

Verizon Enterprise Solutions

We deliver the
connected world.

Simply.
Reliably.
Securely.



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Abstract

Die Telekommunikationsbranche befindet sich seit Jahren im Umbruch. Neue Kommunikationsformen a la WhatsApp senken den Bedarf an traditionellen Telefongesprächen und lassen die Preise und damit die Gewinne erodieren.

Es gibt mehr Smartphones als PCs. Immer mehr "Dinge" sind drahtlos mit dem Internet verbunden, Mobilfunkparten lösen daher die Festnetzparten als "Cashcows" innerhalb der Telekommunikationskonzerne ab. Das Internet der Dinge klopft an die Tür. Neue Geschäftsfelder in der digitalen Welt müssen erschlossen werden.

Dieser Vortrag führt aus, wie die Festnetzparte des zweitgrößten Telekommunikationsanbieters der Welt diesen Herausforderungen begegnet, um Produktinnovationzyklen drastisch zu senken und durch höhere Automatisierung und Standardisierung unter Einsatz von OpenSource Werkzeugen, eine verbesserte Qualität von neuen, immer öfter rein softwarebasierten Kommunikationslösungen (vgl. Software Defined Networks) zu schaffen.

Wir beschreiben den seit 2012 eingeschlagenen Weg, die IT Systementwicklung in einem gigantischen „Brownfield“ Ansatz auf den Kopf zu stellen und neu zu erfinden. Methoden die bislang nur aus Start-Ups und von "Einhörnern" (Google, Netflix, usw.) bekannt waren einzusetzen, um den bisherigen Wasserfall basierten SDLC abzulösen, Continuous Integration/Delivery (CI/CD) zu implementieren und neue KPIs zur IT System-Konsolidierung zu entwickeln.

Aufgrund der in den USA zentralisierten operativen Systeme die durch dezentrale global verteilte Teams entwickelt werden, ergeben sich strukturelle Probleme, die durch das Scaled Agile Framework (SAFE) gelöst werden sollen. Ziel ist die Agile Software Fabrik, wie Gene Kim et al. sie in ihrer Novelle "The Phoenix Project" beschrieben haben. Da für uns gilt: Ohne DevOps kein Agile!

Einige hartnäckige Aufgaben, wie zum Beispiel die bislang rein manuell durchgeföhrten IT Compliance Checks (z.B. SOX) müssen im Rahmen der DevOps Pipeline noch automatisiert werden. Wir zeigen einige Stationen der bisherigen Reise auf, der sich uns bislang als steinig aber lohnenswert präsentiert, wie erste Kennzahlen zeigen.

Die Reise vom endlosen Wasserfall zur Agilen Software Fabrik. (Extended Edition)

Jörg Heitkötter
Verizon Enterprise Solutions

 @hiimjoke
 <https://github.com/jheitkoetter/>



Death by Powerpoint

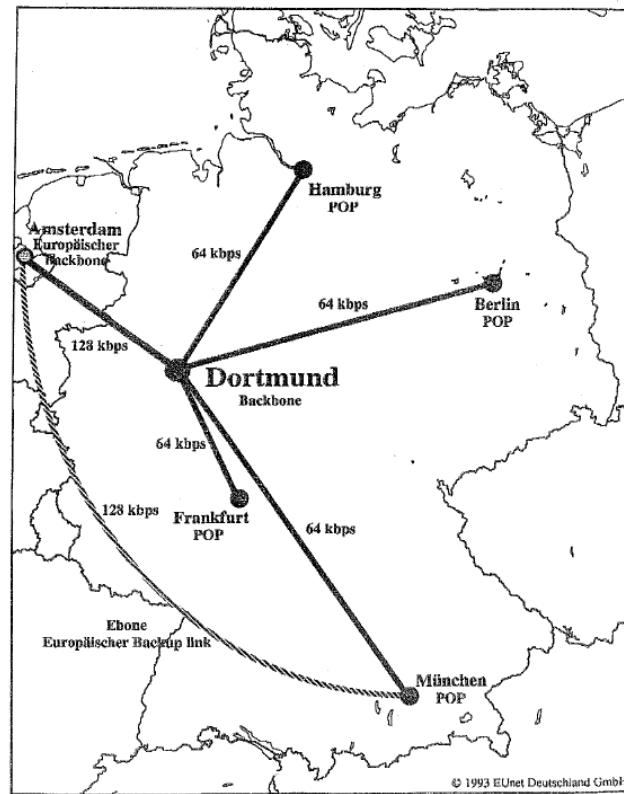


Neulich, in 1993...



"On the Internet, nobody knows you're a dog."

EUnet
Connecting Europe since 1962



Deutsche EUnet Infrastruktur

Rückblick...

1984 USENIX/EUnet

1992 EUnet GmbH

1996 UUNET

2001 WorldCom

2004 MCI

2006 Verizon

**2012 ~~Verizon-Vodafone~~
Enterprise Services**

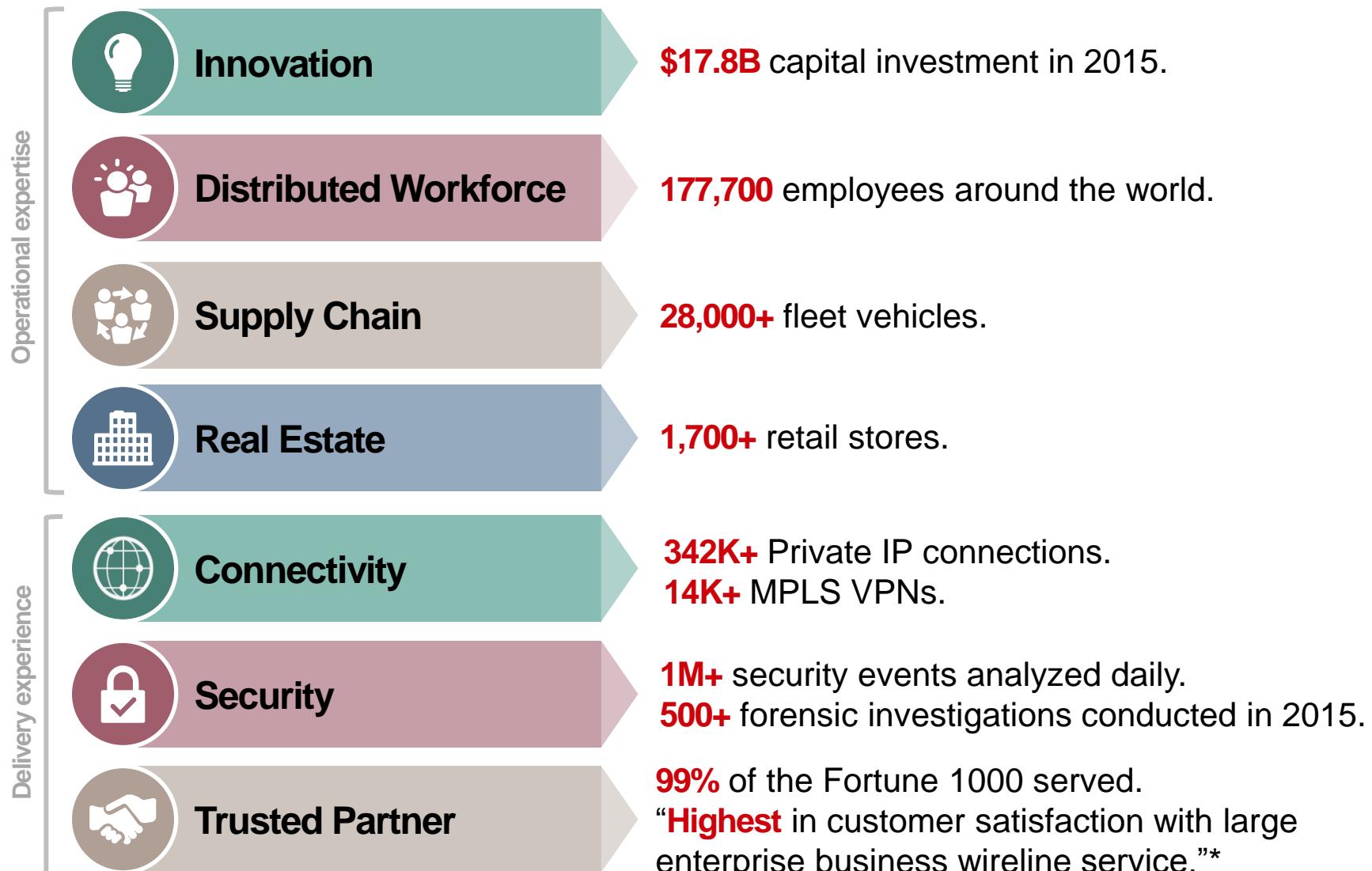


Was macht ein Enterprise Architekt bei Verizon?

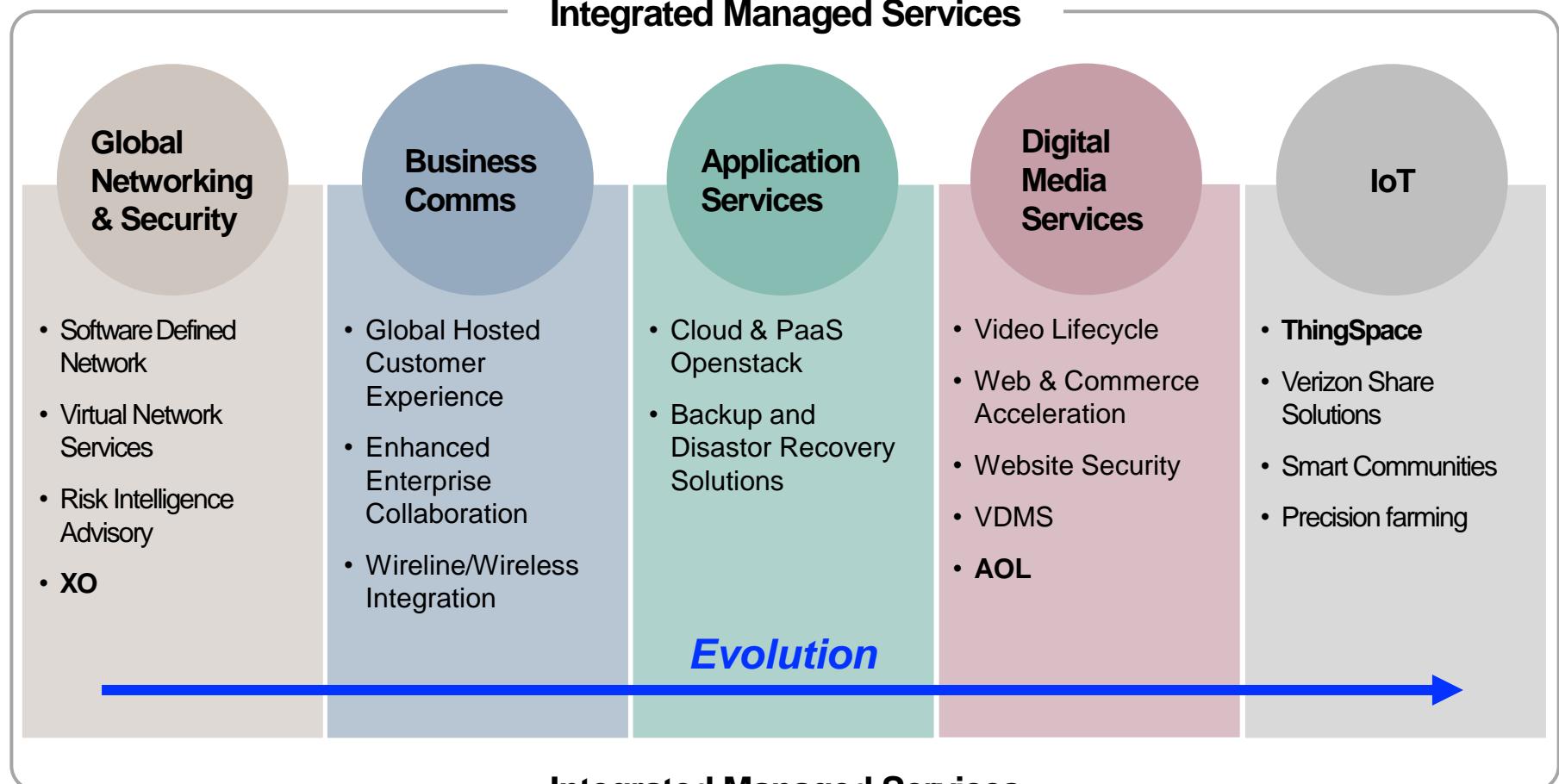
- Architektur aller IT Systeme und Roadmap zum „End-state“
- Kooperation mit IT System Architekten und den Architekten der Non-IT Systeme
- Technische Expertisen „für diverses“, Evaluierung, „Forschung & Entwicklung“
- Geschäftsprozesse: Standartisierung, Optimierung und Umsetzung (Keine Elfenbeintürme!)
- RFP Beratung
- Audits, Compliance (SOX, CPNI, PCI, FISMA, etc.) und Zertifizierung (TK45g)
- „Feuer austreten“...



Verizon serves businesses and consumers around the globe.



Portfolio innovation and evolution.



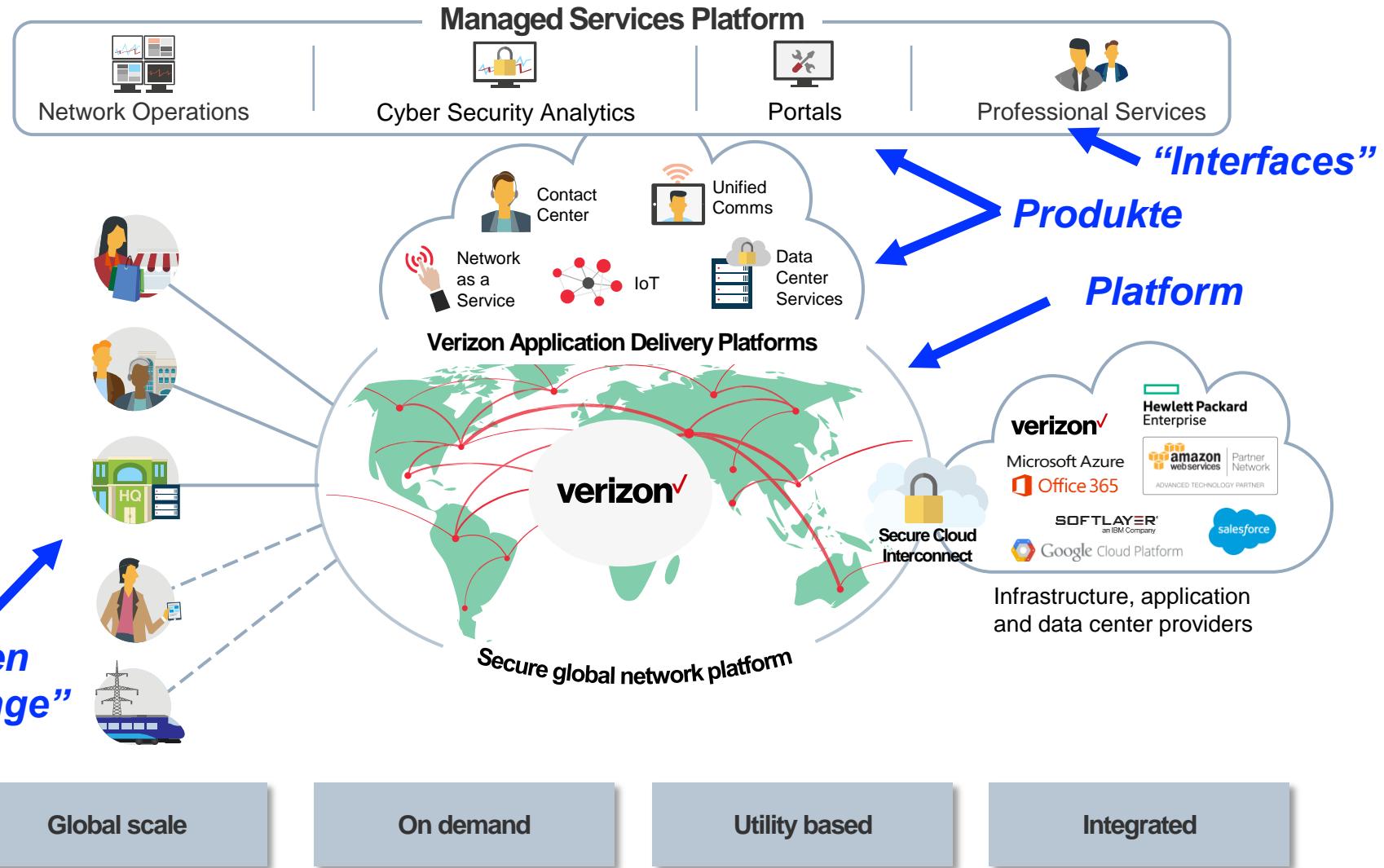
Global scale

Cross platform analytics

Utility based

Integrated

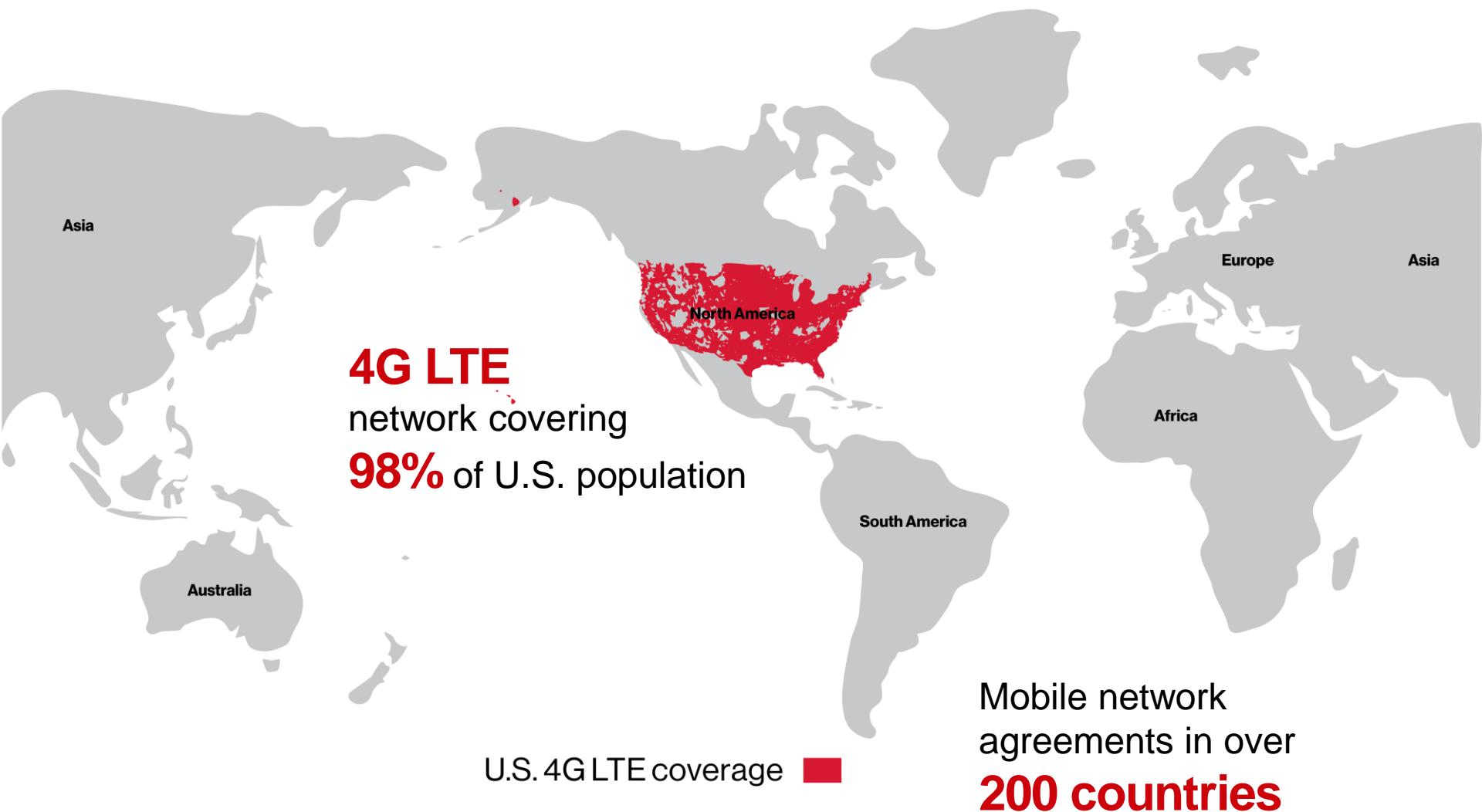
Our integrated portfolio delivers the connected world.



What makes Verizon Enterprise Solutions better.



What makes Verizon Enterprise Solutions better.



What makes Verizon Enterprise Solutions better.

