

CMS Internal Note

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IGUANA Plans for 2002

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Abstract

This document describes the aims, milestones and deliverables of the IGUANA (“Interactive Graphics for User ANALysis”) project for 2002. These have been determined by an iterative process from the requests and feedback of the CCS and PRS groups. This document constitutes the baseline IGUANA plan for 2002 against which progress may be measured by both CCS and PRS.

This document does *not* cover existing features of IGUANA nor does it supplant the continually evolving design, reference, and user documentation.

This plan is not frozen. On the contrary, we welcome requests for new features, bug reports, refined priorities and even contributions from the PRS groups, whom we will support through with tutorials and the provision of documentation.

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1 IGUANA Aims and Milestones in 2002

In 2001 the IGUANA development concentrated on creating a solid foundation upon which a wide variety of interactive visualisation applications could be built. This included development of the architecture, the visualisation sub-framework, integration of generic graphics toolkits, and development of browser components. A functional application was deployed in the context of ORCA to provide 3D detector and event display for the PRS groups.

In 2002, the main focus will be very much on functionality. The solid IGUANA foundations will be exploited to broaden the applications provided by IGUANA to the PRS groups, particularly:

- many incremental improvements to the ORCA visualisation;
- provision of a new interactive GEANT4 visualisation program for OSCAR;
- visualisation for the "Detector Description Database" (DDD); and
- some support for specialised applications such as test beam monitoring and control.

Figure 1 shows the main milestones (M1 to M7) for IGUANA development in 2002. There are two major releases foreseen, with many intermediate releases as required.

IGUANA 3, foreseen for April 2002, will include the first major release of the generic GEANT4 visualisation system with at least the basic core functionality of interactive GEANT3. This will be based on the new IGUANA plug-in architecture (M2: March 2002 (IGUANA 3.0)). This must include the display of the full CMS detector (from OSCAR) with the ability to control visibility of the detector tree, zooms, rotations, cut planes, and picking to query volumes or the tree. It should be integrated with the pre-existing overlap detection software of OSCAR and generally facilitate the user interaction with OSCAR.

IGUANA 4, foreseen for October 2002, should include: coherent fully functional ORCA and OSCAR visualisation systems, based on the new IGUANA plug-in architecture (M3: May 2002 (IGUANA 3.1)); an interactive DDD visualisation system (M4: July 2002 (IGUANA 3.2)); integrated 3D and 2D browsers (M5: Aug 2002 (IGUANA 3.3)); complete range of the associated IGUANA infrastructure including items such as software configuration, build, release and documentations systems; and design, user, developer, and maintainer documentation (M6: Oct 2002 (IGUANA 4.0)). The final task for 2002 focuses on polishing the ORCA, OSCAR, and DDD applications based on IGUANA 4 (M7: Dec 2002 (IGUANA 4.1)).

The deliverables associated to these milestones are described in the remainder of this document, arranged by task. Section 2 describes generic deliverables pertaining to the core visualisation software, such as 2D and 3D browsers; section 3 describes the deliverables for ORCA visualisation; section 4 describes the deliverables for OSCAR and DDD visualisation; and section 5 describes infrastructure deliverables associated to the IGUANA project, such as documentation, performance, and quality assurance. This work will be carried out by the IGUANA team of Northeastern University with the support of the US NSF; contributions from others are also most welcome.

