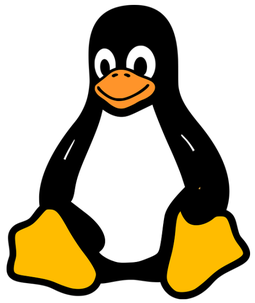
Time-Inhomogeneous Performance Modeling

Predicting Performance over Time

Sude Ergün
Saarland University

Configurable Systems



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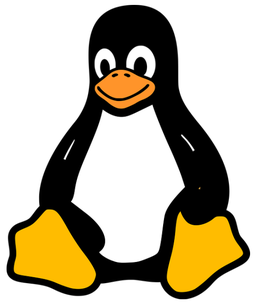

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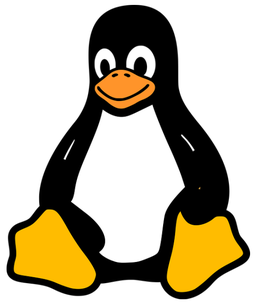

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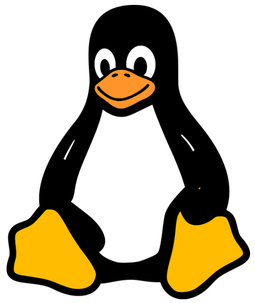
Configurable Systems



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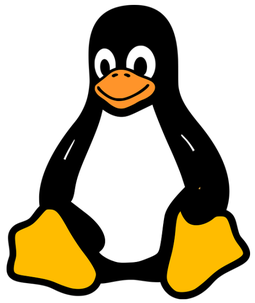
1097.39668559875 * post + 6852.58846993721 * GradientSolver +
752.542387648181 * BiCGSTABSolver + 1.88645994097499 * cells * post *
post + 547.236997276589 * GradientSolver * pre * pre + -
113.547148735501 * cells * GradientSolver + 0.706383967601375 * cells *
cells * cells + 385.840181761216 * GradientSolver * post * post +
2.72707363219899 * cells * pre + -39.9822314861407 * BiCGSTABSolver *
pre * pre + -11.9701281275527 * cells * GradientSolver * pre * pre + -
8.2288112361045 * cells * GradientSolver * post * post +
112.152829956782 * post * SeqSOR

Configurable Systems



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SQLite

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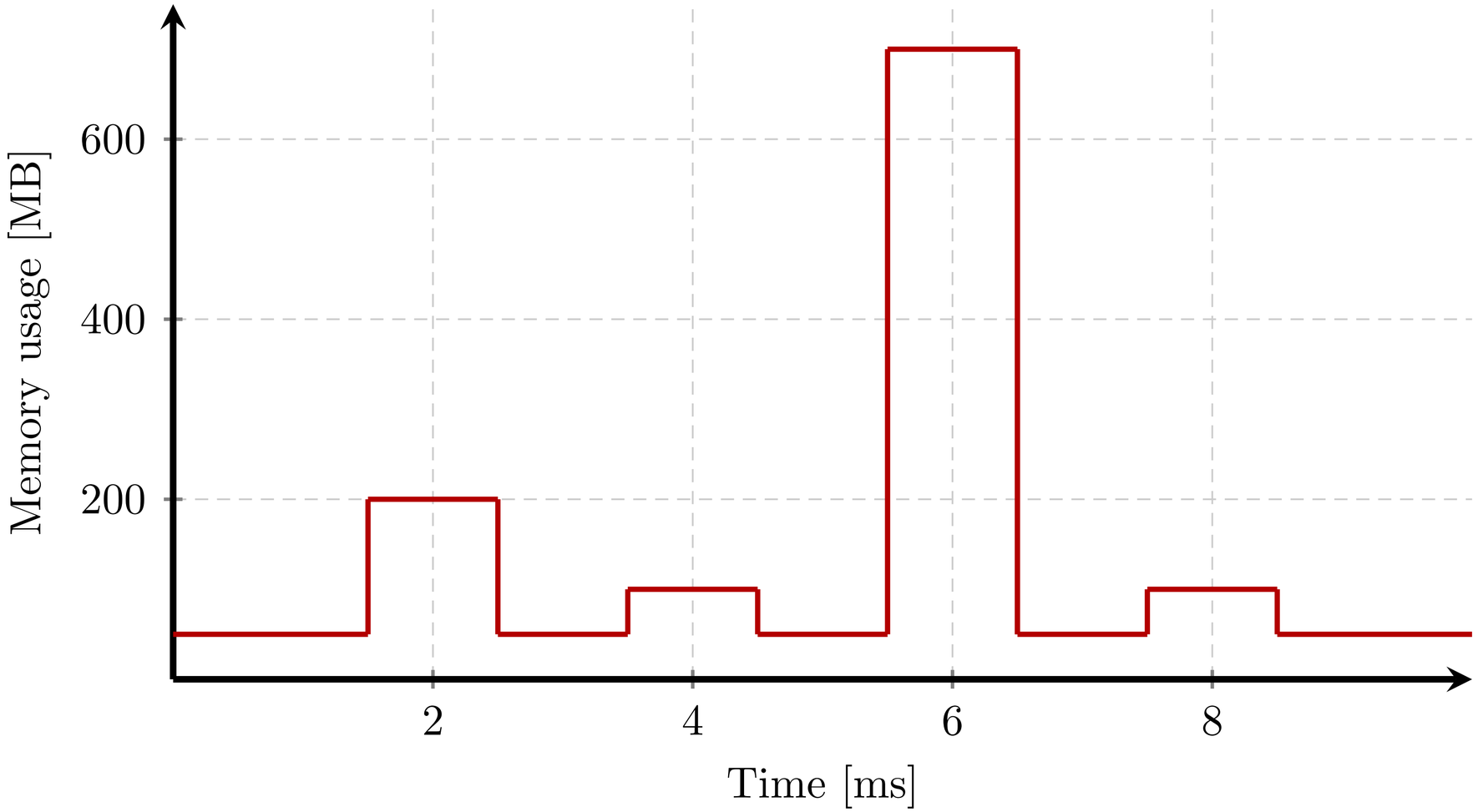
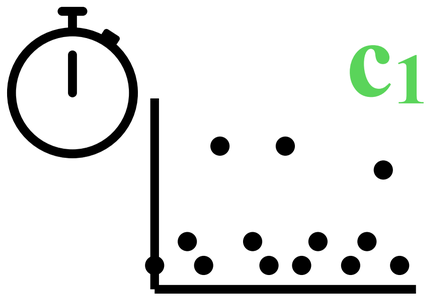
8.2288112361045 * cells * GradientSolver * post * post +
112.152829956782 * post * SeqSOR

$$\Pi : C \rightarrow \mathbb{R}$$

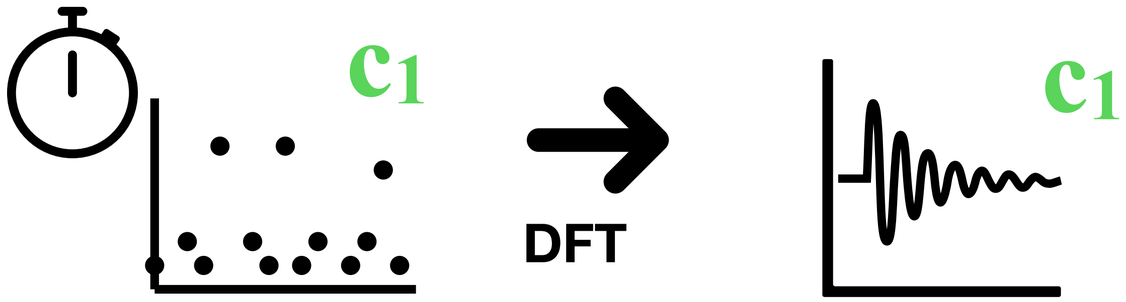
Execution over Time



Overview



Overview



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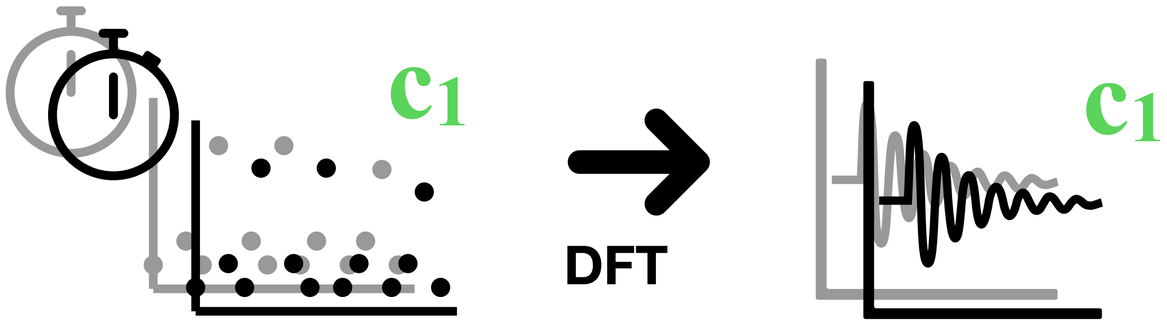

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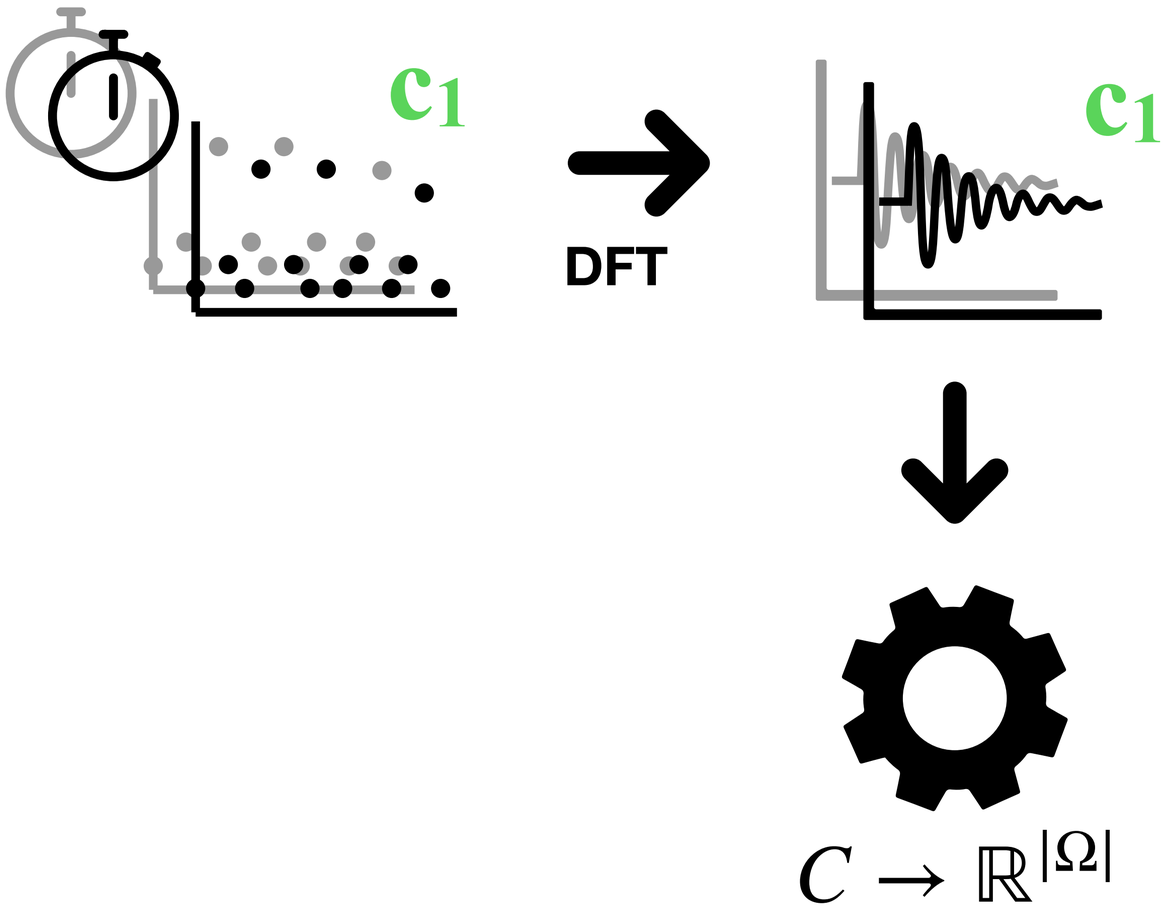

