

Streamlining Target Fabrication Requests at the National Ignition Facility

ICALEPCS 2017

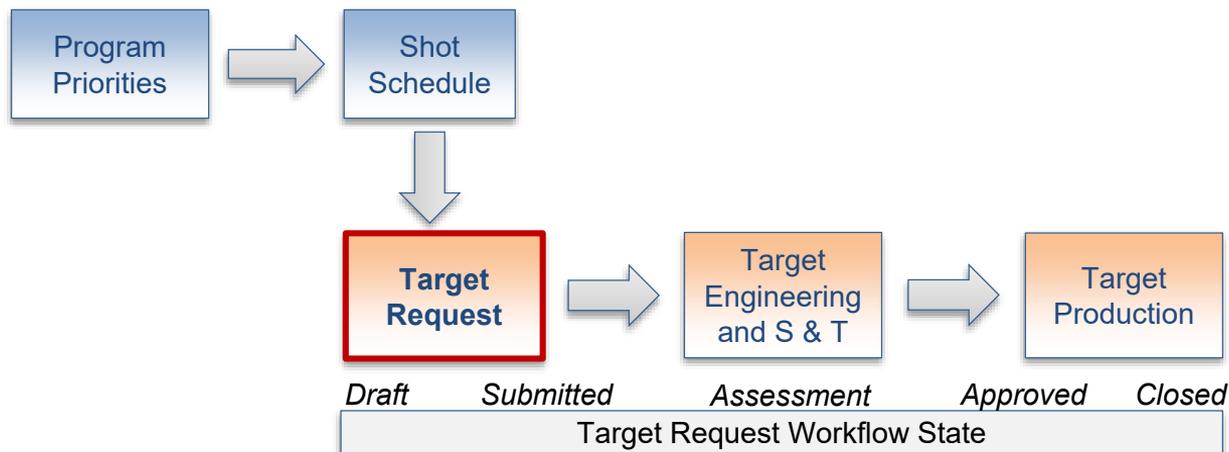
October 10, 2017

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NIF Shot Data Systems

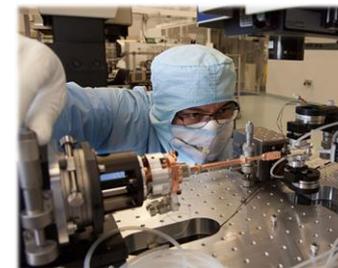


NIF Target Fabrication Background

- Estimated 500 targets produced each year.
- Targets are usually standard but many need to be customized.
- Each target produced is paired with an experiment and a request.
- Requests go through a series of approvals before a target is fabricated.



Example of a target



Technician at target fabrication facility

A software application has been used to manage the target requests.

Former Target Request tool

CLARK94 Logout

Target Summary | **Target Requests** | Available Targets | LoCoS Datasets | Target BDMs | Target Drawings | Taxon Fields | Part/Type Lists | SBAC/CMT Lists | Capsule Inventory

PORT Home > Targets Home > Target Requests > Request Form > Target Request

Target Request

Request #: 14_0012

- Requesting Site: LLNL
- Request R: fobey1
- TF Engineer: fry12
- Expected FLIP ID: LTHD_KeyStag_AAA
- Target Type: [dropdown]
- Positioner: CryoTarpos
- Need Date: 01-AUG-2014

Intended Special Materials

Created: CHOATE3 - 03/19/2013 02:06 PM
Modified: CHOATE3 - 06/03/2015 01:12 PM

Delete this request?

