

# Interactive Web-based Analysis Clients using AJAX: examples for CMS, ROOT and GEANT4

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# What is AJAX?



# What AJAX is not...




# What AJAX is not...



# What AJAX is not...



# **A**ynchronous **J**avascript **A**nd **X**ML





# AJAX

**AJAX** is a buzz-word used to indicate a set of **techniques** and **programming patterns**, involving **Javascript** and **XML**, which allow to create web applications that give the same feel and responsiveness of traditional desktop applications.

# Traditional web pages workflow

The client does an HTTP GET Request to the server

Client



HTTP GET Request



Server



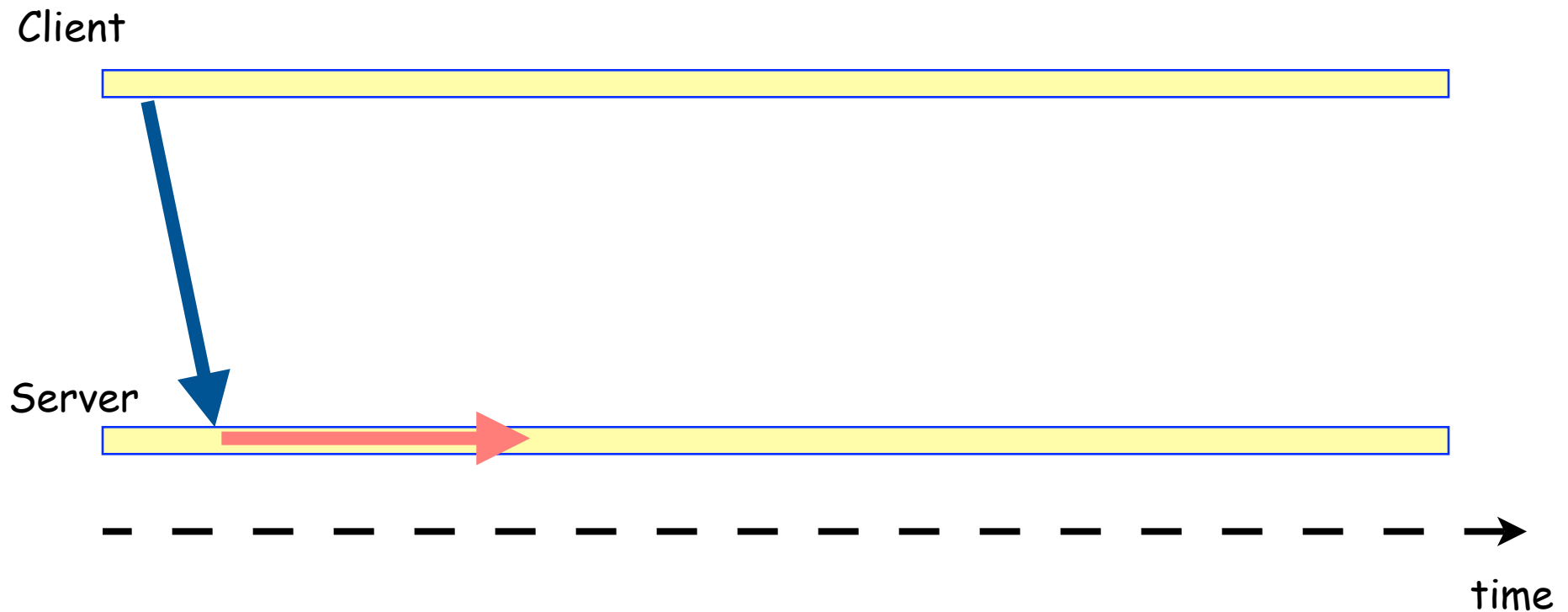
time





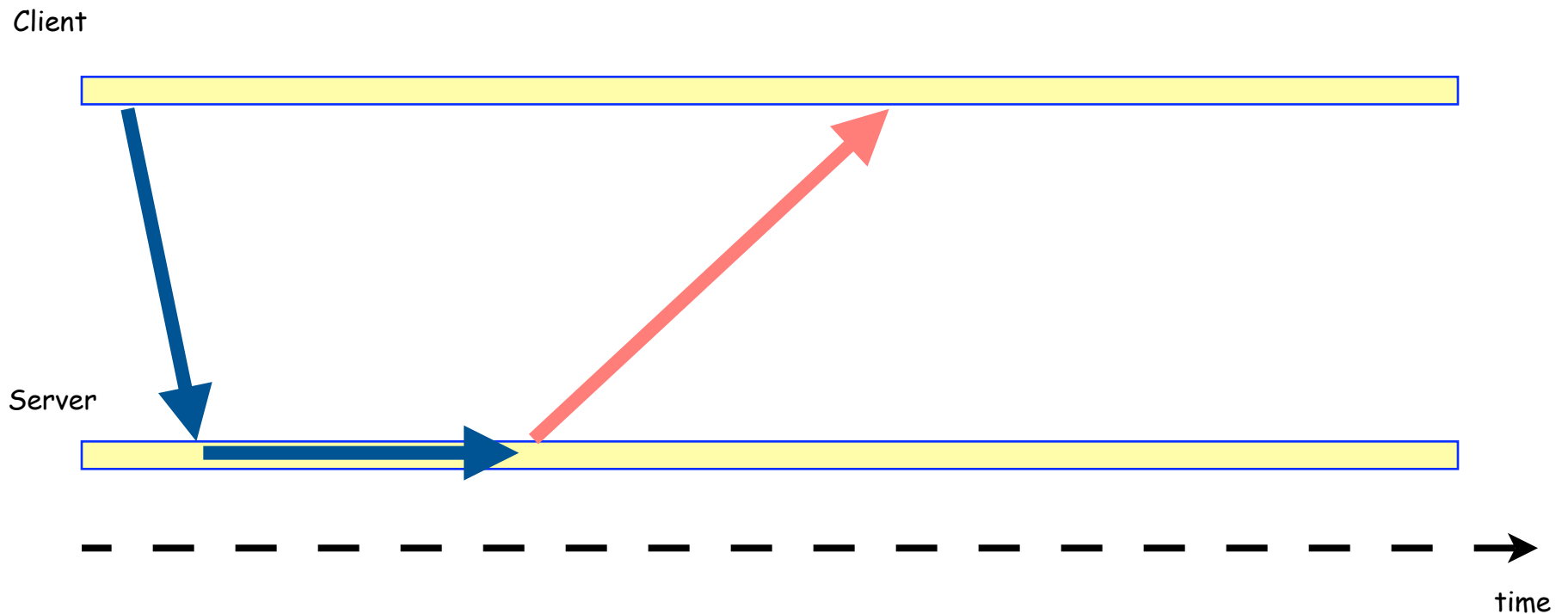
# Traditional web pages workflow

The server constructs the full web page



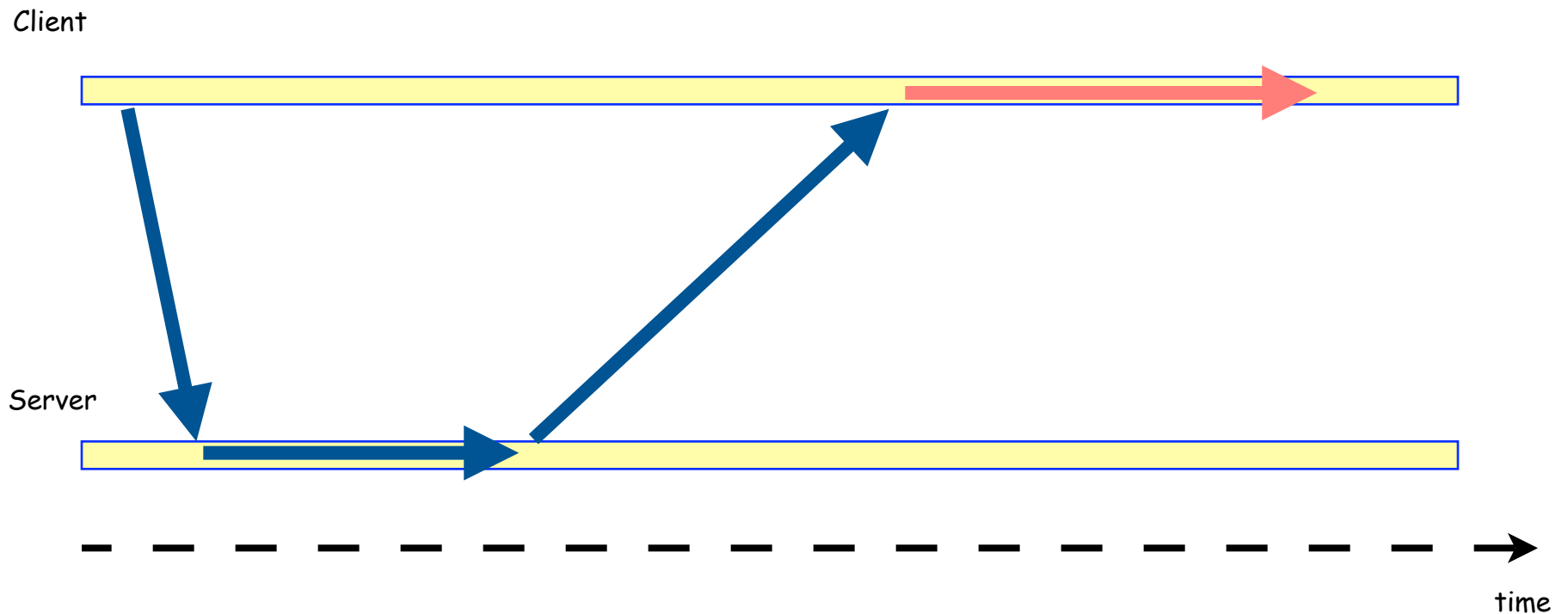
# Traditional web pages workflow

The full page is sent...



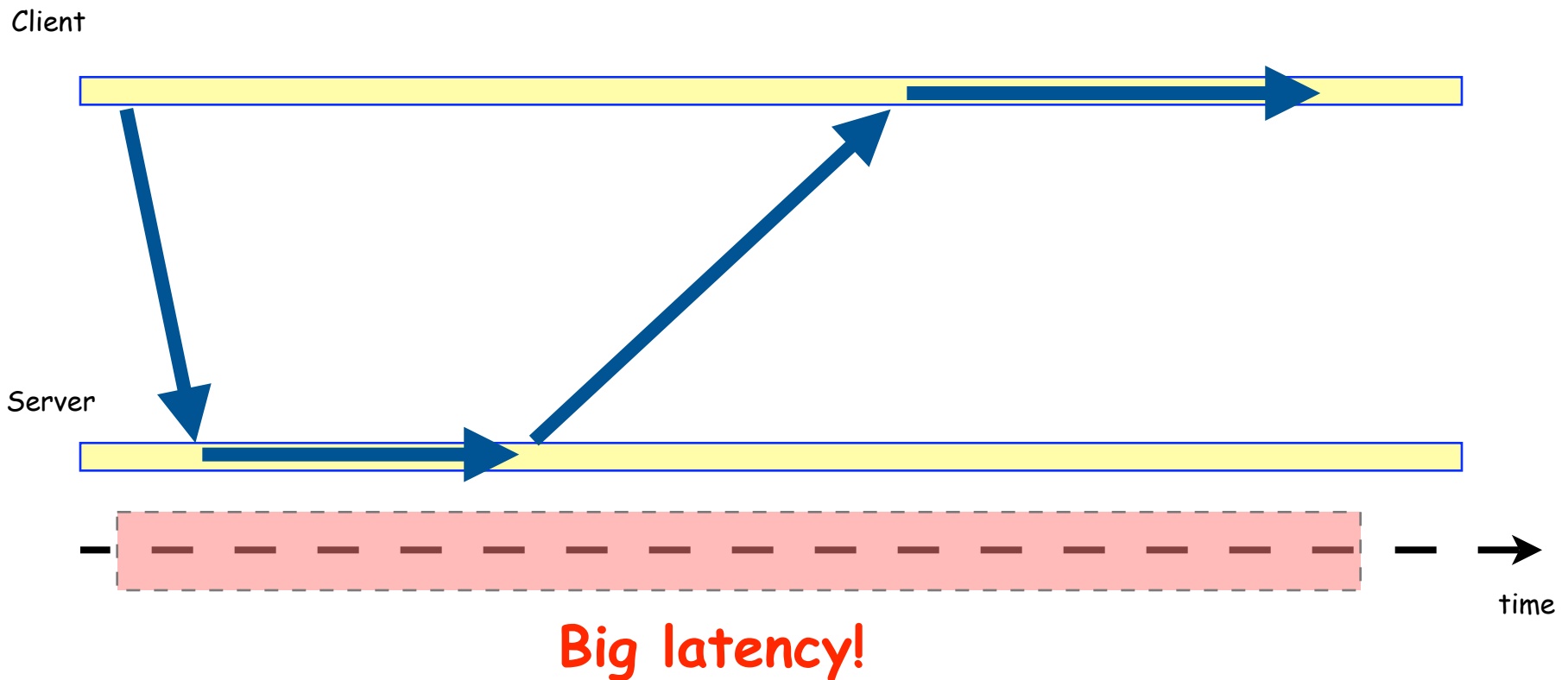
# Traditional web pages workflow

...and processed by the client...



# Traditional web pages workflow

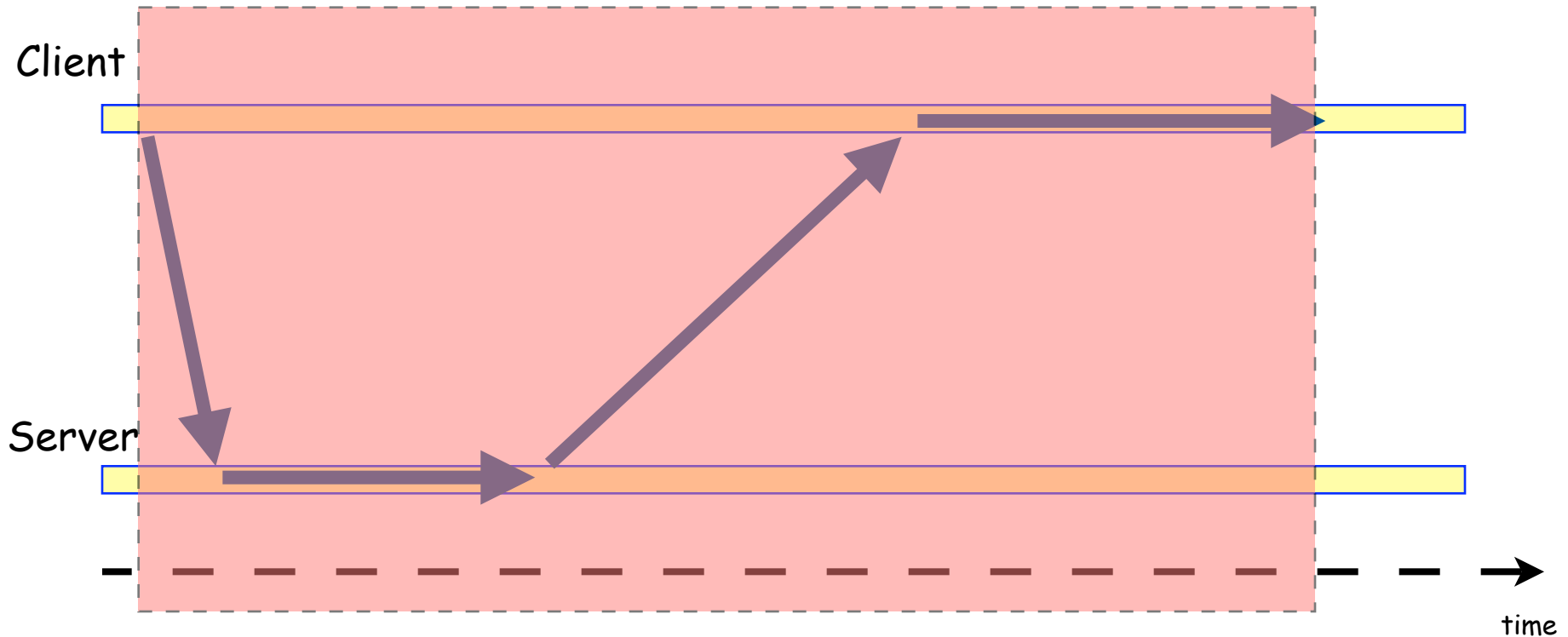
If the complete web page is complex enough, a big interval of time intercourses between request for a page and its actual availability to the user



**Big latency!**

# Traditional web pages workflow

moreover the user cannot use the web page until fully loaded.



