AMPHINICY TECHNOLOGIES
Nothing is Impossible.

18 hroug

10x Faster than NASA: Processing Satellite Telemetry in Java

Tomislav Nakić-Alfirević, Amphinicy Technologies

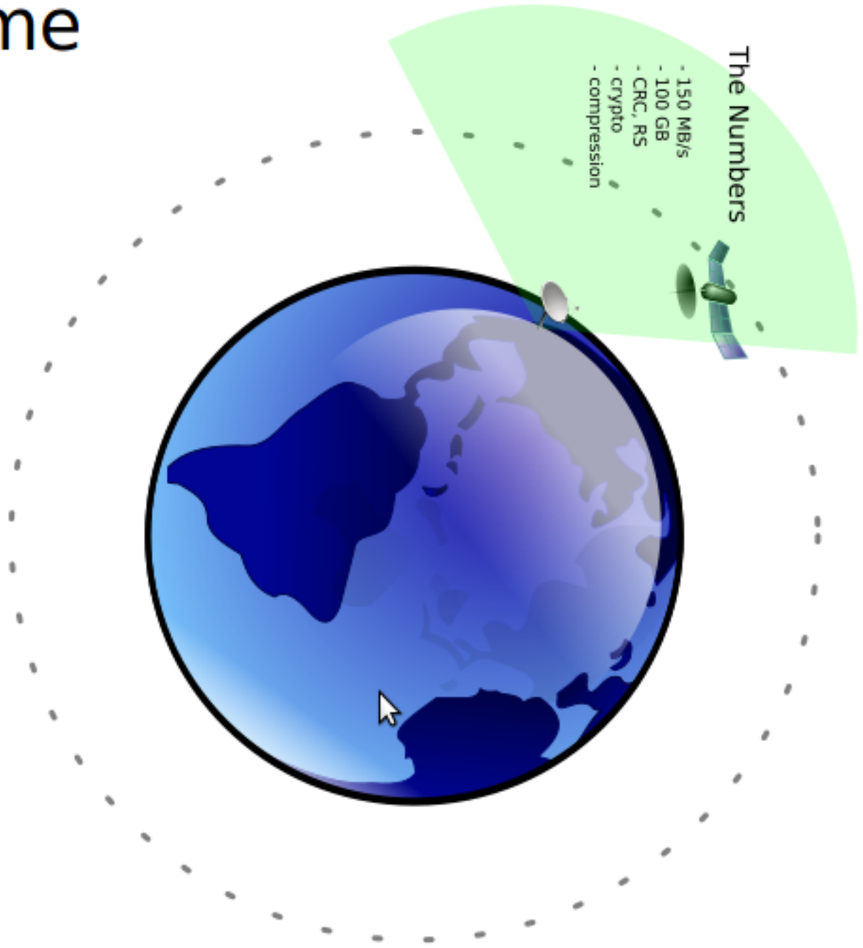
Amphinicy Technologies

- domain:
  - satellite industry
  - media & mobile
- about 30 employees
- >90% export-oriented
- HQ in Zagreb, office in Luxembourg

Introduction

- get data down from satellite to ground
- lots of data, very little time

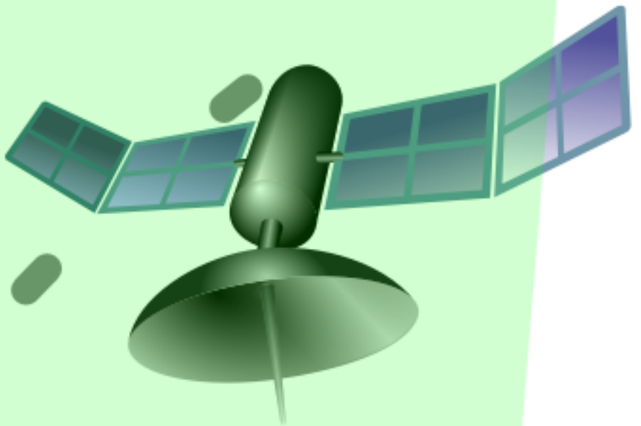
- mostly specialised HW
- SW: troubleshooting



