



On the Road to Ground Systems that Scale For The Future

This presentation focuses on the architecture of the new DigitalGlobe ground system and some of the concepts and discoveries that we believe are transferrable to other projects.

For a discussion of the reason that all companies should be considering this sort of transition and some of the advantages, pitfalls, and surprising discoveries along the way, please see our other presentation at this conference: [Moving to the Cloud Isn't Difficult... Adapting to New Methods and Technologies is Hard](#)

Discussion of DigitalGlobe's New Ground-System Architecture (GSAW 2017)

Mike Wierzbinski, Enterprise Cloud Architect
Jon Upham, Director of Architecture and Innovation
Mike Waters, Enterprise Software Architect

Email: GSAW-Correspondence@DigitalGlobe.com

See a better world.™



- Intro to DigitalGlobe
- Our Challenge
- Decisions and major Architectural building blocks
- DNA Items
- Current Challenges
- Close and Next Steps

- Started in Oakland, CA in 1992; currently Headquartered in Westminster, CO
- Owns and operates a constellation of satellites that image the earth: imagery collected $> 3,500,000 \text{ km}^2/\text{day}$
 - Slightly more than the landmass of India
- Downlink $\sim 5\text{-}6 \text{ TB}$ of new “raw” imagery per day ($\sim 2 \text{ PB}$ year)
- Create products from that imagery with various forms of image processing and analytics: $40 \text{ TB} - 100 \text{ TB}$ per day
- Manage a platform in the cloud where you can run algorithms against our imagery (Take the processing to the imagery)

DigitalGlobe sets the standard for quality



Accuracy. Currency. Completeness. Consistency. We lead the industry.



Orbit: 617 km
Resolution: 31 cm
Daily capacity: >400,000 km²
Agile: 10.6 s to slew 200 km

Launched: Nov 11th, 2016
First customer: Feb 1st, 2017

Our Challenge / Quandary

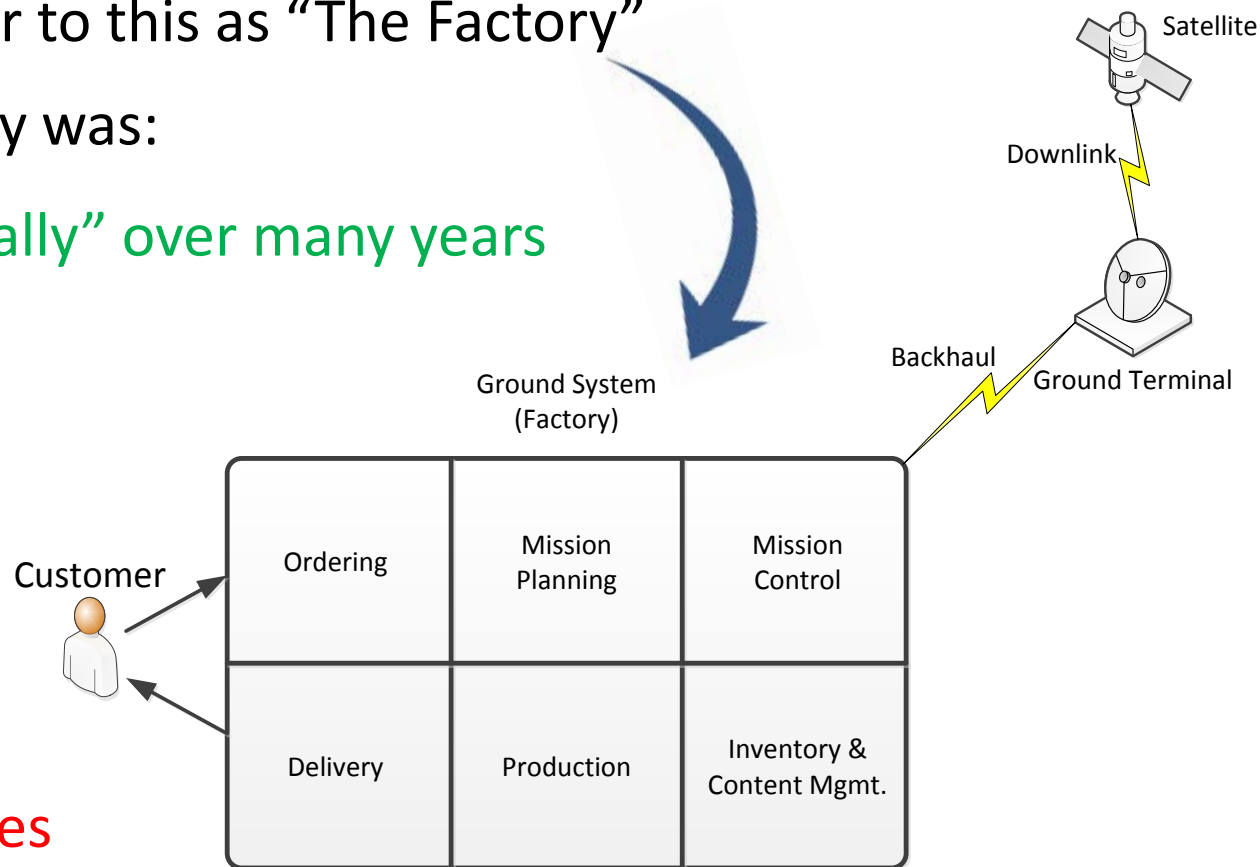


- “Ground System” == “Everything from Order to Delivery”
- We frequently refer to this as “The Factory”
- Our existing Factory was:

