National Genomic Testing Process (NGTP)

Document Purpose

This diagram has been developed within the National Interoperability Project for the Genomic Medicine Service. The primary intention of this operational flow diagram is to provide the visual reference points against which data and configuration requirements can be stated.

Further Synopsis

This diagram illustrates a nationally applicable, generic process occurring between the requesting of a genomic test and the subsequent receipt of a results report. To achieve national applicability, the task sequence detail is held to a level that renders it solution and location agnostic. Sub-processes are not expanded as that detail often varies inside different organisational boundaries.

The diagram presents a sequence/flow applicable to the handling of a single test request.

Additional note – The concept of send-away activity is demonstrated by the 'Remote' swim-lane. Once it is entered, the NGTP should be read as though to treat the appropriate upper, 'Local' swim-lane as the Remote location from that point onwards.

This method for reading the NGTP allows for a theoretical unlimited number of send-away locations to be involved in the end-to-end process without the need to present further swim lanes.

Version Control

Version	Date	Modifier	Comments/Updates
0.1	11.02.22	M Price	Initial draft – SE_GLH process flow lifted into BPMN template- method and style adjustment. Process and sequence updates applied.
0.2	14.02.22	M Price	Interpretation & Report expanded sub processes added
0.3	17.02.22	M Price	Variant Identification process steps added, Reflex Testing placement adjusted. Validation of draft (with Subject Matter Experts) to commence from this version onwards. Extensive updates planned for subsequent drafts.
0.4-05	10.03.22	M Price	Review and updates via Clinical Directors (Cancer pathways) + Further informatics input driven amendment.
0.6	17.03.22	M Price	Error paths added/developed + minor amends. DPYD scenario added (new slide)
0.7	28.03.22	M Price	Copy is post Informatics review 28th Mar. WGS Scenario slide added. Further updates and validation now planned. Minor amendments include:- various terminology updates, additional decision point in error flow. Counterpart documents to update also.
0.8	04.04.22	M Price	Reference labels added and updated to align with data counterpart document
0.9	29.04.22	M Price	Minor amends following Scientific Advisors and Ops Directors reviews - 5.11.1 task added, 3.01 – 3.05 sequence revised.
0.9.1	06.05.22	M Price	Task 3.02 sequences updated, intermediate events adjusted.
0.9.2	26.05.22	M Price	DPYD & WGS copies uplifted to match current master diagram.
0.9.3	01.07.22	M Price	Copy Approved @ GOMT. Minor labelling amendment at 2.09.
1.0	10.10.22	M Price	Baselined – draft stable
1.1	23.08.23	M Price	Added – Reanalysis. Reinterpretation. Prep-Only. Prep Loop. Task reference numbering overhaul. Store report removed.
1.1.2	06.10.23	M Price	Stage-based colouring added + Failure path for genomic analysis (pipeline)
1.2	13.10.23	M Price	Tasks 2.18 – 2.20 updated/added
1.3-1.5	Dec 2023	M Price	Ref IDs overhaul. Colour coding added. Reflex & Confirmatory test touch points separated + minor amends.
1.6	23.04.24	M Price	Removed 350.60/350.70 (450.30 now handling). Added 450.10 & 450.35. Connected 150.20 to 100.20. Task 50.00 elaborated further through annotation. Added WGS slide.

BPMN & General KEY

Start Event: – Indicates the event that triggers the start of the process.

End Event – Indicating the event that occurs, marking the end points of either sub processes of the main process flow.

Intermediate Event – Represents any notable event that occurs between the start and end events.

Intermediate Timer – Indicates a time constraint applicable to a task.

Gateway: Parallel – Depicts commencement of tasks occurring in parallel. Follow-on instances ensure that parallel tasks complete prior to the next task in the flow commencing.

Gateway: Either/Or – Indicating the process flow will only follow one of the subsequent attached flows.

Gateway: Inclusive – Present when one or more flows can be followed optionally. The second, merging instance serves to ensure all active sequences complete prior to any subsequent task commencing.

Sub Task: Collapsed – Indicates a task that is comprised of a series of sub-tasks, which are linked to within the document and expanded in a separate page.

Sub Task: Expanded – Used to contain the expanded view of sub process tasks.

Sequence Flows:– Indicate and connect the general flow between tasks, gateways and events. Additional markers are used, such as the forward slash, which depicts the default flow, where multiple flows are present.

