FIBRE-TO-THE-DISTRIBUTION-POINT SELF INSTALL

G.FAST SUMMIT 2014 – PARIS – MAY, 22nd 2014

FTT – what?!

- In order to offer superfast broadband to a larger customer base in a reasonable timeframe, operators have to rely on **mixed copper-fiber architectures**. This approach is becoming a solid reality **in many countries** where **it is barely impossible to push fiber up inside all the homes of all the potential customers**.
- **FTTC** is basically a "**compromise**" between **broadband performances** and **architectural limits**

> *"It's acceptable to offer to the customers 80 Mbps if we can use mini-DSLAMs in the cabinets and avoid drilling the last 500m into each building."*
> **FTTC APPROACH**

FTTdp is based on the idea of
complementing the "pure FTTH" approach

1 NO COMPROMISE ON SERVICES

2 NO NEED TO PUSH FIBRE
RE-USE COPPER over the last 20, 50 or more meters

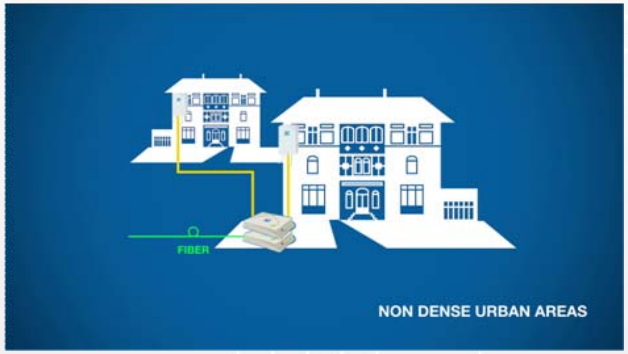
3 EASY and FAST DEPLOYMENT

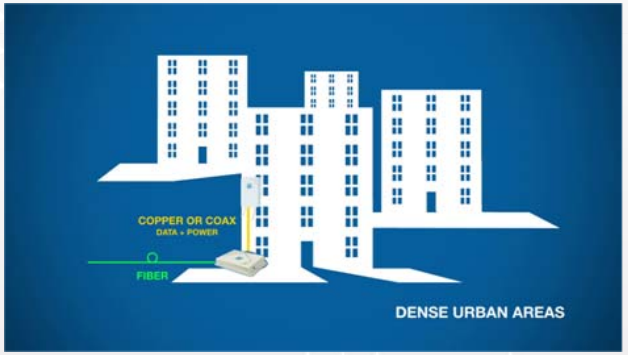
FTTdp AND REVERSE POWER FEEDING CONCEPTS

- **FTTdp** is deployed by installing "**micro-DSLAMs**" at the last copper distribution point **for single users or up to 4, 8 or more ports**, using **G.Fast over copper**

- FTTdp nodes are **not powered locally,** but **reverse powered from the customer premises over the same copper pair used for data connectivity**.

- **Reverse Power Feeding** in the FTTdp architecture is done thanks to **dedicated power supply units** (or even integrated in the CPE) placed **inside the home of the customer and connected to the telephone plug in order to inject power to the FTTdp node**.





WE'RE IN AN UNKNOWN TERRITORY

- **Reverse Power Feeding injects power from inside the home through the existing copper wiring**, it means that the power source is inside an "unknown territory" connected to the home network.

REGULATORY ISSUES

- In-house wiring could be operated as a **TNV-1 (or even a SELV, not exposed), which means a circuit with maximum 60V@250mA (15VA).** A Remote Power Injector would initially inject a test signal to check that there's an authorized power drainer before entering into full operation.
- **It must stop powering if it senses there is something external present in the network in order to avoid damaging anything connected in one of the home sockets.**

CUSTOMER PERCEPTION

- The customer needs also to be reassured that **the amount of power drained from his house is somehow "acceptable"** and similar to the power consumption of any other device they already know and own, like a set-top box or a the G.Fast modem itself.

ETSI is defining Reverse Power Feeding (RPF) architecture, suggesting a scheme derived from PoE.
RPF won't inject power if it's not feeding the FTTdp node at the distribution point.
FTTdp nodes have power consumption below 10W, acceptable from both an architectural point of view and a customer perception perspective.

…WE'RE NOT DRILLING, SO WHY ENTER THE HOMES AT ALL?

- FTTdp has been designed in order to avoid all the problems that could give uncertainty to service availability in different areas and service activation lead times.

- The **customer** must be able to **install and activate** all the new hardware needed by himself without scheduling an appointment with an engineer, **just like good old ADSL**. This will avoid:
  - **hassle for the customer** and time (4 hours appointment, need to get time away from work…)
  - **cost** for **the operator**
  - eventual cost for the customer

- **FTTdP needs to be deployed** as "**self-install**" for the enduser

A “SELF-INSTALL” TECHNOLOGY

- **FTTdp** installation must feel **"just like" an ADSL** activation for a new customer.

- **Operators must feel safe sending the power supply to the customer by mail and having that customer plug it into wall by himself**

- This mandatory "self-install" requirement drives a number of technological challenges:
  - reverse powering mechanism
  - **safety concerns**
  - **migration scheme** from and to the old connectivity

- Having the customer connect the reverse power feeder by himself assumes that the **FTTdp nodes at the distribution point**:
  - Have been **installed by an engineer without contacting the customer and giving him a minimal, or completely absent, service interruption**.
  - Are able to be **transparent while unpowered**. In other words, if the customer has no reverse power feeder connected, he should be able to still use his old POTS or ADSL, at least up to the moment when he will switch to FTTdp by connecting the reverse power feeder.
  - Are able to automatically disconnect the user from his old service at start-up and to connect him back to the old service if suddenly power is lost.

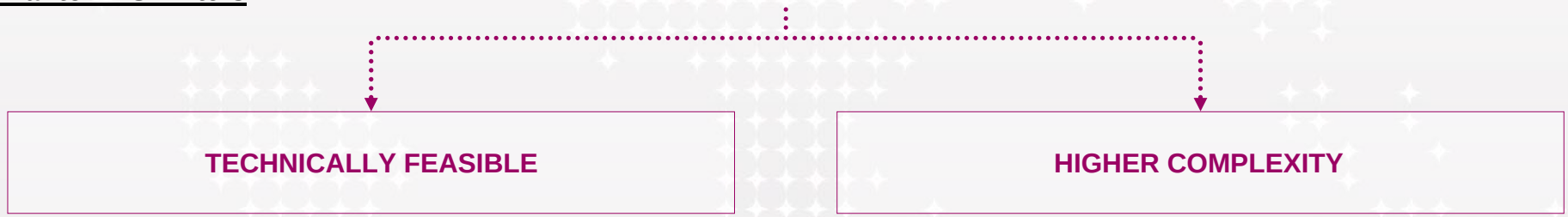
SHOULD WE CARE ABOUT POTS? AFTER ALL, IT'S "FTTH"…

- **Fibre-to-the-Distribution-Point** architecture and **Reverse Power Feeding** take into account the possibility of **maintaining POTS services** to the customer

- **ETSI work on Reverse Power Feeding includes this scenario**, proposing a solution to all the challenges that come from the cohexistence of Reverse Powering and POTS signalling in the same loop: **POTS signalling has to be stopped at both the Distribution Point and Reverse Power Feeder and regenerated (different options available)**

- POTS survivability also raises a number of questions regarding how to manage the coexistence of telephones in the home network with the power injected: if the home network is not separated from the building loop, **Reverse Powering will be injected to all the sockets in the house**

- **Reverse Power Feeding "standard-to-come" proposes the possibility to use Phone Adapters, active elements Powered by the RPF that will intercept and regenerate the signalling**.This won't affect the self install requirement, as they would be **similar to ADSL filters**.



LET'S START WITH A SINGLE PORT DEVICE, NO POTS…

- **FTTdp installation** is performed in **two asynchronous steps** in order to **grant service continuity** to the customer with the "**OLD**" service (ADSL, POTS…):
  - **AFTER** the installation of the FTTdp node at the distribution point
  - **BEFORE** the connection of the RPF in the home of the customer

