

Node ESM Resolution Trace v1

Node.js ESM and Module Resolution

Outcome. Predict and verify how a pinned Node runtime classifies and resolves a bounded ESM import, then distinguish package-interface, specifier, and format failures from TypeScript or bundler behavior.

Evidence gate. Accept only a trace that records the exact Node version, command, working directory, package scope, specifier class, interface rule, observed runtime result, detected mutation, bounded repair, transfer, and residual limit.

The Six-Step ESM Resolution Trace

01 IMPORT SPECIFIER Authority: Provides the exact relative, absolute, bare, or imports-map request Boundary: Editor completion is not runtime evidence	02 PACKAGE SCOPE Authority: Supplies the nearest package.json and module-format marker Boundary: The same extension can be classified differently across scopes	03 SPECIFIER CLASS Authority: Selects relative URL rules or package lookup rules Boundary: Extension repair applies to relative ESM targets, not every import
04 PACKAGE INTERFACE Authority: Applies exports or imports mappings to permitted public subpaths Boundary: Physical file presence does not guarantee an exposed subpath	05 RESOLVED URL AND FORMAT Authority: Identifies the concrete target and its runtime interpretation Boundary: Bundler rewrites may differ from direct Node behavior	06 LOAD RESULT Authority: Records success or the classified runtime failure Boundary: Use the pinned Node version and exact working directory

Identity, decision, and claim boundary

Learner		Reviewer	
Case / attempt		Capture date	
Scenario / concern		Decision	ACCEPT / REPAIR / DEFER

Claim boundary. This is a bounded executable lab. Retain implementation, applicable runtime, browser, DOM, or tool observations, mutation, repair, transfer, and residual-limit evidence; one passing checker is not whole-system proof. No ESM resolution claim is accepted from an editor or bundler alone; retain pinned-runtime, scope, specifier, interface, mutation, repair, transfer, and limitation evidence.

Required record fields and evidence tests

A field is complete only when its value is bounded, traceable, and classified. Use UNKNOWN when the required observation is unavailable or contradictory.

Field	Question to close	Minimum evidence	Invalid promotion
dimension	What does dimension mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
input	What does input mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
prediction	What does prediction mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
observation	What does observation mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
diagnosis	What does diagnosis mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
bounded_repair	What does bounded repair mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
post_repair_observation	What does post repair observation mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation
residual_limit	What does residual limit mean in this case?	Bounded scenario fact, source, or observable	Inference can be relabeled as observation

Evidence and failure states

Evidence: OBSERVED / INFERRED / UNKNOWN. Decisions: ACCEPT / REPAIR / DEFER. Failure layers: RUNTIME_VERSION / PACKAGE_SCOPE / MODULE_FORMAT / SPECIFIER_CLASS / PACKAGE_INTERFACE / LOAD.

Node ESM Resolution Trace

English support projection from derived_text/tables/WEB-002-TAB1.example.en-US.json. This example demonstrates field relationships; it does not supply the learner's transfer or final decision evidence.

Field	Governed row 1	Governed row 2	Comparison question
dimension	module_format	specifier_class	Which boundary changed, and which evidence remains stable?
input	app/main.js inside package with type=module	./local	Which boundary changed, and which evidence remains stable?
prediction	Node interprets the .js entry as ESM	relative specifier requires an explicit target extension	Which boundary changed, and which evidence remains stable?
observation	record after run	record after run	Which boundary changed, and which evidence remains stable?
diagnosis	pending learner evidence	pending learner evidence	Which boundary changed, and which evidence remains stable?
bounded_repair	only if the format marker is wrong	repair only the relative target	Which boundary changed, and which evidence remains stable?
post_repair_observation	record after repair	record after repair	Which boundary changed, and which evidence remains stable?
residual_limit	does not prove other package scopes	does not prove bare package behavior	Which boundary changed, and which evidence remains stable?
Source-package validation	ACCEPTED_IMPORTABLE; 0 blockers; 0 warnings · QA_ACCEPTED_ELIGIBLE		

Complete Node ESM Resolution Trace v1

Enter one bounded value per required field. Every material entry needs an evidence locator and a state. Use additional workbook rows when the artifact needs multiple concerns, responsibilities, resources, or path steps.