Target Request Attachments

no data found

Target Features

- Capsule Type: [dropdown]
- Hohl Material: Au
- Hohlraum Diameter: [dropdown]
- [dropdown]
- LEH Size: 3.101
- Tent Thickness: na
- Starburst: Yes
- HDC Window Au Coating: Yes
- Backlighter Mat: [dropdown]
- Factory: [dropdown]

Other Features: Spherical stepped Au later at r=500um for shock stagnation measurement

Shot Planner Attachments

no data found

Build Approvals

Actual Materials

Beryllium: [dropdown] Uranium: [dropdown]

Plutonium: [dropdown]

Depleted Uranium: [dropdown]

Tritium: [dropdown] Other Rad: [dropdown]

Deuterium: [dropdown] SM Updated: [dropdown]

TR Status: TFRT Approved Locked: No

Program Approval: 19-APR-2013

R&D Required: [dropdown]

TFRT Required: [dropdown]

TFRT Approval: 19-APR-2013

Goal Date: [dropdown]

Hold Date: [dropdown]

Approver: [dropdown]

Comments: [text area]

Updated: CHOATE3 03/23/2014 11:22 AM

Build Count: 1

Contingency: [dropdown] wks

FLIP Shot Plan

FLIP ID: [dropdown]

Schedule Date: not in FLIP

Primary1: 36220001

Backup1: NA

Primary2: NA

Backup2: NA - 2 pos shot

Selection: [dropdown]

Comments: [text area]

Updated: CHOATE3 - 07/31/2014 08:36 AM

Build Targets

New SNs are added per the Build Count

Build TR	Target SN	Part Alias	M	Description	TF Engineer	Icd	Glovia Status	Assy WO	SN Status	Ready Date	First Flip Dt	Float	Primary TR	Backup TR	Updated	By
14.0012	36220001	3622		-	fry12	46	Inventory B298R111	PTRG144238	RVP	06/09/14	-	-	14.0012	-	06/02/2014 05:21 PM	CHOATE3

(use the SN link for deletes)

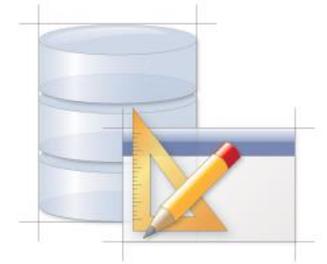
Display of duplicate data

Hard-coded features prevent readily adapting to new engineering processes

Overly complicated logic for sourcing data that slowed the page load time

Limitations of former Target Request tool

- Former target request application developed in Oracle Application Express (APEX) had multiple limitations.
- Process and user interaction limitations:
 - Engineering processes evolved making existing user interaction out of date.
 - Underlying data architecture was not optimized for current use.
 - Development over time led to inefficient use of data.
 - Page loading times were very slow.
- Technology limitations:
 - Customization was possible within the limitations of the APEX framework.
 - All development had to be done through the APEX Web interface.
 - There was no built-in version control.
- Decision was made by the Shot Data Systems (SDS) team to develop a new application, with new technologies and on a new data model, rather than modifying the existing one.



ORACLE[®]
Application Express

New Target Request Tool (TRT)

The screenshot displays the TRT interface with the following sections:

- Target Order:** TR # 2497, Rev 4, Primary/Backup TR Pairings, Requestor schneider5, Order Date 06/13/2017.
- Target Features:** Do you want to populate the target features menu by searching the target catalog or by copying an existing TR? (Select Value), SM Copied From 48160003, PM Copied From 1021516040, TR # Copied From 3761527, Target Platform Crys, Sub-platform Crys.
- Target Status:** Transition TR Status (Select Value), TR Status Approved, TR Status Date 09/13/2017, Target Fab Engineer h481, Target Designer h481, Draw Release Date 09/07/2017, Release Step, Target Ready Date 10/04/2017, Target Flight 29, Target Part No. 1002816000, Target Serial No. 5117001, Target Drawing Tower (Sym-B, 215_Au_540_1013_3M, HCG:NA:NA, UNCDPFG:444, 64_T_1002816000), Target Factory (B301).
- Shot Pairing:** FLIP ID (Fa_Diag_SymCCDO_SpecPQ_AAA), Other TRs Linked to FLIP ID (No Other Pairings were found), Goal Date (optional), Shot Date (FLIP) 11/02/2017, Shot Date (FLIP Proposed) 11/02/2017.
- Target Configuration:** Primary Positioner (Tm), Secondary Positioner (NA), DM 90-78 Instrument (DISC3), DM 90-124 Orientation (Horizontal), DM 90-124 Instrument (NA), DM 90-124 Orientation (NA), DM 90-315 Instrument (DISC2), DM 90-315 Orientation (Horizontal).
- Experimental Team:** Institution (LLNL), Campaign Abbr (Diag), Campaign Lead (schneider5), Alternate Campaign Lead, Shot ID (schneider5), Project Engineer (ehsch1), Supporting IS 1, Supporting IS 2.
- Target Area Data:** Shot Type (C), Target Shot Temperature (80), Hohlraum Fab (h48), Capsule Fill (C2 - Krypton), Hohlraum Pressure (Standard), Capsule Pressure (Standard), Backlighter Fab (NA), Backlighter Pressure (NA), Target Gas Fill Description, Intended Special Materials (None).
- Menu Options:** Target Type (Sym-09-315), Positioner (Tm), Scale (540 1013), Hohl Mod (Au), LEIR Invert (3.449), Capsule (HCG:NA:NA:UNCDPFG:444:64), Upper Tent (45), Lower Tent (45), Fill Tube Size (10 um), Starboard (No), RCP Coating (Yes), DR Window Coating (No), Slats (No), Core Coating (NONE), Backlighter (NA), Air Thickness (NA), Heat Switch (No).
- Shot Charge Requests (SCRs):** Table with columns SCR No. and SCR State.

SCR No.	SCR State
2029	CLOSED
2092	DRAFT
2318	CLOSED
2374	OPEN
- Target Pairing:** FLIP IDs Paired to TR (Table with TR Num, FLIP ID, TR State), TRs Paired to Selected FLIP ID (Table with TR Num, FLIP ID, TR State).
- Comments Log:** 10/06/2017 10:58 AM HCN:RUCM: special WINCOWS for 90-78 and 90-315. I enclose a picture we have talked to Jeremy KOF about the Capsule Fill is different. C2 = 2.00% or (or close to this).
- Attachments:** 1 linked to TR.
- Target Request:** SymCCDO_SpecPQ_20170902.pdf

Display of common data

Customizable features that allow for readily adapting to new engineering processes

Simplified logic for sourcing data that improves page load time

Displayed here is the full view of TRT composed of 3 columns that are gradually displayed as the user makes his/her selections

Zoom in view of two top panels of TRT's left column

NIF Target Orders > Requester Page

Remember to press SAVE to update the database with any data entered on this page including comments.

Find TR by Number

Target Order

TR # 2497
Rev 4
Primary / Backup TR Pairings [See Target Pairing Panel on the right](#)
Requestor schneider5
Order Date 06/13/2017

Shot Pairing

FLIP ID Fa_Diag_SymCDD_SpecPQ_AAA ▾

Other TRs Linked to FLIP ID No Other Pairings were found

Need Date (optional)

Shot Date (FLIP) 11/02/2017
Shot Date (FLIP Proposed) 11/02/2017

Sequence of steps to create a target request

1

New target request
Left panel is displayed

2

Select FLIP* ID

3

Data related to FLIP ID is populated

NIF Target Orders > Requester Page

Remember to press SAVE to update the database with any data entered on this page including comments.

Cancel Save Submit Copy Find TR by Number [] go

Target Order

TR #
Rev
Primary / Backup TR Pairings See Target Pairing Panel on the right
Requestor man1
Order Date

Shot Pairing

Scheduled in FLIP or FLIP Proposed? - Select Value -

NIF Target Orders > Requester Page

Remember to press SAVE to update the database with any data entered on this page including comments.