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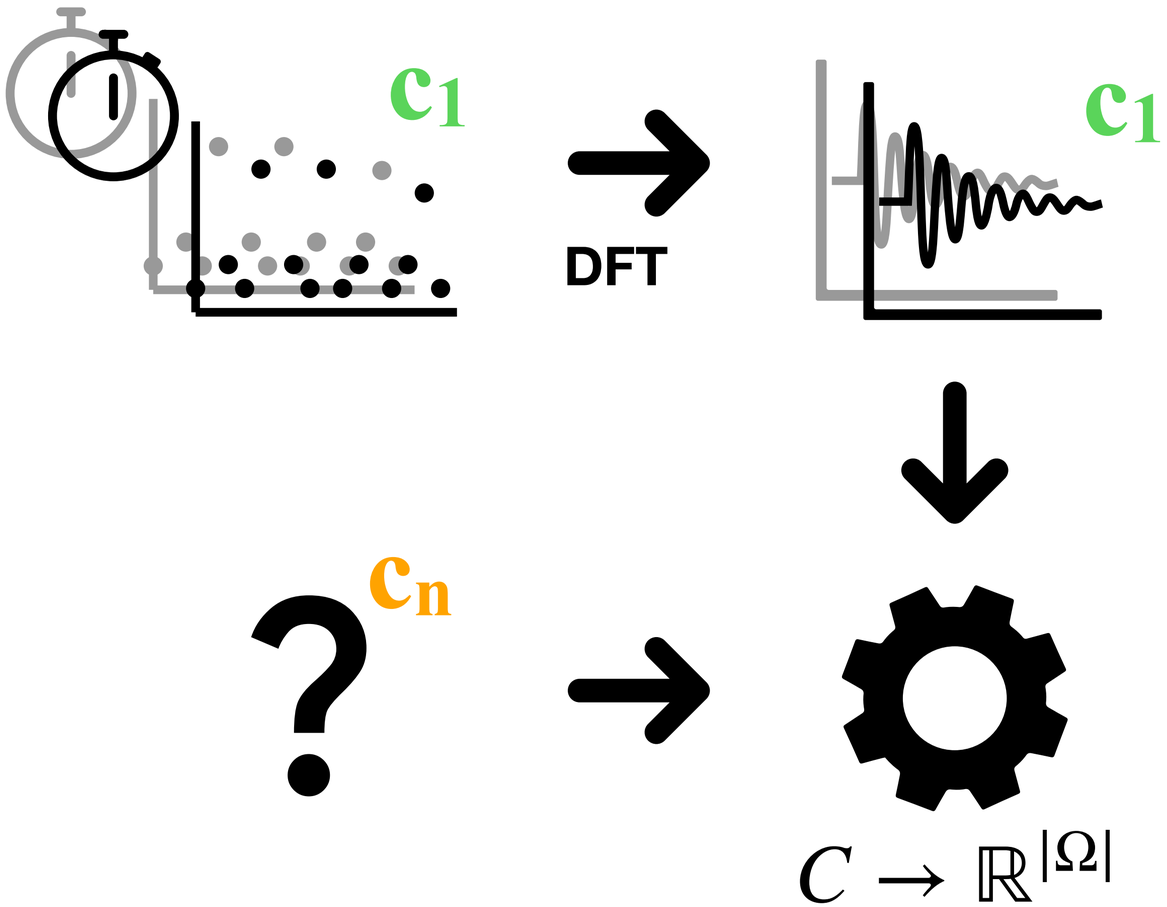
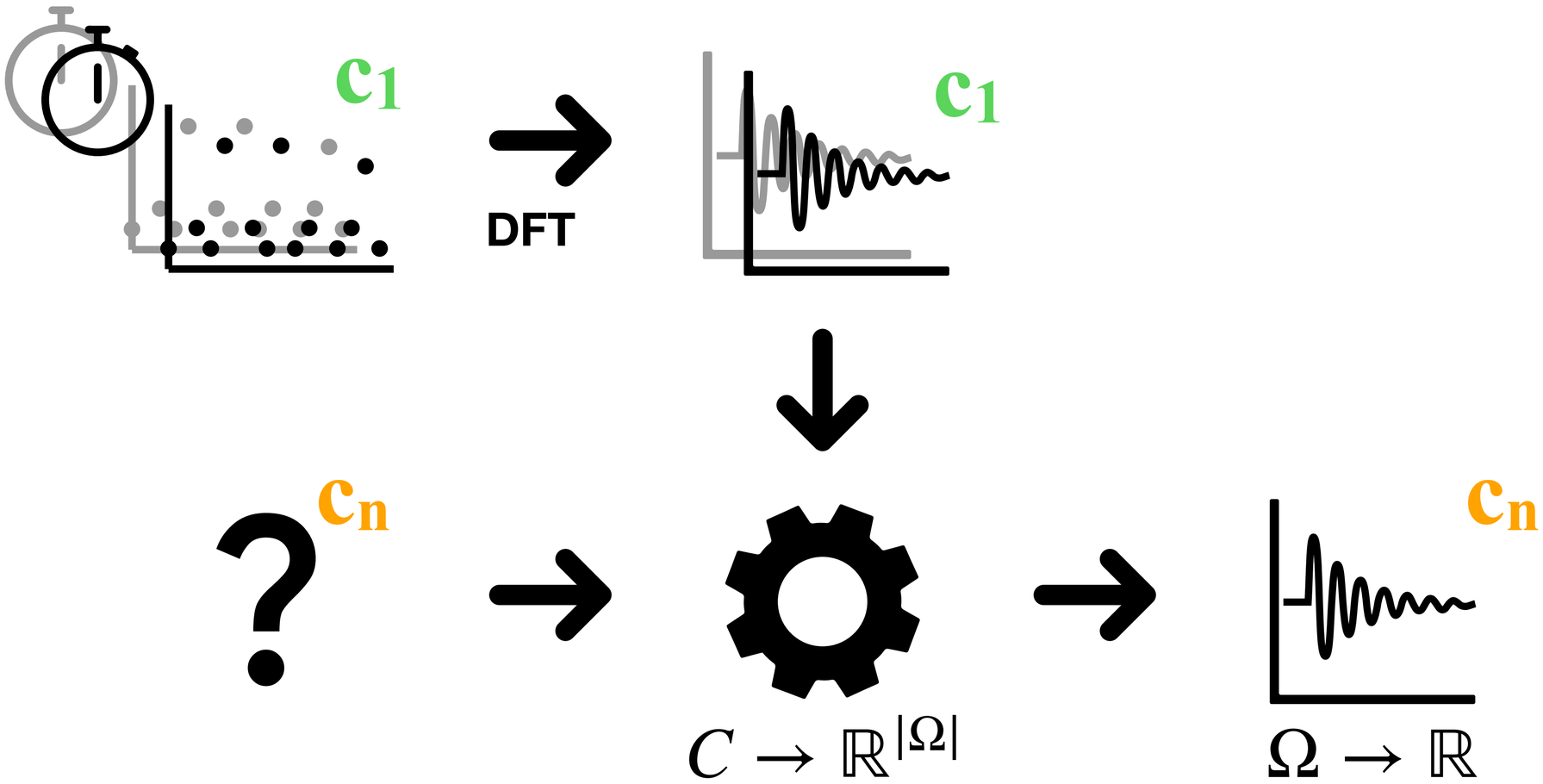
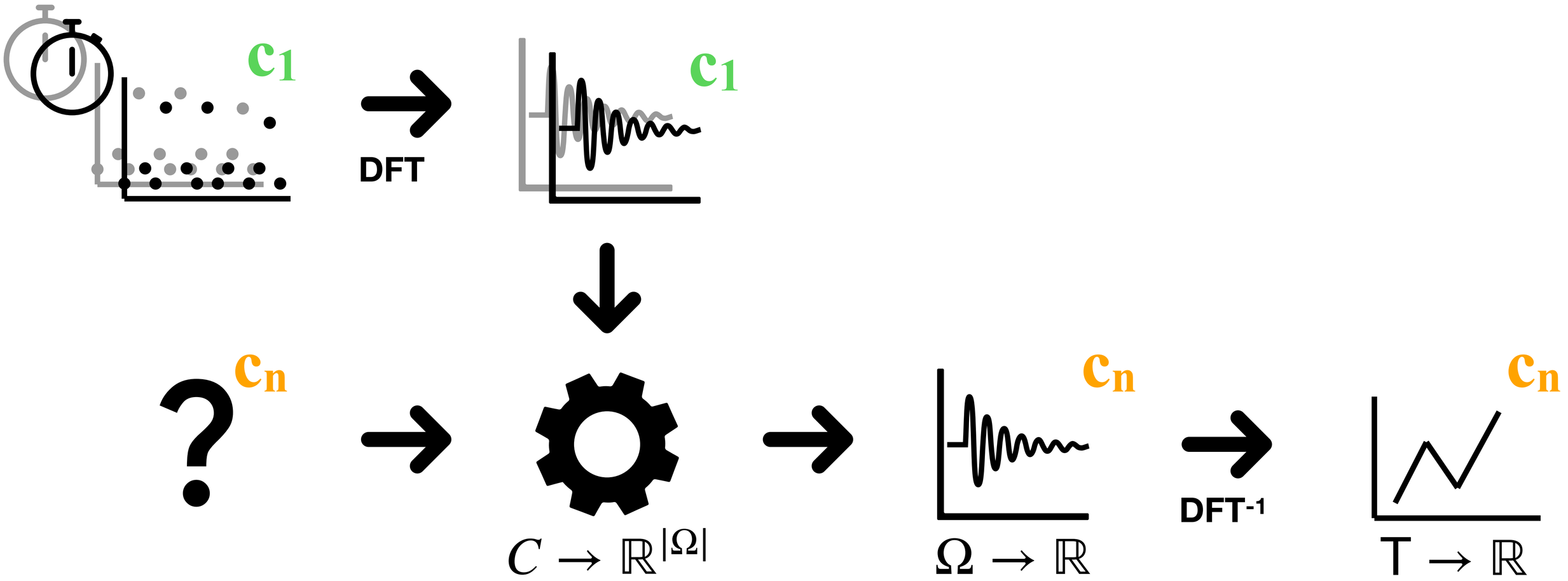


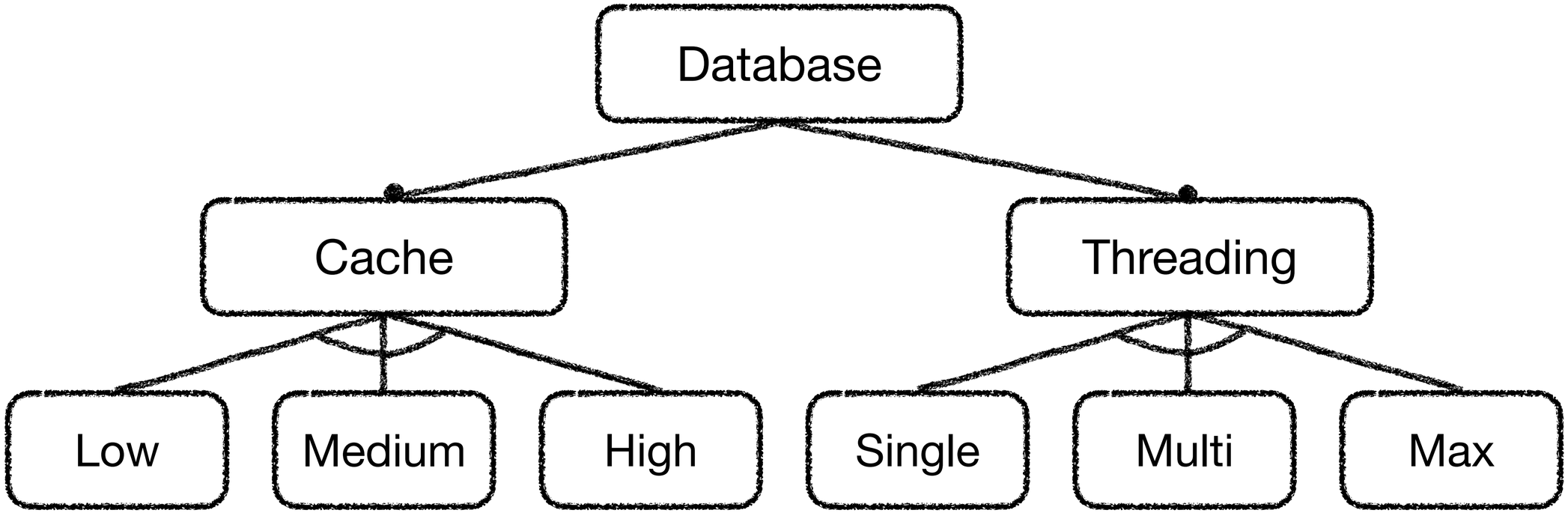
Overview


c_1
DFT
c_1
?
c_n
$C \rightarrow \mathbb{R}^{|\Omega|}$
c_n
$\Omega \rightarrow \mathbb{R}$

Overview


c1
DFT
c1
?
cn
$C \rightarrow \mathbb{R}^{|\Omega|}$
cn
$\Omega \rightarrow \mathbb{R}$
DFT-1
cn
$T \rightarrow \mathbb{R}$

Example: Database System



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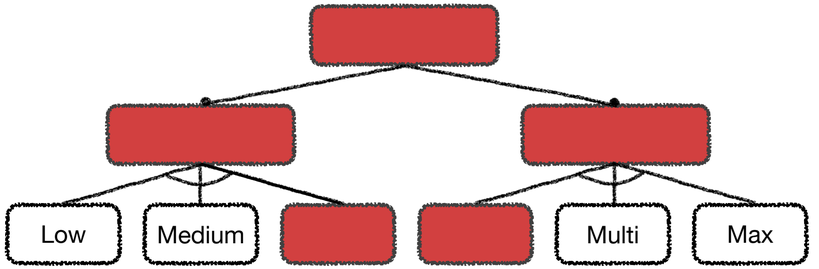

