Cadence Quality Initiative: *Delivering Software that Works*

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Cadence Custom IC and Simulation Group

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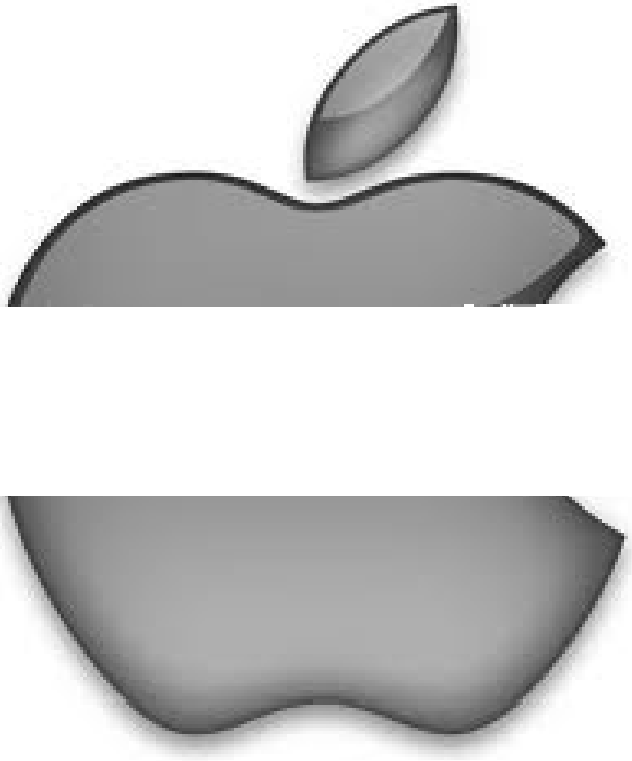
Top 5 technology companies rated for “Quality”

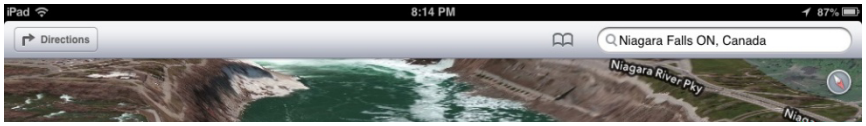
From *Fortune Magazine* 2012

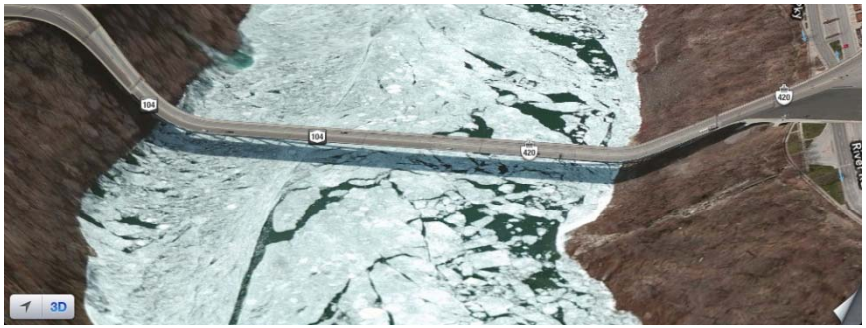


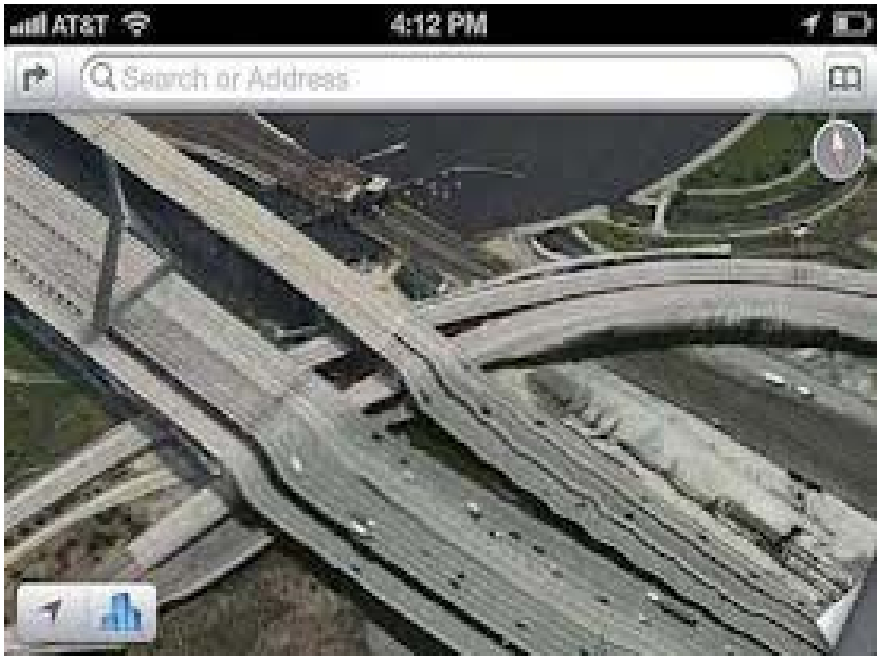
#1 for 5 years in a row

But even champions run into Quality problems

Apple Maps







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Requiring the CEO to apologize

And reiterate Apple's commitment to Quality

To our customers,

At Apple, we strive to make world-class products that deliver the best experience possible to our customers. With the launch of our new Maps last week, we fell short on this commitment.

...

