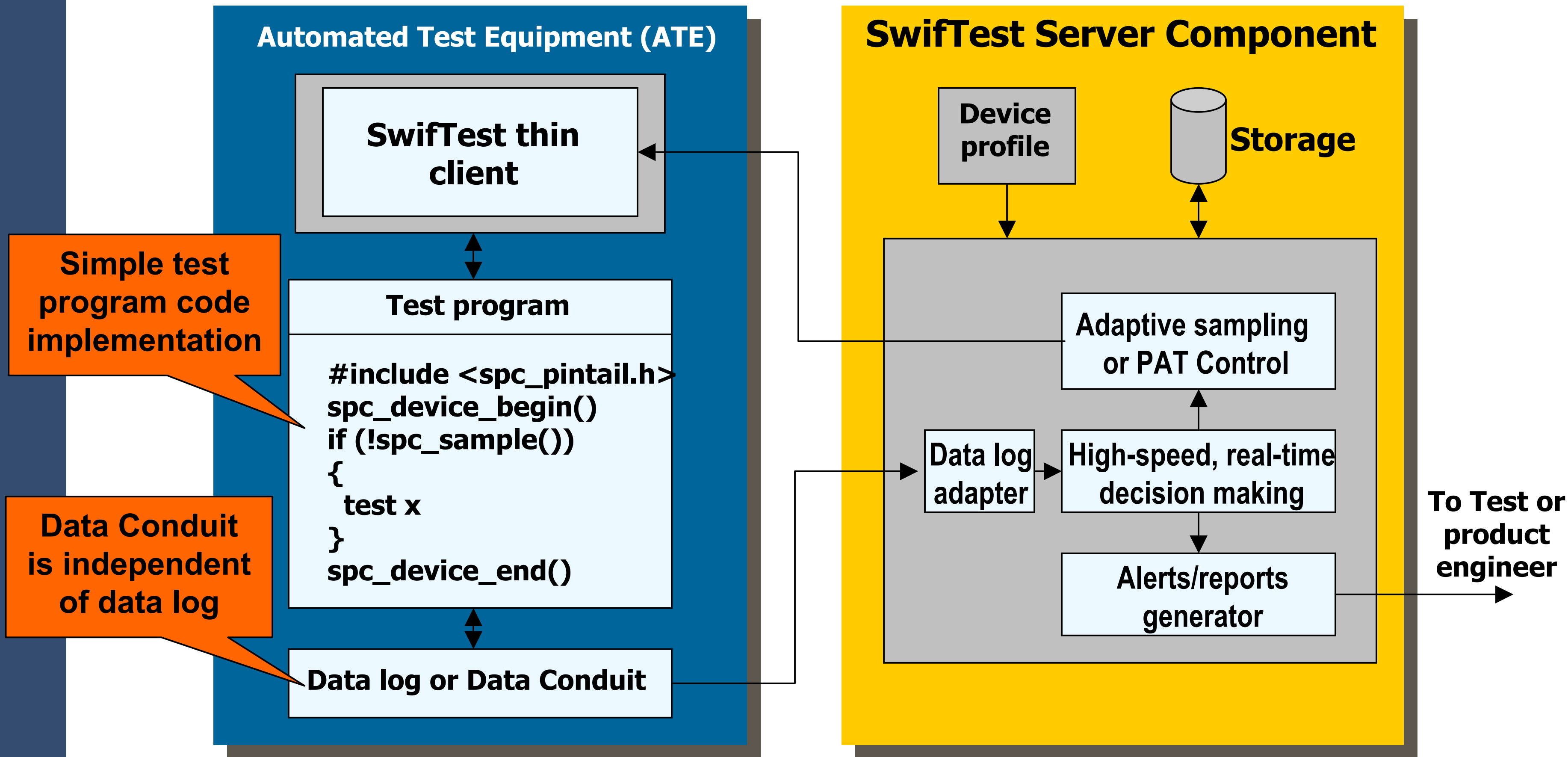
What are the challenges?

- Cost of test is too high
  - Statistical Process Control (SPC) sampling
  - Reduce re-test, scrap, yield losses via monitoring
- Zero defects initiatives
  - Part Average Testing (PAT) outlier removal
  - Improve DPM and ensure reliability
- Parts are getting more complex
  - ATE companies struggle to lower capital costs