Period the web page is unavailable to the user

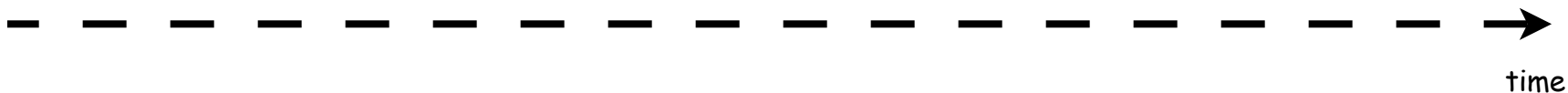
# AJAX

The client does an HTTP GET Request to the server

Client



Server



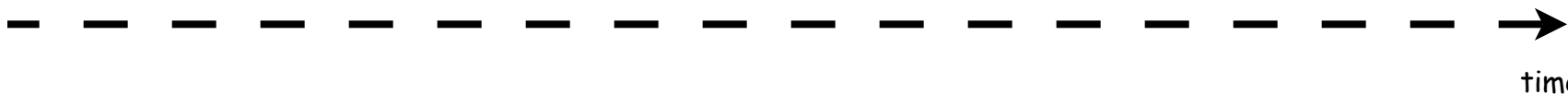
# AJAX

The server constructs the minimal web page for the user to start browsing

Client



Server





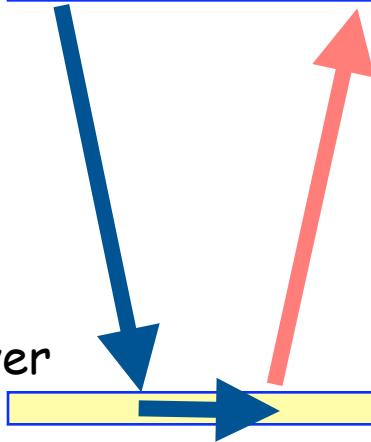
# AJAX

The minimal page is sent

Client

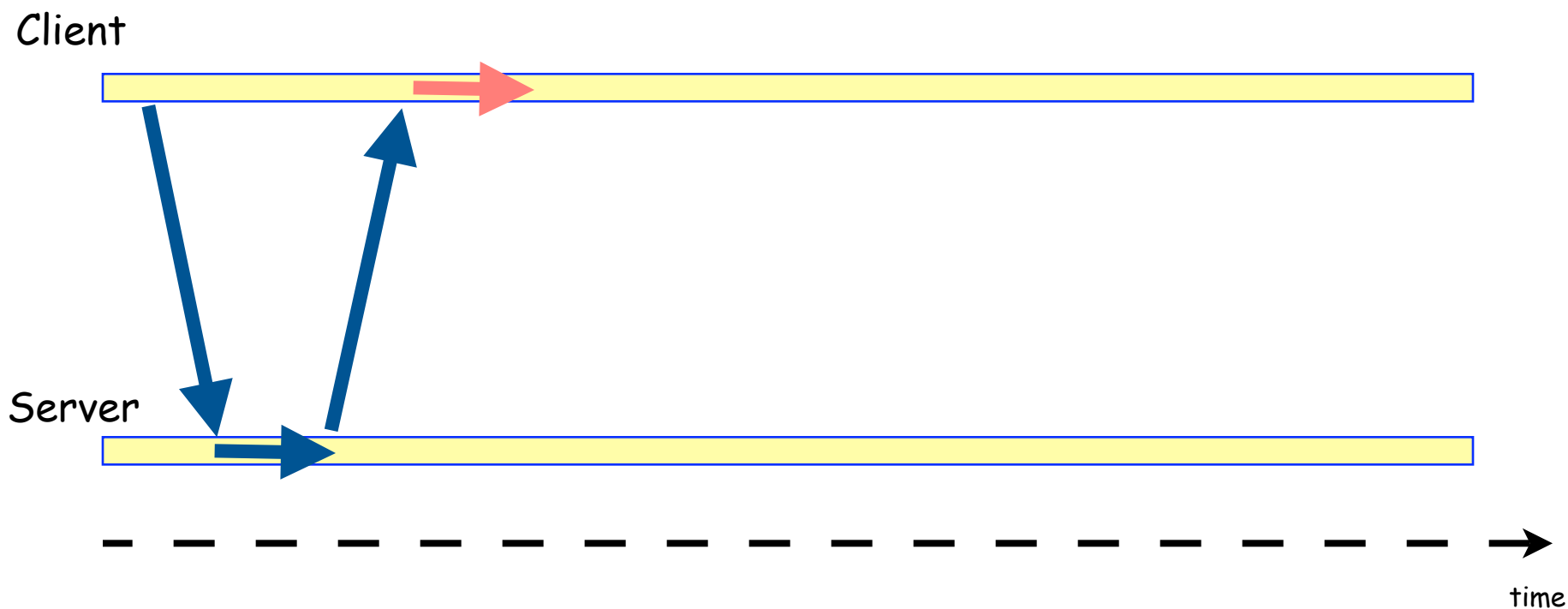


Server



# AJAX

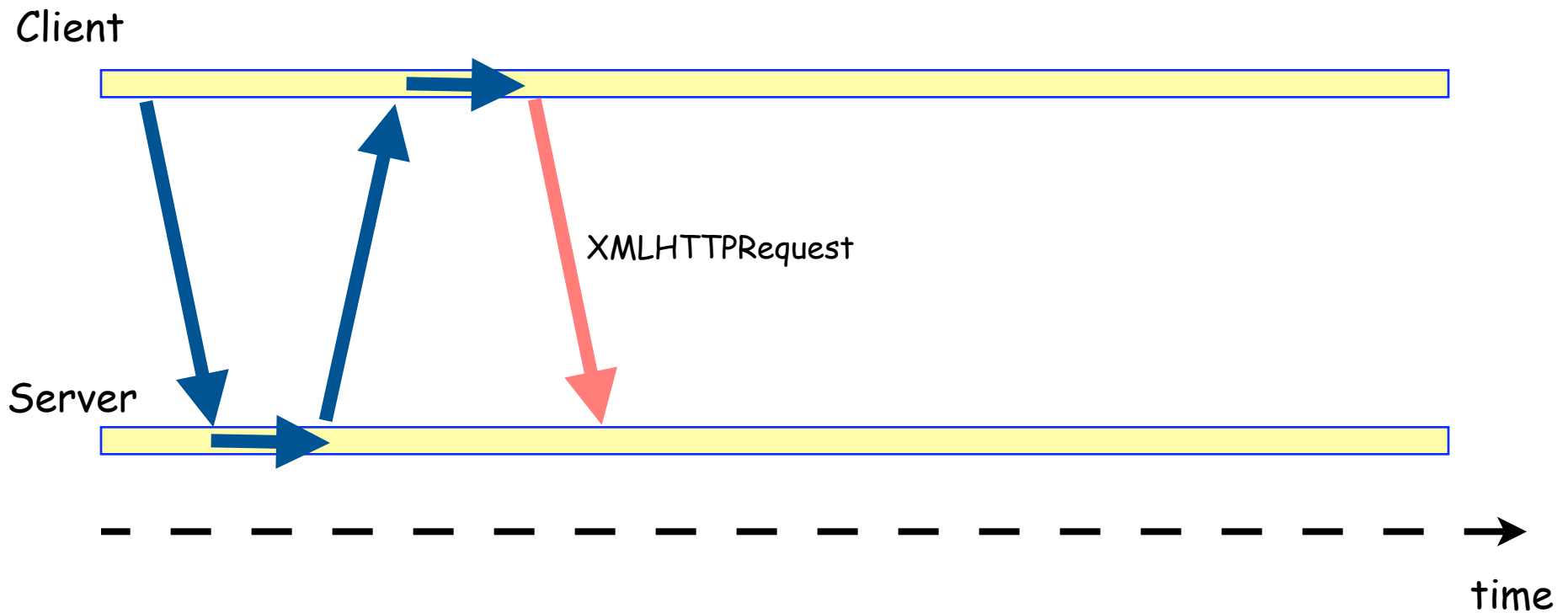
The client processes the web page