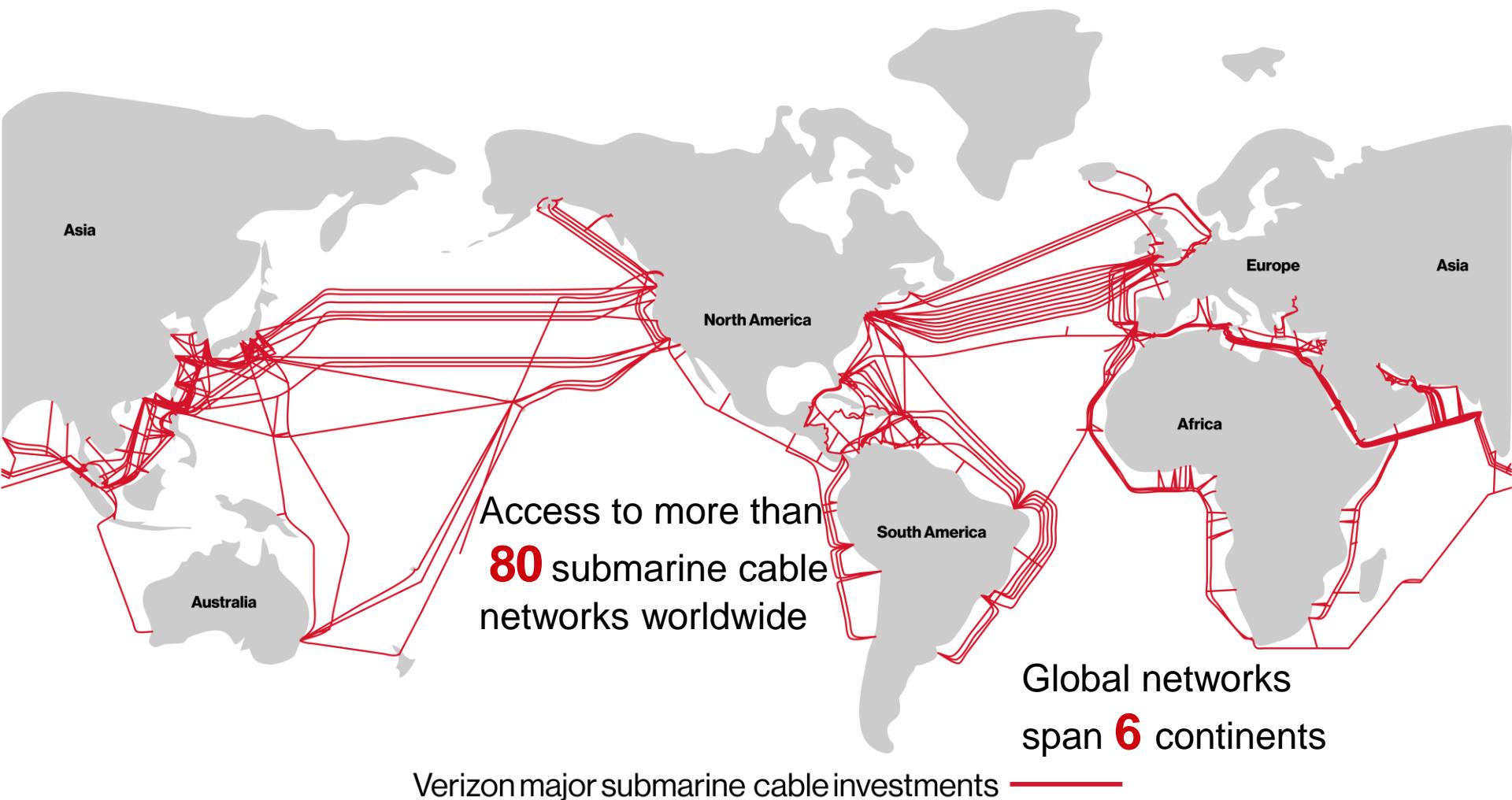
Private IP Services
in more than
150 countries

330,000
connections

Verizon Private IP available



What makes Verizon Enterprise Solutions better.



What makes Verizon Enterprise Solutions better.



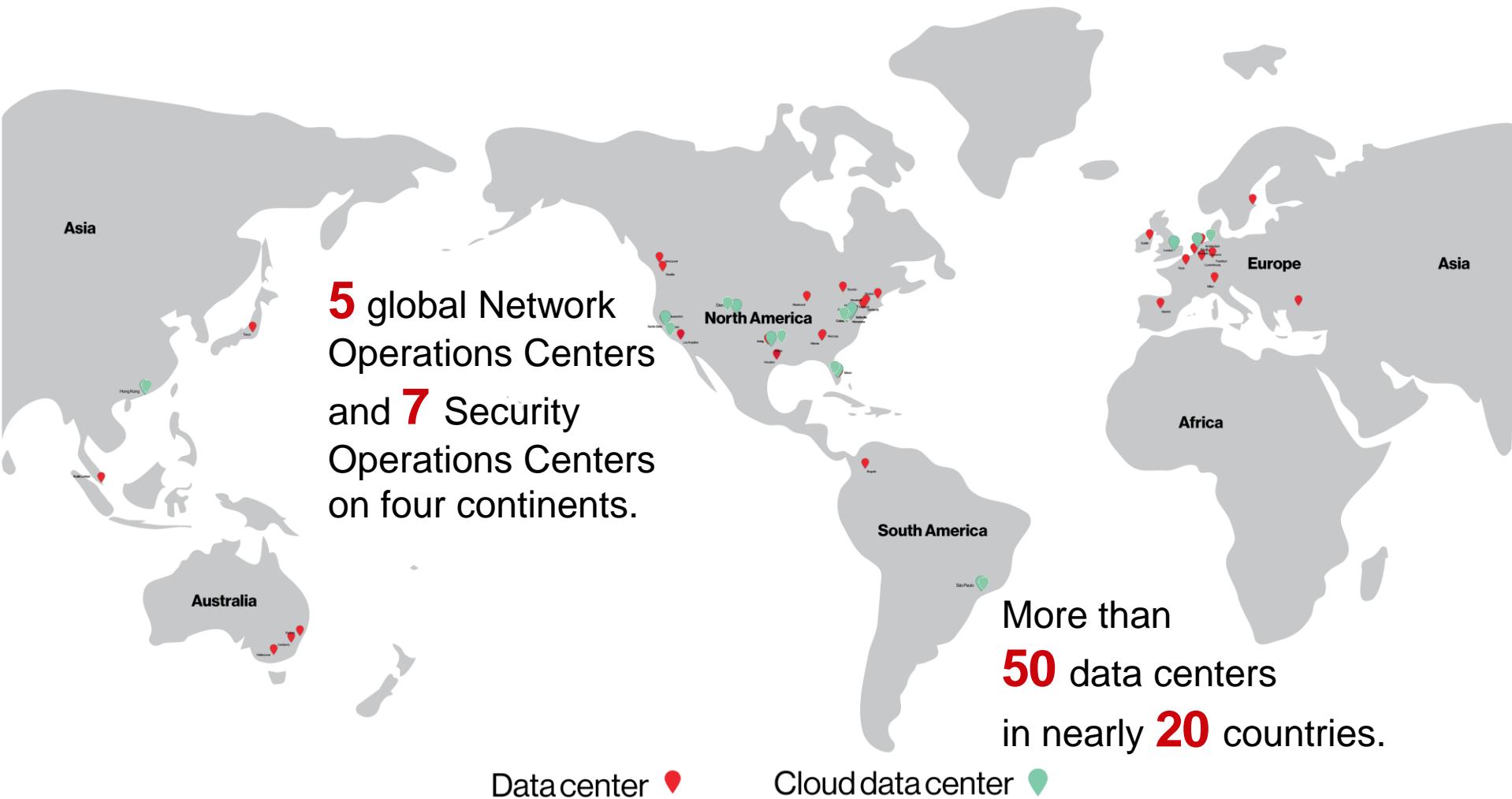
Carry IP, data, and voice traffic across more than **800,000** network route miles.

Terrestrial network

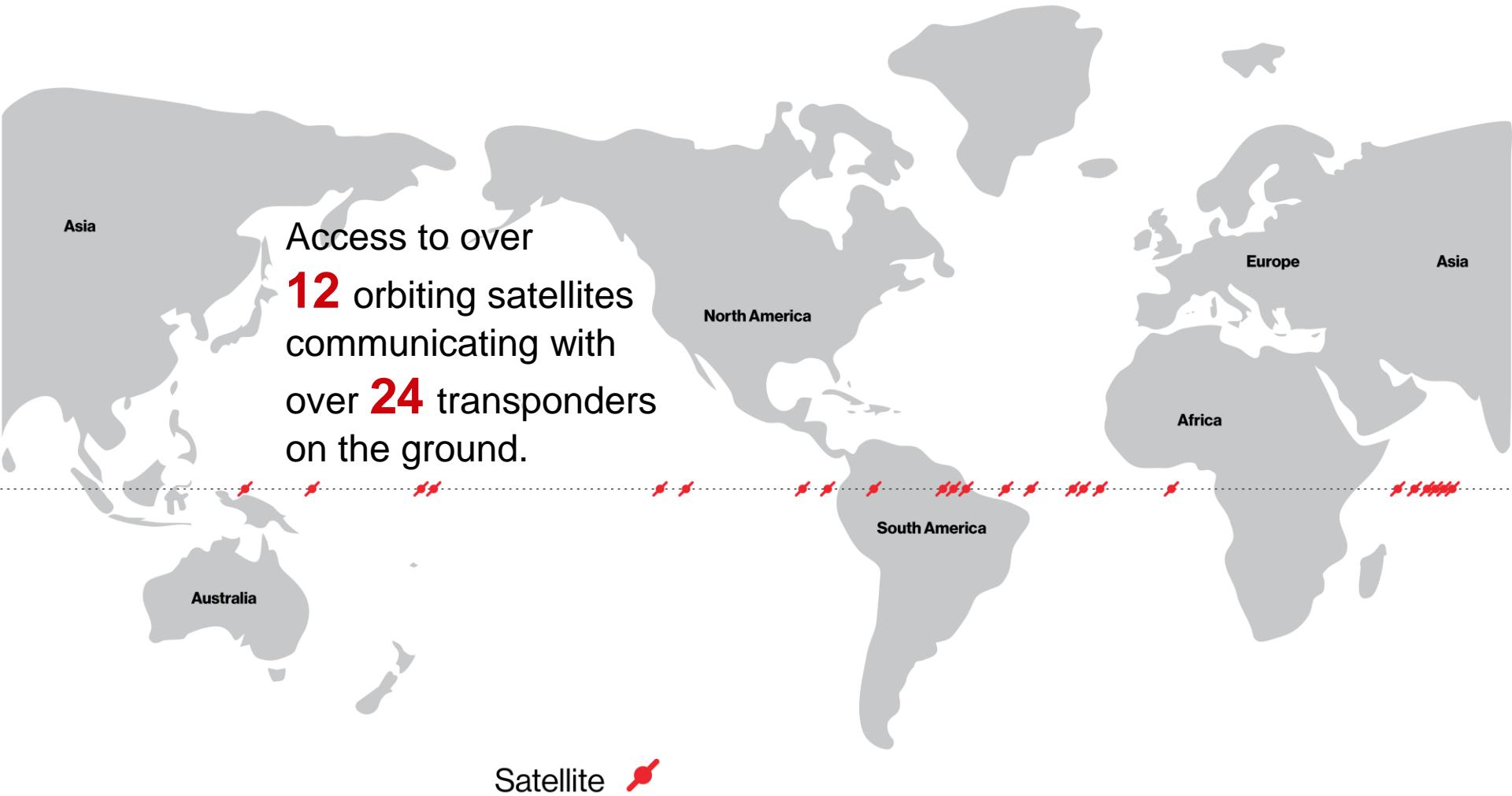
Capital city □

Connecting city ○

What makes Verizon Enterprise Solutions better.

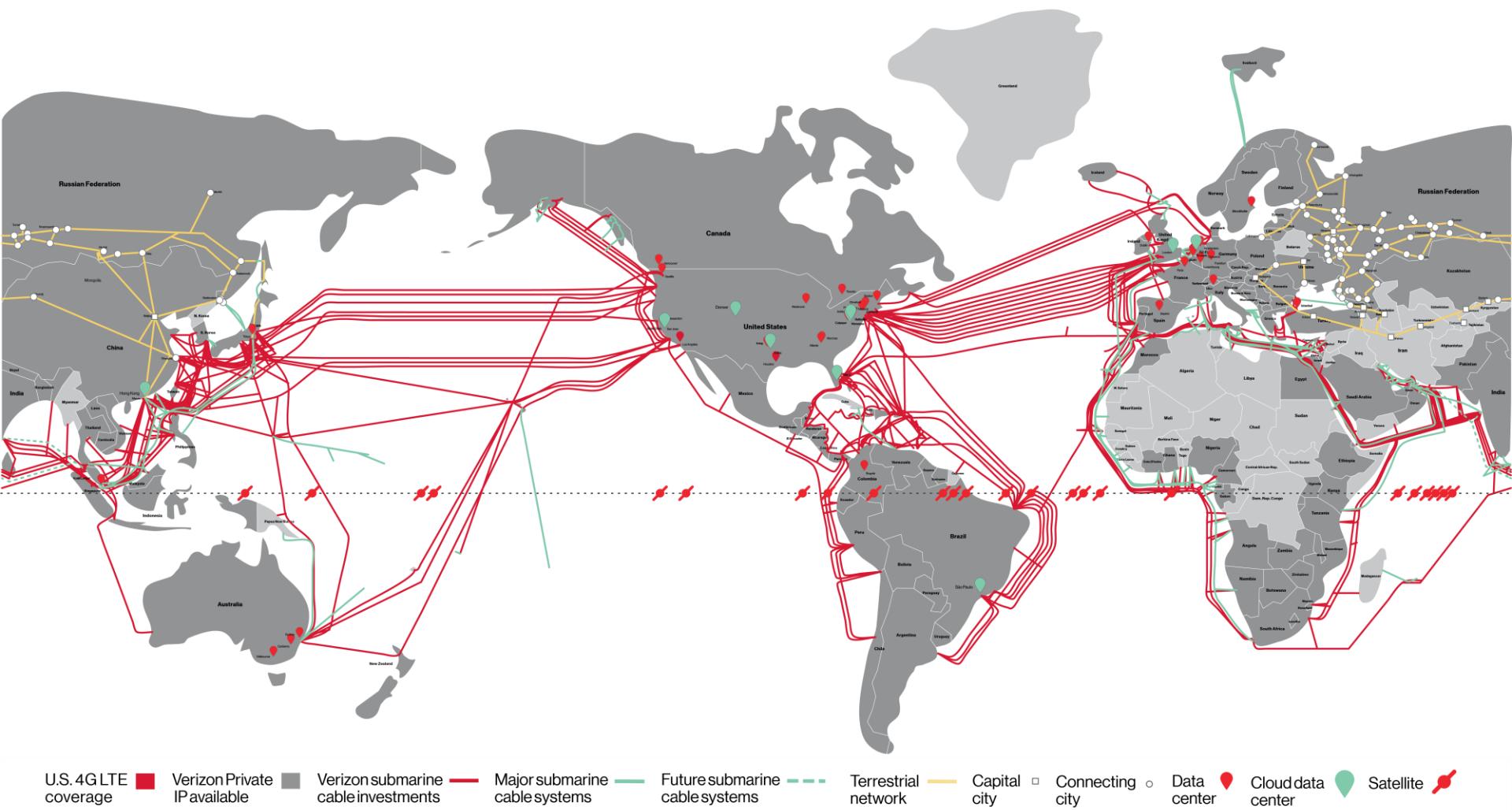


What makes Verizon Enterprise Solutions better.



Access to over **12** orbiting satellites communicating with over **24** transponders on the ground.

What makes Verizon Enterprise Solutions better.



What makes Verizon Enterprise Solutions the right choice.

4G LTE network covering **98%** of U.S. population.

Services in more than **150 countries**.

330,000 + Private IP connections.

Access to more than **80** submarine cable networks worldwide.

Global networks span **6** continents.

In 2015, we invested more than **\$17B** to improve and expand our assets and capabilities.

Carry IP, data, and voice traffic across more than **800,000** network route miles.

5 Global Network Operations Centers and **7** Security Operations Centers on four continents.

More than **50** data centers in nearly **20** countries.

Over **700** consultants around the globe, with over **80** specializing in cloud solutions.

10 top-tier network access point facilities.

Access to **12** satellites orbiting the globe.

People + technology = better business outcomes.

Gartner®

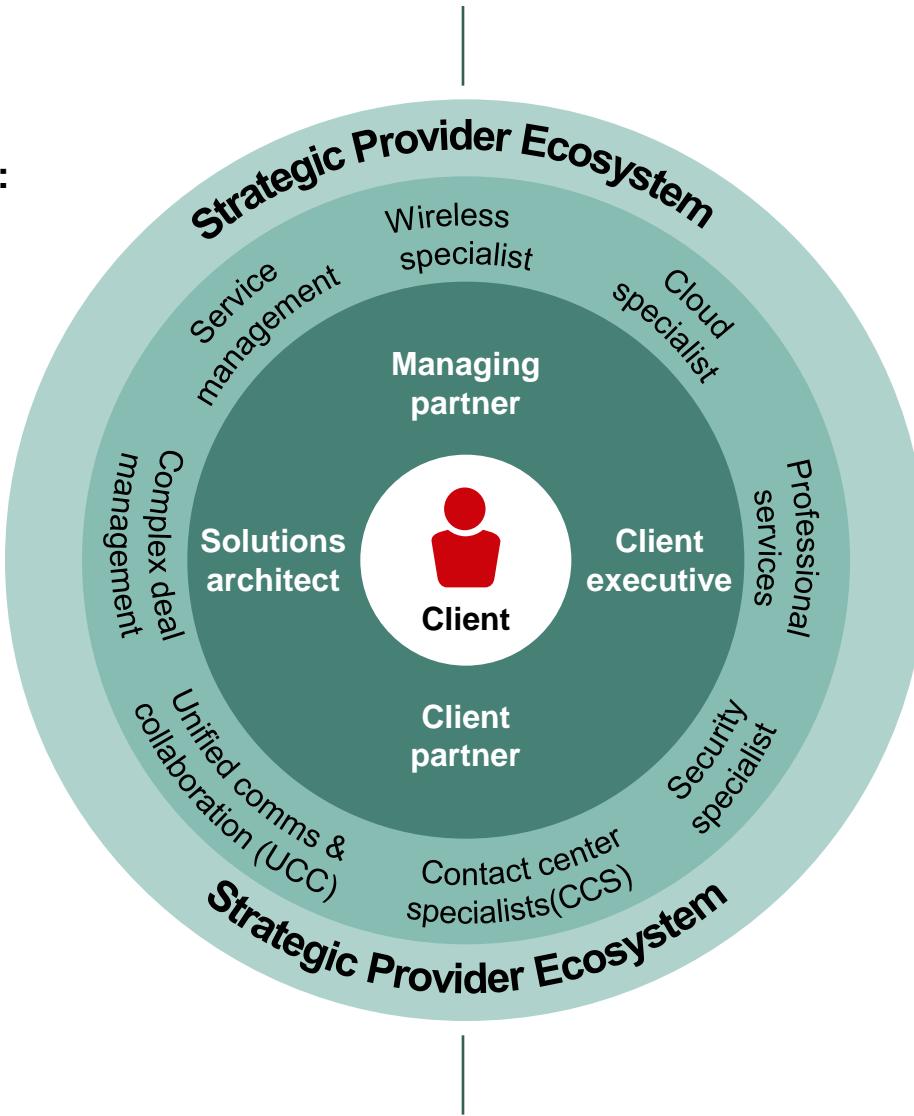
Magic Quadrant Reports:

- Managed Security Services Worldwide
- Cloud-Enabled Managed Hosting, Europe
- Network Services Global

IDC
Analyze the Future

MarketScape Reports:

- Worldwide Advanced Enterprise WAN Data Services
- Worldwide UCaaS Service Provider
- Worldwide Network Consulting Services



FORRESTER®

Cited as a leader in The Forrester Wave™:

- Managed Security Services: North America, Q4 2014

Current Analysis

Listed as “Very strong”

- Managed Security Services
- Global M2M Services
- Global Enterprise Market for Collaboration and Communications Services
- U.S. Business Services Market
- Global WAN Services
- U.S. WAN Services

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Your partner
behind the
scenes.