Message Flows: – Serves as the bridging link between tasks in separate pools or lanes, and indicates the flow of messages between tasks.

Document Validation

This document has been validated by providing communities-of-interest, with the opportunity to review and feedback. A combination of interviews and workshops has been held with Operational, Scientific and Informatics stakeholders. The following, non-exhaustive list of roles is applicable. The document has been exposed to multiple stakeholders from each region engaged in the GMS.

- Director of Operations
- Deputy Operations Lead for Clinical Bioinformatics
- GLH Bioinformatics Lead
- Deputy Directors to the GU
- Scientific Director
- Consultant Clinical Scientist Lead
- Principal Clinical Scientist
- Consultant Clinical Scientist
- Clinical Scientist
- Consultant in Clinical Genetics
- Laboratory Lead for Precision Medicine
- Cardiologist
- Scientific Advisor to the GU
- Informatics lead
- IT Manager

Key Forums

- Genomics Operational Management Team (GOMT)
  General sign-off/approval – Jul 2022
- Informatics Programme Board
  NGTP - Use and approach within the National Interoperability Project presented – Mar 2023

National Genomic Testing Process (NGTP) | v1.6

Requestor

Test Coordination (Typically Home GLH)

Local Wet Lab

Local Dry Lab

Remote & Specialist Lab Locations (Send-Away Activity)

External Sample Location (External to GLH/NHS Network)

Sub-process inclusive of new requests or updates and modifications to on order.

Genomic Test Required

RoD and/or Consent

Patient

Requesting Clinician

Nominated Clinical Staff

Sample(s) S1

10.00 Request Genomic Test

Sub-process includes
- *possible order/request **modification** driven by a GLH/lab decision. - Potential to create a **new test** at the lab. (decisions to cancel original and create new or commence a **salvage test** following failure tasks.*
- *Underlying comms to **manage re-commencement of tasks** that failed and are now recoverable.*

The sub-process also presumes a notification (order receipt) is incorporated.

*For variant **re-interpretation** (re-classification) – A new test request drivest a new report for a patient based on the re-interpretation of a variant.*

*The **re-analysis** scenario is effectively the re-processing of data as opposed to a sample. Data note – In practice, the data may need to be moved if reanalysis is fulfilled by a location differing from that which provided the original analysis.*

Notes:
Processes and tasks beyond the results report being issued for the Ordering Entity are outside the scope of the NGTP. However, consider the following:

1. Once received or retrieved, the report may be stored, integrated or distributed further.
2. Upon the provision of structured results data (i.e. a machine readable report format), that data can be consumed by systems and processes automatically. For example, into pharmacogenomic system's, a unified genomic record (UGR) or systems triggering notifications or alerts based upon the test outcome.

Requestor Notified of Process Failure

Local / Remote

F200.00 Notification Distribution

F200.00 Notify Requestor

F150.00 Recoverable? (N / Y)

F100.00 Determine Test Recoverability

Test Request Valid? (10.10) — No

50.00 Process Genomic Test Request

10.50 Test Request Received

Yes → 50.20 Require External Lab Sample? — Yes / No

50.30 Request Sample (From external lab)

50.70 Log Sample Confirmation

Looping sub-process to align and link test requests and samples or no-sample scenarios.

Sample(s) S2 — *Sample available at local lab*

50.80 Book Sample(s) into Lab

100.00 Request & Sample Alignment

100.05 Sample or Request Not Present (Conditional, test-dependent time frames)

100.10 All **Required** Sample(s) & Request Received or Available

Potential to complete this task multiple times depending on when and where each aspect of prep work is to be completed. E.g. validate, extract, plate