Tim Cook
Apple's CEO

One of My Team's *Quality Apology* Moments

"We demand our money back"

Semiconductor's supporting:

- Automation
- Automotive
- Chip Card and Security
- Consumer
- Data Processing
- Electromobility
- Industrial
- Lighting
- Medical
- Mobile Devices
- Motor Control & Drives
- Motorcycles, E-Bikes and Small E-Vehicles
- Power Management
- Renewable Energy
- Smart Grid
- Wind Energy Systems
- Solar Energy Systems

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Lucky me, I got some new Marching Orders

Lip-Bu Tan, President and CEO of Cadence

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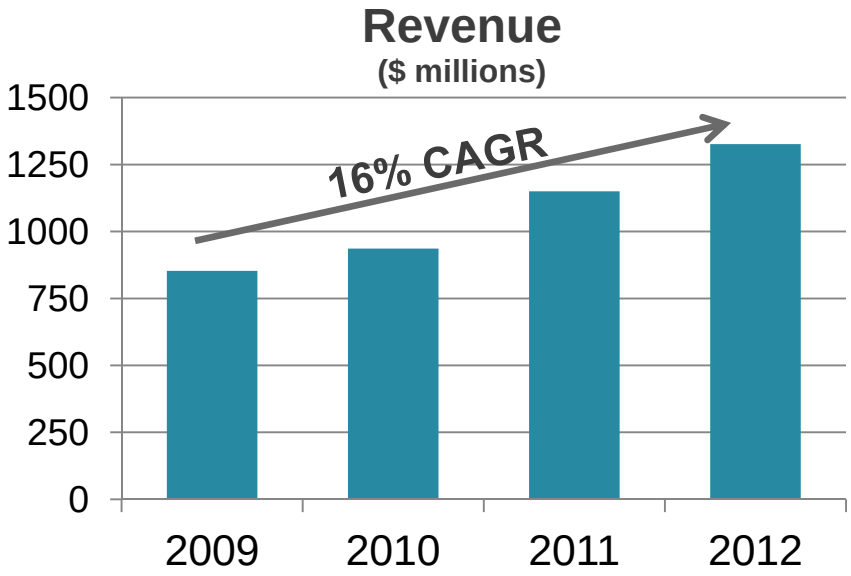
Cadence Quality Strategy: *Never Be Satisfied*

Cadence Design Systems, Inc.

25 years of software innovation

Global leader in Design IP and Electronic Design Automation (EDA)

Our products are used to design electronic products like semiconductors, printed circuit boards, mobile devices, and “cloud” infrastructure



2012 Results

- **15% revenue growth**
- **23% non-GAAP operating margin**
- **Thousands of customers globally**
- **5,200+ employees worldwide**

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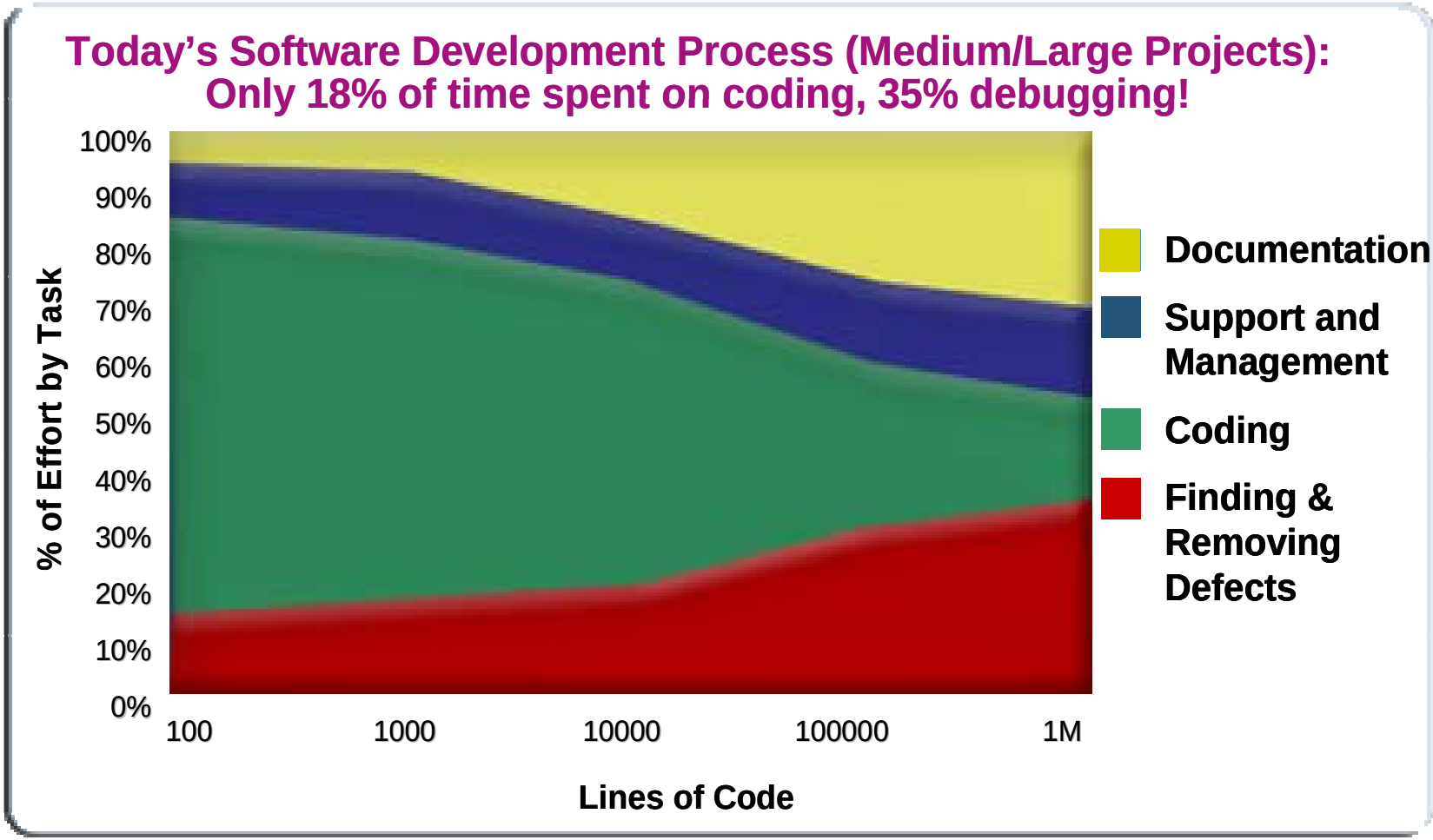
Cadence Quality Strategy

