Scale and Scope Implications for CMMI

Rick Hefner & Fred Manthey, TRW

rick.hefner@trw.com, 310.812.7290

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SEI CMM LEVEL 3

Background

- **The Capability Maturity Model Integration (CMMI) model was published in November 20000**

- **Model scope includes software engineering, systems engineering, Integrated Product and Process Development (IPPD), acquisition, …**

How does the model map to organizations with various types of projects (e.g., software only, systems engineering only, etc.)?

How does the model components map to projects with various scopes of work (e.g, software only, software and systems engineering, Independent Verification & Validation, etc.)?

How does the model map to small projects?

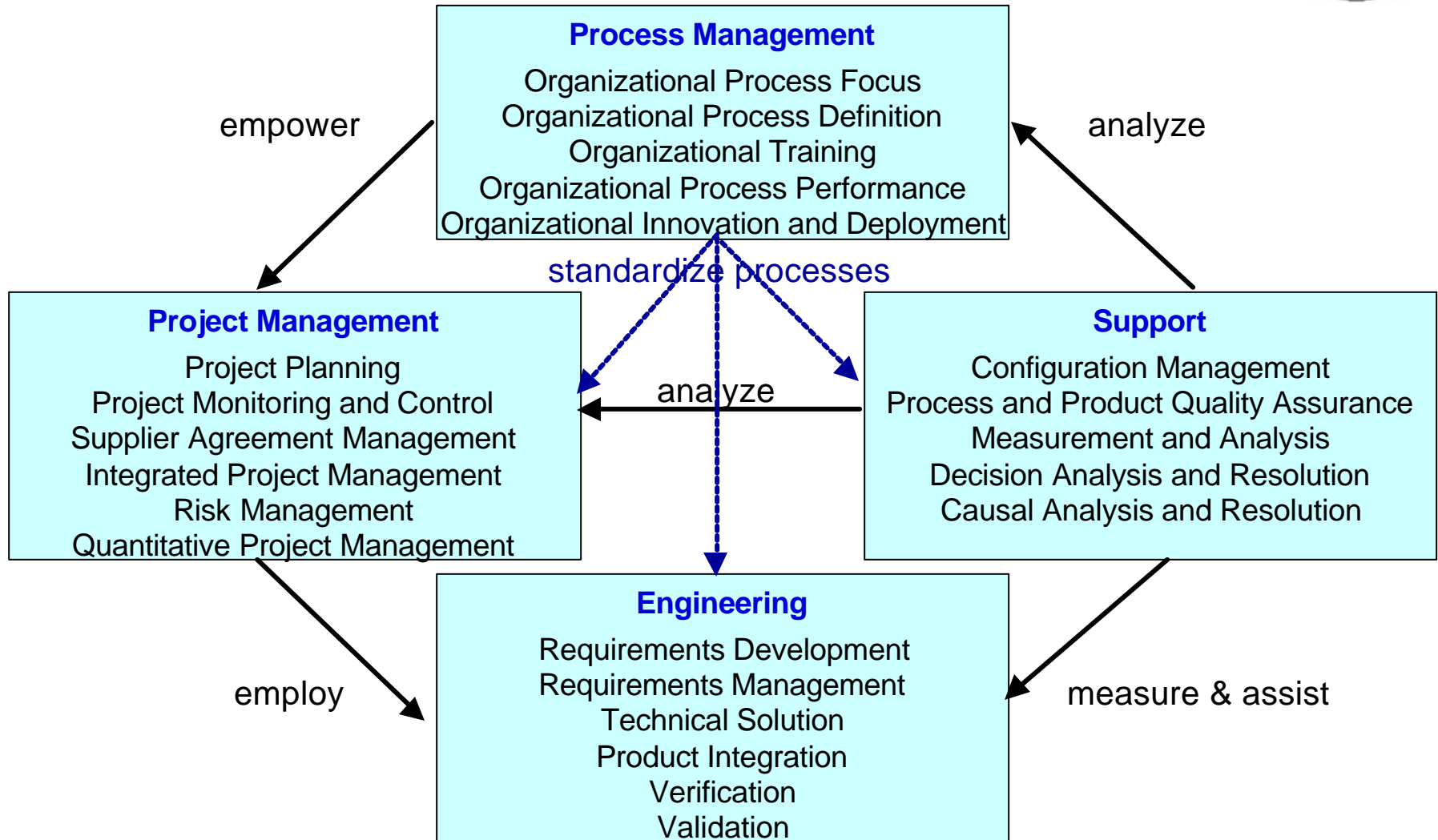*How does the model map to projects in non-traditional development environments?*

