Multi BOM Configuration Management

GLOBAL PRODUCT DATA
INTEROPERABILITY
SUMMIT
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ELYSIUM   Parker Aerospace   NORTHROP GRUMMAN   BOEING

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Multi BOM Configuration Management

- **Introductions**
- **Complexities of CAD and Multi BOM integration**
- **Configuration Control Zones (CCZ)**
- **Establishing Use Cases**
- **Questions**

Introductions

- **Presentation created as a collaboration between aerospace companies (CIMData Aerospace and Defense Action group)**

- **Key Contributors**
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  - **Benoit Plante (Airbus)**
  - **Ian Gilkerson (Boeing)**
  - **Alek Przybylo (Boeing)**

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- **The aerospace industry is working with the CIMdata group to collaborate on areas where we agree to work on commonality.**
- **Sub teams were formed to prototype use cases and report out findings.**

- **Examples:**
- **CAD data standards**
- **Multi BOM accountability**

- **What we have learned so far…..**
  - **After several discussions between Boeing and Airbus on multi BOM accountability (EBOM/MBOM), we discovered that we first needed a good way to communicate concepts. A way to communicate conceptual EBOM and MBOM architecture.**

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- We discovered we need a common "accepted" vocabulary for talking about configuration complexities. Where Processes and System integrate to manage configuration lifecycles. Boeing shared our method of using "Configuration Control Zones"

- Configuration Control Zones (CCZ):
  - Definition: The data that is owned by a single revision of a configuration.
  - Examples: A revision of an assembly owns the relationships to the components and related data unique to that assembly.
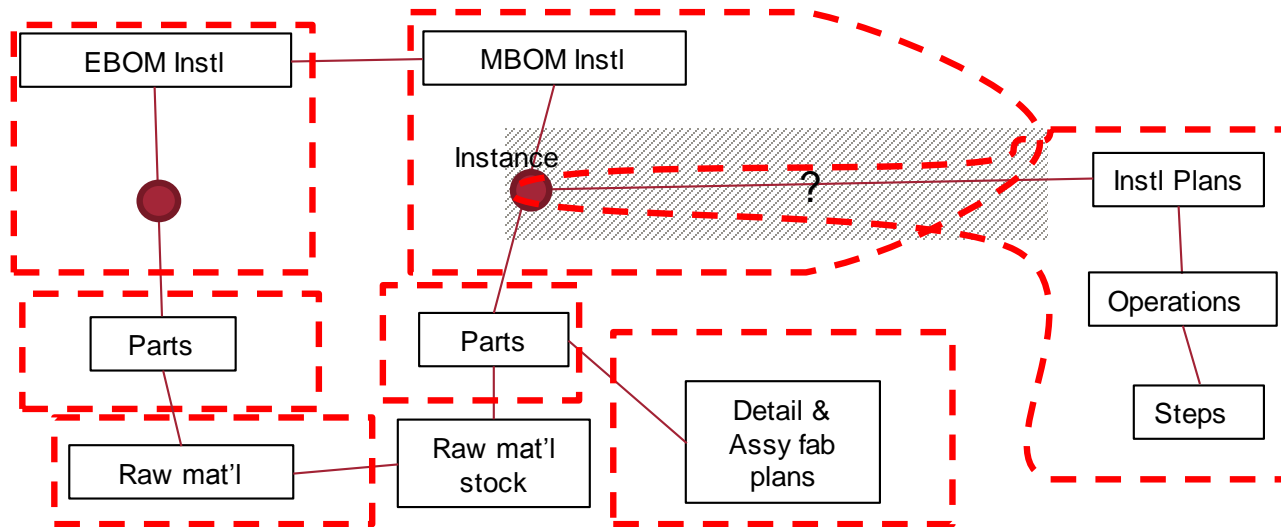
# CCZs communicate a conceptual configuration architecture
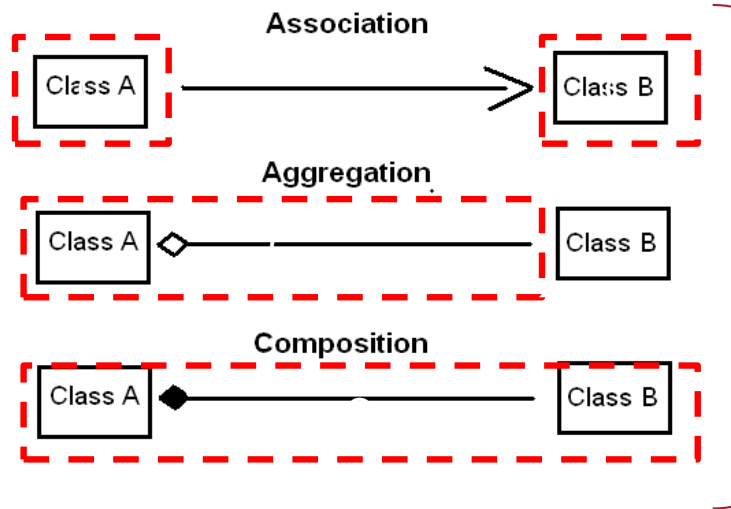
The Configuration Control Zones concept creates a language that can describe system behavior without needing to use the abstract definitions of UML.

