Real-time Management of Petroleum Exploration Process Data at Campos Basin

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Agenda

- Petrobras facts
- The evolution of PI at UN-BC
- Structure of PI System at UN-BC
- Successful applications

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Petrobras by numbers

- 13th largest oil company in the world
- Around 40000 employees
- Net revenues of $32 billion (2003)
- Net profit of $6 billion (2003)
- 12 refineries and 2 fertilizer plants distributed along all country
- 98 offshore oil platforms
- 1.7 million bpd oil production
- 1.7 million bpd refining capacity
- 53 million m^3 of natural gas/day

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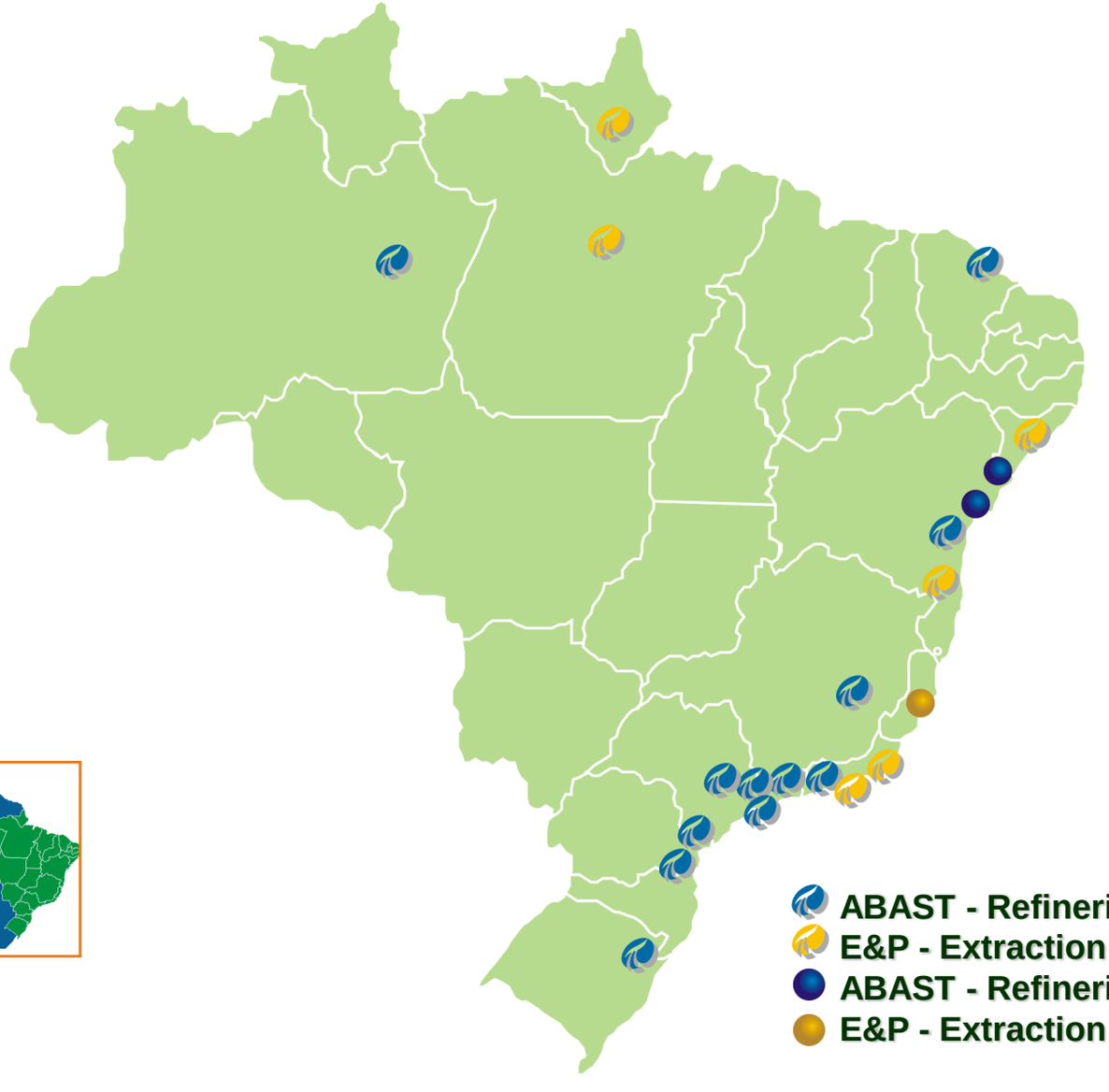
Petrobras outstands

