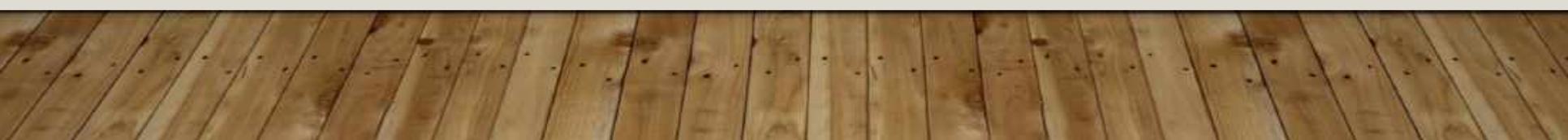


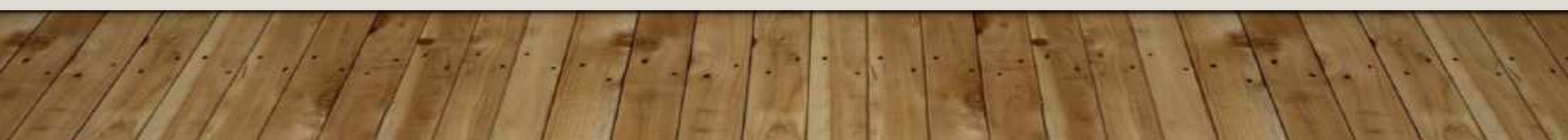
INTRODUCTION



TESTIMONIALS

- The XINA software is a significant advance in that it provides an accessible set of tools for our scientists and engineers to access the full set of data from our space instruments throughout their development and space operations cycles and to carry out a rich set data manipulation and trending operations.
 - Paul Mahaffy, Director Solar System Exploration Division, code 690
- Thank you for the excellent support we have been receiving with the XINA effort. I have not had any regrets since day one.
 - Jim Pontius, GEDI Project Manager, code 496
- I only wish we had started using XINA sooner
 - Paul Stysley, GEDI Laser PDL

WHAT IS XINA?



WHAT XINA IS **NOT**



WHAT XINA IS **NOT**



WHAT XINA IS NOT

XINA

Is

Not

An Acronym



WHAT XINA IS

- A team
- A process



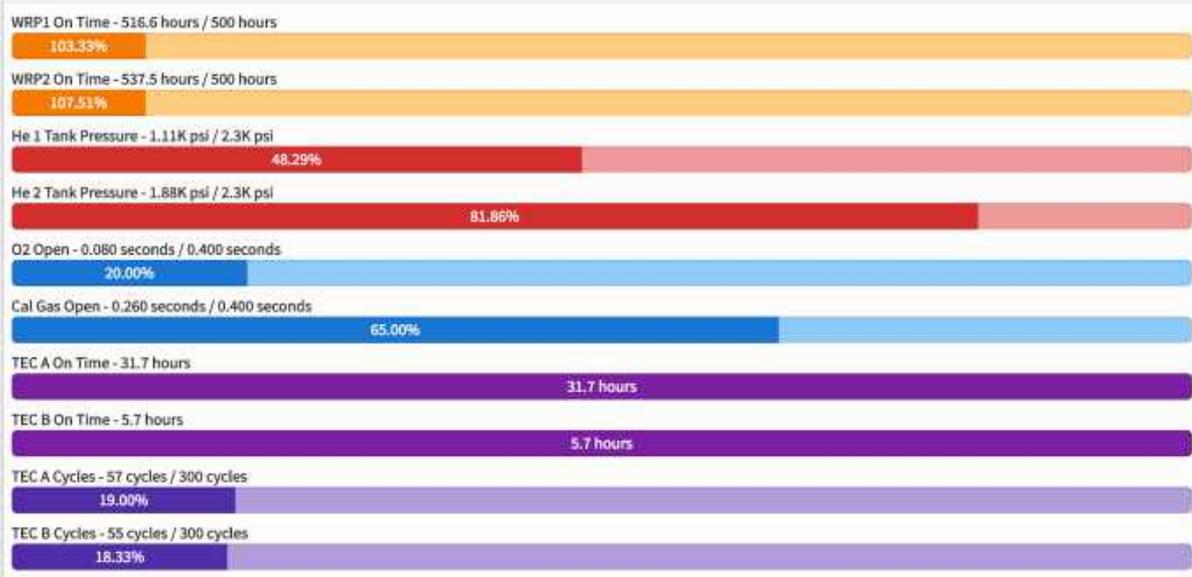
XINA TEAM

- Nick Dobson
- Brad Tse
- Joe Avolio
- Joe Cirillo

- Rick Mason
- Eric Lyness

MISSIONS

- ExoMars/MOMA
- MSL/SAM
- LADEE/NMS
- MAVEN/NGIMS



WHAT XINA IS: THE PROCESS



Cotton Fields



Cotton is processed



Thread is machined into material and dyed



User can buy material and sew own clothes



user



Material is cut rolled and cataloged



Machines make clothes from material

User has a wardrobe full of clothes to choose from

WHAT XINA **IS**: THE PROCESS



Ground System

Science Instrument
during ground test or
flight operations

Can be anything:

- Rack of GSE Equipment
- ASIST
- Other GSE Software
- Planetary Data System
- Files provided over email

WHAT XINA IS: THE PROCESS



Science Instrument
during ground test or
flight operations

Ground System

Bandwidth depends on
network and hardware

Processing
Software

Software customized to
decode data based on
ground data system. Might
be CCSDS packets, might be
simple CSV tables. Provides
real-time visualization

WHAT XINA IS: THE PROCESS



Science Instrument during ground test or flight operations

Ground System

Processing Software

Bandwidth is lower here due to processing and outside network

Packets are gone. Data is mnemonics attached to Time/Value pairs or BLOBs.