If An arrow is used there is an Association between objects. Association is whenever the Class A object needs to know about a Class B object to perform it's functionality
Example: An airplane is associated to an engineering inspector

If the diamond is left empty, it signifies an Aggregation. Class A owns a relationship instance to Class B. But the lifecycle of B is independent of the lifecycle of A. If A is deleted, B can live independently.
**Example: A factory location aggregates airplanes that are being built.**

If the diamond is black, this means it is a Composition. Class A completely contains the relationship and the ownership of Class B. The lifecycle of Class A also controls the lifecycle of Class B. If A is deleted, B will also be deleted.
Example: And airplane is composed of an engine
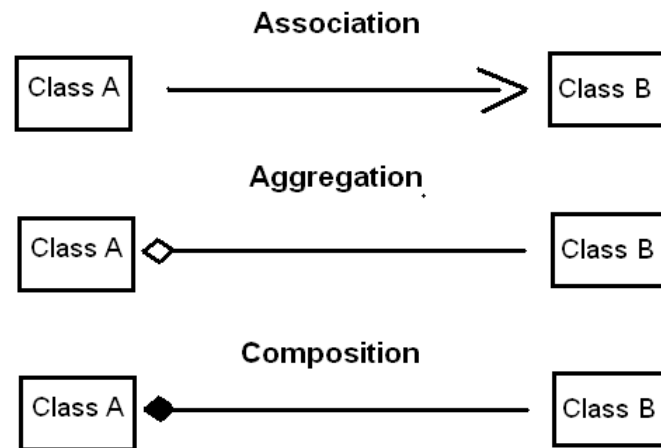
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- **The cost and complexity of implementing each new generation of PLM creates the need for the Aerospace industry to consolidate on common functionality.**

- **PLM providers create flexible capabilities for managing the variation that occurs when we integrate CAD/EBOM/MBOM.**
- **Some of this variation is created by "opposing forces" that drive customizations in PLM because there is no industry standard or best practice.**