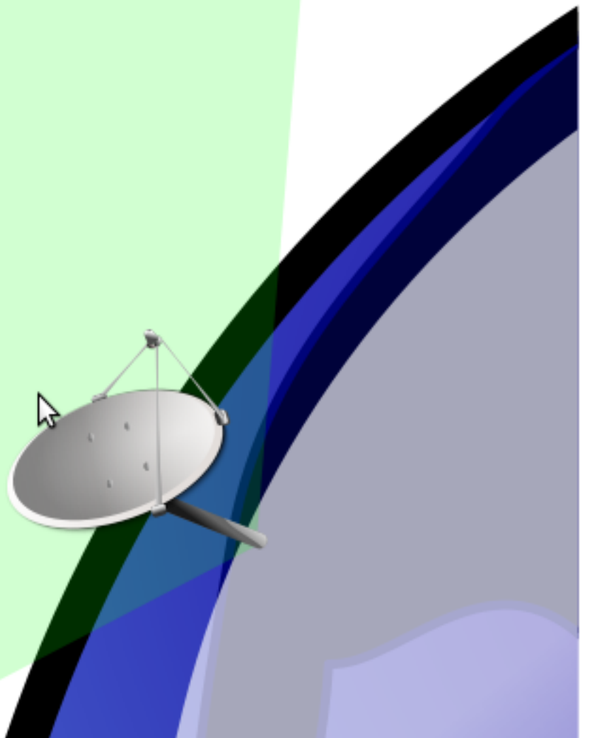
AMPHINICY TECHNOLOGIES
Nothing is Impossible.®