Real-time Software Solutions



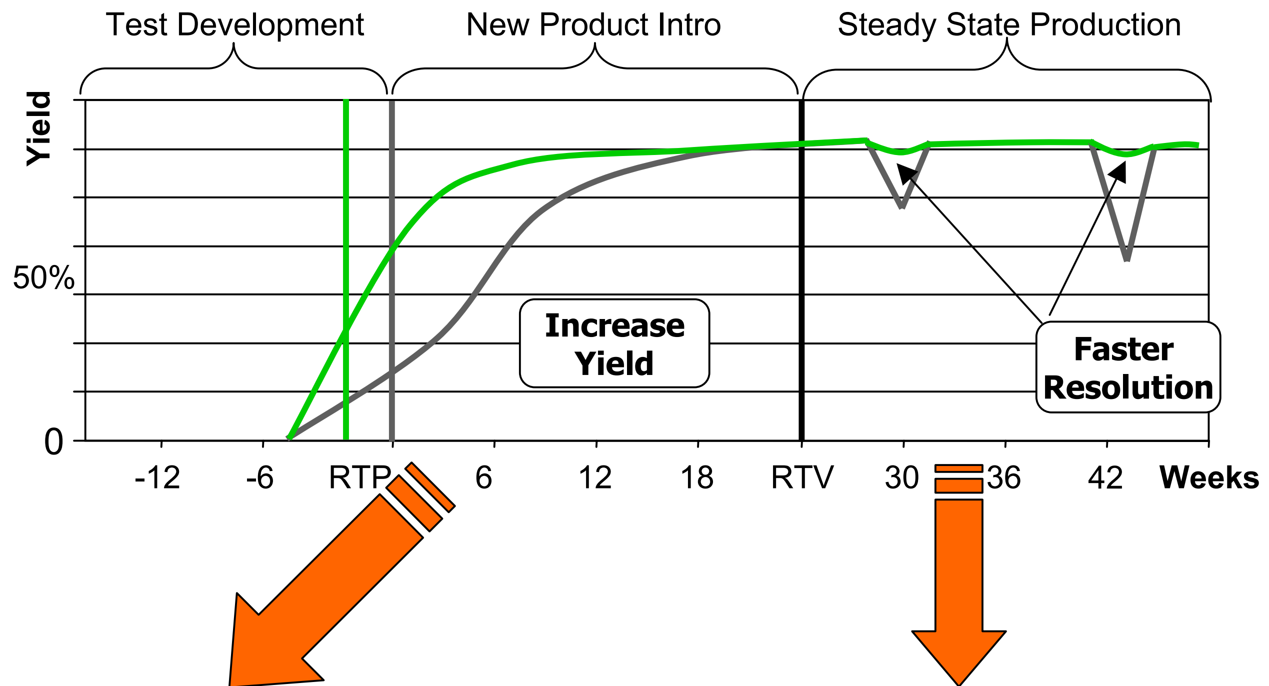
Client/Server Design



Real-time Monitoring

- A real-time data capture and analysis tool
  - Monitors the test process
  - Thresholds, triggers, alerts, actions
- Prerequisite for sampling and PAT
- Runs on the ATE or on a server
- Written in Java for portability
- Data conduit streams data to monitoring engine
  - Very small footprint (minimum CPU, memory & disk)
  - Independent of ATE data log
- Data port for optional TestScape DBMS

Real-time Monitoring



During the New Product Intro phase Monitoring will:

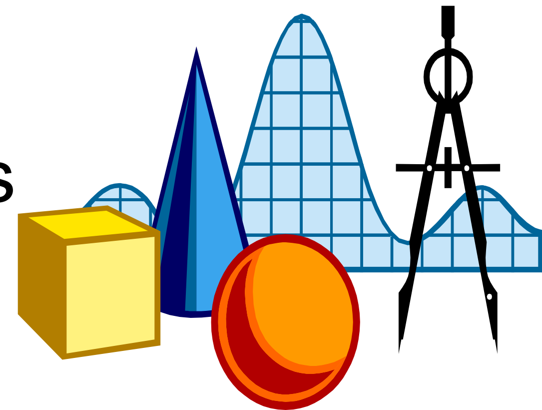
- Help ferret out test issues
- Provide timely information about testing
- Reduce re-test and scrap

During the Steady State phase Monitoring will:

- Provide timely information about testing and maverick lots
- Reduce re-test and scrap
- Monitor OEE

Real-Time Sampling

- ***Real-time statistical sampling works!***
- Proven in production by major IDMs & Fabless users
- Works at ***both*** probe and final test
- Supports single and multi-site configurations
- Dramatically reduces test time
- Assures highest quality standards



Test Program Preparation

- Add skip code to test program
- Check for dependencies

```
/* add img_skip function for each TESTF selected for sampling */
TESTF MyTest_A()
{
    if (! img_skip())
    {
        /* do regular test processing */
    }
}
```

