HPC Track

GLOBAL PRODUCT DATA
INTEROPERABILITY
SUMMIT
2016

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CEI: Beyond EnSight

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Darin McKinnis, VP Sales and Marketing

EnSight

Leading HPC post-processor

High-quality rendering
High Performance
Interactivity and Batch Operations
Extensive feature set
Visualization and Calculation Capabilities
      Variable Calculator
      Plotting
General Purpose
      Multi-physics
      Mix solver results
      FEA, CFD, EMAG, Particles, etc.
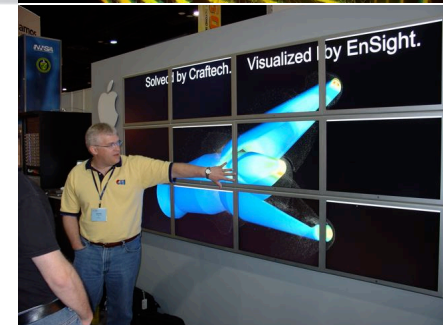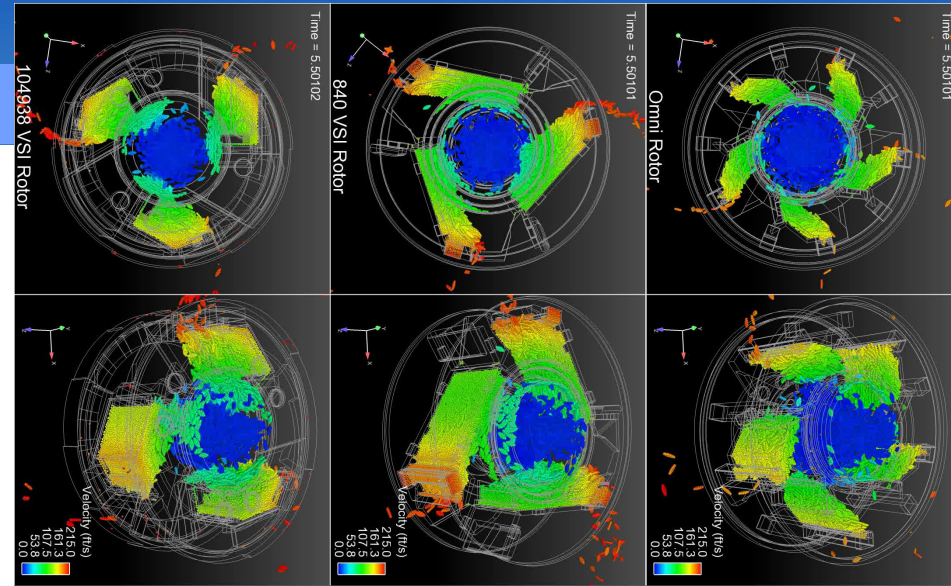**Python Extensibility**
Multi-case Support
      32 cases at one time
      4 cases cloned
HPC Capacity – Client-server and Distributed Arch
Virtual Reality - Caves, Walls, Headsets