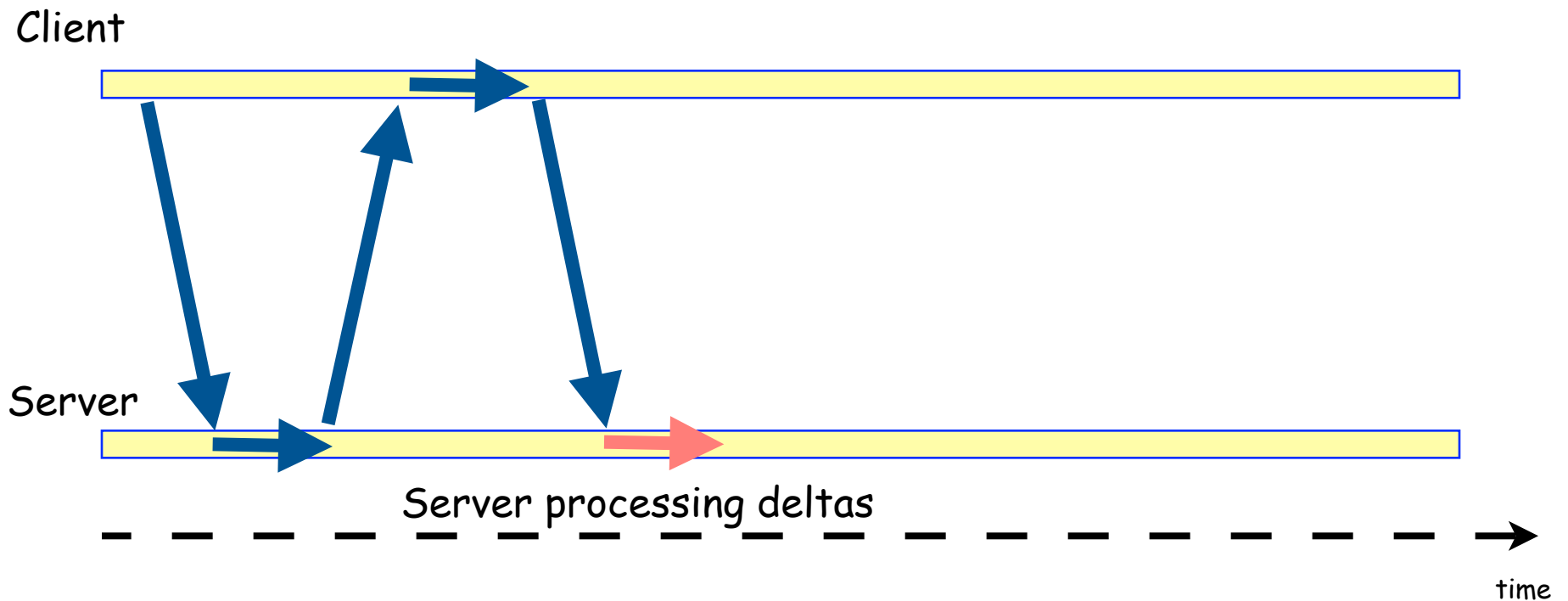
# AJAX

a new request for DELTAs is done



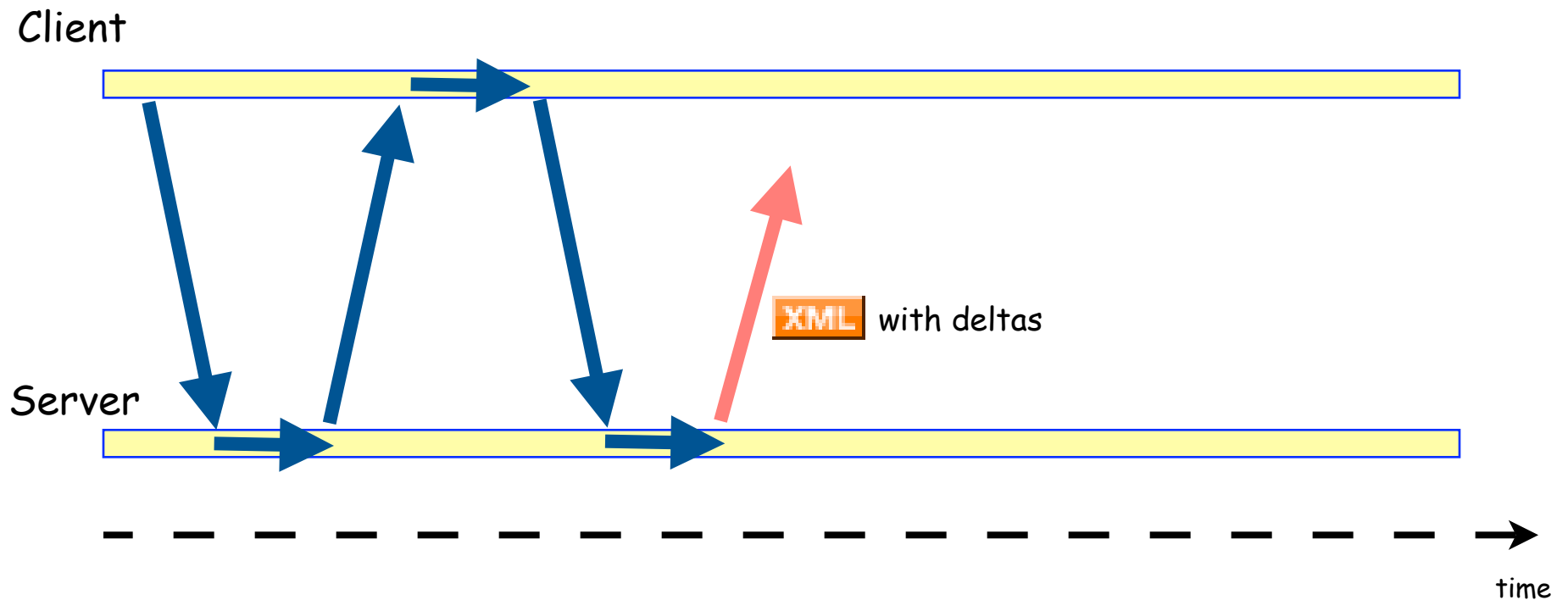
# AJAX

the server processes the request and decides what has changed



# AJAX

response is given formatting delta into XML







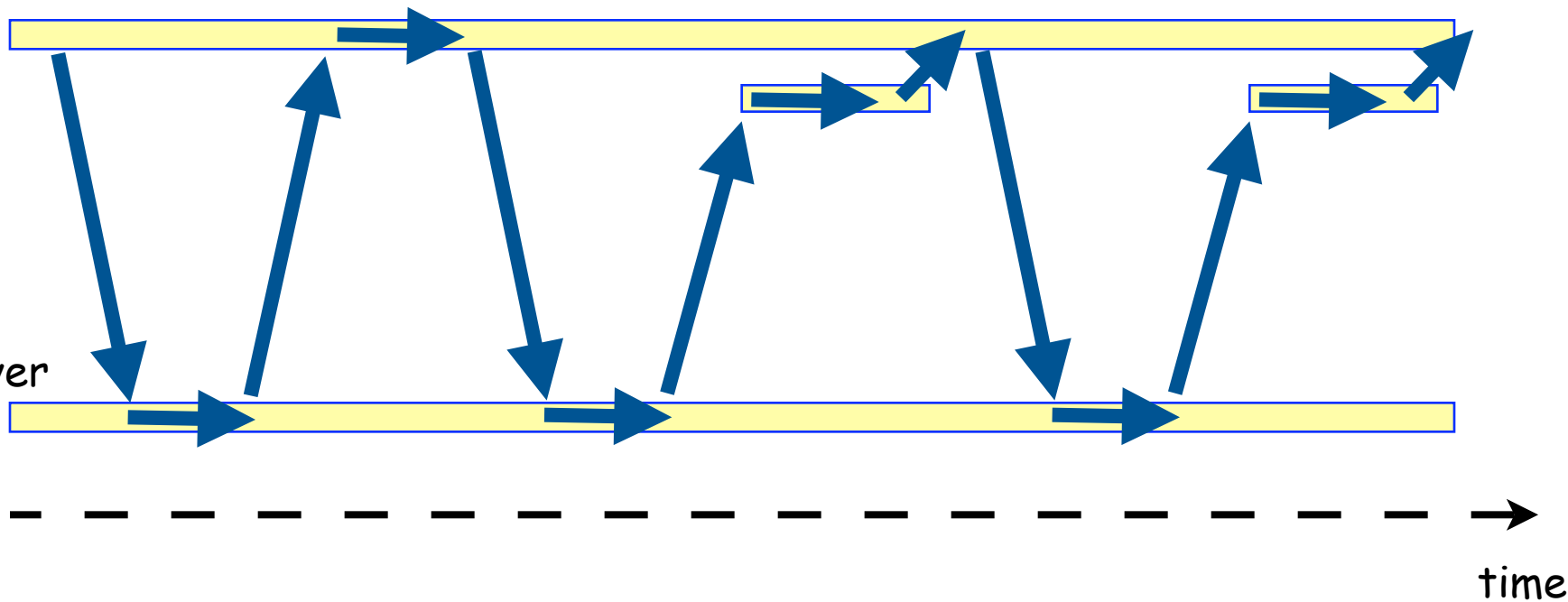


# AJAX

iterate on new user's requests

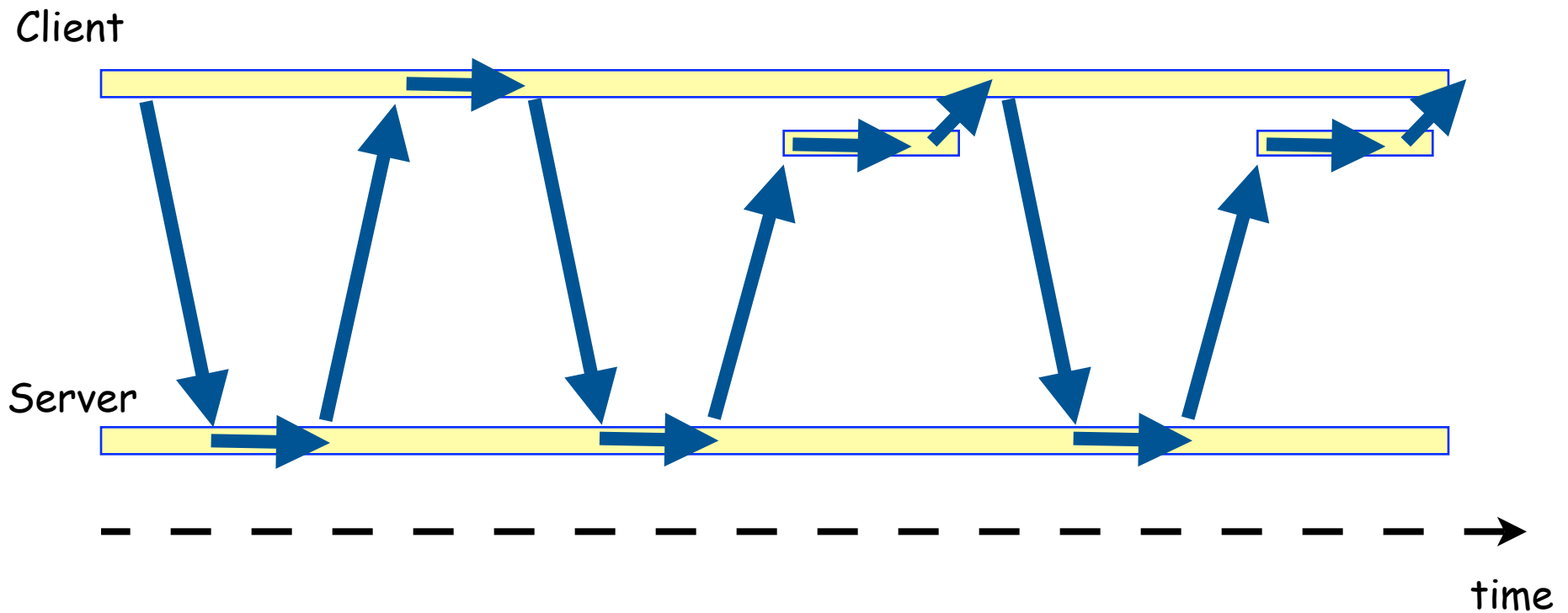
Client

Server



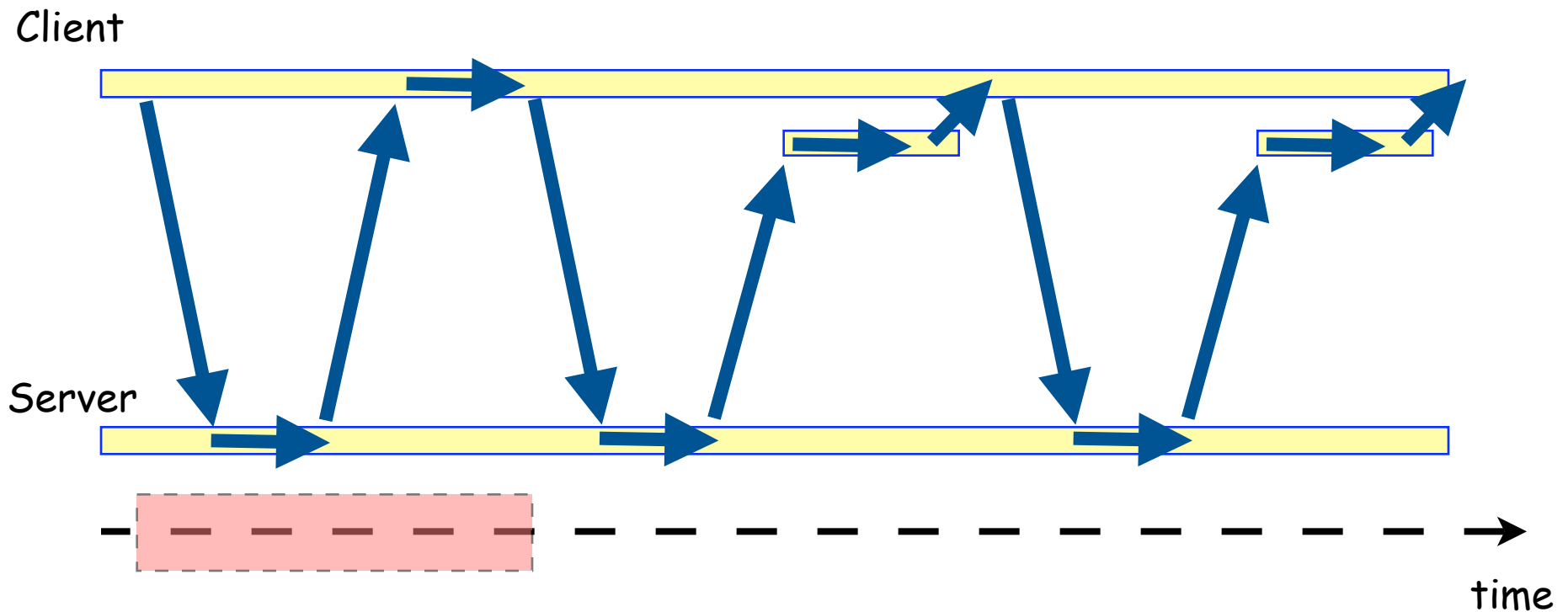
time

# The AJAX advantage



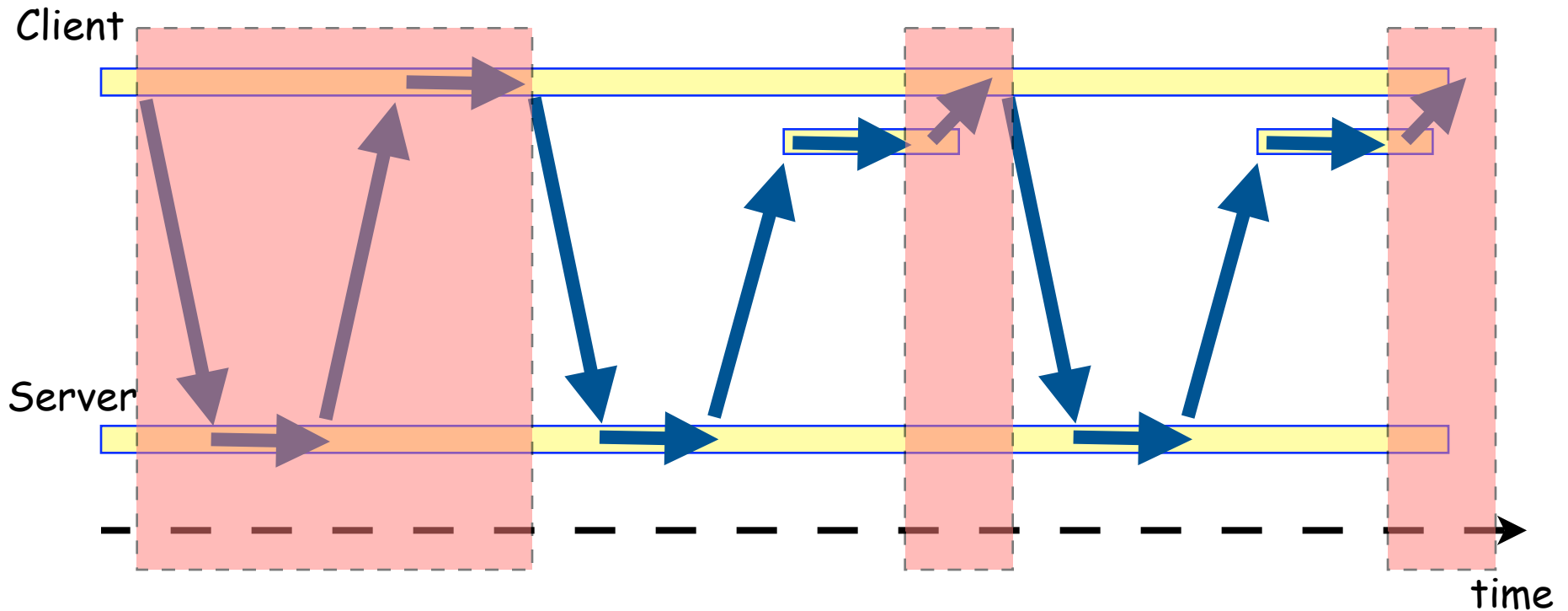
# The AJAX advantage

LOW LATENCY!