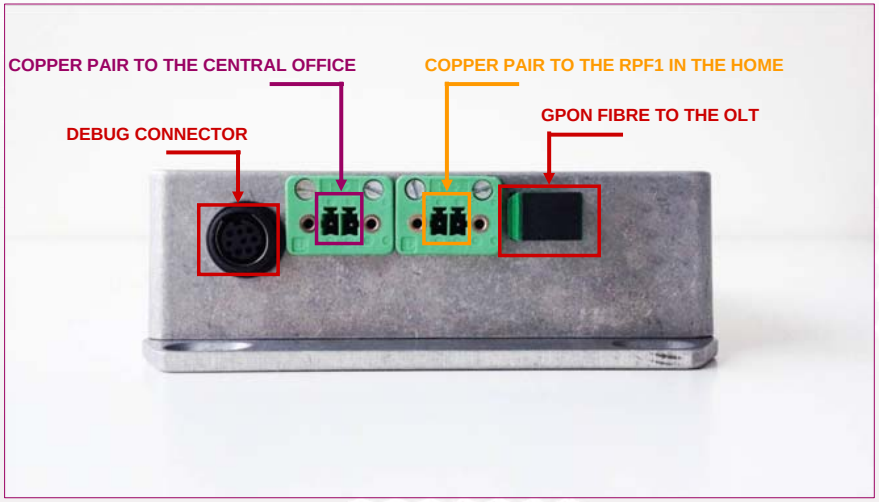


Figure1: FTTdp node connectors

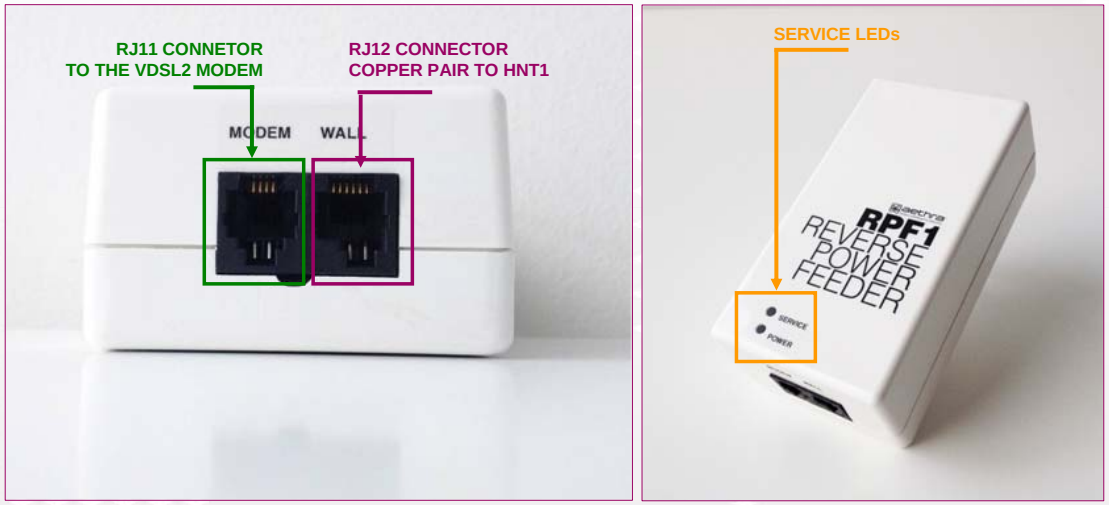


Figure 2: RPF connectors and LEDs

INSTALLATION PROCEDURE STEP 1: THE DP

FTTdp

ZERO TOUCH INSTALLATION STEP 1

1

ENGINEER INSTALLS (AND TESTS) THE FTTdp NODE AT THE DP WITH VERY SHORT / NONE “OLD” SERVICE INTERRUPTION FOR THE USER.

USER PROFILE IS READY IN THE NMS.

2

AFTER THE ENGINEER LEAVES, THE SYSTEM IN NOT POWERED AND PASSTHROUGH

3

THE USER STILL MAINTAINS HIS OLD SERVICE UNTIL HE RECEIVES THE RPF FROM THE OPERATOR

INSTALLATION PROCEDURE STEP 2: THE HOME

FTTdp

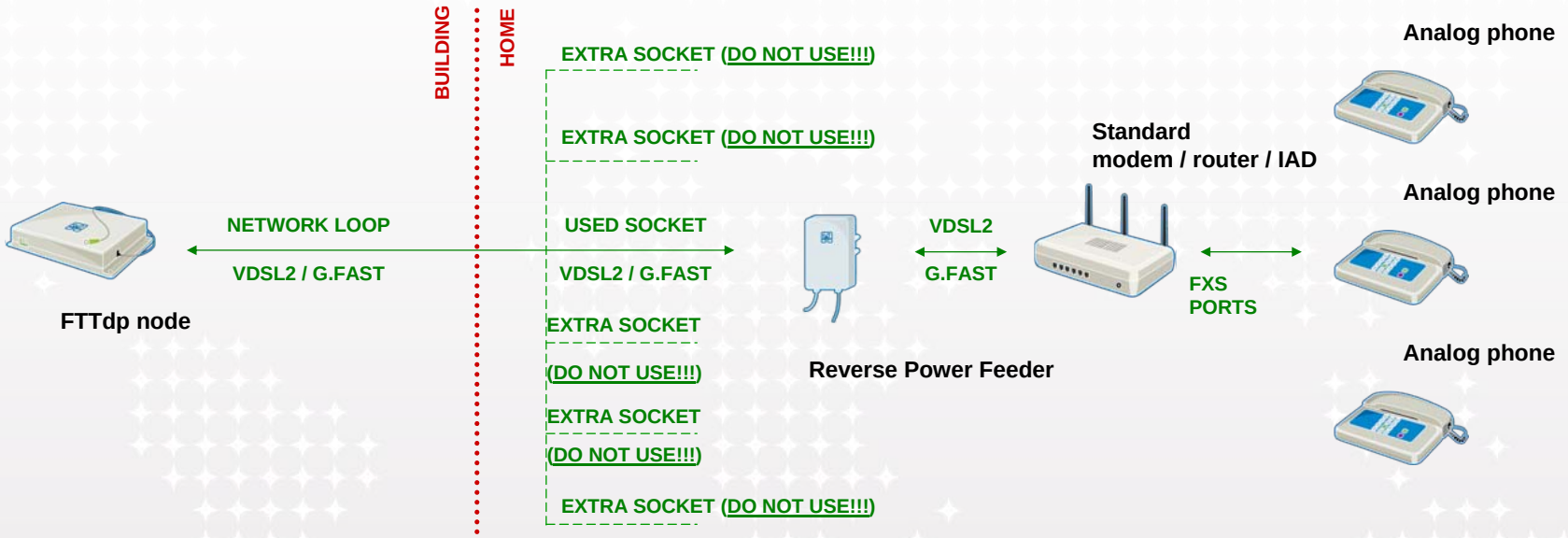
ZERO TOUCH INSTALLATION STEP 2

1. THE OPERATOR SENDS RPF, EVENTUALLY MODEM AND INSTRUCTIONS TO THE CUSTOMER
2. THE CUSTOMERS PLUGS THE RPF AND THE MODEM
3. FTTdp SYSTEM IS POWERED ON, AUTOMATICALLY DISCONNECTS THE CO SIDE AND ACTIVATES WITH THE OLT (INCLUDING SW UPGRADE, CONF DOWNLOAD…)

WHAT HAPPENS IN THE HOME (WHEN NO POTS IS INVOLVED)?

- Installation can be easily performed without the need for an engineer appointment
- **Voice services** are provided through VoIP and so **using FXS ports on the CPE / IAD**

ANY PHONE, FAX OR DEVICE MUST BE CONNECTED TO ONE OF THE FXS PORTS OF THE VDSL2 IAD
ANY OTHER SOCKET INSIDE THE HOME NETWORK (IF PRESENT) IS NOT WORKING AND USELESS ANYWAY



WHAT HAPPENS IN THE HOME (WHEN NO POTS IS INVOLVED)?

WHAT HAPPENS IF SOMETHING IS CONNECTED TO THE "EXTRA" SOCKETS?

ANALOG PHONE, ON-HOOK

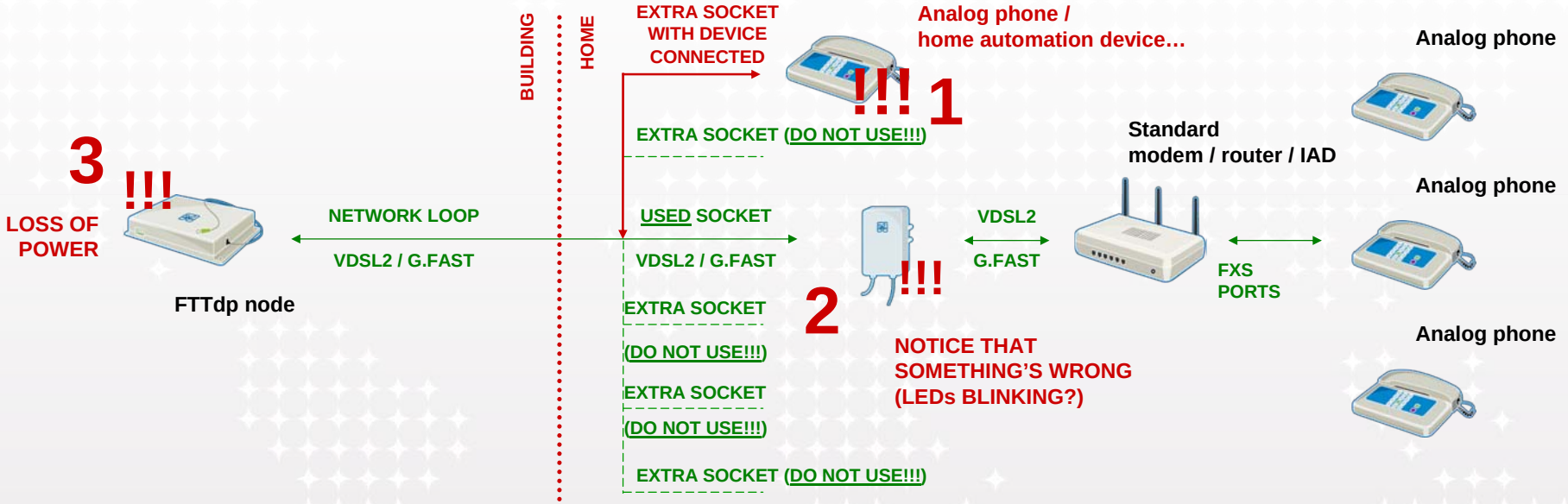
- The phone can't receive or make calls but **as soon as it stays on hook, everything works as normal**