Release: October 2016

Focus on

- **Enhanced graphics performance**
  - **Vertex Buffer Objects (VBOs) and LIC**
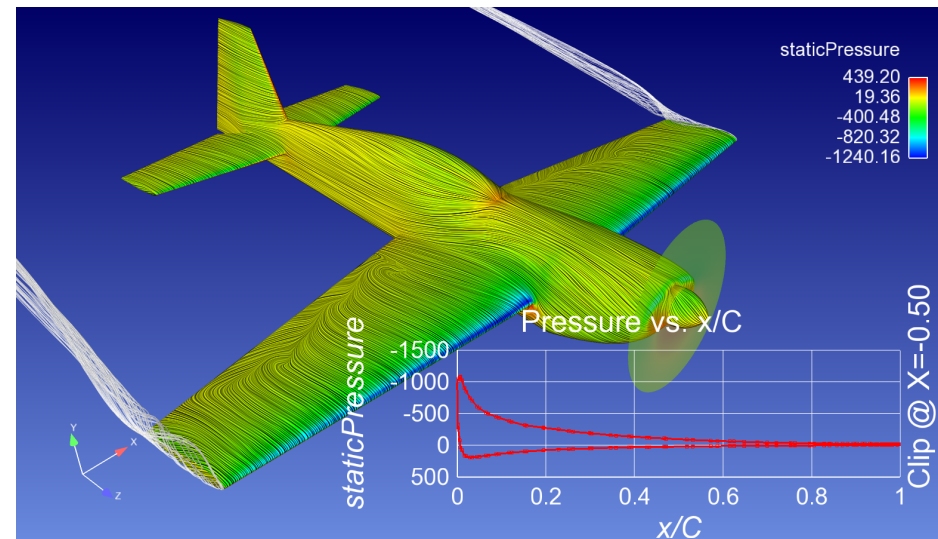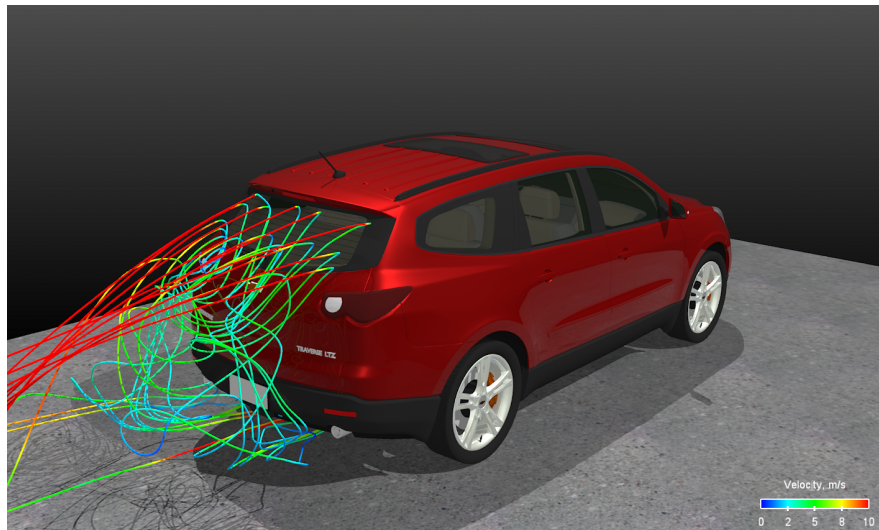- **Enhanced graphics realism**
  - **Materials Library**
  - **Additional Lighting Models**
  - **Integrated Ray-tracing output**
- **Co-processing**
- **Supports Knowledge Capture Triggers and Events**

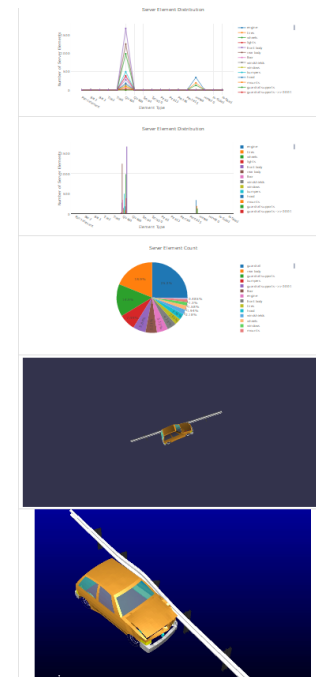## Overcome Problems with Current Post-processing

Output is Images, Movies, Plots, Values without Connections

Loss of Provenance

Single system for some customers

Provide a connection to other Tools/Systems

Caching/Compatibility system for other vendor's systems

Provide high-quality, interactive output from information gleaned from multiple EnSight sessions and other sources (e.g. solver)