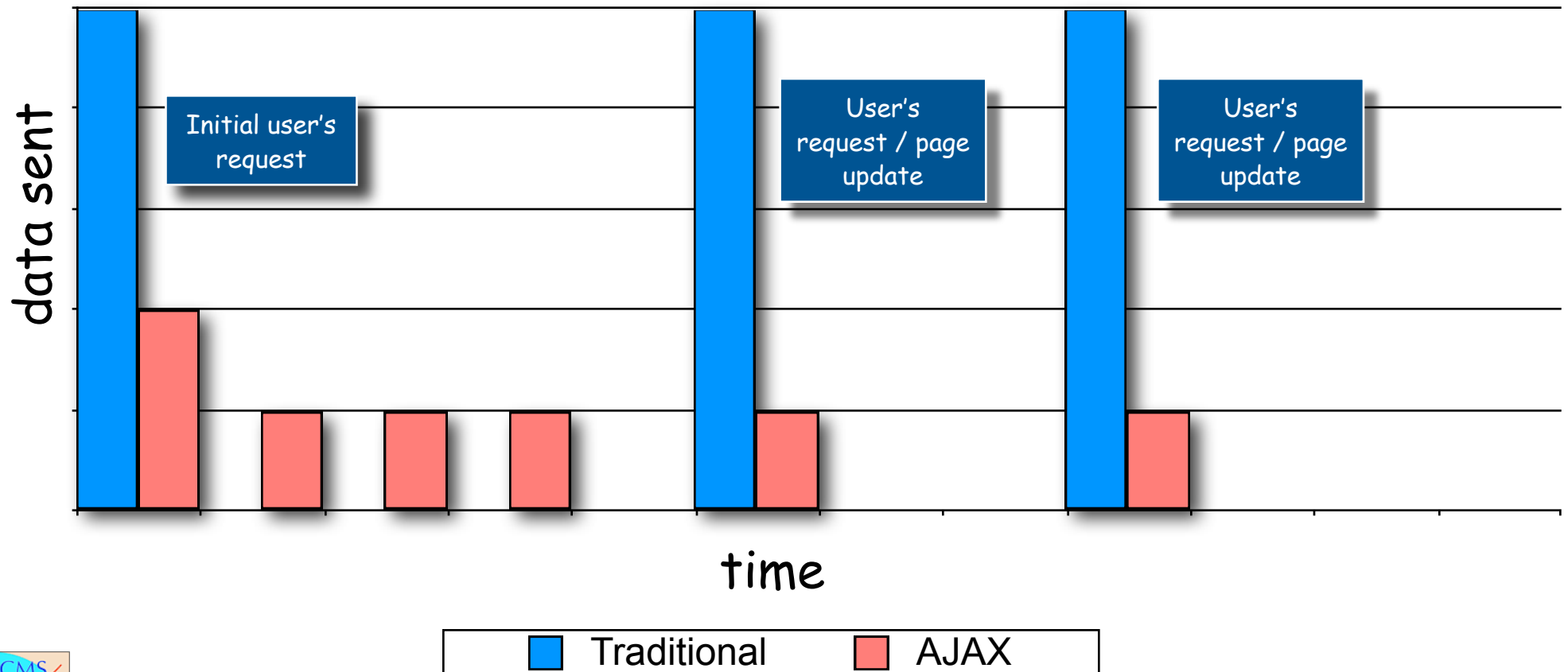
# The AJAX advantage

Reduced time the web page is not available



# The AJAX advantage

On update only deltas are sent

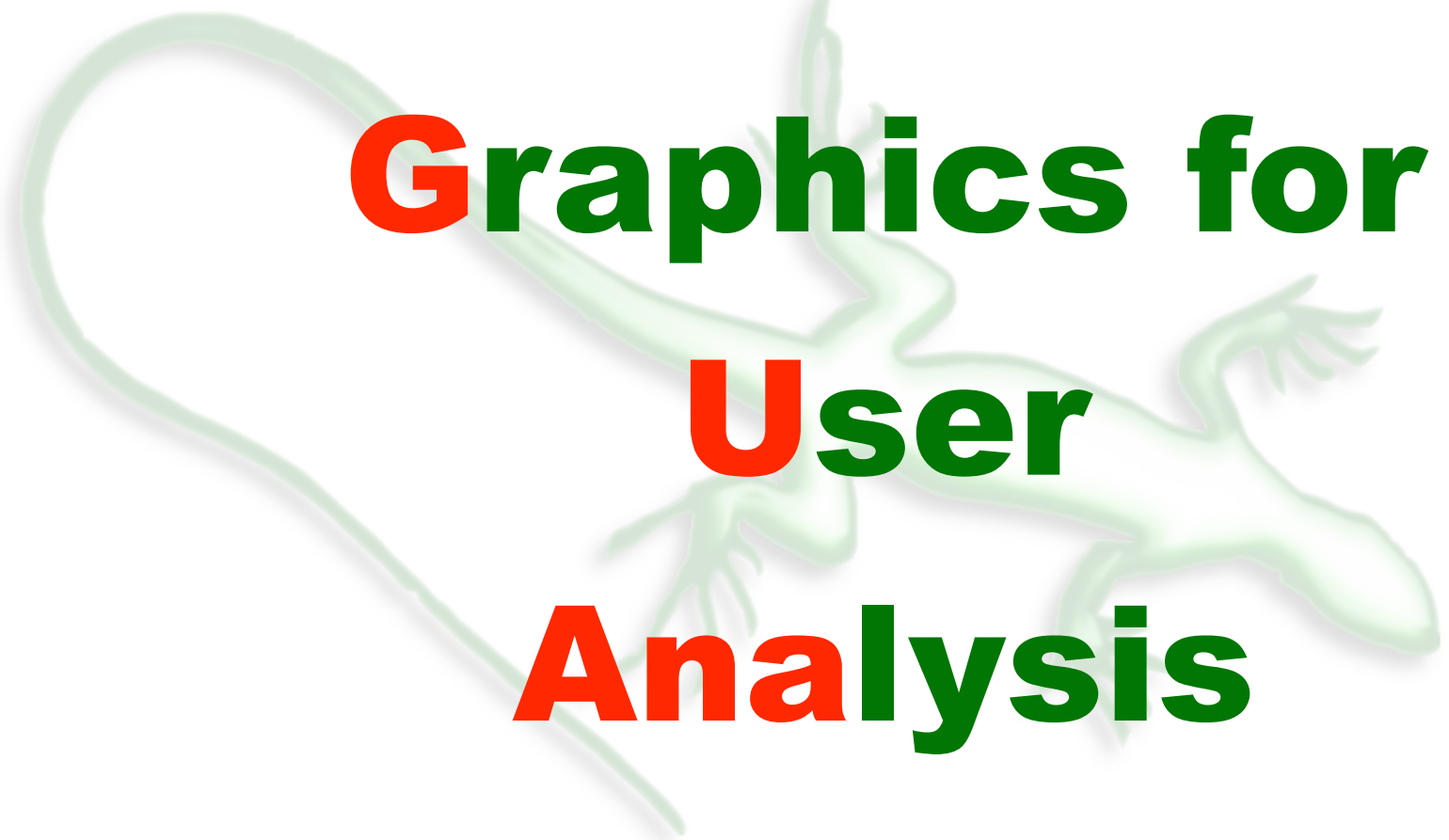


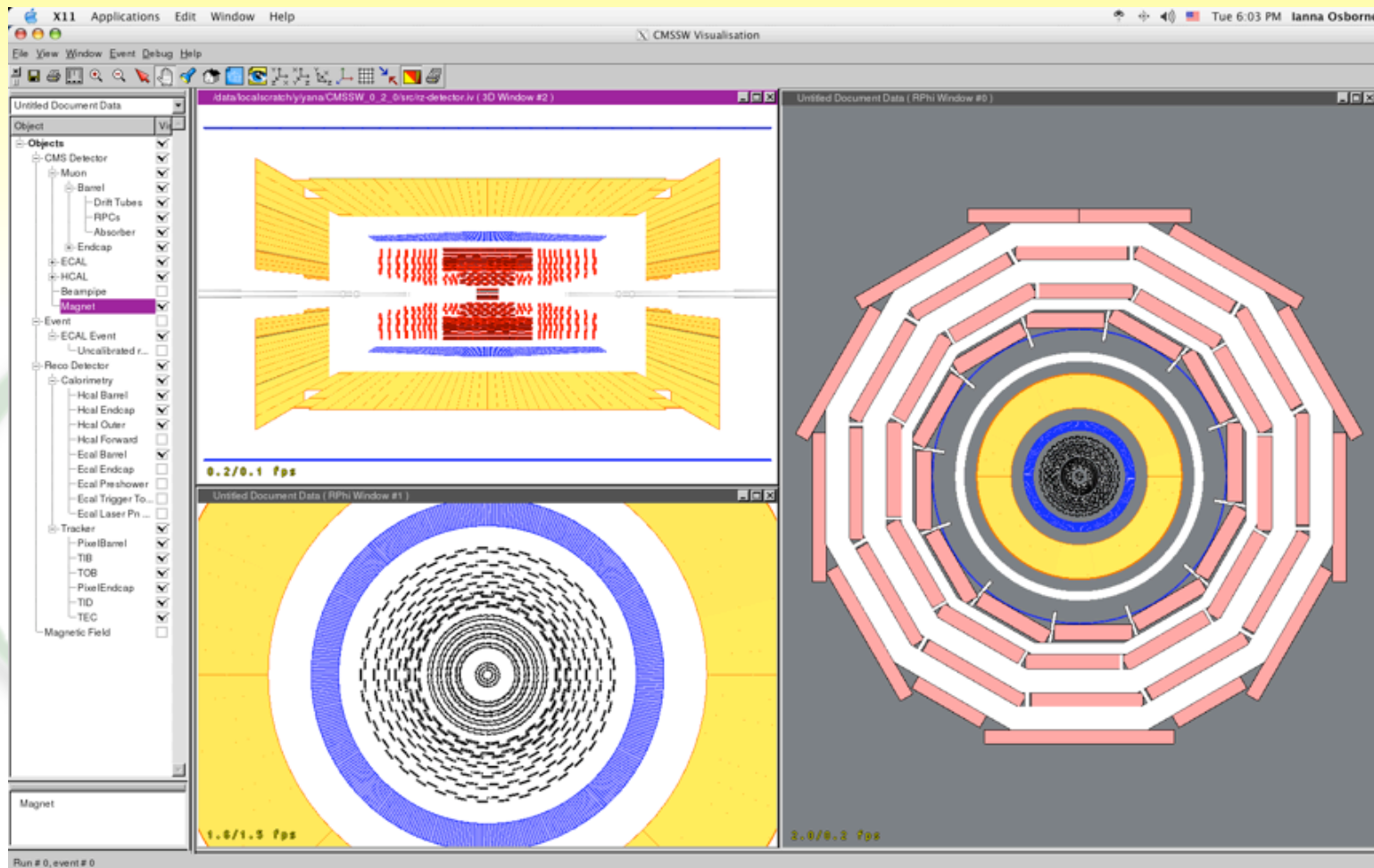


# **IGUANA and AJAX**



# **I**nteractive **G**raphics for **U**ser **A**nalysis





QT

Open Inventor

ROOT

## IGUANA object model and visualization toolkit

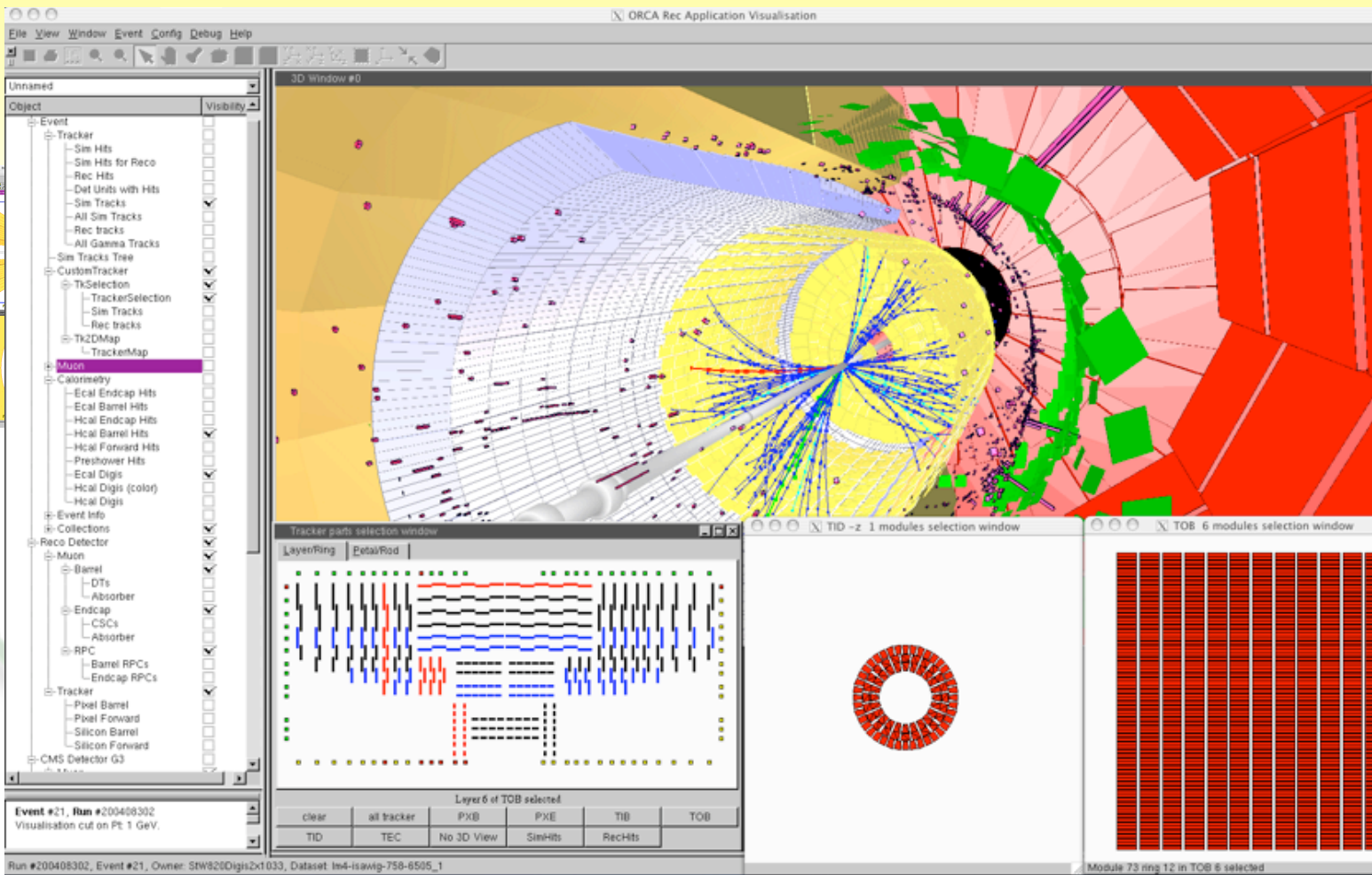
Data sources

Online software

Offline software

Data Quality Monitoring

G4



QT

Open Inventor

ROOT

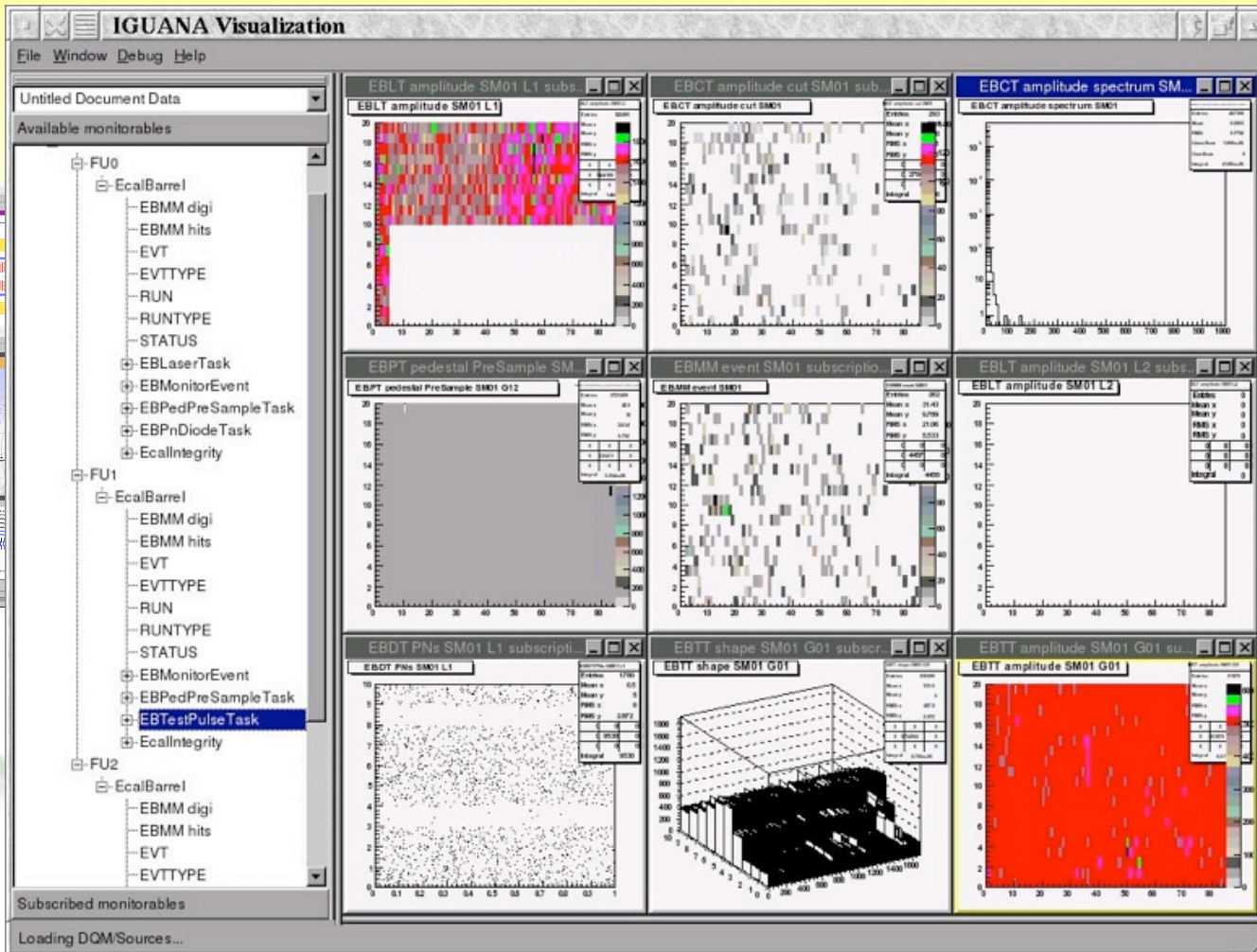
# IGUANA object model and visualization toolkit

