The Evolution of Integration between PI and SAP
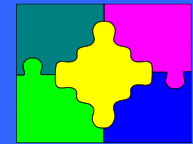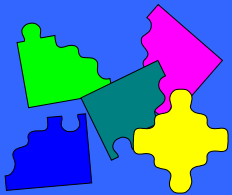
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Outline

- Introduction
- Why Integrate?
- Requirements/Constraints
- Upgraded Design Strategies
- Interface Architecture / Sample data
- Fault Tolerance
- Resource Requirements
- Integration Savings
- Key Learnings / Summary

Why Talk Again

- Provide a reality check to last year's pre-startup presentation

- Change your perspective on SAP integration, so you ask the right questions and do sufficient prototyping up front

Why Integrate PI and SAP?

- Handle consumption rate of 1100/day

- Minimize manual entry and their errors

- Minimize recipe & BOM maintenance

- Calculate complex data summaries not available manually or in SAP

- Get SAP off the shop floor

Integration Requirements/Constraints
(Note: PC = Process Control)

- Use off-the-shelf software solutions
- Consumptions and productions from PC to SAP
- Map SAP reservations to PC consumptions
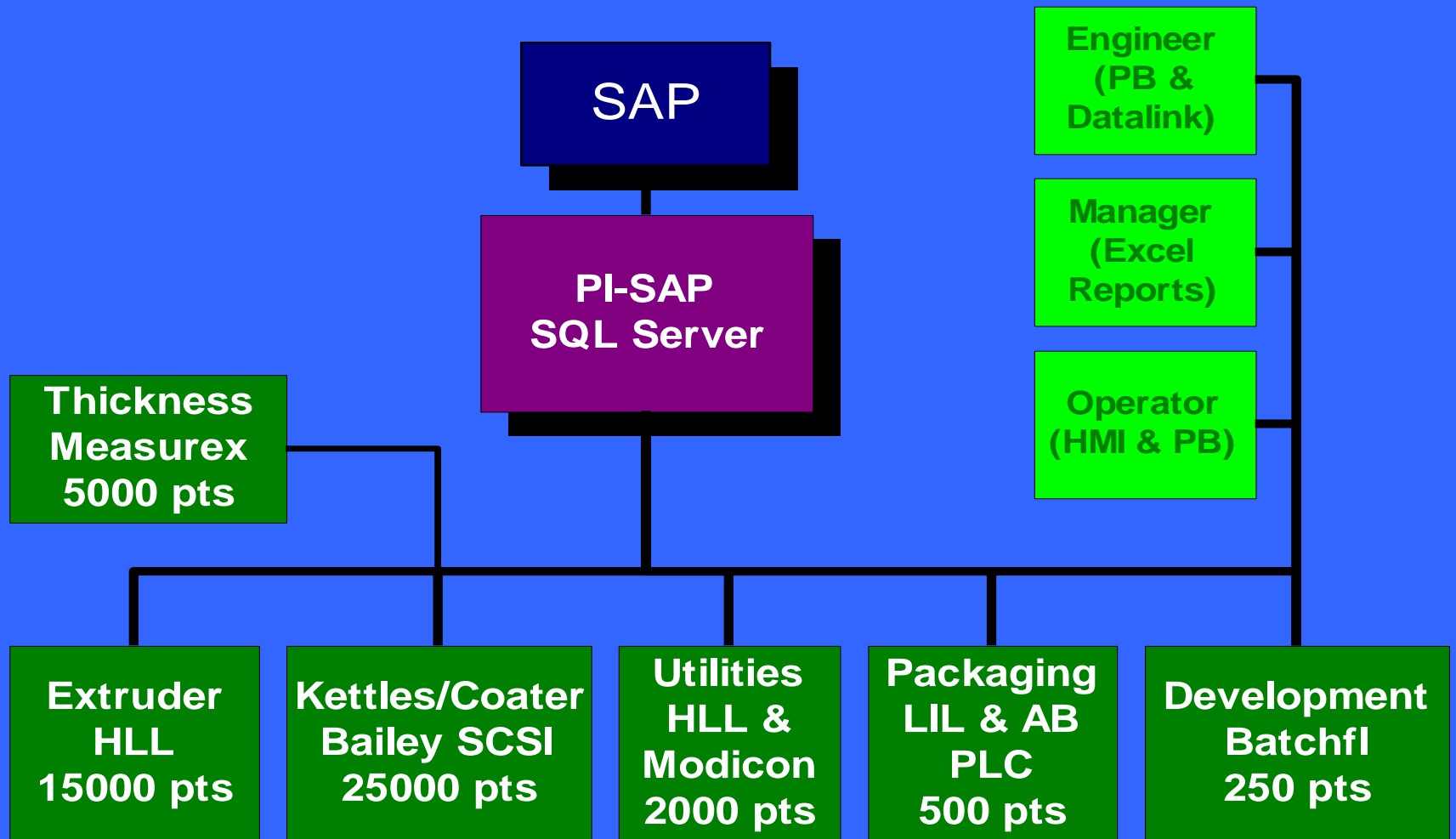- Small generic SAP control recipes to PC