- **Support for multiple deployment scenarios**
  - **Isolated user (local), Departmental, Cloud (both as a source and target)**
- **Infrastructure for handling data from multiple sessions**
  - **Parameter studies, Longitudinal studies, QA/QC, etc.**
    - Ability to coalesce data from different datasets/runs into composite visuals
  - **Playing a larger role in data stewardship**
- **Leverage framework advances ushered in by the move to the Cloud**
  - **Web-orientated toolsets**
    - High-quality plotting packages, portable animation formats, 3D Geometry
    - JavaScript, HTML5, WebGL, etc
- **Customizable to integrate with existing workflows**
  - **Value-add (above EnSight) data products that can be externally integrated**
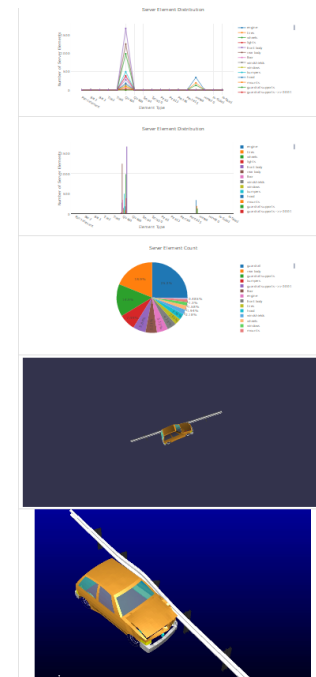
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- **Capture: mechanism to collect and organize "data items"**
  - Standard elements: Text, HTML, 3D Geometry, Tables, Images, Movies
    - User/Tool/Site customizable
  - Automated and user activated capture "triggers"
- **Common item storage**
  - Database storage, local or remote
  - Provenance specified via context
    - User tags, application information, dataset
    - Watermarking
- **Report generation**
  - Hierarchical templates
    - Item selection/filtering mechanism
    - Process (think pivot tables) and display elements
  - **HTML output, potentially other targets**
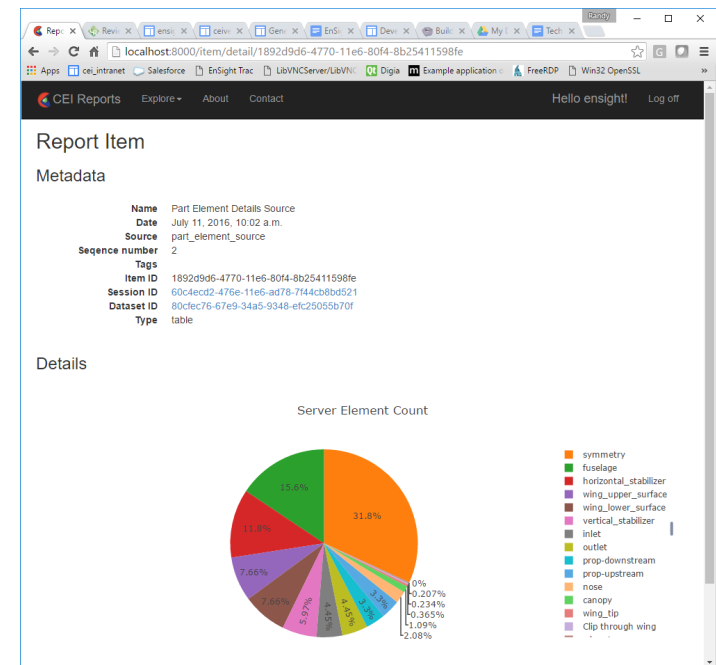
Terminology

- ## Data Item (Items)
  - ### A basic unit of information that is stored in the database
  - ### Focus on raw data, report framework provides visual representation
- ## Source
  - ### EnSight Python extension that produces report items
  - ### Each instance can have independent parameters
- ## Trigger
  - ### Cause one or more sources to generate items, placing them in the database
  - ### EnSight Python extension: Python/command language, interactive & automatic triggers

Run-time Data Ingest

Report Item	
Session	550104fe-26a7-11e6-99…
Dataset	8245ee01-58d5-3347-91…
TimeDate	2016-05-30 16:53:39.696566
UserTags	DataLoad, Run Number
Source	...urce
Type	Image

Dataset	
Dataset	8245ee01-58d5...
Reader	Case
UserTags	My dataset,…
Filename	foo.case
…	

Copying Information

Session	
Session	550104fe-26a7-11e6-99…
Application	EnSight
Version	10.2.0(a)
Platform	win64
…	

EnSight

Data Load
- Image Source
- Table Source

User Trigger
- Custom HTML

Report Generation Framework

Web Server

REST Interface

Item Database

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Solver
Fluent/ANSYS/LS-Dyna/etc

Solution Information Export Script (Python)

EnSight

Data Load

Image Source

Table Source

User Trigger

Custom HTML

Report Generation Framework

Web Server

REST Interface

Item Database

Report Item	
Session	9b11802c-e640-4b08-bf…
Dataset	13ce7f9a-abb5-4384-80…
TimeDate	2016-05-28 13:33:23.45434
UserTags	Fluent, Inputdeck, Run Number 10, …
Source	Fluent Input Deck Source
Type	Text

Dataset	
Dataset	13ce7f9a-abb5-4384-80…
Reader	Fluent
UserTags	Run Number 10
Filename	pipe_sf.cas, pip…
…	