Make quality a core competency / competitive differentiator

Tremendous cost of software defects

Piled on top of customer perceptions



Source:
ARM
Capers Jones, Estimating Software Costs, pg. 140
Capers Jones, Patterns of Software Systems Failure & Success
Charted by Andrew Herbert, Microsoft Research, Cambridge

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Focus areas

Prevent

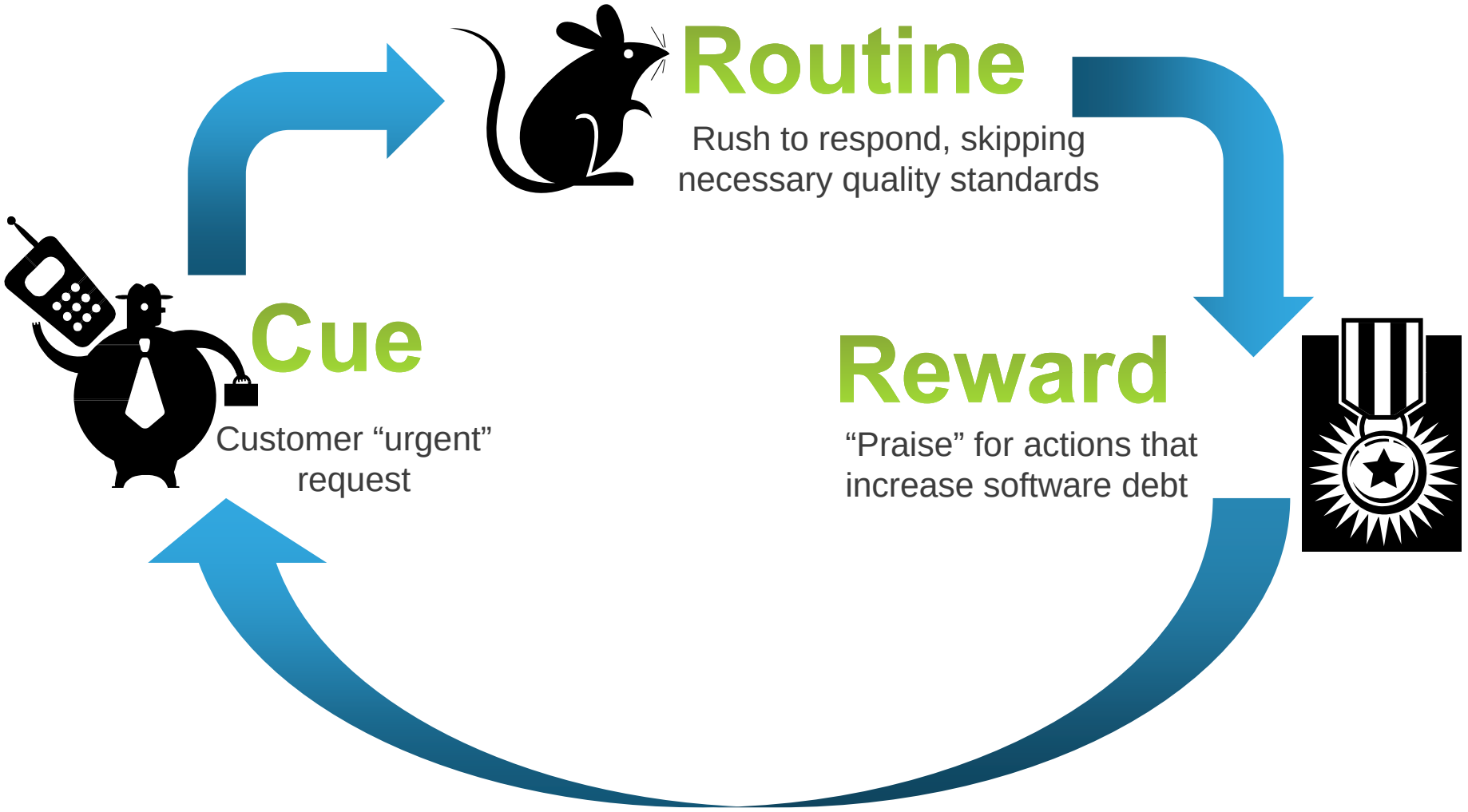
- Avoid initial defect creation
- Detect remaining defects early
- Develop complete and effective tests
- Budget time to enable quality work