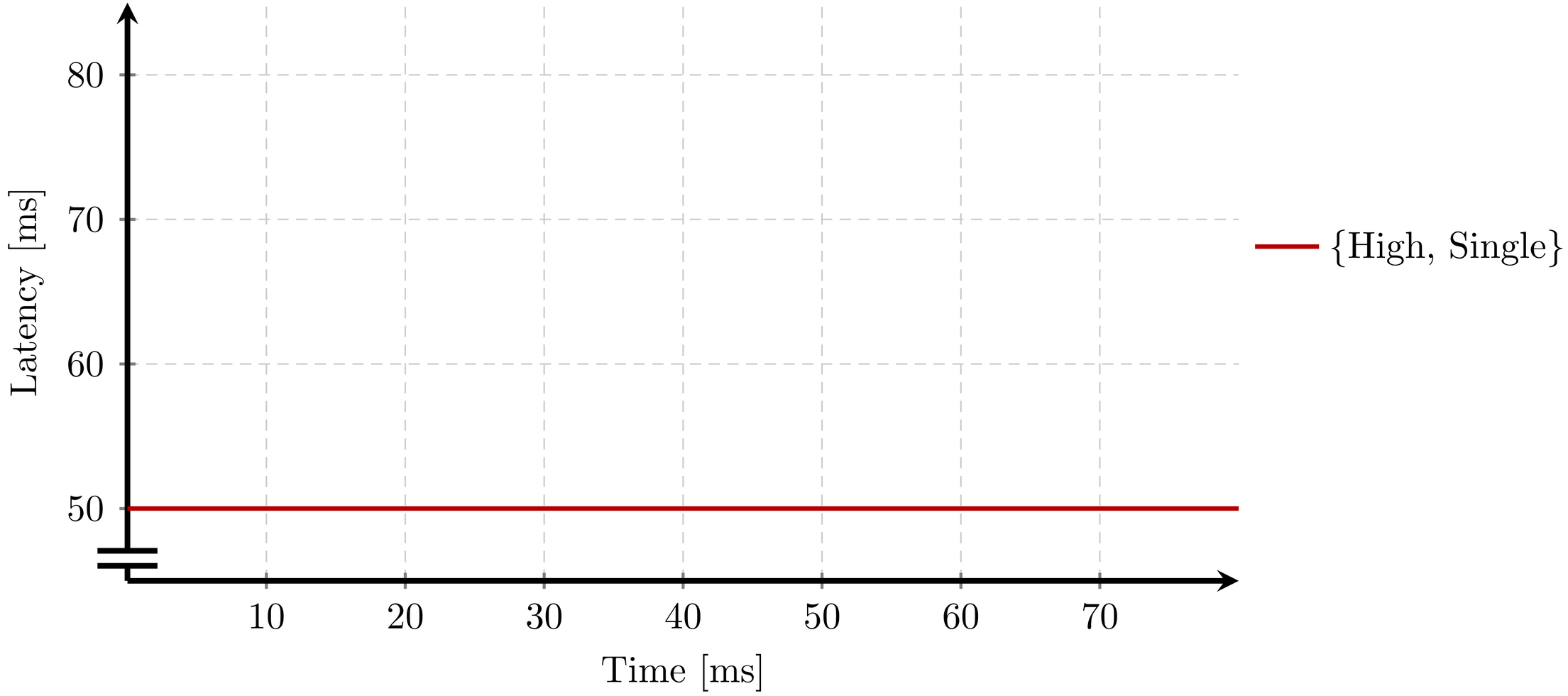

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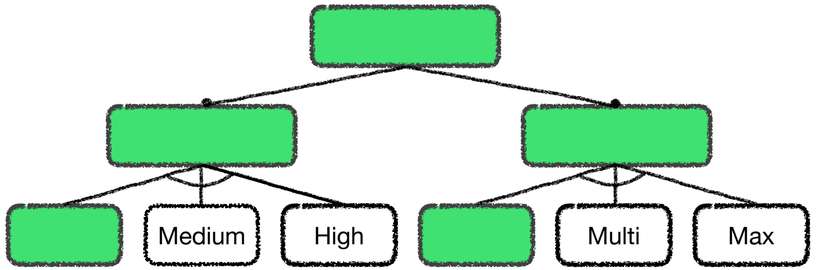

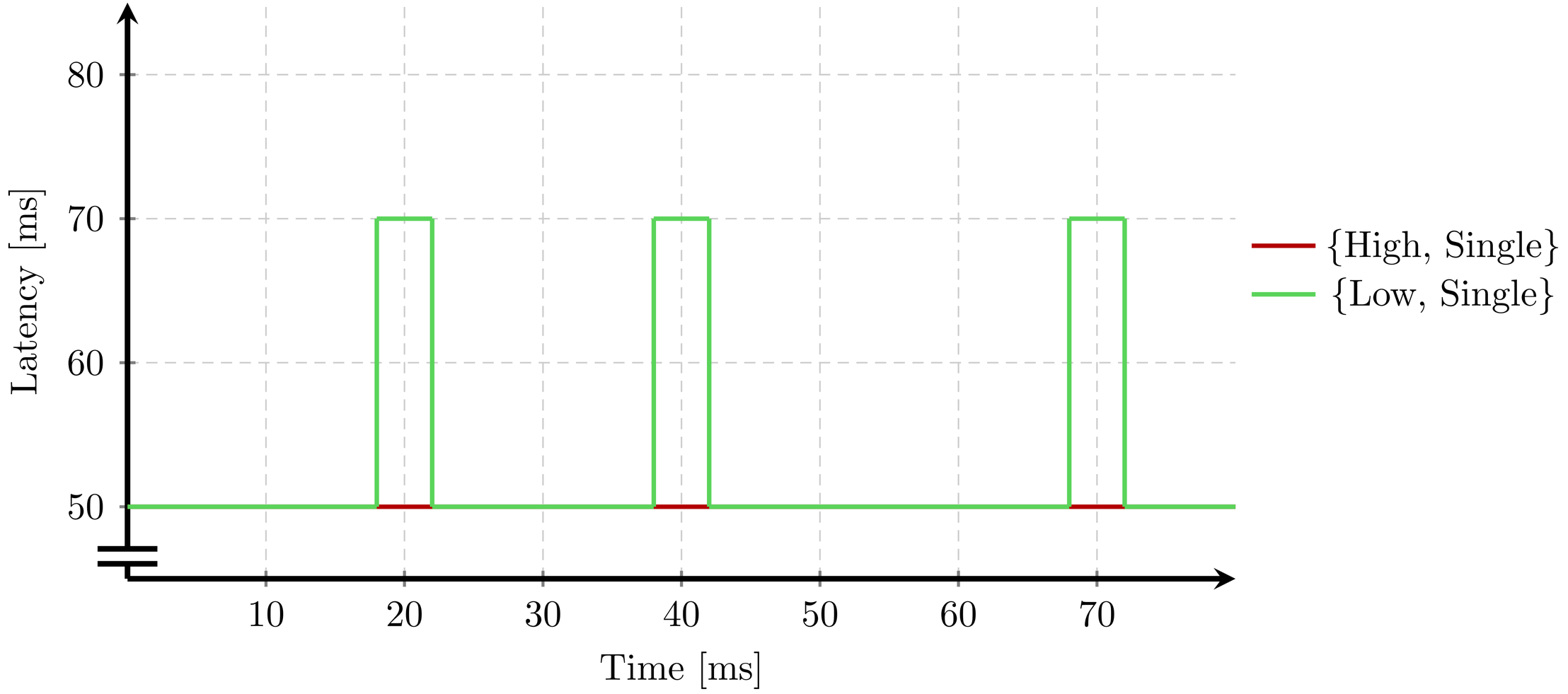

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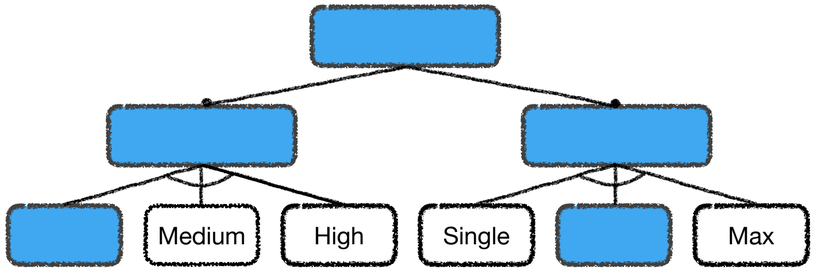

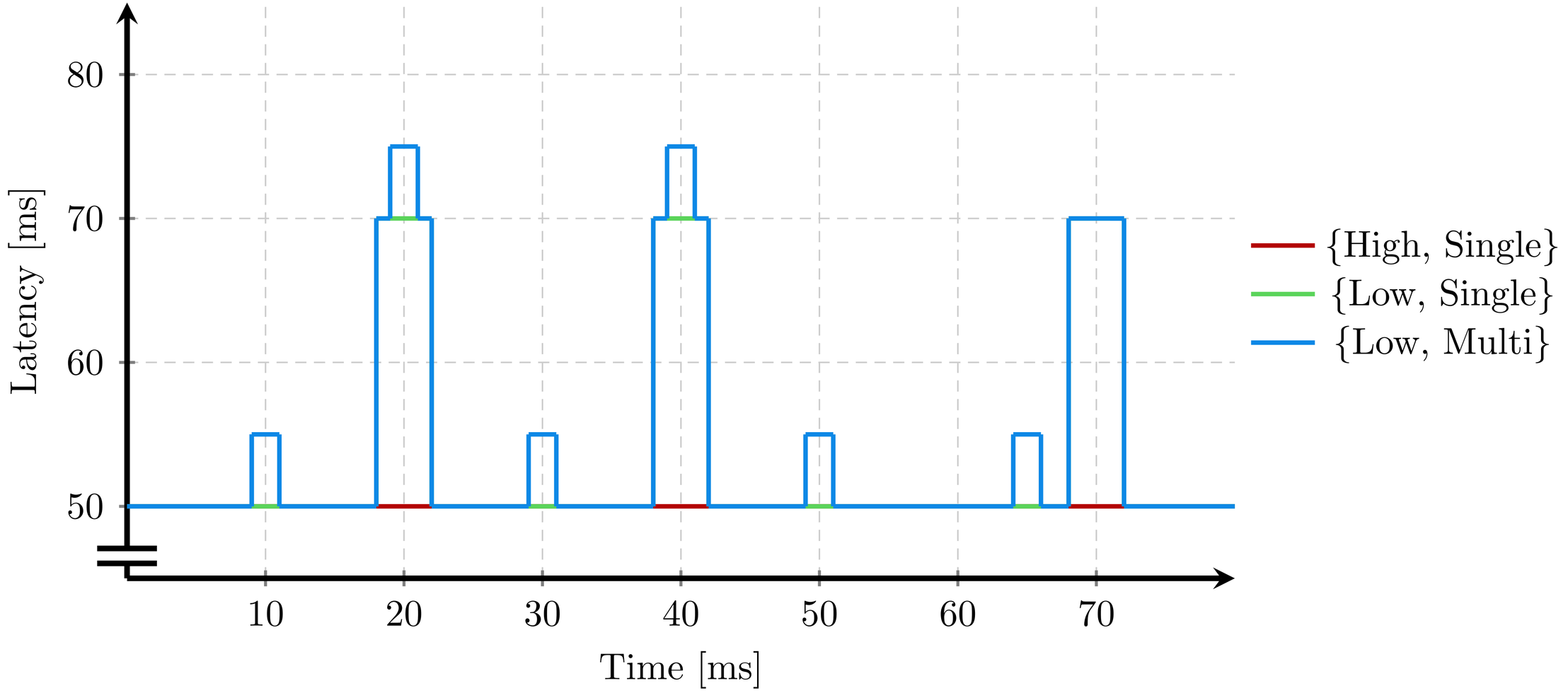

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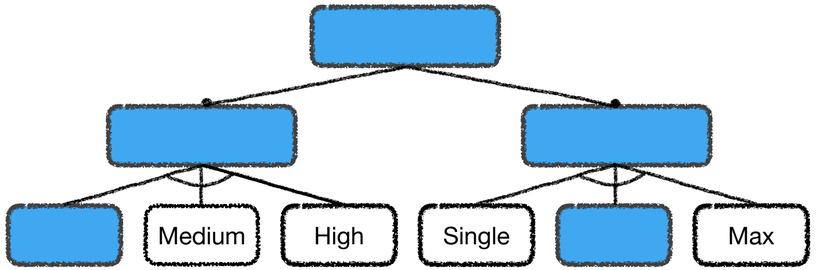