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CMMI Maturity Level
An Improvement Path for Organizational & Project Performance

Level	Focus	Process Areas
5 Optimizing	*Continuous improvement*	**Causal Analysis and Resolution** **Organizational Innovation and Deployment**
4 Quantitatively Managed	*Quantitative management*	**Quantitative Project Management** **Organizational Process Performance**
3 Defined	*Process standardization*	**Organizational Process Focus** **Organizational Process Definition** **Organizational Training** **Integrated Project Management** **Risk Management** **Decision Analysis and Resolution** **Requirements Development** **Technical Solution** **Product Integration** **Verification** **Validation**
2 Managed	*Basic project management*	**Requirements Management** **Project Planning** **Project Monitoring and Control** **Supplier Agreement Management** **Measurement and Analysis** **Process and Product Quality Assurance** **Configuration Management**
1 Performed		

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Process Area Group Relationships

Process Management

Organizational Process Focus
Organizational Process Definition
Organizational Training
Organizational Process Performance
Organizational Innovation and Deployment

empower

analyze

standardize processes

Project Management

Project Planning
Project Monitoring and Control
Supplier Agreement Management
Integrated Project Management
Risk Management
Quantitative Project Management

analyze

Support

Configuration Management
Process and Product Quality Assurance
Measurement and Analysis
Decision Analysis and Resolution
Causal Analysis and Resolution

employ

Engineering

Requirements Development
Requirements Management
Technical Solution
Product Integration
Verification
Validation

measure & assist

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What the CMMI Says

"Professional judgment should be used by your organization to interpret CMMI practices. Although process areas depict behavior that should be exhibited in any organization, practices must be interpreted using an in-depth knowledge of the CMMI model, the organization, the business environment, and the specific circumstances involved."
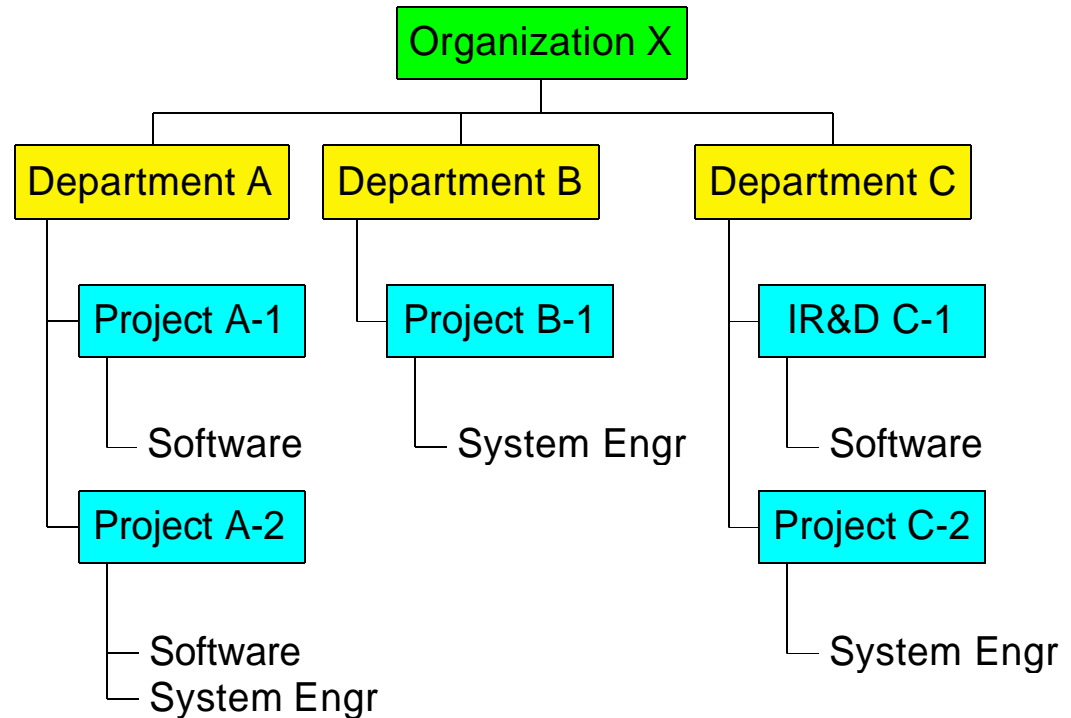
Organizational scope