Cancel Save Submit Copy Find TR by Number [] go

Target Order

TR #
Rev
Primary / Backup TR Pairings See Target Pairing Panel on the right
Requestor man1
Order Date

Shot Pairing

Scheduled in FLIP or FLIP Proposed? Yes RESET

FLIP ID - Select Value -

- Select Value
- D_Astro_ARC_PairPlan_AAA
- D_Astro_ARC_PairPlan_BBB
- D_Astro_BField_LDMap_AAA
- D_Astro_BField_LDMap_BBB
- D_Astro_Catnox_ACSEL_OGG
- D_Astro_Catnox_ACSEL_HHH

NIF Target Orders > Requester Page

Remember to press SAVE to update the database with any data entered on this page including comments.

Cancel Save Submit Copy Find TR by Number [] go

Target Order

TR #
Rev
Primary / Backup TR Pairings See Target Pairing Panel on the right
Requestor man1
Order Date

Shot Pairing

Scheduled in FLIP or FLIP Proposed? Yes RESET

FLIP ID D_Astro_BField_LDMap_AAA

Other TRs Linked to FLIP ID
2630, 2676, 2673, 2464, 2476, 2475, 2474, 2472, 2383, 2395, 2390, 2389, 2386, 2387, 2388, 2395, 2395, 2441, 2222, 2227, 2201, 2200, 2198, 2152, 2065, 2036, 636.0001

Need Date (optional) []

Shot Date (FLIP) 6/12/2017
Shot Date (FLIP Proposed) 6/16/2017

Target Configuration

Primary Positioner CDS
Secondary Positioner NA
DM 90.78 Instrument ECXCAF
DM 90.78 Orientation Vertical
DM 90.124 Instrument NA
DM 90.124 Orientation NA
DM 90.215 Instrument NA
DM 90.215 Orientation NA

Experimental Team

Institution LLNL
Campaign Astro
Campaign Lead 080606
Alternate Campaign Lead 080604
Shot ID 080606
Project Engineer zck7ar1e1
Supporting RI 1
Supporting RI 2

Target Area Data

Shot Type W-B
Target Shot Temperature Room Temp
Hohlraum FIB NA
Capsule FIB NA
Hohlraum Pressure NA
Capsule Pressure NA
Backlighter FIB Ch3 50/50 atomc
Backlighter Pressure 10 ATM
Target Gas FIB Description
Intended Special Materials None

*FLIP = Facility and Laser Integrated Planning

Sequence of steps to create a target request (continued)

4

Select how to obtain target features

Target Features

Do you want to populate the target features menu by searching the target catalog or by copying an existing TR? Select Value - Select Value -

Yes, search target catalog Yes, copy existing TR No

Attachments

Upload to TR

Target Request

Shot Planner



5

Target features are loaded into the middle column

Target Features Menu

Do you want to populate the target features menu by searching the target catalog or by copying an existing TR? Yes, search target ... RESET

TR# 43270002
SN Copied From 1000045236
PN Copied From 674.0002
TR # Copied From 674.0002

Target Platform:
Sub platform:

Cryo Feature Selection Menu

Do you want to update menu features? No Exact Duplicate

Variation Degree: Exact Duplicate

Menu Options

All yellow and red triangles indicate invalid feature values that must be updated prior to submitting the TR. To Modify these menu options, please select Yes for 'Do you want to update menu features?' when available.

Target Type: THD-75-50
Positioner: Cbs

Scale: 609.026
HWH Max: Au
LEH Max: 2.101
Cathode: CHANA THD-1.205-75-108
Upper Test: 30
Lower Test: 30
Fill Tube Size: Select Value -

Startured: Yes
HDC Coating: Yes
DI Window Coating: Yes
Storm: Yes

Cone Coating: NONE
Backlighter: NA
Ice Thickness: TBD
Heat Switch: No

Comments Log:
Add Comments:

Attachments

6

TR can be saved. TR# is generated

Action buttons (save, submit, withdraw, cancel)