18 hroug

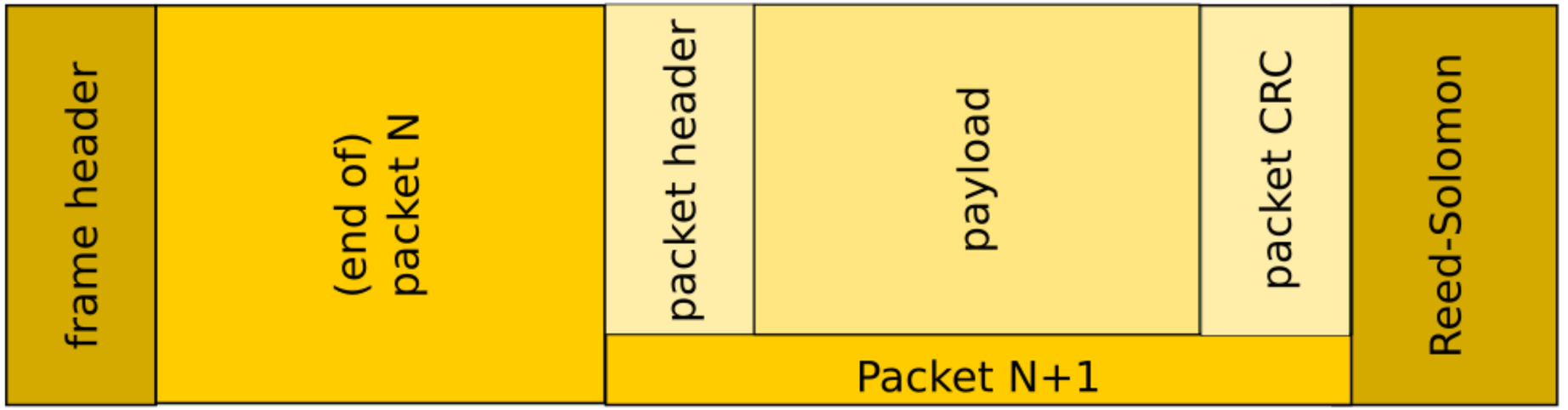
The Numbers

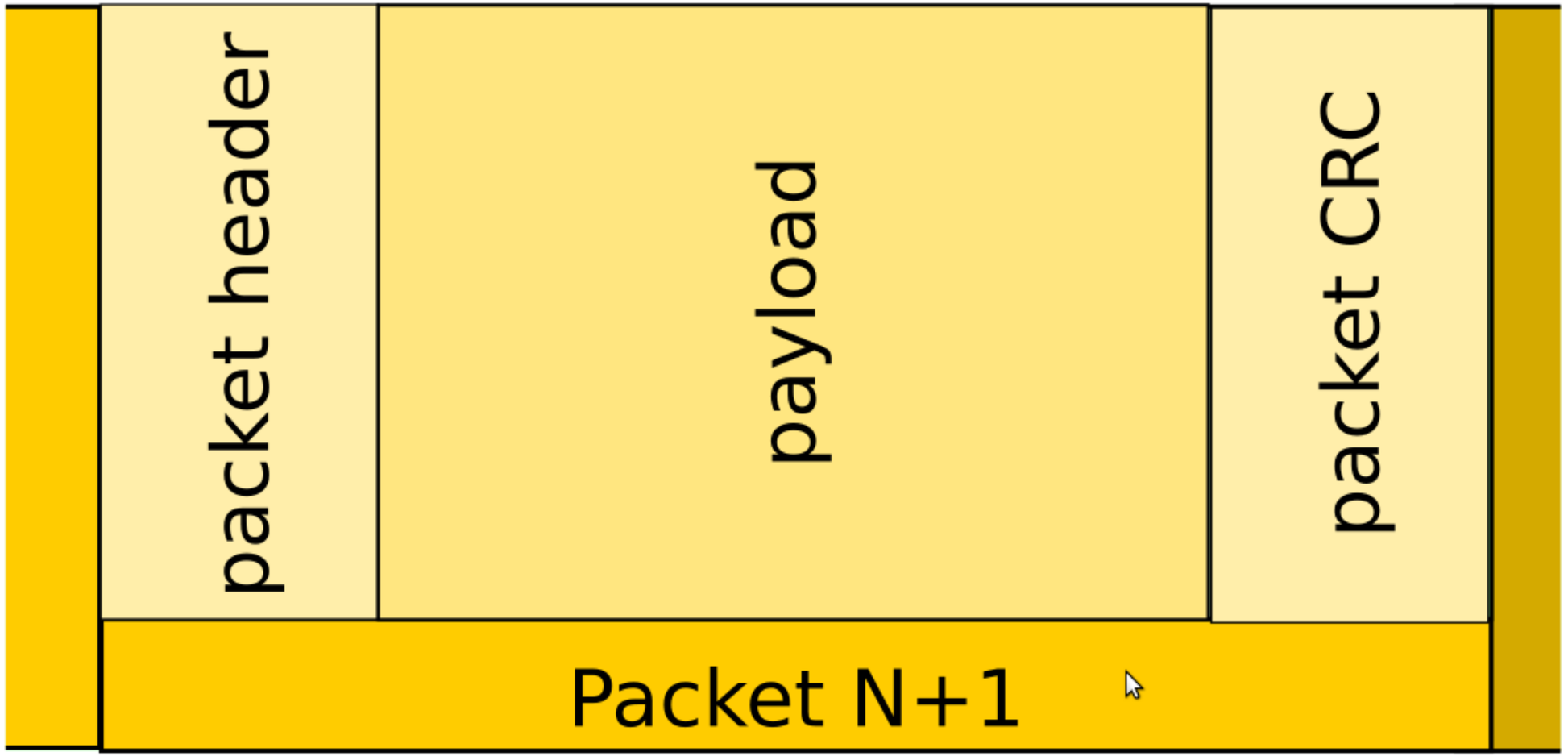


- 150 MB/s
- 100 GB
- CRC, RS
- crypto
- compression



The Data




packet header
payload
packet CRC
Packet N+1

Processing Output

- neatly separated satellite data
    - per application and channel
    - erroneous vs. correct
    - idle vs actual
- (XML) reports
    - frame- and packet-level errors/events/stats
    - overall stats (files, size)

Why (not!) special hardware

For:

- fast enough ✔
- status quo ✔

Against:

- slow and expensive to modify ✖
- slow and expensive to deliver ✖
- rigid licencing ✖

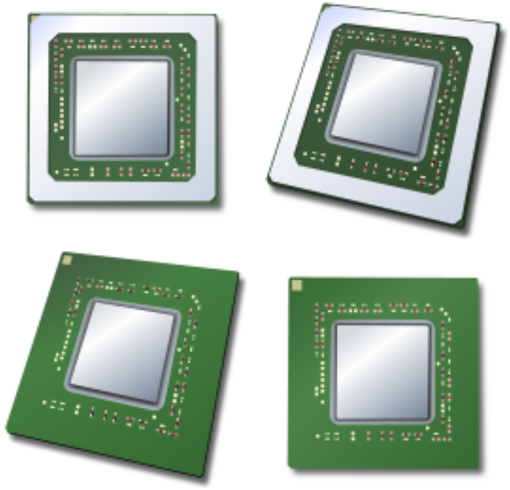
State of the Art: NASA RT-STPS

- Java ✔
- mature code ✔
- decent design ✔
- single-threaded ✖
- <20% of real-time speed ✖

Results?

- used only for post-processing
- 3 years of complaints about speed :-\

Next Generation



context:
- multi-core CPUs
- parallelisable task
- x86 HW support: AES, LZW, CRC...

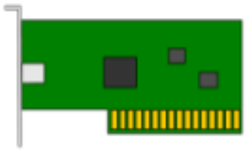
Logical approach: light up the CPU!