Post-Startup Integration Requirements/Constraints

- Remove backflushing from SAP due to time and complex lot assignments.

- Prevent sending any over-consumption to SAP

- Custom front-end, but use SAP for validation with automated contingencies via PI when SAP is down.
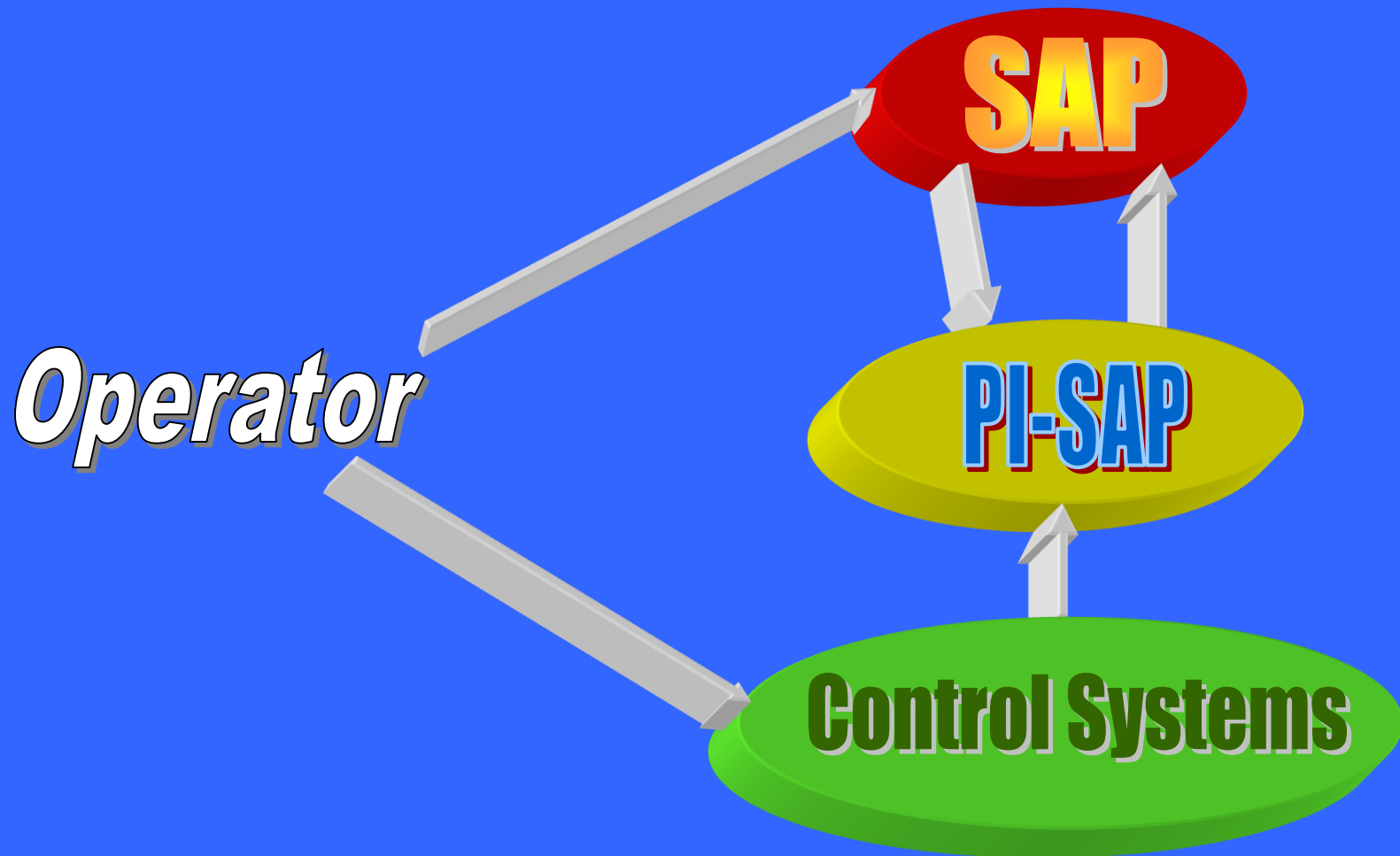
Upgraded Design Strategies