NIF Target Order - Responder Page

Do you want to populate the target features menu by searching the target catalog or by copying an existing TR? Select Value - Select Value -

Yes, search target catalog Yes, copy existing TR No

Upload to TR

Target Order

Shot Planning

Other TRs Linked to FLP ID: 2002, 2016, 2071, 2084, 2474, 2475, 2474, 2474, 2003, 2045, 2016, 2008, 2008, 2008, 2008, 2008, 2004, 2200, 2200, 2200, 2200, 2180, 2180, 2122, 2085, 2005, 083001

Need Date (optional):
Shot Date (FLP): 02/12/2017
Shot Date (FLP Proposal): 02/12/2017

Target Configuration

Primary Positioner: Cbs
Secondary Positioner: NA
DMW 90-75 Invariant: RQDQAF
DMW 90-75 Orientation: Vertical
DMW 90-54 Invariant: NA
DMW 90-54 Orientation: NA
DMW 90-315 Invariant: NA
DMW 90-315 Orientation: NA

Experimental Team

Institution: LLNL
Campaign Abb: ATR
Campaign Lead: jpk@llnl.gov
Alternate Campaign Lead: jpk@llnl.gov
Shot ID: jpk@llnl.gov
Project Engineer: jpk@llnl.gov
Supporting BR 1
Supporting BR 2

Target Area Data

Shot Type: 412
Target Shot Temperature: Room Temp
Helium Gas Flow: NA
Capacitor Flow: NA
Helium Pressure: NA
Capacitor Pressure: NA
Backlighter Flow: CH40 5000 atm
Backlighter Pressure: 10 kPa
Target Gas Fill Description:

Independent Support Networks: None

Comments Log:
Add Comments:

Attachments

Business Status: Your Target Request has been created.

Transaction TO Status:
TR Status Date: 05/05/2017
Target FWP Engineer
Target Designer
Drug Release Date
Reorder Step
Target Ready Date
Target Final
Target Final No.
Target Draining Team

Shell Change Requests (SCR)

SCR No.:
SCR State:

Target Planning

FLP ID's Planned to TR:

FLP ID	TR State
No Submitted TRs were Found	

TRs Planned to Selected FLP ID:

TR Num	FLP ID	TR State
2287	D_Astro_EFWild_LDRng_AAA	backup
2158	D_Astro_EFWild_LDRng_AAA	primary
638 0001	D_Astro_EFWild_LDRng_AAA	primary
2232	D_Astro_EFWild_LDRng_AAA	primary
2393	D_Astro_EFWild_LDRng_AAA	backup

Pop-up menu to select record to copy from

Technologies chosen for the development of TRT

- Node.js
 - Open-source, cross-platform JavaScript run-time environment for executing JavaScript code server-side.
 - Modern technology that is supported by a large community of developers.
 - Suitable for non-CPU-intensive operations.
- Express
 - Open-source, minimal and flexible Node.js Web application framework written in JavaScript.
 - *De-facto* standard framework for the majority of Node.js applications.
- Kendo UI
 - Commercial off-the-shelf library for data-rich Web applications that provides more than 70 reusable UI components.
- JavaScript, jQuery, HTML, and CSS
 - Commonly-used Web technologies that allow for an easy implementation with Node.js as the back-end.