Data sources

Online software	Offline software	Data Quality Monitoring	G4
-----------------	------------------	-------------------------	----







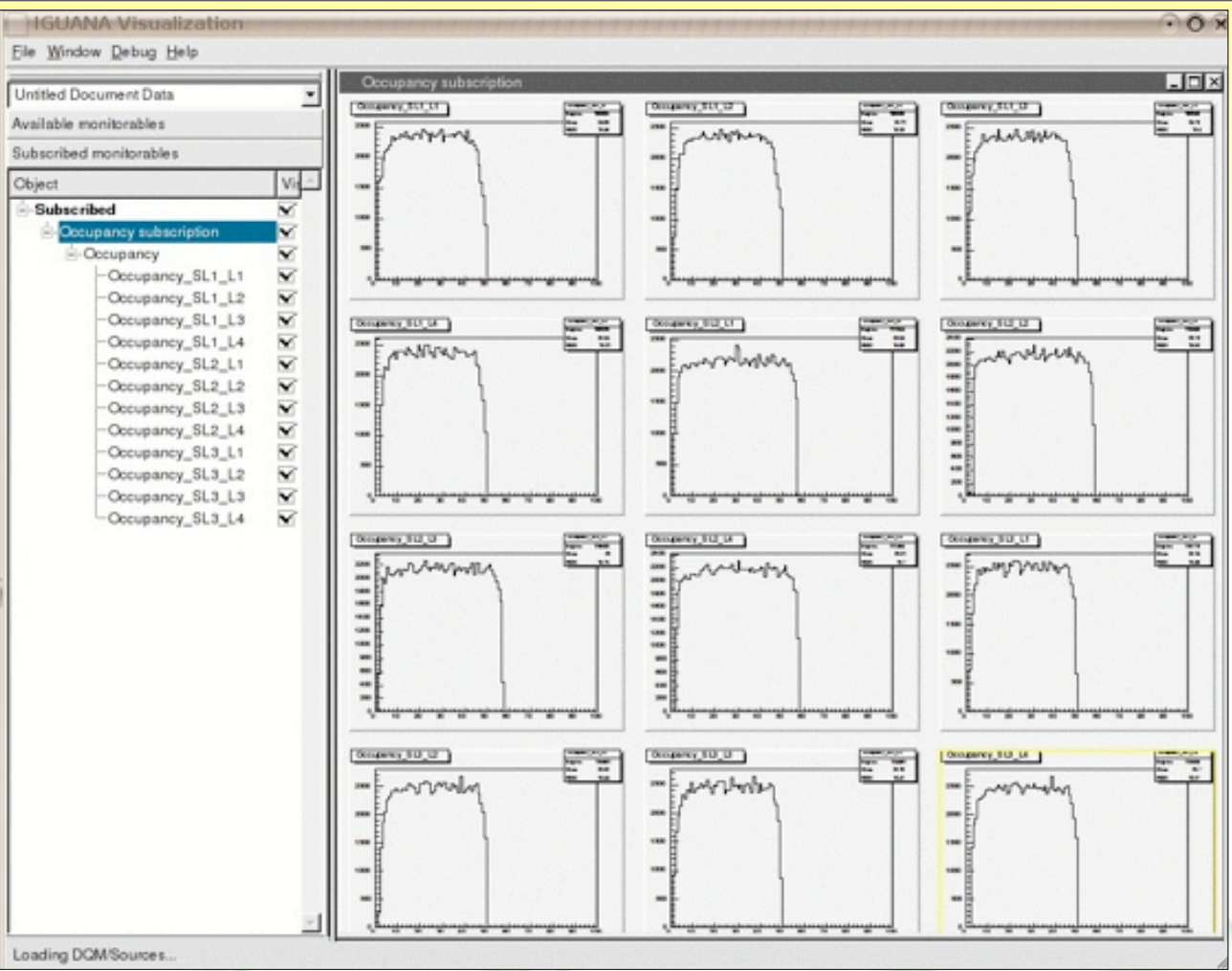
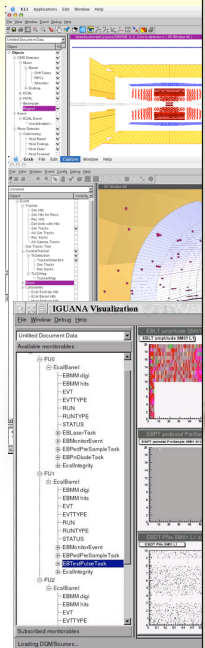
QT    Open Inventor    ROOT

# IGUANA object model and visualization toolkit

Data sources

Online software    Offline software    Data Quality Monitoring    G4





QT

Open Inventor

ROOT

## IGUANA object model and visualization toolkit

Data sources

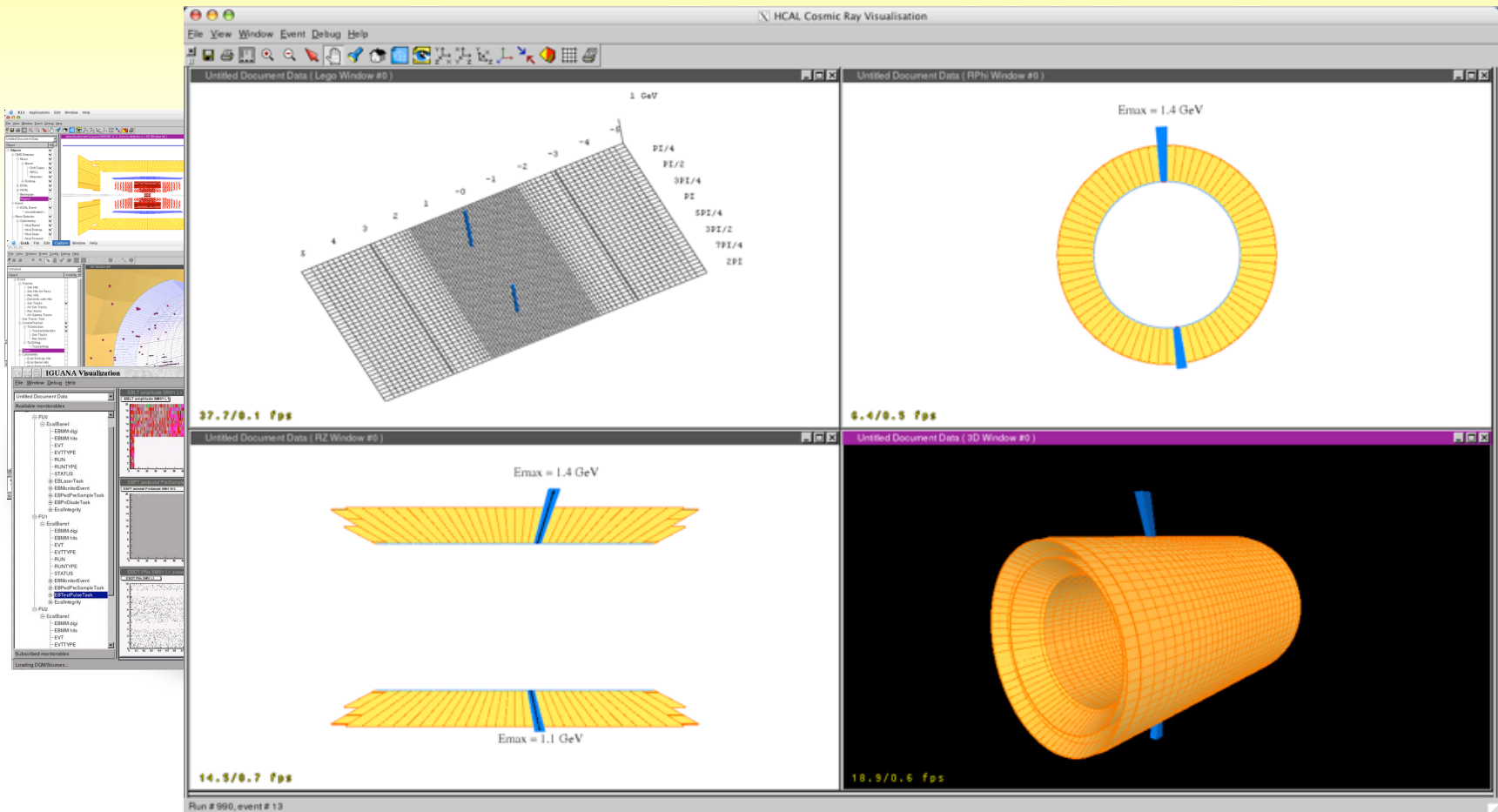
Online software

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QT    Open Inventor    ROOT

## IGUANA object model and visualization toolkit

Data sources

Online software

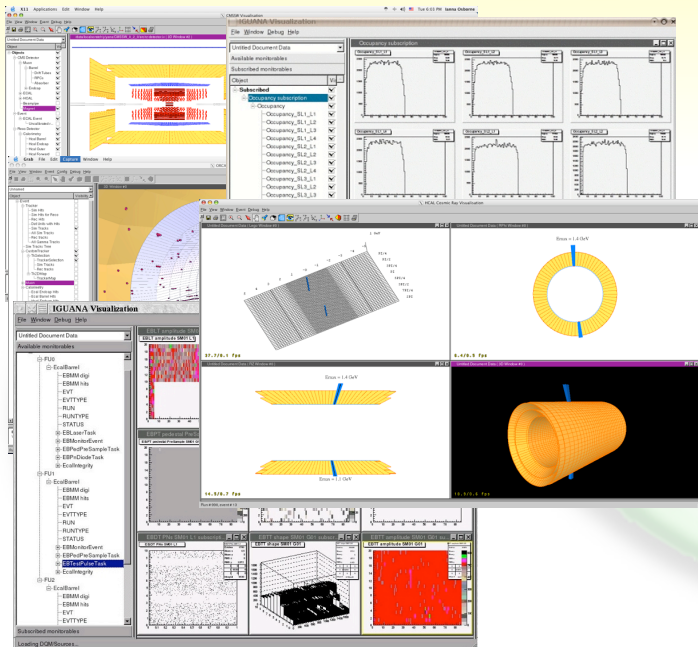
Offline software

Data Quality Monitoring

G4







QT    Open Inventor    ROOT

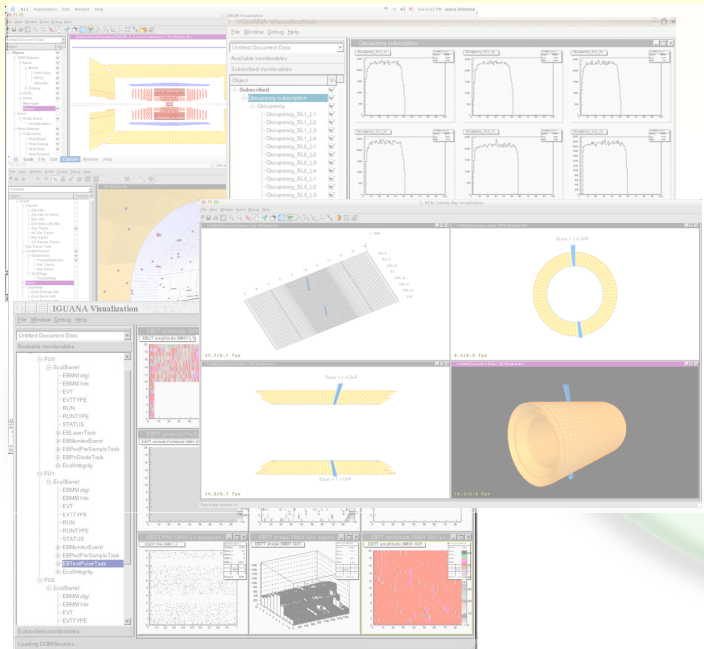
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IGUANA Web Services