<https://youtu.be/kzFaopuHwMg>

1:33

Verizon Data Breach Report

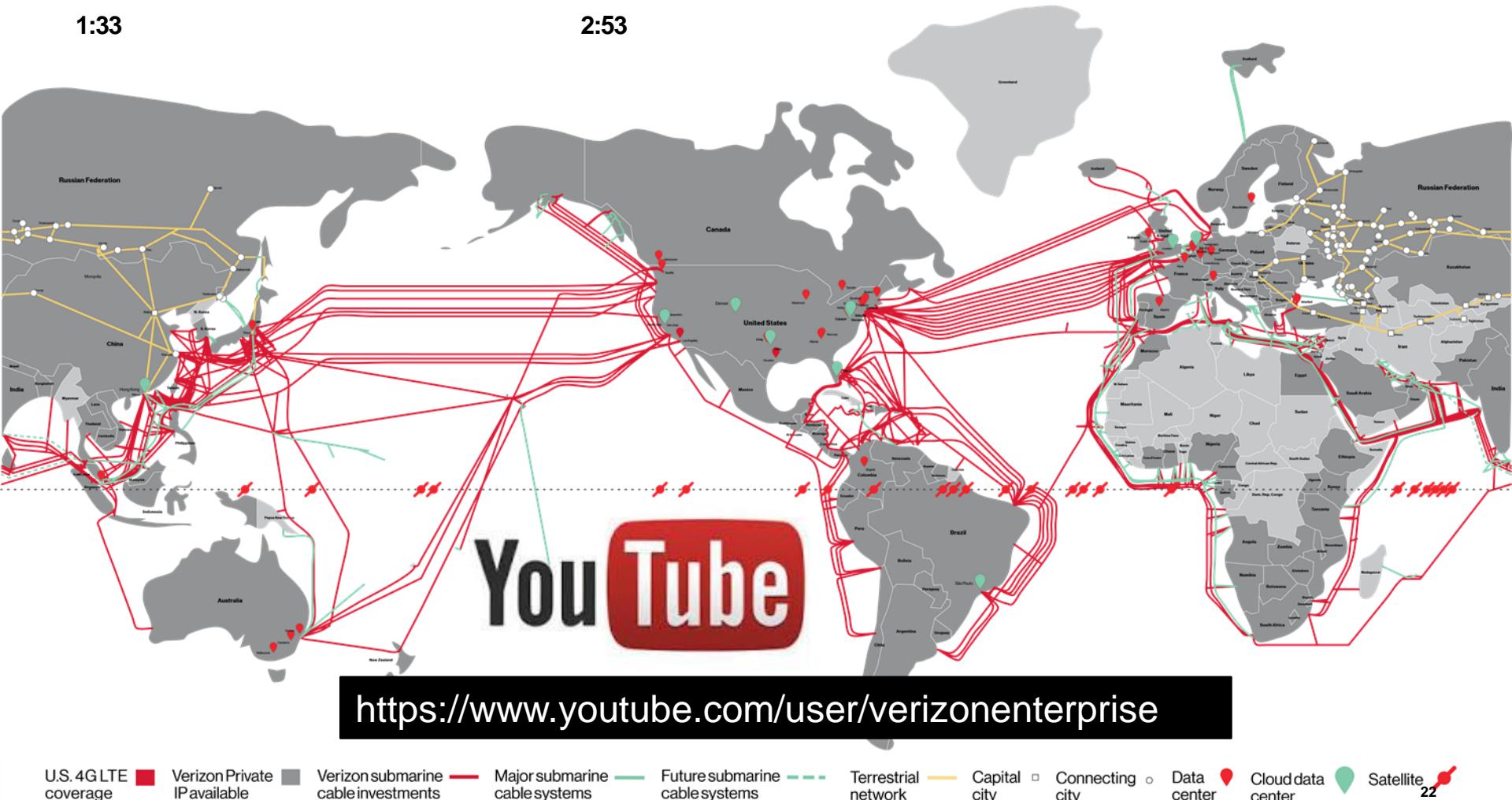
<https://youtu.be/wsdDC7DbgLE>

2:53

IoT. Precision
farming.

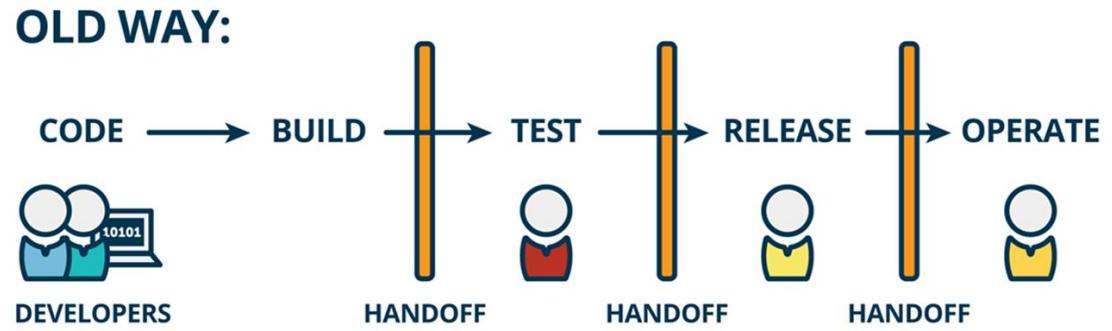
<https://youtu.be/lhsF9dv5zrk>

3:06



Umbruch in der IT Systementwicklung.

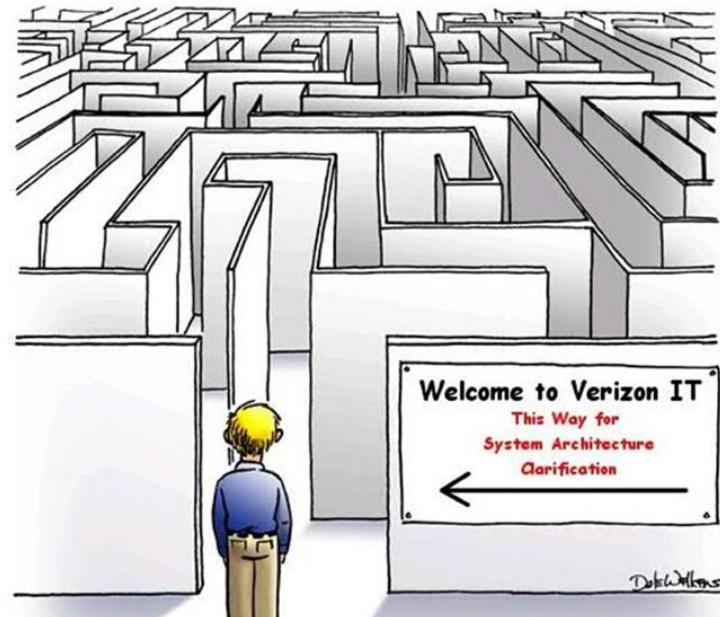
Ein gigantischer „Brownfield“ Ansatz



Die dunkle Seite der Merger...



**2006 - Merger mit MCI und
Enterprise Systemkonsolidierung
(z.B. 44 Billingsysteme in EMEA, 34
in USA)**



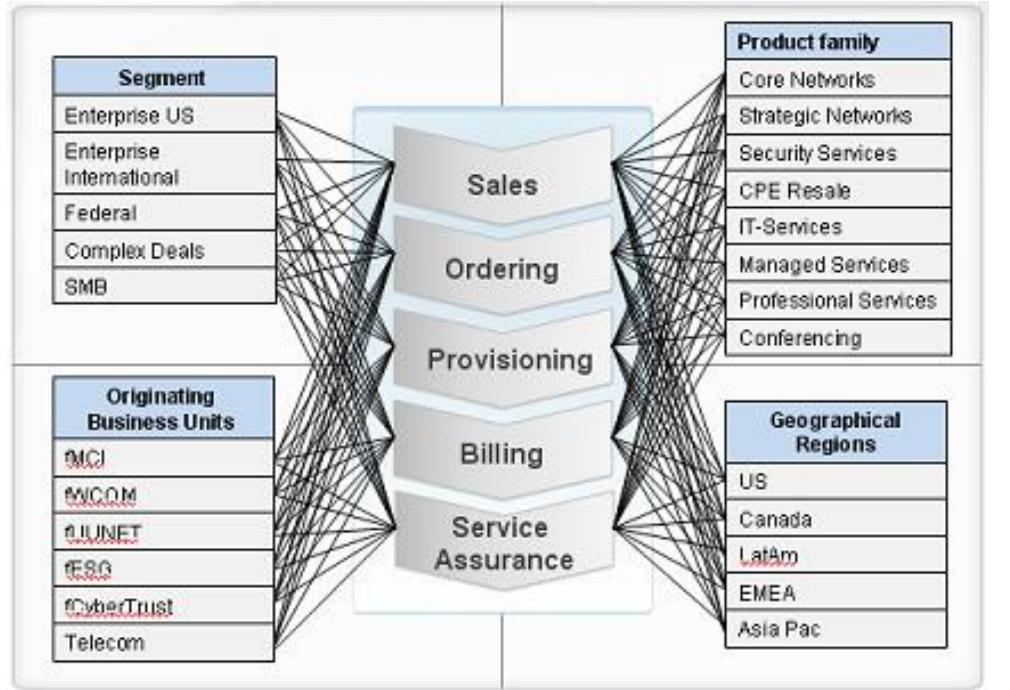
Multiple mergers resulted in process, system and product complexity

Expensive and slow to maintain and extend.

Confusing and difficult for customers and internal resources.

Significant manual process intervention required.

Lack of visibility to where time and money is spent.

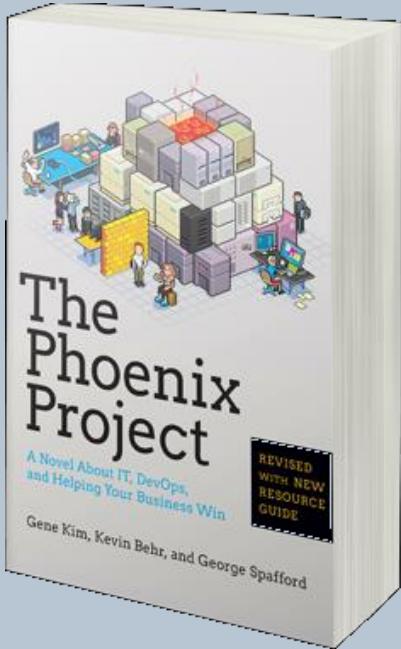


Examples

- Manual customer identification
- Manual ticket / order initiation
- Redundant entry of information across multiple systems
- Lack of cross organization ticket assignment and tracking
- Coordination of changes across verticals is manual and cumbersome
- Lack of visibility to true customer impacts
- Inconsistent management of network / customer devices
- Inability to carry out end to end root cause analysis

6.000+
Prozessvariationen

Episode IV – Eine Neue Hoffnung...



2012 - Verizon Lean Six Sigma (VLSS)

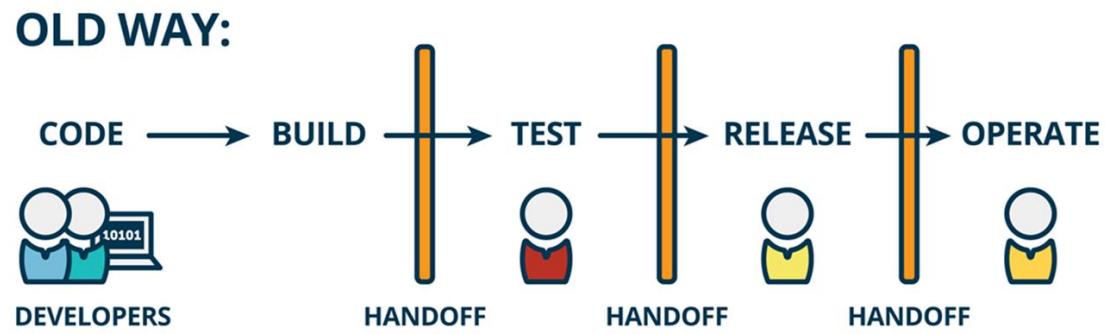
**2013 - Agile mindset training the
trainers + IT Next Initiative**

**2014 - Agile coaching & Agile Cafes mit
Dean Leffingwell + DevOps Council**

**2015 - Scaling Agile + IT Kick off mit
Gene Kim, DevOps Cup, Hackathons**

**2016 - Verizon SAFE, Noch mehr
Hackathons, Fixathons, Speedathons,
Gamification, Continuous Education,
DevOps Cup 2.0**

Wir sind zu langsam, der Wasserfall ist endlos...



Warum stecken wir im Wasserfall fest? “Software is eating the world...”*

	1970s–1980s	1990s	2000s–Present
Era	Mainframes	Client/Server	Commoditization and Cloud
Representative technology of era	COBOL, DB2 on MVS, etc.	C++, Oracle, Solaris, etc.	Java, MySQL, Red Hat, Ruby on Rails, PHP, etc.
Cycle time	1–5 years	3–12 months	2–12 weeks
Cost	\$1M–\$100M	\$100k–\$10M	\$10k–\$1M
At risk	The whole company	A product line or division	A product feature
Cost of failure	Bankruptcy, sell the company, massive layoffs	Revenue miss, CIO's job	Negligible

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Quelle: Adrian Cockcroft (Netflix), “Velocity and Volume (or Speed Wins),” presentation at FlowCon, San Francisco, CA, November 2013.

* Marc Andressen, “Why Software is Eating the World”. Essay, WSJ, 2011.

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Wie schaffen “die” das?

Company	Deploy Frequency	Deploy Lead Time	Reliability	Customer Responsiveness
Amazon	23,000 / day	minutes	high	high
Google	5,500 / day	minutes	high	high
Netflix	500 / day	minutes	high	high
Facebook	1 / day	hours	high	high
Twitter ²	3 / week	hours	high	high
typical enterprise	once every 9 months	months or quarters	low/medium	low/medium

Quelle: The Phoenix Project: A NOVEL ABOUT IT, DEVOPS, AND HELPING YOUR BUSINESS WIN by Gene Kim, et al. (2014).

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6 Major
releases /
year

6 Minor
release/
year

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What can we learn from Amazon?

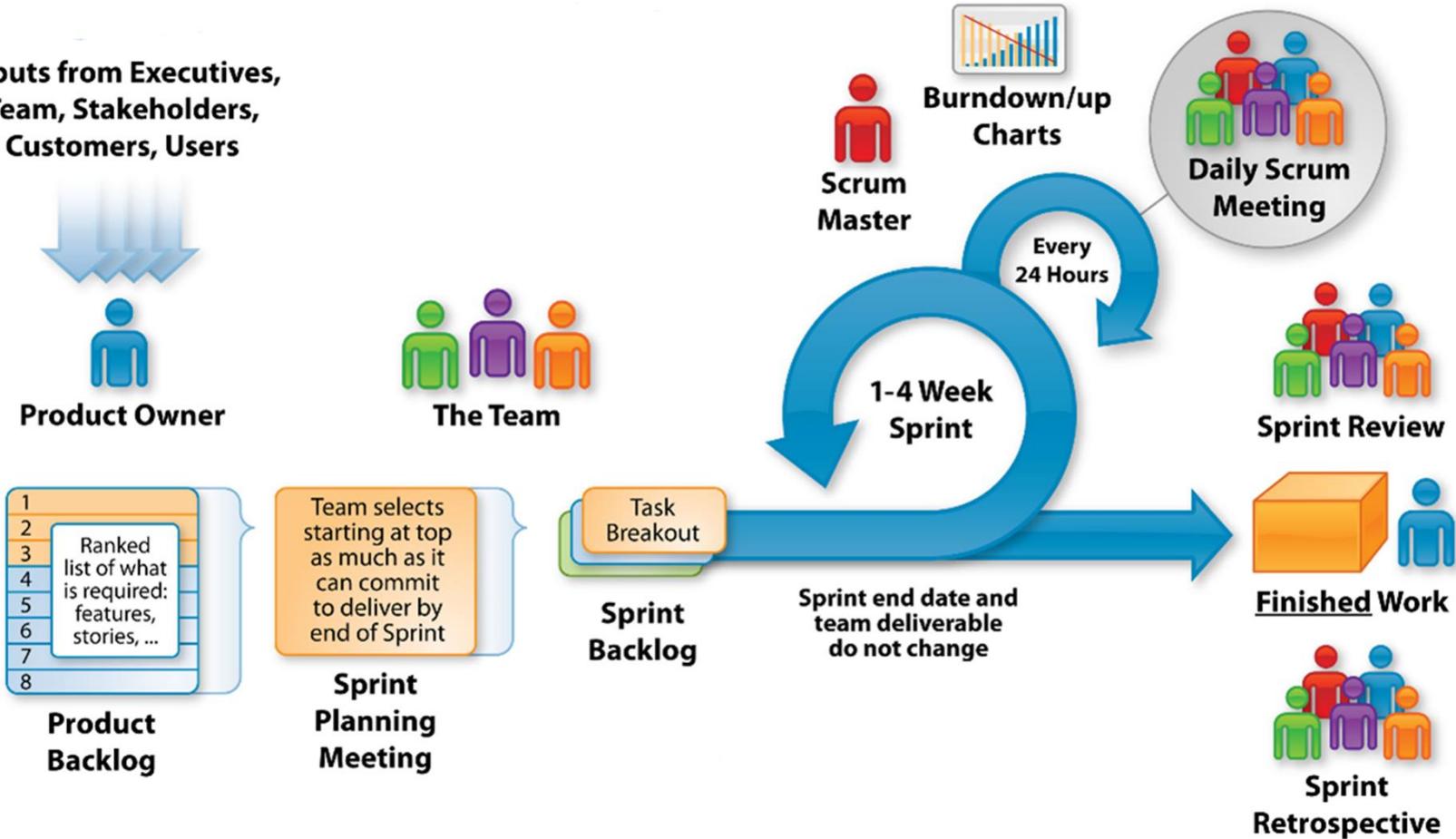
- All teams will henceforth expose their data and functionality through service interfaces.
- Teams must communicate with each other through these interfaces.
- There will be no other form of inter-process communication allowed: no direct linking, no direct reads of another team's data store, no shared-memory model, no back-doors whatsoever. The only communication allowed is via service interface calls over the network.
- It doesn't matter what technology they use. HTTP, Corba, Pub-Sub, custom protocols — doesn't matter. Bezos doesn't care.
- All service interfaces, without exception, must be designed from the ground up to be externalizable. That is to say, the team must plan and design to be able to expose the interface to developers in the outside world. No exceptions.



<https://apievangelist.com/2012/01/12/the-secret-to-amazons-success-internal-apis/>

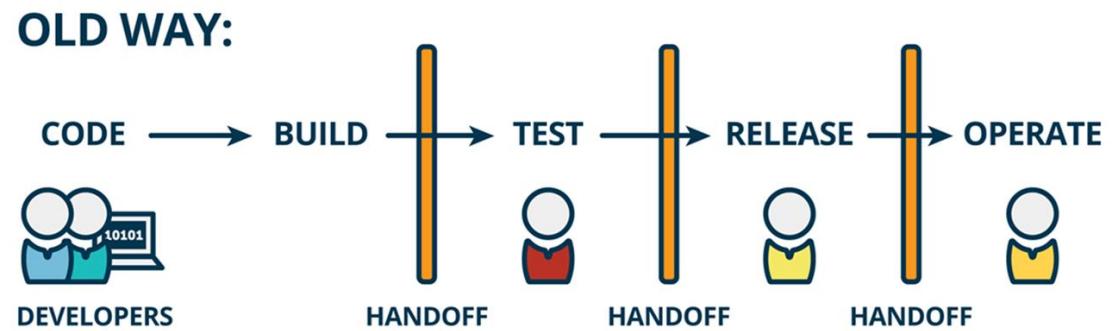
Agile Scrum Framework

Inputs from Executives,
Team, Stakeholders,
Customers, Users



Wir müssen „Agile“ werden und das ganze skalieren...