- Created “organically” over many years
- Well understood
- Massive
- Fast

– as well as –

- Brittle
- Highly Coupled
- Older Technologies
- Expensive to Operate





- Refactor in place is perceived as too big, expensive, and risky
- Build a new Factory based on our best architectural patterns
- Move out of the legacy Factory
- Move into the new Factory – starting with WorldView-4

Key Concepts – μ Services and Domain Driven Design

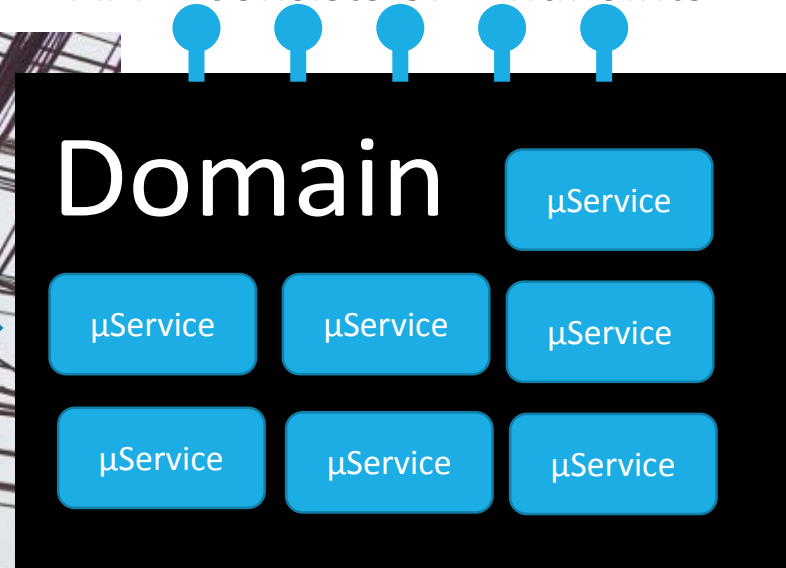


Initial State



Organize Business Functions
Into “Domains”

Define “External View”
API – Consists of “EndPoints”