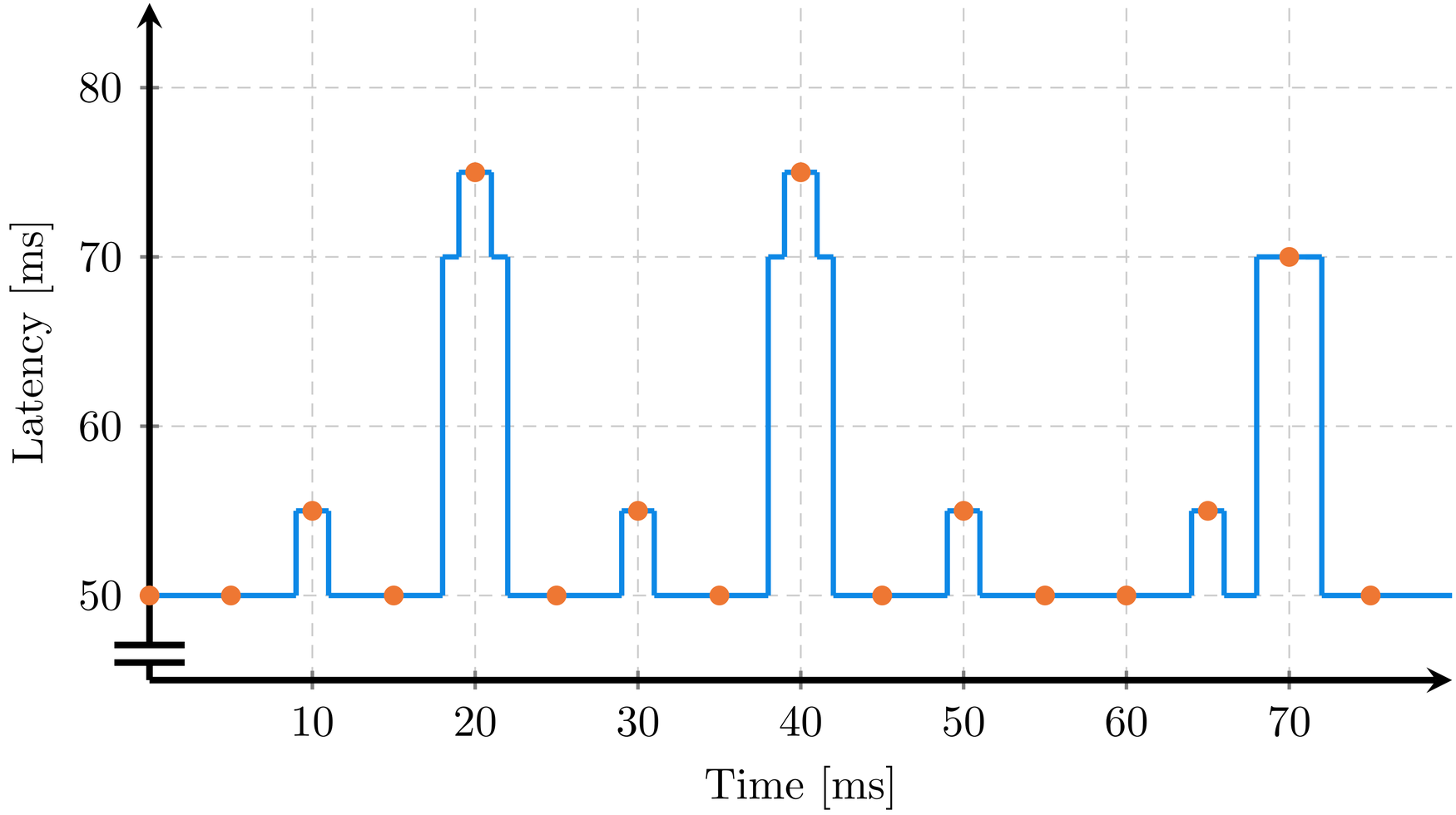

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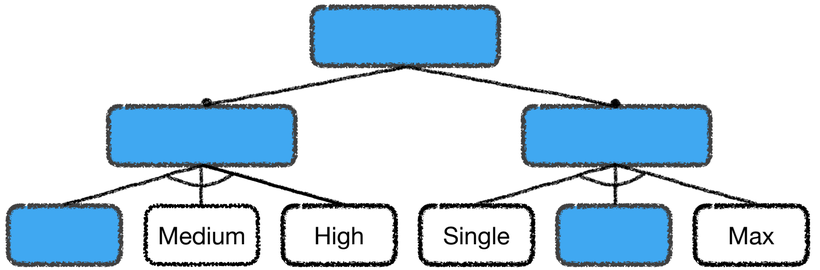
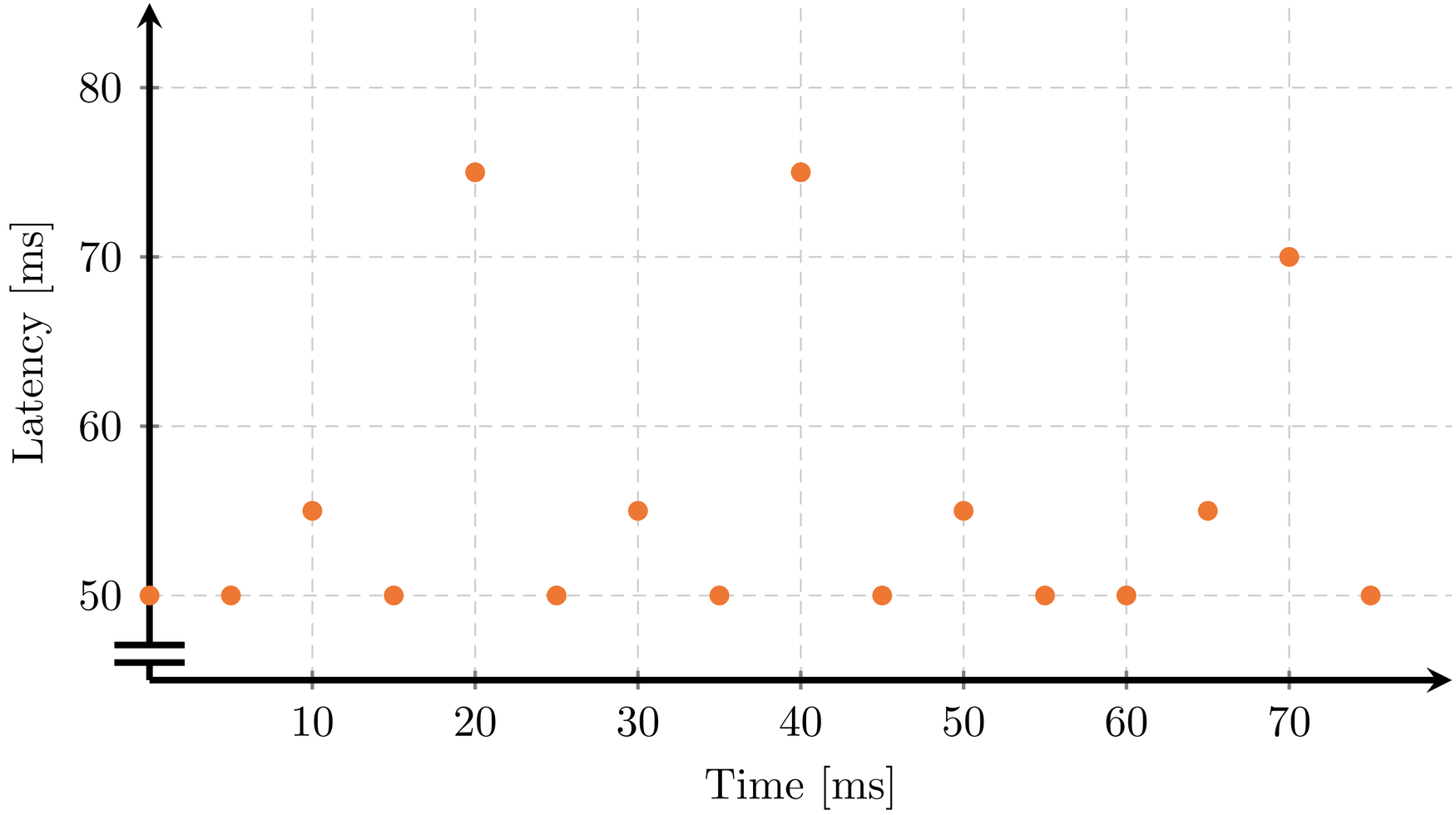
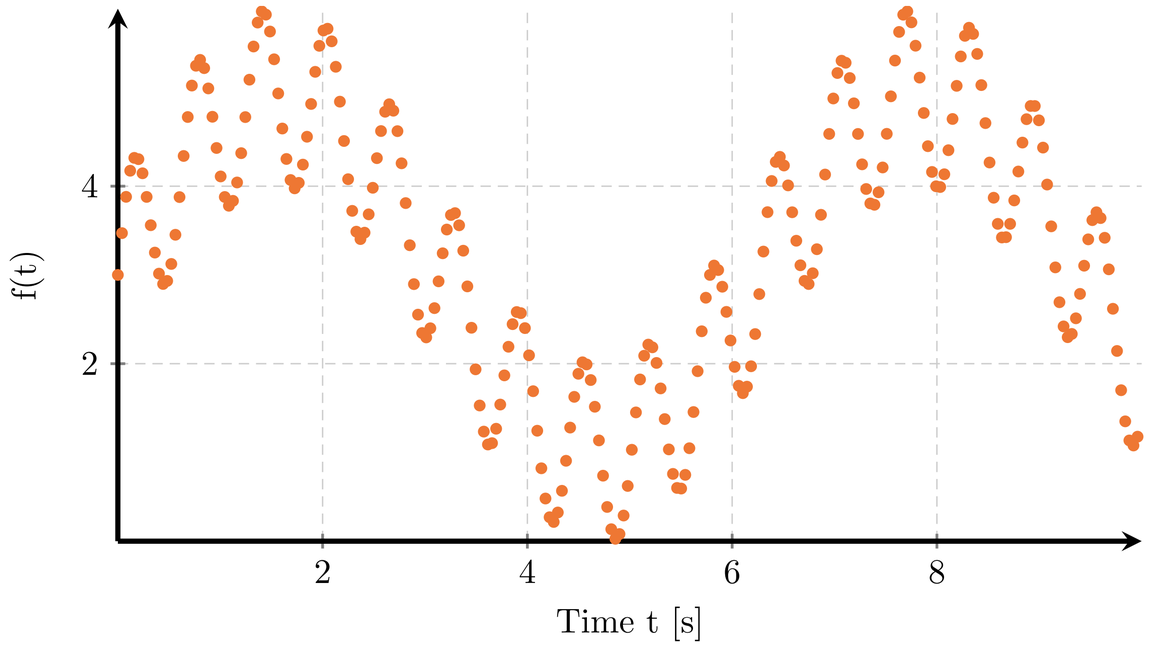




Discrete Fourier Transform



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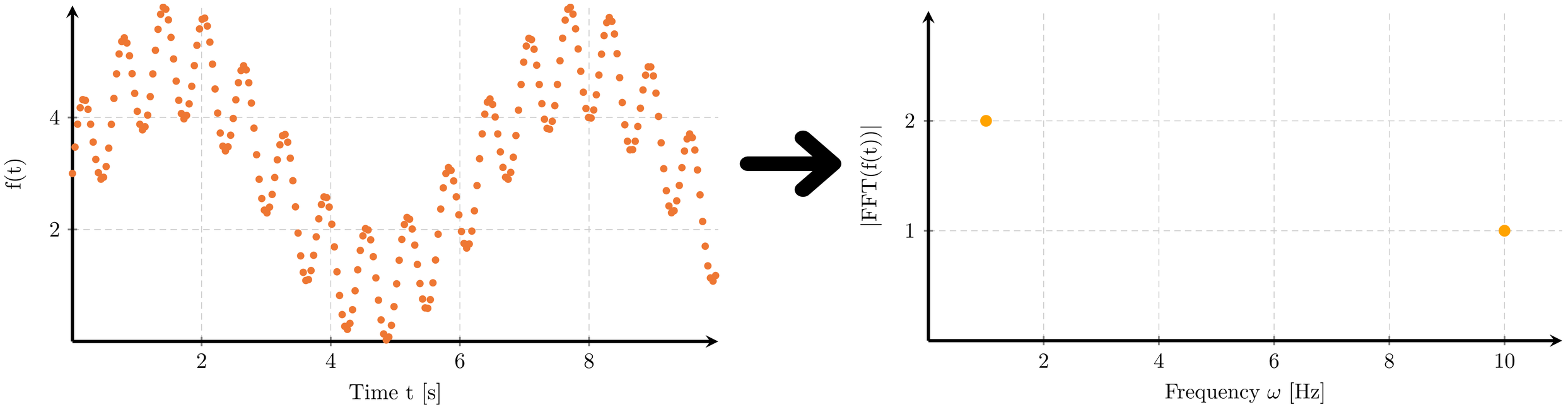

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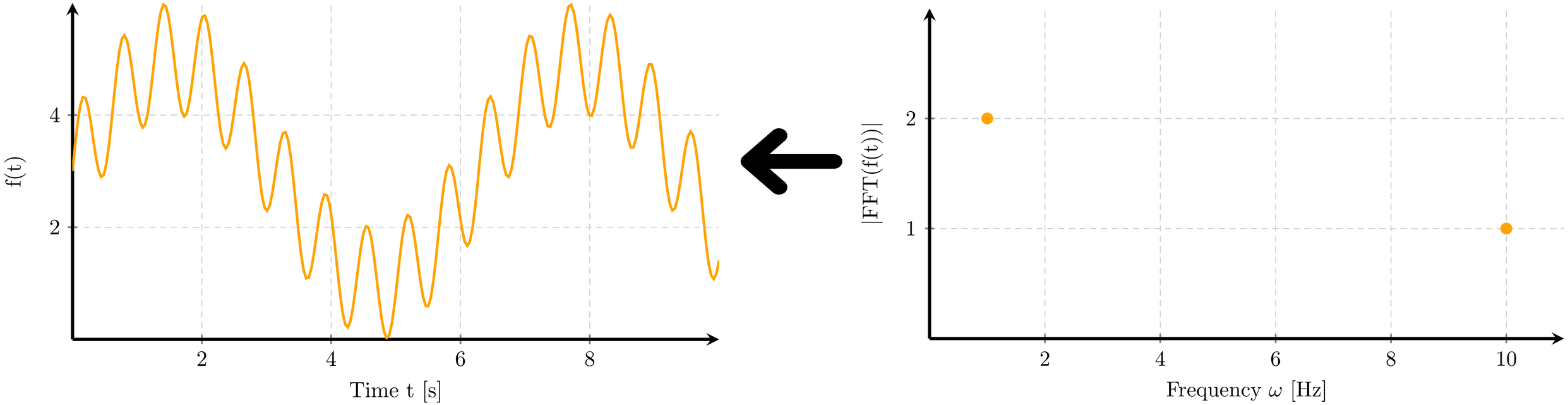

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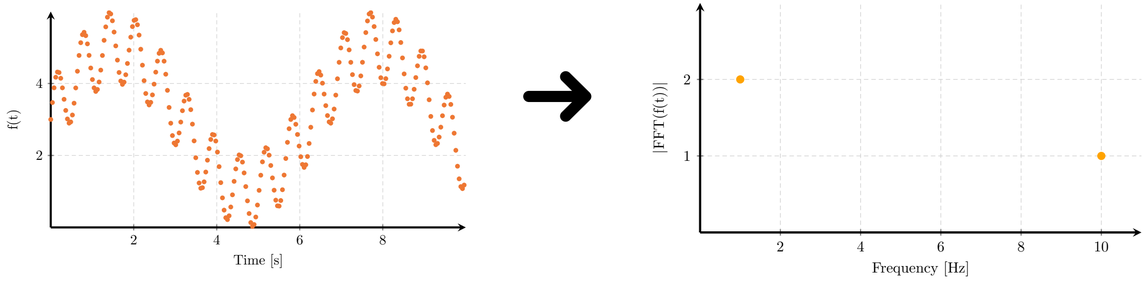