ANALOG PHONE, OFF-HOOK

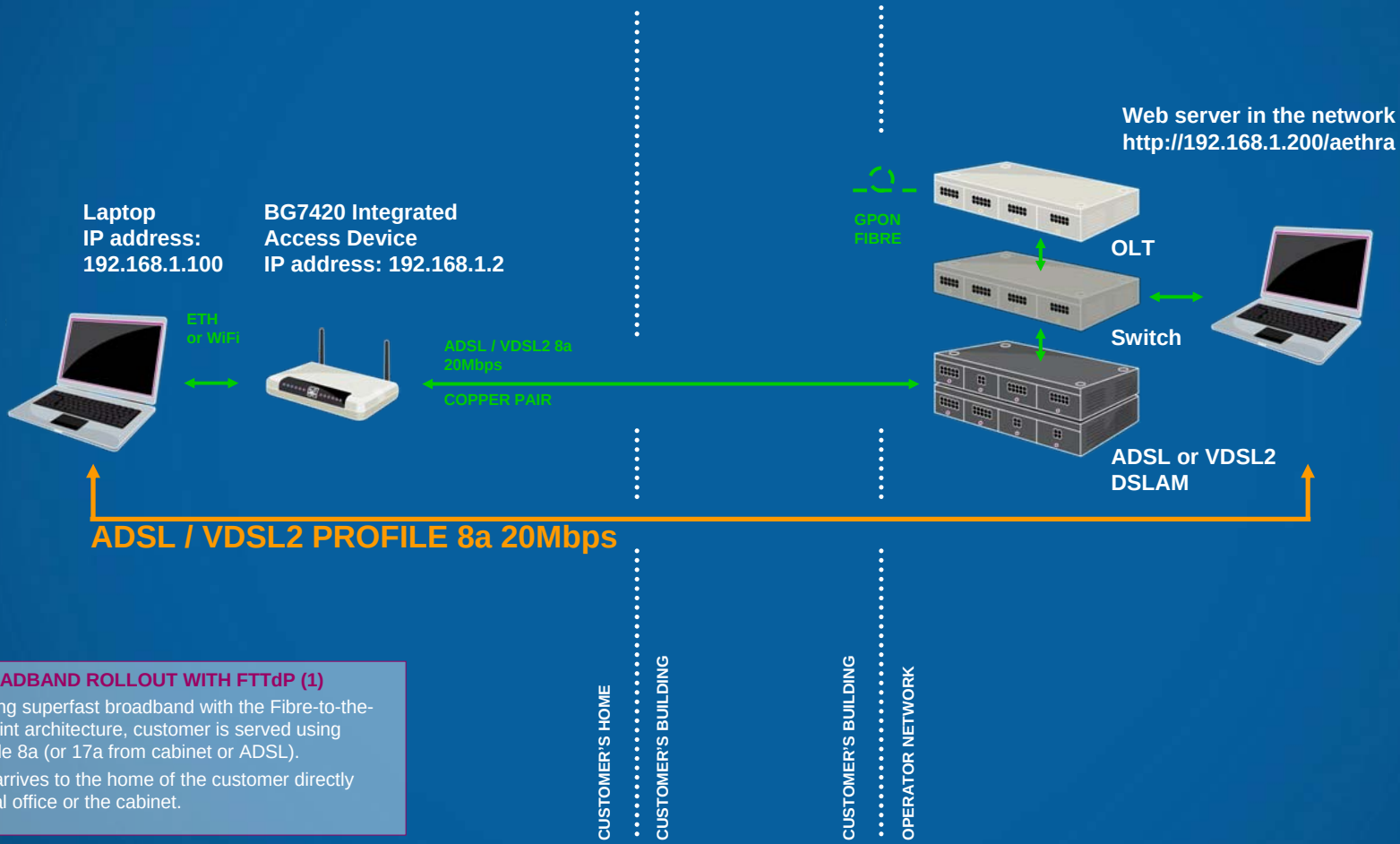
- If off hook, the phone closes the loop powering off the FTTdp node.

HOME AUTOMATION DEVICES

- Home automation devices making service calls MUST be connected to the FXS ports of the IAD; door openers using off hook signals won't work anymore



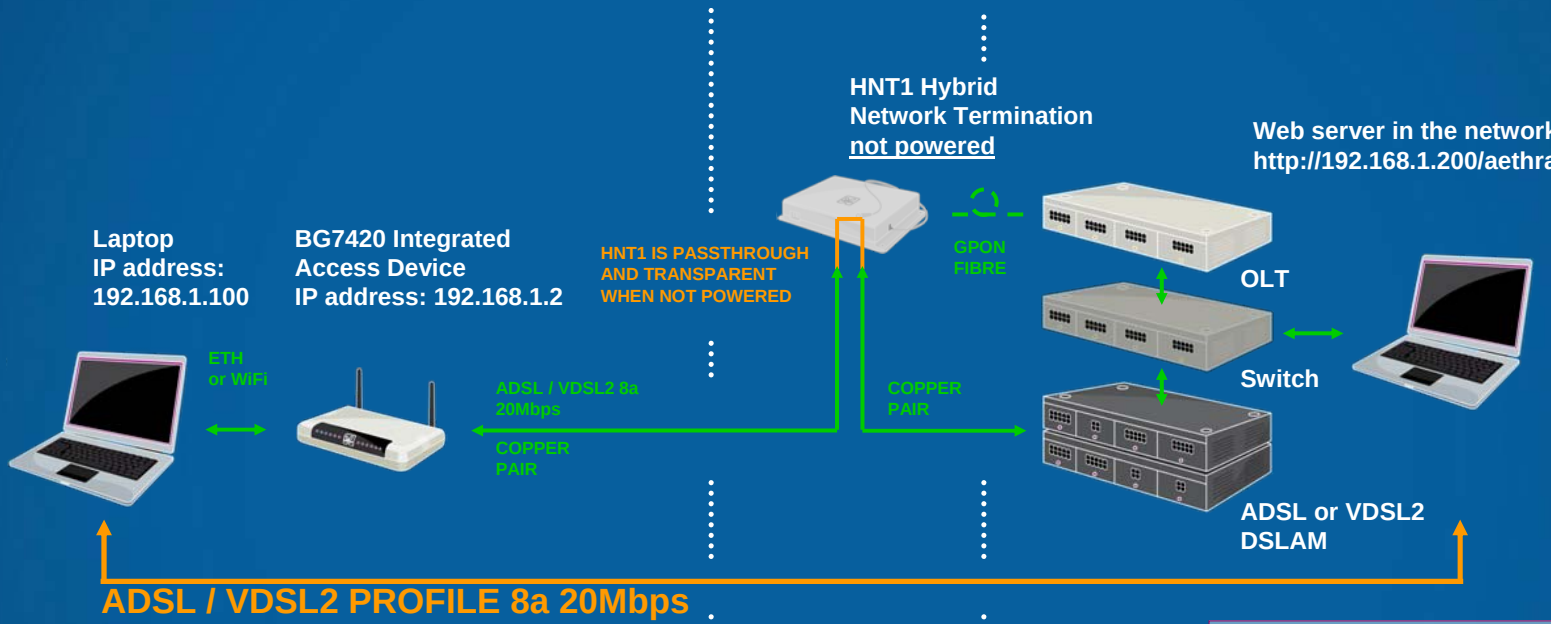
FTTdp INSTALLATION DEMO AT OUR DESK



SUPERFAST BROADBAND ROLLOUT WITH FTTdP (1)

- Before deploying superfast broadband with the Fibre-to-the-Distribution-Point architecture, customer is served using VDSL2 in profile 8a (or 17a from cabinet or ADSL).
- Copper cable arrives to the home of the customer directly from the central office or the cabinet.

FTTdP INSTALLATION STEP 1



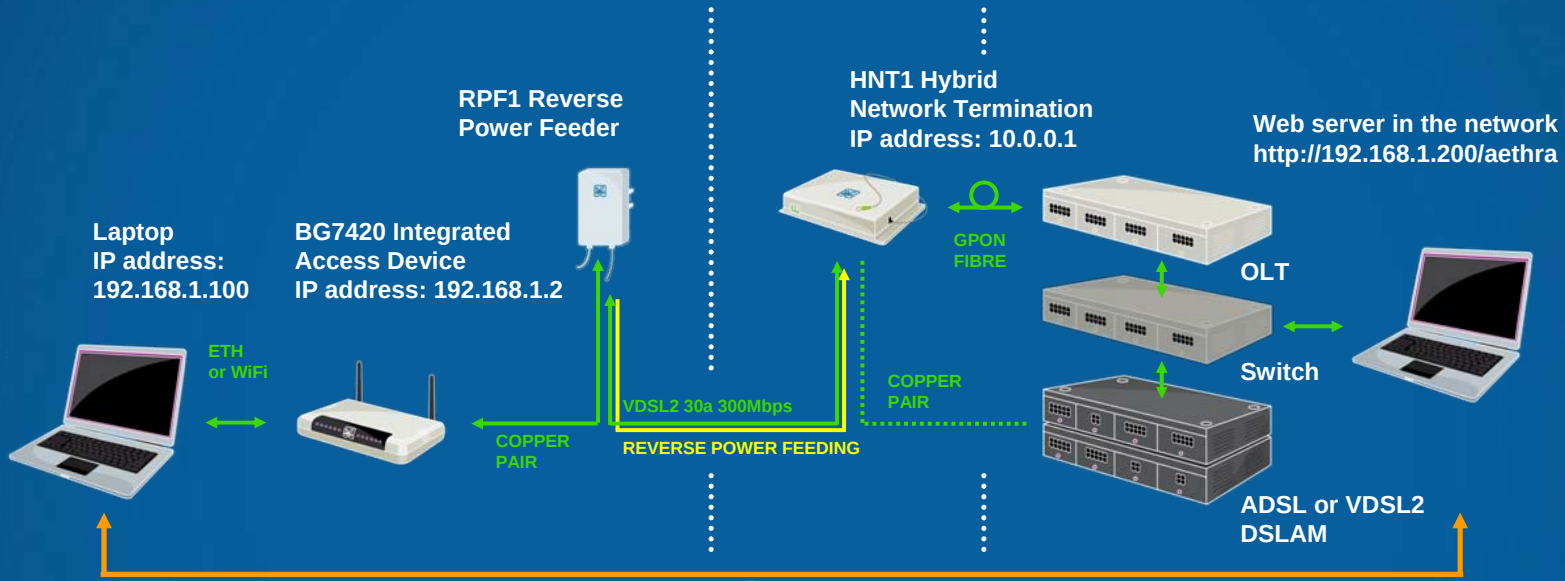
SUPERFAST BROADBAND ROLLOUT WITH FTTdP (2)