Required field	Learner value	Evidence locator	State / review note
dimension			OBSERVED / INFERRED / UNKNOWN
input			OBSERVED / INFERRED / UNKNOWN
prediction			OBSERVED / INFERRED / UNKNOWN
observation			OBSERVED / INFERRED / UNKNOWN
diagnosis			OBSERVED / INFERRED / UNKNOWN
bounded_repair			OBSERVED / INFERRED / UNKNOWN
post_repair_observation			OBSERVED / INFERRED / UNKNOWN
residual_limit			OBSERVED / INFERRED / UNKNOWN

Human closure

Decision	ACCEPT / REPAIR / DEFER	Reviewer	
Residual uncertainty		Consequence	
Smallest next evidence		Evidence owner / date	

Run → observe → mutate → repair → transfer

Run the bounded fixture and retain observable results. Predict each deliberate mutation before executing it, then prove the repair and changed-context transfer.

Case	Bounded concern or change	Provisional decision	Deciding evidence	Learner observation	Stable / unresolved boundary
FORMAT MARKER	Run main.js inside a package marked type=module	Node classifies the .js entry as ESM	Nearest package.json plus pinned-runtime output	_____	_____
RELATIVE TARGET	Compare ./local with ./local.js	The extensionless relative ESM target fails before load	Exact specifier and runtime error classification	_____	_____
PUBLIC SUBPATH	Compare demo-pkg/public.js with the package exports map	A non-exported subpath fails despite the file being present	Dependency package.json plus runtime failure	_____	_____
TRANSFER PACKAGE	Resolve a helper file and utility package with a different public interface	The method transfers while literal specifiers and exports differ	Independent transfer trace and successful final output	_____	_____

Reasoning sequence

Phase	Action	Required capture	Truth rule
Boundary	Verify the required Node version before collecting evidence.	Scenario fact, evidence locator, or explicit UNKNOWN	No ESM resolution claim is accepted from an editor or bundler alone; retain pinned-runtime, scope, specifier, interface, mutation, repair, transfer, and limitation evidence.
Boundary	Inspect package scope, exact specifiers, and the dependency exports map.	Scenario fact, evidence locator, or explicit UNKNOWN	No ESM resolution claim is accepted from an editor or bundler alone; retain pinned-runtime, scope, specifier, interface, mutation, repair, transfer, and limitation evidence.
Boundary	Predict the first failure before direct Node execution.	Scenario fact, evidence locator, or explicit UNKNOWN	No ESM resolution claim is accepted from an editor or bundler alone; retain pinned-runtime, scope, specifier, interface, mutation, repair, transfer, and limitation evidence.
Stress test	Remove a required relative extension.	Prediction, changed assumption, stable boundary, next evidence	A plausible counterexample does not become an observed implementation fact
Stress test	Close an exported package subpath.	Prediction, changed assumption, stable boundary, next evidence	A plausible counterexample does not become an observed implementation fact
Stress test	Change the package module marker and classify the resulting failure.	Prediction, changed assumption, stable boundary, next evidence	A plausible counterexample does not become an observed implementation fact

Guardrail. Module format, specifier syntax, package interface, and runtime resolution are separate failure boundaries.

Changed-context transfer

Repair the independent utility-package fixture, record its different package scope and interface, and retain the final direct-Node resolution trace.

Transfer item	Changed-context requirement	Learner evidence	Review check
Scenario	State the changed concern, resource, or responsibility boundary.	_____	Worked scenario not copied
Observed facts	Record only facts supplied or directly observed.	_____	Inference stays separate
Concern split	Create separate rows for independent responsibilities or paths.	_____	No page-wide shortcut
Classification	Choose only ACCEPT / REPAIR / DEFER or preserve UNKNOWN.	_____	Placement is justified
Failure probe	Apply one counterexample that tests an over-broad claim.	_____	No invented mechanism
Non-claims	State at least two limits plus the smallest next evidence.	_____	Residual and next evidence stated

Non-compensatory review

Critical dimension	PASS / REPAIR	Evidence locator	Repair or rationale
Scenario and responsibility boundary correctness	_____ _____	_____	_____
Observation, inference, and source traceability	_____ _____	_____	_____
Decision rationale and next-evidence quality	_____ _____	_____	_____
Failure diagnosis and overclaim resistance	_____ _____	_____	_____
Transfer, residual uncertainty, and non-goals	_____ _____	_____	_____

Canonical QA gate

Validation	ACCEPTED_IMPORTABLE; 0 blockers; 0 warnings	Disposition	QA_ACCEPTED_ELIGIBLE
Blocker / note	No canonical-source blocker recorded.	Clearance receipt	_____

Media decision. Deck and video are NOT_APPLICABLE_WITH_RATIONALE; the embedded visuals, editable record, worksheet, and learner-authored reasoning are the assessed support.