Agile Development in a Large Company

IEEE NJ Coast Section Technical Talk
June 10, 2009

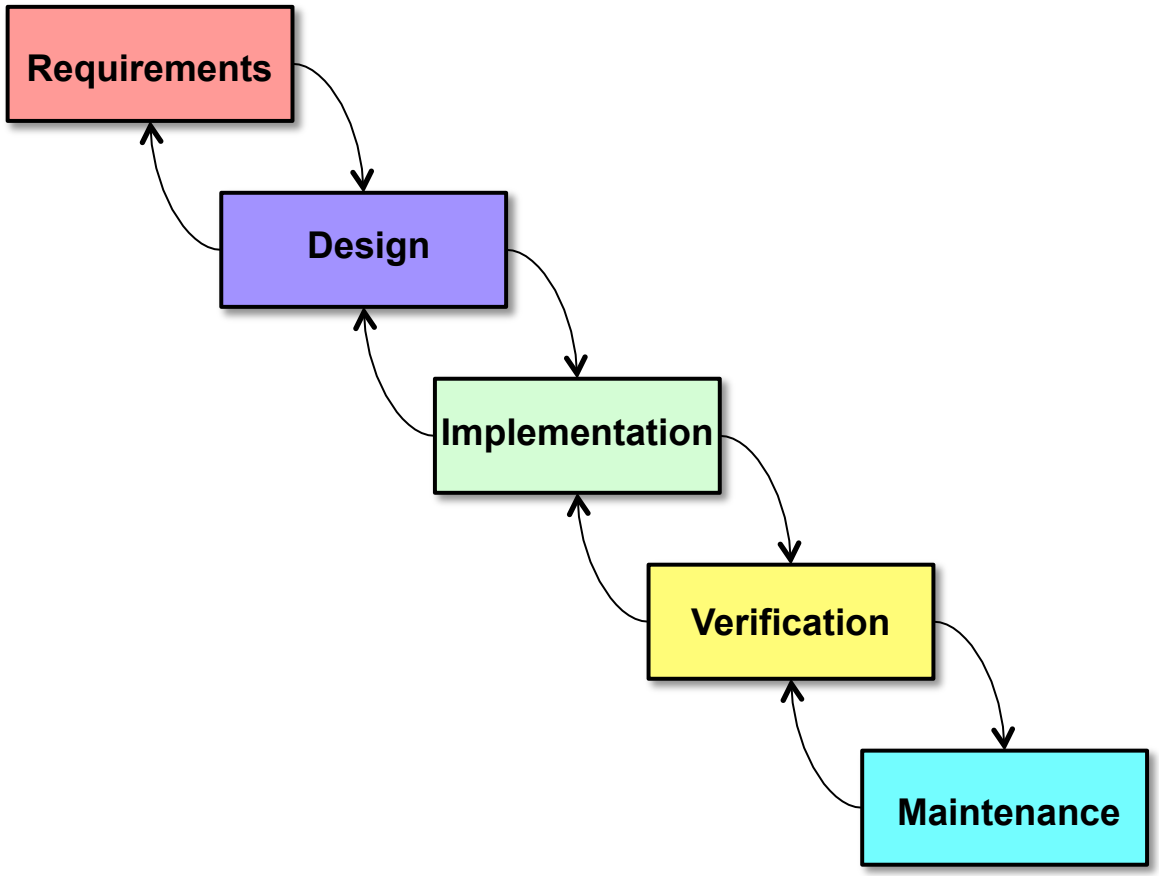
John Palframan

palframan@avaya.com

Research for this topic on Avaya projects was done in collaboration with Randy Hackbarth – Avaya Labs, and David Weiss – Iowa State University

What Is Iterative and Agile Programming

Before Agile – The Waterfall Model



http://en.wikipedia.org/wiki/Waterfall_model

Where Waterfall Has Problems

AVAYA labs

- Risk mitigation is postponed
  - Design up front, but then may encounter implementation difficulties
  - Testing not done until the end, issues may require a redesign
- Scope Management
  - Requirement always change, especially with a long development cycle
- Building the right thing
  - Clients usually don't know what they want until they see a prototype
  - Requirements are usually oriented mainly towards functionality
  - Studies show a large proportion of early requirements are never used
- Because of rework due to the above, cost and time estimates are difficult
- Documentaiton is difficult to keep up to date

"From Waterfall to Evolutionary Development", Trond Johansen , Tom Gilb
"Understanding The Pros And Cons Of The Waterfall Model Of Software Development", Melonfire
"A Rational Design Process: How and Why to Fake It", Dave Parnis
"Managing The Development Of Large Software Systems", Dr. Winston W. Rovce

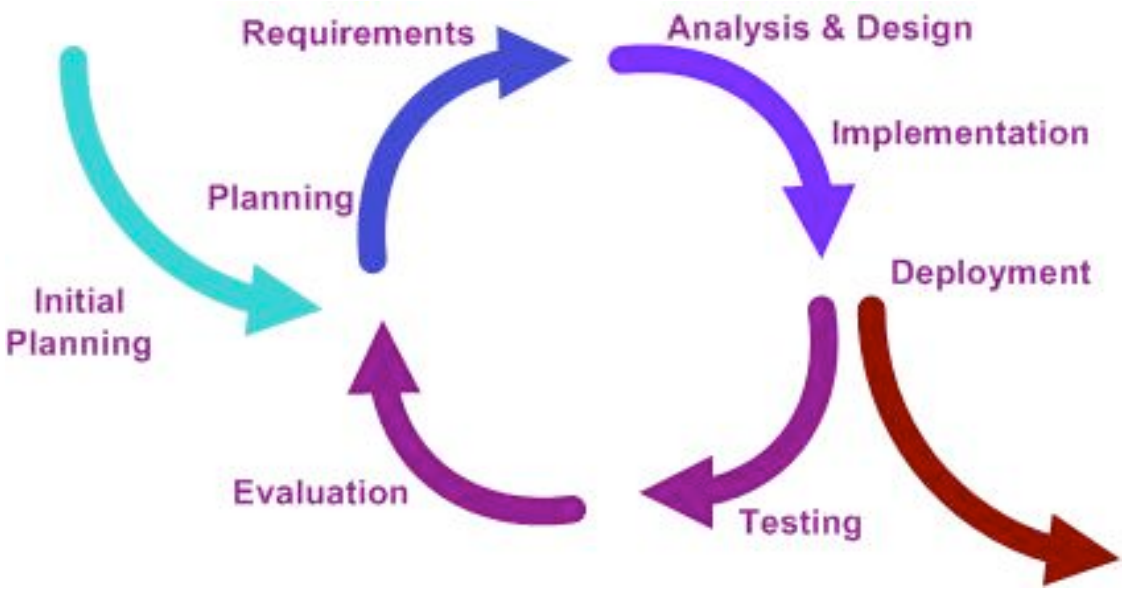
Waterfall Studies

AVAYA labs

- UK study of 1,027 projects:
  - 87% failure rate
  - 82% cited waterfall-style scope management as the "single largest contributing factor for failure"
- 1995 study of $37M worth of DoD projects
  - 46% of the systems so egregiously did not meet the real needs (although they met the specifications) that they were never successfully used
  - 20% required extensive rework to be usable
- Study of 6,700 projects:
  - Four out of the five key factors contributing to project failure were associated with and aggravated by the waterfall model
  - Inability to deal with changing requirements
  - Problems with late integration
- Study of over 400 waterfall projects:
  - Only 10% of the developed code was actually deployed
  - Only 2% was actually used

