

We Build Great Space Apps, for the World. ▲



Space Apps RAD – Project Kickoff
With Cory Mckinnon and Justin Mosbey

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Global New Space Market Trends

- Global space economy currently valued at \$330 billion (Space Foundation)
- Predictions of Space industry valuation by 2040's:
 - \$1 Trillion (Goldman Sachs)
 - \$1.1 Trillion (Morgan Stanley)
 - \$2.7 Trillion (Bank of America Merrill Lynch)
- Increased investment activity:
 - Average space investors per year up from 8 in early 2000s to 110 recently (Bryce Tech)
 - 30% increase in new space startups reporting investment in 2017 vs 2016 (Bryce Tech)



Satellite Launch Market Trends

- Small-satellite market may reach \$62 billion by 2030.
- Demand for small-satellite launches for new constellations and replacement missions is estimated to be 11,631 by 2030 (Satellite Today)
- 3000 satellites over 50kg including 23 constellations between 2017-2026 (Euroconsult)
 - \$304B overall market, \$30B average / year
 - 25% increase over previous decade



Rising Tide of Data

More spacecraft means...

- More EO and scientific data to store, analyze, and share
- More downstream “end user” client needs

Example Downstream Activities

- Receiving data sets from space
- Consolidation and storage
- Complex analysis by machines and data scientists
- Real-time and trend reporting
- Packaging and producing for end customers (B2B or B2C)



“The space sector’s downstream challenge is...”

- Increasing business activities in space sector means massive increase in data from space
- Managing this data and providing downstream software applications is complex
- It requires superior software expertise (a different skillset and mindset from the space sector traditional strengths)
- Globally: custom big data, AI, and software development projects are statistically likely to fail



“...which is why it needs Rapid Application Development”

- A Rapid Application Development platform focused on space sector downstream needs, will:
 - Quickly build data collecting, processing, and publishing software applications and pipelines for downstream users
 - Favour configuration over custom development
 - Facilitate the use of standard AI algorithms and Big Data tools and techniques
 - Decrease software project failure risk and timelines
 - Deliver high ROI compared to consulting and in-house development
 - Decrease Total Cost of Ownership / Increase Return on Investment



THE CHALLENGES



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Data-related Challenges

- Data preparation is about 80% of data science work (Crowdfunder)

Data-related challenges

- Multiple data sources
- Complex data mappings from source to destination
- Often unique proprietary data schemas
- Lack of classification and management tools
- Complex integrations
- Exponentially growing volume of data
- Hardware limitations for processing and storage



People-related Challenges

- 300,000 AI experts only worldwide (Technology Review)
- By 2018, 50-60% supply gap in Data Scientist jobs in US alone (McKinsey)
- Over 40% of data science tasks automated by 2020 (Gartner)



People-related challenges

- Lack of data scientists
- Integrations and transformations require developers and architects
- Knowledge gaps on latest storage, data-gathering, consolidation, analysis, and reporting technologies and approaches
- Lack of training and support
- Lack of time

Process-related Challenges

- Big Data and AI environment is like the wild west
- Governance, compliance, and risk management

Process-related challenges

- Lack of data standardization
- Changing approaches to data gathering, consolidation, transformation, and reporting
- External consultants often required to augment team on big data / AI projects
- Complex data sovereignty, classification, security compliance, and governance needs



Technology-related Challenges

- Constant disruption and reinvention.
- Technical limitations and constraints.

Technology-related challenges

- **Constantly changing technology landscape**
- **Complex requirements for data storage, reporting, integration, distribution**
- **Geospatial technologies are often difficult to learn and use**
- **Infrastructure limitations and expense for processing, analytics, and storage**



Project Challenges

- Globally, 70% of software projects fail (Standish annual “Chaos Report”)
- 85% of big data projects fail (Gartner)

Project-related challenges

- Project cost & durations
- Unclear business objectives
- Scope creep
- Custom requirements means custom code
- Likelihood of project failure
- Post-project support & storage costs



Space Data Provider-Specific Challenges

- UrtheCast, Planet, NorthStar, SkyWatch amongst others have APIs to let developers access their data (and SkyWatch facilitates this)
- But, easier data access still doesn't solve the real needs of business end users unless software is built that directly address those
- This is an opportunity for a software specialist to add value and innovate on the end user side ("the last mile")



THE VISION



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Vision

- “We build great space apps, for the world”
- Build a world where every organization can use software apps powered by space data.