Repair

- Assess existing codebase
- Prioritize for value
- Plan and commit resources
- Track and regularly re-assess

Improve

- Deploy rigorous software development process
- Establish best known methods (BKM)
- Enable global knowledge sharing
- Regularly review, assess, and correct
- Strive for flawless execution

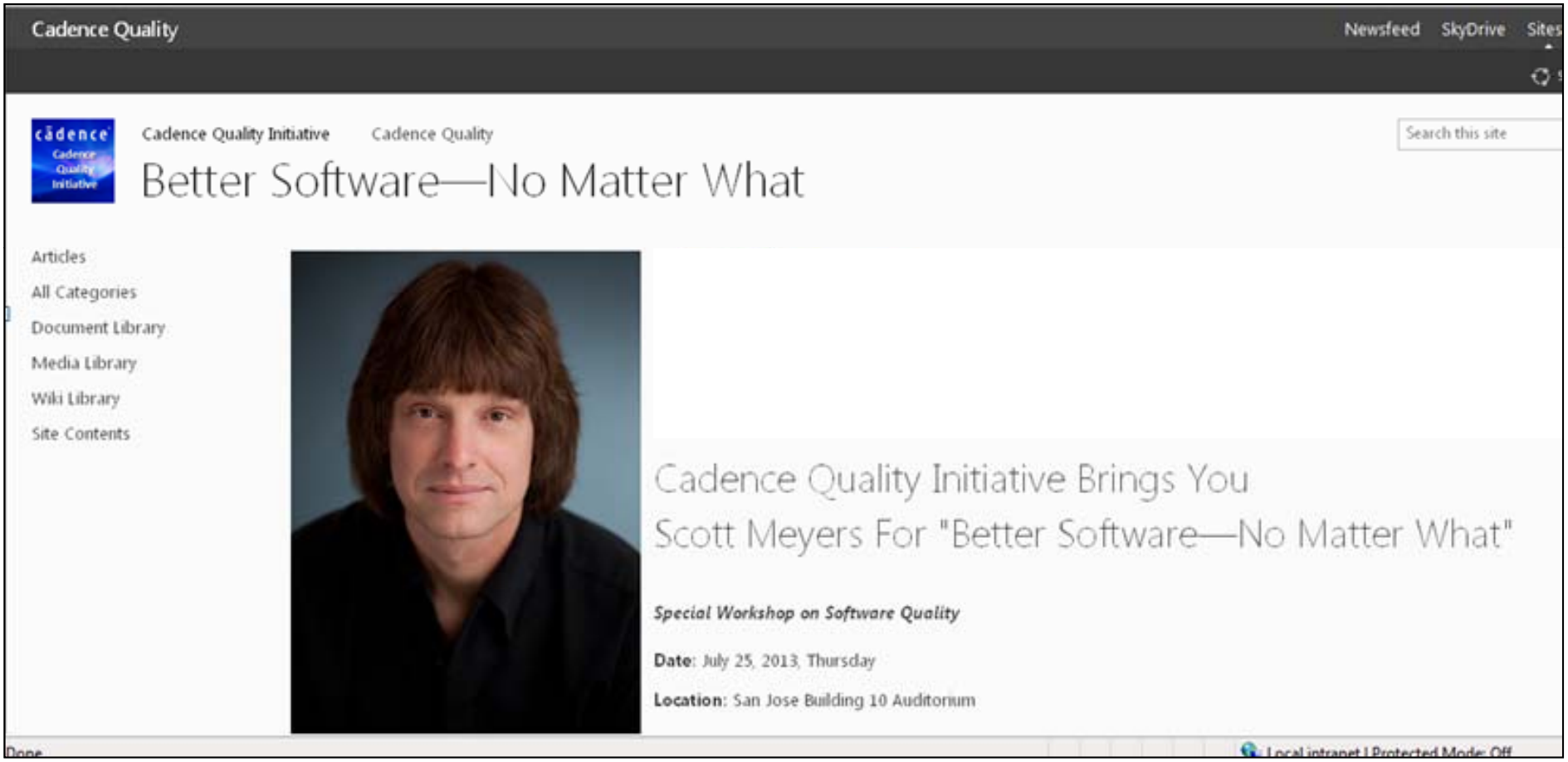


The Habit Loop

Creating a culture of quality
An organizational challenge

- Establish quality action plan with each business unit
- Require quality improvement objective from each employee
- Connect compensation to quality improvement results
- Deploy world-class software development process globally
- Report quality metrics to executive team regularly
- Continue to align plans with goals and refresh annually

Investing in our people
Training and industry experts



Measuring results
Internal and external

- Internal metrics
  - Defect rates
  - Detection phase
  - Time to closure
  - Build stream stability
  - Stability in test
  - Quality of Results
  - Performance trending
  - Time to adoption