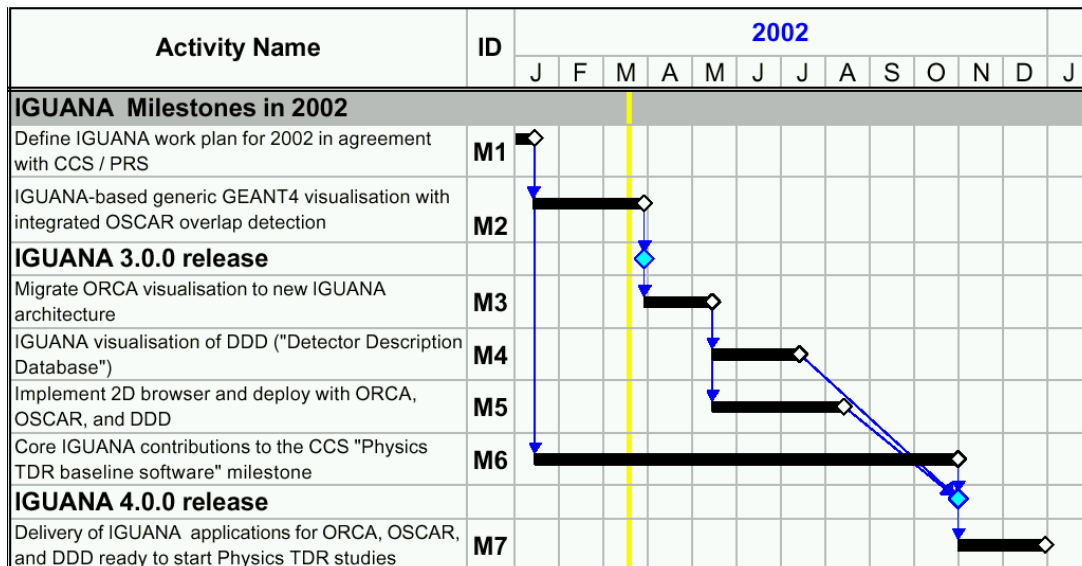


Figure 1: IGUANA milestones for 2002 in the context of the CPT milestones (CMS v31 planning).

2 IGUANA Core Software Deliverables

The IGUANA core software includes the architecture, interactive plug-in framework and services, and the generic toolkits for items such as 3D and 2D browsers, graphics representables, etc. The “IGUANA studio” will allow all (OSCAR, ORCA) to be used in the same environment – to begin with in separate sessions, later perhaps to be configured into one COBRA run (initially just the current visualisation environment). Moving to the new architecture requires building more services, or the middle-ware architecture, such as a property inspector, material editor, etc.

This section does not describe the full system, rather only the incremental changes to be implemented in 2002. Changes specific to ORCA and OSCAR are described in sections 3 and 4 respectively.

2.1 Application Environment and Configuration

2.1-a Session settings

M6: Oct 2002 (IGUANA 4.0)

IGUANA should provide a possibility to save and restore previous session settings, configuration, preferences. By default the options changed in a session will be saved for the next session (user can select not to do it). It will include windows layout, visibility of the objects, camera position, tree expansion, viewpoints, clip planes, etc.

2.1-b Environment checking

M6: Oct 2002 (IGUANA 4.0)

Plug-in (widget/GUI) to check environment.

2.2 2D and 3D Viewers

Both 2D and 3D viewers will have similar sets of detector shapes. It will be possible to have both views of the same scene at the same time with correlated visual settings, for example, colours, and controls.

2.2-a 2D Viewer

M5: Aug 2002 (IGUANA 3.3)

Make an OpenInventor / Qt-based 2D viewer with a Twig controller, layers, etc.

2.2-b 2D Detector and Event Shapes

M5: Aug 2002 (IGUANA 3.3)

Add 2D views of the detectors with various level of details. The same for event.

2.2-c Scale indicator

M6: Oct 2002 (IGUANA 4.0)

Provide cross wires and unit reference frame that do not scale with the rest of the picture, visualised on the main view: small scale indicator, e.g. a segment with its actual length in cm in the 1:1 scale.

2.2-d Axes

M6: Oct 2002 (IGUANA 4.0)

Add new nodes for axes, grids, etc. Provide a few pre-defined axes of different sizes placed in the scene.

2.2-e Reference points

M6: Oct 2002 (IGUANA 4.0)

Provide a few labelled reference points for people to use to check their geometry conventions.

2.2-f Planar grid

M6: Oct 2002 (IGUANA 4.0)

Provide planar grids, e.g. square mesh with 1m by 1m or whatever spacing, perpendicular to x, y, z axes. Similarly, think about the eta-phi possibilities.

