Decision Log Specification v1

1. Purpose

The Decision Log system provides a **structured, complete, and traceable record of all caption-related decisions** made by the system.

It enables:

- Full **auditability** of caption behaviour
- **Explainability** for debugging and review
- **Claude-based reasoning and validation**
- **Regression testing and comparison**
- Cross-system consistency between WallSpace and Echo

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2. Scope

A "decision" includes any operation where the system:

- Evaluates or applies a rule
- Resolves a conflict between constraints
- Modifies caption content, timing, or segmentation
- Applies, modifies, or suppresses an enhancement
- Determines rendering layout or positioning
- Selects behaviour via policy

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3. Core Design Principles

3.1 Completeness

All decisions affecting caption behaviour **must be logged**.

3.2 Determinism

Logs must allow reconstruction of **exact system behaviour**.

3.3 Dual Readability

Logs must be:

- Machine-readable (JSON)
- Human-readable (clear reasoning strings)

3.4 Layer Alignment

Each decision must identify **which system layer produced it**:

- rules_engine
- policy_engine
- renderer
- enhancement_layer

All system stages must produce decision logs when modifying caption behaviour.

3.5 Traceability

Each decision must be linked to:

- caption_id
- processing stage
- prior decisions (optional chain)

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4. Decision Log Structure (JSON Schema)

```
{
  "decision_id": "string (UUID)",

  "timestamp": "ISO8601",

  "stage": "rules_engine | policy_engine | renderer | enhancement_layer",

  "caption_id": "string",

  "sequence_id": "string (optional group identifier)",

  "decision_type": "rule_evaluation | policy_resolution |
enhancement_application | rendering_action",

  "input_state": {
```

```
    "text": "string",
    "start_time": "float",
    "end_time": "float",
    "wpm": "float (optional)",
    "speaker_id": "string | null",
    "metadata": {}
  },

  "applied_rules": [
    {
      "rule_id": "string",
      "rule_class": "A | B | C | D",
      "result": "pass | fail | warning"
    }
  ],

  "constraints": [
    {
      "name": "READABILITY_PRIORITY",
      "source_rule_id": "BBC-TIM-001"
    }
  ],

  "conflict_resolution": {
    "conflict_detected": "boolean",
    "priority_applied": [
      "READABILITY",
      "TIMING",
      "VISUAL_SAFETY"
    ],
    "dropped_behaviours": [
      "enhancement_emotion_scaling"
    ]
  },

  "decision": {
    "action": "string",
    "details": {}
  },
```

```
  "reasoning": "human-readable explanation",

  "confidence": "float (0–1, optional)",

  "previous_decision_id": "string (optional)",

  "tags": [
    "timing_adjustment",
    "enhancement_suppressed"
  ]
}
```

Each constraint must include a reference to the originating rule_id to ensure full traceability between rule evaluation, constraint generation, and policy decisions.

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5. Required Fields

The following fields are **mandatory**:

- decision_id
- timestamp
- stage
- caption_id
- decision_type
- input_state
- decision
- reasoning

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6. Decision Types

Type	Description
rule_evaluation	Result of applying a rule
policy_resolution	Decision based on profile or constraints

Type	Description
enhancement_application	Applying or modifying enhancement
rendering_action	Final layout/visual decision

Decision actions (e.g. adjust_timing, split_caption) are separate from decision types and must be recorded within the "decision.action" field.

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7. Standard Actions

Examples:

- adjust_timing
- split_caption
- merge_caption
- suppress_enhancement
- apply_emotion_styling
- reposition_caption
- clamp_font_size
- fallback_to_safe_mode

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8. Constraint Vocabulary (standardised)

Use consistent identifiers:

- READABILITY_PRIORITY
- TIMING_LIMIT
- VISUAL_SAFETY
- SAFE_REGION
- SPEAKER_CLARITY
- NO_REFLOW
- LOW_CONFIDENCE_MODE

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9. Example Decision Logs

9.1 Timing Violation


```
{
  "decision_id": "d1",
  "stage": "rules_engine",
  "caption_id": "c101",
  "decision_type": "rule_evaluation",
  "input_state": {
    "text": "We need to move quickly now",
    "start_time": 10.0,
    "end_time": 11.0,
    "wpm": 220
  },
  "applied_rules": [
    {
      "rule_id": "BBC-TIM-001",
      "rule_class": "A",
      "result": "fail"
    }
  ],
  "decision": {
    "action": "flag_violation"
  },
  "reasoning": "Reading speed exceeds allowed threshold"
}
```


9.2 Policy Adjustment


```
{
  "decision_id": "d2",
  "stage": "policy_engine",
  "caption_id": "c101",
  "decision_type": "policy_resolution",
  "constraints": ["READABILITY_PRIORITY"],
  "decision": {
    "action": "adjust_timing",
    "details": {
      "new_duration": 2.0
    }
  },
  "reasoning": "Extended duration to restore readability"
}
```


9.3 Enhancement Suppression


```
{
  "decision_id": "d3",
  "stage": "enhancement_layer",
  "caption_id": "c101",
```

```
  "decision_type": "enhancement_application",
  "conflict_resolution": {
    "conflict_detected": true,
    "priority_applied": ["READABILITY"],
    "dropped_behaviours": ["emotion_scaling"]
  },
  "decision": {
    "action": "suppress_enhancement"
  },
  "reasoning": "Emotion scaling would cause reflow and reduce readability"
}
```

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10. Decision Chain Reconstruction

The system must support:

Caption → Decision 1 → Decision 2 → Decision 3 → Output

This allows:

- full debugging
- Claude reasoning
- replaying system behaviour

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11. Integration with Validation

Each validation result must include:

- decision chain
- applied rules
- constraint decisions
- final outcome

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12. Integration with Claude

Claude should:

Input:

- caption data
- decision logs
- rules matrix

Output:

- validation report
- incorrect decisions
- missed rules
- improvement suggestions

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13. Logging Levels

Level	Description
minimal	critical decisions only
standard	all decisions
verbose	includes intermediate states

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14. Performance Considerations

- Logs should be append-only
- Optional sampling in real-time systems
- Batch export for analysis

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15. Storage Options

- JSON files (development)
- Indexed DB / NoSQL (runtime)
- Log stream (real-time debugging)
- Export to CSV / analytics pipelines

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16. Testing Requirements

Tests must verify:

- correct rules applied
- correct priority order

- correct decision output
- log accuracy

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17. Future Extensions

- visual debugging UI
- timeline-based decision replay
- automated anomaly detection
- ML-assisted optimisation

🔚 **Summary**

This Decision Log Spec gives you:

- A **common language** across systems
- A **debugging backbone**
- A **Claude interface layer**
- A **research-grade audit trail**