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Bringing open-source to space, challenges and success

Luc Maisonobe

Agenda

- Brief Introduction
- Space Systems specificity
- Open-sourcing in a niche technology field
- Summary

Introduction

- In 2002, CS started to develop a new space flight dynamics library
  - A building block for ground systems
- In 2006, it was thought to be worth providing as a tool by itself
  - Marketing failure
- In 2008, the product was open-sourced
  - So what?

Space systems

- Non-mission specific parts
  - Space segment
    - Launcher, spacecraft
  - Ground segment
    - Ground stations, user interface
- Mission specific parts
  - Space segment
    - Payload, spacecraft
  - Ground segment
    - Control center, mission center

Space systems context

- Costly
  - Small series
  - Long development time
  - Difficult validation
- Risky
  - Single failure point
  - No in orbit repair, almost no spares
  - New threat: debris
- Niche market
  - Strategic field for rich countries
  - Geopolitics
  - Large investments for big companies

Space community

- Agencies
  - Manage research programs
- Operators
  - Run commercial programs
- Big corp
  - Build launchers and spacecrafts
- Software companies
  - Write on-board and ground software
- Academics
  - Design instruments, analyze results

Historical organization

- National agencies set up large programs
  - Public funding
- High tech companies develop the systems
  - Intellectual property concentrated on a few stakeholders
  - Who owns the rights depends on contract
- Small number of product lines
  - Few customers
  - Difficult validation
  - Costly
  - Silo effect

Open-Sourcing?

- Cons
  - Niche market
    - Small community, established products
  - Highly conservative field
    - Technical, administrative, psychological reasons
- Pros
  - Reduced funding
  - New space actors
  - Opening market
  - Global industrial trend

Two layers

- Orekit
  - Space flight dynamics library
  - Apache V2 License
  - Started from a single private company
- Apache Commons Math
  - General purpose mathematical library
  - Apache Software Foundation

Orekit community evolution

- 2002-2008
  - private CS product
- 2008-2010
  - Open-source
  - CS team manages everything
- 2011
  - First external committer
- 2012
  - Meritocratic organization
  - Project Management Committee

The first release day

- Initial push from a private company
  - Preserve already done investment
  - Company already based on service providing
  - Press release
- Initial feedback from space microcosm
  - Stunned by the move
  - Warm welcome from tech people
  - Dubious reaction from agencies management

Creating a community

- This is a LOT of work!
  - Niche market: word to mouth only
  - Meeting, conferences, mail, phone calls, lobbying...
  - Fight reluctance to change
  - Fight FUD
- It takes a looooooong time
  - Initial welcome, friendly messages are not enough
  - Requires support from management
    - Still maintaining everything for free

Does it work?

- Yes!
  - Slow start
  - Few contributions
  - Then spreading
- New committers and PMC gained for both layers
- Orekit is now the basis for many systems
  - Official choice for French space agency
  - Several known projects worldwide

Community

- Gathered from nowhere...
  - People that once did not exchange together
  - Open-source DID trigger communication!
- Community built from tech people own choices
  - Space systems provisioning needs validation
- First: small companies, academics
  - Already knowledgeable about open-source
- Then: agencies, big companies
  - Not accustomed to collaborative development

Collaboration types

- Typical crowd sourcing
  - Questions, bug reports, patches
  - Random new features added
  - Mainly based on single people goodwill
- Institutional contributions
  - Promises, promises...
  - Very difficult to change minds
    - Large developments done out of community
    - Expected to be contributed back... one day
    - This will create a real merging problem

Lessons learned

- Open-source in niche technical fields
  - Can be done
  - Lots of communication towards people you already know
  - People you don't know appear magically
  - A small community is still a community
- Beware
  - Out of community development
  - One way decisions (from customer to contractor)
  - Politics