2.2-g Transparency

M6: Oct 2002 (IGUANA 4.0)

Possibility to make one shape (detector) transparent (e.g. I am looking from the positive z side and I want to see through the barrel forward endcap onto the backward).

2.2-h Emissive colours

M6: Oct 2002 (IGUANA 4.0)

More use of emissive colour except for lines and dots. Test performance compared with diffuse.

2.2-i Colour schemes

M6: Oct 2002 (IGUANA 4.0)

Support for different detector and event colour schemes, e.g. realistic, stylised high-contrast (ALEPH-style), coloured by material, etc.

- 2.2-j Windows layout** *M6: Oct 2002 (IGUANA 4.0)*
 Provide a possibility to have multiple simultaneous views (e.g. 3D, 2D, barrel, endcaps, etc.). Controllers may be common (correlated) or distinct.
- 2.2-k Windows size** *M6: Oct 2002 (IGUANA 4.0)*
 Make more useful default sizes/layout of windows of all applications (e.g. larger graphics window and smaller text O/P window).

2.3 GUI Controls for Interactive Viewers

The scene navigation and management in both 2D and 3D viewers should be the same. It should include the following features:

- 2.3-a Volume selection** *M2: March 2002 (IGUANA 3.0)*
 Select what to draw. Implement selection methods by hierarchy tree when volumes are shown as a tree of the volumes with one level down from the drawn volumes so that the user can click to select them and by long or short name as well as ancestors n levels up when a user can select a volume even if parent is not selected.
- 2.3-b Volume expansion** *M2: March 2002 (IGUANA 3.0)*
 Expand all descendants, descendants n levels down, expand by categories: only expand volumes of selected categories.
- 2.3-c Twig browser context menus** *M6: Oct 2002 (IGUANA 4.0)*
 Add context menus to the twig browser so that common tasks become much easier.
- 2.3-d Zoom interface** *M6: Oct 2002 (IGUANA 4.0)*
 The implementation of a zoom interface with a slider - a fine control with extrema, and a stepper with a preset factor that gives magnifications of e.g. $\times 0.1$, $\times 0.5$, $\times 2$, $\times 10$
- 2.3-e Rubber band** *M6: Oct 2002 (IGUANA 4.0)*
 A possibility to select an area with a “rubber band” cursor operation, wherever meaningful.
- 2.3-f Clip plane panel** *M6: Oct 2002 (IGUANA 4.0)*
 A GUI panel to manipulate the clip planes.
- 2.3-g Physics parameters panel** *M6: Oct 2002 (IGUANA 4.0)*
 A generic GUI panel that would allow to display and manipulate e.g. physics parameters (PT cuts, etc.).
- 2.3-h Icons** *M6: Oct 2002 (IGUANA 4.0)*
 Revise the icons and replace those that are not particularly obvious in their function, for example, the one that changes the view from a perspective to a simple view.
- 2.3-i Status bar** *M6: Oct 2002 (IGUANA 4.0)*
 Provide information on time consuming operations. Use an hourglass to indicate that program is doing something and a status bar to show what exactly is going on.
- 2.3-j Pan controls** *M6: Oct 2002 (IGUANA 4.0)*
 Provide better controls to “pan” feature.

2.4 Object Inspection

- 2.4-a Object properties service** *M2: March 2002 (IGUANA 3.0)*
 Add a service for object properties.
- 2.4-b Object properties browser** *M2: March 2002 (IGUANA 3.0)*
 Add a browser to show the object properties, twig (= G4 volume) properties. Get volume info by information type (name) or by volume selection, e.g. by clicking in drawn volume; by clicking volume tree; by long name; by short name: all volumes with that name.

2.4-c Pick tool

Implement a "pick" tool like in GEANT to get information about a particular detector: name, position, etc. Re-direct all printout to stream in a "graphics text O/P widget". Use debug level.