- Unparalleled offshore technology
  (Twice honored with the deep-water oil production prize by OTC)
- Largest number of ISO-9000/14000 certificates in Brazil
- Subsidiaries in Angola, Argentina, Bolivia, Colombia, Nigeria and USA

Petrobras units in Brazil



ABAST - Refineries (with PI)
E&P - Extraction and Production (with PI)
ABAST - Refineries (without PI)
E&P - Extraction and Production (without PI)

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UN-BC by numbers

- Located in Macaé, northeast of the State of Rio de Janeiro
- Oil production: 80% of national production
- Gas production: 30% of national production
- 31 platforms (18 floating e 13 fixed), 2 rented
- 6 drilling platforms
- 28 production fields, with 1490 wells

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The evolution of PI at UN-BC

- PI was first acquired by Petrobras in 1995
- Although widely used since the beginning in the ABAST division (downstream), PI was only introduced in the E&P division in 2000, in two offshore units managed by UN-BC
- Today PI is present in the 32 offshore units managed by UN-BC, with 30000 tags and 400 users
- Plans for the future include integration with SAP/PM

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PI System structure at UN-BC

- Server: PI 3.3 SR2 (will be upgraded to 3.4 soon!)
- 13 platforms running a custom interface with VXL (VXL-PI) on OVMS (PINet)
- 18 platforms running PI-DDE with Intouch and 1 platform running PI-Cimplicity on Windows (PI-API)
- Integration with SampleManager (LIMS)
- 250 PI Combos
- 5 PI Professional Packs
- 3 custom applications developed using PI-SDK

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Main difficulties

- Custom interface VXL-PI had to be developed in-house (no standard interface available), which took 4-5 months
- Due to the high complexity of the Intouch applications, it was necessary to enhance the PI-Intouch interface for PI-DDE (testing phase took 3-4 months)
- A redundancy mechanism for PINet/VXL-PI had to be developed
- A redundancy mechanism for PI-DDE/Intouch is currently being developed

Was it worth it?

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General benefits achieved by PI

- Significant reduction on the need for engineers and technicians to go onboard the platforms to perform their work
- Preventive maintenance could be replaced by predictive maintenance
- Better quality of data
  - better input data for simulation tools $\Rightarrow$ better simulation results
- Longer periods of historical data can be online at a given time
- Data is available in real-time