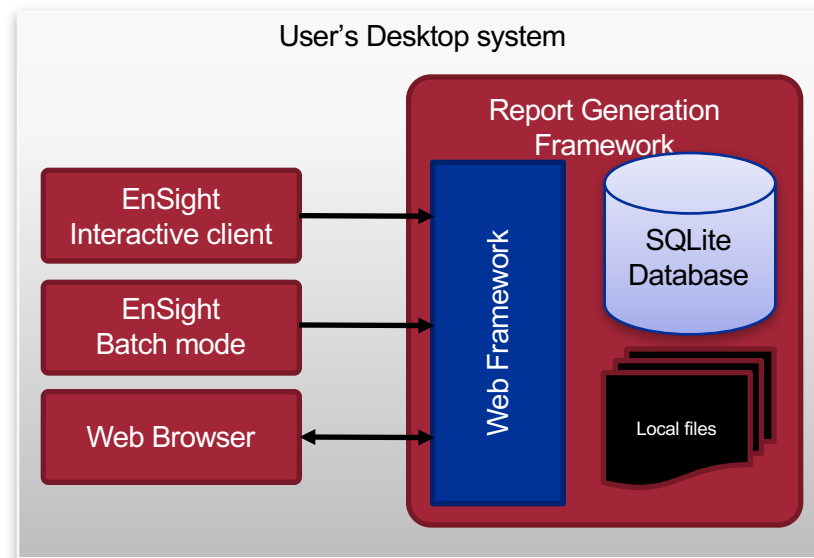| Session	
Session	9b11802c-e640-4b08-bf…
Application	Fluent
Version	17.0
Platform	win64
…	

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Report Generation
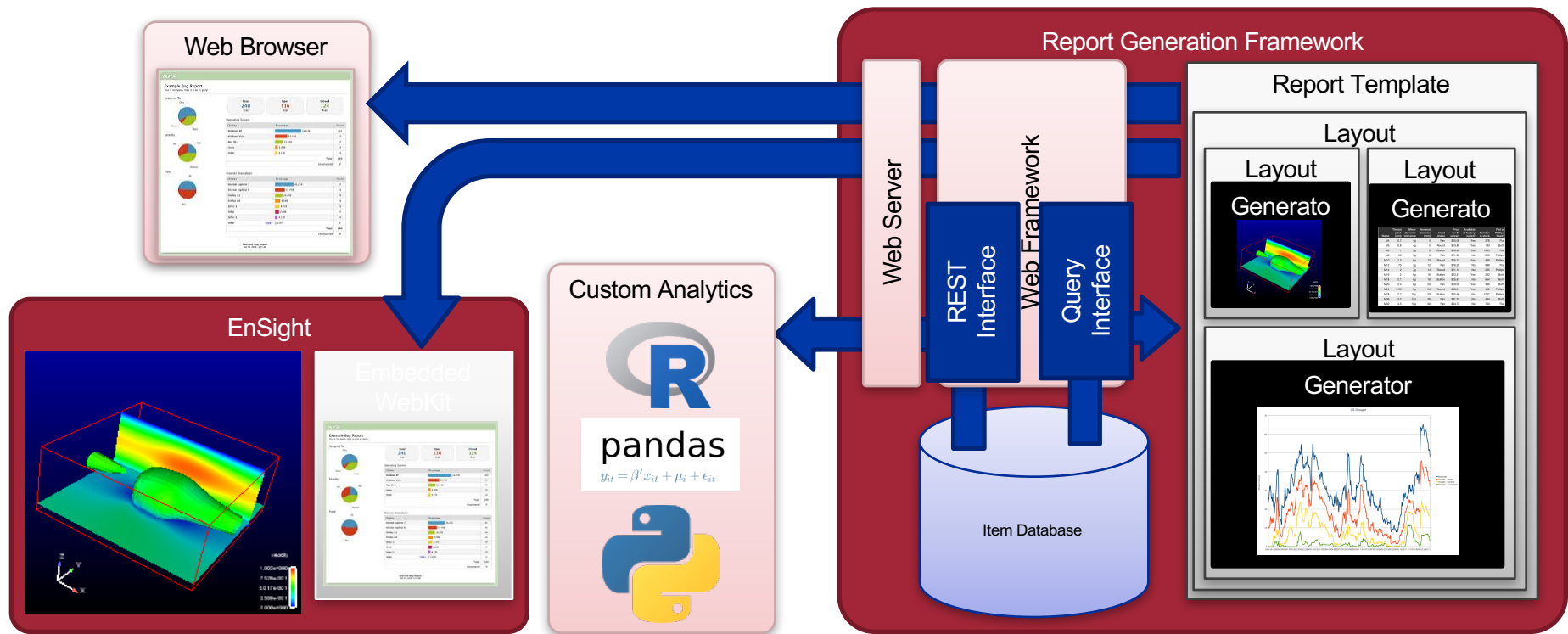
- **Start with a general search, select all items included in the report**
- **Reports are a hierarchy of templates**
  - **Each templates includes a filtering/sorting operation**
    - **Select what items are to be passed to which child templates**
  - **Child templates can be repeated**
    - **Example: parent template categorizes all input items by crank angle. The child template is then invoked repeatedly, each time with the subset of items for that specific angle.**
  - **Generator templates compute new items from input items**
    - **New items are not stored in the database**
    - **Force specific visual appearance**
      - Examples: force as pie chart, change background color, label formatting, etc
    - **Generate new data**
      - Examples: collect all rows with a specific name from all input table items and make a new table. Collapse all columns in the input table into a table of maximum values.
  - **Leaf nodes generate HTML output as per current rendering schemes**