Database and API

WHAT XINA IS: THE PROCESS



Science Instrument during ground test or flight operations

Ground System

Processing Software

Distribution

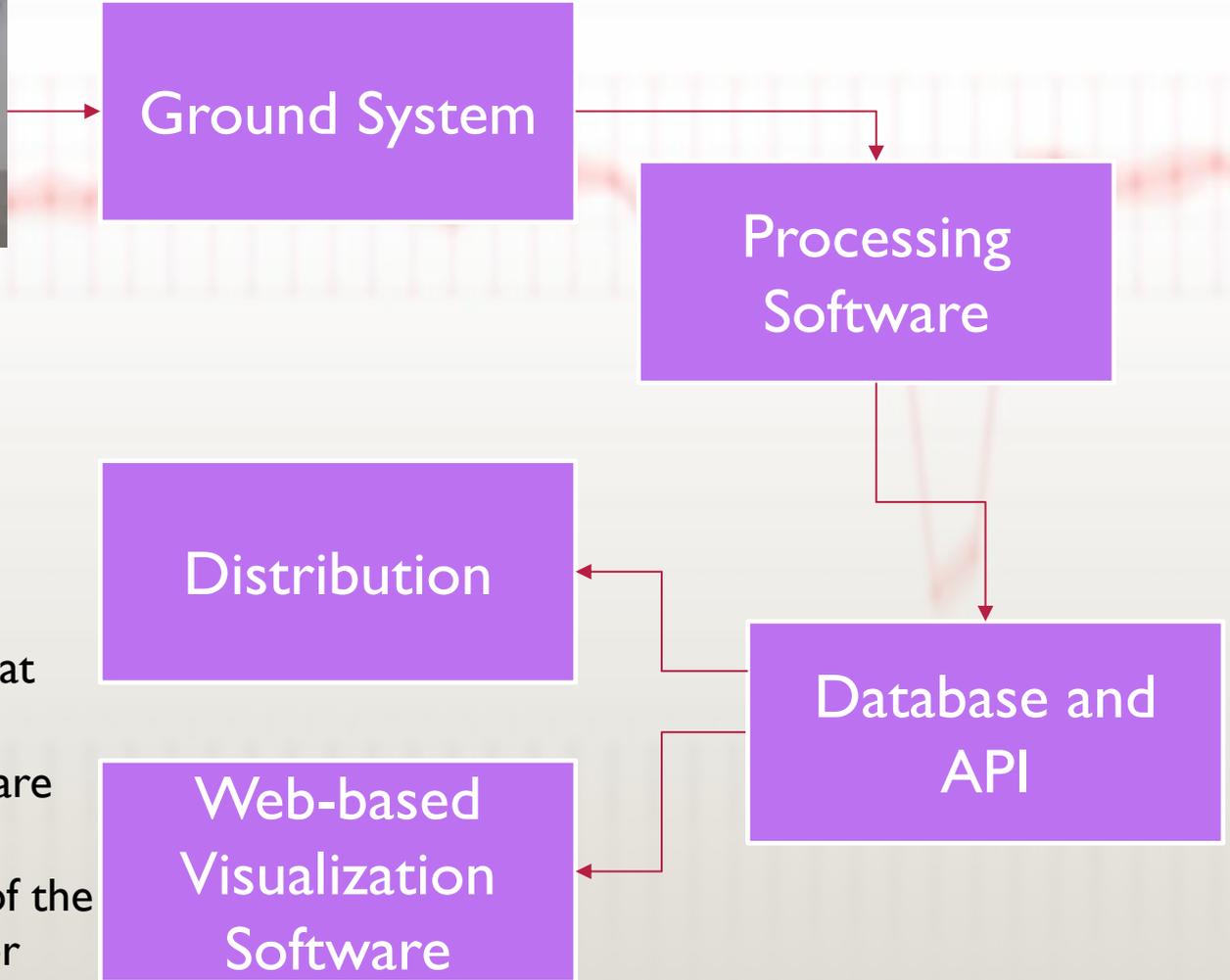
Database and API

Web-based Visualization Software



Files can be exported with pre-formatted or in raw format

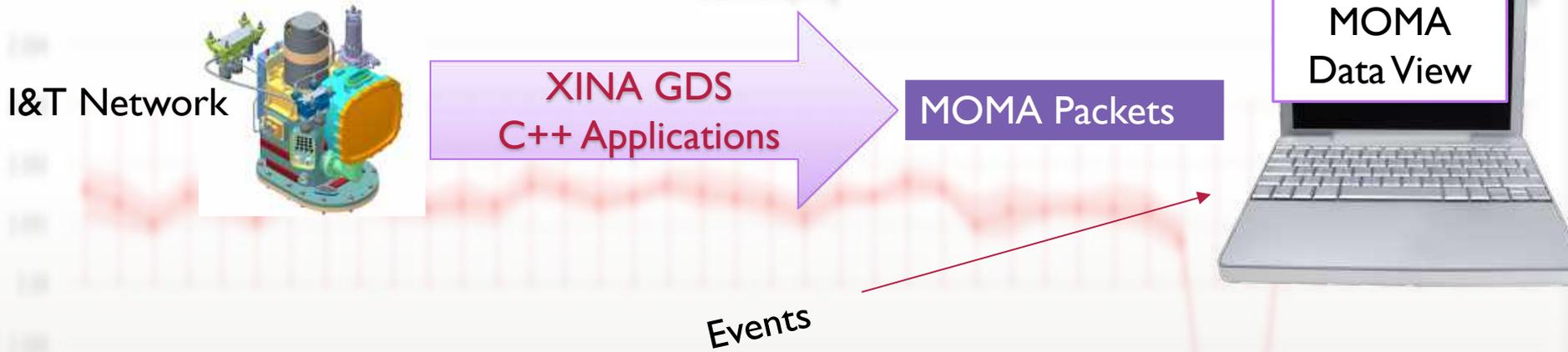
Custom software can provide visualizations of the data in browser