"Agile and Iterative Development: A Manager's Guide", Craig Larman

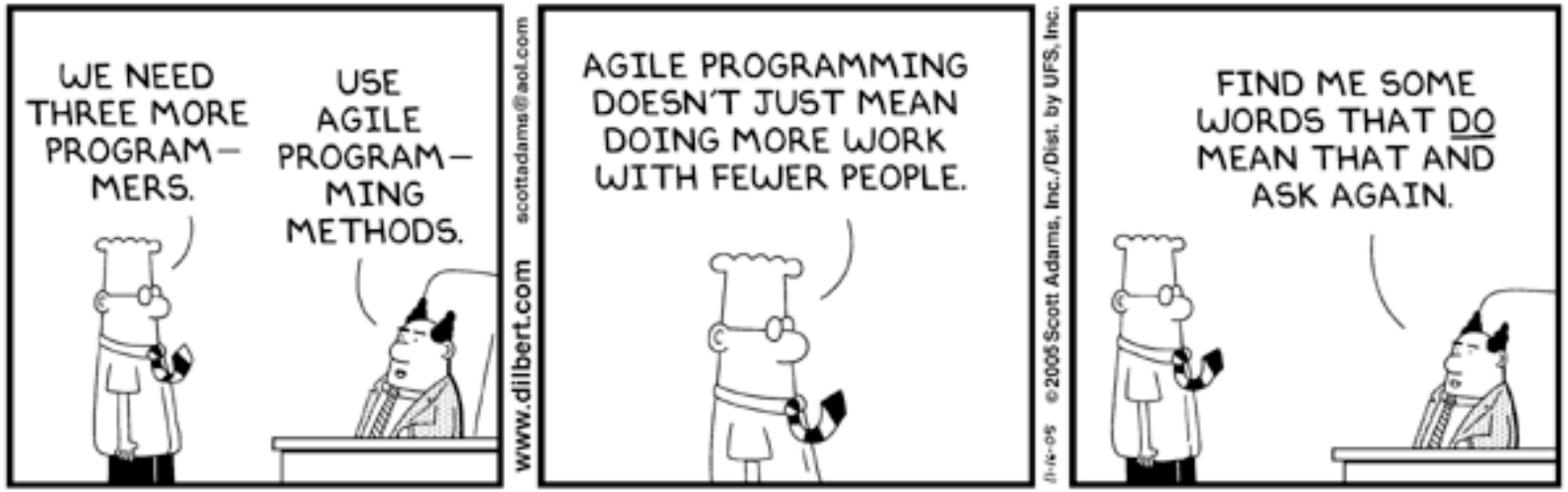
Iterative Development



http://en.wikipedia.org/wiki/Iterative_development

Agile Development

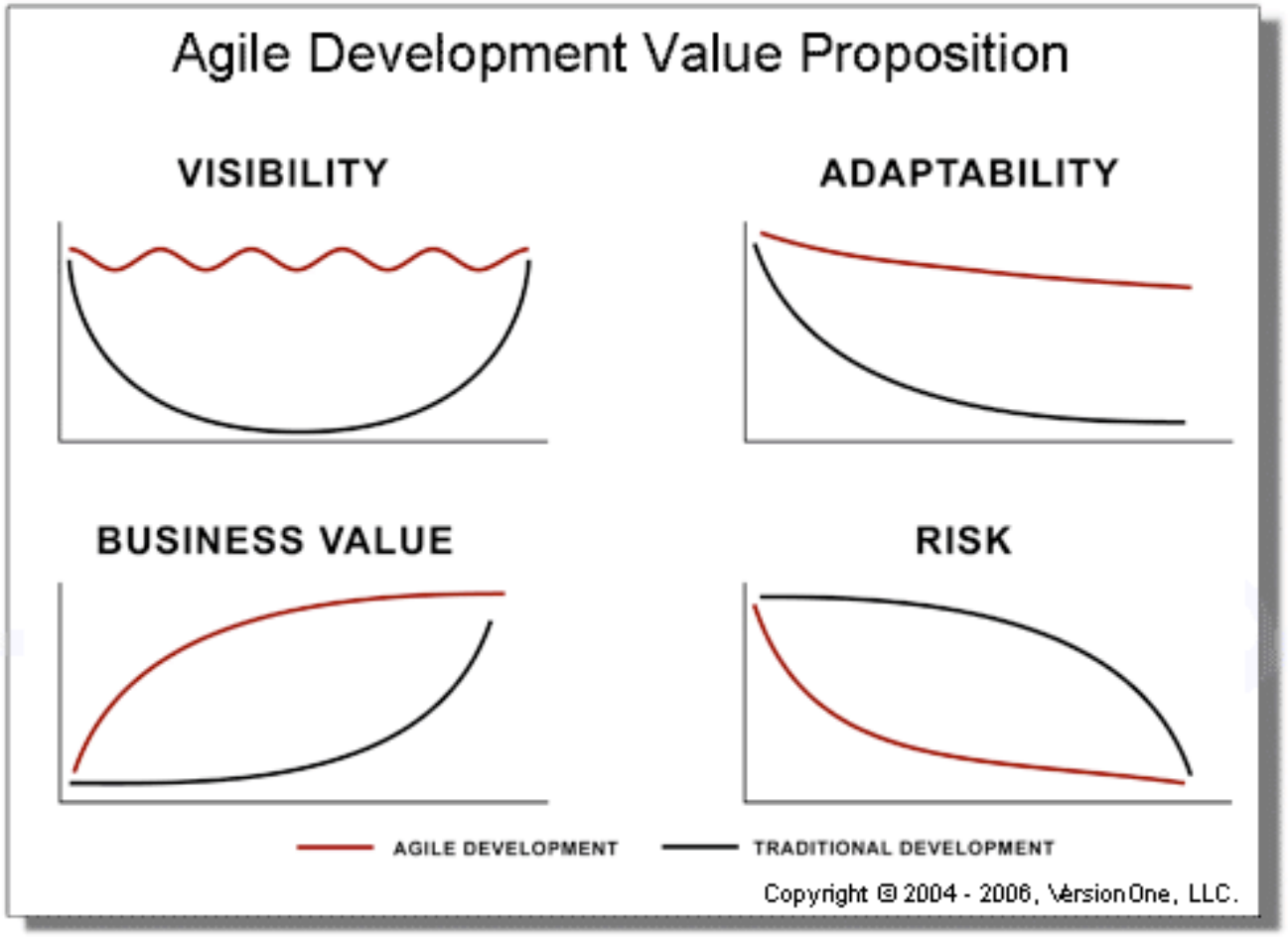
- A group of software development methodologies based on iterative development
- Requirements and solutions evolve through collaboration between self-organizing cross-functional teams



© Scott Adams, Inc./Dist. by UFS, Inc.

http://en.wikipedia.org/wiki/Agile_software_development

Traditional vs Agile



http://www.versionone.com/Resources/AgileBenefits.asp

Manifesto for Agile Software Development

AVAYA labs

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- **Individuals and interactions** over processes and tools
- **Working software** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Kent Beck, Mike Beedle, Arie van Bennekum, Alistair Cockburn, Ward Cunningham, Martin Fowler, James Grenning, Jim Highsmith, Andrew Hunt, Ron Jeffries, Jon Kern, Brian Marick