Scaled Agile Framework 4.0



A Globally Distributed Team

Product Development,
Architecture,
Business Analysis,
Operations

United
States

Architecture,
Application Development

Dominican
Republic

Quality Assurance,
Testing

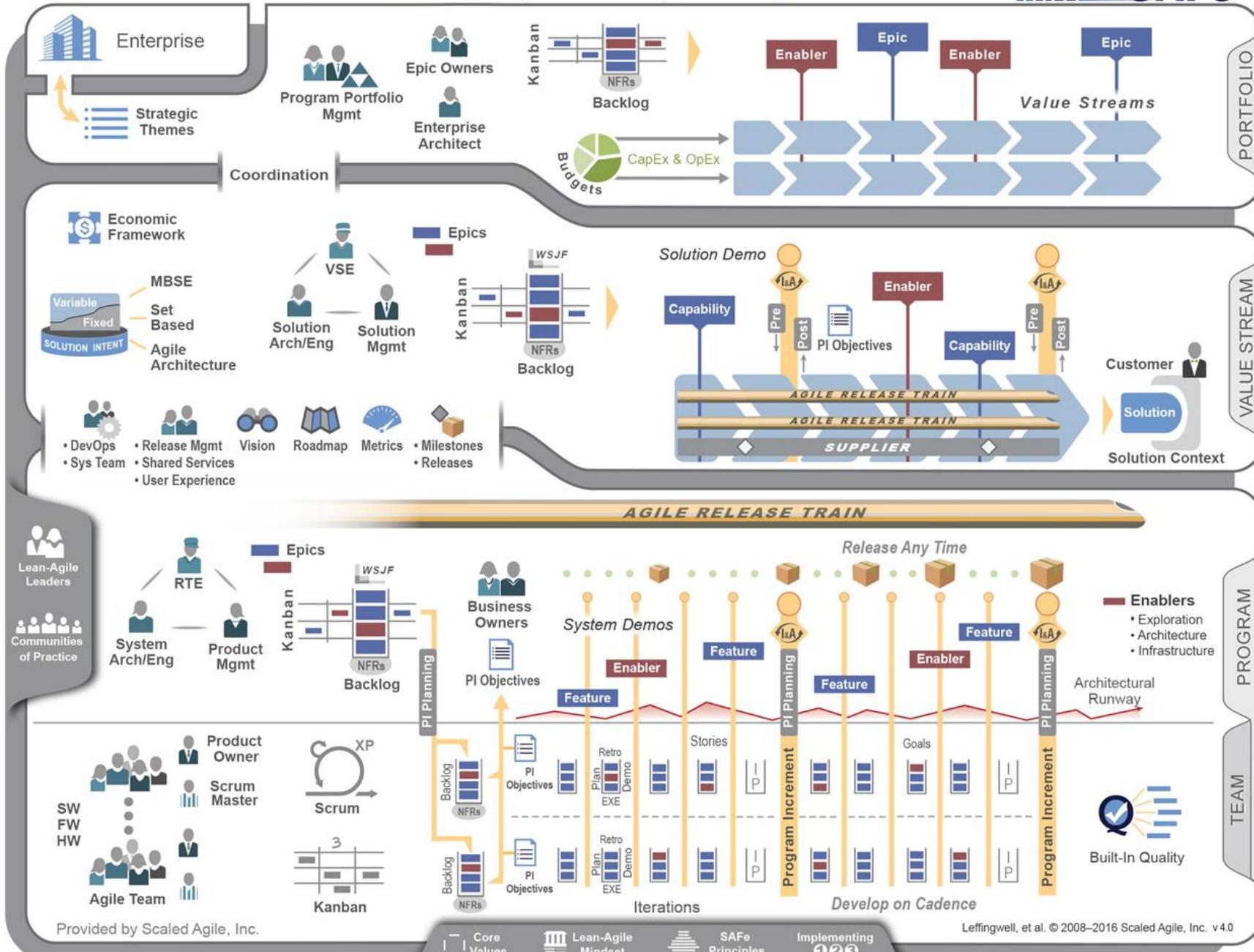
Peru

Application Development

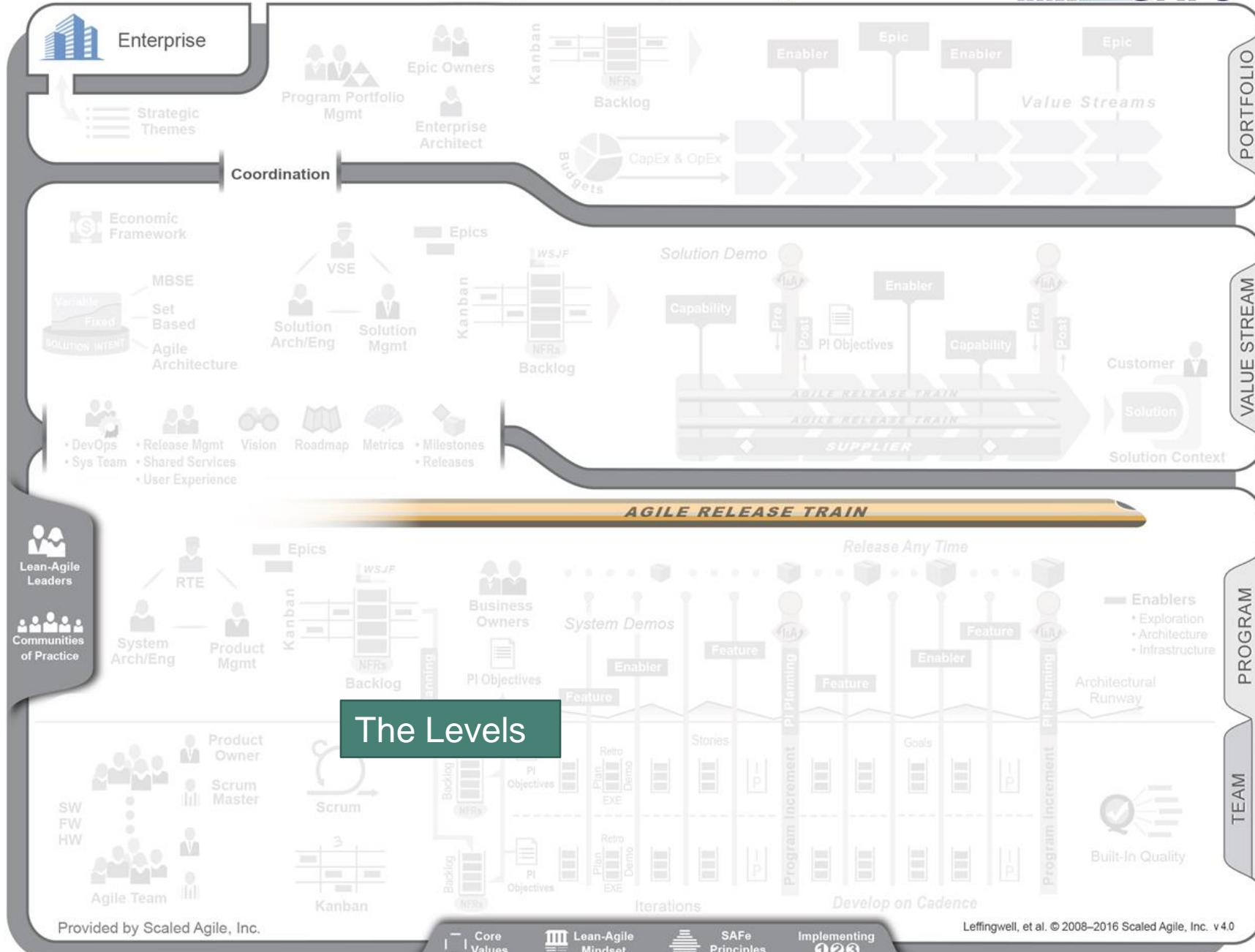
Architecture,
Application Development

India

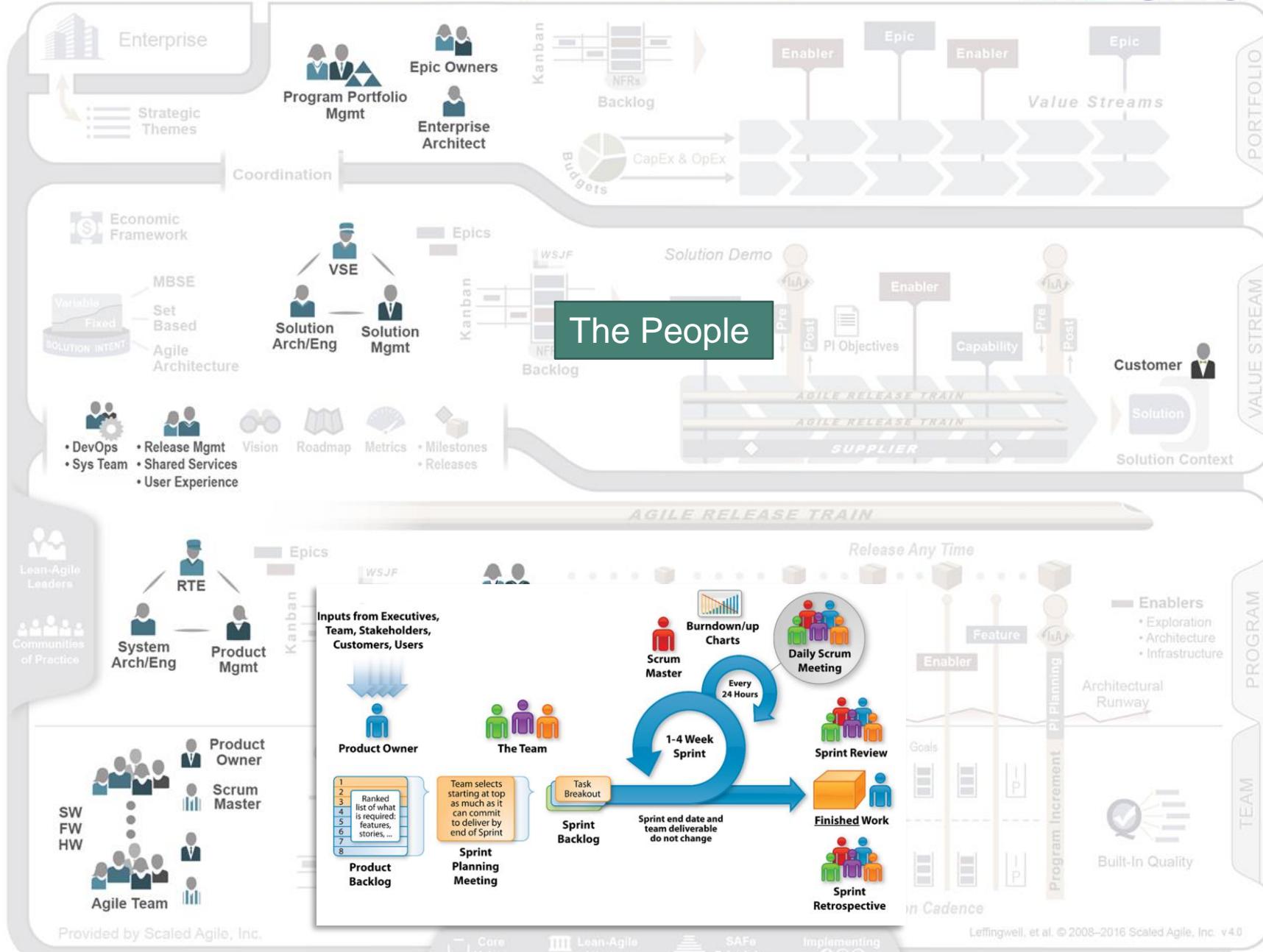
SAFe® 4.0 for Lean Software and Systems Engineering

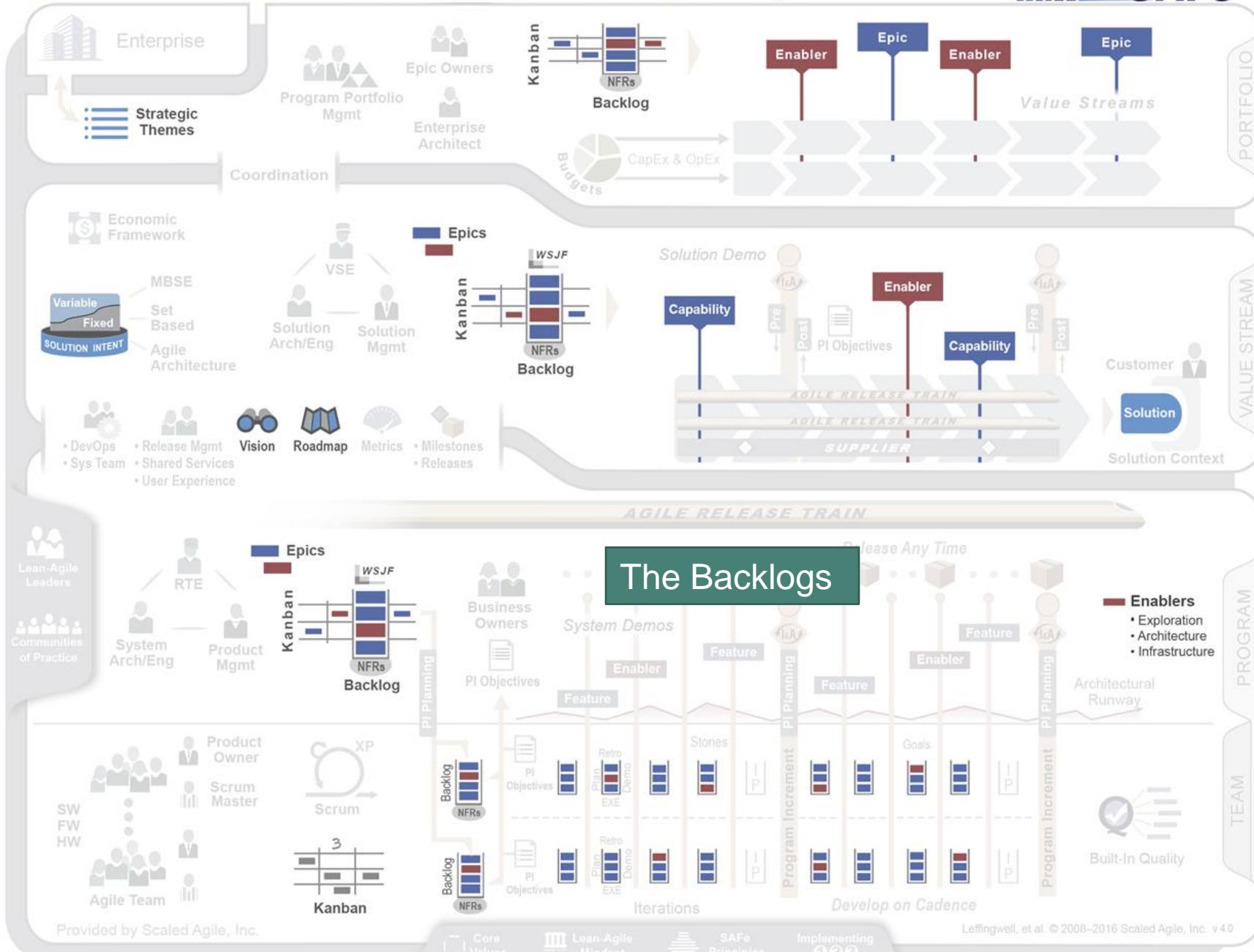


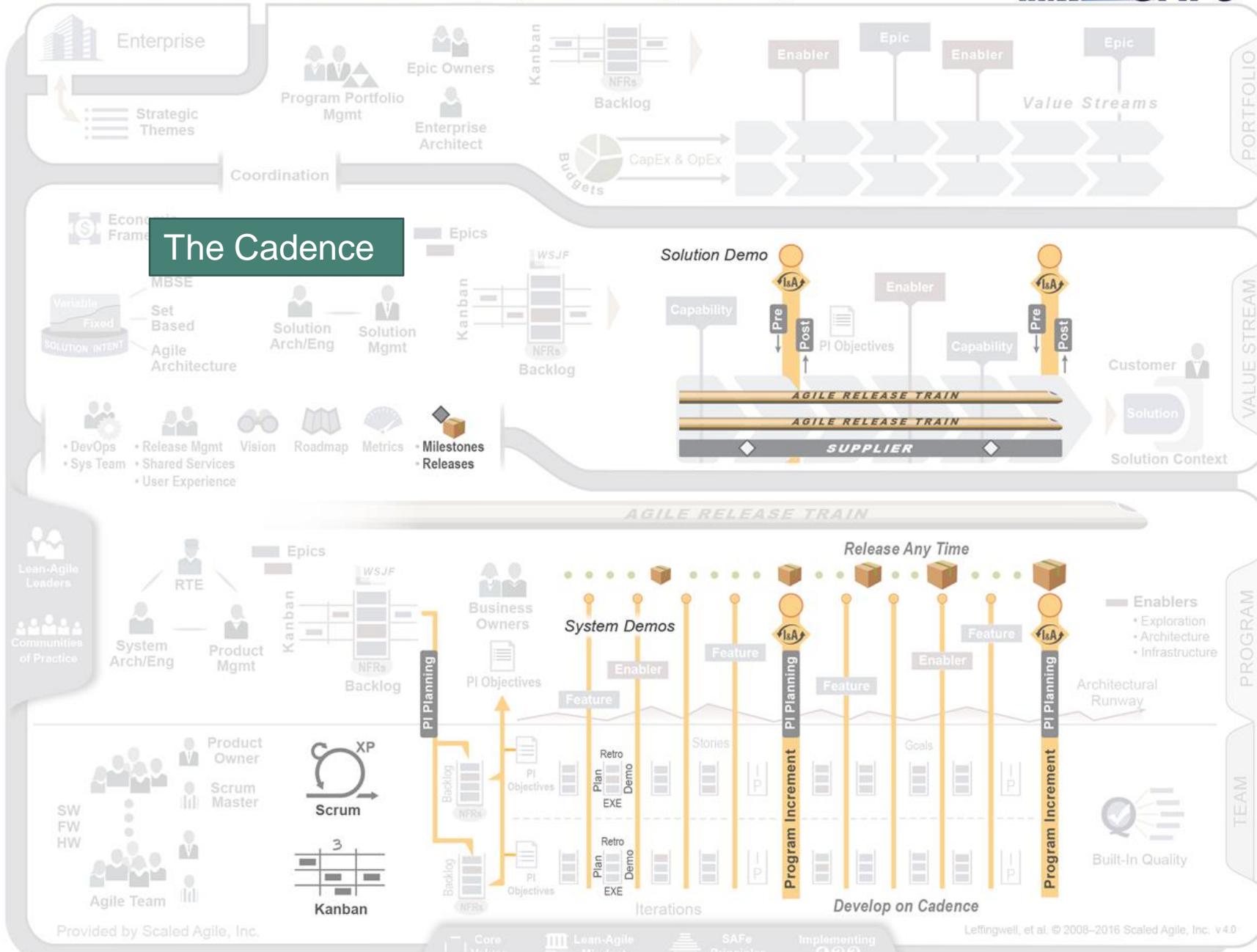
Provided by Scaled Agile, Inc.



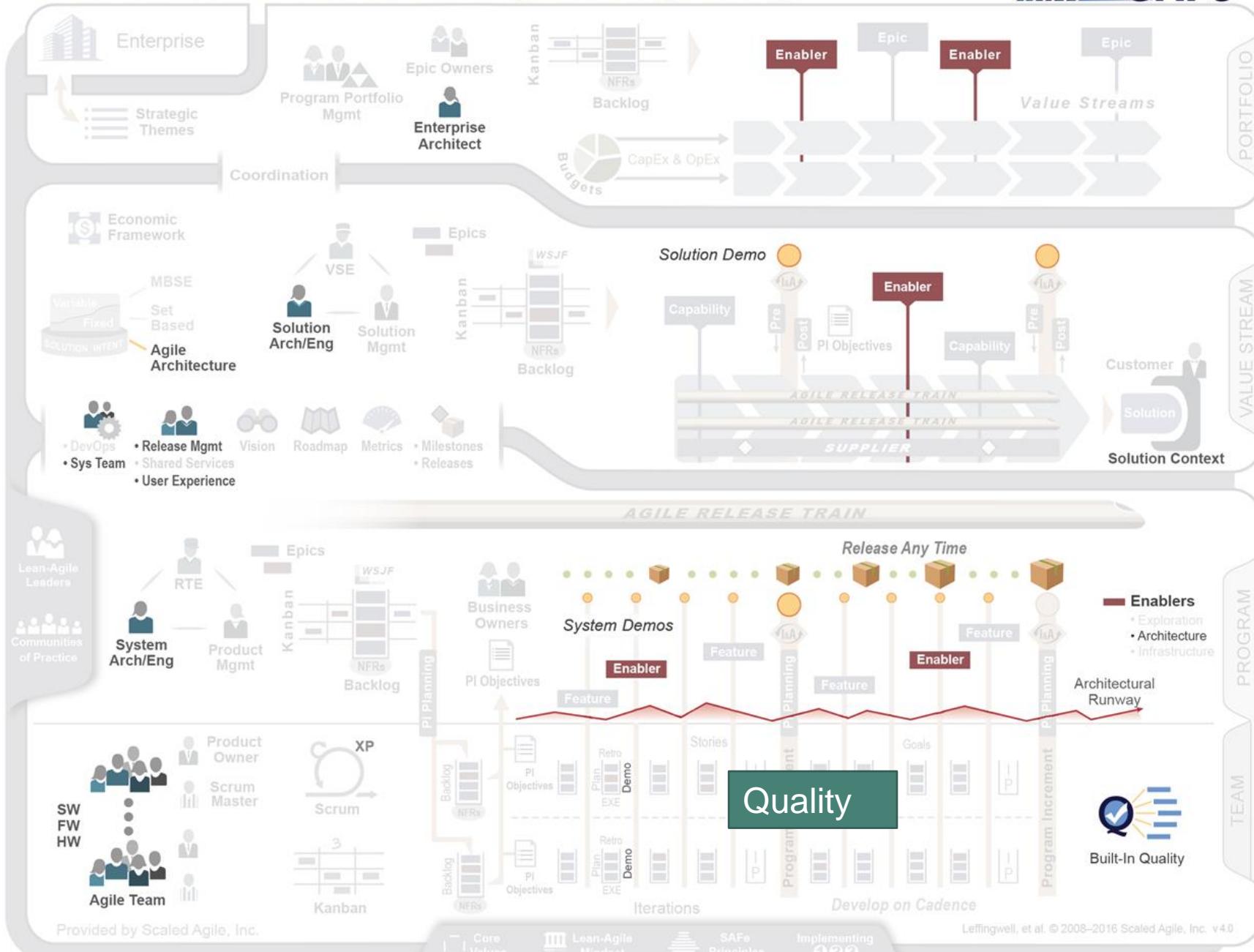
SAFe® 4.0 for Lean Software and Systems Engineering