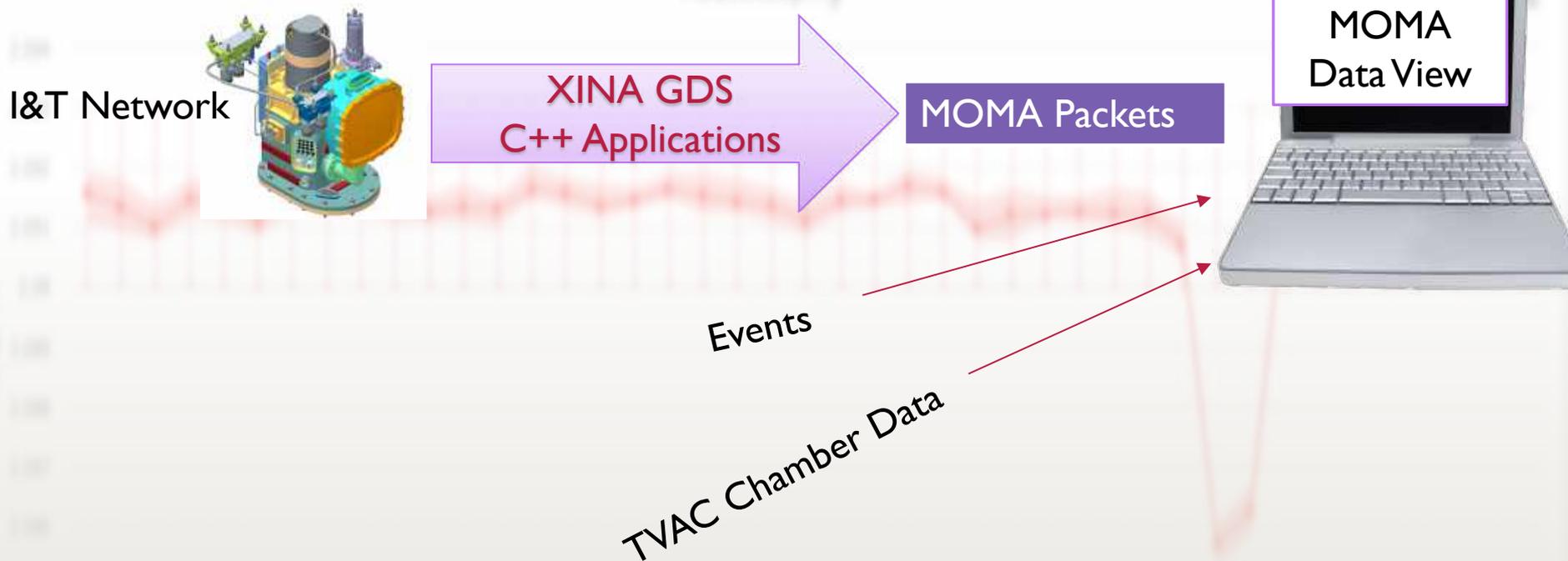
UNDER THE HOOD: MOMA DATA FLOW



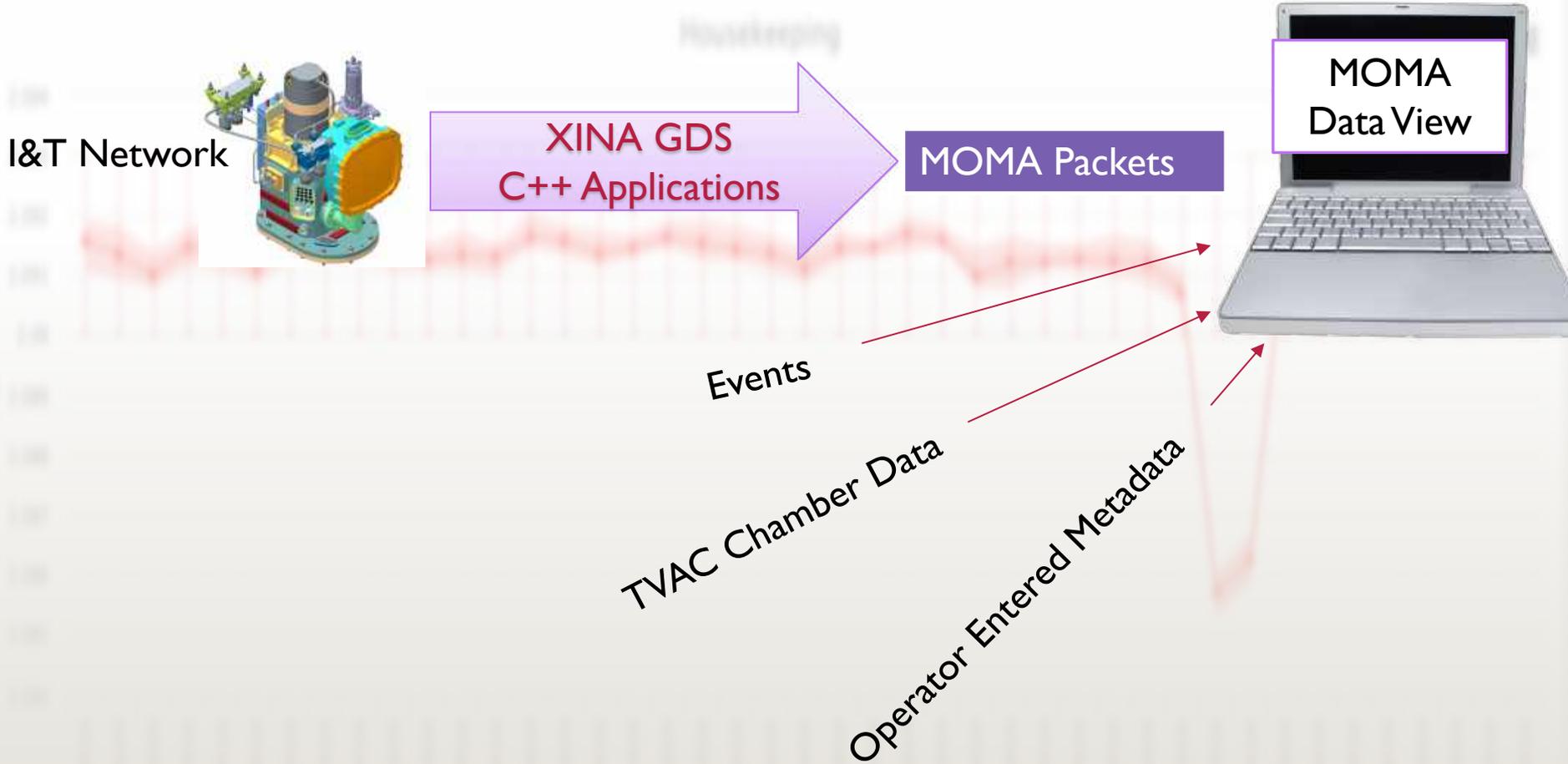
UNDER THE HOOD: MOMA DATA FLOW



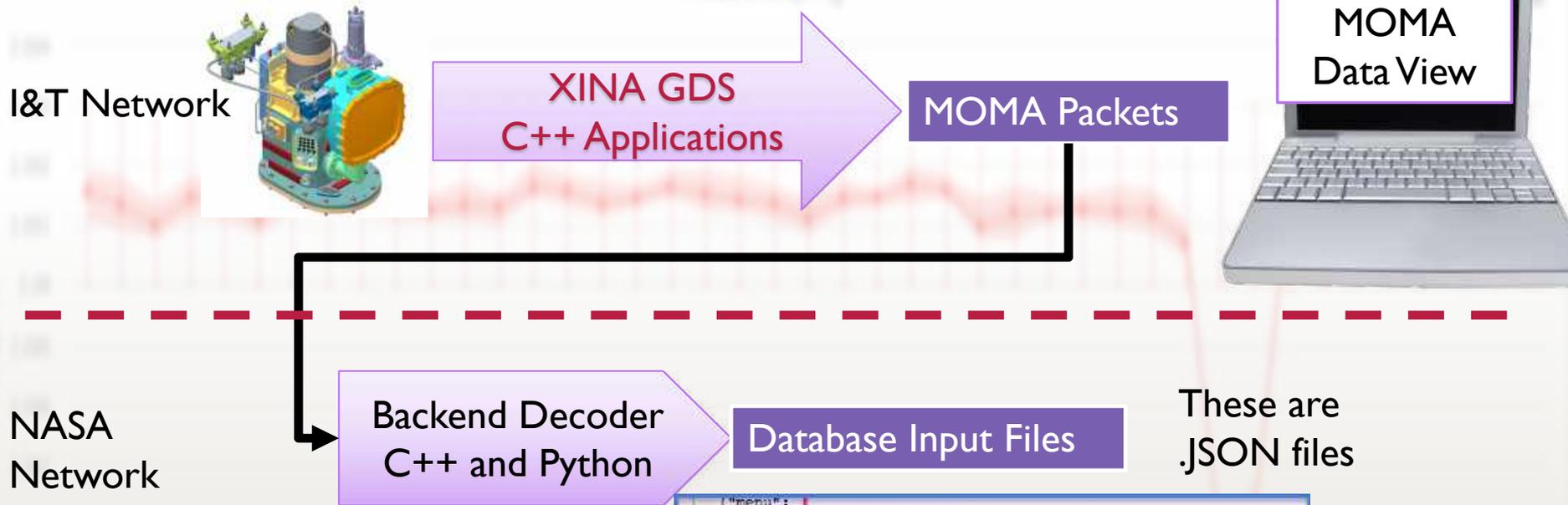
UNDER THE HOOD: MOMA DATA FLOW



UNDER THE HOOD: MOMA DATA FLOW

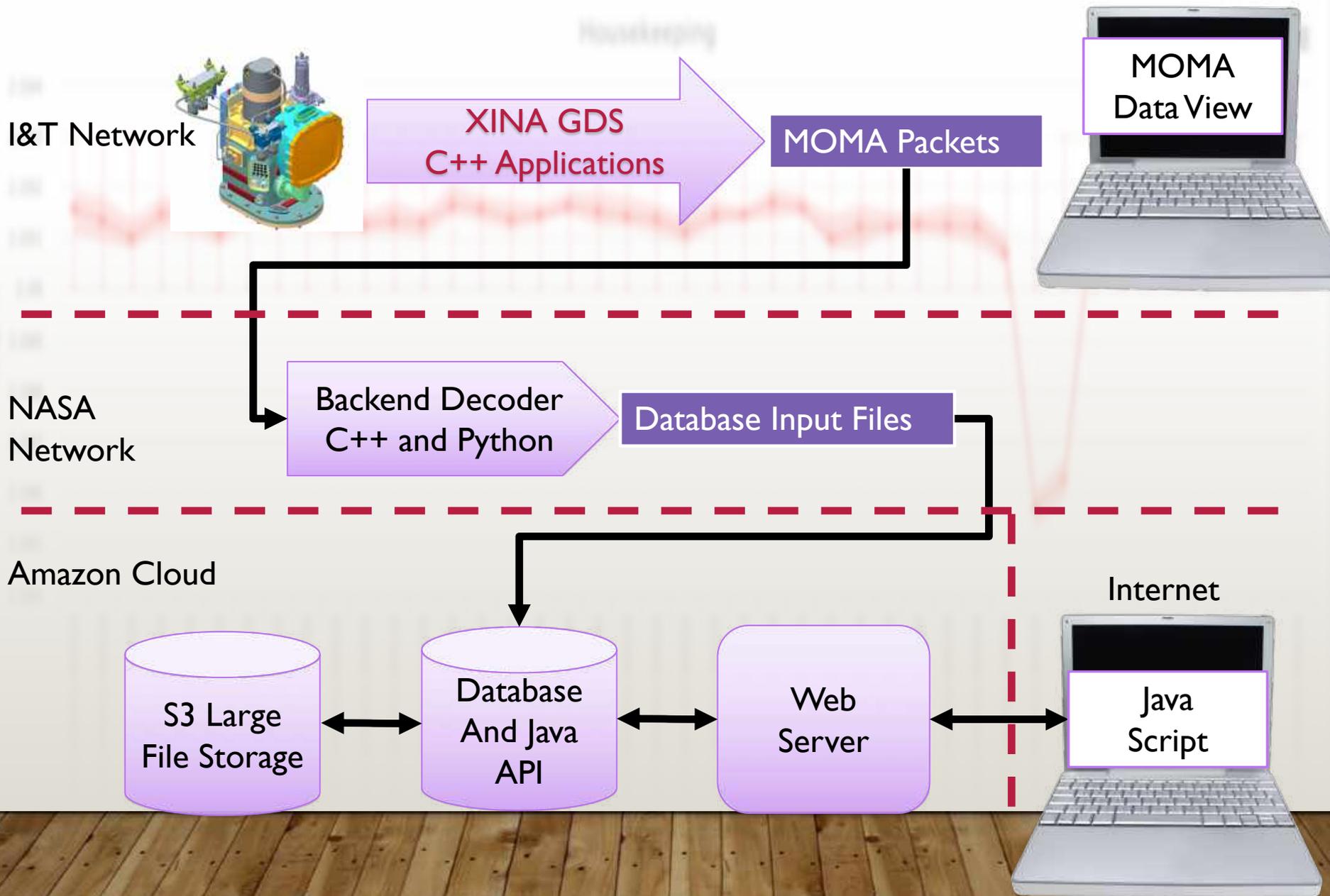