Project scope

Project scale

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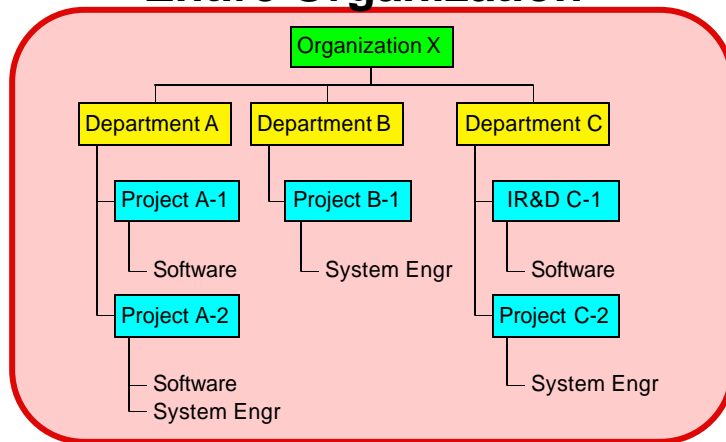
Organizational Scope

- **An organization may have many lines of business, projects, and scopes of work**

- **The organization must decide, based on business reasons, what portions to improve (or assess)**
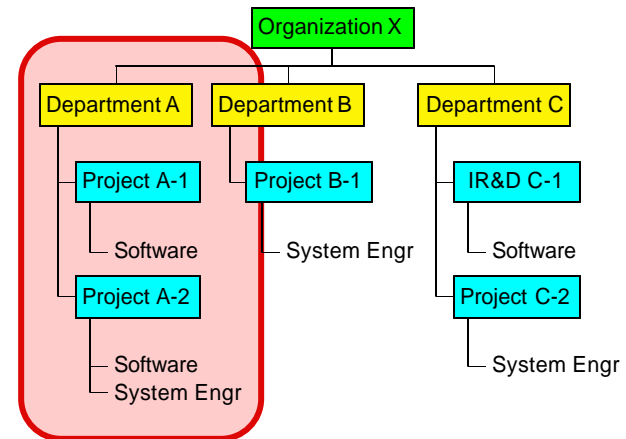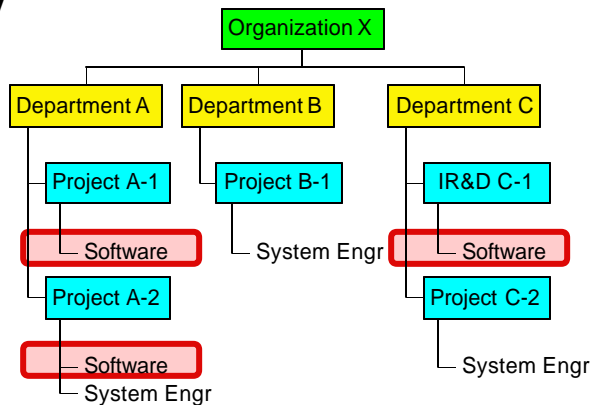
```
                        Organization X
            ┌─────────────────┼─────────────────┐
       Department A       Department B       Department C
          │                   │                   │
       Project A-1        Project B-1         IR&D C-1
          │                   │                   │
        └ Software         └ System Engr       └ Software
       Project A-2                            Project C-2
          │                                       │
        ├ Software                             └ System Engr
        └ System Engr
```

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Examples - Setting Organizational Scope