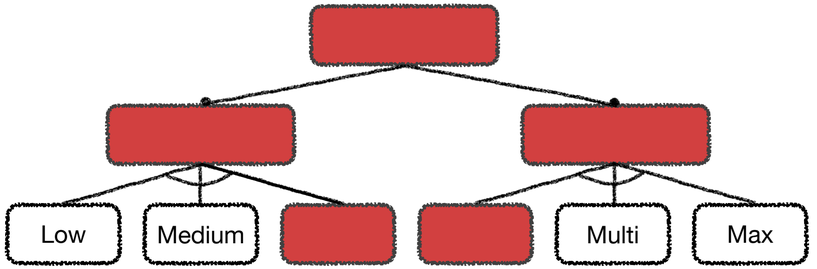

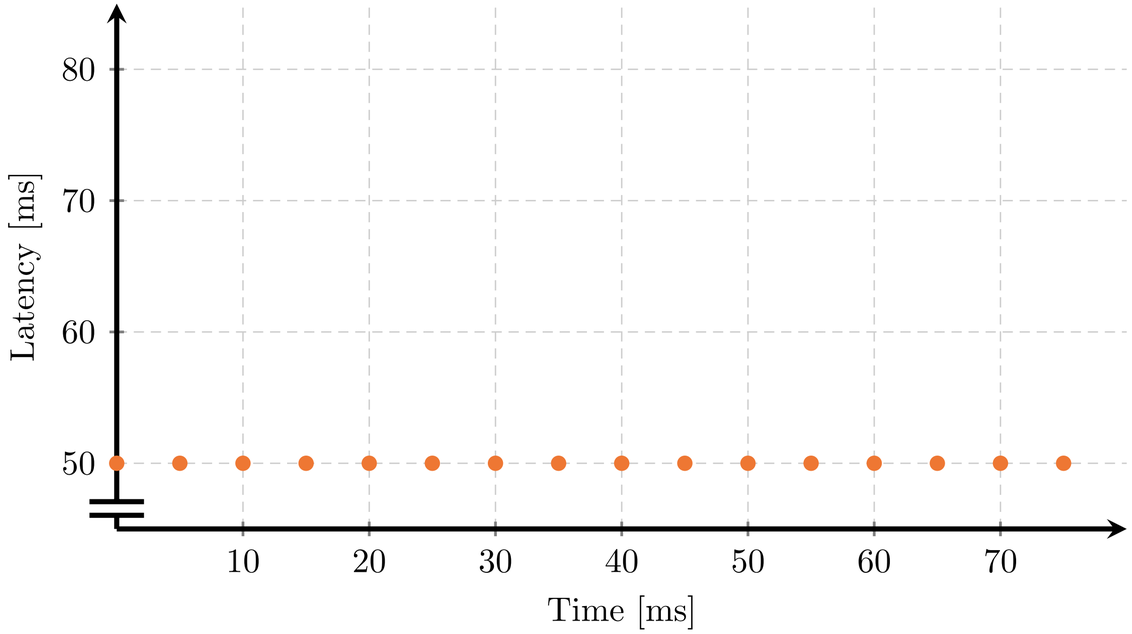

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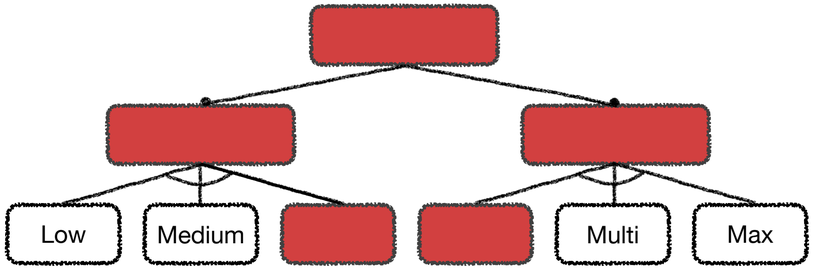

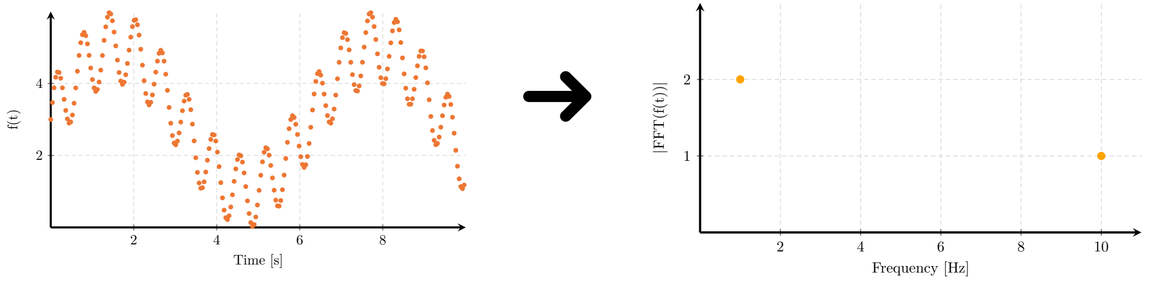

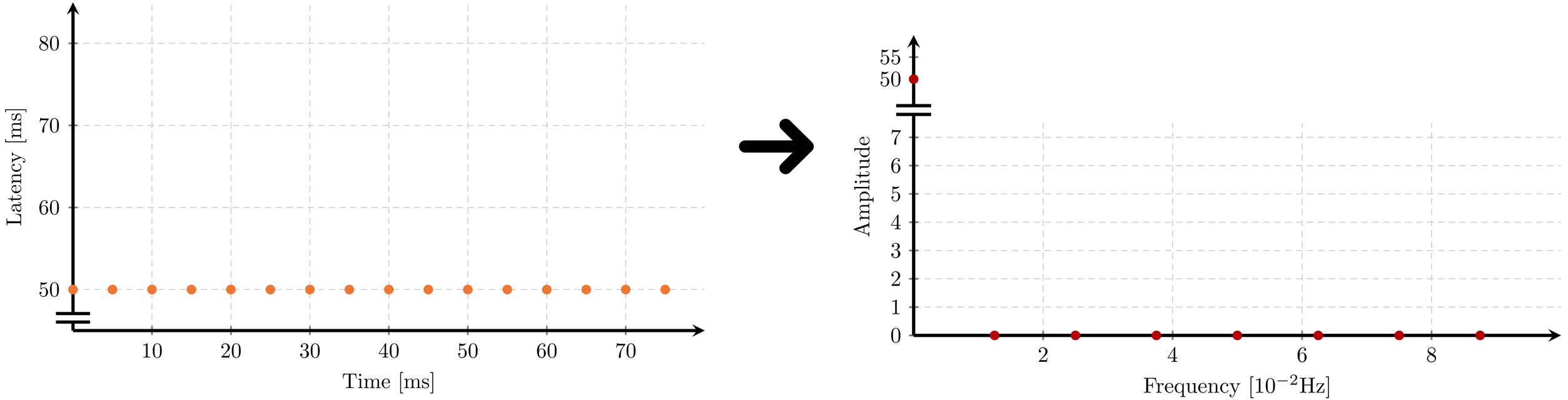

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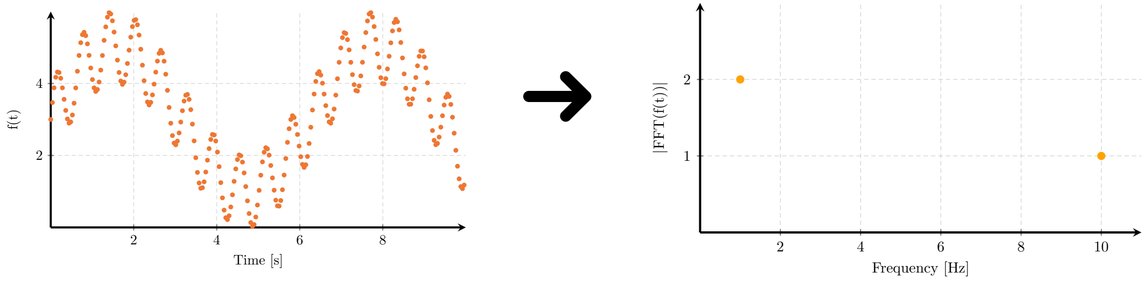

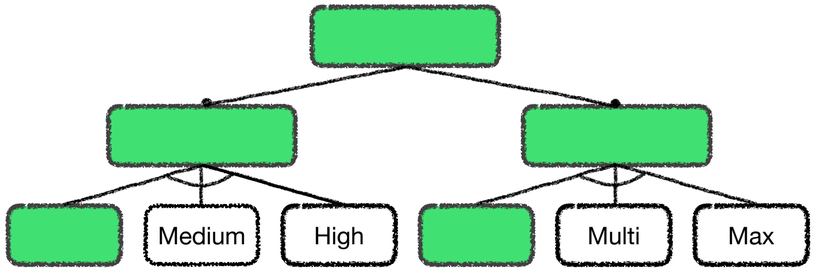

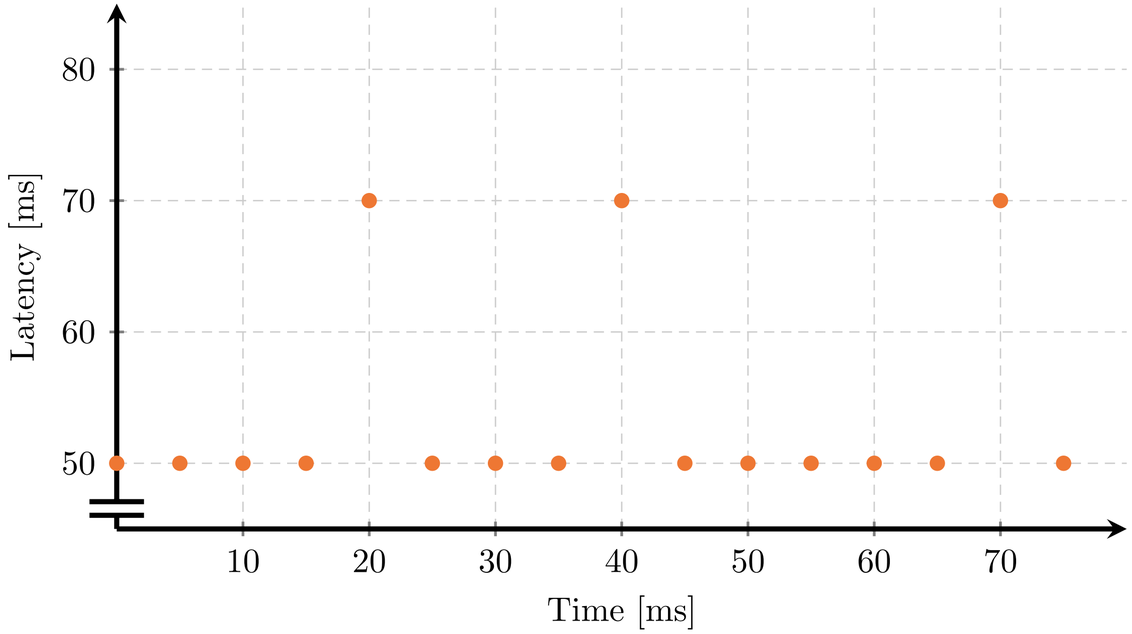

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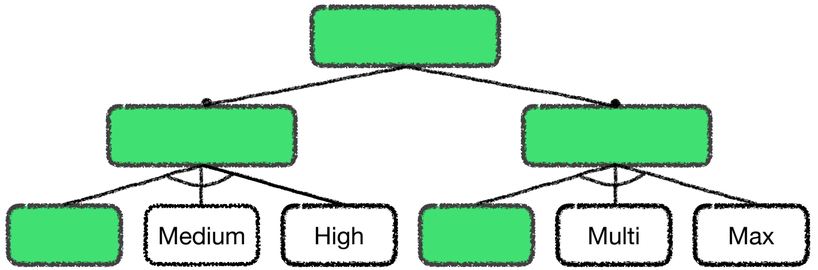