UNDER THE HOOD: MOMA DATA FLOW

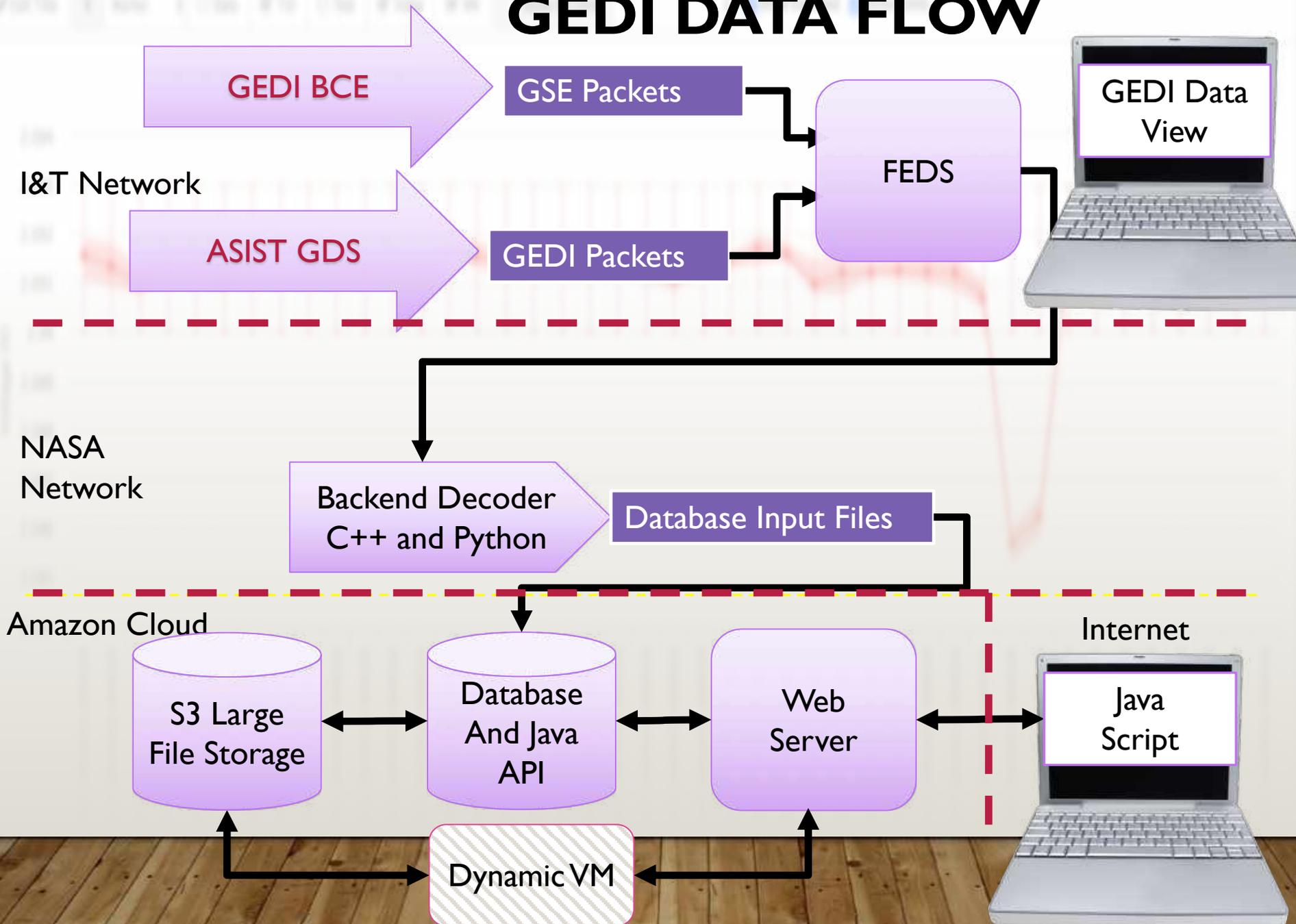


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27 }
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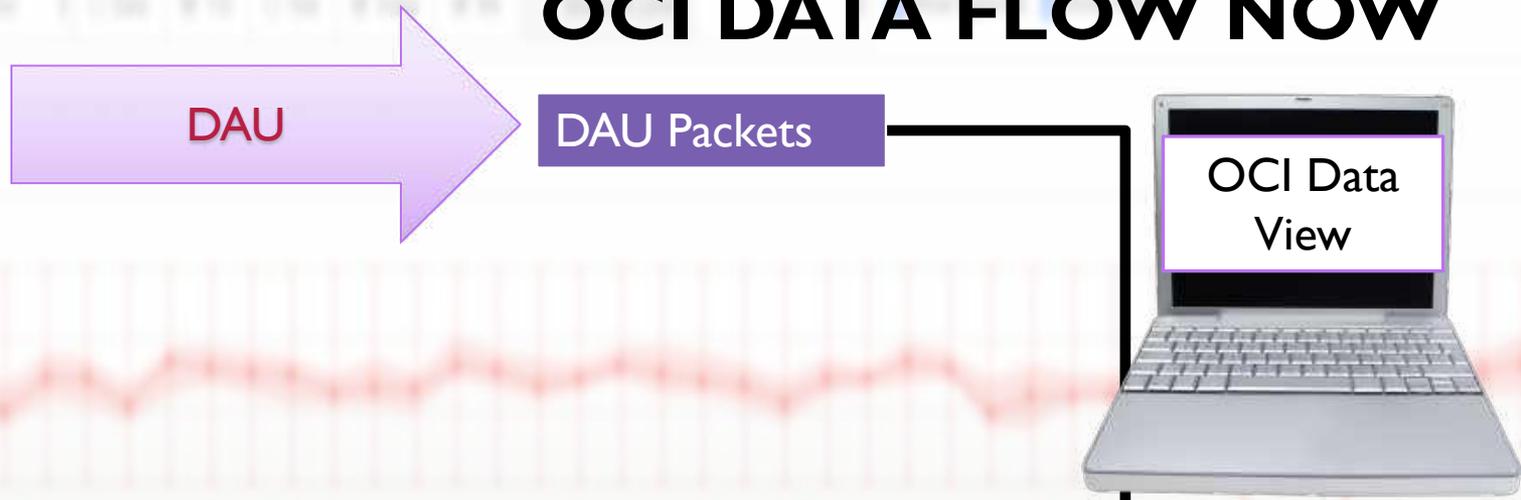
UNDER THE HOOD: MOMA DATA FLOW