Entire Organization

Key Line of Business Only

Software (or SE) Work Only Only

Key/Representative Projects

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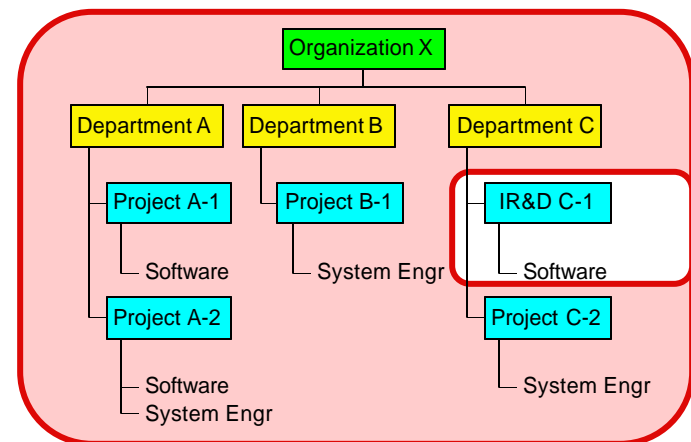
Project Scope of Work

- **Definition of "project" from the CMMI:**
  - A "project" is a managed set of interrelated resources that delivers one or more products to a customer or end user
  - Has a definite beginning and end and typically operates according to a plan
  - A project can be composed of projects

- **A project may have multiple disciplines**
  - Software engineering, systems engineering, IPPD, …

- **The project must decide, based on organizational objectives and project-specific goals, what portions of the project to improve (or assess)**

Dealing with Multiple Disciplines

Process Management

Organizational Process Focus
Organizational Process Definition
Organizational Training
Organizational Process Performance
Organizational Innovation and Deployment

Project Management

Project Planning
Project Monitoring and Control
Supplier Agreement Management
Integrated Project Management
Risk Management
Quantitative Project Management

Engineering

Requirements Development
Requirements Management
Technical Solution
Product Integration
Verification
Validation

Support

Configuration Management
Process and Product Quality Assurance
Measurement and Analysis
Decision Analysis and Resolution
Causal Analysis and Resolution

Must address both software and systems engineering for:

- **Organizational process descriptions**

- **Training**

- **Project plans & monitoring**
  - Program plan, or SEMP and SDP, or all 3

- **Risk management plans & monitoring**

- **Methods, tools, procedures**

- **CM plans & systems**

- **QA plans & systems**

- **Measures and analysis**

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Dealing with Scope of Work on the Project

Process Management
Organizational Process Focus
Organizational Process Definition
Organizational Training
Organizational Process Performance
Organizational Innovation and Deployment

Project Management
Project Planning
Project Monitoring and Control
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In some situations, not all Engineering process areas may be in the scope of work of the project

- **Research studies (e.g., defining requirements)**
- **V&V contracts**

In general, the other process areas will always be in scope

- **Except: Supplier Agreement Management is not applicable if no suppliers are used**
- **For example, Project Management process areas would apply managing work within the scope of the project**

*Process areas are not judged not applicable simply because:*

- **You failed to bid the activities**
- **Your customer does not want to pay for the activities**

Do you have the (proven) capability to perform the process area?

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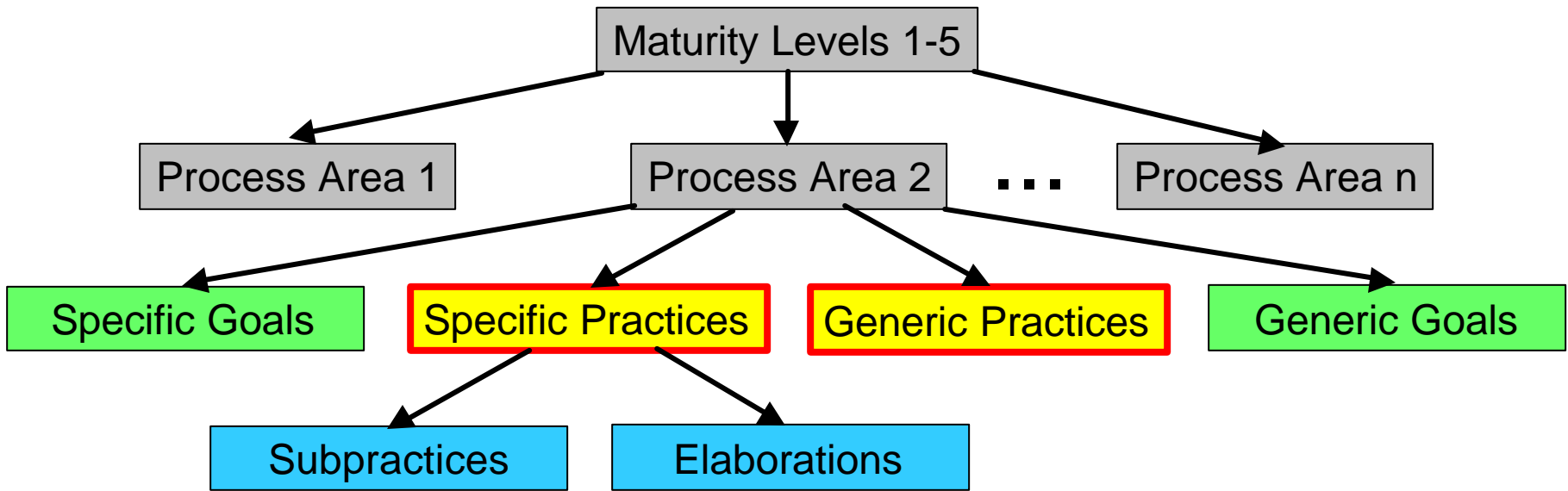**TRW**