IGUANA Javascript GUI library

QT

Open Inventor

ROOT

IGUANA embedded HTTP/1.1 server

IGUANA Web Services Framework

IGUANA object model and visualization toolkit

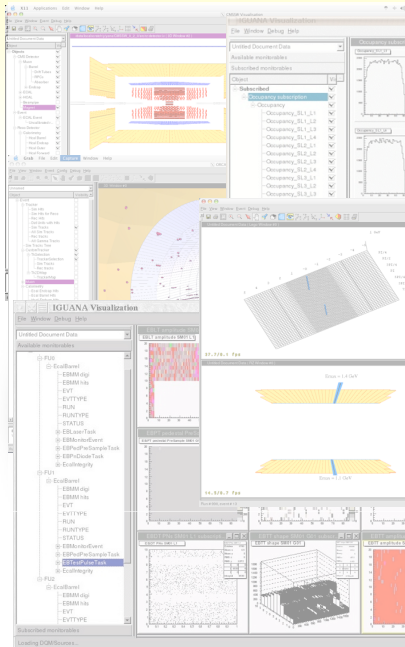
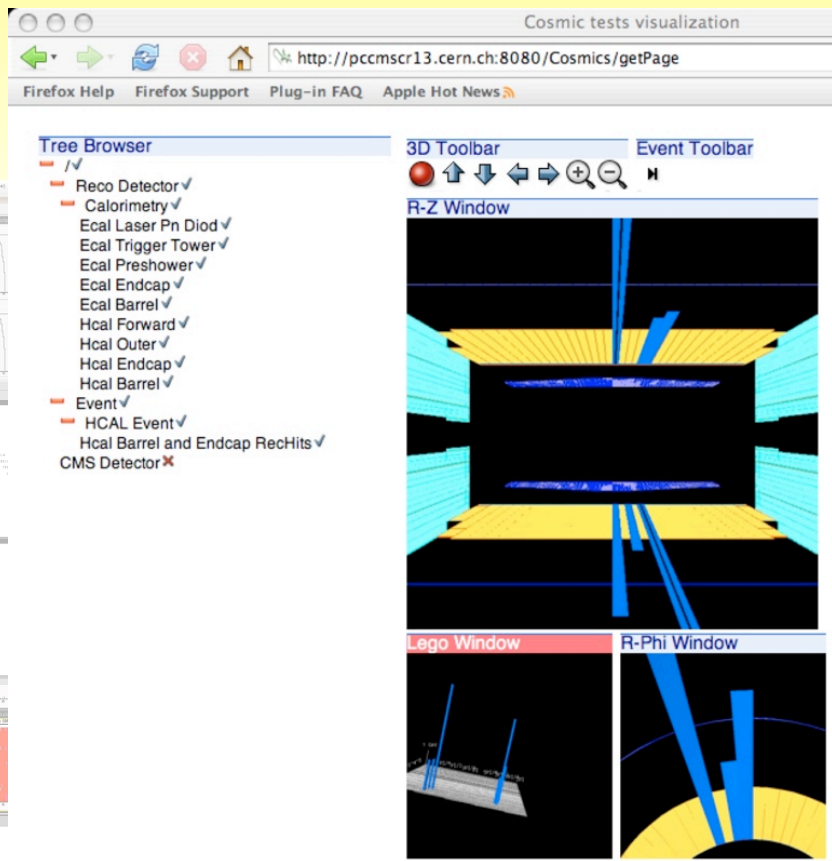
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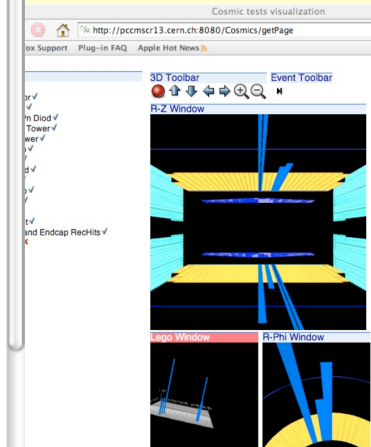
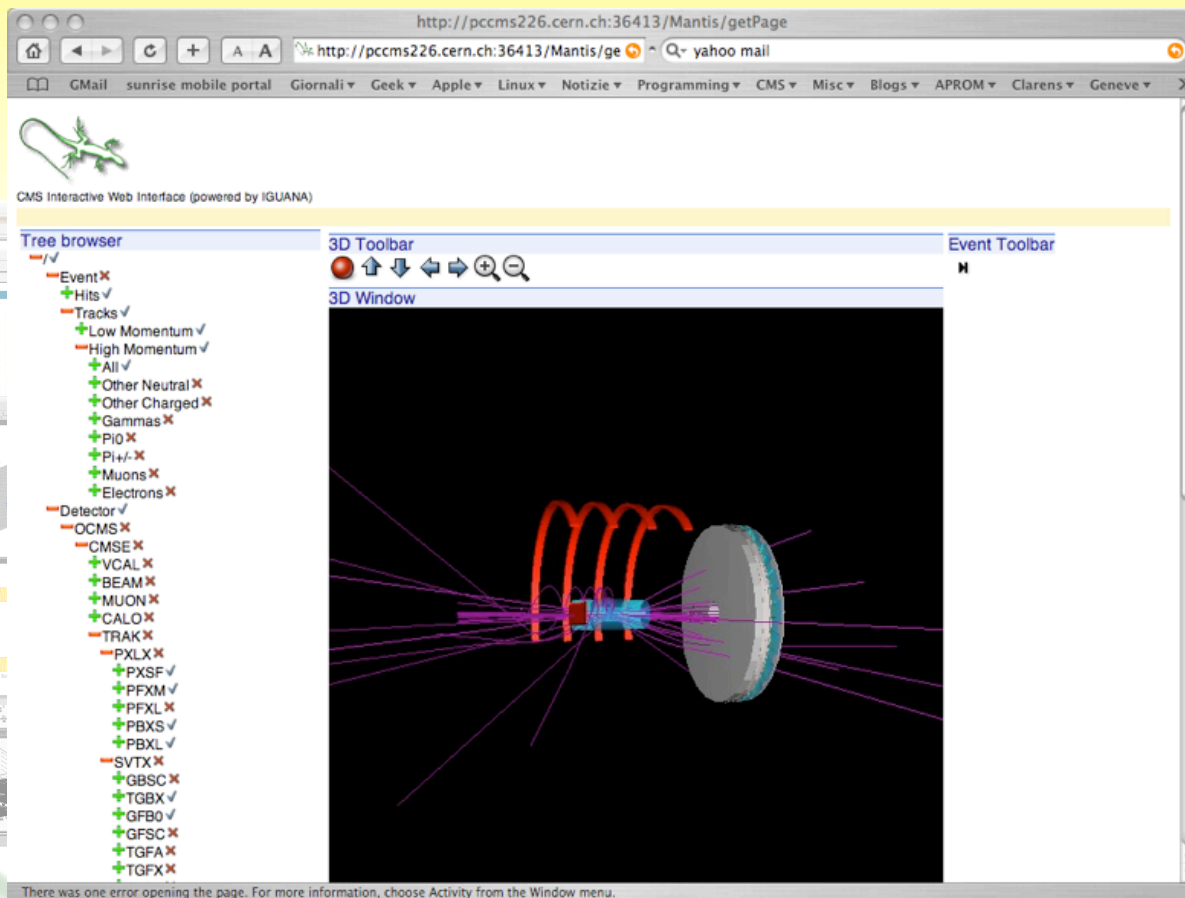
IGUANA Web Services Framework

IGUANA object model and visualization toolkit

Data sources

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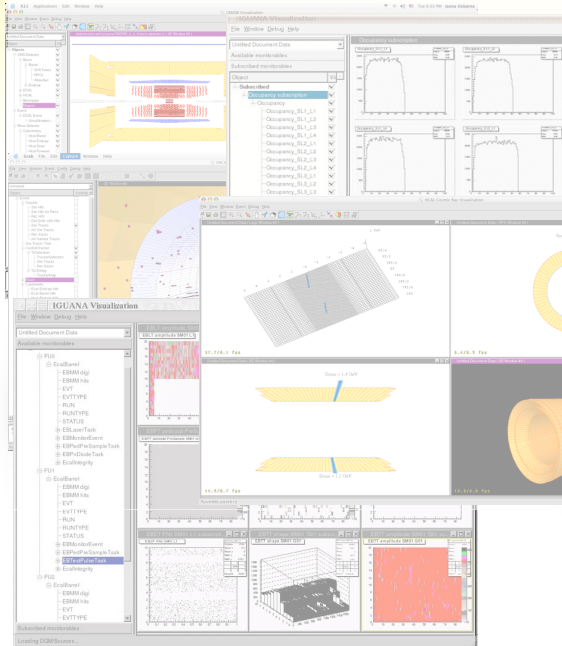
IGUANA object model and visualization toolkit

Data sources

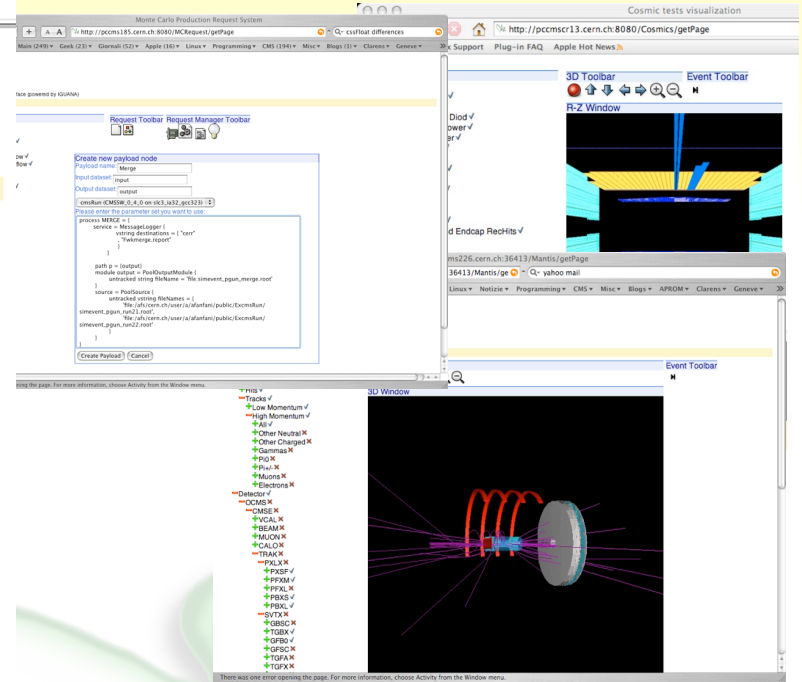
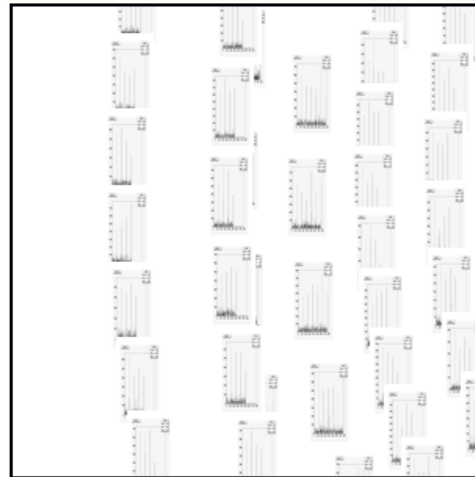
Online software      Offline software      Data Quality Monitoring      G4







CMS Interactive Web Interface (powered byIGUANA)



Done AdBlock

IGUANA Web Services

IGUANA Javascript GUI library

QT

Open Inventor

ROOT

IGUANA embedded HTTP/1.1 server

IGUANA Web Services Framework

IGUANA object model and visualization toolkit

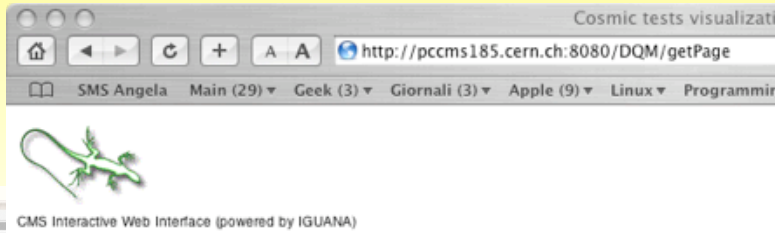
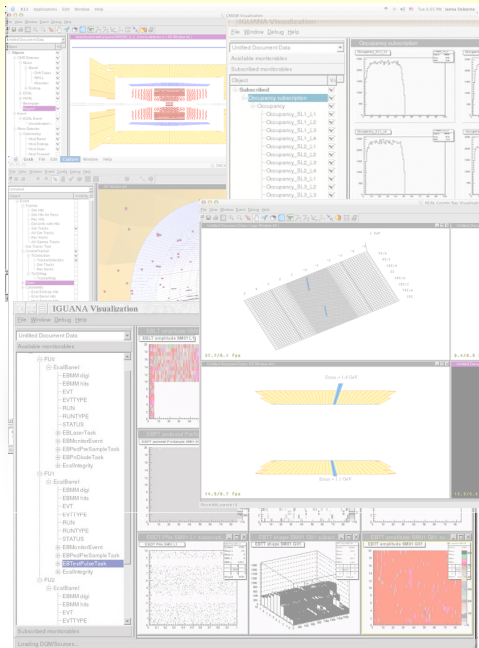
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Offline software

Data Quality Monitoring

G4

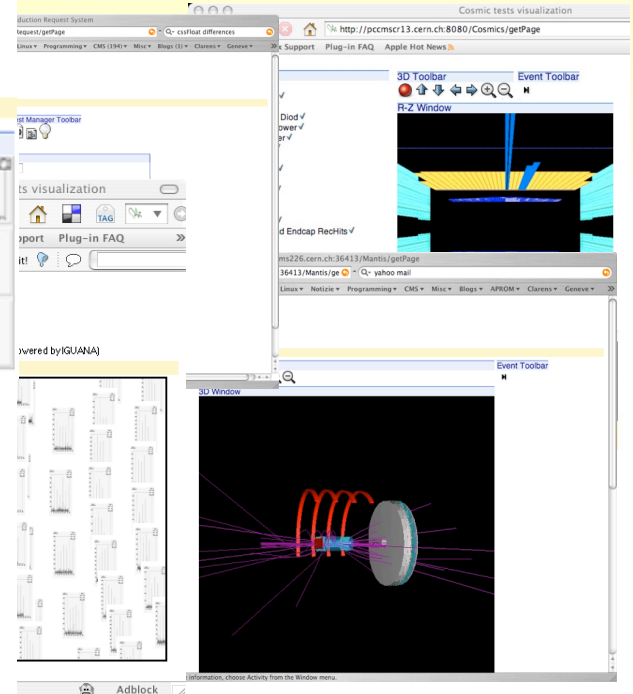
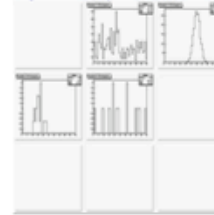


CMS Interactive Web Interface (powered by IGUANA)

Tree Browser

- + Subscribed ✓
- Available ✓
- Collector ✗
- FU0 ✗
  - C1 ✗
  - C2 ✗
  - + s1 ✗
  - + int1 ✗
  - + histo6 ✗
  - + histo5 ✗
  - + histo4 ✗
  - + histo3 ✗
  - + float1 ✗
  - + histo2 ✗
  - + histo ✗
  - + upchart ✗
  - + FU0\_updel ✗
  - + FU0\_size ✗