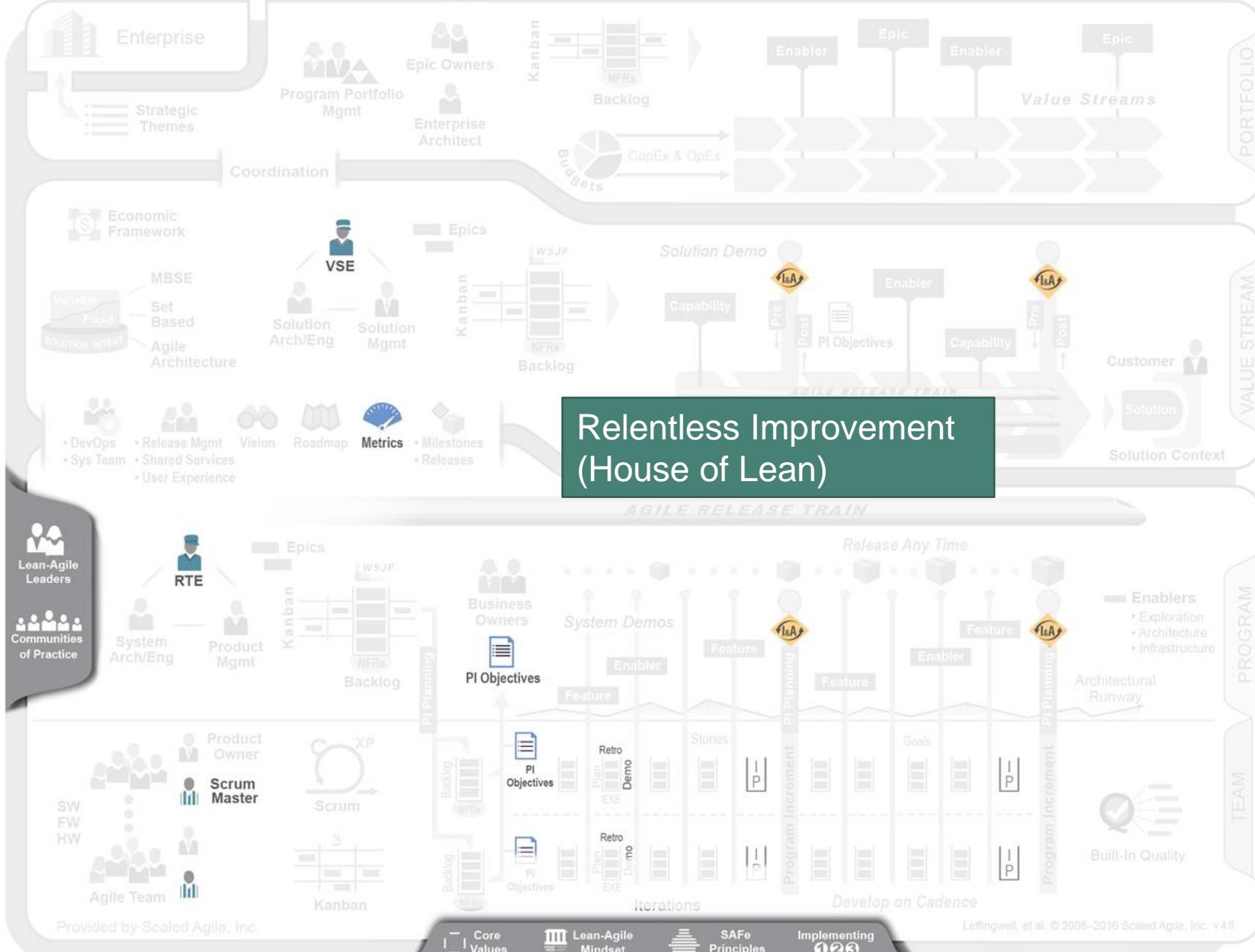




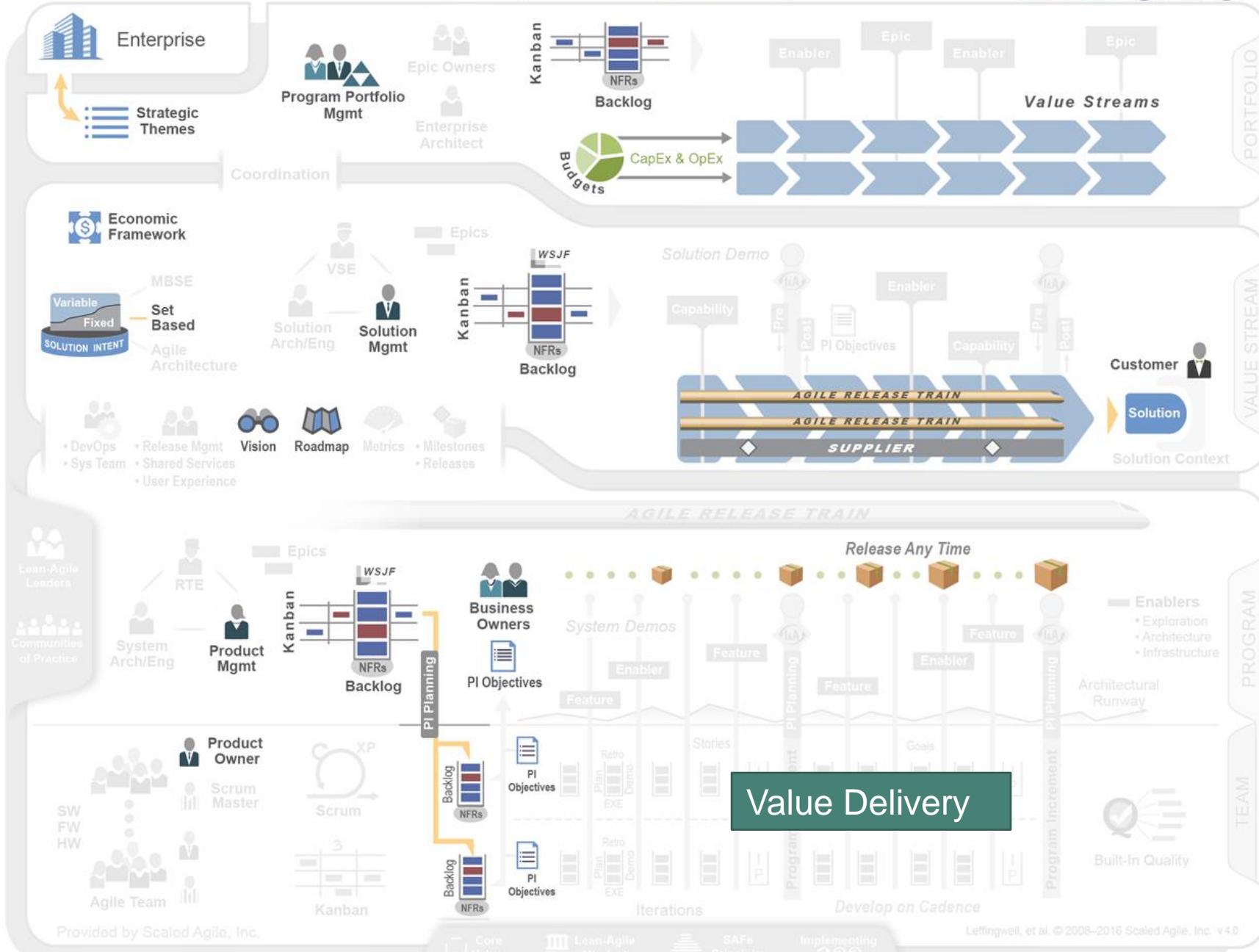


SAFe® 4.0 for Lean Software and Systems Engineering

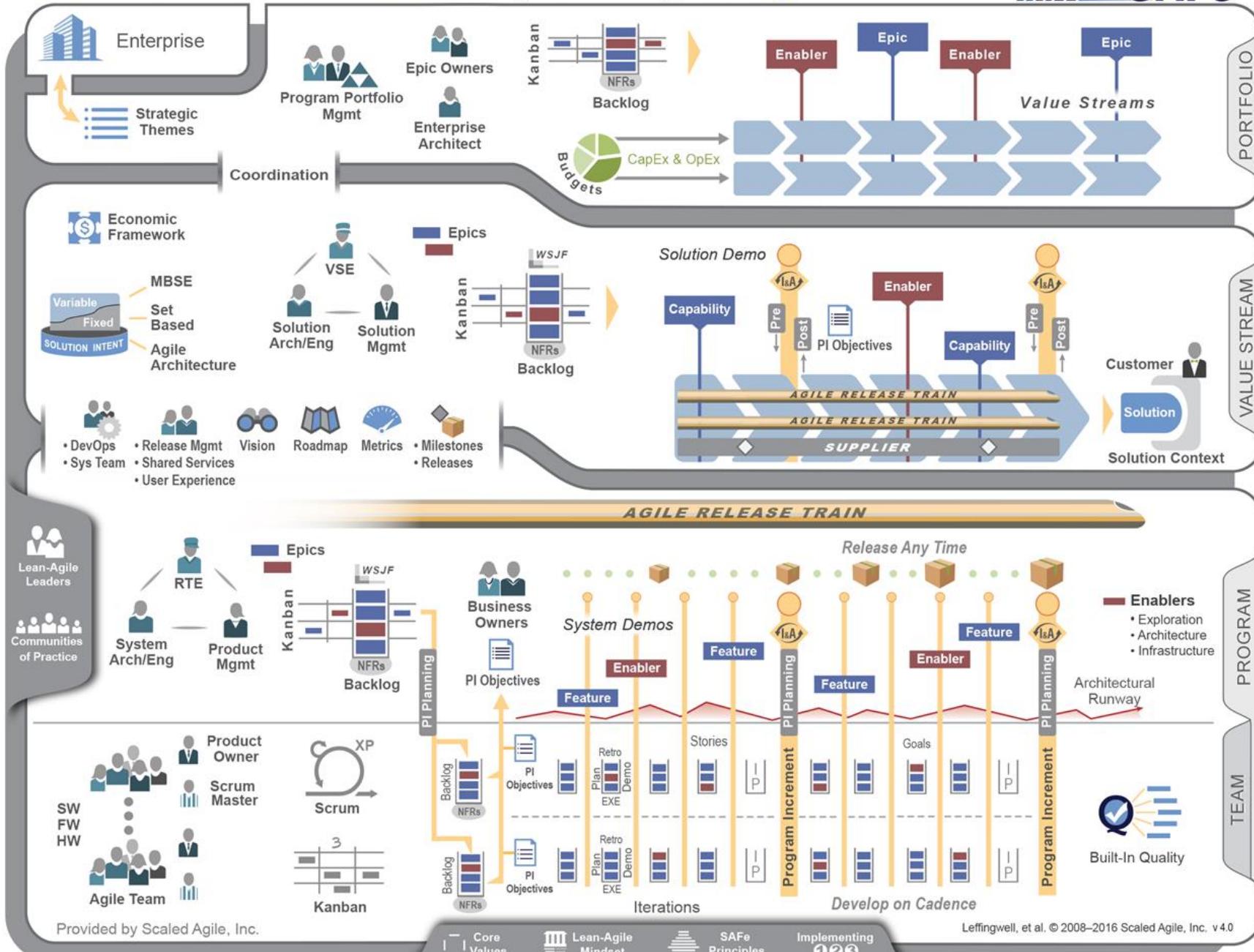




SAFe® 4.0 for Lean Software and Systems Engineering

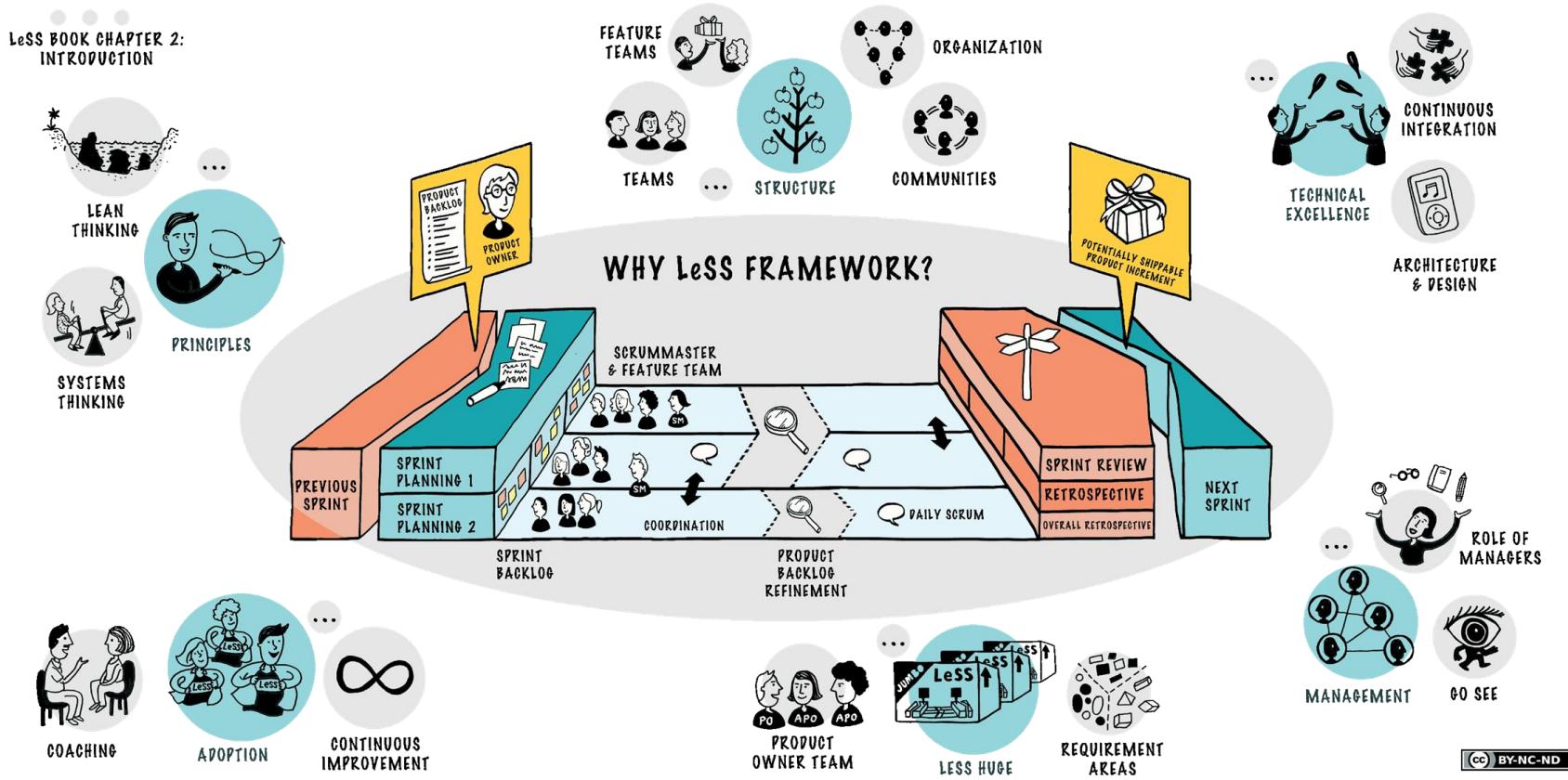


SAFe® 4.0 for Lean Software and Systems Engineering



Provided by Scaled Agile, Inc.

Doing More with LeSS?



Regardless of the Framework- It's People who make it work.

What can we learn from
Empirical Software
Engineering?

CONWAY'S LAW

*"Any organization
that designs a
system will
inevitably produce a
design whose
structure is a copy of
the organization's
communication
structure."*

*Melvin E. Conway,
1967*



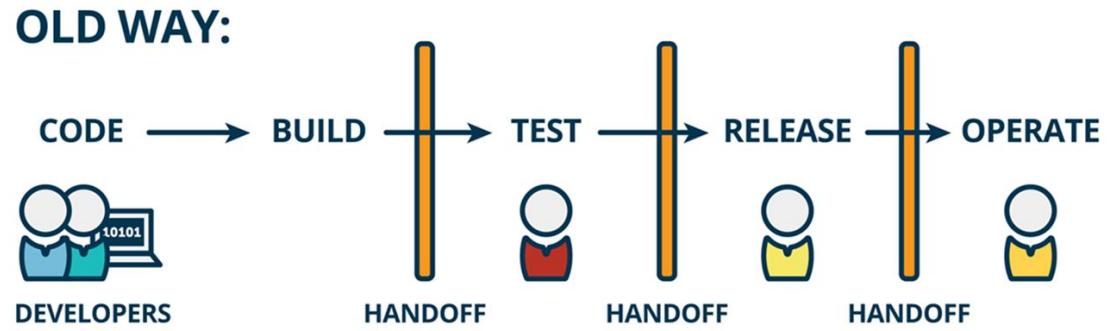
Microsoft Research and others that analyzed global development teams found (among many other defective behavior patterns in globally distributed teams), that **organizational structure impacts software quality**.

They backtrack this fact to Conway's law, which can also be stated as: ***"the longer the reporting lines of development teams, testers, and other stakeholders, the poorer the software quality these teams produce."****

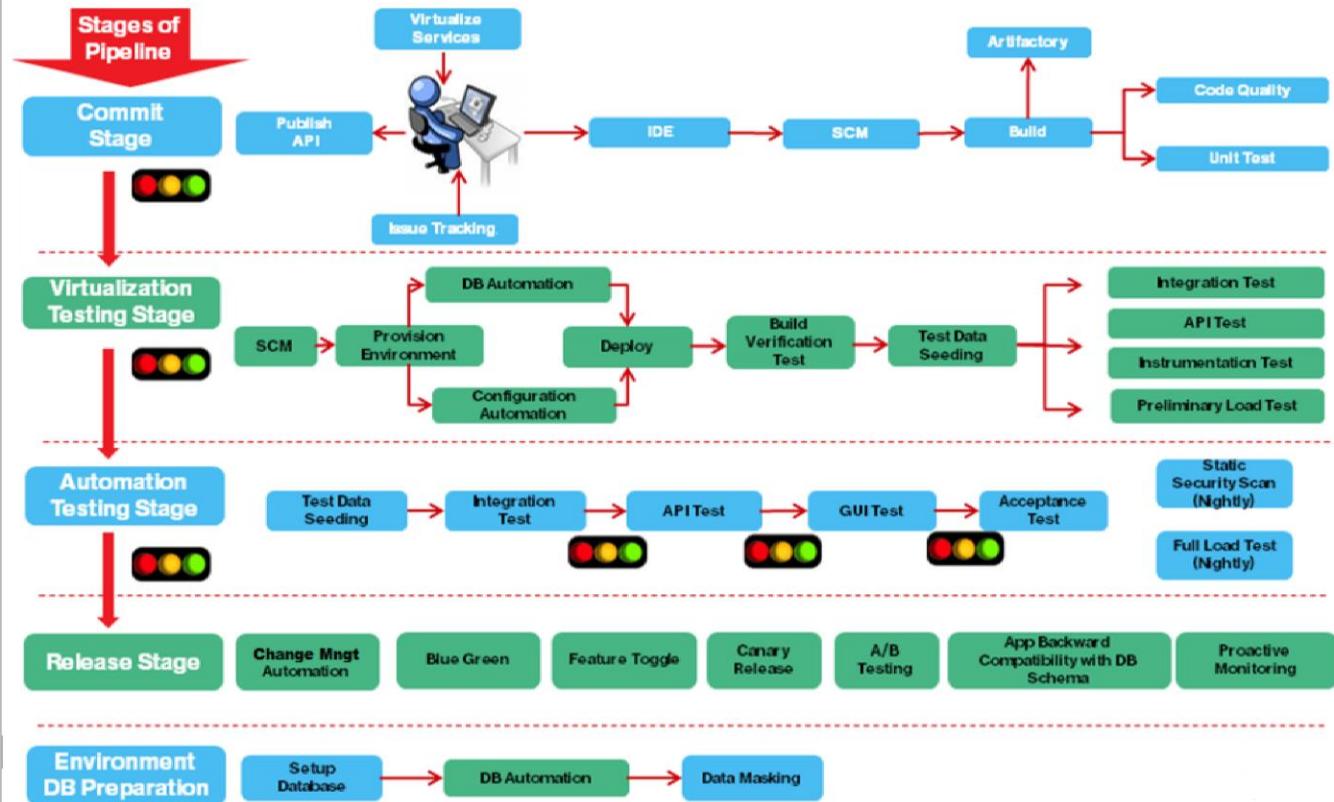
*The Influence of Organizational Structure on Software Quality, Nachiappan Nagappan, Brendan Murphy, Victor Basili, International Conference on Software Engineering (ICSE 2008), Leipzig, Germany. <http://research.microsoft.com/apps/pubs/default.aspx?id=70535>

Dev, QA und Ops müssen zusammenwachsen...