- Distributed PI systems (1 NT server/area)
- One SAP interface to the process systems
- Minimize SAP control recipe instructions
- Eliminate SAP screens on the shop floor (Eliminate the use of PP-PI sheets)
- SAP is the master of inventories and genealogy, but PI is its backup when SAP is down.

Topology

SAP

PI-SAP SQL Server

Engineer (PB & Datalink)

Manager (Excel Reports)

Operator (HMI & PB)

Thickness Measurex 5000 pts

Extruder HLL 15000 pts

Kettles/Coater Bailey SCSI 25000 pts

Utilities HLL & Modicon 2000 pts
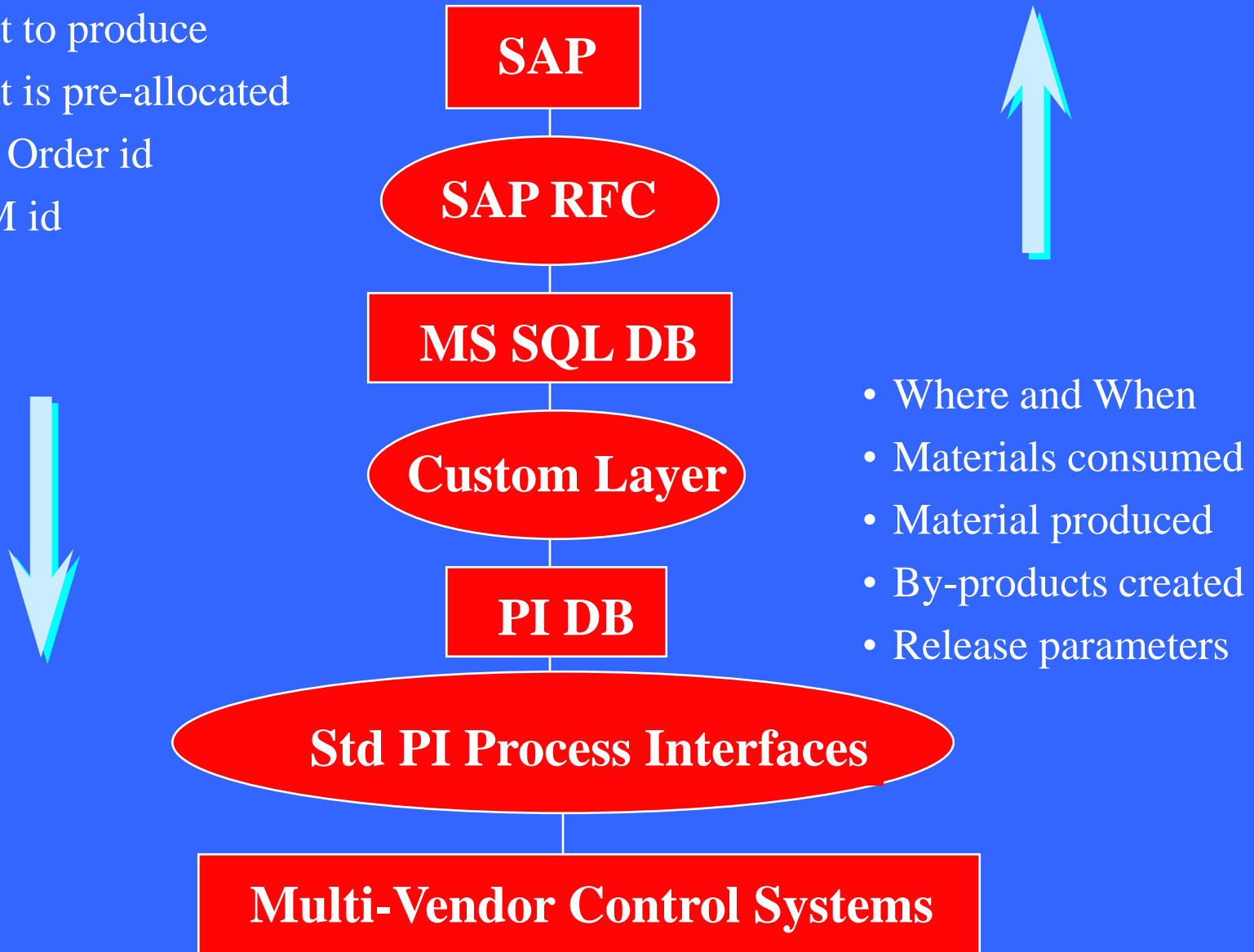
Packaging LIL & AB PLC 500 pts