http://agilemanifesto.org/

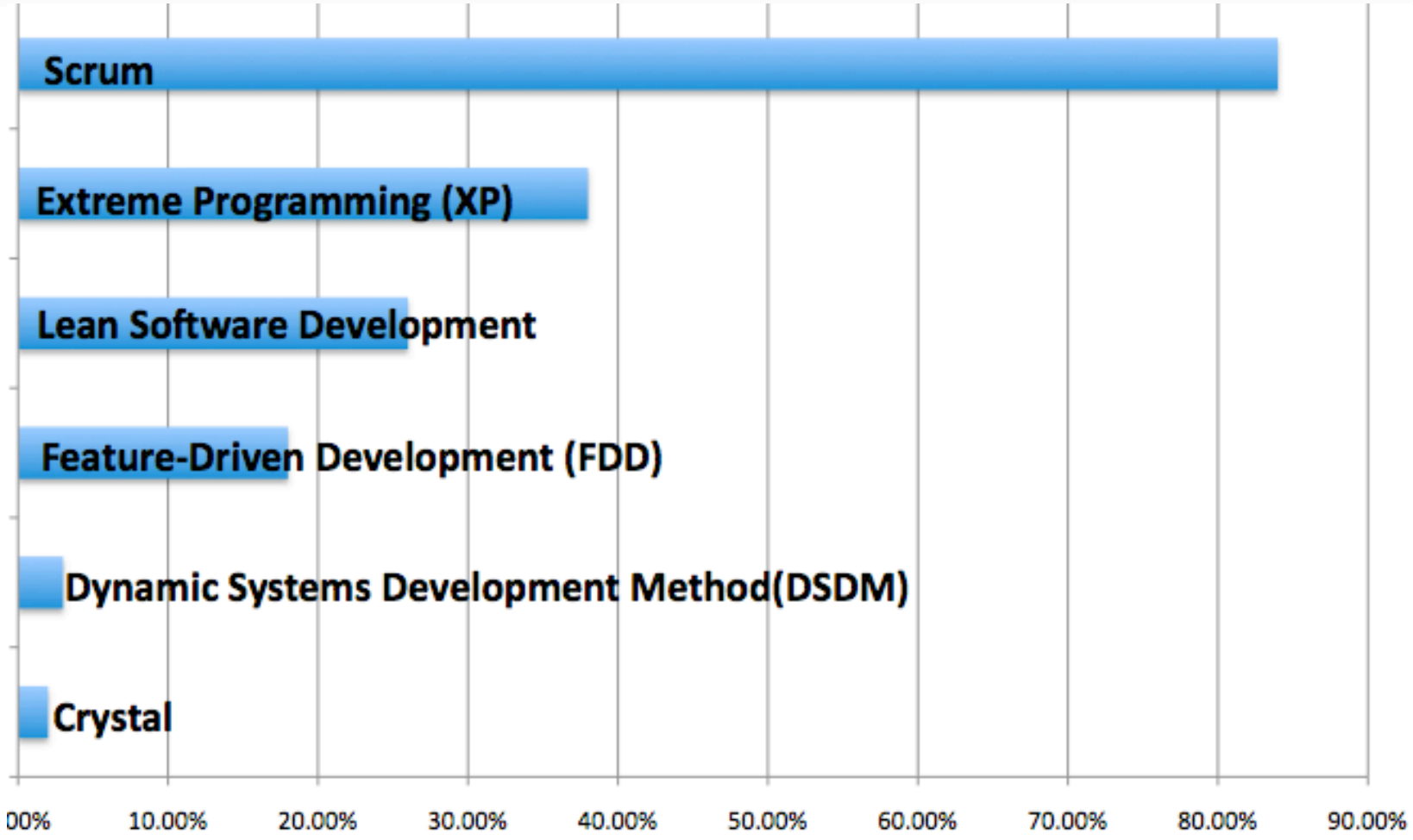
Principles behind the Agile Manifesto

AVAYA labs

1. *Our highest priority is to satisfy the customer through **early and continuous delivery** of valuable software.*
2. ***Welcome changing requirements**, even late in development. Agile processes harness change for the customer's competitive advantage.*
3. ***Deliver working software frequently**, from a couple of weeks to a couple of months, with a preference to the shorter timescale.*
4. *Business people and developers must work together daily throughout the project.*
5. *Build projects around **motivated individuals**. Give them the environment and support they need, and **trust** them to get the job done.*
6. *The most efficient and effective method of conveying information to and within a development team is **face-to-face conversation**.*
7. ***Working software is the primary measure of progress**.*
8. *Agile processes promote sustainable development. The sponsors, developers, and users should be able to **maintain a constant pace indefinitely**.*
9. ***Continuous attention** to technical excellence and good design enhances agility.*
10. ***Simplicity**--the art of maximizing the amount of work not done--is essential.*
11. *The best architectures, requirements, and designs emerge from **self-organizing teams**.*
12. *At regular intervals, the team reflects on how to become more effective, then tunes and **adjusts its behavior** accordingly.*

http://agilemanifesto.org/

% of Companies Using Agile Using Selected Agile Methodologies



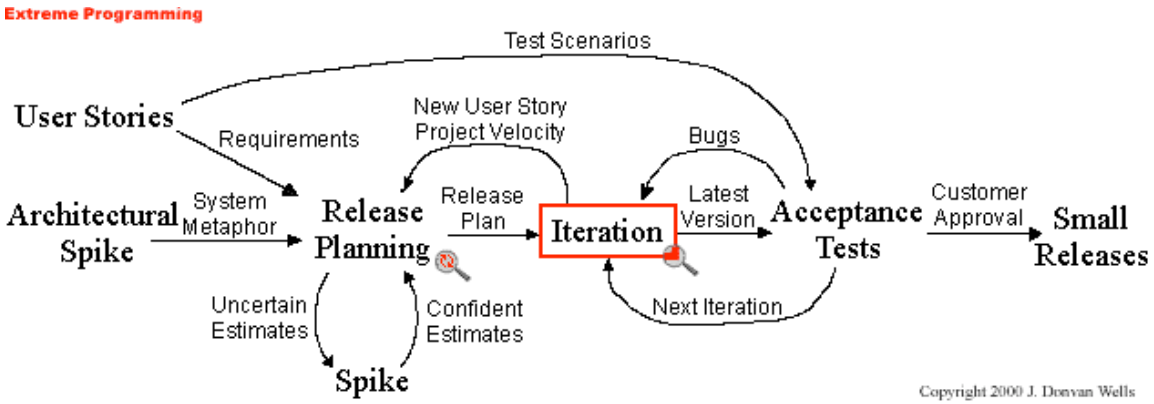
http://www.versionone.com/Resources/AgileMethodologies.asp
"Best Practices: Software Development Processes", David West, April 15, 2009

Agile – Commonalities

- Frequent Deliveries
- Base kept at a high quality level throughout development
- Team is empowered, self organized, accountable
- Large Amount of Communications/Interactions Among Members
- Stakeholder Involvement
- Transparency
- Disciplined project management process

XP – Kent Beck

- Deliver high-quality software (Simple Designs, Pair Programming, Test-Driven Development, Refactoring, Continuous Integration, Collective Code Ownership, Coding Standards)
- Deliver quickly and continuously (every 1-3 weeks)
- High customer involvement (acceptance tests, on-site)
- Rapid Feedback Loops
- Continuous Planning and Testing



http://www.extremeprogramming.org/

Other Methodologies

AVAYA labs

FDD

Domain Object Modeling
Developing by Feature
Component/Class Ownership
Design/Build by Feature Teams
Inspections
Config Management
Regular Builds
Visibility of progress and result

DDSM

Business Needs/Value
Risk Analysis & Mitigation
Planning
Active User Involvement
Empowered Teams
Frequent Deliveries
Testing Throughput Development
Stakeholder Collaboration

Crystal

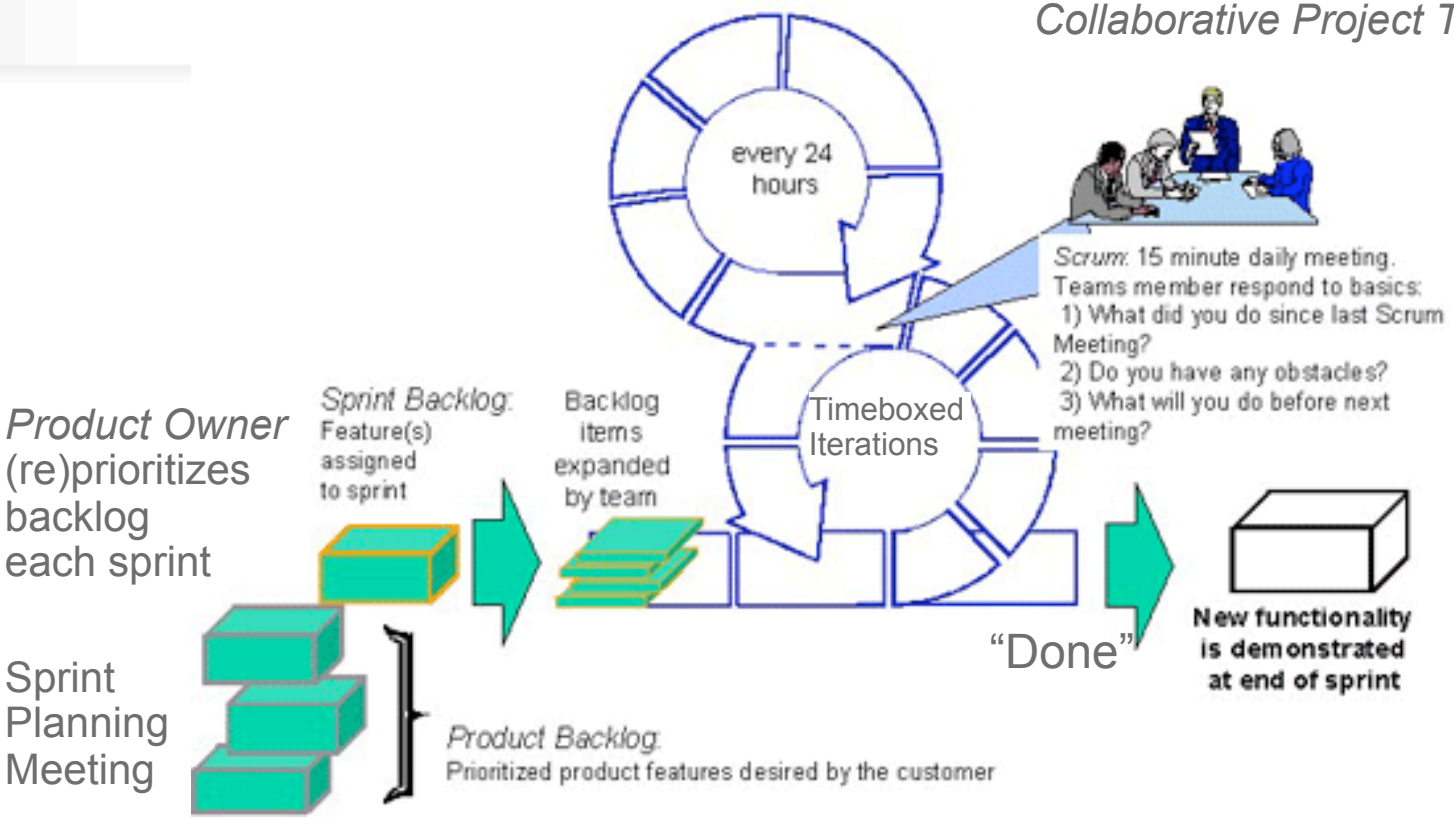
Tailor to characteristics
(team size, criticality, priorities..)
Teamwork
Communications
Simplicity
Ongoing process improvement