M2: March 2002 (IGUANA 3.0)

2.4-d Mechanisms to control visualisation settings

Add the mechanisms to control visualisation settings based on object properties. Make properties, quantities, and colours changeable by a user. Implement a "material editor" to allow a user to change visual representation of selected object, such as colours, line thickness, transparency, draw style.

M6: Oct 2002 (IGUANA 4.0)

2.4-e Correlated selection

Add correlated selection in cloned multiple views.

M6: Oct 2002 (IGUANA 4.0)

3 ORCA Visualisation Deliverables

This section describes ORCA-specific tasks. Many requests from ORCA developers are also included in the generic IGUANA tasks, described in section 2.

3.1 Migration to new IGUANA Architecture

The migration to the new architecture which is already in use for the 3D OSCAR visualisation is a high priority. Apart from being a more flexible and powerful (modular) system it will features already developed for OSCAR to be exploited and will avoid the need to support parallel architectures.

3.1-a Migration of existing application

Migrate existing application core to the new application driver (= IgVis core application parts).

M3: May 2002 (IGUANA 3.1)

3.1-b ORCAVis application driver

Write a new application driver that can sit outside the COBRA event loop. This requires some work with writing the thread- exchange command object queue.

M3: May 2002 (IGUANA 3.1)

3.1-c New twigs

Migrate the existing twigs into new twigs.

M3: May 2002 (IGUANA 3.1)

3.1-d Multiple windows

Possibility to have two views updated at the same time, meaning e.g.:

- I have a z transverse projection with the barrel ECAL on
- I have an x projection with endcap ECAL on but barrel ECAL off
- I hit "next event" and they are both updated

M6: Oct 2002 (IGUANA 4.0)

3.2 ORCA Configuration and User Interface

3.2-a Configuration wizard

Configuration wizard for initialisation of ORCA visualisation, consistent with existing UI (e.g. .orcarc).

M6: Oct 2002 (IGUANA 4.0)

3.2-b Reconstruction parameters and cuts

Ability to control parameters of reconstruction (event by event) as well as parameters of visualisation. Ability to apply cuts to track and SimTrack Pt.

M6: Oct 2002 (IGUANA 4.0)

3.2-c Event access

Random (not sequential) access to events by run and event number with a possibility to select from the list of runs and events to click and select. Display Event/Run number in the banner.

M6: Oct 2002 (IGUANA 4.0)

3.3 Detector Visualisation

3.3-a Tracker geometry

Improve tracker geometry performance.

M2: March 2002 (IGUANA 3.0)

3.3-b Tracker geometry shapes

Add edges for the shapes (new shapes) used in the tracker geometry.

M2: March 2002 (IGUANA 3.0)

3.3-c Detector name

Display selected detector name and associated parameters.

M6: Oct 2002 (IGUANA 4.0)

3.3-d Envelope surfaces for detectors

Investigate use of simplified "envelopes" for various sub-detectors, e.g. draw cylinders at the average radius of a certain tracker layer at the effective radius.

M6: Oct 2002 (IGUANA 4.0)

3.3-e EDMS tree

Consider possibility of arranging the detector hierarchy as it is in EDMS, or at least something close to it.

M6: Oct 2002 (IGUANA 4.0)

3.3-f Simplified Detector shapes

Make fast versions of all detector elements.

M6: Oct 2002 (IGUANA 4.0)