Development Batchfl 250 pts

Off-the-shelf Architecture

Interface Architecture

- What to produce
- What is pre-allocated
- SAP Order id
- BOM id

SAP

SAP RFC

MS SQL DB

Custom Layer

PI DB

Std PI Process Interfaces
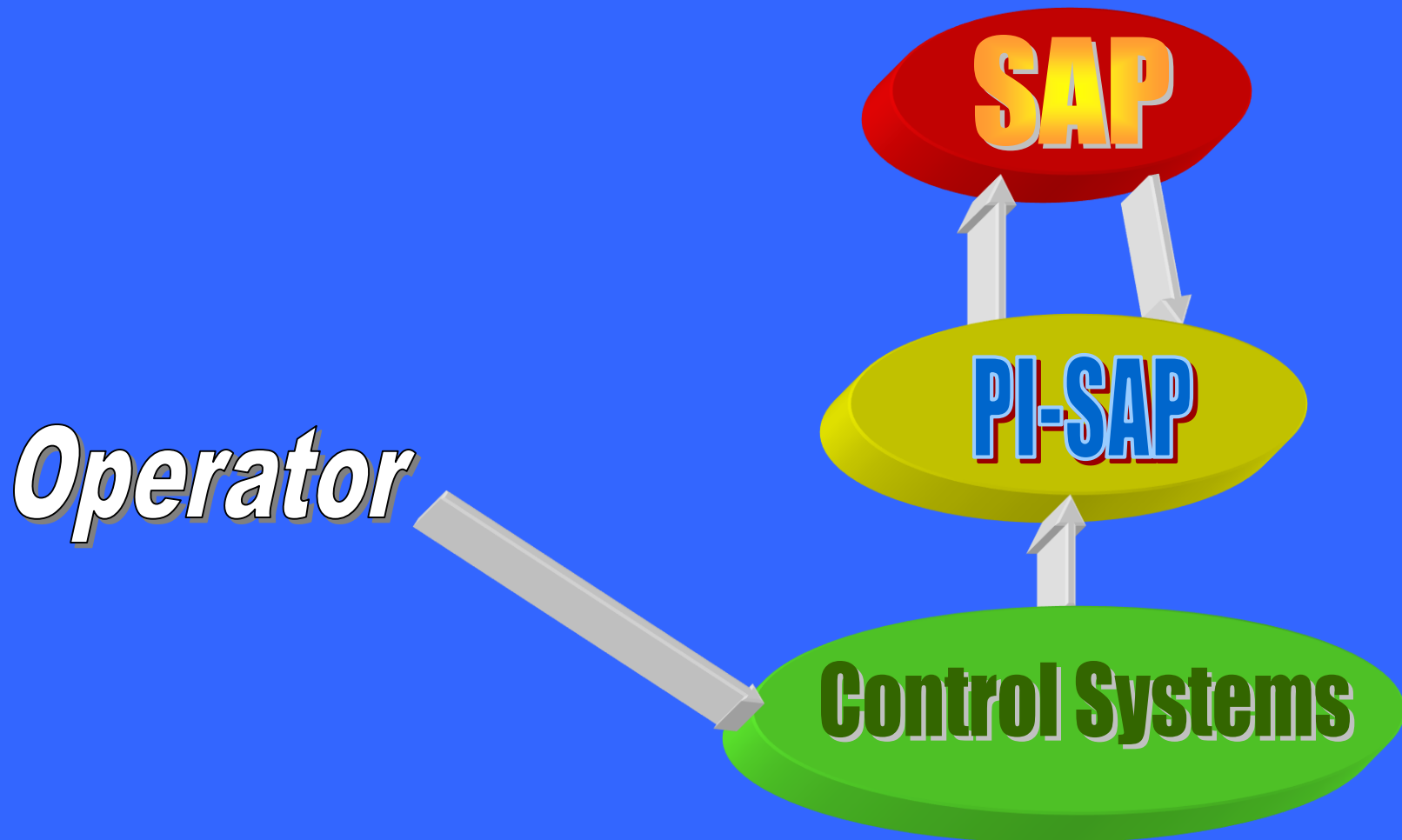
Multi-Vendor Control Systems