Lean

Eliminating Waste
Amplifying Learning
Deciding as Late as Possible
Delivering as Fast as Possible
Empowering the Team
Building Integrity In
Seeing the Whole

SCRUM

Scrummaster: removes obstacles
Collaborative Project Team



Transparency in planning and module development
Base breakage minimized

http://www.controlchaos.com

Scrum in 10 Minutes: http://www.youtube.com/watch?v=Q5k7a9YEoUI&fmt=22

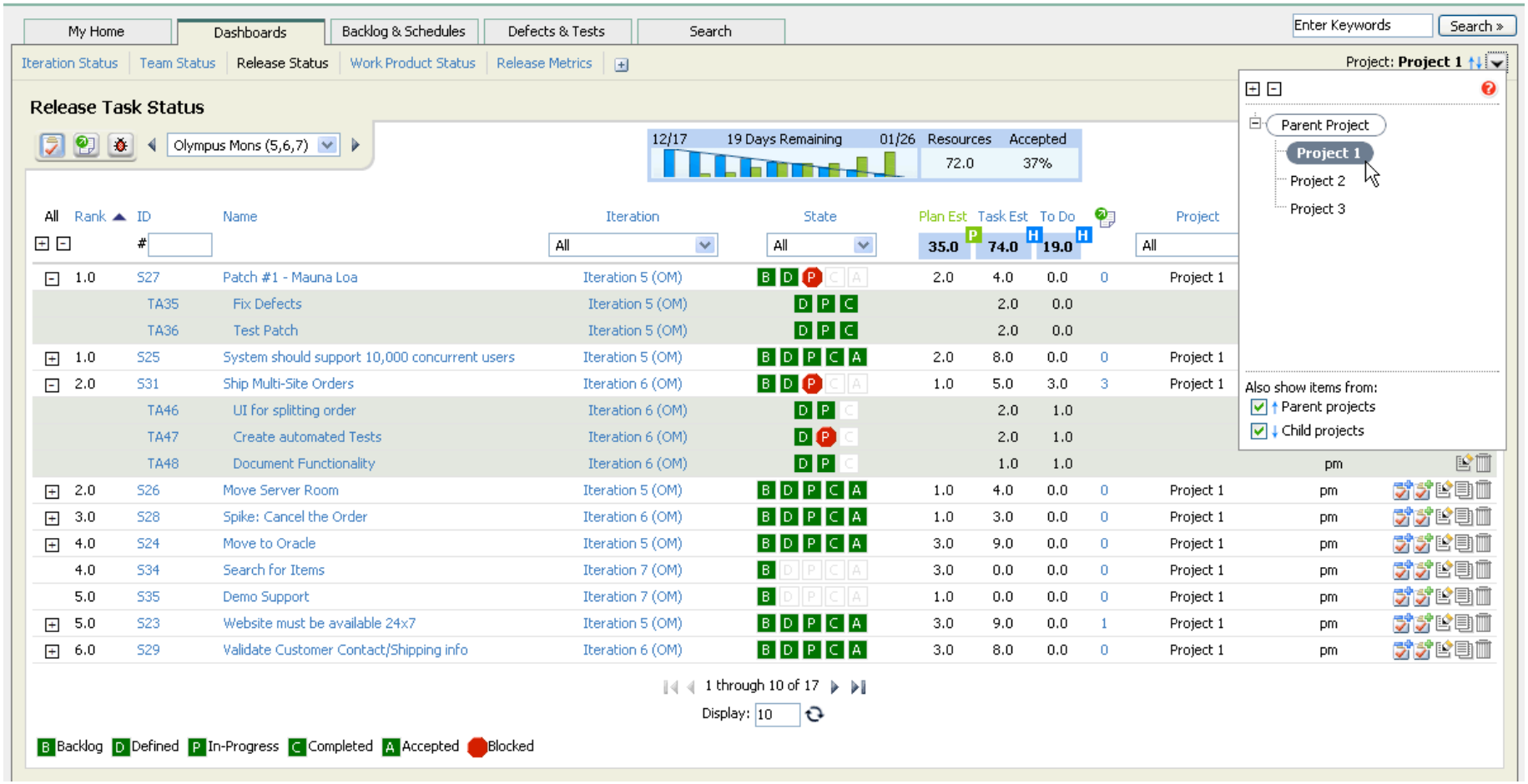
SCRUM - Tools

AVAYA labs

- Product Backlog
  - Prioritized list of features, infrastructure items, wish-list items
  - Rough estimates of business value and development effort
- Sprint Backlog
  - User Stories broken into tasks & staff hours
  - Tasks prioritized and team members sign-up to develop
- Burn Downfor tasks completed (and Burn-Up for projects)
  - Public, up-to-date display of progress on sprint backlog
- Project Management Tools such as Rally or Scrumworks

http://en.wikipedia.org/wiki/Scrum_(development)

SCRUM - Project Management (1/2)



SCRUM - Project Management (2/2)

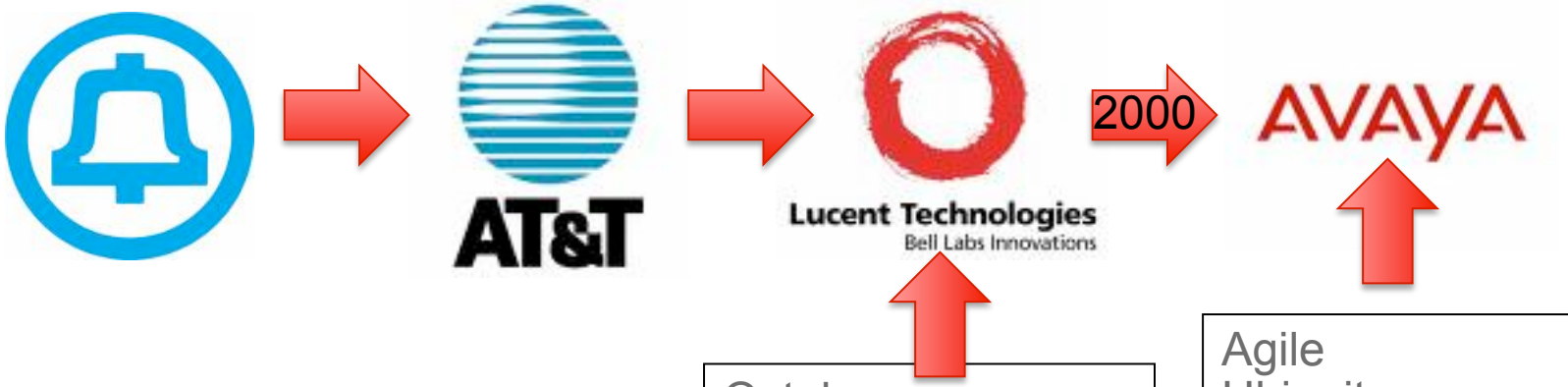
Challenges of Deploying Agile In a Large Enterprise

AVAYA labs

- Large distributed projects
- Code base could be 10s of millions of lines of code
  - Code ownership
  - Frequent builds
- Interworking with many other products (being developed simultaneously) with consistent policies, look and feel, “common” resources….
- Mission critical reliability
- Millions of lines of legacy code, perhaps with no automated tests
- May only have indirect contact with end customers

What Is Avaya

Avaya – Enterprise Communications



Converged Communications
Unified Messaging
Contact Centers
Communications Enabled Business Processes

Octel
Lannet
Soundlogic CTI
Mosaix
CCOM
TKM Communications
Prominet
Quadriek
SX Business Systems PLC
Triple C Call Center
Agile Networks

Agile
Ubiquity
Traverse Networks
iSphere
Tenovis
NimCat
RouteScience
Spectel
Tata
Expanets
VISTA IT
Conita
Quintus
VPNet

http://www.avaya.com

Converged Communications

Converged Communication

- SIP, IP, Digital & Analog
- Cross Network
- Management
- Scale
- Security
- Simplification

VoIP (Voice over IP i.e. Internet) and Traditional Switches, Gateways, Phones, Control Interfaces (API) for

Small Office

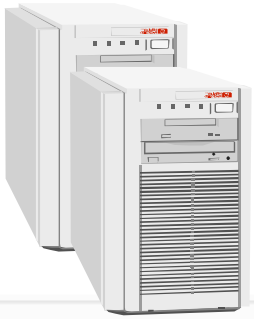
Small Branch

Mid-Size Campus

Global Enterprise

Targeting industry segments with special features: e.g.