- When fibre rollout is completed up to the basement, building floor or pole, it is possible to offer superfast broadband to the customers using FTTdP.
- Installation can be managed in two steps without:
  - drilling any further
  - scheduling an engineer appointment

FTTdP INSTALLATION STEP 1

- The engineer installs the HNT1 board at the distribution point; the HNT1 board is still not powered
- The engineer cuts the copper pair and insert the two endings in the HNT1
- When not powered, HNT1 is passthrough; galvanic continuity of the copper pair and old service is restored.
- Service disruption for the customer due to the installation procedure is minimal and lasts less than 5 mins: just cut, reconnect and go showtime again

FTTdP INSTALLATION STEP 2



FTTdP INSTALLATION STEP 2

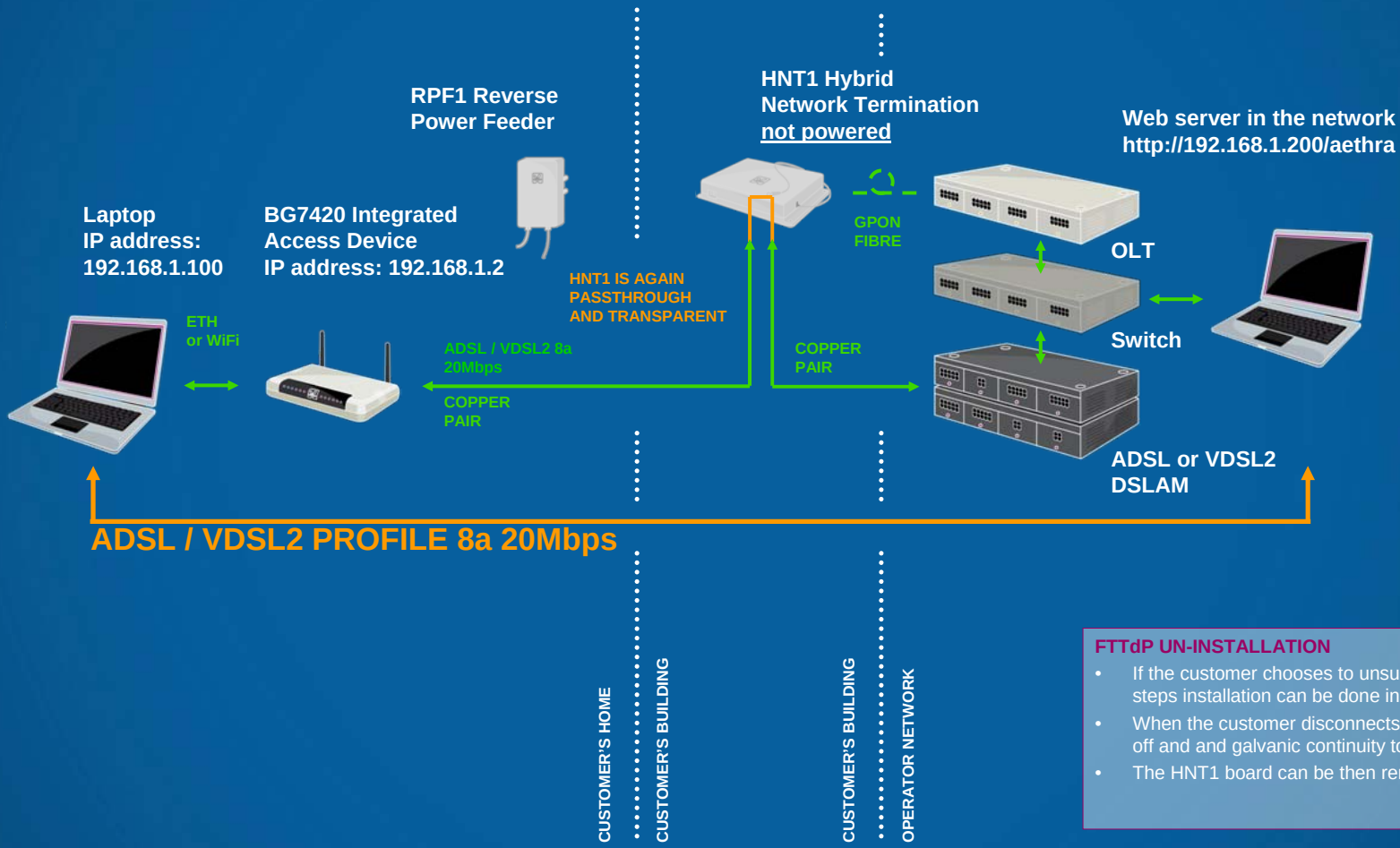
- The customer receives the RPF1 and plugs it to the power socket
- The customer disconnets the modem from the master socket and connectes it to the RPF1 RJ11 socket which becomes the “new” master socket

CUSTOMER'S HOME | CUSTOMER'S BUILDING | CUSTOMER'S BUILDING | OPERATOR NETWORK

FTTdP INSTALLATION STEP 2 (continues)

- The customer connects the RPF1 to the wall master socket using the RJ12-to-RJ11 cable provided with RPF1
- Current flows through the building loop powering the HNT1 previously installed at the distribution point
- The HNT1 disconnects the central office from the customer and start providing broadband access in VDSL2 profile 30a with 250Mpbs fibre-like darates
- There is no need to change the modem