- **The pain points we all experience – the opposing forces:**
  - **Flat vs. Hierarchical product structures**
  - **Filtered configuration by option vs. persistent definition**
  - **Internal tabulation (150% BOM) vs. part number control**
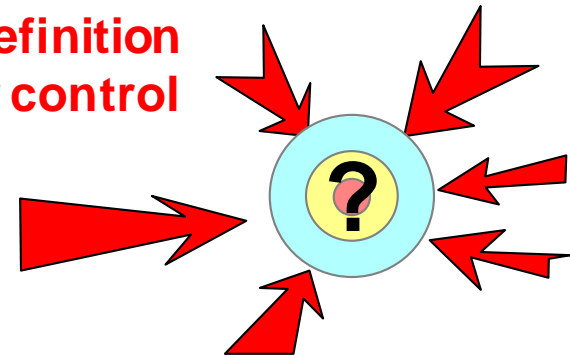
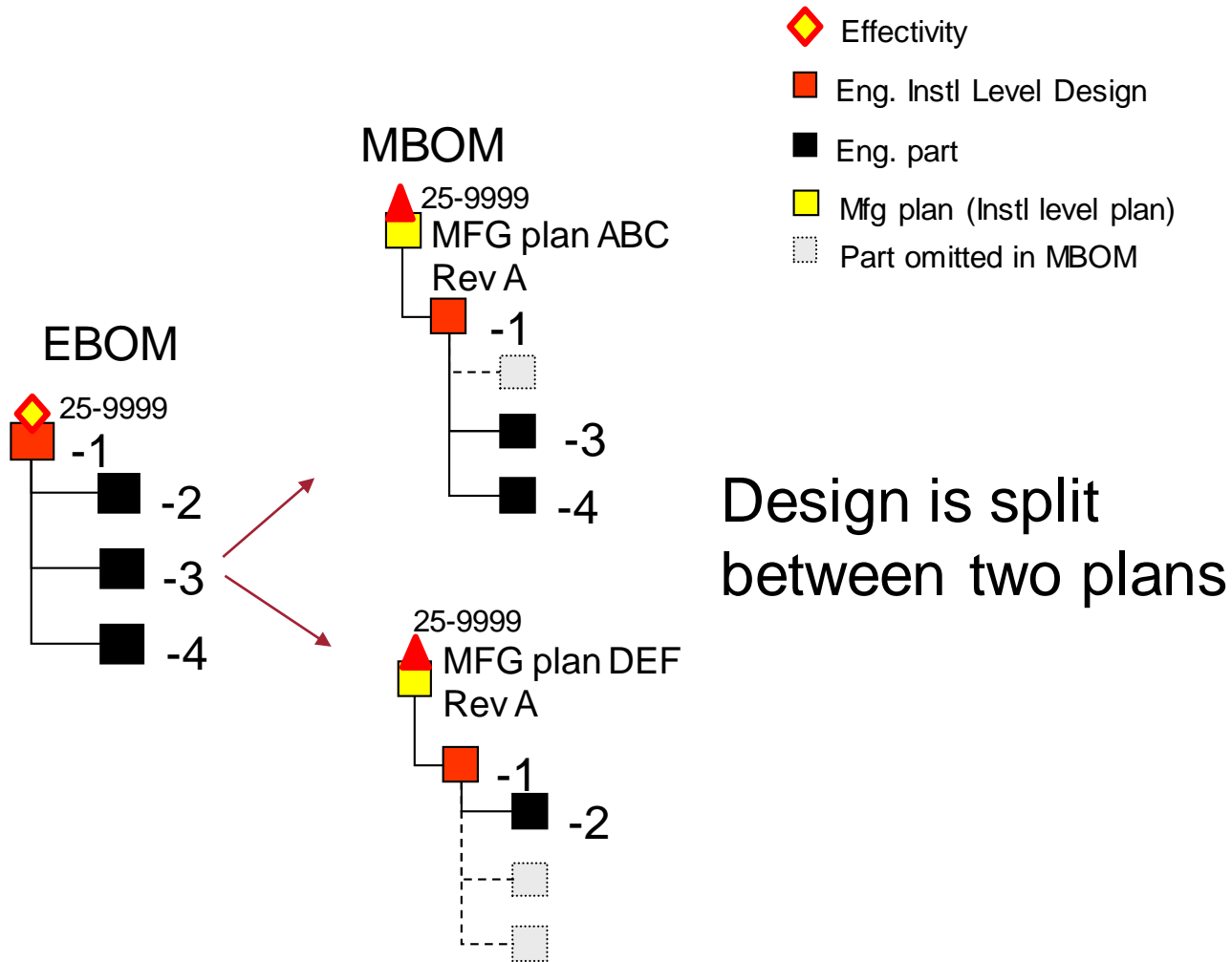# Multi BOM Configuration Management - EBOM and MBOM Concepts
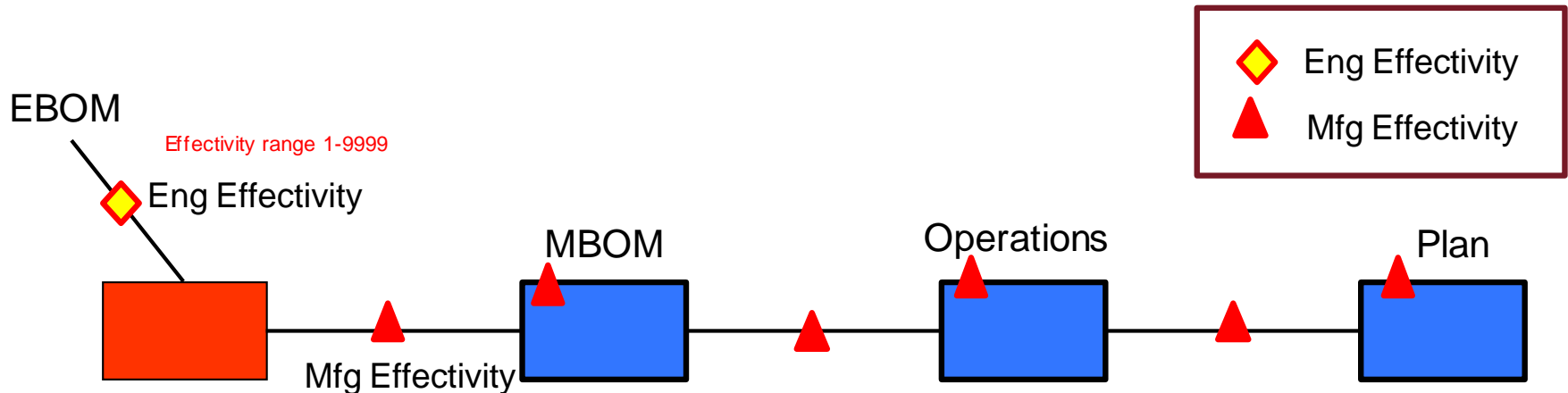
- **PLM systems allow effectivity on objects and relationships without a common schema to ensure accountability. Without an industry best practice in this area, every company must create internal effectivity schemas that are very difficult to change once implemented.**