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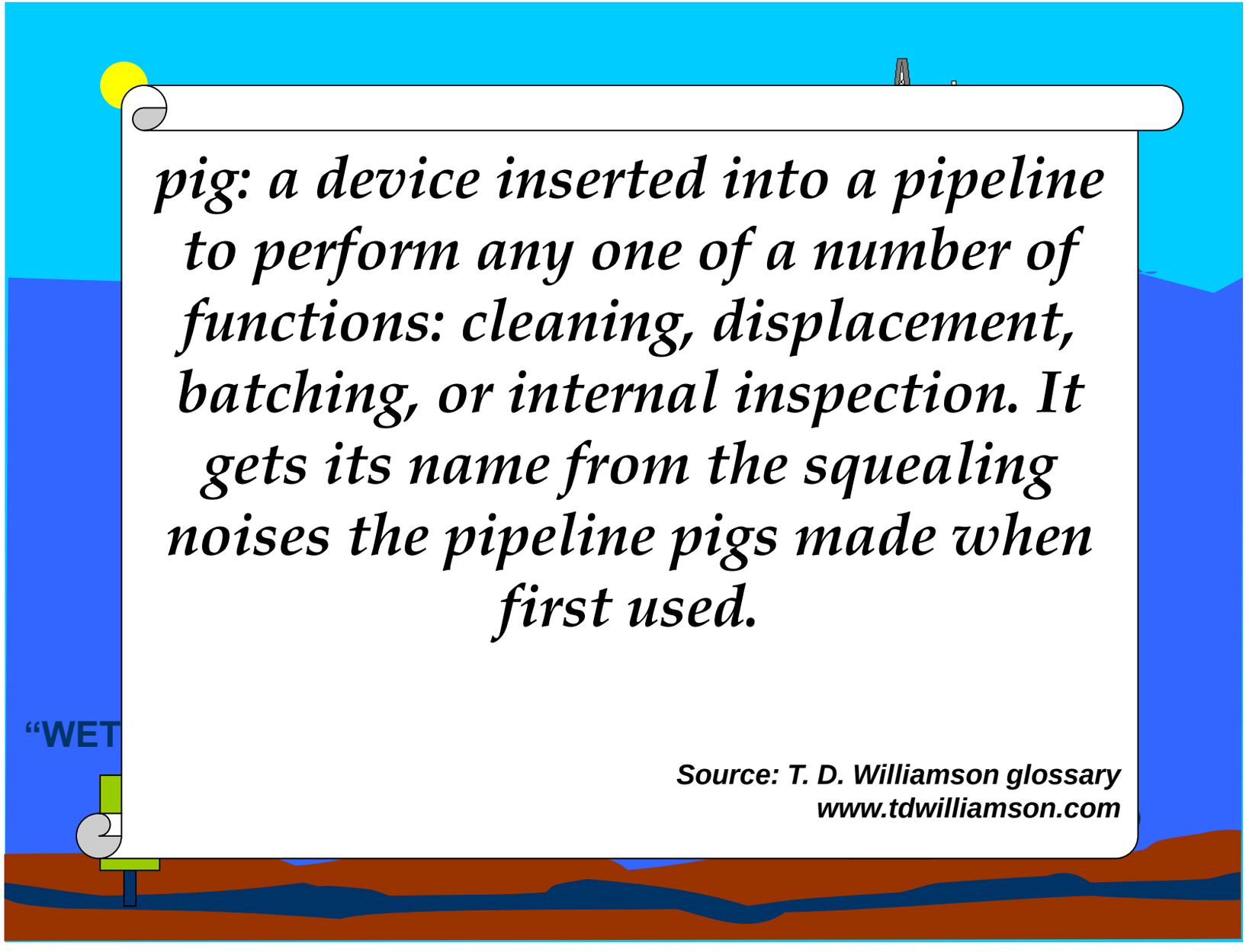
Problem: wax deposition



pig: a device inserted into a pipeline to perform any one of a number of functions: cleaning, displacement, batching, or internal inspection. It gets its name from the squealing noises the pipeline pigs made when first used.