- 3.3-g GEANT3 tree** *M6: Oct 2002 (IGUANA 4.0)*
Drawing of complete set of all GEANT3 elements in the hierarchy, either directly or via DDD.
- 3.3-h Option to show only the hit cells** *M6: Oct 2002 (IGUANA 4.0)*
Show only detector volumes with hits in (rather than all volumes) - e.g. wafers on tracks, crystals, towers, etc.
- 3.3-i Default views panel** *M6: Oct 2002 (IGUANA 4.0)*
Define default view parameters for the tracker, Calo, Muons, r-phi, rz etc.
- 3.3-j Detector selection** *M6: Oct 2002 (IGUANA 4.0)*
For RPC: possibility to select a layer or a wheel or even a single chamber and to have only it displayed. Similar for the other detectors: endcaps, etc. The same for the Tracker.
- 3.3-k Crystal geometry** *M6: Oct 2002 (IGUANA 4.0)*
Fix wrong crystal geometry used for ECAL bumps.
- 3.3-l Pre-shower** *M3: May 2002 (IGUANA 3.1)*
Draw something that looks like the preshower!
- 3.3-m Magnetic field** *M6: Oct 2002 (IGUANA 4.0)*
Show magnetic field (especially locally).
- 3.4 Event Visualisation**
- 3.4-a Tracks representation** *M2: March 2002 (IGUANA 3.0)*
Draw accurate curved low Pt tracks allowing for B field. Join tracks between tracker and muon system with a reasonably estimated trajectory (not simple straight line).
- 3.4-b Event info** *M4: July 2002 (IGUANA 3.2)*
Meta-data display: sample, run. Show event info: how many pileup events, date, time, energy, number of events, luminosity, name of the dataset.
- 3.4-c Threshold control** *M6: Oct 2002 (IGUANA 4.0)*
Ability to apply physics cuts to what has been visualised.
- 3.4-d Improvements to track displays** *M6: Oct 2002 (IGUANA 4.0)*
Display neutral tracks. Distinguish categories of tracks: e.g. muons, electrons, neutrals, etc. and by order (e.g. pt). Add GEANT-created muons for TkSimTrack colouring (e.g. red). Ability to visualise GEANT tracks independent of whether or not they are tracker SimTracks.
- 3.4-e Decay tree** *M6: Oct 2002 (IGUANA 4.0)*
Show particle decay tree in tree widget.
- 3.4-f Reconstructed track** *M6: Oct 2002 (IGUANA 4.0)*
Show valid and invalid measurements (different colours) for reconstructed track.
- 3.4-g List of information** *M6: Oct 2002 (IGUANA 4.0)*
Show information about energy in each sensitive volume, proportion of hadronic energy, what comes from neutrals.
- 3.4-h Edges of ECAL bumps** *M6: Oct 2002 (IGUANA 4.0)*
Fix edges of ECAL bumps to be visible even when very small.
- 3.4-i Transformed view** *M6: Oct 2002 (IGUANA 4.0)*
A set of lego plots of calorimetric towers (ECAL+HCAL), in the appropriate coordinates, with tower energy coded in the "bin" content. EM and HAD energy coded by two different colours Level1 calo trigger candidates indicated by boxing the corresponding region on the plan. Jets coded by circles indicating the cone radius.

3.4-j Pseudo-lego plots

M6: Oct 2002 (IGUANA 4.0)

A set of pseudo-lego plots in the appropriate coordinates (η, ϕ). Emilio will provide the code to visualise clusters in the main view as e.g. a rectangular-base parallelepiped with base sizes proportional to shower shape (Emilio needs the primitive to do this). Tracks should be coded by line perpendicular to the plan, height proportional to the momentum (or transverse mom, configurable).

3.4-k Level of details for ECAL clusters

M6: Oct 2002 (IGUANA 4.0)

The closeup view should show an area (still a lego) centred on the clicked cluster (e.g. 100x100 crystals) with crystal assignment to clusters colour-coded. A colour-coded cluster list with parameters should appear in the same window.

3.4-l Jets with different algorithms

M6: Oct 2002 (IGUANA 4.0)

Implement support for displaying jets created from various templated Jet algorithms.

3.4-m Jet shapes

M6: Oct 2002 (IGUANA 4.0)

Replace current conic jet shape with a (variety of) better shape(s), e.g. a lego of hadronic and electro magnetic energy, and constituents as appropriate: e.g. tracks, digis, etc. Try to display jet parameters, such as proportion of hadronic and electro magnetic energy for the jet, sphericity, oblateness, etc.