100.50 Retrieve Variant Priorities List

100.55 Successful? — No

Re-Interpretation / Re-Analysis — 100.30 Scenario Type

100.40 Retrieve Previous Genetic/ Genomic Sequence Data

100.45 Successful? — No

Sample(s) S4

150.30 Forward Order Request (Send Away)

Sample(s) S5

150.40 Forward Order Request (Send Away)

200.10 No Sample Scenario — Yes / No

200.20 Send Away Sample — Yes / No

Requires Prep? (150.35) — Yes / No

150.00 Sample Preparation

150.30 Send Away? — Yes / No

150.10 Successful? — Yes / No

150.20 Further Prep — Yes - Local / Yes - Remote

200.00 Sample Processing

No - Process / No - Prep Only

200.10 Successful? — No

200.20 Technically Processing Genetic/ Genomic Data Locally

200.30 Other GLH Processing Genetic/ Genomic Data

250.00 Genetic/ Genomic Data Processing

250.10 Successful?

250.20 Conducting Interpretation? — Yes / No

250.30 Local Interpretation? — Yes / No

250.40 Other GLH Interpretring? — Yes / No

300.00 Interpretation

300.10 Successful? — No

300.30 Action to Report — Yes / No

150.50 Parallel — Action to Store Sample

150.60 Prepped Sample Stored

350.00 Produce Interim Report

360.00 MDT Required? — Yes / No

400.40 Provide MDT with Further Clinical Details

400.50 Detail required locally or remotely? — Local / Remote

400.60 Require MDT? — Yes / No

400.00 Genomic MDT — *(GTAB, GRDAB)*

400.30 Require Further Clinical Detail? — Yes / No

400.35 Local Interpretation? — Yes / No

450.00 Produce Final Report

450.50 Request Reflex/ Confirmatory Test

Continue Testing / Distribute Report(s)? (450.55) — Yes / and/or / Local

450.30 Follow-On Test(s)? — Yes / No — *(Reflex/ Confirmatory)*

450.40 Local/Remote Distribution

450.20 Mark Test Complete

450.10 Determine Follow-On Test Requirements

500.00 Distribute Report

Test Report Received by Requestor

*IF the report is the final report for the original test request (i.e not a reflex/confirmatory test related report, **THEN** the referral is closed within this sub-process.*

The sub-process also presumes a notification (completed/ready report) is incorporated.

Sub Process Notes:

1) If Reflex/Confirmatory test request(s) were instigated, the final report task may tie together (in locally appropriate ways) the results of the original and any/all subsequent tests. Most typically, finalisation of the single report for the original test request is sufficient.

2) If order/request was for a prep/store only, the report produced will simply reflect the completion of that instruction.

Samples and connectors provide:

1) basic depiction of sample logistics.

2) The dataflow of the Sample Linkage Form (hard copy).

***Inclusive Gateway note** – Allowing both sequence flows to occur in parallel if necessary. For example, so-called tumour-first and Germline later scenarios.*

(a) F100.00 Determine Test Recoverability

Sample(s) S2 — *Sample as sourced from a Remote (GLH Network) location*

(a) 150.00 Sample Preparation

(a) 200.00 Sample Processing

(a) 250.00 Genetic/ Genomic Data Processing

(a) 300.00 Interpretation

(a) 350.00 Produce Interim Report

(a) 400.00 Genomic MDT

(a) 450.00 Produce Final Report

(a) 500.00 Distribute Report

50.60 Identify Test/ Sample(s)

50.65 Send Sample Availability Confirmation

Sample(s) S3

50.68 Sample(s) Available? — Y/N

Important Note #1

The Remote swim lane is included to visualise the concept of send-away location activity. Once the Remote swim lane is entered, the NGTP should be read as though to treat the upper, local swim lane as the Remote location from that point onwards.

This method for reading the NGTP allows for a theoretical unlimited number of send-away locations to be involved in the end-to-end process without the need to present further swim lanes.

As such, the Remote swim lane features only the core tasks of the process and the inbound message sequences.