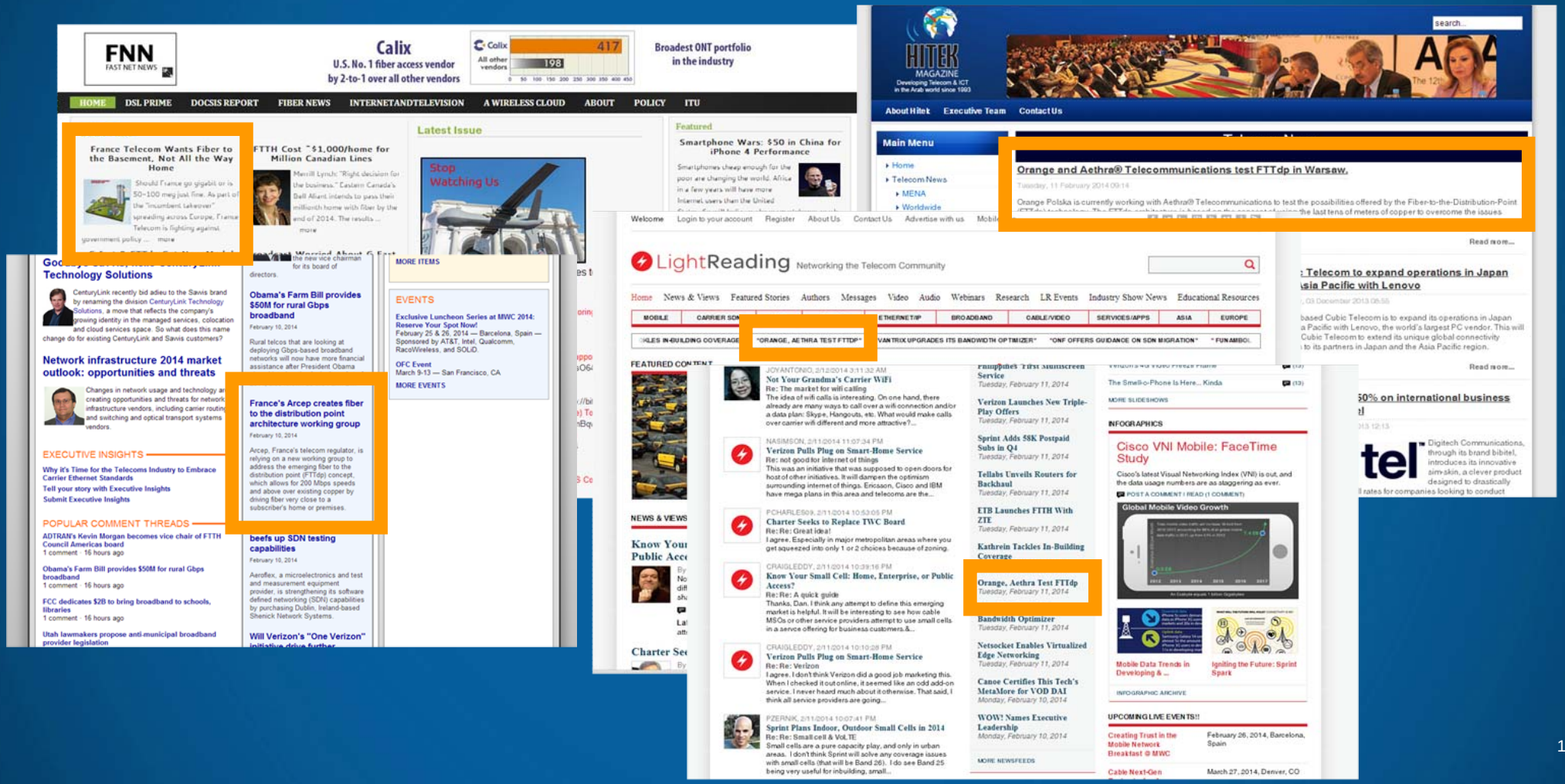
FTTdP UN-INSTALLATION



FTTdP UN-INSTALLATION

- If the customer chooses to unsubscribe the service, the two steps installation can be done in reverse
- When the customer disconnects the RPF1, HNT1 is switched off and and galvanic continuity to central office is restored
- The HNT1 board can be then removed to be reused

ORANGE POLAND FTTdp FIELD TRIAL IN WARSAW



FTTdp TRIAL IN WARSAW: FACTS AND KPIs…

- **20 Aethra® Telecommunications HGV1 Access System deployed in a University Campus in Warsaw as a part of an Orange Poland FTTdp evaluation project**
- Started in January 2014, still ongoing (ending in June 2014)
- Test FTTdp systems stability & reliability
- Test FTTdp systems available functionalities & remote management
- **Compare user experience between FTTdp and pure FTTH** (other users in the Campus are connected in FTTH)
  - **Testing both VDSL2 profile 17a and a pre-release of profile 30a Annex P (200Mbps downstream speeds)**

TEST FTTdp INSTALLATION PROCESS AND CUSTOMER SELF INSTALL
(RPFs AND MODEM GIVEN TO THE STUDENTS)

ENGINEER TIME AT THE DISTRIBUTION POINT TO INSTALL ONE SINGLE DPU IS AROUND 30min.
(CAN ANYWAY BE OPTIMIZED)

NO TECHNOLOGICAL ISSUES ON THE SELF INSTALL PROCEDURES, JUST HUMAN ERRORS / "WEIRD" BEAHVIOURS
(PEOPLE DO NOT READ MANUALS!)

WHAT ABOUT MULTI-PORT SYSTEMS?

- **Reverse Power Feeding** technology **MUST handle power sharing**
  - **one single reverse power feeder** unit (RPF1, what you plug to the wall in the subscriber flat / apartment) can **power up an entire board** with one channel active
  - if an **extra user** is activated, **his power feeder contributes to the feeding of the boards**, **sharing the power consumption with the other ones connected and so lowering it for each one**
  - **G.Fast ports are automatically de-activated if the relative RPF is disconnected**, to avoid that customers disconnecting their power feeders would still be able to have access to the service

POWER SHARING: HOW FAIR IS FAIR ENOUGH?

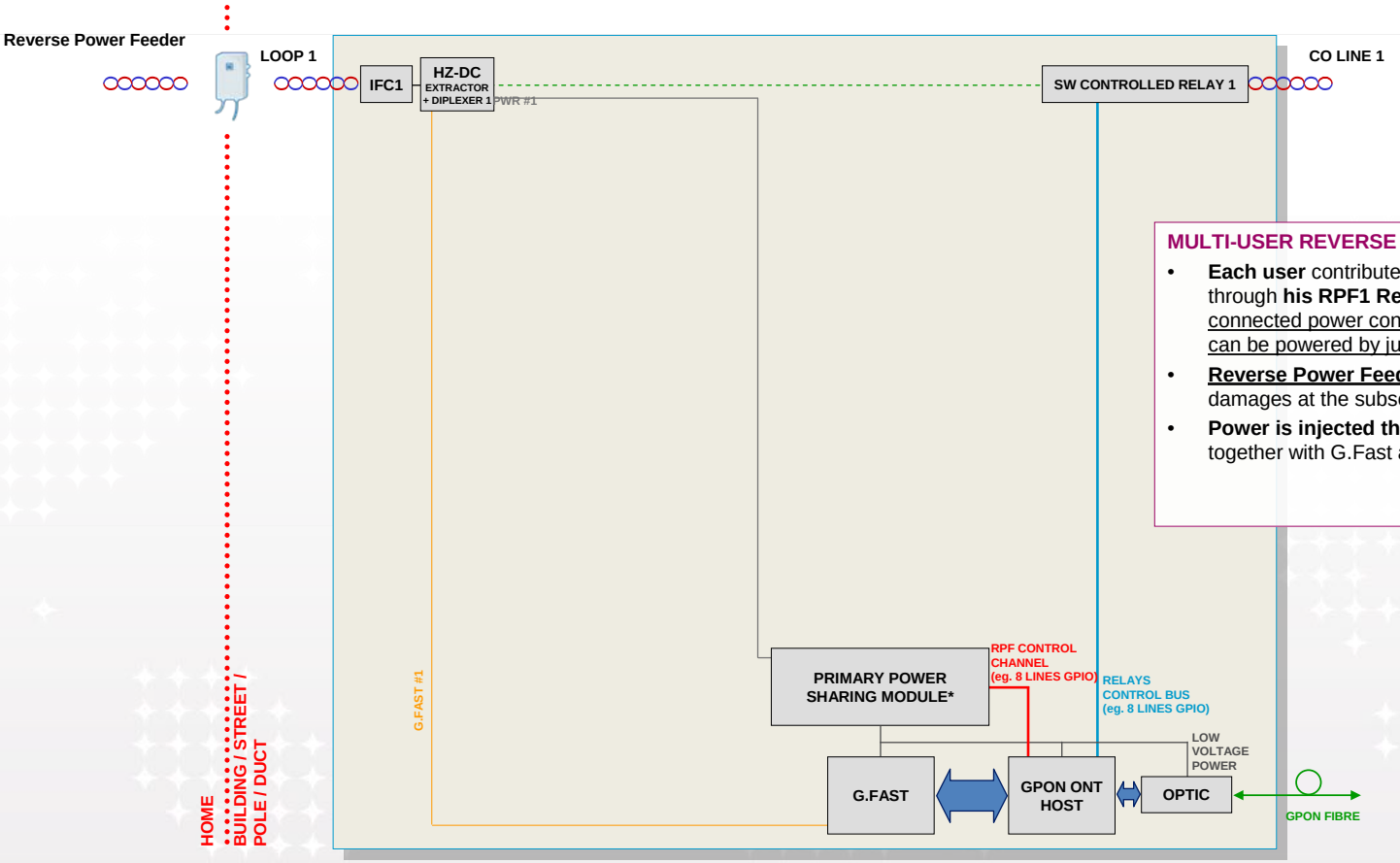
- **How much power can we drain from each customer so that it can be considered “fair”?**

- Some concepts and possible approaches:
  1. If a **user disconnects his Reverse Power Feeder, he must not be able to access the service**

  2. If more than one user is connected, the **Power drained from each one of the users connected should be equally divided, regardless of the distance or quality of the cable**

  3. Other options may include:
     - Power should be drained only if the user is actually using the service (taking advantage of G.Fast low power mode)
     - Power should be drained in relationship to the actual usage of the service (“I’m using more bandwidth, I’m providing more power”)