3.5 Display Program for CSC Test Stand

This item covers the development of a display system for the CSC detector community to replace their existing CSC test control program with HIGZ-based histogram displays.

3.5-a CSC event display

M4: July 2002 (IGUANA 3.2)

Provide interactive displays using Qt and QPlotter with event by event access: wire strip display, switched capacitor array display, anode trigger display, cathode trigger display, scintillator hits and ALCT wire hits.

3.5-b CSC event display integration

M6: Oct 2002 (IGUANA 4.0)

Integrate interactive CSC displays with ORCA.

4 OSCAR and DDD Visualisation Deliverables

4.1 OSCAR Visualisation

The OSCAR visualisation will include all the basic IGUANA features described in section 2 and elsewhere. In addition to that the following specific implementations are foreseen in 2002.

- 4.1-a Overlap detection** *M2: March 2002 (IGUANA 3.0)*
Provide GUI to Martin Liendl's overlap detection. IGUANA will provide a GUI to run the overlap detection, set its parameters and to show the results, and provide 3D view of the detected overlaps.
- 4.1-b G4 configuration** *M2: March 2002 (IGUANA 3.0)*
Provide a G4 configuration wizard that allows the user to easily select the detector geometry, physics lists, magnetic field, generator and various G4 user actions.
- 4.1-c G4 volume tree browser** *M2: March 2002 (IGUANA 3.0)*
Provide a browser to show G4 volumes. Allow volume selection by full or partial name search or hierarchical browsing. It should be possible to expand the hierarchy in a variety of ways, including all children, n levels down, etc.
- 4.1-d Visualisation by physical hierarchy** *M2: March 2002 (IGUANA 3.0)*
Provide a GUI to construct the visualised geometry by the physical volume hierarchy.
- 4.1-e Visualisation by logical hierarchy** *M2: March 2002 (IGUANA 3.0)*
Provide a GUI to construct the visualised geometry by the logical volume hierarchy.
- 4.1-f Material filter** *M2: March 2002 (IGUANA 3.0)*
Provide a GUI to filter the visualised geometry by material. The user should be able to turn each individual material on and off, make easy selections by material type or by density cut. This should be otherwise orthogonal to the means of choosing the geometry.
- 4.1-g G4 volume properties** *M2: March 2002 (IGUANA 3.0)*
Provide a panel to show G4 volume properties.
- 4.1-h Category filter** *M4: July 2002 (IGUANA 3.2)*
Provide a GUI to filter the visualised geometry by category, such as sensitive detectors, cabling, cooling and so forth. The user should be able to turn each individual category on and off, and make easy group selection. This should be otherwise orthogonal to the means of choosing the geometry.
- 4.1-i G4 session history** *M4: July 2002 (IGUANA 3.2)*
Provide a means to save and restore session settings such that particular detector geometry and visualisation settings can be used in a later session. In particular, one should be able to save the selected geometry configuration (including the filters applied) and come back to it at later time. First time users should be provided with a sensible default.
- 4.1-j Visualisation settings** *M4: July 2002 (IGUANA 3.2)*
Provide a means to apply pre-defined visualisation settings, such as filters, visibility and colour schemes. GEANT4 visualisation attributes and colouring by material type should be among the choices. Allow user to apply a different setting to any G4 volume, either a particular instance of it or to all instances, and to be able to save that setting.
- 4.1-k Volume location service** *M4: July 2002 (IGUANA 3.2)*
Provide a GUI to show all the places where a particular logical volume is used, and to locate volumes by name or part of a name.

4.1-l Non geometrical objects

Add tracks with track numbers and hits to visualisation. IGUANA will ask OSCAR at runtime for the geometry, hits and tracks.

M6: Oct 2002 (IGUANA 4.0)

4.1-m Material budget

Provide a 3D rendering of material budget properties: radiation length and interaction length.

M6: Oct 2002 (IGUANA 4.0)

4.1-n Magnetic and possibly other 3D scalar and vector fields

Provide a 3D rendering of magnetic field and possible other 3D fields such as temperature, neutron background, etc.