My subscription



IGUANA Web Services

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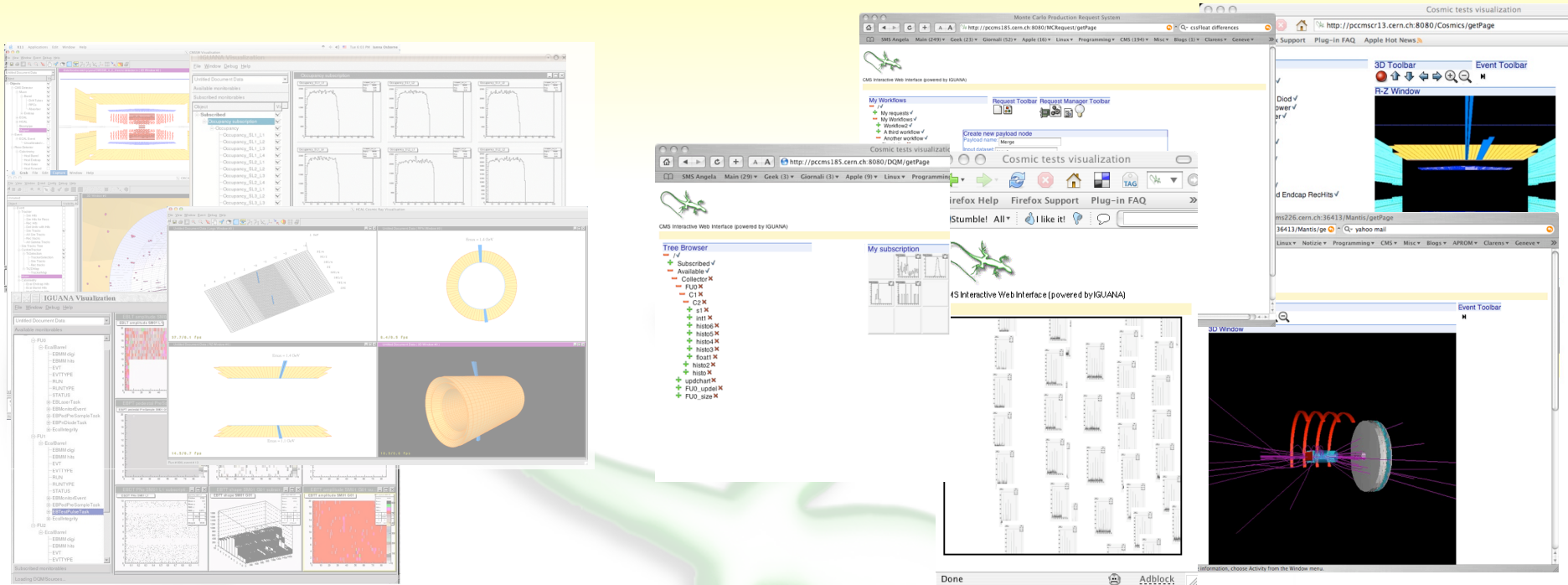
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Data sources

Online software      Offline software      Data Quality Monitoring      64



# G4 Visualization

The screenshot shows a web browser window displaying the CMS Interactive Web Interface. The browser's address bar shows the URL `http://pccms226.cern.ch:36413/Mantis/getPage`. The interface includes a navigation menu with items like GMail, sunrise mobile portal, Giornali, Geek, Apple, Linux, Notizie, Programming, CMS, Misc, Blogs, APROM, Clarens, and Geneve. A green lizard logo is visible in the top left. The main content area is divided into three sections: a 'Tree browser' on the left, a '3D Window' in the center, and '3D Toolbar' and 'Event Toolbar' at the top right. The 'Tree browser' contains a hierarchical list of simulation components, including Event, Hits, Tracks, Low Momentum, High Momentum, All, Other Neutral, Other Charged, Gammas, Pi0, Pi+/-, Muons, PFXM, PFXL, PBXS, PBXL, SVTX, GBSC, TGBX, GFB0, GFSC, TGFA, and TGFX. The '3D Window' displays a 3D visualization of the CMS detector, showing a central interaction point with red tracks and purple lines representing particle paths. The '3D Toolbar' includes icons for panning, zooming, and other navigation functions. The 'Event Toolbar' has a single icon. Three yellow callout boxes provide additional information: one on the left describes the tree browser, one above the 3D window describes the panning and zooming controllers, and one at the bottom right describes the live, navigable 3D window.

Tree browser with the full G4 description of CMS, as found in the old OSCAR simulation program

Panning and zooming controllers

Framework controller.

Live, navigable by mouse dragging 3D window. Does not require any plugin.

There was one error opening the page. For more information, choose Activity from the Window menu.





# CMS offline software

Cosmic tests visualization

<http://pccmscr13.cern.ch:8080/Cosmics/getPage>

Firefox Help Firefox Support Plug-in FAQ Apple Hot News

**Tree Browser**

- Reco Detector ✓
- Calorimetry ✓
  - Ecal Laser Pn Diod ✓
  - Ecal Trigger Tower ✓
  - Ecal Preshower ✓
  - Ecal Endcap ✓
  - Ecal Barrel ✓
  - Hcal Forward ✓
  - Hcal Outer ✓
  - Hcal Endcap ✓
  - Hcal Barrel ✓
- Event ✓
  - HCAL Event ✓
  - Hcal Barrel and Endcap RecHits ✓
- CMS Detector ✗

**3D Toolbar**   **Event Toolbar**

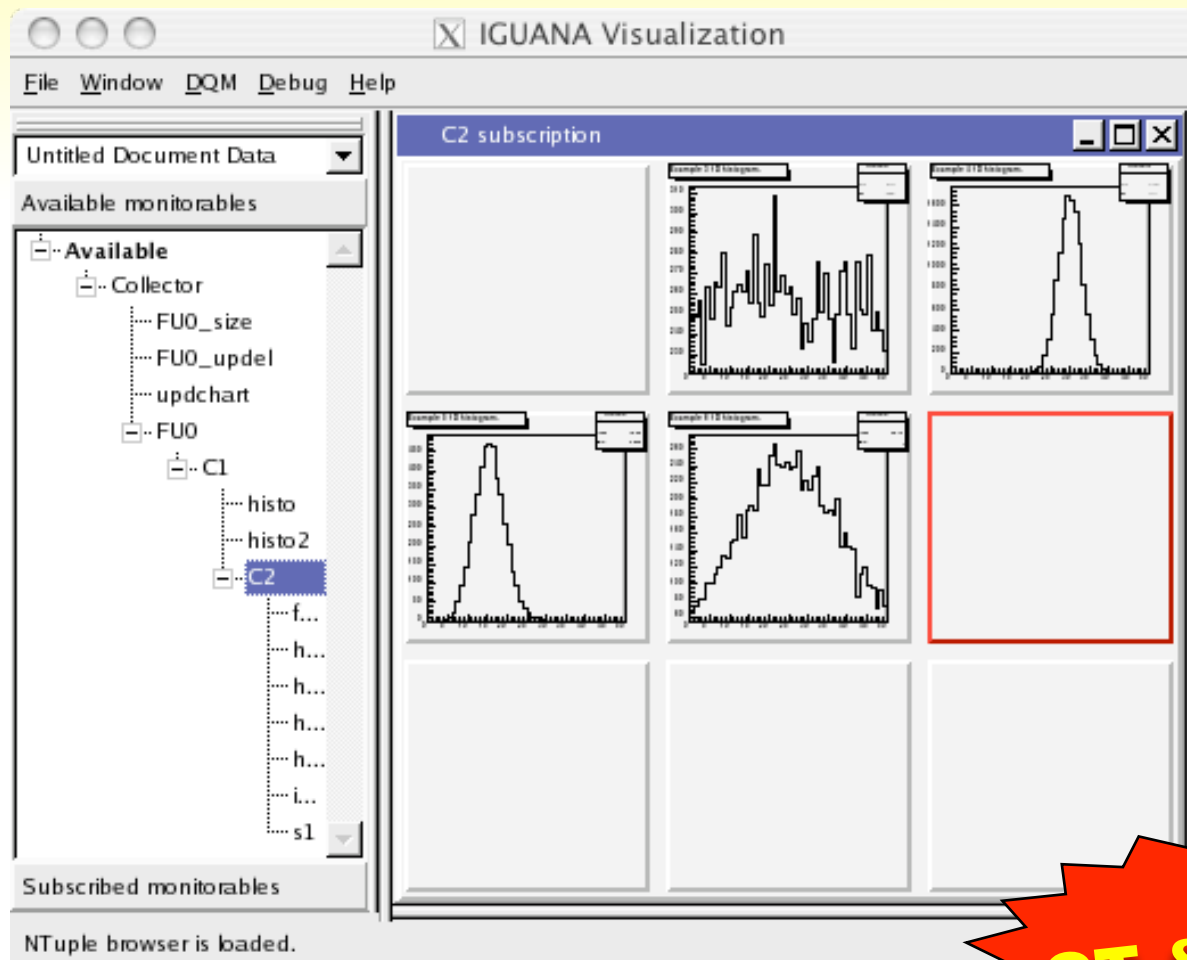
**R-Z Window**

**Lego Window**   **R-Phi Window**

Getting ready for CMS cosmic challenge

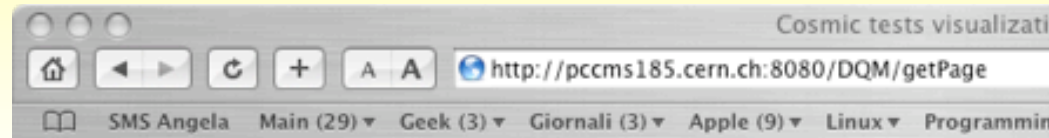


# Generic DQM GUI



**QT & ROOT**

# Generic DQM GUI



CMS Interactive Web Interface (powered by IGUANA)



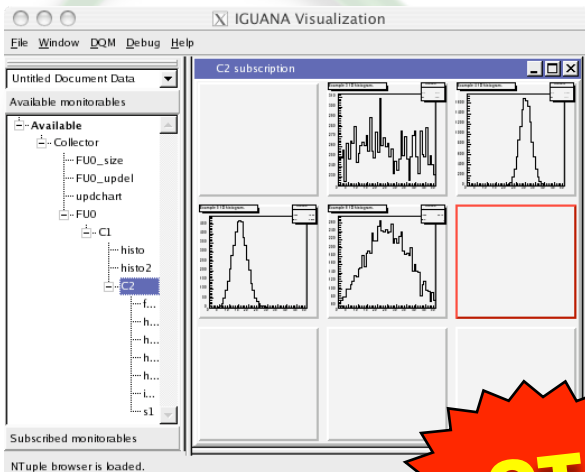
## Tree Browser

- / ✓
- + Subscribed ✓
- Available ✓
- Collector ✗
- FU0 ✗
- C1 ✗
- C2 ✗
- + s1 ✗
- + int1 ✗
- + histo6 ✗
- + histo5 ✗
- + histo4 ✗
- + histo3 ✗
- + float1 ✗
- + histo2 ✗
- + histo ✗
- + updchart ✗
- + FU0\_updel ✗
- + FU0\_size ✗

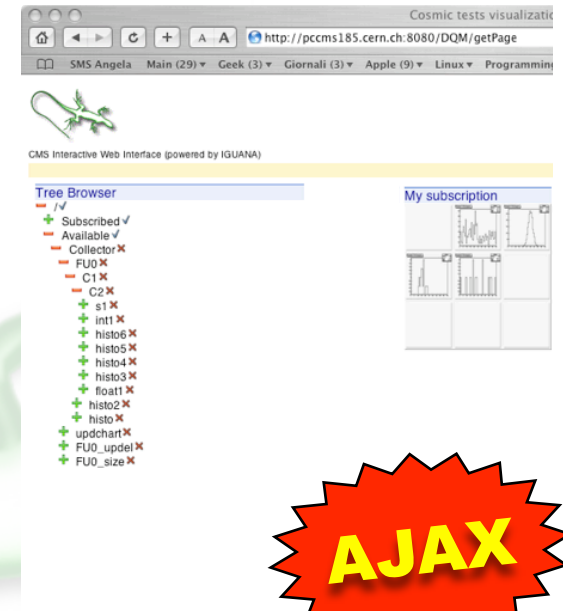


# Generic DQM GUI

The two implementations share most of the code!!!