- Where and When
- Materials consumed
- Material produced
- By-products created
- Release parameters

Interface Architecture

- Product 612
- Curd 61, Batch 13
- Order 0006500000312
- BOM 612_Line2

SAP

SAP RFC

MS SQL DB

- Line 2, 3/26/98 8:05 - 8:32
- Curd 61, Batch 13, 250 gal, 8:15
- NaCl, Batch 924, 10 gal, 8:24
- Product 612, 10K sqft, Batch 75
- Pellets, 45 lbs, Batch 12A
- High quality, pH 4.75

Custom Layer

PI DB

Std PI Process Interfaces

Multi-Vendor Control Systems
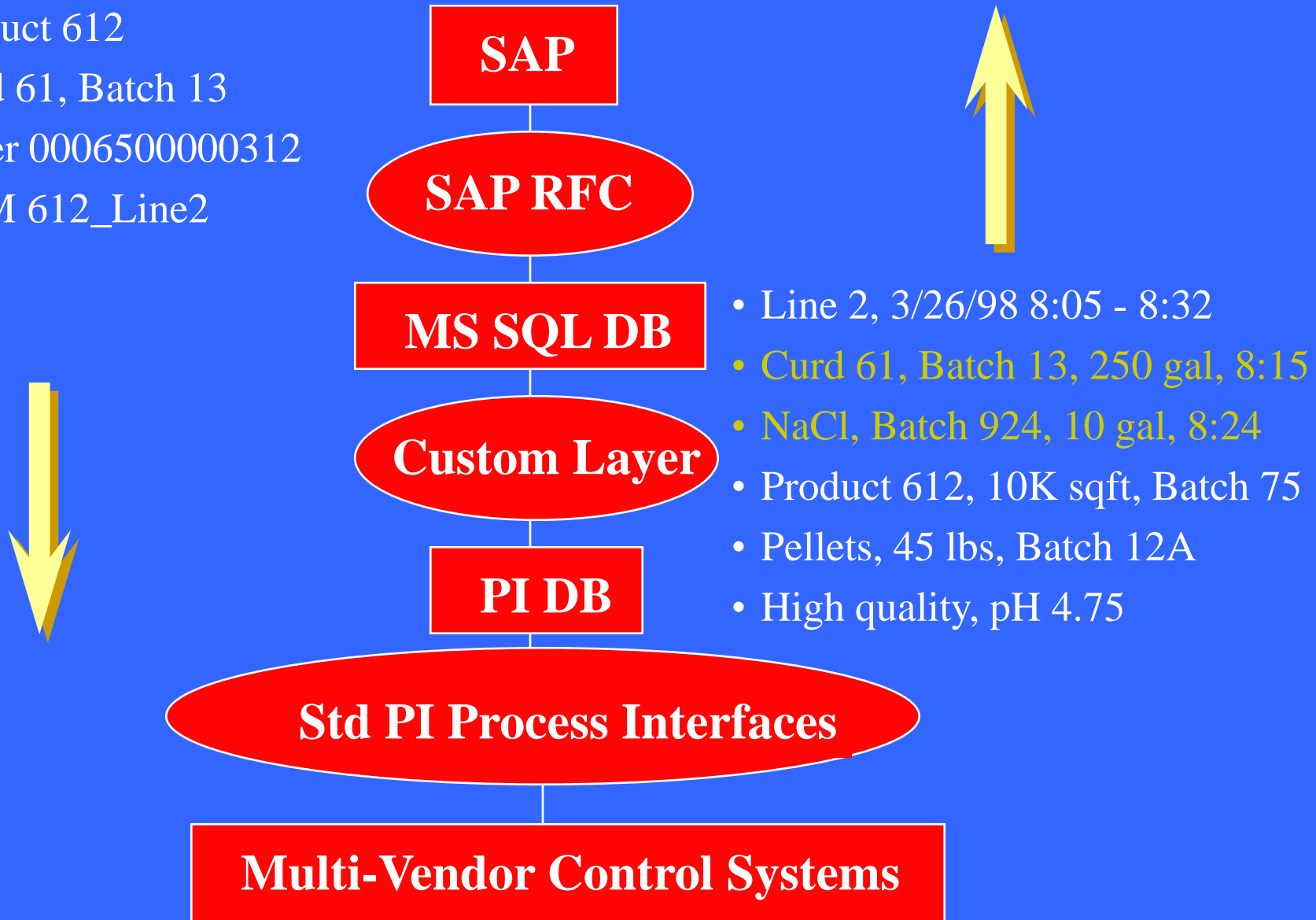
Customized Architecture