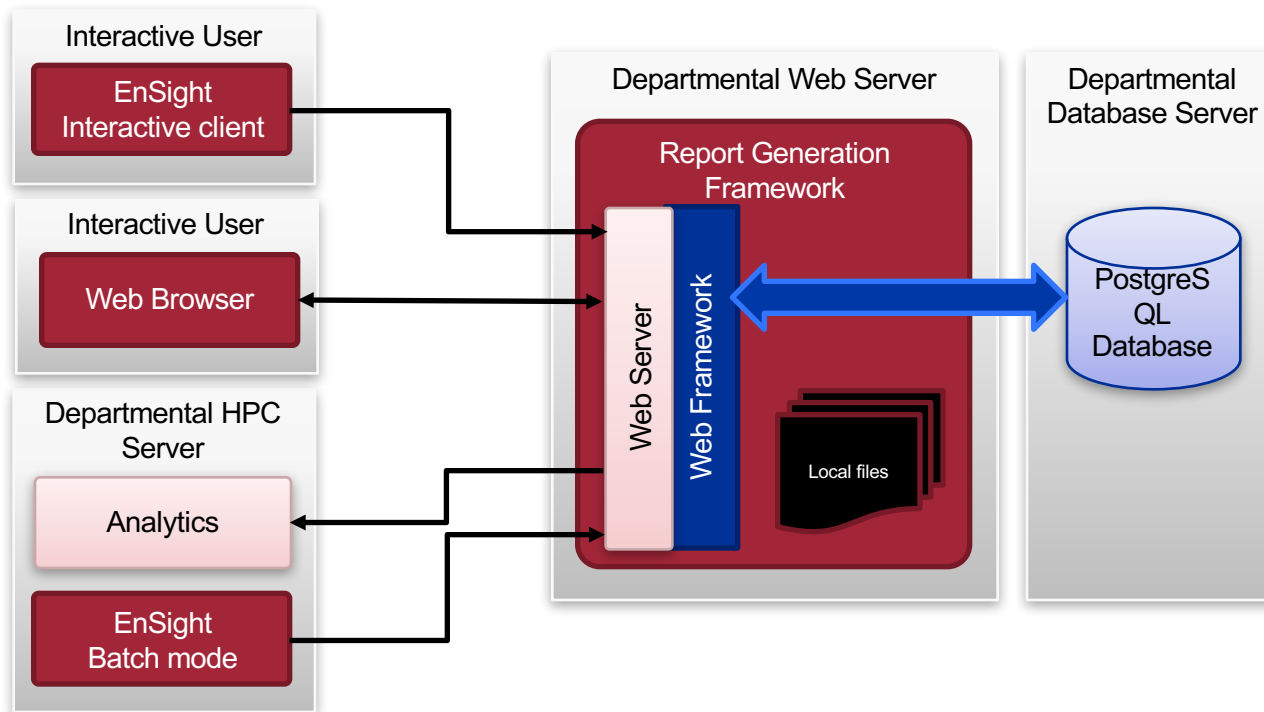# Deployment: Local Desktop

User's Desktop system

Report Generation Framework

EnSight Interactive client

EnSight Batch mode