The Offering:

- **Customized space apps:**
 - Data consolidation, extraction, storage, reporting, platform
 - Data distribution via e-commerce and publishing systems
 - All without requiring custom development



Mission

- Develop innovative software applications for organizations worldwide, that help them use data from space
- Use a rapid application development process supported by a cloud-based software factory and DSLs.
- Build software that combines space data sets with compelling UX
- Gold standard of space apps



Software Factory

- RAD approach
- Input -> describe your business needs in a domain specific language
- Output -> customizable space app, infrastructure, and deployment scripts

THE SOLUTION



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What is Space Apps RAD?

- It's a **"Software Factory for downstream satellite data applications"**
- Rapid Application Development (RAD) toolset, used internally at Deploy, for assembling development-free downstream software solutions that easily consume, leverage, and distribute space-based data
- Our Space Apps RAD methodology makes it simple and cost-effective to give our customers a 100% working, space industry-aware
 - Data lake, data warehouse, and long-term storage and data lifecycle management
 - EO image processing pipeline
 - Data catalog and search engine
 - Report server, data visualization, and data science capabilities
 - CI/CD deployment pipeline
 - Administrative website to manage scheduled jobs, user management & permissions, auditing etc
 - B2B/B2C publishing and collaboration
- All hosted in the client's Amazon Web Services account, and built to scale



Why use Space Apps RAD?

- The toolset is tailored to space industry downstream requirements and data types
- Standardized approach to common big data analytics and software development needs
- Favours configuration over custom development
- Decrease Total Cost of Ownership / Increase Return on Investment
- Decreased software project failure risk



Platform Elements

1. *Hypatia*: Modular client AWS-cloud solution including ETL pipeline, data lake + catalogue, search engine, data warehouse, report server, support for data science including AI models
2. *Cleo*: Client storefronts/content management system for distributing packaged data to B2C & B2B
3. *Ada*: Software Factory used internally by Deploy for generating Hypatia and Cleo solutions (with client configurations)



Space Apps Modules

- A packaged set of *system components* (ex a web server or database), *functionality* (ex publish data to a web page), and *content* (ex a set of web pages)
 - Free modules are always available - to ensure we have necessary components to build ES modules
 - Customer pays for Enterprise Subscription Modules. Cost of ES varies based on # of applications/modules
 - We certify and perform updates for all modules under a client's current ES agreement.
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- **Free Modules**
 - Basic Admin and End User App
 - Basic data collection and storage
 - Basic Search
 - CI/CD pipeline
 - Secure Cloud Infrastructure
 - **Enterprise Subscription Modules**
 - Enterprise Admin and End User App
 - Data Lake & long-term storage
 - Data Warehouse
 - Enterprise Search
 - Reporting and Data Science
 - Tableau Desktop & Server
 - Workstation
 - Hybrid Data Pipeline
 - Collaboration
 - Publishing (Content & Data)
 - Data Processing Pipeline (AI, Earth Observation processing, ETL/ELT, etc)