GEDI DATA FLOW

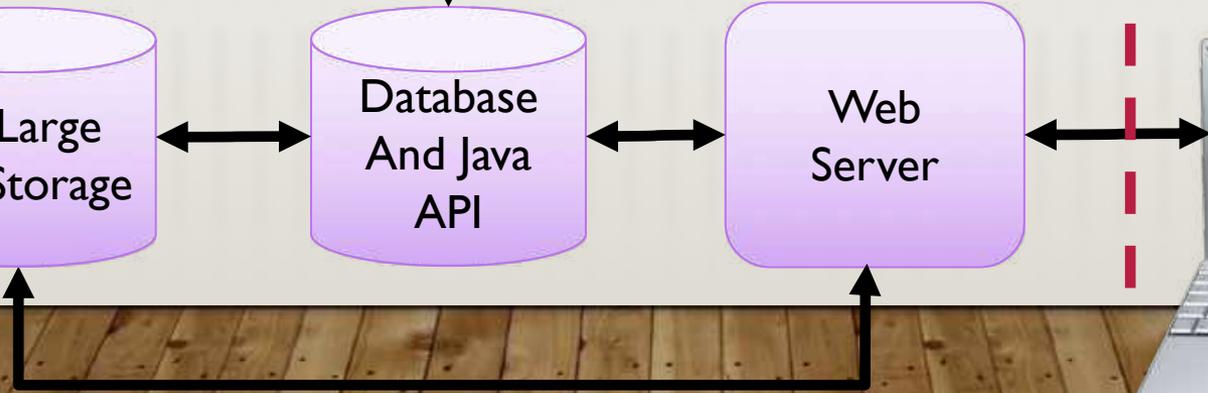
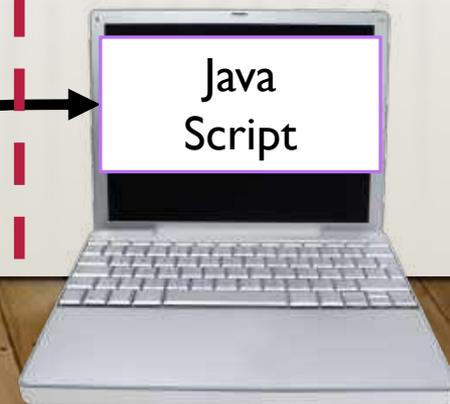
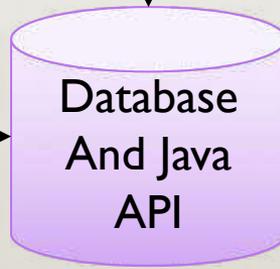