- Financial:
  - Highly reliable 99.999% = 5 minutes downtime a year)
- Hotel
  - Access to hotel services
  - Wakeup calls

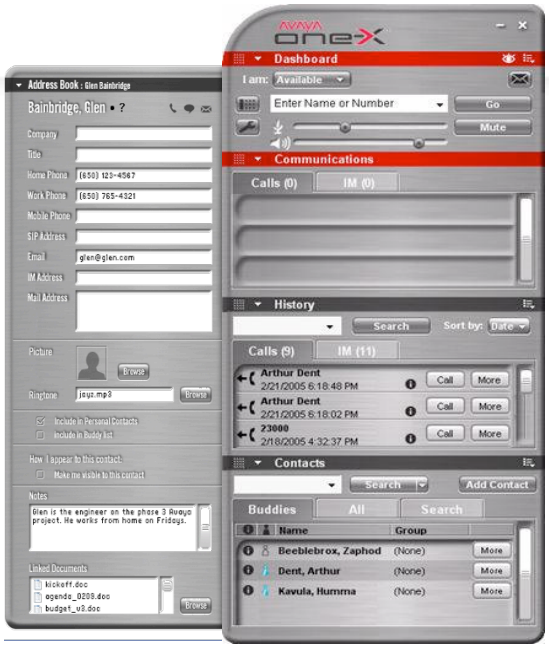


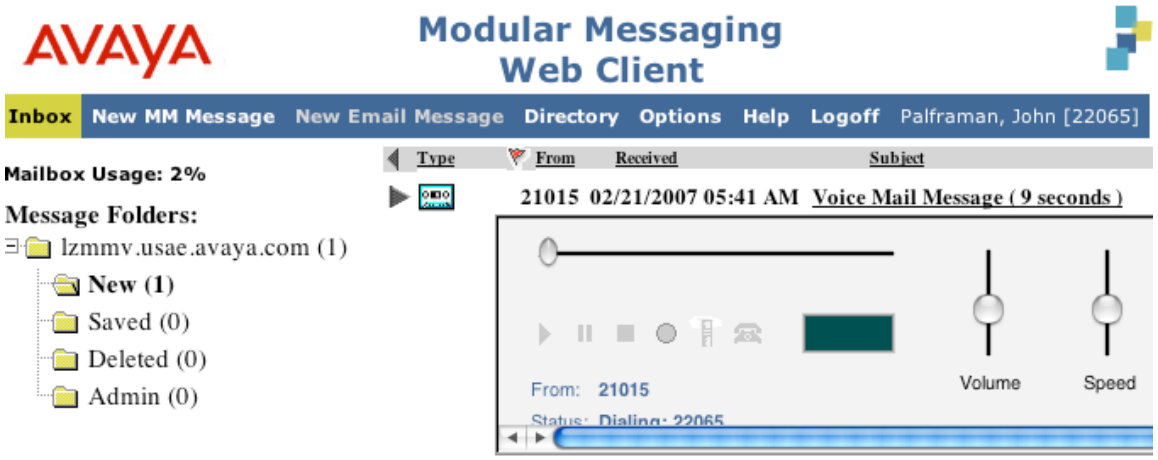
Unified Communications

AVAYA labs

Unified Communication

- Unified Access
- Mobility
- Telephony
- Messaging
- Conferencing
- Video
- Presence
- Multi Vendor

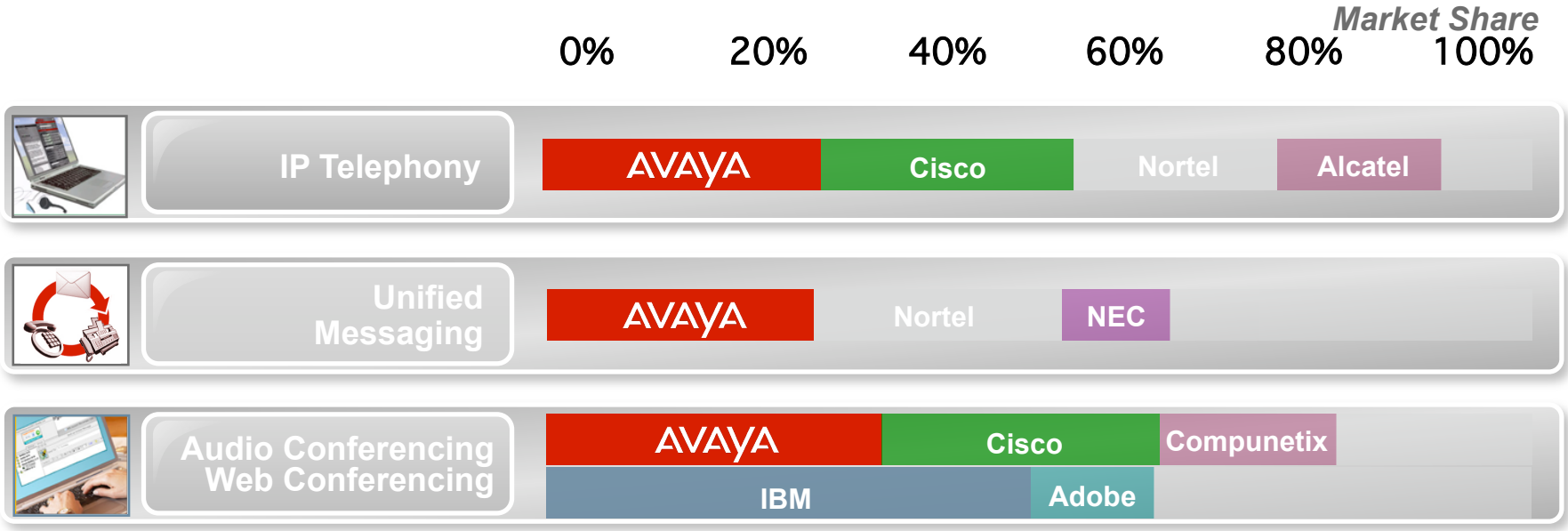




Avaya Customers

- Global Enterprises
- Branches of Those Enterprises

Avaya's Competitors (2007)