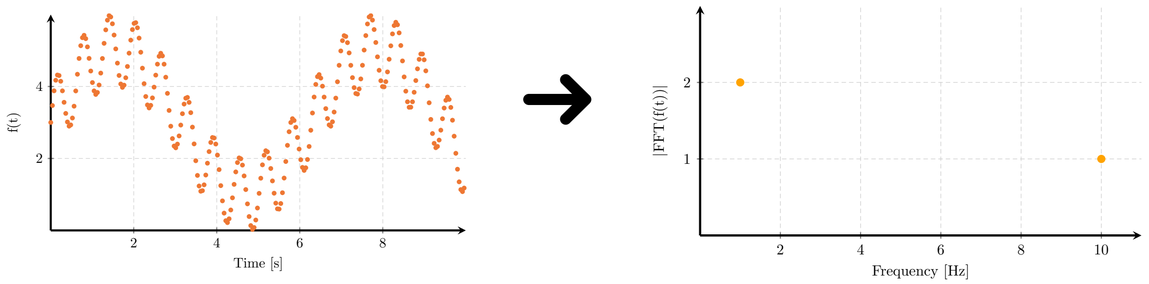

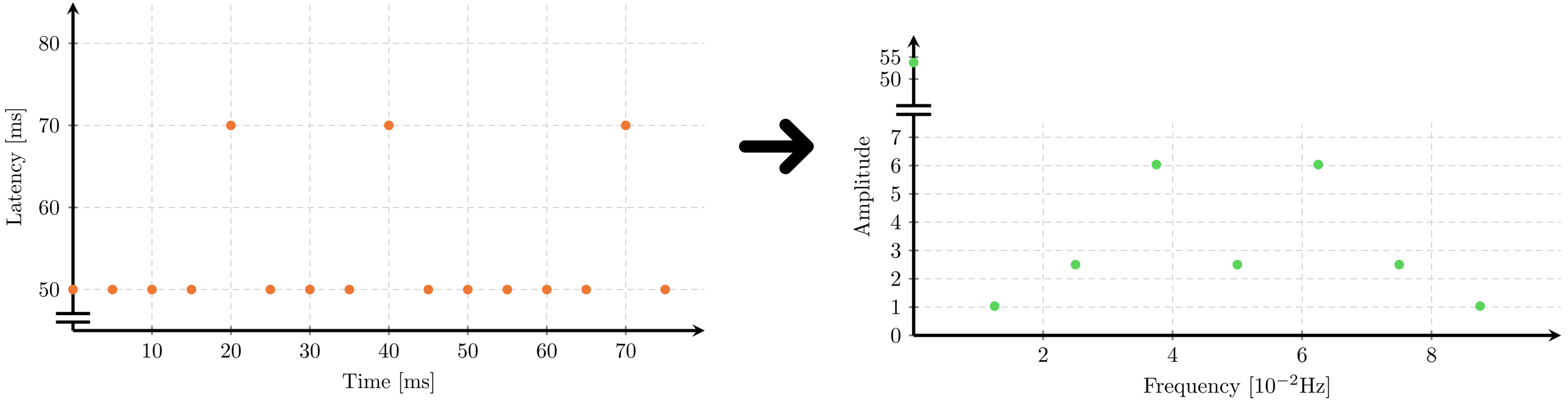

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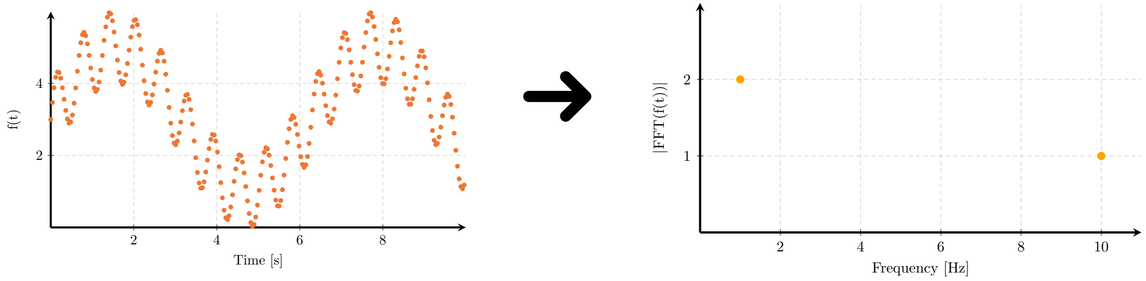
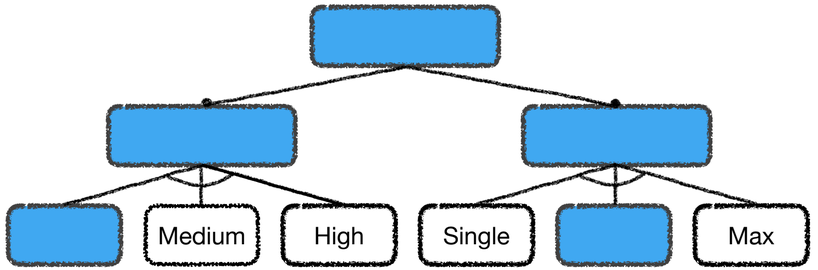
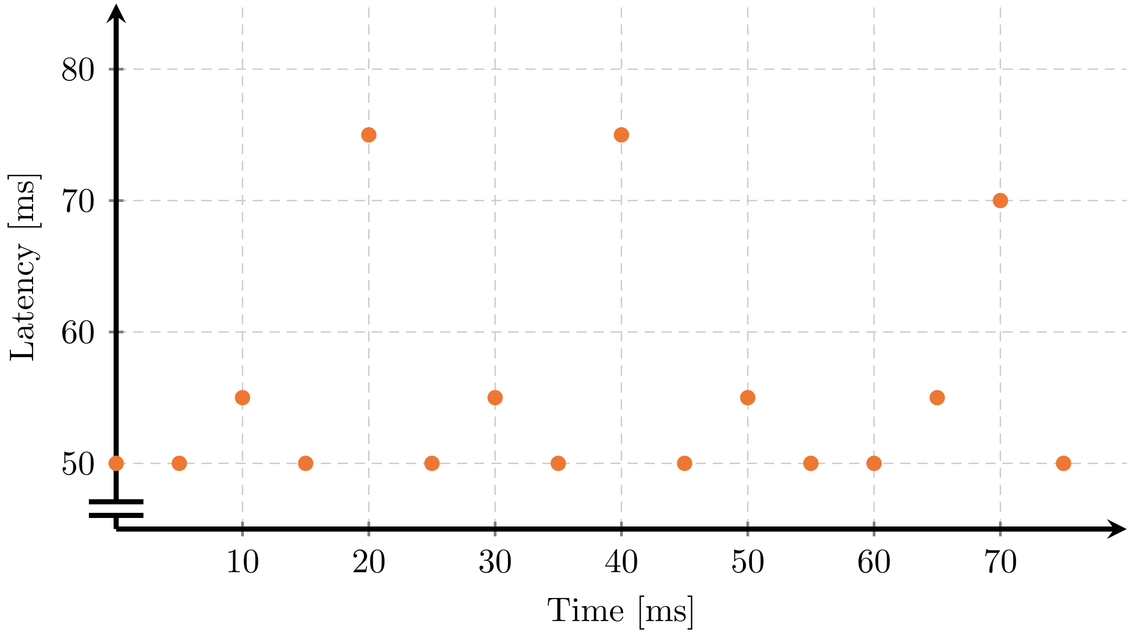
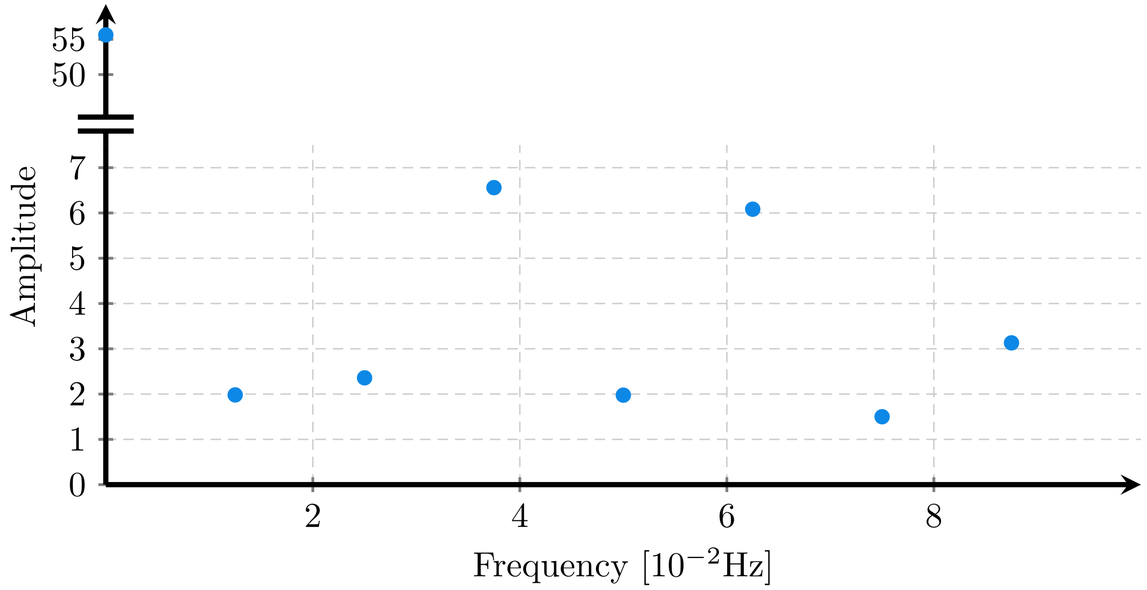
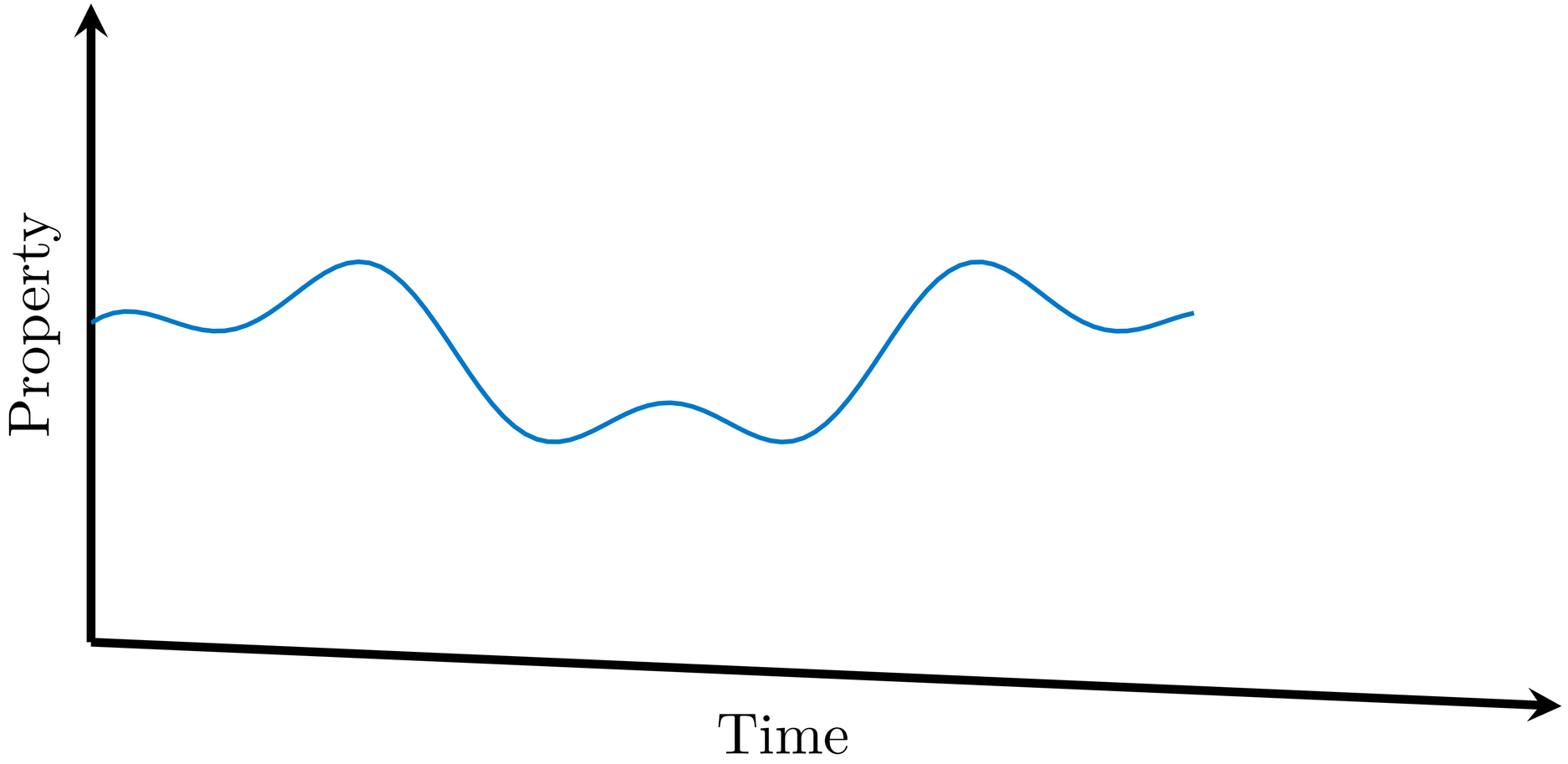