Project Scale

- **The CMMI captures generally accepted industry best practices for software and/or system engineering**

- **The CMMI applies to any kind of project**
  - Development, maintenance, IR&D, …
  - External customer, internal customer, …
  - Large projects, small projects, …

- **The CMMI requires discipline, not bureaucracy**
  - Formality is not important
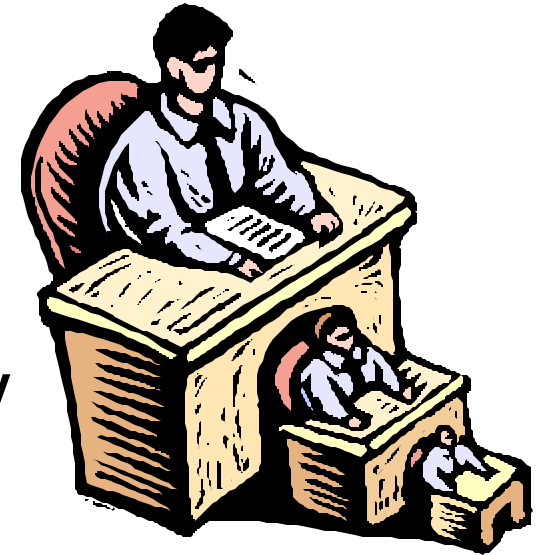
The key is to match the
formality/scale of the CMMI-related practices
to the
formality/scale of the project

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Required, Expected, Informative

```
                    ┌──────────────────────┐
                    │  Maturity Levels 1-5 │
                    └──────────────────────┘
        ┌────────────────────┼────────────────────────┐
        ▼                    ▼                         ▼
┌───────────────┐    ┌───────────────┐  . . .  ┌───────────────┐
│ Process Area 1│    │ Process Area 2│         │ Process Area n│
└───────────────┘    └───────────────┘         └───────────────┘
```

| Specific Goals | Specific Practices | Generic Practices | Generic Goals |

| Subpractices | Elaborations |

| **Required** | Needed to satisfy CMMI ← applies to all types of projects |

| **Expected** | Typical practices to meet goals ← typical ways to meet the goals; alternatives are acceptable if they meet the goals |

| **Informative** | Ideas to consider ← things to consider |

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Aug 2001, Rev B

Examples of CMMI-Compliant Practices on Small Projects

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Organizational Process Definition
Organizational Training
Organizational Process Performance
Organizational Innovation and Deployment

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Causal Analysis and Resolution

- **Project plans documented in memos or engineering notebooks**

- **Suppliers managed through integrated teams**

- **Requirements provided orally by the customer are documented**

- **Support processes are applied only to <u>selected</u> work products where control, quality, etc, are critical to project success**

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Summary

- **The Capability Maturity Model Integration (CMMI) model maps to all types of organizations and projects**

- **Organizations must decide which disciplines and processes they want to improve**

- **Projects must map their scope of engineering work to the model**

- **Projects must consider (and be able to justify) alternative practices which satisfy the CMMI goals**

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