Back-end

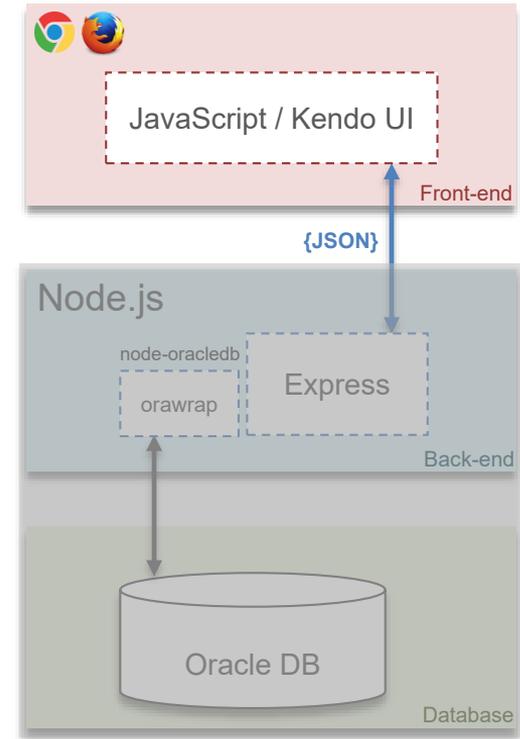


Front-end



Reasons for using chosen technologies in TRT Architecture

- Front-end:
 - Model-view-controller pattern - selected to provide a clear separation between view and logic.
 - Allowed to easily subdivide the UI into multiple sections and panels which in turn provided flexibility to divide the work among developers.
 - Improved performance significantly as it allowed asking the back-end for data only when needed.
 - Simplified the addition of new panels and features to the UI as most panels are independent and do not need to be reworked for accommodating the new panels.
 - Kendo UI – selected to simplify implementation and speed development.
 - Allowed to customize available UI components to the tool's needs.
 - Provided an easy integration with other Web technologies used in the tool.
 - Improved the look-and-feel of the UI with a simple and clean look.
 - JavaScript, jQuery, HTML and CSS – selected technologies to complement the JavaScript-based back-end.



Developed in a standard model-view-controller pattern.

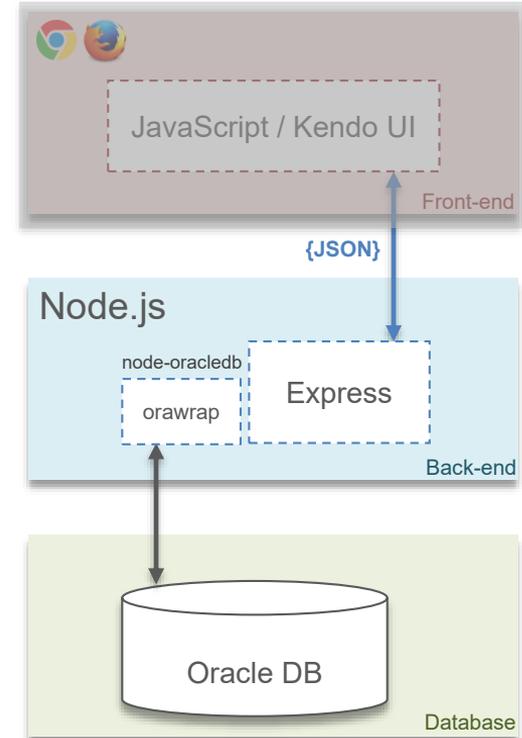
Reasons for using chosen technologies in TRT Architecture (continued)

- Back-end:

- Node.js – has proven to work well and be reliable for other SDS applications.
 - Allowed us to seamlessly connect to existing Oracle database.
 - Provided a fast turnaround for developing the application.
 - Paired well with Web technologies used for the front-end.
- Express – is easy to use and provides a well-written online documentation.
 - Provided multiple methods for querying the request and constructing the result as a JSON file.
 - Provided a thin layer of fundamental Web application features, without obscuring Node.js features.

- Database:

- Oracle database – is the supported infrastructure for the facility and used for all SDS applications.
- 'node-oracledb' driver - manages a fast and stable database connection.
- 'orawrap' library - creates a listening pool on the provided port and provides an easy way to handle SQL queries.
 - *The orawrap library is no longer being maintained. It has been added to the core Oracle database driver (node-oracledb).*



Conclusion

- The use of modern technologies allowed the SDS team to meet the overall project goals primarily within the development time allocated.
- TRT provides faster loading time, improved user interaction, and smooth data integration.
- Future maintenance is simplified given the MVC pattern adopted.

Thank you