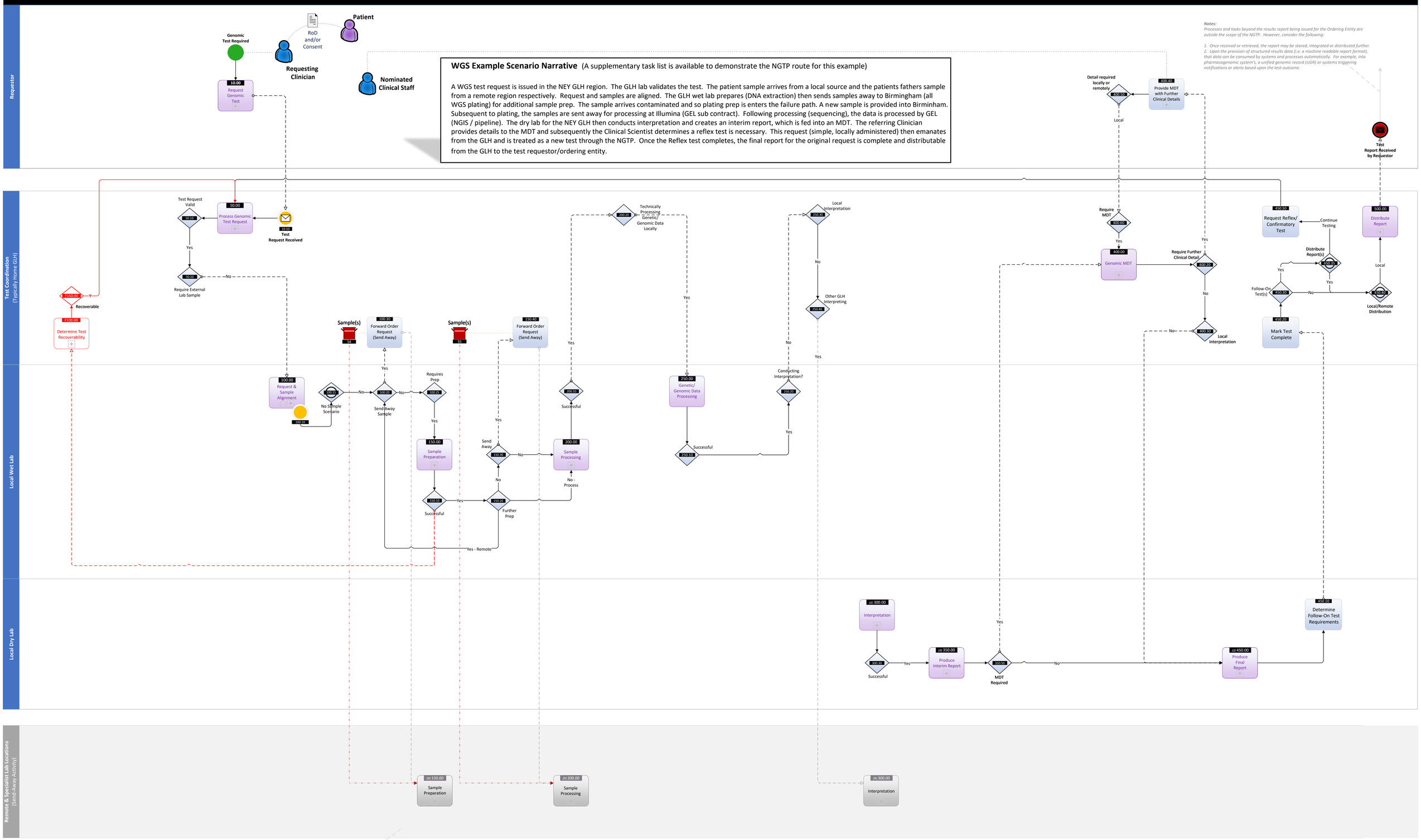
KEY

- Operational Tasks & Gateways
- 000.00 — Reference ID's – Serves data mapping, time-stamps and broad electronic standardisation purposes.
- Standard sequence/flow connectors
- Operational Tasks & Gateways Targeted for electronic status updates
- Message connectors – The flows most typically understood as cross organisational

Important Note #2

Note – In a send-away scenario the report typically distributes back to the location that requested the send-away as opposed to direct to the Ordering Entity. However, the NGTP diagram also facilitates (Inclusive Gateway 450.40) the distribution as being direct back to the Ordering Entity if this is required.

National Genomic Testing Process (NGTP) | v1.6 – Whole Genome Sequencing (WGS – GEL)



WGS Example Scenario Narrative (A supplementary task list is available to demonstrate the NGTP route for this example)

A WGS test request is issued in the NEY GLH region. The GLH lab validates the test. The patient sample arrives from a local source and the patients fathers sample from a remote region respectively. Request and samples are aligned. The GLH wet lab prepares (DNA extraction) then sends samples away to Birmingham (all WGS plating) for additional sample prep. The sample arrives contaminated and so plating prep is enters the failure path. A new sample is provided into Birminham. Subsequent to plating, the samples are sent away for processing at Illumina (GEL sub contract). Following processing (sequencing), the data is processed by GEL (NGIS / pipeline). The dry lab for the NEY GLH then conducts interpretation and creates an interim report, which is fed into an MDT. The referring Clinician provides details to the MDT and subsequently the Clinical Scientist determines a reflex test is necessary. This request (simple, locally administered) then emanates from the GLH and is treated as a new test through the NGTP. Once the Reflex test completes, the final report for the original request is complete and distributable from the GLH to the test requestor/ordering entity.

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