OCI DATA FLOW NOW

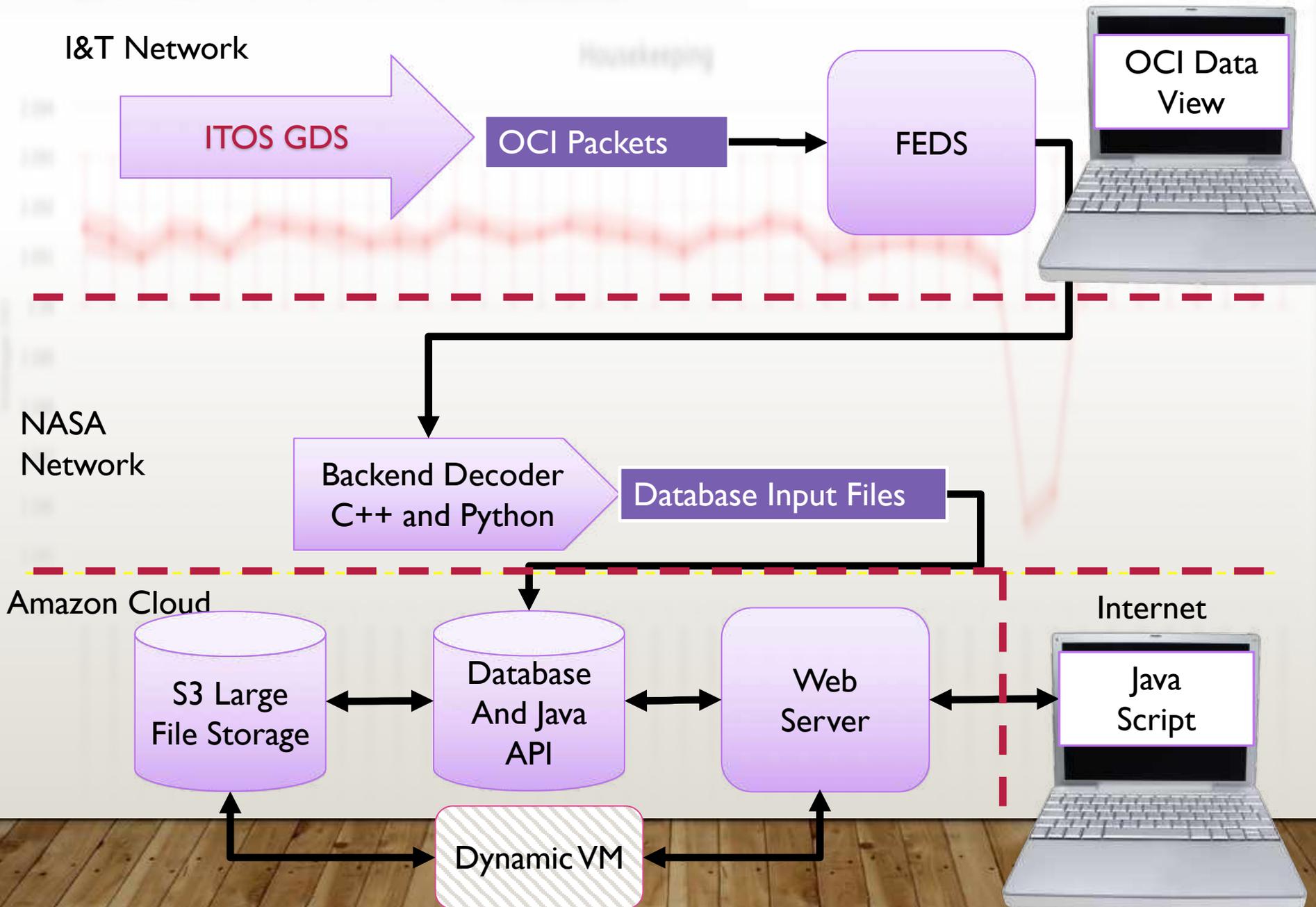


Amazon Cloud

Internet



OCI DATA FLOW FUTURE



SUBSYSTEM LIFETIME: BDU

BDU Team Rack and Software



BDU

Data in BDU team format before and after environmental tests

Decoder Software

Laser Team Rack and Software



Laser Subsystem

BDU

Data in Laser team format before and after environmental tests

Decoder Software

GEDI GDS



GEDI Instrument

Laser Subsystem

BDU

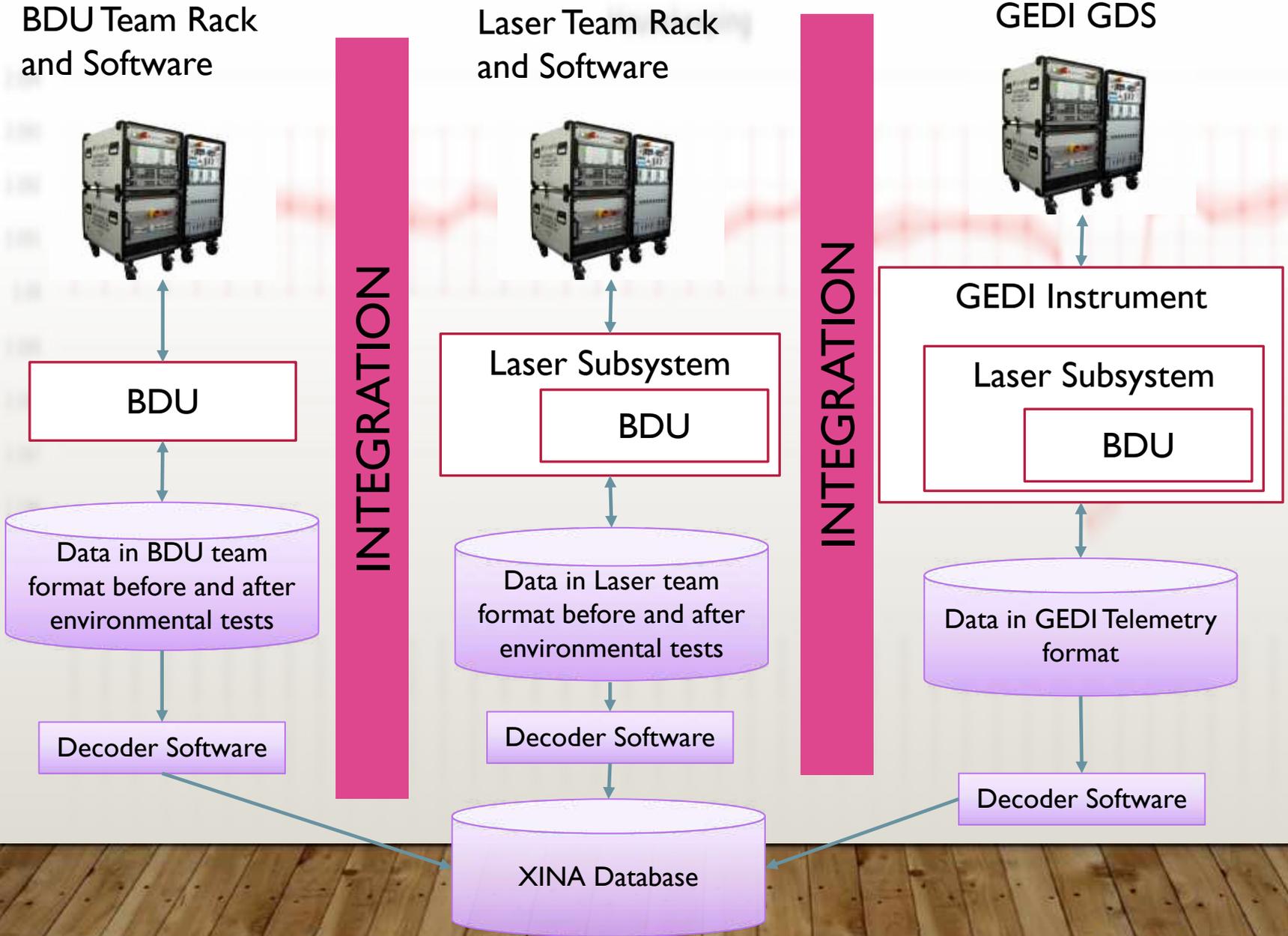
Data in GEDI Telemetry format

Decoder Software

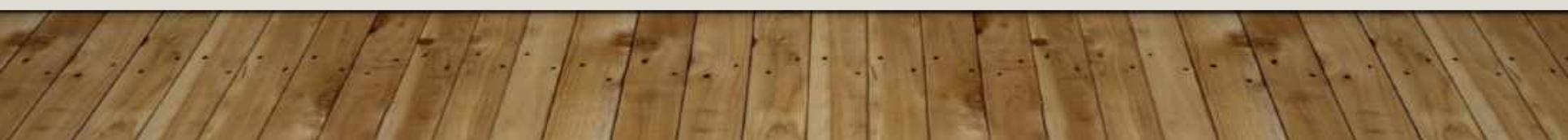
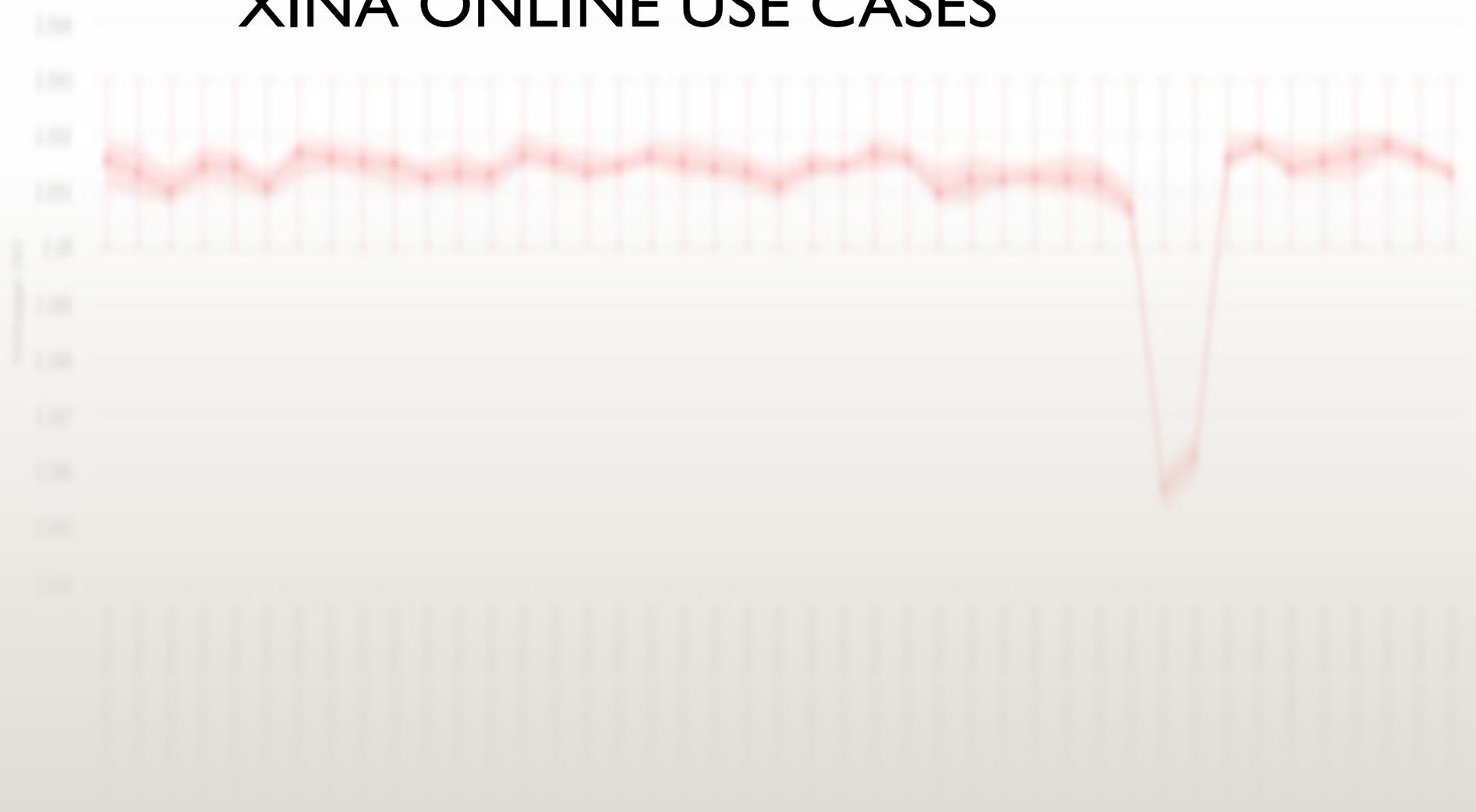
XINA Database

INTEGRATION

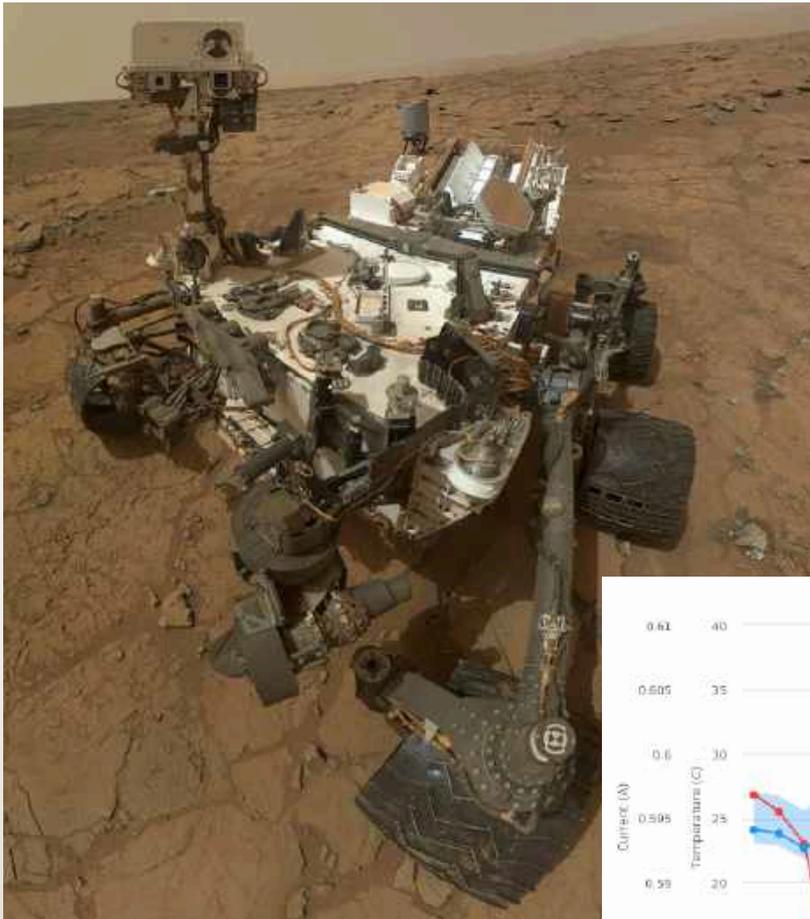
INTEGRATION



XINA ONLINE USE CASES



QUESTION: IS SAM HEALTHY?