Fault Tolerance

- Distributed PI servers; 1 per area (When PI is down, production is down)

- Time independent interfaces (PI to SAP) with automated contingencies

- Common Hardware with Raid 5 & 1 full spare server (4 hour reconstruction time)

- Daily incremental and Weekly full system and Automatic PI database backups

- Recovery from communications failure *

Resources (# of people)

Manufacturing Experts (15)

Business Analysts (4)

SAP System Analysts (30)

Process Info Experts (4)

Project facilitators (0)

Resources

Manufacturing Experts (10)

Business Analysts (4)

SAP System Analysts (15)

Process Info Experts (4)

Project facilitators (2)

Integrators (2)

Integrator

- System analyst
- Knowledge of:
  - Manufacturing processes
  - Workflow
- Application Independent
  - Not application biased
  - Efficient use of multiple platforms
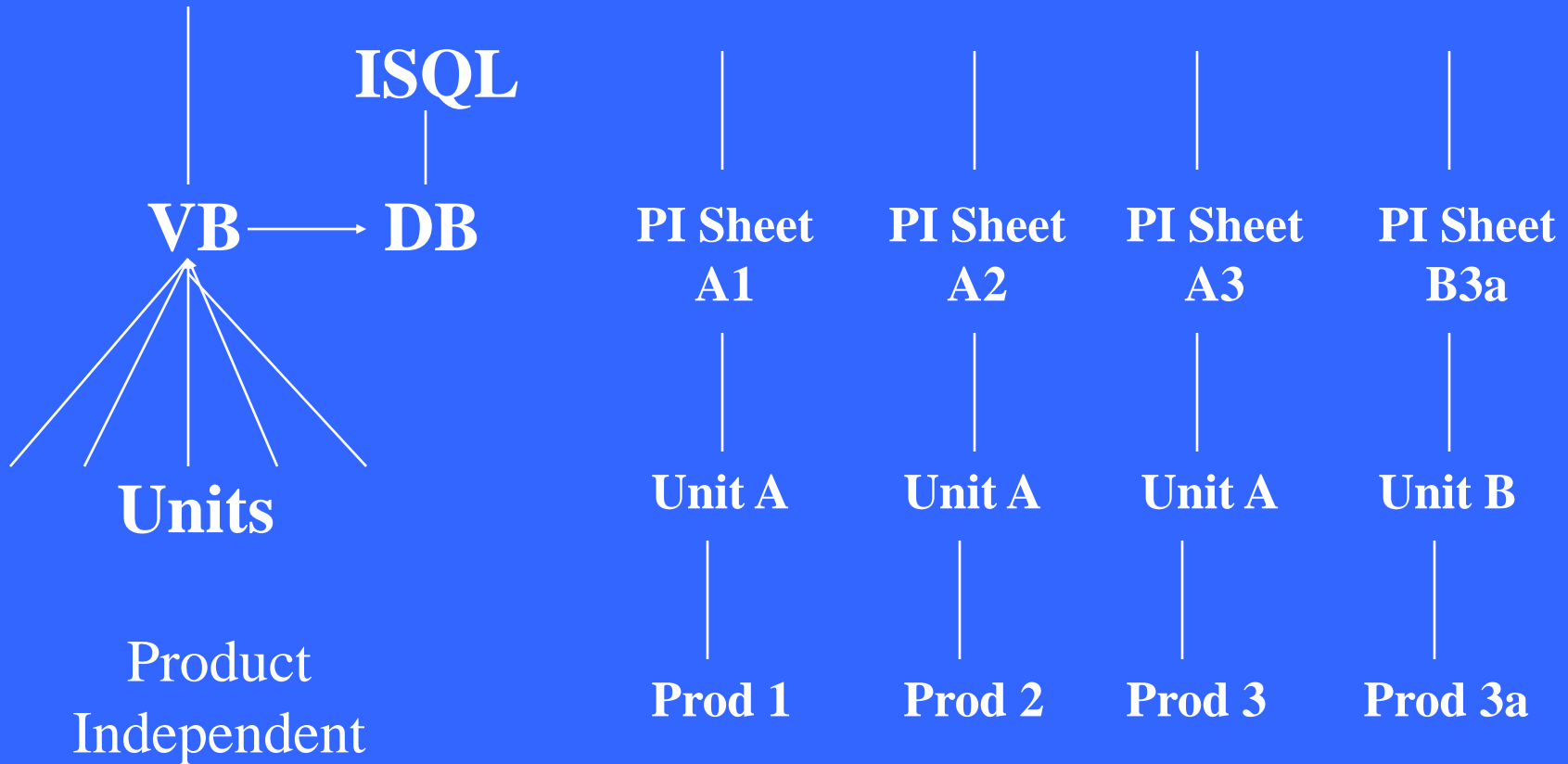- Someone within the company