R&R: Rapid and Responsive

- problem #1: low-latency
  - solution: buffered decoupling

- problem #2: high-throughput
  - solutions:
    - multi-threading
    - optimised algorithms

Design



Socket reader

Network speed

Input ring buffer

CPU speed

Processing threads

CPU speed

Output ring buffer

Disk write

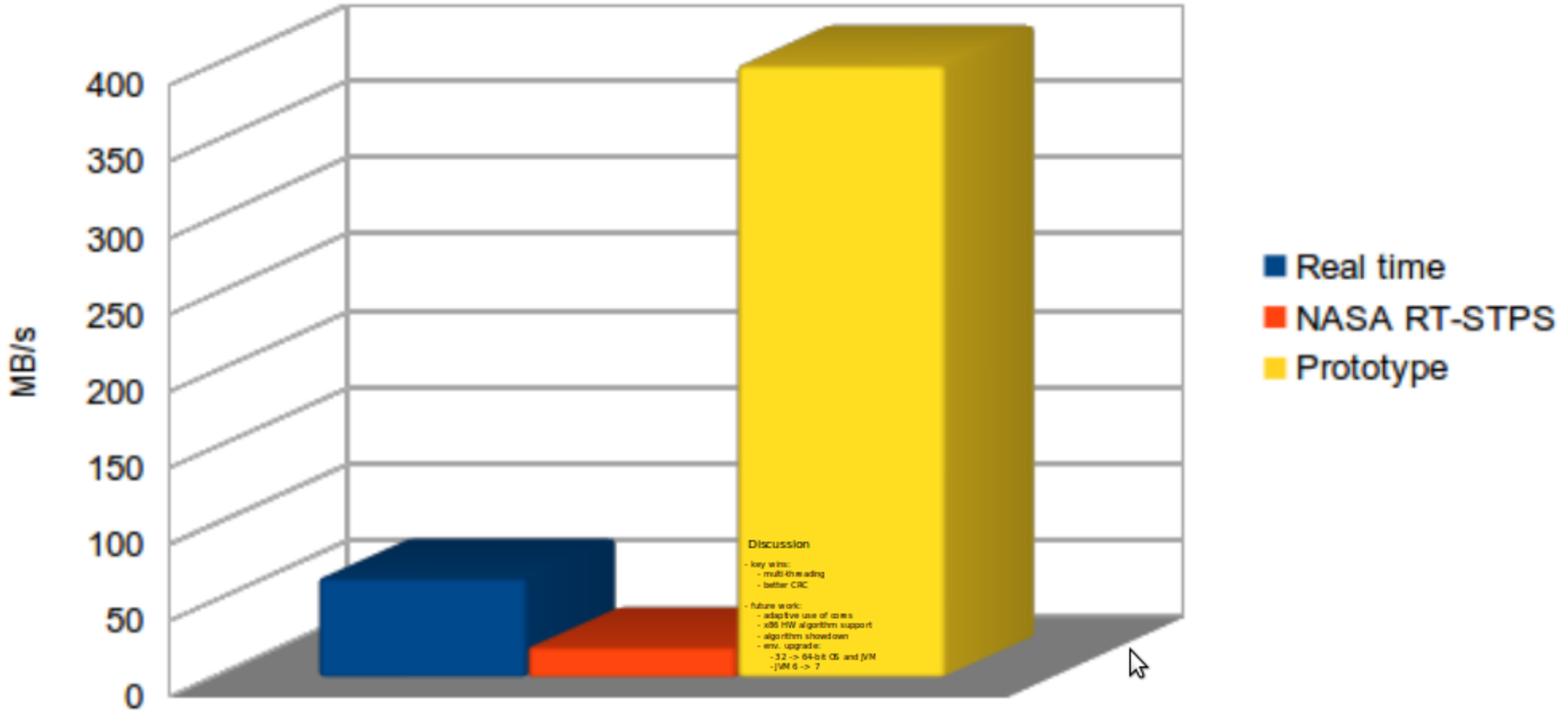
Disk speed

Testbed

- 32-bit software: JDK 6, CentOS 5.7
- 4 core Xeon
- 6 GB RAM
- 14-disk RAID 10

- 20 GB data samples
- various configurations
- multiple runs

Performance Test Results



AMPHINICY TECHNOLOGIES
Nothing is Impossible.®

18 hroug

Discussion

- key wins:
  - multi-threading
  - better CRC

- future work:
  - adaptive use of cores
  - x86 HW algorithm support
  - algorithm showdown
  - env. upgrade:
    - 32 -> 64-bit OS and JVM
    - JVM 6 -> 7

Java **can** crunch numbers.

Telemetry processing is about to **change**.

Lots of **exciting** work ahead!