- **There are many different approaches to simplifying this problem.**
1. **Create PLM customizations to keep the EBOM and MBOM reconciled <u>prior to release</u>. (Boeing non-787 models)**
2. **Use as COTS, eliminate the MBOM and force the EBOM to manage all mfg changes (Airbus)**
3. **Use as COTS with MBOM and use reconciliation reports post release (ENOVIA/DELMIA) Boeing 787**

Split Design Use Case

Legend:
- ◆ Effectivity
- ■ Eng. Instl Level Design
- ■ Eng. part
- ▢ Mfg plan (Instl level plan)
- ▢ Part omitted in MBOM

MBOM

25-9999
MFG plan ABC
Rev A
-1
-3
-4

EBOM

25-9999
-1
-2
-3
-4

25-9999
MFG plan DEF
Rev A
-1
-2

Design is split between two plans

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EBOM

Installation

- Part 1
- Part 2
- Part 3

Boeing 787

CCZ

Plan BCD
- Part 1

CCZ

Plan ABC
- Part 2
- Part 3
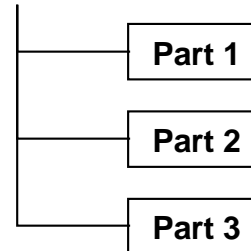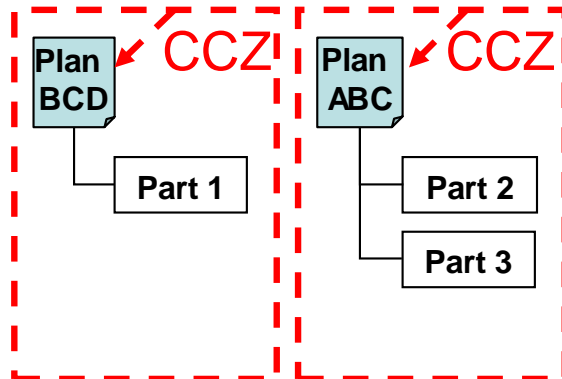
Plan CCZ owns part relationships