Source: T. D. Williamson glossary
www.tdwilliamson.com

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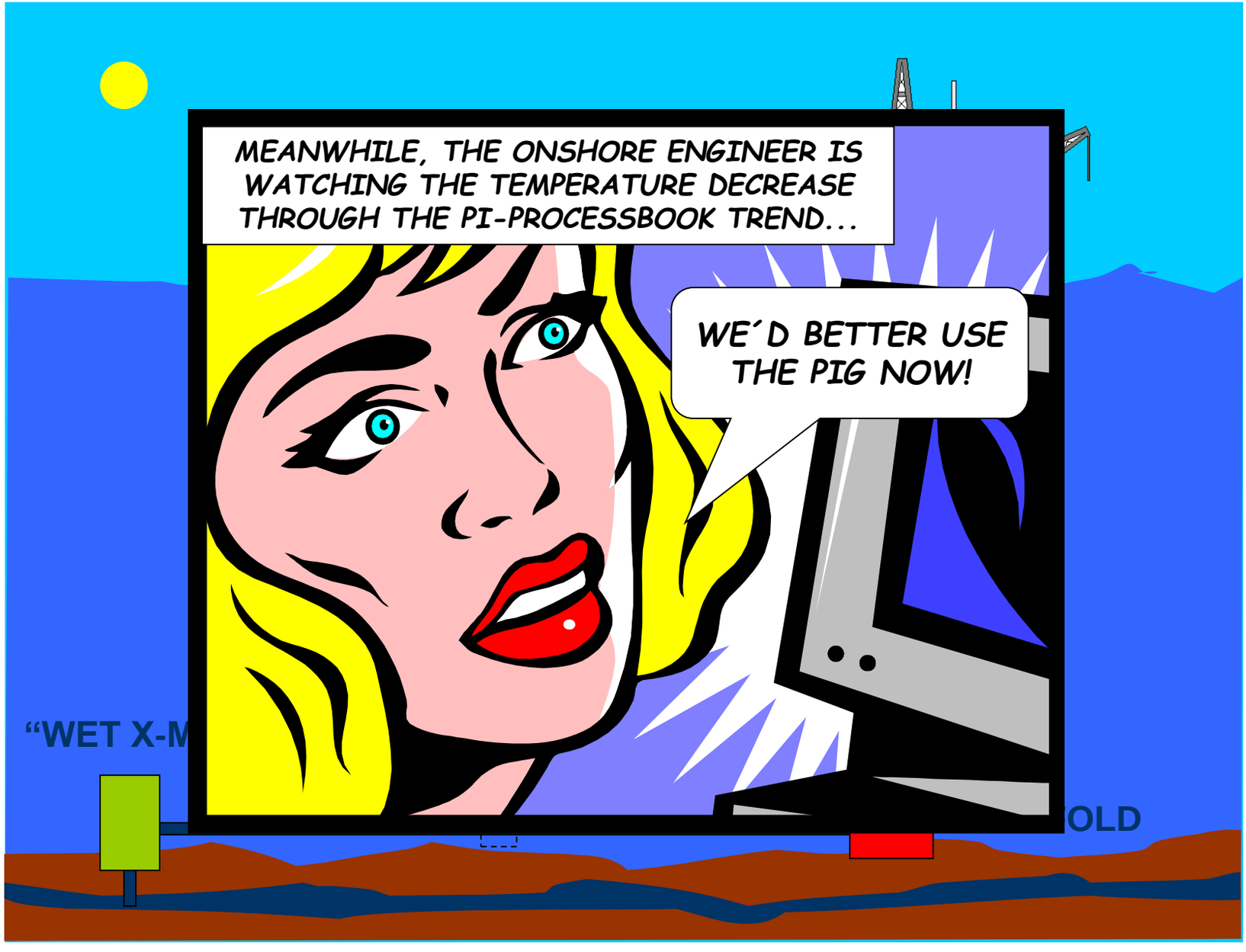
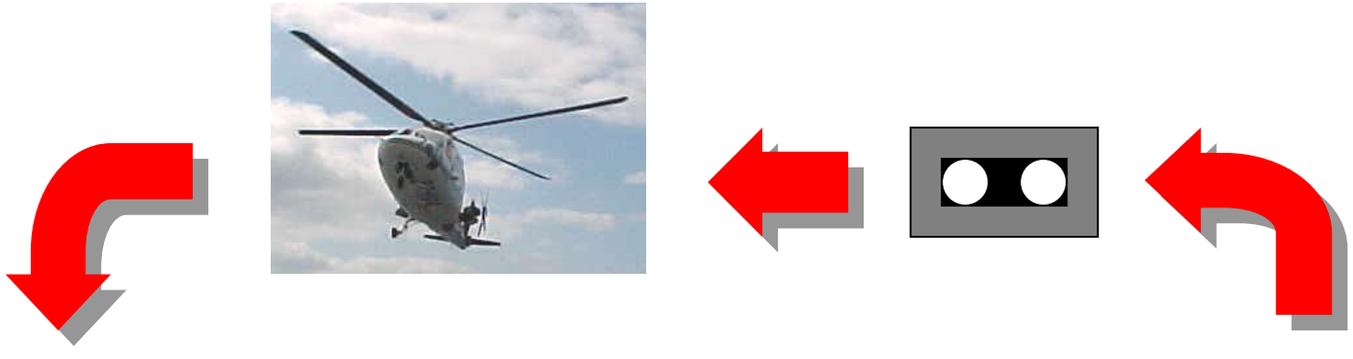
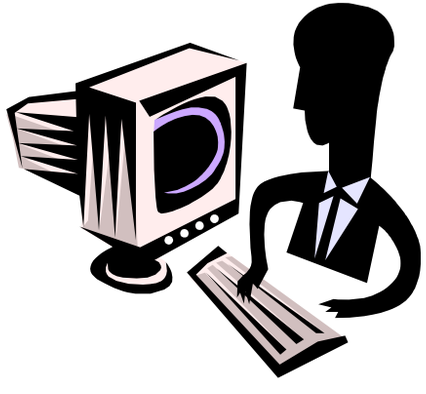
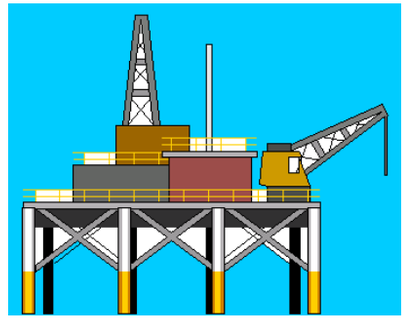
Solution: predictive maintenance