Software Factory

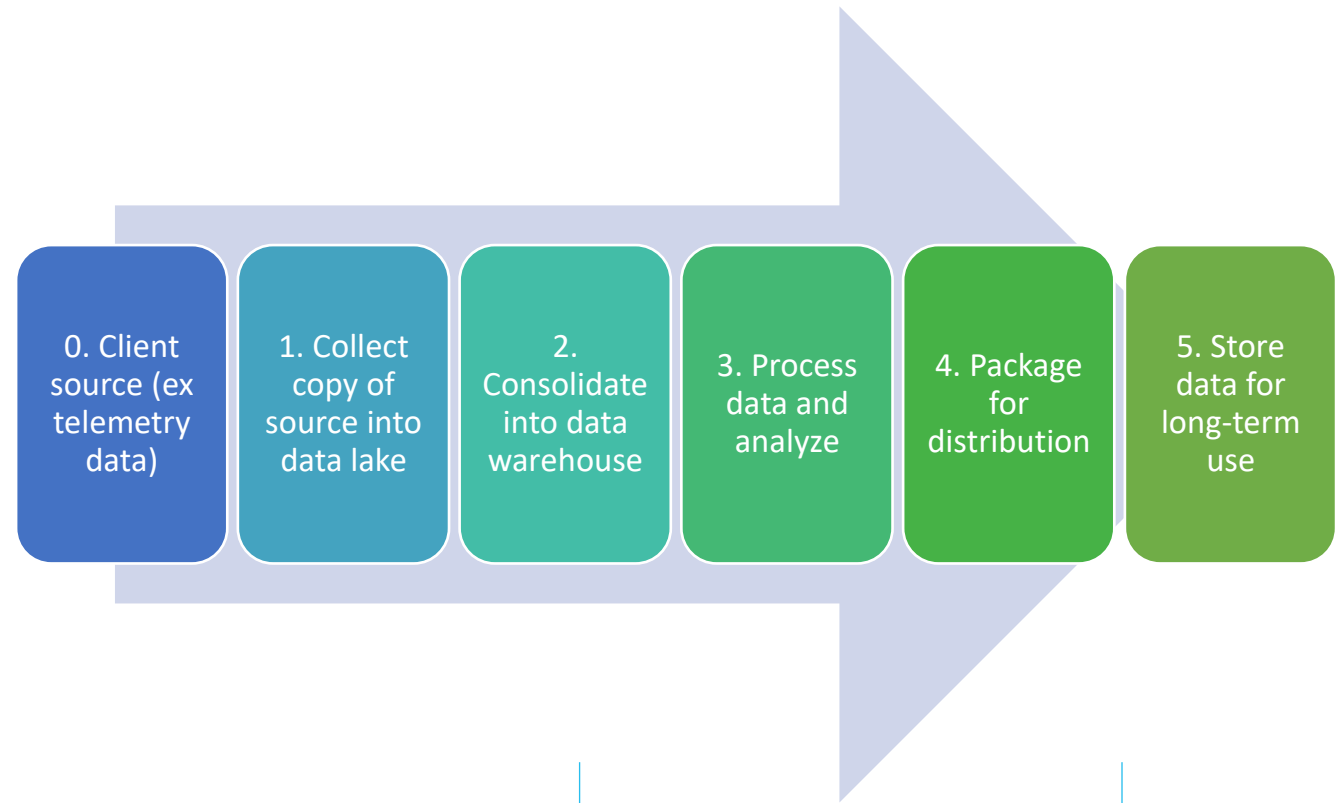
- Online web application that Deploy and clients can access (multi-tenant)
- Stores and describes customer space app modules and configurations and supporting downloads and documents
- Generates working space apps that can be deployed into customer AWS account
- Manages “solution blueprints”
- Tracks customer Enterprise Subscription status and solution versioning



Processing Pipeline

- Space Apps RAD has built-in processing pipeline
- Process client data from source telemetry to destination (including B2B/B2C distribution)
- Standardize and automate to reduce time, effort, cost, risk

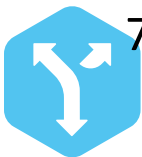
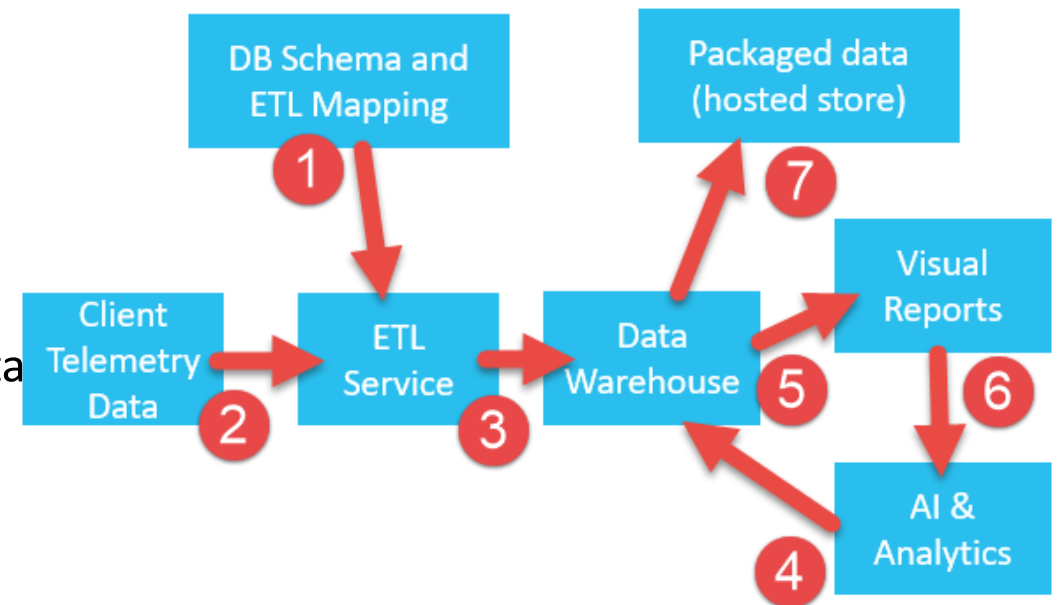
High Level Process for Satellite Data (Example)