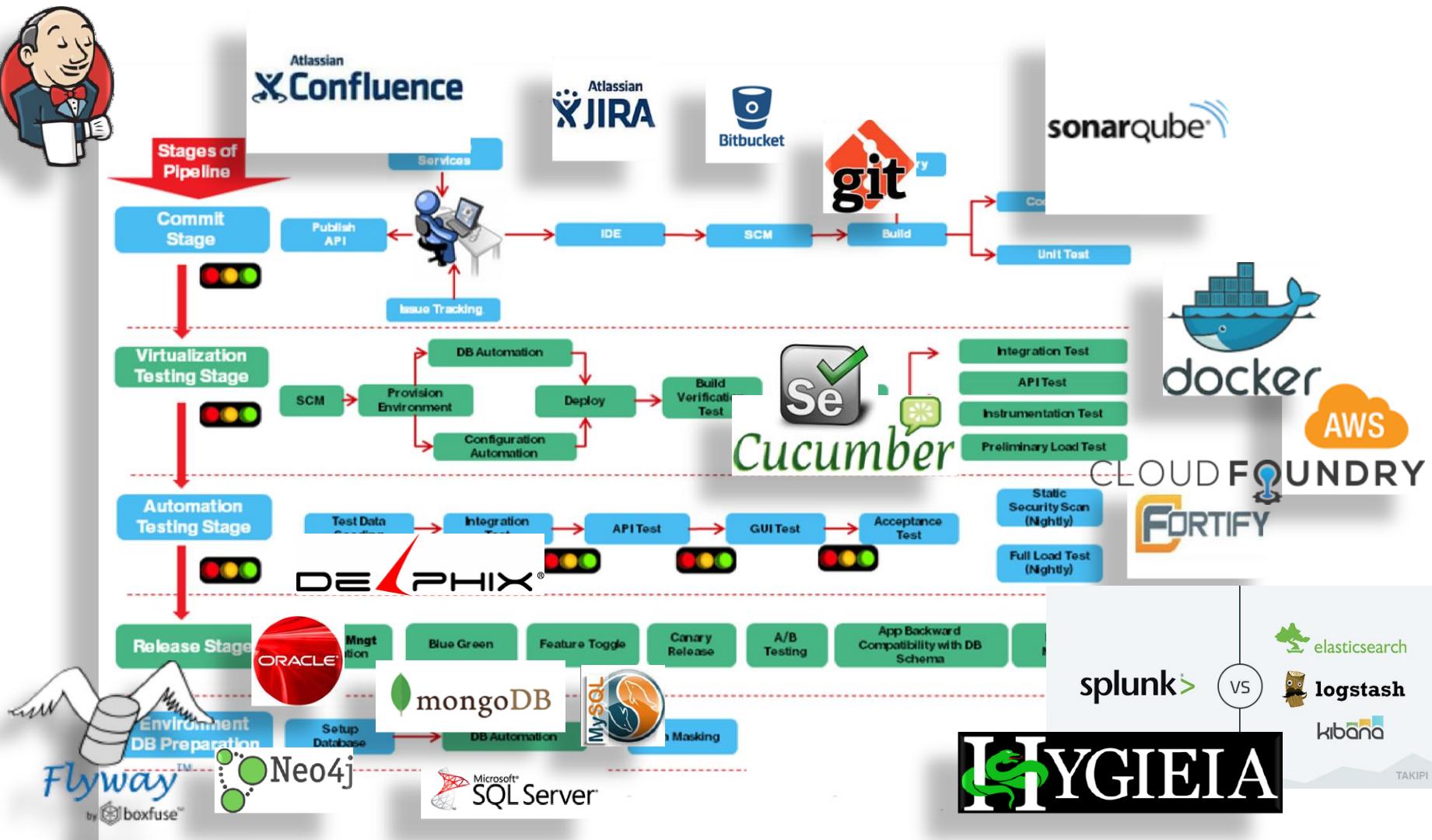
Welcome to DevOps...



DevOps Delivery Pipeline



DevOps Delivery Pipeline Tools (sample)



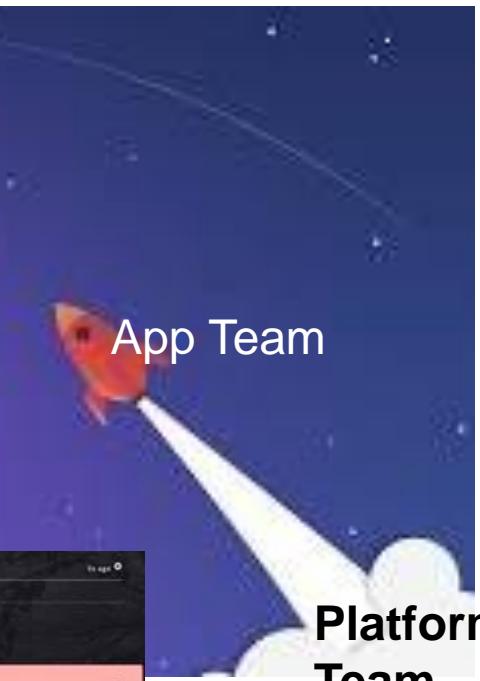
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The DevOps Cup 2016 Mission:

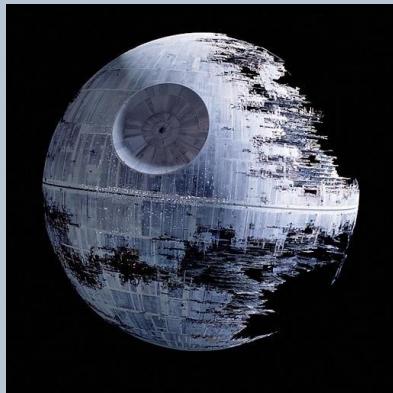
Platform teams create the velocity to put the Application teams to the moon (and beyond)...

Application & Platform teams must work together on our common goal:

Excellence in DevOps



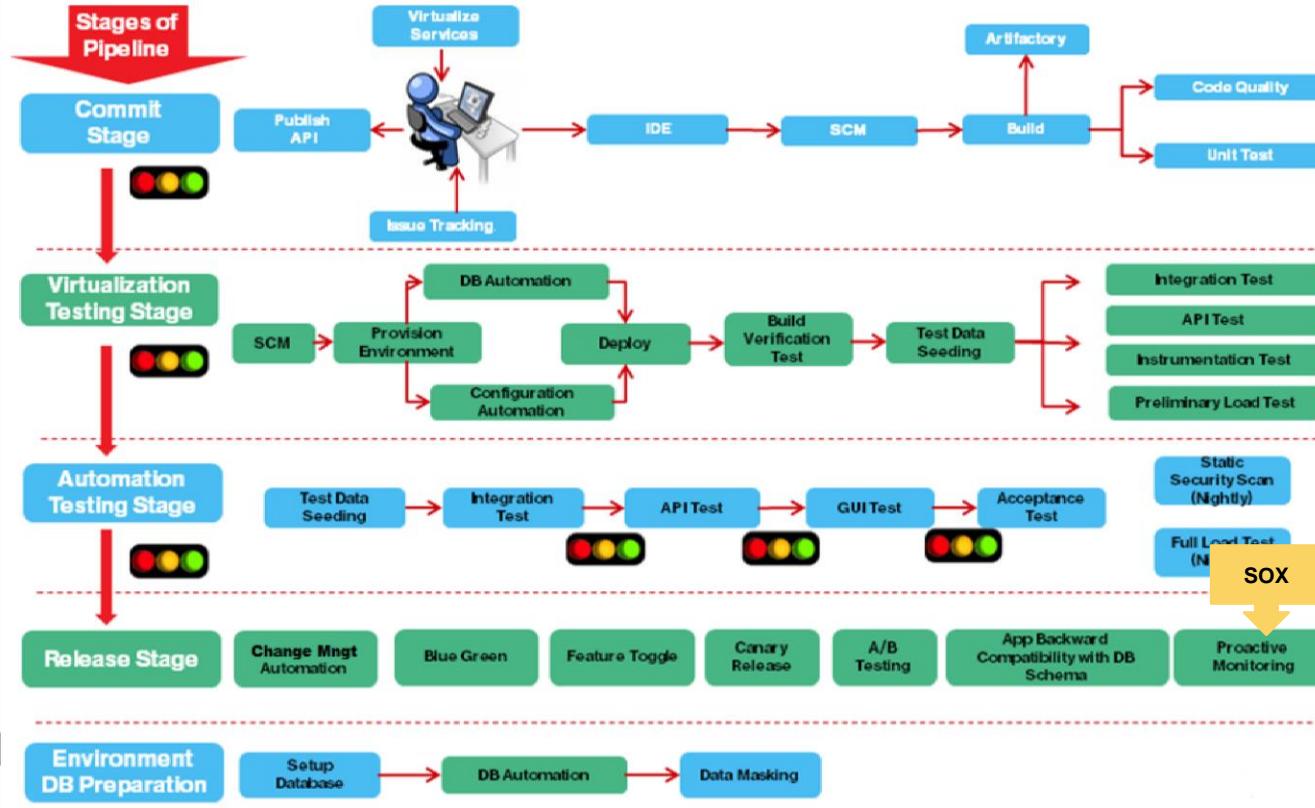
Digitizing Compliance



~~Episode I, July 27th~~
~~Episode II, August 1st~~
~~Episode III, August 29th~~
~~Episode IV, September 8th~~
~~Episode V, November 29th~~

Sarbanes Oxley (SOX).
California Senate Bill 1386 (SB 1386).
Gramm-Leach Bliley Act (GLBA).
Health Insurance Portability and Accountability Act (HIPAA).
Health Information Technology for Economic and Clinical Health Act (HITECH).
Payment Card Industry Data Security Standard (PCI-DSS).
Payment Application Data Security Standard (PA-DSS).
Massachusetts Data Protection Law.
Federal Information Security Modernization Act (FISMA).
CPI-810 Information Security Controls.
CPNI (Customer Proprietary Network Information).
Global offshore clearance.
GSAM (Global Sensitive Account Management).
User access reviews.

Shift left: Add tests for compliance during build!





W. Edwards Deming – Inventor of Design Thinking

“Eliminate the need for inspection on a mass basis by building quality into the product in the first place.”

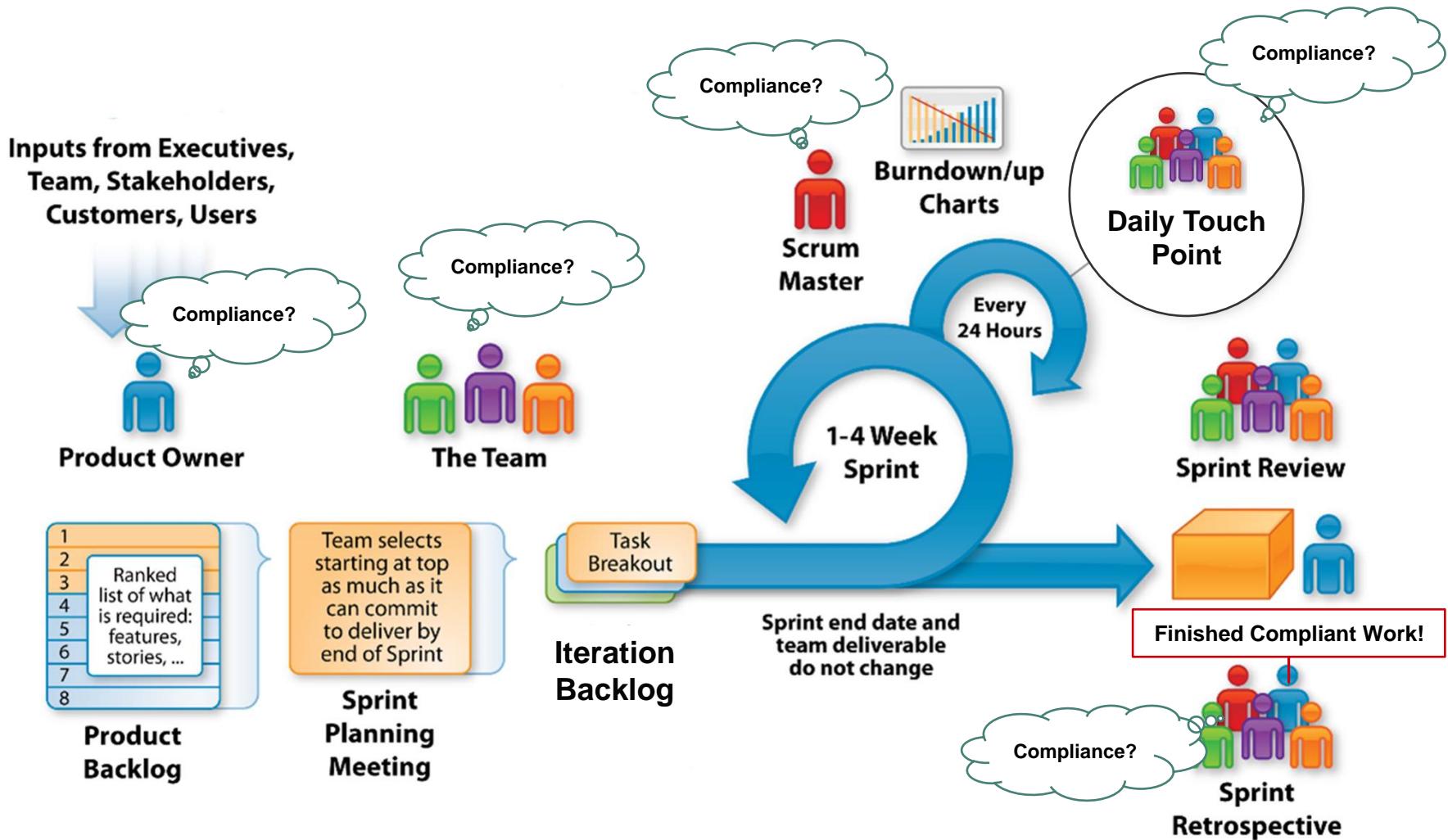
W. Edwards Deming, “Fourteen Points for the Transformation of Management”



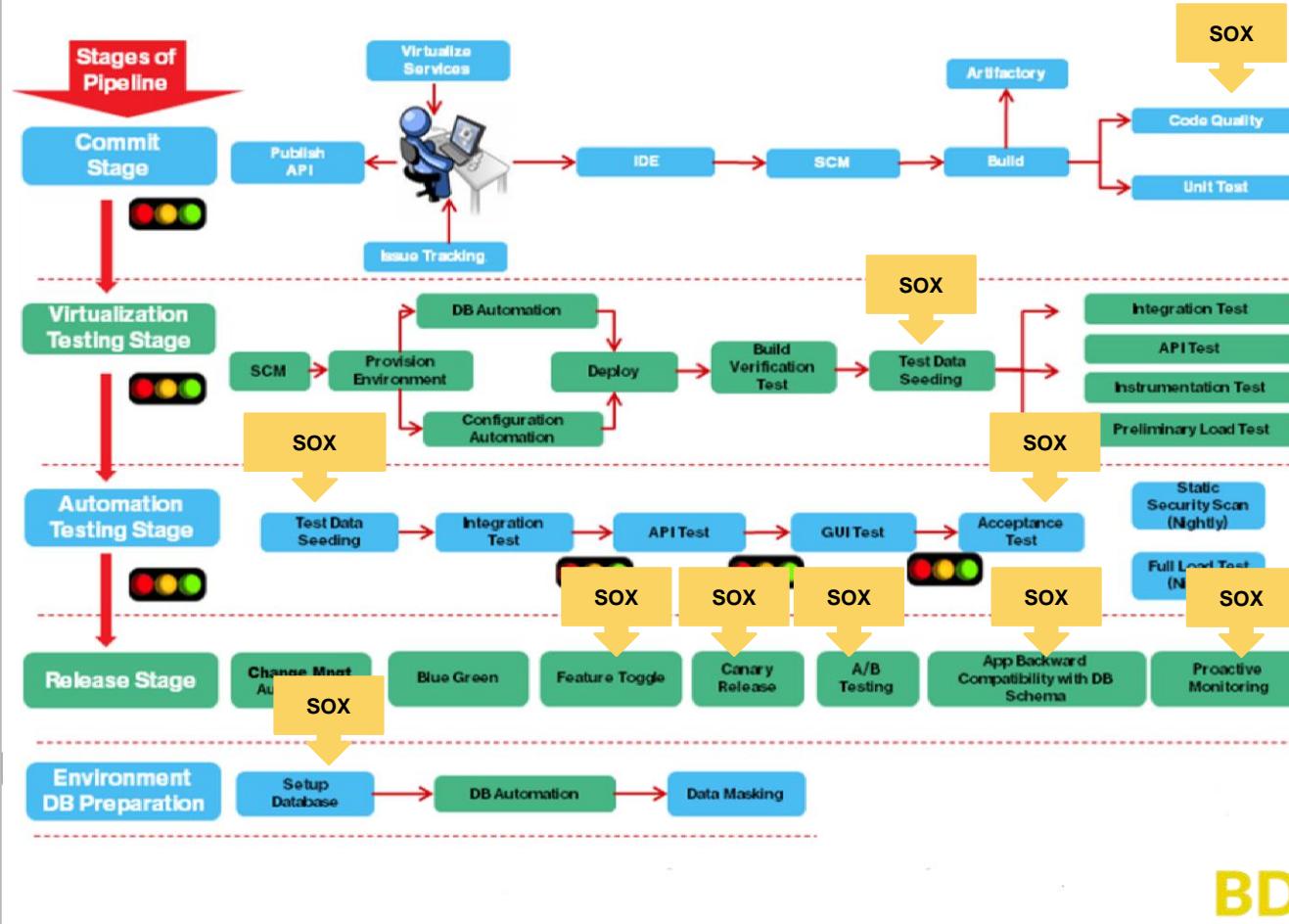
In this model, developers work with security, compliance and testing experts to design and deliver work in **small batches** throughout the product lifecycle.

This idea is also known as **shifting left**.

Fail compliance in development, rather than production.



Shift left: Add tests for compliance during build



BDD-Security

Gamification

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Are you a TECH SAVVY MAVERICK...

who is eager to take on **new** challenges in delivering the Next-Gen customer experience, work on **new** programs that make a difference, explore **new** technologies, and collaborate with **new** people across VES IT ?



We've been
Looking for you!

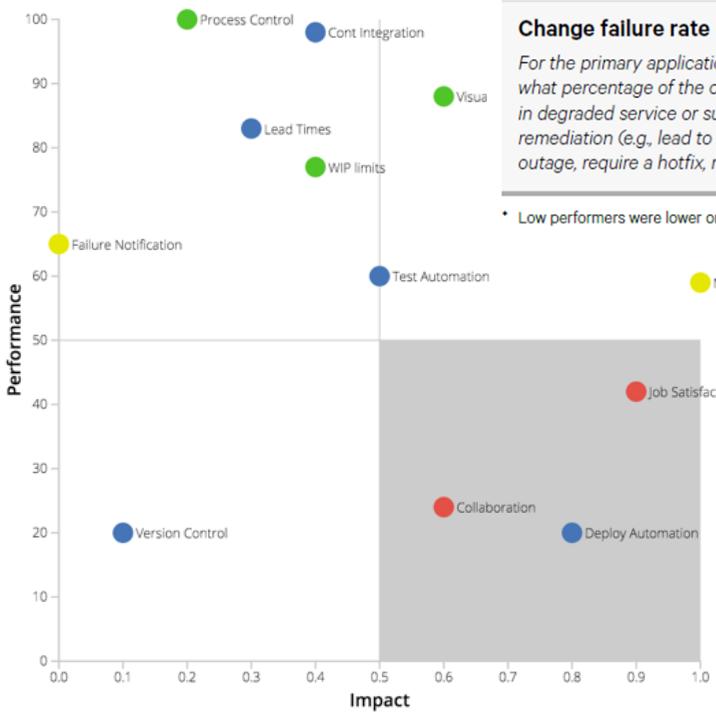


Stay Tuned!

More details on the event and registration to follow on **Oct 25.**

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Wo sind wir auf der DevOps Scorecard?



2016 IT Performance by Cluster

High IT Performers

Deployment frequency

For the primary application or service you work on, how often does your organization deploy code?

On demand
(multiple deploys per day)

Lead time for changes

For the primary application or service you work on, what is your lead time for changes (i.e., how long does it take to go from code commit to code successfully running in production)?

Less than one hour

Mean time to recover (MTTR)

For the primary application or service you work on, how long does it generally take to restore service when a service incident occurs (e.g., unplanned outage, service impairment)?

Less than one hour

Change failure rate

For the primary application or service you work on, what percentage of the changes either result in degraded service or subsequently require remediation (e.g., lead to service impairment, service outage, require a hotfix, rollback, fix forward, patch)?