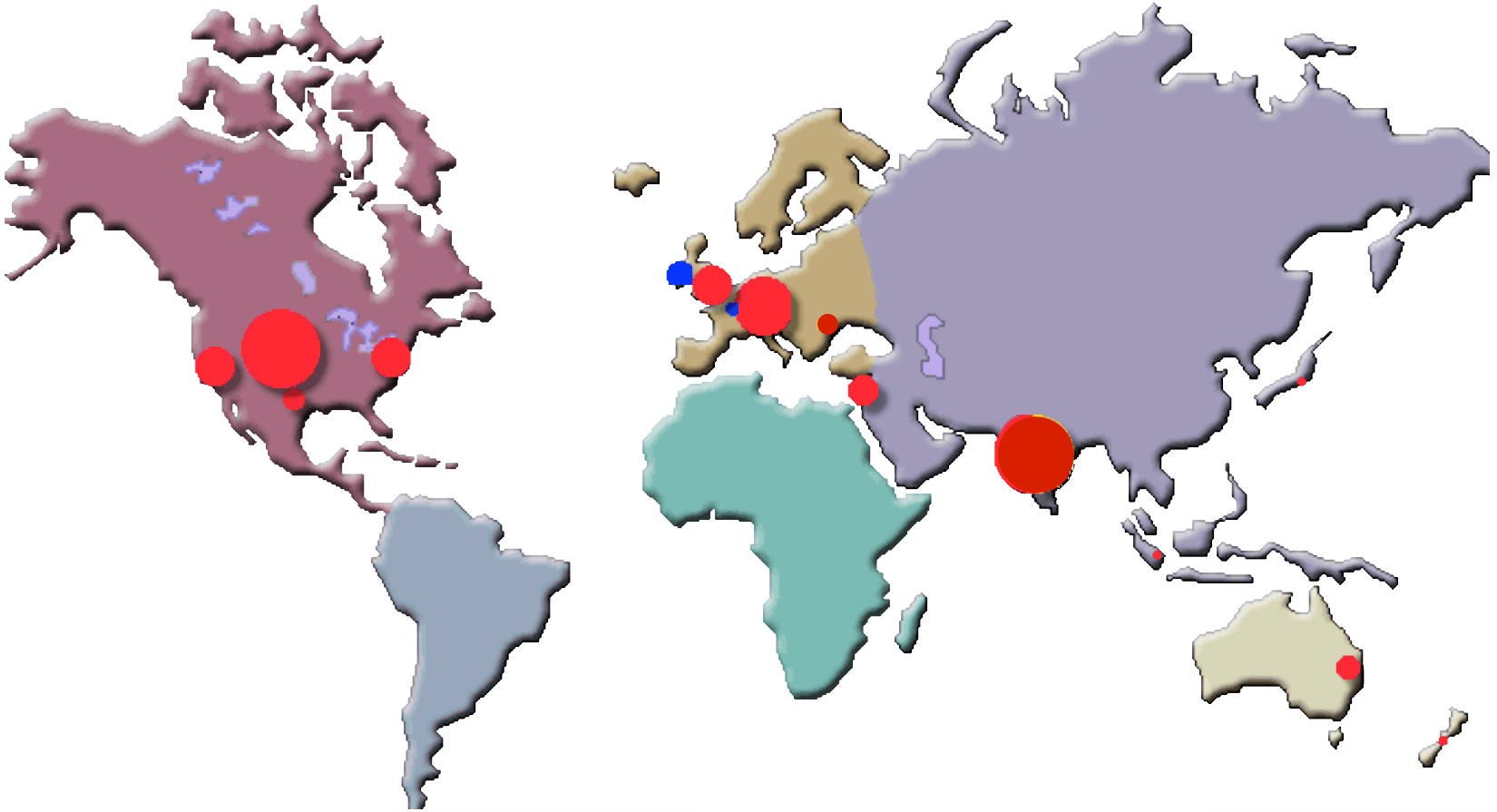


Avaya R&D Organization Characteristics

- Culture
  - Many different development cultures due to acquisitions
  - Siloed – Business Units have P&L responsibility
  - Individual projects are run independently
- Very Schedule Driven, though oscillates between
  - Cost (drive to outsource)
  - Quality (drive for improved customer satisfaction)
  - Schedule (Making a name for AVAYA after spin, coordinating interdependent products to be released together)
- Experience
  - Combination of very experienced staff and new hires
  - Takes 1-2 years to become productive on a complex product
- Geography
  - Distributed Development across 16 time zones (BU organization, where experience is, where developers and System Verification can be leveraged, and where functional orgs are).

Avaya Research and Development

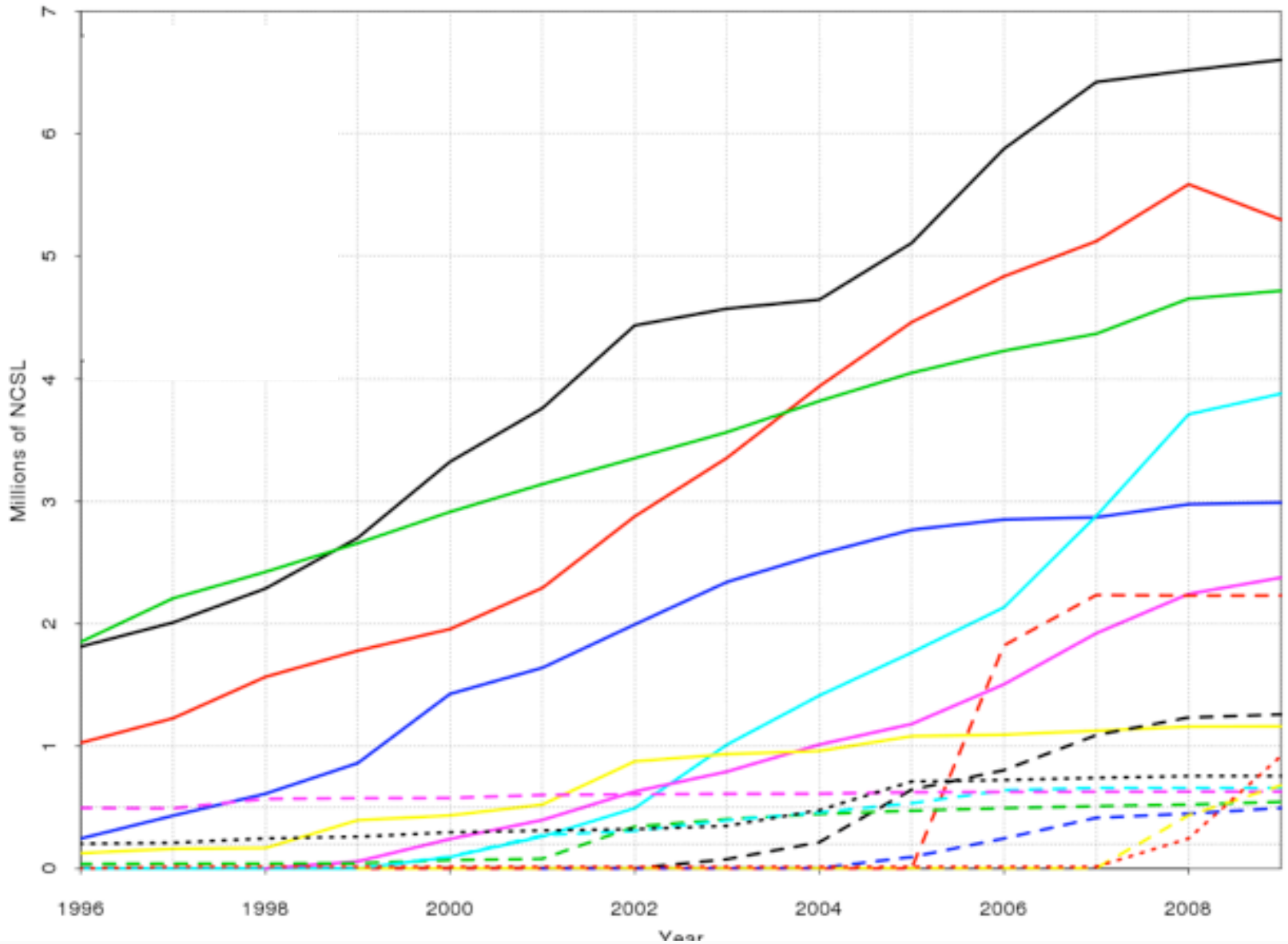
- 2300 staff + additional contractors/outsource organizations
- 30% from Lucent Bell Labs, 40% new hires since 2001, 30% acquisitions



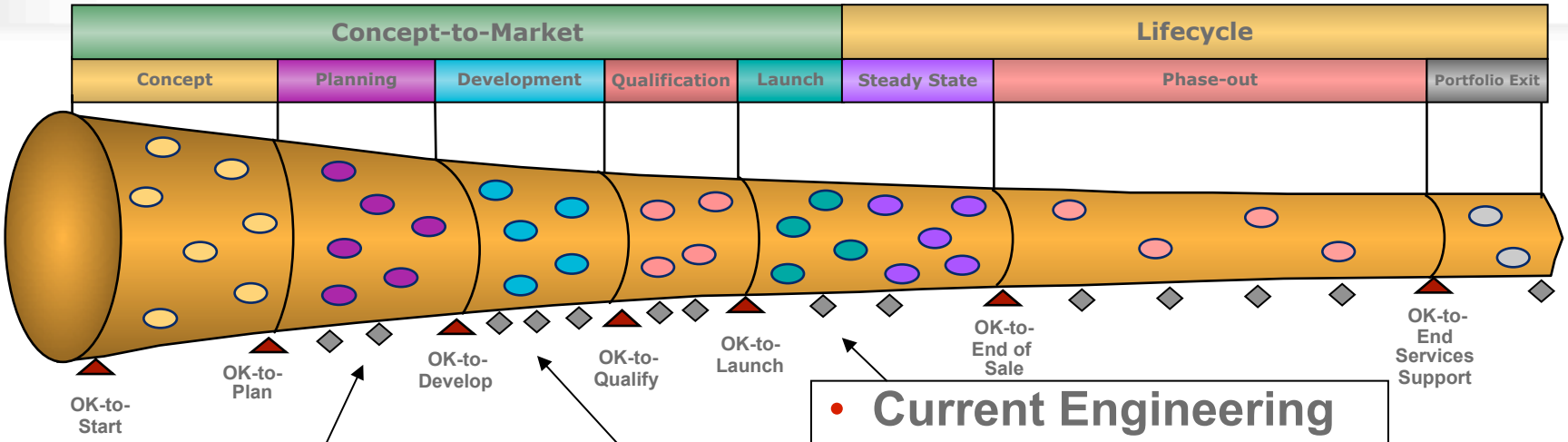
Avaya – R&D Software Characteristics

- Real Time
- Embedded
- Critical Reliability
- A lot of legacy code through Bell Labs and Acquisitions
- Interdependent (e.g. Switch, Presence Server, SIP server, Interface server etc all work together).
- Networked
- Highly Configurable
- Large (some bases take days to compile and smoke test)
- Complex
- Integrated with 3rd party and open source code
- Many languages (mostly C, C++, JAVA, PHP, C#), hardware platforms, and operating systems (Linux, Windows, VxWorks..)