LET'S HAVE A LOOK AT HOW IT WORKS…



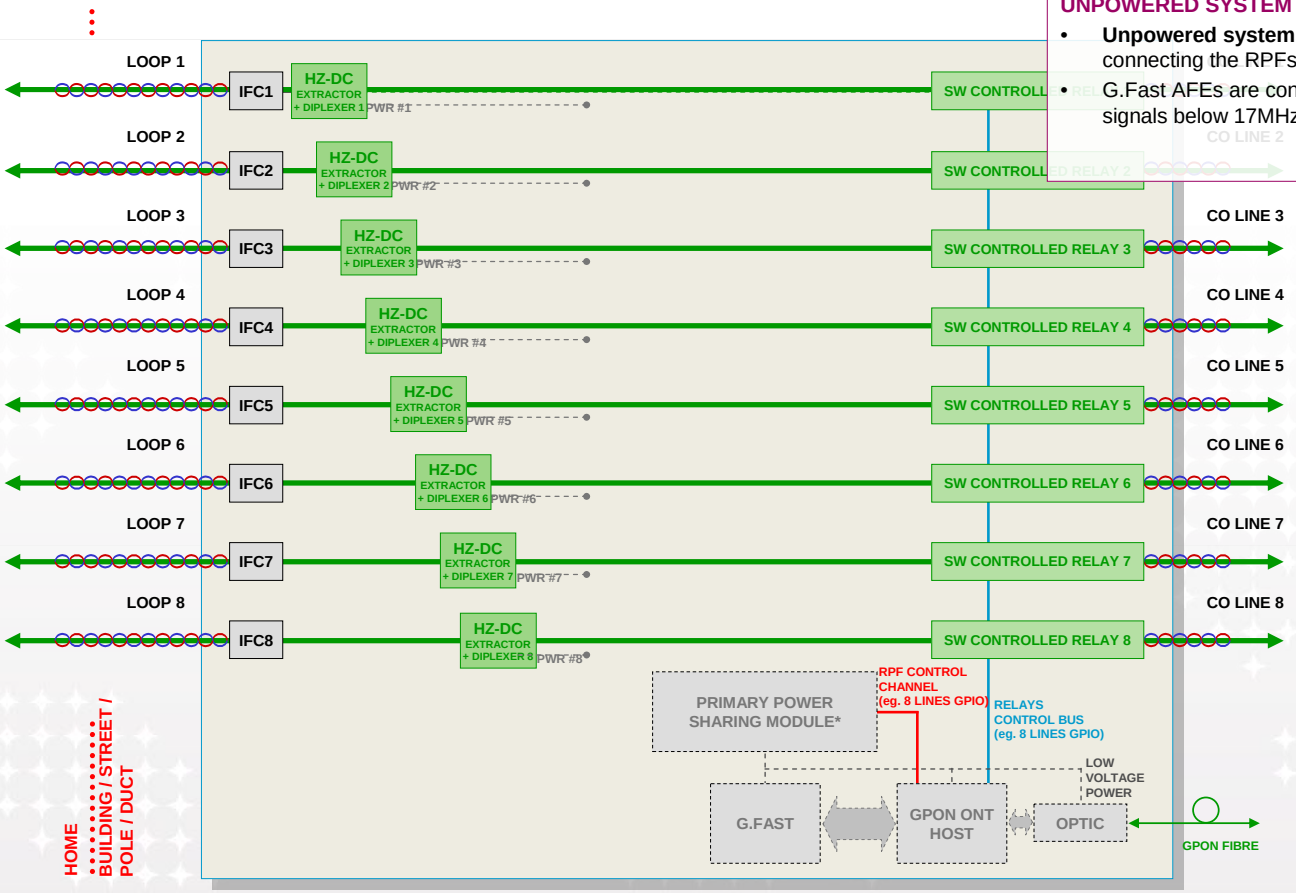
MULTI-USER REVERSE POWER FEEDING TECHNOLOGY

- **Each user** contributes to the powering of the HNT8 system through **his RPF1 Reverse Power Feeder**; if just one user is connected power consumption is less than 8W, so the board can be powered by just one RPF1
- **Reverse Power Feeding technology** prevent problems and damages at the subscriber apartment / flat
- **Power is injected through the building loop in DC**, carried together with G.Fast and extracted inside the HNT1 board

LET'S HAVE A LOOK AT HOW IT WORKS…

UNPOWERED SYSTEM IS PASS THROUGH

- **Unpowered system** is passthrough until the users start connecting the RPFs activating their service
- G.Fast AFEs are connected to line using diplexers, so that signals below 17MHz can pass through the cable

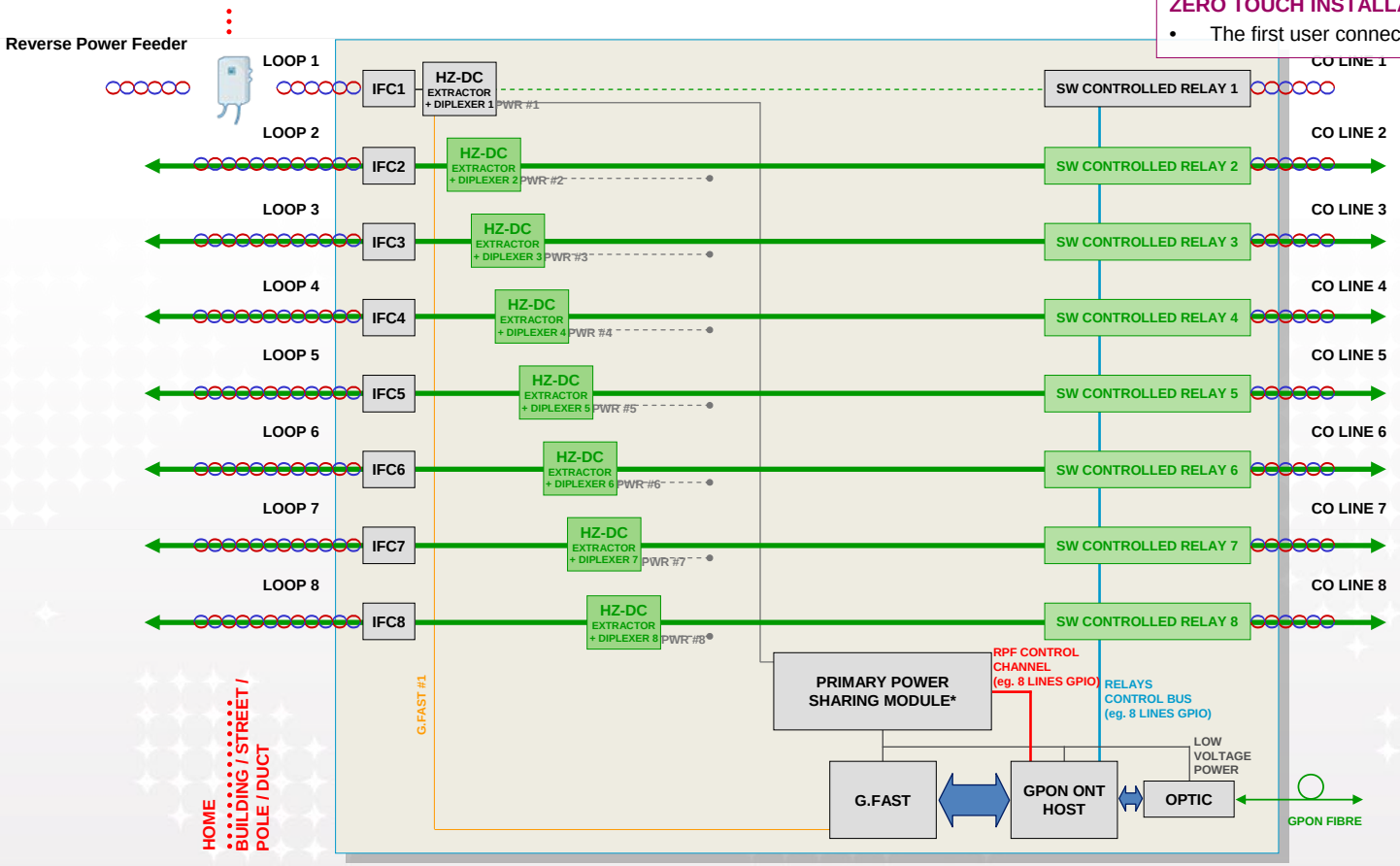


aethra telecommunications

LET'S HAVE A LOOK AT HOW IT WORKS…

ZERO TOUCH INSTALLATION

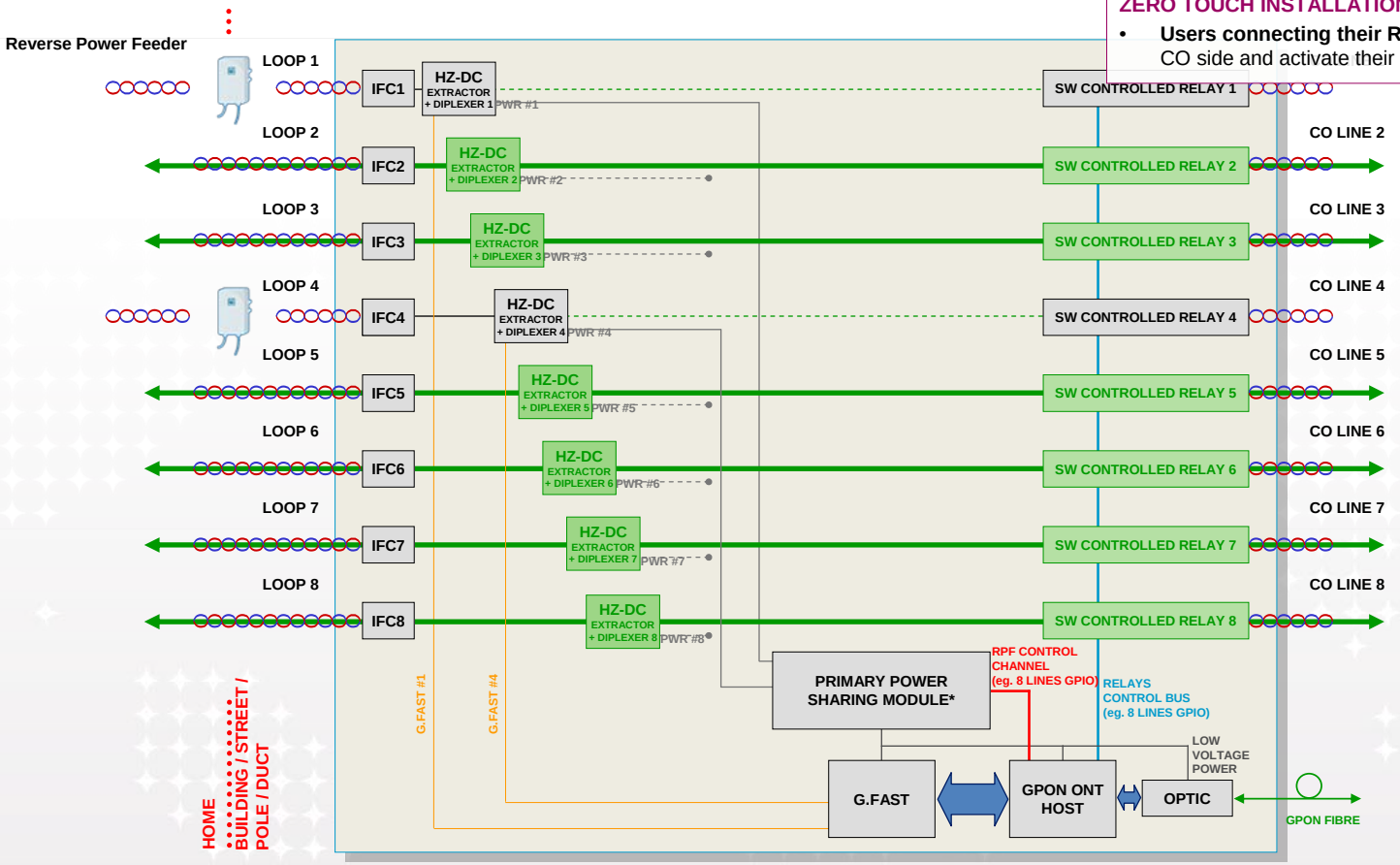
- The first user connection activates the boards