0-15%

31-45%

16-30%

* Low performers were lower on average (at a statistically significant level).

Feedback loops

Management practices

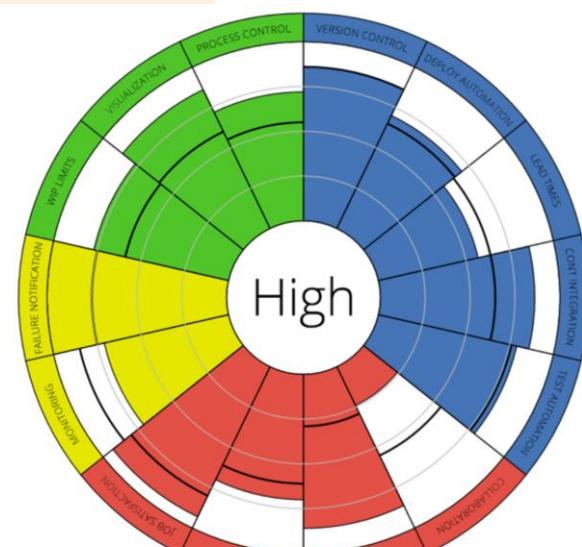
High IT Performers

Medium IT Performers

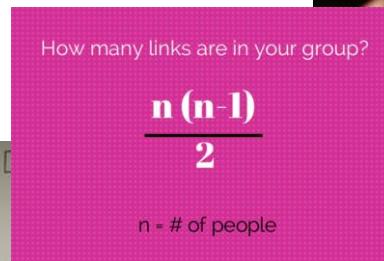
Low IT Performers

Technical practices

Culture



Agile @ IBM



The Agile Team Tool dashboard includes the following data:

Team	Velocity	Throughput	Deployment Requests
2 Pizza Rule - Oldad Team	~100	~150	~10
2 Pizza Rule - Current Team	~120	~180	~10

Deployment Requests by Team Size:

Team Size	Count
< 5 members	~10
5-12 members	~20
> 12 members	~10

+20%
Increase in
velocity

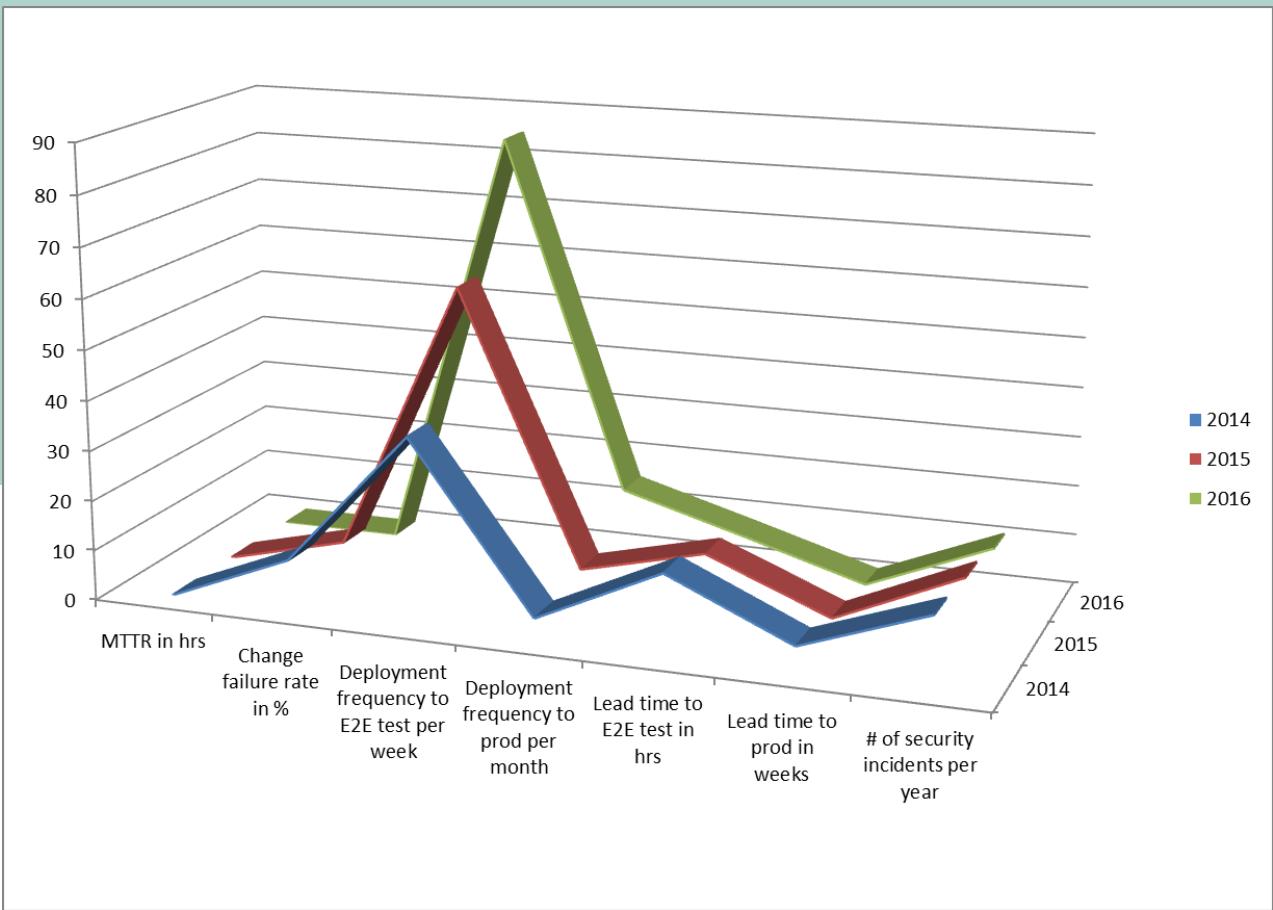
+70%
Faster problem
resolution

-55%
Fewer leaders

+40%
CSAT
improvement

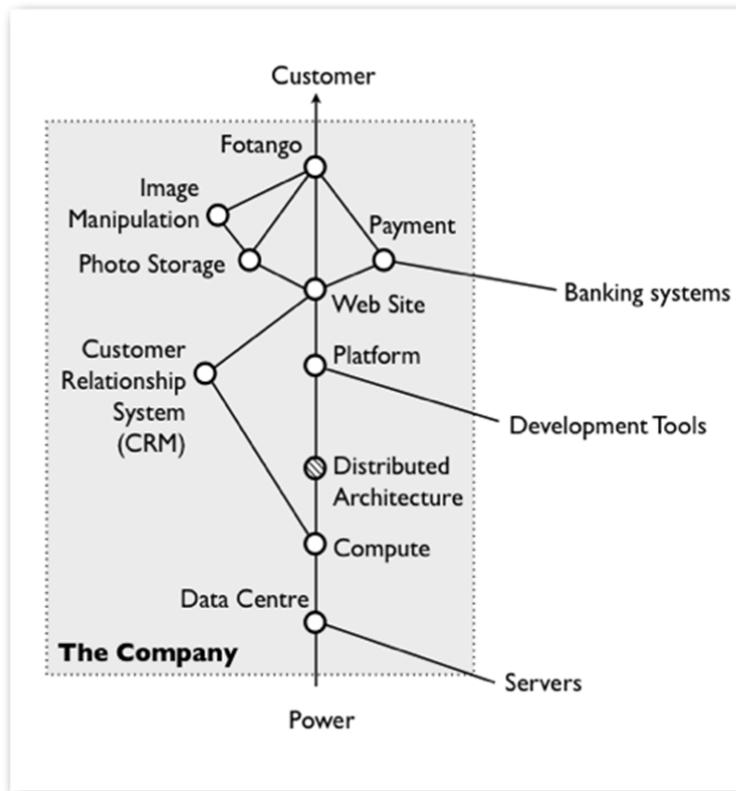
+10%
Employee
engagement

Die nächsten Schritte der Reise...

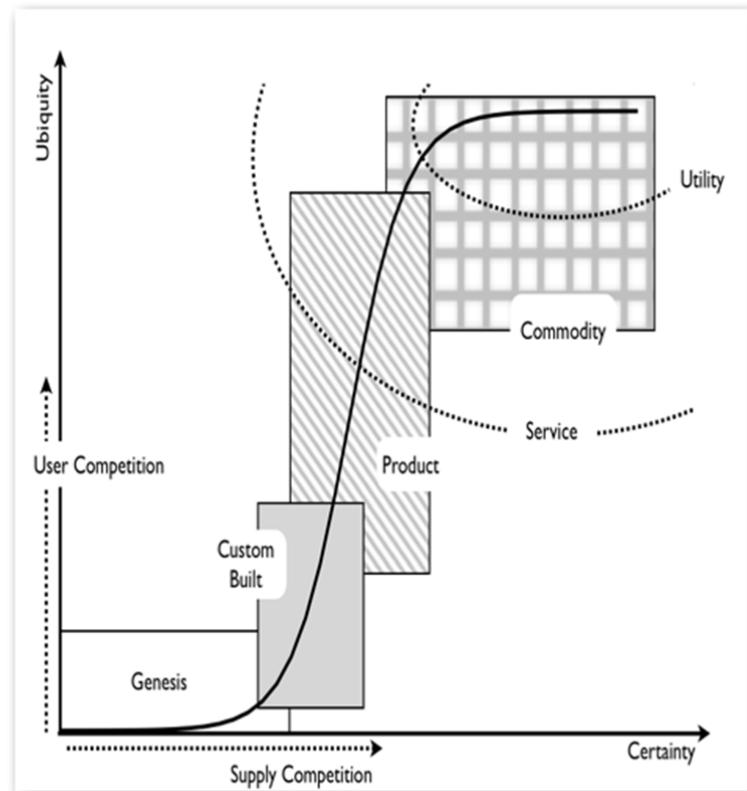


Wertschöpfungsketten und Firmen verändern sich!

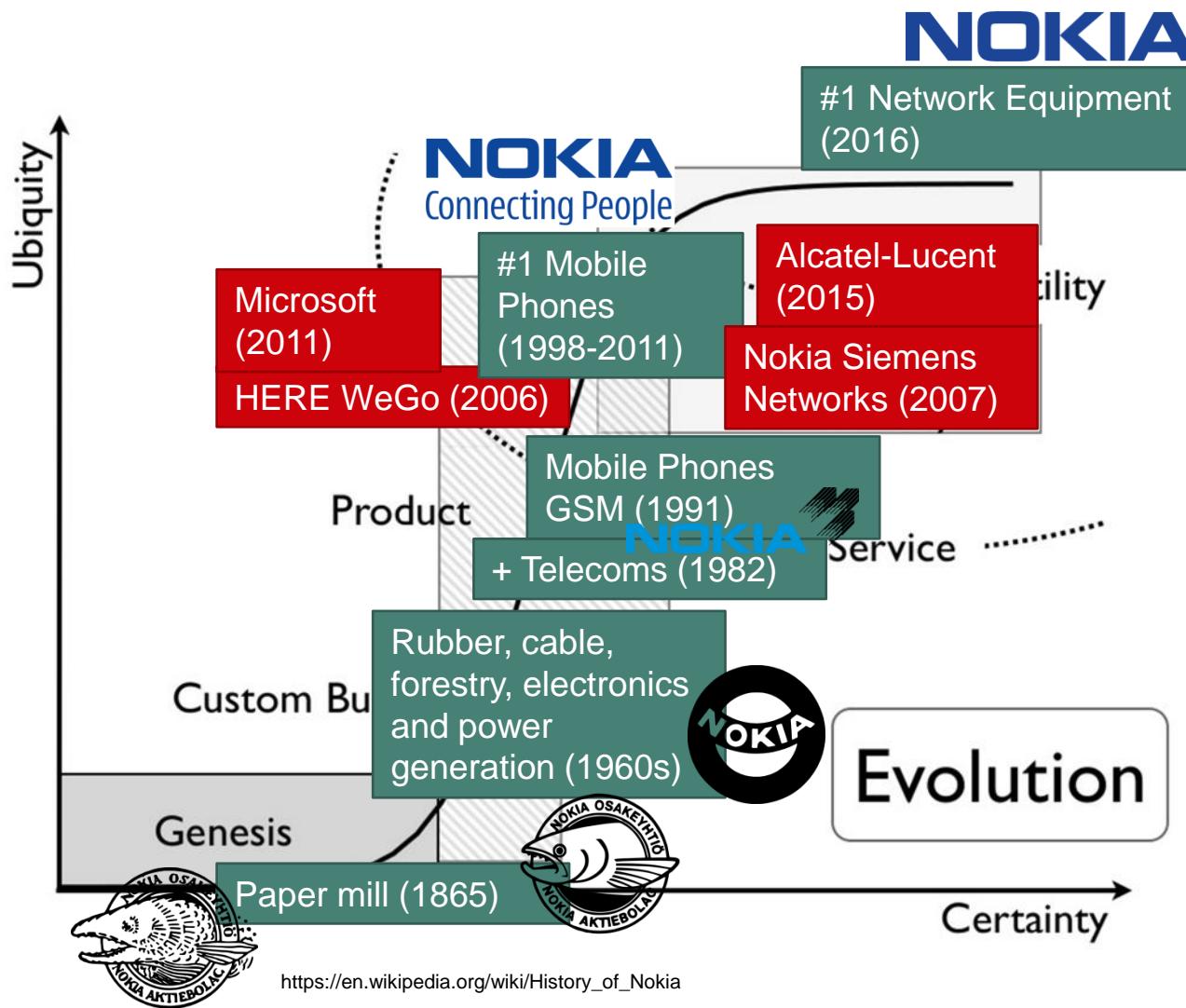
Value Chain (describes organisation)



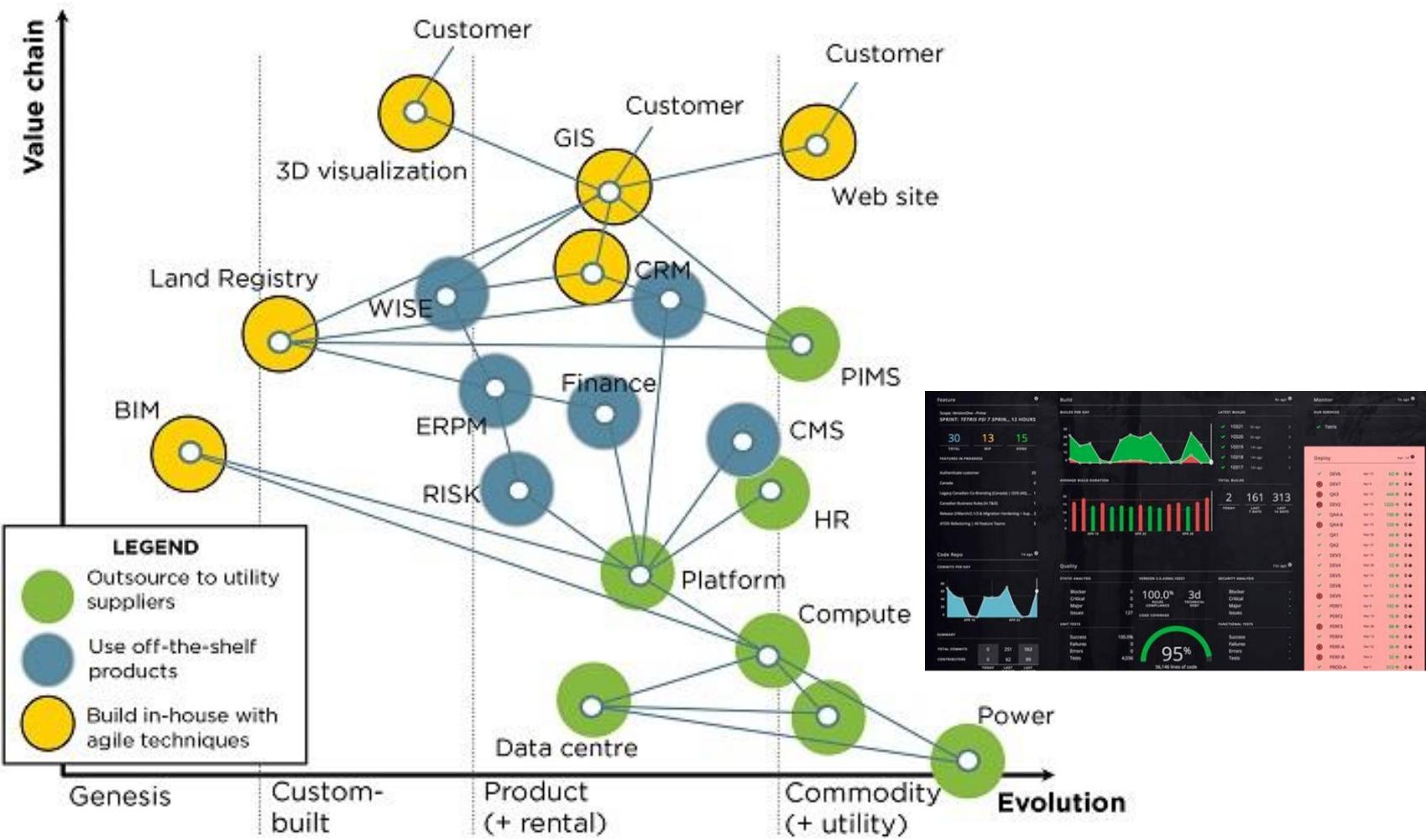
Evolution (describes change)



NOKIA (1865-2016)