Two Possible Predictions



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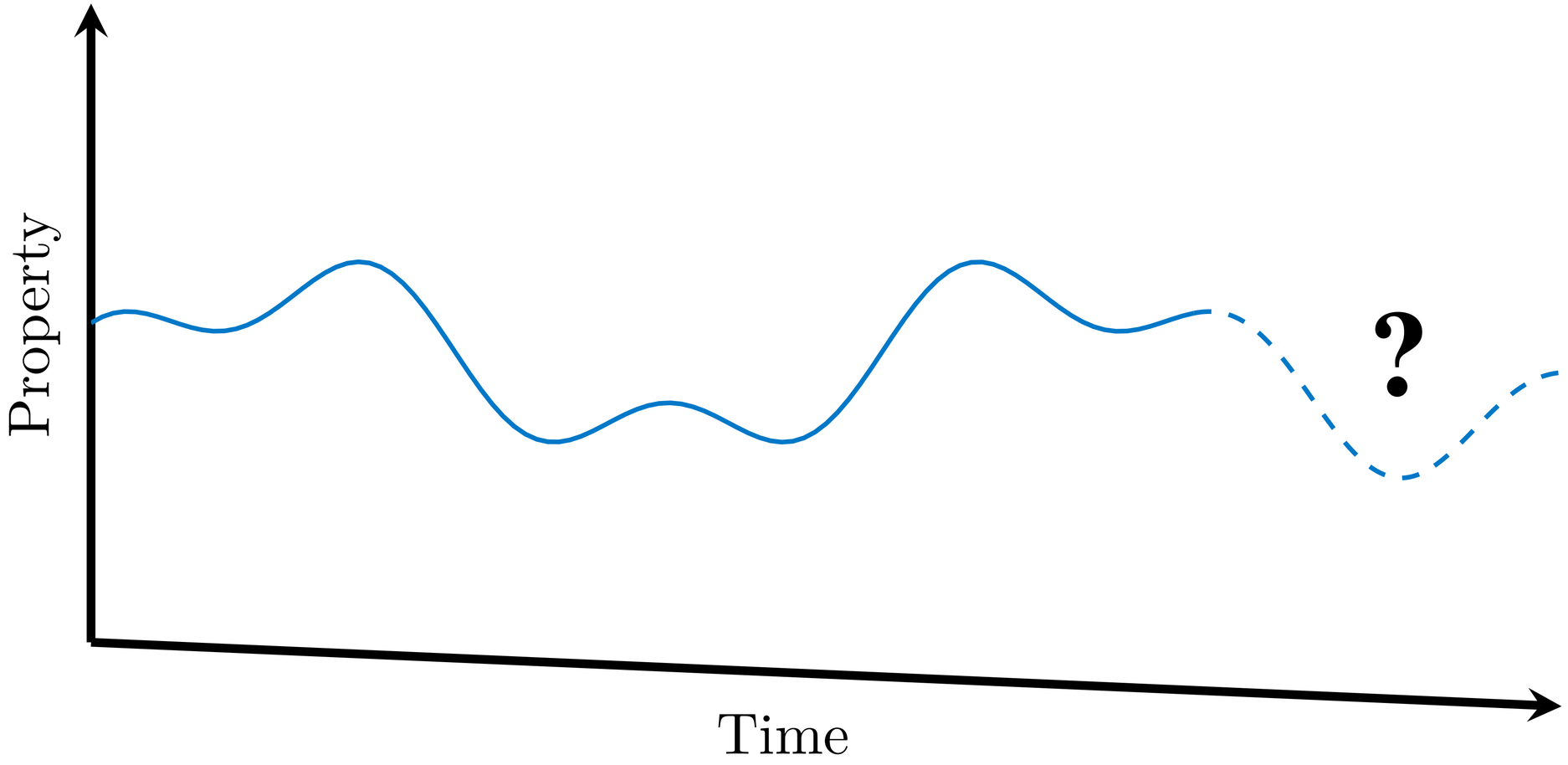

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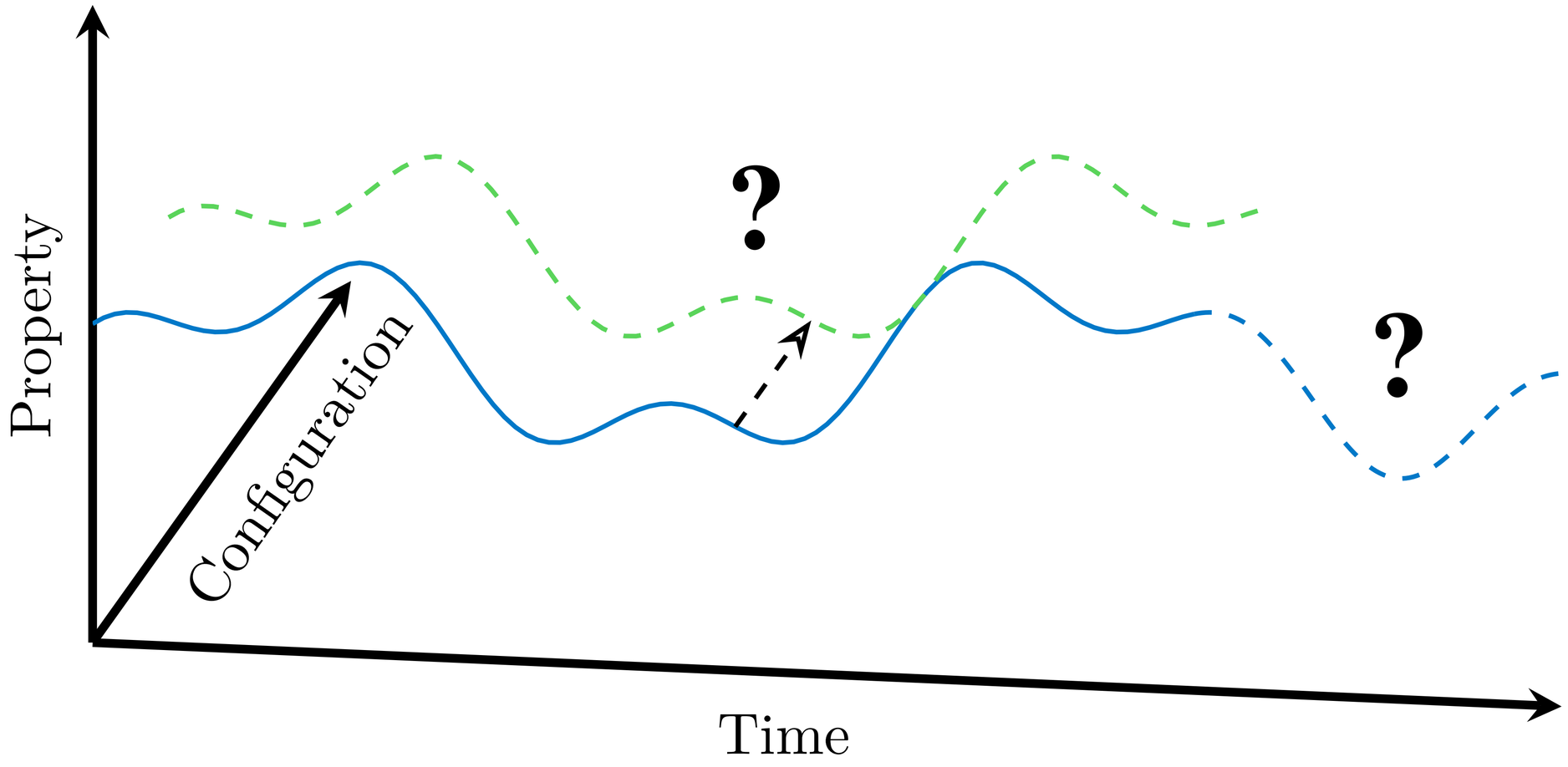
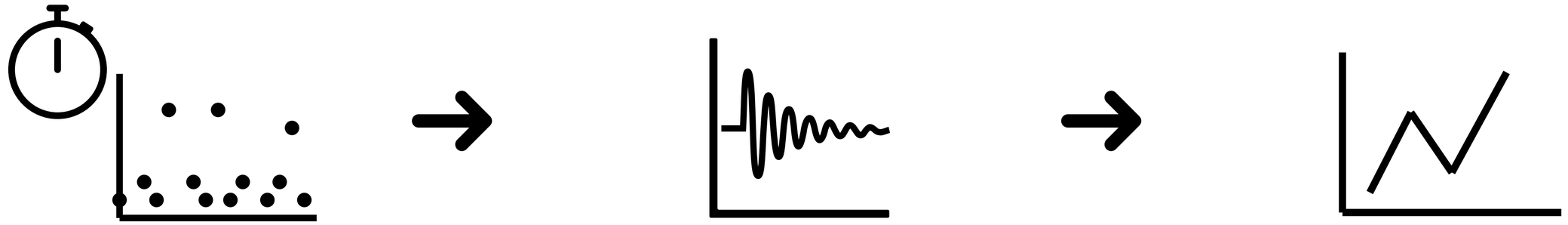


Discrete Fourier Transform



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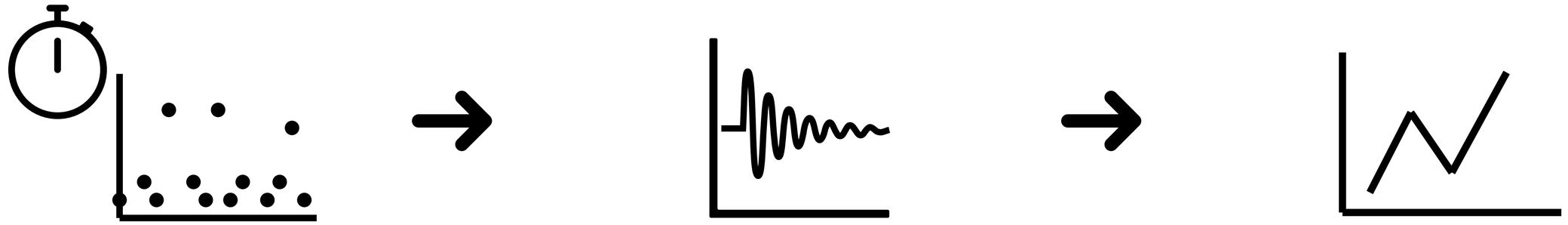
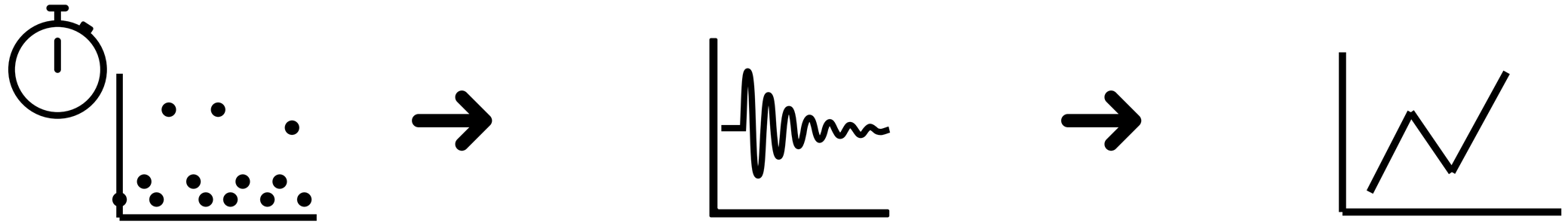


$$\Pi : C \rightarrow \mathbb{R}^{|\Omega|}$$

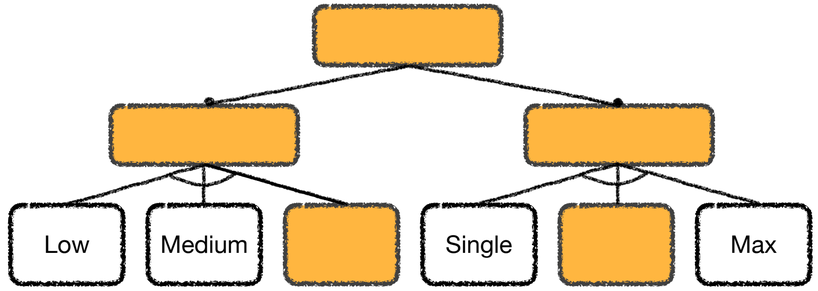
Discrete Fourier Transform



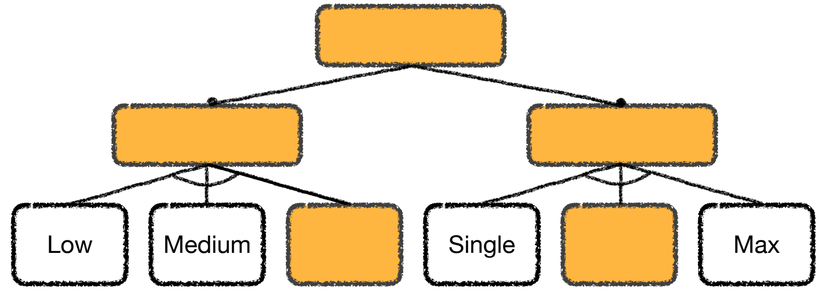
$$\Pi : C \rightarrow \mathbb{R}^{|\Omega|}$$

$$\Pi(c) = \sum_{j=1}^{s} \vec{\omega}_j \prod_{f \in T_j \subseteq F} c(f)$$

Let’s Predict

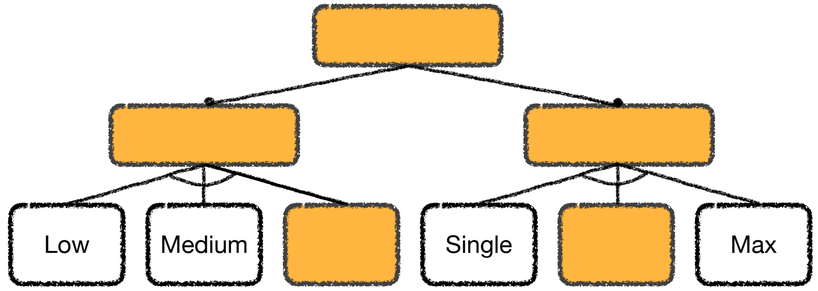


Let's Predict



$$\Pi(\{\text{High}, \text{Multi}\}) = \begin{pmatrix} 50 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 3.75 \\ 1.0355 \\ 2.5 \\ 6.0355 \\ 2.5 \\ 6.0355 \\ 2.5 \\ 1.0355 \end{pmatrix} \cdot \text{Low} + \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot \text{High} + \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot \text{Single} + \begin{pmatrix} 1.875 \\ 0.9617 \\ 0.4784 \\ 0.7626 \\ 0.8839 \\ 0.5778 \\ 1.1548 \\ 2.1 \end{pmatrix} \cdot \text{Multi}$$