**QT**

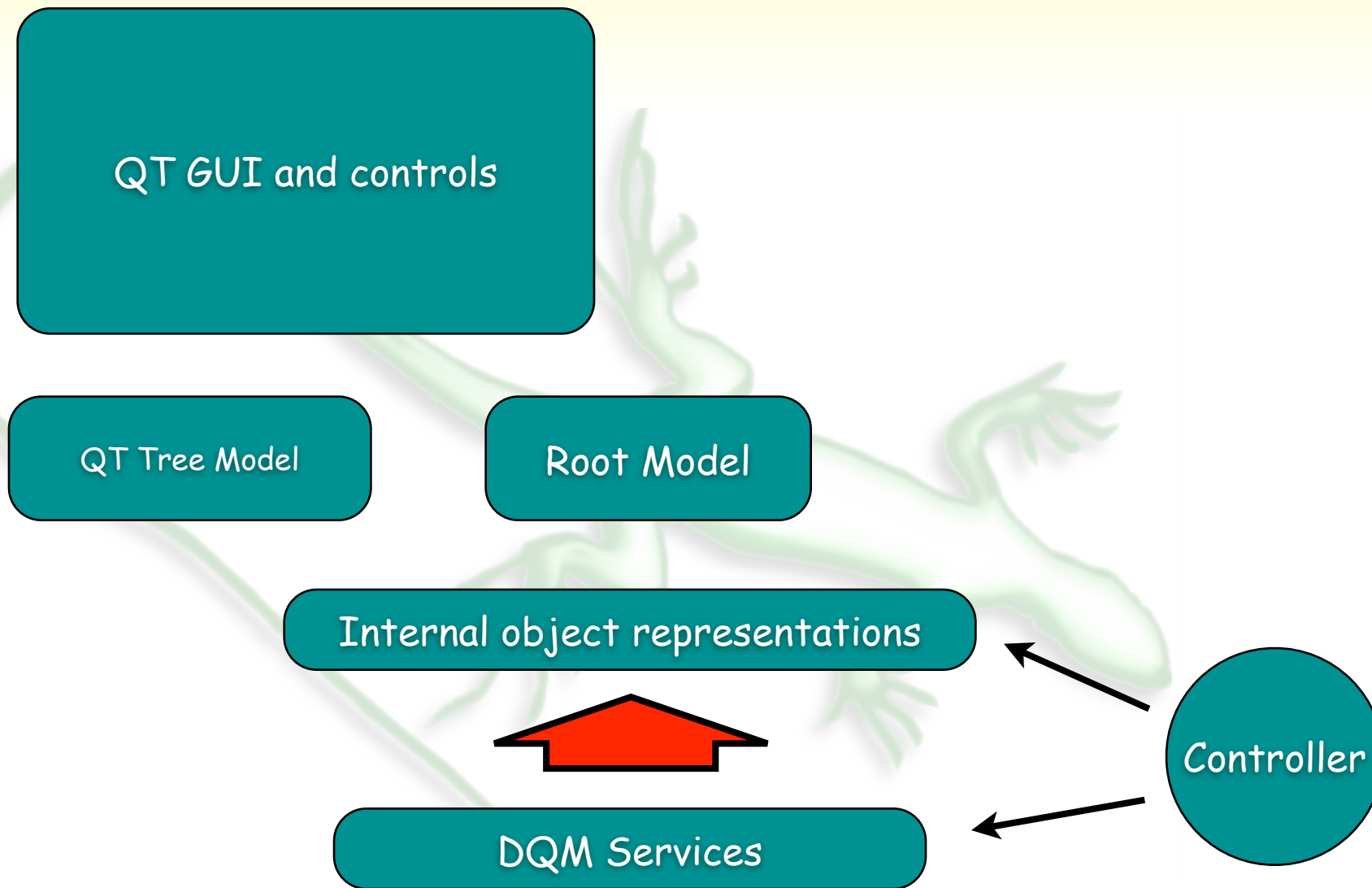


**AJAX**

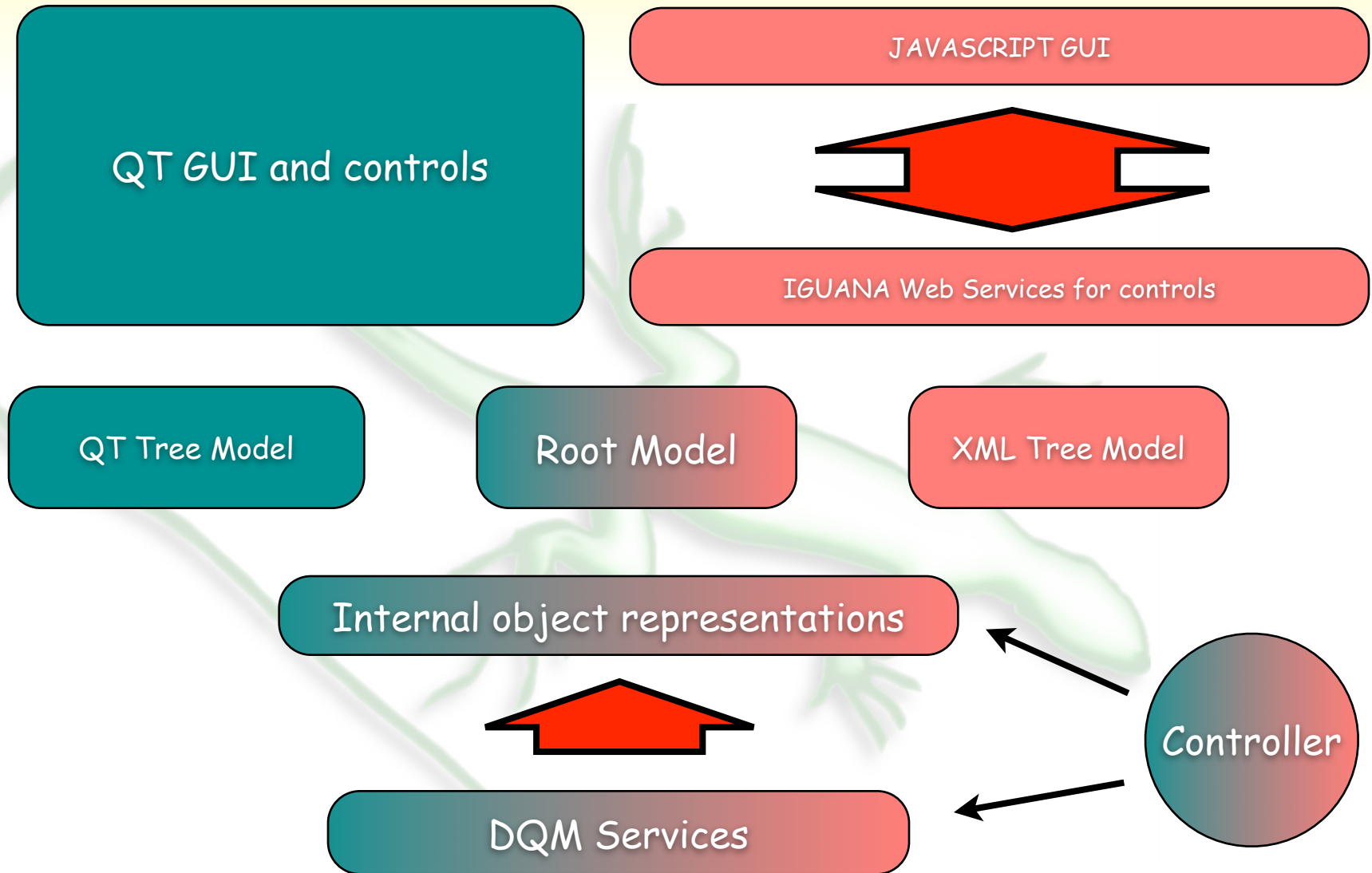
AJAX allows to have the same behaviour of desktop and web applications.



# Generic DQM GUI



# Generic DQM GUI



# MC Request system



CMS Interactive Web Interface (powered by IGUANA)

## My Workflows

- + My requests ✓
- My Workflows ✓
- + Workflow2 ✓
- + A third workflow ✓
- Another workflow ✓
- Simulation ✗
- Generation ✗
- + MyWorkflow ✓

## Request Toolbar



## Request Manager Toolbar



Javascript generated GUI with connection to backend DBs via CORAL

## Create new payload node

Payload name:

Input dataset:

Output dataset:

cmsRun (CMSSW\_0\_4\_0 on slc3\_ia32\_gcc323) ⌵

Please enter the parameter set you want to use:

```
process MERGE = {
  service = MessageLogger {
    vstring destinations = { "cerr"
      , "Fwkmerge.report"
    }
  }

  path p = {output}
  module output = PoolOutputModule {
    untracked string fileName = 'file:simevent_pgun_merge.root'
  }
  source = PoolSource {
    untracked vstring fileNames = {
      'file:/afs/cern.ch/user/a/afanfani/public/ExcmsRun/
simevent_pgun_run21.root',
      'file:/afs/cern.ch/user/a/afanfani/public/ExcmsRun/
simevent_pgun_run22.root'
    }
  }
}
```

Create Payload

Cancel



# MC Request system



CMS Int

Tree widget populated on the fly with requests from the request DB.

## My Workflows

- / ✓
  - + My requests ✓
  - My Workflows ✓
  - + Workflow2 ✓
  - + A third workflow ✓
  - Another Simulation Generation
  - + MyWorkflows
- |             |
|-------------|
| Workflow... |
| Submit      |
| Add payload |

## Request Toolbar



## Request Manager Toolbar



Actions performed by the toolbars and menus are lazily loaded only when clicking.

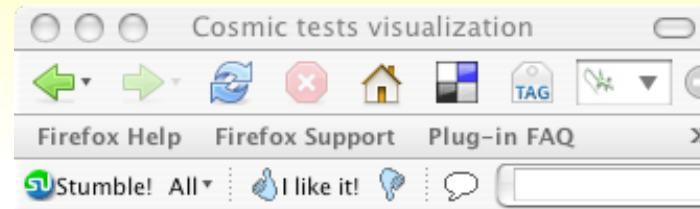


# Google Map

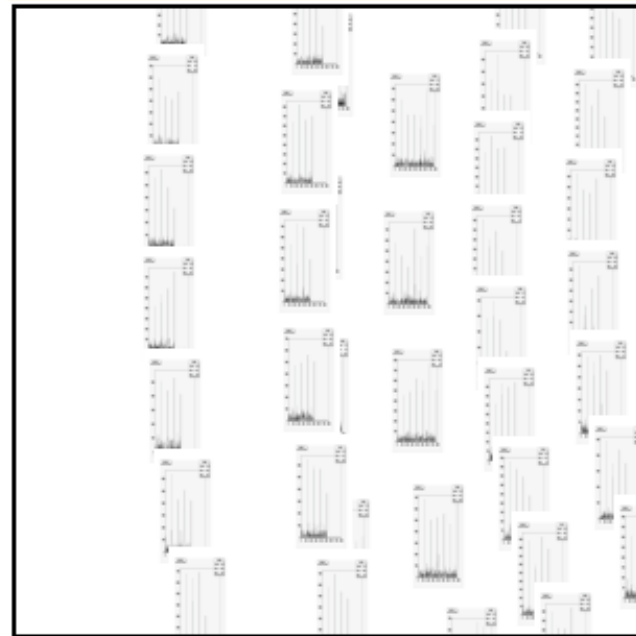
The screenshot shows a web browser window titled "Google Local - Milan". The address bar contains "http://maps.google.com/". Below the browser window, the Google Local interface is visible. It includes the Google logo, navigation links for "Web", "Images", "Groups", "News", "Froogle", "Local", and "more >". A search bar contains the text "Milan" and a "Search" button. To the right of the search bar, there are links for "Search the map", "Find businesses", and "Get Directions". Below the search bar, the word "Local" is displayed. To the right of "Local", there are links for "Print", "Email", and "Link to this page". The main content area is a satellite map of Milan, showing a dense urban area with many buildings and streets. The map is oriented with North at the top. On the left side of the map, there are navigation controls including a compass, a zoom-in (+) and zoom-out (-) button, and a vertical scale bar. In the bottom left corner of the map, there is a scale bar showing "200 ft" and "100 m". In the bottom right corner of the map, there is a copyright notice: "©2005 Google - Imagery ©2005 DigitalGlobe - Terms of Use".




# Tracker Map



CMS Interactive Web Interface (powered byIGUANA)



Done  Adblock

# Final words



# AJAX recap

- ✓ AJAX breaks the GET/DISPLAY/RELOAD paradigm used by standard web pages.
- ✓ In AJAX web applications data is transferred a little bit at the time in small chunks, when the user requests for it.
- ✓ The updates of web pages is asynchronous and happens without touching what the user sees until the end.
- ✓ It allows complex, interactive, low latency web applications, without the need for external plugins or JAVA virtual-machine (JAVASCRIPT is not related to JAVA !!!)

# IGUANA and AJAX

Iguana provides a framework for creating AJAX applications and has examples for a variety of tasks CMS, ranging from event display to data quality monitoring to MC request system.

# Who else uses AJAX

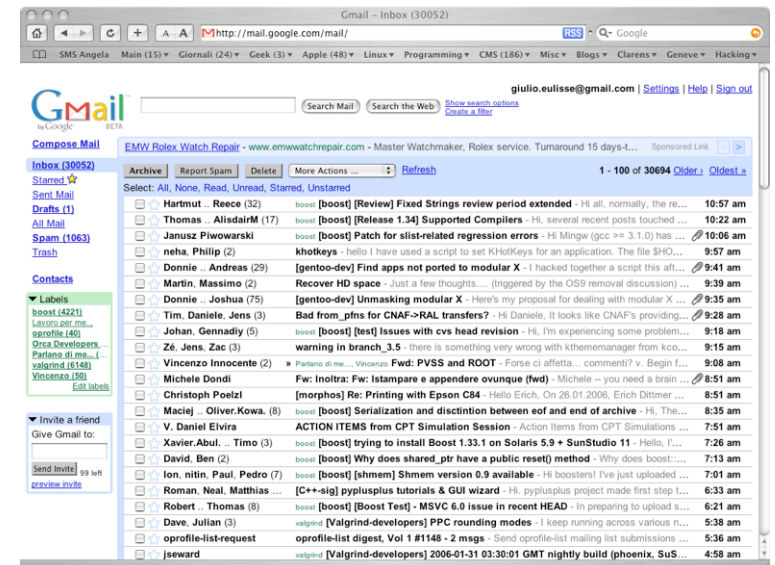
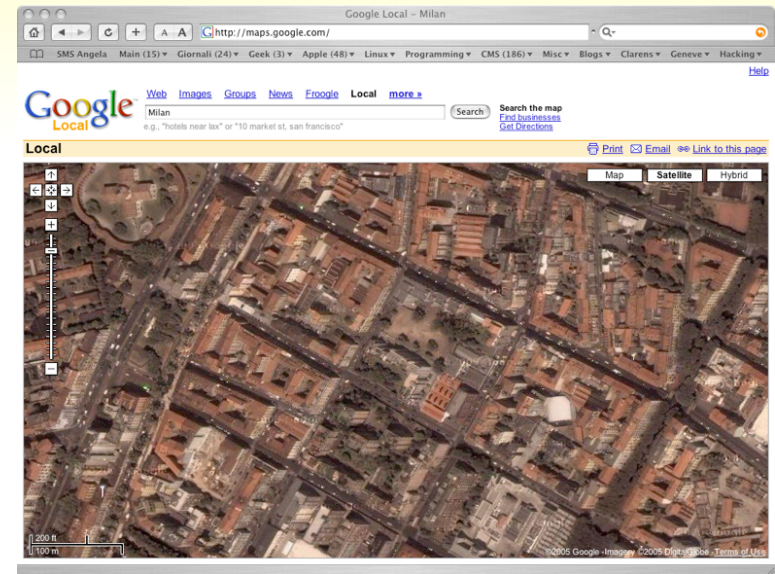
- ∨ There are a few "startups" ;) that are using AJAX techniques more and more as well...





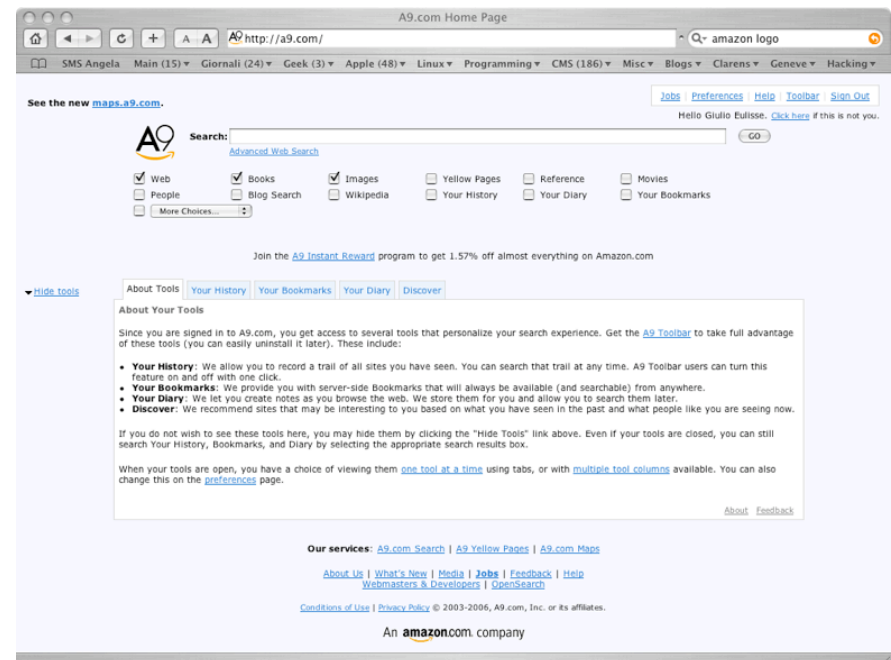
# Who else uses AJAX

✓ There are a few "startups" ;) that are using AJAX techniques more and more as well...



# Who else uses AJAX

- There are a few "startups" ;) that are using AJAX techniques more and more as well...





# and a few others...

A screenshot of a web browser window showing a Google search for "AJAX javascript". The browser's address bar contains the search URL. The search results page displays the Google logo, navigation links, and search filters. A summary bar is highlighted with a black border, showing "Results 1 - 20 of about 18,700,000 for [AJAX](#) javascript. (0.26 seconds)". Below the summary bar, several search results are listed, including "Take Command with AJAX [JavaScript & DHTML Tutorials]", "John Reynolds's Blog: AJaX: Two steps forward... Two steps back?", "Yahoo! Maps Web Services - AJAX API Getting Started Guide", "adaptive path » ajax: a new approach to web applications", and "Initial AJAX JavaScript objects". On the right side, there are sponsored links for "www.backbase.com", "www.backpackit.com", "www.lightstreamer.com", and "www.tersus.org/about/visual\_ajax".