Integration Savings
(Based on 1000 SAP Orders/day)

- Support Labor savings:
  - 3 SAP super users (100%) & 6 data clerks (100%)

    vs

  - 1 programmer (5%) & 1 SAP super user (10%)

- Based on manual entry via PI-PI sheets
- Job functions: develop, test, support, maintain

PP-PI Sheet Maintenance

ISQL

VB —→ **DB**

Units

Product
Independent

| PI Sheet A1	PI Sheet A2	PI Sheet A3	PI Sheet B3a
Unit A	Unit A	Unit A	Unit B
Prod 1	Prod 2	Prod 3	Prod 3a

Error Propagation

- Error correction:
  - Rolling back the error
  - Adding the correct messages

- 20 mins   1 instruction repair
- 1 hr   1 instruction on multiple rolls
- 12 hr   Cross shift coordination
- 24 hrs   >50 rolls
- 48 hrs   >100 rolls

Support/Problem Resolution

- Check for incomplete orders (daily)
- Review error log (daily/on-demand)
- Load BOMs into SAP and PI-SAP (on-demand)
- Correct problems and retry failed orders (on-demand)
  - BOM correction
  - Operator entry correction

Key Learnings
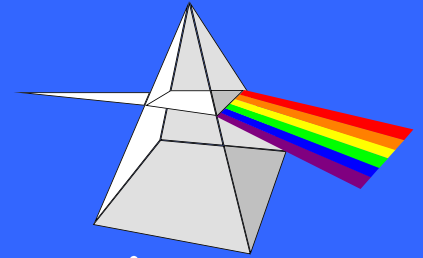
- Just "*Had*" to integrate evolved to wanting to
- Integration is far more than a simple data pipe
- Evolved away from a labor-intensive off-the-shelf design
- Integration: systems and people… requiring a higher commitment to teamwork
- SAP control recipe is not a DCS control recipe
- Learn to archive SAP before startup

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In Summary

- SAP and control systems have awesome capabilities, but integration is individual

- Design across platforms, not simply within a platform or at their interface points

- Include automated contingencies for planned and unplanned SAP outages (4 hrs)

- Potential: Genealogy, PI Futures

By the Way

Unexplained problems are by default the integration programmer's fault…

Even if there is no integration in that area!