To create a security assurance case for Instant Messaging (IM) software using Goal Structuring Notation (GSN), we start by defining the top-level goal which broadly states the main aim of the assurance case. This is typically broken down into sub-goals that address specific areas such as encryption, privacy, and user authentication. Let's construct this in a simple hierarchical tree format:

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- G1: Ensure the security and privacy of the IM software

- G1.1: Ensure all messages are encrypted

- G1.1.1: Implement end-to-end encryption (E2EE)

- S1.1.1.1: Use industry standard encryption protocols (e.g., AES, RSA)

- S1.1.1.2: Regularly update encryption algorithms

- G1.1.2: Encryption keys are securely managed

- S1.1.2.1: Keys are generated, stored, and disposed of securely

- S1.1.2.2: Implement key rotation policies

- G1.2: Protect user identity and privacy

- G1.2.1: Anonymize user data where possible

- S1.2.1.1: Use pseudonymization techniques for user identifiers

- S1.2.1.2: Provide users with privacy configuration options

- G1.2.2: Use secure methods for user authentication

- S1.2.2.1: Implement Multi-Factor Authentication (MFA)

- S1.2.2.2: Regularly review and update authentication methods

- G1.3: Ensure IM software is free from vulnerabilities

- G1.3.1: Conduct regular security audits

- S1.3.1.1: External audits are performed annually

- S1.3.1.2: Internal audits are performed quarterly

- G1.3.2: Implement a robust patch management process

- S1.3.2.1: Patches are reviewed and tested before deployment

- S1.3.2.2: Patches are deployed in a timely manner

- G1.4: Ensure compliance with relevant legal and regulatory requirements

- G1.4.1: Adhere to data protection laws (e.g., GDPR, CCPA)

- S1.4.1.1: Implement procedures for handling, processing, and storing personal data

- S1.4.1.2: Perform regular compliance audits

- G1.4.2: Maintain transparency in data processing operations

- S1.4.2.1: Publicly available privacy policies

- S1.4.2.2: Clear user consent mechanisms for data processing

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### Explanation:

- \*\*G1 (Goal 1)\*\*: Top-level goal focused on overall security and privacy.

- \*\*G1.1 - G1.4\*\*: Sub-goals breaking down the main goal into manageable and specific objectives.

- \*\*S1.x.x.x (Strategies)\*\*: Strategies supporting how each goal can be achieved, often backed by specific solutions or actions.

Each sub-goal is supported by specific strategies that define how the goal will be achieved, often referencing standards, specific techniques, or procedural actions. Further granularity can be added by defining even more specific sub-nodes, for example detailing the technological implementations or defining procedures for audits and updates.