Validation: Fabless User

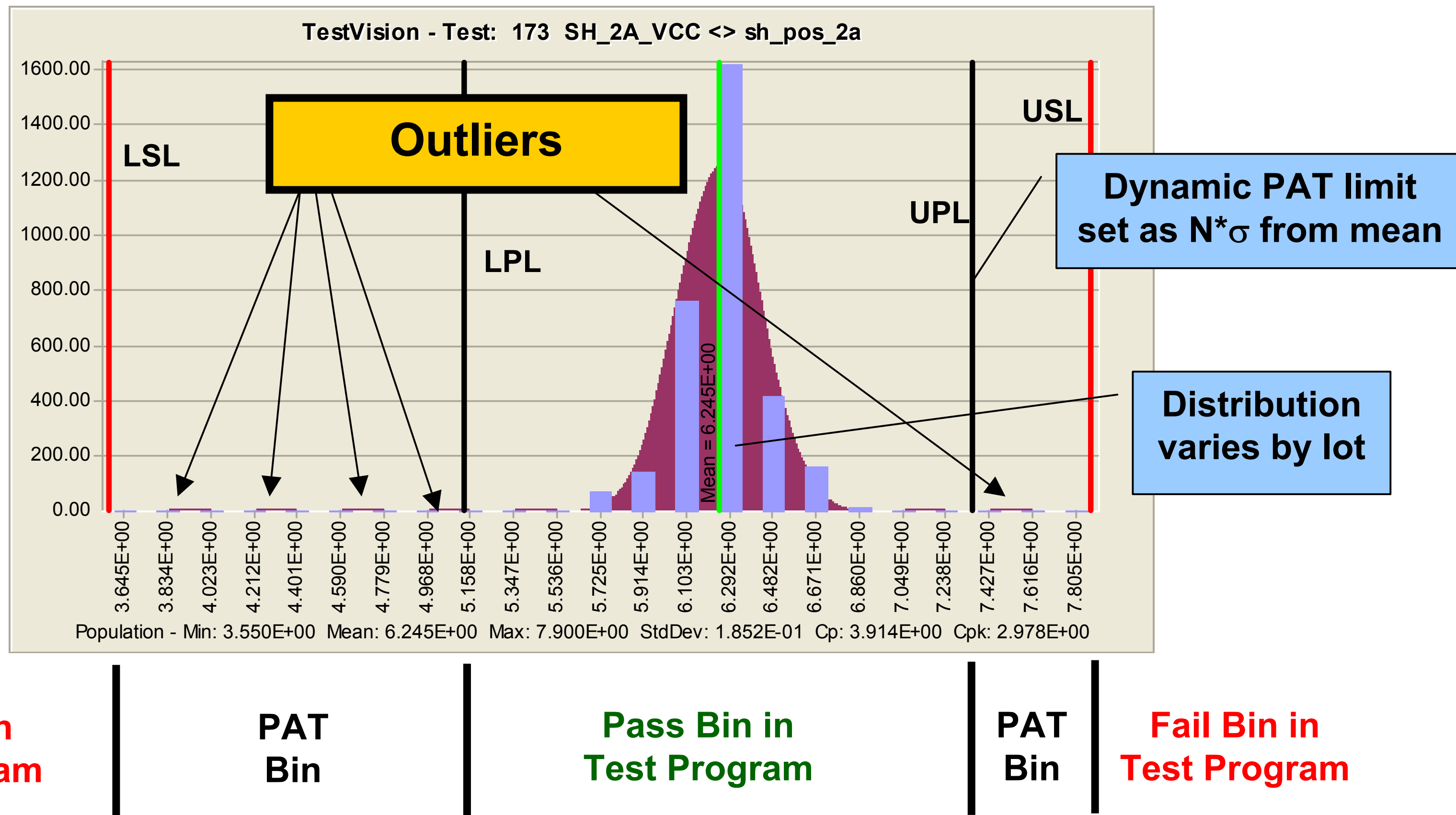
- Major Fabless vendor of wireless devices
- Real-time sampling at wafer test
- **35%** test time reduction (TTR) per device
- **30%** throughput increase
- No impact on ATE performance
- No impact on quality

Real-Time PAT

- ***Real-time PAT works!***
- Dynamic outlier detection and removal
- Parts Average Testing (PAT) is a technique endorsed by the Automotive Electronics Council (AEC) for reducing DPM
- Goal = zero Defects Per Million (DPM)
- Real-time PAT per AEC-Q001 at ***both*** wafer probe and final test
- Typical yield loss is 0.5% to 1.5%

Dynamic PAT Binning

Reject any parts that behave differently than their siblings



Dynamic PAT Features

- User configurable parameters
- Handles non-normal distributions
- Dynamic PAT limits calculated at baseline using mean +/- (n*sigma) defined by user
- Simple test program binning preparation
- PAT binning applied in real-time
  - Unique "outlier" software and hardware bin
  - Works at probe or package test
  - No test time overhead
- Outlier count trigger
- PAT outlier summary report

Test Program Preparation

```
SEQUENCER voltage_tests()
{ seq MyTest_B

  $20 "%.3f v" > (patLsl(20, 3.500)) < (patUsl(20, 7.500)) "Test_20“ f(2);
  $21 "%.3f v" > (patLsl(21, 3.500)) < (patUsl(21, 7.500)) "Test_21“ f(2);
  $22 "%.3f v" > (patLsl(22, 3.500)) < (patUsl(22, 7.500)) "Test_22“ f(2);
}
```

Simple PAT test limit and binning entries

- **No test flow changes**
- **No correlation required**

Validation: Major IDM

- Major supplier of automotive devices
- Real-time PAT at package test
- **0.8%** average yield loss
- **1.0** DPM
- No impact on ATE performance

Summary

- Real-time sampling can significantly lower the test time and increase throughput without sacrificing quality.
- Real-time PAT can remove outliers from the population and significantly lower the DPM with minimal yield loss.