- External Customer metrics
  - Written surveys
  - Executive interviews

Our commitment to quality

The job is never finished

Executive commitment

- Top-down
- Companywide
- Long-term
- Visibly engaged
- Personally invested

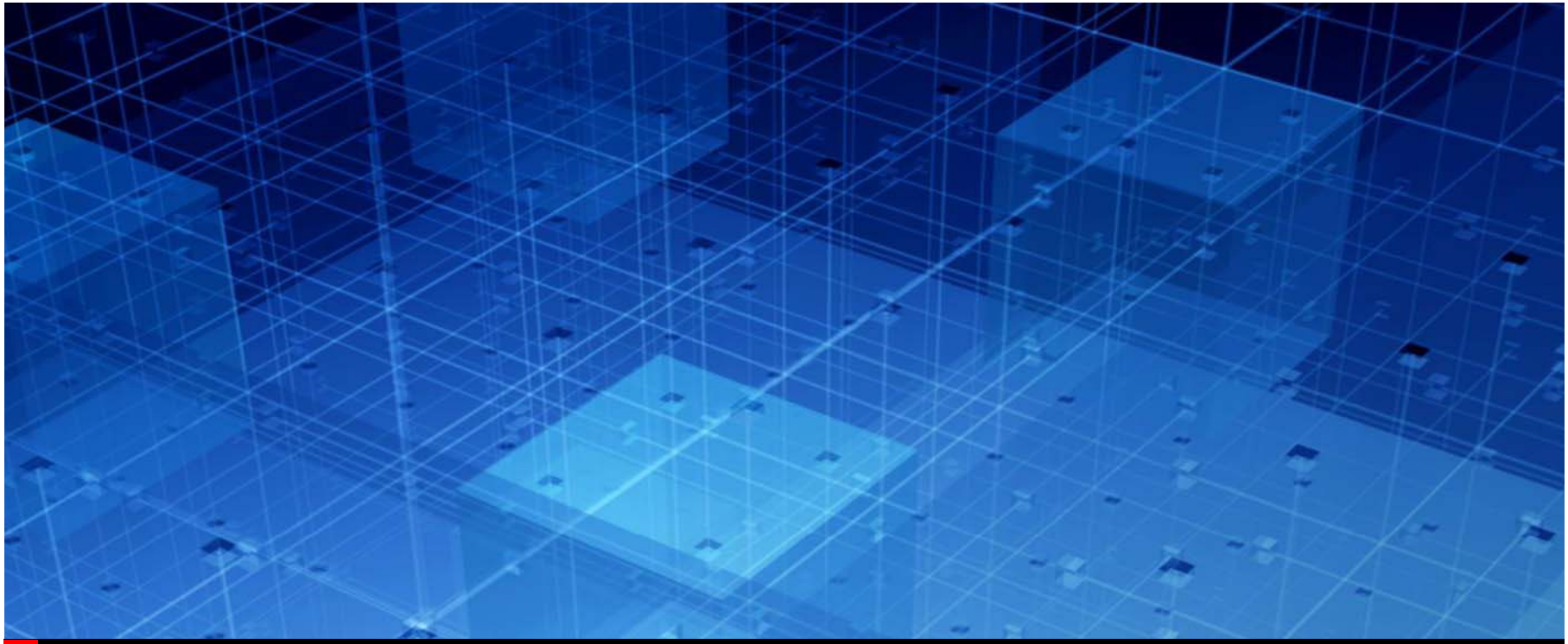
Bias for action

- Bottom-up
- Commit
- Execute
- Review
- Adjust
- Repeat

Engage with customers

- Share our strategy
- Report results
- Listen
- Collaborate

Vision: Be recognized as the industry leader in delivery of high-quality, full-featured products within five years.



Team Software Process℠ [TSP℠] / Personal Software Process℠ [PSP℠] *Two Year Case Study at Cadence*

•℠ Team Software Process, TSP, Personal Software Process and PSP are service marks of Carnegie Mellon University.