Avaya Code Base Growth - Selected Projects



How Products are Developed



- Current Engineering
- Field Support

- Prototyping
- Requirements
- Development Planning
- Development Infrastructure
- Software Architecture

- Design
- Coding & Unit Test
- Integration & Functional Test
- System Test
- Alpha and Beta Programs
- TRADITIONAL & AGILE MODELS USED

How Does Avaya Approach Agile Development

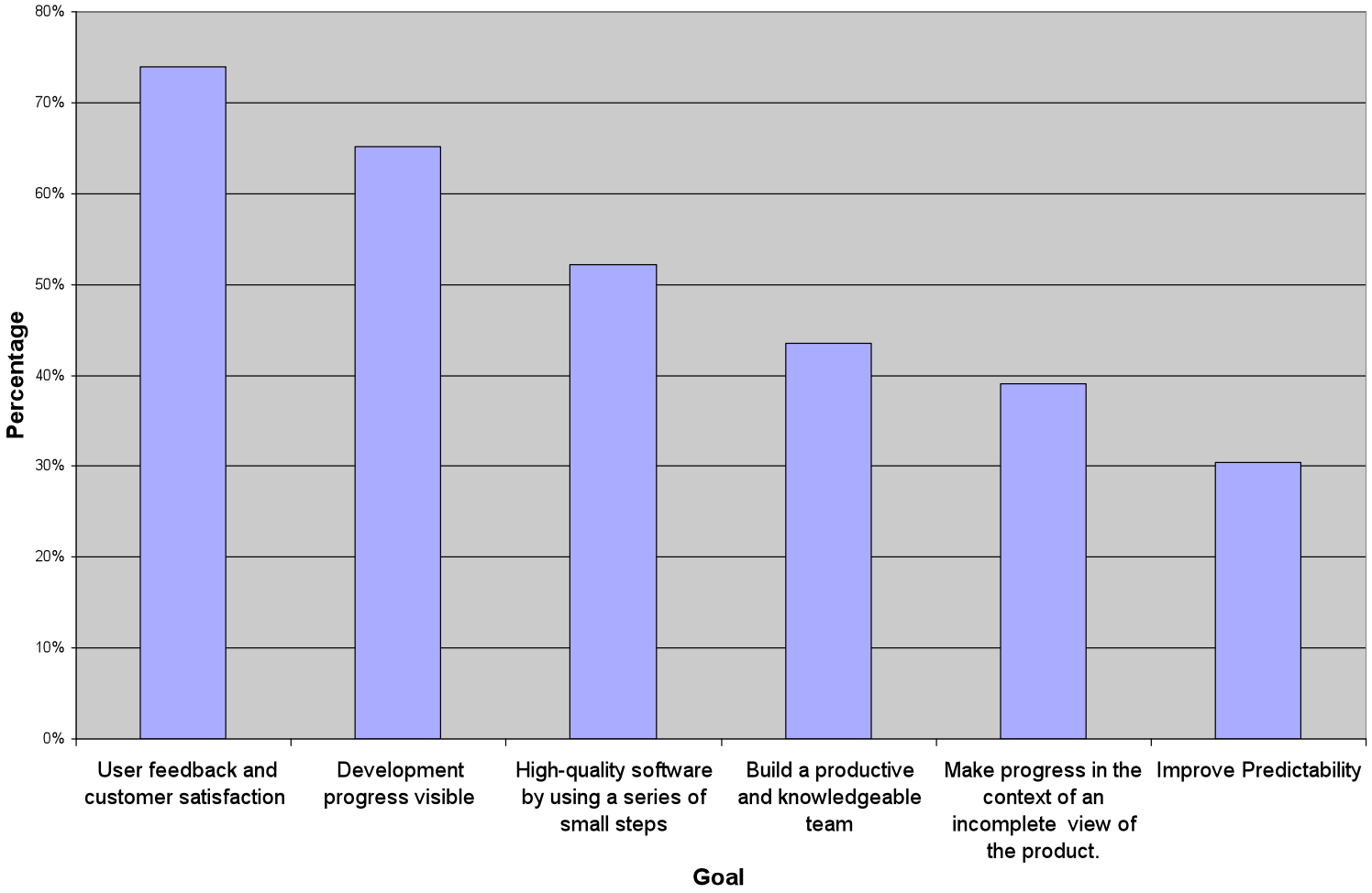
Primary Goals In Avaya for Agile Development

(as reported by projects)

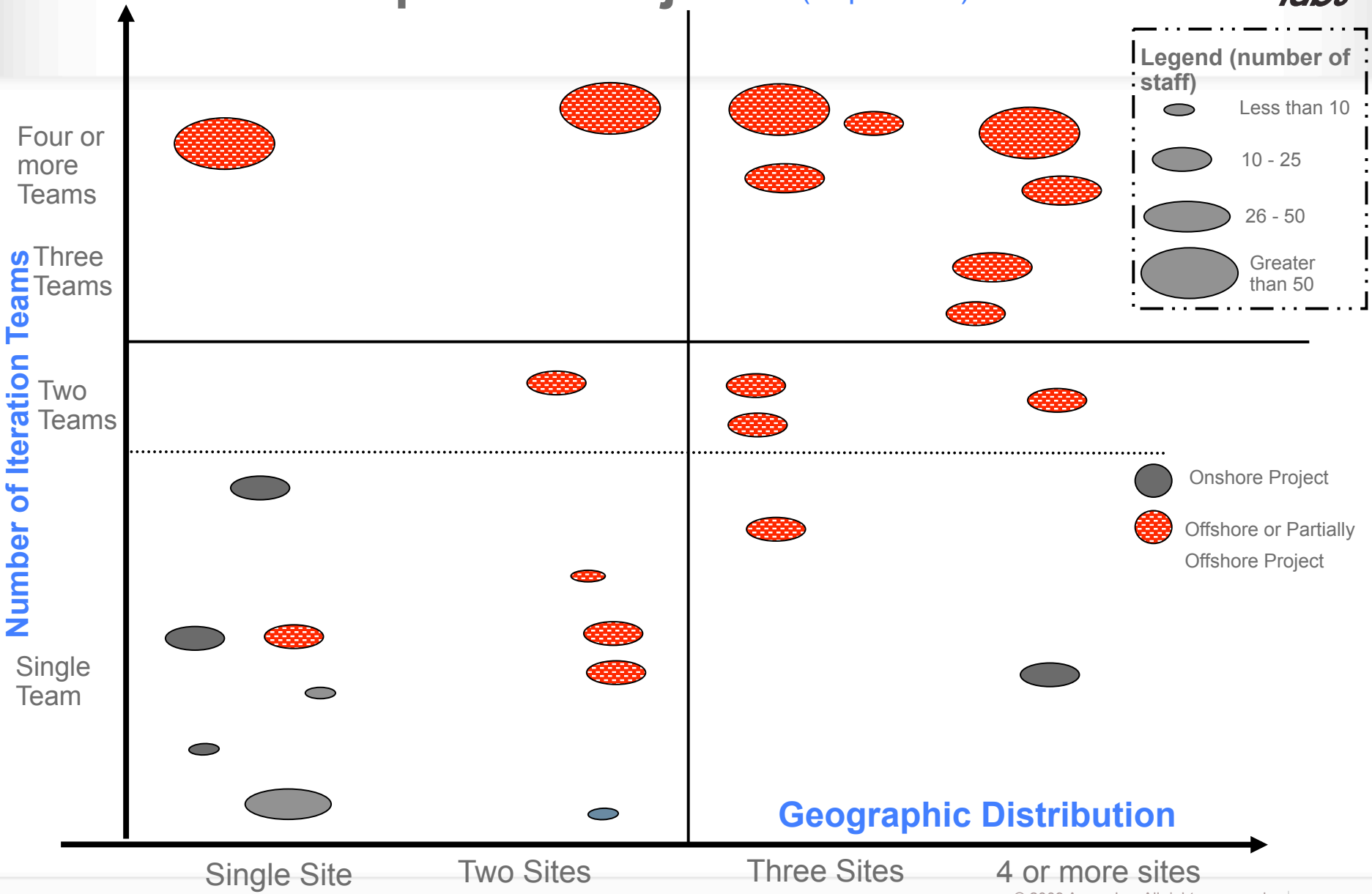
AVAYA labs

1. Make it easier to obtain and incorporate user feedback in order to improve customer satisfaction
2. Make development progress visible by doing development in small steps, thereby giving the development team clear, short-term projects.
3. Make it easier to develop correct, high-quality software by using a series of small steps
4. Build a productive and knowledgeable team.
5. Make Progress in the context of an incomplete view
6. Improve predictability