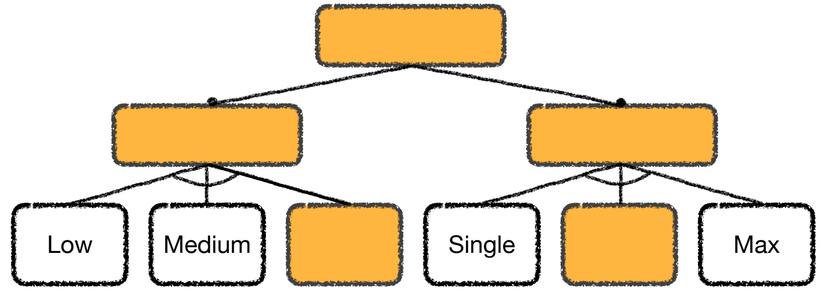
Let's Predict



$$\Pi(\{\text{High}, \text{Multi}\}) = \begin{pmatrix} 50 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 3.75 \\ 1.0355 \\ 2.5 \\ 6.0355 \\ 2.5 \\ 6.0355 \\ 2.5 \\ 1.0355 \end{pmatrix} \cdot \text{Low} + \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot \text{High} + \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot \text{Single} + \begin{pmatrix} 1.875 \\ 0.9617 \\ 0.4784 \\ 0.7626 \\ 0.8839 \\ 0.5778 \\ 1.1548 \\ 2.1 \end{pmatrix} \cdot \text{Multi}$$

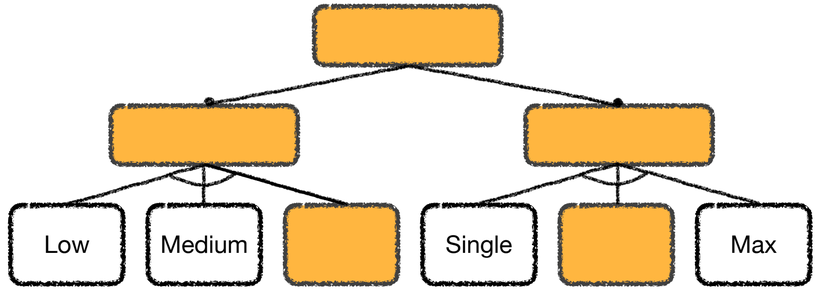
$$\overrightarrow{\omega}_j$$

Let’s Predict

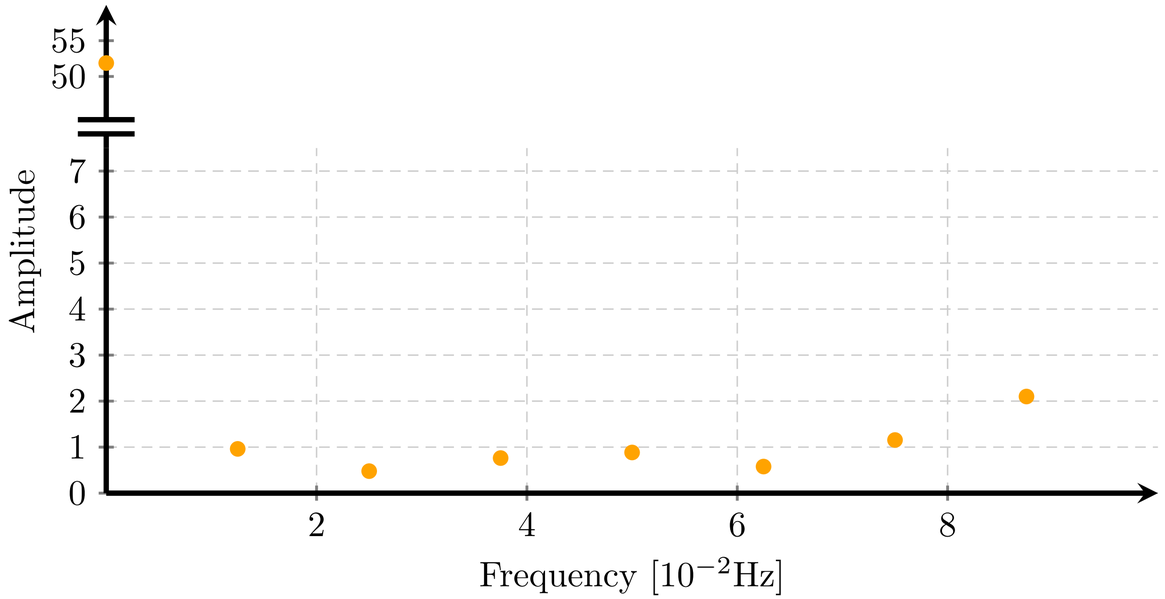


$$\Pi(\{\text{High}, \text{Multi}\}) = \vec{\omega}_0 + \vec{\omega}_1 \cdot \text{Low} + \vec{\omega}_2 \cdot \text{High} + \vec{\omega}_3 \cdot \text{Single} + \vec{\omega}_4 \cdot \text{Multi}$$

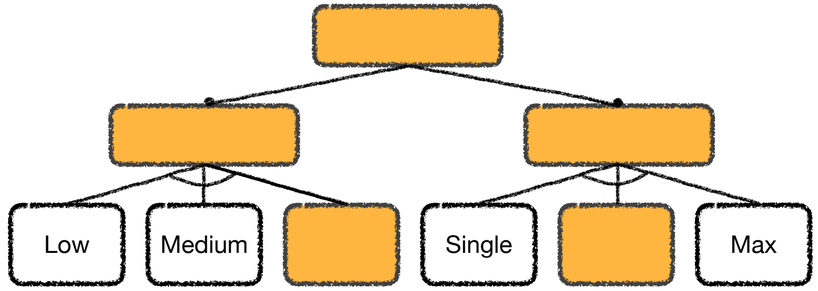
Let's Predict



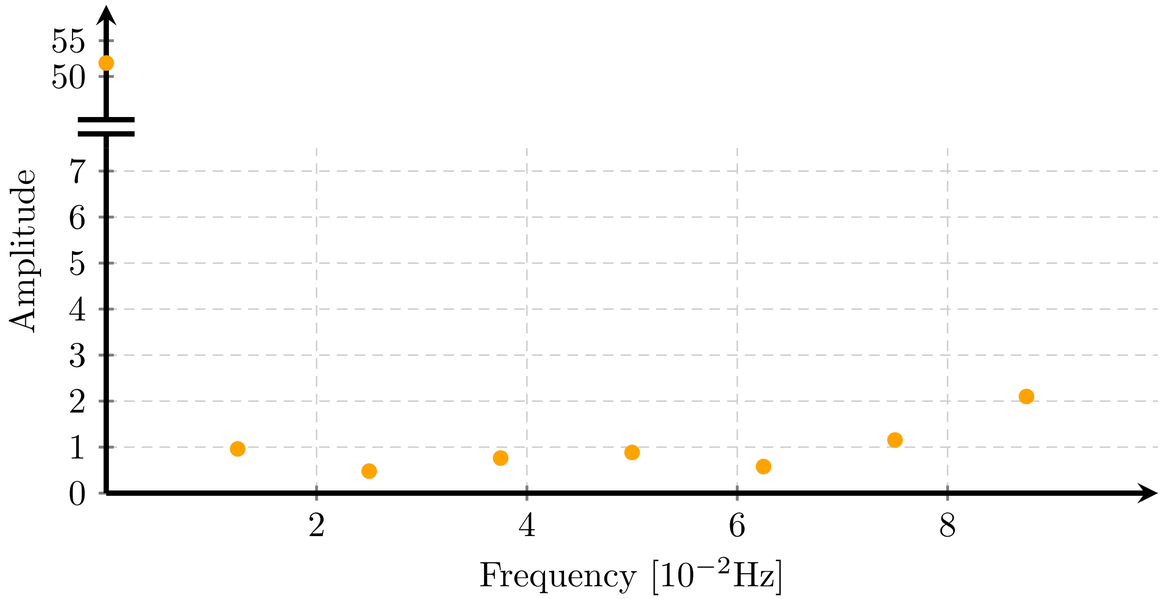
$$\Pi(\{\text{High}, \text{Multi}\}) = \vec{\omega}_0 + \vec{\omega}_1 \cdot \text{Low} + \vec{\omega}_2 \cdot \text{High} + \vec{\omega}_3 \cdot \text{Single} + \vec{\omega}_4 \cdot \text{Multi}$$

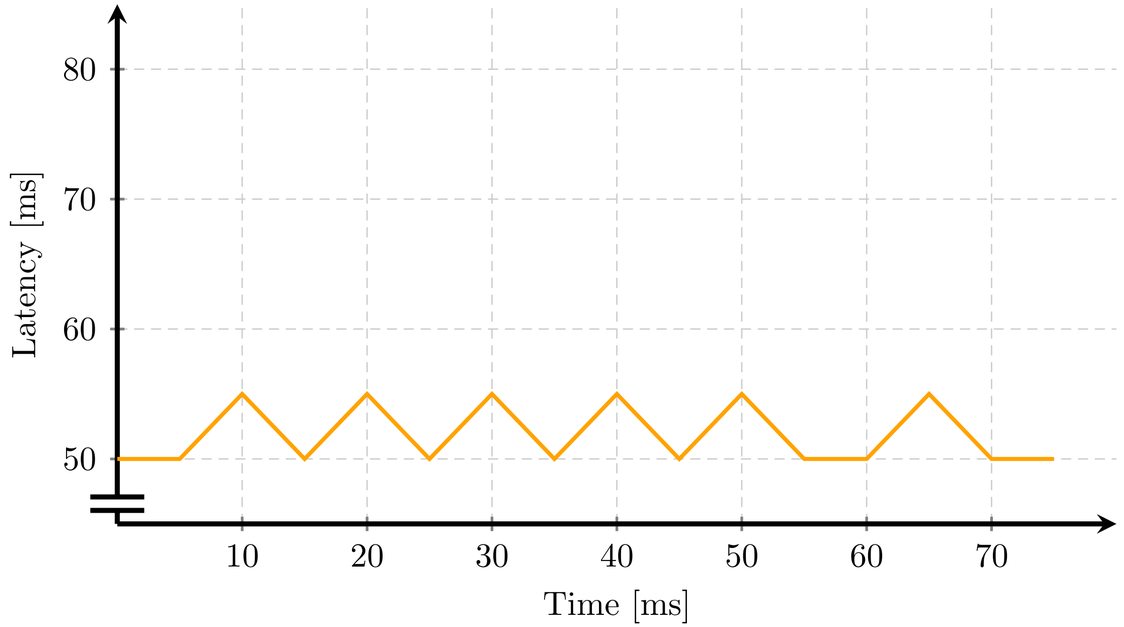


Let's Predict

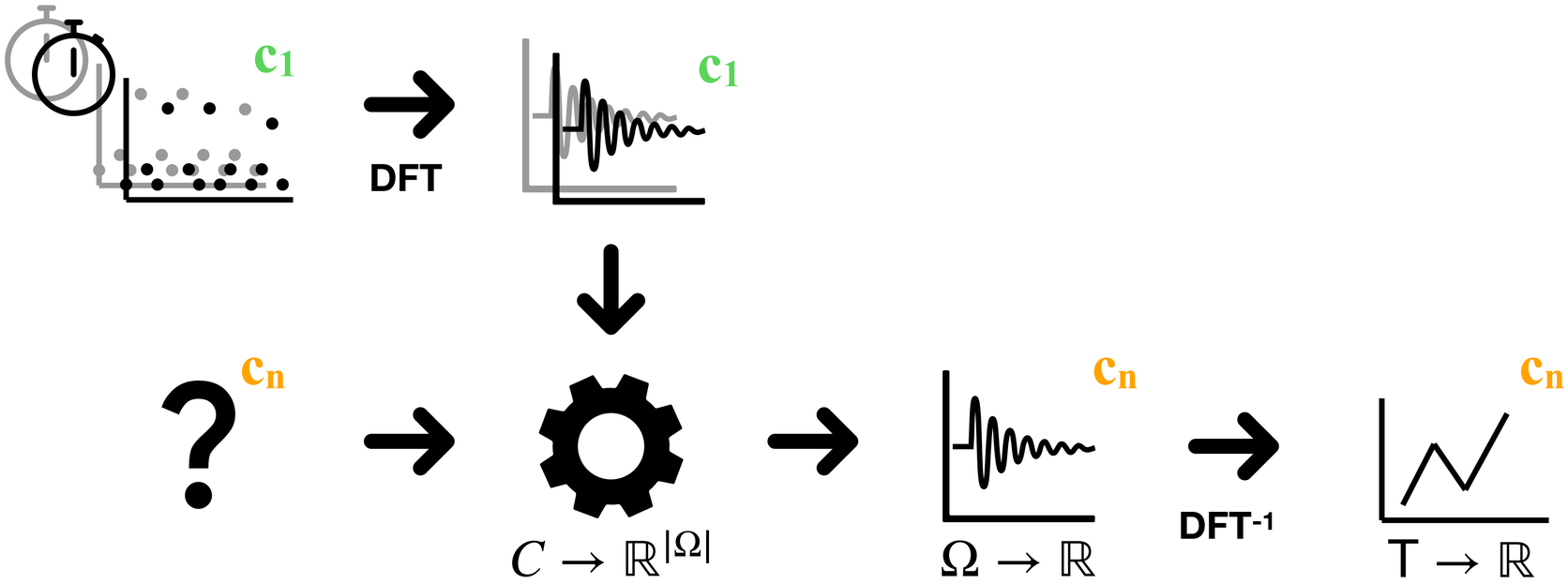


$$\Pi(\{\text{High}, \text{Multi}\}) = \vec{\omega}_0 + \vec{\omega}_1 \cdot \text{Low} + \vec{\omega}_2 \cdot \text{High} + \vec{\omega}_3 \cdot \text{Single} + \vec{\omega}_4 \cdot \text{Multi}$$





Summary


c1
DFT
c1
?
cn
$C \rightarrow \mathbb{R}^{|\Omega|}$
cn
$\Omega \rightarrow \mathbb{R}$
DFT-1
cn
$T \rightarrow \mathbb{R}$

Summary

$$\Pi : C \rightarrow \mathbb{R}^{|\Omega|}$$

$$\Pi(c) = \sum_{j=1}^{s} \vec{\omega}_j \prod_{f \in T_j \subseteq F} c(f)$$