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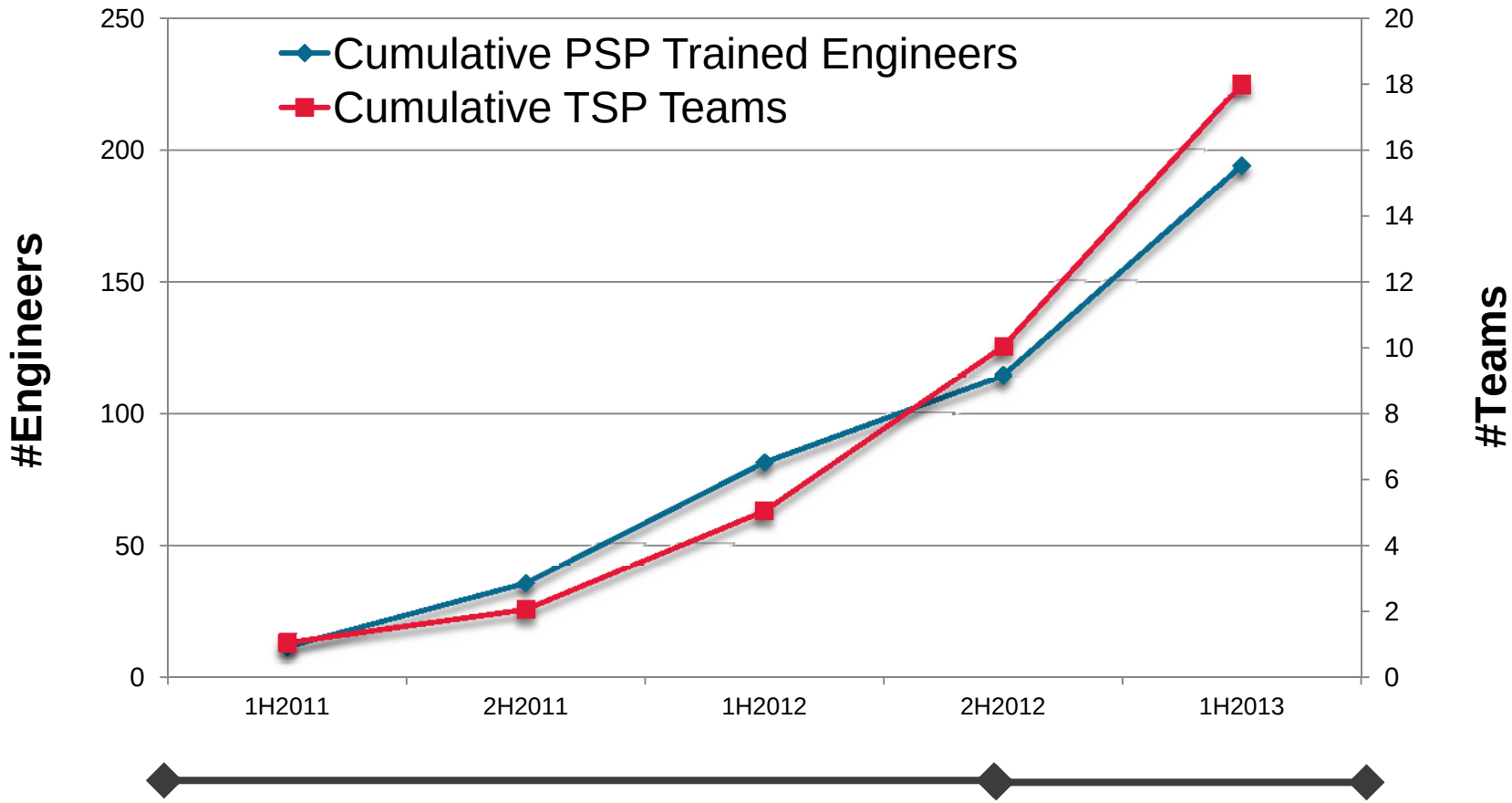
PSP/TSP Cadence Rollout



All within one Business Unit

Expanding to include 6 total BUs