Boeing non-787 Programs

CCZ

Installation
- Part 1 — Plan BCD
- Part 2
- Part 3 — Plan ABC
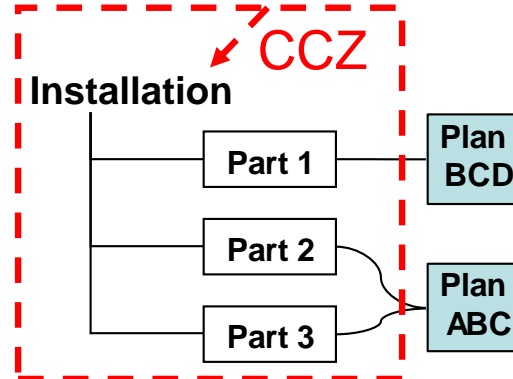
MBOM Accountability view CCZ owns part relationships

Airbus A350

CCZ

Installation
- Part 1 — Plan BCD
- Part 2
- Part 3 — Plan ABC
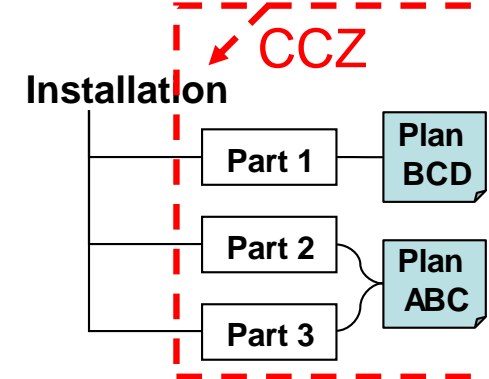
Dynamic CCZ extendable up to a defined scope

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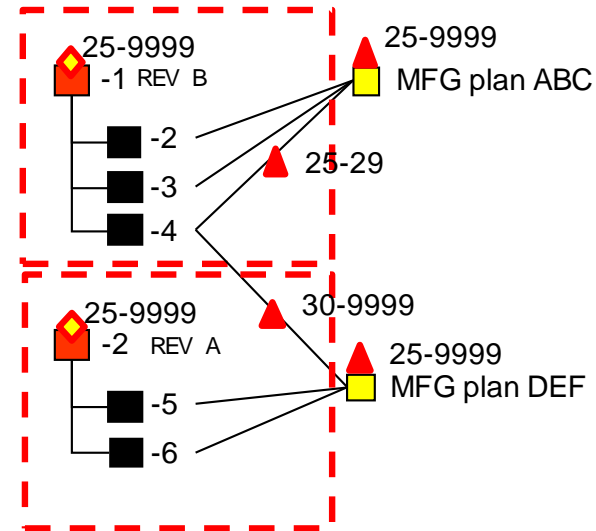- Deeper description of the method used on Boeing non-787 programs (737, 767, 747, 777)
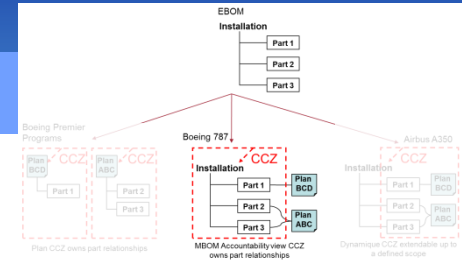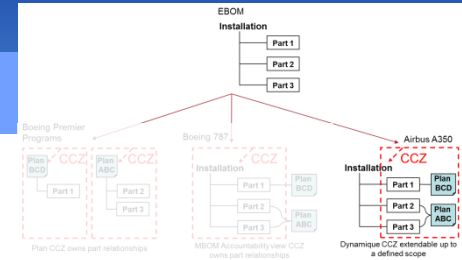
Initial State:
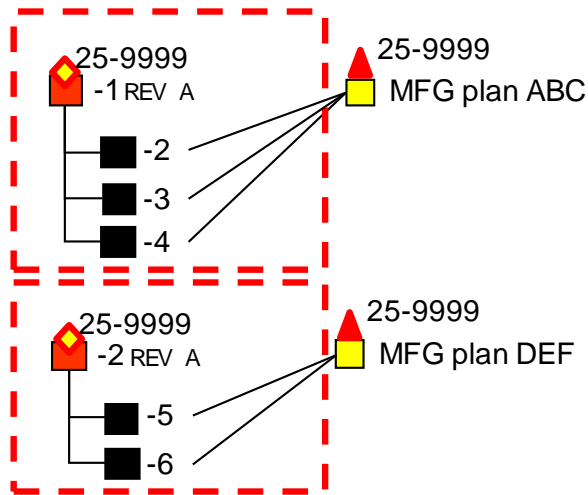
Second State:
Mixed case of splitting Installation in several manufacturing plan and merging several installation in a common manufacturing plan
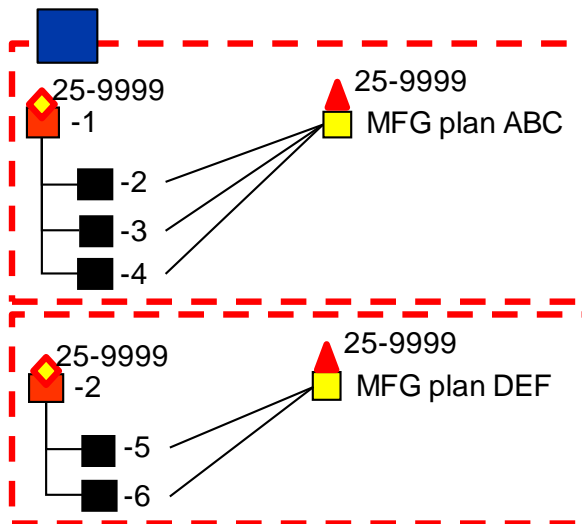
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- Deeper description of the method used on Airbus A350