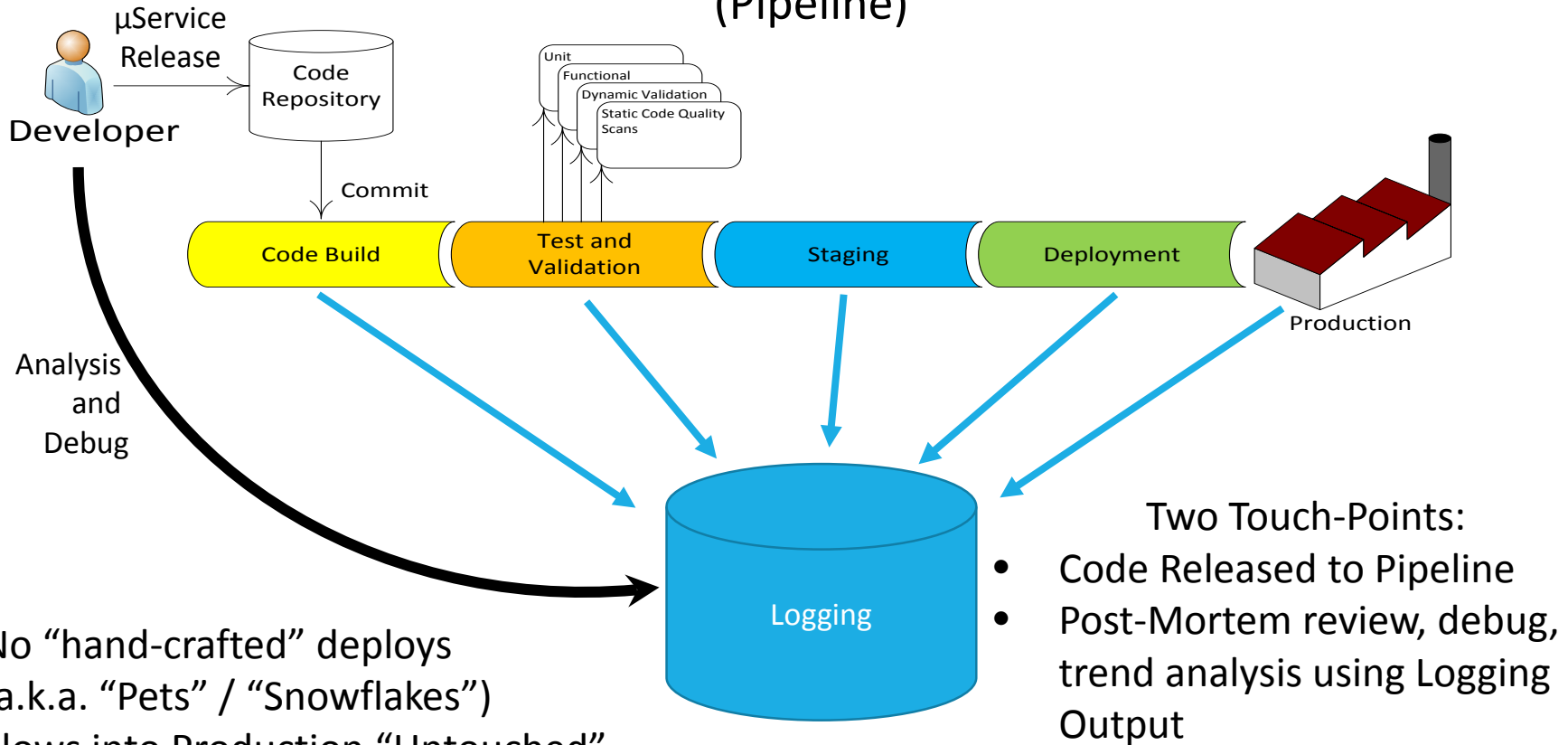


Domain Driven Design
Decompose Domain into μ Services

Key Concepts – CI/CD and Automation



Continuous Integration / Continuous Deployment (Pipeline)



- No “hand-crafted” deploys (a.k.a. “Pets” / “Snowflakes”)
- Flows into Production “Untouched”
- Every Deployment is repeatable
- Roll forward / Rollback as needed

Key Concept – Infrastructure as Code



- PaaS is where apps that make up the ground system “live”

Platform as a Service

- PaaS and IaaS deployments are performed by Pipeline
- Applications that run in PaaS are portable between environments
- These are standard 12-factor applications: don't have to be

Infrastructure as a Service

- Developers manage the deployments of their Apps / Containers
- Information Technology manages the Hardware and IaaS layers

Hardware

DNA - trying to be Fast (but not too fast)



- Concentrate on a small number of use cases - - - But there are some things that have to be built in from the start (too hard to retrofit)
- High-Availability for continuous ops and Business Continuity
- Support Eventing as the basis for flexibility and easier integration
- Highly monitored Central Logging to support audit, troubleshooting/debug, and system-wide metrics
- BPM Orchestration to supporting changing business flows
- Security baked in
 - Zero trust model
 - Security: Infrastructure / Communications / Authorization for services and data





- Infrastructural elements must be “production ready” early
 - Stability and management of:
 - Virtualization (IaaS)
 - Application Deployment and Containers (PaaS)
 - CI/CD Pipeline
 - Common Services
 - Eventing
 - Logging
 - Service Discovery
 - Configuration Service
 - Identity and Authorization Model
 - UI framework and standards for look and feel

- How we governed this process:
 - “Build Governance” – guidelines for creating microservices (12-factor apps)
 - “SOA Governance” – guidance re: API design
 - “RESTful Service Conventions”
 - Weekly “Developer’s Roundtables” – deep dives and identification of issues
 - “Quarterly Punchlists” – identify aspects of these governance documents required as part of “Definition of Done” on a quarterly basis
 - Then “raise the bar”: Get more formal / strict / compliant over time
- Wish we’d done more in the following areas:
 - Service versioning and emphasis on non-breaking changes
 - Testing Frameworks
 - Guidance re: testing strategy and difference between development / integration / system testing



- Aggregation of business-pertinent information (Business Intelligence / Reporting).
 - How to leverage Data as a Service constructs to allow aggregation without introducing tight coupling back into the system
- Stronger, more diligent uses of Logging for metrics, trending, and reporting
- Encourage broader adoption of the tools/techniques/lessons learned from this project across the corporation
- Continued hardening / maturation of the platform – additional aggregation/division of microservices now that they are in production

- This project has been tremendously valuable re:
 - Allowing DigitalGlobe to be more agile/aggressive in pursuing the evolution of our ground systems
 - Motivating/energizing our development teams
 - Supporting integration with other portions of our business (still in process)
 - Permitting various infrastructure strategies (on a project by project basis)
 - Air-Gapped micro-environments
 - Private Cloud on internal virtualized infrastructure
 - AWS-deployed
- For us: The challenge and the risk are worth the reward