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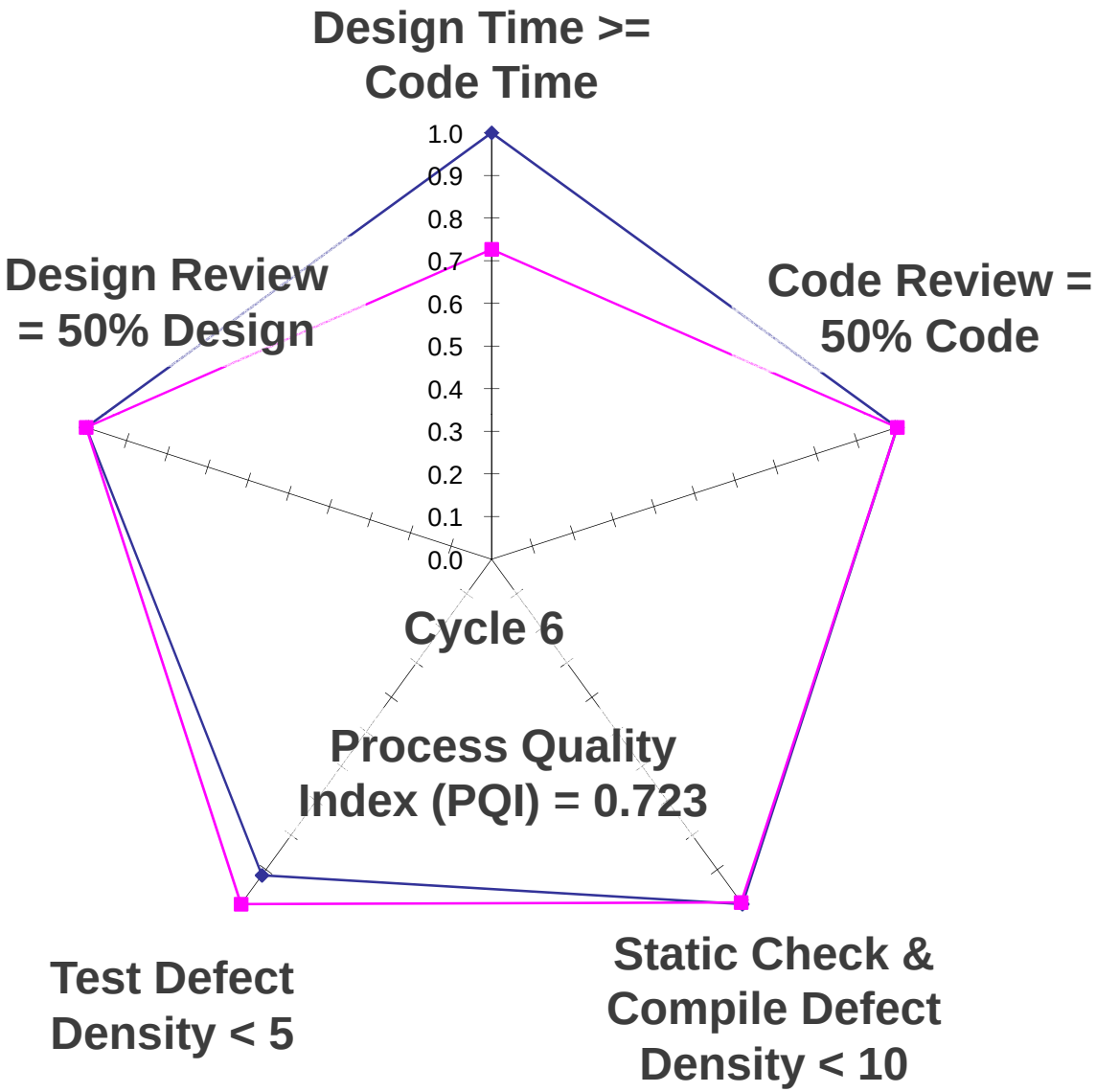
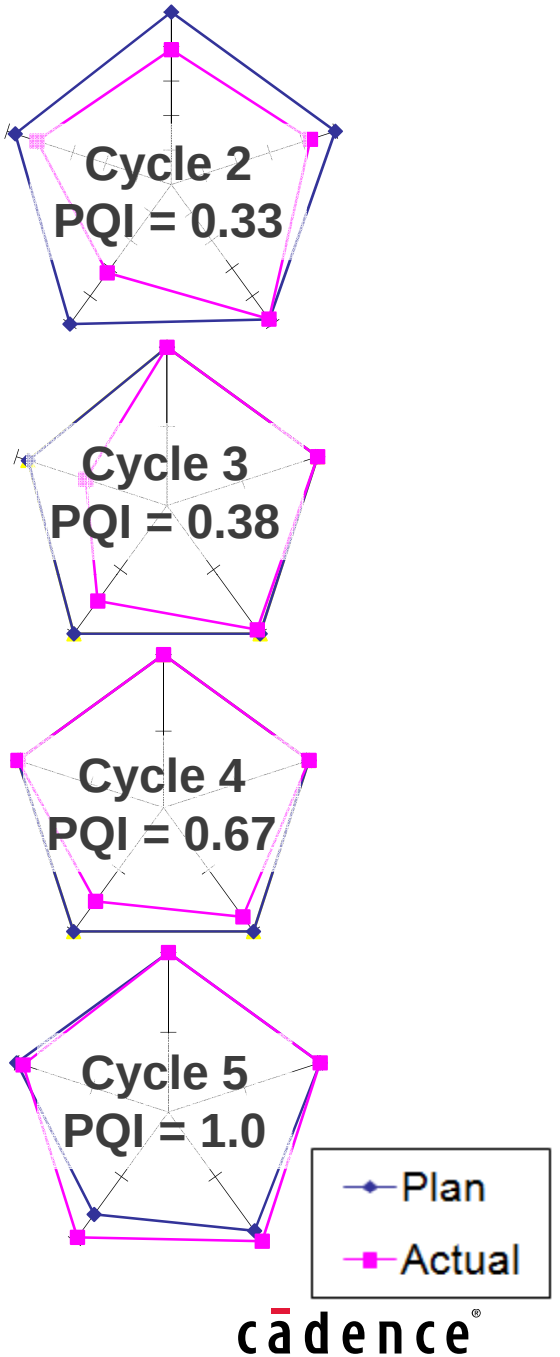
Pilot Team Introduction & TSP History