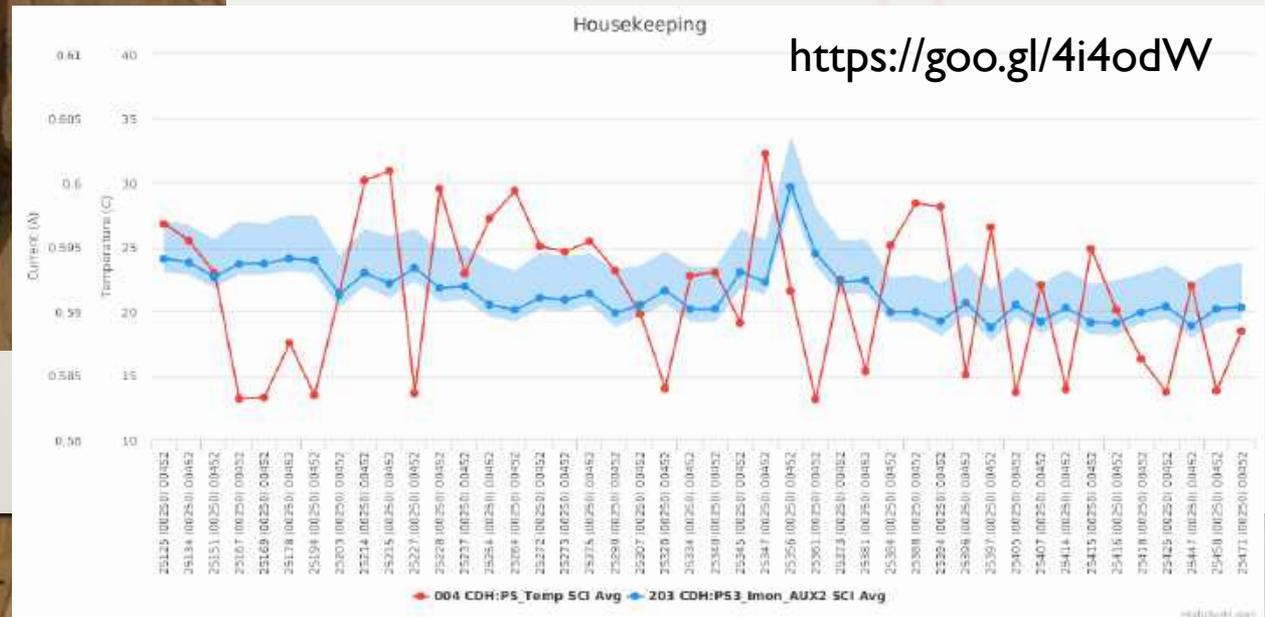


Sample Analysis at Mars instrument performs regular electrical baseline tests.

44 have been performed on Mars in 6.5 years since landing.

Test checks over 1200 data points.

XINA Web interface provide trend of every point.



QUESTION: IS MOMA STILL WORKING AFTER BEING MOVED?

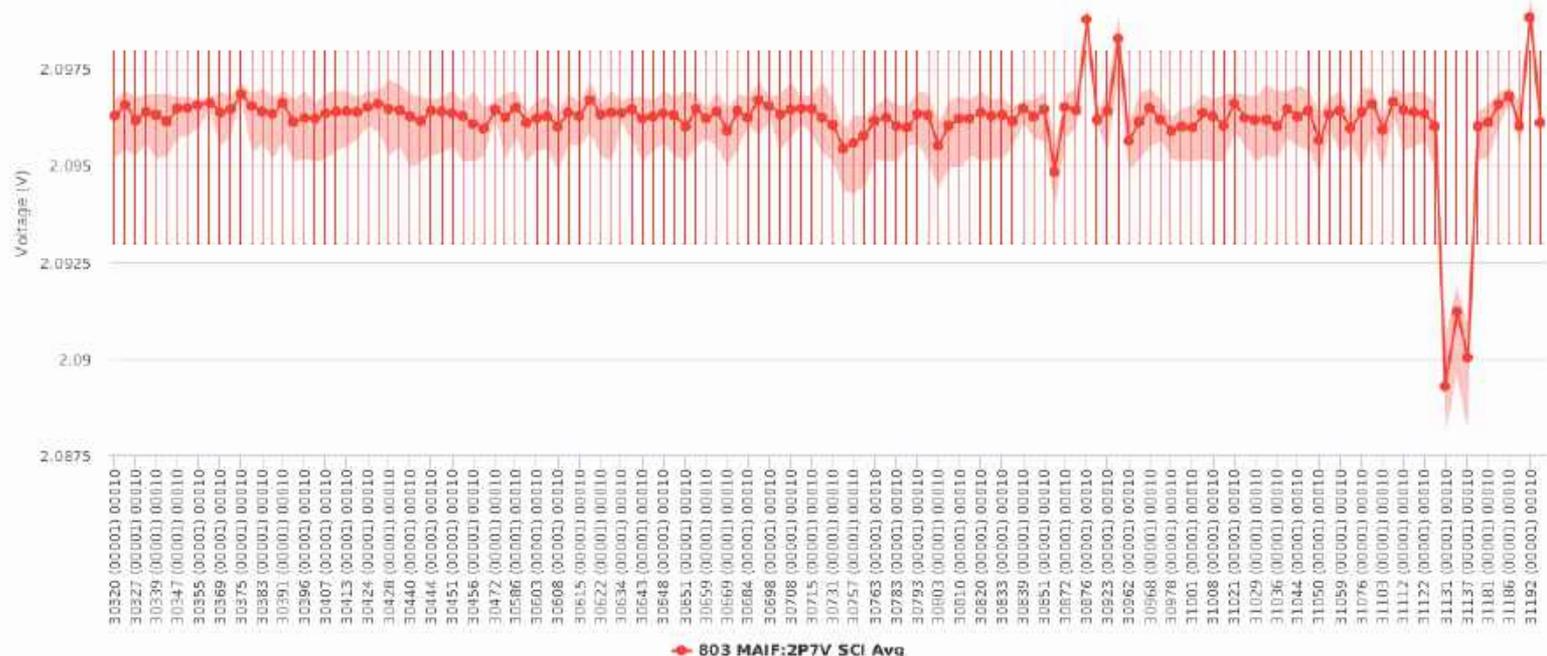


MOMA performs similar baseline tests to SAM

Trending tests found a 7mV shift in supply voltage, indicating pressure sensor problem.

Housekeeping

<https://goo.gl/tVvD2J>



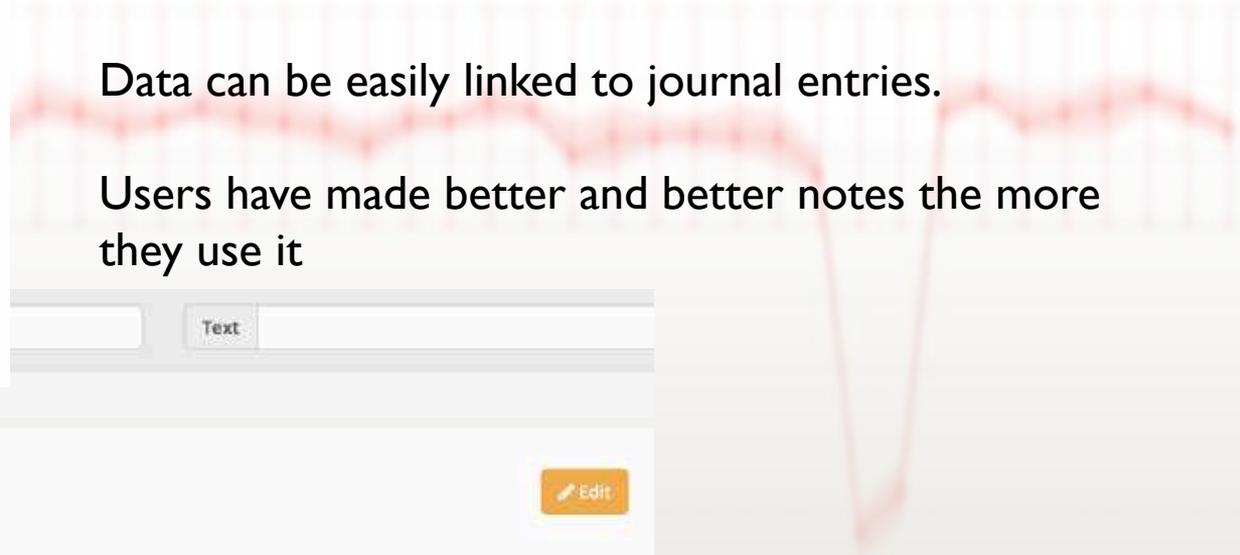
QUESTION: WHAT THE HECK WERE WE DOING THAT DAY



Users take copious notes in the online XINA Journal.