Example Processing Pipeline in a Space App

1. Client describes business needs and data to a Deploy expert who records them in Space Apps RAD's Domain Specific Languages
2. Space Apps RAD software factory automatically builds a processing pipeline that will convert the source data to a desired state.
3. The processing service uses your mapping instructions to bring your data into a data warehouse, where...
4. ...AI algorithms and human analytics shape the data further.
5. Client studies the enhanced data in visual reports.
6. Applies their learnings back into the analytics.
7. The solution packages the final data products and publish to the hosted storefront for their partners and customers to use.

Example High Level Steps



Packaged Data Products


Workflow


1. Users collaborate on their satellite and related data in a space app we built for them using Space Apps RAD
2. They produce a production-ready “data package”
3. They choose a publishing destination (such as their e-commerce site)
4. They set commercial terms such as pricing, licensing requirements
5. They publish the data package using the space app publishing capabilities
6. The clients / partners access and download the packages

Example e-Commerce product page

[Shop](#) [Cart](#) [Checkout](#) [My Account](#) [in](#) [twitter](#)

GTA Agriculture Observations

2019-01-07 by 



~~\$2,999.00~~ **\$2,700.00**

This data package contains a set of 25 satellite observation images and agricultural data for the Greater Toronto Area (GTA) taken between Jan 12, 2020 and December 28, 2021.

Data set includes:

- Normalized Difference Vegetation Index (NDVI)
- Satellite predicted yields for common crops

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Category: [Satellite Data Packages](#)



THE BUSINESS STRATEGY & PLAN



Customer Segments

1. Downstream is the primary focus for now
2. “Outside In” = Non-Space Industry focus
 - Focus on major industries that could use this service but do not have extensive (or any) geospatial knowledge
3. “Inside Out” = Satellite data providers
 - Focus on satellite data providers (EO and sensor data) that wish to rapidly get their data in the hands of business end users





Space Apps – Customer Sales Pipeline

1. Introductory call



2. Phase I: Discovery



3. Phase II: Build Space App



4. Enterprise Subscription

Sales Pipeline – 1. Introductory Call

- Brief call to make introductions and discuss Discovery engagement
- Follow-up materials with more details and next steps
- Goal: Customer signs up for Phase I: Discovery paid engagement



Sales Pipeline – 2. Phase I: Discovery

- Paid engagement
- Up to 2 weeks of work
- Activities:
 - Requirements Gathering Workshops: Data, Business and User Requirements, Infrastructure
 - Hackathon -> prototype
 - Review prototype with Customer
 - Design & architecture, customization module mapping, plan, and budget
- Output: Phase II plan, budget, architecture, design, UX prototype.
- Goal: Customer signs up for Phase II: Build Space Apps paid engagement



Sales Pipeline – 3. Phase II: Build Space App

- Paid engagement - price varying based on modules and customizations
- Up to 6 weeks of work
- Activities:
 - Build alpha using mapped modules, review with Customer
 - Customizations alpha, review with Customer. Identify standardization options for customization requests
 - Beta using mapped modules and customizations, review with Customer. Identify standardization options for customization requests
 - Production using mapped modules and customizations, formal testing and UAT, release to client environment
- Output: Working space app with as little customization as possible, in client AWS account.
- Goal: Customer renews Enterprise Subscription for 12 months