Initial State:
One to one relation between manufacturing plan and installation eBOM

25-9999 -1

-2

-3

-4

25-9999 MFG plan ABC

25-9999 -2

-5

-6

25-9999 MFG plan DEF

CCZ is defined by the Installation scope

Second State:
Mixed case of splitting Installation in several manufacturing plan and merging several installation in a common manufacturing plan

25-9999 -1

-2

-3

-4

25-29 MFG plan ABC

30-9999 MFG plan ABD

30-9999 MFG plan ABE

25-9999 -2

-5

-6

25-29 MFG plan DEF

30-9999 MFG plan DEG
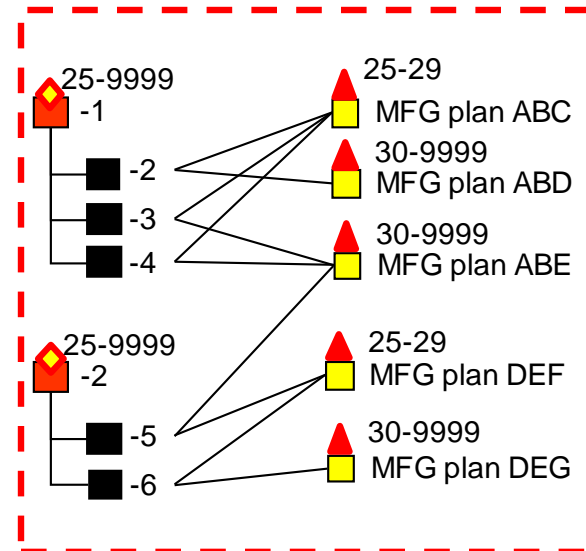
New plan managed by PNR control

CCZ is extended to the second installation: reconciliation is performed in the full CCZ perimeter

Conclusions

- **We continue to work with CIMData and the A&D Action group to mature the ideas above and statement of direction in 2017**

- **We would like to invite additional companies that would like to help us collaborate and mature these concepts**

Questions?

- **Questions or Comments?**

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