Data can be easily linked to journal entries.

Users have made better and better notes the more they use it



+ Create Note

2018-02-14 1 note(s).

Samuel Larson 2/14 10:28am

TID 8322-FM_SEB_Both_CEMs

- Powered on CEM A up to -2000V in steps of 500V
 - Saw discharge events
- Switched high speed to -5kV monitor since scopes were monitoring both CEMs
- Ramp up CEM B up to -2000V in steps of 500V while leaving CEM A at -2000V
- See some spikes on the -5kV monitor
- Ramped up CEM A up to -2300V in steps of 100V until discharge was seen
 - Saw discharge on scope on CEM side A ONLY
- Set CEM A back to -2000V
- Ramped up CEM B up to -2400V in steps of 100V until discharge was seen
 - Saw discharge on scope on CEM side B ONLY
 - Bus current went up 15mA
 - Increased B to -2500V and current level did not go up
 - TEK 44 - big spike at -2500
- Turned off High Voltage
- Added 1M load on dynode A, (only had on CEMs before)
- Turned on dynode A (see current increase now that there's a load)
- Ramp up CEM A to -2000V and then CEM B to -2000V
- Ramp up CEM A to -2500V in steps of 100V until discharge was seen
- Set CEM A back to -2000V and discharge stopped
- Ramped up CEM B up to -2400V in steps of 100V until discharge was seen

<https://ssed.gsfc.nasa.gov/xina/xo/view/note/database/217>

QUESTION: HAS INSTRUMENT PERFORMANCE DEGRADED?

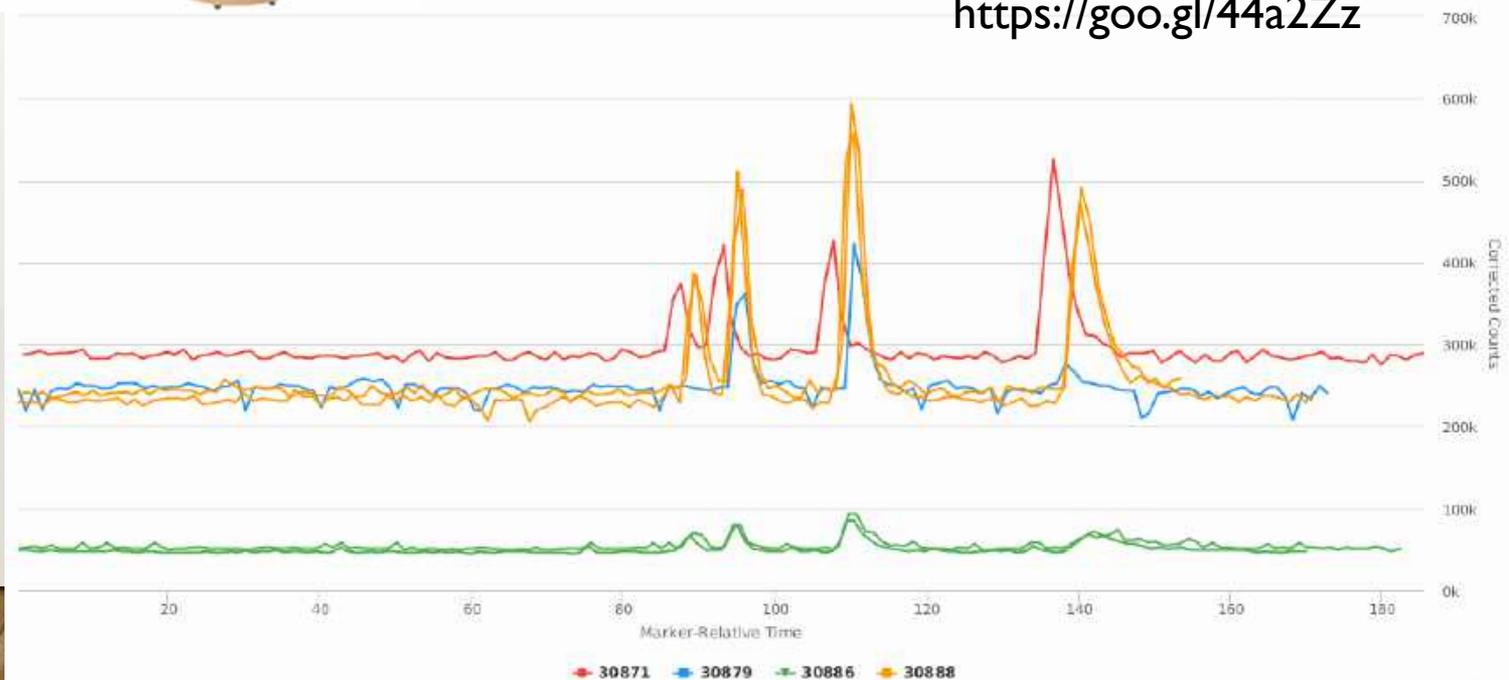


MOMA performs gas chromatograph pyrolysis injections with known gases.

XINA allows comparison of injections of the same gas at different times.

MOMA Chromatogram

<https://goo.gl/44a2Zz>



GEDI BENCHMARKS

- Throughput
 - GEDI 128mbits/second into viewer (real-time)
 - 24mbits/second processing
 - 8mbits/sec real-time into XINA
 - Rate can be substantially increased with hardware
- Data Volume
 - Science data stored in files places in Amazon S3. Cost is ~\$250/year/TB
 - Virtual Machines on Amazon Cloud ~\$500/year
 - Slight increase as volume increases

XINA ONLINE

- Created with **Google's** modern **AngularJS** application platform
- User interface built with Twitter's **Bootstrap** framework with *responsive* design
 - Supports **desktop and mobile** platforms without additional work
- Built on a foundation of well supported, free, cutting edge tools

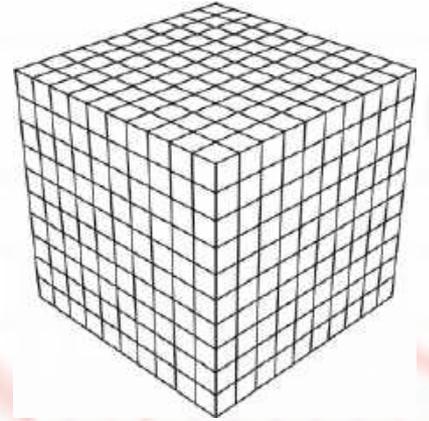
LARGER THAN THE SUM OF THE PARTS

Organized, query-able data allows customized visualizations

- Consumable tracking
- Performance trending tools
- Tools to track uplinked data products
- Tools specifically tracking MOMA laser operation
- Tools to alert users of potential problems
- Tools to track samples tested by the instruments



ADVANTAGES



- No need to support a distributed application
 - No operating systems or versions to worry about
- New visualizations never before thought of are possible
- Specialized work of packet decoding and data processing is separate from user interface
 - Data become a generic computer science problem, not a space computer science problem
 - Students directly from university can begin programming interfaces
- Supports any source of data source
- Lots of free cutting edge visualization tools available

TAKE AWAYS

- XINA is not an application (or an acronym!)
- XINA must be customized to data source but data source can be almost anything
 - Close collaboration between XINA team and engineering and science helps
- Combining data make software far more powerful
- Data pipeline worked out ending with scalable cloud environment
- Adopting XINA early in a project is worth it!