Sales Pipeline – 4. Enterprise Subscription

- Paid annual subscription, varying based on modules and customizations that need support
- Activities:
 - Develop patches and updates
 - Test module updates against customer environment
 - Deploy patches and updates to customer
- Output: Supported space app with patching and administration support in client AWS account for 12 months.
- Goal: Customer renews Enterprise Subscription for 12 months. Upselling additional modules/space apps



THE DEVELOPMENT STRATEGY & PLAN



Overall Development Strategy

- Goal: Build product MVP in 7 months:
 - “Outside In” & “Inside Out” space apps
 - Software factory to generate the space apps
 - Domain Specific Language
- Agile (5 day sprints) + LaunchPadRAD Methodology (OASIS)
- “API First”:
 - Space Apps API for each module
 - Client APIs for space app customizations
 - Software Factory API for creating Space Apps
 - OData, REST, and GraphQL support
 - Postman for API development, testing, publishing
- Hackathon challenges to simulate UX process for actual client apps

High Level Timelines

- **July: Requirements, Design, Architecture, basic infra**
- **August: “Walking Skeleton”**
- **September: “Outside In” alpha (from NRCan EGS EO)**
- **October: “Inside Out” alpha**
- **November: Software factory**
- **December: Customization process & support**
- **January: DSL support for building space apps**



The WordPress Approach to Standardization

- We need to build space apps quickly, using templates and standardization. **But**, we know there will have to be customizations!
- So, we will follow the **WordPress approach**:
 1. Always: we provide a core codebase and features via plugins (“modules”) and a basic design (“theme”).
 2. Always: A customer’s space app can be extend with their own modules and themes which adhere to our supported development standards & API, or via API integration.
 3. Sometimes (generally avoided!): client customizations directly to the codebase or modules, which may be expensive and risk issues during upgrades.



Solution Blueprints

- We know that customers will always want their own content in the space apps we build.
- Therefore, our solution modules will deliberately separate content from presentation and infrastructure
- We can make changes to the module functionality without squashing customer content!
- Collectively, we refer to the combination of *core software, modules, theme,* and the *customer content* as a **solution blueprint**. It is the unique description of the customer's space app.



Prototyping and Hacking

- We need to be able to create a wide variety of prototypes and hacks quickly, for clients in different industries, to test our space apps solutions, and to add options for design and user experiences
- We need a standardize process for that, which we can improve
- It would be good to involve students in structured hackathons
- WordPress sites -> Gatsby -> HTML?




Dev Team Roles & Responsibilities

- Architecture, Design, UX, API
 - Nick Kellett
 - Cory Mckinnon
 - Oliver Schoenborn
- Reporting and Project Coordination
 - Justin Mosbey
- Space Apps Front End (“Hypatia”)
 - 1 x Web Front End (co-op)
- Space Apps Back End (“Hypatia”)
 - 2 x C# / ASP.NET Developer (co-op)
- Software Factory (“Ada”)
 - 1 x FTE Developer
 - 1 x C# / ASP.NET Developer (co-op)
- Space Apps Hackathons / Prototypes
 - Riipen students
 - Cory Mckinnon
 - Justin Mosbey



Development Timeframes (IRAP/MVP Project)

	Space App (“Hypatia”)	Publishing App (“Cleo”)	Software Factory (“Ada”)	Ops Admin
July 2020	Requirements, Design, Architecture, API alpha	Requirements, Design, Architecture, API alpha	Requirements, Design, Architecture, API alpha	AWS basic infra for CI/CD
August	Walking Skeleton, API alpha	Walking Skeleton, API alpha	Walking Skeleton, API alpha	AWS hosting for alpha/walking skeleton. CI/CD pipeline. Purchase AWS reserved instances.
September	Outside In app + API (alpha)	Static AWS S3 bucket publishing prototype/alpha app	Content and configuration blueprints	AWS hosting for Outside In prototype
October	Inside Out app + API (alpha)	WordPress publishing/alpha	Content and configuration blueprints	AWS hosting for Inside Out prototype
November		WordPress -> Static S3 publishing/alpha	Software Factory capable of building the alpha space apps	AWS hosting for Software Factory
December 2020	Customization process and tools/beta app	Customization process and tools/beta app	Customization process and tools/build beta apps	AWS support for customizations
January 2021	Domain Specific Language for describing space app (DSL) business needs/MVP	DSL for publishing content/MVP	DSL for configuring / managing software factory deployments/build MVP	AWS support for DSLs
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