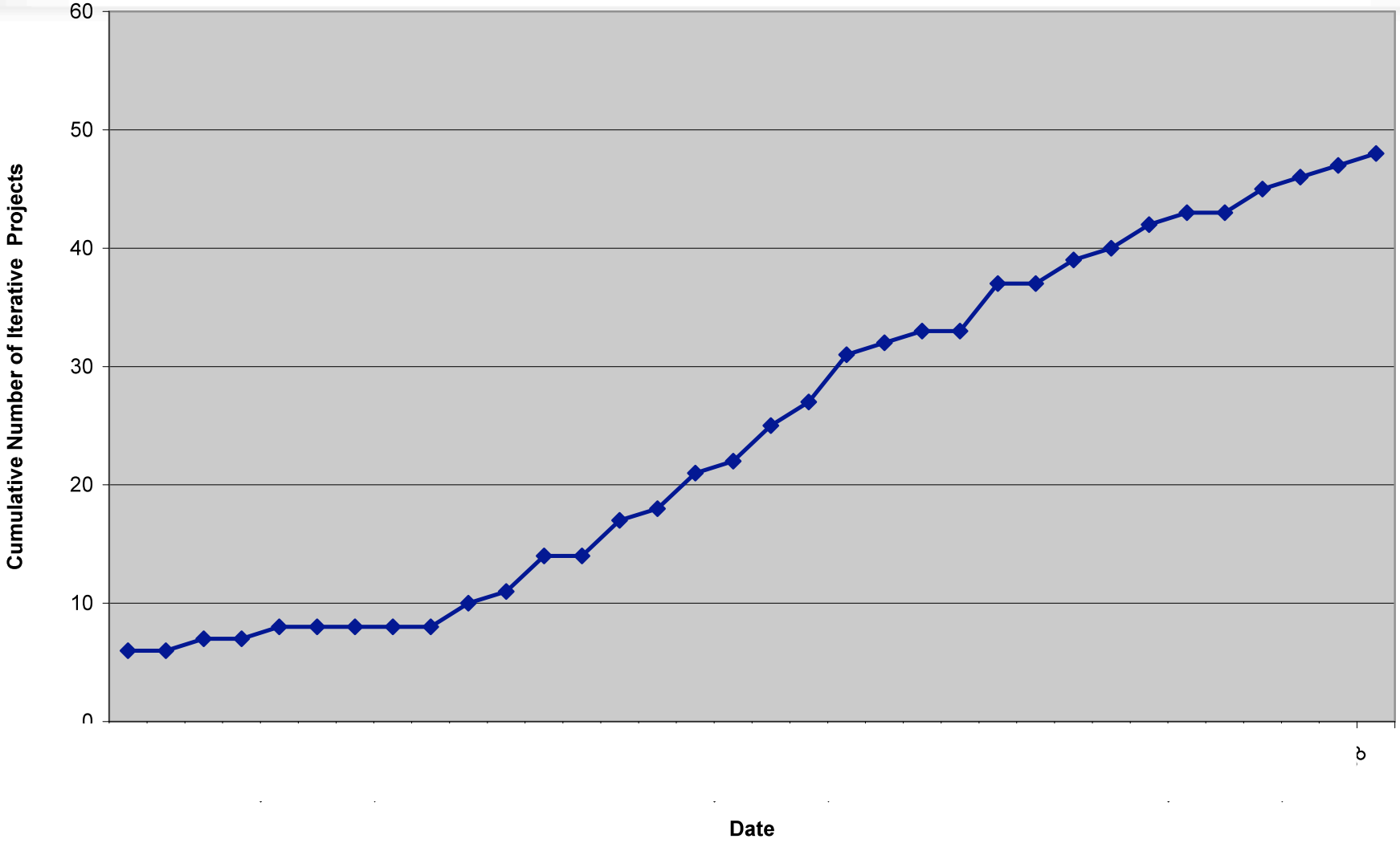
Percentage of Avaya Iterative Projects with Stated Goal



Size & Distribution of Active Avaya R&D Iterative Development Projects (Sept. 2008)



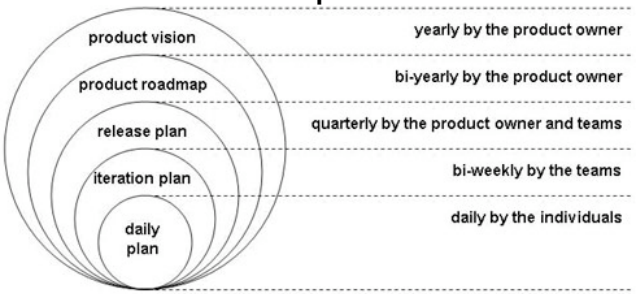
Cumulative Number of Avaya Projects With Agile Practices



Areas We Track in R&D for "Architecture Guided Iterative Development" – Traditional Practices

AVAYA labs

- **Architecture Guided**
  - Decompose work into minimally interdependent modules
  - Develop interface specifications so teams (and projects) can work independently
  - Ensure project characteristics, (e.g. performance, reliability, capacity) are reachable
  - Use common code, algorithms, databases across and other technologies products
  - Architecture Scorecards to ensure consistency
  - Architecture reviews across divisions
  - Prototyping allows for early feedback and technology risk assessment
- Baselined High-Level Requirements
  - Determine how products interoperate
  - Enough detail for an initial architecture
- Plan and Track the Entire Release, Not Just Iterations
  - Teams and functional areas must converge
  - Plan for Alpha and Beta tests in complex customer environments



"5 Levels of Agile Planning: From Enterprise Product Vision to Team Stand-up" Hubert Smits

Areas We Track in R&D for "Architecture Guided Iterative Development" – Traditional Practices

AVAYA labs

- Common Repositories & Tools
  - All teams have access to code, defect reports, test results, code coverage
  - Common procedures and checks for check-in code
- Reviews and Inspections
  - Cross product architecture reviews
  - Meetingless design reviews across teams
  - Inspect code or test plans, especially reviews of inexperienced or outsourced staff by experienced staff
- Automated Build Management with Sanity Tests.
  - Most projects build daily, some do continuous builds, allowing immediate feedback to developers to fix base problems
  - Developers deliver tests along with code to build up sanity tests
  - Legacy code may not have automated tests
  - Automated propagation of the tested compiled base to all sites
- Manage 3rd Party Deliverables (acceptance plan, quality assessment, SCM)
  - Commercial and open source
  - Early warning if something is amiss

Areas We Track for "Architecture Guided Iterative Development" – Avaya Agile Practices – SCRUM Based

- Collaborative Project Team*
  - In Avaya this is generally limited to R&D (e.g. services, documentation, product introduction, etc not included)
  - SCRUM of SCRUMS used to scale to multiple teams and multiple locations
  - Cross location team could employ open phone!
- Empowered Product Owner*
  - Usually Product Manager, usually not co-located with R&D
  - Established an onsite team lead when there are offshore members
- Empowered Team Lead*
  - ScrumMaster
- Time-Boxed Iterations with Demo*
  - Most projects have 4 week iterations
  - Value of Demo is "huge". Rotating responsibility for end-end demo hardened the demo and allowed centralized dispersal of feedback
  - Demos use simulators and web conferencing for distributed environment
  - Demo is good at getting visibility into remote or offshore work

* - SRUM Practice

Areas We Track for "Architecture Guided Iterative Development" – Avaya Agile Practices – SCRUM Based

- Ease of Communication/Transparent Status*
  - Widespread use of Rally, Wikis, Sharepoints for metrics, code, methodology, designs, interface specs, architecture etc.
  - Other functional areas sometimes involved in development sprints
- Prioritized Feature List, with Cut-Offs*
  - Mixed success; some projects unable to prioritize
- Code Refactoring
  - Mixed success – intense schedule pressure
- Plan &Track Each Iteration with Business Goal, Fixed Resources and Content*
  - Each team understands how they mesh with the other teams
- Automated Test Framework
  - Consistency of testing across teams (legacy code tests only partially automated)
  - Some Test Driven Design
  - Various SV strategies (work with development, lag an iteration, just take it at the end)
- Iteration Retrospectives*
  - Teams find they can implement 2-3 process changes per iteration

Areas We Track for "Architecture Guided Iterative Development" – Avaya Agile Practices – SCRUM Based

- Document Just Enough
  - Combination of traditional documents and specs embedded in the code (e.g. JAVADOCs, D'Oxygen) – keeps documentation accurate for those at other sites.

- Customer Feedback Throughout Lifecycle*
  - Product Management usually acts as proxy, some support interaction, some customer focus groups
  - Conference calls allow whole team to participate with forums such as Customer Advisory Panels
  - Rotating developers through customer support, regardless of location, improves understanding of customers

- Brief Daily Stand-up Meeting*
  - Manage across time zones (time shift, rotate times, fewer, conference bridge)
  - Issues are identified early which allows quicker mitigation.
  - The meetings often identify concrete areas where extended team members and other domain experts can assist.
  - The meetings keep the team focused
  - The development staff must account for themselves.
  - Knowledge is dispersed throughout the team.
  - Helped SV team when they were not co-located to understand product earlier

Bottom Line

- Use of Agile Methods Continues to Grow
- Increased Quality and Productivity Not Yet Quantitatively Verified
- No Change In Time To Market (releases coordinated with non-Agile products, and timed to twice a year)
- Hampered By:
  - Limited Involvement Outside of Development
  - Legacy Code
  - Lack of Legacy Automated Tests
  - Interdependence with non-Agile projects
- Can Scale to Large Distributed Teams

thank you

John Palframan

palframan@avaya.com

Some References