M6: Oct 2002 (IGUANA 4.0)

4.1-o Geantino tracing

Provide interactive control of geantino “firing” into the detector with subsequent display of intersected elements and associated properties.

M6: Oct 2002 (IGUANA 4.0)

4.2 DDD Visualisation

DDD Visualisation will include all basic IGUANA features described in section 2. In addition to that the following specific implementations will be provided.

4.2-a DDD browser

Implement a DDD geometry browser with similar features to the OSCAR and ORCA browsers.

M4: July 2002 (IGUANA 3.2)

4.2-b Geometry debugger

Tool to help verify the compatibility of two detector geometry descriptions which are believed to be equivalent. For example, it might support the possibility to visualise DDD geometry and the one from OSCAR, ORCA in the same window with multiple Twig trees connected to one 3D viewer.

M6: Oct 2002 (IGUANA 4.0)

5 IGUANA Support and Infrastructure Deliverables

5.1 User Documentation

5.1-a New IGUANA home WWW site

Migration to the new web site (new IGUANA home) will include update of the current web pages content, including the snapshot documentation and links and notes on other projects, talks, presentations, etc.

M3: May 2002 (IGUANA 3.1)

5.1-b Examples/Tutorial

The examples will be available as a subsystem where a user can choose, compile and run described example. the tutorial will provide a “walk through” the examples.

M3: May 2002 (IGUANA 3.1)

5.1-c IGUANA User Guide

This guide will provide information for users on ORCA and OSCAR visualisation. Current tutorial will be extended to cover most of IGUANA features plus more ORCA specific items will be added. It will include also information for developers on how to use IGUANA in other projects

M6: Oct 2002 (IGUANA 4.0)

5.1-d Feature list system

A feature list system covering project planning will be available from IGUANA WWW page so users and developers can request features through web and we can track them and do them. Updated once per release. This note is a first step in this direction.

M6: Oct 2002 (IGUANA 4.0)

5.1-e Tool tips in IGUANA applications

Provide and automatic help hints on menu items and button actions. When a user points with a mouse to a button, small window with a hint will pop up.

M6: Oct 2002 (IGUANA 4.0)

5.1-f Context-sensitive help in IGUANA applications

Provide more detailed context-sensitive help (bubble help) on menu items, button actions, and so on. A user may ask for more detailed help switching to “What’s this” mode: a cursor changes to a question mark. Clicking with the cursor on a button or a menu item will pop up a small window with help information.

M6: Oct 2002 (IGUANA 4.0)

5.2 Developer Documentation

5.2-a Design documentation

Documentation on IGUANA architecture describing the ideas, implementations, with instructions on how to create new IGUANA plug-ins. The Application Programmer Interface (API) should be described.

M3: May 2002 (IGUANA 3.1)

5.2-b Hyper-linked source code browsing

Links to the tools used by IGUANA to create reference documentation: doxygen, lxr, bonsai, etc. The specific use of the tools, such as configuration issues, will be described.

M3: May 2002 (IGUANA 3.1)

5.2-c Document briefly: How to build and release

This document will describe steps a release administrator should follow to release IGUANA.

M4: July 2002 (IGUANA 3.2)

5.2-d Document briefly: How to work with multiple projects note

A note about how to work with multiple projects including how to use IGUANA in other projects and how to develop within several SCRAM projects.

M4: July 2002 (IGUANA 3.2)

5.2-e Document briefly: How to debug

This document will cover IGUANA specifically debugging issues.

M4: July 2002 (IGUANA 3.2)

5.2-f Document briefly: How to update configuration

This document will cover configuration issues related to IGUANA project.

M4: July 2002 (IGUANA 3.2)

5.2-g Document briefly: How to update web pages

This document will describe certain conventions and rules on how to update IGUANA web pages.