Problem: delay in data analysis







Onshore technician had to wait 1-4 days to access process data

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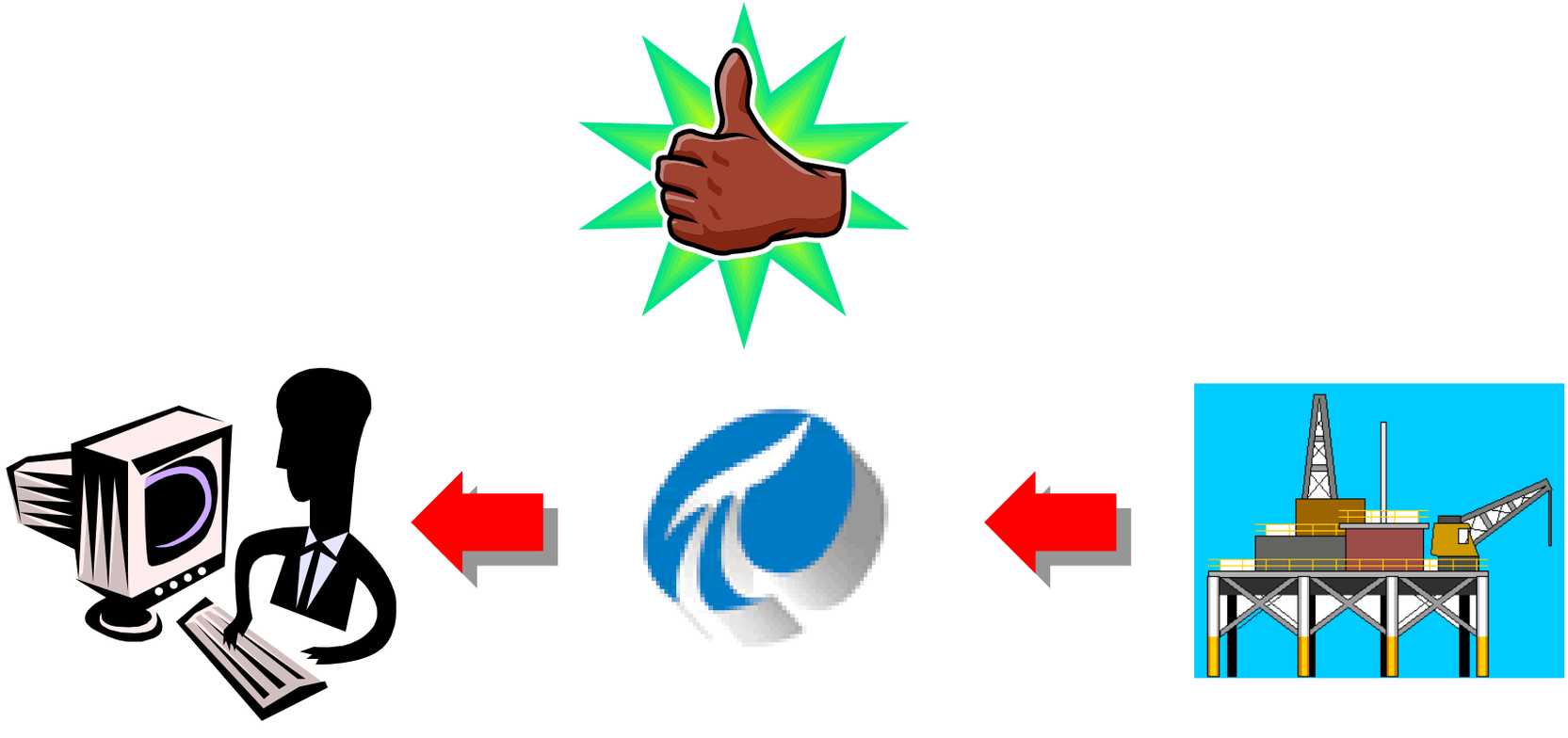
Solution: deliver data in real-time!