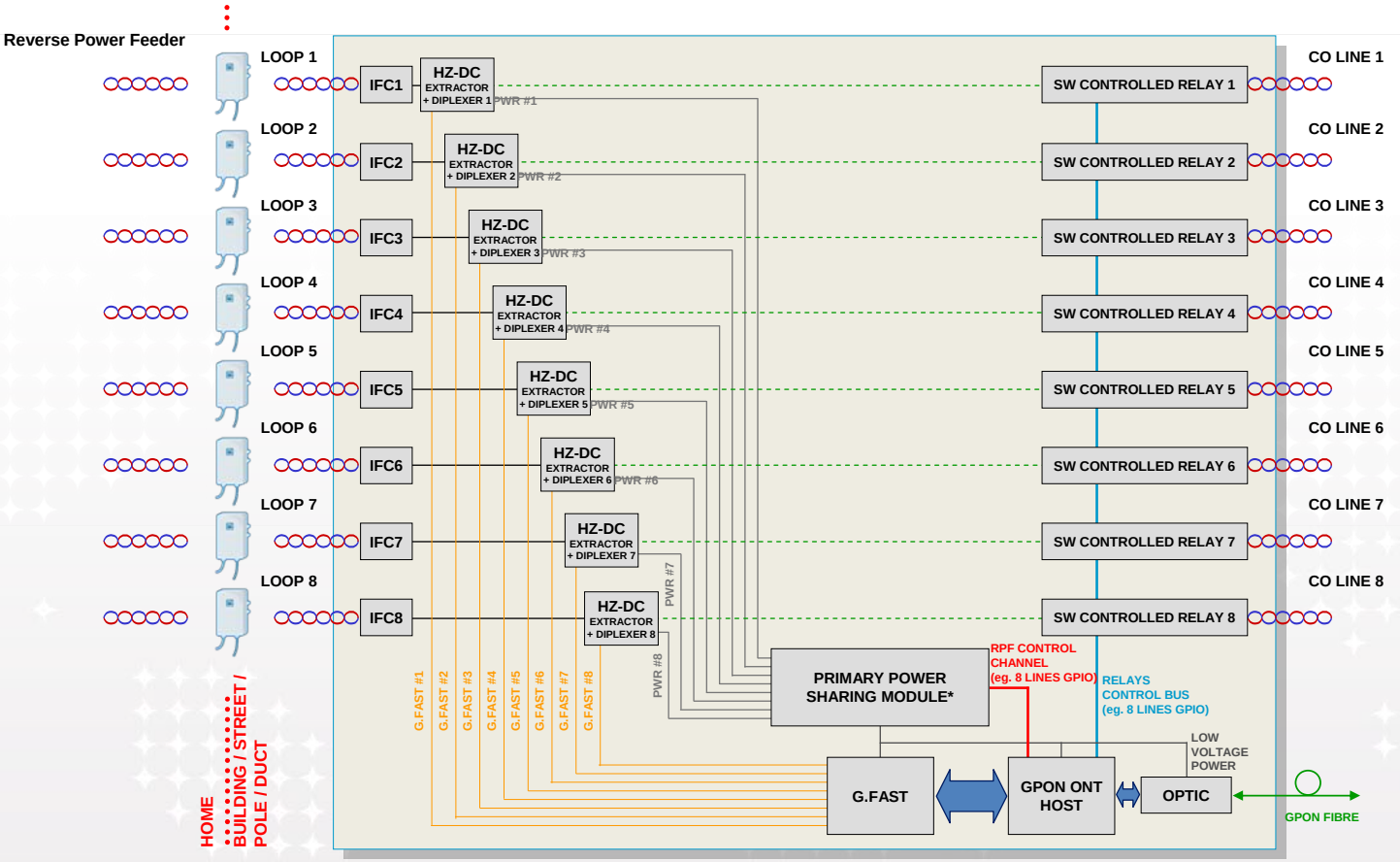
LET'S HAVE A LOOK AT HOW IT WORKS…

ZERO TOUCH INSTALLATION

- **Users connecting their RPFs** automatically disconnect the CO side and activate their line