M4: July 2002 (IGUANA 3.2)

- 5.2-h Document briefly: How to make a screen shot** *M4: July 2002 (IGUANA 3.2)*
 This document will describe steps to follow to create a good quality and small size screen shot.
- 5.3 Configuration and Release Management**
- 5.3-a Repository clean up** *M3: May 2002 (IGUANA 3.1)*
 Deleting empty directories, etc.
- 5.3-b Documentation Tools/Systems** *M3: May 2002 (IGUANA 3.1)*
 This constitutes the tools required to handle documentation rather than the content of the documentation. It includes the scripts to create automatically the web pages from the documents and code kept in the CVS repository. It produces versioned (from release to release) documentation and documentation for snapshots.
- 5.3-c Upgrading external software** *M3: May 2002 (IGUANA 3.1)*
 This covers the installation, testing, evaluation and integration of new versions of currently used external software. Notable upgrades already foreseen include: Qt (3.0), OpenInventor (3.0 from TGS and free versions), and XFree.
- 5.3-d Standalone distribution** *M4: July 2002 (IGUANA 3.2)*
 DAR-based IGUANA distribution. Available on WWW and CD-ROM.
- 5.3-e Library loading** *M6: Oct 2002 (IGUANA 4.0)*
 Handle library loading for other projects. In general need to discuss use of inter-dependent libraries.
- 5.3-f New compilers and platforms** *M6: Oct 2002 (IGUANA 4.0)*
 Evaluation and testing of new compilers and OS either already certified or requested. It will include adding the KCC compiler to IGUANA configuration and checking code for MSVC++.
- 5.3-g Integration of new external software** *M6: Oct 2002 (IGUANA 4.0)*
 This covers the installation, testing, evaluation and integration of new versions of new external software packages which have not previously been used by IGUANA.
- 5.3-h Preparation of a licence-free version of IGUANA** *M6: Oct 2002 (IGUANA 4.0)*
 This covers ongoing work on the migration to completely free versions of all dependent packages. This is not policy but a natural trend. Notable packages to be converted to free equivalents: TGS OpenInventor.
- 5.4 Software Quality**
- 5.4-a Traceback reporting** *M3: May 2002 (IGUANA 3.1)*
 Implement traceback reporting feature to provide diagnostics in case of crash in all applications using IGUANA.
- 5.4-b Release script(s)** *M4: July 2002 (IGUANA 3.2)*
 Implement script(s) to facilitate the making of releases. Should also do some basic checking, e.g. no private references in build files, heuristic checking of unused #include declarations, etc.
- 5.4-c Ignominy analysis of package dependencies and metrics** *M5: Aug 2002 (IGUANA 3.3)*
 Automate the use of Ignominy for regular checks between releases.
- 5.4-d Integration/acceptance tests** *M6: Oct 2002 (IGUANA 4.0)*
 Implement integration/acceptance tests (e.g. using OVAL).
- 5.4-e Debugging Services** *M6: Oct 2002 (IGUANA 4.0)*
 Implement the JIT-debugging and possibly also map most of debugging support into services so that GUI can present info about execution while it is still running.

5.5 Performance

- 5.5-a Evaluate and recommend a performant graphics environment** *M2: March 2002 (IGUANA 3.0)*
Measure and document recommended software (OS, tools, compiler options, GL, XFree...) and hardware (CPU, memory, graphics card,...)
- 5.5-b Rendering performance** *M4: July 2002 (IGUANA 3.2)*
Implement or deploy existing tool (e.g. ivperf) for profiling scene graphs and OpenInventor applications.
- 5.5-c Memory** *M6: Oct 2002 (IGUANA 4.0)*
Check memory requirements, leaks, etc. Various tools such as **mpatrol**, **mprof**, **mleak**, etc. could be used.
- 5.5-d Improve rendering performance for current applications** *M6: Oct 2002 (IGUANA 4.0)*
Improve performance (e.g. by replacing all the ECAL crystals with fewer simpler volumes).
- 5.5-e Graphical performance displays** *M7: Dec 2002 (IGUANA 4.1)*
Implement performance displays: e.g. memory consumption, CPU time.