Now, with PI, data is available in real-time, anytime!

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Problem: reports made by hand

Offshore operator stayed up to 3 hours after shift time to elaborate report

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Solution: use PI-Datalink!

Reports are generated instantly and are more precise

Operator can drop work at the right time

Problem: high cost of maintenance

- When a piece of equipment broke down on the platform:
  - a technician had to go onboard to analyze the problem
  - sometimes another technician needed to go onboard to fix the problem
- Production decreases while the equipment is not fixed

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Solution: analyze it onshore

- With PI, the onshore engineer can analyze the cause of the problem prior to sending a technician onboard
  - saves time
  - avoids unnecessary boardings
- Sometimes, problems can even be predicted and avoided before they actually occur!

Case 1: machine dead after 4000h

- A machine with an expected life of 36000h died after 4000h of operation
- The manufacturer claimed that Petrobras should pay for the fix because the machine supposedly had not been used within recommended specifications
- Through PI-ProcessBook trends, onshore engineers proved that the manufacturer was wrong
- The manufacturer fixed the machine at no cost for Petrobras ($ millions saved!!!)

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Case 2: Emergency Shutdown

- On a certain oil platform, Emergency Shutdowns (ESDs) occurred always on the same day of the week
- Through PI, onshore engineers discovered that this day matched the team shift day
- After that, they changed the team shift routine so the production coordinator shifts one day after the rest of his team to pass the information about the production to the next coordinator prior to leaving the platform
- No ESDs have occurred since then!!!

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Case 3: problem in pipeline

The gas production is continuous, which means that if there is any problem with the transmission of the gas through the pipeline, the exceeding gas must be burned. This represents a huge loss for the company, because not only the production decreases, but there are also high fees charged by the government for environmental hazards and waste of natural resources (560000 m^3/day @ \$0.09/m^3).

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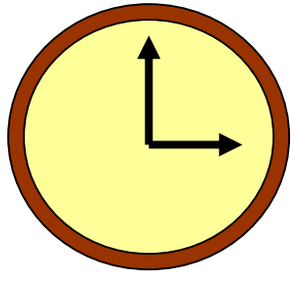
Problem: data from many sources

Chemical Analysis

Corrosion Rate Metal loss / ER Probe

Process Data

Corrosion Rate data is currently brought from platforms each 3 months by technicians



3 hours (after 14 years of experience!)

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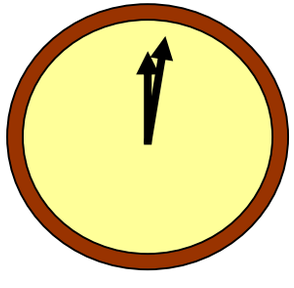
Solution: integrate data with PI

Chemical Analysis

Corrosion Rate Metal loss / ER Probe

Process Data



Corrosion Rate data will soon be available in real-time through PI!

5 minutes (no great expertise required)

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Returning to the previous question...

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Was it worth it?

...the answer is quite obvious:

Yes,

definetely!

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Thank you very much!

Sergio Saad and Eduardo Ladeira aboard an offshore unit in Campos Basin (July 2003)