Web Browser

Web Framework

SQLite Database

Local files

Deployment: Departmental Server

Deployment: Cloud (AWS) Server
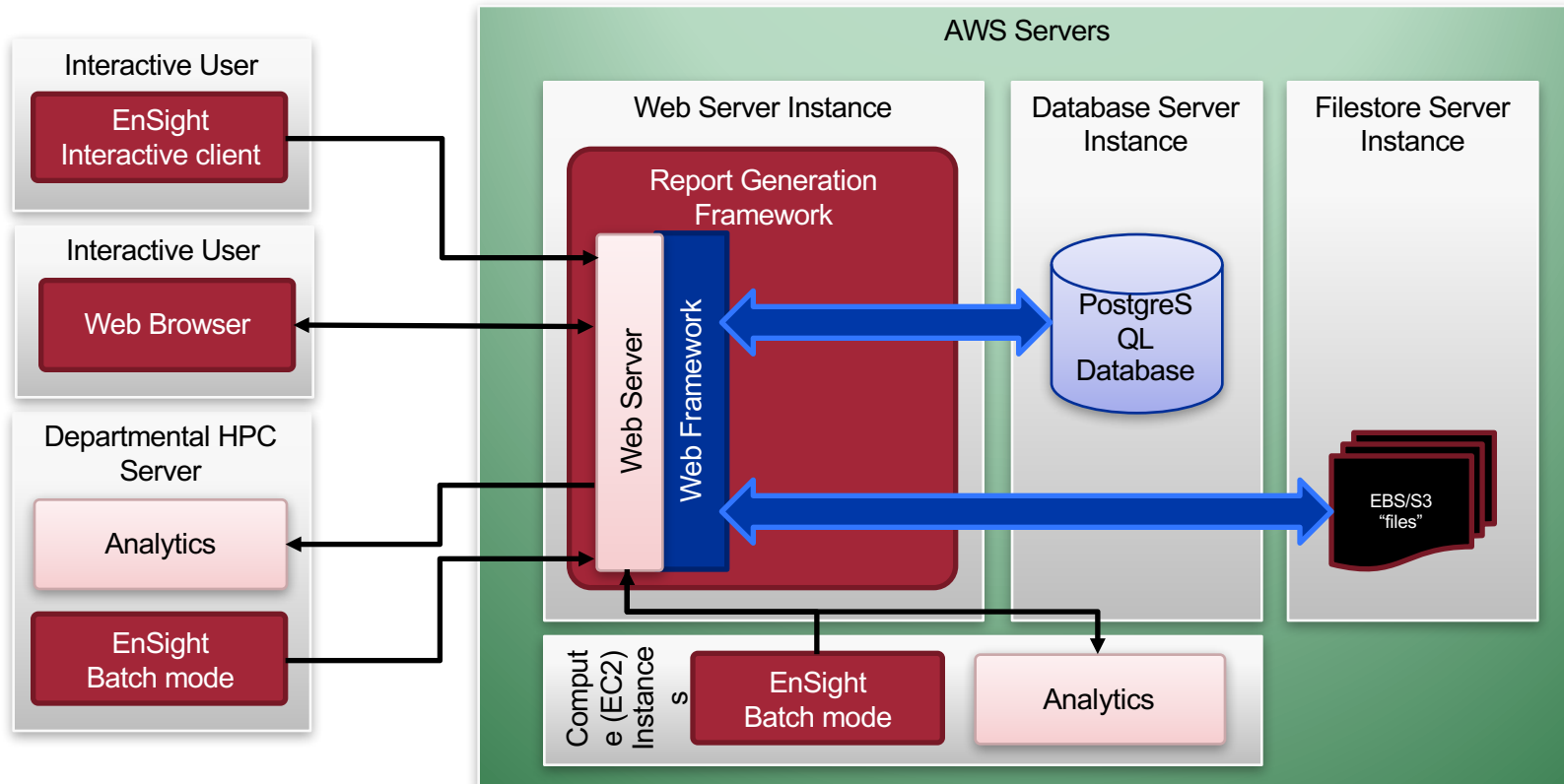
The Tech Stack