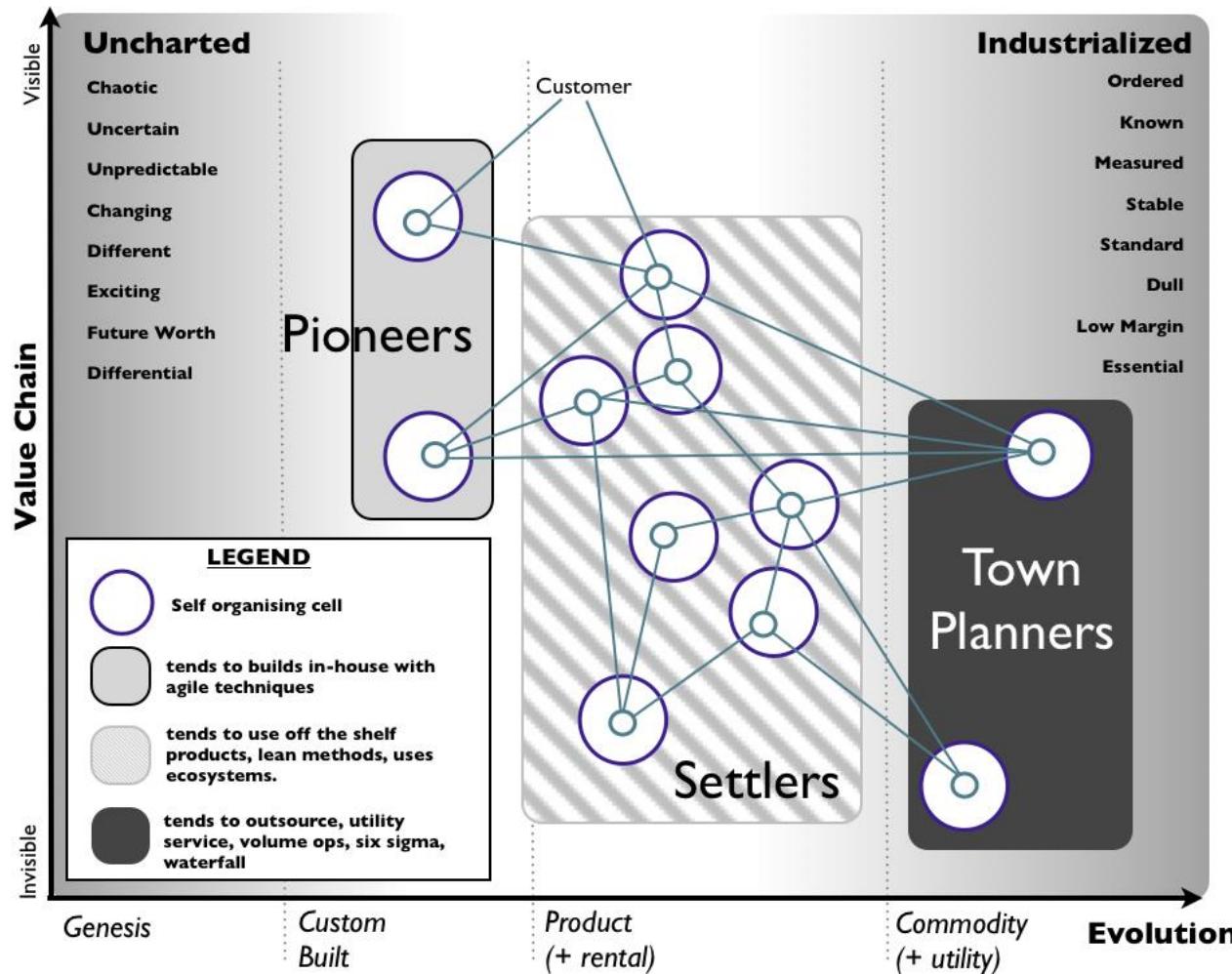


Wardley Maps und die IT Roadmap



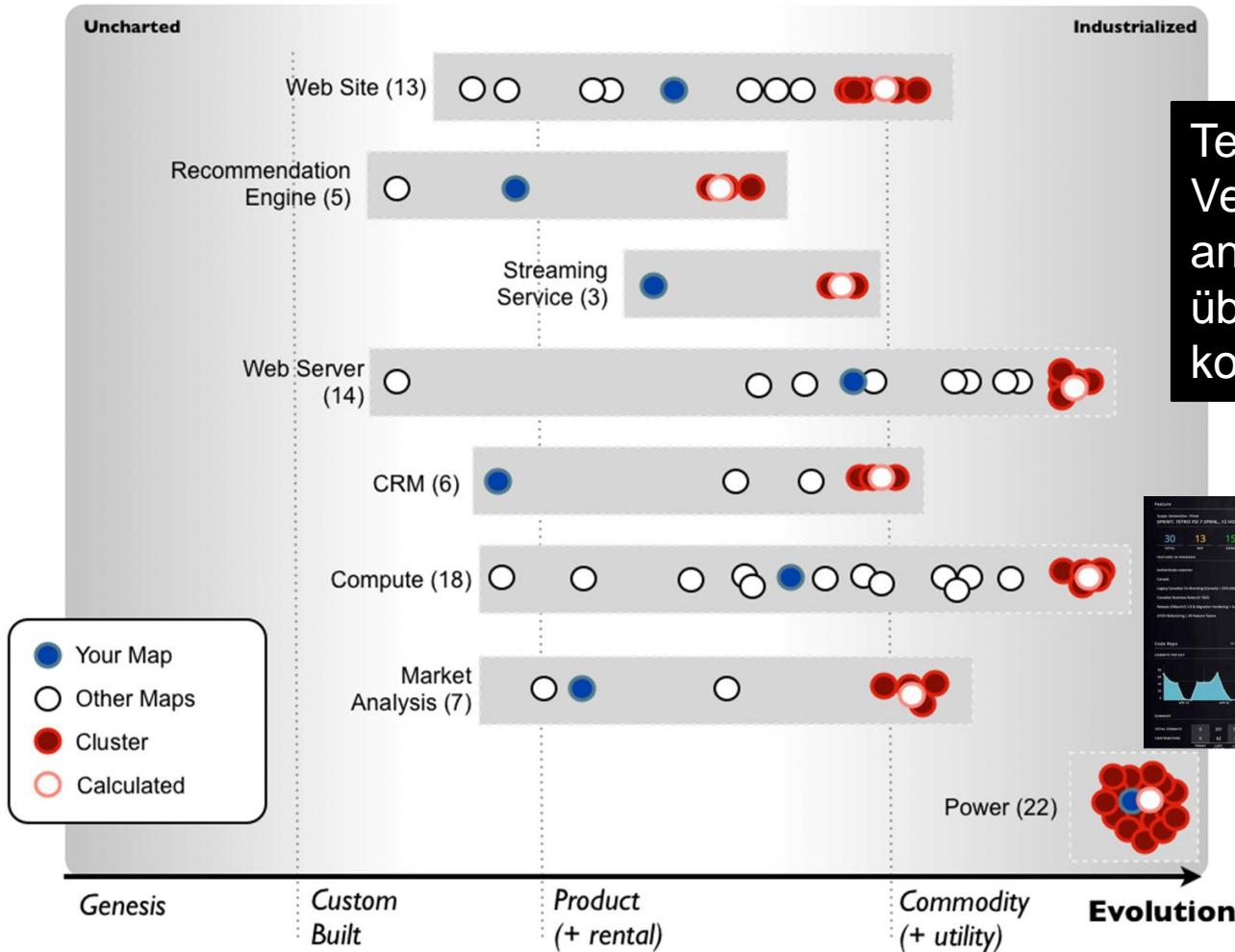
3 Mitarbeiter Archetypen: Pioniere, Siedler und Stadtplaner

Map courtesy of Simon Wardley (LEF) CC3.0 by SA. Content by Jörg Heitkötter (joke).



Wardley Maps und die IT Roadmap: System-Konsolidierung

Map courtesy of Simon Wardley (LEF) CC3.0 by SA. Content by Jörg Heitkötter (joke).

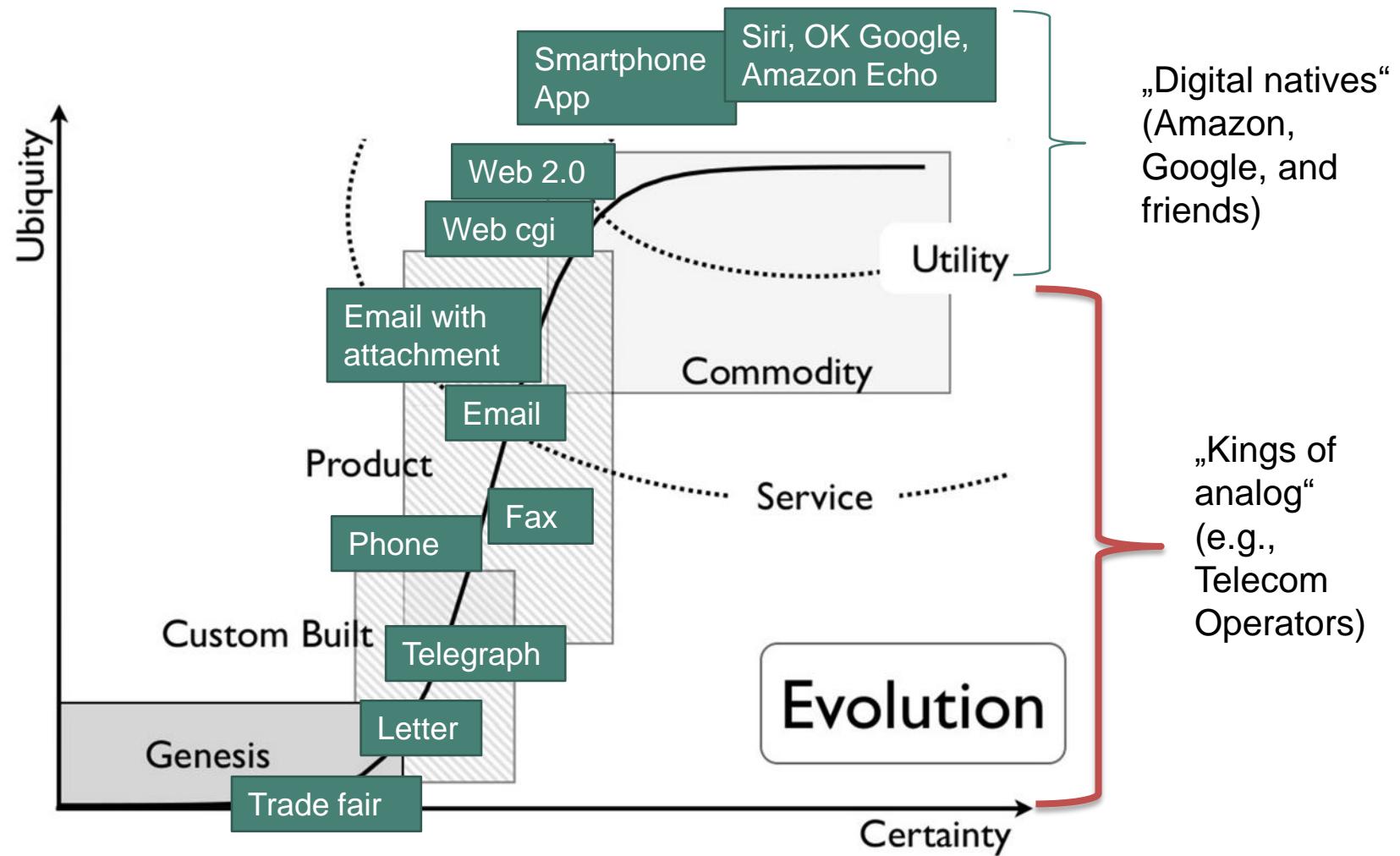


Teams mit hoher Velocity dürfen andere Systeme übernehmen und konsolidieren...



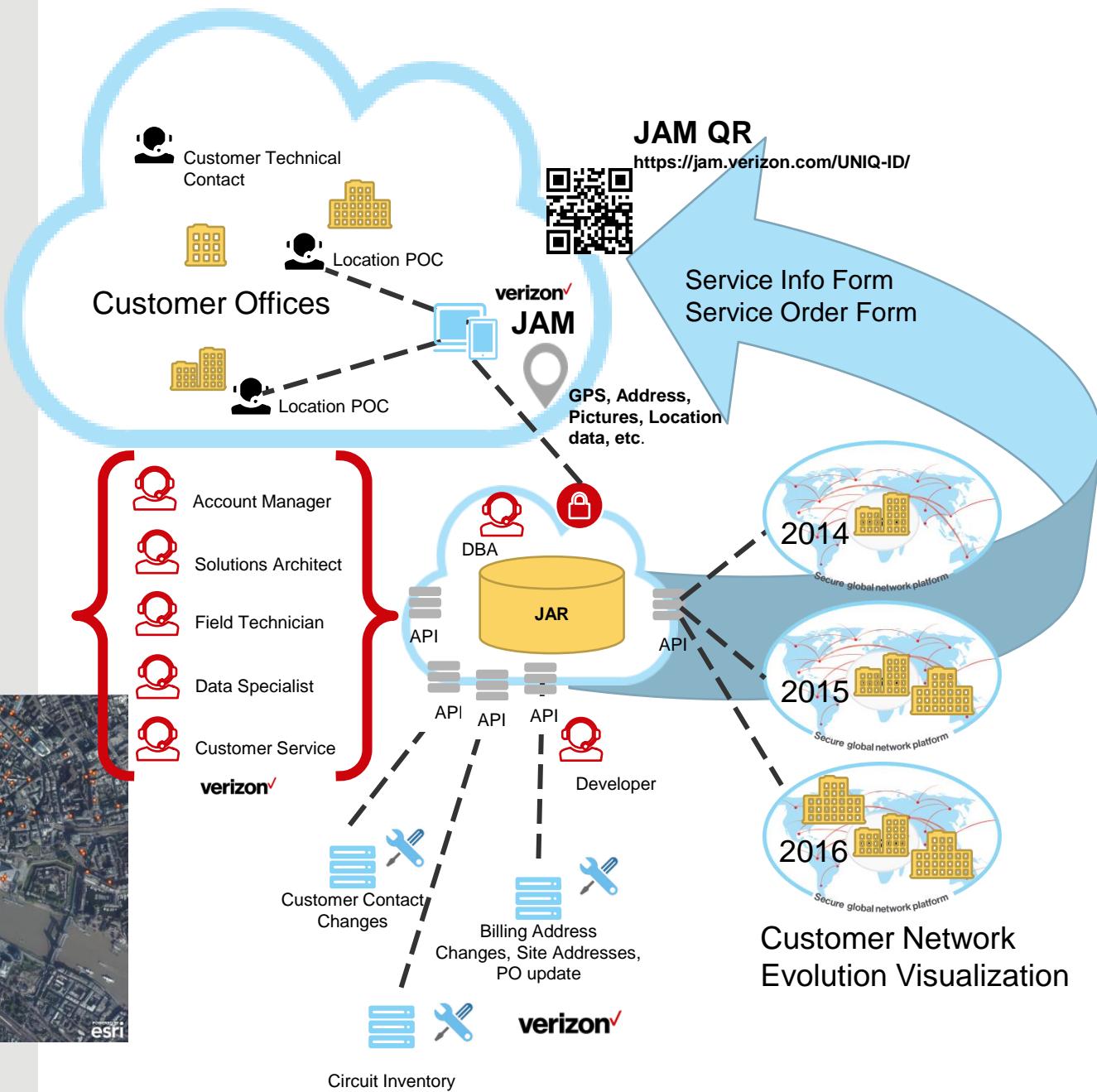
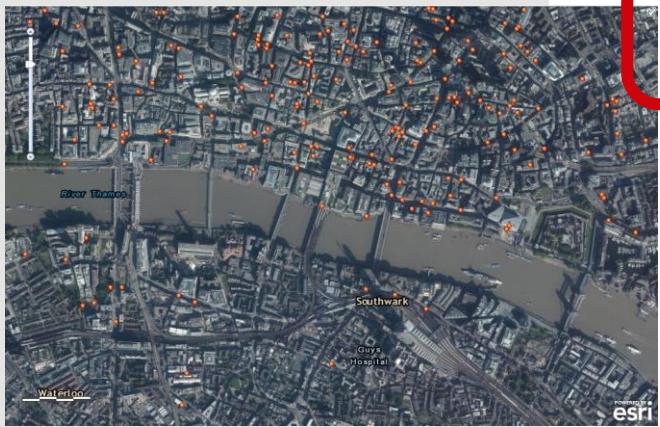
Thank you.

Wie kommen die Daten von Kunden in die IT Systeme ihres Unternehmens?



Hackathon: Customer Data Onboarding & Management

„Just JAM it into the JAR!“



Bringing
Verizon into
Minecraft.

<https://www.youtube.com/watch?v=sMH3wLuR9f0>



Weiterführendes

Verizon Insight Labs <http://www.verizonenterprise.com/verizon-insights-lab/>

Thingspace <https://thingspace.verizon.com/developer/>

Data Breach Investigation Report <http://www.verizonenterprise.com/verizon-insights-lab/dbir/>

Festnetzsparte „Verizon Enterprise Solutions“ <http://www.verizonenterprise.com/de/>

Verizon Foundation: Powerful answers
<http://www.verizon.com/powerfulanswers/inspirehermind/>

The Phoenix Project: A NOVEL ABOUT IT, DEVOPS, AND HELPING YOUR BUSINESS WIN by Gene Kim, et al. (2014) <http://itrevolution.com/books/phoenix-project-devops-book/>

DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations. Gene Kim, Jez Humble, et al. (2016)
<http://itrevolution.com/devops-handbook>

DORA. DevOps Research & Assessment. DevOps Score Card. <https://devops-research.com/>

Scaled Agile Framework 4.0 <http://www.scaledagileframework.com/>

The Science Behind Why Jeff Bezos's Two-Pizza Team Rule Works
<http://blog.idonethis.com/two-pizza-team/>

Weiterführendes

Jeff Smith, A Corporation as Big as a Small Country: Towards an Agile Enterprise (2016) <https://www.infoq.com/presentations/ibm-agile>

The IBM Agile Process Maturity Model. A contextual framework that can help you effectively adopt an agile strategy (2009)

ftp://public.dhe.ibm.com/software/emea/de/rational/neu/TheIBM_Agile_Process_Maturity_Model_EN_2009.pdf

An introduction to Wardley (Value Chain) Mapping (2015)

<http://blog.gardeviance.org/2015/02/an-introduction-to-wardley-value-chain.html>

Wardley Maps. <http://www.wardleymaps.com/>

Simon Wardley, Cloud Computing - Why IT matters. (2009).

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Simon Wardley, Anticipating the Future - An Introduction to Value Chain mapping (2014). <https://www.youtube.com/watch?v=NnFelt-uaEc>

Simon Wardley, Situation Normal, Everything Must Change - Keynote (2015).

<https://www.youtube.com/watch?v=Ty6pOVEc3bA>

Adrian Cockcroft, “Velocity and Volume (or Speed Wins),” presentation at FlowCon, San Francisco, CA, November 2013. http://flowcon.org/dl/flowcon-sanfran-2013/slides/AdrianCockcroft_VelocityAndVolumeorSpeedWins.pdf

Glossary: DevOps tools

Agile is a time boxed, iterative approach to software delivery that builds software incrementally from the start of the project, instead of trying to deliver it all at once near the end.

DevOps (a clipped compound of development and operations) is a culture, movement or practice that emphasizes the collaboration and communication of both software developers and other IT professionals while automating the process of software delivery and infrastructure changes.

Canary release is a technique to reduce the risk of introducing a new software version in production by slowly rolling out the change to a small subset of users before rolling it out to the entire infrastructure and making it available to everybody.

Blue Green is a technique to reduce the risk of introducing a new software version in production by first ensuring it is running fine in a new “green” production environment, and then switch all users over from the “blue” environment. If anything goes wrong, seamless switching back to the blue environment must be in place.

A/B Testing is comparing two versions of a web page to see which one performs better. You compare two web pages by showing the two variants (let's call them **A** and **B**) to similar visitors at the same time. The one that gives a better conversion rate, wins!

Feature toggle is a technique to test user feedback on new features that are being rolled out in production but can be switched on and off, and are only visible to some select users. Features with the better conversion rate, win.

JIRA is a project management tool by Atlassian, tuned towards agile teams to plan, track, and release software. (See: onejira.verizon.com)

Confluence is a web-based software project documentation management platform by Atlassian, tuned to be used with **Jira** and **Stash** (See: oneconfluence.verizon.com)

Stash is a source code management (SCM) system by Atlassian. It was recently renamed Bitbucket. (See: onestash.verizon.com)

Jenkins is an OpenSource process automation tool, it features thousands of plug-ins to automate almost any task, except coffee making. (See: onejenkins.verizon.com)

OWASP The Open Web Application Security Project (founded 2001) is an online community which creates freely-available articles, methodologies, documentation, tools, and technologies in the field of web application security.

Lebenslauf



Jörg Heitkötter, Jahrgang 1965, verheiratete, 2 Kinder, war während seines Informatik und Biologie Studiums an der Technischen Universität Dortmund an zwei Max-Planck-Instituten bei Dr. Theo Plesser als Programmierer und Forschungsassistent tätig, bevor er am Lehrstuhl 11 für Systemanalyse bei Prof. Hans-Paul Schwefel arbeitete und gemeinsam mit anderen Studenten Erstveröffentlichungen im Bereich Genetischer Algorithmen schrieb.

Dennoch brach er das Studium ab, um 1993 bei der eben gegründeten EUnet Deutschland GmbH anzuheuern und mitzuhelfen „Das Internet nach Deutschland zu holen“. (Spätestens seit der ersten Erwähnung des World-Wide Web in den Tagesthemen 1994 war er sich sicher, das richtige getan zu haben. Als einer der ersten „Webmaster“ Deutschlands betrieb er den Webserver www.Germany.EU.net. Und sorgte gemeinsam mit Microsoft dafür, das im ersten Windows‘95 Release EUnet als einziger Deutscher Interneteinwahl Serviceanbieter auftauchte.)

Während der europäischen Konsolidierungsphase der inzwischen zu UUNET Deutschland umfirmierten Firma, entwickelte er ab 1997 Web-basierte IT Systeme, mit über Europa verteilten Teams und baute 1999 ein Offshore Development Center in Indien mit auf.

Seit dem Merger mit Verizon in 2006 und der sich anschließenden Zentralisierungsphase, der inzwischen in MCI, später Verizon Deutschland umfirmierten Firma, fokussierte er sich auf das massive Konsolidieren von IT Systemen. So wurden aus 44 europäischen MCI Abrechnungssystemen in 2002, eines (1), welches 2012 in die USA umzog.

Seit 2010 ist er als Enterprise Architekt mit den Schwerpunkten IT Security, Compliance, Data Architecture und Globalisierung tätig. Er ist Mitglied des Verizon DevOps Council. Zertifizierter Scrum Master. Und Blackbelt Absolvent des Verizon Lean Six-Sigma Operational Excellence Programmes.

In seiner Freizeit betreut er für die Verizon Foundation Programme, die junge Frauen an MINT Berufe heranführt. Und ist seit Jahren Mitorganisator des Girl’s Day am Standort Dortmund bei Verizon.

Veröffentlichungen

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<http://www.cs.sjsu.edu/~khuri/csc94.ps>

S. Khuri, M. Schütz, J. Heikötter, Evolutionary Heuristics for the Bin Packing Problem, Proceedings of the ICANNGA, Springer-Verlag, Vienna, 1994, pp. 285-288. <http://www.cs.sjsu.edu/~khuri/icannga.ps>

S. Khuri, T. Bäck, J. Heikötter, The Zero/One Multiple Knapsack Problem and Genetic Algorithms, Proceedings of the 1994 ACM Symposium on Applied Computing, 1994, pp. 188-193. http://www.cs.sjsu.edu/~khuri/sac94_a.ps

Jörg Heitkötter und Gerhard Weinreich, "Autoimmunnetzwerke in Rechnernetzen", Neue Zürcher Zeitung—NZZ Wissenschaft, 1999.

<https://hhg2ec.blogspot.de/2013/06/autoimmunsysteme-von-rechnernetzen-nzz.html>

Jörg Heitkötter and David Beasley. The Hitch-Hiker's Guide to Evolutionary Computation (RTFM), 1994-1999.

<https://github.com/jheitkoetter/hhg2ec/blob/master/hhg2ec-7.1.pdf>

AOL.