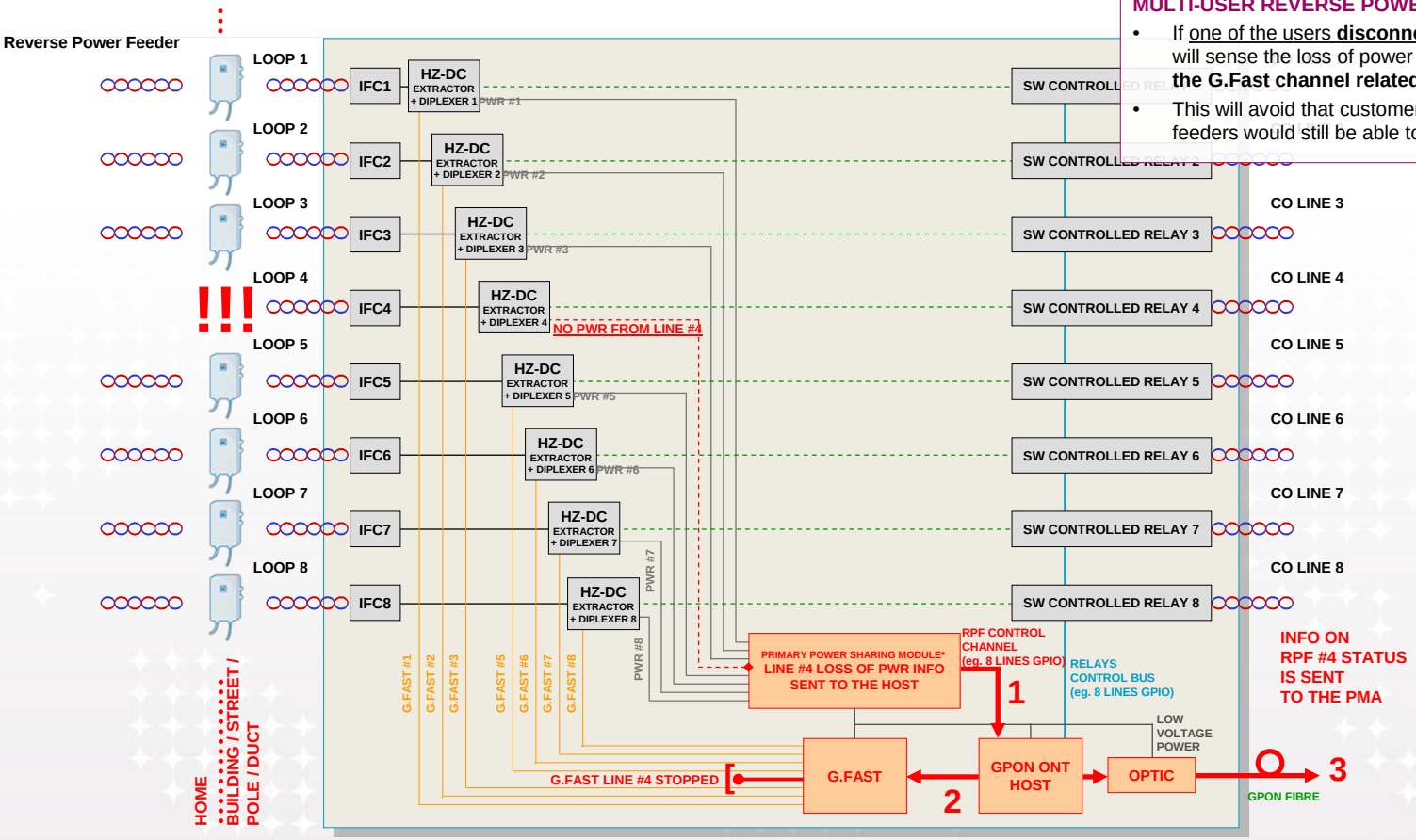
LET'S HAVE A LOOK AT HOW IT WORKS…



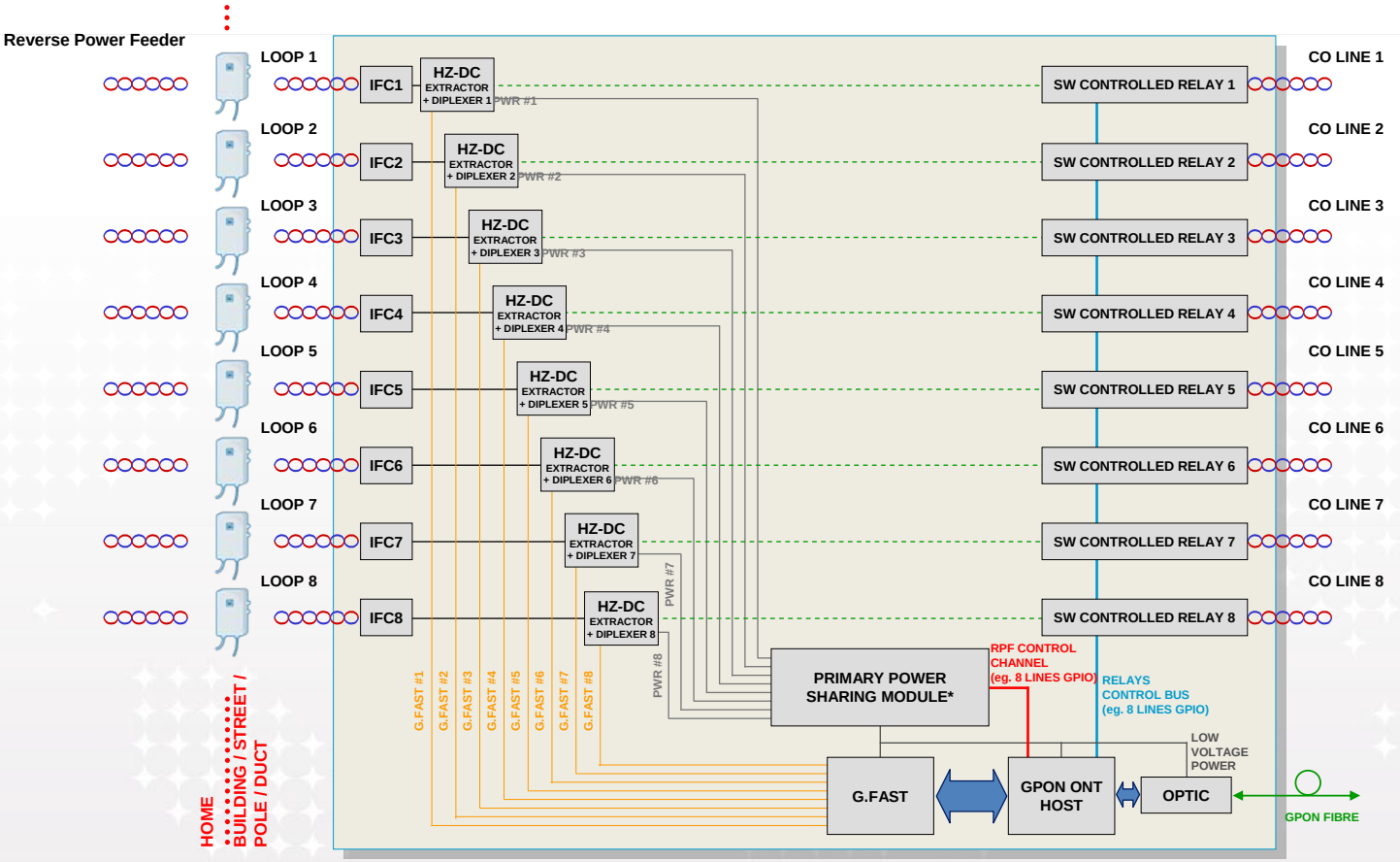
LET'S HAVE A LOOK AT HOW IT WORKS…

MULTI-USER REVERSE POWER FEEDING TECHNOLOGY

- If one of the users **disconnects** his Power Supply, the system will sense the loss of power and will automatically **switch OFF the G.Fast channel related to that user**
- This will avoid that customers disconnecting their power feeders would still be able to have access to the service



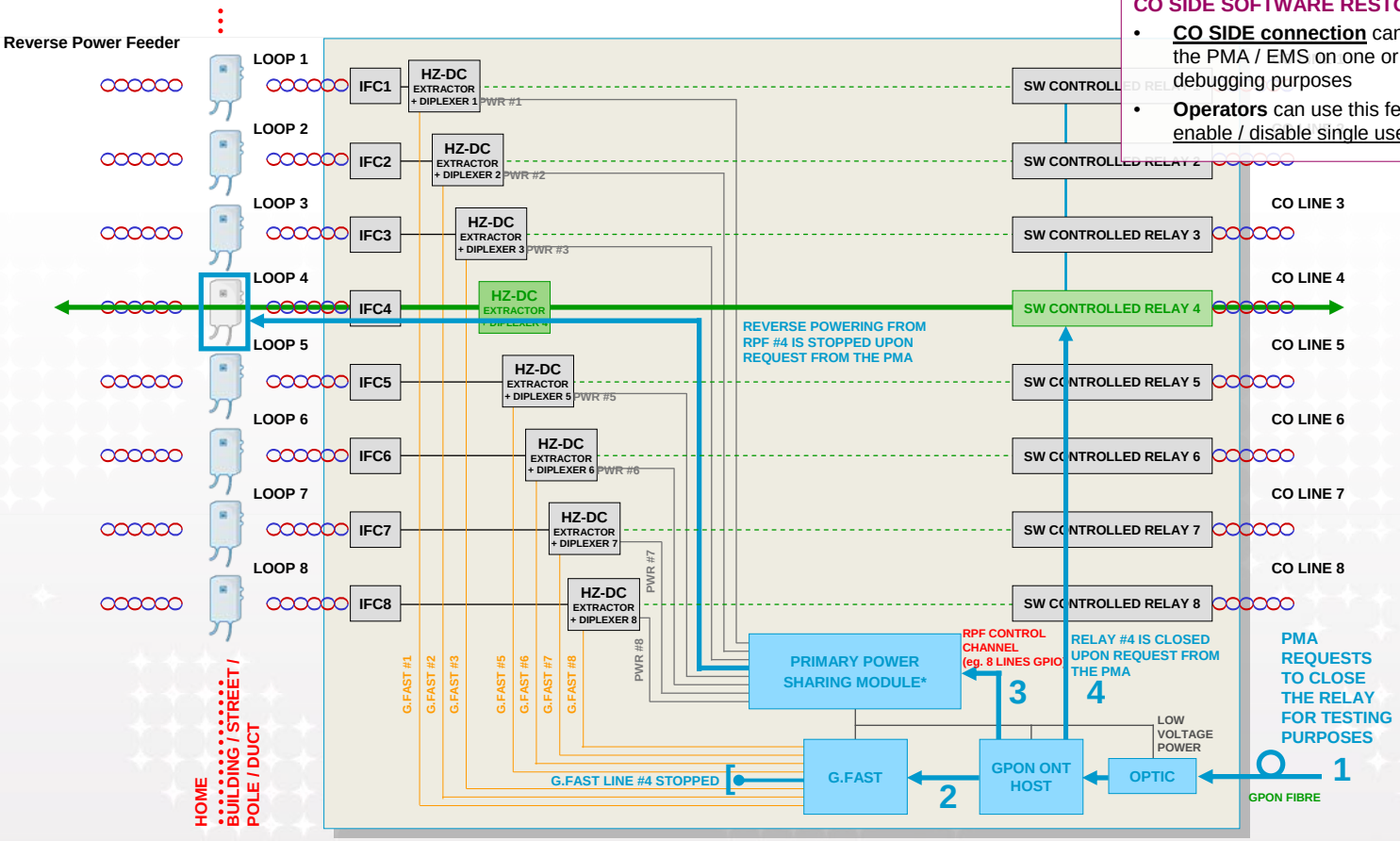
LET'S HAVE A LOOK AT HOW IT WORKS…



LET'S HAVE A LOOK AT HOW IT WORKS…

CO SIDE SOFTWARE RESTORE

- **CO SIDE connection** can be restored upon request from the PMA / EMS on one or more channels for line testing / debugging purposes
- **Operators** can use this feature to perform line tests or enable / disable single users from the central office



WE'RE HAVING FUN, SO LET'S ADD SOME MORE COMPLEXITY..

1

WHAT HAPPENS WHEN THE CO SIDE COPPER, IN SOME YEARS FROM NOW, WON'T BE MANAGED ANYMORE?

2

"SELF INSTALL" G.FAST PERFORMANCES ARE WORSE THAN "ENGINEER INSTALLED" G.FAST… IS IT ACCEPTABLE?

3

…IS ANYBODY STILL INTERESTED IN KEEPING POTS WITH ACTIVE DONGLES?

CONCLUSIONS

- **G.Fast** and **FTTdp** have been designed to speed up the roll-out of **superfast broadband without impacting on the existing infrastructure** where the impact would raise the highest number of problems, **the home of the customer**

- **Great technological effort in order to:**
  - Give certain deployment times
  - Save money
  - Offer FTTH-like service without compromises

- **Self Install is a key point in the success of this technology**

www.aethra.com