- **Target platform**
  - **HTML5 (canvas) and WebGL**
  - **Chrome, Firefox, IE11, Edge, Safari, Qt5 WebKit**
- **OpenSource components**
  - **3D Geometry**
    - **Babylon.js/WebGL, simple export demonstrated**
  - **Plotting**
    - **plotly.js (recently OpenSource)**
  - **Web Framework**
    - **Django + Bootstrap.js + Apache**
  - **Databases**
    - **PostgreSQL, SQLite**
- **Cloud/distributed deployment**
  - **AWS, custom (departmental, local)**

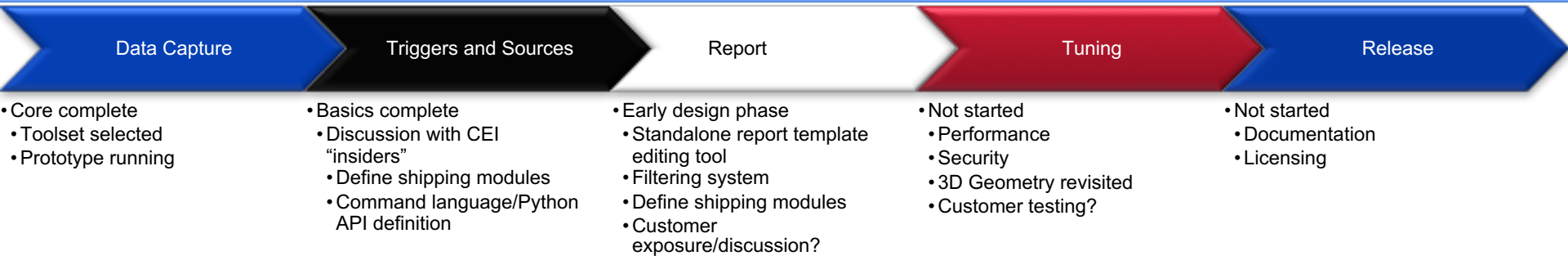ELYSIUM   Parker   NORTHROP GRUMMAN   BOEING   GLOBAL PRODUCT DATA INTEROPERABILITY SUMMIT **2016**

- **Currently in a prototyping stage**
  - **Core EnSight extensions in place**
    - **All Python extensions are potential data sources and triggers**
    - **Report item and Trigger interfaces prototyped**
  - **New technologies**
    - **Improved mp4 (H.264) support (display in all major browsers)**
    - **3D Geometry prototype integrated (babylon.js)**
    - **Basic plotting integration complete: line, bar, pie (plotly.js)**
    - **Django web framework, SQLite and PostgreSQL backend databases tested**
    - **Watermarked imagery**
- **Installer in place**
  - **Core extensions built into EnSight**
  - **Installer for server framework**
    - **Part of EnSight 10.2**

Notional Timeline

Data Capture	Triggers and Sources	Report	Tuning	Release

Data Capture
- Core complete
- Toolset selected
- Prototype running

Triggers and Sources
- Basics complete
- Discussion with CEI "insiders"
  - Define shipping modules
  - Command language/Python API definition

Report
- Early design phase
- Standalone report template editing tool
- Filtering system
- Define shipping modules
- Customer exposure/discussion?

Tuning
- Not started
- Performance
- Security
- 3D Geometry revisited
- Customer testing?

Release
- Not started
- Documentation
- Licensing

End

- **Thank you**

Backup slides

- **JavaScript - ECMAScript 6**
  - **The programming language of the browser**
  - **JSON – JavaScript Object Notation**
- **REST - Representational state transfer**
  - **APIs over HTTP(S)**
- **Web Server – Apache, Nginx**
  - **Handles incoming REST formatted requests vs URIs**
    - **scheme:[//[user:password@]host[:port]][/]path[?query][#fragment]**
  - **Can dispatch to other frameworks**
- **Web Framework**
  - **Maps REST (URLs + action + payloads) to code that generates web pages**
  - **Django**
- **ORM - Object-relational mapping**
  - **Makes a database (e.g. SQL) look like objects**

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The Pipes and Tubes

WebBrowser
Chrome, IE, Safari

HTML5

WebGL

JavaScript

URI + JSON

HTML/Javascript/files

WebServer
Apache, Nginx

Handles
HTTP, proxy
redirects,
Authentication

WebFramework
Django

Data model
objects

Generates
HTML/JSON/etc

ORM

SQL Database
PostGIS, SQLite

Tables

Filestore
S3, local disk

HTML
png
glTF

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