- 10 engineers, located in Pittsburgh, PA
- Working on Virtuoso Layout Suite GXL
  - Modgens, Analog Placer, misc other development
- Primarily C/C++ development
  - ~36KLOC developed in that time.
  - Team's code base is ~150KLOC within a ~15MLOC system
- Generally following a customer-driven / spiral development model

TSP Cycle	Launch / Cycle Start	Cycle End
1	April 2011	July 2011
2	July 2011	Nov. 2011
3	Nov. 2011	March 2012
4	March 2012	July 2012
5	July 2012	Oct. 2012
6	Oct. 2012	Feb. 2013
7	Feb. 2013	April 2013

TSP Process Quality Metrics





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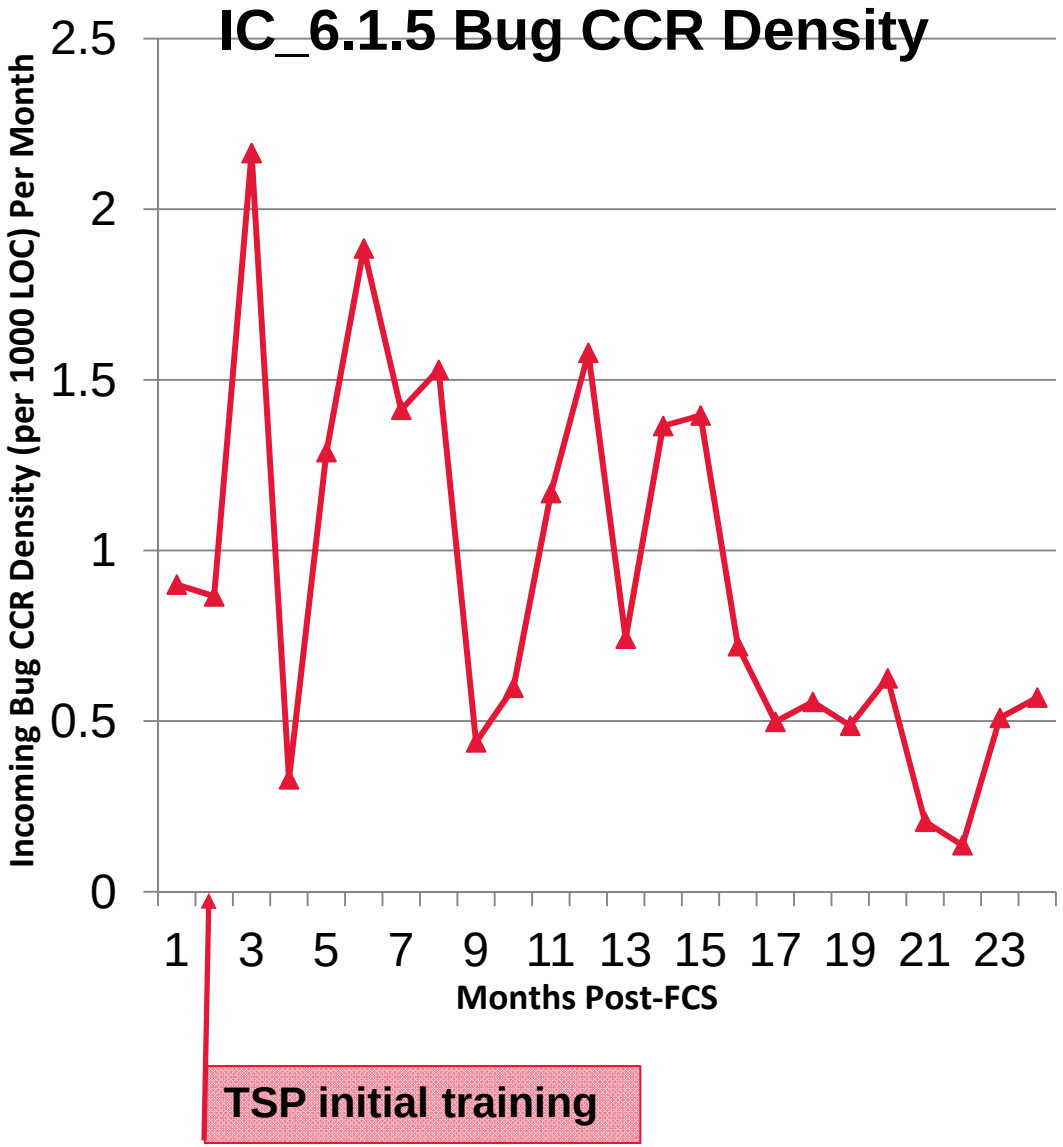
Incremental Software Release Quality Metrics

- Assume the first 6 months of 6.1.5_ISR quality is primarily driven by pre-TSP development methodology
- After that (when almost 2X the amount of code was developed in 6.1.5_ISR) the TSP methodology quality takes over
- Average Per Month CCR Density for first 6 months: 1.23 CCRs/KLOC/Month
- Average CCR density for following 17 months of 6.1.5_ISR: 0.807 CCRs/KLOC
- **34% reduction**



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How about a real *release-to-release* comparison?

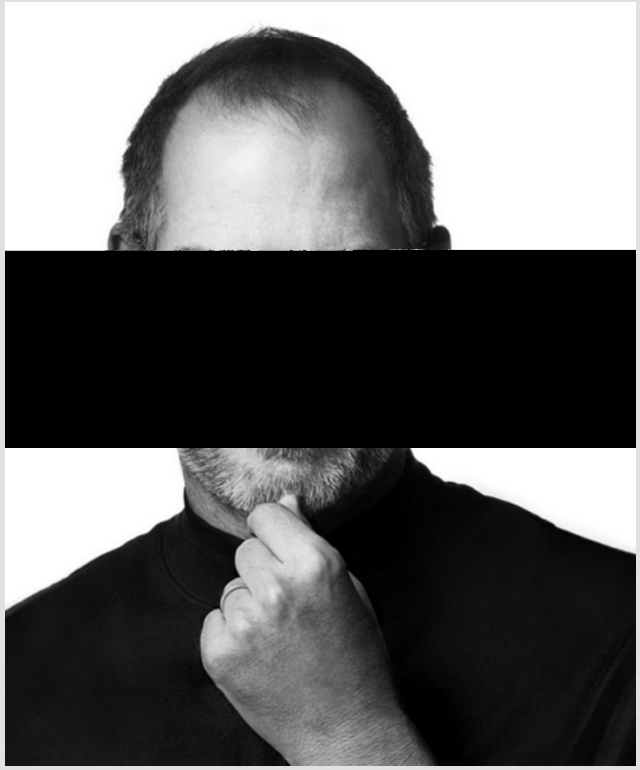
Release	Modgen Added & Modified LOC	Bug CCRs Pre-FCS per KLOC	Bug CCRs within 2 months Post-FCS per KLOC
IC_6.1.4 base	12862	9.33	N/A**
IC_6.1.5 base	5702	25.95	8.94
IC_6.1.6 base	24770	5.25 *1.7x – 4.9x improvement*	1.77 *5x improvement*

- IC_6.1.6 was entirely developed using TSP
- So quality is 1.7x – 5x better than previous releases
  - Clearly not 'defect-free', but it is hard to isolate which bugs that came in are on new code, and which are on legacy code

*** Not enough customer usage of Modgen in first two months of IC_6.1.4 base to be meaningful*

Summary

“**Be a yardstick of quality. Some people aren't used to an environment where excellence is expected.**”



Steve Jobs (1955 - 2011)

American Entrepreneur and co-founder Apple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